TECHNICAL ORDER PAGE SUPPLEMENT

TECHNICAL MANUAL
OPERATION AND MAINTENANCE INSTRUCTIONS
TRANSMITTER GROUP
OT-139/FPS-118(V)
7343532G1(V)1
OT-139A/FPS-118(V)
7343532G2(V)1
OT-180/FPS-118(V)
7343532G3(V)2
OT-180A/FPS-118(V)
7343532G4(V)2

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TECHNICAL ORDER PAGE SUPPLEMENT

OPERATION AND MAINTENANCE INSTRUCTIONS

WARNING

Refer to Verification Status Page(s) before performing procedures in this manual.

TRANSMITTER GROUP

OT-139/FPS-118(V)	OT-180/FPS-118(V)
7343532G1 (V)1	7343532G3 (V)2
OT-139A/FPS-118(V)	OT-180A/FPS-118(V)
7343532G2 (V)1	7343532G4 (V)2

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RESCINDED

TECHNICAL MANUAL
OPERATION AND MAINTENANCE INSTRUCTIONS

C-525

WARNING

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TRANSMITTER GROUP

OT-139/FPS-118(V)
7343532G1(V)1

OT-139A/FPS-118(V)
7343532G2(V)1

OT-180/FPS-118(V)
7343532G3(V)2

OT-180A/FPS-118(V)
7343532G4(V)2

GENERAL ELECTRIC COMPANY
GOVERNMENT ELECTRONIC SYSTEMS DIVISION
SYRACUSE, NEW YORK

F19628-82-C-0114(V)1
F19628-86-C-0174(V)2

THIS MANUAL INCORPORATES UNPUBLISHED BASIC AND CHANGE 1
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7 MAY 1990

CHANGE 2 - 30 JUNE 1991

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

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Change..........1..........19 September 1990
Change..........2..........30 June 1991

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TECHNICAL ORDER VERIFICATION STATUS TEMPORARY "B" PAGE

(If more space is needed, use a separate form and identify by page number.)

TECHNICAL ORDER NO. T.O. 31P6-2FPS118-71

LEGEND:

(A) DATA USABLE CODE: A-USABLE FOR OPERATION OR MAINTENANCE. B-USABLE WITH PCR, ITOFCN OR TOFCN. C-NOT USABLE *(REQUIRES CONTRACTOR ASSISTANCE)*. D-TO BE PERFORMED BY CONTRACTOR UNTIL VERIFIED.

(C) CATEGORY: 1. MUST BE VERIFIED PRIOR TO DEPLOYMENT. 2. CAN BE VERIFIED AFTER DEPLOYMENT. 3. WILL BE VERIFIED ON FIRST OPPORTUNITY BASIS.

(D) VALIDATION COMPLETED BY: P-PERFORMANCE, S-SIMULATION, A-ANALYSIS.

(E) TYPE VERIFICATION TO BE SCHEDULED: P-PERFORMANCE, S-SIMULATION, A-ANALYSIS.

BLOCKS (B), (F), (G) AND (H) - SELF EXPLANATORY.

DATE (BASIC) 07 MAY 1990 | CHANGE NO. 1

DATE (CHANGE) | DATE OF ISSUE 9/12/90

DATA USABLE CODE A	FUNCTION/PARA/ SECTION ETC. B	CATEGORY C	VAL COMP D	TYPE VERIF E	DATE VERIF F	PUBLICATION CHANGE REQUEST (PCR) NUMBER G	PCR INCORP DATE/REMARKS H
C	6-7.5.11	3	S	P	8/2/90	N/A	Incorp. in basic issue
D	6-9.2	3	S	P	11/14/90	N/A	Replacement pages
D	6-9.5	3	P	P	11/14/90	N/A	Replacement pages
D	6-11.10	3	P	P	5/25/91		
D	6-12.8	3	P	P	5/25/91		
D	6-9.17.9	3	P	P	8/5/91		C2
~~D~~	~~6-9.17.10~~	~~3~~	~~P~~				~~C2 Deleted~~

PREFACE

PURPOSE.

This is one of a group of technical orders (TOs) that support operation and maintenance for the radar system designated as Radar Set AN/FPS-118(V). The radar set is an Over-the-Horizon Back-scatter (OTH-B) radar. It provides surveillance, tracking, and identification of aircraft over 180° of azimuth at ranges that extend from 500 to 1800 nautical miles (nmi) maximum. The radar set consists of three 60° operating segments designated as segments 1, 2, and 3. It has components located at three separate locations; transmit site, receive site, and operations center (OC).

RELATED TECHNICAL ORDERS AND PUBLICATIONS.

A complete list of all AN/FPS-118(V) series TOs and related publications is in the List of Applicable Publications (LOAP), TO 31P6-2FPS118-01.

SAFETY PRECAUTIONS.

When operating or maintaining the radar set, observe the warnings and cautions in the front of this manual to prevent personal injury or death and equipment damage.

SCOPE AND APPLICATION OF MANUAL.

This manual is prepared to specifications MIL-M-38798B and MIL-M-38784B. This manual contains operating and maintenance instructions for Transmitter Groups OT-139/FPS-118(V)$^{(V)1}$, OT-139A/FPS-118(V)$^{(V)1}$, OT-180/FPS-118(V)$^{(V)2}$ and OT-180A/FPS-118(V)$^{(V)2}$. For simplification, the common name transmitter group is substituted for Transmitter Group OT-139/FPS-118(V)$^{(V)1}$, OT-139A/FPS-118(V)$^{(V)1}$, OT-180/FPS-118(V)$^{(V)2}$ and OT-180A/FPS-118(V)$^{(V)2}$ throughout this TO. This manual covers OTH-B radar systems; AN/FPS-118(V)1 [East Coast Radar System (ECRS)] and AN/FPS-118(V)2 [West Coast Radar System (WCRS)]. When characteristics, parameters, and/or hardware are unique to a particular system or segment, that item is identified for ECRS or WCRS with $^{(V)1}$ or $^{(V)2}$ respectively. The manual consists of Chapters 1 through 6 which are briefly described below.

Chapter 1, General Information. This chapter provides the following information about the equipment:

1. Purpose
2. Description
3. Leading Particulars
4. Capabilities and Limitations
5. Equipment Supplied
6. Equipment Required But Not Supplied
7. Special Tools and Test Equipment
8. Related TOs and Publications.

Chapter 2, Installation and Chapter 3, Preparation for Use and Shipment. These chapters are not applicable.

Chapter 4, Operation. This chapter provides the following information about the equipment:

1. Section I, Controls and Indicators
2. Section II, Operating Instructions
3. Section III, Emergency Operation.

Chapter 5, Theory of Operation. This chapter provides the following information about the equipment:

1. Section I, Functional System(s) Operation
2. Section II, Functional Operation of Electronic Circuits.

Chapter 6, Maintenance. This chapter provides the following information about the equipment:

1. Section I, On-Equipment Maintenance, consisting of:
   a. General Safety Procedures
   b. Preventive Maintenance
   c. Inspection, Cleaning, and Painting Procedures
   d. Lubrication Services
   e. General Removal, Repair, and Installation Procedures
   f. Removal and Installation Procedures
   g. Equipment Performance Monitoring/Automatic Fault Location (EPM/AFL) Procedures
   h. Check, Test, and Alignment Procedures.
2. Section II, Off-Equipment Maintenance
3. Section III, Performance Test Checks.

CONVENTIONS USED IN MANUAL.

Reference Designators. A reference designator marking system is used throughout the radar set equipment (except certain vendor equipments) to specify unit, assembly, subassembly, and component location. This reference designator system is used in the text and illustrations in this manual. A typical full reference designator for a specific component location may be divided into major hardware divisions as shown in the Equipment Reference Designator Assignment Scheme. The markings in the equipment for each major hardware division are adjacent to that particular item of hardware within the equipment.

Figure and Table Numbers. Figure and table numbers are consecutive within chapters (i.e., 4-1, 4-2, 4-3, etc.) and are within applicable chapters. Foldout figures (i.e., FO-1, FO-2, etc.) are at the back of the TO in which they are referenced. Figure number references that do not have a chapter number prefix (i.e., Figure 5, Figure 50, etc.) are references to figures in the associated circuit diagram TOs.

Difference-Among-Models Coverage. Several methods are used throughout the AN/FPS-118(V) series of TOs to indicate difference-among-models coverage.

1. Two major versions of the radar exist; the East Coast Radar System (ECRS) designated by $^{(V)1}$, and the West Coast Radar System (WCRS) designated by $^{(V)2}$.
2. Text within paragraphs, information within figures, sheets within figures, or information within tables that are unique to a particular system will be designated with a $^{(V)1}$ or $^{(V)2}$ as applicable when the differences are minor or easily understood.
3. In certain instances, where the number of differences between systems is significant, or the material is unique to only one system, entire paragraphs, tables, or figures will be designated with $^{(V)1}$ or $^{(V)2}$. In this case, the basic paragraph, table, or figure number is suffixed with $^{(V)1}$ or $^{(V)2}$ to uniquely identify the version of the system to which the material applies.
4. If a functionally equivalent version exists for both systems, then the basic paragraph, table, or figure number is repeated and suffixed with the appropriate $^{(V)1}$ and $^{(V)2}$ designators.
5. All paragraphs, tables, figures, or text not uniquely identified apply equally to all versions of the system.
6. In a number of instances, different but interchangeable versions of commercial vendor replaceable units are used in the same location within cabinets of the system. In these cases one version is described and designated as standard; the others are described and designated as alternate.

Part Numbers. When a part number includes a group (G) or purchase (P) number with leading zeros (i.e., 7343534G002 or 77C714804P001) the leading zeros are dropped except in the illustrated parts breakdown (IPB). For example, 7343534G002 is designated as 7343534G2; and 77C714804P001 is designated as 77C714804P1.

410 A1 N1 A304 U38

MAJOR UNIT NUMBER

CABINET OR ASSEMBLY NUMBER WITHIN UNIT 410

WIRING BACKPLANE OR RACK LOCATION NUMBER (IF REQUIRED) WITHIN UNIT OR ASSEMBLY A1 OF UNIT 410.

SUBASSEMBLY OR CARD LOCATION NUMBER WITHIN BACKPLANE OR RACK N1 OF ASSEMBLY A1 OF UNIT 410. IN THE CASE OF CARD NUMBERS, THE FIRST DIGIT (3) OF THE CARD NUMBER (A304) INDICATES THE VERTICAL LEVEL OF THE BACKPLANE (FROM THE TOP) IN WHICH THE CARD IS LOCATED.

COMPONENT LOCATION WITHIN SUBASSEMBLY OF CARD A304 OF PLANE N1 OF ASSEMBLY A1 OF UNIT 410.

GTA45629

Equipment Reference Designator Assignment Scheme

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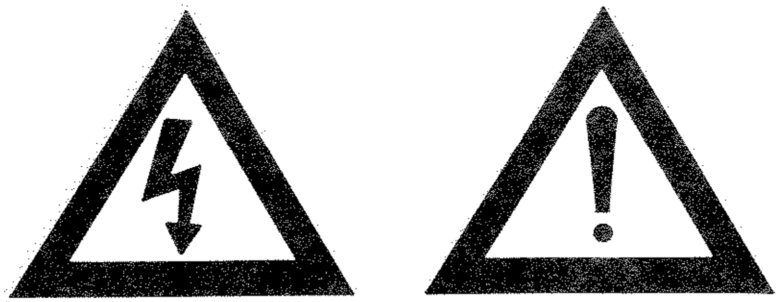
SAFETY SUMMARY



WARNING

VOLTAGE, CURRENT, AND LIGHTNING HAZARD

The voltage, current, and lightning hazards listed in A through D below exist for the transmitter group. Death or serious injury may result if personnel fail to observe the following safety precautions.

1. Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment. Also, this person must be competent in administering first aid and cardiopulmonary resuscitation (CPR). When the technician is aided by operators, he must warn them about dangerous areas.

2. Be careful not to contact high-voltage or high-current connections when installing, maintaining, or operating this equipment.

3. Whenever the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

4. Remove all rings, watches, bracelets, and necklaces before performing installation, operation, or maintenance of this equipment.

5. Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. When working inside the equipment after the power has been turned off always ground every part before touching it.

6. If the device controlling power to the equipment being repaired is turned off, the device should be marked with a warning sign that indicates maintenance is being performed. The sign must not be removed nor the power turned on until maintenance is complete. Where circuit breaker lock-out devices are provided, they must be used.

7. Extremely high-current low-voltage dc is used in portions of this equipment. Do not be misled by the low-voltage rating (5 to 60 V dc) of the current sources. Severe personal injury and equipment damage will occur if the current sources are shorted (directly connected) to ground or ground returns by tools or test equipment.

8. Observe all caution and danger instruction signs mounted on equipment.

9. During installation and maintenance, check cabinet grounds in accordance with preventive maintenance schedule.

10. If personnel have been exposed to electrical shock and suffered respiratory or cardiac arrest, immediately perform respiratory or resuscitation procedures as required.

NOTE

For hazards associated with the communications subsystem, real property installed equipment (RPIE), and other government furnished equipment (GFE) or vendor equipment, refer to appropriate manuals furnished with the item.

A. DC VOLTAGE HAZARDS.

1. <u>24 to 60 V Dc</u>. A potential of 24 to 60 V dc exists between certain power buses within the following equipment:

a. Transmitter module, Units 110 through 121, (cabinet 1) and power supply (cabinet 2) 24 and 28 V dc power supplies.

b. Exciter/auxiliary exciter, Units 151 and 152, 24 V dc, 60 V dc, and -60 V dc power supplies.

2. 200 to 5000 V Dc. Potentials of 200 to 5000 V dc exist between certain power supply lines and ground within the transmitter module cabinet and high voltage power supply (HVPS) cabinet.

3. 10,000 V Dc or More. Potentials in excess of 10,000 V dc exist within the HVPS cabinet and the transmitter module cabinet.

B. DC CURRENT HAZARDS. Certain low voltage power supplies, 25 A dc or more, in the following equipments are bused together. They supply extremely high current at voltages ranging from 5 to 60 V dc. In addition to the high continuous current capability, instantaneous short-circuit current available at the buses may exceed hundreds of amperes. Direct connections (shorts) placed anywhere across the output lines from these supplies may cause damage to the equipment and severe burns or temporary flash-blindness to personnel.

1. Transmitter module, Units 110 through 121, 15 V dc, 24 V dc, and 28 V dc power supplies
2. Transmit beamformer, Unit 150, ac-to-dc converter, 5 V dc and 15 V dc power supplies
3. Exciter/auxiliary exciter, Units 151 and 152, 5 V dc, 15 V dc, 24 V dc, and 60 V dc power supplies.

C. AC VOLTAGE AND CURRENT HAZARDS.

1. 60 Cycle 120/208 V Ac. High-voltage, high-amperage, 60-cycle power is supplied to and is present within the following equipment:

a. Transmitter module, Units 110 through 121

b. High Voltage Power Supply, Units 122 through 133

c. Transmit beamformer, Unit 150, fan assembly, service receptacles, and ac-to-dc converter

d. Exciter/auxiliary exciter, Units 151 and 152, fan assembly, service receptacles, synthesizers, analog-to-digital converter (A/DC), and calibrator.

2. 1000 V Ac to 5000 V Ac. Potentials in excess of 1000 V ac exist within the transmitter HVPS.

3. 10,000 V Ac or More. Potentials in excess of 10,000 V ac exist within the high voltage ac switch, high voltage power supply, and transmitter disconnect switch.

D. LIGHTNING HAZARDS. No maintenance shall be performed on the transmit antenna towers or ground screens when thunderstorms are imminent or in progress.

WARNING

RADIO FREQUENCY RADIATION HAZARDS

The radio frequency (RF) radiation hazards listed in A through D below exist for the transmitter group. For hazards associated with RPIE and other GFE or vendor equipment, refer to appropriate manuals furnished with the item.

A. RADIO FREQUENCY RADIATION HAZARDS. The transmitters of the transmitter group generate and radiate high power RF energy through the antenna elements into free space. The RF radiation fields inside the transmitter module (cabinet 1) and RF radiation from the transmit antenna elements present a potential hazard to personnel unless certain safety precautions are followed. The RF radiation heats the body tissues. When the power or energy density is high enough, the radiation may produce enough heat to damage the body tissues permanently. Recent research has indicated some nonthermal biological effects. Precautions must be taken so that personnel are not exposed to RF radiation levels that are in excess of the RF radiation protection guides below. For normal environmental conditions and for incident electromagnetic energy of frequencies from 2 to 3 MHz, the radiation protection guide is 100 mW/cm^2. For frequencies from 3 MHz to 30 MHz, the radiation protection guide exposure limit at any frequency can be found by dividing 900 by the frequency in MHz squared. The result is in milliwatts per square centimeter. The power density is averaged over any 0.1 hour (6 minute) period. This means the following:

Power density: 100 mW/cm^2 (in milliwatts per square centimeter) for frequencies from 2 to 3 MHz during 0.1 hour period.

Energy density: 10 mW hrs/cm^2 (in milliwatt-hours per square centimeter) for frequencies from 2 to 3 MHz during any 0.1 hour period.

Power density: 900/(frequency in MHz)^2 (in milliwatts per square centimeter) during any 0.1 hour period (3 to 30 MHz).

Energy density: 90/(frequency in MHz)^2 (in milliwatt-hours per square centimeter) during any 0.1 hour period (3 to 30 MHz).

These formulated recommendations pertain to both whole body irradiation and partial body irradiation. Partial body irradiation must be included since it has been shown that some parts of the human body (e.g., eyes, testicles) may be harmed if exposed to incident radiation levels significantly in excess of the recommended levels.

An RF radiation hazard in excess of the radiation protection guide given above exists inside the transmitter module (cabinet 1) and in the area inside the interlocked antenna field fence. Because the transmit antenna beam is elevated, any elevated object entering the beam (over 10 feet from the ground) will encounter hazardous levels at distances beyond the main antenna field fence.

B. RADIO FREQUENCY RADIATION HAZARD TO PACEMAKERS. The RF radiation due to a stationary beam from the transmitter group could present a potential hazard to personnel wearing cardiac pacemakers. With consideration for the effect of frequency, an E-field of 200 V/meter (rms) is the recommended safe operating limit for pacemaker wearers. Levels above this limit will exist inside the interlocked antenna field fence.

C. RADIO FREQUENCY RADIATION HAZARD TO ELECTROEXPLOSIVE DEVICES. The RF radiation from the transmitter group could cause accidental detonation of electroexplosive devices (EEDs). With consideration for the effect of frequency, an average power density of 0.01 W/square meter is the recommended safe operating limit for EEDs in an exposed condition. At this level, Hazardous Electromagnetic Radiation to Ordnance (HERO) restrictions shall be enforced out to a distance of 3121 meters (10,144 feet) in front of the transmit antenna elements or 901 meters (2928 feet) in front of the sounder antenna. This distance shall be doubled if reflections, that could double the field intensity, are to be considered. Because the transmit beam is elevated, the antenna gain was not included when calculating the above distance. Any elevated objects entering the beam will encounter hazardous levels at distances greater than those given above.

U.S. Air Force regulation AFR 127-100, entitled Explosive Safety Standards, establishes safety limits in regard to hazards of electromagnetic radiation to electroexplosive devices. The limits are defined for various configurations and conditions for EEDs. In general, the limits are given for EEDs in transport and/or storage in nonmetallic containers when there are no known EEDs in the area. Although the indicated limits for EEDs are expressed as average power levels, the averaging for beam movement is not always acceptable. This is because the fusible link in some EEDs might explode after exposure to power density levels in excess of the limit for very short periods of time. Averaging for beam movement is not used here because the OTH beam can dwell at one azimuth angle for up to several seconds even when it is scanning. The recommended average power density limit for EEDs in transport and/or storage is 0.26 W/square meter. At this level the safe distance (from transmit antenna) for EEDs in transport or storage is 985 meters (3200 feet) or 285 meters (926 feet) for the sounder antenna. Because the transmit beam is elevated, the antenna gain was not included when calculating the above distance. Any elevated object entering the beam will encounter hazardous levels at distances greater than those given above.

D. RADIO FREQUENCY RADIATION HAZARD PRECAUTIONS. The following RF radiation hazard precautions shall be observed when operating or performing maintenance on the transmit antennas:

1. Proper precautions shall be taken to protect pacemaker users.
2. Visual inspection of the transmit and sounder antennas can be conducted with the radar system fully operational and radiating, provided the personnel remain behind the safety fence and do not work above 10 feet in elevation at all times during the inspection.
3. Maintenance shall not be conducted on the transmit or sounder antennas, ground screens, or any equipment inside the antenna field fence unless all the respective site radar system transmitters are definitely turned off so as not to radiate for the purpose of such maintenance.
4. Perform initial and periodic RF radiation surveys outside the safety fences including the entire length of the back of the transmit antenna field at predetermined intervals to determine if any personnel hazards exist resulting from radar system radiation or adjacent RF radiation sources. The survey shall include measurements from towers, poles, buildings, and other surfaces. If hazardous areas exist, ensure that radiation restrictions are established and put into effect and that required warning signs are posted and observed by personnel.
5. Prior to and during operation and maintenance, observe all radiation restrictions in effect at the radar site.
6. Do not attempt to climb, step, or stand on transmit elements located on the towers in the transmit antenna field. Damage may occur to the antenna structure and RF radiation may exist.
7. In accordance with design requirements:
   a. The primary radar system is designed to prevent RF radiation when the key from the high voltage main switch cabinet is inserted and rotated in the transmitter building key block. Only then can the antenna field gate keys be released from the key block allowing access to the transmit antenna field. Do not, under any circumstances, attempt to defeat the equipment interlocks that implement this safety provision when operating or performing maintenance on the radar system.
   b. The transmit sounder system is designed to prevent RF radiation when the two keys from the distribution panel circuit breakers are inserted and rotated in the transmitter building key block. Only then can the antenna field gate keys be released from the key block allowing access to the transmit sounder antenna field. Do not, under any circumstances, attempt to defeat the equipment interlocks that implement this safety provision when operating or performing maintenance on the radar set.
8. If personnel are suspected or known to have been exposed to RF radiation in excess of RF

protection guide, seek medical advice immediately.

9. Do not stand in front of the transmit elements (inside fenced area) as an RF radiation hazard may exist.

10. Do not attempt to defeat equipment interlocks and operate the transmitter modules (cabinet 1) with any of the shields, panels, or covers removed. Hazardous RF and X-ray fields exist within the transmitter module cabinet.

11. Do not attempt to disconnect RF high power coaxial transmission lines from a transmitter module cabinet, or from each other, while the transmitter or any of the other transmitters are operating. The transmitter may not automatically shut down due to high voltage standing wave ratio (VSWR). In addition, high levels of RF energy may be coupled from the other transmitters to the antenna elements associated with the transmission lines and may be present within the transmission lines. In either case, severe RF burns to personnel due to RF radiation from the open transmission line connections could occur.

12. Always perform an RF radiation survey to determine if a hazard exists after performing a maintenance action which requires removal, disconnection, or replacement of transmission lines or connectors, or transmitter directional couplers, or the transfer switches where the transmission lines are connected.

CAUTION
RADIATION AREA

WARNING

X-RAY RADIATION HAZARD

Hazardous X-ray radiation may cause death or serious injury to personnel. MIL-STD-454, Requirement 1, defines an X-ray radiation area to be an area where the level of X-ray radiation exceeds 2.0 milliroentgen/hour at a distance of 5 centimeters from the source of the X-ray emissions. The high power tetrode tubes in the transmitter module units generate X-rays as a result of the electrons striking the metal structure within the tube. Shielding incorporated in construction of the cabinet normally prevents any X-ray radiation hazard to personnel. However, should any of these protective shields, doors, etc. be damaged or otherwise become defective, or personnel place themselves in close proximity to the tubes when high voltage is applied, injury from X-ray radiation could result. The following precautions should be observed regarding X-ray radiation hazards:

1. Perform initial and periodic X-ray emission level surveys to determine if an X-ray radiation hazard exists at edges of the transmitter module cabinet doors. Perform the X-ray level survey in accordance with the established survey procedures.
2. Insure that all X-ray radiation hazard areas are properly posted with X-ray radiation hazard warning signs.
3. If personnel are suspected or known to have been exposed to X-ray emissions in excess of the X-ray radiation protection guide, they are required to seek medical advice immediately. In addition, any such occurrence must be reported to the safety specialist so that appropriate action to eliminate the cause of the hazard can be taken.

DANGER

WARNING

TOXIC MATERIAL/ ENVIRONMENTAL HAZARDS, MAJOR MAINTENANCE HAZARDS, FIRE SUPPRESSION HAZARDS, FIRE/EXPLOSION HAZARDS

NOTE

The hazards listed in A through D below exist when performing maintenance of the transmitter group. For hazards associated with RPIE, GFE, or other vendor equipment, refer to appropriate manuals furnished with the item.

A. TOXIC MATERIAL/ENVIRONMENTAL HAZARDS.

1. Toxic or Flammable Solvents and Corrosive Chemicals. Cleaning and painting operations may involve the use of caustic or acid solutions, skin irritants, and organic solvents that are flammable and/or toxic. The following minimum precautions must be observed by personnel using such materials:

   a. Work only in well-ventilated areas. Do not rely on equipment room ventilating system for this purpose since it may be recirculating a major part of the equipment room air. Open equipment room doors and use exhaust fans.

   b. Wear organic vapor respirators when using organic solvents or corrosive chemicals.

   c. Wear chemical safety goggles, gloves, and aprons when using corrosive chemicals.

   d. Do not use flammable chemicals near flame or electrical sparks.

   e. Maintain a fully-stocked first-aid cabinet nearby for emergency treatment of scalds, chemical burns, etc.

   f. Maintain a fresh water supply nearby with a flexible nozzle to flush away corrosive chemicals from any part of the body.

   g. Observe and follow all cautions, warnings, and procedures on containers for solvents, paints, and cleaning chemicals.

   h. If personnel suffer respiratory or cardiac failure due to toxic hazards, immediately perform respiratory or resuscitation procedures as applicable. Seek medical attention as soon as possible if exposure to toxic materials occurs.

2. Beryllium Oxide. The tubes in transmitters contain parts made of beryllium oxide which is inert in the form used. Do not attempt to cut open sealed devices containing beryllium oxide parts or attempt to cut, grind, file, or machine beryllium oxide parts in any manner. Beryllium oxide dust particles are toxic. They are a hazard to health when ingested, inhaled, or deposited in open wounds. If beryllium oxide particles are ingested, inhaled, or deposited in open wounds, consult medical officer immediately.

3. Benzene, Carbon Tetrachloride, and Trichloroethane Solvents. Do not use these solvents for cleaning. The fumes are toxic and are a hazard to health. The fumes can cause death by central nervous system depression.

4. Freon and Freon TE. Use only Freon TE for cleaning. Do not expose Freon compounds to open flame or intense heat. Freon compounds will decompose into extremely toxic phosgene gas (odor of new-mown hay) and may cause death.

B. MAJOR MAINTENANCE HAZARDS. The precautions given in 1 through 4 below must be observed to prevent personnel injury or death.

1. Verify that bused power supplies are turned off and buses discharged before attempting maintenance of power supplies or backplanes.

2. When removing test equipment weighing 35 pounds minimum (power supplies, synthesizers, spectrum analyzers, sweep generators, or frequency standards) exercise caution to prevent personnel injury due to the weight of these assemblies. Observe any weight hazard warning labels on AN/FPS-118 equipment.

3. If horn sounds and fire light is flashing, personnel have approximately 30 seconds to clear the equipment group area before Halon is discharged on the area.

4. During maintenance refer to TO 00-25-234 for precautionary measures that shall be taken while handling electrostatically sensitive equipment. Electrostatically sensitive components are listed in the illustrated parts breakdown.

5. Deionized cooling water at pressures up to 80 lbf/in^2 is connected through reinforced hoses to the transmitter modules and to the sounder amplifiers. Before performing maintenance on piping or water-cooled assemblies and components within these units, make sure the RPIE water supply and return valves have been turned off and the water pressure within the units has been vented.

6. Compressed air at pressures up to 20 lbf/in^2 is connected to the transmitter modules to operate various pneumatic devices. Before performing maintenance on piping or any pneumatic devices of the transmitter module, make sure that the RPIE compressed air supply valve for the transmitter module has been turned off, and the air pressure within the unit has been vented.

7. When performing maintenance on the transmitter, receiver, sounder, or communications tropo radio antennas and transmission lines in inclement weather, make sure appropriate protective clothing and gloves are worn to prevent hypothermia or frostbite.

C. FIRE SUPPRESSION HAZARDS. Halon 1301 used in deluge suppression systems and Halon 1211 used in portable extinguishers are low order toxins which are not hazardous in and of themselves at concentration levels necessary for fire extinguishment. However, certain precautions must be taken in the event of a Halon spill or when exposed to the combination of the products of combustion and Halon extinguishment agents. These precautions are as follows:

1. Observe the following precautions in the event of a spill or ruptured tank to prevent overexposure. High concentration levels of Halon may cause acute cardiac and respiratory effects.

   a. Halon 1211.

   (1) Notify safety personnel, ventilate area, and wear protective clothing and required equipment for clean-up. Do not smoke with contaminated hands. Do not consume food in areas of use. Do not allow liquid to contact skin or eyes. Avoid inhalation of vapors. Avoid contamination of tobacco and food.

   (2) Small spills do not require respiratory protection in well-ventilated areas. Use Self-Contained Breathing Apparatus (SCBA) when cleaning up large spills.

   (3) First aid procedures include flushing exposed eyes with water for 15 minutes, washing exposed skin with soap and water, moving inhalation victim to fresh air, and providing oxygen and artificial ventilation if required. Seek medical advice in all cases.

   b. Halon 1301.

   (1) Move leaking cylinders to a ventilated area (outside of building, if necessary). Completely discharge cylinder contents and return defective cylinders to vendor.

   (2) If respiratory problems are noted, move victim to fresh air and provide supplemental oxygen. Administer artificial respiration if required and seek medical advice immediately.

2. In the event of a fire, observe the following precautions when using Halon 1211.

   a. Use extinguishers only in the event of a fire, being careful not to inhale vapors from the products of combustion. In all but the beginning stage of a fire, evacuate and do not attempt extinguishment.

   b. During overhaul operations, observe the same precautions as for a spill.

D. FIRE/EXPLOSION HAZARDS.

1. Solvent. Solvents used in thinners, paints, and certain cleaners are extremely flammable. They are toxic and are hazardous to health. To avoid explosions and fire, do not use paints, thinners, and cleaners near flame or electrical sparks. When using these items

in a confined area, the area must be ventilated to outside air to avoid explosive or toxic concentration of the solvent fumes. Do not rely on equipment room ventilating system for this purpose since it may be recirculating a major part of the equipment room air. Open equipment room doors and use exhaust fans. In addition to adequate ventilation, organic respirators must be worn to reduce the toxic effects of the solvents. If personnel suffer respiratory or cardiac failure due to the hazards listed above, immediately perform respiratory or resuscitation procedures as applicable. When, and if possible, seek medical advice.

2. Electrolytic Capacitor. Ensure terminal polarity markings [positive (+) and negative (-)] are observed when connecting electrolytic capacitors to dc (+) and (-) buses. If capacitors are installed backwards (reverse polarity), an explosion will result when dc voltage is applied.

CHAPTER 1

GENERAL INFORMATION

1-1 PURPOSE.

1. Transmitter Groups OT-139/FPS-118(V)$^{(V)1}$, OT-139A/FPS-118(V)$^{(V)1}$, OT-180/FPS-118(V)$^{(V)2}$, and OT-180A/FPS-118$^{(V)2}$ are major equipment groups of the AN/FPS-118(V) radar set. The radar set is an Over-The-Horizon Backscatter (OTH-B) radar. It provides surveillance, tracking, and identification of aircraft over 180° of azimuth at ranges that extend from 500 to 1800 nautical miles (nmi) maximum. The radar set consists of three 60° operating segments designated as 1, 2, and 3. They have components located at three separate locations; transmit site, receive site, and operations center (OC).
2. The Transmitter Groups are part of the segment 1, 2, and 3 transmit subsystem equipment located at the transmit site. At each segment, the group supports the radar set mission. It provides waveform generation, beamforming, beamsteering, power amplification, and radiation into space of the radar transmitted signal.
3. For simplification, the common name transmitter group is substituted for Transmitter Groups OT-139/FPS-118(V)$^{(V)1}$, OT-139A/FPS-118(V)$^{(V)1}$, OT-180/FPS-118(V)$^{(V)2}$, and OT-180A/FPS-118$^{(V)2}$ throughout this technical order (TO).

1-2 DESCRIPTION.

1. The transmitter group radiates high power radio frequency (RF) signals for surveillance. The transmitter group (Figure 1-1) consists of a transmit antenna, Unit 100; 12 identical elemental transmitters; transmit beamformer (TBF), Unit 150; and exciter and auxiliary exciter, Units 151 and 152. The 12 elemental transmitters consist of transmitter modules (TMs), Units 110 through 121; high voltage power supplies (HVPSs), Units 122 through 133; and high voltage ac (HVAC) switches, Units 222 through 233.
2. The TMs, HVPSs, and HVAC switches are on the main floor of the transmit site building. The location of the units is shown in Figure 1-2. The TBF, exciter, and auxiliary exciter, Units 150, 151, and 152, respectively, are in the control and monitor room of the transmit site building.

1-2.1 Transmit Antenna, Unit 100. Transmit antenna, Unit 100 (Figure 1-3) is a broadside array. It extends to 3640 feet. The antenna comprises six subarrays of broadband dipole elements with back and ground screens. Each of the subarrays comprising 12 dipole elements is dedicated to one of six frequency bands. The bands are designated A through F. The antenna ground screen extends to 750 feet in length and 4913 feet in width. The height of the backscreen varies with frequency. At the lowest frequency it reaches 135 feet in height. The maximum length of the broadband dipole at the lowest operating frequency is 77.1 feet. This length is reduced to 8.6 feet at the highest operating frequency. Figure 1-3, Sheet 2, shows how the dimensions and orientation of the dipole elements vary with frequency. Interface between the transmitter and the transmit antenna dipole elements is via a coaxial line and balun.

1-2.2 Transmitter Modules, Units 110 through 121.

1. The TM (Figure 1-4) is 1 of 12 identical units. Each TM is capable of producing a RF 100 kW output over one of six frequency subbands in the range of 5 to 28 MHz. External excitation is supplied to each by exciter, Unit 151, via the TBF, Unit 150. The RF output from the TM is connected to dedicated transmit antenna elements by coaxial transmission lines.
2. Components of the TM are in a free-standing metal cabinet. The internal parts are accessible by doors on the cabinet. The doors are interlocked electrically to protect personnel from high voltage shock.
3. The TM consists of a control and monitoring panel, four amplifier stages with frequency bandpass filters between each stage, six output frequency bandpass filters, and six output transfer switches. The output is connected to an antenna system. However, the output switches allow only one band of RF to be connected to the antenna at one time.
4. The control and monitoring panels are shown in Figure 1-4, Sheet 2. These panels are used for monitoring, display, and protection of circuit parameters in the elemental

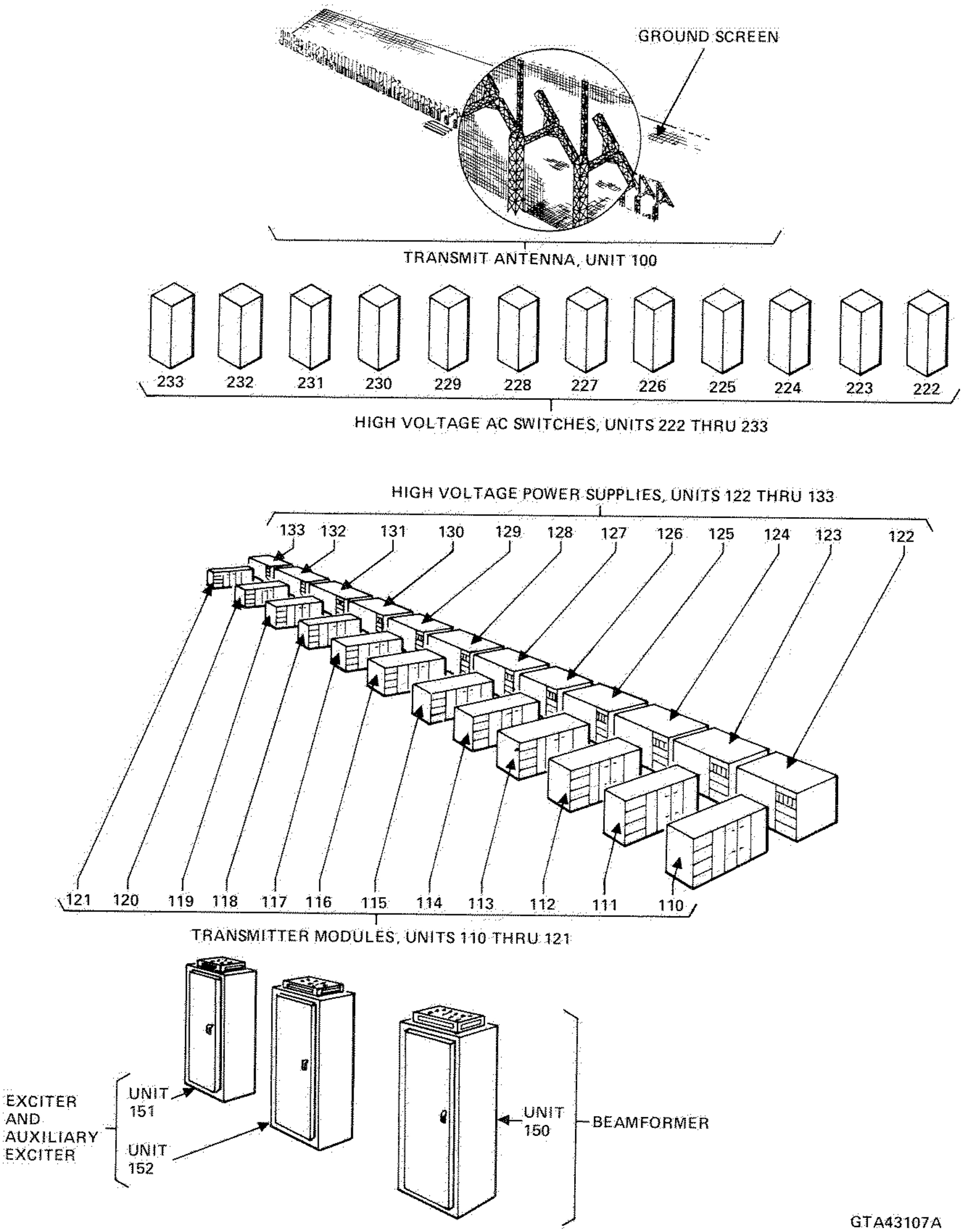


Figure 1-1. Transmitter Group

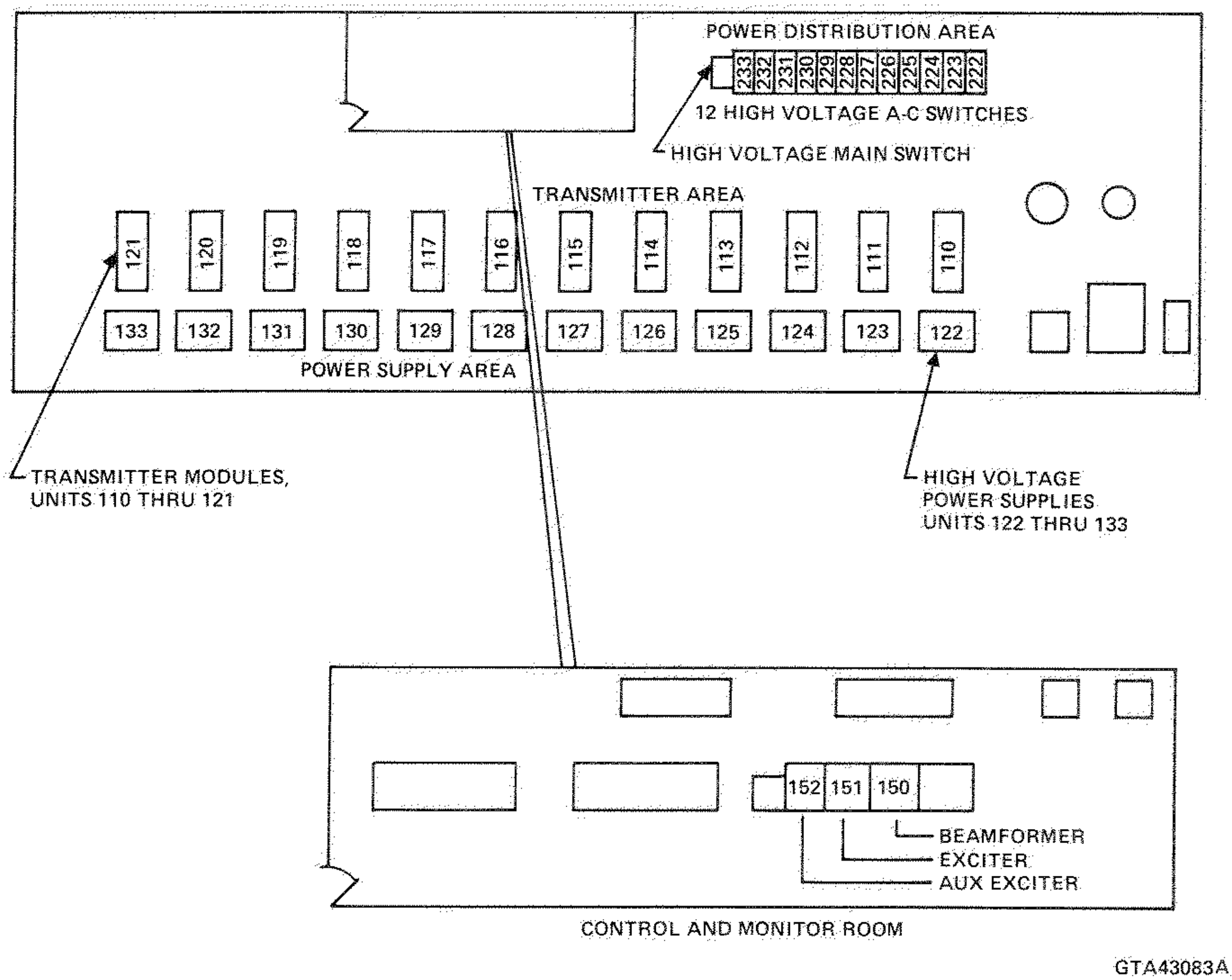


Figure 1-2. Transmitter Group Typical Layout

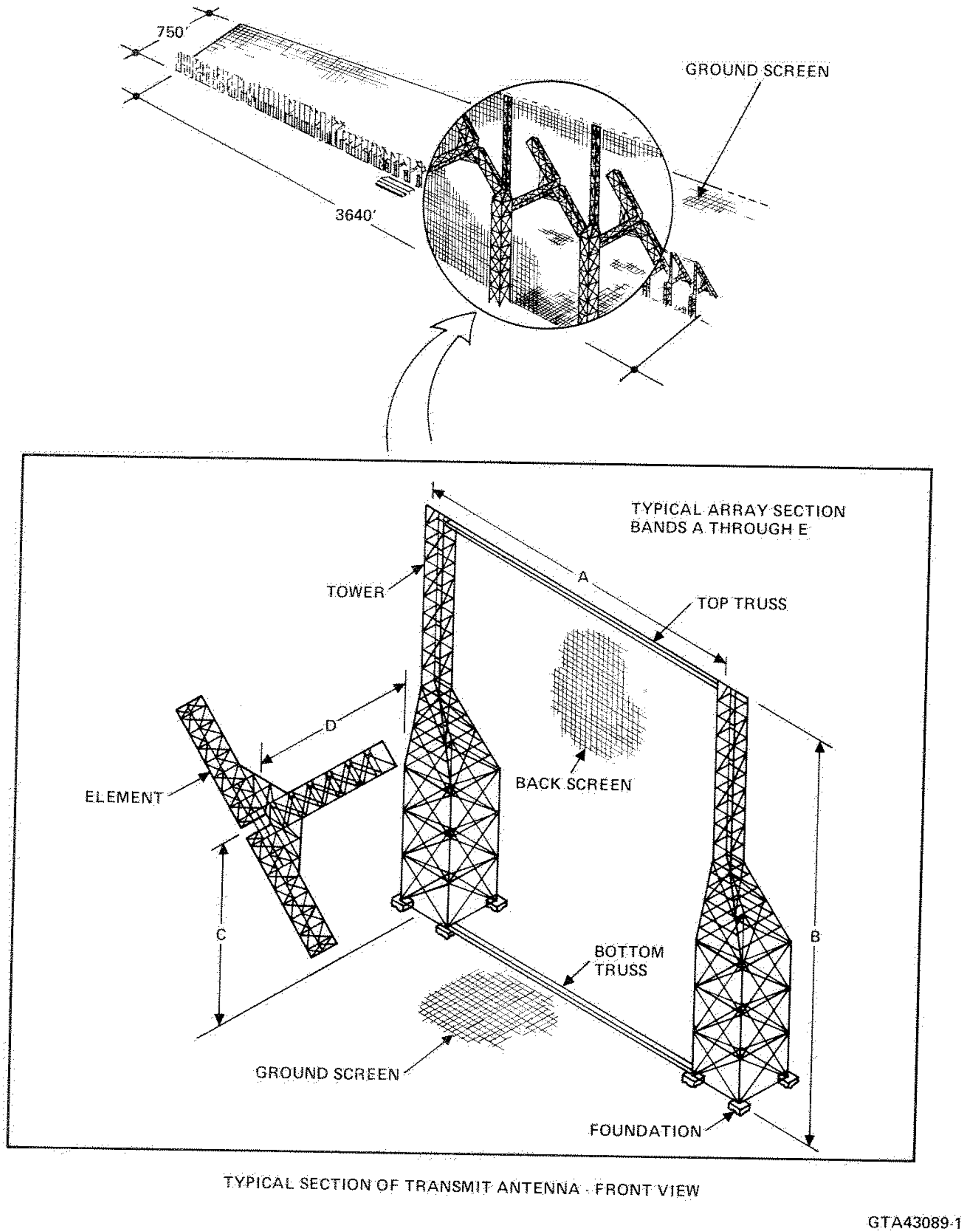
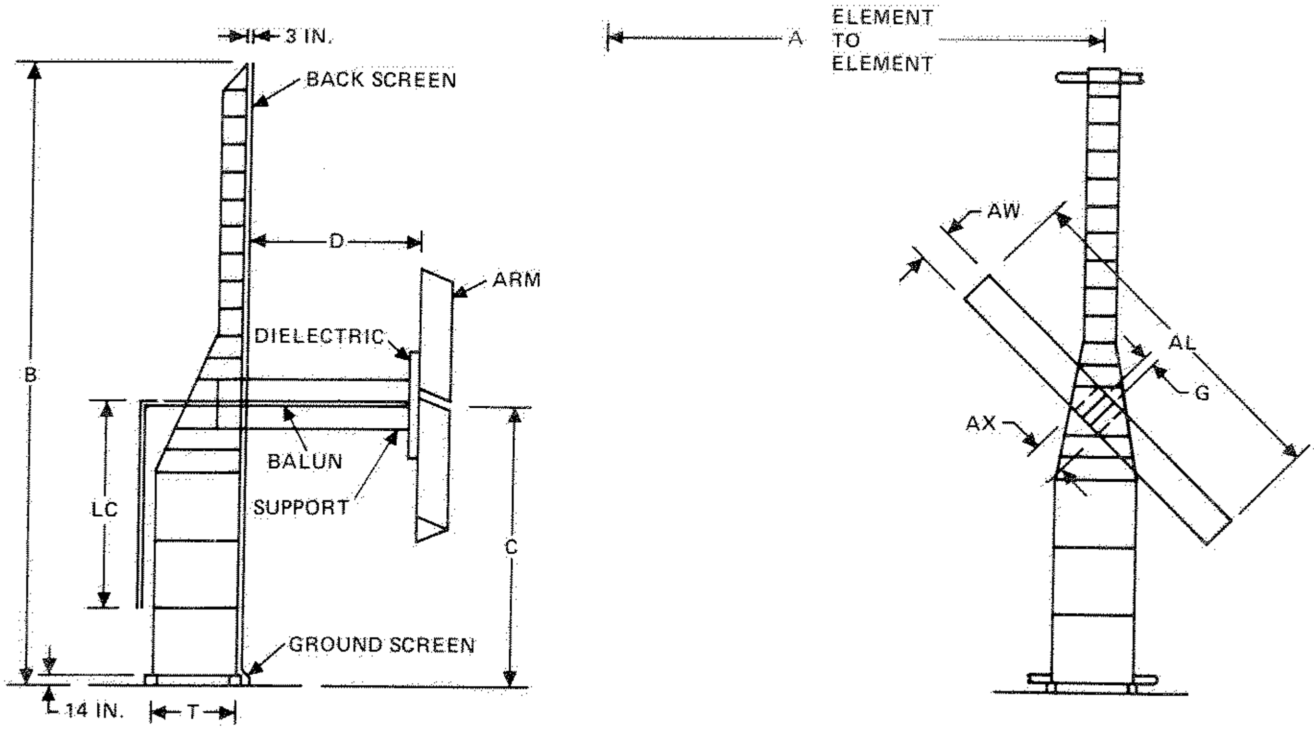


Figure 1-3. Transmit Antenna, Unit 100 (Sheet 1 of 2)



BAND	ORIENTATION	A(FT)	B(FT)	C(FT)	D(FT)	AL(FT)	AX(FT)	AW(FT)	LC(FT)	T(FT)	G(FT)
A	CANTED	90.5	135	60.0	45.1	77.1	7.9	7.8	53.5	18.0	2.43
B	CANTED	67.0	100	44.5	33.5	58.9	5.8	5.9	37.0	15.0	1.56
C	CANTED	49.8	75	33.0	24.8	44.7	4.2	4.5	25.5	12.0	1.85
D	CANTED	36.9	55	24.5	18.4	32.6	3.1	3.4	17.0	9.0	2.97
E	VERTICAL	27.4	45	19.5	13.6	24.7	3.8	2.8	12.0	7.0	1.83
F	VERTICAL	20.3	35	14.5	10.1	18.6	2.8	1.9	7.0	6.0	1.69

* TOWER-TO-TOWER SPACING IS 61.0 FEET

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Figure 1-3. Transmit Antenna, Unit 100 (Sheet 2 of 2)

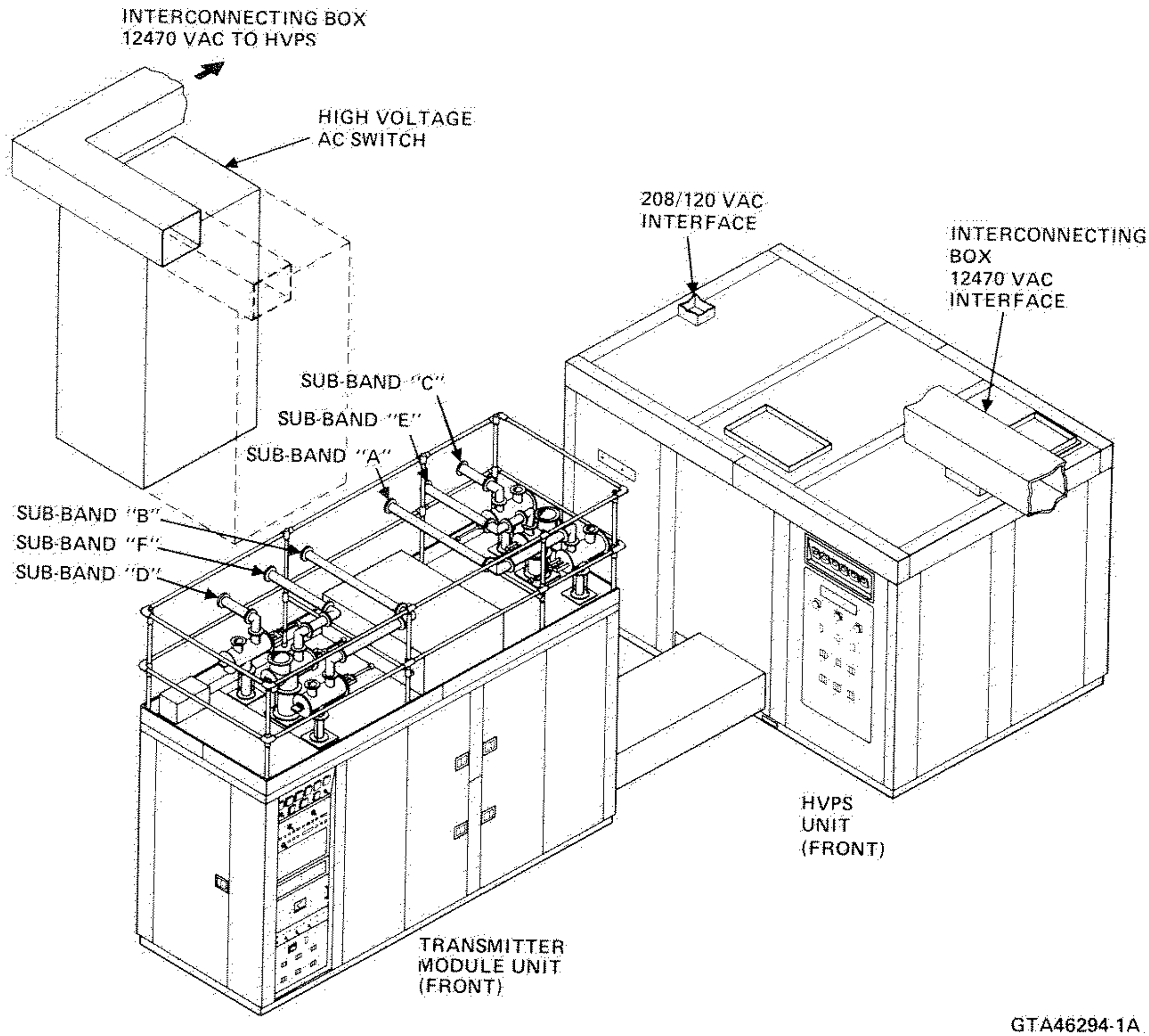

Figure 1-4. Transmitter Modules, Units 110 through 121, High Voltage Power Supply, Units 122 through 133, and High Voltage Ac Switch, Units 222 through 233 (Sheet 1 of 3)

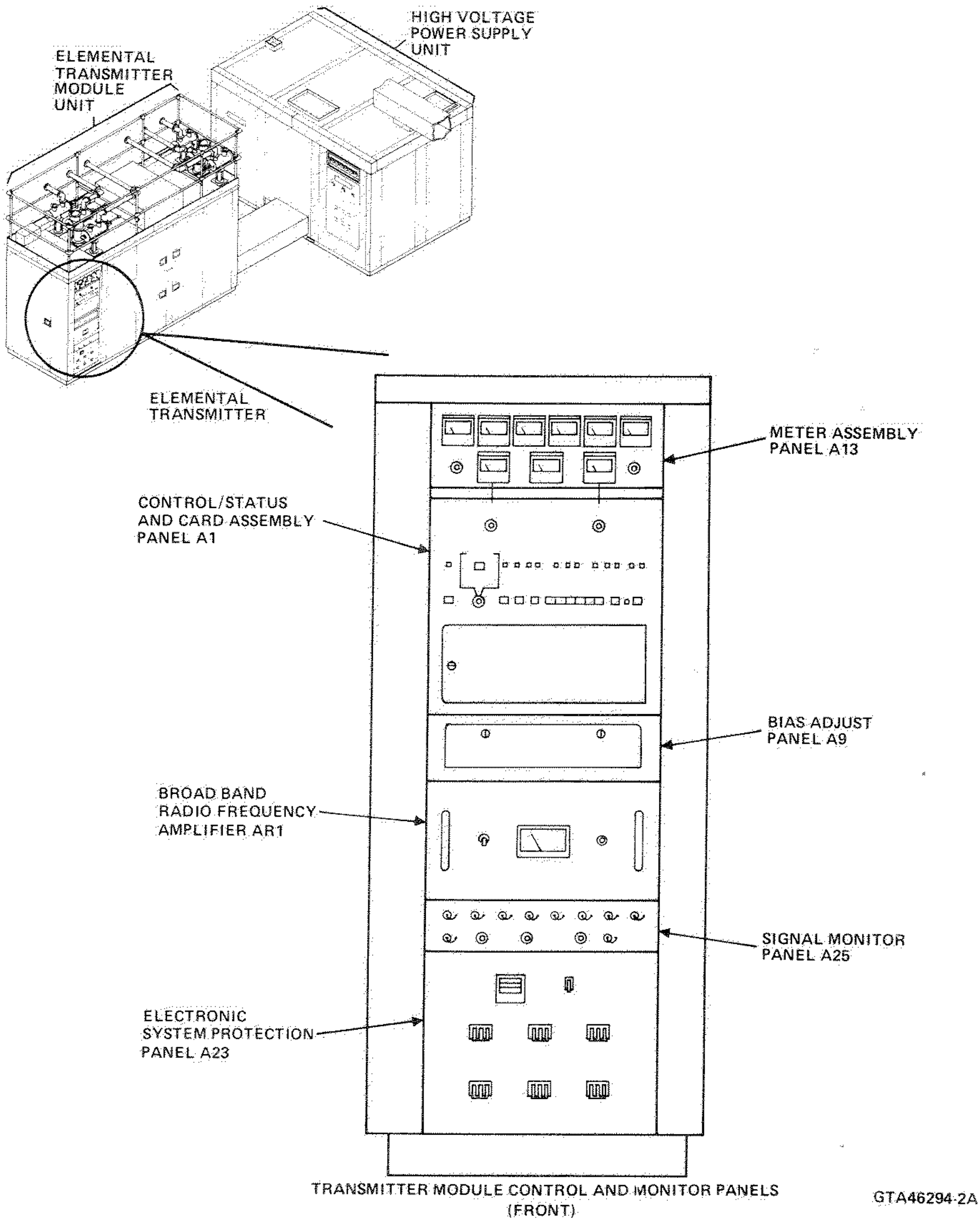

Figure 1-4. Transmitter Modules, Units 110 through 121, High Voltage Power Supply, Units 122 through 133, and High Voltage Ac Switch, Units 222 through 233 (Sheet 2 of 3)

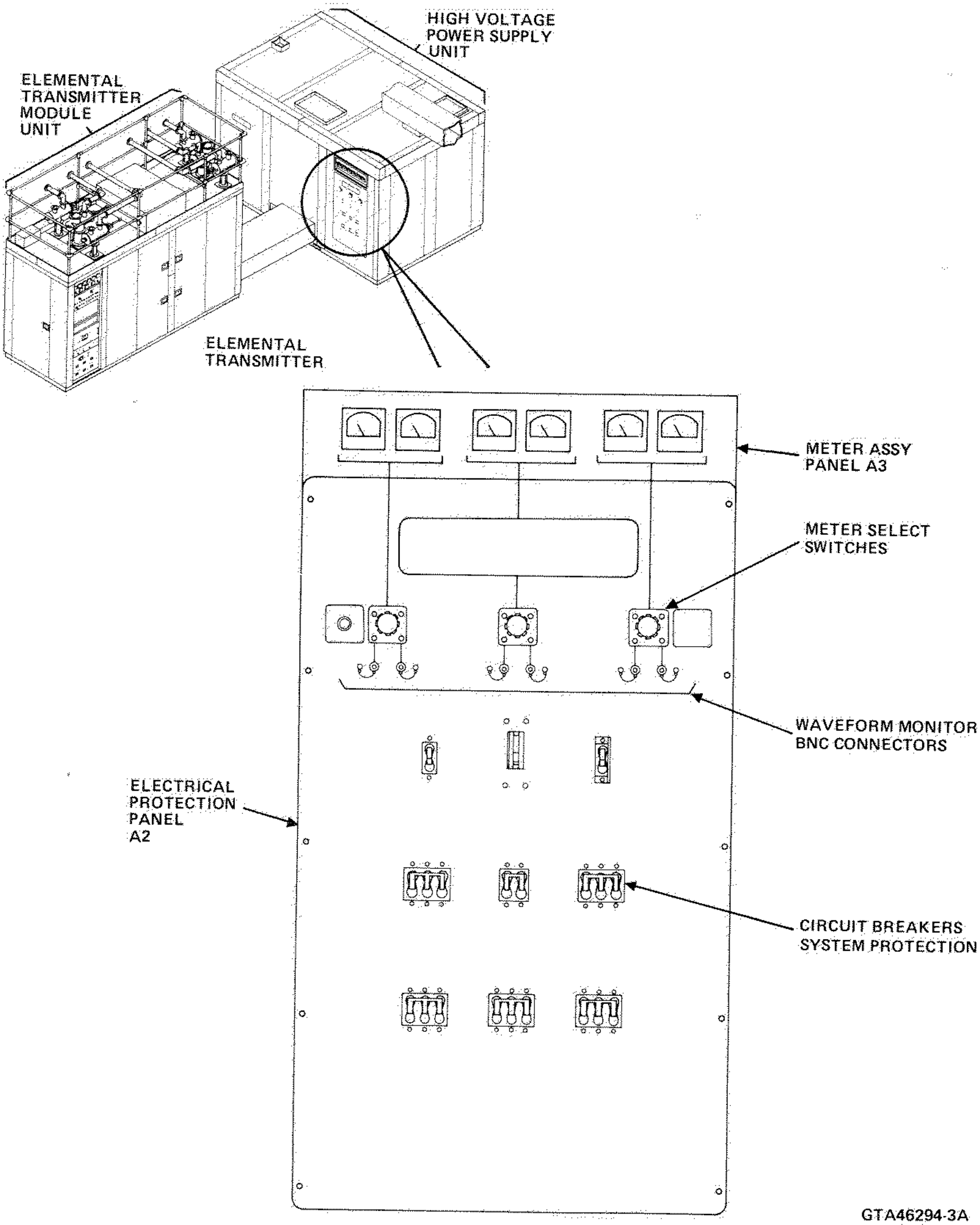

Figure 1-4. Transmitter Modules, Units 110 through 121, High Voltage Power Supply, Units 122 through 133, and High Voltage Ac Switch, Units 222 through 233 (Sheet 3 of 3)

transmitter. The control voltage power supplies (PSs), control relays, and broadband low level amplifier are in the control and monitoring panel area. The input RF signal, remote control commands, and remote monitoring signals are received and distributed by the control and monitoring panel.

5. The last three amplifier stages in the TM are similar. Each stage consists of a tetrode vacuum tube, a grid bias PS assembly, filament PS of discrete components, and anode and screen power furnished by the related HVPS unit. Each amplifier stage has a dummy load connected to the grid of the electron tube. The control and monitor panel comprises the following individual panels:

   a. Meter assembly A13. The top panel is meter assembly A13. The meter assembly panel contains nine meters to monitor transmitter parameters.

   b. Control/status and card assembly panel A1. The control/status and card assembly panel is the second panel from the top. This panel contains control switches, status indicators, and a circuit card panel. Eight circuit card assemblies are located behind the circuit card panel.

   c. Bias adjust panel A9. Bias adjust panel A9 is the third panel from the top. This panel contains variable resistors for adjusting the static current on the intermediate power amplifier (IPA), driver amplifier, and power amplifier (PA) tubes.

   d. Broadband RF PA AR1. The broadband RF PA is located below bias adjust panel A9. This amplifier is a low level RF amplifier. It contains an RF wattmeter on its front panel to indicate its power output.

   e. Signal monitor panel A25. The signal monitor panel is the second panel up from the bottom. This panel consists of BNC test points for connecting external test equipment to monitor various RF signal levels.

   f. Electronic system protection panel A23. The electronic system protection panel is located at the bottom. This panel contains the circuit breakers that supply power to various units within the elemental transmitter.

6. For additional information on the TM, see TO 31P6-2FPS118-81.

1-2.3 <u>High Voltage Power Supplies, Units 122 through 133.</u>

1. The HVPS (Figure 1-4, Sheet 1) is 1 of 12 identical units. Each HVPS is associated with one of the TMs. The HVPS contains the dc anode and screen PSs for the TM intermediate, driver, and PA tube stages. In addition, the HVPS contains a vacuum contactor for the 12,470 V, 3-phase, 60-Hz ac power, the crowbar, the main circuit breaker (CB) for the 208 V ac distribution, a meter assembly panel, and a circuit protection panel.

2. Meter assembly panel A3 and electrical protection panel A2 (Sheet 3) are on the right side of the HVPS unit. The meter assembly panel contains six analog meters that monitor primary input ac voltage and current, and the dc anode and screen PS voltages. The selection of specific monitoring parameters is by meter select switches on the electrical protection panel. This panel also contains BNC connectors to monitor ac voltage and current and dc voltage waveforms, and a system protection group of CBs that are associated with the control of the HVPS subassemblies.

3. Each HVPS is in a free-standing metal cabinet. Air cooling for the TM and HVPS enters at the top of the HVPS at the rate of 4600 to 5000 cfm. Approximately one-half of the air is ducted to the TM while the other one-half cools the HVPS. The HVPS air is exhausted at a port located on the top of the cabinet.

4. For additional information on the HVPS, see TO 31P6-2FPS118-81.

1-2.4 <u>High Voltage Ac Switches, Units 222 through 233.</u> The HVAC switch (Figures 1-1 and 1-4, Sheet 1), is 1 of 12 identical units. The group of 12 HVAC switches serves as the main disconnect for the 12,470 V, 3-phase, 60-Hz ac input to the HVPSs. The HVAC switch is a fused 3-pole knife type. It is operated manually. It has provisions for key interlocks associated with the transmitter that it interfaces. The HVAC switch is located behind a safety barrier in the switch cabinet. The cabinet has safety doors for access to the three fuses. Interface between each HVAC switch output and the associated HVPS input is made at the top of the respective cabinets via an interconnecting box (raceway) common to all switches and power supplies. The raceway carries 12 sets of 12,470 V ac plus ground cables. One set is used to connect each ac switch to a corresponding HVPS.

1-2.5 Transmit Beamformer, Unit 150.

1. The TBF, Unit 150 (Figure 1-5), consists of a single equipment cabinet. The cabinet contains all of the hardware to provide beam-steering drive inputs to the 12 transmitter PA modules. The TBF is located in the control and monitor room of the transmit site building.

2. Figure 1-5, Sheet 1, shows the front view of the TBF cabinet and its complement of rack mounted assemblies. Uppermost in the cabinet is the power ON/OFF assembly N2. Circuit breaker CB1 is the power ON/OFF device for various regulated power supplies in the TBF cabinet. Below the N2 assembly is assembly N3. Digital wire wrap boards (WWBs) N3A101 and N3A105 through N3A115 are in this assembly. The specific name of each board and its reference designator are shown in legend A (Sheet 3). Analog printed wiring board (PWB) assemblies N4 and N5, located midway in the TBF cabinet, contain analog boards N4A1 through N4A18 and N5A1 through N5A18, respectively. The specific name of each board and its reference designator are given in legends B or C (Sheet 3). Below the N5 assembly is channel balance N6 showing two manual balance controls. If removal of a PWB board becomes necessary, a PWB card extractor is mounted internally on this assembly. Analog PWB assembly N7 is in the lower-half of the TBF cabinet, below the channel balance panel. It contains five analog boards, i.e., N7A1, N7A7, N7A8, N7A10, and N7A11. The specific board names and their reference designators are listed in legend D (Sheet 3). A calibration multiplexer (MUX) assembly N8 is above the lowermost panel in the TBF cabinet. It functions as a switching network. It samples various parameters of the transmitter group. An empty panel below the MUX is usable as an access port to the MUX.

3. Figure 1-5, Sheet 2, shows the rear view of the TBF cabinet. It also shows the locations of various components and assemblies. Uppermost in the cabinet is switching assembly A11. This assembly provides selected paths for the 12 transmit channels. Below this assembly is monitor panel A3. It has provisions for making manual adjustments for output voltage on regulated PSs. The midsection of the TBF cabinet has eight voltage regulators. These regulators include VR1 and VR2 (+5 V dc), VR3 and VR4 (-5 V dc), VR5 and VR6 (+15 V dc), and VR7 and VR8 (-15 V dc). The lower left side of the cabinet has the ac-to-dc converter A2. This converter supplies dc power to the voltage regulators.

4. Power input and signal input/output (I/O) cabling is done through the top of the TBF cabinet. Cooling required by the converter and other assemblies in the TBF cabinet is provided by fan assembly N10A1. This is in the extreme lower portion of the cabinet. Air input at the rate of 230 scfm has its intake at the bottom of the cabinet. It is exhausted at the top of the cabinet.

1-2.6 Exciter and Auxiliary Exciter, Units 151 and 152.

1. Exciter and auxiliary exciter, Units 151 and 152, respectively, (Figure 1-6) are identical. Each unit consists of a single equipment cabinet. The cabinet contains hardware to generate RF drive signals used by the TBF. The exciter and auxiliary exciter are in the control and monitor room in the transmit site building.

2. Sheet 2 shows the front view of the exciter and auxiliary exciter cabinet and the rack mounted assemblies. Located at the top of the cabinet (Sheet 1) are temperature sensing switches S1 and S2, relays K1, K2, and K3, and LOCAL/REMOTE switch S3. Shown on Sheet 2 at the top left of the cabinet are PS controllers N4A1 and N4A2, and the divider assembly. Fan assembly A14 is at the top right of the cabinet. Below the fan assembly are circuit breakers CB1 through CB5 (Sheet 4). Circuit breaker CB1 controls cabinet ac power. Circuit breakers CB2 through CB5 control ac power to +60 V dc power supply A6, -60 V dc power supply A7, +15 V dc power supply A8, and -15 V dc power supply A9. These PSs are located below the CBs. Near the top left of the cabinet is rack mounted converter A2. Below converter A2 is analog bucket N1. Analog boards N1A1 through N1A7, N1A9, and N1A11 through N1A13 are in this assembly. The specific name of each board and its reference designator are shown in legend A (Sheet 3). Analog bucket N2 located below N1 contains boards N2A1 through N2A13. The specific names of these boards and their reference designators are shown in legend B (Sheet 3). Digital bucket N3 is below analog bucket N2. Digital boards N3A101 through N3A108 and N3A113 through N3A116 are in

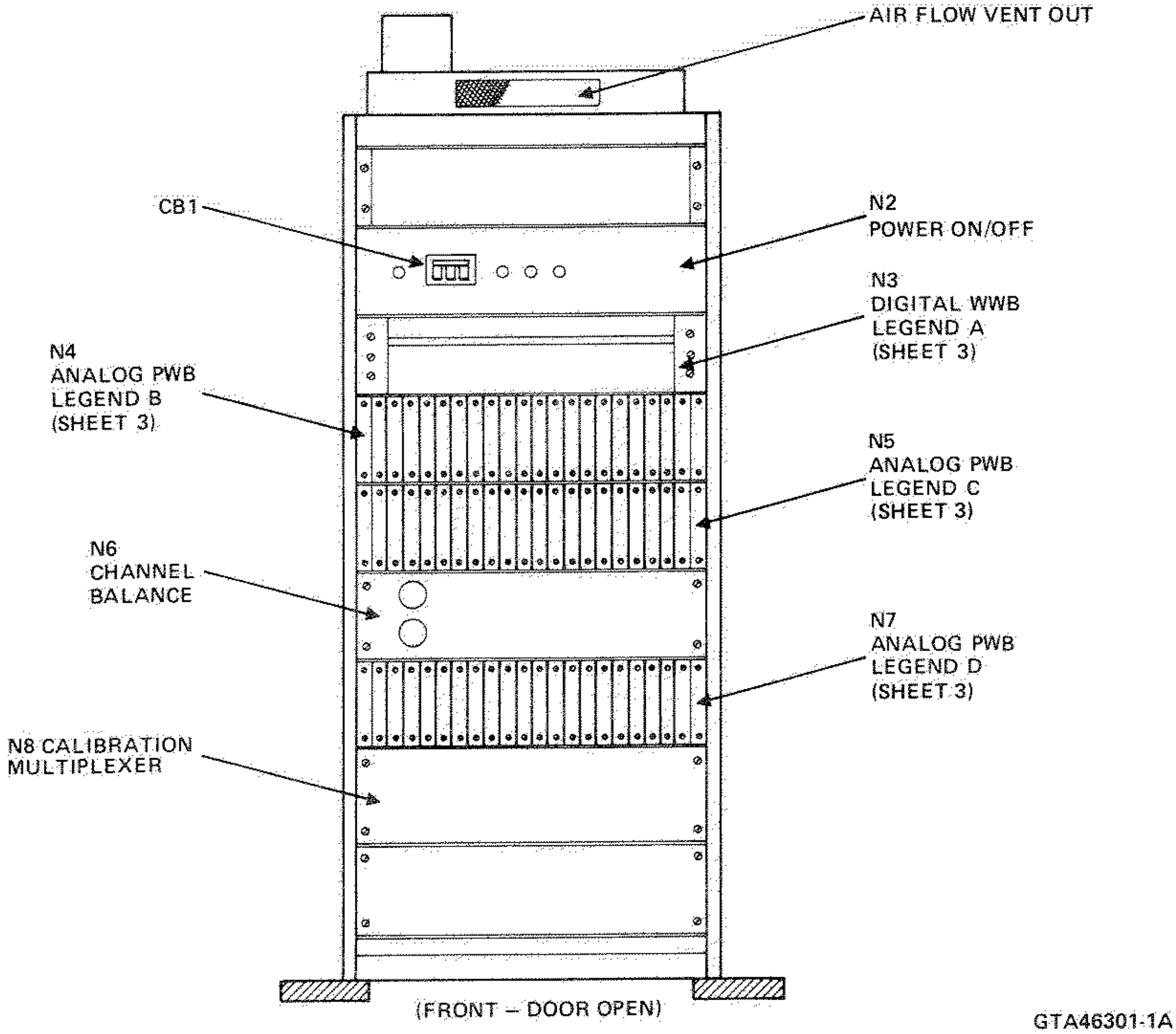

Figure 1-5. Transmit Beamformer, Unit 150 (Sheet 1 of 3)

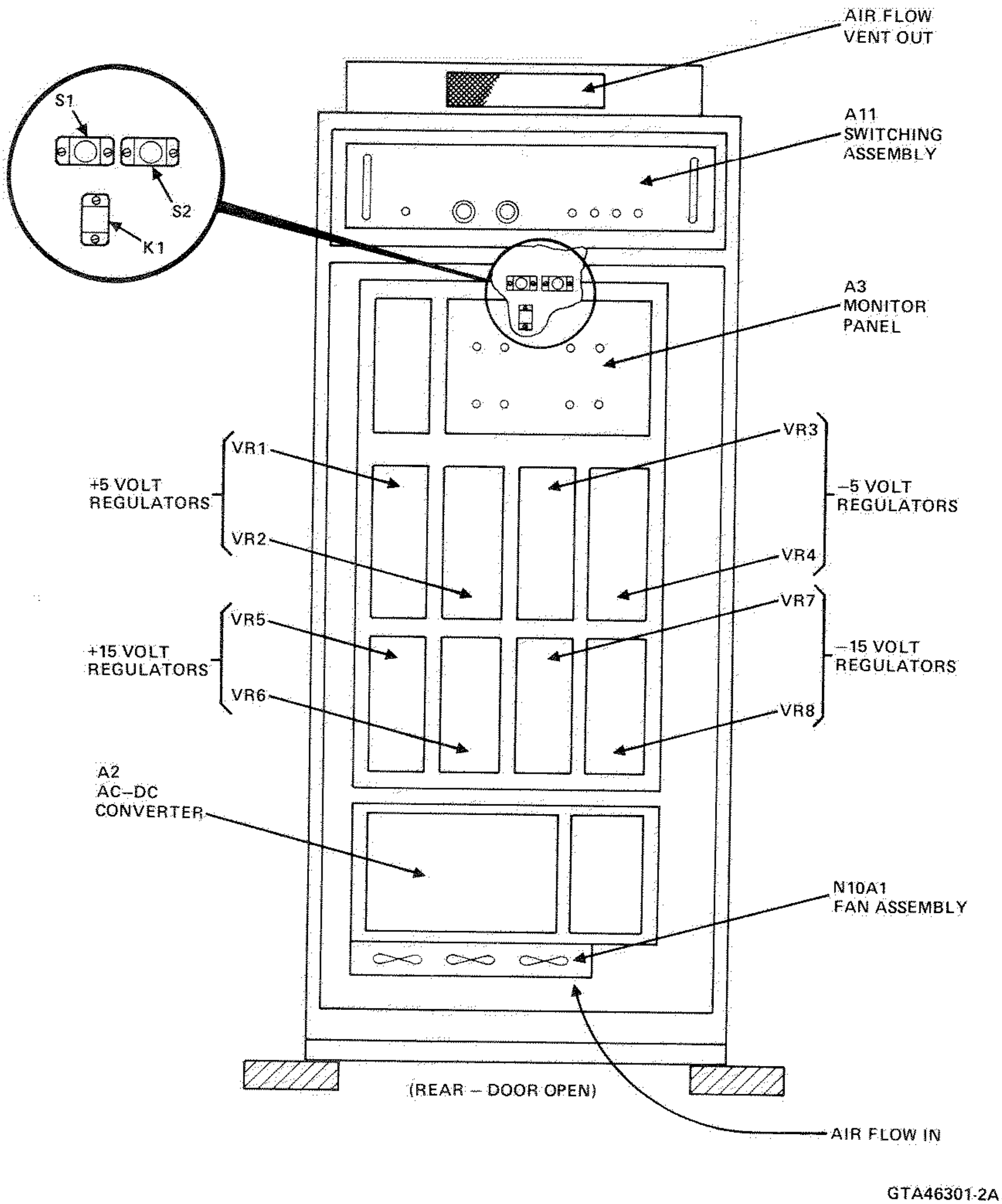

Figure 1-5. Transmit Beamformer, Unit 150 (Sheet 2 of 3)

LEGEND A - DIGITAL WWB N3

CABLE CARD	N3A101
PARTY LINE I/O	N3A105
MAINTENANCE CONTROL	N3A106
DATA COLLECTOR	N3A107
REGISTER	N3A108
REGISTER	N3A109
REGISTER	N3A110
REGISTER	N3A111
REGISTER	N3A113
DECODER DRIVER	N3A114
CALIBRATION MULTIPLEXER, DECODER–DRIVER	N3A115

LEGEND B - ANALOG PWB N4

MODULATOR CONTROL	N4A1
MODULATOR CONTROL	N4A2
MODULATOR CONTROL	N4A3
MODULATOR CONTROL	N4A4
MODULATOR CONTROL	N4A5
RF MODULATOR	N4A7
RF AMPLIFIER	N4A8
RF MODULATOR	N4A9
RF AMPLIFIER	N4A10
RF MODULATOR	N4A11
RF AMPLIFIER	N4A12
RF MODULATOR	N4A13
RF AMPLIFIER	N4A14
RF MODULATOR	N4A15
RF AMPLIFIER	N4A16
VARIABLE ATTENUATOR	N4A17
VARIABLE ATTENUATOR	N4A18

LEGEND C - ANALOG PWB N5

MODULATOR CONTROL	N5A1
MODULATOR CONTROL	N5A2
MODULATOR CONTROL	N5A3
MODULATOR CONTROL	N5A4
MODULATOR CONTROL	N5A5
MODULATOR CONTROL	N5A6
RF MODULATOR	N5A7
RF AMPLIFIER	N5A8
RF MODULATOR	N5A9
RF AMPLIFIER	N5A10
RF MODULATOR	N5A11
RF AMPLIFIER	N5A12
RF MODULATOR	N5A13
RF AMPLIFIER	N5A14
RF MODULATOR	N5A15
RF AMPLIFIER	N5A16
RF MODULATOR	N5A17
RF AMPLIFIER	N5A18

LEGEND D - ANALOG PWB N7

MODULATOR CONTROL	N7A1
RF MODULATOR	N7A7
RF AMPLIFIER	N7A8
VARIABLE ATTENUATOR	N7A10
VARIABLE ATTENUATOR	N7A11

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Figure 1-5. Transmit Beamformer, Unit 150 (Sheet 3 of 3)

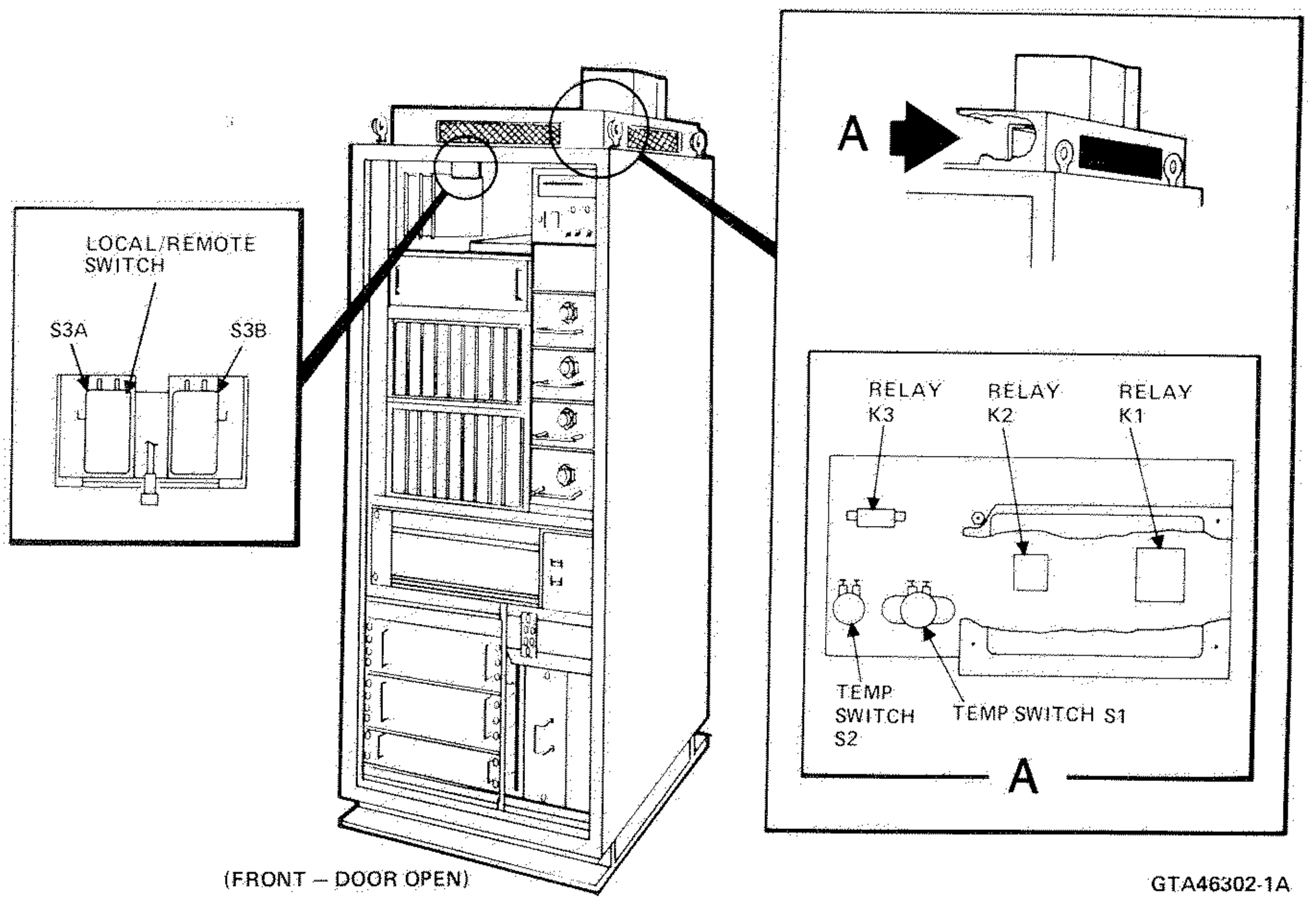
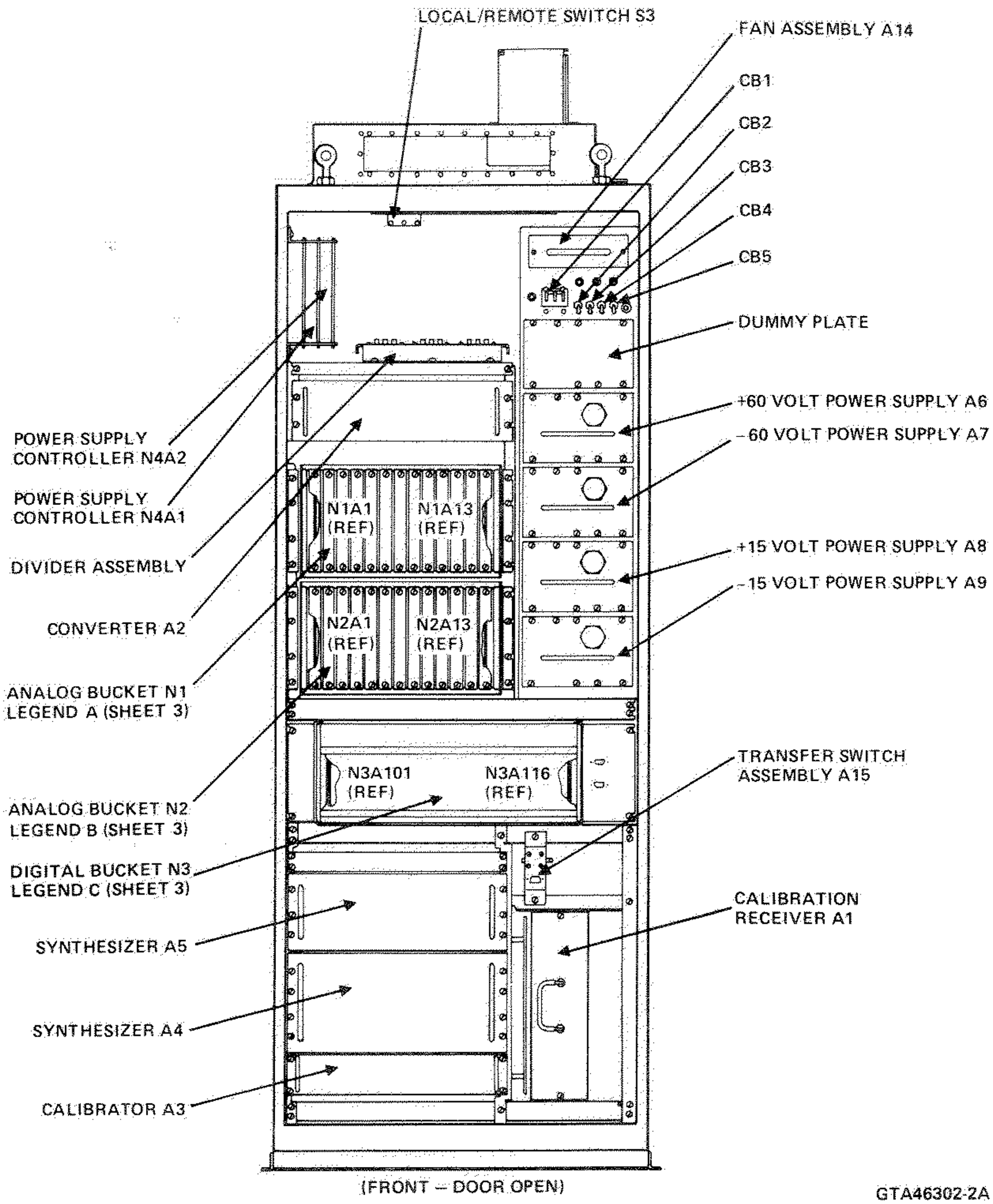


Figure 1-6. Exciter and Auxiliary Exciter, Units 151 and 152 (Sheet 1 of 6)



(NOTE: A3 is non-functional in Unit 152 and may be used as a hot spare for Unit 151.)

Figure 1-6. Exciter and Auxiliary Exciter, Units 151 and 152 (Sheet 2 of 6)

ANALOG BUCKET N1
LEGEND A

D/A CONVERTER	N1A1
RADIO FREQUENCY MIXER	N1A2
POWER AMPLIFIER	N1A3
TONE GENERATOR	N1A4
POWER AMPLIFIER	N1A5
FREQUENCY DIVIDER	N1A6
POWER AMPLIFIER	N1A7
POWER AMPLIFIER	N1A9
POWER AMPLIFIER	N1A11
SUM TAPER ATTENUATOR	N1A12
POWER AMPLIFIER	N1A13

DIGITAL BUCKET N3
LEGEND C

SINE CONVERTER	N3A101
QUAD GENERATOR	N3A102
TIMING CONTROL NO. 2	N3A103
TIMING CONTROL	N3A104
MONITOR CONTROL	N3A105
I&D CONTROL	N3A106
MONITOR RECEIVER	N3A107
RECEIVER CONTROL	N3A108
FREQUENCY CONTROL	N3A113 THRU N3A116

ANALOG BUCKET N2
LEGEND B

RADIO FREQUENCY OSCILLATOR	N2A1
RADIO FREQUENCY OSCILLATOR	N2A2
RADIO FREQUENCY OSCILLATOR	N2A3
RADIO FREQUENCY OSCILLATOR	N2A4
RADIO FREQUENCY OSCILLATOR	N2A5
RADIO FREQUENCY OSCILLATOR	N2A6
RADIO FREQUENCY OSCILLATOR	N2A7
RADIO FREQUENCY OSCILLATOR	N2A8
RADIO FREQUENCY OSCILLATOR	N2A9
RADIO FREQUENCY OSCILLATOR	N2A10
RADIO FREQUENCY OSCILLATOR	N2A11
RADIO FREQUENCY OSCILLATOR	N2A12
RADIO FREQUENCY OSCILLATOR	N2A13

GTA46302-3A

Figure 1-6. Exciter and Auxiliary Exciter, Units 151 and 152 (Sheet 3 of 6)

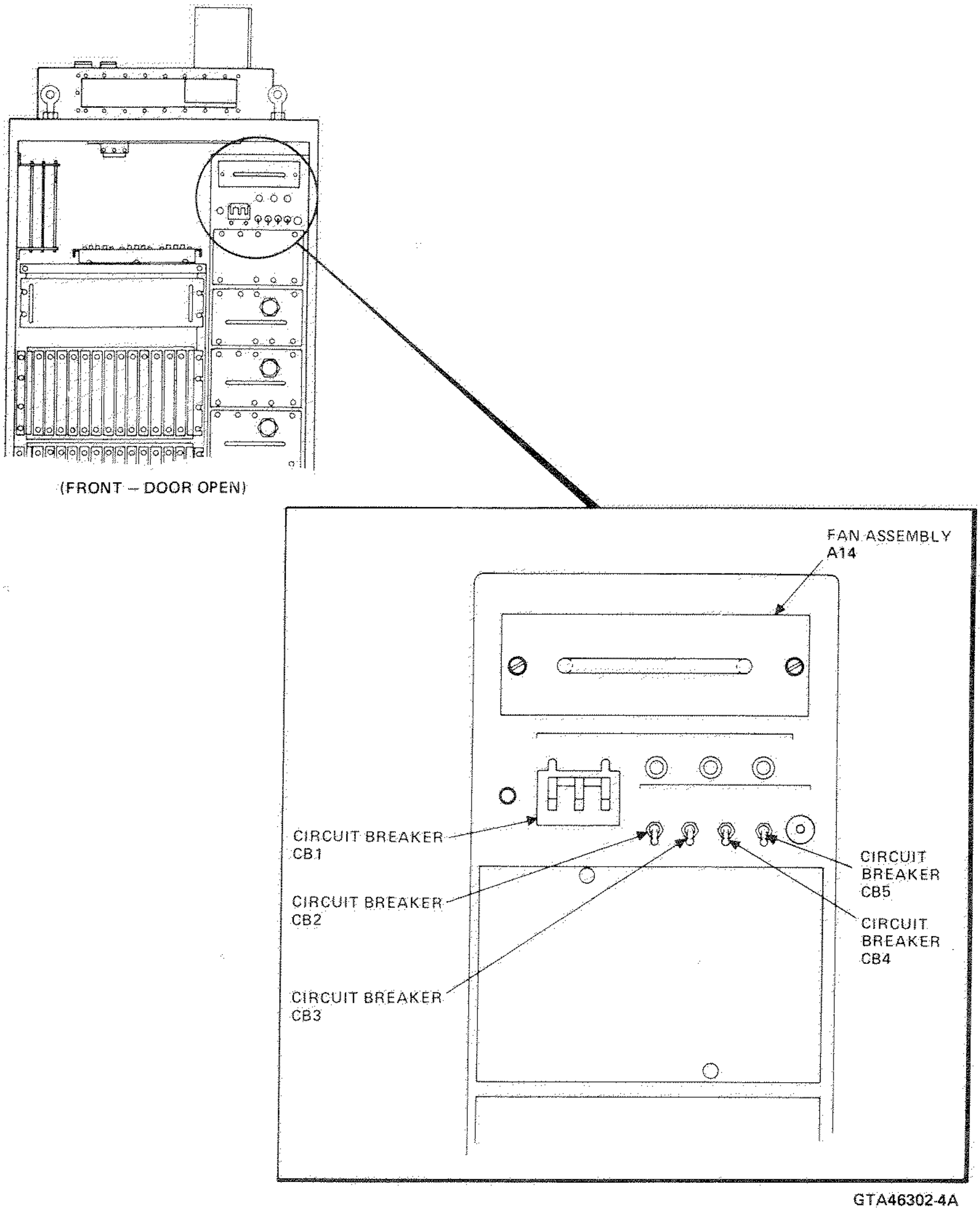


Figure 1-6. Exciter and Auxiliary Exciter, Units 151 and 152 (Sheet 4 of 6)

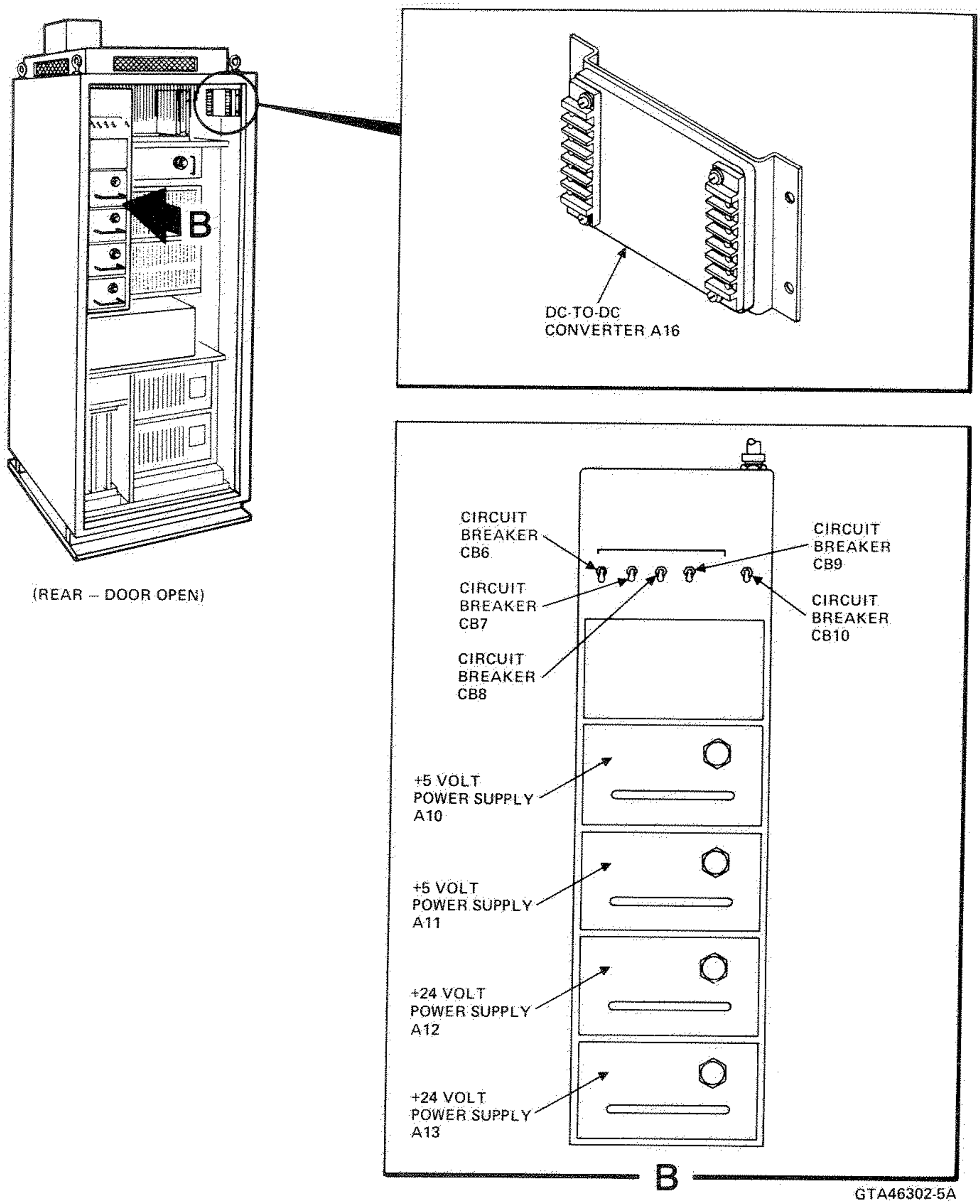
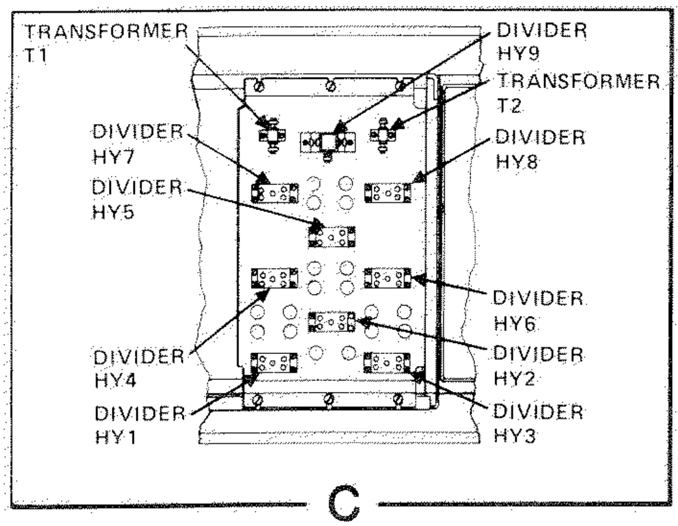
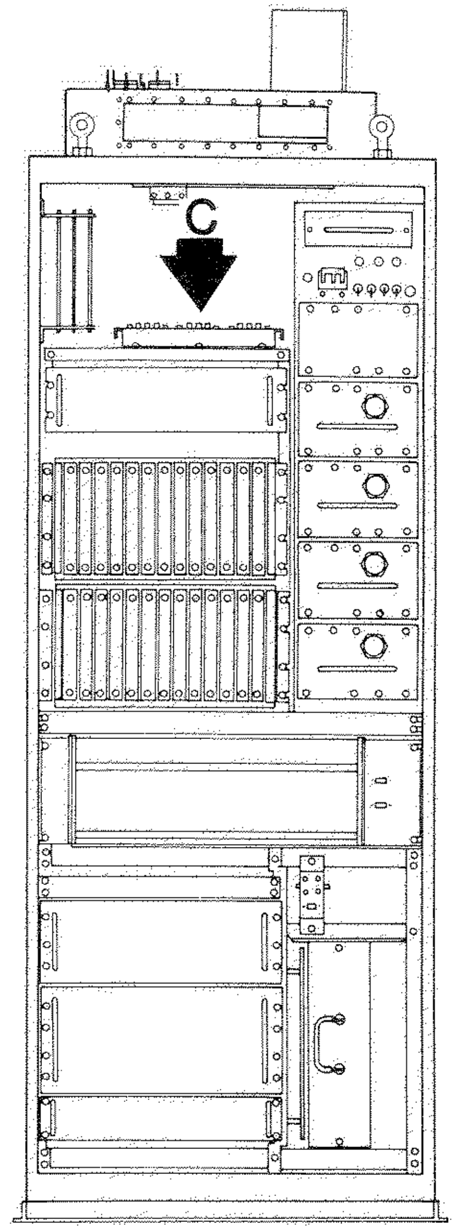


Figure 1-6. Exciter and Auxiliary Exciter, Units 151 and 152 (Sheet 5 of 6)





GTA46302-6A

Figure 1-6. Exciter and Auxiliary Exciter, Units 151 and 152 (Sheet 6 of 6)

this assembly. The specific board names and their reference designators are shown in legend C (Sheet 3). At the bottom left of the cabinet, and mounted in descending position, are synthesizer A5, synthesizer A4, and calibrator A3. To the right of these units is mounted calibration receiver A1. Transfer switch assembly A15 is above calibration receiver A1. A divider assembly made up of transformers T1 and T2 and dividers HY1 through HY9 is located as shown in Sheets 2 and 6 of the figure.

3. The rear view of the exciter cabinet is shown on Sheet 5. Circuit breakers CB6 and CB7 control the ac power input for +5 V dc PSs A10 and A11. Circuit breakers CB8 and CB9 control the ac power input for +24 V dc PSs A12 and A13. Dc-to-dc (+24 V dc to +5 V dc) converter A16 is mounted in the rear upper right corner of the exciter cabinets. It is behind power supply controllers N4A1 and N4A2. Circuit breaker CB10 controls the cabinet ac power outlets.

4. Power input requirements and signal I/O cabling are accomplished through the top of the exciter and auxiliary exciter cabinet. Fan assembly A14 provides 118 scfm of air flow to cool the assemblies within the cabinets.

1-3 LEADING PARTICULARS.

Leading Particulars (Table 1-1) data for the transmitter group includes power requirements, equipment size and weight, and equipment heat dissipation. Cabling requirements are given in the cabling diagrams and wiring lists in circuit diagram TO 31P6-2FPS118-73-1, TO 31P6-2FPS118-73-2, and the facility Real Property Installed Equipment (RPIE) manuals.

1-4 CAPABILITIES AND LIMITATIONS.

Characteristics, parameter data, and environmental requirements for the transmitter group are in Table 1-2. For classified characteristics and parameter data for the radar set, see TO 31P6-2FPS118-1-1.

1-5 EQUIPMENT SUPPLIED.

The Equipment Supplied List (Table 1-3) is a tabulation of all supplied units and assemblies of the transmitter group to the line replaceable unit (LRU) component level. Table 1-3 identifies this equipment by unit and reference designator, common name, official nomenclature, and part number. A reference is provided at each cabinet level entry to the paragraph in this chapter containing the associated equipment physical description. Cables used with the equipment are shown on the diagrams in circuit diagram TO 31P6-2FPS118-73-1. Data about cables that are part of the equipment group are given in the illustrated parts breakdown, TO 31P6-2FPS118-74. Data about cables in commercial equipment used with the group are given in the manuals referenced from paragraph 1-8.

1-6 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

The Equipment Required But Not Supplied List (Table 1-4) gives all equipment needed (but not supplied) for service or installation of the transmitter group equipment. This equipment includes tools, test equipment, cables, connectors, and applicable Government furnished property (GFP). Identification of this equipment in Table 1-4 includes item number (reference from maintenance procedures), nomenclature, manufacturer type/part number, manufacturer, and, as applicable, Commercial and Government Entity (CAGE) code. The manufacturer type/part number, manufacturer, and CAGE information is one of several sources of supply for common tools. Also given are total quantities used at the transmit, operation, and receive sites. This informs the reader of the other users of the same test equipment should the reader's equipment be inoperative, and it is necessary to borrow an operative unit. In the event an item is not available a suitable substitute can be used. Note that the item identifications in Table 1-4 are not consecutive. The identification given for each entry in the table is the identification number assigned to the same item in the Equipment Required But Not Supplied table for the radar set. Use of the identical item numbers in this manual and radar set manual provides consistency among the set of AN/FPS-118(V) series TOs.

1-7 SPECIAL TOOLS AND TEST EQUIPMENT.

Special tools and test equipment lists (Tables 1-5 and 1-6) give those special tools and standard and/or special test equipment required to support maintenance of the transmitter group. Identification of special tools in Table 1-5 includes part number, manufacturer's code or name and address, nomenclature, and use. The use column is a reference to the maintenance procedure in Chapter 6 of this manual describing use of a tool. Identification of test equipment listed in Table 1-6 includes type designation, alternate type designation (where applicable), nomenclature, and use. The use column is a reference to a typical maintenance procedure in Chapter 6 of this manual describing use of the respective test equipment.

1-8 RELATED TECHNICAL MANUALS.

Table 1-7 lists related TOs and publications needed to operate and maintain the equipment. For a complete list of all AN/FPS-118(V) series TOs and related publications, refer to the List of Applicable Publications (LOAP), TO 31P6-2FPS118-01.

Table 1-1. Leading Particulars

Parameter/Equipment	Particulars
Dimensions:	
TMs, Units 110 through 121	85.00 in high; 150.00 in wide; 54.75 in deep; 127 in high to top of railing.
HVPSs, Units 122 through 133	92.00 in high; 144.00 in wide; 90.00 in deep
HVAC Switches, Units 222 through 233	90.00 in high; 48.00 in wide; 38.00 in deep
TBF, Unit 150	98.00 in high; 32.00 in wide; 32.00 in deep
Exciter and Auxiliary Exciter, Units 151 and 152	98.00 in high; 32.00 in wide; 32.00 in deep
Unpacked Weight:	
TMs, Units 110 through 121	5600 lb per unit
HVPSs, Units 122 through 133	12,000 lb per unit
HVAC Switches, Units 222 through 233	1800 lb per unit
TBF, Unit 150	800 lb
Exciter and Auxiliary Exciter, Units 151 and 152	1350 lb
Power Requirement:	
TMs, Units 110 through 121	
Ac Power (from HVPS)	208 V, 3-phase, 60-Hz ac, 10,000 VA
	120 V, 1-phase, 60-Hz ac, 1000 VA
Dc power (from HVPS)	
IPA	Anode 3.5 kV, 4A; Screen 1.5 kV, 0.5 A
Driver	Anode 4.5 kV, 6A; Screen 1.5 kV, 0.5 A
PA	Anode 11.0 kV, 20A; Screen 1.5 kV, 1.5 A
HVPSs, Units 122 through 133	12,470 V, 3-phase, 60-Hz ac, 285,000 VA
	208/120 V, 3-phase, 60-Hz ac, 14,000 VA
	120 V, 1-phase, 60-Hz ac, 1000 VA (UPS[1] Ridethru Source)
TBF, Unit 150	208/120 V, 3-phase, 60-Hz ac, 2200 VA

Table 1-1. Leading Particulars -CONT

Parameter/Equipment	Particulars
Exciter and Auxiliary Exciter, Units 151 and 152	208/120 V, 3-phase, 60-Hz ac, 1600 VA each unit
Heat Dissipation (nominal):	
TMs, Units 110 through 121	653,000 BTU/HR each unit
HVPSs, Units 122 through 133	34,150 BTU/HR each unit
TBF, Unit 150	6830 BTU/HR
Exciter and Auxiliary Exciter, Units 151 and 152	4712 BTU/HR each unit

[1]Uninterruptible Power Supply

Table 1-2. Capabilities and Limitations

Characteristic	Parameter
Transmit Antenna, Unit 100:	
Type	Broadband Dipole (with balun)
Frequency Range	5 to 28 MHz
Number of Bands	6
Elements per Band	12
Power Handling	100 kW from VSWR[1] = 1.0 to VSWR = 1.6
Directive Gain	20.6 to 26.0 dB
Elevation Coverage (-3 dB Points)	5 MHz 7.5° to 30°
	28 MHz 5° to 12°
Azimuth Beamwidth	7° to 9.9° at Broadside Uniform Illumination
Scan Limits	±27° (-3 dB points to ±30)
Sidelobes	See classified TO 31P6-2FPS118-1-1
Backlobe	See classified TO 31P6-2FPS118-1-1
Elemental Transmitter, Units 110 through 133:	
Type	Broadband (vacuum tube design)
Frequency Range	5 to 28 MHz
Subbands	Band A 5.0 to 6.79 MHz
	Band B 6.69 to 9.14 MHz
	Band C 9.04 to 12.30 MHz
	Band D 12.20 to 16.55 MHz

Table 1-2. Capabilities and Limitations -CONT

Characteristic	Parameter
	Band E 16.45 to 22.30 MHz
	Band F 22.20 to 28.00 MHz
Subband Change Time	100 milliseconds
RF Input Drive Level (into 50 Ohms)	Minimum +17 dBm ± 2 dB
RF Outputs	6 (50 Ohms)
Harmonic Distortion (input level +17 dBm)	Down 40 dB (minimum) from carrier center frequency amplitude
Rated RF Power Output	100 kW per subband (each elemental transmitter)
TBF, Unit 150:	
RF Inputs	2 (Exciter and Auxiliary Exciter)
Input Level	+20 dBm ± 0.5 dB into 50 Ohms
Frequency Range	5 to 28 MHz in 1-Hz steps
Harmonic Distortion	43 dB down from carrier center frequency amplitude
Output Channels	12 independent
Output Level	+20 dBm ± 0.5 dB into 50 Ohms (input level A +20 dBm)
Phase Control	Each channel adjustable over 360° range in increments of 1.4°
Switching Time (Power, Amplitude or Phase)	<3 milliseconds
Exciter and Auxiliary Exciter, Units 151 and 152:	
Operating Frequency	5 to 28 MHz (1-Hz steps)
Modulation	FM/CW,[2] FM/ICW,[3] CW[4]
Sweep (Frequency vs Time)	Positive
Bandwidth	5, 10, 20, and 40 kHz
Waveform Rep Rate	10, 12.5 15, 18, 20, 25, 30, 36, 40, 45, 50, 54, and 60 Hz
FM/ICW Duty Cycle	1/2, 1/3, 1/4, 1/6, 1/8
Configuration Time	≤ 5 ms
Output Level	+20 dBm ± 0.5 dB
Output Taper	1 step of 3 dB
Output Impedance	50 Ohms
Frequency Standard (Calibrators 151A3 and 152A3)	
Frequency	1 MHz and 5 MHz
Stability	5 x 10^{-10}/Day
Calibration Receiver 151A1, 152A1	

Table 1-2. Capabilities and Limitations -CONT

Characteristic	Parameter
Gain, maximum	20 dB
Gain, range	20 dB
Gain, error	±0.1
I-Q Balance	±0.1 amplitude, ±2° Phase
System Clock (Ref Time Base)	8.2944 MHz
Temperature - operation:	
Environmentally controlled areas (all equipment)	+65 to +75 °F (+18.3 to +23.9 °C)
Nonenvironmentally controlled areas (all equipment)	+50 to +105 °F (+10 to +40.6 °C)
Outdoor areas (all equipment)	-40 to +100 °F (-40 to +37.8 °C) (without solar loading)
Temperature - Nonoperation: (all equipment)	-40 to +125 °F (-40 to +51.7 °C)
Relative humidity - operation:	
Environmentally controlled areas (all equipment)	40% to 60%
Nonenvironmentally controlled areas (all equipment)	10% to 100%
Relative humidity - nonoperation: (all equipment)	10% to 100%
Ice - operation (all outdoor equipment)	2.0 in rime
	1.5 in clear
Ice - survive (all outdoor equipment)	Ice +50 knot wind
Wind - operation (all outdoor equipment)	No performance degradation up to 40 knots at 30 feet above ground level
Wind - survive (all outdoor equipment)	Up to 90 knots at 30 feet above ground level

[1]Voltage standing wave ratio

[2]Frequency modulation/continuous wave

[3]Frequency modulation/interrupted continuous wave

[4]Continuous wave

Table 1-3. Equipment Supplied List

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
	• Transmitter group (Signal transmission group)	Transmitter Group		1-2
	Segment 1$^{(V)1}$	OT-139/FPS-118(V)	7343532G1	
	Segments 2 and 3$^{(V)1}$	OT-139A/FPS-118(V)	7343532G2	
	Segments 1 and 2$^{(V)2}$	OT-180/FPS-118(V)	7343532G3	
	Segment 3$^{(V)2}$	OT-180A/FPS-118(V)	7343532G4	
100	• • Transmit antenna			
	Segment 1$^{(V)1}$		7325110G1	
	Segments 2 and 3$^{(V)1}$		7344912G1	
	Segments 1 and 2$^{(V)2}$		7344912G1	
	Segment 3$^{(V)2}$		7325110G1	
	• • Elemental transmitter	Elemental transmitter T-1524/FPS-118(V)	7252903G1$^{(V)1}$ 7252903G2$^{(V)2}$	
110 through 121	• • • TM		126101-1	1-2.2
A1	• • • • Control/status and card assembly panel		126117-1	
A1	• • • • • Control RF feedback Circuit card assembly		150125-1	
A2	• • • • • Signal monitor Circuit card assembly		150126-1	
A3	• • • • • Band filter driver Circuit card assembly		150144-1	
A4	• • • • • Band command Circuit card assembly		150129-1	
A5	• • • • • Band prove Circuit card assembly		150122-1	
A6	• • • • • Bias control and reset Logic circuit card assembly		150127-1	
A7	• • • • • Serial command Circuit card assembly		150130-1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
A8	• • • • • Serial status Circuit card assembly		150128-1	
A9	• • • • • HV control Circuit card assembly		150118-1	
A10	• • • • • Water flow Circuit card assembly		150120-1	
A11	• • • • • Fault overload Circuit card assembly		150119-1	
A12	• • • • • First event logic Circuit card assembly		150121-1	
A13	• • • • • Test meter scaling Circuit card assembly		150124-1	
A14	• • • • • Extender service Circuit card assembly		150161-1	
A15 through A17	• • • • • RF detector		109-0569	
A18	• • • • • Distribution wiring Circuit card assembly		150157-1	
AR1 through AR3	• • • • • RF amplifier		109-0615	
AR4, AR5	• • • • • Intermediate frequency (IF) amplifier		150153-1	
AR4A1-5A1	• • • • • RF-IF amplifier Circuit card assembly		150155-1	
A2, A3	• • • • Grid detector		126110-1	
A4	• • • • PA grid detector		126111-1	
A5	• • • • PA anode detector		126112-1	
A6	• • • • IPA monitoring network		126113-1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
A7	• • • • Driver amplifier monitoring network		126114-1	
A8	• • • • RF ARC sensor		150101-1	
A8A1	• • • • • ARC sensor component board		126177-1	
A9	• • • • Bias adjust panel		126118-1	
A10	• • • • RF IPA anode sample pickup		130390-1	
A11	• • • • RF driver amplifier anode sample pickup		130386-1	
A12	• • • • PA monitoring network		126121-1	
A13	• • • • Meter assembly panel		126158-1	
A14 through A20	• • • • ARC sensor probe		150100-1	
A21	• • • • Parasitic suppressor		126197-1	
A22	• • • • Parasitic suppressor		130469-1	
A23	• • • • Electron system panel protection		126119-1	
A24	• • • • Relay assembly		126120-1	
A25	• • • • Signal monitor panel		150123-1	
AR1	• • • • RF broadband amplifier		109-0560	
AT1	• • • • IPA grid dummy load		126106-1	
AT2	• • • • Driver amplifier grid dummy load		126107-1	
AT3	• • • • PA grid dummy load		126108-1	
DC1	• • • • Directional coupler		160-0111	
DC2	• • • • Directional coupler		160-0100	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
DC3	• • • • Directional coupler assembly		160-0105	
DC4	• • • • Directional coupler assembly		160-0106	
DC5	• • • • Directional coupler assembly		160-0107	
DC6	• • • • Directional coupler assembly		160-0108	
DC7	• • • • Directional coupler assembly		160-0109	
DC8	• • • • Directional coupler assembly		160-0110	
FL1	• • • • IPA grid band pass - Band ABC filter		126125-1	
FL2	• • • • IPA grid band pass - Band DE filter		126126-1	
FL3	• • • • IPA grid band pass - Band F filter		126127-1	
FL4	• • • • Driver amplifier grid band pass - Band ABC filter		126128-1	
FL5	• • • • Driver amplifier grid band pass - Bands DE&F filter		126129-1	
FL7	• • • • PA grid band pass - Band pass filter		126131-1	
FL8	• • • • PA grid band pass - Bands CD&E filter		126132-1	
FL9	• • • • PA grid band pass - Band F filter		126133-1	
FL10	• • • • PA output band pass - Band A filter		126134-1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
FL11	• • • • PA output band pass - Band B filter		126135-1	
FL12	• • • • PA output band pass - Band C filter		126136-1	
FL13	• • • • PA output band pass - Band D filter		126137-1	
FL14	• • • • PA output band pass - Band E filter		126138-1	
FL15	• • • • PA output band pass - Band F filter		126139-1	
K6	• • • • Coaxial relay		150143-1	
PS1	• • • • Dc PS		109-0562	
PS2	• • • • Dc PS		109-0563	
PS3	• • • • IPA bias PS		126145-1	
PS4	• • • • Driver amplifier bias PS		126146-1	
PS5	• • • • PA bias PS		126155-1	
PS6	• • • • Dual DC PS		109-0561	
S32 through S35	• • • • Dummy load/RF output transfer switch		150517-1	
S36	• • • • Dummy load/RF output transfer switch		150516-1	
S37	• • • • Dummy load/RF output transfer switch		150516-1	
S38	• • • • Grounding switch		126171-1	
122 through 133	• • • HVPS		126102-1	
A1	• • • • Electronic crowbar		150110-1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
A2	• • • • Electrical system protection panel		150113-1	
A3	• • • • Meter assembly panel		150115-1	
A4	• • • • Electric motor controller		109-0605	
S2	• • • • Grounding lever switch		150116-1	
Z1	• • • • Phase monitor		149651-1	
Z2	• • • • Phase monitor		149651-1	
222 through 233	• • • HVAC switch		150117-1	
150	• • TBF		7325112G1	
A11	• • • Switching assembly		7344745G1	
N3A101	• • • Circuit card assembly (Cable card)		77D607097G1	
A105	• • • Circuit card assembly (Party line I/O)		7245639G1	
A106	• • • Circuit card assembly (Maintenance control)		7245645G1	
A107	• • • Circuit card assembly (Data collector)		7245643G1	
A108 through A111 A113	• • • Circuit card assembly (Register)		7245641G1	
A114	• • • Circuit card assembly (Decoder-driver)		7245891G1	
A115	• • • Calibration multiplexer decoder-driver		7252342G1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
N4A1 through A5 N5A1 through A6 N7A1	• • • Modulator control		77D607152G1	
N4A7 A9 A11 A13 A15 N5A7 A9 A11 A13 A15 A17 N7A7	• • • RF modulator		77D607154G1	
N4A8 A10 A12 A14 A16 N5A8 A10 A14 A16 A18 N7A8	• • • RF amplifier		7344737G1	
N4A17 N7A10	• • • Variable attenuator		7325283G1	
N4A18 N7A11	• • • Variable attenuator		7325283G2	
N10A1	• • • Fan assembly		7343842G1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
A2	• • • Ac-to-Dc converter (15/25 V type)		7344735G1	
A3	• • • Monitor panel		7344814G1	
VR1 through VR4	• • • Voltage regulator (5 V type)		77D609500G1	
VR5 through VR8	• • • Voltage regulator (15 V type)		77D609503G1	
151	• • Exciter		7328386G1	
152	• • Auxiliary exciter		7328386G2	
A1	• • • Calibration receiver		7345028G1	
A2	• • • Converter		7846107P1	
A3	• • • Calibrator (frequency)		77C714803P1	
A4 A5	• • • Synthesizer		77C714804P1	
A6 A7	• • • PS (60 V type) PS (60 V type)		7343908G1 7343908G1	
A8	• • • PS (15 V type)		7329140G1	
A8	• • • PS (15 V type)		7328363G1	
A10 A11	• • • PS (5 V type)		7343912G1	
A12 A13	• • • PS (24 V type)		7343910G1	
A14	• • • Fan assembly		7344993G1	
A15	• • • Transfer switch assembly		77D613073G1	
A16	• • • PS (Dc-to-Dc Converter)		77C723326G1	
N1A1	• • • D/A converter		77D611558G1	
A2	• • • RF mixer		77D611561G1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
A3 A5 A7 A9 A11 A13	• • • Power amplifier		77D611567G1	
A4	• • • Tone generator		77D613190G1	
A6	• • • Frequency divider		77D611718G1	
A12	• • • Sum taper attenuator		77D611570G2	
N2A1	• • • RF oscillator		77D613152G1	
A2	• • • RF oscillator		77D613154G1	
A3	• • • RF oscillator		77D613156G1	
A4	• • • RF oscillator		77D613158G1	
A5	• • • RF oscillator		77D611573G1	
A6	• • • RF oscillator		77D613146G1	
A7	• • • RF oscillator		77D613160G1	
A8	• • • RF oscillator		77D613138G1	
A9	• • • RF oscillator		77D613140G1	
A10	• • • RF oscillator		77D613142G1	
A11	• • • RF oscillator		77D613144G1	
A12	• • • RF oscillator		77D613148G1	
A13	• • • RF oscillator		77D613150G1	
N3A101	• • • Sine converter		7252197G1	
A102	• • • Quad generator		7252179G1	
A103	• • • Control timing No. 2		7252177G1	
A104	• • • Control timing		7252175G2	
A105	• • • Control monitor		7252199G1	

Table 1-3. Equipment Supplied List -CONT

Reference Designator	Common Name	Official Nomenclature	Part Number	Group Description Reference
A106	• • • Interface and distribution control		7252185G1 (Exciter) 7252185G4 (Aux Exciter)	
A107	• • • Receiver monitor		7252157G1	
A108	• • • Receiver control		7252155G1	
A113 through A116	• • • Frequency controller		7252193G1	
N4A1 A2	• • • PS controller		77D611601G1	

Table 1-4. Equipment Required But Not Supplied

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
Items 2 through 17 are Common Test Equipment							
2	Analyzers						
a	Data Error Analyzer	Fireberd 2000 Opt. 004	Tele. Comm. Techniques Corp.	61141	1	1	1
	(Preferred)	5500	Phoenix Micro System Inc.	79824	-	-	-
b	Interface, RS449-422/423 DTE/DCE	40200	Tele. Comm. Techniques Corp.	61141	1	1	1
	(Preferred)	5500-420	Phoenix Micro System Inc.	79824	-	-	-
c	Logic Probe	545A	Hewlett-Packard Co.	28480	2	2	2
d	Analyzer, Spectrum (Display Main Frame)	141T	Hewlett-Packard Co.	28480	3	-	3
e	Plug-in, IF Section	8552B	Hewlett-Packard Co.	28480	3	-	3
g	Plug-in, RF Section	8554B	Hewlett-Packard Co.	28480	3	-	3
h	Logic Pulser	546A	Hewlett-Packard Co.	28480	2	2	2
i	Network Analyzer	8753A	Hewlett-Packard Co.	28480	1	-	1
j	Test Set, Transmission/ Reflection [with Adapter, 7MM to (N) (F) 50 Ohm]	85044A	Hewlett-Packard Co.	28480	1	-	1
3	Board Extenders						
b	Digital (WWB[4])	7327173G1	General Electric Co.	03538	3	-	3
f	RF Board Extender (TBF)	7342481G1	General Electric Co.	03538	3	-	-
g	RF Board Extender	7342481G2	General Electric Co.	03538	3	-	3
h	PWB[8] Extender	10773727	General Electric Co.	03538	3	-	-
4	Clips (IC[5] Tests)						
a	Clip 16 Pin IC Test	923700	AP Incorporated	30146	2	2	2

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
b	Clip Min	141-020120-009	Foundation Instruments Inc.	36658	1	1	1
c	Clip 24 Pin IC Test	923714	AP Incorporated	30146	2	2	2
5	Counters						
a	Counter, Frequency	5342A OPT 1 & 3	Hewlett-Packard Co.	28480	1	-	1
	(Preferred) Counter, Frequency	548A-05-06-08-W10	Hewlett-Packard Co.	28480	1	-	1
6	Generators						
a	Generator, Microwave Signal	8683B	Hewlett-Packard Co.	28480	1	1	1
b	Generator, Signal	8640B-003	Hewlett-Packard Co.	28480	3	-	-
e	Degaussing Coil	9317	G.C. Electronics	72653	1	1	1
f	Oscillator, Audio	200CD	Hewlett-Packard Co.	28480	1	1	1
g	Generator, Pattern Error Detector	3780A	Hewlett-Packard Co.	28480	1	1	1
h	Generator, Pulse Function	8116A/OPTOO1	Hewlett-Packard Co.	28480	1	-	1
7	Loads						
a	Load, Solid State	PS[2] L-1000	Acme Electric Corp	00159	1	1	1
b	Load Battery	1090	Austron Inc.	24672	1	1	1
9	Meters						
a	Meter, Power	435A OPT. 001	Hewlett-Packard Co.	28480	3	1	3
b	Power Sensor	8482A	Hewlett-Packard Co.	28480	3	1	3
c	Power Sensor	8482B	Hewlett-Packard Co.	28480	3	1	3
d	Power Sensor	8481A	Hewlett-Packard Co.	28480	1	1	1
e	Meter, Volt, Ohm	630NS	Triplett Corp.	60741	3	1	3
f	Multimeter, Digital	8050A	John Fluke Mfg., Co., Inc.	89536	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
g	Probe, High Voltage	80K-40	John Fluke Mfg., Co., Inc.	89536	1	1	1
h	Set, Test Probe	Y8134	John Fluke Mfg., Co., Inc.	89536	3	1	3
i	Clamp-On, Current ac Transformer	80I-600	John Fluke Mfg., Co., Inc.	89536	3	1	3
j	Digibridge, RLC	1658-9700	Gen Rad Inc.	24655	1	1	1
k	Ammeter, ac Clamp-On	RS-300	Amprobe Instrument	15566	3	1	3
m	Voltmeter, RF	3406A	Hewlett-Packard Co.	28480	1	1	1
n	Meter, RF Vector Impedance	4193A	Hewlett-Packard Co.	28480	3	-	-
o	Multimeter, Digital	3468A-326	Hewlett-Packard Co.	28480	1	1	1
p	Kit, Accessory	11570A	Hewlett-Packard Co.	28480	3	1	3
q	Thermocouple Module	80TK	John Fluke Mfg., Co., Inc.	89536	1	-	1
r	Probe, Junction	80PK-6A	John Fluke Mfg., Co., Inc.	89536	1	-	1
s	Meter, Field Strength	HI-3002	Holaday Industries	52433	1	-	-
t	Meter, Radiation	491	Victoreen	63060	1	-	-
u	Probe, Radiation	489-4	Victoreen	63060	1	-	-
v	Meter, Volt Ohm	260	Simpson Electric Co.	55026	3	-	-
w	Meter, Current	931	Weston, Inc.	11842	1	-	-
x	Meter, Capacitance	938 DCM	Data Precision Div.	51692	1	-	-
10	Oscilloscopes						
b	Time Domain Reflectometer (TDR)	1502-04	Tektronix Inc.	80009	1	-	-
c	Time Domain Reflectometer (Optical)	9920	Laser Precision Corp.	51275	1	1	1
d	Oscilloscope, Portable	2465-22	Tektronix Inc.	80009	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
13	Supplies, Power						
a	Supply, Power	ATE25-2M	Kepco Inc.	85604	2	-	2
b	Supply, Power 0-100 V dc, 0-1 A	ATE100-1M	Kepco Inc.	85604	2	4	2
c	Supply, Power 0-64 V dc, 0-50 A	6459A-001	Hewlett-Packard Co.	28480	1	1	1
d	Supply, Power 0-15V 3A	JMK15-3M	Kepco, Inc.	85604	1	-	1
e	Variac Voltage	V53PN116B	Superior Electric Co.	58474	1	1	1
f	Supply, Power 0-60 V dc, 0-30 A	6268B w/opt 026	Hewlett-Packard Co.	28480	1	-	-
14	Testers, System						
a	Deleted						
c	High Frequency Generator Tester	BD-10AS	Electro-Technic Products Inc.	3N762	3	1	1
e	IGM Simulator	020-0314	Liebert Corp.	55455	1	1	1
g	Attenuator Test Set, Optical	FI-OATS-R	Foundation Instruments	36658	1	-	1
h	Transmission Test Set	TTS400C	Gandolf Data Ltd.	57165	1	1	1
15	Test Accessories Adapters						
a	Adapter, Straight OSM Jack/Jack (217)	2080-0000-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
b	Adapter, Straight OSM Plug/Plug (218)	2081-0000-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
c	Adapter, BNC Plug/ OSM Jack (21180)	3282-2240-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
d	Adapter, BNC Jack/ OSM Plug (21190)	3282-2241-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
e	Adapter, BNC Plug/ OSM Plug (21200)	3281-2241-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
g	Adapter, Straight - N Plug/OSM Jack (21020)	3082-2240-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
h	Adapter, Straight - N Plug/OSM Plug (21040)	3081-2241-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
i	Adapter, Straight - SMC Jack/OSM Jack (21270)	5082-2240-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
j	Adapter, Straight - SMC Plug/OSM Jack (21280)	5080-2240-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
k	Adapter, Straight - OSM Plug/Jack (216)	2082-5133-00	Omni Spectra, Inc. (Microwave Connector Division)	26805	3	1	3
l	Adapter, Optical D4 to SMA	0DS001	NEC Electronics, Inc.	33297	2	-	2
o	Reducer 50 Ohm 6 1/8 in to 3 1/8 in Coaxial	1872	Andrews Corp.	84147	2	-	-
p	Adapter 50 Ohm 3 1/8 in to N (F), Coaxial	2262	Andrews Corp.	84147	1	2	1
q	Adapter, Straight N Jack/OSM Plug	3082-2241-00	Omni Spectra, Inc.	26805	3	1	3
r	Adapter, Angle OSM Jack/OSM Jack	2086-1230-00	Omni Spectra, Inc.	26805	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
s	Adapter, Angle OSM Jack/OSM Plug	2088-5013-00	Omni Spectra, Inc.	26805	3	1	3
t	Adapter, Straight BNC Jack/OSM Jack	3280-2240-00	Omni Spectra, Inc.	26805	3	1	3
u	Adapter, 50 Ohm 1 5/8 in to (N) (F) Coaxial	2261A	Andrews Corp.	84147	1	-	-
v	Adapter, BNC Plug	AD1W(BNC)	Trompeter Elex, Inc.	14949	2	2	2
w	Adapter, TNC Plug/ BNC Jack	3182-2320-00	Omni Spectra, Inc.	26805	3	1	3
x	Adapter, BNC(M) to BNC(M)	103-0029-00	Tektronix, Inc.	80009	3	1	3
y	Adapter, N Jack/ N Jack	3080-0000-00	Omni Spectra, Inc.	26805	3	1	3
z	Adapter, N Jack/ BNC Plug	3082-2321-00	Omni Spectra, Inc.	26805	3	1	12
aa	Adapter, BNC(M) (N) (F)	HP1250-0077	Hewlett-Packard Co.	28480	1	1	1
ab	Adapter, (N) (F) Both Ends	HP1250-0777	Hewlett-Packard Co.	28480	1	1	3
ac	Adapter, Straight N Plug to TNC Jack	3682-2310-02	Omni Spectra Inc. (Microwave Connector Division)	16179	3	-	-
ad	Adapter, Angle BNC (F/M)	3534	Pomona Electronics Div.	05276	3	-	-
16	Test Accessories Attenuators						
a	Attenuator, 3 dB, 2 W (N)	3082-6191-03	Omni Spectra, Inc. (Microwave Connector Division)	16179	9	-	-

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
c	Attenuator, 10 dB, 2 W (N)	3082-6193-10	Omni Spectra, Inc. (Microwave Connector Division)	16179	3	-	3
d	Attenuator, 20 dB, 2 W (N)	3082-6194-20	Omni Spectra, Inc. (Microwave Connector Division)	16179	3	-	3
g	Attenuator, Coaxial Medium Power, 10 dB (N)	766-10	Narda Microwave Corp.	99899	3	-	3
h	Attenuator, Coaxial Medium Power, 20 dB (N)	766-20	Narda Microwave Corp.	99899	3	-	3
i	Attenuator, Variable	432D	Kay Elemetrics Corp.	80138	1	-	1
j	Hybrid 90°	JH-6-4/8474	Anzac Division	21912	1	-	-
k	Attenuator, 3 dB SMA	4772-3	Narda Microwave Corp.	99899	3	-	-
m	Attenuator, 20 dB (N)	011-0086-00	Tektronix Inc.	80009	-	-	1
o	Attenuator, Optical, 0-5503	OD-8511-DFA	NEC Electronics, Inc.	33297	1	-	-
p	Splitter, Power	11667A	Hewlett-Packard Co.	28480	1	-	1
q	Splitter, Power, 3-Way	11850D	Hewlett-Packard Co.	28480	1	-	1
s	Spark Gap	J-12	Champion Spark Plug Co.	11583	1	-	-
t	Transformer, Current	Type 301-X	Pearson Electronics	05280	1	-	-
u	Switch, Pushbutton	400 10-9	Grayhill, Inc.	81073	1	-	-
17	Terminations						
a	Termination, SMA (M) 50 Ohm	4370D	Narda Microwave Corp.	99899	3	-	-

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
c	Termination, BNC Plug 50 Ohm	3201-6100-00	Omni Spectra Inc. (Microwave Component Division)	16179	3	1	3
Items 18 through 21 are Peculiar Test Equipment							
18	Cables						
a	Cable Assembly	77D610875G1	General Electric Co.	03538	1	1	1
b	Cable Assembly	77D610875G3	General Electric Co.	03538	1	-	1
c	Test Cable	SK58022-440-021	General Electric Co.	03538	1	-	-
d	Test Cable for 60 V dc Power Supply (PS) Assembly	SK58022-440-006	General Electric Co.	03538	1	-	1
e	Test Cable for PS Assembly	SK58022-440-007	General Electric Co.	03538	1	-	1
f	Test Cable for 15 V dc PS Assembly	SK58022-440-008	General Electric Co.	03538	1	-	1
g	Test Cable for 24 V dc PS Assembly	SK58022-440-009	General Electric Co.	03538	1	-	1
h	Test Cable for 5 V dc PS Assembly	SK58022-440-010	General Electric Co.	03538	1	-	1
i	Test Cable Set	SK58022-440-022	General Electric Co.	03538	3	-	-
j	Test Cable Set	SK58022-440-020	General Electric Co.	03538	1	-	1
k	Test Cable, BNC Male/ Double Banana Plug	2BB-BNC-48	Pomona Electronics Div.	05276	1	-	1
l	Patch Cord, Alligator Clip/Banana Plug	1166-48	Pomona Electronics Div.	05276	1	-	1
m	Patch Cord, Spade Lugs	1693-48	Pomona Electronics Div.	05276	4	-	4
n	Patch Cord, Spade Lug/ Banana Plug	1370-48	Pomona Electronics Div.	05276	1	-	1

Table 1-4. Equipment Required But Not Supplied -CONT

	Equipment		Source of Supply		Total Per Location		
Item No.	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] -Ctr.	Rx[3] Site
p	Cable Assembly	77D610875G2	General Electric Co.	03538	1	-	1
q	Cable Assembly	HP11500A	Hewlett-Packard Co.	28480	2	-	-
s	Cable, Fibre Optic	1-1-002-B-B	Foundation Instruments	36658	3	-	3
t	Cable, Fibre Optic	2-2-002-B-B	Foundation Instruments	36658	3	-	3
u	Cable Set	HP11851B	Hewlett-Packard Co.	28480	3	-	3
19	Fixtures						
b	Adapter, Grounding, Vector Impedance Meter	150152-1	Continental Electronics Manufacturing Company	52151	3	-	-
c	4 to 1 Test J16	SK0010	Foundation Instruments	36658	1	-	-
20	Terminations						
a	Dummy Load	126103-1	Continental Electronics Manufacturing Company	52151	3	-	-
b	Resistor 3.3K, 2W	RCR42G322J8	Allen-Bradley	01121	1	-	1
21	Test Sets						
b	Spectral Purity Test Set	159980-3	Continental Electronics Manufacturing Company	52151	3	-	-
e	TCMG Simulator	149786-1	Continental Electronics Manufacturing Company	52151	3	-	-
f	Ac Current Overload Test Set	---	Continental Electronics Manufacturing Company	52151	1	-	-
Item 22 is peculiar tools.							
22	Service Equipment						
a	Hoist, Electric, Tube/Capacitor	150149-1	Continental Electronics Manufacturing Company	52151	3	-	-
	w/Lift Bar	150791-1	Continental Electronics Manufacturing Company	52151	3	-	-

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
b	Support, Hoist, Tube Removal	150150-1	Continental Electronics Manufacturing Company	52151	3	-	-
c	Table, Lift, Filter/ Tube Servicing	150146-1	Continental Electronics Manufacturing Company	52151	3	-	-
d	Lift, Heavy Component Handling	150147-1	Continental Electronics Manufacturing Company	52151	3	-	-
e	Platform, Material Handling, HVPS	150148-1	Continental Electronics Manufacturing Company	52151	3	-	-
f	Tool Kit, Filter Removal and Installation	150151-1	Continental Electronics Manufacturing Company	52151	3	-	-
g	Heavy Component Handling Lift, Short Reach	149785-1	Continental Electronics Manufacturing Company	52151	3	-	-
	(Preferred)	L20-3	Lift Rite	38221	-	-	-
h	Plate, Lift	149783-1	Continental Electronics Manufacturing Company	52151	6	-	-
i	Side Lift Adapter	149782-1	Continental Electronics Manufacturing Company	52151	3	-	-
j	PA Bias PS Removal Tool	149784-1	Continental Electronics Manufacturing Company	52151	3	-	-
k	Extension Fork w/Riser	149781-1	Continental Electronics Manufacturing Company	52151	3	-	-
l	Fan, 3 Speed, Bench	HV-13	Global	60401	1	-	1
Items 23 through 33 are common tools.							
23	Cleaning Equipment						
a	Cleaner, Vacuum Heavy Duty 15 Gallon	8925	Milwaukee Electric Tool Corp.	40817	1	1	1

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
b	Kit, Wet and Dry Cleaning	49-90-1670	Milwaukee Electric Tool Corp.	40817	1	1	1
c	Nozzle, Rubber Blower	49-90-0460	Milwaukee Electric Tool Corp.	40817	1	1	1
d	Brush, 3 in Round Dust	49-90-0730	Milwaukee Electric Tool Corp.	40817	1	1	1
24	Connector Tools						
a	Press, Cable	3640	3M Company	52942	3	1	3
b	Plate Assembly	3443-54	3M Company	52942	3	1	3
c	Hand Tool	3430	3M Company	52942	3	1	3
d	Tool, Installing/ Removal	M24308/18-2	Daniels Mfg. Corp.	11851	3	1	3
e	Positioner	3430-1000	3M Company	52942	3	1	3
f	Tool, Basic Crimping	M22520/1-01	Daniels Mfg. Corp.	11851	3	1	3
g	Positioner	M22520/1-02	Daniels Mfg. Corp.	11851	3	1	3
h	Tool, Installing/ Removal	M18278-1	Daniels Mfg. Corp.	11851	3	1	3
i	Tool, Basic Crimping	M22520/2-01	Daniels Mfg. Corp.	11851	3	1	3
j	Positioner/Turret	M22520/2-08	Daniels Mfg. Corp.	11851	3	1	3
k	Positioner/Turret	TLSW22	Hughes	9K389	3	1	3
m	Tool, Installing	TW022IT000	Hughes	9K389	3	1	3
n	Tool, Installing/ Removal	MS27534-22D	Daniels Mfg. Corp.	11851	3	1	3
o	Tool, Installing/ Removal	MS27534-12	Daniels Mfg. Corp.	11851	3	1	3
p	Tool, Insertion/ Removal	MS27534-16	Daniels Mfg. Corp.	11851	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
q	Tool, Installing/ Removal	MS27534-20	Daniels Mfg. Corp.	11851	3	1	3
r	Tool, Installing	MS17805 (DAK 123)	Daniels Mfg. Corp.	11851	3	1	3
s	Tool, Removal	MS17806 (DAK 124)	Daniels Mfg. Corp.	11851	3	1	3
t	Tool, Removal	TW022RT006	Hughes	9K389	3	1	3
u	Tool, Basic Crimping	M22520/5-01	Daniels Mfg. Corp.	11851	3	1	3
v	Positioner	M22520/5-043	Daniels Mfg. Corp.	11851	3	1	3
w	Positioner	M22520/5-19	Daniels Mfg. Corp.	11851	3	1	3
x	Positioner	M22520/5-25	Daniels Mfg. Corp.	11851	3	1	3
y	Positioner	M22520/5-37	Daniels Mfg. Corp.	11851	3	1	3
z	Positioner	M22520/5-61	Daniels Mfg. Corp.	11851	3	1	3
aa	Positioner	M22520/1-03	Daniels Mfg. Corp.	11851	3	1	3
ab	Positioner	M22520/1-04	Daniels Mfg. Corp.	11851	3	1	3
ac	Positioner	M22520/1-12	Daniels Mfg. Corp.	11851	3	1	3
ad	Positioner	M22520/1-13	Daniels Mfg. Corp.	11851	3	1	3
ae	Positioner	220222-2	Amp Inc.	00779	3	1	3
af	Positioner	69410-1	Amp Inc.	00779	3	1	3
ag	Tool, Crimping	M22520/7-01	Daniels Mfg. Corp.	11851	3	1	3
ah	Positioner	M22520/7-04	Daniels Mfg. Corp.	11851	3	1	3
ai	Tool, Hand Crimping	51-G-887	National Telephone Supply	76691	1	-	1
25	Hand Tools						
a	IC Insertion/ Extraction Kit	WK-7	OK Machine and Tools Corp.	08666	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] -Ctr.	Rx[3] Site
	Kit Includes:						
	Inserter (14-16 PIN)	MOS-1416	OK Machine and Tools Corp.	08666	-	-	-
	Inserter (24-28 Pin)	MOS-2428	OK Machine and Tools Corp.	08666	-	-	-
	Inserter (36-40 Pin)	MOS-40	OK Machine and Tools Corp.	08666	-	-	-
	Extractor (14-16 Pin)	EX-1	OK Machine and Tools Corp.	08666	-	-	-
	Extractor (24-40 Pin)	EX-2	OK Machine and Tools Corp.	08666	-	-	-
b	Nut Driver, 3/16 in	9206	Proto Tool Co.	74298	3	1	3
c	Nut Driver, 7/32 in	9207	Proto Tool Co.	74298	3	1	1
d	Nut Driver, 1/4 in	9208	Proto Tool Co.	74298	3	1	3
e	Nut Driver, 9/32 in	9209	Proto Tool Co.	74298	3	1	1
f	Nut Driver, 5/16 in	9210	Proto Tool Co.	74298	3	1	3
g	Nut Driver, 11/32 in	9211	Proto Tool Co.	74298	3	1	3
h	Nut Driver, 3/8 in	9212	Proto Tool Co.	74298	3	1	3
i	Hammer, Hand, Machinist, Ball Peen, 2 lbs	314B	Stanley Tools	78525	3	1	3
j	Hammer, Hand, Soft Face, Plastic Tip, 8 oz	594	Stanley Tools	78525	3	1	3
k	Pliers, Needle Nose 6-1/2 in	E703	Snap-on-Tools Corp.	55719	3	1	3
m	Pliers, Needle Nose 4-1/2 in	E708	Snap-on-Tools Corp.	55719	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
n	Basic Crimping Tool	59980-1	Amp Inc.	00779	3	1	3
o	Tool Basic Crimping	69311-1	Amp Inc.	00779	3	1	3
p	Positioner	220221-2	Amp Inc.	00779	3	1	3
q	Tool, Installing/ Removal	91052-1	Amp Inc.	00779	3	1	3
r	Knife, X-acto Heavy Duty, (Blade 24)	No. 5	X-acto Inc.	99941	3	1	3
s	Light, Trouble/ Extension (50 ft 3 Conductor, 16 AWG)	EC-392	Snap-on-Tools Corp.	55719	3	1	3
t	Cord, Extension (25 ft 3 Conductor, 16 AWG)	EC-267	Snap-on-Tools Corp.	55719	3	1	3
u	Oiler, Handled, Fixed Spout 7 in Long	N20	TPH, Division Parker-Hannifin Corp.	77335	3	1	3
v	Pliers, Connector	12830	Utica Tool Co.	30106	3	1	3
w	Pliers, Locking	7608	Dresser Industries	26848	3	1	3
x	Screwdriver Yankee Offset Ratchet	68-412	Stanley Tools	78525	3	1	3
y	Tweezer, Electronic with Side Lock, Nickel Plated, 6-1/2 in Long	7947	G.C. Electronic	72653	3	1	3
z	Gun, Lubricating with	GA 473A	Snap-on-Tools Corp.	55719	3	1	3
	Hose, Flex	GA 472-9	Snap-on-Tools Corp.	55719	3	1	3
aa	Screwdriver, Cross-Tip	64-100	Stanley Tools	78525	3	1	3
ab	Screwdriver, Cross-Tip	64-101	Stanley Tools	78525	3	1	3
ac	Screwdriver, Cross-Tip	64-102	Stanley Tools	78525	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
ad	Screwdriver, Flat Blade 6 in	66-166	Stanley Tools	78525	3	1	3
ae	Screwdriver, Flat Blade 3 in	66-183	Stanley Tools	78525	3	1	3
af	Screwdriver, Flat Blade 8 in	66-188	Stanley Tools	78525	3	1	3
ag	Pliers, Diagonal Cutter	E710	Snap-on-Tools Corp.	55719	3	1	3
ah	Stethoscope, Mechanics	GA11B	Snap-on-Tools Corp.	55719	3	1	3
ai	Screwdriver, Flat Blade (29 in)	SSD520	Snap-on-Tools Corp.	55719	3	1	3
aj	Nutdriver, 7/16 in	9214	Proto Tool Co.	72498	3	1	3
ak	Nutdriver, 1/2 in	9216	Proto Tool Co.	72498	3	1	3
al	Tool, Installation, Cable Tie	GS2B	Panduit Corp.	06383	3	-	-
am	Tie, Cable 14-1/2 in	PLT 41-CP	Panduit Corp.	06383	3	-	-
an	Pliers, Adj., Joint (12 in)	HL112P	Snap-on-Tools Corp.	55719	1	1	1
ao	Screwdriver, Cross-Tip No. 3 (11 in O.A.)	64-103	Stanley Tools	78525	3	1	3
ap	Screwdriver, Jewelers	Type 1 GGG-S-808	Military	---	1	1	1
aq	Sling, Nylon 54 in W/41 ft Sleeves	EE-1001	Wear Flex Slings Div.	54827	1	-	-
ar	Sling	CH-1490	Hercules Tool Corp.	11728	1	1	1
as	Screwdriver, Cross-Tip No. 2 (14-1/2 in O.A.)	64-172	Stanley Tools	78525	3	1	3
at	Screwdriver, Flat Blade 10 in	66-160	Stanley Tools	78525	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
au	Snips, Cutting	DAS10B	Snap-on-Tools Corp.	55719	3	1	3
av	Screwdriver, T-15, Tip TORX	SSTX415	Snap-on-Tools Corp.	55719	2	2	2
aw	Screwdriver, Flat Blade (29 in)	SSD520	Snap-on-Tools Corp.	55719	3	1	3
ax	Starter, Screw	GA199A	Snap-on-Tools Corp.	55719	3	1	3
ay	Puller, 2-W, S.T. Jaw, Set	4234	Proto Tool Co.	72498	1	1	1
az	Pliers, Snap-Ring 7-1/4 in	PRC36	Snap-on-Tools Corp.	55719	3	1	3
ba	Kit, Alignment Tool	8280	GC Electronics	72653	1	1	1
bb	Grounding, Stick	(Fabricate in Accordance with TO 00-25-234)			3	1	3
bc	Drill Blank, Size 72 1-1/8 in long	3009A289	McMaster Carr Supply Co.	39428	3	1	3
26	Power Tools/Bits						
a	Drill, Electric 1/2 in	1001-1 Rev	Milwaukee Electric Tool Corp.	40817	3	1	3
b	Drill, Twist (Set)	48-89-0010	Milwaukee Electric Tool Corp.	40817	3	1	3
c	Drill, Reversing, SCOR 2/4 in W/115V ac Base	9021	Black & Decker Mfg.	07429	3	-	-
27	Pullers/Boards						
a	Puller, Analog Board	10772802	Army Ordnance	17773	3	1	3
c	Extractor, PWB	77D614062G1	General Electric Co.	03538	3	-	3
28	Socket Sets						
a	Socket, Set 3/8 in, 3/8 to 3/4	222FSP	Snap-on-Tools Corp.	55719	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] -Ctr.	Total Per Location: Rx[3] Site
b	Bar Extension 3/8 in, (5-1/2 in)	FX6	Snap-on-Tools Corp.	55719	3	1	3
c	Socket, Set 1/2 in, 3/8 to 1-1/4	344AMB	Snap-on-Tools Corp.	55719	3	1	3
d	Socket, Set 3/4 in, 5/8 to 1-1/4	5500B	Proto Tool Co.	72498	3	1	3
e	Socket, 1/2 in Hex with 1/2 in Drive	SA16A	Snap-on-Tools Corp.	55719	3	1	3
f	Socket, 1/2 in Hex with 1/2 in Drive	TW481	Snap-on-Tools Corp.	55719	3	1	3
g	Socket, Set 1/4 in, 8/32 to 9/16	167TMB	Snap-on-Tools Corp.	55719	3	1	3
h	Adapter 1/4 to 3/8	TA3	Snap-on-Tools Corp.	55719	3	1	3
i	Socket, Deep Well 3/8 DR 5/8 in Size	FEL200	Snap-on-Tools Corp.	55719	3	1	3
j	Socket, Deep Well 3/8 DR, 9/16 in Size	SF181	Snap-on-Tools Corp.	55719	3	1	3
k	Socket, Deep Well 3/8 DR, 3/4 in Size	SF241	Snap-on-Tools Corp.	55719	3	1	3
l	Socket, Deep Well 3/8 DR, 1 in Size	SFS321	Snap-on-Tools Corp.	55719	3	-	-
29	Soldering Equipment						
a	Scriber, Pocket 2-7/8 in Length Point	70B	L.S. Starrett Co.	57163	3	1	3
b	Soldapullt (Anti-Static)	70105	Edsyn Inc.	21325	3	1	3
c	Soldering Iron (25 W)	WP25-3	Weller Industrial Service Equipment	97049	1	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
d	Soldering Iron (100 W)	W100-3	Weller Industrial Service Equipment	97049	1	1	3
e	Soldering Station	SX-301	Pace, Inc.	54111	3	1	3
f	Soldering Tool Stand	PH60	Weller Industrial Service Equipment	97049	1	1	3
g	Soldering Tool Stand	PH100	Weller Industrial Service Equipment	97049	1	1	3
h	Propane Soldering Torch, Kit	Item 1310	Sp Mfg.	---	1	1	1
30	Torques/Dial Test						
a	Wrench, Torque 0-75 in lbs) (1/4 Drive)	TEC6F4A	Snap-on-Tools Corp.	55719	3	1	3
b	Wrench, Torque (0-175 in lbs) (1/2 Drive)	74717	Dresser Industries	26848	3	1	3
c	Screwdriver, Torque 6-30 in lbs	OTS130A	Snap-on-Tools Corp.	55719	1	1	1
d	Wrench, Torque 150-1000 in/lbs 3/8 DR	QJR2840	Snap-on-Tools Corp.	55719	3	1	3
31	Wire/Cable Tools						
a	Gun, Heat with	HG501A	Master Appliance Corp.	83284	3	1	3
	Adapter, Pinpoint	51309	Master Appliance Corp.	83284	3	1	3
b	Stripper, Wire (AWG 10-20)	45-092	Ideal Tool Co.	30119	3	1	3
c	Stripper, Wire	525653	Gardner-Denver Co.	32945	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
d	Stripper, Wire (AWG 20-30)	45-098	Ideal Tool Co.	30119	3	1	3
e	Tool-Unwrap (Wire Removal) (26)	515665	Gardner-Denver Co.	32945	3	1	3
f	Tool-Unwrap (Wire Removal) (30)	515666	Gardner-Denver Co.	32945	3	1	3
g	Wire-Wrap Tool	2800AA5	Gardner-Denver Co.	32945	3	1	3
h	Bit-Wrap, No. 30 Wire	507063	Gardner-Denver Co.	32945	3	1	3
i	Bit-Wrap, No. 26 Wire	506445	Gardner-Denver Co.	32945	3	1	3
j	Sleeve-Wrap, No. 26-30 Wire	507100	Gardner-Denver Co.	32945	3	1	3
k	Wire Marker	B500	W.H. Brady Co.	62619	-	A/R[6]	-
l	Cutter, Circle, Power	8000414	Preform Line Products	04025	1	1	1
m	Cable Splice Pack	8006085	Preform Line Products	04025	1	1	1
n	Tool, Cleaning	500-00400-001	Foundation Instruments	36658	1	1	1
o	Stripper, No-Nik	NN200	No-Nik Stripper	---	1	1	1
32	Wrenches						
a	Wrench, Box/Open, Set (5/16 in - 1-5/8 in)	OEX723K	Snap-on-Tools Corp.	55719	3	1	3
b	Wrench, Hex-Head Set	AW-1020K	Snap-on-Tools Corp.	55719	3	1	3
c	Wrench Box/Open 3/16 in	OX16	Snap-on-Tools Corp.	55719	3	1	3
d	Wrench Strap	Military	Military	81348	1	1	1
e	Slotted Screw Bit 3/16 in W 1/4 in DR	TMC104A	Snap-on-Tools Corp.	55719	3	1	3
f	Slotted Screw Bit 3/16 in W 3/8 in DR	F23D	Snap-on-Tools Corp.	55719	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment: Nomenclature	Equipment: Mfg Type/Part	Source of Supply: Manufacturer	Source of Supply: CAGE	Total Per Location: Tx[1] Site	Total Per Location: Ops[2] Ctr.	Total Per Location: Rx[3] Site
g	Wrench Box/Open End 1 - 1/2 in	OEX48	Snap-on-Tools Corp.	55719	3	1	3
h	Wrench Box/Open End 1 - 5/16 in	OEX42	Snap-on-Tools Corp.	55719	3	1	3
i	Wrench Box/Open End 1/4 in	OEX80	Snap-on-Tools Corp.	55719	3	1	3
j	Crow Foot 5/8 in	FRH 200S	Proto Tool Co.	72498	3	1	3
k	Crow Foot 11/16 in	FRH 220S	Proto Tool Co.	72498	3	1	3
k.1	Crow Foot 1 11/16	FC34A	Snap-on-Tools Corp.	55719	3	-	-
l	Wrench Hexagonal Jam Nut	JR200	Daniels Mfg. Corp.	11051	3	1	3
m	Wrench Pipe 10 in	31090(810)	Rigid Tool Co.	50893	1	1	1
n	Wrench, Adjustable (4 in long, 9/16 opening)	7435A31	McMaster Carr Supply Co.	39428	3	-	3
33	Service Equipment General						
a	Elevating Table 58 in	LTH-20-2436	Equip. Co. of America	29656	3	-	-
b	Vacuum Pump 4.9 cfm[7]	91705-13	Central Scientific Company Educational	11273	3	-	-
c	Static Control Work Station	8013	3M Company	52942	1	1	1
d	Forklift Truck	SP30	Clark Equip. Co.	89749	3	-	-
	(Preferred)	E40XL	Hyster Co.	04627	-	-	-
e	Platform Ladder	7606	Lynn Ladder & Scaffolding	7S349	3	-	3
f	Cart, Mobile Scope	Model 3	Tektronix Inc.	80009	3	1	3
g	Lift Truck, Hydraulic	C-62, 600LB CW	Lee Engineering Co.	81085	1	-	-
i	Wrist Strap	S2066	Pace Inc.	---	3	1	3

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] -Ctr.	Rx[3] Site
j	Hand Truck	Military	FLZ	Military	3	1	3
k	36 V dc Battery	KW 18-75F-15	KW Battery Co.	32578	3	-	-
l	Elec. Battery Charger	SSC-18500-120 V ac 1-Phase	Exide Co.	97069	3	-	-
m	Flashlight, 2 cell	Type 1	Military		3	1	3
n	Lamp, Magnifier	174181	Global	60401	1	1	1
o	Inspection Mirror	GA 295	Snap-on-Tools Corp.	55719	1	1	1
q	Floor Crane	CH 323	Hercules Tool Corp.	11728	-	-	-
r	Rule Tape	VA-153-A	Snap-on-Tools Corp.	55719	1	1	1
s	Frame Hacksaw	HS8A	Snap-on-Tools Corp.	55719	1	1	1
t	File Round 6 in	6R	Snap-on-Tools Corp.	55719	2	2	2
u	Blades Hacksaw	HSBM 1232	Snap-on-Tools Corp.	55719	10	10	10
v	Blades Hacksaw	HSBM 1024	Snap-on-Tools Corp.	55719	10	10	10
w	Blades Hacksaw	HSBM 1218	Snap-on-Tools Corp.	55719	10	10	10
x	Hammer Bronze Tip	BE 216	Snap-on-Tools Corp.	55719	1	-	1
y	Chisel Round Nose Cape	PPC 12A	Snap-on-Tools Corp.	55719	1	-	-
z	Shears Metal Cutting	DAS108	Snap-on-Tools Corp.	55719	1	1	1
aa	Miter Box	19-246	Stanley Tools	78525	1	-	-
ab	Face Shield, Head Gear, Ratchet Lock Head Band	5121	Zee Medical Services Co.	1CM47	3	1	3
ac	Apron	C6952	LAB Safety Supply	---	3	1	3
ad	Protective Gloves	T7514	LAB Safety Supply	---	6	2	8
ae	Square Steel 8 in	45-068	Stanley Tools	78525	1	1	1
af	Goggles, Splash	H-883F	LAH Safety Equipment	6M644	1	1	1
ag	Gloves, Rubber	H-4375	LAH Safety Equipment	6M644	1	1	1

Table 1-4. Equipment Required But Not Supplied -CONT

Item No.	Equipment		Source of Supply		Total Per Location		
	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
ah	Apron	H-3003	LAH Safety Equipment	6M644	1	1	1
ai	Brush, Wire	AC58C	Snap-on-Tools Corp.	55719	1	1	1

Table 1-4. Equipment Required But Not Supplied -CONT

	Equipment		Source of Supply		Total Per Location		
Item No.	Nomenclature	Mfg Type/Part	Manufacturer	CAGE	Tx[1] Site	Ops[2] Ctr.	Rx[3] Site
aj	Scraper, Carbon	CSA14	Snap-on-Tools Corp.	55719	1	1	1
ak	Binoculars, 7 x 50	Military	Military	81348	2	-	2
al	Extension Ladder 32 ft	FE2232	Emerson Electric Co.	01252	3	1	3
am	Nylon Sling, Adjustible with S-Hooks - 800 lb Tensile Strength	730-4028 (Modified by Breaking Plastic Shield Off One Hook	NAPA, Balkamp	---	9	-	-
an	Lift Chain, 14 inch with Hooks, 1000 lb Tensile Strength	---	Any	---	3	-	-
ao	Electrostatic Grounding Set (HV)	T600-0891	A.B. Chance	73569	3	-	-
ap	Garden Water Hose, 6 ft	---	Any	---	3	-	-
aq	Nut	8-32	Any	---	3	-	-
ar	Bolt	8-32	Any	---	3	-	-
as	Nut	10-32	Any	---	3	-	-
at	Resistor	1.2K, 1W	Any	---	1	-	-
au	Resistor	3.9K, 1W	Any	---	1	-	-

[1] Transmit
[2] Operations
[3] Receive
[4] Wire Wrap Board
[5] Integrated Circuit
[6] As Required
[7] Cubic Feet per Minute
[8] Printed Wire Board

Table 1-5. Special Tools List

Part No.	CAGE	Nomenclature	Use
149781-1	52151	Extension Fork with Riser	On-equipment maintenance, elemental transmitter. Used with a fork lift when removing and replacing transformers T4, T14, and T15 in HVPS unit.
149782-1	52151	Side Lift Adapter	On-equipment maintenance, elemental transmitter. Used with a fork lift when removing and replacing transformer T2 and inductors L17 and L36 in the TM.
149783-1	52151	Plate, Lift	On-equipment maintenanee, elemental transmitter. Used with lifting devices to move HVPS and TM components weighing up to 2500 pounds.
149784-1	52151	PA Bias Power Supply Removal Tool	On-equipment maintenance, elemental transmitter. Used to stabilize PA bias power supply in an upright position while removing and replacing attaching hardware.
149785-1	52151	Heavy Component Handling Lift, Short Reach	On-equipment maintenance, elemental transmitter. Used when removing and replacing items such as capacitors C17, C18, C23, and C24; transformer T9, and reactor L1 in HVPS unit.
150146-1	52151	Table, Lift Filter/Tube Replacing	On-equipment maintenance, elemental transmitter. Used when removing and replacing band E and F bandpass filter and PA tube or related tube socket in TM.
150147-1	52151	Lift, Heavy Component Handling	On-equipment maintenance, elemental transmitter. Used to move heavy components weighing up to 3000 pounds in and out of TM and HVPS units.
150148-1	52151	Platform, Material Handling, HVPS	On-equipment maintenance, elemental transmitter. Used with heavy component handling lift when moving components in and out of the HVPS.
150149-1	52151	Hoist, Electric Tube/Capacitor	On-equipment maintenance, elemental transmitter. Used when removing and replacing PA tube or socket and capacitors in TM and HVPS units.
150150-1	52151	Support, Hoist Tube Removal	On-equipment maintenance, elemental transmitter. Used with electric hoist when removing or replacing PA tube or socket in TM.
150151-1	52151	Tool Kit, Filter Removal and Installation	On-equipment maintenance, elemental transmitter. Used when removing and replacing bandpass filters in TM.

Table 1-6. Test Equipment List

Type Designation	Alternate Designation	Nomenclature	Use
ATE25-2M CAGE-85604		Supply, power	Off-equipment maintenance, general use
ATE100-1M CAGE-85604		Supply, power 0-100 V dc 0-1 A	Off-equipment maintenance, power control 77D611601G1
JH-6-4 CAGE-21912		Hybrid 90°	Off-equipment maintenance, RF modulator 77D607154G1
PS² L-1000 CAGE-00159		Load, solid state	Off-equipment maintenance, power supply 7343908G1, 7343910G1, 7328363G1, and 7343912G1
RS-3A CAGE-15566		Ammeter, ac clamp-on	On- and off-equipment maintenance, general use
SK58022-440-003 CAGE-03538		Test fixture (power control)	Off-equipment maintenance, power control 77D611601G1
SK58022-440-006 CAGE-03538		Test cable for 60 V dc PS assembly	Off-equipment maintenance, power supply 7343908G1
SK58022-440-007 CAGE-03538		Test cable for PS assembly	Off-equipment maintenance, power supply 7343908G1, 7343912G1, 7328363G1, and 7343910G1
SK58022-440-008 CAGE-03538		Test cable for 15 V dc PS assembly	Off-equipment maintenance, power supply 7328363G1
SK58022-440-009 CAGE-03538		Test cable for 24 V dc PS assembly	Off-equipment maintenance, power supply 7343910G1
SK58022-440-010 CAGE-03538		Test cable for 5 V dc PS assembly	Off-equipment maintenance, power supply 7343912G1
SK58022-440-020 CAGE-03538		Test cable set	Off-equipment maintenance, ac/dc converters
SK58022-440-022 CAGE-03538		Test cable set	On-equipment maintenance, transmit antenna
Y8134 CAGE-89536		Set, meter test probe	On- and off-equipment maintenance, general use with 8053A digital multimeter
011-0086-00 CAGE-80009		Attenuator, 20 dB (N)	On- and off-equipment maintenance, general use
77D610875G1 CAGE-03538		Cable assembly	Off-equipment maintenance, voltage regulator 77D609500G1
80I-600 CAGE-89536		Clamp-on, ac current transformer	Off-equipment maintenance, used with digital multimeter
80K-40 CAGE-89536		Probe, high voltage	On- and off-equipment maintenance, used with digital multimeter
103-0028-00 CAGE-80009		Adapter, connector (BNC female to BNC female)	On- and off-equipment maintenance, general use

Table 1-6. Test Equipment List -CONT

Type Designation	Alternate Designation	Nomenclature	Use
141T CAGE-28480		Analyzer, spectrum (display main frame)	On-equipment maintenance, general use
200CD CAGE-28480		Oscillator, audio	On- and off-equipment maintenance, general use on communications equipment
260 CAGE-55026		Meter, volt-ohm	On-equipment maintenance of elemental transmitter
293 with kit 18533 CAGE-04237		Vibraground tester, earth	On-equipment maintenance, system grounding resistance periodic checks
355D CAGE-28480		Attenuator, VHF (BNC) (0-120)	Off-equipment maintenance, general use
432D CAGE-80138		Attenuator, variable	Off-equipment maintenance, general use
435R Opt. 001 CAGE-28480		Meter, power	On- and off-equipment maintenance, general use
545A CAGE-28480		Logic probe	On- and off-equipment maintenance, general use
546A CAGE-28480		Logic pulser	Off-equipment maintenance, general use
630NS CAGE-60741		Meter, volt, Ohm	On- and off-equipment maintenance, general use
766-10 CAGE-99899		Attenuator, coaxial medium power 10 dB (N)	On-and off-equipment maintenance, general use
766-20 CAGE-99899		Attenuator, coaxial medium power 20 dB (N)	On- and off-equipment maintenance, general use
931 CAGE-11842		Meter, current	On-equipment maintenance of elemental transmitter
938 DCM CAGE-51692		Meter, capacitance	On-equipment maintenance of elemental transmitter
1502-04 CAGE-80009		TDR	On-equipment maintenance, transmitter and sounder group transmission line components
1658-9700 CAGE-24655		Digibridge, RLC	On- and off-equipment maintenance, general use
1872 CAGE-84147		Reducer 50 Ohm 6 1/8 in to 3 1/8 in coaxial	On-equipment maintenance, used with time domain reflectometer
2080-0000-00 CAGE-26805		Adapter, straight OSM jack/jack (217)	On- and off-equipment maintenance, general use
2081-0000-00 CAGE-26805		Adapter, straight OSM plug/plug (218)	On- and off-equipment maintenance, general use

Table 1-6. Test Equipment List -CONT

Type Designation	Alternate Designation	Nomenclature	Use
2082-5133-00 CAGE-26805		Adapter, straight OSM plug/jack (216)	On- and off-equipment maintenance, general use
2086-1230-00 CAGE-26805		Adapter, angle OSM jack/OSM jack	On- and off-equipment maintenance, general use
2088-5013-00 CAGE-26805		Adapter, angle OSM jack/OSM plug	On- and off-equipment maintenance, general use
2235 CAGE 24665		Logic test system	Off-equipment maintenance for digital boards
2261A CAGE-84147		Adapter, 50 Ohm 3 1/8 in to N (F) coaxial	On-equipment maintenance, used with time domain reflectometer
2262 CAGE-84147		Adapter, 50 Ohm 3 1/8 in to N (F) coaxial	On-equipment maintenance, used with time domain reflectometer
2465-22 CAGE-80009		Oscilloscope, portable	On- and off-equipment maintenance, general use
3002-6113-00 CAGE-16179		Termination, type N (F) 50 Ohm	On- and off-equipment maintenance, general use
3081-2241-00 CAGE-26805		Adapter, straight N plug/OSM plug (21040)	On- and off-equipment maintenance, general use
3081-2321-00 CAGE-26805		Adapter, N plug/BNC plug	On- and off-equipment maintenance, general use
3082-2240-00 CAGE-26805		Adapter, straight N plug/OSM jack (21020)	On- and off-equipment maintenance, general use
3082-2241-00 CAGE-26805		Adapter, straight N jack/OSM plug	On- and off-equipment maintenance, general use
3082-2320-00 CAGE-26805		Adapter, N plug/BNC jack	On- and off-equipment maintenance, general use
3082-6191-03 CAGE-84147		Attenuator, 3 dB, 2 W (N)	On- and off-equipment maintenance, general use
3082-6193-10 CAGE-16179		Attenuator, 10 dB, 2 W (N)	On- and off-equipment maintenance, general use
3082-6194-20 CAGE-16179		Attenuator, 20 dB, 2 W (N)	On- and off-equipment maintenance, general use
3201-6100-00 CAGE-16179		Termination, BNC plug 50 Ohm	On- and off-equipment maintenance, general use
3280-2240-00 CAGE-26805		Adapter, straight BNC jack/OSM jack	On- and off-equipment maintenance, general use
3281-2241-00 CAGE-26805		Adapter, BNC plug/OSM plug (21200)	On- and off-equipment maintenance, general use
3282-2240-00 CAGE-26805		Adapter, BNC plug/OSM jack (21180)	On- and off-equipment maintenance, general use

Table 1-6. Test Equipment List -CONT

Type Designation	Alternate Designation	Nomenclature	Use
3282-2241-00 CAGE-26805		Adapter, BNC jack/OSM plug (21190)	On- and off-equipment maintenance, general use
3406A CAGE-28480		Voltmeter, RF	On- and off-equipment maintenance, general use
3468A CAGE-28480		Multimeter, digital	On- and off-equipment maintenance, general use
4193A CAGE-28480		Meter, RF vector impedance	On- and off-equipment maintenance, general use
4370DM CAGE-99899		Termination, SMA (N) 50 Ohm	On- and off-equipment maintenance, general use
4772-3 CAGE-99899		Attenuator, 3 dB (SMA)	On- and off-equipment maintenance, general use
5080-2240-00 CAGE-26805		Adapter, straight SMC plug/OSM jack (21280)	On- and off-equipment maintenance, general use
5082-2240-00 CAGE-26805		Adapter, straight SMC jack/OSM jack (21270)	On- and off-equipment maintenance, general use
5342A CAGE-28480		Counter, frequency	Off-equipment maintenance, general use
6268B (w/opt 026) CAGE-28480		Supply, power 0-60 V dc, 0-30 A	On-equipment maintenance of elemental transmitter
6459A-001 CAGE-28480		Supply, power 0-64 V dc 0-50 A	Off-equipment maintenance, voltage regulator tests
8050A CAGE-89536		Multimeter, digital	On- and off-equipment maintenance, general use
8481A CAGE-28480		Power sensor	On- and off-equipment maintenance, used with power meter
8482A CAGE-28480		Power sensor	On- and off-equipment maintenance, used with power meter
8482B CAGE-28480		Power sensor	On- and off-equipment maintenance, used with power meter
8552B CAGE-28480		Plug-in, IF section	On- and off-equipment maintenance, used with spectrum analyzer
8553B CAGE-28480		Plug-in, RF section	On- and off-equipment maintenance, used with spectrum analyzer
8554B CAGE-28480		Plug-in, RF section	On- and off-equipment maintenance, used with spectrum analyzer
8601A CAGE-28480		Generator, signal sweep	On- and off-equipment maintenance, general use

Table 1-6. Test Equipment List -CONT

Type Designation	Alternate Designation	Nomenclature	Use
8640B-003 CAGE-28480		Generator, signal	On- and off-equipment maintenance, general use
126103-1 CAGE-52151		Dummy load	On-equipment maintenance, elemental transmitter
159980-3 CAGE-52151		Spectral purity test set	On-equipment maintenance, elemental transmitter
149786-1 CAGE-52151		TCMG simulator	On-equipment maintenance, elemental transmitter
150152-1 CAGE-52151		Adapter, grounding, vector impedance meter	On- and off-equipment maintenance, used with vector impedance meter
--- CAGE 52151		Ac Current overload test set	On-equipment maintenance, elemental transmitter
923700 CAGE-30146		Clip, 16-pin IC test	Off-equipment maintenance, general use
923714 CAGE-30146		Clip, 24-pin IC test	Off-equipment maintenance, general use
7327173G1 CAGE-03538		Extender digital board (WWB)	On-equipment maintenance
7342481G1 CAGE-03538		RF extender board (TBF)	On-equipment maintenance of transmit beamformer
7342481G2 CAGE-03538		RF extender board	On-equipment maintenance
10773727 CAGE-03538		PWB extender	On-equipment maintenance of transmit beamformer

Table 1-7. Related Technical Orders and Publications

Title	TO Number
Radar Set AN/FPS-118(V)	
List of Applicable Publications (LOAP)	31P6-2FPS118-01
System General Information	31P6-2FPS118-1
System General Information Supplement (Classified)	31P6-2FPS118-1-1
Scheduled Inspection, Servicing, and Lubrication Requirements	31P6-2FPS118-6
Work Unit Code	31P6-2FPS118-06
Transmit Subsystem Part of Radar Set AN/FPS-118(V)	
Operation and Maintenance Instructions	31P6-2FPS118-11

Table 1-7. Related Technical Orders and Publications -CONT

Title	TO Number
Illustrated Parts Breakdown	31P6-2FPS118-14
Work Card Set	31P6-2FPS118-16WC-1
Circuit Diagrams (ICD[1]) Book 1	31P6-2FPS118-23-1
Circuit Diagrams (ICD) Book 2	31P6-2FPS118-23-2
Circuit Diagrams (ICD) Book 3	31P6-2FPS118-23-3
[(V)1]Communications Group (Communications Subsystem) OA-9240/ FPS-118(V)	
Operation and Maintenance Instructions with Illustrated Parts Breakdown	31P6-2FPS118-171
Circuit Diagrams	31P6-2FPS118-173
[(V)2]Communications Group (Communications Subsystem) OA-9397/ FPS-118(V)	
Operation and Maintenance Instructions with Illustrated Parts Breakdown	31P6-2FPS118-251
Circuit Diagrams	31P6-2FPS118-253
Transmitter Group OT-139/FPS-118(V) and OT-139A/FPS-118(V)	
Operation and Maintenance Instructions	31P6-2FPS118-71
Circuit Diagrams	31P6-2FPS118-73-1
Circuit Diagrams (Wiring Lists)	31P6-2FPS118-73-2
Illustrated Parts Breakdown	31P6-2FPS118-74
Radar Transmitter (Elemental Transmitter) T-1524/FPS-118(V) Part of Transmitter Group OT-139/FPS-118(V) and OT-139A/FPS-118(V)	
Operation and Maintenance Instructions	31P6-2FPS118-81
Circuit Diagrams	31P6-2FPS118-83
Illustrated Parts Breakdown	31P6-2FPS118-84
Transmit Control-Monitor Group OK-509(V)1/FPS-118(V), OK-509(V)2/FPS-118(V), and OK-509(V)3/FPS-118(V)	
Operation and Maintenance Instructions	31P6-2FPS118-141
Circuit Diagrams	31P6-2FPS118-143-1
Circuit Diagrams (Wiring Lists)	31P6-2FPS118-143-2
Illustrated Parts Breakdown	31P6-2FPS118-144
Transmit Group, Ionosphere Sounding OT-140/FPS-118(V) and OT-140A/FPS-118(V)	
Operation and Maintenance Instructions with Illustrated Parts Breakdown and Circuit Diagrams	31P6-2FPS118-91

Table 1-7. Related Technical Orders and Publications -CONT

Title	TO Number
Power Supply Controller Test Fixture Operation and Maintenance Instructions with Illustrated Parts Breakdown	
Synthesizer John Fluke Co., Inc. Model 645A/DC	33A1-5-389-1
Frequency Calibrator Operation and Maintenance Manuals (2) Frequency and Time Systems, Inc. Model FTS 1050A	
Power Supply 60V Gould Power Supplies Inc. Model MG60-6CV200	35C1-2-1143-1
Power Supply 15V Gould/Advance Power Supplies, Ltd. Model MG15-8CV276	35C1-2-1141-2
Power Supply 5V Gould/Advance Power Supplies, Ltd. Model MG5-40CV275	35C1-2-1140-2
Power Supply 24V Gould/Advance Power Supplies, Ltd. Model MG24-15CV277	35C1-2-1142-2
Quartz Frequency Standard Oscilloquartz, S.A. Model 2200, 2201, 2203, and 2210	
A/D Converter Tustin Electric Co. Model 2115A-9-9/5-120M	31P6-2FPS118-221
60 Watt DC/DC Converter Computer Products Stevens Arnold Division	31C1-4-147-1
Vacuum Contactor Ross Engineering Corp. Model MB3/MB2-51-XX	35CA7-22-1
Regulated Power Supply Lambda Electronics Model 15566	35C1-2-1139-1
Regulated Power Supply Lambda Electronics Model 15567	35C1-2-1138-1
Regulated Power Supply Lambda Electronics Model 15568	35C1-2-1137-1

Table 1-7. Related Technical Orders and Publications -CONT

Title	TO Number
Broadband Amplifier Operation and Maintenance Electronic Navigation Industries Model A300	31P6-2FPS118-231
Power Supply 15V Gould/Advance Power Supplies Ltd. Model MG15-6CV376	35C1-2-1141-2
A/D Converter Phoenix Data Inc. Model DAS 6915HS-10276	(TBS)

[1] Interface control drawing

CHAPTER 2

INSTALLATION

(Not applicable)

CHAPTER 3

PREPARATION FOR USE AND RESHIPMENT

(Not applicable)

CHAPTER 4

OPERATION

Section I. CONTROLS AND INDICATORS

4-1 GENERAL.

This section describes, locates, and illustrates various controls and indicators of the transmitter group of the radar set.

4-2 USE OF TABLES AND ILLUSTRATIONS.

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains hazards that may cause death or serious injury to personnel. Do not manipulate transmitter equipment controls and indicators unless familiar with their operation and the general safety procedures listed in paragraph 6-2 have been followed. Improper manipulation of transmitter equipment controls can create serious safety hazards for personnel.

CAUTION

EQUIPMENT DAMAGE HAZARD

Improper manipulation of transmitter equipment controls and indicators can cause damage to equipment. Do not manipulate transmitter controls and indicators unless familiar with their operation.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

Tables 4-1 through 4-5 list functional names, reference designators, and functions of the controls or indicators. Figures 4-1 through 4-5 illustrate this information. The corresponding figure for each table is referenced in each table title. The equipment in the transmitter group and locational information is summarized as follows:

Unit No.	Unit Description	Unit Table
100	Transmit antenna	None
110-121	Transmitter module (TM)	4-1
122-133	High voltage power supply (HVPS)	4-2
222-233	High voltage ac (HVAC) disconnect switch	4-3
150	Transmit beamformer (TBF)	4-4
151 and 152	Transmit exciter Transmit auxiliary exciter	4-5

4-3 LOCATIONAL INFORMATION.

The location of the control and indicator panels is shown in Chapter 1. The detailed locations of controls on the panels are shown in Figures 4-1 through 4-5.

4-4 TRANSMITTER GROUP INTERLOCKS.

Interlock circuits associated with equipment in the transmitter group are described in paragraphs 4-4.1 through 4-4.6.

4-4.1 Transmit Antenna, Unit 100, Interlocks. There are no interlocks associated with the transmit antenna.

4-4.2 Transmitter Modules, Units 110 through 121, Interlocks. There are many interlocks associated with the TMs. The status of each interlock is shown through a number of indicators on the 1A1 status panel and 1A1 subassemblies. The interlock circuits (with indicator reference) include:

1. Excessive reverse power - 1A1DS1 and 1A1A12DS11
2. Radio frequency (RF) arcing between components - 1A1DS2 and 1A1A12DS10

3. Current overload power amplifier (PA) anode dc - 1A1DS4 and 1A1A12DS2
4. Current overload PA anode ac - 1A1DS5 and 1A1A12DS1
5. Current overload PA screen grid dc - 1A1DS6 and 1A1A12DS3
6. Current overload driver anode dc - 1A1DS7 and 1A1A12DS5
7. Current overload driver anode ac - 1A1DS8 and 1A1A12DS4
8. Current overload driver screen grid dc - 1A1DS9 and 1A1A12DS6
9. Current overload intermediate power amplifier (IPA) anode dc - 1A1DS10 and 1A1A12DS7
10. Current overload IPA anode ac - 1A1DS11 and 1A1A12DS8
11. Current overload IPA screen grid dc - 1A1DS12 and 1A1A12DS9
12. Interlock open - 1A1DS13
13. Excessive RF drive - 1A1DS16
14. Actuator air fault - 1A1A9DS1
15. Cabinet air fault - 1A1A9DS2
16. Circuit breaker (CB) tripped - 1A1A9DS3
17. Crowbar circuit fired - 1A1A9DS4 and 1A1A12DS12
18. Grounding stick fault (9 interlocks) - 1A1A10DS1
19. Cooling water pressure fault - 1A1A10DS2
20. PA cooling water temperature fault - 1A1A10DS3
21. Driver cooling water temperature fault - 1A1A10DS4
22. IPA cooling water temperature fault - 1A1A10DS5
23. Ground switch fault - 1A1A10DS6
24. Cabinet rear door open (6 interlocks) - 1A1A10DS7
25. Cabinet front door open (6 interlocks) - 1A1A10DS8
26. HVPS door open - 1A1A10DS9

If equipment operation is inhibited due to an interlock condition, one or several of the above indicators light. The indicated fault condition must clear before normal equipment operation may begin.

4-4.3 High Voltage Power Supplies, Units 122 through 133, Interlocks. The interlocks for this equipment are part of the operation of the TMs (paragraph 4-4.2).

4-4.4 High Voltage Ac Switches, Units 222 through 233, Interlocks. The cabinet door for this equipment is interlocked such that equipment operation is inhibited if the equipment door is not shut and latched.

4-4.5 Transmit Beamformer, Unit 150, Interlocks. There are no interlocks associated with this equipment.

4-4.6 Transmit Exciter, Unit 151, and Auxiliary Exciter, Unit 152, Interlocks. The transmit exciters interlock for local/remote operation.

1. A LOCAL/REMOTE interlock circuit provides LOCAL or REMOTE control status information for the computer control program. This places the cabinet into a LOCAL control condition that allows online equipment replacement, certain manual functions, and other configuration changes during system operation. Such changes during REMOTE control could cause the computer to generate false or misleading fault indications or system shutdown.
2. The LOCAL/REMOTE interlock functions with the operation of the exciter cabinet front door. When the exciter cabinet door is closed, the cabinet is in REMOTE operation. When the exciter door is opened, the cabinet is placed into LOCAL operation by pulling the plunger of the LOCAL/REMOTE switch (at the top of the door frame) into the detent position. To return to REMOTE operation, push the switch out of the detent position, or close the cabinet door.

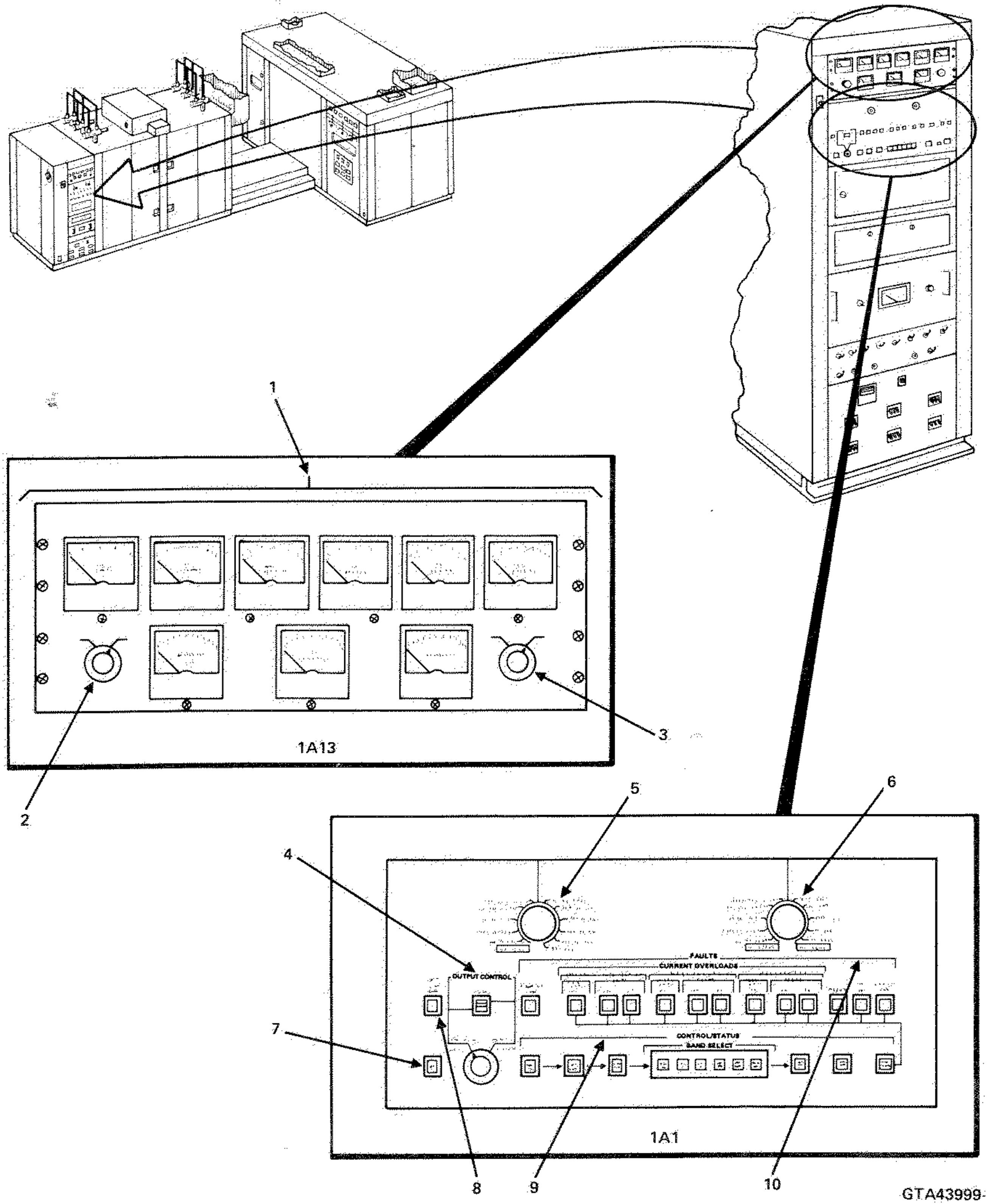


Figure 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Sheet 1 of 3)

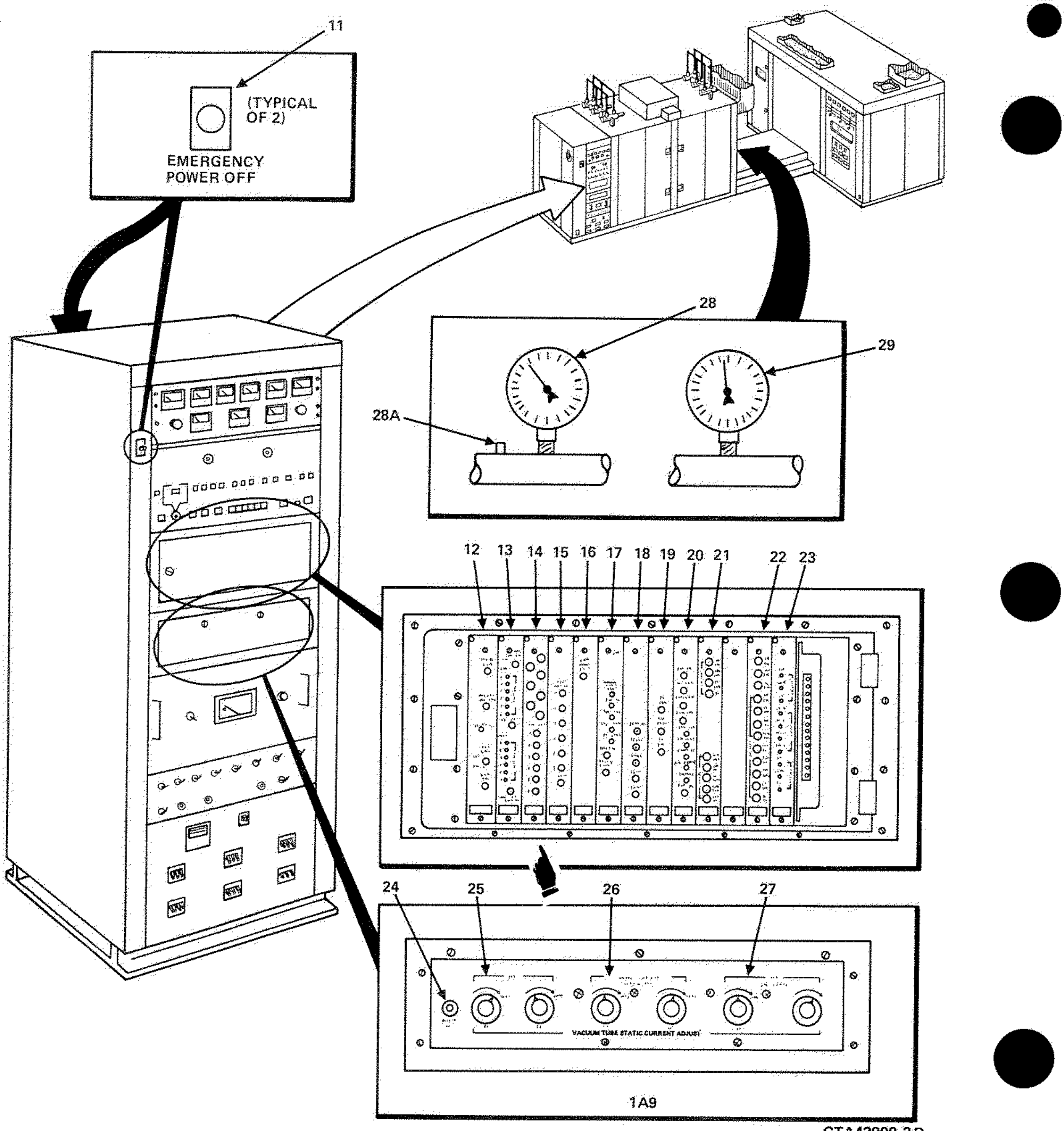


Figure 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Sheet 2 of 3)

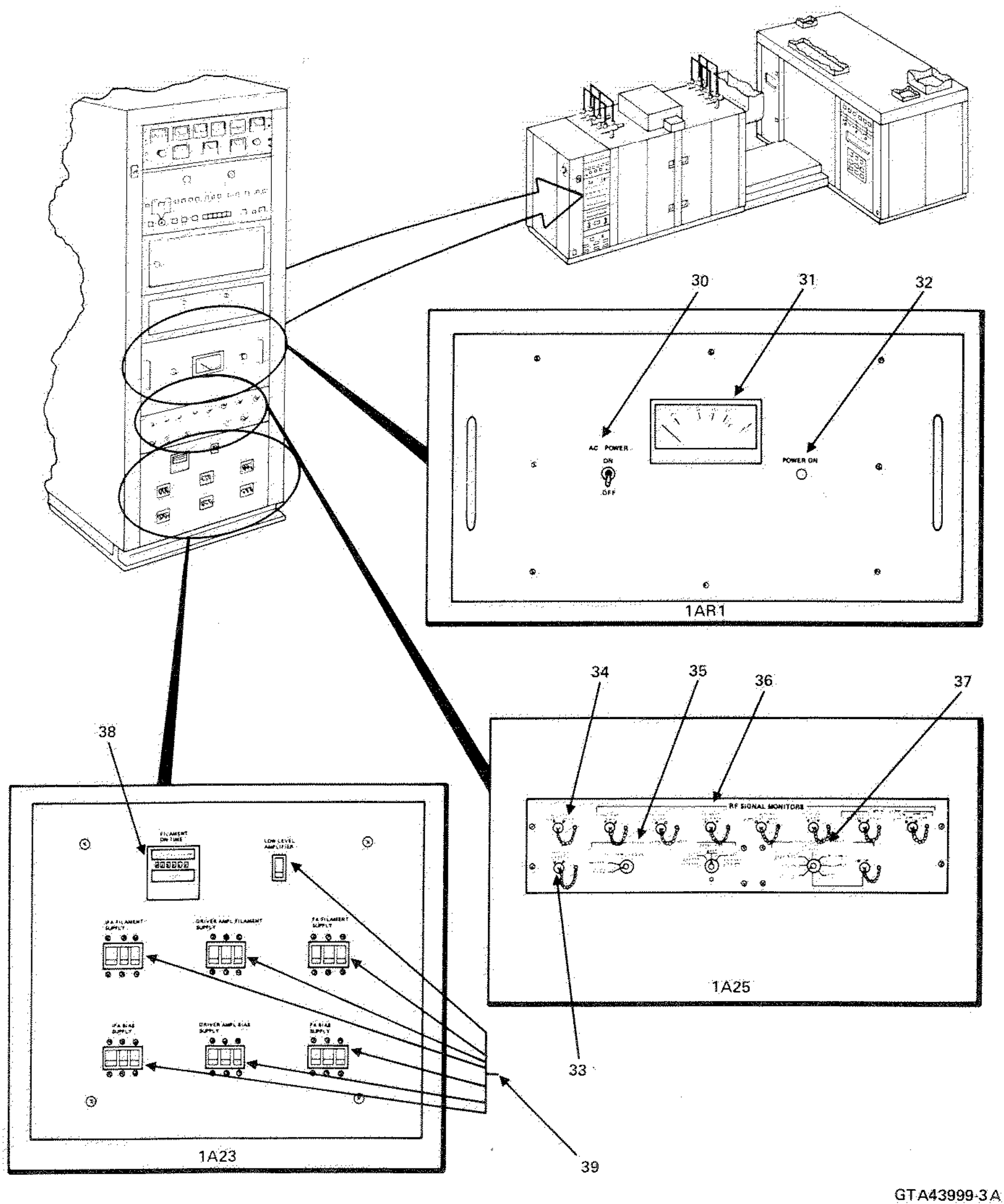


Figure 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Sheet 3 of 3)

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1)

Figure Index	Control or Indicator	Reference Designator	Function
Meter Panel Assembly 1A13:			
1	Meter Panel	1A13	
	IPA-		
	CATHODE (A) meter	M6	Displays IPA cathode current on a 0-5 A scale.
	DRIVER AMPLIFIER-		
	SCREEN GRID (mA) meter	M5	Displays driver amplifier screen grid current on a 0-500 mA scale.
	CATHODE (A) meter	M4	Displays driver amplifier cathode current on a 0-10 A scale.
	POWER AMPLIFIER-		
	SCREEN GRID (A) meter	M3	Displays PA screen grid current on a 0-1 A scale.
	CATHODE (A) meter	M2	Displays PA cathode current on a 0-30 A scale.
	POWER (kW) meter	M1	Displays forward (0-150 kW) or reflected (0-15 kW) power output, as selected by RF POWER select switch, 1A13S1.
	TEST METER (test meter No. 1)	M9	Displays dc volts on a 0-10 or 0-5 scale. See associated meter select switch, 1A1S2.
	IPA SCREEN GRID (mA) meter	M8	Displays IPA screen grid current on a 0-150 mA scale.
	TEST METER (test meter No. 2)	M7	Displays dc current or RF level as selected by 1A1S1.
2	METERS-switch ON-OFF	1A13S2	When OFF position selected, all meter displays are inhibited. ON position enables panel meter operation.
3	RF POWER-switch	1A13S1	
	RVS (X0.1)		RVS (X0.1) selects reverse RF power to display on meter M1.
	FWD		FWD selects forward RF power to display on meter M1.
Control/Status Panel 1A1:			
4	OUTPUT CONTROL-indicators:	1A1	
	LOAD-ANTENNA-	DS14/G	ANTENNA - Lights (green) when RF routing is to a remote antenna load.

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	TEST	DS14/O	TEST - Lights (orange) when RF routing is to a local dummy test load.
	Control Switch:		
	TEST LOAD (LOCAL)	S13	TEST LOAD (LOCAL) - Selects local dummy test load for transmitter RF output. Enables RF INHIBIT selector switch on the RF signal monitor panel.
	ANTENNA (REMOTE)	S13	ANTENNA (REMOTE) - Selects remote antenna load for transmitter RF output. Disables RF INHIBIT selector switch on the RF signal monitor panel.
5	DC VOLTS-meter select switch (test meter No. 1)	1A1S2	Switch selects dc voltage inputs from indicated power supply to be displayed on meter 1A13M9. Quantities in ( ) denote scale used for reading.
	IPA FIL (10V)		Intermediate PA filament voltage, 0-10 V dc scale.
	DRVR FIL (10V) (1000V)		Driver amplifier filament voltage, 0-10 V dc scale.
	PA FIL (50V)		PA filament voltage, 0-50 V dc scale.
	IPA BIAS (1000V)		IPA bias voltage, 0-1000 V dc scale.
	DRVR BIAS		Driver amplifier bias voltage, 0-1000 V dc scale.
	PA BIAS		PA bias voltage, 0-1000 V dc scale.
	+26V PS (50V)		+26 V dc power supply voltage, 0-50 V dc scale.
	+15 V PS (50V)		+15 V dc power supply voltage, 0-50 V dc scale.
	+5V PS (10V)		+15 V dc power supply voltage, 0-10 V dc scale.
	+15V PS (50V)		+15 V dc power supply voltage, 0-50 V dc scale.
	-15V PS (50V)		-15 V dc power supply voltage, 0-50 V dc scale.
6	DC CURRENT/RF LEVEL- meter select switch (test meter No. 2)	1A1S1	Switch selects dc currents of indicated power supply or RF power from indicated stages on meter 1A13M7. Quantities in ( ) denote scale used for reading.
	IPA FIL (500A)		Intermediate PA filament current, 0-500 A scale.
	DRVR FIL (500A)		Driver amplifier filament current, 0-500 A scale.
	PA FIL (500A)		PA filament current, 0-500 A scale.
	IPA GRID (100mA)		IPA grid current, 0-100 mA scale.
	DRVR GRID (100mA)		Driver amplifier grid current, 0-100 mA scale.
	PA GRID (1A)		PA grid current, 0-1 A scale.
	RF LEVEL-		
	IPA GRID		IPA grid RF level.
	DRVR GRID		Driver amplifier grid RF level.
	PA GRID		PA grid RF level.
	PA ANODE		PA anode RF level.

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
7	LAMP TEST pushbutton	1A1S14/ DS29	Press pushbutton to test all control/status panel indicators. All lamps should light except POWER (OFF).
8	RF DRIVE LIMIT indicator	1A1DS16	Lights (yellow) when amplifier stage has exceeded a set threshold for a RF drive level.
9	CONTROL/STATUS-control/indicators:	1A1	
	POWER (OFF) pushbutton	DS28/S12	Turns off 208 V ac from filament, 12.47 kV ac, bias, and screen supplies interlock lines. The 120 V ac ride-through voltage remains on. The switch is inactive when operating in the REMOTE control mode.
	FIL DELAY indicator	DS27	Lights (green) during filament warm-up time.
	STANDBY (HV OFF) indicator/pushbutton	DS26/S11	Depress to start transmitter turn-on. Lights (green) after filament warm-up takes place and all interlocks are closed. The switch is inactive when operating in the REMOTE control mode.
	BAND SELECT indicators/ pushbuttons		
	BAND A	DS25/S10	Press to select band A (5.0 to 6.79 MHz). Lights (green) when band is selected. The switch is inactive when operating in the REMOTE control mode.
	BAND B	DS24/S9	Press to select band B (6.69 to 9.14 MHz). Lights (green) when band is selected. The switch is inactive when operating in the REMOTE control mode.
	BAND C	DS23/S8	Press to select band C (9.04 to 12.30 MHz). Lights (green) when band is selected. The switch is inactive when operating in the REMOTE control mode.
	BAND D	DS22/S7	Press to select band D (12.20 to 16.55 MHz). Lights (green) when band is selected. The switch is inactive when operating in the REMOTE control mode.
	BAND E	DS21/S6	Press to select band E (16.45 to 22.30 MHz). Lights (green) when band is selected. The switch is inactive when operating in the REMOTE control mode.
	BAND F	DS20/S5	Press to select band F (22.20 to 28.00 MHz). Lights (green) when band is selected. The switch is inactive when operating in the REMOTE control mode.
	HV ON indicator/ pushbutton	DS19/S4	Press to energize high voltage (HV). Lights (green) after HV interlocks are proved. The switch is inactive when operating in the REMOTE control mode.
	TM READY indicator	DS18	Lights (green) when transmitter is ready for RF application.

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	FAULT (RESET) indicator/pushbutton	DS17/S3	Press to reset all fault indicator lamps. Lights (red) when faults occur, and light extinguishes when fault resets. Switch operates in both local and remote modes.
10	FAULTS-	1A1	
	INTERLOCK OPEN indicator	DS13	Lights (red) when door, air, or water interlocks are open.
	CROWBAR indicator	DS3	Lights (red) when a crowbar occurs.
	RF ARC indicator	DS2	Lights (red) when any RF arc occurs.
	REVERSE POWER indicator	DS1	Lights (red) when the RF reverse power has exceeded preset limits in any band as determined by limits set on the 1A1A2 circuit card assembly.
	CURRENT OVERLOADS-INTERMEDIATE POWER AMPLIFIER-		
	SCREEN GRID DC indicator	DS6	Lights (red) when a screen grid DC overload occurs.
	ANODE-		
	AC indicator	DS5	Lights (red) when an anode AC overload occurs.
	DC indicator	DS4	Lights (red) when an anode DC overload occurs.
	DRIVER AMPLIFIER-		
	SCREEN GRID DC indicator	DS9	Lights (red) when a screen grid DC overload occurs.
	ANODE-		
	AC indicator	DS8	Lights (red) when an anode AC overload occurs.
	DC indicator	DS7	Lights (red) when an anode DC overload occurs.
	POWER AMPLIFIER-		
	SCREEN GRID DC	DS6	Lights (red) when a screen grid DC overload occurs.
	ANODE-		
	AC indicator	DS5	Lights (red) when an anode AC overload occurs.
	DC indicator	DS4	Lights (red) when an anode DC overload occurs.
11	EMERGENCY OFF push-button (front/rear)	1S39/S40	Press in an emergency situation to remove primary power from transmitter. One pushbutton is at front; one is at rear.
Control/Status Card Assembly Panel, Part of 1A1:			
12	RF FEEDBACK CONTROL card switches and indicators	1A1A1	

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	DET RF INPUT test point	TP1	Test point (TP) to monitor detected RF input, which is a negative dc voltage with an amplitude proportional to the transmitter's RF input power. Voltage varies from 0 V dc for 0 output power, to -1.6 V dc for 100 kW output power.
	DET XMTR FWD PWR test point	TP2	TP to monitor the detected sample of the RF power produced at the forward port of the directional coupler in use. The output is a negative voltage ranging from 0 V dc (no transmitter output) to approximately -2.0 V dc (100 kW transmitter power).
	RF DRIVE control	R25	Variable resistor used to set the quiescent operating point of the voltage controller attenuator used in the RF feedback loop.
	FDBK LOOP-switch	S1	
	TEST		Feedback loop switch position which opens the RF feedback loop during maintenance.
	OPR		Feedback loop switch position which closes the RF feedback loop for normal operation.
	ATTEN VDC test point	TP3	TP to monitor the control line to the voltage controlled feedback attenuator. Typical voltage level is +20 V dc at 100 kW.
13	SIGNAL MONITOR Circuit card assembly switches and indicators	1A1A2	
	FWD PWR CLIP switch	S1	
	DSBL		Disable forward power clipping used during test to open the automatic drive limit control loop.
	ENBL		Enable forward power clipping by closing the automatic drive limit control loop for normal operation.
	FWD CLP controls-		
	A	R7	Sets maximum band A forward power level limit.
	B	R8	Sets maximum band B forward power level limit.
	C	R9	Sets maximum band C forward power level limit.
	D	R10	Sets maximum band D forward power level limit.
	E	R11	Sets maximum band E forward power level limit.
	F	R12	Sets maximum band F forward power level limit.
	DR ATTN test point	TP1	TP monitors the control line to the voltage controlled automatic drive limit attenuator. Typical voltage level range is +4.6 V dc to +6.2 V dc.
	OFS	R52	Offset adjustment for attenuator control circuit.
	RVS CLIP-controls		

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	A	R73	Sets maximum band A reverse power level limit.
	B	R74	Sets maximum band B reverse power level limit.
	C	R75	Sets maximum band C reverse power level limit.
	D	R76	Sets maximum band D reverse power level limit.
	E	R77	Sets maximum band E reverse power level limit.
	F	R78	Sets maximum band F reverse power level limit.
	DET XMTR RVS PWR test point	TP2	TP to monitor the detected sample of the reverse power produced at the reverse port of the directional coupler in use. Values range between 0 V dc for no reverse power, to -1.6 V dc for 10 kW of reverse power.
14	BAND FILTER DRIVER circuit card assembly switches and indicators	1A1A3	
	Fuses		
	A thru F	XF1 thru XF6	Band filter driver fuse protection.
	SPARE 3A 120 VAC	XF7	Spare fuse for XF1 through XF6.
	FLTR CMD - test points for bandpass filter band select		
	A	TP6	TP for band A selection. If band A is selected, TP is greater than +25 V dc. If band A is not selected, TP is less than +0.5 V dc.
	B		TP for band B selection. If band B is selected, TP is greater than +25 V dc. If band B if not selected, TP is less than +0.5 V dc.
	C	TP4	TP for band C selection. If band C is selected, TP is greater than +25 V dc. If band C is not selected, TP is less than +0.5 V dc.
	D	TP3	TP for band D selection. If band D is selected, TP is greater than +25 V dc. If band D is not selected, TP is less than +0.5 V dc.
	E	TP2	TP for band E selection. If band E is selected, TP is greater than +25 V dc. If band E is not selected, TP is less than +0.5 V dc.
	F	TP1	TP for band F selection. If band F is selected, TP is greater than +25 V dc. If band F is not selected, TP is less than +0.5 V dc.
15	BAND COMMAND circuit card assembly switches and indicators	1A1A4	
	BAND SELECTED-test points for band command output		

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	A	TP1	TP for band A selection. If band A is selected, TP is greater than +14 V dc. If band A is not selected, TP is less than +0.5 V dc.
	B	TP2	TP for band B selection. If band B is selected, TP is greater than +14 V dc. If band D is not selected, TP is less than +0.5 V dc.
	C	TP3	TP for band C selection. If band C is selected, TP is greater than +14 V dc. If band C is not selected, TP is less than +0.5 V dc.
	D	TP4	TP for band D selection. If band D is selected, TP is greater than +14 V dc. If band D is not selected, TP is less than +0.5 V dc.
	E	TP5	TP for band E selection. If band E is selected, TP is greater than +14 V dc. If band E is not selected, TP is less than +0.5 V dc.
	F	TP6	TP for band F selection. If band F is selected, TP is greater than +14 V dc. If band F is not selected, TP is less than +0.5 V dc.
	GND	TP7	Ground reference point for test equipment.
16	BAND PROVE circuit card assembly switches and indicators	1A1A5	
	BAND PROVE FAULT indicator	DS1	Lights (red) when a fault exists in proving the band pass filters engaged match those required for the selected band.
17	BIAS CONTROL AND RESET LOGIC circuit card assembly switches and indicators	1A1A6	
	$\overline{\text{RESET}}$ test point	TP1	TP to monitor the 110 millisecond negative pulse (greater than +25 V dc) present following a predetermined time out for resetting the transmitter following a fault.
	ANT/DL test point	TP2	TP to monitor the command sent to the dummy load port. A logic high (greater than +25 V dc) indicates selection of dummy load port. A logic low (less than +1.0 V dc) indicates selection of the antenna port.
	ICW BIAS test point	TP3	TP to monitor selection of interrupted continuous wave (ICW) bias (less than +1.0 V dc for ICW).
	CW BIAS test point	TP4	TP to monitor selection of continuous wave (CW) bias (less than +1.0 V dc for CW).
	RF INHB test point	TP5	TP to monitor the RF inhibit command to the low level amplifier (greater than +2.5 V dc inhibits, less than +0.7 V dc enables low level amplifier).

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	LOCKOUT indicator	DS2	Lights (red) when transmitter has made four recycle attempts following faults during a 2.5 minute period. The transmitter is now locked out from automatic cycle. A manual FAULT (RESET) is required to reactivate transmitter.
	RECYCLE ACTIVE indicator	DS1	Lights (red) when transmitter has had a fault within 2.5 minutes, and less than 30 seconds has elapsed between faults. The transmitter recycles instantly upon application of RF inhibit or first fault and 30 seconds after application of RF inhibit on second or third faults. Transmitter operates with indicator on unless a fourth fault has occurred in less than 2.5 minutes.
18	SERIAL COMMAND INTERFACE circuit card assembly switches and indicators	1A1A7	
	DATA IN test point	TP1	TP to monitor the serial bit stream containing transmitter commands from the transmit control and monitor group (TCMG).
	LATCH test point	TP2	TP to monitor latch pulse which occurs immediately following receiving the command data (from TCMG).
	CLOCK test point	TP3	TP to monitor a serial bit stream which is sent with each command signal group, readback group, or reporting the transmitter status (from TCMG).
	LOAD test point	TP4	TP to monitor a single pulse, which initializes the sending of status to the TCMG. Also known as the status request pulse.
	GND test point	TP5	Ground reference point for test equipment.
19	SERIAL STATUS INTERFACE circuit card assembly switches and indicators	1A1A8	
	RF INHB test point	TP1	TP to monitor a remote RF inhibit (+0.7 V dc level) has been sent to the transmitter from the TCMG.
	SMY FAULT test point	TP2	TP to monitor a signal (greater than +4.0 V dc) which indicates to the TCMG that the transmitter is down from a fault.
	SER OUT test point	TP3	TP to monitor a transistor-transistor-logic (TTL) level pulse train which occurs each time a command readback or transmitter status request is initiated.
20	HV CONTROL circuit card assembly switches and indicators	1A1A9	

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	CABINET AIR indicator	DS2	Lights (red) for a fault in cabinet air pressure.
	CKT BKRS indicator	DS3	Lights (red) when one or more CBs is open or has tripped, HVAC switch is open, or loss of one or more phase of 208 V ac or 12.46 kV power has occurred.
	CROWBAR indicator	DS4	Lights (red) when crowbar has fired or heating lamp is not on.
	ACTR AIR indicator	DS1	Lights (red) when there is insufficient actuator air pressure.
	PWR CMD indicator	TP1	TP to monitor signal (+26.5 V dc) that is present when a STANDBY command has been initiated in either remote or local control.
	SER INTLK	TP2	TP to monitor signal (+26.5 V dc) is present when standby is initiated, there is cabinet air flow, and 3-phase power is within tolerance.
	WATER FL test point	TP3	TP to monitor signal (+26.5 V dc) is present when there is sufficient water flow and TP1 and TP2 are both at +26.5 V dc.
	STBY PROVE test point	TP4	TP to monitor signal (+26.5 V dc with ripple) is present when all interlocks preceding the turn-on of the high frequency (HF) to the transmitter has proved.
	STANDBY test point	TP5	TP to monitor signal (+26.5 V dc with ripple) is present when an HV turn-on command has been issued and latched the HV control line on.
	ACTR AIR test point	TP6	TP to monitor signal (+26.5 V dc with ripple) is present when the HV command has been issued and there is sufficient actuator air pressure present.
21	WATER FLOW circuit card assembly switches and indicators	1A1A10	
	WATER-		
	IPA TEMP indicator	DS5	Lights (red) when the water in the IPA vacuum tube anode has exceeded +170 °F ±5 °F). This fault also causes the DRIVER and PA TEMP indicators to light as well as the IPA TEMP indicator lamp.
	DRVR TEMP indicator	DS4	Lights (red) when the water flowing in the driver vacuum tube has exceeded +170 °F (±5 °F). This fault causes the PA TEMP indicator to light also.
	PA TEMP indicator	DS3	Lights (red) when the water flowing in the PA vacuum tube anode exceeds +170 °F (±5 °F).
	FLOW indicator	DS2	Lights (red) when there is insufficient water flow.

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	INTLKS-		
	GND DVC indicator	DS1	Lights (red) when one or more of the grounding sticks is not stored properly.
	HVPS DR indicator	DS9	Lights (red) when the HVPS door or the ground switch in the HVPS are not in their safe-to-operate positions.
	FR DOOR indicator	DS8	Lights (red) when one or more of the following are open: control door, band F hatch, and left or right front transmitter doors.
	REAR DOOR indicator	DS7	Lights (red) when one or more of the following are open: band E hatch, PA tube hatch, and right and left rear transmitter doors.
	GND SW indicator	DS6	Lights (red) when the transmitter ground switch is closed (shorting out supply voltage).

NOTE

1A1A11, Fault Overload circuit card, has no switches or indicators.

Figure Index	Control or Indicator	Reference Designator	Function
22	FIRST EVENT LOGIC circuit card assembly switches and indicators	1A1A12	
	CROW BAR indicator	DS12	Lights (red) when crowbar triggering circuit has initiated a fault condition.
	RVS PWR indicator	DS11	Lights (red) when the transmitter fault was initiated by the sensing of excessive reverse power flow from the antenna to the transmitter.
	RF ARC indicator	DS10	Lights (red) when the transmitter failed due to the sensing of an arc in the PA vacuum area or in one of the output bandpass filters.
	CUR FLT-		
	IPA SCRN indicator	DS9	Lights (red) when an IPA screen fault has occurred.
	IPA A AC indicator	DS8	Lights (red) when an IPA anode power supply ac overload has occurred.
	IPA A DC indicator	DS7	Lights (red) when an IPA anode power supply dc overload has occurred.
	DRVR SCRN indicator	DS6	Lights (red) when a driver anode power supply dc overload has occurred.
	DRVR A DC indicator	DS5	Lights (red) when a driver anode power supply dc overload has occurred.
	DRVR A AC indicator	DS4	Lights (red) when a driver anode power supply ac overload has occurred.
	PA SCRN indicator	DS3	Lights (red) when a PA screen power supply fault has occurred.

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	PA A DC indicator	DS2	Lights (red) when the PA anode power supply dc overload has occurred.
	PA A AC indicator	DS1	Lights (red) when the PA anode power supply ac overload exceeds the 17.7 A (+20 percent) limit.
23	TEST METER SCALING circuit card assembly switches and indicators	1A1A13	
	BIAS V-controls		
	IPA	R9	Variable resistor calibrates the IPA bias voltmeter (test meter M9).
	DRVR	R10	Variable resistor calibrates the DRVR bias voltmeter (test meter M9).
	PA	R11	Variable resistor calibrates the PA bias voltmeter (test meter M9).
	RF LVL controls		
	PA A	R12	Variable resistor calibrates the PA anode RF sample meter (test meter M7).
	PA G	R13	Variable resistor calibrates the PA grid RF sample meter (test meter M7).
	DRVR G	R14	Variable resistor calibrates the driver grid RF sample meter (test meter M7).
	IPA G	R15	Variable resistor calibrates the IPA grid RF sample meter (test meter M7).
	FIL CUR-controls		
	PA	R16	Variable resistor calibrates the PA filament current meter (test meter on right).
	DRVR	R17	Variable resistor calibrates the driver filament current meter (test meter on right).
	IPA	R18	Variable resistor calibrates the IPA filament current meter (test meter on right).
Bias Adjust Panel 1A9:			
24	CROWBAR TEST pushbutton	1A9S1	Depress the test fire crowbar circuit.
25	VACUUM TUBE STATUS CURRENT ADJUST-	1A9	

NOTE

Adjustments to the IPA, DRIVER AMPLIFIER, and PA are made first in the CW mode. Do not change these adjustments once they have been made, since this will affect the feedback control circuit and associated circuits.

IPA-controls

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	CW-INC 1K control	R1	Potentiometer adjusts the IPA cathode current in the CW operation. Adjustment is made in the CW mode first. Do not change these adjustments once they have been made.
	ICW-INC 1K controls	R2	Potentiometer adjusts the IPA driver cathode current in the ICW operation.
26	DRIVER AMPLIFIER-controls	1A9	
	CW-INC 1k	T1	Variable transformer adjusts the driver cathode current in CW operation. Adjustment is made in the CW mode first. Do not change these adjustments once they have been made.
	ICW-INC 1k	R3	Potentiometer adjusts the driver cathode current in ICW operation.
27	PA-controls	1A9	
	CW-INC 1k	T2	Variable transformer adjusts the PA cathode current in CW operation. Adjustment is made in the CW mode first. Do not change these adjustments once they have been made.
	ICW-INC 1k	R4	Potentiometer adjusts the PA cathode current in ICW operation.
Cooling Water Indicators:			
28	COOLING WATER INLET pressure meter	1	Displays cooling water inlet pressure on a 0-15 lbf/in² scale.
28a	Bleeder Valve	1	Valve bleeds off inlet pressure.
29	COOLING WATER OUTLET pressure meter	1	Displays cooling water outlet pressure on a 0-100 lbf/in² scale.
RF Broadband Low Level Amplifier, 1AR1:			
30	AC POWER-switch ON-OFF	1AR1S1	Switches broadband amplifier (1AR1) ac power ON or OFF.
31	WATTMETER meter	M1	Meter indicates broadband amplifier power output.
32	POWER ON indicator	DS1	Indicator lights (green) when keyline is enabled.
Signal Monitor Panel, 1A25:			
33	TEST LOAD INTERLOCK jack	1A25J5	Jack for cable connecting dummy load to TM. TEST LOAD INTERLOCK monitors the water temperature and flow in the dummy load.
34	RF INPUT SIGNAL SOURCE jack	1A25W5J1	Input jack for external RF signal selected by switch 1A25A2.
35	ACTIVE UNDER LOCAL CONTROL-switches	1A25	

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	RF INPUT SELECTOR LOCAL-REMOTE	S2	Controls relay K5 which selects local RF source at W5J1 or remote RF source at W1J1.
	BIAS/RF INHIBIT-	S3	
	CW BIAS/DRIVE ENABLED		Enables CW bias on tubes of each stage. Can be adjusted with controls on bias adjust panel A9.
	CUTOFF		Cuts off all status current to the tube and removes keyline ground from the low level amplifier.
	ICW BIAS/DRIVE ENABLED		Enables ICW bias on each tube stage. Tubes of each stage can be adjusted with controls on bias adjust panel A9.
36	RF SIGNAL MONITORS-jacks	1A25	
	RF INPUT XMTR	W4J1	Monitor jack for RF input to transmitter.
	RF OUTPUT LL AMPL	W3J1	Monitor jack for RF output of low-level amplifier.
	RF OUTPUT IPA ANODE	J3	Monitor jack for RF output of IPA anode.
	RF OUTPUT DRVR AMPL ANODE	J2	Monitor jack for RF output of driver amplifier anode.
	RF OUTPUT PA ANODE	J1	Monitor jack for RF output of PA anode.
	BAND SWITCHING-jacks		
	XMTR OUTPUT FWD POWER SAMPLE	W2J1	Monitor jack for transmitter of forward power sample.
	XMTR OUTPUT RVS POWER SAMPLE	W1J1	Monitor jack for transmitter of reverse power sample.
37	XMTR METER PANEL MONITOR-switch/jack	1A25	
	Panel Monitor switch	S1	Selects current to be monitored at panel monitor jack J4. This is the same current that is indicated on A13 Meter Panel.
	IPA SCRN I		Monitors IPA screen current.
	IPA CATH I		Monitors IPA cathode current.
	DRVR SCRN I		Monitors driver screen current.
	DRVR AMPL CATH I		Monitors driver cathode current.
	PA SCRN I		Monitors PA screen current.
	PA CATH I		Monitors PA cathode current.
	OFF		No monitor signal present at jack.
	Y		Monitors signal connected at 1A25J4.
	Y Panel Monitor jack	J4	Monitor jack for currents selected by monitor switch S1.

Table 4-1. Transmitter Modules, Units 110 through 121 - Controls and Indicators (Figure 4-1) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
Electronic System Protection Panel, 1A23:			
38	FILAMENT ON-TIME meter	1A23M1	Indicates total time that filament voltage is applied to PA tubes.
39	Electronic System Protection Panel	1A23	
	LOW LEVEL AMPLIFIER CB	CB1	Provides protection to low level amplifier circuits.
	IPA FILAMENT SUPPLY CB	CB5	Provides protection to IPA filament supply circuits.
	DRIVER AMPL FILAMENT SUPPLY CB	CB6	Provides protection to driver amplifier filament supply circuits.
	PA FILAMENT SUPPLY CB	CB7	Provides protection to PA filament supply circuits.
	IPA BIAS SUPPLY CB	CB2	Provides protection to IPA bias supply circuits.
	DRIVER AMPL BIAS SUPPLY CB	CB3	Provides protection to driver amplifier bias supply circuits.
	PA BIAS SUPPLY CB	CB4	Provides protection to PA bias supply circuits.

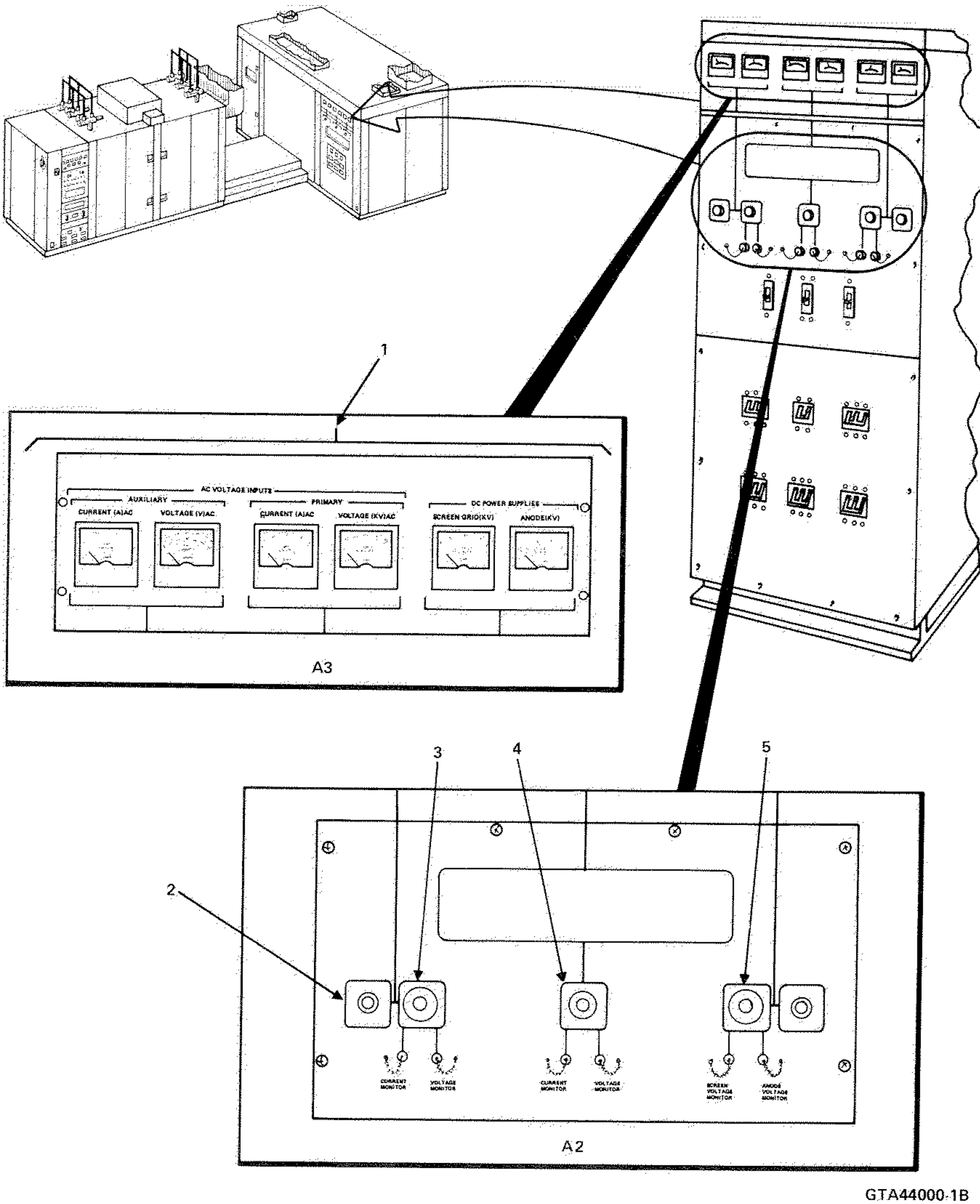


Figure 4-2. High Voltage Power Supplies, Units 122 through 133 - Controls and Indicators (Sheet 1 of 2)

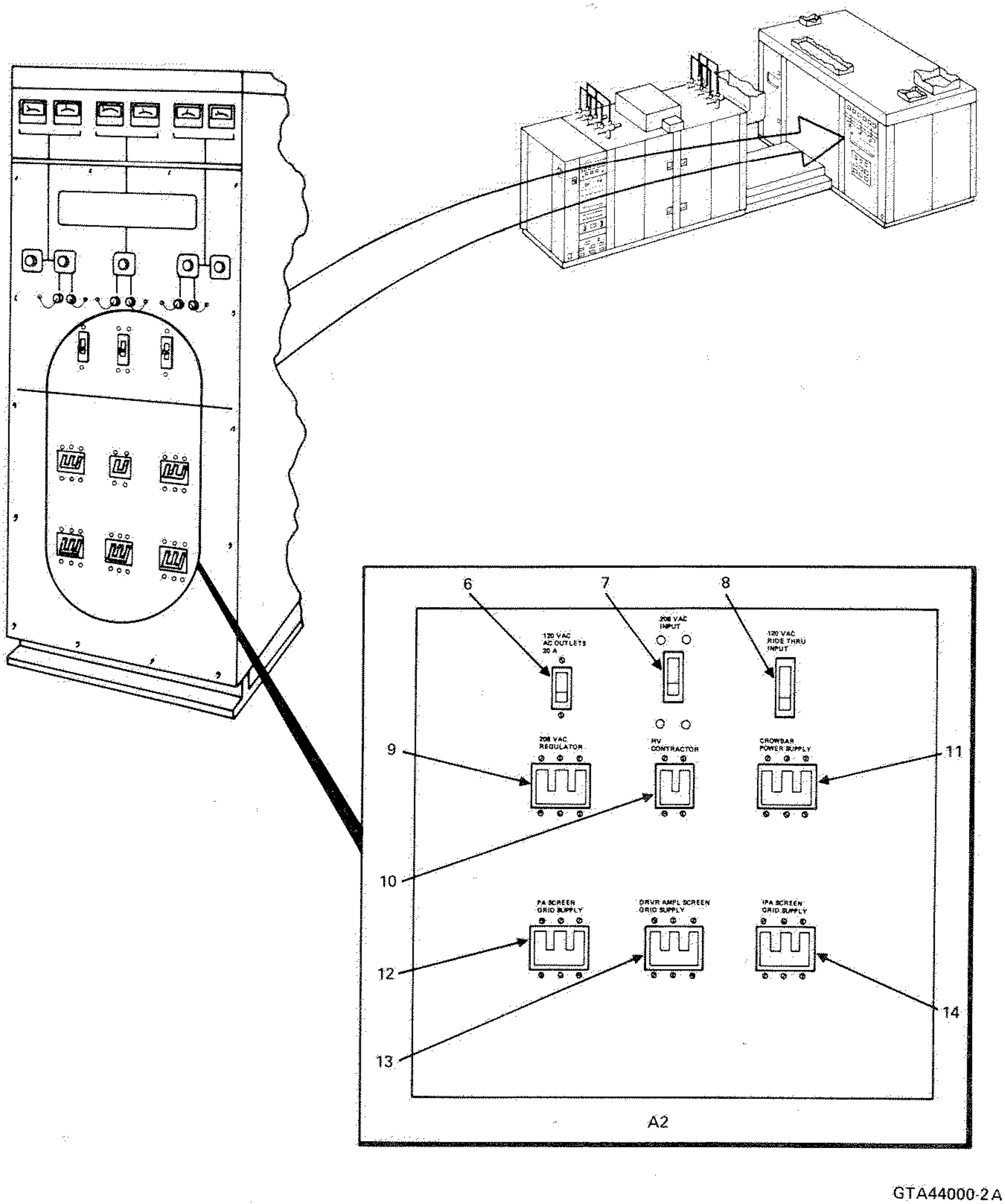


Figure 4-2. High Voltage Power Supplies, Units 122 through 133 - Controls and Indicators (Sheet 2 of 2)

Table 4-2. High Voltage Power Supplies, Units 122 through 133 - Controls and Indicators (Figure 4-2)

Figure Index	Control or Indicator	Reference Designator	Function
HVPS Meter Assembly, 2A3:			
1	Meter Panel		
	AC VOLTAGE INPUTS-		
	AUXILIARY-		
	CURRENT (A) AC meter	M2	Indicates low voltage ac (LVAC) current of the phase that is selected by 2A2S1 or ride through current when in the OFF position, and switch 2A2S4 is pressed.
	VOLTAGE (V) AC meter	M1	Indicates LVAC voltage of the phase that is selected by 2A2S1 on the 0-300 scale or ride through voltage on the 0-150 scale when in the OFF position, and switch 2A2S4 is pressed.
	PRIMARY-		
	CURRENT (A) AC meter	M4	Indicates HVAC current of the phase that is selected by switch 2A2S2.
	VOLTAGE (KV) AC meter	M3	Indicates HVAC voltage of the phase that is selected by switch 2A2S2.
	DC POWER SUPPLIES-		
	SCREEN GRID (KV) meter	M6	Indicates screen grid voltage of the amplifier selected by switch 2A2S3 (PA, Driver, or IPA).
	ANODE (KV) meter	M5	Indicates anode voltage of the amplifier selected by switch 2A2S3 (PA on the 0-15 scale, and Driver or IPA on the 0-7.5 scale).
Control and Monitor Panel, Part of 2A2:			
2	PUSH FOR RIDE THRU 120 V AC 0-150 SCALE (OFF POSITION ONLY) switch	S4	Push to use AUXILIARY meters to indicate logic and control circuits voltage and current. LVAC switch 2A2S1 must be in the OFF position.
3	AC VOLTAGE INPUTS-AUXILIARY-VOLTMETER AMMETER LVAC switch 1 2 3 OFF	S1	Selects the phase of LVAC current and voltage to be indicated by AUXILIARY meters.
	CURRENT MONITOR jack	J2	Scope monitor jack for LVAC current as selected by switch 2A2S2.
	VOLTAGE MONITOR jack	J1	Scope monitor jack for LVAC voltage as selected by switch 2A2S2.

Table 4-2. High Voltage Power Supplies, Units 122 through 133 - Controls and Indicators (Figure 4-2) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
4	AC VOLTAGE INPUTS-PRIMARY-VOLTMETER AMMETER HVAC-switch 1 2 3 OFF	S2	Selects the phase of HVAC current and voltage to be indicated by PRIMARY meters.
	CURRENT MONITOR jack	J4	Scope monitor jack for HVAC current as selected by switch 2A2S2.
	VOLTAGE MONITOR jack	J3	Scope monitor jack for HVAC voltage as selected by switch 2A2S2.
5	DC POWER SUPPLIES-ANODE SCREEN HVDC POWER AMPL DRIVER AMPL INTERMED AMPL OFF	S3	Selects POWER AMPL (PA), DRIVER AMPL (DRVR), or INTERMED AMPL (IPA) for indication of screen grid and anode voltages.
	SCREEN VOLTAGE MONITOR jack	J4	Scope monitor jack for screen grid voltage as indicated by switch 2A2S3.
	ANODE VOLTAGE MONITOR jack	J3	Scope monitor jack for anode voltage as selected by switch 2A2S3.
HV Power Supply CB Panel 2A2:			
6	120 V AC OUTLETS 20 A	CB9	Provides protection to the 120 V ac outlets.
7	208 VAC INPUT	CB1	Provides protection to the 208 V ac input.
8	120 VAC RIDE THRU IN-PUT	CB8	Provides protection to the 120 V ac ride thru input.
9	208 VAC REGULATOR	CB2	Provides protection to the 208 V ac regulator.
10	HV CONTACTOR	CB3	Provides protection to the HV contractor.
11	CROWBAR POWER SUP-PLY	CB4	Provides protection to the crowbar power supply.
12	PA SCREEN GRID SUP-PLY	CB5	Provides protection to the PA screen grid supply.
13	DRVR AMPL SCREEN GRID SUPPLY	CB6	Provides protection to the driver amplifier screen grid supply.
14	IPA SCREEN GRID SUP-PLY	CB7	Provides protection to the IPA screen grid supply.

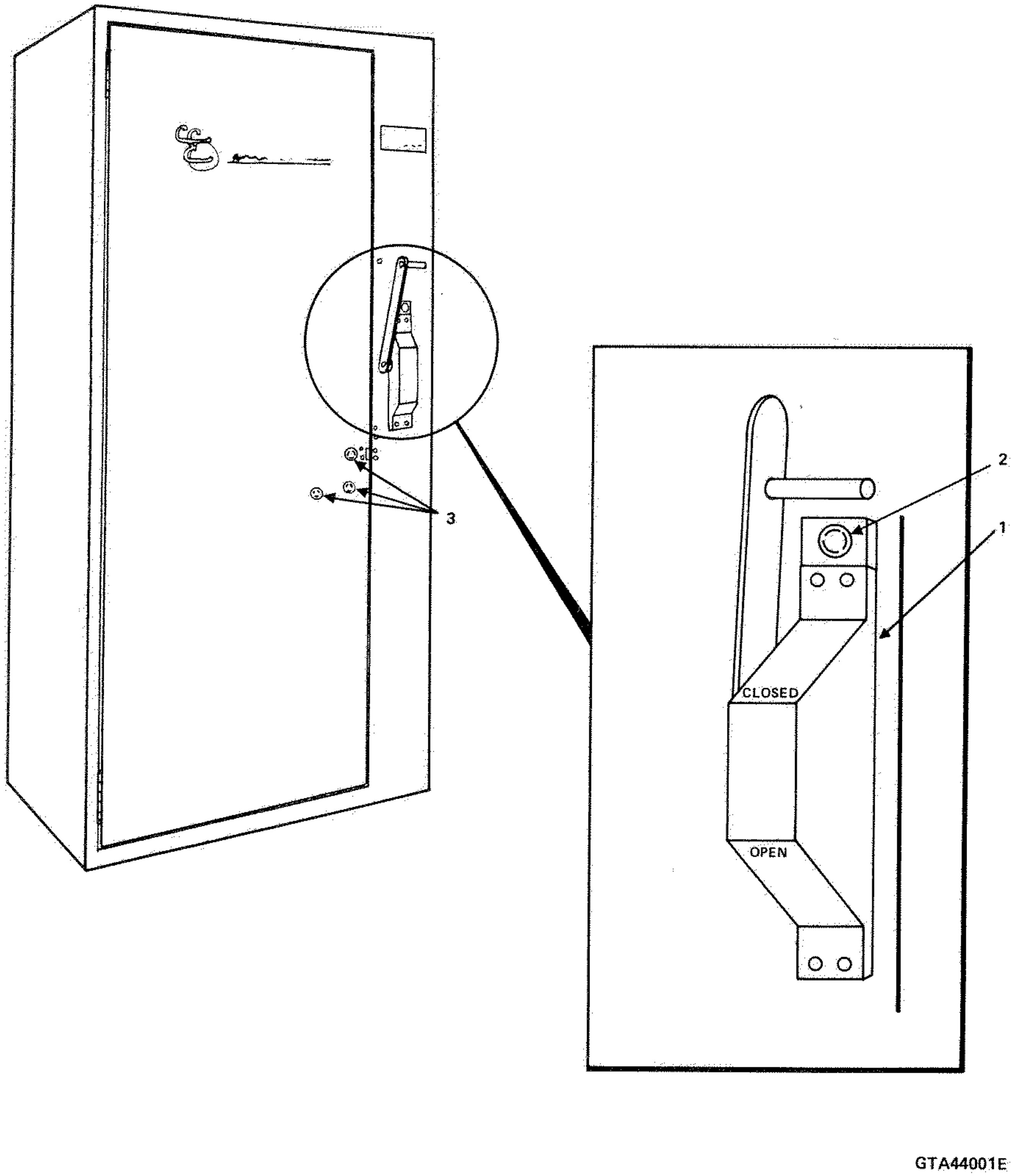


Figure 4-3. High Voltage Ac Disconnect Switches, Units 222 through 233 - Controls and Indicators

Table 4-3. High Voltage Ac Disconnect Switches, Units 222 through 233 - Controls and Indicators (Figure 4-3)

Figure Index	Control or Indicator	Reference Designator	Function
1	HVAC Knife Switch	3S1	Disconnects HVAC (12,470 V ac) from transmitter. When handle is down, switch is open.
2	HVAC Knife Switch Key Lock	-	Locks knife switch in the OPEN or CLOSED position.
3	Cabinet Door Locks	-	Locks cabinet access door in the open or closed position.
			Unlocks key to be used to access (unlock) HVAC disconnect switch and HVPS cabinets.

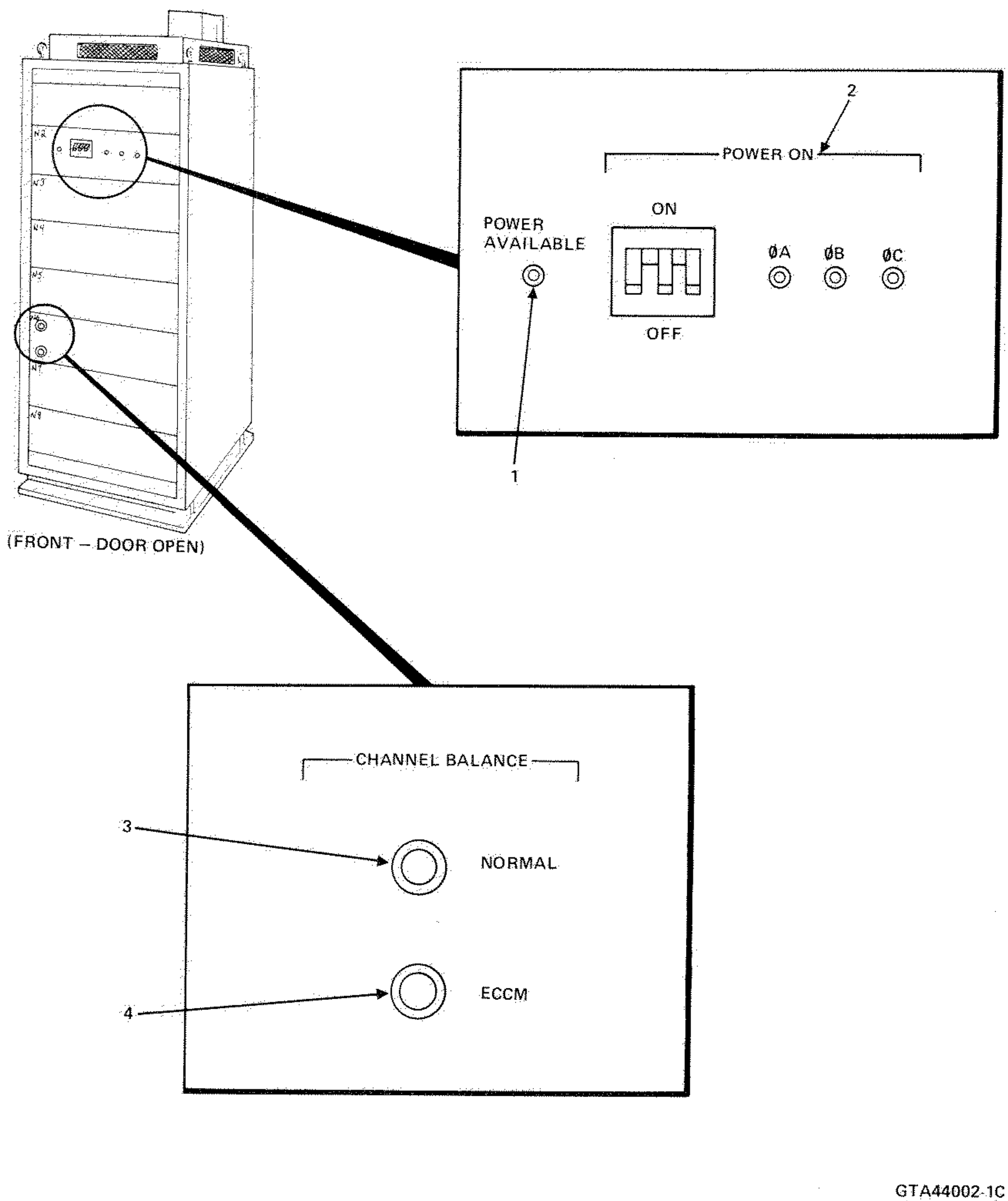


Figure 4-4. Transmit Beamformer, Unit 150 - Controls and Indicators (Sheet 1 of 2)

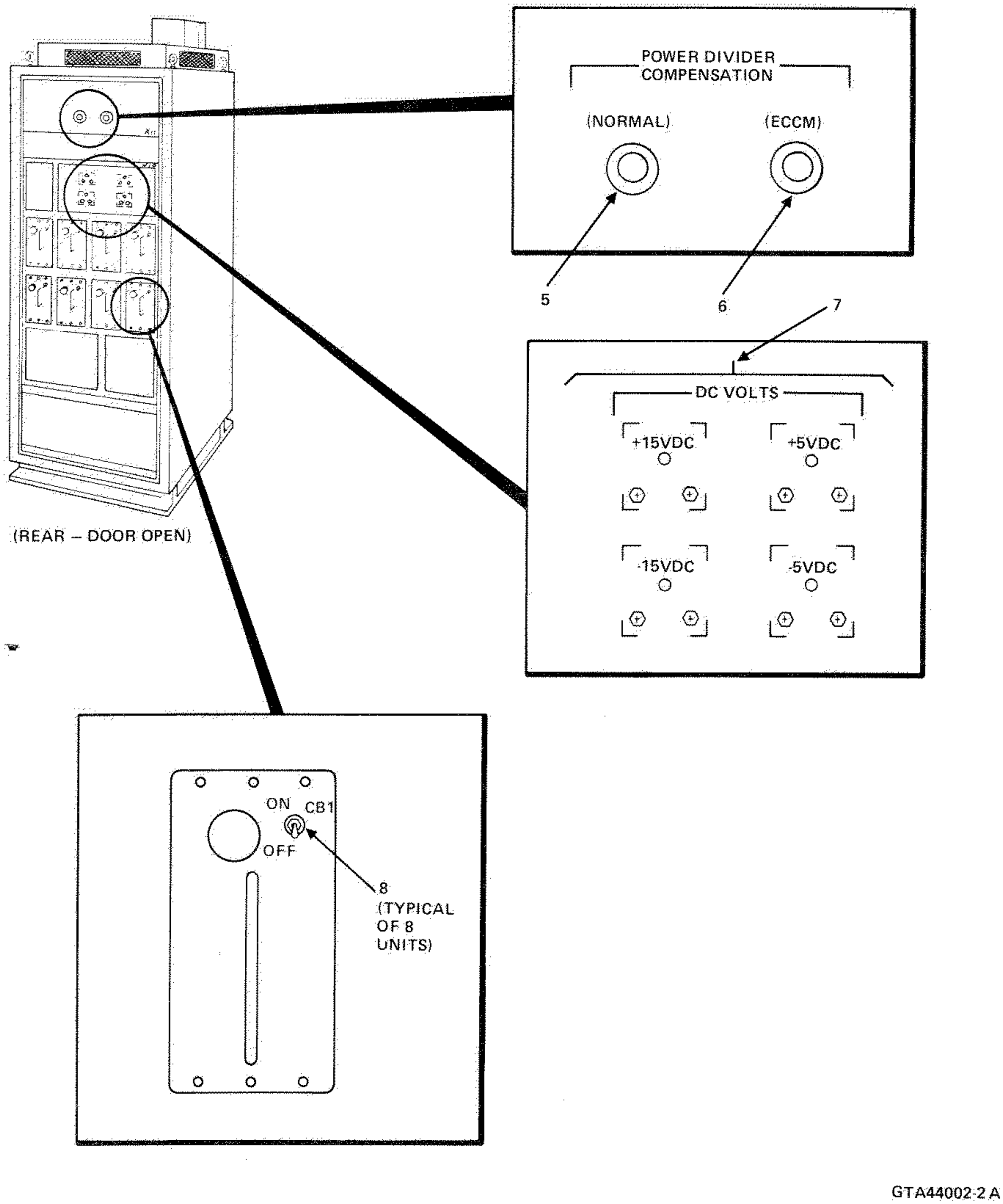


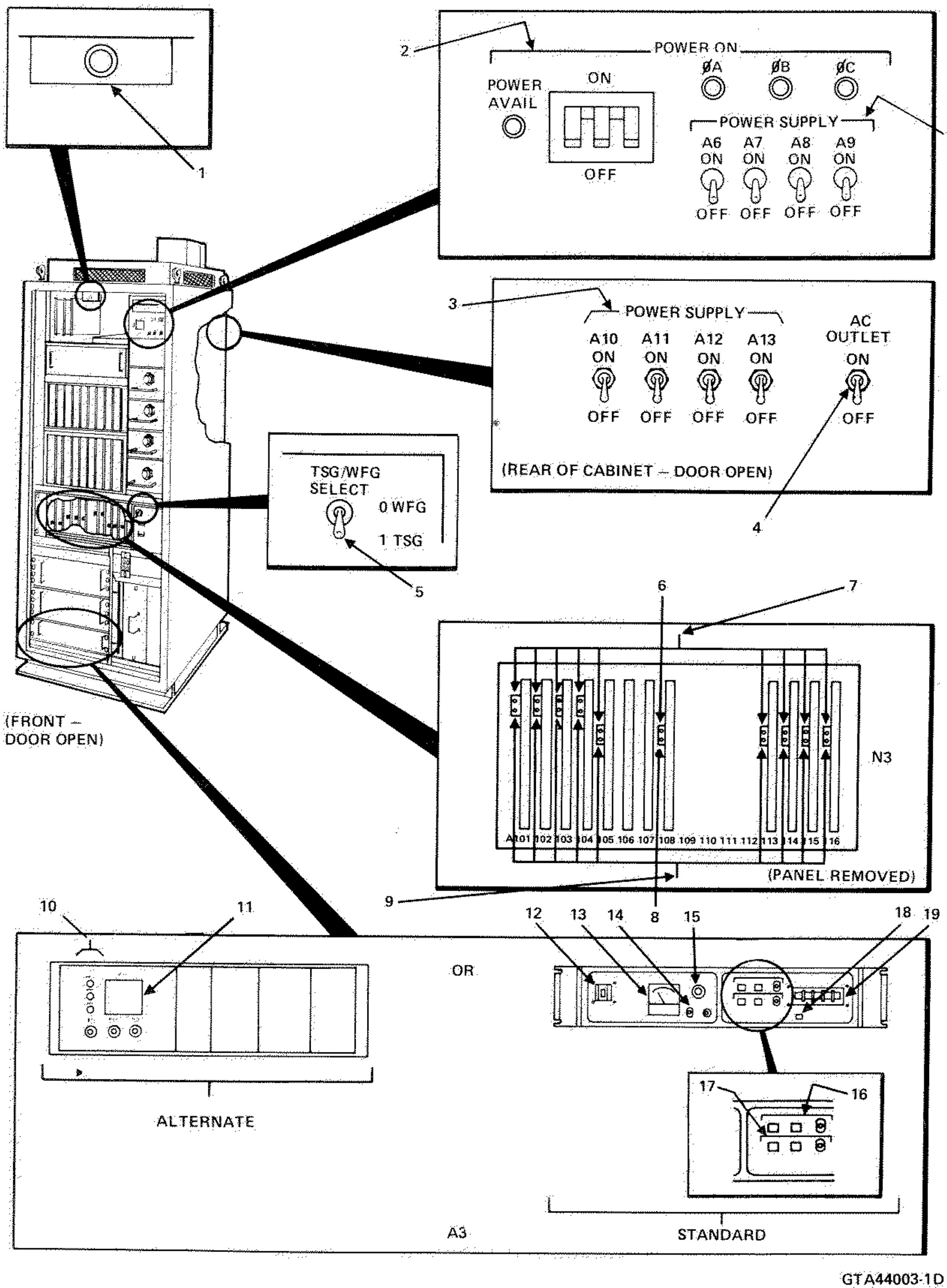
Figure 4-4. Transmit Beamformer, Unit 150 - Controls and Indicators (Sheet 2 of 2)

Table 4-4. Transmit Beamformer, Unit 150 - Controls and Indicators (Figure 4-4)

Figure Index	Control or Indicator	Reference Designator	Function
1	POWER AVAILABLE indicator	N2DS4	Lights (green) when 208 V, phase-C, 60-Hz ac power is present at cabinet.
2	POWER ON-		
	ON-OFF	N2CB1	Main power breaker that applies 208 V, 3-phase, 60-Hz ac primary power to cabinet.
	ØA ØB ØC	DS1 DS2 DS3	Lights (green) when circuit breaker CB1 is on and 208 V, 60-Hz ac power is active for indicated phase.
3	CHANNEL BALANCE-NORMAL 0 to 10 dB attenuator	N6AT1	Attenuator control used to compensate for insertion of 2-way hybrid combiner in normal signal path when both exciter cabinets are in operation.
4	CHANNEL BALANCE-ECCM 0 to 10 dB attenuator	N6AT2	Attenuator control used to compensate for insertion of 2-way hybrid combiner in electronic counter countermeasures (ECCM) signal path when both exciter cabinets are in operation.
5	POWER DIVIDER COMPENSATION-NORMAL 0 to 10 dB attenuator	A11AT1	Attenuator control used to compensate for insertion of 2-way power divider in normal signal path when both exciter cabinets are in operation.
6	POWER DIVIDER COMPENSATION-ECCM 0 to 10 dB attenuator	A11AT2	Attenuator control used to compensate for insertion of 2-way power divider in ECCM signal path when both exciter cabinets are in operation.
7	Test Panel:	N10A3	
	+5 V dc (+) jack +5 V dc (-) jack +5 V dc control	J1 J2 R1	Monitoring test points and adjustment potentiometer for nominal +5 V dc, distribution supplied from VR1 and VR2.
	-5 V dc (-) jack -5 V dc (+) jack -5 V dc control	J3 J4 R2	Monitoring test points and adjustment potentiometer for -5.2 V dc, ± 0.025 V dc distribution supplied from VR3 and VR4.
	+15 V dc (+) jack +15 V dc (-) jack +15 V dc control	J5 J6 R3	Monitoring test points and adjustment potentiometer for +15 V dc, ± 0.5 V dc, distribution supplied from VR5 and VR6.
	-15 V dc (-) jack -15 V dc (+) jack -15 V dc control	J7 J8 R4	Monitoring test points and adjustment potentiometer for -15 V dc, ± 0.5 V dc, distribution supplied from VR7 and VR8.
8	Voltage Regulators:	VR1-VR8	
	+5 V dc voltage regulators VR1 and VR2, ON-OFF CB	CB1	Controls dc power to the +5 V dc voltage regulators.
	-5 V dc voltage regulators VR3 and VR4, ON-OFF CB	CB1	Controls dc power to the -5 V dc voltage regulators.

Table 4-4. Transmit Beamformer, Unit 150 - Controls and Indicators (Figure 4-4) -CONT

Figure Index	Control or Indicator	Reference Designator	Function
	+15 V dc voltage regulators VR5 and VR6, ON-OFF CB	CB1	Controls dc power to the +15 V dc voltage regulators.
	-15 V dc voltage regulators VR7 and VR8, ON-OFF CB	CB1	Controls dc power to the -15 V dc voltage regulators.



(NOTE: A3 is non-functional in Unit 152 and may be used as a hot spare for Unit 151.)

Figure 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Sheet 1 of 5)

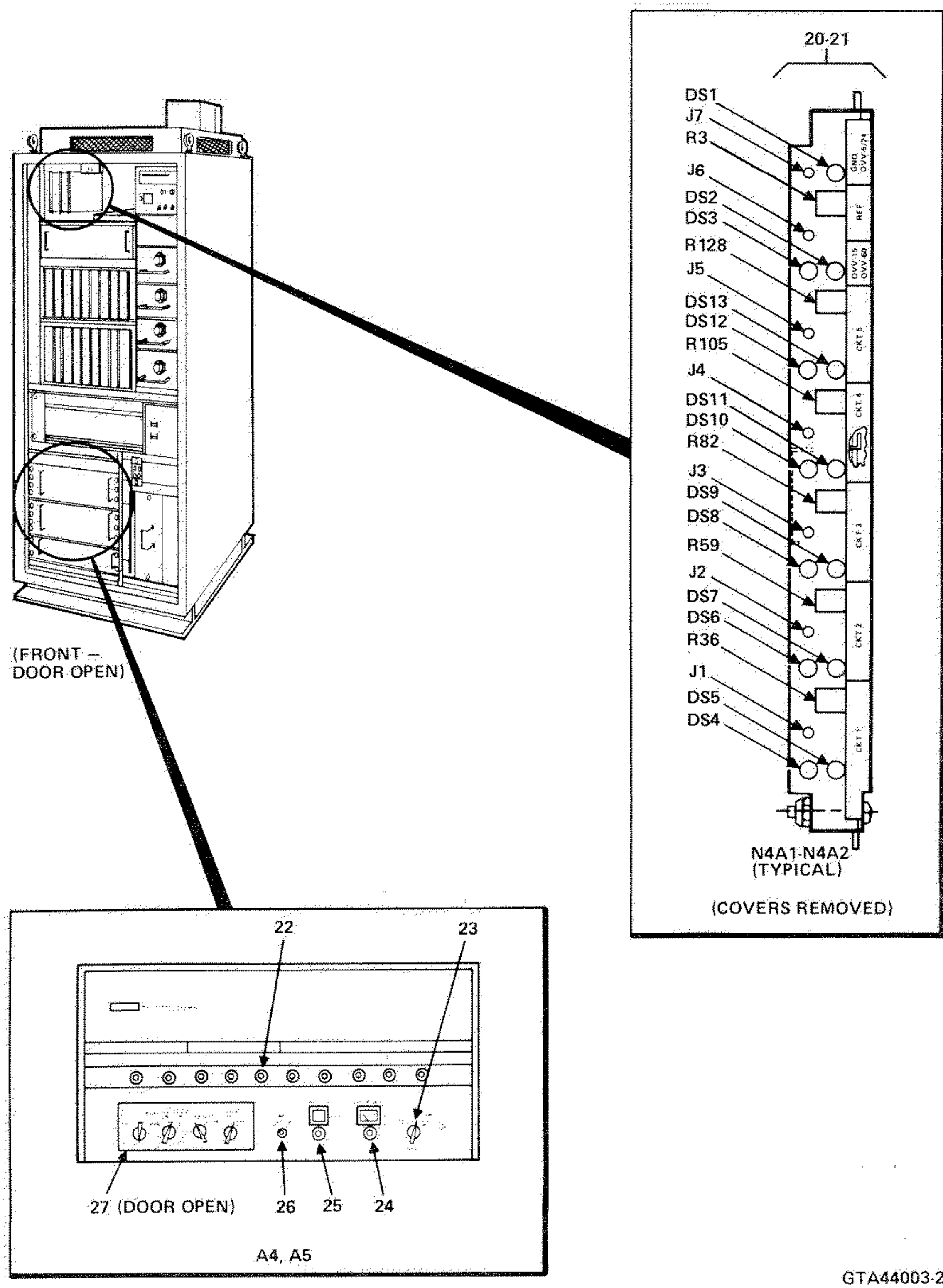


Figure 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Sheet 2 of 5)

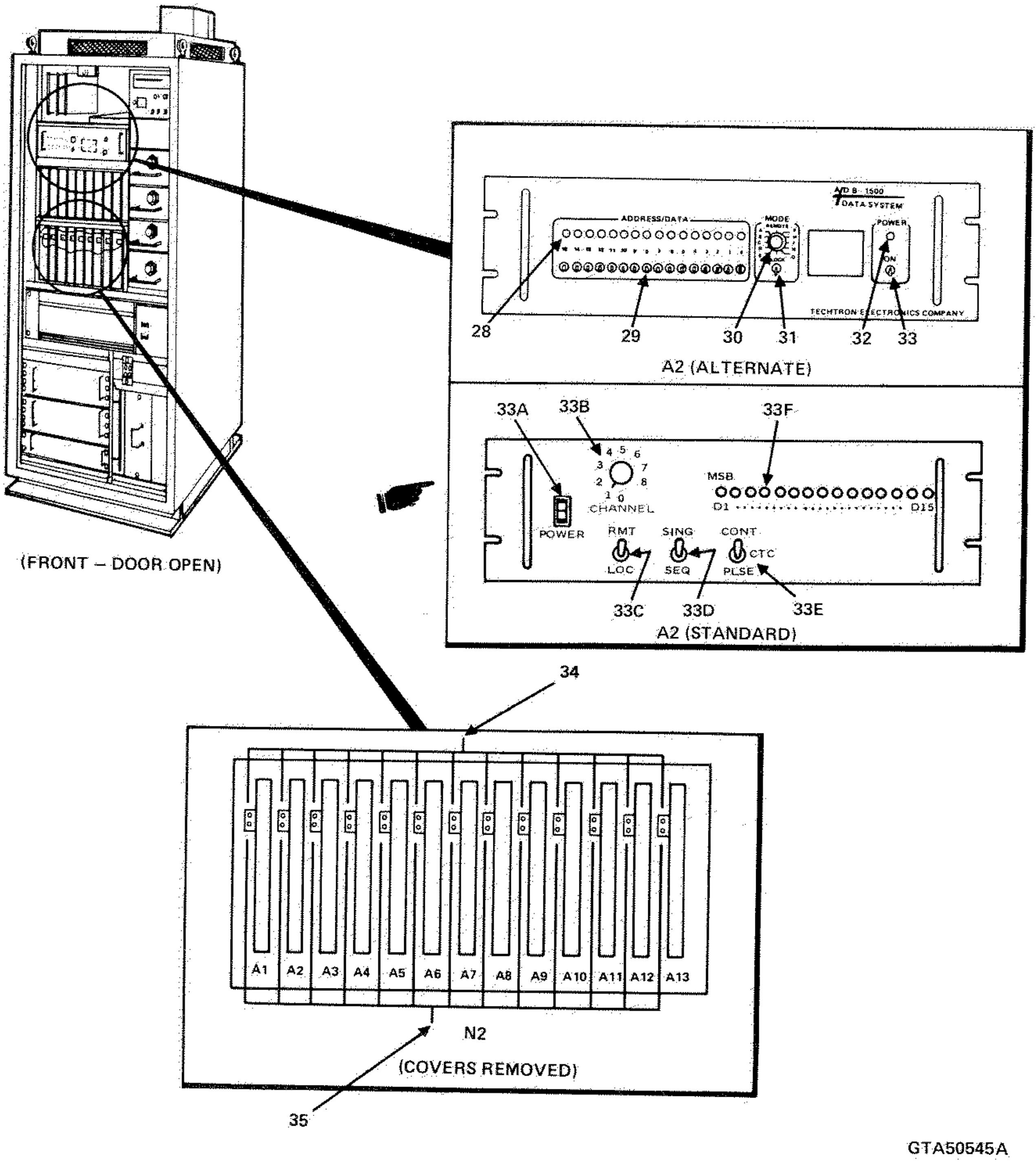


Figure 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Sheet 3 of 5)

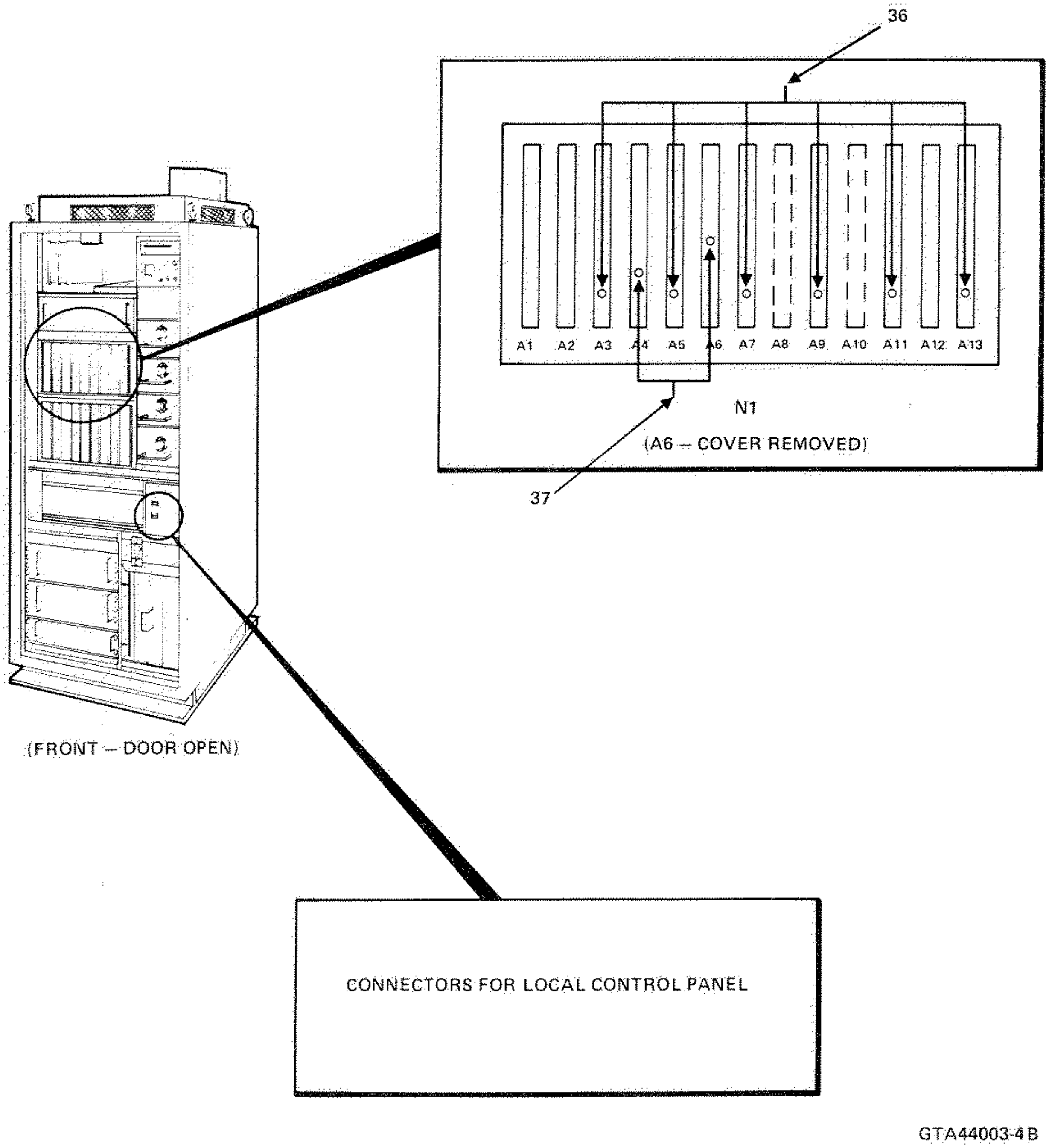


Figure 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Sheet 4 of 5)

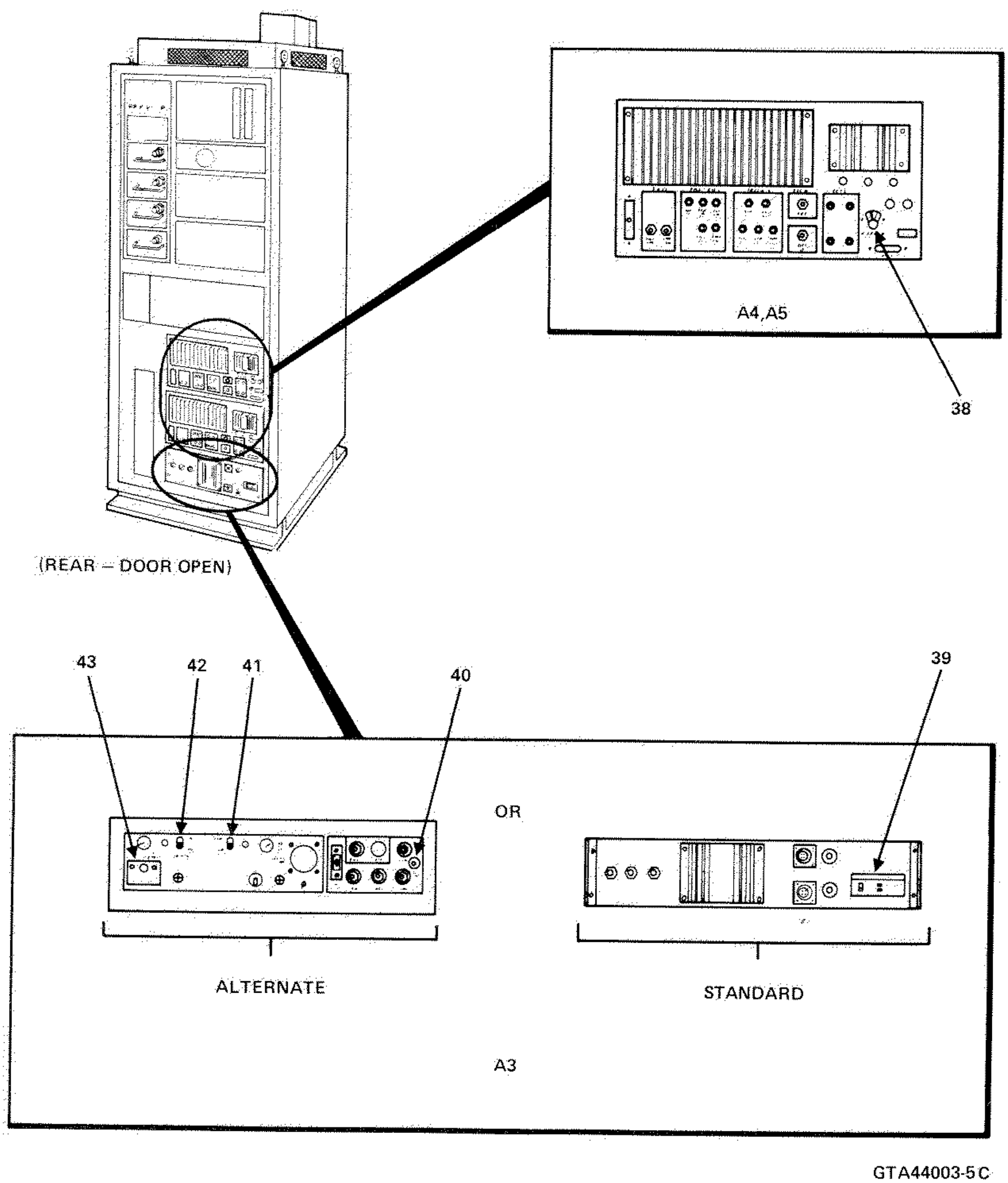


Figure 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Sheet 5 of 5)

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
1	LOCAL-REMOTE interlock switch	S3	Pull switch plunger into detent position for LOCAL control. Push switch plunger or close cabinet door to place in REMOTE.
2	POWER ON-		
	POWER AVAIL indicator	DS1	Lights (green) when 208 V, 60-Hz ac power is present at cabinet.
	ON-OFF circuit breaker	CB1	Main power breaker that applies 208 V, 3-phase, 60-Hz ac primary power to cabinet.
	ØA ØB ØC	DS2 DS3 DS4	Lights (green) when circuit breaker CB1 is on and 208 V, 60-Hz ac power is active for indicated phase.
3	POWER SUPPLY-circuit breaker ON-OFF		
	A6-ON-OFF	CB2	Controls 115 V ac primary power to A6 +60 V dc power supply.
	A7-ON-OFF	CB3	Controls 115 V ac primary power to A7 -60 V dc power supply.
	A8-ON-OFF	CB4	Controls 115 V ac primary power to A8 +15 V dc power supply.
	A9-ON-OFF	CB5	Controls 115 V ac primary power to A9 -15 V dc power supply.
	A10-ON-OFF	CB6	Controls 115 V ac primary power to A10 +5(A) V dc power supply.
	A11-ON-OFF	CB7	Controls 115 V ac primary power to A11 +5(B) V dc power supply.
	A12-ON-OFF	CB8	Controls 115 V ac primary power to A12 +24(A) V dc power supply.
	A13-ON-OFF	CB9	Controls 115 V ac primary power to A13 +24(B) V dc power supply.
4	AC OUTLET- circuit breaker ON-OFF	CB10	Controls 115 V ac primary power to cabinet duplex outlets.
5	TSG/WFG SELECT switch 0 WFG 1 TSG	S4	Not used.
6	LOCAL/REMOTE	N3A108 U54DS1	Lights (red) when Cabinet is in REMOTE control mode.
7	Error Indicators:	N3	
	INPUT PARITY ERROR	A101 U45DS1	Lights (red) for an input control or input Q1 (quadratic) data parity error.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
	INPUT PARITY ERROR	A102 U45DS1	Lights (red) when an input control data parity error is detected.
	INPUT PARITY ERROR	A103 U45DS1	Lights (red) when an input control data parity error is detected.
	INPUT PARITY ERROR	A104 U45DS1	Lights (red) when an input control data parity error is detected.
	BOARD AJAR ERROR	A105 U54DS1	Lights (red) when a cabinet plug-in board assembly is ajar.
	Spare	A113 U54DS2	Not used.
	Spare	A114 U54DS2	Not used.
	Spare	A115 U54DS2	Not used.
	Spare	A116 U54DS2	Not used.
8	DATA ACTIVITY indicator	N3A108 U54DS2	Lights (red) when data transfer is occurring between the cabinet and the data processing equipment.
9	Error Indicators:	N3	
	SUMMARY FAULT	A101 U45DS2	Lights (red) when any of four conditions is detected: 1. Sine Test Vector 2 Noncompare (channel 1). Calculated value does not compare with expected value. 2. Cosine Test Vector 2 Noncompare (channel 2). Calculated value does not compare with expected value (not used). 3. Mixer Clock Fault. Missing mixer clock pulses. 4. Analog-to-Digital (A/D) Clock Fault. Missing A/D clock pulses.
	NON-COMPARE ERROR	A102 U45DS2	Lights (red) for comparison error between test vector 1 output and expected output value stored in programmable read-only memory (PROM).
	Spare	A103 U45DS2	Not used.
	Spare	A104 U54DS2	Not used.
	BOARD AJAR ERROR	A105 U54DS2	Lights (red) when a cabinet plug-in board assembly is ajar.
	COMPARISON ERROR	A113 U54DS1	Lights (red) for errors between input parallel data and output serial data.
	COMPARISON ERROR	A114 U54DS1	Lights (red) for errors between input parallel data and output serial data.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5) - CONT

Figure Index	Control or Indicator	Reference Designator	Function
	COMPARISON ERROR	A115 U54DS1	Lights (red) for errors between input parallel data and output serial data.
	COMPARISON ERROR	A116 U54DS1	Lights (red) for errors between input parallel data and output serial data.

NOTE

Items 10 and 11 below apply only to the Alternate Frequency Calibrator, Assembly A3. Assembly A3 is non-functional in Unit 152 and may be used as a hot spare for Unit 151.

Figure Index	Control or Indicator	Reference Designator	Function
10	Status Indicators:	A3	
	OVEN alarm	DS1	Lights (red) when temperature of oscillator oven is below rated value.
	BATT	DS3	Lights (red) when equipment is operating on internal standby battery.
	POWER	DS2	Lights (green) when switch A3S2 is on and 115 V ac, 60-Hz power is active.
11	Delta F switch	A3R1	Fine frequency adjust. Resolution is approximately $2x10^{-10}$ per step.

NOTE

Items 12 through 19 below apply only to the Standard Frequency Calibrator, Assembly A3. Assembly A3 is non-functional in Unit 152 and may be used as a hot spare for Unit 151.

Figure Index	Control or Indicator	Reference Designator	Function
12	MONITOR-Meter select switch	A3	Meter parameter select switch may be positioned from a setting 1 to 5.
	1. OVEN		Voltage supplied to oven. Below 4 V dc, OVEN READY indicator lights. Nominal voltage is 3.5 V dc.
	2. SUPPLY		Regulated supply voltage. Nominal voltage is 22 V dc (meter reading 2.2 V dc).
	3. CONTROL		Voltage applied to the internal oscillator. Nominal voltage is 7 V dc (meter reading 3.5 V dc).
	4. CHARGE		Nominal 1.5 V dc for trickle charge and 1.5 V dc to 4.5 V dc for fast charge (CHARGE lights during fast charge).
	5. BATT		Internal battery voltage when TEST pushbutton is pressed. Nominal voltage is 28 V dc (2.8 V dc on meter).
13	MONITOR-meter indicator	A3	Meter reading corresponding to parameter selected by meter select switch.
14	1PPS SYNC ENABLE-IN	A3	Press to synchronize output 1 pps pulse with 1 pps reference pulse connected to 1 PPS SYNC IN BNC connector.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
15	CONTROL VOLTAGE switch EXT-INT	A3	Determines if frequency adjustment is from front panel CONTROL VOLTAGE control (INT) or via rear panel connector (EXT).
16	AC POWER-Controls and indicators:	A3	
	ON indicator	-	Lights (green) when equipment is being operated off ac power source.
	ALARM indicator	-	Lights (red) when ac power has been interrupted. To reset indicator, press AC POWER RESET pushbutton.
	RESET pushbutton	-	Switch resets AC POWER ALARM indicator. When equipment is first powered, this button turns on equipment.
17	BATTERY-Controls and indicators:	A3	
	ON indicator	-	Lights (red) when equipment is being operated off internal battery source. Battery allows operation for 12 hours.
	CHARGE indicator	-	Lights (green) when the battery is being fast charged. Indicator blinks when battery is near full capacity.
	TEST pushbutton	-	When pressed, power source switches to internal battery. Also sets ALARM indicator. To clear ALARM, press RESET.
18	OVEN READY indicator	A3	Lights (green) when crystal oven has reached operating temperature. During initial powering, indicator may blink.
19	CONTROL VOLTAGE switch	A3	Fine frequency adjust used to enter small frequency corrections. Resolution is:

Resolution	Switch Setting				
	x	x	x	x	x
	|	|	|	|	|
4×10^{-8}	|	|	|	|	|
4×10^{-9}	---	|	|	|	|
4×10^{-10}	---	---	|	|	|
4×10^{-11}	---	---	---	|	|
4×10^{-12}	---	---	---	---	|

20	Power supply monitors	N4A1	
	CKT 1	DS4	Lights (red) when A10 +5(A) V dc power supply output current exceeds limits.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
		DS5	Lights (green) when A10 +5(A) V dc power supply output current is within limits. If power supply current load is low, indicator does not light.
		J1	TP used with R36 to zero out dc offset in monitor circuit.
		R36	Potentiometer used with J1 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A10 +5(A) V dc power supply turned off.
	CKT 2	DS6	Lights (red) when A11 +5(B) V dc power supply output current exceeds limits.
		DS7	Lights (green) when A11 +5(B) V dc power supply output current is within limits. If power supply current load is low, indicator does not light.
		J2	TP used with R59 to zero out dc offset in monitor circuit.
		R59	Potentiometer used with J2 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A11 +5(B) V dc power supply turned off.
	CKT 3	DS8	Not used.
		DS9	Not used.
		J3	Not used.
		R82	Not used.
	CKT 4	DS10	Lights (red) when A6 +60 V dc power supply output current exceeds limits.
		DS11	Lights (green) when A6 +60 V dc power supply output current is within limits. If power supply current load is low, indicator does not light.
		J4	TP used with R105 to zero out dc offset in monitor circuit.
		R105	Potentiometer used with J4 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A6 +60 V dc power supply turned off.
	CKT 5	DS12	Lights (red) when A8 +15 V dc power supply output current exceeds limits.
		DS13	Lights (green) when A8 +15 V dc power supply output current is within limits. If power supply current load is low, indicator does not light.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
		J5	TP used with R128 to zero out dc offset in monitor circuit.
		R128	Potentiometer used with J5 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A8 +15 V dc power supply turned off.
	Overvoltage	DS1	Lights (red) when A10 +5 (A) V dc power supply output voltage exceeds +5.88 V dc.
		DS2	Lights (red) when A6 +60 V dc power supply output voltage exceeds +66.00 V dc.
		DS3	Lights (red) when A8 +15 V dc power supply output voltage exceeds +16.40 V dc.
		J6	TP used in conjunction with R3 to adjust the +2.50 V dc reference.
		J7	Ground TP for test equipment.
		R3	Potentiometer used in conjunction with J6 to adjust the +2.50 V dc reference. Correct adjustment, using high impedance voltmeter, is +2.50 V dc.
21	Power supply monitors	N4A2	
	CKT 1	DS4	Lights (red) when A12 +24(A) V dc power supply output current exceeds limits.
		DS5	Lights (green) when A12 +24(A) V dc power supply output current is within limits. If power supply current load is low, indicator does not light.
		J1	TP used with R36 to zero out dc offset in monitor circuit.
		R36	Potentiometer used with J1 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A12 +24(A) V dc power supply turned off.
	CKT 2	DS6	Lights (red) when A13 +24(B) V dc power supply output current exceeds limits.
		DS7	Lights (green) when A13 +24(B) V dc power supply output current is within limits. If power supply current load is low, indicator does not light.
		J2	TP used with R59 to zero out dc offset in monitor circuit.
		R59	Potentiometer used with J2 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A13 +24(B) V dc power supply turned off.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
	CKT 3	DS8	Not used.
		DS9	Not used.
		J3	Not used.
		R82	Not used.
	CKT 4	DS10	Lights (red) when A7 -60 V dc power supply output current exceeds limits.
		DS11	Lights (green) when A7 -60 V dc power supply output current is within limits. If power supply current load is low, indicator does not light.
		J4	TP used with R105 to zero out dc offset in monitor circuit.
		R105	Potentiometer used with J4 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A7 -60 V dc power supply turned off.
	CKT 5	DS12	Lights (red) when A9 -15 V dc power supply output current exceeds limits.
		DS13	Lights (green) when A9 -15 V dc power supply output current is within limits. If power supply current load is low, indicator does not light.
		J5	TP used with R128 to zero out dc offset in monitor circuit.
		R128	Potentiometer used with J5 to zero out dc offset in monitor circuit. Correct adjustment is 0.00 V dc, relative to the +2.50 V dc reference, and is made with A9 -15 V dc power supply turned off.
	Overvoltage	DS1	Lights (red) when A13 +24(C) V dc power supply output voltage exceeds +26.60 V dc.
		DS2	Lights (red) when A7 -60 V dc power supply output voltage exceeds -66.00 V dc.
		DS3	Lights (red) when A9 -15 V dc power supply output voltage exceeds -16.40 V dc.
		J6	TP used in conjunction with R3 to adjust the +2.50 V dc reference.
		J7	Ground TP for test equipment.
		R3	Potentiometer used in conjunction with J6 to adjust the +2.50 V dc reference. Correct adjustment, using high impedance voltmeter, is +2.50 V dc.
22	FREQUENCY DIALS 10 decade switches	A4,A5	In-line digit switches that provide selection of the synthesizer output frequency.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
23	OUTPUT-selector switch	A4,A5	
	EXT AM		Amplitude of outputs are determined by input signal at rear panel EXTERNAL MODULATION INPUT connector.
	1V RMS		The 0-100-kHz and 50 Hz - 50 MHz output signals are preset to respective levels of 0.1 and 1.0 V dc rms, ±1-dB.
	ALC		The amplitude of the 50 Hz - 50 MHz output is adjustable from 0.2 to 1.0 V dc rms with ALC LEVEL control (+0.25 dB).
24	DIGIT INTERPOLATOR control	A4,A5	Control provides continuous adjustment above or below the digit of the selected frequency decade.
25	DECADE SELECTOR control 0.01 through 100K	A4,A5	Selects the desired 0.01 through 100K SEARCH decade. Selected frequency decade lights frequency dial indicator.
26	POWER-switch	A4,A5	Push switch to energize equipment.
27	Operator controls:	A4,A5	
	SEARCH DIGIT INTERPOLATOR MODE-switch		
	LOCAL		The SEARCH deviation is controlled by the DIGIT INTERPOLATOR dial.
	REMOTE		The SEARCH deviation is controlled by dc voltage applied to rear panel REMOTE SEARCH INPUT connector.
	SWEEP		The SEARCH mode is swept at a rate and magnitude selected by the SWEEP TIME-SEC and SWEEP WIDTH controls.
	SWEEP TIME-SEC control 0.01 through 50		Selects the desired 0.01 through 50 second-half range sweep time.
	SWEEP WIDTH- switch X1 X0.5 X0.2		Selects desired X1, X0.5, or X0.2 sweep range. The X1 position is proportional to a full decade digit.
	FREQUENCY SELECTION switch		
	LOCAL		Selection of the synthesizer output frequency is provided with the front panel frequency dials.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5) - CONT

Figure Index	Control or Indicator	Reference Designator	Function
	REMOTE		Selection of synthesizer output frequency is accomplished by dc voltage applied to the rear panel connector.

NOTE

Items 28 through 33 only apply to the ALTERNATE A/D converter.

Figure Index	Control or Indicator	Reference Designator	Function
28	ADDRESS/DATA indicators 0 through 15	A2	Displays digital output for channel selected with MULTIPLEX ADDRESS switch setting.
29	ADDRESS/DATA switches 0 through 15	A2	Selects the multiplexer address. Only switches 3, 2, 1, 0 are used to enter the channel address 0 to 8 in BCD format.
30	MODE-switch	A2	
	REMOTE		Switch position means all command/clock inputs are controlled externally.
	A-ADC SEQ CHANNEL		Switch position means manual clock activation sequentially digitizes each channel at a 333-kHz rate.
	B-ADC RANDOM CHANNEL		ADC Switch position means manual clock activation digitizes channel selected by address switches.
	C through L		Not used.
31	CLOCK switch	A2	In REMOTE, manual clock switch is disabled. In a manual mode, switch down is momentary, up is steady 1-kHz rate.
32	POWER indicator	A2	Lights (red) when 115 V, 60-Hz ac, primary power is active in equipment.
33	POWER- switch ON	A2	Applies 115 V, 60-Hz ac, primary power to the equipment.

NOTE

Items 33A through 33F only apply to the STANDARD A/D converter.

Figure Index	Control or Indicator	Reference Designator	Function
33A	POWER switch/indicator	A2	Applies 115 V ac primary power to the unit.
33B	CHANNEL select switch 0 through 8	A2	Selects channel to be displayed by indicator lights.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5) - CONT

Figure Index	Control or Indicator	Reference Designator	Function
33C	Local-Remote mode switch	A2	
	LOC		Selects local mode of operation.
	RMT		Selects remote mode of operation.
33D	Channel addressing mode select switch (CAS)	A2	
	SING		Selects single mode of channel addressing.
	SEQ		Selects sequential mode of channel addressing.
			The CAS is non-functional when the converter is in RMT operational mode.
33E	Clock control switch (CCS)	A2	
	CONT		Command to convert (CTC) signals are continuously generated from internal clock.
	CTC		No CTC signals are generated.
	PLSE		A momentary position that allows the generation of a single CTC signal each time the switch is depressed and released.
			The CCS is non-functional when the converter is in RMT operational mode.
33F	Digital indicator lamps D1 through D15	A2	Displays converted digital data of the channel selected by the CHANNEL select switch. The data is displayed in two's complement form.

NOTE

For items 34 and 35 below, remove covers to view indicators.

34	Summary fault indicators		Lights (red) when any of the following oscillator faults are detected: 1. Frequency reference input missing 2. Divide-by-N2 output missing 3. Oscillator output missing 4. Phase lock loop (PLL) is unlocked 5. Single ended output No. 1 missing 6. Single ended output No. 2 missing 7. Differential output No. 1 missing 8. Differential output No. 2 missing
	SUMMARY FAULT	N2A1DS2	22.1184-MHz oscillator fault indication
	SUMMARY FAULT	N2A2DS2	26.2656-MHz oscillator fault indication
	SUMMARY FAULT	N2A3DS2	32.4864-MHz oscillator fault indication
	SUMMARY FAULT	N2A4DS2	34.5600-MHz oscillator fault indication

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5) - CONT

Figure Index	Control or Indicator	Reference Designator	Function
	SUMMARY FAULT	N2A5DS2	12.0960-MHz oscillator fault indication
	SUMMARY FAULT	N2A6DS2	16.5888-MHz oscillator fault indication
	SUMMARY FAULT	N2A7DS2	2.1600-MHz oscillator fault indication
	SUMMARY FAULT	N2A8DS2	13.9140-MHz oscillator fault indication
	SUMMARY FAULT	N2A9DS2	14.6880-MHz oscillator fault indication
	SUMMARY FAULT	N2A10DS2	15.5520-MHz oscillator fault indication
	SUMMARY FAULT	N2A11DS2	16.4160-MHz oscillator fault indication
	SUMMARY FAULT	N2A12DS2	17.0208-MHz oscillator fault indication
	SUMMARY FAULT	N2A13DS2	17.9712-MHz oscillator fault indication
35	Phaselock indicators		Lights (green) when the PLL portion of the oscillator is phase locked.
	PLL LOCK	N2A1DS1	22.1184-MHz oscillator phase locked
	PLL LOCK	N2A2DS1	26.2656-MHz oscillator phase locked
	PLL LOCK	N2A3DS1	32.4864-MHz oscillator phase locked
	PLL LOCK	N2A4DS1	34.5600-MHz oscillator phase locked
	PLL LOCK	N2A5DS1	12.0960-MHz oscillator phase locked
	PLL LOCK	N2A6DS1	16.5888-MHz oscillator phase locked
	PLL LOCK	N2A7DS1	2.1600-MHz oscillator phase locked
	PLL LOCK	N2A8DS1	13.9140-MHz oscillator phase locked
	PLL LOCK	N2A9DS1	14.6880-MHz oscillator phase locked
	PLL LOCK	N2A10DS1	15.5520-MHz oscillator phase locked
	PLL LOCK	N2A11DS1	16.4160-MHz oscillator phase locked
	PLL LOCK	N2A12DS1	17.0208-MHz oscillator phase locked
	PLL LOCK	N2A13DS1	17.9712-MHz oscillator phase locked
36	RF Output Indicators:		

NOTE

Two additional indicators, DS1 (RF input present) and DS3 (low RF output) are not in operator view.

	RF OUTPUTS PRESENT	N1A3DS2	Lights (green) when all four RF output signals are present.
	RF OUTPUTS PRESENT	N1A5DS2	Lights (green) when all four RF output signals are present.
	RF OUTPUTS PRESENT	N1A7DS2	Lights (green) when all four RF output signals are present.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
	RF OUTPUTS PRESENT	N1A9DS2	Lights (green) when all four RF output signals are present.
	RF OUTPUTS PRESENT	N1A11DS2	Lights (green) when all four RF output signals are present.
	RF OUTPUTS PRESENT	N1A13DS2	Lights (green) when all four RF output signals are present.
37	Error Indicators		
	SUMMARY FAULT	N1A4DS1	Lights (red) when either of the following conditions are detected: 1. 5.0-kHz input missing 2. 5.4-kHz input missing 3. Two-tone generator output missing.
	NOTE Assembly N1A6 is not used in exciter cabinet applications.		
	SUMMARY FAULT	N1A6DS1	Lights (red) when any of the following conditions are detected: 1. 2.16-MHz input missing 2. 5-MHz input missing 3. 5-kHz output missing 4. 5.4-kHz output missing 5. 40-kHz output missing 6. 43.2-kHz output missing.
38	100-115-200-230 V ac voltage select switch	A4, A5	Slide switch used to select 110-115-200 or 230 V ac power line input. Setting for this equipment application is 115.
	NOTE Item 39 applies only to the Standard Frequency Calibrator, Unit A3.		
39	115-230 V ac voltage select card switch	A3	Card switch used to select 115 V ac or 230 V ac power line input. Setting for this equipment application is 115 V ac.
	NOTE Items 40 through 43 below apply only to the Alternate Frequency Calibrator, Unit A3.		
40	F ADJ. variable control	A3	Variable control used for course frequency adjustment of equipment frequency standard. Range is 4 x 10-7.
41	OPERATE select switch	A3S3	Sets the equipment into operation by selecting OPERATE.

Table 4-5. Transmit Exciter, Unit 151, and Transmit Auxiliary Exciter, Unit 152 - Controls and Indicators (Figure 4-5)

Figure Index	Control or Indicator	Reference Designator	Function
42	EXT. POWER select switch	A3S2	Switch for source power selection. ON position selects 115 V ac input power. OFF selects internal battery input power.
43	115-230 V ac voltage select switch	A3S1	Slide switch used to select 115 V ac or 230 V ac power line input. Setting for this equipment application is 115 V ac.

Section II. OPERATING INSTRUCTIONS

4-5 GENERAL.

The transmitter group portion of the AN/FPS-118(V) radar system operates unattended by computer control via a communications link with the operations center. Therefore, operating instructions consist of configuration procedures for placing the transmitter group equipment into readiness for overall system operation. Once these procedures are completed, refer to system level operating instructions in TO 31P6-2FPS118-11.

4-6 NORMAL OPERATION.

The following paragraphs provide instructions for the transmitter group equipment:

1. Paragraph 4-6.1 - Equipment Energizing Procedure
2. Paragraph 4-6.2 - Equipment Configuring Procedure
3. Paragraph 4-6.3 - Equipment Deenergizing Procedure.

4-6.1 Equipment Energizing Procedure.

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains hazards that may cause death or serious injury to personnel. Do not manipulate transmitter equipment controls and indicators unless familiar with their operation and the general safety procedures listed in paragraph 6-2 have been followed. Improper manipulation of transmitter equipment controls can create serious safety hazards for personnel.

CAUTION

EQUIPMENT DAMAGE HAZARD

Improper manipulation of transmitter equipment controls and indicators can cause damage to equipment. Do not manipulate transmitter controls and indicators unless familiar with their operation.

ENERGIZING PROCEDURE AFTER MAJOR MAINTENANCE

If major maintenance work was performed on any cabinet of an elemental transmitter, do not energize the elemental transmitter using the energizing procedure given in paragraphs 4-6.1.2 and 4-6.1.3. Instead, refer to the maintenance turn-on procedure in Chapter 4, TO 31P6-2FPS118-81, Section II Maintenance Operating Instructions, for energizing instructions.

NOTE

If performing this procedure as a result of a maintenance action reference from Chapter 6, only perform the energizing procedure for the applicable cabinet.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

The energizing procedure results in all equipment being powered and ready for the configuring procedure found in paragraph 4-6.2. The energizing procedure assumes all equipment are turned OFF via the associated CB panels and disconnect switches. From this point, the various equipment switches are positioned for initial powering. This is followed by all CBs and disconnect switches being turned on. With the equipment now powered, the equipment indicators are examined for correct indications. The final step in the energizing procedure is to allow sufficient warm-up time for equipment operation to stabilize. The energizing procedure sequence may be summarized as follows:

1. Paragraph 4-6.1.1 - Primary Power Circuit Breakers Verified OFF
2. Paragraph 4-6.1.2 - Pre-Power Equipment Switch Positioning
3. Paragraph 4-6.1.3 - Apply Primary Power
4. Paragraph 4-6.1.4 - Verify Equipment Indicators

5. Paragraph 4-6.1.5 - Equipment Requiring Warm-Up Time.

4-6.1.1 Primary Power Circuit Breakers Verified OFF. Verify all primary power CBs (Table 4-6) are OFF. The CB panels are wall mounted at a location within the facility (FO-1).

4-6.1.2 Pre-Power Equipment Switch Positioning. Select the pre-power equipment switch positions as summarized in Table 4-7. Any switch or control not referenced in this table is not applicable to the energizing procedure. This step may be omitted if no switch or CB positions were changed during period power was off.

4-6.1.3 Apply Primary Power.

WARNING

HAZARD TO PERSONNEL

Before primary power is applied to equipment, ensure that personnel are clear of all cabinet interiors and circuitry. Application of primary power creates voltage and current levels which can cause death or serious injury to personnel.

HIGH VOLTAGE AND CURRENT HAZARD

The RF drive to TMs must be inhibited before applying power to high voltage power supplies. Inhibit RF drive via transmit maintenance console (TMC), for REMOTE operating mode, and manually for LOCAL operating mode. Refer to Positional Handbook for TMC operating instructions, and Table 4-1 for manual instructions.

CAUTION

EQUIPMENT DAMAGE HAZARD

Ensure that cooling air, compressed air, and deionized water cooling systems are operating.

1. Ensure that all TMs have the OUTPUT CONTROL switch on CONTROL/STATUS panel, in the LOCAL position.
2. Energize the transmitter group equipment by sequentially placing all the primary power circuit breakers listed by Table 4-6 in the ON position.
3. At TMC, use the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY to verify all TMs are disabled (RF drive inhibited).
4. On the front panel of all 12 TMs, place the broadband amplifier power switch to ON, then place the OUTPUT CONTROL switch to the REMOTE position.
5. At the TMC, enable all 12 TMs using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY.
6. If mission software commands are not arriving from the OPS center or TMs do not cycle up to STANDBY, perform the following:
   a. At TMC, access the TXAFL TEST SELECTION MENU and terminate mission software.
   b. Run the TRANSMIT DATA CONDITIONER AFL test.
   c. Restart mission (terminate TXAFL testing).
7. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

4-6.1.4 Verify Equipment Indicators.

NOTE

Table 4-8 is valid only when mission software commands are not being applied to the transmitter group. If mission software commands are being applied to the transmitter group, the equipment sequences to online mission operation and verification of equipment indicators is not possible.

Verify equipment indicators summarized in Table 4-8 are correct. Any indicator not referenced in this table is not applicable to the energizing procedure. If any indicator display is incorrect, check the detailed information in Section I, Controls and Indicators, of this chapter. If necessary, turn off the equipment primary power CB and reference the maintenance section of this manual. Some equipment cannot be powered until ac voltage is applied; hence, the indicators are not lit. These equipment are noted in the table with a turn-on procedure.

4-6.1.5 Equipment Requiring Warm-Up Time.

1. The TMs require approximately 3 minutes for filament warm-up time. During filament

warm-up, the front panel indicator 1A1DS27 FIL DELAY is lit.

2. The frequency standard calibrator, equipment A3 in exciter, Unit 151, and auxiliary exciter, Unit 152, requires approximately 6 hours to stabilize fully. There are two different types of frequency calibrators used in Units 151 and 152. The calibrators are differentiated from each other by denoting one as standard and the other as alternate.

3. On the alternate calibrator, the OVEN alarm indicator (1A3DS1) is lit until the oscillator oven has reached its operating temperature. When this temperature is reached, the OVEN alarm indicator turns off.

4. On the standard calibrator, the OVEN READY indicator lights (green) when the oven has reached its operating temperature. If the indicator is not lit, the oven is in the process of coming up to temperature. If this indicator is flashing, the crystal oven is settling at its operating temperature.

5. The frequency synthesizer equipment located in the exciter, Unit 151, and auxiliary exciter, Unit 152, use an external frequency standard input from the calibrator; hence, these equipment do not need a warm-up period, except for that associated with the calibrator.

4-6.2 Equipment Configuring Procedure.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

The transmitter group equipment is energized and in the REMOTE operating mode after the completion of the equipment energizing procedure in paragraph 4-6.1. The mission software initiates system operation when the equipment is in the REMOTE mode. No further manual action is needed to prepare the transmitter group equipment for system operation. Certain equipment in the transmitter group can be configured to LOCAL mode for maintenance and testing purposes. The following paragraphs detail the configuring procedures for the transmitter group equipment.

4-6.2.1 Transmitter Modules, Units 110 through 121, Configuring Procedures. The TMs may be configured to LOCAL mode for maintenance and testing purposes. For detailed instructions on operation of TMs, refer to chapter 4 in TO 31P6-2FPS118-81. After completion of the pre-power equipment switch positioning (paragraph 4-6.1.2), the TM is configured for remote operation. The following procedures start with the TM in this state (remote) and list the necessary steps to reconfigure the operational mode to local, and then back to remote:

1. The TM Remote to Local Operating Mode.

NOTE

If changing TM from REMOTE to LOCAL operating mode for fault isolation/troubleshooting purposes, be advised that the fault indicators on TM will be cleared (reset) upon reconfiguration.

a. Remove (disable) RF drive from TM to be reconfigured via the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on the TMC. Refer to Positional Handbook for TMC operating instructions.

b. Verify RF drive is not present by reading zero on POWER (KW) meter 1A13M1 and broadband amplifier wattmeter 1AR1M1 on affected TMs.

c. Set the OUTPUT CONTROL on the control/status panel to TEST LOAD (LOCAL) position.

d. Connect dummy load to TM in accordance with procedure in Chapter 4 of TO 31P6-2FPS118-81.

e. The TM is configured for local operation. Refer to Chapter 4 in TO 31P6-2FPS118-81 for TM local operation instructions.

2. The TM Local to Remote Operational Mode.

a. Remove RF drive from TM.

b. Depress STANDBY (HV OFF) of Control/Status Panel, 1A1. The TM READY and HV ON indicators are extinguished and the STANDBY indicator is lit. The HV is removed from TM circuits.

c. Remove dummy load from transmitter in accordance with procedure in Chapter 4 of TO 31P6-2FPS118-81.

d. Turn off and disconnect any other test equipment attached to transmitter during local operation. Ensure all panels and covers are secured.

e. Verify the RF INPUT SELECTOR switch on transmitter is set to REMOTE.

CAUTION

EQUIPMENT DAMAGE HAZARD

When changing position of the OUTPUT CONTROL switch, monitor the OUTPUT CONTROL LOAD lamp closely. The lamp corresponding to position of OUTPUT CONTROL switch should light up within three seconds. If not, immediately move switch back to original position and open 120 VAC RIDE THRU INPUT circuit breaker on associated HVPS cabinet. Inform site supervision of equipment malfunction.

f. Place the OPERATE CONTROL switch on Control/Status Panel to the REMOTE position.

NOTE

When the OUTPUT CONTROL switch placed in REMOTE position, the TM assumes the condition selected by the TCMG software. The software automatically brings the transmitter up and online.

g. Ensure the transmitter does not have RF drive inhibited by using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC. Refer to Positional Handbook for TMC operating instructions.

h. The TM now is configured for REMOTE operation.

4-6.2.2 <u>High Voltage Power Supplies, Units 122 through 133, Configuring Procedure</u>. This equipment is configured for operation after completion of the pre-power equipment switch positioning (paragraph 4-6.1.2).

4-6.2.3 <u>High Voltage Ac Knife Switches, Units 222 through 233, Configuring Procedure</u>. This equipment is configured for operation after completion of the pre-power equipment switch positioning (paragraph 4-6.1.2).

4-6.2.4 <u>Transmit Beamformer, Unit 150, Configuring Procedure</u>. There is no configuring procedure for the TBF. The variable attenuators located on panel N6 and assembly A11 are factory set.

4-6.2.5 <u>Exciter, Unit 151, and Auxiliary Exciter, Unit 152, Configuring Procedure</u>.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

Ensure affected cabinet is designated as BACKUP on the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC.

At the completion of the pre-power equipment switch positioning (paragraph 4-6.1.2), this equipment is configured for operation. The exciter and auxiliary exciter are configured to LOCAL mode for maintenance and testing purposes. The mode of operation is controlled by the LOCAL/REMOTE interlock switch located in the top of cabinet door frame. The equipment is operable in LOCAL while the cabinet door is open. This is accomplished by pulling the LOCAL/REMOTE switch plunger into the detent position. To return to REMOTE operation, push the switch plunger out of detent, or close the cabinet door.

4-6.3 <u>Equipment Deenergizing Procedure</u>.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

If performing this procedure as a result of a maintenance action reference from Chapter 6, only place the applicable cabinet CB(s) to OFF.

This procedure completely shuts down the transmitter group portion of the AN/FPS-118(V) radar system.

1. Remove RF drive from TMs. Inhibit RF drive (disable TMs) via the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY TMC, for REMOTE operating mode, and manually for LOCAL operating mode. Refer to Positional Handbook for

TMC operating instructions, and Table 4-1 for manual instructions.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

The RF drive to TMs must be inhibited before removing power from HVPSs.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Place all 12 transmitter modules in local mode by setting the OUTPUT CONTROL switch on the control/status panel to the LOCAL position; then place broadband amplifier power switch to the OFF position.
4. Deenergize transmitter group equipment by switching the main HVAC disconnect switch, Unit 321, and all primary CBs to the OFF position in the order summarized by Table 4-9. See FO-1 for CB panel locations.
5. Verify that the disconnect switch, Unit 321, is in the OPEN position by visually inspecting the switch hardware (inside cabinet) via the window on cabinet door.
6. Any switch or control not referenced in the table is not applicable to the deenergizing procedure.

NOTE

The frequency calibrator unit (equipment A3 in exciter, Unit 151, and auxiliary exciter, Unit 152) automatically switches to internal battery operation when the ac power source is removed. Typically, the battery powers the calibrator for a few hours. If it is desirable to maintain the calibrator crystal oscillator oven at temperature during the deenergizing period, do not remove fuse from rear panel fuseholder marked BATT FUSE; otherwise remove fuse.

Table 4-6. (V)[1] Transmitter Group Primary Power Circuit Breakers or Switches[1]

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	305E	CB4	Transmit Beamformer, Unit 150
1	310J	CB2	Auxiliary Exciter, Unit 152
1	310J	CB1	Exciter, Unit 151
1	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
1	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
1	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
1	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
1	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
1	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
1	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
1	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
1	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
1	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
1	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
1	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
1	302B	CB13	Feed for Breaker Panel 317Q
1	317Q	CB12	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
1	317Q	CB11	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
1	317Q	CB10	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
1	317Q	CB9	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
1	317Q	CB8	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
1	317Q	CB7	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
1	317Q	CB6	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
1	317Q	CB5	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
1	317Q	CB4	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
1	317Q	CB3	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles

Table 4-6. (V)1 Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	317Q	CB2	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
1	317Q	CB1	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
1	302B	CB12	HVPS, Unit 122, 208 V ac
1	302B	CB11	HVPS, Unit 123, 208 V ac
1	302B	CB10	HVPS, Unit 124, 208 V ac
1	302B	CB9	HVPS, Unit 125, 208 V ac
1	302B	CB8	HVPS, Unit 126, 208 V ac
1	302B	CB7	HVPS, Unit 127, 208 V ac
1	302B	CB6	HVPS, Unit 128, 208 V ac
1	302B	CB5	HVPS, Unit 129, 208 V ac
1	302B	CB4	HVPS, Unit 130, 208 V ac
1	302B	CB3	HVPS, Unit 131, 208 V ac
1	302B	CB2	HVPS, Unit 132, 208 V ac
1	302B	CB1	HVPS, Unit 133, 208 V ac
1	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133
2	305E	CB4	Transmit Beamformer, Unit 150
2	305E	CB9	Auxiliary Exciter, Unit 152
2	305E	CB8	Exciter, Unit 151
2	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
2	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
2	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
2	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
2	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
2	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
2	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
2	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
2	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
2	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
2	306F	CB5	HVPS, Unit 132, Keep Alive Circuit

Table 4-6. (V)[1] Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
2	301A	CB5	Feed for Breaker Panel 317Q
2	317Q	CB12	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
2	317Q	CB11	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
2	317Q	CB10	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
2	317Q	CB9	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
2	317Q	CB8	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
2	317Q	CB7	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
2	317Q	CB6	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
2	317Q	CB5	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
2	317Q	CB4	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
2	317Q	CB3	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
2	317Q	CB2	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
2	317Q	CB1	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
2	301B	CB12	HVPS, Unit 122, 208 V ac
2	301B	CB11	HVPS, Unit 123, 208 V ac
2	301B	CB10	HVPS, Unit 124, 208 V ac
2	301B	CB9	HVPS, Unit 125, 208 V ac
2	301B	CB8	HVPS, Unit 126, 208 V ac
2	301B	CB7	HVPS, Unit 127, 208 V ac
2	301B	CB6	HVPS, Unit 128, 208 V ac
2	301B	CB5	HVPS, Unit 129, 208 V ac
2	301B	CB4	HVPS, Unit 130, 208 V ac
2	301B	CB3	HVPS, Unit 131, 208 V ac
2	301B	CB2	HVPS, Unit 132, 208 V ac
2	301B	CB1	HVPS, Unit 133, 208 V ac

Table 4-6. (V)1 Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	Unit 321	MAIN HVAC DIS-CON-NECT switch	HVPS, Units 122 through 133
3	305E	CB4	Transmit Beamformer, Unit 150
3	305E	CB9	Auxiliary Exciter, Unit 152
3	305E	CB8	Exciter, Unit 151
3	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
3	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
3	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
3	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
3	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
3	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
3	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
3	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
3	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
3	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
3	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
3	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
3	301A	CB6	Feed for Breaker Panel 317Q
3	317Q	CB12	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
3	317Q	CB11	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
3	317Q	CB10	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
3	317Q	CB9	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
3	317Q	CB8	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
3	317Q	CB7	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
3	317Q	CB6	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
3	317Q	CB5	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles

Table 4-6. (V)1 Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	317Q	CB4	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
3	317Q	CB3	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
3	317Q	CB2	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
3	317Q	CB1	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
3	302B	CB8	HVPS, Unit 122, 208 V ac
3	302B	CB7	HVPS, Unit 123, 208 V ac
3	302B	CB6	HVPS, Unit 124, 208 V ac
3	302B	CB5	HVPS, Unit 125, 208 V ac
3	302B	CB4	HVPS, Unit 126, 208 V ac
3	302B	CB3	HVPS, Unit 127, 208 V ac
3	302B	CB2	HVPS, Unit 128, 208 V ac
3	302B	CB1	HVPS, Unit 129, 208 V ac
3	301A	CB10	HVPS, Unit 130, 208 V ac
3	301A	CB9	HVPS, Unit 131, 208 V ac
3	301A	CB8	HVPS, Unit 132, 208 V ac
3	301A	CB7	HVPS, Unit 133, 208 V ac
3	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133

[1] See FO-1(V)1 for CB panel locations.

Table 4-6. (V)2 Transmitter Group Primary Power Circuit Breakers or Switches[1]

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	305E	CB14	Transmit Beamformer, Unit 150
1	305E	CB25	Auxiliary Exciter, Unit 152
1	305E	CB20	Exciter, Unit 151
1	306F	CB3	HVPS, Unit 122, Keep Alive Circuit
1	306F	CB4	HVPS, Unit 123, Keep Alive Circuit
1	306F	CB5	HVPS, Unit 124, Keep Alive Circuit
1	306F	CB6	HVPS, Unit 125, Keep Alive Circuit
1	306F	CB7	HVPS, Unit 126, Keep Alive Circuit
1	306F	CB8	HVPS, Unit 127, Keep Alive Circuit
1	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
1	306F	CB10	HVPS, Unit 129, Keep Alive Circuit
1	306F	CB11	HVPS, Unit 130, Keep Alive Circuit
1	306F	CB12	HVPS, Unit 131, Keep Alive Circuit
1	306F	CB13	HVPS, Unit 132, Keep Alive Circuit
1	306F	CB14	HVPS, Unit 133, Keep Alive Circuit
1	301A	CB6	Feed for Breaker Panel 317Q
1	317Q	CB1	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
1	317Q	CB2	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
1	317Q	CB3	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
1	317Q	CB4	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
1	317Q	CB5	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
1	317Q	CB6	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
1	317Q	CB7	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
1	317Q	CB8	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
1	317Q	CB9	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
1	317Q	CB10	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles

Table 4-6. (V)[2] Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	317Q	CB11	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
1	317Q	CB12	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
1	301A	CB19	HVPS, Unit 122, 208 V ac
1	301A	CB18	HVPS, Unit 123, 208 V ac
1	301A	CB17	HVPS, Unit 124, 208 V ac
1	301A	CB16	HVPS, Unit 125, 208 V ac
1	301A	CB15	HVPS, Unit 126, 208 V ac
1	301A	CB14	HVPS, Unit 127, 208 V ac
1	301A	CB13	HVPS, Unit 128, 208 V ac
1	301A	CB12	HVPS, Unit 129, 208 V ac
1	301A	CB11	HVPS, Unit 130, 208 V ac
1	301A	CB10	HVPS, Unit 131, 208 V ac
1	301A	CB9	HVPS, Unit 132, 208 V ac
1	301A	CB8	HVPS, Unit 133, 208 V ac
1	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133
2	305E	CB14	Transmit Beamformer, Unit 150
2	305E	CB25	Auxiliary Exciter, Unit 152
2	305E	CB20	Exciter, Unit 151
2	306F	CB14	HVPS, Unit 122, Keep Alive Circuit
2	306F	CB13	HVPS, Unit 123, Keep Alive Circuit
2	306F	CB12	HVPS, Unit 124, Keep Alive Circuit
2	306F	CB11	HVPS, Unit 125, Keep Alive Circuit
2	306F	CB10	HVPS, Unit 126, Keep Alive Circuit
2	306F	CB9	HVPS, Unit 127, Keep Alive Circuit
2	306F	CB8	HVPS, Unit 128, Keep Alive Circuit
2	306F	CB7	HVPS, Unit 129, Keep Alive Circuit
2	306F	CB6	HVPS, Unit 130, Keep Alive Circuit
2	306F	CB5	HVPS, Unit 131, Keep Alive Circuit
2	306F	CB4	HVPS, Unit 132, Keep Alive Circuit

Table 4-6. (V)[2] Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	306F	CB3	HVPS, Unit 133, Keep Alive Circuit
2	301A	CB6	Feed for Breaker Panel 317Q
2	317Q	CB1	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
2	317Q	CB2	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
2	317Q	CB3	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
2	317Q	CB4	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
2	317Q	CB5	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
2	317Q	CB6	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
2	317Q	CB7	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
2	317Q	CB8	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
2	317Q	CB9	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
2	317Q	CB10	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
2	317Q	CB11	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
2	317Q	CB12	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
2	301A	CB19	HVPS, Unit 122, 208 V ac
2	301A	CB18	HVPS, Unit 123, 208 V ac
2	301A	CB17	HVPS, Unit 124, 208 V ac
2	301A	CB16	HVPS, Unit 125, 208 V ac
2	301A	CB15	HVPS, Unit 126, 208 V ac
2	301A	CB14	HVPS, Unit 127, 208 V ac
2	301A	CB13	HVPS, Unit 128, 208 V ac
2	301A	CB12	HVPS, Unit 129, 208 V ac
2	301A	CB11	HVPS, Unit 130, 208 V ac
2	301A	CB10	HVPS, Unit 131, 208 V ac
2	301A	CB9	HVPS, Unit 132, 208 V ac
2	301A	CB8	HVPS, Unit 133, 208 V ac

Table 4-6. (V)2 Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	Unit 321	MAIN HVAC DIS-CON-NECT switch	HVPS, Units 122 through 133
3	305E	CB14	Transmit Beamformer, Unit 150
3	305E	CB25	Auxiliary Exciter, Unit 152
3	305E	CB20	Exciter, Unit 151
3	306F	CB14	HVPS, Unit 122, Keep Alive Circuit
3	306F	CB13	HVPS, Unit 123, Keep Alive Circuit
3	306F	CB12	HVPS, Unit 124, Keep Alive Circuit
3	306F	CB11	HVPS, Unit 125, Keep Alive Circuit
3	306F	CB10	HVPS, Unit 126, Keep Alive Circuit
3	306F	CB9	HVPS, Unit 127, Keep Alive Circuit
3	306F	CB8	HVPS, Unit 128, Keep Alive Circuit
3	306F	CB7	HVPS, Unit 129, Keep Alive Circuit
3	306F	CB6	HVPS, Unit 130, Keep Alive Circuit
3	306F	CB5	HVPS, Unit 131, Keep Alive Circuit
3	306F	CB4	HVPS, Unit 132, Keep Alive Circuit
3	306F	CB3	HVPS, Unit 133, Keep Alive Circuit
3	301A	CB6	Feed for Breaker Panel 317Q
3	317Q	CB12	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
3	317Q	CB11	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
3	317Q	CB10	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
3	317Q	CB9	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
3	317Q	CB8	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
3	317Q	CB7	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
3	317Q	CB6	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
3	317Q	CB5	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles

Table 4-6. (V)2 Transmitter Group Primary Power Circuit Breakers or Switches[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	317Q	CB4	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
3	317Q	CB3	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
3	317Q	CB2	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
3	317Q	CB1	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
3	301A	CB19	HVPS, Unit 122, 208 V ac
3	301A	CB18	HVPS, Unit 123, 208 V ac
3	301A	CB17	HVPS, Unit 124, 208 V ac
3	301A	CB16	HVPS, Unit 125, 208 V ac
3	301A	CB15	HVPS, Unit 126, 208 V ac
3	301A	CB14	HVPS, Unit 127, 208 V ac
3	301A	CB13	HVPS, Unit 128, 208 V ac
3	301A	CB12	HVPS, Unit 129, 208 V ac
3	301A	CB11	HVPS, Unit 130, 208 V ac
3	301A	CB10	HVPS, Unit 131, 208 V ac
3	301A	CB9	HVPS, Unit 132, 208 V ac
3	301A	CB8	HVPS, Unit 133, 208 V ac
3	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133

[1] See FO-1(V)2 for CB panel locations.

Table 4-7. Transmitter Group Pre-Power Equipment Switch Positioning

Unit	Control	Position
TMs, Units 110 to 121:		
Front Panel	1A13S2 METERS switch	ON
	1A13S1 RF POWER switch	FWD
	1A1S13 TEST LOAD/ANTENNA switch	TEST LOAD (LOCAL)
	1A1S2 DC VOLTS meter (meter No. 1)	IPA FIL (10V)
	1A1S1 DC CURRENT/RF LEVEL switch	NA
	1A1A1S1 FDBK LOOP switch	OPERATE
	1A1A2 FWD PWR CLP switch	ENBL
	1AR1 AC POWER switch	OFF
	1A25S2 RF INPUT SELECTOR switch	REMOTE
	1A25S3 BIAS/RF INHIBIT switch	CW BIAS
	1A25S1 XMTR METER PANEL MONITOR switch	OFF
	1A23 LOW LEVEL AMPLIFIER CB1	ON
	1A23 IPA FILAMENT SUPPLY CB5	ON
	1A23 DRVR AMP FIL SUPPLY CB6	ON
	1A23 PA FIL SUPPLY CB7	ON
	1A23 IPA BIAS SUPPLY CB2	ON
	1A23 DRVR AMP BIAS SUPPLY CB3	ON
	1A23 PA BIAS SUPPLY CB4	ON
HVPSs, Units 122 to 133:		
Front Panel	2A2 120 VAC OUTLETS CB9	ON
	208 VAC INPUT CB1	ON
	120 VAC RIDE THRU INPUT CB8	ON
	208 VAC REGULATOR CB2	ON
	HV CONTACTOR CB3	ON
	CROWBAR POWER SUPPLY CB4	ON
	PA SCREEN GRID SUPPLY CB5	ON
	DRVR AMPL SCREEN GRID SUPPLY CB6	ON
	IPA SCREEN GRID SUPPLY CB7	ON
	2A2S1 VOLTMETER AMMETER LVAC	POSITION 1
	2A2S2 VOLTMETER AMMETER HVAC	POSITION 1
	2A2S3 VOLTMETER AMMETER HVDC	POWER AMPL
HVAC Switch, Units 222 to 233:		
Front of Cabinet	HVAC knife switch	ON

Table 4-7. Transmitter Group Pre-Power Equipment Switch Positioning -CONT

Unit	Control	Position
TBF, Unit 150:		
Breaker Panel	Main Power CB1	ON
Voltage Regulators	VR1 and VR2 +5 V dc voltage regulator CB1	ON
	VR3 and VR4 -5 V dc voltage regulator CB1	ON
	VR5 and VR6 +15 V dc voltage regulator CB1	ON
	VR7 and VR8 -15 V dc voltage regulator CB1	ON
Exciter/Auxiliary Exciter, Units 151 and 152:		
Breaker Panel (front)	Main Power CB1	ON
	A6 +60 V dc power supply CB2	ON
	A7 -60 V dc power supply CB3	ON
	A8 +15 V dc power supply CB4	ON
	A9 -15 V dc power supply CB5	ON
Breaker Panel (rear)	A10 +5(A) V dc power supply CB6	ON
	A11 +5(B) V dc power supply CB7	ON
	A12 +24(A) V dc power supply CB8	ON
	A13 +24(B) V dc power supply CB9	ON
	AC OUTLETS CB10	ON
A/D Converter (A2)	MUX ADDRESS switches	OFF
(Alternate)	MODE switch	REMOTE
	POWER switch	ON
A/D Converter (A2)	RMT-LOC Switch	RMT
(Standard)	SING-SEQ switch	SEQ
	CONT-CTC-PLSE switch	CTC
	POWER switch	ON
	CHANNEL switch	O
Calibrator	Delta F	500
(A3)	115/230 V ac select switch (rear)	115 V ac
(Alternate)	EXT. POWER switch	EXT
	OPERATE switch	OPERATE
Calibrator	Meter select switch	2
(A3)	CONTROL V EXT-INT	INT
(Standard)		

Table 4-7. Transmitter Group Pre-Power Equipment Switch Positioning -CONT

Unit	Control	Position
	NOTE Ensure that a fuse is installed in the rear panel fuseholder labeled BATT FUSE.	
Synthesizer	SEARCH DIGIT INTERPOLATOR MODE switch	REMOTE
(Fluke 645A)	OUTPUT switch	1 V rms
(A4 and A5)	FREQUENCY SELECTION switch	REMOTE
	POWER switch	ON
	100/115/200/230 V ac select switch (rear)	115 V ac

Table 4-8. Transmitter Group Initial Power Indicators

Unit	Indicator	Illumination
TMs, Units 110 to 121:		
Front Panel		
	1A1DS14 LOAD ANTENNA-TEST	ANTENNA
	1A1DS29 LAMP TEST	OFF
	1A1DS16 RF DRIVE LIMIT	OFF
	1A1DS28 POWER (OFF)	OFF
	1A1DS27 FIL DELAY	ON (OFF in NORMAL operation)
	1A1DS26 STANDBY (HV OFF)	ON (OFF in NORMAL operation)
	1A1DS20-DS25 BAND SELECT	ONE IS ON
	1A1DS19 HV ON	OFF (ON in NORMAL operation)
	1A1DS18 TM READY	OFF (ON in Normal operation)
	1A1DS17 FAULT (RESET)	OFF
	1A1DS1-DS14 FAULT	OFF
	1A1A5DS1 BAND PROVE FAULT	OFF
	1A1A6DS2 LOCKOUT	OFF
	1A1A6DS1 RECYCLE ACTIVE	OFF
	1A1A9DS1 ACTR AIR	OFF
	1A1A9DS2 CABINET AIR	OFF
	1A1A9DS3 CKT BKRS	OFF
	1A1A9DS4 CROWBAR	OFF
	1A1A10DS1-DS9 INTERLOCK	OFF
	1A1A12DS1-DS12 FAULT	OFF
	1AR1 POWER ON	OFF (ON in NORMAL operation)
HVPS, Units 122 to 133:		
Front Panel	2A3M1 AUXILIARY VOLTAGE (V) AC meter	208 V ac ±10%
	2A3M2 AUXILIARY CURRENT (A) AC meter (RIDE THRU position)	6 Amps ±0.5A
	2A3M3 PRIMARY VOLTAGE (kV) AC meter	12.47 kVac ±3%
	2A3M4 PRIMARY CURRENT (A) AC meter	0 (other reading in normal operation)
	2A3M5 DC POWER SUPPLIES ANODE (kV) meter (POWER AMPL position)	11.4 kV ±300 V dc

Table 4-8. Transmitter Group Initial Power Indicators -CONT

Unit	Indicator	Illumination
	2A3M6 DC POWER SUPPLIES SCREEN (kV) meter	50 V
HVAC Switch, Units 222 to 233:		
Front Panel	None.	
TBF, Unit 150:		
Breaker Panel	N2DS4 POWER AVAIL	ON
	N2DS1 0 A	ON
	N2DS2 0 B	ON
	N2DS3 0 C	ON
Exciter, Unit 151, and Auxiliary Exciter, Unit 152:		
Breaker Panel (front)	DS1 POWER AVAIL	ON
	DS2 0 A	ON
	DS3 0 B	ON
	DS4 0 C	ON
Power Supply Controllers (N4A1)	CKT 1	ON(Green) OFF (Red)
	CKT2	ON(Green) OFF (Red)
	CKT4	ON (Green) OFF (Red)
	CKT5	ON (Green) OFF (Red)
	OVV-5/24 GND	OFF (Red)
	OVV-60 REF	OFF (Red)
	OVV-15 REF	OFF (Red)
Power Supply Controllers (N4A2)	CKT1	ON (Green) OFF (Red)
	CKT2	ON (Green) OFF (Red)
	CKT4	ON (Green) OFF (Red)
	CKT5	ON (Green) OFF (Red)
	OVV-5/24 GND	OFF (Red)
	OVV-60 REF	OFF (Red)
	OVV-15 REF	OFF (Red)
A/DC (A2)	POWER indicator	ON

Table 4-8. Transmitter Group Initial Power Indicators -CONT

Unit	Indicator	Illumination
Calibrator (A3) (Alternate)	OVEN READY (off until crystal oven reaches operating temperature)	ON
	POWER indicator	ON
	NOTE A3 (Standard) can be powered only after application of primary power. Press AC POWER RESET and then proceed.	
Calibrator (A3) (Standard)	MONITOR METER	22 V dc
	AC POWER	ON
Synthesizer (Fluke 645A) (A4 and A5)	One frequency indicator will be lit	
	NOTE If the above POWER indication is not lit, press the POWER ON button again.	

Table 4-9. (V)[1] Transmitter Group Deenergizing Procedure[1]

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	Unit 321	Main HVAC DISCONNECT switch	HVPS, Units 122 through 133
1	302B	CB1	HVPS, Unit 133, 208 V ac
1	302B	CB2	HVPS, Unit 132, 208 V ac
1	302B	CB3	HVPS, Unit 131, 208 V ac
1	302B	CB4	HVPS, Unit 130, 208 V ac
1	302B	CB5	HVPS, Unit 129, 208 V ac
1	302B	CB6	HVPS, Unit 128, 208 V ac
1	302B	CB7	HVPS, Unit 127, 208 V ac
1	302B	CB8	HVPS, Unit 126, 208 V ac
1	302B	CB9	HVPS, Unit 125, 208 V ac
1	302B	CB10	HVPS, Unit 124, 208 V ac

Table 4-9. (V)1 Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	302B	CB11	HVPS, Unit 123, 208 V ac
1	302B	CB12	HVPS, Unit 122, 208 V ac
1	317Q	CB1	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
1	317Q	CB2	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
1	317Q	CB3	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
1	317Q	CB4	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
1	317Q	CB5	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
1	317Q	CB6	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
1	317Q	CB7	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
1	317Q	CB8	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
1	317Q	CB9	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
1	317Q	CB10	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
1	317Q	CB11	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
1	317Q	CB12	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
1	302B	CB13	Feed for Breaker Panel 317Q
1	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
1	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
1	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
1	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
1	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
1	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
1	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
1	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
1	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
1	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
1	306F	CB14	HVPS, Unit 123, Keep Alive Circuit

Table 4-9. (V)[1] Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
1	310J	CB1	Exciter, Unit 151
1	310J	CB2	Auxiliary Exciter, Unit 152
1	305E	CB4	Transmit Beamformer, Unit 150
2	Unit 321	MAIN HVAC DIS-CON-NECT switch	HVPS, Units 122 through 133
2	301B	CB1	HVPS, Unit 133, 208 V ac
2	301B	CB2	HVPS, Unit 132, 208 V ac
2	301B	CB3	HVPS, Unit 131, 208 V ac
2	301B	CB4	HVPS, Unit 130, 208 V ac
2	301B	CB5	HVPS, Unit 129, 208 V ac
2	301B	CB6	HVPS, Unit 128, 208 V ac
2	301B	CB7	HVPS, Unit 127, 208 V ac
2	301B	CB8	HVPS, Unit 126, 208 V ac
2	301B	CB9	HVPS, Unit 125, 208 V ac
2	301B	CB10	HVPS, Unit 124, 208 V ac
2	301B	CB11	HVPS, Unit 123, 208 V ac
2	301B	CB12	HVPS, Unit 122, 208 V ac
2	317Q	CB1	HVPS, Unit 133, and TM, Unit 121, Lights and Receptacles
2	317Q	CB2	HVPS, Unit 132, and TM, Unit 120, Lights and Receptacles
2	317Q	CB3	HVPS, Unit 131, and TM, Unit 119, Lights and Receptacles
2	317Q	CB4	HVPS, Unit 130, and TM, Unit 118, Lights and Receptacles
2	317Q	CB5	HVPS, Unit 129, and TM, Unit 117, Lights and Receptacles
2	317Q	CB6	HVPS, Unit 128, and TM, Unit 116, Lights and Receptacles
2	317Q	CB7	HVPS, Unit 127, and TM, Unit 115, Lights and Receptacles
2	317Q	CB8	HVPS, Unit 126, and TM, Unit 114, Lights and Receptacles

Table 4-9. (V)1 Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	317Q	CB9	HVPS, Unit 125, and TM, Unit 113, Lights and Receptacles
2	317Q	CB10	HVPS, Unit 124, and TM, Unit 112, Lights and Receptacles
2	317Q	CB11	HVPS, Unit 123, and TM, Unit 111, Lights and Receptacles
2	317Q	CB12	HVPS, Unit 122, and TM, Unit 110, Lights and Receptacles
2	301A	CB5	Feed for Breaker Panel 317Q
2	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
2	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
2	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
2	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
2	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
2	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
2	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
2	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
2	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
2	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
2	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
2	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
2	305E	CB8	Exciter, Unit 151
2	305E	CB9	Auxiliary Exciter, Unit 152
2	305E	CB4	Transmit Beamformer, Unit 150
3	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133
3	301A	CB7	HVPS, Unit 133, 208 V ac
3	301A	CB8	HVPS, Unit 132, 208 V ac
3	301A	CB9	HVPS, Unit 131, 208 V ac
3	301A	CB10	HVPS, Unit 130, 208 V ac
3	302B	CB1	HVPS, Unit 129, 208 V ac
3	302B	CB2	HVPS, Unit 128, 208 V ac
3	302B	CB3	HVPS, Unit 127, 208 V ac

Table 4-9. (V)1 Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	302B	CB4	HVPS, Unit 126, 208 V ac
3	302B	CB5	HVPS, Unit 125, 208 V ac
3	302B	CB6	HVPS, Unit 124, 208 V ac
3	302B	CB7	HVPS, Unit 123, 208 V ac
3	302B	CB8	HVPS, Unit 122, 208 V ac
3	317Q	CB1	HVPS, Unit 133, and TM, Unit 121, Lights and Receptacles
3	317Q	CB2	HVPS, Unit 132, and TM, Unit 120, Lights and Receptacles
3	317Q	CB3	HVPS, Unit 131, and TM, Unit 119, Lights and Receptacles
3	317Q	CB4	HVPS, Unit 130, and TM, Unit 118, Lights and Receptacles
3	317Q	CB5	HVPS, Unit 129, and TM, Unit 117, Lights and Receptacles
3	317Q	CB6	HVPS, Unit 128, and TM, Unit 116, Lights and Receptacles
3	317Q	CB7	HVPS, Unit 127, and TM, Unit 115, Lights and Receptacles
3	317Q	CB8	HVPS, Unit 126, and TM, Unit 114, Lights and Receptacles
3	317Q	CB9	HVPS, Unit 125, and TM, Unit 113, Lights and Receptacles
3	317Q	CB10	HVPS, Unit 124, and TM, Unit 112, Lights and Receptacles
3	317Q	CB11	HVPS, Unit 123, and TM, Unit 111, Lights and Receptacles
3	317Q	CB12	HVPS, Unit 122, and TM, Unit 110, Lights and Receptacles
3	301A	CB6	Feed for Breaker Panel 317Q
3	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
3	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
3	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
3	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
3	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
3	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
3	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
3	306F	CB11	HVPS, Unit 126, Keep Alive Circuit

Table 4-9. [(V)1] Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
3	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
3	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
3	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
3	305E	CB8	Exciter, Unit 151
3	305E	CB9	Auxiliary Exciter, Unit 152
3	305E	CB4	Transmit Beamformer, Unit 150

[1] See FO-1[(V)1] for CB panel locations.

Table 4-9. [(V)2] Transmitter Group Deenergizing Procedure[1]

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	Unit 321	Main HVAC DIS-CONNECT switch	HVPS, Units 122 through 133
1	301A	CB8	HVPS, Unit 133, 208 V ac
1	301A	CB9	HVPS, Unit 132, 208 V ac
1	301A	CB10	HVPS, Unit 131, 208 V ac
1	301A	CB11	HVPS, Unit 130, 208 V ac
1	301A	CB12	HVPS, Unit 129, 208 V ac
1	301A	CB13	HVPS, Unit 128, 208 V ac
1	301A	CB14	HVPS, Unit 127, 208 V ac
1	301A	CB15	HVPS, Unit 126, 208 V ac
1	301A	CB16	HVPS, Unit 125, 208 V ac
1	301A	CB17	HVPS, Unit 124, 208 V ac
1	301A	CB18	HVPS, Unit 123, 208 V ac
1	301A	CB19	HVPS, Unit 122, 208 V ac
1	317Q	CB12	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles

Table 4-9. (V)[2] Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	317Q	CB11	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
1	317Q	CB10	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
1	317Q	CB9	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
1	317Q	CB8	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
1	317Q	CB7	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
1	317Q	CB6	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
1	317Q	CB5	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
1	317Q	CB4	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
1	317Q	CB3	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
1	317Q	CB2	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
1	317Q	CB1	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
1	301A	CB6	Feed for Breaker Panel 317Q
1	306F	CB14	HVPS, Unit 133, Keep Alive Circuit
1	306F	CB13	HVPS, Unit 132, Keep Alive Circuit
1	306F	CB12	HVPS, Unit 131, Keep Alive Circuit
1	306F	CB11	HVPS, Unit 130, Keep Alive Circuit
1	306F	CB10	HVPS, Unit 129, Keep Alive Circuit
1	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
1	306F	CB8	HVPS, Unit 127, Keep Alive Circuit
1	306F	CB7	HVPS, Unit 126, Keep Alive Circuit
1	306F	CB6	HVPS, Unit 125, Keep Alive Circuit
1	306F	CB5	HVPS, Unit 124, Keep Alive Circuit
1	306F	CB4	HVPS, Unit 123, Keep Alive Circuit
1	306F	CB3	HVPS, Unit 122, Keep Alive Circuit
1	305E	CB20	Exciter, Unit 151
1	305E	CB25	Auxiliary Exciter, Unit 152
1	305E	CB14	Transmit Beamformer, Unit 150

Table 4-9. (V)[2] Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	Unit 321	MAIN HVAC DIS- CON- NECT switch	HVPS, Units 122 through 133
2	301A	CB8	HVPS, Unit 133, 208 V ac
2	301A	CB9	HVPS, Unit 132, 208 V ac
2	301A	CB10	HVPS, Unit 131, 208 V ac
2	301A	CB11	HVPS, Unit 130, 208 V ac
2	301A	CB12	HVPS, Unit 129, 208 V ac
2	301A	CB13	HVPS, Unit 128, 208 V ac
2	301A	CB14	HVPS, Unit 127, 208 V ac
2	301A	CB15	HVPS, Unit 126, 208 V ac
2	301A	CB16	HVPS, Unit 125, 208 V ac
2	301A	CB17	HVPS, Unit 124, 208 V ac
2	301A	CB18	HVPS, Unit 123, 208 V ac
2	301A	CB19	HVPS, Unit 122, 208 V ac
2	317Q	CB12	HVPS, Unit 133, and TM, Unit 121, Lights and Receptacles
2	317Q	CB11	HVPS, Unit 132, and TM, Unit 120, Lights and Receptacles
2	317Q	CB10	HVPS, Unit 131, and TM, Unit 119, Lights and Receptacles
2	317Q	CB9	HVPS, Unit 130, and TM, Unit 118, Lights and Receptacles
2	317Q	CB8	HVPS, Unit 129, and TM, Unit 117, Lights and Receptacles
2	317Q	CB7	HVPS, Unit 128, and TM, Unit 116, Lights and Receptacles
2	317Q	CB6	HVPS, Unit 127, and TM, Unit 115, Lights and Receptacles
2	317Q	CB5	HVPS, Unit 126, and TM, Unit 114, Lights and Receptacles
2	317Q	CB4	HVPS, Unit 125, and TM, Unit 113, Lights and Receptacles
2	317Q	CB3	HVPS, Unit 124, and TM, Unit 112, Lights and Receptacles
2	317Q	CB2	HVPS, Unit 123, and TM, Unit 111, Lights and Receptacles

Table 4-9. (V)2 Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	317Q	CB1	HVPS, Unit 122, and TM, Unit 110, Lights and Receptacles
2	301A	CB6	Feed for Breaker Panel 317Q
2	306F	CB3	HVPS, Unit 133, Keep Alive Circuit
2	306F	CB4	HVPS, Unit 132, Keep Alive Circuit
2	306F	CB5	HVPS, Unit 131, Keep Alive Circuit
2	306F	CB6	HVPS, Unit 130, Keep Alive Circuit
2	306F	CB7	HVPS, Unit 129, Keep Alive Circuit
2	306F	CB8	HVPS, Unit 128, Keep Alive Circuit
2	306F	CB9	HVPS, Unit 127, Keep Alive Circuit
2	306F	CB10	HVPS, Unit 126, Keep Alive Circuit
2	306F	CB11	HVPS, Unit 125, Keep Alive Circuit
2	306F	CB12	HVPS, Unit 124, Keep Alive Circuit
2	306F	CB13	HVPS, Unit 123, Keep Alive Circuit
2	306F	CB14	HVPS, Unit 122, Keep Alive Circuit
2	305E	CB20	Exciter, Unit 151
2	305E	CB25	Auxiliary Exciter, Unit 152
2	305E	CB14	Transmit Beamformer, Unit 150
3	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133
3	301A	CB8	HVPS, Unit 133, 208 V ac
3	301A	CB9	HVPS, Unit 132, 208 V ac
3	301A	CB10	HVPS, Unit 131, 208 V ac
3	301A	CB11	HVPS, Unit 130, 208 V ac
3	301A	CB12	HVPS, Unit 129, 208 V ac
3	301A	CB13	HVPS, Unit 128, 208 V ac
3	301A	CB14	HVPS, Unit 127, 208 V ac
3	301A	CB15	HVPS, Unit 126, 208 V ac
3	301A	CB16	HVPS, Unit 125, 208 V ac
3	301A	CB17	HVPS, Unit 124, 208 V ac
3	301A	CB18	HVPS, Unit 123, 208 V ac
3	301A	CB19	HVPS, Unit 122, 208 V ac

Table 4-9. (V)[2] Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	317Q	CB1	HVPS, Unit 133, and TM, Unit 121, Lights and Receptacles
3	317Q	CB2	HVPS, Unit 132, and TM, Unit 120, Lights and Receptacles
3	317Q	CB3	HVPS, Unit 131, and TM, Unit 119, Lights and Receptacles
3	317Q	CB4	HVPS, Unit 130, and TM, Unit 118, Lights and Receptacles
3	317Q	CB5	HVPS, Unit 129, and TM, Unit 117, Lights and Receptacles
3	317Q	CB6	HVPS, Unit 128, and TM, Unit 116, Lights and Receptacles
3	317Q	CB7	HVPS, Unit 127, and TM, Unit 115, Lights and Receptacles
3	317Q	CB8	HVPS, Unit 126, and TM, Unit 114, Lights and Receptacles
3	317Q	CB9	HVPS, Unit 125, and TM, Unit 113, Lights and Receptacles
3	317Q	CB10	HVPS, Unit 124, and TM, Unit 112, Lights and Receptacles
3	317Q	CB11	HVPS, Unit 123, and TM, Unit 111, Lights and Receptacles
3	317Q	CB12	HVPS, Unit 122, and TM, Unit 110, Lights and Receptacles
3	301A	CB6	Feed for Breaker Panel 317Q
3	306F	CB3	HVPS, Unit 133, Keep Alive Circuit
3	306F	CB4	HVPS, Unit 132, Keep Alive Circuit
3	306F	CB5	HVPS, Unit 131, Keep Alive Circuit
3	306F	CB6	HVPS, Unit 130, Keep Alive Circuit
3	306F	CB7	HVPS, Unit 129, Keep Alive Circuit
3	306F	CB8	HVPS, Unit 128, Keep Alive Circuit
3	306F	CB9	HVPS, Unit 127, Keep Alive Circuit
3	306F	CB10	HVPS, Unit 126, Keep Alive Circuit
3	306F	CB11	HVPS, Unit 125, Keep Alive Circuit
3	306F	CB12	HVPS, Unit 124, Keep Alive Circuit
3	306F	CB13	HVPS, Unit 123, Keep Alive Circuit
3	306F	CB14	HVPS, Unit 122, Keep Alive Circuit
3	305E	CB20	Exciter, Unit 151

Table 4-9. (V)2 Transmitter Group Deenergizing Procedure[1] -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	305E	CB25	Auxiliary Exciter, Unit 152
3	305E	CB14	Transmit Beamformer, Unit 150

[1] See FO-1(V)2 for CB panel locations.

Section I. EMERGENCY OPERATION

4-7 GENERAL.

Emergency operation of the transmitter group is coordinated at the system level, as described in TO 31P6-2FPS118-11. This manual section identifies and discusses the equipment in the transmitter group that have an emergency operation.

4-8 EMERGENCY OPERATION SHUTDOWN PROCEDURES.

4-8.1 Transmitter Module Emergency Power-Off Buttons. Each TM has two emergency power-off buttons. When pushed, the buttons immediately remove all primary power from the TM. One button is located on the front of TM at the top left-hand corner of cabinet. The other button is located on the back of the TM at the top right-hand corner of cabinet. See Figure 4-1 for location.

4-8.2 Sounder Power Amplifier and Transmitter Emergency Shutdown Buttons. Six pushbutton stations are located throughout the transmitter bay and pump room. When pushed, they shut down the transmitter HVPSs, sounders, and cooling pumps. See RPIE manual for locations.

CHAPTER 5

THEORY OF OPERATION

Section I. FUNCTIONAL SYSTEM

5-1 TRANSMITTER GROUP OVERVIEW.

The transmitter group is an integral part of the transmit subsystem. It performs all primary transmit operations associated with the radar set. This includes generation, amplification, and transmission of various waveforms used by the radar. The equipment in the transmitter group operates under control of the transmit control and monitor group (TCMG). Using scan templates supplied by TCMG, the transmitter group creates and transmits the desired output signal. Radiated output can be frequency modulated/continuous waves (FM/CWs), frequency modulated/interrupted continuous waves (FM/ICWs), or continuous waves (CWs). The 5- to 28-MHz operating range of the radar set is divided into six subbands designated as bands A through F:

1. Band A = 5.0 to 6.79 MHz
2. Band B = 6.69 to 9.14 MHz
3. Band C = 9.04 to 12.30 MHz
4. Band D = 12.20 to 16.55 MHz
5. Band E = 16.45 to 22.30 MHz
6. Band F = 22.20 to 28.00 MHz.

Figure 5-1 shows how the transmitter group interfaces with other groups in the transmit subsystem. Six separate, side-by-side, 12-element antenna subarrays are used. Each of the six subarrays covers a different frequency band (A through F). Only one subarray is active at a time. The 12 antenna elements that make up a subarray are driven independently of each other by separate transmitters. The 12 transmitters operate simultaneously, each delivering up to 100 kW of average power into a separate antenna element. A computer controlled beamformer drives the 12 transmitters. The beamformer introduces independent phase and amplitude control for 12 output channels. Altering the phase and amplitude of radiated energy from each antenna element creates the desired 7.5° beam that can be steered to any of the eight sectors in the segment. The beam is steered to a location determined by TCMG. The beamformer is driven by two redundant exciters that generate the basic transmit waveforms. Exciter output frequency and waveform selection is also under control of TCMG. The 1 MHz and 5 MHz frequency standards are generated by the exciters and output to the TCMG and transmit sounder group (TxSG), respectively. The frequency standards are used to synchronize timing of various equipments within the transmit site. The transmitter group also supplies status signals to TCMG. These status signals indicate selected operating parameters and operational status of certain assemblies. The transmitter group shown in Figure 1 of circuit diagram TO 31P6-2FPS118-73-1 consists of the functions listed below. Principles of operation for these functions are described in paragraphs 5-2 through 5-4. Descriptions of the electronic circuits for these functions are given in Section II of this chapter.

1. Exciter, Unit 151, and auxiliary exciter, Unit 152, consist of:
   a. Exciter/auxiliary exciter waveform generation (WFG) function
   b. Exciter/auxiliary exciter calibration receiver function
   c. Exciter/auxiliary exciter timing and control function
   d. Exciter/auxiliary exciter status and monitoring function.
2. Transmit beamformer (TBF), Unit 150, consists of:
   a. TBF function
   b. TBF control function
   c. TBF status and monitoring function.
3. Transmitter function consists of:
   a. Transmit antenna, Unit 100
   b. Transmitter modules (TMs), Units 110 through 121
   c. High voltage power supplies (HVPSs), Units 122 through 133

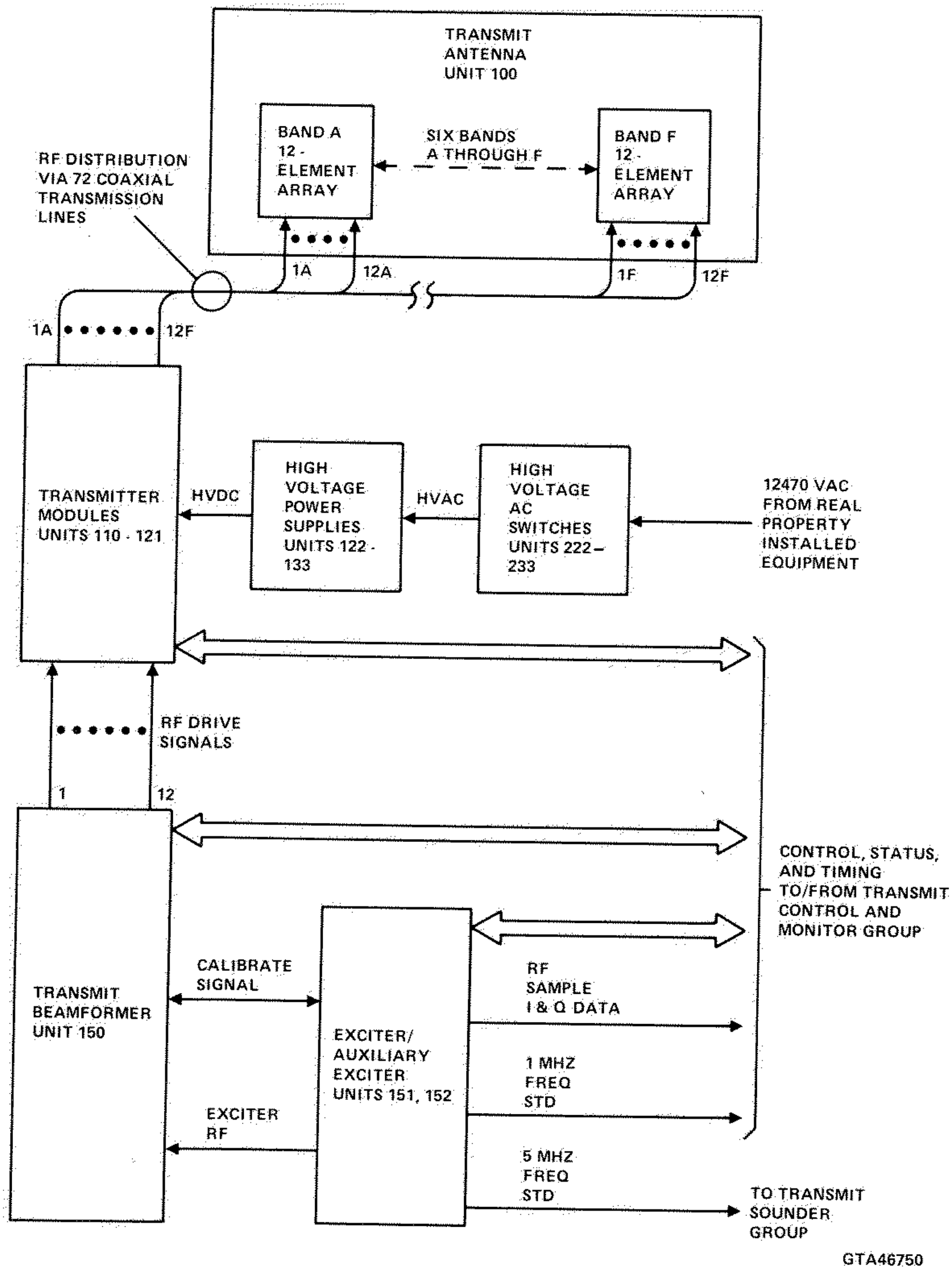


Figure 5-1. Transmitter Group Interfaces

d. High voltage ac (HVAC) switches, Units 222 through 233.

5-2 EXCITER, UNIT 151, AND AUXILIARY EXCITER, UNIT 152, OVERVIEW.

1. The exciter, Unit 151, and auxiliary exciter, Unit 152, are identical units as shown in Figure 1, Sheets 1 and 2, of circuit diagram TO 31P6-2FPS118-73-1. The exciters perform two primary tasks for the transmitter group. They generate the basic transmit waveform for output to the TBF. They also supply digital calibration data to TCMG. The calibration data is used for monitoring and correcting radiated output of the transmitter group to achieve the desired phase and amplitude illumination. The calibration data is generated using samples of the output signals from the 12 transmitters. These radio frequency (RF) samples are applied to the exciter cabinets via the TBF.

2. The exciter waveform generation function generates CW, FM/CW, and FM/ICW signals in the 5-MHz to 28-MHz frequency range. The output center frequency for all waveforms is selectable in 1.0 Hz increments. The waveform type (CW, FM/CW, or FM/ICW) remains constant during each coherent integration time (CIT), but can be changed on a CIT-to-CIT basis. The exciter RF and auxiliary exciter RF signals are both routed to the TBF. Both exciter cabinets are configured to provide identical (redundant) outputs to the TBF. The waveform generation function also allows application of amplitude taper to the RF drive signal when operating in the FM/CW mode. Taper is the gradual increase or decrease of the output signal at the beginning or end of each CIT. Amplitude taper may or may not be necessary, depending on the variation in transmitter output power from one CIT to the next. A calibration RF signal is also output to the TBF. This signal has the same waveform as the RF drive signal, only it is hard-limited to a constant amplitude. Two frequency standard outputs (1 MHz and 5 MHz) are produced by the exciter waveform generation function. The 1-MHz frequency standard from the main exciter is output to the TCMG. The 5-MHz standard from the main exciter is output as a synchronizing signal to the auxiliary exciter. The 5-MHz frequency standard is then output from the auxiliary exciter to the TxSG. Other outputs from the waveform generation function include the first local oscillator (LO) signal and the two-tone signal that are applied to the calibration receiver. The first LO signal is from the local oscillator and the two-tone signal is generated by a separate two-tone generator.

3. The calibration receiver produces amplitude and phase data that is output to the TCMG. The data is used by TCMG to calculate any correction (compensation) values to be applied to the transmitter input signals. The data consists of values for the in-phase (I) and quadrature (Q) components of the following signals:

   a. Twelve transmitter output forward signals and 12 reflected signals

   b. Two TBF input signals and 12 output TBF signals

   c. Two hard-limited RF calibration signals.

   These input signals are time-multiplexed onto a single line by a 40-way multiplexer (MUX) in the TBF cabinet. The calibration receiver accepts the multiplexed input and performs the conversion necessary to obtain discrete I&Q components for each signal. The resulting values are analog-to-digital (A/D) converted to 15-bit binary values. The binary I&Q data then is supplied to TCMG. The A/D clock, MUX reset, and sample and hold trigger are used to control the analog-to-digital converters (A/DCs). Digitized data from the A/DC is output onto a single 15-bit bus that alternates between I data and Q data. Results are sent to TCMG to support calibration and performance monitoring functions. A two-tone test signal from the waveform generation function is applied to the A/DCs. The two-tone signal is routed through the A/DCs.

4. The exciter timing and control function interfaces with the TCMG and distributes control data to other functions in the exciter cabinet. A local control and power interface is provided between the exciter and auxiliary exciter cabinets. The control data from TCMG consists of the following:

   a. Frequency selection

   b. Waveform selection

   c. Amplitude taper control

   d. Timing and control for the calibration receiver.

5. The exciter status and monitoring function interfaces with TCMG and reports equipment faults and status of selected parameters in the exciter cabinet. The status of selected parameters is determined by comparing actual configuration data from the calibration receiver function (data out) with the configuration requested by control messages from TCMG (data in). After comparing the two, a serial status message is sent to TCMG. The serial status message also includes fault data for any equipment faults in the cabinet.

5-3 TRANSMIT BEAMFORMER, UNIT 150, OVERVIEW.

1. The TBF, Unit 150, as shown in Figure 1, Sheet 3, of circuit diagram TO 31P6-2FPS118-73-1, provides beamforming and beamsteering for the transmit signal. The TBF accepts RF drive signal inputs from both the main and auxiliary exciters. Input from either exciter can be selected to drive all 12 transmitters. The main exciter input can be selected to drive transmitters 1 through 6 while the auxiliary exciter input drives transmitters 7 through 12. In either case, the TBF generates 12 separate output channels that drive the TMs. Each output channel is adjusted independently in both phase and amplitude to achieve the desired illumination pattern for the transmit beam. To provide calibration and performance monitoring capability, the TBF uses a 40-way MUX to route various signal samples back to the calibration receiver function in the exciter/auxiliary exciter cabinets.
2. The TBF function uses 12 parallel wide-band amplifier circuits to generate low-power RF drive signals for the TMs. The overall output level for all 12 channels is simultaneously adjustable. (In addition, separate amplitude controls are provided in the TM such that each channel is individually adjustable.) The output phase of each channel is individually adjustable over a 360° range, in increments of 1.4°. The TBF can select the output from either exciter cabinet to drive the 12 transmitters (redundant/failover mode).
3. Operation of the TBF function is controlled by the TCMG. The TBF control function decodes control data from TCMG and supplies amplitude and phase data to each channel in the TBF function. Control data from TCMG also selects the input configuration for the beamforming function. The inputs can be configured to accept RF drive signals from either or both exciters. Individual on/off control is provided for each of the 12 output channels. Timing and control signals for the 40-way MUX are supplied to the TBF status and monitoring function.
4. The TBF status and monitoring function contains the 40-way MUX. The MUX supplies RF test samples to calibration receivers in the exciter/auxiliary exciter cabinets. Control signals for the MUX are supplied by the TBF control function. The MUX consists of multiple RF switches that can be configured to route any one of the 40 inputs onto a single output. The single output then is split and routed to both exciter cabinets. Using this method, a waveform sample from any of the 40 inputs can be sent to the calibration receivers located in the exciters. These signal samples are used to generate performance feedback to the TCMG.

5-4 TRANSMITTER FUNCTION.

The transmitter function, as shown in Figure 1, Sheet 4, of circuit diagram TO 31P6-2FPS118-73-1, provides power amplification, distribution, and radiation into space for the radar transmit signal. Radiated output is collimated into a 7.5° beam that is steered to any of the eight sectors in the segment. Twelve identical TMs, Units 110 through 121, drive separate dipole elements in the antenna array. Each TM has its own HVPSs, Units 122 through 133, and associated HVAC switches, Units 222 through 233. The TMs receive RF drive input from the TBF cabinet. Each transmitter receives a different channel output from the TBF. All 12 channels have the same basic RF waveform, but each has had individual phase and amplitude adjustment before being output from the TBF. The TMs amplify the RF drive signal, each producing up to 100 kW of output power in any of the six frequency subbands. Band-switching between transmit subbands is performed in the TMs, under control of TCMG. Each transmitter has six outputs, A through F, to accommodate the six subbands. Only one output from each transmitter is active at a time. Outputs from the transmitters are routed to the antenna array, Unit 100, via 72 coaxial transmission lines. The 72-element antenna array is made up of six, side-by-side subarrays. Each subarray has 12 dipole elements which are driven independently by a separate transmitter. Only one subarray is active at a time. To provide calibration and performance monitoring capability, transmitter output forward and reflected power signals are routed to the exciter calibration receiver function via the 40-way MUX in the TBF cabinet.

Section II. FUNCTIONAL OPERATION OF ELECTRONIC CIRCUITS

5-5 EXCITER, UNIT 151, AND AUXILIARY EXCITER, UNIT 152.

The exciter, Unit 151, and auxiliary exciter, Unit 152, are identical cabinets. These cabinets generate the basic RF signal for output to the TBF. The two cabinets are configured to provide redundant outputs to the beamformer. Each cabinet also contains a calibration receiver that receives RF samples from the beamformer cabinet. The RF samples are down-converted and digitized in the calibration receivers to produce I&Q data. The digital I&Q data is routed back to TCMG where it is used to support monitoring and calibration of the transmitter group equipment. The calibration receivers use LO signals for down-conversion of the RF samples. The first LO signal is a replica of the basic transmit waveform. The first LO is created in the waveform generation function using the same methods that are used for generating the basic transmit signal. Control messages for the exciter cabinets are provided by TCMG. These control messages are applied to the exciter/auxiliary exciter timing and control function. The messages contain setup parameters that define the operating frequency and type of waveforms to be generated. After each control message is used in the exciter, local cabinet status information is added to the message, and it is sent back to TCMG. The return message (with status) is examined for errors and fault conditions by TCMG. Other control signals received from TCMG include the CIT start signal and controls for the A/D conversions in the calibration receiver. Additional outputs from the cabinets include 1-MHz and 5-MHz stable reference frequencies to the TCMG and TxSGs, respectively.

5-5.1 Exciter Waveform Generation Function. The exciter waveform generation function, as shown in Figure 2 of TO 31P6-2FPS118-73-1, generates the exciter RF signal used at the transmit site. The exciter RF outputs to the TBF where it generates 12 separate RF drive signals for the elemental transmitters. The waveform generation function also produces the calibration signal applied to the calibration receiver via the beamformer 40-way MUX. This calibration signal is produced by splitting a small signal from the exciter RF and then limiting this signal to a constant amplitude of 8 dBm ±0.1 dB. First, second, and third LO signals are produced independently by the waveform generation function. The first LO is output to the calibration receiver where it is used for down-converting RF sample signals. The second and third LOs are also routed to the calibration receiver but are not used. Other circuits in the waveform generation function produce 1-MHz and 5-MHz stable reference frequencies for synchronizing operations at the transmit site. Description of the waveform generation function is divided into the following signal generation areas:

1. Reference frequency generation circuits
2. Exciter RF waveform generation circuits
3. First LO generation circuits
4. Second LO generation circuits
5. Third LO generation circuits
6. A/DC test tone generation circuits.

Hybrid dividers HY7, HY8, and HY9 are not used in the exciters.

5-5.1.1 Reference Frequency Generation Circuits. These circuits generate precise frequency reference signals and clocks. The signals are used internally by other circuits of the waveform generation function. Stable 1-MHz and 5-MHz reference signals are generated by the main exciter and sent to the TCMG and auxiliary exciter, respectively. The frequency generation circuits consist of calibrator A3, power amplifier (PA) N1A9, frequency divider N1A6, and oscillators N2A6 through N2A13. See Figure 2, Sheet 2 of TO 31P6-2FPS118-73-1.

5-5.1.1.1 Calibrator A3. Calibrator A3 (frequency calibrator) generates 1-MHz and 5-MHz reference signals. The 1-MHz signal is applied at a level of +13 dBm ±3 dB to the TCMG where it is used to synchronize transmit subsystem operations. The 5-MHz signal is supplied to PA N1A9. The 5-MHz oscillator signal is applied to the auxiliary exciter. It also is applied to multiplier/divider circuits within calibrator A3 to generate 10-MHz, 1-MHz, and 100-kHz output signals. The 10-MHz and 100-kHz output signals are not used. Also generated by calibrator A3 is a synchronized 1 pps output. Normally, the calibrator is powered from an external source. In the event of external power loss, the unit automatically switches over to an internal battery. The battery supplies up to 12 hours of continuous operation.

5-5.1.1.2 Power Amplifier N1A9.

1. The PA N1A9 is one of six identical amplifiers used in the exciter cabinet. It has an input signal selection circuit, two amplification channels, and associated divider and combiner networks. The unit amplifies and power divides the selected input signal to

provide four output signals. Two output signals are adjusted to have a power level of +13 dBm ±1 dB. Two are adjusted for +30 dBm ±1 dB. The signal amplified in the unit is selected from four RF inputs as commanded by the control I/O inputs. The control I/O bits are applied to the signal selection circuit formed by a demultiplexer, relay drivers, and four relays. One relay is associated with each input signal. Depending on the I/O inputs (truth table below), the relay for the selected signal is energized and routes the signal to the amplification stages.

PA N1A9 Control I/O Truth Table

CONT	CONT	Selected Input
1	0	A1
0	0	A2
0	1	A3
1	0	A4
1	1	A5

2. The 5-MHz signal from calibrator A3 is applied to PA N1A9. It is selected for amplification from four possible inputs (three are not used) by the I/O control. Four 5-MHz outputs are produced. One +13 dBm output is applied to synthesizer A4 (Sheet 1). The second +13 dBm output is applied to frequency divider N1A6 (Sheet 2). One +30 dBm output is routed through 16-dB attenuator AT71 (Sheet 1) and supplied to synthesizer A5. The second 30-dBm output is applied to the auxiliary exciter cabinet.

3. Fault detection logic and light-emitting diodes (LEDs) in the PA assembly provide a visual indication of amplifier status. A status bit is generated by the fault detection logic and sent to the exciter status and monitoring function. A logic low and logic high status bit represents a no-fault or fault condition, respectively.

5-5.1.1.3 Frequency Divider N1A6. Frequency divider N1A6 divides 5-MHz and 2.16-MHz inputs to produce 5.0-kHz, 5.4-kHz, 40-kHz, and 43.2-kHz transistor-transistor-logic (TTL) output signals. The 5-MHz input signal is applied from PA N1A9. The 2.16-MHz input is a TTL signal supplied from oscillator N2A7. After being converted to a TTL signal in the unit, the 5-MHz signal is divided by 125 to produce a 40-kHz output. It is further divided by 8 to produce a 5.0-kHz output. Similarly, the 2.16-MHz signal is divided by 50 to produce a 43.2 kHz signal; then it is further divided by 8 to produce a 5.4 kHz output. The 40-kHz output is applied to oscillator N2A7. The 43.2-kHz output is supplied to oscillators N2A1 through N2A6 and N2A8 through N2A13. At each oscillator, the related 40- or 43.2-kHz signal is used as the reference frequency in the phase detector error correction circuit. The 5.0-kHz and 5.4-kHz outputs are routed through bandpass filters FL5 and FL6, then are applied to tone generator N1A4. All input and output signals are detected and monitored by fault detection logic. The fault detection logic provides status indications. A LED provides a visual indication of amplifier status. A summary AFI status bit generated by the fault detection logic is sent to the exciter status and monitoring function. A logic low and logic high status bit represents a no-fault or fault condition, respectively.

5-5.1.1.4 Oscillators N2A6 through N2A13.

1. Oscillators N2A6 and N2A7 generate system clocks; N2A8 through N2A13 generate gated waveform clock signals. The clocks are applied to the exciter timing and control function. Except for frequency of operation and some component values, the oscillators are identical to each other. They also are identical to oscillators N2A1 through N2A5. Operation of the oscillators is described below. The specific frequencies generated by the oscillators are given in Table 5-1. With the exception of oscillator N2A7, only the differential TTL and status outputs generated by oscillators N2A6 through N2A13 are used. In addition to these outputs, the 2.16-MHz TTL signal generated by oscillator N2A7 is also used. It is applied to frequency divider N1A6.

2. Oscillators N2A6 through N2A13 each consist of a varactor tuned crystal oscillator, a phase lock loop (PLL) frequency correction circuit, amplification stages, frequency dividers, and fault detection logic. The voltage controlled oscillator (VCO) circuit generates the base frequency CW signal that is amplified to a level of +10 dBm ±3 dB for the CW output. It is also amplified and routed through combinational logic to provide a base frequency CW TTL output. Additional processing and division of the base frequency TTL signal in sequential logic produces a pair of gated, divided-by-two TTL outputs. One gated TTL output is true; the other the complement. A gated, divided-by-two TTL differential output is produced also.

Table 5-1. Oscillators N2A1 through N2A13 Output Frequency Data

Oscillator Reference Designator	Base Frequency CW and CW TTL Output	Gated Divide-By-Two TTL and Differential TTL LO Frequency
N2A1	22.184 MHz ± 1 Hz	11.0592 MHz ± 0.5 Hz
N2A2	26.2650 MHz ± 1 Hz	13.1328 MHz ± 0.5 Hz
N2A3	32.4864 MHz ± 1 Hz	16.2432 MHz ± 0.5 Hz
N2A4	34.5600 MHz ± 1 Hz	17.2800 MHz ± 0.5 Hz
N2A5	12.0960 MHz ± 1 Hz	3.0240 MHz ± 3 Hz*
N2A6	16.5880 MHz ± 17 Hz	8.2944 MHz ± 9 Hz
N2A7	2.1600 MHz ± 1 Hz	1.0800 MHz ± 0.5 Hz
N2A8	13.9104 MHz ± 14 Hz	6.9552 MHz ± 7 Hz
N2A9	14.6880 MHz ± 15 Hz	7.3440 MHz ± 8 Hz
N2A10	15.5520 MHz ± 16 Hz	7.7760 MHz ± 8 Hz
N2A11	16.4160 MHz ± 16 Hz	8.2080 MHz ± 8 Hz
N2A12	17.0208 MHz ± 17 Hz	8.5104 MHz ± 9 Hz
N2A13	17.9712 MHz ± 18 Hz	8.9856 MHz ± 9 Hz

*Divided by four to produce quadrature outputs

3. Each oscillator is controlled by a gate input from the exciter timing and control function. When high, the gated output is active; when low it is turned off. The 43.2-kHz (40.0 kHz for N2A7) signal applied to the oscillators from frequency divider N2A6 is a reference frequency input. It is used by the phase detector stage in the oscillator PLL frequency correction circuit. There, it and a divided sample of the oscillator signal are compared. Phase lock occurs when the two signals are in quadrature. If the oscillator frequency drifts, the two signals fall out of quadrature and an error voltage is generated. The error voltage then is applied to the varactor tuning stage of the oscillator to correct the oscillator output frequency.

4. All input/output (I/O) signals are monitored by fault detection logic. Also monitored is the status of the PLL. One LED is provided to give a visual indication of oscillator status; another indicates PLL status. A summary status bit generated by the fault detection logic is sent to the exciter status and monitoring function. A logic low or logic high status bit represents a no-fault or fault, respectively.

5-5.1.2 Exciter Radio Frequency Waveform Generation Circuits. The waveform generation circuits produce various RF waveforms. The two major signals produced are the RF drive that is supplied to the TBF and the first LO used for down-converting RF samples in the calibration receiver. Additional second and third LOs and an A/DC test tone are produced also. The RF output to the TBF is called exciter RF. The exciter RF and first LO signals are frequency agile. Frequency changes are made on a CIT-to-CIT basis. Waveforms are generated in the frequency range of 5 to 28 MHz. The frequency resolution is 0.01 Hz. The waveforms are generated as FM/CW, FM/ICW, or CW signals. Both FM waveforms can be produced using FM bandwidths of 5, 10, 20, or 40 kHz, with phase coding. When generated in the FM/ICW mode, the waveforms can have a duty factor of 1/2, 1/3, 1/4, 1/6, or 1/8. The exciter waveform generation circuits consist of the following assemblies; digital-to-analog (D/A) converter N1A1, RF mixer N1A2, synthesizer A4, transfer switch A15, PA N1A11, and taper attenuator N1A12. See Figure 2, Sheet 1, of TO 31P6-2FPS118-73-1.

5-5.1.2.1 Digital-to-Analog Converter N1A1.

1. The D/A converter generates either an FM/CW or CW, 1.2312-MHz, baseband modulation signal for application to RF mixer N1A2. The D/A converter N1A1 receives 12-bit sine digitally encoded sine function waveform data words and related waveform clock from the timing and control function. It also gets a mode (FM/CW or CW) selection command and 0.6912-MHz and 0.54-MHz clock inputs from the timing and control function. Selection of a FM/CW or CW baseband output is determined by the mode selection command. Application of this command to a mode switch in the unit selects the desired signal. When the select command is logic high, the CW output signal is selected; when the select command is logic low, the FM/CW output signal is selected.

2. Use of the CW mode selects a 1.2312-MHz, CW unmodulated output from the converter. It is derived by mixing the 0.6912-MHz and 0.54-MHz clocks. The output from the mixing stage is amplified. It is routed through a 1.2312-MHz center frequency bandpass filter to yield a 1.2312-MHz sum signal. Then it is routed through the mode switch and sent to RF mixer N1A2.

3. Use of the FM/CW mode selects an FM/CW baseband signal centered on 1.2312-MHz from the converter. It is a linear frequency modulated (LFM) signal that represents the selected RF waveform. Refer to classified TO 31P6-2FPS118-1-1 for specific data about the waveforms used with the radar set. Generation of the FM/CW signal is by conversion of the 12-bit sine vector waveform data word inputs to the equivalent analog signal by an onboard D/A converter integrated circuit. Application of new word inputs to the D/A converted during the CIT period is controlled by the waveform clock signal. Each clock causes a new 12-bit word to be latched in registers for conversion by the D/A converter to its analog equivalent. The output from the D/A converter is a staircase sine wave. The stair stepping occurs at the waveform clock frequency. The period of the sine wave determines the modulation frequency for FM/CW operation. The signal is buffered and routed through a 1.2312-MHz center frequency bandpass filter. The bandpass filter smoothes the sine wave by removing the stairsteps imparted by the D/A conversion while passing the FM signal. Then, it is routed through the mode switch and sent to RF mixer N1A2.

4. The I/O signals are monitored by fault detection logic to provide status indications. The LEDS provide a visual indication of D/A converter status. One LED indicates parity status; a second LED indicates output signal level status. Status data generated by the fault detection logic also is sent to the exciter status and monitoring function.

5-5.1.2.2 Radio Frequency Mixer N1A2. The RF mixer N1A2 translates the 1.2312-MHz baseband signal applied from D/A converter N1A1 into a 3.0024-MHz signal. The 3.0024-MHz signal is used to modulate synthesizers A4 and A5. The TTL inputs of 1.08 MHz and 0.6912 MHz are applied to the RF mixer from the timing and control function. These signals are filtered, amplified, and then mixed to produce a 1.7712-MHz signal. After amplification and filtering, the 1.7712-MHz signal is mixed with the 1.2312-MHz baseband input signal to yield a 3.0024-MHz signal. It is filtered, amplified, and power divided to provide two -8 dBm output signals. One output is supplied as a modulation input to synthesizer A4; the second output is supplied to synthesizer A5. These signals have the characteristics for the selected FM/CW or CW RF waveform.

5-5.1.2.3 Frequency Synthesizer A4.

1. Frequency synthesizer A4 generates the RF output waveform in the 5- to 28-MHz range. It can produce output signals of 0 to 50 MHz at increments of 0.01 Hz. The synthesizer receives a 5-MHz reference input applied to the unit from PA N1A9. All synthesizer outputs are derived from the 5-MHz input through a direct process of frequency multiplication, division, and translation. This technique produces coherent outputs that are related to the 5-MHz reference by a ratio of two integers.

2. For normal operation, output frequency selection is by remote frequency commands applied to the unit from the timing and control function. Remote frequency selection commands are decimal logic commands, 10 lines per decade. A local control mode of operation for the unit is available where frequency selection is made using the front panel controls.

3. The FM/CW or CW modulation of the synthesizer output waveform is done by the input (sync mod 3) signal applied at the SEARCH INPUT connector at the rear panel of the unit. The SEARCH INPUT connector and related cabling changes are a modification to the standard synthesizer. The SEARCH INPUT accepts a 2.9- to 3.1-MHz

signal at an amplitude of -8dBm ±1 dB. This input signal replaces the search oscillator that is disconnected but left in place. As a result, the digit interpolator and sweep circuits of the synthesizer are disabled. Instead, the 3.0024-MHz signal replaces the search oscillator signal normally generated by the synthesizer. Setting the DECADE SELECTOR control at the 100K position causes the synthesizer output frequency to vary in direct relation to the frequency deviation from 3.0024 MHz of the sync mod 3 signal. The RF output from synthesizer A4 is routed through 3-dB attenuator AT72 and transfer switch A15; it is applied to PA N1A11.

5-5.1.2.4 Transfer Switch Assembly A15. Transfer switch A15 is used to interrupt and dummy load the RF output during the waveform-off interval of FM/ICW operation. A logic high TTL command supplied from the timing and control function causes the waveform to be routed through the switch for application to PA N1A11. A logic low, applied during the waveform-off interval of FM/ICW operation, causes the waveform to be routed through the switch and dummy loaded for the off period. Switch A15 has a maximum insertion loss of 1 dB; it has a minimum isolation between the input and off ports of 60 dB. It has a maximum operating level of +13 dBm with less than 1-dB compression.

5-5.1.2.5 Power Amplifier N1A11. The PA N1A11 amplifies the RF signal for application to taper attenuator N1A12. The amplifier is one of six identical amplifiers used in the cabinet. Operation of the amplifier is the same as described for PA N1A9 (paragraph 5-5.1.1.2) with the following exceptions. The signal being amplified is the exciter RF waveform applied from synthesizer A4 via transfer switch A15. Two +13 dBm ±1 dB and one +30 dBm ±1 dB outputs generated by the unit are not used. The remaining +30 dBm ±1 dB output is routed to taper attenuator N1A12.

5-5.1.2.6 Taper Attenuator N1A12.

1. Taper attenuator N1A12 provides from 0 to 95 dB of attenuation for the exciter RF output to the beamformer. The attenuation level, mode for inserting attenuation, and switching path is selected by the control data and other timing inputs applied from the timing and control function. Taper attenuator N1A12 consists of a digitally controlled attenuator, taper mode control circuits, and output signal distribution circuits. Amplitude taper is applied to the exciter RF signal to keep the transmitters operating within the guidelines prescribed for transmitter on/off cycles. Abrupt changes in transmitter output power can create large transients in the PAs in the elemental transmitters when operating at high power levels. Taper is necessary when the transmitters are turned on or off when operating at power levels greater than 40 kW. When taper is used, the RF drive signal to the elemental transmitters is applied in two steps. The first step takes the RF drive level to half-power, and the second step takes the RF drive to the required power level (taper up). Two half-power steps are also used for turning the transmitters off (taper down). This amplitude taper is applied to the exciter RF output to the beamformer.

2. Operation of the taper attenuator starts with the application of a start pulse (Figure 5-2) from the timing and control function. The start pulse causes status bits from the previous CIT to be latched on board. Following the start pulse, the shift register clock serially shifts in a new control data message (Figure 5-3). At the same time, the shift register clock causes the control message with status bits from the previous CIT (bits 12 through 15) to be serially shifted back to the timing and control function. After the control message is clocked in, a data latch pulse causes it to be transferred from serial to parallel registers on board for use during the current CIT.

3. The attenuation level applied to the waveform is selected by bits 1 through 7 of the control data message. Attenuation is selectable in 1-dB steps for 0 dB and for 95 dB with command inputs 1111111 for 0 dB and 0000000 for 95 dB.

4. Step clock pulses are used to increase or decrease the signal level from the level selected by the control data message. The level is increased or decreased depending on the logic status of bit 0 in the control message. With a logic low in bit 0 of the control word, a taper up and taper down mode of operation is selected. In this mode, the step clock pulses cause the signal level to increase (taper up) in 1-dB steps. Application of a 17th and additional pulses cause the signal level to decrease (taper down) in 1-dB steps. If 0-dB attenuation is reached any time during the first 16 pulses, the attenuation remains at 0 dB until a 17th pulse input is applied. As before, the 17th and additional pulses cause the signal level to decrease

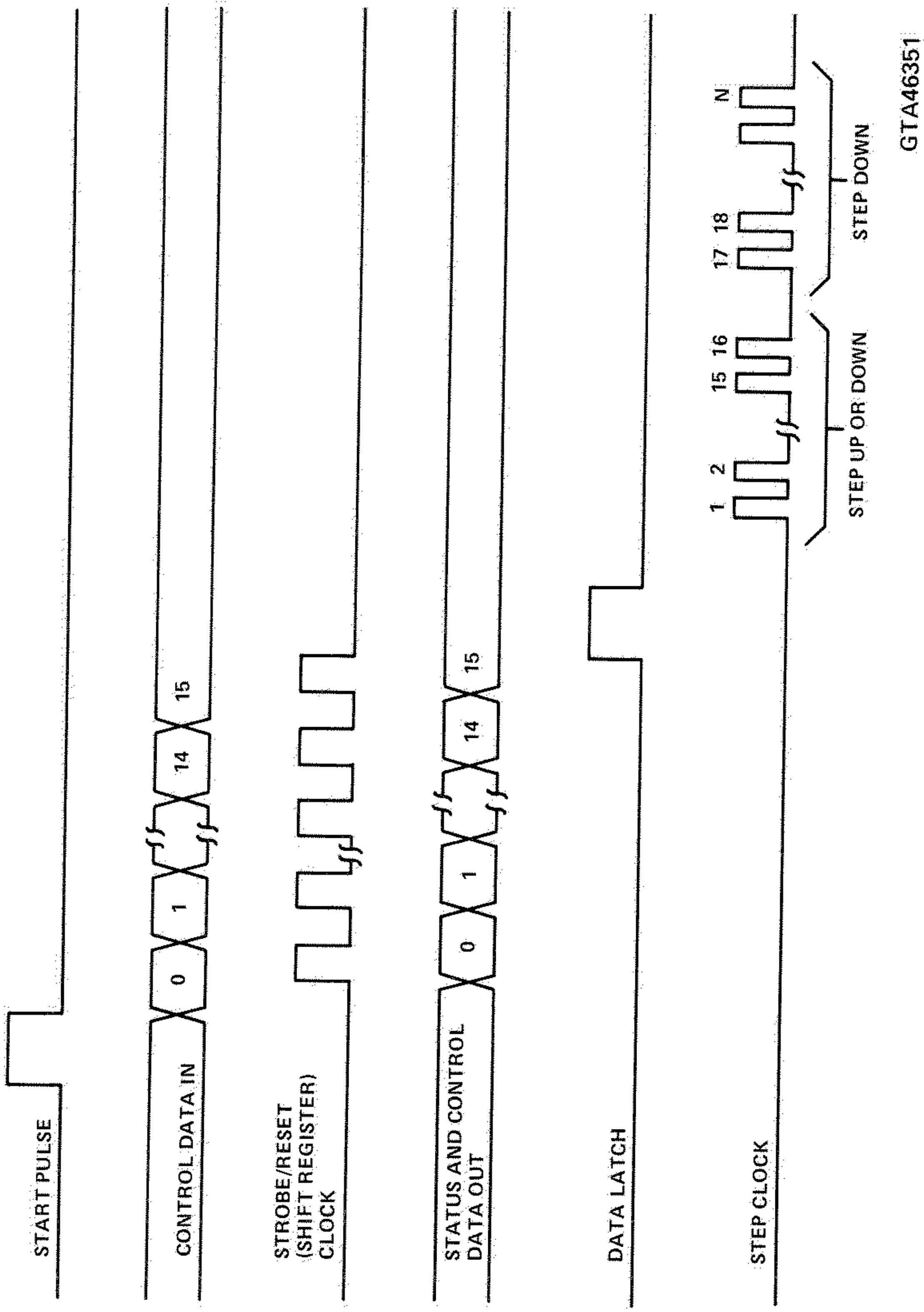


Figure 5-2. Taper Attenuator Simplified Timing Diagram

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
STATUS				OUTPUT SELECT CONT				ATTENUATION VALUE							TU TD

TU/TD = TAPER UP/ TAPER DOWN SELECT BIT

ATTENUATION VALUE = SELECTED ATTENUATION 0 TO 95 DB

OUTPUT SELECT CONT = SELECTS SINGLE, DUAL, OR NO OUTPUT - BIT 10 IS NOT USED

STATUS = USED WITH COMMAND DATA OUTPUT MESSAGE TO REPORT STATUS

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Figure 5-3. Taper Attenuator Control Data In and Status and Control Data Out Message Format

again in 1-dB steps. With a logic high in bit 0 of the control word, a taper down mode is selected. In this mode, the step clock pulses cause the signal level to decrease (taper down) in 1-dB steps until 95 dB of attenuation is selected. Once the 95-dB level is reached no further decrease in the signal level can occur. The taper modes are used when generating additional test waveforms (ramps) at the start or end of a CIT.

5. Output signal distribution circuits, consisting of relays and control logic, route the waveform processed in the unit into one of three paths. Selection of the path is controlled by bits 8 through 11 (bit 10 not used) of the control data message. Output signal switching can be selected depending on the status of these bits. Normally, only a single output (exciter RF) is selected. When bit 11 is high, the signals being processed in the taper attenuator are dummy loaded in the unit so that no output signals are generated.

6. The taper amplifier also has an output signal path that is not switched. This path contains an additional 0.25- to 20-dB variable attenuator. The unswitched output is adjusted to a level of 8 dBm ±0.1 dB. This signal is output to the beamformer cabinet as the calibration signal.

7. In addition to the status bits returned to the timing and control function, fault detection logic circuits and an LED provide a visual indication of taper attenuator status. The fault detection logic also generates a status bit sent to the status and monitoring function. A logic low and logic high status bit represents a no-fault and fault, respectively.

5-5.1.3 First Local Oscillator Generation Circuits. The first LO generation circuits produce the first LO for the calibration receiver. There, the first LO is mixed with the RF sample signals applied to the calibration receiver. The first LO is frequency agile. Frequency changes are made on a CIT-to-CIT basis. First LO waveforms are generated in the same 5- to 28-MHz frequency range as the exciter RF signal. The frequency resolution is 0.01 Hz. First LO waveforms are generated as FM/CW, FM/ICW, or CW waveforms to demodulate the RF samples derived from the same modes of transmitter operation. First LO waveforms can be produced with bandwidths of 5, 10, 20, or 40 kHz, with or without phase coding. When used in the FM/ICW mode, the waveforms can have a duty factor of 1/2, 1/3, 1/4, 1/6, or 1/8. The first LO is a replica of the exciter

RF signal and is generated by synthesizer A5. See Figure 2, Sheet 1, of TO 31P6-2FPS118-73-1.

1. Frequency synthesizer A5 generates the 5- to 28-MHz range first LO waveforms. It can produce output signals of 0 to 50 MHz in increments of 0.01 Hz. The synthesizer receives a 5-MHz reference input applied to the unit from PA N1A9. All synthesizer outputs are derived from the 5-MHz input through a direct process of frequency multiplication, division, and translation. This technique produces coherent outputs that are related to the 5-MHz reference by a ratio of two integers.
2. For normal operation, output frequency selection is by remote frequency commands applied to the unit from the timing and control function. Remote frequency selection commands are decimal logic commands, 10 lines per decade. A local control mode of operation for the unit is available where frequency selection is made using the front panel controls.
3. The FM/CW or CW modulation of the synthesizer generated output waveforms is done by the input (sync mod 2) signal applied from RF mixer N1A2. The unit accepts an FM/CW or CW, 3.0024-MHz sync mod 2 signal at an amplitude of -8 dBm ±1 dB. The first LO waveform output from synthesizer A5 is applied directly to the calibration receiver.

5-5.1.4 Second Local Oscillator Generation Circuits. Second LO generation circuits produce second LO signals that are applied to the calibration receiver. These signals serve no function in the calibration receiver. Second LOs are frequency agile. Frequency changes are made on a CIT-to-CIT basis. The second LOs are gated (CIT-to-CIT) unmodulated CW signals generated at one of four fixed frequencies; 11.0592, 13.1328, 16.2432, or 17.2800 MHz. The second LO generation circuits consist of oscillators N2A1 through N2A4 (Figure 2, Sheet 2), PA N1A3, and power dividers HY1 and HY2 (Figure 2, Sheet 3).

5-5.1.4.1 Oscillators N2A1 through N2A4. Oscillators N2A1 through N2A4 collectively produce the four fixed second LO frequencies of 11.0592, 13.1328, 16.2432, or 17.2800 MHz for application to PA N1A3. Except for frequency of operation and some component values, the four oscillators are identical to each other. They also are identical to oscillators N2A5 through N2A13. Operation is the same as described for oscillators N2A6 through N2A13 in paragraph 5-5.1.1.4 with the following exceptions. The specific frequencies generated by each oscillator is given in Table 5-1. Only the gated TTL true and status output from each oscillator is used.

5-5.1.4.2 Power Amplifier N1A3 and Power Dividers HY1 and HY2. The PA N1A3 is used to select and amplify the second LO inputs applied from oscillators N2A1 through N2A4. Operation of the amplifier is the same as described for PA N1A9 (paragraph 5-5.1.1.2) with the following exceptions. The two +13 dBm outputs are not used. The two +30 dBm ±1 dB outputs are split by 4-way power dividers HY1 and HY2. The four outputs from HY1 and three outputs from HY2 are not used. The remaining second LO output from HY2 is applied to the calibration receiver.

5-5.1.5 Third Local Oscillator Generation Circuits. The third LO generation circuits produce CW quadrature (I&Q) third LO signals at a fixed frequency of 3.024 MHz. Third LO signals are also routed to the calibration receiver. Like the second LO signals, the third LO serves no function in the calibration receiver. The third LO generation circuits consist of the following assemblies; oscillator N2A5 (Figure 2, Sheet 2), PAs N1A5 and N1A7 (Figure 2, Sheet 3), and power dividers HY3 through HY6.

5-5.1.5.1 Oscillator N2A5. Oscillator N2A5 produces 3.0240-MHz I&Q third LO frequencies for application to PAs N1A5 and N1A7, respectively. Except for frequency of operation and some component differences, the oscillator is identical to oscillators N2A1 through N2A4 and N2A6 through N2A13. Operation is the same as described for oscillators N2A6 through N2A13 in paragraph 5-5.1.1.4 with the following exceptions. The basic frequency generated by the oscillator stage is 12.0960 MHz ± 12 Hz. The basic frequency is divided by four to produce the 3.0240-MHz ± 3 Hz gated outputs. Also the output circuitry is changed to provide TTL quadrature outputs instead of TTL true and complement outputs. Only the quadrature and status outputs from the unit are used.

5-5.1.5.2 Power Amplifiers N1A5 and N1A7 and Power Dividers HY3 through HY6. The PAs N1A5 and N1A7 are used to amplify the third LO inputs applied from oscillator N2A5. Operation of the amplifiers is the same as described for PA N1A9 (paragraph 5-8.1.1.2) with the following exceptions. The two +13 dBm outputs from each amplifier are not used. The two +30 dBm ±1 dB, 3.0240-MHz (I) outputs from N1A5 are split by 4-way power dividers HY3 and HY4. The two +30 dBm ±1 dB, 3.0240-MHz (Q) outputs from N1A7 are split by 4-way power dividers HY5 and HY6. Third LO I&Q signals are taken from HY4 and HY6, respectively, and applied to the calibration receiver. The remaining outputs from HY3 through HY6 are not used.

5-5.1.6 Analog-to-Digital Converter Test Tone Generation Circuits. The tone generation circuits produce waveforms for equipment performance monitoring/automatic fault isolation (EPM/AFI) testing. The A/D test tones are produced for application to the calibration receiver A/DC. The A/D test tones test third order intermodulation and linearity of the converters. The tone generation circuits, shown on Figure 2 of circuit diagram TO 31P6-2FPS118-73-1, consist of bandpass filters FL5 and FL6 (Figure 2, Sheet 2) and tone generator N1A4 (Figure 2, Sheet 1).

5-5.1.6.1 Bandpass Filters FL5 and FL6. Bandpass filters FL5 and FL6 filter the 5.0-kHz and 5.4-kHz TTL signals sent from frequency divider N1A6 to tone generator N1A4. Filters FL5 and FL6 have a minimum 3-dB bandwidth of 480 Hz, centered at 5.0 kHz and 5.4 kHz, respectively. Each has a maximum voltage loss at the center frequency of 7.75 dB ± 1 dB. Maximum phase shift at the center frequency is ±10°.

5-5.1.6.2 Tone Generator N1A4. Not used in Exciter and Auxiliary Exciter.

5-5.2 Calibration Receiver Function. The calibration receiver, Figure 7 of circuit diagram TO 31P6-2FPS118-73-1, consists of an elemental receiver A1 and an A/DC A2. Under control of TCMG, the calibration receiver accepts RF input from the TBF cabinet. This RF input can be any one of 40 different signals, as selected by the 40-way MUX in the TBF cabinet. The input signal is converted to baseband to provide I&Q output signals. The I&Q signals are digitized by A/DC A2 and output to TCMG. The TCMG uses the data to evaluate operational performance of the transmitter group equipment. The serial data, clock, and shift/load strobe, transfer operating parameters from the exciter timing and control function to the calibration receiver. The serial data originates at TCMG; it is supplied to the timing and control function as 128-bit serial data words. Of these, 59 bits control the calibration receiver. The timing and control function decodes the 128-bit serial data words to produce 88-bit serial data words. The 88-bit serial data words are routed to the calibration receiver as serial data together with the data clock and strobes. Control signals for A/DC A2 are supplied by TCMG via the status and monitoring function. These control signals consist of an A/DC clock, MUX reset, and sample and hold trigger. Local oscillator and A/D test tones also are supplied to the calibration receiver function from the waveform generation function. The first local oscillator signal is supplied at a level of +13 dBm ±1 dB. The status of the calibration receiver is supplied to TCMG via the status and monitoring function.

5-5.2.1 Calibrate Receiver Radio Frequency Input Signals. To support equipment performance monitoring (EPM) for the transmitter group, the calibration receiver accepts 36 different RF samples from the 40-way MUX. These are:

1. Twelve forward power samples from the transmitter outputs
2. Twelve reverse power samples from the transmitter outputs
3. Twelve RF drive samples from the transmitter inputs (TBF outputs).

Figure 5-4 shows the timing for the 36 RF samples in relation to a CIT. In the example shown, the CIT has 16 waveform repetition intervals (WRIs). At the start of the CIT, the forward power sample from TM 1 is active. This signal is routed to the calibration receiver input via the 40-way MUX in the TBF cabinet. The transmitter 1 forward power sample is active for 4 milliseconds. During this 4-millisecond period, the calibration receiver generates the I&Q components for the signal; the A/DC conversions are performed. When this period has elapsed, the transmitter 1 forward power sample is removed; the reverse power sample is applied via the 40-way MUX. This signal is present for 5 milliseconds. The I&Q signals are generated and A/DC converted in the same manner. When the 5-millisecond interval ends, the reverse power sample is removed. The transmitter 1 RF drive signal from the transmitter input (TBF output) is applied. This signal is also present for 5 milliseconds. It is converted to digitized I&Q data in the same manner. When this 5-millisecond interval ends, the transmitter 1 signal is replaced by the transmitter 2 forward power sample. The cycle is repeated for the transmitter 2 RF signals. Note that although the transmitter 2 forward power sample is immediately switched at the 40-way MUX, calibration receiver timing for the transmitter 2 RF signals does not begin until the start of the next WRI. The transmitter 2 forward power is tested for 4 milliseconds at the start of the second WRI. This cycle repeats for 12 WRIs until all 36 samples have been tested. The timing for converting the 36 samples is automatically initiated at the beginning of the CIT, unless specifically inhibited by command. The automatic switching sequence can be stopped by a control message from TCMG to the TBF cabinet. When inhibited, the MUX remains in the manual mode for one CIT. When in the manual mode, the position of the 40-way MUX is determined by a 6-bit code pattern in the TBF control message. Four additional RF signals are routed to the calibration receiver via the 40-way MUX. These are the two TBF RF input signals (exciter RF and auxiliary exciter RF) and two hard-limited RF calibration signals (from the

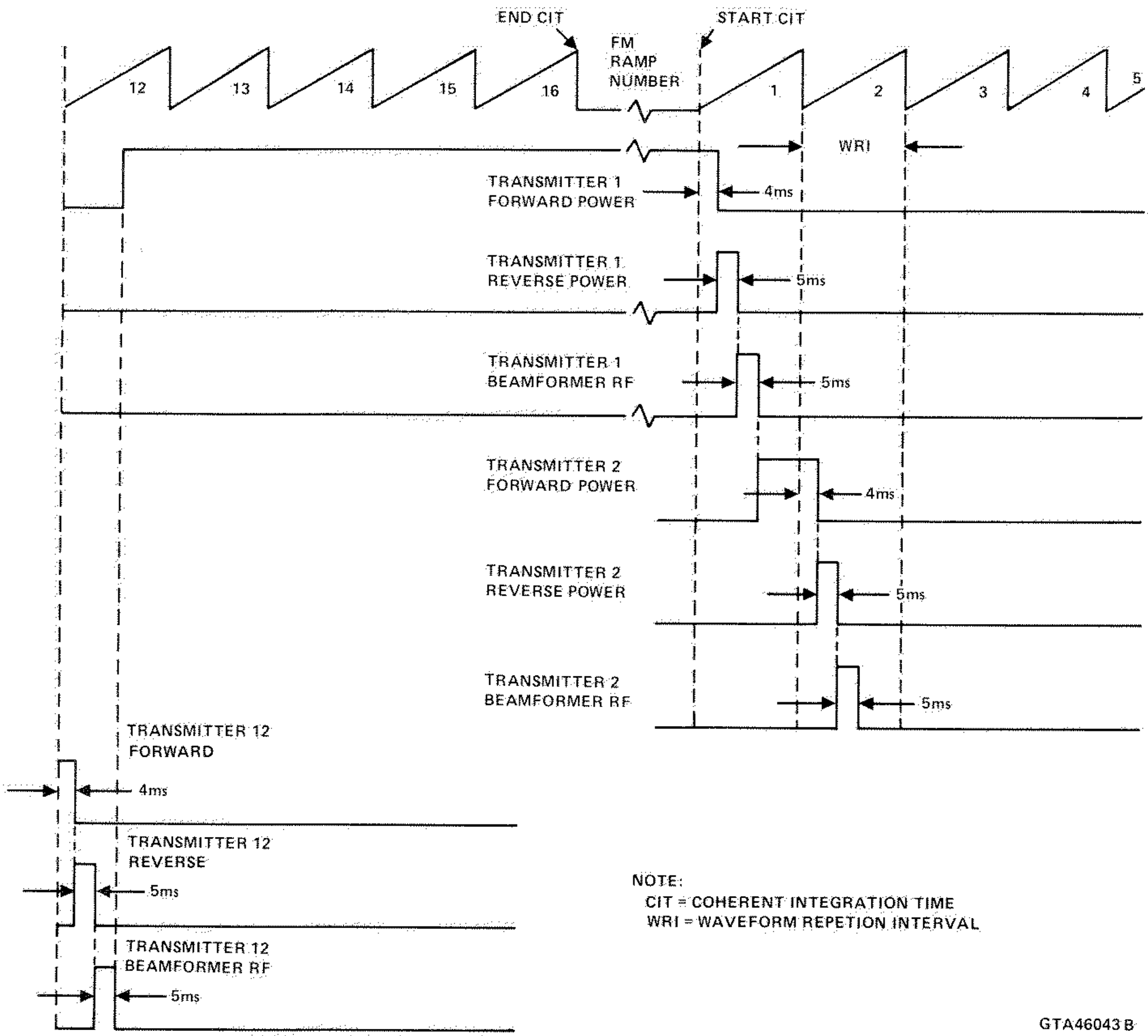

Figure 5-4. Calibration Receiver Input Multiplexer Select Waveform Timing

exciter and auxiliary exciter). Each TBF RF input signal is tested every 3 minutes as part of the EPM test cycle. Hard-limited calibration signals are used as part of the AFI tests that are invoked at the transmit maintenance console at TCMG. The I&Q data is generated and digitized for these signals in the manner described below.

5-5.2.2 Calibration Receiver (Elemental Receiver) A1. Under control of TCMG, the calibration receiver accepts RF input from the 40-way MUX in the TBF, Unit 150. This signal is converted to baseband to provide I&Q output signals. The 40 RF signals comprise:

1. Transmitter output forward power samples
2. Transmitter output reverse power samples
3. Transmitter input (TBF output) samples
4. Exciter RF (TBF input) samples.

The calibration receiver provides a gain of 12.5 ± 1.5 dB for both the I signal and the Q signal. The I&Q signals are matched to within 1 dB of amplitude. There is a $90° \pm 6°$ phase difference between the I&Q outputs. The exciter timing and control function receives a 59-bit serial data word from TCMG and converts it to an 88-bit serial data word (data in) for control of calibration receiver parameters. Seventy-two of the 88 bits are used for receiver control; 16 bits are reserved for status bits as shown in Figure 5-5. The calibration receiver sends an 88-bit serial data word (data out) to the exciter status and monitor function as shown in Figure 5-6. If the calibration receiver is working correctly, 72 of the data out bits will be the same as the data in bits. The remainder of the data out bits are used as follows; four bits indicate the status of the LOs, four bits indicate the status of the power supplies, and eight bits are spares. The calibration receiver contains a power distribution board and six signal boards. These six signal boards are shown in Figure 5-7 and described in the following paragraphs:

1. The RF input board provides the necessary input selectivity for the calibration receiver. Input is from the 40-way MUX in the TBF. The RF input board can also provide from 0- to 20-dB attenuation. This selection is accomplished through the use of 17 data bits of the serial data in.
2. The preselector board provides 15 preselector filters. These 15 preselectors are used to provide the necessary narrow passband around the operating frequency to reduce background noise to an acceptable level. Selection of the proper preselector filter for each operating frequency is accomplished through the use of 17 data bits. One data bit is used for the selection of each filter; two data bits are used for the selection of the appropriate bank of filters.
3. The first frequency (IF) amplifier in the calibration receiver does not generate IF signals as the name implies. Instead, it processes the Q component of the first LO signal. The first LO signal is a replica of the basic exciter RF signal. Down-conversion to baseband is accomplished by mixing the first LO with the RF input sample from the TBF. Sixteen data bits control the first IF amplifier board. These 16 bits are used as follows; 6 bits are used to select 0 to 30 dB of attenuation, 2 bits are used to select 0 or 10 dB of amplification, and 8 bits are used for IF filter selection.
4. The second IF amplifier conditions the I component of the first LO signal. Operation is similar to that of the first IF amplifier board. Eleven data bits control the second IF amplifier. These 11 data bits consist of; 2 data check bits, 4 data bits for selecting 0 to 17.5 dB of attenuation in 2.5-dB steps, 2 data bits to select or bypass a 10.3-dB amplifier, and 2 data bits to select or bypass a 10.2-dB amplifier. In addition, the RF input signal sample is split and routed to the I baseband board and the Q baseband board.
5. The I baseband board receives the first local oscillator I signal and down-converts the RF signals to an in-phase signal that ranges from dc to 6 kHz with a maximum 20 V peak-to-peak swing. Five data bits are used for filter selection on this board. One data bit is used for each filter.
6. The Q baseband board receives the first local oscillator Q signal and down-converts the RF signals to a quadrature signal that ranges from dc to 6 kHz with a maximum 20 V peak-to-peak swing. Five data bits are used for filter selection on this board. One data bit is used for each filter.

5-5.2.3 Analog-to-Digital Converters A2. The A/DC A2 receives the I&Q signal pairs from the calibration receiver A1 and outputs 15-bit data words. The A/DC A2 simultaneously samples and converts the I&Q input signals in pairs. A/DC A2 contains nine converter channels (two data channels, one test channel, and six unused channels). The nine converter channels have separate differential amplifiers, followed by nine simultaneous sample and hold amplifiers, a MUX, buffer amplifier, and a 15-bit binary A/DC board. The full scale input voltage is ± 10 V. The digital coding is in 2's complement format. The front panel of the A/DC

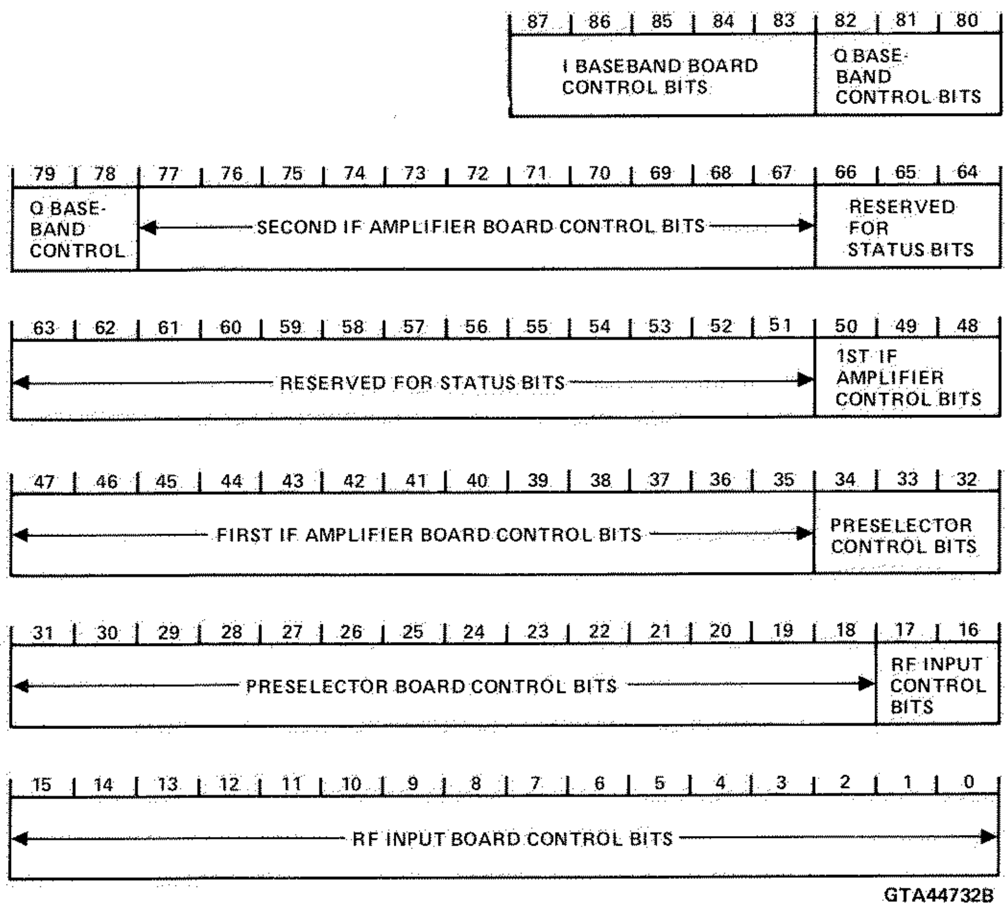

Figure 5-5. Calibration Receiver, Serial Data In

87	86	85	84	83	82	81	80
I BASEBAND BOARD CONTROL BITS					Q BASEBAND CONTROL BITS		

79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Q BASEBAND CONTROL		← SECOND IF AMPLIFIER BOARD CONTROL BITS →											LO	LO	LO
													STATUS BITS		

63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
LO	+5V	+24V	+60V	-60V	← SPARE →								1ST IF AMPLIFIER CONTROL BITS		
STATUS BITS															

47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
← FIRST IF AMPLIFIER BOARD CONTROL BITS →													PRESELECTOR CONTROL BITS		

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
← PRESELECTOR BOARD CONTROL BITS →														RF INPUT CONTROL BITS	

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
← RF INPUT BOARD CONTROL BITS →															

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Figure 5-6. Calibration Receiver, Serial Data Out

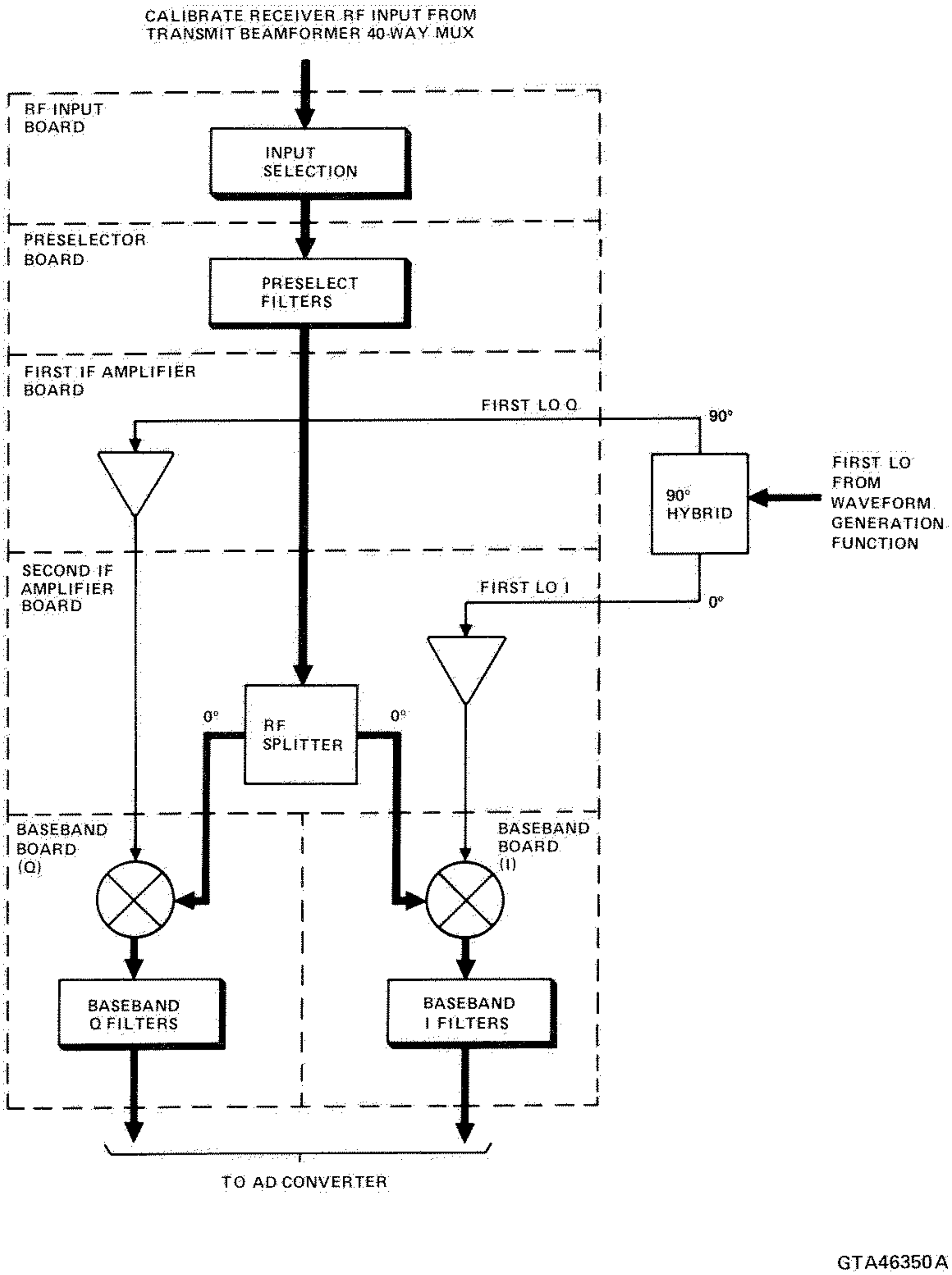


Figure 5-7. Calibration Receiver, Simplified Block Diagram

contains a mode switch that enables local or remote control. The A/DC supplies local/remote status to TCMG via the exciter status and monitor function. This signal indicates if local control has been selected. Usually, the A/DC is operated in the external mode. The sample and hold (S/H) trigger, MUX reset, and A/DC clock are supplied by the exciter status and monitoring function. Digital conversions are performed at the rate of 40 pairs per CIT. A timing diagram for the A/DC is shown in Figure 5-8. The A/DC MUX reset is used to initiate the conversion cycle. However, once the conversion cycle is started all other timing functions are controlled within the A/DC. The MUX reset signal causes the MUX within the A/DC to advance to the first A/DC channel on the next clock pulse. The S/H trigger is a logic high for holding data and a logic low for acquiring data. The S/H amplifiers must remain in the hold mode until the outputs are digitized. A two-tone 5-kHz and 5.4-kHz test tone is routed to the seventh A/DC channel in the A/DC.

5-5.3 Exciter/Auxiliary Exciter Timing and Control Function. The exciter timing and control function, Figure 11 of circuit diagram TO 31P6-2FPS118-73-1, is made up of digital boards in digital bucket N3. A total of 12 boards are used in the digital bucket. Two of these boards (monitor control N3A105 and monitor receiver N3A107) are used in the status and monitoring function (paragraph 5-5.4). The remaining 10 boards make up the timing and control function. Together, these 10 circuit boards provide control and timing signals for the waveform generation function and calibration receiver. For the purpose of discussion, the timing and control function is separated into the three major topics outlined below.

1. A general description of cabinet timing including:
   a. I/O communication
   b. CIT timing.
2. Waveform generation control circuits include:
   a. Control interface and distribution (I&D) board N3A106
   b. Timing control No. 1 board N1A104
   c. Timing control No. 2 board N1A103
   d. Quadratic generator board N3A102
   e. Sine converter board N3A101
   f. Frequency control boards N3A113 and N3A114.
3. Calibration receiver control circuits including:
   a. Receiver control board N3A108
   b. Frequency control boards N3A115 and N3A116.

5-5.3.1 Exciter/Auxiliary Exciter General Cabinet Timing. The exciter and auxiliary exciter cabinets generate internal timing and control signals that define certain characteristics of the transmit waveform. A description of the cabinet timing is provided as an introduction to the digital logic boards that produce the timing signals. In general, the exciter cabinet is controlled by TCMG on a CIT-to-CIT basis. Control messages from TCMG are sent to the exciter before the start of each CIT. These messages contain the setup parameters for the waveform generation function and the calibration receiver. One exception to the CIT-to-CIT processing scheme is the generation of RF samples to support EPM. During a normal CIT, RF samples are routed through the 40-way MUX in the TBF cabinet. The RF samples selected at the MUX are applied to the calibration receiver. The I&Q components of each sample are digitized in the A/DC. The digital I&Q data is supplied to TCMG to support EPM. During this process, TCMG is in direct control of both the 40-way MUX and the A/DC. The TCMG determines when each desired RF sample is selected at the 40-way MUX. The TCMG then sends the appropriate A/DC clock, reset, and S/H triggers to the calibration receiver via the exciter status and monitoring function.

5-5.3.1.1 Input/Output Communication. The exciter timing and control function receives exciter control data from TCMG. The control data is received as two separate 128-bit serial data messages. These two control messages are sent on a CIT-to-CIT basis. They contain setup parameters for the next CIT. One control message contains control information for the calibration receiver; it is described in paragraph 5-5.3.3. The other control message contains control information for the exciter waveform generation function; it is described in paragraph 5-5.3.2. In either case, the control message is loaded into a 128-bit shift register in serial fashion. As each new control word is registered, the old control word from the previous CIT is shifted out of the register. The old control word is sent back to TCMG as a 128-bit status reply message. Certain data fields in both control messages are reserved for exciter status. In the control message from TCMG, these fields are nulls (zeros). The timing and control function will add status bits to these fields before sending the reply message back to TCMG. The reply message (with status bits added) is checked by TCMG to detect errors.

5-5.3.1.2 Coherent Integration Time Timing. Figure 5-9 is a simplified diagram that illustrates CIT

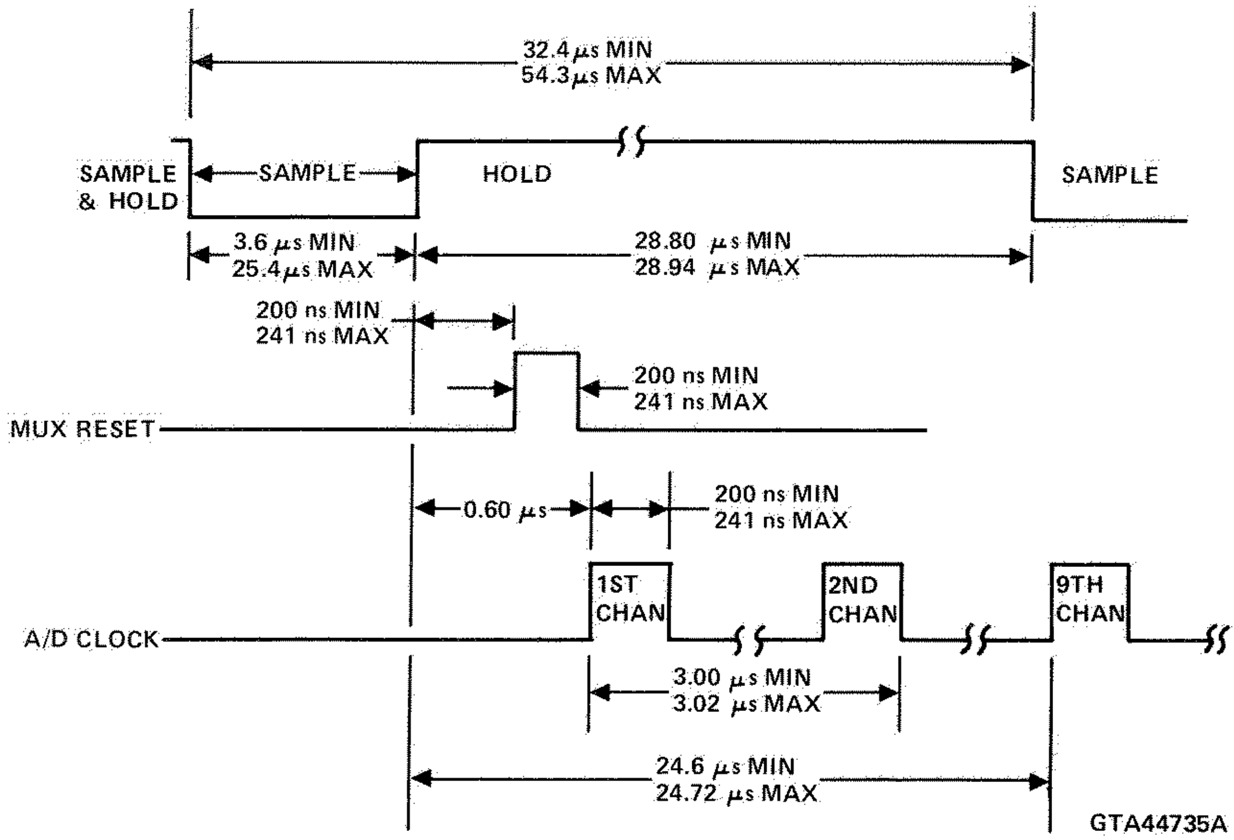


Figure 5-8. Analog-to-Digital Converter, Timing Diagram

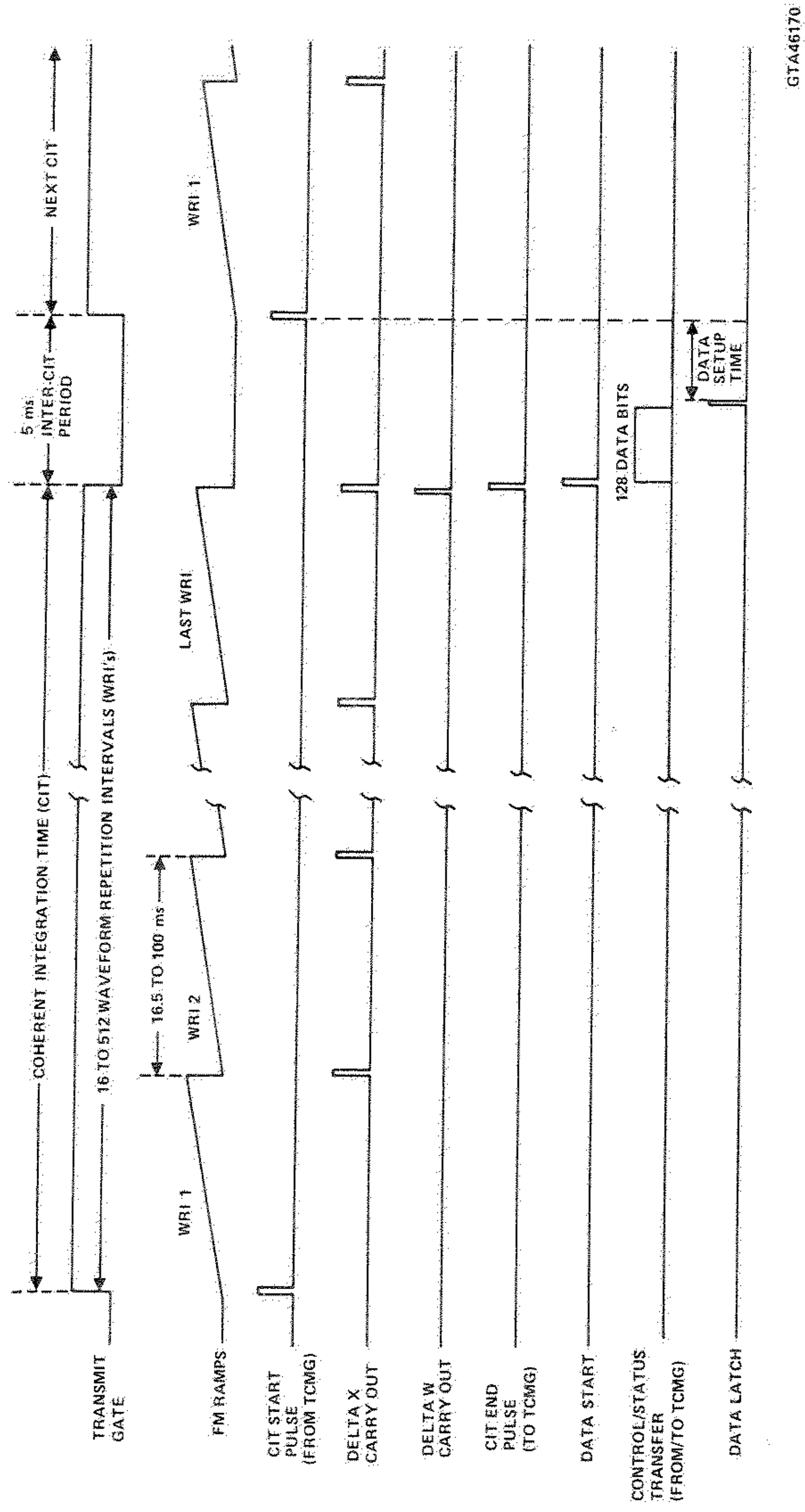


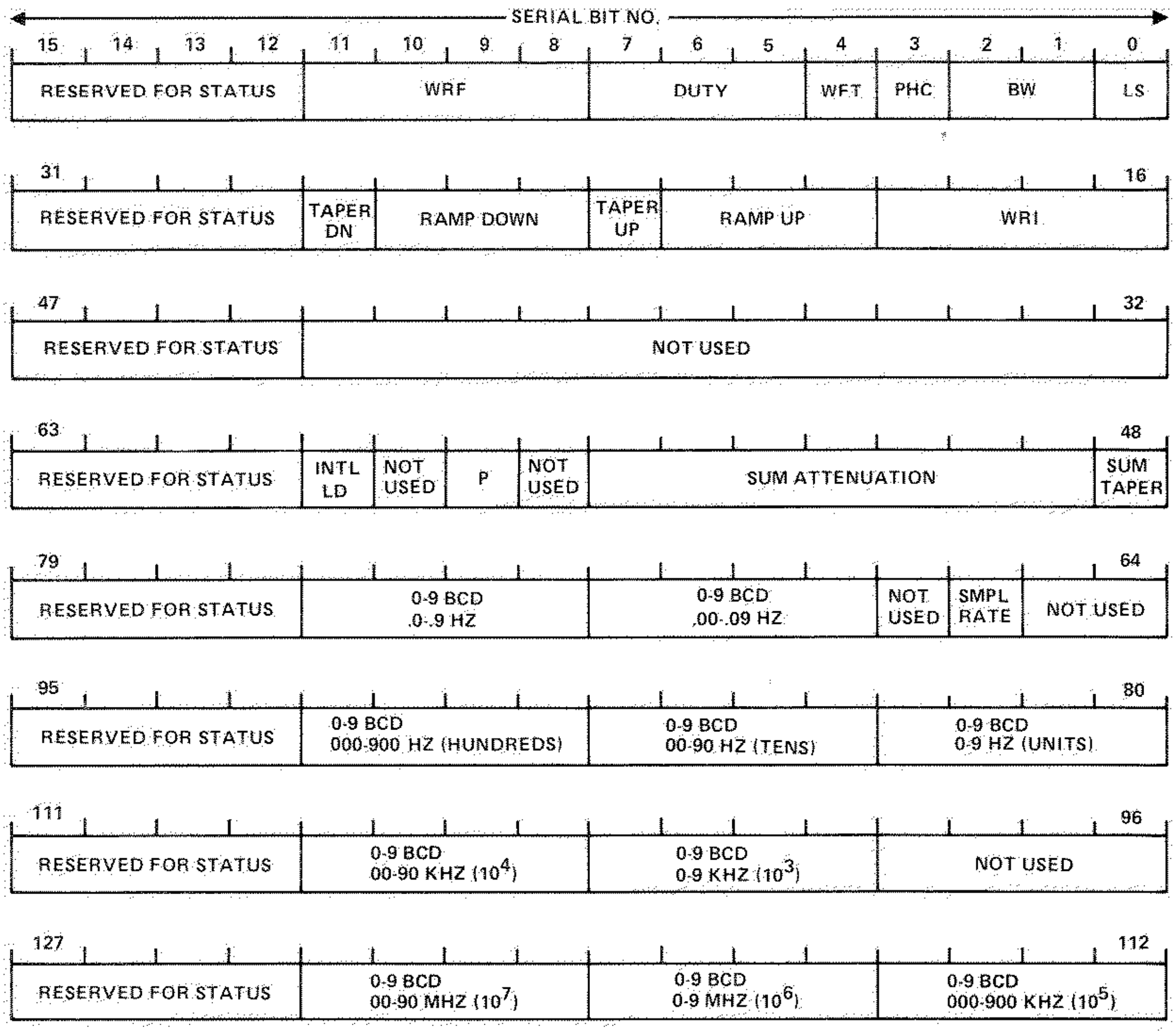
Figure 5-9. Simplified Coherent Integration Time Timing

timing. The CIT begins when a CIT start pulse is received from TCMG. The CIT start pulse is a synchronizing signal that enables timing and control logic in the exciter cabinet. Two binary counters (located on timing control No. 1 circuit board N3A104) provide the basic timing for the transmit waveform. The two counters are preset to values determined by the control message from TCMG. The first counter is called the delta X counter. This counter is driven by the waveform clock; it determines the number of waveform clock cycles in each WRI. The second counter is called the delta W counter. This counter determines the number of WRIs in the CIT. When the CIT starts, the delta X counter begins counting waveform clock cycles until a full count is reached. While the delta X counter advances, an FM ramp is generated for that WRI. When the counter reaches full count, the carry out signal indicates the end of that WRI. The delta X carry out signal is wrapped around to the load input of the same counter. This starts the new count for the next WRI. At the same time, the delta X carry out signal also is applied to the count input of the delta W counter. Since the carry out signal occurs at the end of each ramp, the delta W counter keeps track of the number of ramps occurring in the CIT. The delta W counter reaches a full count when the specified number of ramps have been generated. When a full count is reached, the carry out signal from the delta W counter is used to generate an end CIT pulse. The end CIT pulse is output to TCMG to indicate the end of the transmit waveform. When TCMG receives the end CIT pulse, two new control data messages are sent to the exciter cabinet. These new messages contain setup parameters for the next CIT.

5-5.3.2 Waveform Generation Control Circuits. The waveform generation control circuits produce control signals for various subassemblies located in the waveform generation function. Control I&D board N3A106 receives control messages from TCMG. These messages are decoded to produce discrete signals which are output to the waveform generation function. Frequency control data is stripped from the control message and routed to frequency control boards N3A113 and N3A114. Together, these boards provide 10 digits of decimal data. This decimal data selects the carrier frequency produced by synthesizer A4 in the waveform generation function as described in paragraph 5-5.1.2.3. Other parameters such as waveform repetition frequency (WRF), number of WRIs, FM bandwidth, and CIT start are routed to timing and control boards N3A104 and N3A103. These boards provide general timing signals for the CIT. Two additional circuit boards work together to produce the baseband LFM signal. These two boards are the quadratic generator N3A102 and sine converter N3A101. The LFM signal is synthesized digitally for use in the FM/CW and FM/ICW modes of operation. The synthesized signal is output as 12-bit binary sine data to D/A converter N1A1 in the waveform generation function. The 12-bit sine data represents a data stream composed of amplitude values calculated to produce the desired LFM signal. These values are converted to analog by the waveform generation function. The resultant analog waveform is the FM baseband signal. This waveform will be of a specified FM bandwidth, centered around the 1.2312 MHz (baseband center) frequency. The FM waveform specifications defining this signal are received in the control data message from TCMG.

5-5.3.2.1 Control Interface and Distribution Board N3A106. The control I&D board (Figure 11, Sheet 1) provides interface and distribution of control data between TCMG and the exciter cabinet. The control I&D board receives the 128-bit control data message for the waveform generation circuits. A message transfer occurs prior to the start of each CIT. Control data, data start, data clock, and data latch are the signals applied to accomplish proper data transfer. Control data consists of 128-bit serial data from TCMG. The 800 nanosecond data start pulse enables an input register at the beginning of each data message transfer. Data is clocked into the onboard 128-bit shift register using a 1.25-MHz data clock. This data clock is gated on only during the message transfer (128 clock cycles). As data is clocked into the shift register, the old data message from the previous CIT is clocked out of the register. This old data message is looped back to TCMG for fault monitoring. An 800 nanosecond latch pulse then is applied to latch the data in the shift register. The data latch pulse initiates data setup for the exciter cabinet. The data setup time occurs in the interval between the data latch pulse and CIT start. During data setup, specific data fields in the registered data message are distributed to the destination boards that use the data. Also, equipment status bits are pushed into the empty status fields of the registered data message. These status bits will be returned to TCMG during the next control message transfer that occurs after the end of the next scheduled CIT. The scheduled CIT begins when the CIT start signal is received from TCMG. A CIT gate is produced onboard and distributed to other boards in the function. Additional outputs include the clocks, board ajar, and board status signals. All data to and from TCMG is transferred on balanced lines, via differential line drivers and line receivers using an RS-422 bus. Data bits 0 through 63 of the control data message contain waveform control data and status bits. Data bits 64 through 127 contain frequency control bits and status bits. The control message format is shown in Figure 5-10 and described below:

1. Local Status (LS). Data bit 0 is a data flag which states whether the exciter is in the remote (normal) or local (test) mode of cabinet operation. (Logic 1 is local, 0 is remote.)
2. Bandwidth (BW). Data bits 1 and 2 determine which of four operating bandwidths is used for the LFM in the FM/CW mode of operation. These four FM bandwidths are 5 kHz, 10 kHz, 20 kHz, and 40 kHz.
3. Phase Coding (PHC). Data bit 3 indicates whether phase coding is to be used. (Logic 1 is phase coded; 0 is not phase coded.)
4. Waveform Type (WFT). Data bit 4 determines whether exciter output is CW or FM/CW mode. (Logic 1 is CW; 0 is FM/CW.)
5. Duty Cycle. Data bits 5 through 7 are used to control the duty cycle of the exciter output during each WRI, when generating FM/ICW mode outputs. Duty cycle can be 1, 1/2, 1/4, 1/8, 1/3, or 1/6.
6. Waveform Repetition Frequency (WRF). Data bits 8 through 11 select the WRF to be used for FM/CW mode. Any one of 12 different repetition frequencies can be selected, ranging from 10 to 60 Hz.
7. Number of WRI/CIT (WRI). Data bits 16 through 19 specify the number of WRIs in a CIT. Number of WRIs can be one of six settings, ranging from 16 to 512.
8. Ramp Up. Data bits 20 through 22 specify the number of extra WRI ramps added at the start of the CIT to allow for taper up. Three-bit binary code specifies 0 to 6 extra ramps.
9. Taper Up. Data bit 23 specifies whether taper up option is used. (Logic 1 is taper up; 0 is no taper up.)
10. Ramp Down. Data bits 24 through 26 specify the number of extra WRI ramps added at the end of the CIT to allow for taper down. Three-bit binary code specifies 0 to 7 extra ramps.
11. Taper Down. Data bit 27 specifies whether taper down option is used. (Logic 1 is taper down; 0 is no taper down.)
12. Sum Taper. Data bit 48 indicates taper up or down. (Logic 1 is taper down; 0 is taper up.)
13. Sum Attenuation. Data bits 49 through 55 specify the amount of attenuation used for the exciter RF output (3 dB of attenuation is used when taper is applied).
14. Probe (P). Data bit 57 enables or disables exciter output. (Logic 1 is enabled; logic 0 is disabled.)
15. Internal Load (INTL LD). Data bit 59 is used to select a 50-ohm terminator on the sum taper board. (Logic 1 is 50-ohm termination; logic 0 is normal output.)
16. Sampling (SMPL) Rate. Data bit 66 enables the 3.072-MHz clock for EPM operations. (Logic 1 is 3.072-MHz clock; logic 0 is normal system clock.)
17. Frequency (0.01 Hz). Data bits 68 through 71 are a binary coded decimal (BCD) value, designating the 0.01-Hz frequency code bits for use in frequency control board N3A114.
18. Frequency (0.1 Hz) Data bits 72 through 75 are a BCD value, designating the 0.1-Hz frequency code bits for use in frequency control board N3A114.
19. Frequency (1.0 Hz). Data bits 80 through 83 are a BCD value, designating the 1.0-Hz frequency code bits for use in frequency control board N3A114.
20. Frequency (10 Hz). Data bits 87 through 84 are a BCD value, designating the 10-Hz frequency code bits for use in frequency control board N3A114.
21. Frequency (100 Hz). Data bits 88 through 91 are a BCD value, designating the 100-Hz frequency code bits for use in frequency control board N3A114.
22. Frequency (1 kHz). Data bits 103 through 100 are a BCD value, designating the 1-kHz frequency code bits for use in frequency control board N3A113.
23. Frequency (10 kHz). Data bits 104 through 107 are a BCD value, designating the 10-kHz frequency code bits for use in frequency control board N3A113.
24. Frequency (100 kHz). Data bits 112 through 115 are a BCD value, specifying the 100-kHz frequency code bits for use in frequency control board N3A113.
25. Frequency (1 MHz). Data bits 116 through 119 are a BCD value, designating the 1-MHz frequency code bits for use in frequency control board N3A113.
26. Frequency (10 MHz). Data bits 120 through 123 are a BCD value, designating the



NOTE:

LS = LOCAL/REMOTE STATUS
BW = BANDWIDTH
PHC = PHASE CODE
WFT = WAVEFORM TYPE (FM/CW OR CW)
DUTY = DUTY CYCLE
P = PROBE
LW = LAST WORD BIT

WRF = WAVEFORM REPETION FREQUENCY
WRI = WAVEFORM REPETION INTERVAL
INTL LD = INTERNAL LOAD
BCD = BINARY CODED DIGIT
SMPL = SAMPLING

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Figure 5-10. Waveform Generation Control Message

10-MHz frequency code bits for use in frequency control board N3A113.

27. Data bits 12 through 15, 28 through 31, 44 through 47, 60 through 63, 76 through 79, 92 through 95, 108 through 111, and 124 through 127 are reserved for status information to be added prior to 128-bit word return to TCMG.

5-5.3.2.2 Timing Control No. 1 Board N3A104.

1. Waveform timing and control logic to the exciter cabinets is contained on two circuit boards; timing control No. 1 and timing control No. 2. Timing control No. 1 receives 24 data bits and one parity bit from the control I&D board. These data bits are registered for onboard and an odd parity check is performed. An onboard fault indicator lights if a parity error is detected. The 24 data bits contain setup parameters for the next CIT. These parameters are used to perform the following tasks:

   a. Select one of six waveform clocks

   b. Provide distribution for the gated waveform clock

   c. Set the number of waveform clock cycles in each WRI

   d. Set the number of WRIs in each of up to three CITs in a dwell

   e. Establish the duty cycle in FM/ICW mode

   f. Provide periodic external reset upon receipt of the data latch pulse. This reset controls distribution of new control data to other logic boards in the function.

2. Waveform clock selection is from one of six waveform clocks supplied by the exciter waveform generation function. The six waveform clocks range in frequency from 6.9552 to 8.9856 MHz. Timing control No. 1 selects the waveform clock according to the selected WRF and FM bandwidth. The WRF must be an even multiple of the selected waveform clock.

3. Of the six waveform clocks available from the waveform generation function, only one selected clock is actively applied to timing control No. 1. This selected clock is gated on at CIT start and off at CIT end. The gated waveform clock is distributed to sine converter N3A101, quadratic generator N3A102, and timing control No. 2 N3A103.

4. The WRF and duty cycle data from control I&D board is used to address an onboard read only memory (ROM). Once addressed, the ROM is read to obtain a stored value representing the number of waveform clock cycles in the specified WRI. This 20-bit value is loaded into an onboard counter. This counter is referred to as the delta X counter. When the CIT starts, the delta X counter begins counting waveform clock cycles until a full count is reached. When the full count is reached, the carry out signal from the counter indicates the end of that WRI. The carry out signal is wrapped back to the load input of the same counter, initiating a new count for the next WRI.

5. At the same time, the carry out signal from the delta X counter advances a second counter called the delta W counter. The delta W counter counts the number of WRIs. This counter also is preloaded to a predetermined value using data from control I&D. The delta W counter is preloaded with the number of WRIs required for the current CIT. Since the delta W counter advances at the end of each WRI, it keeps track of the number of ramps occurring in the CIT. When a full count is reached, the carry out signal from the delta W counter generates an end CIT signal.

6. The duty cycle control bits received from the control I&D board set up timing control No. 1 for developing RF switch control gates. The RF switch control gate is necessary for FM/ICW mode of operation. The RF output in this mode is active for a fraction of the WRI and suppressed for the remainder. For example, with a duty cycle of 1/8, the FM output will have an effective WRF of eight times the actual WRF. This FM signal is generated digitally, D/A converted, and passed on to frequency synthesizer A4 in the waveform generation function. At the output of the synthesizer, the first portion of the WRI (effective WRI) is passed to the following amplifier. Synthesizer output is attenuated for the remainder of the WRI. The RF switch control gates are used to control synthesizer output.

7. Timing control No. 1 receives the data latch and CIT start pulses from the control I&D board. These are the same signals that are sent from TCMG to end the serial control message transfer and start the CIT, respectively. The time interval between the receipt of data latch and the start of CIT is referred to as the inter-CIT period or data setup time (Figure 5-9). The inter-CIT interval is set at 5 milliseconds. During this interval, timing

control No. 1 generates a series of control pulses. The control pulses clear and then load discrete data registers located on other circuit boards within the function. These registers are loaded from the control data stored in the 128-bit shift register of the control I&D board. During the process of distributing and registering this data, the data also is decoded so that it can be used at the destination boards. Generally, data is decoded by onboard decode ROMs at the destination board. Control sequences for these decode ROMs are also provided by timing control No. 1 as part of the inter-CIT setup sequence.

5-5.3.2.3 Timing Control No. 2 Board N3A103.

1. Waveform timing and control logic for the exciter cabinets is contained on two circuit boards; timing control No. 1 described above, and timing control No. 2. Timing control No. 2 performs three primary tasks:

   a. Taper control for the waveform generation function

   b. Control data distribution to the quadratic generator and sine converter boards

   c. System clock distribution within the timing and control function.

2. Taper attenuation must be performed whenever large changes are made in the transmitter output power level. These changes can occur between two consecutive CITs in a particular dwell, or when the transmitter is turned on and off at the beginning and end of the dwell. In either case, taper must be used if the output power level is changed by 40 kW or more. For power level changes that are less than 40 kW, no taper is necessary. For larger changes, the change must occur in two separate half-power steps. These steps are used to protect the transmitter from large transients which could occur from a rapid increase or decrease in power. The gradual power increase or decrease is referred to as taper up or taper down, respectively. If taper is necessary, taper up will occur at the beginning of a CIT and taper down will occur at the end of a CIT. When taper is used, the RF drive signal is attenuated at the exciter to a 1/2 power level for a predetermined amount of time. This time period will be equal to an integral number of WRIs. Then, a second step is used to reach the full power (taper up) or zero power (taper down) level. The specific number of WRIs required for taper is determined by control data from TCMG. These WRIs are added to the beginning (taper up) or end (taper down) of the CIT. Timing control No. 2 produces the control signals for taper attenuator N1A12 located in the waveform generation function. These signals include control data, step clock, and strobe/reset clock.

3. Timing and control No. 2 receives registered waveform control data and one parity bit from the control I&D board. This waveform data is odd parity checked and then reformatted for output to the quadratic generator N3A102 and sine converter N3A101. The reformatted data for the quadratic generator is nine bits with one parity bit. Reformatted data for the sine converter is 17 bits with one parity bit. The onboard odd parity check of incoming data, reformatting, and data distribution are all performed during the inter-CIT setup period. An onboard fault indicator will light if a parity error is detected in the incoming data.

4. The 8.2944-MHz system clock is received from the waveform generation function. Onboard buffers provide the necessary fan out for the system clock. The system clock is distributed to the control I&D, timing control No. 1, quadratic generator, sine converter, and monitor control boards.

5-5.3.2.4 Quadratic Generator Board N3A102

1. The quadratic generator board calculates quadratic vectors which represent the slope of the FM ramps. The vectors are applied to the sine converter board N3A101 where a sine/cosine function is performed to produce the digitally synthesized LFM signal. Each FM ramp imparts the base modulation frequency sweep needed to create a WRI. The LFM signal derived from the quadratic vectors is used only when transmitting in the FM/CW or FM/ICW modes. During operation in the CW mode, the FM ramps are still generated and are used to define individual WRIs. The WRIs generated during CW operation are used only to support transmitter timing. (The D/A converter N1A1 in the waveform generation function has an RF switch that selects the LFM baseband signal for FM/CW and FM/ICW modes, or a CW baseband signal for CW mode.)

2. All quadratic vectors are calculated using input control data from timing control No. 2. Nine control data bits and one parity bit are received. The data is registered and an onboard odd parity check is performed. An onboard fault indicator will light if a parity

error is detected in the control data. The control data defines the following waveform characteristics:

a. FM bandwidth (2 bits)

b. WRF (4 bits)

c. Duty cycle (3 bits).

3. Vectors are calculated and output to the sine converter board at the selected waveform clock rate (6.9552- to 8.9856-MHz). Vector data is output as 12-bit parallel data with one parity bit. Each 12-bit parallel data word is a binary magnitude value which is the result of the quadratic calculation:

$$Q1 = (X + 1)^2$$

4. The resulting quadratic vector represents a running computation of Q1, where X is incremented after each calculation is performed. The starting value of X determines the slope of the vector and consequently the slope of the FM ramp. This starting value for X is read from an onboard ROM. This ROM is addressed by FM bandwidth, WRF, and duty cycle data received during the inter-CIT setup period. The initial value for X then is read from the addressed memory location and loaded into the arithmetic logic prior to CIT start.

5. During each CIT, a quadratic test vector is read from an onboard data ROM and compared with the calculated quadratic vector. The test vector is read from memory together with the starting value for X. This test vector represents the expected pattern for the calculated Q1 value at the end of the first WRI. At the end of the first ramp these values are compared to verify proper operation of the board. If the values do not compare, an onboard fault indicator lights.

5-5.3.2.5 Sine Converter Board N3A101.

1. The sine converter board performs sine functions required for digital synthesis of the LFM baseband signal. These arithmetic functions are performed on the 12-bit quadratic vectors received from the quadratic generator. Data throughput occurs at the selected waveform clock rate. The calculated sine values are output to D/A converter N1A1 in the waveform generation function. The sine values are output in 12-bit parallel format with one parity bit.

2. The sine converter receives 17 bits of control data from timing control No. 2. Of these, 15 data bits and one parity bit are registered on the sine converter. The remaining two data bits (waveform type and taper up) are registered by timing control No. 2 and sent to the sine converter. Six of the data bits (number of WRIs and number of extra WRIs for taper up) are required for phase code specification. The remaining bits are used to specify a test vector for error detection. An odd parity check is performed on the 15 registered bits, and the data is decoded for onboard use. The control data defines the following waveform parameters:

a. WRF (4 bits)

b. Duty cycle (2 bits)

c. FM bandwidth (2 bits)

d. Number of WRIs (3 bits)

e. Number of extra WRIs for taper up (3 bits)

f. Phase coding (1 bit)

g. Waveform type FM or CW (1 bit)

h. Taper up (1 bit).

3. In addition to the 12-bit sine data output, the sine converter also supplies clock signals to the D/A converter in the waveform generation function. In the FM mode (waveform type control bit asserted low), the sine converter supplies the selected waveform clock signal. The waveform clock is used as a D/A converter clock in the conversion process. In the CW mode, the sine converter supplies 0.5400 and 0.6912-MHz signals to the D/A converter. These signals are combined by the D/A converter to produce the unmodulated 1.23-MHz baseband signal used for CW operation. The 0.5400 signal is derived from a divide by two of a 1.08-MHz clock. The 0.6912-MHz signal is derived from a divide by 12 of a 8.2944-MHz clock. These clocks are received from the waveform generation function. To provide greater isolation between the FM and CW signal paths, the 0.5400- and 0.6912-MHz outputs are inhibited in the FM mode. A separate output supplies the 0.6912-MHz signal to RF mixer N1A2. This output is active in both the CW and FM modes and is used together with the 1.08-MHz signal for upconverting the baseband signal to 3 MHz.

4. The sine converter performs several error detection tasks that are important to EPM. Two onboard fault indicators are provided for monitoring results of these checks. The first indicator will light if an error is detected in the odd parity check for the

15-bit control data received from timing control No. 2. The other indicator will light giving a summary status of any of the following errors:

a. Odd parity error on 12-bit quadratic vectors received from the quadratic generator (disabled in CW mode)

b. Noncompare of sine test vectors (read from an onboard test vector ROM) with calculated sine values (disabled in CW mode)

c. Analog waveform mixer clocks missing

d. Waveform clock missing.

5-5.3.2.6 Frequency Control Boards N3A113 and N3A114. Frequency control boards N3A113 and N3A114 provide frequency control data to frequency synthesizer A4 in the waveform generation function. See Figure 11, Sheet 2, of TO 31P6-2FPS118-73-1. The control I&D board supplies 40 serial frequency bits to the boards. These bits are converted to produce 10 BCD digits needed for synthesizer control. Each board is capable of registering 7 BCD digits; therefore, two boards are required to process the 10 digits required to produce 0.01 Hz synthesizer frequency resolution. The registered BCD data then is converted to decimal output by a series of BCD-to-decimal converters (4-to-10 line decoders). This yields 10 separate output lines for each of 10 separate frequency control digits (100 total lines). Frequency control board N3A113 handles the five decades from 1 kHz to 10 MHz. Frequency control board N3A114 handles the five decades from 0.01 Hz to 100 Hz. Error checking is performed to detect discrepancies between the converted decimal outputs and the registered BCD input data. Any detected errors will cause an onboard fault indicator to light.

5-5.3.3 Calibration Receiver Control Circuits. The calibration receiver control circuits operate under control of TCMG. Receiver control board N3A108 receives 128-bit serial control messages from TCMG in a manner similar to that described for the control I&D board (paragraph 5-5.3.2.1). The control message contains configuration parameters for the calibration receiver, as well as frequency control data for synthesizing the first LO in the exciter waveform generation function. The first LO frequency control data is stripped from the control message and routed to frequency control boards N3A115 and N3A116. Together these boards provide 10 digits of BCD data. The BCD data selects the first LO frequency produced by synthesizer A5 in the waveform generation function.

5-5.3.3.1 Receiver Control Board N3A108. The receiver control board provides interface and distribution of calibration receiver control data between TCMG and the exciter cabinet. See TO 31P6-2FPS118-73-1, Figure 11, Sheet 1. A 128-bit serial message transfer occurs prior to the start of each CIT. Control data, data start, data clock, and data latch are the signals applied to accomplish proper data transfer. Control data consists of 128-bit serial data from TCMG. The 800 nanosecond data start pulse enables an input register at the beginning of each data message transfer. Data is clocked into the onboard 128-bit shift register using a 1.25 MHz data clock. This data clock is gated on only during the message transfer (128 clock cycles). As data is clocked into the shift register, the old data message from the previous CIT is clocked out of the register. This old data message is looped back to TCMG for fault monitoring. An 800 nanosecond latch pulse then is applied to latch the data in the shift register. The data latch pulse initiates data setup for the exciter cabinet. The data setup time occurs in the interval between the data latch pulse and CIT start. During data setup, specific data fields in the registered data message are distributed to the calibration receiver and frequency control boards that use the data. Also, equipment status bits are pushed into the empty status fields of the registered data message. These status bits are returned to TCMG during the next control message transfer that occurs after the end of the next scheduled CIT. The scheduled CIT begins when the CIT start signal is received from TCMG. All data to and from TCMG is transferred on balanced lines, via differential line drivers and line receivers using an RS-422 bus. Data bits 0 through 63 of the control data message contain calibration receiver control data and status bits. Data contained in these bits is reformatted to produce the 88-bit serial message sent to the calibration receiver (Figure 5-5). Data bits 64 through 127 contain first LO frequency control bits and status bits. The control message format is shown in Figure 5-11 and described below:

1. Port. Data bits 0 and 1 select the input for the calibration receiver. (Binary code 11 selects input from the 40-way MUX, all others not used.)

2. Filter Preselect. Data bits 2 through 5 are used to select 1 of 15 preselector filters.

3. RF Attenuation. Data bit 6, when set, selects 20-dB attenuation.

4. Test Mode. Data bits 7 through 9 select the RF section injection point for test signals.

5. Data Check. Data bits 34 through 37 always have a bit pattern of 001.

6. IF Attenuator A. Data bits 39 and 40 select 0 or 2.5-dB attenuation at the calibration

SERIAL BIT NO.

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	RESERVED FOR STATUS (15–12)	NOT USED (11–10)	TEST MODE (9–7)	RF ATTEN (6)	FILTER PRESELECT (5–2)	PORT (3) (1–0)
31 – 16	RESERVED FOR STATUS	NOT USED				
47 – 32	RESERVED FOR STATUS	IF ATTEN B	IF ATTEN A	NOT USED	DATA CHECK I O O	NOT USED
63 – 48	RESERVED FOR STATUS	BASEBAND Q FILTER	BASEBAND I FILTER	NOT USED		
79 – 64	RESERVED FOR STATUS	0-9 BCD 0-.1 HZ	0-9 BCD 0-.01 HZ	NOT USED		
95 – 80	RESERVED FOR STATUS	0-9 BCD 0-100 HZ	0-9 BCD 0-10 HZ	0-9 BCD 0-1 HZ		
111 – 96	RESERVED FOR STATUS	BCD 0-10 KHZ	0-9 BCD 0-1 KHZ	NOT USED		
127 – 112	RESERVED FOR STATUS	0-9 BCD 0-10 MHZ	0-9 BCD 0-1 MHZ	0-9 BCD 0-100 KHZ		

NOTE:
RF = RADIO FREQUENCY
IF = INTERMEDIATE FREQUENCY
ATTEN = ATTENUATOR
BCD = BINARY CODED DIGIT

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Figure 5-11. Calibration Receiver Control Message receiver second IF. (Binary code 01 is 0 dB, code 10 is 2.5 dB.)

7. IF Attenuator B. Data bits 41 through 43 select 0-, 5-, or 10-dB attenuation at the calibration receiver second IF. (Binary code 100 is 0 dB, code 010 is 10 dB, and code 001 is 5 dB.)

8. Baseband I Filter. Data bits 50 through 54 select one of five filters in the I channel of the baseband section.

9. Baseband Q Filter. Data bits 55 through 59 select one of five filters in the Q channel of the baseband section.

10. Frequency (0.01 Hz). Data bits 68 through 71 are a BCD value indicating the 0.01 Hz frequency code bits for use in frequency control N3A116.

11. Frequency (0.10 Hz). Data bits 72 through 75 are a BCD value indicating the 0.10 Hz frequency code bits for use in frequency control N3A116.

12. Frequency (1 Hz). Data bits 80 through 83 are a BCD value indicating the 1.0 Hz frequency code bits for use in frequency control N3A116.

13. Frequency (10 Hz). Data bits 84 through 87 are a BCD value indicating the 10.0 Hz frequency code bits for use in frequency control N3A116.

14. Frequency (100 Hz). Data bits 88 through 91 are a BCD value indicating the 100 Hz frequency code bits for use in frequency control N3A116.

15. Frequency (1 kHz). Data bits 100 through 103 are a BCD value indicating the 1-kHz frequency code bits for use in frequency control N3A115.

16. Frequency (10 kHz). Data bits 104 through 107 are a BCD value indicating the 10-kHz frequency code bits for use in frequency control N3A115.

17. Frequency (100 kHz). Data bits 112 through 115 are a BCD value indicating the 100-kHz frequency code bits for use in frequency control N3A115.

18. Frequency (1 MHz). Data bits 116 through 119 are a BCD value indicating the 1-MHz frequency code bits for use in frequency control N3A115.

19. Frequency (10 MHz). Data bits 120 through 123 are a BCD value indicating the 10-MHz frequency code bits for use in frequency control N3A115.

20. Data bits 12 through 15, 28 through 31, 44 through 47, 60 through 63, 76 through 79, 92 through 95, 108 through 111, and 124 through 127 are reserved for status data.

5-5.3.3.2 Frequency Control Boards N3A115 and N3A116. Frequency control boards N3A115 and N3A116 provide frequency control data to frequency synthesizer A5 in the waveform generation function. See TO 31P6-2FPS118-73-1 Figure 11, Sheet 2. Receiver control board A108 (Figure 11, Sheet 1) supplies 40 serial frequency bits to the boards. These bits are converted to produce 10 BCD digits needed for synthesizer control. Each board is capable of registering 7 BCD digits; therefore, two boards are required to process the 10 digits required to produce 0.01 Hz synthesizer frequency resolution. The registered BCD data then is converted to decimal output by a series of BCD-to-decimal converters (4-to-10 line decoders). This yields 10 separate output lines for each of 10 separate frequency control digits (100 total lines). Frequency control board N3A115 handles the five decades from 1 kHz to 10 MHz. Frequency control board N3A116 handles the five decades from 0.01 Hz to 100 Hz. Error checking is performed to detect discrepancies between the converted decimal outputs and the registered BCD input data. Any detected errors cause an onboard fault indicator to light.

5-5.4 Exciter/Auxiliary Exciter Status and Monitoring Function. The exciter status and monitoring function, Figure 15 of circuit diagram TO 31P6-2FPS118-73-1, is made up of two digital circuit boards in the digital bucket N3. These boards are the monitor receiver N3A107 and monitor control N3A105 (Sheet 1). The status and monitoring function also includes interfacing for power supply controllers N4A1 and N4A2. Relays K1 and K2 provide a local control and power interface between the main exciter and auxiliary exciter (Sheet 2) cabinets. The purpose of the status and monitoring function is to support EPM for the two exciter cabinets.

5-5.4.1 Monitor Control Board N3A105. Monitor control board N3A105 (Figure 15, Sheet 1) collects cabinet status signals and formats these signals into a serial message. The serial status message is sent to the monitor receiver board N3A107. Board ajar signals from other circuit boards in the logic bucket are summarized into a single status bit. This bit is inserted in the serial message to the monitor receiver board if a board ajar error is detected. In addition, one of two onboard fault indicators lights, giving a visual indication of the board ajar condition. Additional status inputs are received as discrete signals and are parallel loaded into a 32-bit shift register. These status bits are shifted out in serial fashion to the monitor receiver board. A time out check also is performed on the CIT gate using the system clock and a 3.0024-MHz secondary clock. During the time out check, a 24-bit counter is advanced at the system clock rate while a second 24-bit counter is advanced at the 3.0024-MHz rate. If the two outputs are in agreement to within 0.5 millisecond, good status is reported in the serial message to the monitor receiver.

5-5.4.2 <u>Monitor Receiver Board N3A107</u>.

1. Monitor receiver board N3A107 handles all return data messages to TCMG. Two serial interfaces and one parallel interface are used. The messages sent to TCMG are used to support EPM for the exciter cabinets and for the primary RF transmission path. The data sent to TCMG consists of the following types of data:

   a. Waveform generation readback status message (serial)

   b. Calibration receiver readback status message (serial).

2. The monitor receiver board sends the waveform generation control and status readback message to TCMG. This 128-bit message contains a readback of waveform generation control data from the previous CIT (Figure 5-10). The control data for readback is input from the control I&D board where it has been stored in a 128-bit shift register. The original control data contained nulls (zeros) in eight separate 4-bit status fields. The monitor receiver inserts actual status data into these fields before sending the reply message back to TCMG. Status is input to the board as a 32-bit serial message from the monitor control board. Each status bit represents a particular error indication as listed in Table 5-2. Note that a logic 0 indicates status is good; logic 1 indicates a fault.

3. The monitor receiver board also sends the calibration receiver control and status readback message to TCMG. This 128-bit message contains a readback of calibration receiver control data from the previous CIT (Figure 5-11). The control data for readback is input from the receiver control board. This is the same serial data message that is used to control the calibration receiver. The control message is input during the control message transfer that precedes each CIT. This control message is stored in an onboard shift register. The original control data contains nulls (zeros) in eight separate 4-bit status fields. The monitor receiver inserts actual status data into these fields before sending the reply message back to TCMG. The data is returned to TCMG during the next control message transfer. The stored control message with status bits inserted is clocked out to TCMG as the next control message is clocked in. Status bits are input to the board from power supplies, the calibration receiver, and other monitored assemblies. Each status bit represents a particular error indication as listed in Table 5-3. Note that a logic 0 indicates status is good; logic 1 indicates a fault.

Table 5-2. Exciter Reply Status (Figure 5-10)

Status Bit Location	Description	Reference Designator
12	1.08-MHz reference	N2A7
13	8.9856-MHz clock	N2A13
14	8.5104-MHz clock	N2A12
15	8.2080-MHz clock	N2A11
28	7.7760-MHz clock	N2A10
29	7.3440-MHz clock	N2A9
30	6.9552-MHz clock	N2A8
31	8.2944-MHz clock	N2A6
44	11.0592-MHz 2nd LO	N2A1

Table 5-2. Exciter Reply Status (Figure 5-10) -CONT

Status Bit Location	Description	Reference Designator
45	13.1328-MHz 2nd LO	N2A2
46	16.2432-MHz 2nd LO	N2A3
47	17.2800-MHz 2nd LO	N2A4
60	3.024-MHz 3rd LO	N2A5
61	Frequency divider	N1A6
62	2nd LO PA	N1A3
63	3rd LO PA (I)	N1A5
76	3rd LO PA (Q)	N1A7
77	1st LO PA	N1A11
78	2nd tone PA	N1A13
79	Frequency standard PA	N1A9
92	Quadratic generator	N3A102
93	Sine converter	N3A101
94	D/A converter	N1A1
95	RF mixer	N1A2
108	Sum taper attenuator	N1A12
109	Control I&D	N3A106
110	Frequency control	N3A113/114
111	Control timing No. 1	N3A104
124	Control timing No. 2	N3A103
125	Monitor control	N3A105
126	3.0024-MHz video carrier frequency	
127	CIT gate	

Table 5-3. Calibration Receiver Reply Status (Figure 5-11)

Fault No.	Status Bit Location	Description	Reference Designator
1	12	+24 V dc power supply	A12
2	13	+24 V dc power supply	A13
3	14	-60 V dc power supply	A7
4	15	-15 V dc power supply	A9
5	28	+5 V dc power supply	A10
6	29	+5 V dc power supply	A11
7	30	+60 V dc power supply	A6

Table 5-3. Calibration Receiver Reply Status (Figure 5-11) -CONT

Fault No.	Status Bit Location	Description	Reference Designator
8	31	+15 V dc power supply	A8
9	44	Tone generator	
10	45	Cabinet overtemperature 120 °F (48.9 °C)	
11	46	Frequency control	N3A115
12	47	Frequency control	N3A116
13	60	Spare	
14	61	Local/remote status	A2
15	62	Spare	
16	63	Spare	
17	76	Spare	
18	77	Spare	
19	78	Receiver -60 V dc status	
20	79	Receiver +60 V dc status	
21	92	Receiver +24 V dc status	
22	93	Receiver +5 V dc status	
23	94	Receiver 1st LO (Q)	A1A6
24	95	Receiver 1st LO (I)	A1A5
25	108	Receiver 1st LO (I)	A1A4
26	109	Receiver 1st LO (Q)	A1A3
27	110	Spare	
28	111	Spare	
29	124	Spare	
30	125	Spare	
31	126	Receiver status local	
32	127	Receiver return data check	

5-5.4.3 Power Supply Controller Boards N4A1 and N4A2. Power supply controller board N4A1 monitors the current supplied by parallel +5 V dc power supplies A10 and A11. See TO 31P6-2FPS118-73-1 Figure 15, Sheet 1. It also monitors the current supplied by +15 V dc power supply A8 and +60 V dc power supply A6. This current is monitored via power supply shunts and regulated via feedback control lines. The main exciter +15 V dc and +60 V dc power supplies are connected in parallel with the auxiliary exciter +15 V dc and +60 V dc power supplies (Figure 15, Sheet 2). Power supply controller N4A1 is connected to the +15 V dc and +60 V dc I (current) via K2. The voltage on the +15 V dc I bus and the +60 V dc I bus represent the average current supplied by the +15 V dc and +60 V dc power supplies, respectively. Voltage comparators in power supply controller N4A1 compare +15 V dc I bus voltage with the +15 V dc power supply A8 shunt voltage. The +60 V dc I bus voltage and +60 V dc power supply A6 bus voltage are also compared. If either the +15 V dc or +60 V dc power supply is delivering less than 80 percent of the average current, power supply controller N4A1 will balance the load. The power supply controller adjusts either supply to a slightly higher voltage as required to produce the desired 50 percent current load. If the current or voltage of any of these power supplies exceeds established limits, power supply controller N4A1 supplies a fault signal to monitor receiver N3A107. Power supply controller N4A2 functions similarly for +24 V dc power supplies A12 and A13; and for -15 V dc and -60 V dc power supplies A9 and A7, respectively. Each power supply controller contains three fault indicators for each monitored power supply. Two of these indicators are red and one is green. One indicator lights (red) when the supply voltage exceeds limits and the other indicator lights (red) when the supply current exceeds limits. The third indicator lights (green) when the monitored supply output is within limits.

5-6 TRANSMIT BEAMFORMER, UNIT 150.

1. The TBF, Unit 150, provides the aperture weighting necessary for beamforming and beamsteering of the transmit signal. The TBF accepts RF drive signal inputs from the main and auxiliary exciters; the TBF provides independent RF outputs to drive 12 separate TMs. The TBF is made up of beamforming, timing and control, and status and monitoring functions.
2. The TBF function can accept RF drive signal inputs from either or both the main and/or auxiliary exciter. The TBF generates 12 separate output channels that drive the TMs. Each output channel is adjusted independently in both phase and amplitude to achieve the desired illumination pattern for the transmit beam.
3. The TBF operation is controlled by TCMG. The TBF timing and control function receives control data from TCMG via a serial data interface. The serial data is registered, decoded, and supplied as amplitude and phase data to each channel in the TBF. Control data from TCMG also selects the input configuration for the TBF. Individual on/off control for each of the 12 RF channels are also issued by control data from TCMG.
4. To enhance calibration and performance monitoring capability, a 40-way MUX is provided as part of the TBF status and monitoring function. Under control of TCMG, RF samples such as transmit forward power, reverse power, TBF output, and exciter samples are sent sequentially to a calibration receiver in the exciter cabinet. The calibration receiver generates digital I&Q data for each of these signal samples. The I&Q data is then routed to TCMG for monitoring. If any of these signals are missing, the error also is monitored by TCMG. Switching for the 40-way MUX is controlled directly by TCMG. The MUX control data is supplied to the TBF status and monitoring function via a separate 6-bit parallel data bus.

5-6.1 Beamforming Function. The transmit TBF function, illustrated in Figure 4 of circuit diagram TO 31P6-2FPS118-73-1, provides beamforming and beamsteering for the transmit signal. The TBF function accepts RF drive signal inputs from both the main and auxiliary exciters and generates 12 separate output channels that drive the TMs. Each output channel is independently adjusted in both phase and amplitude to achieve the desired illumination pattern for the transmit beam. The TBF function consists of the following electronic assemblies and components:

1. Directional couplers DC1 through DC14 (Figure 4, Sheets 1 through 3)
2. Switching Matrix A11 (Sheet 1)
3. Variable Attenuators N4A17, N4A18, N7A10, and N7A11 (Sheet 1)
4. Variable Attenuators N6AT24 and N6AT25 (Sheet 1)
5. 90° Hybrid Transformers N6HY1 and HY2 (Sheet 1)
6. Power Dividers N6HY3 through N6HY6 (Sheet 1)
7. RF Modulators N4A7, N4A9, N4A11, N4A13, N4A15, N5A9, N5A11, N5A13, N5A15, N5A17, and N7A7 (Sheets 2 and 3)
8. Modulator Control N4A1 through N4A5, N5A1 through N5A6, and N7A1 (Sheets 2 and 3)
9. RF Amplifier N4A8, N4A10, N4A12, N4A14, N4A16, N5A10, N5A12, N5A14, N5A16, N5A18, and N7A8 (Sheets 2 and 3).

5-6.1.1 Directional Couplers DC13 and DC14, and Switching Matrix A11.

1. The TBF has two RF inputs. One input is from a main exciter or the auxiliary exciter; one input is from an auxiliary exciter. See TO 31P6-2FPS118-73-1 Figure 4. Both inputs accept RF drive signals from the exciters to perform the TBF function. Each RF input is initially connected to a directional coupler. The main exciter is the input to directional coupler DC13. The auxiliary exciter is the input to directional coupler DC14. The purpose of the directional couplers is twofold. First, to transfer the RF drive signal to switching matrix A11, and second, to transfer a low-level replica of the RF drive signal (RF sample) to a 40-way

MUX, for the purpose of performance monitoring and calibration.

2. The TBF operates in a frequency range of 5 to 28 MHz. It has a maximum input level of +20 dBm. The RF sample level from directional couplers DC13 and DC14 is 20 dB down from the main drive signal or 0 dBm. The directional couplers exhibit an insertion loss of 0.5 dBm.

3. The two output drive signals from directional couplers DC13 and DC14 are the inputs to switching matrix A11. The switching matrix accepts commands from TCMG via the timing and control function. Control is in the form of a 2-bit code. This code configures analog switches within the matrix to provide different paths for the 12 transmit channels. The switches, driven by a decoder-driver, can be configured to allow either the main exciter or the auxiliary exciter to supply RF drive to the TBF.

5-6.1.2 Attenuators N4A17, N4A18, N7A10, N7A11, N6AT24, and N6AT25; Hybrids N6HY1 and N6HY2; and Power Dividers N6HY3 through N6HY6.

1. Switching matrix A11 supplies two drive signals to the TBF RF channels. The drive signals are the inputs to two pairs of variable attenuators. The variable attentuators provide precisely selectable attenuation levels in both TBF RF channels. Attenuators N4A17 and N4A18 in one channel are series connected, as are attenuators N7A10 and N7A11 in the other channel. This series arrangement provides the total attenuation necessary for proper TBF operation. Units N4A17 and N4A18 provide RF level control of channels 1 through 6 and units N7A10 and N7A11 provide RF level control of channels 7 through 12.

2. All four variable attenuators are controlled digitally by commands from TCMG. Attenuation select data consists of two data sets. One set controls channels 1 through 6; the other set controls channels 7 through 12. Each of the data set control words is 6 bits in length. The first attenuator in each channel uses 4 bits of digital control to provide 16 attenuation steps; the second attenuator uses 2 bits of digital control to provide 4 attenuation steps. The total attenuation function provides from 0.0 to 15.75 dB of attenuation in 64 steps of 0.25 dB each.

3. The RF outputs of variable attenuators N4A17 and N4A18 (RF channels 1 through 6) and variable attenuators N7A10 and N7A11 (RF channels 7 through 12), have their outputs connected to additional attenuators. These are manually adjusted attenuators N6AT24 and N6AT25. The attenuators, adjustable over a range of 0 to 10 dB, are on the channel balance panel N6.

4. The two gain controlled RF paths are input to a pair of hybrid quadrature transformers. Channels 1 through 6 go to hybrid N6HY1; channels 7 through 12 go to hybrid N6HY2. The hybrid transformers function to produce separate I&Q components of the incoming RF signal. The phase balance, which is the peak-to-peak phase difference between the I&Q outputs is $90° \pm 3°$. The level of the I&Q RF signals at the output ports is -3 dB below the RF input. The device exhibits an insertion loss of 0.7 dB, and has a maximum amplitude difference between output ports of 0.5 dB.

5. The I&Q RF signal components at the output ports of hybrid transformers N6HY1 and N6HY2 are coupled to four 6-way power dividers. The I components are the inputs to the power dividers N6HY3 and N6HY5. The Q components are the inputs to power dividers N6HY4 and N6HY6. This division of signals results in six I&Q signal components available to RF channels 1 through 6 and six I&Q signal components available to RF channels 7 through 12. The output level from the four power divider output ports is -7.78 dB below the input signal. Isolation between output ports is 30 dB minimum, and each divider exhibits an insertion loss of 1 dB maximum.

5-6.1.3 Radio Frequency Modulators N4A7, N4A9, N4A11, N4A13, N4A15, N5A7, N5A9, N5A11, N5A13, N5A15, N5A17, and N7A7; and Modulator Controls N4A1 through N4A5, N5A1 through N5A6, and N7A1.

1. Signal processing in all 12 channels of the TBF is identical. Therefore, only a single channel is covered in the paragraphs that follow. The RF modulator N4A7 accepts one I component and one Q component of the RF drive signal. See TO 31P6-2FPS118-73-1 Figure 4, Sheet 2. These signals are one pair from the 12 I&Q signals made available by power dividers N6HY3 through N6HY6. The RF modulator provides precisely controlled phase rotation and amplitude control of these signal components.

2. The RF modulator is divided into two independent modulator sections. One section

controls the quadrant and amplitude of the I component of the RF signal; the other section controls the quadrant and amplitude of the Q component. The I&Q components, having been processed in separate sections of the modulator, are then combined in a summing section. The resultant phase shifted signal is supplied to RF amplifier N4A8.

3. Each section of the RF modulator (N4A7) contains tandem connected attenuators isolated by wideband amplifiers. The amplitude and phase of the I&Q components of the RF signal is determined by control voltages applied to these attenuators. The initial attenuator of the tandem pair in each section of the modulator requires a bi-polar (+/-) analog voltage. The second attenuator of the tandem pair of each section requires a positive only (+) analog voltage. Varying magnitudes of the two voltages determines the quadrant and amplitude of the I or Q components. The conditioned I&Q outputs are now combined in a combiner circuit as an output to RF amplifier N4A8, permitting a full 360° rotation of the RF signal.

4. The modulator control N4A1 provides precise control voltages to RF modulator N4A7. The modulator control is divided into two identical processing channels, I control and Q control. Each channel, under control of TCMG, receives an eight-bit word (seven bits plus sign). The control word is converted to an analog voltage by a D/A converter circuit. Operational amplifiers within the modulator control circuit condition the D/A output voltage to provide +I, +Q, and -I, -Q voltages. These control voltages are the inputs to the RF modulator. They provide vector rotation from 0° to 360° with amplitude control.

5. The RF modulator N4A7 used in conjunction with modulator control N4A1, provides phase rotation over a 360° range with a resolution of 2.8°. The attenuation provided by the RF modulator is variable over a range of 31.75 dB, controlled in 0.25-dB steps. Attenuation is selected to maintain an output level of -16 dBm ± 1.5 dB from the RF modulator.

5-6.1.4 <u>Radio Frequency Amplifiers N4A8, N4A10, N4A12, N4A14, N4A16, N5A8, N5A10, N5A14, N5A16, and N5A18; and Directional Couplers DC1 through DC14.</u>

1. The RF amplifier N4A8 is essentially a wideband RF amplifier. It provides a means to amplify the combined I&Q signal from RF modulator N4A7. Once the gain of the amplified signal is adjusted, the resultant RF signal is divided, amplified, and re-combined. The final RF signal is then provided as drive to one of the TMs. The RF amplifier can be selected or deselected at any time depending on a channel select command from TCMG. This on/off control is selected by a single bit. During the off channel time, the channel exhibits an attenuation of 60 dB minimum. The output drive level of the RF amplifier is +20 dBm ±0.5 dB.

2. The output signal from RF amplifier N4A8 is an input to directional coupler DC1. This coupler, in addition to providing an RF drive signal to a TM, supplies a low level RF sample signal output. This low level signal is diverted to the 40-way MUX for performance monitoring and calibration.

5-6.2 <u>Beamformer Control Function</u>. The TBF control function, as shown in Figure 9 of circuit diagram TO 31P6-2FPS118-73-1, operates under control of TCMG. To achieve this control, TCMG sends periodic control messages to the TBF cabinet via a 16-bit parallel interface. Data received during the message transfer is stored in local registers for use during the next scheduled CIT. In addition, a readback of the control message is performed to support EPM. During readback, all registered data received from TCMG is sent back over the same parallel interface. This allows TCMG to check for errors by comparing the data sent with the data received during readback. The TBF control function is made up of digital boards located in the digital bucket N3. A total of 11 circuit boards are located in the digital bucket. One of these circuit boards (calibration MUX decoder driver N3A115) is used in the TBF status and monitoring function (paragraph 5-6.3). The remaining 10 circuit boards make up the TBF control function. General cabinet timing is described first, followed by descriptions for the circuit boards listed below:

1. TBF control timing
2. Cable card N3A101
3. Party line I/O N3A105
4. Maintenance control N3A106
5. Data collector N3A107
6. Register N3A108 through N3A111 and N3A113
7. Decoder driver N3A114.

5-6.2.1 <u>Transmit Beamformer Control Timing</u>. The TBF operates under control of TCMG. Two parallel data buses are implemented for control of the TBF. One of the parallel buses is used solely to control switching of the 40-way MUX and is described in paragraph 5-6.3. The other is a 17-bit bidirectional parallel data bus. The 17-bit bus handles control and status I/O messages between TCMG and the TBF. Control data messages are sent to the TBF on a CIT-to-CIT basis (normal mode), or the message transfers are performed on an unscheduled basis (immediate mode). The immediate mode of message transfer is used during startup since there is no active CIT to provide normal control message timing. Once startup is completed, each active CIT produces the timing signals necessary for scheduled control message transfers. The control messages contain aperture weights (phase and amplitude adjustments) for forming and steering the transmit beam. The control data message is made up of 16-bit (plus parity) parallel data words. A total of 29 data words are used for TBF control. Note that the TBF control message can contain one or all of the 29 data words. The first 24 data words contain the aperture weights. The last five words contain input configuration and attenuation values for the TBF. Upon receipt of the control data message, each of the 29 data words is stored in a local register. To support EPM, the registered control data is read back to TCMG and compared to the data actually sent. Readback of the control data is performed under request of TCMG. Upon request, the TBF outputs the 29 words of registered control data together with two additional status words. The two status words (30 and 31) are appended to the end of the readback message. They contain power supply and cabinet status information for the TBF. Protocol, an exchange of control signals referred to as handshaking, controls the transfer of each I/O message word.

5-6.2.2 Cable Card N3A101. The cable card N3A101 provides the hardware connections between the TBF cabinet and TCMG. See TO 31P6-2FPS118-73-1 Figure 9. Electrical connections are provided for the following interface signals:

1. Parallel control data bus (16 bits plus one parity bit)
2. Five protocol (handshake) signals for the control data bus:
   a. External function present (EFP) signal
   b. Output data present (ODP) signal
   c. Input data present (IDP) signal
   d. Attention request signal (not used)
   e. Acknowledge signal.
3. Calibration MUX control data bus (6 bits plus one parity bit)
4. Master clear signal
5. Unit offline (summary status) signal
6. Cabinet CB1 on/off status signal.

5-6.2.3 Party Line Input/Output Board N3A105. The party line I/O board N3A105 implements the communication interface for the 17-bit control data bus. Message transfers are categorized as control words (output from TCMG to the TBF) and readback and status words (input to TCMG from the TBF). Table 5-4 lists the five protocol signals associated with the message transfers. A request/acknowledge exchange occurs for each message word transferred. All I/O activities are initiated by TCMG. Basically, two types of control words are sent to the party line I/O, external function (EF) command words and output data (OD) words. The distinction between EF and OD words is established by the protocol signals (EFP and ODP) associated with the data bus. Because TCMG recognizes the TBF as a peripheral, EF words implement control of the unit. The EF words are shown in Figure 5-12. The EF word sets up the TBF command registers to receive (write) data or to send back (read) data. The EF word is decoded by the party line I/O, which, in turn, sends the appropriate read/write strobe to register boards N3A108 through N3A111 and N3A113. The OD words containing aperture weights and TBF configuration data then are sent to the party line I/O. These data words are shown in Figure 5-13. Each of these words contains eight bits of TBF data plus a seven-bit board and register address code. The address code steers the data to the appropriate register on the selected register board. If a register read is requested, data words are transferred back to TCMG in the same manner using the IDP protocol signal. All control message words are odd parity checked by the party line I/O. If a parity error is detected, a parity error signal is output to the data collector N3A107 where it is included in the status reply message to TCMG.

5-6.2.4 Maintenance Control Board N3A106. The maintenance control board N3A106 is used for factory testing of the TBF cabinet. The board contains an ROM resident control program that allows limited dynamic testing of the TBF without the use of the TCMG computer. Operation of this board requires the use of a special maintenance panel for user interface. During factory tests, TBF control data is entered manually from selection switches on the maintenance panel. The maintenance control board routes the control data to appropriate register boards for storage.

Table 5-4. Transmit Beamformer/Transmit Control and Monitor Group Interface Control Signals

Signal Name	Source	Description
External function present (EFP)	TCMG	TCMG has an external function command word on the parallel data lines for the TBF to accept.
Output data present (ODP)	TCMG	TCMG has an output data word on the parallel data lines for the TBF to accept.
Input data present (IDP)	Beamformer	The TBF has an output data word on the parallel data lines for TCMG to accept.
Acknowledge (ACK)	TCMG/Beamformer (bi-directional)	TCMG or the TBF has received a parallel data word. This signal acknowledges receipt of the current word and instructs the sending device to send the next word (if not last word).

5-6.2.5 Data Collector Board N3A107. The data collector board N3A107 collects fault status signals and register test data for output to TCMG. Status messages are output to TCMG in response to a read status EF word (Table 5-4). The status message is returned to TCMG via the party line I/O. Two status words are generated by the data collector. The first status word contains power supply status for cabinet voltage regulators VR1 through VR8. The other status word contains bits for control word parity error, cabinet overtemperature, and calibration MUX control parity error.

5-6.2.6 Register Board N3A108 through N3A111 and N3A113. The register boards provide local storage of TBF control data. See TO 31P6-2FPS118-73-1 Figure 9, Sheets 2 and 3. This data includes aperture weights for beamsteering, input signal configuration and attenuation data, and individual channel on/off selection. A total of five register boards store this data. Each register board contains eight uniquely addressable eight-bit data registers. All five boards share a common seven-bit address bus and an eight-bit data bus. During register read/write operations, the party line I/O sets the appropriate register address on the seven-bit address bus. Data then is transferred from/to the selected register via the eight-bit data bus. During register writes, the party line I/O sends an acknowledge strobe to latch the data into the register. Once registered, the stored data is sent to modules in the TBF function that use the data. Aperture weights for beam steering are output as I&Q controls to modulator controls N4A1 through N4A5, N5A1 through N5A6, and N7A1 in the TBF function. The registers also store the channel on/off select data that is output to RF amplifiers N4A8, N4A10, N4A12, N4A14, N4A16, N5A8, N5A10, N5A14, N5A16, and N5A18, also in the TBF function. Attenuation values are output to N4A17, N4A18, N7A10, and N7A11.

5-6.2.7 Decoder Driver N3A114. Decoder driver N3A114 provides the decode logic to drive switching matrix A11 in the TBF function. See TO 31P6-2FPS118-73-1 Figure 9, Sheet 3. The switching matrix selects RF inputs from the main exciter or auxiliary exciter as described in paragraph 5-6.1.1. The decoder driver provides a three-bit control signal for the switching matrix. A two-bit configuration select code is input to the board from register N3A113. This two-bit code is converted into the three-bit signals for the switch matrix as shown in the following truth table:

Decoder Driver N3A114 Truth Table

Input Pin No.		Output Pin No.		
45	47	60	62	61
(L1)	(L2)	(K1)	(K2,K4)	(K3,K5)
0	0	0	1	0
0	1	1	1	0
1	0	0	1	1
1	1	0	0	0

REGISTER READ/WRITE EXTERNAL FUNCTION WORD

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
UNIT			MODE			TE	WA	MC	BOARD CODE				REG CODE		

UNIT
0 0 1 = ALWAYS SET TO THIS CODE TO ADDRESS THE BEAMFORMER

MODE
0 0 0 = WRITE TO REGISTER ADDRESSED BY BITS 00 THROUGH 06
0 0 1 = READ REGISTER ADDRESSED BY BITS 00 THROUGH 06
0 1 0 = READ ALL REGISTERS ON BOARD ADDRESSED BY BITS 03 THROUGH 06
0 1 1 = READ ALL REGISTERS IN THE UNIT DEFINED BY BITS 13 THROUGH 15

TE
0 = NORMAL OPERATION
1 = TEST ENABLE, INHIBITS OUTPUT FROM THE REGISTERS

WA
0 = NORMAL OPERATION (WRITE TO REGISTERS SELECTED BY THE MODE FIELD)
1 = WRITE ALL, FORCES ALL REGISTERS TO LOAD THE CONTROL WORD

MC
0 = NORMAL OPERATION
1 = MASTER CLEAR, CLEARS ALL REGISTERS

BOARD CODE
0 0 0 0 = SELECTS REGISTER BOARD N3A108
0 0 0 1 = SELECTS REGISTER BOARD N3A109
0 0 1 0 = SELECTS REGISTER BOARD N3A110
0 0 1 1 = SELECTS REGISTER BOARD N3A111
0 1 0 1 = SELECTS REGISTER BOARD N3A113

REGISTER CODE
0 0 0 = SELECTS THE FIRST REGISTER ON THE SELECTED BOARD
|
|
1 1 1 = SELECTS THE EIGHTH REGISTER ON THE SELECTED BOARD

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Figure 5-12. Transmit Beamformer External Function Command Words

BEAMFORMER CONTROL DATA WORD FORMAT

15	14	13	12	11	1Ø	Ø9	Ø8	Ø7	Ø6	Ø5	Ø4	Ø3	Ø2	Ø1	ØØ
CONTROL DATA								--	BOARD CODE				REG CODE		

CONTROL MESSAGE SEQUENCE:

																BOARD:
1	APERTURE CH 1-I	8-BIT DATA								Ø	Ø	Ø	Ø	1	Ø	Ø	N3A1Ø8
2	APERTURE CH 1-Q	8-BIT DATA								Ø	Ø	Ø	Ø	1	Ø	1	N3A1Ø8
3	APERTURE CH 2-I	8-BIT DATA								Ø	Ø	Ø	Ø	1	1	Ø	N3A1Ø8
4	APERTURE CH 2-Q	8-BIT DATA								Ø	Ø	Ø	Ø	1	1	1	N3A1Ø8
5	APERTURE CH 3-I	8-BIT DATA								Ø	Ø	Ø	1	Ø	Ø	Ø	N3A1Ø9
6	APERTURE CH 3-Q	8-BIT DATA								Ø	Ø	Ø	1	Ø	Ø	1	N3A1Ø9
7	APERTURE CH 4-I	8-BIT DATA								Ø	Ø	Ø	1	Ø	1	Ø	N3A1Ø9
8	APERTURE CH 4-Q	8-BIT DATA								Ø	Ø	Ø	1	Ø	1	1	N3A1Ø9
9	APERTURE CH 5-I	8-BIT DATA								Ø	Ø	Ø	1	1	Ø	Ø	N3A1Ø9
1Ø	APERTURE CH 5-Q	8-BIT DATA								Ø	Ø	Ø	1	1	Ø	1	N3A1Ø9
11	APERTURE CH 6-I	8-BIT DATA								Ø	Ø	Ø	1	1	1	Ø	N3A1Ø9
12	APERTURE CH 6-Q	8-BIT DATA								Ø	Ø	Ø	1	1	1	1	N3A1Ø9
13	APERTURE CH 7-I	8-BIT DATA								Ø	Ø	1	Ø	Ø	Ø	Ø	N3A11Ø
14	APERTURE CH 7-Q	8-BIT DATA								Ø	Ø	1	Ø	Ø	Ø	1	N3A11Ø
15	APERTURE CH 8-I	8-BIT DATA								Ø	Ø	1	Ø	Ø	1	Ø	N3A11Ø
16	APERTURE CH 8-Q	8-BIT DATA								Ø	Ø	1	Ø	Ø	1	1	N3A11Ø
17	APERTURE CH 9-I	8-BIT DATA								Ø	Ø	1	Ø	1	Ø	Ø	N3A11Ø
18	APERTURE CH 9-Q	8-BIT DATA								Ø	Ø	1	Ø	1	Ø	1	N3A11Ø
19	APERTURE CH 1Ø-I	8-BIT DATA								Ø	Ø	1	Ø	1	1	Ø	N3A11Ø
2Ø	APERTURE CH 1Ø-Q	8-BIT DATA								Ø	Ø	1	Ø	1	1	1	N3A11Ø
21	APERTURE CH 11-I	8-BIT DATA								Ø	Ø	1	1	Ø	Ø	Ø	N3A111
22	APERTURE CH 11-Q	8-BIT DATA								Ø	Ø	1	1	Ø	Ø	1	N3A111
23	APERTURE CH 12-I	8-BIT DATA								Ø	Ø	1	1	Ø	1	Ø	N3A111
24	APERTURE CH 12-Q	8-BIT DATA								Ø	Ø	1	1	1	1	1	N3A111
25	EXCITER 1 SEL	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	1	1	1	1	N3A113
	EXCITER 2 SEL	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	1	1	1	1	N3A113
	EXCITER 1&2 SEL	1	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	1	1	1	1	N3A113
26	CHANNEL 1 SEL	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	N3A1Ø8
	CHANNEL 2 SEL	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	N3A1Ø8
	CHANNEL 3 SEL	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	N3A1Ø8
	CHANNEL 4 SEL	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	N3A1Ø8
	CHANNEL 5 SEL	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	N3A1Ø8
	CHANNEL 6 SEL	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	N3A1Ø8
	CHANNEL 7 SEL	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	N3A1Ø8
27	CHANNEL 8 SEL	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	N3A1Ø8
	CHANNEL 9 SEL	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	N3A1Ø8
	CHANNEL 1Ø SEL	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	N3A1Ø8
	CHANNEL 11 SEL	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	N3A1Ø8
	CHANNEL 12 SEL	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	N3A1Ø8
28	INPUT ATTEN (MAIN)	8-BIT DATA								Ø	Ø	Ø	Ø	Ø	1	1	N3A1Ø8
29	INPUT ATTEN (AUX)	8-BIT DATA								Ø	Ø	Ø	Ø	Ø	1	Ø	N3A1Ø8

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Figure 5-13. Transmit Beamformer Control Data Words (Sheet 1 of 2)

BEAMFORMER STATUS WORD FORMAT

15	14	13	12	11	10	Ø9	Ø8	Ø7	Ø6	Ø5	Ø4	Ø3	Ø2	Ø1	ØØ
STATUS DATA								--	BOARD CODE				REG CODE		

STATUS WORD SEQUENCE: BOARD:

		15	14	13	12	11	10	Ø9	Ø8	Ø6	Ø5	Ø4	Ø3	Ø2	Ø1	ØØ	
3Ø	NO FAULT	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR1 FAULT	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR2 FAULT	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR3 FAULT	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR4 FAULT	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR5 FAULT	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR6 FAULT	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR7 FAULT	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
	VR8 FAULT	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	Ø	Ø	1	N3A1Ø7
31	NO FAULT	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	Ø	Ø	Ø	Ø	N3A1Ø7
	BF PARITY ERROR	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	1	1	1	Ø	Ø	Ø	Ø	N3A1Ø7
	OVERTEMPERATURE	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	1	1	1	Ø	Ø	Ø	Ø	N3A1Ø7
	MUX PARITY ERROR	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	1	1	1	Ø	Ø	Ø	Ø	N3A1Ø7

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Figure 5-13. Transmit Beamformer Control Data Words (Sheet 2 of 2)

5-6.3 Beamformer Status and Monitoring Function. The TBF status and monitoring function, as shown in Figure 13 of circuit diagram TO 31P6-2FPS118-73-1, contains the 40-way MUX used for transmitter calibration. The MUX supplies RF test samples to calibration receivers in the exciter/auxiliary exciter cabinets. Control signals for the MUX are supplied by the calibration MUX decoder driver N3A115. The calibration MUX decoder driver accepts inputs from TCMG via the cable card in the TBF control function. The MUX consists of multiple RF switches that are configured to route any one of 40 RF inputs onto a single output. The single output then is split and routed to both exciter cabinets. Using this method, a waveform sample from any of the 40 inputs is sent to the calibration receivers located in the exciters. These signal samples generate performance feedback to the TCMG.

5-6.3.1 Calibration Multiplexer Decoder Driver N3A115. The calibration MUX decoder driver N3A115 receives six bits of calibration MUX control data plus one parity bit from TCMG via the cable card in the TBF control function. The input data is applied to differential receivers that convert the input signals to TTL logic levels. The data is odd parity checked for errors and then decoded to produce control outputs for the 40-way MUX. If a parity error is detected, a parity error signal is output to the data collector in the TBF control function. Note that the parallel MUX control data entering the cabinet is not registered or clocked into the calibration MUX decoder driver. Parallel data entering the board is immediately decoded and output to the 40-way MUX since no onboard clocking occurs. Therefore, TCMG has immediate (real-time) control over the 40-way MUX.

5-6.3.2 40-Way Multiplexer N8S1 through N8S6. The 40-way MUX is configured using six 8-to-1 RF switches N8S1 through N8S6. The first five RF switches each receive eight RF inputs and provide a single output. The sixth RF switch receives these five outputs as inputs. This cascading allows any one of the 40 inputs to be selected at the output of the sixth RF switch. The 40-way MUX receives control inputs from the calibration MUX decoder driver. The following input signals are time-multiplexed onto a single line by the 40-way MUX:

1. Transmitter output forward (12) and reflected (12) signals
2. Beamformer input (2) and output (12) signals
3. Hard-limited RF calibration signals (2).

5-6.3.3 Cabinet Status. Several cabinet status signals are generated to support EPM for the TBF. These signals include power supply status for cabinet voltage regulators VR1 through VR8, cabinet overtemperature, and CB1 on/off status (Figure 13, Sheet 2). Power supply status and cabinet overtemperature status are output to the data collector in the TBF control function. These signals are included in the status message that is returned to TCMG via the party line I/O. CB1 on/off status is routed to TCMG as a separate discrete signal via the cable card in the TBF control function.

5-7 TRANSMITTER FUNCTION.

The transmitter function, as shown in Figure 6 of circuit diagram TO 31P6-2FPS118-73-1, provides power amplification, distribution, and radiation into space for the radar transmit signal. Radiated output is collimated into a 7.5° beam that is steered to any of the eight sectors in the radar segment. Twelve identical TMs, Units 110 through 121, drive separate dipole elements in the antenna array. Each TM has its own HVPSs, Units 122 through 133, and associated HVAC switches, Units 222 through 233. Outputs from the transmitters are routed to the antenna array, Unit 100, via 72 coaxial transmission lines. The 72-element antenna array is made up of six side-by-side, 12-element subarrays. The transmitter function is under the control of the TCMG. The transmitter function produces a 63.0 dB overall gain with an RF input signal range from 17.0 to 20.5 dBm.

5-7.1 Elemental Transmitters. Twelve identical elemental transmitters are used in the transmitter function. The elemental transmitters are covered under a separate TO listed in Table 1-7. A brief description of the elemental transmitters is provided in the following paragraphs. Each elemental transmitter consists of:

1. HVAC Switches, Units 222 through 233 (designated cabinet 3 in the manufacturer's manual)
2. HVPSs, Units 122 through 133 (designated cabinet 2 in the manufacturer's manual)
3. TMs, Units 110 through 121 (designated cabinet 1 in the manufacturer's manual).

5-7.1.1 High Voltage Ac Switches, Units 222 through 233. The HVAC switches (Figure 6, Sheet 1) connect the 12,470 V ac provided by facilities to the HVPSs, Units 122 through 133. The HVAC switch is in a free-standing metal cabinet. It is actuated manually.

5-7.1.2 High Voltage Power Supplies, Units 122 through 133.

1. The HVPSs, Units 122 through 133, provide the power control, monitoring, and distribution for the TM, Units 110 through 121. The

site facilities provide the HVPS with 208 V, 3-phase, 60-Hz ac power; 120 V, 1-phase, 60-Hz ac power; and 120 V, 1-phase, 60-Hz ac ride-through service power. The 208 V, 3-phase ac signal supplies the PA, driver amplifier, and intermediate power amplifier (IPA) screen dc power supplies. The PA power supply generates 1.5 kV at 1.5 A, the driver amplifier power supply 1.5 kV at 0.5 A, and the IPA power supply 1.5 kV at 0.5 A. The power generated by each of the screen power supplies is fed into grounding switch A2S2. Grounding switch A2S2 directs the power to grounding switch S38 in the TM. The TM then distributes the power to the respective amplifier stages. Each screen power supply is monitored for overcurrent conditions and their voltages are read on the front meter panel A3 on the HVPS. Excessive current in any of the screen power supplies causes a screen current fault to be sent to the control/status panel A1 in the TM. This fault then is forwarded to the TCMG.

2. The 12,470 V, 3-phase power supplied by the HVAC switch generates the dc anode voltages for the PA, driver amplifier, and IPA. The PA anode power supply delivers 11.7 kV at 20 A. The IPA anode power supply delivers 4.5 kV at 6 A. The driver amplifier anode power supply delivers 3.5 kV at 4 A. The power generated by the anode power supplies is routed to the electrical system protection panel A2 and on to grounding switch A2S2. Switch A2S2 outputs the power to grounding switch S38 of the TM that distributes the power to the respective amplifier stages. The primary power supplied to the HVPS by the HVAC switch is controlled and monitored. Meters on the transmitter control panel are switched to read voltage and current of all three phases. Should a transmitter fault occur, a fault sense signal causes a high speed trip circuit to open three vacuum contactors that will remove the 12.47 kV ac from the input of the HVPS. At the same time, alarm circuits and indicators signal this condition. Excessive current causes a dc anode current fault to be sent to the TCMG via the control/status panel, A1, in the TM.

3. The transmitter amplifier stages require dc power supplies for both bias and filament voltages. These power supplies are in the transmitter cabinets and are supplied with regulated 208 V, 3-phase, 60 Hz ac from the HVPS. The indicator lamps, convenience outlets, and some control circuitry are powered by the 120 V, 1-phase, 60-Hz ac power line. The distribution of the 208 V, 3-phase, 60 Hz ac; regulated 208 V, 3-phase, 60 Hz ac; and 120 V, 1-phase, 60 Hz ac are metered and protected. All of these input ac voltages and their phases are monitored for overload. Excessive current causes the overloaded power line to be removed from the circuit. Alarm circuits and indicators on the front panel indicate the overloaded circuit.

4. The various transmitter modes of operation require negative dc voltage bias supplies that are switched to provide CW, FM/CW, or FM/ICW modulation of the IPA, driver amplifier, and PA stages. These modes are obtained through the BIAS/RF INHIBIT switch on the transmitter cabinet control panel. The required dc bias and dc filament voltage power supplies are in the transmitter cabinet. Their characteristics are listed in Tables 5-5 and 5-6.

5-7.1.3 Transmitter Module, Units 110 through 121. The TM description is broken down into the following topics:

1. Input attenuation network
2. IPA stage
3. Driver amplifier stage
4. PA stage

Table 5-5. Transmitter Dc Bias Power Supply Characteristics

Bias Supply	Cutoff	FM/CW	FM/ICW	Current
IPA	-700 V dc	-290 V dc	-230 V dc	0.20 A
Driver	-700 V dc	-335 V dc	-200 V dc	0.50 A
PA	-800 V dc	-375 V dc	-240 V dc	1.0 A

5. Output network
6. Control Status Panel A1
7. Transmitter control data
8. Transmitter status data.

5-7.1.3.1 Input Attenuation Network.

1. The RF input signals are supplied to the TM from the transmit beamforming function. The RF input is sent to directional coupler (DC1) by relay K5. The relay controls the remote/local RF input selection for the TM. Coupler DC1 provides an RF input sample for signal monitor panel A25. The output of coupler DC1 is fed through a fixed attenuator, AT6, to AT1, a voltage controlled attenuator. Attenuator AT6 reduces the signal level to protect the voltage controlled attenuator AT1. The RF signal is fed to RF amplifier AR3, that has a gain of 20 dB. The RF output signal from amplifier AR3 is driven through divider HY1 to attenuator AT2 and on to attenuator AT3. Voltage controlled attenuators AT1 and AT3 are controlled by the attenuator control circuitry. The attenuator control circuitry uses the RF input sample and forward power sample it receives to determine the proper levels of attenuation for attenuators AT1 and AT3. The outputs of attenuators AT1 and AT3 are adjustable from 0 to 30 dB.

2. The conditioned signal is applied to a low level, solid state, broadband amplifier, AR1. Amplifier AR1 amplifies the RF signal by 55.0 dB. The amplifier output is rated at 300 W across 50 ohms. The RF output of amplifier AR1 is fed to directional coupler 2 (DC2). Coupler DC2 sends the RF input signal to the IPA stage. Coupler DC2 also sends a RF sample to signal monitor panel A25. The directional coupler is rated at 50 ohms resistive impedance at 500 W.

5-7.1.3.2 Intermediate Power Amplifier Stage.

1. The RF output from coupler DC2 enters coaxial relay K6 that routes the RF input signal through one of three bandpass filters, i.e., FL1, FL2, or FL3. Band control signals from the control/status panel A1 select the proper bandpass filter for the IPA grid circuit. The band control signals are initiated manually at the TM control panel or sent from the TCMG. The bandpass characteristics of each of the IPA grid bandpass filters are shown in Table 5-7.

Table 5-6. Transmitter Dc Filament Power Supply Characteristics

Filament Supply	Voltage	Current
IPA	7.50 V dc	75 A
Driver	6.30 V dc	168 A
PA	15.50 V dc	215 A

Table 5-7. Transmitter Bandpass Filter Characteristics

Location	Filter/Band	Bandpass (MHz)	Output
IPA grid	1FL1/A,B,C	5.00 to 12.30	140 V dc at 1.4 A
IPA grid	1FL2/D,E	12.30 to 22.30	138 V dc at 2.7 A
IPA grid	1FL3/F	22.30 to 28.00	150 V dc at 3.6 A
Driver grid	1FL4/A,B,C	5.00 to 12.30	475 V dc at 10.5 A
Driver grid	1FL5/D,E,F	12.20 to 28.00	463 V dc at 31.3 A
PA grid	1FL7/A,B,C	5.00 to 12.30	475 V dc at 23.0 A
PA grid	1FL8/D,E	12.20 to 22.30	463 V dc at 53.5 A

Table 5-7. Transmitter Bandpass Filter Characteristics -CONT

Location	Filter/Band	Bandpass (MHz)	Output
PA grid	1FL9/F	22.20 to 28.00	376 V dc at 53.5 A
PA output	1FL10/A	5.00 to 6.79	2.4 kV dc at 50.0 A
PA output	1FL11/B	6.69 to 9.14	2.4 kV dc at 50.0 A
PA output	1FL12/C	9.04 to 12.30	2.4 kV dc at 50.0 A
PA output	1FL13/D	12.20 to 16.55	2.4 kV dc at 50.0 A
PA output	1FL14/E	16.45 to 22.30	2.4 kV dc at 50.0 A
PA output	1FL15/F	22.20 to 28.00	2.4 kV dc at 50.0 A

2. The output of the selected IPA grid bandpass filter is fed to the IPA. The IPA incorporates a power tetrode tube that is grid biased. The RF signal is fed to the IPA grid circuit and also to the IPA grid dummy load AT1 that provides a low impedance grid load. Dummy load AT1 has an impedance of 100 ohms and is rated at 15 kW. The dummy load AT1 is water cooled. The dummy load AT1 together with suppressor A22, combine to prevent parasitic oscillations in the IPA grid circuit. Grid detector circuit A2 sends a sample of the grid RF level to the control/status panel A1. Band prove signals are sent to the control/status panel to verify that only one IPA grid bandpass filter for a single band of frequencies has been selected. Cooling of the IPA stage is accomplished by air directed through the tube socket and over the grid and filament seals. The anode is cooled by circulating water through the tube integral water jacket. Sensors detect air or water flow stoppage. A cooling fault is indicated by fault lights on the control/status panel and also directed to the TCMG as a fault message. A RF sample-status of the IPA output from the IPA anode RF sample pickup A10 is sent to the signal monitor panel A25. The IPA power output is coupled directly to the driver grid bandpass filter bank.

5-7.1.3.3 Driver Amplifier Stage. The driver amplifier stage uses a power tetrode tube that is grid biased and driven by either of two switchable grid bandpass filters FL4 and FL5. The bandpass characteristics of each of the driver grid bandpass filters are shown in Table 5-7. The output of the selected driver grid bandpass filter is fed to the driver grid circuit and also to the driver grid dummy load AT2, that provides a low impedance grid load. Dummy load AT2 has an impedance of 50 ohms and can dissipate 15 kW. The dummy load is water cooled. A grid detector circuit A3, sends a sample of the grid RF level to the control/status panel A1. Band prove signals are sent to the control/status panel. These signals ensure that only one driver grid bandpass filter for a single band of frequencies has been selected. Cooling of the driver stage is accomplished by air directed through the tube socket and over the grid and filament seals. The anode is cooled by circulating water through the tube integral water jacket. Sensors detect air and water flow stoppage. A cooling fault is indicated by fault lights on the control/status panel and also sent to the TCMG as a fault message. An RF sample from the driver amplifier RF output pickup A11 is sent to the signal monitor panel A25. The driver output is coupled directly to the PA grid bandpass filter bank.

5-7.1.3.4 Power Amplifier Stage.

1. The PA stage employs a high power tetrode that is grid biased and driven by one of three switchable PA grid bandpass filters, i.e., FL7, FL8, or FL9. The bandpass characteristics of each of the PA grid bandpass filters are shown in Table 5-7. The output of the selected PA grid bandpass filter is fed to the PA grid circuit and also to the PA grid dummy load AT3. Dummy load AT3 has an impedance of 28 ohms and is rated at 30 kW. The dummy load is water cooled. This dummy load, together with parasitic suppressor A21 combines to prevent parasitic oscillations in the PA grid circuit. A grid detector circuit A4 sends a sample of the grid RF level to the control/status panel A1. Band prove signals also are sent to the control/status panel. The band prove signals ensure that only one PA grid bandpass filter

for a single band of frequencies is selected. Cooling of the PA stage is accomplished by air directed through the tube socket and over the grid and filament seals. The anode is cooled by circulating water through the tube integral water jacket. Sensors detect air or water flow stoppage. A cooling fault is indicated by fault lights on the control/status panel and also sent to the TCMG as a fault message.

2. The PA anode power is coupled to the input of six PA output RF bandpass filters FL10 through FL15 for bands A through F. Because of the very high PA anode voltage (11.7 kV), arc sensor probes A14 through A19 are connected to each of the bandpass filters. Arc sensor probe A20 is located near the final electron tube. Their output is sensed for an RF arc fault signal that is fed to the RF arc sensor module. An arc fault signal then is sent to the control/status panel and to the remote TCMG function. Any high voltage arcing causes the high voltage to be turned off and an indicator to light on the front panel. Turning on the high voltage then is inhibited until the arc fault is cleared. The arc fault signal opens the HVAC switch and removes all high voltage from the TM.

5-7.1.3.5 Output Network.

1. The RF power fed from the PA output RF bandpass filters is transferred to directional couplers DC3 through DC8. These have a resistive impedance of 50 ohms with 60 dB attenuated forward and 50 dB attenuated reverse taps. These taps supply samples of forward power and reverse power through relays K3 and K4 to the beamforming circuits status and monitoring function. In addition, forward power samples are sent through relay K1 to the attenuator control circuitry in control/status panel A1. The directional couplers are capable of 100 kW dissipation each. Water cooling with temperature sensing protects these directional couplers.

2. The RF power from the couplers is connected to the bank of six dummy load/RF output transfer switches S32 through S37. These are pneumatically-operated, single pole, double throw switches. The switches are operated manually at the front panel or automatically from the remote TCMG function. The RF power is directed to the antenna transmission lines and then to antenna array, Unit 100, or to dummy load ports. Interlock circuits prevent more than one band of frequencies (A through F) from being connected to the antenna transmission lines at one time. When connected to the dummy load ports, the antenna transmission line ports are shorted to prevent RF from entering the cabinet. As a further safety measure, RF output is inhibited by interlocks during switching. These design precautions prevent personnel injury and/or equipment damage during switching intervals. When the dummy load is connected to one of the output ports, interlock sensors and indicators ensure that water cooling, temperature sensing, and electrical connections are made properly. The dummy load is capable of dissipating 100 kW.

5-7.1.3.6 Control/Status Panel A1.

1. Control/status panel A1 monitors the operation of the HVPS and TM by receiving status/fault signals from the modules. The control/status panel also interfaces with the TCMG. Command and status messages are sent to/from the TM and TCMG. The TCMG remotely controls and monitors the operation of the HVPS and TM. The messages sent to/from the TCMG and TM are listed below; they are followed by an explanation of their function:

   a. Serial command data

   b. Clock

   c. Status request pulse

   d. Serial status data

   e. Data latch pulse

   f. Summary fault

   g. RF inhibit.

2. The serial command (transmitter control) data is sent as a 16-bit serial command word from the TCMG to each TM. All of the data (12 words) is sent to each of the 12 TMs even though only one of the words contains commands for any particular TM. The commands relevant to any one TM are clocked into the input register of that TM by the 16 clock pulses sent uniquely to each of the TMs. The command data pulses are timed so that the center of a command data pulse coincides with the leading edge of a clock pulse.

3. As the new serial command data is clocked into the I/O register in each TM, the data that is in the register is clocked back to the

TCMG over the serial status data line. The data that is in the register will be either the previous serial command data or the serial status data, depending on whether or not the status request pulse has been sent. If the status request pulse is sent, the arrival of the pulse causes the serial status data to parallel load into the TM I/O register. Then, as the serial command data arrives, the serial status data is clocked back to the TCMG to provide TM/HVPS status information for EPM. If the status request pulse is not sent, the previous serial command data in the I/O register of the TM is clocked out of the register back to the TCMG as a loop test to check the control circuits. The status request pulse normally is sent so that status information is returned. However, at least once every 3 minutes, the status request pulse is not sent so that the loop test is performed. The data latch causes the serial command data in the I/O register of each TM to latch into the TM control circuits.

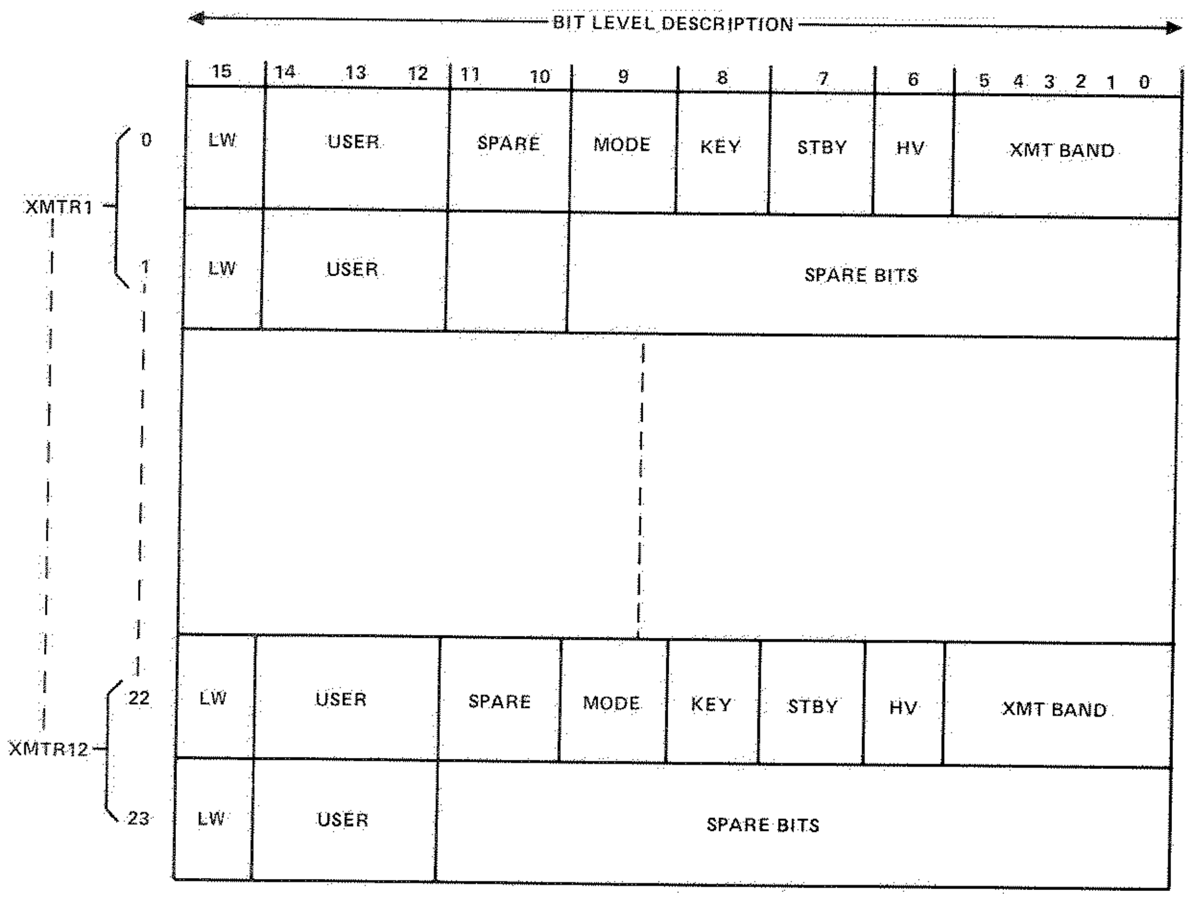
4. The summary fault and RF inhibit signals are discrete signals. The summary fault signal indicates whether a fault has or has not occurred in the TM or HVPS. The RF inhibit signal prevents RF radiation.

5-7.1.3.7 Transmit Command Data. The serial command data (XMTR CTL) consists of two 16-bit words for each TM. The odd numbered words for each TM are not used; they are spare words. Word 0 and the even numbered words contain the control data for the TMs, as shown in Figure 5-14 and described below:

1. The XMT Band (Bit 0 through Bit 5). The XMT Band comprises six bits that define in which frequency band the TM will operate.
2. HV (Bit 6). The HV, High Voltage On, controls the application of ac power to the screen and anode dc power supplies. The TM responds to HV command only after the standby state has been achieved.
3. STBY (Bit 7). STBY, Standby, this command causes the TM to come on from a cold start to the standby state, that is a prerequisite to high voltage turn-on.
4. Key (Bit 8). Key, Keyline, will inhibit RF radiation.
5. Mode (Bit 9). Mode is either FM/CW or FM/ICW.
6. Spare (Bits 10, 11). Spare Bits.
7. User (Bits 12 through 14). User indicates when command data is being sent to TM.
8. LW (Bit 15). The LW, Last Word, indicates if last word or not last word.

5-7.1.3.8 Transmit Status Data. The serial status data consists of two 16-bit words for each TM. The odd numbered words for each TM are not used; they are spare words. Word 0 and the even numbered words contain the status data for the TMs, as shown in Figure 5-15 and described below:

1. Bit 0, Primary ac Contactor Open. States whether the contactor connecting the 12,470 V ac to the anode power supply is open or closed.
2. Bit 1, Pressurized Air Pressure Fault. Reports the status of the air pressure supplied to the input of the TM from real property installed equipment (RPIE).
3. Bit 2, Cooling Air Flow Fault. Indicates if the cooling air flow from RPIE is sufficient to cool TM or not sufficient to cool TM.
4. Bit 3, Cooling Water Fault. Indicates if the water flow is adequate and the temperature is low enough for the TM to function.
5. Bit 4, Recycle Active. Certain faults will cause the TM to drop out and then begin an automatic recycle to a ready condition. This function indicates whether the TM is recycling or not recycling.
6. Bit 5, Crowbar Fired. Reports the firing of the crowbar tube that connects across the PA anode power supply.
7. Bit 6, RF Arc Occurred. Reports the sensing of an arc in the PA or in the output bandpass filter in use at the time.
8. Bit 7, Reverse Power Trip. Reports whether the reverse power has exceeded the preset value.
9. Bit 8, Fault Lockout. Reports that the TM recycle has been completed and the fault has not cleared.
10. Bit 9, HVPS Output dc Voltage Fault. This is a summary status function that reports whether any of the screen or anode power supplies has had a current overload.
11. Bit 10, Local/Remote Switch. Indicates whether TM control is local or remote (TCMG).
12. Bit 11, Drive Limit Indication. Provides the TCMG with an indication when the RF level has exceeded a predetermined level.



NOTE:
HV = HIGH VOLTAGE
LW = LAST WORD
STBY = STANDBY
XMT = TRANSMIT
XMTR = TRANSMITTER

GTA46539 B

Figure 5-14. Transmitter Control Message Format

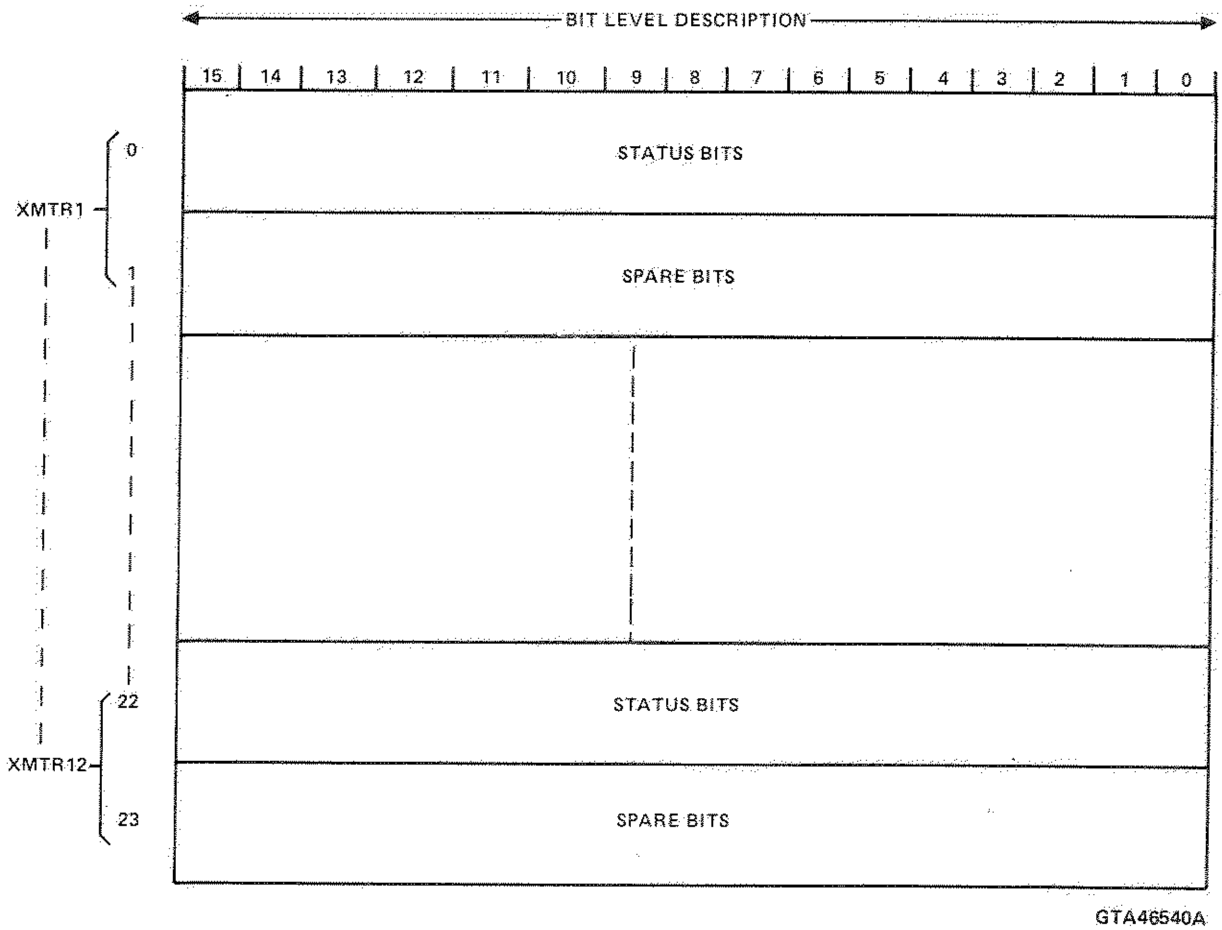


Figure 5-15. Transmitter Status Message Format

13. Bit 12, Filament Time Delay In Process. Reports that the filament time delay is in process or not in process.

14. Bit 13, TM Ready Verification. Informs TCMG when the TM is in an RF ready state.

15. Bit 14, Standby Complete Verification. Informs TCMG whether the interlocks have moved to the standby state (i.e., doors closed, filaments hot, ground switch open, bias supplies on, and RF load connected).

16. Bit 15, HVAC Verification. Provides the status of the 12,470 V ac power after the fuses in the HVAC fuse disconnect assembly.

5-7.2 Antenna Array, Unit 100. The antenna array description is broken down into the following topics:

1. RF transmission
2. Antenna phase correction
3. Beamsteering
4. Beam collimation.

5-7.2.1 Radio Frequency Transmission. The antenna transmission lines carry the RF signal from the transmitter to the antenna. The lines vary in size and length. The lines are nitrogen filled coaxial cable. Each coaxial cable is routed from the transmit building and terminated at a directional coupler located near the base of each antenna element support structure. This termination is the interface between the unbalanced transmitter and coaxial line impedance, and the balanced antenna element impedance. At this point it is necessary to match the two impedances to obtain an efficient power transfer. A balun transformer matches the two impedances. The balun carries the RF signal from the directional coupler to the antenna element where it is radiated into the atmosphere.

5-7.2.2 Antenna Phase Correction. The different lengths of the feed cables from the TBF to transmitter, and the transmitter to antenna elements, results in different electrical lengths for the 12 transmission paths in each antenna subarray (Figure 5-16). The data defining the electrical lengths of each path are stored in the TCMG software data base. Some paths have a shorter electrical length than others. This creates unwanted phase shifts in the RF signal radiation. These phase shifts are resultant from some RF signals reaching their antenna elements and radiating before other RF signals because their electrical path to the antenna element is shorter. For maximum RF energy radiated in a beam (one direction) the RF signals are radiated at the same time (in-phase). The TCMG compensates for the phase shifts created by the different electrical lengths of the transmission paths. The compensation makes all transmission paths the same electrical length thereby producing in-phase RF radiation. This is accomplished by inducing corrective phase shifts to the RF signals being transmitted. The TCMG accesses its data base and obtains the electrical lengths of the 12 transmission paths for a given subarray and frequency. (Electrical length is also frequency dependent.) It then calculates a phase shift for each of the 12 RF signals being transmitted that would make them all arrive at their respective antenna elements and radiate at the same time (in-phase). The TCMG sends the calculated phase shifts to the TBF and instructs it to induce these shifts on the RF signals.

5-7.2.3 Beamsteering. The TCMG receives a command from the operations center that defines which sector is to be lit with a transmit beam. The TCMG processes this command and initiates its own set of commands to accomplish this task. One of those commands is the beamsteering command sent to the TBF. This command instructs the beamformer as to which direction to radiate the beam. This beamsteering is accomplished by inserting time delays (phase shifts) between the RF transmissions from the individual antenna elements in a subarray. These phase shifts are calculated by TCMG. Figure 5-17 shows how small time delays between transmissions, from elements 12 to 1 on a given subarray, set up a wave front that is not perpendicular to the subarray, but rather travels out at an angle dependent on the delay time. In this example, element number 12 transmits first; element number 1 transmits last. This has the effect of steering the beam toward element number 1. This example illustrates that changing the element-to-element phasing of a subarray electronically steers the beam to a different direction.

5-7.2.4 Beam Collimation. The TCMG also directs the collimation of the transmit beam. The TCMG directs the TBF to induce amplitude tapering to the RF signals being transmitted. The amplitude tapering causes the 12 separately transmitted RF signals to combine in the atmosphere to form one 7.5° transmit beam. The area a 7.5° beam covers is called a sector. Eight sectors make up a segment. A segment covers 60° of illumination. The beams from the antenna array are steered +27.5° about the centerline of the segment. The balance of 5° of coverage is provided by overlap at the extremes of the steering angles.

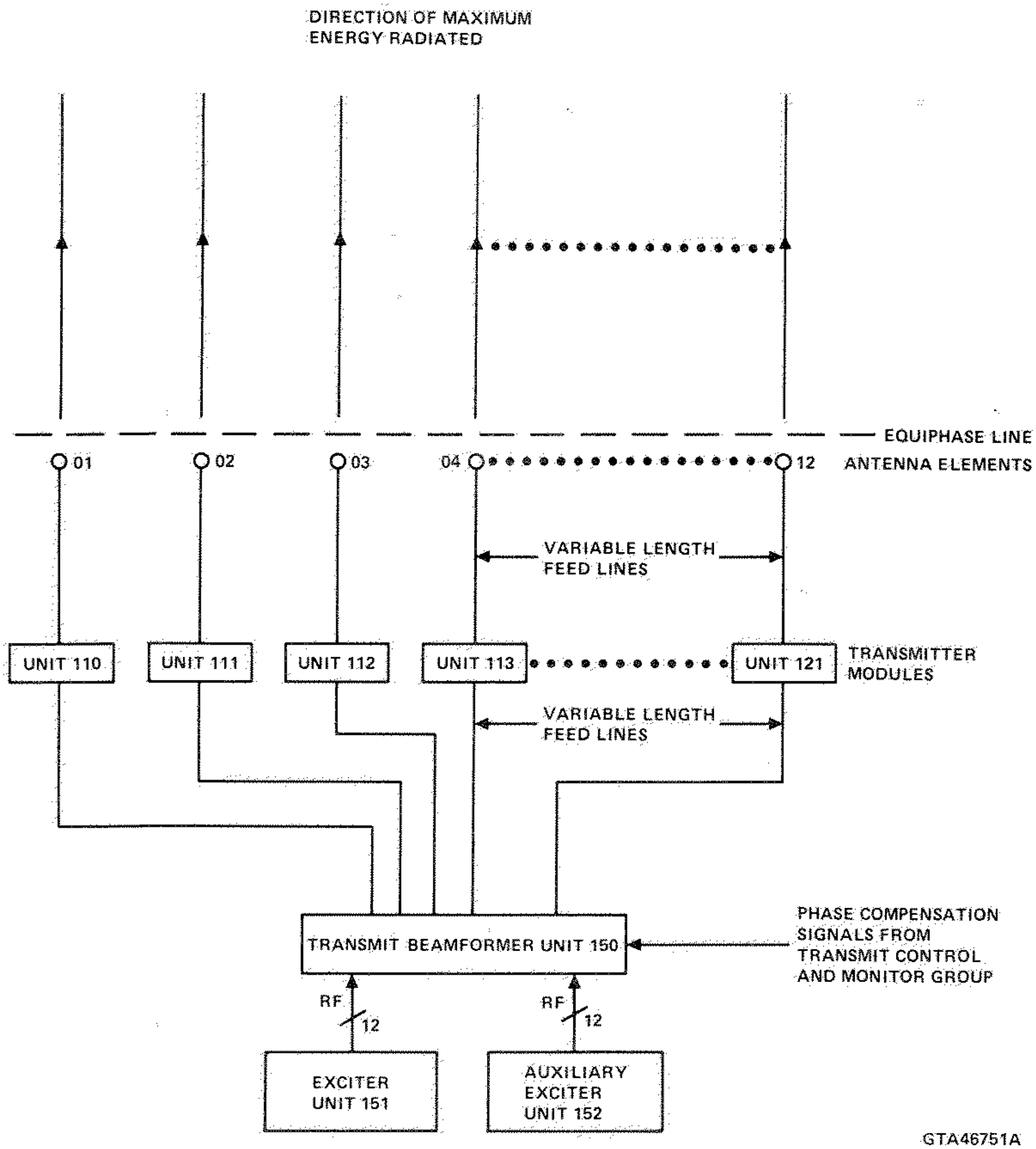


Figure 5-16. Antenna Phase Relationships

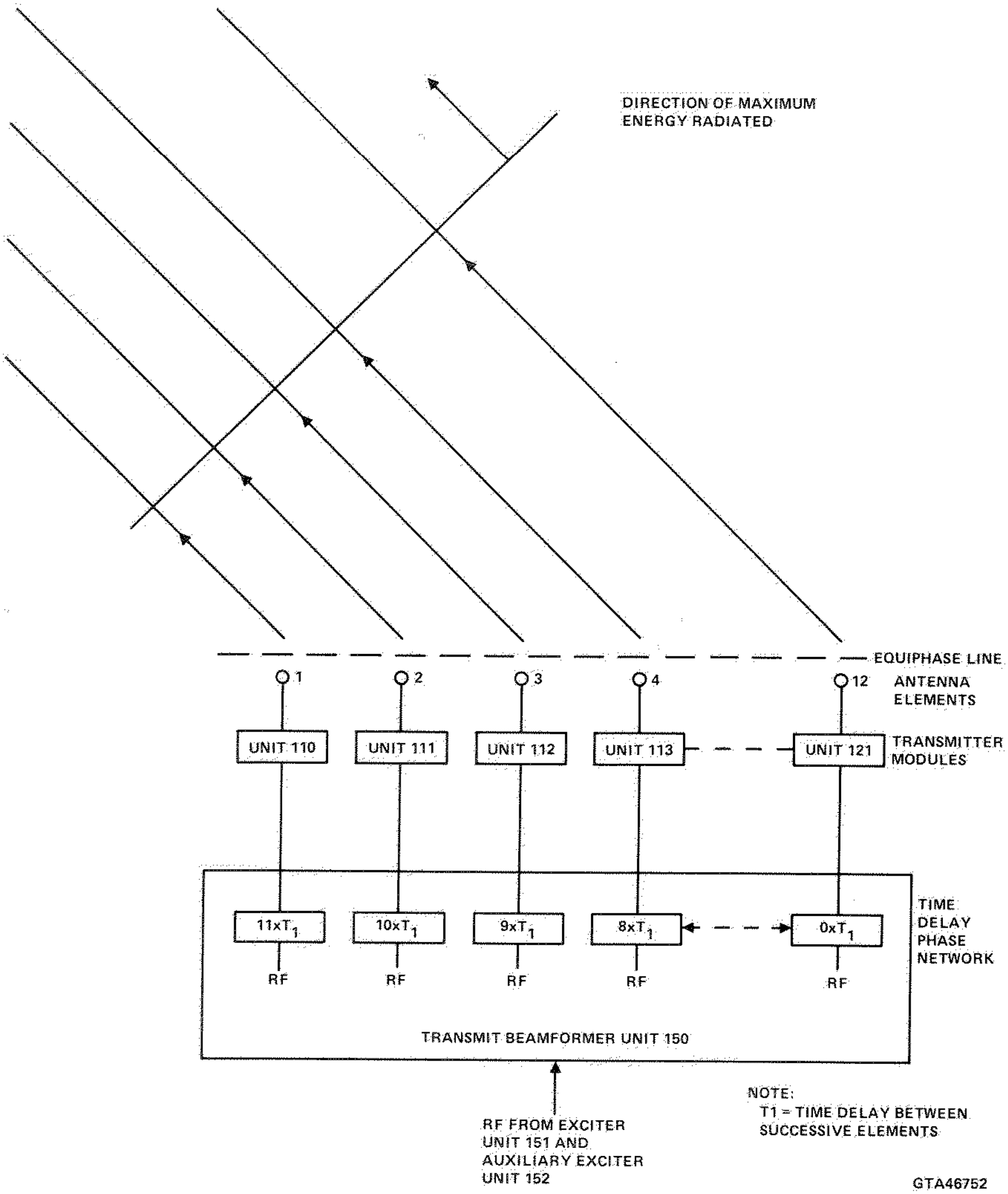


Figure 5-17. Antenna Beamsteering Network

5-8 POWER DISTRIBUTION.

Power distribution for the transmitter group is shown in Figures 17 through 27 of circuit diagram TO 31P6-2FPS118-73-1. Figure 17 shows ac power distribution. Figures 18 through 21 show dc power distribution for the TBF. Figures 22 through 27 show dc power distribution for the exciter cabinets.

5-8.1 Transmitter Group Ac Power Distribution.

1. The transmitter group receives 12,470 V, 3-phase, HVAC power from the RPIE high voltage main switch (Figure 17, Sheet 1). The HVAC power is distributed to HVPSs, Units 122 through 133, via HVAC switches, Units 222 through 233 (Figure 17, Sheets 1 through 3). The high voltage ac power is converted to dc by the HVPSs and they provide dc plate voltages for amplifier tubes in the TMs.

2. The remaining ac power distribution consists of 208/120 V, 3-phase, ac power. The 208/120 V ac power is distributed via CBs located on the RPIE power distribution panels. The HVPSs, Units 122 through 133, receive 208/120 V ac power from RPIE distribution panels 302B, 306F, and 317Q (Figure 17, Sheets 1 through 4).

3. The ac power distribution for the exciter, Unit 151, and the auxiliary exciter, Unit 152, cabinets is supplied from RPIE distribution panel 305E (Figure 17, Sheet 5). Power distribution for both exciter cabinets is identical. The ac power phases A, B, and C are routed to fan assembly A14 and terminal board TB1 via filters FL1 through FL3 and circuit breaker CB1. The neutral power line is routed to TB1 via filter FL4. The POWER AVAIL (power available) indicator DS1 monitors the phase-C power supplied to circuit breaker CB1. The POWER ON indicators DS2 through DS4 monitor each phase of ac power (A, B, and C, respectively). Phase-C power is supplied to ac duplex outlets J66 and J67 via POWER OUTLET CB1. The duplex outlets provide ac power for A/DC A2, calibrator A3, and frequency synthesizers A4 and A5. Table 5-8 shows the CBs associated with ac power distribution to the eight internal dc power supplies.

Table 5-8. Exciter/Auxiliary Exciter Cabinet Power Distribution

Ac Power Phase	Circuit Breaker	Power Supply Ref Des[1]/Voltage		Power Supply Controller	Figure Reference
A	CB2	A6	+60 V dc	N4A1	27
B	CB3	A7	-60 V dc	N4A2	26
C	CB4	A8	+15 V dc	N4A1	24
C	CB5	A9	-15 V dc	N4A2	23
A	CB6	A10	+5 V dc	N4A1	22
B	CB7	A11	+5 V dc	N4A1	22
A	CB8	A12	+24 V dc	N4A2	25
B	CB9	A13	+24 V dc	N4A2	25
N/A[2]	N/A	A16[3]	+5 V dc	N/A	22

[1] Reference Designator

[2] Not Applicable

[3] Power supply A16 is a +24 to +5 V dc-to-dc converter. The +24 V dc input is provided by parallel power supplies A12 and A13.

4. The ac power distribution for the TBF, Unit 150, is supplied from RPIE distribution panel 305E (Figure 17, Sheet 6). The ac power phases A, B, C, and neutral are routed to terminal board N2TB1 via line filters N2FL1 through N2FL4 and CB N2CB1. The POWER AVAIL indicator N2DS1 monitors the phase-C power supplied to CB1. The POWER ON indicators N2DS2 through N2DS4 monitor each phase of ac power (A, B, and C, respectively). All the phases of ac power are routed to fan assembly N10A1 and ac-to-dc converter A2 via terminal board N10TB1. The ac-to-dc converter provides dc outputs to voltage regulators VR1 through VR8 as shown in Table 5-9.

5-8.2 Exciter, Unit 151, and Auxiliary Exciter, Unit 152, Dc Power Distribution.

1. The dc power distribution for the exciter, Unit 151, and auxiliary exciter, Unit 152, is shown in Figures 22 through 27. The exciter and auxiliary exciter each contain the following power supplies:

   a. +60 V dc power supplies A6 and -60 V dc power supply A7

   b. +15 V dc power supply A8 and -15 V dc power supply A9

   c. +5 V dc power supplies A10 and A11

   d. +24 V dc power supplies A12 and A13

   e. +24 V dc to +15 V dc converter (power supply) A16.

2. Table 5-8 lists the power supplies with the phase of ac power used as well as the associated circuit breaker, power supply controller, and figure reference. Each +60 V dc and -60 V dc power supply operates from a different phase of ac. Likewise, each +5 V dc power supply and each +24 V dc power supply operates from a different phase of ac. The +5 V dc, +15 V dc, and +60 V dc power supplies are controlled by power supply controller N4A1. The two +24 V dc power supplies and the -15 V dc and -60 V dc power supplies are controlled by power supply controller N4A2.

5-8.2.1 Power Supply Controller N4A2.

1. Each power supply has a sense lead connection and sense return lead connection for monitoring and regulating the output voltage. Each power supply has a shunt +, shunt -, and control connection to a power supply controller. The shunts enable the power supply controller to monitor the current delivered by each power supply. The control connection enables the power supply controller to regulate the current delivered by each power supply. The status of the power supplies is reported to TCMG by the power supply controllers via the exciter status and monitoring function (paragraph 5-5.4.3).

Table 5-9. Transmit Beamformer Cabinet Power Distribution

Ac-to-Dc Converter A2 Output V/Regulator Input V	Regulator Ref Des/Output V	Figure Reference
+/-15 V dc	VR3/VR4 -5 V dc	18
+/-15 V dc	VR1/VR2 +5 V dc	19
+/-25 V dc	VR7/VR8 -15 V dc	20
+/-25 V dc	VR5/VR6 +15 V dc	21

Note:

The input voltage to the VRs is floating and is not referenced to ground.

The output of the voltage regulator pairs, listed above, is in parallel.

2. The output voltage from both +5 V dc power supplies in the exciter or auxiliary exciter cabinet are connected in parallel. Likewise, the output voltage from both +24 V dc power supplies in the exciter or auxiliary exciter cabinet are connected in parallel. Each cabinet only has one of the following power supplies; +60 V dc, -60 V dc, +15 V dc, and -15 V dc. Therefore, these power supplies are connected in parallel with a power interface cable routed between the exciter and auxiliary exciter cabinet. Relay K1, when energized, connects the +60 V dc, -60 V dc, +15 V dc, and -15 V dc power supplies to the power interface. Relay K2, when energized, connects power supply controller N4A1 to the +60 V dc bus and +15 V dc bus in the power interface. Relay K2 also connects power supply controller N4A2 to the -60 V dc bus and -15 V dc bus in the power interface.

5-8.2.2 Dc Power Supply Assemblies A6 through A13 and A16.

1. Table 5-8 lists the dc power supplies used in the exciter and auxiliary exciter cabinets. Except for voltage and current output, all of the dc power supplies A6 through A13 are similar. Each dc power supply assembly contains a switching power supply, a field effect transistor (FET) and associated components, and a shunt resistor. The shunt resistor is in series with the dc return and the switching power supply. The shunt resistor enables the power supply controller to monitor the current delivered by the power supply. The power supply controller then adjusts the current, as required, via a control voltage supplied to the FET gate. The sense leads from the switching power supply are externally connected to the power output leads. The switching power supply senses the voltage output and adjusts the voltage as required. The +/-15 V dc and +/-60 V dc power supplies also have a voltage adjust potentiometer.
2. Power supply A16 is a dc-to-dc converter. It supplies +24 V dc and outputs +5 V dc. The +24 V dc input is supplied by +24 V dc power supplies A12 and A13 operating in parallel. The +5 V dc output is supplied to RF oscillators N2A1 through N2A13.

5-8.3 Transmit Beamformer, Unit 150, Dc Power Distribution. The ac-to-dc converter N10A2 receives 208 V, 3-phase, ac power and provides floating 15 V and 25 V unregulated dc outputs to the VRs. Table 5-9 shows the VRs input and voltage and the related power distribution figure.

5-8.3.1 Ac-to-Dc Converter A2. Ac-to-dc converter A2 supplies unregulated dc power regulators VR1 through VR8. The 208 V 3-phase ac supplied to the ac-to-dc converter is routed to an internal step-down power transformer. The transformer has a delta-connected primary and two wye-connected secondaries. The stepped down ac from the wye-connected secondaries is rectified by diodes to produce +/-15 V unregulated dc for the +5 V and -5 V regulators and +/-25 V unregulated dc for the +15 V and -15 V regulators. The unregulated dc voltages are routed to the applicable voltage regulators via terminal board TB4. For each supply voltage, two regulators are connected in parallel to produce the required output. The voltage regulator status is determined indirectly by monitoring the output from each regulator.

5-8.3.2 Voltage Regulators VR1 through VR8. Eight switching voltage regulators are used in the beamformer (Table 5-9). Except for the output voltage and current, all of the regulators are similar in operation. Only the -5 V dc regulators VR3 and VR4 (Figure 18, Sheet 1) are described here. Each voltage regulator consists of a solid state switch, an inductor, a current sense resistor, a voltage reference, and two voltage comparators. One comparator controls the output voltage. The second comparator controls the output current. The two comparators are connected in an OR configuration. Thus, either comparator can turn off the solid state switch. Filter capacitance is provided at the input and output of each voltage regulator to reduce noise and ac ripple. Each voltage regulator is protected against an overcurrent fault by a three terminal CB. The CB is configured to allow an initial surge of current to charge the input filter capacitors. A flyback diode allows the continuation of current flow through the inductor when the solid state switch is turned off. A decoupling diode isolates the regulator from the load when the regulators are operated in parallel. A crowbar circuit protects the load if an overvoltage occurs. The switching circuit operates at approximately 18 kHz. Each voltage regulator provides a status signal to the data collector in the beamformer control function (paragraph 5-6.2.5). The status signal is a closed ground return loop during normal operation. An open circuit in the loop (no ground) indicates a power supply failure. The broken loop is pulled up to +5 V dc logic level by a pull-up resistor on the data collector board.

5-9 LINE REPLACEABLE UNIT LEVEL THEORY.

The LRU theory is given in paragraphs 5-9.1 through 5-9.10 to support off-equipment maintenance rather than to describe operation in the on-equipment environment. More specifically, it assists the technician in manually troubleshooting and repairing these assemblies on the bench. Theory is given in part number order. Test procedures, disassembly procedures, and assembly procedures are given in Chapter 6.

5-9.1 +/-15 V Dc Power Supply Assembly (7328363G1). This +/-15 V dc power supply assembly operates at 115/120 or 220/240 V, 60-Hz ac. This +/-15 V dc power supply assembly comprises power supply PS1, current sensing shunt resistor R1, voltage programming resistors, and a voltage trim circuit. These components are interconnected (configured) by external jumpers. (During tests the jumpers are part of the test cables.) Figure 5-18 shows a typical circuit configuration. Current sensing shunt resistor R1 is connected in series with the ground return and senses the output current. The voltage programming resistors set the nominal output voltage. The voltage trim circuit enables remote voltage adjustments. The power supply assembly normally is used in parallel with another power supply assembly and controlled by a power supply controller (Figure 5-18). The power supply controller is part of a control loop. The power supply controller monitors the power supply assembly current via the shunt + and - REF (reference) from R1 and supplies a control voltage (0 to +10 V dc) to the voltage trim circuit. The control voltage maintains the proper output voltage of the supply for balancing the load current. (Refer to paragraph 5-9.10 for a description of the power supply controller.) The power supply assembly is shown schematically by Figure 54 of transmit group circuit diagram TO 31P6-2FPS118-73-1.

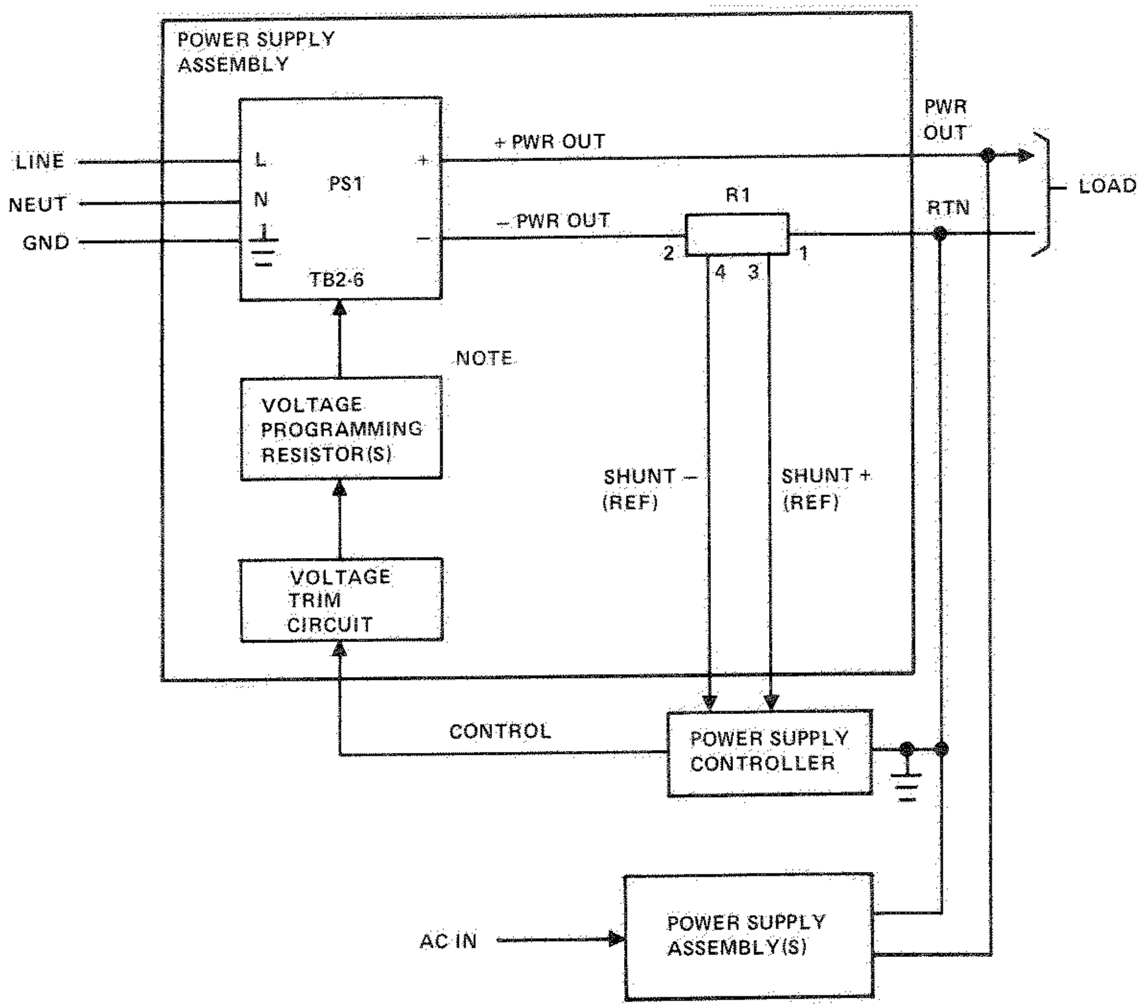
1. Current sensing shunt resistor R1 is series connected with the return lead of PS1 via external jumpers. (During bench tests these jumpers are part of the test cables.) The voltage drop across R1 is monitored (via the shunt + and - REF connections) to determine the current output of PS1. During tests the shunt + and - REF points are monitored by a digital voltmeter. There are +5 mV across these REF points for each ampere of current supplied to the load by PS1. In a typical application, the shunt + and - REF points are monitored by a power supply controller board.

2. The PS1 is a regulated switching power supply that operates at 115/120 or 220/240 V, 60-Hz ac, and outputs +/-15 V dc (nominal) at 8 A. Ripple voltage is limited to 10 mV rms. (Note: This ripple is not a sine wave. The reader should not attempt to convert it mathematically to a peak-to-peak voltage.) The output voltage is adjusted via the voltage programming resistors and voltage trim circuit described in the following paragraphs. The voltage trim circuit provides external adjustment of the voltage output of PS1 via a power supply controller board. The voltage supplied by PS1 is adjustable by the voltage trim circuit from +/-15 to at least 15.42 V dc (+/-15.52 V dc maximum). The PS1 regulates this voltage within 0.1 percent. For a detailed description of PS1 refer to TO 35C1-2-1141-2.

3. Series connected voltage programming resistors R2, R4, and R5 (Figure 5-19) set the output voltage of PS1. The R4 is adjustable and enables setting the lower voltage limit of PS1. During bench tests the voltage programming resistors are functionally connected between the + (plus) sense on PS1 and PS1TB2-6 by jumpers in the test cable.

4. The voltage trim circuit comprises Q1, CR1, and R3. When a positive control voltage is applied to CR1 it is forward biased and supplies a voltage to R3. The voltage developed across R3 is coupled to the gate of Q1. The Q1 is a P-channel field effect transistor (FET) in parallel with R2. The more positive the gate voltage of Q1 the greater the source to drain resistance of Q1. This increases the resistance of the R4, R5, Q1-R2 string and increases the output voltage of PS1.

5-9.2 +/-15 V Dc Power Supply Assembly (7329140G1). This +/-15 V dc power supply assembly operates at 115/120 or 220/240 V, 60-Hz ac. This +/-15 V dc power supply assembly comprises power supply PS1, current sensing shunt resistor R1, voltage programming resistors, and a voltage trim circuit. These components are interconnected (configured) by external jumpers. (During tests these jumpers are part of the test cables.) Figure 5-18 shows a typical circuit configuration. Current sensing shunt resistor R1 is connected in series with the ground return and senses the output current. The voltage programming resistors set the nominal output voltage. The voltage trim circuit enables remote voltage adjustments. The power supply assembly normally is used in parallel with another power supply assembly and controlled by a power supply controller (Figure 5-18). The power supply controller is part of a control loop. The power supply controller monitors the power supply assembly current via the shunt + and - REF from



NOTE:

THE +/− 60 V DC AND +/− 15 V DC POWER SUPPLY ASSEMBLIES CONTAIN THREE PROGRAMMING RESISTORS. THE +5 V DC AND +24 V DC POWER SUPPLY ASSEMBLIES CONTAIN ONE PROGRAMMING RESISTOR.

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Figure 5-18. Typical Dc Power Supply and Power Supply Controller Configuration, Block Diagram

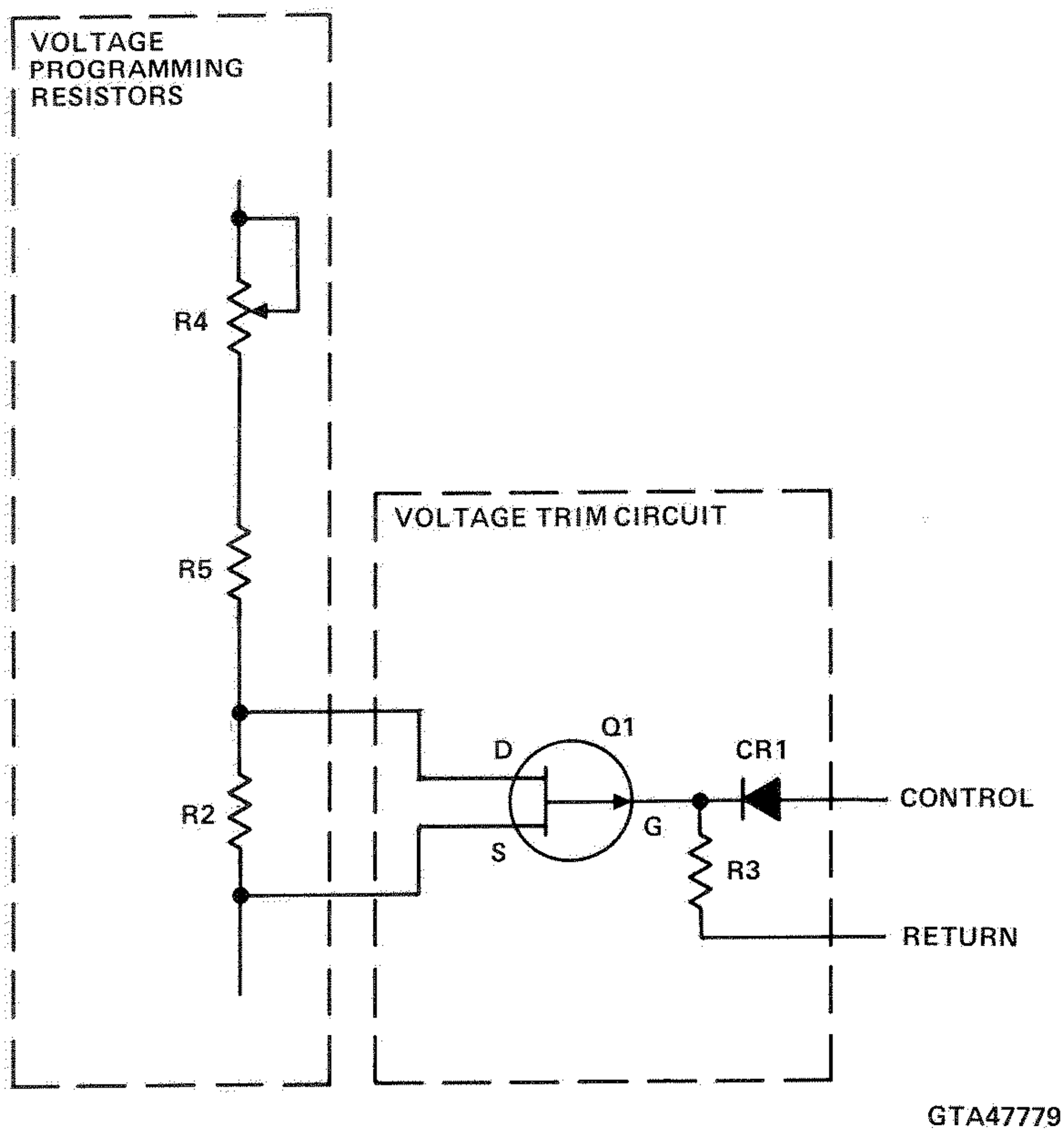

Figure 5-19. Voltage Programming Resistors and Voltage Trim Circuit, Simplified Circuit Diagram

R1 and supplies a control voltage (0 to +10 V dc) to the voltage trim circuit. The control voltage maintains the proper output voltage of the supply for balancing the load current. (Refer to paragraph 5-9.10 for a description of the power supply controller.) The power supply assembly is shown schematically by Figure 53 of transmit group circuit diagram TO 31P6-2FPS118-73-1.

1. Current sensing shunt resistor R1 is series connected with the return lead of PS1 via external jumpers. (During bench tests, these jumpers are part of the test cables.) The voltage drop across R1 is monitored (via the shunt + and - REF connections) to determine the current output of PS1. During tests, the shunt + and - REF points are monitored by a digital voltmeter. There are +2.5 mV across these REF points for each ampere of current supplied to the load by PS1. In a typical application, the shunt + and - REF points are monitored by a power supply controller board.

2. The PS1 is a regulated switching power supply that operates at 115/120 or 220/240 V, 60-Hz ac, and outputs +/-15 V dc (nominal) at 16 A. Ripple voltage is limited to 10 mV rms. (Note: This ripple is not a sine wave. The reader should not attempt to convert it mathematically to a peak-to-peak voltage.) The output voltage is adjusted via the voltage programming resistors and voltage trim circuit described in the following paragraphs. The voltage trim circuit provides external adjustment of the voltage output of PS1 via a power supply controller board. The voltage supplied by PS1 is adjustable by the voltage time circuit from +/-15 to at least 15.42 V dc (+/-15.52 V dc maximum). The PS1 regulates this voltage within 0.1 percent. For a detailed description of PS1 refer to TO 31S5-4-3176-1.

3. Series connected voltage programming resistors R2, R4, and R5 (Figure 5-19) set the output voltage of PS1. The R4 is adjustable and enables setting the lower voltage limit of PS1. During bench tests the voltage programming resistors are functionally connected between the + (plus) sense on PS1 and PS1TB2-6 by jumpers in the test cable.

4. The voltage trim circuit comprises Q1, CR1, and R3. When a positive control voltage is applied to CR1, it is forward biased and supplies a voltage to R3. The voltage developed across R3 is coupled to the gate of Q1. The Q1 is a P-channel FET in parallel with R2. The more positive the gate voltage of Q1 the greater the source to drain resistance of Q1. This increases the resistance of the R4, R5, Q1-R2 string and increases the output voltage of PS1.

5-9.3 <u>+/-60 V Dc Power Supply Assembly (7343908G1)</u>. This +/-60 V dc power supply assembly operates at 115/120 V, 60-Hz ac. This +/-60 V dc power supply assembly comprises power supply assembly PS1, current sensing shunt resistor R1, voltage programming resistors, and a voltage trim circuit. These components are interconnected (configured) by external jumpers. (During tests, these jumpers are part of the test cables.) Figure 5-18 shows a typical circuit configuration. Current sensing shunt resistor R1 is connected in series with the ground return and senses the output current. The voltage programming resistors set the nominal output voltage. The voltage trim circuit enables remote voltage adjustments. The power supply assembly normally is used in parallel with another power supply and controlled by a power supply controller (Figure 5-18). The power supply controller is part of a control loop. The power supply controller monitors the power supply current via the shunt + and - REF from R1 and supplies a control voltage (0 to +10 V dc) to the voltage trim circuit. The control voltage maintains the proper output voltage of the supply for balancing the load current. (Refer to paragraph 5-9.10 for a description of the power supply controller.) The power supply assembly is shown schematically by Figure 52 of transmit group circuit diagram TO 31P6-2FPS118-73-1.

1. Current sensing shunt resistor R1 is series connected with the return lead of PS1 via external jumpers. (During bench tests, these jumpers are part of the test cables.) The voltage drop across R1 is monitored (via the shunt + and - REF connections) to determine the current output of PS1. During tests, the shunt + and - REF points are monitored by a digital voltmeter. There are +5 mV across these REF points for each ampere of current supplied to the load by PS1. In a typical application, the shunt + and - REF points are monitored by a power supply controller board.

2. The PS1 is a regulated switching power supply that operates at 115/120 V, 60-Hz ac, and outputs +/-60 V dc (nominal) at 2.5 A. Ripple voltage is limited to 10 mV rms. (Note: This ripple is not a sine wave. The reader should not attempt to convert it mathematically to a peak-to-peak voltage.) The output voltage is adjusted via the voltage programming resistors and voltage trim circuit described in the

following paragraphs. The voltage trim circuit provides external adjustment of the voltage output of PS1 via a power supply controller board. The voltage supplied by PS1 is adjustable by the voltage trim circuit from +/-60 to at least 60.42 V dc (+/-60.52 V dc maximum). The PS1 regulates this voltage within 0.1 percent. For a detailed description of PS1 refer to the TO 35C1-2-1143-2.

3. Series connected voltage programming resistors R2, R4, and R5 (Figure 5-19) set the output voltage of PS1. The R4 is adjustable and enables setting the lower voltage limit of PS1. During bench tests, the voltage programming resistors are functionally connected between the + (plus) sense on PS1 and PS1TB2-6 by jumpers in the test cable.

4. The voltage trim circuit comprises Q1, CR1, and R3. When a positive control voltage is applied to CR1, it is forward biased, and the voltage developed across R3 is coupled to the gate of Q1. The Q1 is a P-channel FET in parallel with R2. The more positive the gate voltage of Q1 the greater the source to drain resistance of Q1. This increases the resistance of the R4, R5, Q1-R2 string and increases the output voltage of PS1.

5-9.4 <u>+24 V Dc Power Supply Assembly (7343910G1).</u> This +24 V dc power supply assembly operates at 115/120 V, 60-Hz ac. This +24 V dc power supply assembly comprises power supply PS1, current sensing shunt resistor R1, a voltage programming resistor, and a voltage trim circuit (Figure 5-18). Current sensing shunt resistor R1 is connected in series with the return and senses the output current. The voltage programming resistor sets the nominal output voltage. The voltage trim circuit enables remote voltage adjustments. The power supply assembly normally is used in parallel with another power supply assembly and controlled by a power supply controller also shown in Figure 5-18. The power supply controller is part of a control loop. The power supply controller monitors the power supply assembly current via the shunt + and - from R1 and supplies a control voltage (0 to +10 V dc) to the voltage trim circuit. The control voltage maintains the proper output voltage of the supply for balancing the load current. (Refer to paragraph 5-9.10 for a description of the power supply controller.) The power supply assembly is shown schematically by Figure 56 of transmit group circuit diagram TO 31P6-2FPS118-73-1.

1. Current sensing shunt resistor R1 is series connected with the return lead of PS1 and used for current sensing. The voltage drop across R1 is monitored (via the shunt + shunt -) to determine the current output of PS1. During tests, the shunt + and - shunt are monitored by a digital voltmeter. There are +3.33 mV across these points for each ampere of current supplied to the load by PS1. In a typical application, the shunt + and shunt - are monitored by a power supply controller board.

2. The PS1 is a regulated switching power supply that operates at 115/120 V, 60-Hz ac, and outputs +24 V dc (nominal) at 15 A. Ripple voltage is limited to 10 mV rms. (Note: This ripple is not a sine wave. The reader should not attempt to convert it mathematically to a peak-to-peak voltage.) The output voltage is adjusted via the voltage programming resistor and voltage trim circuit described in the following paragraphs. The voltage trim circuit provides external adjustment of the voltage output of PS1 via a power supply controller board. The voltage supplied by PS1 is adjustable by the voltage trim circuit from +24 to at least +24.42 V dc (+24.52 V dc maximum), and PS1 regulates this voltage within 0.1 percent. For a detailed description of PS1 refer to TO 35C1-2-1142-2.

3. Voltage programming resistor R2 (Figure 5-20) sets the output voltage of PS1. It is connected between PS1TB2-5 and PS1TB2-6. The voltage trim circuit comprises Q1, CR1, and R3. When a positive control voltage is applied to CR1, it is forward biased, and the voltage developed across R3 is coupled to the gate of Q1. Q1 is a P-channel FET in parallel with R2. The more positive the gate voltage of Q1 the greater the source to drain resistance of Q1. This increases the resistance of parallel Q1-R2 and increases the output voltage of PS1.

5-9.5 <u>+5 V Dc Power Supply Assembly (7343912G1).</u> This +5 V dc power supply assembly operates at 115/120 or 220/240 V, 60-Hz ac. This +5 V dc power supply assembly comprises power supply PS1, current sensing shunt resistor R1, a voltage programming resistor, and a voltage trim circuit (Figure 5-18). Current sensing resistor R1 is connected in series with the return and measures the output current. The voltage programming resistor sets the nominal output voltage; the voltage trim circuit enables remote voltage adjustments. The power supply assembly normally is used in parallel with another power supply assembly and controlled by a power supply controller also shown in Figure 5-18. The power supply controller is part of a control loop. The power supply controller monitors the shunt + and - from R1 and supplies a control voltage (0 to +10 V dc) to the voltage trim

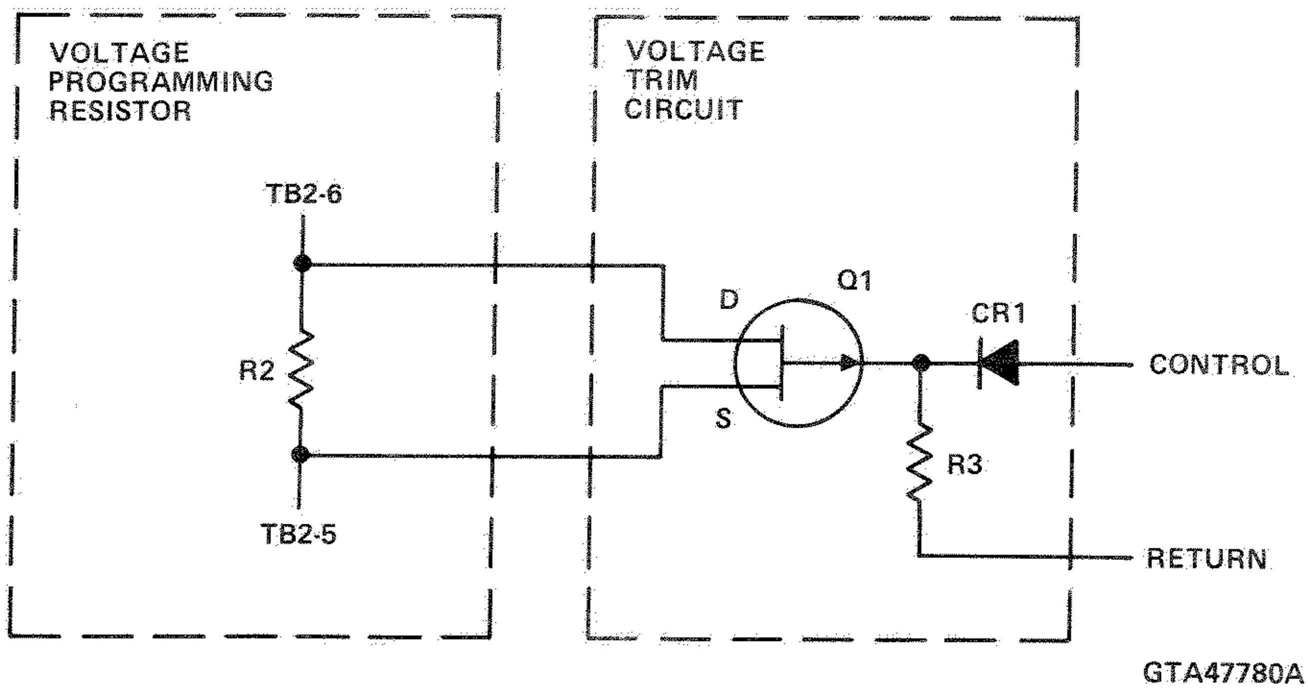

Figure 5-20. Voltage Programming Resistor and Voltage Trim Circuit, Simplified Circuit Diagram

circuit. The control voltage maintains the proper output voltage of the supply for balancing the load current. (Refer to paragraph 5-9.10 for a description of the power supply controller.) The power supply assembly is shown schematically by Figure 55 of transmit group circuit diagram TO 31P6-2FPS118-73-1.

1. Current sensing shunt resistor R1 is series connected with the negative lead of PS1. The voltage drop across R1 is monitored (via the shunt + and shunt - connections) to determine the current output of PS1. During tests, the shunt + and - shunt are monitored by a digital voltmeter. There is +1 mV across these points for each ampere of current supplied to the load by PS1. In a typical application, the shunt + and shunt - are monitored by a power supply controller board.

2. The PS1 is a regulated switching power supply that operates at 115/120 or 220/240 V, 60-Hz ac, and outputs +5 V dc (nominal) at 40 A. Ripple voltage is limited to 10 mV rms. (Note: This ripple is not a sine wave. The reader should not attempt to convert it mathematically to a peak-to-peak voltage.) The output voltage is adjusted via the voltage programming resistor and voltage trim circuit described in the following paragraph. The voltage trim circuit provides external adjustment of the voltage output of PS1 via a power supply controller board. The voltage supplied by PS1 is adjustable by the voltage trim circuit from +5 to at least +5.42 V dc (+5.52 V dc maximum). The PS1 regulates this voltage within 0.1 percent. For a detailed description of PS1 refer to TO 35C1-2-1140-2.

3. Voltage programming resistor R2 (Figure 5-20) sets the output voltage of PS1. It is connected between PS1TB2-5 and PS1TB2-6. The voltage trim circuit comprises Q1, CR1, and R3. When a positive control voltage is applied to CR1, it is forward biased, and the voltage developed across R3 is coupled to the gate of Q1. Q1 is a P-channel FET in parallel with R2. The more positive the gate voltage of Q1 the greater the source to drain resistance of Q1. This increases the resistance of parallel Q1-R2 and increases the output voltage of PS1.

5-9.6 +/-15/25 V Dc Ac-Dc Converter (7344735G1). This ac-dc converter is a dual-power outputs device that operates on a 208 V, 3-phase 60-Hz ac, 10 A power source. It converts this input power to supply two independent +/-15 ± 5 V dc outputs and two independent +/-25 ± 5 V dc outputs. These outputs are floating and not referenced to ground. This converter is illustrated schematically by Figure 29 of transmit group circuit diagram TO 31P6-2FPS118-73-1. One +/-15 V dc output is capable of supplying a 9.25 A load between J2-A and J2-B. The other +/-15 V dc output is capable of supplying a 5.25 A load between J2-C and J2-D. One +/-25 V dc output is capable of supplying a 10.75 A load between J2-E and J-2F. The other +/-25 V dc output is capable of supplying a 3.0 A load between J2-G and J2-H. The +/-15 V dc outputs are normally used as a power source for the +/-5 V dc regulators described in paragraph 5-9.8. The +/-25 V dc outputs are normally used with the +/-15 V dc regulators described in paragraph 5-9.9. The +/-15 V dc converter section is shown on Figure 29, Sheet 2, and the +/-25 V section is shown on Sheet 3 of this figure. This converter uses a 3-phase input transformer T1. The delta-configured primary windings are connected to a 3-phase, 60-Hz, 208 V ac input. Two wye-connected secondary windings (T1A) are used for the +/-15 V dc outputs and are each connected to a 3-phase, full-wave bridge rectifier (CR1 and CR2). Two delta-connected secondary windings (T1B) are used for the +/-25 V dc outputs and are each connected to a 3-phase, full-wave bridge rectifier (CR3 and CR4). The outputs of diode bridges CR1 and CR2 are +/-15 ± 5 V dc at full load with a ripple of 2.0 V rms or less. The outputs of diode bridges CR3 and CR4 are +/-25 ± 5 V dc at full load with a ripple of 3.0 V rms.

5-9.7 Dc-to-Dc Converter (77C723326G1). This dc-to-dc converter operates from a dc power source of +/-18 to +/- 36 V dc (+/-24 V dc nominal) at 2.6 A maximum. The dc inputs and outputs are floating. It supplies a single +/-5 V dc (nominal) 10 A output. The output voltage is adjustable over the range of +/-4.5 to 5.5 V dc and has an accuracy of ±1 percent. Ripple is limited to 10 mV rms. For a description of the operation of the dc-to-dc converter, refer to TO 31C1-4-147-1.

5-9.8 +/-5 V Dc Voltage Regulator (77D609500G1). The +/-5 V dc regulator is a voltage stepdown switching regulator. It operates on a +/-15 ± 5 V dc power supply to deliver a regulated full-load output of +/-5.2 ± 0.025 V dc at 43 A. Voltage regulation is 20 mV rms with a load range of 8.6 to 43 A. Ripple in the range of 1 to 30 Hz is limited to 25 mV rms at full load. (Note: This ripple is not a sine wave. The reader should not attempt to convert the rms mathematically to a peak-to-peak voltage.) The regulator has floating inputs and outputs with a common negative. It can be used as a positive or negative voltage regulator, depending on which output is referenced to ground. Voltage regulation and current limiting is accomplished by switching (turning on and off) the input voltage at 18 +/-5 kHz rate and filtering the output voltage. The switching frequency is determined by the load current. The greater the load current the higher the switching frequency. As shown in Figure 5-21, the regulator consists of chassis-mounted components and regulator card A1. The chassis-mounted components are discussed in paragraph 5-9.8.1. Regulator card A1 is discussed in paragraph 5-9.8.2. The chassis-mounted components provide a current path for the input/output current. They also enable voltage regulator card A1 to monitor parameters such as the voltage and current supplied by the regulator. Regulator card A1 uses these parameters to determine the switching frequency. Regulator card A1 also provides a fault status output for EPM/AFL.

5-9.8.1 Chassis-Mounted Regulator Components.

1. The chassis-mounted components provide filtering and an input/output current path under control of voltage regulator card A1. See Figure 5-21 and Figure 42 of circuit diagram TO 31P6-2FPS118-73-1. The input voltage is filtered via input filter capacitors C2 and C3 and supplied to the emitter of power switch Q1 and collector of power switches Q2 and Q3. Power switches Q2 and Q3 are biased with R2 and operated in parallel to increase the current carrying capacity. They are connected in series with the load via L1, CR2, and R5. When Q2 and Q3 are turned on, flyback diode CR1 is reverse biased and decoupling diode CR2 is forward biased. This enables output filter capacitor C6 to charge via power switches Q2 and Q3. When power switches Q2 and Q3 are turned off, the magnetic field around L1 collapses and forward biases flyback diode CR1 and decoupling diode CR2. This further charges output filter capacitor C6 to produce a well-regulated output voltage. (C8 is an RF bypass capacitor.) Power switches Q2 and Q3 are switched on and off at a 18 ± 5 kHz rate to maintain the required output voltage. Voltage regulator card A1 senses the voltage developed across C6 or at J1-K if an external voltage adjust is used. It senses the current through current sensing resistor R5. Voltage regulator card A1 uses these parameters to determine the required switching frequency. Regulator card A1 functions as a driver to switch power switch Q1 on and off. Power

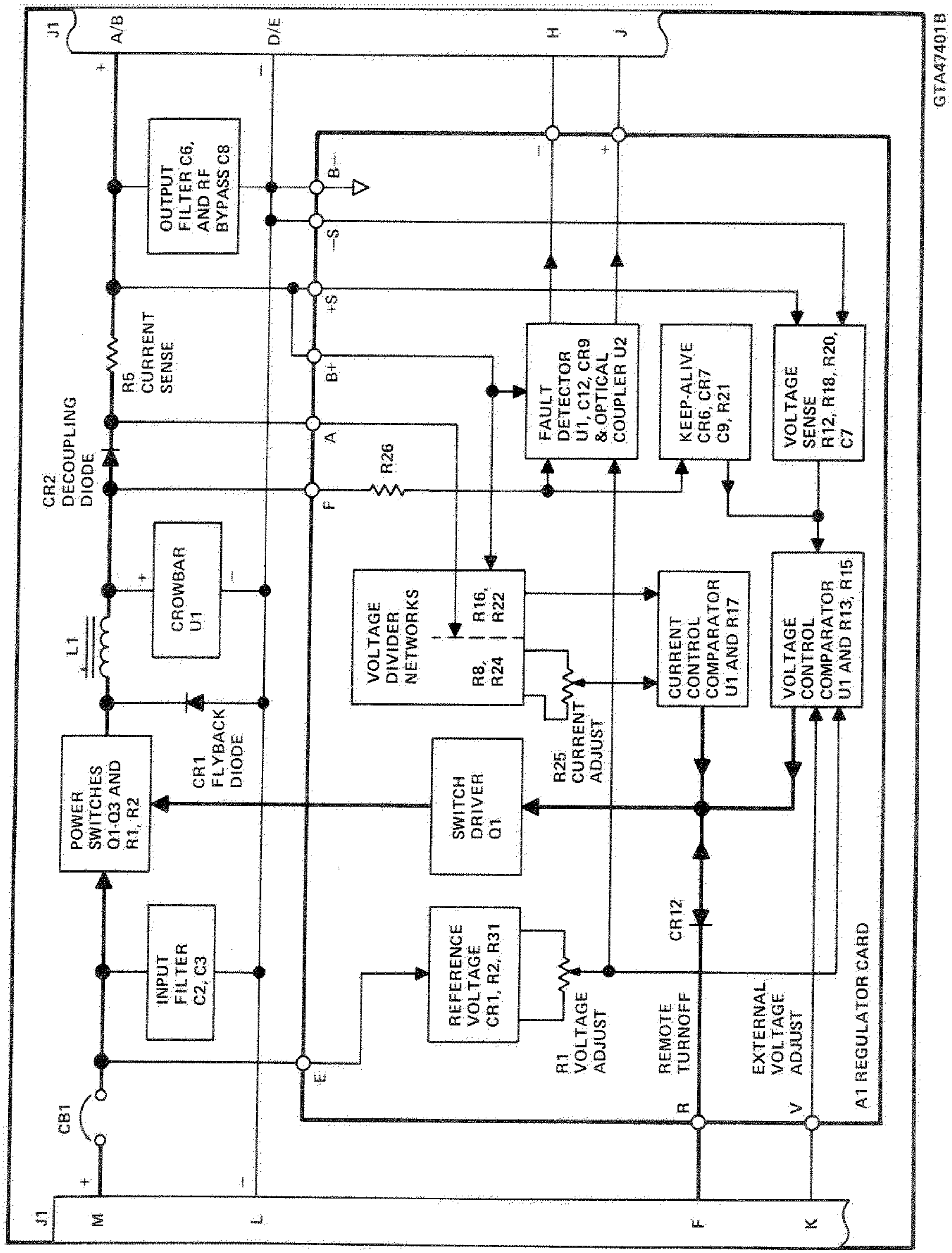

Figure 5-21. Voltage Regulator, Block Diagram

switch Q1 biases (switches) Q2 and Q3 on and off.

2. Resistor R1 is the biasing resistor for Q1. Q1 is turned on when regulator card A1 supplies a path to ground and approximately 0.6 V dc is developed across R1. When Q1 is turned on, approximately 0.6 V dc is developed across R2 to bias on Q2 and Q3. However, since these transistors are switched on and off at a 18 ± 5 kHz rate, these are not necessarily the voltages that would be measured with a voltmeter. During tests, use the nominal values supplied in the test procedure. Crowbar U1 is a protective device. If the output voltage exceeds +7.4 V dc ±5 percent at the anode of CR2, U1 turns on and pulls the dc output to ground. U1 functions as a clamp for short duration transients and a crowbar for large energy transients. In the clamp function, the response time of U1 is less than 10 nanoseconds. In the crowbar function, the response time of U1 is less than 50 microseconds. In the crowbar function, U1 latches to ground and remains latched until the input power is interrupted.

5-9.8.2 Regulator Card A1.

1. This circuit card monitors the regulator output voltage and current and controls the operation of power switches Q1 through Q3. Regulator A1 also provides EPM/AFL for external monitoring. Integrated circuit U1 is a quad comparator. See Figure 5-21 and Figure 42 of circuit diagram TO 31P6-2FPS118-73-1. One comparator provides voltage control, another provides current control, and the other two are for fault detection (EPM/AFL). The voltage and current comparator outputs are ORed with a remote turn-off to control switch driver A1Q1. If the output of either of the comparators goes low, or a low is coupled via CR12, A1Q1 and Q1 through Q3 are switched off. The reference voltage for the noninverting input of voltage comparator A1U1 is derived from a network consisting of zener diode A1CR1, A1R2, A1R31, and voltage adjust A1R1. The regulator output voltage is sensed via a voltage sense circuit that comprises A1R12, A1R18, A1R20, and C7. (C7 is a noise filter.) If the regulator output sense voltage applied to voltage control comparator A1U1 is less than the reference voltage, the voltage comparator output goes high thereby turning on power switches Q1 through Q3 via switch driver A1Q1. Current control comparator A1U1 operates in a manner similar to the voltage control comparator except the voltage developed across current sense resistor R5 is compared by current control comparator A1U1. The inverting input is obtained from a voltage divider network consisting of A1R8, A1R24, and current adjust A1R25. The noninverting input to current control comparator A1U1 is obtained via a voltage divider network that comprises A1R22 and A1R16. If the regulator output current limit of 43.0 to 43.5 A is exceeded, the inverted input to current control comparator A1U1 goes up, and the output of U1 goes low. This turns off switch driver A1Q1, and Q1 through Q3. Resistor A1R17 provides a start-up bias for current control comparator A1U1 where there is no output voltage or when the output is shorted.

2. Varying ripple current and voltage affect the switching speed and stability of the regulator. Therefore, compensation is incorporated with resistors A1R13 and A1R15 providing hysteresis on voltage control comparator A1U1.

3. A keep-alive circuit consisting of A1CR6, A1CR7, A1C9, and A1R21 is provided to periodically turn on the regulator to prevent generation of a fault indication. When switches Q1 through Q3 turn on, A1C9 charges through A1R26 and A1CR7. The time constant of A1C9 and A1R21 is 1 millisecond. Normally, A1C9 is always charged. When the regulator output sense voltage at the input to voltage control comparator A1U1 is higher than the reference voltage, A1C9 discharges. This discharge occurs because the output of the voltage control comparator is low, and because there is no increase in output voltage. Capacitor A1C9 discharges until its voltage is lower than the reference voltage. This condition initiates current flow through A1CR6 which lowers the sense voltage. When the sense voltage drops to less than the reference voltage, the voltage control comparator output goes high. Switches Q1 through Q3 are turned on, and the output voltage is increased. The resulting current through A1R26 recharges A1C9.

4. The regulator contains a fault detection function that is similar in operation to the keep-alive circuit. Since the regulator may be used in a parallel configuration, monitoring the output voltage is not sufficient. The output voltage does not change with the failure of one regulator of a parallel pair. Therefore, the regulator output fault sense point is isolated from the load by decoupling

diode CR2. The fault sense input is developed across capacitor A1C12. It charges through A1R26 and A1CR9 and remains charged during normal regulator on-off switching. The fault sense input is compared to the reference voltage established by voltage adjust potentiometer A1R1. The fault sense voltage normally is higher than the reference voltage. This condition maintains normal current flow to the diode of optical coupler A1U2 thereby providing a fail-safe mode of operation. (The optical coupler provides electrical isolation between the regulator and external EPM/AFL circuits.) In the event the regulator fails to switch on, capacitor A1C12 discharges causing the fault sense voltage to decrease. When the fault sense voltage decays below the reference voltage, fault detector A1U1 goes high. This fault condition inhibits current flow through the optical coupler.

5-9.9 +/-15 V Dc Voltage Regulator (77D609503G1). The +/-15 V dc regulator is a voltage stepdown switching regulator. It operates on a +/-25 ± 5 V dc power supply to deliver a regulated full-load output of +/-15.5 ± 0.05 V dc at 15 A. Voltage regulation is 50 mV rms at full load. The regulator has floating inputs and outputs with a common negative. It can be used as a positive or negative voltage regulator, depending on which output is referenced to ground. Voltage regulation and current limiting is accomplished by switching (turning on and off) the input voltage at 17.5 ± 5 kHz rate and filtering the output voltage. The switching frequency is determined by the load current. The greater the load current the higher the switching frequency. As shown in Figure 5-21, the regulator consists of chassis-mounted components and regulator card A1. The chassis-mounted components are discussed in paragraph 5-9.9.1. Regulator card A1 is discussed in paragraph 5-9.9.2. The chassis-mounted components provide a current path for the input/output current. They also enable voltage regulator card A1 to monitor parameters such as the voltage and current supplied by the regulator. Regulator card A1 uses these parameters to determine the switching frequency. Regulator card A1 also provides a fault status output for EPM/AFL.

5-9.9.1 Chassis-Mounted Regulator Components.

1. The chassis-mounted components provide filtering and an input/output current path under control of voltage regulator card A1. See Figure 5-21 and Figure 43 of circuit diagram TO 31P6-2FPS118-73-1. The input voltage is filtered via input filter capacitors C2 and C3 and supplied to the emitter of power switch Q1 and collector of power switches Q2 and Q3. Power switches Q2 and Q3 are biased with R2 and operated in parallel to increase the current carrying capacity. They are connected in series with the load via L1, CR2, and R5. When Q2 and Q3 are turned on, flyback diode CR1 is reverse biased and decoupling diode CR2 is forward biased. This enables output filter capacitor C6 to charge via power switches Q2 and Q3. When power switches Q2 and Q3 are turned off, the magnetic field around L1 collapses and forward biases flyback diode CR1 and decoupling diode CR2. This further charges output filter capacitor C6 to produce a well-regulated output voltage. (C8 is an RF bypass capacitor.) Power switches Q2 and Q3 are switched on and off at a 17 ± 5 kHz rate to maintain the required output voltage. Voltage regulator card A1 senses the voltage developed across C6 or at J1-K if an external voltage adjust is used. It senses the current through current sensing resistor R5. Voltage regulator card A1 uses these parameters to determine the required switching frequency. Regulator card A1 functions as a driver to switch power switch Q1 on and off. Power switch Q1 biases (switches) Q2 and Q3 on and off.

2. Resistor R1 is the biasing resistor for Q1. Q1 is turned on when regulator card A1 supplies a path to ground and approximately 0.6 V dc is developed across R1. When Q1 is turned on, approximately 0.6 V dc is developed across R2 to bias on Q2 and Q3. However, since these transistors are switched on and off at a 17 ± 5 kHz rate, these are not necessarily the voltages that would be measured with a voltmeter. During tests, use the nominal values supplied in the test procedure. Crowbar U1 is a protective device. If the output voltage exceeds +19 V dc ± 5 percent at the anode of CR2, U1 turns on and pulls the dc output to ground. U1 functions as a clamp for short duration transients and a crowbar for large energy transients. In the clamp function, the response time of U1 is less than 10 nanoseconds. In the crowbar function, the response time of U1 is less than 50 microseconds. In the crowbar function, U1 latches to ground and remains latched until the input power is interrupted.

5-9.9.2 Regulator Card A1.

1. This circuit card monitors the regulator output voltage and current and controls the operation of power switches Q1 through Q3. Regulator A1 also provides EPM/AFL for external monitoring. Integrated circuit U1 is

a quad comparator. See Figure 5-21 and Figure 43 of circuit diagram TO 31P6-2FPS118-73-1. One comparator provides voltage control, another provides current control and the other two are for fault detection (EPM/AFL). The voltage and current comparator outputs are ORed with a remote turn-off to control switch driver A1Q1. If the output of either of the comparators goes low or a low is coupled via CR12, A1Q1 and Q1 through Q3 are switched off. The reference voltage for the noninverting input of voltage comparator A1U1 is derived from a network consisting zener diode A1CR1, A1R2, A1R31, and voltage adjust A1R1. The regulator output voltage is sensed via a voltage sense circuit that comprises A1R12, A1R18, A1R20, and C7. (C7 is a noise filter.) If the regulator output sense voltage applied to voltage control comparator A1U1 is less than the reference voltage, the voltage comparator output goes high thereby turning on power switches Q1 through Q3 via switch driver A1Q1. Current control comparator A1U1 operates in a manner simular to the voltage control comparator except the voltage developed across current sense resistor R5 is compared by current control comparator A1U1. The inverting input is obtained from a voltage divider network consisting of A1R8, A1R24, and current adjust A1R25. The noninverting input to current control comparator A1U1 is obtained via a voltage divider network that comprises A1R22 and A1R16. If the regulator output current limit of 13.5 to 14.5 A is exceeded, the inverted input to current control comparator A1U1 goes up and the output of U1 goes low. This turns off switch driver A1Q1, and Q1 through Q3. Resistor A1R17 provides a start-up bias for current control comparator A1U1 where there is no output voltage or when the output is shorted.

2. Varying ripple current and voltage affect the switching speed and stability of the regulator. Therefore, compensation is incorporated with resistors A1R13 and A1R15 providing hysteresis on voltage control comparator A1U1.

3. A keep-alive circuit consisting of A1CR6, A1CR7, A1C9, and A1R21 is provided to periodically turn on the regulator to prevent generation of a fault indication. When switches Q1 through Q3 turn on, A1C9 charges through A1R26 and A1CR7. The time constant of A1C9 and A1R21 is 1.0 millisecond. Normally, A1C9 is always charged. When the regulator output sense voltage at the input to voltage control comparator A1U1 is higher than the reference voltage, A1C9 discharges. This discharge occurs because the output of the voltage control comparator is low, and because there is no increase in output voltage. Capacitor A1C9 discharges until its voltage is lower than the reference voltage. This condition initiates current flow through A1CR6 that lowers the sense voltage. When the sense voltage drops to less than the reference voltage, the voltage control comparator output goes high. Switches Q1 through Q3 are turned on, and the output voltage is increased. The resulting current through A1R26 recharges A1C9.

4. The regulator contains a fault detection function that is similar in operation to the keep-alive circuit. Since the regulator may be used in a parallel configuration, monitoring the output voltage is not sufficient. The output voltage does not change with the failure of one regulator of a parallel pair. Therefore, the regulator output fault sense point is isolated from the load by decoupling diode CR2. The fault sense point is developed across capacitor A1C12. It charges through A1R26 and A1CR9 and remains charged during normal regulator on-off switching. The fault sense input is compared to the reference voltage established by voltage adjust potentiometer A1R1. The fault sense voltage normally is higher than the reference voltage. This condition maintains normal current flow to the diode of optical coupler A1U2 thereby providing a fail-safe mode of operation. (The optical coupler provides electrical isolation between the regulator and external EPM/AFL circuits.) In the event the regulator fails to switch on, capacitor A1C12 discharges causing the fault sense voltage to decrease. When the fault sense voltage decays below the reference voltage, fault detector A1U1 goes high. This fault condition inhibits current flow through the optical coupler.

5-9.10 <u>Power Supply Controller (77D611601G1).</u> The power supply controller monitors and controls the operation of multiple dc power supply assemblies. It is capable of controlling the operation of +5 V, +/-15 V, +24 V, and +/-60 V dc power supply assemblies. Its primary control function is to monitor the output of like dc power supply assemblies operating in parallel and enforcing load sharing and balancing. Power supply assembly operation also is monitored to produce alarms in the event of an overvoltage condition or power supply assembly fault. As shown in Figure 5-22, the power supply controller consists of an overvoltage level sensing circuit and five current control circuits. The current control circuits are similar and each one is dedicated to controlling the paralleled operation of a specific power supply assembly. Each power supply controller contains one +/-15 V dc and one +/-60 V dc current control circuit. Therefore, it is obvious that two controllers are required to control a paralleled pair of +/-15 V or +/-60 V dc power supplies. Three of the current control circuits (Nos. 1 through 3) are functionally identical and are dedicated to controlling either +5 V or +24 V power supplies. Therefore, a pair of power supply controllers can control up to three +5 V and three +24 V dc power supply assemblies. Refer to paragraph 5-9.10.1 for a description of the operation of the overvoltage sensing function. Paragraph 5-9.10.2 gives a description of the operation of current control circuits Nos. 1 through 5.

5-9.10.1 Overvoltage Level Sensing. The power supply controllers contain overvoltage sensing circuits for the equipment +5 V, +/-15 V, +24 V, and +/-60 V dc distribution system. These are shown in block diagram form by Figure 5-23. Refer to Figure 86 of transmit group circuit diagram TO 31P6-2FPS118-73-1 for a schematic of these circuits. This function contains three sensing circuits, i.e., one for the +5 V or +24 V dc distribution system and one each for the +/-15 V and +/-60 V dc distribution systems. An external jumper on the mating connector is used to select the proper reference for either +5 V dc or +24 V dc operation. All three sensing circuits use comparators (U2A, B, and C) that compare the distribution system line voltage with a +5.8 V precision reference voltage. In addition to the comparators, the +/-15 V dc and the +/-60 V dc level sensing circuits use dual-input operational amplifiers U1A and U1B to enable these level sensing circuits to respond to both plus and minus supplies. The level sensing comparators are connected to hex inverter U4 to provide the necessary logic for overvoltage (OVV) LEDs (red) DS1 through DS3. When the +5/24 V dc level sensing circuit is connected by external jumper to operate at +5 V dc, the level sensing comparator issues an overvoltage signal to light DS1 whenever the distribution system line voltage is +5.88 V dc or greater. When the +5/24 V level sensing circuit is connected by an external jumper to operate at +24 V dc, the level sensing comparator issues an overvoltage signal to light DS1 whenever the distribution system line voltage is +26.6 V dc or greater. The +/-60 V dc level sensing circuit issues an overvoltage signal to light DS2 whenever the distribution line voltage is +/-66 V dc or greater. The +/-15 V dc level sensing circuit issues an overvoltage signal to light DS3 whenever the distribution line voltage is +/-17.15 V dc or greater. The three level sensing circuits also send an overvoltage signal to the fault monitoring circuits of their respective current control circuits (Figure 5-24). The +2.5/5.8 V precision reference circuits (CR1, U1C, U1D) also provide both voltage references to the current control circuits. Precision reference voltage calibration is accomplished by adjusting the voltage between +2.5 $\pm$ 0.003 V dc using potentiometer R3 (Figure 5-23). A nonprecision voltage reference source (CR2, CR3) also provides +0.7/10 V to the current control circuits (Figure 5-24).

5-9.10.2 Current Control Circuits (Nos. 1 through 5). As previously mentioned, each of the five current control circuits is dedicated to the control and monitoring of a specific power supply assembly. The purpose being to enforce load sharing and balancing the load between paralleled power supply assemblies. This is accomplished by monitoring the load current of each power supply assembly and comparing that value to a voltage proportional to the average current delivered by each of the power supply assemblies operating in parallel. An error/control signal is generated if a particular power supply assembly is delivering less than 80 percent of the average current sampled. These five similar current control circuits are typically represented by the block diagram (Figure 5-24) for the +5/24 V current control circuit No. 1. Refer to Figure 86 of transmit group circuit diagram TO 31P6-2FPS118-73-1 for a schematic of this circuit. Monitoring of the power supply load current is done by a load sensing circuit consisting of operational amplifier U6A with a gain of 100. This circuit senses the power supply assembly load current through a current sensing shunt resistor (part of the power supply assembly) connected between P1-4 (shunt 1-) and P1-5 (shunt 1+). In the case of the +5/24 V dc power supplies controlled by current control circuit No. 1, the shunt produces 1 mV per ampere of load current. Each of these load sensing circuits are individually adjustable. Their output is set to 0 $\pm$ 0.002 V dc (at J1 for circuit No. 1) with respect to the +2.5 V dc precision voltage reference (at J6). The zero setting is referenced to +2.5 V dc to permit a negative swing to be sensed. Zero adjust potentiometer R36 is used to make this adjustment for circuit No. 1. The sensed power supply assembly current is used by the load share sensing circuit to determine if the power supply assembly is delivering at least 80 percent of its share of the load. The load share sensing circuit consists of operational amplifier U6B, and C12. This circuit compares the power supply assembly current from the load sensing function with a voltage proportional to 80 percent of the average current of each of the parallel power supply assemblies carrying the load (or power supply assembly load share x 0.80). This 80 percent share reference value appears at input connector P1-9 for circuits No. 1 and No. 2 (labeled I-BUS+5/24). If the power supply

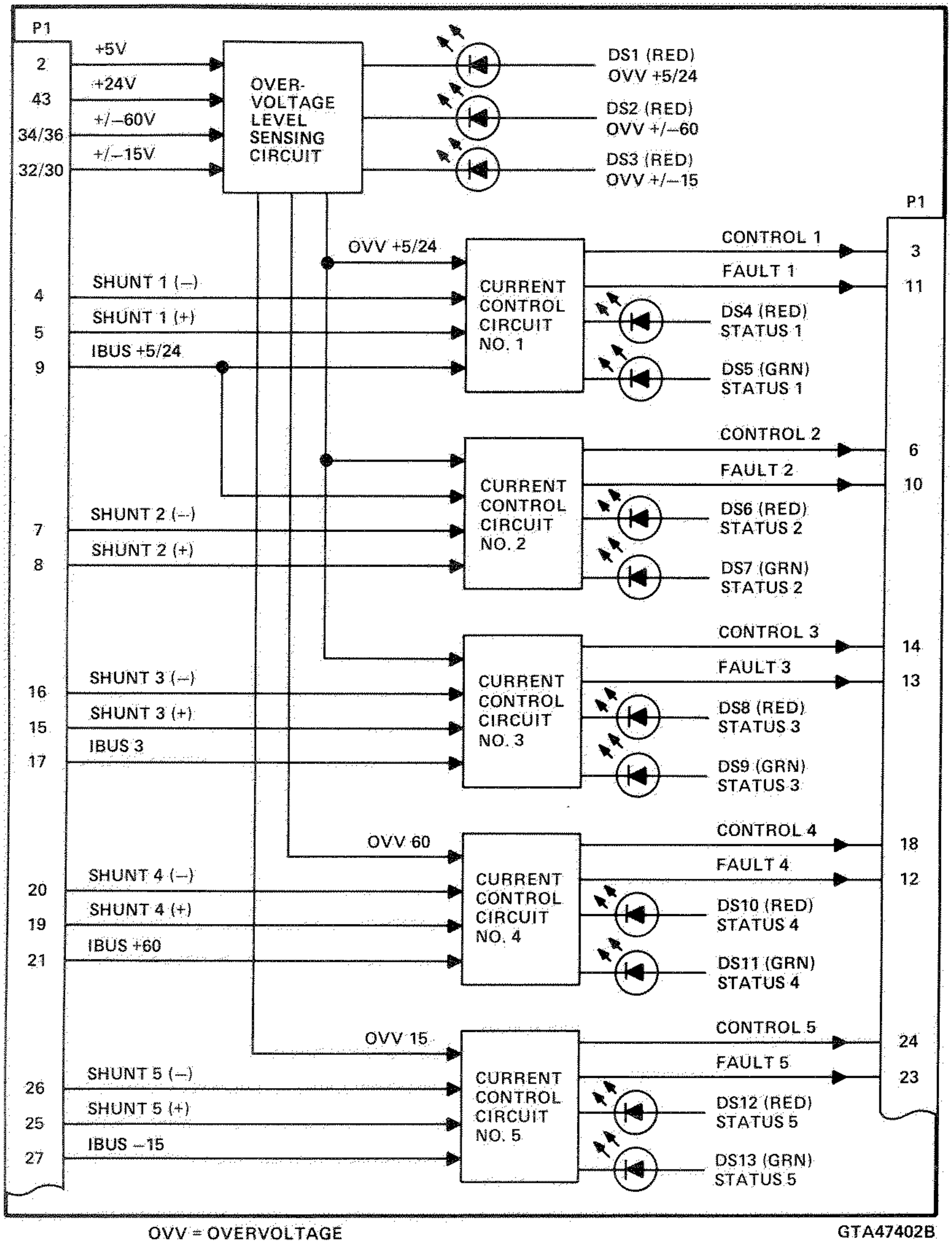

Figure 5-22. Power Supply Controller, Overall Block Diagram

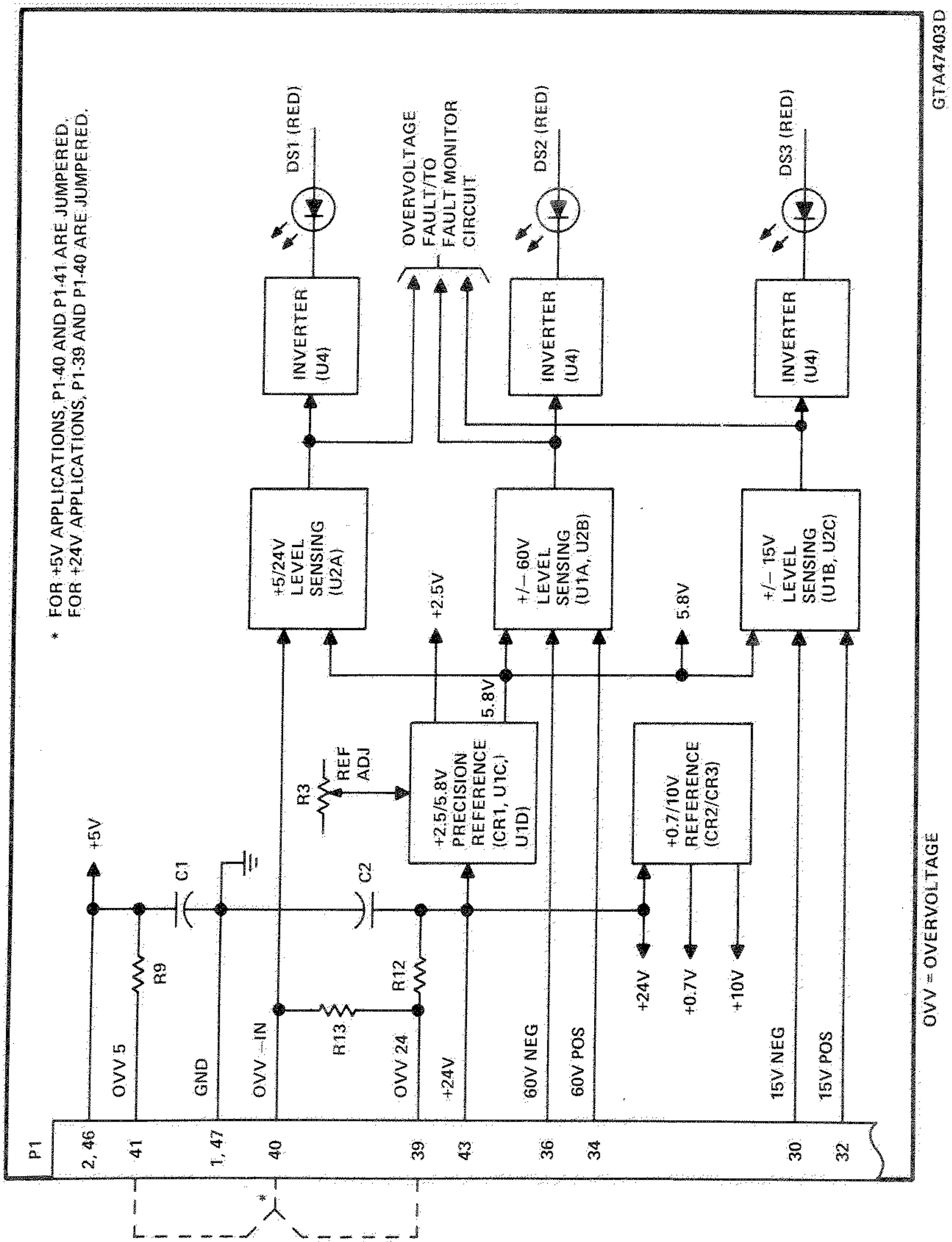

Figure 5-23. Power Supply Controller, Overvoltage Level Sensing, Block Diagram

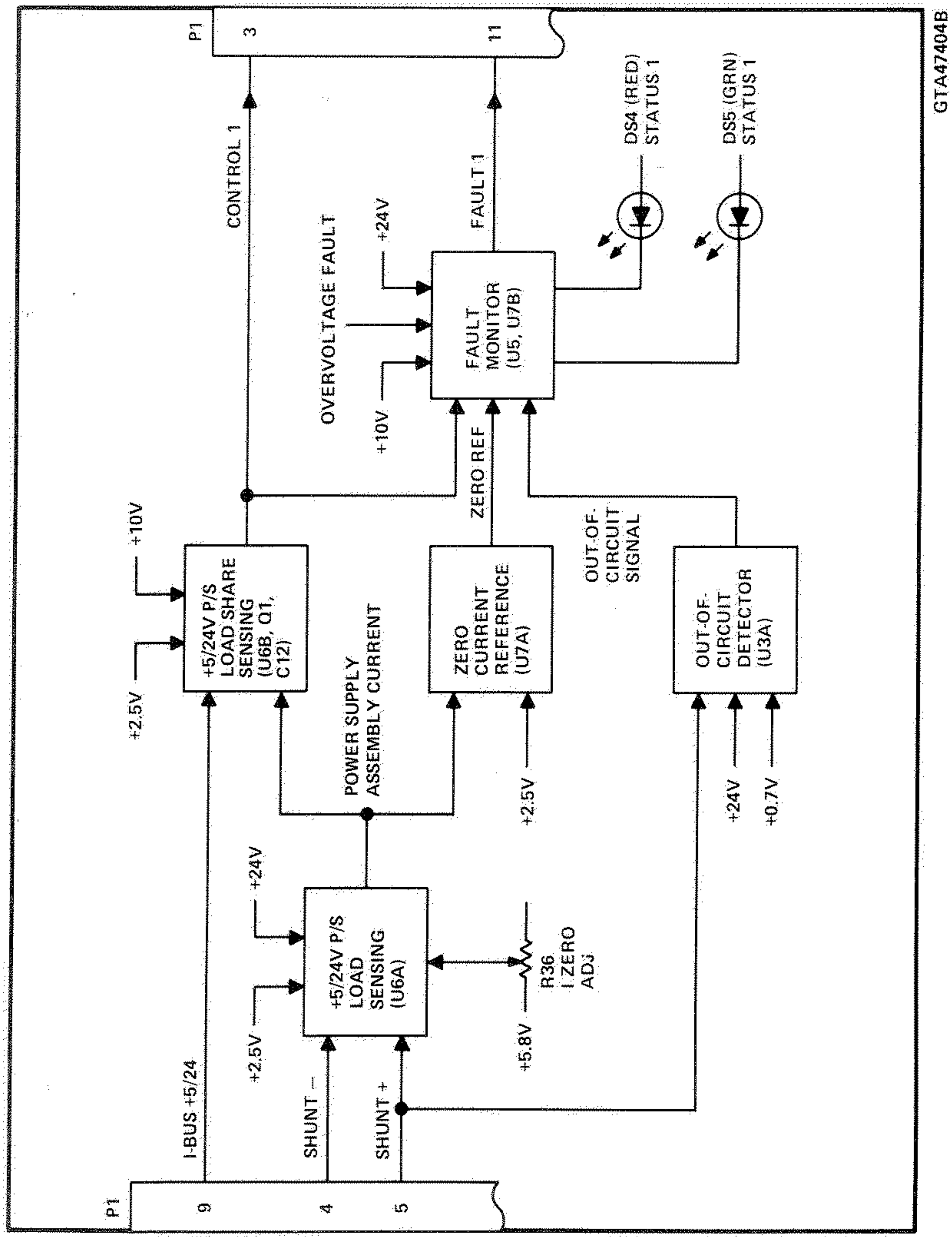

Figure 5-24. Power Supply Controller, Current Control Circuit (Typical), Block Diagram

assembly is carrying less than 80 percent of its share, an error signal is developed and integrated by capacitor C12 and returned to the power supply assembly via connector P1-3 as a control 1 signal. This signal forces the power supply assembly to a slightly higher voltage to increase its output current. (Refer to paragraph 5-9.5.) Each power supply assembly current control circuit provides for fault monitoring of its associated power supply assembly. Fault monitoring consists of evaluating the power supply assembly overvoltage signal (OVV+5/24 for current control circuits Nos. 1 through 3), power supply assembly load share control (error) signal, a power supply assembly out-of-circuit signal, and a 0 current reference. The +2.5 V zero current reference is developed by comparator U7A for a 0 current level from the power supply assembly under control. Comparator U3A generates an out-of-circuit fault signal when the power supply assembly current sensing shunt circuit is open. The fault monitoring circuit consisting of inverter U5 and comparator U7B produces a fault 1 signal at connector P1-11. This fault 1 signal is the logical sum of the status of the load share error signal, 0 current reference, and the overvoltage OVV+5/24 signal. The fault monitoring circuit also generates a power supply assembly status signal for lighting the STATUS LEDs (red or green) as appropriate. DS4, for current control circuit No. 1, lights (red) in the event of a power supply assembly overvoltage condition. DS5 lights (green) during a no-fault condition.

CHAPTER 6

MAINTENANCE

Section I. ORGANIZATIONAL AND INTERMEDIATE MAINTENANCE

6-1 INTRODUCTION.

This section provides procedures for organizational and intermediate maintenance of the transmitter group. These procedures are performed at the radar system transmit site, as required, by organizational and intermediate maintenance personnel. The concept for organizational and intermediate maintenance of the radar system primarily is based on automatic equipment performance monitoring (EPM) and automatic fault location/isolation (AFL/I) with repair accomplished by line replaceable unit (LRU) replacement at the transmit site. Failed LRUs then are returned to a maintenance facility for repair. Maintenance data given in this section includes safety procedures; preventive maintenance services; inspection, cleaning, and painting procedures; lubrication services; general repair procedures; equipment group LRU removal and installation procedures; automatic EPM and AFL/I procedures; equipment group checks, and test and alignment procedures.

6-1.1 Equipment Required But Not Supplied. The equipment required but not supplied, necessary to perform the maintenance procedures given in this chapter, is identified in Chapter 1, Table 1-4.

6-1.2 Consumable Materials. Consumable materials used when performing the maintenance procedures given in this chapter are identified in Table 6-1.

6-1.3 Test Equipment Characteristics. Test equipment required when performing the maintenance procedures given in this chapter is identified in Table 6-2. A brief description of the operating characteristics for each equipment is also provided.

6-2 GENERAL SAFETY PROCEDURES .

The following paragraphs provide general safety procedures that should be followed when maintenance is performed on the transmitter group. Included is a brief description of the safety interlock circuits incorporated in the transmitter group. Additional general maintenance practices are described in TO 31-1-75.

6-2.1 Interlocks.

1. Transmitter Module. There are an extensive number of interlocks associated with the transmitter module. The status of each interlock is shown through a number of indicators on the status panel and subassemblies. INTERLOCK OPEN indicator on the status panel lights (red) when any cabinet or stick interlock is open and equipment operation is inhibited.
2. Antenna Gate Interlock Key Block. An antenna field gate interlock key block is located in the transmitter building in all three segments. The key block is meant to prevent unsafe entry into the antenna fields. The key block contains the field gate keys that allow access to the main transmit antenna field and sounder out-of-coverage antenna field. These keys can be obtained only after the RF energy radiating in their respective fields has been disabled. For the main transmit antenna field, both the transmitter and sounder RF energy must be disabled before keys can be obtained. The key block releases the main antenna field gate keys only when the key from the main HVAC disconnect switch is inserted and rotated in key block. Also, the insertion and rotation of main HVAC switch key automatically removes high voltage from the sounder power amplifiers. To obtain the sounder out-of-coverage antenna field gate key only the sounder RF energy must be disabled. The key block releases the sounder out-of-coverage antenna field gate key only when the keys from the sounder power amplifier primary power circuit breakers are inserted and rotated in the key block.

6-2.2 Voltage and Current Hazards. Dangerous voltages and current sources exist within equipment cabinets and housing of the transmitter group. Observe the following precautions when performing maintenance activities:

1. Unless required for test purposes, ensure circuit breakers or switches supplying power to the equipment are set to OFF position and marked with a warning sign that indicates maintenance is being performed and that they must not be energized. Do not remove the sign nor turn on the power until maintenance is complete. Do not depend on door or equipment actuated interlock switches to remove power for maintenance purposes.

Table 6-1. Consumable Materials List

Item No.	Item	Ident No.	Specification	Unit of Issue	Responsible Technical Service or Source[1]	Purpose
1	Adhesive	7236275P2 or RTV 108 clear	--	oz oz	CAGE 03538 CAGE 01139	Securing door gaskets and blower gaskets
2	Alcohol, butyl (butanol) (N-butyl alcohol)		ASTM-D304	gal	CAGE 81348	Preparing alcohol-phosphoric acid solution
3	Alcohol, denatured 190 proof		0-E-00760 grade 3	gal	CAGE 81348	Cleaning printed wiring board (PWB)
4	Alcohol, isopropyl (propanol)		TT-I-735	gal	CAGE 81348	General cleaning and preparing alcohol-phosphoric acid solution
5	Aluminum wool		MIL-A-4864	lb	CAGE 81349	Cleaning aluminum surfaces
6	Brush, artist's, flat edge, 1/2-in wide		H-B-118	Each	CAGE 81348	Applying paints or cleaners
7	Brush, cleaning, aircraft[2]		MIL-B-23958	Each	CAGE 80244	Applying paint remover
8	Brush, acid, 3/8-in wide	AB-1	--	Each	CAGE 16571	Cleaning or applying solvents
9	Brush, varnish, flat, with chisel edge, 1-in wide x 7/16-in thick x 2 1/4-in long		H-B-695	Each	CAGE 81348	Apply paints or cleaners
10	Brush wire, stainless steel	7187T4	--	Each	CAGE 39428	Remove heavy corrosion from steel

Table 6-1. Consumable Materials List -CONT

Item No.	Item	Ident No.	Specification	Unit of Issue	Responsible Technical Service or Source[1]	Purpose
11	Chamois, leather, sheepskin		KK-C-300	Each	CAGE 81348	Wiping and drying glass and painted surfaces of equipment after washing
12	Cheesecloth		CCC-C-440	yd	CAGE 80244	Tack rags and general cleaning
13	Cleaning compound, degreasing, self-emulsifying		MIL-C-11090	gal	CAGE 81349	Removing oil, dust, and grease from painted metal surfaces
14	Cloth, abrasive, aluminum oxide, grit No. 240, grade 7/0		P-C-451 type I	Sheets	CAGE 81348	Mechanical removal of corrosion
15	Cloth, abrasive, aluminum oxide, grit No. 320, grade 9/0		P-C-451 type I	Sheets	CAGE 81348	Mechanical removal of corrosion
16	Cloth, crocus	AA-1206	--	Sheet	CAGE 58536	Removing corrosion and cleaning finely finished surfaces
17	Coating, conductive	7849855P1 or Penetrox A13	-- --	qt qt	CAGE 03538 CAGE 09922	Prevents oxidation of aluminum terminal connections
18	Coating compound, metal pretreatment, resin acid		DOD-P-15328	5 gal	CAGE 81348	For pretreatment of metal before painting
19	Corrosion-removing compound		MIL-C-10578 type I	qt	CAGE 81349	Chemical removal of corrosion products
20	Corrosion-resistant primer		MIL-C-5541	4-oz bottle	CAGE 81349	Paint base and corrosion-resistant film for aluminum

Table 6-1. Consumable Materials List -CONT

Item No.	Item	Ident No.	Specification	Unit of Issue	Responsible Technical Service or Source[1]	Purpose
21	Compound, antiseize		MIL-T-22361	lb	CAGE 81349	Between threaded aluminum parts or between threaded steel and aluminum parts
22	Compound, sealing		MIL-S-22473	2 cc tube	CAGE 05972	Applied to threads of screws
23	Detergent, painted surface		P-D-220	5 lb	CAGE 81348	Cleaning painted surfaces
24	Enamel, blue	15045	TT-E-489 (Fed Std 595)	gal	CAGE 80244	Enamel finish coat
25	Enamel, gray	26622	TT-E-529 (Fed Std 595)	gal	CAGE 81348	Enamel finish coat (interior)
26	Enamel, gray	26492	TT-E-529 (Fed Std 595)	gal	CAGE 81348	Enamel finish coat (outside surfaces of control panels)
27	Grease, silicone		MIL-C-21567	lb	CAGE 81349	Weatherseal for transmission line group tread plates
28	Lubricant, silicone spray	G620S or silicon 7	--	16-oz aerosol	CAGE 01139 CAGE 92381	General lubrication
29	Phosphoric acid		OME-PD109 MIL-C-10578	qt	CAGE 81348 CAGE 81349	For preparing alcohol-phosphoric acid solution
30	Band (sleeve), crimping	188-3-VG	--	Each	CAGE 76691	Antenna ground screen repair
31	Compound, sealing	7846206 or CP16	--	pt	CAGE 59730	For use on antenna element assembly
32	Passivation compound	Pasa-Jell 101	--	qt	CAGE 83574	For use on corrosion-resistant steel
33	Primer		MIL-S-22473-GNFR	6-oz can	CAGE 81348	Apply to screw threads
34	Heliax transmission line	H8-50	--	Roll	CAGE 84147	3 in transmission line

Table 6-1. Consumable Materials List -CONT

Item No.	Item	Ident No.	Specification	Unit of Issue	Responsible Technical Service or Source[1]	Purpose
35	Primer, zinc chromate		TT-P-1757	gal	CAGE 81348	Primer coat
36	Rags, wiping, cotton		DDD-R-30	50 lb bale	CAGE 81348	General cleaning
37	Remover, paint, organic solvent type		MIL-R-25134 or TT-R-248	qt	CAGE 81349 CAGE 81348	For removing paint and lacquer
38	Solvent	Freon TE	--	gal	CAGE 73925	For general cleaning
39	Heliax transmission line	H11-50	--	Roll	CAGE 84147	4 in transmission line
40	Sodium phosphate, tribasic, anhydrous, technical		O-S-642	25 lb bag	CAGE 81348	For cleaning lacquered surfaces
41	Spray coolant	Freon R12	--	Aerosol can	Commercial	For rapid cooling of components during testing
42	Steel wool		FF-W-1825	--	CAGE 81348	Mechanical cleaning of steel and steel alloys
43	Steel wool, stainless		FF-W-1825	Roll	CAGE 81348	Remove severe corrosion from steel
44	Tape, thread sealing	9975260 GT66	-- --	Roll Roll	 CAGE 06090	Secure transmission line components
45	Thinner, synthetic		TT-T-306 type 2	gal	CAGE 80244	For thinning synthetic enamels
46	Thinner, paint, mineral spirits	TT-T-291 type 1	--	gal	CAGE 80244	General cleaning and paint thinning
47	Thermal-conducting grease	7844068P1 or V-742 Insul grease	--	2 oz 2 oz	CAGE 03538 CAGE 01139	Heat-conductive compound used when mounting heat-sensitive components

Table 6-1. Consumable Materials List -CONT

Item No.	Item	Ident No.	Specification	Unit of Issue	Responsible Technical Service or Source[1]	Purpose
48	Wire, daisy-chain jumper	47067		Roll (250 jumpers)	CAGE 22526	For use in troubleshooting wire-wrap boards and backplane assemblies
49	Wire fabric	77C714817P1	--	Roll	CAGE 14045	Repair 22 in x 22 in mesh back-screen
50	Wire fabric	77C714817P2	--	Roll	CAGE 14045	Repair 22 in x 22 in mesh back-screen
51	Wire fabric	77C714817P3	--	Roll	CAGE 14045	Repair 22 in x 22 in mesh back-screen
52	Wire fabric	77C714817P4	--	Roll	CAGE 14045	Repair 22 in x 22 in mesh back-screen
53	Wire fabric	77C714817P5	--	Roll	CAGE 14045	Repair 22 in x 22 in mesh back-screen
54	Wire fabric	77C714817P6	--	Roll	CAGE 14045	Repair 14 in x 14 in mesh back-screen
55	Wire fabric	77C714817P7	--	Roll	CAGE 14045	Repair 14 in x 14 in mesh back-screen
56	Wire fabric	77C714817P8	--	Roll	CAGE 14045	Repair 14 in x 14 in mesh back-screen
57	Wire fabric	77C714817P9	--	Roll	CAGE 14045	Repair 14 in x 14 in mesh back-screen
58	Wire fabric	77C714817P10	--	Roll	CAGE 14045	Repair 10 in x 10 in mesh back-screen
59	Wire fabric	77C714817P11	--	Roll	CAGE 14045	Repair 10 in x 10 in mesh back-screen
60	Wire fabric	77C714817P12	--	Roll	CAGE 14045	Repair 10 in x 10 in mesh back-screen
61	Wire fabric	77C714817P15	--	Roll	CAGE 14045	Repair 10 in x 10 in mesh back-screen

Table 6-1. Consumable Materials List -CONT

Item No.	Item	Ident No.	Specification	Unit of Issue	Responsible Technical Service or Source[1]	Purpose
62	Wire fabric	77C714817P16	--	Roll	CAGE 14045	Repair 10 in x 10 in mesh back-screen
63	Tubing, copper, soft 5/16 inch ID	--	WW-T-799	Roll	CAGE 81348	12 inch straight section for heat gun extension
64	Heliax transmission line	H9-50	--	Roll	CAGE 84147	5 in transmission line
65	Reattachment kit	34767A-10	--	Each	CAGE 84147	Repair 3 in heliax cable
66	Reattachment kit	34767A-15	--	Each	CAGE 84147	Repair 4 in heliax cable
67	Reattachment kit	34767A-8	--	Each	CAGE 84147	Repair 5 in heliax cable
68	Wire	No. 8 Awg	--	Roll	CAGE 73616	Repair of groundscreen
69	Compound, pipe thread	888738-81	TT-S-1732	lb	CAGE 89481	Sealing pipe threads
70	Vinyl tubing 1/2 ID, 1 1/2 inch long	--	--	--	Any	Drain transmitter accumulator tank
71	Vinyl tubing 1/2 OD, 8 ft long	--	--	--	Any	Drain transmitter accumulator tank

[1] Commercial and Government Entity code numbers.

[2] This brush is supplied without a handle. Be sure to provide a long handle before working with acid solution.

Table 6-2. Test Equipment Characteristics

Nomenclature	Characteristics
Analyzer, spectrum (display main frame) (HP 141T)	Maximum Input Level: peak or average power +13 dB (1 mW) (1.4 V ac peak), ± 50 V dc
Plug-in intermediate frequency (IF[1]) section, (HP 8552B)	Included in HP 8553B and HP 8554B characteristics below
Plug-in, radio frequency (RF[2]) section, (HP 8553B)	With HP 8552B IF Section
	Frequency Range: 0 to 110 MHz
	Frequency Accuracy
	Center frequency accuracy: The dial indicates the display center frequency within ± 1 MHz on the 0 to 110 MHz tuning range; ± 200 kHz on the 0 to 11 MHz tuning range with fine tune centered
	Absolute Amplitude Calibration Range
	Log: from -130 to +10 dB (1 mW), 10 dB/division on a 70-dB display or 2 dB/division on a 16-dB display
	Amplitude Accuracy: Log Frequency response (Flatness: attenuator settings >10 dB): ± 0.5 dB from 1 kHz to 110 MHz
Plug-in, RF section, (HP 8554B)	With HP 8552B IF Section
	Frequency Range: 110 kHz to 1250 MHz
	Frequency Accuracy
	Center frequency accuracy: The dial indicates the display center frequency within 10 MHz
	Absolute Amplitude Calibration Range
	Log: from -122 to +10 dB (1 mW): 10 dB/division on a 70-dB display or 2 dB/division on a 16-dB display
	Amplitude Accuracy: Log frequency response (flatness) ± 1.0 dB from 100 kHz to 1250 MHz
Logic pulser (HP 546A)	Output Voltage: high is > 3.0 V dc, low is < 0.8 V dc
	Output Current: < 650 mA
	Pulse Width: > 0.5 microsecond
	Pulse Repetition Rate: Single pulse. Pulse stream of 1, 10, or 100 Hz. Bursts of 10 or 100 Hz. Bursts of 10 or 100 pulses
Counter, frequency (HP 5342A)	Signal Input 1
	Frequency Range: 500 MHz to 18 GHz
	Accuracy: ± 1 count ± time base error
	Sensitivity: 500 MHz to 12.4 GHz: -25 dB (1 mW)
	12.4 GHz to 18 GHz: -20 dB (1 mW)

Table 6-2. Test Equipment Characteristics -CONT

Nomenclature	Characteristics
	Maximum Input: +7 dB (1 mW)
	Signal Input 2
	Frequency Range: 10 Hz to 520 MHz direct count
	Sensitivity: 50 Ohm: 10 Hz to 520 MHz: 25 mV rms 1
	Mohm: 10 Hz to 25 MHz: 50 mV rms
	Maximum Input: 50 Ohm: 3.5 V rms [+ 24 dB (1 mW)]; 1 MOhm: 200 V dc + 5 V rms
Generator, signal (HP 8640B-003)	Frequency Range: 0.5 to 512 MHz direct count
	Accuracy: 6 1/2 digit light-emitting diode (LED) display with X10 and X100 expand; accuracy depends on internal or external reference used
	Internal reference (after 2 H warm-up and calibration at 25 °C)
	Aging Rate: < 0.05 ppm/h; < 2 ppm/90 days
	Typical Overall Accuracy (within 3 months of calibration and from 15° to 35°): ± 2 ppm
	Power Output: +18.5 to -145 dB (1 mW) ± 0.5 dB
Generator, signal, sweep (HP 8601A)	Output Frequency: 0.1 to 110 MHz
	Accuracy: 1% of frequency, 0.5% linearity, and 2% of sweep width
	Calibrated Output: ± 0.25 dB flatness over full range, output accuracy ± 1 dB (1 mW) from +10 to -110 dB (1 mW)
Oscillator, audio (HP 200CD)	Frequency Range: 5 Hz to 600 kHz ± 2%
	Power Output: 0 to 160 mW ± 0.1%
Load, solid state (ACME PS² L-1000)	Loading Power: 1000 W maximum
	Loading voltage: 60 V dc maximum
	Loading Current: 110 A dc maximum
Meter, power (HP 435B)	Frequency Range: 100 kHz to 26.5 GHz (depending on power sensor used)
	Power Range (calibrated in W and dB)
	With 8482A: -25 dB (1 mW) (3 uW) to +20 dB (1 mW) (100 mW) full scale
	With 8482B: +5 dB (1 mW)(3 mW) to +44 dB (1 mW) (25 W) full scale
	Accuracy: ± 1% of full scale on all ranges
Meter, volt (Triplett 630NS)	Dc V: 0 to 1200 V dc ± 1.5%

Table 6-2. Test Equipment Characteristics -CONT

Nomenclature	Characteristics
	Ac V: 0 to 1200 V ± 3%
	Resistance: 0 to 100 MOhm± 1.5%
	Dc A: 0 to 12 A ± 1.5%
Multimeter, digital (Fluke 8050A)	Dc Voltage
	Range: 0 to 1000 V dc. Maximum of 40 kV with 80k-40 probe
	Accuracy: ± (0.03% of reading + 2 digits) all ranges
	Ac Voltage (True rms, ac Coupled)
	Range: 0 to 750 V ac
	Voltage Readout Accuracy
	± (1.0% + 10 digits) for 20 Hz to 45 Hz
	± (0.5% + 10 digits) for 45 Hz to 10 kHz
	± (1% + 10 digits) for 10 to 20 kHz
	± (5% + 30 digits) for 20 to 50 kHz
	Resistance
	Range: 0 to 20 MOhm
	Accuracy: ± (0.1% reading + 2 digits + 0.02 Ohm) on lowest range, ± (0.25% reading + 3 digits) on highest range
	Ac Current (True rms, ac Coupled)
	Range: 0 to 2000 mA
	Accuracy: ± (2% of reading + 10 digits) for 20 to 45 Hz all ranges, ± (1% of reading + 10 digits) for 45 Hz to 10 kHz on 200 µA through 200 mA ranges. This includes 2000 mA range from 20 Hz to 2 kHz, ± (2% + 10 digits) for 10 to 20 kHz on 200 µA through 200 mA ranges
Digibridge, RLC (GenRad 1658-9700)	Resistance: 0.0001 to 99.999 MOhm± 1%
	Inductance: 0.00001 mH to 9999.9 H ± 1%
	Capacitance: 0.00001 nF to 99,999 µF ± 1%
Ammeter, ac clamp-on (Snapper 1000)	Ac Current: 0 to 300 A
	Ac Voltage: 0 to 600 V
Voltmeter, RF (HP 3406A)	Voltage Range: 1 mV to 3 V
	Frequency Range: 10 kHz to 1.2 GHz; useful sensitivity from 1 kHz to beyond 2 GHz
	Power Input: -50 to +20 dB (1 mW) [0 dB (1 mW) = 1 mW into 50 Ohm]

Table 6-2. Test Equipment Characteristics -CONT

Nomenclature	Characteristics
	Full Scale Accuracy with appropriate accessory (after probe is properly calibrated): ± 13% for 10 to 20 kHz input, decreasing to ± 3% for 100 kHz to 100 MHz, and increasing to ± 13% for 1 to 1.2 GHz input
Meter, RF vector impedance (HP 4193A)	Frequency Range: 400 kHz to 110.0 MHz
	Frequency Accuracy: ±0.01% of setting after calibration
	Impedance Measurement Specifications
	Resistance: 10 Ohm to 100 kOhm± 3%
	Phase: -180° to +180° ± 3.2%
Multimeter, digital (HP 3468A)	Dc Voltage Range: 0 to 300 V
	Accuracy: ± (0.005 +4 counts) on 0.3 V range to ± (0.0055 +2 counts) on 300 V range
	Resistance: 0 to 30 MOhm
	Accuracy: ± (0.004 +4 counts) on 300 Ohm range to ± (0.036 +2 counts) on 30 MOhm range
	Ac Voltage (true rms): 0 to 300 V
	Accuracy varies on each range for 20 to 300 kHz input: from maximum of ± (1.74% +882 counts) on the 0.3 V range for 50 to 100 kHz input to a maximum of ± (1.26% + 825 counts) on the 300 V range for 50 to 100 kHz range. All ranges have a ± (10.1% +3720 count) tolerance for a 100 to 300 kHz input
Time domain reflectometer (Tek 1502-04)	Cables Tested: Any type paired conductor and coaxial cable
	Display: Step pulse
	Fault Resolution: 0.6 in. on short cables to a maximum of 2000 ft
Oscilloscope, portable (Tek 2465-22)	Bandwidth: 350 MHz maximum
	Vertical Sensitivity: 2 mV/division at 350 MHz
Supply, power (Kepco ATE25-2M)	Output Voltage: 0 to 25 V dc
	Output Current: 0 to 2 A
	Meter Accuracy: ± 3% all ranges
Supply, power (Kepco ATE100-1M)	Output Voltage: 0 to 100 V dc
	Output Current: 0 to 1 A
	Meter Accuracy: ± 3% all ranges
Supply, power (HP 6459A-001)	Output Voltage: 0 to 64 V dc ±0.2% + 10 mV
	Output Current: 0 to 50 A ± 1% or 0.5 A

Table 6-2. Test Equipment Characteristics -CONT

Nomenclature	Characteristics
Vibroground tester, earth (Biddle 293 with kit)	Resistance: 0.25 Ohm minimum
	Resistivity: 20 Ohms/cm minimum
Test fixture (Power control) (GE 7344319)	Provides jacks and switches to connect four power supplies and shunt resistors to the power control PWB
Spectral purity test set (Cont 136110)	Spectral Waveform Measurement: Measure spectral content of waveforms to within ± 5 cycles.
TCMG simulator (Cont 149786-1)	Output Voltage: High (1), Low (0)
	Pulse Repetition Rate: 16-bit serial command representative of a command from the transmit control and monitor group (TCMG)

[1]Intermediate Frequency

[2]Radio Frequency

2. Always use voltOhm meter to check circuits before disconnecting wires to confirm voltage is not present.
3. Remove all rings, bracelets, watches, necklaces, etc., before performing any maintenance.
4. If power is on for test purposes, verify that other personnel proficient in cardiopulmonary resuscitation (CPR) and first aid procedures are present before attempting test procedures within the equipment. Be careful not to short power wires or buses together with tools or test equipment.
5. If electrostatic sensitive equipment is encountered and requires replacement, refer to TO 00-25-234 for precautionary measures that must be taken while handling equipment. Electrostatic sensitive equipment is identified in the applicable Illustrated Parts Breakdown manual.

6-2.3 Weight Hazards. Certain items of the equipment (transformers, power supplies, etc.) weigh in excess of 35 pounds. Ensure that adequate personnel and handling equipment are available before attempting to remove or replace such items.

6-2.4 Toxic, Flammable, and Corrosive Material Hazards. Certain precautions must be observed while cleaning and preparing surfaces for painting. Failure to comply with these precautions may result in harm to personnel and damage to equipment.

1. Cleaning and subsequent operations may involve the use of caustic materials, such as hot, aqueous, alkaline solutions; acid solutions both hot and cold; liquids that are skin irritants; liquids that, if taken into the body either by inhalation of their vapors or otherwise, are toxic; and liquids that are flammable. Many organic solvents are flammable, toxic, or both flammable and toxic. Do not use benzene, ether, alcohol, or gasoline for cleaning because of fire hazard. Benzene is also toxic when swallowed, absorbed through the skin, or when the vapors are inhaled. Carbon tetrachloride and trichloroethane are toxic and readily absorbed through the skin. They form a toxic vapor which is colorless. Being heavier than air, the vapor tends to collect in low places. Do not use carbon tetrachloride and trichloroethane for cleaning purposes. Use Freon TE solvent for cleaning purposes. Do not use Freon TE solvent, Freon R12 spray coolant, or Freon R22

refrigerant near open flame. Highly poisonous phosgene gas may form (odor of new-mown hay).

2. Personnel must work only in well ventilated areas. If ventilation is not adequate, operators should wear organic vapor respirators when using organic solvents which emit toxic or irritating fumes.

3. Operators must wear chemical safety goggles, gloves, and aprons of suitable material to protect eyes, hands, and body from injury by acids and alkalies or irritation by solvents.

4. Keep a first aid kit stocked for emergency treatment in accordance with local regulations. The kit must be in a clear, readily accessible area.

5. Have running water available at all times, preferably by means of a shower or faucet and a short length of hose, so that water used to flush away corrosive substances can be directed toward any part of the body.

6. Beryllium oxide (BeO) components are used as heatsinks. Do not cut, grind, or file components of BeO. Dust created from cutting, grinding, or filing BeO components is extremely toxic and a hazard to health.

7. Personnel should use caution and not damage mercury wetted relays. Contact with the mercury can result in personal illness.

6-2.5 Mechanical Hazards.

1. Compressed Air. When used in maintenance procedures, compressed air contacting human skin or causing flying debris can cause serious injury to personnel. Personnel using compressed air for cleaning must ensure that the air pressure is kept below 15 lbf/in^2, that adequate eye protection is used, and that personnel in the immediate area are warned that compressed air is in use.

2. Retaining Rings. During removal and installation, retaining rings may fracture or slip off of the retaining tool, causing injury to personnel. Use adequate eye protection when removing or installing retaining rings.

3. Motorized Wire Wheels or Grinders. In maintenance procedures, the use of motorized wire wheels or grinders may result in flying debris (pieces of wire or abrasive from the wheels, rust, scale, etc.). Personnel using motorized wire wheels or grinders must ensure that adequate eye protection is used, and that personnel in the immediate area are warned that motorized wire wheels or grinders are in use.

4. Hammering Operations. When hammering operations (such as chiseling, driving pins, fracturing bearing rings, etc.) using hardened tools or parts are employed during maintenance procedures, personnel must wear adequate eye protection to avoid injury due to flying metal chips from the tools or parts.

5. Falling Objects or Sharp Protrusions. When performing maintenance where other personnel are working overhead, wear hard hats to avoid head injuries due to falling objects or sharp protrusions, equipment extended on pullout slides, or cabinet door and swing-out racks accidentally closing on personnel. In areas where overhead work is being performed (i.e., transmit antenna) safety barriers should be used to cordon off the area, and unauthorized personnel should not be allowed into the area.

6. Climbing Hazards. Site personnel should not climb on antenna towers. Only members of a rigging crew conduct maintenance on the towers.

6-2.6 Cold Weather Hazard. In extremely cold weather, ensure that adequate arctic clothing is used. Personnel should wear gloves and not touch components of the transmit antenna field with bare hands during cold weather.

6-2.7 Elemental Transmitter Access and Exit Procedure.

WARNING

HAZARD TO PERSONNEL

The elemental transmitter equipment contains current and voltage levels which can cause death or serious injury to personnel. Elemental transmitter equipment must be completely powered down prior to any maintenance action.

The following procedure allows maintenance personnel to gain access to the shielded interlocked areas of the transmitter module, high voltage power supply (HVPS), or ac power switch cabinets of an individual elemental transmitter while the rest of the transmitters are operating. [Assume transmitter is being controlled from a remote location with the transmitter cabinet OUTPUT CONTROL switch in the ANTENNA (REMOTE) position.]

6-2.7.1 High Voltage Ac Switch Access and Exit Procedures.

1. High Voltage Ac Switch Access Procedure.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

a. Notify system maintenance console technician of maintenance to be performed.

b. At the applicable display terminal on the transmit maintenance console (TMC):

(1) Disable all transmitters at the transmit site using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY.

(2) Terminate mission using TXAFL TEST SELECTION MENU.

Refer to Positional Handbook for TMC operating instructions.

c. Place all transmitters in TEST (LOCAL) mode.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not disconnect high voltage ac (HVAC) from transmitter power supplies unless RF drive is removed from transmitters and transmitters are in LOCAL mode. Ensure no RF drive is applied to transmitters before removing HVAC.

d. Disconnect HVAC from all 12 transmitters by switching the main HVAC disconnect switch, Unit 321, to the OFF position.

e. Verify that the disconnect switch, Unit 321, is in the OPEN position by visually inspecting the switch hardware (inside cabinet) via the window on cabinet door.

f. Remove the interlock key from the front of main HVAC disconnect switch cabinet (Figure 6-1). Tag key to denote it is from the main HVAC disconnect switch cabinet.

g. Tag main HVAC disconnect switch, Unit 321, with a maintenance-in-progress sign.

WARNING

HIGH VOLTAGE HAZARD

Make sure the switch blades in the main HVAC disconnect switch, Unit 321, are open (step e) prior to attempting entry into the transmitter HVAC switch cabinet interior. The HVAC switch cabinet voltage levels can cause death or serious injury to personnel. Use grounding rods to discharge all potential storing components and voltage buses prior to entering the HVAC switch cabinet interior. Leave grounding rods attached to high voltage bus. Refer to TO 31P6-2FPS118-81 for specific locations to attach grounding rods.

FAILURE OF HVAC CABINET DOOR TO OPEN

If the HVAC switch cabinet door does not open with the switch in the OPEN position (off), do not attempt to enter cabinet. Discontinue this procedure and refer to TO 31P6-2FPS118-81

h. Remove HVAC from HVAC knife switch by placing the switch in the OPEN (off) position. The necessary steps are listed below.

(1) Place switch in the OPEN position.

(2) Lock knife switch OPEN by rotating key in lock on switch handle

i. Tag HVAC knife switch with a maintenance-in-progress sign.

j. Remove key from switch handle and insert and rotate in lower lock on HVAC switch door.

k. Remove other key from lock.

l. Insert and rotate key in upper door lock.

m. Open door and visually inspect switch to ensure all three switch contacts are OPEN.

n. For a detailed explanation of cabinet interior, see TO 31P6-2FPS118-81.

o. Personnel must observe all safety procedures when performing maintenance inside the switch cabinet.

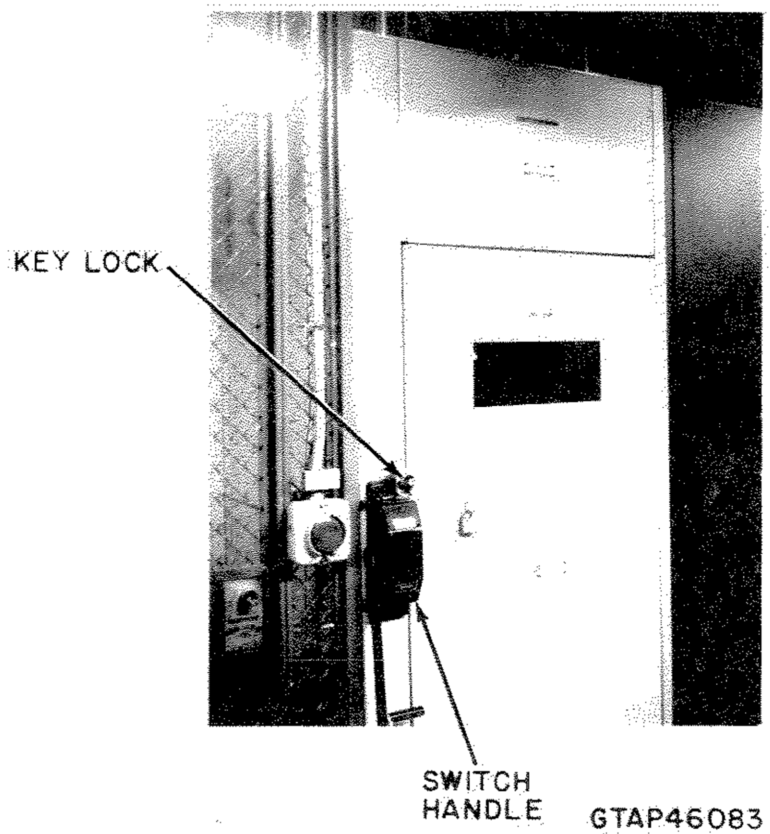

Figure 6-1. Main High Voltage Ac Switch, Unit 321

2. High Voltage Ac Switch Exit Procedure.

a. Close cabinet door.

b. Lock cabinet door closed by rotating key in upper lock on front of switch cabinet.

c. Remove key from lock and place it in lower lock on cabinet door.

d. Rotate key in lock thereby unlocking other key for HVAC switch handle.

e. Insert key in HVAC switch handle.

f. Unlock switch handle by rotating key in switch handle lock.

g. Place switch handle in the CLOSED (on) position.

h. Remove maintenance-in-progress sign from HVAC knife switch cabinet.

i. Place the main HVAC disconnect switch interlock key in the key lock on front of main HVAC switch cabinet, Unit 321.

WARNING

HAZARD TO PERSONNEL

Before power-up procedure is performed, ensure that all personnel are clear of equipment interior and circuitry. Power-up procedure creates current and voltage levels which can cause death or serious injury to personnel.

CAUTION

ENERGIZING PROCEDURE AFTER MAJOR MAINTENANCE

If major maintenance work was performed on any cabinet in the elemental transmitter, do not energize the equipment using this procedure. Instead, refer to the maintenance turn-on procedure in TO 31P6-2FPS118-81 for energizing instructions.

EQUIPMENT DAMAGE HAZARD

Do not apply HVAC to HVPS unless RF drive to associated transmitter module is inhibited. Ensure that no RF drive is applied to transmitters before the main HVAC switch is placed in the CLOSED position.

j. Unlock main HVAC disconnect switch by rotating key in key lock.

k. Apply HVAC to the HVPS by placing the main HVAC disconnect switch in the CLOSED (on) position. Check that switch blades are closed by viewing through window on front of cabinet. Place all transmitter modules in ANTENNA (REMOTE) mode.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

l. At TMC:

(1) Restart mission using TXAFL TEST SELECTION MENU.

(2) Enable all transmitters at site using TRANSMIT SITE INITIALIZATION/ RECONFIGURATION DISPLAY.

Refer to Positional Handbook for TMC operating instructions.

m. Notify system maintenance console technician that maintenance action has been completed.

6-2.7.2 <u>Transmitter Module Access and Exit Procedures.</u>

WARNING

RF RADIATION HAZARDS

The RF radiation from the transmitter can present a potential hazard to personnel. The RF and high voltage inputs to the transmitter module cabinet must be inhibited prior to personnel conducting maintenance activities inside the cabinet. Take proper precautions to protect cardiac pacemaker users.

X-RAY RADIATION HAZARD

Hazardous X-ray radiation may cause death or serious injury to personnel. The high power tetrode tubes in the transmitter module cabinets generate X-rays as a result of the electrons striking the metal structure within the tube. Shielding incorporated in construction of the tubes normally prevents any X-ray radiation hazard to personnel. However, should any of these protective shields, jacket covers, etc. be damaged or otherwise become defective, or personnel place themselves in close proximity to the tubes when high voltage is applied, injury from X-ray radiation could result.

HIGH VOLTAGE HAZARD

High voltage may cause death or serious injury to personnel. If entrance to the transmitter module cabinet is required for maintenance service, use grounding rods to discharge all components using high voltage.

AIR PRESSURE HAZARD

Compressed air is used in the transmitter module cabinet and may cause injury to personnel. Blower operation must cease and compressed air bled before air lines are disconnected.

TOXIC MATERIAL HAZARD

Transmission lines and directional couplers are pressurized with nitrogen gas. Increased concentration of nitrogen with decreased levels of oxygen may result in increased respiration and pulse rate, incoordination, and other metabolic maladies. Use extreme care when disconnecting components containing the gas. Also, the tubes in the transmitter module contain parts made of beryllium oxide (BeO). Handle tubes with care. Beryllium oxide dust particles are toxic and a hazard to health when ingested, inhaled, or deposited in open wounds.

WATER PRESSURE HAZARD

Pressurized water is used for cooling amplifier tubes, filters, and dummy loads. Pressurized water may cause serious injury to personnel. Water flow must cease and water lines must be bled before maintenance is conducted on associated components inside the transmitter module cabinet.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Transmitter Module Access.
   a. Notify system maintenance console technician of maintenance to be performed.
   b. At the applicable display terminal on the TMC, disable the transmitter module to be accessed using TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY. Refer to Positional Handbook for TMC operating instructions; refer to Table 6-3 to determine applicable transmitter module.
   c. At front panel of affected transmitter module, verify no RF drive is present by reading zero on forward power meter and broadband amplifier.
   d. On the affected transmitter module, set the OUTPUT CONTROL switch located on the control/status panel to the TEST LOAD (LOCAL) position.
   e. Remove HVAC from HVPS by placing the associated HVAC knife switch in the OPEN (OFF) position. Refer to Table 6-3 for list detailing the HVAC knife switch associated with each HVPS. The necessary steps are listed below:
      (1) Place switch in the OPEN position.
      (2) Lock knife switch OPEN by rotating key in lock on switch handle. Remove key.
      (3) Tag HVAC knife switch with a maintenance-in-progress sign.
   f. Remove power from the HVPS by switching applicable circuit breakers to the OFF position. Refer to Tables 6-3 and 6-4 to determine appropriate circuit breakers; refer to FO-1 for circuit breaker panel locations.
   g. Tag circuit breaker panels with a maintenance-in-progress sign.
   h. The transmitter should be completely shut down. If transmitter shows evidence of having power, review previous steps.

Table 6-3. Transmitter Module Versus High Voltage Ac Knife Switch and High Voltage Power Supply

Transmitter Module	High Voltage Ac Knife Switch	High Voltage Power Supply
110	222	122
111	223	123
112	224	124
113	225	125
114	226	126
115	227	127
116	228	128
117	229	129
118	230	130
119	231	131
120	232	132
121	233	133

Table 6-4. (V)1 Transmitter Group Primary Power Circuit Breakers

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	305E	CB4	Transmit Beamformer, Unit 150
1	310J	CB2	Auxiliary Exciter, Unit 152
1	310J	CB1	Exciter, Unit 151
1	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
1	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
1	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
1	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
1	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
1	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
1	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
1	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
1	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
1	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
1	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
1	306F	CB4	HVPS, Unit 133, Keep Alive Circuit

Table 6-4. (V)1 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	302B	CB13	Feed for Breaker Panel 317Q
1	317Q	CB12	HVPS, Unit 122, TM, Unit 110, Lights & Receptacles
1	317Q	CB11	HVPS, Unit 123, TM, Unit 111, Lights & Receptacles
1	317Q	CB10	HVPS, Unit 124, TM, Unit 112, Lights & Receptacles
1	317Q	CB9	HVPS, Unit 125, TM, Unit 113, Lights & Receptacles
1	317Q	CB8	HVPS, Unit 126, TM, Unit 114, Lights & Receptacles
1	317Q	CB7	HVPS, Unit 127, TM, Unit 115, Lights & Receptacles
1	317Q	CB6	HVPS, Unit 128, TM, Unit 116, Lights & Receptacles
1	317Q	CB5	HVPS, Unit 129, TM, Unit 117, Lights & Receptacles
1	317Q	CB4	HVPS, Unit 130, TM, Unit 118, Lights & Receptacles
1	317Q	CB3	HVPS, Unit 131, TM, Unit 119, Lights & Receptacles
1	317Q	CB2	HVPS, Unit 132, TM, Unit 120, Lights & Receptacles
1	317Q	CB1	HVPS, Unit 133, TM, Unit 121, Lights & Receptacles
1	302B	CB12	HVPS, Unit 122, 208 V ac
1	302B	CB11	HVPS, Unit 123, 208 V ac
1	302B	CB10	HVPS, Unit 124, 208 V ac
1	302B	CB9	HVPS, Unit 125, 208 V ac
1	302B	CB8	HVPS, Unit 126, 208 V ac
1	302B	CB7	HVPS, Unit 127, 208 V ac
1	302B	CB6	HVPS, Unit 128, 208 V ac
1	302B	CB5	HVPS, Unit 129, 208 V ac
1	302B	CB4	HVPS, Unit 130, 208 V ac
1	302B	CB3	HVPS, Unit 131, 208 V ac
1	302B	CB2	HVPS, Unit 132, 208 V ac
1	302B	CB1	HVPS, Unit 133, 208 V ac
2	305E	CB4	Transmit Beamformer, Unit 50

Table 6-4. (V)1 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	305E	CB9	Auxiliary Exciter, Unit 152
2	305E	CB8	Exciter, Unit 151
2	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
2	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
2	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
2	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
2	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
2	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
2	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
2	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
2	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
2	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
2	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
2	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
2	301A	CB5	Feed for Breaker Panel 317Q
2	317Q	CB12	HVPS, Unit 122, TM, Unit 110, Lights & Receptacles
2	317Q	CB11	HVPS, Unit 123, TM, Unit 111, Lights & Receptacles
2	317Q	CB10	HVPS, Unit 124, TM, Unit 112, Lights & Receptacles
2	317Q	CB9	HVPS, Unit 125, TM, Unit 113, Lights & Receptacles
2	317Q	CB8	HVPS, Unit 126, TM, Unit 114, Lights & Receptacles
2	317Q	CB7	HVPS, Unit 127, TM, Unit 115, Lights & Receptacles
2	317Q	CB6	HVPS, Unit 128, TM, Unit 116, Lights & Receptacles
2	317Q	CB5	HVPS, Unit 129, TM, Unit 117, Lights & Receptacles
2	317Q	CB4	HVPS, Unit 130, TM, Unit 118, Lights & Receptacles
2	317Q	CB3	HVPS, Unit 131, TM, Unit 119, Lights & Receptacles
2	317Q	CB2	HVPS, Unit 132, TM, Unit 120, Lights & Receptacles

Table 6-4. (V)1 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	317Q	CB1	HVPS, Unit 133, TM, Unit 121, Lights & Receptacles
2	301B	CB12	HVPS, Unit 122, 208 V ac
2	301B	CB11	HVPS, Unit 123, 208 V ac
2	301B	CB10	HVPS, Unit 124, 208 V ac
2	301B	CB9	HVPS, Unit 125, 208 V ac
2	301B	CB8	HVPS, Unit 126, 208 V ac
2	301B	CB7	HVPS, Unit 127, 208 V ac
2	301B	CB6	HVPS, Unit 128, 208 V ac
2	301B	CB5	HVPS, Unit 129, 208 V ac
2	301B	CB4	HVPS, Unit 130, 208 V ac
2	301B	CB3	HVPS, Unit 131, 208 V ac
2	301B	CB2	HVPS, Unit 132, 208 V ac
2	301B	CB1	HVPS, Unit 133, 208 V ac
3	305E	CB4	Transmit Beamformer, Unit 150
3	305E	CB9	Auxiliary Exciter, Unit 152
3	305E	CB8	Exciter, Unit 151
3	306F	CB15	HVPS, Unit 122, Keep Alive Circuit
3	306F	CB14	HVPS, Unit 123, Keep Alive Circuit
3	306F	CB13	HVPS, Unit 124, Keep Alive Circuit
3	306F	CB12	HVPS, Unit 125, Keep Alive Circuit
3	306F	CB11	HVPS, Unit 126, Keep Alive Circuit
3	306F	CB10	HVPS, Unit 127, Keep Alive Circuit
3	306F	CB9	HVPS, Unit 128, Keep Alive Circuit
3	306F	CB8	HVPS, Unit 129, Keep Alive Circuit
3	306F	CB7	HVPS, Unit 130, Keep Alive Circuit
3	306F	CB6	HVPS, Unit 131, Keep Alive Circuit
3	306F	CB5	HVPS, Unit 132, Keep Alive Circuit
3	306F	CB4	HVPS, Unit 133, Keep Alive Circuit
3	301A	CB5	Feed for Breaker Panel 317Q
3	317Q	CB12	HVPS, Unit 122, TM, Unit 110, Lights & Receptacles
3	317Q	CB11	HVPS, Unit 123, TM, Unit 111, Lights & Receptacles

Table 6-4. (V)1 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	317Q	CB10	HVPS, Unit 124, TM, Unit 112, Lights & Receptacles
3	317Q	CB9	HVPS, Unit 125, TM, Unit 113, Lights & Receptacles
3	317Q	CB8	HVPS, Unit 126, TM, Unit 114, Lights & Receptacles
3	317Q	CB7	HVPS, Unit 127, TM, Unit 115, Lights & Receptacles
3	31Q	CB6	HVPS, Unit 128, TM, Unit 116, Lights & Receptacles
3	317Q	CB5	HVPS, Unit 129, TM, Unit 117, Lights & Receptacles
3	317Q	CB4	HVPS, Unit 130, TM, Unit 118, Lights & Receptacles
3	317Q	CB3	HVPS, Unit 131, TM, Unit 119, Lights & Receptacles
3	317Q	CB2	HVPS, Unit 132, TM, Unit 120, Lights & Receptacles
3	317Q	CB1	HVPS, Unit 133, TM, Unit 121, Lights & Receptacles
3	302B	CB8	HVPS, Unit 122, 208 V ac
3	302B	CB7	HVPS, Unit 123, 208 V ac
3	302B	CB6	HVPS, Unit 124, 208 V ac
3	302B	CB5	HVPS, Unit 125, 208 V ac
3	302B	CB4	HVPS, Unit 126, 208 V ac
3	302B	CB3	HVPS, Unit 127, 208 V ac
3	302B	CB2	HVPS, Unit 128, 208 V ac
3	302B	CB1	HVPS, Unit 129, 208 V ac
3	301A	CB10	HVPS, Unit 130, 208 V ac
3	301A	CB9	HVPS, Unit 131, 208 V ac
3	301A	CB8	HVPS, Unit 132, 208 V ac
3	301A	CB7	HVPS, Unit 133, 208 V ac

Table 6-4. (V)2 Transmitter Group Primary Power Circuit Breakers

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	305E	CB14	Transmit Beamformer, Unit 150
1	305E	CB25	Auxiliary Exciter, Unit 152
1	305E	CB20	Exciter, Unit 151
1	306F	CB3	HVPS, Unit 122, Keep Alive Circuit-CB3
1	306F	CB4	HVPS, Unit 123, Keep Alive Circuit-CB4
1	306F	CB5	HVPS, Unit 124, Keep Alive Circuit-CB5
1	306F	CB6	HVPS, Unit 125, Keep Alive Circuit-CB6
1	306F	CB7	HVPS, Unit 126, Keep Alive Circuit-CB7
1	306F	CB8	HVPS, Unit 127, Keep Alive Circuit-CB8
1	306F	CB9	HVPS, Unit 128, Keep Alive Circuit-CB9
1	306F	CB10	HVPS, Unit 129, Keep Alive Circuit-CB10
1	306F	CB11	HVPS, Unit 130, Keep Alive Circuit-CB11
1	306F	CB12	HVPS, Unit 131, Keep Alive Circuit-CB12
1	306F	CB13	HVPS, Unit 132, Keep Alive Circuit-CB13
1	306F	CB14	HVPS, Unit 133, Keep Alive Circuit-CB14
1	301A	CB6	Feed for Breaker Panel 317Q
1	317Q	CB1	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
1	317Q	CB2	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
1	317Q	CB3	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
1	317Q	CB4	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
1	317Q	CB5	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
1	317Q	CB6	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
1	317Q	CB7	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
1	317Q	CB8	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
1	317Q	CB9	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
1	317Q	CB10	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles

Table 6-4. (V)2 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	317Q	CB11	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
1	317Q	CB12	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
1	301A	CB19	HVPS, Unit 122, 208 V ac
1	301A	CB18	HVPS, Unit 123, 208 V ac
1	301A	CB17	HVPS, Unit 124, 208 V ac
1	301A	CB16	HVPS, Unit 125, 208 V ac
1	301A	CB15	HVPS, Unit 126, 208 V ac
1	301A	CB14	HVPS, Unit 127, 208 V ac
1	301A	CB13	HVPS, Unit 128, 208 V ac
1	301A	CB12	HVPS, Unit 129, 208 V ac
1	301A	CB11	HVPS, Unit 130, 208 V ac
1	301A	CB10	HVPS, Unit 131, 208 V ac
1	301A	CB9	HVPS, Unit 132, 208 V ac
1	301A	CB8	HVPS, Unit 133, 208 V ac
1	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133
2	305E	CB14	Transmit Beamformer, Unit 150
2	305E	CB25	Auxiliary Exciter, Unit 152
2	305E	CB20	Exciter, Unit 151
2	306F	CB14	HVPS, Unit 122, Keep Alive Circuit
2	306F	CB13	HVPS, Unit 123, Keep Alive Circuit
2	306F	CB12	HVPS, Unit 124, Keep Alive Circuit
2	306F	CB11	HVPS, Unit 125, Keep Alive Circuit
2	306F	CB10	HVPS, Unit 126, Keep Alive Circuit
2	306F	CB9	HVPS, Unit 127, Keep Alive Circuit
2	306F	CB8	HVPS, Unit 128, Keep Alive Circuit
2	306F	CB7	HVPS, Unit 129, Keep Alive Circuit
2	306F	CB6	HVPS, Unit 130, Keep Alive Circuit
2	306F	CB5	HVPS, Unit 131, Keep Alive Circuit
2	306F	CB4	HVPS, Unit 132, Keep Alive Circuit

Table 6-4. (V)2 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	306F	CB3	HVPS, Unit 133, Keep Alive Circuit
2	301A	CB6	Feed for Breaker Panel 317Q
2	317Q	CB1	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
2	317Q	CB2	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
2	317Q	CB3	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
2	317Q	CB4	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
2	317Q	CB5	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
2	317Q	CB6	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
2	317Q	CB7	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
2	317Q	CB8	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles
2	317Q	CB9	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
2	317Q	CB10	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
2	317Q	CB11	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
2	317Q	CB12	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
2	301A	CB19	HVPS, Unit 122, 208 V ac
2	301A	CB18	HVPS, Unit 123, 208 V ac
2	301A	CB17	HVPS, Unit 124, 208 V ac
2	301A	CB16	HVPS, Unit 125, 208 V ac
2	301A	CB15	HVPS, Unit 126, 208 V ac
2	301A	CB14	HVPS, Unit 127, 208 V ac
2	301A	CB13	HVPS, Unit 128, 208 V ac
2	301A	CB12	HVPS, Unit 129, 208 V ac
2	301A	CB11	HVPS, Unit 130, 208 V ac
2	301A	CB10	HVPS, Unit 131, 208 V ac
2	301A	CB9	HVPS, Unit 132, 208 V ac
2	301A	CB8	HVPS, Unit 133, 208 V ac

Table 6-4. (V)2 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
2	Unit 321	MAIN HVAC DIS-CON-NECT switch	HVPS, Units 122 through 133
3	305E	CB14	Transmit Beamformer, Unit 150
3	305E	CB25	Auxiliary Exciter, Unit 152
3	305E	CB20	Exciter, Unit 151
3	306F	CB14	HVPS, Unit 122, Keep Alive Circuit
3	306F	CB13	HVPS, Unit 123, Keep Alive Circuit
3	306F	CB12	HVPS, Unit 124, Keep Alive Circuit
3	306F	CB11	HVPS, Unit 125, Keep Alive Circuit
3	306F	CB10	HVPS, Unit 126, Keep Alive Circuit
3	306F	CB9	HVPS, Unit 127, Keep Alive Circuit
3	306F	CB8	HVPS, Unit 128, Keep Alive Circuit
3	306F	CB7	HVPS, Unit 129, Keep Alive Circuit
3	306F	CB6	HVPS, Unit 130, Keep Alive Circuit
3	306F	CB5	HVPS, Unit 131, Keep Alive Circuit
3	306F	CB4	HVPS, Unit 132, Keep Alive Circuit
3	306F	CB3	HVPS, Unit 133, Keep Alive Circuit
3	301A	CB6	Feed for Breaker Panel 317Q
3	317Q	CB12	HVPS, Unit 122, TM, Unit 110 Lights and Receptacles
3	317Q	CB11	HVPS, Unit 123, TM, Unit 111 Lights and Receptacles
3	317Q	CB10	HVPS, Unit 124, TM, Unit 112 Lights and Receptacles
3	317Q	CB9	HVPS, Unit 125, TM, Unit 113 Lights and Receptacles
3	317Q	CB8	HVPS, Unit 126, TM, Unit 114 Lights and Receptacles
3	317Q	CB7	HVPS, Unit 127, TM, Unit 115 Lights and Receptacles
3	317Q	CB6	HVPS, Unit 128, TM, Unit 116 Lights and Receptacles
3	317Q	CB5	HVPS, Unit 129, TM, Unit 117 Lights and Receptacles

Table 6-4. (V)2 Transmitter Group Primary Power Circuit Breakers -CONT

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
3	317Q	CB4	HVPS, Unit 130, TM, Unit 118 Lights and Receptacles
3	317Q	CB3	HVPS, Unit 131, TM, Unit 119 Lights and Receptacles
3	317Q	CB2	HVPS, Unit 132, TM, Unit 120 Lights and Receptacles
3	317Q	CB1	HVPS, Unit 133, TM, Unit 121 Lights and Receptacles
3	301A	CB19	HVPS, Unit 122, 208 V ac
3	301A	CB18	HVPS, Unit 123, 208 V ac
3	301A	CB17	HVPS, Unit 124, 208 V ac
3	301A	CB16	HVPS, Unit 125, 208 V ac
3	301A	CB15	HVPS, Unit 126, 208 V ac
3	301A	CB14	HVPS, Unit 127, 208 V ac
3	301A	CB13	HVPS, Unit 128, 208 V ac
3	301A	CB12	HVPS, Unit 129, 208 V ac
3	301A	CB11	HVPS, Unit 130, 208 V ac
3	301A	CB10	HVPS, Unit 131, 208 V ac
3	301A	CB9	HVPS, Unit 132, 208 V ac
3	301A	CB8	HVPS, Unit 133, 208 V ac
3	Unit 321	MAIN HVAC DISCONNECT switch	HVPS, Units 122 through 133

i. Allow 10 minutes for HVPS and transmitter module to cool.

j. Turn off the applicable starter-disconnect switch (column-mounted near HVPS) for transmitter cooling fan, Unit 348, feeding the HVPS and transmitter module with cooling air. Refer to Real Property Installed Equipment (RPIE) Manual.

k. Turn off the compressed air feeding the transmitter module by closing the green compressed air isolation valve above the right rear of the transmitter module. Refer to RPIE Manual.

CAUTION

EQUIPMENT DAMAGE HAZARD

Turn off the deionized water INLET valve before the deionized water OUTLET valve.

l. Turn off the deionized water which feeds the transmitter module with cooling water. Refer to RPIE Manual.

m. Personnel must observe all safety procedures when performing maintenance inside of cabinet.

WARNING

HAZARD TO PERSONNEL

Do not access transmitter module unless the transmitter cooling fan, compressed air, and deionized water systems have been turned OFF.

n. Access transmitter module.

2. Transmitter Module Exit Procedure.

WARNING

HAZARD TO PERSONNEL

Before power-up procedure is performed, ensure that all personnel are clear of equipment interior and circuitry. Power-up procedure creates current and voltage levels which can cause death or serious injury to personnel.

CAUTION

ENERGIZING PROCEDURE AFTER MAJOR MAINTENANCE

If major maintenance work was performed on any cabinet of an elemental transmitter do not energize the elemental transmitter using this procedure. Instead, refer to the maintenance turn-on procedure in TO 31P6-2FPS118-81 for energizing instructions.

EQUIPMENT DAMAGE HAZARD

Do not energize equipment if RF drive is applied to transmitter module. Ensure no RF drive is applied to transmitter module. Do not energize equipment unless transmitter cooling fan, compressed air and deionized water systems are operating.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

a. Turn ON the transmitter cooling fan, compressed air, and deionized water systems. Refer to RPIE Manual.

b. Apply primary power to the associated HVPS by placing the applicable circuit breakers (used in access procedure) back to the ON position. Refer to Table 6-4 and FO-1 for circuit breaker list and panel location.

c. Remove maintenance-in-progress sign from breaker panels.

d. Insert key in HVAC switch handle and unlock handle.

e. Place the associated HVAC knife switch (Table 6-3) to the CLOSED (ON) position. Remove maintenance-in-progress sign.

f. Place the transmitter OUTPUT CONTROL switch on control/status panel 1A1 to the ANTENNA (REMOTE) position.

g. At TMC, use the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY to ensure RF inhibit (disable) is removed from transmitter. Refer to Positional Handbook for TMC operating instructions.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

h. If mission software commands are not arriving from the operations center (OC), or the transmitter modules do not cycle up to STANDBY, perform the following:

(1) At TMC, access the TXAFL TEST SELECTION MENU and terminate mission software.

(2) Run the Transmit Data Conditioner AFL Test.

(3) Restart mission (terminate TXAFL TESTING).

i. The mission software controls the equipment once all power is applied. The mission software brings the equipment online and operating without any further manual action.

j. Notify system maintenance console technician that maintenance action has been completed.

6-2.7.3 <u>High Voltage Power Supply Access and Exit Procedures</u>.

1. High Voltage Power Supply Access Procedure.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

a. Notify system maintenance console technician of maintenance to be performed.

b. At the applicable display terminal on the TMC, use the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY to disable transmitter module associated with the HVPS. Refer to Positional Handbook for TMC operating instructions; refer to Table 6-3 to determine applicable transmitter module.

c. At front panel of associated transmitter module, verify that no RF drive is present by reading zero on the FORWARD POWER meter and broad band amplifier.

d. On the affected transmitter module, set the OUTPUT CONTROL switch located on the control/status panel to the TEST LOAD (LOCAL) position.

e. Remove power from the HVPS by switching applicable circuit breakers to the OFF position. Refer to Tables 6-3 and 6-4 to determine appropriate circuit breakers; refer to FO-1 for circuit breaker panel locations.

f. Tag circuit breaker panels with a maintenance-in-progress sign.

g. The transmitter should be completely shut down. If transmitter shows evidence of having power, review previous steps.

WARNING

HIGH VOLTAGE HAZARD

Place the HVAC knife switch in the OPEN (OFF) position prior to attempting entry to cabinet interior. The HVAC switch cabinet voltage levels can cause death or serious injury to personnel. Use grounding rods to discharge all potential storing components and voltage buses prior to entering the HVAC switch cabinet interior. Leave grounding rods attached to high voltage bus. Refer to TO 31P6-2FPS118-81 for specific locations to attach grounding rods.

FAILURE OF HVAC CABINET DOOR TO OPEN

If the HVAC switch cabinet door does not open with the switch in the OPEN position (OFF), do not attempt to enter cabinet. Discontinue this procedure and refer to TO 31P6-2FPS118-81.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not disconnect HVAC from transmitter power supplies unless RF drive is removed from transmitters. Ensure no RF drive is applied to transmitters before removing HVAC.

h. Remove HVAC from HVPS by placing the associated HVAC knife switch in the OPEN (OFF) position. Refer to Table 6-3 for list detailing the HVAC knife switch associated with each HVPS. The necessary steps are listed below.

   (1) Place switch in the OPEN position.

   (2) Lock knife switch OPEN by rotating key in lock on switch handle.

i. Tag HVAC knife switch with a maintenance-in-progress sign.

j. Insert and rotate key in lower lock on HVAC knife switch door.

k. Remove and tag the unlocked key for use in accessing HVPS cabinet.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

Remove all power from cabinet prior to attempting entry to cabinet interior. The HVPS cabinet voltage and current levels can cause death or serious injury to personnel.

l. Verify that all primary power circuit breakers for HVPS are set to the OFF position. Refer to Table 6-4 for circuit breaker listing.

m. Allow 10 minutes for HVPS and transmitter module to cool.

n. Insert the key from HVAC switch cabinet interior in the lock on the left front door of HVPS.

WARNING

HIGH VOLTAGE HAZARD

Use grounding rods to discharge all potential storing components and voltage buses prior to entering the HVAC switch cabinet interior. Leave grounding rods attached to high voltage bus. Refer to TO 31P6-2FPS118-81 for specific locations to attach grounding rods.

HAZARD TO PERSONNEL

Do not open HVPS door unless transmitter cooling fan and compressed air feeding HVPS have been turned OFF.

o. Rotate the key to unlock the left hand door and access the interior of HVPS. Remove the other key in door if access to the right hand door is desired.

p. Tag HVPS cabinet with a maintenance-in-progress sign.

q. Once access is gained from the front left door, the right front door may be opened from inside the HVPS.

r. For a detailed explanation of cabinet interior see TO 31P6-2FPS118-81.

s. Personnel must observe all safety procedures when performing maintenance inside the HVPS cabinet.

1. High Voltage Power Supply Exit Procedure.

   a. If right hand door was open, close door and rotate key in right lock. Remove key from lock.

   b. Close left hand door and insert key from right hand door. Lock doors closed by rotating the other key in lock.

   c. Remove maintenance-in-progress sign from HVPS cabinet.

   d. Remove the HVAC switch cabinet key used to lock left hand door from HVPS cabinet.

   e. At associated HVAC knife switch, place key in lower lock on switch cabinet door and rotate it.

f. Rotate and remove switch handle key in lower lock and place it in lock on switch handle.

g. Unlock switch handle by rotating key in switch handle lock.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not apply HVAC to HVPS unless RF drive to associated transmitter module is inhibited. Ensure that no RF drive is applied to transmitters before the main HVAC switch is placed in the CLOSED position.

h. Apply HVAC to HVPS by placing knife switch handle in the CLOSED (ON) position.

i. Lock switch CLOSED by rotating the key in switch handle.

j. Remove maintenance-in-progress sign from HVAC knife switch cabinet.

WARNING

HAZARD TO PERSONNEL

Before power-up procedure is performed, ensure that all personnel are clear of equipment interior and circuitry. Power-up procedure creates current and voltage levels which can cause death or serious injury to personnel.

CAUTION

ENERGIZING PROCEDURE AFTER MAJOR MAINTENANCE

If major maintenance work was performed on any cabinet in the elemental transmitter do not energize the equipment using this procedure. Instead, refer to the maintenance turn-on procedure in TO 31P6-2FPS118-81 for energizing instructions.

EQUIPMENT DAMAGE HAZARD

Do not energize equipment unless associated cooling fan and compressed air system are operating.

k. Apply primary power to the HVPS by placing the applicable circuit breakers (used in access procedure) back to the ON position. Refer to Table 6-4 and FO-1 for circuit breaker list and panel location.

l. Remove maintenance-in-progress sign from breaker panels.

m. Depress the STANDBY (HV OFF) pushbutton on control/status panel so primary power is applied to transmitter circuitry.

n. Place the transmitter OUTPUT CONTROL switch on control/status panel 1A1 to the ANTENNA (REMOTE) position.

o. At TMC, use the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY to ensure RF inhibit (disable) is removed from transmitter. Refer to Positional Handbook for TMC operating instructions.

p. The mission software controls the equipment once all power is applied. The mission software brings the equipment online and operating without any further manual action.

q. Notify system maintenance console technician that maintenance action has been completed.

6-2.8 Transmit Antenna Field Access and Exit Procedures.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel must not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

The following procedure allows maintenance personnel to gain access to the transmit antenna field to perform maintenance on the transmission lines, towers, and ground screen.

6-2.8.1 Transmit Antenna Field Access. For personnel to access the antenna field, the transmit antenna and transmit sounder antenna cannot be radiating energy. Disable the transmitter modules, Units 110 through 121, and sounder power amplifiers, Units 136 and 137, and remove HVAC from them before attempting antenna field access. An interlocked key block in the transmitter building contains the gate keys that allow access to the antenna field after all transmitter and sounder RF energy has been disabled. The following paragraphs list the steps necessary to access the transmit antenna field:

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Transmit Site Shutdown Procedure.

   a. Notify system maintenance console technician of maintenance to be performed.

   b. At applicable display terminal at the TMC, have technician:

      (1) Disable all 12 transmitters using the TRANSMIT SITE INITIALIZATION/ RECONFIGURATION DISPLAY Menu. Refer to positional handbook for TMC operating instructions.

      (2) Terminate mission using the TXAFL TEST SELECTION MENU. Refer to positional handbook for TMC operating instructions.

CAUTION

EQUIPMENT DAMAGE HAZARD

The transmitter module must be disabled (RF drive removed) prior to switching the OUTPUT CONTROL switch to the LOCAL position.

   c. At front panel of all 12 transmitter modules, verify no RF drive is present by reading zero on the FORWARD POWER meter and broadband amplifier.

   d. On front panel of all 12 transmitter modules, place the OUTPUT CONTROL switch to the LOCAL position; then place broadband amplifier power switch to the off position.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not disconnect HVAC from transmitter power supplies unless RF drive is removed from transmitters and transmitters are in LOCAL. Ensure no RF drive is applied to transmitters before removing HVAC.

   e. Disconnect HVAC from all 12 transmitters by switching the main HVAC disconnect switch, Unit 321, to the OFF position.

   f. Verify that the disconnect switch, Unit 321, is in the OPEN position by visually inspecting the switch hardware (inside cabinet) via the window on cabinet door.

   g. Remove the interlock key from the front of main HVAC disconnect switch cabinet (Figure 6-2). Tag key to denote it is from the main HVAC disconnect switch cabinet.

   h. Place a maintenance-in-progress sign on switch cabinet, Unit 321.

   i. On the front panel of sounder power amplifiers, Units 136 and 137, depress the STANDBY pushbutton. The amplifiers are now in the standby mode. Sounder RF energy is disabled.

WARNING

RF RADIATION HAZARD

Place the power amplifiers in the OFF mode to protect personnel from accidental exposure to sounder RF radiation. Do NOT leave amplifiers in the REMOTE/LOCAL mode.

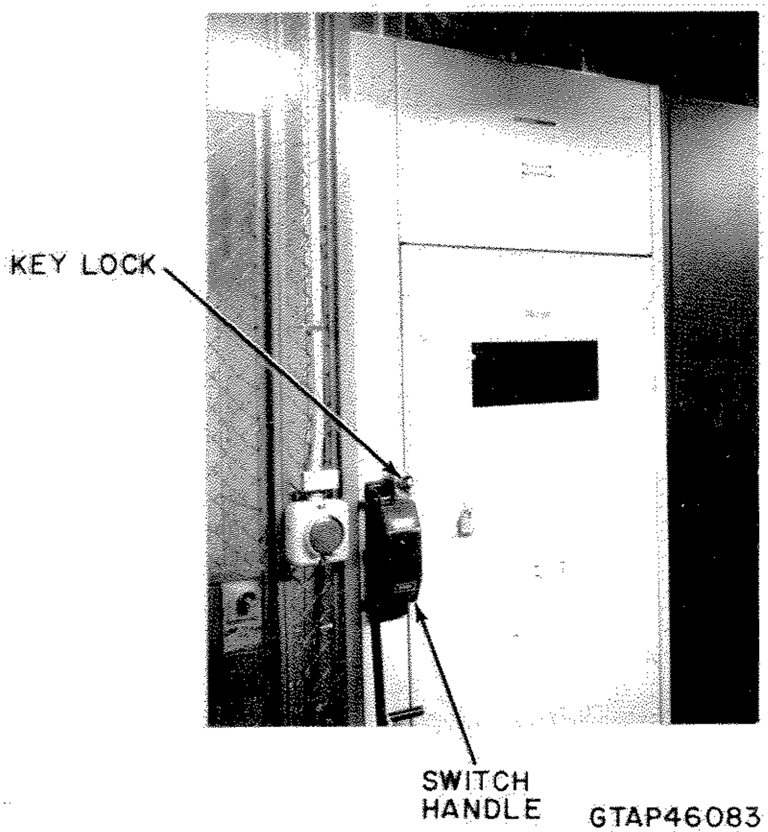

Figure 6-2. Main High Voltage Ac Disconnect Switch, Unit 321

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not place KEYLOCK switch in the OFF position unless the power amplifier is in the STANDBY state.

j. On the front panel of Units 136 and 137, place LOCAL-REMOTE keylock switch A3A2S6 in the OFF position. The amplifiers sequence to a power-off state.

k. Place a maintenance-in-progress sign on power amplifier cabinets, Units 136 and 137.

2. Antenna Field Access Procedure.

a. At gate interlock key block (Figure 6-3), insert and rotate key from HVAC switch cabinet in interlock labeled MAIN HIGH VOLTAGE disconnect switch.

b. Rotating main HVAC disconnect key in the key block automatically unlocks the main antenna field gate keys. Also, it prevents high voltage from being applied to the sounder power amplifiers.

c. At gate interlock key block remove key(s) for desired antenna field gate(s). Tag key(s) appropriately.

d. Tag gate key interlock block with a maintenance-in-progress sign.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the transmit safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

e. Proceed to antenna field gate with gate keys, then access field.

6-2.8.2 Transmit Antenna Field Exit.

WARNING

RF RADIATION HAZARD

All personnel must be outside of the antenna safety fence in order to be protected from RF radiation. Do NOT enable RF energy if personnel are within antenna safety fence.

1. Ensure that all personnel and equipment are removed from transmit antenna field.

2. Close and remove keys from all transmitter antenna field gates.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

3. Insert and rotate transmit antenna field gate keys in gate interlock key block (Figure 6-3) in transmitter building.

4. Rotate main HVAC disconnect switch key and remove from key block.

5. On the front panel of Units 136 and 137, place the LOCAL-REMOTE keylock switch in the LOCAL-REMOTE position.

6. Remove maintenance-in-progress signs from power amplifier cabinets.

7. Insert and rotate HVAC switch key in main HVAC disconnect switch cabinet, Unit 321.

8. Apply HVAC to all transmitter modules by switching HVAC switch, Unit 321, to the ON position. Remove maintenance in-progress sign from cabinet.

9. On the front panel of all 12 transmitters modules, place the broadband amplifier power switch to the ON position; then place the OUTPUT CONTROL switch to the remote position.

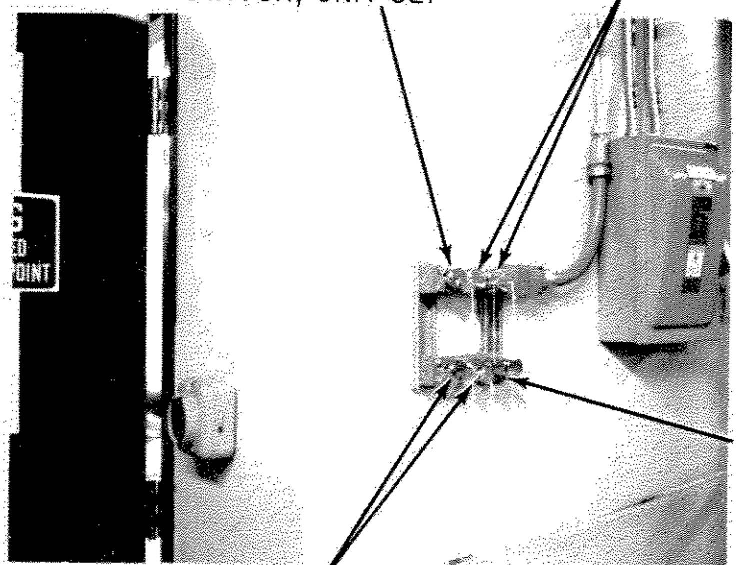

Figure 6-3. Antenna Gate Interlock Key Block

10. At applicable display terminal at the TMC, have the technician:
    a. Restart mission software (Terminate TxAFL testing) using the TXAFL TEST SELECTION MENU. Refer to the Positional Handbook for TMC operating instructions.
    b. Enable all 12 transmitters using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY Menu. Refer to Positional Handbook for TMC operating instructions.
11. Notify system maintenance console technician that maintenance performed has been completed.

6-3 EQUIPMENT GROUP PREVENTIVE MAINTENANCE SERVICES.

6-3.1 General. Preventive maintenance services have been established to ensure efficient and safe equipment operation. Certain equipment malfunctions can be detected or avoided by performing preventive maintenance at prescribed intervals. By observing these intervals, the equipment failure rate during missions can be reduced to a minimum.

6-3.2 Preventive Maintenance Services Schedule.

1. The schedule of preventive maintenance services for the equipment group, with references to appropriate procedures if required, is given in Table 6-5. Do not perform any preventive maintenance services except those listed in Table 6-5. The preventive maintenance schedule in this TO supersedes all schedules listed by commercial manuals. These services, based on system operation of up to 24 hours a day, 7 days a week, are required in conjunction with the lubrication services given in paragraph 6-5. As shown in the Notes column of Table 6-5, some of the preventive maintenance services can be performed while the system is energized and operating normally (Note 1). Others must be performed when the system is partially or totally deenergized (Note 3).
2. The interval between the accomplishment of each requirement is the longest period of time that an item or component can safely operate without an inspection or observation. When the equipment is operated in other than the primary purpose or major use class, the necessary requirements are adjusted accordingly; the requirements are identified as to class of operation. These requirements and inspection intervals are the maximum; they should never be exceeded. Local conditions (type of missions, special use, geographical locations, etc.) may dictate more frequent inspection, or replacement, or more thorough inspections. Therefore, command, local commanders, and maintenance officers have the prerogative to increase the frequency of scope of any requirements; they are expected to exercise this prerogative.

6-4 INSPECTION, CLEANING, AND PAINTING PROCEDURES.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside cabinets of major groups.

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel should not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

Table 6-5. Preventive Maintenance Services Schedule

Major Equipment	Preventive Maintenance Action	D	W	M	Q	SA	A	S	Notes	Procedure
Transmitter Group	Check indicators.					X			1	Perform indicator check in accordnance with Table 4-8.
Transmit Antenna, Unit 100	Check antenna supports, backscreen, balun, and transmission lines for deterioration.				X				1	Paragraph 6-9.6
	Check balun domes, antenna element dielectric supports, balun/element terminals and ground screens.					X			2,3	Paragraph 6-9.8. If repair is required refer to paragraph 6-7.2.
Elemental Transmitter, Units 110 through 133 and 222 through 233	Run performance checks and alignments:									
	1 Input overdrive							X	2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	2 RF power gain							X	2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	3 Output power flatness							X	2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	4 Automatic recycle							X	2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	5 Output power amplitude							X	2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	6 Performance monitor/ control functions							X	2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	7 Reverse RF power trip						X		2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	8 Interlock circuits test						X		2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	9 Spectral purity test.							X	1	Refer to Table 6-3 in TO 31P6-2FPS118-81.
Transmitter Module, Units 110 through 121	Check indicators.				X				1	Refer to Table 6-3 in TO 31P6-2FPS118-81.

Table 6-5. Preventive Maintenance Services Schedule -CONT

Major Equipment	Preventive Maintenance Action	D	W	M	Q	SA	A	S	Notes	Procedure
	Inspection, check for wear and lubrication and clean filament leads.						X		2,4D	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	Visual inspection of lower compartment components.				X				2,4D, 5	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	Visual inspection, clean, and test lower compartment components.					X			2,4D, 5	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	Visual inspection of upper compartment components.			X					2,4D, 5	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	Check X-ray radiation.						X		1	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	RF radiation hazard check							X	1	Refer to Table 6-3 in TO 31P6-2FPS118-81.
High Voltage Power Supply Units 121 through 133	Check indicators.				X				1	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	Visual inspection of components.			X					2,4D, 5	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	Visual inspection, clean, and test components.					X			2,4D, 5	Refer to Table 6-3 in TO 31P6-2FPS118-81.
	Test fire the crowbar circuit.					X			2,4N	Refer to Table 6-3 in TO 31P6-2FPS118-81.
High Voltage Ac Knive Switch, Units 222 through 233	Visual inspection, clean, and lubricate.					X			2,4D, 5	Refer to Table 6-3 in TO 31P6-2FPS118-81.
Transmit Beamformer, Unit 150	Inspect cabinet interior and exterior for dirt accumulation.						X		1	If cleaning is required refer to paragraph 6-4.1.3.
	Inspect cabinet interior and exterior for paint deterioration.						X		1	If repair is required refer to paragraphs 6-4.2 and 6-4.3.
	Inspect air outlet RF screens on top of cabinet.						X		1	If cleaning is required refer to paragraph 6-4.1.1.
	Clean air filter at bottom of A1 swingout rack; check operation of cabinet fans.				X				1	Paragraphs 6-9.1 and 6-4.1.1

Table 6-5. Preventive Maintenance Services Schedule -CONT

Major Equipment	Preventive Maintenance Action	D	W	M	Q	SA	A	S	Notes	Procedure
	Inspect air inlet RF screen located in base of cabinet.						X		2,3	Paragraph 6-4.1.2.
	Check voltage regulator and power supply fault report.						X		1,2	Paragraph 6-9.3
	Check voltage regulator ripple and noise.						X		1	Paragraph 6-9.14
	Voltage regulator voltage check and adjustment.						X		1	Paragraph 6-9.16
	Check cabinet overtemperature switch fault report.						X		1,2	Paragraph 6-9.2
Exciter, Auxiliary Exciter, Units 151 and 152	Inspect cabinet interior and exterior for dirt accumulation.						X		1	If cleaning is required refer to paragraph 6-4.1.3.
	Inspect cabinet interior and exterior for paint deterioration.						X		1	If repair is required refer to paragraphs 6-4.2 and 6-4.3.
	Inspect air inlet RF screen located in base of cabinet.						X		1	Paragraph 6-4.1.2.
	Inspect RF screen located directly below power supply A9 and above fan assembly A14 for dirt accumulation.						X		1	Paragraph 6-9.7
	Inspect air outlet RF screens on top of cabinet.				X				1	If cleaning is required refer to paragraph 6-4.1.1.
	Check operation of cabinet fans.				X				1	Paragraph 6-9.4
	Check A/DC (A2) fan for proper operation.				X				1	Paragraph 6-9.18
	Check cabinet overtemperature switch fault report.						X		1	Paragraph 6-9.5
	Check voltage regulator and power supply fault report.						X		1,2	Paragraph 6-9.3
	Check dc power supply ripple and noise.						X		1	Paragraph 6-9.13

Table 6-5. Preventive Maintenance Services Schedule -CONT

Major Equipment	Preventive Maintenance Action	D	W	M	Q	SA	A	Notes	Procedure
	Check frequency calibrator A3 frequency drift.		X					1	Paragraph 6-9.11
	Check frequency calibrator A3 battery charge and load.			X				1	Paragraph 6-9.12

Legend

D Daily
W Weekly
M Monthly
Q Quarterly
SA Semiannually
A Annually

Notes

1. Conduct while system is operating in NORMAL mode.
2. Coordinate all maintenance affecting system operation with the system maintenance console technician.
3. Remove cabinet input power during performance of procedure.
4. System status required for equipment.
   4N = Equipment not operational and voltage is applied.
   4O = Equipment operational and voltage is applied.
   4D = Equipment not operational and voltage is disconnected.
5. Maintenance period adjustments may be made based on environmental conditions that may exist at a specific transmit site.

These procedures provide instructions for inspecting, cleaning, and painting equipment areas in the transmit facility, including cabinets of major groups. Do not remove cabinet power for minor repair procedures performed on doors or external surfaces of the cabinet(s). Remove power from cabinet(s) paragraph 6-2.7 and for elemental transmitter cabinets and paragraph 4-6.3 for all other cabinets only for procedures involving interior surfaces and major refinishing of cabinet exterior. Make sure that prime power circuit breakers are turned off and tagged with a maintenance-in-progress sign before performing work inside a cabinet. Perform the applicable removal/installation procedure for any LRU(s) that need to be removed or repositioned to complete those procedures. If access to transmit sounding group cabinets is required, perform equipment cabinet access procedure in paragraph 6-2.7 as required. If access to sounder or sounder antenna fields and/or associated antenna equipment is required, perform the applicable antenna field access procedure in paragraph 6-2.8.

6-4.1 Inspection and Cleaning Procedures.

6-4.1.1 Typical Cabinet Air Outlet/Inlet Radio Frequency Screen Cleaning Procedure.

6-4.1.1.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Brush, dust	1	23d
Cleaner, vacuum	1	23a

6-4.1.1.2 Procedure.

1. Obtain vacuum cleaner (Table 1-4, Item 23a) with soft brush nozzle (Table 1-4, Item 23d).

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains current and voltage levels which can cause death or serious injury to personnel. If maintenance action requires access to interior of a cabinet, ensure cabinet is completely powered down prior to performing maintenance action.

CAUTION

EQUIPMENT DAMAGE HAZARD

Use extreme care when cleaning or removing RF screens to prevent damage to honeycomb structure. Do not use filter coating materials on screens or filters.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. For filters and screens on interior of cabinet (except at bottom of swingout rack), access applicable display terminal of TMC:
   a. Access TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY and determine if there is a backup unit for cabinet.
   b. BACKUP EXISTS. Put cabinet OFFLINE and place backup unit ONLINE.
   c. BACKUP DOES NOT EXIST. Terminate mission using the TXAFL TEST SELECTION MENU on TMC.
   d. Refer to Positional Handbook for TMC operating instructions.
3. Remove power from cabinet prior to any maintenance action. See paragraph 6-2.7 for elemental transmitter cabinets and paragraph 4-6.3 for all other cabinets power removal procedures.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3, and overtemperature switches S1 and S2 in Exciter, and Auxiliary Exciter, Units 151 and 152 cabinets.

NOTE

If RF screens have an accumulation of dust and oil, remove screens and filters and carefully clean them with a solution of mild detergent and water. Ensure RF screens are dry before installation.

4. Using vacuum cleaner with soft brush nozzle, remove dust accumulation from RF screens and filters.

NOTE

If power was removed from cabinet perform steps 5 through 7 below.

5. Reapply power to cabinet in accordance with the energizing procedure paragraph 6-2.7 for elemental transmitter and in paragraph 4-6.1 for all other cabinets.

6. Configure cabinet for operation in accordance with the configuring procedure in paragraph 4-6.2.

7. Perform the applicable step below on the TMC. Reference step 2.

   a. Return cabinet to ONLINE status and backup to OFFLINE using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY.

   b. Restart mission using the TXAFL TEST SELECTION MENU.

6-4.1.2 Typical Cabinet Floor Air Inlet Radio Frequency Screen Inspection Procedure.

6-4.1.2.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Flashlight	1	33m
Mirror, inspection	1	33o

6-4.1.2.2 Procedure.

1. Obtain flashlight (Table 1-4, Item 33m), and mirror (Table 1-4, Item 33o).

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside cabinets of major groups.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. At applicable display terminal of TMC:

   a. Access TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY and determine if there is a backup unit for cabinet.

   b. BACKUP EXISTS. Put cabinet OFFLINE and place backup unit ONLINE.

   c. BACKUP DOES NOT EXIST. Terminate mission using the TXAFL TEST SELECTION MENU on TMC.

   d. Refer to Positional Handbook for TMC operating instructions.

3. Remove power from cabinet prior to any maintenance action. See paragraph 4-6.3 for power removal procedure.

4. Open cabinet doors.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3, and overtemperature S1 and S2 in Exciter and Auxiliary Exciter, Units 151 and 152 cabinets.

NOTE

Do not remove cabinet assemblies for inspection or cleaning purposes.

5. Using flashlight and mirror, inspect RF honeycomb screen visible through holes in cabinet floor plate.

NOTE

Using suction-cupped device supplied with floor panel package, remove floor panels (as required).

6. If screens are visibly obstructed with dust or dirt, conduct under-floor cleaning of the RPIE air conditioning system and screens.

7. Close cabinet doors.

8. Reapply power to cabinet in accordance with the energizing procedure in paragraph 4-6.1.

9. Configure cabinet for operation in accordance with the configuring procedure in paragraph 4-6.2.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

10. Perform the applicable step below on the TMC. Reference step 2.

    a. Restart mission using the TXAFL TEST SELECTION MENU.

    b. Return cabinet to ONLINE status and backup to OFFLINE using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY.

6-4.1.3 Typical Cabinet Cleaning Procedures.

6-4.1.3.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Brush, dust	1	23d
Cleaner, vacuum	1	23a

6-4.1.3.2 Procedure.

1. Obtain vacuum cleaner (Table 1-4, Item 23a) with soft brush nozzle (Table 1-4, Item 23d).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. At applicable display terminal of TMC:

    a. Access TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY and determine if there is a backup unit for cabinet.

    b. BACKUP EXISTS. Put cabinet OFFLINE and place backup unit ONLINE.

    c. BACKUP DOES NOT NOT EXIST. Terminate mission using the TXAFL TEST SELECTION MENU on TMC.

    d. Refer to Positional Handbook for TMC operating instructions.

3. Remove power from cabinet before cleaning interior surfaces of cabinet. For elemental transmitter cabinets power removal refer to paragraph 6-2.7; for all other cabinets refer to paragraph 4-6.3

4. Open cabinet doors.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside cabinets of major groups. Ensure unit circuit breaker on appropriate power distribution panel is set to OFF before cleaning interior of cabinets. Do not remove power from cabinets for minor cleaning procedures performed on exterior surfaces of cabinets.

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3, and overtemperature S1 and S2 in Exciter and Auxiliary Exciter, Units 151 and 152 cabinets.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise care when cleaning cabinets to avoid damage to backplane wiring and cabling. Do not use brushes of any kind to clean backplane wiring.

5. Using vacuum cleaner with soft brush nozzle, thoroughly remove any dust and debris from cabinet.

6. Using low pressure air (vacuum cleaner exhaust port) blow dust from backplane wiring; do not remove boards or assemblies from backplane for cleaning purposes.

WARNING

FLAMMABLE AND TOXIC MATERIALS HAZARD

Isopropyl alcohol is flammable and toxic. Drinking this alcohol can cause death. Avoid inhalation of fumes and vapors. Use in a well-ventilated area. Keep away from open spark or flame.

7. Using lint-free cloth moistened with isopropyl alcohol remove dirt and grime from interior of cabinet.

8. Using lint-free cloth moistened with isopropyl alcohol, remove dirt and grime from exterior surfaces of cabinet.
9. Close and secure cabinet doors.
10. Reapply power to cabinet. For elemental transmitter cabinets refer to power up procedure in paragraph 6-2.7, for all other cabinets refer to procedure in paragraph 4-6.1.
11. Configure cabinet for operation in accordance with the configuring procedure in paragraph 4-6.2.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

12. Perform the applicable step below on the TMC. Reference step 2.
    a. Restart mission using the TXAFL TEST SELECTION MENU.
    b. Return cabinet to ONLINE status and backup to OFFLINE using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY.

6-4.2 Painting Procedures.

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains current and voltage levels which can cause death or serious injury to personnel. If maintenance action requires access to interior of a cabinet, ensure cabinet is completely powered down prior to performing maintenance action.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

All materials recommended in this paragraph are identified in Table 6-1.

These procedures provide instructions for inspecting, cleaning, and painting equipment areas in the transmit facility including cabinets of major groups. Do not remove cabinet power for procedures performed on doors or external surfaces of the cabinet(s). Remove power from cabinet(s) for elemental transmitter cabinets refer to paragraph 6-2.1 and for all other cabinets refer to paragraph 4-6.3 only for procedures involving interior surfaces. Make sure prime power circuit breakers are turned off and tagged with a maintenance-in-progress sign before performing work inside a cabinet. Perform the applicable removal/installation procedure for any LRU(s) that needs to be removed or repositioned to complete those procedures. If access to transmit sounding group cabinets is required, perform equipment cabinet access procedures in paragraph 6-2.1 as required. If access to sounder or sounder out-of-coverage antenna fields and/or associated antenna equipment is required, perform the applicable antenna field access procedure in paragraph 6-2.2.

6-4.2.1 General. Remove contaminants that accelerate corrosion as soon as possible. Oil, grease, and adherent nonporous oxide coatings may protect against corrosion. Remove these coatings before preventive compounds, protective finishes, electroplated metal, or paint finishes are applied. Thorough cleaning is essential in any preservation method. No method can protect a part if contaminants or residues, which accelerate corrosion or interfere with adhesion, are present on the part's surface. Improper cleaning makes all preservation methods ineffective. Clean metal items that are given chemical finishes or coatings. Their surfaces must be free of dust, grit, grease, oil, acid, alkaline and salt residues, corrosion, and other contaminants. Contaminants may cause protective coatings to be broken. This results in pinholes, craters, and fissures, or other defects making the coating ineffective. Use the cleaning method most suitable for the material of which the part is made and the service requirements of the finished item.

6-4.2.2 Cleaning Instructions.

6-4.2.2.1 General Cleaning. Follow general cleaning instructions prior to and during disassembly of the equipment.

6-4.2.2.2 General Cleaning of Painted Surfaces. For general cleaning of painted surfaces, use clean water or a soap solution of 1 cup of detergent to 1 gallon of hot water. Painted surfaces contaminated by salt spray should be rinsed with clean water as soon as possible.

6-4.2.2.3 Cleaning of Phosphate-Finished Metals.

WARNING

FLAMMABLE AND TOXIC MATERIALS HAZARD

Mineral spirits paint thinner and Freon TE are flammable and/or toxic. Ensure area is well ventilated and wear organic-vapor respirators.

CAUTION

EQUIPMENT DAMAGE HAZARD

Use care in cleaning any coated surface to prevent damage to the coating, either by abrasion or chemical action. Do not clean highly finished surfaces by any method that will mar the finish. Degreasing solvents may be used on such surfaces.

Use Freon TE, mineral spirits paint thinner, or vapor degreasing to clean phosphate-finished surfaces. Strong alkaline materials such as sodium hydroxide (caustic soda), sodium carbonate (soda ash), tribasic sodium phosphate, or a solution of alkali-type cleaning compound of the strength used to clean ferrous metals should not be used since they will dissolve the phosphate coating.

6-4.2.2.4 Cleaning of Anodized Aluminum Alloys.

CAUTION

EQUIPMENT DAMAGE HAZARD

If steam cleaning is the method to be used, careful selection of alkali is necessary. The precautions followed in the choice of cleaner for alkaline immersion methods should be followed in the choice of cleaner for steam cleaning method.

Clean anodized surfaces of aluminum alloys or aluminum prior to painting by steam cleaning or by solvent cleaning using Freon TE, mineral spirits paint thinner, or any of the commercial nonetching aluminum cleaners.

6-4.2.2.5 Cleaning of Painted or Lacquered Metal Surfaces. Use self-emulsifying solvent cleaning compound or water solution of painted-surface detergent to remove dirt, oil, and grease from painted metal surfaces. A weak solution of tribasic sodium phosphate (2 or 3 tablespoonfuls per gallon of water) can be used for the same purpose. Rinse the surface with clean water after cleaning. Sheepskin leather chamois is suitable for wiping and drying the surfaces. Emulsion cleaning and steam cleaning can be used to remove dirt, oil, and grease from painted metal surfaces if required equipment is available. Both of these methods are suitable for rapid cleaning or large quantities of material. Use Freon TE or mineral spirits paint thinner to clean old finishes in good condition before applying new topcoats. These solvents also can be used to clean painted surfaces before applying decals.

6-4.2.2.6 Dip Tanks.

CAUTION

EQUIPMENT DAMAGE HAZARD

To prevent damage to lubrication in sealed bearings, rubber seals or gaskets, and electrical components, do not immerse them in any cleaning solution.

When dip tanks are available, and all nonmetal parts are removed from part to be cleaned, use vapor-degreasing process. Wash rubber parts in soap and water. Wipe electrical-wiring insulation (except Teflon) clean with a cloth moistened in Freon TE. Teflon is cleaned with soap and water.

6-4.3 General Corrosion Removal.

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains current and voltage levels which can cause death or serious injury to personnel. If maintenance action requires access to interior of a cabinet, ensure cabinet is completely powered down prior to performing maintenance action.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

All materials recommended in this paragraph and following paragraphs are identified in Table 6-1.

These procedures provide instructions for inspecting, cleaning, and painting equipment areas in the transmit facility including cabinets of major groups. Do not remove cabinet power for procedures performed on doors or external surfaces of the cabinet(s). Remove power from cabinet(s) for elemental transmitter cabinets refer to paragraph 6-2.7 and for all other cabinets refer to paragraph 4-6.3 only for procedures involving interior surfaces. Make sure that prime power circuit breakers are turned off and tagged with a maintenance-in-progress sign before performing work inside a cabinet. Perform the applicable removal/installation procedure for any LRU(s) that need to be removed or repositioned to complete those procedures. If access to transmit sounding group cabinets is required, perform equipment cabinet access procedures in paragraph 6-2.7. If access to sounder or sounder out-of-coverage antenna fields and/or associated antenna equipment is required, perform the applicable antenna field access procedure in paragraph 6-2.8. Prior to corrosion removal, clean surfaces as specified in paragraphs 6-4.2.1 and 6-4.2.2 and remove paint as outlined in paragraph 6-4.3.1 below. Then procedures in paragraphs 6-4.4 through 6-4.6 can be performed while observing general precautions of paragraph 6-4.3.1.

6-4.3.1 Paint Removal.

1. Using aircraft cleaning brush, apply organic solvent type paint remover; apply remover with as little brushing as possible.
2. Allow remover to remain on surface until paint is softened.
3. Wash area thoroughly with water.
   a. Use hose if area can be flushed without getting water and paint remover in equipment.
   b. Otherwise, wipe all remover from area with a damp cloth, changing it frequently.
4. Repeat steps 1 through 3 above until all paint has been removed from the surface.

6-4.3.2 Corrosion Removal Methods. Corrosion products must be removed completely. If any residue remains on the surfaces, corrosive properties continue even after area is refinished. The two accepted methods of corrosion removal are the mechanical method and chemical method. Mechanical removal of corrosion products is the method used for areas that are in an advanced stage of corrosion as indicated by deep pitting. It is the most useful method in cases of intergranular corrosion and areas containing complex assemblies as well as interior surfaces. Use this method whenever there is any possibility of damaging adjacent areas by the use of chemicals or rinse water. Paints and lacquers do not adhere over rust, corrosion, dirt, grease, wax, oil, damp surfaces, or old paint that is loose or badly cracked. Remove rust, corrosion, and loose scale by mechanical means such as wire brushing, light abrasive blasting, or use of phosphoric-acid base (metal conditioner and rust remover) corrosion-removing compound. Remove old paint in poor condition by use of paint remover or by mechanical means such as scraping and sanding. Remove grease and dirt by use of a cleaner in water solution followed by a thorough drying or use of organic solvents. The surface then is sanded and all dust is removed with a painter's dusting brush or an air hose. Phosphoric-acid base corrosion-removing compound is used after cleaning those metal surfaces on which a phosphate coating is needed for primer or paint to adhere well. Refer to paragraphs 6-4.4 through 6-4.6 for corrosion removal on specific metals. The chemical removal method of removing corrosion products from dimensionally critical surfaces is preferred. When working with any acid solution in the chemical removal of corrosion, keep solution confined to the area being treated and away from operating mechanisms and plated steel parts. This can be accomplished by covering adjacent areas with waterproof paper and masking tape. Keep wet cloth at hand and immediately wipe away any acid splashes.

6-4.4 Steel Corrosion Removal.

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains current and voltage levels which can cause death or serious injury to personnel. If maintenance action requires access to interior of a cabinet, ensure cabinet is completely powered down prior to performing maintenance action.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

All materials recommended in this paragraph are identified in Table 6-1.

These procedures provide instructions for inspecting, cleaning, and painting equipment areas in the transmit facility including cabinets of major groups. Do not remove cabinet power for procedures performed on doors or external surfaces of the cabinet(s). Remove power from cabinet(s) (for elemental transmitter cabinets refer to paragraph 6-2.7 and for all other cabinets refer to paragraph 4-6.3) only for procedures involving interior surfaces. Make sure that prime power circuit breakers are turned off and tagged with a maintenance-in-progress sign before performing work inside a cabinet. Perform the applicable removal/installation procedure for any LRU(s) that need to be removed or repositioned to complete those procedures. If access to transmit sounding group cabinets is required, perform equipment cabinet access procedures in paragraph 6-2.7. If access to sounder or sounder out-of-coverage antenna fields and/or associated antenna equipment is required, perform the applicable antenna field access procedure in paragraph 6-2.8.

6-4.4.1 General. Use mechanical method for areas of deep pitting. The chemical method may be used for areas of light corrosion.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not use the following method on aluminum or magnesium.

6-4.4.2 Mechanical Method.

WARNING

DEBRIS HAZARD

Motorized wire wheels may cause flying debris. Use adequate shields over the wire wheels and adequate eye protection when personnel employ motorized wire wheels. Warn all personnel in the immediate area that motorized wire wheels are being used.

1. Remove severe corrosion with files, steel wire brushes, motorized steel wire wheels, or 320-grit aluminum-oxide abrasive cloth. Steel wool also may be used if the corrosion is light.

NOTE

On corrosion-resistant steel, use stainless steel wire brushes, motorized stainless steel wire wheels, or stainless steel wool.

2. After removing all visible corrosion product, scrape away material to a further depth of at least 0.002 inch to ensure that absolutely no corrosion product remains.
3. Blend edges of the area into surrounding areas to form smooth, saucer-shaped depression.
4. Polish area to a gloss equal to that of the rest of the part.
5. Apply appropriate finish. See paragraph 6-4.7.

6-4.4.3 Chemical Method.

WARNING

ACID SOLUTION HAZARD

Personnel shall wear rubber gloves, rubber apron, and goggles while working with acid solution. If acid comes in contact with the skin or eyes, flush the affected area immediately with clean water for at least 20 minutes. Get medical attention. Always pour acid into solution.

EXPLOSIVE MATERIAL HAZARD

Do not allow acid solution in any location where it may possibly come in contact with any explosive material.

FLAMMABLE AND TOXIC MATERIALS HAZARD

Isopropyl alcohol is flammable and toxic. Drinking this alcohol can cause death. Avoid inhaling fumes and vapors. Use in a well-ventilated area. Keep away from open flame or spark.

1. Prepare an alcohol-phosphoric acid cleaning solution:

   35 percent butyl alcohol

   25 percent isopropyl alcohol

   20 percent water

   20 percent phosphoric acid

2. Mask off nearby operating mechanisms, cracks, and noncorroded areas.

WARNING

FLAMMABLE AND TOXIC MATERIALS HAZARD

Freon TE is flammable and toxic. Use in a well-ventilated area. Ensure that personnel wear organic respirators. Avoid inhaling its fumes. Keep away from open flame or spark.

3. Remove scaly deposits with steel wire brush, steel wool, or 320-grit aluminum-oxide abrasive cloth; remove any loose particles from surface by wiping with a cloth dampened in Freon TE.
4. Apply alcohol-phosphoric acid solution with aircraft cleaning brush; continue to brush and replenish solution until all corrosion product is removed.
5. Rinse off acid solution thoroughly with fresh water.
6. Apply appropriate finish. See paragraph 6-4.7.

6-4.5 Aluminum Corrosion Removal.

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains current and voltage levels which can cause death or serious injury to personnel. If maintenance action requires access to interior of cabinet, ensure cabinet is completely powered down prior to performing maintenance action.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

All materials recommended in this paragraph are identified in Table 6-1.

These procedures provide instructions for inspecting, cleaning, and painting equipment areas in the transmit facility including cabinets of major groups. Do not remove cabinet power for procedures that are performed on doors or external surfaces of the cabinet(s). Remove power from cabinet(s) (for elemental transmitter cabinets refer to paragraph 6-2.7 and for all other cabinets refer to paragraph 4-6.3) only for procedures involving interior surfaces. Make sure that prime power circuit breakers are turned off and tagged with a maintenance-in-progress sign before performing work inside a cabinet. Perform the applicable removal/installation procedure for any LRU(s) that need to be removed or repositioned to complete those procedures. If access to transmit sounding group cabinets is required, perform equipment cabinet access procedures in paragraph 6-2.7. If access to sounder or sounder out-of-coverage antenna fields and/or associated antenna equipment is required, perform the applicable antenna field access procedure in paragraph 6-2.8.

6-4.5.1 General. Use mechanical method on aluminum alloys whenever possible. Use chemical method where mechanical method is impractical because of structural complexities or because damage to dimensionally critical surfaces may occur.

6-4.5.2 Mechanical Method.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not use steel wool.

1. For light corrosion, rub area with 320-grit aluminum-oxide abrasive cloth or aluminum wool; for heavy corrosion use carbide-tipped scraper or rotary file.
2. After removing all visible corrosion product, scrape away material to further depth of at least 0.002 inch to ensure absolutely no corrosion product remains.
3. Blend edges of area into surrounding areas to form smooth, saucer-shaped depression.
4. After all scraping is completed, polish area, first with 240-grit aluminum-oxide abrasive cloth and then with 320-grit aluminum-oxide abrasive cloth.
5. Apply appropriate finish. See paragraph 6-4.7.

6-4.5.3 Chemical Method.

1. Mask off nearby magnesium, plated steel, cracks, and joining surfaces.
2. Apply corrosion removing compound to the corroded area with an aircraft cleaning brush; continue to brush and replenish solution until all corrosion product is removed.
3. After 5 to 10 minutes, wipe off corrosion removing compound with damp cloth.
   a. Rinse cloth frequently in water to remove all traces of compound.
   b. Do not leave compound in contact with surface for more than 20 minutes.
4. Repeat steps 2 and 3 above, concentrating on the pitted areas until all corrosion product is removed.
   a. The bottom of each pit should appear clean and bright.
   b. Examine pits with a magnifying glass (Table 1-4, Item 33n).
5. Apply appropriate finish. See paragraph 6-4.7.

6-4.6 Brass and Copper Corrosion Removal.

WARNING

HAZARD TO PERSONNEL

The transmitter group equipment contains current and voltage levels which can cause death or serious injury to personnel. If maintenance action requires access to interior of a cabinet, ensure cabinet is completely powered down prior to performing maintenance action.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

All materials recommended in this paragraph are identified in Table 6-1.

These procedures provide instructions for inspecting, cleaning, and painting equipment areas in the transmit facility including cabinets of major groups. Do not remove cabinet power for procedures performed on doors or external surfaces of the cabinet(s). Remove power from cabinet(s) (for elemental transmitter cabinets refer to paragraph 6-2.7 and for all other cabinets refer to paragraph 4-6.3) only for procedures involving interior surfaces. Make sure that prime power circuit breakers are turned off and tagged with a maintenance-in-progress sign before performing work inside a cabinet. Perform the applicable removal/installation procedure for any LRU(s) that need to be removed or repositioned to complete those procedures. If access to transmit sounding group cabinets is required, perform equipment cabinet access procedures in paragraph 6-2.7. If access to sounder or sounder out-of-coverage antenna fields and/or associated antenna equipment is required, perform the applicable antenna field access procedure in paragraph 6-2.8.

6-4.6.1 Mechanical Method.

1. Remove loose scale with a brass wire brush.
2. Sand corroded area with 320-grit aluminum oxide abrasive cloth; on electrical parts, use crocus cloth.
3. Scrape away material to a further depth of at least 0.002 inch to ensure that absolutely no corrosion product remains.
4. Blend edges of that area into surrounding areas to form smooth, saucer-shaped depression.

WARNING

FLAMMABLE AND TOXIC MATERIALS HAZARD

Isopropyl alcohol is flammable and toxic. Drinking this alcohol can cause death. Avoid inhaling its fumes. Use in a well-ventilated area. Keep away from open flame.

5. Remove any loose particles from the surface; clean treated area with a clean cloth moistened in isopropyl alcohol.
6. Apply appropriate finish. See paragraph 6-4.7.

6-4.6.2 Chemical Method. No chemical method is recommended for brass and copper.

6-4.7 Surface Treatment and Finishing.

WARNING

FLAMMABLE AND TOXIC MATERIALS HAZARD

Painting fumes are flammable and toxic. Ensure painting area is well-ventilated and wear organic-vapor respirators when applying finishes to equipment.

NOTE

All materials recommended in this paragraph are listed in Table 6-1.

6-4.7.1 General. Immediately after removal of corrosion products (paragraphs 6-4.4 through 6-4.6), treat and finish the surfaces to prevent reoccurrence of corrosion. Table 6-6 gives the surface treatments and finishes required for various metals. Mounting surfaces, mating surfaces, and electrical connectors should not be treated and finished. Mounting and mating surfaces, especially heatsink surfaces, should be cleaned only.

6-4.7.2 Treatment for Aluminum.

1. Prepare corrosion-resistant primer by adding 1 ounce of primer to 2 quarts of clean water.
2. Apply solution evenly and liberally with nylon brush; keep metal wet with solution until surface becomes a gold color (1 to 5 minutes).
3. Remove solution by rinsing with water or by blotting with clean soft cloth; do not rub until surface has dried.

Table 6-6. Treatment and Finish

Material	Procedure
Aluminum against similar metals	Apply corrosion resistant primer (paragraph 6-4.7.2).
	Apply resin acid metal pretreatment (paragraph 6-4.7.3).
	Apply 1 coat of zinc chromate primer.
	Apply 2 coats of appropriate enamel.
Aluminum against dissimilar metals	Apply corrosion resistant primer (paragraph 6-4.7.2).
	Apply resin acid metal pretreatment (paragraph 6-4.7.3).
	Apply 2 coats of zinc chromate primer.
	Apply 2 coats of appropriate enamel.
Steel	Apply resin acid metal pretreatment (paragraph 6-4.7.3).
	Apply 3 coats of zinc chromate primer.
	Apply 2 coats of appropriate enamel.
Stainless steel	Apply Pasa-Jell 71.
	Apply resin acid metal pretreatment (paragraph 6-4.7.3).
	Apply 1 coat of zinc chromate primer.
	Apply 2 coats of appropriate enamel.
Miscellaneous metals	Use same treatment as given for steel.
Antenna structure (j-bolts, etc.)	Perform steel corrosion removal (paragraph 6-4.4)
	Apply 2 coats of zinc dust primer

6-4.7.3 Pretreatment.

1. Preparation. Prepare resin acid metal pretreatment coating compound as follows:

a. This compound is supplied in 2 containers. One contains resin and enough space to add acid; the other contains acid and is taped to the resin can.

b. Usually, the compound is prepared for use by slowly pouring acid into the resin while stirring constantly.

NOTE

After mixing, the useful life of solution is only 4 hours. After this time, the adhesion of the coating is lower, even though no change in solution may be apparent. When area to be refinished is small, or full amount of coating compound will not be used within 4 hours, mix only part of amount supplied.

c. Mix 1 part acid to 4 parts resin by volume in stainless steel or glass container. Stir both components before pouring; pour acid into resin slowly, stirring constantly.

6-4.7.4 Application. Apply this compound in a thin, almost transparent coat. Thick coats do not harden properly and provide poor adhesion between chemical treatment and paint coats.

6-5 LUBRICATION SERVICES.

6-5.1 General. Lubricants used in the maintenance of the radar system must be stored in tightly sealed containers. This type of storage prevents contaminants from destroying the effectiveness of the lubricants. Observe any expiration dates marked on lubricant containers. Dispose of, and replace, any lubricants that have exceeded their expiration dates. Ensure that assemblies, lubrication tools, and components are clean before applying fresh lubricants. Do not apply excessive amounts of lubricant; too much lubricant can be as harmful as too little lubricant. Wipe off excessive lubricant with a clean, lint-free cloth. Materials referenced in the following paragraphs are fully described in the Consumable Materials List, Table 6-1. Specific tools and equipment referenced by item numbers in the following paragraph are fully described in Table 1-4, Equipment Required But Not Supplied.

6-5.2 Lubrication Services Schedule. The schedule of lubrication for the equipment group and references to appropriate procedures are given in Table 6-7. Do not perform any lubrication services except for those specified in Table 6-7. The lubrication services schedule in this TO supersedes all schedules listed by commercial manuals. These lubrication services are based on system operation of up to 24 hours a day, 7 days a week. These services are required in conjunction with the preventive maintenance services given in paragraph 6-3.

6-5.3 Typical Equipment Door or Panel Hinge, Door Latch, Door Interlock Switch Plunger, Drawer Slide, and Door or Rack Slide Bar Lubrication. This procedure provides the instructions for lubricating the equipment door or panel hinge, door latch, door interlock switch plunger, drawer slide, and door or rack slide bar in the equipment cabinets of the transmitter group.

1. Unlatch and open equipment doors.

2. Perform the typical door or panel hinge lubrication as specified below:

a. Liberally apply G620S spray silicone lubricant to joints of hinges and exposed hinge pins as shown in Figure 6-4. While lubricant is wet, operate hinge several times.

b. Wipe excess lubricant off adjacent surfaces of equipment with cloth.

3. Perform the typical door or panel latch lubrication as specified below:

a. Liberally apply G620S spray silicone lubricant to moving parts and shaft bushings of latch mechanism as shown in Figure 6-5. While lubricant is wet, operate latch several times.

b. Wipe excess lubricant off surfaces adjacent to latch mechanism with cloth.

4. Perform the typical door or panel interlock switch plunger lubrication as specified below:

a. Apply G620S spray silicone lubricant to plunger shaft, roller pin, and roller slot of interlock switch as shown in Figure 6-6. Actuate plunger several times while lubricant is still wet.

b. Wipe excess lubricant off adjacent equipment surfaces with cloth.

Table 6-7. Lubrication Services Schedule

Equipment	Periodicity M	Q	SA	A	Lubricant or Material Required	Reference Paragraph
Transmit Beamformer, Unit 150						
Door and rack hinges and slide bars, door latch mechanism, N3 swing-down retainer panel hinge assemblies, and N10A3 swing-down monitor panel hinge assembly.				X	G620S spray silicone	6-5.3
Exciter, Auxiliary Exciter, Units 151 and 152						
Door hinges, analog-to-digital converter A/DC A2 drawer slides, door slide bars, door latch mechanism, door interlock switch plunger, and N3 swing-down retainer panel hinge assemblies.				X	G620S spray silicone	6-5.3

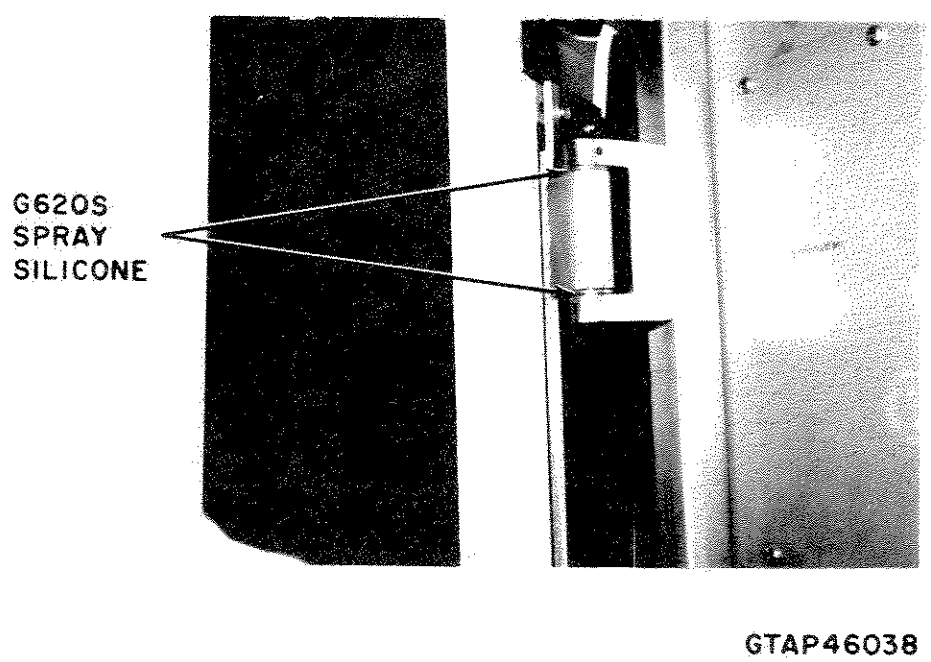

Figure 6-4. Typical Door or Panel Hinge Lubrication

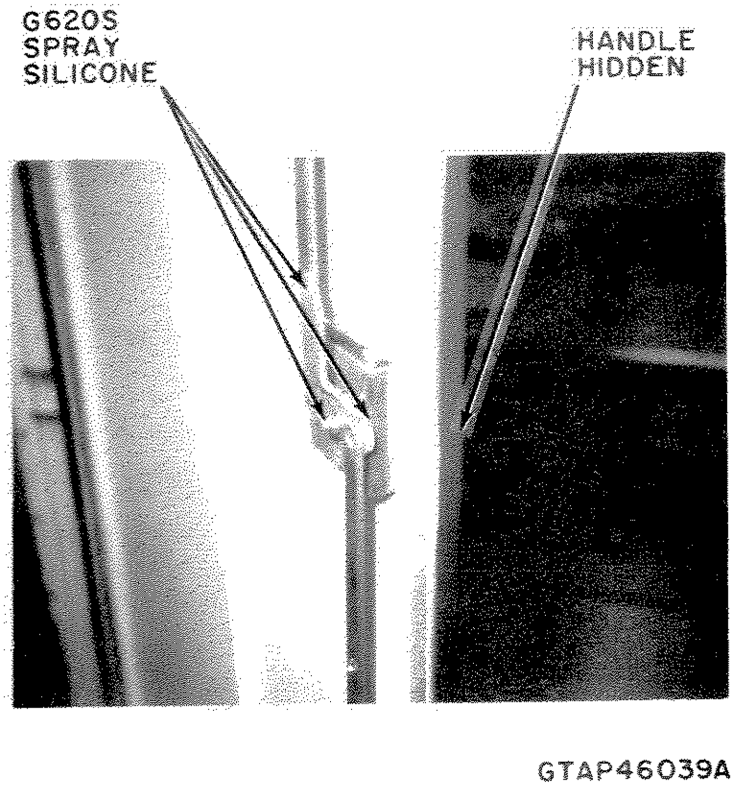

Figure 6-5. Typical Door or Panel Latch Lubrication

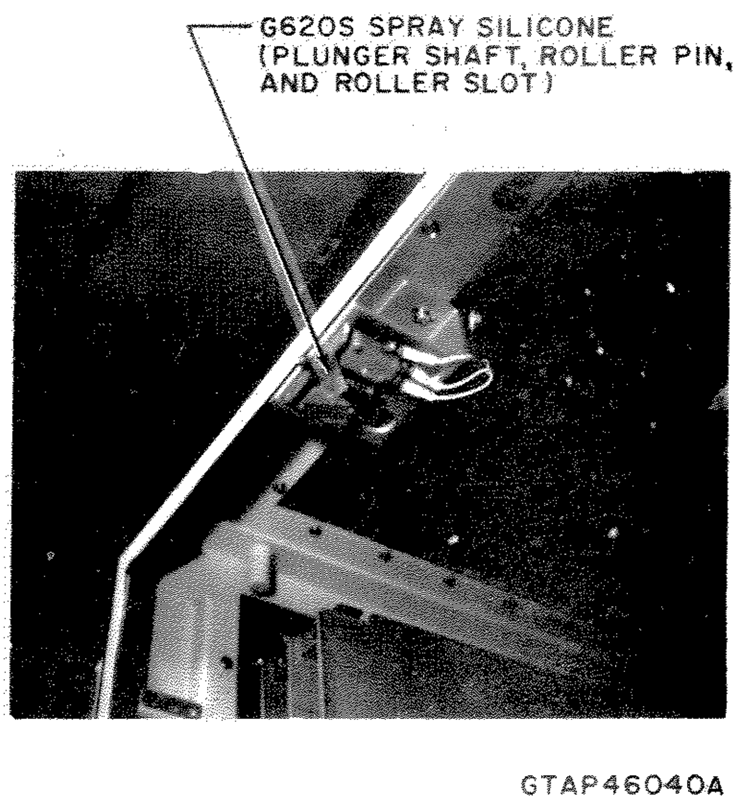

Figure 6-6. Typical Door or Panel Interlock Switch Lubrication

5. Perform the typical drawer slide lubrication as specified below:

   a. Release and pull out equipment mounted on drawer slides.

   b. Apply G620S spray silicone lubricant to grooves at tops and bottoms of slides or roller bearings as shown in Figure 6-7. While lubricant is wet, move equipment in and out several times on slides.

   c. Wipe excess lubricant off adjacent equipment surfaces with cloth.

   d. Close and secure equipment mounted on slides.

6. Typical rack or door slide bar lubrication.

   a. Pull swingout rack fully open.

   b. Apply G620S spray lubricant to joint and slide pin as shown in Figure 6-8. While lubricant is still wet, open and close rack several times.

   c. Wipe excess lubricant off adjacent equipment surfaces with cloth.

   d. Close and secure equipment racks.

7. Close and latch equipment doors.

6-6 GENERAL REMOVAL, REPAIR, AND INSTALLATION PROCEDURES.

6-6.1 Introduction. The following paragraphs describe maintenance procedures. The paragraphs contain information common to the transmitter group. Prior to and after completion of any maintenance procedure, notify the system maintenance console technician that the procedure has started/been completed.

6-6.2 Board Extender. The digital wire wrap board extender (Figure 6-9) is available for use in maintenance (Table 1-4, Item 3a). The extender board is inserted and removed in the same manner as the boards.

6-6.3 Wire Removal and Replacement on Wire Wrap Pins.

6-6.3.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Bit-wrap (26)	1	31h
Bit-wrap (30)	1	31i
Pliers, diagonal/cutter	1	25ag
Pliers, needlenose	1	25k
Sleeve-wrap	1	31j
Stripper, wire	1	31d
Tool-unwrap (26)	1	31e
Tool-unwrap (30)	1	31f
Wire-wrap	1	31g

WARNING

HIGH CURRENT HAZARD

High current sources supply dc voltage to backplane/board socket pins. Ensure all supplies providing power to backplane are turned off before performing any maintenance activity on backplane/board socket pins or wiring.

NOTE

More than one wire may be wrapped on a single pin. Once unwrapped, all wires above the one to be replaced must be removed, discarded, and replaced, in addition to the one being replaced, if there is less than 1-1/2 inches of slack in them.

6-6.3.2 Removal.

1. At applicable display terminal of TMC:

   a. Access Transmit Site Initialization/RECONFIGURATION DISPLAY and determine if there is a backup unit for cabinet.

   b. BACKUP EXISTS. Put cabinet OFFLINE and place backup unit ONLINE.

   c. BACKUP DOES NOT EXIST. Terminate mission using the TXAFL TEST SELECTION MENU on TMC.

   d. Refer to Positional Handbook for TMC operating instructions.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

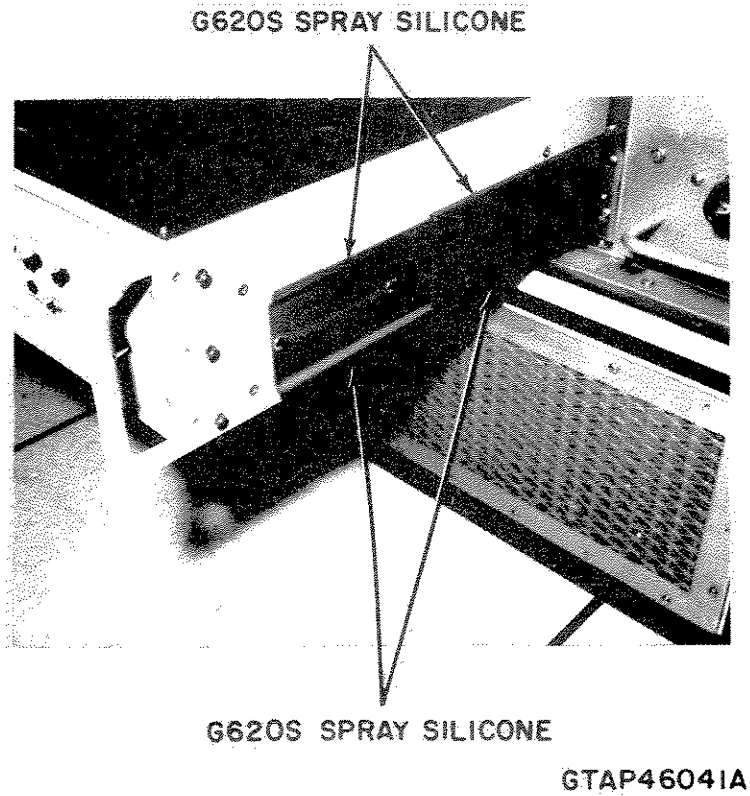

Figure 6-7. Typical Drawer Slide Lubrication

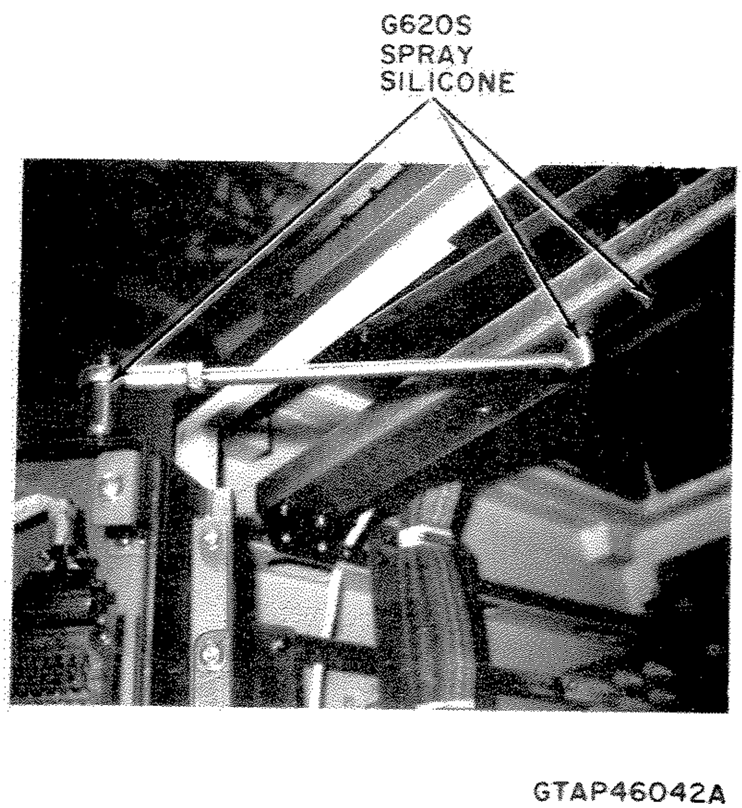

Figure 6-8. Typical Rack or Door Slide Bar Lubrication

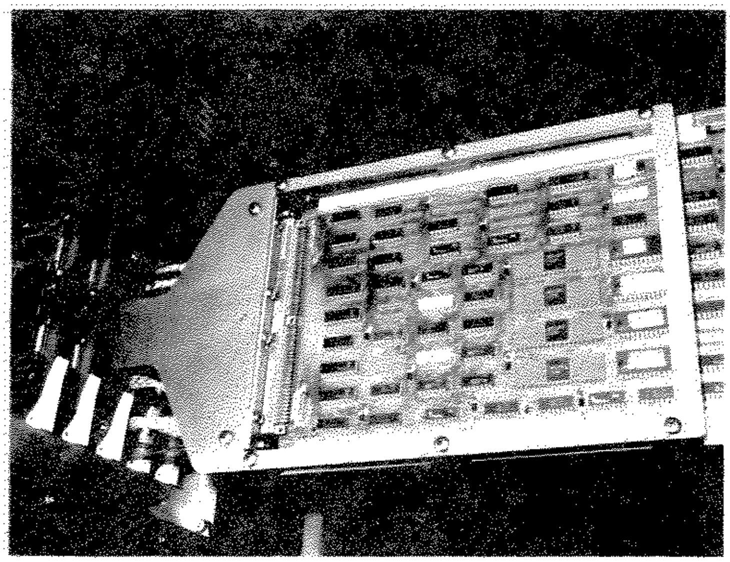

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Figure 6-9. Digital Wire Wrap Board Extender

2. Turn off all power applied to backplane or board.

3. Place small end of unwrap tool (Figure 6-10) over wire wrap pin; turn tool clockwise or counterclockwise until tool catches end of wire. Turn tool until coils of wire on pin are loose.

CAUTION

EQUIPMENT DAMAGE HAZARD

In steps 4 and 5 below, ensure that any small pieces of wire that break off are removed from the wiring backplane or board.

4. Remove tool and unwind wire from pin with needlenose pliers. Cut off bare, unwrapped section. Remove any small pieces of wire that are cut or that break off.

5. Note wire run on board or backplane. Lift wire gently from board or backplane. If there is less than 1-1/2 inches of slack in the wire, remove wrap on other end of wire as described in steps 3 and 4 above and discard wire.

6. Repeat steps 3 through 5 for all wires until the one to be replaced is removed. Remove any small pieces of wire that break off wires being replaced.

6-6.3.3 Replacement.

1. Using 26- or 30-gauge insulated wire as required, strip 1 inch of insulation from one end of wire.

2. Insert the stripped portion of wire into small hole in bit end of power wrapping tool (Figure 6-10) as shown in Figure 6-11. Bend wire at right angles to bit; lay in notch at side of bit.

3. Place bit of power wrapping tool over the full extent of the pin. Gently pull on wire while turning tool for 3 seconds to wrap wire.

4. Remove tool and inspect wire wrap. Wire must be tightly wrapped around pin with coils touching one another as shown in Figure 6-12.

5. Run wire to other pin. Cut wire 1-1/2 inches longer than required and strip off 1 inch of insulation. Repeat steps 2 through 4 for other end of wire.

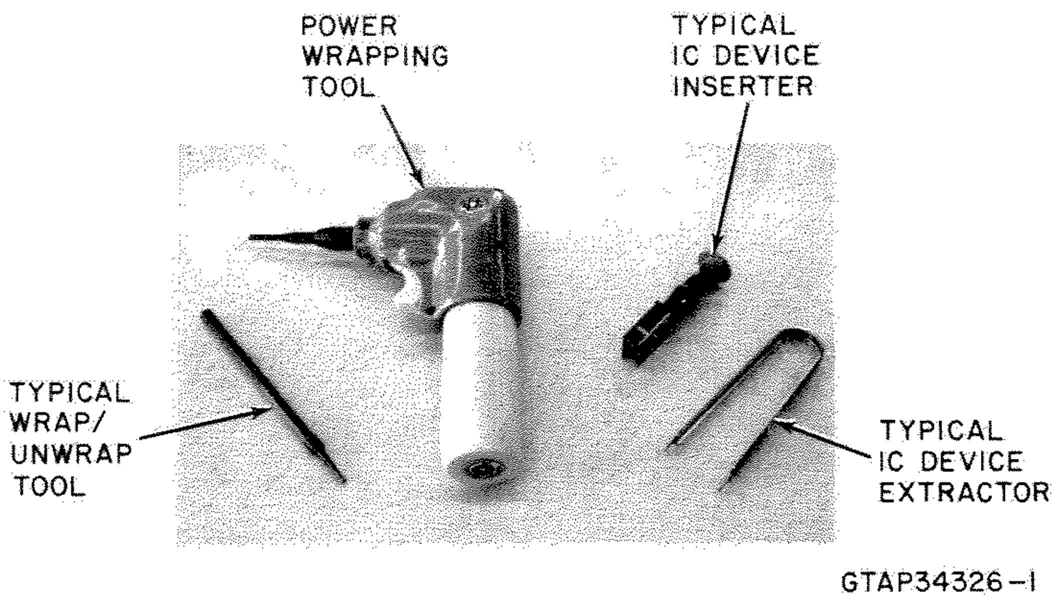

Figure 6-10. Wire Wrap and Integrated Circuit Device Removal and Replacement Tools

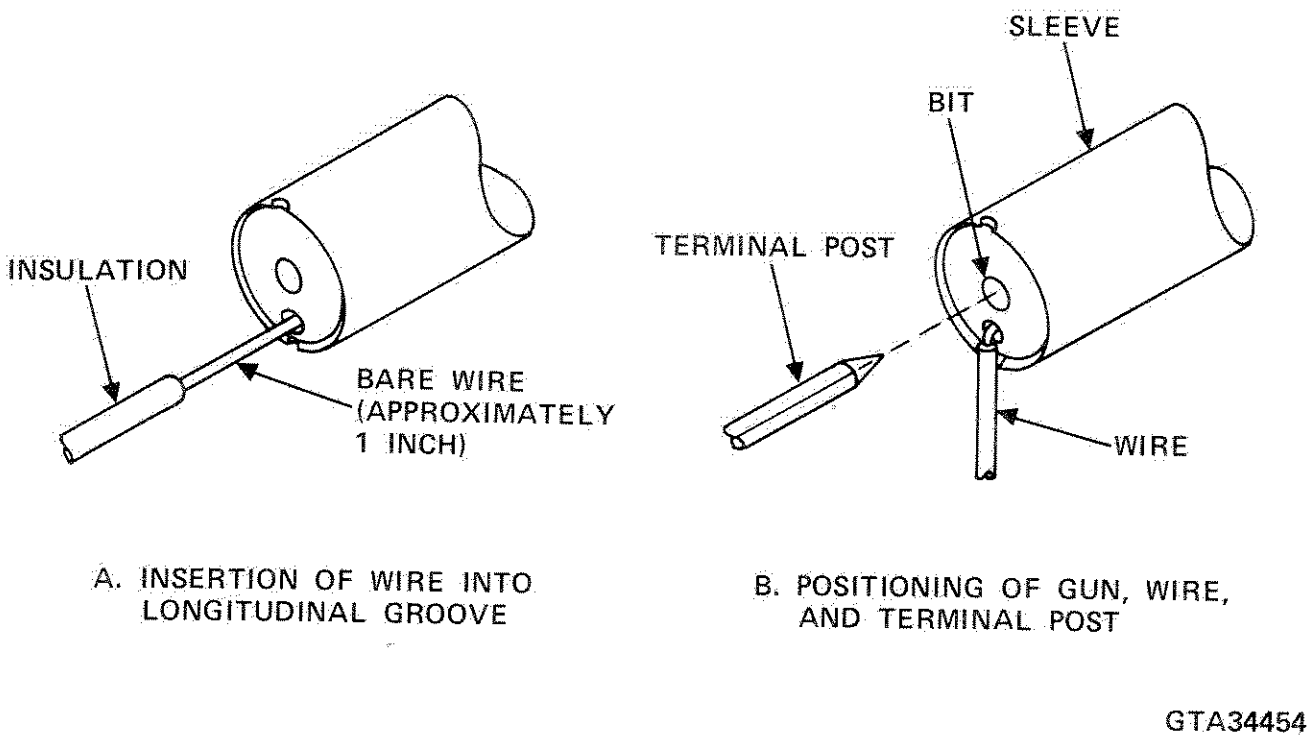

Figure 6-11. Preparation for Wire Wrapping

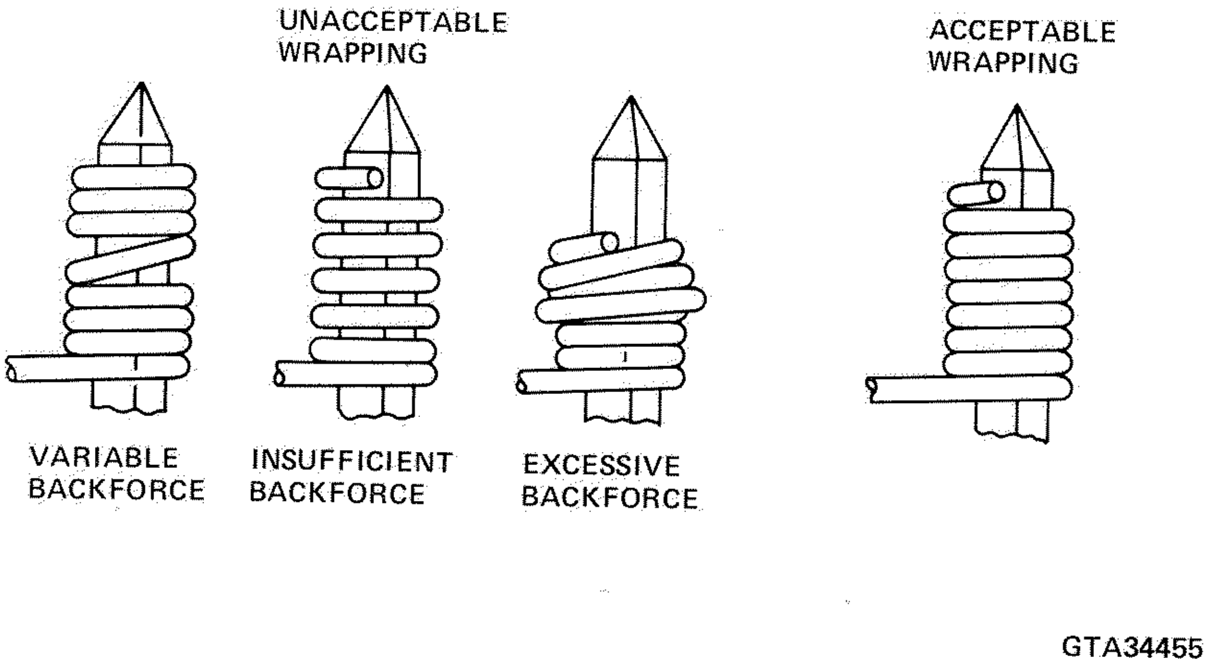

Figure 6-12. Wire Wrap Connections

6. Repeat steps 1 through 5 as required for all wires to be replaced on pin.

7. If no other maintenance is to be performed, reapply power to backplane or board, and close cabinet doors and/or panels.

8. Perform the applicable step below on the TMC. Reference step 1 in removal procedure.

   a. Restart mission using the TXAFL TEST SELECTION MENU.

   b. Return cabinet to ONLINE status and backup to OFFLINE using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY.

6-6.4 Typical Backplane Board Socket Wire Wrap Pin Removal and Replacement Procedure.

6-6.4.1 Tool Fabrication. Fabricate tools shown in Figure 6-13.

WARNING

HIGH CURRENT HAZARD

High current sources supply dc voltage to backplane/board socket pins. Ensure all supplies providing power to backplane are turned off before performing any maintenance activity on backplane/board socket pins or wiring.

6-6.4.2 Removal. (Figure 6-14).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. At applicable display terminal of TMC:

   a. Access TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY and determine if there is a backup unit for cabinet.

   b. BACKUP EXISTS. Put cabinet OFFLINE and place backup unit ONLINE.

   c. BACKUP DOES NOT EXIST. Terminate mission using the TXAFL TEST SELECTION MENU on TMC.

   d. Refer to Positional Handbook for TMC operating instructions.

2. Turn off all supplies providing dc power to backplane assembly.

3. Remove 2 or 3 boards from front of backplane in area where pin to be replaced is located.

CAUTION

EQUIPMENT DAMAGE HAZARD

Be careful not to damage wiring on adjacent pins when performing the following steps.

4. At rear of backplane (wiring side), carefully note connections of wire connected to pin to be removed. Then remove and discard wiring from pin (paragraph 6-6.3 above) and place extractor tool (A) over pin.

NOTE

Pin should bottom out in hole in extractor tool and tip of tool should be 2 or 3 mm away from bushing in backplane. When removing pin(s) mounted in board locator bushing (3), both pins must be driven out before bushing is driven out. If pin has broken off, use a flat punch to drive remainder of pin flush with bushing. Use pin punch or drill blank (Table 1-4, item 25bc) to drive remainder of pin out of bushing, then use extractor tool to drive bushing out of backplane.

5. While holding seating tool (B) firmly against metal backplane in an area adjacent to pin at front of backplane, carefully drive pin toward front of backplane using extractor tool and soft-faced hammer. When tip of tool touches bushing, carefully continue driving until bushing is pushed back through backplane.

6. Remove pin and bushing from front of backplane. If bushing is board locator bushing, note position of and then remove and retain indexing insert (2). Discard pin and bushing.

6-6.4.3 Replacement.

1. At front of backplane, insert appropriate new bushing (3, 4, 5, or 6) so that tip(s) of bushing(s) protrude from rear of backplane. If

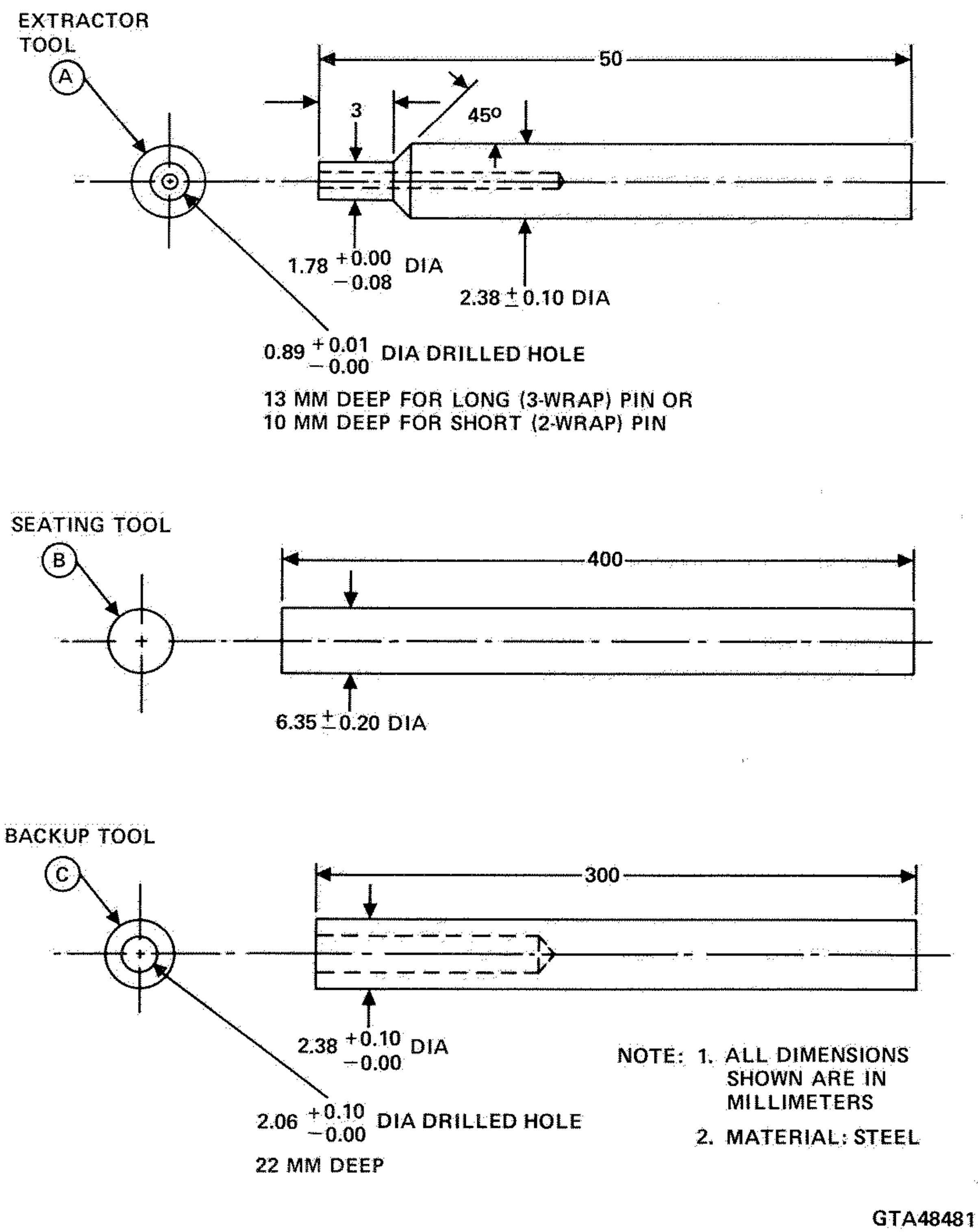

Figure 6-13. Backplane Pin Extractor and Inserter Tools

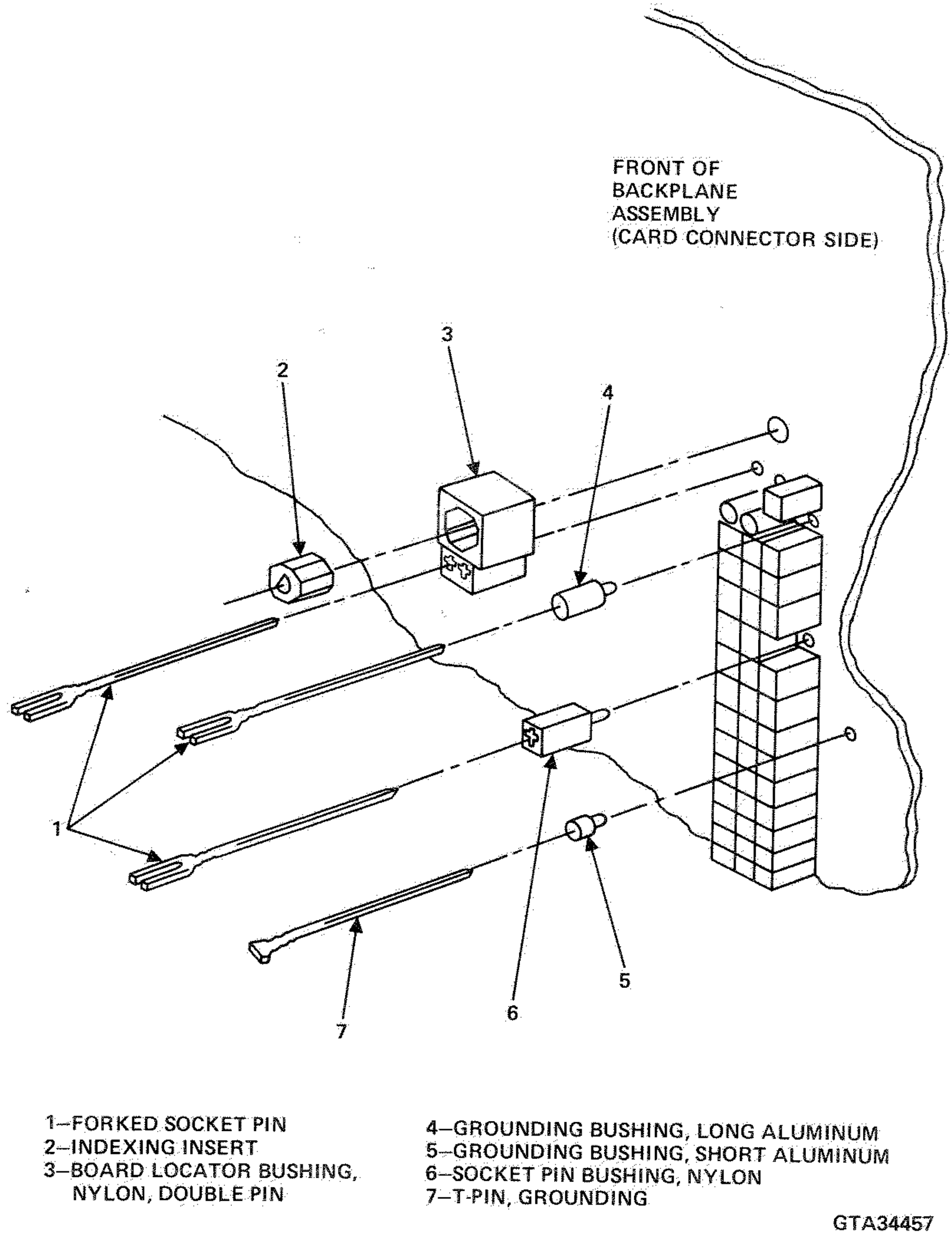

Figure 6-14. Typical Backplane Board Socket Wire Wrap Pins

bushing is board locator bushing (3), replace indexing insert in position noted in 5 above.

2. Using finger pressure, insert appropriate new pin (1 or 7) in bushing. If pin is forked socket pin (1), ensure pin is seated in bushing (3, 4, or 6) with the same orientation as pins in other adjacent bushings.

3. Place backup tool (C) over pin and protruding bushing at rear of backplane. Ensure tool is seated firmly on backplane, not on tip of bushing.

4. While exerting pressure on backup tool (C) at front of backplane, use seating tool (B) and soft faced hammer to gently seat pin in bushing. Ensure that forked pins in aluminum bushing (4) do not rotate when being seated.

5. Replace wiring on pin (paragraph 6-6.3 above) and replace boards in backplane.

6. If no other maintenance is to be performed, reapply power to backplane, close cabinet doors and panels.

7. Perform the applicable step below on the TMC. Reference step 1 in removal procedure.

   a. Restart mission using the TXAFL TEST SELECTION MENU.

   b. Return cabinet to ONLINE status and backup to OFFLINE using the TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY.

8. Verify repair with EPM and AFL/I programs.

6-6.5 Cable and Twisted Pair Wire Replacement. Flexible coaxial cables used in parallel signal channels in the transmitter group are critical length cables. If these cables become damaged, replace them with a spare. In an emergency, a new cable can be fabricated if it is cut to the exact physical length of the damaged cable. Twisted pair wiring or ribbon cable used in the equipment is not critical length wiring. If damage to twisted pair wires or ribbon cable occurs, excess slack can be used for repair purposes. Replace the twisted pair wires or ribbon cable with new wire or cable cut to the approximate length of the one removed.

6-6.6 Cable Connector Torque Values.

6-6.6.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Adapter	1	28h
Bar, extension	1	28b
Wrench, crowfoot	1	32j
Wrench, crowfoot	1	32k
Wrench, torque	1	30q

6-6.6.2 Procedure. Screw-type coaxial cable connectors must be tightened using appropriate crowfoot wrench to a specific value to ensure adequate electrical shielding without damaging the connectors. The values are as follows:

1. N type connectors = 12 to 15 inch-pounds

2. TNC type connectors = 10 to 15 inch-pounds

3. SMA/SMC/OSM type connectors = 7 to 10 inch-pounds.

6-6.7 Typical Connector Repair. Connectors and connector pins in numerous power and signal data cables may be replaced if the pins become defective. Refer to TO 31-10-14 and TO 00-25-234 for procedures.

6-6.8 Fastener Torque or Tension Requirements.

6-6.8.1 Non-Structural Standard Fastener Torque Values. Table 6-8 lists all suggested torque value requirements for bolts, screws, and nuts used in non-structural applications where steel components are being clamped. Use these values unless specific torque values are given in procedures contained in removal and installation paragraphs of this manual. Where self-locking components are used, the torque necessary to turn the part before contact (called tare or turn-down torque) must be measured on the torque wrench. The tare torque value must be added to the value specified in Table 6-8 to obtain the actual or final torque value. When using the values given in Table 6-8, observe the following:

Table 6-8. Suggested Standard Torque Value for Fasteners

Fine or coarse thread fastener	Grade designation	Tensile strength minimum	Material	Screw, stud, or bolt shank size or diameter — Torque figures are in foot pounds unless otherwise noted																		
				2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1-1/8	1-1/4
Cap screw	SAE 2 ASTM A-307 Steel	64,000 psi	Low carbon steel								6	11	19	30	45	66	93	150	202	300	474	659
Cap screw	SAE 5 ASTM A-449 Steel	105,000 psi	Medium carbon steel or low alloy heat treated								9	18	31	50	75	110	150	250	378	583	782	1097
Cap screw	ASTM A-325 *			*Torque specifications are for permanent fastenings on steel structures											100		200	355	525	790	1060	1495
Cap screw	SAE 8 Steel	150,000 psi	Medium carbon alloy quenched tempered								13	28	46	75	115	165	225	370	591	893	1410	1964
Cap screw	A-354-BD A-490 *	150,000 psi	Medium carbon alloy quenched tempered	* Specifications are for permanent steel structures									55	90	138	198	270	444	709	1071	1692	2360
Socket cap screw	Socket head cap screw	160,000 psi	High carbon alloy quenched tempered								14	30	50	81	121	176	240	395	629	964	1523	2120
Setscrew	Socket set-screws (steel)	212,000 to 225,000 psi	High carbon alloy quenched tempered					9 in. lb.	16 in. lb.	30 in. lb.	70 in. lb.	140 in. lb.	18 ft. lb.	29	43	63	100	146				
Cap screw, Mach. screw	Stainless steel		18-8	2.5 in. lb.	4 in. lb.	5.2 in. lb.	8 in. lb.	9.6 in. lb.	20 in. lb.	23 in. lb.	75 in. lb.	132 in. lb.	20 ft. lb.	31	43	57	92	124	194	259	390	480
Cap screw, Mach. screw	Stainless steel		316 series	2.6 in. lb.	4 in. lb.	5.5 in. lb.	8 in. lb.	10 in. lb.	21 in. lb.	24 in. lb.	79 in. lb.	138 in. lb.	21 ft. lb.	33	45	59	97	130	202	271	408	504
Cap screw, Mach. screw	Yellow brass	60,000	Cu 63 Zn 37	2 in. lb.	3.2 in. lb.	4.3 in. lb.	6.3 in. lb.	8 in. lb.	16 in. lb.	19 in. lb.	62 in. lb.	107 in. lb.	16 ft. lb.	26	35	47	76	102	158	212	318	394
Cap screw, Mach. screw	Aluminum 2024-T4	55,000	Cu 3.8-4.9 1.2-1.8 Mn .3-.9 Al balance	1.4 in. lb.	2.1 in. lb.	2.9 in. lb.	4.2 in. lb.	5.5 in. lb.	11 in. lb.	14 in. lb.	45 in. lb.	80 in. lb.	12 ft. lb.	19	26	34	60	80	125	166	251	308
Sems, Mach screw	Steel	55,000	1010, etc. Not heat treated	2.5 in. lb.	3.7 in. lb.	6 in. lb.	8 in. lb.	11 in. lb.	20 in. lb.	32 in. lb.	75 in. lb.	140 in. lb.										
Mach. screw	Heat treated steel (used at times)	Above 55,000		Divide the minimum tensile strength of the material constituting the finished machine screw by the factor 55,000. Multiply this figure obtained by the torque value in the applicable screw No. column just above.																		
Sems	Heat treated steel	120,000	1018 1022	4 in. lb.	5 in. lb.	7 in. lb.	10 in. lb.	14 in. lb.	25 in. lb.	35 in. lb.	85 in. lb.	195 in. lb.	325 in. lb.									

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1. Use the torque values directly when non-plated parts with no special lubrication or no hardened steel flat washers are being torqued.

2. Multiply the torque values by a factor of 0.90 when capscrews are cadmium plated; multiply by 0.80 when both nuts and bolts are cadmium plated.

3. Multiply the torque values by a factor of 0.80 when special high stress lubricants (graphite, molybdenum disulfide, colloidal copper, white lead, and antiseize compound) are used on the parts to be torqued, or when hardened steel flat washers are used under the rotating part of the fastener to be torqued.

4. Torque values apply only to steel components being clamped by fasteners and do not apply to components made of softer materials (brass, aluminum, plastics, etc.).

6-6.8.2 American Society for Testing and Materials Structural Steel Fastener Tensioning Requirements. The following requirements have been extracted and modified slightly from those contained in the Research Council on Structural Connections (RCSC) Specifications for American Society for Testing and Materials (ASTM) A325 or A490 fasteners. The requirements apply only to these Fasteners when used to secure high carbon steel, high strength low alloy steel, or quenched and tampered structural steel. The tensioning requirements given below apply unless specific torque requirements are given in the removal and installation paragraphs in this manual for certain fasteners in any steel structures covered by this manual.

1. Handling and Storage of Fasteners. Protect fasteners from dirt and moisture at the job site. Take only as many fasteners from protected storage as are anticipated to be installed and tightened during a work period. Return fasteners not used to protected storage at the end of the period. Do not clean fasteners of lubricant that is present in as-delivered condition. Fasteners for slip-critical connections, which must be cleaned of accumulated rust or dirt resulting from job site conditions, should be cleaned and relubricated prior to installation.

2. Washer Requirements. Use washers in high strength bolted connections as follows:

a. Where the outer face of the bolted parts has a slope greater than 1:20 with respect to a plane normal to the bolt axis, use a hardened beveled washer to compensate for the lack of parallelism.

b. Hardened washers are not required for connections using A325 and A490 bolts except as required in paragraphs e. and g. below for slip-critical connections and connections subject to direct tension or as required in paragraph 4 below for shear/bearing connections.

c. Use hardened washers under the element turned in tightening when the tightening is performed by calibrated wrench method.

d. Irrespective of the tightening method, use hardened washers under both the head and the nut when A490 bolts are installed and tightened to the tension specified in Table 6-9 in material having a specified yield point less than 40,000 lbf/in²

e. Where A325 bolts of any diameter or A490 bolts equal to or less than 1 inch in diameter are installed and tightened in an oversized or short-slotted hole in an outer ply, use a hardened washer conforming to ASTM F436.

f. When A490 bolts over 1 inch diameter are installed or tightened in an oversized or short-slotted hole in an outer ply, use hardened washers conforming to ASTM F436 with 5/16 inch minimum thickness under both the head and the nut in place of standard-thickness hardened washers. Multiple hardened washers with combined thickness equal to or greater than 5/16 inch do not satisfy this requirement.

g. Where A325 bolts of any diameter or A490 bolts equal to or less than 1 inch diameter are installed and tightened in a long-slotted hole in an outer ply, a plate washer or continuous bar of at least 5/16 inch thickness with standard holes are provided. These washers and bars should be large enough to completely cover the slot after installation and constructed of structural grade material. These washers and bars need not be hardened except as follows. When A490 bolts over 1 inch diameter are used in long-slotted holes in external plies, use a single hardened washer conforming to ASTM F436, with 5/16 inch minimum thickness in place of washers or bars of structural grade material. Multiple hardened washers with a combined thickness equal to or greater than 5/16 inch minimum thickness do not satisfy this requirement.

3. Tension Calibrator. A tension measuring device is required at all job sites where bolts in slip-critical joints or connections subject to direct tensions are being installed or tightened. The tension measuring device is used to confirm:

   a. Suitability to satisfy the requirements of Table 6-9 of the complete fastener assembly, including lubrication if required to be used in the work.

   b. Calibration of wrenches, if applicable.

   c. Understanding and proper use by personnel of the method to be used.

   The frequency of confirmation testing, the number of tests to be performed, and the test procedures are specified in paragraph 5 below. The accuracy of the tension measuring device is confirmed through calibration by an approved testing agency at least annually.

4. Joint Assembly and Tightening of Shear/Bearing Connections. Ensure that bolts in connections not within the slip-critical category nor subject to tension loads, nor required to be fully-tensioned bearing-type connections are installed in properly aligned holes. They need only be tightened to the snug-tight condition. The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a technician using an ordinary spud wrench. If a slotted hole occurs in an outer ply, a flat hardened washer or common plate washer is installed over the slot. Bolts which are tightened to other than a snug-tight condition are clearly identified on the drawings.

5. Joint Assembly and Tightening of Connections Requiring Full Pre-Tensioning. In slip-critical connections, connections subject to direct tension, and fully pre-tensioned bearing connections, fasteners, together with washers of size and quality specified, located as required by paragraph 2 above, shall be installed in properly aligned holes and tightened by one of the methods described below to at least the minimum tension specified in Table 6-9 when all the fasteners are tight. Tightening may be done by turning the bolt while the nut is prevented from rotating when it is impractical to turn the nut. Impact wrenches, if used, shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately 10 seconds.

   a. Turn-of-Nut Tightening. When turn-of-nut tightening is used, hardened washers are not required except as may be specified in paragraph 2 above. A representative sample of not less than three bolts and nuts of each diameter, length, and grade to be used in the work shall be checked at the start of work in a device capable of indicating bolt tension. The test should demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by personnel develops a tension not less than 5 percent greater than the tension required by Table 6-9. Bolts shall be installed in all holes of the connection and brought to a snug-tight condition. Snug tight is defined as the tightness that exists when the plies of a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a technician using an ordinary spud wrench. Snug tightening shall progress systematically from the most rigid part of the connection to the free edges. Then the bolts of the connection shall be retightened in a similar systematic manner as necessary until all bolts are simultaneously snug tight and the connection is fully compacted. Following this initial operation, all bolts in the connection shall be tightened further by the applicable amount of rotation specified in Table 6-10. During the tightening operation, there shall be no rotation of the part not turned by the wrench. Tightening shall progress systematically from the most rigid part of the joint to its free edges.

Table 6-9. Nut Rotation from Snug Tight Condition[1,2]

NUT ROTATION FROM SNUG TIGHT CONDITION [1,2]

BOLT LENGTH (UNDER SIDE OF HEAD TO END OF BOLT)	DISPOSITION OF OUTER FACE OF BOLTED PARTS		
	BOTH FACES NORMAL TO BOLT AXIS	ONE FACE NORMAL TO BOLT AXIS AND OTHER SLOPED NOT MORE THAN 1:20 (BEVELED WASHER NOT USED)	BOTH FACES SLOPED NOT MORE THAN 1:20 FROM NORMAL TO THE BOLT AXIS (BEVELED WASHER NOT USED)
UP TO AND INCLUDING 4 DIAMETERS	1/3 TURN	1/2 TURN	2/3 TURN
OVER 4 DIAMETERS BUT NOT EXCEEDING 8 DIA.	1/2 TURN	2/3 TURN	5/6 TURN
OVER 8 DIAMETERS BUT NOT EXCEEDING 12 DIA. [3]	2/3 TURN	5/6 TURN	1 TURN

[1] NUT ROTATION IS RELATIVE TO BOLT REGARDLESS OF THE ELEMENT (NUT OR BOLT) BEING TURNED. FOR BOLTS INSTALLED BY 1/2 TURN AND LESS, THE TOLERANCE SHOULD BE PLUS OR MINUS 30 DEGREES; FOR BOLTS INSTALLED BY 2/3 TURN AND MORE, THE TOLERANCE SHOULD BE PLUS OR MINUS 45 DEGREES.

[2] APPLICABLE ONLY TO CONNECTIONS IN WHICH ALL MATERIAL WITHIN THE GRIP OF THE BOLT IS STEEL.

[3] NO RESEARCH HAS BEEN PERFORMED BY THE COUNCIL TO ESTABLISH THE TURN-OF-NUT PROCEDURE FOR BOLT LENGTHS EXCEEDING 12 DIAMETERS. THEREFORE, THE REQUIRED ROTATION MUST BE DETERMINED BY ACTUAL TEST IN A SUITABLE TENSION MEASURING DEVICE WHICH SIMULATES CONDITIONS OF SOLIDLY FITTED STEEL.

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Table 6-10. Fastener Tension Required for Slip-Critical Connections and Connections Subject to Direct Tension

NORMAL BOLT SIZE, INCHES	MINIMUM TENSION[1] IN 1000'S OF POUNDS (KIPS)	
	A325 BOLTS	A490 BOLTS
1/2	12	15
5/8	19	24
3/4	28	35
7/8	39	49
1	51	64
1 1/8	56	80
1 1/4	71	102
1 3/8	85	121
1 1/2	103	148

[1] EQUAL TO 70 PERCENT OF SPECIFIED MINIMUM TENSILE STRENGTHS OF BOLTS (AS SPECIFIED IN ASTM SPECIFICATIONS FOR TESTS OF FULL SIZE A325 AND A490 BOLTS WITH UNC THREADS LOADED IN AXIAL TENSION) ROUNDED TO THE NEAREST KIP.

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b. Calibrated Wrench Tightening. Calibrated wrench tightening is used only when installation procedures are calibrated on a daily basis and when a hardened washer is used under the element turned in tightening. This procedure does not recognize standard torques determined from tables or from formulas which are assumed to relate torque to tension. When calibrated wrenches are used for installation, they shall be set to provide a tension not less than 5 percent in excess of the minimum tension specified in Table 6-9. Calibrate installation procedures at least once each working day for each bolt diameter, length, and grade using fastener assemblies that are being installed in the work. Calibration shall be accomplished in a device capable of indicating actual bolt tension by tightening three typical bolts of each diameter, length, and grade from the bolts being installed and with a hardened washer from the washers being used in the work under the element turned in tightening. Re-calibrate wrenches when significant difference is noted in the surface condition of the bolt threads, nuts, or washers. During actual installation in the assembled steelwork verify that the wrench adjustment selected by the calibration does not produce a nut or bolt head rotation from snug tight greater than that permitted in Table 6-9. If manual torque wrenches are used, turn nuts in the tightening direction when torque is measured. When calibrated wrenches are used to install and tension bolts in a connection, bolts are installed with hardened washers under the element turned in tightening bolts in all holes of the connection and brought to a snug-tight condition. Following this initial tightening operation, the connection shall be tightened using the calibrated wrench. Tightening shall progress systematically from the most rigid part of the joint to its free edges. Return the wrench to touch up previously tightened bolts that may have relaxed as a result of the subsequent tightening of adjacent bolts until all bolts are tightened to the prescribed amount.

6. Reuse of Bolts. Do not reuse A490 bolts and A325 bolts. Touching up or retightening previously tightened bolts which may have been loosened by the tightening of adjacent bolts is not considered reuse, provided the snugging up continues from the initial position and does not require greater rotation, including the tolerance, than that required by Table 6-9.

7. Inspector Responsibility. While the work is in progress, an inspector shall observe the calibration procedures when such procedures are required and shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is properly used to tighten all bolts. In addition to the requirement of this paragraph, for all connections specified to be slip critical or subject to axial tension, the inspector shall assure that the specified procedure was followed to achieve the pretension specified in Table 6-9. Bolts installed by procedures in paragraph 5 may reach tensions substantially greater than values given in Table 6-9, but this is not cause for rejection. Bolts in conditions identified as not being slip critical or subject to direct tension need not be inspected for bolt tension other than to ensure that the plies of the connection elements have been brought into snug contact.

8. Arbitration Inspection. When high-strength bolts in slip-critical connections and connections subject to direct tension have been installed by any of the tightening methods in paragraph 5 and inspected in accordance with paragraph 7, and disagreement exists as to the minimum tension of the installed bolts, the following arbitration procedure may be used. Other methods for arbitration inspection may be used if approved.

a. The inspector shall use a manual torque wrench that indicates torque by means of a dial or that may be adjusted to give an indication that the job inspecting torque has been reached.

b. This procedure does not recognize standard torques determined from tables or from formulas which are assumed to relate torque to tension. Testing using such standard torques is not considered valid.

c. Tighten a representative sample of five bolts from the diameter, length, and grade of bolts used in the work in the tension measuring device by any convenient means to an initial condition equal to approximately 15 percent of the required fastener tension and then to the minimum tension supplied in Table 6-9. Tightening beyond the initial condition must not produce greater nut rotation than 1-1/2 times that permitted in Table 6-10. The job inspecting torque is the average of three values thus determined after rejecting the high and low values. Then apply the inspecting wrench to the tightened bolts in the work; the torque necessary to turn the nut or head 5° (approximately 1 inch at 12-inch radius) in the tightening direction shall be determined.

d. Bolts represented by the sample in the foregoing paragraph which have been tightened in the structure shall be inspected by applying, in the tightening direction, the inspecting wrench and its job torque to 10 percent of the bolts, but not less than 2 bolts, selected at random in each connection in question. If no nut or bolt head is turned by application of the job inspecting torque, the connection is accepted as properly tightened. If any nut or bolt is turned by the application of the job inspecting torque, than all bolts in the connection are tested. All bolts whose nuts or heads are turned by the job inspecting torque shall be tightened and reinspected. Alternatively, personnel have the option, to retighten all of the bolts in the connection, and then resubmit the connection for the specified inspection.

9. Delayed Verification or Periodic Preventive Maintenance Inspection. The procedures specified in paragraphs 7 and 8 above are intended for inspection of bolted connections and verification of pretension at the time of tensioning the joint. If verification of bolt tension is required after a passage of a period of time and exposure of the completed joints, the procedures of paragraph 8 will provide indication of bolt tension that is of questionable accuracy. Procedures appropriate to the specific situation should be used for verification of bolt tension. This might involve the use of the arbitration inspection procedure contained herein, or might require the development and use of alternate procedures. Periodic preventive maintenance checks of bolt tension, other than visual checks, shall not be accomplished. Replace and retension any visibly loose bolts.

6-6.9 Replacement of Screw Thread Inserts.

1. Three types of screw thread inserts can be used for repair purposes. The Rosan insert (Figure 6-15) is a two-piece, solid metal insert consisting of the threaded insert with a locking collar and a separate serrated locking ring. The Heli-Coil insert (Figure 6-16) is a single-piece, single-wire insert. The Kelox insert (Figure 6-17) consists of a key ring and a threaded insert. Removal and installation is provided for Rosan inserts in paragraph 6-6.10 below. Heli-Coil inserts are described in paragraph 6-6.11 below. Kelox inserts are described in paragraph 6-6.12.

2. Steel inserts not coated with sealing compound are given corrosion preventive treatment in magnesium prior to insallation.

6-6.10 Locking (Rosan) Screw Thread Insert. (Figure 6-15).

6-6.10.1 Removal.

1. Drill out serrated locking collar of the thread insert to the depth of the counterbore. For the correct size drill, refer to Table 6-11.

2. Drive a square-type easy-out tool of the proper size (Table 6-11) into thread insert. Screw out the thread insert.

3. If serrated locking ring fails to come out as thread insert is unscrewed, collapse the remaining portion of the ring with a punch; remove the ring.

6-6.10.2 Installation.

NOTE

A new thread insert may be installed in an existing tapped hole by following the procedures in steps 1 through 5 below.

1. Determine the size of the thread insert to be installed. Select the correct size tap drill (Table 6-11); drill to a depth slightly more than the length of thread insert.

2. Using a counterbore of the correct diameter, counterbore to the required depth, as shown in Table 6-11. If the chamfered counterbore tool is not used, chamfer the hole 45° before tapping.

3. Select the correct tap thread size (Table 6-11); tap to a depth corresponding to the length of thread insert.

4. Apply a thin coating of zinc-chromate primer to all threads of the hole as a protection against corrosion.

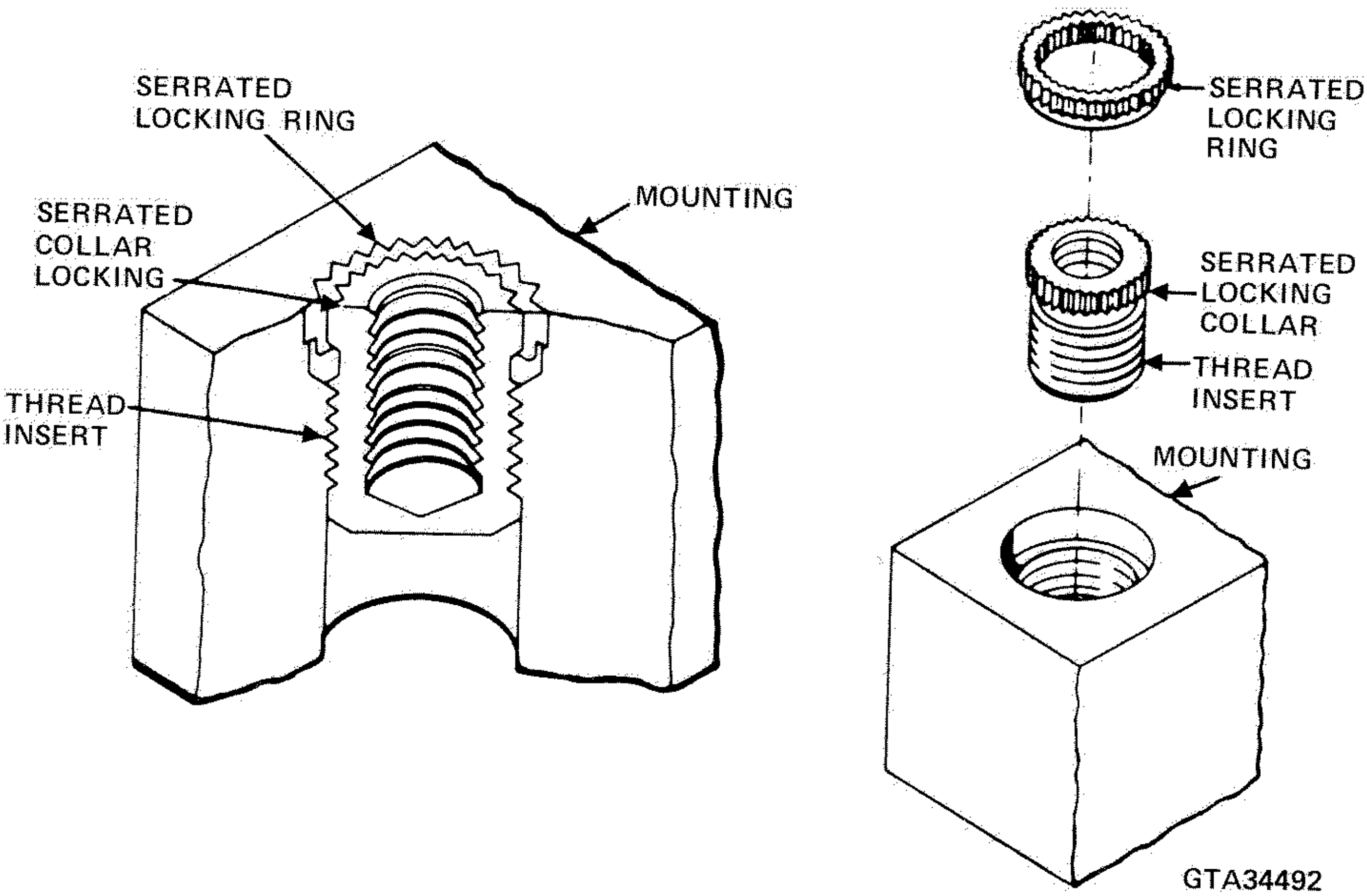

Figure 6-15. Locking (Rosan) Screw Thread Insert

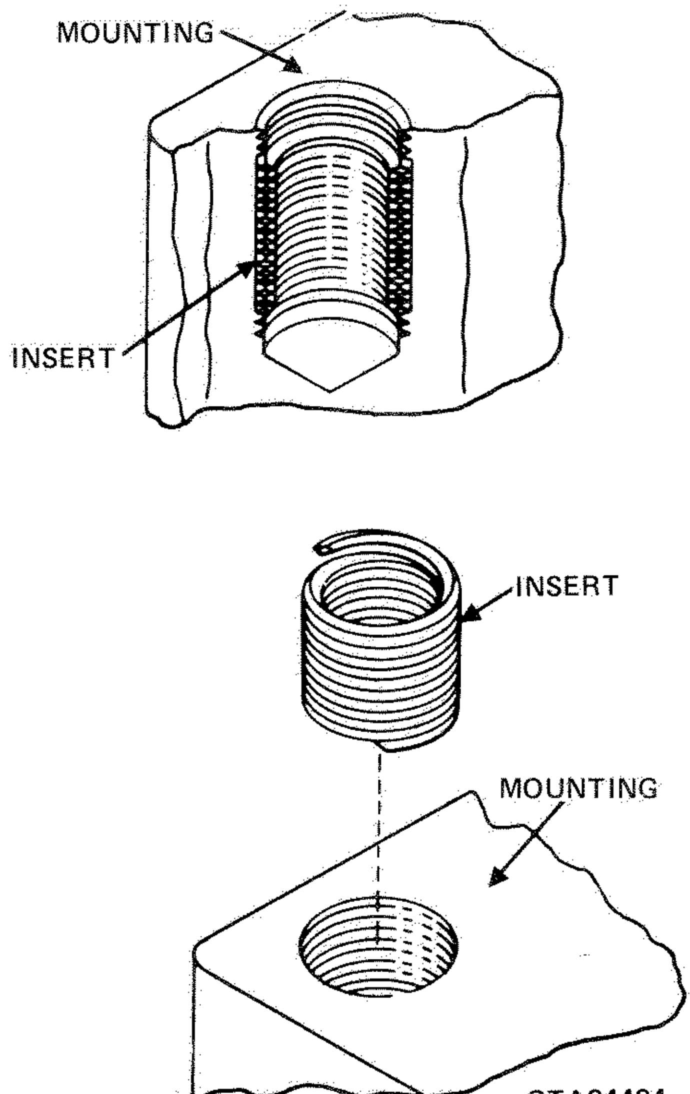

Figure 6-16. Helical (Heli-Coil) Screw Thread Insert

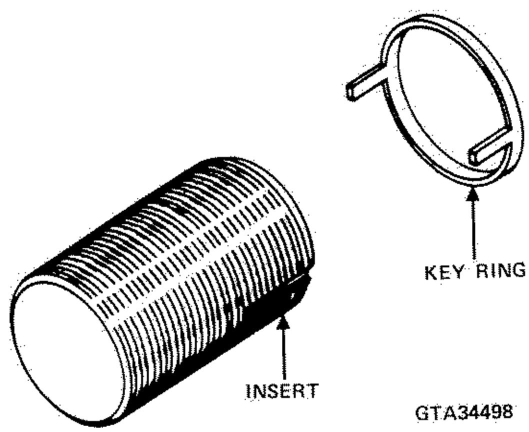

Figure 6-17. Locking (Kelox) Screw Thread Insert

Table 6-11. Locking (Rosan) Screw Thread Insert Data and Tools

Manufacturer's part no.		Screw size	Tap thread size	Tap drill size	Insert length	Counterbore		Removal drill size	Special tools		
Insert	Lock ring					Dia	Depth		C-bore tool	Inserting tool	Drive tool
R102SM-4	—	4-40NC	10-32NF-3	0.194	—	—	—	—	—	—	—
R202SM-4	—	4-48NF	—	—	1 1/64	—	—	—	RSS16-149	R1102-W	R102-D
R302SM-4	RL16SM-5	4-48NF	10-24NC-3	0.59	¼	0.250	3/32	—	RCC-16159	—	—
R902SM-4	—	4-40NC	—	—	—	—	—	—	—	—	—
R103SM-5	—	6-32NC	—	—	—	—	—	—	—	—	—
R203SM-5	—	6-40NF	12-24NC-3	0.177	5/16	0.281	—	1 3/64	RCC18-177	R1103-W	R103-D
R303SM-5	RL18SM-6	6-40NF	12-28NF-3	0.180	—	—	—	—	RCC18-180	—	—
R903SM-5	—	6-32NC	—	—	—	—	—	—	—	—	—
R104SM-6	—	8-32NC	—	—	—	—	—	—	—	—	—
R204SM-6	—	8-36NF	¼-20NC-3	0.201	3/8	0.328	7/64	1 5/64	RCC21-201	R1104-W	R104-D
R304SM-6	RL21SM-6	8-36NF	¼-28NF-3	0.213	—	—	—	—	RCC21-213	—	—
R904SM-6	—	8-32NC	—	—	—	—	—	—	—	—	—
R105SM-7	—	10-24NC	—	—	—	—	—	—	—	—	R105-D
R205SM-7	—	10-32NF	5/16-18NC-3	0.257	7/16	0.375	9/64	5/32	RCC24-257	—	R205-D
R305SM-7	RL24SM-7	10-32NF	5/16-24NF-3	0.272	—	—	—	—	RCC24-272	R1105-W	R205-D
R905SM-7	—	10-24NC	—	—	—	—	—	—	—	—	R105-D
R106SM-8	—	¼-20NC	—	—	—	—	—	—	—	—	R106-D
R206SM-8	—	¼-28NF	3/8-16NC-3	0.312	½	0.437	5/32	1 1/32	RCC28-312	—	R206-D
R306SM-8	RL28SM-8	¼-28N	3/8-24NF-3	0.332	—	—	—	—	RCC28-332	R1106-W	R206-D
R906SM-8	—	¼-20NC	—	—	—	—	—	—	—	—	R106-D
RA107SM-8	—	5/16-18NC	—	—	—	—	—	—	—	—	DA107-D
RA207SM-8	RL33SM-9	5/16-24NF	½-13NC-3	0.422	—	0.515	—	27/64	RCC33-422	RA1107X-W	R207-D
R307SB-9	RL31SM-9	5/16-24NF-3	7/16-20NF-3	0.386	9/16	0.484	—	25/64	RCC31-386	R1107-W	R107-D
R906SM-9	—	5/16-18NC	—	—	—	—	—	—	—	—	R108-D
R107SM-10	—	3/8-16NC	—	—	—	—	—	—	—	—	—
R208SM-10	—	3/8-24NF	9/16-12NC-3	0.484	—	—	—	—	RCC38-484	R1108-W	R208-D
R308SM-10	RL38SM-9	3/8-24N	½-20NF-3	0.453	5/8	0.593	1 1/64	31/64	RCC38-453	—	R208-D
R908SM-10	—	3/8-16NC	—	—	—	—	—	—	—	—	R108-D
R109SM-11	—	7/16-14NC	—	—	—	—	—	—	—	—	R109-D
R209SM-11	—	7/16-20NF	5/8-11NC-3	0.531	—	—	—	—	RCC47-531	R1110-W	R209-D
R309SM-11	RL47SM-10	7/16-20NF	5/8-18NF-3	0.562	1 1/16	0.734	3/16	1 9/32	RCC47-562	—	R209-D
R909SM-11	—	7/16-15NC	—	—	—	—	—	—	—	—	R109-D
R110SM-12	—	½-13NC	—	—	—	—	—	—	—	—	R110-D
R210SM-12	—	½-20NF	¾-10NC-3	0.641	—	—	—	—	RCC56-641	R1111-W	R210-D
R310SM-12	RL56SM-11	½-20NF	¾-16NF-3	0.687	¾	0.875	1 3/64	29/32	RCC56-687	—	R210-D
R901SM-12	—	½-13NC	—	—	—	—	—	—	—	—	R110-D
R912SB-16	RL72SB-11	5/8-11UNC-3B	1-14NF-3A	0.921	1	1.125	1 3/64	—	—	—	R110-D

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5. While the primer is still wet, screw the thread insert into the tapped hole using the correct size socket type inserting tool. Ensure the insert is flush with the mounting surface and not more than 0.010 inch maximum under flush. If the socket type inserting tool is not available, use a bolt and nut. Screw the bolt into the thread insert; lock it with a nut. Use a wrench on the nut to install thread insert.

6. Place serrated locking ring on top of thread insert with the pilot side down; engage the serrations. Using a drive tool or the equivalent, press the drive ring into the material until it is flush with the surface of the insert.

6-6.11 Helical (Heli-Coil) Screw Thread Insert. (Figure 6-16).

6-6.11.1 Removal. Remove a damaged insert using a Heli-Coil extracting tool. For the correct extracting tool, refer to Table 6-10 and Figure 6-18.

6-6.11.2 Installation. (Figure 6-19).

NOTE

A new insert may be installed in an existing tapped hole by following the procedures given in steps 3 and 4 below.

1. Select the proper size insert to be installed. Refer to Table 6-12 for the correct diameter standard machine drill; drill the hole to the required depth.

2. Tap the hole, using the correct size Heli-Coil tap from Table 6-12. Gauge the hole.

3. Apply a thin coating of zinc-chromate primer to all the threads of the hole for protection against corrosion.

4. Use the proper Heli-Coil installation tool; while the primer is still wet install the insert.

NOTE

The first coil of the insert may be reduced in diameter to facilitate installation. If the hole is countersunk, the top edge of the insert shall be 1 to 1-1/2 turns below the surface. If the hole is not countersunk, the top edge of the insert shall be 1/4 to 1/2 turn below the surface.

NOTE

If the insert has been improperly installed, it may be removed by placing the blade of the extracting tool (Figure 6-18) into the insert and hitting the tool with a nonsparking hammer. Push down on the tool; rotate it counterclockwise to back the insert out of the hole.

5. When notched inserts are installed, use the proper Heli-Coil tang breakoff tool to remove the tang.

6-6.12 Kelox Screw Thread Inserts. (Figure 6-17).

6-6.12.1 Removal.

1. Drill out the top of insert (Figure 6-17) to the depth of the keys on key ring.

2. Pry out the key ring with a scribe, screwdriver, or similar small pointed tool.

3. Remove the remainder of the insert with an easy-out tool (Figure 6-20) or similar tool.

NOTE

Kelox inserts may be replaced a maximum of three times in one hole. Both the key ring and the insert are replaced together. Rotate the keyways 60° with each replacement.

6-6.12.2 Repair of Threaded Holes Using Kelox Inserts.

1. Installation Without Special Tools. Kelox inserts can be installed without special tools using the following method.

   a. Screw insert (Figure 6-17) into the hole until the top thread of the insert is below the bottom of the thread relief.

   b. Place the key ring (Figure 6-17) upside down in the thread relief and screw the insert out until the top is flush with the inverted key ring.

   c. Place the ring so keys align with the insert keyways; drive the keys in with a metal or wooden block and hammer.

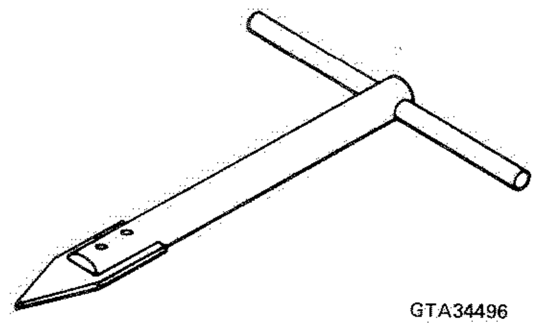

Figure 6-18. Helical (Heli-Coil) Extracting Tool

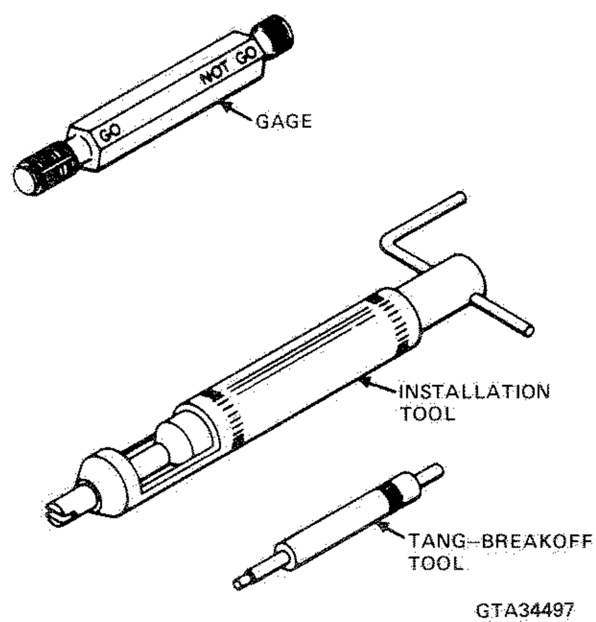

Figure 6-19. Helical (Heli-Coil) Installation Tools

Table 6-12. Helical (Heli-Coil) Screw Thread Insert Data and Tools

Part no.		Thread size	Insert length	Drilled hole diameter		Drilled hole depth	Finish tap [1]	Special tools		
Notched	Unnotched			Min	Max			Inserting tools	Tang breaking-off tool	Extracting tool
MS21208C0810	MS21208C810	8-32NF	0.164	0.170	0.176	0.305	2CPA	528-2N	1194-2	1227-06
MS122119	MS122139	—	0.246	—	—	0.385	—	—	—	—
MS21208C0820	MS122179	—	0.328	—	—	0.469	—	—	—	—
MS122199	MS122219	—	0.410	—	—	0.551	—	—	—	—
MS122239	MS122239	—	0.492	—	—	0.632	—	—	—	—
MS21208C1-10	MS122100	10-24NC	0.190	0.199	0.205	0.377	3CPA	528-3N	1195-2	1227-06
MS21208C1-15	MS122140	—	0.285	—	—	0.472	—	—	—	—
MS21208C1-20	MS21208C1-20	—	0.380	—	—	0.567	—	—	—	—
MS122200	MS122220	—	0.475	—	—	0.662	—	—	—	—
MS122240	MS122260	—	0.570	—	—	0.757	—	—	—	—
MS21208F1-10	MS124675	10-32NF	0.190	0.199	0.205	0.377	3FPA	535-3N	1196-3	1227-06
MS21208F1-15	MS124715	—	0.285	—	—	0.472	—	—	—	—
MS21208F1-20	MS124755	—	0.380	—	—	0.567	—	—	—	—
MS124775	MS124795	—	0.475	—	—	0.662	—	—	—	—
MS124815	MS124835	—	0.570	—	—	0.757	—	—	—	—
MS21208C4-10	MS122101	1/4-20NC	1/4	0.261	0.267	0.475	4CPA	528-4N	1195-4	1227-06
MS21208C4-15 [2]	MS122143 [3]	—	3/8	—	—	0.600	—	—	—	—
MS21208C4-20	MS122181 [4]	—	1/2	—	—	0.725	—	—	—	—
MS122201	MS122221	—	5/8	—	—	0.850	—	—	—	—
MS122241	MS122261	—	3/4	—	—	0.975	—	—	—	—
MS212084F4-10	MS124676	1/4-28NF	1/4	0.261	0.267	0.475	4FPA	535-4N	1196-4	1227-06
MS212008F4-15 [5]	MS124716 [6]	—	3/8	—	—	0.600	—	—	—	—
MS21208F4-20 [7]	MS124756 [8]	—	1/2	—	—	0.725	—	—	—	—
MS124776	MS124796	—	5/8	—	—	0.850	—	—	—	—
MS124816 [9]	MS124836	—	3/4	—	—	0.975	—	—	—	—
MS21208C5-10 [10]	MS122102	5/16-18NC	5/16	0.328	0.334	0.562	5CPA	528-5N	1195-5	1227-06
MS21208C5-15 [11]	MS122142	—	15/32	—	—	0.719	—	—	—	—
MS21208C5-20 [12]	MS122182 [13]	—	5/8	—	—	0.875	—	—	—	—
MS122202	MS122222 [14]	—	25/32	—	—	1.031	—	—	—	—
MS122242	MS122262	—	15/32	—	—	1.187	—	—	—	—
MS21208F5-10	MS124677	5/16-24NF	5/16	0.328	0.334	0.562	5FPA	535P5N	1196-5	1227-06
MS21208F5-15	MS124717	—	15/32	—	—	0.719	—	—	—	—
MS21208F5-20 [15]	MS21208F5-20 [16]	—	5/8	—	—	0.875	—	—	—	—
MS124777	MS124797	—	25/32	—	—	1.031	—	—	—	—
MS124817	MS124837	—	15/16	—	—	1.187	—	—	—	—
MS21208C6-10 [17]	MS122103	3/8-16	3/8	0.390	0.398	0.656	6CPA	528-6N	1195-6	1227-06
MS21208C6-15 [18]	MS122143	—	9/16	—	—	0.844	—	—	—	—
MS21208C6-20 [19]	MS122183 [20]	—	3/4	—	—	1.031	—	—	—	—
MS122203	MS122223	—	15/16	—	—	1.219	—	—	—	—
MS122243	MS122263	—	1-1/8	—	—	1.406	—	—	—	—
MS124658	MS124678	3/8-24NF	3/8	0.390	0.398	0.656	6FPA	535-6N	1196-6	1227-06
MS21208F6-15 [21]	MS124618 [22]	—	9/16	—	—	0.844	—	—	—	—
MS21208F6-20 [23]	MS124758 [24]	—	3/4	—	—	1.031	—	—	—	—
MS124778	MS124798 [25]	—	15/16	—	—	1.219	—	—	—	—
MS124818	MS124838	—	1-1/8	—	—	1.406	—	—	—	—
MS122084	MS122104	7/16-14NC	7/16	0.453	0.463	0.754	7CPA	528-7N	1195-7	1227-16
MS122124	MS122144	—	21/32	—	—	0.972	—	—	—	—
MS21208C7-20 [26]	MS122184 [27]	—	7/8	—	—	1.191	—	—	—	—
MS122204	MS122224	—	1-3/32	—	—	1.410	—	—	—	—
MS122244	MS122264	—	1-5/16	—	—	1.629	—	—	—	—
MS124659	MS124679	7/16-20NF	7/16	0.453	0.463	0.754	7FPA	535-7N	1196-7	1227-16
MS21208F7-15	MS124719	—	21/32	—	—	0.972	—	—	—	—
MS21208F7-20	MS124759	—	7/8	—	—	1.191	—	—	—	—
MS124779	MS124799	—	1-3/32	—	—	1.410	—	—	—	—
MS124819	MS124839	—	1-5/16	—	—	1.629	—	—	—	—

See footnotes at end of table.

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Table 6-12. Helical (Heli-Coil) Screw Thread Insert Data and Tools -CONT

Part no. Notched	Part no. Unnotched	Thread size	Insert length	Drilled hole diameter Min	Drilled hole diameter Max	Drilled hole depth	Finish tap [1]	Special tools Inserting tools	Special tools Tang breaking-off tool	Extracting tool
MS21208C8-10	MS122105	1/2-13NC	1/2	0.515	0.525	0.846	8CPA	528-8N	1195-8	1227-16
MS122125 [28]	MS122145 [29]	—	3/4	—	—	1.096	—	—	—	—
MS122165	MS122185	—	1	—	—	1.346	—	—	—	—
MS122205	MS122225	—	1-1/4	—	—	1.596	—	—	—	—
MS122245	MS122265	1/2-20NF	1-1/2	0.515	0.525	1.846	8FPA	535-8N	1196-8	1227-16
MS21208F8-10 [30]	MS124680	—	1/2	—	—	0.846	—	—	—	—
MS21208F-15	MS124720	—	3/4	—	—	1.096	—	—	—	—
MS21208F8-20 [31]	MS124760 [32]	—	1	—	—	1.346	—	—	—	—
MS124780	MS124800	—	1-1/4	—	—	1.596	—	—	—	—
MS124820	MS124840	—	1-1/2	—	—	1.846	—	—	—	—

[1] Finish tap numbers are manufacturer's part numbers and are for class 2B taps (plug chamfer) to tap aluminum and magnesium.

[2] 5340-559-3039
[3] 5340-045-2642
[4] 5340-550-8682
[5] 5340-291-3484
[6] 5340-545-2654
[7] 5340-616-4266
[8] 5340-045-2658
[9] 5340-290-4501
[10] 5340-045-2664
[11] 5340-290-4521
[12] 5340-550-8679
[13] 5340-550-8681
[14] 5340-592-9986
[15] 5340-514-2321
[16] 5340-664-2864
[17] 5340-290-4519
[18] 5340-045-2692
[19] 5340-543-4097
[20] 5340-045-2694
[21] 5340-261-2983
[22] 5340-598-5645
[23] 5340-598-5646
[24] 5340-576-3474
[25] 5340-550-8680
[26] 5340-045-2720
[27] 5340-664-2863
[28] 5349-543-4125
[29] 5340-297-1953
[30] 5340-598-5634
[31] 5340-664-2862
[32] 5340-598-5634

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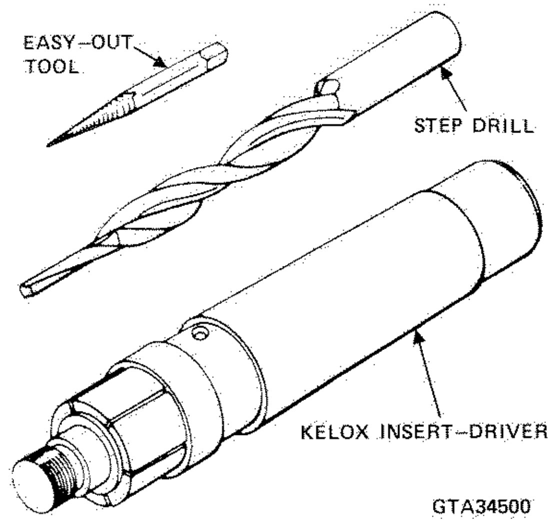


Figure 6-20. Tools for Installing and Removing Helical (Kelox) Inserts

2. Installation Using Special Tools. (Figure 6-20).

NOTE

If the hole contained other than a Kelox insert, perform steps a. through h. below. If the hole contained a Kelox insert, perform steps d. through h. below.

a. Select the Kelox insert for the hole to be repaired.

b. Obtain from Table 6-13 the drill size, hole depth, and thread relief dimensions for preparing the hole.

CAUTION

EQUIPMENT DAMAGE HAZARD

It is important in drilling out the old threads to maintain the hole center location and angle of penetration to ensure proper mating of parts. Locally fabricated drill guides should be used in performing these repairs.

c. Using the drill recommended in Table 6-13, drill out the old threads. Use step drill (Figure 6-20) to obtain the proper hole and thread relief dimensions in one operation. Remove all metal particles from the hole.

d. Select the recommended tap from Table 6-13. Use a bushing, tap machine, or other positive means for holding the tap in alignment with the hole. Tap the hole to the recommended depth; remove the metal particles.

e. Check the hole for correct threading. Check the insert and the key ring for proper size and type.

f. Select the recommended insert driver (Figure 6-20) from Table 6-13. Assemble the insert and the key ring; screw the assembly onto threaded end of the driver. Compress the drive mandrel; slide the key ring over the assembly. Release the drive mandrel; allow the insert to pull free from the key ring.

Table 6-13. Helical (Kelox) Data

Insert information						Installation data					
						Thread relief			Tap information		
Kelox insert	Key ring part no.	Int thread	Ext thread	Length	Tap drill diameter	Hole depth	Dia	Depth	Size	Depth	Insert driver
158-1-8	KR8-1[1]	5/16-18	1/2-13	1/2	27/64(0.4218)	$\frac{11}{16}{}^{-0}_{+1/8}$	0.500	0.078	1/2-13	9/16±1/16	T5-18-8
258-1-8	KR8-1[1]	5/16-24	1/2-13	1/2	27/64(0.4218)	$\frac{11}{16}{}^{-0}_{+1/8}$	0.500	0.078	1/2-13	9/16±1/16	T5-24-8
269-1-12	KR9-1	3/8-24	9/16-12	3/4	31/64(0.4843)	$1{}^{-0}_{+1/16}$	0.562	0.078	9/16-12	13/16±1/16	—
335-1-5	KR5-1	10-32	5/16-24	5/16	I (0.2720)	$\frac{7}{16}{}^{-0}_{+1/16}$	0.312	0.046	5/16-24	3/8±1/16	T3-32-5
346-1-6	KR6-1	1/4-28	3/8-24	3/8	Q (0.3320)	$\frac{1}{2}{}^{-0}_{+1/8}$	0.375	0.062	3/8-24	7/16±1/16	T4-28-6
346-1-7	KR6-1	1/4-28	3/8-24	7/16	Q (0.3320)	$\frac{9}{16}{}^{-0}_{+1/8}$	0.375	0.062	3/8-24	1/2±1/16	—
369-1-9	KR9-1	3/8-24	9/16-18	9/16	33/64(0.5156)	$\frac{11}{16}{}^{-0}_{+1/8}$	0.562	0.078	9/16-18	5/8±1/16	T6-24-9
436-1-6	KR6-1	10-24	3/8-24	3/8	Q (0.3320)	$\frac{1}{2}{}^{-0}_{+1/16}$	0.375	0.062	3/8-24	7/16±1/16	T3-24-6
468-1-8	KR8-1[1]	3/7-16	1/2-20	1/2	29/64(0.4531)	$\frac{5}{8}{}^{-0}_{+1/8}$	0.500	0.078	1/2-20	9/16±1/16	T6-18-8
1710-1-10	KR10-1	7/16-14	5/8-11	5/8	17/32(0.5312)	$\frac{7}{8}{}^{-0}_{+1/8}$	0.625	0.078	5/8-11	11/16±1/16	T7-14-10
2812-1-10	KR12-1	1/2-20	3/4-10	5/8	21/32(0.6562)	$1{}^{-0}_{+1/16}$	0.750	0.093	3/4-10	11/16±1/16	T8-20-12
3812-1-12	KR12-1	1/2-20	3/4-16	3/4	11/16(0.6875)	$\frac{15}{16}{}^{-0}_{+1/8}$	0.750	0.093	3/4-16	13/16±1/16	T8-20-12
31012-1-15	KR12A-15	5/8-18	3/4-16	15/16	11/16(0.6875)	$1\text{-}1/8{}^{-00}_{+1/8}$	0.750	0.093	3/4-16	—	T10-18-12A
4812-1-8	KR12-1	1/2-13	3/4-16	1/2	11/16(0.6875)	$\frac{11}{16}{}^{-0}_{+1/8}$	0.750	0.093	3/4-16	9/16±1/16	T8-13-12

[1] Part number 9018442, federal stock number 5310-630-7111.

GTA34499

g. Apply a thin coat of zinc-chromate primer to all threads of the hole for protection against corrosion.

h. While primer is still wet, screw insert into hole until the key ring drags on the first thread of tapped hole. Drive key ring flush to surface of material by pressing or striking insert driver tool (Figure 6-20). Key ring should be flush or below surface of material after installation.

6-6.13 Replacement of Cabinet Mounted Circuit Breakers, Thermal Switches, Interlock Switches, Line Filters, and Selector Switches. Replacement of various cabinet mounted circuit breakers, thermal switches, interlock switches, line filters, and selector switches is obvious. However, observe the following precautions.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

Ensure that circuit breakers controlling power to components being replaced or adjacent components are turned OFF before replacing components.

1. If cabinet mounted circuit breakers controlling ac and/or dc power in Units 150, 151, and 152 are being replaced, ensure that prime power is removed (paragraph 4-6.3) before replacing these circuit breakers.

2. Ensure that cabinet circuit breakers controlling ac and/or dc power to interlock switches, selector switches, or line filters to be replaced and adjacent components are turned OFF before replacing component. Use power distribution or interlock circuit signal flow diagrams in appropriate circuit diagram manual to identify appropriate circuit breakers.

3. Ensure that appropriate cabinet circuit breakers in Units 150, 151, and 152 are set to OFF before replacing temperature sensing switches in cabinets.

4. When replacing mechanically activated interlock switches, ensure that switch is activated by mechanical device after installation is complete.

5. Ensure that wires connected to lugs of circuit breakers and relays are secured tightly to lugs. Refer to paragraph 6-6.14 below for lug tightening torque values for various sizes of wires.

6-6.14 Electrical Connector Lug Tightening Torque Values. Mechanically tightened electrical connector lugs on circuit breakers and relays are designed for the wire tightening torque values given in Table 6-14.

6-6.15 Circuit Board Handling Procedures. Circuit boards are susceptible to damage from electrostatic discharge. This paragraph outlines some basic rules for handling circuit boards in the field. The rules are intended to keep boards at the same electrical potential as the work area, tools, and personnel. Do not handle boards in areas of high static susceptibility such as carpeted areas or areas of extremely low humidity. Observe the guidelines listed below when working with circuit boards. All the guidelines given intend to reduce the possibility of a potential difference between the board being handled and the surrounding work area. Refer to TO 00-25-234 and applicable Illustrated Parts Breakdown manual for detailed information concerning electrostatic discharge control.

1. Use a power receptacle that has a connection to earth ground.

2. Only use a soldering iron that has a three-wire ground. If a grounded iron is not available, always attach a wire from the iron tip to ground or the work area, to prevent any potential difference between the device and the soldering iron. Do not use a transformer type soldering iron.

3. If sitting in a chair while removing a board, it is recommended that the chair be electrically connected to the frame of the cabinet. If not possible, use care to prevent the chair from touching the cabinet, thus preventing a static discharge between chair and cabinet.

4. If standing while handling circuit boards, avoid rubbing your clothing against the cabinet or nearby furniture, thereby preventing the buildup of static electricity.

Table 6-14. Electrical Lug Tightening Torque Values

	Tightening Torque in Inch-Pounds			
	Screwdriver		Wrench	
Size of wire	Minimum	Maximum	Minimum	Maximum
14 Awg	16	20	--	--
12	16	20	--	--
10	16	20	--	--
8	16	20	--	--
6	20	35	80	100
5	20	35	80	100
4	20	35	80	100
3	40	50	100	125
2	40	50	100	125
1	40	50	100	125
1/0	40	50	120	150
2/0	40	50	120	150
3/0	--	--	160	200
4/0	--	--	160	200
200 MCM	--	--	160	200
250	--	--	200	250
300	--	--	200	250
400	--	--	200	250
500	--	--	240	300
600	--	--	240	300
700	--	--	240	300

5. Boards are generally packaged in a conductive plastic bag. Before opening the bag, touch the work table or metal connected to it to discharge any static buildup. Empty the contents of the bag onto the work area without touching the board.

6-7 REMOVAL, REPAIR, AND INSTALLATION PROCEDURES.

6-7.1 Introduction. Removal and installation procedures for LRUs of the transmitter group are provided in the following subparagraphs. The procedures are arranged in alphanumeric order by equipment reference designator. It may be necessary to use a trouble light in some of the following procedures. Use a wrist strap when handling printed wire boards.

6-7.2 Transmit Antenna, Unit 100 - Removal, Repair, and Installation Procedures.

6-7.2.1 Transmission Line Gas Purge and Refill Procedures.

6-7.2.1.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Platform ladder	1	33e
Pump, vacuum	1	33b
Wrench, box/open, set	1	32a

6-7.2.1.2 Purge Procedure. (Figures 6-21 and 6-22).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

If RF output power from transmitter module feeding the affected transmission line is disabled go to step 2; otherwise perform step 1.

1. Disable RF output from transmitter module that feeds the transmission line to be purged of gas. Disable transmitter module via the TRANSMIT SITE INITIALIZATION/ RECONFIGURATION DISPLAY on the TMC. Refer to positional handbook for TMC operating instructions.

WARNING

RF RADIATION HAZARD

The transmitter module that feeds the affected transmission line must have its RF output power inhibited. Do not continue the purge procedure if the transmitter module is outputting RF power to the transmission line.

2. On nitrogen manifold, set supply valves for all unaffected transmission lines to the closed position.

WARNING

HIGH PRESSURE HAZARD

The entire RF distribution system for the transmit antenna (every transmission line, directional coupler, balun, and dipole) is pressurized with nitrogen gas. Operating pressure is 5 lbf/in² gage from December through March and 10 lbf/in² gage during remainder of year. Use reasonable care when releasing pressure.

3. Set manifold nitrogen supply valve above transmitter at main nitrogen line to closed position. Remove conveniently accessible pipe plug on tee at bottom of manifold and allow gas to bleed off.

6-7.2.1.3 Refill Procedure.

1. Connect vacuum pump (Table 1-4, Item 33b) to tee at bottom of manifold using pipe nipples and reducers if necessary.
2. Open vacuum pump isolation valve and turn on vacuum pump until -10 lbf/in² gage is indicated on vacuum gauge; turn off vacuum pump and close isolation valve at pump.

NOTE

Nitrogen gas operating pressure from December through March is 5 lbf/in² gage and 10 lbf/in² gage for remainder of year.

3. Open manifold nitrogen supply valve above transmitter and allow gas to flow and fill line untill manifold pressure gauge indication stabilizes at operating pressure.
4. Close manifold nitrogen supply valve and repeat steps 2 through 4 two more times.
5. Close manifold nitrogen supply valve and remaining affected transmission line supply valve.
6. Disconnect vacuum pump from manifold and replace pipe plug.

NOTE

Nitrogen gas operating pressure from December through March is 5 lbf/in² gage and 10 lbf/in² gage for remainder of year.

7. Open manifold nitrogen supply valve and all transmission line supply valves. Adjust transmission line supply valves for correct operating pressure after gauge indications stabilize.

6-7.2.2 Transmission Lines (Bands A through F).

NOTE

The following removal and installation procedures are a general guide for replacement of a complete transmission line between transmit building and antenna. However, actual removal and installation of a transmission line shall be performed by a professional rigging crew. If transmission line is repairable (see note at beginning of repair paragraph 6-7.2.2.3), do not perform removal procedure; proceed with repair procedure in paragraph 6-7.2.2.3.

HIGH PRESSURE HAZARD

The entire RF distribution system for the transmit antenna (every transmission line, directional coupler, balun, and dipole) is pressurized with nitrogen gas. Operating pressure is minimum 5 lbf/in^2 gage when outside ambient temperature is below 70 degrees F and is expected to remain below 70 degreees F (approximately November thru April) and minimum 15 lbf/in^2 the remainder of the year.

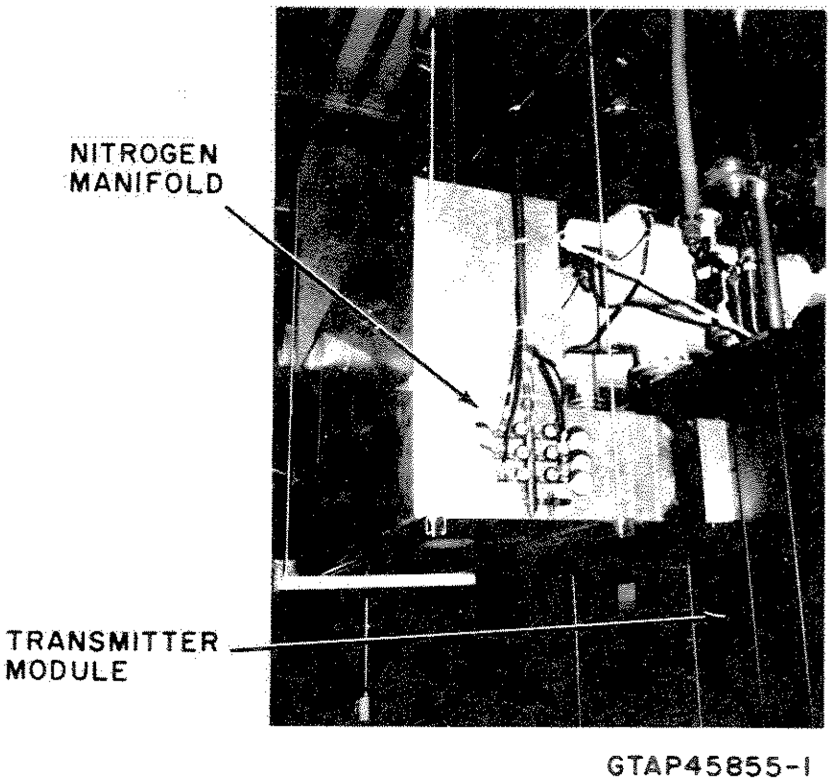


Figure 6-21. Typical Nitrogen Manifold (Sheet 1 of 2)

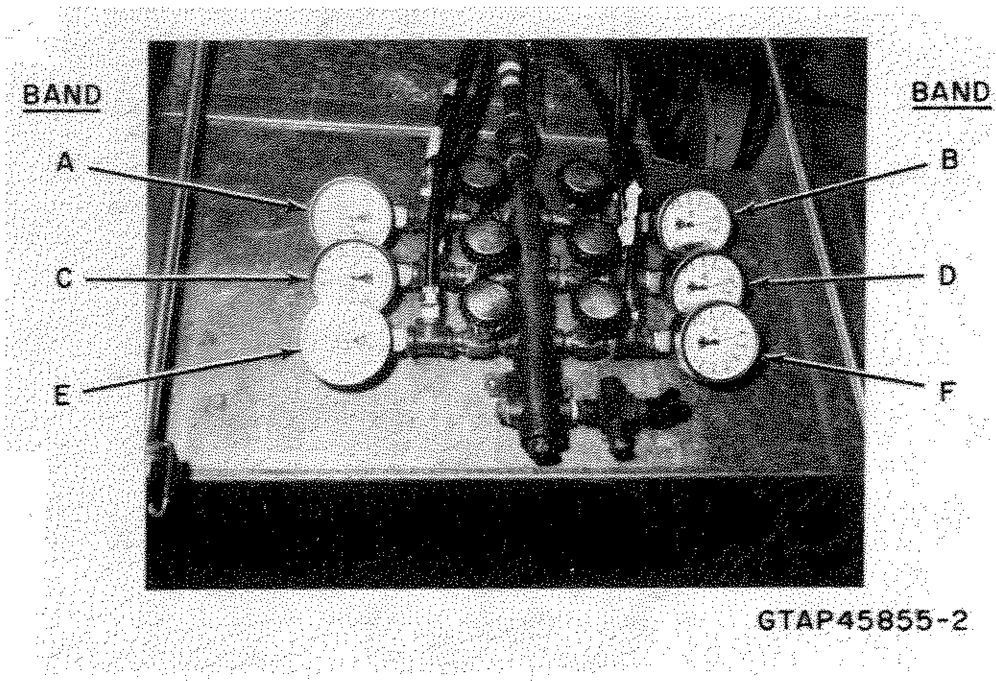


Figure 6-21. Typical Nitrogen Manifold (Sheet 2 of 2)

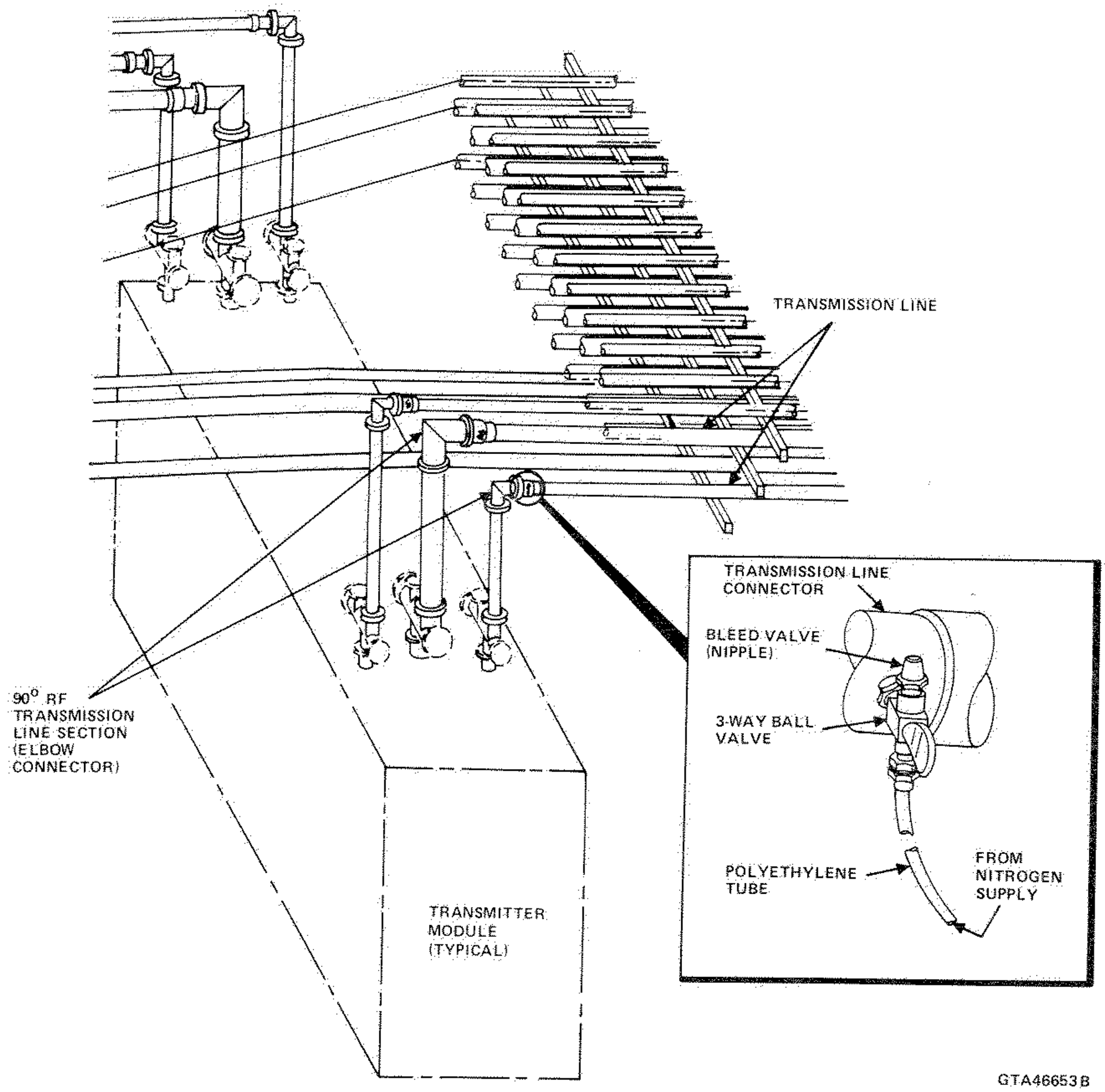


Figure 6-22. Typical Transmission Line Connection to Transmitter Module and Nitrogen Supply

6-7.2.2.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
File, 6 in round	1	33t
Hacksaw blades	1	33u
Hacksaw frame	1	33s
Hammer, plastic tip	1	25j
Kit, propane soldering torch	1	29h
Knife, x-acto	1	25r
Ladder, platform	1	33e
Lever bar and/or spanner wrenches (Furnished as part of connector or splice bit.)	A/R	--
Miter box	1	33aa
Pliers, needlenose	1	25m
Rod, nonmetalic (Fabricate locally from 1/4 in or 3/8 in diameter wood dowel or nylon rod - 3 in long.)	1	--
Screwdriver, flat blade	1	25ad
Shears, metal cutting	1	33z
Socket set	1	28a
Square, steel	1	33ae
Wrench, box/open, set	1	32a
Wrench, torque	1	30d

WARNING

RF RADIATION HAZARD

Remove transmit site RF power from transmitter outputs and antenna elements to protect personnel from RF radiation. Do not perform removal procedure if the transmission lines have RF power applied to them. Ensure transmit antenna field access procedure in paragraph 6-2.8.1 has been performed.

6-7.2.2.2 Removal.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Perform transmit antenna field access procedure in paragraph 6-2.8.1; except do not leave transmitter building.

2. Perform transmission line gas purge procedure in paragraph 6-7.2.1 on transmission line to be removed.

NOTE

Flanges on 3 1/8 inch connectors (Figure 6-23) require 6 bolts, lockwashers, and nuts and 6 flat washers. Flanges on 6 1/8 inch connectors (Figure 6-24) require 12 bolts, lockwashers, and nuts and 12 flat washers.

3. Remove bolts, lockwashers, flat washers, and nuts that secure transmission line connector to 90° transmission line section (elbow connector, Figure 6-22).

NOTE

Some transmission line connectors have removable inner connectors. Inspect elbow connector to ensure inner connector from transmission line is not attached to elbow.

4. Carefully disconnect transmission line connector from elbow connector.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

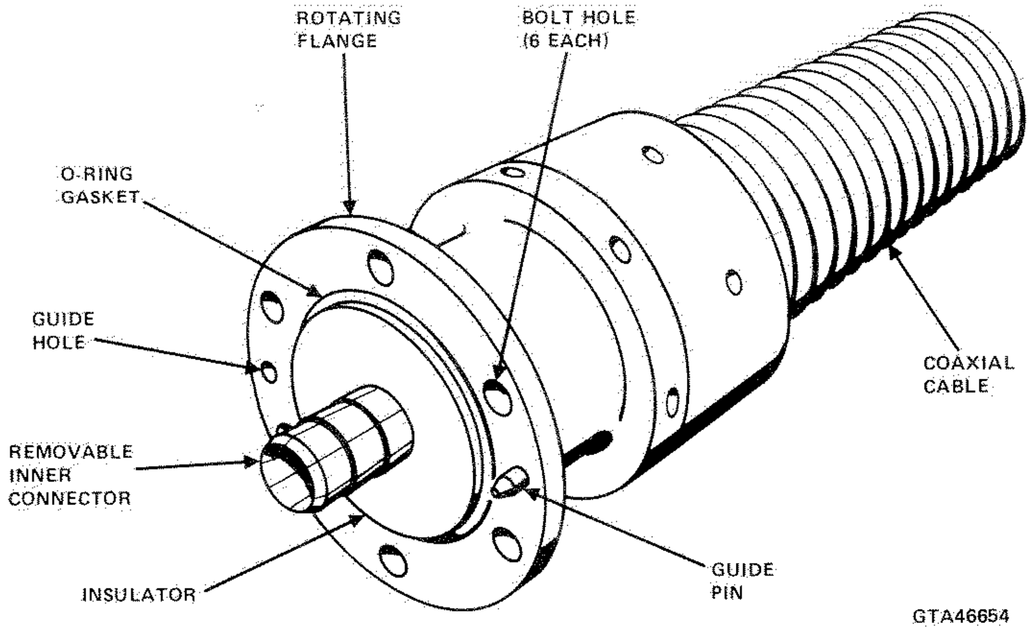


Figure 6-23. Transmission Line with 3 1/8 Inch Connector

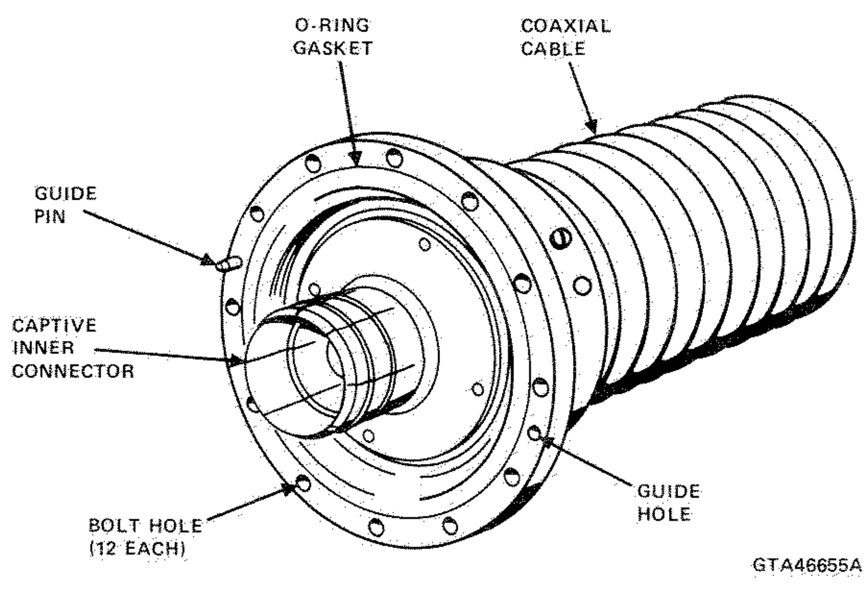


Figure 6-24. Transmit Line with 6 1/8 Inch Connector

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If it is necessary to cross transmission lines, use wooden crosswalks provided for that purpose.

5. Carrying tools for disconnecting transmission line connector and removing coaxial cable clamps, proceed through interlocked gate in safety fence to antenna end of defective transmission line (Figure 6-25).
6. Remove bolts, lockwashers, flat washers, and nuts that secure transmission line connector to directional coupler connector.
7. Carefully disconnect transmission line connector from directional coupler connector.

NOTE

Inspect directional coupler connector to ensure inner connector from transmission line is not attached to coupler.

8. Remove and discard used O-ring gasket from seal groove of either connector.
9. Remove all clamps that secure defective transmission line to wooden supports.
10. Note layout (routing, positioning, etc.) of transmission line to ensure correct installation of replacement.
11. Carefully (to avoid damage to adjacent transmission lines) remove transmission line from all wooden supports.
12. Inside building, use safety stepladder for access, remove transmission line clamps securing line above transmitter.
13. Using safety stepladders as needed, carefully pull and guide transmission line from above transmitter through wall opening to outside of building.

6-7.2.2.3 Repair.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

There are three sizes of coaxial cables used in transmission lines and antenna elements. Three sizes of connectors are used on the transmission lines, and a different type of connector is used at each end. A gas barrier type connector is required at the transmitter end of each transmission line; a nonbarrier type connector is required at the antenna end. Also, nonbarrier type connectors are required if connectors are used for splicing. Repair may consist of the following; connector replacement, connector O-ring gasket replacement, connector part replacement (i.e., replacement of removable inner connector), coaxial cable splicing, and coaxial cable soldering. Review the repair procedures in the following steps to be sure correct parts, materials, and tools are made available at the repair work area.

1. Perform the transmit antenna field access procedure in paragraph 6-2.8.1.
2. Perform the transmission line gas purge procedure in paragraph 6-7.2.1 on transmission line to be repaired.

WARNING

RF POWER AND HIGH PRESSURE HAZARD

Do not proceed with procedure unless RF power has been removed from all transmission lines and affected line has been purged of nitrogen gas.

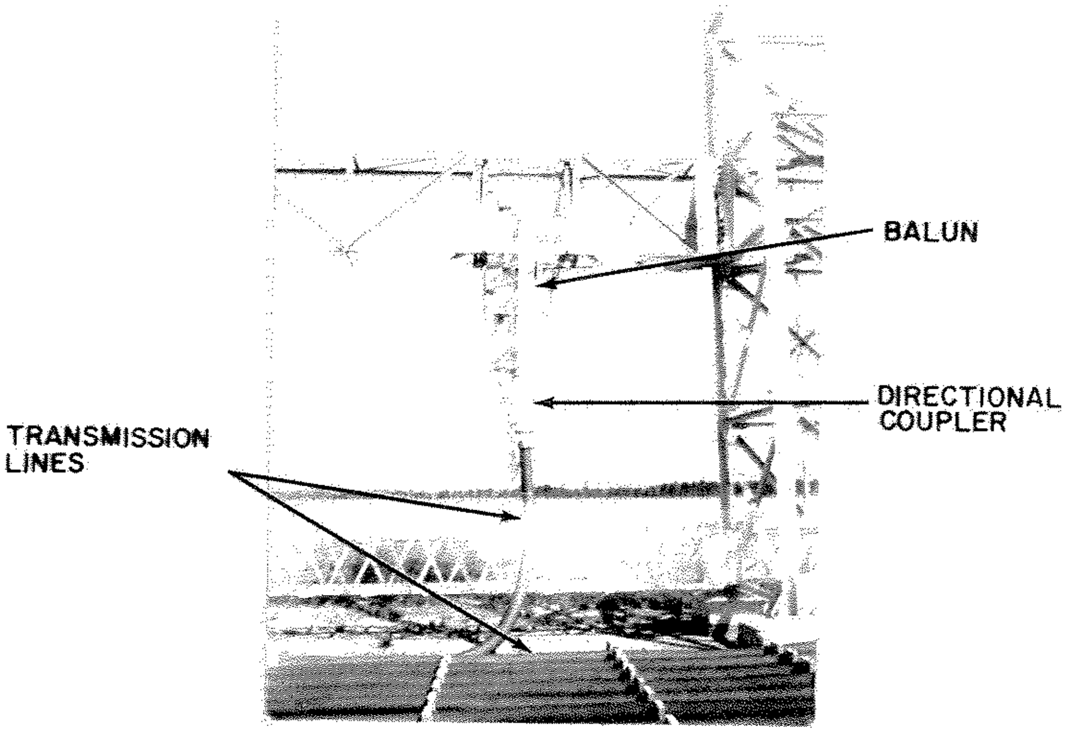


Figure 6-25. Typical Transmission Line Connection to Directional Coupler (Sheet 1 of 2)

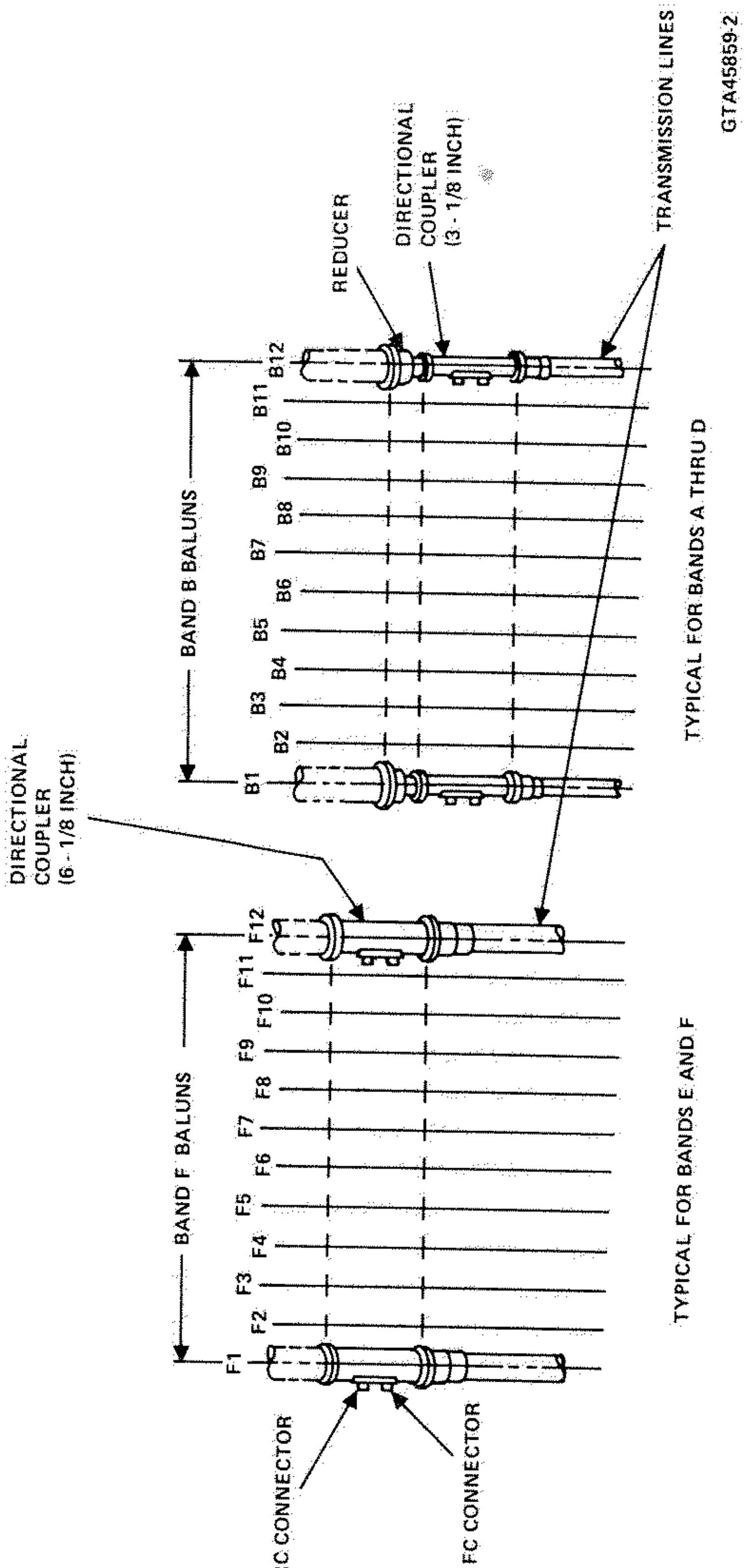


Figure 6-25. Typical Transmission Line Connection to Directional Coupler (Sheet 2 of 2)

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If it is necessary to cross transmission lines to reach a defect, use wooden crosswalks provided for that purpose.

3. Carrying transmission line repair parts, tools, and materials, proceed (through interlocked gate in safety fence, if applicable) to area of defect in transmission line.

NOTE

If a connector is defective, the extent of repair or replacement may not be obvious until the connector is disconnected and disassembled for inspection. Perform steps 4 through 10 below for removal of a defective connector. If a coaxial cable is defective, skip steps 4 through 10 below and proceed to step 11 below. Read note that precedes step 11.

4. If defective connector is at transmitter end of transmission line (Figure 6-22), use safety ladder for access to unscrew and disconnect polyethylene tube adapter from nitrogen inlet in defective connector.
5. Remove bolts, lockwashers, flat washers, and nuts (Figures 6-23 and 6-24) that secure rotating flange of defective connector to fixed flange of mating connector.
6. Disconnect defective connector from mating connector; discard used flange gasket (O-ring).

NOTE

Installation bulletins provided by manufacturer with replacement connectors identify parts of the different connectors used on transmission lines, and also show assembly details.

7. Inspect inner connector for arcing burns, corrosion, and loose contact with mating inner connector.
8. While holding clamping nut to prevent turning, use spanner wrench to unscrew outer body of defective connector from clamping nuts.

NOTE

Remove and discard all used O-ring gaskets as connector is disassembled. Whether the connector is reused or replaced partially or totally, use only new gaskets during assembly.

9. Using appropriate wrench size, unscrew left-hand threaded inner connector from inner stub. (Turn clockwise to unscrew.)
10. Remove all remaining parts of defective connector from coaxial cable.

NOTE

Whether installing a connector or splicing a coaxial cable, cutting and preparing the coaxial cable is a similar requirement. The major difference is that a miter box must be used to make a square first-cut when the cable must be spliced. For all other cuts through the coaxial cable, a used clamping ring may be screwed onto the cable to guide the saw blade for a square cut. Coaxial cable must be straight for at least 18 inches before making a cut. Use two technicians to hold and support the cable while sawing through. If the only defect is a small puncture in the cable, attempt repair by soft soldering before making any cuts. For all cleaning specified in this repair procedure, use nonresidue and nonflammable solvent (Table 6-1, Item 38). For all silicone grease specified in this repair procedure, use Item 27 in Table 6-1.

11. Clean outer conductor of coaxial cable around area where cut is to be made.

12. Using a hacksaw with a fine-toothed blade, cut squarely through the coaxial cable.

13. Repeat steps 11 and 12 above on other side of defect in coaxial cable; discard defective piece of cable.

NOTE

If more than 20 feet of coaxial cable is cut from the transmission line, check beamforming characteristics upon completion of repair. If more than 2.0 percent of total transmission line length is removed, the line will be too short; an equivalent length of coaxial cable must be cut from stock and spliced into the line.

14. To cut coaxial cable from stock, repeat steps 11 and 12 above after measuring and marking the required length.

15. Inspect cut ends of coaxial cable to ensure inner and outer conductors are cut flush and square.

CAUTION

EQUIPMENT DEGRADATION HAZARD

Hold end of coaxial cable downward while removing burrs from cut edges of inner and outer conductors. After removing burrs, continue holding end downward while shaking and tapping the cable to make sure no loose particles remain inside.

16. Using a fine file, remove all burrs from cut edges of inner and outer conductors. A knife may be used to deburr inside edges of conductors.

17. Clean inner and outer conductors with solvent at cut ends, including accessible areas on inside and outside surfaces of each conductor.

18. Apply thin coating of silicone grease to external surface of coaxial cable for approximately 6 inches from end.

19. Apply thin coating of silicone grease to inside surfaces of clamping nut (or outer body if splice is being used).

20. Slide clamping nut (or outer body) onto coaxial cable, with threaded area (or flange) toward end of cable (Figure 6-26).

21. Apply thin coating of silicone grease to inside surface of large rubber and metal (or rubber only) gasket.

NOTE

If gasket supplied with connector has no metal side, a separate flat metal ring is supplied. Make sure this ring is installed on coaxial cable between gasket and clamping nut. Splice type connections do not require a metal ring.

22. Screw gasket onto corrugations of coaxial cable. Orient metal side, if applicable, toward clamping nut.

23. Apply thin coating of silicone grease to inside surface of clamping ring.

24. Screw clamping ring far enough onto coaxial cable to permit cutting a series of slits into end of outer conductor.

25. Clean end of outer conductor with solvent to remove silicone grease.

26. Using metal snips, cut slits in outer conductor to depth of approximately 3/16 inch at intervals of approximately 5/16 inch to form tabs around entire circumference.

27. Screw clamping ring toward tabs to within approximately 3/16 inch of end of outer conductor.

28. Screw gasket against clamping ring.

29. Using pliers, bend tabs outward toward face of clamping ring to start forming a flare.

CAUTION

REPAIR DEGRADATION HAZARD

Do not strike tabs hard enough to reduce thickness of metal.

30. Using nonmetallic rod and mallet with nonmetallic head, carefully flare tabs against clamping ring (Figure 6-27).

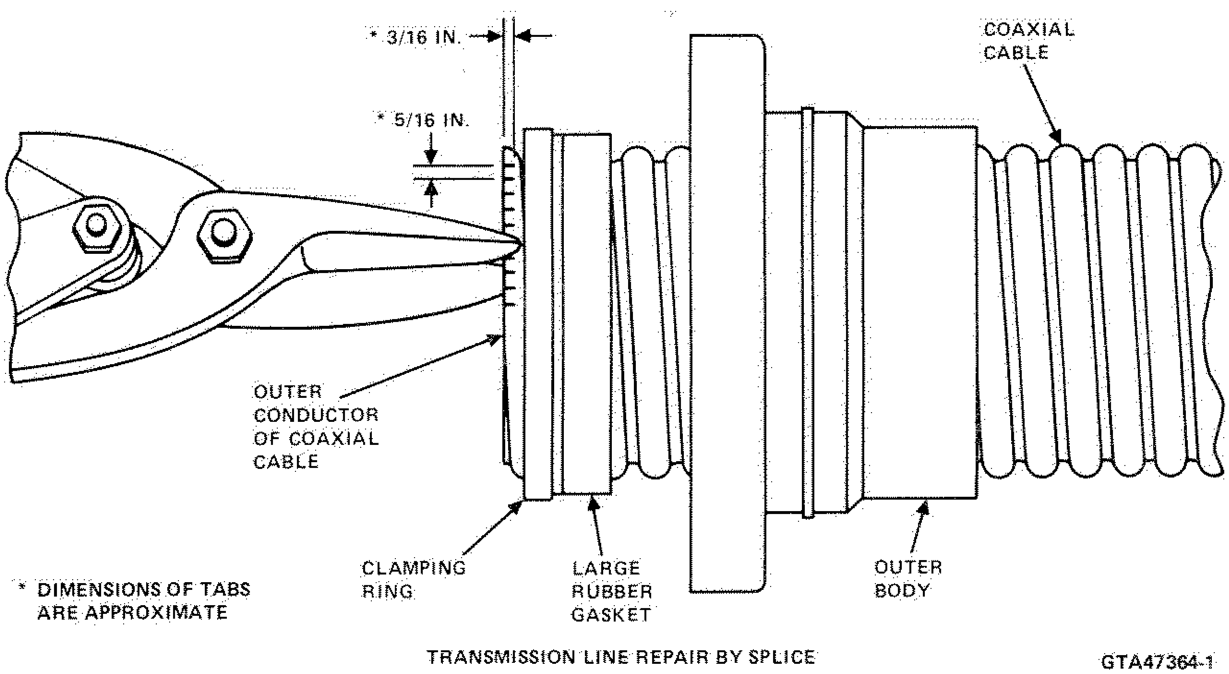


Figure 6-26. Transmission Line Repair (Sheet 1 of 2)

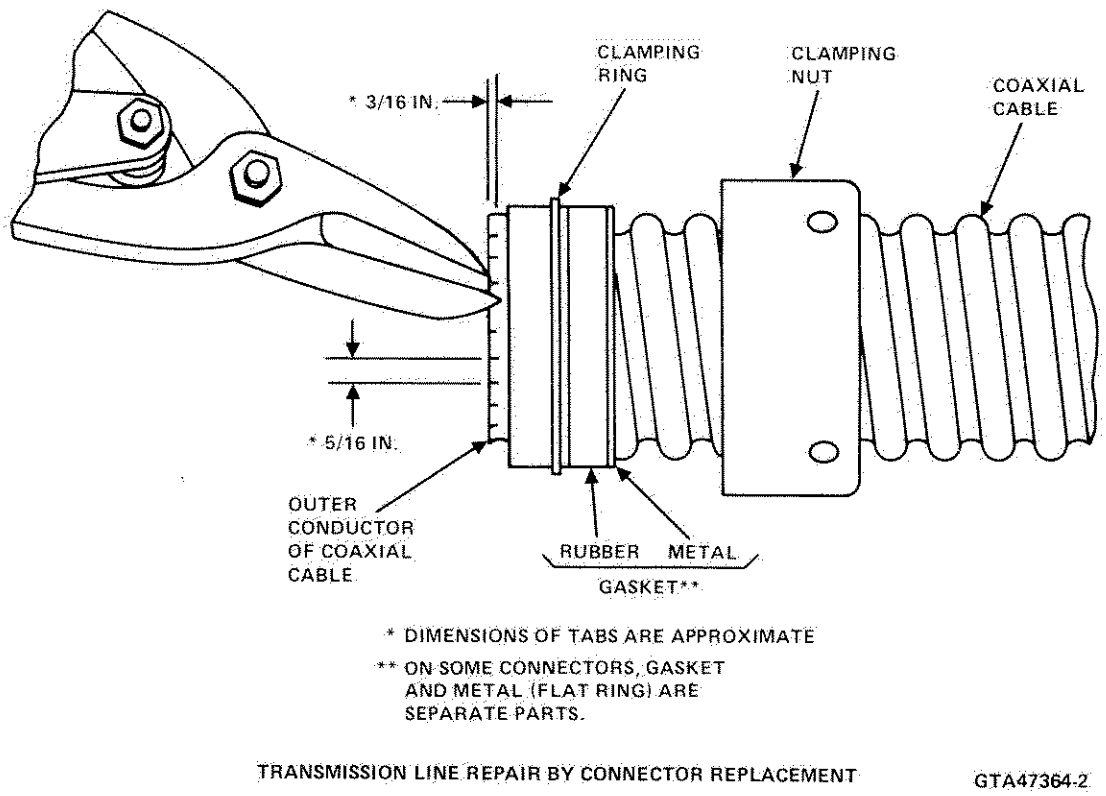


Figure 6-26. Transmission Line Repair (Sheet 2 of 2)

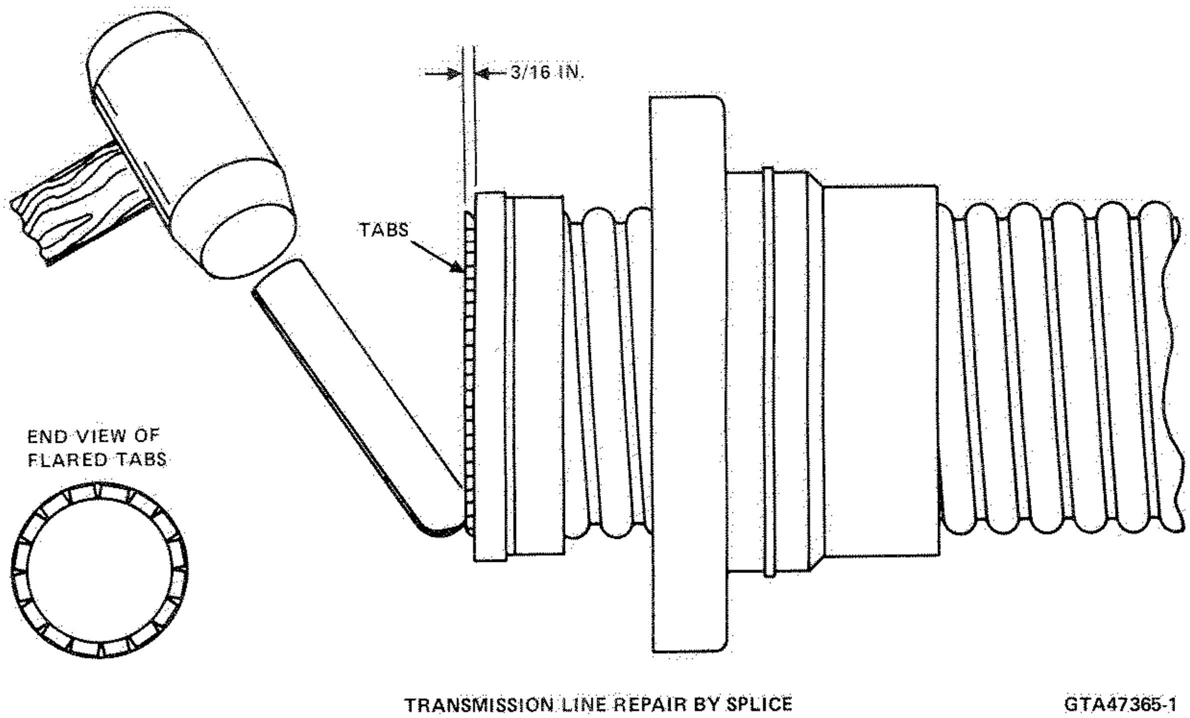


Figure 6-27. Transmission Line Repair, Detail of Flaring Tabs (Sheet 1 of 2)

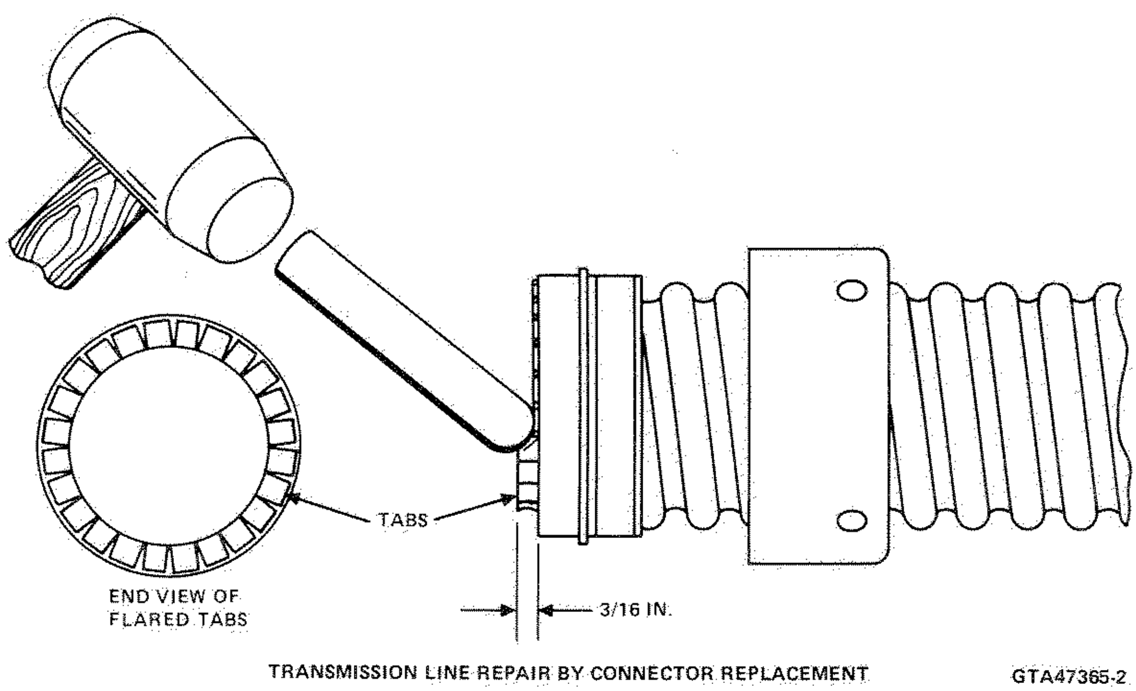


Figure 6-27. Transmission Line Repair, Detail of Flaring Tabs (Sheet 2 of 2)

31. Inspect flared tabs for high spots, and for protrusions beyond outside diameter of clamping ring.

32. Carefully trim or file excess tab material noted during inspection.

33. Inspect dielectric spacing material (located between inner and outer conductors) for protrusion beyond flared tabs.

34. Carefully trim excess dielectric material noted during inspection.

CAUTION

EQUIPMENT DAMAGE HAZARD

Inner stubs (male and female) are reverse-threaded. Use caution not to damage stubs and inner conductor.

35. Screw inner stub (male or female, as supplied with connector or splice) approximately 1/2 inch into inner conductor to permit cutting a series of notches into end of inner conductor (Figure 6-28).

36. Cut 45° V-shaped notches in inner conductor to depth of approximately 3/16 inch at intervals of approximately 5/16 inch (width at base of notch) to form tabs around entire circumference.

37. Unscrew inner stub until face of stub extends approximately 1/8 inch or 1/16 inch beyond flared tabs of outer conductor (Figure 6-29). (Refer to manufacturer's installation bulletin for connector or splice being installed.)

38. Using screwdriver and nonmetallic mallet, tap two tabs into slot in inner stub to lock stub in place.

39. Using nonmetallic rod and mallet, carefully flare remaining tabs inward against inner stub; do not overlap tabs.

40. If splice is being made in coaxial cable, repeat steps 17 through 39 above at other end of coaxial cable in transmission line, and at both ends of replacement length of coaxial cable if applicable.

NOTE

Repair procedures vary more widely from this point to completion, depending upon type and size of connector or connection being used. The following steps provide general information to ensure a high quality repair when installation instruction bulletins supplied by the manufacturer are used for specific details.

41. If splice type connection is being used, refer to manufacturer's instructions and steps a. through q. below. If a connector is being replaced, or connectors are being used for splicing, omit steps a. through q. below and proceed to step 42 below (for gas barrier connectors) or step 43 below (for nonbarrier connectors).

CAUTION

EQUIPMENT DAMAGE HAZARD

Threaded stud in next step has left-hand threads on one end and right-hand threads on other end. Screw threads on the stud and in both inner stubs will be damaged if wrong end of stud is screwed into stub.

a. Screw left-hand threads of threaded stud two turns into inner stub that has left-hand threads (Figure 6-30).

b. Apply thin coating of silicone grease to all surfaces of square O-ring gasket.

c. Temporarily position square O-ring gasket on coaxial cable between outer body and large rubber gasket.

d. Clean all flared tabs with solvent.

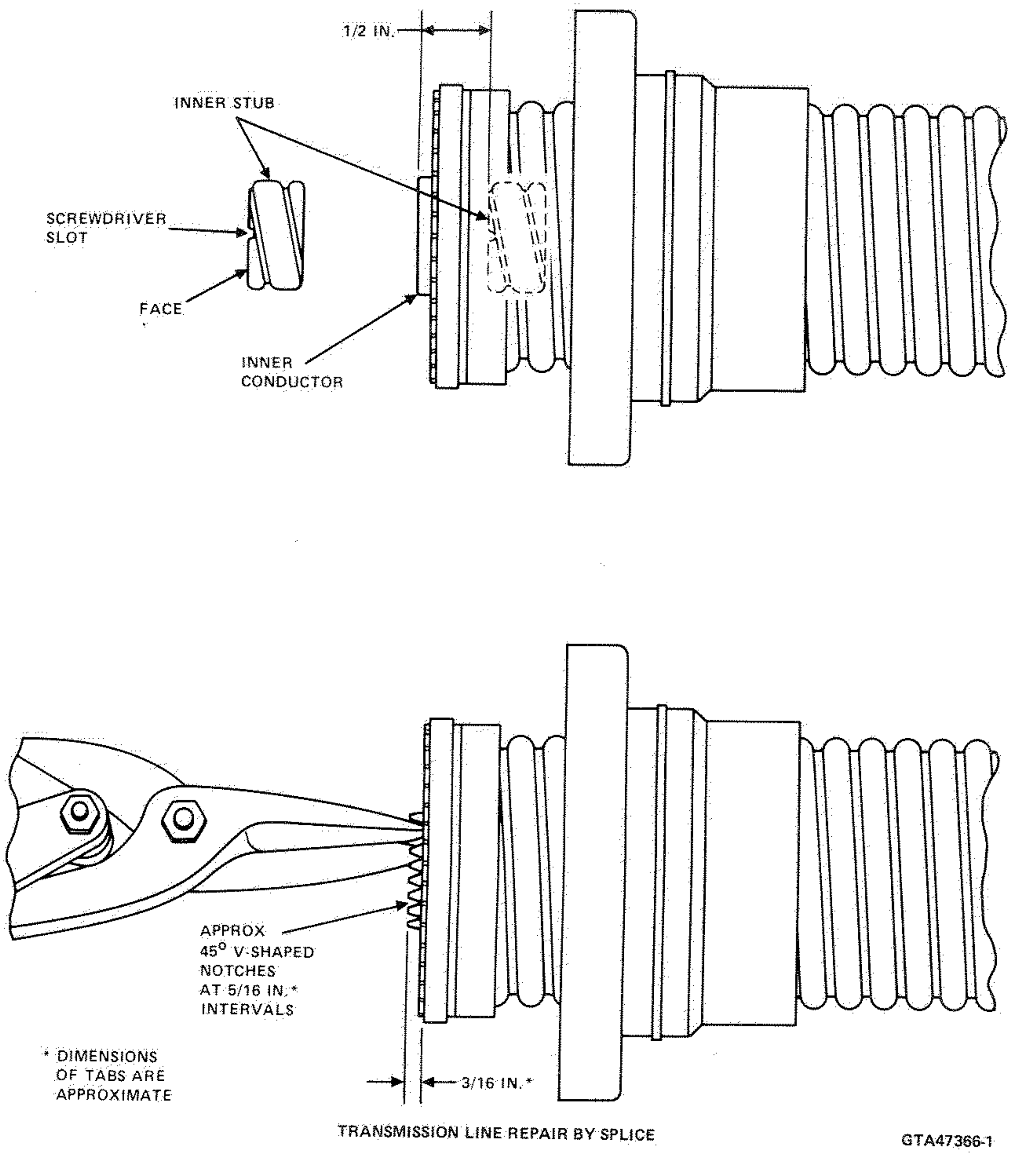


Figure 6-28. Transmission Line Repair, Detail of V-Shaped Notches (Sheet 1 of 2)

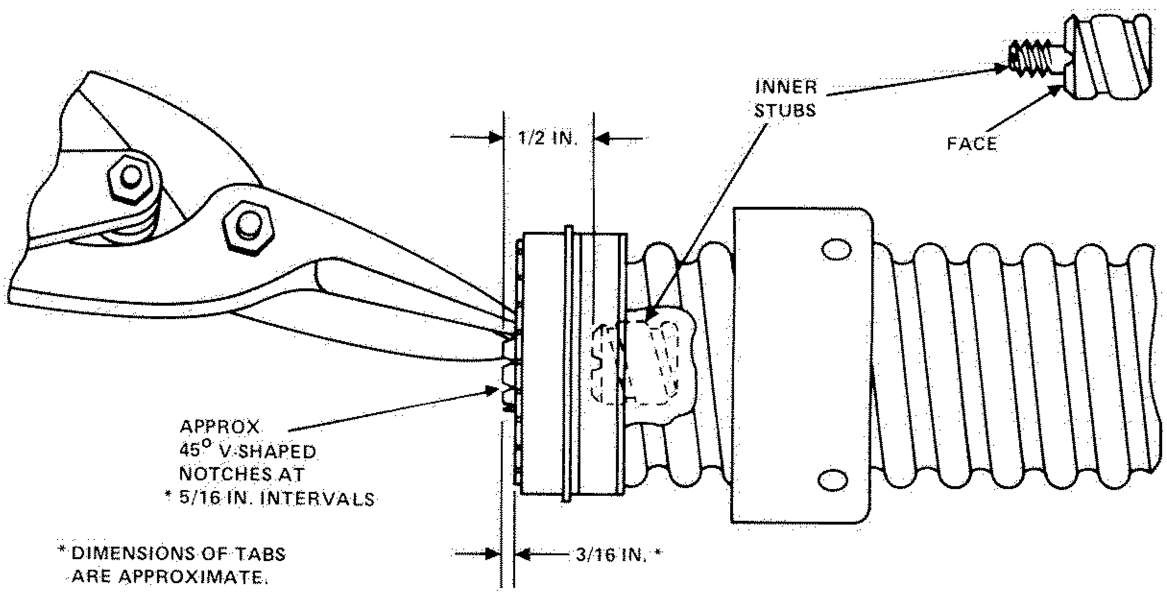


Figure 6-28. Transmission Line Repair, Detail of V-Shaped Notches (Sheet 2 of 2)

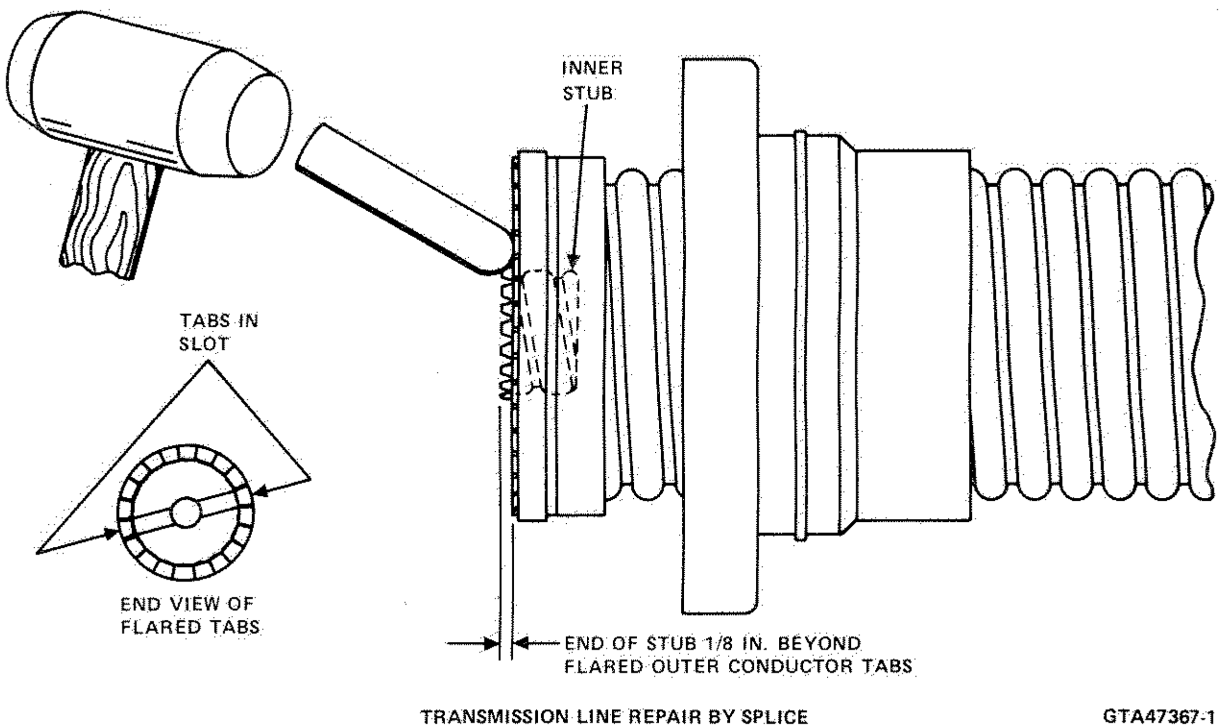


Figure 6-29. Transmission Line Repair, Detail of Inner Stub Alignment (Sheet 1 of 2)

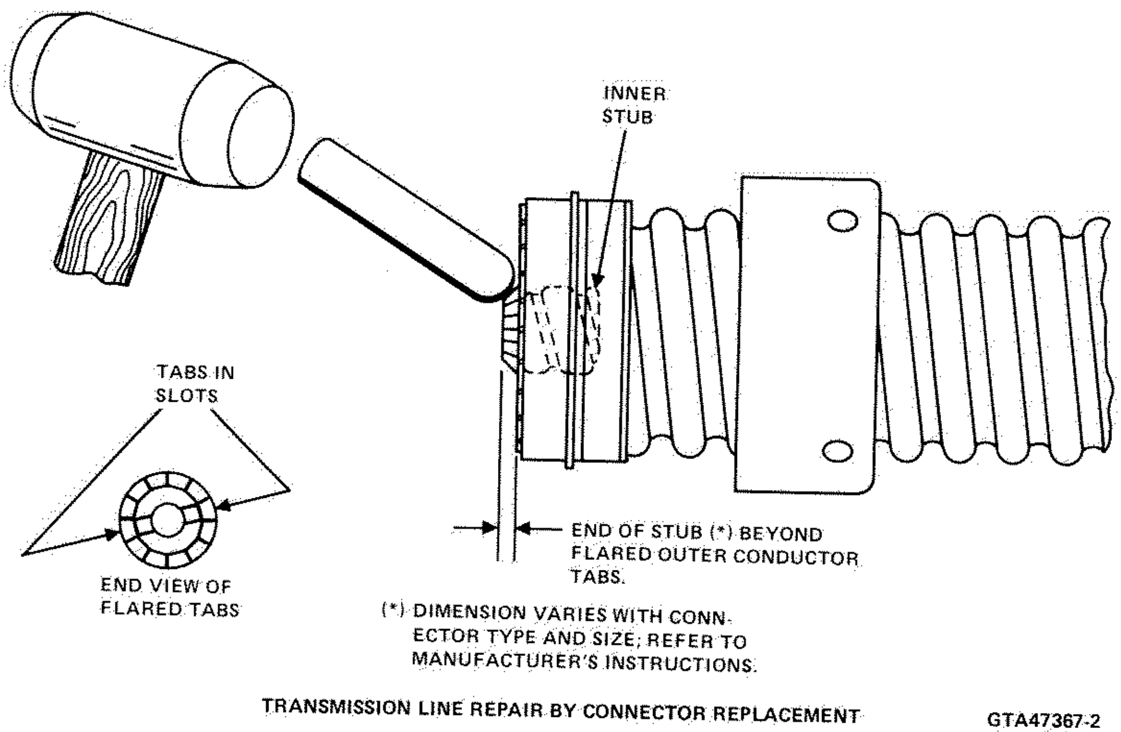


Figure 6-29. Transmission Line Repair, Detail of Inner Stub Alignment (Sheet 2 of 2)

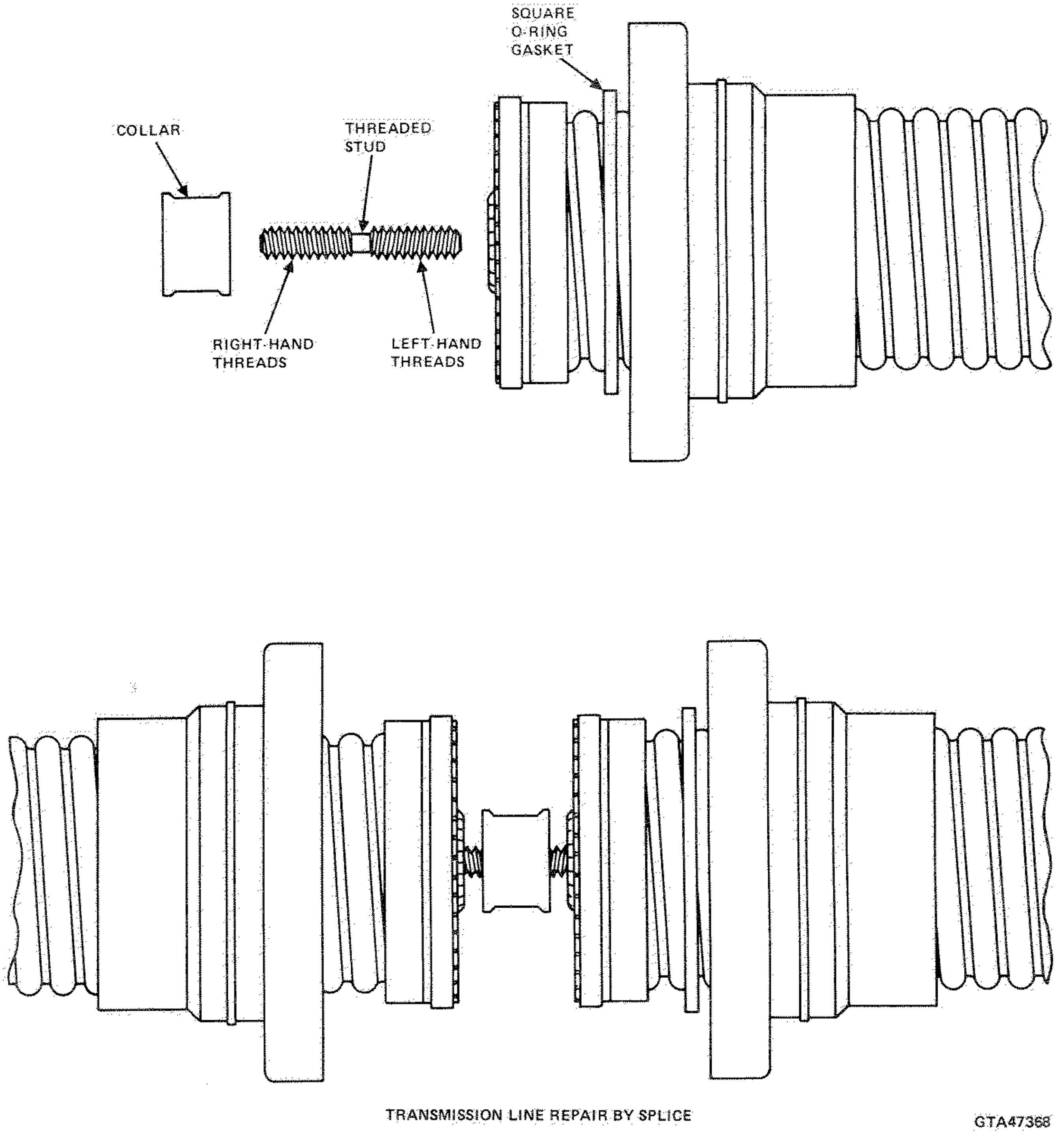


Figure 6-30. Transmission Line Repair, Detail of Threaded Stud Installation

e. Position collar at center of threaded stud.

f. Align inner stub in mating end of splice with threaded stud and carefully turn collar so that threaded stud screws into both stubs simultaneously.

g. Using wrench, tighten collar firmly against flared tabs of both inner conductors.

h. Insert spacer halves between flared tabs of outer conductors as described in steps (1) through (6) below (Figure 6-31).

(1) Separate spacer halves carefully to avoid damage to factory-set alignment pins.

(2) Move spliced area of coaxial cable slightly to one side to increase space between flared tabs of outer conductors on that side.

(3) Carefully insert one spacer half between tabs of outer conductors.

(4) Move spliced area of cable to opposite side.

(5) Carefully insert second spacer half between tabs on opposite side, oriented for mating with alignment pin and hole in first spacer half.

(6) Make sure pins and holes on spacer halves are fully mated, and mated halves are centered between outer conductors.

i. Apply thin coating of silicone grease to outside surface of both large rubber gaskets.

j. Move square O-ring gasket into gasket groove in spacer halves.

k. Align bolt holes in flanges on outer bodies.

l. Pull flanges together to force outer bodies evenly over large rubber gaskets.

m. Loosely install bolts, lockwashers, and nuts in bolt holes of aligned flanges.

n. Pull flanges toward square O-ring gasket until both flanges are pressed evenly against the gasket; tighten nuts by hand.

o. Tighten nuts in small, equal increments and in pairs 180° apart until both flanges are fully and evenly tightened against square O-ring gasket.

p. Repeat steps a. through o. for second splice connection when a length of coaxial cable is being added.

q. Perform transmission line gas purge and refill procedures in paragraph 6-7.2.1 on repaired transmission line.

42. If gas barrier connector at transmitter end of transmission line is being replaced, refer to manufacturer's instructions and steps a. through s. below.

a. Temporarily place inner flare ring and support ring (or outer flare ring) against flared tabs of inner and outer conductors; ensure that exposed surfaces of rings are flush with each other (Figure 6-32).

b. Clean flared tabs, flare rings, and inner connector with solvent.

CAUTION

EQUIPMENT DAMAGE HAZARD

Use care when seating O-ring into seal groove.

NOTE

Apply thin coating of silicone grease to all O-ring gaskets just before assembly.

c. For male inner stub only, assemble applicable (tiny) O-ring gasket into seal groove of stub.

d. Assemble applicable (small) O-ring gasket into seal groove of insulator or inner connector, as preferred.

e. Install insulator on inner connector.

f. Install inner flare ring on inner connector against insulator.

CAUTION

REPAIR DEGRADATION HAZARD

Inner connectors and inner stubs have left-hand threads. Threads will be damaged if forced and cross-threaded by a clockwise starting direction.

g. While holding outer flare ring (or support ring) against flared tabs of outer conductor, carefully thread assembled inner connector

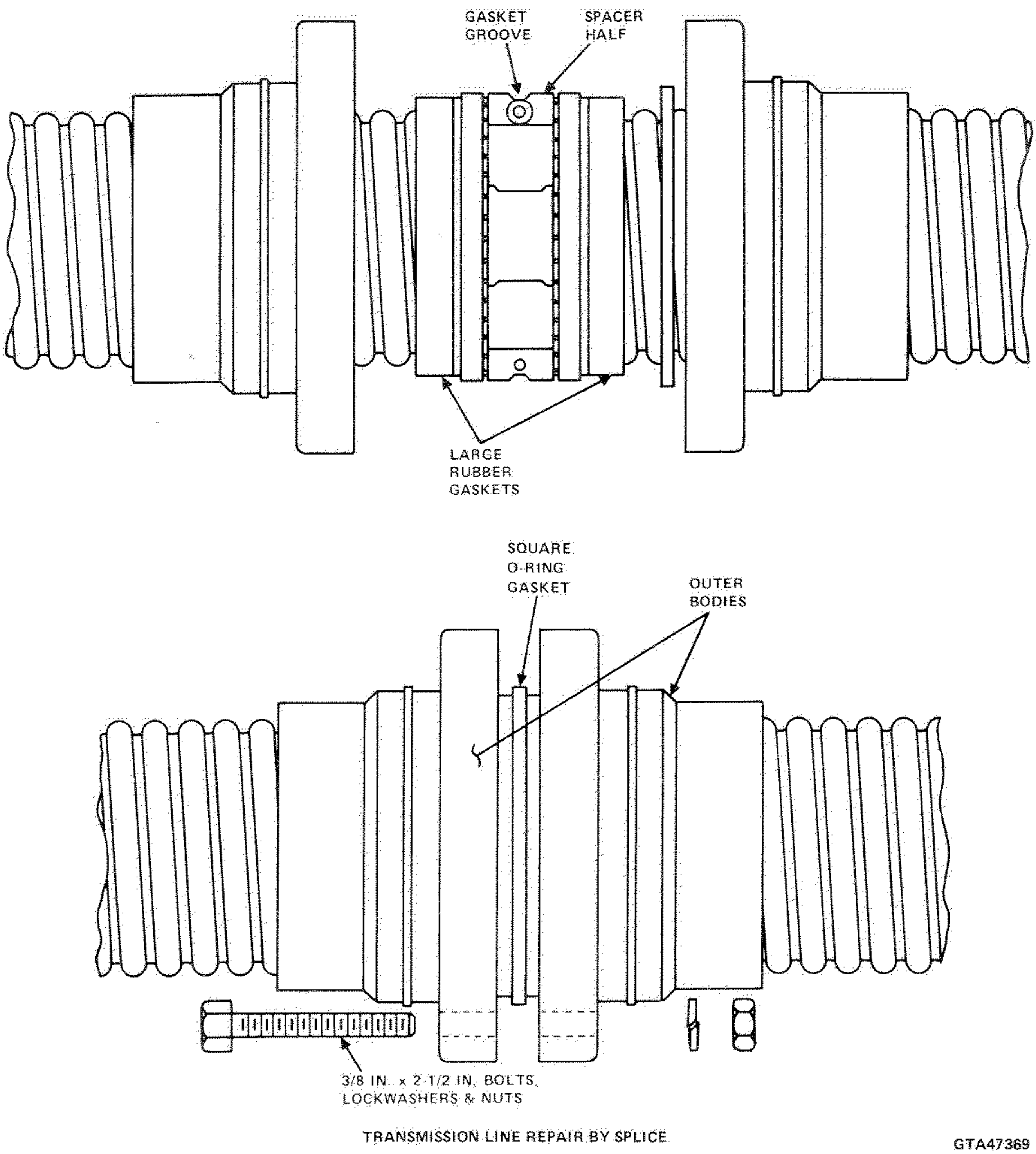


Figure 6-31. Transmission Line Repair, Detail of Splice Connection

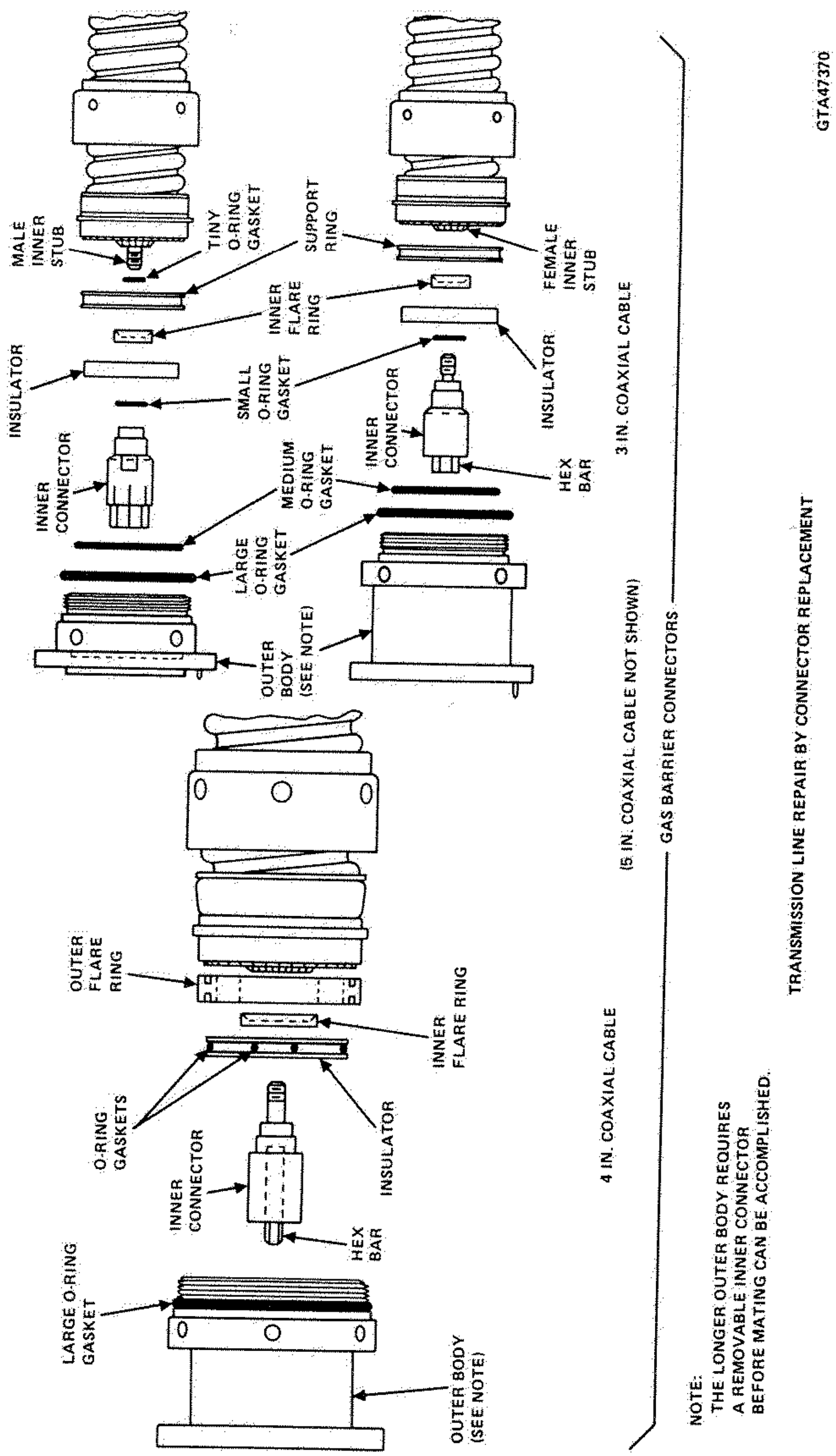


Figure 6-32. Transmission Line Repair, Detail of Gas Barrier Connectors

counterclockwise into (or onto) inner stub until finger tight.

CAUTION

REPAIR DEGRADATION HAZARD

Some gas barrier connectors require installation of a hex bar into inner connector to tighten the inner connector. Any attempt to remove the hex bar after tightening the inner connector may destroy the integrity of the inner connection between cable and connector. The hex bar has left-hand threads.

h. If applicable, screw hex bar counterclockwise into inner connector.

i. Using wrench (on hex bar or on flats of inner connector) tighten inner connector counterclockwise until inner flare ring is firmly against flared tabs of inner conductor.

j. Assemble applicable (medium-sized) O-ring gasket into seal groove on insulator or inside of outer body.

k. Assemble large O-ring gasket into seal groove at end of threads on outside of outer body.

l. Apply thin coating of silicone grease to outside surface of large rubber gasket (or rubber and metal gasket) on coaxial cable (Figure 6-26).

m. Slide clamping nut over large gasket and clamping ring.

CAUTION

REPAIR DEGRADATION HAZARD

Clamping ring and associated gasket must not turn and move away from flared tabs of outer conductor. Do not turn clamping nut or allow clamping nut to turn while outer body is being tightened into clamping nut, since such turning could destroy the integrity of the outer connection between cable and connector.

n. Assemble outer body carefully over insulator and rings and start turning threads of outer body into threads of clamping nut (Figure 6-32). Do not allow clamping nut to turn.

o. Using spanner wrenches, (supplied with connector) one to hold clamping nut and one to turn outer body, tighten outer body connection to clamping nut. Do not allow clamping nut to turn.

NOTE

Some gas barrier connectors (those with longer outer bodies) require installation of a removable inner connector before connection can be made to a mating connector.

p. Align removable inner connector with captive inner connector centered in outer body (Figure 6-33).

q. Press removable inner connector into outer body until insulator is fully seated in insulator groove.

r. Inspect seating of removable inner connector; if more than half of insulator width is visible, connector has been assembled incorrectly.

s. Perform transmission line gas purge and refill procedures in paragraph 6-7.2.1 on repaired transmission line.

43. If nonbarrier connector at antenna end of transmission line is being replaced (or if nonbarrier connectors are being used to make a splice) refer to manufacturer's instructions and steps a. through m. below.

a. Clean flared tabs, flare ring, and inner connector with solvent (Figure 6-34).

CAUTION

EQUIPMENT DAMAGE HAZARD

Inner connector and inner stub have left-hand threads. Threads will be damaged if forced and cross-threaded by a clockwise starting direction.

b. Carefully thread inner connector counterclockwise into (or onto) inner stub until finger tight.

c. Using a wrench, tighten inner connector counterclockwise until firmly against flared tabs of inner conductor.

d. Position and hold flare ring (or support ring) against flared tabs of outer conductor, and snap insulator into position in recess of inner connector to hold ring against flared tabs.

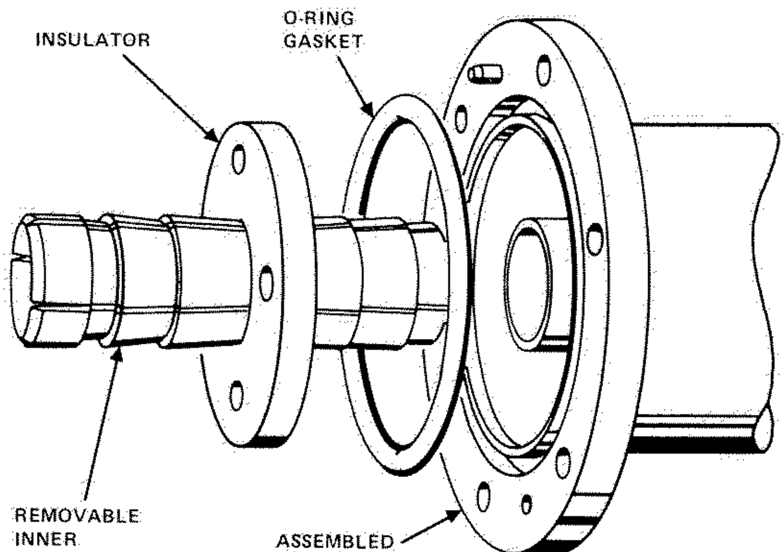


Figure 6-33. Transmission Line Repair, Detail of Inner Connector Alignment

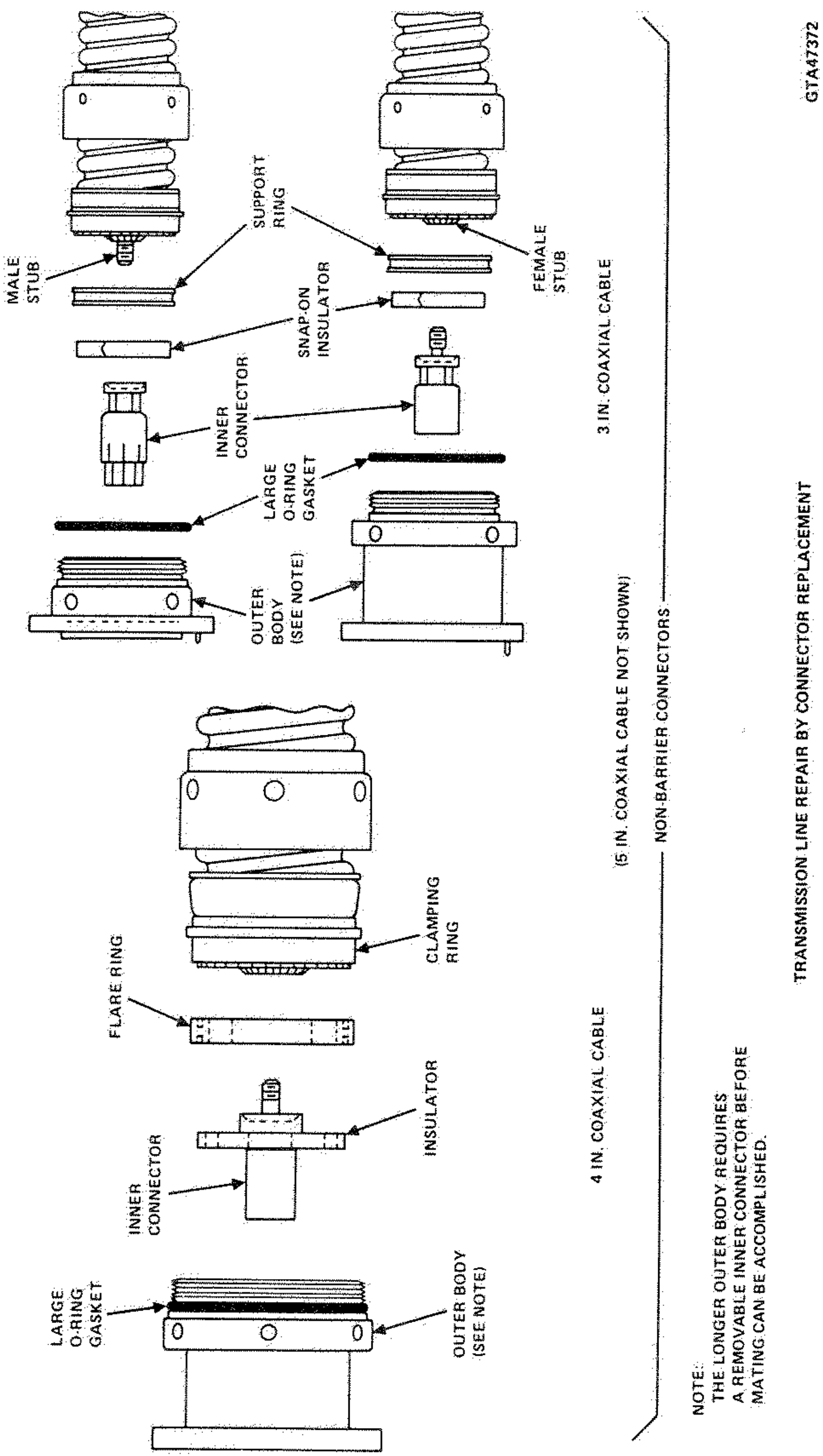


Figure 6-34. Transmission Line Repair, Detail of Non-Barrier Connectors

e. Apply thin coating of silicone grease to large O-ring gasket and assemble gasket into seal groove at end of threads on outside of outer body.

f. Apply thin coating of silicone grease to outside surface of large rubber gasket (or rubber and metal gasket) on coaxial cable (Figure 6-26).

g. Slide clamping nut over large gasket and clamping ring.

CAUTION

REPAIR DEGRADATION HAZARD

Clamping ring and associated gasket must not turn and move away from flared tabs of outer conductor. Do not turn clamping nut or allow clamping nut to turn while outer body is being tightened into clamping nut, since such turning could destroy the integrity of the outer connection between cable and connector.

h. Assemble outer body carefully over insulator and ring and start turning threads of outer body into threads of clamping nut (Figure 6-34). Do not allow clamping nut to turn.

i. Using spanner wrenches, one to hold clamping nut and one to turn outer body, tighten outer body connection to clamping nut. Do not allow clamping nut to turn.

NOTE

Some nonbarrier connectors (those with longer outer bodies) require installation of a removable inner connector before connection can be made to a mating connector.

j. Align removable inner connector with captive inner connector centered in outer body (Figure 6-33).

k. Press removable inner connector into outer body until insulator is fully seated in insulator groove.

l. Inspect seating of removable inner connector; if more than half of insulator width is visible, connector has been assembled incorrectly.

m. Perform transmission line gas purge and refill procedure in paragraph 6-7.2.1 on repaired transmission line.

6-7.2.2.4 Installation.

WARNING

WEIGHT HAZARD

Transmission lines on cable reels weigh approximately 500 to 4000 pounds, depending on length and diameter. Ensure that adequate equipment and manpower are used during handling.

HIGH PRESSURE HAZARD

Replacement transmission lines are shipped with 15 lbf/in² gage of nitrogen gas. Do not attempt to release pressure except as instructed by this procedure.

CAUTION

TRANSMISSION LINE CONTAMINATION HAZARD

Do not release nitrogen gas from replacement transmission line until plastic end caps must be removed to make connections.

TRANSMISSION LINE DAMAGE HAZARD

Stepping on the coaxial cable transmission line may permanently destroy its operating characteristics. If it is necessary to cross lines during installation, use wooden crosswalks provided for that purpose.

NOTE

The following installation procedure is a general guide for installing a transmission line between transmit building and antenna. Actual installation requires skills and equipment beyond the scope of this manual.

1. Position cable reel containing replacement transmission line at location described in step a. or b. below.

   a. If last connector wound onto reel is identified by a transmitter module reference designation TX 110 through TX 121, position reel near wall openings through which defective transmission line was withdrawn from transmit building.

b. If last connector wound onto reel is identified by an antenna element reference designation ELE A through ELE F, position reel near directional coupler from which defective transmission line was disconnected.

2. Pull enough transmission line from reel to reach nearest destination: elbow connection above transmitter module or directional coupler at antenna element.

NOTE

Lay transmission line along route from which defective line was removed, and ensure that enough slack is available to make connection without strain on coaxial cable or connector. If line has been routed into transmit building, wall panels may be installed as tagged or marked during removal.

3. Move reel slowly toward farthest destination while laying transmission line on wooden supports as noted during removal.

4. Ensure that transmission line is properly routed to reach farthest connection without strain.

WARNING

HIGH PRESSURE HAZARD

Replacement transmission lines are shipped with 15 lbf/in^2 gage of nitrogen gas. Use care when releasing pressure.

5. At transmitter end of transmission line, slowly loosen, but do not remove, nitrogen inlet plug on connector outer body to release nitrogen gas pressure.

6. At antenna end of transmission line, remove protective metal cover from connector.

NOTE

Install metal cover on connector of defective transmission line. Some transmission line connectors have removable inner connectors. Inspect connectors before mating to ensure inner connector is present and securely seated. For all cleaning specified in this procedure, use nonresidue and nonflammable solvent (Table 6-1, Item 38). For all silicone grease specified in this repair procedure, use (Table 6-1, Item 27).

7. Clean mating connectors on transmission line and directional coupler with solvent.

8. Apply thin coating of silicone grease to new O-ring gasket supplied with connector.

9. Press O-ring gasket into seal groove of either mating connector. Remove excess silicone grease from connector.

10. Carefully align and partially join inner connectors of mating connectors.

11. Align guide pins and guide holes in connector flanges and continue joining inner connectors until O-ring gasket is fully pressed into seal grooves of both connectors.

NOTE

Flanges on 3 1/8 inch connectors require 6 bolts, lockwashers, and nuts and 6 flat washers. Flanges on 6 1/8 inch connectors require 12 bolts, lockwashers, and nuts and 12 flat washers.

12. Loosely install new bolts, lockwashers, flat washers, and nuts (supplied with connector) in bolt holes of aligned flanges.

13. Tighten nuts evenly by hand while forcing connector bodies together with other hand.

14. Tighten nuts in small, equal increments and in pairs 180° apart until all nuts are tightened to 200 to 220 inch-pounds torque.

15. At transmitter end of transmission line, remove protective metal cover from connector.

NOTE

Install metal cover on connector of defective transmission line.

16. Lay nearest end of defective transmission line onto empty cable reel and pick up entire line as reel is moved toward farthest end.

17. Remove all installation equipment, tools, materials, defective assemblies and parts, and personnel from fenced antenna area, and secure the interlocked gate.

18. At transmitter end of transmission line, clean mating connectors (on line and elbow) with solvent.

19. Carefully align and join inner connectors of mating connectors.

20. Loosely install new bolts, lockwashers, flat washers, and nuts (supplied with connector) in bolt holes of aligned flanges.

21. Tighten nuts evenly by hand while forcing connector bodies together with other hand.

22. Tighten nuts in small, equal increments and in pairs 180° apart until all nuts are tightened to 200 to 220 inch-pounds torque.
23. Reconnect clamps securing transmission line above transmitters.
24. Perform transmission line gas purge and refill procedures in paragraph 6-7.2.1 on affected transmission line.
25. Perform transmit antenna field exit procedure in 6-2.8.2.
26. Perform RF radiation check on transmission line connection at top of transmitter module in accordance with paragraph 6-9.19.

6-7.2.3 Directional Couplers.

6-7.2.3.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Socket set, 3/8 in	1	28a
Wrench, box/open, set	1	32a
Wrench, torque	1	33a

6-7.2.3.2 Removal.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Perform transmit antenna field access procedure in paragraph 6-2.8.1; except do not leave transmitter building.
2. Perform transmission line gas purge procedure in paragraph 6-7.2.1 on transmission line that feeds affected directional coupler.

WARNING

RF RADIATION AND HIGH PRESSURE HAZARD

Do not proceed with procedure unless RF power has been removed from all transmission lines and affected line (one that feeds affected directional coupler) has been purged of nitrogen gas.

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If necessary to cross transmission lines, use wooden crosswalks provided for that purpose.

3. Carrying replacement directional coupler, O-ring gasket, silicone grease (Table 6-1, Item 27), solvent (Table 6-1, Item 38), torque wrench with 9/16 inch socket, 2 safety stepladders, and 9/16 inch wrench, proceed through interlocked gate in safety fence to defective directional coupler (Figure 6-35).
4. Remove and retain bolts, lockwashers, flat washers, and nuts that secure transmission line connector to defective directional coupler.
5. Carefully disconnect transmission line connector from directional coupler connector.

NOTE

Some transmission line connectors have a removable inner connector. Inspect transmission line connector to ensure inner connector is present and securely attached.

6. Remove and discard used O-ring gasket from seal groove of either connector.
7. Cover open end of transmission line for protection against environmental conditions and equipment damage.

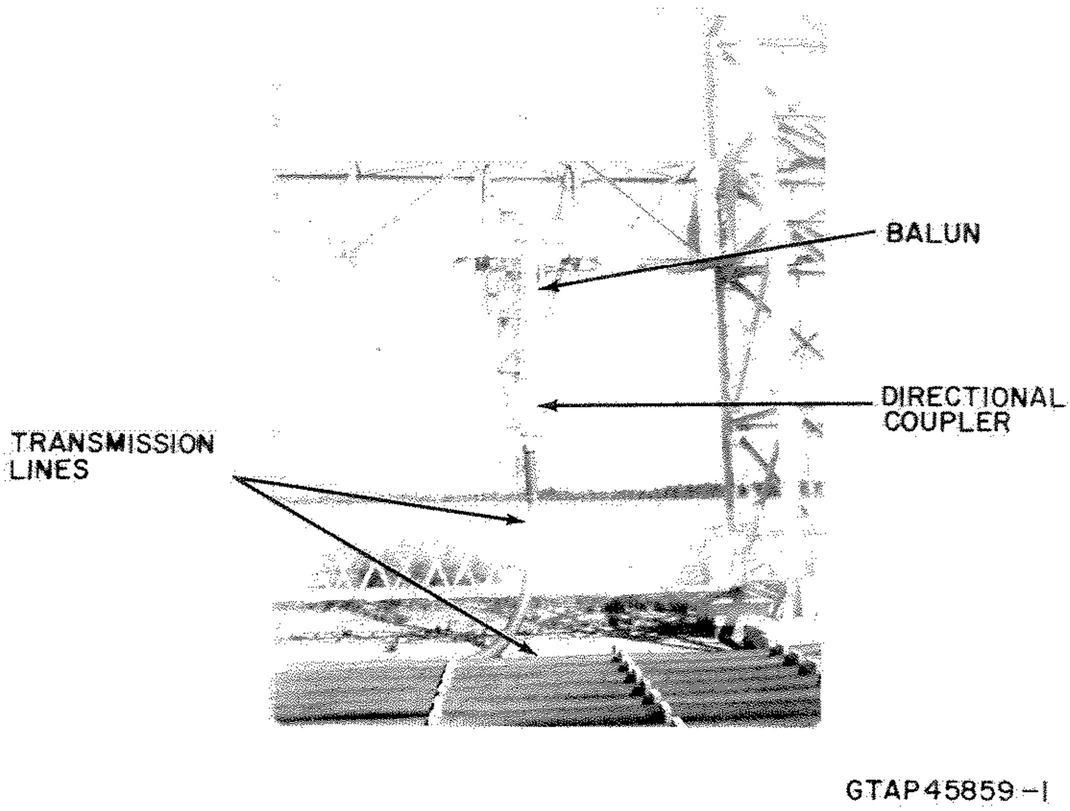


Figure 6-35. Typical Directional Couplers (Installed)

NOTE

Use one safety stepladder for access to top of coupler and one ladder for technician to support coupler. If test leads are connected to RC or FC connectors on directional coupler, disconnect and remove the leads (Figure 6-36).

8. With one technician supporting coupler to prevent damage, remove and retain bolts, lock-washers, flat washers, and nuts that secure rotating flange on directional coupler to fixed flange on reducer (for bands A through D) or balun (for bands E and F).

9. Carefully disconnect coupler connector from reducer or balun connector.

10. Inspect reducer or balun inner connector to ensure inner connector from defective coupler is not attached to reducer or balun.

11. Remove and discard used O-ring gasket from seal groove of either connector.

6-7.2.3.3 Installation.

CAUTION

DIRECTIONAL COUPLER CONTAMINATION HAZARD

Do not loosen or remove either protective end cap (cover) from replacement directional coupler until ready to connect that end.

1. At protective cover on rotating flange of directional coupler, slowly and carefully loosen attaching hardware to release nitrogen gas pressure.

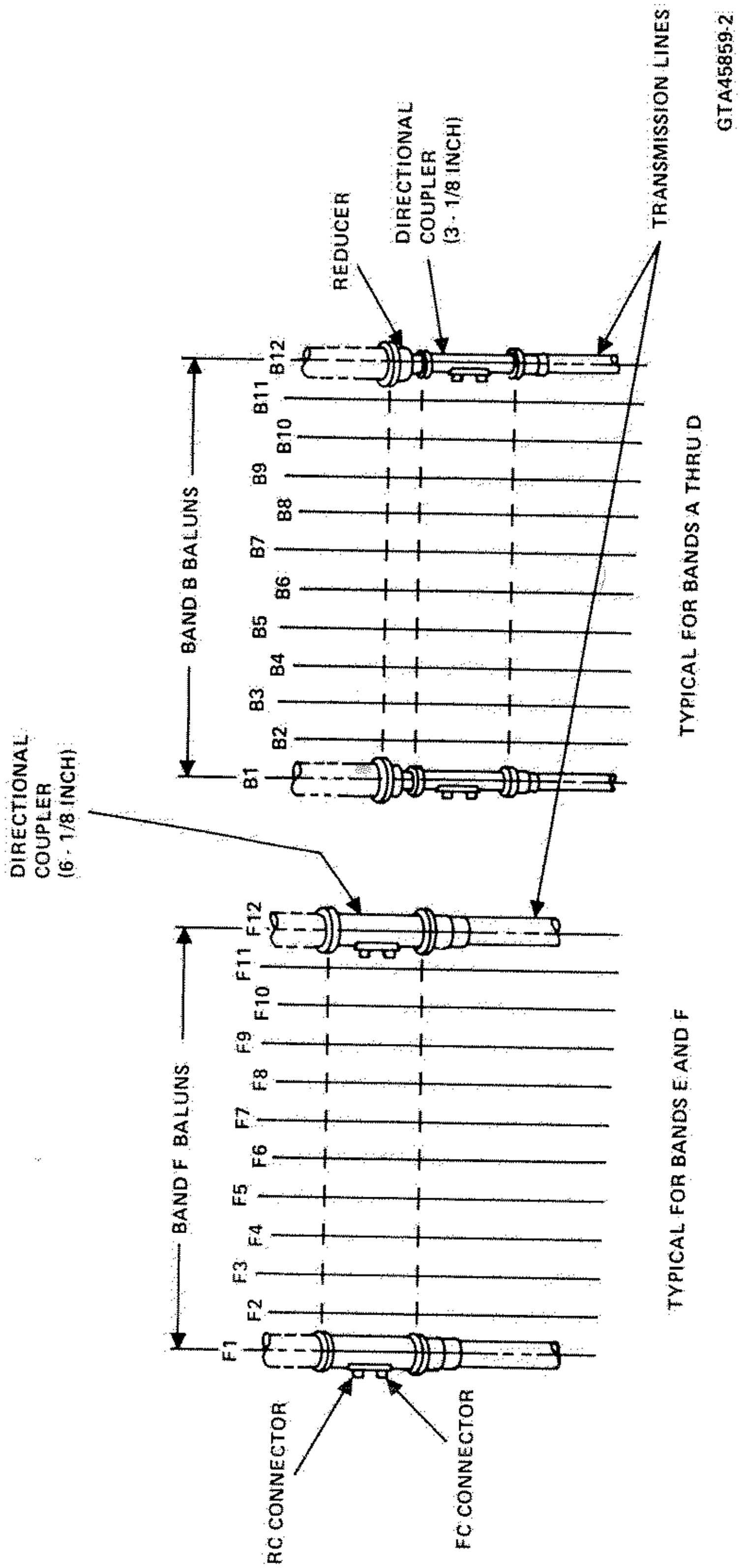


Figure 6-36. Detail of Typical Directional Couplers (Sheet 1 of 2)

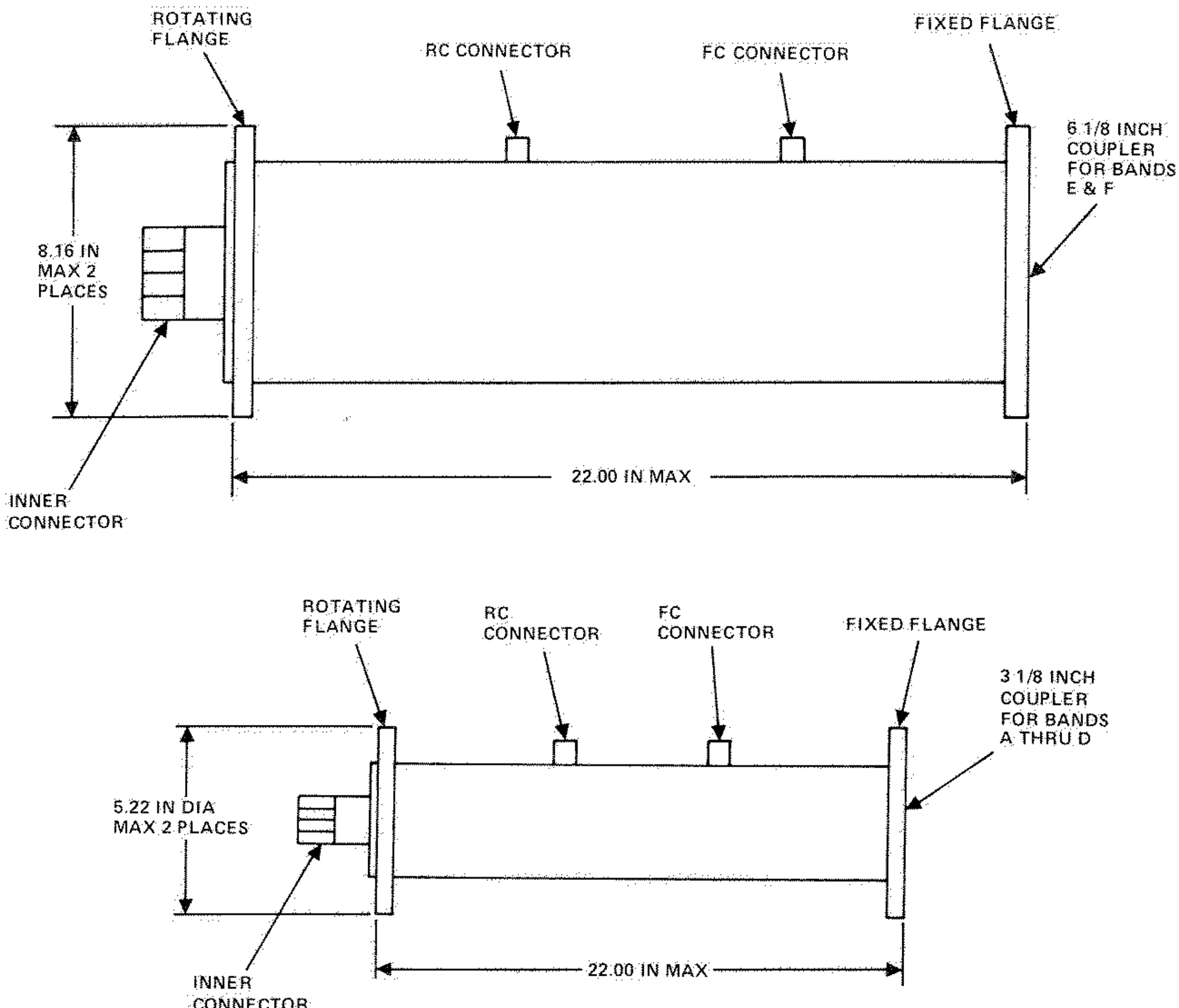


Figure 6-36. Detail of Typical Directional Couplers (Sheet 2 of 2)

2. Remove protective cover from rotating flange of coupler.

NOTE

Install protective covers on defective directional coupler after replacement directional coupler is fully connected. Some connectors have removable inner connectors. Inspect connectors before mating to ensure required inner connector is present and securely seated. For all cleaning specified in this procedure, use nonresidue and nonflammable solvent (Table 6-1, Item 38). For all silicone grease specified in this repair procedure, use Table 6-1, Item 27.

3. Use solvent to clean mating connector parts on coupler and on balun or reducer.
4. Apply thin coating of silicone grease to new O-ring gasket supplied with coupler.
5. Press O-ring gasket into seal groove of either mating connector (between coupler and reducer or balun). Remove excess silicone grease from connector.
6. Carefully align and partially join inner connectors of mating connectors.
7. Align guide pins and guide holes in connector flanges and continue joining inner connectors until O-ring gasket is fully pressed into seal grooves of both connectors.

NOTE

Flanges on 3 1/8 inch connectors require 6 bolts, lockwashers, and nuts and 6 flat washers. Flanges on 6 1/8 inch connectors require 12 bolts, lockwashers, and nuts and 12 flat washers.

8. Loosely install new bolts, lockwashers, flat washers, and nuts (supplied with coupler) in bolt holes of aligned flanges.
9. Tighten nuts evenly by hand while forcing connector bodies together with other hand.
10. Tighten nuts in small, equal increments and in pairs 180° apart until all nuts are tightened to 200 to 220 inch-pounds torque.
11. Remove protective cover from fixed flange of coupler.
12. Use solvent to clean mating connector parts on coupler and on transmission line.
13. Apply thin coating of silicone grease to new O-ring gasket.
14. Press O-ring gasket into seal groove of transmission line connector. Remove excess silicone grease from connector.
15. Repeat steps 6 through 10 above, except install used hardware in step 8.
16. Install protective covers and attaching hardware on defective coupler.
17. Remove all installation equipment, ladders, defective coupler, materials, tools, and personnel from fenced antenna area, and secure the interlocked gate.
18. Perform transmission line gas purge and refill procedure in paragraph 6-7.2.1 on affected transmission line.
19. Perform transmit antenna field exit procedure in 6-2.8.2.

6-7.2.4 <u>Balun Removal and Installation Procedures</u>.

6-7.2.4.1 <u>Tools and Test Equipment Required</u>.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Screwdriver, flat blade	1	25ad
Socket set, 3/8 in	1	28a
Wrench, box/open, set	1	32a
Wrench, torque	1	30a

6-7.2.4.2 <u>Removal</u>. (Figure 6-37).

WARNING

HEIGHT HAZARD

The aboveground maintenance action must be performed by a professional rigging crew - not site personnel. The skills and equipment required to access the baluns are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action aboveground.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

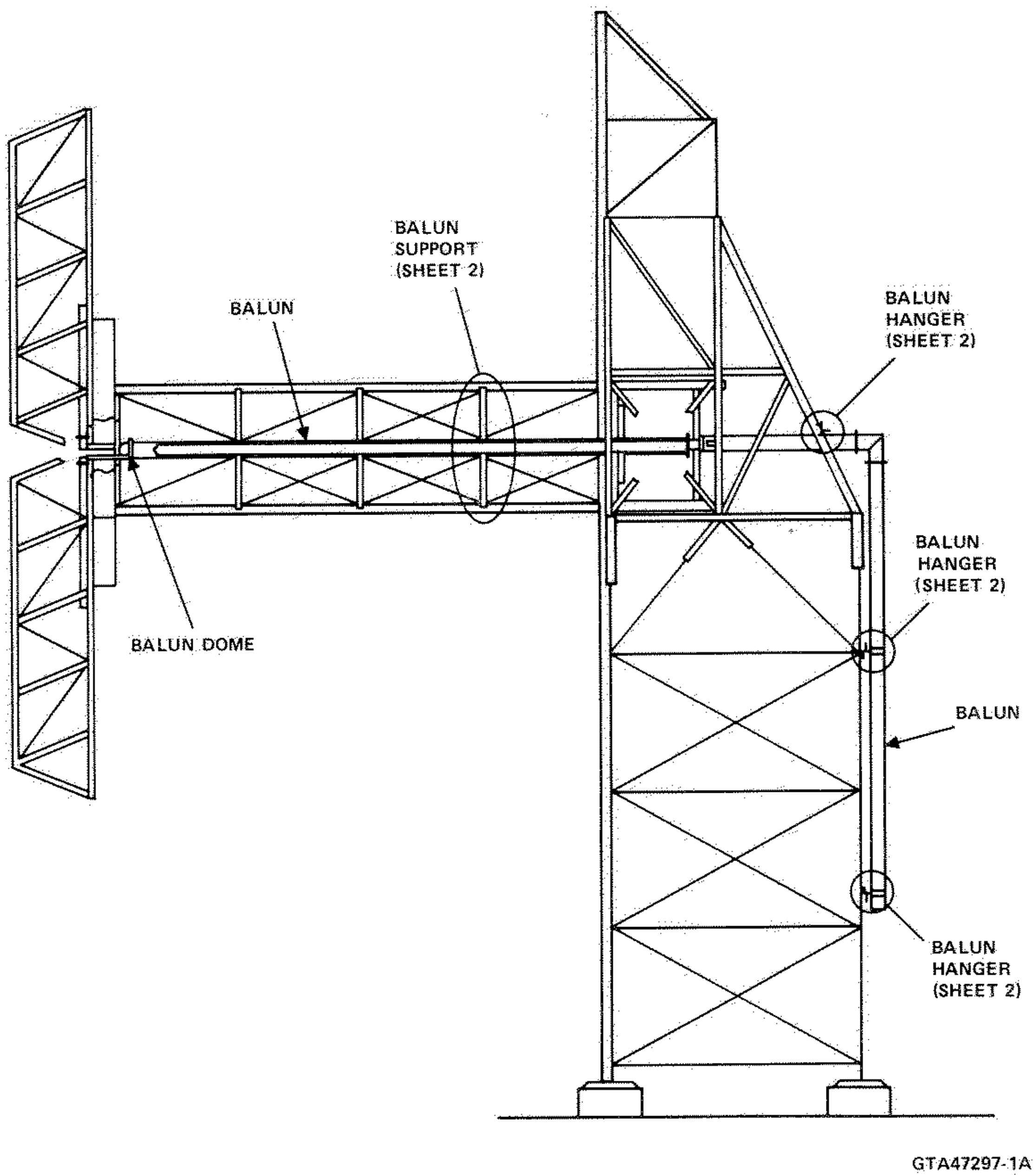
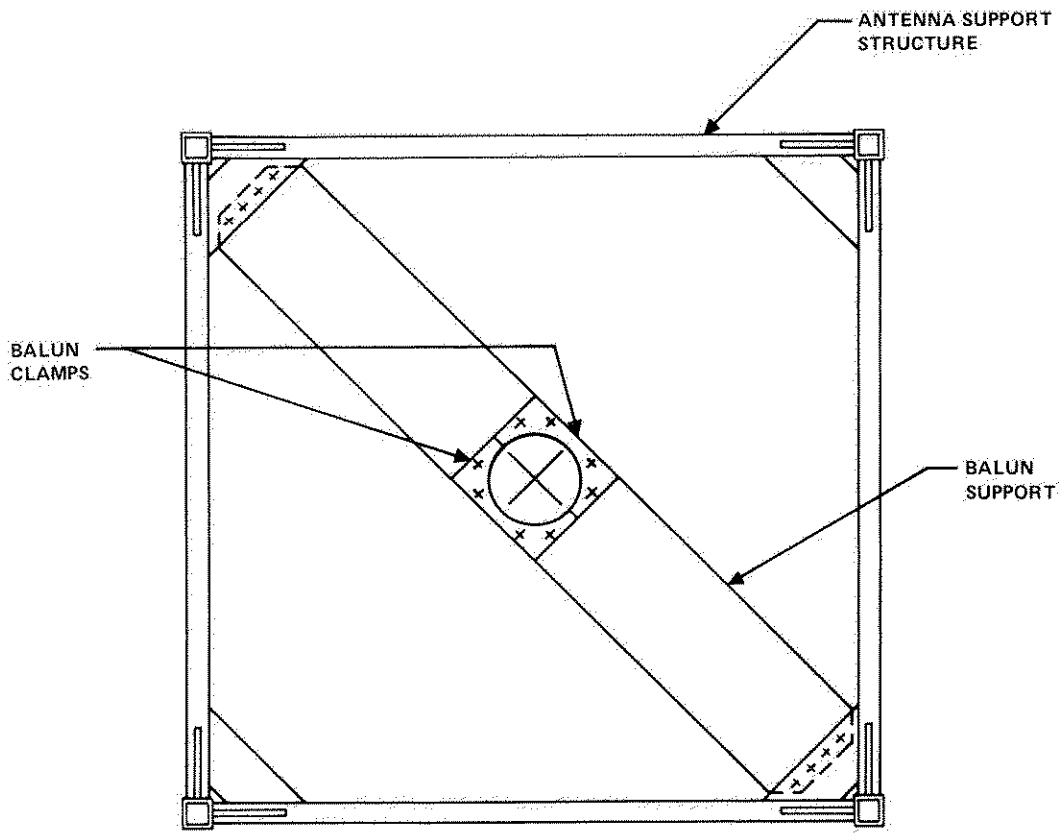
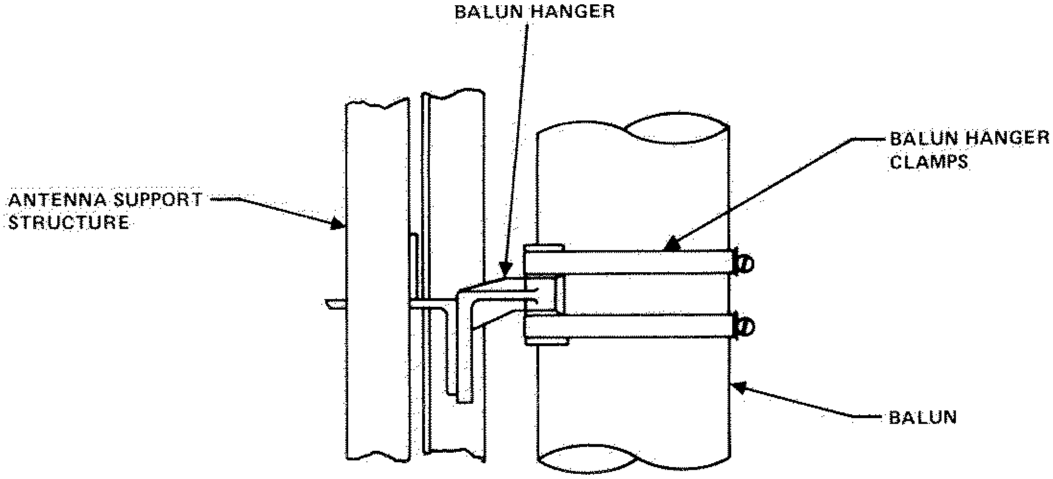


Figure 6-37. Typical Transmit Antenna Element and Balun Configuration (Sheet 1 of 2)



BALUN SUPPORT DETAIL



BALUN HANGER DETAIL

GTA47297-2

Figure 6-37. Typical Transmit Antenna Element and Balun Configuration (Sheet 2 of 2)

1. Perform transmit antenna field access procedure in paragraph 6-2.8.1; except do not leave transmitter building.

2. Perform transmission line gas purge procedure in paragraph 6-7.2.1 on transmission line that feeds affected balun.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If necessary to cross transmission lines, use wooden crosswalks provided for that purpose.

3. Proceed to base of affected antenna element via interlocked gate in safety fence.

4. Use safety stepladder to access bottom of balun.

5. Remove bolts, lockwashers, flat washers, and nuts that secure balun to reducer (bands A through D) or directional coupler (bands E and F).

6. Carefully disconnect balun connector from reducer or directional coupler.

7. Inspect directional coupler connector and balun to ensure inner connector from directional coupler is not attached to balun, but is attached to directional coupler.

8. Remove and discard used O-ring from seal groove of either connector.

WARNING

HEIGHT HAZARD

The aboveground maintenance action must be performed by a professional rigging crew, not site personnel. The skills and equipment required to access the baluns are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action aboveground.

9. On the vertical section of balun, sequentially remove hanger clamps securing balun to antenna structure. Retain hanger clamps for new balun installation.

10. At the 90° elbow section of balun, remove the bolts, lockwashers, flat washers, and nuts that secure the balun elbow to vertical section.

11. Loosen the elbow connection to horizontal balun section to facilitate the removal of vertical balun section.

12. Disconnect the vertical balun section from elbow section.

13. Working from the back of antenna structure, on the horizontal section of balun to the last balun interconnection point before the balun dome, sequentially free sections of balun using the following steps as a guideline:

    a. Remove hanger clamps securing balun to antenna structure. Retain hanger clamps for new balun installation.

    b. Disconnect balun shorting plate from antenna structure by removing the bolts, lockwashers, flat washers, and nuts securing it.

    c. Remove top half of balun clamps from balun supports by removing the bolts, lockwashers, flat washers, and nuts securing it.

14. At the last balun interconnection point before the balun dome, remove the bolts, lockwashers, flat washers, and nuts that secure the connection.

15. The section of balun, from that connection to the back of antenna structure, is now free.

16. Carefully work the two sections of balun apart at the disassembled connection.

17. Remove the free section of balun from the antenna structure by sliding it through the balun support holes and out the back of antenna structure.
18. At the balun dome area, disconnect the nitrogen gas tubing from balun.
19. At the balun dome area, perform balun dome removal procedure in 6-7.2.5.
20. Working from the balun dome area on horizontal section of balun, sequentially free the remaining section of balun using the following steps as a guideline:
    a. Remove hanger clamps securing balun to antenna structure. Retain hanger clamps for new balun installation.
    b. Remove the top half of balun clamps from antenna structure by removing the bolts, lockwashers, flat washers, and nuts securing it.

CAUTION

EQUIPMENT DAMAGE HAZARD

When removing balun out the front of antenna structure, be careful not to damage dipole elements or hardware.

21. Remove the remaining section of balun by sliding it through the balun support holes and out the front of antenna structure (dipole end).

6-7.2.4.3 Installation. (Figure 6-37).

WARNING

HEIGHT HAZARD

The aboveground maintenance action must be performed by a professional rigging crew - not site personnel. The skills and equipment required to access the baluns are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action aboveground.

NOTE

To avoid system mission interference, make sure that coordination wi\th the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

Use this installation procedure only as a guideline; the actual installation procedure is beyond the scope of this manual. For details of installation procedure, see specification for installation of transmit antenna elements.

1. Obtain replacement balun for specific antenna band element.

CAUTION

EQUIPMENT DAMAGE HAZARD

The balun transformer is a critical item and must be handled carefully. Cover the open end of balun during installation to provide protection from environment. Use care when handling balun O-rings.

NOTE

Clean all balun mating pieces with denatured alcohol immediately preceding assembly. Coat all balun O-rings with silicone grease immediately preceding installation. The horizontal section of balun is installed in two steps. The back section of balun (all balun sections except piece with dome) is installed first, followed by the front section of balun (dome end).

2. Assemble (on ground) back end of horizontal balun in accordance with markings on balun sections. Secure balun connections using hardware supplied with balun.

WARNING

HEIGHT HAZARD

The aboveground maintenance action must be performed by a professional rigging crew - not site personnel. The skills and equipment required to access the baluns are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action aboveground.

3. With balun being supported, install balun sections to horizontal antenna structure through back of antenna.

4. Guide balun sections through holes in balun supports and position balun on balun clamps.

NOTE

Apply sealing compound to threads of all balun clamp screws prior to installation.

5. Secure installed balun loosely by installing top half of balun clamps using screws, lockwashers, flat washers, and nuts.

6. With the front section of balun being supported, guide balun front section into horizontal antenna structure through front of antenna (dipole end).

7. Guide balun section through holes in balun supports and position balun on balun clamps.

8. Secure front section of balun loosely by installing top half of balun clasps using screws, lockwashers, flat washers, and nuts.

9. Perform balun dome installation in 6-7.2.5.3.

10. Connect the two halves of horizontal balun using hardware supplied with balun.

11. Assemble (on ground) vertical section of balun in accordance with markings on balun sections. Secure balun connections using hardware supplied with balun.

12. Connect balun 90° elbow to vertical section and secure using hardware supplied with balun.

NOTE

Balun must be supported while it is being installed to antenna structure.

13. With balun being supported, guide balun to balun hangers along back of antenna structure and secure using hanger clamp hardware. Ensure balun is placed exactly as dictated in specification for installation of transmit antenna elements.

14. Connect back section of balun to 90° elbow in rear of antenna structure using hardware supplied with balun.

15. Install balun shorting plate to antenna structure.

16. Tighten balun clamps to a torque of 60 to 70 inch-pounds.

17. Remove all installation equipment and personnel from fenced antenna area, and secure the interlocked gate.

18. Perform transmission line gas purge and refill procedure in paragraph 6-7.2.1 on affected transmission line.

19. Perform transmit antenna field exit procedure in paragraph 6-2.8.2.

6-7.2.5 Balun Dome Removal and Installation Procedure.

6-7.2.5.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Bar, extension 3/8 in	1	28b
Socket set, 3/8 in	1	28a
Wrench, torque	1	30d
Wrench, box/open, set	1	32a

6-7.2.5.2 Removal. (Figure 6-38).

WARNING

HEIGHT HAZARD

The above ground maintenance action must be performed by a professional rigging crew - not site personnel. The skills and equipment required to access and remove the balun domes are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action above ground.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Perform transmit antenna field access procedure in paragraph 6-2.8.1, except do not leave transmit building.

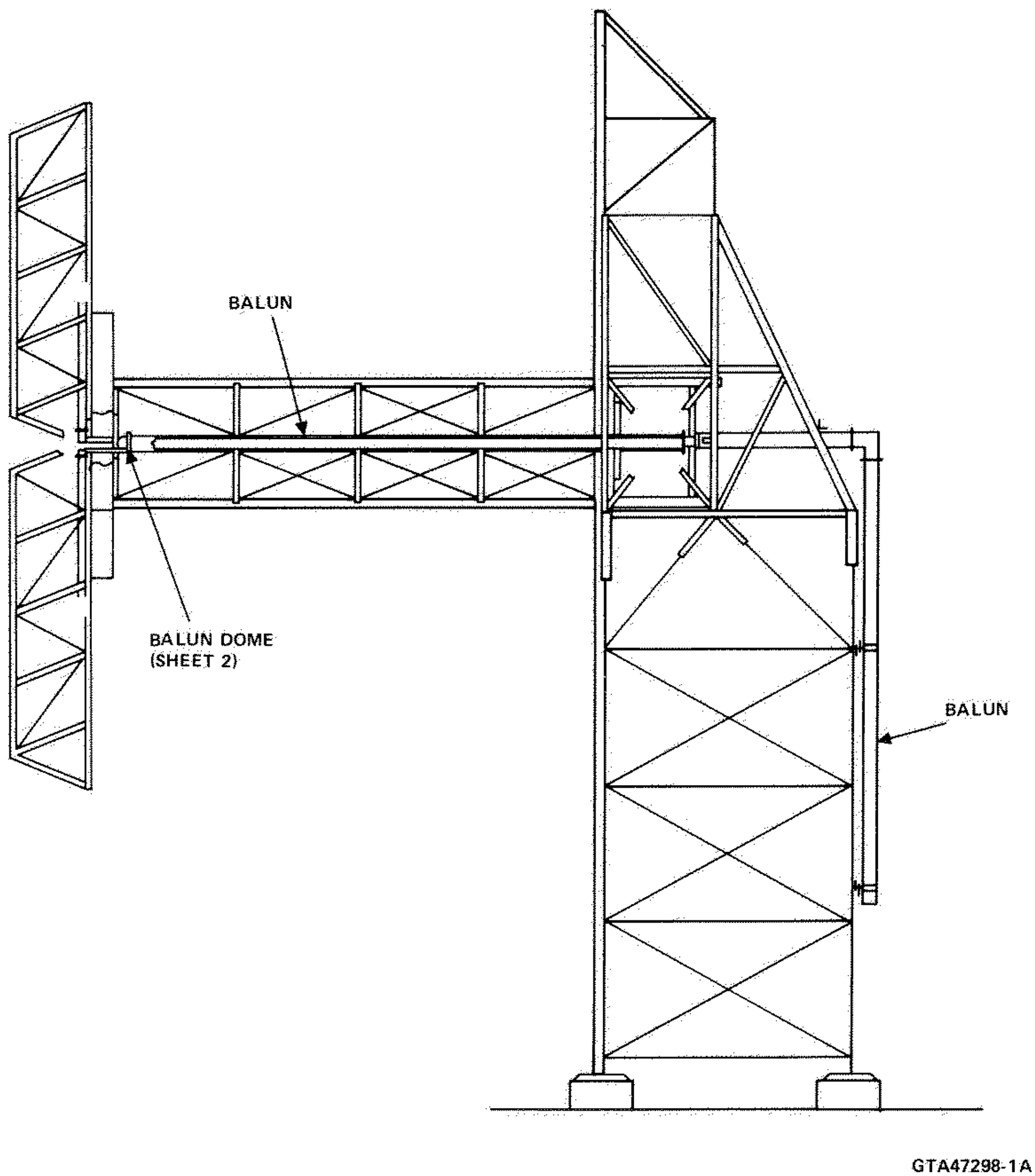


Figure 6-38. Typical Transmit Antenna Element and Balun Dome Configuration (Sheet 1 of 2)

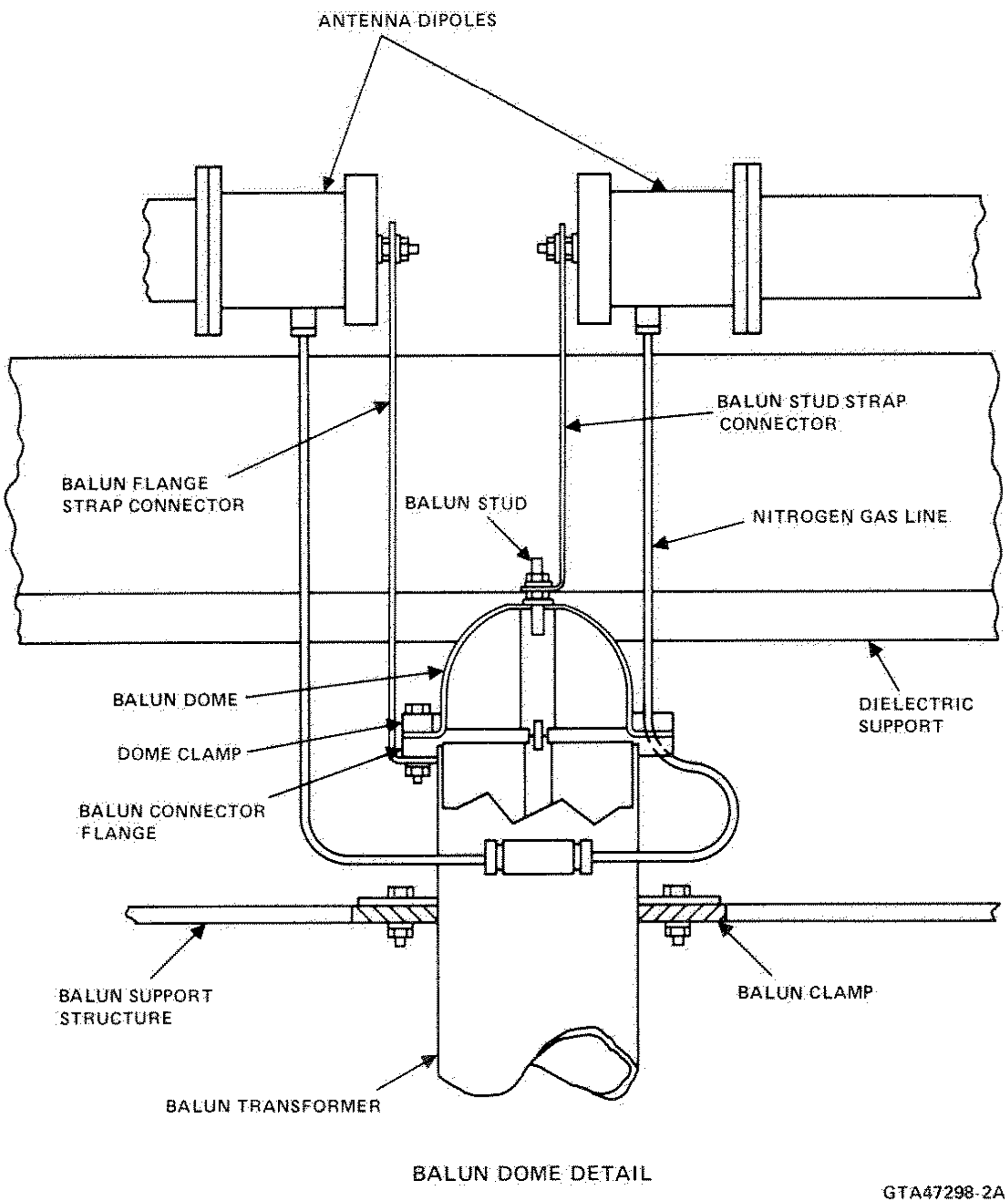


Figure 6-38. Typical Transmit Antenna Element and Balun Dome Configuration (Sheet 2 of 2)

2. Perform transmission line gas purge procedure in paragraph 6-7.2.1 on transmission line that feeds affected balun.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If necessary to cross transmission lines, use wooden crosswalks provided for that purpose.

3. Access transmit antenna field and go to balun transformer dome.
4. Remove and retain nuts, washers, and lockwashers securing stud strap connector to dome.
5. Remove and discard O-ring from stud connector.
6. Remove and retain nuts, washers, lockwashers, and bolts securing flange strap connector to dome.
7. Remove and retain nuts, washers, lockwashers, bolts, and dome clamp securing dome to balun.
8. Remove dome from balun.
9. Remove and discard O-ring from balun connector flange.

6-7.2.5.3 Installation. (Figure 6-38).

WARNING

HEIGHT HAZARD

The aboveground maintenance action must be performed by a professional rigging crew - not site personnel. The skills and equipment required to access the balun domes are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action aboveground.

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If necessary to cross transmission lines, use wooden crosswalks provided for that purpose.

DAMAGE TO O-RINGS HAZARD

Use care when handling O-rings during balun dome assembly. Do not install damaged O-rings.

1. Access balun dome area of balun transformer.
2. Apply silicone grease to new balun flange O-ring.
3. Install new O-ring to balun connector flange. Ensure O-ring is fully seated in groove. Remove excess silicon grease from connector flange.
4. Position new dome on balun connector flange.
5. Position dome clamp on dome and loosely secure using nuts, bolts, and lockwashers.
6. Install flange strap connector to balun by removing and then reinstalling applicable nuts, lockwashers, and flat washers from balun flange.

7. Tighten nuts securing balun dome clamp to a torque of 200 to 220 inch-pounds.

8. Apply silicone grease to new stud strap O-ring.

9. Install new O-ring to balun stud strap connector. Ensure O-ring is fully seated in groove. Remove excess silicone grease from connector.

10. Secure stud strap connector to balun dome using washers, lockwashers, and nuts.

11. Remove all installation equipment and personnel from fenced antenna area, and secure the interlocked gate.

12. Perform transmission line gas purge and refill procedure in paragraph 6-7.2.1 on affected transmission line.

13. Perform transmit antenna field exit procedure in paragraph 6-2.8.2.

6-7.2.6 Ground Screen.

NOTE

Removal and installation of the ground screen for transmit antenna requires skills and equipment beyond the scope of this manual. The following procedure is only for repair of a broken weld in the ground screen.

6-7.2.6.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Snips, cutting	1	25au
Tool, crimping	1	24ai

6-7.2.6.2 Repair. (Figure 6-39).

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

WARNING

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

1. Perform transmit antenna field access procedure in paragraph 6-2.8.1.

NOTE

If required repair of ground screen is other than for broken weld at junction of transverse and line wires, use a straight piece of wire and dimensions specified in applicable portions of procedure given below. Bend wire as necessary to make parallel overlaps for crimping.

2. At broken weld in ground screen, cut transverse and line wires approximately 1.0 inch from weld at four places and remove 2.0 x 2.0-inch area of defective wire mesh from ground screen.

3. From wire mesh stock material, cut transverse and line wires approximately 1.5 inches from good weld at four places to form overlapping patch of wire mesh.

4. Position wire mesh patch in cutout area of ground screen and check for approximately 0.5 inch overlap of transverse and line wires in patch and screen.

5. Slide metal crimping band (Table 6-1, Item 6.1) onto overlapping wires at four places.

6. Position any one crimping band so that overlapping wires of patch and screen extend no more than 0.25 inch beyond either side of crimping band.

7. Carefully place crimping tool 51-G-887 (Table 1-4, Item 24ai) over crimping band and operate tool to provide permanent bond.

8. Repeat steps 6 and 7 until remaining three crimping bands are positioned and secured.

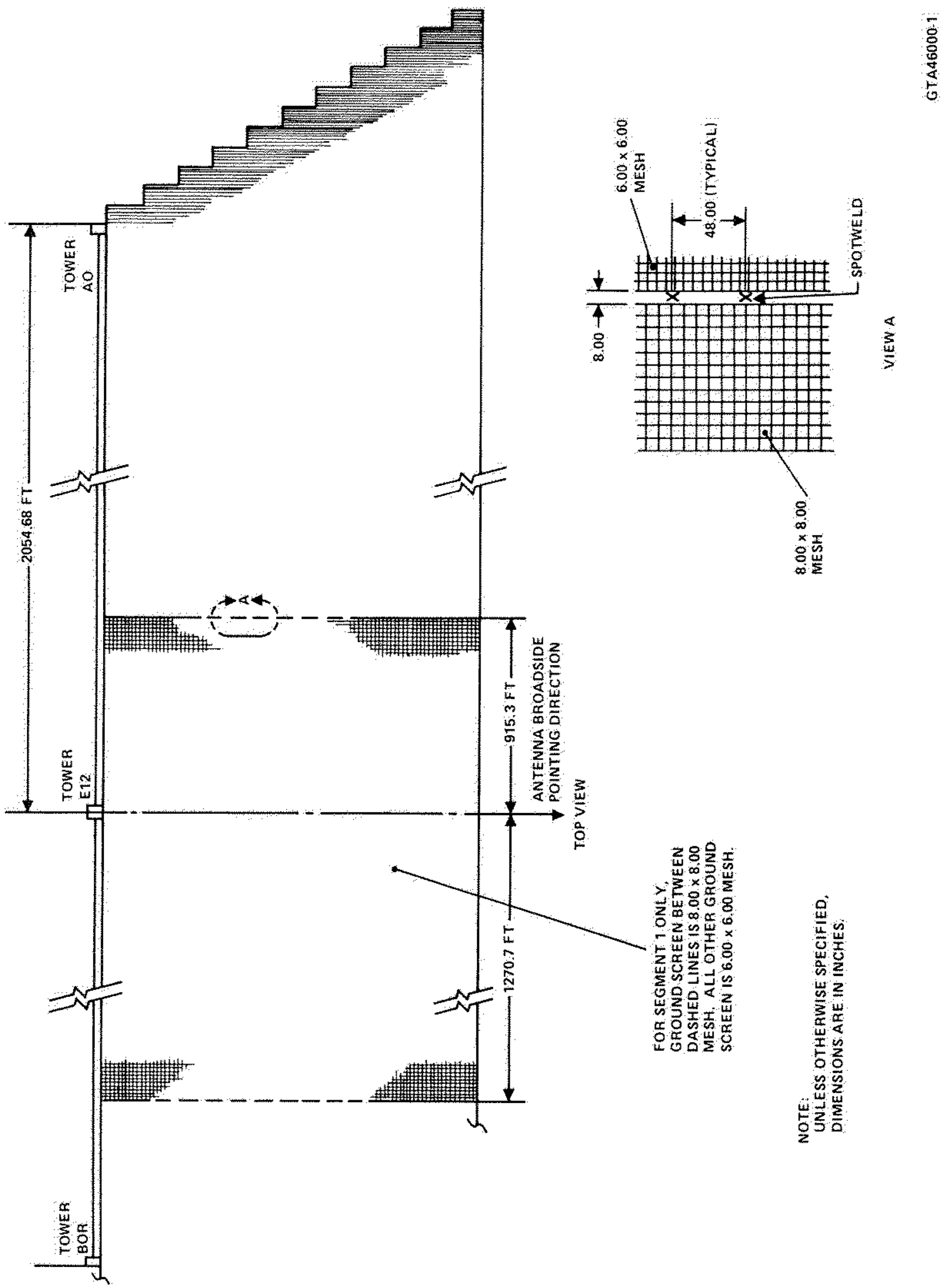


Figure 6-39. Transmit Antenna, Unit 100, Ground Screen (Sheet 1 of 2)

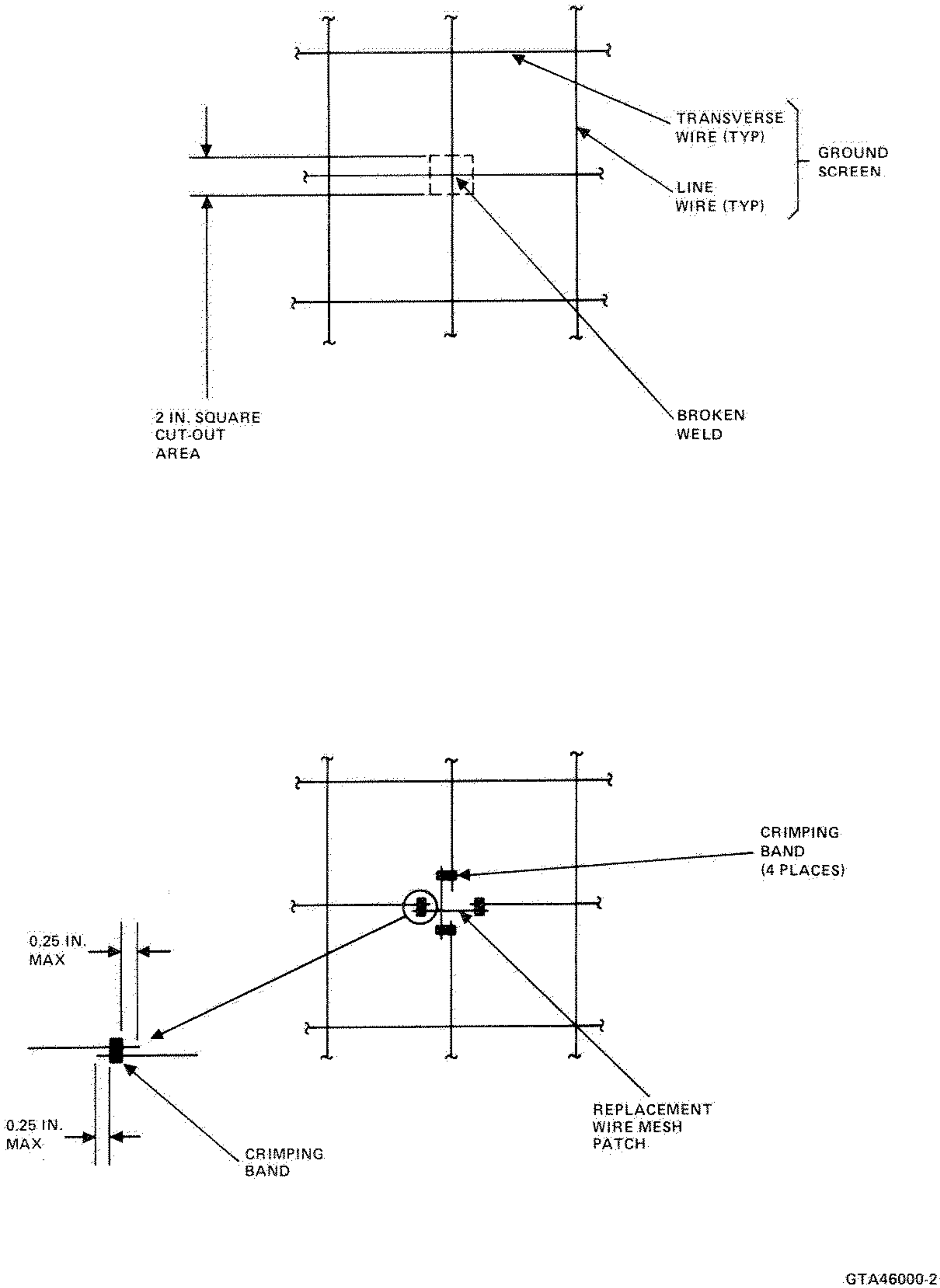


Figure 6-39. Transmit Antenna, Unit 100, Ground Screen (Sheet 2 of 2)

9. Measure distance between ends of wires and crimping band; trim wire if any end exceeds 0.25 inch from band.

10. Perform transmit antenna exit procedure in paragraph 6-2.8.2.

6-7.2.7 Antenna Dipole Element Removal and Installation Procedure.

6-7.2.7.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Wrench, box/open	1	32c
Wrench, box/open, set	1	32a

6-7.2.7.2 Removal. (Figure 6-40).

WARNING

HEIGHT HAZARD

The aboveground maintenance action must be performed by a professional rigging crew, not site personnel. The skills and equipment required to access and remove the dipole elements are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action aboveground

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Perform transmit antenna field access procedure in paragraph 6-2.8.1, except do no leave transmit building.

2. Perform transmission line gas purge procedure in paragraph 6-7.2.1 on transmission line that feeds affected dipole elements.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If necessary to cross transmission lines, use wooden crosswalks provided for that purpose.

3. Access transmit antenna field and go to dipole element.

4. Remove and retain nuts, washers, and lockwashers securing stud strap connector and/or flange strap connector to dipole element.

5. Disconnect the nitrogen gas line from dipole element.

CAUTION

EQUIPMENT DAMAGE

Prior to removing clamps ensure the dipole element is independently supported to prevent dipole element from falling to the ground.

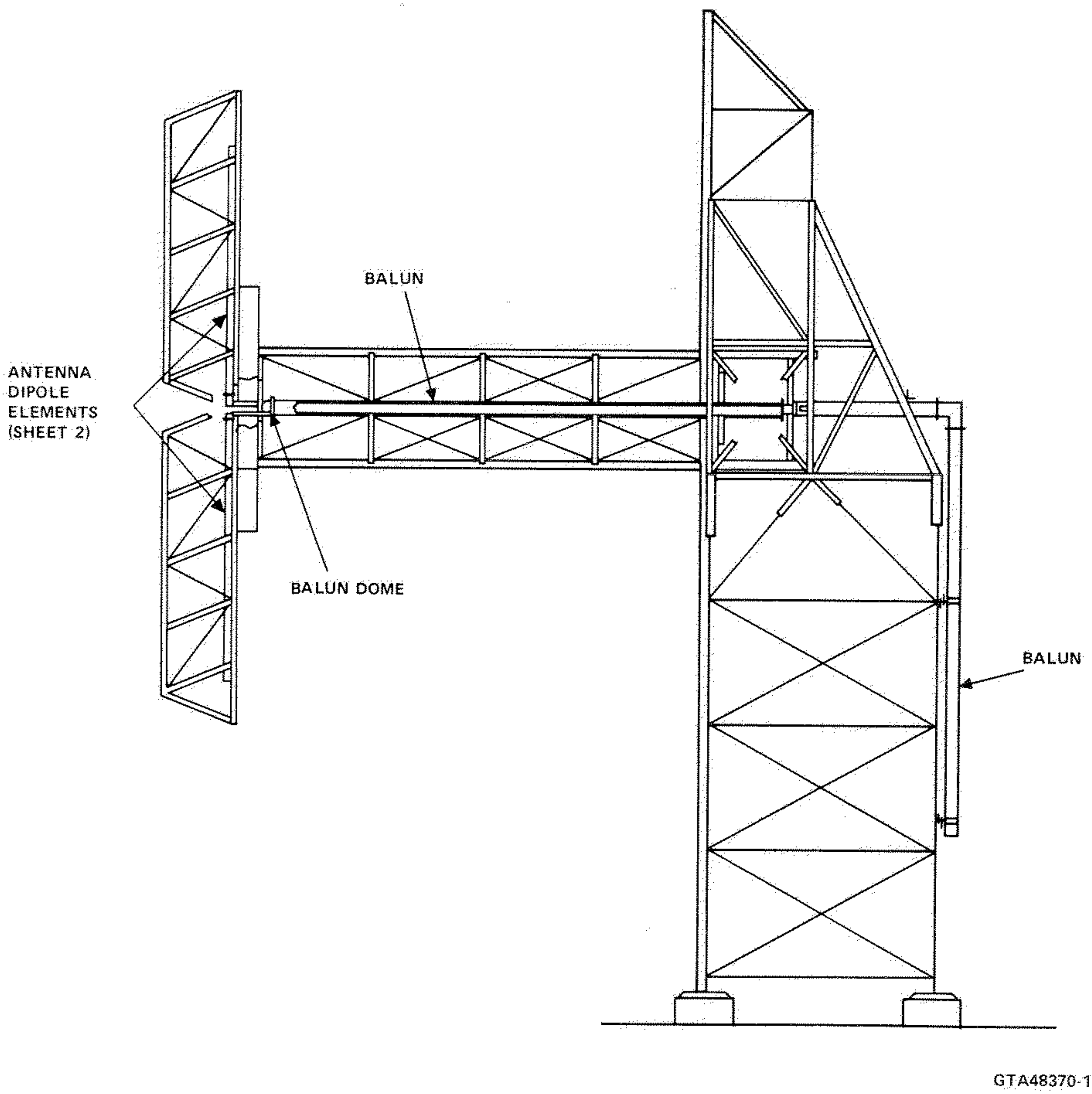


Figure 6-40. Typical Transmit Antenna Dipole Element Detail (Sheet 1 of 2)

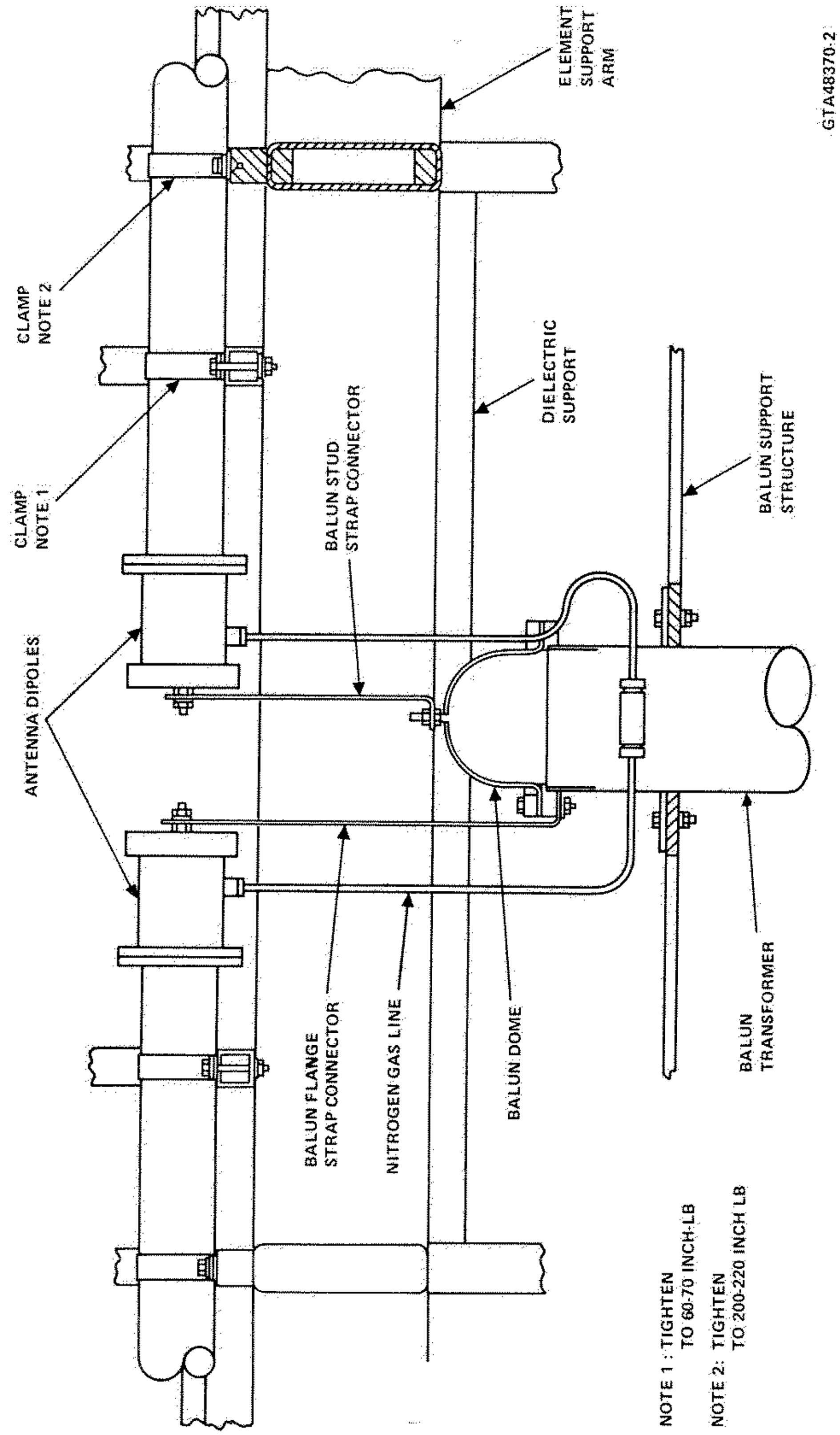


Figure 6-40. typical Transmit Antenna Dipole Element Detail (Sheet 2 of 2)

6. Working from the balun transformer end of dipole element, sequentially remove and retain the clamps securing the dipole element to the antenna support arm.
7. Remove dipole element from antenna support arm.
8. Repeat steps 4 through 7 as necessary.

6-7.2.7.3 Installation.

WARNING

HEIGHT HAZARD

The aboveground maintenance action must be performed by a professional rigging crew - not site personnel. The skills and equipment required to access the dipole elements are beyond the scope of this manual. The site personnel only give guidance to rigging crew for maintenance action above ground.

CAUTION

TRANSMISSION LINE DAMAGE HAZARD

Stepping on a coaxial cable transmission line may permanently destroy its operating characteristics. If necessary to cross transmission lines, use wooden crosswalks provided for that purpose.

1. With replacement dipole element being supported, position dipole element on antenna support arm.
2. Secure replacement dipole element to antenna support arm using the clamps.
3. Tighten clamps to correct torque valves (Figure 6-40, Sheet 2).
4. Secure stud strap connector and/or flange strap connector to dipole element using washers, lockwashers, and nuts.
5. Connect nitrogen gas line to dipole element.
6. Remove all installation equipment and personnel from fenced antenna area, and secure the interlocked gate.
7. Perform transmission line gas purge and refill procedure in paragraph 6-7.2.1 on affected transmission line.
8. Perform transmit antenna field exit procedure in paragraph 6-2.8.2.

6-7.3 Transmitter Modules, Units 110 through 121, High Voltage Power Supplies, Units 122 through 133, and High Voltage Ac Switches, Units 222 through 233 - Removal and Installation Procedures.

WARNING

RF RADIATION HAZARD

Before attempting maintenance on transmitter modules, Units 110 through 121, high voltage power supplies, Units 122 through 133, or high voltage ac switches, Units 222 through 233, elemental transmitter access procedure in paragraph 6-2.7.1 must be performed to protect maintenance personnel from RF power.

6-7.3.1 Transmitter Modules, Units 110 through 121. Refer to TO 31P6-2FPS118-81 for instructions on replacement of assemblies and components.

6-7.3.2 High Voltage Power Supplies, Units 122 through 133. Refer to TO 31P6-2FPS118-81 for instructions on replacement of assemblies and components.

6-7.3.3 High Voltage Ac Switches, Units 222 through 233. Refer to TO 31P6-2FPS118-81 for instructions on replacement of assemblies and components.

6-7.4 Transmit Beamformer Cabinet, Unit 150 - Removal and Installation Procedures.

6-7.4.1 Fan Assembly A1.

6-7.4.1.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, diagonal/cutter	1	25ag

6-7.4.1.2 Removal. (Figure 6-41).

1. Open rear door of cabinet.

CAUTION

EQUIPMENT OVERHEATING HAZARD

If cabinet is in operation with fans removed for more than 10 minutes, equipment can become overheated and subsequently damaged. Power must be removed from cabinet to protect equipment from overheating.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

To remove power, open front door of cabinet and set POWER ON CB1 to OFF.

2. At bottom of swing rack on front of fan assembly, disengage 2 slide fasteners that secure front filter retainer to fan assembly.
   a. Remove front filter retainer.
   b. Slide filter element out of remaining 3 filter retainers.
3. Loosen winghead turnlock fastener at top and bottom of swing rack; pull rack fully open.
4. Release and disconnect wiring harness connector P12 from fan assembly connector J1.
5. Disengage 6 slide fasteners that secure fan assembly to swing rack; remove fan assembly from rack.

6-7.4.1.3 Installation.

1. Position replacement fan assembly to bottom of swing rack; secure fan assembly to rack with 6 slide fasteners.
2. Connect wiring harness connector P12 to fan assembly connector J1.
3. Check for proper operation of fan.
4. Maneuver door to install plastic tie wraps on wiring harness; secure to fan assembly.
5. Close swing rack and secure to cabinet with winghead turnlock fastener at top and bottom of rack.
6. From front, slide filter element into 3 filter retainers.
7. Position front filter retainer on fan assembly; secure with 2 slide fasteners.
8. Close and secure cabinet door.

6-7.4.2 17 V Ac-to-Dc Converter A2.

6-7.4.2.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, connector	1	25v
Screwdriver, flat blade	1	25ai

6-7.4.2.2 Removal. (Figure 6-42).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
2. Open front door of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Primary ac power must be removed from cabinet to protect equipment from being damaged.

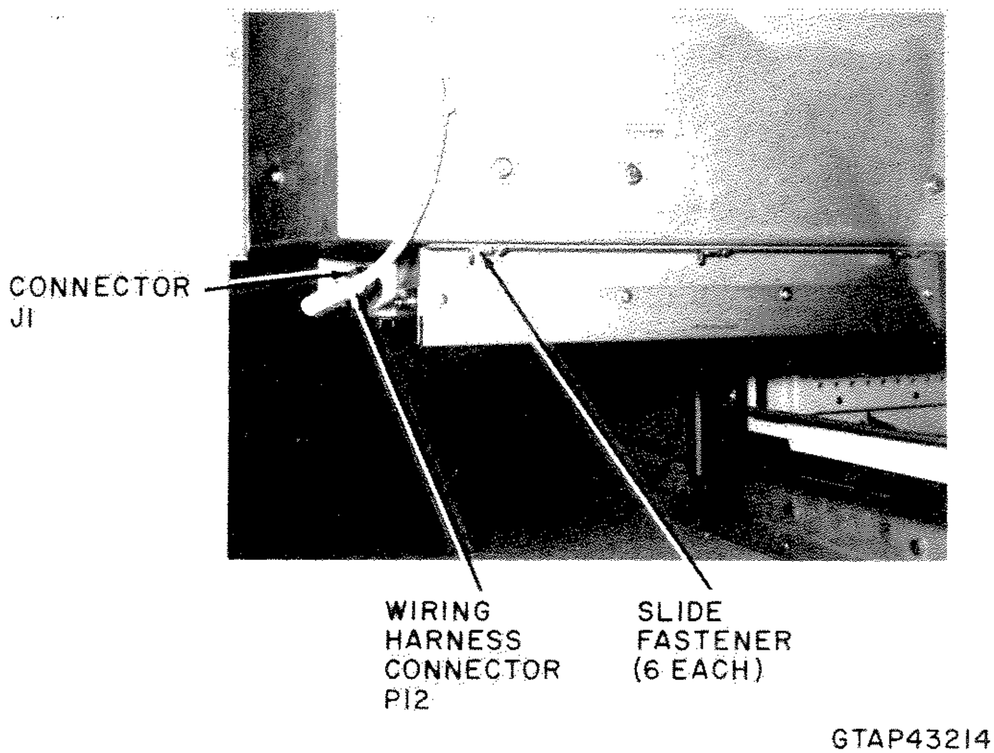


Figure 6-41. Transmit Beamformer Cabinet, Unit 150, Fan Assembly A1

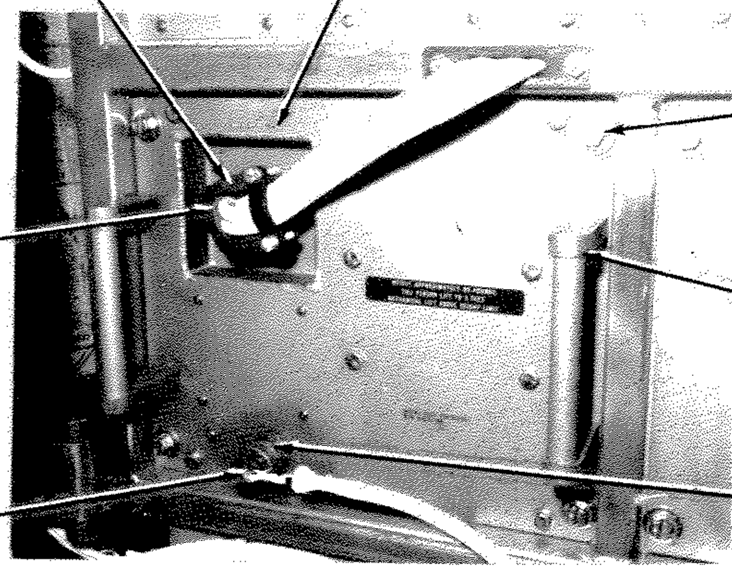


Figure 6-42. Transmit Beamformer Cabinet, Unit 150, 17 V Ac-to-Dc Converter A2

3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.
   c. Verify fans are not operating.
4. Open rear door of cabinet.
5. Release and disconnect power cable connectors P10 and P11 from 17 V ac-to-dc converter connectors J1 and J2, respectively.
6. Loosen 4 captive fasteners that secure converter to swing rack.

WARNING

WEIGHT HAZARD

Ac-to-dc converter is not on slides. Ac-to-dc converter weighs approximately 80 pounds. Use two technicians to lift and support ac-to-dc converter during removal and replacement.

7. Carefully remove converter from swing rack, using two technicians and supporting rear of converter before fully withdrawn.

6-7.4.2.3 Installation.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 4 captive turnlock fasteners that secure replacement converter to swing rack.

1. Carefully slide replacement 17 V ac-to-dc converter fully into rack until guide pins, behind converter handles, are seated in cabinet.
2. Tighten 4 captive fasteners that secure converter to rack.
3. Connect and secure power cables P10 and P11 to converter connectors J1 and J2, respectively.
4. Set 3-pole POWER ON circuit breaker CB1 to the ON position.
5. Close and secure cabinet doors.

6. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.3 Monitor Panel A3.

6-7.4.3.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Screwdriver, flat blade	1	25af
Wrench, box/open, set	1	32a

6-7.4.3.2 Removal. (Figure 6-43).

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

2. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

3. Remove primary ac power from cabinet.

   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.

   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.

   c. Verify fans are not operating.

4. Open rear door of cabinet.

5. Loosen 2 captive fasteners that secure top edge of hinged monitor panel to swing rack; carefully pull downward until each of 2 stay braces are fully extended.

6. Remove 6 screws, lockwashers, and flat washers that secure plastic safety cover to posts; remove safety cover.

7. Loosen 2 screwlock fasteners on cable connector P9; disconnect cable connector P9 from monitor panel connector J9.

8. Remove 4 screws, lockwashers, flat washers, and the nut that secure monitor panel and one end of ground strap to hinge.

9. Slide 2 stay braces on pivot pins until openings on stay braces line up with pivot pins.

10. Disengage stay braces from pivot pins and remove monitor panel.

6-7.4.3.3 Installation.

1. On replacement monitor panel, align each of 2 stay brace openings with pivot pin and engage stay braces on pivot pins.

2. Position replacement monitor panel on swing rack hinge; secure panel to hinge with 4 screws, lockwashers, flat washers, and the nut.

3. Connect cable connector P9 to panel connector J9; secure with 2 screwlock fasteners.

4. Position plastic safety cover on posts; secure with 6 screws, lockwashers, and flat washers.

5. Close monitor panel; secure panel to rack with 2 captive fasteners.

6. Set 3-pole POWER ON circuit breaker CB1 to the ON position.

7. Close and secure cabinet doors.

8. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

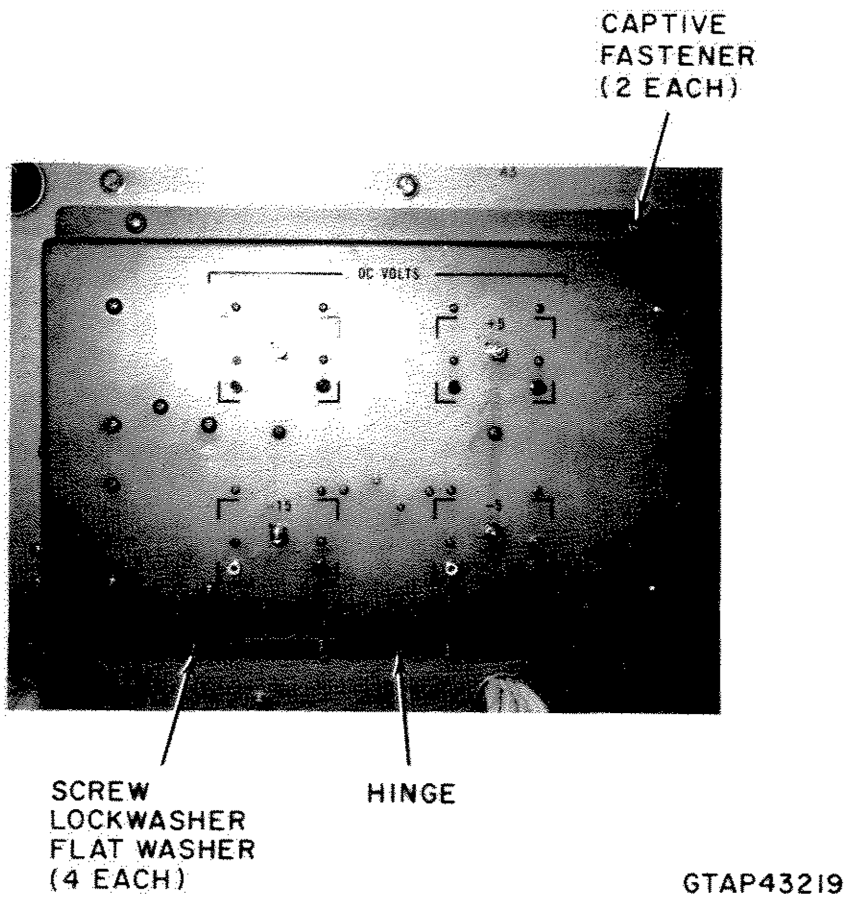


Figure 6-43. Transmit Beamformer Cabinet, Unit 150, Monitor Panel A3 (Sheet 1 of 2)

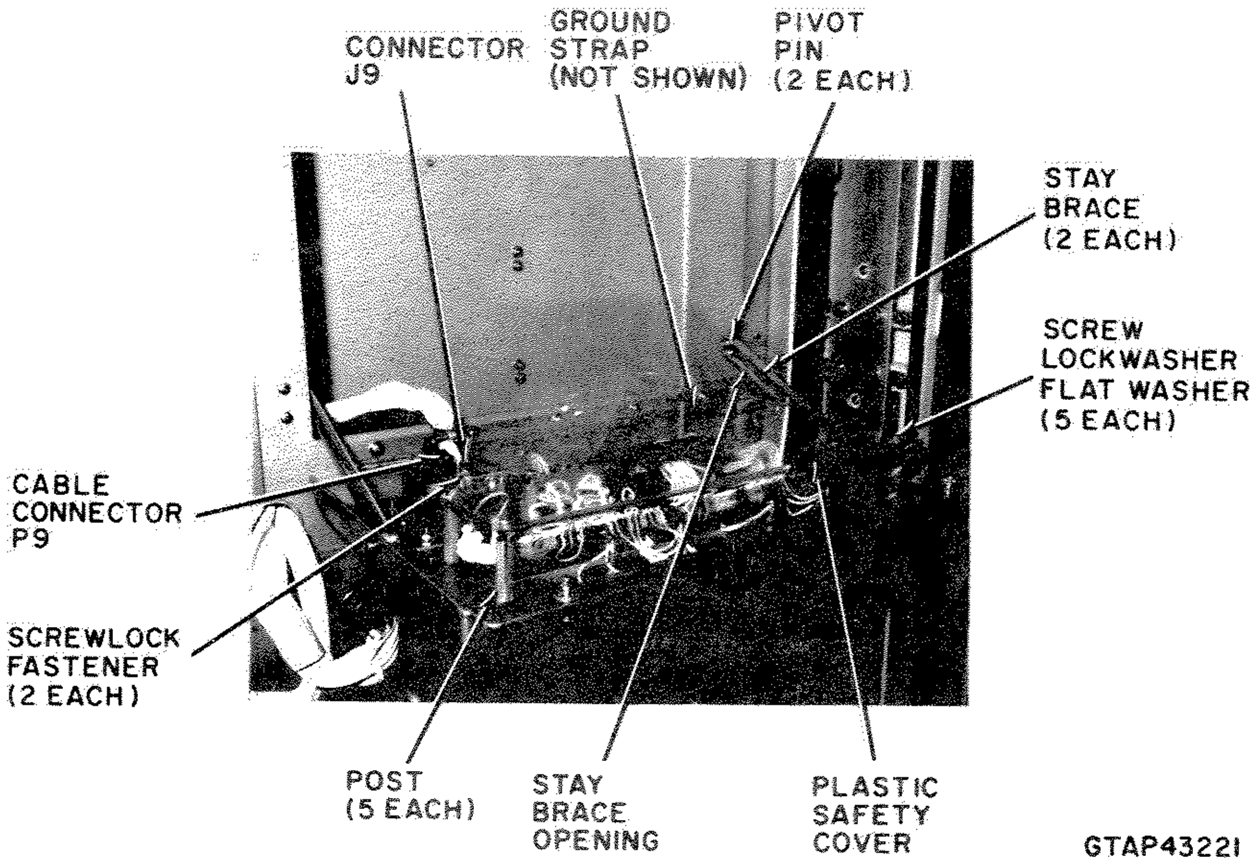


Figure 6-43. Transmit Beamformer Cabinet, Unit 150, Monitor Panel A3 (Sheet 2 of 2)

6-7.4.4 Switching Assembly A11.

6-7.4.4.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, flat blade	1	25ad
Wrench, box/open, set	1	32a

6-7.4.4.2 Removal. (Figure 6-44).

1. Open front door of cabinet.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

3. Remove primary ac power from cabinet.

   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.

   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.

   c. Verify fans are not operating.

4. Open rear door of cabinet.

5. Disconnect cable connectors P300, W1P2, W2P2, W3P1, and W9P1 from switch assembly connectors J1 through J5, respectively.

6. Remove any wire ties from assembly.

7. Loosen 4 captive fasteners that secure switch assembly to cabinet brackets; remove switch assembly from brackets.

6-7.4.4.3 Installation.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 4 captive fasteners on replacement switch assembly that secure assembly to cabinet brackets.

1. Position replacement switch assembly on cabinet brackets; secure assembly to brackets with 4 captive fasteners.

2. Connect cable connectors P300, W1P2, W2P2, W3P1, and W9P1 to switch assembly connectors J1 through J5, respectively.

3. Reinstall all tie wraps to assembly.

4. Close and secure rear door of cabinet.

5. Set 3-pole POWER ON circuit breaker CB1 to the ON position.

6. Close and secure cabinet door.

7. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

8. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.4.5 Attenuators A11AT1 and A11AT2.

6-7.4.5.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, locking	1	25w
Screwdriver, cross-tip	1	25aa
Screwdriver, flat blade	1	25af
Wrench, box/open, set	1	32a
Wrench, hex-head, set	1	32b

6-7.4.5.2 Removal. (Figure 6-45).

1. Perform switching assembly A11 removal procedure in paragraph 6-7.4.4.2.

2. On rear of switch assembly A11, loosen and disconnect cable connectors from connector J1 and J2 of defective AT1 or AT2.

3. Loosen 2 set screws securing knob to attenuator shaft; remove knob.

4. Loosen and remove 3 screws and lockwashers that secure defective attenuator to panel; remove attenuator.

6-7.4.5.3 Installation.

1. Position replacement attenuator on panel of switching assembly A11; secure with 3 screws, lockwashers, and flat washers.

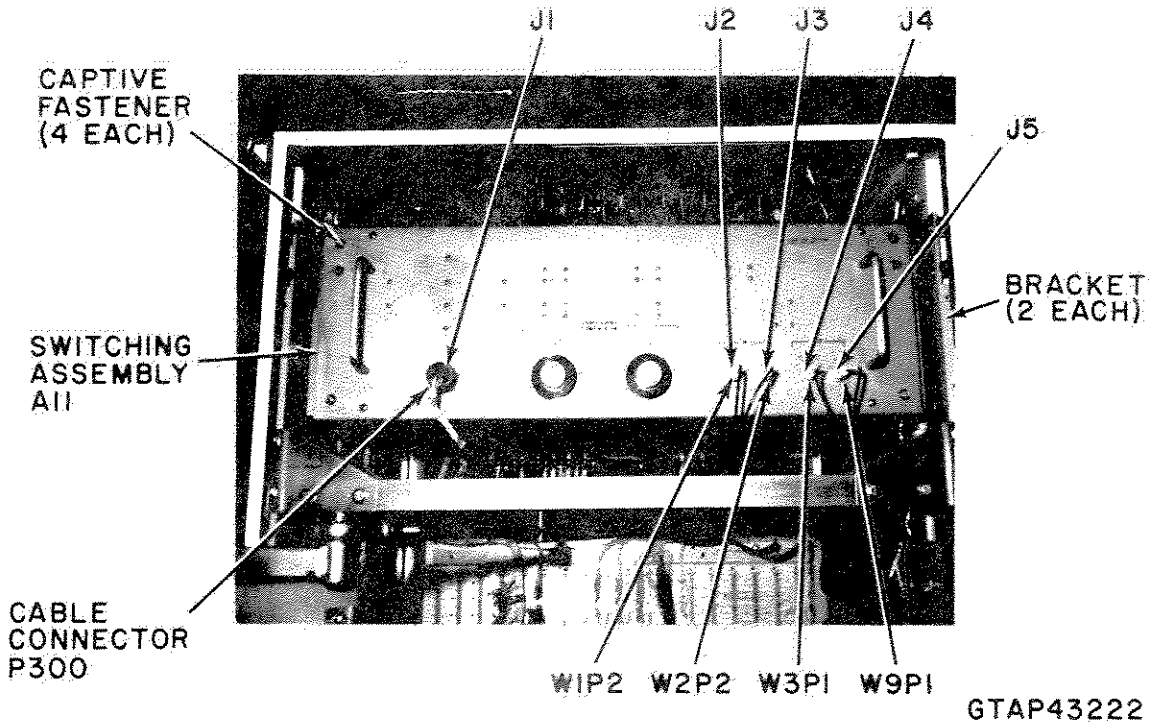


Figure 6-44. Transmit Beamformer Cabinet, Unit 150, Switching Assembly A11

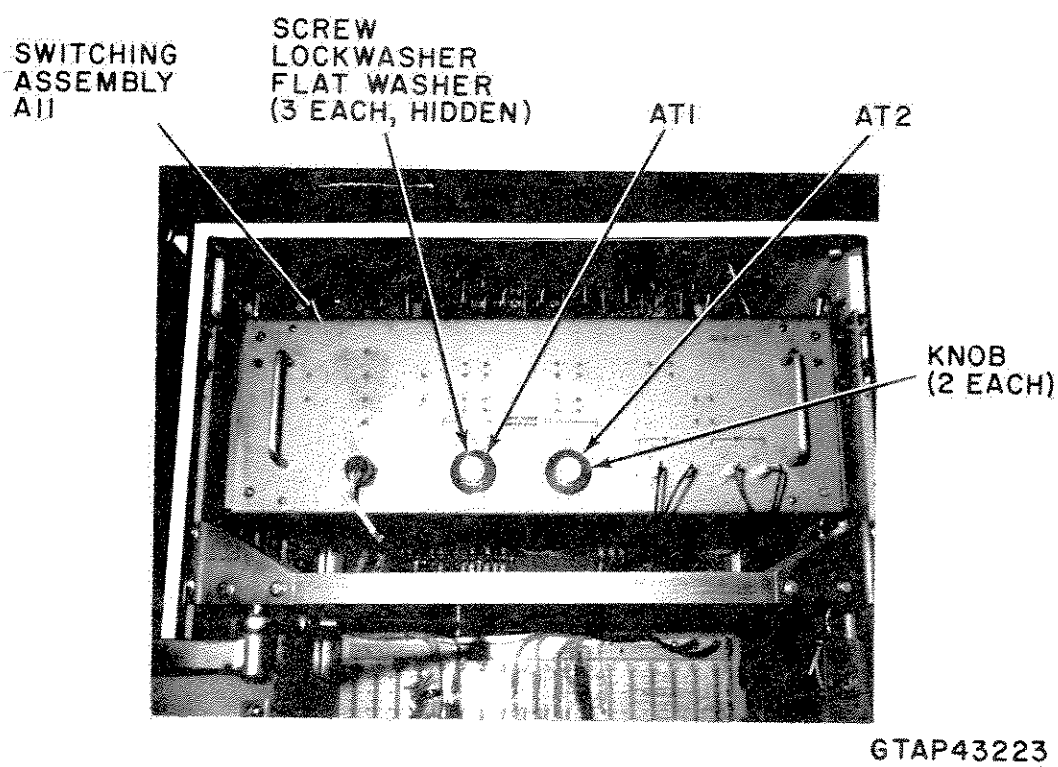


Figure 6-45. Transmit Beamformer Cabinet, Unit 150, Attenuators A11AT1 and A11AT2

2. Position knob on attenuator shaft and secure with set screw.

3. Connect and secure cable connectors to replacement attenuator connectors J1 and J2.

4. Perform switching assembly A11 installation procedure in paragraph 6-7.4.4.3..

6-7.4.6 Couplers DC1 through DC14.

6-7.4.6.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, locking	1	25w
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad

6-7.4.6.2 Removal. (Figure 6-46).

1. Open front door of cabinet.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

3. Remove primary ac power from cabinet.

   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.

   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.

   c. Verify fans are not operating.

4. Open rear door of cabinet.

5. Loosen winghead turnlock fasteners at top and bottom of swing rack; pull rack fully open.

6. Loosen and disconnect cable connectors from defective coupler connectors A, C, and D and dummy load connector from coupler connector B.

7. Loosen and remove 2 screws, lockwashers, and flat washers that secure coupler mounting bracket to coupler panel; remove bracket (with coupler attached).

8. Remove 2 screws and lockwashers that secure coupler to bracket and remove coupler.

6-7.4.6.3 Installation.

1. Position replacement coupler on coupler mounting bracket; secure with 2 screws and lockwashers.

2. Position coupler mounting bracket (with coupler attached) on coupler panel; secure with 2 screws, lockwashers, and flat washers.

3. Connect and secure cable connectors to replacement coupler connectors A, C, and D and dummy load connector to connector B.

4. Close swing rack; secure rack with winghead turnlock fasteners at top and bottom of rack.

5. Close and secure rear door of cabinet.

6. Set 3-pole POWER ON circuit breaker CB1 to the ON position.

7. Close and secure cabinet doors.

8. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.7 Radio Frequency Interference Filters FL1 through FL5.

6-7.4.7.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Screwdriver, flat blade	1	25ae
Wrench, box/open, set	1	32a

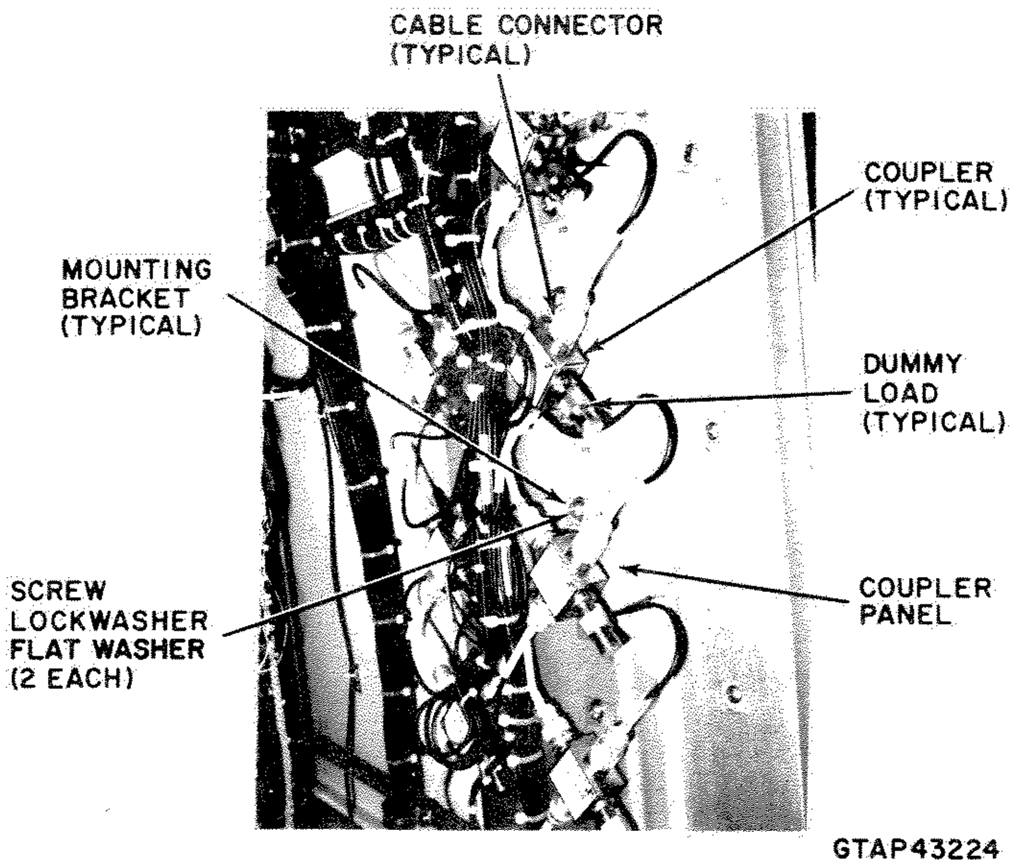


Figure 6-46. Transmit Beamformer Cabinet, Unit 150, Couplers DC1 through DC14
(Inside Rear of Cabinet)

6-7.4.7.2 Removal. (Figure 6-47).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
2. Remove primary ac power from cabinet.
   a. Set applicable circuit breaker on breaker panel 305E to the OFF position.
      (V)1 CB4
      (V)2 CB14
   b. Tag with maintenance-in-progress sign.
   c. Open front door of cabinet.
   d. Observe POWER AVAILABLE lamp DS4 is not lit.
   e. Verify fans are not operating.
3. Open rear door of cabinet.
4. Loosen winghead turnlock fasteners at top and bottom of swing rack; pull rack fully open.
5. Using safety stepladder for access to top-rear of cabinet, loosen 6 screws, lockwashers, and flat washers that secure filter access cover to cabinet and mounting support.
6. Inside top-rear of cabinet, loosen 2 captive fasteners that secure plastic safety shield to shield posts; remove shield.
7. At radio frequency interference (RFI) filter being replaced, disconnect leadwire terminal lugs from both ends of filter by removing screw and lockwasher from each RFI filter terminal.
8. Remove large nut and lockwasher that secure RFI filter to top of cabinet; remove RFI filter.

6-7.4.7.3 Installation.

1. Position replacement RFI filter through opening in top of cabinet; secure with large nut and lockwasher.
2. Use 2 screws and lockwashers (supplied with replacement RFI filter) to connect and secure leadwire terminal lugs to both ends of filter.
3. Position safety shield on posts; secure with 2 captive fasteners.
4. Position access cover on cabinet and mounting support; secure with 6 screws, lockwashers, and flat washers.
5. Close swing rack; secure rack to cabinet with 2 winghead turnlock fasteners at top and bottom of rack.
6. Restore primary ac power to cabinet.
   a. Observe that POWER AVAILABLE lamp DS4 is lit.
   b. Remove maintenance-in-progress sign.
7. Close and secure cabinet doors.
8. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.8 Relay K1.

6-7.4.8.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Screwdriver, flat blade	1	25ae
Soldering station	1	29e
Wrench, box/open, set	1	32a

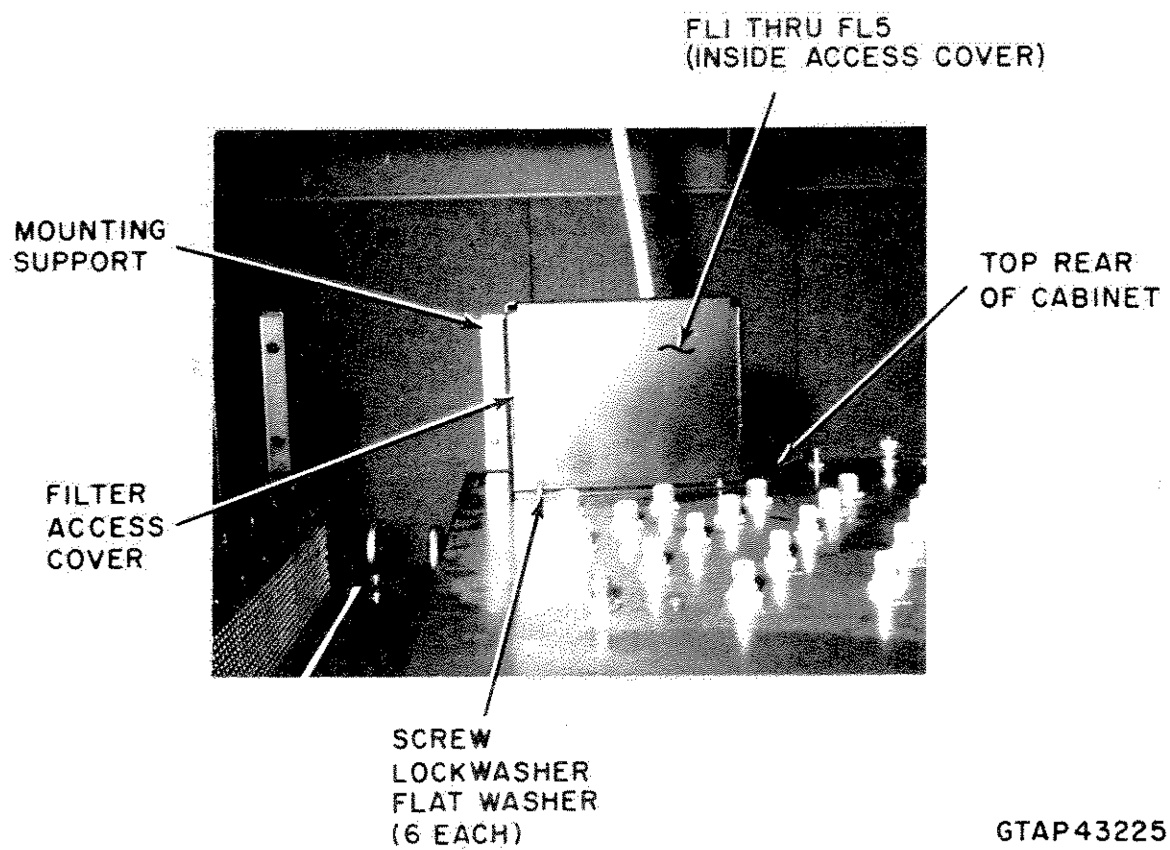


Figure 6-47. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Interference Filters FL1 through FL5 (Sheet 1 of 2)

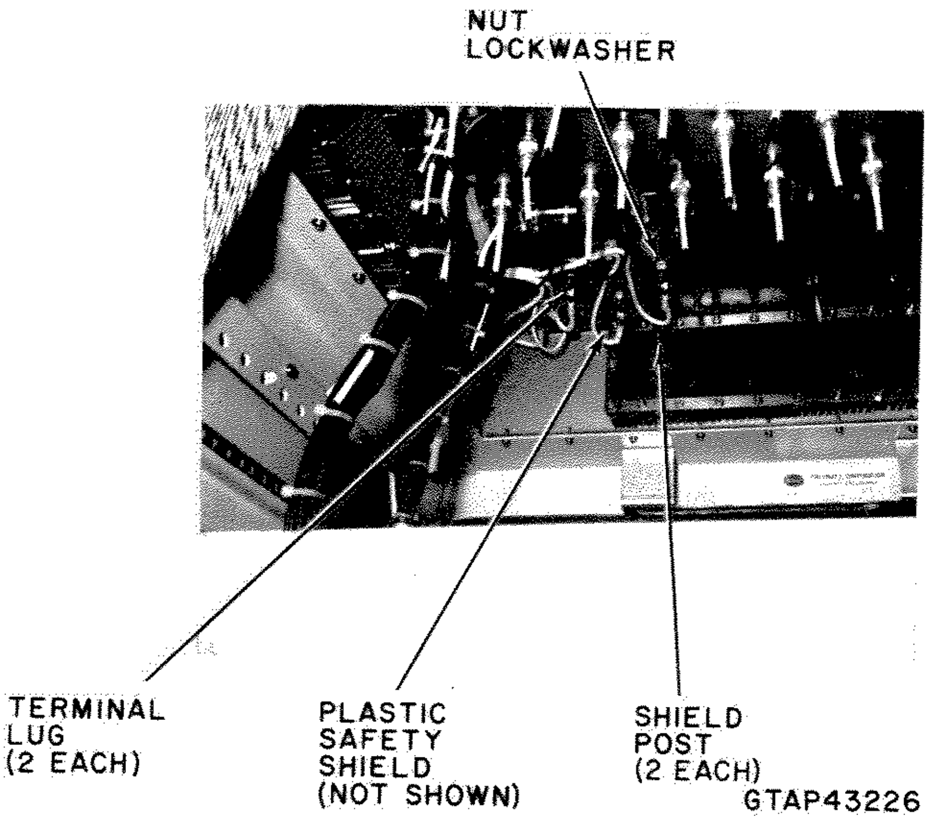


Figure 6-47. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Interference Filters FL1 through FL5 (Sheet 2 of 2)

6-7.4.8.2 Removal. (Figure 6-48).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

2. Remove primary ac power from cabinet.

   a. Set applicable circuit breaker on breaker panel 305E to the OFF position.
      (V)1 CB4
      (V)2 CB14

   b. Tag with maintenance-in-progress sign.

   c. Open front door of cabinet.

   d. Observe POWER AVAILABLE lamp DS4 is not lit.

   e. Verify fans are not operating.

3. Open rear door of cabinet.

4. Loosen winghead turnlock fasteners at top and bottom of swing rack; pull rack away from cabinet.

5. Loosen captive fasteners that secure plastic safety shield to stud receptacles; remove safety shield.

6. Tag wires soldered to terminals on relay, as necessary, to identify correct connections.

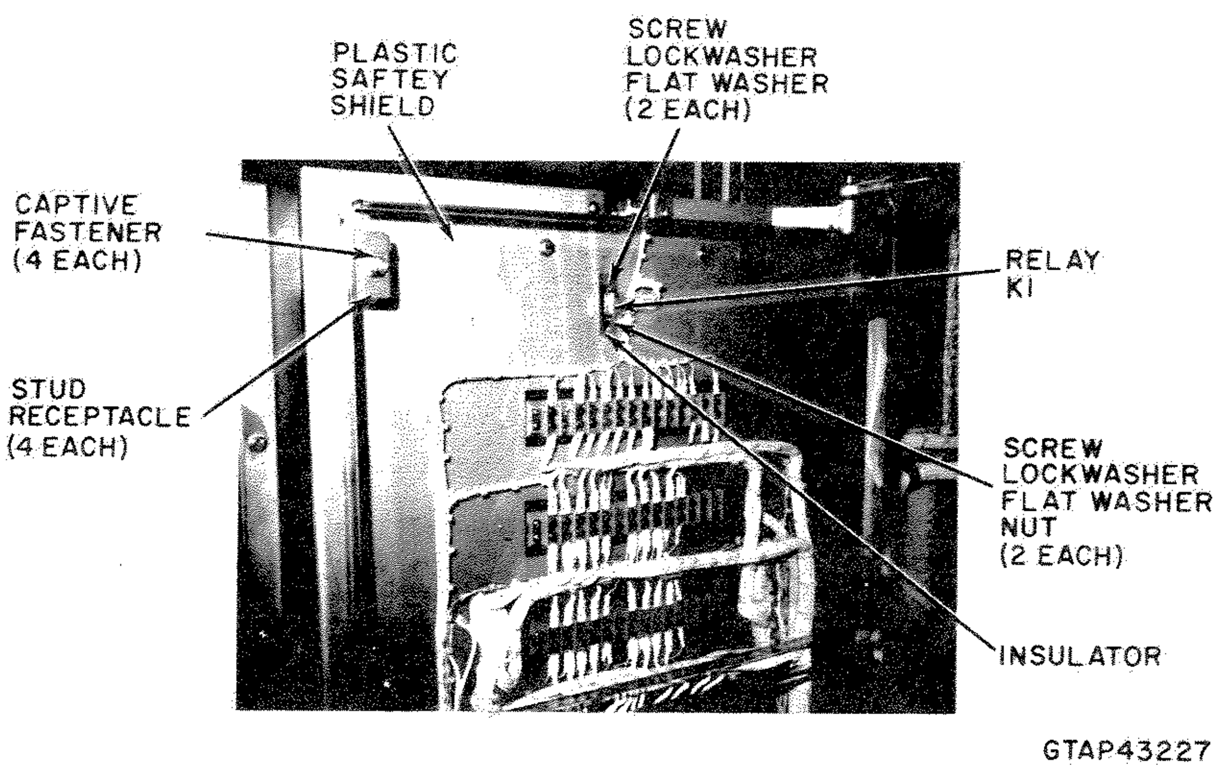


Figure 6-48. Transmit Beamformer Cabinet, Unit 150, Relay K1

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

7. Unsolder and disconnect wires from terminals on relay.

8. Remove 2 screws, lockwashers, and flat washers securing insulator (with relay attached) to swing rack; remove insulator.

9. After noting orientation of relay on insulator, remove 2 screws, lockwashers, flat washers, and nuts that secure relay to insulator; remove relay.

6-7.4.8.3 Installation.

1. Position replacement relay on insulator, oriented as noted during removal; secure relay to insulator with 2 screws, lockwashers, flat washers, and nuts.

2. Position insulator (with relay attached) on swing rack; secure insulator to rack with 2 screws, lockwashers, and flat washers.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

3. Connect and solder wires to relay terminals, as noted during removal.

4. Position plastic safety shield on 4 stud receptacles; secure with 4 captive fasteners.

5. Close swing rack; secure rack to cabinet with winghead turnlock fasteners at top and bottom of rack.

6. Restore primary ac power to cabinet.

a. Observe that POWER AVAILABLE lamp DS4 is lit.

b. Remove maintenance-in-progress sign.

7. Close and secure cabinet doors.

8. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.9 Circuit Breaker N2CB1.

6-7.4.9.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Wrench, box/open, set	1	32a

6-7.4.9.2 Removal. (Figure 6-49).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

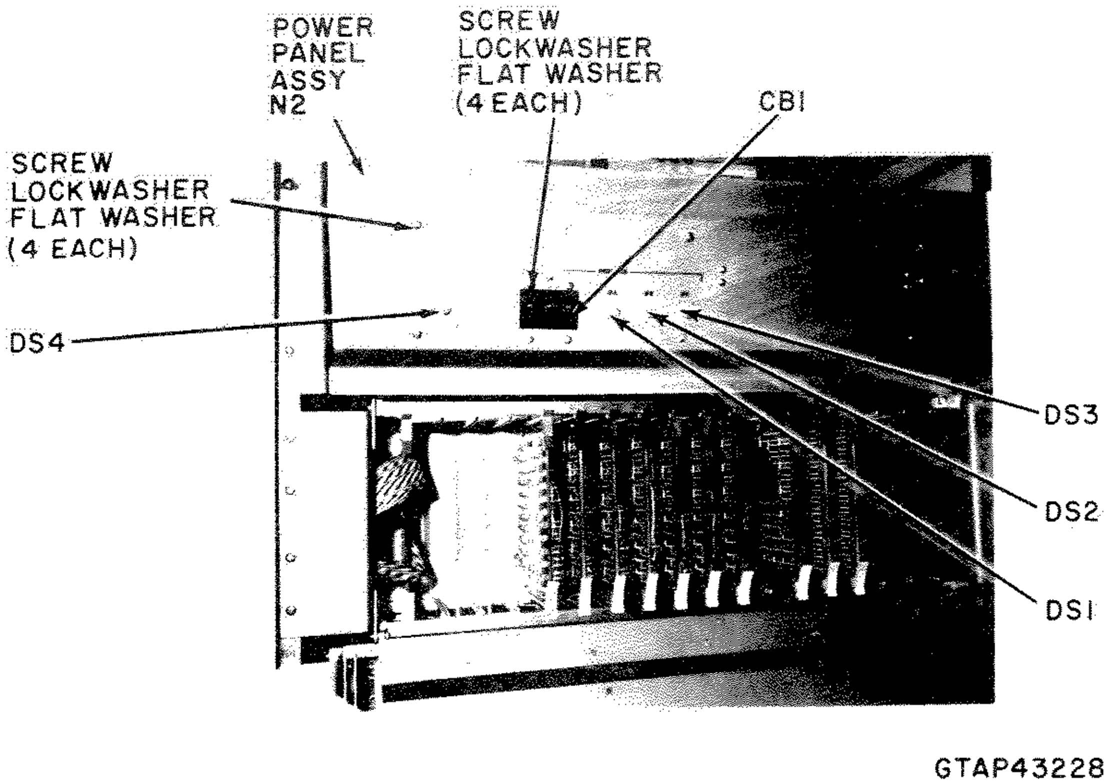


Figure 6-49. Transmit Beamformer Cabinet, Unit 150, Circuit Breaker N2CB1 (Sheet 1 of 2)

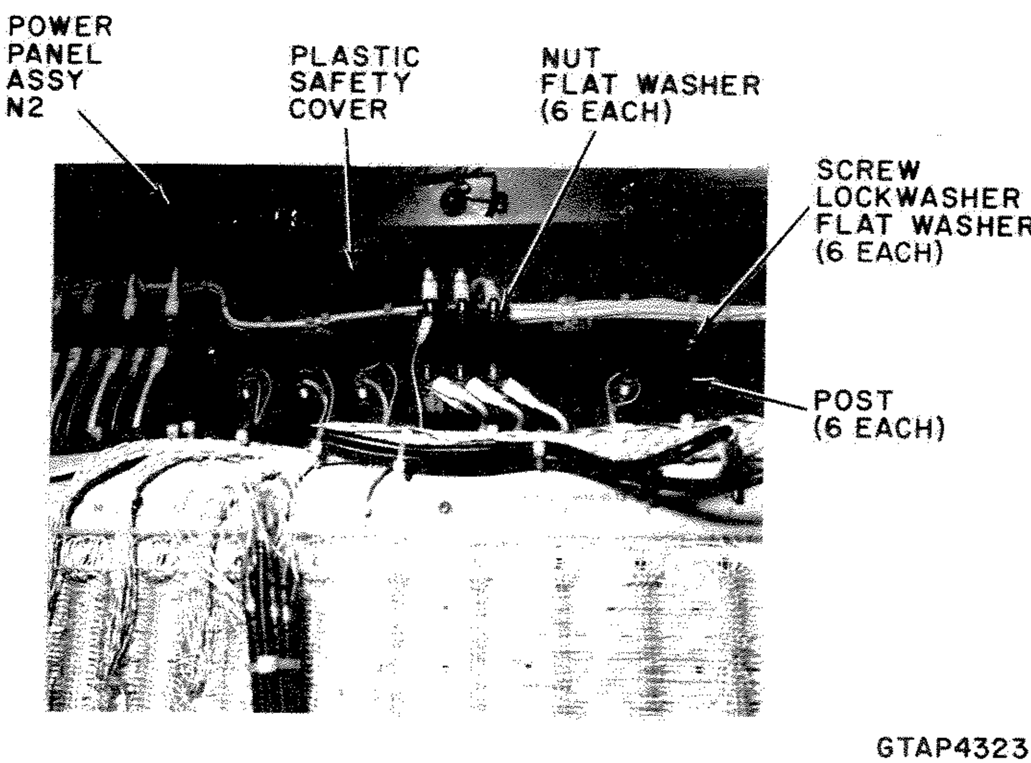


Figure 6-49. Transmit Beamformer Cabinet, Unit 150, Circuit Breaker N2CB1 (Sheet 2 of 2)

2. Remove primary ac power from cabinet.
   a. Set applicable circuit breaker on breaker panel 305E to the OFF position.
      (V)1 CB4
      (V)2 CB14
   b. Tag with maintenance-in-progress sign.
   c. Open front door of cabinet.
   d. Observe POWER AVAILABLE lamp DS4 is not lit.
   e. Verify fans are not operating.
3. Open rear door of cabinet.
4. Loosen winghead turnlock fasteners at top and bottom of swing rack; pull rack away from cabinet.
5. On rear of panel, remove 6 screws, lockwashers, and flat washers that secure plastic safety cover to posts; remove plastic safety cover.
6. Tag wires connected to 6 terminal studs on circuit breaker CB1, as necessary, to identify correct connections.
7. Remove 6 nuts and flat washers from 6 terminal studs on CB1; disconnect all wire terminal lugs from studs.
8. On front of power panel assembly, remove 4 screws, lockwashers, and flat washers that secure CB1 to power panel assembly.
   a. Remove CB1.
   b. Retain screws and washers for installation of replacement.

6-7.4.9.3 Installation.

1. Position replacement circuit breaker in power panel assembly opening; secure with 4 screws, lockwashers, and flat washers.
2. Remove 6 nuts and flat washers from 6 terminal studs on replacement circuit breaker. Make sure 1 flat washer remains on each terminal stud.
3. Connect wire terminal lugs to terminal studs, as identified during removal, and secure connections with 6 nuts and flat washers.
4. Position plastic safety cover on posts; secure with 6 screws, lockwashers, and flat washers.
5. Close swing rack; secure rack to cabinet with winghead turnlock fasteners at top and bottom of rack.
6. Ensure circuit breaker CB1 is set to OFF.
7. Restore primary ac power to cabinet.
   a. Observe that POWER AVAILABLE lamp DS4 is lit.
   b. Remove maintenance-in-progress sign.
8. Set circuit breaker CB1 to ON; observe ØA, Ø B, and ØC lamps DS1 through DS3 are lit.
9. Close and secure cabinet doors.
10. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.10 Lamps (With Lenses) N2DS1 through N2DS4.

6-7.4.10.1 Tools and Test Equipment Required. None.

6-7.4.10.2 Removal. (Figure 6-50).

1. Open front door of cabinet.
2. On power panel assembly N2, loosen and remove defective lamp (with lens) from lampholder by turning lenses counterclockwise.

6-7.4.10.3 Installation.

1. On power panel assembly N2, position replacement lamp (with lens) from lampholder; tighten by turning clockwise.
2. Close and secure cabinet doors.

6-7.4.11 Lampholders N2XDS1 through N2XDS4.

6-7.4.11.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Soldering station	1	29e
Wrench, box/open, set	1	32a

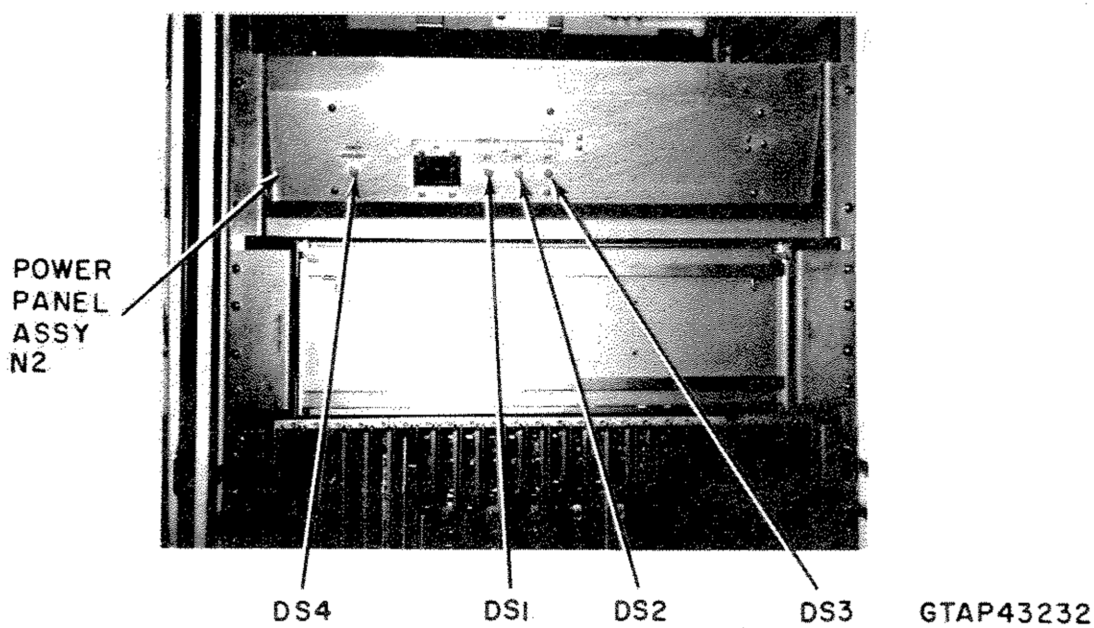


Figure 6-50. Transmit Beamformer Cabinet, Unit 150, Lamps (With Lenses) N2DS1 through N2DS4

6-7.4.11.2 Removal. (Figures 6-51 and 6-52).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
2. Remove primary ac power from cabinet.
   a. Set applicable circuit breaker on breaker panel 305E to the OFF position.
      (V)1 CB4
      (V)2 CB14
   b. Tag with maintenance-in-progress sign.
   c. Open front door of cabinet.
   d. Observe POWER AVAILABLE lamp DS4 is not lit.
   e. Verify fans are not operating.
3. Open rear door of cabinet.
4. Loosen winghead turnlock fasteners at top and bottom of swing rack; pull rack away from cabinet.
5. Loosen 6 screws, lockwashers, and flat washers that secure plastic safety cover to posts; remove safety cover.
6. Tag wires soldered to terminals on lampholder being removed, as necessary, to identify correct connections.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

7. Unsolder and disconnect wires from lampholder terminals.
8. Loosen and remove nut and lockwasher that secure lampholder to power panel; remove lampholder.

6-7.4.11.3 Installation.

1. Position replacement lampholder in opening on power panel; secure with lockwasher and nut.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

2. Connect and solder wires to replacement lampholder terminals, as identified during removal.
3. Position plastic safety cover on posts; secure with 6 screws, lockwashers, and flat washers.
4. Close swing rack; secure rack to cabinet with winghead turnlock fasteners at top and bottom of rack.
5. Restore primary ac power to cabinet.
   a. Observe that POWER AVAILABLE lamp DS4 IS LIT.
   b. Remove maintenance-in-progress sign.
6. Close and secure cabinet doors.
7. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.12 Printed Wiring Board N3A1 through A18.

6-7.4.12.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Wrist strap	1	33i

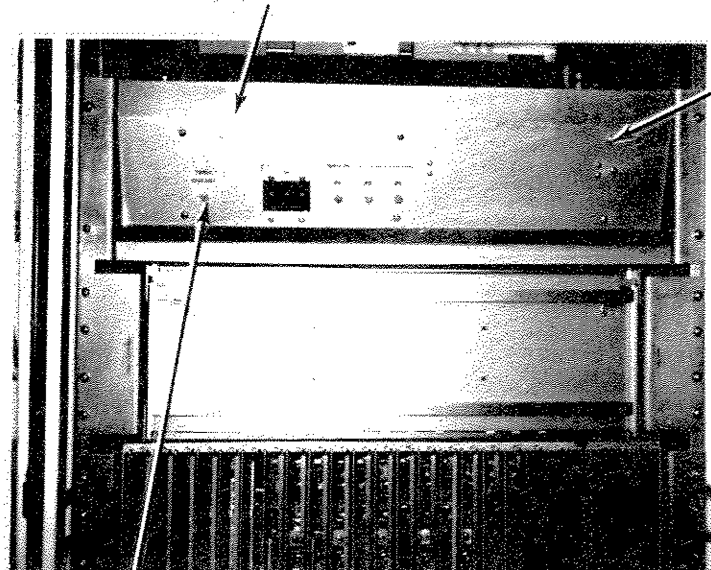


Figure 6-51. Transmit Beamformer Cabinet, Unit 150, Power Panel Assembly N2 (Front View)

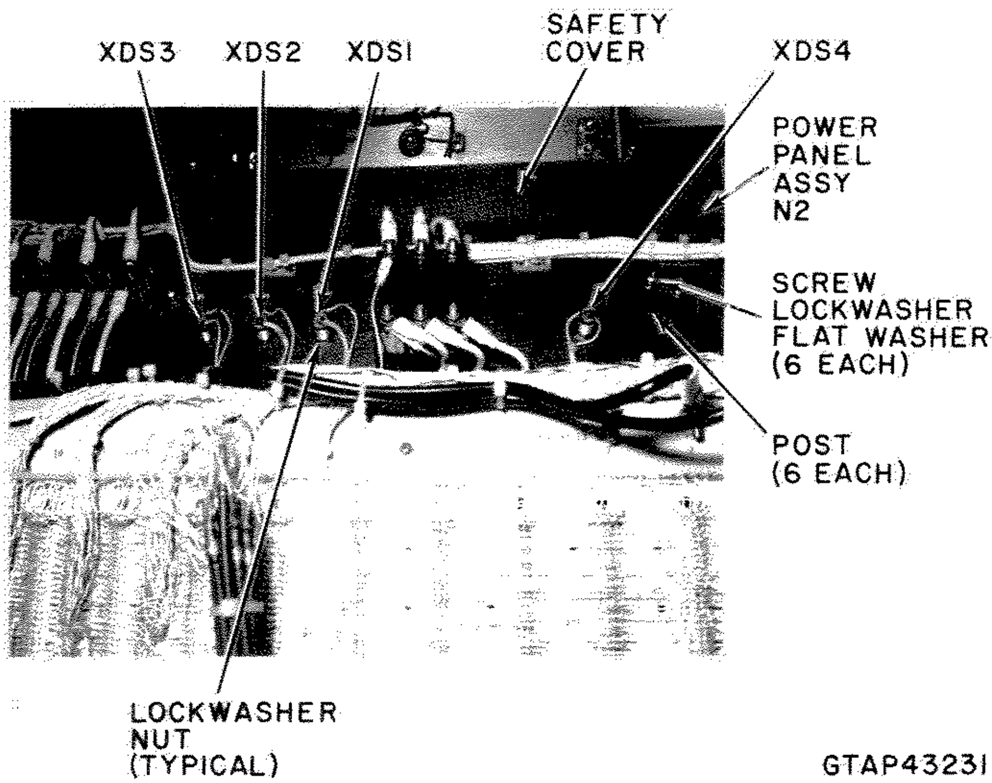


Figure 6-52. Transmit Beamformer Cabinet, Unit 150, Lampholder N2XDS1 through N2XDS4 (Rear View)

6-7.4.12.2 Removal. (Figures 6-53 and 6-54).

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Open front door of cabinet.
2. Operate 2 spring-loaded release rods on PWB retainer panel of PWB chassis; open retainer panel.
3. Note orientation of PWB in chassis.
4. Carefully and evenly operate 2 inserter/extractor levers on PWB to disconnect; remove PWB from PWB chassis.

6-7.4.12.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

The PWBs are mechanically indexed to slot location. Forcing a wrong board into a slot may cause damage to indexing inserts on backplane. If the wrong PWB has been inserted, check that indexing inserts have not been removed when PWB was removed from chassis.

1. Carefully insert PWB partially into guides in PWB chassis, oriented as noted during removal.
2. Raise inserter/extractor levers; continue inserting PWB until opposite ends of levers are under lip of PWB chassis.
3. Carefully and evenly push inserter/extractor levers to seat PWB fully into socket connector.
4. Close and secure PWB retainer panel.
5. Close and secure cabinet doors.

6-7.4.13 Printed Wiring Boards N4A1 through 18, N5A1 through 18, and N7A1 through 18.

6-7.4.13.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Puller, board	1	27a
Screwdriver, flat blade	1	25ad
Wrist strap	1	33i

6-7.4.13.2 Removal. (Figure 6-55).

1. Open front door of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Loosen 2 captive fasteners that secure PWB retainer cover over PWB being removed. Remove retainer cover.

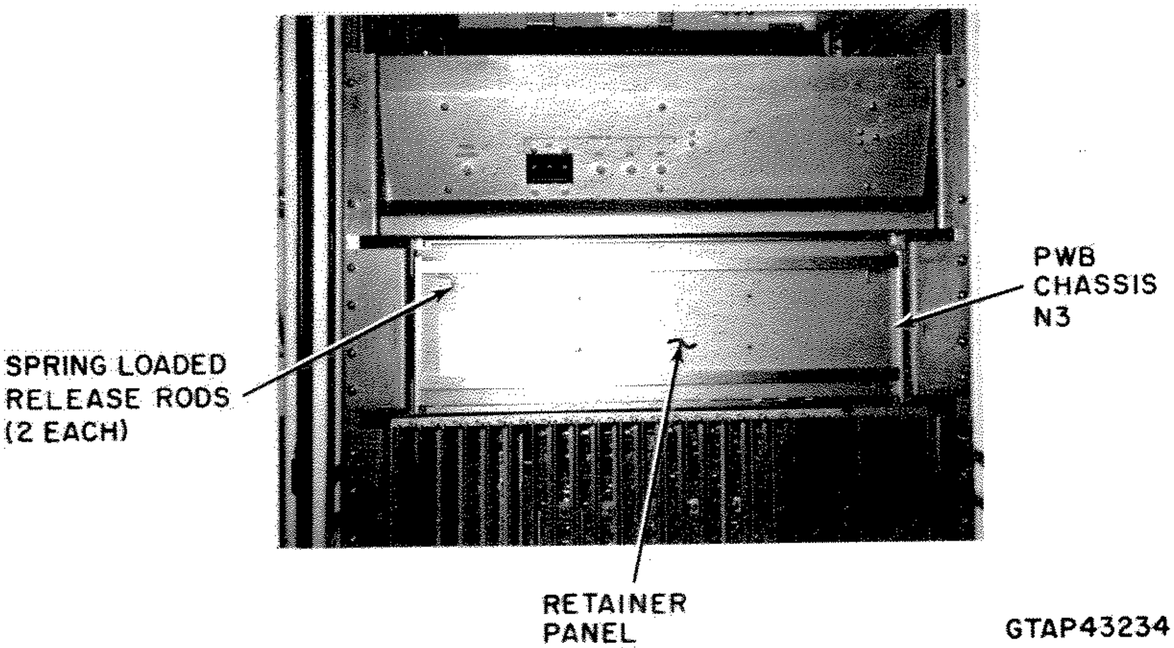


Figure 6-53. Transmit Beamformer Cabinet, Unit 150, Printed Wiring Boards Chassis N3, Retainer Panel Closed

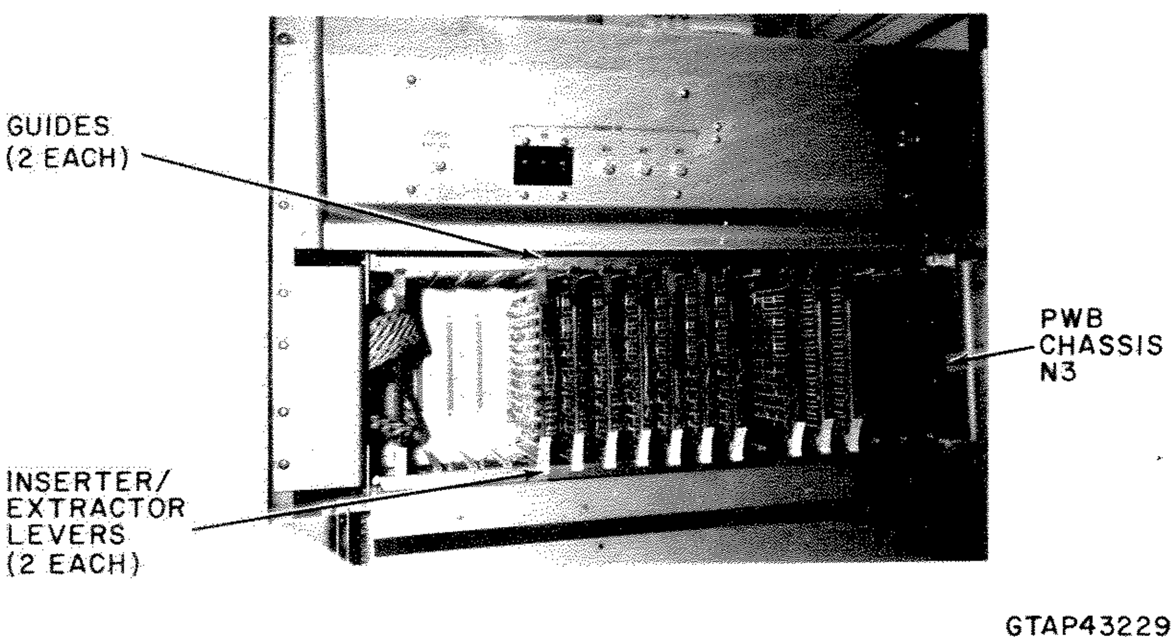


Figure 6-54. Transmit Beamformer Cabinet, Unit 150, Printed Wiring Boards N3A1 through N3A18, Retainer Panel Open

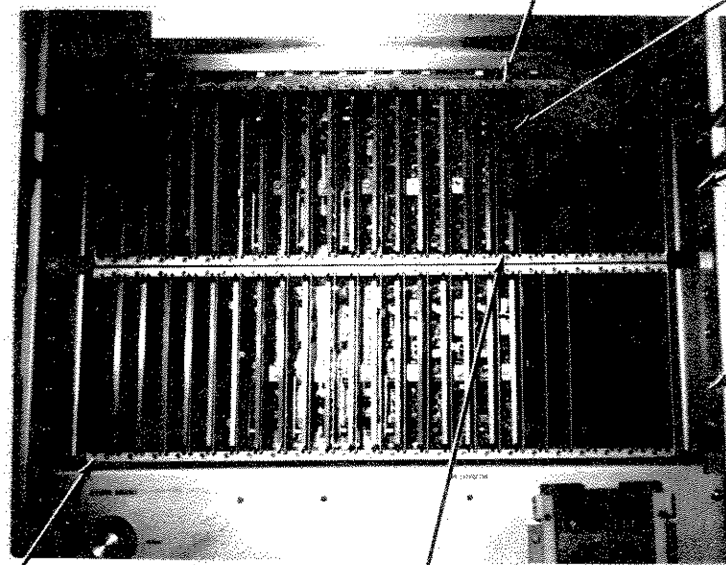


Figure 6-55. Transmit Beamformer Cabinet, Unit 150, Printed Wiring Boards N4A1 through 18, N5A1 through 18, and N7A1 through 18

3. Note orientation of PWB in chassis.

4. Using board puller (Table 1-4, Item 27a) as applicable, remove PWB from chassis.

6-7.4.13.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

The PWBs are mechanically indexed to slot location. Forcing a wrong board into a slot may cause damage to indexing inserts on backplane. If the wrong PWB has been inserted, check that indexing inserts have not been removed when PWB was removed from chassis.

1. Carefully insert replacement PWB into guides in PWB chassis, oriented as noted during removal.

2. Press PWB into chassis until fully seated in socket connector.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 2 captive fasteners on PWB retainer cover.

3. Position PWB retainer cover over PWB; secure with 2 captive fasteners.

4. Close and secure cabinet doors.

5. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.4.14 Attenuators N6AT1 and N6AT2.

6-7.4.14.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Wrench, hex-head	1	32b

6-7.4.14.2 Removal. (Figure 6-56).

1. Open front door of cabinet.

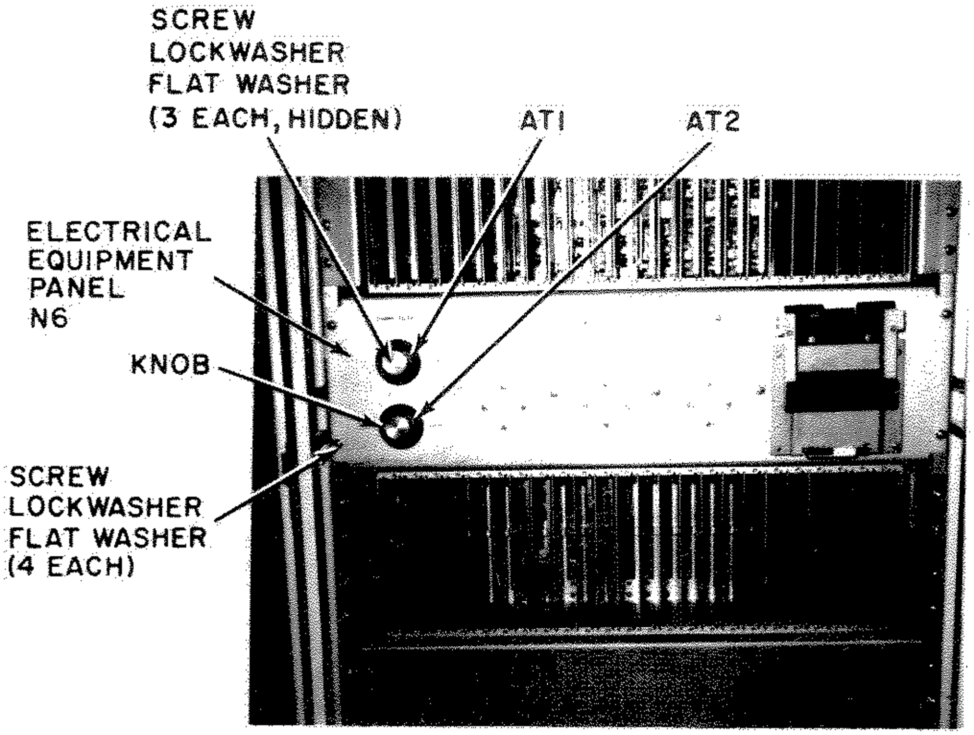


Figure 6-56. Transmit Beamformer Cabinet, Unit 150, Attenuators N6AT1 and N6AT2

CAUTION

EQUIPMENT DAMAGE HAZARD

Primary ac power must be removed from cabinet to protect equipment from being damaged.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.
   c. Verify fans are not operating.
4. Loosen 2 set screws securing knob to shaft of defective attenuator; remove knob and housing.
5. On electrical equipment panel N6, remove 4 screws, lockwashers, and flat washers that secure panel to cabinet; carefully position panel for access to defective attenuator.
6. Loosen and disconnect cable connectors from connectors J1 and J2 on defective attenuator.
7. Loosen and remove 3 screws, lockwashers, and flat washers that secure defective attenuator to panel; remove attenuator.

6-7.4.14.3 Installation.

1. Position replacement attenuator on electrical equipment panel N6; secure with 3 screws, lockwashers, and flat washers.
2. Connect and secure cable connectors to attenuator connectors J1 and J2.
3. Position electrical equipment panel N6 on cabinet; secure with 4 screws, lockwashers, and flat washers.
4. Position knob and housing on attenuator shaft; secure with 2 set screws.
5. Set 3-pole POWER ON circuit breaker CB1 to the ON position.

6. Close and secure cabinet doors.
7. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
8. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.4.15 Radio Frequency Power Dividers N6HY1 and H6HY2.

6-7.4.15.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Wrench, box/open, set	1	32a

6-7.4.15.2 Removal. (Figure 6-57).

1. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.
   c. Verify fans are not operating.
4. On electrical equipment panel N6, remove 4 screws, lockwashers, and flat washers that secure panel to cabinet; carefully position panel for access to defective divider.
5. At defective divider, loosen and disconnect cable connectors from connectors 1, 2, and 3 and dummy load connector from connector 4.
6. Remove 2 screws, lockwashers, flat washers, and nuts that secure defective divider to panel; remove divider.

6-7.4.15.3 Installation.

1. Position replacement divider on electrical panel N6; secure with 2 screws, lockwashers, flat washers, and nuts.
2. At replacement divider, connect and secure cable connectors to connectors 1, 2, and 3 and dummy load connector to connector 4.
3. Position electrical equipment panel N6 on cabinet; secure with 4 screws, lockwashers, and flat washers.
4. Set 3-pole POWER ON circuit breaker CB1 to the ON position.
5. Close and secure cabinet door.
6. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
7. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.4.16 Radio Frequency Power Dividers N6HY3 through N6HY6.

6-7.4.16.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25aa
Screwdriver, flat blade	1	25ad

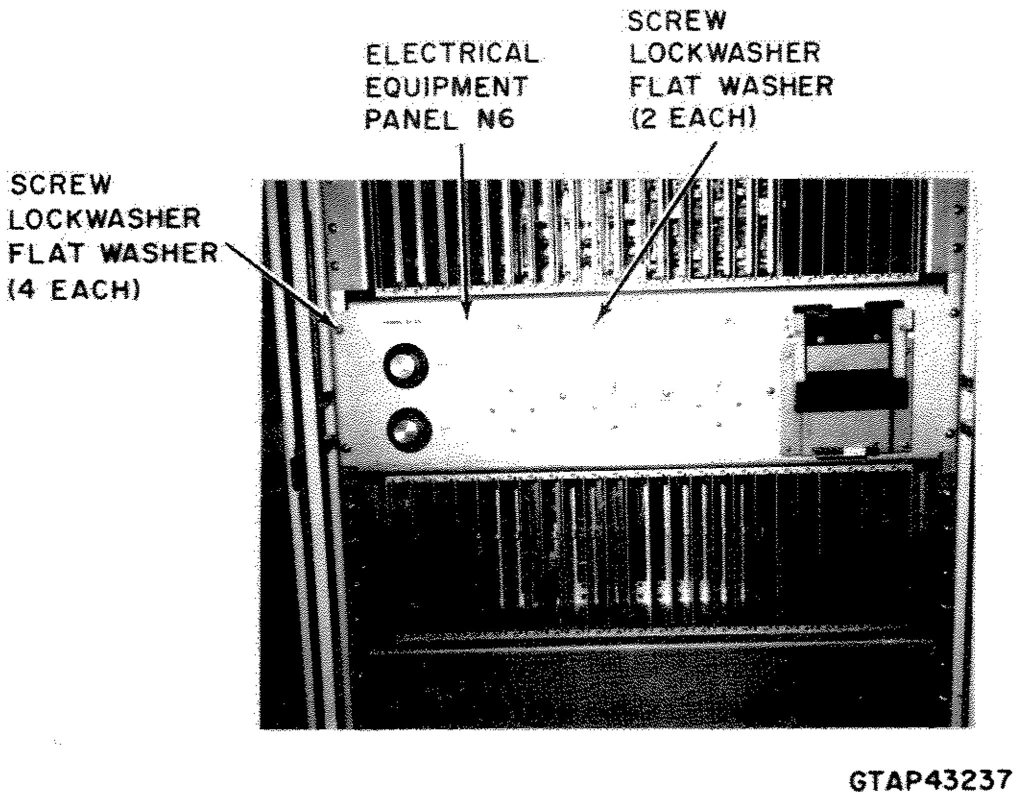


Figure 6-57. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Power Dividers N6HY1 and N6HY2 (Sheet 1 of 2)

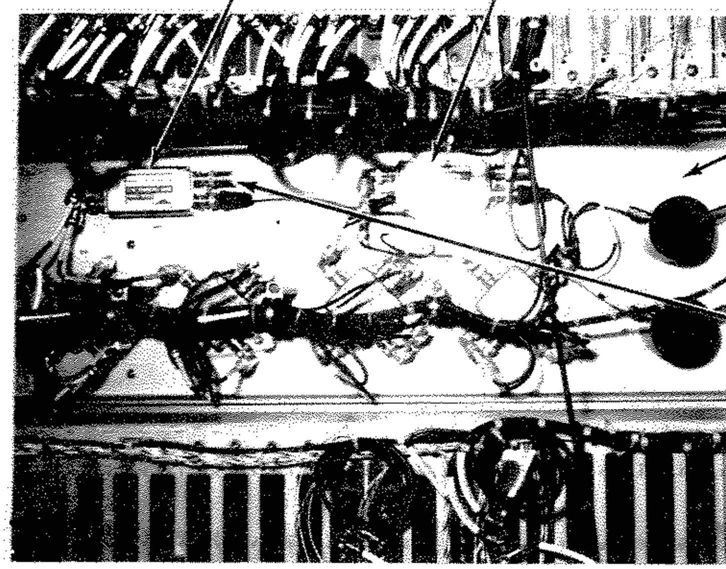


Figure 6-57. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Power Dividers N6HY1 and N6HY2 (Sheet 2 of 2)

6-7.4.16.2 Removal. (Figure 6-58).

1. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.
   c. Verify fans are not operating.
4. On electrical equipment panel N6, remove 4 screws, lockwashers, and flat washers that secure panel to cabinet; carefully position panel for access to defective divider.
5. At defective divider, loosen and disconnect cable connectors from connectors 1 through 6 and INPUT.
6. On front of panel, remove 4 screws and lockwashers that secure defective divider to panel; remove divider.

6-7.4.16.3 Installation.

1. Position replacement divider on panel N6 and secure with 4 screws, lockwashers, and flat washers.
2. At replacement divider, connect and secure cable connectors to connectors 1 through 6 and INPUT.
3. Position electrical equipment panel N6 on cabinet and secure with 4 screws, lockwashers, and flat washers.
4. Set 3-pole POWER ON circuit breaker CB1 to the ON position.
5. Close and secure cabinet door.
6. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
7. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.4.17 Radio Frequency Power Divider N8HY1.

6-7.4.17.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, locking	1	25w
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ad

6-7.4.17.2 Removal. (Figure 6-59).

1. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.
   c. Verify fans are not operating.
4. Open rear door of cabinet.
5. Loosen winghead turnlock fasteners that secure swing rack to cabinet; pull rack fully open.
6. Loosen and disconnect cable connectors from divider connectors INPUT, 1 and 2.
7. Loosen and remove 4 screws, lockwashers, and flat washers that secure divider to switch mounting bracket; remove divider.

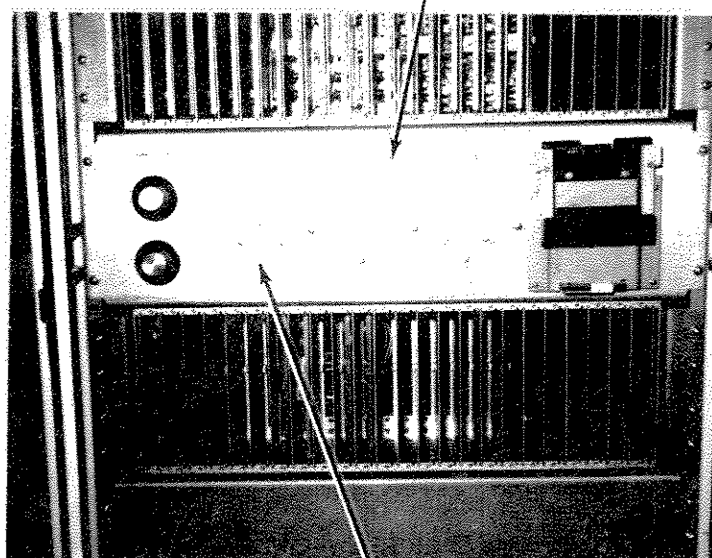


Figure 6-58. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Power Dividers N6HY3 through N6HY6 (Sheet 1 of 2)

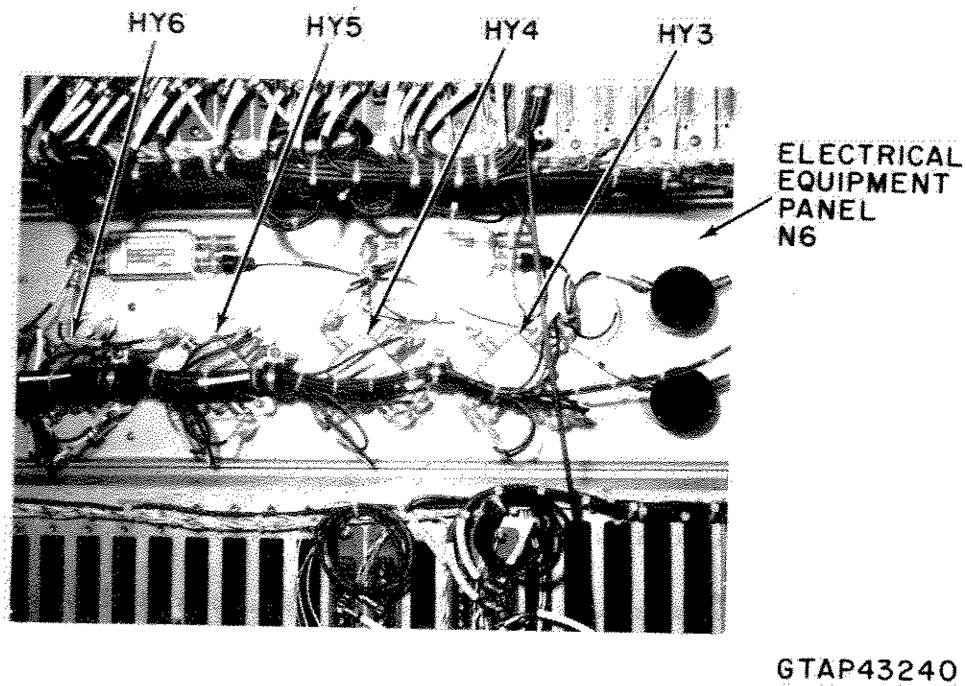


Figure 6-58. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Power Dividers N6HY3 through N6HY6 (Sheet 2 of 2)

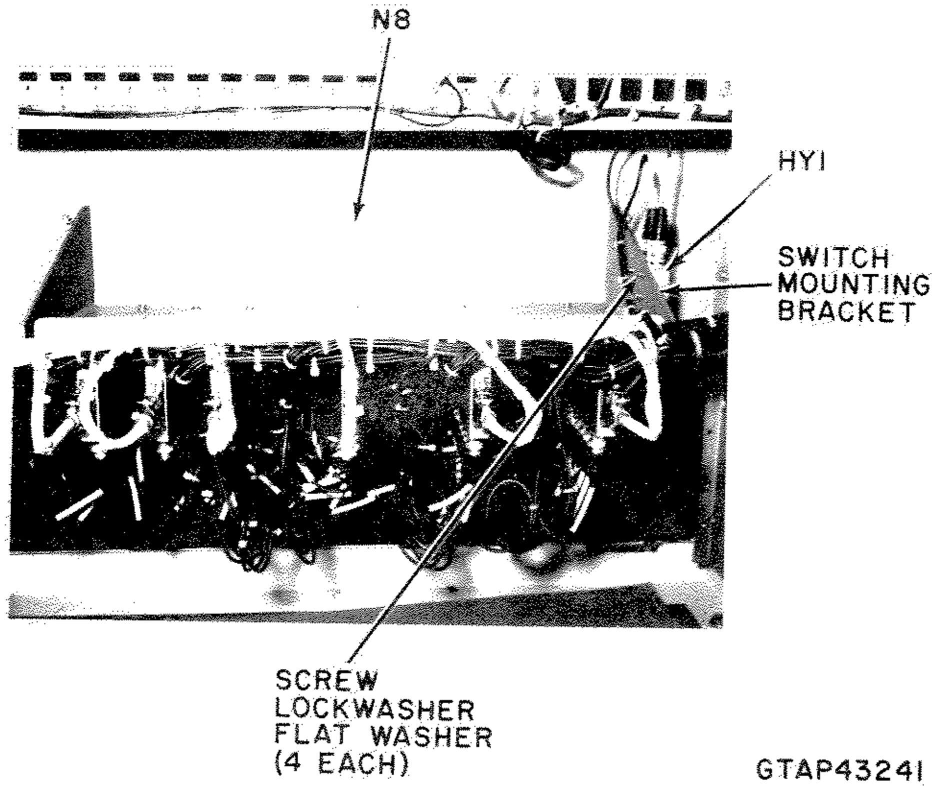


Figure 6-59. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Power Divider N8HY1 (Rear View)

6-7.4.17.3 Installation.

1. Position replacement divider on switch mounting bracket; secure with 4 screws, lockwashers, and flat washers.
2. Connect cable connectors to divider connectors INPUT, 1 and 2.
3. Close swing rack; secure rack to cabinet with winghead turnlock fasteners at top and bottom of rack.
4. Close and secure cabinet door.
5. Set 3-pole POWER ON circuit breaker CB1 to the ON position.
6. Close and secure cabinet door.
7. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.18 Radio Frequency Relay Switches N8S1 through N8S6.

6-7.4.18.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Pliers, connector	1	25v
Pliers, locking	1	25w
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Screwdriver, flat blade	1	25af

6-7.4.18.2 Removal. (Figure 6-60).

1. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.
   c. Verify fans are not operating.
4. Remove 4 screws, lockwashers, and flat washers that secure blank panel to bottom front of cabinet; remove blank panel.
5. Open rear door of cabinet.
6. Loosen winghead turnlock fastener at top and bottom of swing rack and pull rack out away from cabinet.
7. From inside of cabinet, loosen 2 captive screws that secure control cable connector to connector J1 on defective relay switch; disconnect control cable connector from relay switch connector.
8. From either front or rear of cabinet, loosen and disconnect RF cable connectors from defective relay switch connectors.
9. Tag RF cables only as necessary to identify correct connections.
   a. Remove 3 screws, lockwashers, and flat washers that secure defective relay switch to relay switch mount.
   b. Remove switch.

6-7.4.18.3 Installation.

1. Position replacement RF relay switch on relay switch mount; secure switch to mount with 3 screws, lockwashers, and flat washers.
2. Connect and secure RF cable connectors to relay switch connectors.
3. Connect and secure control cable connector to relay switch connector J1, using 2 captive screws.
4. Close swing rack; secure rack to cabinet with winghead turnlock fasteners at top and bottom of rack.
5. Close and secure rear door of cabinet.
6. Position blank panel on bottom front of cabinet; secure with 4 screws, lockwashers, and flat washers.
7. Set 3-pole POWER ON circuit breaker CB1 to the ON position.
8. Close and secure cabinet door.

6-7.4.18.2 Removal. (Figure 6-60).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

2. Remove 4 screws, lockwashers, and flat washers that secure blank panel to bottom front of cabinet; remove blank panel.

3. Open rear of door cabinet.

4. Loosen winghead turnlock fastener at top and bottom of swing rack and pull rack out away from cabinet.

5. From inside of cabinet, loosen 2 captive screws that secure control cable connector to connector J1 on defective relay switch; disconnect control cable connector from relay switch connector.

6. From either front or rear of cabinet, loosen and disconnect RF cable connectors from defective relay switch connectors.

7. Tag RF cables only as necessary to identify correct connections.

a. Remove 3 screws, lockwashers, and flat washers that secure defective relay switch to relay switch mount.

b. Remove switch.

6-7.4.18.3 Installation.

(Steps 1 thru 6 remain the same)

7. (Deleted).

8. (Remains the same).

Figure 6-60. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Relay Switches N8S1 through N8S6 (Sheet 1 of 2)

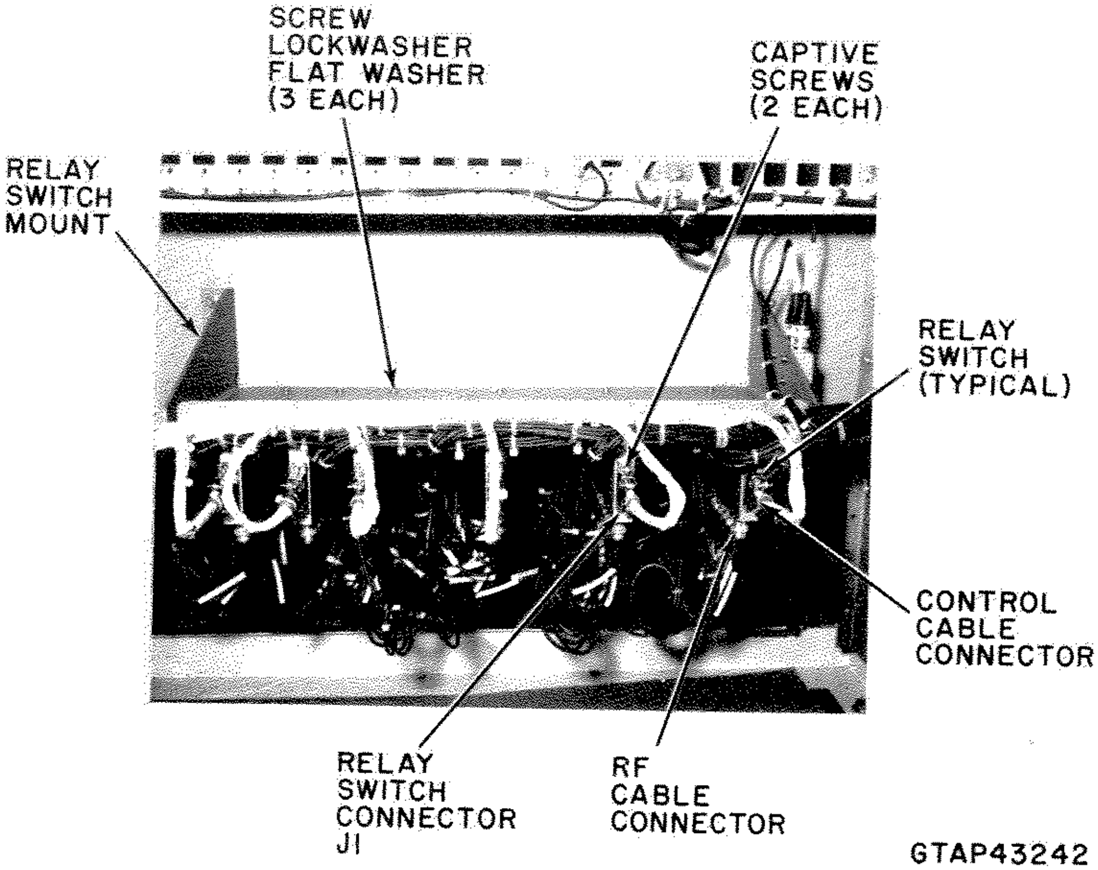


Figure 6-60. Transmit Beamformer Cabinet, Unit 150, Radio Frequency Relay Switches N8S1 through N8S6 (Sheet 2 of 2)

9. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.19 Overtemperature Switch S1.

6-7.4.19.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Soldering station	1	29e
Wrench, box/open, set	1	32a

6-7.4.19.2 Removal. (Figure 6-61).

1. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.
   c. Verify fans are not operating.
4. Open rear door of cabinet.
5. Loosen winghead turnlock fastener at top and bottom of swing rack; pull rack out away from cabinet.
6. Using safety ladder for access, loosen 2 screws, lockwashers, and flat washers that secure switch bracket to support angle.
7. Lift switch bracket off 2 loosened screws on support angle; pull bracket out away from rack for access to defective switch.
8. Tag wires, as necessary, to identify correct connections to switch terminals.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

9. Unsolder and disconnect wires from defective switch.

NOTE

Observe orientation of switch on insulator and switch bracket to ensure replacement switch is installed correctly.

10. Remove 2 screws, lockwashers, and nuts that secure insulator to switch bracket; remove insulator (with switch attached).
11. Remove 2 screws, lockwashers, flat washers, and nuts that secure switch to insulator; remove switch.

6-7.4.19.3 Installation.

1. Position replacement switch on insulator; secure switch to insulator with 2 screws, lockwashers, flat washers, and nuts.
2. Position insulator (with switch attached) on switch bracket; secure insulator to bracket with 2 screws, lockwashers, and nuts.
3. Connect and solder wires to switch terminals, as identified during removal.
4. Slide switch bracket onto 2 support angle screws.
   a. Secure bracket to support angle by tightening 2 screws.
   b. Ensure bracket is positioned between flat washers and support angle.
5. Close swing rack; secure rack to cabinet with winghead turnlock fasteners on top and bottom of swing rack.

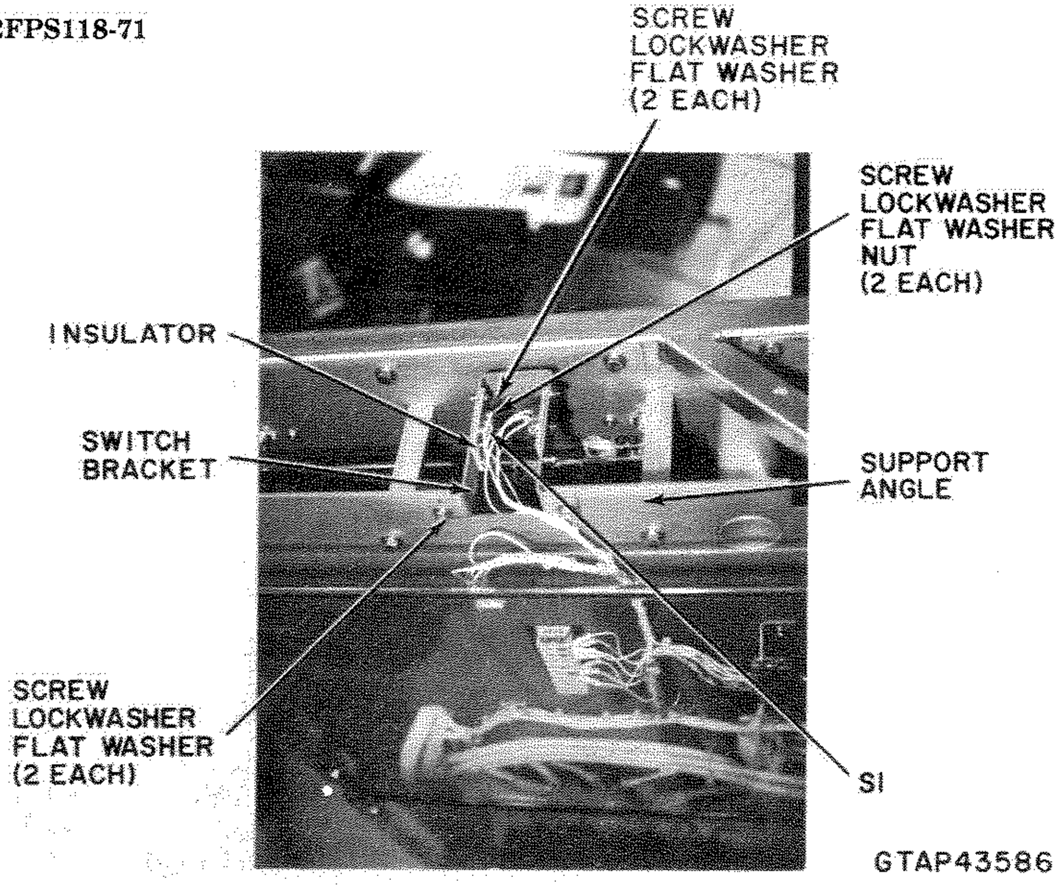


Figure 6-61. Transmit Beamformer Cabinet, Unit 150, Overtemperature Switch S1

6. Set 3-pole POWER ON circuit breaker CB1 to the ON position.
7. Close and secure cabinet doors.
8. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.20 Overtemperature Switch S2.

6-7.4.20.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Soldering station	1	29e
Wrench, box/open, set	1	32a

6-7.4.20.2 Removal. (Figure 6-62).

1. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.

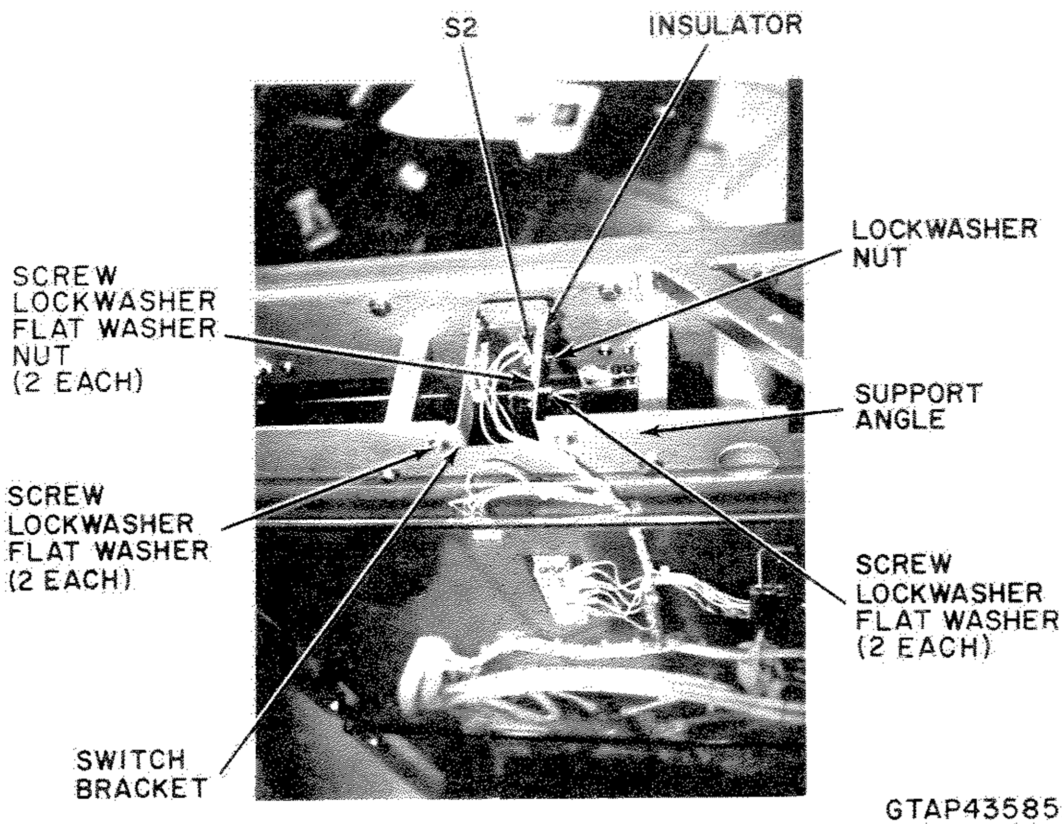


Figure 6-62. Transmit Beamformer Cabinet, Unit 150, Overtemperature Switch S2

b. Observe that ØA, ØB, and ØC lamps DS1 through DS3 are not lit.

c. Verify fans are not operating.

4. Open rear door of cabinet.

5. Loosen winghead turnlock fastener at top and bottom of swing rack; pull rack out away from cabinet.

6. Using safety ladder for access, loosen 2 screws, lockwashers, and flat washers that secure switch bracket to support angle.

7. Lift switch bracket off 2 loosened screws on support angle; pull bracket out away from rack for access to defective switch.

8. Tag wires as necessary to identify correct connections to switch terminals.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

9. Unsolder and disconnect wires from defective switch.

NOTE

Observe orientation of switch on insulator and switch bracket to ensure replacement switch is installed correctly.

10. Remove 2 screws, lockwashers, and nuts that secure insulator to switch bracket; remove insulator (with switch attached).

11. Remove nut and lockwasher that secure switch to insulator; remove switch.

6-7.4.20.3 Installation.

1. Position replacement switch on insulator; secure switch to insulator with lockwasher and nut.

2. Position insulator (with switch attached) on switch bracket; secure insulator to bracket with 2 screws, lockwashers, and nuts.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

3. Connect and solder wires to switch terminals, as identified during removal.

4. Slide switch bracket onto 2 support angle screws.

a. Secure bracket to support angle by tightening 2 screws.

b. Make sure bracket is positioned between flat washers and support angle.

5. Close swing rack; secure rack to cabinet with winghead turnlock fasteners at top and bottom of rack.

6. Set 3-pole POWER ON circuit breaker CB1 to the ON position.

7. Close and secure cabinet doors.

8. Restart mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.4.21 5 V and 15 V Voltage Regulators VR1 through VR8.

6-7.4.21.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, connector	1	25v
Screwdriver, flat blade	1	25ad

6-7.4.21.2 Removal. (Figure 6-63).

1. Open rear door of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Primary ac power must be removed from the regulator to prevent equipment damage.

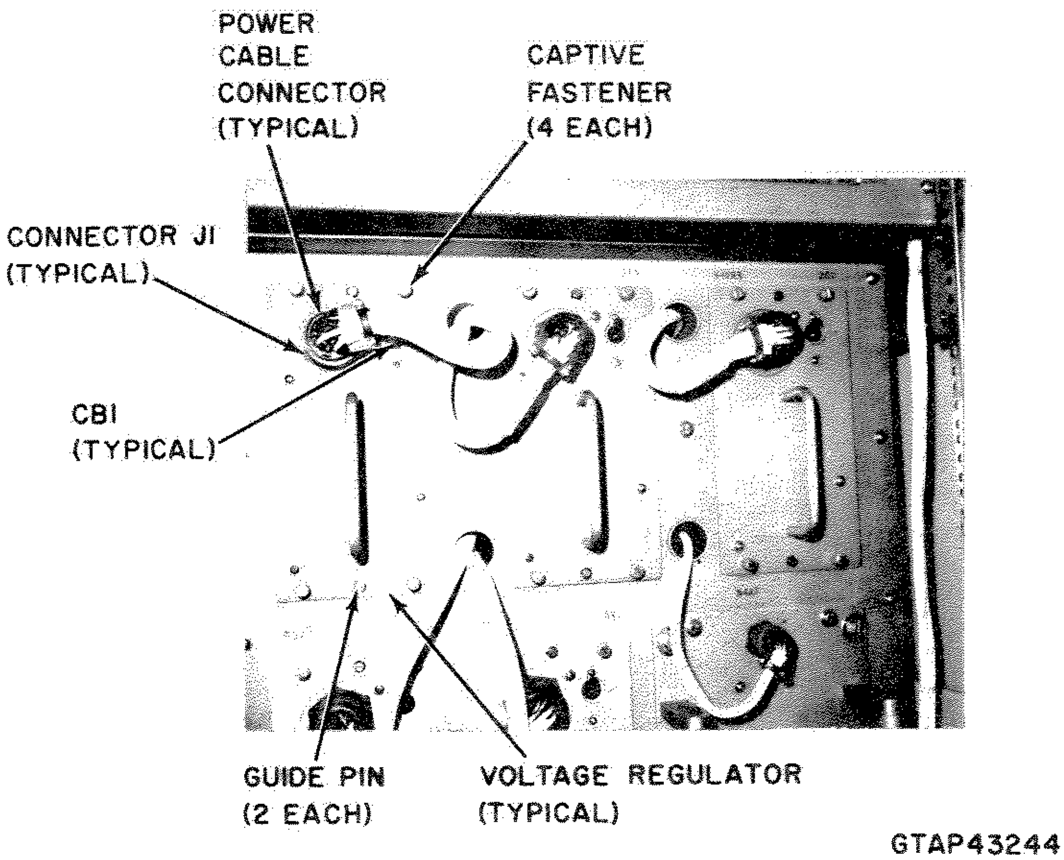


Figure 6-63. Transmit Beamformer Cabinet, Unit 150, Typical Voltage Regulators

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. On voltage regulator being removed, set circuit breaker CB1 to OFF.
3. Release and disconnect power cable connector from voltage regulator connector J1.
4. Loosen 4 captive fasteners that secure voltage regulator to cabinet.
5. Remove voltage regulator from cabinet by carefully pulling on handle while supporting rear of regulator with free hand.

6-7.4.21.3 Installation.

1. On voltage regulator, be sure circuit breaker CB1 is set to OFF.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 4 captive fasteners that secure voltage regulator to cabinet.

2. Slide voltage regulator into cabinet until locator holes in front panel are seated on 2 guide pins.
3. Tighten 4 captive fasteners that secure voltage regulator to cabinet.
4. Connect and secure applicable power cable connector (P1 through P8) to voltage regulator connector J1.
5. On voltage regulator, set circuit breaker CB1 to ON.
6. Close and secure rear door of cabinet.

6-7.5 Exciter/Auxiliary Exciter Cabinet, Unit 151/152 - Removal and Installation Procedures.

6-7.5.1 Calibration Receiver Al.

6-7.5.1.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, flat blade	1	25ae
Screwdriver, flat blade	1	25af
Wrench, box/open, set	1	32a

6-7.5.1.2 Removal. (Figure 6-64).

1. Open front and rear doors of cabinet.

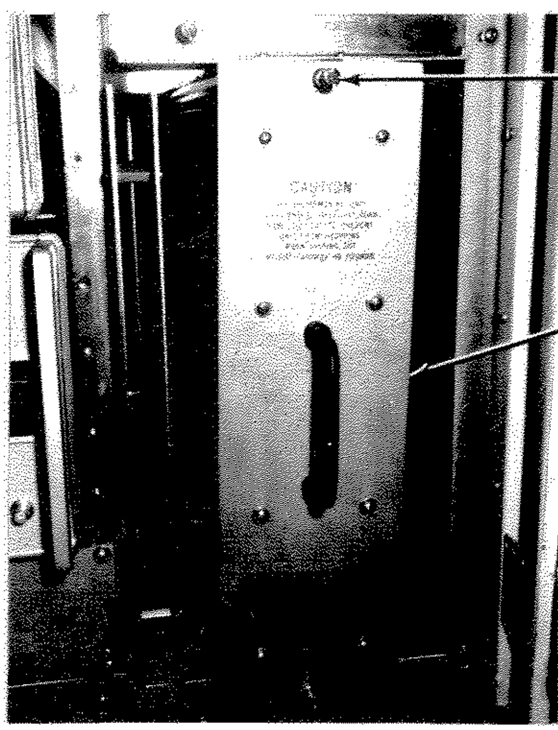


Figure 6-64. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Calibration Receiver A1

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. At rear of calibration receiver A1, disconnect cables connectors J1 and J3 through J16.

3. Disconnect ground wire from terminal E1 (on rear of A1) by removing nut and lockwasher; reinstall nut and lockwasher on terminal.

4. Loosen 2 captive fasteners that secure receiver in cabinet.

WARNING

WEIGHT HAZARD

Receiver A1 weighs approximately 45 pounds. Use two technicians to remove or install this unit. Hand support the rear of the unit to prevent the unit from dropping.

5. Remove receiver from cabinet.

6-7.5.1.3 Installation.

1. Carefully position rear of receiver between top and bottom slides in cabinet.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 2 captive fasteners that secure receiver in cabinet.

2. Slide receiver fully into cabinet; secure with 2 captive fasteners.

3. At rear of receiver, connect ground wire to terminal E1 and secure with nut and lockwasher.

4. Connect and secure cables to receiver connectors J1 and J3 through J16.

5. Close and secure cabinet doors.

6. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.5.2 Analog-to-Digital Converter A2.

6-7.5.2.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, diagonal/cutter	1	25ag
Screwdriver, cross-tip	1	25ac

6-7.5.2.2 Removal. (Figures 65 and 66).

1. Open front and rear doors of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Primary ac power must be removed from analog-to-digital converter (A/DC) to protect equipment from being damaged.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. On front panel of A/DC A2, set POWER switch to OFF (down).

3. At front of cabinet remove 4 screws, lockwashers, and flat washers that secure A/DC in cabinet.

4. Using handles, withdraw A/DC part way out of cabinet.

5. Carefully release and disconnect all cable connectors.

6. Following the routing of the power cable, cut tie wraps and disconnect power cable from outlet.

7. Route the power cable under the bottom of the A/DC so that the end is hanging from the front of the converter.

8. Using handles, withdraw A/DC until drawer slides stop and lock.

CAUTION

HANDLING HAZARD

Converter weighs approximately 25 pounds. Use two technicians to support during removal.

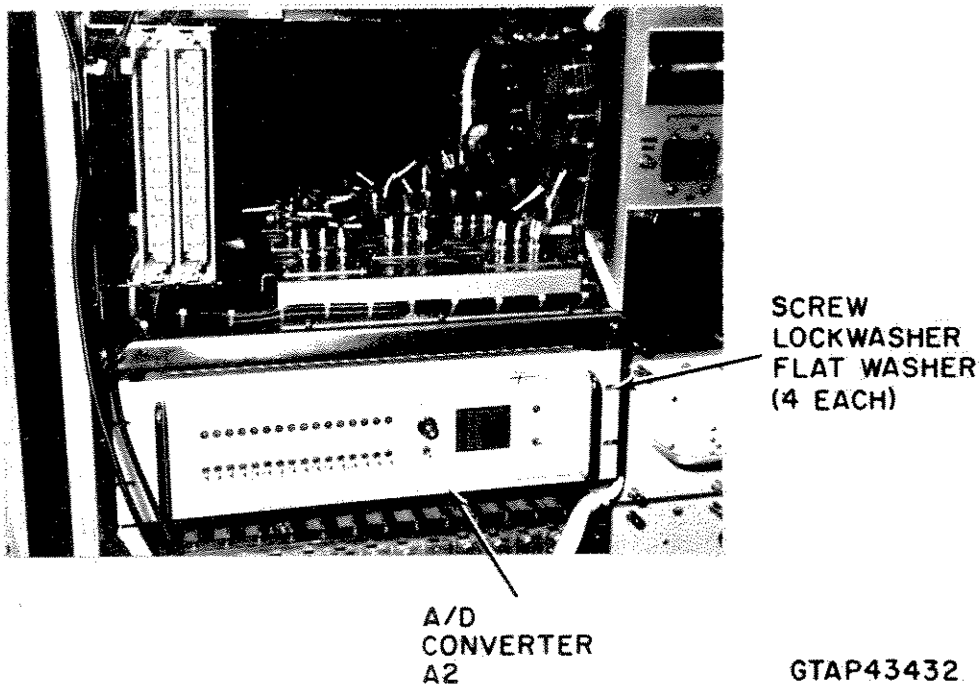


Figure 6-65. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Analog-to-Digital Converter A2

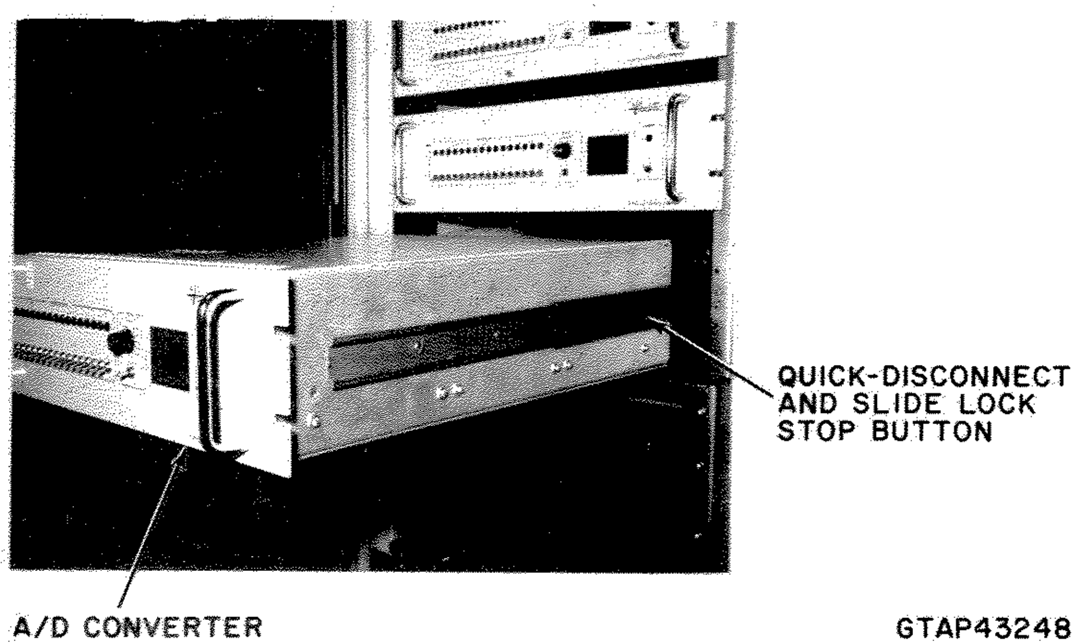


Figure 6-66. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Drawer Slide for Analog-to-Digital Converter A2

9. Supporting front and rear of A/DC, disengage quick-disconnect mechanisms on drawer slides (Figure 6-66); lift converter forward and out of drawer slide sections in cabinet.

6-7.5.2.3 Installation.

NOTE

If replacement is required, see TO 31P6-2FPS118-221 for any unique set-up procedures for this installation.

1. If replacement A/DC has a complete drawer slide assembly installed, remove the outer half of the drawer slide assembly prior to installation.

2. Push inward on drawer slide sections in cabinet to be sure both are locked in extended position.

CAUTION

HANDLING HAZARD

Converter weights approximately 25 pounds. Use two technicians to support during removal.

3. Supporting front and rear of A/D, align converter slide sections with cabinet slide sections; slide converter into cabinet until slide locks engage.

4. Route power cable toward rear of cabinet.

5. Disengage slide locks on both drawer slides (Figure 6-66); push converter part way into cabinet.

6. Connect and secure all cable connectors to A/DC; also connect power cable and secure with tie wraps.

CAUTION

EQUIPMENT DAMAGE HAZARD

To prevent damage when converter is pushed into cabinet, be sure cables at rear, including power cable, are clear of converter and drawer slides.

7. Push converter fully into cabinet.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of four screws that secure converter in cabinet.

8. Secure converter by installing 4 screws, lockwashers, and flat washers (Figure 6-65).

9. Close and secure rear cabinet door.

10. Perform pre-power equipment switch positioning in paragraph 4-6.1.2.

11. Close and secure cabinet door.

6-7.5.3 Frequency Calibrator A3.

6-7.5.3.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25ac

6-7.5.3.2 Removal. (Figure 6-67).

1. Open front and rear doors of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Frequency calibrator A3 contains an internal battery that is connected automatically to provide power whenever external power is interrupted. To avoid discharging the battery unnecessarily, see vendor manual for instructions.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Release and disconnect, the 2 coaxial cables from connectors on rear panel of calibrator A3; disconnect power cable from calibrator.

3. Remove 4 screws, lockwashers, and flat washers that secure calibrator A3 in cabinet.

4. Using handles on front panel, carefully withdraw calibrator A3 from cabinet. Support rear of calibrator during withdrawal and removal.

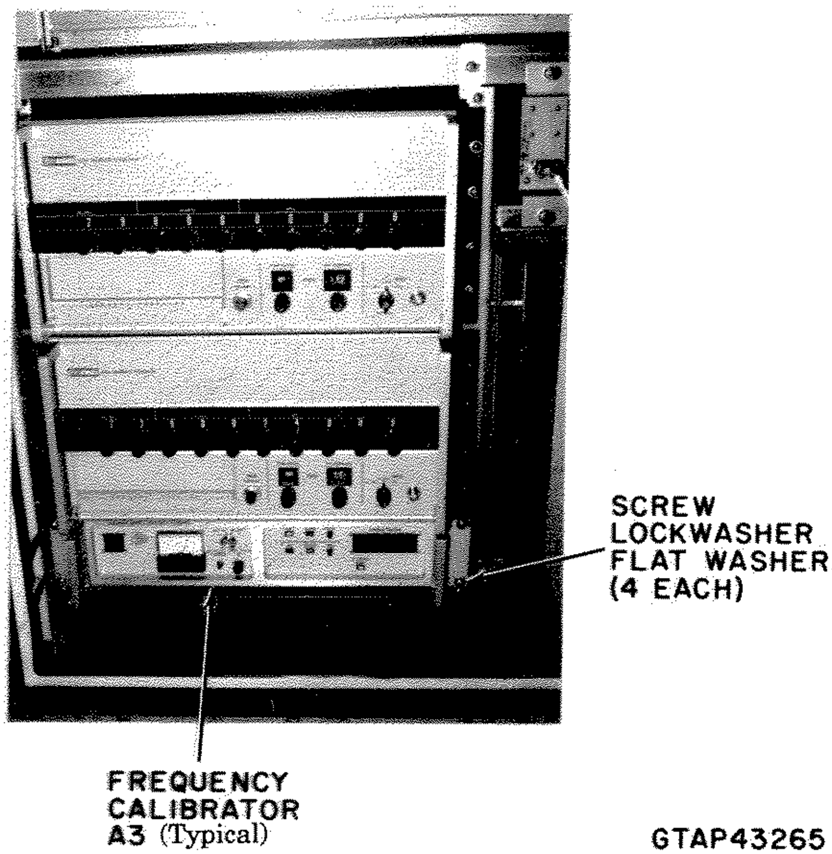


Figure 6-67. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Frequency Calibrator A3

6-7.5.3.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

To prevent damage when calibrator is pushed into cabinet, make sure cables at rear (including power cable) are clear of calibrator chassis and supporting angle brackets.

NOTE

If replacement is required see applicable technical manual as listed in Table 1-6 for any unique set-up procedures for this installation.

1. Carefully position rear of calibrator on supporting angle brackets in cabinet; slide calibrator fully into cabinet.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 4 screws that secure calibrator in cabinet.

2. Secure calibrator in cabinet by installing 4 screws, lockwashers, and flat washers.
3. At rear, connect and secure 2 coaxial cables to appropriate calibrator connectors; connect power cable to calibrator.
4. Perform the pre-power equipment switch positioning procedure in paragraph 4-6.1.2 for this equipment.
5. If replacement occurred in Unit 151, perform the frequency calibrator alignment procedure in paragraph 6-9.15.
6. Close and secure cabinet doors.

6-7.5.4 Frequency Synthesizers A4 and A5.

6-7.5.4.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25ac
Wrench, hex-head, set	1	32b

6-7.5.4.2 Removal. (Figure 6-68).

1. Open front and rear doors of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Primary ac power must be removed from frequency synthesizers to protect equipment from being damaged.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. On front panel of defective frequency synthesizer, press POWER switch to OFF.
3. Using hex-head wrench, disconnect multiple pin connector from rear of synthesizer (hex screw located in center of connector).
4. Release and disconnect cable connectors and power cable from rear of synthesizers.
5. Remove 8 screws, lockwashers, and flat washers that secure synthesizer in cabinet.

WARNING

WEIGHT HAZARD

Synthesizers weigh approximately 90 pounds. Use two technicians to lift and support synthesizer during removal and installation.

6. Using handles on front panel, partially withdraw synthesizer from cabinet.
   a. Support rear of synthesizer.
   b. Remove from cabinet.

6-7.5.4.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

To prevent damage when synthesizer is pushed into cabinet, be sure cables at rear (including power cable) are clear of synthesizer chassis and all supporting angle brackets.

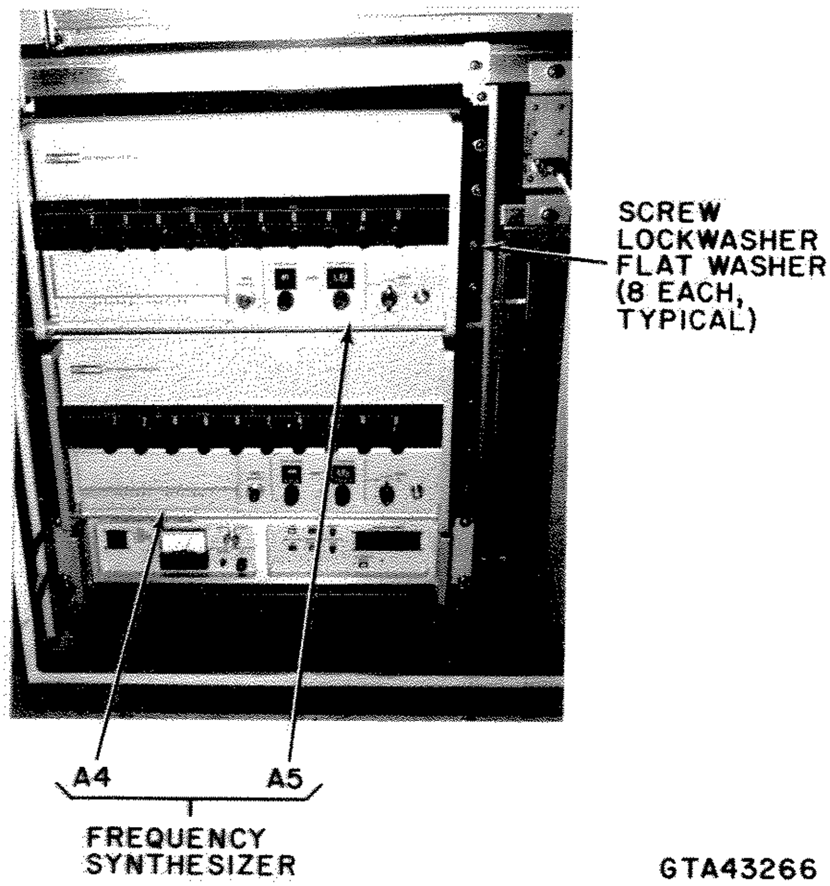


Figure 6-68. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Frequency Synthesizers A4 and A5

NOTE

If replacement is required see TO 33A1-5-389-1 for any unique set-up procedures for this installation.

1. Carefully position rear of replacement synthesizer on supporting angle brackets in cabinet; slide synthesizer fully into cabinet.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 8 screws that secure synthesizer in cabinet.

2. Secure synthesizer in cabinet by installing 8 screws, lockwashers, and flat washers.
3. Using hex-head wrench, connect and secure multiple pin connector on rear of synthesizer.
4. Connect and secure remaining cable connectors and power cable on rear of synthesizers.
5. Perform pre-power equipment switch positioning procedure in paragraph 4-6.1.2 for this equipment.
6. Close and secure cabinet doors.
7. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.5.5 Power Supplies A6 through A13.

6-7.5.5.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Pliers, connector	1	25v
Screwdriver, flat blade	1	25ad

6-7.5.5.2 Removal. (Figures 6-69 and 6-70).

1. Open front door of cabinet to remove power supply A6 through A9; open rear door of cabinet to remove power supply A10 through A13.

CAUTION

EQUIPMENT DAMAGE HAZARD

Primary ac power must be removed from power supplies to protect equipment from being damaged.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

Circuit breakers are located in panel above power supplies.

2. Turn off power supply by setting circuit breaker for power supply being removed to OFF.
3. Disconnect wiring harness from output connector J2 on power supply (Figure 6-69 or 6-70).
4. Loosen 6 captive fasteners that secure power supply in cabinet.
5. Withdraw power supply far enough to access input connector J1 behind front panel of power supply.
6. Disconnect wiring harness from input connector J1 on power supply.
7. Remove power supply from cabinet.

6-7.5.5.3 Installation.

1. Ensure circuit breaker for power supply being installed is set to OFF.
2. Partially install power supply in cabinet and connect and secure wiring harness to input connector J1 on power supply.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 6 captive fasteners that secure power supply in cabinet.

3. Slide power supply fully into cabinet until 2 locator holes in front panel are seated on 2 positioning pins (Figure 6-69 or 6-70).
4. Tighten 6 captive fasteners that secure power supply in cabinet.
5. Connect and secure wiring harness to output connector J2.
6. Set circuit breaker for replacement power supply to ON.
7. Close and secure cabinet door.

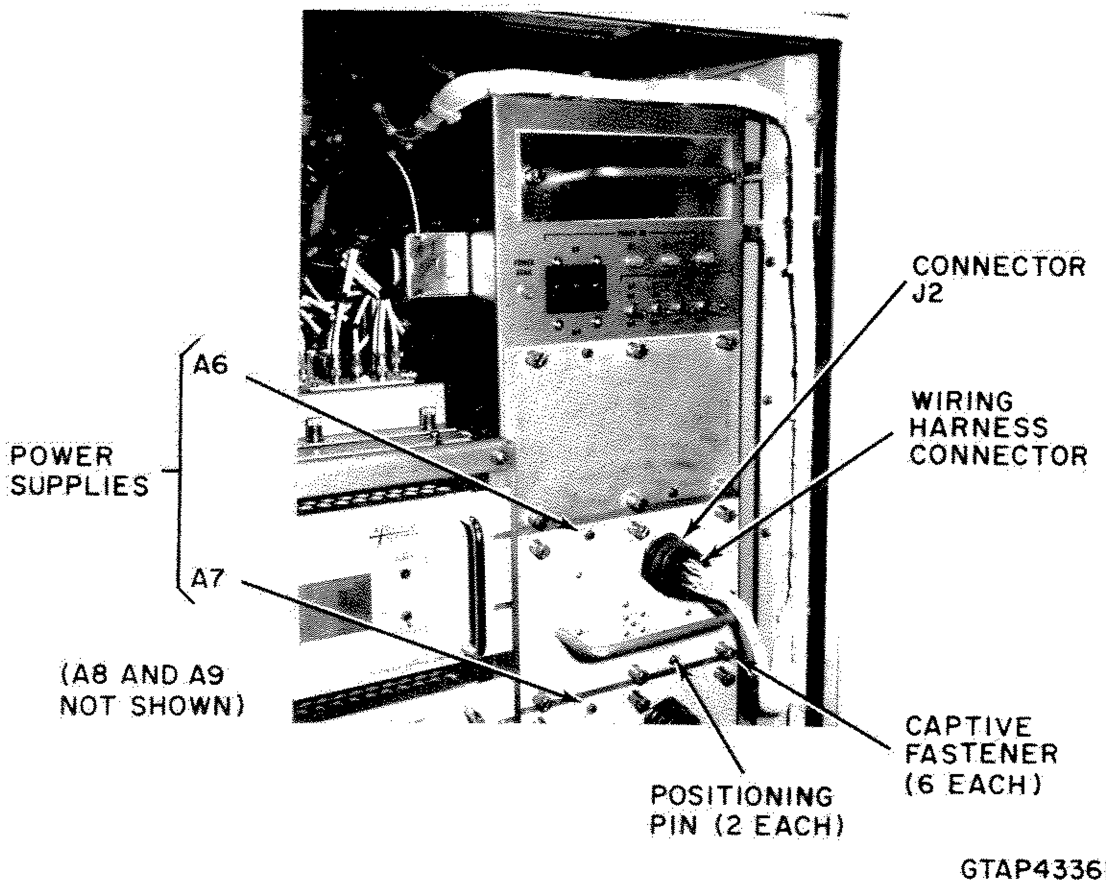


Figure 6-69. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Power Supplies A6 through A9

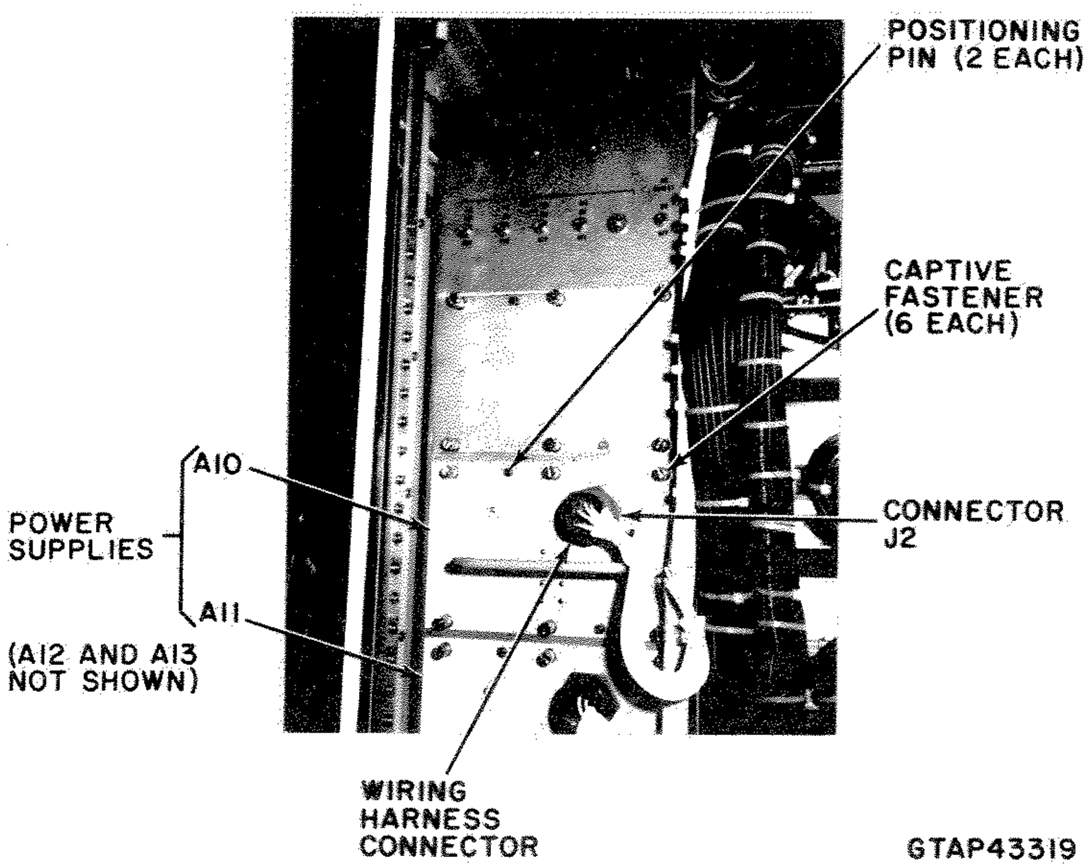


Figure 6-70. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Power Supplies A10 through A13

6-7.5.6 Fan Assembly A14.

6-7.5.6.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, flat blade	1	25ad
Screwdriver, flat blade	1	25ae

6-7.5.6.2 Removal. (Figure 6-71).

WARNING

HIGH VOLTAGE HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V, 3-phase, 60-Hz, ac power.

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3, and overtemperature switches S1 and S2.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
2. Remove primary ac power from cabinet.
   a. Set applicable circuit breaker in Table 6-15 to OFF.
   b. Tag with maintenance-in-progress sign.
   c. Open front door of cabinet.
   d. Observe that POWER AVAIL lamp DS1 is not lit.
   e. Verify fans are not operating.
3. Loosen 6 captive fasteners that secure dummy plate to cabinet; remove dummy plate to cabinet; remove dummy plate.
4. Release and disconnect harness connector P88 from fan assembly connector P1.
5. Loosen 2 captive fasteners that secure fan assembly in cabinet; remove fan assembly and wiring harness.
6. Support bottom of fan assembly and remove from cabinet.

6-7.5.6.3 Installation.

1. Insert fan assembly for convenient support while connection is made.
2. Connect and secure wiring harness connector P88 to fan assembly connector P1.
3. Restore primary power to cabinet.
4. Check for proper operation of fans.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 2 captive fasteners that secure fan assembly in cabinet.

5. Slide fan assembly fully into cabinet. Ensure positioning pin at rear is seated in locator hole in fan assembly.
6. Tighten 2 captive fasteners that secure fan assembly in cabinet.
7. Position dummy plate and tighten 6 captive fasteners that secure plate to cabinet.
8. Close and secure cabinet door.
9. Restart mission using the TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.

6-7.5.7 Transfer Switch Assembly A15.

6-7.5.7.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Screwdriver, flat blade	1	25ad
Screwdriver, flat blade	1	25ae
Wrench, box/open, set	1	32a

6-7.5.7.2 Removal. (Figure 6-72).

1. Open front door of cabinet.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

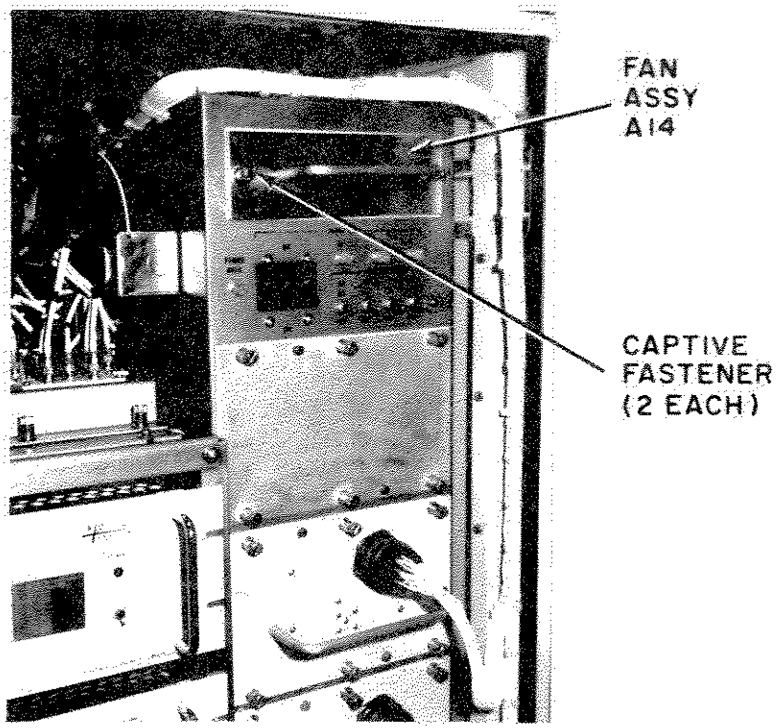


Figure 6-71. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Fan Assembly A14

Table 6-15. (V)1 Exciter/Auxiliary Exciter Primary Power Circuit Breakers[1]

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1	310J	CB1	Exciter, Unit 151
1	310J	CB2	Auxiliary Exciter, Unit 152
2,3	305E	CB8	Exciter, Unit 151
2,3	305E	CB9	Auxiliary Exciter, Unit 152

[1]See FO-1(V)1 for circuit breaker panel locations.

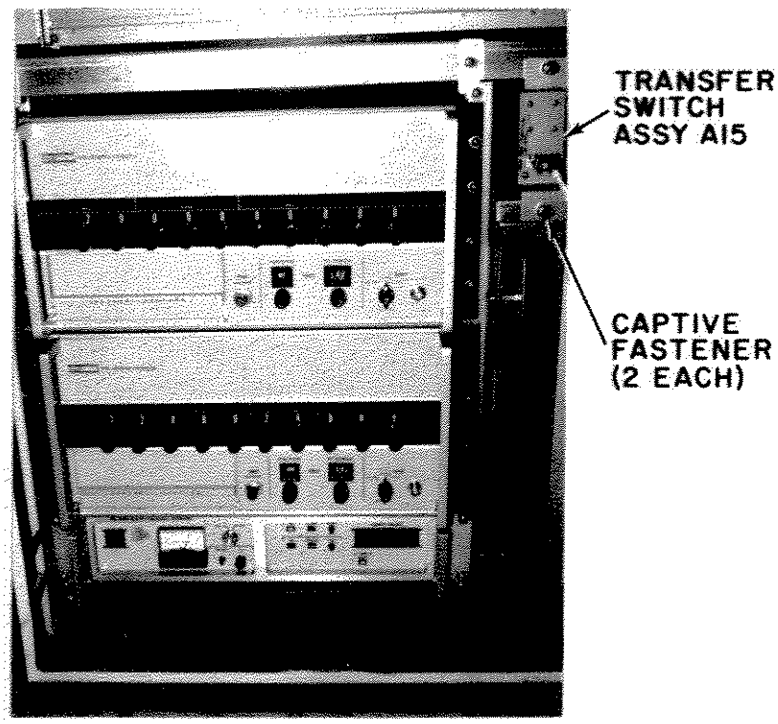


Figure 6-72. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Transfer Switch Assembly A15

Table 6-15. (V)2 Exciter/Auxiliary Exciter Primary Power Circuit Breakers[1]

Segment	Circuit Breaker Panel	Circuit Breaker	Destination
1,2,3	305E	CB20	Exciter, Unit 151
1,2,3	305E	CB25	Auxiliary Exciter, Unit 152

[1]See FO-1(V)2 for circuit breaker panel locations.

2. Disconnect front cable connector from switch S1.

3. Loosen 2 captive fasteners that secure transfer switch assembly to cabinet; disconnect 2 cable connectors on switch assembly and remove assembly.

6-7.5.7.3 Installation.

NOTE

If dummy load is not installed on RF1 jack of replacement switch, remove dummy load from old switch and install on new switch prior to installing switch in cabinet.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 2 captive fasteners that secure transfer switch assembly A15 to cabinet.

1. Connect and secure 2 cable connectors on switch assembly.

2. With transfer switch in position, secure by tightening 2 captive fasteners.

3. Connect and secure J1 on transfer switch assembly.

4. Close and secure cabinet door.

5. Refer to paragraph 6-9.17 and determine if alignment is required.

6-7.5.8 Power Supply A16.

6-7.5.8.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ae

6-7.5.8.2 Removal. (Figures 6-73 and 6-74).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been acomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC.

   For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.

2. Open rear door of cabinet.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of power supply. While output voltage is low, the current can cause a severe burn.

3. On circuit breaker panel located at top left of cabinet, set POWER SUPPLY A10 through A13 circuit breakers CB6 through CB9 to OFF (Figure 6-73).

4. At power supply A16 located near top right of cabinet, tag lead wires and jumper wires as necessary to identify correct connections (Figure 6-74).

5. Disconnect lead wire terminal lugs from terminal board connectors 2, 4, 8, and 10.

6. Remove 4 screws and lockwashers that secure power supply chassis to cabinet; remove power supply and chassis.

7. Disconnect terminal lugs on jumper wires from terminal board connector pairs 3 and 7, 9 and 12, and 11 and 14.

6-7.5.8.3 Installation.

1. Connect terminal lugs on jumper wires to terminal board connector pairs 3 and 7, 9 and 12, and 11 and 14, as identified during removal.

2. Position replacement power supply and chassis on cabinet; secure chassis to cabinet with 4 screws and lockwashers (Figure 6-74).

3. Connect lead wire terminal lugs to terminal board connectors 2, 4, 8, and 10, as identified during removal.

4. On circuit breaker panel, set POWER SUPPLY A10 through A13 circuit breakers CB6 through CB9 to ON (Figure 6-73).

5. Close and secure rear door of cabinet.

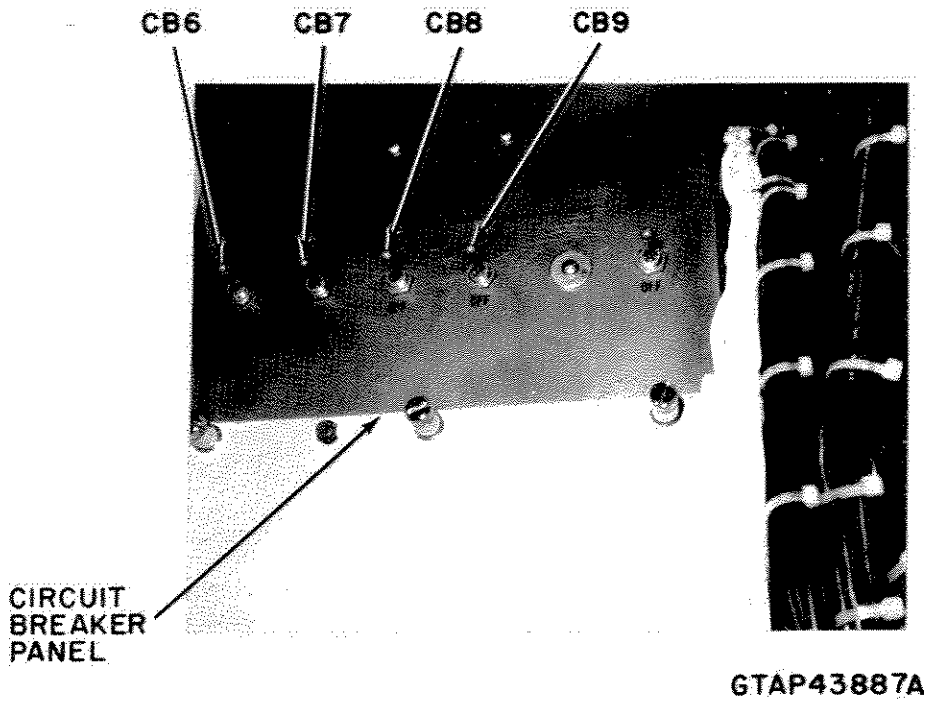


Figure 6-73. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Circuit Breakers for Power Supply A16 (via Power Supplies A10 through A13)

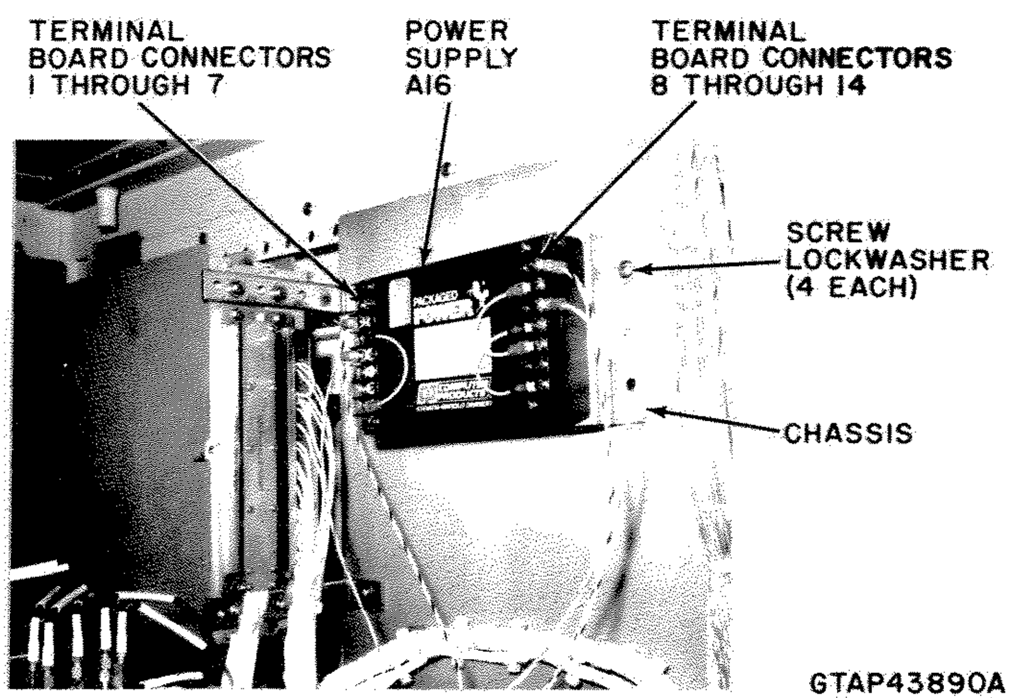


Figure 6-74. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Power Supply A16

6. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.9 3-Pole POWER ON Circuit Breaker CB1.

6-7.5.9.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Wrench, box/open, set	1	32a

6-7.5.9.2 Removal. (Figure 6-75).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.

2. Remove primary ac power from cabinet.

   a. Set applicable circuit breaker in Table 6-15 to OFF.

   b. Tag with maintenance-in-progress sign.

   c. Open front door of cabinet.

   d. Observe POWER AVAIL lamp DS1 is not lit (Figure 6-75).

   e. Verify fans are not operating.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3, and overtemperature S1 and S2.

3. Loosen 6 captive fasteners on dummy plate below circuit breakers; remove dummy plate.

4. Remove 4 screws, lockwashers, and flat washers that secure CB1 to panel; rotate rear of CB1 down.

5. Tag wires connected to 6 terminal studs on circuit breaker CB1, as necessary, to identify correct connections.

6. Remove 6 nuts and washers from 6 terminal studs on CB1; disconnect all wire terminal lugs from studs.

6-7.5.9.3 Installation.

1. Remove 6 nuts and flat washers from 6 terminal studs on replacement circuit breaker; be sure one flat washer remains on each terminal stud.

2. Make sure circuit breaker is oriented correctly. Connect wire terminal lugs to terminal studs, as identified during removal; secure connections with 6 nuts and flat washers.

3. Position circuit breaker in panel opening. Ensure that wires are not pinched between circuit breaker and panel. Secure circuit breaker with 4 screws, lockwashers, and flat washers.

4. Ensure that replacement circuit breaker is in the OFF position.

5. Restore primary ac power to cabinet.

   a. Observe that POWER AVAIL lamp DS1 is lit (Figure 6-75).

   b. Remove maintenance-in-progress sign.

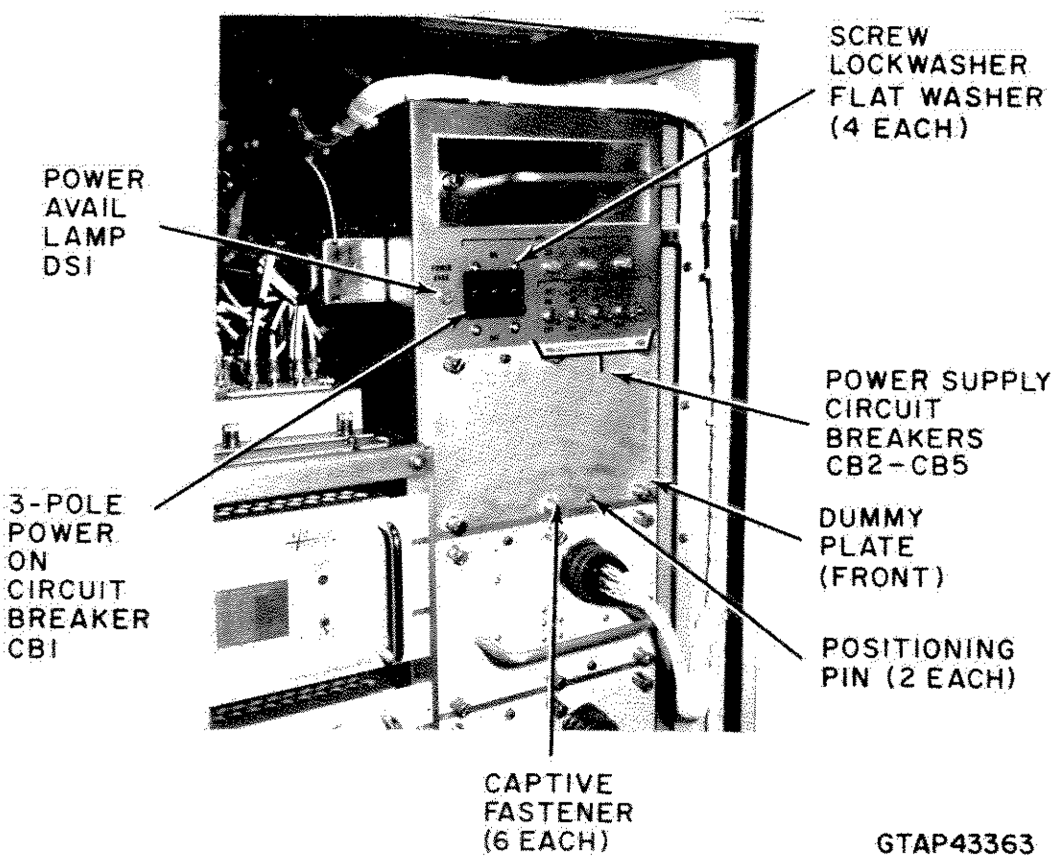


Figure 6-75. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Circuit Breakers CB1 through CB5 and Dummy Plate (Front)

6. Set POWER ON circuit breaker CB1 to ON; observe that POWER ON ØA, ØB, and ØC lamps DS2 through DS4 are lit.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of captive fasteners that secure dummy plates to access openings.

7. Position front dummy plate over access opening; secure with 6 captive fasteners.

8. Close and secure cabinet doors.

9. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.10 POWER SUPPLY Circuit Breakers CB2 through CB9 and AC OUTLET Circuit Breaker CB10.

6-7.5.10.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Marker, wire	A/R	31k
Pliers, needlenose	1	25m
Screwdriver, flat blade	1	25ad
Soldering station	1	29e
Wrench, box/open, set	1	32a

6-7.5.10.2 Removal. (Figure 6-76).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.

2. Remove primary ac power from cabinet.

   a. Set applicable circuit breaker in Table 6-15 to OFF.

   b. Tag with maintenance-in-progress sign.

   c. Open front door of cabinet.

   d. Observe POWER AVAIL lamp DS1 is not lit.

   e. Verify fans are not operating.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3, and overtemperature S1 and S2.

NOTE

If CB2 through CB5 are being removed perform step 4 below and omit step 5. If CB6 through CB10 are being removed, omit step 4 below and perform step 5.

3. Loosen 6 captive fasteners on dummy plate below circuit breakers; remove dummy plate.

4. Open rear door of cabinet; remove dummy plate as in step 4 (Figure 6-76).

5. Remove nut and lockwasher that secure circuit breaker to panel; remove circuit breaker.

6. Tag wires soldered to 2 main terminals on circuit breaker being removed, as necessary, to identify correct connections.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

7. Unsolder and disconnect wires from circuit breaker terminals.

6-7.5.10.3 Installation.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

1. Connect and solder wires to main terminals, as identified during removal.
2. Position replacement circuit breaker in panel opening; secure with lockwasher and nut.
3. Ensure replacement circuit breaker is in the OFF position.
4. Restore primary ac power to cabinet.
   a. Observe that POWER AVAIL lamp DS1 is lit (Figure 6-75).
   b. Remove maintenance-in-progress sign.
5. Set replacement circuit breaker to ON.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of captive fasteners.

6. Position dummy plate over access opening and secure with 6 captive fasteners.
7. Close and secure cabinet doors.
8. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.11 Radio Frequency Interference Filters FL1 through FL4.

6-7.5.11.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Marker, wire	A/R	31k
Pliers, diagonal/cutter	1	25ag
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Wrench, box/open	1	32i
Wrench, box/open, set	1	32a

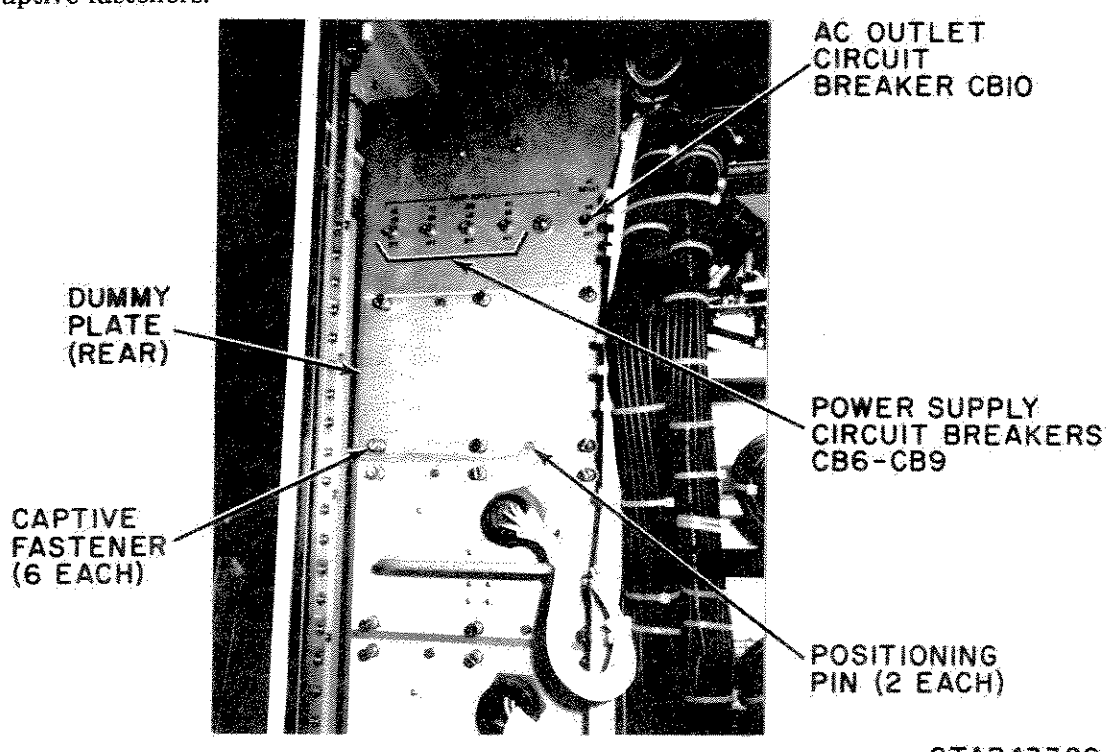


Figure 6-76. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Circuit Breakers CB6 through CB10 and Dummy Plate (Rear)

6-7.5.11.2 Removal. (Figure 6-77).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

ELECTRICAL SHOCK HAZARD

60 V power must be removed from cabinet to protect maintenance personnel from shock hazard.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.
2. Remove primary ac power from cabinet.
   a. Set applicable circuit breaker in Table 6-15 to OFF.
   b. Tag with maintenance-in-progress sign.
   c. Open front door of cabinet.
   d. Observe POWER AVAIL lamp DS1 is not lit.
   e. Verify fans are not operating.
3. Remove 60 V power from cabinet.
   a. Access top of cabinet using stepladder.
   b. Disconnect J6 and J7 from cabinet.
4. On top of cabinet, remove 6 screws, lockwashers, and flat washers that secure access cover to mounting support and junction panel; remove access panel.
5. At defective RFI filter, disconnect leadwire by removing screw and lockwasher from filter terminal.
6. Open rear door of cabinet.
7. Loosen 6 captive fasteners on rear dummy plate below circuit breakers; remove dummy plate.
8. Locate the 4 leadwires that are attached to the RFI filters (the 4 wires that are routed aft of the fan assembly).
9. Cut one tie wrap securing the 4 leadwires to the power supply box and any other tie wrap(s) that will allow sufficient slack in the 4 wires to perform step 11.
10. Loosen 2 B nuts on the flexible conduit.
11. By bending the flexible conduit, pull conduit out of the filter shield and power supply box conduit fittings.
12. On top of cabinet, remove 16 screws and lockwashers that secure filter shield to junction panel.
13. Lower filter shield; tag and disconnect 4 leadwires from RFI filter terminals.
14. Carefully remove filter shield from cabinet.
15. Remove large nut and lockwasher that secure defective RFI filter to junction panel; remove RFI filter.

6-7.5.11.3 Installation.

1. Position RFI filter through the opening in junction panel; secure with large lockwasher and nut.
2. Carefully position filter shield in cabinet and route 4 wires through conduit fitting.
3. Using lockwashers and screws, connect and secure 4 leadwires to RFI filter terminals.
4. Raise filter shield to junction panel.
5. By bending flexible conduit, install conduit into filter shield and power supply box conduit fittings.
6. On top of cabinet, secure filter shield to junction panel with 16 lockwashers and screws.
7. Connect and secure leadwire to RFI filter terminal with lockwasher and screw.
8. Tighten 2 B nuts on flexible conduit.
9. Position and secure wire bundle to power supply box standoff with tie wrap.
10. Install any other tie wraps that were removed during the removal procedure.
11. Install and secure dummy plate with 6 captive fasteners.

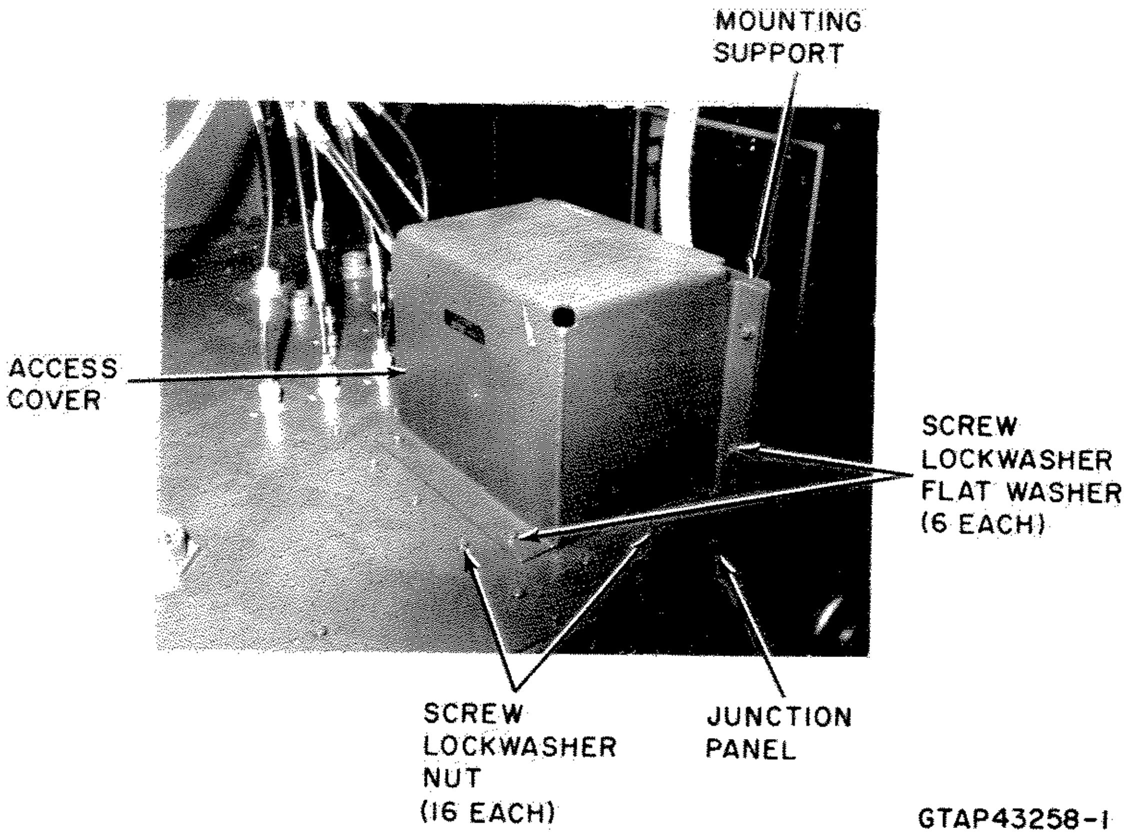
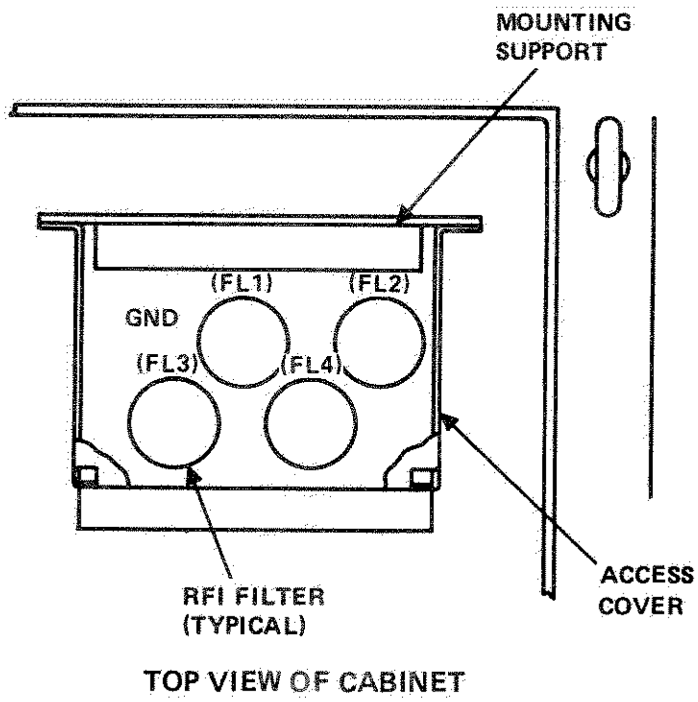


Figure 6-77. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Radio Frequency Interference Filters FL1 through FL4 (Sheet 1 of 2)



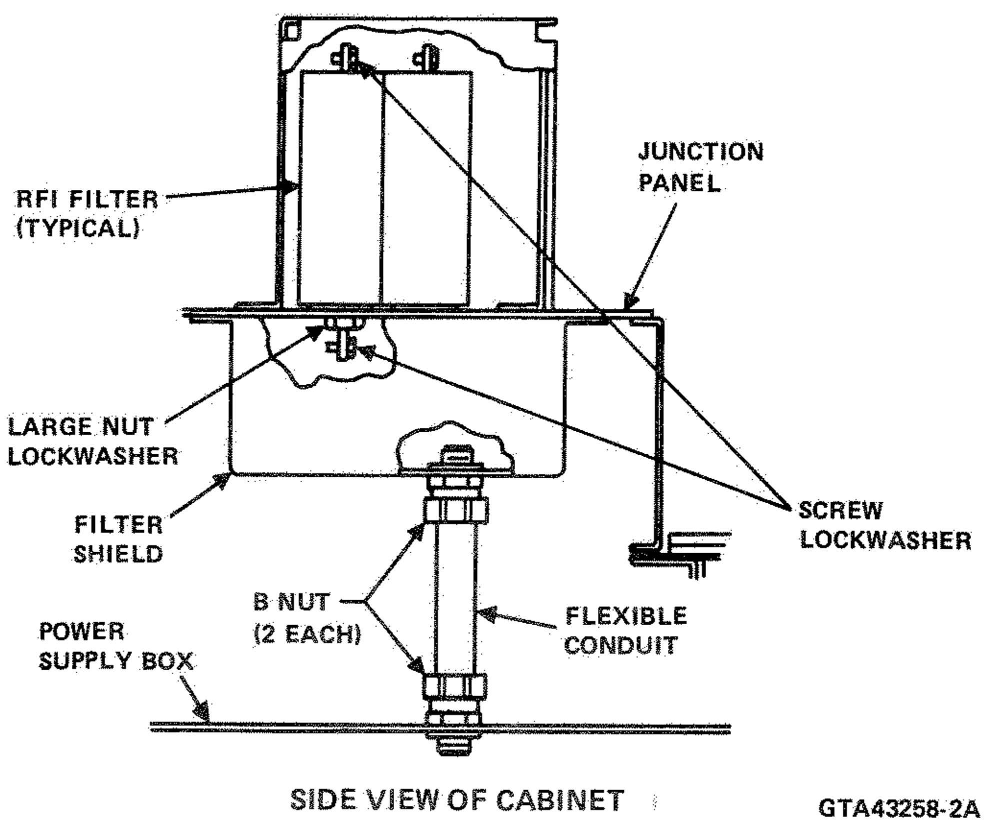


Figure 6-77. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Radio Frequency Interference Filters FL1 through FL4 (Sheet 2 of 2)

12. Position access cover over RFI filters and secure to mounting support and junction panel with 6 flat washers, lockwashers, and screws.
13. At top of cabinet connect J6 and J7 to junction panel.
14. Restore primary ac power to cabinet.
    a. Observe that POWER AVAIL lamp DS1 is lit.
    b. Remove maintenance-in-progress sign.
15. Close and secure cabinet doors.
16. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.12 Radio Frequency Filters FL5 or FL6.

6-7.5.12.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Wrench, box/open, set	1	32a

6-7.5.12.2 Removal.

1. Open rear door of cabinet.
2. Release and disconnect 2 cable connectors from filter (Figure 6-78).
3. Remove 4 nuts and lockwashers securing filter to bracket; remove filter.

6-7.5.12.3 Installation.

1. Position filter in bracket with jack numbers oriented as marked on bracket.
2. Secure filter with 4 nuts and lockwashers.
3. Reconnect 2 cables to jacks on filter.
4. Close and secure cabinet door.

6-7.5.13 Radio Frequency Power Dividers HY1 through HY8.

6-7.5.13.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Screwdriver, cross-tip	1	25ac
Wrench, box/open, set	1	32a

6-7.5.13.2 Removal. (Figure 6-79).

1. Open front door of cabinet to remove power dividers HY1 through HY6; open rear door of cabinet to remove power divider HY7 or HY8.
2. Using safety stepladder for access, release and disconnect 5 cable connectors from connectors J1 through J5 on power divider being removed.
3. Note orientation of power divider on divider plate assembly.
4. Remove 4 screws and lockwashers that secure power divider to divider plate assembly; remove power divider from cabinet.

6-7.5.13.3 Installation.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 4 screws that secure power divider to divider plate assembly.

1. Position power divider on divider plate assembly, oriented as noted during removal; secure with 4 screws and lockwashers.
2. Connect and secure 5 cable connectors to power divider connectors J1 through J5.
3. Close and secure cabinet doors.

6-7.5.14 Radio Frequency Power Divider HY9.

6-7.5.14.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Screwdriver, cross-tip	1	25ac
Wrench, box/open, set	1	32a

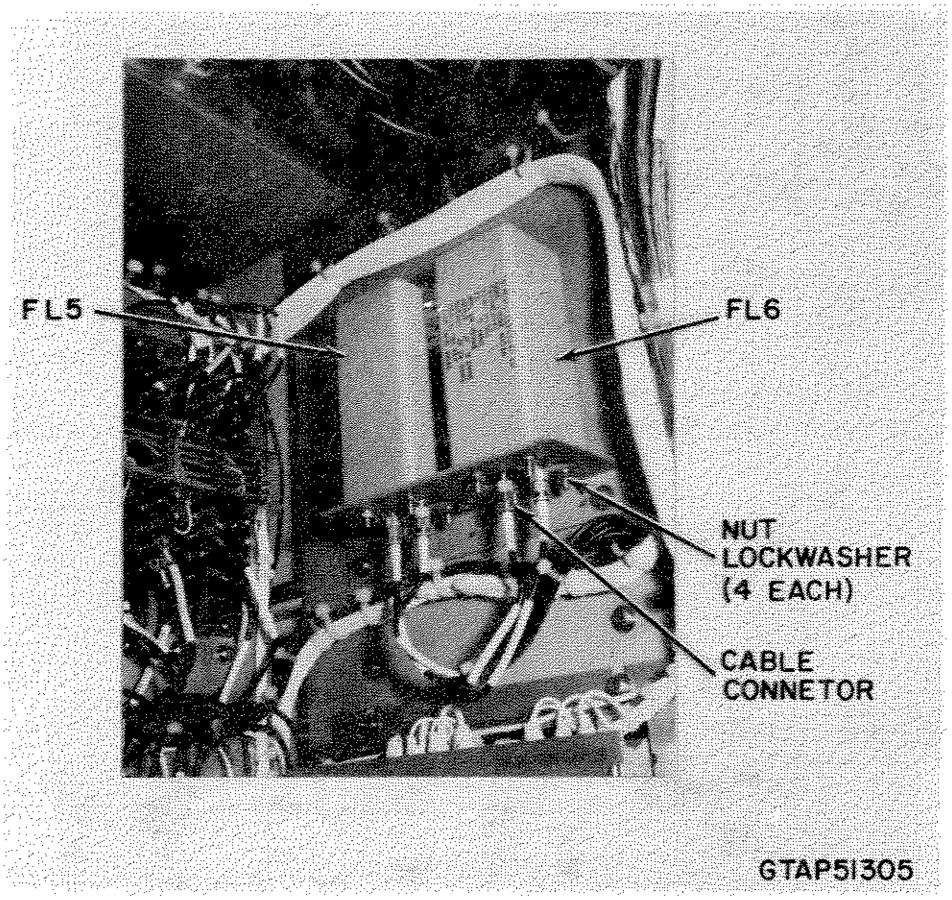


Figure 6-78. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Radio Frequency Filters FL5 and FL6

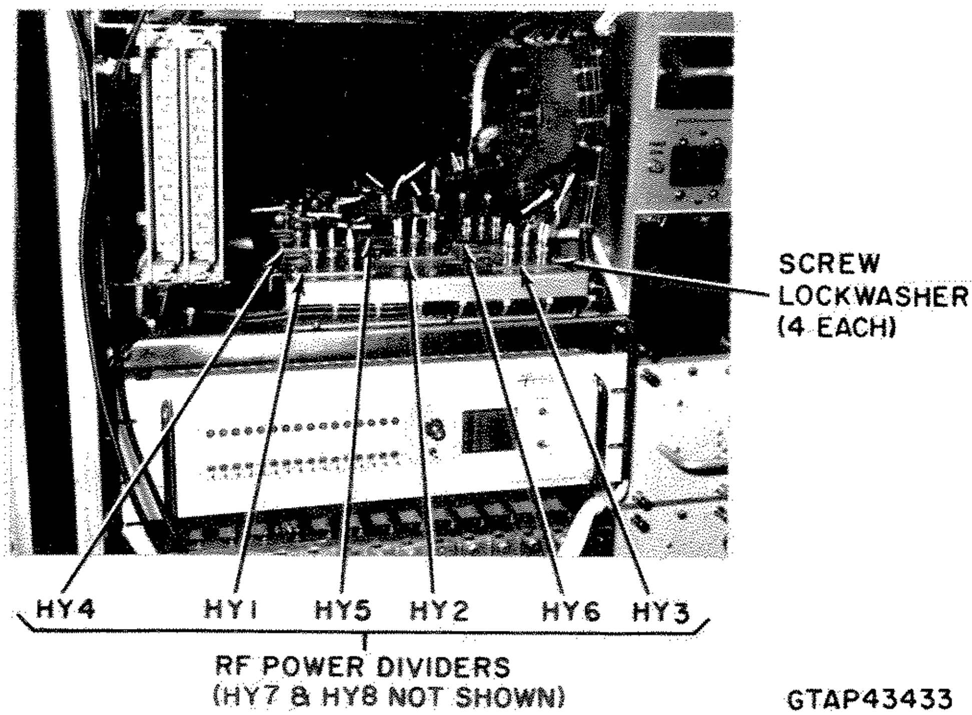


Figure 6-79. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Radio Frequency Power Dividers HY1 through HY8 (Sheet 1 of 2)

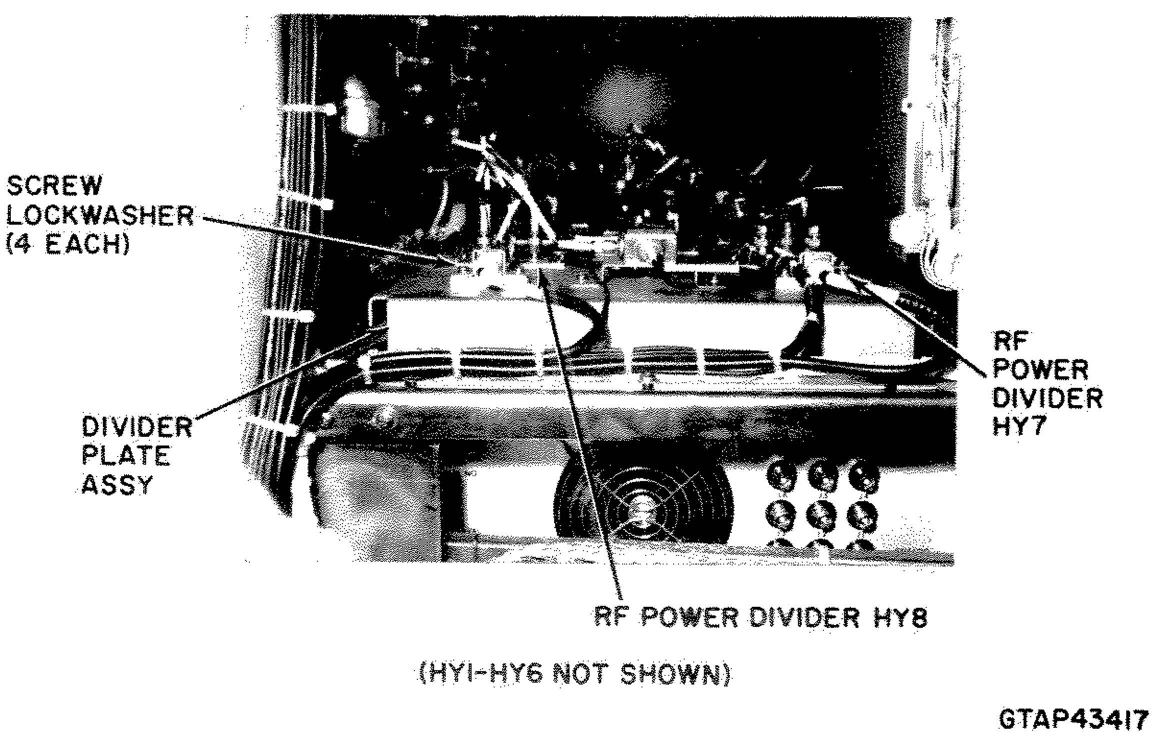


Figure 6-79. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Radio Frequency Power Dividers HY1 through HY8 (Sheet 2 of 2)

6-7.5.14.2 Removal. (Figure 6-80).

1. Open rear door of cabinet.
2. Using safety stepladder for access, release and disconnect 3 cable connectors from power divider connectors B, C, and D.
3. Note orientation of power divider on divider plate assembly.
4. Remove 2 screws, lockwashers, and flat washers that secure divider bracket to divider plate assembly; remove divider bracket with power divider attached.
5. Remove 2 screws and lockwashers that secure power divider to divider bracket; remove divider from bracket.

6-7.5.14.3 Installation.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 2 screws that secure power divider to divider bracket, and to threads of 2 screws that secure divider bracket to divider plate assembly.

1. Position replacement power divider on divider bracket; secure with 2 screws and lockwashers.
2. Position assembled divider bracket and power divider on divider plate assembly, with power divider oriented as noted during removal; secure with 2 screws, lockwashers, and flat washers.
3. Connect and secure 3 cable connectors to power divider connectors B, C, and D.
4. Close and secure cabinet doors.

6-7.5.15 Relays K1 and K2.

6-7.5.15.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Light trouble/ extension	1	25s
Marker, wire	A/R	31k
Pliers, diagonal/cutter	1	25ag
Pliers, needlenose	1	25m
Screwdriver, cross-tip	1	25ac
Soldering station	1	29e
Wrench, box/open, set	1	32a

6-7.5.15.2 Removal. (Figure 6-81).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.
2. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS2 through DS4 are not lit.
   c. Verify fans are not operating.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power must be removed from cabinet to protect maintenance personnel from shock hazard.

4. Remove 60 V power from cabinet.
   a. Access top of cabinet using stepladder.
   b. Disconnect J6 and J7 from cabinet.
5. Using stepladder for access to top of cabinet, remove 4 screws and lockwashers securing relay bracket to top of cabinet.
6. Inside top of cabinet, cut 2 tie wraps securing relay wiring harness to top of cabinet while supporting relay bracket.
7. Move relay bracket with attached harness to a convenient working position near center of cabinet.

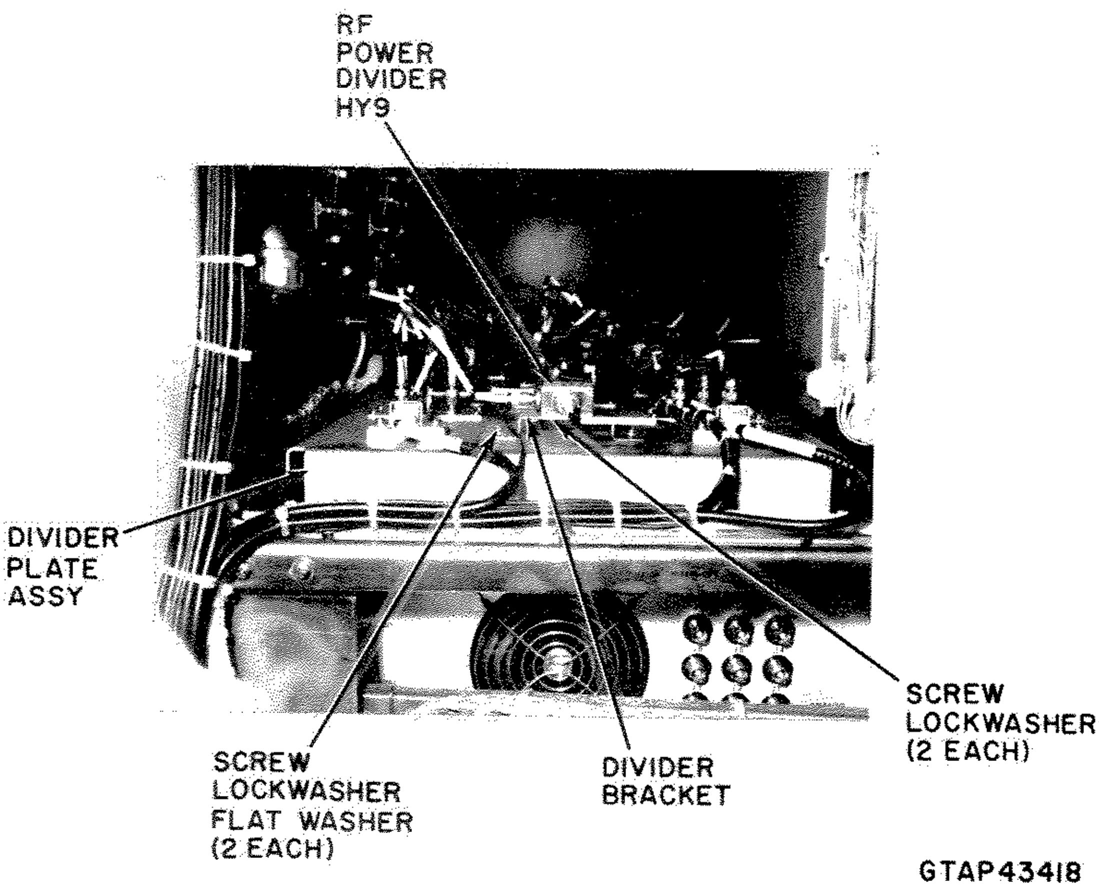


Figure 6-80. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Radio Frequency Power Divider HY9

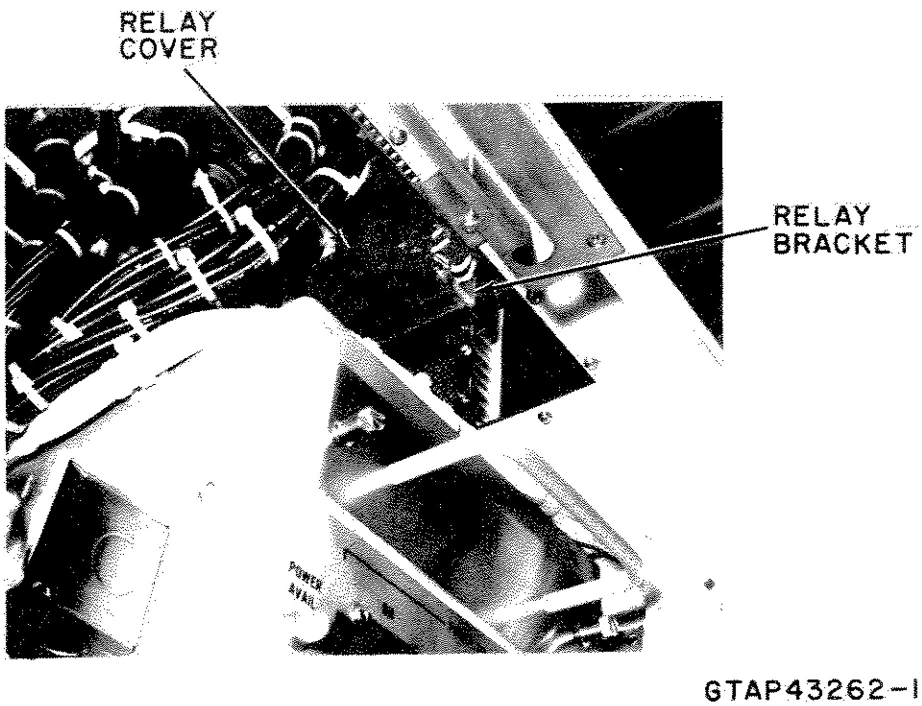


Figure 6-81. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Relays K1 and K2
(Sheet 1 of 2)

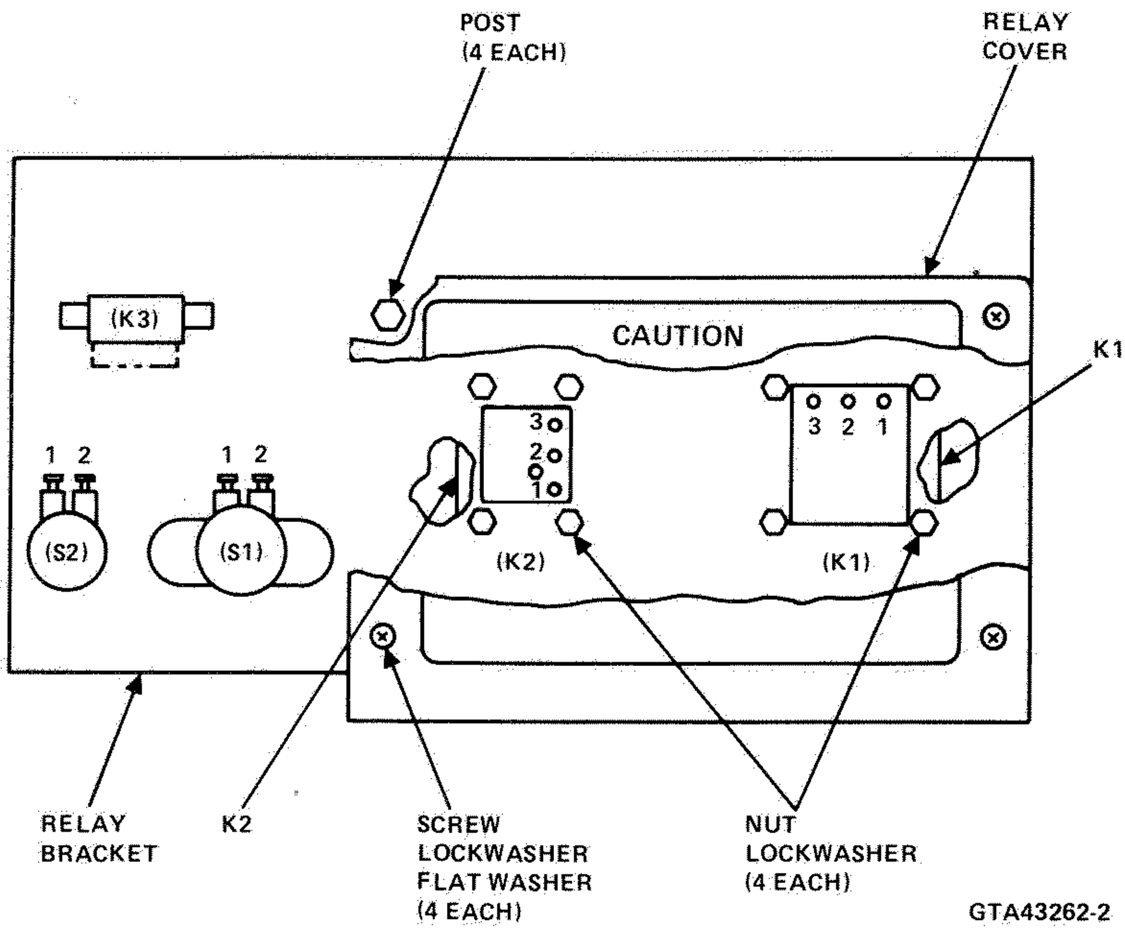


Figure 6-81. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Relays K1 and K2
(Sheet 2 of 2)

8. Remove 4 screws, lockwashers, and flat washers that secure relay cover to 4 posts on relay bracket; remove relay cover.

9. Tag wires soldered to terminals of defective relay, as necessary, to identify correct connections.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

10. Unsolder and disconnect wires from relay terminals.

NOTE

Observe orientation of relay on bracket to be sure replacement relay will be installed correctly.

11. Remove 4 nuts and lockwashers that secure relay to relay bracket; remove relay.

6-7.5.15.3 Installation.

1. Position replacement relay on relay bracket, oriented as noted during removal; secure with 4 nuts and lockwashers.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

2. Connect and solder wires to relay terminals, as identified during removal.

3. Position relay cover on posts; secure with 4 screws, lockwashers, and flat washers.

4. Position relay bracket and harness in original location at top of cabinet.

5. Secure relay bracket to top of cabinet with 4 screws and lockwashers.

6. Secure harness to cabinet with 2 tie wraps.

7. Reconnect J6 and J7 to cabinet.

8. Set 3-pole POWER ON circuit breaker CB1 to the ON position.

9. Close and secure cabinet doors.

10. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.16 Relay K3.

6-7.5.16.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Light, trouble/ extension	1	25s
Marker, wire	A/R	31k
Pliers, diagonal/cutter	1	25ag
Pliers, needlenose	1	25m
Screwdriver, cross-tip	1	25ab
Soldering station	1	29e
Wrench, box/open, set	1	32a

6-7.5.16.2 Removal. (Figure 6-82).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.

2. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

3. Remove primary ac power from cabinet.

   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.

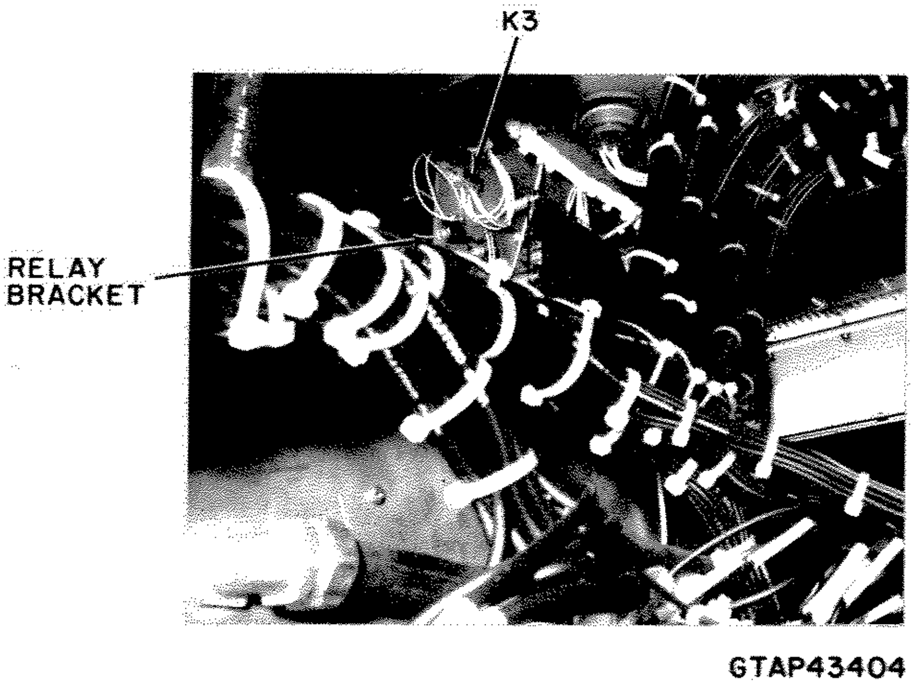


Figure 6-82. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Relay K3
(Sheet 1 of 2)

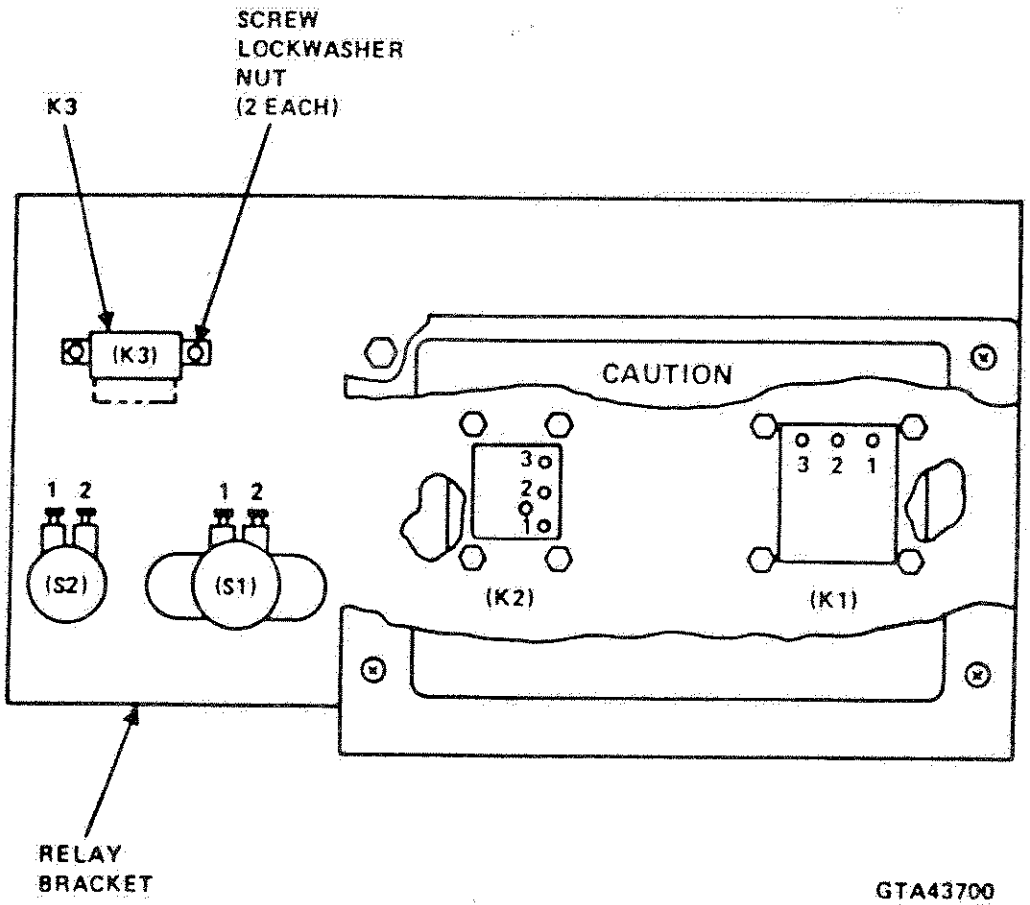


Figure 6-82. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Relay K3 (Sheet 2 of 2)

b. Observe that ØA, ØB, and ØC lamps DS2 through DS4 are not lit.

c. Verify fans are not operating.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power must be removed from cabinet to prot\ect maintenance personnel from shock hazard.

4. Remove 60 V power from cabinet.

a. Access top of cabinet using stepladder.

b. Disconnect J6 and J7 from cabinet.

5. Using stepladder for access to top of cabinet, remove 4 screws and lockwashers securing relay bracket to top of cabinet.

6. Inside top of cabinet, cut 2 tie wraps securing relay wiring harness to top of cabinet while supporting relay bracket.

7. Move relay bracket with attached harness to a convenient working position near center of cabinet.

8. Tag wires soldered to terminals of relay, as necessary, to identify correct connections.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

9. Unsolder and disconnect wires from relay terminals.

NOTE

Observe orientation of relay on bracket to be sure replacement relay will be installed correctly.

10. Remove 2 nuts, lock-washers, and screws that secure relay to relay bracket; remove relay.

6-7.5.16.3 Installation.

1. Position replacement relay on relay bracket, oriented as noted during removal; secure with 2 screws, lockwashers, and nuts.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

2. Connect and solder wires to relay terminals, as identified during removal.

3. Position relay bracket and harness in original location at top of cabinet.

4. Secure relay bracket to top of cabinet with 4 screws and lockwashers.

5. Secure harness to cabinet with 2 tie wraps.

6. Reconnect J6 and J7 to cabinet.

7. Set 3-pole POWER ON circuit breaker CB1 to ON.

8. Close and secure cabinet doors.

9. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.17 Printed Wiring Boards N1A1 through A13 and N2A1 through A13.

6-7.5.17.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Extractor, board	1	27b
Puller, board	1	27a
Screwdriver, flat blade	1	25ae
Wrist Strap	1	33i

6-7.5.17.2 Removal. (Figure 6-83).

1. Open front door of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25234. When not connected, keep ends of cable assembly leads isolated from ground.

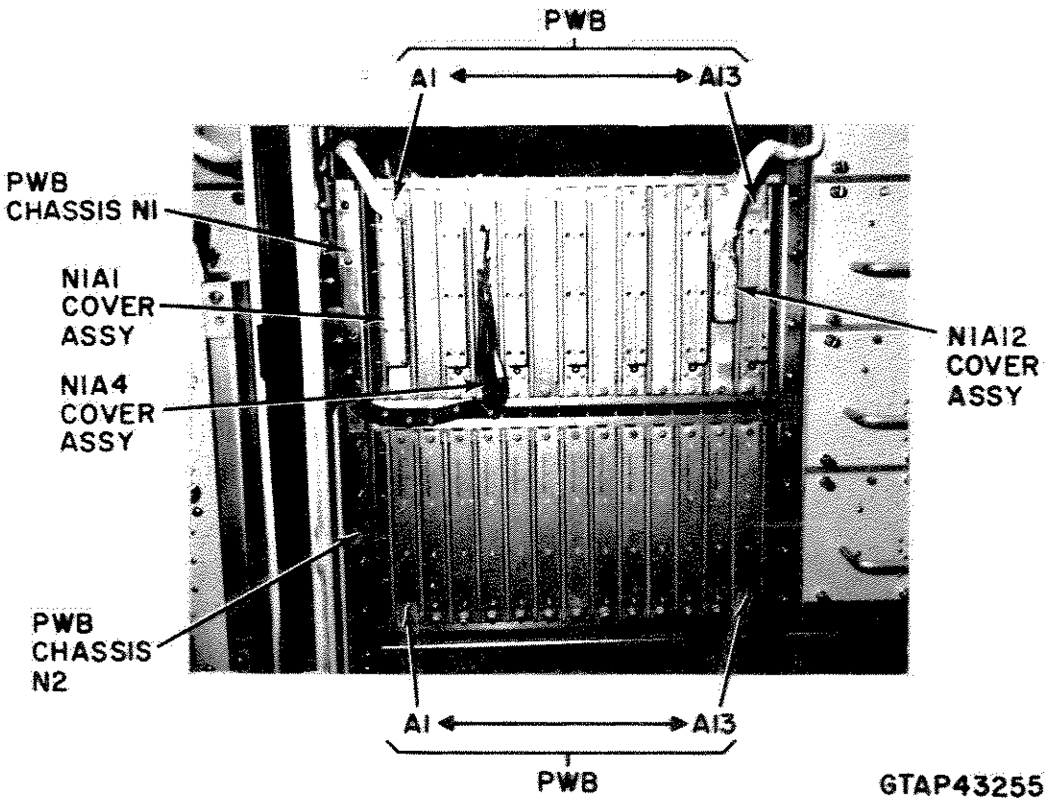


Figure 6-83. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Printed Wiring Board Chassis N1A1 through A13 and N2A1 through A13

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. N1A1 and N1A12.

CAUTION

EQUIPMENT DAMAGE HAZARD

The PWB cover assemblies for digital-to-analog (D/A) converter PWB N1A1 and sum taper attenuator PWB N1A12 include an electrical connector. Remove these 2 cover assemblies carefully to avoid damage to connector contacts.

a. Loosen 2 captive fasteners that secure PWB cover to PWB being removed and remove cover.

b. Note orientation of PWB in chassis.

c. Using board extractor (Table 1-4, Item 27b), remove PWB from chassis.

3. N1A3, A5, A7, A9, A11, and A13.

NOTE

The PWB cover assemblies for these PWBs are attached to and removed with the associated PWB.

a. Loosen 2 captive fasteners that secure PWB being removed to chassis and remove cover.

b. Note orientation of PWB in chassis.

c. Grasping the applicable PWB heatsink; wiggling PWB up and down, remove PWB from chassis.

4. N1A4.

a. Release and disconnect 5 coaxial cable connectors from PWB cover assembly.

b. Loosen 2 captive fasteners that secure PWB cover to PWB being removed.

c. Note orientation of PWB in chassis.

d. Grasping fasteners, wiggle PWB up and down and remove PWB from chassis.

5. N1A2, A6, A8 and A10 and N2A1 through N2A13.

a. Loosen 2 captive fasteners that secure PWB cover to PWB being removed and remove cover.

b. Note orientation of PWB in chassis.

c. Using board extractor (Table 1-4, Item 27a), remove PWB from chassis.

6-7.5.17.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

The PWBs are mechanically indexed to slot location. Forcing a wrong board into a slot may cause damage to indexing inserts on backplane. If wrong PWB has been inserted, check that indexing inserts have no\t been removed when PWB has removed from chassis.

1. N1A1 and N1A12.

a. Carefully insert PWB into holders (guides) in PWB chassis, oriented as noted during removal.

b. Press PWB into chassis until fully seated in socket connector.

CAUTION

EQUIPMENT DAMAGE HAZARD

The PWB cover assemblies for digital-to-analog (D/A) converter PWB N1A1 and sum taper attenuator PWB N1A12 include an electrical connector. Install these 2 cover assemblies carefully to avoid damage to connector contacts.

NOTE

If binding occurs, apply antiseize compound (Table 6-1, Item 21) to threads of captive fasteners.

c. Install and secure the cover assembly with 2 captive fasteners.

d. Refer to paragraph 6-9.17 and determine if alignment is required if N1A12 is replaced.

2. N1A3, A5, A7, A9, A11, and A13.

NOTE

If binding occurs, apply antiseize compound (Table 6-1, Item 21) to threads of captive fasteners.

a. Carefully insert PWB into holder (guides) in PWB chassis, oriented as noted during removal.

b. Press PWB into chassis until fully seated in socket connector and tighten 2 captive fasteners.

c. Refer to paragraph 6-9.17 and determine if alignment is required if N1A11 is replaced.

3. N1A4.

NOTE

If binding occurs, apply antiseize compound (Table 6-1, Item 21) to threads of captive fasteners.

a. Carefully insert PWB into holder (guides) in PWB chassis, orientated as noted during removal.

b. Press PWB into chassis until fully seated in socket connector and tighten 2 captive screws..

c. Connect and secure 5 coaxial cable connectors.

4. N1A2, A6, A8 and A10, and N2A1 through N2A13.

a. Carefully insert PWB into holder (guides) in PWB chassis, orientated as noted during removal.

b. Press PWB into chassis until fully seated in socket connector.

NOTE

If binding occurs, apply antiseize compound (Table 6-1, Item 21) to threads of captive fasteners.

c. Replace PWB cover and tighten 2 captive fasteners.

6-7.5.18 Printed Wiring Boards N3A101 through A116.

6-7.5.18.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Wrist strap	1	33i

6-7.5.18.2 Removal. (Figure 6-84).

1. Open front door of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Operate 2 spring-loaded release rods on PWB retainer panel of PWB chassis; open retainer panel.

3. Note orientation of PWB in chassis.

4. Carefully and evenly operate 2 inserter/extractor levers on PWB to disconnect; remove PWB from chassis.

6-7.5.18.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

The PWB are mechanically indexed to slot location. Forcing a wrong board into a slot may cause damage to indexing inserts on backplane. If the wrong PWB has been inserted, check that indexing inserts have not been removed when PWB was removed from chassis.

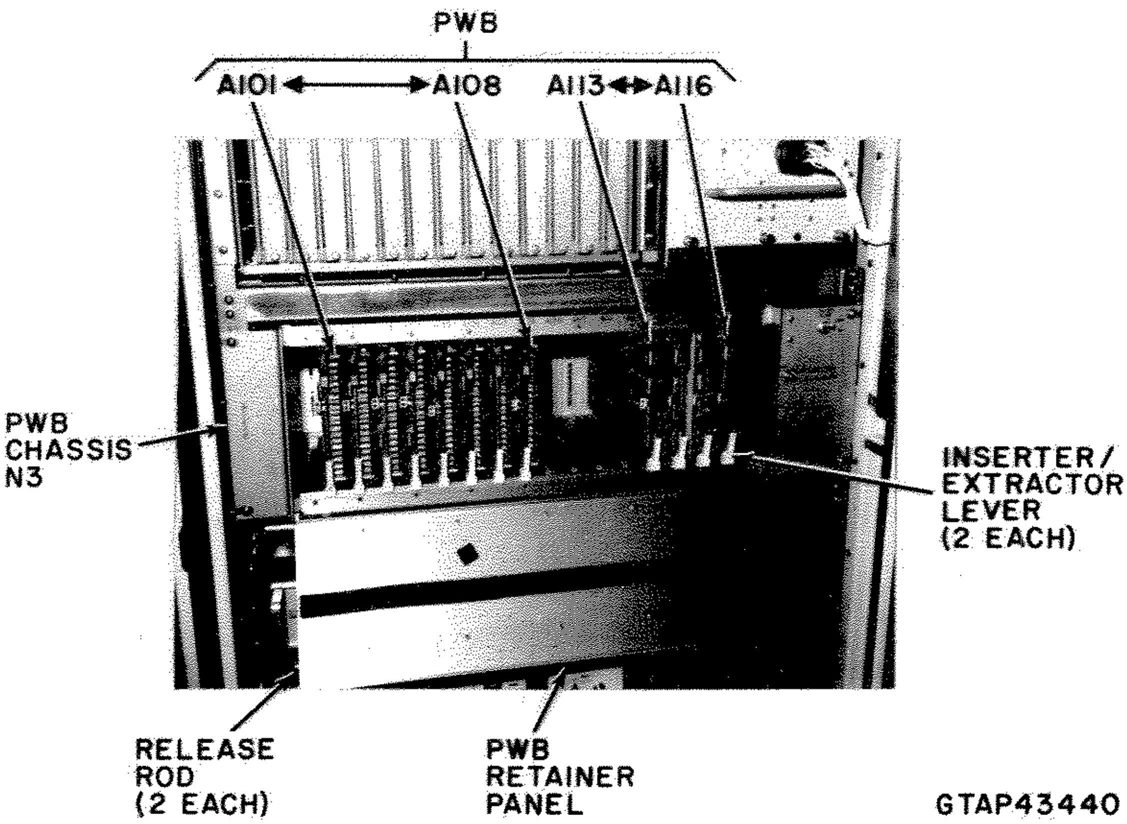


Figure 6-84. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Printed Wiring Board Chassis N3A101 through A116 with Retainer Panel Open

1. Carefully insert PWB partially into guides in chassis, oriented as noted during removal.
2. Raise inserter/extractor levers; continue inserting PWB until opposite ends of levers are under lip of chassis.
3. Carefully and evenly push 2 inserter/extractor levers to seat PWB fully into socket connector.
4. Close and secure PWB retainer panel.
5. Close and secure cabinet doors.

6-7.5.19 Power Supply Controller Boards N4A1 and N4A2.

6-7.5.19.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Puller, board	1	27a
Screwdriver, flat blade	1	25ae
Wrist strap	1	33i

6-7.5.19.2 Removal. (Figure 6-85).

1. Open front door of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

2. Loosen 2 captive fasteners that secure PWB cover assembly over PWB being removed; remove cover assembly.
3. Note orientation of PWB in PWB assembly N4.
4. Using board puller (Table 1-4, Item 27a) remove PWB from PWB assembly N4.

6-7.5.19.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

The PWB are mechanically indexed to slot location. Forcing a wrong board into a slot may cause damage to indexing inserts on backplane. If the wrong PWB has been inserted, check that indexing inserts have not been removed when PWB was removed from chassis.

1. Carefully insert PWB into holders (guides) in PWB assembly N4, orientated as noted during removal.
2. Press PWB into PWB assembly until fully seated in socket connector.
3. Observe indicator lamps on front edge of PWB for correct indications. Refer to paragraph 4-6.1.4.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 2 captive fasteners on PWB cover assembly.

4. Position PWB cover assembly over PWB; tighten 2 captive fasteners.
5. Close and secure cabinet doors.

6-7.5.20 Overtemperature Fault Switch S1.

6-7.5.20.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Light trouble/ extension	1	25s
Marker, wire	A/R	31k
Pliers, diagonal/cutter	1	25ag
Pliers, needlenose	1	25m
Screwdriver, cross-tip	1	25ab
Soldering station	1	29e
Wrench, box/open, set	1	32a

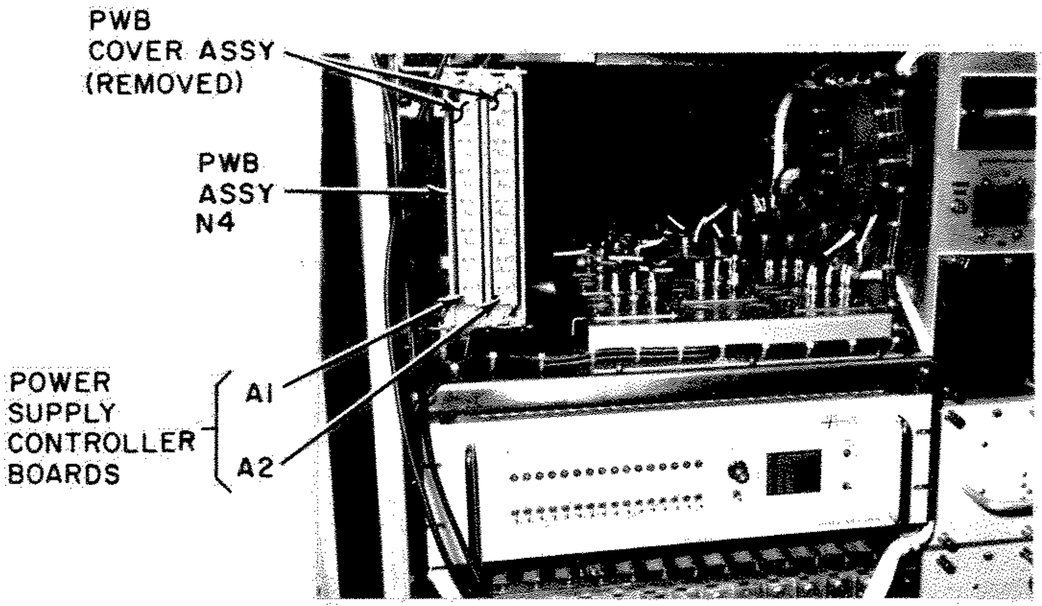


Figure 6-85. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Power Supply Controller Boards N4A1 and N4A2

6-7.5.20.2 Removal. (Figure 6-86).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.
2. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS2 through DS4 are not lit.
   c. Verify fans are not operating.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power must be removed from cabinet to protect maintenance personnel from shock hazard.

4. Remove 60 V power from cabinet.
   a. Access top of cabinet using stepladder.
   b. Disconnect J6 and J7 from cabinet.
5. Using stepladder for access to top of cabinet, remove 4 screws and lockwashers securing relay bracket to top of cabinet.
6. Inside top of cabinet, cut 2 tie wraps securing relay wiring harness to top of cabinet while supporting relay bracket.
7. Move relay bracket with attached harness to a convenient working position near center of cabinet.
8. Tag wires soldered to terminals of switch, as necessary, to identify correct connections.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

9. Unsolder and disconnect wires from switch terminals.

NOTE

Observe orientation of switch on bracket to be sure replacement switch is installed correctly.

10. Remove 2 nuts, lockwashers, and screws that secure switch to relay bracket; remove switch.

6-7.5.20.3 Installation.

1. Position switch on relay bracket, oriented as noted during removal; secure with 2 screws, lockwashers, and nuts.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

2. Connect and solder wires to switch terminals, as identified during removal.
3. Position relay bracket and harness in original location at top of cabinet.
4. Secure relay bracket to top of cabinet with 4 screws and lockwashers.
5. Secure harness to cabinet with 2 tie wraps.
6. Reconnect J6 and J7 to cabinet.
7. Set 3-pole POWER ON circuit breaker CB1 to the ON.
8. Close and secure cabinet doors.

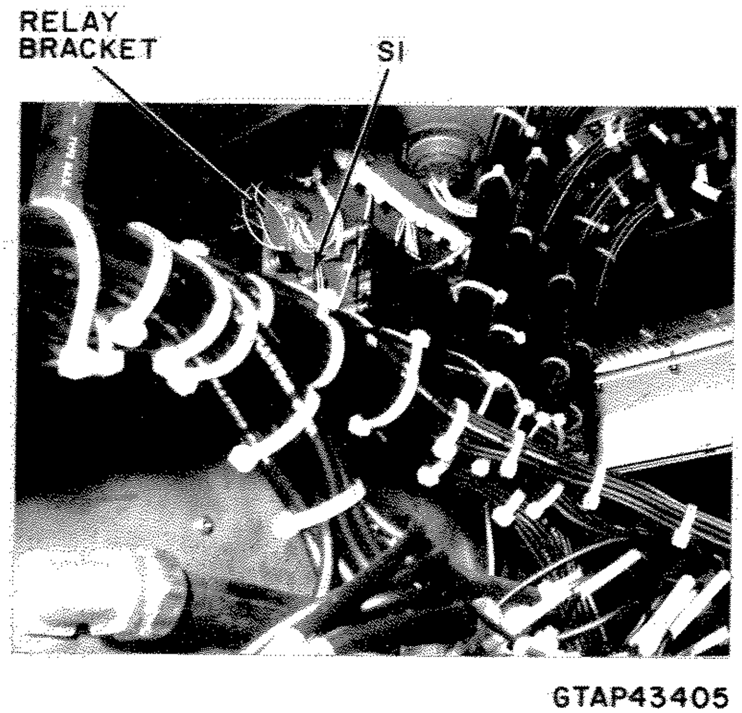


Figure 6-86. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Overtemperature Fault Switch S1 (Sheet 1 of 2)

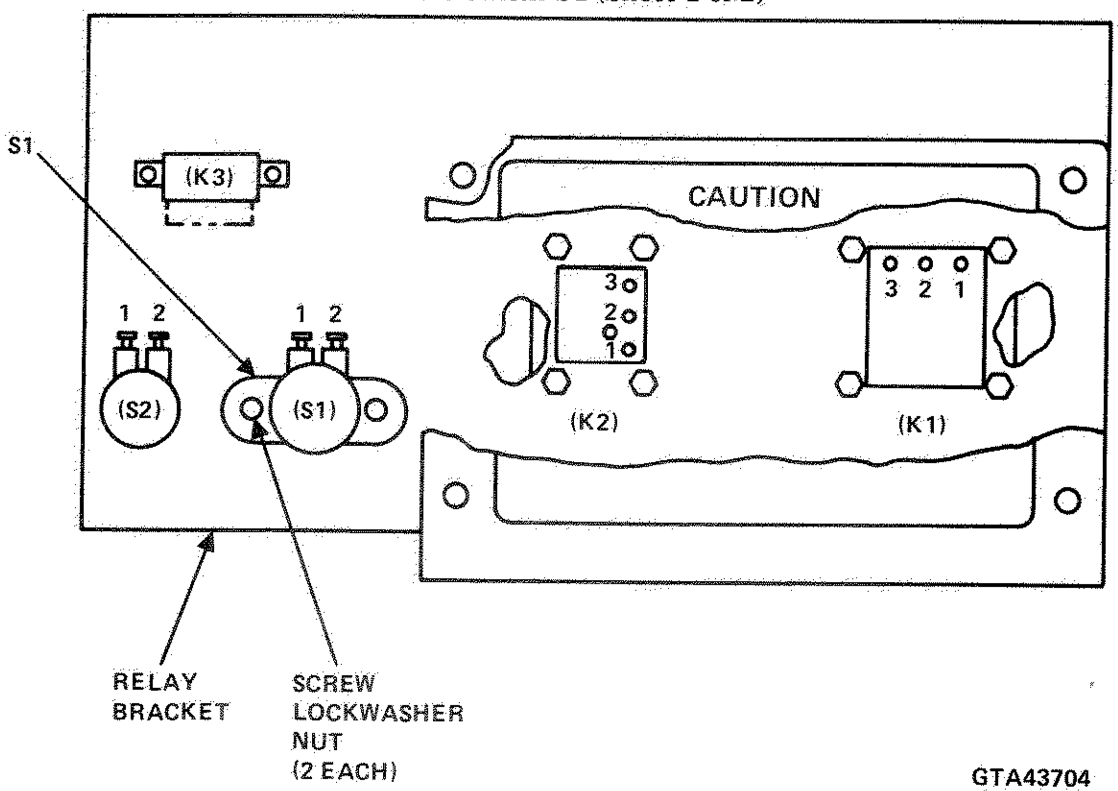


Figure 6-86. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Overtemperature Fault Switch S1 (Sheet 2 of 2)

9. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.21 Overtemperature Fault Switch S2.

6-7.5.21.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Light, trouble/ extension	1	25o
Marker, wire	A/R	31k
Pliers, diagonal/cutter	1	25ag
Pliers, needlenose	1	25m
Soldering station	1	29e
Wrench, box/open, set	1	32a

6-7.5.21.2 Removal. (Figure 6-87).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.

2. Open front door of cabinet.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with 208 V 3-phase, 60-Hz ac power.

3. Remove primary ac power from cabinet.

a. Set 3-pole POWER ON circuit breaker CB1 to OFF.

b. Observe that ØA, ØB, and ØC lamps DS2 through DS4 are not lit.

c. Verify fans are not operating.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power must be removed from cabinet to protect maintenance personnel from shock hazard.

4. Remove 60 V power from cabinet.

a. Access top of cabinet using stepladder.

b. Disconnect J6 and J7 from cabinet.

5. Remove 4 screws and lockwashers securing relay bracket to top of cabinet.

6. Inside top of cabinet, cut 2 tie wraps securing relay wiring harness to top of cabinet while supporting relay bracket.

7. Move relay bracket with attached harness to a convenient working position near center of cabinet.

8. Tag wires soldered to terminals of switch, as necessary, to identify correct connections.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

9. Unsolder and disconnect wires from switch terminals.

NOTE

Observe orientation of switch on bracket to be sure replacement switch will be installed correctly.

10. Remove nut and lockwasher that secure switch to relay bracket; remove switch.

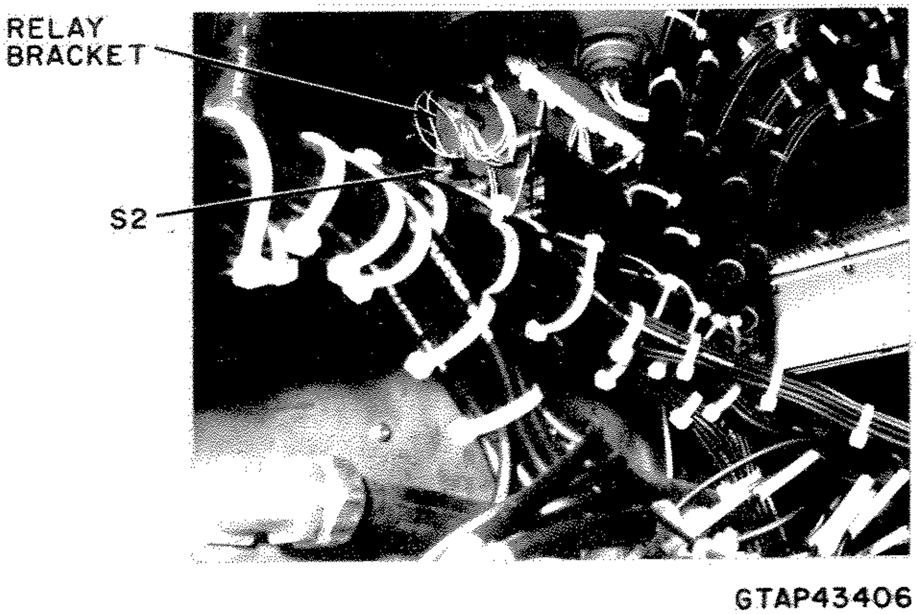


Figure 6-87. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Overtemperature Fault Switch S2 (Sheet 1 of 2)

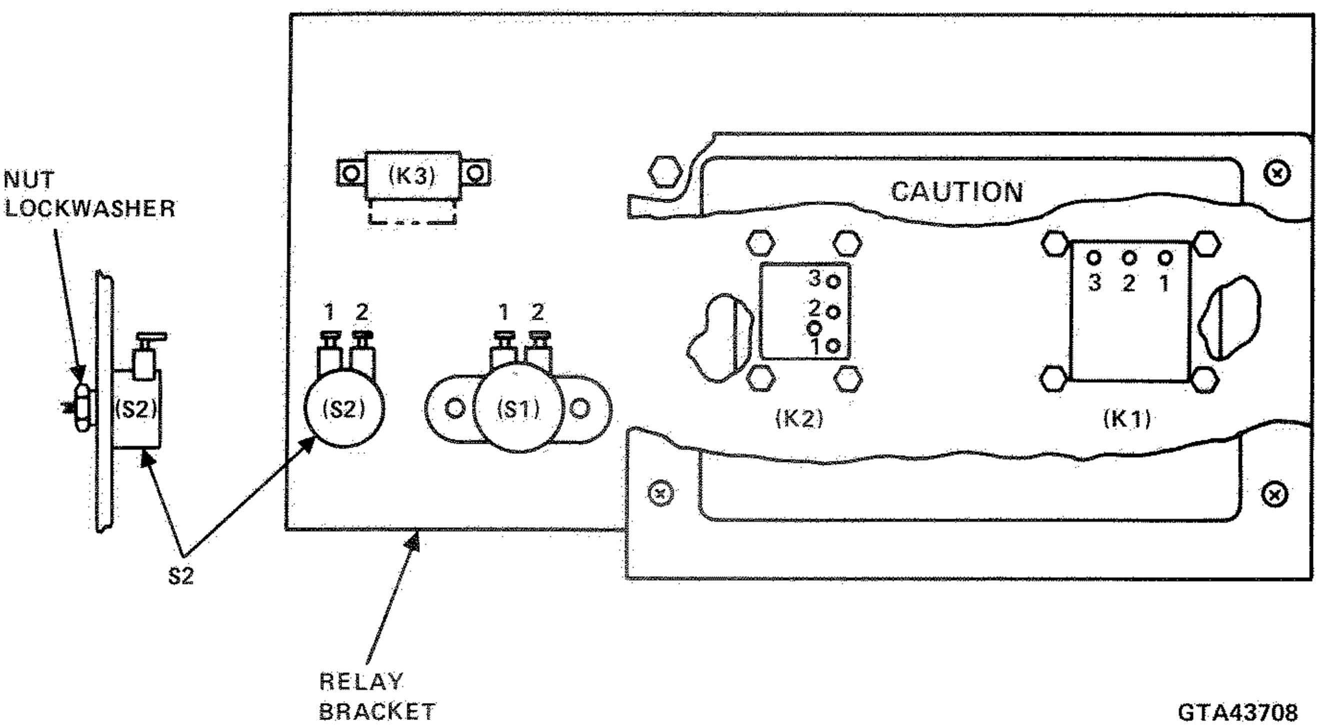


Figure 6-87. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Overtemperature Fault Switch S2 (Sheet 2 of 2)

6-7.5.21.3 Installation.

1. Position switch on relay bracket, oriented as noted during removal; secure with nut and lockwasher.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

2. Connect and solder wires to switch terminals, as identified during removal.
3. Position relay bracket and harness in original location at top of cabinet.
4. Secure relay bracket to top of cabinet with 4 screws and lockwashers.
5. Secure harness to cabinet with 2 tie-wraps.
6. Reconnect J6 and J7 to cabinet.
7. Set 3-pole POWER ON circuit breaker CB1 to the ON.
8. Close and secure cabinet doors.
9. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.22 Local/Remote Switch S3.

6-7.5.22.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Marker, wire	A/R	31k
Screwdriver, flat blade	1	25ae
Screwdriver, Yankee offset, ratchet	1	25x

6-7.5.22.2 Removal. (Figure 6-88).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.
2. Open front door of cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Primary ac power must be removed from cabinet to protect equipment from damage when replacing S3.

3. Remove primary ac power from cabinet.
   a. Set 3-pole POWER ON circuit breaker CB1 to OFF.
   b. Observe that ØA, ØB, and ØC lamps DS2 through DS4 are not lit.
   c. Verify fans are not operating.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3, and overtemperature S1 and S2.

4. Using safety stepladder for access, tag wires connected to terminals of switch, as necessary, to identify correct connections.
5. Remove screws and lockwashers that secure wire terminal lugs to switch terminals; disconnect wires from switch.

NOTE

Observe orientation of switch on bracket to be sure replacement switch is installed correctly. Do not disturb position of switch bracket mounted to cabinet.

6. Remove 2 screws, lockwashers, and flat washers that secure switch to bracket; remove switch.

6-7.5.22.3 Installation.

1. Position replacement switch on bracket, oriented as noted during removal and secure with 2 screws, lockwashers, and flat washers.

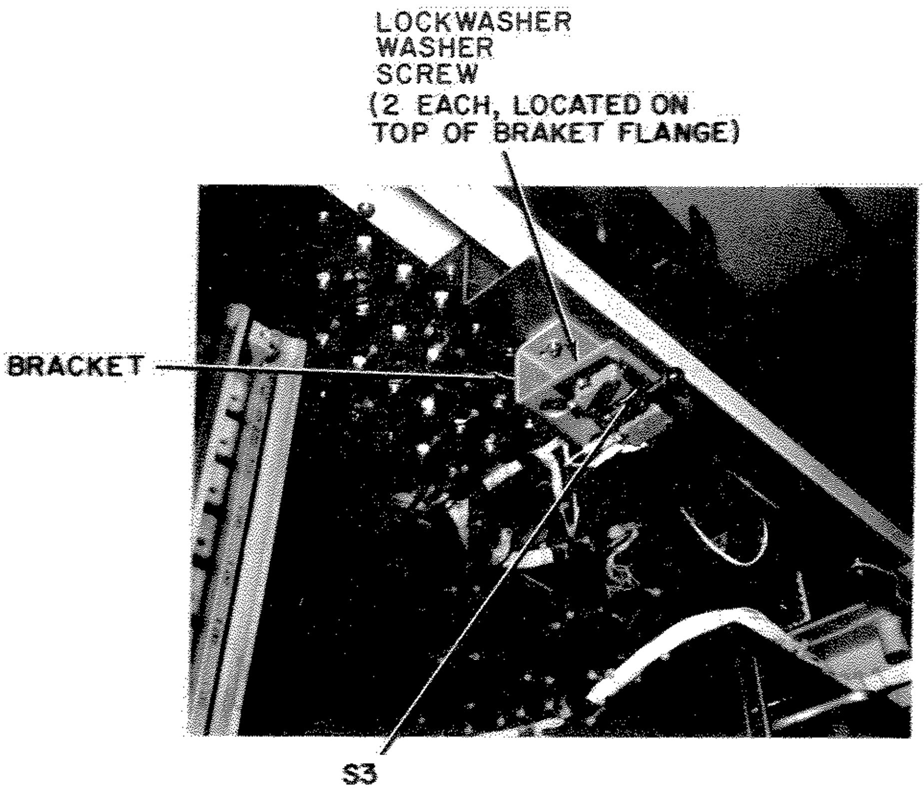


Figure 6-88. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, LOCAL/REMOTE Switch S3

2. Position wire terminal lugs on switch terminals, as identified during removal; secure with screws and lockwashers.
3. Set 3-pole POWER ON circuit breaker CB1 to ON.
4. Close and secure cabinet doors.
5. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY on TMC and place cabinet ONLINE. Refer to Positional Handbook for TMC operating instructions.

6-7.5.23 Radio Frequency Transformers T1 and T2.

6-7.5.23.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Ladder, platform	1	33e
Screwdriver, cross-tip	1	25ac

6-7.5.23.2 Removal. (Figure 6-89).

1. Open rear door of cabinet.
2. Using safety stepladder for access, release and disconnect 2 coaxial cable connectors from 50 to 75 Ohm connectors on transformer being removed.
3. Loosen 2 screws (with lockwashers and flat washers) that secure transformer between retaining strap and spacer.
4. Note orientation of transformer with respect to 50 Ohm and 75 Ohm connectors; remove transformer.

6-7.5.23.3 Installation.

CAUTION

EQUIPMENT DAMAGE HAZARD

Avoid damage to pad (cemented to underside of retaining strap) when inserting replacement transformer between spacer and retaining strap; do not force transformer against pad.

1. Carefully insert replacement transformer between spacer and retaining strap pad, with connectors oriented as noted during removal; loosen screws as necessary.
2. With lockwashers and flat washers, tighten 2 screws that secure transformer between retaining strap and spacer.
3. Connect and secure 2 coaxial connectors to transformer connectors.
4. Close and secure cabinet doors.

6-7.5.24 POWER AVAIL and POWER ON ØA, ØB, and ØC Lamp Sockets XDS1 through XDS4.

6-7.5.24.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Face shield	1	33ab
Ladder, platform	1	33e
Marker, wire	A/R	31k
Pliers, needlenose	1	25m
Screwdriver, flat blade	1	25ad
Soldering station	1	29e
Wrench, adjustable	1	32n

6-7.5.24.2 Removal. (Figure 6-90).

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. For Unit 151, terminate mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY and place cabinet OFFLINE. Refer to Positional Handbook for TMC operating instructions.

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with the 208 V 3-phase 60 Hz power.

2. Remove primary power from cabinet (Table 6-15) by setting the appropriate circuit breaker to OFF; tag with maintenance-in-progress warning sign.

3. Open front and rear door of cabinet; observe POWER AVAIL lamps DS1 and POWER ON ØA, ØB, and ØC lamps are not lit (Figure 6-90).

WARNING

ELECTRIC SHOCK HAZARD

Primary ac power must be removed from cabinet to protect maintenance personnel from contact with the 208 V 3-phase 60 Hz power.

4. At both front and rear of cabinet loosen 6 captive fasteners on dummy plate below circuit breakers; remove dummy plates.

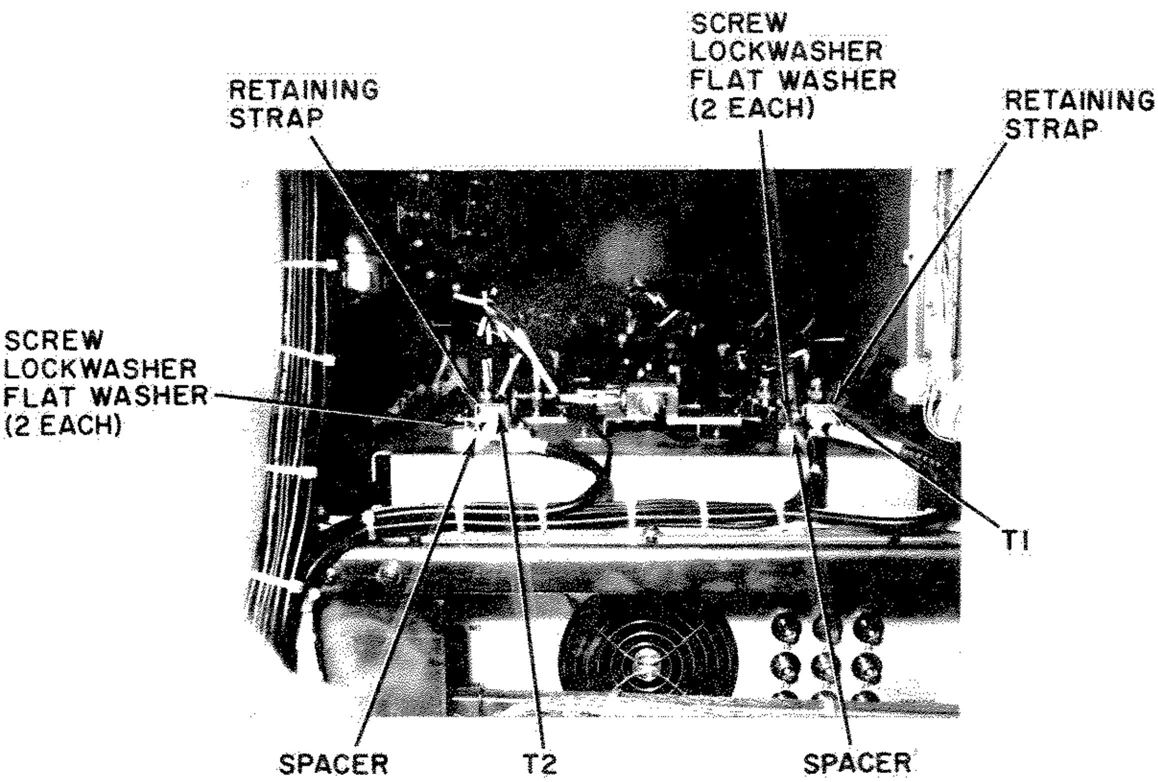


Figure 6-89. Exciter/Auxiliary Exciter Cabinet, Unit 151/152, Radio Frequency Transformers T1 and T2

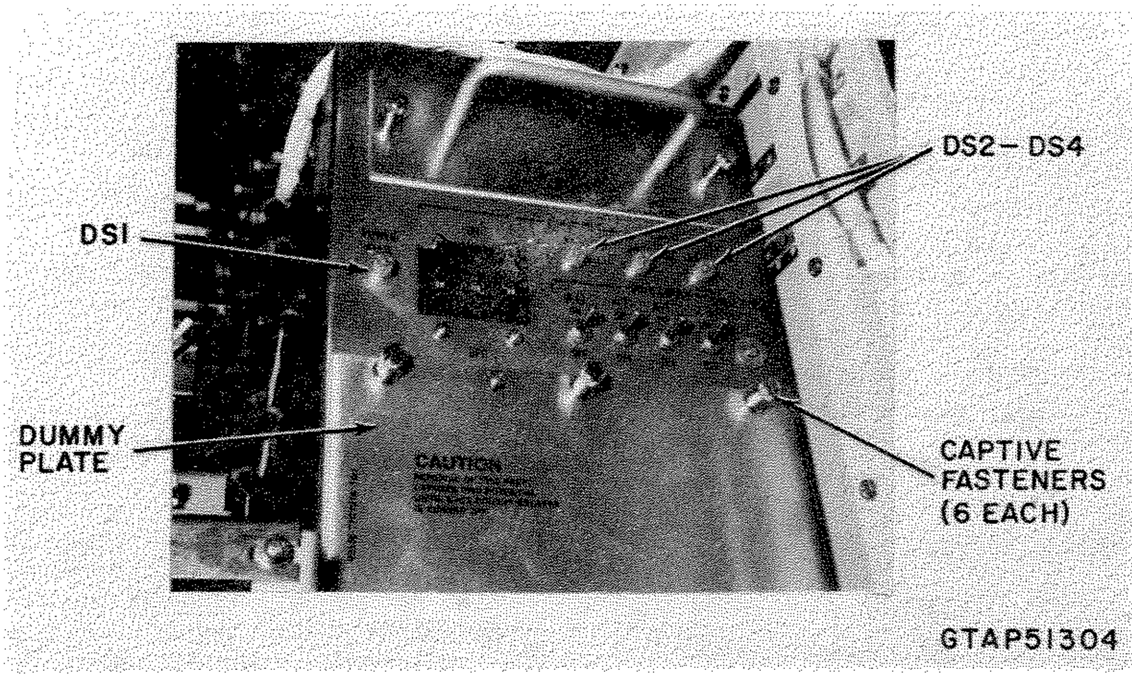


Figure 6-90. Exciter and Auxiliary Exciter, Units 151, 152 Lamp Sockets XDS1 through XDS4 (Front)

5. Remove fan assembly A14 in accordance with the procedures given in paragraph 6-7.5.6.
6. Unscrew lamp and lamp cover and remove from socket, loosen nut and washer securing lamp socket to panel and slide nut and washer off socket and up wires soldered to socket.
7. Remove socket from front of panel; mark wires for identification of connections.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering. Eye protection is required.

8. Unsolder and disconnect wires from lamp socket and remove socket.

6-7.5.24.3 Installation.

1. Remove nut and washer from lamp socket (make sure nut and washer from previous socket are still on wire.
2. Connect and solder wires to lamp socket terminals as identified during removal.
3. Position socket in panel with index tab in panel notch.
4. Slide washer and nut down wires and secure lamp socket to panel.
5. Install lamp and lamp cover.

NOTE

If binding occurs, apply antiseize compound (Table 6-1, Item 21) to threads of captive fasteners that secure fan assembly and dummy plates to access openings.

6. Reinstall fan assembly A14 in accordance with the procedures given in paragraph 6-7.5.6.
7. Position front and rear dummy plates over access openings and secure each with 6 captive fasteners.
8. Restore primary power to cabinet.
   a. Observe that POWER AVAIL lamp and POWER ON ØA, ØB, and ØC lamps DS1 through DS4 are lit.
   b. Remove maintenance-in-process warning sign.
9. Close and secure cabinet doors.
10. For Unit 151, restart mission using TXAFL TEST SELECTION MENU on TMC. For Unit 152, use TRANSMIT SITE INITIALIZATION/RECONFIGURATION DISPLAY and place cabinet ONLINE. Refer to Positional Handbook for TMC operating procedures.

6-8 TRANSMIT EQUIPMENT PERFORMANCE MONITORING AND AUTOMATIC FAULT LOCATION/ISOLATION.

The EPM tests detect, and when possible, isolate the occurrence of equipment degradation and failures at the transmit segment(s) that cause transmit performance to fall below mission requirements. The AFL/I tests isolate those faults that cannot be isolated by EPM.

1. Paragraph 6-8.1 - Transmit Equipment Performance Monitoring Function
2. Paragraph 6-8.2 - Transmit Automatic Fault Location/Isolation Function
3. Paragraph 6-8.3 - Transmit Equipment Performance Monitoring Procedures
4. Paragraph 6-8.4 - Transmit Automatic Fault Location/Isolation Procedures.

6-8.1 Transmit Equipment Performance Monitoring Function.

1. The transmit EPM function (FO-2), runs during dedicated time slots and is intermixed with mission software. For this reason EPM tests are referred to as online tests and require no dedicated mission time line. EPM runs continuously and cycles through all its tests every 3 minutes except when tactical operations prohibit the EPM tests from completing in 3 minutes and the EPM testing extends to 4 minutes. The main transmit EPM tests are listed below. See Table 6-16 for a listing of the subtests that make up the main tests.

   Transmit EPM tests:

   a. The RF Radiation and Beamforming Evaluation Test (TX1)
   b. Waveform and Frequency Test (TX2)
   c. Sounder Transmitter Test (TX3)
   d. Facilities Fault Sensor Monitoring (TX4)
   e. Data Conditioner Loop Test (TX6)
   f. Data Processor Fault Monitoring.

2. The EPM monitors key locations in the transmit equipment by a combination of built-in test equipment (BITE) and software driven tests.

Table 6-16. Transmit Equipment Performance Monitoring Test/Subtests

Subtest ID[1]	Description
RF Radiation and Beamforming Evaluation Test	
TSO1A	Beam Pointing Azimuth Error Status
TSO1B	Beamwidth Error Status
TSO1C	Average Sidelobe Level Status
TSO1D	Peak Sidelobe Level Status
TSO1E	Available ERP Status
TSO1F	PA Gain Status
TSO1G	TBF Gain Status
TSO1H	Transmit Path Gain Status
TSO1I	VSWR Status
TSO1J	PA Phase Status
TSO1K	TBF Phase Status
TSO1L	Transmit Path Phase Status
Waveform and Frequency Test	
TSO2A	Exciter-1 CIT Status
TSO2B	Exciter-1 RF Center Frequency Status
TSO2C	Exciter-2 CIT Length Status
TSO2D	Exciter-2 RF Center Frequency Status
TSO2E	Cal Receiver 1 Quad Performance Status
TSO2F	Cal Receiver 2 Quad Performance Status
TSO2G	Beatnote Amplitude Error Status or Normalized Beatnote Image Amplitude Status - Cal RCVR 1
TSO2H	Beatnote Amplitude Error Status or Normalized Beatnote Image Amplitude Status - Cal RCVR 2
TSO2I	Deleted
TSO2J	Deleted
TSO2K	Long Term Frequency Test Status Exciter 1
TSO2L	Long Term Frequency Test Status Exciter 2
TSO2M	Short Term Frequency Test Status Exciter 1
TSO2N	Short Term Frequency Test Status Exciter 2
Sounder Transmitter Test	
TSO3A	Sounder Transmitter Status Error Codes
TSO3B	Sounder Sweep Generator A Status Error Codes
TSO3C	Sounder Sweep Generator B Status Error Codes

Table 6-16. Transmit Equipment Performance Monitoring Test/Subtests -CONT

Subtest ID[1]	Description
TSO3D	Deleted
TSO3E	Deleted
TSO3F	Sounder Data Comparison
TSO3H	CM Status Summary-Sounder Module
TSO3I	Sounders and Sounder Monitor Summary Status
Facilities Fault Sensor Monitoring	
TSO4A	Transmitter Facilities Status
Data Conditioner Loop Test	
TSO6A	Deleted
TSO6B	TDC Data Comparison Status
TSO6C	Cabinet Voltage Regulator Status
TSO6D	Transmitter Status Data Status
TSO6E	TDC Loop Test Cabinet Summary Status
TSO6F	TDC Loop Test Site Status
TSO6G	TBF Summary Fault Status
TSO6H	Exciter 1 Summary Fault Status
TSO6I	Exciter 2 Summary Fault Status
TSO6J	Time of Day Status Summary
TSO6K	CM Status Summary
Data Processor Fault Monitoring	
TS99A	Deleted
TS99B	DP Test Results Message
TS99C	DP Response Indicator Status
TS99D	Deleted
TS99E	DP Software Error Indicator Status

[1] The identification (ID) indicates which test/subtest detected a specific fault. The first two characters indicate the type segment at which a fault was detected. The next two characters indicate the segment number for the test detecting the fault. The 5th character is the subtest identifier and the last character (6th), is used to provide further definition of the detected fault (if applicable).

a. The BITE collects status bits from equipment.

b. The software driven tests inject test vectors within a known response into a circuit. If the actual response of circuitry does not match the known valid response, a fault is declared.

3. The EPM test results from all three segments are sent to the RCS&EA function at the operations center (OC) from the manned segment via the narrowband link. Test results from the remote segments are routed to the manned segment via the fiber-optic communication system.

4. The RCS&EA function analyzes the data and forms an equipment status signature based on passed/failed tests and status bits, and compares it to a list of unique fault signatures. The fault signatures point to the faulted equipment. There exists a data base that maps fault signatures to faulted equipment and required action to resolve the fault.

5. The RCS&EA function searches the fault signature data base for a matching fault signature. When a match is found a fault update message is sent to the segment where the fault occurred and to the SMC at the OC. Also, a hard copy printout is automatically printed at the RCS&EA line printer. At the transmit sites, a hard copy printout must be requested by the technician at the transmit maintenance console (TMC).

6. The fault update message is sent to the applicable transmit site; its arrival is announced at the TMC by an audible and visual alarm on the TMC terminals. The fault message is also entered in the site fault log data base and an alert is added to the Transmit Site Status and Selection Menu Alert List.

7. The transmit site fault log data base has the capacity of storing 50 active faults (max). When the fault priority is one, the applicable segment STATUS ALERT indicator lights (red) and an audible alarm sounds on the status panel, Unit 160A2 (Figure 6-91). Clearing a priority one fault causes the applicable segment STATUS NORMAL indicator, Unit 160A2, to light (green) providing there is not any other active priority one fault remaining in the fault log data base.

8. The Transmit Site Status and Selection Menu displays the 10 most recent unacknowledged alerts. An OVERFLOW indication appears in the prompt area of the menu display if there are more than 10 alerts present. If more than 10 alerts arrive, the oldest alert is removed to make room for new alert(s). The alert field (top of display) blinks if an alert has has not been acknowledged within 2 minutes. In the case of multiple alerts, the 2 minute timer is associated with the oldest alert.

9. Acknowledging an alert from a terminal at one segment does not cause an acknowledgement of same alert at the other two segments.

10. To view information on uncleared faults, access the Transmit Site Equipment Fault Log Display. When this menu is selected, the number of the most recent fault log data entry appears in the lower righthand corner of the Transmit Site Status and Selection Menu. If a different fault log data base entry number is desired, enter appropriate number in the prompt area.

11. The Transmit Site Equipment Fault Log Display supplies pertinent information about the fault and required maintenance action to resolve the fault. The action required could direct the technician to remove and replace a specific failed LRU, or a group of LRUs one at a time, run an AFL test, or refer to the TO for manual fault isolation procedures.

12. When the fault log display directs the technician to perform a specific AFL test, that test should be performed as soon as possible.

13.(V)1 There may be some fault log displays that indicate a fault at sites A, B, or local. Site A would be segment one when the technician is located in segments two or three and segment two if technician is located at segment one. Site B would be segment three when the technician is located at segments one or two and segment two if the technician is located at segment three. Local is the segment where the technician is located.

13.(V)2 There may be some fault log displays that indicate a fault at sites A, B, or local. Site A would be segment three when the technician is located at segments one or two and segment two if the technician is located at segment three. Site B would be segment one when the technician is located at segments two and three and segment two if the technician is located at segment one. Local is the segment where the technician is located.

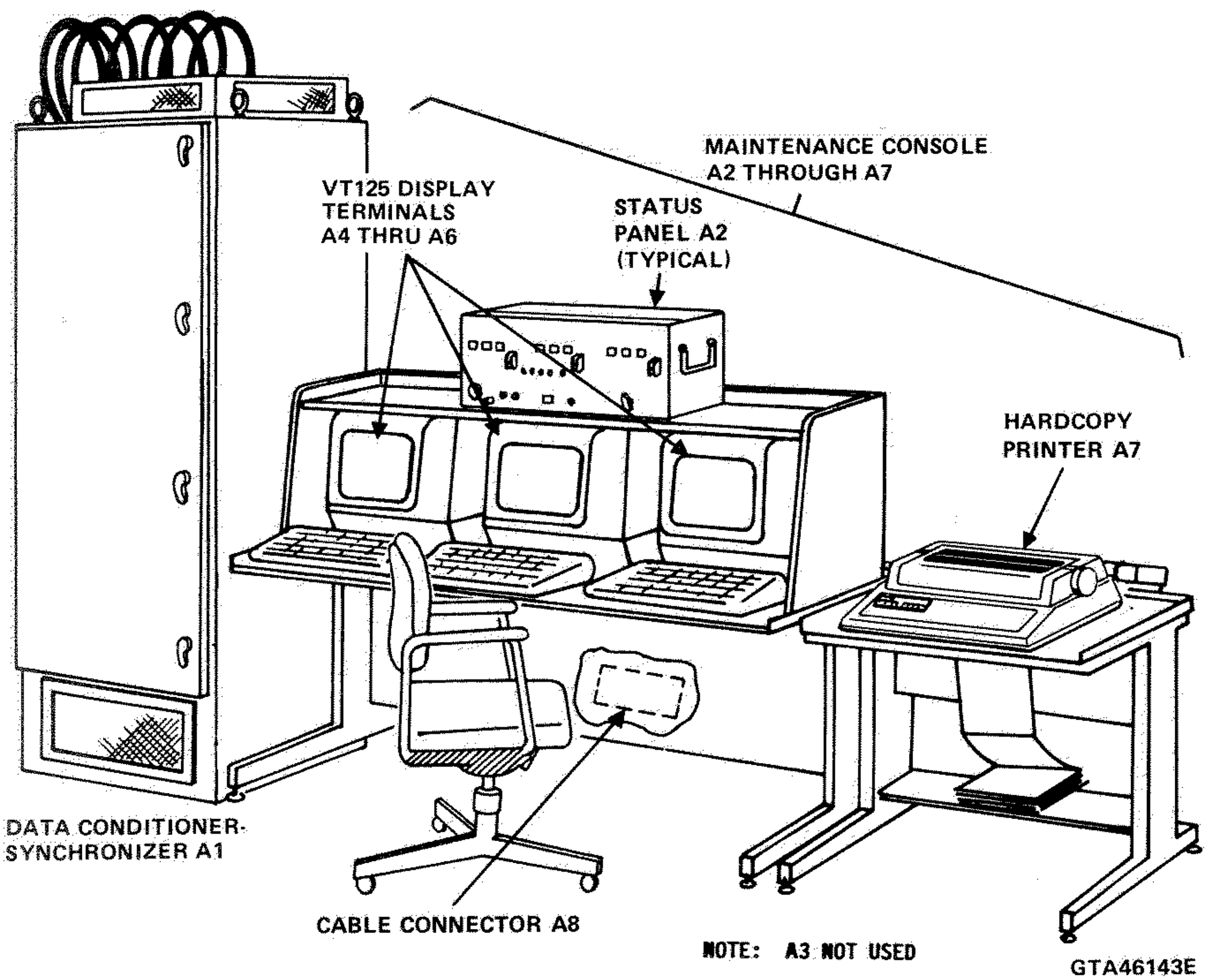


Figure 6-91. Typical Transmit Maintenance Console, Part of Unit 160

14. Transmit segments require manual action (depress PF4 key) to obtain a hard copy on their respective LA120 line printer(s), Unit 160A7. The PRINTER SELECT switch on the TMC status panel enables the technician at any one segment to print a hard copy from another segment. This switch must be positioned to the applicable segment prior to depressing the PF4 key or the terminal may lock-up and cannot be cleared unless the software is reinitialized.

15. The EPM assigns each fault a priority number (1, 2, or 3) which is displayed on the Transmit Site Fault Log Display. This priority number indicates the severity the fault has on system operation.

   a. 1 - High Priority Fault. Categorized as subsystem down. Fatal fault and repair is urgent.

   b. 2 - Moderate Priority Fault. Categorized as equipment fault. Non fatal fault but repair is urgent.

   c. 3 - Low Priority Fault. Categorized as equipment fault. Non fatal and repair is not as urgent as the moderate priority fault.

6-8.2 Transmit Automatic Fault Location/Isolation Function.

1. The transmit AFL/I function (Figure 6-92) is a set of manually initiated software tests which locate/isolate a fault to a failed LRU or group of LRUs. The AFL/I tests are an extension of EPM in the sense that AFL/I provides additional fault isolation beyond that of EPM. The AFL/I is normally used to isolate a fault which EPM cannot.

2. The AFL/I tests are initiated at the TMC and are executed by the transmit data processor, Unit 154 or 155. The AFL/I tests do not require the use of external test equipment.

3. Transmit site AFL/I tests are accessed by the transmit automatic fault location (TxAFL) Test Selection Menu. TxAFL tests consist of three types of tests. The three types of tests are the transmit data conditioner, exciter cabinet, and transmit beamformer AFI tests. The exciter and transmit beamformer tests can be run as either an online or offline test, while the transmit data conditioner AFI test can only be run as an offline test. Offline TxAFL tests require mission software to be terminated (i.e., offline). The TxAFL tests are:

   a. Transmit Data Conditioner Test

   b. Exciter Cabinet Test

   c. Transmit Beamformer Test.

4. The TxAFL function analyzes the data and forms a unique equipment status signature based on passed/failed tests and status bits and compares it to a unique set of fault signatures. The fault signatures point to the faulted equipment. There exists a data base that maps fault signatures to failed equipment and required action to resolve the fault.

5. The TxAFL function searches the fault signature data base for the matching fault signature and when a match is found, a TxAFL fault group display is sent to the TMC. If a match is not found, a TxAFL test message display is sent to the TMC containing the unidentified equipment status signature.

6. The TxAFL fault display automatically appears on the TMC at the completion of a selected TxAFL test and if the fault has been isolated. The display supplies pertinent information about the fault and required action to resolve the fault. The required action directs the technician to remove and replace a specific failed LRU, or a group of LRUs one at a time and to rerun the TxAFL test after each replacement.

7. The TxAFL test message display appears upon completion of a selected TxAFL test and only if the TxAFL test cannot isolate the fault.

8. When the transmit beamformer ON-line test is selected, a prompt appears requesting selection of the exciter to be used for test; enter 11 for exciter No. 1, or 12 for exciter No. 2, or 13 for both exciter No. 1 and No. 2.

9. When 00 is entered for the fault number on the TxAFL test selection menu, the TxAFL test that is selected runs using the AFL default parameters. The technician is notified by a prompt that the default parameters are being used for test. When the selected TxAFL test and the EPM test which isolated the fault have compatible control parameters, the selected TxAFL test runs using the operational parameters in effect when the fault was detected by EPM. If the control parameters are not compatible, then the AFL default parameters are used to execute the TxAFL test and a prompt stating this is displayed.

6-8.3 Transmit Equipment Performance Monitoring Procedures. See Transmit Subsystem TO 31P6-2FPS118-11.

6-8.4 Transmit Automatic Fault Location/Isolation Procedures. See Transmit Subsystem TO 31P6-2FS118-11.

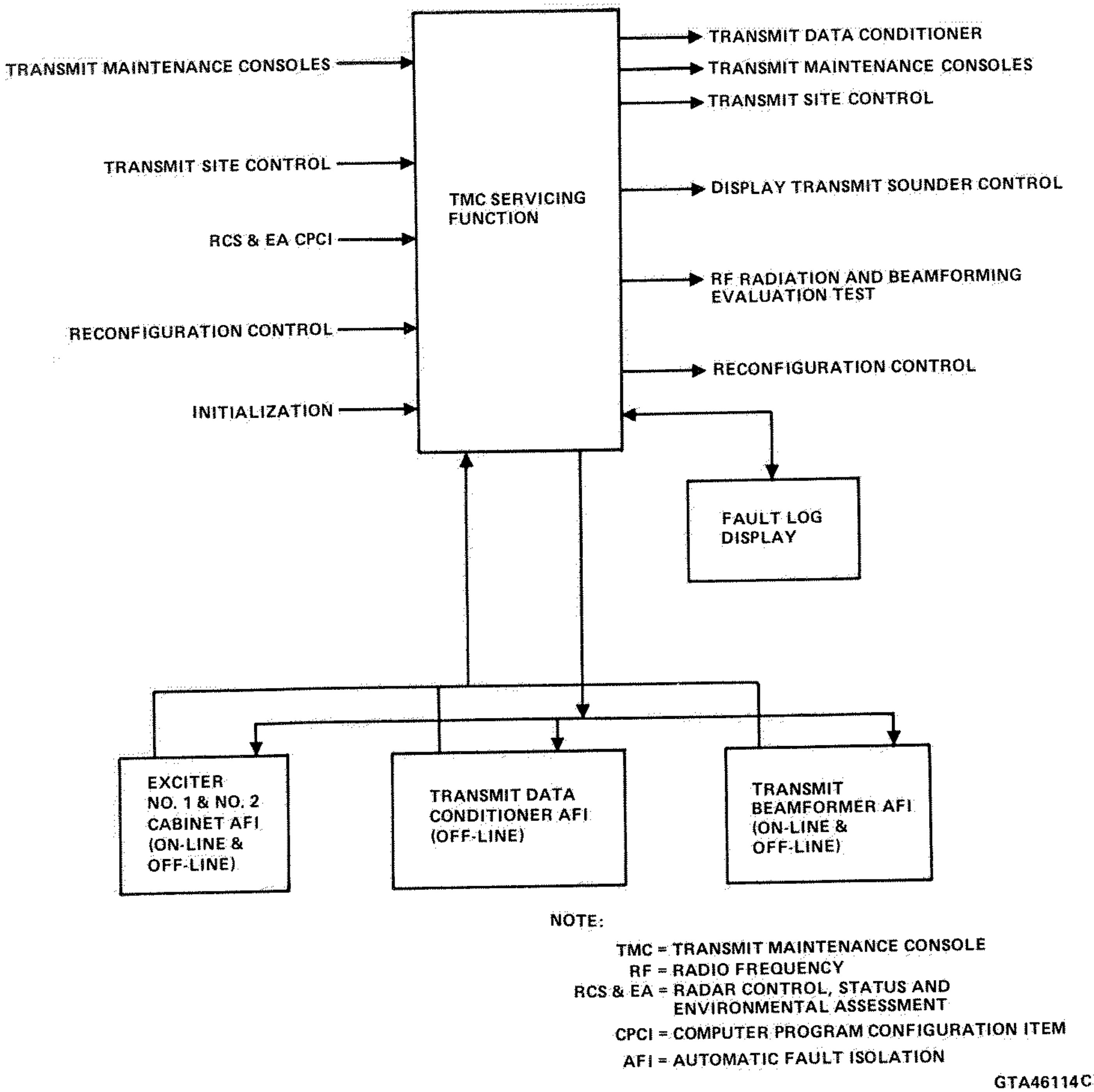


Figure 6-92. Transmit Subsystem Automatic Fault Location/Isolation Functional Block Diagram

6-8.5 Fault Isolation Procedures. This section provides fault isolation procedures of significant length that do not appear in the fault isolation table (Table 6-17) in the Transmit Subsystem TO 31P6-2FPS118-11. Table 6-17 provides the cross-reference list from the fault ID to the paragraph number for the fault isolation procedure.

6-8.5.1 Use of Table. Table 6-17 contains all the necessary fault isolation procedures. The fault isolation procedures are indexed by fault ID number. The technician simply scans the table for the fault ID under investigation to find the respective fault isolation procedure necessary to repair the fault.

6-8.5.2 Transmission Line/Path Fault Isolation Procedure.

6-8.5.2.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Dummy load	1	20a
Wrench, box/open, set	1	32a

6-8.5.2.2 Procedure. This procedure provides the steps necessary to isolate a fault in the complete transmission path, i.e. from the transmitter end of the transmission line to the antenna dipole elements. The equipment subject to this test includes the transmission line, directional coupler, balun, balun dome, and dipole elements.

NOTE

Refer to the Positional Handbook for TMC operating instructions throughout this procedure.

1. At TMC, observe message stating that a transmitter fault exists.

2. At TMC, acknowledge the fault message via keyboard entry.

3. On the front panel of transmitter module associated with faulted transmission line/path, observe a fault indication of a reverse power trip.

4. Check nitrogen pressure readings on affected transmission line/path. The transmission line/path pressure reading should be 5 lbf/in² gage during December through March and 15 lbf/in² gage the remainder of the year.

5. If nitrogen pressure readings are not satisfactory, perform time domain reflectometer test in paragraph 6-9.9 on the affected transmission line/path along with visually inspecting the line/path for leaks and/or damage.

6. At TMC, disable the transmitter module associated with affected transmission line/path.

CAUTION

EQUIPMENT DAMAGE HAZARD

The transmitter module must be disabled (RF drive removed) prior to switching the OUTPUT CONTROL switch to LOCAL.

7. On the front of the transmitter module associated with affected transmission line/path, place the OUTPUT CONTROL switch to the LOCAL position.

8. Operate affected transmitter module in LOCAL MODE in the faulty band in accordance with Chapter 4 of TO 31P6-2FPS118-81.

   a. If the transmitter module experiences a reverse power trip the transmitter module itself contains the fault. Refer to Chapter 6 in TO 31P6-2FPS118-81 and terminate this procedure.

   b. Otherwise, continue with this procedure.

9. Perform the TDR test in paragraph 6-9.9 on the affected transmission line/path.

10. If the TDR test determines that the fault is contained in transmission path equipment other than the transmission line, see the listing below for applicable paragraph of remove/installation procedure. Otherwise, continue with this procedure.

Equipment Containing	Remove/Installation Paragraph No.
Directional coupler	6-7.2.3
Balun	6-7.2.4
Balun Dome	6-7.2.5
Dipole Element	6-7.2.7

Table 6-17. Fault Isolation Procedure Cross-Reference List

Fault ID	Fault Isolation Procedure Description	Paragraph No.
TS-00163 | | | TS-00223	Transmission Line Fault Isolation	6-8.5.2

11. For repair of fault section of transmission line located by the TDR test refer to paragraph 6-7.2.2.3. If transmission line must be replaced refer to paragraph 6-7.2.2.2 for remove and replace procedure.

12. Upon completion of repair or replacement procedure, perform VSWR test on affected transmission line/path to ensure removal of VSWR fault.

13. Connect transmission line to transmitter module output port from which it was removed.

14. Perform transmission line gas refill procedure in paragraph 6-7.2.1.3.

15. On the front panel of all 12 transmitter modules, place the OUTPUT CONTROL switch to the REMOTE position.

16. At TMC, enable all 12 transmitter modules for remote operation.

17. Observe that repaired/replaced transmission line/path no longer registers a fault.

18. At TMC, remove transmission line/path fault record from data base.

6-9 CHECK, TEST, AND ALIGNMENT PROCEDURES.

The following procedures provide operational checks and tests concerned with overall equipment group operation. These procedures include testing and adjustment of cabinet assemblies in transmitter group.

6-9.1 Fan Check, Unit 150. This procedure provides instructions for checking the operation of the fans in the transmit beamformer cabinet.

6-9.1.1 Tools and Test Equipment Required. None.

6-9.1.2 Procedure.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside the cabinet. Use extreme caution while working inside cabinet.

1. Open rear door of cabinet.
2. Loosen fasteners; pull swingout rack fully open.
3. Locate 3 fans (B1, B2, and B3) on bottom fan deck of rack assembly A1.
4. On front of fan assembly, release 2 slide fasteners that secure front filter retainer to fan assembly; remove front filter retainer.
5. Observe all 3 fans are operating properly and are not noisy.
6. Replace filter; secure cabinet.

6-9.2 Overtemperature Switch Fault Report Check, Unit 150. This procedure provides instructions for checking the operation of the overtemperature switches located in the transmit beamformer cabinet.

6-9.2.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Cord, extension	1	25t
Heat gun with pinpoint adapter	1	31a
Module, thermocouple	1	9q
Multimeter, digital	1	9f
Probe, junction	1	9r
Screwdriver, flat blade	1	25ad

6-9.2.2 Procedure.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside cabinets. Use extreme caution while working inside the cabinets.

CAUTION

EQUIPMENT DAMAGE HAZARD

Use extreme care when applying heat to the overtemperature switches to avoid overheating the switches and adjacent components. Alternately heat and then monitor switch temperature using probe. As soon as the desired indication is obtained, use less heat and continue monitoring switch temperature. Ensure equipment temperature does not exceed 150 °F. The EPM may take a few minutes to display the fault even though the switch has activated.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

Overtemperature switches associated with transmit beamformer cabinet are shown in Table 6-18 and Figure 6-93. One of these switches (S1) provides an increasing temperature warning for EPM. The other switch (S2) monitors an overtemperature condition. To locate each switch to be tested, refer to Table 6-18 and Figure 6-93.

1. Open rear door of cabinet.
2. Using extension cord, plug heat gun into RPIE utility receptacle, not the cabinet service receptacles.
3. Loosen fasteners at top and bottom of swingout rack; pull rack fully open.

NOTE

For overtemperature switches not easily reached using the heat gun with pinpoint adapter, attach a 12 inch section of copper tubing (Table 6-1, Item 63), with an inside diameter of 5/16 inch, to pinpoint adapter to aid in accessing switch.

4. In sequence shown in Table 6-18, use heat gun with pinpoint adapter to carefully direct hot air over switch to be tested.

NOTE

If difficulty is encountered in reading trip temperature in step a. below, place a thin cardboard shield under temperature sensor.

   a. Use probe to monitor temperature.
   b. At TMC, verify that EPM acknowledges the fault condition.
   c. Allow each switch to cool until the fault indication is removed before proceeding to next switch.

5. Close and secure swing out rack.
6. Close and secure cabinet door.

6-9.3 Transmitter Group Voltage Regulator and Power Supply Fault Report Test. This procedure provides the instructions for testing the fault report capability of each voltage regulator and power supply in the transmitter group. When a voltage regulator or power supply fails, a fault condition is reported in the fault log on the SMC in the OC and also on the TMC at the transmit site.

6-9.3.1 Tools and Test Equipment Required. None.

6-9.3.2 Procedure.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

Table 6-18. Overtemperature Switch Fault Report, Unit 150

Switch Reference Designator	Cabinet Location	Fault Temperature	ID
150S1	Inside top center of swingout rack. (Figure 6-93)	120 ± 4 °F (48.9 ± 2°C)	TS-00366
150S2	Inside top center of swingout rack. (Figure 6-93).	140 ± 4 °F (60 ± 2°C	TS-00681

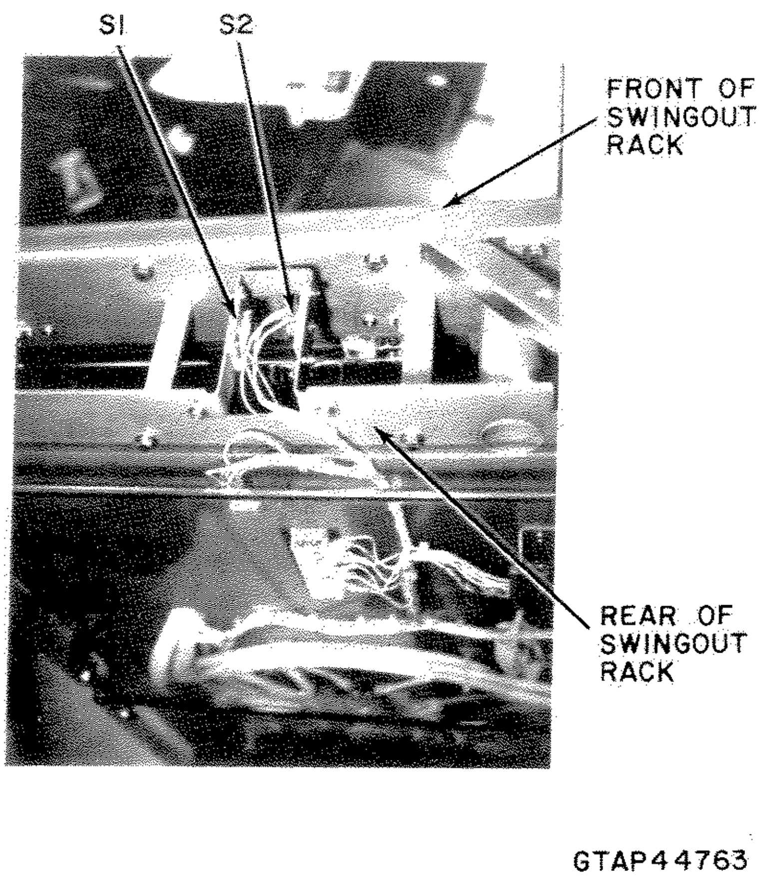


Figure 6-93. Overtemperature Switch Locations, Unit 150 (Sheet 1 of 2)

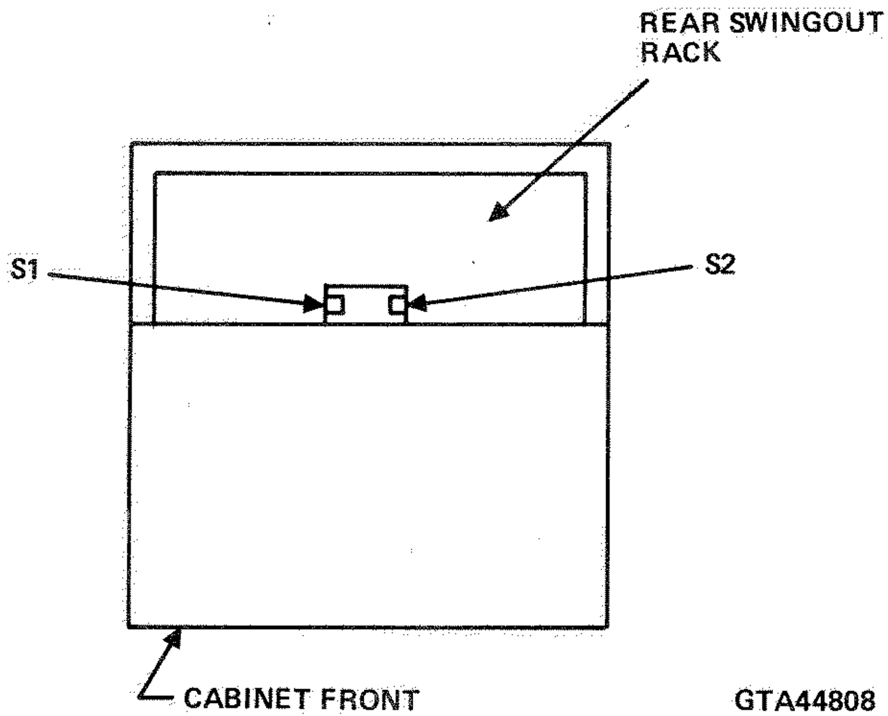


Figure 6-93. Overtemperature Switch Locations, Unit 150 (Sheet 2 of 2)

1. Table 6-19 lists the dc voltage regulators and power supplies in the transmitter group by equipment cabinet.
2. Before performing this procedure, the SMC should verify that no voltage regulator or power supply faults exists in the fault log for the LRUs listed in Table 6-19.
3. Open equipment cabinet doors.
4. In the applicable cabinet:
   a. Turn OFF one voltage regulator or power supply (see Table 6-19).
   b. Wait approximately 9 minutes for fault to appear on the TMC.
   c. Acknowledge fault alert at TMC.
   d. Turn ON the voltage regulator or power supply.
5. Repeat step 4 for the remaining voltage regulators and power supplies listed in Table 6-19.
6. Check with the SMC at the OC to ensure that all the applicable voltage regulator and power supply faults are in the fault log as listed in Table 6-19.
7. Check to see that the TMC fault log at the transmit site contains an identical listing of faults.
8. Request that SMC clear the fault reports.
9. If a voltage regulator or power supply fault was not added to the fault log, repeat step 4 for the applicable LRU(s). If the fault is not reported, replace the faulted LRU, clear fault, and repeat step 4.
10. Close and secure cabinet doors.

Table 6-19. Transmitter Group Voltage Regulator and Power Supply Fault Report

Voltage Regulator/ Power Supply Designation	Assembly Power Switch Designation	Fault ID
Transmitter Beamformer, Unit 150		
VR1	CB1	TP-00021
VR2	CB2	TP-00022
VR3	CB3	TP-00023
VR4	CB4	TP-00024
VR5	CB5	TP-00025
VR6	CB6	TP-00026
VR7	CB7	TP-00027
VR8	CB8	TP-00028
Exciter, Unit 151		
NOTE: The following power supply switches are located on panels at the top of the cabinet directly above the power supplies.		
A6	A6	TP-00007
A7	A7	TP-00008
A8	A8	TP-00005
A9	A9	TP-00006
A10	A10	TP-00001
A11	A11	TP-00002
A12	A12	TP-00003
A13	A13	TP-00004
Auxiliary Exciter, Unit 152		
NOTE: The following power switches are located at the top of the cabinet directly above the power supply assemblies.		
A6	A6	TP-00017
A7	A7	TP-00018
A8	A8	TP-00015
A9	A9	TP-00016
A10	A10	TP-00011
A11	A11	TP-00012
A12	A12	TP-00013
A13	A13	TP-00014

6-9.4 Fan Check, Units 151 and 152. This procedure provides instructions for checking the operation of the fans in exciter and auxiliary exciter cabinets.

6-9.4.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Flashlight	1	33m
Screwdriver, flat blade	1	25ad

6-9.4.2 Procedure.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside the cabinet. Use extreme caution while working inside cabinet with dummy plate removed.

1. Open front door of cabinet.
2. Locate fan assembly A14 at upper right of cabinet (Figure 6-94).
3. Loosen 6 captive fasteners on dummy plate below circuit breakers; remove dummy plate.
4. Observe fans are operating properly and are not noisy.

NOTE

If binding occurs apply antiseize compound (Table 6-1, Item 21) to threads of 6 captive fasteners that secure dummy plate.

5. Reinstall and secure dummy plate with 6 captive fasteners.
6. Close and secure cabinet door.

6-9.5 Overtemperature Switch Fault Report Check, Units 151 and 152. This procedure provides instructions for checking the operation of the overtemperature switches located in the exciter and auxiliary exciter cabinets.

6-9.5.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Cord, extension	1	25t
Heat gun with pinpoint adapter	1	31a
Multimeter, digital	1	9f
Module, thermocouple	1	9q
Probe, junction	1	9r

6-9.5.2 Procedure.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside cabinets. Use extreme caution while working inside the cabinets.

CAUTION

MAINTENANCE HAZARD

Use extreme care when applying heat to overtemperature switches to avoid overheating the switches and adjacent components. Alternately heat and then monitor switch temperature using probe. As soon as desired indication is obtained, use less heat and continue monitoring switch temperature. Ensure equipment temperature does not exceed 150 °F (65.6°C). The EPM may take a few minutes to display the fault even though the switch has activated.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

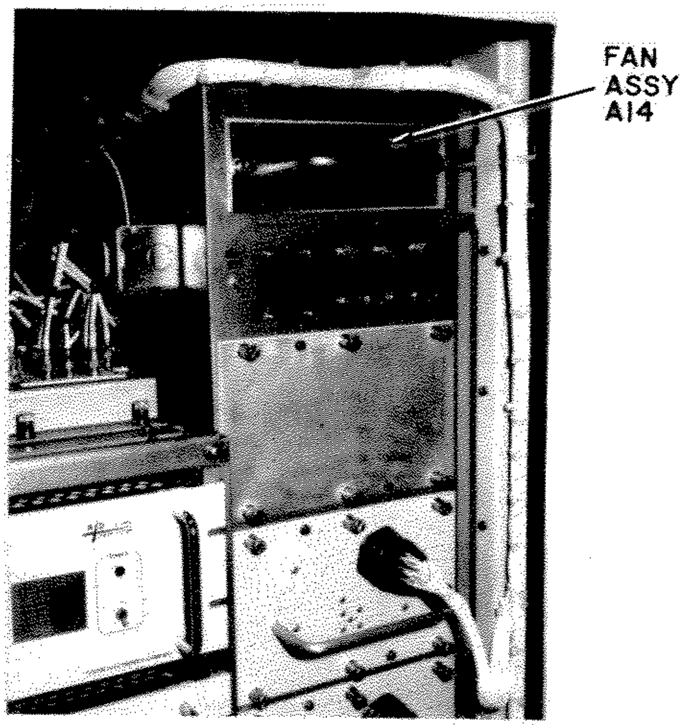


Figure 6-94. Cabinet Fan Location, Units 151 and 152

NOTE

Associated with the exciter and auxiliary exciter cabinets are overtemperature switches shown in Table 6-20 and Figure 6-95. One of these switches (S1) provides an increasing temperature warning for EPM. The other switch (S2) monitors an overtemperature condition. To locate each switch to be tested refer to Table 6-20 and Figure 6-95.

1. Open front and rear doors of cabinet.
2. Using extension cord, plug heat gun into RPIE utility receptacle, not the cabinet service receptacles.

NOTE

For overtemperature switches not easily reached using the heat gun with pinpoint adapter, attach a 12 inch section of copper tubing (Table 6-1, Item 63), with an inside diameter of 5/16 inch, to pinpoint adapter to aid in accessing switch.

3. In sequence shown in Table 6-20, use heat gun with pinpoint adapter to carefully direct hot air over switch to be tested.

NOTE

If difficulty is encountered in reaching trip temperature in step a. below, place a thin cardboard shield under temperature sensor.

   a. Use probe to monitor temperature.
   b. At TMC, verify that EPM acknowledges a fault condition.
   c. Allow each switch to cool until fault indication is removed before proceeding to next switch.

4. Close and secure cabinet doors.

6-9.6 Transmit Antenna Inspection (Transmitters Operating), Unit 100. This procedure provides instructions for inspecting the main and sounder transmit antenna components during the period that the main and sounder transmitters are operating.

6-9.6.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Binoculars, 7 x 50 power	2	33ak

6-9.6.2 Procedure.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter fence of the transmit antenna field. The inspecting personnel should remain behind the safety fence at all times.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. The site personnel shall inspect the antenna field components during the allotted downtime.
2. Maintenance personnel shall remain outside of the perimeter fence behind the antenna towers.

NOTE

A ladder may be necessary to view portions of antenna near site buildings.

3. Starting at one end of the antenna field, personnel shall inspect the condition of antenna structure and components. Personnel shall walk entire length of the transmit antenna field inspecting antenna for damage. The following antenna components (Figure 6-96) are included in the inspection of the towers.
   a. Antenna element aluminum support and arms for physical damage or signs of corrosion.
   b. Stud straps and flange straps for signs of overheat damage, corrosion, or physical damage.
   c. The RF transmission line assembly for overheat damage, corrosion, or physical damage; verify that lexan dome is not damaged.
   d. Antenna element towers for corrosion or physical damage.

Table 6-20. Overtemperature Switch Fault Report, Units 151 and 154

Switch Reference Designator	Cabinet Location	Temperature	Fault ID
151S1	Top right side as viewed from front of cabinet (Figure 6-95)	120 ± 4 °F (48.9 ± 2°C)	TS-00303
151S2	Top right side as viewed from front of cabinet (Figure 6-95)	140 ± 5 °F (60 ± 2.5°C)	TS-00680
152S1	Top right side as viewed from front of cabinet (Figure 6-95)	120 ± 5 °F (48.9 ± 2.5°C)	
152S2	Top right side as viewed from front of cabinet (Figure 6-95)	140 ± 5 °F (60 ± 2.5°C)	TS-00679

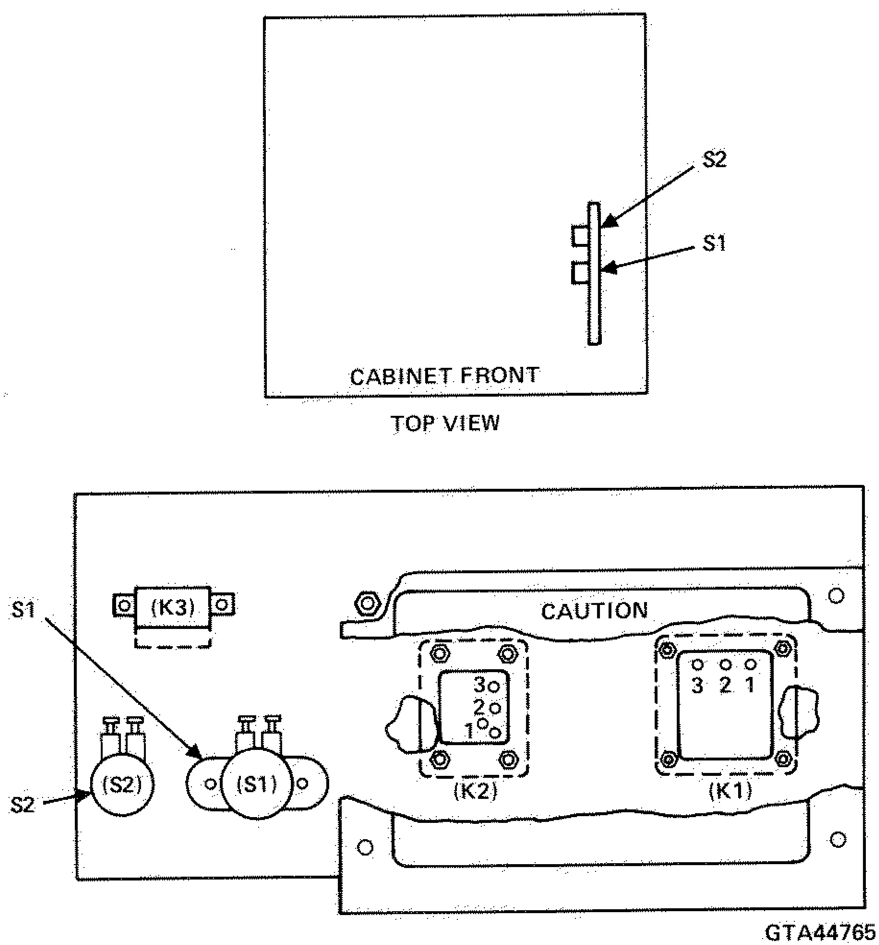


Figure 6-95. Overtemperature Switch Locations, Units 151 and 152

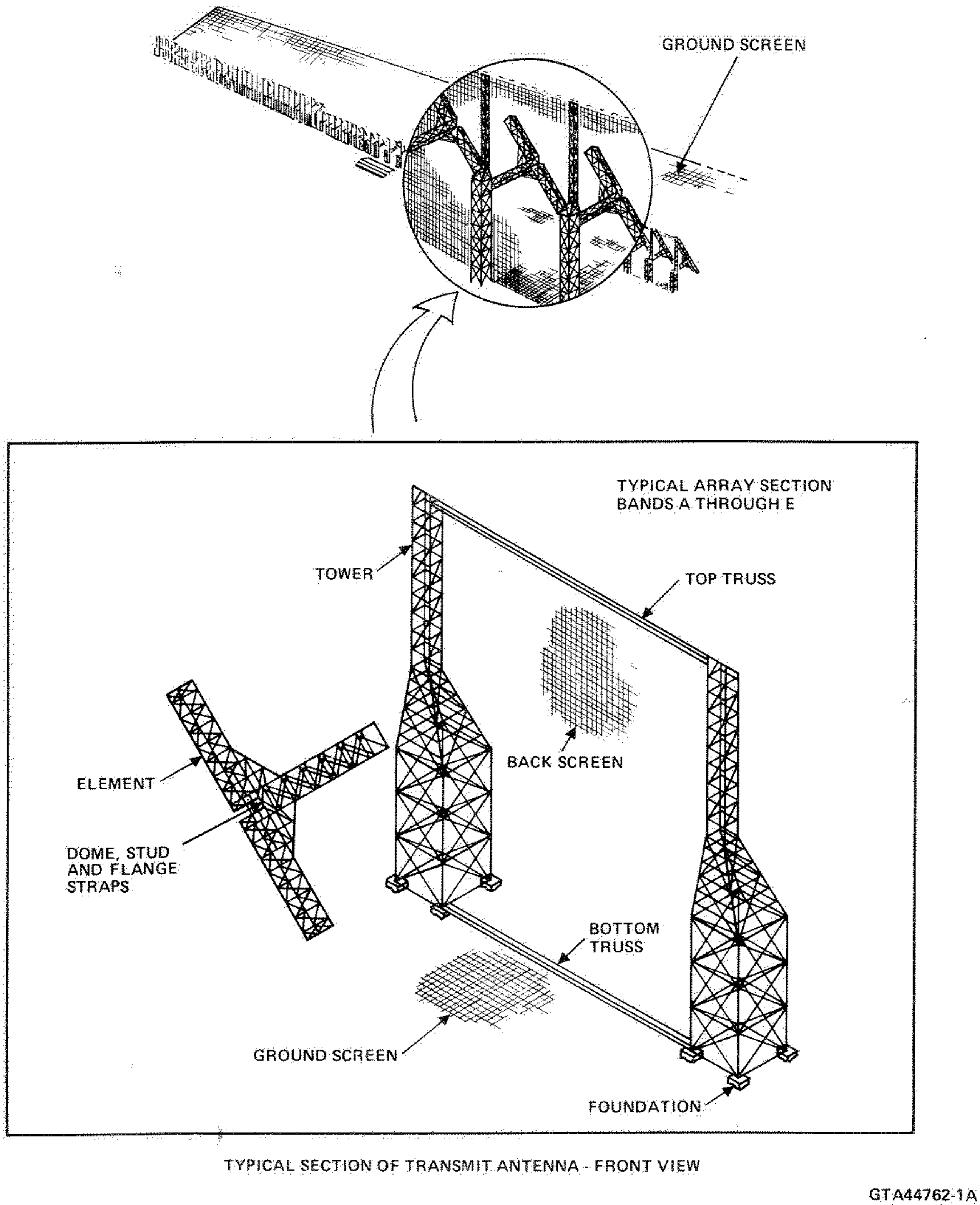


Figure 6-96. Transmit Antenna, Unit 100 (Sheet 1 of 2)

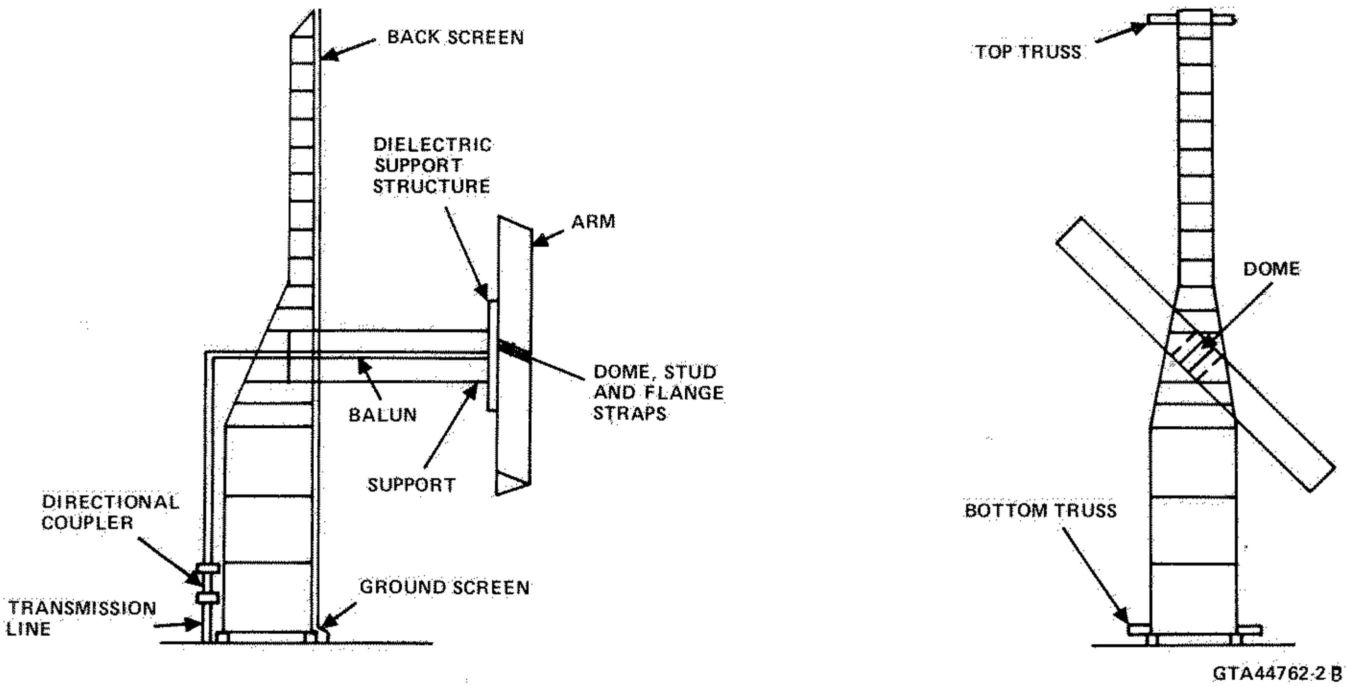


Figure 6-96. Transmit Antenna, Unit 100 (Sheet 2 of 2)

e. Upper and lower truss for wear, corrosion, or physical damage.

f. Backscreen welds for corrosion, signs of weld separation, or physical damage.

g. Backscreen for physical damage and obvious corrosion.

4. Personnel shall repeat step 3 for remaining transmit antenna fields.

5. If physical damage or excessive corrosion is found, the location shall be noted for corrective action during next scheduled transmitter shutdown.

6-9.7 Radio Frequency Screen Inspection and Cleaning, Units 151 and 152. This procedure provides instructions for inspecting and cleaning the RF screen located in the center of the cabinet.

6-9.7.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Brush, dust	1	23d
Cleaner, vacuum	1	23a
Flashlight	1	33m
Mirror, inspection	1	33o

6-9.7.2 Procedure.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside cabinet. Use extreme caution when removing cabinet assemblies and performing inspection or cleaning procedures below.

CAUTION

EQUIPMENT DAMAGE HAZARD

Use extreme caution when cleaning RF screen to prevent damage to screen, cables, and other assemblies.

1. Open cabinet doors.

2. Locate power supply A9 at right side in front section of cabinet and power supply A13 at left side at rear section.

3. Remove power supplies A9 and A13 according to paragraph 6-7.5.5.

4. Loosen 6 captive fasteners on dummy plate below circuit breakers; remove dummy plate.

5. Using flashlight or trouble light, and mirror, inspect both RF screens located directly below power supply A9 and above fan assembly by shining light into power supply enclosure and observing screen with mirror outside power supply enclosure.

6. If significant dust and debris has accumulated on screens perform the following; otherwise go to step 7.

   a. Remove fan assembly A14 at top of cabinet in accordance with paragraph 6-7.5.6.

WARNING

ELECTRICAL SHOCK HAZARD

60 V power is still applied to relays K1, K2, K3 and overtemperature S1 and S2.

   b. Use dust brush and vacuum cleaner with soft brush nozzle to clean the screens.

   c. Reinstall fan assembly A14 in accordance with paragraph 6-7.5.6.

7. Reinstall power supplies according to procedure identified in step 3 above.

8. Position dummy plate and secure with 6 captive fasteners.

9. Close and secure cabinet doors.

6-9.8 Transmit Antenna Inspection (Transmitters Shut-Down), Unit 100. This procedure provides instructions for inspecting the main transmit antenna components during the period that the main and sounder transmitters are not operating.

6-9.8.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Binoculars, 7 x 50 power	2	33ak

6-9.8.2 Procedure.

WARNING

RF RADIATION HAZARD

Harmful radiation exists within the perimeter of the antenna safety fence. Maintenance personnel shall not enter the secure perimeter area unless all transmitter and sounder RF energy is inhibited. Take proper precautions to protect cardiac pacemaker users.

LIGHTNING HAZARD

Maintenance personnel shall not work on antenna field components when thunderstorms are imminent or taking place.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

NOTE

For known serious antenna tower component or ground screen degradation (deterioration of specific components logged during a previous inspection) arrangements shall have been made with approved riggers prior to the scheduled downtime period. The riggers should be available to climb the towers and replace defective tower components during the maintenance period. If antenna tower components require replacement refer to paragraph 6-7.2.

1. The site personnel shall inspect the antenna field components during the allotted downtime.

2. Verify that the transmitter and sounder RF energy is inhibited as described in the transmit antenna field access procedure in paragraph 6-2.8.

NOTE

A ladder may be necessary to view portions of antenna near site building.

3. Using binoculars, maintenance personnel shall position themselves in front and behind

of the designated towers to start the inspection. The following antenna components (Figure 6-96) are included in the inspection of the towers:

a. Antenna element aluminum support and arms for physical damage or signs of corrosion.

b. Two end terminals and associated coaxial lines for heat damage, corrosion, or physical damage. These are located in the element arms.

c. Dielectric support structure for wear, corrosion, or physical damage.

d. The RF transmission line (balun) assembly for overheat damage, corrosion, or physical damage; verify that lexan dome is not damaged.

4. If physical damage or excessive corrosion is found during antenna inspection, the location shall also be noted for immediate corrective action or for repair during next scheduled transmitter shutdown. It may be possible to perform immediate antenna tower repair if the riggers are already at the radar facility.

5. Personnel shall also walk in front of the towers with each man inspecting the ground screen for deterioration and breaks. Slight discoloring is permissible around ground screen weld joints.

6. Physical damage or excessive corrosion found during the ground screen inspection shall be logged as follows for immediate corrective action or for repair during next scheduled antenna shutdown:

a. Using a coordinated antenna field map, identify damage found in the ground screen.

b. If colored or numbered flags are available, flag each antenna ground screen defect for future repairs.

7. If the ground screen requires repair refer to paragraph 6-7.2.6.

8. Repeat steps 3 through 7 for each remaining antenna field.

6-9.9 Transmission Line/Path Time Domain Reflectometer Test Procedure.

6-9.9.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Adapter, BNC(M), type N(F)	1	15aa
Adapter, type N(F) both ends	1	15ab
Adapter, 3 1/8 in, type N(F)	1	15ac
Cable assembly	2	18q
Cart, test	1	33f
Ladder, platform	1	33e
Reducer, 6 1/8 in - 3/18 in	2	15ad
Screwdriver, flat blade	1	25ad
TDR	1	10b
Wrench, box/open	1	32c

6-9.9.2 Procedure. This procedure provides the steps necessary to perform a TDR test on the complete transmission path. The complete transmission path begins at the transmitter end of the transmission line and extends to the antenna dipole element.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Turn on TDR test equipment and note time of day.

2. Perform transmit antenna field access procedure in paragraph 6-2.8.1, except do not leave transmitter building.

WARNING

RF POWER HAZARD

Do not attempt this procedure unless all 12 elemental transmitters have been disabled.

3. At affected transmitter module, disconnect transmission line from rigid elbow of faulty band.

4. Bleed off any static potential between the inner and outer conductor of transmission line by using an insulated tool to temporarily short the inner to the outer conductor.

NOTE

The TDR unit requires a 20-minute warmup period prior to use.

5. Perform operational checkout of TDR test equipment. Refer to test equipment manual supplied with TDR for procedure.
6. Set up test equipment (Figure 6-97).
7. Refer to equipment manual for detailed test equipment operating instructions.
8. The display shows if any discontinuities exist in the cable. The location of the discontinuity can be determined by analyzing the display. Reference data plate on transmission line for cable length.
9. Perform repair or removal procedure (as applicable) for cables.

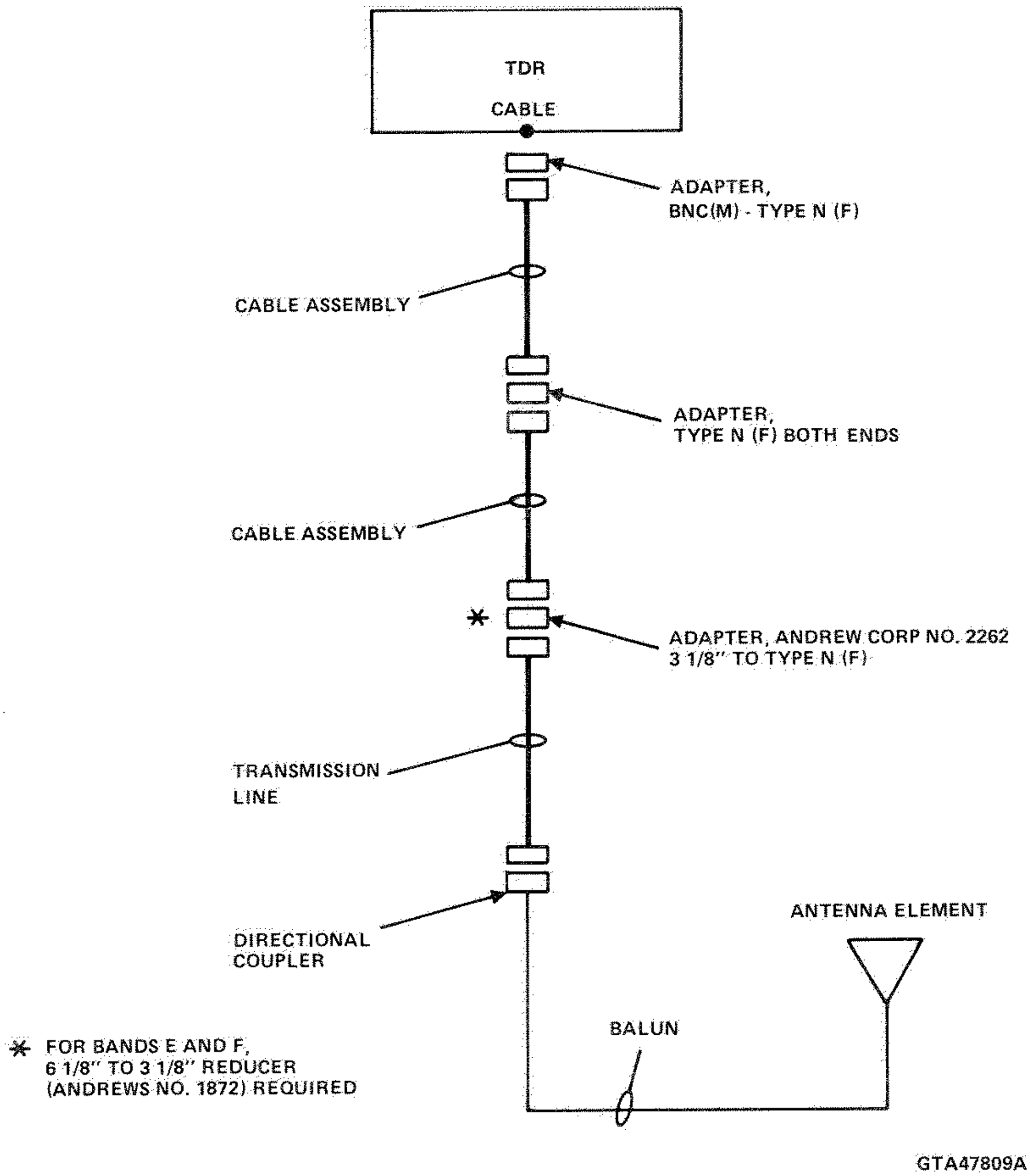


Figure 6-97. Transmission Path Time Domain Reflectometer Test Set-up

NOTE

Perform the following steps only if there are no further maintenance or test procedures to be performed.

10. Connect transmission line to transmitter module rigid elbow from which it was removed.

WARNING

RF RADIATION HAZARD

Ensure that there are no other maintenance actions being performed on equipment by other personnel.

11. Perform transmit antenna field exit procedure in paragraph 6-2.8.2.

6-9.10 Transmission Line/Path Voltage Standing Wave Ratio Test Procedure.

6-9.10.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Accessory kit	1	9p
Adapter, type N(F) both ends	1	15ab
Adapter, 3 1/8 in type N(F)	1	15ac
Cable assembly	2	18q
Cable set	1	18u
Network analyzer (incl 3 manuals)	1	2i
Reducer, 6 1/8 in - 3 1/8 in	2	15ad
Test cart	1	33f
Test set, transmission/reflection	1	2j
Wrench, box/open, set	1	32a

6-9.10.2 Procedure. This procedure provides the steps necessary to perform a VSWR test on the complete transmission path. The complete transmission path begins at the transmitter end of the transmission line and extends to the antenna dipole element.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Turn on all test equipment and note time of day.

2. Perform transmit antenna field access procedure in paragraph 6-2.8.1, except do not leave transmitter building.

WARNING

RF POWER HAZARD

Do not attempt this procedure unless all 12 elemental transmitters have been disabled.

3. At affected transmitter module, disconnect transmission line from rigid elbow of faulty band.

4. Bleed off any static potential between the inner and outer conductor of transmission line by using an insulated tool to temporarily short the inner to the outer conductor.

NOTE

The network analyzer unit requires a 30-minute warmup period prior to use.

5. Perform operational check on network analyzer and transmission/reflection test set.

6. Connect the transmission line to the test setup (Figure 6-98).

7. Perform VSWR check on affected transmission line in accordance with manuals supplied with test equipment.

8. Make VSWR test measurements and record data using network analyzer printer.

9. Repeat VSWR to verify test results.

10. Check VSWR test results versus the maximum allowable VSWR. Refer to Table 6-21 for VSWR limits.

11. This complete the VSWR test.

NOTE

Perform the following steps only if there are no further maintenance or test procedures to be performed.

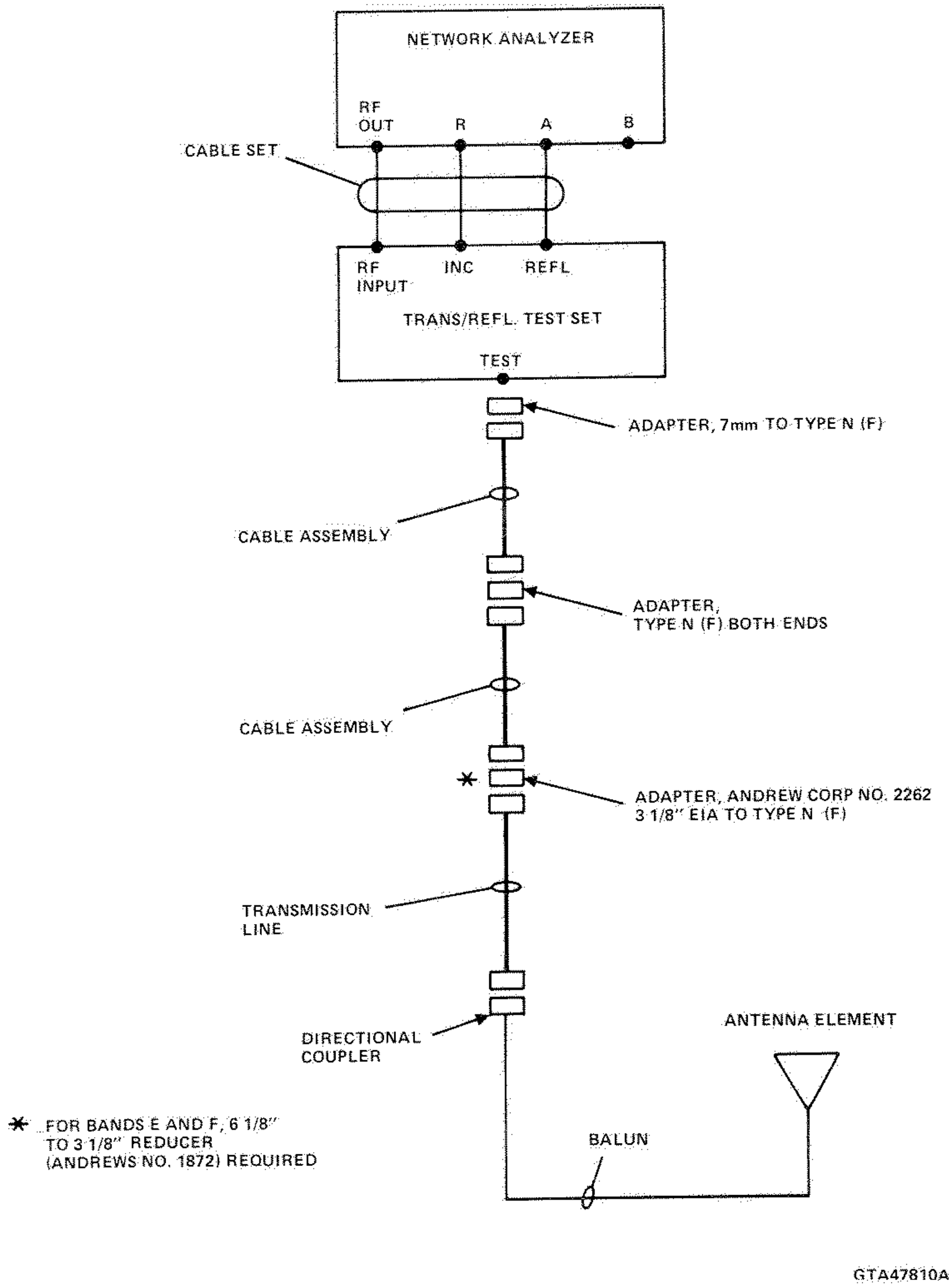


Figure 6-98. Transmission Path Voltage Standing Wave Ratio Test Procedure

Table 6-21. Antenna Elements: Frequency Range and Maximum Acceptable Voltage Standing Wave Radio

Antenna Array Band	Swept Frequency Range MHz	Antenna Elements	VSWR Limit
A	5.00 - 6.74	A_1, A_{12}	1.75
A	5.00 - 6.74	A_2, A_{11}	2.25
A	5.00 - 6.74	A_3, A_{10}	2.00
A	5.00 - 6.74	A_4, A_5, A_6, A_7, A_8, A_9	2.00
B	6.74 - 9.08	B_1, B_{12}	1.75
B	6.74 - 9.08	B_2, B_{11}	2.25
B	6.74 - 9.08	B_3, B_{10}	2.25
B	6.74 - 9.08	B_4, B_5, B_6, B_7, B_8, B_9	2.25
C	9.08 - 12.24	C_1, C_{12}	1.75
C	9.08 - 12.24	C_2, C_{11}	2.25
C	9.08 - 12.24	C_3, C_{10}	2.00
C	9.08 - 12.24	C_4, C_5, C_6, C_7, C_8, C_9	2.00
D	12.24 - 16.50	D_1, D_{12}	1.75
D	12.24 - 16.50	D_2, D_{11}	2.25
D	12.24 - 16.50	D_3, D_{10}	2.00
D	12.24 - 16.50	$D_4$4, D_5, D_6, D_7, D_8, D_9	2.25
E	16.50 - 22.25	E_1, E_{12}	1.75
E	16.50 - 22.25	E_2, E_{11}	1.75
E	16.50 - 22.25	E_3, E_{10}	1.75
E	16.50 - 22.25	E_4, E_5, E_6, E_7, E_8, E_9	1.75
A	5.00 - 6.74	A_1, A_{12}	1.75
F	22.25 - 28.00	F_1, F_{12}	1.75
F	22.25 - 28.00	F_2, F_{11}	1.75
F	22.25 - 28.00	F_3, F_{10}	1.75
F	22.25 - 28.00	F_4, F_5, F_6, F_7, F_8, F_9	1.75

12. Connect transmission line to transmitter module rigid elbow from which it was removed.

WARNING

RF RADIATION HAZARD

Ensure that there are no other maintenance actions being performed on equipment by other personnel.

13. Perform transmit antenna field exit procedure in paragraph 6-2.8.2.

6-9.11 Frequency Drift Check, Unit 151A3.

6-9.11.1 Tools and Test Equipment Required. None.

6-9.11.2 Procedure. (Figure 6-99).

1. Open front door of data conditioner cabinet, Unit 160, if applicable.
2. Observe linear phase recorder, Unit 160A1A4. An acceptable indication is 1 to 3 sloping solid lines in the display area. If there is more than 3, continue with this procedure.

NOTE

Allow time between adjustments to allow frequency calibrator to stabilize.

3. Monitoring linear phase recorder, adjust CONTROL VOLTAGE thumbwheel switches on frequency calibrator, Unit 151A3, until solid line on recorder indicates a slight slope.
4. Close and secure cabinet doors.

6-9.12 Battery Charge and Load Check, Units 151A3 and 152A3.

6-9.12.1 Tools and Test Equipment Required. None.

6-9.12.2 Procedure.

1. On front panel of calibrator, Units 151A3 and 152A3, position MONITOR meter select switch to 4 CHARGE (reference Table 4-5).
2. Monitor meter voltage readings:
   a. 1.0-1.5V NORMAL trickle charge operation.
   b. 1.5-4.5V FAST charge operation.

   The trickle charge reading is expected under normal conditions.
3. On front panel of Units 151A3 and 152A3, set MONITOR meter select switch to 5 BATT.
4. Depress and hold the BATTERY TEST pushbutton; the monitor meter should read between 2.6 and 3.5 (26V to 35V).
5. A reading of zero indicates that the battery voltage is below the minimum allowed value of 26 V dc under load.
6. Depress and release RESET switch.
7. Position MONITOR meter select switch to 2 SUPPLY.

6-9.13 Dc Power Supply Ripple and Noise Check, Units 151 and 152. This procedure provides instructions for performing ripple and noise tests on power supplies in the exciter/auxiliary exciter cabinets.

6-9.13.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Oscilloscope, portable	1	10d

6-9.13.2 Procedure.

WARNING

HIGH CURRENT HAZARD

The outputs of the power supplies tested in the following procedure provide high current. Use extreme care to prevent shorting outputs of supplies.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Open rear door of cabinet.

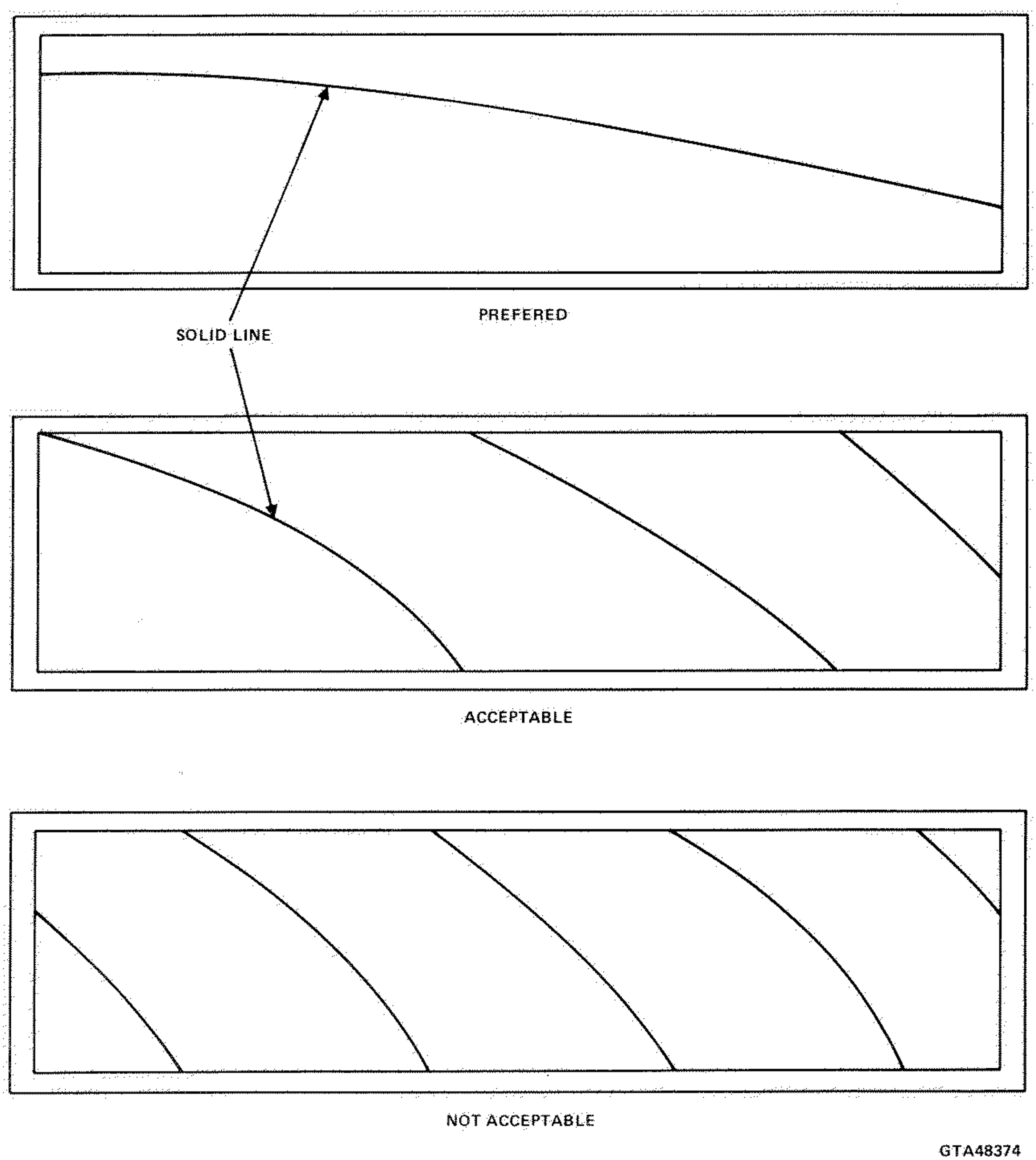


Figure 6-99. Linear Phase Recorder Displays

2. At test points indicated in Table 6-22, use oscilloscope to measure ripple and noise for each voltage.
   a. Use access holes in terminal board covers where provided.
   b. Ripple and noise content must not exceed values specified.
3. If ripple or noise exceeds specified value, perform the following:
   a. In Table 6-23, locate power supply or supplies that exceed ripple and noise specifications for the voltage being measured.
   b. Except for power supply A16, turn off power to each supply, using circuit breaker on panel above supplies, one at a time while observing ripple and noise at monitor point.
   c. If noise and ripple return to specifications with a supply off, replace power supply (or supplied).
   d. On the ± 60 V dc power supplies, if noise and ripple exceed specifications with the single source power supplies off, check identical supply in adjacent bused cabinet(s).
   e. Set applicable power supply circuit breaker to ON for all supplies.
4. Disconnect and remove test equipment.
5. Close and secure cabinet doors.

6-9.14 Voltage Regulator Ripple and Noise Tests, Unit 150. This procedure provides instructions for performing ripple and noise tests on voltage regulators on the transmit beamformer cabinet.

6-9.14.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Oscilloscope, portable	1	10d

6-9.14.2 Procedure.

WARNING

HIGH CURRENT HAZARD

High current sources exist inside the cabinet. The outputs of the voltage regulators tested in the following procedure provide high current. Use extreme care to prevent shorting the outputs of the regulators.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

1. Open rear door of cabinet, Unit 150.
2. At test points indicated in Table 6-24 on test panel N10A3 (reference Chapter 4), use oscilloscope with test probe to measure ripple and noise levels of regulators.
3. If ripple or noise level exceeds the value specified in Table 6-24 perform the following:
   a. In Table 6-25, locate regulators associated with supply voltage that exceeds the ripple or noise specification.
   b. Turn off one of the two voltage regulators.
   c. Repeat ripple and noise measurement.
   d. If measurements indicate ripple and noise within specification, replace turned off voltage regulator with spare; if ripple or noise still exceed specifications, repeat above procedure for remaining voltage regulator associated with defective voltage source (Table 6-25).
   e. At completion of test, ensure all voltage regulators are ON.
4. Close and secure cabinet doors.

Table 6-22. Dc Power Supply Ripple and Noise Values, Units 151 and 152

Voltage	Measure Between Test Points	Maximum Ripple Peak-to-Peak	Maximum Noise Peak-to-Peak
+5 V dc	TB2-1 TB2-10 (Ground)	20 mV	200 mV
-15 V dc	TB7-1 TB7-8 (Ground)	20 mV	250 mV
+15 V dc	TB4-1 TB4-8 (Ground)	20 mV	200 mV
+24 V dc	TB6-1 TB6-9 (Ground)	20 mV	200 mV
-60 V dc	TB9-1 TB9-8 (Ground)	50 mV	300 mV
+60 V dc	TB8-1 TB8-8 (Ground)	20 mV	300 mV
24 V to 5 V dc (Converted)	A16TB1B-8 (Ground) A16TB1B-10	45 mV	200 mV

Table 6-23. Dc Power Supplies, Units 151 and 152

Voltage	Terminal Board Monitoring	Associated Assemblies
Units 151, 152		
+5 V dc	TB2	A10, A11
-15 V dc	TB7	A9
+15 V dc	TB4	A8
+24 V dc	TB6	A12, A13
-60 V dc	TB9	A7
+60 V dc	TB8	A6
24 V to 5 V dc (Converted)	A16TB1B	A16

Table 6-24. Dc Power Supply Ripple and Noise Values, Unit 150

Voltage	Measure Between Test Points	Maximum Ripple Peak-to-Peak	Maximum Noise Peak-to-Peak
Test Panel 150N10A3			
-5 V dc	-5 V (J3) and GND (J4)	75 mV	85 mV
+5 V dc	+5 V (J1) and GND (J2)	35 mV	75 mV
-15 V dc	-15 V (J7) and GND (J8)	45 mV	55 mV
+15 V dc	+15 V (J5) and GND (J6)	50 mV	95 mV

Table 6-25. Voltage Regulator Identification, Unit 150

Voltage	Associated Assemblies
150N10A3	
-5 V dc	VR3, VR4
+5 V dc	VR1, VR2
-15 V dc	VR7, VR8
+15 V dc	VR5, VR6

6-9.15 Frequency Calibrator Alignment, Unit 151A3.

6-9.15.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Adapter, (N)(F)	1	15ab
Adapter, N jack/BNC plug	1	15z
Cable set	1	18u
Oscilloscope, portable	1	10d

6-9.15.2 Procedure.

1. Observe linear phase recorder, Unit 160A1A4, for a solid line or random marks.
2. If recorder indicates a solid line, perform frequency drift check in paragraph 6-9.11; then terminate this procedure.
3. If recorder indicates random marks, connect oscilloscope to INPUT jacks A and B on the front of linear phase recorder and synchronize oscilloscope to the sine waveform.

NOTE

In step 4, adjust thumbwheel switches a maximum of 5 positions (detents) at any one time and allow time after each adjustment for frequency calibrator to stabilize.

4. Monitoring oscilloscope, adjust the CONTROL VOLTAGE thumbwheel switches (up or down depending on the direction of drift) on the frequency calibrator until waveform stops drifting.
5. Continue adjusting frequency calibrator until recorder starts to indicate a steady solid line.
6. Perform frequency drift check in paragraph 6-9.11.
7. Disconnect oscilloscope from phase recorder INPUT jacks A and B.
8. Perform LORAN-C alignment in accordance with TO 31P6-2FPS118-141, Chapter 6.
9. Complete installation procedures in accordance with paragraph 6-7.5.3.3.

6-9.16 Voltage Regulator Check and Adjustment, Unit 150. This procedure provides instructions for checking and adjusting regulated dc voltages provided by the voltage regulators in the TBF, Unit 150.

6-9.16.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Digital multimeter	1	9o

6-9.16.2 Procedure.

WARNING

HIGH CURRENT HAZARD

The output of the voltage regulators provide high current. Avoid shorting the outputs of the regulators.

NOTE

Transmit beamformer cabinet, Unit 150, provides test panel monitoring and adjustment for +5 V dc and +26 V dc regulated voltage. For initial check and adjustment of Unit 150 voltage, the test panel test points are used in accordance with Table 6-26. Ensure that proper voltage is present at each cabinet test point in accordance with Table 6-26. If necessary, readjust voltage in accordance with Table 6-26.

1. Using digital multimeter with test probe set, measure desired dc voltage at test points indicated in Table 6-26.
2. Verify and, if necessary, readjust voltages in accordance with Table 6-26.

Table 6-26. Voltage Regulator Adjustment, Unit 150

Test Panel Test Points	Adjustment	Voltage
+5 V dc (J1) and GND (J2)	+5 V dc (R1) ADJUST	+5.20 ± 0.025 V dc
-5 V dc (J3) and GND (J4)	-5 V dc (R2) ADJUST	-5.20 ± 0.025 V dc
-15 V dc (J7) and GND (J8)	-15 V dc (R4) ADJUST	-15.50 ± 0.50 V dc
+15 V dc (J5) and GND (J6)	+15 V dc (R3) ADJUST	+15.50 ± 0.050 V dc

6-9.17 Exciter/Auxiliary Exciter and Transmit Beamformer, Units 151, 152 and 150, Check and Alignment. Replacement of certain assemblies in the exciter, auxiliary exciter and transmit beamformer cabinet may require that a portion or all of the procedures given below be performed to restore system alignment. The assemblies involved are listed in Table 6-26.1 along with a reference to the subparagraph(s) of the alignment that relate directly to them. During normal troubleshooting, the assemblies should be replaced and the EPM/AFL rerun first to determine if the failure has been corrected. If the fault remains, then the specific alignments associated with the assembly should be performed. If the fault still remains or if information-only messages such as "High phase and output amplitude errors," "Calibration receiver output errors," "Beat note amplitude errors" or "Dc offset errors" etc., are listed by EPM/AFL with no accompanying fault group; or if transmitters begin to trip due to over drive or if the Operations Site receives "power limit alerts"; then the entire alignment should be performed. An overview of the entire alignment is shown in Figure 6-99.1 with the subparagraphs referenced for each major part of the alignment. The first subparagraph, which is not shown on the flowchart, is a procedure to activate the software required to conduct the alignment and is common to each of the remaining subparagraphs.

NOTE

To avoid system mission interference, make sure that coordination with the system maintenance console technician has been accomplished before proceeding with procedure.

6-9.17.1 Activate Alignment Test Software [Hardware Test Software (HTS) and User Test Files (UTF)].

1. Terminate mission using TXAFL TEST SELECTION MENU on TMC. Refer to Positional Handbook for TMC operating instructions.
2. On both computer A and B, terminate mission software and log off as follows:
   a. At LA120 console (or VT100 terminal if available), press RTN.
   b. At USERNAME: type OTHOPERATOR and press RTN and then respond to other requirements (as required).
   c. At OTH OPERATOR OPTIONS menu (Figure 4-6); select 2, TERMINATE MISSION and press RTN.
   d. At DO YOU REALLY WANT TO KILL THE TESTBED? <N>, select Y and press RTN.
   e. At DO YOU STILL WANT TO TERMINATE? <N>, select Y and press RTN.
   f. At ENTER RETURN TO RETURN TO MENU; press RTN.
   g. At OTH OPERATOR OPTIONS menu; select 0, LOG OFF and press RTN.
3. At either computer A or B press RTN and at USERNAME: type SWITCH, press RTN and then respond to other requirements (as required).
4. At WOULD YOU LIKE TO CONNECT TO DT07 [Y/N]?; select Y and press RTN.
5. At WOULD YOU LIKE TO DISCONNECT THE DT07 [Y/N]?; select N and press RTN.
6. On applicable segment TMC terminal, press RTN. At USERNAME: type MAINT_HTS; press RTN and then respond to other requirements (as required).
7. Type ALIGN and press RTN to get alignment directory to begin alignment process.
8. Enter @ALIGNMENT and press RTN to start the alignment program. Then type ECRS or WCRS as applicable and press RTN. The Alignment Main Menu (Figure 6-99.2) should then appear. The specific alignment subroutine can be selected from this menu for checking and aligning the Transmit Site Control and Monitor Room equipment: Exciter, Aux Exciter, Calibration Receivers and Transmit Beamformer. The user will be directed which menu options to select during the alignment process.

6-9.17.2 Check/Set Exciter/Auxiliary Exciter Hard Limit Values.

Tools and Test Equipment Required

Name	Qty.	Table 1-4 Item No.
Adapter N plug to TNC jack	1	15ac
Platform ladder	1	33e
Power meter, with 8482 power sensors	1	9a,b,c
Tuning wand	1	25ba

Table 6-26.1. Crossreference of Assemblies to Alignment Procedure Subparagraph(s)

Assembly Name	Reference Designator	Procedure Subparagraph(s)
Exciter, Auxiliary Exciter, Unit 151 or 152		
Calibration Receiver	A1	6-9.17.4
Power Amplifier	N1A11	6-9.17.2 and 6-9.17.3
Sum Taper Attenuator	N1A12	6-9.17.2 and 6-9.17.3
Synthesizer	A4	6-9.17.2 and 6-9.17.3
Transfer Switch	A15	6-9.17.2 and 6-9.17.3
Transmit Beamformer, Unit 150		
Modulator Control	N4A1 through A5 N5A1 through A6 N7A1	6-9.17.6
RF Modulator	N4A7, A9, A11, A13, A15 N5A7, A9, A11, A13, A15, A17 N7A7	6-9.17.7
RF Amplifier	N4A8, A10, A12, A14, A16 N5A8, A10, A12, A14, A16, A18 N7A8	6-9.17.8 and 6-9.17.9
Switching Assembly	A11 A11AT1, AT2	6-9.17.5
Variable Attenuator	N4A17, A18 N7A10, A11	6-9.17.5
Channel Balance Attenuators	N6AT1, AT2	6-9.17.5
90^{0} Hybrid	N6HY1 , HY2	6-9.17.5
Power Divider	N6HY3 through HY6	6-9.17.5

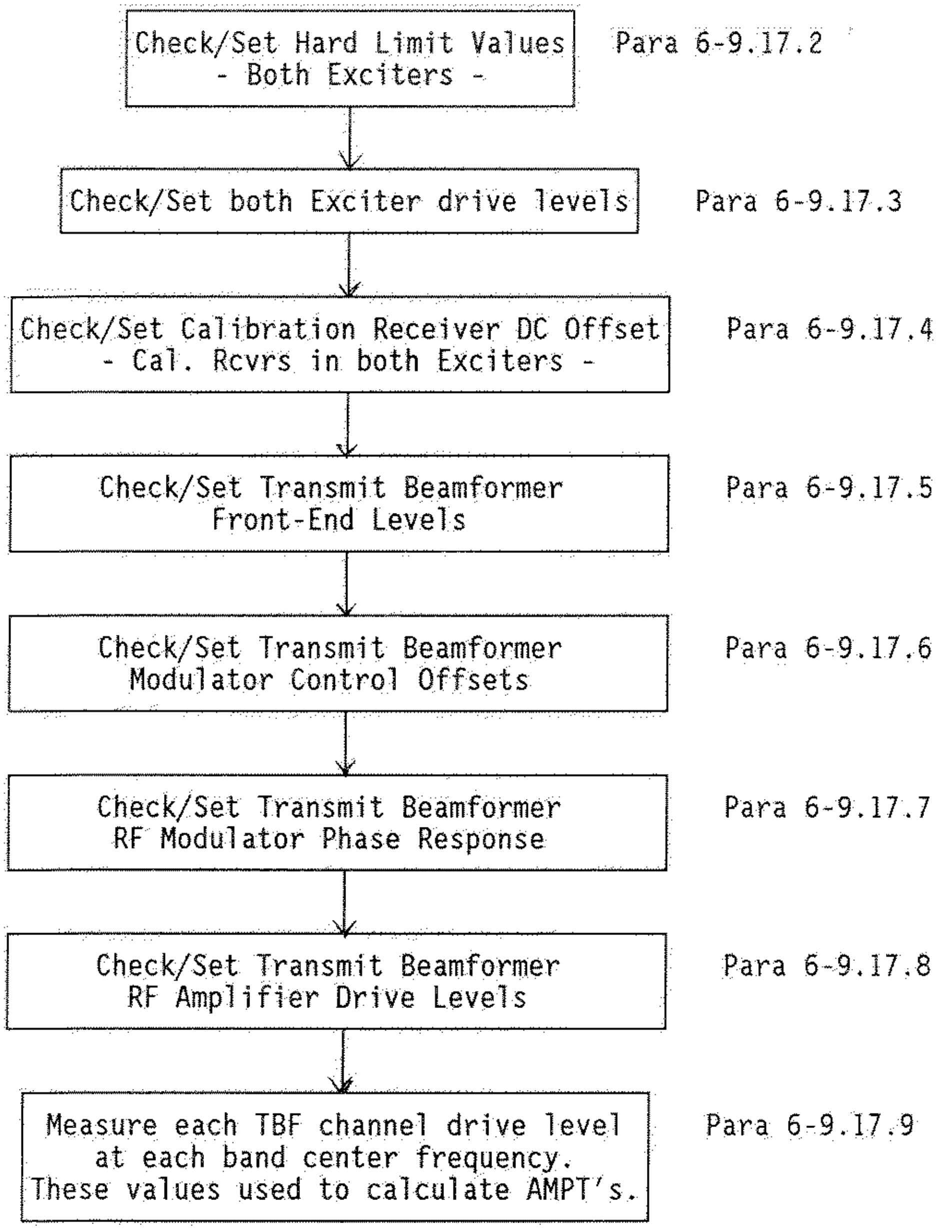


Figure 6-99.1. Exciter/Auxiliary Exciter and Transmit Beamformer Alignment Procedure Flowchart

```
                    TRANSMIT SITE SUBSYSTEM ALIGNMENT
                               MAIN MENU

SELECT OPTION

1.EXCITER 1
2.EXCITER 2
3.TRANSMIT BEAMFORMER
4.CALIBRATION RECEIVER 1
5.CALIBRATION RECEIVER 2
6.EXIT ALIGNMENT MAIN MENU

              ENTER YOUR CHOICE:
```

Figure 6-99.2. Alignment Main Menu

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. Calibrate the power meter with adapter.
2. If not already accomplished, perform procedures in paragraph 6-9.17.1. Select option 1 from the main menu to activate Exciter 1, Unit 151 (Figure 6-99.3).
3. Connect the power meter at J20 of Exciter 1.
4. Select option 1 from the Exciter menu.
5. The hard limit value should be 8.00 dbm ± 0.05 db. If the Measurement is out of tolerance, remove J1 from N1A12 (Sum Taper Attenuator) and adjust N1A12AT12 for 8dbm.
6. Select option 2 to step exciter through 8 frequencies and record readings on Table 6-26.2. Ensure measurements are equal to 8 dbm ± .5db.
7. Select option 5 to return to the main menu.
8. Repeat steps 3 through 7 for Exciter 2, Unit 152. Select main menu option 2 for Exciter 2. Record measurements on Table 6-26.2.
9. Reconnect cables to J1 on N1A12 and J20 at top of Exciter cabinet.
10. To exit alignment routine if desired, select option 6 from main menu. Then restore computer and system operation.

6-9.17.3 Check/Set the Exciter/Auxiliary Exciter Drive Level.

Tools and Test Equipment Required

Name	Qty.	Table 1-4 Item No.
Adapter N plug to TNC jack	1	15ac
Platform ladder	1	33e
Power Meter with 8482 power sensors	1	9a,b,c
Tuning wand	1	25ba
RF board extender	1	3g
Wrist strap	1	33i

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. Calibrate the power meter with adapter.
2. If not already accomplished, perform procedures in paragraph 6-9.17.1. Select option 1 from the main menu to activate Exciter 1, Unit 151, (Figure 6-99.3).
3. Connect the power meter at J21 of Exciter 1.
4. Select option 3 from the Exciter menu.
5. Ensure that the RF drive level is set for 18.5 dbm ± 0.2 db. If the measurement is out of tolerance, place 151N1A11 on a board extender and adjust N1A11AT1 for 18.5 dbm.
6. Select option 4 from the Exciter menu to step the exciter through 8 frequencies and record readings under Table 6-26.3, Column A; then select option 5 to return to main menu.
7. Disconnect power meter from J21 of Exciter 1 and reconnect cable.
8. Connect the power meter at J21 of Exciter 2.
9. Select option 2 from the main menu to activate exciter 2, Unit 152.
10. Select option 4 from the Exciter 2 menu and record the readings under Table 6-26.3, column B. When the test file finishes the computer will ask you to input the measurements from Table 6-26.3, column A and then column B.
11. Record the Exciter 2 adjustment value in Box 1. Press RTN. If the adjustment value is less than 0.20 db, go to step 14.
12. Select option 3 from the Exciter menu. Place 152N1A11 on a board extender and adjust N1A11AT1 by the amount in Box 1.
13. Select option 4 from the Exciter menu and record measurements under Table 6-26.3, column C. This shows the results adjustment made in step 12.
14. If used, remove board extender and replace N1A11 in cabinet.
15. Disconnect power meter from J21 of Exciter 2 and reconnect cable.
16. Select option 5 to return to main menu.
17. To exit alignment routine if desired, select option 6 from main menu. Then restore computer and system operation.

```
                    EXCITER 1 ALIGNMENT MENU

SELECT OPTION

1.HARDLIMIT ALIGNMENT
2.HARDLIMIT MEASUREMENT
3.RF DRIVE LEVEL ALIGNMENT
4.RF DRIVE LEVEL MEASUREMENT
5.RETURN TO MAIN MENU

              ENTER YOUR CHOICE:
```

Figure 6-99.3. Exciter Alignment Menu (Same for Exciter 2)

Table 6-26.2. Exciter Hard Limit Test Data

Freq Mhz	Exciter 1	Exciter 2
5.00		
5.83		
7.61		
10.54		
14.23		
19.22		
24.89		
28.00		

The Hard Limit for both Exciters must be 8.00 ± 0.5 dbm.

Are the Hard Limits for each Exciter within tolerance?

Exciter 1 - YES ☐ NO ☐

Exciter 2 - YES ☐ NO ☐

Table 6-26.3. Exciter Drive Level Test Data

	A	B	C
Freq Mhz	Exciter 1	Exciter 2	Exciter 2
5.00			
5.83			
7.61			
10.54			
14.23			
19.22			
24.89			
28.00			

Box-1

Exciter 2 Adjustment Value - [ ] If less than 0.20 db, do not adjust.

6-9.17.4 Check/Set Exciter/Auxiliary Exciter Calibration Receiver DC Offset.

Tools and Test Equipment Required

Name	Qty.	Table 1-4 Item No.
Digital multimeter	1	9o
Tuning wand	1	25ba
1/4 inch open end wrench	1	32i
50 ohm male BNC termination	1	17c
Adapter BNC to TNC	1	15w

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. If not already accomplished, perform procedures in paragraph 6-9.17.1. If Unit 151A1 has been replaced, select option 4 from the main menu to activate Calibration Receiver 1, Unit 151 (Figure 6-99.4). If Unit 152A1 has been replaced, go to step 19.
2. Remove the cable on J3 of the Cal Rx and install a 50 ohm terminator in its place.
3. Remove the cable on J10 (I) of Cal Rx1. Set the multimeter to the dc mv range. Connect ground lead of multimeter to ground stud of receiver. Connect positive lead of multimeter to one of two sockets in J10 that provides the highest voltage indication on the multimeter.
4. Select option 1 from the Cal Rx 1 menu.
5. Record the 6 measurements (including sign) on Table 6-26.4 under I value column. When the test file finishes the computer will ask you to input the measurements (including sign) from Table 6-26.4 I value column.

NOTE

If any of the six measurements exceeds 100 mv (positive or negative), replace the receiver and repeat alignment.

6. Record the offset adjustment in Box 2 under the I column. Press RTN.
7. Select option 2 from the Cal Rx menu.
8. Adjust R1 on Cal Rx by amount recorded in Box 2. (Increase means more positive, decrease means less positive.)
9. Reconnect cable at J10.
10. Remove the cable on J11 (Q) of Cal Rx1. Set the multimeter to the dc mv range. Connect ground lead of multimeter to ground stud of receiver. Connect positive lead of multimeter to one of two sockets in J11 that provides the highest voltage indication on the multimeter.
11. Select option 1 from the Cal Rx 1 menu.
12. Record the 6 measurements (including sign) on Table 6-26.4 under Q value column. When the test file finishes the computer will ask you to input the measurements (including sign) from Table 6-26.4 Q value column.

NOTE

If any of the six measurements exceeds 100 mv (positive or negative), replace the receiver and request alignment.

13. Record the offset adjustment in Box 2 under the Q column. Press RTN.
14. Select option 2 from the Cal Rx menu.
15. Adjust R2 on Cal Rx by amount recorded in Box 2 if more than 0.20 dB.
16. Reconnect cable at J11.
17. Remove 50 ohm termination and reconnect cable on J3.
18. Select option 3 to return to the main menu.
19. Repeat steps 2 through 18 for Cal Rx2, Unit 152A1, by selecting option 5 from the main menu and using Table 6-26.5. and box 3.
20. To exit alignment routine if desired, select option 6 from main menu. Then restore computer and system operation.

```
                    CALIBRATION RECEIVER1 ALIGNMENT MENU

SELECT OPTION

1.OFFSET MEASUREMENT
2.OFFSET ALIGNMENT
3.RETURN TO MAIN MENU

              ENTER YOUR CHOICE:
```

Figure 6-99.4. Calibration Receiver Menu (Same for Receiver 2)

Table 6-26.4. Calibration Rx 1 Dc Offset Test Data

MEAS. number	I Value	Q Value
1		
2		
3		
4		
5		
6		

Calibration RX 1 Adjustment Values

I	Q

Box-2

Table 6-26.5. Calibration Rx 2 Dc Offset Test Data

MEAS. number	I Value	Q Value
1		
2		
3		
4		
5		
6		

Calibration RX 2 Adjustment Values

I	Q

Box-3

6-9.17.5 Transmit Beamformer Front End Alignment.

Tools and Test Equipment Required

Name	Qty.	Table 1-4 Item No.
Adapter BNC right angle	1	15ad
Adapter N plug to TNC jack	1	15ac
Power meter, with 8482 sensor	1	9a,b,c
Tuning wand	1	25ba
Screwdriver, small	1	25ae

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. Calibrate the power meter with adapter.
2. If not already accomplished, perform procedures in paragraph 6-9.17.1. Select option 3 from the main menu to begin the Transmit Beamformer, Unit 150, alignment (Figure 6-99.5).
3. From the Beamformer alignment menu select option 1 to turn on the Exciter at 28 MHz.
4. Disconnect the cable at 150A11J4 and connect the power meter to J4.
5. Adjust A11AT1 (POWER DIVIDER COMPENSATION - NORMAL) for 15.5 dbm ±0.3 db.
6. Remove power meter and reconnect cable at J4.
7. Disconnect the cable at A11J5 and connect the power meter to J5.
8. Adjust A11AT2 (POWER DIVIDER COMPENSATION - ECCM) for 15.5 dbm ±0.3 db.
9. Remove power meter and reconnect cable at J5.
10. Remove cable at hybrid N6HY1-2.
11. Connect power meter to N6HY1-2.
12. Adjust N6AT1 (CHANNEL BALANCE - ECCM) for 10.0 dbm ±0.3 db.
13. Remove power meter and reconnect cable at N6HY1-2.
14. Remove cable at hybrid H6HY2-2.
15. Connect power meter to N6HY2-2.
16. Adjust N6AT2 (CHANNEL BALANCE - NORMAL) for 10.0 dbm ±0.3 db.
17. Remove power meter and reconnect cable at H6HY2-2.
18. Select option 7 to return to the main menu.
19. To exit alignment routine if desired, select option 6 from main menu. Then restore computer and system operation.

6-9.17.6 Transmit Beamformer Modulator Control Board Alignment.

Tools and Test Equipment Required

Name	Qty.	Table 1-4 Item No.
Digital multimeter	1	9o
PWB extender	1	3h
Tuning wand	1	25ba
Wrist strap	1	33i

NOTE

This procedure need only be performed if a channel does not meet the amplitude and phase specifications.

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. If not already accomplished, perform procedures in paragraph 6-9.17.1. Select option 3 from the main menu to begin the Transmit Beamformer, Unit 150, alignment (Figure 6-99.5).
2. Select option 2 from the Beamformer alignment menu.
3. Place suspected Unit 150 modulator control board on an extender.
4. Connect multimeter to P2-6 of board.
5. Adjust R38 for 0.000VDC ±.005V.
6. Connect multimeter to P2-12 of board.
7. Adjust R40 for 0.000VDC ±.005V.
8. Connect multimeter to P2-24 of board.
9. Adjust R54 for 4.000VDC ±.007V.
10. Connect multimeter to P2-52 of board.
11. Adjust R57 for 4.000VDC ±.005V.

```
                    BEAMFORMER ALIGNMENT MENU

SELECT OPTION

1. FRONTEND ALIGNMENT
2. MODULATOR CONTROL BOARD ALIGNMENT
3. RF MODULATOR BOARD MEASUREMENTS
4A.RF MODULATOR BOARD I ALIGNMENT
4B.RF MODULATOR BOARD Q ALIGNMENT
5. RF AMPLIFIER ALIGNMENT
6A.RF AMPLIFIER MEASUREMENTS
6B.AMPT CONVERSION
7. RETURN TO MAIN MENU

              ENTER YOUR CHOICE:
```

Figure 6-99.5. Transmit Beamformer (TBF) Alignment Menu

12. If any of the above measurements cannot be adjusted into specifications, the board should be replaced; then repeat steps 2 through 11.

13. Disconnect multimeter from P2-52. Remove modulator control board from extender card and reinstall.

14. Repeat procedure for any other suspected modulator control boards or select option 7 to return to the main menu.

15. To exit alignment procedure if desired, select option 6 from the main menu. Then restore computer and system operation.

6-9.17.7 Transmit Beamformer RF Modulator Board Alignment.

Tools and Test Equipment Required

Name	Qty.	Table 1-4 Item No.
Platform ladder	1	33e
Power meter with 8482 sensors	1	9a,b,c
RF board extender, (TBF)	1	3f
Tuning wand	1	25ba
Wrist strap	1	33i

NOTE

This procedure need only be performed if a channel does not meet the amplitude and phase specifications.

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. Calibrate the power meter with adapter.

2. If not already accomplished, perform procedures in paragraph 6-9.17.1. Select option 3 from the main menu to begin the Transmit Beamformer, Unit 150, alignment (Figure 6-99.5).

3. Connect the power meter to the appropriate channel output jack (CP1 through CP12 at top of beamformer) for the desired Unit 150 RF modulator board.

4. Select option 3 from the Beamformer alignment menu and record the 8 power meter measurements on Table 6-26.6 for the appropriate channel.

5. Calculate the amplitude delta for the channel. If the delta is greater than 1.5db proceed with step 6 of this procedure; otherwise, go to step 21.

6. Place the channel's corresponding RF modulator board on a board extender.

7. Select option 4A from the beamformer alignment menu.

8. Set power meter to mw scale. While viewing the power meter rotate R5 on board fully clockwise and note meter reading.

9. Rotate R5 fully counter-clockwise and note reading.

10. Set R5 to midpoint value.

11. While viewing the power meter rotate R28 on board fully clockwise and note meter reading.

12. Rotate R28 fully counter-clockwise and note reading.

13. Set R28 to midpoint value. Record value in Box 4.

14. Select option 4B from the beamformer alignment menu.

15. While viewing the power meter rotate R46 on board fully clockwise and note meter reading.

16. Rotate R46 fully counter-clockwise and note reading.

17. Set R46 to midpoint value.

18. Set R70 on board to level recorded in Box 4.

19. Repeat steps 4 through 5. If the delta is greater than 1.5 db, replace the RF modulator board and return to step 4.

20. Remove RF modulator board extender and card. Reinstall board in cabinet.

21. Disconnect power meter from top of cabinet and ensure all cables have been reconnected.

22. Repeat procedure for any other suspected RF modulator boards or select option 6 to return to the main menu.

23. To exit alignment procedure if desired, select option 6 from main menu. Then restore computer and system operation.

Table 6-26.6. RF Modulator Board Response Test Data

Corresp. Angle	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6
0						
45						
90						
135						
180						
225						
270						
315						
Delta						
RF Mod R28 Meas.						

Box-4

Table 6-26.6. RF Modulator Board Response Test Data -CONT

Corresp. Angle	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12
0						
45						
90						
135						
180						
225						
270						
315						

Delta						

RF Mod R28 Meas.						

Box-4

6-9.17.8 Transmit Beamformer RF Amplifier Board Alignment.

Tools and Test Equipment Required

Name	Qty.	Table 1-4 Item No.
Platform ladder	1	33e
Power meter, with 8482 sensors	1	9a,b,c
Tuning wand	1	25ba

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. Calibrate the power meter with adapter.
2. If not already accomplished, perform procedures in paragraph 6-9.17.1. Select option 3 from the main menu to begin the Transmit Beamformer, Unit 150, alignment (Figure 6-99.5).
3. Connect the power meter to the appropriate channel output jack (CP1 through CP12 at top of beamformer) for the desired RF amplifier board.
4. Select option 5 from the beamformer alignment menu.
5. Adjust AT1 on RF amplifier board to 17.5 dbm ±.3db.
6. Disconnect the power meter from the CP jack and reconnect the cable.
7. Repeat steps 3, 5, and 6 for any of the other 11 channels (if required).
8. Select option 7 from the Beamformer menu to return to the main menu.
9. Perform procedures in paragraph 6-9.17.9.

6-9.17.9 Measurement of Transmit Beamformer Channel Drive Levels at Band Centers for AMPT Calculations.

Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Platform ladder	1	33e
Power meter, with 8482 sensors	1	9a,b,c
Tuning wand	1	25ba

NOTE

Press RTN after selecting option to activate options in following steps. When applicable, type ECRS or WCRS after prompt and press RTN.

1. Calibrate the power meter with adapter.
2. If not already accomplished, perform procedures in paragraph 6-9.17.1. Select option 3 from the main menu to begin the Transmit Beamformer, Unit 150, alignment (Figure 6-99.5).
3. Connect the power meter to the appropriate channel output jack (CP1 through CP12) at the top of the beamformer for the desired RF amplifier board.
4. Select option 6a from the beamformer alignment menu.
5. The test file will step through the midband of each of the six subbands (A through F). Record the power meter measurements on Table 6-26.7 for the appropriate channel.
6. Disconnect the power meter from the CP jack and reconnect the cable.
7. Repeat steps 3 through 6 for any other newly aligned channels.
8. Select option 6b to convert the measurements to AMPT constant. Record the AMPT constant values on Table 6-26.7. Press RTN.
9. Select option 7 from Beamformer menu to return to main menu. Then select option 6 from main menu to exit alignment.
10. At TMC terminal type SET DEF [-.-] and press RTN.
11. Type SET DEF [.WB.DAT] and press RTN.
12. Type EDT TX1_ or TX2_ or TX3_ MEAS.DAT as applicable and press RTN. At the asterisk (*), type C and press RTN.
13. Press PF1 and PF3. At SEARCH FOR: type AMP T and press ENTER.
14. Type new AMPT values into table for the bands as shown in Figure 6-99.6 and delete old values. Make sure comma delimiters are inserted between values.
15. Press CTRL Z and at asterisk (*) type EXIT and press RTN.
16. Restore computer and system operation.

Table 6-26.7. Measurements for AMPT Calculations

Band		Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6
A	dbm						
	ampt						
B	dbm						
	ampt						
C	dbm						
	ampt						
D	dbm						
	ampt						
E	dbm						
	ampt						
F	dbm						
	ampt						

Band		Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12
A	dbm						
	ampt						
B	dbm						
	ampt						
C	dbm						
	ampt						
D	dbm						
	ampt						
E	dbm						
	ampt						
F	dbm						
	ampt						

BAND A	BAND B	BAND C	BAND D	BAND E	BAND F

~~,429,.~~ ~~.9852,.~~ ~~5,~~
.[illegible]4,.9407,.9768,.9842,.99[illegible].9732,
.9572,.9385,.9792,.9832,.9928,.9730, / END OF AMP F
~~1493.55,1123.88,1359.00,1036.86,1107.18,1144.77,~~
1526.59,1194.59,1371.57,1099.56,1105.91,928.37,
1478.15,1395.47,1346.54,1238.00,1100.83,955.47,
~~1444.51,1505.63,1329.59,1300.83,1097.03,966.54,~~
1436.21,1363.70,1220.44,1221.01,1090.74,954.38,
1462.92,1514.33,1349.64,1325.01,1113.57,972.12,
~~1553.17,1419.77,1342.84,1168.74,1155.37,964.32,~~
1400.29,1390.65,1308.34,1222.42,1094.51,952.18,
1563.94,1398.68,1419.77,1232.31,1138.20,953.28,
~~1432.91,1423.05,1335.73,1240.85,1102.10,957.68,~~
1222.42,1459.55,1158.03,1256.66,1017.93,957.68,
1167.40,1439.53,1086.97,1252.33,972.12,956.58, / END OF AMP T
~~.0005370,.0005188,.0004898,.0004732,.0004467,.0004416,~~
.0005370,.0005188,.0004898,.0004732,.0004467,.0004416,
.0005370,.0005188,.000[illegible].0004732,.0[illegible]67,.0004416
~~.0005188,~~

CHANNELS

A	B	C	D	E	F
1 → 12 (up)	1 → 12 (down)	1 → 12 (up)	1 → 12 (down)	1 → 12 (up)	1 → 12 (down)

READ CHANNEL NUMBERS 1 THROUGH 12 FROM THE BOTTOM UP FOR BANDS A, C, AND E; READ FROM THE TOP DOWN FOR BANDS B, D, AND F.

Figure 6-99.6. Typical AMPT File Printout

17. Identify the recorded AMPT calculations table with appropriate site and segment number. Forward a copy (or the updated TX1, TX2 or TX3_ MEAS.DAT file) to Site System Software Manager and request a change to the Mission Software Data Base for the new values.

6-9.18 Analog-to-Digital Converter Fan Check, Units 151 and 152. This procedure provides instructions for checking the operation of the A/DC fan in the exciter and auxiliary exciter.

6-9.18.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Flashlight	1	33m

6-9.18.2 Procedure.

WARNING

HIGH VOLTAGE AND CURRENT HAZARD

High voltage and current sources exist inside the cabinets. Use extreme caution while working inside cabinets.

1. Open rear door of cabinet.
2. Locate A/DC in top half of cabinet on right side.
3. Observe that all fans are operating properly and are not noisy.
4. Close and secure cabinet door.

6-9.19 Radio Frequency Radiation Hazard Check.

6-9.19.1 Tools and Test Equipment Required.

Name	Qty.	Table 1-4 Item No.
Meter, field strength	1	9s

6-9.19.2 Procedure.

1. Ensure all panels, covers, and doors on transmitter module are secured.

NOTE

The transmitter module must be transmitting at or near full power.

2. Reference Table 6-27 for maximum acceptable E and H field readings.
3. Station one technician at the front panel of transmitter module to monitor output power and which band the transmitter is operating in. The other technician is to perform scans.

NOTE

During E and H field scans, if an area of equipment exceeds acceptable limits tag area for investigation at termination of E and H field scans.

4. Using the E field probe, carefully scan the affected area of transmission line, and transmission line connection points on the transmitter module.
5. Using the H field probe, carefully scan affected area of transmission line and transmission line connection points on the transmitter module.
6. If any measurements exceed maximum acceptable readings.
   a. Power down transmitter module in accordance with paragraph 6-2.7.2.
   b. Check area of noncompliance for loose connections, missing parts, defective components and repair as necessary.
   c. Perform this procedure again to verify problem was corrected.
   d. If after repair of equipment measurements still exceed acceptable limits:
      (1) Power down transmitter module in accordance with paragraph 6-2.7.2.
      (2) Notify appropriate safety personnel of hazard.

Table 6-27. Maximum Acceptable Readings for RF Radiation Hazard Check

Band	E Field	H Field	Power Density
A	103,595	0.65	25.90
B	57,465	0.36	14.37
C	31,620	0.20	7.90
D	17,422	0.11	4.35
E	9,590	0.06	2.40
F	5,714	0.35	1.43

Note: Center frequency of each band was used to calculate acceptable readings.

Section II. SPECIAL MAINTENANCE

6-10 INTRODUCTION.

This section provides procedures in part number order for manually troubleshooting and repairing specific assemblies on the bench. Test procedures are given in paragraph 6-11 and alignment procedures are given in paragraph 6-12. Paragraph 6-13 gives disassemble and assembly procedures and paragraph 6-14 gives electronic assembly parts location illustrations.

6-11 ANALOG AND MECHANICAL ASSEMBLY TEST PROCEDURES.

6-11.1 Introduction. The following paragraphs provide bench test procedures necessary to maintain various LRUs in the transmitter group. The procedures are used as an aid for LRU troubleshooting or as otherwise required to determine the operational condition of an LRU. Parameter data consisting of waveforms, power levels, and/or voltage values obtained from a single equipment are provided, as required for each LRU test procedure. This data provides point of measurement for each parameter. The test procedure also references the associated alignment procedure if alignment of the LRU is required. Each of the test procedures given below contains a list of test equipment required but not supplied to perform the test. Each piece of test equipment given is identified by an item number. The item number refers to equipment listed in Table 1-4 of Chapter 1. As necessary, each procedure references the associated schematic, logic, or parts diagrams to aid the user. The schematic or logic diagram references refer to the transmitter group circuit diagram TO 31P6-2FPS118-73-1. The parts location diagram references refer to paragraph 6-14.

6-11.2 +/-15 V Dc Power Supply (7328363G1) Performance Test.

6-11.2.1 Purpose. This procedure provides the following tests that evaluate the performance of the +/-15 V dc power supply.

1. Load current
2. Output voltage.

6-11.2.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-11.2.3 Reference Material. See schematic diagram Figure 54 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagram Figures 6-118 and 6-129 in this TO. For power supply PS1 refer to TO 35C1-2-1141-2.

6-11.2.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Screwdriver, flat blade	1	25ae
Set, test probe	1	9h
Static control work station	1	33c
Supply power 0-15V, 3A	1	13d
Test cable (assembly 1)	1	18e
Test cable (assembly 2)	1	18f
Test cable, BNC	1	18k
Wrench set	1	32a
Wrist strap	1	33i

6-11.2.5 Prerequisites. None.

6-11.2.6 Test Procedure. Refer to Figure 6-100 and Table 6-28. The maintenance personnel shall always perform the entire procedure in Table 6-28 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standard when performing a step, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.2.7 Alignment Procedure. Perform steps in paragraph 6-12.2.

6-11.2.8 Postrequisites. None.

6-11.3 +/-15 V Dc Power Supply (7329140G1) Performance Test.

6-11.3.1 Purpose. This procedure provides the following tests that evaluate the performance of the +/-15 V dc power supply.

1. Load current
2. Output voltage.

6-11.3.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-11.3.3 Reference Material. See schematic diagram Figure 53 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-119 and 6-130 in this TO. For power supply PS1, see TO 31S5-4-3176-1.

6-11.3.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Load solid state	1	7a
Multimeter digital (1)	1	9f
Multimeter digital (2)	1	9o
Screwdriver, flat blade	1	25ae
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-15V, 3A	1	13d
Test cable (assembly 1)	1	18e
Test cable (assembly 2)	1	18f
Test cable, BNC	1	18k
Wrench set	1	32a
Wrist strap	1	33i

6-11.3.5 Prerequisites. None.

6-11.3.6 Test Procedure. Refer to Figure 6-101 and Table 6-29. The maintenance personnel shall always perform the entire procedure in Table 6-29 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standard when performing a step, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.3.7 Alignment Procedure. Perform steps in paragraph 6-12.3.

6-11.3.8 Postrequistes. None.

6-11.4 +/-60 V Dc Power Supply (7343908G1) Performance Test.

6-11.4.1 Purpose. This procedure provides the following tests that evaluate the performance of the +/-60 V dc power supply.

1. Load current
2. Output voltage.

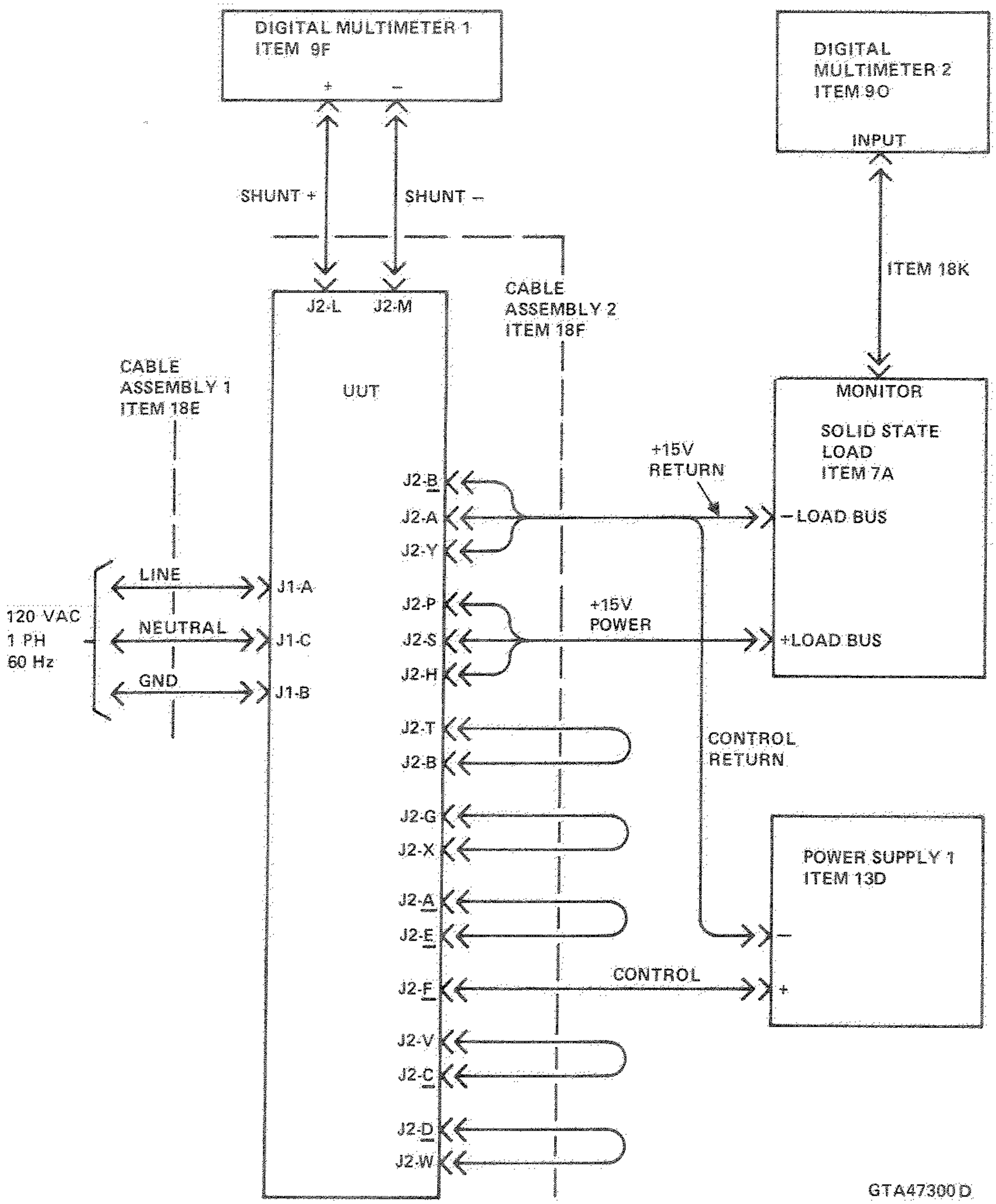


Figure 6-100. +/-15 V Dc Power Supply (7328363G1) Test Setup

Table 6-28. +/-15 V Dc Power Supply (7328363G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1a	Condition digital multimeters 1 and 2 to read dc voltage. Adjust power supply 1 for 0 V dc output voltage. Condition solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.			

Table 6-28. +/-15 V Dc Power Supply (7328363G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep cable assembly leads isolated from ground when not in use. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1b	Connect test equipment to UUT per Figure 6-100. Turn on digital multimeters 1 and 2 and solid-state load. Apply ac input power to UUT.			
2	Load Current Test.			
2a	On solid-state load, adjust resistance control by turning MAIN RESISTANCE control cw.	Between J2-H and J2-A		7.4 ± 0.4 A. (Represented by -370 ± 20 mV dc on digital multimeter 2).

Table 6-28. +/-15 V Dc Power Supply (7328363G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b		Between J2-L and J2-M		7.4 ± 1.0 A. (Represented by +37 ± 5 mV dc on digital multimeter 1).
3	Output Voltage Tests.			
3a	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative).	Between J2-H (PS1TB3+) and J2-A (R1-1)	Adjust R4 (15V ADJ) on UUT for performance standard.	+15V ± 15 mV dc. Record voltage.

NOTE

All voltages following substeps are nominal.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(1)	Connect digital multimeter 1 test leads to PS1TB3+ and PS1TB3-.	Between PS1TB3+ and PS1TB3-		+15.1 V dc ± 2.5 V dc.
3a(2)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1		+15.0 V dc ± 2.5 V dc.
3a(3)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1		0.0 V dc.

Table 6-28. +/-15 V Dc Power Supply (7328363G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(4)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1		0.0 V dc.
3a(5)	Connect digital multimeter 1 test leads to WT6 (positive) and R1-1 (negative).	Between Q1 Source and R1-1		0.0 V dc.
3a(6)	Connect digital multimeter 1 test leads to WT3 (positive) and R1-1 (negative).	Between Q1 drain and R1-1		+0.1 V dc ± .02 V dc.
3a(7)	Connect digital multimeter 1 test leads to R1-1 (positive) and R1-2 (negative).	Between R1-1 and R1-2		0.0 V dc.
3a(8)	Refer to TO 35C1-2-1141-2 for testing of power supply PS1 component.			
3b	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Turn power supply 1 on and slowly increase output voltage to +8.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 7.6 A. (-380 mV dc on digital multimeter 2).	Between J2-H (PS1TB3+) and J2-A (R1-1)		Output voltage must slowly increase at least +15.42 V dc and not exceed +15.52 V dc.

Table 6-28. +/-15 V Dc Power Supply (7328363G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3c	Slowly increase power supply 1 output voltage to +10 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 7.6 A. (-380 mV dc on digital multimeter 2).	Between J2-H (PS1TB3+) and J2-A (R1-1)		Output voltage must not exceed +15.52 V dc.
3c(1)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1		+15.4 V dc ± 2.5 V dc.
3c(2)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1		0.0 V dc.
3c(3)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1		+9.7 V dc ± 1.5 V dc.
3c(4)	Connect digital multimeter 1 test leads to WT6 (positive) and R1-1 (negative).	Between Q1 source and R1-1		0.0 V dc.
3c(5)	Connect digital multimeter 1 test leads to WT3 (positive) and R1-1 (negative).	Between Q1 drain and R1-1		+0.5 V dc ± .08 V dc.

Table 6-28. +/-15 V Dc Power Supply (7328363G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3d	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Reduce power supply 1 output voltage to 0 V dc. Then, turn off power supply 1. Adjust solid-state load resistance controls [MAIN RESISTANCE] to reduce UUT load current to 1.6 A (nominal) or -80 mV dc on digital multimeter 2.	Between J2-H (PS1TB3+) and J2-A (R1-1)		Output voltage of step 3a must not change by more than 55 mV dc.
3e	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Adjust solid-state load resistance controls [MAIN RESISTANCE] until UUT output voltage drops to +12.75 ± 2.0 V dc on digital multimeter 1.	Between J2-H (PS1TB3+) and J2-A (R1-1)		8.0 ± 1.0 A (represented by -400 ± 50 mV dc on digital multimeter 2.)
4	Procedure Completed. Remove power from test setup.			

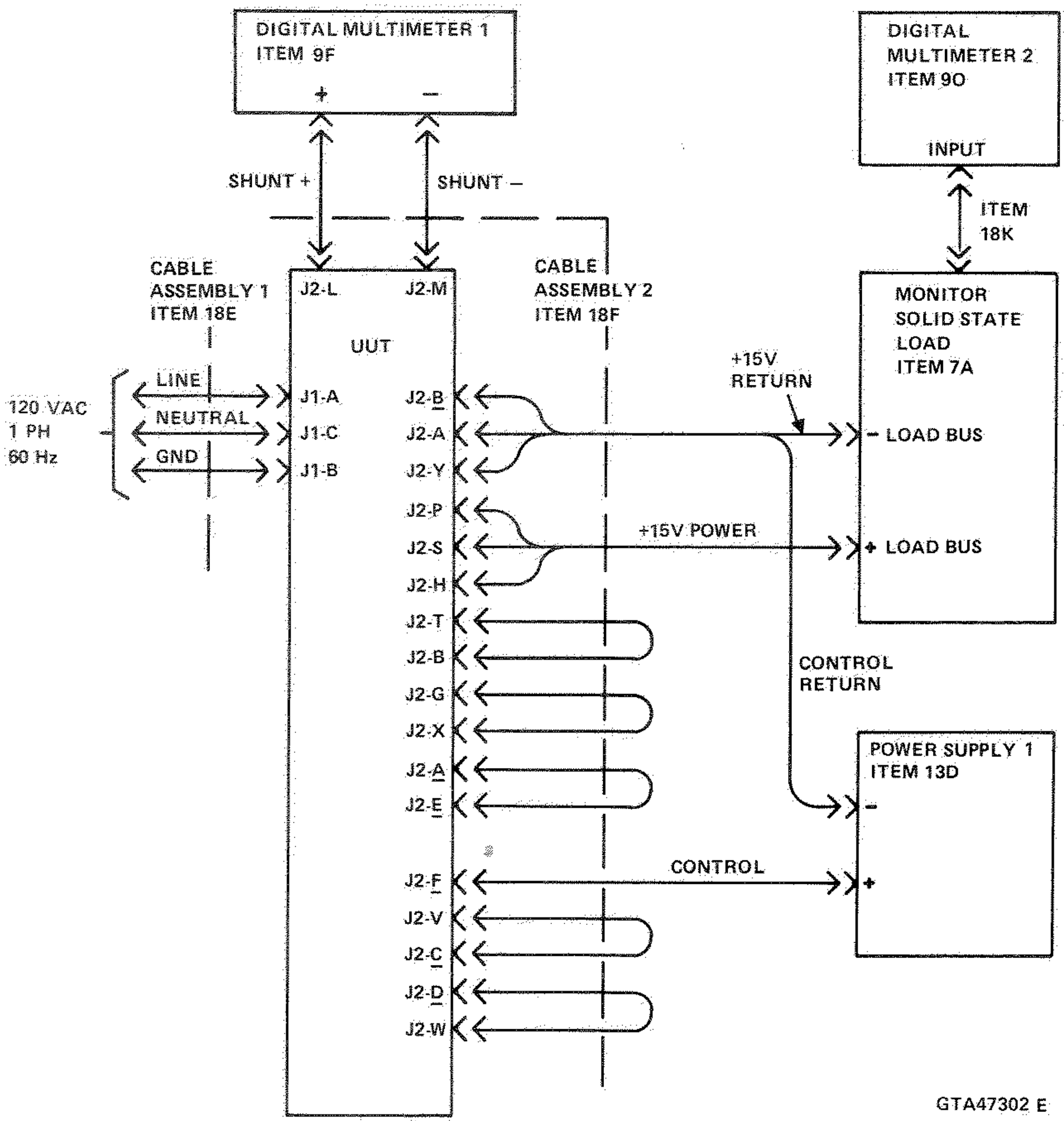


Figure 6-101. +/-15 V Dc Power Supply (7329140G1) Test Setup

Table 6-29. +/-15 V Dc Power Supply (7329140G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1a	Condition digital multimeters 1 and 2 to read dc voltage. Adjust power supply 1 for 0 V dc output voltage. Condition solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.			

Table 6-29. +/-15 V Dc Power Supply (7329140G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep cable assembly leads isolated from ground when not in use. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1b	Connect test equipment to UUT per Figure 6-101. Turn on digital multimeters 1 and 2 and solid state load. Apply ac input power to UUT.			
2	Load Current Test.			
2a	On solid-state load, adjust resistance control for performance standard. [MAIN RESISTANCE control cw].	Between J2-H and J2-A.		14.8 ± 0.4 A. Represented by -740 ± 20 mV dc on digital multimeter 2).

Table 6-29. +/-15 V Dc Power Supply (7329140G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b		Between J2-L and J2-M.		14.8 ± 1.5 A. (Represented by 37 ± 4 mV dc on digital multimeter 1).
3	Output Voltage Tests.			
3a	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative).	Between J2-H (PS1TB3+) and J2-A (R1-1).	Adjust R4 (15V ADJ) on UUT for performance standard.	+15 V ± 15 mV dc. Record voltage.

NOTE

All voltages in the following substeps are nominal.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(1)	Connect digital multimeter 1 test leads to PS1TB3+ and PS1TB3-.	Between PS1TB3+ and PS1TB3-.		+15.1 V dc ± 2.5 V dc.
3a(2)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1.		+14.9 V dc ± 2.5 V dc.
3a(3)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1.		+0.1 V dc ± .015 V dc.

Table 6-29. +/-15 V Dc Power Supply (7329140G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(4)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1.		+0.1 V dc ± .08 V dc.
3a(5)	Connect digital multimeter 1 test leads to WT6 (positive) and R1-1 (negative).	Between Q1 drain and R1-1.		+0.1 V dc ± .08 V dc.
3a(6)	Connect digital multimeter 1 test leads to WT3 (positive) and R1-1 (negative).	Between Q1 source and R1-1.		+0.1 V dc ± .08 V dc.
3a(7)	Connect digital multimeter 1 test leads to R1-1 (positive) and R1-2 (negative).	Between R1-1 and R1-2.		0.0 V dc.
3a(8)	Refer to TO 31S5-4-3176-1 for testing of power supply PS1 component.			
3b	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Turn power supply 1 on and slowly increase output voltage to +8.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 15.2 A. (-760 mV dc on digital multimeter 2).	Between J2-H (PS1TB3+) and J2-A (R1-1).		Output voltage must slowly increase to at least +15.42 V dc and not to exceed +15.52 V dc.

Table 6-29. +/-15 V Dc Power Supply (7329140G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3c	Slowly increase power supply 1 output voltage to +10.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 15.2 A. (-760 mV dc on digital multimeter 2).	Between J2-H (PS1TB3+) and J2-A (R1-1).		Output voltage must not exceed +15.52 V dc.
3c(1)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1.		+15.4 V dc ± 2.5 V dc.
3c(2)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1.		+0.1 V dc ± .08 V dc.
3c(3)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1.		+9.6 V dc ± 1.5 V dc.
3c(4)	Connect digital multimeter 1 test leads to WT3 (positive) and R1-1 (negative).	Between Q1 source and R1-1		+0.1 V dc ± .08 V dc.
3c(5)	Connect digital multimeter 1 test leads to WT6 (positive) and R1-1 (negative).	Between Q1 drain and R1-1.		+0.6 V dc ± 0.1 V dc.

Table 6-29. +/-15 V Dc Power Supply (7329140G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3d	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Reduce power supply 1 output voltage to 0 V dc. Turn off power supply 1. Adjust solid-state load resistance controls [MAIN RESISTANCE] to reduce UUT load current to 3.2 A (nominal) or -160 mV dc on digital multimeter 2.	Between J2-H (PS1TB3+) and J2-A (R1-1).		Output voltage of step 3a must not change by more than 110 mV dc.
3e	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Adjust solid-state load resistance controls [MAIN RESISTANCE] until UUT output voltage drops to +12.75 ± 1.0 V dc on digital multimeter 1.	Between J2-H (PS1TB3+) and J2-A (R1-1).		16.8 ± 1.2 A (represented by -840 ± 60 mV dc on digital multimeter 2.)
4	Procedure Completed. Remove power from test setup.			

6-11.4.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-11.4.3 Reference Material. See schematic diagram Figure 52 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-121 and 6-131 in this TO. For power supply PS1, see TO 35C1-2-1143-2.

6-11.4.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Load solid state	1	7a
Multimeter digital (1)	1	9f
Multimeter digital (2)	1	9o
Screwdriver, flat blade	1	25ae
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-15V, 3A	1	13d
Test cable (assembly 1)	1	18e
Test cable (assembly 2)	1	18d
Test cable, BNC	1	18k
Wrist strap	1	33i
Wrench set	1	32a

6-11.4.5 Prerequisites. None.

6-11.4.6 Test Procedure. Refer to Figure 6-102 and Table 6-30. The maintenance personnel shall always perform the entire procedure in Table 6-30 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standard when performing a step, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.4.7 Alignment Procedure. Perform steps in paragraph 6-12.4.

6-11.4.8 Postrequistes. None.

6-11.5 +24 V Dc Power Supply (7343910G1) Performance Test.

6-11.5.1 Purpose. This procedure provides the following tests that evaluate the performance of the +24 V dc power supply.

1. Load current
2. Output voltage.

6-11.5.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

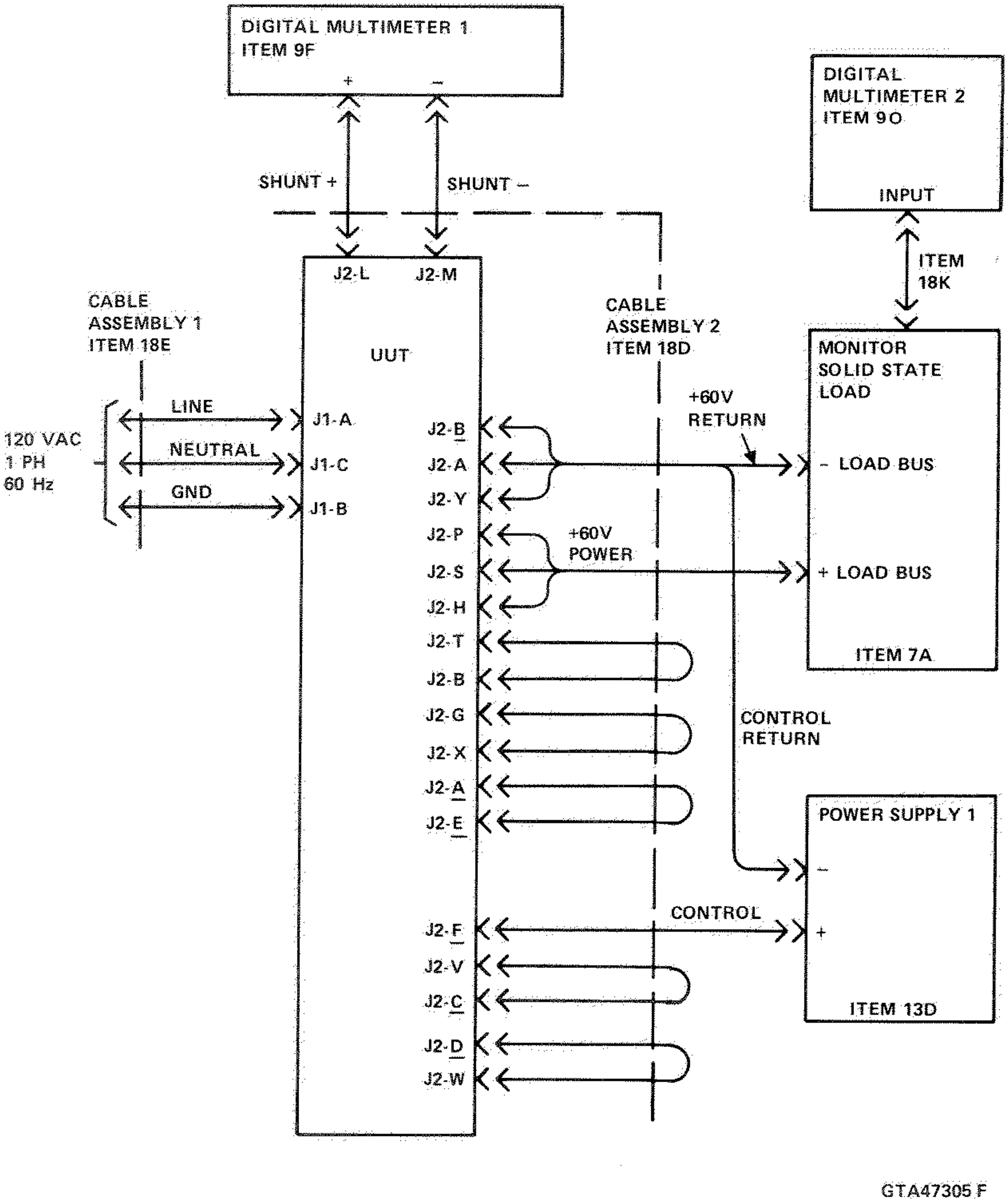


Figure 6-102. +/-60 V Dc Power Supply (7343908G1) Test Setup

Table 6-30. +/-60 V Dc Power Supply (7343908G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1a	Condition digital multimeters 1 and 2 to read dc voltage. Adjust power supply 1 for 0 V dc output voltage. Condition solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.			

Table 6-30. +/-60 V Dc Power Supply (7343908G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep cable assembly leads isolated from ground when not in use. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1b	Connect test equipment to UUT per Figure 6-102. Turn on digital multimeter 2 and solid-state load. Apply ac input power to UUT.			
2	Load Current Test.			
2a	On solid-state load, adjust resistance control for performance standard. [MAIN RESISTANCE control cw].	Between J2-H and J2-A.		2.31 ± 0.06 A. (Represented by -115 ± 3 mV dc on digital multimeter 2).

Table 6-30. +/-60 V Dc Power Supply (7343908G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b		Between J2-L and J2-M.		2.31 ± 0.50 A. (Represented by +11 ± 3 mV dc on digital multimeter 1).
3	Output Voltage Tests.			
3a	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative).	Between J2-H (PS1TB3+) and J2-A (R1-1).	Adjust R4 (15V ADJ) on UUT for performance standard.	+60 V ± 60 mV dc. Record voltage.

NOTE

All voltages in following substeps are nominal.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(1)	Connect digital multimeter 1 test leads to PS1TB3+ and PS1TB3-.	Between PS1TB3+ and PS1TB3-.		+60.1 V dc ± 9 V dc.
3a(2)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1.		+60.0 V dc ± 9 V dc.
3a(3)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1.		0.0 V dc.

Table 6-30. +/-60 V Dc Power Supply (7343908G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(4)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1.		0.0. V dc.
3a(5)	Connect digital multimeter 1 test leads to WT6 (positive) and R1-1 (negative).	Between Q1 source and R1-1.		0.0 V dc.
3a(6)	Connect digital multimeter 1 test leads to WT3 (positive) and R1-1 (negative).	Between Q1 drain and R1-1.		+0.1 V dc ± .015 V dc.
3a(7)	Connect digital multimeter 1 test leads to R1-1 (positive) and R1-2 (negative).	Between R1-1 and R1-2.		0.0 V dc.
3a(8)	Refer to TO 35C1-2-1143-2 for testing of power supply PS1 component.			
3b	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Turn power supply 1 on and slowly increase output voltage to +8.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 2.375 A. (-119 mV dc on digital multimeter 2).	Between J2-H (PS1TB3+) and J2-A (R1-1).		Output voltage of step 3a must slowly increase at least 0.42 V dc and not to exceed 0.52 V dc.

Table 6-30. +/-60 V Dc Power Supply (7343908G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3c	Slowly increase power supply 1 output voltage to +10.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 2.375 A. (-119 mV dc on digital multimeter 2).	Between J2-H (PS1TB3+) and J2-A (R1-1).		Output voltage must not increase from step 3a voltage by more than 0.52 V dc.
3c(1)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1.		+60.5 V dc ± 9 V dc.
3c(2)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1.		0.0 V dc.
3c(3)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1.		+9.7 V dc ± 1.5 V dc.
3c(4)	Connect digital multimeter 1 test leads to WT3 (positive) and R1-1 (negative).	Between Q1 source and R1-1.		0.0 V dc.
3c(5)	Connect digital multimeter 1 test leads to WT6 (positive) and R1-1 (negative).	Between Q1 drain and R1-1.		+0.5 V dc ± .1 V dc.

Table 6-30. +/-60 V Dc Power Supply (7343908G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3d	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Reduce power supply 1 output voltage to 0 V dc. Then, turn off power supply 1. Adjust solid-state load resistance controls [MAIN RESISTANCE] to reduce UUT load current to 0.5 A (nominal) or -25 mV dc on digital multimeter 2.	Between J2-H (PS1TB3+) and J2-A (R1-1).		Output voltage of step 3a must not change by more than 250 mV dc.
3e	Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative). Adjust solid-state load resistance controls [MAIN RESISTANCE] until UUT output voltage drops to +51 ± 4 V dc on digital multimeter 1.	Between J2-H (PS1TB3+) and J2-A (R1-1).		2.625 ± 0.200 A (represented by -131 ± 10 mV dc on digital multimeter 2.).
4	Procedure Completed. Remove power from test setup.			

6-11.5.3 Reference Material. See schematic diagram Figure 56 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-122 and 6-132 in this TO. For power supply PS1, see TO 35C1-2-1142-2.

6-11.5.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Kit, Alignment Tool	1	25ba
Load solid state	1	7a
Multimeter digital (1)	1	9f
Multimeter digital (2)	1	9o
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-15V, 3A	1	13d
Test cable (assembly 1)	1	18e
Test cable (assembly 2)	1	18g
Test cable, BNC	1	18k
Wrist strap	1	33i

6-11.5.5 Prerequisites. None.

6-11.5.6 Test Procedure. Refer to Figure 6-103 and Table 6-31. The maintenance personnel shall always perform the entire procedure in Table 6-31 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standard when performing a step, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.5.7 Alignment Procedure. Perform steps in paragraph 6-12.5.

6-11.5.8 Postrequistes. None.

6-11.6 +5 V Dc Power Supply (7343912G1) Performance Test.

6-11.6.1 Purpose. This procedure provides the following tests that evaluate the performance of the +5 V dc power supply.

1. Load current
2. Output voltage.

6-11.6.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-11.6.3 Reference Material. See schematic diagram Figure 55 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-123 and 6-133 in this TO. For power supply PS1, see TO 35C1-2-1140-2.

6-11.6.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Kit, alignment tool	1	25ba
Load solid state	1	7a
Multimeter digital (1)	1	9f
Multimeter digital (2)	1	9o
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-15V, 3A	1	13d
Test cable (assembly 1)	1	18e
Test cable (assembly 2)	1	18h
Test cable, BNC	1	18k
Wrist strap	1	33i

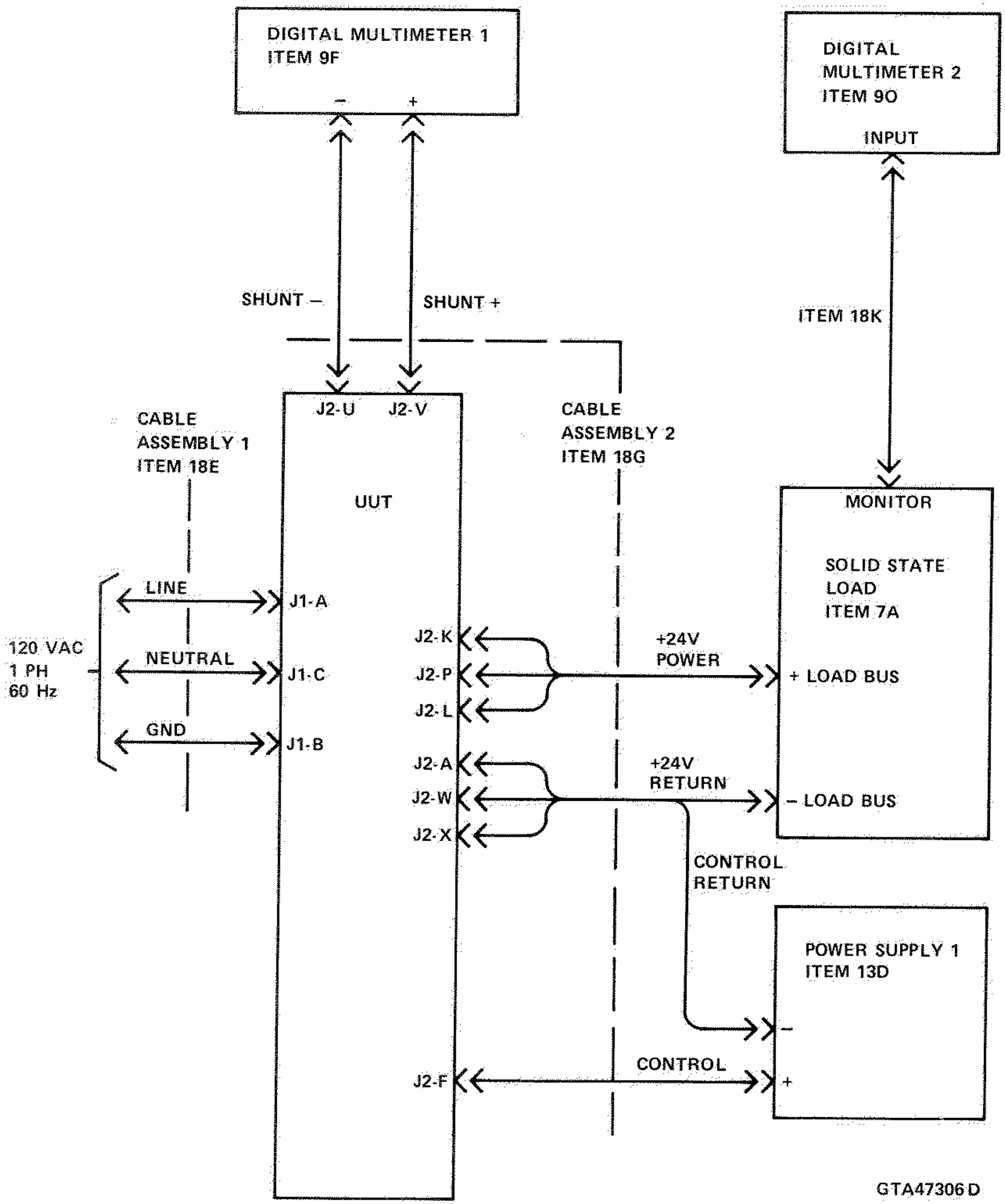


Figure 6-103. +24 V Dc Power Supply (7343910G1) Test Setup

Table 6-31. +24 V Dc Power Supply (7343910G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1a	Condition digital multimeters 1 and 2 to read dc voltage. Adjust power supply 1 for 0 V dc output voltage. Condition solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.			

Table 6-31. +24 V Dc Power Supply (7343910G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep cable assembly leads isolated from ground when not in use. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1b	Connect test equipment to UUT per Figure 6-103. Turn on digital multimeters 1 and 2 and solid-state load. Apply ac input power to UUT.			
2	Load Current Tests.			
2a	On Solid-state load, adjust resistance control for performance standard. [MAIN RESISTANCE control cw].	Between J2-P and J2-A		13.85 ± 0.35 A. (Represented by -692 ± 18 mV dc on digital multimeter 2).

Table 6-31. +24 V Dc Power Supply (7343910G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b		Between J2-U and J2-V		13.85 ± 0.9 A. (Represented by +46 ± 3 mV dc on digital multimeter 1).
3	Output Voltage Test.			
3a	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) AND J2-A (R1-1) (negative) on UUT.	Between J2-P (PS1TB3+) and J2-A (R1-1)	Adjust PS1R114 (ADJ VOLTS) on UUT for performance standard.	+24 V ± 24 mV dc. Record voltage.

NOTE

All voltages in following substeps are nominal.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(1)	Connect digital multimeter 1 test leads to PS1TB3+ and PS1TB3-.	Between PS1TB3+ and PS1TB3-		+24.1 V dc ± 3.5 V dc.
3a(2)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1		+24.0 V dc ± 3.5 V dc.
3a(3)	Connect digital multimeter 1 test leads to PS1TB2-5 (positive) and R1-1 (negative).	Between PS1TB2-5 and R1-1		+0.1 V dc ± .015 V dc.

Table 6-31. +24 V Dc Power Supply (7343910G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(4)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1.		0.0 V dc.
3a(5)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1		0.0 V dc.
3a(6)	Connect digital multimeter 1 test leads to R1-1 (positive) and R1-2 (negative).	Between R1-1 and R1-2		0.0 V dc.
3a(7)	Refer to TO 35C1-2-1142-2 for testing of power supply PS1 components.			
3b	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Turn power supply 1 on and slowly increase output voltage to +8.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 14.25 A (-713 mV dc on digital multimeter 2).	Between J2-P (PS1TB3+) and J2-A (R1-1)		Output voltage of step 3a must slowly increase by 0.42 V dc and not exceed 0.52 V dc.

Table 6-31. +24 V Dc Power Supply (7343910G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3c	Slowly increase power supply 1 output voltage to +10.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 14.25 A (-713 mV dc on digital multimeter 2).	Between J2-P (PS1TB3+) and J2-A (R1-1)		Load voltage must not increase from step 3a voltage by more than 0.52 V dc.
3c(1)	Connect digital multimeter 1 test leads to PS1TB2-5 (positive) and R1-1 (negative).	Between PS1TB2-5 and R1-1		+0.5 V dc ± 0.1 V dc.
3c(2)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1		0.0 V dc.
3c(3)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1		+9.6 V dc ± 1.5 V dc.
3d	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Reduce power supply 1 output voltage to 0 V dc. Turn off power supply 1. Adjust solid-state load resistance controls [MAIN RESISTANCE] to reduce UUT load current to 3A (nominal) or -150 mV dc on digital multimeter 2.	Between J2-P (PS1TB3+) and J2-A (R1-1)		Output voltage of step 3a must not change by more than 60 mV dc.

Table 6-31. +24 V Dc Power Supply (7343910G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3e	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Adjust solid-state load resistance controls [MAIN RESISTANCE control cw] until UUT output voltage drops to +20.5 ± 2.0 V dc on digital multimeter 1.	Between J2-P (PS1TB3+) and J2-A (R1-1)		15.75 ± 1.50 A (represented by -787 ± 75 mV dc on digital multi-meter 2).
4	Procedure Completed. Remove power from test setup.			

6-11.6.5 Prerequisites. None.

6-11.6.6 Test Procedure. Refer to Figure 6-104 and Table 6-32. The maintenance personnel shall always perform the entire procedure in Table 6-32 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standard when performing a step, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.6.7 Alignment Procedure. Perform steps in paragraph 6-12.6.

6-11.6.8 Postrequistes. None.

6-11.7 +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test.

6-11.7.1 Purpose. This procedure provides the following tests that evaluate the performance of the +/-15/25 V ac-to-dc converter.

1. Input resistance
2. Output resistance
3. Load current
4. Output voltage
5. Diode voltage
6. Output ripple.

6-11.7.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced air cooling must be provided during entire procedure allowing the air to transfer heat away from the assembly. Always adjust load for minimum load current before turning load off.

6-11.7.3 Reference Material. See schematic diagram Figure 29 in transmitter group circuit diagram TO 31P6-2FPS118-73-1.

6-11.7.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Fan, 3 speed, bench	1	22l
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Oscilloscope, portable	1	10d
Set, test probe	1	9h
Test cable (assembly 1)	1	18j(W22)
Test cable (assembly 2)	1	18j(W27)
Test cable, BNC	1	18k

6-11.7.5 Prerequisites. None.

6-11.7.6 Test Procedure. Refer to Figure 6-105 and Table 6-33. The maintenance personnel shall always perform the entire procedure in Table 6-33 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standard when performing a step, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.7.7 Alignment Procedure. None.

6-11.7.8 Postrequistes. None.

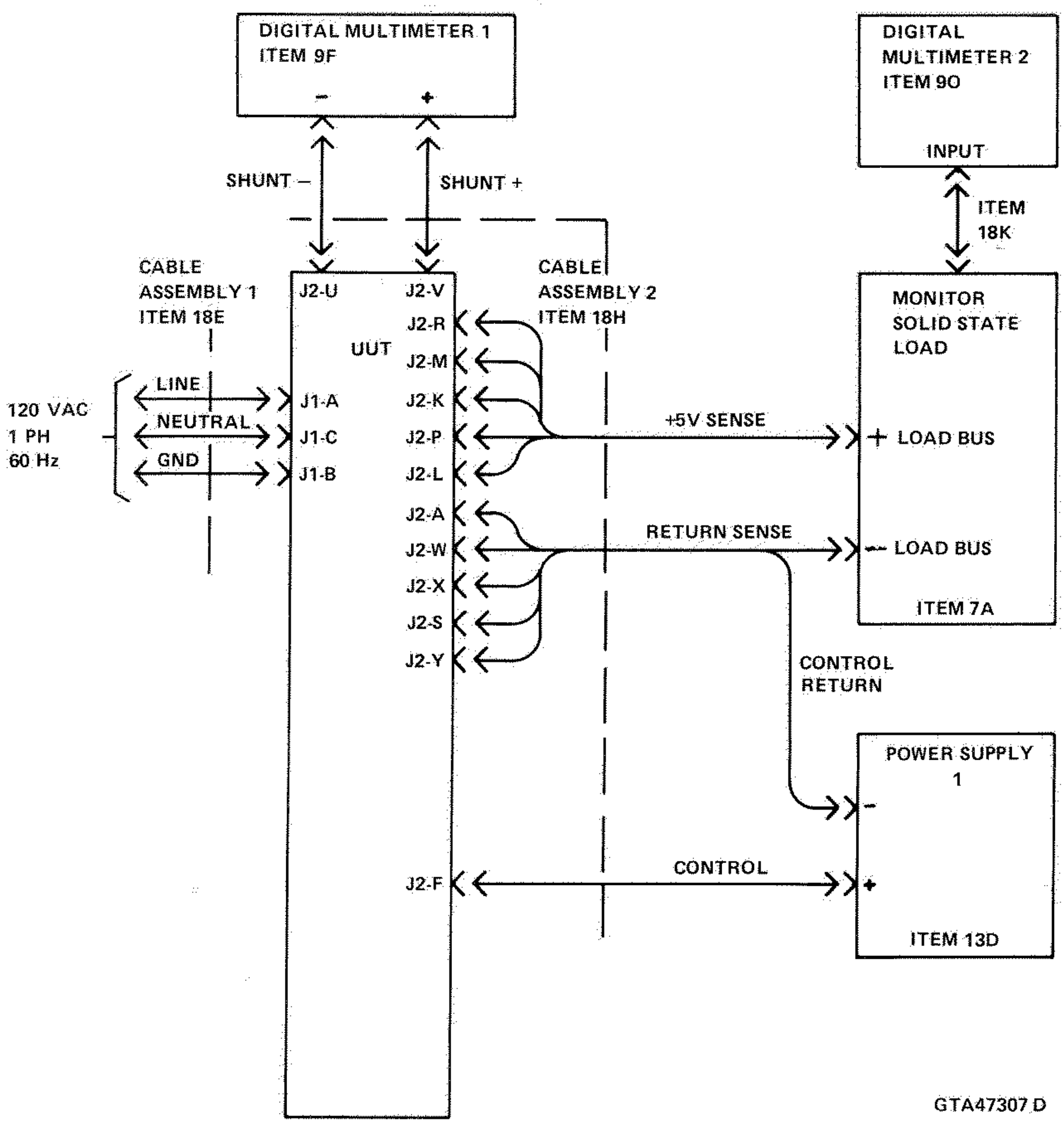


Figure 6-104. +5 V Dc Power Supply (7343912G1) Test Setup

Table 6-32. +5 V Dc Power Supply (7343912G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1a	Condition digital multimeters 1 and 2 to read dc voltage. Adjust power supply 1 for 0 V dc output voltage. Condition solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.			

Table 6-32. +5 V Dc Power Supply (7343912G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supply. While output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep cable assembly leads isolated from ground when not in use. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1b	Connect test equipment to UUT per Figure 6-104. Turn on digital multimeters 1 and 2 and solid-state load. Apply ac input power to UUT.			
2	Load Current Tests.			
2a	On Solid-state load, adjust resistance control for performance standard. [MAIN RESISTANCE control cw].	Between J2-P and J2-A		37 ± 1 A. (Represented by -1.85 V ± 50 mV dc on digital multimeter 2).

Table 6-32. +5 V Dc Power Supply (7343912G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b		Between J2-U and J2-V		37 ± 3 A. (Represented by +37 ± 3 mV dc on digital multimeter 1).
3	Output Voltage Test.			
3a	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT.	Between J2-P (PS1TB3+) and J2-A (R1-1)	Adjust PS1R114 (ADJ VOLTS) on UUT for performance standard.	+5 V ± 5 mV dc. Record voltage.

NOTE

All voltages in following substeps are nominal.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(1)	Connect digital multimeter 1 test leads to PS1TB3+ and PS1TB3-.	Between PS1TB3+ and PS1TB3-		+5.1 V dc ± 0.8 V dc.
3a(2)	Connect digital multimeter 1 test leads to PS1TB2-1 (positive) and R1-1 (negative).	Between PS1TB2-1 and R1-1		+5.0 V dc ± 0.8 V dc.
3a(3)	Connect digital multimeter 1 test leads to PS1TB2-5 (positive) and R1-1 (negative).	Between PS1TB2-5 and R1-1		+0.1 V dc ± .015 V dc.

Table 6-32. +5 V Dc Power Supply (7343912G1) Performance Test Table -CONT
Done on PC

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3a(4)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1.		0.0 V dc.
3a(5)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1		0.0 V dc.
3a(6)	Connect digital multimeter 1 test leads to R1-1 (positive) and R1-2 (negative).	Between R1-1 and R1-2		0.0 V dc.
3a(7)	Refer to TO 35C1-2-1140-2 for testing o4 power supply PS1 components.			
3b	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Turn power supply 1 on and slowly increase output voltage to +8.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 38 A (-1.9 mV dc on digital multimeter 2).	Between J2-P (PS1TB3+) and J2-A (R1-1)		Output voltage must slowly increase to +5.42 V dc and not exceed +5.52 V dc.

Table 6-32. +5 V Dc Power Supply (7343912G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3c	Slowly increase power supply 1 output voltage to +10.0 ± 0.2 V dc. If necessary, adjust solid-state load resistance controls [MAIN RESISTANCE] so load current does not exceed 38 A (-1.9 mV dc on digital multimeter 2).	Between J2-P (PS1TB3+) and J2-A (R1-1)		Load voltage must not exceed +5.52 V dc.
3c(1)	Connect digital multimeter 1 test leads to PS1TB2-5 (positive) and R1-1 (negative).	Between PS1TB2-5 and R1-1		+0.5 V dc ± .08 V dc.
3c(2)	Connect digital multimeter 1 test leads to PS1TB2-6 (positive) and R1-1 (negative).	Between PS1TB2-6 and R1-1		+0.0 V dc.
3c(3)	Connect digital multimeter 1 test leads to WT4 (positive) and R1-1 (negative).	Between Q1 gate and R1-1		+9.7 V dc ± 1.5 V dc.
3d	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Reduce power supply 1 output voltage to 0 V dc. Turn off power supply 1. Adjust solid-state load resistance controls [MAIN RESISTANCE] to reduce UUT load current to 8 A (nominal) or -400 mV dc on digital multimeter 2.	Between J2-P (PS1TB3+) and J2-A (R1-1)		Output voltage of step 3a must not change by more than 45 mV dc.

Table 6-32. +5 V Dc Power Supply (7343912G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3e	Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Adjust solid-state load resistance controls [MAIN RESISTANCE control cw] until UUT output voltage drops to +4.25 ± 0.5 V dc on digital multimeter 1.	Between J2-P (PS1TB3+) and J2-A (R1-1)		42 ± 4 A (represented by -2100 ± 200 mV dc on digital multimeter 2).
4	Procedure Completed. Remove power from test setup.			

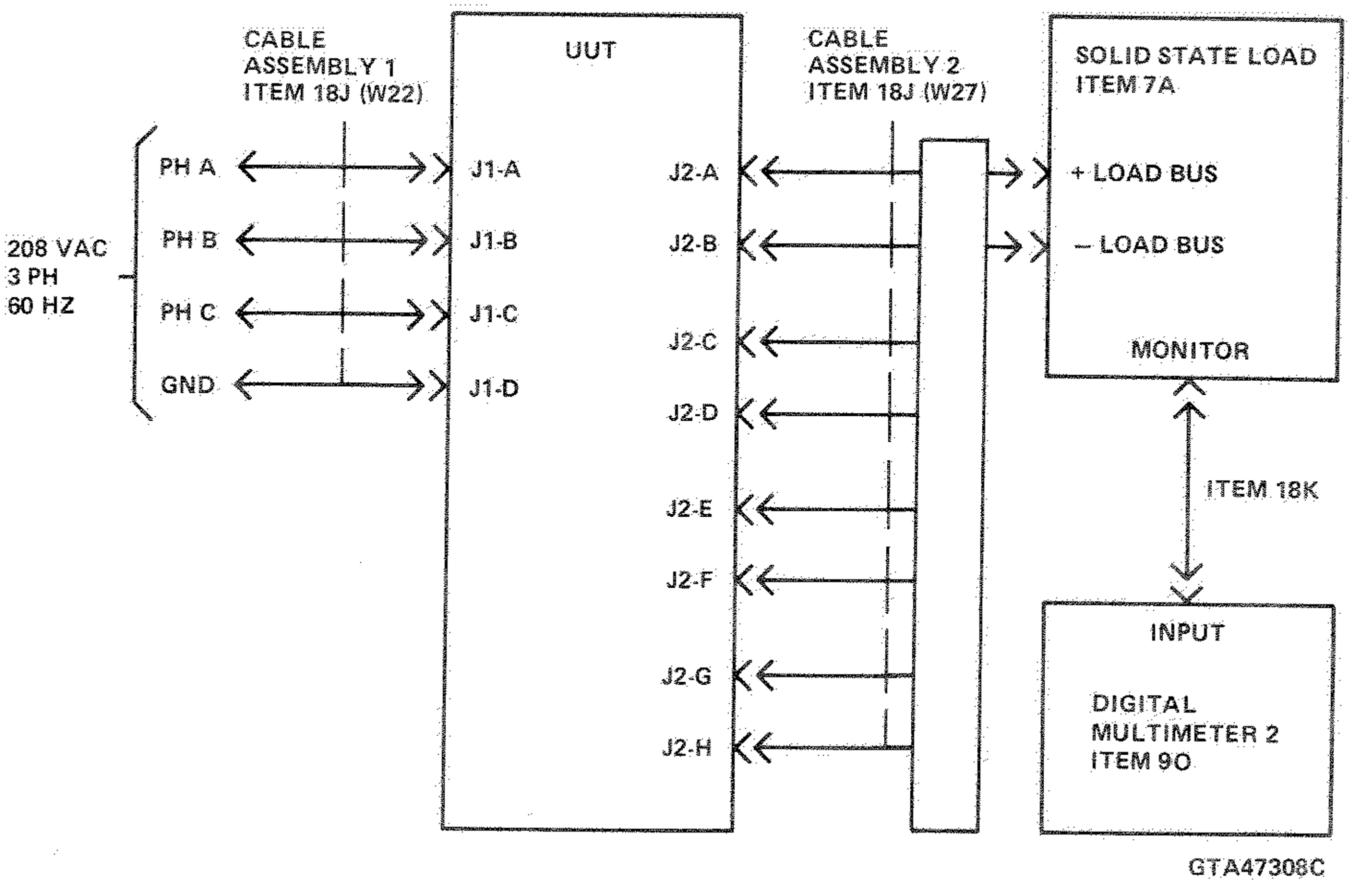


Figure 6-105. +/-15/25 V Ac-to-Dc Converter (7344735G1) Test Setup

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Resistance Checks. Connect digital multimeter 1 to each UUT point of test and J1-E (chassis ground).	Between J1-A, J1-B, J1-C, J2-A, J2-B, J2-C, J2-D, J2-E, J2-F, J2-G, J2-H, and J1-D (chassis ground)		Resistance shall be > 1 megOhm.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the converter. The output current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling must be provided during the entire procedure allowing the air to transfer heat away form the assembly.

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Voltages obtained in substeps are dependent upon the accuracy of the ac input power. Current calculation will be necessary if another solid state load is used.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2	Initial Test Setup. Condition digital multimeter 2 to read dc voltage. Set solid-state load controls by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.] Remove transformer terminal cover. Set cable assembly 2 switch box to position 1. Connect test equipment to UUT per Figure 6-105. Turn on all test equipment including fan. Apply ac input power to UUT.			

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3	Load Current Test. On solid-state load, adjust resistance control by turning MAIN RESISTANCE control cw.	Between J2-A and J2-B		9.25 ± 0.5 A load current or 462.5 ± 25 mV dc as represented by digital multimeter 2, at -50 mV/A
4	Output Voltage Test.			
4a	Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-A and J2-B		+15 ± 5 V dc.

NOTE

All voltages in following substeps are nominal.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
4a(1)	Condition digital multimeter 1 to read ac voltage. Connect digital multimeter 1 test leads to T1-4 and T1-5.	Between T1-4 and T1-5		13.1 V ac ± 2 V ac.
4a(2)	Connect digital multimeter 1 test leads to T1-4 and T1-6.	Between T1-4 and T1-6		13.2 V ac ± 2 V ac.
4a(3)	Connect digital multimeter 1 test leads to T1-5 and T1-6.	Between T1-5 and T1-6		13.0 V ac ± 2 V ac.

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

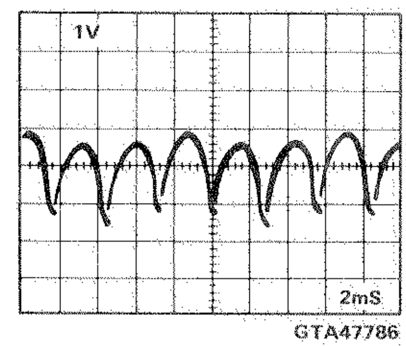
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
5	Diode Test.			
5a	Condition oscilloscope for low frequency measurement. Connect oscilloscope probe to solid-state load positive bus. Connect probe ground lead to negative bus.	Between J2-A and J2-B		
6	Ripple Voltage Test.			
6a	Condition digital multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-A and J2-B		2 V ac maximum
7	Test Setup.			
7a	Condition solid-state load by turning MAIN RESISTANCE control ccw.			

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
7b	Place cable assembly 2 test box switch to position 2.			
8	Load Current Test. On solid-state load, adjust resistance control by turning MAIN RESISTANCE control cw.	Between J2-C and J2-D		5.25 ± 0.5 A load current or 262.5 ± 25 mV dc as represented by digital multimeter 2.
9	Output Voltage Test.			
9a	Condition digital multimeter 1 to measure dc voltage. Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-C and J2-D		+15 ± 5 V dc.
9a(1)	Condition digital meter 1 to measure ac voltage. Connect digital multimeter 1 test leads to T1-7 and T1-8.	Between T1-7 and T1-8		13.3 V ac ± 2 V ac.
9a(2)	Connect digital multimeter 1 test leads to T1-7 and T1-9.	Between T1-7 and T1-9		13.1 V ac ± 2 V ac.
9a(3)	Connect digital multimeter 1 test leads to T1-8 and T1-9.	Between T1-8 and T1-9		13.1 V ac ± 2 V ac.

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

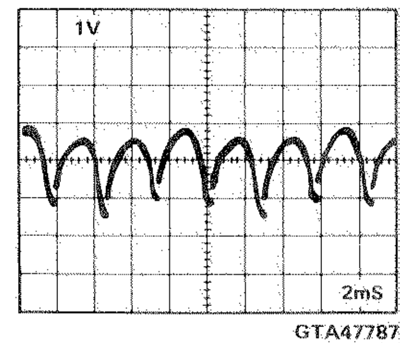
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10	Diode Test			
10a	Connect oscilloscope probe to positive bus on load. Connect probe ground lead to negative bus on load.	Between J2-C and J2-D		
11	Ripple Voltage Test.			
11a	Condition digital multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-C and J2-D		2 V ac maximum.
12	Test Setup.			
12a	Condition solid-state load by turning MAIN RESISTANCE control ccw.			
12b	Place cable assembly 2 test box switch to position 3.			

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
13	Load Current Test.			
13a	Adjust solid-state load resistance control by turning MAIN RESISTANCE control cw.	Between J2-E and J2-F		10.75 ± 0.50 A load current or 537.5 ± 25 mV dc as represented by digital multimeter 2.
14	Output Voltage Test.			
14a	Condition digital multimeter 1 for dc voltage measurement. Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-E and J2-F		+25 ± 5 V dc.
14a(1)	Condition digital multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to T1-10 and T1-11.	Between T1-10 and T1-11		20.2 V ac ± 3 V ac.
14a(2)	Connect digital multimeter 1 test leads to T1-10 and T1-12.	Between T1-10 and T1-12		19.9 V ac ± 3 V ac.
14a(3)	Connect digital multimeter 1 test leads to T1-11 and T1-12.	Between T1-11 and T1-12		20.4 V ac ± 3 V ac.

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

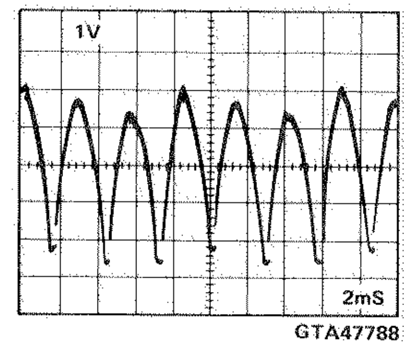
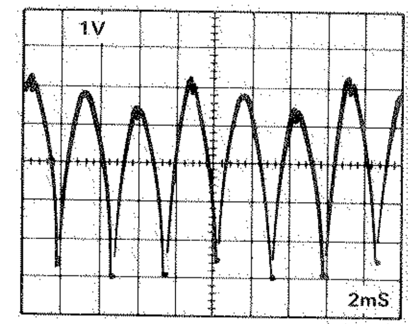
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
15	Diode Test			
15a	Connect oscilloscope probe to positive bus on load. Connect probe lead to negative bus on load.	Between J2-E and J2-F		
16	Ripple Voltage Test.			
16a	Condition multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-E and J2-F		3 V ac maximum
17	Test Setup.			
17a	Condition solid-state load by turning MAIN RESISTANCE control ccw. Place cable assembly 2 test box switch to position 4.			

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
18	Load Current Test.			
18a	Adjust solid-state load resistance control by turning MAIN RESISTANCE control cw.	Between J2-G and J2-H		3.0 ± 0.2 A load current or 150 ± 10 mV dc as represented by digital multimeter 2.
19	Output Voltage Test.			
19a	Condition digital multimeter 1 for dc voltage measurement. Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-G and J2-H		+25 ± 5 V dc.
19a(1)	Condition digital multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to T1-13 and T1-14.	Between T1-13 and T1-14		20.3 V ac ± 3 V ac.
19a(2)	Connect digital multimeter 1 test leads to T1-13 and T1-15.	Between T1-13 and T1-15		20.0 V ac ± 3 V ac.
19a(3)	Connect digital multimeter 1 test leads to T1-14 and T1-15.	Between T1-14 and T1-15		20.3 V ac ± 3 V ac.

Table 6-33. +/-15/25 V Ac-to-Dc Converter (7344735G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
20	Diode Test			
20a	Connect oscilloscope probe to positive bus on load. Connect probe ground lead to negative bus on load.	Between J2-G and J2-H		
21	Output Ripple Test.			
21a	Condition digital multimeter 1 to read ac voltage. Connect digital multimeter 1 test leads to cable assembly 2 test box TP1 (+) and TP2 (-) test jacks.	Between J2-G and J2-H		3 V ac maximum.
22	Procedure Completed.			
22a	Remove power from test setup. Reduce load current to minimum. Turn off all test equipment. Fasten cover to transformer.			

6-11.8 Dc-to-Dc Converter (77C723326G1) Performance Test.

6-11.8.1 Purpose. This procedure provides the following tests that evaluate the performance of the dc-to-dc converter.

1. Input voltage
2. Output voltage
3. Reduced load
4. Output voltage (reduced load)
5. Ripple
6. Noise
7. Full load
8. Output voltage (full load)
9. Noise
10. Ripple
11. Regulation.

6-11.8.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of the converter. While the output voltage is low, current can cause a severe burn.

6-11.8.3 Reference Material. Refer to TO 31C1-4-147-1.

6-11.8.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Load, solid state	1	7a
Multimeter digital (1)	1	9f
Multimeter digital (2)	1	9o
Oscilloscope, portable	1	10d
Patch cord, pin tips	3	18v
Patch cord, spade lugs	4	18m
Set, test probe	1	9h
Supply, power 0-64 V dc, 0-50A	1	13c
Test cable, BNC	1	18k

Name	Qty.	Table 1-4 Item No.

6-11.8.5 Prerequisites. None.

6-11.8.6 Test Procedure. Refer to Figure 6-106 and Table 6-34. The maintenance personnel shall always perform the entire procedure in Table 6-34 starting with step 1 adhering to all warnings and cautions. Stage-by-stage testing of the power supply PS1 components is performed using TO 31C1-4-147-1.

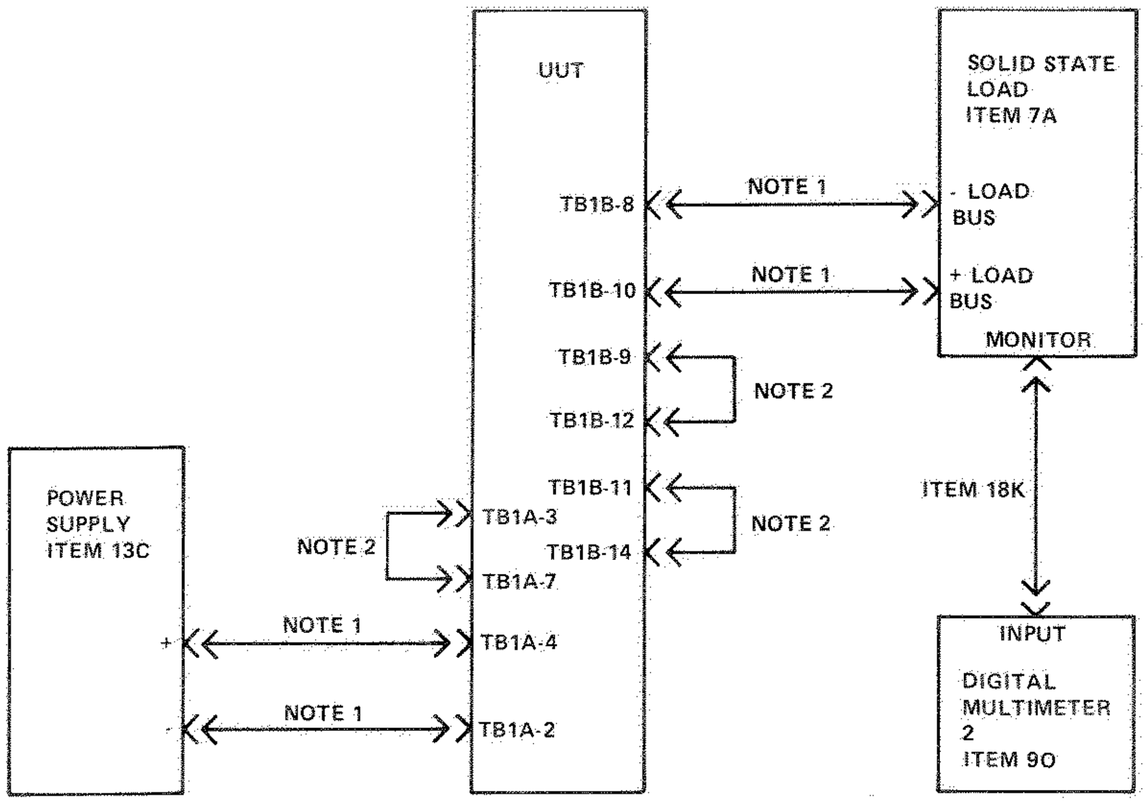
6-11.8.7 Alignment Procedure. For alignment of power supply PS1 refer to TO 31C1-4-147-1.

6-11.8.8 Postrequistes. None.

6-11.9 +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test.

6-11.9.1 Purpose. This procedure provides the following tests that evaluate the performance of the +/-5 V dc voltage regulator.

1. Initial checkout
2. Input voltage
3. Output voltage (reduced load)
4. Performance monitoring
5. Reduced load
6. Output voltage
7. Switching frequency
8. Ripple
9. Noise
10. Remote turnoff
11. Performance monitoring
12. Full load
13. Switching frequency
14. Noise
15. Ripple
16. Output voltage (full load)
17. Regulation
18. Remote voltage adjust
19. Current limit
20. Switching frequency
21. Fold-back current.



NOTES:

1. FABRICATE CABLES USING NO. 12 STRANDED WIRE AND APPROPRIATE SPADE LUG CONNECTORS.

2. IF VENDOR ASSEMBLY (WR24505/50K3) IS USED ADD THREE JUMPER WIRES USING NO. 12 STRANDED WIRE AND APPROPRIATE SPADE LUG CONNECTORS.

GTA47332A

Figure 6-106. Dc-to-Dc Converter (77C723326G1) Test Setup

Table 6-34. Dc-to-Dc Converter (77C723326G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Initial Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1a	Adjust power supply for 24 ± 2 V dc output. Condition digital multimeters 1 and 2 for dc voltage measurement. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.			
1b	Connect equipment to UUT per Figure 6-106. Note their location and remove any other jumper wires connected to UUT terminal boards.			

Table 6-34. Dc-to-Dc Converter (77D723326G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2	Input voltage test.			

WARNING

HIGH CURRENT HAZARD

Use caution when working in vicinity of converter. While output voltage is low, current can cause a severe burn.

NOTE

Testing of the Dc-to-Dc Converter components is performed using TO 31C1-4-147-1.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2a	Connect digital multimeter 1 test leads to TB1A-4 (positive) and TB1A-2 (negative) on UUT. Turn on all test equipment. Adjust power supply if necessary.	Between TB1A-2 and TB1A-4		+24 ± 2 V dc. Record data.
3	Output Voltage Test.			
3a	Connect digital multimeter 1 test leads to TB1B-10 (positive) and TB1B-8 (negative) on UUT.	Between TB1B-8 and TB1B-10		+5.0 ± 0.2 V dc. Record data.

Table 6-34. Dc-to-Dc Converter (77D723326G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
4	Reduced Load Test.			
4a	On solid-state load, adjust resistance control for performance standard. [Adjust MAIN RESISTANCE control cw].	Between TB1B-8 and TB1B-10		2.5 ± 0.1 A dc. (Represented by -125 ± 5 mV dc on digital multimeter 2, at -50 mV/A.
4b	Output Voltage Test. Condition digital multimeter 1 for dc voltage measurement.	Between TB1B-8 and TB1B-10		+5.000 ± 0.050 V dc. Record data.
4c	Ripple Test. Condition digital multimeter 1 to measure true rms voltage.	Between TB1B-8 and TB1B-10		< 10 mV rms.
4d	Noise Test. Connect oscilloscope probe to TB1B-10 (positive) and ground lead to TB1B-8 (negative) on UUT. Condition oscilloscope for noise measurement.	Between TB1B-8 and TB1B-10		< 150 mV P-P. Measure between 5 Hz and 20 mHz.
5	Full Load Test.			
5a	Increase solid-state load loading capability. Adjust load resistance and current controls until performance standard is obtained. [Adjust MAIN RESISTANCE control.]	Between TB1B-8 and TB1B-10		10.0 ± 0.1 A. (Represented by -500 ± 5 mV dc on digital multimeter 2.)

Table 6-34. Dc-to-Dc Converter (77D723326G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
5b	Output Voltage Test. Condition digital multimeter 1 for dc voltage measurement.	Between TB1B-8 and TB1B-10		+5.000 ± 0.050 V dc. Record data.
5c	Noise Test. Connect oscilloscope probe to TB1B-10 (positive) and ground lead to TB1B-8 (negative) on UUT.	Between TB1B-8 and TB1B-10		< 150 mV P-P. Measure between 5 Hz and 20 MHz.
5d	Ripple Test. Connect digital multimeter 1 test leads to TB1B-10 (positive) and TB1B-8 (negative) on UUT. Condition digital multimeter 1 to measure true rms voltage.	Between TB1B-8 and TB1B-10		< 10 mV rms.
6	Regulation.			
6a	Calculate UUT output voltage regulation.			Regulation = V (step 4b)-V (step 5b) = 50 mV maximum. Record data.
7	Procedure Completed. Remove power from test setup. Install jumper wires if removed at start of procedure.			

6-11.9.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of the regulator. While the output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling (fan) must be provided during entire procedure, allowing the air to transfer heat away from the UUT. When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-11.9.3 Reference Material. See schematic diagram Figure 42 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-127 and 6-134 in this TO.

6-11.9.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Cable assembly	1	18a
Fan, 3 speed, bench	1	22l
Load, solid state	1	7a
Multimeter digital (1)	1	9f
Multimeter digital (2)	1	9o
Oscilloscope, portable	1	10d
Patch cord, alligator Clip	1	18l
Resistor 3.3K, 2 W	1	20b
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade	1	25ad
Screwdriver, jewelers	1	25ap
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-64 V dc, 0-50A (1)	1	13c
Supply, power (2)	1	13a
Test cable, BNC	1	18k
Wrist strap	1	33i

6-11.9.5 Prerequisites. Remove UUT cover assembly. Remove ground guards and terminal board protective covers where applicable.

6-11.9.6 Test Procedure. Refer to Figure 6-107 and Table 6-35. The maintenance personnel shall always perform the entire procedure in Table 6-35 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standards when performing a test, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.9.7 Alignment Procedure. Refer to paragraph 6-12.7.

6-11.9.8 Postrequistes. Install UUT ground guard and terminal board protective covers. Install UUT cover assembly.

6-11.10 +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test.

6-11.10.1 Purpose. This procedure provides the following tests that evaluate the performance of the +/-15 V dc voltage regulator.

1. Initial checkout
2. Input voltage
3. Output voltage (reduced load)
4. Performance monitoring
5. Reduced load
6. Output voltage
7. Switching frequency
8. Ripple
9. Noise
10. Remote turnoff
11. Performance monitoring
12. Full load
13. Switching frequency
14. Noise
15. Ripple
16. Output voltage (full load)

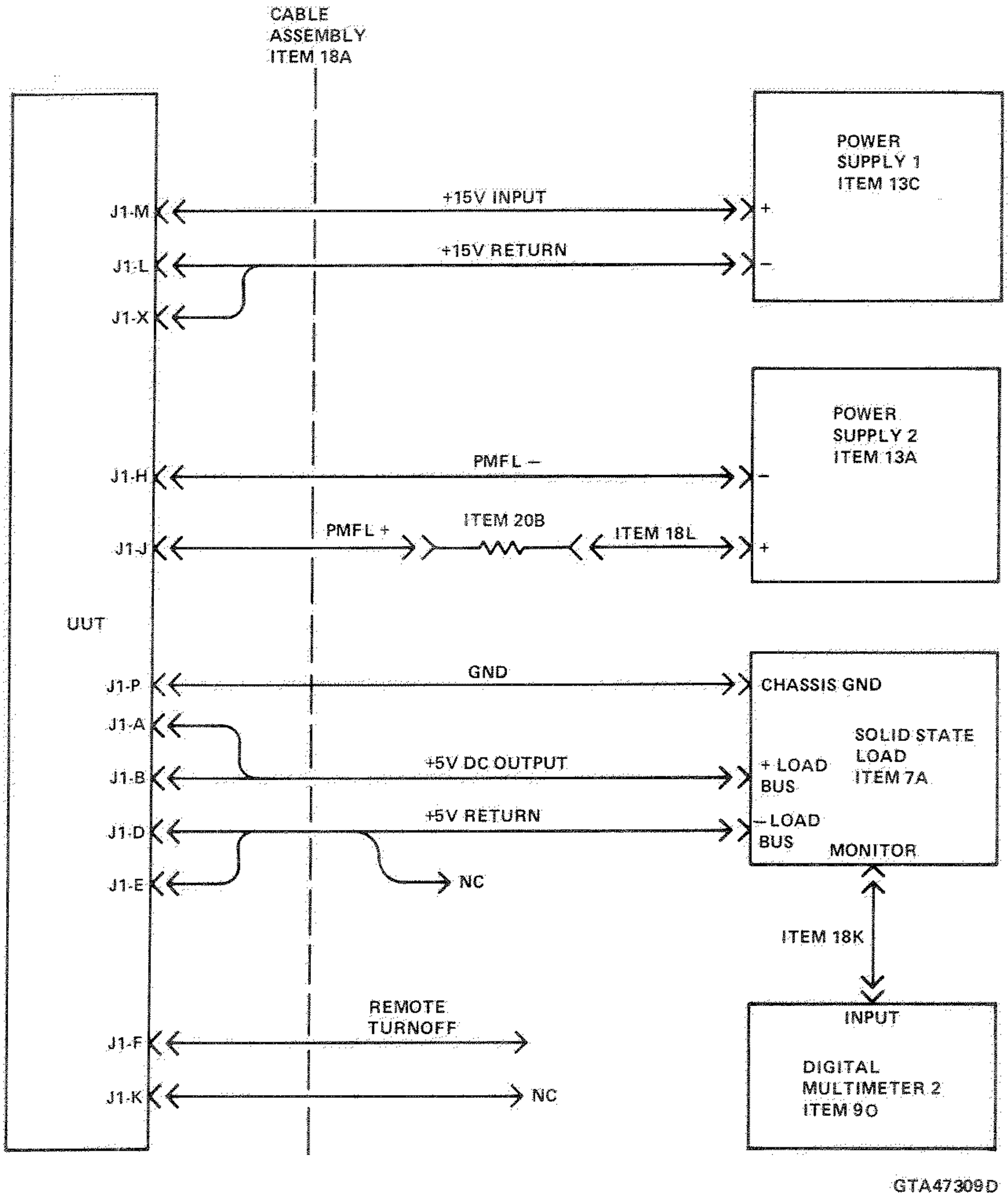


Figure 6-107. +/-5 V Dc Voltage Regulator (77D609500G1) Test Setup

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Initial Checkout			
1a				
1b	Connect digital multimeter 1 test leads to C2 negative and J1-P (chassis ground).	Between C2 negative and J1-P		Resistance shall be > 1 megOhm.
1c	Connect digital multimeter 1 to each UUT point of test and J1-P (chassis ground).	Between J1-A, J1-B, J1-D, J1-E, J1-L, J1-M, J1-X, and J1-P		Resistance shall be > 1 megOhm.
2	Initial Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

2a	Condition solid-state load by setting MANUAL MODE switch to MAIN R position and adjusting MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.			

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b	Connect test equipment to UUT per Figure 6-107.			

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep all cable assembly leads isolated from ground when not connected.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3	Input Voltage Test.			
3a	Connect digital multimeter 1 test leads to UUT J1-M (CB1-A) (positive) and J1-L (C2 negative) inside UUT. Turn on digital multimeter 1 and condition for dc voltage measurement. Turn on power supply 1. Adjust output voltage for +16.5 ± 0.1 V dc. Turn on power supply 2 and adjust output voltage for +5.0 ± 0.1 V dc.	Between J1-M (CB1-A) and J1-L (C2 negative)		+16.5 ± 0.1 V dc.

Table 6-35. +/ᴾ V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

WARNING

HIGH CURRENT HAZARD

Use caution when working in vicinity of regulator. While output voltage is low, current can cause a severe burn.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
4	Reduced Load Tests.			
4a	Turn on solid-state load and adjust resistance control for performance standard. [Adjust MAIN RESISTANCE Control cw]. Turn on digital multimeter 2 and condition for dc voltage measurement.	Between J1-A,B and J1-D,E	Turn on CB1.	8.6 ± 0.1 A. (Represented by -430 ± 5 mV dc on digital multimeter 2, at -50 mV/A).
5	Output Voltage Test.			
5a	Connect digital multimeter 1 test leads to J2-A,B (C6 positive) and J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)	Readjust A1R1 (VOLTAGE ADJUST) on UUT for performance standard.	+5.200 ± 0.025 V dc. Record voltage for use in step 17a.
6	Switching Frequency Test.			
6a	Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT. Oscilloscope ac coupled.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		18 ± 5 kHz. (43 to 77 microseconds).

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

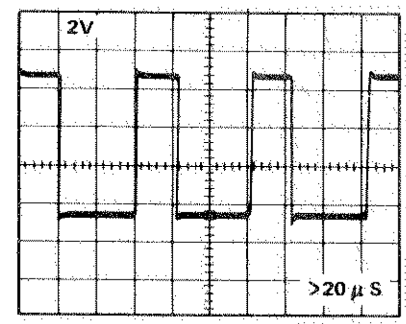
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6a(1)	Connect digital multimeter 1 test leads to A1U1 pin 4 (positive) and A1B- (negative).	Between A1U1 pin 4 and A1B-		+2.5 V dc ± 0.5 V dc.
6a(2)	Connect digital multimeter 1 test leads to A1U1 pin 5 (positive) and A1B- (negative).	Between A1U1 pin 5 and A1B-		+2.5 V dc ± 0.5 V dc.
6a(3)	Connect digital multimeter 1 test leads to A1U1 pin 2 (positive) and A1B- (negative). Connect oscilloscope probe to A1U1 pin 2 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1U1 pin 2 and A1B-		+2.8 V dc ± 0.5 V dc.  GTA47916 Frequency may vary slightly.
6a(4)	Connect digital multimeter 1 test leads to A1Q1 gate (positive) and A1B- (negative).	Between A1Q1 gate and A1B-		+2.6 V dc ± 0.5 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

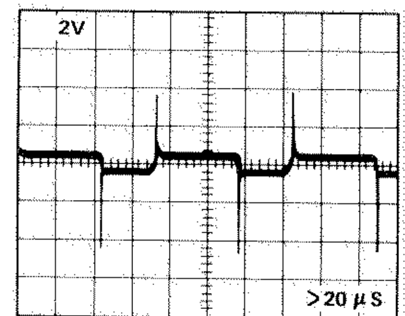
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6a(5)	Connect digital multimeter 1 test leads to A1Q1 source (positive) and A1B- (negative).	Between A1Q1 source and A1B-		+1.0 V dc ± 0.2 V dc.
6a(6)	Connect digital multimeter 1 test leads to A1WT1 drain (positive) and A1B- (negative). Connect oscilloscope probe to A1WT1 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1WT1 drain and A1B-		+16.2 V dc ± 2.5 V dc.  GTA47917 Frequency may vary slightly.
6a(7)	Connect digital multimeter 1 test leads to Q1 emitter (positive) and A1B- (negative).	Between Q1 emitter and A1B-		+16.5 V dc ± 2.5 V dc.
6a(8)	Connect digital multimeter 1 test leads to Q1 collector (positive) and A1B- (negative).	Between Q1 collector and A1B-		+6.0 V dc ± 1.0 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

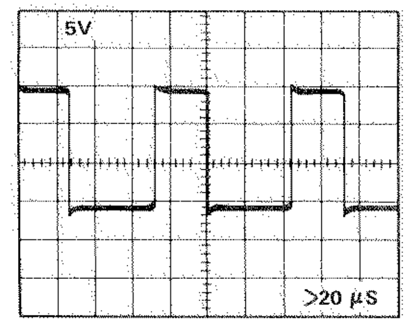
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6a(9)	Connect digital multimeter 1 test leads to Q3 emitter (positive) and A1B- (negative). Connect oscilloscope probe to Q3 emitter and ground lead to A1B-. Oscilloscope ac coupled.	Between Q3 emitter and A1B-		+5.7 V dc ± 1.0 V dc.  GTA47918 Frequency may vary slightly.
6a(10)	Connect digital multimeter 1 test leads to A1U1 pin 6 (positive) and A1B- (negative).	Between A1U1 pin 6 and A1B-		+5.1 V dc ± 1.0 V dc.
6a(11)	Connect digital multimeter 1 test leads to A1U1 pin 7 (positive) and A1B- (negative).	Between A1U1 pin 7 and A1B-		+5.2 V dc ± 1.0 V dc.
6a(12)	Connect digital multimeter 1 test leads to A1U1 pin 1 (positive) and A1B- (negative).	Between A1U1 pin 1 and A1B-		+2.8 V dc ± 0.5 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
7	Ripple Test.			
7a	Condition digital multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		< 26 mV ac
8	Noise Test.			
8a	Condition oscilloscope for noise measurement. Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		< 500 mV P-P. Measure between 1 Hz and 20 MHz.
9	Remote Turnoff Test.			
9a	Condition multimeter 1 for dc voltage measurement. Connect UUT J1-F (using cable assembly, item 18a) to UUT A1B-. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-C,D (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		< +0.2 V dc.
9a(1)	Connect digital multimeter 1 test leads to A1U1 pin 2 (positive) and A1B- (negative).	Between A1U1 pin 2 and A1B-		+0.7 V dc ± 0.1 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9a(2)	Connect digital multimeter 1 test leads to A1WT1 (positive) and A1B- (negative).	Between A1WT1 and A1B-		+16.5 V dc ± 2.5 V dc.
10	Performance Monitoring Test.			
10a	Connect digital multimeter 1 across externally connected resistor (item 20b). UUT J1-F is still connected to UUT A1 board ground per step 11a. Connect positive lead on power supply 2 side.	Across external resistor (item 20b)		< +0.2 V dc.
10a(1)	Connect digital multimeter 1 test leads to A1U1 pin 8 (positive) and A1B- (negative).	Between A1U1 pin 8 and A1B-		0.0 V dc.
10a(2)	Connect digital multimeter 1 test leads to A1U1 pin 9 (positive) and A1B- (negative).	Between A1U1 pin 9 and A1B-		+2.4 V dc ± 0.5 V dc.
10a(3)	Connect digital multimeter 1 test leads to A1U1 pin 14 (positive) and A1B- (negative).	Between A1U1 pin 14 and A1B-		0.0 V dc.
10a(4)	Disconnect UUT J1-F from A1B- (board ground).			

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11	Performance Monitoring Test.			
11a	Connect digital multimeter 1 test leads across externally connected resistor (item 20b). Connect positive lead to power supply 2 side.	Across external resistor (item 20b)		> +3 V dc.
11a(1)	Connect digital multimeter 1 test leads to A1U1 pin 8 (positive) and A1B- (negative).	Between A1U1 pin 8 and A1B-		+4.2 V dc ± 0.6 V dc.
11a(2)	Connect digital multimeter 1 test leads to A1U1 pin 9 (positive) and A1B- (negative).	Between A1U1 pin 9 and A1B-		+2.6 V ± 0.5 V dc.
11a(3)	Connect digital multimeter 1 test leads to A1U1 pin 14 (positive) and A1B- (negative).	Between A1U1 pin 14 and A1B-		+0.1 V dc ± 0.02 V dc.
11a(4)	Connect digital multimeter 1 test leads to A1U1 pin 10 (positive) and A1B- (negative).	Between A1U1 pin 10 and A1B-		+4.2 V dc ± 0.06 V dc.
11a(5)	Connect digital multimeter 1 test leads to A1U1 pin 11 (positive) and A1B- (negative).	Between A1U1 pin 11 and A1B-		+2.5 V dc ± 0.05 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
12	Full Load Test.			

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling (fan) must be provided for the UUT.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
12a	Condition solid-state load for maximum loading capability. Adjust load resistance and current controls until performance standard is obtained. [Set MANUAL MODE switch to DUAL R position. Adjust DUAL I or R control]. Check that voltage output of power supply 1 remains at +16.5 ± 0.1 V dc and, if necessary, adjust current output of power supply 1 to achieve performance standard.	Between J1-A,B and J1-D,E		43 ± 0.1 A. (Represented by -2150 ± 5 mV dc on digital multimeter 2.)
13	Switching Frequency Test.			
13a	Condition oscilloscope for low frequency test.Connect oscilloscope to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		18 ± 5 kHz. (43 to 77 microseconds)

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

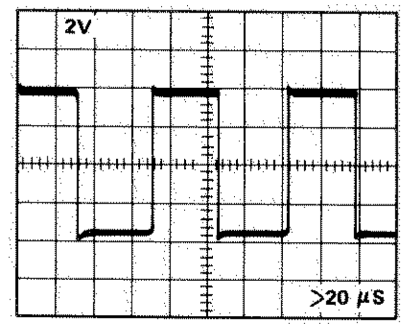
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
13a(1)	Connect digital multimeter 1 test leads to A1U1 pin 4 (positive) and A1B- (negative).	Between A1U1 pin 4 and A1B-		+2.5 V dc ± 0.5 V dc.
13a(2)	Connect digital multimeter 1 test leads to A1U1 pin 5 (positive) and A1B- (negative).	Between A1U1 pin 5 and A1B-		+2.5 V dc ± 0.5 V dc.
13a(3)	Connect digital multimeter 1 test leads to A1U1 pin 2 (positive) and A1B- (negative). Connect oscilloscope probe to A1U1 pin 2 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1U1 pin 2 and A1B-		+3.6 V dc ± 0.6 V dc.  GTA47919 Frequency may vary slightly.
13a(4)	Connect digital multimeter 1 test leads to A1Q1 gate (positive) and A1B- (negative).	Between A1Q1 gate and A1B-.		+3.4 V dc ± 0.6 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

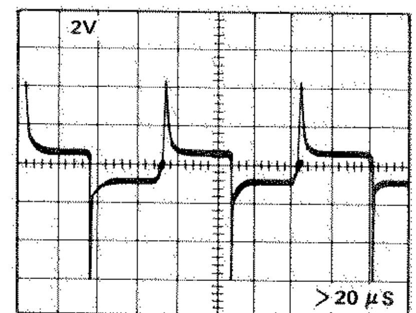
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
13a(5)	Connect digital multimeter 1 test leads to A1Q1 source (positive) and A1B- (negative).	Between A1Q1 source and A1B-		+1.4 V dc ± 0.4 V dc.
13a(6)	Connect oscilloscope probe to A1WT1 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1WT1 and A1B-		 GTA47920 Frequency may vary slightly.
13a(7)	Connect digital multimeter 1 test leads to Q1 emitter (positive) and A1B- (negative).	Between Q1 emitter and A1B-		+16.4 V dc ± 2.5 V dc.
13a(8)	Connect digital multimeter 1 test leads to Q1 collector (positive) and A1B- (negative).	Between Q1 collector and A1B-		+6.7 V dc ± 1.0 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

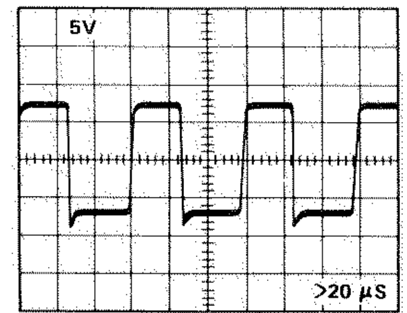
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
13a(9)	Connect digital multimeter 1 test leads to Q3 emitter (positive) and A1B- (negative). Connect oscilloscope probe to Q3 emitter and ground lead to A1B-. Oscilloscope ac coupled.	Between Q3 emitter and A1B-		+6.1 V dc ± 1.0 V dc.  Frequency may vary slightly.
13a(10)	Connect digital multimeter 1 test leads to A1U1 pin 6 (positive) and A1B- (negative).	Between A1U1 pin 6 and A1B-		+5.2 V dc ± 1.0 V dc.
13a(11)	Connect digital multimeter 1 test leads to A1U1 pin 7 (positive) and A1B- (negative).	Between A1U1 pin 7 and A1B-		+5.3 V dc ± 1.0 V dc.
13a(12)	Connect digital multimeter 1 test leads to A1U1 pin 1 (positive) and A1B- (negative).	Between A1U1 pin 1 and A1B-		+3.6 V dc ± 0.6 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
14	Noise Test.			
14a	Condition oscilloscope for noise test. Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative).		< 500 mV P-P. Measure between 1 Hz and 20 MHz.
15	Ripple Test.			
15a	Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT. Condition digital multimeter 1 to measure ac voltage.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative).		< 26 mV ac
16	Output Voltage Test.			
16a	Condition digital multimeter 1 for dc voltage measurement.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative).		Read and record dc voltage
17	Regulation.			
17a				Calculate UUT output voltage regulation. Regulation = V (step 5a)-V (step 16a)=20 mV maximum. Record data.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
17a(1)	If voltage regulation of step 17a cannot be obtained, perform steps 19a and 19b. Then repeat procedure starting at step 13a.			
18	Remote Voltage Adjust			
18a	Reduce power supply 2 output voltage to 0 V dc. Turn all test equipment off.			
18b	Disconnect power supply 2 and external resistor from cable assembly. Connect J1-K on UUT to power supply 2 positive terminal using cable assembly lead connector. Connect power supply 2 negative terminal to cable assembly voltage adjust return lead. Condition solid-state load for reduced load per step 2a. [Set MANUAL MODE switch to MAIN R position.]			

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
18c	Turn all test equipment on and condition solid state load per step 4a for reduced load.			
18d	Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT. Rotate power supply 2 dc output voltage between 5 V dc (maximum) and 0 V dc.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		Voltage shall vary ± 0.4 V dc minimum.
18e	Turn power supply 2 off and disconnect from test setup.			
19	Current Limit Test.			
19a	Condition solid-state load for maximum loading capability. Adjust load resistance and current controls for performance standard. [Set MANUAL MODE switch to DUAL R position. Adjust DUAL I or R control]. Check that voltage output of power supply 1 remains at +16.5 ± 0.1 V dc and, if necessary, adjust current control of power supply 1 to achieve performance standard.	Between J1-A,B and J1-D,E.	It may be necessary to adjust A1R25 (CURRENT ADJUST) on UUT and increase current limit to obtain the performance standard.	43.5 ± 0.1A. (-2175 ± 5 mV dc on digital multimeter 2.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
19b	Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative). Then connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative).	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)	Adjust A1R25 (CURRENT ADJUST) on UUT for performance standard.	50 to 100 mV dc voltage drop at 43.5 ± 0.1 A load. A slight change in frequency shall also be noted on the oscilloscope.
20	Switching Frequency Test.			
20a	Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT. Condition oscilloscope for low frequency measurement.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		18 ± 5 kHz. (43 to 77 microseconds).
21	Fold-Back Current Test.			
21a	Connect digital multimeter test leads to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT. Adjust solid-state load resistance and current controls until UUT output voltage decreases to 2.5 ± 0.5 V dc [Adjust DUAL I or R control].	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		Load current shall be > 20 A (-1000 mV dc on digital multimeter 2) when UUT output voltage is 2.5 ± 0.5 V dc.
21a(1)	Connect digital multimeter test leads to A1U1 pin 6 (positive) and A1B- (negative).			+2.7 V dc ± 0.5 V dc.
21a(2)	Connect digital multimeter test leads to A1U1 pin 7 (positive) and A1B- (nega-			+2.6 V dc ± 0.5 V dc.

Table 6-35. +/-5 V Dc Voltage Regulator (77D609500G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
22	Procedure Completed. Reduce power supply 1 output voltage to 0 V dc. Turn remaining test equipment off.		Turn UUT off. Fasten cover assembly.	

17. Regulation

18. Remote voltage adjust

19. Current limit

20. Switching frequency

21. Fold-back current.

6-11.10.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of the regulator. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling (fan) must be provided during entire procedure allowing the air to transfer heat away from the UUT. When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-11.10.3 Reference Material. See schematic diagram Figure 43 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-127 and 6-134 in this TO.

6-11.10.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Cable assembly	1	18p
Fan, 3-speed, bench	1	22l
Load, solid state	1	7a
Multimeter digital (1)	1	9f
Multimeter digital (2)	1	9o
Oscilloscope, portable	1	10d
Patch cord, alligator clip	1	18l
Resistor 3.3K, 2W	1	20b
Screwdriver, cross-top	1	25ac
Screwdriver, flat blade	1	25ae
Screwdriver, jewelers	1	25ap
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-64 V dc, 0-50A	1	13c
Supply, power supply (2)	1	13a
Test cable, BNC	1	18k
Wrist strap	1	33i

6-11.10.5 Prerequisites. Remove UUT cover assembly. Remove ground guards and terminal board protective covers where applicable.

6-11.10.6 Test Procedure. Refer to Figure 6-108 and Table 6-36. The maintenance personnel shall always perform the entire procedure in Table 6-36 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standards when performing a test, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.10.7 Alignment Procedure. Refer to paragraph 6-12.8.

6-11.10.8 Postrequistes. Install UUT ground guard and terminal board protective covers. Install UUT cover assembly.

6-11.11 Power Supply Controller (77D611601G1) Performance Test.

6-11.11.1 Purpose. This procedure provides the following tests that evaluate the performance of the power supply controller.

1. Initial checkout

2. Circuit calibration

3. Fault indication.

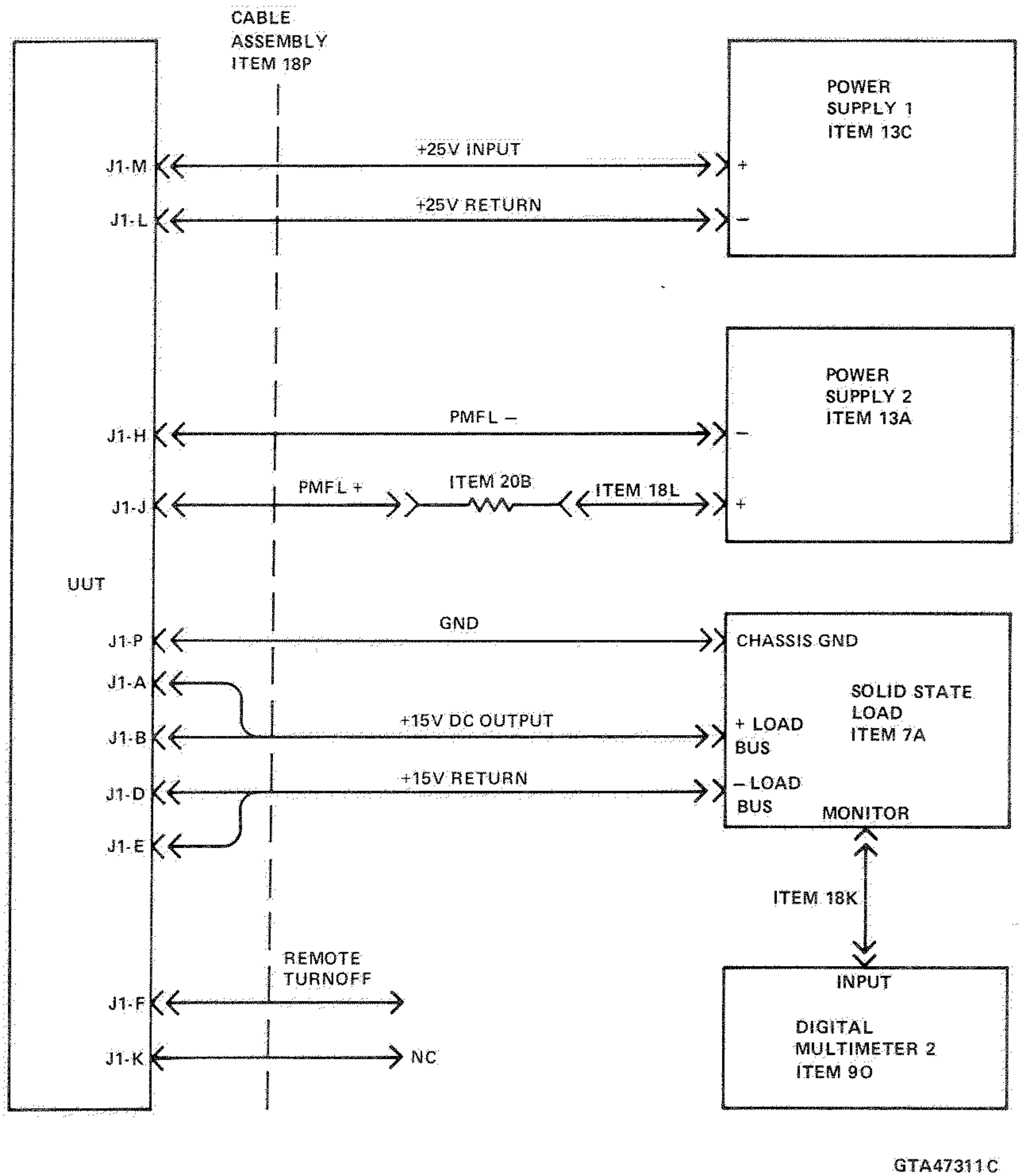


Figure 6-108. +\-15 V Dc Voltage Regulator (77D609503G1) Test Setup

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Initial Checkout			
1a				
1b	Connect digital multimeter 1 test leads to C2 negative and J1-P (chassis ground).	Between C2 negative and J1-P		Resistance shall be > 1 megOhm.
1b	Connect digital multimeter 1 to each UUT point of test and J1-P (chassis ground).	Between J1-A, J1-B, J1-D, J1-E, J1-L, J1-M, and J1-P		Resistance shall be > 1 megOhm.
2	Initial Test Setup.			

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the general statements. Current calculation will be necessary if another solid state load is used.

2a	Condition solid-state load by setting MANUAL MODE switch to MAIN R position and adjusting MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw.] Set meter range for maximum current reading.			

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b	Connect test equipment to UUT per Figure 6-108.			

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep all cable assembly leads isolated from ground when not connected.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3	Input Voltage Test.			
3a	Connect digital multimeter 1 test leads to J1-M (CB1-A) (positive) and J1-L (C2 negative) inside UUT. Turn on digital multimeter 1 and condition for dc voltage measurement. Turn on power supply 1 and adjust output voltage for +26.5 ± 0.1 V dc. Turn on power supply 2 and adjust output voltage for +5.0 ± 0.2 V dc.	Between J1-M (CB1-A) and J1-L (C2 negative)		26.5 ± 0.1 V dc.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

WARNING

HIGH CURRENT HAZARD

Use caution when working in vicinity of regulator. While output voltage is low, current can cause a severe burn.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
4	Reduced Load Tests.			
4a	Turn on solid-state load and adjust resistance control for performance standard. [Adjust MAIN RESISTANCE Control cw]. Turn on digital multimeter 2 and condition for dc voltage measurement.	Between J1-A,B and J1-D,E	Turn on CB1.	3.0 ± 0.1 A. (Represented by 150 ± 5 mV dc on digital multimeter 2, at -50 mV/A).
5	Output Voltage Test.			
5a	Connect digital multimeter 1 test leads to J2-A,B (C6 positive) and J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)	Readjust A1R1 (VOLTAGE ADJUST) on UUT for performance standard.	15.500 ± 0.050 V dc. Record voltage for use in step 17a.
6	Switching Frequency Test.			
6a	Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT. Oscilloscope ac coupled.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		17.5 ± 5 kHz. (45 to 80 microseconds).

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

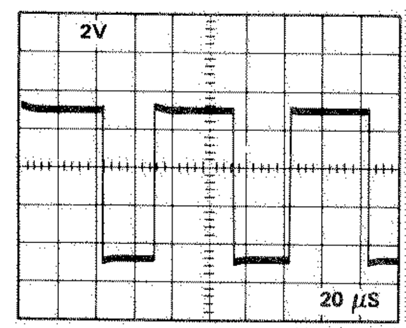
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6a(1)	Connect digital multimeter 1 test leads to A1U1 pin 4 (positive) and A1B- (negative).	Between A1U1 pin 4 and A1B-		+5.8 V dc ± 1 V dc.
6a(2)	Connect digital multimeter 1 test leads to A1U1 pin 5 (positive) and A1B- (negative).	Between A1U1 pin 5 and A1B-		+5.8 V dc ± 1 V dc.
6a(3)	Connect digital multimeter 1 test leads to A1U1 pin 2 (positive) and A1B- (negative). Connect oscilloscope probe to A1U1 pin 2 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1U1 pin 2 and A1B-		+4.9 V dc ± 1 V dc.  GTA47756
6a(4)	Connect digital multimeter 1 test leads to A1Q1 gate (positive) and A1B- (negative).	Between A1Q1 gate and A1B-		+4.3 V dc ± 0.8 V dc.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

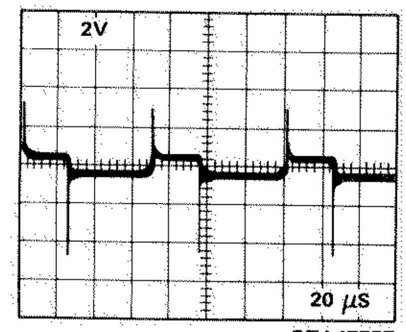
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6a(5)	Connect digital multimeter 1 test leads to A1Q1 source (positive) and A1B- (negative).	Between A1Q1 source and A1B-		+2.0 V dc ± 0.4 V dc.
6a(6)	Connect digital multimeter 1 test leads to A1WT1 source (positive) and A1B- (negative). Connect oscilloscope probe to A1WT1 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1WT1 source and A1B-		+26.1 V dc ± 5 V dc.  GTA47757
6a(7)	Connect digital multimeter 1 test leads to Q1 emitter (positive) and A1B- (negative).	Between Q1 emitter and A1B-		+26.5 V dc ± 5 V dc.
6a(8)	Connect digital multimeter 1 test leads to Q1 collector (positive) and A1B- (negative).	Between Q1 collector and A1B-		+16.4 V dc ± 2.5 V dc.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

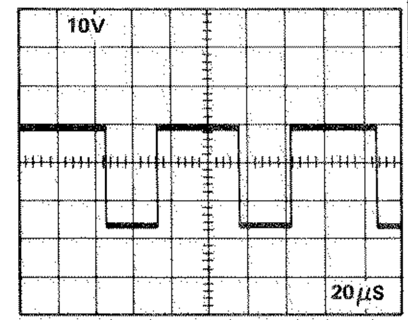
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6a(9)	Connect digital multimeter 1 test leads to Q3 emitter (positive) and A1B- (negative). Connect oscilloscope probe to Q3 emitter and ground lead to A1B-. Oscilloscope ac coupled.	Between Q3 emitter and A1B-		+16.0 V dc ± 2.5 V dc. 
6a(10)	Connect digital multimeter 1 test leads to A1U1 pin 6 (positive) and A1B- (negative).	Between A1U1 pin 6 and A1B-		+15.3 V dc ± 2.5 V dc.
6a(11)	Connect digital multimeter 1 test leads to A1U1 pin 7 (positive) and A1B- (negative).	Between A1U1 pin 7 and A1B-		+15.5 V dc ± 2.5 V dc.
6a(12)	Connect digital multimeter 1 test leads to A1U1 pin 1 (positive) and A1B- (negative).	Between A1U1 pin 1 and A1B-		+4.9 V dc ± 0.9 V dc.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
7	Ripple Test.			
7a	Condition digital multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		< 26 mV ac.
8	Noise Test.			
8a	Condition oscilloscope for noise measurement. Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		< 200 mV P-P. Measure between 1 Hz and 20 MHz.
9	Remote Turnoff Test.			
9a	Condition multimeter 1 for dc voltage measurement. Connect UUT J1-F (using cable assembly, item 18a) to UUT A1B- (negative). Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		< +0.2 V dc.
9a(1)	Connect digital multimeter 1 test leads to A1U1 pin 2 (positive) and A1B- (negative).	Between A1U1 pin 2 and A1B-		+0.7 V dc ± 0.1 V dc

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9a(2)	Connect digital multimeter 1 test leads to A1WT1 (positive) and A1B- (negative).	Between A1WT1 and A1B-		+26.5 V dc ± 5 V dc.
10	Performance Monitoring Test.			
10a	Connect digital multimeter 1 across externally connected resistor (item 20b). UUT J1-F is still connected to UUT A1 board ground per step 11a. Connect positive lead on power supply 2 side.	Across external resistor. (item 20b)		< +0.2 V dc.
10a(1)	Connect digital multimeter 1 test leads to A1U1 pin 8 (positive) and A1B- (negative).	Between A1U1 pin 8 and A1B-		0.0 V dc.
10a(2)	Connect digital multimeter 1 test leads to A1U1 pin 9 (positive) and A1B- (negative).	Between A1U1 pin 9 and A1B-		+5.7 V dc ± 1 V dc.
10a(3)	Connect digital multimeter 1 test leads to A1U1 pin 14 (positive) and A1B- (negative).	Between A1U1 pin 14 and A1B-		0.0 V dc.
10a(4)	Disconnect UUT J1-F from A1B-			

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11	Performance Monitoring Test.			
11a	Connect digital multimeter 1 test leads across externally connected resistor (item 20b). Connect positive lead to power supply 2 side.	Across external resistor (item 20b)		> +3 V dc
11a(1)	Connect digital multimeter 1 test leads to A1U1 pin 8 (positive) and A1B- (negative).	Between A1U1 pin 8 and A1B-		+10.9 V dc ± 1.5 V dc
11a(2)	Connect digital multimeter 1 test leads to A1U1 pin 9 (positive) and A1B- (negative).	Between A1U1 pin 9 and A1B-		+5.8 V dc ± 1.5 V dc.
11a(3)	Connect digital multimeter 1 test leads to A1U1 pin 14 (positive) and A1B- (negative).	Between A1U1 pin 14 and A1B-		+0.1 V dc ± 1 V dc.
11a(4)	Connect digital multimeter 1 test leads to A1U1 pin 10 (positive) and A1B- (negative).	Between A1U1 pin 10 and A1B-		+10.9 V dc ± 1.5 V dc.
11a(5)	Connect digital multimeter 1 test leads to A1U1 pin 11 (positive) and A1B- (negative).	Between A1U1 pin 11 and A1B-		+5.8 V dc ± 1 V dc.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
12	Full Load Test.			

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling (fan) must be provided for the UUT.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
12a	Condition solid-state load for maximum loading capability. Adjust load resistance and current controls until performance standard is obtained. [Set MANUAL MODE switch to DUAL R position. Adjust DUAL I or R control]. Check that voltage output of power supply 1 remains at +26.5 ± 0.1 V and, if necessary, adjust current output of power supply 1 to achieve performance standard.	Between J1-A,B and J1-D,E		15.0 ± 0.1 A. (Represented by -750 ± 5 mV dc on digital multimeter 2.)
13	Switching Frequency Test.			
13a	Condition oscilloscope for low frequency test. Connect oscilloscope to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		17.5 ± 5 kHz. (45 to 80 microseconds.)

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

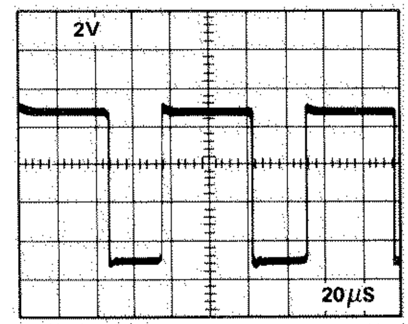
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
13a(1)	Connect digital multimeter 1 test leads to A1U1 pin 4 (positive) and A1B- (negative).	Between A1U1 pin 4 and A1B-		+5.8 V dc ± 1 V dc.
13a(2)	Connect digital multimeter 1 test leads to A1U1 pin 5 (positive) and A1B- (negative).	Between A1U1 pin 5 and A1B-		+5.8 V dc ± 1 V dc.
13a(3)	Connect digital multimeter 1 test leads to A1U1 pin 2 (positive) and A1B- (negative). Connect oscilloscope probe to A1U1 pin 2 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1U1 pin 2 and A1B-		+5.2 V dc ± 1 V dc.  GTA47759
13a(4)	Connect digital multimeter 1 test leads to A1Q1 gate (positive) and A1B- (negative).	Between A1Q1 gate and A1B-		+4.6 V dc ± .9 V dc.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

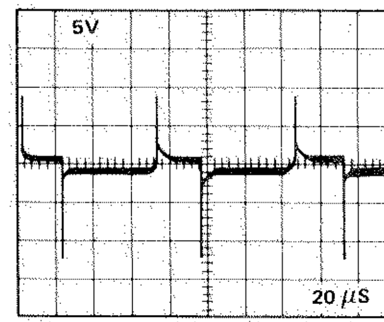
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
13a(5)	Connect digital multimeter 1 test leads to A1Q1 source (positive) and A1B- (negative).	Between A1Q1 source and A1B-		+2.1 V dc ± 0.4 V dc.
13a(6)	Connect digital multimeter 1 test leads to A1WT1 (positive) and A1B- (negative). Then connect oscilloscope probe to A1WT1 and ground lead to A1B-. Oscilloscope ac coupled.	Between A1WT1 and A1B-		+26.0 V dc ± 3.5 V dc.  GTA47760
13a(7)	Connect digital multimeter 1 test leads to Q1 emitter (positive) and A1B- (negative).	Between Q1 emitter and A1B-		+26.5 V dc ± 3.5 V dc.
13a(8)	Connect digital multimeter 1 test leads to Q1 collector (positive) and A1B- (negative).	Between Q1 collector and A1B-		+16.8 V dc ± 2.5 V dc.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

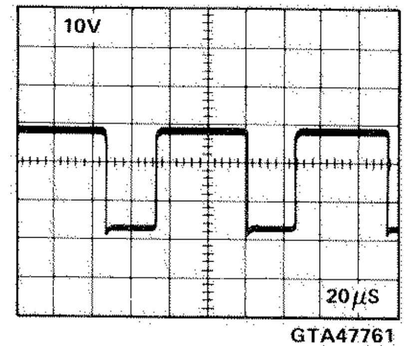
Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
13a(9)	Connect digital multimeter 1 test leads to Q3 emitter (positive) and A1B- (negative). Connect oscilloscope probe to Q3 emitter and ground lead to A1B-. Oscilloscope ac coupled.	Between Q3 emitter and A1B-		+16.3 V dc ± 2.5 V dc. 
13a(10)	Connect digital multimeter 1 test leads to A1U1 pin 6 (positive) and A1B- (negative).	Between A1U1 pin 6 and A1B-		+15.4 V dc ± 2.5 V dc.
13a(11)	Connect digital multimeter 1 test leads to A1U1 pin 7 (positive) and A1B- (negative).	Between A1U1 pin 7 and A1B-		+15.5 V dc ± 2.5 V dc.
13a(12)	Connect digital multimeter 1 test leads to A1U1 pin 1 (positive) and A1B- (negative).	Between A1U1 pin 1 and A1B-		+5.1 V dc ± 1 V dc.
14	Noise Test.			
14a	Condition oscilloscope for noise test. Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative).		< 200 mV P-P. Measure between 1 Hz and 20 mHz.

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
15	Ripple Test.			
15a	Condition digital multimeter 1 to measure ac voltage. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative).		< 26 mV ac.
16	Output Voltage Test.			
16a	Condition digital multimeter 1 for dc voltage measurement.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative).		Read and record dc voltage.
17	Regulation.			
17a				Calculate UUT output voltage regulation. Regulation = V (step 5a)-V (step 16a)=50 mV maximum. Record data.
17a(1)	If voltage regulation of step 18a cannot be obtained, perform steps 20a and 20b. Then repeat procedure starting at step 13a.			
18	Remote Voltage Adjust			
18a	Reduce power supply 2 output voltage to 0 V dc. Turn all test equipment off.			

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
18b	Condition solid-state load for reduced load per step 2a. [Set MANUAL MODE switch to MAIN R position.]Disconnect power supply 2 and external resistor from cable assembly. Connect J1-K on UUT to power supply 2 positive terminal using cable assembly lead connector. Connect power supply 2 negative terminal to negative load bus on solid-state load using item 18e.			
18c	Turn all test equipment on and condition solid state load per step 4a for reduced load.			
18d	Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT. Rotate power supply 2 dc output voltage between 15 V dc (maximum) and 0 V dc.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		Voltage shall vary ± 1.0 V dc minimum.
18e	Turn power supply 2 off and disconnect from test setup.			

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
19	Current Limit Test.			
19a	Condition solid-state load for maximum loading capability. Adjust load resistance and current controls for performance standard. [Set MANUAL MODE switch to DUAL R position. Adjust DUAL I or R control]. Check that voltage output of power supply 1 remains at +26.5 ± 0.1 V dc and, if necessary, adjust current control of power supply 1 to achieve performance standard.	Between J1-A,B and J1-D,E.	It may be necessary to adjust A1R25 (CURRENT ADJUST) on UUT and increase current limit to obtain the performance standard.	16.0 ± 0.1 A. (-800 ± 5 mV dc on digital multimeter 2.
19b	Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative). Then connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative).	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)	Adjust A1R25 (CURRENT ADJUST) on UUT for performance standard.	50 to 200 mV dc voltage drop at 16.0 ± 0.1 A load. A slight change in frequency shall also be noted on the oscilloscope.
20	Switching Frequency Test.			
20a	Condition oscilloscope for low frequency measurement. Connect oscilloscope probe to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT.	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		17.5 ± 5 kHz. (45 to 80 microseconds).

Table 6-36. +/-15 V Dc Voltage Regulator (77D609503G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
21	Fold-Back Current Test.			
21a	Connect digital multimeter test leads to J1-A,B (C6 positive) and ground lead to J1-D,E (C6 negative) on UUT. Adjust solid-state load resistance and current controls until UUT output voltage decreases to 7.5 ± 1.0 V dc [Adjust DUAL I or R control].	Between J1-A,B (C6 positive) and J1-D,E (C6 negative)		Load current shall be > 6 A (-300 mV dc on digital multimeter 2) when UUT output voltage is 7.5 ± 1.0 V dc.
21a(1)	Connect digital multimeter test leads to A1U1 pin 6 (positive) and A1B- (negative).			+7.6 V dc ± 1.2 V dc.
21a(2)	Connect digital multimeter test leads to A1U1 pin 7 (positive) and A1B- (negative).			+7.7 V dc ± 1.2 V dc.
22	Procedure Completed. Reduce power supply 1 output voltage to 0 V dc. Turn remaining test equipment off.		Place circuit breaker CB1 on UUT in OFF position. Install cover on UUT.	

6-11.11.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in immediate vicinity of power supplies. While the output voltage is low, current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-11.11.3 Reference Material. See schematic diagram Figure 86 sheet 2 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagram Figures 6-128 and 6-135 in this TO.

6-11.11.4 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Multimeter digital (1)	1	9f
Patch cord, spade lugs	2	18n
Screwdriver, jewelers	1	25ap
Set, test probe	1	9h
Static control work station	1	33c
Supply, power (1)	1	13a
Supply, power (2)	1	13a
Supply, power 0-100 V dc, 0-1A (3)	1	13b
Supply, power (5)	1	13a
Supply, power 0-64 V dc, 0-50A (6)	1	13c
Test fixture (power control)	1	19a
Wrist strap	1	33i

6-11.11.5 Prerequisites. None.

6-11.11.6 Test Procedure. Refer to Figure 6-109 and Table 6-37. The maintenance personnel shall always perform the entire procedure in Table 6-37 starting with step 1 adhering to all warnings and cautions. After selected steps, stage-by-stage measurements used in troubleshooting are incorporated into the procedure using substeps. If the user obtains the required performance standard when performing a step, the substeps following the step (enclosed in parentheses) may be ignored. If a performance standard cannot be obtained, the user should then perform the substeps following the step. It may be necessary to perform more than one step, acquiring additional data, until troubleshooting information (substeps) are encountered. After a repair has been performed on the UUT, the maintenance personnel should repeat the entire performance test table starting at step 1.

6-11.11.7 Alignment Procedure. Perform steps in paragraph 6-12.9.

6-11.11.8 Postrequistes. None.

6-12 ANALOG AND MECHANICAL ASSEMBLY ALIGNMENT PROCEDURES.

6-12.1 Introduction. The following paragraphs provide bench alignment procedures for various LRUs in the transmitter group. The following procedures shall be performed to correct LRU operation after a repair action has been performed on an LRU. Parameter data consisting of waveforms, power levels, and/or voltage values are provided, as required for each LRU alignment procedure. This data provides point of measurement for each parameter. Each of the test procedures given below contains a list of test equipment necessary to perform the alignment. Each piece of test equipment listed is identified by an item number. The item number refers to equipment listed in Table 1-4 of Chapter 1. As necessary, each procedure references the associated schematic, logic, or parts diagrams to aid the user. The schematic or logic diagram references refer to the transmitter group circuit diagram TO 31P6-2FPS118-73-1. The parts location diagram references refer to paragraph 6-14.

6-12.2 +/-15 V Dc Power Supply (7328363G1) Alignment Procedure.

6-12.2.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Kit alignment tool	1	25ba
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Screwdriver, flat blade	1	25ae
Static control work station	1	33c
Test cable (1)	1	18e
Test cable (2)	1	18f
Test cable, BNC	1	18k
Wrench set	1	32a
Wrist strap	1	33i

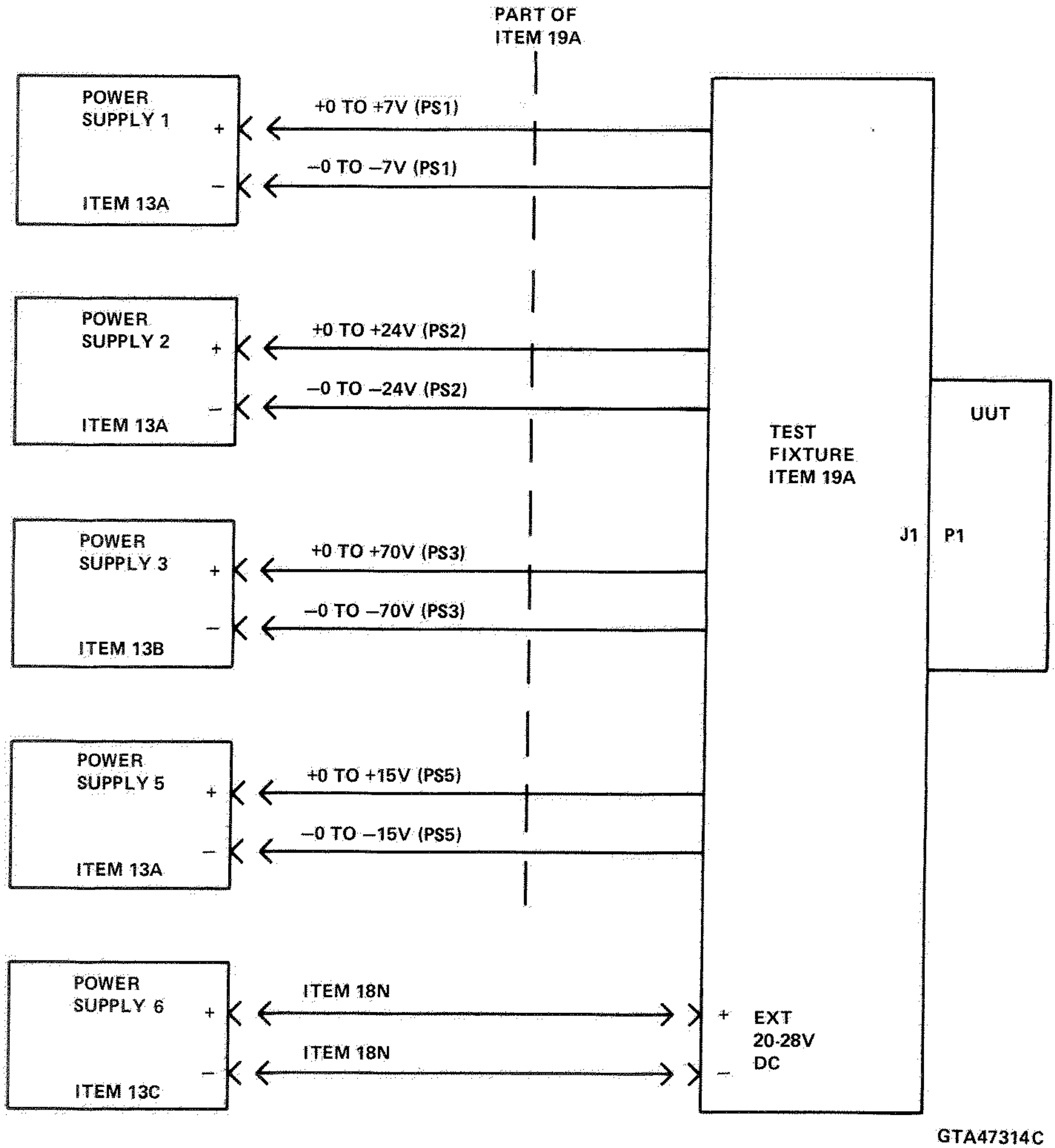


Figure 6-109. Power Supply Controller (77D611601G1) Test Setup

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Initial Test Setup.			

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of power supplied. While the output voltage is low, high current can cause a severe burn.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1a	Connect test equipment per Figure 6-109. Do not insert UUT into test fixture at this time. On test fixture place toggle switches S1 through S10 in OFF position. Place S11 in 1 position. Place I Bus switch in +5/24 V position on test fixture.			
1b	Adjust controls of power supplies 2, 3, and 5 so that when activated, they will provide minimum output voltage.			
1c	Carefully insert UUT into test fixture jack.			

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1d	Connect digital multimeter 1 test leads between TP2 (positive) and TP1 (negative) on test fixture. Turn power supply 1 on and readjust output voltage for +5 ± 0.1 V dc, if necessary.			
1e	Connect digital multimeter 1 test leads between TP43 (positive) and TP1 (negative) on test fixture. Turn power supply 6 on and readjust output voltage for +24 ± 0.2 V dc, if necessary.			
2	Voltage checks.			
2a	Connect digital voltmeter test leads to J6 (REF) (positive) and J7 (GND) (negative) on UUT.	Between J6 (REF) and J7 (GND) on UUT	Adjust R3 (REF) on UUT for performance standard.	+2.500 ± 0.003 V dc.

NOTE

All Voltages in following substeps are nominal. The digital multimeter negative lead is always connected to either J7 (chassis ground) on UUT or TP1 (ground) on test fixture unless otherwise stated.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2a(1)	Connect digital multimeter 1 test leads to U1-8 (positive) and chassis ground (negative).	Between U1-8 and chassis ground		+5.8 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2a(2)	Connect digital multimeter 1 test leads to U1-10 (positive) and chassis ground (negative).	Between U1-10 and chassis ground		+5.8 V dc ± 1 V dc.
2b	Connect digital multimeter 1 test leads to TP 2 (positive) and TP1 (negative) on test fixture. Set switch S11 on test fixture to position 2. Adjust power supply 1 output voltage for + 5.790 ± 0.005 V dc.	UUT DS1 (OVV-5/24)		DS1 is extinguished.
2b(1)	Connect digital multimeter 1 test leads to U4-2 (positive) and chassis ground (negative).	Between U4-2 and chassis ground		+5.2 V dc ± 1 V dc.
2b(2)	Connect digital multimeter 1 test leads to U4-1 (positive) and chassis ground (negative).	Between U4-1 and chassis ground		+0.1 V dc ± .015 V dc.
2b(3)	Connect digital multimeter 1 test leads to U2-5 (positive) and chassis ground (negative).	Between U2-5 and chassis ground		+5.7 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2b(4)	Connect digital multimeter test leads to U2-4 (positive) and chassis ground (negative).	Between U2-4 and chassis ground.		+5.8 V dc ± 1 V dc.
2c	Connect digital multimeter 1 test leads to TP2 (positive) and TP1 (negative) on test fixture. Adjust power supply 1 output voltage between voltage in step 2b and +5.885 V dc.	UUT DS1 (OVV-5/24)		DS1 is lit (red).
2c(1)	Connect digital multimeter 1 test leads to U4-2 (positive) and chassis ground (negative).	Between U4-2 and chassis ground		+0.3 V dc ± .05 V dc.
2c(2)	Connect digital multimeter 1 test leads to U4-1 (positive) and chassis ground (negative).	Between U4-1 and chassis ground		+5.9 V dc ± 1 V dc.
2c(3)	Connect digital multimeter 1 test leads to U2-5 (positive) and chassis ground (negative).	Between U2-5 and chassis ground		+5.9 V dc ± 1 V dc.
2c(4)	Connect digital multimeter 1 test leads to U2-4 (positive) and chassis ground (negative).	Between U2-4 and chassis ground		+5.8 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2d	Connect digital multimeter 1 test leads to TP2 (positive) and TP1 (negative) on test fixture. On test fixture, set switch S11 to position 1. Adjust power supply 1 output voltage for + 5 ± 0.1 V dc.			
2e	Connect digital multimeter 1 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for +25.70 ± 0.1 V dc.	UUT DS1 (OVV-5/24)		DS1 is extinguished.
2e(1)	Connect digital multimeter 1 test leads to U4-2 (positive) and chassis ground (negative).	Between U4-2 and chassis ground		+4.4 V dc ± .8 V dc.
2e(2)	Connect digital multimeter 1 test leads to U4-1 (positive) and chassis ground (negative).	Between U4-1 and chassis ground		+0.1 V dc ± .015 V dc.
2e(3)	Connect digital multimeter 1 test leads to U2-5 (positive) and chassis ground (negative).	Between U2-5 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2e(4)	Connect digital multimeter 1 test leads to U2-4 (positive) and chassis ground (negative).	Between U2-4 and chassis ground		+5.8 V dc ± 1 V dc.
2f	Connect digital multimeter 1 test leads to TP43 (positive) and TP1 (negative) on test fixture. Increase power supply 6 output voltage between voltage in step 2e and +26.60 V dc.	UUT DS1 (OVV-5/24)		DS1 is lit (red).
2f(1)	Connect digital multimeter 1 test leads to U4-2 (positive) and chassis ground (negative).	Between U4-2 and chassis ground		+0.3 V dc ± .05 V dc.
2f(2)	Connect digital multimeter 1 test leads to U4-1 (positive) and chassis ground (negative).	Between U4-1 and chassis ground		+5.0 V dc ± 1 V dc.
2f(3)	Connect digital multimeter 1 test leads to U2-5 (positive) and chassis ground (negative).	Between U2-5 and chassis ground		+5.9 V dc ± 1 V dc.
2f(4)	Connect digital multimeter 1 test leads to U2-4 (positive) and chassis ground (negative).	Between U2-4 and chassis ground		+5.8 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2g	Connect digital multimeter 1 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for + 24.0 ± 0.1 V dc.			
2h	Connect digital multimeter test leads to TP32 (positive) and TP30 (negative) on test fixture. Turn power supply 2 on. Increase power supply 2 output voltage to +16.40 ± 0.01 V dc.	UUT DS3 (OVV-15)		DS3 is extinguished.
2h(1)	Connect digital multimeter 1 test leads to U4-10 (positive) and chassis ground (negative).	Between U4-10 and chassis ground		+4.4 V dc ± .7 V dc.
2h(2)	Connect digital multimeter 1 test leads to U4-11 (positive) and chassis ground (negative).	Between U4-11 and chassis ground		+0.1 V dc ± .015 V dc.
2h(3)	Connect digital multimeter 1 test leads to U2-9 (positive) and chassis ground (negative).	Between U2-9 and chassis ground		+5.7 V dc 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2h(4)	Connect digital multimeter 1 test leads to U2-8 (positive) and chassis ground (negative).	Between U2-8 and chassis ground		+5.8 V dc ± 1 V dc.
2i	Connect digital multimeter 1 test leads to TP32 (positive) and TP30 (negative) on test fixture. Increase power supply 2 output voltage between the voltage of step 2h and +17.15 V dc.	UUT DS3 (OVV-15)		DS3 is lit (red).
2i(1)	Connect digital multimeter 1 test leads to U4-10 (positive) and chassis ground (negative).	Between U4-10 and chassis ground		+0.3 V dc ± .05 V dc.
2i(2)	Connect digital multimeter 1 test leads to U4-11 (positive) and chassis ground (negative).	Between U4-11 and chassis ground		+5.0 V dc ± 1 V dc.
2i(3)	Connect digital multimeter 1 test leads to U2-9 (positive) and chassis ground (negative).	Between U2-9 and chassis ground		+5.9 V dc ± 1 V dc.
2i(4)	Connect digital multimeter 1 test leads to U2-8 (positive) and chassis ground (negative).	Between U2-8 and chassis ground		+5.8 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2j	Reduce power supply 2 output voltage to 0. Turn power supply 2 off.			
2k	Connect digital multimeter 1 test leads to TP34 (positive) and TP36 (negative) on test fixture. Turn on power supply 3. Adjust power supply 3 output voltage for +62.40 ± 0.02 V dc.	UUTDS2 (OVV-60)		DS2 is extinguished.
2k(1)	Connect digital multimeter 1 test leads to U4-6 (positive) and chassis ground (negative).	Between U4-6 and chassis ground		+4.4 V dc ± .8 V dc.
2k(2)	Connect digital multimeter 1 test leads to U4-5 (positive) and chassis ground (negative).	Between U4-5 and chassis ground		+0.1 V dc ± .015 V dc.
2k(3)	Connect digital multimeter 1 test leads to U2-7 (positive) and chassis ground (negative).	Between U2-7 and chassis ground		+5.6 V dc ± 1 V dc.
2k(4)	Connect digital multimeter 1 test leads to U2-6 (positive) and chassis ground (negative).	Between U2-6 and chassis ground		+5.8 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2l	Connect digital multimeter 1 test leads to TP34 (positive) and TP36 (negative) on test fixture. Increase power supply 3 output voltage between voltage in step 2k and +66.00 V dc.	UUT DS2 (OVV-60)		DS2 is lit (red).
2l(1)	Connect digital multimeter 1 test leads to U4-6 (positive) and chassis ground (negative).	Between U4-6 and chassis ground		+0.3 V dc ± .05 V dc.
2l(2)	Connect digital multimeter 1 test leads to U4-5 (positive) and chassis ground (negative).	Between U4-5 and chassis ground		+5.0 V dc ± 1 V dc.
2l(3)	Connect digital multimeter 1 test leads to U2-7 (positive) and chassis ground (negative).	Between U2-7 and chassis ground		+5.9 V dc ± 1 V dc.
2l(4)	Connect digital multimeter 1 test leads to U2-6 (positive) and chassis ground (negative).	Between U2-6 and chassis ground		+5.8 V dc ± 1 V dc.
2m	Connect digital multimeter 1 test leads to TP34 (positive) and TP36 (negative) on test fixture. Adjust power supply 3 output voltage for + 60.0 ± 0.1 V dc.			

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2n	On test fixture, place switches S6, S7, S8, S9, and S10 in the ON position.			
	NOTE Disregard status of UUT indicators when performing steps 2o through 2s.			
2o	Connect digital multimeter 1 test leads to J1 (CKT1) (positive) and J6 (REF) (negative) on UUT. If possible, adjust zero adjust control on digital multimeter for zero reading before taking measurement.	Between J1 and J6 on UUT	Adjust R36 (CKT1) on UUT for performance standard.	0.000 ± 0.002 V dc.
2p	Connect digital multimeter 1 test leads to J2 (CKT2) (positive) and J6 (REF) (negative) on UUT.	Between J2 and J6 on UUT	Adjust R59 (CKT2) on UUT for performance standard.	0.000 ± 0.002 V dc.
2q	Connect digital multimeter 1 test leads to J3 (CKT3) (positive) and J6 (REF) (negative) on UUT.	Between J3 and J6 on UUT	Adjust R82 (CKT3) on UUT for performance standard.	0.000 ± 0.002 V dc.
2r	Connect digital multimeter 1 test leads to J4 (CKT4) (positive) and J6 (REF) (negative) on UUT.	Between J4 and J6 on UUT	Adjust R105 (CKT4) on UUT for performance standard.	0.000 ± 0.002 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
2s	Connect digital multimeter 1 test leads to J5 (CKT5) (positive) and J6 (REF) (negative) on UUT.	Between J5 and J6 on UUT	Adjust R128 (CKT5) on UUT for performance standard.	0.000 ± 0.002 V dc.
3	Circuit 1 tests.			
3a	On test fixture, set switch S6 in the OFF position.	DS4 (CKT1) and DS5 (CKT1) on UUT		DS4 and DS5 are extinguished.
3a(1)	Connect digital multimeter 1 test leads to U5-11 (positive) and chassis ground (negative).	Between U5-11 and chassis ground		+3.5 V dc ± .5 V dc.
3a(2)	Connect digital multimeter 1 test leads to U5-13 (positive) and chassis ground (negative).	Between U5-13 and chassis ground		+5.0 V dc ± 1 V dc.
3a(3)	Connect digital multimeter 1 test leads to U3-2 (positive) and chassis ground (negative).	Between U3-2 and chassis ground		0.0 V dc.
3b	Place test fixture switches S1 and S6 in the ON position.	UUT DS5 (CKT1)		DS5 is lit (green).
3b(1)	Connect digital multimeter 1 test leads to U5-11 (positive) and chassis ground (negative).	Between U5-11 and chassis ground		+0.3 V dc ± .05 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3b(2)	Connect digital multimeter 1 test leads to U5-13 (positive) and chassis ground (negative).	Between U5-13 and chassis ground		+5.0 V dc ± 1 V dc.
3b(3)	Connect digital multimeter 1 test leads to U3-2 (positive) and chassis ground (negative).	Between U3-2 and chassis ground		+5.0 V dc ± 1 V dc.
3c	Connect digital multimeter test leads to TP11 (positive) and TP1 (negative) on test fixture.	Between P1-11 and P1-1 on UUT		TP11 = < +0.7 V dc.
3c(1)	Connect digital multimeter 1 test leads to U5-4 (positive) and chassis ground (negative).	Between U5-4 and chassis ground		+5.0 V dc ± 1 V dc.
3c(2)	Connect digital multimeter 1 test leads to U5-5 (positive) and chassis ground (negative).	Between U5-5 and chassis ground		+5.0 V dc ± 1 V dc.
3d	Connect digital multimeter test leads to TP3 (positive) and TP1 (negative) on test fixture.	Between P1-3 and P1-1 on UUT		TP3 = < +0.3 V dc.
3d(1)	Connect digital multimeter 1 test leads to U6-6 (positive) and chassis ground (negative).	Between U6-6 and chassis ground		+2.5 V dc ± .5 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
3d(2)	Connect digital multimeter 1 test leads to U6-5 (positive) and chassis ground (negative).	Between U6-5 and chassis ground		+2.1 V dc ± .5 V dc.
4	Circuit 2 Tests.			
4a	On test fixture, place switch S7 in OFF position.	DS6 (CKT2) and DS7 (CKT2) on UUT		DS6 and DS7 are extinguished.
4a(1)	Connect digital multimeter 1 test leads to U8-11 (positive) and chassis ground (negative).	Between U8-11 and chassis ground		+3.5 V dc ± .5 V dc.
4a(2)	Connect digital multimeter 1 test leads to U8-13 (positive) and chassis ground (negative).	Between U8-13 and chassis ground		0.0 V dc.
4a(3)	Connect digital multimeter 1 test leads to U3-1 (positive) and chassis ground (negative).	Between U3-1 and chassis ground		0.0 V dc.
4b	Place test fixture switches S2 and S7 in the ON position.	UUT DS7 (CKT2)		DS7 is lit (green).
4b(1)	Connect digital multimeter 1 test leads to U8-11 (positive) and chassis ground (negative).	Between U8-11 and chassis ground		+0.3 V dc ± .05 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
4b(2)	Connect digital multimeter 1 test leads to U8-13 (positive) and chassis ground (negative).	Between U8-13 and chassis ground		+5.0 V dc ± 1 V dc.
4b(3)	Connect digital multimeter 1 test leads to U3-1 (positive) and chassis ground (negative).	Between U3-1 and chassis ground		+5.0 V dc ± 1 V dc.
4c	Connect digital multimeter 1 test leads to TP10 (positive) and TP1 (negative) on test fixture.	Between P1-10 and P1-1 on UUT		TP10 = < +0.7 V dc.
4c(1)	Connect digital multimeter 1 test leads to U8-4 (positive) and chassis ground (negative).	Between U8-4 and chassis ground		+5.0 V dc ± 1 V dc.
4c(2)	Connect digital multimeter 1 test leads to U8-5 (positive) and chassis ground (negative).	Between U8-5 and chassis ground		+5.0 V dc ± 1 V dc.
4d	Connect digital multimeter 1 test leads to TP6 (positive) and TP1 (negative) on test fixture.	Between P1-6 and P1-1 on UUT		TP6 = < +0.3 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
4d(1)	Connect digital multimeter 1 test leads to U6-13 (positive) and chassis ground (negative).	Between U6-13 and chassis ground		+2.5 V dc ± .5 V dc.
4d(2)	Connect digital multimeter 1 test leads to U6-12 (positive) and chassis ground (negative).	Between U6-12 and chassis ground		+2.1 V dc ± .4 V dc.
5	Circuit 3 Test.			
5a	Place I Bus switch on test fixture in position 3. On test fixture, place switch S8 in OFF position.	DS8 (CKT3) and DS9 (CKT3) on UUT		DS8 and DS9 are extinguished.
5a(1)	Connect digital multimeter 1 test leads to U9-11 (positive) and chassis ground (negative).	Between U9-11 and chassis ground		+3.5 V dc ± .5 V dc.
5a(2)	Connect digital multimeter 1 test leads to U9-13 (positive) and chassis ground (negative).	Between U9-13 and chassis ground		0.0 V dc.
5a(3)	Connect digital multimeter 1 test leads to U3-14 (positive) and chassis ground (negative).	Between U3-14 and chassis ground		0.0 V dc.
5b	Place test fixture switches S3 and S8 in the ON position.	UUT DS9 (CKT3)		DS9 is lit (green).

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
5b(1)	Connect digital multimeter 1 test leads to U9-11 (positive) and chassis ground (negative).	Between U9-11 and chassis ground		+0.3 V dc ± .05 V dc.
5b(2)	Connect digital multimeter 1 test leads to U9-13 (positive) and chassis ground (negative).	Between U9-13 and chassis ground		+5.0 V dc ± 1 V dc.
5b(3)	Connect digital multimeter 1 test leads to U3-14 (positive) and chassis ground (negative).	Between U3-14 and chassis ground		+5.0 V dc ± 1 V dc.
5c	Connect digital multimeter 1 test leads to TP13 (positive) and TP1 (negative) on test fixture.	Between P1-13 and P1-1 on UUT		TP13 = < +0.7 V dc.
5c(1)	Connect digital multimeter 1 test leads to U9-4 (positive) and chassis ground (negative).	Between U9-4 and chassis ground		+5.0 V dc ± 1 V dc.
5c(2)	Connect digital multimeter 1 test leads to U9-5 (positive) and chassis ground (negative).	Between U9-5 and chassis ground		+5.0 V dc ± 1 V dc.
5d	Connect digital multimeter 1 test leads to TP14 (positive) and TP1 (negative) on test fixture.	Between TP-14 and P1-1 on UUT		TP14 = < +0.3 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
5d(1)	Connect digital multimeter 1 test leads to U10-6 (positive) and chassis ground (negative).	Between U10-6 and chassis ground		+2.5 V dc ± .5 V dc.
5d(2)	Connect digital multimeter 1 test leads to U10-5 (positive) and chassis ground (negative).	Between U10-5 and chassis ground		+2.1 V dc ± .4 V dc.
6	Circuit 4 Tests.			
6a	Place I Bus switch on test fixture in position 60. On test fixture, place switch S9 in the OFF position.	DS10 (CKT4) and DS11 (CKT4) on UUT		DS10 and DS11 are extinguished.
6a(1)	Connect digital multimeter 1 test leads to U12-11 (positive) and chassis ground (negative).	Between U12-11 and chassis ground		+3.6 V dc ± .6 V dc.
6a(2)	Connect digital multimeter 1 test leads to U12-13 (positive) and chassis ground (negative).	Between U12-13 and chassis ground		0.0 V dc.
6a(3)	Connect digital multimeter 1 test leads to U3-13 (positive) and chassis ground (negative).	Between U3-13 and chassis ground		0.0 V dc.
6b	Place test fixture switches S4 and S9 in the ON position.	UUT DS11 (CKT4)		DS11 is lit (green).

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6b(1)	Connect digital multimeter 1 test leads to U12-11 (positive) and chassis ground (negative).	Between U12-11 and chassis ground		+0.3 V dc ± .05 V dc.
6b(2)	Connect digital multimeter 1 test leads to U12-13 (positive) and chassis ground (negative).	Between U12-13 and chassis ground		+5.0 V dc ± 1 V dc.
6b(3)	Connect digital multimeter 1 test leads to U3-13 (positive) and chassis ground (negative).	Between U3-13 and chassis ground		+5.0 V dc ± 1 V dc.
6c	Connect digital multimeter 1 test leads to TP12 (positive) and TP1 (negative) on test fixture.	Between P1-12 and P1-1 on UUT		TP12 = < +0.7 V dc.
6c(1)	Connect digital multimeter 1 test leads to U12-4 (positive) and chassis ground (negative).	Between U12-4 and chassis ground		+5.0 V dc ± 1 V dc.
6c(2)	Connect digital multimeter 1 test leads to U12-5 (positive) and chassis ground (negative).	Between U12-5 and chassis ground		+5.0 V dc ± 1 V dc.
6d	Connect digital multimeter 1 test leads to TP18 (positive) and TP1 (negative) on test fixture.	Between P1-18 and P1-1 on UUT		TP18 = < +0.3 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6d(1)	Connect digital multimeter 1 test leads to U10-13 (positive) and chassis ground (negative).	Between U10-13 and chassis ground		+2.5 V dc ± .5 V dc.
6d(2)	Connect digital multimeter 1 test leads to U10-12 (positive) and chassis ground (negative).	Between U10-12 and chassis ground		+2.1 V dc ± .4 V dc.
7	Circuit 5 Tests.			
7a	Place I Bus switch on test fixture in position 15. On test fixture, place switch S10 in the OFF position.	DS12 (CKT5) and DS13 (CKT5) on UUT		DS12 and DS13 are extinguished.
7a(1)	Connect digital multimeter 1 test leads to U13-11 (positive) and chassis ground (negative).	Between U13-11 and chassis ground		+3.5 V dc ± .8 V dc.
7a(2)	Connect digital multimeter 1 test leads to U13-13 (positive) and chassis ground (negative).	Between U13-13 and chassis ground		0.0 V dc.
7a(3)	Connect digital multimeter 1 test leads to U15-14 (positive) and chassis ground (negative).	Between U15-14 and chassis ground		0.0 V dc.
7b	Place test fixture switches S5 and S10 in the ON position.	UUT DS13 (CKT5)		DS13 is lit (green).

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
7b(1)	Connect digital multimeter 1 test leads to U13-11 (positive) and chassis ground (negative).	Between U13-11 and chassis ground		+0.3 V dc ± .05 V dc.
7b(2)	Connect digital multimeter 1 test leads to U13-13 (positive) and chassis ground (negative).	Between U13-13 and chassis ground		+5.0 V dc ± 1 V dc.
7b(3)	Connect digital multimeter 1 test leads to U15-14 (positive) and chassis ground (negative).	Between U15-14 and chassis ground		+5.0 V dc ± 1 V dc.
7c	Connect digital multimeter 1 test leads to TP23 and TP1 on test fixture.	Between P1-23 and P1-1 on UUT		TP23 = < +0.7 V dc.
7c(1)	Connect digital multimeter 1 test leads to U13-4 (positive) and chassis ground (negative).	Between U13-4 and chassis ground		+5.0 V dc ± 1 V dc.
7c(2)	Connect digital multimeter 1 test leads to U13-5 (positive) and chassis ground (negative).	Between U13-5 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
7d	Connect digital multimeter 1 test leads to TP24 (positive) and TP1 (negative) on test fixture.	Between P1-24 and P1-1 on UUT		TP24 = < +0.3 V dc.
7d(1)	Connect digital multimeter 1 test leads to U14-6 (positive) and chassis ground (negative).	Between U14-6 and chassis ground		+2.5 V dc ± .5 V dc.
7d(2)	Connect digital multimeter 1 test leads to U14-5 (positive) and chassis ground (negative).	Between U14-5 and chassis ground		+2.1 V dc ± .4 V dc.
7e	Verify switch S11 in position 1 and switches S1 through S10 in ON position on test fixture. Place I BUS switch in +5/24V position on test fixture. Connect digital multimeter 1 test leads to TP1 and TP48 on test fixture. Turn on power supply 5 and adjust output voltage for +2.500 ± 0.003 V dc on digital multimeter 1.			

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards

NOTE

If an incorrect measurement is obtained during any of the following substeps (multiple of required voltage), readjust power supply output voltage to level setting obtained prior to last adjustment. Then slowly adjust power supply output voltage for required setting. This should correct the problem of a chip hanging up in the wrong logic state due to the logic probe accidentally touching two pins at once.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8	Circuit 1 and 2 tests.			
8a	Connect digital multimeter 1 test leads to TP3 (positive) and TP1 (negative) on test fixture.	Between P1-3 and P1-1 on UUT		<+0.2 V dc at TP3.
8a(1)	Connect digital multimeter 1 test leads to U6-7 (positive) and chassis ground (negative).	Between U6-7 and chassis ground		<+0.3 V dc.
8a(2)	Connect digital multimeter 1 test leads to U6-6 (positive) and chassis ground (negative).	Between U6-6 and chassis ground		+2.6 V dc ± .5 V dc.
8a(3)	Connect digital multimeter 1 test leads to U6-5 (positive) and chassis ground (negative).	Between U6-5 and chassis ground		+2.5 V dc ± .5 V dc.
8b	Connect digital multimeter 1 test leads to TP6 (positive) and TP1 (negative) on test fixture.	Between P1-6 and P1-1 on UUT.		<+0.2 V dc at TP6.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8b(1)	Connect digital multimeter 1 test leads to U6-14 (positive) and chassis ground (negative).	Between U6-14 and chassis ground		<+0.3 V dc.
8b(2)	Connect digital multimeter 1 test leads to U6-13 (positive) and chassis ground (negative).	Between U6-13 and chassis ground		+2.6 V dc ± .5 V dc.
8b(3)	Connect digital multimeter 1 test leads to U6-12 (positive) and chassis ground (negative).	Between U6-12 and chassis ground		+2.5 V dc ± .5 V dc.
8c	Connect digital multimeter test leads to J1 (CKT1) (positive) and J7 (GND) (negative) on UUT.	Between J1 and J7 on UUT		+2.500 ± 0.100 V dc.
8c(1)	Connect digital multimeter 1 test leads to U6-2 (positive) and chassis ground (negative).	Between U6-2 and chassis ground		0.0 V dc.
8c(2)	Connect digital multimeter 1 test leads to U6-3 (positive) and chassis ground (negative).	Between U6-3 and chassis ground		0.0 V dc.
8d	Connect digital multimeter test leads to J2 (CKT2) (positive) and J7 (GND) (negative) on UUT.	Between J2 and J7 on UUT		+2.500 ± 0.100 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8d(1)	Connect digital multimeter 1 test leads to U6-9 (positive) and chassis ground (negative).	Between U6-9 and chassis ground		0.0 V dc.
8d(2)	Connect digital multimeter 1 test leads to U6-10 (positive) and chassis ground (negative).	Between U6-10 and chassis ground		0.0 V dc.
8e	Connect digital multimeter 1 test leads to TP3 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +5.000 ± 0.003 V dc on digital multimeter 2.	Between P1-3 and P1-1 on UUT		+1.250 + 0.150/ -0.050 V dc at TP3.
8e(1)	Connect digital multimeter 1 test leads to U6-7 (positive) and chassis ground (negative).	Between U6-7 and chassis ground		+2.5 V dc ± .5 V dc.
8e(2)	Connect digital multimeter 1 test leads to U6-6 (positive) and chassis ground (negative).	Between U6-6 and chassis ground		+3.8 V dc ± .6 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8e(3)	Connect digital multimeter 1 test leads to U6-5 (positive) and chassis ground (negative).	Between U6-5 and chassis ground		+3.7 V dc ± .7 V dc.
8f	Connect second digital multimeter 1 test leads to TP6 (positive) and TP1 (negative) on test fixture.	Between P1-6 and P1-1 on UUT		+1.250 + 0.150/ -0.050 V dc at TP6.
8f(1)	Connect digital multimeter 1 test leads to U6-14 (positive) and chassis ground (negative).	Between U6-14 and chassis ground		+2.5 V dc ± .5 V dc.
8f(2)	Connect digital multimeter 1 test leads to U6-13 (positive) and chassis ground (negative).	Between U6-13 and chassis ground		+3.8 V dc ± .7 V dc.
8f(3)	Connect digital multimeter 1 test leads to U6-12 (positive) and chassis ground (negative).	Between U6-12 and chassis ground		+3.7 V dc ± .7 V dc.
8g	Connect digital multimeter 1 test leads to J1 (CKT1) (positive) and J7 (GND) (negative) on UUT.	Between J1 and J7 on UUT		+3.750 ± 0.150 V dc.
8g(1)	Connect digital multimeter 1 test leads to U6-2 (positive) and chassis ground (negative).	Between U6-2 and chassis ground		0.0 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8g(2)	Connect digital multimeter 1 test leads to U6-3 (positive) and chassis ground (negative).	Between U6-3 and chassis ground		0.0 V dc.
8h	Connect digital multimeter 1 test leads to J2 (CKT1) (positive) and J7 (GND) (negative) on UUT.	Between J2 and J7 on UUT		+3.750 ± 0.150 V dc.
8h(1)	Connect digital multimeter 1 test leads to U6-9 (positive) and chassis ground (negative).	Between U6-9 and chassis ground		0.0 V dc.
8h(2)	Connect digital multimeter 1 test leads to U6-10 (positive) and chassis ground (negative).	Between U6-10 and chassis ground		0.0 V dc.
8i	Connect digital multimeter 1 test leads to TP3 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +7.500 ± 0.003 V dc on digital multimeter 2.	Between P1-3 and P1-1 on UUT		+2.500 + 0.200/ -0.100 V dc at TP 3.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8i(1)	Connect digital multimeter 1 test leads to U6-7 (positive) and chassis ground (negative).	Between U6-7 and chassis ground		+5.1 V dc ± 1 V dc.
8i(2)	Connect digital multimeter 1 test leads to U6-6 (positive) and chassis ground (negative).	Between U6-6 and chassis ground		+5.1 V dc ± 1 V dc.
8i(3)	Connect digital multimeter 1 test leads to U6-5 (positive) and chassis ground (negative).	Between U6-5 and chassis ground		+4.9 V dc ± 1 V dc.
8j	Connect digital multimeter 1 test leads to TP6 (positive) and TP1 (negative) on test fixture.	Between P1-6 and P1-1 on UUT		+2.500 + 0.200/ -0.100 V dc at TP6.
8j(1)	Connect digital multimeter 1 test leads to U6-14 (positive) and chassis ground (negative).	Between U6-14 and chassis ground		+5.0 V dc ± 1 V dc.
8j(2)	Connect digital multimeter 1 test leads to U6-13 (positive) and chassis ground (negative).	Between U6-13 and chassis ground		+5.1 V dc ± 1 V dc.
8j(3)	Connect digital multimeter 1 test leads to U6-12 (positive) and chassis ground (negative).	Between U6-12 and chassis ground		+4.9 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8k	Connect digital multimeter 1 test leads to J1 (CKT1) (positive) and J7 (GND) (negative) on UUT.	Between J1 and J7 on UUT		+5.000 ± 0.200 V dc.
8k(1)	Connect digital multimeter 1 test leads to U6-2 (positive) and chassis ground (negative).	Between U6-2 and chassis ground		0.0 V dc.
8k(2)	Connect digital multimeter 1 test leads to U6-3 (positive) and chassis ground (negative).	Between U6-3 and chassis ground		0.0 V dc.
8l	Connect digital multimeter 1 test leads to J2 (CKT2) (positive) and J7 (GND) (negative) on UUT.	Between J2 and J7 on UUT		+5.000 ± 0.200 V dc.
8l(1)	Connect digital multimeter 1 test leads to U6-9 (positive) and chassis ground (negative).	Between U6-9 and chassis ground		0.0 V dc.
8l(2)	Connect digital multimeter 1 test leads to U6-10 (positive) and chassis ground (negative).	Between U6-10 and chassis ground		0.0 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8m	Connect digital multimeter 1 test leads to TP3 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +10.000 ± 0.003 V dc on digital multimeter 2.	Between P1-3 and P1-1 on UUT		+3.750 + 0.250/ -0.150 V dc at TP3.
8m(1)	Connect digital multimeter 1 test leads to U6-7 (positive) and chassis ground (negative).	Between U6-7 and chassis ground		+7.5 V dc ± 1.2 V dc.
8m(2)	Connect digital multimeter 1 test leads to U6-6 (positive) and chassis ground (negative).	Between U6-6 and chassis ground		+6.3 V dc ± 1.1 V dc.
8m(3)	Connect digital multimeter 1 test leads to U6-5 (positive) and chassis ground (negative).	Between U6-5 and chassis ground		+6.1 V dc ± 1.1 V dc.
8n	Connect digital multimeter 1 test leads to TP6 (positive) and TP1 (negative) on test fixture.	Between P1-6 and P1-1 on UUT		+3.750 + 0.250/ -0.150 V dc at TP6.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8n(1)	Connect digital multimeter 1 test leads to U6-14 (positive) and chassis ground (negative).	Between U6-14 and chassis ground		+7.5 V dc ± 1.2 V dc.
8n(2)	Connect digital multimeter 1 test leads to U6-13 (positive) and chassis ground (negative).	Between U6-13 and chassis ground		+6.4 V dc ± 1.1 V dc.
8n(3)	Connect digital multimeter 1 test leads to U6-12 (positive) and chassis ground (negative).	Between U6-12 and chassis ground		+6.1 V dc ± 1.1 V dc.
8o	Connect digital multimeter 1 test leads to J1 (CKT1) (positive) and J7 (GND) (negative) on UUT.	Between J1 and J7 on UUT		+6.250 ± 0.250 V dc.
8o(1)	Connect digital multimeter 1 test leads to U6-2 (positive) and chassis ground (negative).	Between U6-2 and chassis ground		+0.1 V dc ± .015 V dc.
8o(2)	Connect digital multimeter 1 test leads to U6-3 (positive) and chassis ground (negative).	Between U6-3 and chassis ground		+0.1 V dc ± .015 V dc.
8p	Connect digital multimeter 1 test leads to J2 (CKT2) (positive) and J7 (GND) (negative) on UUT.	Between J2 and J7 on UUT		+6.250 ± 0.250 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8p(1)	Connect digital multimeter 1 test leads to U6-9 (positive) and chassis ground (negative).	Between U6-9 and chassis ground		+0.1 V dc ± .015 V dc.
8p(2)	Connect digital multimeter 1 test leads to U6-10 (positive) and chassis ground (negative).	Between U6-10 and chassis ground		+0.1 V dc ± .015 V dc.
8q	Connect digital multimeter 1 test leads to TP3 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +12.500 ± 0.003 V dc on digital multimeter 2.	Between P1-3 and P1-1 on UUT		+5.000 + 0.300/ -0.200 V dc at TP3.
8q(1)	Connect digital multimeter 1 test leads to U6-7 (positive) and chassis ground (negative).	Between U6-7 and chassis ground		+10.1 V dc ± 1.5 V dc.
8q(2)	Connect digital multimeter 1 test leads to U6-6 (positive) and chassis ground (negative).	Between U6-6 and chassis ground		+7.5 V dc ± 1.2 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8q(3)	Connect digital multimeter 1 test leads to U6-5 (positive) and chassis ground (negative).	Between U6-5 and chassis ground		+7.4 V dc ± 1.2 V dc.
8r	Connect digital multimeter 1 test leads to TP6 (positive) and TP1 (negative) on test fixture.	Between P1-6 and P1-6 on UUT		+5.000 + 0.300/ -0.200 V dc at TP6.
8r(1)	Connect digital multimeter 1 test leads to U6-14 (positive) and chassis ground (negative).	Between U6-14 and chassis ground		+10.1 V dc ± 1.5 V dc.
8r(2)	Connect digital multimeter 1 test leads to U6-13 (positive) and chassis ground (negative).	Between U6-13 and chassis ground		+7.5 V dc ± 1.2 V dc.
8r(3)	Connect digital multimeter 1 test leads to U6-12 (positive) and chassis ground (negative).	Between U6-12 and chassis ground		+7.3 V dc ± 1.2 V dc.
8s	Connect digital multimeter 1 test leads to J1 (CKT1) (positive) and J7 (GND) (negative) on UUT.	Between J1 and J7 on UUT		+7.500 ± 0.300 V dc

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8s(1)	Connect digital multimeter 1 test leads to U6-2 (positive) and chassis ground (negative).	Between U6-2 and chassis ground		+0.1 V dc ± .015 V dc.
8s(2)	Connect digital multimeter 1 test leads to U6-3 (positive) and chassis ground (negative).	Between U6-3 and chassis ground		+0.1 V dc ± .015 V dc.
8t	Connect digital multimeter 1 test leads to J2 (CKT2) (positive) and J7 (GND) (negative) on UUT.	Between J2 and J7 on UUT		+7.500 ± 0.300 V dc.
8t(1)	Connect digital multimeter 1 test leads to U6-9 (positive) and chassis ground (negative).	Between U6-9 and chassis ground		+0.1 V dc ± .015 V dc.
8t(2)	Connect digital multimeter 1 test leads to U6-10 (positive) and chassis ground (negative).	Between U6-10 and chassis ground		+0.1 V dc ± .015 V dc.
8u	Connect digital multimeter 1 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for +27.0 ± 0.1 V dc. Reduce power supply 5 to its lowest output.			

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8v	Connect digital multimeter 1 test leads to J1 (CKT1) (positive) and J7 (GND) (negative) on UUT. Connect digital multimeter 2 test leads to TP11 (positive) and TP1 (negative) on test fixture. Raise power supply 5 output voltage until performance standard is obtained.	Between J1 and J7 on UUT		The following transitions and indications occur between +2.75 and +3.00 V dc at J1.
		Between P1-11 and P1-1 on UUT		TP11 = > +2.8 V dc.
		DS4 (CKT1) and DS5 (CKT1) on UUT.		DS4 is lit (red).
				DS5 is extinguished.
8v(1)	Connect digital multimeter 1 test leads to U5-3 (positive) and chassis ground (negative).	Between U5-3 and chassis ground		+0.2 V dc ± .03 V dc.
8v(2)	Connect digital multimeter 1 test leads to U5-2 (positive) and chassis ground (negative).	Between U5-2 and chassis ground		+5.0 V dc ± 1 V dc.
8v(3)	Connect digital multimeter 1 test leads to U3-2 (positive) and chassis ground (negative).	Between U3-2 and chassis ground		+5.0 V dc ± 1 V dc.
8v(4)	Connect digital multimeter 1 test leads to U5-11 (positive) and chassis ground (negative).	Between U5-11 and chassis ground		+3.5 V dc ± .6 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8w	Connect digital multimeter 1 test leads to TP11 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for +24.0 ± 0.1 V dc on digital multimeter 2.	Between P1-11 and P1-1 on UUT DS4 (CKT1) and DS5 (CKT1) on UUT		TP11 = < +0.7 V dc. DS5 is lit (green). DS4 is extinguished.
8w(1)	Connect digital multimeter 1 test leads to U5-3 (positive) and chassis ground (negative).	Between U5-3 and chassis ground		+5.0 V dc ± 1 V dc.
8w(2)	Connect digital multimeter 1 test leads to U5-2 (positive) and chassis ground (negative).	Between U5-2 and chassis ground		+0.1 V dc ± .015 V dc.
8w(3)	Connect digital multimeter 1 test leads to U3-2 (positive) and chassis ground (negative).	Between U3-2 and chassis ground		+5.0 V dc ± 1 V dc.
8w(4)	Connect digital multimeter 1 test leads to U5-11 (positive) and chassis ground (negative).	Between U5-11 and chassis ground		+0.3 V dc ± .04 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8x	Connect digital multimeter 1 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for +27.0 ± 0.1 V dc.	Between J2 and J7 on UUT		The following transitions and indications occur between +2.75 and +3.00 V dc at J2.
	Reconnect digital multimeter 1 test leads to J2 (CKT2) (positive) and J7 (GND) (negative) on UUT. Connect digital multimeter 2 test leads to TP10 and TP1 (negative) on test fixture. Adjust power supply 5 output voltage for performance standard.	Between P1-10 and P1-1 on UUT		TP10 = > +2.8 V dc.
		DS6 (CKT2) and DS7 (CKT2) on UUT		DS6 is lit (red). DS7 is extinguished.
8x(1)	Connect digital multimeter 1 test leads to U8-3 (positive) and chassis ground (negative).	Between U8-3 and chassis ground		+0.2 V dc ± .03 V dc.
8x(2)	Connect digital multimeter 1 test leads to U8-2 (positive) and chassis ground (negative).	Between U8-2 and chassis ground		+5.0 V dc ± 1 V dc.
8x(3)	Connect digital multimeter 1 test leads to U3-1 (positive) and chassis ground (negative).	Between U3-1 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8x(4)	Connect digital multimeter 1 test leads to U8-11 (positive) and chassis ground (negative).	Between U8-11 and chassis ground		+3.5 V dc ± .6 V dc.
8y	Connect digital multimeter 1 test leads to TP10 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for +24.0 ± 0.1 V dc on digital multimeter 2.	Between P1-10 and P1-1 on UUT		TP10 = < +0.7 V dc.
		DS6 (CKT2) and DS7 (CKT2) on UUT		DS7 is lit (green). DS6 is extinguished.
8y(1)	Connect digital multimeter 1 test leads to U8-3 (positive) and chassis ground (negative).	Between U8-3 and chassis ground		+5.0 V dc ± 1 V dc.
8y(2)	Connect digital multimeter 1 test leads to U8-2 (positive) and chassis ground (negative).	Between U8-2 and chassis ground		+0.1 V dc ± .015 V dc.
8y(3)	Connect digital multimeter 1 test leads to U3-1 (positive) and chassis ground (negative).	Between U3-1 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8y(4)	Connect digital multimeter 1 test leads to U8-11 (positive) and chassis ground (negative).	Between U8-11 and chassis ground		+0.3 V dc ± .04 V dc.
8z	Connect digital multimeter 1 test leads to TP3 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage until performance standard is obtained. (Do not allow power supply 5 output voltage to exceed +14 V dc.)	Between P1-3 and P1-1 on UUT		The following transitions and indications occur between +4.65 and +5.20 V dc at TP3.
		DS4 (CKT1) and DS5 (CKT1) on UUT		DS4 is lit (red). DS5 is extinguished.
8z(1)	Connect digital multimeter 1 test leads to U7-6 (positive) and chassis ground (negative).	Between U7-6 and chassis ground		+9.8 V dc ± 1.5 V dc.
8z(2)	Connect digital multimeter 1 test leads to U7-1 (positive) and chassis ground (negative).	Between U7-1 and chassis ground		0.0 V dc.
8z(3)	Connect digital multimeter 1 test leads to U5-12 (positive) and chassis ground (negative).	Between U5-12 and chassis ground		+5.0 V dc ± 1 V dc.
8z(4)	Connect digital multimeter 1 test leads to U5-11 (positive) and chassis ground (negative).	Between U5-11 and chassis ground		+3.5 V dc ± .8 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
8aa	Connect digital multimeter 1 test leads to TP6 (positive) and TP1 (negative) on test fixture. Adjust power supply 5 output voltage until performance standard is obtained. (Do not allow power supply 5 output voltage to exceed +14 V dc.)	Between P1-6 and P1-1 on UUT		The following transitions and indications occur between +4.65 and +5.20 V dc at TP6.
		DS6 (CKT2) and DS7 (CKT2) on UUT		DS6 is lit (red). DS7 is extinguished.
8aa(1)	Connect digital multimeter 1 test leads to U7-10 (positive) and chassis ground (negative).	Between U7-10 and chassis ground		+9.7 V dc ± 1.5 V dc.
8aa(2)	Connect digital multimeter 1 test leads to U7-13 (positive) and chassis ground (negative).	Between U7-13 and chassis ground		0.0 V dc.
8aa(3)	Connect digital multimeter 1 test leads to U8-12 (positive) and chassis ground (negative).	Between U8-12 and chassis ground		+5.0 V dc ± 1 V dc.
8aa(4)	Connect digital multimeter 1 test leads to U8-11 (positive) and chassis ground (negative).	Between U8-11 and chassis ground		+3.5 V dc ± .8 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9	Circuit 3 Tests.			
9a	Connect digital multimeter 1 test leads to TP14 (positive) and TP1 (negative) on test fixture. On test fixture, set I BUS selector switch to position 3. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Adjust power supply 5 output voltage for +2.500 ± 0.003 V dc on digital multimeter 2.	Between P1-14 and P1-1 on UUT		<+0.2 V dc at TP14.
9a(1)	Connect digital multimeter 1 test leads to U10-7 (positive) and chassis ground (negative).	Between U10-7 and chassis ground		<+0.3 V dc.
9a(2)	Connect digital multimeter 1 test leads to U10-6 (positive) and chassis ground (negative).	Between U10-6 and chassis ground		+2.6 V dc ± .5 V dc.
9a(3)	Connect digital multimeter 1 test leads to U10-5 (positive) and chassis ground (negative).	Between U10-5 and chassis ground		+2.5 V dc ± .5 V dc.
9b	Connect digital multimeter test leads to J3 (CKT3) (positive) and J7 (GND) (negative) on UUT.	Between J3 and J7 on UUT		+2.500 ± 0.100 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9b(1)	Connect digital multimeter 1 test leads to U10-2 (positive) and chassis ground (negative).	Between U10-2 and chassis ground		0.0 V dc.
9b(2)	Connect digital multimeter 1 test leads to U10-3 (positive) and chassis ground (negative).	Between U10-3 and chassis ground		0.0 V dc.
9c	Connect digital multimeter 1 test leads to TP14 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +5.000 ± 0.003 V dc on digital multimeter 2.	Between TP14 and TP1 on UUT		+1.250 + 0.150/ -0.050 V dc at TP 14.
9c(1)	Connect digital multimeter 1 test leads to U10-7 (positive) and chassis ground (negative).	Between U10-7 and chassis ground		+2.6 V dc ± .5 V dc.
9c(2)	Connect digital multimeter 1 test leads to U10-6 (positive) and chassis ground (negative).	Between U10-6 and chassis ground		+3.8 V dc ± .7 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9c(3)	Connect digital multimeter 1 test leads to U10-5 (positive) and chassis ground (negative).	Between U10-5 and chassis ground		+3.6 V dc ± .5 V dc.
9d	Connect digital multimeter 1 test leads to J3 (CKT3) (positive) and J7 (GND) (negative) on UUT.	Between J3 and J7 on UUT		+3.750 ± 0.150 V dc.
9d(1)	Connect digital multimeter 1 test leads to U10-2 (positive) and chassis ground (negative).	Between U10-2 and chassis ground		0.0 V dc.
9d(2)	Connect digital multimeter 1 test leads to U10-3 (positive) and chassis ground (negative).	Between U10-3 and chassis ground		0.0 V dc.
9e	Connect digital multimeter 1 test leads to TP14 (positive) and TP1 (negative) on test fixtures. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +7.500 ± 0.003 V dc on digital multimeter 2.	Between P1-14 and P1-1 on UUT		+2.500 + 0.200/ -0.100 V dc at TP14.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9e(1)	Connect digital multimeter 1 test leads to U10-7 (positive) and chassis ground (negative).	Between U10-7 and chassis ground		+5.1 V dc ± 1 V dc.
9e(2)	Connect digital multimeter 1 test leads to U10-6 (positive) and chassis ground (negative).	Between U10-6 and chassis ground		+5.1 V dc ± 1 V dc.
9e(3)	Connect digital multimeter 1 test leads to U10-5 (positive) and chassis ground (negative).	Between U10-5 and chassis ground		+4.8 V dc ± .8 V dc.
9f	Connect digital multimeter 1 test leads to J3 (CKT3) (positive) and J7 (GND) (negative) on UUT.	Between J3 and J7 on UUT		+5.000 ± 0.200 V dc.
9f(1)	Connect digital multimeter 1 test leads to U10-2 (positive) and chassis ground (negative).	Between U10-2 and chassis ground		0.0 V dc.
9f(2)	Connect digital multimeter 1 test leads to U10-3 (positive) and chassis ground (negative).	Between U10-3 and chassis ground		0.0 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9g	Connect digital multimeter 1 test leads to TP14 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +10.000 ± 0.003 V dc on digital multimeter 2.	Between P1-14 and P1-1 on UUT		+3.750 + 0.250/ -0.150 V dc at TP14.
9g(1)	Connect digital multimeter 1 test leads to U10-7 (positive) and chassis ground (negative).	Between U10-7 and chassis ground		+7.7 V dc ± .9 V dc.
9g(2)	Connect digital multimeter 1 test leads to U10-6 (positive) and chassis ground (negative).	Between U10-6 and chassis ground		+6.4 V dc ± .9 V dc.
9g(3)	Connect digital multimeter 1 test leads to U10-5 (positive) and chassis ground (negative).	Between U10-5 and chassis ground		+6.1 V dc ± .9 V dc.
9h	Connect digital multimeter 1 test leads to J3 (CKT3) (positive) and J7 (GND) (negative) on UUT.	Between J3 and J7 on UUT		+6.250 ± 0.250 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9h(1)	Connect digital multimeter 1 test leads to U10-2 (positive) and chassis ground (negative).	Between U10-2 and chassis ground		0.0 V dc.
9h(2)	Connect digital multimeter 1 test leads to U10-3 (positive) and chassis ground (negative).	Between U10-3 and chassis ground		0.0 V dc.
9i	Connect digital multimeter 1 test leads to TP14 (positive) and TP1 (negative) on test figure. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +12.500 ± 0.003 V dc on digital multimeter 2.	Between P1-14 and P1-1 on UUT		+5.000 + 0.300/ -0.200 V dc.
9i(1)	Connect digital multimeter 1 test leads to U10-7 (positive) and chassis ground (negative).	Between U10-7 and chassis ground		+10.1 V dc ± 1.5 V dc.
9i(2)	Connect digital multimeter 1 test leads to U10-6 (positive) and chassis ground (negative).	Between U10-6 and chassis ground		+7.5 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9i(3)	Connect digital multimeter 1 test leads to U10-5 (positive) and chassis ground (negative).	Between U10-5 and chassis ground		+7.3 V dc ± 2 V dc.
9j	Connect digital multimeter 1 test leads to J3 (CKT3) (positive) and J7 (GND) (negative) on UUT.	Between J3 and J7 on UUT		+7.500 ± 0.300 V dc.
9j(1)	Connect digital multimeter 1 test leads to U10-2 (positive) and chassis ground (negative).	Between U10-2 and chassis ground		+0.1 V dc ± .015 V dc.
9j(2)	Connect digital multimeter 1 test leads to U10-3 (positive) and chassis ground (negative).	Between U10-3 and chassis ground		+0.1 V dc ± .015 V dc.
9k	Connect digital multimeter 1 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for +27.0 ± 0.1 V dc. Reduce power supply 5 to its lowest output.			

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
91	Connect digital multimeter 1 test leads to UUT J3 (CKT3) (positive) and J7 (GND) (negative). Connect digital multimeter 2 test leads to TP13 (positive) and TP1 (negative) on test fixture. Raise power supply 5 output voltage until performance standard is obtained.	Between J3 and J7 on UUT		The following transitions and indications shall occur between +2.75 and +3.00 V dc at UUT J3.
		Between P1-13 and P1-1 on UUT		TP13 = > +2.8 V dc.
		DS8 (CKT3) and DS9 (CKT3) on UUT		DS8 is lit (red). DS9 is extinguished.
91(1)	Connect digital multimeter 1 test leads to U9-3 (positive) and chassis ground (negative).	Between U9-3 and chassis ground		+0.2 V dc ± .03 V dc.
91(2)	Connect digital multimeter 1 test leads to U9-2 (positive) and chassis ground (negative).	Between U9-2 and chassis ground		+5.0 V dc ± 1 V dc.
91(3)	Connect digital multimeter 1 test leads to U3-14 (positive) and chassis ground (negative).	Between U3-14 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9l(4)	Connect digital multimeter 1 test leads to U9-11 (positive) and chassis ground (negative).	Between U9-11 and chassis ground		+3.5 V dc ± .8 V dc.
9m	Connect digital multimeter 1 test leads to TP13 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP43 (positive) and TP1 (negative) on test fixture. Adjust power supply 6 output voltage for +24.0 ± 0.1 V dc on digital multimeter 2.	Between P1-13 and P1-1 on UUT DS8 (CKT3) and DS9 (CKT3) on UUT		TP13 = < +0.7 V dc. DS9 is lit (green). DS8 is extinguished.
9m(1)	Connect digital multimeter 1 test leads to U9-3 (positive) and chassis ground (negative).	Between U9-3 and chassis ground		+5.0 V dc ± 1 V dc.
9m(2)	Connect digital multimeter 1 test leads to U9-2 (positive) and chassis ground (negative).	Between U9-2 and chassis ground		0.0 V dc.
9m(3)	Connect digital multimeter 1 test leads to U3-14 (positive) and chassis ground (negative).	Between U3-14 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9m(4)	Connect digital multimeter 1 test leads to U9-11 (positive) and chassis ground (negative).	Between U9-11 and chassis ground		+0.3 V dc ± .045 V dc.
9n	Connect digital multimeter 1 test leads to TP14 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage for performance standard. (Do not exceed + 14 V dc.)	Between P1-14 and P1-1 on UUT.		The following transitions indicated shall occur between +4.65 and +5.20 V dc at TP14.
		DS8 (CKT3) and DS9 (CKT3) on UUT		DS 8 is lit (red). DS9 is extinguished.
9n(1)	Connect digital multimeter 1 test leads to U11-6 (positive) and chassis ground (negative).	Between U11-6 and chassis ground		+9.7 V dc ± 1.5 V dc.
9n(2)	Connect digital multimeter 1 test leads to U11-1 (positive) and chassis ground (negative).	Between U11-1 and chassis ground		0.0 V dc.
9n(3)	Connect digital multimeter 1 test leads to U9-12 (positive) and chassis ground (negative).	Between U9-12 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
9n(4)	Connect digital multimeter 1 test leads to U9-11 (positive) and chassis ground (negative).	Between U9-11 and chassis ground		+3.6 V dc.
10	Circuit 4 Tests.			
10a	Connect digital multimeter 1 test leads to TP18 (positive) and TP1 (negative) on test fixture. On test fixture, set I BUS selector switch to position 60 V. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Adjust power supply 5 output voltage for +2.500 ± 0.003 V dc on digital multimeter 2.	Between P1-18 and P1-1 on UUT		<+0.2 V dc.
10a(1)	Connect digital multimeter 1 test leads to U10-14 (positive) and chassis ground (negative).	Between U10-14 and chassis ground		<+0.3 V dc.
10a(2)	Connect digital multimeter 1 test leads to U10-13 (positive) and chassis ground (negative).	Between U10-13 and chassis ground		+2.6 V dc.
10a(3)	Connect digital multimeter 1 test leads to U10-12 (positive) and chassis ground (negative).	Between U10-12 and chassis ground		+2.5 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10b	Connect digital multimeter 1 test leads to J4 (CKT4) (positive) and J7 (GND) (negative) on UUT.	Between J4 and J7 on UUT		+2.500 ± 0.100 V dc.
10b(1)	Connect digital multimeter 1 test leads to U10-9 (positive) and chassis ground (negative).	Between U10-9 and chassis ground		0.0 V dc.
10b(2)	Connect digital multimeter 1 test leads to U10-10 (positive) and chassis ground (negative).	Between U10-10 and chassis ground		0.0 V dc.
10c	Connect digital multimeter 1 test leads to TP18 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +5.000 ± 0.003 V dc on digital multimeter 2.	Between P1-18 and P1-1 on UUT		+1.2 to 1.4 V dc.
10c(1)	Connect digital multimeter 1 test leads to U10-14 (positive) and chassis ground (negative).	Between U10-14 and chassis ground		+2.6 V dc ± .5 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10c(2)	Connect digital multimeter 1 test leads to U10-13 (positive) and chassis ground (negative).	Between U10-13 and chassis ground		+3.8 V dc ± .6 V dc.
10c(3)	Connect digital multimeter 1 test leads to U10-12 (positive) and chassis ground (negative).	Between U10-12 and chassis ground		+3.6 V dc ± .6 V dc.
10d	Connect digital multimeter 1 test leads to J4 (CKT4) (positive) and J7 (GND) (negative) on UUT.	Between J4 and J7 on UUT		+3.750 ± 0.150 V dc.
10d(1)	Connect digital multimeter 1 test leads to U10-9 (positive) and chassis ground (negative).	Between U10-9 and chassis ground		0.0 V dc.
10d(2)	Connect digital multimeter 1 test leads to U10-10 (positive) and chassis ground (negative).	Between U10-10 and chassis ground		0.0 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10e	Connect digital multimeter 1 test leads to TP18 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +7.500 ± 0.003 V dc on digital multimeter 2.	Between P1-18 and P1-1 on UUT		+2.500 + 0.200/ -0.100 V dc.
10e(1)	Connect digital multimeter 1 test leads to U10-14 (positive) and chassis ground (negative).	Between U10-14 and chassis ground		+5.1 V dc ± 1 V dc.
10e(2)	Connect digital multimeter 1 test leads to U10-13 (positive) and chassis ground (negative).	Between U10-13 and chassis ground		+5.1 V dc ± 1 V dc.
10e(3)	Connect digital multimeter 1 test leads to U10-12 (positive) and chassis ground (negative).	Between U10-12 and chassis ground		+4.8 V dc ± 1 V dc.
10f	Connect digital multimeter 1 test leads to J4 (CKT4) (positive) and J7 (GND) (negative) on UUT.	Between J4 and J7 on UUT		+5.000 ± 0.200 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10f(1)	Connect digital multimeter 1 test leads to U10-9 (positive) and chassis ground (negative).	Between U10-9 and chassis ground		0.0 V dc.
10f(2)	Connect digital multimeter 1 test leads to U10-10 (positive) and chassis ground (negative).	Between U10-10 and chassis ground		0.0 V dc.
10g	Connect digital multimeter 1 test leads to TP18 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +10.000 ± 0.003 V dc on digital multimeter 2.	Between P1-18 and P1-1 on UUT		+3.750 + 0.250/ - 0.150 V dc.
10g(1)	Connect digital multimeter 1 test leads to U10-14 (positive) and chassis ground (negative).	Between U10-14 and chassis ground		+7.7 V dc ± 1.2 V dc.
10g(2)	Connect digital multimeter 1 test leads to U10-13 (positive) and chassis ground (negative).	Between U10-13 and chassis ground		+6.4 V dc ± 1.1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10g(3)	Connect digital multimeter 1 test leads to U10-12 (positive) and chassis ground (negative).	Between U10-12 and chassis ground		+6.1 V dc ± 1 V dc.
10h	Connect digital multimeter 1 test leads to J4 (CKT4) (positive) and J7 (GND) (negative) on UUT.	Between J4 and J7 on UUT		+6.250 ± 0.250 V dc.
10h(1)	Connect digital multimeter 1 test leads to U10-9 (positive) and chassis ground (negative).	Between U10-9 and chassis ground		+0.1 V dc ± .015 V dc.
10h(2)	Connect digital multimeter 1 test leads to U10-10 (positive) and chassis ground (negative).	Between U10-10 and chassis ground		+0.1 V dc ± .015 V dc.
10i	Connect digital multimeter 1 test leads to TP18 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +12.500 ± 0.003 V dc on digital multimeter 2.	Between P1-18 and P1-1 on UUT		+5.000 + 0.300/ -0.200 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10i(1)	Connect digital multimeter 1 test leads to U10-14 (positive) and chassis ground (negative).	Between U10-14 and chassis ground		+10.1 V dc ± 1.5 V dc.
10i(2)	Connect digital multimeter 1 test leads to U10-13 (positive) and chassis ground (negative).	Between U10-13 and chassis ground		+7.5 V dc ± 1 V dc.
10i(3)	Connect digital multimeter 1 test leads to U10-12 (positive) and chassis ground (negative).	Between U10-12 and chassis ground		+7.3 V dc ± 1 V dc.
10j	Connect digital multimeter 1 test leads to J4 (CKT4) (positive) and J7 (GND) (negative) on UUT.	Between J4 and J7 on UUT		+7.500 ± 0.300 V dc.
10j(1)	Connect digital multimeter 1 test leads to U10-9 (positive) and chassis ground (negative).	Between U10-9 and chassis ground		+0.1 V dc ± .015 V dc.
10j(2)	Connect digital multimeter 1 test leads to U10-10 (positive) and chassis ground (negative).	Between U10-10 and chassis ground		+0.1 V dc ± .015 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10k	Connect digital multimeter 1 test leads to TP34 (positive) and TP36 (negative) on test fixture. Adjust power supply 3 output voltage for +67.0 ± 0.1 V dc. Reduce power supply 5 to its lowest output.			
10l	Connect digital multimeter 1 test leads to J4 (CKT4) (positive) and J7 (GND) (negative) on UUT. Connect digital multimeter 2 test leads to TP12 (positive) and TP1 (negative) on test fixture. Raise power supply 5 output voltage until performance standard is obtained.	Between J4 and J7 on UUT		The following transitions and indications occur between +2.75 and +3.00 V dc at J4.
		Between P1-12 and P1-1 on UUT		TP12 = > +2.8 V dc.
		DS10 (CKT4) and DS11 (CKT4) on UUT		DS10 is lit (red).
				DS11 is extinguished.
10l(1)	Connect digital multimeter 1 test leads to U12-3 (positive) and chassis ground (negative).	Between U12-3 and chassis ground		+0.2 V dc ± .03 V dc.
10l(2)	Connect digital multimeter 1 test leads to U12-2 (positive) and chassis ground (negative).	Between U12-2 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
101(3)	Connect digital multimeter 1 test leads to U3-13 (positive) and chassis ground (negative).	Between U3-13 and chassis ground		+5.0 V dc ± 1 V dc.
101(4)	Connect digital multimeter 1 test leads to U12-11 (positive) and chassis ground (negative).	Between U12-11 and chassis ground		+3.5 V dc ± .6 V dc.
10m	Connect digital multimeter 1 test leads to TP12 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP34 (positive) and TP36 (negative) on test fixture. Adjust power supply 3 output voltage for +60.0 ± 0.1 V dc on digital multimeter 2.	Between P1-12 and P1-1 on UUT DS10 (CKT4) and DS11 (CKT4) on UUT		TP12 = < +0.7 V dc. DS11 is lit (green). DS10 is extinguished.
10m(1)	Connect digital multimeter 1 test leads to U12-3 (positive) and chassis ground (negative).	Between U12-3 and chassis ground		+5.0 V dc ± 1 V dc.
10m(2)	Connect digital multimeter 1 test leads to U12-2 (positive) and chassis ground (negative).	Between U12-2 and chassis ground		+0.1 V dc ± .015 V dc.
10m(3)	Connect digital multimeter 1 test leads to U3-13 (positive) and chassis ground (negative).	Between U3-13 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10m(4)	Connect digital multimeter 1 test leads to U12-11 (positive) and chassis ground (negative).	Between U12-11 and chassis ground		+0.1 V dc ± .015 V dc.
10n	Connect digital multimeter 1 test leads to TP18 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage until performance standard is obtained. (Do not exceed +14.0 V dc.)	Between P1-18 and P1-1 on UUT		The following transitions and indications occur between +4.65 and +5.20 V dc at TP18.
		DS10 (CKT4) and DS11 (CKT4) on UUT		DS10 is lit (red).
				DS11 is extinguished.
10n(1)	Connect digital multimeter 1 test leads to U11-10 (positive) and chassis ground (negative).	Between U11-10 and chassis ground		+9.8 V dc ± 1.4 V dc.
10n(2)	Connect digital multimeter 1 test leads to U11-13 (positive) and chassis ground (negative).	Between U11-13 and chassis ground		0.0 V dc.
10n(3)	Connect digital multimeter 1 test leads to U12-12 (positive) and chassis ground (negative).	Between U12-12 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
10n(4)	Connect digital multimeter 1 test leads to U12-11 (positive) and chassis ground (negative).	Between U12-11 and chassis ground		+3.6 V dc ± .8 V dc.
11	Circuit 5 Tests.			
11a	Connect digital multimeter 1 test leads to TP24 and TP1 (negative) on test fixture. On test fixture, set I BUS selector switch to position 15 V. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Reduce power supply 5 output voltage for +2.500 ± 0.003 V dc on digital multimeter 2.	Between P1-24 and P1-1 on UUT		<+0.2 V dc.
11a(1)	Connect digital multimeter 1 test leads to U14-7 (positive) and chassis ground (negative).	Between U14-7 and chassis ground		<+0.3 V dc.
11a(2)	Connect digital multimeter 1 test leads to U14-6 (positive) and chassis ground (negative).	Between U14-6 and chassis ground		+2.6 V dc ± .5 V dc.
11a(3)	Connect digital multimeter 1 test leads to U14-5 (positive) and chassis ground (negative).	Between U14-5 and chassis ground		+2.5 V dc ± .5 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11b	Connect Digital multimeter 1 test leads to J5 (CKT5) positive) and J7 (GND) (negative) on UUT.	Between J5 and J7 on UUT		2.500 ± 0.100 V dc.
11b(1)	Connect digital multimeter 1 test leads to U14-2 (positive) and chassis ground (negative).	Between U14-2 and chassis ground		0.0 V dc.
11b(2)	Connect digital multimeter 1 test leads to U14-3 (positive) and chassis ground (negative).	Between U14-3 and chassis ground		0.0 V dc.
11c	Connect digital multimeter 1 test leads to TP24 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP 48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +5.000 ± 0.003 V dc on digital multimeter 2.	Between P1-24 and P1-1 on UUT		+1.250 + 0.150/-0.050

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11c(1)	Connect digital multimeter 1 test leads to U14-7 (positive) and chassis ground (negative).	Between U14-7 and chassis ground		+2.6 V dc ± .5 V dc.
11c(2)	Connect digital multimeter 1 test leads to U14-6 (positive) and chassis ground (negative).	Between U14-6 and chassis ground		+3.8 V dc ± .6 V dc.
11c(3)	Connect digital multimeter 1 test leads to U14-5 (positive) and chassis ground (negative).	Between U14-5 and chassis ground		+3.6 V dc ± .6 V dc.
11d	Connect digital multimeter 1 test leads to J5 (CKT5) (positive) and J7 (GND) (negative) on UUT.	Between J5 and J7 on UUT		+3.750 ± 0.150 V dc.
11d(1)	Connect digital multimeter 1 test leads to U14-2 (positive) and chassis ground (negative).	Between U14-2 and chassis ground		0.0 V dc.
11d(2)	Connect digital multimeter 1 test leads to U14-3 (positive) and chassis ground (negative).	Between U14-3 and chassis ground		0.0 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11e	Connect digital multimeter 1 test leads to TP24 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +7.500 ± 0.003 V dc on digital multimeter 2.	Between P1-24 and P1-1 on UUT		+2.500 + 0.200/ -0.100 V dc.
11e(1)	Connect digital multimeter 1 test leads to U14-7 (positive) and chassis ground (negative).	Between U14-7 and chassis ground		+5.1 V dc ± 1 V dc.
11e(2)	Connect digital multimeter 1 test leads to U14-6 (positive) and chassis ground (negative).	Between U14-6 and chassis ground		+5.1 V dc ± 1 V dc.
11e(3)	Connect digital multimeter 1 test leads to U14-5 (positive) and chassis ground (negative).	Between U14-5 and chassis ground		+4.8 V dc ± .9 V dc.
11f	Connect digital multimeter 1 test leads to J5 (CKT5) (positive) and J7 (GND) (negative) on UUT.	Between J5 and J7 on UUT		+5.000 ± 0.200 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11f(1)	Connect digital multimeter 1 test leads to U14-2 (positive) and chassis ground (negative).	Between U14-2 and chassis ground		0.0 V dc.
11f(2)	Connect digital multimeter 1 test leads to U14-3 (positive) and chassis ground (negative).	Between U14-3 and chassis ground		0.0 V dc.
11g	Connect digital multimeter 1 test leads to TP24 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +10.000 ± 0.003 V dc on digital multimeter 2.	Between P1-24 and P1-1 on UUT		+3.750 + 0.250/ -0.150 V dc.
11g(1)	Connect digital multimeter 1 test leads to U14-7 (positive) and chassis ground (negative).	Between U14-7 and chassis ground		+7.6 V dc ± 1.2 V dc.
11g(2)	Connect digital multimeter 1 test leads to U14-6 (positive) and chassis ground (negative).	Between U14-6 and chassis ground		+6.4 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11g(3)	Connect digital multimeter 1 test leads to U14-5 (positive) and chassis ground (negative).	Between U14-5 and chassis ground		+6.1 V dc ± 1 V dc.
11h	Connect digital multimeter 1 test leads to J5 (CKT5) (positive) and J7 (GND) (negative) on UUT.	Between J5 and J7 on UUT		+6.250 ± 0.250 V dc.
11h(1)	Connect digital multimeter 1 test leads to U14-2 (positive) and chassis ground (negative).	Between U14-2 and chassis ground		0.0 V dc.
11h(2)	Connect digital multimeter 1 test leads to U14-3 (positive) and chassis ground (negative).	Between U14-3 and chassis ground		0.0 V dc.
11i	Connect digital multimeter 1 test leads to TP24 (positive) and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP48 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage to +12.500 ± 0.003 V dc on digital multimeter 2.	Between P1-24 and P1-1 on UUT		+5.000 + 0.300/ -0.200 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11i(1)	Connect digital multimeter 1 test leads to U14-7 (positive) and chassis ground (negative).	Between U14-7 and chassis ground		+10.1 V dc ± 1.5 V dc.
11i(2)	Connect digital multimeter 1 test leads to U14-6 (positive) and chassis ground (negative).	Between U14-6 and chassis ground		+7.5 V dc ± 1.3 V dc.
11i(3)	Connect digital multimeter 1 test leads to U14-5 (positive) and chassis ground (negative).	Between U14-5 and chassis ground		+7.3 V dc ± 1.3 V dc.
11j	Connect digital multimeter 1 test leads to J5 (CKT5) (positive) and J7 (GND) (negative) on UUT.	Between J5 and J7 on UUT		+7.500 ± 0.300 V dc.
11j(1)	Connect digital multimeter 1 test leads to U14-2 (positive) and chassis ground (negative).	Between U14-2 and chassis ground		+0.1 V dc ± .015 V dc.
11j(2)	Connect digital multimeter 1 test leads to U14-3 (positive) and chassis ground (negative).	Between U14-3 and chassis ground		+0.1 V dc ± .015 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11k	Connect digital multimeter 1 test leads to TP32 (positive) and TP30 (negative) on test fixture. Adjust the output voltage of power supply 2 for +17.0 ± 0.1 V dc. Reduce power supply 5 to its lowest output.			
11l	Connect digital multimeter 1 test leads to UUT J5 (CKT5) and J7 (GND). Connect digital multimeter 2 test leads to TP23 and TP1 (negative) on test fixture. Raise power supply 5 output voltage until performance standard is obtained.	Between J5 and J7 on UUT		The following transitions and indications occur between +2.75 and +3.00 V dc at J5.
		Between P1-23 and P1-1 on UUT		TP23 = > +2.8 V dc.
		DS12 (CKT5) and DS13 (CKT5)		DS12 is lit (red). DS13 is extinguished.
11l(1)	Connect digital multimeter 1 test leads to U13-3 (positive) and chassis ground (negative).	Between U13-3 and chassis ground		+0.2 V dc ± .03 V dc.
11l(2)	Connect digital multimeter 1 test leads to U13-2 (positive) and chassis ground (negative).	Between U13-2 and chassis ground		+5.0 V dc ± 1 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11l(3)	Connect digital multimeter 1 test leads to U15-14 (positive) and chassis ground (negative).	Between U15-14 and chassis ground		+5.0 V dc ± 1 V dc.
11l(4)	Connect digital multimeter 1 test leads to U13-11 (positive) and chassis ground (negative).	Between U13-11 and chassis ground		+3.5 V dc ± .6 V dc.
11m	Connect digital multimeter 1 test leads to TP23 (positive and TP1 (negative) on test fixture. Connect digital multimeter 2 test leads to TP32 (positive) and TP30 (negative) on test fixture. Adjust output voltage of power supply 2 for +15.0 ± 0.1 V dc on digital multimeter 2.	Between P1-23 and P1-1 on UUT		TP23 = < +0.7 V dc.
		DS12 (CKT5) and DS13 (CKT5) on UUT		DS13 is lit (green). DS12 is extinguished.
11m(1)	Connect digital multimeter 1 test leads to U13-3 (positive) and chassis ground (negative).	Between U13-3 and chassis ground		+5.0 V dc ± 1 V dc.
11m(2)	Connect digital multimeter 1 test leads to U13-2 (positive) and chassis ground (negative).	Between U13-2 and chassis ground		0.0 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11m(3)	Connect digital multimeter 1 test leads to U15-14 (positive) and chassis ground (negative).	Between U15-14 and chassis ground		+5.0 V dc ± 1 V dc.
11m(4)	Connect digital multimeter 1 test leads to U13-11 (positive) and chassis ground (negative).	Between U13-11 and chassis ground		+0.3 V dc ± .045 V dc.
11n	Connect Digital multimeter 1 test leads to TP24 (positive) and TP1 (negative) on test fixture. Increase power supply 5 output voltage until performance standard is obtained. (Do not exceed +14.0 V dc.)	Between P1-24 and P1-1 on UUT		The following transitions and indications occur between +4.65 and +5.20 V dc at TP24.
		DS12 (CKT5) and DS13 (CKT5) on UUT		DS12 is lit (red). DS13 is extinguished.
11n(1)	Connect digital multimeter 1 test leads to U15-6 (positive) and chassis ground (negative).	Between U15-6 and chassis ground		+9.7 V dc ± 1.4 V dc.
11n(2)	Connect digital multimeter 1 test leads to U15-1 (positive) and chassis ground (negative).	Between U15-1 and chassis ground		0.0 V dc.

Table 6-37. Power Supply Controller (77D611601G1) Performance Test Table -CONT

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
11n(3)	Connect digital multimeter 1 test leads to U13-12 (positive) and chassis ground (negative).	Between U13-12 and chassis ground		+5.0 V dc ± 1 V dc.
11n(4)	Connect digital multimeter 1 test leads to U13-11 (positive) and chassis ground (negative).	Between U13-11 and chassis ground		+3.5 V dc ± .6 V dc.
12	Procedure Completed. Remove power from test setup.			

6-12.2.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the power supply. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

For reference material refer to schematic diagram Figure 54 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-118 and 6-129 in this TO.

6-12.2.3 Procedure.

1. Connect test equipment to UUT per Figure 6-110.

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the following general statements. Current calculation will be necessary if another solid state load is used.

2. Condition digital multimeters 1 and 2 to read dc voltage. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.
3. Turn on digital multimeters 1 and 2 and solid-state load. Apply ac input power to UUT. On solid-state load, adjust resistance control [MAIN RESISTANCE control cw] for a 7.4 ± 0.4 A load current (represented by -370 ± 20 mV dc on digital multimeter 2, at -50 mV/A). Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Adjust R4 (15 V ADJ) on UUT for a +15 V ± 15 mV dc reading on digital multimeter 1. Remove power from test setup.
4. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.2.

6-12.3 +/-15 V Dc Power Supply (7329140G1) Alignment Procedure.

6-12.3.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Screwdriver, flat blade	1	25ae
Static control work station	1	33c
Test cable (1)	1	18e
Test cable (2)	1	18f
Test cable, BNC	1	18k
Wrench, set	1	32a
Wrist strap	1	33i

6-12.3.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the power supply. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

For reference material refer to schematic diagram Figure 53 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-119 and 6-130 in this TO.

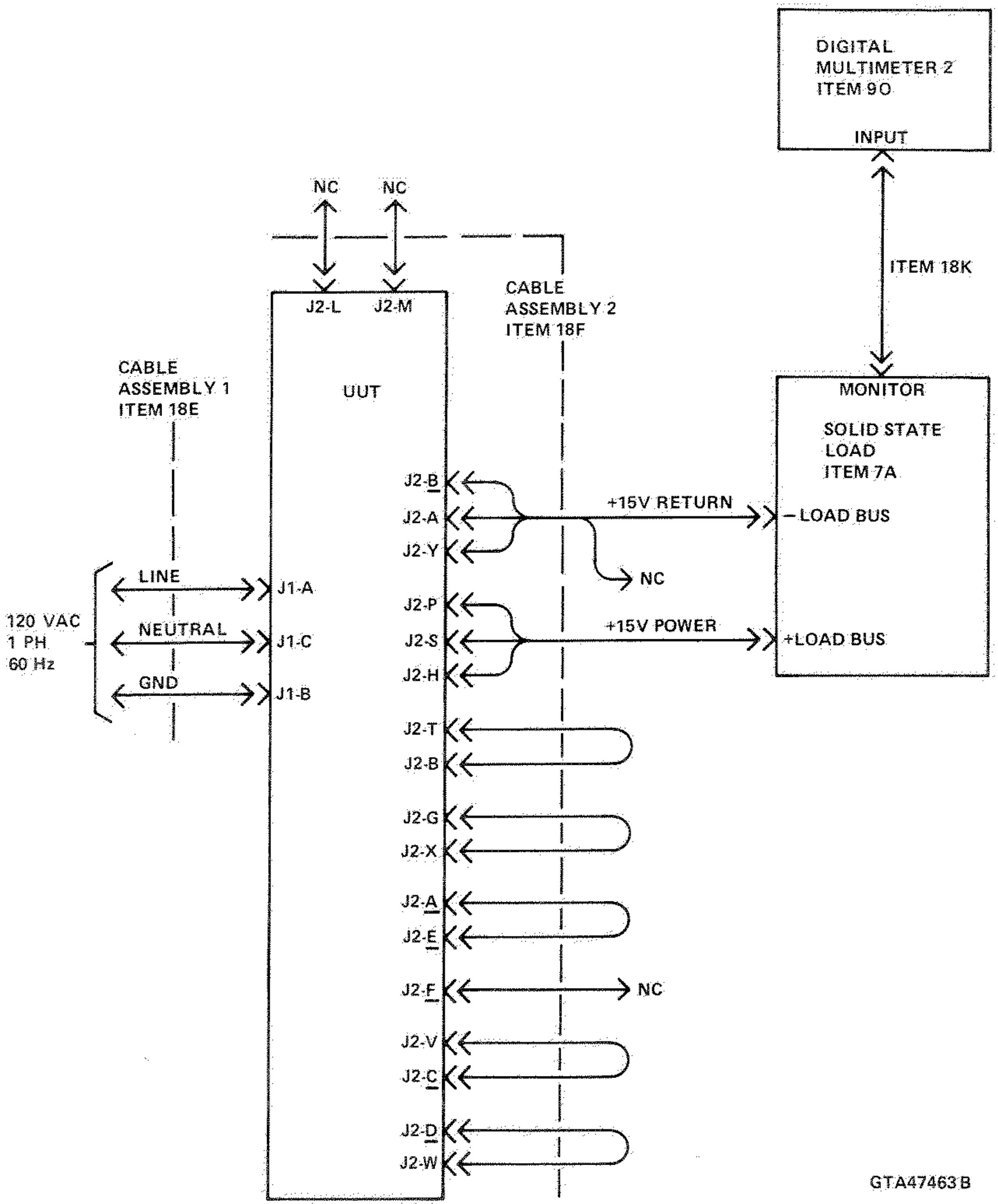


Figure 6-110. +/-15 V Dc Power Supply (7328363G1) Alignment Setup

6-12.3.3 Procedure.

1. Connect test equipment to UUT per Figure 6-111.

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the following general statements. Current calculation will be necessary if another solid state load is used.

2. Condition digital multimeters 1 and 2 to read dc voltage. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.

3. Turn on all test equipment. Apply ac input power to UUT. On solid-state load, adjust resistance control [MAIN RESISTANCE control cw] for a 14.8 ± 0.4 A load current (represented by -740 ± 20 mV dc on digital multimeter 2, at -50 mV/A. Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Adjust R4 (15 V ADJ on UUT for a +15 V ± 15 mV dc reading on digital multimeter 1. Remove power from test setup.

4. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.3.

6-12.4 +/-60 V Dc Power Supply (7343908G1) Alignment Procedure.

6-12.4.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Screwdriver, flat blade	1	25ae
Static control work station	1	33c
Test cable (1)	1	18e
Test cable (2)	1	18d
Test cable, BNC	1	18k
Wrench, set	1	32a
Wrist strap	1	33i

6-12.4.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the power supply. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

For reference material refer to schematic diagram Figure 52 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-121 and 6-131 in this TO.

6-12.4.3 Procedure.

1. Connect test equipment to UUT per Figure 6-112.

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the following general statements. Current calculation will be necessary if another solid state load is used.

2. Condition digital multimeters 1 and 2 to read dc voltage. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.

3. Turn on digital multimeters 1 and 2 and solid-state load. Apply ac input power to UUT. On solid-state load, adjust resistance control [MAIN RESISTANCE control cw] for a 2.31 ± 0.06 A load current (represented by -115 ±3 mV dc on digital multimeter 2, at -50 mV/A). Connect digital multimeter 1 test leads to J2-H (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Adjust R4 (60 V

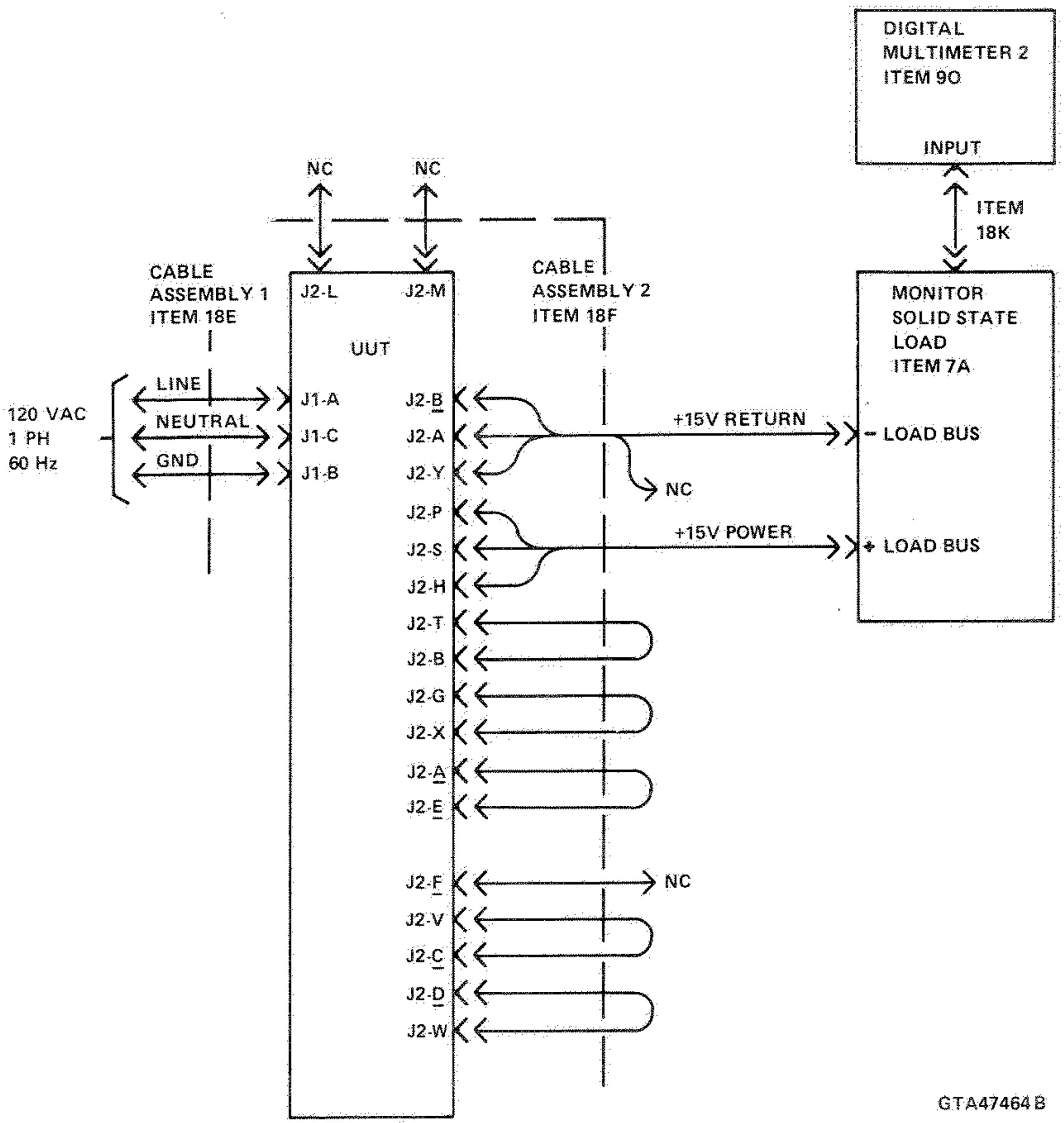


Figure 6-111. +/-15 V Dc Power Supply (7329140G1) Alignment Setup

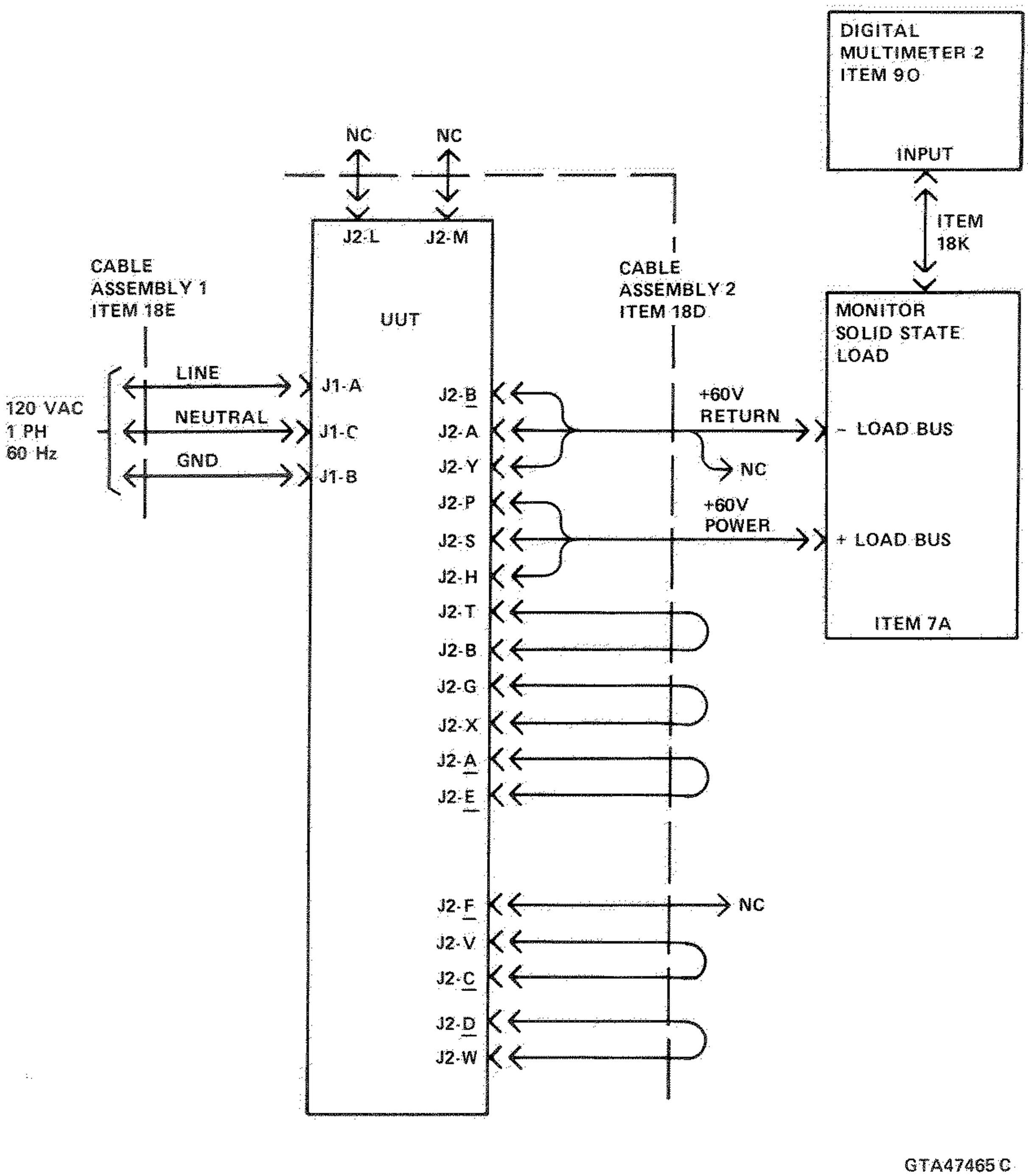


Figure 6-112. +/-60 V Dc Power Supply (7343908G1) Alignment Setup

ADJ) on UUT for +60 V ± 60 mV dc reading on digital multimeter 1. Remove power from test setup.

4. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.4.

6-12.5 +24 V Dc Power Supply (7343910G1) Alignment Procedure.

6-12.5.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Kit, alignment tool	1	25ab
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Static control work station	1	33c
Test cable (1)	1	18e
Test cable (2)	1	18g
Test cable, BNC	1	18k
Wrist strap	1	33i

6-12.5.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the power supply. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

For reference material refer to schematic diagram Figure 56 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-122 and 6-132 in this TO.

6-12.5.3 Procedure.

1. Connect test equipment to UUT per Figure 6-113.

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets [ ]. If another load is used, maintenance personnel shall condition the equipment from the following general statements. Current calculation will be necessary if another solid state load is used.

2. Condition digital multimeters 1 and 2 to read dc voltage. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.

3. Turn on digital multimeters 1 and 2 and solid-state load. Apply ac input power to UUT. On solid-state load, adjust resistance control [MAIN RESISTANCE control cw] for a 13.85 ± 0.0.35 A load current (represented by -692 ± 18 mV dc on digital multimeter 2, at -50 mV/A). Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Adjust PS1R114 (ADJ VOL TS) on UUT for +24 V ± 24 mV dc reading on digital multimeter 1. Remove power from test setup.

4. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.5.

6-12.6 +5 V Dc Power Supply (7343912G1) Alignment Procedure.

6-12.6.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Kit, alignment tool	1	25ba
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Static control work station	1	33c
Test cable (1)	1	18e
Test cable (2)	1	18h
Test cable, BNC	1	18k
Wrist strap	1	33i

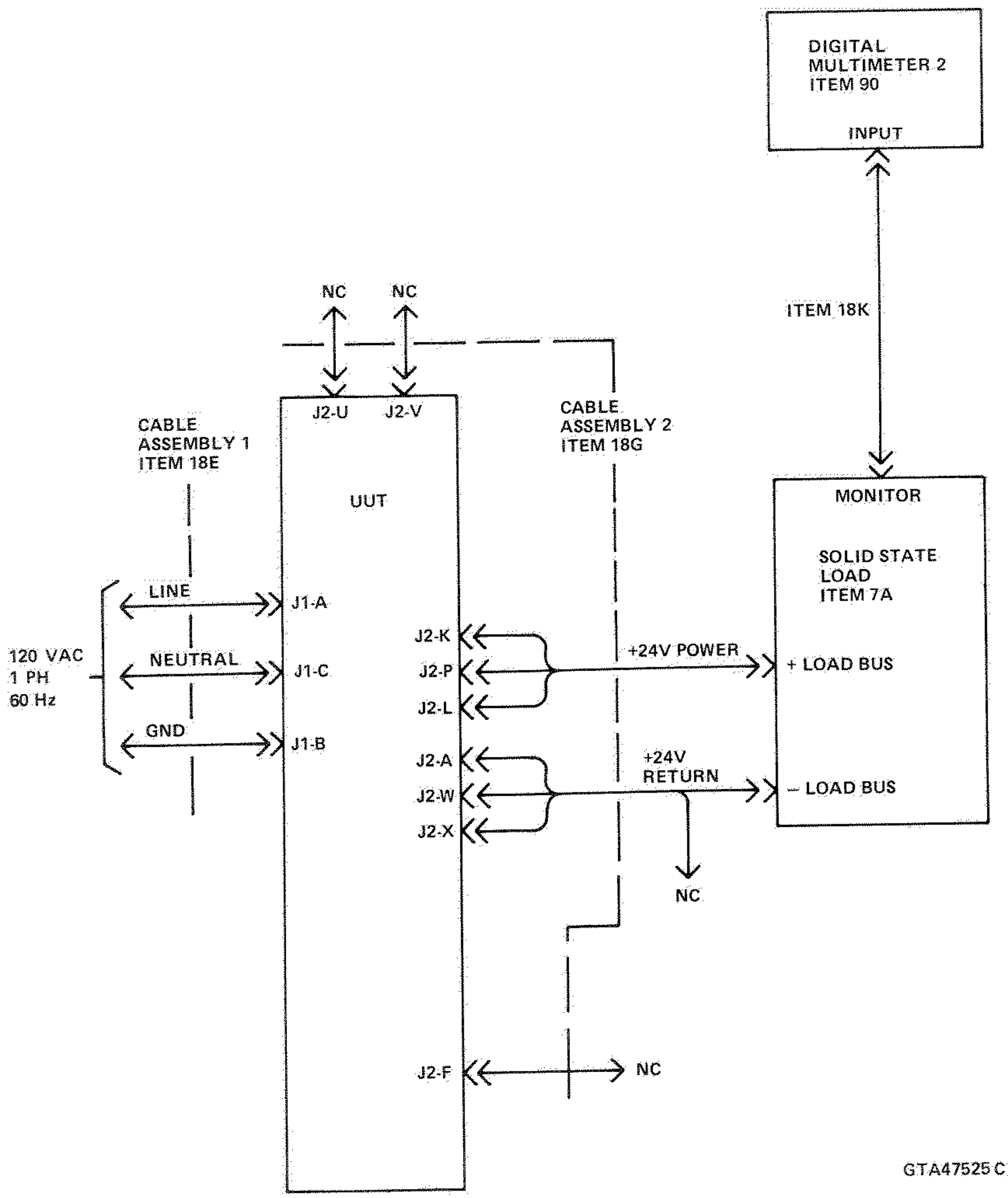


Figure 6-113. +24 V Dc Power Supply (7343910G1) Alignment Setup

6-12.6.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the power supply. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. When not connected, keep ends of cable assembly leads isolated from ground.

For reference material refer to schematic diagram Figure 55 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-123 and 6-133 in this TO.

6-12.6.3 Procedure.

1. Connect test equipment to UUT per Figure 6-114.

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the following general statements. Current calculation will be necessary if another solid state load is used.

2. Condition digital multimeters 1 and 2 to read dc voltage. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R control fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.
3. Turn on digital multimeters 1 and 2 and solid-state load. Apply ac input power to UUT. On solid-state load, adjust resistance control [MAIN RESISTANCE control cw] for a 37 ± 1 A load current (represented by -1.85 V ± 50 mV dc on digital multimeter 2, at -50 mV/A). Connect digital multimeter 1 test leads to J2-P (PS1TB3+) (positive) and J2-A (R1-1) (negative) on UUT. Adjust PS1R114 (ADJ VOL-TS) on UUT for +5 V ± 5 mV dc reading on digital multimeter 1. Remove power from test setup.
4. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.6.

6-12.7 +/-5 V Dc Voltage Regulator (77D609500G1) Alignment Procedure.

6-12.7.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Cable assembly	1	18a
Fan, 3-speed, bench	1	22l
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade 3 in	1	25ae
Screwdriver, jewelers	1	25ap
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-64 V dc, 0-50A	1	13c
Test cable, BNC	1	18k
Wrist strap	1	33i

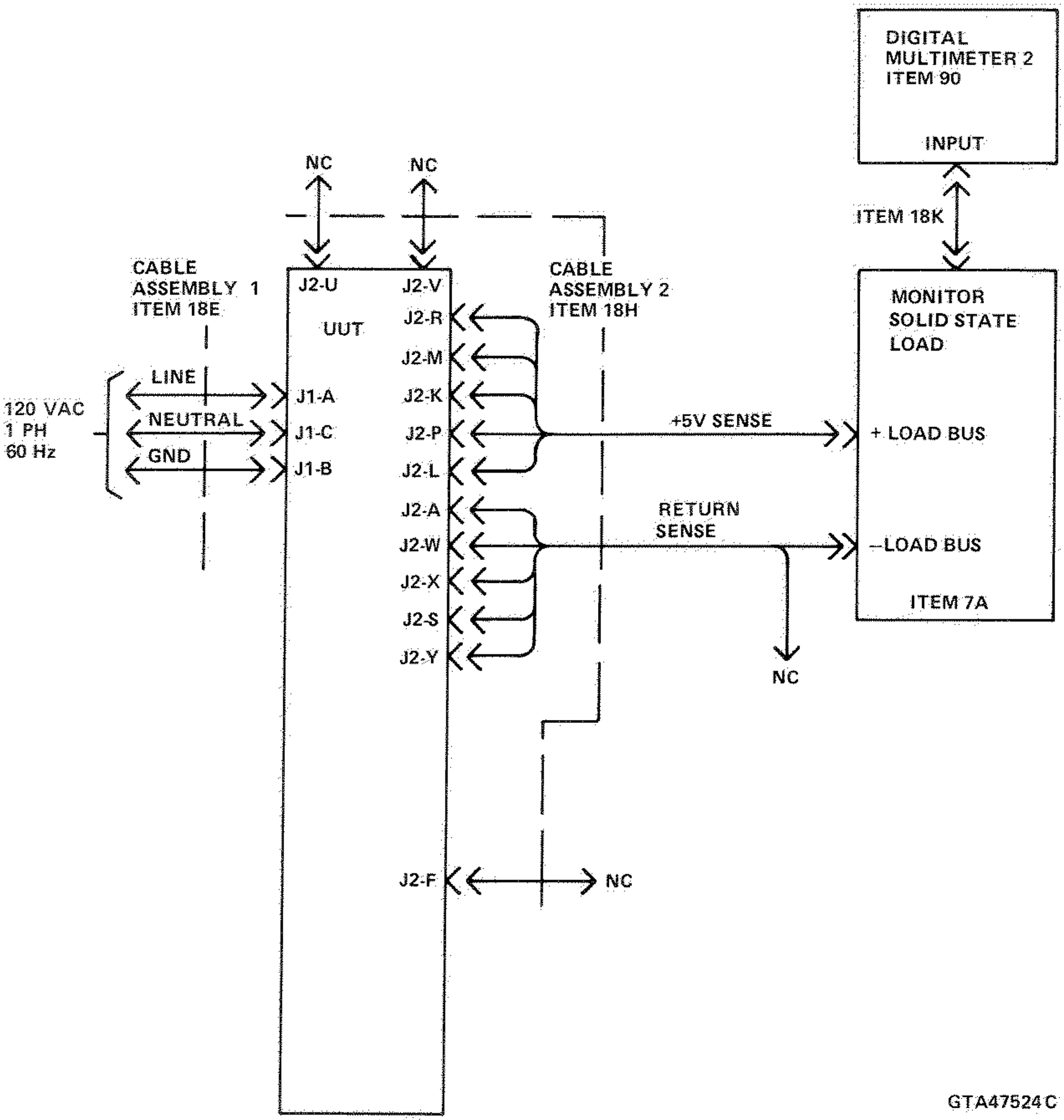


Figure 6-114. +5 V Dc Power Supply (7343912G1) Alignment Setup

6-12.7.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the regulator. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling (fan) must be provided during entire procedure allowing the air to transfer heat away from the UUT. When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-12.7.2.1 Reference Material. See schematic diagram Figure 42 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-127 and 6-134 in this TO.

6-12.7.2.2 Prerequisites. Remove UUT cover assembly. Remove ground guards and terminal board protective covers where applicable.

6-12.7.3 Procedure.

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the following general statements. Current calculation will be necessary if another solid state load is used.

1. Adjust power supply 1 for +16.5 ± 0.1 V dc output voltage. Condition digital multimeters 1 and 2 for dc voltage measurement. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R controls fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.

2. Turn all test equipment off. Connect test equipment to UUT per Figure 6-115. Place CB1 on UUT in OFF position.

3. Turn all test equipment on. Connect digital multimeter 1 test leads to J1-M (CB1-A) and J1-L (C2 negative) inside UUT. Readjust power supply 1 output voltage for a +16.5 ± 0.1 V dc reading on digital multimeter 1, if necessary.

4. Place CB1 on UUT in ON position. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) inside UUT. Adjust A1R1 (VOLTAGE ADJUST) for a +5.200 ± 0.025 V dc reading on digital multimeter 1.

5. On solid-state load, adjust resistance control (MAIN RESISTANCE control cw) for an 8.6 ± 0.1 A load current (represented by -430 ± 5 mV dc on digital multimeter 2, at 50 mV/A). Readjust A1R1 for 5.200 ± 0.025 V dc.

6. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) inside UUT. On solid-state load, adjust resistance control [MAIN RESISTANCE control cw] for a 43.5 ± 0.1 A load current (represented by -2175 ± 5 mV dc on digital multimeter 2). Readjust power supply 1 output voltage per step 1, if necessary. It may also be necessary to adjust current output of power supply 1 to obtain the load current. Then adjust A1R25 (CURRENT ADJUST) on UUT to obtain the load current. Then adjust A1R25 (CURRENT ADJUST) on UUT for a current limit condition (indicated by a 50 to 100 mV dc voltage drop on digital multimeter 1). Remove power from test setup. Install UUT ground guard and terminal board protective covers. Install UUT cover assembly.

7. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.9.

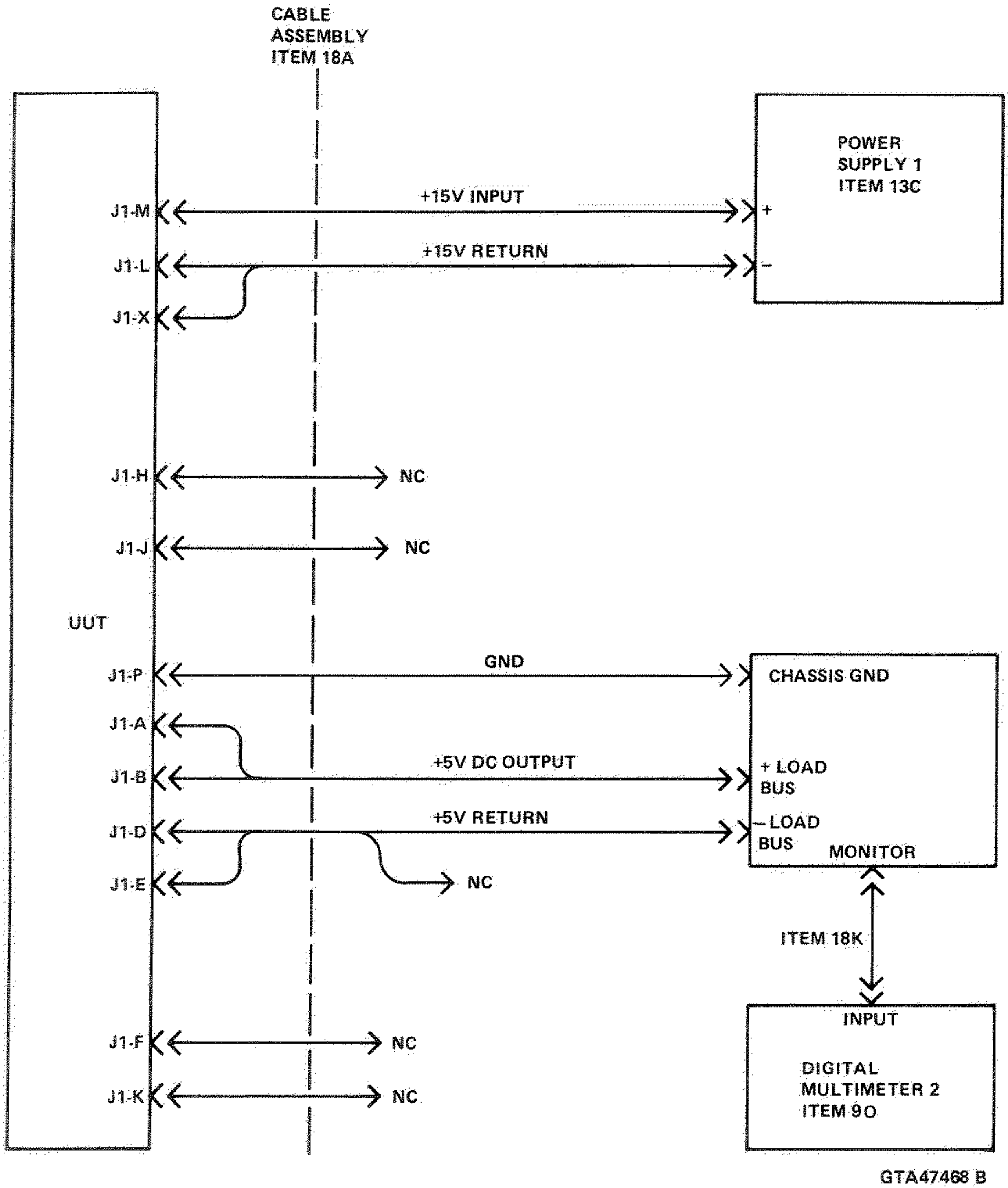


Figure 6-115. +/-5 V Dc Voltage Regulator (77D609500G1) Alignment Setup

6-12.8 +/-15 V Dc Voltage Regulator (77D609503G1) Alignment Procedure.

6-12.8.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Cable assembly	1	18b
Fan, 3-speed, bench	1	22l
Load, solid state	1	7a
Multimeter, digital (1)	1	9f
Multimeter, digital (2)	1	9o
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade 3 in	1	25ae
Screwdriver, jewelers	1	25ap
Set, test probe	1	9h
Static control work station	1	33c
Supply, power 0-64 V dc, 0-50A	1	13c
Test cable, BNC	1	18k
Wrist strap	1	33i

6-12.8.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of the regulator. While the output voltage is low, the current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling (fan) must be provided during entire procedure allowing the air to transfer heat away from the UUT. When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-12.8.2.1 Reference Material. See schematic diagram Figure 43 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-127 and 6-134 in this TO.

6-12.8.2.2 Prerequisites. Remove UUT cover assembly. Remove ground guards and terminal board protective covers where applicable.

6-12.8.3 Procedure.

NOTE

Due to the complexity of the solid-state load conditioning, adjustments for the specified load are indicated in brackets []. If another load is used, maintenance personnel shall condition the equipment from the following general statements. Current calculation will be necessary if another solid state load is used.

1. Adjust power supply 1 for +26.5 ± 0.1 V dc output voltage. Condition digital multimeters 1 and 2 for dc voltage measurement. Adjust solid-state load by setting MANUAL MODE switch to MAIN R position and adjust MAIN RESISTANCE and DUAL I or R controls fully ccw. Rotate the MAIN CURRENT control fully cw. Set meter range for maximum current reading.
2. Turn all test equipment off. Connect test equipment to UUT per Figure 6-116. Place CB1 on UUT in OFF position.
3. Turn all test equipment on. Connect digital multimeter 1 test leads to J1-M (CB1-A) and J1-L (C2 negative) inside UUT. Readjust power supply 1 output voltage for a +26.5 ± 0.1 V dc reading on digital multimeter 1, if necessary.
4. Place CB1 on UUT in ON position. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) on UUT. Adjust A1R1 (VOLTAGE ADJUST) for a +15.5 ± 0.02 V dc reading on digital multimeter 1.
5. On solid-state load, adjust resistance control (MAIN RESISTANCE control cw) for a 3.0 ± 0.1 A load current (represented by -150 ± 5 mV dc on digital multimeter 2, at 50 mV/A). Readjust A1R1 for +15.500 ± 0.050 V dc.
6. Connect digital multimeter 1 test leads to J1-A,B (C6 positive) and J1-D,E (C6 negative) inside UUT. On solid-state load, adjust resistance control [MAIN RESISTANCE control cw] for a 16.0 ± 0.1 A load current (represented by -800 ± 5 mV dc on digital multimeter 2). Readjust power supply 1 output voltage per step 1, if necessary. It may also be necessary to adjust current output of power supply 1 to obtain the load current. Then adjust A1R25 (CURRENT ADJUST) on UUT to obtain the load current. Adjust A1R25 (CURRENT ADJUST) on UUT for a current limit condition (indicated by a 50 to

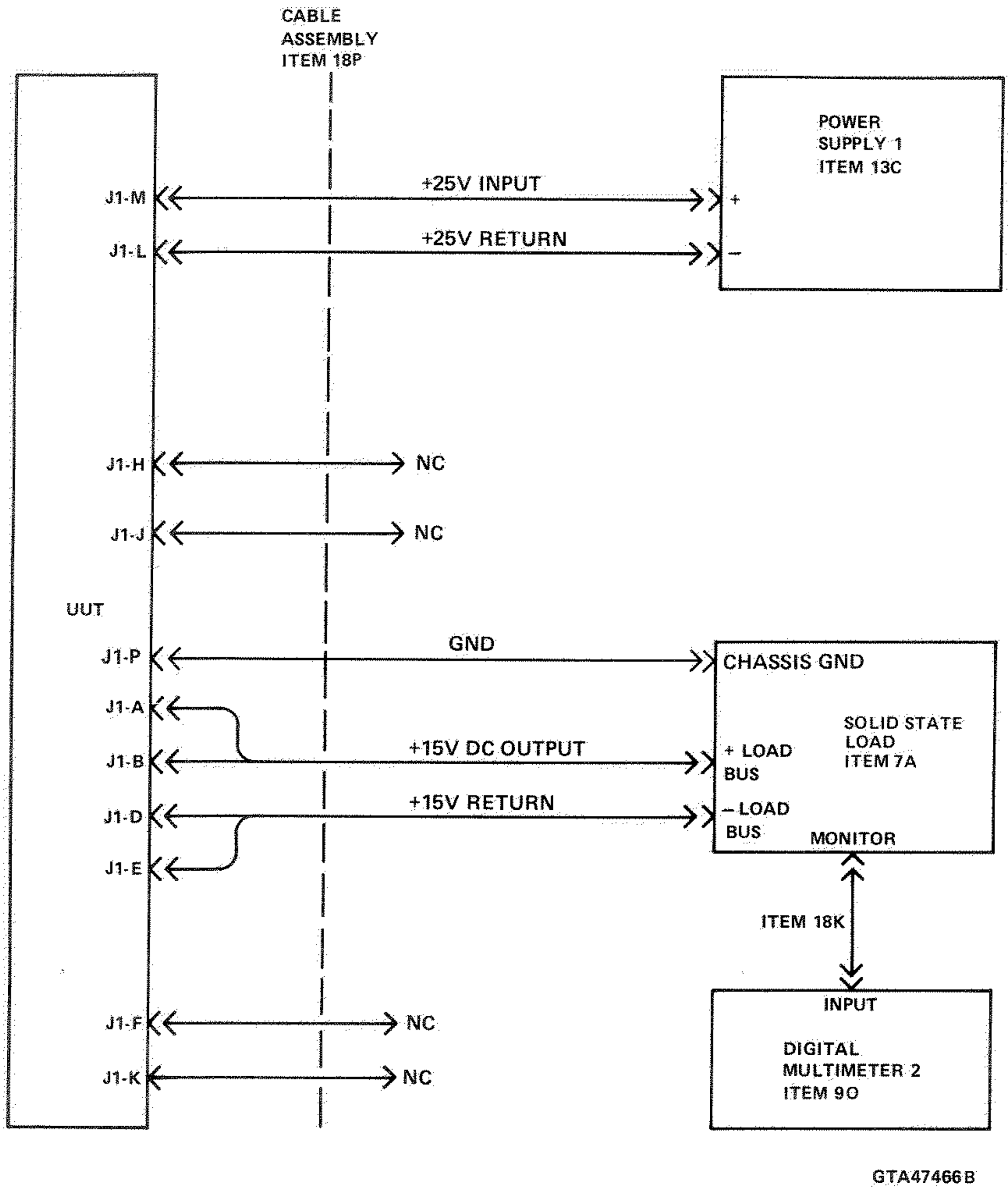


Figure 6-116. +/-15 V Dc Voltage Regulator (77D609503G1) Alignment Setup

200 mV dc voltage drop on digital multimeter 1). Remove power from test setup. Install UUT ground guard and terminal board protective covers. Install UUT cover assembly.

7. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.10.

6-12.9 Power Supply Controller (77D611601G1) Alignment Procedure.

6-12.9.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Multimeter, digital	1	9f
Patch cord, spade lug	2	18n
Screwdriver, jewelers	1	25ap
Static control work station	1	33c
Supply, power (1)		13a
Supply, power (6)	1	13c
Test fixture (power control)	1	19a
Wrist strap	1	33i

6-12.9.2 Special Instructions.

WARNING

HIGH CURRENT HAZARD

Use caution when working in the immediate vicinity of power supplies. While output voltage is low, high current can cause a severe burn.

CAUTION

EQUIPMENT DAMAGE HAZARD

When not connected keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

EQUIPMENT DAMAGE HAZARD

Adequate forced-air cooling (fan) must be provided during entire procedure allowing the air to transfer heat away from the UUT. When not connected, keep ends of cable assembly leads isolated from ground. This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

For reference material refer to schematic diagram Figure 86, Sheet 2 in transmitter group circuit diagram TO 31P6-2FPS118-73-1 and parts location diagrams Figures 6-128 and 6-135 in this TO.

6-12.9.3 Procedure.

1. Connect test equipment per Figure 6-117. Do not insert UUT into test fixture at this time. On test fixture, place switches S1 through S10 in OFF position. Place switch S11 in position 2. Turn po wer supplies 1 and 6 on. Adjust power supply 1 output voltage for +5.0 ± 0.1 V dc. Adjust power supply 6 output voltage for +24.0 ± 0.1 V dc. Turn power supplies 1 and 6 off. Carefully insert UUT into test fixture jack. Connect digital multimeter test leads to TP2 (positive) and TP1 (negative) on test fixture. Turn power supply 1 on and readjust output voltage for +5.0 ± 0.1 V dc, if necessary. Connect digital multimeter test leads to TP43 (positive) and TP1 (negative) on test fixture. Turn power supply 6 on and readjust output voltage for +24.0 ± 0.2 V dc, if necessary.

2. Connect digital multimeter test leads to J6 (REF) and J7 (GND) on UUT. Adjust R3 (REF) on UUT for +2.500 ± 0.003 V dc reading on digital multimeter.

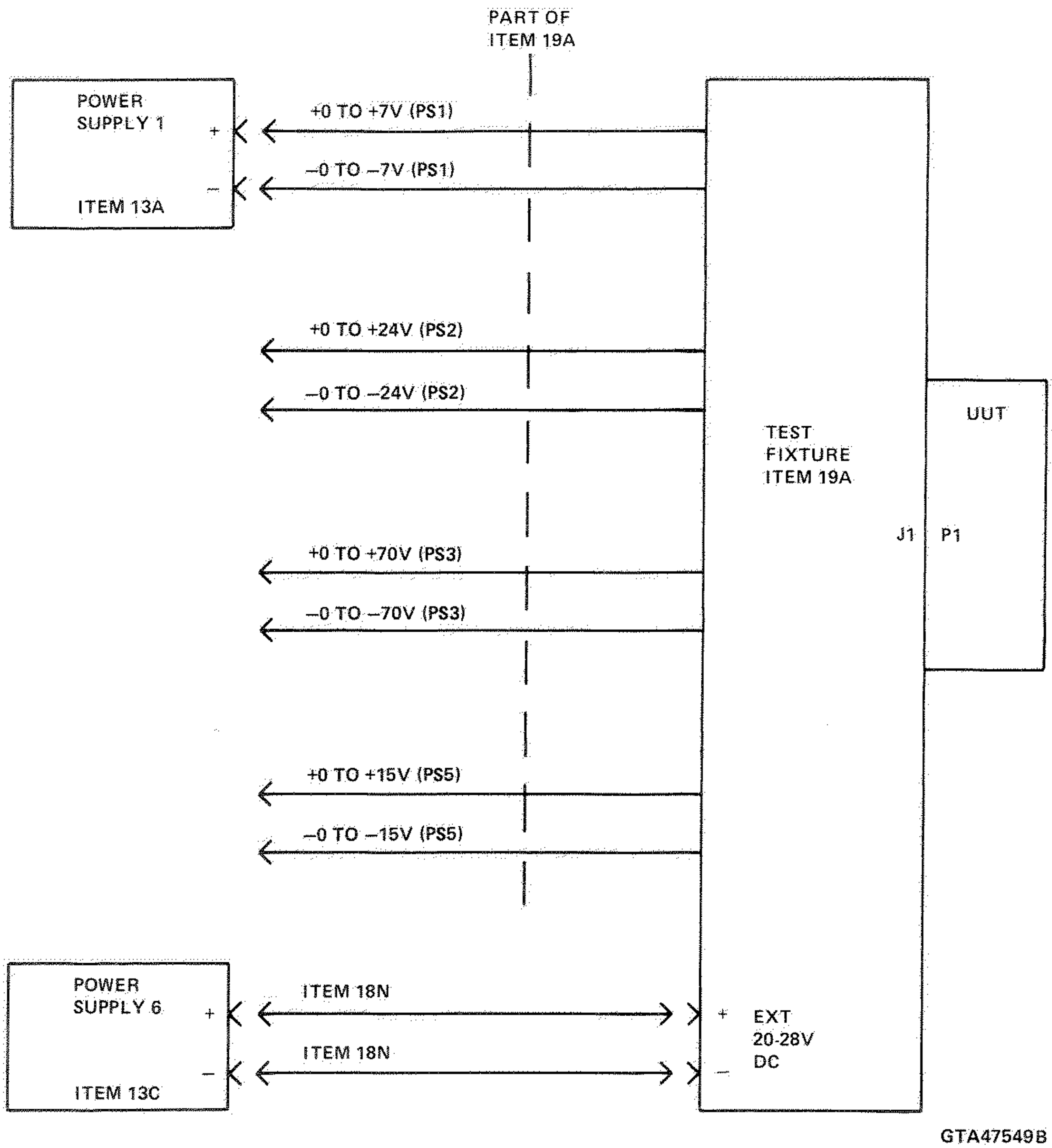


Figure 6-117. Power Supply Controller (77D611601G1) Alignment Setup

3. Place switches S6, S7, S8, S9, and S10 on test fixture in the ON position. Connect digital multimeter test leads to J1 (CKT 1) and J6 (REF) on UUT. If possible, adjust zero adjust on digital multimeter for zero reading before taking voltage measurement. Adjust R36 (CKT 1) on UUT for 0.000 ± 0.002 V dc reading on digital multimeter.

4. Connect digital multimeter test leads to J2 (CKT 2) and J6 (REF) on UUT. If possible, adjust zero adjust on digital multimeter for zero reading before taking voltage measurement. Adjust R59 (CKT 2) on UUT for 0.000 ± 0.002 V dc reading on digital multimeter.

5. Connect digital multimeter test leads to J3 (CKT 3) and J6 (REF) on UUT. If possible, adjust zero adjust on digital multimeter for zero reading before taking voltage measurement. Adjust R82 (CKT 3) on UUT for 0.000 ± 0.002 V dc reading on digital multimeter.

6. Connect digital multimeter test leads to J4 (CKT 4) and J6 (REF) on UUT. If possible, adjust zero adjust on digital multimeter for zero reading before taking voltage measurement. Adjust R105 (CKT 4) on UUT for 0.000 ± 0.002 V dc reading on digital multimeter.

7. Connect digital multimeter test leads to J5 (CKT 5) and J6 (REF) on UUT. If possible, adjust zero adjust on digital multimeter for zero reading before taking voltage measurement. Adjust R128 (CKT 5) on UUT for 0.000 ± 0.002 V dc reading on digital multimeter.

8. Turn all power supplies off before removing UUT from test fixture.

9. If problems are encountered in performing this alignment procedure, refer to performance test paragraph 6-11.11.

6-13 LINE REPLACEABLE UNIT DISASSEMBLY AND ASSEMBLY.

The following paragraphs provide bench-type disassembly and assembly procedures necessary to maintain various LRUs in the transmitter group. The procedures below describe the disassembly and assembly of those LRUs that are mechanically complex. Coverages for LRUs where the disassembly and assembly are obvious are not given. Regardless of the mechanical complexity, special precautions and special considerations pertaining to the repair of an LRU are given, when necessary.

6-13.1 +/-15 V Dc Power Supply Assembly (7328363G1).

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. Electrostatic sensitive components are identified throughout this procedure.

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

6-13.1.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade 3 in	1	25ae
Screwdriver, flat blade 10 in	1	25at
Soldering station	1	29e
Static control work station	1	33c
Wrench, box/open, set (5/16 in - 1-5/8 in)	1	32a
Wrist strap	1	33i

6-13.1.2 Procedure.

1. Disassembly procedure (Figure 6-118). To service components mounted on the rear surface of the power supply chassis (5), it is necessary to first remove power supply PS1 (1).

   a. Power supply PS1 (1) removal.

      (1) Remove power supply PS1 (1) mounting screw (2), lockwasher (3), and flat washer (4) four places. Set screws and washers aside.

      (2) Separate power supply PS1 (1) far enough from chassis (5) to gain access to power supply PS1 (1) terminal blocks.

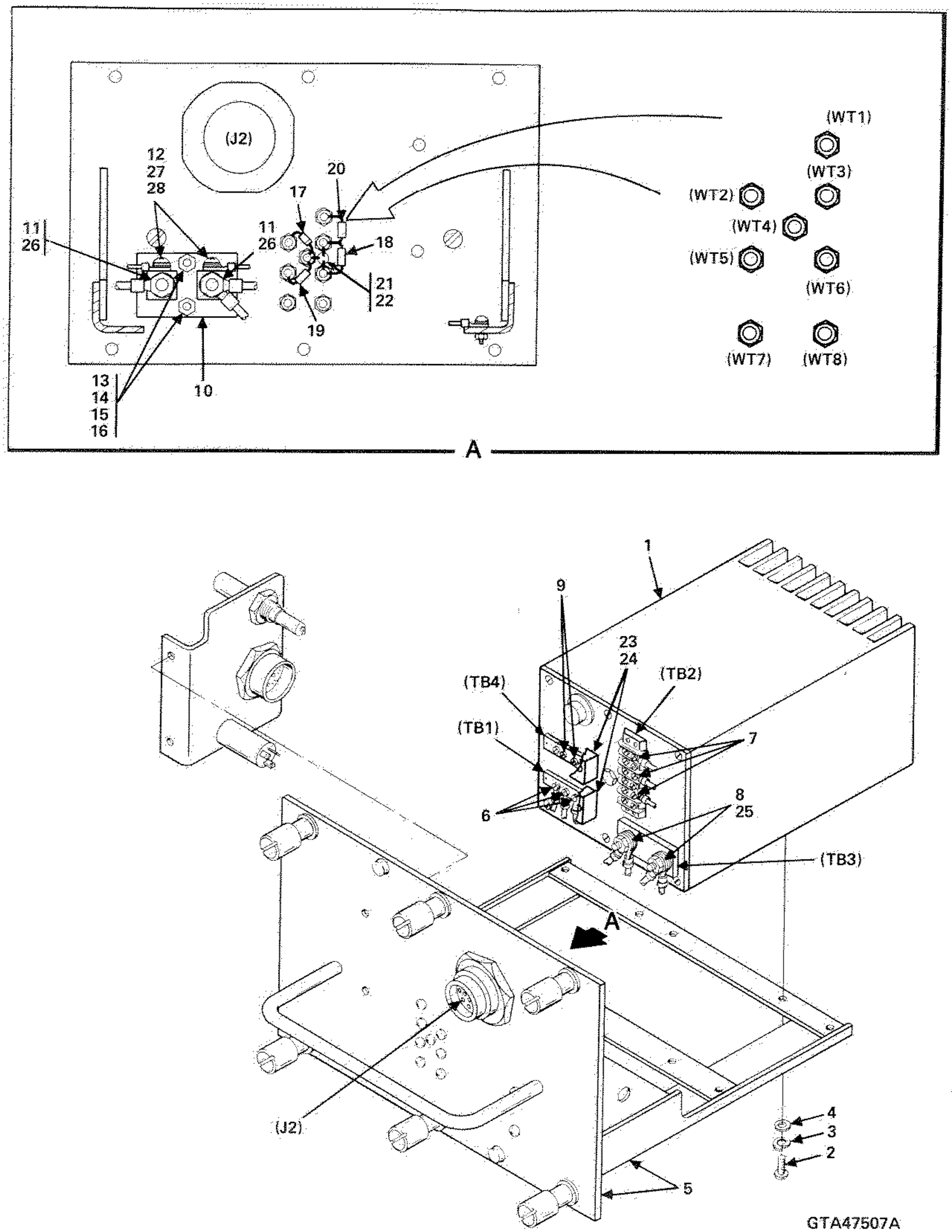


Figure 6-118. +/-15 V Dc Power Supply Assembly (7328363G1)

(3) Remove terminal block covers (23) from terminal blocks TB1 and TB4 by removing two screws (24) for each cover. Set covers and screws aside.

(4) Note wires connected to power supply PS1 (1) terminal blocks TB1, 2, and 3. Label connecting wires as necessary with terminal identification markers.

(5) Disconnect connecting wires from terminal blocks TB1 and TB2 by removing terminal screws (6) and (7), respectively. Set terminal screws aside.

(6) Disconnect connecting wires from terminal block TB3 by removing two terminal nuts (8) and flat washers (25). Set terminal and washers nuts aside. Remove connecting wires from terminal block TB3.

(7) Remove jumper from terminal block TB4 only if power supply PPS1 (1) is to be replaced. Remove two terminal screws (9) from terminal block TB4. Set screws and jumper aside.

(8) Remove power supply PS1 (1) from chassis (5). Set aside if it is to be reused.

b. Shunt resistor R1 (10) removal (Figure 6-118, view A).

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Note wires connected to terminals 1 through 4 of resistor R1 (10). Label connecting wires as necessary with terminal identification markers.

(3) Remove terminal nuts (11) and lockwashers (26) from resistor R1 (10) terminals 1 and 2. Remove connecting wires from terminal studs and set terminal nuts and washers aside.

(4) Disconnect wires from resistor R1 (10) terminals 3 and 4 by removing two screws (12), lockwashers (27), and flat washers (28). Set screws and washers aside.

(5) Remove resistor R1 (10) from chassis (5) by removing screw (13), lockwasher (14), flat washer (15), and nut (16) two places. Set screws, washers, and nuts aside.

(6) Remove resistor R1 (10) from chassis (5).

c. Diode CR1 (17) removal (Figure 6-118, view A). Diode CR1 (17) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PPS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Observe polarity of CR1 (17). Cathode is connected to standoff WT4.

(3) Unsolder and remove diode CR1 (17) leads from standoffs WT2 and WT4.

d. Resistor R2 (18), R3 (19), or R5 (20) removal (Figure 6-118, view A). Resistors R2 (18) and R5 (20) are electrostatic sensitive components; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Determine resistor R2 (18), R3 (19), or R5 (20) to be removed. Resistor R2 (18) is connected to standoffs WT3 and WT6. Resistor R3 (19) is connected to standoffs WT4 and WT5. Resistor R5 (20) is connected to standoffs WT1 and WT3.

(3) Unsolder and remove resistor from respective standoffs.

e. Transistor Q1 (21) removal (Figure 6-118, view A). Transistor Q1 (21) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Note and mark source, gate, and drain connections at standoffs WT6, WT4, and WT3, respectively.

(3) Unsolder and remove transistor Q1 (21) leads from standoffs WT3, WT4, and WT6.

(4) Straighten transistor leads and remove mounting pad (22) from transistor removed. Set mounting pad aside.

2. Assembly procedure (Figure 6-118).

a. Transistor Q1 (21) installation (Figure 6-118), view A). Transistor Q1 (22) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Thread leads of transistor Q1 (21) through the respective holes in mounting pad (22) retained in step 1.e.(4). Bend leads outward at a right angle adjacent to the mounting pad.

(2) Connect transistor, source, gate, and drain leads to standoffs WT6, WT4, and WT3, respectively.

(3) Solder transistor leads to standoffs.

(4) Position transistor Q1 (21) to clear standoffs.

b. Resistor R2 (18), R3 (19), or R5 (20) installation (Figure 6-118, view A). Resistors R2 (18) and R5 (20) are electrostatic sensitive components; observe precautionary procedures found in TO 00-25-234.

(1) Position resistor midway between respective standoffs as follows:

(a) Connect R2 (18) to standoffs WT3 and WT6.

(b) Connect R3 (19) to standoffs WT4 and WT5.

(c) Connect R5 (20) to standoffs WT1 and WT3.

(2) Solder resistor leads to respective standoff terminals.

c. Diode CR1 (17) installation (Figure 6-118, view A). Diode CR1 (17) is an electrostatic sensitive component; observe precautionary procedures found in TO-00-25-234.

(1) Position diode CR1 (17) midway between standoffs WT2 and WT4 with the cathode at the WT4 end as observed in step 1.c.(2).

(2) Connect diode leads to WT2 and WT4.

(3) Solder two connections at WT2 and WT4.

d. Shunt resistor R1 (10) installation (Figure 6-118, view A).

(1) Position resistor R1 (10) on chassis (5) and align two mounting holes.

(2) Secure resistor R1 (10) to chassis (5) two places. Use screws (13), lockwashers (14), flat washers (15), and nuts (16) retained in step 1.b.(5).

(3) Connect wires to resistor terminals 3 and 4 as labeled in step 1.b.(2). Secure terminals with two screws (12), lockwashers (27), and flat washers (28) retained in step 1.b.(4).

(4) Connect wires to resistor terminals 1 and 2 as labeled in step 1.b.(3).

(5) Secure wires to resistor terminals 1 and 2 with two nuts (11) and lockwashers (26) retained in step 1.b.(3).

e. Power supply PS1 (1) installation.

(1) Install jumper between terminals 2 and 3 of power supply terminal block TB4. Use terminal screws (9) and jumper retained in step 1.a.(7).

(2) Place power supply PS1 (1) in approximate mounting position on chassis (5).

(3) Connect wires to terminals of terminal block TB3, as labeled in step 1.a.(4). Secure terminal connections with two terminal nuts (8) and flat washer (25) retained in step 1.a.(6).

(4) Connect wires to terminals of terminal blocks TB1 and TB2 as labeled in step 1.a.(4). Secure respective terminal connections with terminal screws (6) and (7) retained in step 1.a.(5).

(5) Install terminal block covers (23) on terminal blocks TB1 and TB4. Secure covers with two screws (24) each. Terminal covers and screws were retained in step 1.a.(3).

(6) Position power supply PS1 (1) on chassis (5) and align four mounting holes. Secure four places with screws (2), lockwashers (3), and flat washers (4) retained in step 1.a.(1).

f. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures contained in paragraph 6-11.

6-13.2 +/-15 V Dc Power Supply Assembly (7329140G1).

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO-00-25-234. Electrostatic sensitive components are identified throughout this procedure.

6-13.2.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31l
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade 6 in	1	25ad
Screwdriver, flat blade 10 in	1	25at
Soldering station	1	29e
Static control work station	1	33c
Wrench, box/open,set (5/16 in - 1-5/8 in)	1	32a
Wrist strap	1	33i

6-13.2.2 Procedure.

1. Disassembly procedure (Figure 6-119). To service components mounted on the rear surface of the power supply chassis (7), it is necessary to first remove power supply PS1 (1).

a. Power supply PS1 (1) removal.

(1) Remove power supply PS1 (1) from chassis (7) as follows:

(a) Remove mounting screw (2), lockwasher (3), and flat washer (4) two places.

(b) Remove screw (5) and lockwasher (6) two places.

(c) Set screws and washers aside.

(2) Separate power supply PS1 (1) far enough from chassis (7) to gain access to power supply PS1 (1) terminal blocks.

(3) Remove terminal block covers (25) from terminal blocks TB1 and TB4 by removing two screws (26) for each cover. Set covers and screws aside.

(4) Note wires connected to power supply PS1 (1) terminal blocks TB1, 2, and 3. Label connecting wires as necessary with terminal identification markers.

(5) Disconnect connecting wires from terminal blocks TB1 and TB2 by removing terminal screws (8) and (9), respectively. Set terminal screws aside.

(6) Disconnect connecting wires from terminal block TB3 by removing two terminal nuts (10) and flat washers (27). Set terminal nuts and washers aside. Remove connecting wires from terminal block TB3.

(7) Remove jumper from terminal block TB4 only if power supply PS1 (1) is to be replaced. Remove two terminal screws (11) from terminal block TB4. Set screws and jumper aside.

(8) Remove power supply PS1 (1) from chassis (7). Set aside if it is to be reused.

b. Shunt resistor R1 (12) removal (Figure 6-119, view A).

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (7).

(2) Note wires connected to terminals 1 through 4 of resistor R1 (12). Label connecting wires as necessary with terminal identification markers.

(3) Remove terminal nuts (13) and lockwashers (28) from resistor R1 (12) terminals 1 and 2. Remove connecting wires from terminal studs and set terminal nuts and washers aside.

(4) Disconnect wires from resistor R1 (12) terminals 3 and 4 by removing two screws (14), lockwashers (29), and flat washers (30). Set screws and washers aside.

(5) Remove resistor R1 (12) from chassis (7) by removing screw (15), lockwasher (16), and flat washer (17), and nut (18) two places. Set screws, washers, and nuts aside.

(6) Remove resistor R1 (12) from chassis (7).

c. Diode CR1 (19) removal (Figure 6-119, view A). Diode CR1 (19) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the

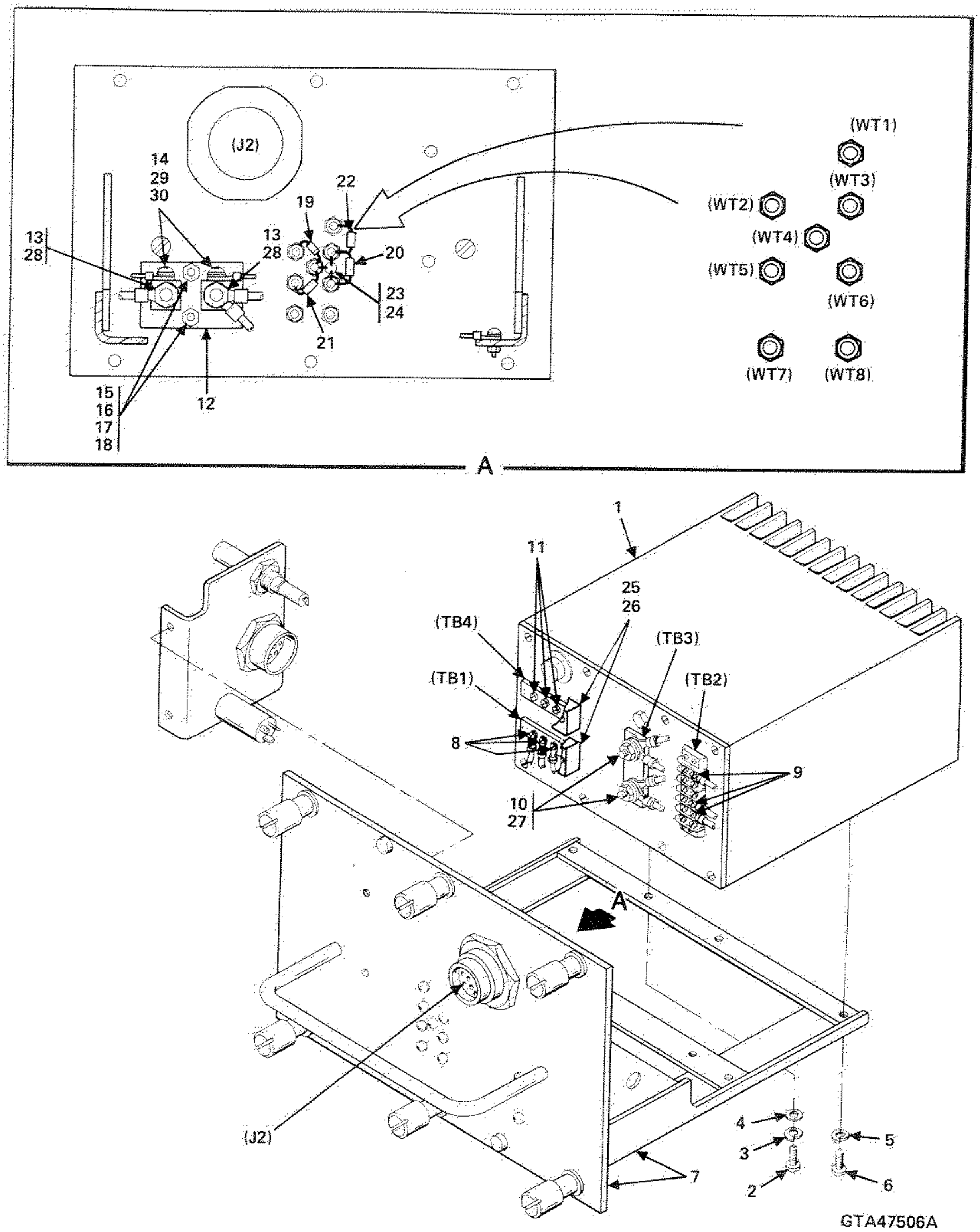


Figure 6-119. +/-15 V Dc Power Supply Assembly (7329140G1)

components mounted on the rear surface of chassis (7).

(2) Observe polarity of CR1 (19). Cathode is connected to standoff WT4.

(3) Unsolder and remove diode CR1 (19) leads from standoffs WT2 and WT4.

d. Resistor R2 (20), R3 (21), or R5 (22) removal (Figure 6-119, view A). Resistors R2 (20) and R5 (22) are electrostatic sensitive components; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (7).

(2) Determine resistor R2 (20), R3 (21), or R5 (22) to be removed. Resistor R2 (20) is connected to standoffs WT3 and WT6. Resistor R3 (21) is connected to standoffs WT4 and WT5. Resistor R5 (22) is connected to standoffs WT1 and WT3.

(3) Unsolder and remove resistor from respective standoffs.

e. Transistor Q1 (23) removal (Figure 6-119, view A). Transistor Q1 (23) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (7).

(2) Note and mark source, gate, and drain connections at standoffs WT6, WT4, and WT3, respectively.

(3) Unsolder and remove transistor Q1 (23) leads from standoffs WT3, WT4, and WT6.

(4) Straighten transistor leads and remove mounting pad (24) from transistor removed. Set mounting pad aside.

2. Assembly procedure (Figure 6-119).

a. Transistor Q1 (23) installation (Figure 6-119, view A). Transistor Q1 (23) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Thread leads of transistor Q1 (23) through the respective holes in mounting pad (24) retained in step 1.e.(4). Bend leads outward at a right angle adjacent to the mounting pad.

(2) Connect transistor, source, gate, and drain leads to standoffs WT6, WT4, and WT3, respectively.

(3) Solder transistor leads to standoffs.

(4) Position transistor Q1 (23) to clear standoffs.

b. Resistor R2 (20), R3 (21), or R5 (22) installation (Figure 6-119, view A). Resistors R2 (20) and R5 (22) are electrostatic sensitive components; observe precautionary procedures found in TO 00-25-234.

(1) Position resistor midway between respective standoffs as follows:

(a) Connect R2 (20) to standoffs WT3 and WT6.

(b) Connect R3 (21) to standoffs WT4 and WT5.

(c) Connect R5 (22) to standoffs WT1 and WT3.

(2) Solder resistor leads to respective standoff terminals.

c. Diode CR1 (19) installation (Figure 6-119, view A). Diode CR1 (19) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Position diode CR1 (19) midway between standoffs WT2 and WT4 with the cathode at the WT4 and as observed in step 1.c.(2).

(2) Connect diode leads to WT2 and WT4.

(3) Solder two connections at WT2 and WT4.

d. Shunt resistor R1 (12) installation (Figure 6-119, view A).

(1) Position resistor R1 (12) on chassis (7) and align two mounting holes.

(2) Secure resistor R1 (12) to chassis (7) two places. Use screws (15), lockwashers (16), flat washers (17), and nuts (18) retained in step 1.b.(5).

(3) Connect wires to resistor terminals 3 and and 4 as labeled in step 1.b.(2). Secure terminals with two screws (14), lockwashers (29), and flat washers (30) retained in step 1.b.(4).

(4) Connect wires to resistor terminals 1 and 2 as labeled in step 1.b.(3).

(5) Secure wires to resistor terminals 1 and 2 with two nuts (13) and lockwasher (28) retained in step 1.b.(3).

e. Power supply PS1 (1) installation.

(1) Install jumper between terminals 2 and 3 of power supply terminal block TB4. Use terminal screws (11) and jumper retained in step 1.a.(7).

(2) Place power supply (1) in approximate mounting position on chassis (7).

(3) Connect wires to terminals of terminal block TB3, as labeled in step 1.a.(4). Secure terminal connections with two terminal nuts (10) and flat washers (27) retained in step 1.a.(6).

(4) Connect wires to terminal of terminal blocks TB1 and TB2 as labeled in step 1.a.(4). Secure respective terminal connections with terminal screws (8) and (9) retained in step 1.a.(5).

(5) Install terminal block covers (25) on terminal blocks TB1 and TB4. Secure covers with two screws (26) each. Terminal covers and screws were retained in step 1.a.(3).

(6) Position power supply PS1 (1) on chassis (7) and align four mounting holes. Secure four places as follows:

(a) Secure two places with screws (5) and lockwasher (6) retained in step 1.a.(1).

(b) Secure two places with screws (2), lockwashers (3), and flat washers (4) retained in step 1.a.(1).

3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

6-13.3 Fan Assembly (7343842G1).

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

6-13.3.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25ac
Wrench, box/open,set (5/16 in - 1-5/8 in)	1	32a

6-13.3.2 Procedure.

1. Disassembly procedure (Figure 6-120).

a. Filter element removal. Perform the following steps to remove filter element (1). Remove the filter element to gain access to fan assembly mounting hardware or to clean or replace filter element.

(1) Disengage two clips (2) that secure filter retainer (3) to fan chassis (4).

(2) Remove filter retainer (3) from filter rack.

(3) Remove filter element (1) by sliding it out of the filter rack.

(4) Retain filter element (1) and filter retainer (3).

b. Fan assembly (5) removal. Perform the following steps to remove fan assemblies B1, B2, and/or B3. Only fan assembly B1 is shown removed from chassis in Figure 6-120. Fan assemblies B2 and B3 are mounted in the same manner.

(1) Make sure that the filter element is removed as described in step 1.a.

(2) Select fan assembly B1, B2, or B3 (5) to be removed (Figure 6-120).

(3) Remove terminal block cover (6) secured by two spring clips (7) (Figure 6-120, exploded view A). Retain terminal block cover.

(4) Remove 3 terminal binding screws (8) that secure fan motor red, blue, and yellow power wires at terminal block TB1 (9), terminals 1, 3, and 5, respectively. Retain terminal binding screws.

(5) Remove screws (10), lockwashers (12), two flat washers (13), and nuts (11) two places that secure fan assembly (5) and fan guard (14) to fan chassis (4). Retain mounting hardware.

(6) Remove fan guard (14) from underside of fan chassis (4). Retain fan guard.

(7) Remove screw (15) and lockwasher (16) that secure the ground wires to fan assembly (5) being removed. Retain ground screw.

(8) Remove fan assembly (5).

2. Assembly procedure (Figure 6-120).

a. Installation of fan assembly (5).

(1) Place fan assembly B1, B2, or B3 (5) over opening in fan chassis (4).

(2) Connect ground wires to ground lug on side of fan assembly housing; secure with screw (15) and lockwasher (16) retained in step 1.b.(7).

(3) Place fan guard (14) under bottom side of fan chassis (4) and align 2 mounting loops in fan guard (14), fan chassis (4), and fan assembly (5).

(4) Secure fan assembly (5) and fan guard (14) to fan chassis (4) using mounting hardware retained in step 1.b.(5).

(a) Place two flat washers (13) on screw (10). Prepare both mounting screws in the same manner.

(b) Insert screws through mounting loops in the fan guard (14), fan chassis (4), and fan assembly (5). Arrange flat washers (13) to captivate the fan guard with a flat washer on each side of the guard.

(c) Secure assembly using lockwasher (12) and nut (11).

(5) Connect red, blue, and yellow fan motor wires to terminal block TB1 (9), terminals 1, 3, and 5, respectively. Make certain that wires from the other fan assemblies are connected also.

CAUTION

EQUIPMENT DAMAGE HAZARD

Check assembly for pinched and/or chafed wires that could result in short circuits or grounds.

(6) Install terminal block cover (6) on terminal block TB1 (9); secure with spring clips (7).

b. Filter element installation.

(1) Slide filter element (1) into filter rack, observing direction of flow arrow marked on filter frame. Direction of flow is toward the fan chassis.

(2) Place filter retainer (3) over two mounting studs to captivate the filter with the retainer flange. Secure filter retainer to chassis with two slide clips.

3. Post repair checkout.

a. Check for chafed and/or pinched wires.

b. Check that all motor wires are reconnected to the correct terminals.

c. Apply rated power to fan assembly. Verify that all fans rotate in the same direction. If not, remove power and check for reversed wiring at TB1. Correct as necessary and retest.

6-13.4 +/-60 V Dc Power Supply Assembly (7343908G1).

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. Electrostatic sensitive components are identified throughout this procedure.

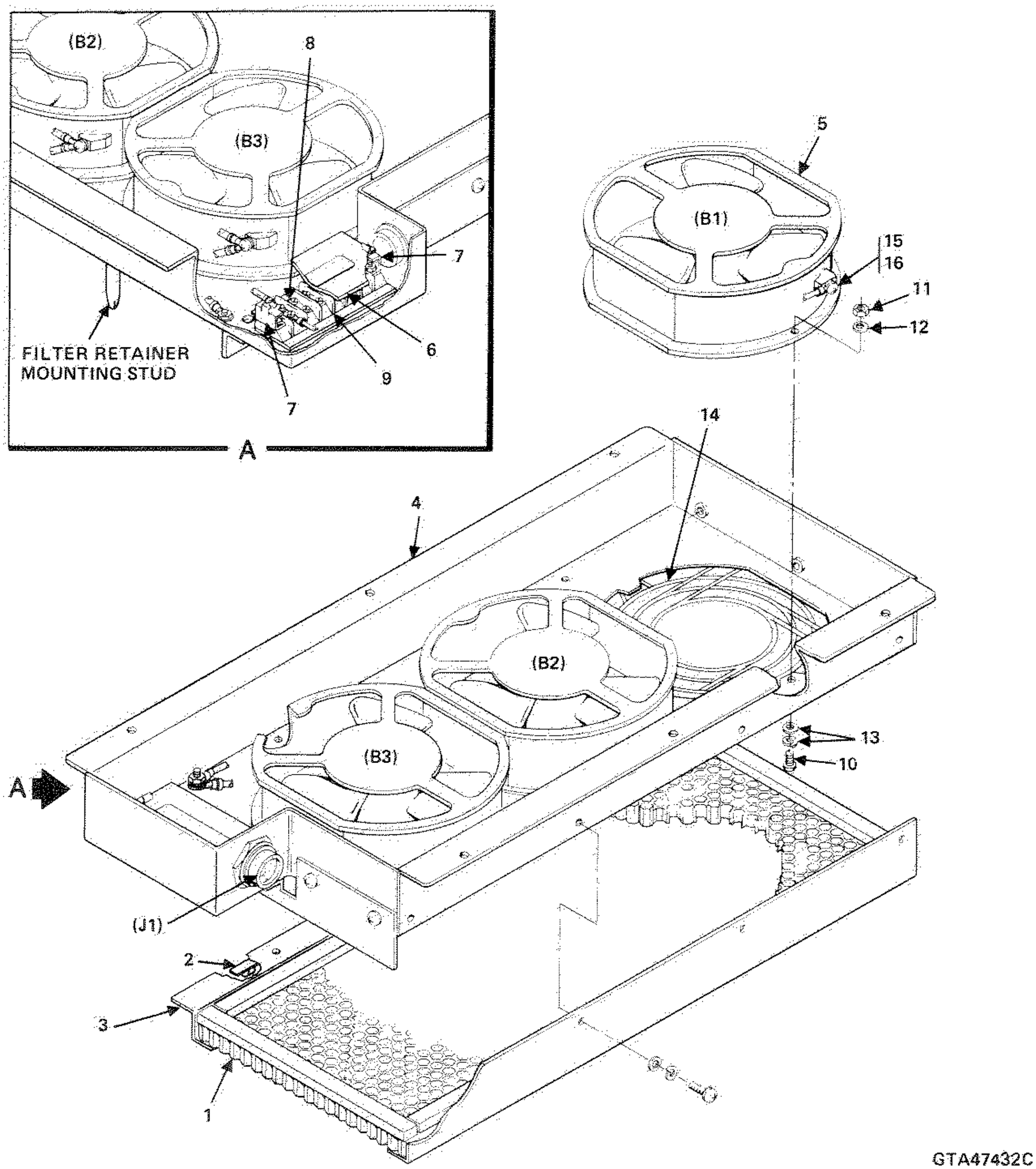


Figure 6-120. Fan Assembly (7343842G1)

6-13.4.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade 6 in	1	25ad
Screwdriver, flat blade 10 in	1	25at
Soldering station	1	29e
Static control work station	1	33c
Wrench, box/open,set (5/16 in - 1-5/8 in)	1	32a
Wrist strap	1	33i

6-13.4.2 Procedure.

1. Disassembly procedure (Figure 6-121). To service components mounted on the rear surface of the power supply chassis (5), it is necessary to first remove power supply PS1 (1).

a. Power supply PS1 (1) removal.

(1) Remove power supply PS1 (1) mounting screw (2), lockwasher (3), and flat washer (4) four places. Set screws and washers aside.

(2) Separate power supply PS1 (1) far enough from chassis (5) to gain access to power supply PS1 (1) terminal blocks.

(3) Remove terminal block covers (23) from terminal blocks TB1 and TB4 by removing two screws (24) for each cover. Set covers and screws aside.

(4) Note wires connected to power supply PS1 (1) terminal blocks TB1, 2, and 3. Label connecting wires as necessary with terminal identification markers.

(5) Disconnect connecting wires from terminal blocks TB1 and TB2 by removing terminal screws (6) and (7), respectively. Set terminal screws aside.

(6) Disconnect connecting wires from terminal block TB3 by removing two terminal nuts (8) and flat washers (25). Set terminal nuts and washers aside. Remove connecting wires from terminal block TB3.

(7) Remove jumper from terminal block TB4 only if power supply PS1 (1) is to be replaced. Remove three terminal screws (9) from terminal block TB4. Set screws and jumper aside.

(8) Remove power supply PS1 (1) from chassis (5). Set aside if it is to be reused.

b. Shunt resistor R1 (10) removal (Figure 6-121, view A).

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Note wires connected to terminals 1 through 4 of resistor R1 (10). Label connecting wires as necessary with terminal identification markers.

(3) Remove terminal nuts (11) and lockwashers (26) from resistor R1 (10) terminals 1 and 2. Remove connecting wires from terminal studs and set terminal nuts and washers aside.

(4) Disconnect wires from resistor R1 (10) terminals 3 and 4 by removing two screws (12), lockwashers (27), and flat washers (28). Set screws and washers aside.

(5) Remove resistor R1 (10) from chassis (5) by removing screw (13), lockwasher (14), and flat washer (15), and nut (16) two places. Set screws, washers, and nuts aside.

(6) Remove resistor R1 (10) from chassis (5).

c. Diode CR1 (17) removal (Figure 6-121, view A). Diode CR1 (17) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Observe polarity of CR1 (17). Cathode is connected to standoff WT4.

(3) Unsolder and remove diode CR1 (17) leads from standoffs WT2 and WT4.

d. Resistor R2 (18), R3 (19), or R5 (20) removal (Figure 6-121, view A). Resistors R2 (18) and R5 (20) are electrostatic sensitive components; observe precautionary procedures found in TPO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

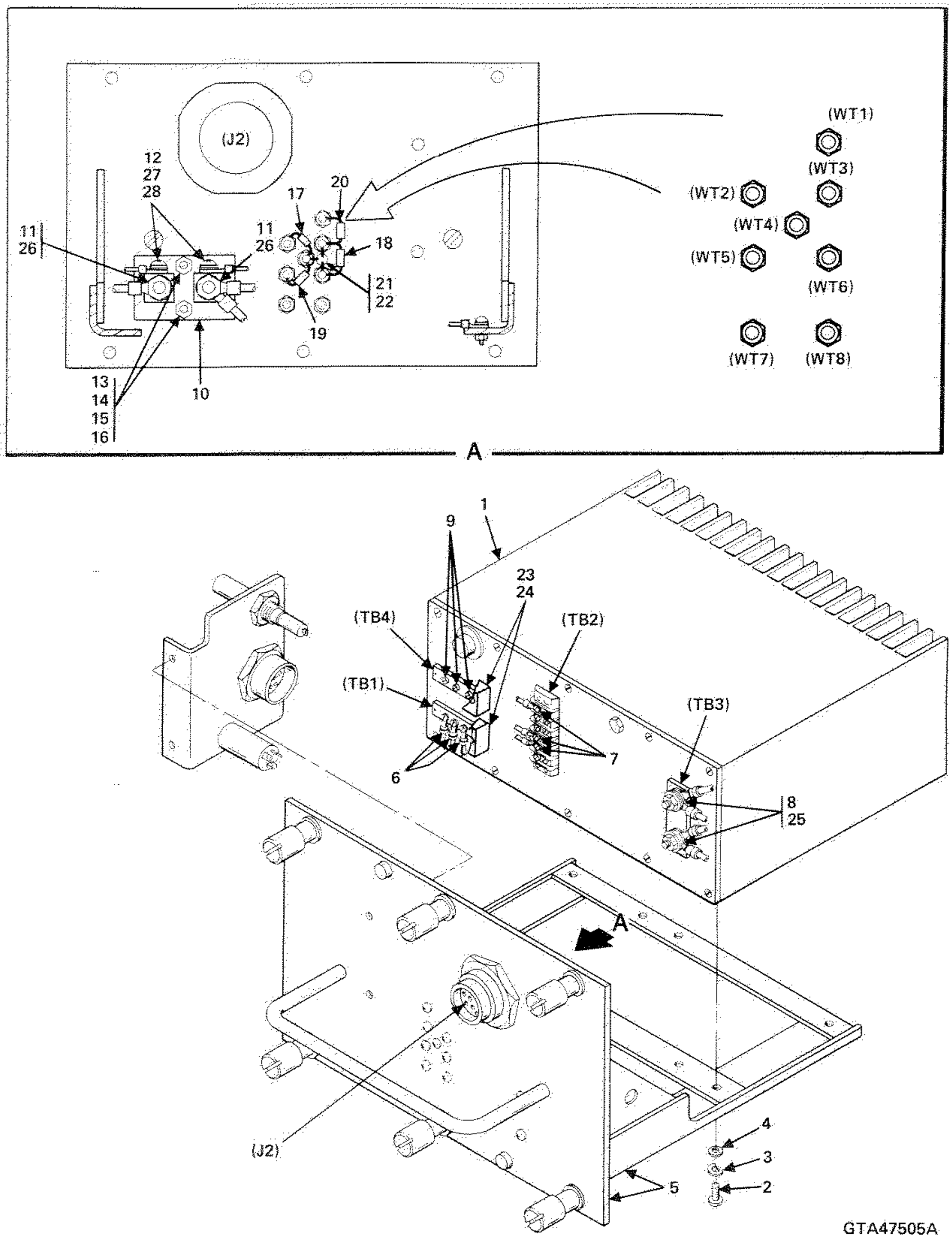


Figure 6-121. +/-60 V Dc Power Supply Assembly (7343908G1)

(2) Determine resistor R2 (18), R3 (19), or R5 (20) is to be removed. Resistor R2 (18) is connected to standoffs WT3 and WT6. Resistor R3 (19) is connected to standoffs WT4 and WT5. Resistor R5 (20) is connected to standoffs WT1 and WT3.

(3) Unsolder and remove resistor from respective standoffs.

e. Transistor Q1 (21) removal (Figure 6-121, view A). Transistor Q1 (21) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a. (1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Note and mark source, gate, and drain connections at standoffs WT6, WT4, and WT3, respectively.

(3) Unsolder and remove transistor Q1 (21) leads from standoffs WT3, WT4, and WT6.

(4) Straighten transistor leads and remove mounting pad (22) from transistor removed. Set mounting pad aside.

2. Assembly procedure (Figure 6-121).

a. Transistor Q1 (21) installation (Figure 6-121, view A). Transistor Q1 is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Thread leads of transistor Q1 (21) through the respective holes in mounting pad (22) retained in step 1.e.(4). Bend leads outward at a right angle adjacent to the mounting pad.

(2) Connect transistor, source, gate, and drain leads to standoffs WT6, WT4, and WT3, respectively.

(3) Solder transistor leads to standoffs.

(4) Position transistor Q1 (21) to clear standoffs.

b. Resistor R2 (18), R3 (19), or R5 (20) installation (Figure 6-121, view A). Resistors R2 (18) and R5 (20) are electrostatic sensitive components; observe precautionary procedures found in TO 00-25-234.

(1) Position resistor midway between respective standoffs as follows:

(a) Connect R2 (18) to standoffs WT3 and WT6.

(b) Connect R3 (19) to standoffs WT4 and WT5.

(c) Connect R5 (20) to standoffs WT1 and WT3.

(2) Solder resistor leads to respective standoff terminals.

c. Diode CR1 (17) installation (Figure 6-121, view A). Diode CR1 (17) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Position diode CR1 (17) midway between standoffs WT2 and WT4 with the cathode at the WT4 end as observed in step 1.c(2).

(2) Connect diode leads to WT2 and WT4.

(3) Solder two connections at WT2 and WT4.

d. Shunt resistor R1 (10) installation (Figure 6-121, view A).

(1) Position resistor R1 (10) on chassis (5) and align two mounting holes.

(2) Secure resistor R1 (10) to chassis (5) two places. Use screws (13), lockwashers (14), flat washer (15), and nut (16) retained in step 1.b.(5).

(3) Connect wires to resistor terminals 3 and 4 as labeled in step 1.b.(2). Secure terminals with two screws (12), lockwashers (27), and flat washers (28) retained in step 1.b.(4).

(4) Connect wires to resistor terminals 1 and 2 as labeled in step 1.b.(2).

(5) Secure wires to terminals 1 and 2 with two nuts (11) and lockwashers (26) retained in step 1.b.(3).

e. Power supply PS1 (1) installation.

(1) Install jumper between terminals 1, 2, and 3 of power supply terminal block TB4. Use terminal screws (9) and jumper retained in step 1.a.(7).

(2) Place power supply PS1 (1) in approximate mounting position on chassis (5).

(3) Connect wires to terminals of terminal block TB3, as labeled in step 1.a.(4). Secure terminal connections with two terminal nuts (8) and flat washers (25) retained in step 1.a.(6).

(4) Connect wires to terminals of terminal blocks TB1 and TB2 as labeled in step 1.a.(4). Secure respective terminal connections with terminal screws (6) and (7) retained in step 1.a.(5).

(5) Install terminal block covers (23) on terminal blocks TB1 and TB4. Secure covers with two screws (24) each. Terminal covers and screws were retained in step 1.a.(3).

(6) Position power supply PS1 (1) on chassis (5) and align four mounting holes. Secure four places with screws (2), lockwashers (3), and flat washers (4) retained in step 1.a.(1).

3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

6-13.5 +24 V Dc Power Supply Assembly (7343910G1).

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. Electrostatic sensitive components are identified throughout this procedure.

6-13.5.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade 6 in	1	25ad
Screwdriver, flat blade 10 in	1	25at
Soldering station	1	29e
Static control work station	1	33c
Wrench, box/open, set (5/16 in - 1-5/8 in)	1	32a
Wrist strap	1	33i

6-13.5.2 Procedure.

1. Disassembly procedure (Figure 6-122). To service components mounted on t he rear surface of the power supply chassis (5), it is necessary to first remove power supply PS1 (1).

a. Power supply PS1 (1) removal.

(1) Remove power supply PS1 (1) mounting screw (2), lockwasher (3), and flat washer (4) four places. Set screws and washers aside.

(2) Separate power supply PS1 (1) far enough from chassis (5) to gain access to power supply PS1 (1) terminal blocks.

(3) Remove terminal block covers (23) from terminal blocks TB1 and TB4 by removing two screws (24) for each cover. Set covers and screws aside.

(4) Note wires connected to power supply PS1 (1) terminal blocks TB1, 2, and 3. Label connecting wires as necessary with terminal identification markers.

(5) Disconnect connecting wires from terminal blocks TB1 and TB2 by removing terminal screws (6) and (7), respectively. Set terminal screws aside.

(6) Disconnect connecting wires from terminal block TB3 by removing two terminal nuts (8) and flat washers (25). Set terminal nuts and washers aside. Remove connecting wires from terminal block TB3.

(7) Remove jumper from terminal block TB4 only if power supply PS1 (1) is to be replaced. Remove three terminal screws (9) from terminal block TB4. Set screws and jumper aside.

(8) Remove power supply PS1 (1) from chassis (5). Set aside if it is to be reused.

b. Shunt resistor R1 (10) removal (Figure 6-122, view A).

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Note wires connected to terminals 1 through 4 of resistor R1 (10). Label connecting wires as necessary with terminal identification markers.

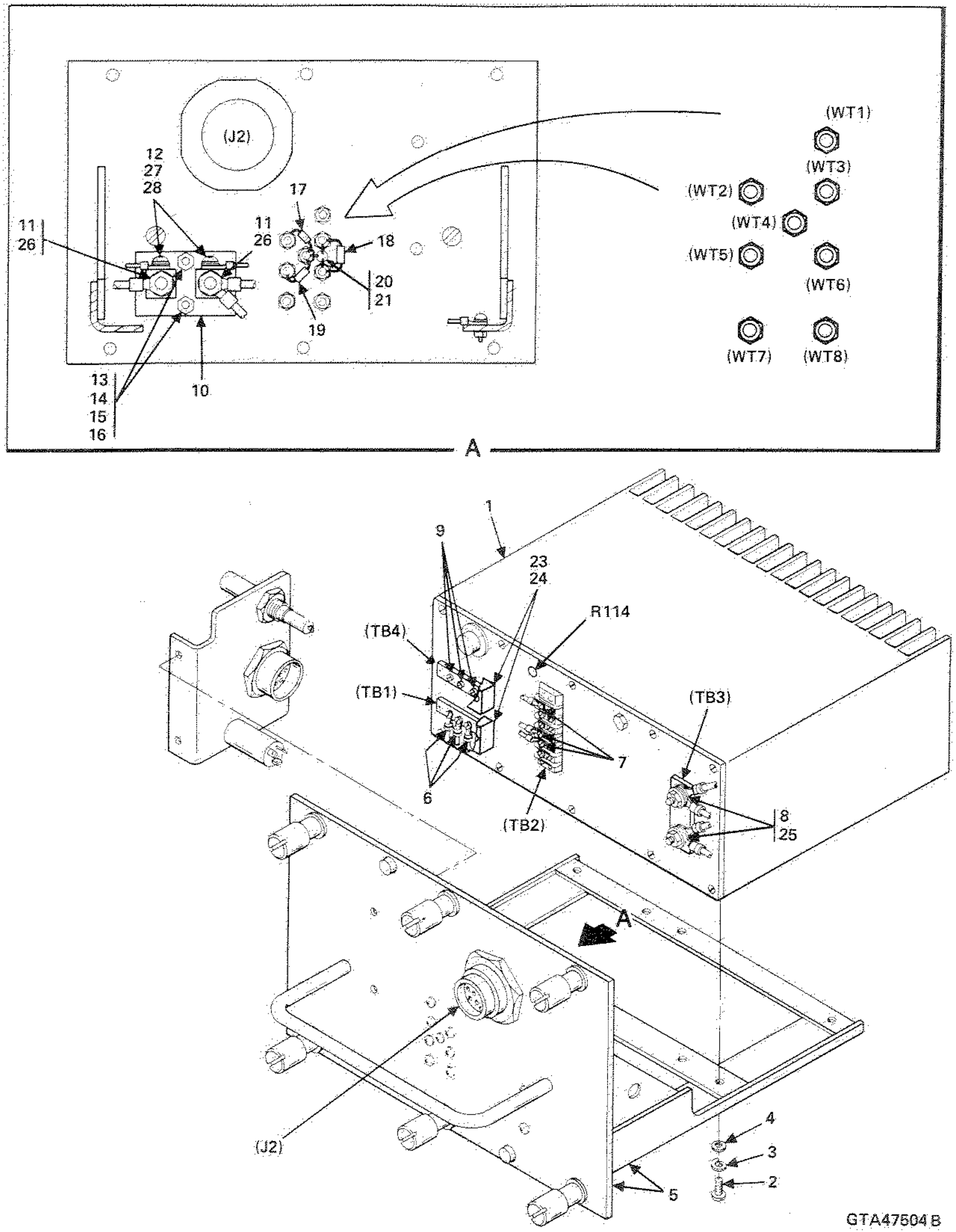


Figure 6-122. +24 V Dc Power Supply Assembly (7343910G1)

(3) Remove terminal nuts (11) and lockwashers (26) from resistor R1 (10) terminals 1 and 2. Remove connecting wires from terminal studs and set terminal nuts and washers aside.

(4) Disconnect wires from resistor R1 (10) terminals 3 and 4 by removing two screws (12), lockwashers (27), and flat washers (28). Set screws and washers aside.

(5) Remove resistor R1 (10) from chassis (5) by removing screw (13), lockwasher (14), flat washer (15), and nut (16) two places. Set screws, washers, and nuts aside.

(6) Remove resistor R1 (10) from chassis (5).

c. Diode CR1 (17) removal (Figure 6-122, view A). Diode CR1 (17) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Observe polarity of CR1 (17). Cathode is connected to standoff WT4.

(3) Unsolder and remove diode CR1 (17) leads from standoffs WT2 and WT4.

d. Resistor R2 (18) or R3 (19) removal (Figure 6-122, view A). Resistor R2 (18) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Determine resistor R2 (18) or R3 (19) to be removed. Resistor R2 (18) is connected to standoffs WT3 and WT6. Resistor R3 (19) is connected to standoffs WT4 and WT5.

(3) Unsolder and remove resistor from respective standoffs.

e. Transistor Q1 (20) removal (Figure 6-122, view A). Transistor Q1 (20) is an electrostatic sensitive component; observe precautionary procedures found in TO-00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Note and mark source, gate, and drain connections at standoffs WT6, WT4, and WT3, respectively.

(3) Unsolder and remove transistor Q1 (20) leads from standoffs WT3, WT4, and WT6.

(4) Straighten transistor leads and remove mounting pad (21) from transistor removed. Set mounting pad aside.

2. Assembly procedure (Figure 6-122).

a. Transistor Q1 (20) installation (Figure 6-122, view A). Transistor Q1 (20) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Thread leads of transistor Q1 through the respective holes in mounting pad (21) retained in step 1.e.(4). Bend leads outward at a right angle adjacent to the mounting pad.

(2) Connect transistor, source, gate, and drain leads to standoffs WT6, WT4, and WT3, respectively.

(3) Solder transistor leads to standoffs.

(a) Position transistor Q1 (20) to clear standoffs.

b. Resistor R2 (18) or R3 (19) installation (Figure 6-122, view A). Resistor R2 (18) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Position resistor midway between respective standoffs as follows:

(a) Connect R2 (18) to standoffs WT3 and WT6.

(b) Connect R3 (19) to standoffs WT4 and WT5.

(2) Solder resistor leads to respective standoff terminals.

c. Diode CR1 (17) installation (Figure 6-122), view A). Diode CR1 (17) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Position diode CR1 (17) midway between standoffs WT2 and WT4 with the cathode at the WT4 end as observed in step 1.c.(2).

(2) Connect diode leads to WT2 and WT4.

(3) Solder two connections at WT2 and WT4.

d. Shunt resistor R1 (10) installation (Figure 6-122, view A).

(1) Position resistor R1 (10) on chassis (5) and align two mounting holes.

(2) Secure resistor R1 (10) to chassis (5) two places. Use screws (13), lockwashers (14), flat washers (15), and nut (16) retained in step 1.b.(5).

(3) Connect wires to resistor terminals 3 and 4 as labeled in step .b.(2). Secure terminals with two screws (12), lockwashers (27), and flat washers (28) retained in step 1.b.(4).

(4) Connect wires to resistor terminals 1 and 2 as labeled in step 1.b.(2).

(5) Secure wires to terminals 1 and 2 with two nuts (11) and lockwashers (26) retained in step 1.b.(3).

e. Power supply PS1 (1) installation.

NOTE

Inspect PS1 terminal board TB2 terminals 1 through 4 for external straps. Remove all straps if supplied.

(1) Install jumper between terminals 1, 2, and 3 of power supply terminal block TB4. Use terminal screws (9) and jumper retained in step 1.a.(7).

(2) Place power supply PS1 (1) in approximate mounting position on chassis (5).

(3) Connect wires to terminals of terminal block TB3, as labeled in step 1.a.(4). Secure terminal connections with two terminal nuts (8) and lockwashers (25) retained in step 1.a.(6).

(4) Connect wires to terminals of terminal blocks TB1 and TB2 as labeled in step 1.a.(4). Secure respective terminal connections with terminal screws (6) and (7) retained in step 1.a.(5).

(5) Install terminal block covers (23) on terminal blocks TB1 and TB4. Secure covers with two screws (24) each. Terminal covers and screws were retained in step 1.a.(3).

(6) Position power supply PS1 (1) on chassis (5) and align four mounting holes. Secure four places with screws (2), lockwashers (3), and flat washers (4) retained in step 1.a.(1).

3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

6-13.6 +5 V Dc Power Supply Assembly (7343912G1).

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. Electrostatic sensitive components are identified throughout this procedure.

6-13.6.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25aa
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade 6 in	1	25ad
Screwdriver, flat blade 10 in	1	25at
Soldering station	1	29e
Static control work station	1	33c
Marker, wire	A/R	31k
Wrench, box/open, set (]5/16 in - 1-5/8 in)	1	32a
Wrist strap	1	33i

6-13.6.2 Procedure.

1. Disassembly procedure (Figure 6-123). To service components mounted on the rear surface of the power supply chassis (7), it is necessary to first remove power supply PS1 (1).

a. Power supply PS1 (1) removal.

(1) Remove power supply PS1 (1) from chassis (7) as follows:

(a) Remove mounting screw (2), lockwasher (3), and flat washer (4) two places.

(b) Remove screw (5) and lockwasher (6) two places.

(c) Set screws and washers aside.

(2) Separate power supply PS1 (1) far enough from chassis (7) to gain access to power supply PS1 (1) terminal blocks.

(3) Remove terminal block covers (24) from terminal blocks TB1 and TB4 by removing two screws (25) for each cover. Set covers and screws aside.

(4) Note wires connected to power supply PS1 (1) terminal blocks TB1, 2, and 3. Label connecting wires as necessary with terminal identification markers.

(5) Disconnect connecting wires from terminal blocks TB1 and TB2 by removing terminal screws (8) and (9), respectively. Set terminal screws aside.

(6) Disconnect connecting wires from terminal block TB3 by removing two erminal nuts (10) and flat washers (26). Set terminal nuts and washers aside. Remove connecting wires from terminal block TB3.

(7) Remove jumper from terminal block TB4 only if power supply PS1 (1) is to be replaced. Remove two terminal screws (1) from terminal block TB4. Set screws and jumper aside.

(8) Remove power supply PS1 (1) from chassis (7). Set aside if it is to be reused.

b. Shunt resistor R1 (12) removal (Figure 6-123, view A).

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (7).

(2) Note wires connected to terminals 1 through 4 of resistor R1 (12). Label connecting wires as necessary with terminal identification markers.

(3) Remove terminal nuts (13) and lockwashers (27) from resistor R1 (12) terminals 1 and 2. Remove connecting wires from terminal studs and set terminal nuts and washers aside.

(4) Disconnect wires from resistor R1 (12) terminals 3 and 4 by removing two screws (14), lockwashers (28), and flat washer (29). Set screws aside.

(5) Remove resistor R1 (12) from chassis (7) by removing screw (15), lockwasher (16), flat washer (17), and nut (18) two places. Set screws, washers, and nuts aside.

(6) Remove resistor R1 (12) from chassis (7).

c. Diode CR1 (19) removal (Figure 6-123, view A). Diode CR1 (19) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (5).

(2) Observe polarity of CR1 (19). Cathode is connected to standoff WT4.

(3) Unsolder and remove diode CR1 (19)leads from standoffs WT2 and WT4.

d. Resistor R2 (20) or R3 (21) removal (Figure 6-123, view A). Resistor R2 (20) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (7).

(2) Determine resistor R2 (20) or R3 (21) to be removed. Resistor R2 (20) is connected to standoffs WT3 and WT6. Resistor R3 (21) is connected to standoffs WT4 and WT5.

(3) Unsolder and remove resistor from respective standoffs.

e. Transistor Q1 (22) removal (Figure 6-123, view A). Transistor Q1 (22) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Remove power supply PS1 (1) as described in steps 1.a.(1) and (2). This provides space enough to work on the components mounted on the rear surface of chassis (7).

(2) Note and mark source, gate, and drain connections at standoffs WT6, WT4, and WT3, respectively.

(3) Unsolder and remove transistor Q1 (22) leads from standoffs WT3, WT4, and WT6.

(4) Straighten transistor leads and remove mounting pad (23) from transistor removed. Set mounting pad aside.

2. Assembly procedure (Figure 6-123).

a. Transistor Q1 (22) installation (Figure 6-123, view A). Transistor Q1 (22) is an

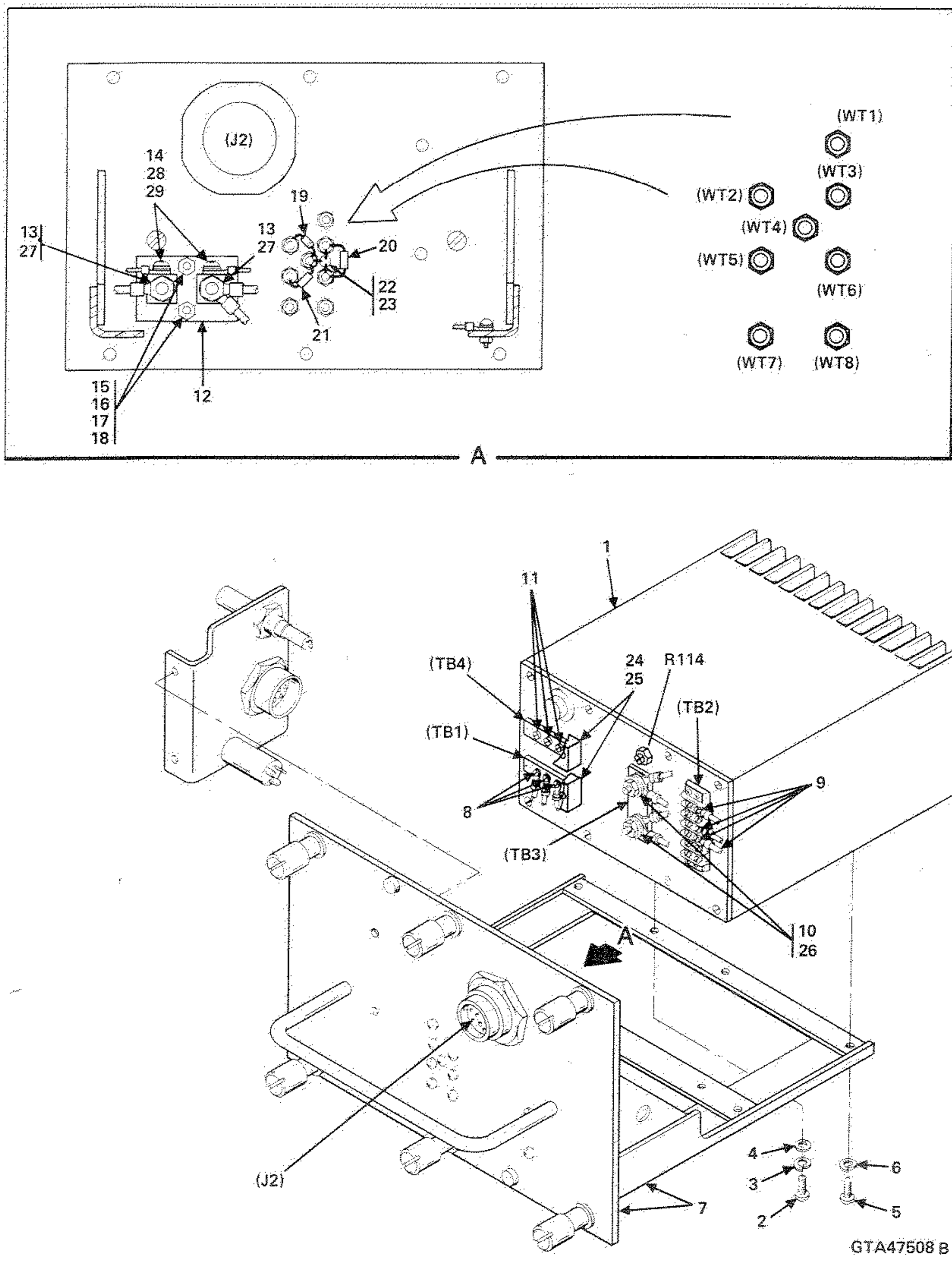


Figure 6-123. +5 V Dc Power Supply Assembly (7343912G1)

electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Thread leads of transistor Q1 (22) through the respective holes in mounting pad (23) retained in step 1.e.(4). Bend leads outward at a right angle adjacent to the mounting pad.

(2) Connect transistor, source, gate, and drain leads to standoffs WT6, WT4, and WT3, respectively.

(3) Solder transistor leads to standoffs.

(4) Position transistor Q1 (22) to clear standoffs.

b. Resistor R2 (20) or R3 (21) installation (Figure 6-123, view A). Resistor R2 (20) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

(1) Position resistor midway between respective standoffs as follows;

(a) Connect R2 (20) to standoffs WT3 and WT6.

(b) Connect R3 (21) to standoffs WT4 and WT5.

(2) Solder resistor leads to respective standoff terminals.

c. Diode CR1 (19) installation (Figure 6-123, view A). Diode CR1 (19) is an electrostatic sensitive component; observe precautionary procedures found in TO 00-25-234.

d. Position diode CR1 (19) midway between standoffs WT2 and WT4 with the cathode at the WT4 end as observed in step 1.c(2).

e. Connect diode leads to WT2 and WT4.

f. Solder two connections at WT2 and WT4.

g. Shunt resistor R1 (12) installation (Figure 6-123, view A).

(1) Position resistor R1 (12) on chassis (7) and align two mounting holes.

(2) Secure resistor R1 (12) to chassis (7) two places. Use screws (15), lockwashers (16), flat washers (17), and nuts (18) retained in step 1.b.(5).

(3) Connect wires to resistor terminals 3 and 4 as labeled in step 1.b.(2). Secure terminals with two screws (14), lockwashers (28), and flat washers (29) retained in step 1.b.(4).

(4) Connect wires to resistor terminals 1 and 2 as labeled in step 1.b.(3).

(5) Secure wires to resistor terminals 1 and 2 with two nuts (13) and lockwashers (27) retained in step 1.b.(3).

h. Power supply PS1 (1) installation.

(1) Install jumper between terminals 1 and 3 of power supply terminal block TB4. Use terminal screws (11) and jumper retained in step 1.a.(7).

(2) Place power supply (1) in approximate mounting position on chassis (7).

(3) Connect wires to terminals of terminal block TB3, as labeled in step 1.a.(4). Secure terminal connections with two terminal nuts (10) and flat washers (26) retained in step 1.a.(6).

(4) Connect wires to terminals of terminal blocks TB1 and TB2 as labeled in step 1.a.(4). Secure respective terminal connections with terminal screws (8) and (9) retained in step 1.a.(5).

(5) Install terminal block covers (24) on terminal blocks TB1 and TB4. Secure covers with two screws (25) each. Terminal covers and screws were retained in step 1.a.(3).

(6) Position power supply PS1 (1) on chassis (7) and align four mounting holes. Secure four places as follows:

(a) Secure two places with screws (5) and lockwasher (6) retained in step 1.a.(1).

(b) Secure two places with screws (2), lockwashers (3), and flat washers (4) retained in step 1.a.(1).

3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

6-13.7 +/-15/25 V Ac-to-Dc Converter (7344735G1).

WARNING

PERSONNEL INJURY HAZARD

Ac-to-dc converter weighs 80 pounds. Mechanical or two person lift is required while handling this equipment.

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

6-13.7.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Screwdriver, cross-tip	1	25ac
Screwdriver, flat blade (29 in)	1	25ai
Soldering station	1	29e
Wrench, box/open, set (5/16 in - 1-5/8 in)	1	32a

6-13.7.2 Procedure.

1. Disassembly procedure (Figure 6-124).
   a. Rectifiers CR1 through CR4 (1) removal.
      (1) Determine which rectifier CR1 through CR4 (1) is to be removed.
      (2) Note wires connected to five terminals of rectifier (1) to be removed. Label connecting wires as necessary with terminal identification markers.
      (3) Unsolder and disconnect wires at five rectifier terminals.
      (4) Remove screw (2), lockwasher (3), and nut (4) two places. In addition to these fasteners, flat washer (5) is used on the terminal 5 end of the rectifier. Set mounting hardware aside.
      (5) Remove rectifier (1) from front panel (6).
   b. Transformer T1 (7) removal.
      (1) Place converter face down on bench surface. The converter is supported by its handles allowing access to the screw heads in the front panel (6). In this position the transformer does not shift when the mounting hardware is removed.
      (2) Remove screw (8), lockwasher (9), and flat washer (10), four places to remove safety cover (11) from transformer T1 (7). Set safety cover and mounting hardware aside.
      (3) Note wires connected to 15 transformer terminals. Label connecting wires as necessary with terminal identification markers.
      (4) Unsolder and disconnect wires at 15 transformer terminals.
      (5) Remove transformer mounting screw (12), lockwasher (13), and flat washer (14) four places. Set mounting hardware aside.
      (6) Remove transformer T1 (7) from front plate (6).
2. Assembly procedure (Figure 6-124).
   a. Transformer T1 (7) installation.
      (1) Position transformer T1 (7) on front plate (6) and align four mounting holes.
      (2) Secure transformer T1 to front plate four places using screws (12), lockwashers (13), and flat washers (14) retained in step 1.b.(5).
      (3) Connect and solder connecting wires to respective transformer terminals 15 places as labeled in step 1.b.(3).
      (4) Place safety cover (11) on rear of transformer and secure four places with screws (8), lockwashers (9), and flat washer (10) retained in step 1.b.(1).
   b. Rectifier CR1 through CR4 (1) installation.
      (1) Position rectifier (1) on front plate (6). Secure to front plate two places with screws (2), lockwashers (3), and nuts (4) retained in step 1.a.(4). Mounting hardware next to rectifier terminal 5 receives flat washer (5), also.
      (2) Connect and solder connecting wires to respective rectifier terminals as labeled in step 1.a.(2).
3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

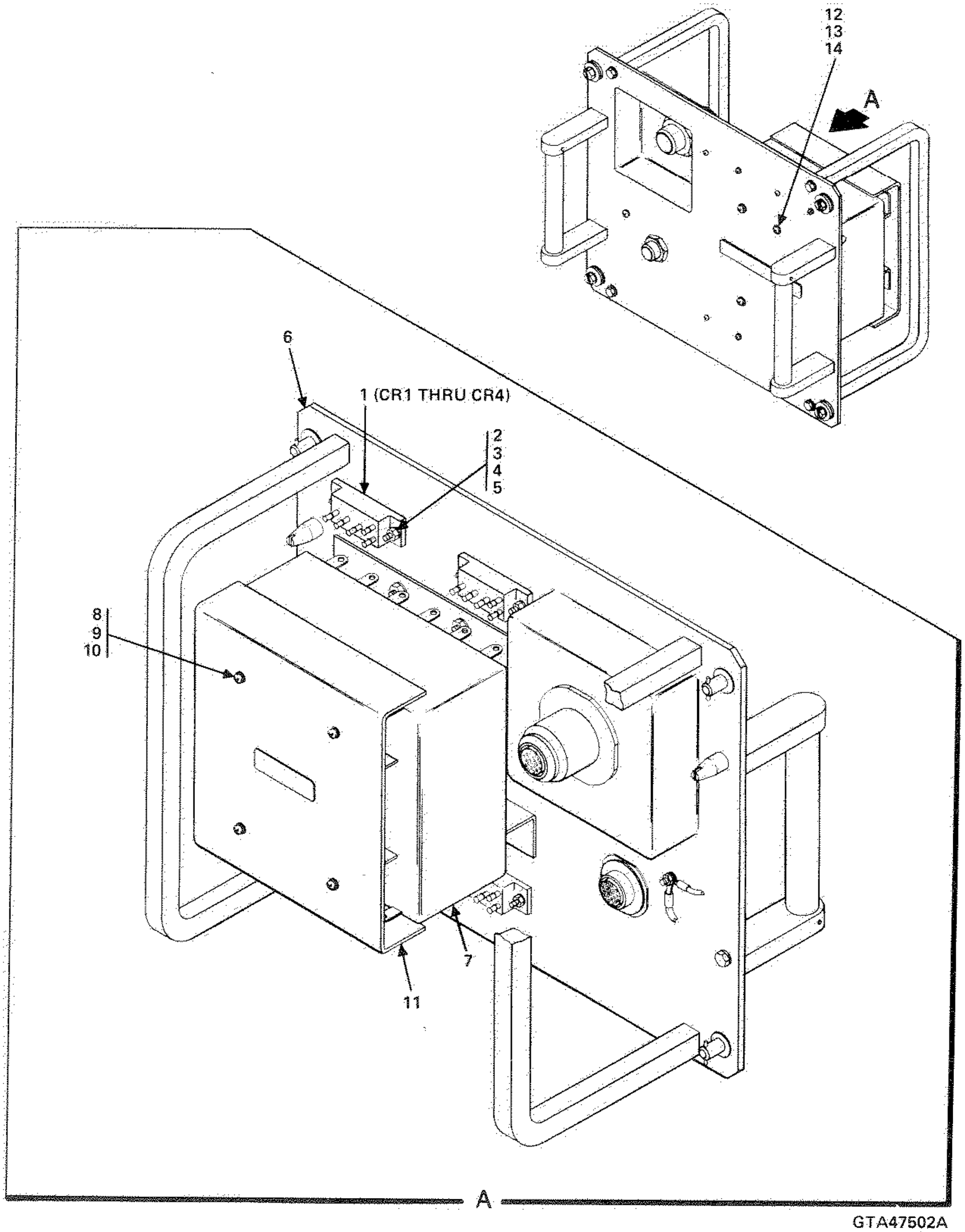


Figure 6-124. +/-15/25 V Ac-to-Dc Converter (7344735G1)

6-13.8 Fan Assembly (7344993G1).

6-13.8.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Screwdriver, cross-tip	1	25ac
Wrench, box/open, set (5/16 in - 1-5/8 in)	1	32a

6-13.8.2 Procedure.

1. Disassembly procedure (Figure 6-125).
   a. Inlet fan guard (1) removal procedure.
      (1) Place fan assembly chassis (2) face down on work surface exposing inlet side of fan and terminal block assemblies.
      (2) Determine fan guard (1) to be removed.
      (3) Remove fan guard retaining nut (3), lockwasher (4), flat washer (5), and screw (6) four places and set aside.
      (4) Remove fan guard and set aside if it is to be reused.
   b. Fan assembly B1 or B2 removal.
      (1) Determine fan assembly B1 of B2 (7) to be removed.
      (2) Remove inlet fan guard (1) as described in step 1.a.
      (3) Remove terminal block cover (10). Terminal block cover is retained by two spring clips (11).
      (4) Remove three terminal binding screws (12) from terminal block TB1 (13) terminals 1, 2, and 3. (These screws secure the red, blue, and yellow fan wires, respectively.) Set screws aside.
      (5) Place fan assembly chassis on edge and remove discharge fan guard (14), fan mounting nut (15), lockwasher (16), flat washer (17), and screw (18) four places. Set mounting hardware and fan guard aside.
      (6) Remove fan assembly (7).
2. Assembly procedure (Figure 6-125).
   a. Fan assembly B1 or B2 (7) installation.
      (1) Position fan assembly (7) against fan chassis (2) align four mounting holes.
      (2) Position discharge fan guard (14) against fan chassis aligning four mounting loops.
      (3) Secure fan guard (14) and fan assembly (7) to fan chassis (2) four places. Secure using screws (18), flat washers (17), lockwashers (16), and nuts (15) retained in step 1.b.(4).
      (4) Check for pinched and/or chafed wires resulting from reassembly in the previous step.
      (5) Connect red, blue, and yellow fan wires to terminal block TB1 (13) terminals 1, 2, and 3, respectively. Secure with terminal binding screws (12) retained in step 1.a.(5).
      (6) Position terminal block cover (10) on terminal block TB1 (13); secure in place with two spring clips (11).
   b. Inlet fan guard (1) installation.
      (1) Place fan chassis (2) face down on work surface.
      (2) Position inlet fan guard (1) retained in step 1.a.(4) on fan assembly (7). Align four mounting loops.
      (3) Secure fan guard (1) to fan assembly four places. Secure with screws (6), flat washers (5), lockwashers (4), and nuts (3) retained in step 1.a.(3).
3. Post repair checkout.
   a. Check for chafed and/or pinched wires.
   b. Check that all motor wires are reconnected to the correct terminals.
   c. Apply rated power to fan assembly. Verify that all fans rotate in the same direction. If not, remove power and check for reversed wiring at TB1. Correct as necessary and retest.

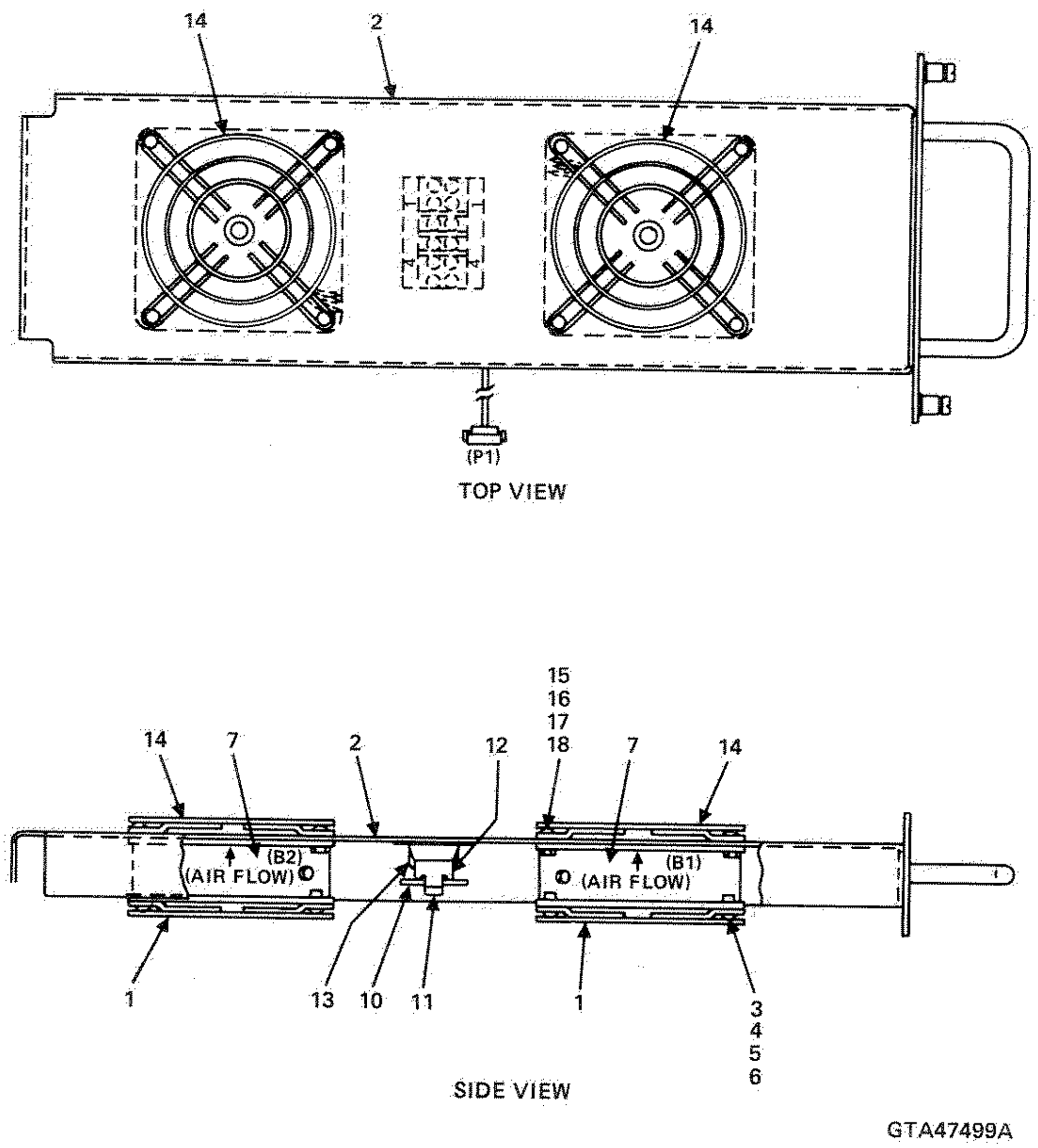


Figure 6-125. Fan Assembly (7344993G1)

6-13.9 Dc-to-Dc Converter (77C723326G1).

6-13.9.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Screwdriver, flat blade	1	25ae

6-13.9.2 Procedure.

1. Disassembly procedure (Figure 6-126).
   a. Remove power supply (2) from chassis (1) by removing screw (3) and lockwasher (4) four places. Set screws, lockwashers, and chassis aside.
   b. Refer to TO 31C1-4-147-1 for power supply PS1 (2) disassembly.
2. Assembly procedure (Figure 6-126).
   a. Refer to TO 31C1-4-147-1 for power supply PS1 (2) assembly procedure.
   b. Place power supply PS1 (2) on chassis (1) and secure four places with screws (3) and lockwashers (4) retained in step 1.a.
3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

6-13.10 Voltage Regulators (77D609500G1 or 77D609503G1).

WARNING

PERSONNEL INJURY HAZARD

Rear surfaces and internal components of the voltage regulator are hot enough to cause burns if touched. Use extreme care not to touch the unit until it is cool.

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234. Electrostatic sensitive components are identified throughout this procedure.

6-13.10.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Marker, wire	A/R	31k
Screwdriver, yankee	1	25x
Screwdriver, cross-tip	1	25ac
Socket, set 1/4 in, (8/32 in - 9/16 in)	1	28g
Soldering station	1	29e
Wrench, box/open, set (5/16 in - 1-5/8 in)	1	32a

6-13.10.2 Procedure.

1. Disassembly procedure (Figure 6-127).
   a. Cover removal.
      (1) Remove cover (4), by removing four screws (1), lockwashers (2), and flat washers (3) securing the cover (4) to the chassis (27).
      (2) Remove cover; retain cover and mounting hardware.

WARNING

HIGH VOLTAGE AND HIGH CURRENT HAZARD

Voltage hazard exists due to stored energy retained in capacitors C2, C3, and C6. Failure to perform step (3) below can cause injury to personnel and damage to equipment.

      (3) Using grounding rod, make sure capacitors C2 (28), C3 (49), C6 (50), and associated circuits are discharged completely.
   b. Removal of regulator printed wire board (PWB) A1 (33).
      (1) Remove cover (4) as described in step 1.a.

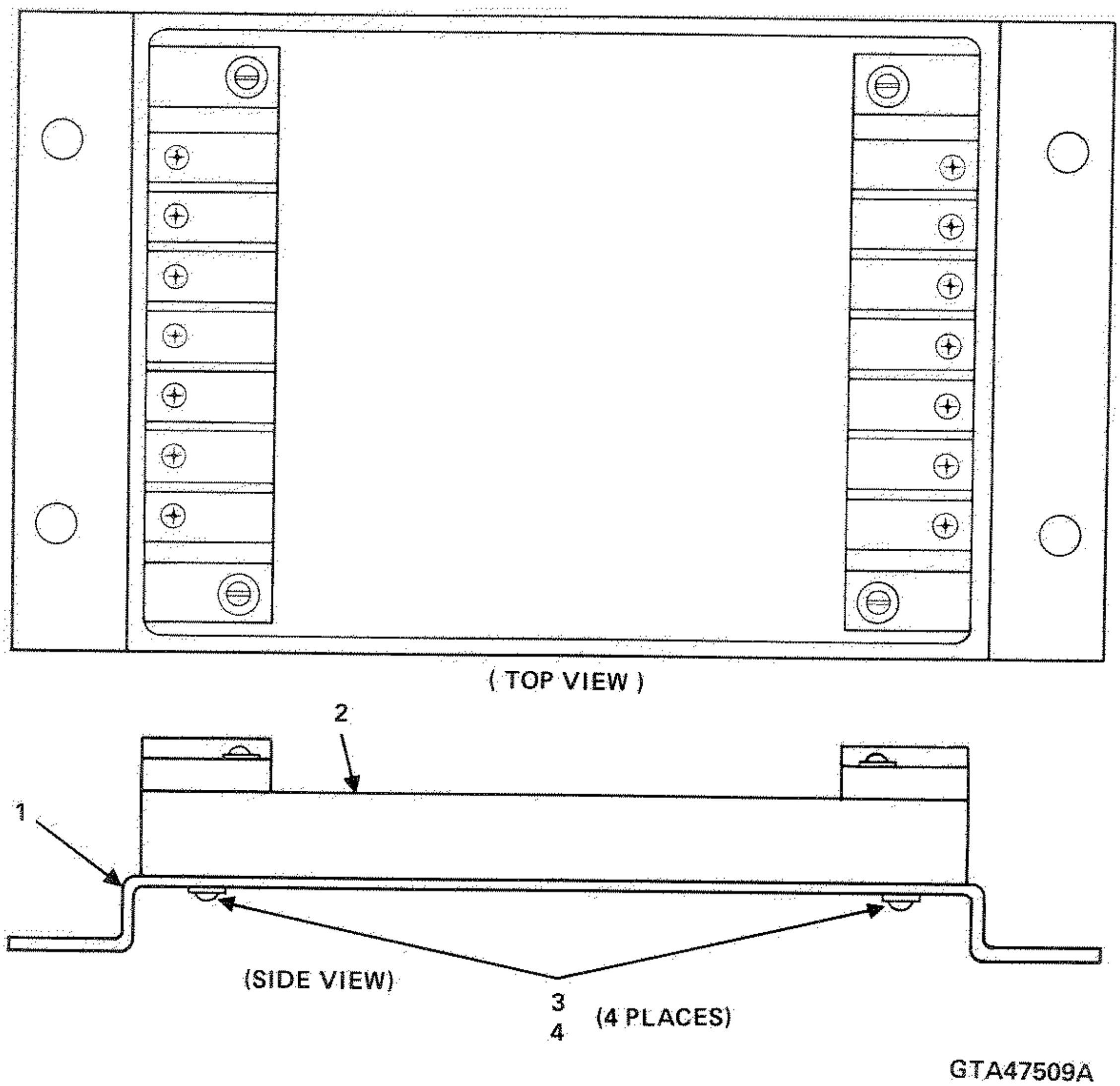


Figure 6-126. Dc-to-Dc Converter (77C723326G1)

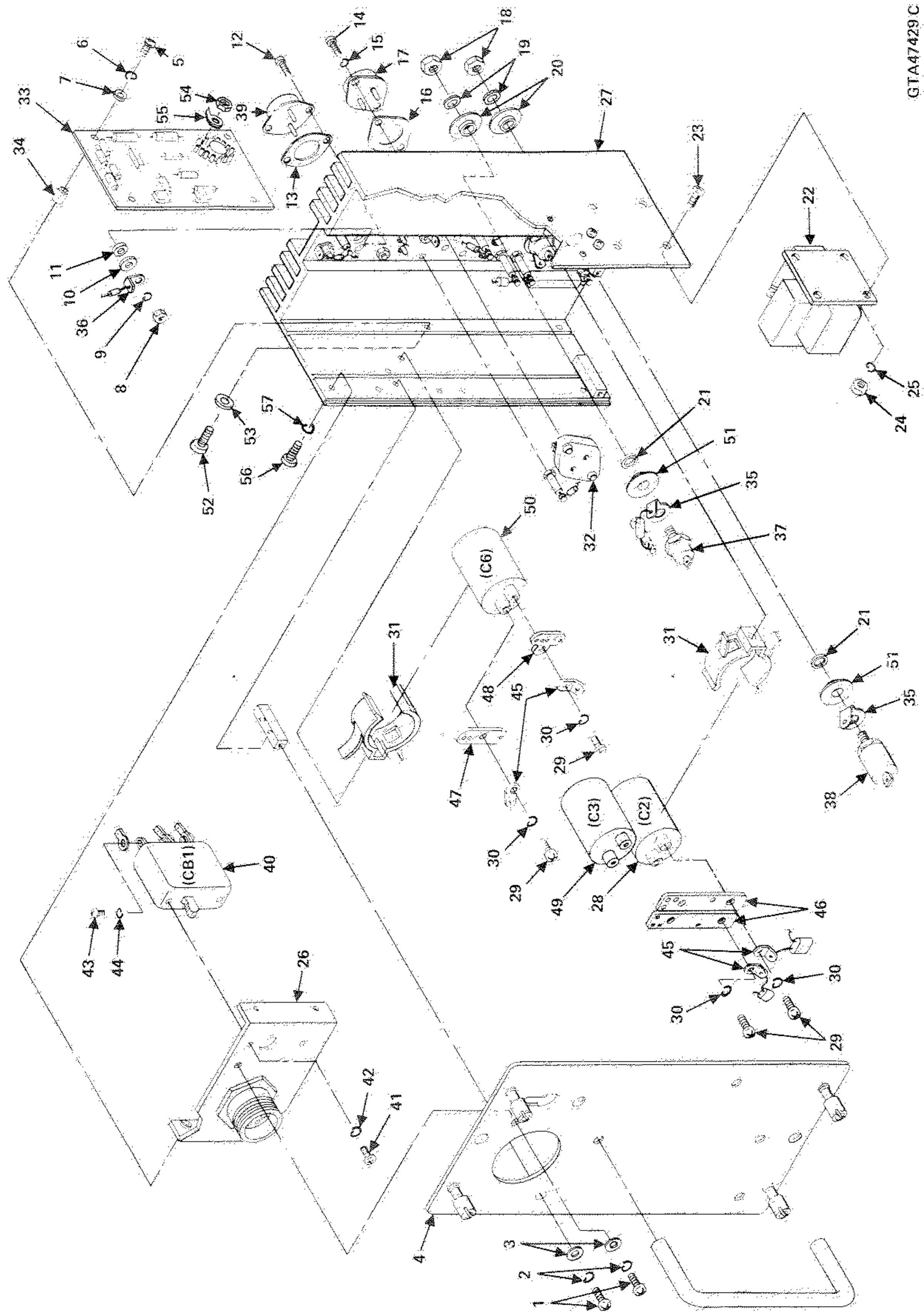


Figure 6-127. Voltage Regulator (77D609500G1 or 77D609503G1)

(2) Label wires connected to PWB A1 (33) standoff terminals as necessary with terminal identification markers as identified on PWB A1.

(3) Unsolder and remove wires from PWB A1 standoff terminals.

(4) Remove PWB A1 (33) from chassis (27).

(a) Remove screw (52) and lockwasher (53), four places and remove PWB A1 board from chassis.

(b) Disconnect wire connected to A1 board (33) transistor Q1. Remove nut (54) and lockwasher (55) and wire from terminal WT1.

(c) Remove standoffs (34) from PWB A1 only if the A1 board is being replaced. Remove screw (5), lockwasher (6), and flat washer (7) four places.

(d) Set all PWB A1 hardware removed in this step aside.

(5) Remove PWB A1 from chassis (27).

c. Transistor Q2 or Q3 removal.

NOTE

Only transistor Q3 (39) is shown removed from chassis in Figure 6-127. Transistor Q2 mounting is identical.

(1) Remove cover (4) as described in step 1.a.

(2) Remove circuit breaker bracket (26) from chassis (27) to gain access to transistors. Remove screw (56) and lockwasher (57) four places. Move bracket for access to transistors. Set screws and washers aside.

(3) Identify transistor Q2 or Q3 to be removed.

(4) Tag wires connected to emitter and base terminals of transistor as necessary with identification markers.

(5) Unsolder and remove wires connected to emitter and base terminals of transistor.

CAUTION

EQUIPMENT DAMAGE HAZARD

Use extreme care when removing transistor to prevent damage to plate insulator (13) and bushing (11).

(6) Remove two nuts (8), lockwashers (9), terminal clip (36) and flat washers (10) from the transistor mounting screws (12).

(7) Carefully remove the transistor, insulator spacer (11), mounting screws (12), and plate insulator (13) from chassis. Retain plate insulator (13), insulator spacers (11), and mounting hardware.

d. Transistor Q1 removal.

(1) Remove cover (4) as described in step 1.a.

(2) Remove two screws (14) and lockwashers (15) securing transistor Q1 (17) to socket (32).

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise care when removing transistor Q1 from socket to prevent damage to socket wiring or plate insulator (16). With transistor mounting screws removed the socket is secured by electrical connections only.

(3) Carefully remove plate insulator (16) from chassis and transistor Q1 (17) from socket (32). Retain plate insulator (16) and mounting hardware.

e. Diodes CR1, CR2, or overvoltage protector U1 removal. Only diode CR1 (37) and overvoltage protector U1 (38) are shown removed from chassis in Figure 6-127. Diode CR2 mounting is identical to CR1 mounting.

(1) Remove cover (4) as described in step 1.a.

(2) Identify diode CR1, CR2, or overvoltage protector U1 to be removed.

(3) Unsolder and remove wire from center terminal of diode or overvoltage protector to be removed.

(4) Remove nut (18), flat washer (19), and rear plate insulator (20) from the mounting stud of the diode or overvoltage protector. Retain plate insulator and mounting hardware.

(5) Carefully remove diode or overvoltage protector from chassis. Remove plate insulator (51), insulating washer (21), and terminal clip (35) from diode or overvoltage protector mounting stud.

Retain terminal clip and insulators for use in reassembly.

f. Reactor L1 removal.

(1) Remove cover (4) as described in step 1.a.

(2) Note wires connected to terminals F and S of reactor L1 (22). Label connecting wires as necessary with terminal identification markers.

(3) Unsolder and remove wires from terminals F and S of reactor L1 (22).

(4) Remove four screws (23), nuts (24), and lockwashers (25) that secure reactor L1 to chassis.

(5) Remove reactor L1 (22) from chassis and retain mounting hardware.

g. Capacitors C2, C3, or C6 removal. Mounting for capacitors C2, C3, and C6 is identical.

(1) Remove cover (4) as described in step 1.a.

(2) Identify capacitor C2 (28), C3 (49), or C6 (50) to be removed.

(3) Remove two screws (29), lockwashers (30), and terminal clip (45) that secure capacitor terminals to terminal/bus bars (47, 48, or 46). Retain terminal hardware.

(4) Observe and note capacitor terminal polarity.

(5) Remove capacitor by snapping it free of the retainer (31).

h. Circuit breaker CB1 (40) removal.

(1) Remove cover (4) as described in step 1.a.

(2) Remove circuit breaker bracket (26) as described in step 1.c.(2).

(3) Note wires connected to circuit breaker terminals. Label connecting wires as necessary with terminal identification markers.

(4) Remove two screws (41 and lockwashers (42) securing circuit breaker (40) to the bracket assembly (26). Retain mounting hardware.

(5) Remove three terminal screws (43) and lockwashers (44) securing wires to circuit breaker terminals. Retain terminal mounting hardware.

(6) Remove circuit breaker.

2. Assembly procedure (Figure 6-127).

a. Circuit breaker CB1 (40) installation.

(1) Connect leads to circuit breaker as labeled in step 1.h.(3). Secure terminals with three screws (43) and lockwashers (44) removed in step 1.h.(5).

(2) Position circuit breaker CB1 (40) on back surface of bracket assembly (26) with the toggle in the OFF position pointing down through the bracket opening.

(3) Mount circuit breaker (40) to bracket (26); align mounting holes in circuit breaker and bracket assembly. Secure with two screws (41) and lockwashers (42) removed in step 1.h.(4).

(4) Mount circuit breaker bracket (26) to chassis (27). Secure with screw (56) and lockwasher (57) four places. Use screws and washers retained in step 1.c.(2).

b. Capacitors C2, C3, or C6 installation.

NOTE

Prior to installation, clean surfaces on terminals of the capacitor by removing oxide. Apply conductive coating 7849855P1 into tapped mounting holes before installing capacitor.

(1) Refer to Figure 6-127 for assembly and position terminals to align properly with circuit terminals according to polarity noted in step 1.g.(4).

(2) In this position, snap capacitor into retainer (31).

(3) Position terminal/bus bar (47, 48, or 46) to capacitor terminals; secure with two screws (29), lockwashers (30), and terminal clip (45) retained in step 1.g.(3).

c. Reactor L1 (22) installation.

(1) Using four screws (23), nuts (24), and lockwashers (25) retained in step 1.f.(5), secure reactor L1 (22) to chassis (27).

(2) Connect and solder wires removed in step 1.f.(3) to reactor terminals F and S as labeled in step 1.f.(2).

d. Diodes CR1, CR2, or overvoltage protector U1 installation.

(1) Position terminal clip (35), plate insulator (51), and insulating washer (21) on mounting stud of replacement CR1, CR2, or U1. Refer to Figure 6-127 for proper orientation of clip and insulators.

(2) Insert mounting stud through chassis; slip plate insulator (20) on the stud extending through chassis (27) as shown in Figure 6-127.

(3) Secure to chassis using nut (18) and flat washer (19) retained in step 1.e.(4). Tighten nut (18) to 12 to 15 inch-pounds torque using a torque wrench and 7/16 inch socket.

(4) Connect and solder wire removed in step 1.e.(3) to center terminal of diode or overvoltage protector.

e. Transistor Q1 (17) installation.

(1) Slide plate insulator retained in step 1.d.(3) over terminal end of transistor Q1.

(2) Support transistor socket and insert transistor Q1.

(3) Refer to Figure 6-127 for assembly and position transistor Q1 and socket to align screw holes in transistor Q1, socket (32), plate insulator (16), and chassis (27).

(4) Using two screws (14) and lockwashers (15) retained in step 1.d.(3), secure transistor Q1 and socket (32) to chassis. Make sure mounting screws (14) remain centered in holes to prevent contact with the chassis.

f. Transistor Q2 or Q3 installation.

(1) Using plate insulator (13) retained in step 1.c.(6), refer to Figure 6-127 for assembly. Position plate insulator (13) centered on transistor mounting hole.

(2) Secure transistor to chassis using insulator (11), two mounting screws (12), flat washers (10), lockwashers (9), terminal clip (36), and nuts (8). Center the transistor and plate insulator to prevent contact with the chassis.

(3) Tighten nuts to 5 to 8 inch-pounds torque using a torque wrench and a 5/16 inch socket.

(4) Connect and solder wires removed in step 1.c.(3) to transistor emitter and base terminals as labeled in step 1.c.(4).

(5) Install circuit breaker bracket (26) to chassis (27) as described in step 2.a.(4).

g. Regulator PWB A1 (33) installation.

(1) Assemble four standoffs (34) to back side of PWB A1 (33) with screws (5), lockwashers (6), and flat washers (7). Use hardware retained in step 1.b.(4). This step is not necessary if the board is supplied with standoffs.

(2) Connect wire to PWB A1 board transistor, Q1, terminal WT1. Use nut (54) and lockwasher (55) retained in step 1.b.(4).

(3) Secure PWB A1 (33) to chassis (27) four places. Use screws (52) and lockwasher (53) retained in step 1.b.(4).

(4) Connect and solder wires to board terminals as labeled in step 1.b.(3).

h. Cover installation.

(1) Position cover (4) on chassis. Make sure that wires are not pinched and/or chafed by cover.

(2) Secure cover to chassis using four screws (1), lockwashers (2), and flat washers (3) retained in step 1.a.(2).

3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

6-13.11 Power Supply Controller (77D611601G1).

WARNING

HAZARD TO PERSONNEL

Avoid breathing fumes generated by soldering or unsoldering. Eye protection is required.

CAUTION

EQUIPMENT DAMAGE HAZARD

This assembly contains electrostatic sensitive components. Observe precautionary procedures found in TO 00-25-234.

6-13.11.1 Tools and Test Equipment.

Name	Qty.	Table 1-4 Item No.
Soldering station	1	29e
Static control work station	1	33a
Wrist strap	1	33i

6-13.11.2 Procedure.

1. Disassembly procedure (Figure 6-128).

a. Transistors Q1 through Q5 (7) removal.

(1) Determine which transistor Q1 through Q5 (7) is to be removed.

(2) Unsolder and remove transistor (7) and mounting pad (8) from PWB.

(3) Remove mounting pad (8) from transistor wires. Set mounting pad aside.

b. Diode DS1 through DS13 (9) removal.

(1) Determine which diode DS1 through DS13 (9) is to be removed.

(2) Unsolder and remove anode and cathode wires from PWB.

(3) Note position of diode index tab.

(4) Remove diode from mounting block (10) by pressing the diode out the opening on the back side of mounting block.

2. Assembly procedure (Figure 6-128).

a. Diode DS1 through DS13 (9) installation.

(1) Insert diode into hole in mounting block (10). Locate diode index tab in the same position as the diode removed in step 1.c.

(2) Place insulating sleeve on both diode wires.

(3) Connect and solder diode anode and cathode wires to respective terminal areas on PWB (2).

(4) Separate diode anode and cathode wires from each other in a manner so they can not touch each other.

b. Transistor Q1 through Q5 (7) installation.

(1) Thread wires of transistor (7) through respective holes of mounting pad (8) retained in step 1.a.(3).

(2) Insert transistor wires through respective hole in PWB (2). Press on transistor until mounting pad (8) rests firmly on PWB.

(3) Solder transistor wires on lower surface of PWB (2) and trim excess wire.

3. Post repair checkout. Perform post repair checkout by performing the analog and mechanical test procedures in paragraph 6-11.

6-14 ELECTRONIC ASSEMBLY PARTS LOCATION ILLUSTRATIONS.

As a result of the manufacturing process, the reference designators for components mounted on certain electronic assemblies in the radar are not marked. As listed below, this paragraph identifies the unmarked assemblies, or assemblies where the markings are obscured by the components. The list is in part number order and gives a reference to the parts location diagram for each one.

Electronic Assembly	Figure
+/-15 V dc Power Supply Assembly (7328363G1)	6-129
+/-15 V dc Power Supply Assembly (7329140G1)	6-130
+/-60 V dc Power Supply Assembly (7343908G1)	6-131
+24 V dc Power Supply Assembly (7343910G1)	6-132
+5 V dc Power Supply Assembly (7343912G1)	6-133
Voltage Regulator-A1 (77D608699) (Part of 77D609500G1, G2, 77D609503G1, and G3)	6-134
Power Supply Controller (77D611601 (3-Sheets)	6-135

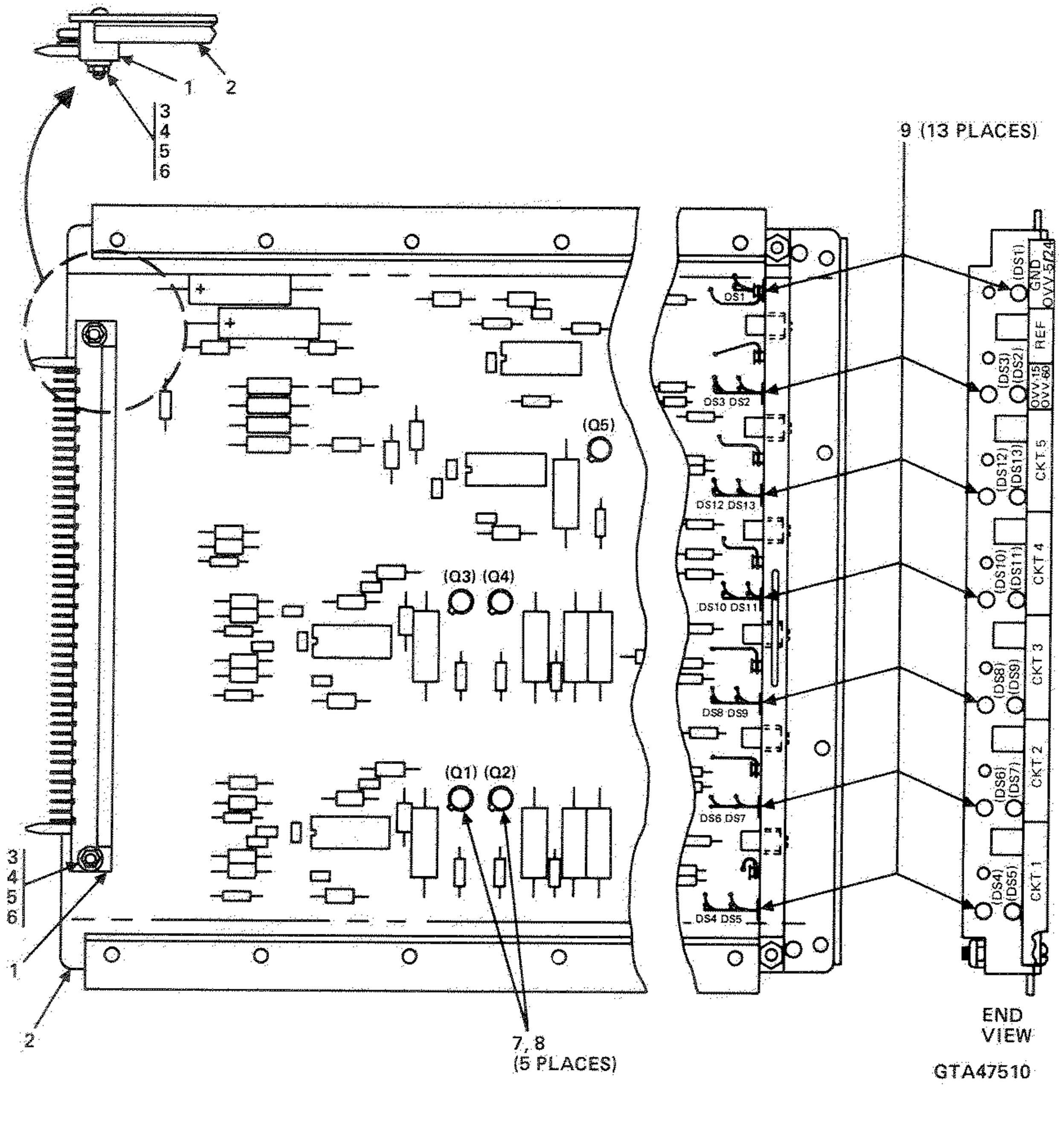


Figure 6-128. Power Supply Controller (77D611601G1)

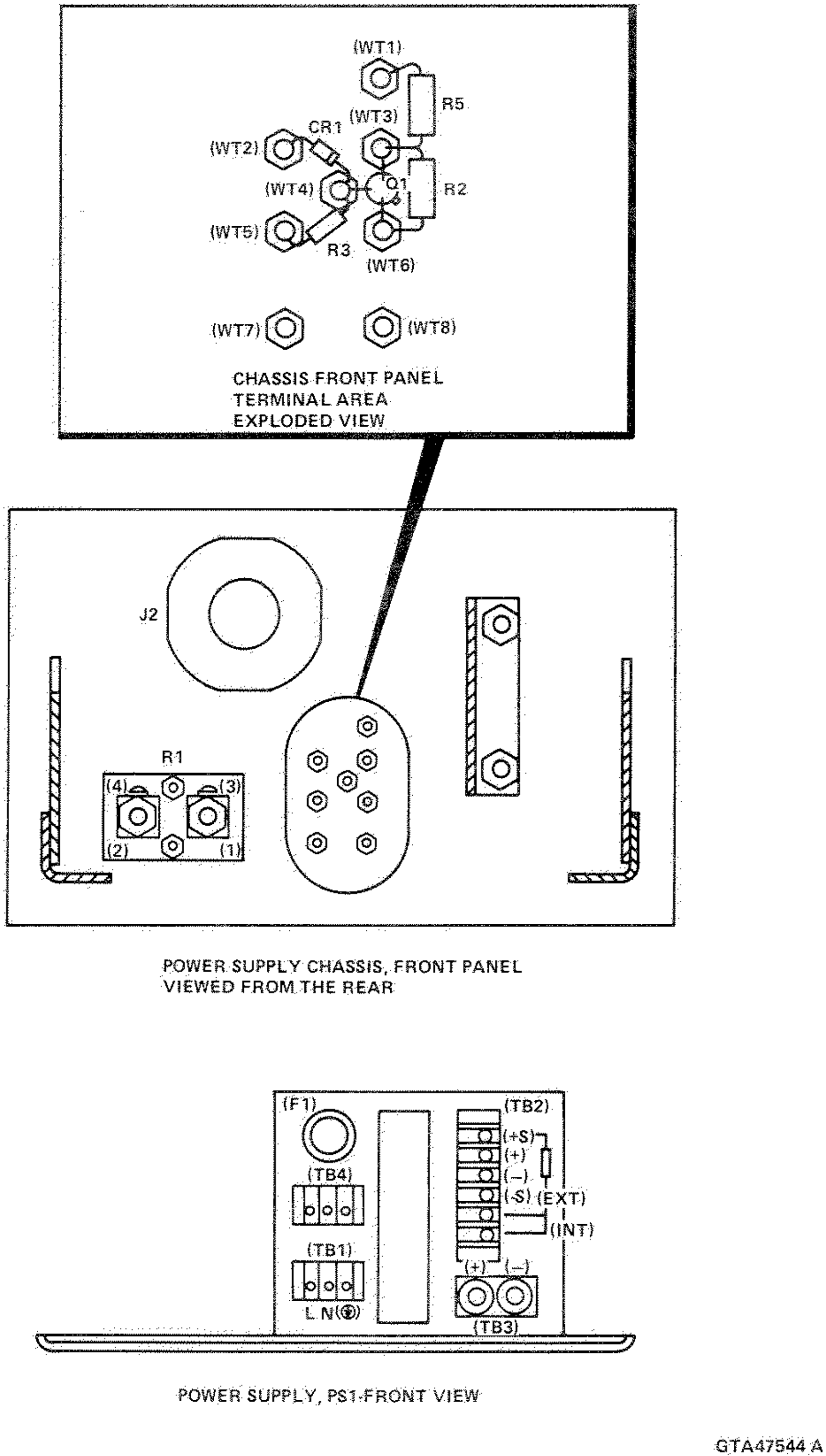


Figure 6-129. +/-15 V Dc Power Supply Assembly (7328363G1) Parts Location Diagram

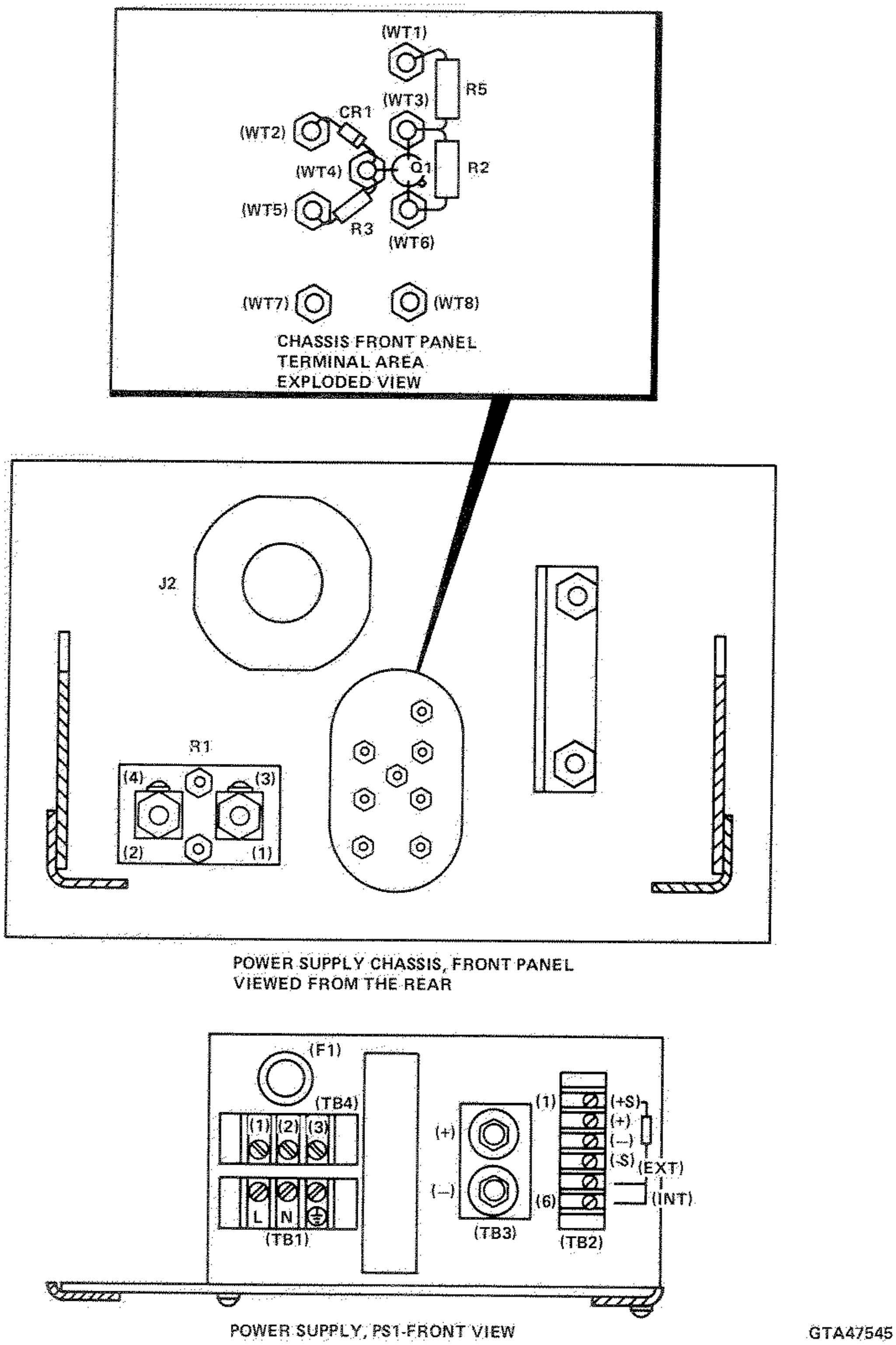


Figure 6-130. +/-15 V Dc Power Supply Assembly (7329140G1) Parts Location Diagram

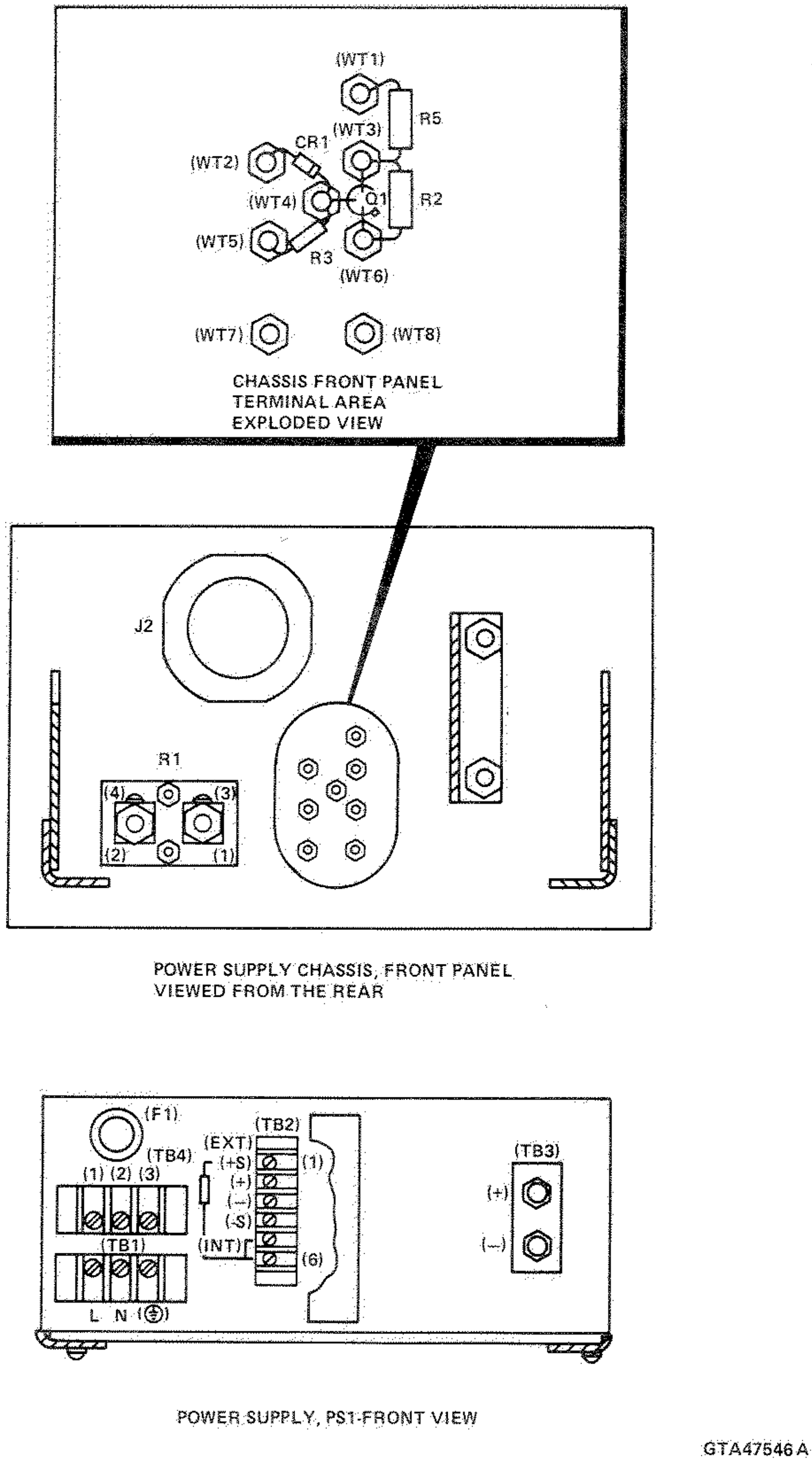


Figure 6-131. +/-60 V Dc Power Supply Assembly (7343908G1) Parts Location Diagram

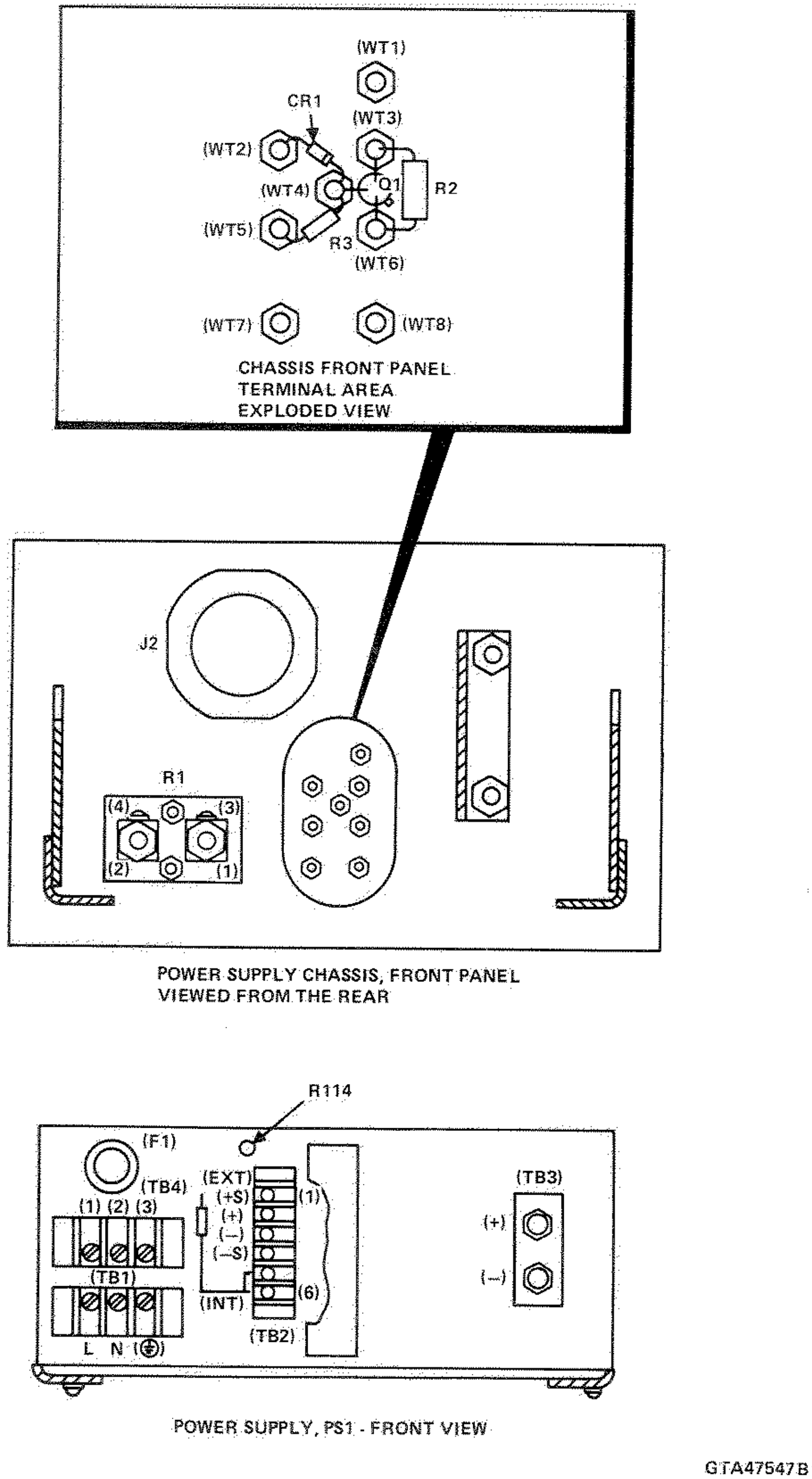


Figure 6-132. +24 V Dc Power Supply Assembly (7343910G1) Parts Location Diagram

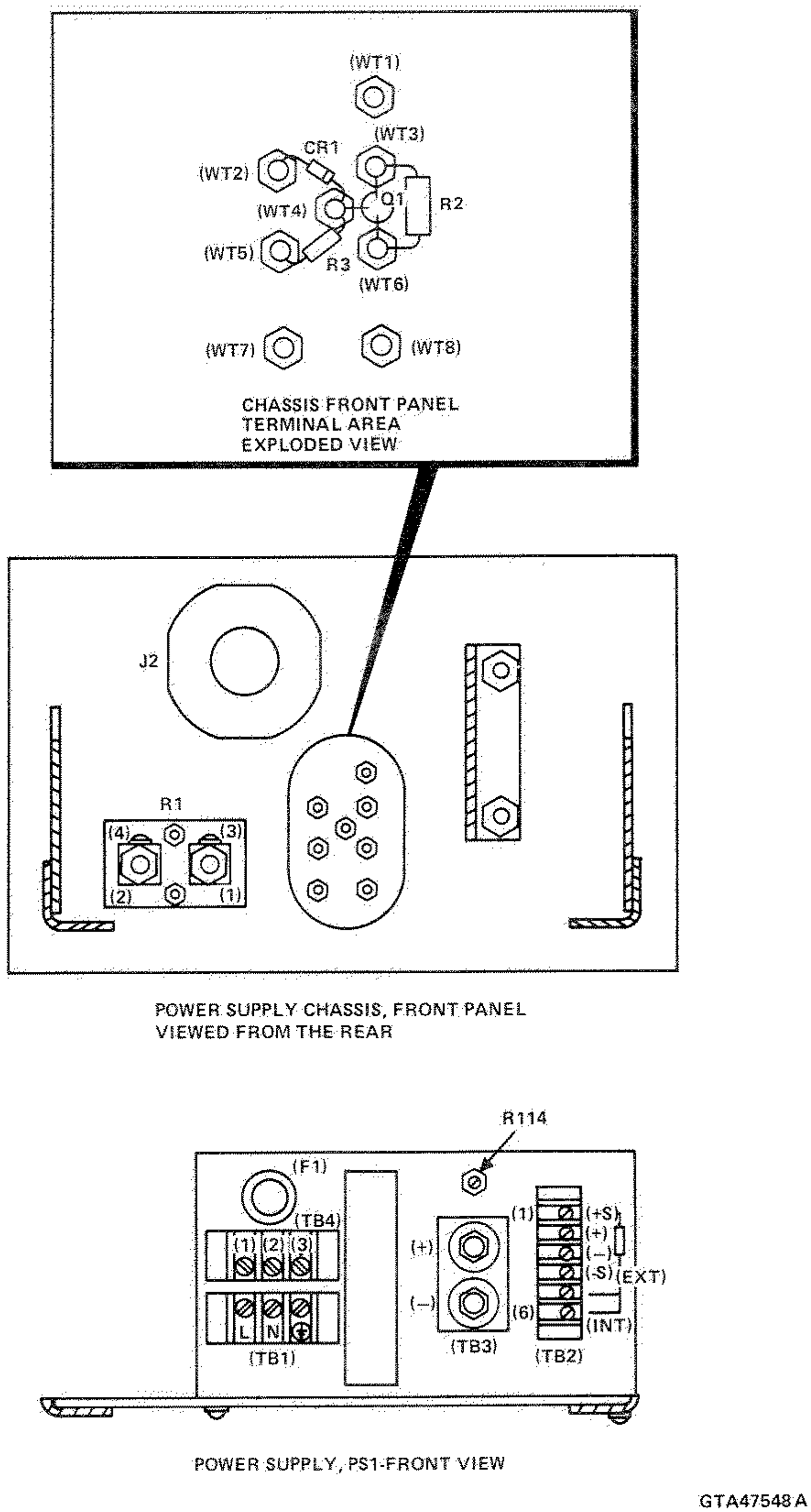
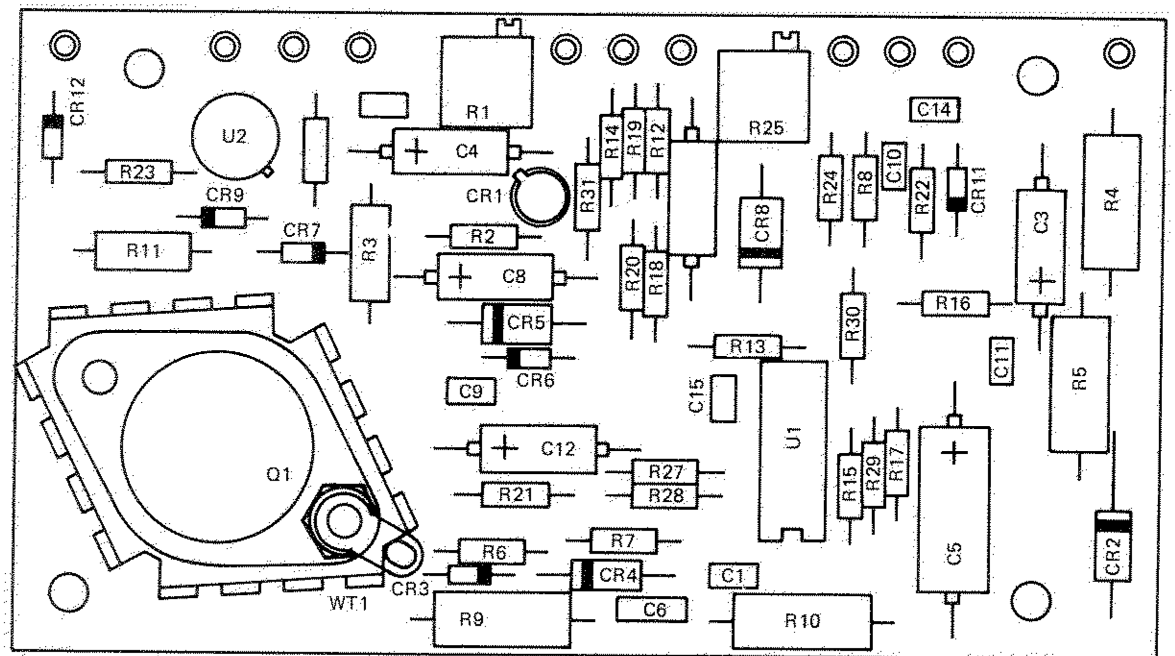


Figure 6-133. +5 V Dc Power Supply Assembly (7343912G1) Parts Location Diagram



77D608699(G)

NOTE: PART OF VOLTAGE REGULATOR ASSEMBLIES
77D609500G1, G2,77D609503G1, AND G3

GTA47521A

Figure 6-134. Voltage Regulator-A1 (77D608699G1, 2, 3, 4, and 5) Parts Location Diagram

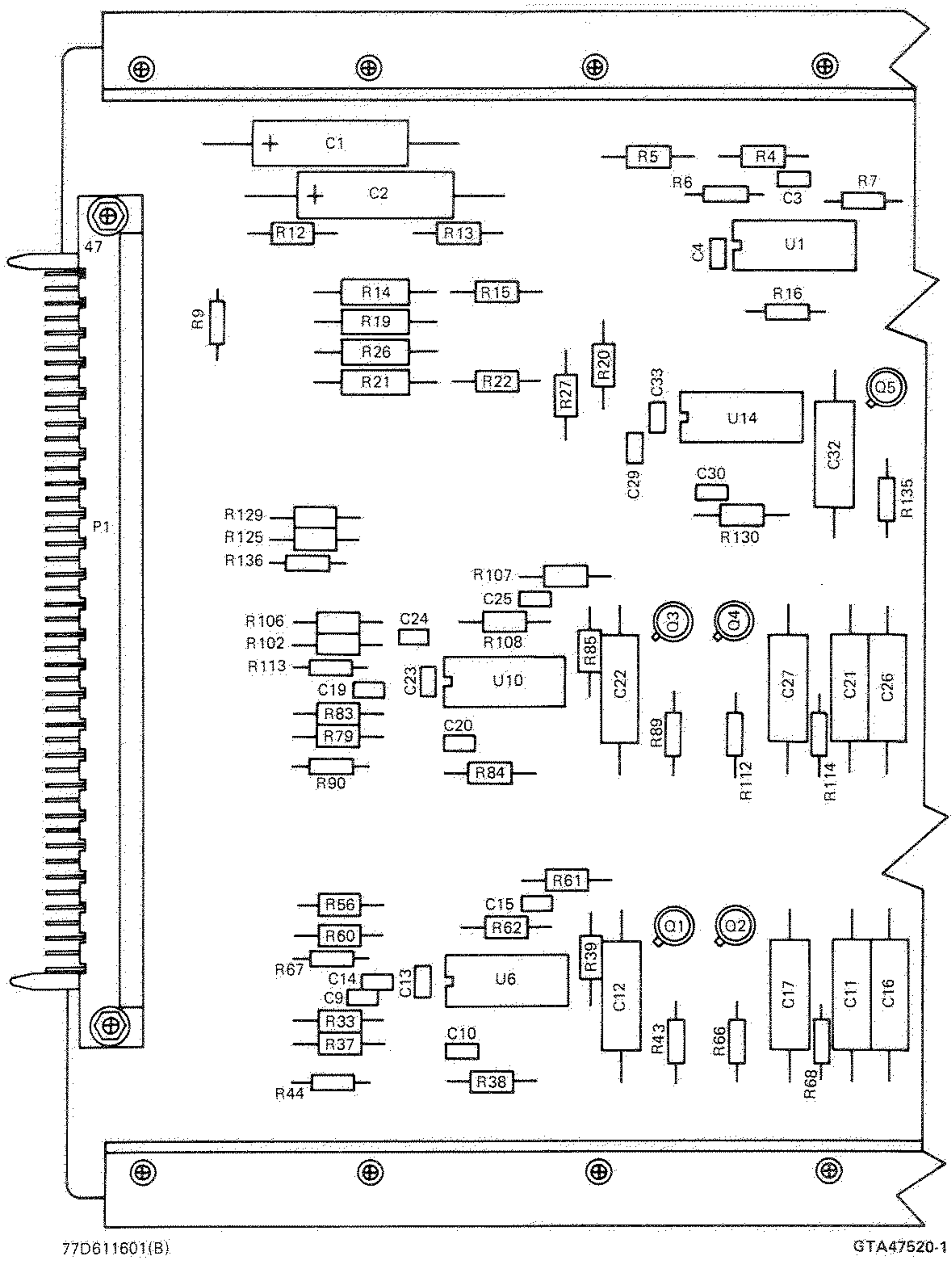


Figure 6-135. Power Supply Controller (77D611601G1) Parts Location Diagram (Sheet 1 of 3)

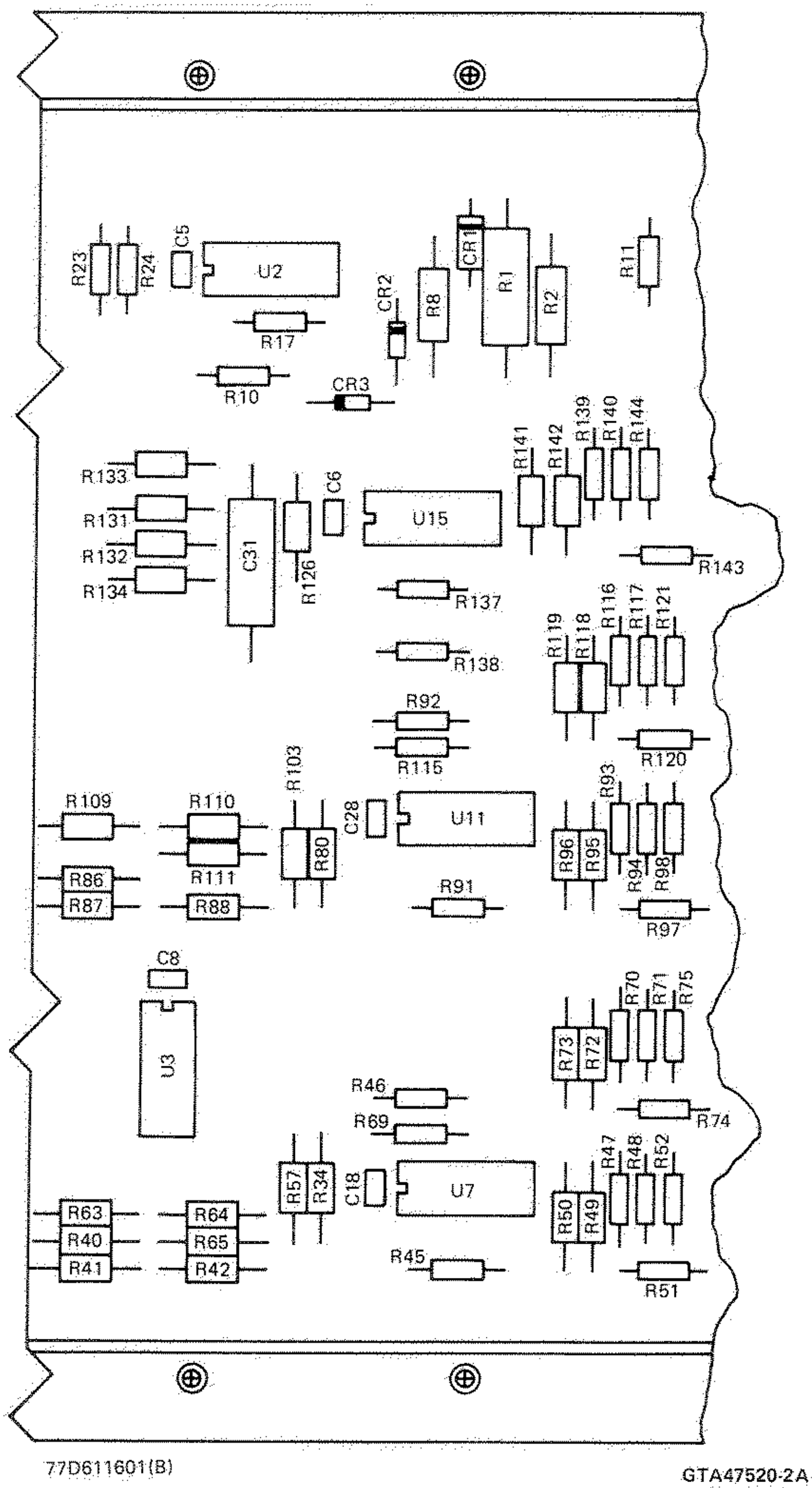


Figure 6-135. Power Supply Controller (77D611601G1) Parts Location Diagram (Sheet 2 of 3)

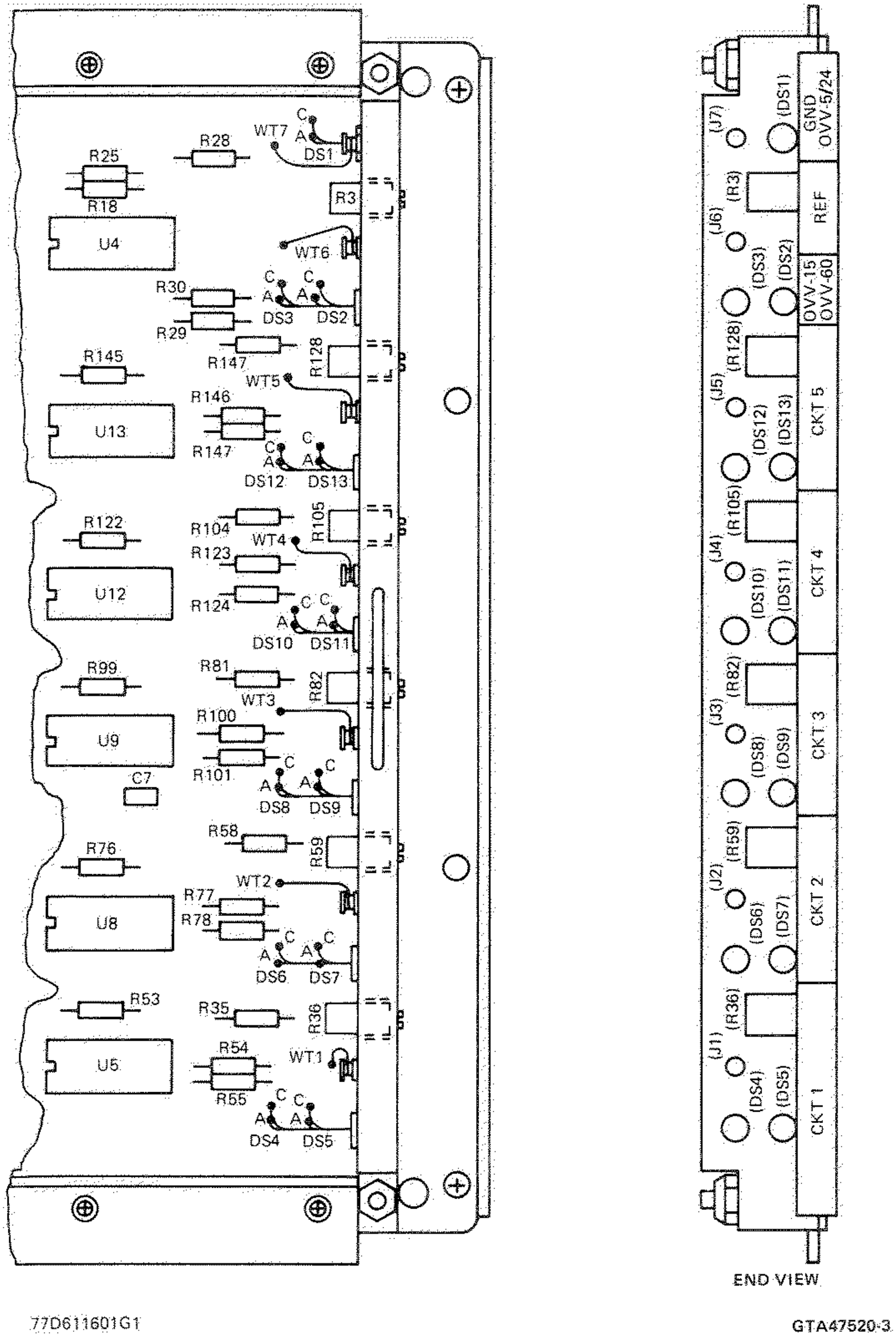


Figure 6-135. Power Supply Controller (77D611601G1) Parts Location Diagram (Sheet 3 of 3)

Section III. PERFORMANCE TEST CHECKS

Continuous performance monitoring of the equipment is accomplished by AN/FPS-118 EPM functions. Performance checks for the T-1524 radar transmitter are contained in TO 31P6-2FPS118-81.

GLOSSARY

A

A--Ampere

ABF--Auxiliary Beamformer

ac--Alternating Current

ACID--Aircraft Identification

ACM--Aperture Coefficient Memory

ACO--Alarm Cut-Off

ACOS--AUTOVON Class of Service

A/D--Analog-to-Digital

Ada--High-Level DoD Programming Language (Trademark)

A/DC--Analog-to-Digital Converter

ADCCP--Advanced Data Communications Control Procedures

ADP--Automatic Data Processing

AF--Air Force

AFB--Air Force Base

AFGWC--Air Force Global Weather Central

AFI--Automatic Fault Isolation

AFL--Automatic Fault Location

AFL/I--Automatic Fault Location/Isolation

AFM--Active Forward Monitor

AFR--Air Force Regulation

AFSC--Air Force Systems Command

AFTN--Aeronautical Fixed Teletype Network

AGC--Automatic Gain Control

AK ROCC--Alaskan Regional Operations Control Center

ALTRV--Altitude Reservation

ALU--Arithmetic Logic Unit

AMD--Air Movement Data

AMDS--Air Movement Data Subsystem

AN/FPS-118--Official AF nomenclature for OTH-B Radar System

ANSI--American National Standards Institute

AP--Array Processor

APA--A Port Address

APAD--Array Processor Debug Loader

APL--Alternate Programming Language

GLOSSARY - CONT

AP Monitor--FFP Array Processor ROM Resident Services

APOS--Array Processor Operating System

APS--A Port Select

A/R--As Required

A-R--Amplitude-Range

A-R-D--Amplitude-Range-Doppler

ARDP--Anchorage Remote Data Processor

ARINC--Aeronautical Radio Incorporated

ARTC--Air Route Traffic Control

ARTCC--Air Route Traffic Control Center

AS--Address Select

ASCII--American Standard Code for Information Interchange

ASTM--American Society for Testing Materials

ATB--Auto Transfer Box

ATN--Astrogeophysical Teletype Network

AU--Arithmetic Unit

AUTODIN--Automatic Digital Network

AUTOSEVOCOM--Automatic Secure Voice Communications

AUTOVON--Automatic Voice Network

AWG--American Wire Gauge

AWS--Air Weather Service

AZ--Azimuth

B

B--Barrier

BAEPE--Beamforming and Elemental Path Evaluation

BBPT--Beamformer Bit Pattern Test

BCD--Binary Coded Decimal

BCI--Bus Control Interface

BCM--Beamformer Coefficient Memory

BeO--Beryllium Oxide

BER--Bit Error Rate

BF--Beamformer

BIT--Built-In Test

BITE--Built-In Test Equipment

GLOSSARY - CONT

BOT--Beginning of Tape

BP--Beam Processor

BPA--B Port Address

bps--Bits per Second

BPS--B Port Select

BRC--BR Communications

b/s--Bits per Second

B/s--Bytes per Second

BSUM--Blind Speed Unmasking

BTU--British Thermal Unit

BTU/HR--British Thermal Unit/Hour

BW--Bandwidth

C

C--Celsius

C^2--Command and Control

CAGE--Commercial and Government Entity

CAS--Channel Addressing Mode Select Switch

CAU--Complex Arithmetic Unit, Crypto Ancillary Unit

CB--Circuit Breaker

CBIT--Continuous Built-In Test

CBR--Calibration Receiver

CBX--Computerized Branch Exchange

CCA--Circuit Card Assembly

CCMS--Communications Circuit Monitoring Subsystem

CCS--Clock Control Switch, Console Communications Set

CDR--Critical Design Review, Call Detail Recording

CDRL--Contract Data Requirements List

CDS--Common Display Services

cemf--Counter Electromotive Voltage

C-E-M--Communications-Electronics-Meteorological

CE ROCC--Canadian East Region Operations Control Center

CEVA--Continental Electronics of Varian Associates

CF--Correction Factor

CFAR--Constant False Alarm Rate

GLOSSARY - CONT

cfd--Cubic Feet Delivered

CFE--Contractor-Furnished Equipment

cfm--Cubic Feet per Minute

CFM--Coefficient Memory

CI--Configuration Item, Computer Interface

C/I--Correlation and Identification

CIBL--Computer Interface Bus Logic

CIC--Computer Interface Controller

C/I-O--Correlation and Identification Operator

C/I-S--Correlation and Identification Supervisor

CIT--Coherent Integration Time

CIU--Control Interface Unit

CLB--Clutter Level Boundary

CLP--Clutter Level Peak

CLR--Clutter-to-Noise-Ratio

CM--Control Message, Control Module

CMS--Control Module Sequencer

CMU--Cache Memory Unit

CNR--Clutter-to-Noise Ratio

CO--Central Office

COB--Communications Data Processor-B

COMM--Communications Subsystem

COMMP--Communications Processing

COMMPreP--Communications Preprocessing

COMMSET--Communications Set

CON--Continuation

CONUS--Continental United States

COS--Class of Service

CP--Communications Preprocessor

CPB--Communications Preprocessor-B

CPCI--Computer Program Configuration Item

CP-CO--Communications Preprocessor-to-Communications Processor Link

CPR--Cardiopulmonary Resuscitation

CPU--Central Processing Unit

CR--Coordinate Registration

GLOSSARY - CONT

CRT--Cathode Ray Tube

CRYPTO--Cryptographic Encode/Decoder Unit

CSR--Clutter-to-Signal Ratio, Control and Status Register

CTC--Command-to-Convert

CTF--Current Track File

CTS--Clear to Send

CTQF--Cumulative Track Quality Figure

CW--Continuous Wave

CW ROCC--Canadian West Regional Operations Control Center

cw--clockwise

ccw--counter clockwise

D

D/A--Digital-to-Analog

dB--Decibel

DBE--Double Bit Error

DBZ--Divide by Zero

dc--Direct Current

DCL--Device Controller Logic, Digital Command Language

DCP--Data Communications Processor

DCU--Data Control Unit

DDM--Display Data Multiplexer

DDMX--Digital Data Multiplexer

DDP--Digital Data Processor

DED--Data Element Dictionary

DFLT--Default

DICS--Display Interface Communication Services, Display Interface and Control Software

DID--Direct-in Data, Direct Inward Dial

DL--Digital Loopback

DMA--Direct Memory Access

DMIM--Direct Memory Interface Module

DoD--Department of Defense

DP--Data Processor

DPDG--Data Processing and Display Group

DPFM--Data Processing Fault Monitoring

GLOSSARY - CONT

DPS--Data Processing System, Dot Pattern Set

DPSD--Data Processing Software Development

DR11-W--DEC Asynchronous High Speed Interface Hardware

DROS--Display Resident Operating System

DSD--Digital Sided Diagnostic

DSR--Data Set Ready

D/T--Detection and Tracking

DTLE--Detailed Task List Entries

DTMF--Dual-Tone Multiple Frequency

D/T-S--Detection and Tracking Supervisor

DTR--Data Terminal Ready

DV--Device

DVF--Divide Fault

DW--Data Word

E

EA--Environmental Assessment

EA-O--Environmental Assessment Operator

ECC--Error Correction Code

ECCM--Electronic Counter Countermeasures

ECL--Emitter-Coupler Logic

ECM--Electronic Countermeasures

ECRS--East Coast Radar System

EED--Electroexplosive Device

EFD--Equipment Fault Detection

EIA--Electronic Industries Association

EMI--Electromagnetic Interference

EMM--Environmental Monitor Module

EO--Operation Code

EOB--End of Block

EOF--End of File

EOFR--End-of-Frame-Receive

EOFX--End-of-Frame-Transmit

EOM--End of Message

EOS--Easterly Operating Segment (Segment 2)

GLOSSARY - CONT

EOT--End of Tape, End of Transmission

EPM--Equipment Performance Monitoring

EPM/AFI--Equipment Performance Monitoring/Automatic Fault Isolation

EPM/AFL--Equipment Performance Monitoring/Automatic Fault Location

EPROM--Eraseable Programmable Read Only Memory

EQPT--Equipment

ERGC--Elemental Receiver Gain Control

ERP--Effective Radiated Power

ESR--Executive Service Request

ET--Elemental Transmitter

ETX--End of Text, End Transmit

F

F--Fahrenheit

FAA--Federal Aviation Administration

FACSFAC--Fleet Area Control Surveillance Facility

FACTS--Fleet Area Control Surveillance Facility (FACSFAC) Area Control Traffic System

FCC--Federal Communication Commission

FCM--Filter Coefficient Memory

FCS--Frame Check Sequence

FDC--Flight Data Console

FDE--Flight Data Edit/Editor

FDEC--Flight Data Edit Console

FDE-O--Flight Data Edit-Operator

FDIR--Flight Data Information Record

FD&L--Fault Detection and Location

FDX--Full-Duplex Transmission

FE--Field Engineer

FET--Field Effect Transistor

FFP--Federation of Functional Processors (GE Trademark)

FFSM--Facilities Fault Sensor Monitoring

FFT--Fast Fourier Transform

FIFO--First In/First Out

FIR--Flight Information Region

FL--Fault Location

GLOSSARY - CONT

FLD--Fault Log Display
FLDB--Fault Log Data Base
FM--Frequency Modulation, Forced Mode
FM/CW--Frequency Modulation/Continuous Wave
FM/ICW--Frequency Modulation/Interrupted Continuous Wave
FMS--Forms Management System
FO--Fiber-Optics, Foldout
FOB--Fan Out Board
FOTIS--Fiber-Optics Telephone Isolation System
FOTS--Fiber-Optic Transmission System
FP--Flight Path
FPA--Fixed Plant Adapter
FPAD--FFP/DDP Debug Loader
FPEX--FFP Executive
FPF--Floating Point Formatter
FPGEN--FFP Load Module Generator
FPIC--Flight Path In Coverage
FPLIBR--Functional Processor Librarian
FPMAC--FFP Macro Preprocessor
FPO--Floating Point Operator
FP/PPR--Flight Plan/Pilot Position Report
FPROM--Functional Processor Read Only Memory
FPRST--FFP Restricted Sequence Tester
FRDP--Fleet Area Control Surveillance Facility (FACSFAC) Remote Data Processor
FS--Full Scale
FSC--Flight Size Check
FSK--Frequency Shift Key
FSW--Frame Sync Words
ft--Foot/Feet
ft^3/min--Cubic Feet per Minute
FTS--Federal Telecommunications System
FWB--Full-Wave Bridge

GLOSSARY - CONT

G

GCB--Gain Control Board

GCR--Gain Control Receiver, Group-Code Recording

GE--General Electric Company

GEO--Geographic

GEOS--GE Ordnance Systems

GESD--Government Electronic Systems Division

GFE--Government Furnished Equipment

GFI--Government Furnished Information

GFP--Government Furnished Property

GM--Global Memory

GMT--Greenwich Mean Time

GOES--Geostationary Operational Environmental Satellite

GRI--Group Repetition Interval

GTLE--General Task List Entry

H

HDX--Half-Duplex Transmission

HERO--Hazardous Electromagnetic Radiation to Ordnance

HF--High Frequency

HOL--Holberg

HPA--High Power Amplifier

hr--Hour(s)

HV--High Voltage

HVAC--High Voltage Ac

HV/LV--High Voltage/Low Voltage

HVPS--High Voltage Power Supply

HW--Hardware

HWB--Half-Wave Bridge

HW/HW--Hardware-to-Hardware

HW/SW--Hardware-to-Software

Hz--Hertz (cycles per second)

I

I--Interrogate

I&D--Interface and Distribution

GLOSSARY - CONT

I&Q--In-phase and Quadrature

IAW--In Accordance With

IBIB--Input Bus Interface Board

IBIT--Initialed Built-In Test

IC--Integrated Circuits

ICAO--International Civil Aviation Organization

ICD--Interface Control Drawing

ICW--Interrupted Continuous Wave

ID--Identification

IEEE--Institute of Electrical and Electronic Engineers

IF--Intermediate Frequency, Interim Flight

IFDP--Interim Flight Data Processor

IG--Information Gathering

IGM--Information Gathering Module/Multiplexer

IMD--Intermodulation Distortion

in--Inch(s)

in/s--Inch(s) per Second

I/O--Input/Output

IOCB--Input/Output Control Block

IOS--Initial Operating Segment (Segment 1)

IPA--Intermediate Power Amplifier

IPC--Interprocess Communication

IQ--Initialization Quality

IR--Infrared

IRAN--Inspect and Repair as Necessary

ISF--Integrated Software Facility

ITM--Input Test Memory

K

K--Kelvin

kb--Kilobits

kB--Kilobytes

kHz--Kilohertz

KIP--Thousands of Pounds

km--Kilometer

GLOSSARY - CONT

Kt--Knots (nautical miles/hour)

kW--Kilowatts

L

Lat--Latitude

lb--Pound

LBBF--Low Band Beamformer

lbf/in^2--Pound Force per Square Inch (Pressure)

lbf/in^2 gage--Pound Force per Square Inch Gage

lbf/in^2 absolute--Pound Force per Square Inch Absolute

LC--Loop Control

LCD--Liquid Crystal Display

LED--Light-Emitting Diode

LFM--Linear Frequency Modulation

LNA--Low Noise Amplifier

LO--Local Oscillator

LOAP--List of Applicable Publications

Long--Longitude

LORAN-C--Long Range Navigation System

LPS--Loop Select

LRU--Line Replaceable Unit

LSB--Least Significant Bit

LSD--Least Significant Digit

LSI--Large Scale Integration

LSP--Least Significant Product

LTC--Line-Time-Clock

LUN--Logical Unit Number

LVAC--Low Voltage Ac

M

MAD--Missed Association Decrement

MATE--Modular Automatic Test Equipment

MB--Megabyte

MBBF--Mid Band Beamformer

MC--Machine Control, Master Clear, Message Control

MCU--Macrocontrol Unit

GLOSSARY - CONT

MDC--Multimode Display Console

MDP--Multimode Display Processor

MDT--Minimum Discernible Target

MDTCS--Minimum Discernible Target Cross Section

MFI--Manual Fault Isolation

MGC--Manual Gain Control

MHz--Megahertz

MI--Memory Interface

MIL-SPEC--Military Specification

MIL-STD--Military Standard

min--Minute

MIU--Memory Interface Unit

MME--Master Mode Entry

MMI--Man-Machine Interface

MMP--Multimode Processor

MMR--Master Mode Run, Master Mode Reset

MODEM--Modulator-Demodulator

MON--Monitor

MOS--Metal-Oxide Semiconductor

MPS--Modular Power System

ms--Millisecond

MSB--Most Significant Bit

MSD--Most Significant Digit

MSI--Medium Scale Integration

MSP--Most Significant Product

MTBF--Mean Time Between Failures

MTTR--Mean-Time-To-Repair

MUF--Maximum Usable Frequency

MUX--Multiplexer

N

N/A--Not Applicable

NADIN--National Airspace Data Interchange Network

NAS--Naval Air Station

NB--Narrowband

GLOSSARY - CONT

NBS--National Bureau of Standards

NCI--Noncoherent Integration

NCIT--Noncoherent Integration Time

NCMC--NORAD Cheyenne Mountain Complex

NCNR--Normalized Clutter-to-Noise Ratio

NDE--NETCOM Diagnostic Extension

NE ROCC--Northeast Region Operations Control Center

NEOS--Northeasterly Operating Segment (Segment 1)

NET--Network

NETCOM--Network Communications

NF--Noise Figure

NFDPS--National Flight Data Processing System

NHD--Negative High Doppler

NLD--Negative Low Doppler

nm--nanometer

nmi--Nautical Miles

NOP--No Operation

NORAD--North American Aerospace Defense Command

NOTAM--Notice to Airman

ns--Nanosecond

NSGA--National Security Group/Agency

NTEQ--New Track Entry Quality

NW SOCC--Northwest Sector Operations Control Center

NWOS--Northwest Operating Sector

O

O&M--Operation and Maintenance

OBIB--Output Bus Interface Board

OC--Operations Center

OCG--Operations Communications Group

OCOS--Operations Center Operating System

OCS--Out-of-Coverage Sounder

ODAPS--Oceanic Display and Planning System

ODID--Operator Display Interactive Device

ODP--Operations Data Processor

GLOSSARY - CONT

OESS&D--Overall Equipment Status Summary and Display

OFDPS--Offshore Data Processing System

OMC--Operations Maintenance Console

OP--Operators

OPM--Operational Performance Monitoring

OPS--Operations

OPSS--Operations Subsystem

OPSTEP--Operations Step

OS--Operating System

OT--Over Temperature

OTH--Over-the-Horizon

OTH-B--Over-the-Horizon Backscatter

OTM--Output Test Memory

OTS--Off-the-Shelf

P

PA--Public Address, Power Amplifier

PABX--Private Automatic Branch Exchange

PBX--Private Branch Exchange

P_c--Probability of Correlation

PC--Phase Code, Program Counter

PCA--Physical Configuration Audit, Power Control Amplifier

PCB--Printed Circuit Board

PCL--Parallel Communications Link

PCO--Processor Computer Operator

PCOT--Processor Computer Operator Terminal

P_d--Probability of Detection

PDD--Peak Detection Data

PDHD--Peak Detection Header Data

PDP--Procurement Data Package, Power Distribution Panel

PDR--Parallel Data Ready

PDU--Power Control and Distribution Unit

PE--Phase-encoded

PEP--Programmable Entry Panel

PHD--Positive High Doppler

GLOSSARY - CONT

PIA--Peripheral Interface Adapter

PIO--Programmed Input/Output

PLD--Positive Low Doppler

PLL--Phase Lock Loop

PLO--Phase Lock Oscillator

PLXO--Phase Locked Crystal Oscillator

PM--Preventive Maintenance

PM&C--Performance Monitor and Control

PM/FL--Performance Monitoring/Fault Location

PMS--Performance Monitoring System

P/N--Part Number

PNAV--Precise Navigation Aircraft

P/O--Part of

POPEN--Pop Enable

p-p--point-to-point

PPD--Pilot Position Data

PPI--Programmable Peripheral Interface

PPR--Pilot Position Report

PR--Previous Results

PROM--Programmable Read-Only-Memory

PS--Power supply

PTT--Push-to-Talk

PWB--Printed Wiring Board

Q

Q--Quadrature

QA--Quality Assurance

QC--Quality Control

QVI--Quasi-Vertical Incidence

R

RAM--Random Access Memory

RBF--Receive Beamformer

RBTB--Receive Beam Test Boundaries

RC--Radar Control

RCD--Range-Compressed Doppler

GLOSSARY - CONT

RC&M--Radar Control and Monitor

RC&M-O--Radar Control and Monitor Operator

RCMG--Receive Control and Monitor Group

RCSC--Research Council on Structural Connections

RCS&EA--Radar Control, Status, and Environmental Assessment

RCVR--Receiver

RDC--Receive Data Conditioner

RDL--Remote Digital Loopback

RDP--Receive Data Processor

RF--Radio Frequency, Register File

RFG--Radio Frequency Gain

RFI--Radio Frequency Interference

RF/IF--Radio Frequency/Intermediate Frequency

RIM--Redundant Interface Module

RIMD--Receiver Intermodulation Distortion

RLC--Resistance-Inductance-Capacitance

RM--Radar Module

RMC--Receive Maintenance Console

r/min--Revolution Per Minute

rms--Root-Mean-Squared

RNFT--Receiver Noise Figure Test

ROCC--Region Operations Control Center

ROCC/NCMC--Region Operations Control Center/NORAD Cheyenne Mountain Complex

ROCS--Read Only Control Store

ROM--Read Only Memory

ROTHR--Relocatable OTH Radar

ROVRLP--Range Overlap

RPIE--Real Property Installed Equipment

RPM--Revolutions Per Minute

RRF--Range Rate Factor, Request Response Form

r/s--Revolution Per Second

RSEC--Revisits Since Initial Entry Count

RSL--Received Signal Level

rss--Root-Sum-Squared

RTS--Request to Send

GLOSSARY - CONT

RVT--Revisit Time

R/W--Read/Write

Rx--Receive

RxAFL--Receive Site Automatic Fault Location

RxCM--Receive Control and Monitor

RxG--Receiver Group

RxSG--Receive Sounding Group

RxSS--Receive Subsystem

S

S--Switch

s--Second

SAP--Service Alarm Panel

SAR--Search and Rescue

SBE--Single Bit Error

SBI--Synchronous Backplane Interface

SCBA--Self-Contained Breathing Apparatus

SCC--Simulation Control Console

scfm--Standard Cubic Feet Per Minute

SCR--Signal-to-Clutter Ratio, Silicon Control Rectifier

SCU--System Control Unit

SD--Senior Director, Serial Data

SD-T--Senior Director Technician

SEG--Segment

SEOS--Southeasterly Operating Segment (Segment 3)

SE ROCC--Southeast Region Operations Control Center

S&H--Sample and Hold

SI--Standard Interface

SID--Sudden Ionospheric Disturbance

SIPPIL--SI Bus Point-to-Point Interface Logic

SIU--Standard Interface Unit

SM--Spectrum Monitor

S&M--Status and Monitoring

SMC--Systems Maintenance Console

SMGC--Spectrum Monitor Gain Control

GLOSSARY - CONT

SMO--System Maintenance Operator

SMR--Source, Maintenance, and Recoverability

SNR--Signal-to-Noise Ratio

SOCC--Sector Operations Control Center

SOM--Start of Message, Sounder Monitor

SOW--Statement of Work

SP--Signal Processor

SPA--System Performance Assessment

SPAFL--Signal Processor Automatic Fault Location

SP&BF--Signal Processor and Beamformer

SPBG--Signal Processing and Beamforming Group

SPP--Signal Processing Program

SPSD--Signal Processing Software Development

SPT--System Performance Test, Signal Processor Test

SRDM--Site Radar Data Multiplexer

SSN--Sunspot Number

SSN_E--Effective Sunspot Number

STX--Start of Text

SW--Software

SW SOCC--Southwest Sector Operations Control Center

SWOS--Southwest Operating Sector

SW/SW--Software-to-Software

SYNC--Hardware Synchronization

T

TAGE--Track Age

TBF--Transmit Beamformer

TBS--To Be Supplied

TCMG--Transmit Control and Monitor Group

TCO--Tactical Computer Operator

TCTO--Time Compliance Technical Order

TD--Tabular Data

TDA--Track Duplication Area

TDC--Transmit Data Conditioner

TDEX--Test and Diagnostic Executive

GLOSSARY - CONT

TDM--Time Division Multiplexer

TDP--Transmit Data Processor

TDR--Time Domain Reflectometer

TDTB--Track Duplication Test Boundaries

TEN--Total Effective Noise

TED--Total Effective Doppler

TETL--Transmit Ensemble Task List

TH--Track History

T_{L1}--Drop Track Threshold

T_L--Track Coast Threshold

TM--Transmitter Module

TMAX--Maximum Time to Establish Track

TMC--Transmit Maintenance Console

TMS--Transmit Monitor Synchronizer, Traffic Management System

TN--True North

TO--Technical Order

TOC--Time of Coincidence

TOD--Time of Day

TODC--Time of Day Clock

TOE--Timeout Error

TOF--Top of Form

TOR--Tactical Operations Room

TP--Test Point

T/R--Transmit/Receive

TSG--Test Signal Generator

TSG/SM--Test Signal Generator/Spectrum Monitor

TSG/WFG--Test Signal Generator/Waveform Generator

TT--Transition Time

TTC--Time-Tag Compare

TTL--Transistor-Transistor Logic

T_{U1}--Track Established Threshold

T_U--Truncated Decision Threshold

Tx--Transmit

TXA--Transmitter Data Processors-A

TxAFL--Transmit Site Automatic Fault Location

GLOSSARY - CONT

TXB--Transmitter Data Processors-B

TxCM--Transmit Control and Monitor

TxG--Transmitter Group

TxSG--Transmit Sounding Group

TxSS--Transmit Subsystem

TYP--Typical

U

UART--Universal Asynchronous Receiver Transmitter

UBI--UNIBUS (Universal Bus) Interface

UPS--Uninterruptible Power Supply

USAF--United States Air Force

UTC--Universal Time Coordinated

UUT--Unit Under Test

V

V--Volt

VA--Volt Ampere

V ac--Volt, Alternating Current

V dc--Volt, Direct Current

VAN--Vancouver

VAX--DEC Trademarks denoting a family of computer systems

VCO--Voltage Controlled Oscillator

VDT--Video Display Terminal

VF--Voice Frequency

VMS--Operating System For VAX (Dec Trademark)

VR--Voltage Regulator

VRDP--Vancouver Remote Data Processor

VST--Vinson Secure Terminals

VSWR--Voltage Standing Wave Ratio

VT--Vertical Tab

W

W--Watt(s)

WATS--Wide Area Telecommunications Service

WB--Wideband

GLOSSARY - CONT

WBW--Waveform Bandwidth

WCFDP--West Coast Flight Data Processor

WCRS--West Coast Radar System

WCS--Writable Control Store

WDM--Wideband Data Multiplexer

WFG--Waveform Generator

WFG/GCR--Waveform Generator/Gain Control Receiver

WICS--Wideband Data Multiplexer Interface Communication Service, Wideband Interface and Control Software

WMO--World Meteorological Organization

WOS--West Operating Sector

WPCC--Waveform Parameter Change Count

WPM--Words per Minute

WRF--Waveform Repetition Frequency

WRI--Waveform Repetition Interval

WWB--Wire Wrap Board

X

X--Horizontal Distance on Displays

Y

Y--Vertical Distance on Displays

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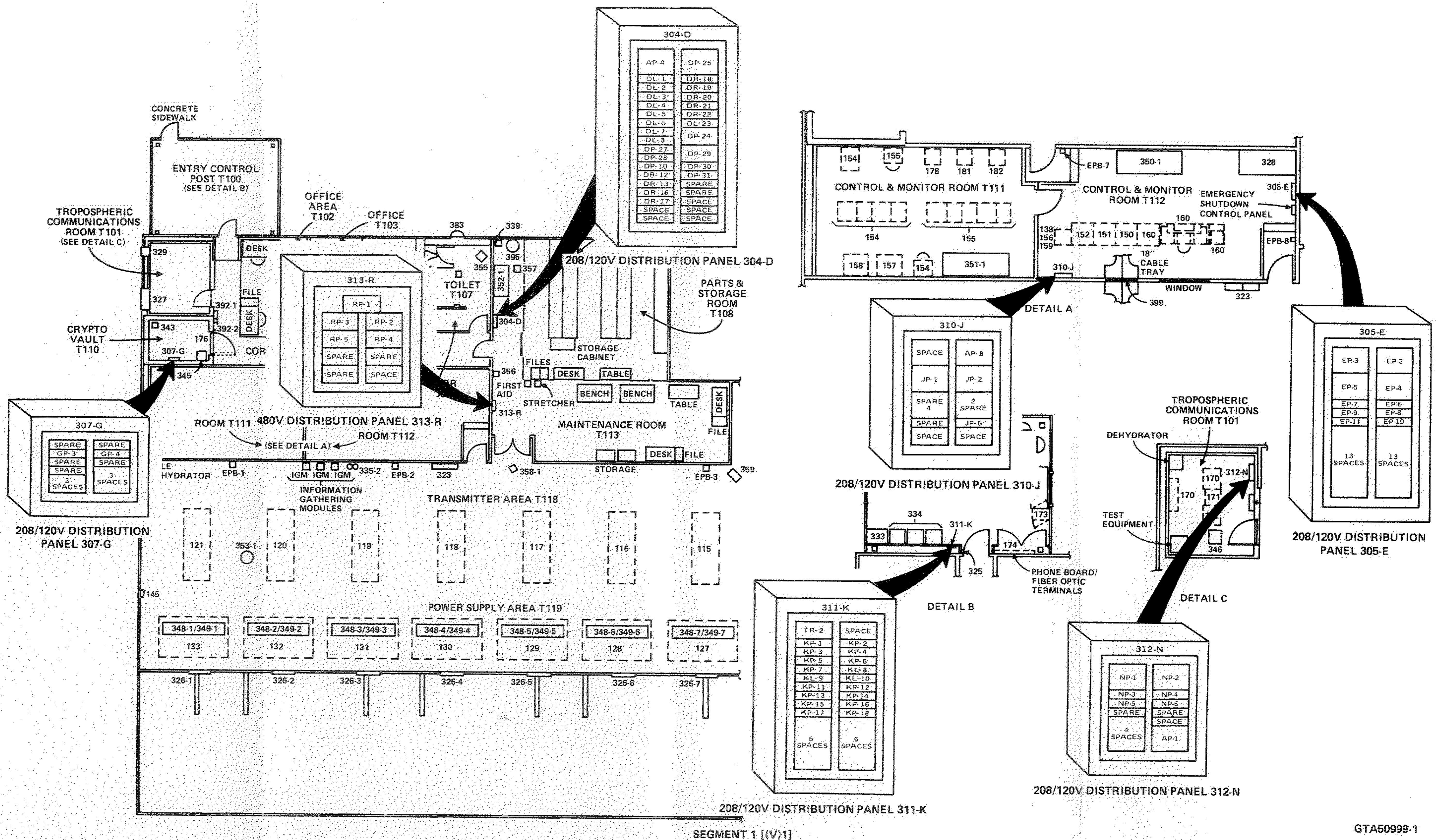

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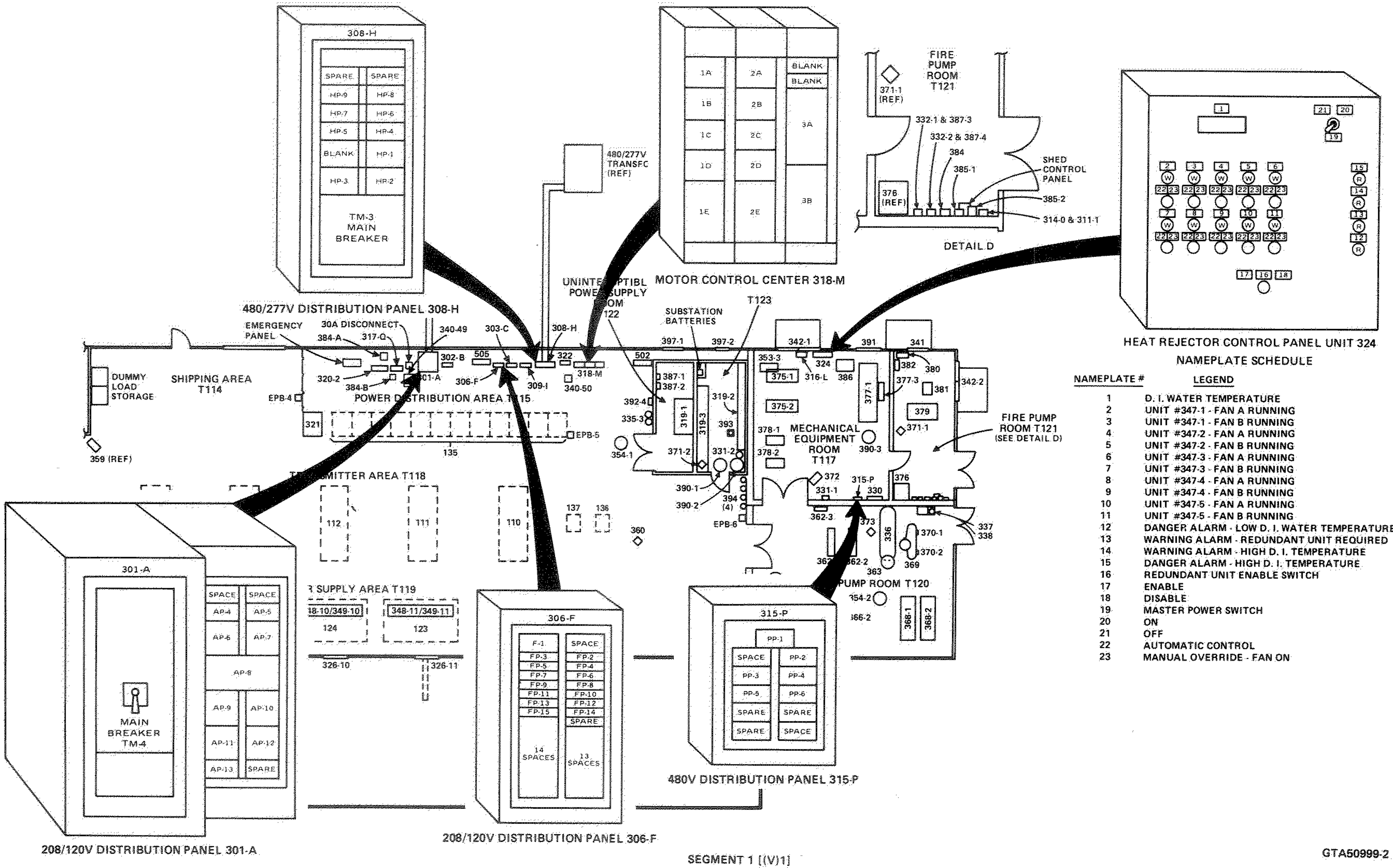

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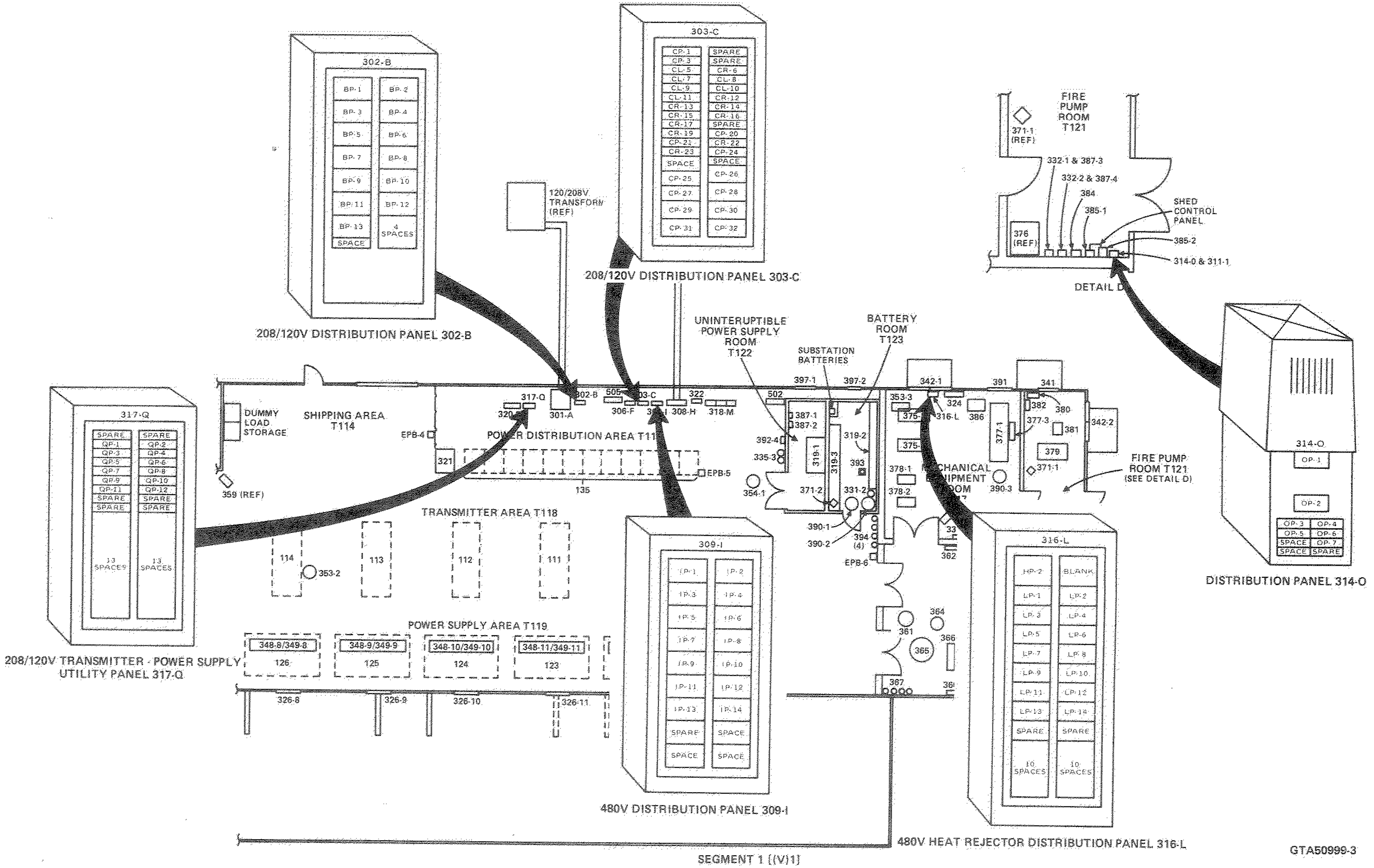

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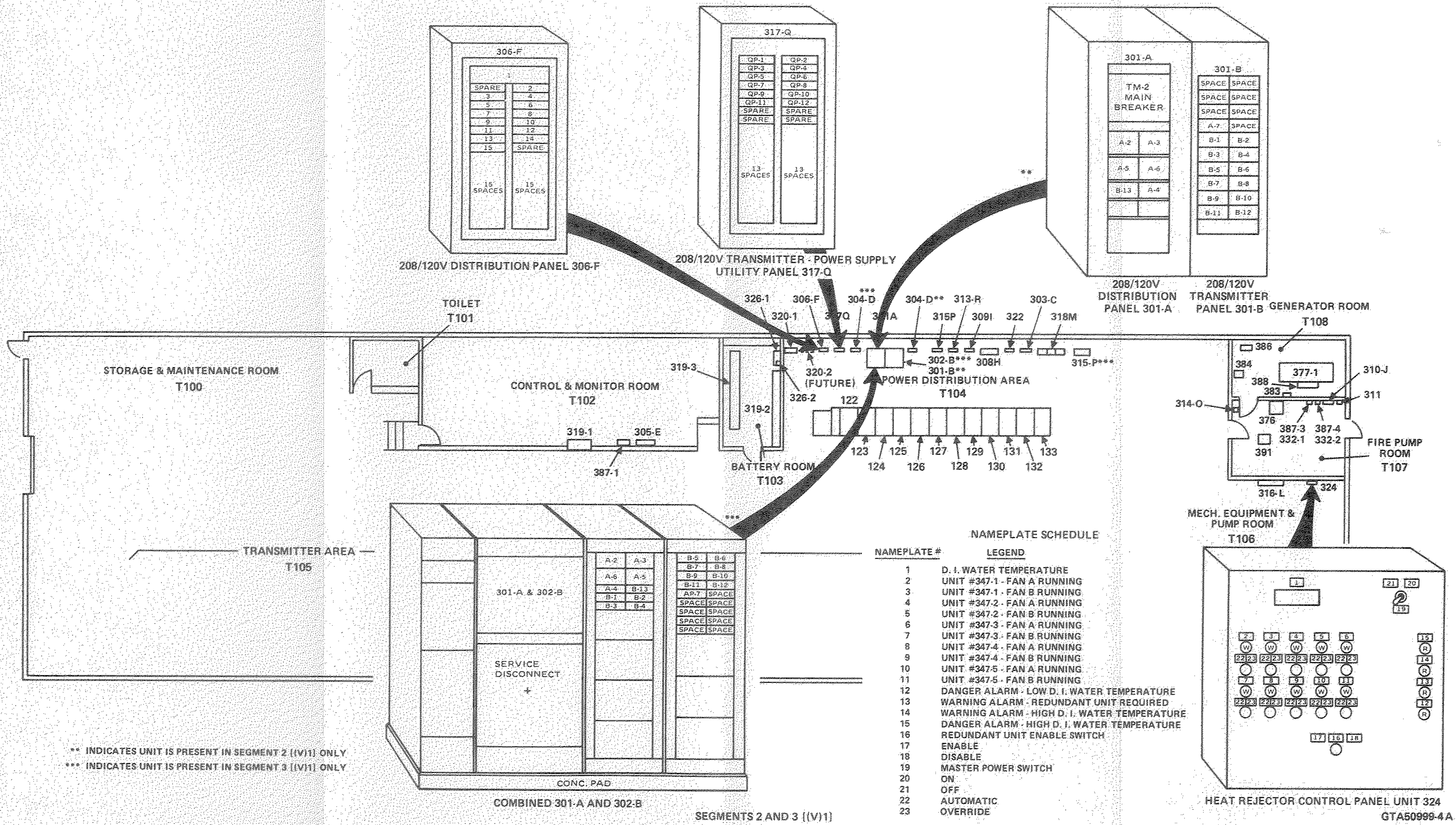
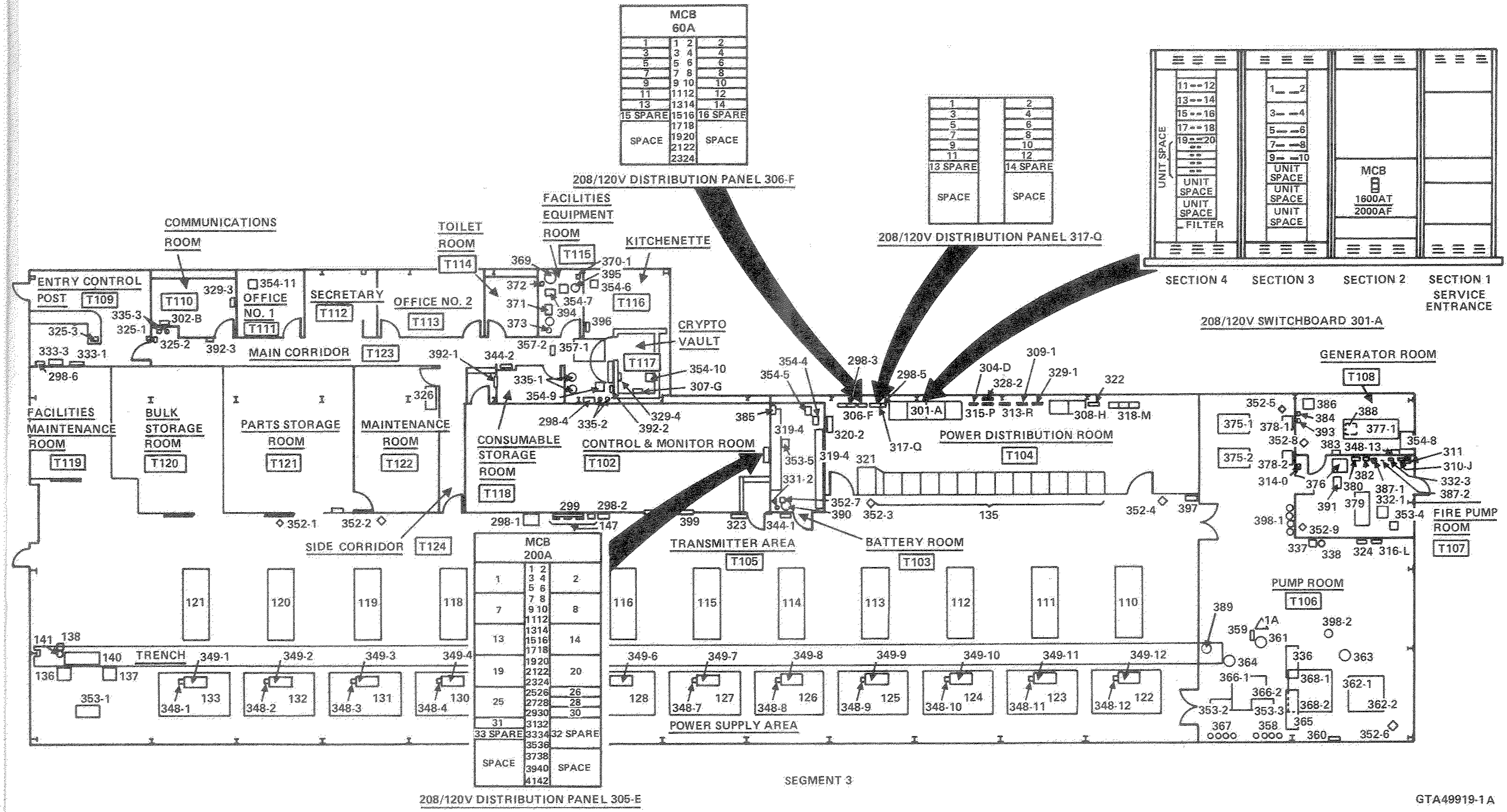


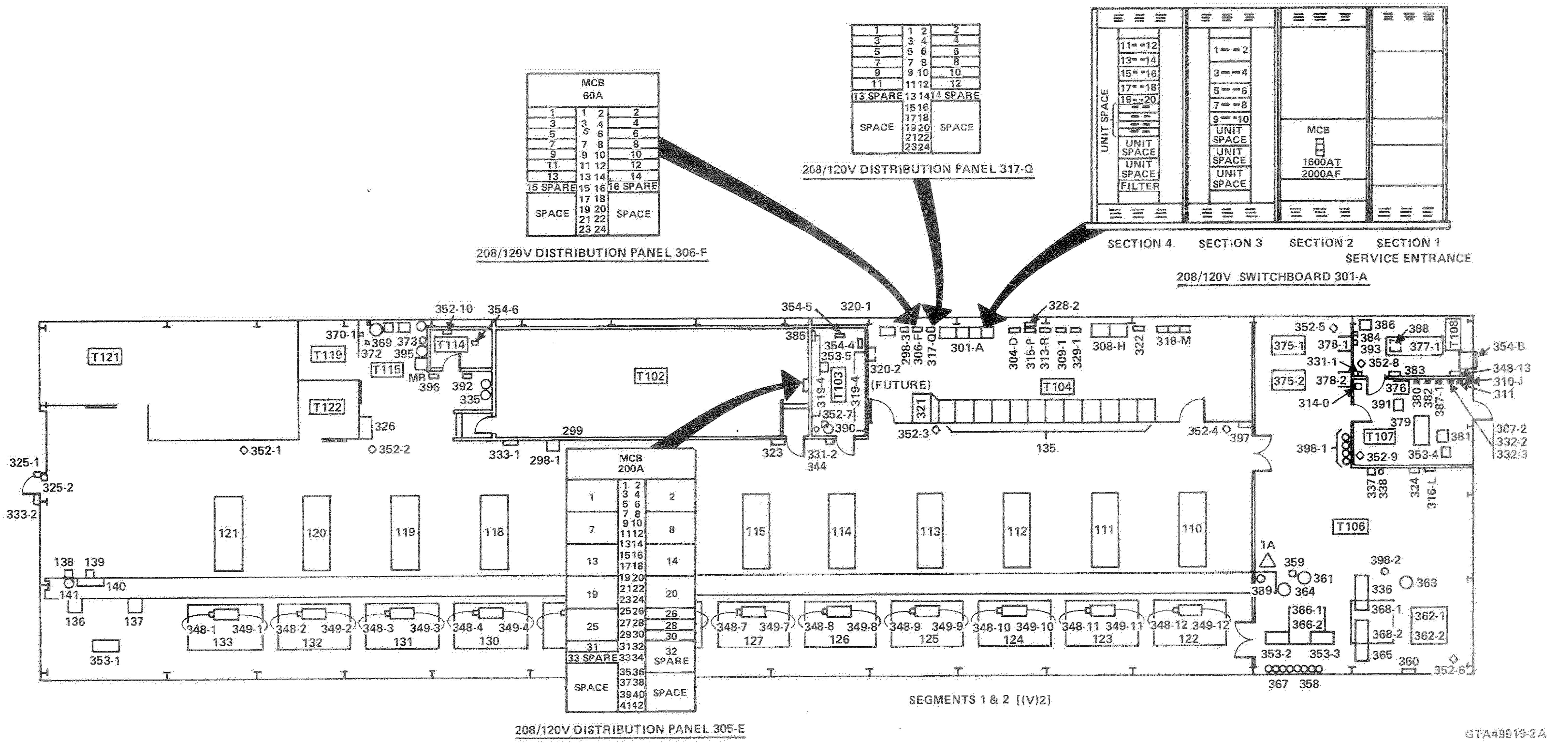
NAMEPLATE SCHEDULE

NAMEPLATE #	LEGEND
1	D. I. WATER TEMPERATURE
2	UNIT #347-1 - FAN A RUNNING
3	UNIT #347-1 - FAN B RUNNING
4	UNIT #347-2 - FAN A RUNNING
5	UNIT #347-2 - FAN B RUNNING
6	UNIT #347-3 - FAN A RUNNING
7	UNIT #347-3 - FAN B RUNNING
8	UNIT #347-4 - FAN A RUNNING
9	UNIT #347-4 - FAN B RUNNING
10	UNIT #347-5 - FAN A RUNNING
11	UNIT #347-5 - FAN B RUNNING
12	DANGER ALARM - LOW D. I. WATER TEMPERATURE
13	WARNING ALARM - REDUNDANT UNIT REQUIRED
14	WARNING ALARM - HIGH D. I. WATER TEMPERATURE
15	DANGER ALARM - HIGH D. I. WATER TEMPERATURE
16	REDUNDANT UNIT ENABLE SWITCH
17	ENABLE
18	DISABLE
19	MASTER POWER SWITCH
20	ON
21	OFF
22	AUTOMATIC
23	OVERRIDE

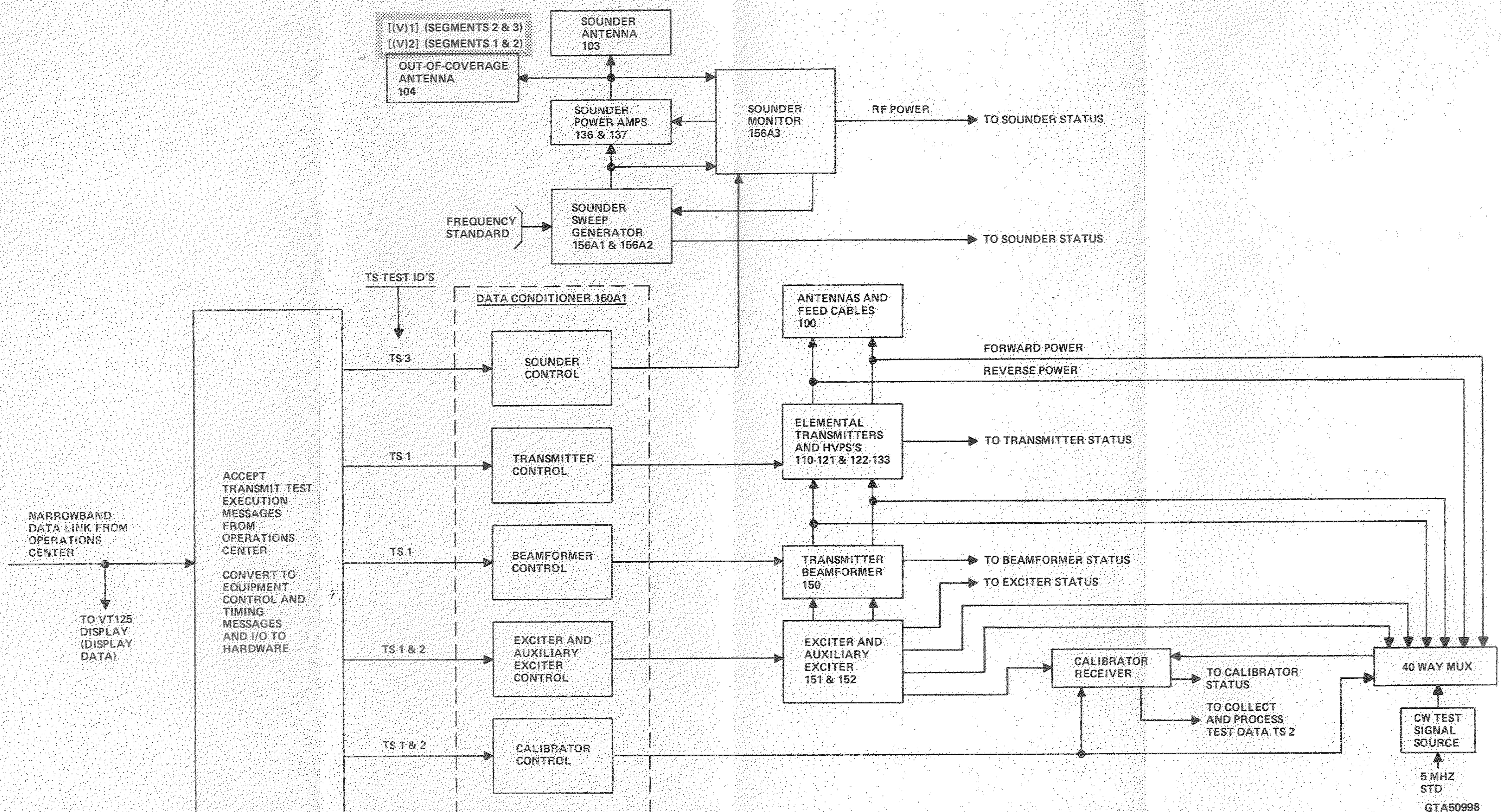
FO-1. (V)1 Transmit Facilities Power Distribution Panels (Sheet 4 of 4)



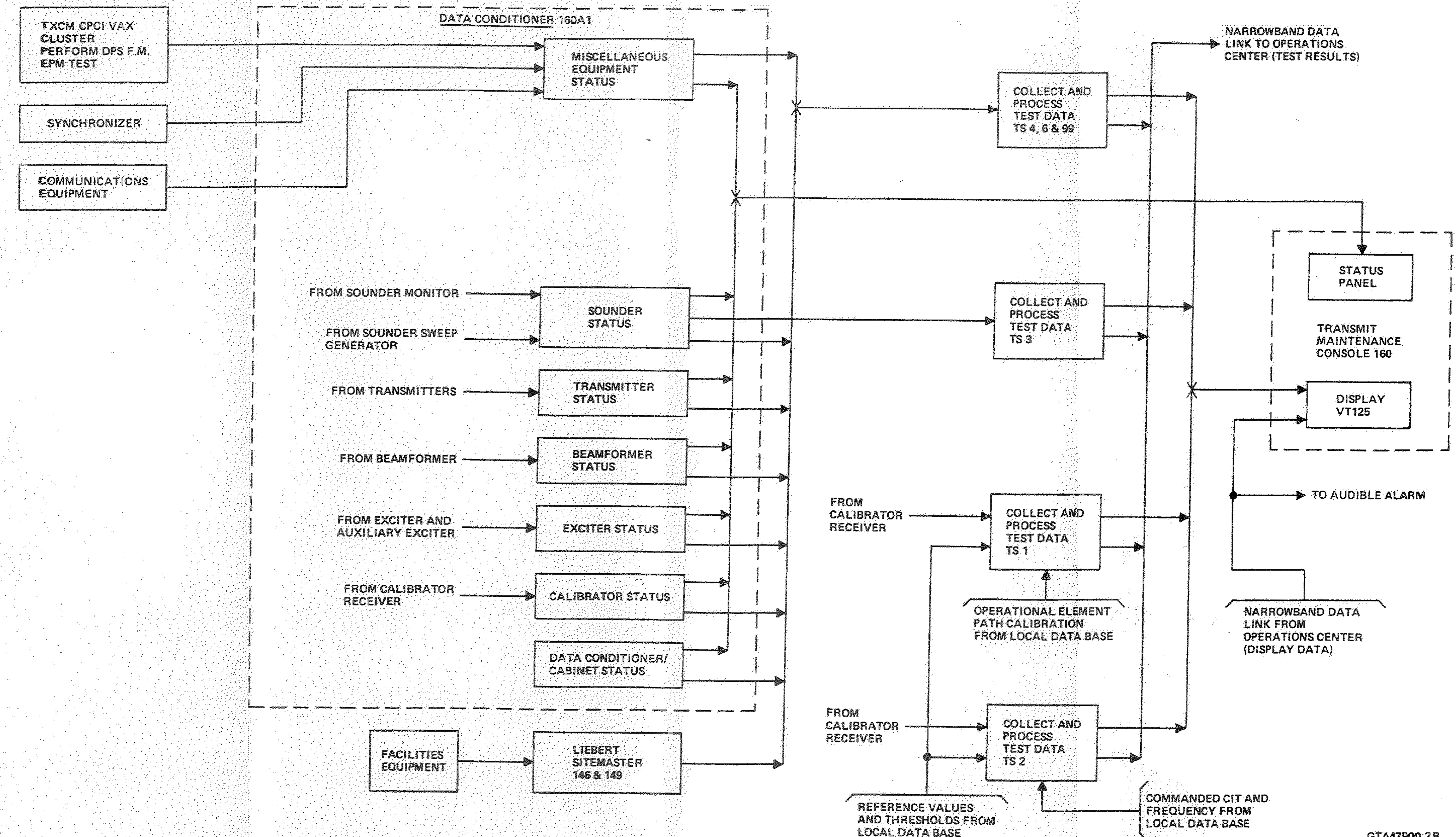
FO-1. (V)2 Transmit Facilities Power Distribution Panels (Sheet 1 of 2)



FO-1. (V)2 Transmit Facilities Power Distribution Panels (Sheet 2 of 2)



FO-2. Transmit Site Equipment Performance Monitoring Function Block Diagram (Sheet 1 of 2)



FO-2. Transmit Site Equipment Performance Monitoring Function Block Diagram (Sheet 2 of 2)

TECHNICAL ORDER PAGE SUPPLEMENT
TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS
RADAR TRANSMITTERS
T-1524/FPS-118(V)
7252903G1
T-1524A/FPS-118(V)
7252903G2

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TECHNICAL MANUAL
OPERATION AND MAINTENANCE INSTRUCTIONS
RADAR TRANSMITTER

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7252903G1
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RESCINDED TO 31P6-2FPS118-81

C-529

TECHNICAL MANUAL
OPERATION AND MAINTENANCE INSTRUCTIONS

RADAR TRANSMITTER

T-1524/FPS-118(V)
7252903G1

T-1524A/FPS-118(V)
7252903G2

(GENERAL ELECTRIC COMPANY)
(CONTINENTAL ELECTRONICS,
A DIVISION OF VARIAN, INC.)

F19628-82-C-0114

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SAFETY SUMMARY

VOLTAGE, CURRENT, AND LIGHTNING HAZARD

The voltage, current, and lightning hazards listed in A through D below exist for the transmitter group. Death or serious injury may result if personnel fail to observe the following safety precautions.

1. Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment. Also, this person must be competent in administering first aid and cardiopulmonary resuscitation (CPR). When the technician is aided by operators, he must warn them about dangerous area.

2. Be careful not to contact high voltage or high current connections when installing, maintaining, or operating this equipment.

3. Whenever the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

4. Remove all rings, watches, bracelets, and necklaces before performing installation, operation, or maintenance of this equipment.

5. Whenever possible, the power supply of the equipment must be shut off before beginning work on the equipment. When working inside the equipment after the power has been turned off always ground every part before touching it.

6. If the device controlling power to the equipment being repaired is turned off, the device should be marked with a warning sign that indicates maintenance is being performed. The sign must not be removed nor the power turned on until maintenance is complete. Where circuit breaker lockout devices are provided, they must be used.

7. Extremely high current low voltage dc is used in portions of this equipment. Do not be misled by the low voltage rating (5 to 60 V dc) of the current sources. Severe personal injury and equipment damage will occur if the current sources are shorted (directly connected) to ground or ground returns by tools or test equipment.

8. Observe all caution and danger instruction signs mounted on equipment.

9. During installation and maintenance, check cabinet grounds in accordance with preventative maintenance schedule.

10. If personnel have been exposed to electrical shock and suffered respiratory or cardiac arrest, immediately perform respiratory or resuscitation procedures as required.

NOTE

For hazards associated with the communications subsystem, real property installed equipment (RPIE), and other government furnished equipment (GFE) or vendor equipment, refer to appropriate manuals furnished with the item.

A. **DC VOLTAGE HAZARDS.**

1. 24 to 60 V dc. A potential of 24 to 60 V dc exists between certain power buses within the transmitter module, Units 110 through 121, (cabinet 1) and power supply (cabinet 2) 24 and 28 V dc power supplies.

2. 200 to 5000 V dc. Potentials of 200 to 5000 V dc exist between certain power supply lines and ground within the transmitter module cabinet and high voltage power supply (HVPS) cabinet.

3. 10,000 V dc or More. Potentials in excess of 10,000 V dc exist within the HVPS cabinet and the transmitter module cabinet.

B. **DC CURRENT HAZARDS.** Certain low voltage power supplies, 25 A dc or more, are bused together. They supply extremely high current at voltages ranging from 5 to60 V dc. In addition to the high continuous current capability, instantaneous short circuit current available at the buses may exceed hundreds of amperes. Direct connections (shorts) placed anywhere across the output lines from these supplies may cause damage to the equipment and severe burns or temporary flash blindness to personnel. DC current hazards are present in the following equipment:

Transmitter module, Units 110 through 121, 15 V dc, 24 V dc, and 28 V dc power supplies.

C. **AC VOLTAGE AND CURRENT HAZARDS.**

1. 60 Cycle 120/208 V ac. High voltage, high amperage, 60 cycle power is supplied to and is present within the following equipment:

   a. Transmitter module, Units 110 through 121.

   b. High Voltage Power Supply, Units 122 through 133.

2. 1000 V ac to 5000 V ac. Potentials in excess of 1000 V ac exist within the transmitter HVPS.

3. 10,000 V ac or More. Potentials in excess of 10,000 V ac exist within the high voltage ac switch, high voltage power supply, and transmitter disconnect switch.

D. **LIGHTNING HAZARDS.** No maintenance shall be performed on the transmit antenna towers or ground screens when thunderstorms are imminent or in progress.

RADIO FREQUENCY RADIATION HAZARDS

The radio frequency (RF) radiation hazards listed in A through D below exist for the transmitter group. For hazards associated with RPIE and other GFE or vendor equipment, refer to appropriate manuals furnished with the item.

A. RADIO FREQUENCY RADIATION HAZARDS. The transmitters of the transmitter group generate and radiate high power RF energy through the antenna elements into free space. The RF radiation fields inside the transmitter module (cabinet 1) and RF radiation from the transmit antenna elements present a potential hazard to personnel unless certain safety precautions are followed. The RF radiation heats the body tissues. When the power or energy density is high enough, the radiation may produce enough heat to damage the body tissues permanently. Recent research has indicated some nonthermal biological effects. Precautions must be taken so that personnel are not exposed to RF radiation levels that are in excess of the RF radiation protection guides below. For normal environmental conditions and for incident electromagnetic energy of frequencies from 2 to 3 MHz, the radiation protection guide is 100 mW/cm. For frequencies from 3 MHz to 30 MHz, the radiation protection guide exposure limit at any frequency can be found by dividing 900 by the frequency in MHz squared. The result is in milliwatts per square centimeter. The power density is averaged over any 0.1 hour (6 minute) period. This means the following:

<u>Power density</u>: 100 mW/cm (in milliwatts per square centimeter) for frequencies from 2 to 3 MHz during 0.1 hour period.

<u>Energy density</u>: 10 mW hrs/cm (in milliwatts per square centimeter) for frequencies from 2 to 3 MHz during any 0.1 hour period.

<u>Power density</u>: 900 (frequency in MHz) (in milliwatts per square centimeter) during any 0.1 hour period (3 to 30 MHz).

<u>Energy density</u>: 90 (frequency in MHz) (in milliwatt hours per square centimeter) during any 0.1 hour period (3 to 30 MHz).

These formulated recommendations pertain to both whole body irradiation and partial body irradiation. Partial body irradiation must be included since it has been shown that some parts of the human body (e.g.,eyes, testicles) may be harmed if exposed to incident radiation levels significantly in excess of the recommended levels.

An RF radiation hazard in excess of the radiation protection guide given above exists inside the transmitter module (cabinet 1) and in the area inside the interlocked antenna field fence. Because the transmit antenna beam is elevated, any elevated object entering the beam (over 10 feet from the ground) will encounter hazardous levels at distances beyond the main antenna field fence.

B. RADIO FREQUENCY RADIATION HAZARD TO PACEMAKERS. The RF radiation due to a stationary beam from the transmitter group could present a potential hazard to personnel wearing cardiac pacemakers. With consideration for the effect of frequency, an E-field of 200 V/meter (rms) is the recommended safe operating limit for pacemaker wearers. Levels above this limit will exist inside the interlocked antenna field fence.

C. RADIO FREQUENCY RADIATION HAZARD TO ELECTRO-EXPLOSIVE DEVICES. The RF radiation from the transmitter group could cause accidental detonation of electro-explosive devices (EEDs). With consideration for the effect of frequency, an average power density of 0.01 W/square meter is the recommended safe operating limit for EEDs in an exposed condition. At this level, Hazardous Electromagnetic Radiation to Ordinance (HERO) restrictions shall be enforced out to a distance of 3121 meters (10,144 feet) in front of the transmit antenna elements or 901 meters (2928 feet) in front of the sounder antenna. This distance shall be doubled if reflections,that could double the field intensity, are to be considered. Because the transmit beam is elevated, the antenna gain was not included when calculating the above distance. Any elevated objects entering the beam will encounter hazardous levels at distances greater than those given above.

U.S. Air Force regulation AFR 127-100, entitled Explosive Safety Standards, establishes safety limits in regard to hazards of electromagnetic radiation to electro-explosive devices. The limits are defined for various configurations and conditions for EEDs. In general, the limits are given for EEDs in transport and/or storage in nonmetallic containers when there are no known EEDs in the area. Although the indicated limits for EEDs are expressed as average power levels, the averaging for beam movement is not always acceptable. This is because the fusible link in some EEDs might explode after exposure to power density levels in excess of the limit for very short periods of time. Averaging for beam movement is not used here because the OTH beam can dwell at one azimuth angle for up to several seconds even when it is scanning. The recommended average power density limit for EEDs in transport and/or storage is 0.26 W/square meter. At this level the safe distance (from transmit antenna) for EEDs in transport or storage is 985 meters (3200 feet) or 285 meters (926 feet) for the sounder antenna. Because the transmit beam is elevated, the antenna gain was not included when calculating the above distance. Any elevated object entering the beam will encounter hazardous levels at distances greater than those given above.

D. RADIO FREQUENCY RADIATION HAZARD PRECAUTIONS. The following RF radiation hazard precautions shall be observed when operating or performing maintenance on the transmit antennas:

1. Proper precautions shall be taken to protect pacemaker users.

2. Visual inspection of the transmit and sounder antennas can be conducted with the radar system fully operational and radiating, provided the personnel remain behind the safety fence and do not work above 10 feet in elevation at all times during the inspection.

3. Maintenance shall not be conducted on the transmit or sounder antennas, ground screens, or any equipment inside the antenna field fence unless all the respective site radar system transmitters are definitely turned off so as not to radiate for the purpose of such maintenance.

4. Perform initial and periodic RF radiation surveys outside the safety fences including the entire length of the back of the transmit antenna field at predetermined intervals to determine if any personnel hazards exist resulting from radar system radiation or adjacent RF radiation sources. The survey shall include measurements from towers, poles, building, and other surfaces. If hazardous areas exist, ensure that radiation restrictions are established and put into effect and that required warning signs are posted and observed by personnel.

5. Prior to and during operation and maintenance, observe all radiation restrictions in effect at the radar site.

6. Do not attempt to climb, step, or stand on transmit elements located on the towers in the transmit antenna field. Damage may occur to the antenna structure and RF radiation may exist.

7. In accordance with design requirements, the primary radar system is designed to prevent RF radiation when the key from the high voltage main switch cabinet is inserted and rotated in the transmitter building key block. Only then can the antenna field gate keys be released from the key block allowing access to the transmit antenna field. Do not, under any circumstances, attempt to defeat the equipment interlocks that implement this safety provision when operating or performing maintenance on the radar system.

8. If personnel are suspected or known to have been exposed to RF radiation in excess of RF protection guide, seek medical advice immediately.

9. Do not stand in front of the transmit elements (inside fenced area) as an RF radiation hazard may exist.

10. Do not attempt to defeat equipment interlocks and operate the transmitter modules (cabinet 1) with any of the shields, panels, or covers removed. Hazardous RF and x-ray fields exist within the transmitter module cabinet.

11. Do not attempt to disconnect RF high power coaxial transmission lines from a transmitter module cabinet, or from each other, while the transmitter or any of the other transmitters are operating. The transmitter may not automatically shut down due to high voltage standing wave ratio (VSWR). In addition, high levels of RF energy may be coupled from the other transmitters to the antenna elements associated with the transmission lines and may be present within the transmission lines. In either case, severe RF burns to personnel due to RF radiation from the open transmission line connections could occur.

12. Always perform an RF radiation survey to determine if a hazard exists after performing a maintenance action which requires removal, disconnection, or replacement of transmission lines or connectors, directional coupler, or RF transfer switches.

CAUTION

RADIATION AREA

X-RAY RADIATION HAZARD

Hazardous x-ray radiation may cause death or serious injury to personnel. MIL-STD-454, Requirement 1, defines an x-ray radiation area to be an area where the level of x-ray radiation exceeds 2.0 milliroentgen/hour at a distance of 5 centimeters from the source of the x-ray emissions. The high power tetrode tubes in the transmitter module units generate x-rays as a result of the electrons striking the metal structure within the tube. Shielding incorporated in construction of the cabinet normally prevents any x-ray radiation hazard to personnel. However, should any of these protective shields, doors, etc. be damaged or otherwise become defective, or personnel place themselves in close proximity to the tubes when high voltage is applied, injury from x-ray radiation could result. The following precautions should be observed regarding x-ray radiation hazards:

1. Perform initial and periodic x-ray emission level surveys to determine if an x-ray radiation hazard exists at edges of the transmitter module cabinet doors. Perform the x-ray level survey in accordance with the established survey procedures.

2. Insure that all x-ray radiation hazard areas are properly posted with x-ray radiation hazard warning signs.

3. If personnel are suspected or known to have been exposed to x-ray emissions in excess of the x-ray radiation protection guide, they are required to seek medical advice immediately. In addition, any such occurrence must be reported to the safety specialist so that appropriate action to eliminate the cause of the hazard can be taken.

DANGER

TOXIC MATERIAL ENVIRONMENTAL HAZARDS, MAJOR MAINTENANCE HAZARDS, FIRE SUPPRESSION HAZARDS, FIRE/EXPLOSION HAZARDS

NOTE

The hazards listed in A through D below exist when performing maintenance of the transmitter group. For hazards associated with RPIE, GFE, or other vendor equipment, refer to appropriate manuals furnished with the item.

A. TOXIC MATERIAL/ENVIRONMENTAL HAZARDS.

1. Toxic or Flammable Solvents and Corrosive Chemicals. Cleaning and painting operations may involve the use of caustic or acid solutions, skin irritants, and organic solvents that are flammable and/or toxic. The following minimum precautions must be observed by personnel using such materials:

   a. Work only in well ventilated areas. Do not rely on equipment room ventilating system for this purpose since it may be recirculating a major part of the equipment room air. Open equipment room doors and use exhaust fans.

   b. Wear organic vapor respirators when using organic solvents or corrosive chemicals.

   c. Wear chemical safety goggles, gloves, and aprons when using corrosive chemicals.

   d. Do not use flammable chemicals near flame or electrical sparks.

   e. Maintain a fully stocked first aid cabinet nearby for emergency treatment of scalds, chemical burns, etc.

   f. Maintain a fresh water supply nearby with a flexible nozzle to flush away corrosive chemicals from any part of the body.

   g. Observe and follow all cautions, warnings, and procedures on containers for solvents, paints, and cleaning chemicals.

   h. If personnel suffer respiratory or cardiac failure due to toxic hazards, immediately perform respiratory or resuscitation procedures as applicable. Seek medical attention as soon as possible if exposure to toxic material occurs.

2. Beryllium Oxide. The tubes in transmitters contain parts made of beryllium oxide which is inert in the form used. Do not attempt to cut open sealed devices containing beryllium oxide part or attempt to cut, grind, file, or machine beryllium oxide parts in any manner. Beryllium oxide dust particles are toxic. They are a hazard to health when ingested, inhaled, or deposited in open wounds. If beryllium oxide particles are ingested, inhaled, or deposited in open wounds, consult medical officer immediately.

3. Benzene, Carbon Tetrachloride, and Trichloroethane Solvents. Do not use these solvents for cleaning. The fumes are toxic and are a hazard to health. The fumes can cause death by central nervous system depression.

4. Freon and Freon TE. Use only Freon TE for cleaning. Do not expose Freon compounds to open flames or intense heat. Freon compounds will decompose into extremely toxic phosgene gas (odor of new-mown hay) and may cause death.

B. MAJOR MAINTENANCE HAZARDS. The precautions given in 1 through 4 below must be observed to prevent personnel injury or death.

1. Verify that bused power supplies are turned off and buses discharged before attempting maintenance of power supplies or backplanes.

2. When removing test equipment weighing 35 pounds minimum (power supplies, synthesizers, spectrum analyzers, sweep generators, or frequency standards) exercise caution to prevent personal injury due to the weight of these assemblies. Observe any weight hazard warning labels on AN/FPS-118 equipment.

3. If horn sounds and fire light is flashing, personnel have approximately 30 seconds to clear the equipment group area before Halon is discharged on the area.

4. During maintenance refer to TO 00-25-234 for precautionary measures that shall be taken while handling electrostatically sensitive equipment. Electrostatically sensitive components are listed in the illustrated parts breakdown.

5. Deionized cooling water at pressures up to 80 lbf/in^2 is connected through reinforced hoses to the transmitter modules. Before performing maintenance on piping or water-cooled assemblies and components within the transmitter, make sure the RPIE water supply and return valves have been turned off and the water pressure with in the units has been vented.

6. Compressed air at pressures up to 20 lbf/in^2 is connected to the transmitter modules to operate various pneumatic devices. Before performing maintenance on piping or any pneumatic devices of the transmitter module, make sure that the RPIE compressed air supply has been turned off, and the air pressure within the unit has been vented.

7. When performing maintenance on the transmitter antennas and transmission lines in inclement weather, make sure appropriate protective clothing and gloves are worn to prevent hypothermia or frostbite.

C. FIRE SUPPRESSION HAZARDS. Halon 1301 used in deluge suppression systems and Halon 1211 used in portable extinguishers are low order toxins which are not hazardous by them selves at concentrated levels necessary for fire extinguishment. However, certain precautions must be taken in the event of a Halon spill or when exposed to the combination of the products of combustion and Halon extinguishing agents. These precautions are as follows:

1. Observe the following precautions in the event of a spill or ruptured tank to prevent overexposure. High concentrated levels of Halon may cause acute cardiac and respiratory effects.

a. Halon 1211.

(1) Notify safety personnel, ventilate area, and wear protective clothing and required equipment for clean up. Do not smoke with contaminated hands. Do not consume food in areas of use. Do not allow liquid to contact skin or eyes. Avoid inhalation of vapors. Avoid contamination of tobacco and food.

(2) Small spills do not require respiratory protection in well ventilated areas. Use Self Contained Breathing Apparatus (SCBA) when cleaning up large spills.

(3) First aid procedures include flushing eyes with water for 15 minutes, washing exposed skin with soap and water, moving inhalation victim to fresh air, and providing oxygen and artificial ventilation if required. Seek medical advice in all cases.

b. Halon 1301.

(1) Move leaking cylinders to a ventilated area (outside of building, if necessary). Completely discharge cylinder contents and return defective cylinders to vendor.

(2) If respiratory problems are noted, move victim to fresh air and provide supplemental oxygen. Administer artificial respiration if required and seek medical advice immediately.

2. In the event of a fire, observe the following precautions when using Halon 1211.

a. Use extinguishers only in the event of a fire, being careful not to inhale vapors from the products of combustion. In all but the beginning stage of a fire, evacuate and do not attempt extinguishment.

b. During overhaul operations, observe the same precautions as for a spill.

D. **FIRE/EXPLOSION HAZARDS.**

1. Solvent. Solvents used in thinners, paints, and certain cleaners are extremely flammable. They are toxic and are hazardous to the health. To avoid explosions and fire, do not use paints, thinners, and cleaners near flame or electrical sparks. When using these items in a confined area, the area must be ventilated to outside air to avoid explosive or toxic concentration of the solvent fumes. Do not rely on equipment room ventilating system for this purpose since it may be recirculating a major part of the equipment room air. Open equipment room doors and use exhaust fans. In addition to adequate ventilation, organic respirators must be worn to reduce the toxic effects of the solvents. If personnel suffer respiratory or cardiac failure due to the hazards listed above, immediately perform respiratory or resuscitation procedures as applicable. When, and if possible, seek medical advice.

2. Electrolytic Capacitor. Ensure terminal polarity markings [positive (+) and negative (-)] are observed when connecting electrolytic capacitors to dc (+) and (-) buses. If capacitors are installed backwards (reverse polarity), an explosion will result when dc voltage is applied.

CHAPTER 1

GENERAL INFORMATION

1-1 PURPOSE.

This section describes the Elemental Transmitter of the T-1524 (V)1 and T-1524A (V)2 Transmitter Group of the AN/FPS-118(V) radar systems, Over the Horizon Backscatter Radar. System configuration is three 60-degree operating groups designated as segments 1, 2, and 3 with functional components at three locations: a transmit site, a receive site, and an operations center.

1-1.1 Use of the Transmitter. The Elemental Transmitter is part of segments 1, 2, and 3 transmit group equipment. A segment consists of 12 identically configured transmitters. The transmitter group supports the radar system mission through high-power RF transmission controlled and processed by the operations center. Refer to Figure 1-1.

1-2 DESCRIPTION.

The complete transmitter consists of three cabinets (Figure 1-1). Nomenclature and designators are: Transmitter Cabinet Number 1, High Voltage Power Supply (HVPS) Cabinet Number 2, and High Voltage AC Power Switch Cabinet Number 3. A pneumatic system operates frequency and band filter controls and RF output switches. Transmitter cooling is accomplished by both air and water systems. RF is output through a band-selectable antenna/dummy load transfer switch located on top of cabinet 1. Cabinet 1 is accessed through interlock-monitored doors. Cabinets 2 and 3 are accessed through a safety-engineered keying system. Table 1-1 cross-references system unit numbers and the three transmitter cabinet numbers.

1-2.1 Transmitter Cabinet 1. Transmitter Cabinet 1 (Figure 1-2) controls and monitors functions of the transmitter in the local mode of operation and monitors functions in the remote mode. The transmitter has three vacuum-tube RF amplification stages with interstage band filtering. The output of each band is switched between an antenna or dummy load by pneumatic-operated switches.

1-2.2 HVPS Cabinet 2. The HVPS (Figure 1-3) provides ac power, monitoring, and high-voltage dc distribution to cabinet 1.

1-2.3 High Voltage AC Power Switch Cabinet 3. The 12.47 kVac supply voltage for HVPS is routed through cabinet number 3 (Figure 1-4). This cabinet provides a manual disconnect switch for the 12.47 kVac.

1-3 LEADING PARTICULARS.

Table 1-2 is leading particular data for the radar transmitter. Cabinets 1 and 2 power sources are: 12.47 kVac, 3-phase, 60 Hz; 208 V ac, 3-phase, 60 Hz; and 120 V ac, 1-phase, 60 Hz. Cabling and wiring requirements are contained in Circuit Diagrams manual TO 31-P6-2FPS118-83 and facility Real Property Installed Equipment (RPIE) manuals.

1-4 CAPABILITIES AND LIMITATIONS.

Table 1-2 lists characteristics of the system.

1-5 EQUIPMENT SUPPLIED.

Table 1-3 lists the equipment supplied.

1-6 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1-4 lists equipment required, but not supplied, for transmitter installation and service.

1-7 SPECIAL TOOLS AND TEST EQUIPMENT.

Table 1-5 lists special tools and Table 1-6 lists both standard and special test equipment required to maintain the transmitter. Table 1-7 lists electrical maintenance support equipment by identification and capabilities/characteristics.

1-8 RELATED TECHNICAL MANUALS.

Table 1-8 lists related technical orders and publications for transmitter operation and maintenance. TO 31P6-2FPS-118-01, the List of Applicable Publications (LOAPS), contains a complete listing of AN/FPS-118(V) series technical orders and related publications.

Table 1-1. Unit Number to Cabinet Cross-Reference

Cabinet Number	Nomenclature	Unit Number Designator
1	Transmitter	110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, and 121
2	High Voltage Power Supply	122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, and 133
3	High Voltage AC Power Switch	222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, and 233

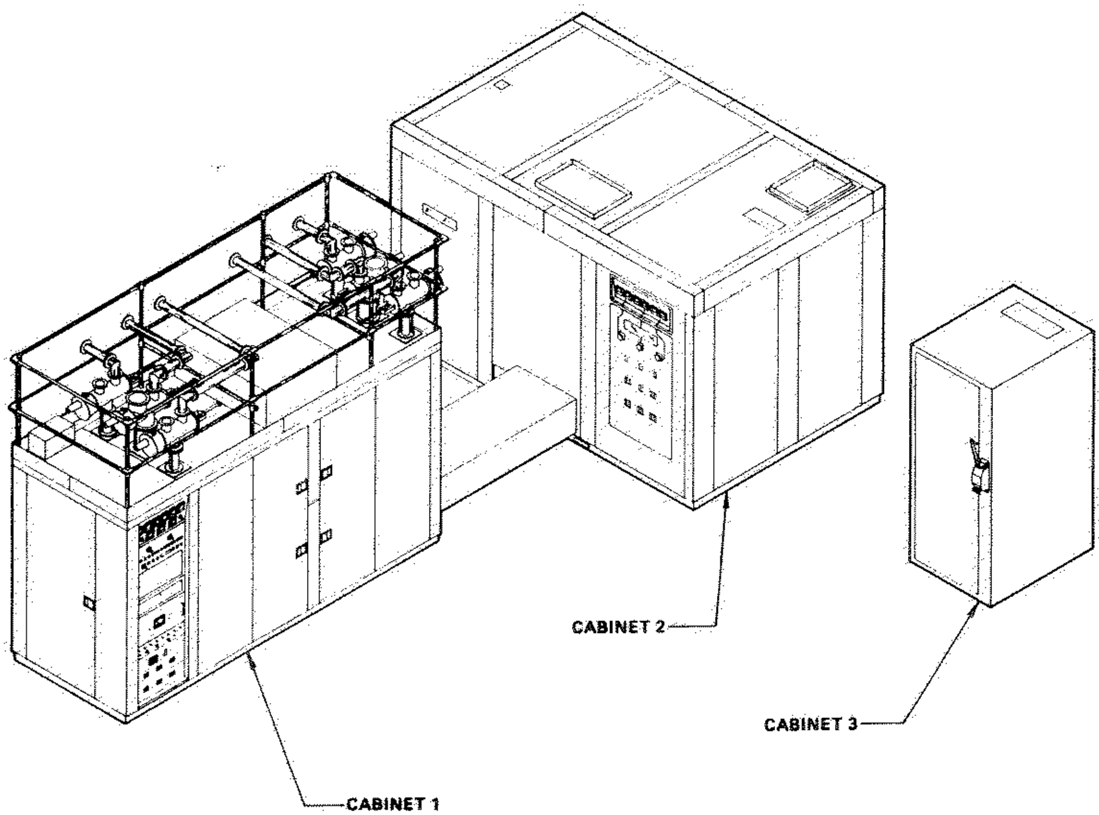


Figure 1-1. Elemental Transmitter

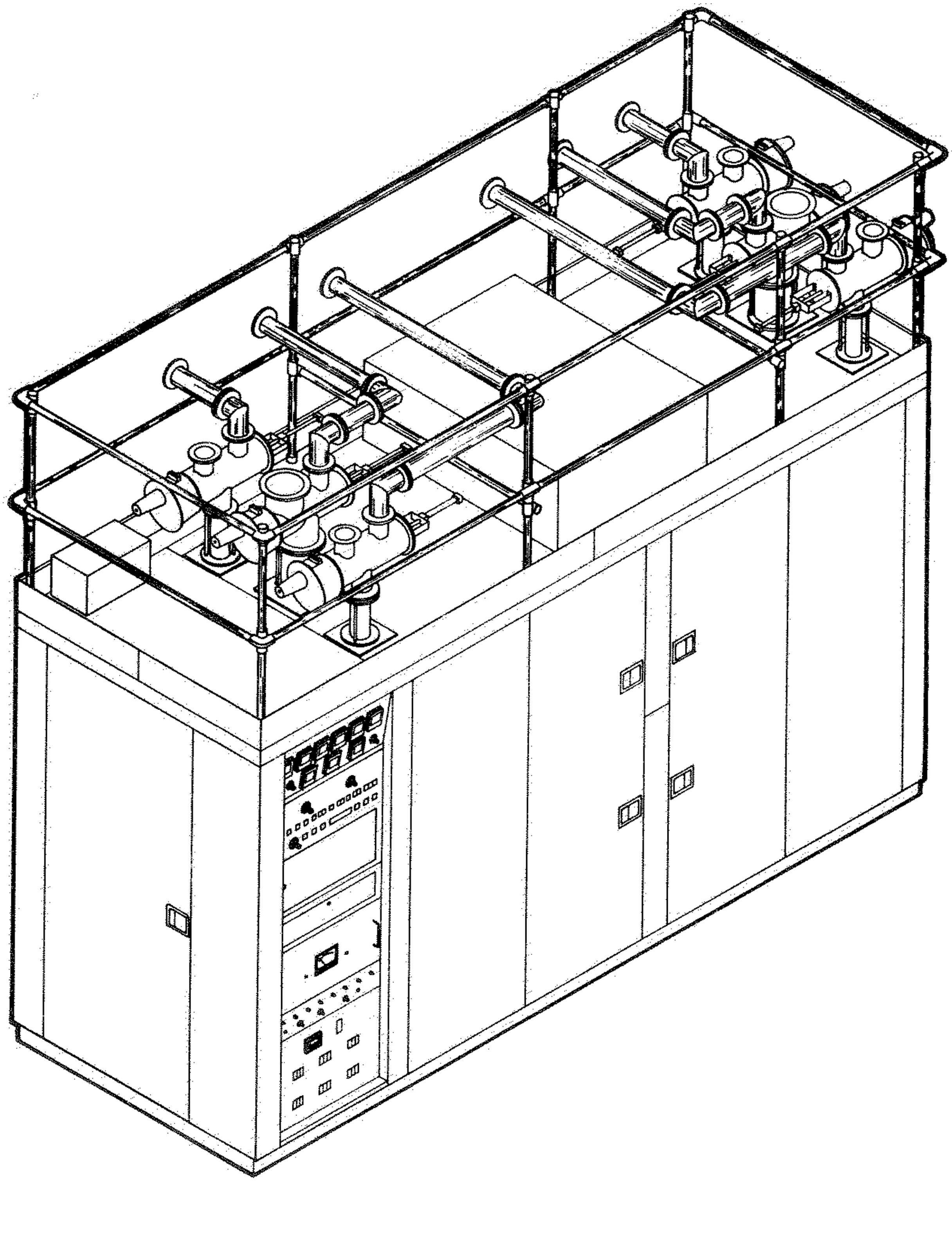


Figure 1-2. Transmitter Cabinet 1

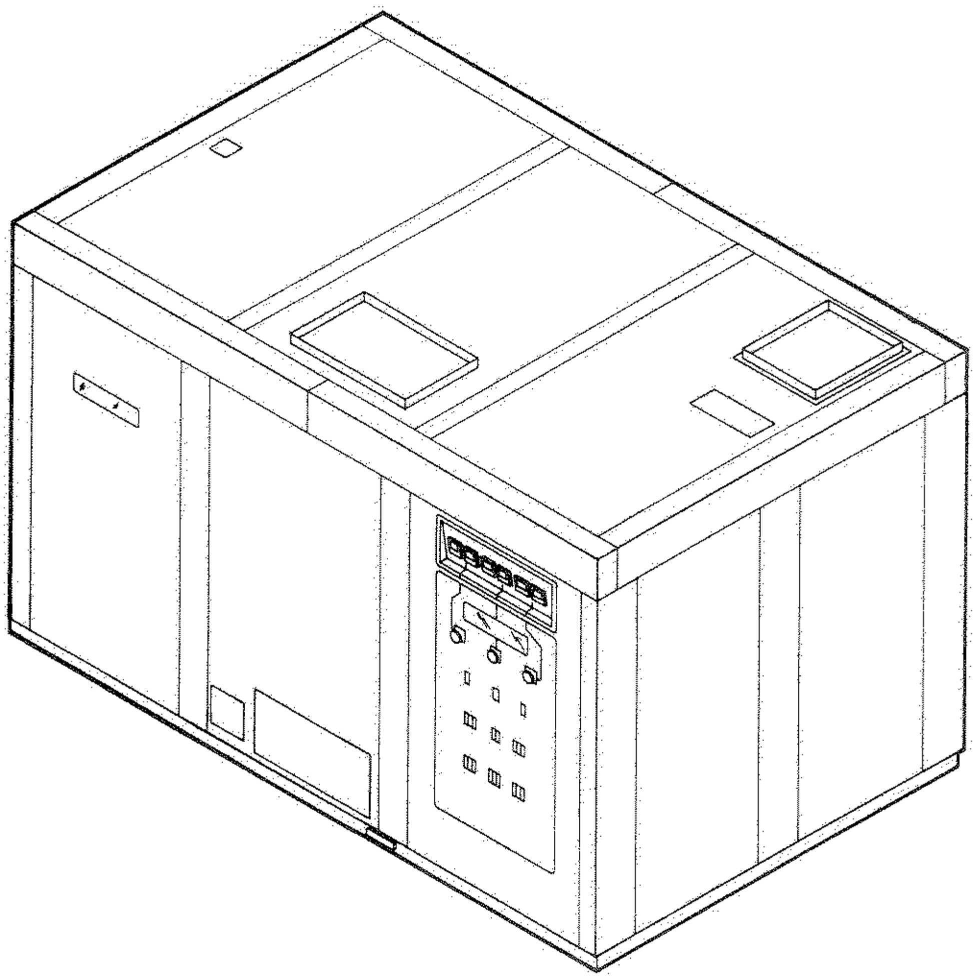


Figure 1-3. HVPS Cabinet 2

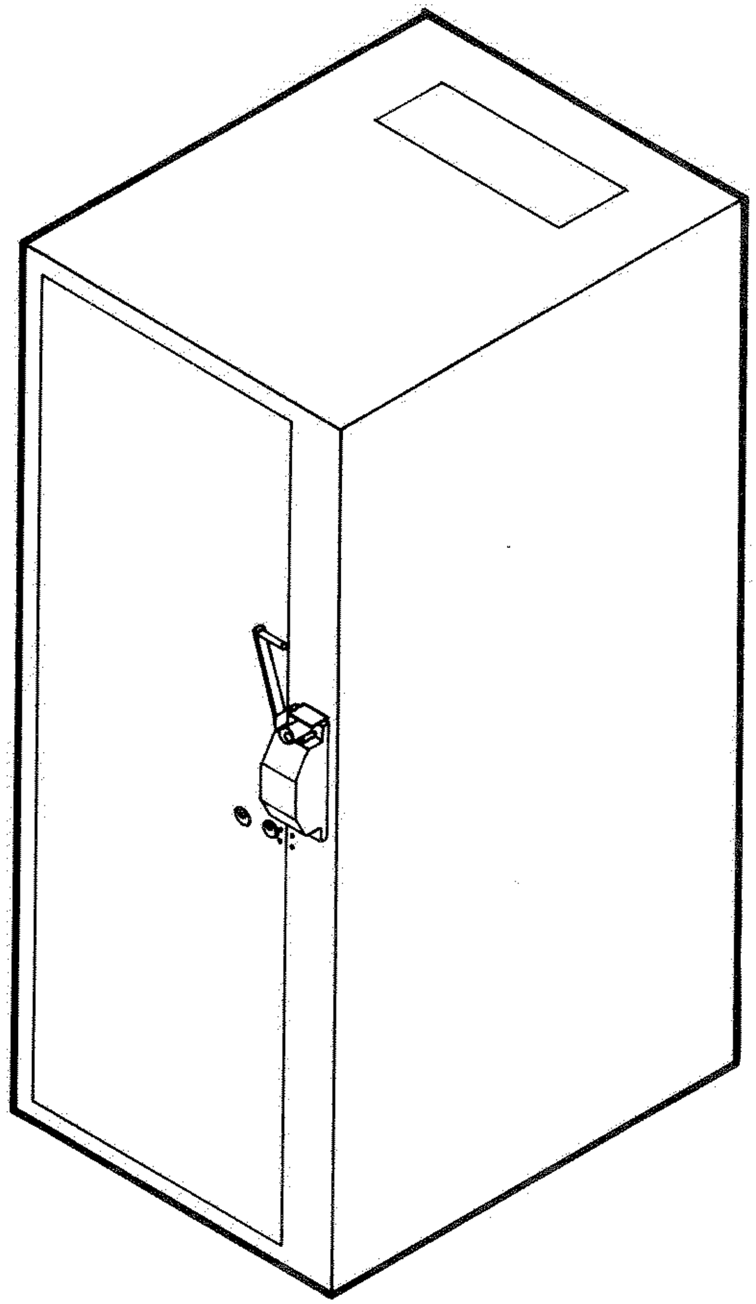


Figure 1-4. High Voltage AC Power Switch Cabinet 3

Table 1-2. Radar Transmitter Characteristics

Characteristics	Parameter
	ELECTRICAL
RF Power Output:	(V)1 110 kW CW Bands A through E; 80 kW CW Band F. (V)2 110 kW CW Bands A through F. For ICW, average RF power at dedicated forward power port should not be less than 6 dB below power at same frequency in CW.
Frequency Range:	5 to 28 MHz (6 bands)
Band	Frequency MHz
A	5.00 to 6.79
B	6.69 to 9.14
C	9.04 to 12.30
D	12.20 to 16.55
E	16.45 to 22.30
F	22.20 to 28.00
Tuning:	Broadband (bandswitched)
Frequency Change Time:	a. Within a given band: 1 to 5 milliseconds. b. Between bands: less than 1.25 seconds.
Impedance:	
Input:	50 ohms (1.5:1 vswr maximum)
Output:	50 ohms (1.6:1 vswr maximum)
Modulation:	CW/ICW
Linearity:	
Amplitude:	± 0.2 dB from rated power output to -10 dB (output vs input) ± 0.5 dB from 10 dB below rated power output to -20 dB.
Phase:	± 1 degree for any 100 kHz BW (5 to 28 MHz)

Table 1-2. Radar Transmitter Characteristics - CONT.

Characteristics	Parameter
Band Response:	± 0.3 dB amplitude flatness (Transmitter terminated into balanced load.)
Spectral Purity:	
Noise/Spurious:	Reference TO 31P6-2FPS118-11
Harmonics:	-70 dB (Transmitter operating into 50 ohm load.)
TRANSMITTER (CABINET 1)	
AC Power (From HVPS):	208 V ac ± 3%, 3-phase, 60 Hz, 10 kVa 120 V ac ± 5%, 60 Hz, 1 kVa
DC Power (From HVPS):	(V1) 11.4 kVdc, 20.00 amps (V2) 12.0 kVdc, 20.00 amps 4.5 kVdc, 6.00 amps 3.5 kVdc, 4.00 amps 1.5 kVdc, 1.50 amps 1.5 kVdc, 0.50 amps 1.5 kVdc, 0.50 amps
ENVIRONMENTAL	
Temperature:	
Operating:	+40° F to +105° F
Storage:	-40° F to +125° F
Altitude:	To 5000 feet above sea level
Humidity:	10% to 95% relative humidity
MECHANICAL	
Size:	
Transmitter Cabinet 1	54"D; 150"L; 85"H
HVPS Cabinet 2	84"D; 144"L; 97"H
HVAC Switch Cabinet 3	36"D; 42"L; 90"H
Weight:	
Transmitter Cabinet 1	5,600 lbs.
HVPS Cabinet 2	12,000 lbs.
HVAC Switch Cabinet 3	1,800 lbs.

Cooling:

WATER

Resistivity:	1.0 megohms (minimum)
pH Factor:	5.5 to 8.0

Table 1-2. Radar Transmitter Characteristics - CONT.

Characteristics	Parameter
Cooling:	
WATER	
Volume:	51.0 gpm (minimum) at 80 to 88 psig Inlet; 5 to 9 psig Outlet
Resistivity:	0.5 megohms (minimum)
pH Factor:	5.5 to 6.0
Particle Size:	10 microns (maximum)
AIR	
Transmitter Cabinet	2300 to 2500 cfm at 0.45 to 0.55 in. H_2O
HVPS Cabinet	4600 to 5000 cfm at 0.5 to 0.6 in. H_2O
Pneumatic Control (Compressed Air)	
Volume:	4 to 5 cfm at 35 ±3 psig
Moisture Content:	Dried to 0° F dew point
Particle Size:	50 microns (maximum)
Oil Content:	Paraffin base mineral oil with Aniline point in the 180 to 210 range, viscosity of 150 to 200 seconds at 100° F, approximately 1 drop per hour serving simultaneously all 12 transmitters(SAE No. 10).
SAFETY	
Radiation Hazards:	<1 mW/cm^2 average power density
Cardiac Pacemaker	<200 V/m

Table 1-3. List of Equipment Supplied

Assembly No.	Title	Part Number
	(V)1 Elemental Transmitter	126100-1
	(V)2 Elemental Transmitter	126100-2
1	(V)1 Transmitter Module	126101-1
	(V)2 Transmitter Module	126101-2
1A1	CONTROL/STATUS & Card Assembly Panel	126117
1A1A1	RF Feedback CCA	150125
1A1A2	Signal Monitor CCA	150126
1A1A3	Band Filter Driver CCA	150144
1A1A4	Band Command CCA	150129
1A1A5	Band Prove CCA	150122
1A1A6	Bias Control & Reset Logic CCA	150127
1A1A7	Serial Command CCA	150130
1A1A8	Serial Status CCA	150128
1A1A9	HV Control CCA	150118
1A1A10	Water Flow CCA	150120
1A1A11	Fault Overload CCA	150119
1A1A12	First Event Logic CCA	150121
1A1A13	Test Meter Scaling CCA	150124
1A1A14	Extender Service CCA	150161
1A1A15-17	Radio Frequency Detector	109-0569
1A1A18	Distribution Wiring CCA	150157
1A1AR1-3	Low Level Amplifier	109-0615
1A1AR4-5	1/F Amplifier CCA	150153
1A1AR4A1-5A1	RF/IF Amplifier CCA	150155
1A2-A3	Grid Detector	126110
1A4	PA Grid Detector	126111
1A5	PA Anode Detector	126112
1A6	IPA Monitoring Network	126113

Table 1-3. List of Equipment Supplied - CONT.

Assembly No.	Title	Part Number
1A7	Driver Amplifier Monitoring Network	126114
1A8	RF Arc Sensor	150101
1A8A1	Arc Sensor Component Board	126177
1A9	Bias Adjust Panel	126118
1A10	IPA Anode RF Sample Pickup	130390
1A11	Driver Amplifier Anode RF Sample Pickup	130386
1A12	PA Monitoring Network	126121
1A13	Meter Assembly Panel	126158
1A14-20	Arc Sensor Probe	150100
1A21	Parasitic Suppressor	126197
1A22	Parasitic Suppressor	130469
1A23	Electronic System Protection Panel	126119
1A24	Relay Assembly	126120
1A25	RF SIGNAL MONITORS Panel	150123
1A26	Arc Sensor Probe	150100
1A27	Arc Sensor Probe	150100
1AR1	Low Level Amplifier	109-0560
1AT1	IPA Grid Dummy Load	126106
1AT2	Driver Amplifier Grid Dummy Load	126107
1AT3	PA Grid Dummy Load	126108
1DC1	Directional Coupler, RF Input	160-0111
1DC2	Directional Coupler, IPA RF Input	160-0100
1DC3	Directional Coupler, Band A Output	160-0105
1DC4	Directional Coupler, Band B Output	160-0106
1DC5	Directional Coupler, Band C Output	160-0107
1DC6	Directional Coupler, Band D Output	160-0108
1DC7	Directional Coupler, Band E Output	160-0109
1DC8	Directional Coupler, Band F Output	160-0110

Table 1-3. List of Equipment Supplied - CONT.

Assembly No.	Title	Part Number
1FL1	IPA Grid Filter Band Pass Band ABC	126125
1FL2	IPA Grid Filter Band Pass Band DE	126126
1FL3	IPA Grid Filter Band Pass Band F	126127
1FL4	DRVR Grid Filter Band Pass Band ABC	126128
1FL5	DRVR Grid Filter Band Pass Band DEF	126129
1FL7	PA Grid Filter Band Pass Band AB	126131
1FL8	PA Grid Filter Band Pass Band CDE	126132
1FL9	PA Grid Filter Band Pass Band F	126133
1FL10	PA Output Filter Band Pass Band A	126134
1FL11	PA Output Filter Band Pass Band B	126135
1FL12	PA Output Filter Band Pass Band C	126136
1FL13	PA Output Filter Band Pass Band D	126137
1FL14	PA Output Filter Band Pass Band E	126138
1FL15	PA Output Filter Band Pass Band F	126139
1K6	Coaxial Relay	150143
1PS1	DC Power Supply	109-0562
1PS2	DC Power Supply	109-0563
1PS3	IPA Bias Power Supply	126145
1PS4	Driver Ampl. Power Supply	126146
1PS5	PA Bias Power Supply	126155
1PS6	Dual DC Power Supply	109-0561
1S32-35	Dummy Load/RF Output Transfer Switch	150517
1S36/37	Dummy Load/RF Output Transfer Switch	150516
1S38	Grounding Switch	126171
	Transmitter Module Enclosure	126221
2	(V)1 High Voltage Power Supply	126102-1
	(V)2 High Voltage Power Supply	126102-2
2A1	Electronic Crowbar	150110
2A2	Electrical System Protection Panel	150113

Table 1-3. List of Equipment Supplied - CONT.

Assembly No.	Title	Part Number
2A3	Meter Assembly Panel	150115
2A4	Electronic Motor Controller	109-0605
2A5	Transformer Current Monitor	179793
2A6	Transformer Current Monitor	179793
2A7	Transformer Current Monitor	179793
2S2	Grounding Lever Switch	150116
2Z1	Phase Monitor (208 V ac, 3-Phase)	149651-1
2Z2	Phase Monitor (12.47 kVac, 3-Phase)	149651-2
	HV Power Supply Module Enclosure	150700
3	HVAC Switch Assembly	150117
(Ref.)	Key Interlock System	150160
	HVAC Switch Module Enclosure	150080

Table 1-4. Equipment Required But Not Supplied

Item	Nomenclature	Type/ Part No.	Mfr.	CAGE
1	Service Equipment			
a	Adapter, Side Lift	149782-1	CED	52151
b	Dummy Load	126103-1	CED	52151
c	Extension, Fork W/Riser	149781-1	CED	52151
d	Hoist, Electric, Tube/Capacitor	150149-1	CED	52151
e	Lift, Heavy Component Handling	150147-1	CED	52151
f	Lift, Heavy Component Handling Short-Reach	149785-1	CED	52151
g	Plate, Lift (Short reach)	149783-1	CED	52151
h	Platform, Material Handling, HVPS	150148-1	CED	52151
i	Simulator, Transmitter Control/Monitor Group	149786-1	CED	52151
j	Support, Hoist, Tube Removal	150150-1	CED	52151
k	Table, Lift Filter/Tube Servicing	150146-1	CED	52151
l	Test Set, Spectral Purity	159980-3	CED	52151
m	Tool, Filter Removal and Installation	150151-1	CED	52151
n	Tool, PA Bias Power Supply Removal	149784-1	CED	52151
o	Rail, Component Replacement	150037-1	CED	52151
p	Hand truck	Any	Any	NA
q	Forklift, Truck	SP30	Clark	89747
r	Ladder, Platform	7606	Lynn Ladder	75349
s	Adapter, Straight (1/2 x 1/4)	411-2432	CED	52151
t	Union, 1/2	411-2451	CED	52151

Item	Nomenclature	Type/Part No.
u	Power Supply, 26V dc	PAB (or equiv)
w	Power Supply, 0-15V dc	JKM15-3M (or equiv)
x	Resistor, 100 ohm, 2W	22-2S-100R0-0 (or equiv)
2		
a	Meter, RF Power	435B (or equiv)
b	Multimeter, Digital	8050A (or equiv)
c	Multimeter	260 (or equiv)
j	Counter, Frequency	HP 5342 (or equiv)
3		
a	Oscilloscope	1740A (or equiv)
4		
a	RF Signal Generator	8656A (or equiv)
b	Pulse Generator	Model 100C (or equiv)

Table 1-4. Equipment Required But Not Supplied - CONT.

Item	Nomenclature	Type/ Part No.	Mfr.	CAGE
1				
u	Power Supply, 26 V dc	PAB or equiv.	Kikisui	61993
v	Test Cable(Ref. 6-8.5.3)		Local Mfg.	
w	Power Supply, 0-15 V dc	JKM15-3M or equiv.	Kepco, Inc	85640
x	Resistor, 100 ohm, 2W	22-2S-100R0-0 or equiv.	Ohmite	2L804
y	AC Current Ovld Test Set			
z	Power Supply 0-60V,30A	6268B with Option 026	Hewlett Packard	28480
2	Meters			
a	Meter, RF Power	435B or equiv.	Hewlett-Packard	28480
b	Multimeter, Digital	8050A or equiv.	John Fluke	89536
c	Multimeter	260 no equiv	Simpson	55026
d	Meter, Field Strength	HI-3002	Holiday Instruments	52433
e	Meter, Radiation	491	Victoreen	63060
f	Probe, Radiation	489-4	Victoreen	63060
g	Flowmeter	FL-6806	Omega	29907
h	Gage, Pressure	379-0242	CED	52151
i	Kit, Accessory	HP 11570A	Hewlett-Packard	28480
j	Counter, Frequency	HP 5342 or equiv.	Hewlett-Packard	28480
k	Meter, Current	931	Weston Inc.	11842
l	Meter, Capacitance	938 DCM	Data Precision	51692
3	Oscilloscopes			
a	Oscilloscope	1740A or equiv.	Hewlett-Packard	28480
4	Signal Generators			
a	RF Signal Generator	8656A or equiv.	Hewlett-Packard	28480
b	Pulse Generator	Model 100C or equiv.	Systron Donner	52542
5	Sensors			
3a	Sensor, Power	8482H	Hewlett-Packard	28480

Table 1-4. Equipment Required But Not Supplied - CONT.

Item	Nomenclature	Type/ Part No.	Mfr.	CAGE
6	Switches			
a	Switch, Pushbutton	400 10-9 or equiv.	Grayhill, Inc.	81073
b	Circuit Breaker	3-amp, 3-phase	Grayhill, Inc.	81073
c	Test Switch	3-position	Grayhill, Inc.	81073
7	Hand Tools			
a	Pliers, Needle Nose	E708 or equiv.	Snap-On Tools Corp	55719
aa	Pliers, Vise-Grip	7608	Dresser Ind.	30106
ab	Pliers, Diagonal Cutting	E710	Snap-on Tools Corp	55719
b	Screwdriver, Flat Blade	Proto 9625 or equiv.	Western Hard-ware & Tool	08325
c	Screwdriver, Flat Blade	Proto 9631 or equiv.	Western Hard-ware & Tool	08325
d	Screwdriver, Phillips Tip #1	Proto 9682 or equiv.	Western Hard-ware & Tool	08325
e	Screwdriver, Phillips Tip #2	Proto 9684 or equiv.	Western Hard-ware & Tool	08325
f	Screwdriver, Phillips Tip #3	Proto 9686 or equiv.	Western Hard-ware & Tool	08325
g	Screwdriver, Offset Phillips Tip	Proto No. 34 1/4 or equiv.	Western Hard-ware & Tool	08325
ga	Starter, Screw	GA199A	Snap-On Tools Corp	55719
h	Wrench, Open End	1/4"	Any	NA
i	Wrench, Open End	3/8"	Any	NA
j	Wrench, Open End	1/2 "	Any	NA
k	Wrench, Open End	3/4 "	Any	NA
l	Wrench, Open End	5/8 "	Any	NA
m	Wrench, Open End	7/8 "	Any	NA
n	Wrench, Open End	5/16"	Any	NA
o	Wrench, Open End	7/16"	Any	NA
p	Wrench, Open End	9/16"	Any	NA
q	Wrench, Open End	11/16"	Any	NA

Table 1-4. Equipment Required But Not Supplied - CONT.

Item	Nomenclature	Type/ Part No.	Mfr.	CAGE
7				
r	Wrench, Open End	13/16"	Any	NA
s	Wrench, Open End	15/16"	Any	NA
t	Wrench, Open End	11/32"	Any	NA
u	Wrench, Open End	1"	Any	NA
ua	Wrench, Open End	1-1/16"	Any	NA
v	Wrench, Allen	1/4"	Any	NA
va	Wrench, Allen	3/16"	Any	NA
w	Ratchet, 3/8 " Square Drive	Proto No. 5249 or equiv.	Western Hard-ware & Tool	08325
x	Ratchet Extension, 3/8" Square Drive	Proto No. 5260-60 or equiv.	Western Hard-ware & Tool	08325
y	1/2" Socket; 3/8" Square Drive	Proto No. 5216H or equiv.	Western Hard-ware & Tool	08325
z	5/8" Socket; 3/8" Square Drive	Proto No. 5217H or equiv.	Western Hard-ware & Tool	08325
za	1" socket; 3/8" Square Drive	Proto No. 5218H or equiv.	Western Hard-ware & Tool	08325
zb	3/8" socket; 3/8" Square Drive	Proto No. 5220H or equiv.	Western Hard-ware & Tool	08325
zc	7/16" socket; 3/8" Square Drive	Proto No. 5222H	Western Hard-ware & Tool	08325
zd	Gap Tool	Any	Any	NA
ze	Spark Gap	J-12	Champion	11583
zf	9\16 socket;3\8" Square Drive	Proto No. 5218 or equiv.	Western Hard-ware & Tool	08325
zg	6 inch machinist ruler	RM607 or 616	Western Hard-ware & Tool	08325
zh	1-11\16" crowfoot	FC34A	Snap-On-Tools	55719
<u>8</u>	<u>Cleaning Equipment</u>			
a	Cleaner, Vacuum	8925 or equiv.	Milwaukee Elec. Tool Corp.	40817
b	Brush, Dust	49-90-0730 or equiv.	Milwaukee Elec. Tool Corp.	40817

Table 1-4. Equipment Required But Not Supplied - CONT.

Item	Nomenclature	Type/ Part No.	Mfr.	CAGE
9	General			
a	Flashlight, 2-Cell	Type 1	NSN 6630-00-163-1856	
b	Iron, Soldering	WP25-3 or equiv.	Weller Industrial Service Equipment	97049
c	Light, Trouble	EC-392 or equiv.	Snap-On-Tools Corp	55719
d	Kit, Alignment Tool	8280	GE	72653
e	Wrist Strap, Grounding	S2066	Pace Inc.	NA
f	Water Hose, 6-foot	Any	Any	NA
g	Vinyl Tubing, 1/2 ID, 1 1\2 inch long	Any	Any	NA
h	Drain Pan	Any	Any	NA
i	Patch Cord, Alligator clip/Banana Plug	1166-48	Pomona Elect. Div.	05276
j	Vinyl Tubing, 1/2 OD 8 foot long	Any	Any	NA
k	Nylon sling, adjusatable with S-hooks. 800 pounds tensil strength	730-4028 Modified by breaking plastic shield off one hook	NAPA/ Balkamp	NA
l	Extension cord 25 ft 12 amp	Any	Any	NA
m	Lift chain, 14 inch, with hooks, 1000 pounds tensile strength	Any	Any	NA
n	Rule, tape	VA-153-A	Snap-On Tools Corp	55719
o.	Electrostatic Grounding Set	T600-0891	A.B. Chance	73569
p.	Face Shield, Head Gear Ratchet Lock Head Band	5121	Zee Medical Services Co.	1CM47

Table 1-4. Equipment Required But Not Supplied - CONT.

Item	Nomenclature	Type/ Part No.	Mfr.	CAGE
9	General			
q	Nut	8-32	Any	
r	Bolt	8-32	Any	
s	Wire jumper	12 inches long	Any	
t	Resistor 1.2K ohm,1W	-	Any	
u	Resistor 3.9K ohm, 1w	-	Any	
v	Nut	10-32	Any	

Table 1-5. Special Tools List

Nomenclature	Type/PN	Mfr.	CAGE	Use
Adapter, Side Lift	149782-1	CED	52151	Used with forklift to remove/ replace 1T1, 1T2, 1L17, and 1L36.
Bar, Lift	150791-1	CED	52151	Part of hoist to re-move/replace 2C4 through 2C11.
Dummy Load	126103-1	CED	52151	Paragraph 6-6.3.3
Extension, Fork W/Riser	149781-1	CED	52151	Used with forklift to remove/ replace 2T14 and 2T15.
Hoist, Electric Tube/Capacitor	150149-1	CED	52151	Paragraph 6-5.22.1
Lift, Heavy Com-ponent Handling	150147-1	CED	52151	Used to move parts weighing up to 3000 pounds in and out of cabinets 1 and 2.
Lift, Heavy Com-ponent Handling Short-Reach	149785-1	CED	52151	Used to remove/ replace such Short-Reach components as 2T9 and 2L1.
Plate, Lift Set (2)	149783-1	CED	52151	Used with lifting devices to move cabinets 1 and 2 components weighing up to 2500 pounds.
Platform, Material Handling, HVPS	150148-1	CED	52151	Used with hoists and lifts to remove/ replace HVPS parts.

Table 1-5. Special Tools List - CONT.

Nomenclature	Type/PN	Mfr.	CAGE	Use
Rail, Component Replacement	150037-1	CED	52151	Supports chain hoist to remove/ replace HVPS components. Part of cabinet 2.
Simulator, TCMG	149786-1	CED	52151	Paragraph 6-10.2.4
Support, Hoist, Tube Removal	150150-1	CED	52151	Paragraph 6-5.22.1
Table, Lift Filter/Tube Servicing	150146-1	CED	52151	Paragraph 6-5.3.1
Test Set, Spectral Purity	159980-3	CED	52151	Paragraph 6-10.2.9
Tool, Filter Removal and Installation	150151-1	CED	52151	Paragraph 6-5.12.3
Tool PA Bias Power Supply Removal	149784-1	CED	52151	Paragraph 6-5.19.1
AC Current Ovld Test Set		CED	52151	Paragraph 6-6.3.1.2.2.3

Nomenclature	Type/Part No.
Meter, RF Power	435B (or equiv)
Multimeter	260 (or equiv)
Multimeter, Digital	8050A (or equiv)
Oscilloscope	1740A (or equiv)
Pulse Generator	100C (or equiv)
Signal Generator, RF	8656A (or equiv)

Table 1-6. Test Equipment List

Nomenclature	Type/PN	Mfr.	CAGE	Use
Meter, Field Strength	HI-3002	Holiday Instruments	52433	Paragraph 6-10.2.11
Meter, Radiation	491	Victoreen	63060	Paragraph 6-10.2.10
Meter, RF Power	435B	Hewlett-Packard	28480	Paragraph 6-6.3.3
Meter, Current	931	Weston Inc.	11842	Paragraph 6-6.3.1.2.1.4
Meter Capacitance	938 DCM	Precision Data	51692	Paragraph 6-5.3.3
Multimeter	260 (No equiv.)	Simpson	55206	Paragraph 6-3.2.4.2
Multimeter, Digital	8050A	Fluke	89536	Paragraph 6-6.3.1.1
Oscilloscope	1740A	Hewlett-Packard	28480	Paragraph 6-10.2.8
Probe, Radiation	489-4	Victoreen	63060	Paragraph 6-10.2.10
Pulse Generator	100C	Systron Donner	52542	Paragraph 6-8.6.4
Signal Generator, RF	8656A	Hewlett-Packard	28480	Paragraph 6-6.2
Sensor, Power	8482H	Hewlett-Packard	28480	Paragraph 6-6.3.3

Table 1-7. Major Maintenance Support Equipment

Equipment Identification	Characteristics	
Meter, Field Strength HI-3002, Holiday Instruments	Freq. Range: Scale	10 MHz - 3.0 GHz 0 - 2 MW/cm^2
Meter, Radiation 491, Victoreen Probe, Radiation 489-4, Victoreen	Range:	MR/h 0 - 1 MR/h 0 - 3 MR/h 0 - 100 MR/h 0 - 30 MR/h 0 - 100 MR/h
Multimeter, Digital Fluke, 8050A	AC,DC & OHMS	
Multimeter, Simpson Model 260	Volt. Range:	(a) 0 V dc to 1000 V dc (b) 0 V ac to 1000 V ac
	Input Imp.:	(a) dc: 20,000 ohm/volt (b) ac: 5,000 ohm/volt
	Accuracy:	(a) RX1: ± 2.5° of arc (b) RX10,000: ± 2° of arc
Oscilloscope, Hewlett-Packard Model 1740A	Dual Channel:	5 mV/div to 100 mHz
	Triggering:	(a) Internal: stable to >100 mHz, one div. vertical deflection (b) External: 100 mV req. to 100 mHz; 50 mV req. to 50 mHz
	Input Imp.:	Front panel selectable, 50 ohm and 1 megohm
Power Sensor Hewlett-Packard 8482H	Freq. Range:	100 kHz - 4.2 GHz
	Power Range:	100 Micro watts to 3 Watts 50 Ohm Input

Table 1-7. Major Maintenance Support Equipment

Equipment Identification	Characteristics	
Pulse Generator Systron Donner 100C	Rep Rate:	Var 0.1 Hz to 10 MHz
	Ext. Trigger:	AC coupled, 0 to 1 MHz from 0.25 V Pule or 50 Hz to 10 MHz from 1 VRMS
RF Power Meter, Hewlett-Packard Model 435B	Freq. Range:	100 kHz to 26.5 gHz
	Power Range:	-65 dBm to +44 dBm
	Power Out:	1.0 mW ± 0.7%
Synthesized Signal Generator, Hewlett-Packard Model 8656A	Frequency:	(a) Range: 100 kHz to 99 mHz; 8-digit display (b) Resolution 100 Hz and 250 Hz (c) Switching: < 2 seconds
	Spectral Purity, Spurious Signals ≤ + 7dBm output levels:	(a) Harmonics < -25 dBc (b) Non-harmonics < -60 dBc < 5 kHz from carrier in CW mode
Meter Current Weston 931	Iron Vane Analog Meter	0 - 30 amps
Meter Capacitance Data Precision 938 DCM	Capacitance Range	10 pf-1990 mf

Table 1-8. Related Technical Manuals

Document Description	Technical Order Number
Radar Set AN/FPS-118(V) List of Applicable Publications	TO 31P6-2FPS118-01
Radar Set AN/FPS-118(V) Work Unit Code Manual	TO 31P6-2FPS118-06
Radar Set AN/FPS-118(V) System General Information Manual	TO 31P6-2FPS118-1
Radar Set AN/FPS-118(V) System General Information Manual Supplement (Classified)	TO 31P6-2FPS118-1-1
Radar Set AN/FPS-118(V) Scheduled Inspection, Servicing, Lubrication Requirements Manual	TO 31P6-2FPS118-6
Transmit Subsystem Combined Operations and Maintenance Instructions Manual	TO 31P6-2FPS118-11
Transmit Subsystem Circuit Diagrams Manual	TO 31P6-2FPS118-13
Transmit Subsystem Work Card Set	TO 31P6-2FPS118-16WC-1
Transmit Subsystem Circuit Diagrams Manual (ICD)	TO 31P6-2FPS118-23-1
Transmit Group OT-139/FPS-118(V) OT-139A/FPS-118(V) OT-180/FPS-118(V) OT-180A/FPS-118(V)	TO 31P6-2FPS118-71
Transmit Group OT-139/FPS-118(V) OT-139A/FPS-118(V) OT-180/FPS-118(V) OT-180A/FPS-118(V) Circuit Diagrams Manual	TO 31P6-2FPS118-73-1
Transmit Group OT-139/FPS-118(V) OT-139A/FPS-118(V) OT-180/FPS-118(V) OT-180A/FPS-118(V) Circuit Diagrams Manual (Wire Lists)	TO 31P6-2FPS118-73-2

Table 1-8. Related Technical Manuals - CONT.

Document Description	Technical Order Number
Transmit Group OT-139/FPS-118(V) OT-139A/FPS-118(V) OT-180/FPS-118(V) OT-180A/FPS-118(V) Illustrated Parts Breakdown	TO 31P6-2FPS118-74
Radar Transmitter T-1524/FPS-118(V) (V)1 T-1524A/FPS-118(V) (V)2 Combined Operations and Maintenance Instruction Manual	TO 31P6-2FPS118-81
Radar Transmitter T-1524/FPS-118(V) (V)1 T-1524A/FPS-118(V) (V)2 Circuit Diagrams Manual	TO 31P6-2FPS118-83
Radar Transmitter T-1524/FPS-118(V) (V)1 T-1524A/FPS-118(V) (V)2 Illustrated Parts Breakdown	TO 31P6-2FPS118-84
Instruction Manual Model A300 Broadband RF Amplifier	TO 31P6-2FPS118-231
Spectral Purity Test Set Part Number 159980-3 Operation and Maintenance Instructions with Parts Breakdown and Circuit Diagrams	TO 33D7-44-340-1
Transmitter Control and Monitor Group Simulator Part Number 149786-1 Operation and Maintenance Instructions with Illustrated Parts Breakdown and Circuit Diagrams	TO 33D7-47-128-1
Instruction Manual Specifications & Instruction Model HB3-51-110/200-2,	TO 35CA7-22-1
Instruction Manual Model 15568, Power Supply	TO 35C1-2-1137-1
Instruction Manual Model 15567, Power Supply	TO 35C1-2-1138-1
Instruction Manual Model 15566, Power Supply	TO 35C1-2-1139-1

CHAPTER 2

NOT APPLICABLE

CHAPTER 3

NOT APPLICABLE

CHAPTER 4

OPERATION

Section I. CONTROLS AND INDICATORS

4-1 GENERAL.

This section describes controls and indicators of the T-1524/FPS118(V), or (V)1, and T-1524A/FPS118(V), or (V)2, transmitters. Locator data consists of reference designators listed in titles of tables and corresponding figures. The information is sufficiently detailed for operation of the system.

4-2 USE OF TABLES AND ILLUSTRATIONS.

Tables 4-1 through 4-12 and corresponding Figures 4-1 through 4-14 identify controls and indicators by functional names and locations. Tables follow associated figures, and figure numbers that correspond to each table are stated in table titles. For user convenience, those tables and figures follow all text of this section.

4-3 TRANSMITTER SYSTEM INTERLOCKS.

Interlock circuits protect personnel from electrical and RF radiation hazards. They also guard against equipment damage. Table 4-13 lists each interlock and gives both location and functional description. Interlock location is indicated by the first number of reference designators. Where the first number is 1, the interlock is in the transmitter cabinet. Where the first number is 2, the interlock is in the HVPS cabinet. As interlock contacts are closed, +26.5 V dc from power supply 1PS1 is routed sequentially through all interlocks contacts until all interlocks are closed. Should any interlock open, the circuit is broken and high voltage cannot be turned on.

4-4 TROUBLESHOOTING THE TRANSMITTER.

Tables 4-1 through 4-13 and associated figures play large parts in the overall troubleshooting concept. They are referred to from Chapter Six, Maintenance, as aids to systematic troubleshooting and repair.

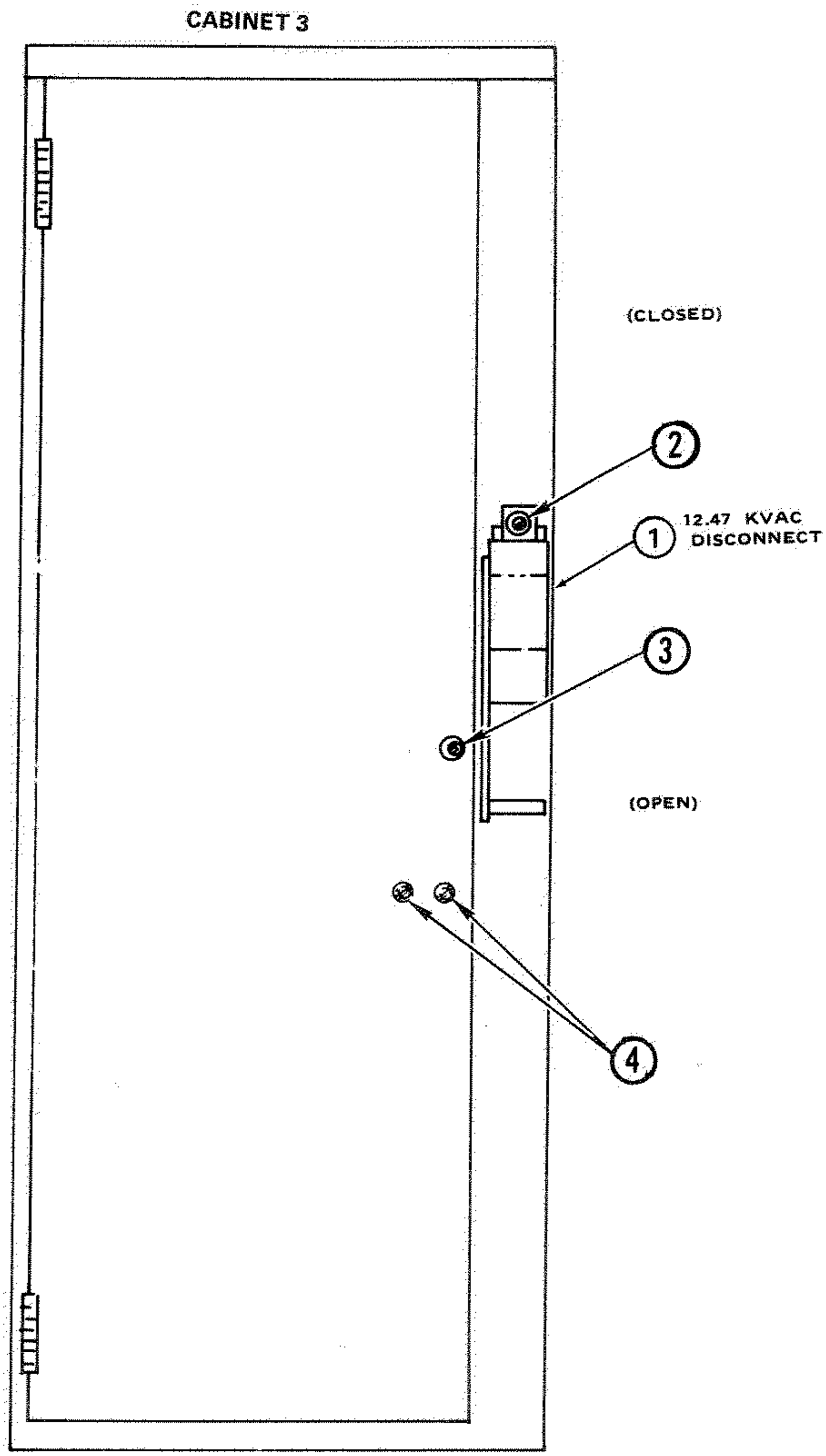
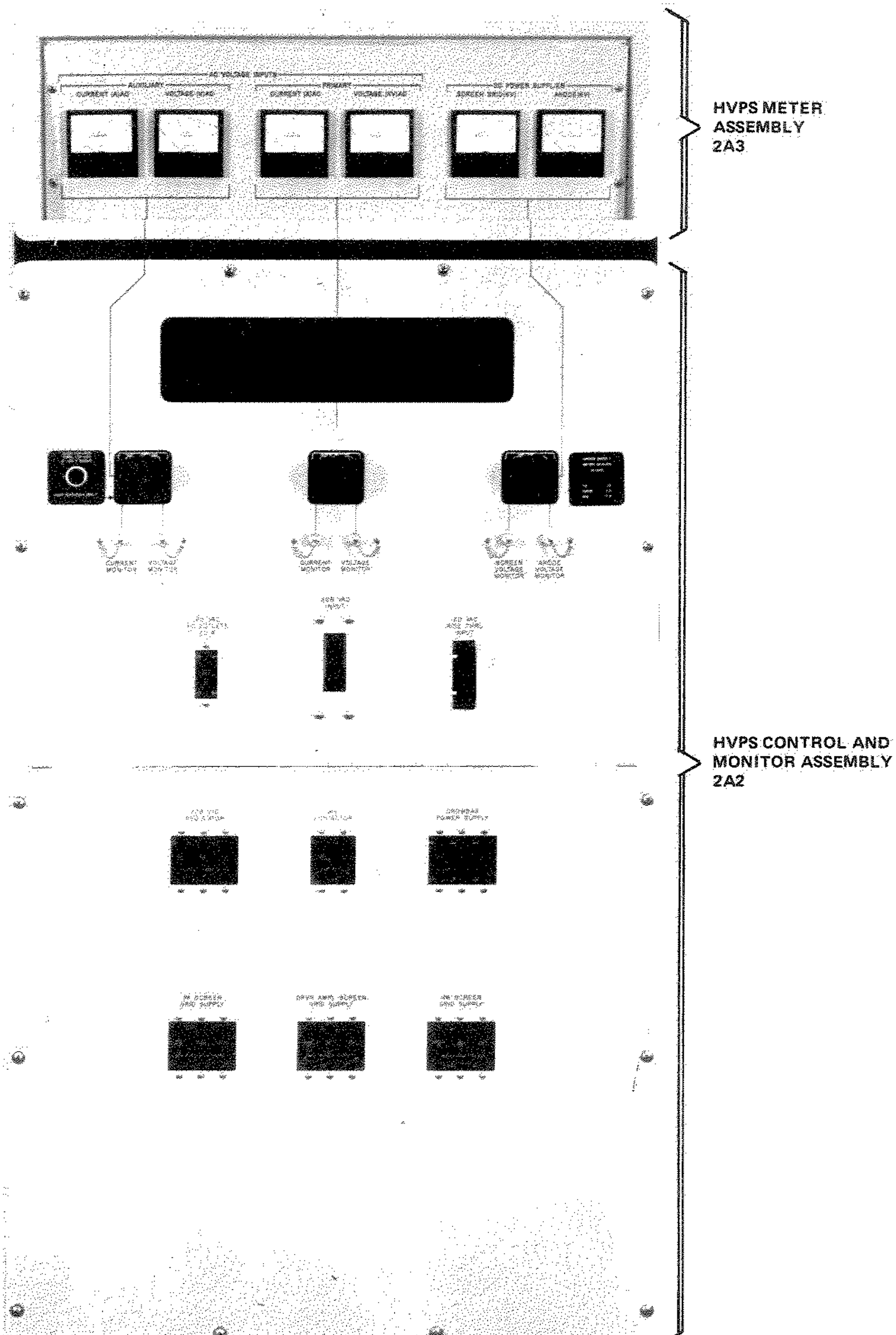


Figure 4-1. High Voltage AC Power Switch

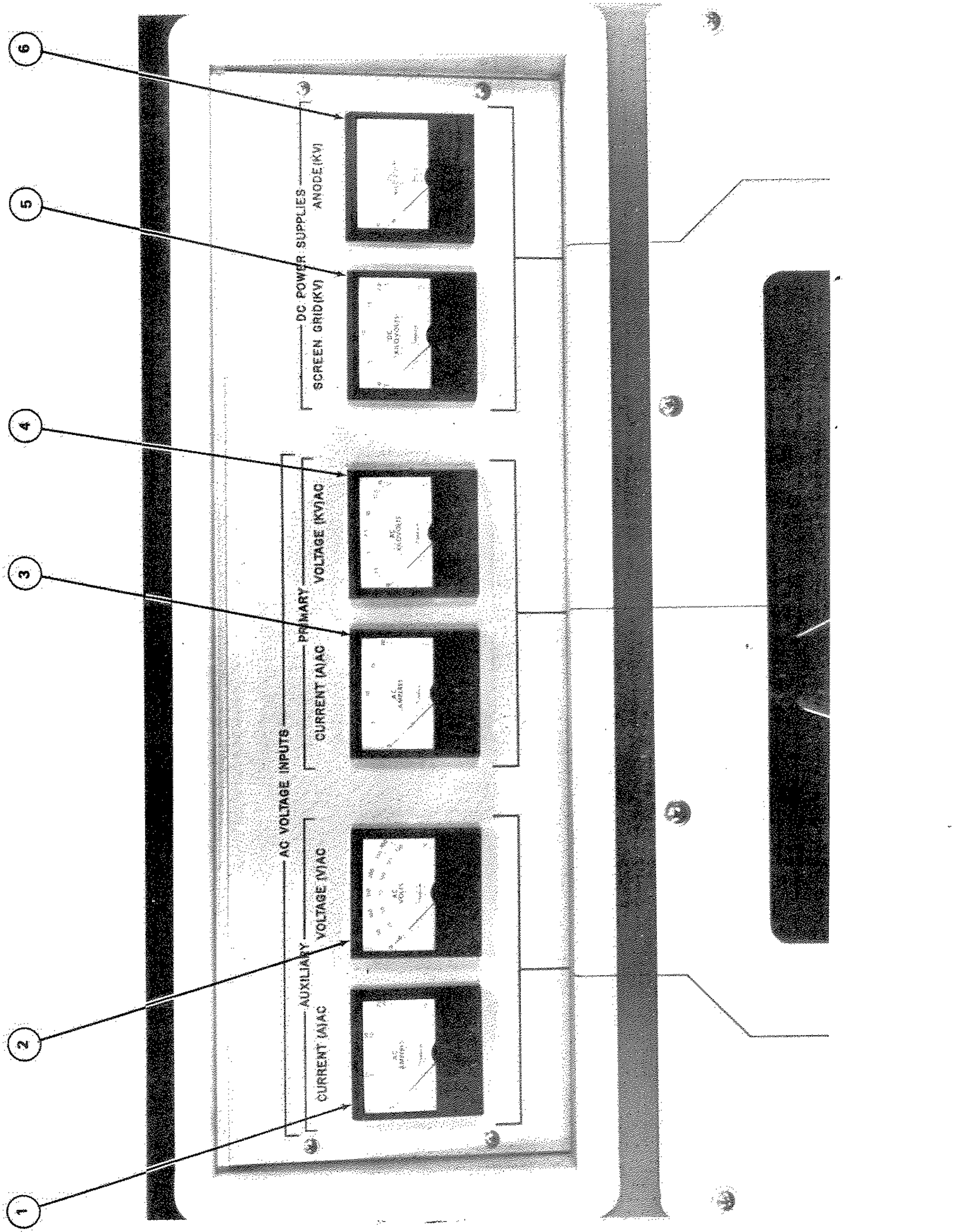
Table 4-1. High Voltage AC Switch Cabinet 3 (Figure 4-1)

Fig index	Control or indicator	Reference designator	Function
1	HVAC 12.47 kVac	3S1	Disconnects 12.47 kVac input from Disconnect Switch transmitter. When handle is down to OPEN, internal knife switch is opened.
2	Switch Key Lock	-	Releases 12.47 KVac disconnect Switch to allow opening of the HVAC switch contacts.
3	Door Key Lock	-	Releases cabinet 3 door to be opened.
4	Latch Key Locks	-	Locks switch striker arms in the retracted position allowing cabinet 3 door to be opened.



85-1178

Figure 4-2. HVPS Cabinet 2



85-1179

Figure 4-3. HVPS Meter Assembly 2A3

Table 4-2. HVPS Meter Assembly 2A3 (Figure 4-3)

Fig index	Control or indicator	Reference designator	Function
	AUXILIARY		
1	CURRENT (A) AC	M2	Shows low-voltage ac current of phase selected by 2A2S1, or ride thru current when OFF is selected and switch 2A2S4 is pressed.
2	VOLTAGE (V) AC	M1	Shows low-voltage ac of phase selected by 2A2S1 (0-300 scale), or ride-through voltage (0-150 scale) when OFF position is selected and switch 2A2S4 is pressed.
	PRIMARY		
3	CURRENT (A) AC	M4	Shows high-voltage ac current of phase selected by switch 2A2S2.
4	VOLTAGE (KV) AC	M3	Shows high-voltage ac of phase selected by switch 2A2S2.
	DC POWER SUPPLIES		
5	SCREEN GRID (KV)	M6	Shows screen grid voltage of amplifier selected by switch 2A2S3 (PA, driver, IPA).
6	ANODE (KV)	M5	Shows anode voltage of amplifier selected by switch 2A2S3 (PA on 0 to 15 scale; driver or IPA on 0 to 7.5 scale).

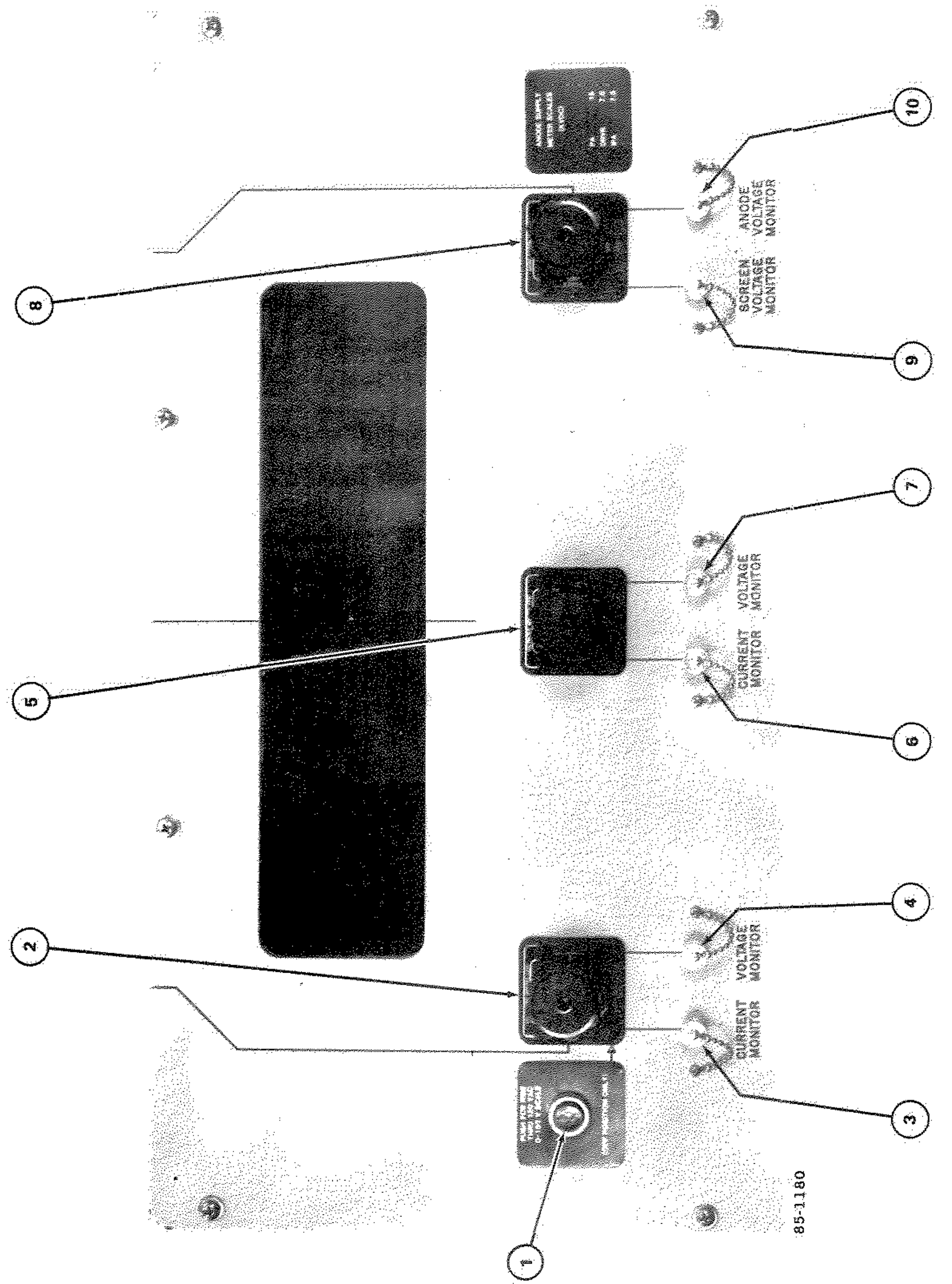


Figure 4-4. HVPS Control and Monitor Panel 2A2

Table 4-3. HVPS Control And Monitor Panel 2A2 (Figure 4-4)

Fig index	Control or indicator	Reference designator	Function
1	PUSH FOR RIDE THROUGH 120 VAC 0-150 V SCALE (OFF POSITION ONLY)	S4	Push to read logic and control circuit voltages and currents on AUXILIARY meters. NOTE: 2A2S1 must be to OFF.
2	VOLTMETER/AMMETER LVAC 1 2 3 OFF	S1	Selects phase of low-voltage ac current and voltage to be indicated on meter.
3	CURRENT MONITOR	J2	Scope monitor for low-voltage ac current as selected by 2A2S1.
4	VOLTAGE MONITOR	J1	Scope monitor for low-voltage ac as selected by 2A2S1.
5	VOLTMETER/AMMETER HVAC 1 2 3 OFF	S2	Selects phase of high-voltage ac current and voltage to be indicated by PRIMARY meters.
6	CURRENT MONITOR	J4	Scope monitor for high-voltage ac current as selected by 2A2S2.
7	VOLTAGE MONITOR	J3	Scope monitor for high-voltage ac voltages as selected by 2A2S2.
8	SCREEN/ANODE HVDC OFF	S3	Selects POWER AMPL (PA), DRIVER AMPL POWER AMPL (driver), or INTER MED AMPL (IPA) DRIVER AMPL for meter reading of screen grid and INTER MED AMPL anode voltages.
9	SCREEN VOLTAGE MONITOR	J6	Scope monitor jack for screen grid voltage as selected by 2A2S3.
10	ANODE VOLTAGE MONITOR	J5	Scope monitor jack for anode voltage as selected by 2A2S3.

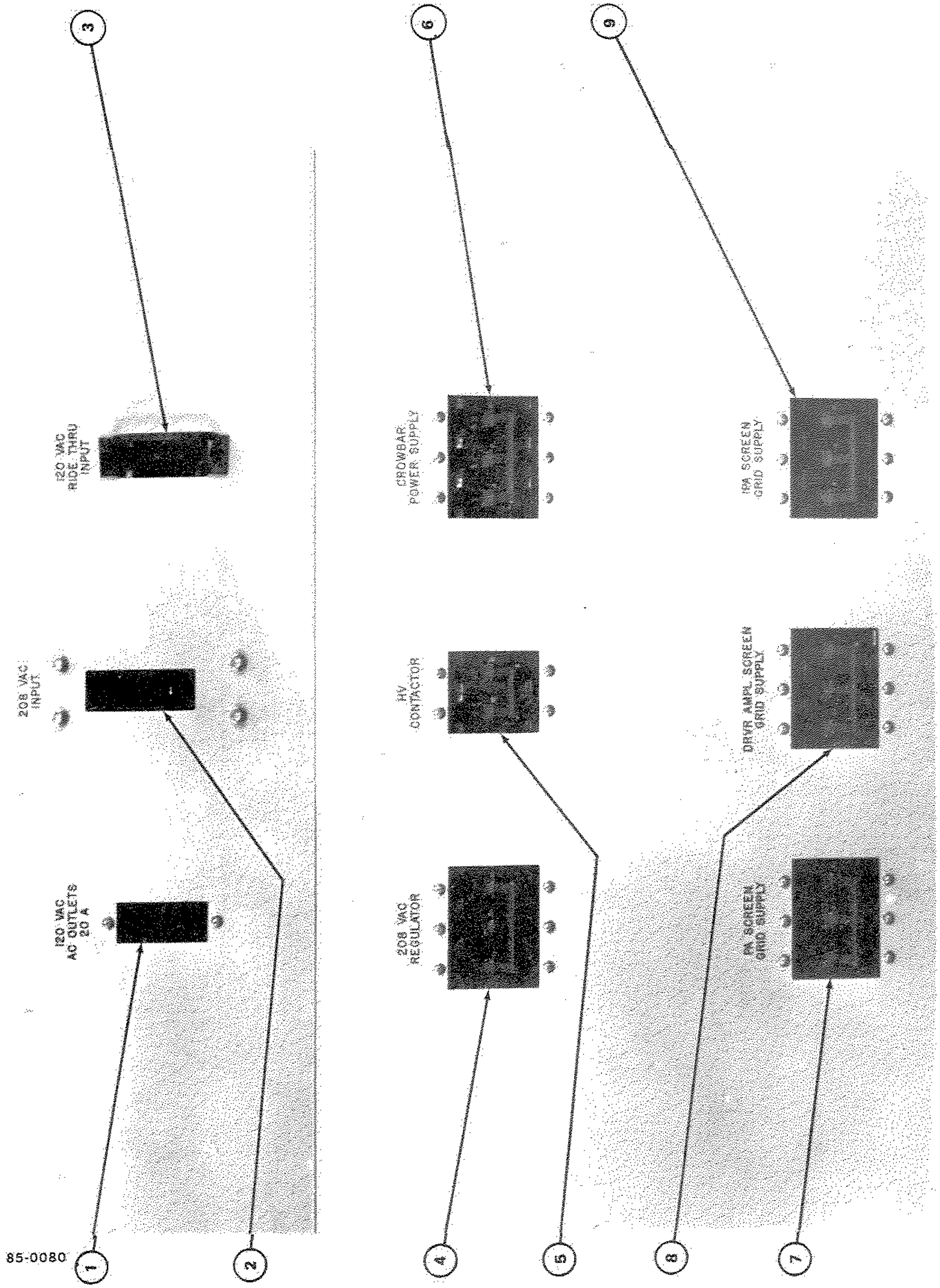


Figure 4-5. HVPS Circuit Breaker Panel 2A2

Table 4-4. HVPS Circuit Breaker Panel 2A2 (Figure 4-5)

Fig index	Control or indicator	Reference designator	Function
1	120 VAC AC OUTLETS 20A	CB9	Protects the 120 V ac line.
2	208 VAC INPUT	CB1	Protects the 208 V ac line.
3	120 VAC RIDE THRU INPUT	CB8	Protects the 120 V ac RIDE THRU.
4	208 VAC REGULATOR	CB2	Protects the 208 V ac regulator.
5	HV CONTACTOR	CB3	Protects the high voltage contactor.
6	CROWBAR POWER SUPPLY	CB4	Protects the crowbar power supply.
7	PA SCREEN GRID SUPPLY	CB5	Protects the PA screen grid supply.
8	DRVR AMPL SCREEN GRID SUPPLY	CB6	Protects the driver screen grid supply.
9	IPA SCREEN GRID SUPPLY	CB7	Protects the IPA screen grid supply.

Table 4-4.1 HVPS Transformer AC Current Monitor CCA, A5, A6, A7, (Figure 4-5.1)

Fig index	Control or indicator	Reference designator	Function A5 PA T1, A6 DRV T7, A7 IPA T9
1	CURRENT SAMPLE	DS1	Lights when exceeds threshold
2	THRESHOLD SAMPLE	DS2	Lights when exceeds threshold
3	26.5 VDC	TP1	26 V dc into CCA
4	OC THRESHOLD	TP2	Level set for overcurrent threshold of any phase
5	AC FAULT *	TP3	Fault output that a phase sample has exceeded threshold
6	AC FAULT *	TP4	Redundant to TP3
7	OA OVERCURRENT FAULT	TP5	OA Current has exceeded threshold hold setting
8	OB OVERCURRENT FAULT	TP6	OB Current has exceeded threshhold setting
9	OC OVERCURRENT FAULT	TB7	OC Current has exceeded threshold setting
10	OA SAMPLE CURRENT	TP8	Sample of current in Phase A of protected transformer
11	OB SAMPLE CURRENT	TP9	Sample of current in Phase B of protected transformer
12	OC SAMPLE CURRENT	TP10	Sample of current in Phase C of protected transformer
13	OB<OA FAULT*	TP14	Difference in OB and OA current exceeds threshold set
14	OA<OB FAULT*	TP15	Difference in OA and OB current exceeds threshold set
15	OC<OA FAULT*	TP16	Difference in OC and OA current exceeds threshold set
16	OA<OC FAULT*	TP17	Difference in OA and OC current exceeds threshold set
17	OC<OB FAULT*	TP18	Difference in OC and OB current exceeds threshold set
18	OB<OC FAULT*	TP19	Difference in OB and OC current exceeds threshold set
19	IMBAL FAULT*	TP20	An imbalance exits between
20	IMBAL FAULT*	TP21	Redundant to TP 20
21	AC FAULT*	TP22	Fault relay output
22	AC FAULT*	TP23	Redundant to TP 22

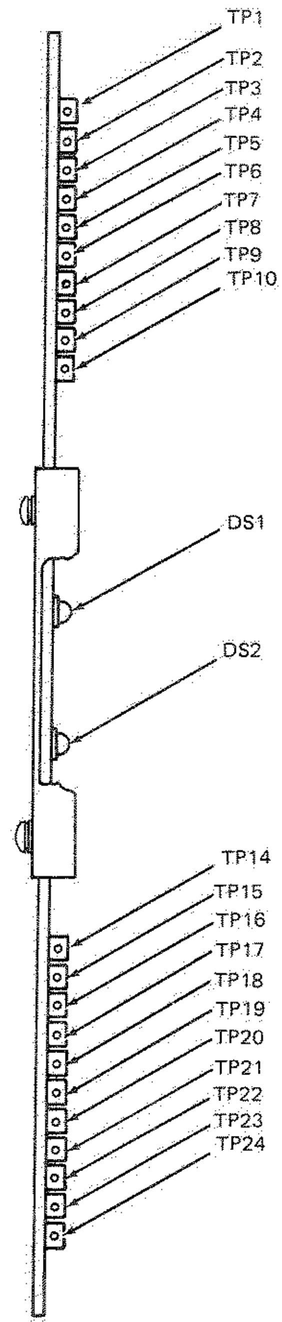


Figure 4-5.1.HVPS Transformer AC Current Monitor CCAs A5, A6, A7 (Table 4-4.1)

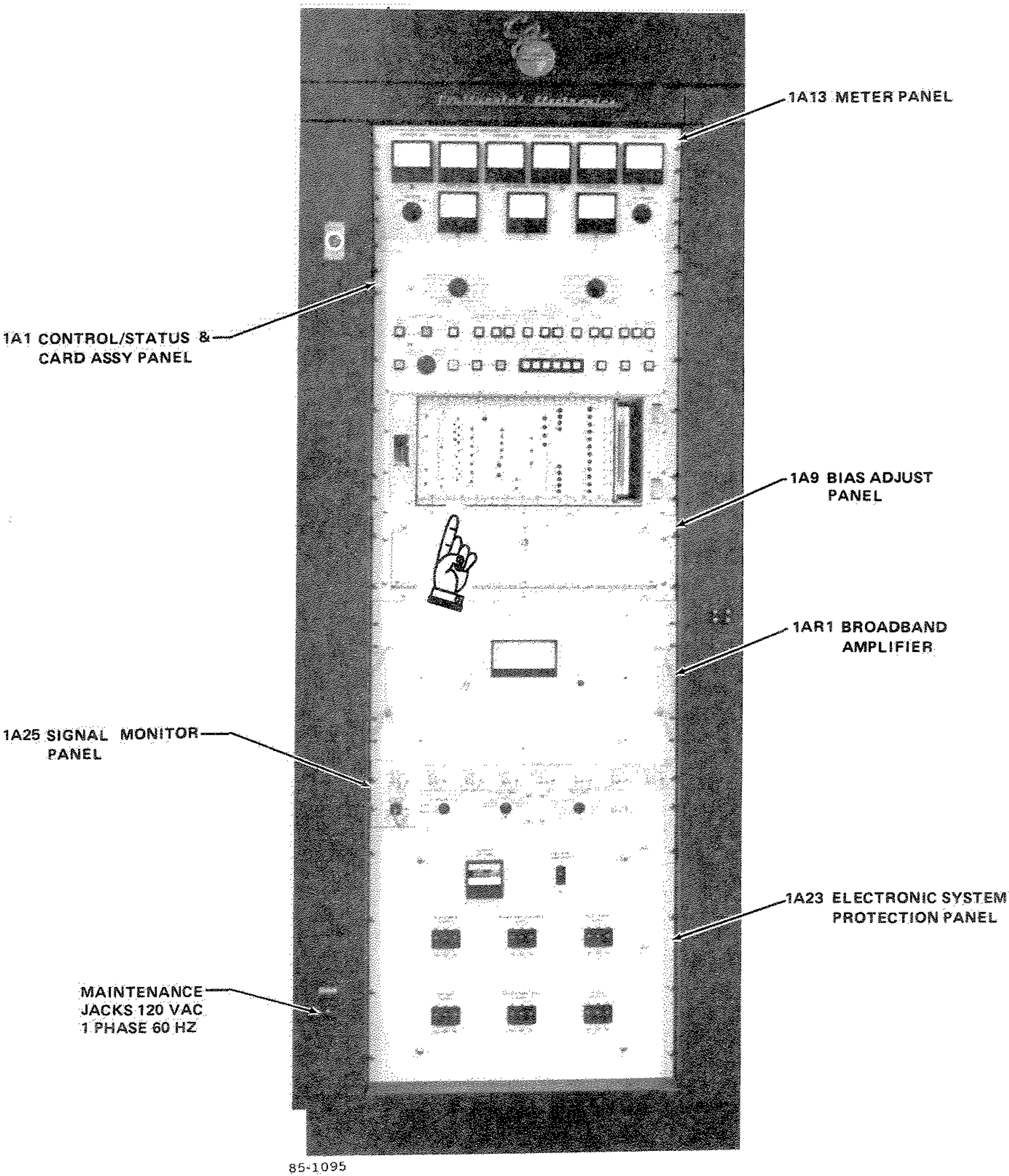


Figure 4-6. Transmitter Controls Section

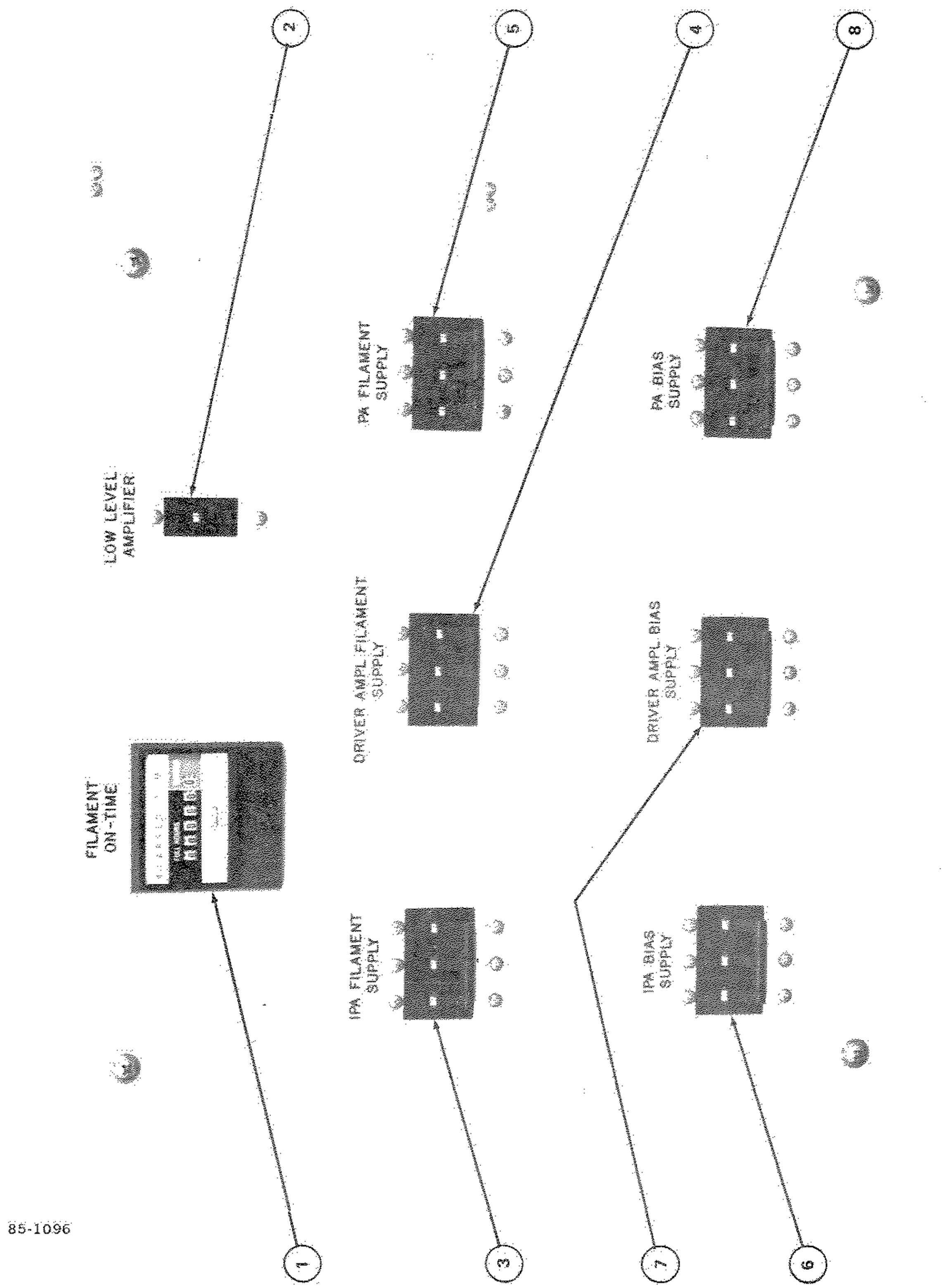


Figure 4-7. Electronic System Protection Panel 1A23

Table 4-5. Electronic System Protection Panel 1A23 (Figure 4-7)

Fig index	Control or indicator	Reference designator	Function
1	FILAMENT ON-TIME	M1	Shows total time that filament voltage is applied to vacuum tubes.
2	LOW LEVEL AMPLIFIER	CB1	Protects Low Level (Broadband) Amplifier Circuits.
3	IPA FILAMENT SUPPLY	CB5	Protects IPA filament supply circuits.
4	DRIVER AMPL FILAMENT SUPPLY	CB6	Protects driver filament circuits.
5	PA FILAMENT SUPPLY	CB7	Protects PA filament supply circuits.
6	IPA BIAS SUPPLY	CB2	Protects IPA bias supply circuits.
7	DRIVER AMPL BIAS SUPPLY	CB3	Protects driver bias supply circuits.
8	PA BIAS SUPPLY	CB4	Protects PA bias supply circuits.

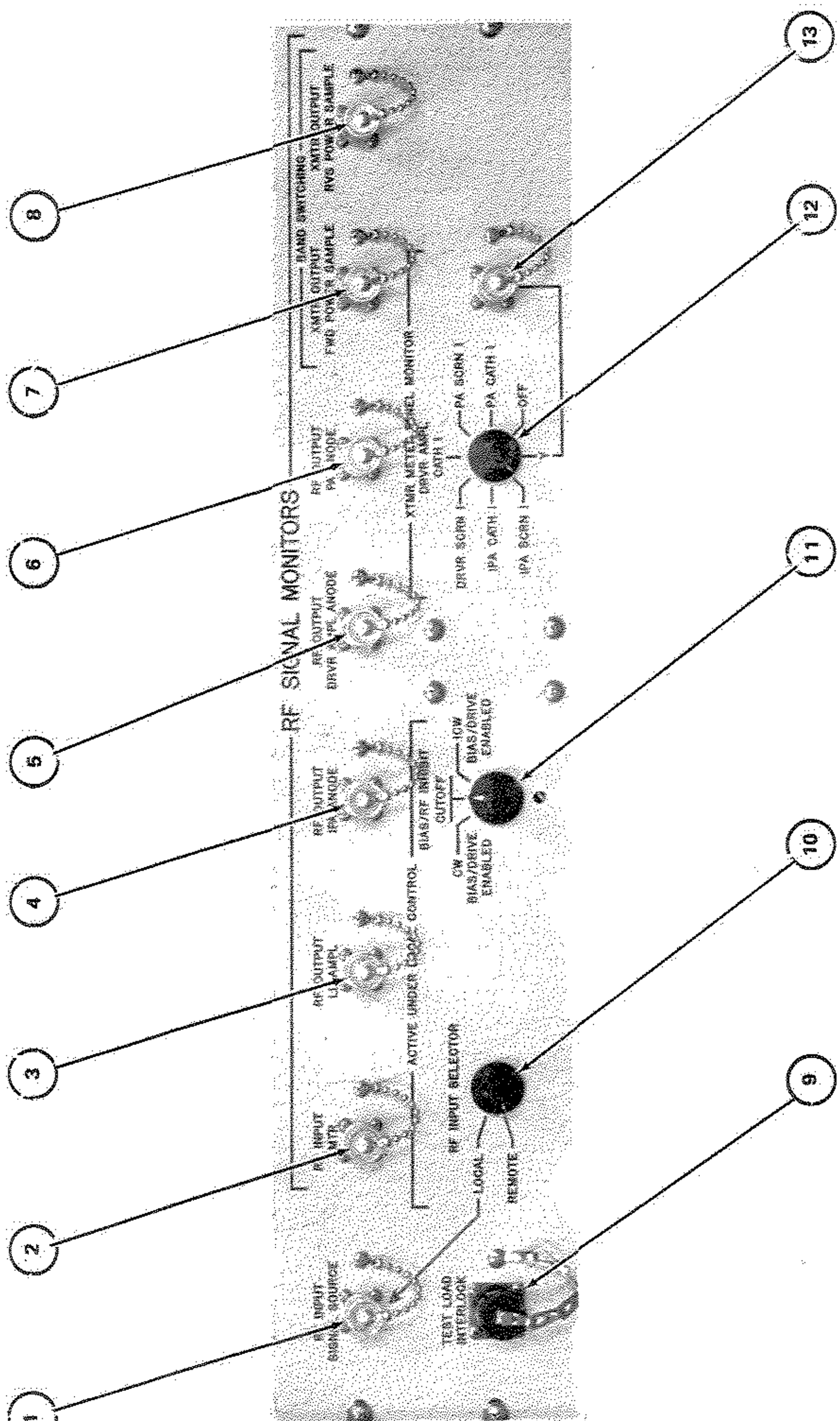


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Figure 4-8. RF SIGNAL MONITORS Panel 1A25

Table 4-6. RF SIGNAL MONITORS Panel 1A25 (Figure 4-8)

Fig index	Control or indicator	Reference designator	Function
1	RF INPUT SIGNAL SOURCE	W5J1	Input jack for external RF signal, selected by switch S2.
	RF SIGNAL MONITORS		
2	RF INPUT XMTR	W4J1	Monitor jack for RF input to transmitter.
3	RF OUTPUT LL AMPL	W3J1	Monitor jack for RF output of low-level (broadband) amplifier.
4	RF OUTPUT IPA ANODE	J3	Monitor jack for IPA anode output.
5	RF OUTPUT DRVR AMP ANODE	J2	Monitor jack for driver anode output.
6	RF OUTPUT PA ANODE	J1	Monitor jack for PA anode output.
	<u>BAND SWITCHING</u>		
7	XMTR OUTPUT FWD POWER SAMPLE	W2J1	Monitor jack for transmitter output forward power sample.
8	XMTR OUTPUT RVS POWER SAMPLE	W1J1	Monitor jack for transmitter output reverse power sample.
9	TEST LOAD INTERLOCK	J5	Interlock jack for water flow and over-temperature of dummy load.
	ACTIVE UNDER LOCAL CONTROL		
10	RF INPUT SELECTOR	S2	Controls RF selector relay K5.
	LOCAL		Selects W5J1 for RF input to transmitter.
	REMOTE		Selects cabinet 1, W1J1 as RF input to transmitter.
11	BIAS/RF INHIBIT CW BIAS/DRIVE ENABLED	S3	Enable CW bias on each tube stage.

Table 4-6. RF SIGNAL MONITORS Panel 1A25 (Figure 4-8) - CONT.

Fig index	Control or indicator	Reference designator	Function
	BIAS/RF INHIBIT CUTOFF		Cuts off all static current to each tube and removes keyline ground from the low level amplifier.
	ICW BIAS/DRIVE ENABLED		Enable ICW bias on each tube stage.
	XMTR METER PANEL MONITOR		
12	(Panel Monitor Switch)	S1	Selects current monitored at 1A25J4. (Same as on 1A13 Meter Panel.)
	IPA SCRN I		Monitors IPA screen current.
	IPA CATH I		Monitors IPA cathode current.
	DRVR SCRN I		Monitors driver screen current.
	DRVR AMPL CATH I		Monitors driver cathode current.
	PA SCRN I		Monitors PA screen current.
	PA CATH I		Monitors PA cathode current.
	OFF		No monitor signal present at jack.
13	(Y Panel Monitor Jack)	J4	Monitor jack for currents selected by monitor switch S1.

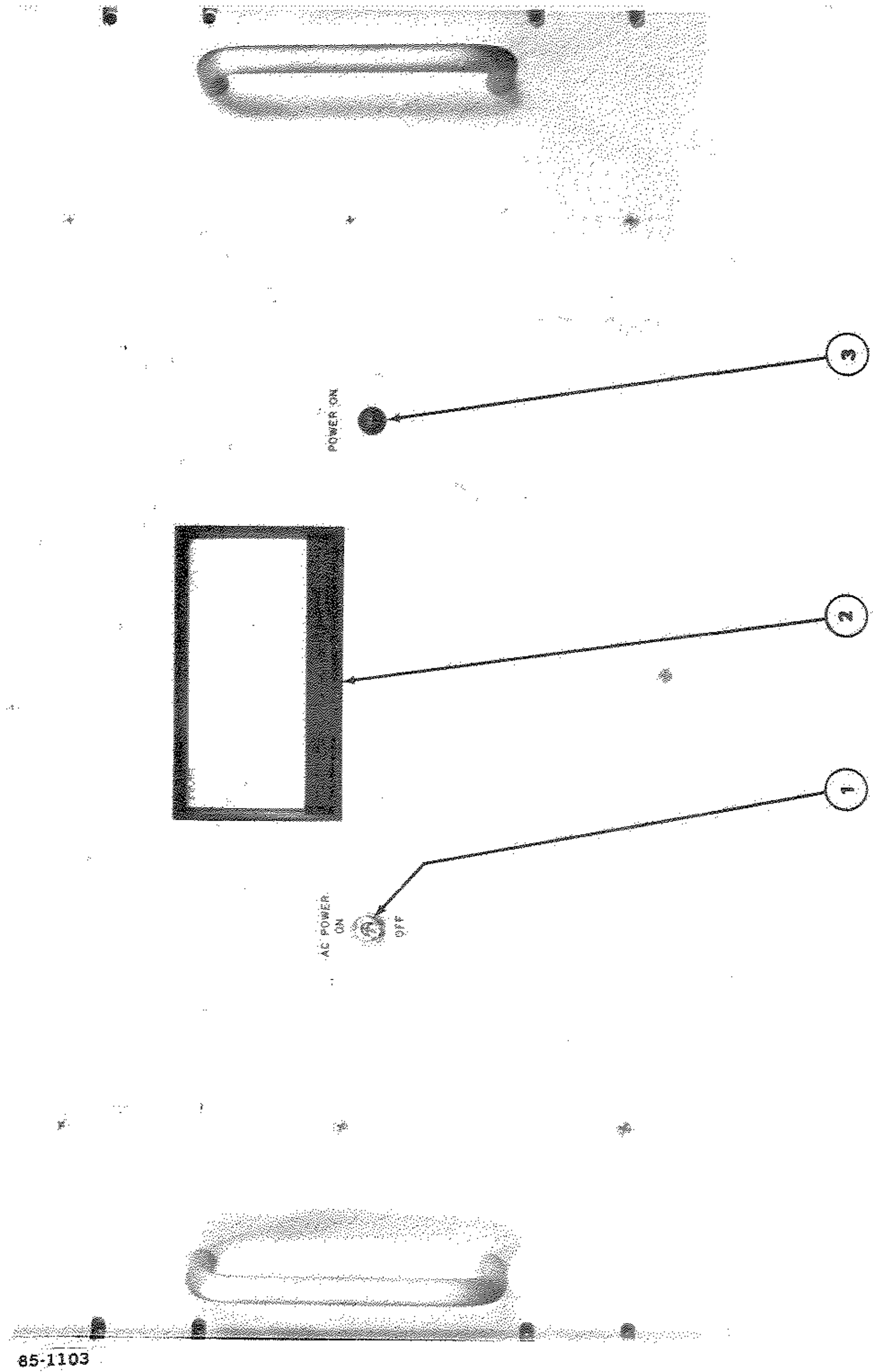

Figure 4-9. Low Level (Broadband) Amplifier 1AR1

Table 4-7. Low Level (Broadband) Amplifier 1AR1 (Figure 4-9)

Fig index	Control or indicator	Reference designator	Function
1	AC POWER ON/OFF	S1	Switches ac power on or off.
2	Wattmeter	M1	Shows amplifier output power on 0-600 watt scale.
3	POWER ON	DS1	Shows keyline is enabled.

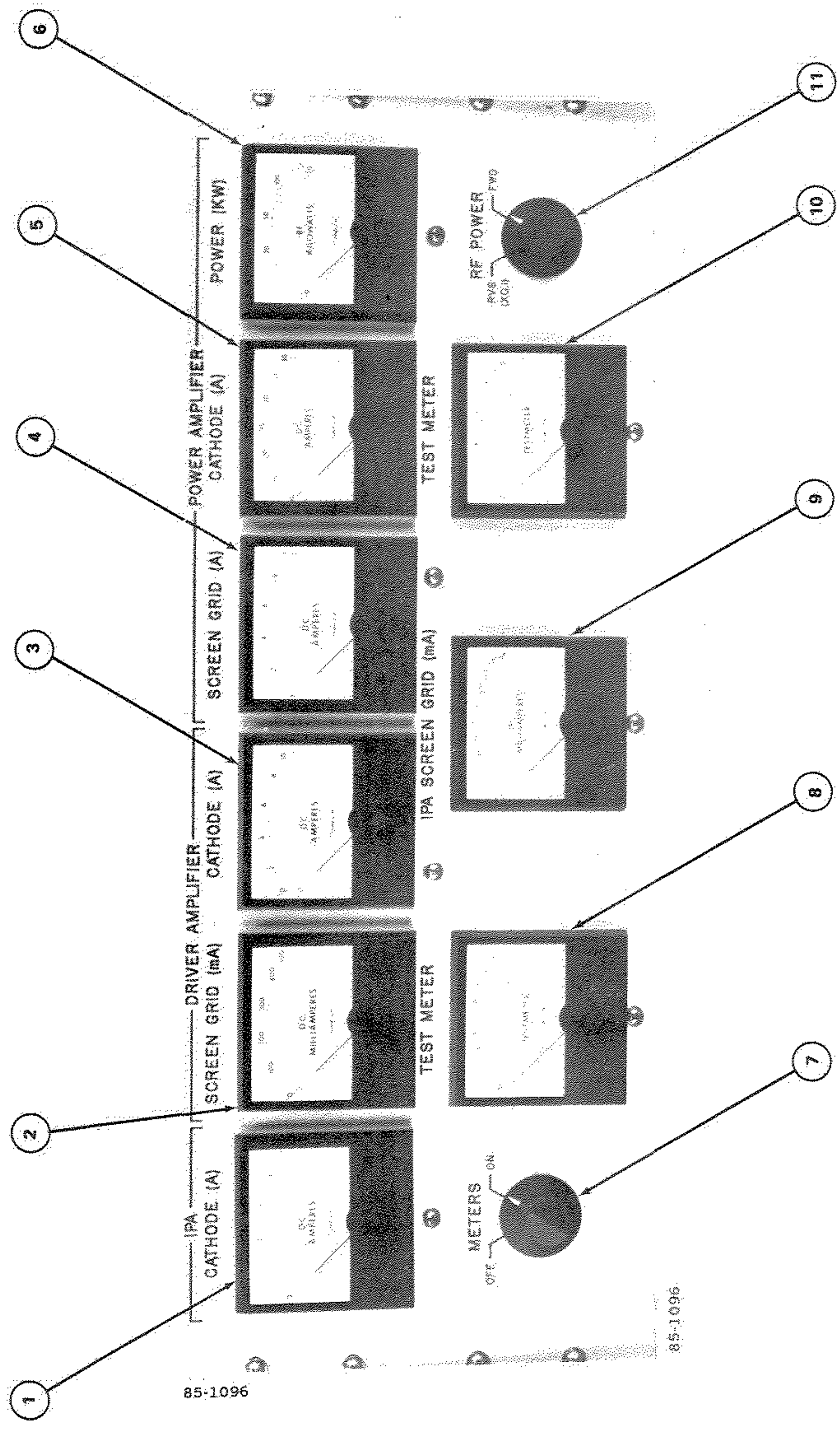

Figure 4-10. Meter Assembly Panel 1A13

Table 4-8. Meter Assembly Panel 1A13 (Figure 4-10)

Fig index	Control or indicator	Reference designator	Function
1	IPA CATHODE (A)	M6	Shows IPA cathode current.
	DRIVER AMPLIFIER		
2	SCREEN GRID (mA)	M5	Shows driver screen grid current.
3	CATHODE (A)	M4	Shows driver cathode current.
	POWER AMPLIFIER		
4	SCREEN GRID (A)	M3	Shows PA screen grid current.
5	CATHODE (A)	M2	Shows PA cathode current.
6	POWER (KW)	M1	Shows PA reverse or forward output power as selected by switch 1A13S1.
7	METERS OFF/ON	S2	Enables panel meter operation. No OFF indication of meters in the OFF/ON position.
8	TEST METER	M9	Shows dc voltage as selected by switch 1A1S2.
9	IPA SCREEN GRID (mA)	M8	Shows IPA screen grid current.
10	TEST METER	M7	Shows dc current or RF level as selected by switch 1A1S1.
11	RF POWER	S1	
	RVS (x0.1)		Selects reverse RF power to M1.
	FWD		Selects forward RF power to M1.

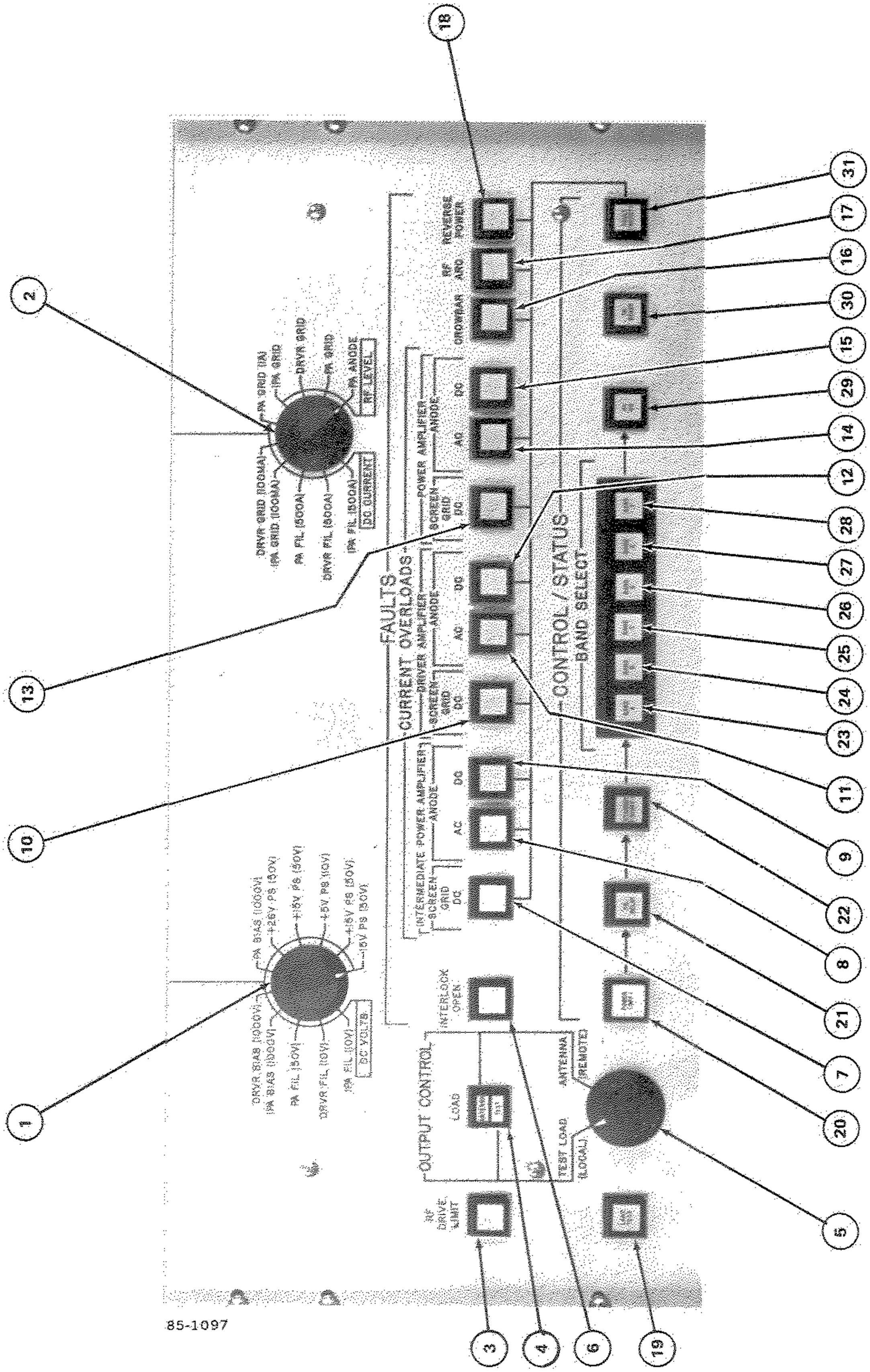

Figure 4-11. CONTROL/STATUS Panel 1A1

Table 4-9. CONTROL/STATUS Panel 1A1 (Figure 4-11)

Fig index	Control or indicator		Reference designator	Function
1	(Test Meter Switch)[1]		S2	Selects dc voltage inputs from indicated power supply to Test Meter 1A13M9. Quantities in parentheses show scale used for reading.
	DC VOLTS			
	IPA FIL	(10V)		
	DRVR FIL	(10V)		
	PA FIL	(50V)		
	IPA BIAS	(1000V)		
	DRVR BIAS	(1000V)		
	PA BIAS	(1000V)		
	+26V PS	(50V)		
	+15V PS	(50V)		
	+5V PS	(10V)		
	+15V PS	(50V)		
	-15V PS	(50V)		
2	(Test Meter Switch)[1]		S1	Selects dc currents of indicated power supply or RF power from indicated stages to Test Meter 1A13M7 input. Quantities in parentheses show scale used for reading.
	DC CURRENT			
	IPA FIL	(500A)		
	DRVR FIL	(500A)		
	PA FIL	(500A)		
	IPA GRID	(100MA)		
	DRVR GRID	(100MA)		
	PA GRID	(1A)		
	RF LEVEL			
	IPA GRID	30 W (10 scale)		
	DRVR GRID	40 W (10 scale)		
	PA GRID	50 W (10 scale)		
	PA ANODE	75 W (10 scale)		
3	RF DRIVE LIMIT		DS16	Turns on when automatic drive limiter circuit is activated.
	OUTPUT CONTROL			
4	LOAD ANTENNA TEST		DS14	Shows load is antenna or dummy load.

Table 4-9. CONTROL/STATUS Panel 1A1 (Figure 4-11) - CONT.

Fig index	Control or indicator	Reference designator	Function
5	OUTPUT CONTROL	S13	In TEST LOAD (LOCAL), selects dummy load and enables RF INHIBIT switch on RF SIGNAL MONITORS Panel. In ANTENNA (REMOTE), disables BIAS/RF INHIBIT CUTOFF switch on RF SIGNAL MONITORS Panel.
	FAULTS		
6	INTERLOCK OPEN	DS13	Lights up when a door, air, or water interlock is open.
	FAULTS - CURRENT OVERLOADS		
	INTERMEDIATE POWER AMPL		
7	SCREEN GRID DC	DS12	Lights up with screen grid dc overload.
8	ANODE AC	DS11	Lights up with anode ac overload.
9	ANODE DC	DS10	Lights up with anode dc overload.
	DRIVER AMPLIFIER		
10	SCREEN GRID DC	DS9	Lights up with screen grid dc overload.
11	ANODE AC	DS8	Lights up with anode ac overload.
12	ANODE DC	DS7	Lights up with anode dc overload.
	POWER AMPLIFIER		
13	SCREEN GRID DC	DS6	Lights up with screen grid dc overload.
14	ANODE AC	DS5	Lights up with anode ac overload.
15	ANODE DC	DS4	Lights up with anode dc overload.
	FAULTS		
16	CROWBAR	DS3	Lights up when a crowbar occurs.
17	RF ARC	DS2	Lights up when any RF arc occurs.
18	REVERSE POWER	DS1	Lights up when RF reverse power limits in any band.

Table 4-9. CONTROL/STATUS Panel 1A1 (Figure 4-11) - CONT.

Fig index	Control or indicator	Reference designator	Function
19	LAMP TEST[1]	S14/ DS29	Depress to test all panel indicator lamps. All should light up except POWER(OFF).
	CONTROL/STATUS[1]		
20	POWER (OFF)	S12	Turns off filament 208 volts, 12.47 kVac, bias and screen supplies, and interlock voltage. 120 V ac RIDE THRU voltage remains on.
21	FIL DELAY	DS27	Lights up during filament warmup.
22	STANDBY (HVOFF)	S11/ S26	Depress to start turn-on. Lights up after filament time delay and interlocks are proved.
	CONTROL/STATUS[1]-BAND SELECT		
23	A	S10/ DS25	Selects and indicates Band A. (5.00 to 6.79 mHz)
24	B	S9/ DS24	Selects and indicates Band B. (6.69 to 9.14 mHz)
25	C	S8/ DS23	Selects and indicates Band C. (9.04 to 12.3 mHz)
26	D	S7/ DS22	Selects and indicates Band D. (12.2 to 16.55 mHz)
27	E	S6/ DS21	Selects and indicates Band E. (16.45 to 22.3 mHz)
28	F	S5/ DS20	Selects and indicates Band F. (22.2 to 28.0 mHz)
	CONTROL/STATUS[1]		
29	HV ON	S4/ DS19	Depress for high voltage. Lights up when HV interlocks are proved.
30	TM READY	DS18	Lights to show RF can be applied.
31	FAULT RESET	S3/ DS17	Depress to reset all fault indicator lamps.

[1]All front panel controls except FAULT (RESET), METER TEST SWITCHES, and LAMP TEST are inactive in the remote mode. Status indicators are active in both local and remote.

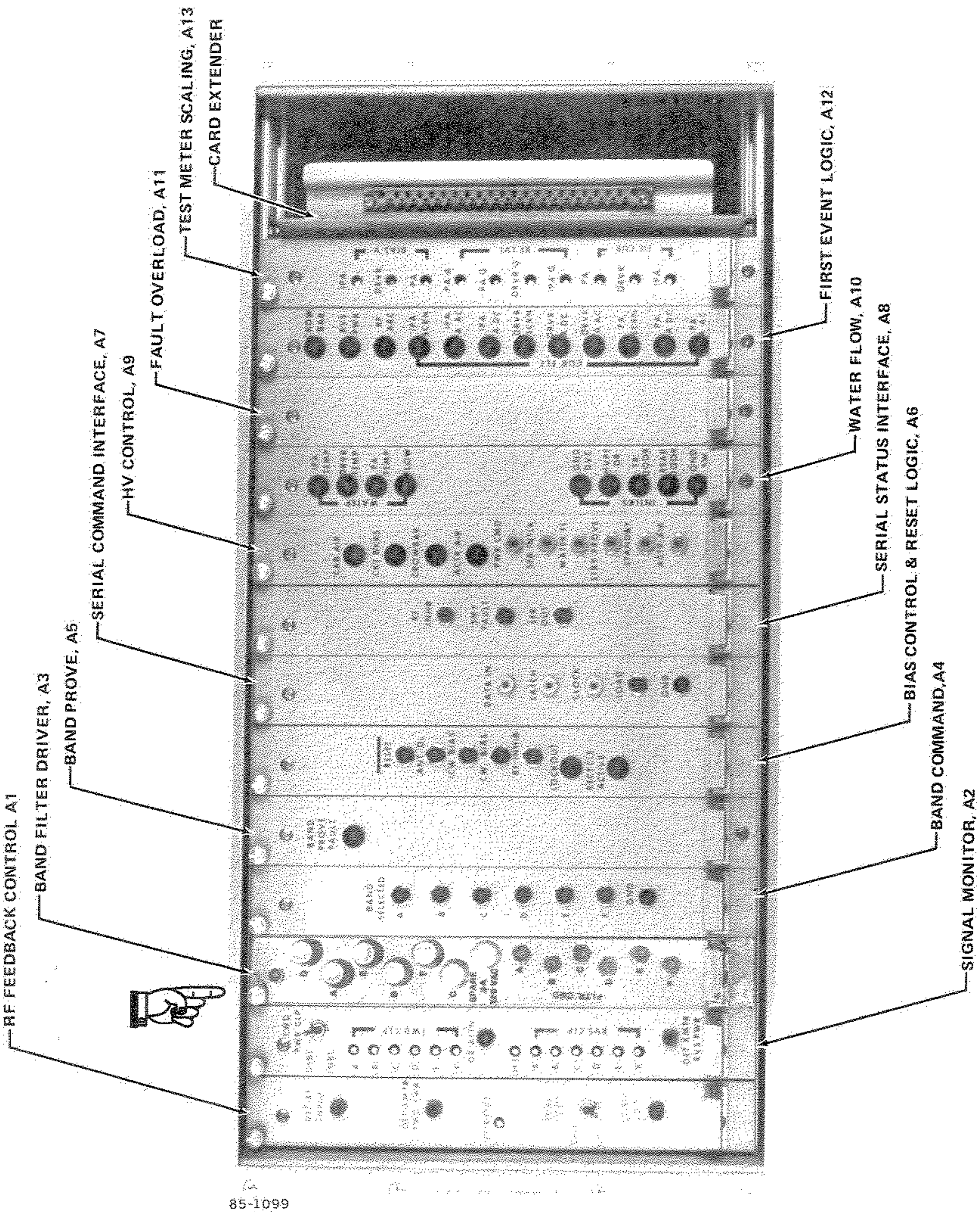

Figure 4-12. Card Assembly Panel 1A1 (Sheet 1 of 3)

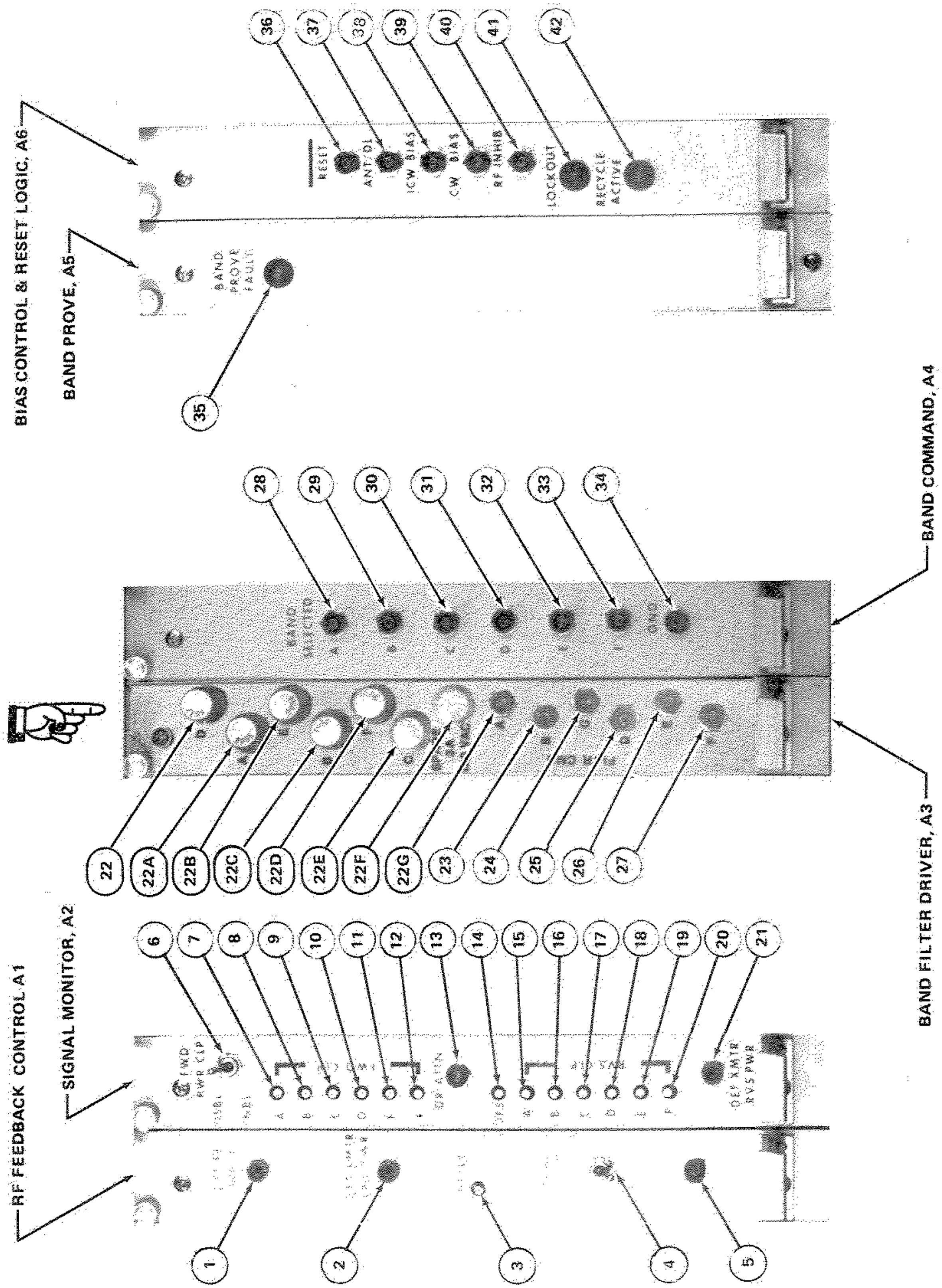

Figure 4-12. Card Assembly Panel 1A1 (Sheet 2 of 3)

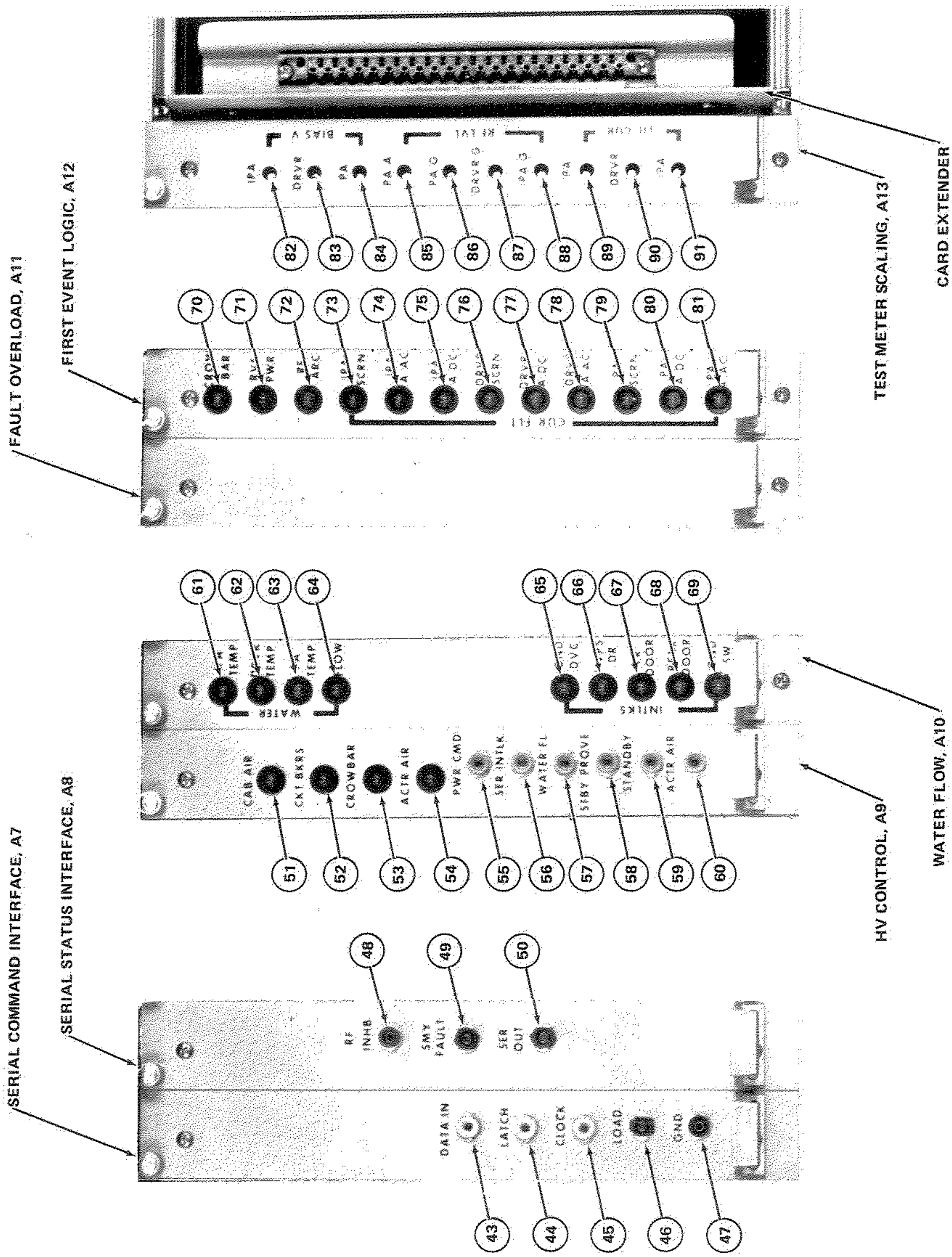

Figure 4-12. Card Assembly Panel 1A1 (Sheet 3 of 3)

Table 4-10. Card Assembly Panel 1A1 (Figure 4-12)

Fig index	Control or indicator	Reference designator	Function
	RF FEEDBACK CONTROL, A1		
1	DET RF INPUT	TP1	Test point to monitor detected RF input, a negative dc voltage with amplitude proportional to RF output power. Voltage varies from 0 to -1.6 V dc for typical output RF power of 0 to 100 kW.
2	DET XMTR FWD PWR	TP2	Test point to monitor detected sample of RF power produced at forward port of selected directional coupler. Output is a negative voltage ranging from -1.21 to +0.3 V dc for transmitter output of 0 to 100 kW.
3	RF DRIVE	R25	Variable resistor used to set quiescent operating point of voltage-controlled attenuator used in RF feedback loop.
4	FDBK LOOP	S1	Selects position of feedback loop.
	TEST		Disables RF feedback loop.
	OPR		Enables RF feedback loop.
5	ATTEN VDC	TP3	Test point to monitor control line to voltage-controlled attenuator used in RF feedback loop. Typical voltage level is +2.0 V dc at 100 kW.
	SIGNAL MONITOR, A2		
6	FWD PWR CLP	S1	Enables or disables forward power clamp circuit.
	DSBL		Opens automatic drive limit control loop.
	ENBL		Enables power clamp circuit.
	FWD CLP		Variable resistors R7 through R12 set maximum forward power level limit of Bands A through F.
7	A	R7	
8	B	R8	
9	C	R9	

Table 4-10. Card Assembly Panel 1A1 (Figure 4-12) - CONT.

Fig index	Control or indicator	Reference designator	Function
10	D	R10	
11	E	R11	
12	F	R12	
13	DR ATTN	TP1	Monitor for drive limit attenuator.
14	OFS	R52	Offset adjustment for attenuator control circuit.
	RVS CLP		Variable resistors R73 through R78 set maximum reverse power level limit of Bands A through F.
15	A	R73	
16	B	R74	
17	C	R75	
18	D	R76	
19	E	R77	
20	F	R78	
21	DET XMTR RVS PWR	TP2	Monitor for reverse power. Between 0 V and -1.6 V dc for 10 kW of reverse power.
	BAND FILTER DRIVER, A3		
	FLTR CMD		Test points of Band Filter Driver. Band in use greater than +25.0 V dc; others less than +0.5 V dc.
22	D	XF4	Band Filter Drvr Fuse protection
22A	A	XF1	Band Filter Drvr Fuse protection
22B	E	XF5	Band Filter Drvr Fuse protection
22C	B	XF2	Band Filter Drvr Fuse protection
22D	F	XF6	Band Filter Drvr Fuse protection
22E	C	XF3	Band Filter Drvr Fuse protection
22F	Spare	XF7	Band Filter Drvr Fuse protection
22G	A	TP6	
23	B	TP5	
24	C	TP4	
25	D	TP3	
26	E	TP2	
27	F	TP1	

Table 4-10. Card Assembly Panel 1A1 (Figure 4-12) - CONT.

Fig index	Control or indicator	Reference designator	Function
	BAND COMMAND, A4		
	BAND SELECTED		Test points of Band Command output. Band in use greater than +14.0 V dc; others less than +0.5 V dc.
28	A	TP1	
29	B	TP2	
30	C	TP3	
31	D	TP4	
32	E	TP5	
33	F	TP6	
34	GND	TP7	Ground reference point for test equipment.
	BAND PROVE, A5		
35	BAND PROVE FAULT	DS1	Shows fault in band prove interlock circuit.
	BIAS CONTROL & RESET LOGIC, A6		
36	RESET	TP1	Test point for 110-ms, greater than -25.0 V dc pulse following transmitter reset after a fault.
37	ANT/DL	TP2	Test point for command to dummy load port. A logic high, greater than 25.0 V dc, shows dummy load selection; a logic low, less than 1.0 V dc, shows antenna selection.
38	ICW BIAS	TP3	Test point for ICW bias selection; less than 1.0 V dc shows ICW selection.
39	CW BIAS	TP4	Test point for CW bias selection; less than 1.0 V dc shows CW selection.
40	RF INHIB	TP5	Test point for RF INHIBIT command to Low Level (Broadband) Amplifier. Greater than 2.5 V dc inhibits RF output; less than 0.7 V dc enables RF output.

Table 4-10. Card Assembly Panel 1A1 (Figure 4-12) - CONT.

Fig index	Control or indicator	Reference designator	Function
64	FLOW	DS2	Shows insufficient water flow.
	INTLKS		
65	GND DVC	DS1	Shows grounding stick(s) improperly stored.
66	HVPS DR	DS9	Shows open HVPS door or ground switch.
67	FR DOOR	DS8	Shows one or more of the following are open: controls compartment door, Band F hatch, transmitter left or right front doors.
68	REAR DOOR	DS7	Shows one or more of the following are open: Band E hatch, PA tube hatch, left or right rear transmitter doors.
69	GND SW	DS6	Shows transmitter ground switch has closed, shorting out anode and screen supplies.
	FIRST EVENT LOGIC, A12		
70	CROWBAR	DS12[3]	Shows crowbar has fired.
71	RVS PWR	DS11[3]	Shows reverse power fault.
72	RF ARC	DS10[3]	Shows arc in PA tube area or an output bandpass filter.
	CUR FLT		
73	IPA SCRN	DS9[3]	Shows IPA screen fault.
74	IPA A AC	DS8[3]	Shows IPA anode power supply ac overload.
75	IPA A DC	DS7[3]	Shows IPA anode power supply dc overload.
76	DRVR SCRN	DS6[3]	Shows driver screen power supply fault.
77	DRVR A DC	DS5[3]	Shows driver anode power supply dc overload.
78	DRVR A AC	DS4[3]	Shows driver anode power supply ac overload.
79	PA SCRN	DS3[3]	Shows PA screen power supply fault.

Table 4-10. Card Assembly Panel 1A1 (Figure 4-12) - CONT.

Fig index	Control or indicator	Reference designator	Function
80	PA A DC	DS2[3]	Shows PA anode power supply dc overload.
81	PA A AC	DS1[3]	Shows PA anode power supply ac overload.
	TEST METER SCALING, A13		
	BIAS V		
82	IPA	R9	Adjusts IPA bias voltage sample.
83	DRVR	R10	Adjusts driver bias voltage sample.
84	PA	R11	Adjusts PA bias voltage sample.
	RF LVL		
85	PA A	R12	Adjusts PA anode RF sample.
86	PA G	R13	Adjusts PA grid RF sample.
87	DRVR G	R14	Adjusts driver grid RF sample.
88	IPA G	R15	Adjusts IPA grid RF sample.
	FIL CUR		
89	PA	R16	Adjusts PA filament current.
90	DRVR	R17	Adjusts driver filament current.
91	IPA	R18	Adjusts IPA filament current.

[1]An IPA temp fault also lights up DRVR and PA TEMP lamps.

[2]A driver temp fault also lights up PA TEMP lamp.

[3]Indicator lamp that is lit up shows circuit with initial fault.

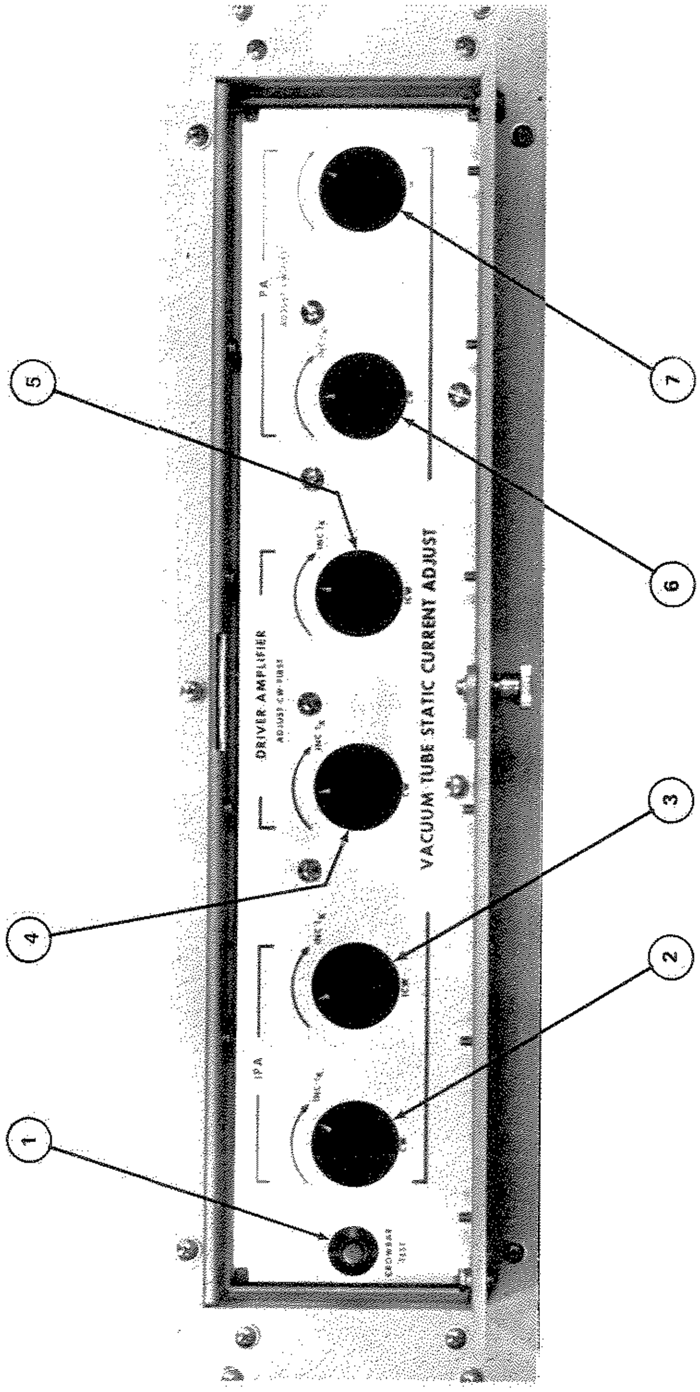

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Figure 4-13. Bias Adjust Panel 1A9

Table 4-11. Bias Adjust Panel 1A9 (Figure 4-13)

Fig index	Control or indicator	Reference designator	Function
1	CROWBAR TEST	S1	Test fires crowbar.
	VACUUM TUBE STATIC CURRENT ADJUST		
	IPA		
2	CW	R1[1]	Adjusts IPA cathode current in CW.
3	ICW	R2	Adjusts IPA cathode current in ICW.
	DRIVER AMPLIFIER		
4	CW	T1[1]	Adjusts driver cathode current in CW.
5	ICW	R3	Adjusts driver cathode current in ICW.
	PA		
6	CW	T2[1]	Adjusts PA cathode current in CW.
7	ICW	R4	Adjusts PA cathode current in ICW.

[1]CW mode adjustments shall be made first.

Table 4-10. Card Assembly Panel 1A1 (Figure 4-12) - CONT.

Fig index	Control or indicator	Reference designator	Function
41	LOCKOUT	DS2	Shows transmitter has made four recycle attempts in a 2.5-minute period. Transmitter is then locked out from automatic RECYCLE. A manual FAULT (RESET) is required.
42	RECYCLE ACTIVE	DS1	Shows less than 30 seconds have elapsed between faults. Reset circuitry cannot function until lamp goes out. Lamp lights up to show a fault has occurred within 2.5 minutes. Transmitter will recycle with RF INHIBIT command on first fault and 30 seconds after INHIBIT on second and third faults. Transmitter operates with lamp lit up unless a fourth fault occurs in less than 2.5 minutes.
	SERIAL COMMAND INTERFACE, A7		
43	DATA IN	TP1	Test point for serial bit stream from TCMG.
44	LATCH	TP2	Test point for latch pulse from TCMG immediately after command data.
45	CLOCK	TP3	Test point for serial bit stream from TCMG sent with each command signal group, read-back group, or reporting of transmitter status.
46	LOAD	TP4	Test point for status request pulse, which initializes sending of status to TCMG.
47	GND	TP5	Test equipment ground.
	SERIAL STATUS INTERFACE, A8		
48	RF INHB	TP1	Test point for remote RF INHIBIT command of 0.7 V dc.
49	SMY FAULT	TP2	Test point for signal of less than 4.0 V dc telling the TCMG the transmitter is down from a fault.
50	SER OUT	TP3	Test point for TTL pulse train upon command read-back or initiation of transmitter status request.

Table 4-10. Card Assembly Panel 1A1 (Figure 4-12) - CONT.

Fig index	Control or indicator	Reference designator	Function
	HV CONTROL, A9		
51	CAB AIR	DS2	Shows a cabinet air-pressure fault.
52	CKT BKRS	DS3	Shows circuit breaker(s) not closed, cabinet 3 is open, or phase(s) of 208 V ac or 12.47 kVac missing.
53	CROWBAR	DS4	Shows crowbar has fired or heat lamp is not on.
54	ACTR AIR	DS1	Shows low actuator air pressure.
55	PWR CMD	TP1	Test point for +26 V dc signal when a STANDBY command has been initiated in either remote or local control.
56	SER INTLK	TP2	Test point for serial interlock +26.5 V dc signal when STANDBY has been initiated, there is cabinet air flow, and 3-phase power is within tolerance.
57	WATER FL	TP3	Test point for +26 V dc signal when there is sufficient water flow.
58	STBY PROVE	TP4	Test point for +26 V dc signal showing interlock prove prior to turn-on of high voltage.
59	STANDBY	TP5	Test point for +26 V dc signal showing STANDBY has been achieved.
60	ACTR AIR	TP6	Test point for +26 V dc signal showing HV command has been sent and actuator air pressure is proper.
	WATER FLOW, A10		
	WATER		
61	IPA TEMP	DS5[1]	Shows water in IPA anode exceeds +170°F ± 5°F.
62	DRVR TEMP	DS4[2]	Shows water in driver anode exceeds +170°F ± 5°F.
63	PA TEMP	DS3	Shows water in PA anode exceeds +170°F ± 5°F.

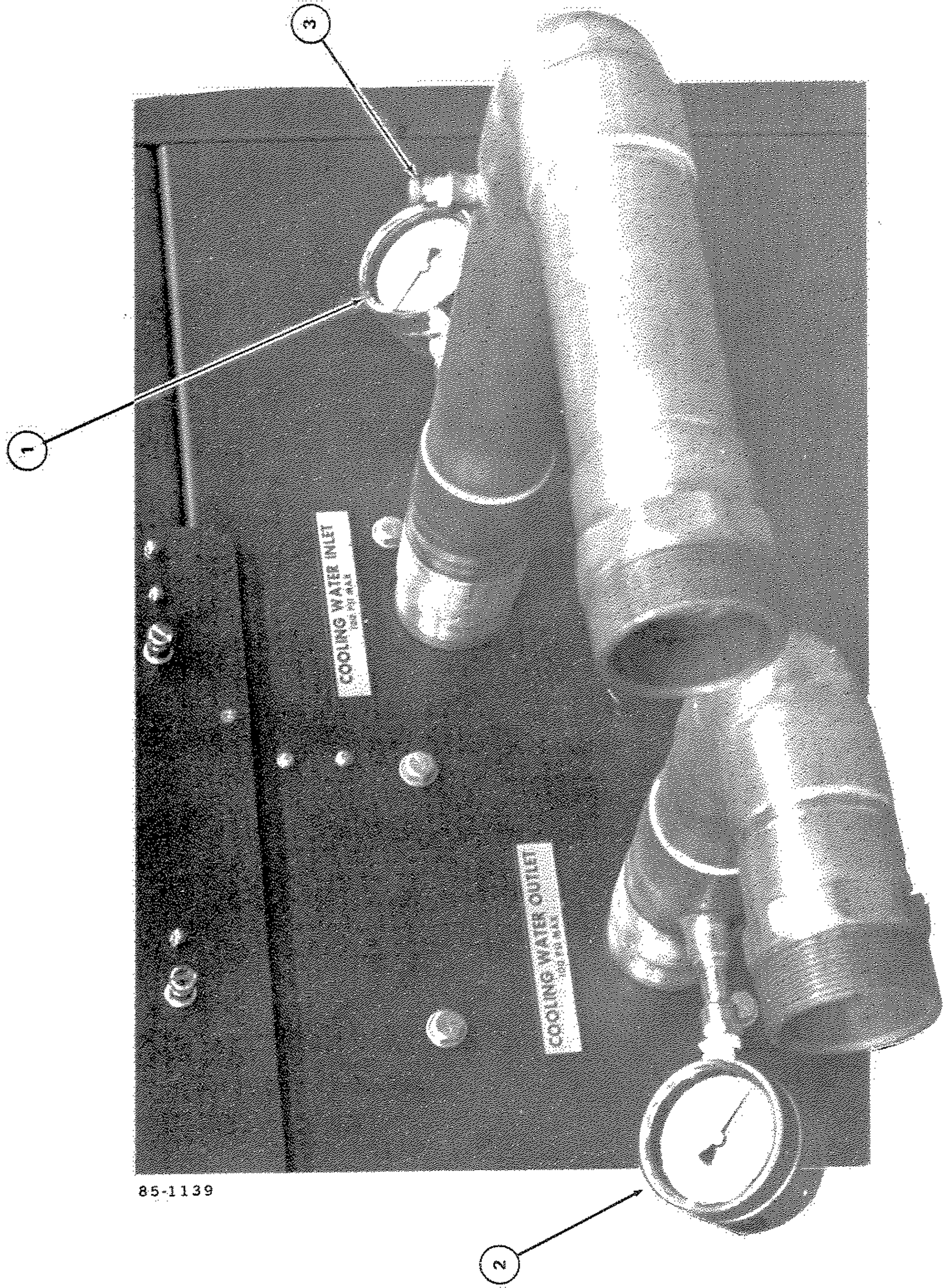


Figure 4-14. Cooling Water Indicators and Bleeder

Table 4-12. Cooling Water Indicator and Bleeder (Figure 4-14)

Fig index	Indicator or bleeder	Function
1	COOLING WATER INLET 100 psi max.	Shows inlet water pressure.
2	COOLING WATER OUTLET 15 psi max.	Shows outlet water pressure.
3	Bleeder Valve	Purges inlet water line of air. Turning thumbscrew ccw opens valve.

Table 4-13. Transmitter System Interlocks

Interlock	Location	Function
STANDBY	1A1A9K1	Relay energized by STANDBY (HVOFF) under local or remote control. Relay is de-energized locally by POWER (OFF) switch and remotely by a POWER OFF command.
MAIN POWER (STANDBY)	1A24K1	Applies +15 V dc and +26.5 V dc to circuits.
12.47 KV	2Z1	Checks phase of 12.47 kVac and provides voltage prove.
208 V	2Z2	Checks phase of 208 V ac and provides voltage prove.
IPA ANODE TEMP	1S26	Opens with ANODE water overtemp.
DRVR ANODE TEMP	1S27	Opens with ANODE water overtemp.
PA ANODE TEMP	1S28	Opens with ANODE water overtemp.
AIR FLOW	1S29	Provides AIR FLOW prove with air present; AIR FLOW fault with no air present.
WATER TEMP (summary)	1A1A9K2	Provides WATER TEMP prove when IPA, driver, and PA anode temps are normal; WATER TEMP fault when not.
WATER FLOW (summary)	1A1A9K3	Actuated by 1A1A10 Logic Card and provides water flow prove or fault for: (1) IPA anode; (2) IPA and driver amplifier grids; (3) PA control grid, filament, and grid filters; (4) Driver amplifier anode; (5) PA grid dummy load; (6) Output filters, Bands A, C, & E; (7) PA anode; and, (8) Output filters, Bands B, D, & F.

Table 4-13. Transmitter System Interlocks - CONT.

Interlock	Location	Function
IPA FIL	1A23CB5	Provides prove when IPA FIL CB is closed; INTERLOCK OPEN when not.
DRVR FIL	1A23CB6	Provides prove when DRVR FIL CB is closed; INTERLOCK OPEN when not.
PA FIL	1A23CB7	Provides prove when PA FIL CB is closed; INTERLOCK OPEN when not.
MASTER FIL CONTROL	1A24K6	Energizes when 1A23CB5, CB6, and CB7 are closed. That energizes PA FIL relay 1A24K5 and IPA and DRVR FIL relay 1A24K2, starting filament time delay.
BROADBAND AMPLIFIER	1A23CB1	Provides prove when CB is closed; INTERLOCK OPEN when not.
IPA BIAS	1A23CB2	Provides prove when CB is closed; INTERLOCK OPEN when not.
DRVR BIAS	1A23CB3	Provides prove when CB is closed; INTERLOCK OPEN when not.
PA BIAS	1A23CB4	Provides prove when CB is closed; INTERLOCK OPEN when not.
PA SCREEN SUPPLY	2A2CB5	Provides prove when CB is closed; INTERLOCK OPEN when not.
DRVR SCREEN SUPPLY	2A2CB6	Provides prove when CB is closed; INTERLOCK OPEN when not.
IPA SCREEN SUPPLY	2A2CB7	Provides prove when CB is closed; INTERLOCK OPEN when not.
CROWBAR SUPPLY	2A2CB4	Provides prove when POWER CB is closed; INTERLOCK OPEN when not.
HV CONTACTOR	2A2CB3	Provides prove when CB is closed; INTERLOCK OPEN when not.

Table 4-13. Transmitter System Interlocks - CONT.

Interlock	Location	Function
208 VAC REGULATOR	2A2CB2	Provides prove when CB is closed; INTERLOCK OPEN when not.
208 VAC MAIN PWR	2A2CB1	Provides prove when CB is closed; INTERLOCK OPEN when not.
TIME DELAY	1A24K7	Allows filament warmup before high voltage can be applied, then provides prove.
REAR	1S9	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
FRONT SIDE	1S10	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
FRONT CENTER	1S11	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
FRONT RIGHT SIDE	1S12	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
FRONT RIGHT SIDE	1S13	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
REAR RIGHT SIDE	1S14	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
REAR RIGHT CENTER	1S15	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
REAR CENTER	1S16	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
CONTROL CABINET	1S17	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.

Table 4-13. Transmitter System Interlocks - CONT.

Interlock	Location	Function
HVPS CABINET 2	2S4	Provides prove if ground stick is in holder; INTERLOCK OPEN if not.
DOOR	2S1	Provides prove if HVPS door is closed; INTERLOCK OPEN if not.
GND SWITCH	2S2	Provides prove if ground switch is open (door closed); INTERLOCK OPEN if not.
CONTROL DOOR	1S30	Provides prove if door is closed; INTERLOCK OPEN if not.
BAND F	1S31	Provides prove if door is closed; INTERLOCK OPEN if not.
LEFT FRONT	1S1/1S2	Provides prove if door is closed and both top and bottom RF covers are in place; INTERLOCK OPEN if not.
RIGHT FRONT	1S3/1S4	Provides prove if door is closed and both top and bottom RF covers are in place; INTERLOCK OPEN if not.
BAND E HATCH	1S41	Provides prove if hatch is in place; HATCH INTERLOCK OPEN if not.
RIGHT REAR	1S5/1S6	Provides prove if door is closed and both top and bottom RF covers are in place; INTERLOCK OPEN if not.
PA TUBE HATCH	1S42	Provides prove if hatch is in place; INTERLOCK OPEN if not.
LEFT REAR	1S7/1S8	Provides prove if door is closed and both top and bottom RF covers are in place; INTERLOCK OPEN if not.

Table 4-13. Transmitter System Interlocks - CONT.

Interlock	Location	Function
HV GND SWITCH CONTROL	1K7	Energizes when all POWER grounding sticks and hatches are in place and all doors are closed. Energizes 1S38.
HV GND SWITCH	1S38	If all doors, ground sticks, filament delay complete, and circuit breakers prove, 1S38 provides prove when energized by 1K7.
CROWBAR PROVE	2A1K1	Provides prove when crowbar power supply proves.
CROWBAR PROVE	2K21	Provides prove when RIDE THRU voltage is applied to heat lamp and lamp functions.
SUMMARY PROVE RELAY	1A24K8	Energizes relay 1A24K3 when all interlocks listed below have proved: Phase Fail Air Flow Water Temp Water Flow Circuit Breakers Fil Time Delay Gnd Sticks, Doors Gnd Switch Crowbar Pwr Supply Crowbar Heat Lamp
IPA & DRVR BIAS	1A24K3	Provides prove and energizes relay 1A24K4.
PA BIAS	1A24K4	Provides prove when energized by 1A24K3.
INTERLOCK PROVE, BIAS ON	1A1A9K4	Energizes when interlocks for the following RF switches and antenna/dummy load ports prove:
	REMOTE	
	Band D	RF Band Switch 1S35S3
	Band F	RF Band Switch 1S37S3
	Band B	RF Band Switch 1S33S3
	Band A	RF Band Switch 1S32S3
	Band E	RF Band Switch 1S36S3
	Band C	RF Band Switch 1S34S3
	Band C	Antenna/Dummy Load Port 1S45
	Band E	Antenna/Dummy Load Port 1S47

Table 4-13. Transmitter System Interlocks - CONT.

Interlock	Location	Function
	Band A	Antenna/Dummy Load Port 1S43
	Band B	Antenna/Dummy Load Port 1S44
	Band F	Antenna/Dummy Load Port 1S48
	Band D	Antenna/Dummy Load Port 1S46
	LOCAL	
	Test Load Interlock jack, 1A25J5	
	Band D	RF Band Switch 1S35S2
	Band F	RF Band Switch 1S37S2
	Band B	RF Band Switch 1S33S2
	Band A	RF Band Switch 1S32S2
	Band E	RF Band Switch 1S36S2
	Band C	RF Band Switch 1S34S2
	Band C	Antenna/Dummy Load Port 1S45
	Band E	Antenna/Dummy Load Port 1S47
	Band A	Antenna/Dummy Load Port 1S43
	Band B	Antenna/Dummy Load Port 1S44
	Band F	Antenna/Dummy Load Port 1S48
	Band D	Antenna/Dummy Load Port 1S46
STANDBY	1A1A9K5	STANDBY (HVOFF) lamp lights up and enables HV ON command when all interlocks have proved, bias is on, and Fault Summary relay 1A1A11K13 is de-energized.

Section II. MAINTENANCE OPERATING INSTRUCTIONS

4-5 GENERAL.

The T1524/FPS-118(V) or T1524A/FPS-118 (V) Radar Transmitter operates in two modes: local and remote. In remote, the transmitter is operated into an antenna. In local, for maintenance and test, it is operated into a dummy load. Emergency operations are covered in Section III of this chapter.

4-6 MAINTENANCE OPERATION.

Procedures for energizing, operating, and shutting down the transmitter follow. Both remote and local modes of operation are covered. Tables 4-14, 4-15, and 4-16 provide switch and control settings and indicator lamp status.

4-6.1 Transmitter Power-Up. To power up the transmitter, perform the following steps.

1. Set all circuit breakers to OFF on Transmitter Cabinet 1 (Figure 4-7) and HVPS Cabinet 2 (Figure 4-5).
2. Verify 12.47 kV disconnect switch at cabinet 3 is down to OPEN.
3. Verify settings of switches and controls per Table 4-14. Make optional settings in accordance with Table 4-14 footnotes.
4. Verify RPIE cooling air, compressed air, and deionized cooling-water sources are connected to transmitter and are turned on.

NOTE

If cooling-water supply to cabinet 1 has been turned off and back on, perform step 5. Otherwise, proceed to step 6.

5. Refer to Table 4-12 and Figure 4-14. Turn bleeder valve ccw to open. When air has been purged from line, close bleeder valve.

Table 4-14. Switch and Control Settings, Power Off

Assy No.	Reference Designator	Switch or Control	Position
		Meter Panel Assembly, 1A13	
1A13	S2	METERS ON/OFF	ON
1A13	S1	RF POWER RVS/FWD	FWD
		Control Panel Assembly, 1A1	
1A1	S2	DC VOLTS (Meter Switch)	NA
1A1	S1	DC CURRENT/RF LEVEL (Meter Switch)	NA
1A1	S13	OUTPUT CONTROL	TEST LOAD (LOCAL)
		Card Cage Assembly, 1A1	
1A1A1	S1	FDBK LOOP (TEST/OPR)	OPR
1A1A2	S1	FWD PWR CLIP DSBL/ENBL	ENBL
		Bias Adjust Panel Assembly, 1A9	
1A9	R1	IPA CW	Leave as Preset
1A9	R2	IPA ICW	Leave as Preset
1A9	T1	DRIVER AMPL CW	Leave as Preset
1A9	R3	DRIVER AMPL ICW	Leave as Preset
1A9	T2	PA CW	Leave as Preset
1A9	R4	PA ICW	Leave as Preset
		RF Broadband Amplifier, 1AR1	
1AR1	S1	AC POWER ON/OFF	ON
		RF SIGNAL MONITORS Panel 1A25	
1A25	S2[1]	RF INPUT SELECTOR	
1A25	S3	BIAS/RF INHIBIT	CUTOFF
1A25	S1	XMTR METER PANEL MONITOR	OFF
		HVPS Control and Monitor Panel Assembly, 2A2	
2A2	S1	VOLTMETER AMMETER LVAC	Position 1
2A2	S2	VOLTMETER AMMETER HVAC	Position 1
2A2	S3	ANODE SCREEN HVDC	POWER AMPL

[1] Position to either LOCAL or REMOTE.

6. Check cooling water inlet and outlet gages at right side of cabinet 1. Inlet gage should read 80 to 88 psig and outlet gage should read 5 to 9 psig.

7. Move 12.47 kV disconnect switch at cabinet 3 up to CLOSED.

8. Verify RPIE 120 VAC RIDE THRU, 208 VAC, and 12.47 kVac circuit breakers are closed (set to ON).

CAUTION

EQUIPMENT DAMAGE HAZARD

One person observe OUTPUT CONTROL LOAD lamp closely when 120 VAC RIDE THRU INPUT circuit breaker is closed on cabinet 2.

Lamp corresponding to position of OUTPUT CONTROL switch should light up within 3 seconds. If not, immediately move switch to other position and open 120 VAC RIDE THRU INPUT circuit breaker. Inform site supervision of the situation.

9. Close all circuit breakers on cabinet 2. Observe meter readings in each switch position per Table 4-15.

10. Close all circuit breakers on cabinet 1. Observe meter readings in each switch position per Table 4-16.

11. Press LAMP TEST switch on CONTROL/STATUS panel. All panel lamps should light up except POWER (OFF).

12. Refer to paragraph 4-6.2 for procedures to bring transmitter to operational status.

Table 4-15. Cabinet 2 Switch Settings and Meter Readings

Assy No	Reference Designator	Meter	Switch Position	Meter Reading
2A3	M2	AUXILIARY CURRENT	S1-1 S1-2 S1-3 S1-OFF (Press S4)	0 0 0 0.4 amp ± 10%
2A3	M1	AUXILIARY VOLTAGE	S1-1 S1-2 S1-3 S1-OFF (Press S4)	208 V ac ± 10% 208 V ac ± 10% 208 V ac ± 10% 120 V ac ± 10%
2A3	M4	PRIMARY CURRENT	S2-1 S2-2 S2-3	0 0 0
2A3	M3	PRIMARY VOLTAGE	S2-1 S2-2 S2-3	12.47 kVac ± 3% 12.47 kVac ± 3% 12.47 kVac ± 3%
2A3	M6	SCREEN GRID	S3-1 S3-2 S3-3	0 0 0
2A3	M5	ANODE	S3-1 S3-2 S3-3	0 0 0

Table 4-16. Cabinet 1 Switch Settings and Meter Readings

Assy No	Meter	Switch Position	Meter Reading
1A13	M6	IPA CATHODE	0
1A13	M5	DRIVER AMP SCREEN GRID	0
1A13	M4	DRIVER AMP CATHODE	0
1A13	M3	POWER AMP SCREEN GRID	0
1A13	M2	POWER AMP CATHODE	0
1A13	M1	POWER AMP POWER (KW)	0
1A13	M8	IPA SCREEN GRID	0
1A13	M9	DC VOLTS (Test Meter)	
		S2-IPA FIL	0
		S2-DRVR FIL	0
		S2-PA FIL	0
		S2-IPA BIAS	0
		S2-DRVR BIAS	0
		S2-PA BIAS	0
		S2- +26 V PS	*+25.0 to +27.0 V dc
		S2- +15 V PS	*+14.5 to +15.5 V dc
		S2- +5 V PS	*+ 4.6 to + 5.4 V dc
		S2- +15 V PS	*+14.2 to +15.8 V dc
		S2- -15 V PS	*-14.2 to -15.8 V dc
1A13	M7 (Test Meter)	DC CURRENT/RF LEVEL	
		S1-IPA FIL	0
		S1-DRVR FIL	0
		S1-PA FIL	0
		S1-IPA GRID	0
		S1-DRVR GRID	0
		S1-PA GRID	0
		S1-IPA GRID	0
		S1-DRVR GRID	0
		S1-PA GRID	0
		S1-PA ANODE	0

* If not within tolerance, perform procedure in paragraph 6-6.3.1

4-6.2 Transmitter Operation. Transmitters can be operated under remote or local control. Under remote control, transmitter receives commands from Transmitter Control and Monitor Group (TCMG) and provides status signals to the TCMG. Under local control, the TCMG is locked out.

4-6.2.1 Remote Operation. Remote operation is accomplished from the TCMG, which communicates with transmitter via control and status signals. Table 4-17 lists signals that interface transmitter and TCMG. To accomplish remote operation, perform the following.

CAUTION

EQUIPMENT DAMAGE HAZARD

If position of OUTPUT CONTROL switch must be changed, observe OUTPUT CONTROL LOAD lamp closely. Lamp corresponding to position of OUTPUT CONTROL switch should light up within 3 seconds. If not, immediately move switch to other position and open 120 VAC RIDE THRU INPUT circuit breaker at HVPS Cabinet 2. Inform site supervision of the situation.

1. Check position of OUTPUT CONTROL switch. If not in ANTENNA (REMOTE), move switch to that position.

2. Press FAULT RESET switch on CONTROL/STATUS panel.

3. Notify operator that transmitter can be brought to mission ready status.

4-6.2.2 Local Transmitter Operation. In local mode, transmitter operation is independent of TCMG control. To accomplish local operation, perform the following. For tools and test equipment required, see Table 1-4, item number 4a.

1. If operating in remote mode, perform procedures in paragraph 4-6.2.3.2.

Table 4-17. Transmitter/TCMG Interface Signals

Command Signals

Bit	Band A	Band B	Band C	Band D	Band E	Band F	Logic 1	Logic 0
B0	1	0	0	0	0	0		
B1	0	1	0	0	0	0		
B2	0	0	1	0	0	0		
B3	0	0	0	1	0	0		
B4	0	0	0	0	1	0		
B5	0	0	0	0	0	1		
B6	HVDC						ON	OFF
B7	STANDBY						ON	CONTROL OFF
B8	KEYLINE						RF DISABLE	RF ENABLE
B9	MODE						CW	ICW
B10 Through B15 - NOT USED								

Status Signals

Bit	Status Description	Logic 1	Logic 0
0	HV CONTACTORS	One/more open	All closed
1	PRESSURIZED AIR	Fault	Go
2	COOLING AIR	Fault	Go
3	COOLING WATER	Fault	Go
4	RECYCLE	Active	Not Active
5	CROWBAR	Fired	Has not Fired
6	RF ARC	Occurred	Has not Occurred
7	REVERSE POWER	Trip	Go
8	FAULT LOCKOUT	Has Occurred	Has not Occurred
9	HVPS STATUS	Fault	No Fault
10	CONTROL	Remote	Local
11	DRIVE LIMIT	Excessive	Within Tolerance
12	FIL TIME DELAY	In Progress	Off or timed out
13	TM READY	Ready for RF	Not ready for RF
14	STANDBY	Complete	Not complete
15	HVAC AND FUSES STATUS	Go	No Go

2. Check position of RF INPUT SELECTOR switch on RF SIGNAL MONITORS panel. If not in LOCAL, move switch to that position.

3. Check position of OUTPUT CONTROL switch. If not in TEST LOAD (LOCAL), move switch to that position.

4. Press BAND SELECT switch for desired frequency band.

5. Install water-cooled dummy load per paragraph 4-6.4.1.

6. Press FAULT RESET switch on CONTROL/STATUS panel.

7. Press STANDBY (HVOFF) switch. FIL DELAY lamp will light up and remain lit for a 3-minute period. FIL DELAY and INTERLOCK OPEN will then go out and STANDBY (HVOFF) will light up.

8. Check position of BIAS/RF INHIBIT switch on RF SIGNAL MONITORS panel. If not in CUTOFF, move switch to that position.

9. Press HV ON switch. After a 2-second delay, TM READY will light up and STANDBY (HVOFF) will go out.

10. Move BIAS/RF INHIBIT switch to desired position: CW or ICW.

11. Apply RF input to transmitter as specified in applicable maintenance procedure.

NOTE

Specific maintenance procedures in this manual provide directions for connection of RF signal generator and levels of input RF drive to be applied. In the event RF drive is to be provided by special equipment, the signal generator called out here will not be applicable.

4-6.2.3 <u>Changing Mode of Control.</u> OUTPUT CONTROL mode changes can be accomplished only at transmitter cabinet 1.

4-6.2.3.1 <u>Local to Remote Control.</u>

1. Turn off RF signal generator. Remove connector from RF INPUT SIGNAL SOURCE jack on RF SIGNAL MONITORS panel.

2. Press STANDBY (HVOFF) switch. STANDBY (HVOFF) lamp will light up; TM READY and HV ON lamps will go out.

3. Remove dummy load per paragraph 4-6.4.2. Turn off and disconnect any other test equipment attached to transmitter during maintenance actions. Install panels, covers, etc.

4. Follow procedure in paragraph 4-6.2.1.

4-6.2.3.2 <u>Remote to Local Control.</u>

CAUTION
EQUIPMENT DAMAGE HAZARD

When changing position of OUTPUT CONTROL switch, LOAD indicator shall be closely watched. If lamp for selected position (ANTENNA/ TEST) does not light up within 3 seconds, immediately move OUTPUT CONTROL switch back to original position and:

1. Notify TMC operator to remove (DISABLE) RF drive for one or all transmitters, as appropriate.

2. Verify RF drive not present by reading zero on POWER (KW) meter 1A13M1 and Broadband Amplifier wattmeter 1AR1M1.

3. Follow procedure in paragraph 4-6.2.2.

4-6.3 <u>Transmitter Shutdown.</u> The following paragraphs cover shutdown procedures for both remote and local modes of operation.

4-6.3.1 <u>Remote Shutdown.</u>

1. At TCMG, remove (DISABLE) RF drive from one or all transmitters, as applicable.

2. Verify RF drive is disabled by reading of zero on POWER (KW) Meter 1A13M1 and broadband amplifier wattmeter 1AR1M1. Broadband amplifier POWER indicator will go out.

CAUTION
EQUIPMENT DAMAGE HAZARD

When changing position of OUTPUT CONTROL switch, LOAD indicator shall be closely watched. If lamp for selected position (ANTENNA/ TEST) does not light up within 3 seconds, immediately move OUTPUT CONTROL switch back to original position.

3. Position OUTPUT CONTROL switch on CONTROL/STATUS panel to TEST LOAD (LOCAL).

4. TM READY and HV ON lamps will go out and INTERLOCK OPEN will light up.

4-6.3.2 Local Shutdown.

1. Turn off RF signal generator. Remove connector from RF SIGNAL SOURCE jack on RF SIGNAL MONITORS panel.

2. Press STANDBY (HVOFF) switch on CONTROL/STATUS panel. TM READY and HV ON lamps will go out and STANDBY (HVOFF) will light up.

3. Observe panel meters on cabinet 2. When DC POWER SUPPLIES meters drop to 10% of full-scale reading, press and hold POWER OFF switch until STANDBY (HVOFF) goes out and INTERLOCK OPEN lights up.

4-6.4 Water-Cooled Dummy Load. Water-cooled dummy load part number 126103 allows transmitter operation in local (maintenance) mode of operation.

4-6.4.1 Dummy Load Installation. To install water-cooled dummy load, refer to Figure 4-15 and perform following.

Tools and Test Equipment Required:

(from Table 1-4):

Qty	Item No.	Description
1	1r	Ladder
1	7p	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7zf	Socket
1	7z	Socket

1. At top rear of cabinet 1, remove cover from RF connector corresponding to selected band.

CAUTION
EQUIPMENT DAMAGE HAZARD

Do not overtighten dummy load connector bolts. They are brass and will break if overtightened.

2. Attach dummy load neck to RF connector. Tighten each connecting bolt, in turn, until resistance is met. Further tighten each one until dummy load neck and RF connector Surfaces are mated and each bollt is just snug tight.

3. Verify COOLING LIQUID FLOW CONTROL knob on front of dummy load is open (fully ccw).

4. Connect interlock cable from dummy load to TEST LOAD INTERLOCK jack on RF SIGNAL MONITORS panel. (Figure 4-15. Dummy Load, Part No. 126103)

5. Remove inlet water hose from dummy load rack (Figure 4-15). Connect hose to RPIE inlet water supply. Repeat for outlet water hose.

NOTE

One person performs next step while second person monitors flow gage device at front of dummy load (Figure 4-15).

6. Open RPIE water supply outlet valve fully. Next, slowly open RPIE inlet valve until 40 gpm is observed on dummy load flow gage device.

7. If necessary, readjust COOLING LIQUID FLOW CONTROL knob on front of dummy load until flow gage indicates 40 gpm.

NOTE

If correct flow rate can not be attained and\or inlet pressure gage at rear of dummy load indicates 50 psig or higher, a restriction may exist internal to dummy load.

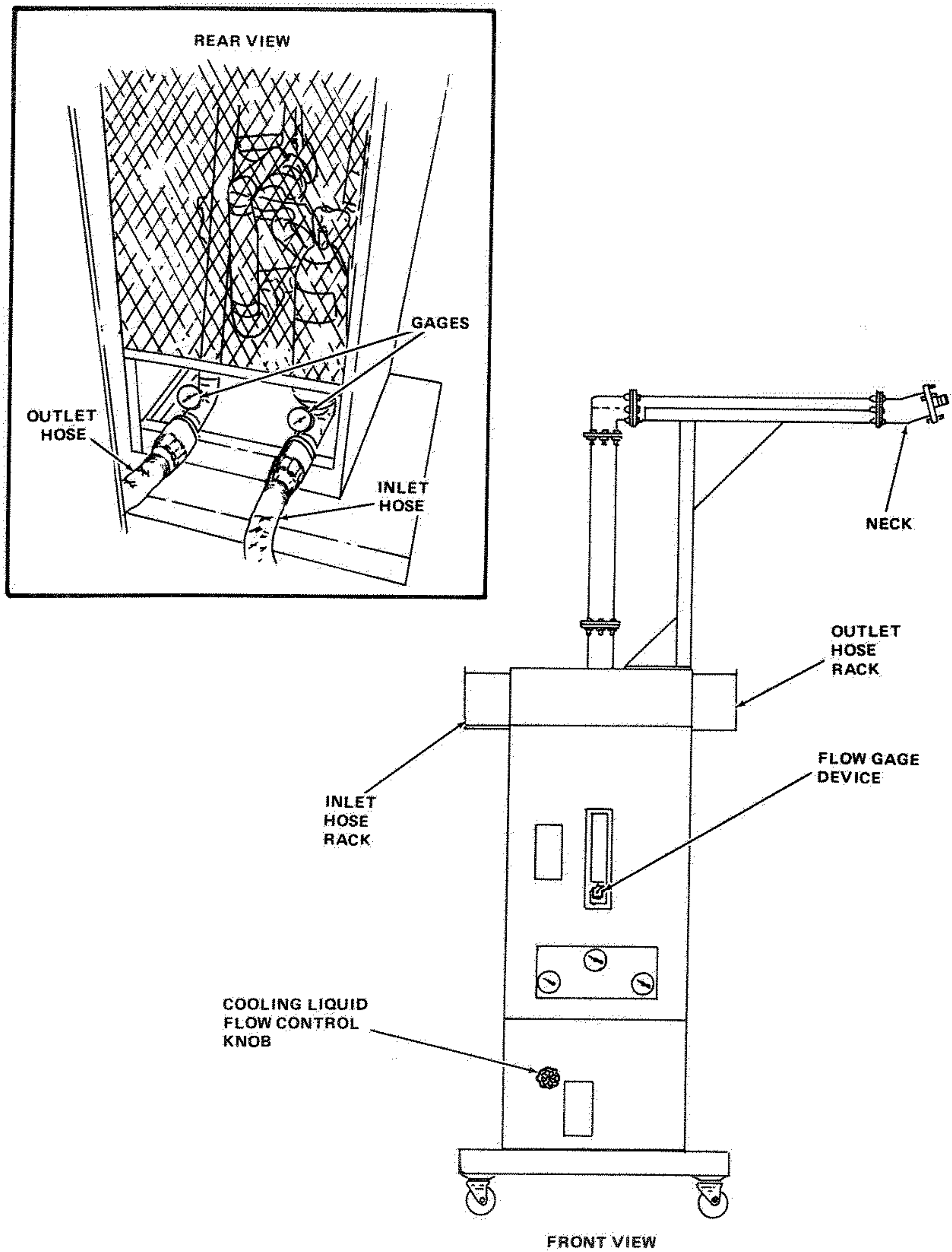


Figure 4-15. Dummy Load

4-6.4.2 Dummy Load Removal. To remove water-cooled dummy load, refer to Figure 4-15 and perform the following:

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1r	Ladder
1	7p	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7zf	Socket
1	9h	Drain Pan
1	7z	Socket

CAUTION

EQUIPMENT DAMAGE HAZARD

Allow water to circulate through dummy load for 3 to 5 minutes following change to STANDBY (HVOFF) mode. Failure to comply may result in equipment damage.

1. Remove interlock cable from TEST LOAD INTERLOCK jack on RF SIGNAL MONITORS panel.

2. Turn off inlet water valve fully. Wait 1 minute, then turn off outlet water valve fully.

3. Remove dummy load water hoses from RPIE supply connections. Catch water spill in drain pan. Return water hoses to racks on sides of dummy load.

4. Disconnect dummy load neck from RF connector. Reinstall RF connector cover.

4-6.4.3 Dummy Load Repositioning. This paragraph covers moving of dummy load when maintenance requires selection of more than one frequency band. Refer to Figure 4-15 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1r	Ladder
1	7p	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7zf	Socket
1	7z	Socket

1. Turn off RF signal generator.

2. Press STANDBY (HVOFF) switch on CONTROL/STATUS panel. STANDBY (HVOFF) lamp will light up; TM READY and HV ON will go out.

3. Disconnect dummy load neck from RF connector. Reinstall RF connector cover.

4. Remove cover from RF connector corresponding to desired frequency band. Attach dummy load neck to RF connector. Tighten each connecting bolt until resistance is met. Further tighten each one until dummy load neck and RF connector surfaces are firmly mated.

5. Press FAULT RESET switch.

6. Press HV ON switch. After a 2-second delay, TM READY will light up and STANDBY (HVOFF) will go out.

Section III. EMERGENCY OPERATION AND SHUTDOWN

4-7 GENERAL.

This section describes operation and shutdown of the transmitter under emergency situations.

4-8 EMERGENCY OPERATION.

The transmitter may be operated at reduced RF power level by reducing RF drive. This may be necessary if operation is required on a band with a high voltage standing wave ratio.

4-9 EMERGENCY SHUTDOWN PROCEDURES.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not use EMERGENCY OFF switches for normal shutdown. The resultant contact arcing will reduce life of safety ground switches and relay contacts for high voltage supplies.

1. Press EMERGENCY OFF switch located on front or rear of cabinet 1 (Figure 4-16). When either switch is pressed, input power is removed by interruption of the main 208 V ac Shunt Trip Coil.

2. If conditions permit, position 12.47 kV disconnect switch at cabinet 3 down to OPEN. Turn off facility 208 VAC and 120 VAC RIDE THRU circuit breakers and tag with Maintenance-in-Progress warning signs.

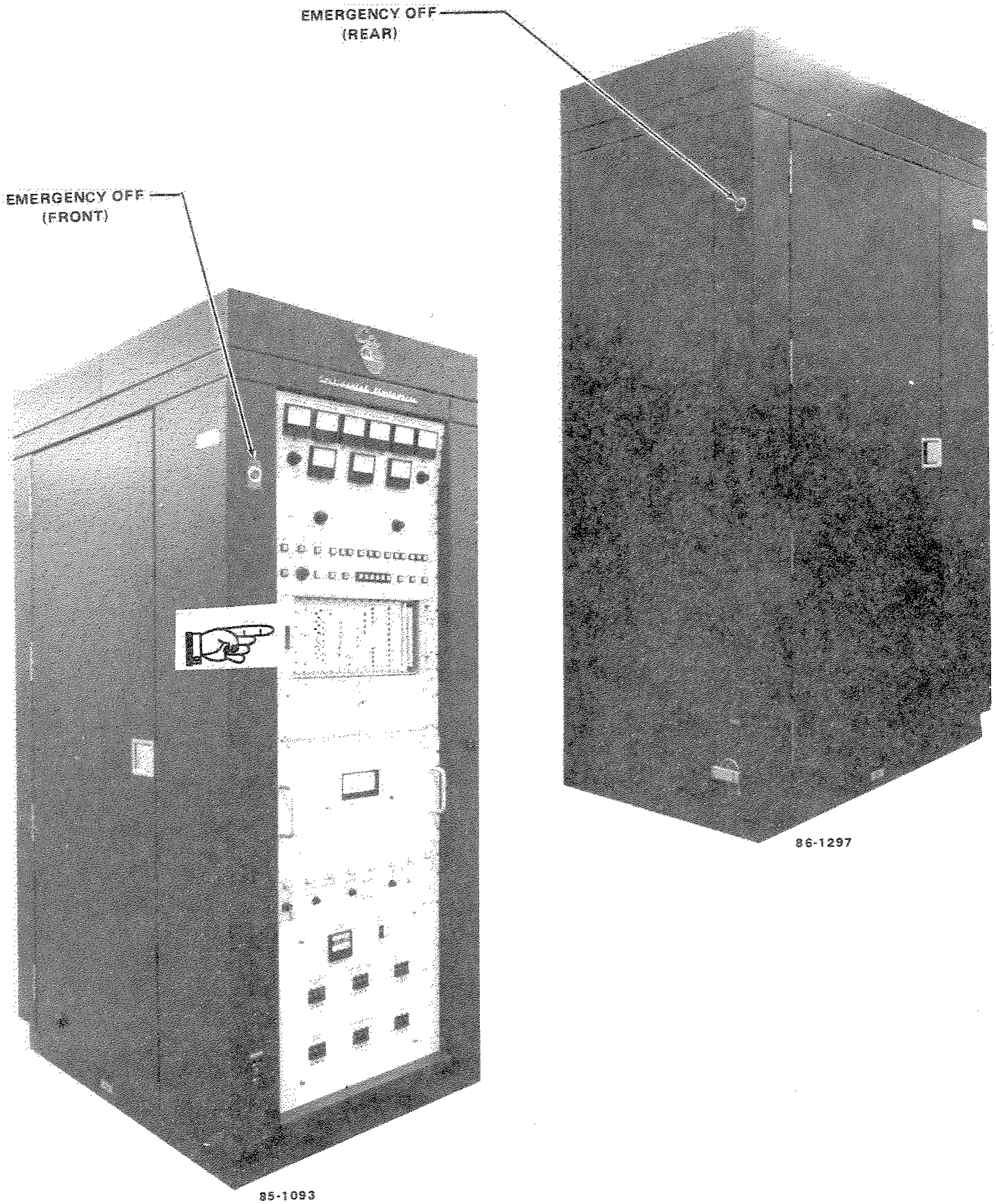


Figure 4-16. Emergency OFF Switches

CHAPTER 5

THEORY OF OPERATION

Section I. FUNCTIONAL SYSTEM THEORY OF OPERATION

5-1 GENERAL.

This chapter provides information necessary to understanding transmitter and control and monitoring circuits. Section I contains functional descriptions. Section II contains detailed electronic circuit descriptions, and Section III describes functional mechanical operation. Functional descriptions, designed for solid but general understanding, are supported by block diagrams. Detailed circuit descriptions are supported by individual unit schematics. Study of this material will enable successful troubleshooting and maintenance of the transmitter.

5-2 FUNCTIONAL SYSTEM DESCRIPTION.

The transmitter system consists of three cabinets (Figure 5-1). Cabinet 1 is a 100 kW Transmitter. Cabinet 2 is a High Voltage Power Supply (HVPS). Cabinet 3 is a High Voltage AC Power Switch. The system requires three power sources from Real Property Installed Equipment (RPIE): 12.47 kVac, 208 V ac, and 120 V ac Ride Thru.

Cabinet 2, the HVPS, accepts facility power and generates or passes on required voltages to cabinet 1. Cabinet 3 accepts 12.47 kV, 3-phase power from facilities and passes it to cabinet 2 via a high-voltage switching device. There are no LRUs in cabinet 3, only the switch and three oversized fuses. Subassemblies and circuits of cabinets 1 and 2 are described in detail in Section II of this chapter. The following paragraphs provide an overview of Transmitter Cabinet 1.

Transmitter RF excitation is external. Interface signals with Transmit Control and Monitor Group (TCMG) enable remote control and monitoring. Local monitor signals and fault location lamps are available at cabinet 1. The transmitter operates on six bands, A through F, over a frequency range of 5.0 MHz to 28.0 mHz. Each band can be connected to a dedicated antenna element for transmission or to a dummy load for maintenance purposes.

5-2.1 <u>Low Level (Broadband) Amplifier (1AR1).</u> The external RF exciter signal is applied either remotely or locally. The Transmitter Group (TXG) transmit beampower remote RF signal is input to connector 1J1 on top of cabinet 1, and routed to an amplitude correction circuit. There, it is detected and compared with forward power samples from directional couplers in the RF output circuit. Transmitter gain is maintained at a constant 63 dB. The output of the amplitude correction circuit is routed to the Low Level (Broadband) Amplifier 1AR1. The broadband amplifier provides a flat frequency response across the operating frequency range.

5-2.1.1 <u>Intermediate Power Amplifier (IPA).</u> Bandpass filters 1FL1 through 1FL3 are located at the input of the intermediate power amplifier stage. The IPA uses a grid-driven 4CW10,000A power tetrode. Circulating water cools the anode and filament base. Bias and filament power supplies are in cabinet 1. Screen grid and anode power supplies are in the HVPS.

5-2.1.2 <u>Driver Amplifier.</u> Bandpass filters 1FL4 and 1FL5 are located at the input of the driver amplifier stage. The driver amplifier uses a grid-driven 4CW25,000A power tetrode. Circulating water cools the anode and filament base. Bias and filament power supplies are in cabinet 1. Screen grid and anode power supplies are in the HVPS.

5-2.1.3 <u>Power Amplifier (PA).</u> Bandpass filters 1FL7 through 1FL9 are located at the input of the power amplifier stage. The PA uses a grid-driven 4CW-150,000E high-power tetrode. Circulating water cools the anode. Bias and filament power supplies are in cabinet 1. Screen grid and anode power supplies are in the HVPS.

5-2.1.4 <u>Output Circuits.</u> The PA output is routed through a switch network to bandpass filters 1FL10 through 1FL15. A separate filter covers each of the six frequency bands. RF from the selected bandpass filter is routed through a dedicated directional coupler.

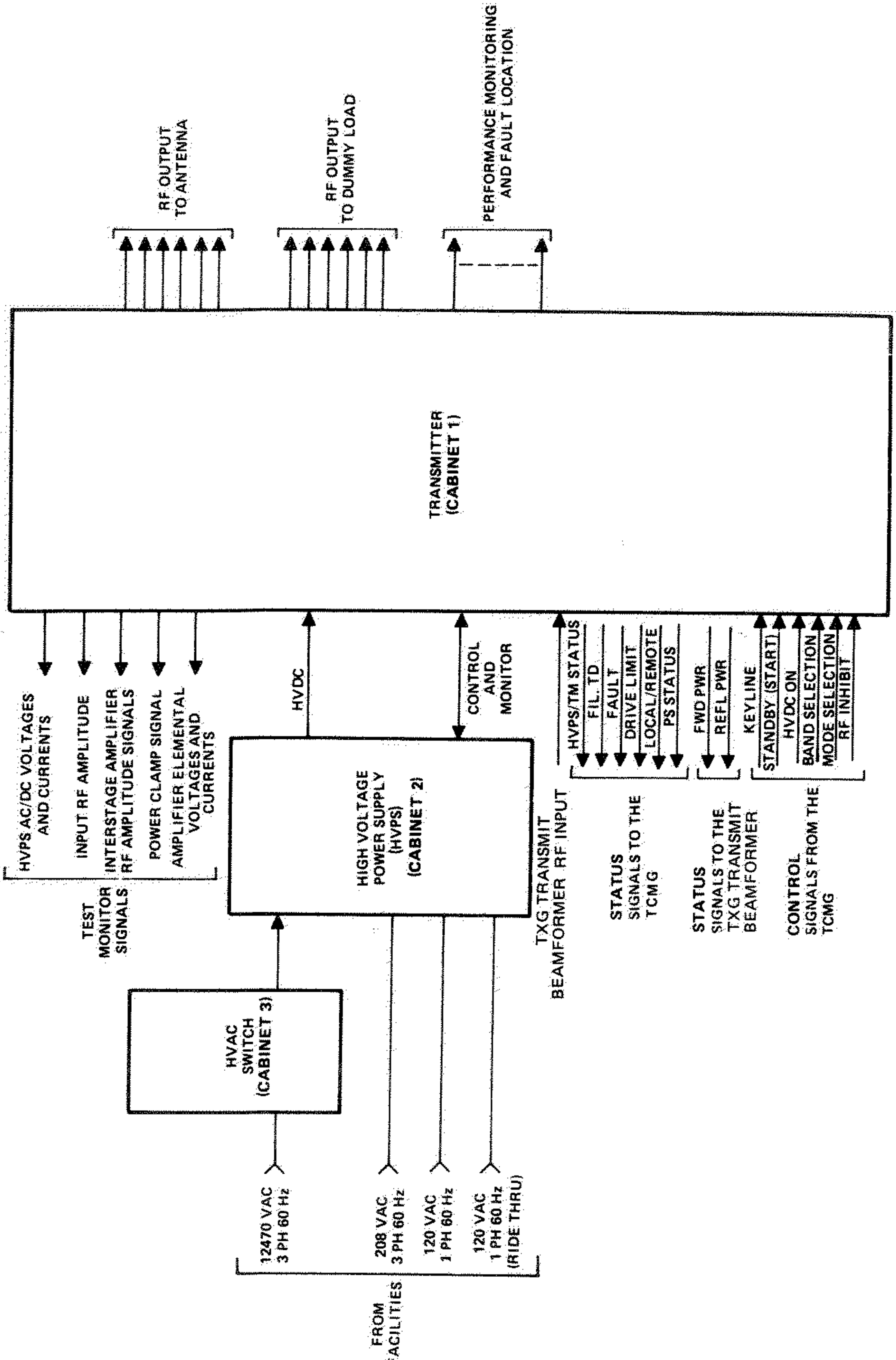


Figure 5-1. Elemental Transmitter Interface Diagram

The directional coupler provides forward and reverse power output samples as feedback to the amplifier envelope input/output comparison circuitry and the TXG. The directional coupler output is routed through an antenna/dummy load transfer switch to the antenna or dummy load.

5-2.2 Control and Monitoring. The transmitter can be controlled and monitored either remotely or under local control.

5-2.2.1 Remote Control and Monitoring. Figure 5-2 shows transmitter and TCMG interface signals. In RS-232C format, interface signals are differential-transmitted over balanced lines (twisted-pair cables) of 100 to 150 ohms impedance.

1. The transmitter receives the following command signals from the TCMG:

   a. Keyline (RF enable/inhibit)

   b. Standby (START)

   c. HVDC ON

   d. Band Selection

   e. Mode Selection (FM/CW or FM/ICW).

2. The TCMG receives the following signals from the transmitter for continuous status monitoring:

   a. HVPS ON (high voltage is on)

   b. STANDBY COMPLETE (filaments are warmed up)

   c. TM READY (RF can be applied)

   d. FILAMENT TIME DELAY (filaments are being heated)

   e. DRIVE LIMIT (transmitter is in drive limit)

   f. Position of OUTPUT CONTROL switch

   g. Status of all HVPS output dc voltages (normal)

   h. Fault lockout

   i. RF output vswr (RF output power interrupted)

3. Forward and reverse power samples are routed from the transmitter to the transmit beamformer for remote monitoring and phase and amplitude control.

5-2.2.2 Local Control and Monitoring. Local control locks out TCMG commands. Meters and indicator lamps on the front panel of cabinet 1 enable Performance Monitoring/Fault Location (PM/FL). Lamp arrangement allows such critical paths as RF signal, coolant, overload status, and interlock strings to be easily traced. A lamp test switch provides a check-out of all indicator lamps. The following are displayed at cabinets 1 and 2.

1. Metering:

   a. Primary ac (voltage and current, 3-phase): cabinet 2

   b. DC power supplies (all outputs): cabinets 1 and 2

   c. Low-Level Broadband Amplifier (watts): cabinet 1

   d. Transmitter amplifier stages (voltages and currents): cabinets 1 and 2

   e. RF output (forward and reverse): cabinet 1

2. Indicator lamps:

   a. Operational status indicators provide RF and HVPS status, including band selected.

   b. Interlock status indicators are arranged in a sequence that facilitates locating of open interlocks.

   c. Fault indicators are assigned to specific overload protective circuits and light up to expedite fault identification. Fault indicators are driven by first-event logic circuitry that identifies the first-occurrence fault and distinguishes it from sympathetic or secondary faults.

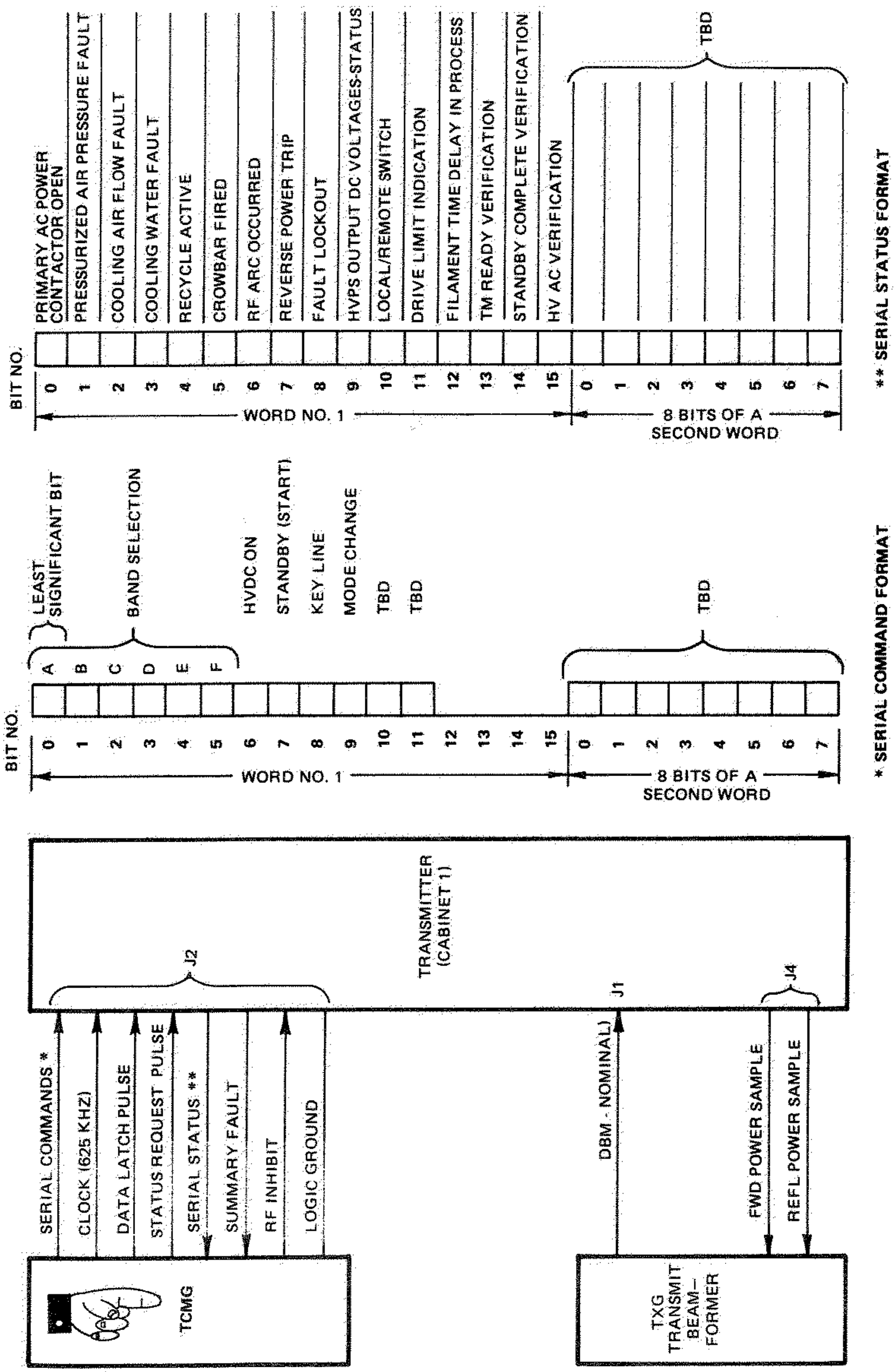


Figure 5-2. Remote Interface Signals

Section II. ELECTRONIC CIRCUIT DESCRIPTION

5-3 PREAMPLIFIER.

Preamplifier circuitry consists of the amplitude correction circuit and the amplitude feedback/constant gain circuit. Figure 5-3 shows the transmitter RF path, including feedback origin and routing. Figure 5-4 shows RF Feedback Control 1A1A1 and Signal Monitor 1A1A2 circuit cards and their locations in the CONTROL/STATUS panel. RF input signals to the transmitter come from local or remote sources. A local signal is inserted at the RF INPUT SIGNAL SOURCE jack 1A25W5J1 on the RF SIGNAL MONITORS panel. A remote signal from the TXG transmit beamformer is applied to connector 1J1 on top of cabinet 1. RF INPUT SELECTOR switch 1A25S2 controls relay 1K5, which routes either a local or remote RF signal to the preamplifier input. Directional Coupler 1DC1 monitors the RF input signal and provides a sample at the RF INPUT XMTR jack 1A25W4J1 on the RF SIGNAL MONITORS panel.

5-3.1 <u>RF Power Samples.</u> Forward and reverse RF power samples are obtained from Directional Couplers 1DC3 through 1DC8 for the selected band and routed to Switching Relays 1A1K1 (forward power) and 1A1K2 (reverse power).

5-3.1.1 <u>Forward Power.</u> The forward power sample from 1A1K1 is routed through Fixed Attenuator 1A1AT4, IF Amplifier 1A1AR4, and RF Amplifier 1A1-AR1. It is then applied to RF Power Divider 1A1HY2. The RF power divider provides an RF sample to XMTR OUTPUT FWD POWER SAMPLE jack 1A25W2J1. The output of the RF power divider is routed to RF Detector 1A1A16. The detected signal is an analog voltage, the magnitude of which varies in linear proportion to the RF input rms voltage to the RF Detector. That voltage is routed to RF Feedback Control Card 1A1A1.

5-3.1.2 <u>Reverse Power.</u> The reverse power sample from 1A1K2 is routed to Manual Attenuator 1A1AT5, IF Amplifier 1A1AR5, and RF Amplifier 1A1AR2. It is then applied to RF Power Divider 1A1HY3. The RF power divider provides an RF sample to XMTR OUTPUT RVS POWER SAMPLE jack 1A25W1J1. The output of the RF power divider is routed to RF Detector 1A1A17. The detected signal is an analog voltage, the magnitude of which is proportional to the power present at the reverse power port of the directional coupler. That voltage is routed to Signal Monitor Card 1A1A2.

5-3.2 <u>Amplitude Correction Circuitry.</u> The output of Directional Coupler 1DC1 is routed to 1A1AT1, a voltage-controlled attenuator (Figure 5-3). The output of 1A1AT1 varies from 0.0 dB to 30.0 dB and is controlled by the DR ATTN control signal from Signal Monitor Card 1A1A2, which sets the clamping action. The signal monitor card performs an RF drive-limiting function on the selected output frequency band. Resistors 1A1A2R7 through 1A1A2R12 adjust the forward power clamp level of each band. Forward power clamps for Bands A through E are set at 110 kW output power. Band F is set at [V(1)] 85 kW or [V(2)] 110 kW. The OFS adjustment pot 1A1A2R52 is adjusted at mid-Band C (10.54 MHz) to obtain +20 dBm output level at 1A1HY1. The DR ATTN signal, which can be monitored at 1A1A2-TP1, sets a power-level threshold that is a protective function to limit drive to the transmitter. FWD PWR CLP switch 1A1A2S1, on the signal monitor card, allows selection of either ENBL or DSBL positions. Under normal operation, the switch is positioned to ENBL. During maintenance, DSBL can be selected to disable the forward power clamp circuit.

5-3.3 <u>Amplitude Feedback/Constant Gain.</u> RF Feedback Control Card 1A1A1 maintains transmitter gain at a constant 63 dB. This is done by comparing the RF input sample to the RF forward power sample. RF Power Divider 1A1HY1 provides the RF input sample which is routed to RF Detector 1A1A15. The selected signal is an analog voltage of negative polarity, the magnitude of which varies in linear proportion to the rms voltage of the RF detector input. That signal is applied as an RF input sample to RF Feedback Control Card 1A1A1 and can be monitored at DET RF INPUT test point 1A1A1TP1. The RF forward power sample is taken from RF Detector 1A1A16 and can be monitored at DET XMTR FWD PWR test point 1A1A1TP2. If the circuit detects a voltage difference, output voltage reacts to drive voltage-controlled attenuator 1A1AT3 in a direction that will restore proper transmitter gain. Output voltage can be monitored at ATTEN VDC test point 1A1A1TP3. FDBK LOOP switch 1A1A1S1 is

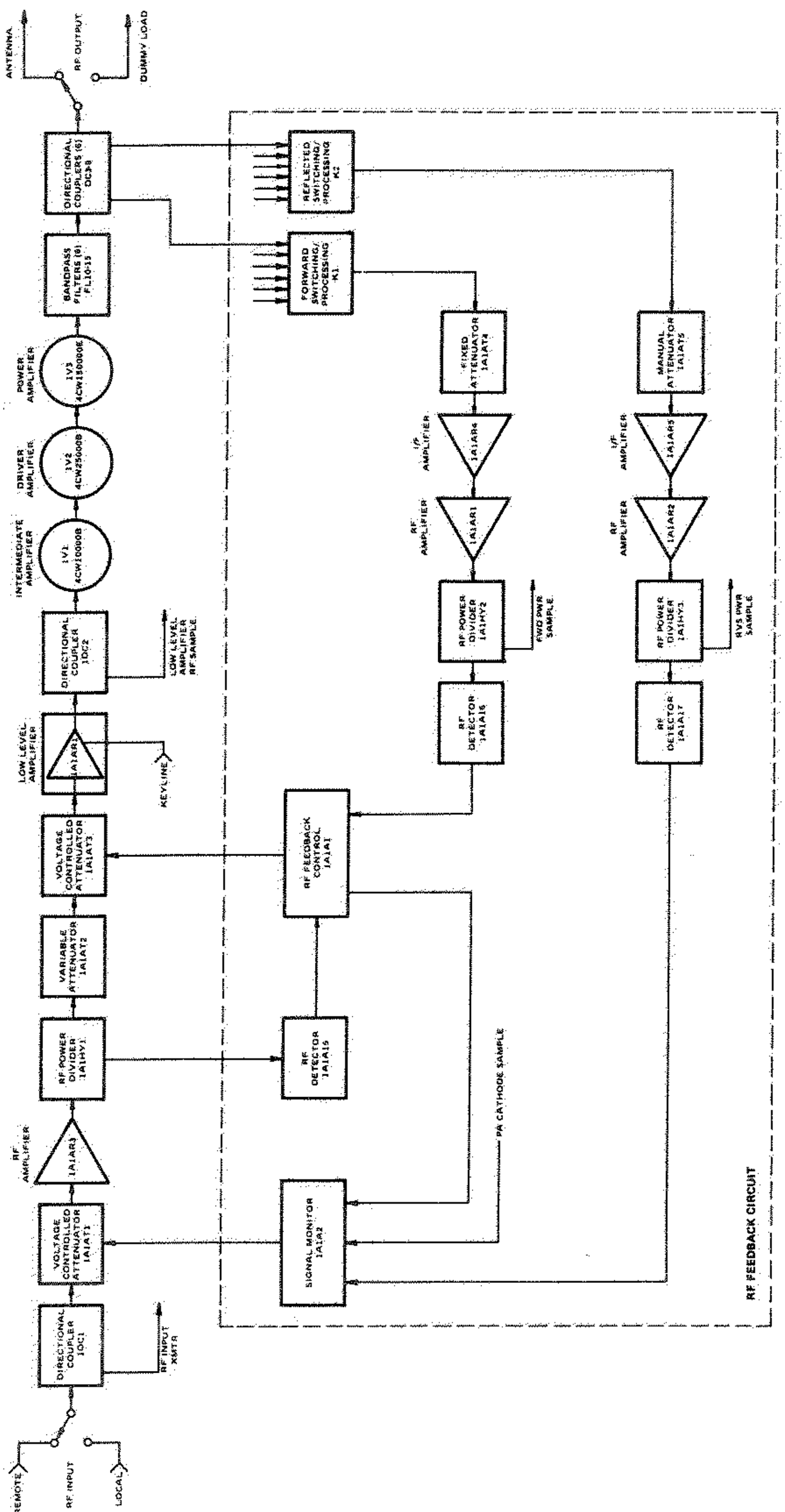


Figure 5-3. RF Signal Path and Feedback

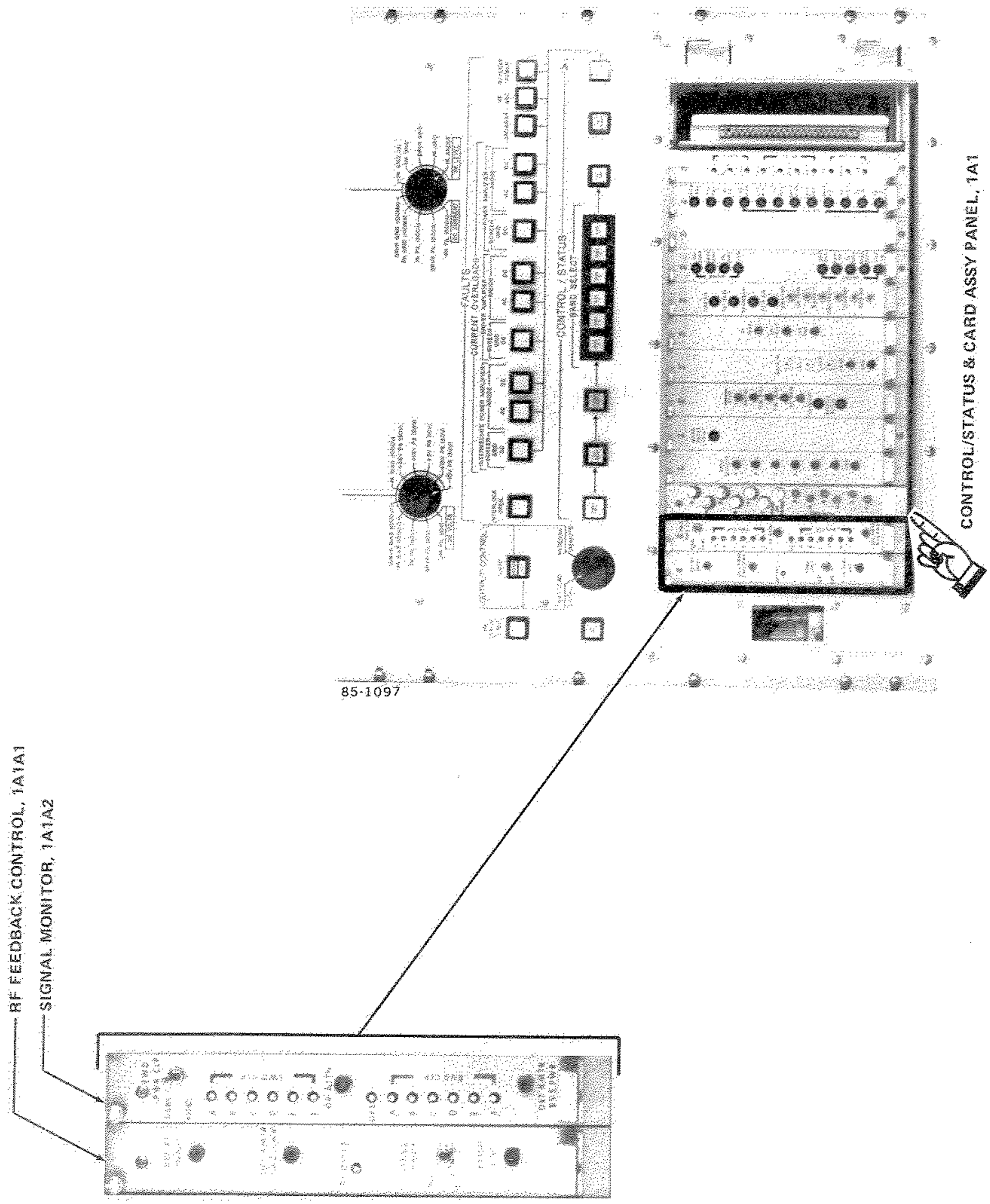


Figure 5-4. RF Feedback and Signal Monitor Cards

normally positioned to OPR; selecting TEST opens the feedback loop.

5-4 LOW LEVEL (BROADBAND) AMPLIFIER.

The T-1524/FPS118(V) and T-1524A/FPS118(V) Radar Transmitter uses an ENI solid-state broadband amplifier for low-level amplification. Figure 5-3 shows its location in the RF chain of the transmitter. Input impedance is 50 ohms. RF input comes from voltage-controlled attenuator 1A1AT3. The broadband amplifier has a flat frequency response over the operating range of the transmitter and provides a nominal gain of 55 dB. Amplifier operation can be enabled or inhibited by applying a logic level at the KEYLINE input. An RF INHIBIT (Logic 1, +5 V dc) on KEYLINE biases the amplifier off. An RF ENABLE (Logic 0, ground) allows normal operation. The POWER ON lamp is lit up when the amplifier is enabled. The 120 V ac input power can be switched on or off with the AC POWER switch on the front panel. RF output voltage is displayed on the front panel meter. The amplifier output is routed through Directional Coupler 1DC2, and an RF sample from 1DC2 goes to RF OUTPUT LL AMPL jack 1A25W3J1.

5-5 INTERMEDIATE POWER AMPLIFIER.

Figure 5-5 is a simplified schematic of the intermediate power amplifier (IPA) with a typical IPA grid filter. Circuit Diagrams Manual TO 31P6-2FPS118-83 contains a detailed schematic for the IPA stage. The IPA stage uses a grid-driven 4CW10,000A power tetrode. The tube socket is designed to direct cooling air through the socket and over filament and grid seals. The anode is cooled by circulating water through the integral water jacket. The output of the selected bandpass filter is routed to the IPA through grid-blocking capacitor 1C1. The RF signal is detected by IPA Grid Detector 1A2. Output dc voltage of 1A2 is switched by 1A1S1 and can be monitored on Test Meter 1A13M7. IPA filament voltage is supplied through inductors 1L4 and 1L5, which function as an RF blocker. Capacitors 1C86 and 1C87 are connected in series with resistors 1R25 through 1R28 and 1R29 through 1R32 and function as a parasitic suppressor. Capacitors 1C9 and 1C10 bypass any RF to ground. Bias, supplied by IPA Bias Power Supply 1PS3, is routed through 1R1. Capacitor 1C46 bypasses any RF at 1R1 to ground. Capacitor adjustment located on 1C2 is adjusted to match bandpass filter output to the IPA input. IPA Grid Dummy Load 1AT1 functions as a water-cooled grid load along with coupling capacitors 1C51 and 1C52. The IPA grid dummy load maintains a constant low impedance of 100 ohms at the IPA tube input no matter which filters or frequencies are selected. At higher frequencies, the low impedance prevents parasitic oscillations in the tube circuit. Screen grid voltage is supplied through inductors 1L32 and 1L1. Capacitor 1C45 and inductor 1L1 bypass any RF to ground. Resistor 1R2 functions as a parasitic suppressor. Capacitor 1C8 is an RF screen bypass capacitor. The IPA anode power supply provides anode voltage through in-ductors 1L3 and 1L2. In bands D, E, and F, relay 1K1 places capacitor 1C7 in the circuit to bypass RF to ground. The RF output of the IPA stage is routed through plate blocking capacitor 1C13 to the driver amplifier stage. A sample voltage is developed in module 1A10 and routed to the RF OUTPUT IPA ANODE jack 1A25J3. Capacitor adjustment located on 1C14 is adjusted to match the output of the IPA tube to the filter input of the driver amplifier stage.

5-6 DRIVER AMPLIFIER.

Figure 5-6 is a simplified schematic of the driver amplifier with a typical driver grid filter. Circuit Diagrams Manual TO 31P6-2FPS118-83 contains a detailed schematic of the driver amplifier stage. The driver amplifier stage uses a grid-driven 4CW25,000A power tetrode. The tube socket is designed to direct cooling air through the socket and over the tube base seal areas. Anode and filament base cooling is accomplished by circulating water. The output of the selected bandpass filter is routed to the driver stage through grid blocking capacitor 1C15. Capacitor adjustment located on 1C16 is adjusted to match the output of bandpass filters to the input of the tube. The monitor RF signal is detected by Grid Detector 1A3. The dc output voltage of 1A3 is routed to switch 1A1S1 and can be monitored on Test Meter 1A13M7. Filament voltage is supplied through inductors 1L10 and 1L11, which function as RF blockers. Capacitors 1C81 and 1C82, connected in series with resistors 1R13 through 1R16 and 1R17 through 1R20, function as a parasitic suppressor. Capacitors 1C23 and 1C133, and 1C24 and 1C134 place the tube cathode at RF ground. Bias, supplied by driver Bias Power Supply 1PS4, is routed through inductors 1L6 and 1L34. Capacitor 1C48 and inductor 1L34

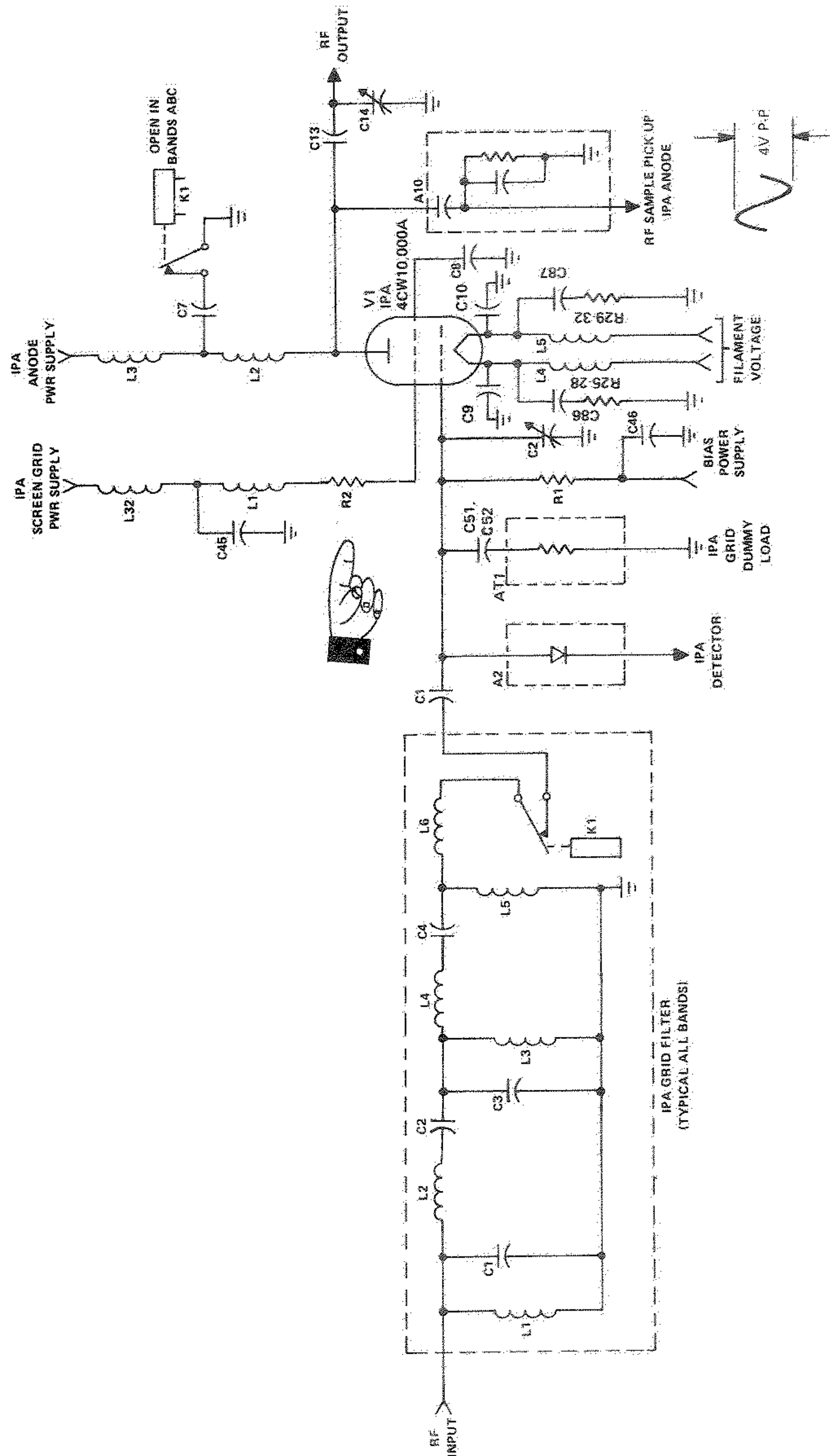


Figure 5-5. Grid Filter and IPA Simplified Schematic

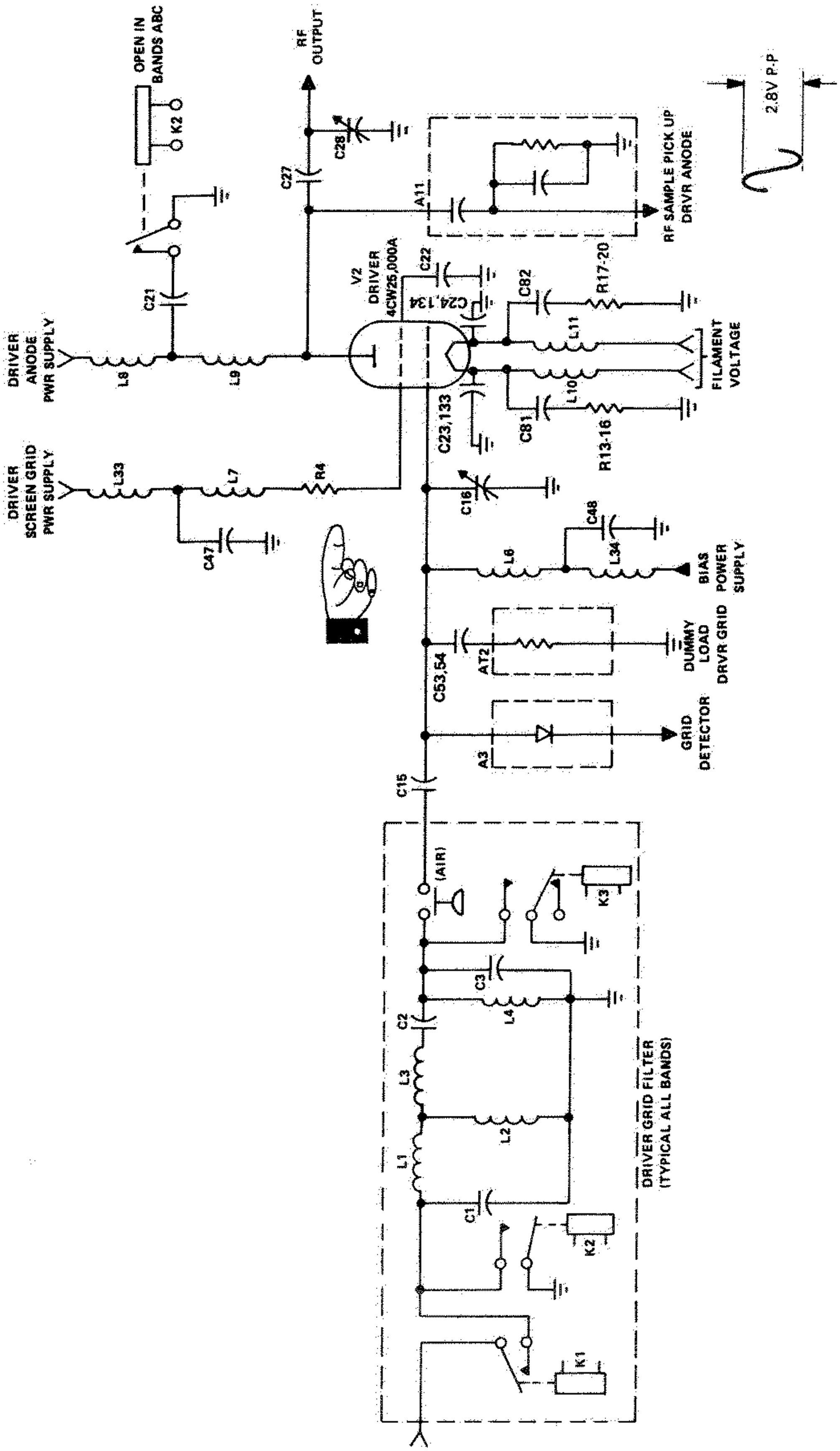


Figure 5-6. Grid Filter and Driver Amplifier Simplified Schematic

form an RF bypass circuit. Driver Grid Dummy Load 1AT2 and coupling capacitors 1C53 and 1C54 function as a water-cooled grid load. The driver grid dummy load keeps a constant, low impedance of 50 ohms at the input of the tube no matter which filters or frequencies are selected. At higher frequencies, the low impedance prevents parasitic oscillations in the tube circuit. Screen grid voltage is supplied through inductors 1L33 and 1L7. Capacitor 1C47 bypasses any RF to ground. Resistor 1R4 is a parasitic suppressor. Capacitor 1C22 is a screen RF bypass capacitor. The driver anode power supply is located in the HVPS. Anode voltage is applied through inductors 1L8 and 1L9. In bands D, E, and F, relay 1K2 places capacitor 1C21 in the circuit to bypass RF to ground. RF output is routed through plate blocking capacitor 1C27 and the selected power amplifier (PA) grid filter to the PA stage. An RF voltage sample is developed in module 1A11 and routed to RF OUTPUT DRVR AMPL ANODE jack 1A25J2. Capacitor 1C28 matches driver amplifier stage output to the filter input of the PA stage.

5-7 POWER AMPLIFIER.

Figure 5-7 is a simplified schematic of the PA with a typical PA grid filter. Circuit Diagrams Manual TO 31P6-2FPS118-83 contains a detailed schematic of the PA stage. The PA stage uses a grid-driven, high-power 4CW150,000E tetrode. The tube socket is designed to direct cooling air through the socket and over the tube base seal areas. The anode is cooled by circulating water through the integral anode water jacket. The output of the selected bandpass filter is routed to the PA stage through grid blocking capacitor 1C29. Capacitor 1C30 is adjusted to match bandpass filter output to PA tube input. The RF signal is detected by PA Grid Detector 1A4. The dc output voltage of the PA grid detector, which can be monitored on Test Meter 1A13M7, is routed to switch 1A1S1. Filament voltage is supplied through inductors external to the PA cavity. Capacitor 1C83, connected in series with resistors 1R21 through 1R24, bypasses RF to ground. It also performs swamping functions to keep the PA cathode from going parallel-resonant at the 5 MHz to 6 MHz range. Capacitors 1C69, 1C70, and 1C71 are RF bypass capacitors for the filament leads. Bias, supplied by PA Bias Power Supply 1PS5, is routed through inductors 1L35 and 1L12. Capacitor 1C50 and inductor 1L35 form an RF bypass circuit for the power supply leads. PA Grid Dummy Load 1AT3 functions as a water-cooled grid load. 1AT3 functions to keep a constant, low impedance of 28 ohms at the PA tube input no matter which filters or frequencies are selected. At higher frequencies, the low impedance reduces parasitic oscillations. The PA screen grid voltage is applied through module 1A21, which functions as a parasitic suppressor. The capacitor/inductor combinations 1C49/1L52 and 1C132/1L13 bypass RF to ground. Inductor 1L13, along with resistor 1R6, also serves as a parasitic suppressor. Spark gap 1E1 protects the screen bypass capacitor, part of the tube socket. The PA anode power supply supplies anode voltage through inductors 1L16, 1L15, 1L14, and 1L30. Inductor 1L30 and resistor 1R7 function as a parasitic suppressor. Inductors 1L14, 1L15, and 1L16 and associated circuitry form a B-Plus filter network that maintains high impedance across the bands to limit power feedback into the B-Plus line. Switch 1S24, activated by pneumatic solenoid, places 1C35 and 1R33 into the circuit in bands C, D, E, and F. In the same manner, switch 1S25 places 1C36 and 1R34 into the circuit in bands E and F. RF output is routed through plate blocking capacitor 1C42 to PA output filters. Capacitor 1C43 is adjusted to match the output of the PA tube to the output filters. A sample RF output voltage, which can be monitored on Test Meter 1A13M7, is developed in module 1A5 and routed to switch 1A1S1.

5-8 BANDPASS FILTERS.

Bandpass filters are installed at inputs of each amplifying stage and output of the PA stage. Figures 5-5 through 5-7 show individual grid bandpass filters and amplifying circuitry. Figure 5-8 is a simplified schematic of the output bandpass filter and associated components. All filters are Chebishev design (constant-k, bandpass). Filters are designed for a single transmission band, with neither cutoff frequencies of zero or infinite.

5-8.1 IPA Grid Bandpass Filters. These filters function to pass high-frequency RF from the low level amplifier to the grid of the IPA. Frequencies the filters pass are given below.

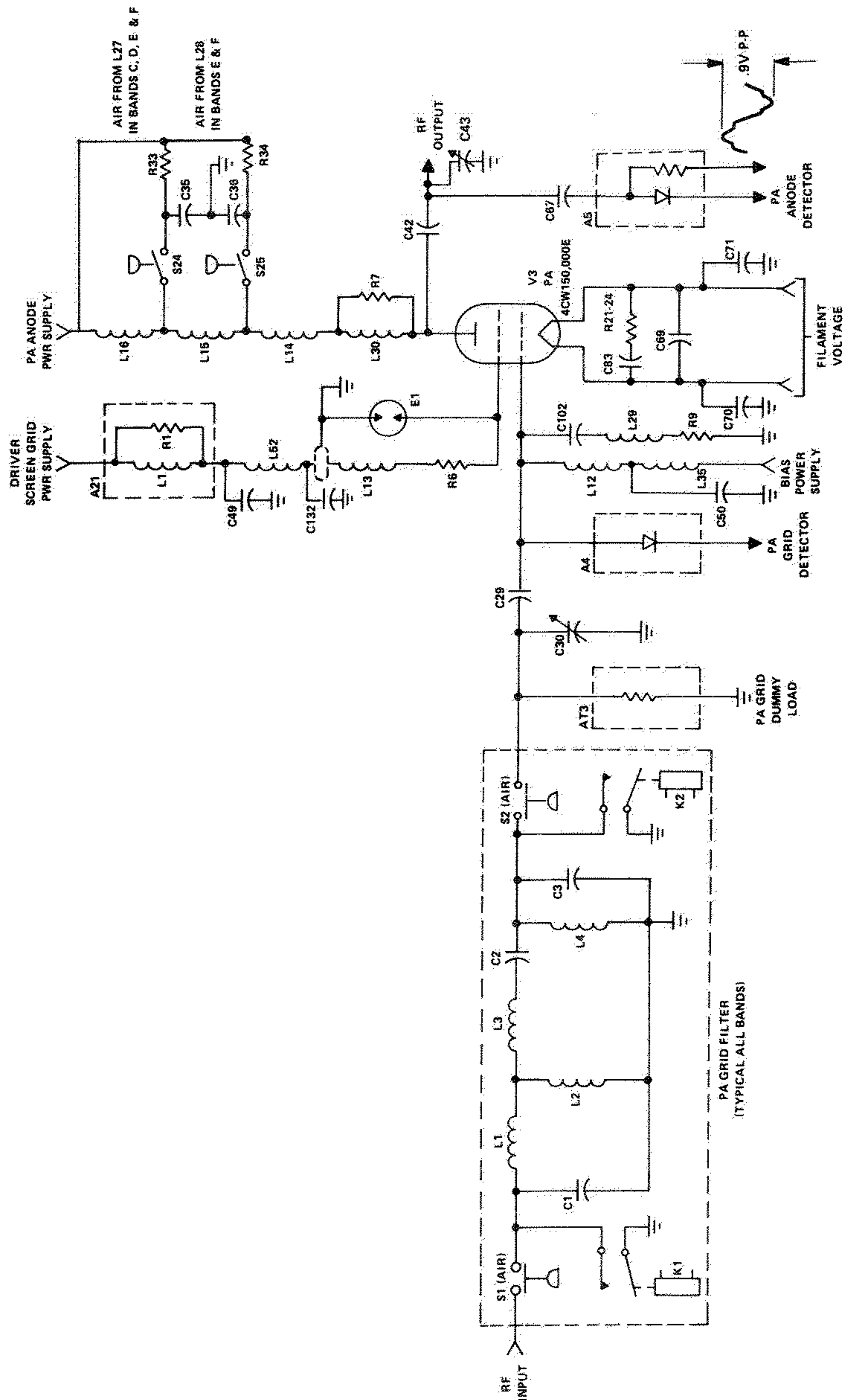


Figure 5-7. Grid Filter and Power Amplifier Simplified Schematic

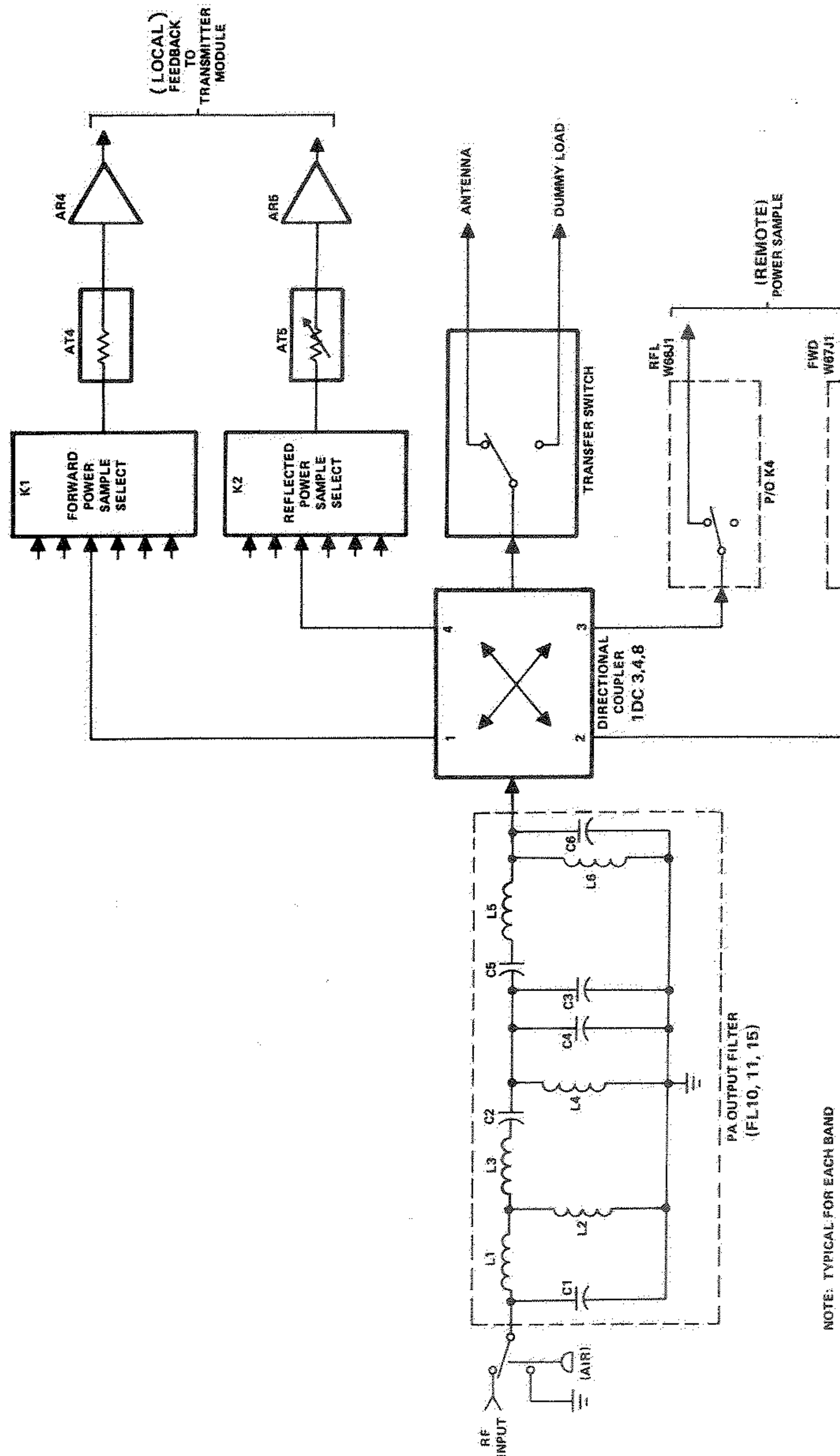


Figure 5-8. PA Output Filter, Directional Coupler, and Transfer Switch Simplified Schematic (1 of 2)

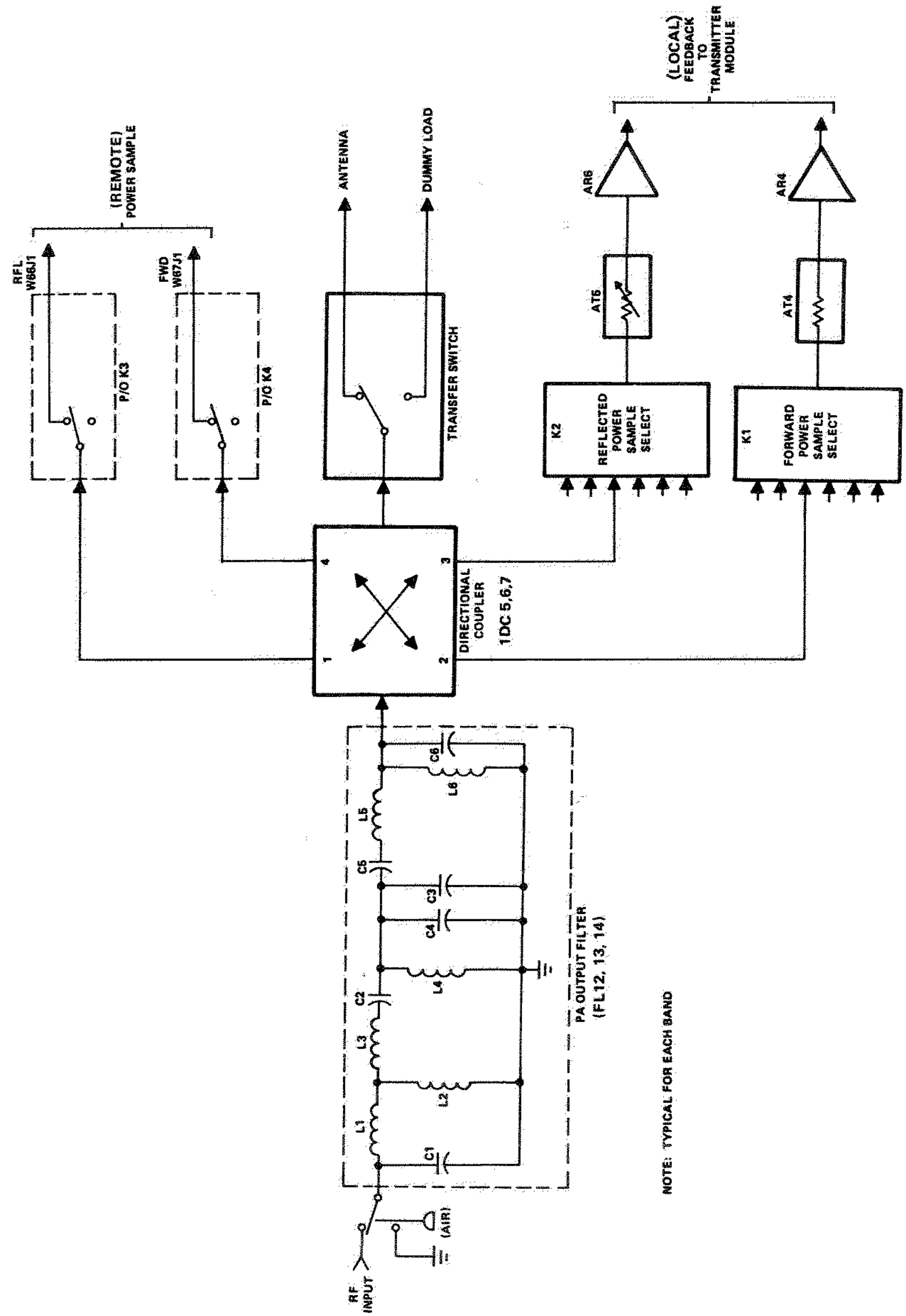


Figure 5-8. PA Output Filter, Directional Coupler, and Transfer Switch Simplified Schematic (2 of 2)

FILTER	BAND(S)	FREQUENCY
1FL1	ABC	5.00 to 12.30 MHz
1FL2	DE	12.20 to 22.30 MHz
1FL3	F	22.20 to 28.00 MHz

Frequencies above and below those listed are rejected. A relay in each filter output switches filters in or out of the circuit.

5-8.2 Driver Amplifier Grid Bandpass Filters. These filters function to pass a band of high-frequency RF from the IPA to the driver amplifier. Frequencies the filters pass are given below.

FILTER	BAND(S)	FREQUENCY
1FL4	ABC	5.00 to 12.30 MHz
1FL5	DE	12.20 to 22.30 MHz
1FL5	F	22.20 to 28.00 MHz

Frequencies above and below those listed are rejected. Filters are switched in or out of the circuit by a relay at the input and an air switch at the output. When not in use, filter inputs and outputs are grounded.

5-8.3 PA Grid Bandpass Filter. These filters function to pass high-frequency RF from the driver amplifier to the grid of the PA.

Frequencies the filters pass are given below.

FILTER	BAND(S)	FREQUENCY
1FL7	AB	5.00 to 9.14 MHz
1FL8	CD	9.04 to 16.55 MHz
1FL8	E	16.45 to 22.30 MHz
1FL9	F	22.20 to 28.00 MHz

Frequencies above and below those listed are rejected. The input and output filters are placed into the circuit by air-operated switches. When not in use, filter inputs and outputs are grounded.

5-8.4 PA Output Bandpass Filter. These filters function to pass high-frequency RF from the PA to either the antenna or dummy load. Frequencies the filters pass are given below.

FILTER	BAND	FREQUENCY
1FL10	A	5.00 to 6.79 MHz
1FL11	B	6.69 to 9.14 MHz
1FL12	C	9.04 to 12.30 MHz
1FL13	D	12.20 to 16.55 MHz
1FL14	E	16.45 to 22.30 MHz
1FL15	F	22.20 to 28.00 MHz

Frequencies above and below those listed are rejected. Filters are switched in or out of the circuit by six air-operated plunger switches located at the output of the PA tube. When not in use, filter inputs are grounded.

5-9 DIRECTIONAL COUPLERS.

PA Output Directional Couplers 1DC3 through 1DC8 function to provide samples of forward and reverse RF power for control and monitoring. Figure 5-8 shows the typical directional coupler in relation to the PA output filter and RF transfer switch. The six directional couplers, located at outputs of bandpass filters, cover the six frequency bands. Characteristics of signal levels of power samples are described in the following paragraphs.

5-9.1 Remote Power Samples. Both forward and reverse power samples from directional couplers are routed through relays 1K3 and 1K4 to connectors on top of cabinet 1. Outputs of 1DC3, 1DC4, and 1DC8 at port two, and 1DC5, 1DC6, and 1DC7 at port one are routed to forward power sample relay 1K3. The desired input is selected in the TCMG or by depressing a BAND SELECT push-button switch on the CONTROL/STATUS panel 1A1. Forward power samples are routed through 1K3 to connector W67J1. For Bands A through E, signal level of the forward power sample is 20 dBm ± 0.3 dB into a 50-ohm termination when operating at 100 kW output at midpoint of each band. For Band F, signal level is 19 dBm ± 0.3 dB when operating at 85 kW output at midband. Reverse power samples from 1DC3, 1DC4, and 1DC8 at port three, and 1DC5, 1DC6, and 1DC7 at port four are routed through relay 1K4 to connector 1W66J1. When the signal level of the reflected power is 10 dBm ± 0.3 dB into a 50-ohm termination, the signal level corresponds to 10 kW reverse power.

5-9.2 Local Power Samples. Directional coupler forward and reverse power samples are used by the local monitor and feedback circuit. Figure 5-3 shows monitor and feedback paths. Outputs of directional couplers 1DC3, 1DC4, and 1DC8 at port one, and 1DC5, 1DC6, and 1DC7 at port two are routed to forward power sample relay 1A1K1. The desired input to relay 1A1K1 is selected in the TCMG or by depressing the BAND SELECT push-button switch on CONTROL/STATUS panel 1A1. Forward power samples at 1A1K1 are routed to control logic as feedback signals to control power and amplitude of the RF signal. Reverse power samples from directional couplers 1DC3, 1DC4, and 1DC8 at port four, and 1DC5, 1DC6, and 1DC7 at port three are routed through relay 1A1K2 to provide a selected band reverse-power trip function. Power samples are also available for monitoring at RF SIGNAL MONITORS panel 1A25. The forward RF power signal level can be monitored at XMTR OUTPUT FWD POWER SAMPLE jack 1A25W2J1. The reverse power signal level can be monitored at XMTR OUTPUT RVS POWER SAMPLE jack 1A25W1J1.

5-10 TRANSFER SWITCH, ANTENNA/DUMMY LOAD.

A single-pole, double-throw coaxial transfer switch is connected at each output port of the transmitter to:

1. Selectively direct transmitter output power to the antenna or dummy load.

2. Provide an RF-safe environment for maintenance when in dummy load position. This is accomplished by shorting the antenna port which prevents antenna-coupled RF from entering the cabinet.

5-10.1 Transfer Switch Operation. Figure 5-9 shows a typical antenna/dummy load transfer switch, operated by a pneumatic actuator. OUTPUT CONTROL switch 1A1S13 on CONTROL/STATUS panel 1A1 selects either TEST LOAD or ANTENNA positions. When the LOAD indicator lamp lights up, load selection is completed. The antenna is connected to port 1J1 at the terminal-board end of the transfer switch. The dummy load is connected to port 1J2 at the air-cylinder end of the switch. Before selection of a dummy load can be completed, a connection must be made from the dummy load to the TEST LOAD INTERLOCK jack on the RF panel. That connection enables water flow and temperature monitoring. More detailed information follows.

1. With OUTPUT CONTROL switch in TEST LOAD (LOCAL), the transmitter is isolated from the antenna. All antenna ports are grounded through the RF transfer switch.

2. Control and protection features are designed to accomplish the transfer function and prevent damage to associated equipment during switching operations. Transmitter RF is inhibited during switching. Interlock circuitry prevents outputs to dummy load ports until dummy load is properly connected and fully operational. Cover plates shall be installed over ports not connected to an antenna or dummy load.

3. When the transmitter is operating, the transfer switch directs the RF path to the antenna transmission line.

5-11 ELECTRONIC SYSTEM PROTECTION PANEL.

Electronic System Protection panel 1A23 (Figure 4-6) contains circuit breakers for cabinet 1 power supplies and Filament On-Time Meter 1A23M1. Those circuit breakers, powered by the HVPS 208 V ac 3-phase supply, are:

LOW LEVEL AMPLIFIER	1A23CB1
IPA FILAMENT SUPPLY	1A23CB5
DRIVER AMPL FILAMENT SUPPLY	1A23CB6
PA FILAMENT SUPPLY	1A23CB7
IPA BIAS SUPPLY	1A23CB2
DRIVER AMPL BIAS SUPPLY	1A23CB3
PA BIAS SUPPLY	1A23CB4

When tube filaments are turned on, filament delay relay 1A24K7 energizes to activate the Filament On-Time Meter. The meter shows cumulative time that power has been applied to tube filaments.

5-12 TRANSMITTER CONTROL AND STATUS.

Figure 5-10 shows transmitter control and status functions. The transmitter can be controlled locally or from a remote location. Signals containing command, status, and fault information are routed from the transmitter to TCMG during remote operation. In the remote mode, transmitter start-up, band selection, and mode selection is accomplished via the TCMG. In either mode of operation, status signals drive meters and indicator lamps. The meters and lamps are designed to facilitate detection and isolation of transmitter problems. In the remote mode, data signals from Serial Command Card 1A1A7 and Serial Status Card 1A1A8 are passed to the TCMG. Controls for local operation are located on CONTROL/STATUS panel 1A1. The OUTPUT CONTROL Switch selects signals from the CONTROL/STATUS panel for local control or remote interface circuit cards for remote control. The OUTPUT CONTROL Switch also directs transmitter output to a dummy load in local operation or the antenna in remote

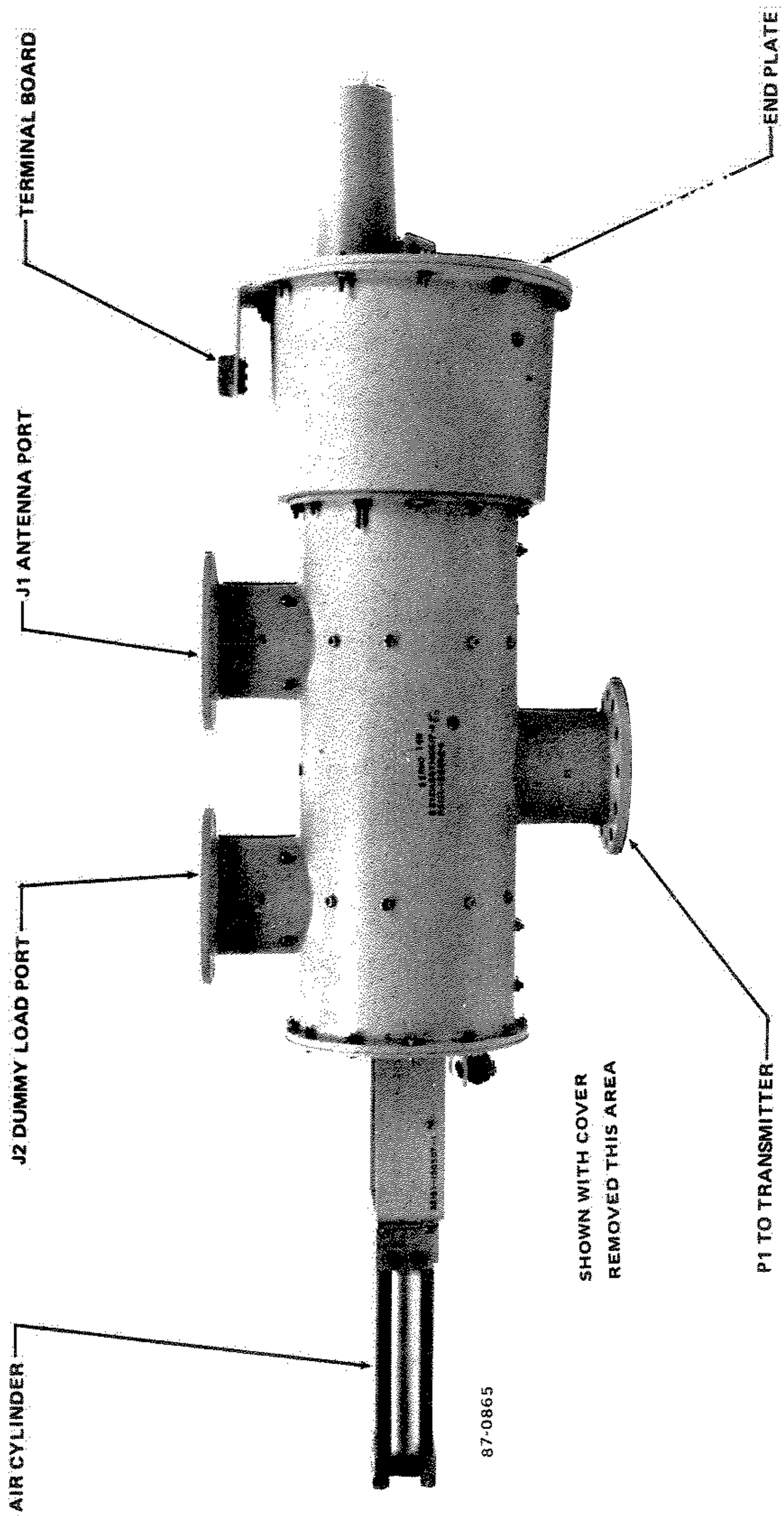


Figure 5-9. RF Transfer Switch

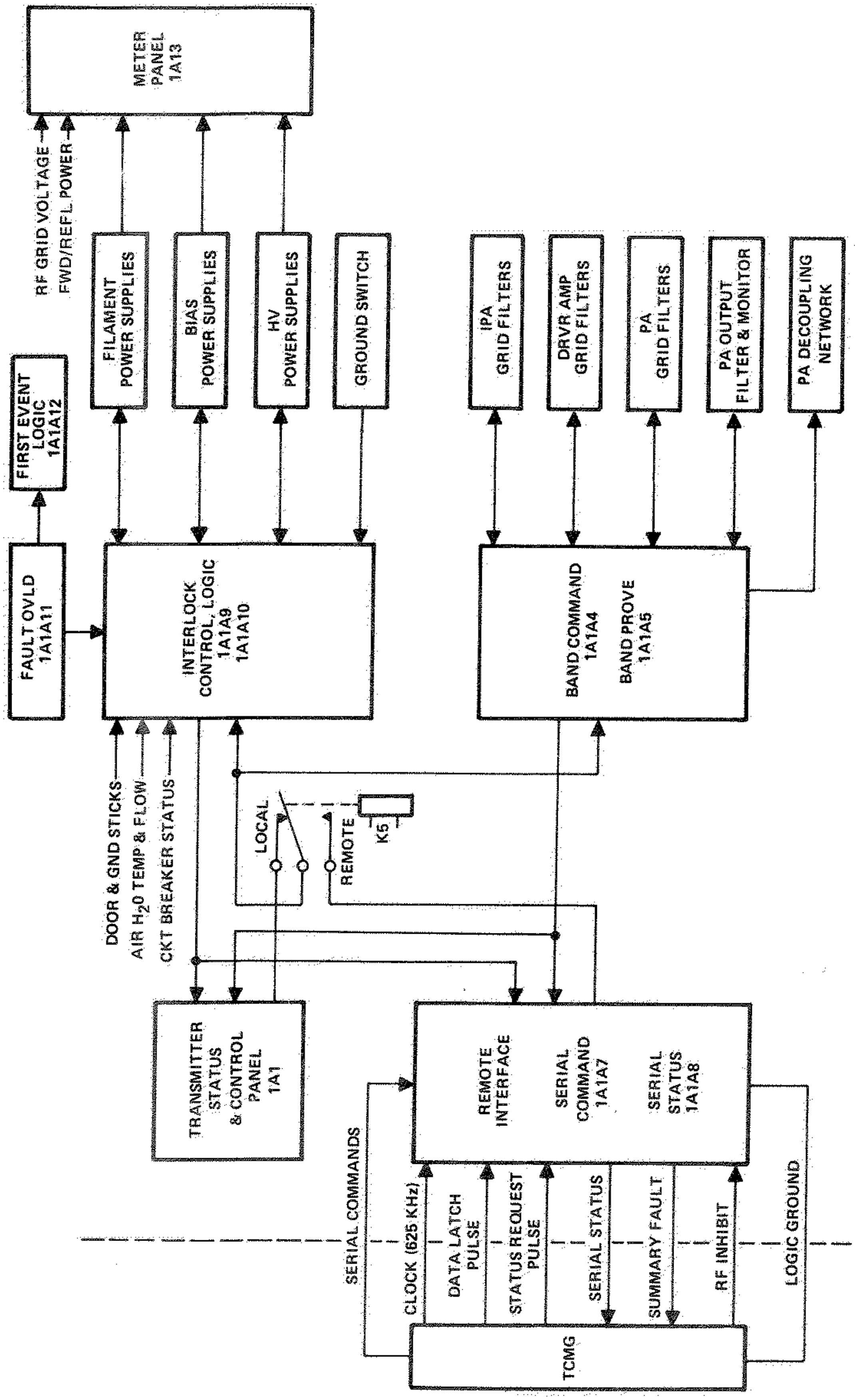


Figure 5-10. Transmitter Control and Status Block Diagram

operation. Signals selected, either local or remote, are routed to interlock Control Logic Circuit Cards 1A1A9 and 1A1A10 and Band Selection Circuit Cards 1A1A3, 1A1A4, and 1A1A5. The interlock control logic receives status information from transmitter power supplies, fault overload circuits, door interlocks, grounding devices, circuit breakers, water and air flow monitors, and temperature sensors. Meter Assembly panel 1A13 provides readouts of power supply voltages and currents and RF levels of individual stages of amplification. Band selection circuits select proper bandpass filters and verify selections through feedback signals.

5-12.1 Band Selection. Figure 5-11 shows band selection circuit cards and Figure 5-12 shows their functional relationship. Band selection can be made locally or from a remote site. The OUTPUT CONTROL Switch on the CONTROL/STATUS panel enables command signals from front panel BAND SELECT Switches or serial commands from the TCMG. Band-select commands are routed to Driver and Filter Card 1A1A3 and Band Prove Card 1A1A5. Test points on the front panel of Band Command Card 1A1A4 can be used to monitor signal levels of all bands. Card 1A1A4 contains logic that limits the band command to a single command at a time. The band command card sends an RF INHIBIT signal of 600-millisecond duration to the broadband amplifier keyer, allowing band-switching with RF inhibited. The actual band change command is issued 2 milliseconds after the RF INHIBIT signal. Band Filter Driver Card 1A1A3 supplies a signal that actuates relays or air solenoids to switch bandpass filters. Each band filter output stage is electrically connected to a BAND SELECT lamp on the CONTROL/STATUS panel. The band filter driver card outputs to a diode matrix that sends signals to the proper relay or air solenoid. Band Prove Card 1A1A5 compares signals from bandpass filter relays and air-pressure sensors with the band-select signal. A mismatch causes the BAND PROVE FAULT LED on front of the band prove card to light up.

5-12.2 Bias Control. Figure 5-13 shows Bias Control and Reset Logic Card 1A1A6. That card performs multiple functions: bias card control; auto reset; ready indicator and Low Level (Broadband) Amplifier keyline; and remote high voltage control. In the following paragraphs, CCA input and output signals are identified with pin numbers in parentheses. Circuit Diagrams Manual TO 31P6-2FPS118-83 contains a detailed schematic of card 1A1A6.

1. To signal the transmitter can be brought on line, the TM READY indicator on CONTROL/STATUS panel 1A1 lights up.

   A Ready Indicator (32) signal is present when Band Change (16) is not in progress, Band Prove (36) is complete, no RF Arc (33) or Overload (34) fault signals are present, and HV ON (35) is present. A Low Level (Broadband) Amplifier Keyline (11) is generated in local control when a Local (12) signal (Logic 1, +5 V dc) is present, and either CW Bias Control (13) or ICW Bias Control (10) is Logic 0 (ground). In remote operation, the Low Level Amplifier Keyline is generated if the Local signal is a Logic 0 and RF Inhibit (38) and Keyline (39) signals are both Logic 0 and Ready Indicator (32) is present. The Low Level Amplifier Keyline signal can be monitored at the RF INHIB test point on front of the bias control and reset logic card.

2. The bias control and reset logic card enables control of transmitter bias states when operating from a remote location. The CW and ICW Bias Control interacts with control relays in IPA, driver amplifier, and PA bias power supplies. Those relays enable CW or ICW adjustments on Bias Adjust panel 1A9. An active CW Bias Control (13) signal is generated when Low Level Amplifier Keyline (11) is present and Remote Mode (8) is Logic 1. An active ICW Bias Control (10) signal is generated when Low Level Amplifier Keyline (11) is present and Remote Mode is Logic 0.

   The ICW Bias Control signal is active for approximately 4 seconds when HV ON (35) goes from Logic 1 to Logic 0, even though CW Mode has been selected. Under local control, the bias control and reset logic card does not control CW Bias. Under local control, ICW Bias is controlled by the bias control and reset logic card when HV ON (35) goes from Logic 1 to Logic 0. The ICW Bias line is held low for approximately 4 seconds to

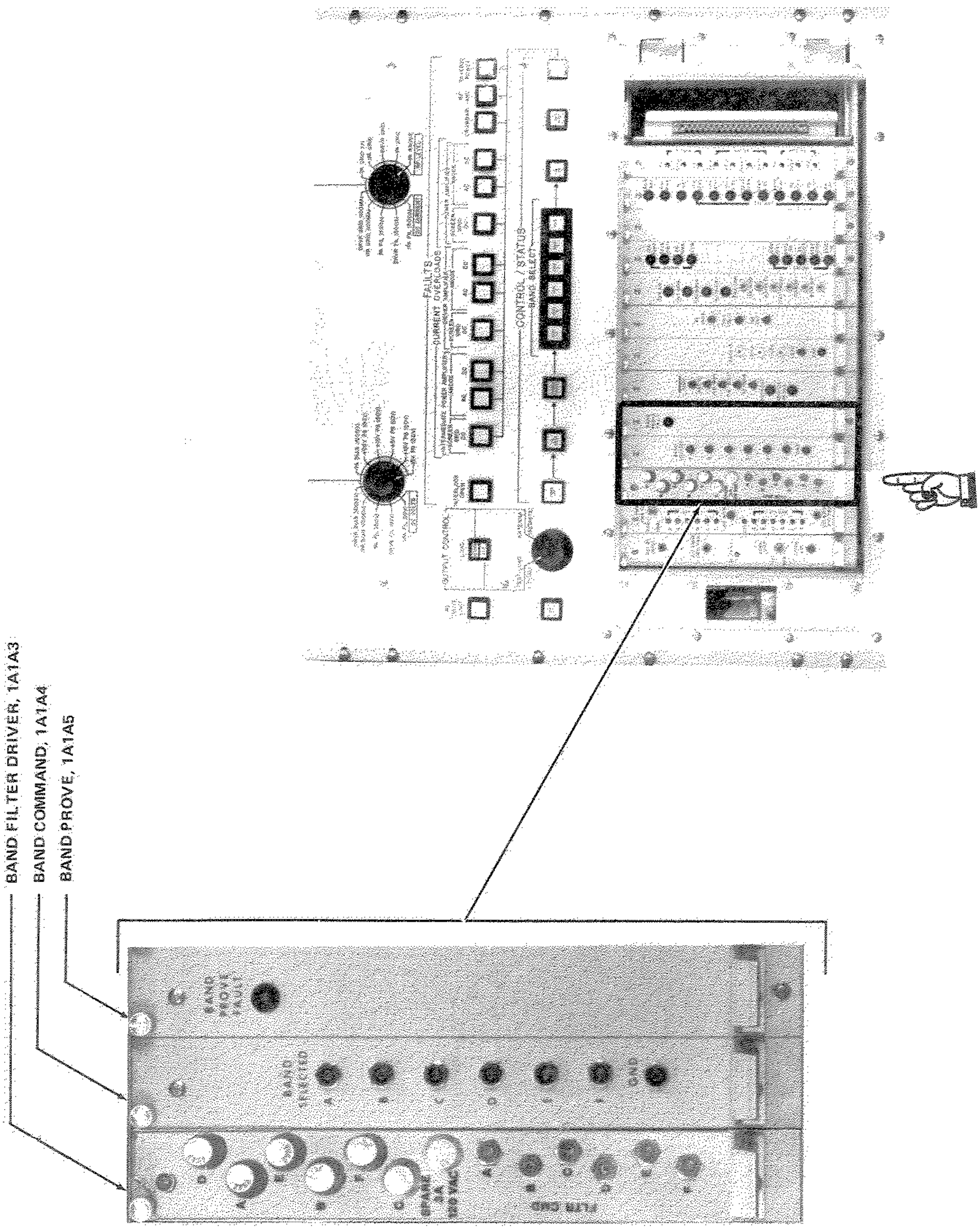


Figure 5-11. Band Selection Control Cards

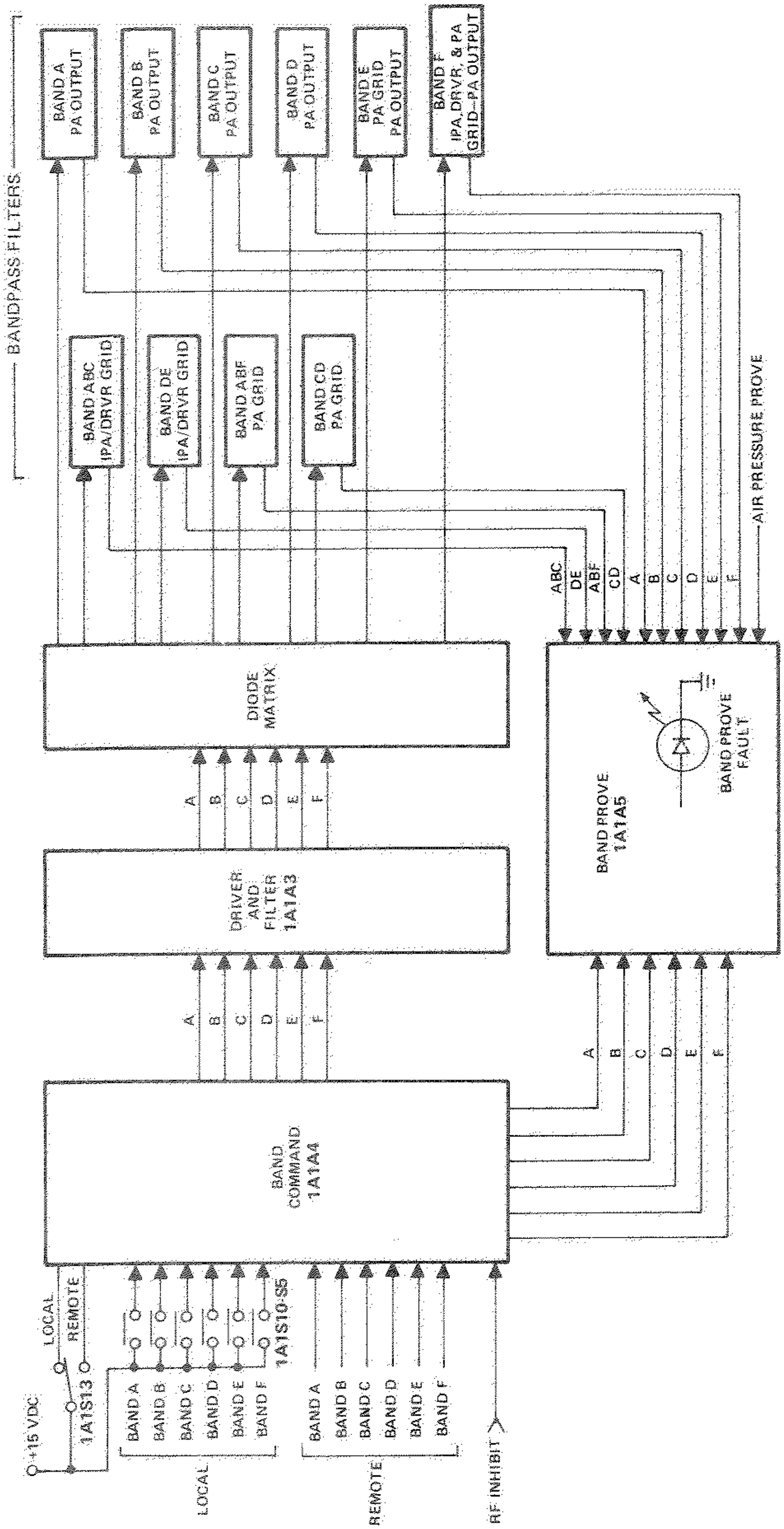


Figure 5-12. Band Selection Block Diagram

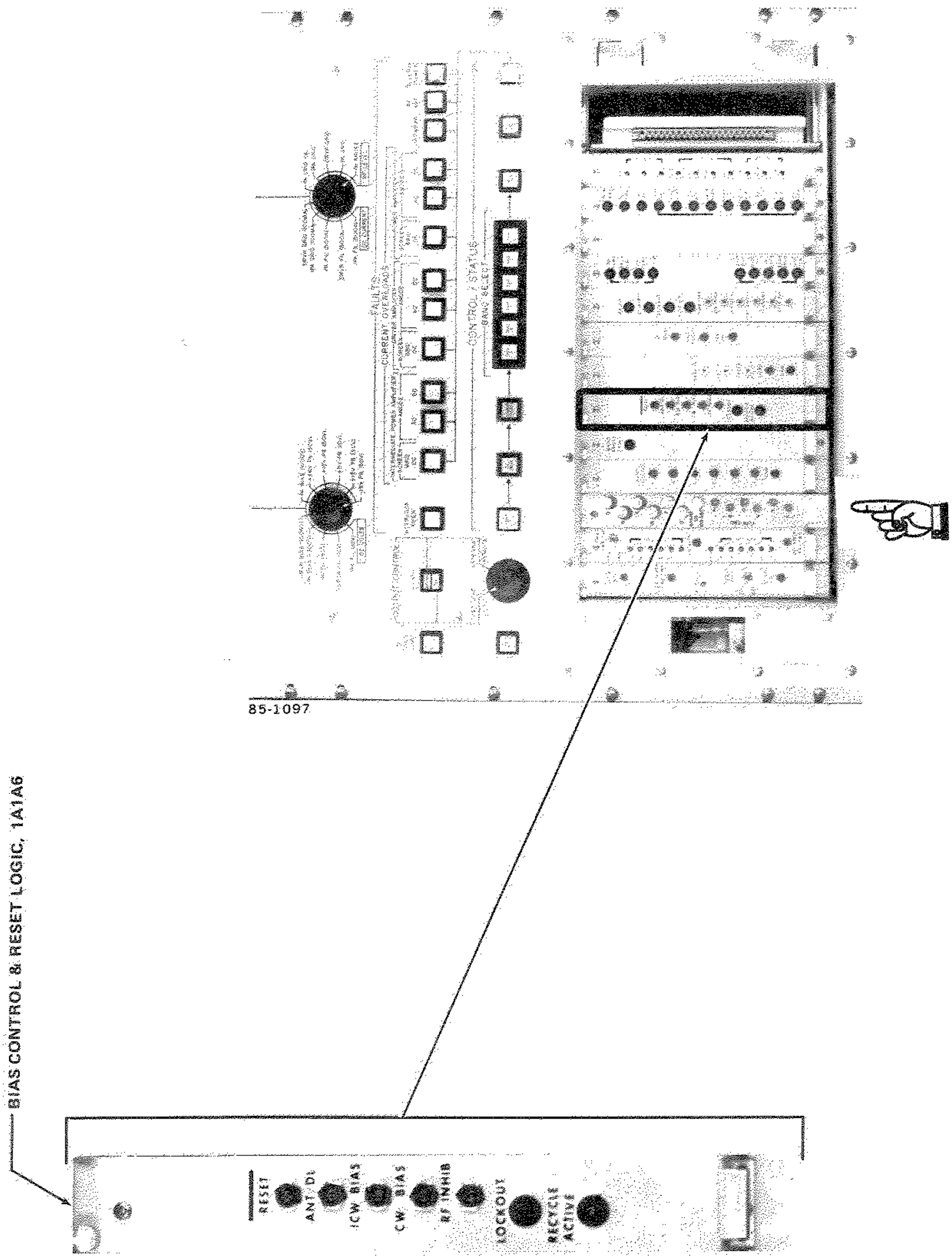


Figure 5-13. Bias Control and Reset Logic Card

speed discharge of the HVPS. Test points on front of the bias control and reset logic card allow monitoring of CW or ICW Bias signal levels.

3. Under remote control, Mode Control (14) output level tracks Remote Mode (8). When Remote Mode is Logic 0, for example, Mode Control output will also be Logic 0 (ICW Mode). Under local control, Mode Control tracks ICW Bias Control (10).

4. The Reset (7) output supplies dc power to an external load except when it is interrupted by the reset circuitry timer for approximately 110 milliseconds. The reset timer can be activated by:

   a. A Manual Reset (25) command.
   b. A Power On initializing pulse.
   c. Automatic Reset logic.

   Automatic reset circuitry is active only in remote operation. Faults are sensed during the time that Overload (34) goes from Logic 1 to Logic 0. A counter records faults occurring within a 2-minute period. A 30-second delay circuit activates after the first fault has been reset. The following describes the sequence of events that takes place when four faults occur within a 2-minute interval.

   a. First fault occurs. Upon receipt of Logic 1 RF Inhibit (38), a Reset Pulse is immediately generated.

   b. Second fault occurs. When RF Inhibit (38) is present, and 30-second timer has timed out, a Reset Pulse is generated. The Recycle Active (37) line is active and the RECYCLE ACTIVE LED on front of bias control and reset logic card lights up until 30-second timer has timed out.

   c. Third fault occurs. If RF Inhibit (38) is present, and at least 2 minutes and 30 seconds have elapsed since the last Reset Pulse was generated, a third Reset Pulse will be generated. The Recycle Active (37) line is active and the RECYCLE ACTIVE LED on front of the bias control and reset Logic card lights up until 2 minutes and 30 seconds timer has timed out.

   d. Fourth fault occurs. No Reset Pulse is generated. The Fault Lockout (4) line is active, and LOCKOUT LED on front of bias control and reset logic card is lit.

5. A +25 V dc level is present at Load SW Prove (29) if +26.5 V dc is present at either Test Load Sw Prove (28) or Ant Sw Prove (30). An output at Test Load Ind (27) or Ant Load Ind (26) will light up split indicator ANTENNA/TEST lamp on the CONTROL/STATUS panel.

6. A Remote HV ON (21) Control signal is generated when Standby (23) is Logic 1 and Remote HV Command (20) goes from Logic 0 to Logic 1. A Remote HV ON Control signal is also generated when a Reset Pulse is generated and Remote HV Command and Standby are both Logic 1. A Remote HV OFF (22) Control signal is generated when either or both Remote HV Command and Standby go from Logic 1 to Logic 0.

5-12.3 <u>Remote Serial Interface.</u> Figure 5-14 shows Serial Command Interface Card 1A1A7 and Serial Status Interface Card 1A1A8. Figure 5-15 shows signals that interface the transmitter with the TCMG.

5-12.3.1 <u>Serial Commands.</u> The serial command interface card receives the following signals from the Transmitter Maintenance Console (TMC).

1. CLOCK pulses at 625 kHz, in 24-pulse sequences. These are accepted by the serial command interface card and applied to shift registers on both the serial command interface and serial status interface cards.

2. SERIAL COMMANDS are shifted through shift registers 1A1A7U2 through 1A1A7U4 by CLOCK pulses. Immediately following the 24th CLOCK pulse, a Data Latch pulse causes data in shift registers to be latched and output from the serial command Interface card as parallel data, as follows.

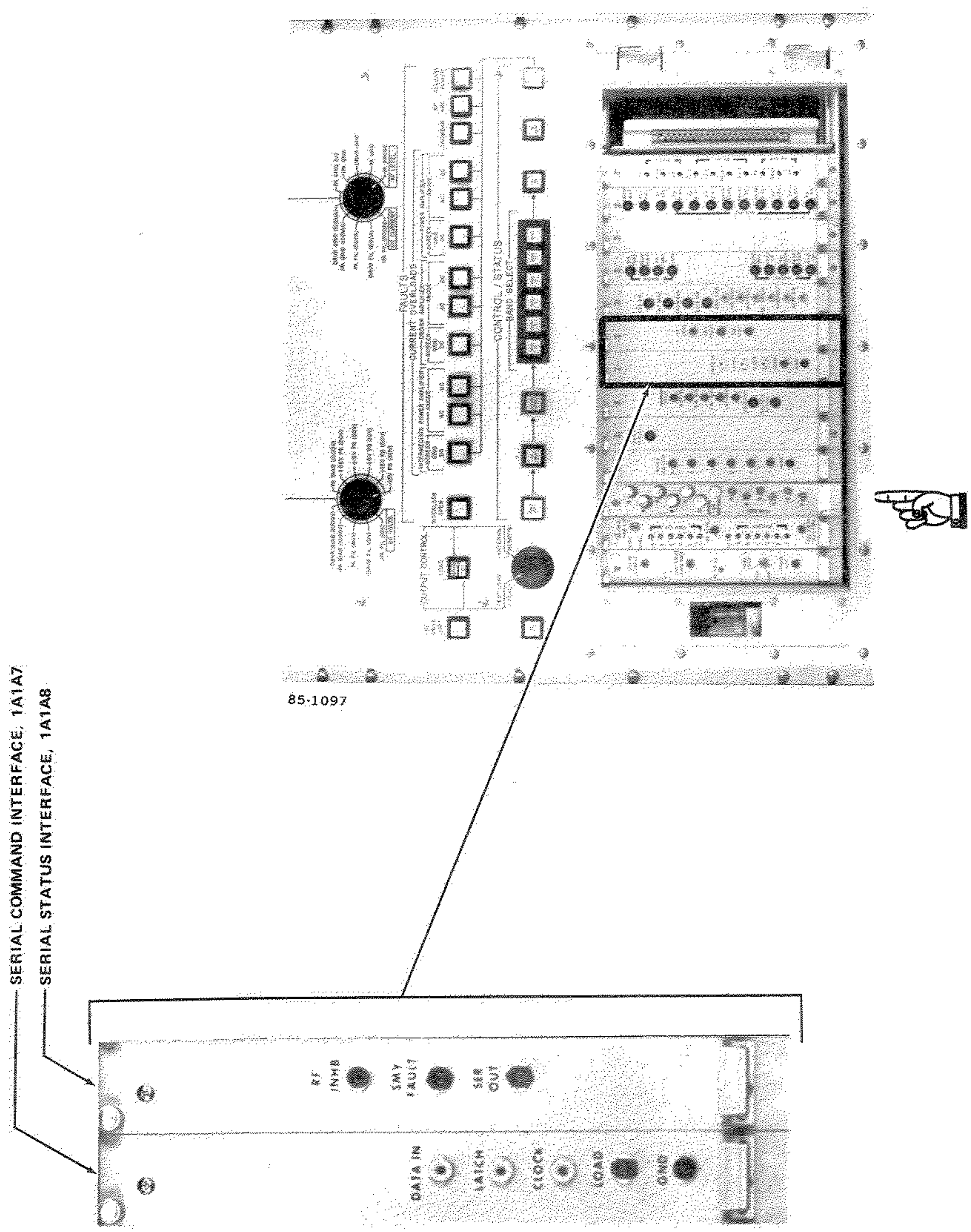


Figure 5-14. Serial Command and Status Cards

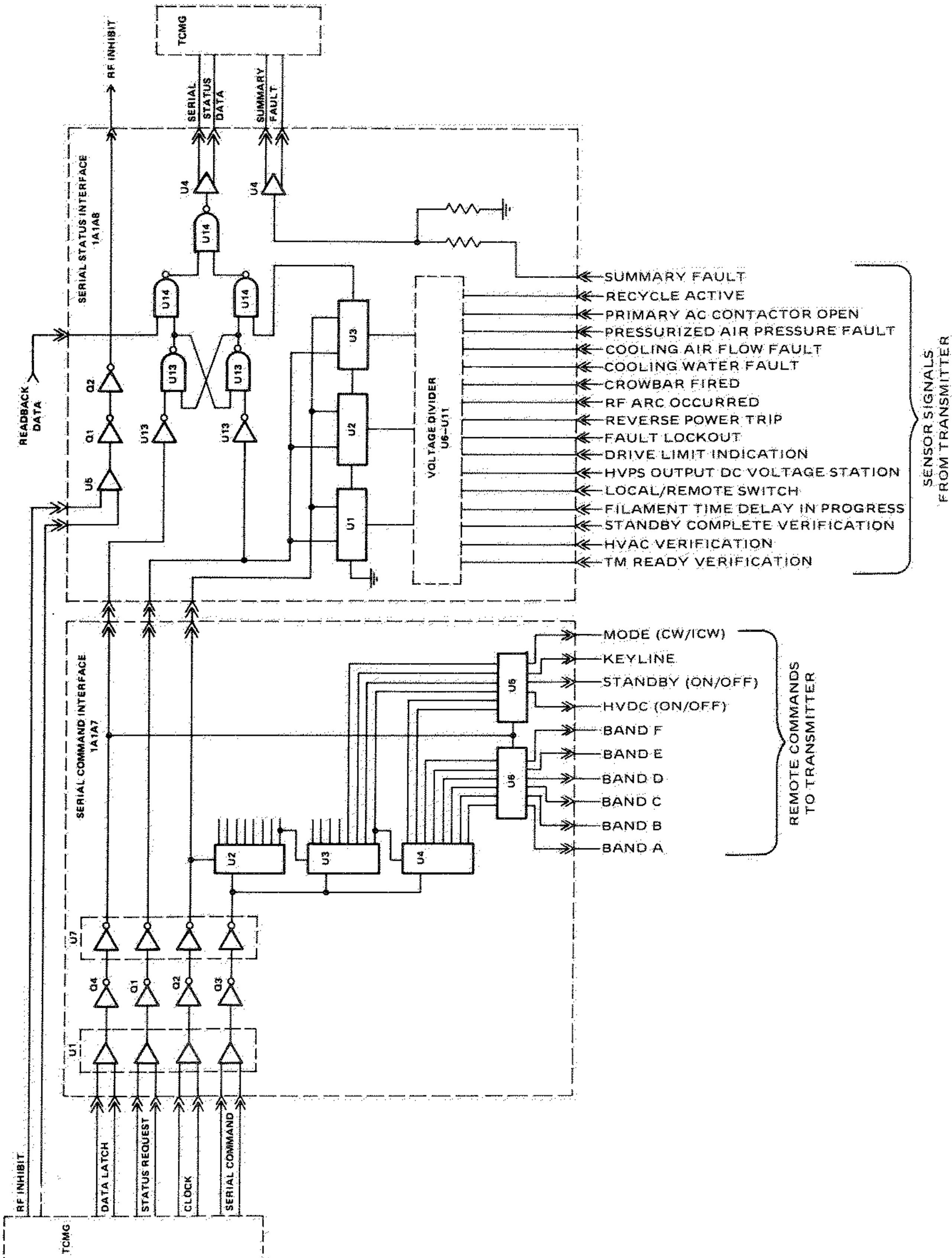


Figure 5-15. Serial Interface Simplified Schematic

a. MODE (CW/ICW) selects either CW or ICW mode of operation.

b. KEYLINE, as well as RF INHIBIT from the serial status interface card, controls operation of Low Level (Broadband) Amplifier 1AR1. When either is Logic 1, the amplifier is inoperable.

c. STANDBY (ON/OFF) initiates turn-on by beginning filament warmup and placing transmitter in standby.

d. HVDC (ON/OFF) switches high-voltage dc power supply on or off.

e. Band-select commands (BAND A through BAND F) accomplish frequency band selection.

3. DATA LATCH is a 1.6 microsecond pulse sent immediately following the 24th CLOCK pulse of the serial command word. DATA LATCH is passed to Serial Status Interface Card 1A1A8, where it latches serial command data from D-type Flip-Flops 1A1A8U13. That allows the serial command word to be read back to the TCMG.

4. STATUS REQUEST is a 1.6 microsecond pulse sent at the beginning of every CLOCK pulse sequence that is not used to transport or read back a serial command word. This pulse is passed to the serial status interface card, where it releases parallel transmitter status bits from D-type Flip-Flops 1A1A8U1 through 1A1A8U3 as a 24-bit serial status word. STATUS REQUEST also resets the R-S Flip-Flop configuration 1A1A8U13 which allows the serial status word to be sent to the TCMG.

5. As explained in 2(b), RF INHIBIT controls Low Level Amplifier 1AR1. For TCMG Simulator operation, exercise of this signal line is allowed only when the Keyline RF Inhibit bit in the command data is set. Output RF is inhibited at all times via one of the two paths.

5-12.3.2 Sensor Signals. Sensor signals from the transmitter are applied to Serial Status Interface Card 1A1A8 (Figure 5-15). Status information is loaded into parallel shift registers and clocked out when a STATUS REQUEST command is received. The status information is sent to the TCMG as SERIAL STATUS DATA and SUMMARY FAULT.

5-12.3.3 SUMMARY FAULT. When a summary fault exists, a Logic 0 is output by the transmitter on balanced lines. Serial status bits that combine to give summary faults are:

BIT	FAULT
0	Primary AC Contactor Open
1	Pressurized Air Fault
2	Cooling Air Flow Fault
3	Cooling Water Flow Fault
5	Crowbar Fired
6	RF Arc Occurred
7	Reverse Power Trip
9	HVPS DC Voltage Fault

5-12.4 High Voltage Control. Figure 5-16 shows High Voltage (HV) Control Card 1A1A9. This card functions to initiate transmitter turn-on when STANDBY (HV OFF) switch 1A1S11 is depressed. Proof of cabinet interlock circuits, cooling air and water flow, and actuator air pressure is routed through this card. The card also contains relays for remote control of the HVPS. Table 4-10 lists and describes high voltage control card test points and fault indicators. The CCA also controls the state of the following lamps on CONTROL/STATUS panel 1A1:

a. FIL DELAY lights up during filament warmup.

b. INTERLOCK OPEN lights up when a door, air, or water interlock is open.

c. STANDBY HVOFF lights up when filaments are warmed and all interlocks are closed.

d. HV ON lights up when HV interlocks have been proved.

5-12.5 Status and Fault Indicators. Figure 5-17 shows status and fault indicator circuit cards: Water Flow Card 1A1A10; Fault Overload Card 1A1A11; and, First Event Logic Card 1A1A12.

1. Water Flow Card 1A1A10 monitors eight different areas of the cooling water system through sensors installed in each vacuum tube water-branch line. Pressure sensors monitor the water flow rate, protecting water-cooled components

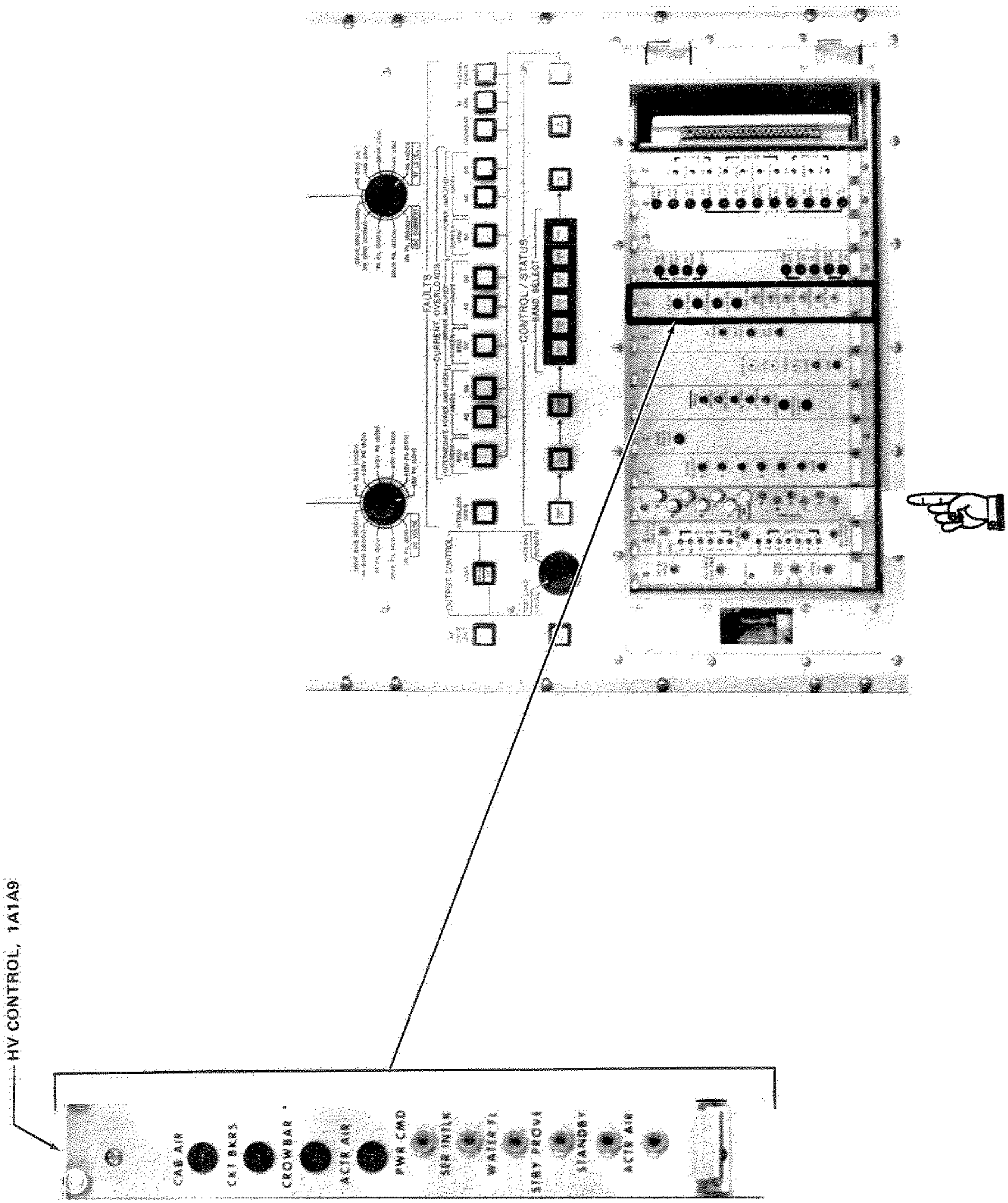


Figure 5-16. High Voltage Control Card

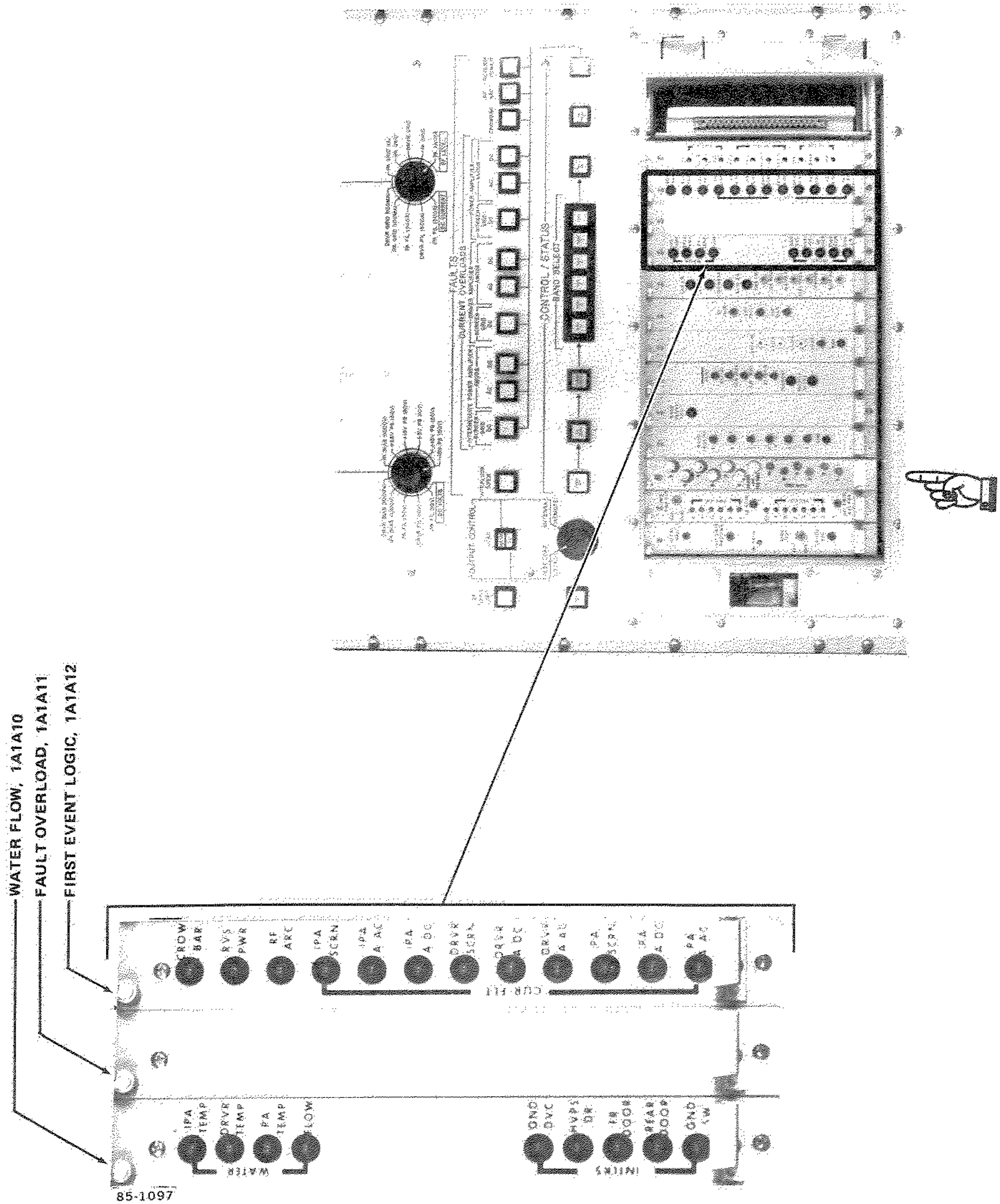


Figure 5-17. Status and Fault Indicator Cards

sensor detects a flow-rate fault, the FLOW fault lamp on front of the water flow card will light. The water flow card also monitors from excessive/inadequate water flow conditions. Each of the eight pressure sensor input circuits are adjustable for upper and lower water-flow limits (paragraph 6-6.3.6). When all eight circuits are within limits, a water flow prove output will result. If a water temperature for the three vacuum tube stages. The following is a list of indicators and over-temperature switches, by vacuum tube stage:

STAGE	INDICATOR	SWITCH
IPA Temperature	1A1A10DS5	1S26
DRVR Temperature	1A1A10DS4	1S27
PA Temperature	1A1A10DS3	1S28

Five interlock areas are also monitored by the Water Flow card. Interlock summary indicators will light up if an interlock is sensed to be open. The five interlock areas summarized by fault lamps are listed below.

a. GND DVC 1A1A10DS1 lights up to show grounding stick(s) improperly stored.

b. HVPS DR 1A1A10DS9 lights up if HVPS door or grounding switch is open.

c. FR DOOR 1A1A10DS8 lights up if one or more of the following are open: control door; Band F hatch; left or right front transmitter doors.

d. REAR DOOR 1A1A10DS7 lights up if one or more of the following are open: Band E hatch; PA tube hatch; right or left rear transmitter doors.

e. GND SW 1A1A10DS6 lights up if transmitter ground switch is closed, indicating anode and screen power supplies are shorted out.

2. Fault Overload Card 1A1A11 inhibits high voltage when an overload fault occurs. High voltage cannot be restored until a FAULT (RESET) command has been issued. For local mode of operation, FAULT (RESET) is a manual function; for remote mode it is automatic. High-voltage inhibit takes place upon receipt of a fault signal from one or more of the 12 inputs. When inhibit is activated, FAULT (RESET) lamp 1A1DS17 lights up. The following is a list of fault overload signals, control relays, and associated indicators. The first nine signals are current overloads; the remaining three are considered miscellaneous overload faults.

FAULT OVERLOAD SIGNAL	RELAY	INDICATORS
IPA SCRN (IPA Screen Grid DC)	1A1A11K1	1A1A12DS9 1A1DS12
IPA A AC (IPA Anode AC)	1A1A11K2	1A1A12DS8 1A1DS10
IPA A DC (IPA Anode DC)	1A1A11K3	1A1A12DS7 1A1DS11
DRVR SCRN (Driver Screen Grid DC)	1A1A11K4	1A1A12DS6 1A1DS9
DRVR A DC (Driver Anode DC)	1A1A11K6	1A1A12DS5 1A1DS7
DRVR A AC (Driver Anode AC)	1A1A11K5	1A1A12DS4 1A1DS8
PA SCRN (PA Screen Grid DC)	1A1A11K7	1A1A12DS3 1A1DS6
PA A DC (PA Anode DC)	1A1A11K8	1A1A12DS2 1A1DS5
PA A AC (PA Anode AC)	1A1A11K9	1A1A12DS1 1A1DS4
CROWBAR (Crowbar Fired)	1A1A11K10	1A1A12DS12 1A1DS3
RF ARC (RF Arc)	1A1A11K12	1A1A12DS11 1A1DS2
RVS PWR (Reverse Power Trip)	1A1A11K11	1A1A12DS10 1A1DS1

A summary fault circuit provides a remote status indication when one or more of the fault overload signals occur. First Event Logic Card 1A1A12 works with Fault Overload logic Card 1A1A11 to latch the relay of the first detected overload. Secondary, or sympathetic, overloads are prevented from latching relays or lighting fault lamps. First-event identification is an important aid to maintenance.

5-13 TRANSMITTER METER ASSEMBLY PANEL.

Figures 5-18 and 5-19 are simplified schematics of meter inputs switching and routing. Meter Assembly panel 1A13 is located at the top of cabinet 1 controls section. CATHODE and SCREEN GRID current meters cover IPA, driver amplifier, and PA stages. The POWER (KW) meter shows forward and reverse PA output, as selected by RF POWER switch 1A13S1. The remaining transmitter parameters are displayed on test meters 1A13M9 and 1A13M7, as selected by switches 1A1S1 and 1A1S2 on CONTROL/ STATUS panel 1A1.

TEST METER 1A13M9 - SWITCH 1A1S2

Switch Position	Switch Position
IPA FIL (10V)	+26V PS (50V)
DRVR FIL (10V)	+15V PS (50V)
PA FIL (50V)	+ 5V PS (10V)
IPA BIAS (1000V)	+15V PS (50V)
DRVR BIAS (1000V)	-15V PS (50V)
PA BIAS (1000V)	

TEST METER 1A13M7 - SWITCH 1A1S1

Switch Position	Switch Position
IPA FIL (500A)	PA GRID (1A)
DRVR FIL (500A)	IPA GRID
PA FIL (500A)	DRVR GRID
IPA GRID (100MA)	PA GRID
DRVR GRID (100MA)	PA ANODE

Each meter is protected from RF by shielded-wire meter leads and a .01 microfarad disc ceramic capacitor across meter terminals. Shields of each meter lead are grounded. Together, the capacitor and shielded wire bypass RF to ground. A zero-reading needle adjustment is on the front of each meter. Zeroing is accomplished at the factory, but shipment or meter replacement may affect needle position. If adjustment is required, it shall be done in a power-off condition. Individual meter circuits can be adjusted on Test Meter Scaling Card 1A1A13. See Figure 5-20. METERS (OFF-ON) switch 1A13S2 will disable all meters. Figure 5-20 shows Test Meter Scale Card 1A1A13. Pots on front are used to adjust (paragraph 6-6.3.7) calibration resistors of multifunctioning TEST METERS 1A13M7 and 1A13M9.

5-14 TRANSMITTER SIGNAL MONITOR PANEL.

Figure 5-21 is a simplified schematic that shows RF signal flow and associated monitor points on RF SIGNAL MONITORS panel 1A25. The panel provides jacks and switches for the display of transmitter functional data. For local mode operational checks or maintenance actions, a signal generator is connected to RF INPUT SIGNAL SOURCE jack 1A25W5J1. To monitor the signal generator input, RF INPUT SELECTOR switch 1A25S2 must be positioned to LOCAL. Remote RF inputs can be monitored with the RF INPUT SELECTOR switch positioned to REMOTE. TEST LOAD INTERLOCK jack 1A25J5 is connected to a dummy load during transmitter tests to provide water flow and water temperature status.

RF SIGNAL MONITOR jacks are:

1.	RF INPUT XMTR:	1A25W4J1
2.	RF OUTPUT LL AMPL:	1A25W3J1
3.	RF OUTPUT IPA ANODE:	1A25J3
4.	RF OUTPUT PA ANODE:	1A25J2

XMTR OUTPUT jacks FWD POWER SAMPLE 1A25W2J1 and RVS POWER SAMPLE 1A25W1J1 are provided to monitor the RF output sample. Each band is assigned a directional coupler with both forward and reverse power sample ports.

Relay 1A1K1 selects forward samples; 1A1K2 selects reverse samples (Figure 5-3). BIAS/RF INHIBIT Switch 1A25S3, active only in the local mode of operation, is used in conjunction with controls on Bias Adjust panel 1A9. With the switch positioned to CW/BIAS DRIVE ENABLE, bias can be adjusted for each vacuum tube stage by turning three CW controls on the bias adjust panel. With the switch positioned to ICW BIAS/DRIVE ENABLE, bias can be adjusted with the three ICW controls. With the switch positioned to CUTOFF, all tubes are biased off.
A Logic 1 is then routed to the Low Level (Broadband) Amplifier 1AR1 keyline input, preventing its operation.

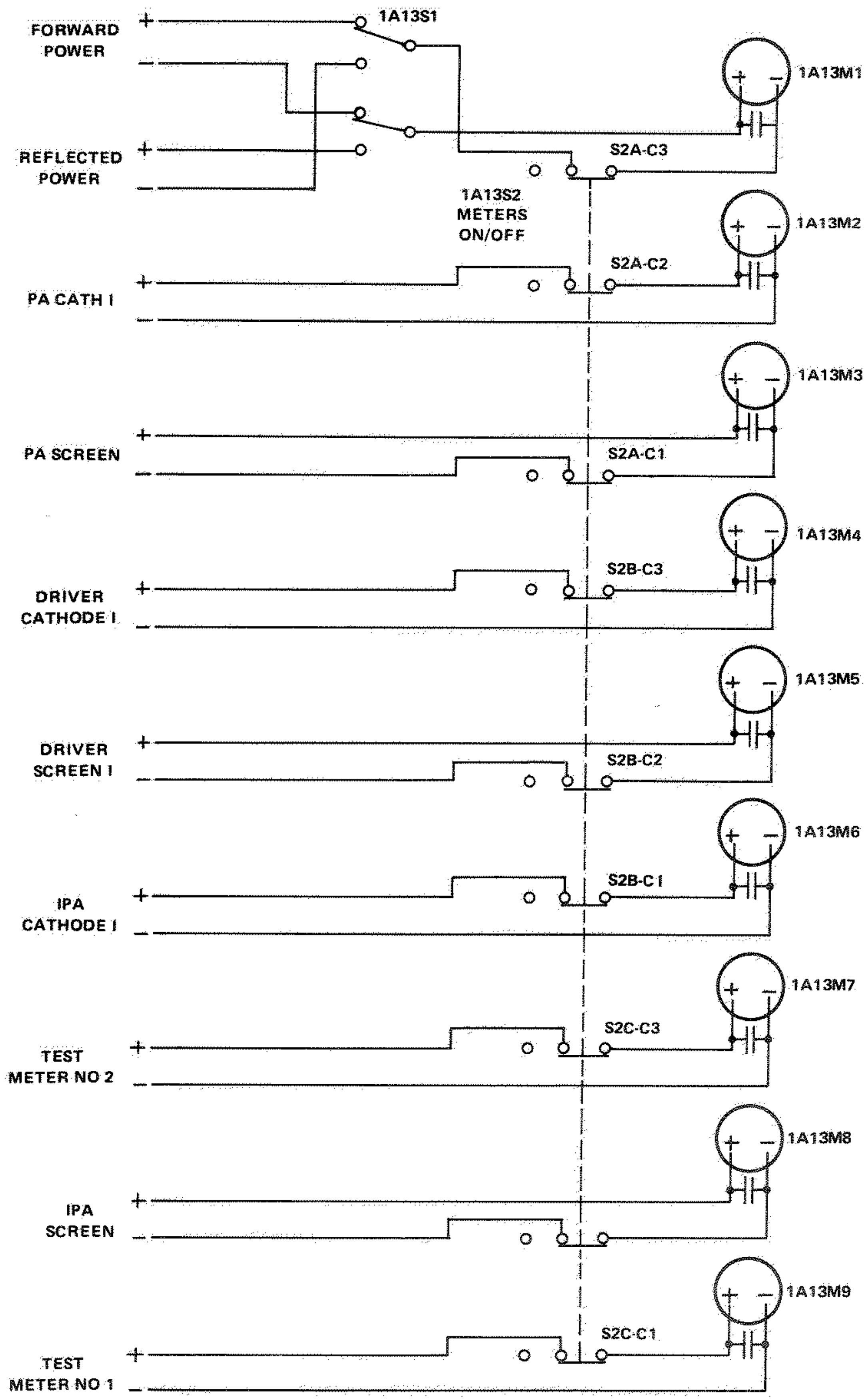


Figure 5-18. Meter Panel 1A13 Simplified Schematic

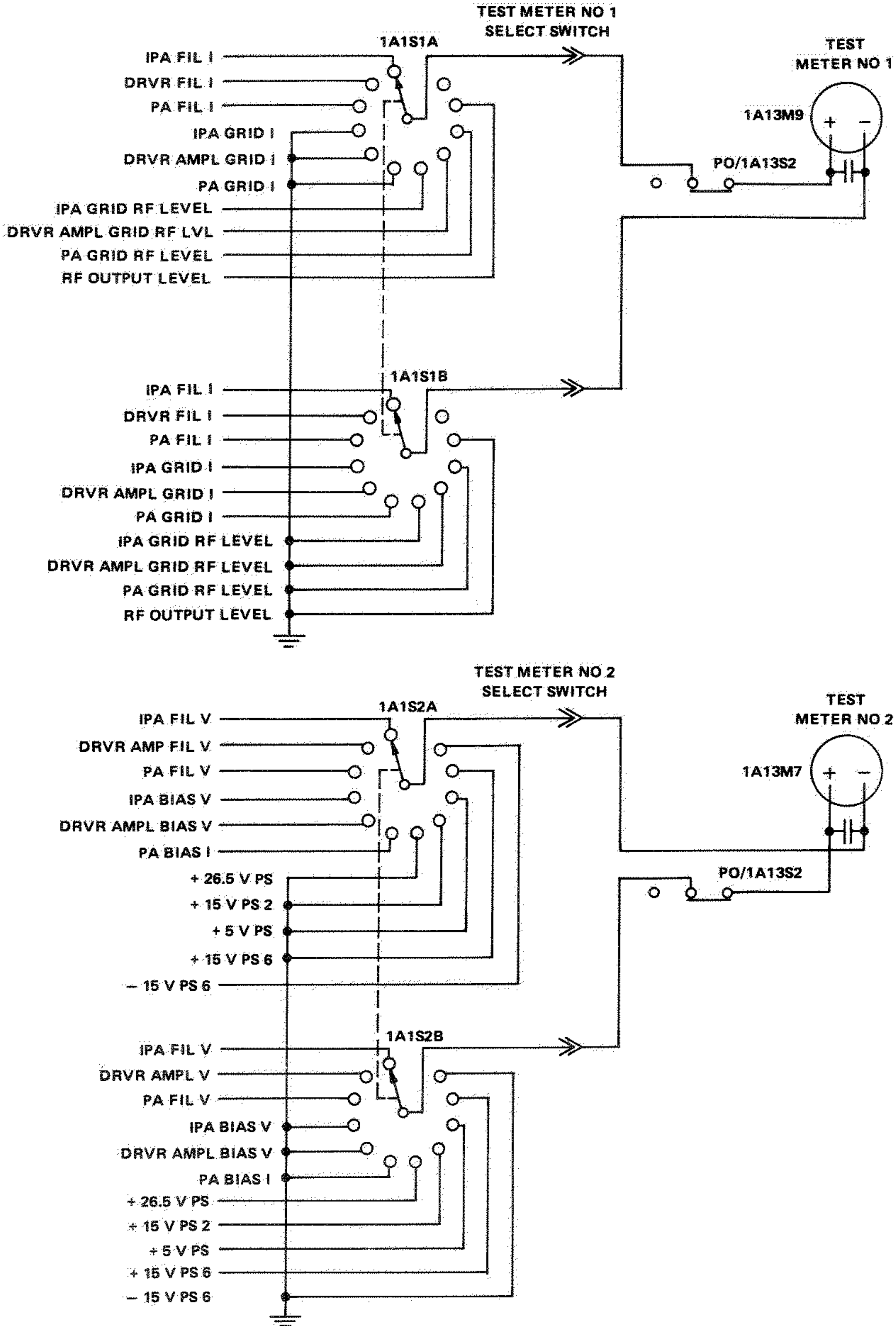


Figure 5-19. Test Meter Selection Simplified Schematic

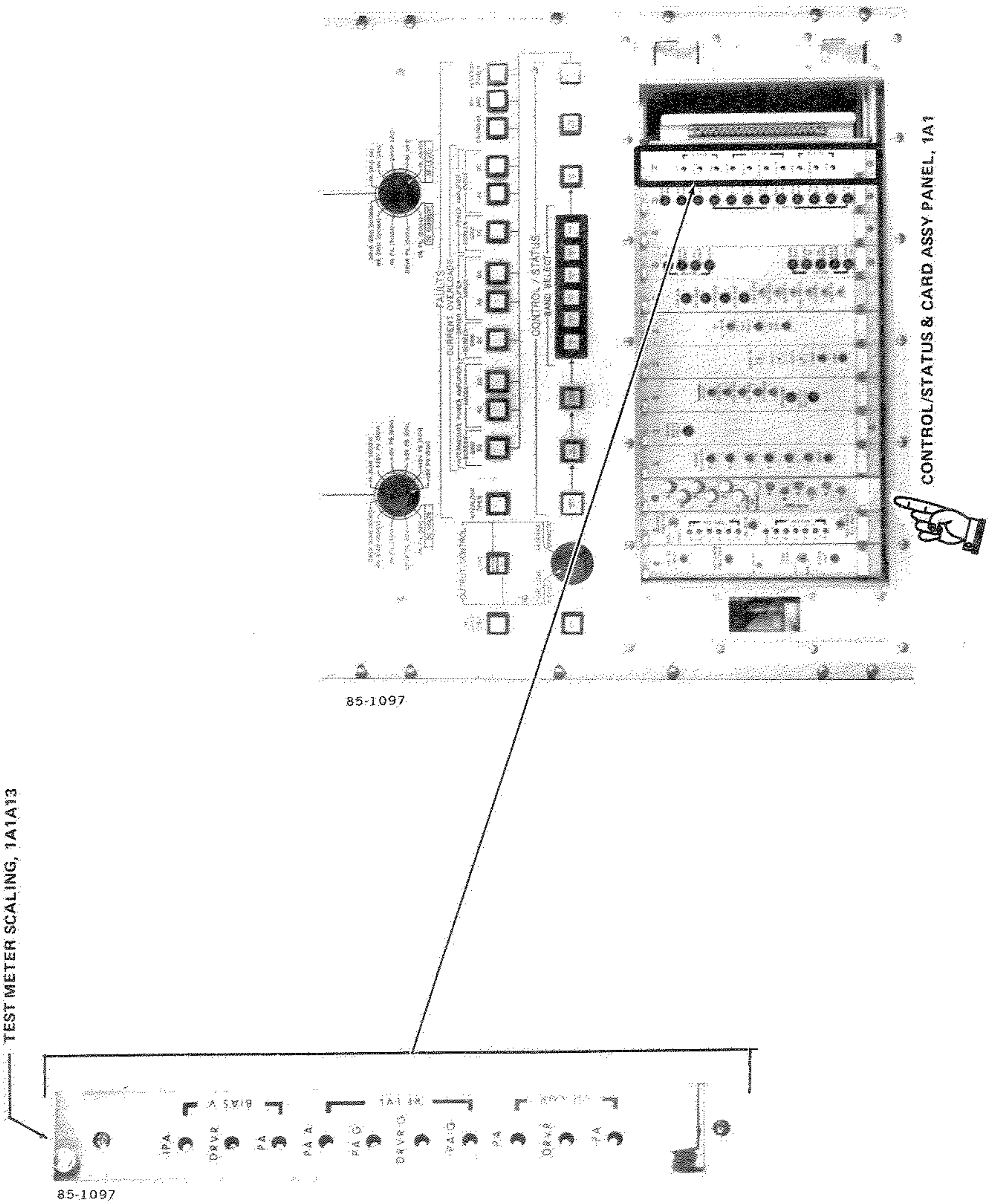


Figure 5-20. Test Meter Scaling Card

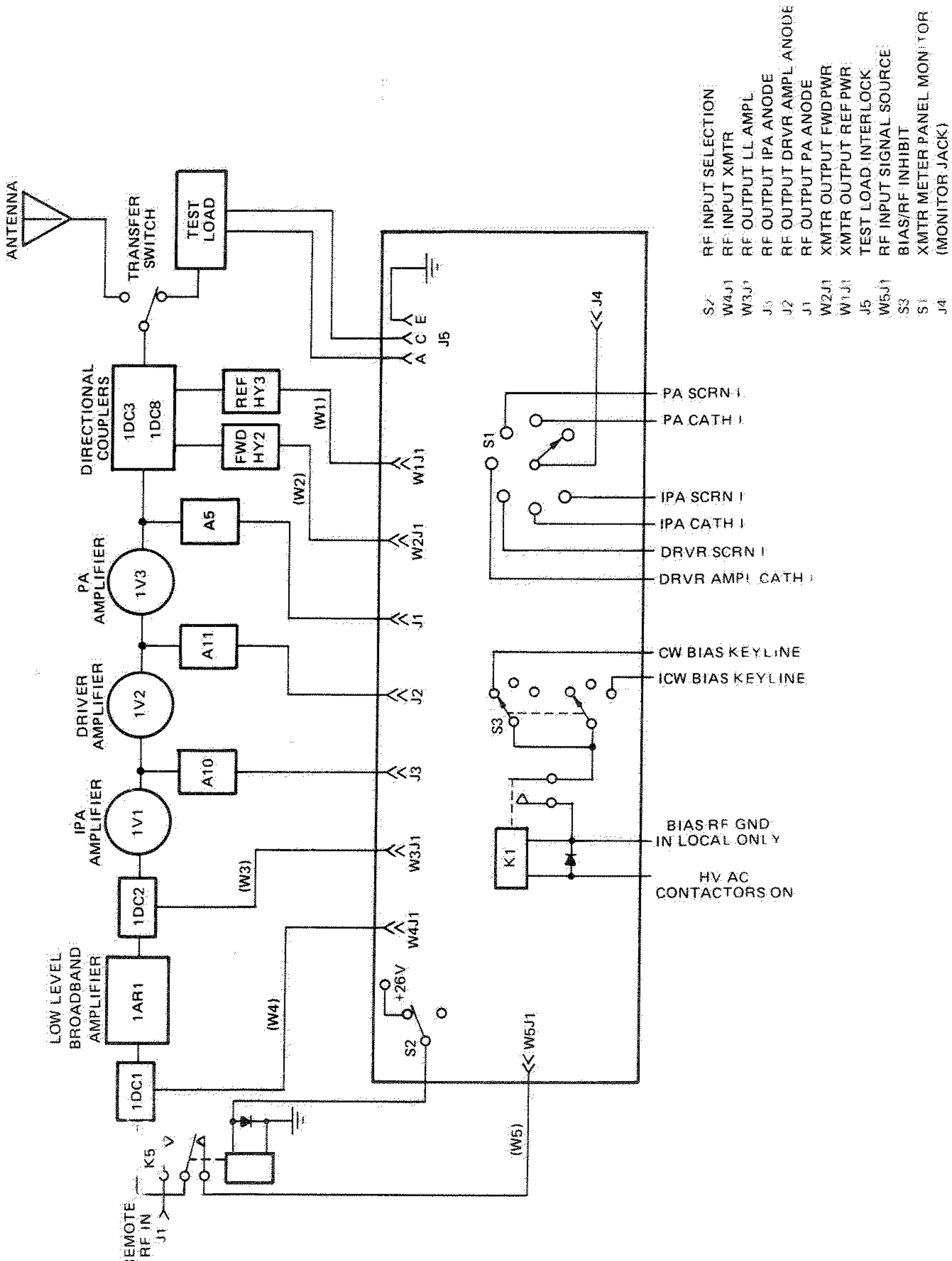


Figure 5-21. RF SIGNAL MONITORS Panel Simplified Schematic

XMTR METER PANEL MONITOR Switch 1A25S1 selects samples of current and routes them to 1A25J4 for external monitoring. These are the same current samples displayed on Meter Assembly panel 1A13, and can be monitored by digital meter or oscilloscope.

Switch Setting	Meter
IPA SCRN I	1A13M8
IPA CATH I	1A13M6
DRVR SCRN I	1A13M5
DRVR AMPL CATH I	1A13M4
PA SCRN I	1A13M3
PA CATH I	1A13M2

5-15 BIAS POWER SUPPLIES.

A bias power supply is provided for each amplifier stage.

Stage	Power Supply
Intermediate Power Amplifier (IPA)	1A1PS3
Driver Amplifier	1A1PS4
Power Amplifier (PA)	1A1PS5

Bias power supplies, located in cabinet 1, are electrically connected to Bias Adjust panel 1A9. Bias output voltages are adjustable by controls on the Bias Adjust panel.

5-15.1 IPA Bias. Source voltage for 1PS3 (Figure 5-22) is routed from the 208 V ac 3-phase regulated supply in the HVPS. Input voltage is applied to the Delta-connected primary of step-up transformer T1. The Wye-connected secondary provides stepped-up voltage to a 3-phase, full-wave bridge rectifier consisting of CR1 through CR6. The rectified output is filtered by a dual-section, choke-input filter that provides a -700 V dc output and designed with a ripple content of -149.5 dB below the dc output. The BIAS/RF INHIBIT switch on RF SIGNAL MONITORS panel 1A25, active only in local mode of operation, works in conjunction with controls on Bias Adjust panel 1A9. With BIAS/RF INHIBIT switch to CUTOFF, relays K1 and K2 are deenergized and -700 V dc cutoff voltage is applied to the IPA vacuum tube control grid. With the switch in CW BIAS/ DRIVE ENABLED, K1 is energized. Variable resistor 1A9R1 is placed in the circuit and can be adjusted for nominal CW bias of -270 V dc ± 20 V dc. With the switch in ICW BIAS/DRIVE ENABLED, K2 is energized. Variable resistor 1A9R2 is placed in the circuit and can be adjusted for nominal ICW bias of -250 V dc ± 20 V dc. A bias sample voltage is obtained from the voltage divider made up of resistors R12, R13, R14, and R11. That proportional voltage is applied to test meter circuitry for bias voltage display. A grid current sample is obtained from variable resistor R16, connected between E8 and ground. When R16 is properly adjusted, 100 mA current through R16 results in 100 mA grid current indication on test meter 1A13M7.

5-15.2 Driver Amplifier Bias. Source voltage for 1PS4 (Figure 5-23) is routed from the 208 V ac 3-phase regulated supply in the HVPS. Input voltage is applied to the Delta-connected primary of step-up transformer T1. Transformer T1 has dual, Wye-connected secondary windings identified in Figure 5-23 as WYE NO. 1 and WYE NO. 2. WYE NO. 1 provides stepped-up voltage to a 3-phase, full-wave bridge rectifier consisting of CR1 through CR6. The rectified output is filtered by a single-section, choke-input filter. This section of 1PS4 provides -300 V dc with a ripple content of -88.5 dB below the dc output. WYE NO. 2 provides stepped-up voltage to a 3-phase, full-wave bridge rectifier consisting of CR7 through CR12. The rectified output is filtered by a dual-section, choke-input filter. This section of 1PS4 provides -400 V dc with a ripple content of -149.5 dB below the dc output. The BIAS/RF INHIBIT switch on RF SIGNAL MONITORS panel 1A25, active only in local mode of operation, works in conjunction with controls on Bias Adjust panel 1A9. With BIAS RF INHIBIT switch in CUTOFF, relays K1 and K2 are deenergized and -700 V dc cutoff voltage is applied to the driver tube control grid. With the switch in CW BIAS/DRIVE ENABLED, K1 is energized. Resistors R6 and R7 are connected to E1, and CW bias is applied to the driver tube control grid. Nominal CW bias of -280 V dc ± 20 V dc can be adjusted by positioning variable transformer 1A9T2. With the switch to ICW BIAS/DRIVE ENABLED, K2 is energized. Variable resistor 1A9R3 is placed in the circuit and can be adjusted for nominal ICW bias of -250 V dc ± 20 V dc. A bias sample voltage is obtained from the voltage divider made up of R14, R15, R16, and R17. That proportional voltage is applied to the Test Meter circuitry for bias voltage display. A grid current sample is obtained from variable resistor R20, connected between E5 and ground. When R20 is properly adjusted, 100 ma current through R20 results in

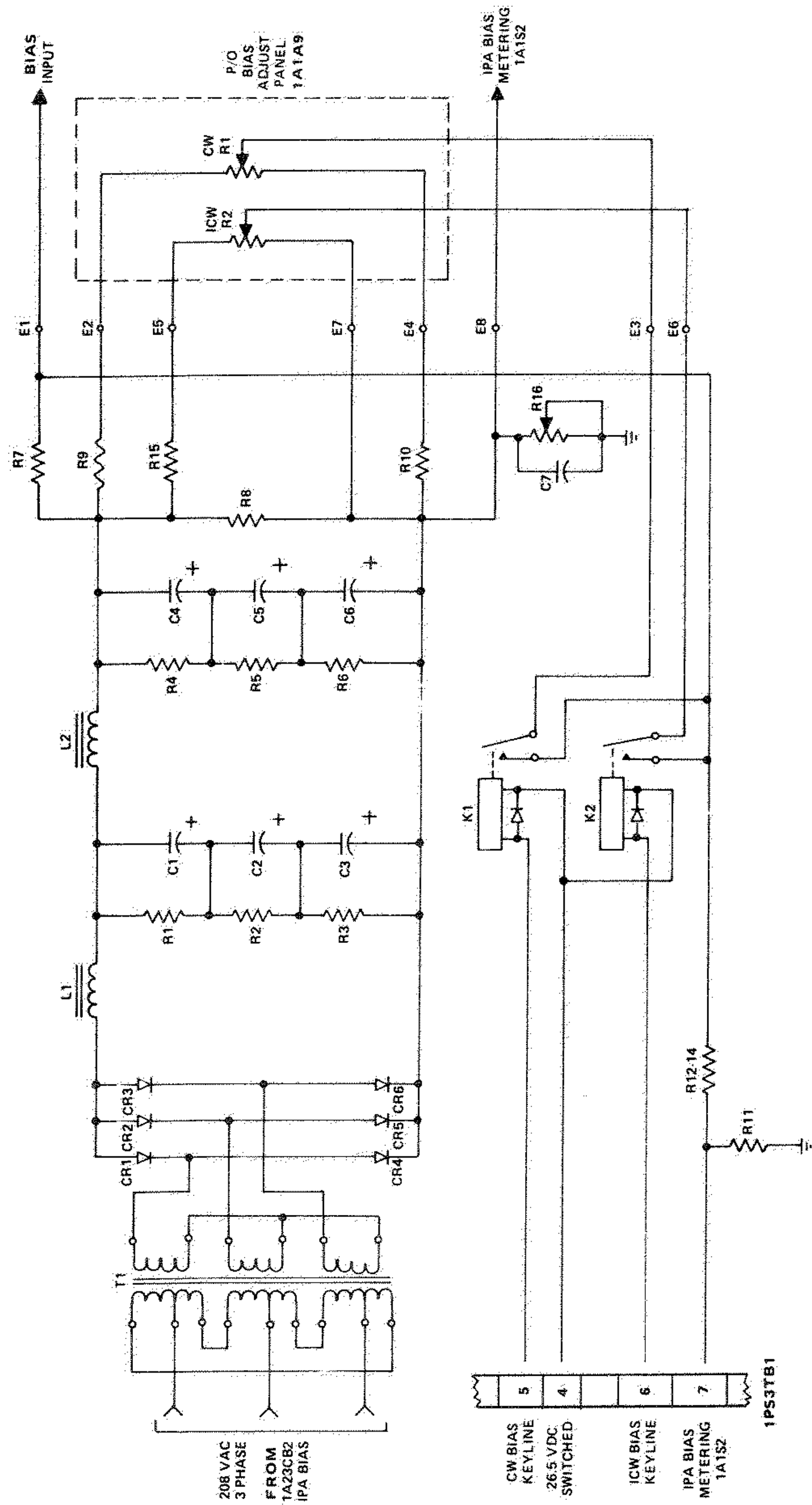


Figure 5-22. IPA Bias Power Supply Simplified Schematic

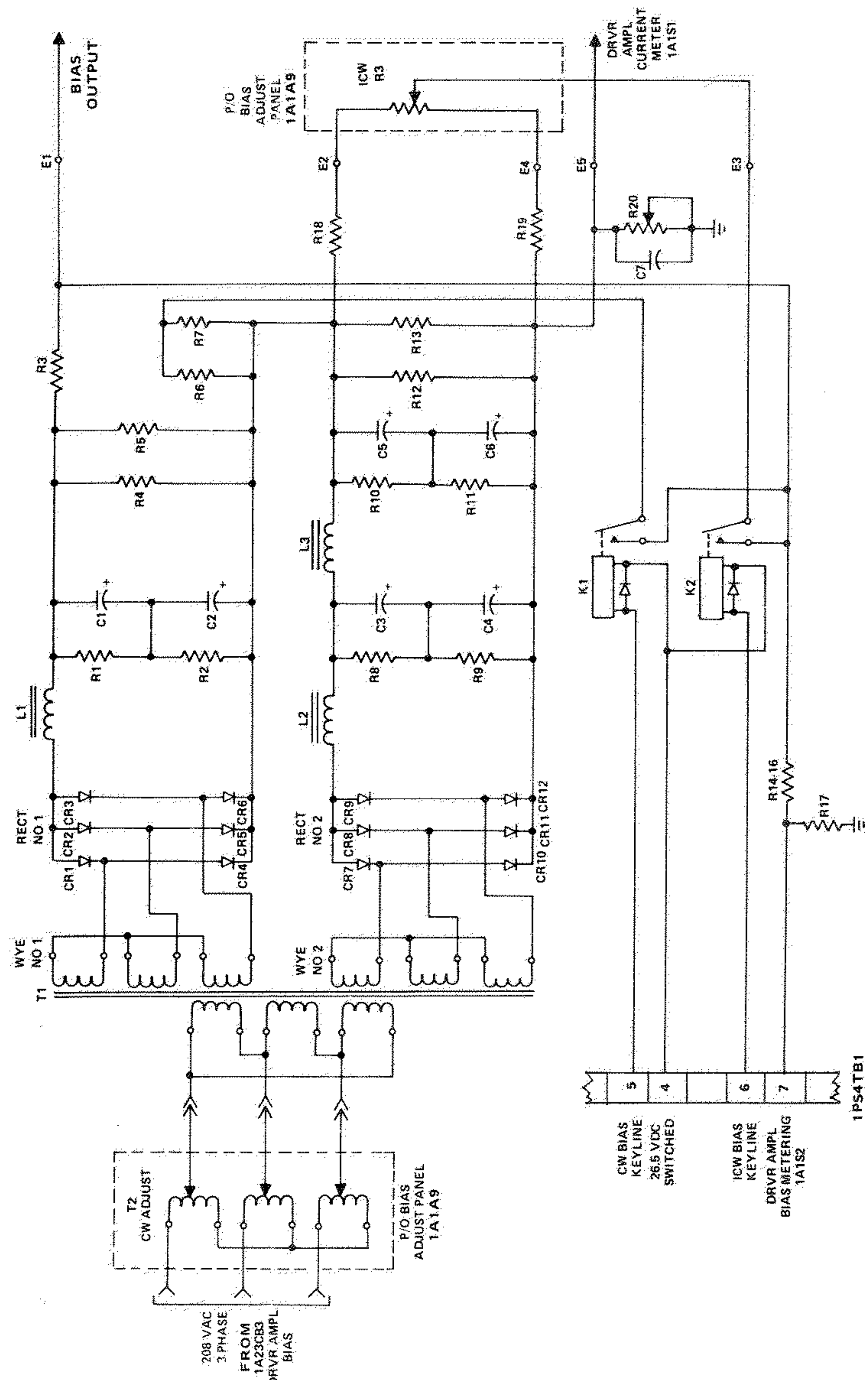


Figure 5-23. Driver Amplifier Bias Power Supply Simplified Schematic

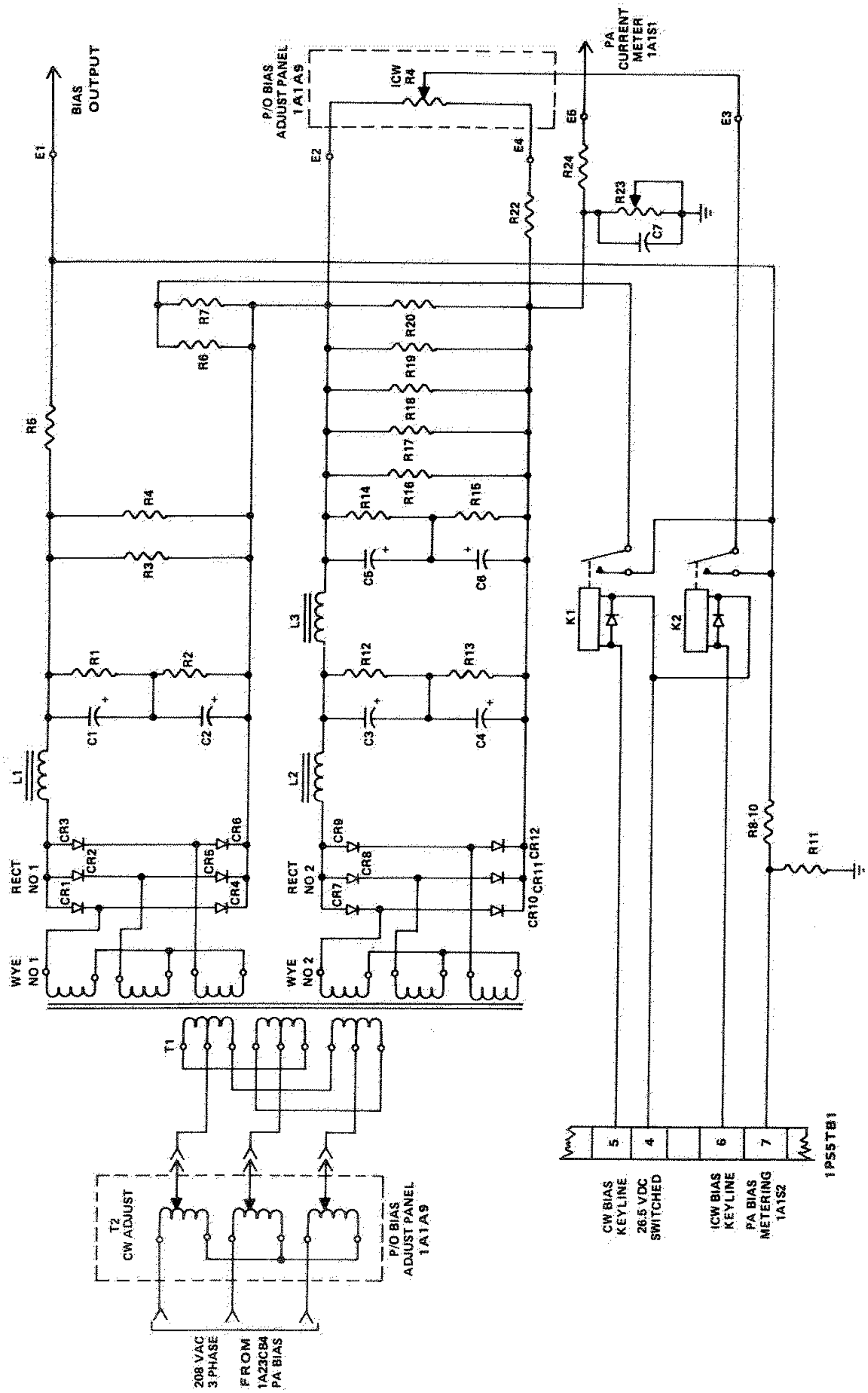


Figure 5-24. PA Bias Power Supply Simplified Schematic

100 ma grid current being indicated on test meter 1A13M7.

5-15.3 PA Bias. Source voltage for 1PS5 (Figure 5-24) is routed from the HVPS 208 V ac 3-phase regulated supply. Input voltage is applied to the Delta-connected primary of step-up transformer T1. Transformer T1 has dual, Wye-connected secondary windings identified in Figure 5-24 as WYE NO. 1 and WYE NO. 2. WYE NO. 1 provides stepped-up voltage to a 3-phase, full-wave bridge rectifier consisting of CR1 through CR6. The rectified output is filtered by a single-section, choke-input filter. This section of 1PS5 provides -320 V dc designed with a ripple content of -88.5 dB below the dc output. WYE NO. 2 provides input voltage to a 3-phase, full-wave bridge rectifier consisting of CR7 through CR12. The rectified output is filtered by a dualsection, choke-input filter. This section of 1PS5 provides -480 V dc with a ripple content of -149.5 dB below the dc output. The BIAS/RF INHIBIT switch on RF SIGNAL MONITORS panel 1A25, active only in local mode of operation, works in conjunction with controls on Bias Adjust panel 1A9. With BIAS/RF INHIBIT switch to CUTOFF, relays K1 and K2 are deenergized and -800 V dc cutoff voltage is applied to the PA tube control grid. With the switch in CW BIAS/DRIVE ENABLED, K1 is energized. Resistors R6 and R7 are connected to E1, and CW bias (-380 V dc ± 30 V dc) is applied to the driver tube control grid. Nominal CW bias of -380 V dc ± 30 V dc can be adjusted by positioning variable transformer 1A9T2. With the switch to ICW BIAS/DRIVE ENABLED, K2 is energized. Variable resistor 1A9R4 is placed in the circuit and can be adjusted for nominal ICW bias of -320 V dc ± 30 V dc. A bias sample voltage is obtained from the voltage divider made up of R8, R9, R10, and R11. That proportional voltage is applied to the test meter circuitry for bias voltage display. A grid current sample is obtained from variable resistor R23, connected between E5 and ground. When R23 is properly adjusted, 1 amp current through R23 results in 1 amp grid current being indicated on test meter 1A13M7.

5-16 HIGH VOLTAGE POWER SUPPLY (HVPS).

Figure 5-25 is a block diagram of the HVPS. Simplified schematics showing individual sections of the HVPS are referred to in following paragraphs. Circuit Diagrams Manual TO 31P6-2FPS118-83 contains detailed schematics of the HVPS. The HVPS requires the following four input power sources.

1. (V1)12.47kVac 3-phase from cabinet 3
2. 208 V ac 3-phase from facilities.
3. 120 V ac 1-phase from Ride Thru power source.
4. 120 V ac 1-phase from facilities (cabinet lights).

The HVPS furnishes power to the following areas of the transmitter.

1. Ride Thru power to transmitter logic and control circuitry.
2. Power for cabinet lights and convenience outlets.
3. Regulated 208 V ac 3-phase.
4. Three screen grid power supplies.
5. Three anode power supplies.

The front panel of the HVPS contains the following.

1. Circuit breakers for various power supplies.
2. Meters and meter switches for:
   a. Current and ac voltage monitoring.
   b. Screen and anode dc voltage supplies.

5-16.1 Primary Line Control and Monitoring. Figure 5-26 shows components that monitor transmitter voltages. Input power to the primary line control and monitor, 12.47 kVac, comes from cabinet 3. That power is used to develop anode voltages for IPA, driver, and PA anode power supplies. Incoming ac line current is sensed by current transformer 2T16 on phase-A and 2T17 on phase-C. Current samples are routed through VOLTMETER AMMETER HVAC Switch 2A2S2 and displayed on PRIMARY CURRENT Meter 2A3M4. Switch position 1 displays phase A, position 2 displays phase B, and position 3 displays phase C. Line to line voltage is sensed by transformers 2T14 and 2T15. Transformer 2T14 is connected across lines A and B. Transformer 2T15 is connected across lines B and C. Voltage samples are routed through VOLTMETER AMMETER HVAC Switch

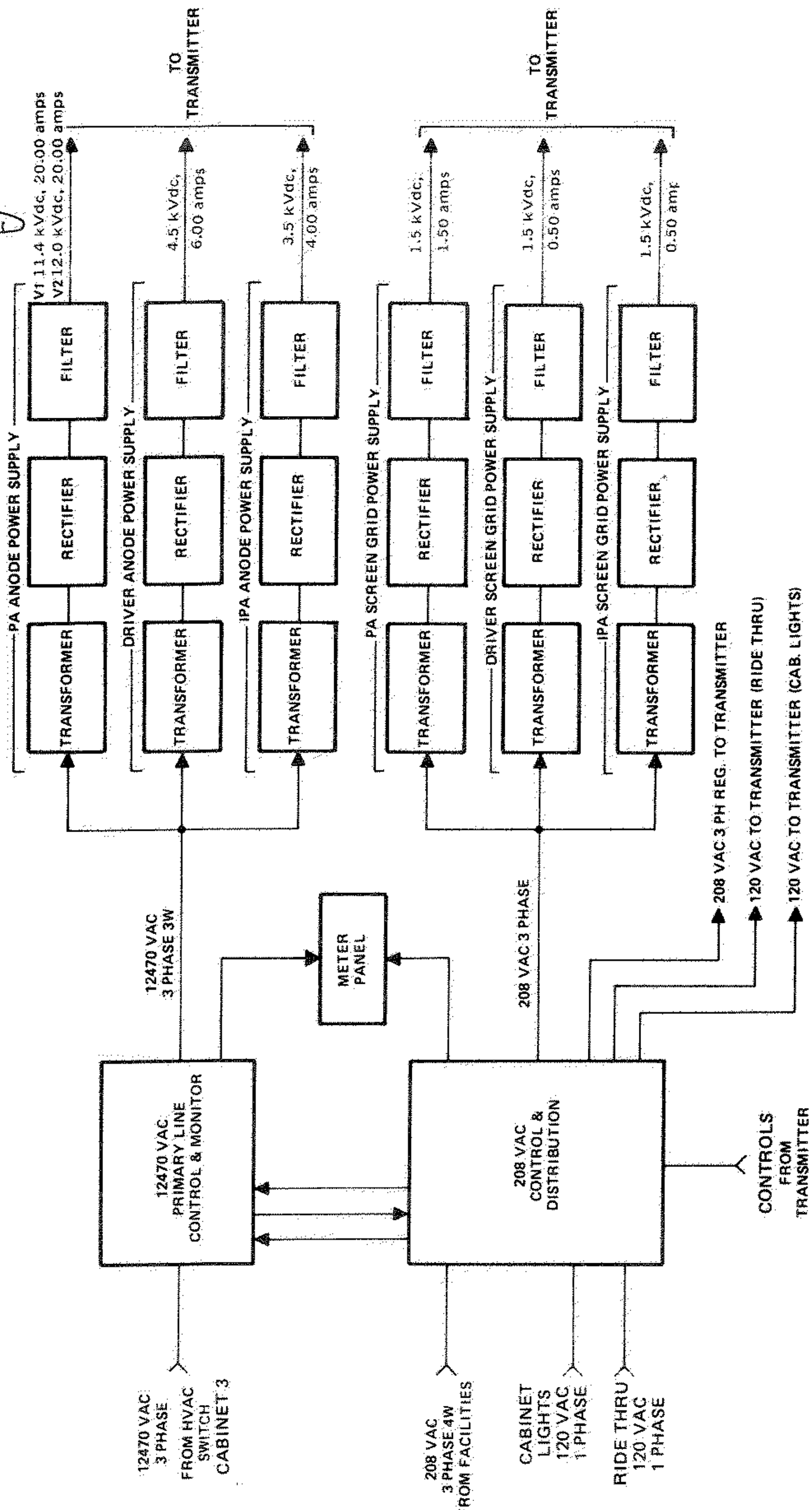


Figure 5-25. HVPS Block Diagram

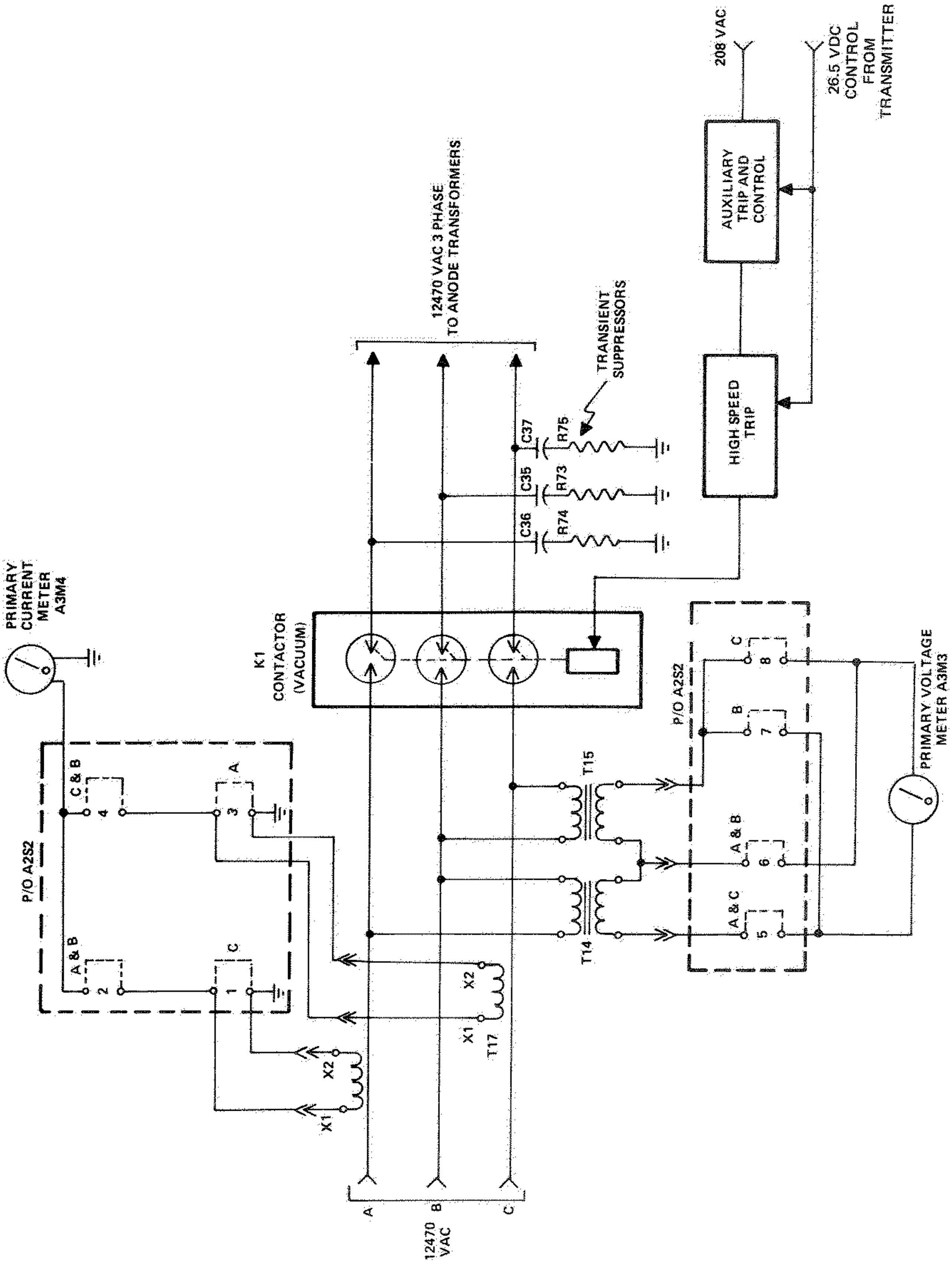


Figure 5-26. Primary Line Control and Monitor Simplified Schematic

2A2S2 and displayed on PRIMARY VOLTAGE Meter 2A3M3. Switch position 1 displays line A to B voltage, position 2 displays line B to C voltage, and position 3 displays line A to C voltage. Incoming 12.47 kVac is then routed through relay 2K1, a high-speed vacuum contactor. The high-speed trip circuit, controlled by 26.5 V dc, opens 2K1 in the event of a 208 V ac overload.

5-16.2 208/120 VAC Control and Distribution. Figure 5-27 shows power distribution to power supplies. Source voltage for the 208/120 V ac control and distribution circuits is from facility power. VOLTMETER AMMETER HVAC Switch 2A2S2 selects current and voltage to be monitored. Transformers 2T20, 2T21, and 2T22 monitor the three phases of the 208 V ac input. Transformers 2T1 and 2T2 sample voltage from the incoming 208 V ac lines. Transformer 2T23 provides a current sample of the uninterrupted Ride Thru input voltage to switch 2A2S4-1. Transformer 2A2T3 provides a Ride Thru input voltage sample to switch 2A2S4-4. Position 1 of VOLTMETER/AMMETER LVAC Switch 2A2S1 displays line A to B voltage on AUXILIARY VOLTAGE Meter 2A3M1 and phase A current on AUXILIARY CURRENT Meter 2A3M2. Position 2 displays line B to C voltage and phase B current. Position 3 displays line A to C voltage and phase C current. Ride Thru voltage and current can be displayed on meters 2A3M1 and 2A3M2 by positioning switch 2A2S1 to OFF and pressing switch 2A2S4. The 208 VAC INPUT Circuit Breaker 2A2CB1 protects all circuits that use 208 V ac 3-phase power. The 208 VAC REGULATOR Circuit Breaker 2A2CB2 protects circuits using the 208 V ac that is regulated by variable transformer 2T24. HV CONTACTOR Circuit Breaker 2A2CB3 protects HV Contactor 2K3. CROWBAR POWER SUPPLY Circuit Breaker 2A2CB4 protects Electronic Crowbar 2A1. PA SCREEN GRID SUPPLY Circuit Breaker 2A2CB5 protects the PA screen grid power supply. Relay 2A2K1 is the PA screen grid voltage contactor. DRVR AMPL SCREEN GRID SUPPLY Circuit Breaker 2A2CB6 protects the driver screen grid power supply. IPA SCREEN GRID SUPPLY Circuit Breaker 2A2CB7 protects the IPA screen grid power supply. Relay 2K2 is the contactor for voltages to driver and IPA screen grid circuits. The 120 VAC RIDE THRU INPUT Circuit Breaker 2A2CB8 protects logic and control circuits that use Ride Thru voltage. The 120 VAC AC OUTLETS 20A Circuit Breaker 2A2CB9 protects circuits for cabinet lights and convenience outlets. Convenience outlets are located in cabinets 1 and 2 to provide power for test equipment and small electrical tools. Voltage samples from the screen grid power supply and the anode power supply are routed to SCREEN/ANODE HVDC Switch 2A2S3. With the switch to POWER AMPL, PA screen grid voltage is displayed on meter 2A3M6 and PA anode voltage is displayed on meter 2A3M5. With the switch to DRIVER AMPL, driver screen grid voltage is displayed on meter 2A3M6 and driver anode voltage is displayed on meter 2A3M5. With the switch to INTERMED AMPL, IPA screen grid voltage is displayed on meter 2A3M6 and IPA anode voltage is displayed on meter 2A3M5.

5-16.3 Screen Grid Power Supplies. Theory of operation is identical for the three screen grid power supplies. Figure 5-28 shows the PA supply and is typical for the purpose of circuit explanation. Circuit Diagrams Manual TO 31P6-2FPS118-83 contains detailed schematics of the three power supplies. Source voltage for screen grid power supplies is 208 V ac 3-phase facility power. Input power is routed through contactor relay 2K1 for the PA and 2K2 for IPA and driver screen supplies. Primary windings on transformer 2T4 provide taps that can be changed about in order to obtain the required 1500 V dc power supply output. The output of 2T4 is rectified by a 3-phase, full-wave bridge rectifier made up of 2CR19, 2CR20, and 2CR21. Inductor 2L2 and capacitor 2C12 function as a choke-input filter to reduce ripple content of the rectified dc. Resistors 2R88 through 2R93 and 2R94 through 2R99 form a bleeder for the power supply. Connected across the voltage source, the bleeder improves voltage regulation by continuously drawing a fixed value of current. It also dissipates the residual filter capacitor charge after the transmitter is turned off. Resistors 2R108 through 2R111 and resistor 2R120 combine to form a voltage divider that provides a voltage sample. Resistor 2R182 provides a current sample. Resistor 2R173 provides a current sample to 1A25J4 on the RF SIGNAL MONITORS panel, as selected by switch 1A25S1. Resistor 2R85 is an excess-current sensor which energizes relay 2K12 to give a DC OVERLOAD. The trip point of 2K12 is set by resistor 2R82.

5-16.4 IPA/Driver Anode Power Supplies. Theory of operation is identical for IPA and driver anode power supplies. Figure 5-29 shows the driver supply and is typical for the purpose of circuit explanation.

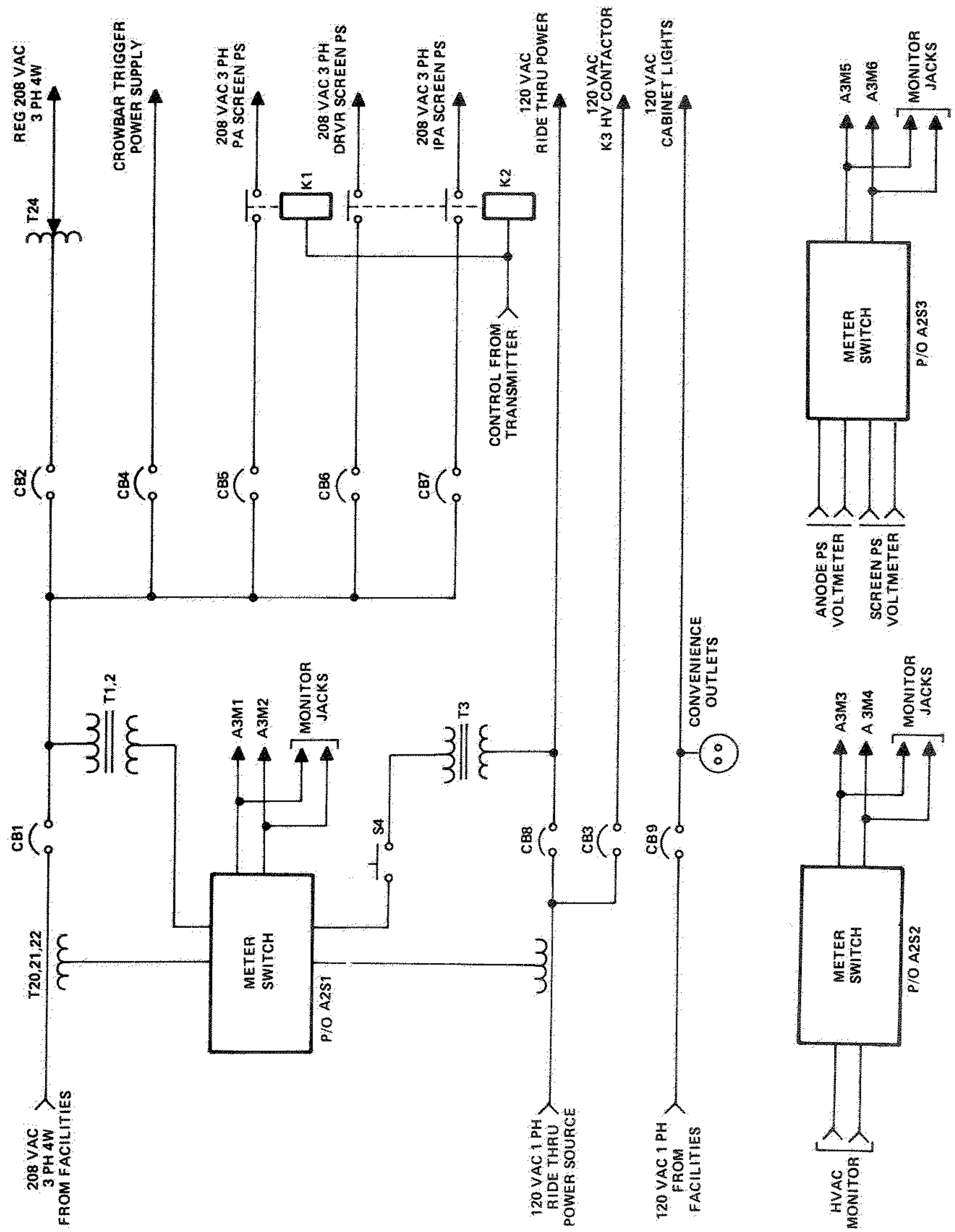


Figure 5-27. 208/120 VAC Power Distribution Simplified Schematic

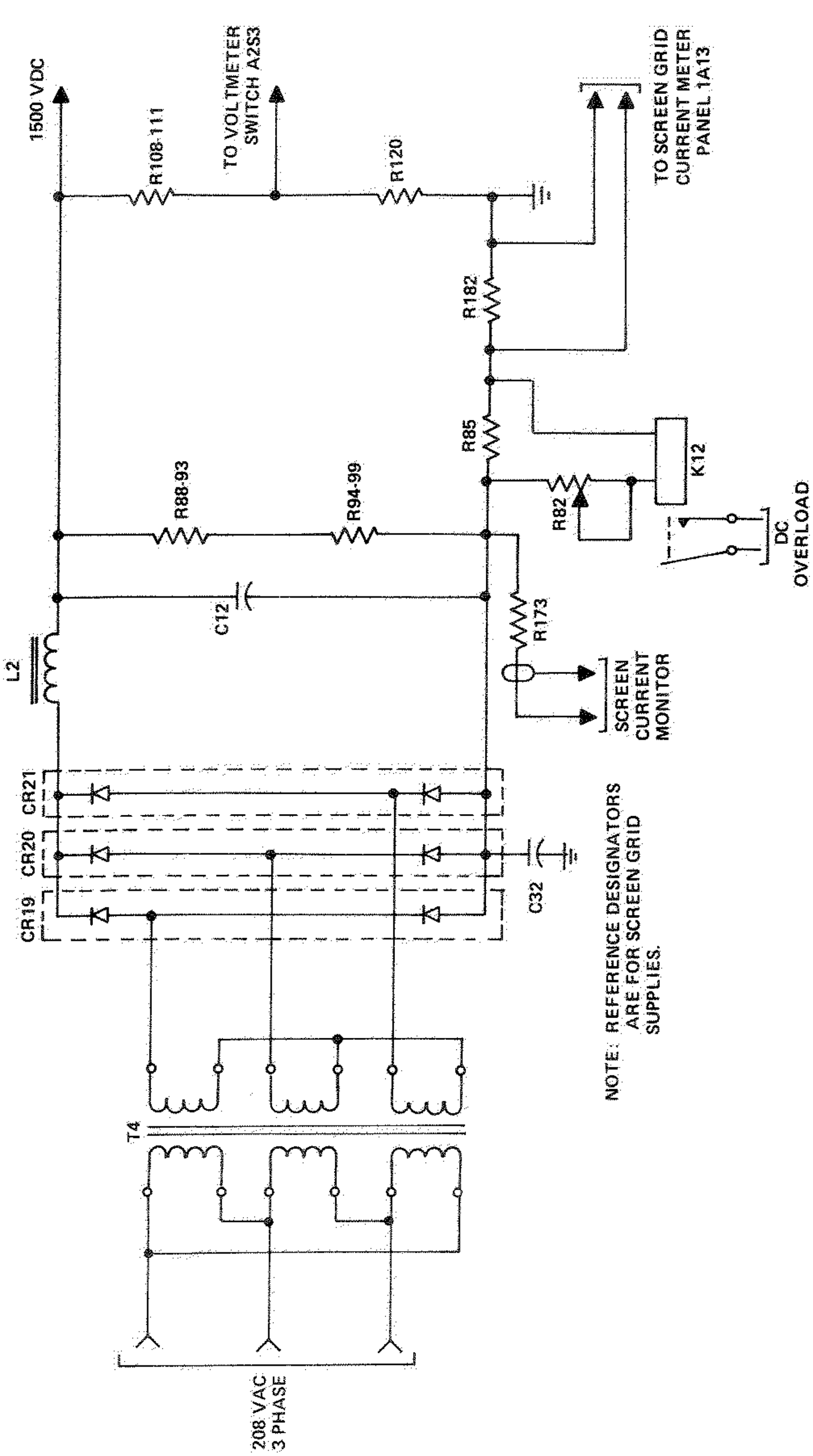


Figure 5-28. Screen Grid Power Supply Simplified Schematic

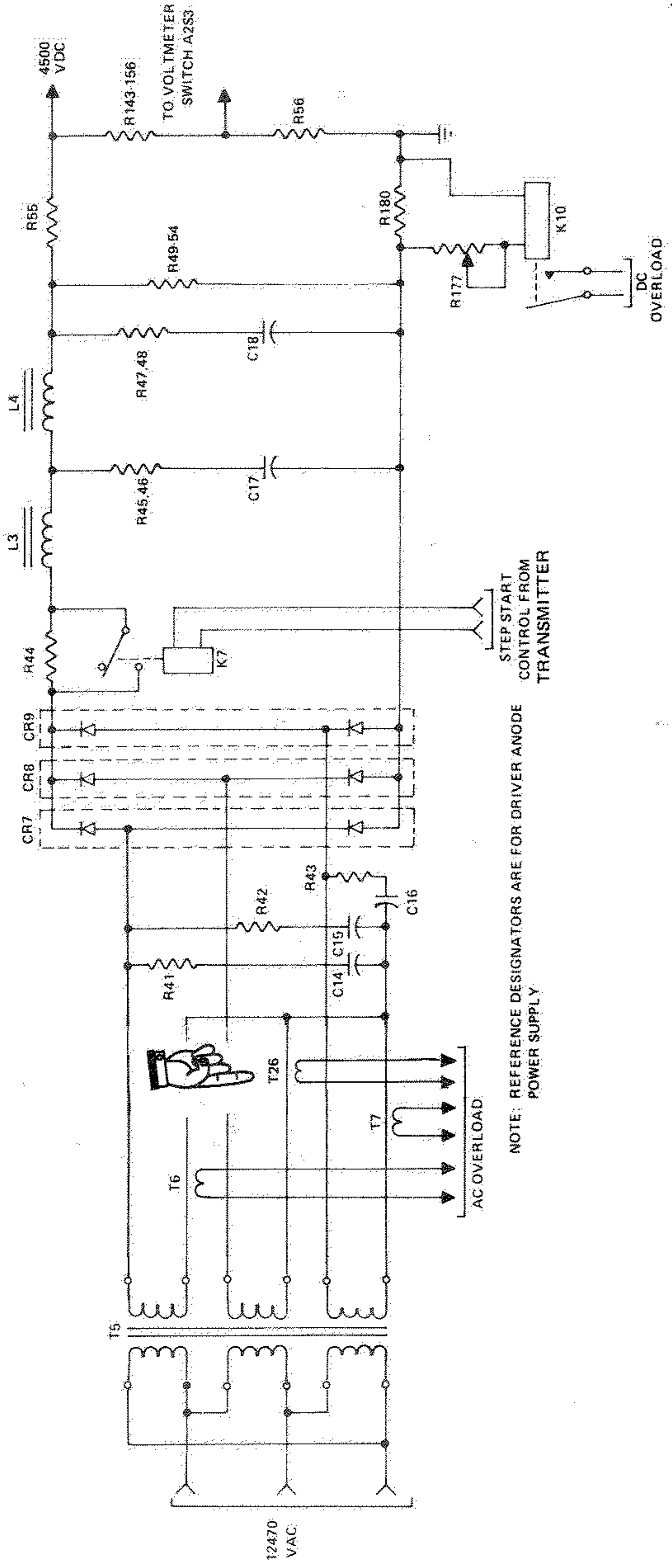


Figure 5-29. IPA/Driver Anode Power Supply Simplified Schematic

Circuit Diagrams Manual TO 31P6-2FPS118-83 contains detailed schematics of the power supplies. Input power is 12.47 kVac 3-phase from cabinet 3. Transformers 2T6, T26 and 2T7 provide a current sample to operate ac current overloads. Transformer 2T5 provides taps that can be changed to obtain the required power supply output. Required output is 4.5 kVdc for the driver and 3.5 kVdc for the IPA. Resistor-capacitor combinations 2R41 and 2C14, 2R42 and 2C15, and 2R43 and 2C16 are transient suppressors that protect rectifiers. The voltage output of 2T5 is rectified by 2CR7 through 2CR9 that make up a 3-phase full-wave bridge rectifier. Resistor 2R44 is in the circuit during start-up to limit current flow while filter capacitors charge. After start-up, 2K7 energizes and 2R44 is bypassed. Inductor 2L3, resistors 2R45 and 2R46, and capacitor 2C17 make up the first of a two-stage choke-input filter. The second stage is made up of inductor 2L4, resistors 2R47 and 2R48, and capacitor 2C18. The filter reduces ripple content of the rectified dc. Resistors 2R49 through 2R54, connected across the voltage source, form a bleeder for the power supply. The bleeder improves voltage regulation by continuously drawing a fixed value of current. The bleeder also dissipates the filter capacitor residual charge after the transmitter is turned off. Resistor 2R180 is an excess-current sensor which energizes relay 2K10 to give a DC OVERLOAD. The trip point of 2K10 is set by resistor 2R177. Resistors 2R143 through 2R156 and resistor 2R56 combine to form a voltage divider for the purpose of obtaining a voltage sample.

5-16.5 PA Anode Power Supply. Figure 5-30 is a simplified schematic of the anode power supply for the PA tube. Source voltage is 12.47 kVac 3-phase from cabinet 3. The required output of the power supply is 11.7 kVdc. Transformers 2T2, T25 and 2T3 provide a current sample to operate the ac current overloads. The output voltage of 2T1 is rectified by 2CR1 through 2CR6, which make up a 3-phase full-wave bridge rectifier. Inductor 2L1, resistors 2R10 through 2R17, and capacitors 2C4 through 2C11 form a choke-input filter that reduces ripple content of the rectified dc. Resistors 2R4 through 2R9 are in the circuit during start-up to limit current flow while filter capacitors charge. After start-up, 2K6 energizes and bypasses resistors 2R4 through 2R9. Resistors 2R18 through 2R35, connected across the voltage source, form a bleeder for the power supply. The bleeder improves voltage regulation by continuously drawing a fixed value of current. The bleeder also dissipates the charge remaining in filter capacitors when the transmitter is turned off. The first line of protection for the PA tube circuit is optical arc detection. If an arc occurs in the PA anode circuit or inside a PA output filter, RF is inhibited and the RF ARC fault lamp on CONTROL/STATUS panel 1A1 lights up. If an arc occurs inside the PA tube itself, Electronic Crowbar 2A1 immediately shorts the 11.7 kVdc anode supply to ground. That action diverts stored energy from the tube arc, turns off the PA anode power supply, and inhibits RF to the tube. The CROWBAR fault lamp on CONTROL/STATUS panel 1A1 lights up to indicate the crowbar has fired. Resistor 2R179 senses excessive current flow and energizes relay 2K9 to give a DC OVERLOAD. The trip point for 2K9 is set by resistor 2R176. Resistors 2R123 through 2R142 and resistor 2R240 form a voltage divider for the purpose of obtaining a voltage sample for display on meter 1A13M6 on Meter Assembly panel 1A13.

5-16.6 Electronic Crowbar (2A1). Figure 5-31 is a simplified schematic of the Electronic Crowbar, which protects the PA tube. Circuits Diagram Manual TO 31P6-2FPS118-83 contains a detailed schematic of the crowbar. The PA tube is protected from excessive current flow in its elements by circuits that sense overcurrent conditions and de-energize appropriate power supplies. Additional protection is needed, however, if the PA tube arcs internally. The Electronic Crowbar system provides that additional protection. The crowbar ignitron 2A1V1, type GL35391, is connected across the PA anode power supply and functions as a high-voltage, high-current shorting switch. The ignitron consists of an anode, a mercury pool cathode, and an ignitor (trigger) electrode contained in an envelope with an insulating top cap. A heat lamp located above the ignitron creates a temperature differential between the anode and cathode to condense the mercury into the cathode pool. That is necessary for the ignitron to hold off voltage and to function with reliability. When a PA internal arc occurs excessive current flow through 2R179, located in the PA anode power supply, develops a voltage that is routed to the crowbar circuit at input jack 2A1J1. Resistors 2A1R7 and 2A1R8 are current-limiting resistors that protect diode

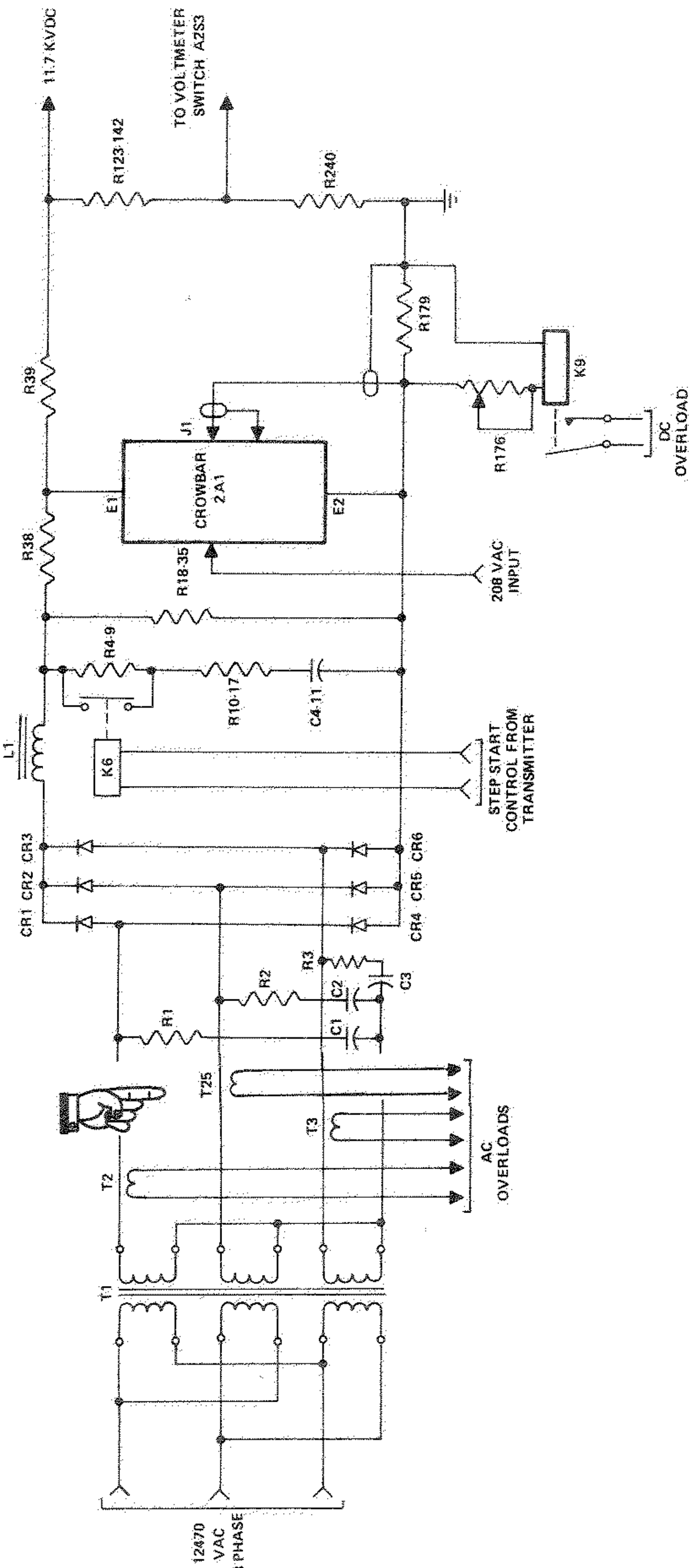


Figure 5-30. PA Anode Power Supply Simplified Schematic

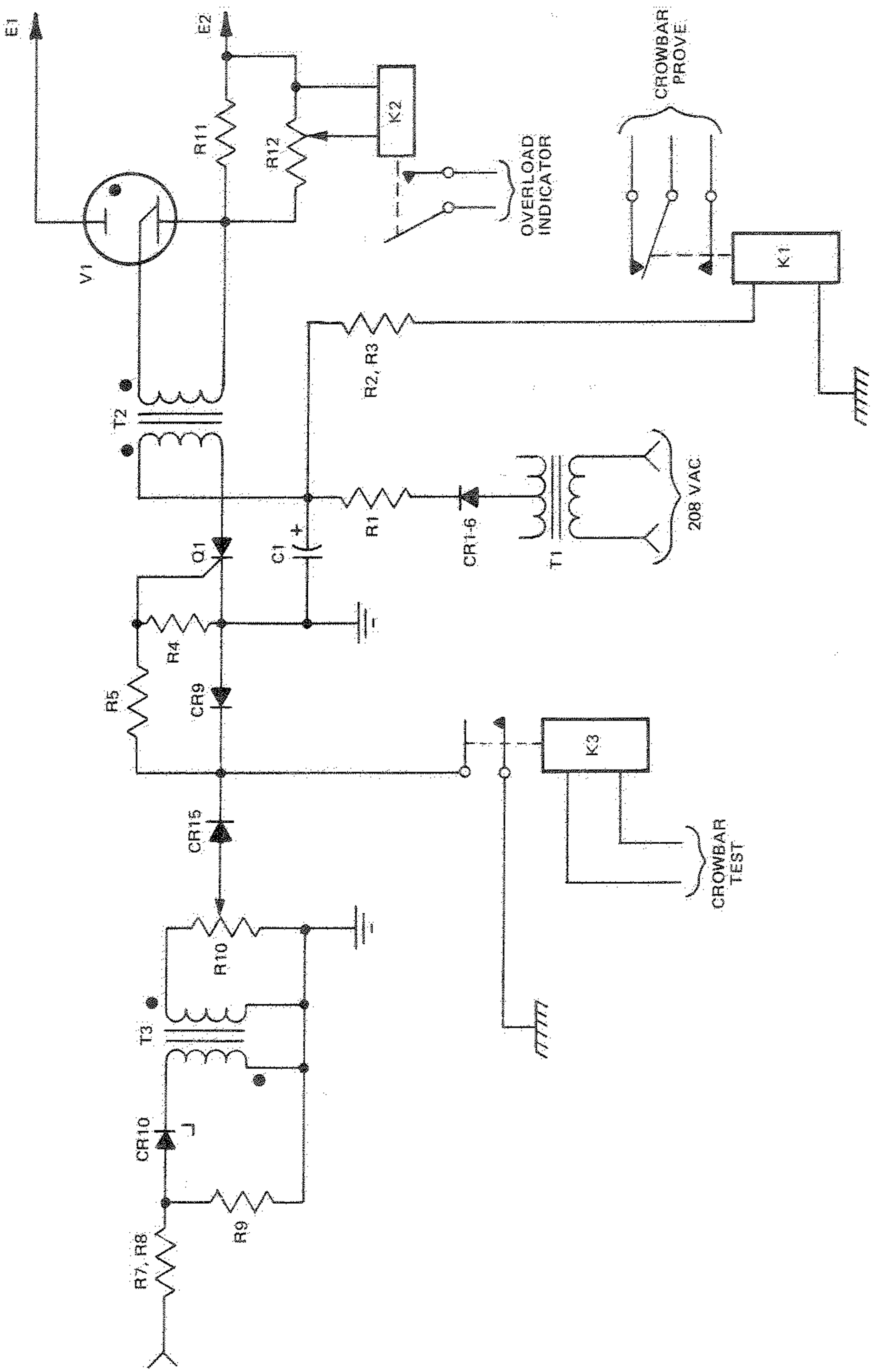


Figure 5-31. Electronic Crowbar Simplified Schematic

2A1CR10 from excessive input levels. An input impedance of 50 ohms is presented by resistors 2A1R7, 2A1R8, and 2A1R9. Diode 2A1CR10 is a transient suppressor diode with a 5.8 working voltage and 143-ampere surge current rating that adds noise immunity to the crowbar circuit by not allowing a pulse less then 5.8 V dc to pass. Transformer 2A1T3 is a pulse transformer with a 2:1 winding ratio, wired with opposing polarities to give a positive-going pulse to diode 2A1CR15. Resistor 2A1R10 is adjusted so an 11-volt negative pulse at 2A1J1 will fire the crowbar. The pulse gates on SCR 2A1Q1, which drives pulse transformer 2A1T2. Capacitor 2A1C1 is pre-charged to approximately 800 V dc from the 208 V ac 3-phase, rectified by diodes 2A1CR1 through 2A1CR6. A voltage prove circuit, 2A1R2, 2A1R3, and 2A1K1, confirms the 800-volt trigger. That voltage must be proved before high voltage can be applied. The output pulse from 2A1T2 is an 800 V dc, 130 amp, 10 microsecond pulse that causes the ignitron to ionize and establishes a very low impedance path between the 12 kVdc anode supply bus and its negative return. Momentarily, a short is created between the tube anode and ground. Current through 2A1R11 and 2A1R12 trips relay 2A1K2 which lights up the CROWBAR fault lamp on CONTROL/STATUS panel 1A1. Relay 2A1K2 also trips the PA contactor that furnishes ac power to plate and screen grid power supplies for IPA, driver, and PA tubes. Variable resistor 2A1R12 adjusts the trip level of 2A1K2.

5-16.7 AC Overload Protection. Figure 5-32 shows circuitry that provides the transmitter with ac overload and imbalance protection. Overload and imbalance is sampled from three phases of the 3-phase power to anode power supplies of the IPA and driver. Current samples are obtained from current transformers placed in line with each phase output line of the power step-down transformer for each of the three anode power supplies. When an ac overload or imbalance occurs, a current transformer produces an output that drives an amplifier in Transformer Current Monitor CCA A5, A6 or A7 for protection of T1, T5, or T9 respectively. The amplifier energizes ac overload relay as described in paragraph 5-12.5. The overload relay lights up the ANODE AC fault lamp on the CONTROL/STATUS panel.

5-17. HIGH VOLTAGE AC SWITCH

The high voltage ac switch cabinet 3 contains a fused (3F1 through 3F3), 12.47 kV disconnect switch (3S1) that applies the RPIE high voltage ac source to the HVPS. Surge suppressors 3RV1 through 3RV3 are located in cabinet 3 of transmitter 12. The suppressors provide line-to-line transient protection for the twelve transmitters of each segment.

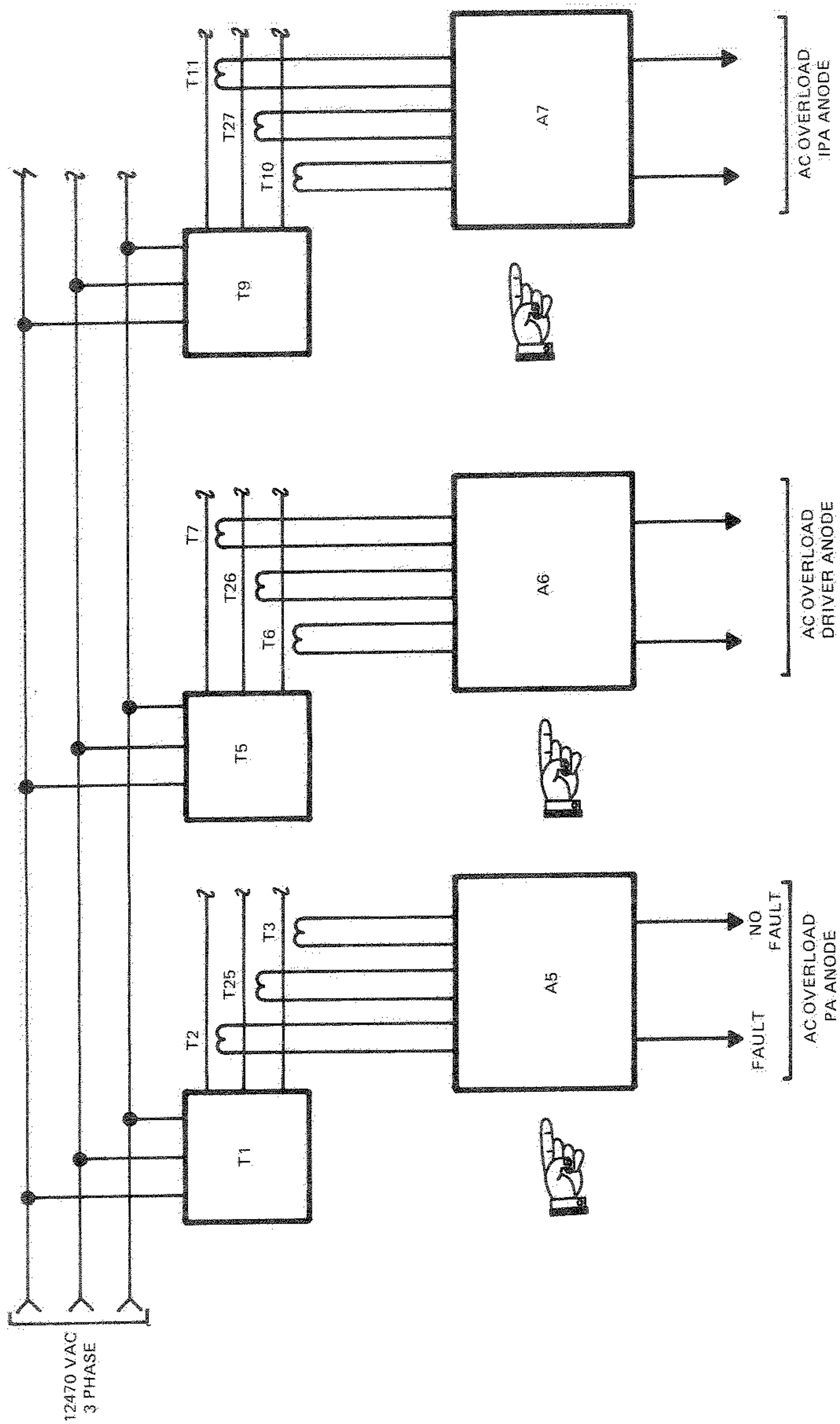


Figure 5-32. Anode AC Overload Protection Simplified Schematic

5-18 TRANSMITTER COOLING WATER.

1. Resistivity: >1.0 Megohom-cm minimum

3. pH Factor: 5.5 to 8.0

Section III. FUNCTIONAL MECHANICAL OPERATION

5-17 TRANSMITTER COOLING AIR.

Total cooling air flow for cabinets 1 and 2 is 3610 to 5710 cfm through 0.84 to 1.25 inches of water-pressure drop, depending on transmitter site altitude (Table 5-1). Temperature of inlet air should not be less than 40° F or more than 105° F with relative humidity of 10 percent to 95 percent. Major sources of heat requiring cabinet ventilation are high-voltage power supplies and high-power bandpass filters. Approximately one-half the estimated total 20 kW heat is dissipated by high-voltage power supply current-limiting resistors, bleeders, and related components. The remainder is dissipated in cabinet 1. An adjustable baffle in the air ducting of cabinet 2 directs the proper amount of air to cabinets 1 and 2. Figure 5-33 shows RPIE cooling air circulation through the two cabinets.

5-18 TRANSMITTER COOLING WATER.

Cooling water for amplifier tubes and other heat-producing components shall be conditioned to the following specifications:

1. Resistivity: >0.5 Megohm-cm minimum
2. Particle size: 10.0 Micron maximum
3. pH Factor: 5.5 to 6.0

Rate of water flow is 51 gpm minimum with capability of 184-kW heat dissipation. Transmitter heat loads are:

1.	4CW150,000E (max dissipation)	130.0	kW
2.	4CW25,000B (max dissipation)	15.0	kW
3.	4CW10,000B (max dissipation)	7.5	kW
4.	Power Ampl Output Tuning Circuit	10.0	kW
5.	Power Ampl Grid Network	0.75	kW
6.	Power Ampl Grid Swamping R	6.0	kW
7.	Driver Output Tuning Circuit	1.5	kW
8.	Driver Grid Swamping R	3.0	kW

* Total estimated heat load in cooling water = 173.75 kW

Valves on INLET and OUTLET lines are used to adjust water pressure. Inlet water pressure is to be adjusted for 80 to 88 psig and outlet pressure 5 to 9 psig. Total flow is affected more by changes in outlet than inlet pressure. Air pockets may develop in inlet water and cause pipe vibration. A bleeder valve on the inlet water line is provided to purge the line of air.

5-18.1 <u>Water Flow Branches and Components.</u> Figure 5-34 shows the cooling water loop, its two accumulators, and proper water flow in the branches. One accumulator is located at the supply manifold. The other is in the cooling water line to driver and IPA grid dummy loads. Accumulators absorb water surges to protect system components. Flow control valves are provided for all but the last branch in the loop. Pressure sensors in each branch detect changes of water pressure and convert them to proportional changes in output voltages. Those voltage changes are routed to Water Flow Card 1A1A10 and cause the FLOW lamp to light up if cooling water pressure is abnormal. Cooling water is circulated through the three vacuum tubes to dissipate heat from the anodes. Cooling water is also applied to filament bases of IPA and driver tubes. Temperature sensors in each tube cooling branch provide overtemperature protection. Switch contacts of the temperature sensors open at 170° F (77° C) and close at 150° F (66° C). Outputs of temperature sensors are routed to the water flow card and cause fault lamps to light up when overtemperature conditions occur. Return lines from each of the cooling branches feed return manifold and outlet water lines.

5-19 TRANSMITTER PNEUMATIC AIR.

Compressed air places bandpass filters in circuits and operates antenna/dummy load transfer switches. The air is routed by solenoid-operated pneumatic valves controlled by a +26.5 V dc signal. Compressed air shall meet the following specifications:

1. Particle size no larger than 50 micron.
2. Dry to 0° dew point.

Table 5-1. Transmitter Cooling Air

Altitude (1000 ft)	HVPS Inlet (100 SCFM)	HVPS[1] Return SCFM (100 SCFM)	XMTR[1] Return (100 SCFM)	Pressure HVPS inlet to either HVPS or XMTR return (inches water)
0-1	36-42	9.6-16.0	26.5-28.0	0.84-0.96
1-2	38-44	10.0-17.0	27.7-29.2	0.88-1.00
2-4	41-47	10.8-18.3	29.8-31.4	0.95-1.08
4-6	44-50	11.6-19.6	31.9-33.6	1.02-1.16
6-8	47-53	12.5-21.0	34.2-36.1	1.10-1.25

COOLING AIR: 40°F to 105°F at 10% to 95% Relative Humidity (Inlet)

MAXIMUM DISSIPATION: HVPS 10.0 kW

XMTR 7.5 kW

[1]Actual HVPS and XMTR cooling requirements shown. All air is fed into the HVPS; ducts are adjusted to control air diverted on through to the XMTR.

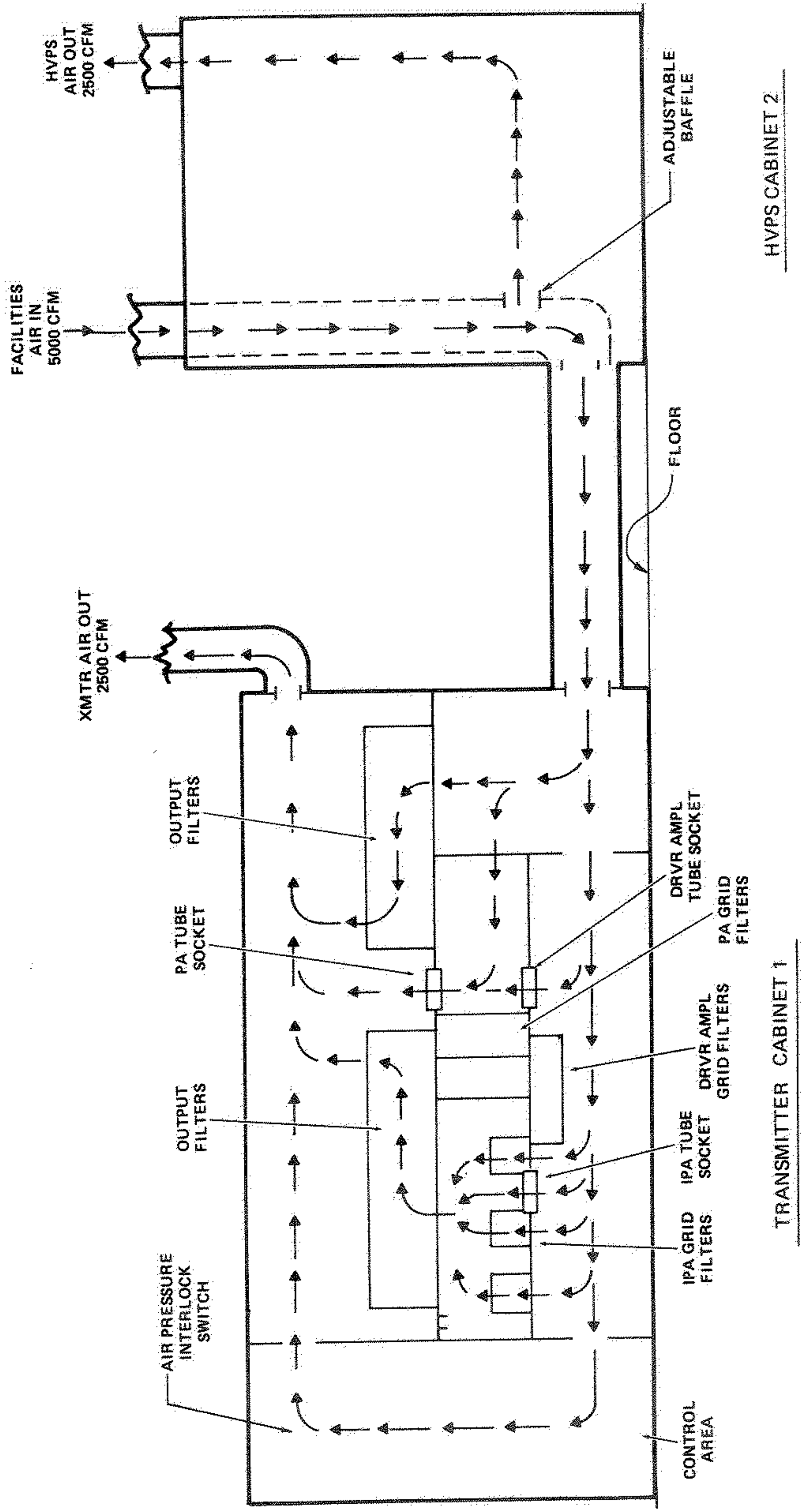


Figure 5-33. Cooling Air Flow

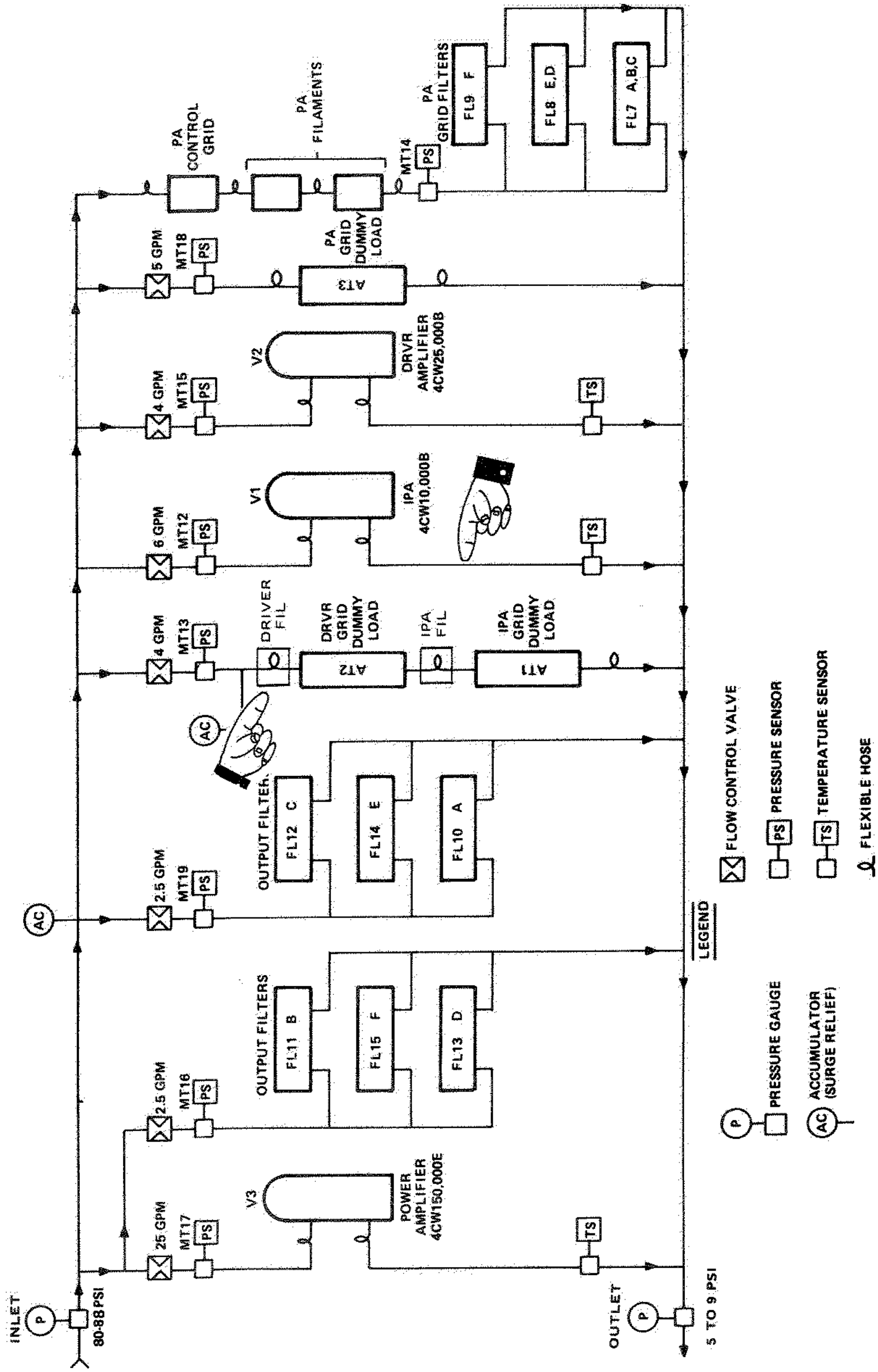


Figure 5-34. Water Flow Control and Monitor Diagram

3. Oil content of a paraffin base mineral oil.

Oil is inserted either into the primary air supply during air usage at the rate of one drop per hour, the total requirement for the 12 transmitters or by individual injectors at each transmitter.

5-19.1 Operation of Pneumatic Valves. Figure 5-35 shows system components locations. Compressed air enters the transmitter through an air supply manifold and is monitored by a pressure sensor. Fifteen solenoid-operated pneumatic valves are located along the manifold. The supply inlet port of each is connected to the air supply manifold. The air output ports supply air for control of bandpass filters, PA B+ switches, and antenna/dummy load transfer switches and their grounding switches. Except for 1L54 and 1L55, which are exhausted to atmosphere, all output exhaust ports are connected to the air return manifold. Reservoir oil level is checked by a dipstick in the return air manifold and an oil drain valve is provided for lowering the oil level as needed. Solenoids 1L18 through 1L28 are operated by a +26.5 V dc signal from the diode matrix, initiated by frequency band selection. Solenoid 1L50 is operated by a +26.5 V dc signal when OUTPUT CONTROL Switch 1A1S13 is positioned to LOCAL. When energized, solenoid 1L50 supplies air to move all six antenna/dummy load transfer switches to dummy-load positions. Solenoid 1L53 is operated by a +26.5 V dc signal when the OUTPUT CONTROL switch is to REMOTE. When energized, solenoid 1L53 supplies air to move all antenna/dummy load transfer switches to antenna positions. The +26.5 V dc that operates solenoids 1L54 and 1L55 is present under two conditions. The first condition begins when the OUTPUT CONTROL switch is positioned to REMOTE, and ends when all six antenna transfer prove switches are activated. The second condition begins when the OUTPUT CONTROL Switch is positioned to LOCAL, and ends when all six dummy load transfer prove switches are activated. When energized, solenoids 1L54 and 1L55 provide air to close all six antenna port grounding switches inside Antenna/Dummy Load Transfer Switches 1S32 through 1S37.

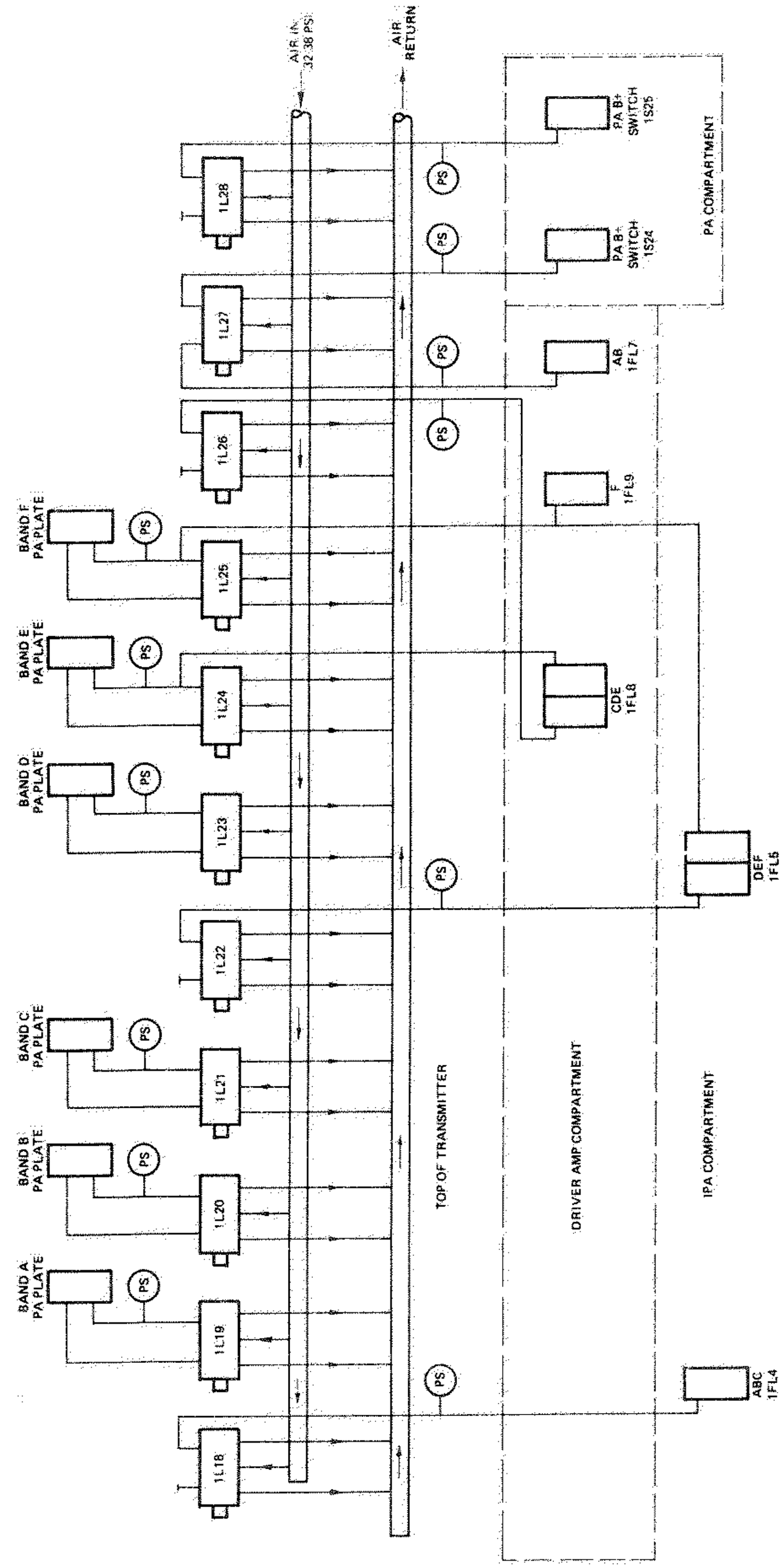


Figure 5-35. Air Pressure System Diagram (Sheet 1 of 2)

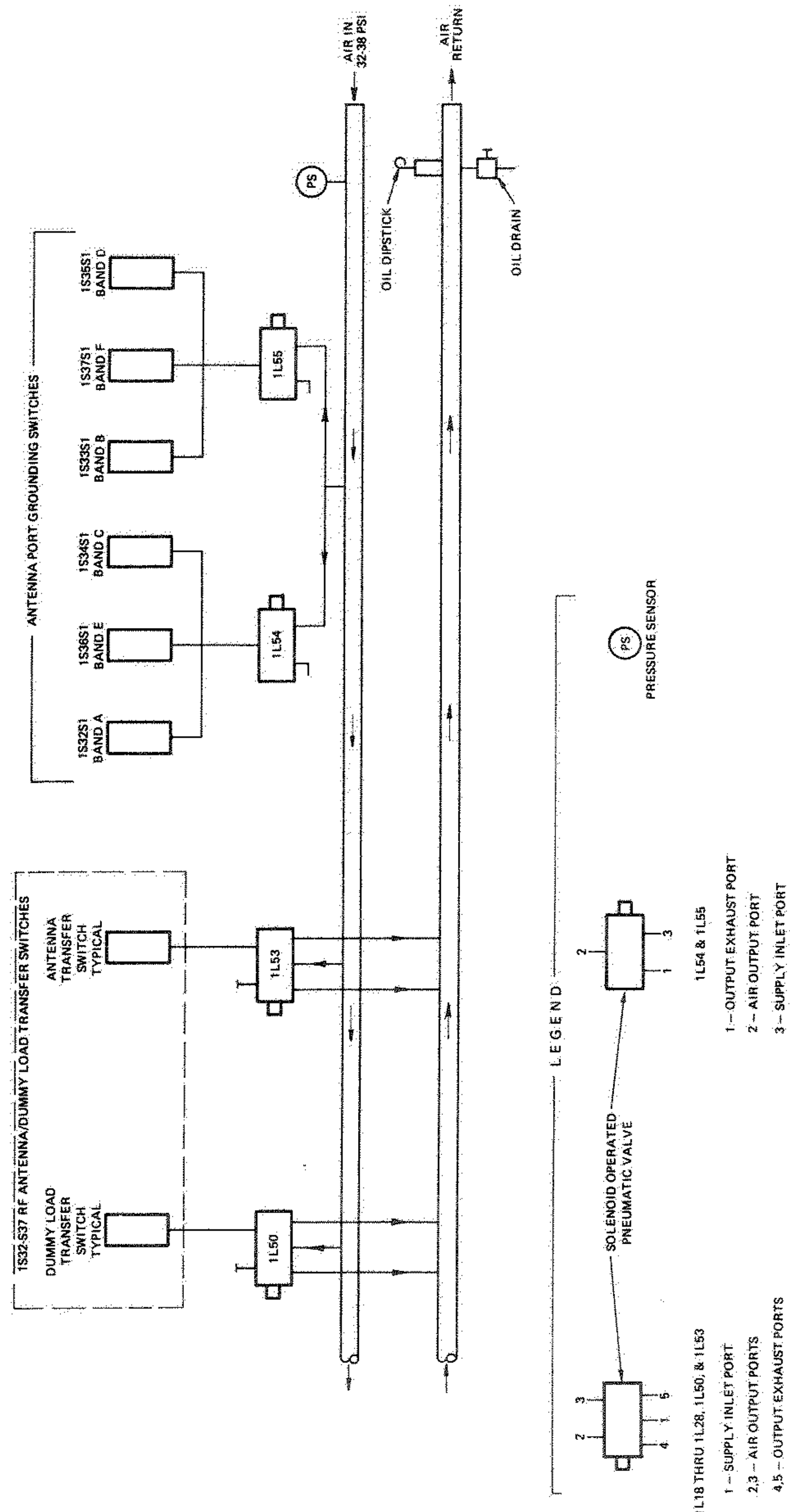


Figure 5-35. Air Pressure System Diagram (Sheet 2 of 2)

CHAPTER 6

MAINTENANCE

Section I. ORGANIZATIONAL MAINTENANCE

6-1 INTRODUCTION.

This section provides procedures for organizational maintenance of the T-1524 and 1524A Transmitter Group of the AN/FPS-118(V) radar system. These procedures are performed on-site, and the maintenance concept is primarily based on unattended automatic operation and Performance Monitoring/Fault Location (PM/FL). Repair is accomplished by replacing faulty Line Replaceable Units (LRUs), which are then transported to the appropriate maintenance facility for repair. Maintenance data provided in this section includes: safety procedures; system access and exit procedures; a preventive maintenance program; troubleshooting concepts; checks, tests, and alignment procedures; inspection, cleaning, and lubrication procedures; general repair procedures; and LRU removal and installation procedures.

6-1.1 Equipment Required but not Supplied. Equipment required, but not supplied, is identified in Table 1-4.

6-1.2 Consumable Materials. Consumable materials required, but not supplied, are identified in Table 6-1.

6-1.3 Changes or Revisions. Changes to this document will be published when necessary to add, delete, revise, or change requirements. Such changes or revisions will be based on factual data resulting from hands-on experience with equipment. Recommended changes shall be submitted on AFTO Form 22, through command headquarters in accordance with TO 00-5-1.

6-2 ACCESS AND EXIT PROCEDURES.

6-2.1 General. The three cabinets are accessed through hinged doors and protective cover assemblies. Cabinets 1 and 2 provide protection against system hazards through interlock circuits that prevent application of high voltage when an INTERLOCK OPEN condition exists. In addition, a lock-and-key system (Figure 6-1) protects against 12.47 kVac being applied while cabinets 2 and 3 are being accessed. Two sets of keys are provided. One set shall be in place as shown in Figure 6-1 and the other shall be in the custody of the Site Supervisor. Replacement of lost and/or damaged keys shall be a Site Supervisor responsibility. Table 6-2 provides necessary information for key replacement.

Table 6-1. Consumable Materials Required

Item	Nomenclature	Type/ Part No.	Manufacturer	CAGE[1]
1	Alcohol, Denatured	O-E-00760	Military	81348
2	Grease, multipurpose	630-2	Lubriplate	73219
3	Grease, high-temp	930-AAA	Lubriplate	73219
4	Handpad, silicon carbide (very-fine grade)	851	Bear-Tex	59401
5	Rags, Wiping, Cotton	DDD-R-30	Military	81348
6	Tape, Masking, 1"	A-A-883	Military	81348
7	Compound, Thermal Joint	120 or Equiv.	Wakefield Engineer	90372
8	Solder	282	Kester	75279
9	Cotton Swabs	Any	Any	NA
10	Tape, thread sealing	9975260 GT66		06090
11	Plank, 2" x 4" x 6 foot	NA	NA	NA
12	Plank 2" x 4" x 1 foot	NA	NA	NA
13	Cleaning Solution	565	Alpha Metals Inc.	96613

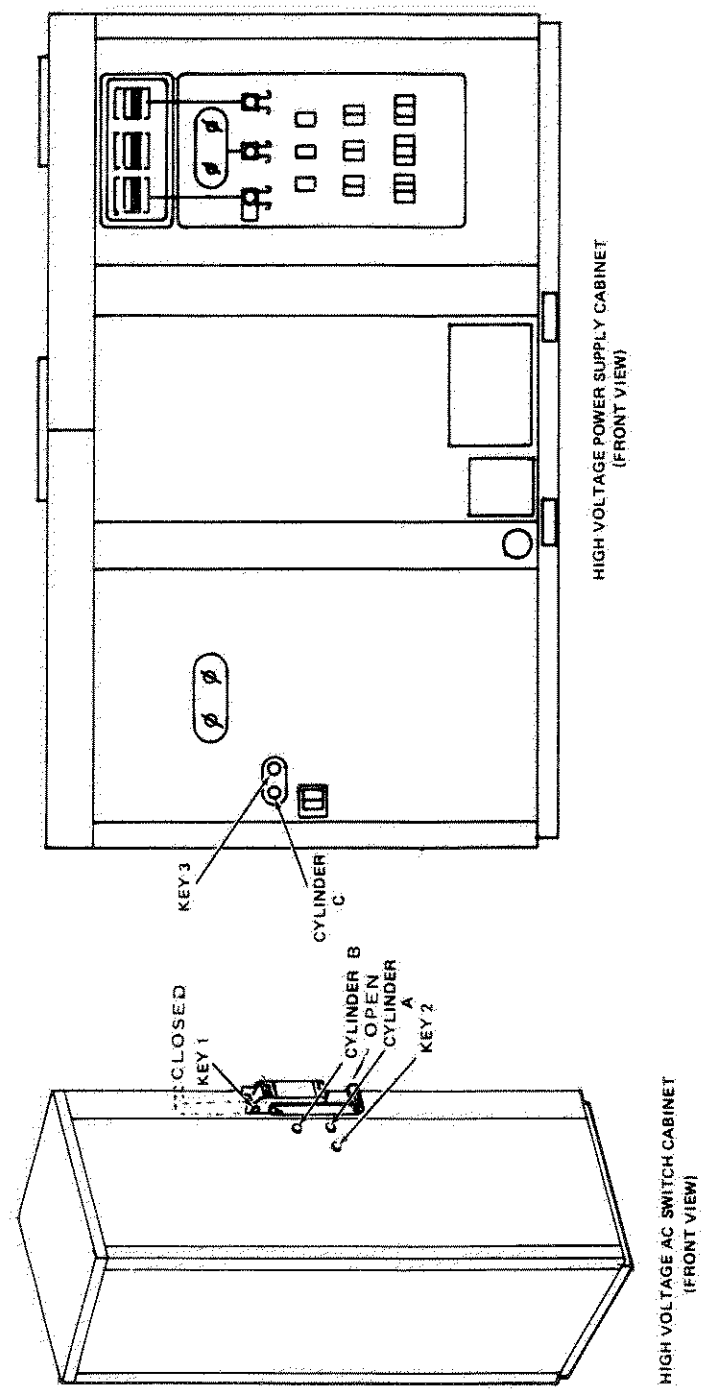


Figure 6-1. Cabinet Access Lock-and-Key System

Table 6-2. Cabinet Access Key Information

Mfr. PN	Vendor Type	Key Release with Bolt Extended/ Withdrawn	Key Interchange	Key No.	Remarks
			XMTR 1		
412-0054	SF	E	C01(357055)	18	HV Disconnect Switch
412-0055	M2SD	E	A01(357056)	11	HVPS Main Door
		W	B01	17	
412-0056	SD	E	B01(357057)	17	HVPS RH Door
412-0057	SD	E	A01(357058)	11	HV Switch Door
412-0102	M2SF	E	A01(TBD)	18	HV Switch Door
		W	C01		HV Switch Door
			XMTR 2		
412-0058	SF	E	C02(357059)	29	HV Disconnect Switch
412-0059	M2SD	E	A02(357060)	13	HVPS Main Door
		W	B02	28	
412-0060	SD	E	B02(357061)	28	HVPS RH Door
412-0061	SD	E	A02(357062)	13	HV Switch Door
412-0103	M2SF	E	A02(TBD)	29	HV Switch Door
		W	C02		HV Switch Door
			XMTR 3		
412-0062	SF	E	C03(357063)	46	HV Disconnect Switch
412-0063	M2SD	E	A03(357064)	32	HVPS Main Door
		W	B03	45	
412-0064	SD	E	B03(357065)	45	HVPS RH Door
412-0065	SD	E	A03(357066)	32	HV Switch Door
412-0104	M2SF	E	A03(TBD)	46	HV Switch Door
		W	C03		HV Switch Door
			XMTR 4		
412-0066	SF	E	C04(357067)	10	HV Disconnect Switch
412-0067	M2SD	E	A04(357068)	48	HVPS Main Door
		W	B04	09	

Table 6-2. Cabinet Access Key Information - CONT.

Mfr PN	Vendor Type	Key Release with Bolt Extended/ Withdrawn	Key Interchange	Key No.	Remarks
412-0068	SD	E	B04(357069)	09	HVPS RH Door
412-0069	SD	E	A04(357070)	48	HV Switch Door
412-0105	M2SF	E W	A04(TBD) C04	10	HV Switch Door HV Switch Door
			XMTR 5		
412-0070	SF	E	C05(357071)	21	HV Disconnect Switch
412-0071	M2SD	E	A05(357072) B05	08 19	HVPS Main Door
412-0072	SD	E	B05(357073)	19	HVPS RH Door
412-0073	SD	E	A05(357074)	08	HV Switch Door
412-0106	M2SF	E W	A05(TBD) C05	21	HV Switch Door HV Switch Door
			XMTR 6		
412-0074	SF	E	C06(357075)	25	HV Disconnect Switch
412-0075	M2SD	E W	A06(357076) B06	24 23	HVPS Main Door
412-0076	SD	E	B06(357077)	23	HVPS RH Door
412-0077	SD	E	A06(357078)	24	HV Switch Door
412-0107	M2SF	E W	A06(TBD) C06	25	HV Switch Door HV Switch Door
			XMTR 7		
412-0078	SF	E	C07(357079)	27	HV Disconnect Switch
412-0079	M2SD	E W	A07(357080) B07	33 26	HVPS Main Door
412-0080	SD	E	B07(357081)	26	HVPS RH Door
412-0081	SD	E	A07(357082)	33	HV Switch Door
412-0108	M2SF	E W	A07(TBD) C07	27	HV Switch Door HV Switch Door

Table 6-2. Cabinet Access Key Information - CONT.

Mfr PN	Vendor Type	Key Release with Bolt Extended/ Withdrawn	Key Interchange	Key No.	Remarks
			XMTR 8		
412-0082	SF	E	C08(357083)	42	HV Disconnect Switch
412-0083	M2SD	E	A08(357084)	34	HVPS Main Door
		W	B08	41	
412-0084	SD	E	B08(357085)	41	HVPS RH Door
412-0085	SD	E	A08(357086)	34	HV Switch Door
412-0109	M2SF	E	A08(TBD)	42	HV Switch Door
		W	C08		HV Switch Door
			XMTR 9		
412-0086	SF	E	C09(357087)	44	HV Disconnect Switch
412-0087	M2SD	E	A09(357088)	37	HVPS Main Door
		W	B09	43	
412-0088	SD	E	B09(357089)	43	HVPS RH Door
412-0089	SD	E	A09(357090)	37	HV Switch Door
412-0110	M2SF	E	A09(TBD)	44	HV Switch Door
		W	C09		HV Switch Door
			XMTR 10		
412-0090	SF	E	C10(357091)	05	HV Disconnect Switch
412-0091	M2SD	E	A10(357092)	39	HVPS Main Door
		W	B10	04	
412-0092	SD	E	B10(357093)	04	HVPS RH Door
412-0093	SD	E	A10(357094)	39	HV Switch Door
412-0111	M2SF	E	A10(TBD)	05	HV Switch Door
		W	C10		HV Switch Door
			XMTR 11		
412-0094	SF	E	C11(357095)	07	HV Disconnect Switch
412-0095	M2SD	E	A11(357092)	50	HVPS Main Door
		W	B11	06	
412-0096	SD	E	B11(357097)	06	HVPS RH Door
412-0097	SD	E	A11(357098)	50	HV Switch Door

Table 6-2. Cabinet Access Key Information - CONT.

Mfr PN	Vendor Type	Key Release with Bolt Extended/ Withdrawn	Key Interchange	Key No.	Remarks
412-0112	M2SF	E W	A11(TBD) C11	07	HV Switch Door HV Switch Door
			XMTR 12		
412-0098	SF	E	C12(357099)	22	HV Disconnect Switch
412-0099	M2SD	E W	A12(357100) B12	01 20	HVPS Main Door
412-0100	SD	E	B12(357101)	20	HVPS RH Door
412-0101	SD	E	A12(357102)	01	HV Switch Door
412-0113	M2SF	E W	A12(TBD) C12	22	HV Switch Door HV Switch Door

6-2.2 Transmitter Cabinet 1 Access/Exit.

6-2.2.1 Transmitter Cabinet 1 Access Procedure. Figure 6-2 shows cabinet 1 with doors closed and open. Figure 6-3 shows the cabinet with doors removed and cover assemblies in place. Figure 6-4 shows the cabinet with cover assemblies removed. For safe access, perform the following.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

The following steps shall be performed in the sequence presented and as written. Failure to comply may result in death or injury to personnel.

2. At cabinet 3, pull 12.47 kVac disconnect lever down to OPEN and tag with Maintenance-in-Progress warning sign. Use KEY 1 (Figure 6-1) at top of lever assembly to lock lever in place. Remove key and keep on person.

3. Turn off RPIE circuit breakers, 208 VAC and 120 VAC RIDE THRU, to cabinet 2. Tag with Maintenance-in-Progress warning signs.

WARNING
BURN HAZARD

Allow blower operation and cooling water circulation to continue several minutes to allow equipment to cool down before turning off blowers.

4. Turn off RPIE blowers using switch located on support column at side of cabinet 1.

5. Open caabinet door(s) and remove required cover assemblies. Use grounded shorting stick(s) behind cabinet door(s) to discharge capacitors and high-voltage components. Leave stick(s) attached to high-voltage circuit.

6. proceed with cabinet access and perform required task.

6-2.2.2 Transmitter Cabinet 1 Exit Procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Verify all electrical connections are tight. Account for all tools, test equipment, and loose parts.

1. Return ground shorting stick(s) to holder(s).

2. At cabinet 2 Power Distribution Panel, turn OFF HV contactor circuit breaker and tag with Maintenance-in-Progress Warning sign.

3. At cabinet 2 Power Distribution Panel, turn OFF 208 VAC and 120 VAC ride thru if voltage is not required for trouble-shooing or maintenance in Cabinet 1.

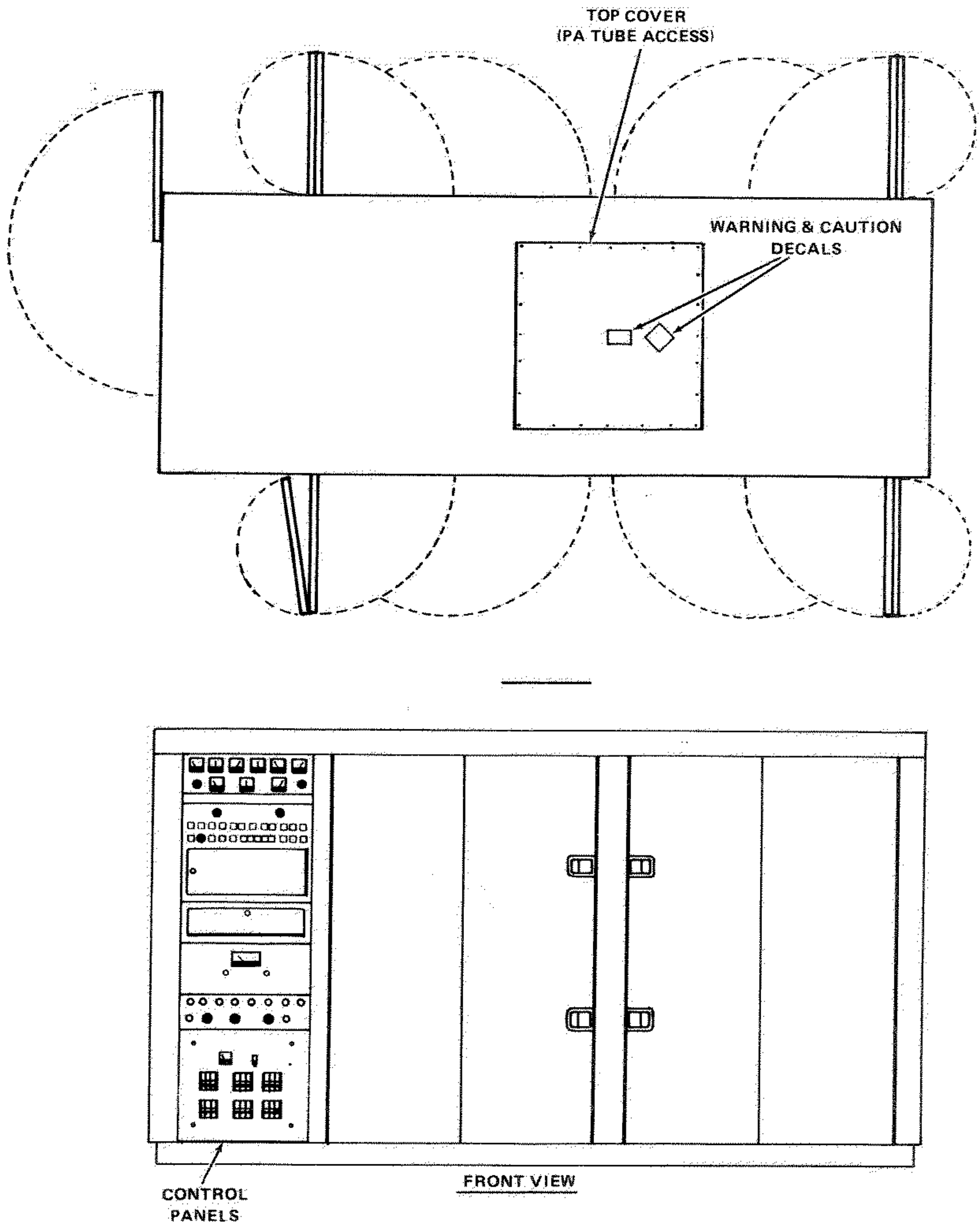


Figure 6-2 Transmitter Cabinet Doors Closed and Open

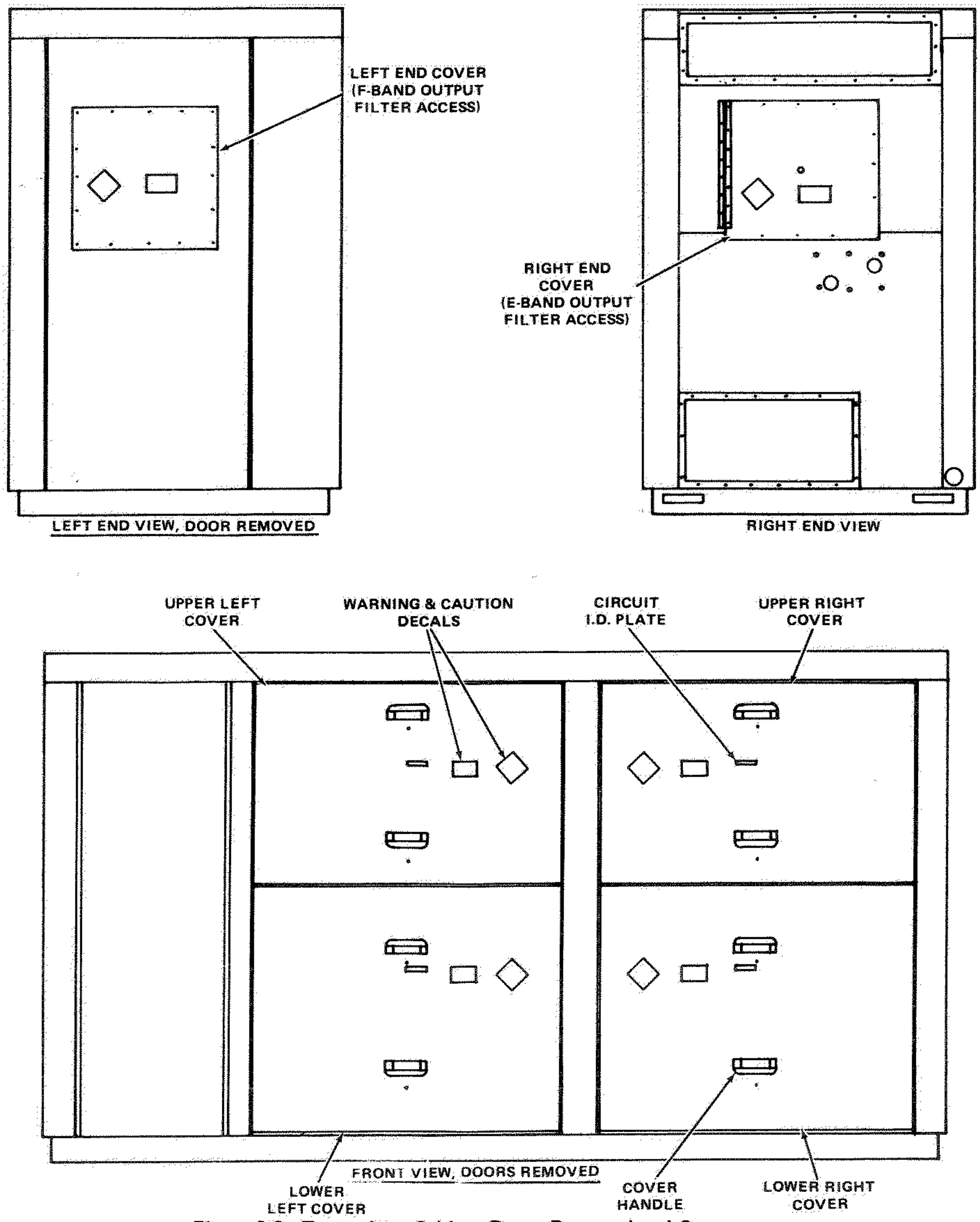


Figure 6-3. Transmitter Cabinet Doors Removed and Cover Assemblies in Place

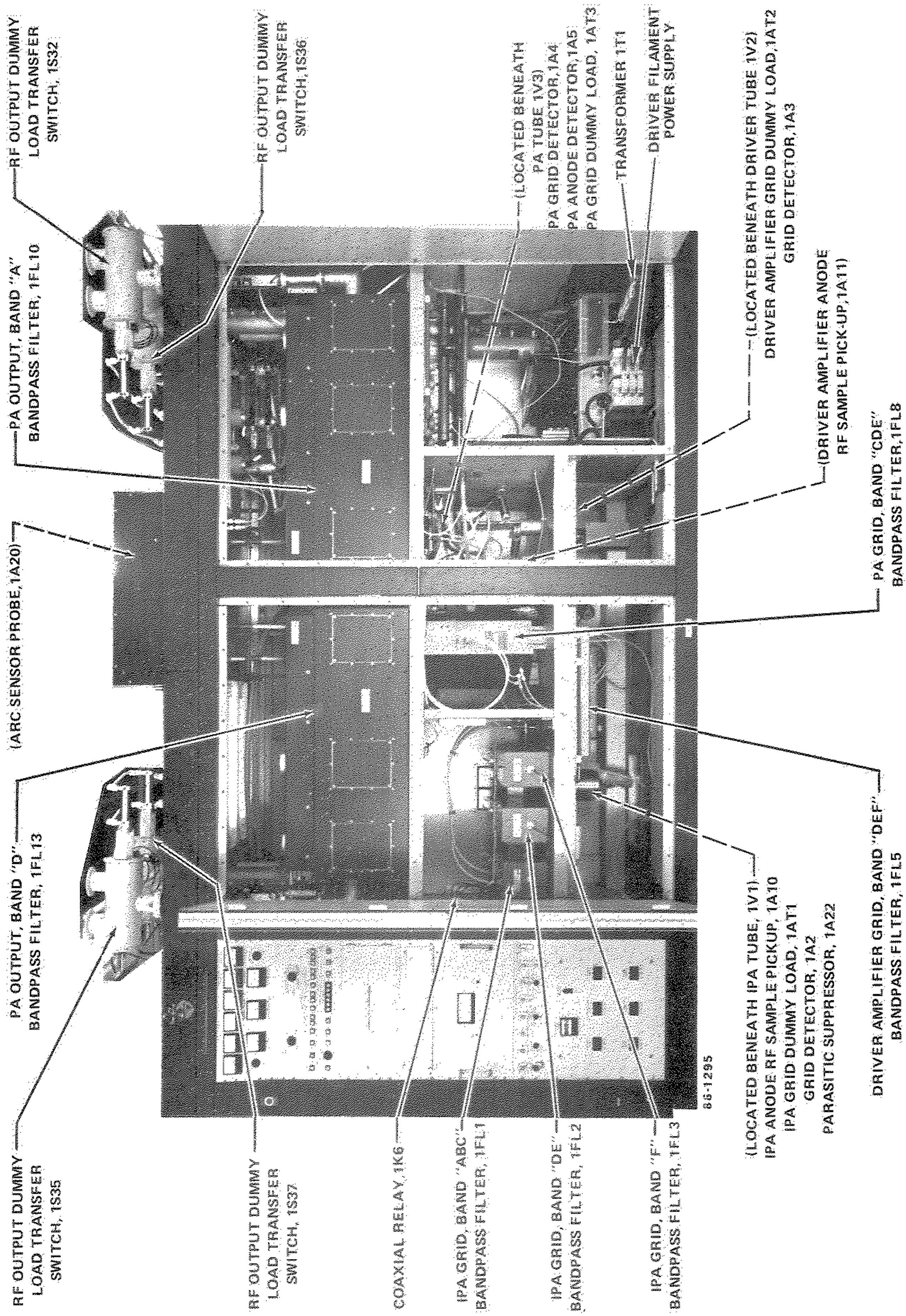


Figure 6-4. Transmitter Cabinet LRU Location (Sheet 1 of 2)

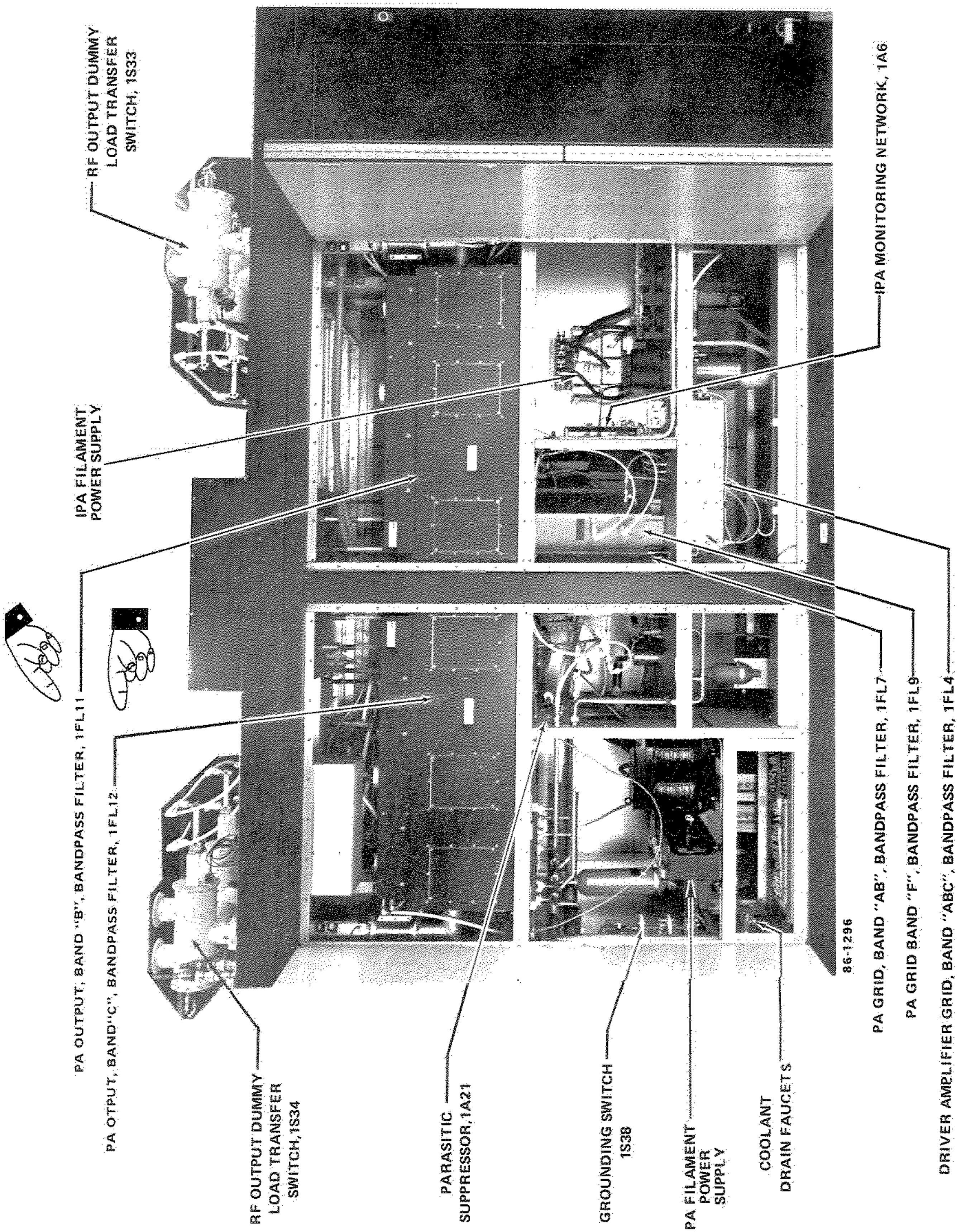


Figure 6-4. Transmitter Cabinet LRU Location (Sheet 2 of 2)

2. Replace cover assemblies. Close all access doors to enable interlock circuits.

3. Turn on RPIE blowers using switch on support column.

4. If major repairs have been accomplished, power up transmitter in accordance with 4-6.1. If major repairs have not been accomplished, power up may, if desired, be accomplished in accordance with TO 31P6-2FPS118-71.

6-2.3 Cooling Water Off/On.

6-2.3.1 Cooling Water Turn-off For Maintenance. Turn the cooling water off according to the following procedure.

WARNING
PERSONNEL BURN HAZARD

After Transmitter Cabinet 1 has been removed from service, allow cooling water to circulate for an approximate 2 to 3 minute cooldown period before turning off. Failure to do so may result in painful burns if water-cooled components are handled.

CAUTION
EQUIPMENT DAMAGE HAZARD

When turning off cooling water supply, inlet cooling water valve must be slowly closed first. Closing outlet valve first will result in flooding of equipment and surrounding area.

1. At right end of cabinet 1, fully close cooling water inlet valve, slowly.Wait for approximately 1 minute, then fully close outlet valve. Tag valves with maintenance-in- progress sign.

2. At rear of cabinet, nearest right end, open door and remove left lower access panel. Locate both coolant line drain faucets (Figure 6-4, sheet 2).

3. Place several cotton wiping rags (Table 6-1, item 5) beneath faucet. Attach common garden hose of sufficient length to reach RPIE drainage. Move free end of hose to drainage.

4. Turn on faucet. On cabinet inlet cooling water line, open bleeder valve (Figure 4-14). Allow cabinet to completely drain, then close bleeder valve.

5. Turn off first faucet. Repeat steps 3 and 4 for second facuet.

6. Return to maintenance procedure.

6-2.3.2 Cooling Water Turn-on.

1. At rear of cabinet, turn off both drain faucets. Unscrew hose and remove from cabinet. Pick up and remove rags.

2. Open bleeder valve on right side of cooling water inlet gage after placing drain pan under bleeder valve. At RPIE supply, open cooling water outlet valve fully.

3. When trapped air has been evacuated, close bleeder valve. Next, slowly open inlet valve until inlet gage reads about 40 psig.

4. Check cabinet for water leaks. If a leak is detected, immediately close cooling water inlet and outlet valves and take corrective action.

5. Slowly open cooling water inlet fully. Check inlet pressure of 80 to 88 psig and outlet pressure of 5 to 9 psig. If pressures are incorrect, check RPIE water system.

CAUTION
EQUIPMENT DAMAGE HAZARD

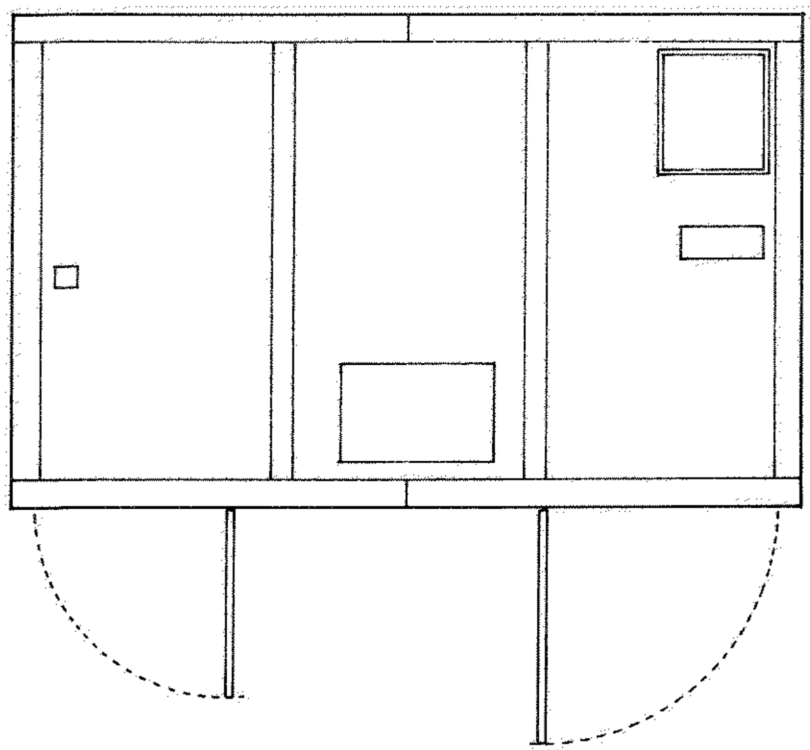
After maintenace has been completed and after equipment has been operated under load for 1 or 2 hours, cabinet must be accessed again and checked for water leaks.

6. Return to maintenance procedureas as required or exit cabinet in accordance with para 6-2.2.2.

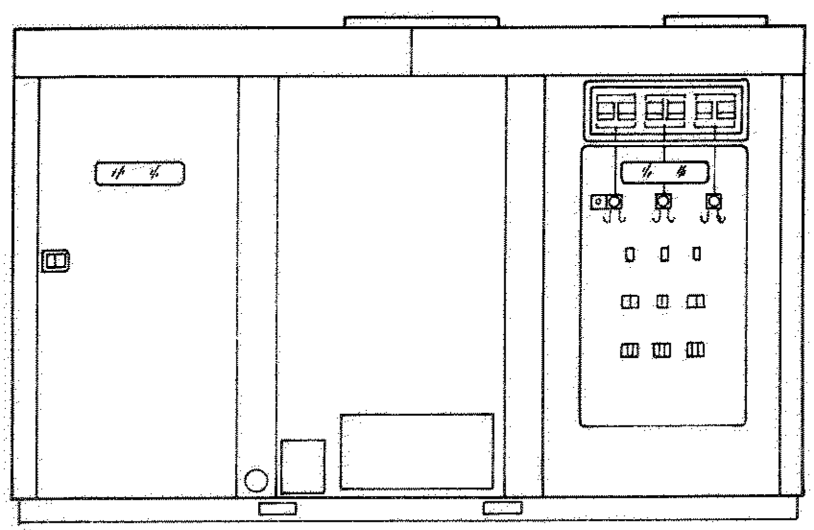
6-2.4 HVPS Cabinet Access/Exit.

6-2.4.1 HVPS Cabinet 2 Access Procedure. Cabinet 2 can be accessed only through the left front door. If required, the right front door can be unlocked from within. Figure 6-5 shows cabinet 2 with doors closed and open. For safe access of cabinet 2, perform the following.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.



TOP VIEW



FRONT VIEW

Figure 6-5. HVPS Cabinet, Doors Closed and Open

WARNING
HIGH VOLTAGE HAZARD

The following steps shall be performed in the sequence presented and as written. Failure to comply may result in death or injury.

2. At cabinet 3, pull 12.47 kVac disconnect lever down to OPEN and tag with Maintenance-in-Progress warning sign.

3. Refer to Figure 6-1. Use KEY 1 to lock disconnect lever in place, then remove key. Insert KEY 1 in CYLINDER A and lock in place. Remove KEY 2 and keep on person.

4. Turn off RPIE circuit breakers, 208 VAC and 120 VAC RIDE THRU, to cabinet 2. Tag with Maintenance-in-Progress warning signs.

5. Refer to Figure 6-1. At cabinet 2, insert KEY 2 in CYLINDER C and lock in place. Remove key and keep on person.

6. Open cabinet door. Turn on light with switch on left wall. Use grounded shorting stick located behind door to discharge capacitors and high-voltage components. Leave stick attached to high-voltage circuit.

7. If required, KEY 3 can be used to unlock right front door from inside cabinet 2.Perform required tasks.

6-2.4.2 <u>HVPS Cabinet 2 Exit Procedure</u>.

CAUTION
EQUIPMENT DAMAGE HAZARD

Verify all electrical connections are tight. Account for all tools, test equipment, and loose parts.

1. If open, close and lock right front door. Remove key and keep on person.

2. Return grounded shorting stick to holder. Close left front door to engage interlock circuitry.

3. Refer to Figure 6-1. Insert KEY 3 in right-hand cylinder on cabinet 2 left front door and lock in place. Remove KEY 2 from CYLINDER C and keep on person.

4. Refer to Figure 6-1. Return KEY 2 to lower left-hand cylinder on front of cabinet 3. Lock in place.

5. If major repairs have been accomplished, power up transmitter in accordance with paragraph 4-6.1. If major repairs have not been made, power up tramsmitter in accordance with TO 31P6-2FPS118-71.

6-2.5 <u>High Voltage AC Switch Access/ Exit.</u>

6-2.5.1 <u>High Voltage AC Switch Cabinet 3 Access Procedure</u>. Cabinet 3 is accessed by a front door. Once door has been opened, a cover assembly must be removed to access ac bus and other circuits. Figure 6-6 shows cabinet 3 with door closed and open. Figure 6-7 shows cabinet with the cover assembly removed.

<u>Tools and Test Equipment Required:</u>

Qty	Item No.	Description
	(from Table 1-4)	
1	9p	Face Shield
1	9o	Grounding Pole

1. Follow procedure in para 4-6.3 to shut down all transmitters.

WARNING
HIGH VOLTAGE HAZARD

The following steps shall be performed in the sequence presented and as written. Failure to comply may result in death or injury.

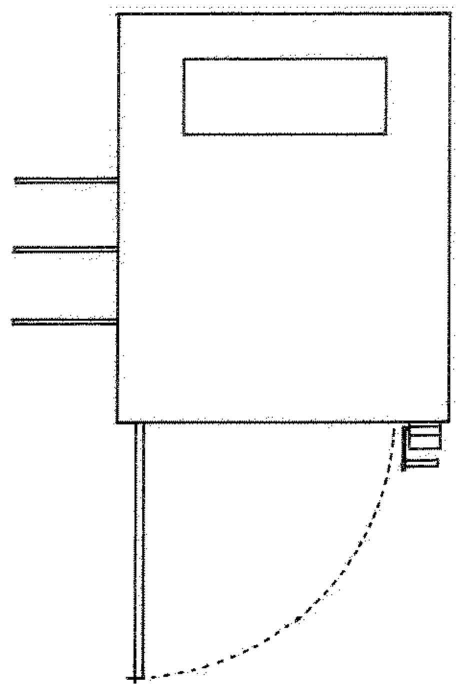
2. Turn off circuit breaker for 12.47 kVac in Unit 321 (refer to TO 31P6-2FPS118-71). Tag with Maintenance-in-Progress warning signs.

3. Pull 12.47 kVac disconnect lever down to OPEN and tag with Main-tenance-in-Progress warning sign. Use KEY 1 (Figure 6-1) to lock lever in place. Remove key and keep on person.

4. Refer to Figure 6-1. Insert KEY 1 in CYLINDER A. Lock in place. Remove KEY 2 then insert in CYLINDER B. Open door.

NOTE

If door will not open, proceed to paragraph 6-2.5.3.



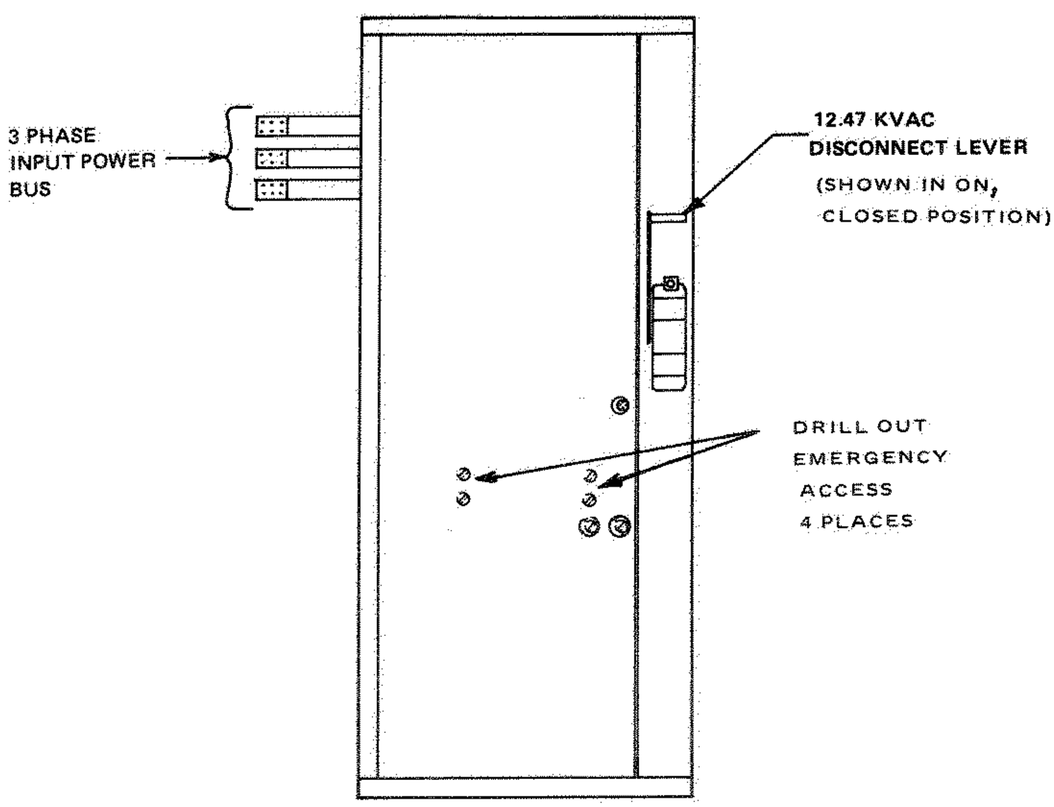


Figure 6-6. High Voltage AC Switch Cabinet 3

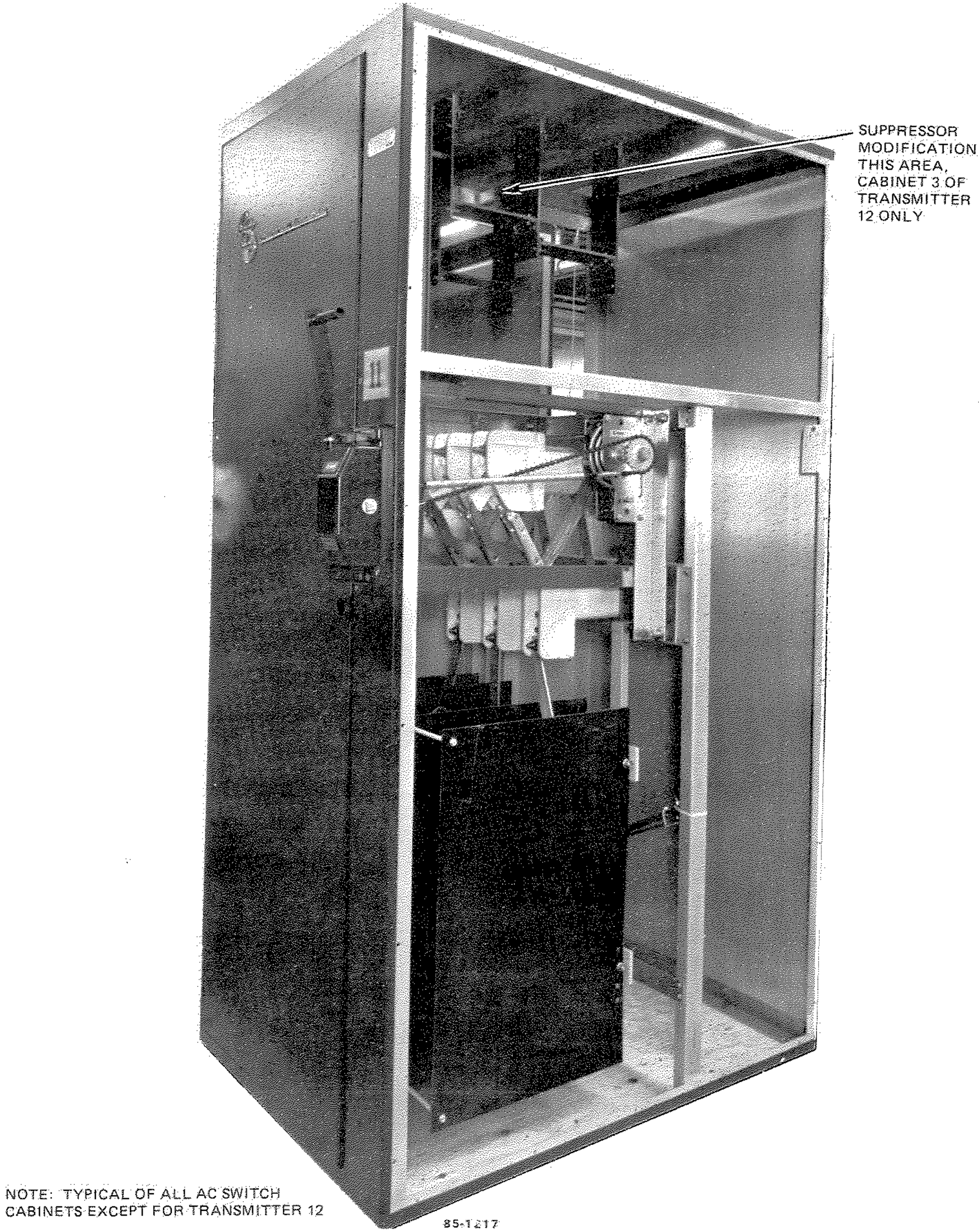


Figure 6-7. AC Switch Cabinet with Cover Removed

5. Remove cover assembly. Use face shield and lineman-type grounding pole to discharge high-voltage components. Leave grounding pole attached to high-voltage circuit.

6. Proceed with cabinet access and perform required task.

6-2.5.2 High Voltage AC Switch Cabinet 3 Exit Procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Verify all electrical connections are tight. Account for all tools, test equipment, and loose parts.

1. Remove grounding pole.

2. Replace cover assembly.

3. Close door. Refer to Figure 6-1. Remove KEY 2 from CYLINDER B. Insert key in lower left-hand cylinder and lock in place. Remove KEY 1 from CYLINDER A.

4. Remove Maintenance-in-Progress warning sign from 12.47 kVac disconnect lever. Return key to cylinder at top of disconnect lever assembly.

5. After all cabinet 3s are secured, remove Maintenance-in-Progress warning signs and turn on 12.47 kVac circuit breakers in Unit 321 (refer to TO 31P6-2FPS118-71).

6. Power up transmitter in accordnce with TO 31P6-2FPS118-71.

6-2.5.3 High Voltage AC Switch Cabinet 3 Emergency Access. If procedure in paragraph 6-2.5.1 has been followed but door to cabinet 3 will not open, emergency access is required. Normally, with switch closed, a metal restraining arm engages cabinet door and it cannot be opened. The arm should retract when disconnect lever is pulled to OPEN, but will not if one or more of the three switch blades fail to break contact with the 12.47 kVac supply. If that occurs four roundhead screws, two on each side of the door, must be drilled out for emergency access of the cabinet. See Figure 6-6.

6-3 TRANSMITTER PREVENTIVE MAINTENANCE PROGRAM.

6-3.1 General. A Preventive Maintenance (PM) program establishes systematic inspection and maintenance that will extend equipment life. A PM works to correct minor defects before they develop into major problems. Electrical and mechanical parts of this system shall be maintained by conventional maintenance techniques. Periodic PM includes inspection, lubrication, cooling system checks, and cleaning of critical parts. Preventive maintenance must be performed at stated intervals to minimize equipment failures. Before performing PM routines, personnel shall become familiar with and observe safety procedures in front matter of this manual.

6-3.2 Preventive Maintenance Schedule. Table 6-3 is the schedule of PM routines for the transmitter system.

Preventive Maintenance routines are based on system operation of up to 24 hours a day, 7 days a week. Environmental conditions for specific transmitter systems may require that PM intervals for routines marked X^3 in Table 6-3 be shortened.

6-3.2.1 Weekly Maintenance Schedule.

None unless added as a result of organizational site requirements.

6-3.2.2 Monthly Maintenance Schedule.

6-3.2.2.1 Inspection of HVPS Cabinet 2. Observe safety procedures in front matter of this manual.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	9c	Trouble Light
	(from Table 6-1)	
AR	2	Multipurpose Grease
AR	5	Cotton Wiping Rags

WARNING
HIGH VOLTAGE HAZARD

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.4.1 to access HVPS Cabinet 2.

Major Equipment	Work card	Preventive Maintenance Action	Maintenance Period[1] D	W	M	Q	SA	A	S	SSR[2]	Procedure Paragraph
Cabinet 3	2-001	Inspect, clean, & lubricate						X[3]		0	
Cabinet 2	1-041	Inspect, clean, & test					X[3]			I	

Table 6-3. Preventive Maintenance Schedule (Sheet 1 of 2)

Major Equipment	Work card	Preventive Maintenance Action	Maintenance Period [1] D	W	M	Q	SA	A	S	SSR[2]	Procedure Paragraph
Cabinet 1 2	1-019 1-020	Check Indicators				X				I	Refer to 6-3.2.3
Cabinet 2	1-007	Inspect			X[3]					I	Refer to 6-3.2.2.1
Cabinet 1	1-005 & 1-006	Inspect			X[3]					I	Refer to 6-3.2.2.2
Cabinet 3	2-001	Inspect, clean, & lubricate					X[3]			I	Refer to 6-3.2.4.1
Cabinet 2	1-041	Inspect, clean, & test					X[3]			0	Refer to 6-3.2.4.2
Cabinet 1	1-039	Inspect, clean, & test					X[3]			I	Refer to 6-3.2.4.3
Cabinet 1 2	1-042 1-042	Test fire crowbar					X[3]			I	Refer to 6-3.2.4.3
Cabinet 1	1-060	Inspect						X		I	Refer to 6-3.2.5.1
Cabinet 1 Pneumatic Switch Act-uator and Transfer Switch	1-060	Clean & Lubricate						X		I	Refer to 6-3.2.5.2
Cabinet 1	1-059 & 1-061	Test						X		I	Refer to 6-3.2.5.3
Transmitter System		Performance Tests:									
		1 Input Overdrive							X	I	Refer to 6-10.1.1
		2 RF Power Gain							X	I	Refer to 6-10.1.2
		3 Output Power Flatness							X	I	Refer to 6-10.1.3

See footnotes at the end of the table

Table 6-3. Preventive Maintenance Schedule (Sheet 2 of 2)

Major Equipment	Work Card	Preventive Maintenance Action	D	W	M	Q	SA	A	S	SSR[2]	Procedure Paragraph
			Maintenance Period [1]								
Transmitter System (cont)		Performance Tests (cont)									
		4 Automatic Recycle							X	I	Refer to 6-10.1.4
		5 Output Power Amplitude							X	I	Refer to 6-10.1.7
		6 Performance Monitor/ Control Functions							X	I	Refer to 6-10.1.8
	1-059	7 Reverse Power Trip						X		I	Refer to 6-10.1.5
	1-059	8 Interlock Circuits Test						X		I	Refer to 6-10.1.6
		9 Spectral Purity Test							X	I	Refer to 6-10.1.9
	1-061	10 X Ray Radiation Hazard Check						X		I	Refer to 6-10.1.10
		11 RF Radiation Hazard Check							X	I	Refer to 6-10.1.11

[1] Maintenance Period Codes:

D = Daily
W = Weekly
M = Monthly
Q = Quarterly
SA = Semiannually
A = Annually
S = Special
SSR = System Status Required

[2] SSR (System Status Required, all remaining 11 transmitters) Codes:

I = In Service
O = Out of Service

[3] Make maintenance period adjustments based on environmental conditions.

2. Use trouble light and inspect:

   a. Wiring for signs of overheating.

   b. Components for signs of overheating or arcing.

   c. Oil-filled capacitors for case excessive bulging or oil leakage.

   d. Grounding Switch 2S2 shaft for thin film of grease If necessary, apply multipurpose grease and wipe off any excess with cotton rag. Remove and replace switch according to 6-5.28.1 and 6-5.28.2 if necessary.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage and transmitter down-time.

3. Follow procedure in paragraph 6-2.4.2 to exit cabinet 2.

6-3.2.2.2 Inspection of Transmitter Cabinet 1. Observe safety procedures in front matter of this manual.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	1r	Ladder
1	9g	1-1\2", 1\2" OD vinyl tube
1	9j	8 ft. flexible 1\2 OD Vinyl Tubing
1	9h	Drain Pan
1	9c	Trouble Light
	(from Table 6-1)	
AR	2	Multipurpose Grease
AR	4	Silicon Carbide Handpad
AR	5	Cotton Wiping Rags

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Use trouble light and inspect:

   a. Plumbing for water leaks.

   b. Wiring for signs of overheating.

   c. Components for signs of overheating or arcs.

   d. Spark gap for evidence of arcing. Clean with handpad or replace as necessary.

   e. Grounding Switch 1S38 for evidence of arcing. Clean with handpad. Remove and replace contacts according to 6-5.20.1 and 6-5.20.2 as necessary.

   f. Grounding Switch 1S38 shaft area for thin film of grease If necessary, apply multipurpose grease and wipe off any excess with cotton rag.

3. On top of transmitter, inspect plumbing for air leaks.

4. On the system accumulator tank, remove dipstick from return air manifold and check level of oil accumulation. To drain oil, insert 1/2 OD vinyl tubing in hole near drain cock and force into 1\2 ID tubing, then force unit onto drain cock. Drain oil into drain pan to maintain level below FULL mark.

5. Ensure drain cock is set off and remove tubing and drain pan.

6. Clean residue with cotton rags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-3.2.3 Quarterly Maintenance Schedule. Check cabinet 1 and 2 indicator benchmark readings as described in Table 6-4. The readings are typical for an optimally operating transmitter. Readings outside the tolerances ranges indicate that the transmitter will experience a failure in the future. Except for filament voltage readings outside of tolerance, no correction should be taken. The transmitter should be watched for increasingly rapid deterioration. Primary RPIE power source voltages that are out of tolerance may cause degraded performance of the transmitter and should be corrected if possible.

6-3.2.4 <u>Semiannual Maintenance Procedures</u>

6-3.2.4.1 <u>Inspection of High Voltage AC Switch Cabinet 3.</u> Observe safety procedures in front matter of this manual.

<u>Tools and Test Equipment Required:</u>

Qty	Item	Description
	(from Table 1-4)	
1	1r	Ladder
1	7e	Phillips Screwdriver
1	8a	Vacuum Cleaner
1	8b	Dust Brush
	(from Table 6-1)	
AR	3	High-Temperature Grease
AR	4	Silicon Carbide Handpad
AR	5	Cotton Wiping Rags

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.5.1 to access all 12 cabinets.

2. Clean cabinet and switch assembly with vacuum cleaner and brush.

3. Check arcing blade and main blade for signs of arcing. Clean with handpad or replace switch assembly as necessary.

4. Apply thin coat of grease to arcing and main blade. Wipe off any excess with cotton wiping rag.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.5.2 to exit all 12 cabinets.

6-3.2.4.2 <u>Inspection of HVPS Cabinet 2.</u> Observe safety procedures in front matter of this manual.

<u>Tools and Test Equipment Required:</u>

Qty	Item No.	Description
	(from Table 1-4)	
1	2c	Multimeter
1	8a	Vacuum Cleaner
1	8b	Dust Brush
1	9c	Trouble light

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Use vacuum cleaner and small brush to thoroughly clean all exposed components and cabinet surfaces. Inspect oil-filled components for signs of leakage.

3. Verify number of diodes on rectifier assemblies CR1 through CR6. Use multimeter to check forward and reverse resistances of individual diodes as follows:

   a. If an assembly contains 20 diodes, forward resistance should be less than 1k ohms read on R X 100 scale. Reverse resistance should be greater than 20k ohms read on R X 10,000 scale.

   b. If an assembly contains 24 diodes, forward resistance should be less than 1k ohms read on R X 100 scale. Reverse resistance should be greater than 50k ohms read on R X 10,000 scale.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

4. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-3.2.4.3 <u>Inspection of Transmitter Cabinet 1.</u> Observe safety procedures in front matter of this manual.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	1r	Ladder
1	8a	Vacuum Cleaner
1	8b	Dust Brush
1	9c	Trouble light
	(from Table 6-1)	
AR	1	Denatured Alcohol
AR	5	Cotton Wiping Rags
AR	9	Cotton Swab

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove cover assemblies from compartment.

CAUTION
EQUIPMENT DAMAGE HAZARD

Take care not to damage honeycomb structure of EMI shielding panels. Take care not to damage any exposed components while cleaning.

3. Clean cabinet interior:

   a. Vacuum all EMI honeycombed shielding panels.

   b. Use vacuum cleaner and brush to clean all exposed components.

4. Perform the following to test arc sensors:

WARNING
ELECTRICAL SHOCK HAZARD

Avoid contact with exposed electrical terminals and connections. Failure to comply may result in death or injury.

   a. Turn on 120 VAC RIDE THRU circuit breaker.

NOTE
With cover assemblies removed, ambient light or light from trouble lamp may activate arc sensor 1A20 (above PA tube). If this occurs, temporarily cover 1A20 with a piece of opaque material such as cardboard. Remove opaque material before replacing cover assemblies.

   b. Direct light beam (minimum 100-watt bulb) through louvers in top of filter 1FL10 and verify RF ARC lamp on card 1A1A12 lights.

   c. If RF ARC lamp does not light, remove center inspection plate from filter. On bands E and F, remove arc sensor. Direct light beam on sensor and verify RF ARC lamp lights. If not, clean arc detector lens with soft cloth or cotton swab and denatured alcohol and retest. Replace inspection plate or reinstall sensor.

NOTE
If lamp did not light up on retest, continue with procedure until second lamp has been tested. If another filter fails both test and retest, terminate this procedure. Perform procedure in paragraph 6-6.1 to adjust arc sensor sensitivity.

   d. Depress FAULT RESET switch to turn off indicators.

   e. Repeat steps 4.b. through 4.d. for filters 1FL11 through 1FL15.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

5. Follow procedure in steps 1 through 3 of paragraph 6-2.2.2 to exit cabinet.

6. Perform procedures in steps 1 through 8 of paragraph 4-6.2.2. Condition transmitter to operate in LOCAL mode in band C.

7. Perform the following to test the Electronic Crowbar circuit:

   a. Set ANODE SCREEN HVDC switch on cabinet 2 Control/Monitor Panel to POWER AMPL.

b. After warmup delay, press HV ON switch on CONTROL/STATUS panel.

c. Press CROWBAR TEST switch on Bias Adjust Panel 1A9. Observe ANODE (KV) meter on HVPS Meter Assembly immediately drop to zero.

d. CROWBAR and FAULT (RESET) indicators on CONTROL/STATUS panel and CROWBAR indicator on First Event Logic Card 1A1A12 should all be lit.

e. Press FAULT (RESET) switch on CONTROL/STATUS panel to reset all fault indicators.

f. Disconnect dummy load according to paragraph 4-6.4.2 and exit cabinet according to paragraph 6-2.2.2.

6-3.2.5 Annual Maintenance Procedures.

6-3.2.5.1 Inspection of Transmitter Cabinet 1. Observe safety procedures in front matter of this manual.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	8b	Dust Brush
	(from Table 6-1)	
AR	1	Denatured Alcohol
AR	4	Silicon Carbide Handpad
AR	5	Cotton Wiping Rags

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedural steps 1 and 2 of paragraph 6-2.2.1 to access cabinet.

2. Turn off RPIE compressed air supply to individual transmitter. Press band select switches A through F several times in sequence to bleed air pressure.

3. Perform remaining steps of paragraph 6-2.2.1 to access cabinet.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care not to damage or bend contacts during cleaning.

4. Inspect and clean contacts of PA band switches 1A1S18 through 1A1-S23 by lifting shaft assembly plunger to access contacts. Gently clean contacts with silicon carbide handpad. Replace contacts as necessary and align according to 6-6.3.9.1 and 6-6.3.9.2.

5. Perform procedures in paragraph 6-2.2.2 to exit cabinet.

6-3.2.5.2 Pneumatic Switch Actuator and Transfer Switch Cleaning and Lubrication. Observe safety procedures in front matter of this manual.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	1r	Platform Ladder
1	7d	Phillips Screw-driver
1	7i	Open end wrench
	(from Table 6-1)	
AR	2	Multipurpose Grease
AR	5	Cotton Wiping Rags

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 4-6.3 shut down transmitter

2. On top of transmitter, remove 4 screws, nuts, and washers, securing RF shield at air cylinder end of switch for 6 switches 1S32 through 1S37, and inspect:

   a. Pneumatic switch actuators for thin film of grease. If necessary, apply multi-purpose grease and wipe off any excess with cotton rag.

   b. Square-shaped transfer switch actuator shafts for thin film of grease. If necessary, apply multi-purpose grease and wipe off any excess with cotton wiping rag.

   c. Operate OUTPUT CONTROL switch several times to spread grease film and check that switches complete movement in less than 3 seconds.

3. Replace RF shield and secure with 4 screws, washers, and nuts on all 6 switches.

6-3.2.5.3 Interlock Circuit, Reverse Power Trip and X-Ray Radiation Hazard Tests.

1. Check interlock circuits according to paragraph 6-10.2.6.

2. Check reverse power trip test according to paragraph 6-10.2.5.

3. Check for X-ray radiation hazard according to paragraph 6-10.2.10.

6-3.2.6 Special Inspection Maintenance Procedures. Observe safety procedures in front matter of this manual. Tests listed in the preventive maintenance procedure to 2check the operational performance of the transmitter system are provided in Section III of this chapter.

6-3.3 Inspection, Cleaning, and Lubrication. Detailed inspection, cleaning, and lubrication information is provided in the Preventive Maintenance Procedure, paragraph 6-3.2. The following provides information of a more general nature regarding inspection, cleaning, and lubrication of various sections of the transmitter that may not be obvious to maintenance personnel.

6-3.3.1 General Inspection. For safe access and exit of cabinets, refer to the following list. Comply with WARNINGS to avoid risk of death or injury.

Cabinet No.	Access Procedure (Paragraph	Exit Procedure (Paragraph)
1	6-2.2.1	6-2.2.2
2	6-2.4.1	6-2.4.2
3	6-2.5.1	6-2.5.2

When inspecting equipment, check all metal parts for corrosion and general deterioration. Examine wiring and components for signs of overheating. Ensure all controls operate smoothly. Inspect all connections and tighten nuts, screws, and bolts as required. Examine all blowers and cabinet fans for normal air flow. Adjust the periodic schedule if excessive dust accumulates.

6-3.3.1.1 Coolant Plumbing. Inspect plumbing for evidence of leaks and take appropriate corrective action. Observe inlet and outlet water pressure gages to check for flow restrictions caused by bent lines or severe system leaks. Inlet pressure shall be 80 to 88 psig and outlet pressure shall be 5 to 9 psig.

6-3.3.1.2 Pneumatic Connections. Inspect pneumatic system for leaks and take appropriate corrective action. Leaks can be identified by signs of oil residue either on tubing or the area of chassis below the leak itself.

6-3.3.2 General Cleaning. A solvent composed of 25% methylene chloride, 5% perchloroethylene, and 70% dry-cleaning fluid may be used to clean equipment. Apply cleaning solvent with a soft-bristled brush or lint-free cloth. Use brush to clean dust from chassis, panels, and components. Use lint-free cloth to remove foreign matter from flat surfaces and such accessible areas. The cleaning solution may be used on the lint-free cloth, in small amounts, to aid in picking up dust. If this is done, dry the area afterward with a clean, dry, lint-free cloth.

6-3.3.2.1 RFI Filters. Cooling air is circulated through the transmitter, between compartments, by use of RFI filters. These should be cleaned using a vacuum cleaner with a soft-bristle nozzle brush.
Care should be taken to prevent bending any webs in filters. Bent webs restrict air flow and reduce cooling capability.

6-3.3.2.2 Cooling Air Filters. The T-1524/FPS-118(V) Radar Transmitter is not designed with air filters as integral parts of cabinets. RPIE supplied cooling air sources shall use air filters with minimum air filter efficiency of 30% National Bureau of Standards atmospheric dust.

6-3.3.3 General Lubrication. Because of sealed bearing motors and assemblies, lubrication requirements are limited. Lubrication requirements are covered in scheduled preventive maintenance procedures.

6-4 TROUBLESHOOTING CONCEPTS.

6-4.1 Performance Monitoring and Fault Location Process. Primary (remote) transmitter control and monitoring is from the Transmit Maintenance Console (TMC). Secondary control is local, using panel-mounted controls and indicators. Performance Monitoring/Fault Location (PM/FL), local or remote, is manually selectable at RF SIGNAL MONITORS Panel 1A25. When LOCAL is selected, PM/FL from the TMC is overridden.

6-4.1.1 Performance Monitoring. The transmitter provides 16 digitally-formatted status signals to the TMC for remote PM/FL (Table 4-17). Panel-mounted meters and indicator lamps permit local PM/FL. All indicator lamps are LEDs arranged in logical order to track such critical paths as RF signal, cooling, overload status, and interlock strings. Fault indicators are augmented by a First-Event Logic circuit designed to distinguish the first fault registered from resultant faults.

6-4.2 Troubleshooting Procedures. Repair of Radar Transmitter equipment consists primarily of LRU replacement at the site. The following troubleshooting procedures are provided to expedite fault isolation and minimize transmitter down-time. Causes of troubles may not be readily apparent. In those cases, the overall trouble shooting concept consists of analysis of circuits in the order they are made operational as the transmitter comes online.
Table 6-5 provides RF waveforms typical of a transmitter operating under the following conditions: Local operation in CW mode at mid-frequency Band C (10.54 mHz) with 100 kW power out into a dummy load. These waveforms will be useful in a troubleshooting situation where transmitter is functioning but at a less-than-acceptable level. They can be monitored at test jacks on RF SIGNAL MONITORS panel 1A25, as pictured on first page of Table 6-5.
Table 6-6 is a cross-reference of fault descriptions and control diagrams by figure and page number. Each control diagram pictures a single, highly condensed control circuit with functionally important components shown in proper relationships. Control diagrams are specifically engineered to expedite fault isolation. That is accomplished by minimizing the need for searching through wiring diagrams and schematics. These procedures and accompanying control diagrams are intended to be supported by circuit analyses and simplified schematics in Chapter Five, Tables 4-1 through 4-12, and schematics in TO 31P6-2FPS118-83, Circuit Diagrams Manual. Table 6-4 lists benchmark meter readings of transmitter in the operational mode identified in the table.

6-4.2.1 Systematic Fault Isolation. It is seldom possible to merely observe symptoms and immediately diagnose system troubles. Usually, a methodical sequence of operational checks, observations, and measurements are required to isolate faulty circuits. As soon as trouble symptoms have been properly gathered and evaluated, Table 6-6 should be consulted so the appropriate control diagram can be directly accessed. Once a faulty transmitter circuit is isolated an LRU, or, in limited instances, components within that circuit must be replaced. Where applicable, electrical adjustments must then be performed to restore equipment to normal operation. The following maintenance procedures, outlined in six logical steps, provide the basis for isolating trouble areas in the transmitter.

1. Symptom recognition is the first step, based on complete understanding of operational characteristics. Equipment troubles are not always direct results of component failure. Troubles in a transmitter, therefore, may not be obvious ones since conditions of less than peak performance do not necessarily call attention to themselves. That kind of equipment trouble is usually discovered during preventive maintenance procedures rather than normal operations. It is important that unfamiliar troubles, as well as familiar and apparent ones, be recognized and this portion of Chapter Six is designed to help maintenance personnel achieve that goal.

2. Troubleshooting aids designed into the equipment shall be used to further analyze trouble symptoms. The local fault indicators and meters will provide valuable data, as will remote TMC displays.

3. Taking note of probable faulty functions is the next step in logical troubleshooting. This provides a number of logical choices as to cause and likely location of a fault. Such choices are based on a thorough understanding of transmitter operation, fully identified trouble symptoms, and information contained in this manual and TO 31P6-2FPS118-83 Circuit Diagram Manual.

4. Isolate faulty functional sections by testing logical choices in an order that consumes the least amount of time. To do that requires deciding which transmitter section to test first. That selection shall be based on validity of logical choices and difficulties in making necessary tests. If tests do not isolate a fault the next selection should be tested, and so on until a faulty section is isolated.

5. After faulty functional sections have been isolated, specific circuits must be identified. This may involve the making of additional logical choices within defective functional sections.

   During circuit analysis, remember to apply the most basic of techniques. Are trouble symptoms limited to a specific area, or are they widespread? If all bands are affected, for example, look for such common elements as power supply, shared amplifier stages, etc.

6. Failure analysis shall be conducted after troubles have been located. Prior to performing corrective actions, maintenance personnel should review fault isolation procedures to determine exactly why the identified fault affected the transmitter as it did. This review assures that discovered faults are source failures rather than resultant, or sympathetic, failures.

Table 6-4. Transmitter Meter Readings, Benchmark

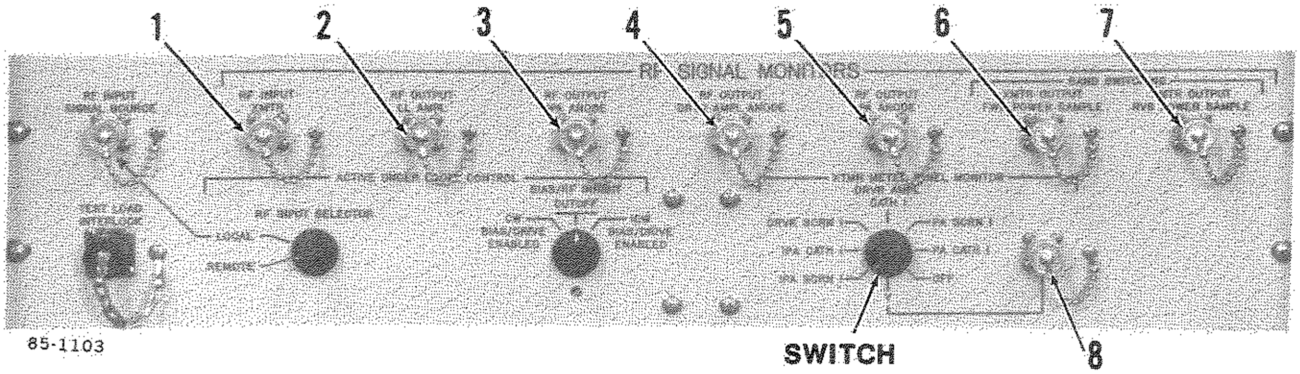
Function	Meter	Reading
NOTE Operational parameters are: (1) CW mode of operation; (2) Midband C (10.54 mHz); and (3) 100 kW RF output into dummy load.		
Auxiliary AC Voltage:		
Phase A-B	2A3M1	208 V ac ± 10%
Phase B-C		208 V ac ± 10%
Phase A-C		208 V ac ± 10%
Ride Thru		120 V ac ± 10%
Auxiliary AC Current:		
Phase A	2A3M2	50 a ± 11%
Phase B		34 a ± 15%
Phase C		34 a ± 15%
Ride Thru		6 a ± 15%
Primary AC Voltage:		
Phase A-B	2A3M3	12470 V ac ± 6%
Phase B-C		12470 V ac ± 6%
Phase A-C		12470 V ac ± 6%
Primary AC Current:		
Phase A	2A3M4	11 a ± 10%
Phase B		11 a ± 10%
Phase C		11 a ± 10%
DC Power Supplies:		
PA Anode	2A3M5	11.40 kV ± 300 V dc
Driver Anode		4.35 kV ± 300 V dc
IPA Anode		3.45 kV ± 200 V dc
PA Screen	2A3M6	1.55 kV ± 150 V dc
Driver Screen		1.50 kV ± 100 V dc
IPA Screen		1.55 kV ± 100 V dc
Power Amplifier:		
RF Power FWD	1A13M1	100 kW ± 2 kW
RF Power RVS		0 kW
Cathode Current	1A13M2	16.25 a ± 1.5 a
Screen Grid Current	1A13M3	180 ma ± 100 ma
Driver Amplifier:		
Cathode Current	1A13M4	3.5 a ± 0.6 a
Screen Grid Current	1A13M5	50 ma ± 30 ma

Table 6-4. Transmitter Meter Readings, Benchmark - CONT.

Function	Meter	Reading
IPA:		
Cathode Current	1A13M6	1.8 a ± 0.2 a
Screen Grid Current	1A13M8	30 ma ± 5 ma
Test Meter (left):		
IPA Fil. Volts	1A13M9	7.13 - 7.87 V dc
DRVR Fil. Volts		6.0 - 6.6 V dc
PA Fil. Volts		14.75-16.25 V dc
IPA Bias Volts		-270 V ± 20 V dc
DRVR Bias Volts		-280 V ± 20 V dc
PA Bias Volts		-380 V ± 30 V dc
+26 Volt PS		26 V ± 1.0 V dc
+15 Volt PS		15 V ± 0.5 V dc
+5 Volt Dual PS		5 V ± 0.4 V dc
+15 Volt Dual PS		15 V ± 0.8 V dc
-15 Volt Dual PS		-15 V ± 0.8 V dc
Test Meter (right):		
IPA Fil. Current	1A13M7	75 a ± 15 a
DRVR Fil. Current		160 a ± 20 a
PA Fil. Current		215 a ± 20 a
IPA Grid Current		10 ma ± 10 ma
DRVR Grid Current		10 ma ± 10 ma
PA Grid Current		50 ma ± 50 ma
IPA Grid RF PWR		*30 w 10 scale
DRVR Grid RF PWR		*40 w 10 scale
PA Grid RF PWR		*50 w 10 scale
PA Anode RF PWR		*75 w 10 scale
Output Power:		
Broadband LL Ampl.	1AR1M1	90 w + 50w, -20w

* NOTE: When at 10.54 MHz, 100 kW these settiings are for reference only.

Table 6-5. RF Waveforms



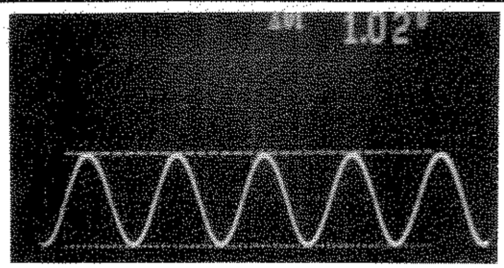
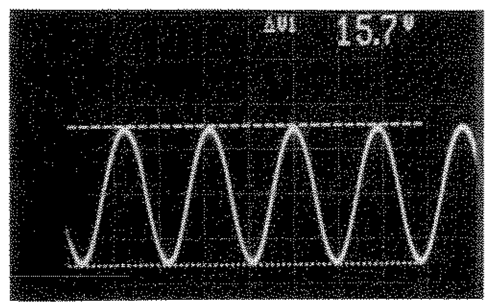
Test Jack	Switch Setting	Waveform
1	NA	
2	NA	

Table 6-5. RF Waveforms - CONT

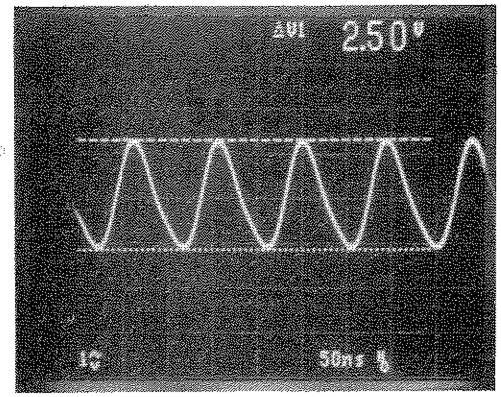
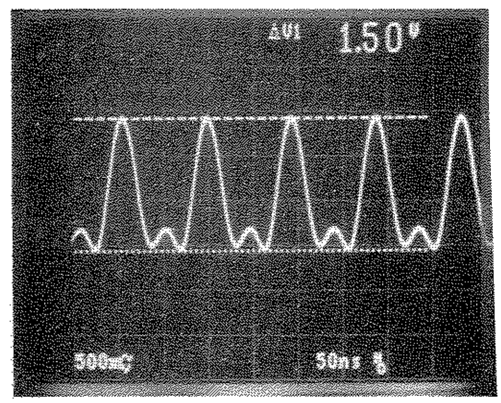
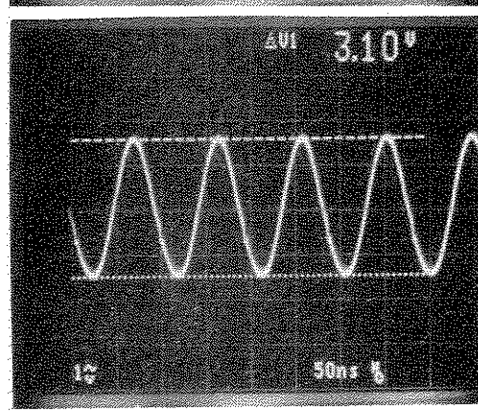
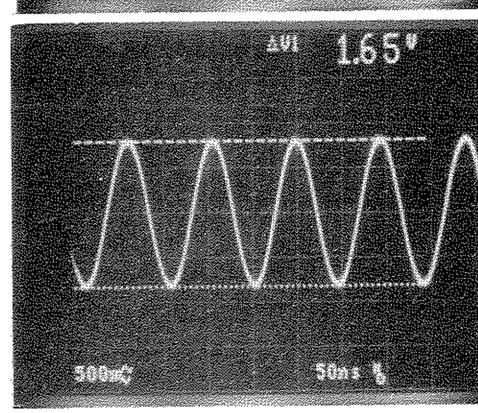
Test Jack	Switch Setting	Waveform
3	NA	
4	NA	
5	NA	
6	NA	

Table 6-5. RF Waveforms - CONT

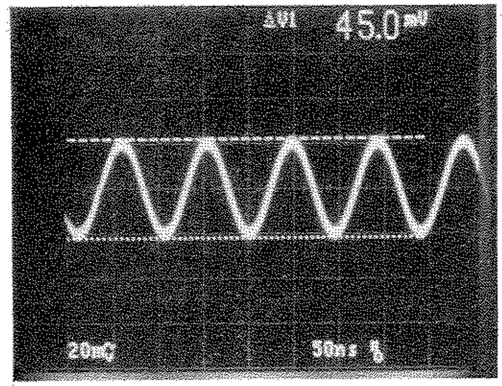
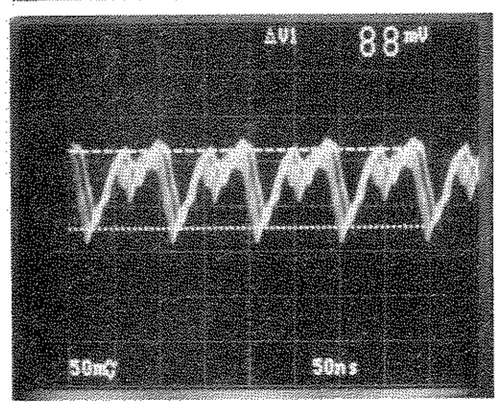
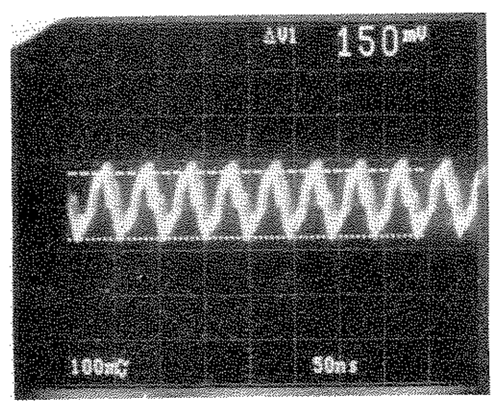
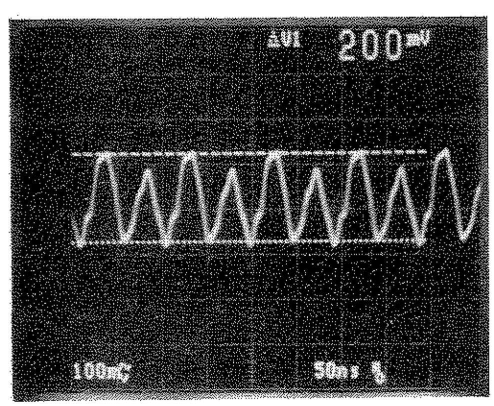
Test Jack	Switch Setting	Waveform
7	NA	
8	PA CATH 1	
8	PA SCRN 1	
8	DRVR AMPL CATH 1	

Table 6-5 RF Waveforms - CONT

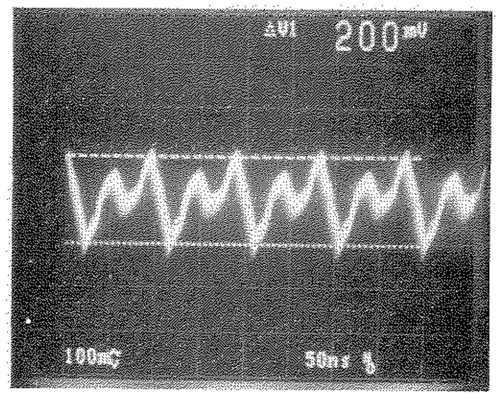
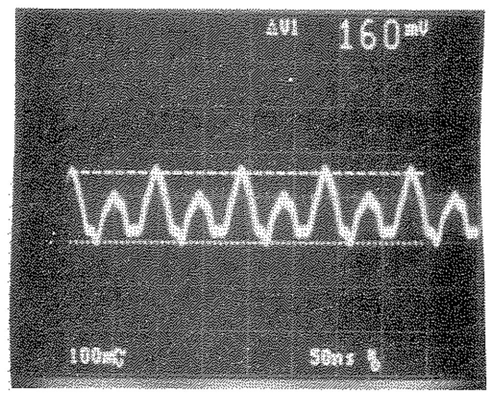
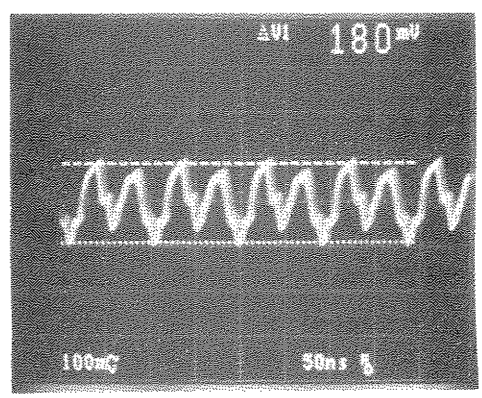
Test Jack	Switch Setting	Waveform
8	DRVR SCRN 1	
8	IPA CATH 1	
8	IPA SCRN 1	

Table 6-6. Control Diagram Cross-Reference

LED/Fault Description	LED Reference Designator	Figure
ACTR AIR Fault	1A1A9DS1	6-8
BAND A	1A1DS25	6-9
BAND B	1A1DS24	6-10
BAND C	1A1DS23	6-11
BAND D	1A1DS22	6-12
BAND E	1A1DS21	6-13
BAND F	1A1DS20	6-14
BAND PROVE FAULT	1A1A5DS1	6-15
CAB AIR	1A1A9DS2	6-16
CKT BRKRS	1A1A9DS3	6-17
CROWBAR Fault Control	1A1DS3	6-18
CROWBAR First Event	1A1A12DS12	6-19
CROWBAR Power Supply	1A1A9DS4	6-20
DRIVER AMPLIFIER ANODE AC	1A1DS8	6-21
DRIVER AMPLIFIER ANODE DC	1A1DS7	6-22
DRIVER AMPLIFIER SCREEN GRID DC	1A1DS9	6-23
DRVR A AC	1A1A12DS4	6-24
DRVR A DC	1A1A12DS5	6-25
DRVR SCRN	1A1A12DS6	6-26
DRVR TEMP	1A1A10DS4	6-27
FAULT RESET	1A1DS17	6-28
FLOW	1A1A10DS2	6-30
GND DVC	1A1A10DS1	6-31
GND SW and FIL DELAY	1A1DS27, 1A1A10DS6	6-29
High Voltage Remote Control	Not Applicable	6-32
HV ON	1A1DS19	6-33

Table 6-6. Control Diagram Cross-Reference - CONT.

LED/Fault Description	LED Reference Designator	Figure
HVPS DR	1A1A10DS9	6-34
INTERLOCK OPEN	1A1DS13	6-35
IPA ANODE AC	1A1DS11	6-36
IPA ANODE DC	1A1DS10	6-37
IPA SCREEN GRID DC	1A1DS12	6-38
IPA A AC	1A1A12DS8	6-39
IPA A DC	1A1A12DS7	6-40
IPA SCRN	1A1A12DS9	6-41
IPA TEMP	1A1A10DS5	6-27
LAMP TEST	1A1DS29	6-42
LOCKOUT	1A1A6DS2	6-43
OUTPUT CONTROL (Antenna Load)	1A1DS14	6-44
OUTPUT CONTROL (Test Load)	1A1DS14	6-45
PA TEMP	1A1A10DS3	6-27
PA A AC	1A1A12DS1	6-46
PA A DC	1A1A12DS2	6-47
PA SCRN	1A1A12DS3	6-48
Plate Contactor Relay	Not Applicable	6-49
PA ANODE AC	1A1DS5	6-50
PA ANODE DC	1A1DS4	6-51
PA SCREEN GRID DC	1A1DS6	6-52
RECYCLE ACTIVE	1A1A6DS1	6-53
Relays 1A24K3, K4, and K8	Not Applicable	6-54
REVERSE POWER	1A1DS1	6-55
RF ARC	1A1DS2	6-56

Table 6-6. Control Diagram Cross-Reference - CONT.

LED/Fault Description	LED Reference Designator	Figure
RF ARC First Event	1A1A12DS10	6-57
RF DRIVE LIMIT	1A1DS16	6-58
RF Interlock Prove	Not Applicable	6-59
RVS PWR	1A1A12DS11	6-60
STANDBY (HV OFF)	1A1DS26	6-61
Standby Power	Not Applicable	6-62
Time Delay Relays	Not Applicable	6-63
TM FR DOOR	1A1A10DS8	6-64
TM READY	1A1DS18	6-65
TM REAR DOOR	1A1A10DS7	6-66
Unit 2 Overload Relay Contacts	Not Applicable	6-67

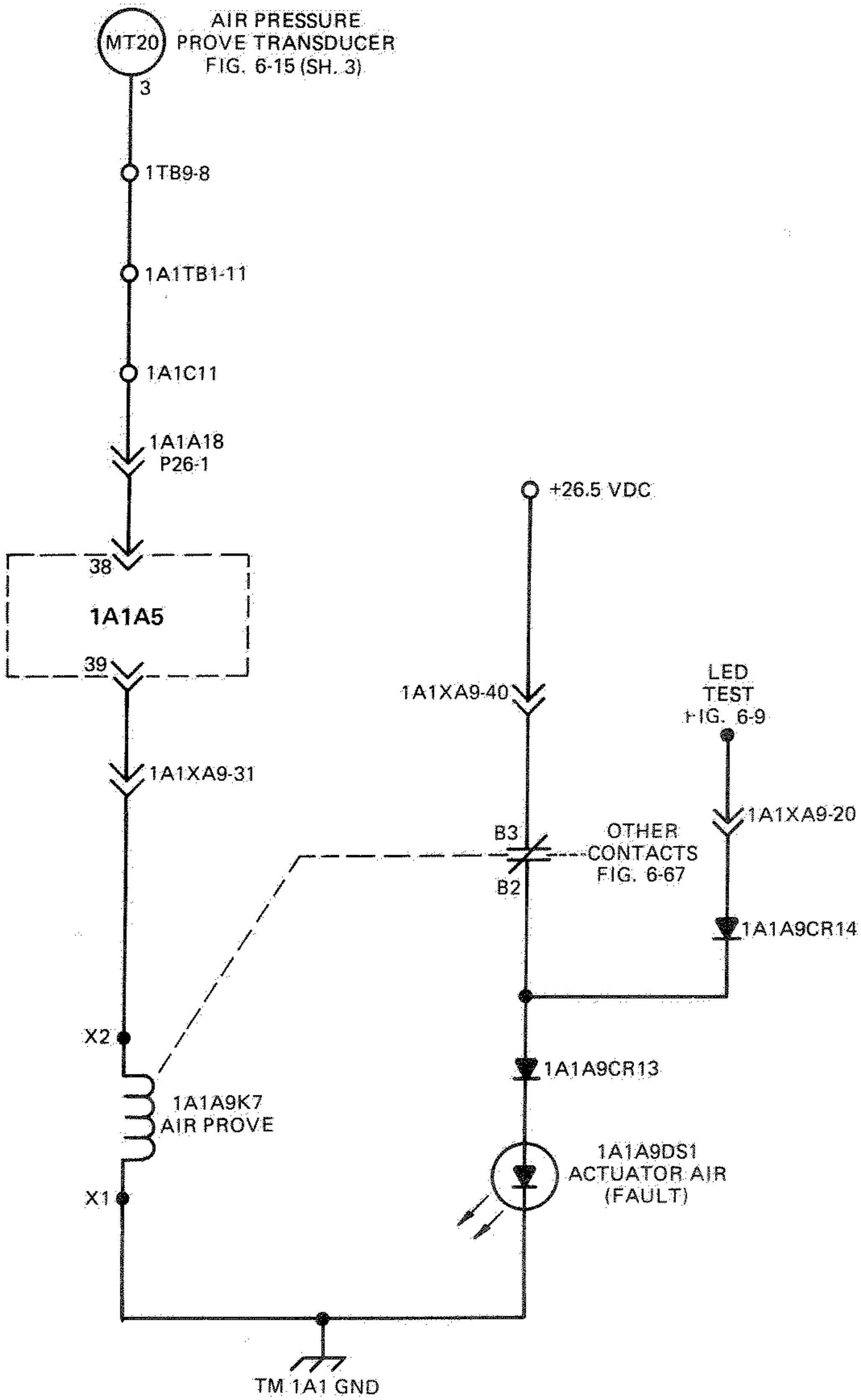


Figure 6-8. ACTR AIR Fault Control Diagram

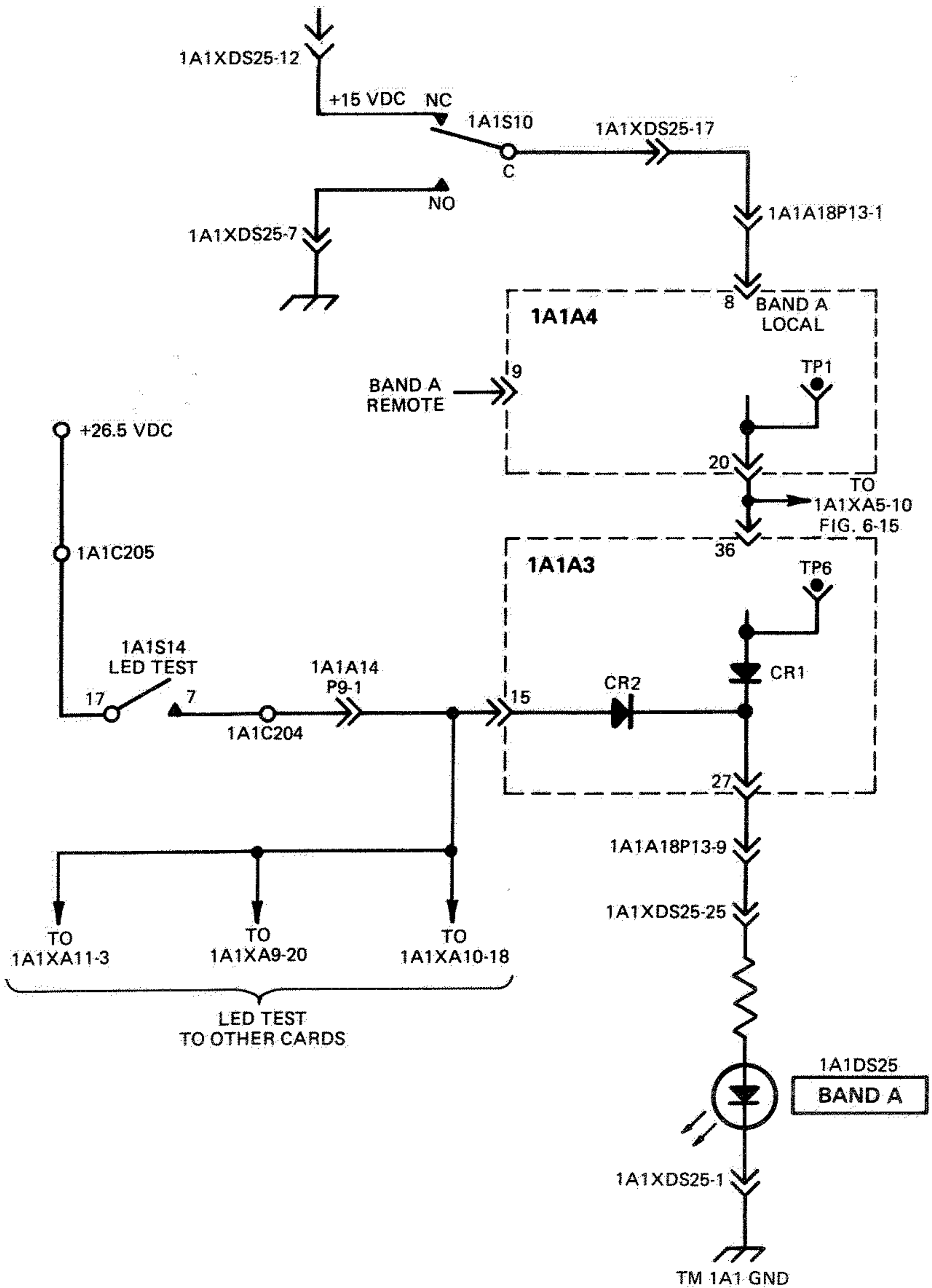


Figure 6-9. BAND A Control Diagram

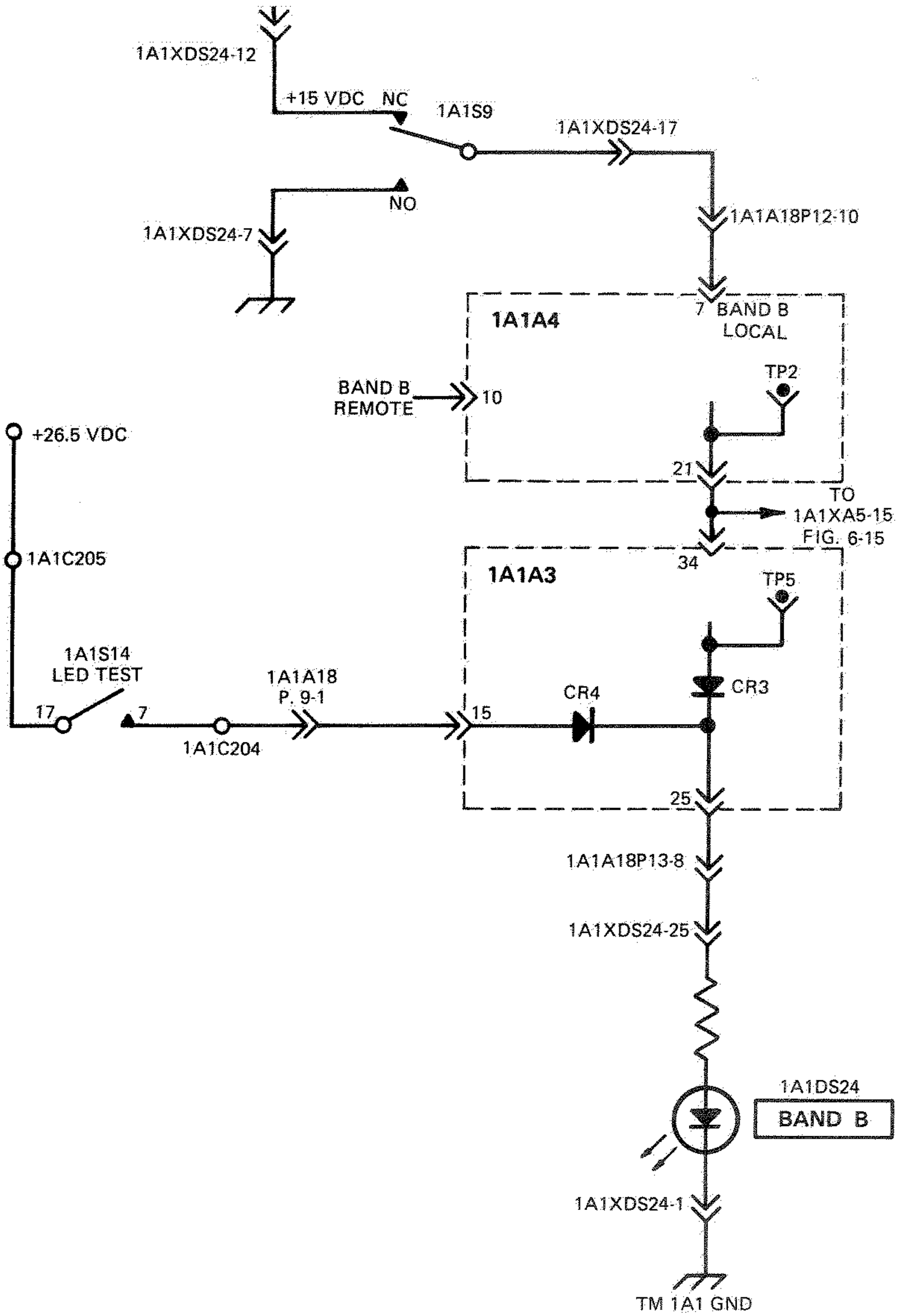


Figure 6-10. BAND B Control Diagram

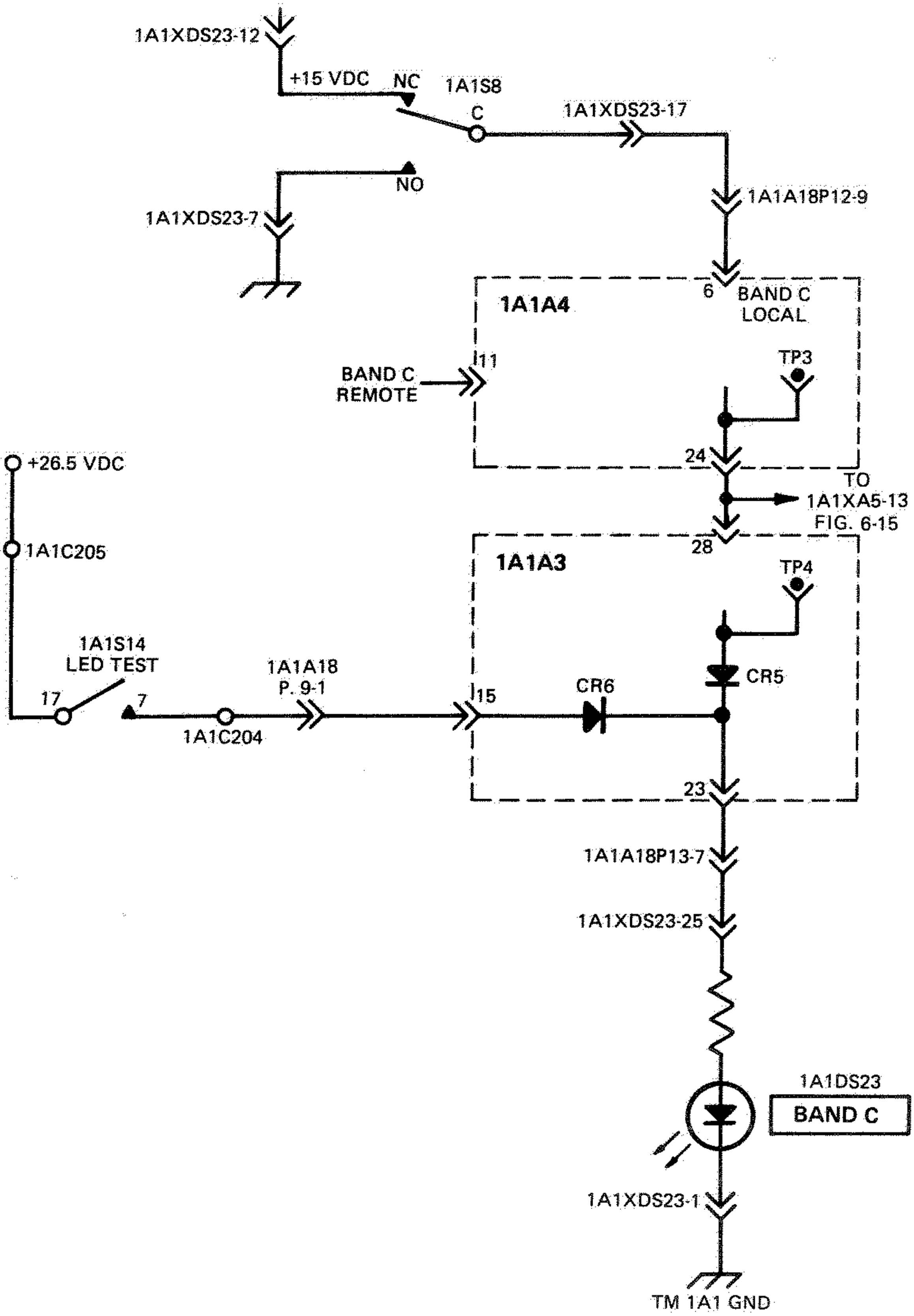


Figure 6-11. BAND C Control Diagram

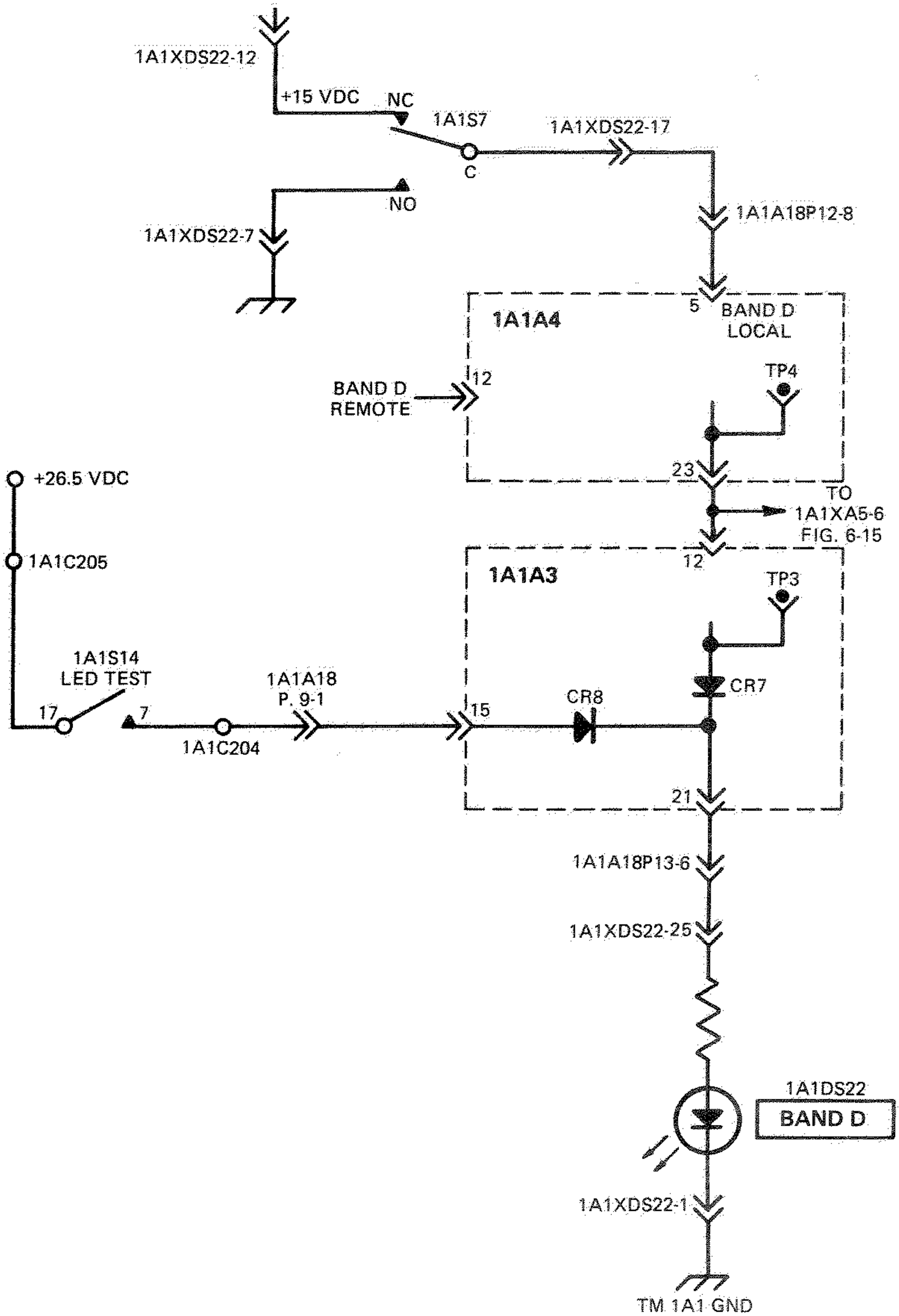


Figure 6-12. BAND D Control Diagram

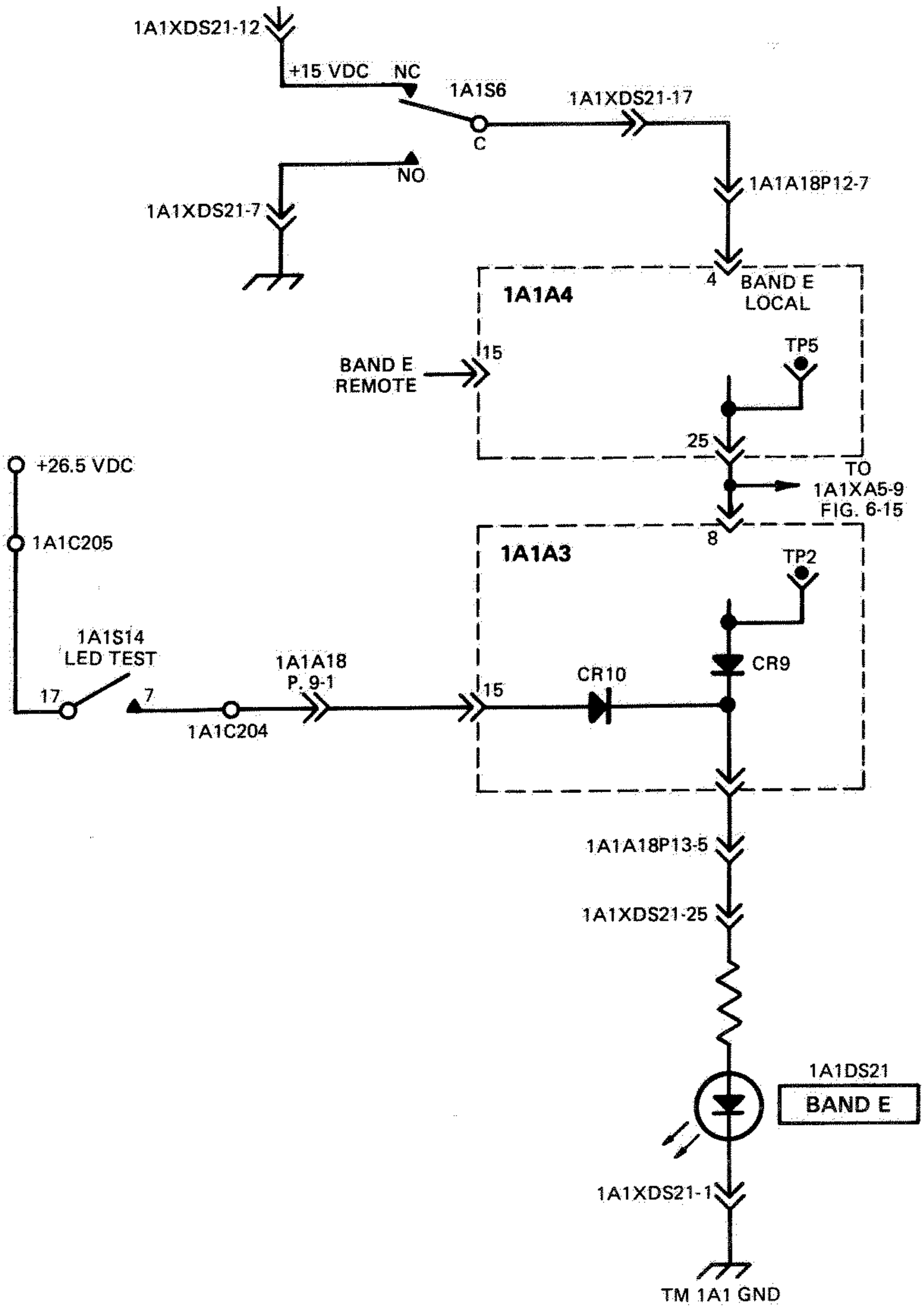


Figure 6-13. BAND E Control Diagram

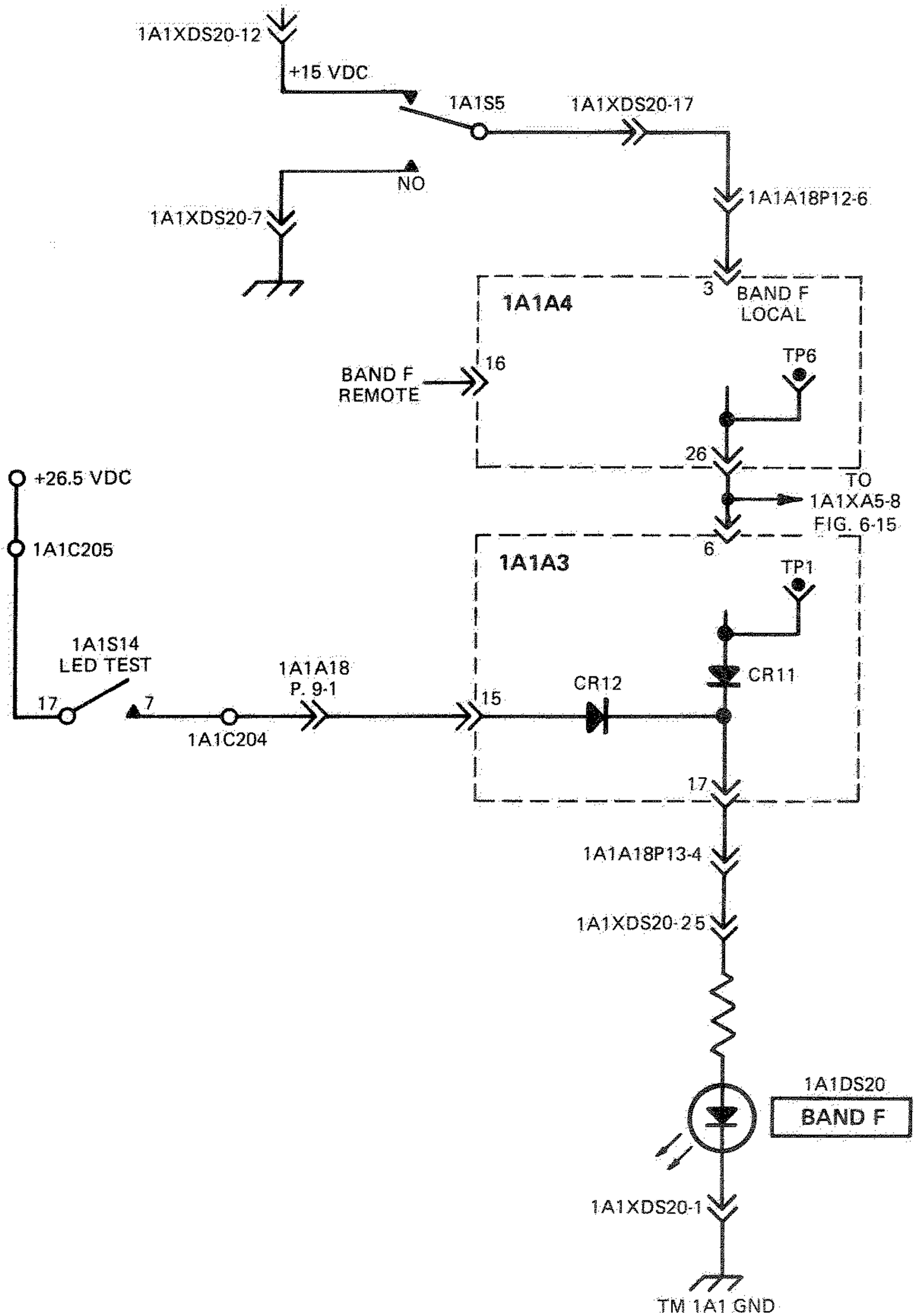


Figure 6-14. BAND F Control Diagram

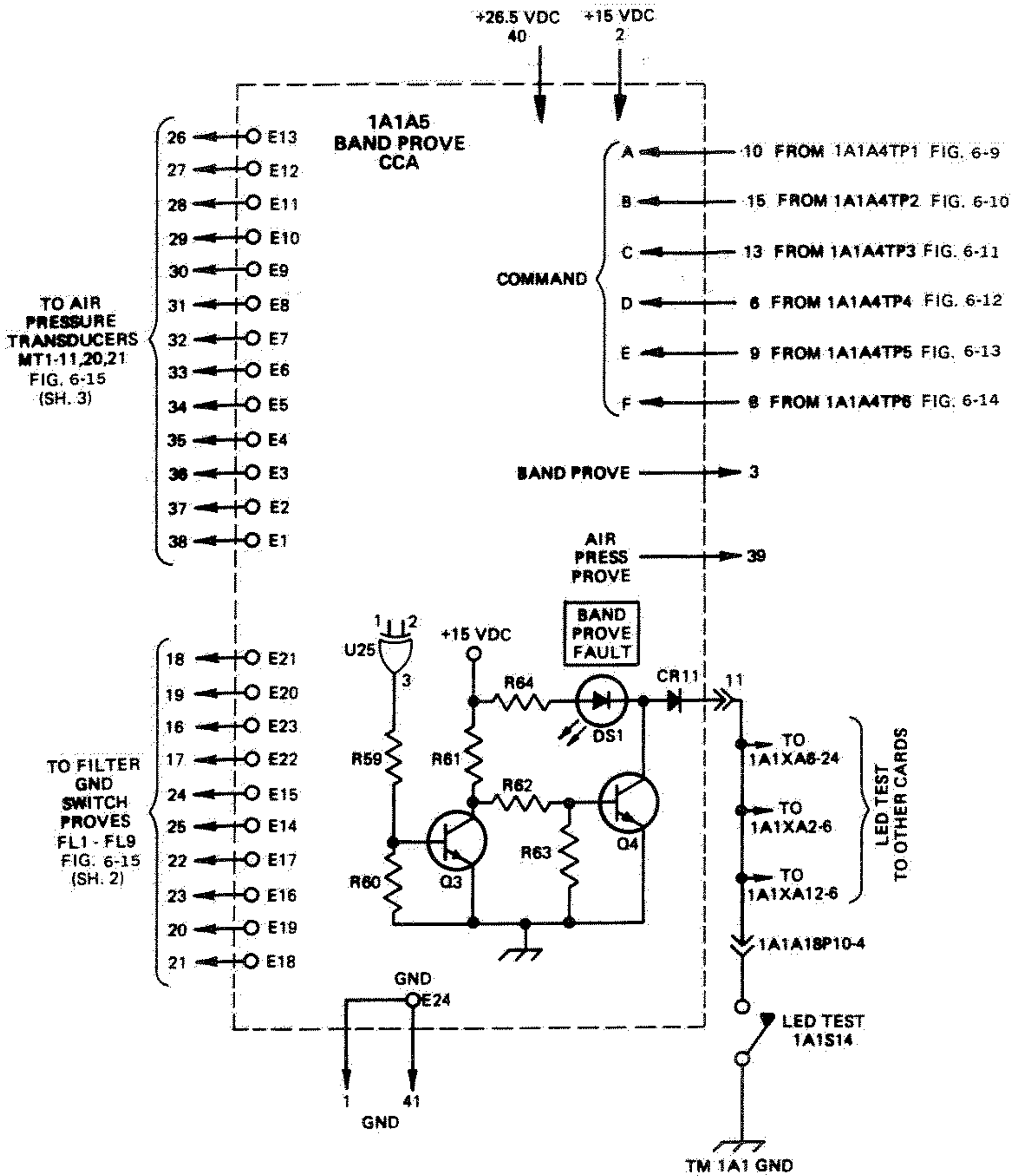


Figure 6-15. BAND PROVE FAULT Control Diagram
(Sheet 1 of 3)

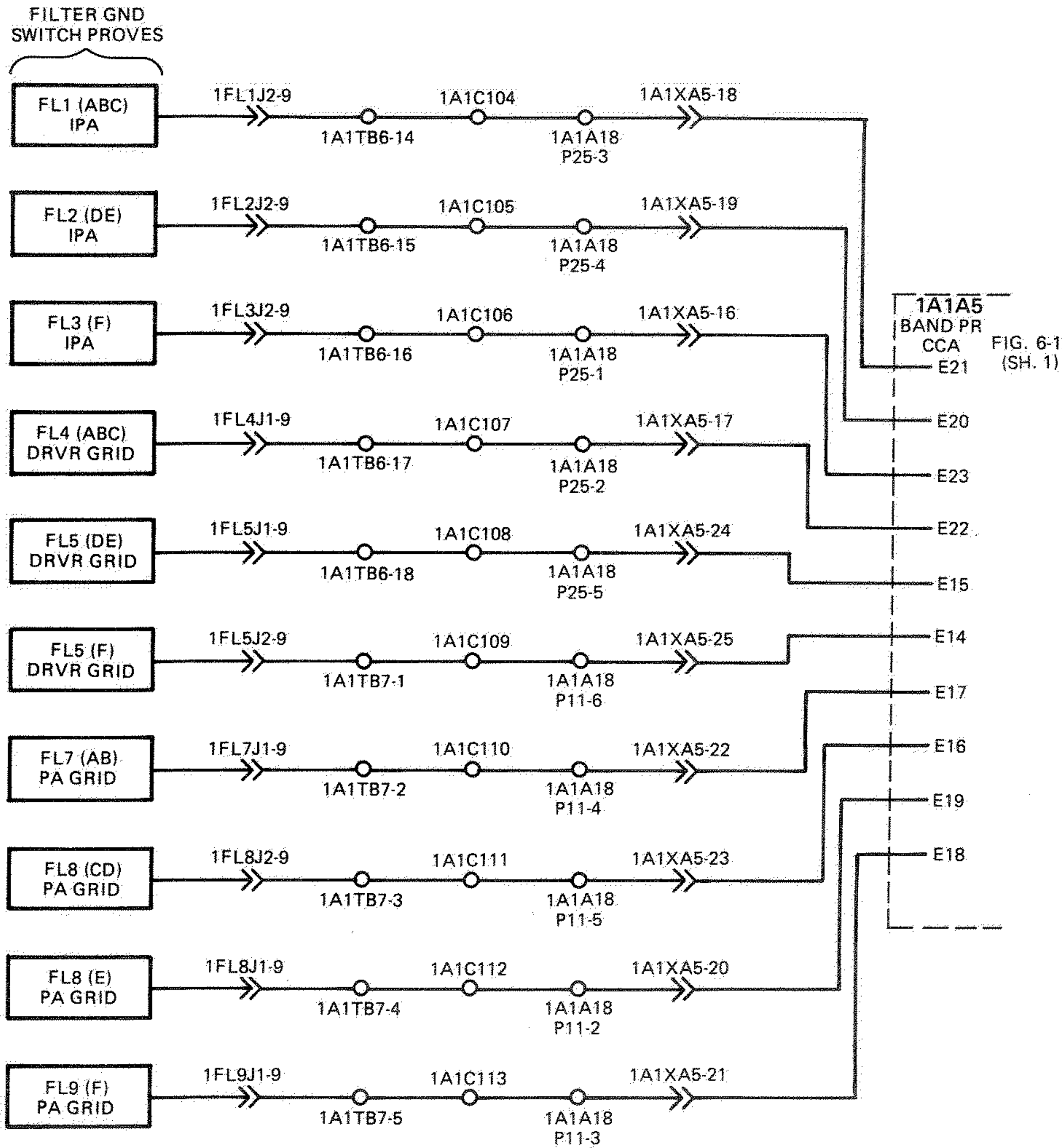


Figure 6-15. BAND PROVE FAULT Control Diagram
(Sheet 2 of 3)

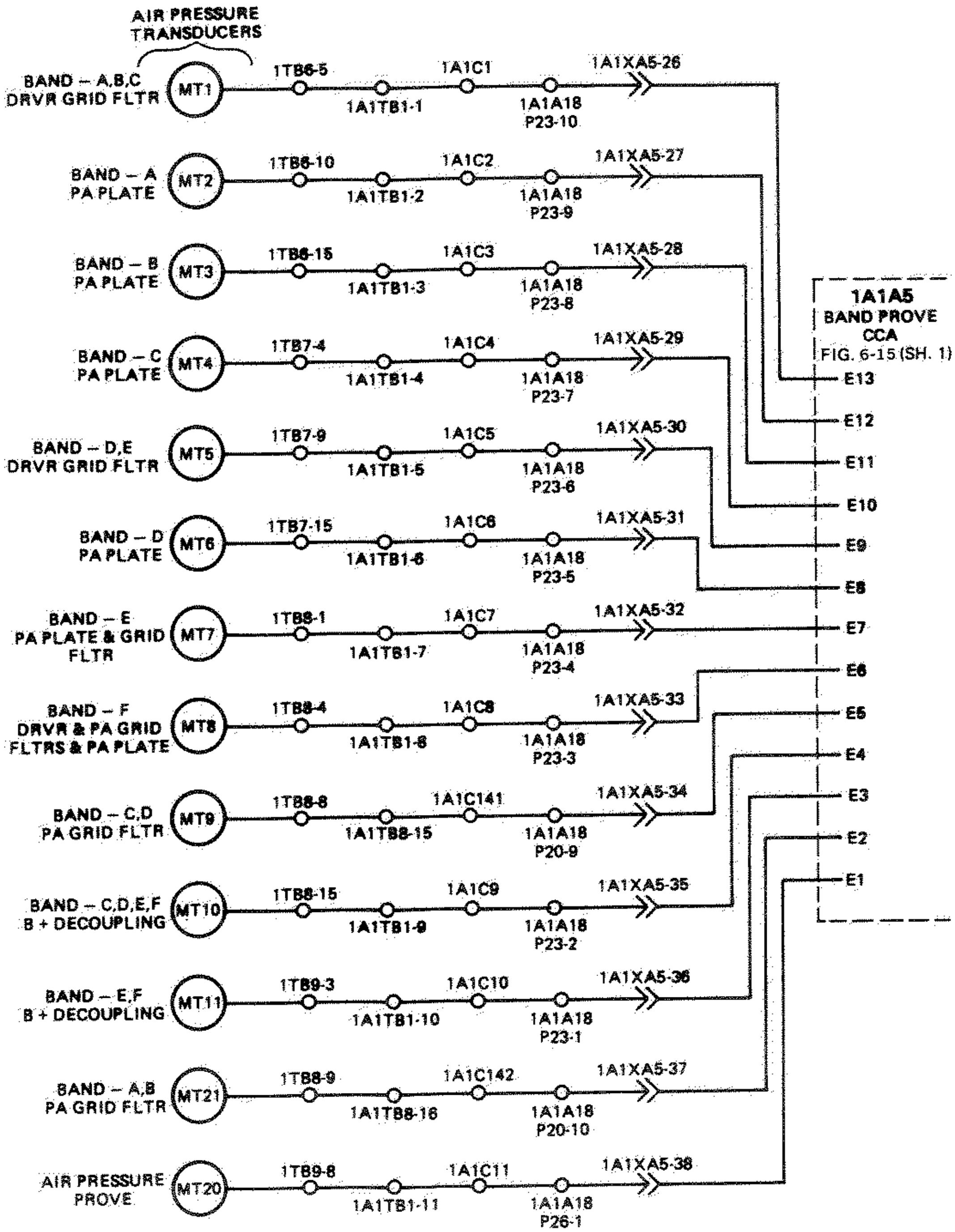


Figure 6-15. BAND PROVE FAULT Control Diagram
(Sheet 3 of 3)

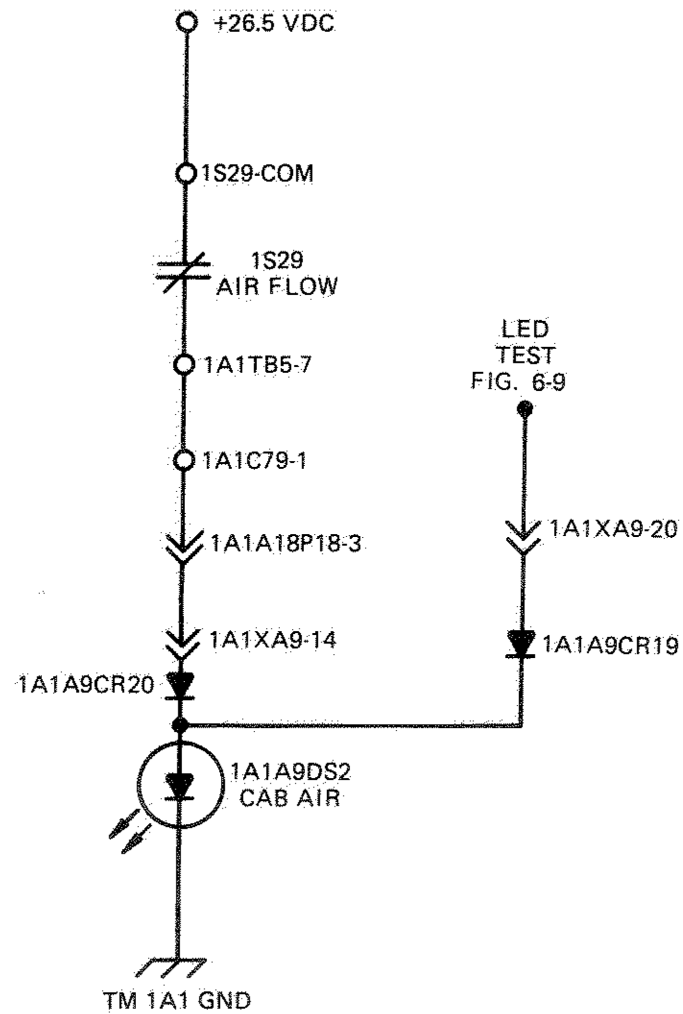


Figure 6-16. CAB AIR Control Diagram

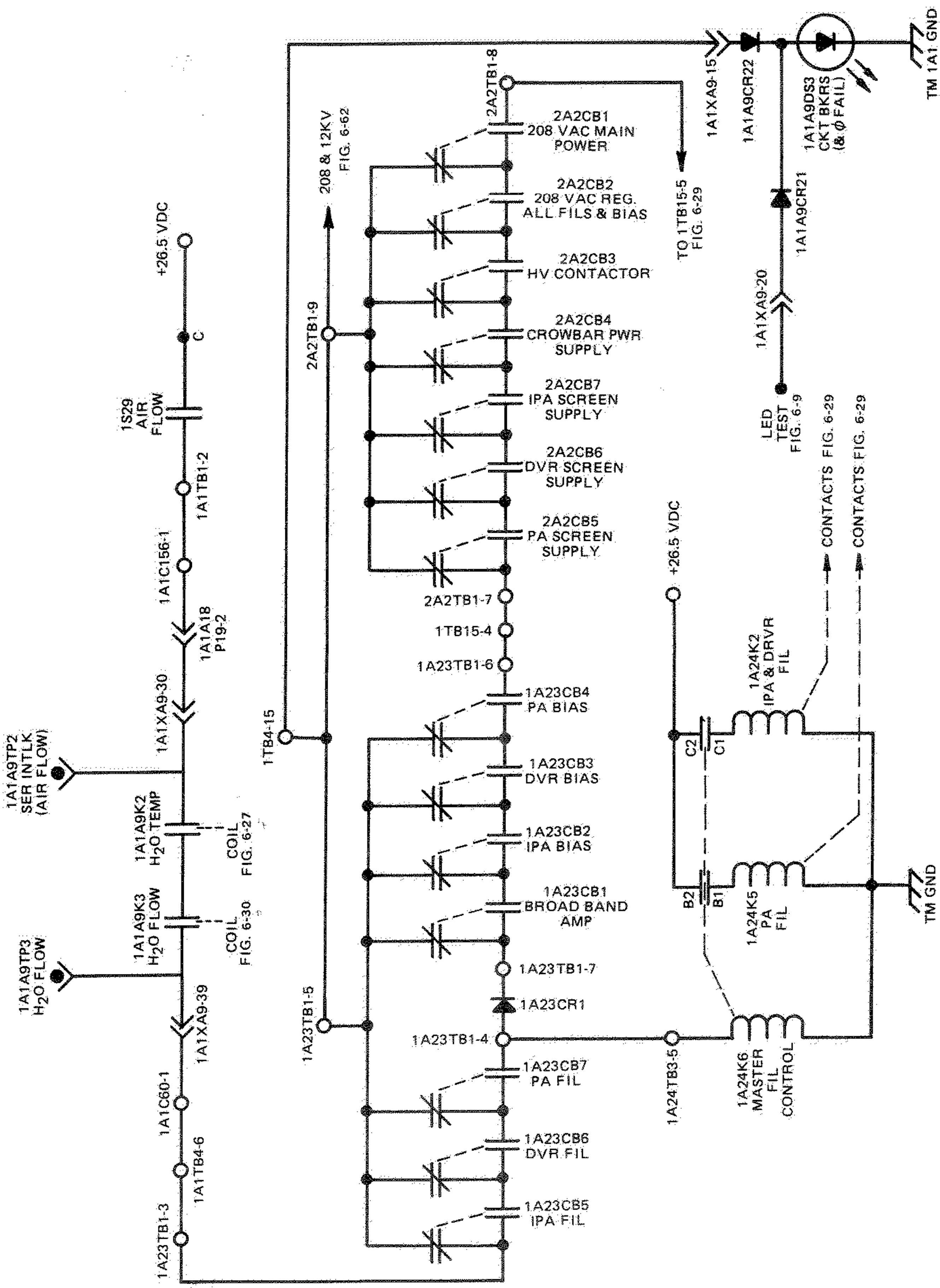


Figure 6-17. CKT BRKRS Control Diagram

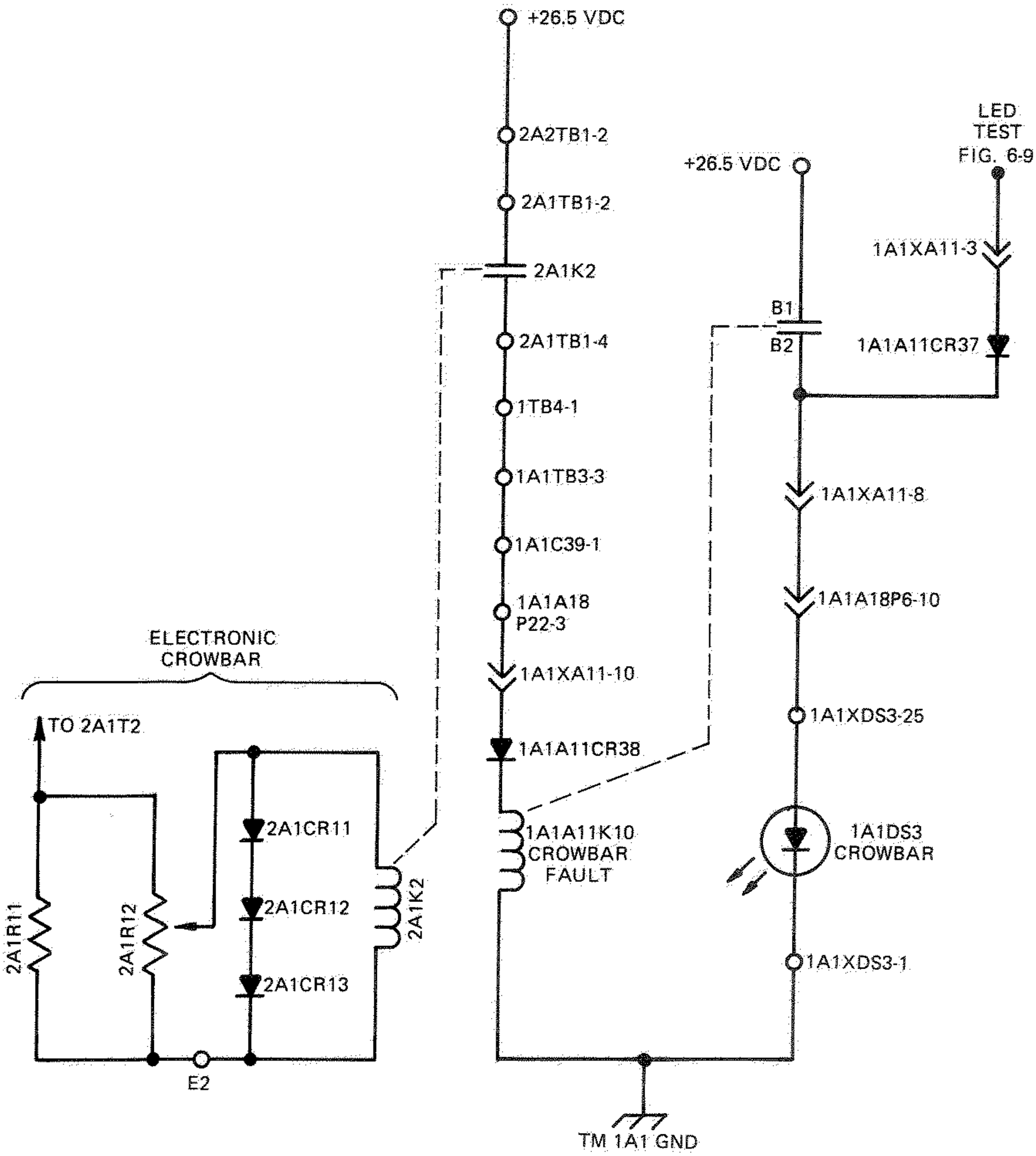


Figure 6-18. CROWBAR Fault Control Diagram

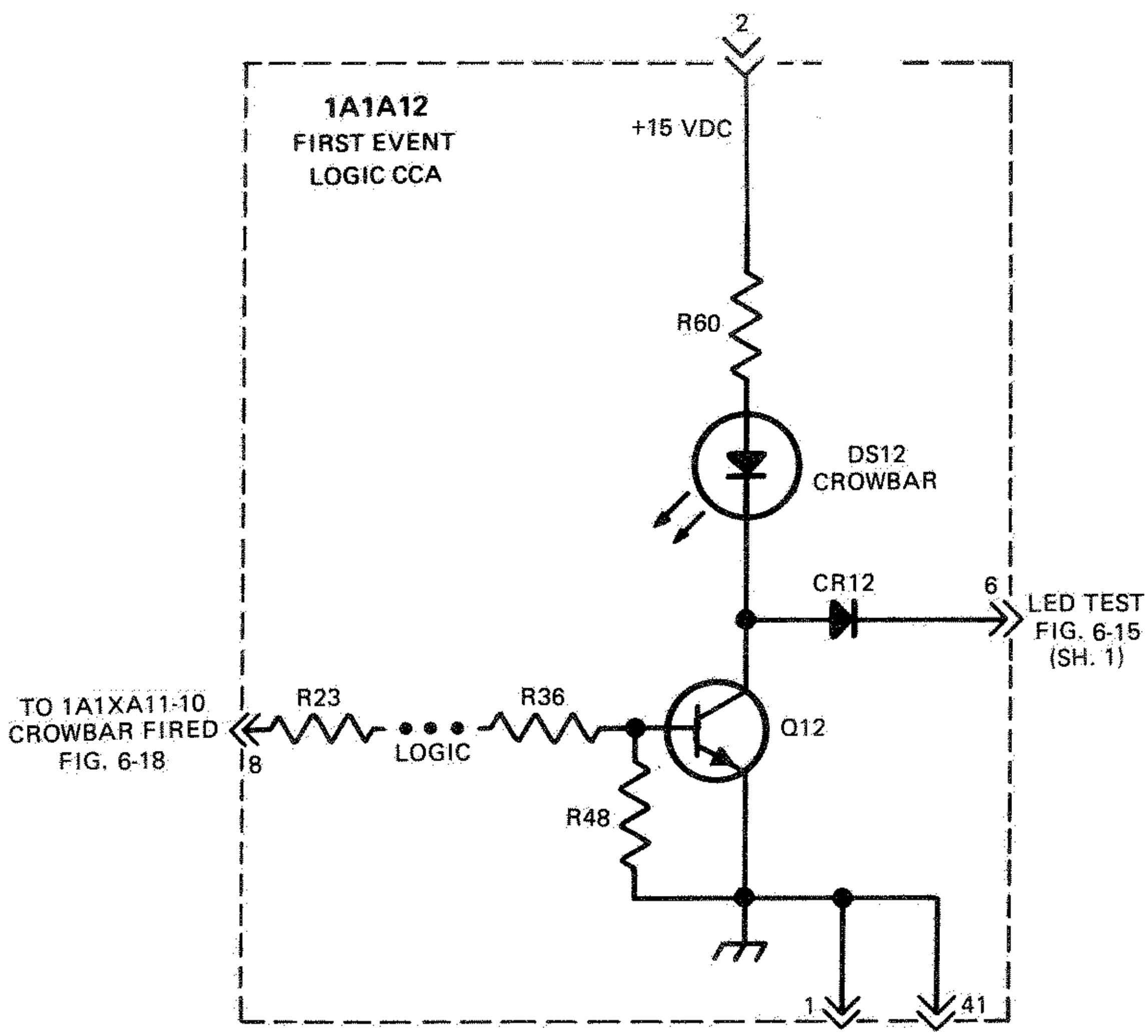


Figure 6-19. CROWBAR First Event Logic Control Diagram

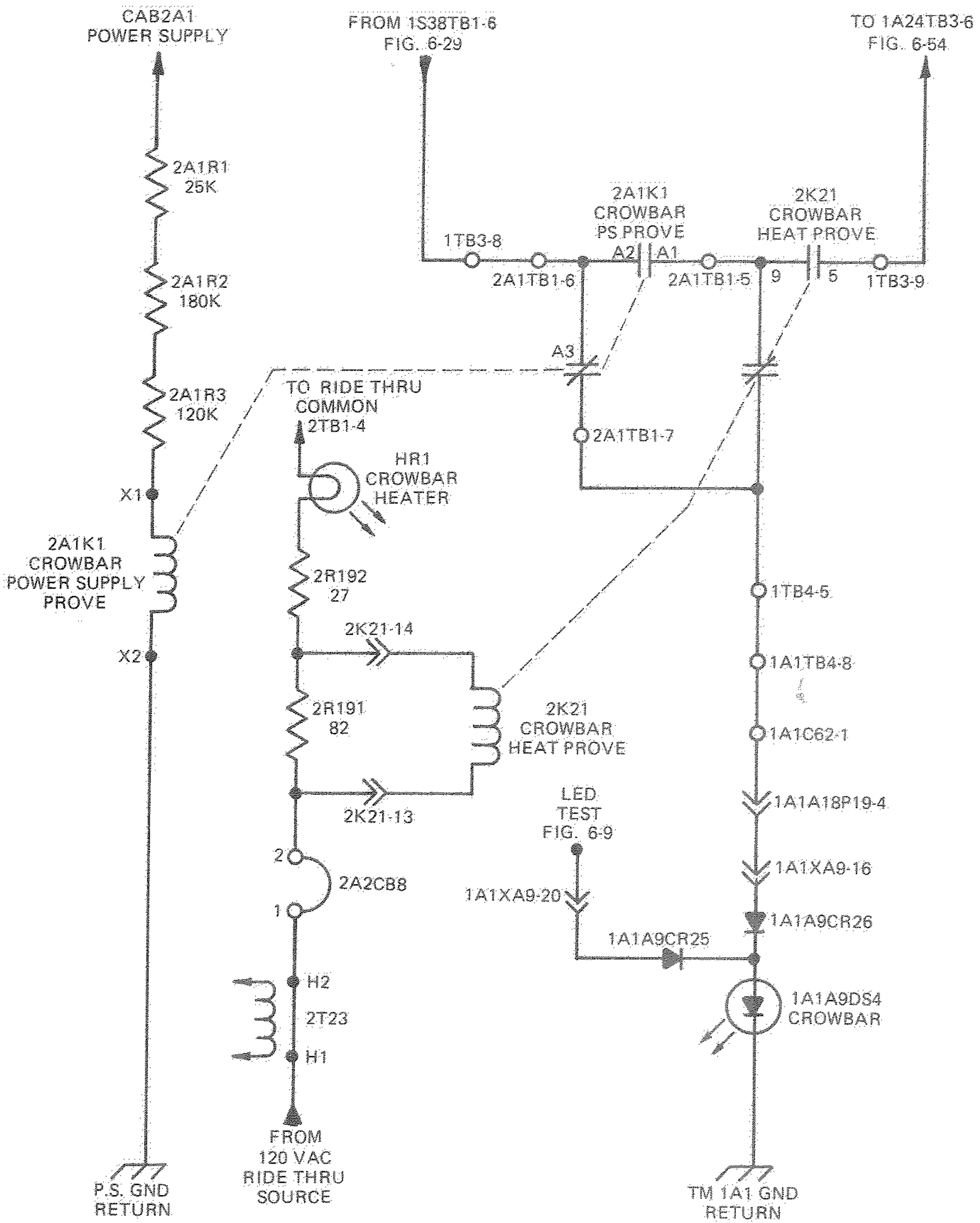


Figure 6-20. CROWBAR Power Supply Control Diagram

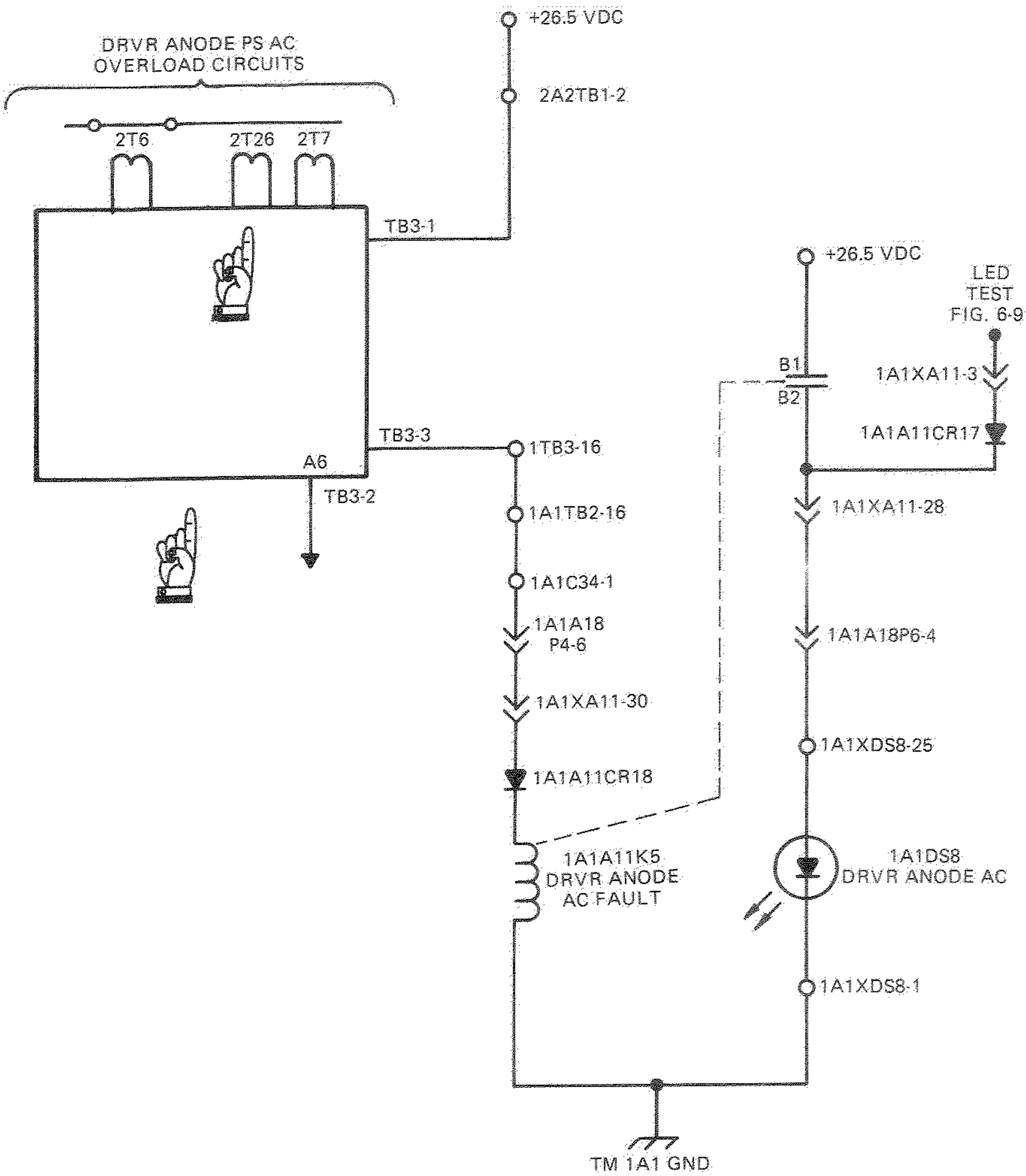


Figure 6-21. DRIVER AMPLIFIER ANODE AC Overload Control Diagram

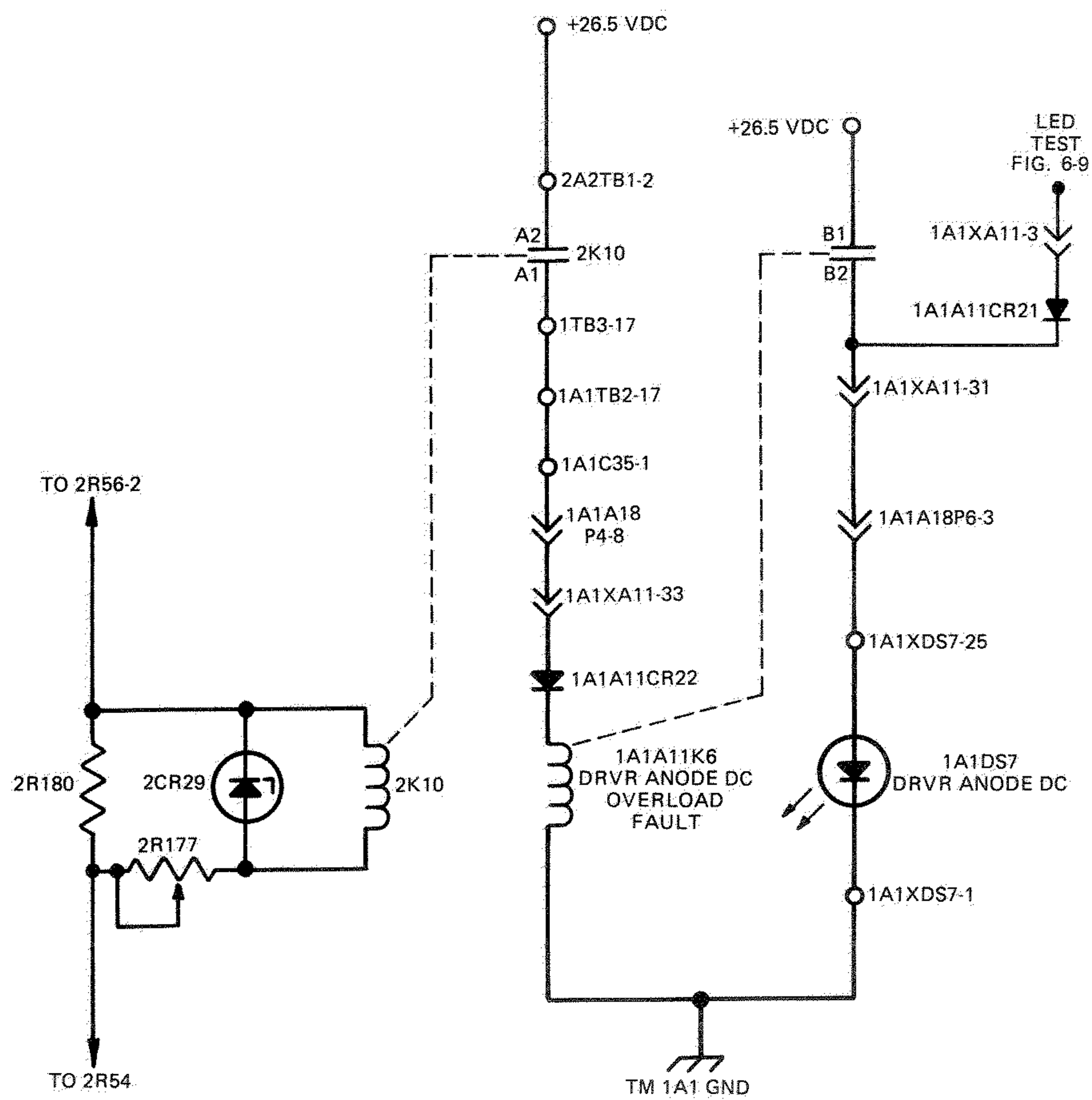


Figure 6-22. DRIVER AMPLIFIER ANODE DC
Overload Control Diagram

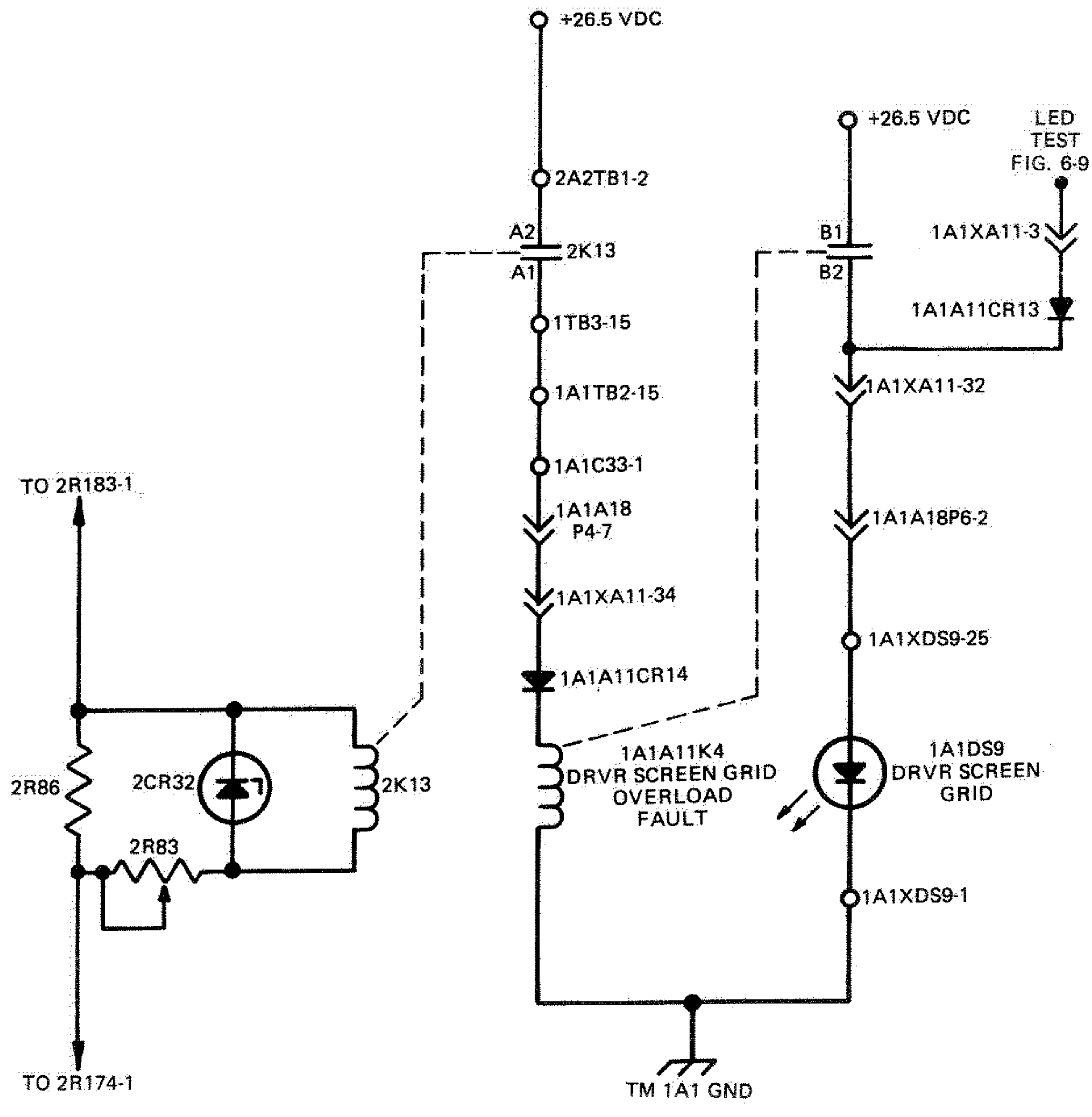


Figure 6-23. DRIVER AMPLIFIER SCREEN GRID
DC Overload Control Diagram

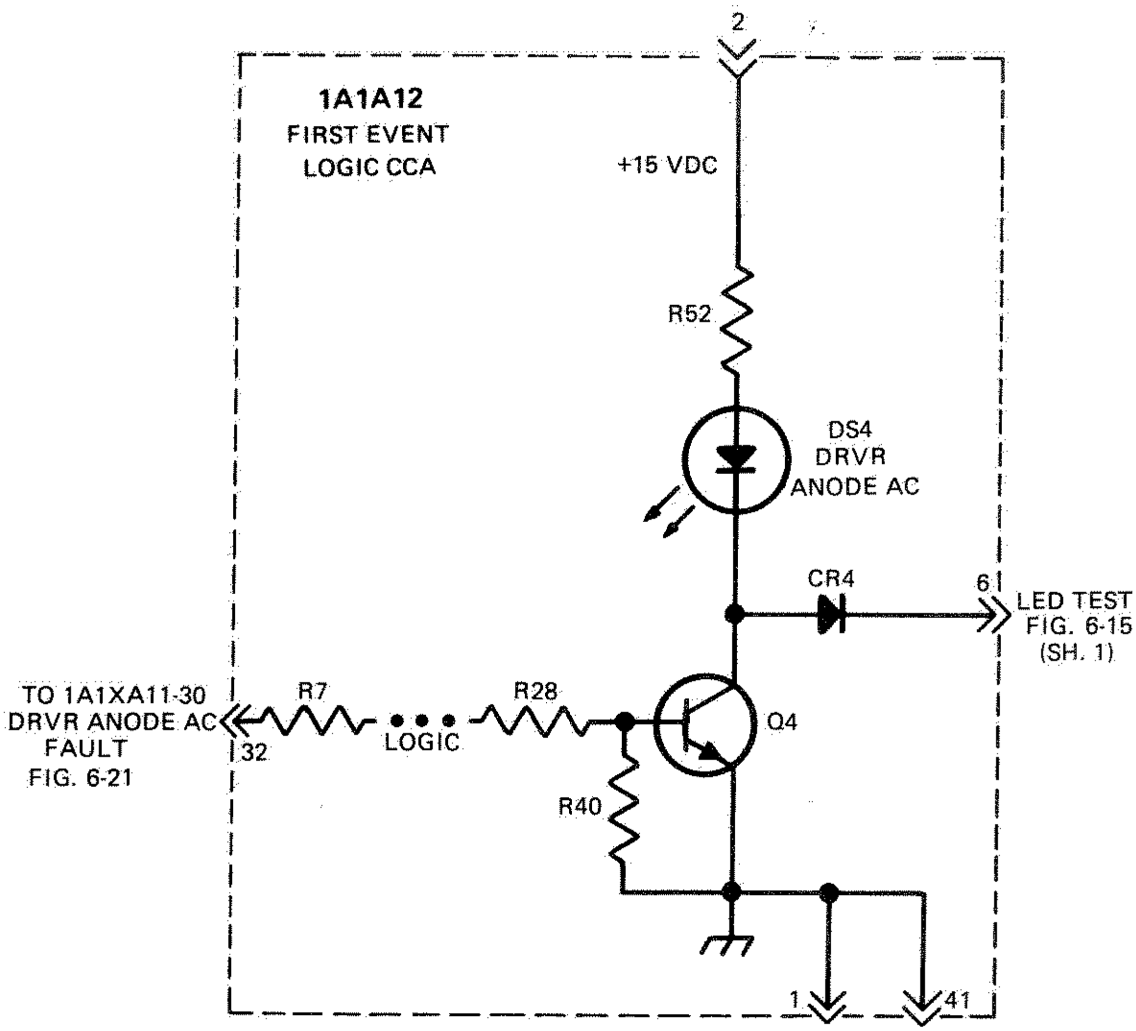


Figure 6-24. DRVR A (Anode) AC First
Event Logic Control Diagram

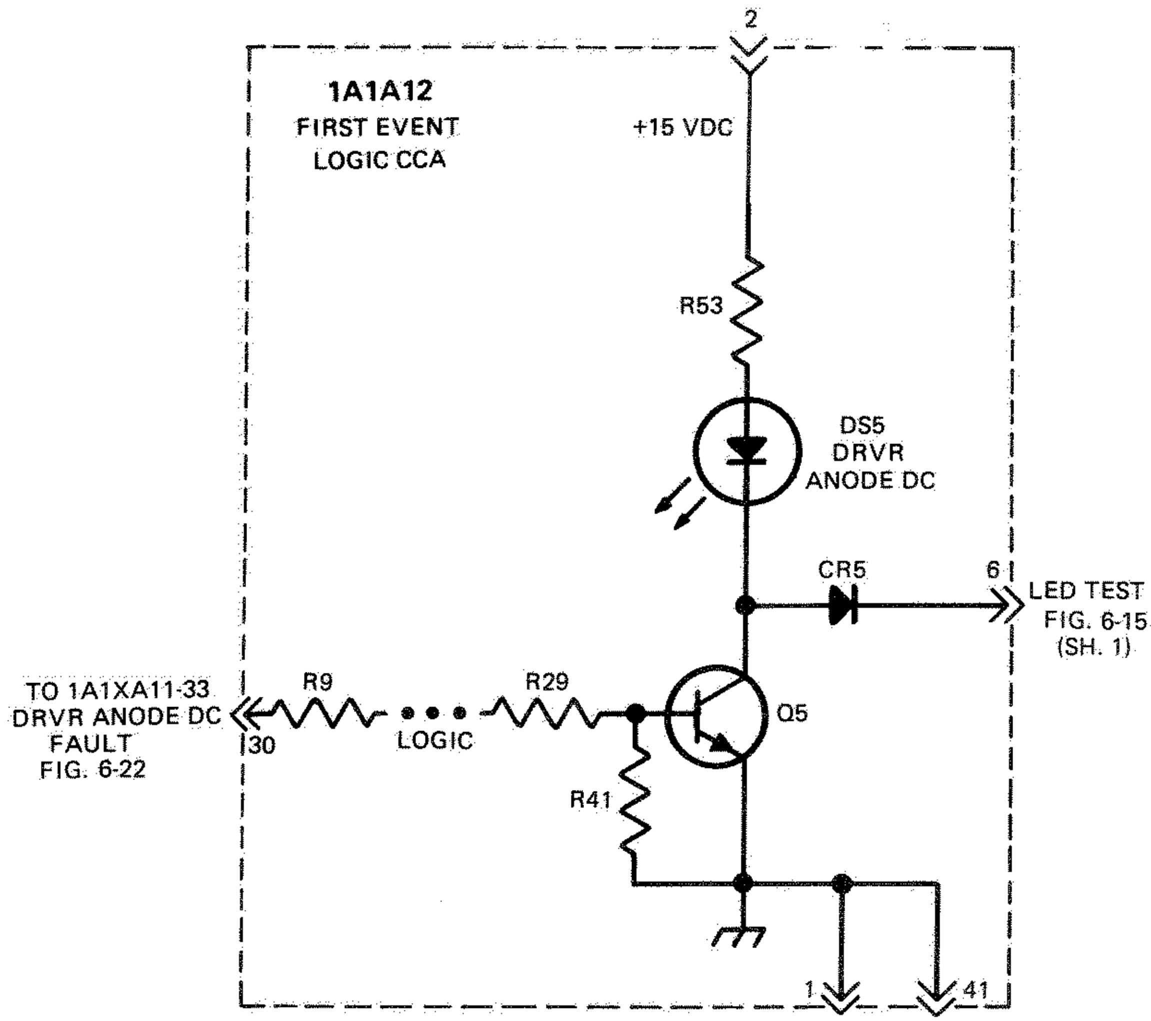


Figure 6-25. DRVR A (Anode) DC First Event Logic Control Diagram

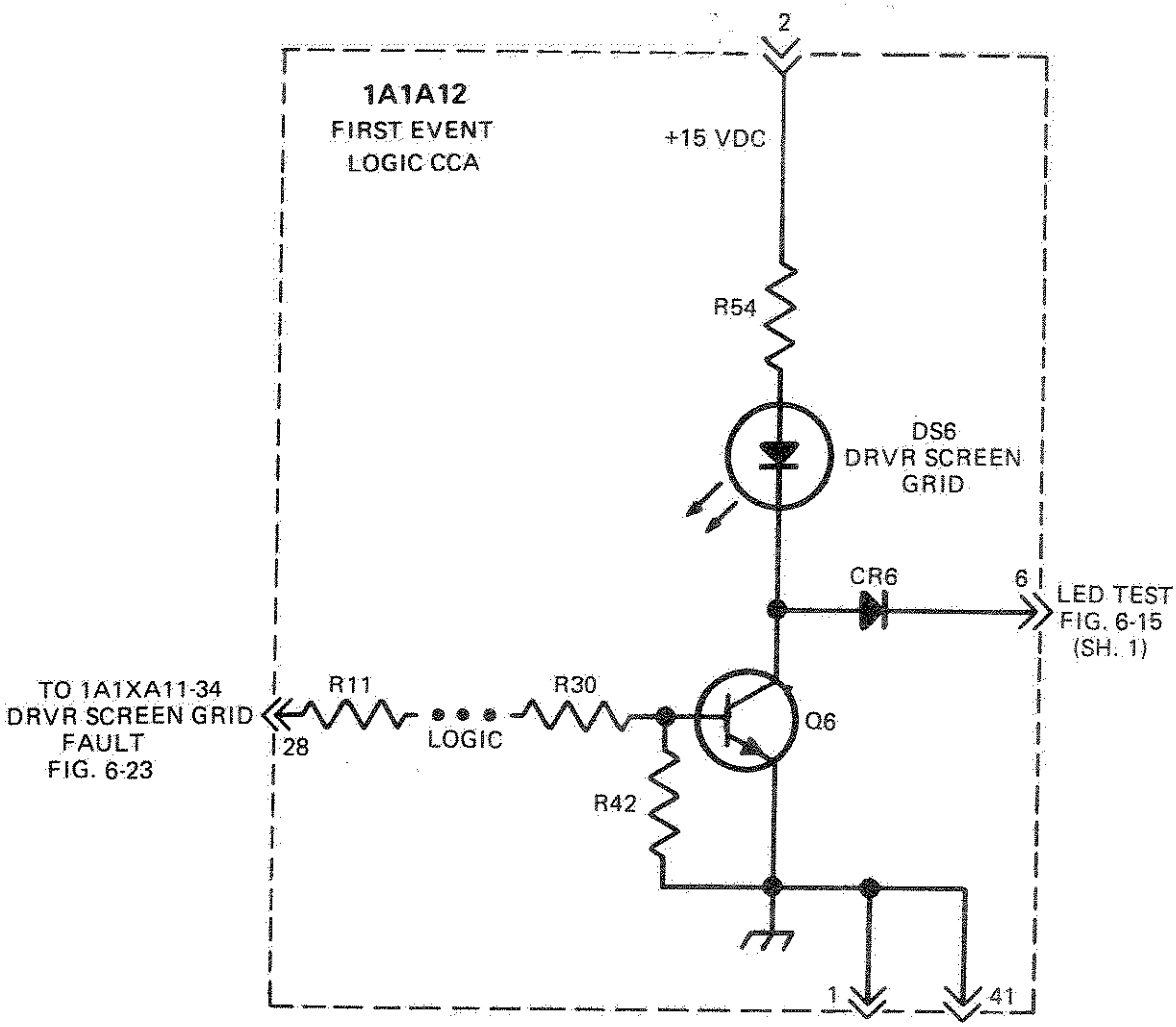


Figure 6-26. DRVR SCRN (Screen Grid)
First Event Logic Control Diagram

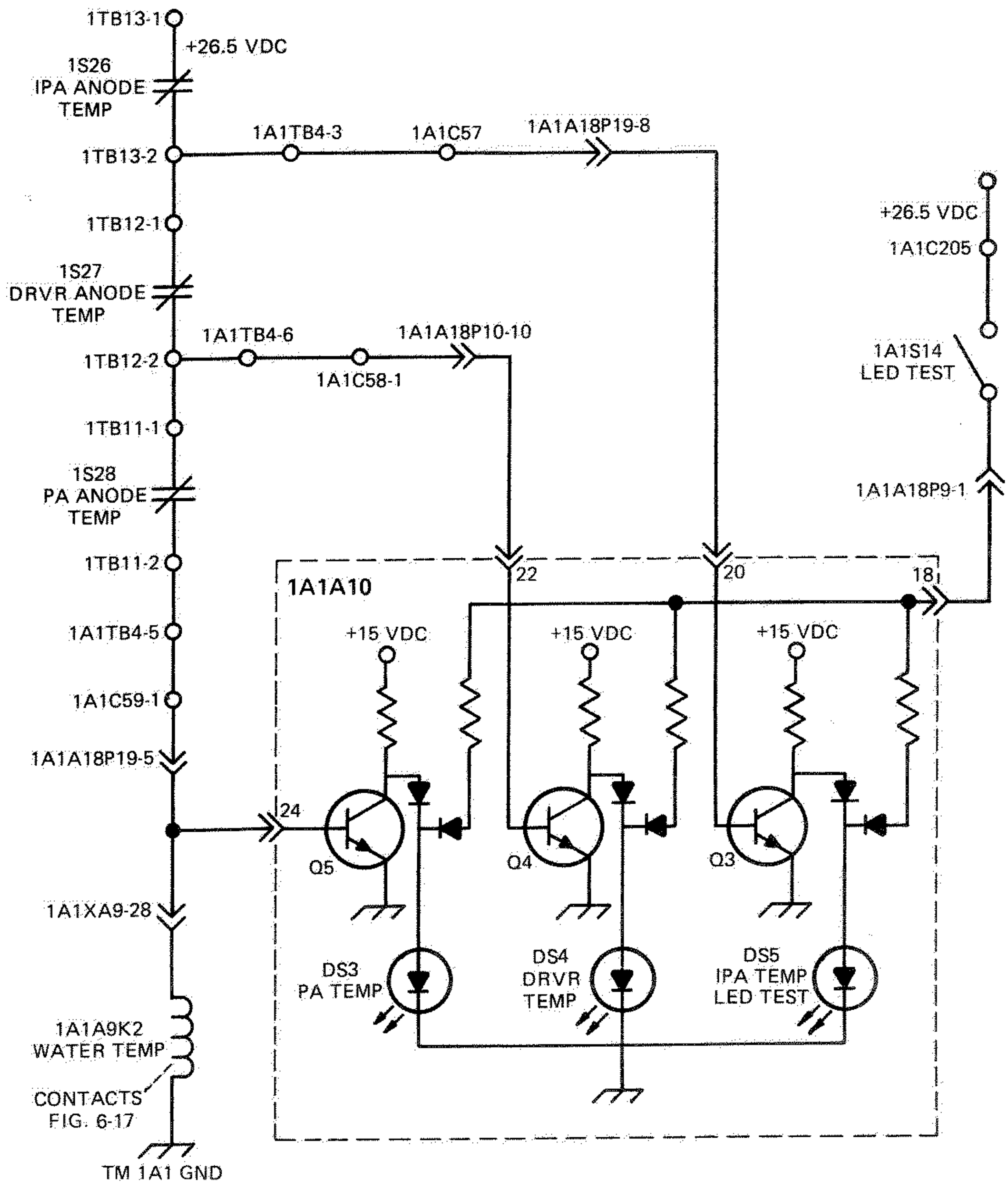


Figure 6-27. PA TEMP, DRVR TEMP, IPA TEMP
Control Diagram

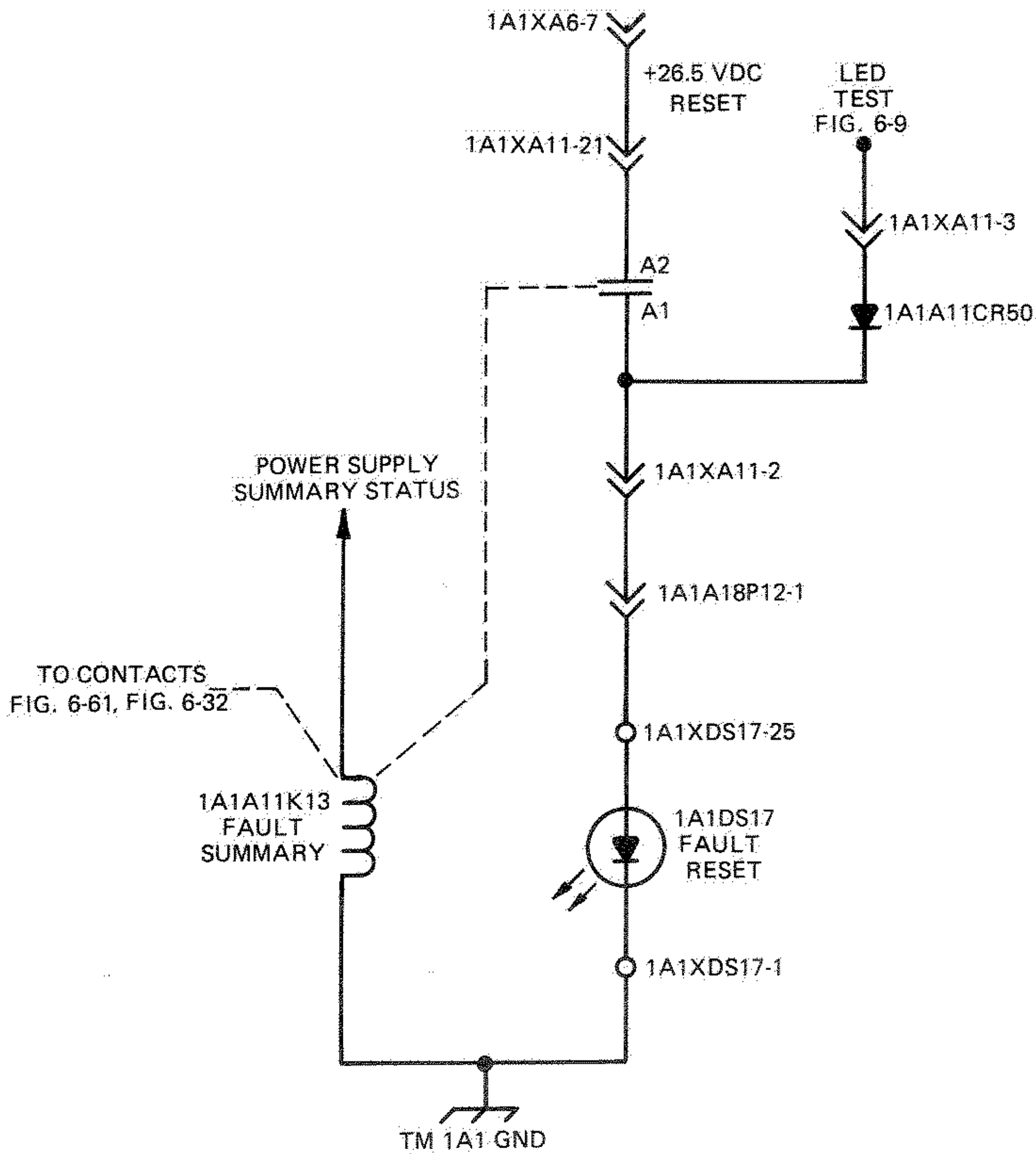


Figure 6-28. FAULT RESET Control Diagram

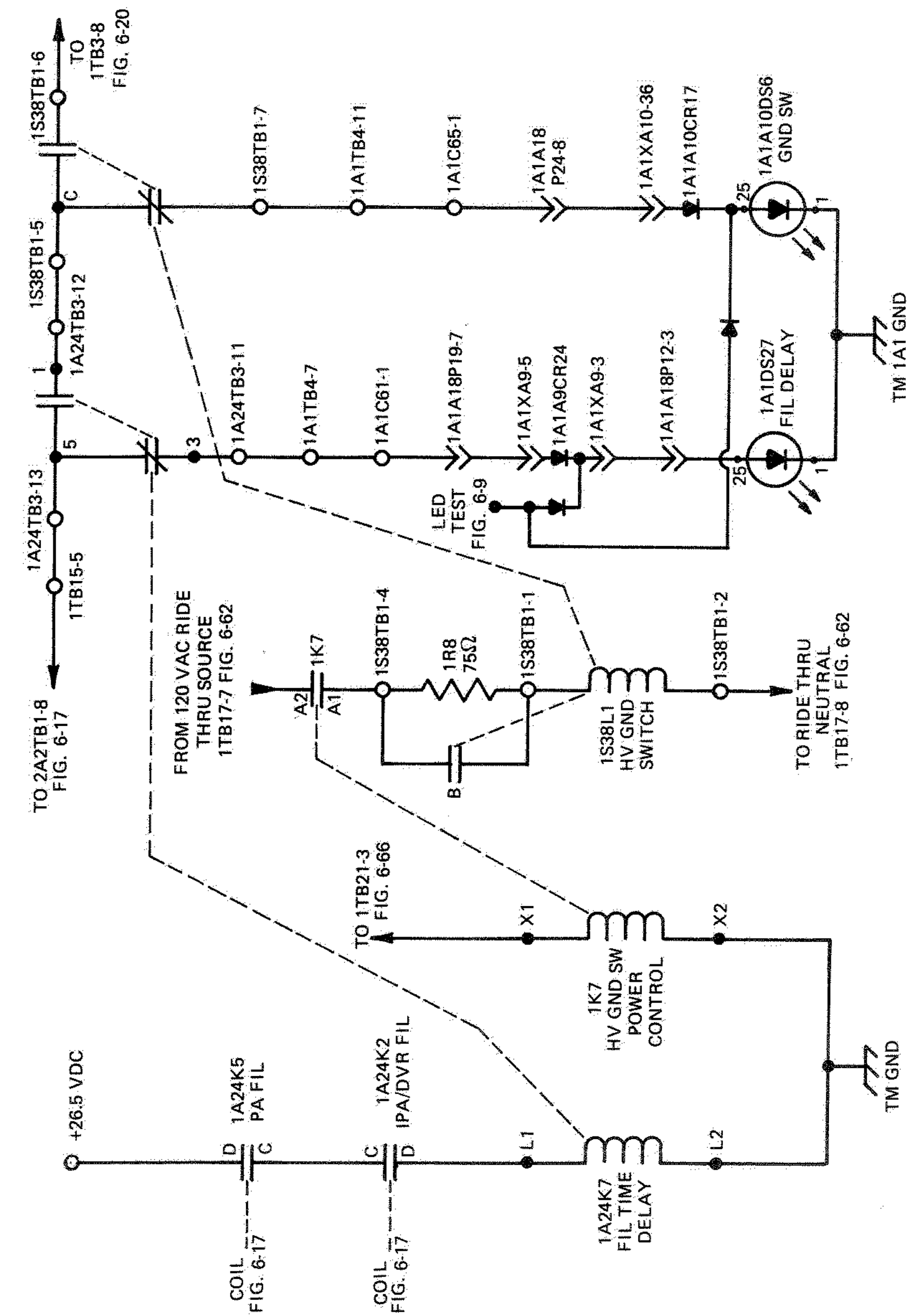


Figure 6-29. GND SW and FIL DELAY Control Diagram

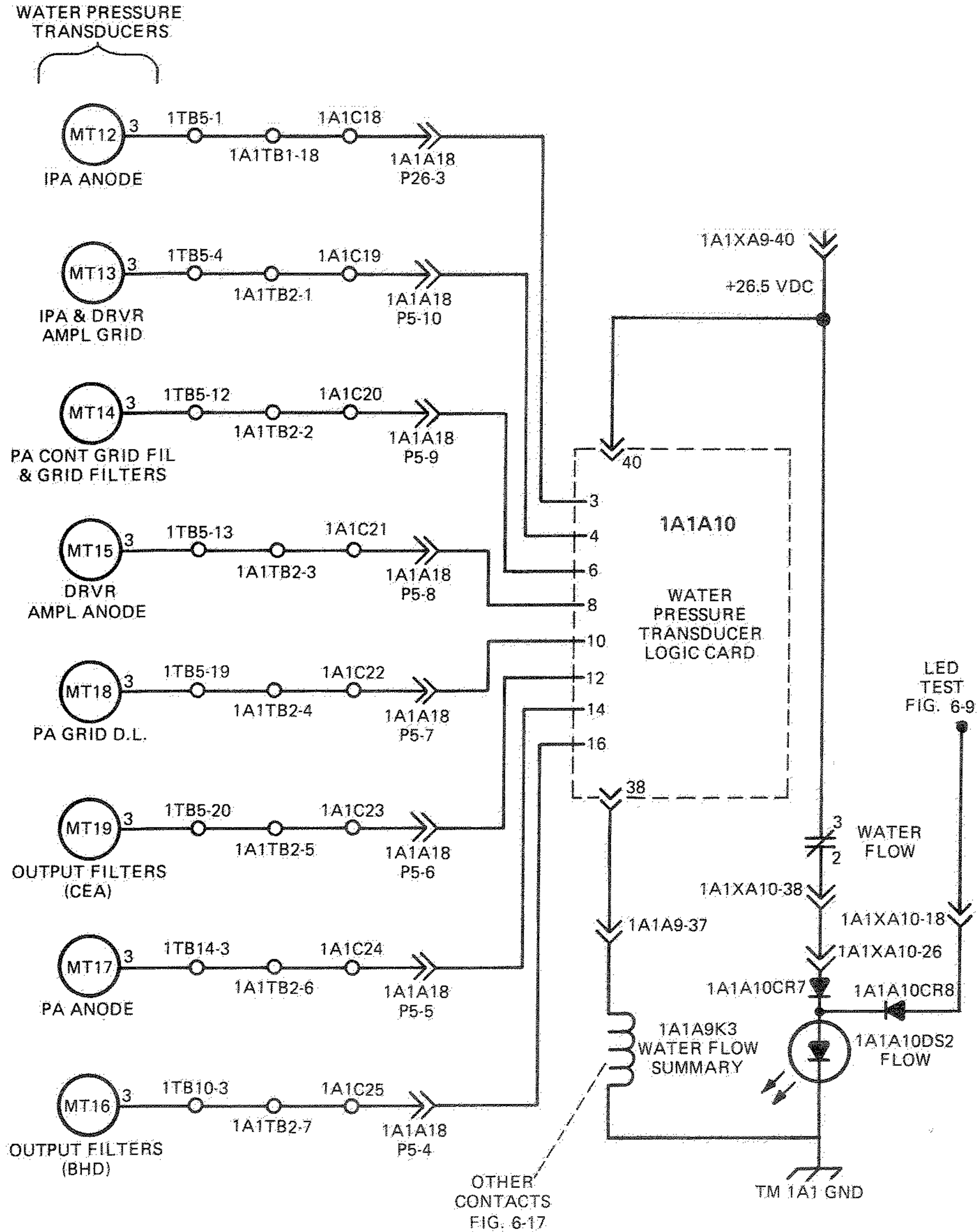


Figure 6-30. FLOW Control Diagram

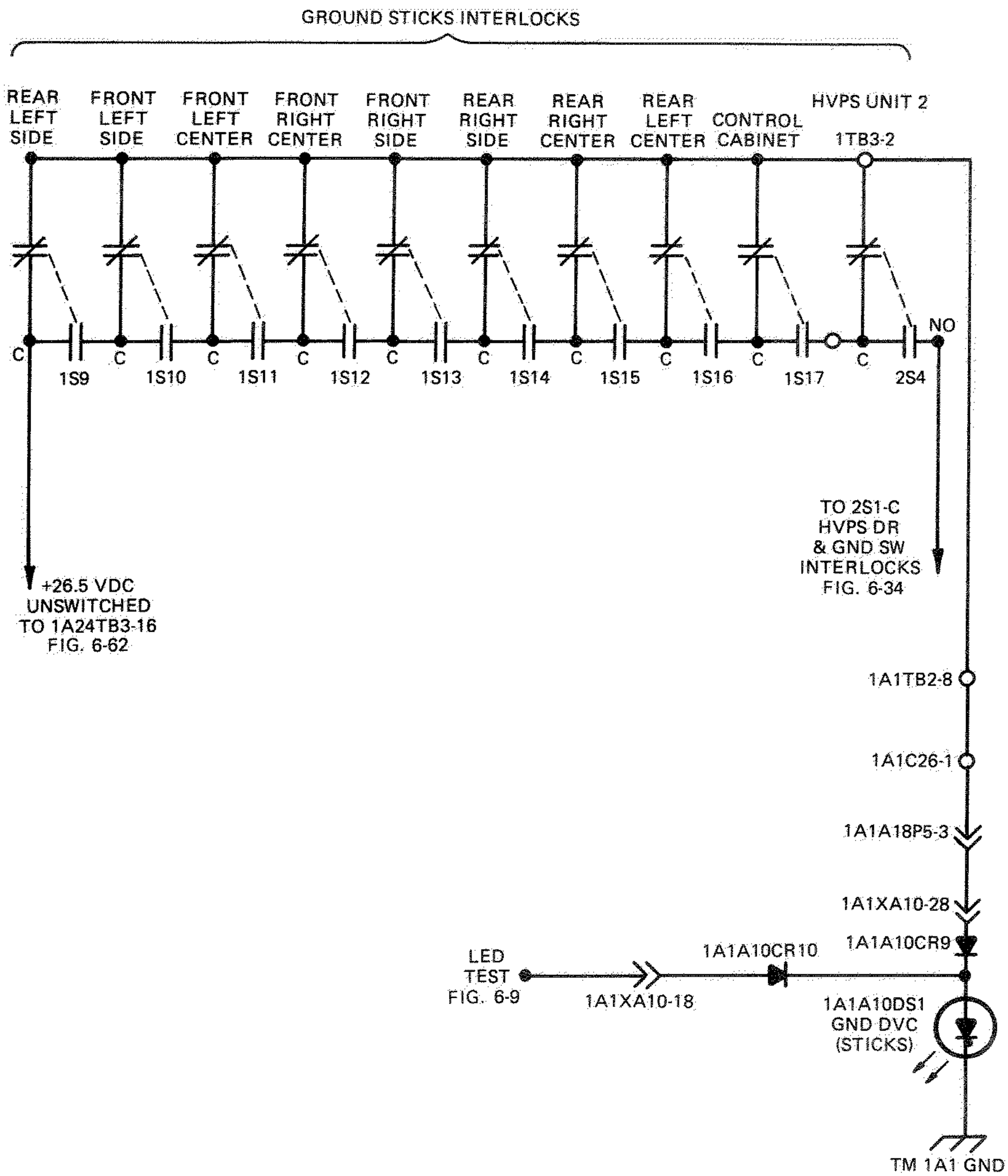


Figure 6-31. GND DVC Control Diagram

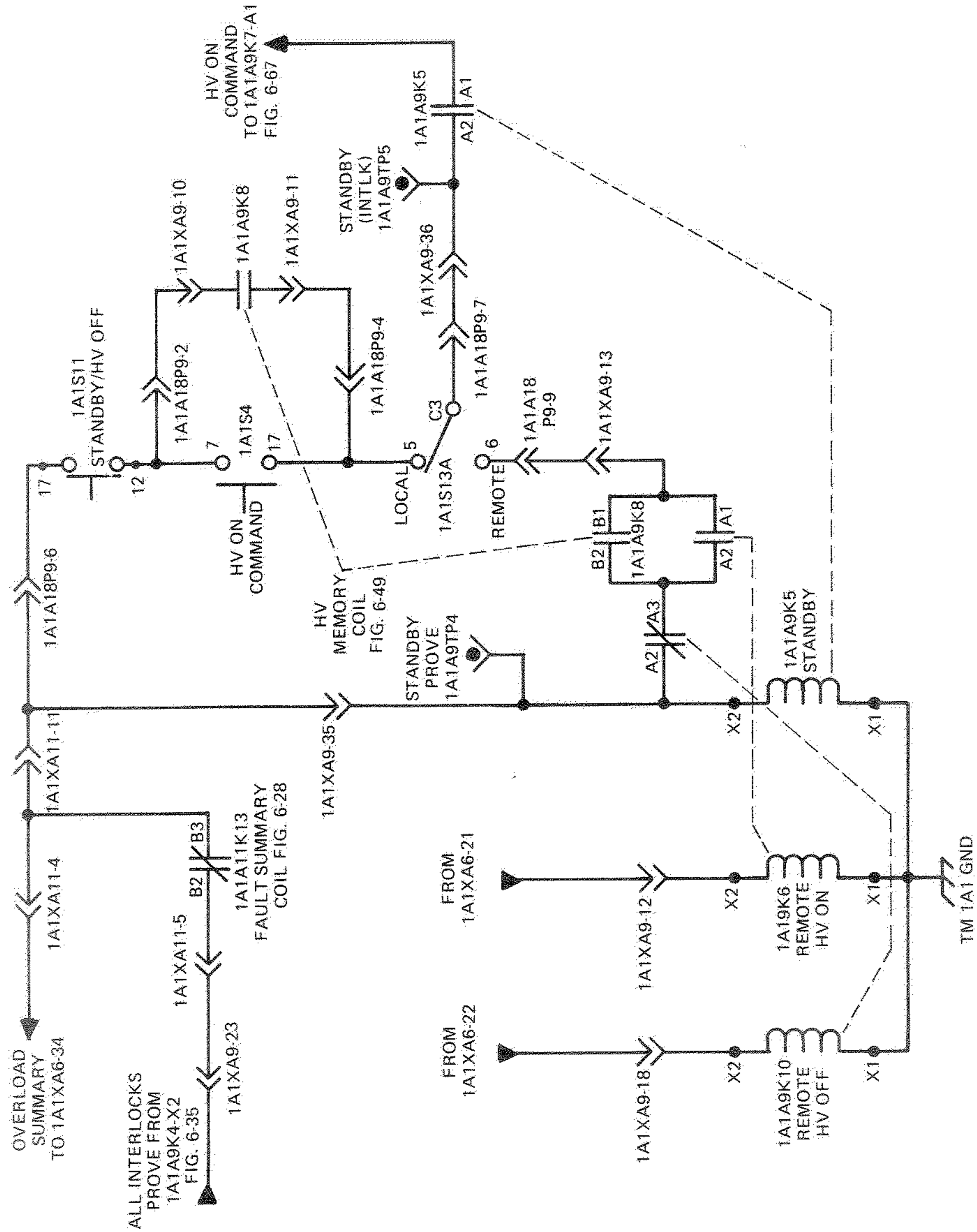


Figure 6-32. High Voltage Remote Control Diagram

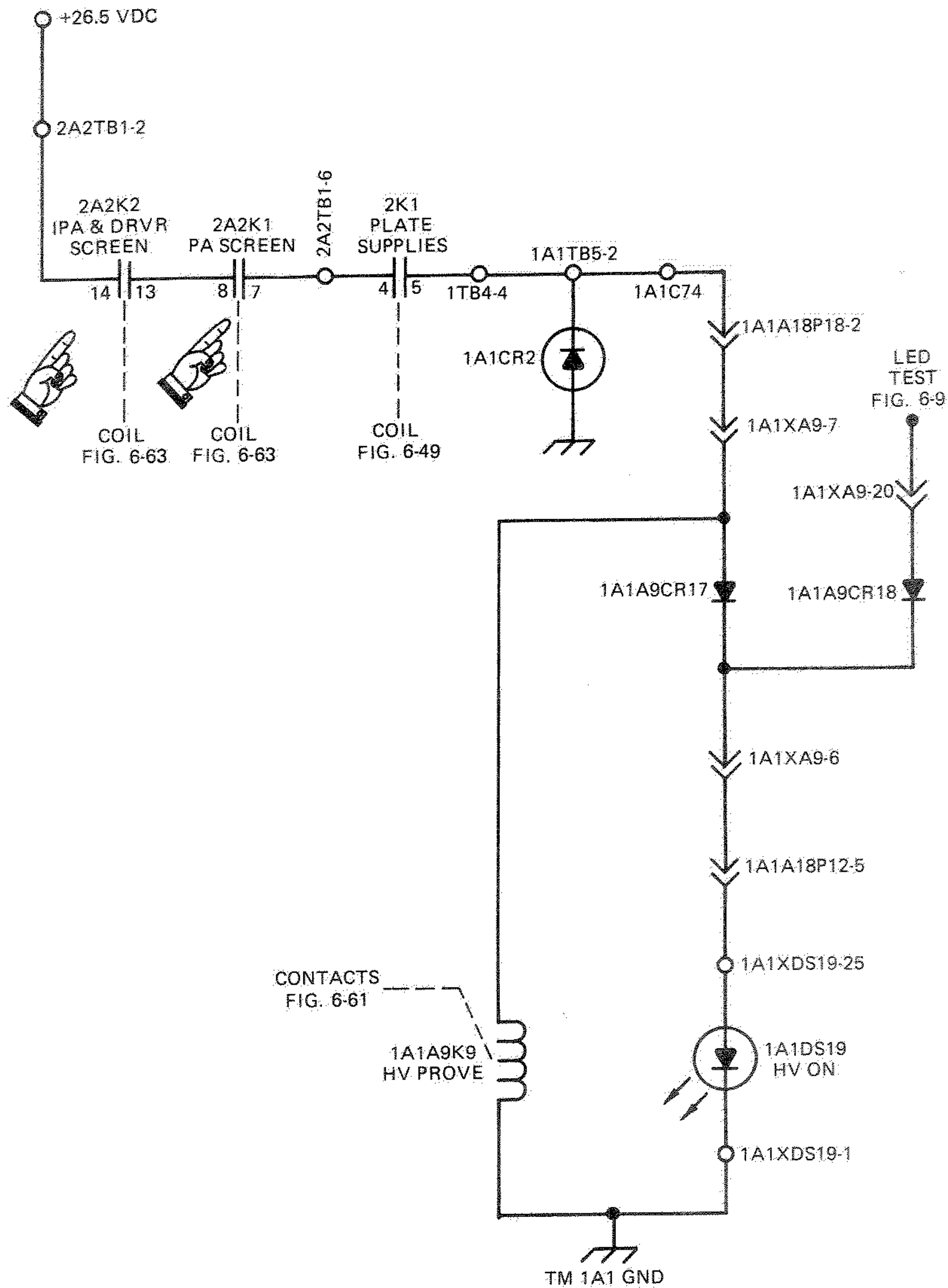


Figure 6-33. HV ON Control Diagram

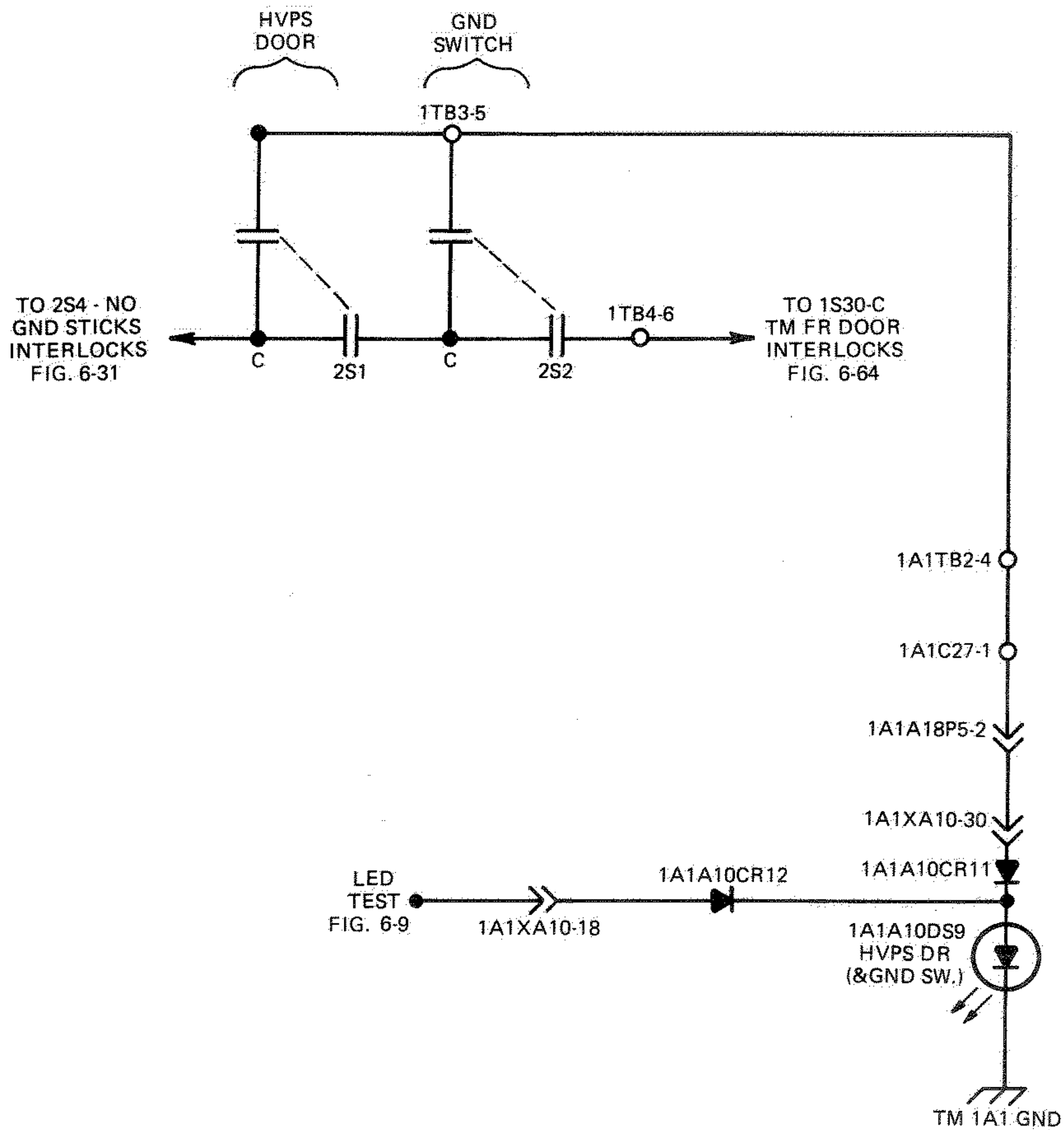


Figure 6-34. HVPS DR Control Diagram

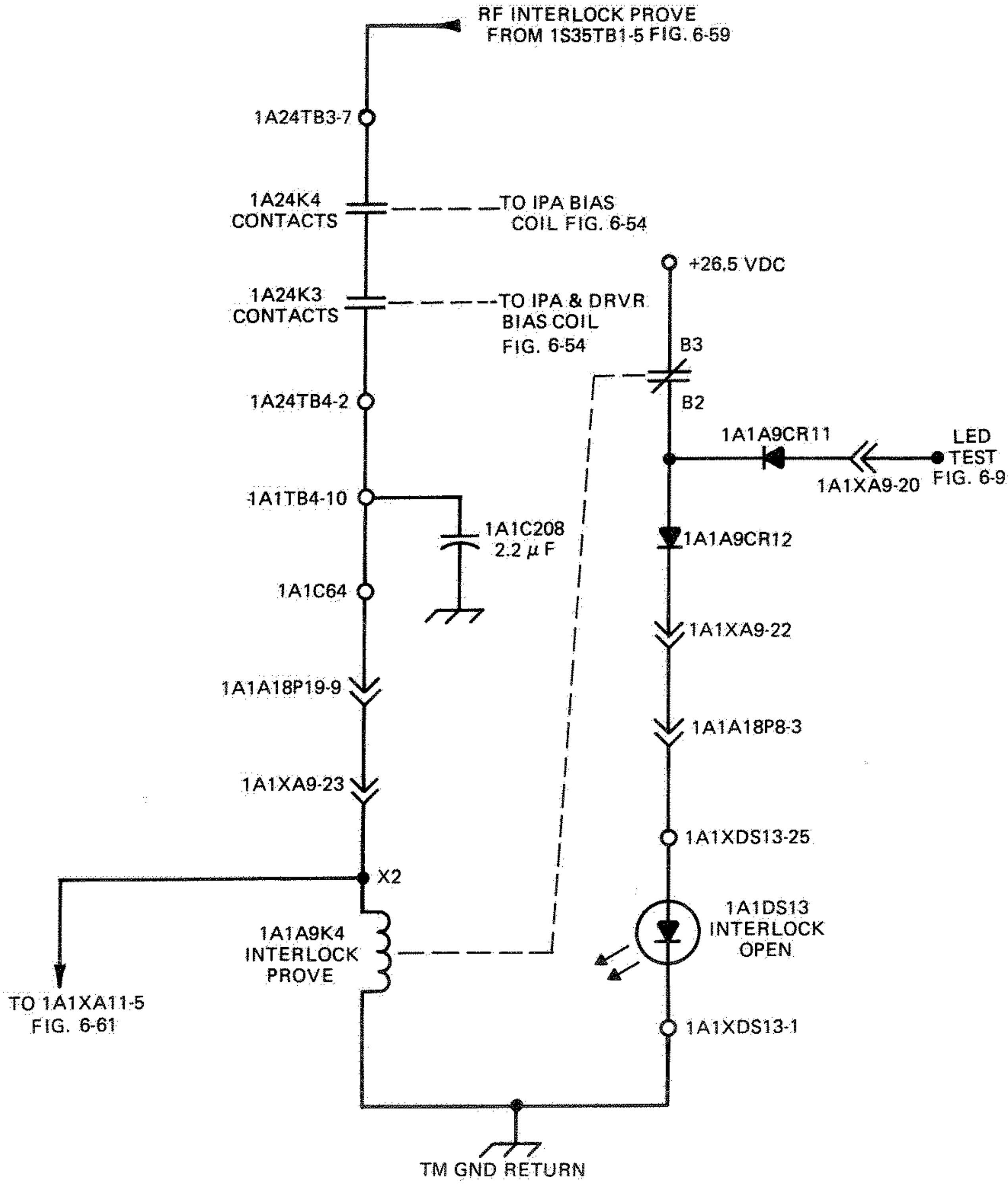


Figure 6-35. INTERLOCK OPEN Control Diagram

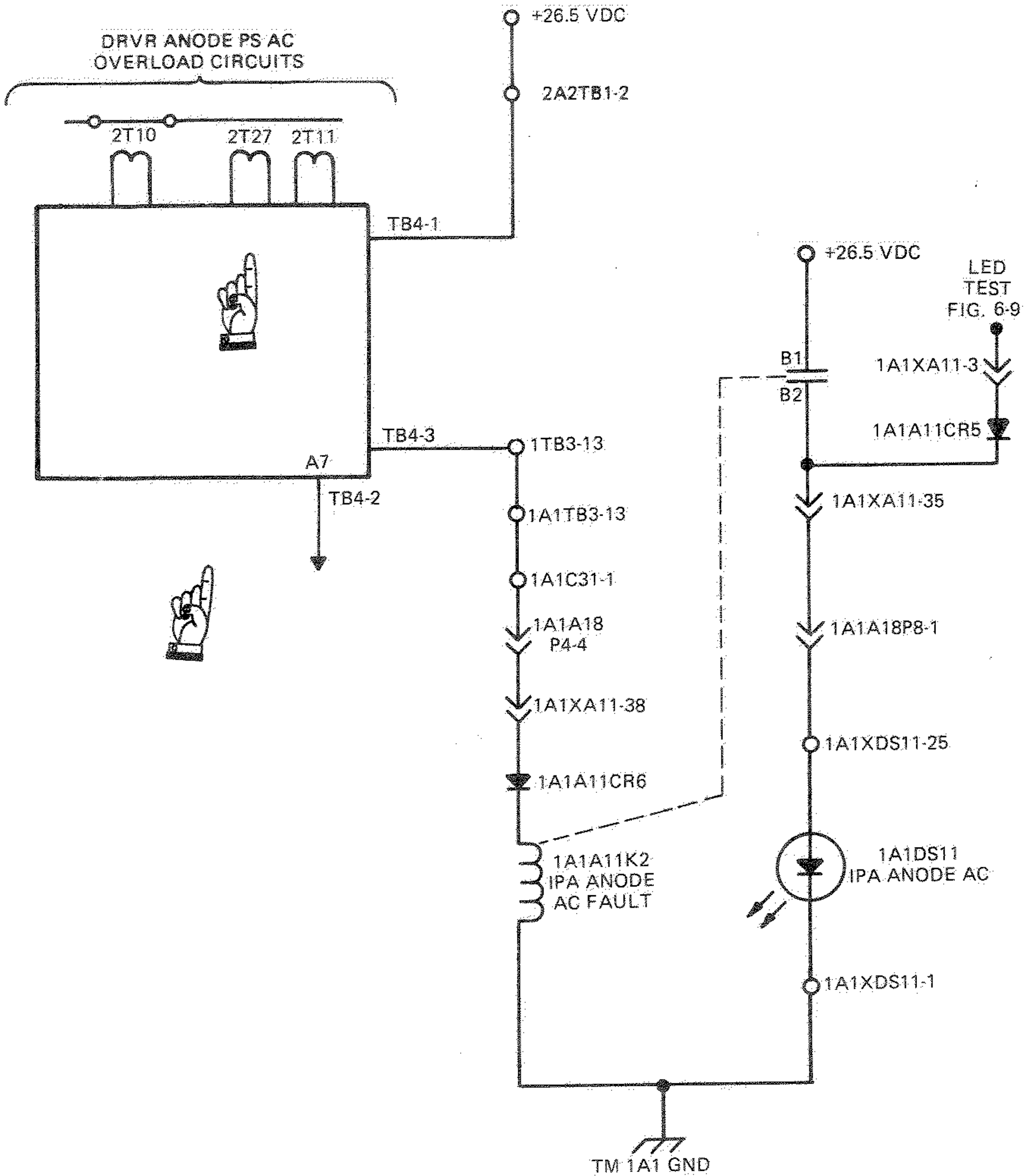


Figure 6-36. IPA ANODE AC Overload Control Diagram

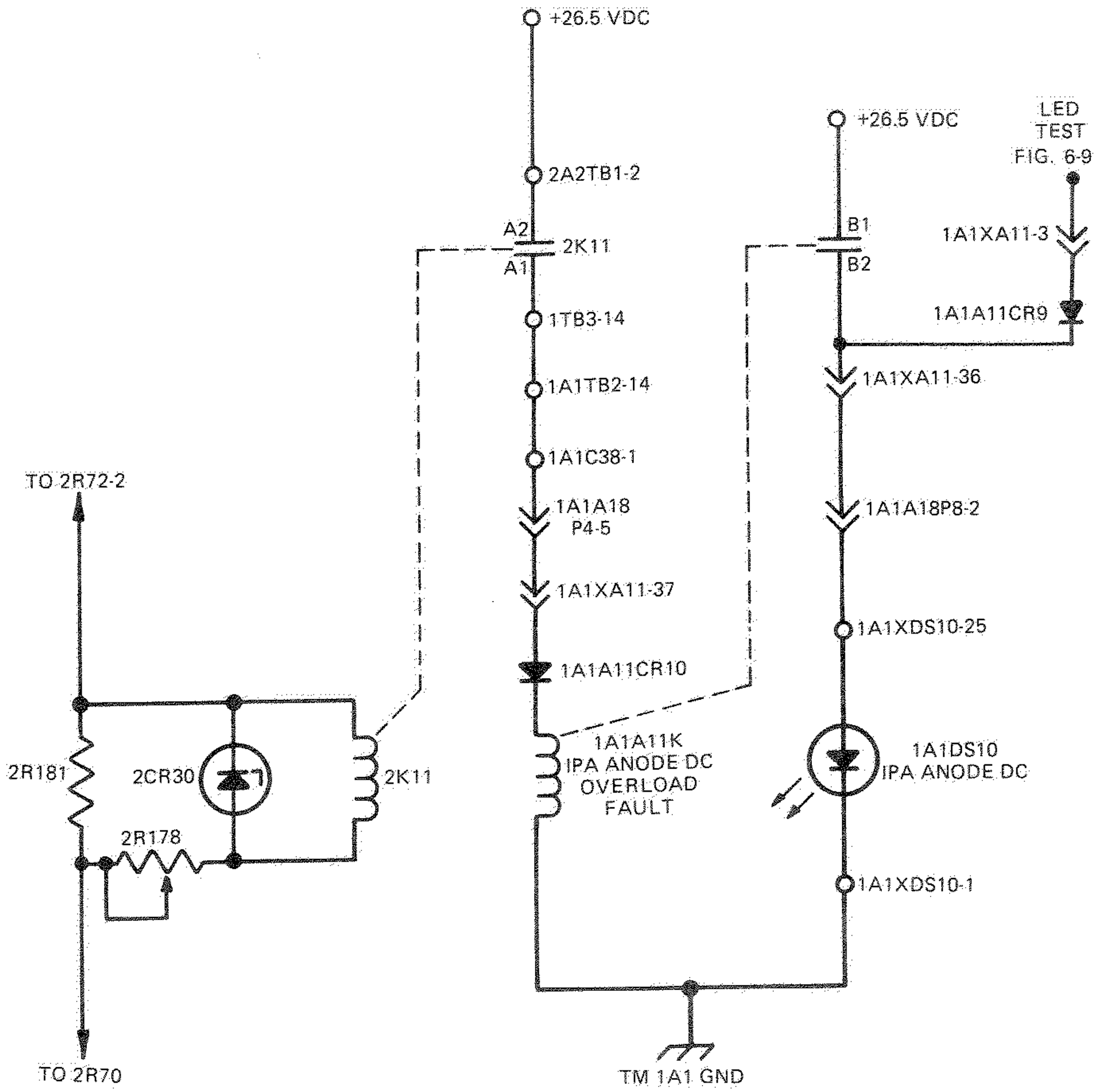


Figure 6-37. IPA ANODE DC Overload Control Diagram

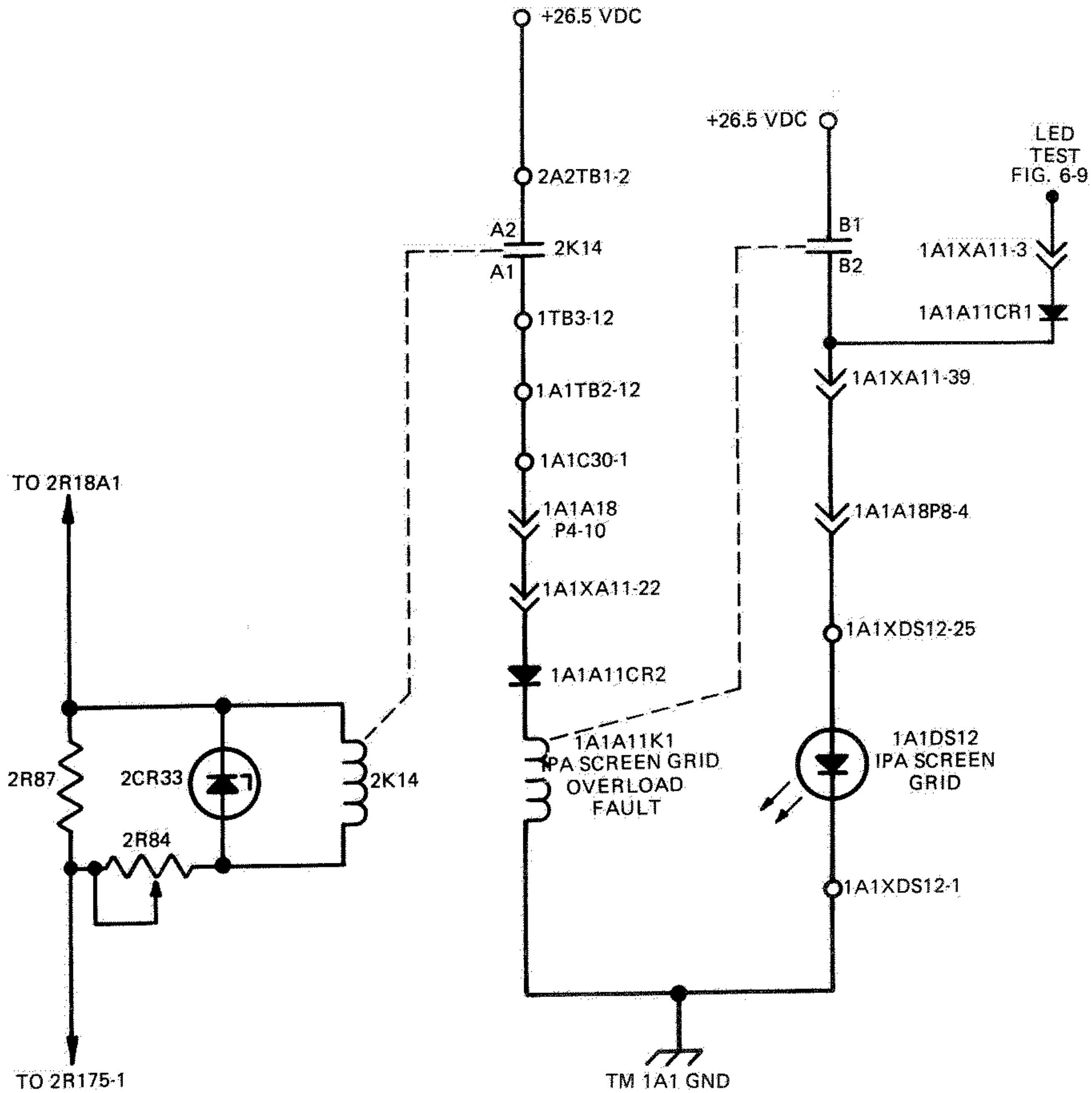


Figure 6-38. IPA SCREEN GRID DC Overload Control Diagram

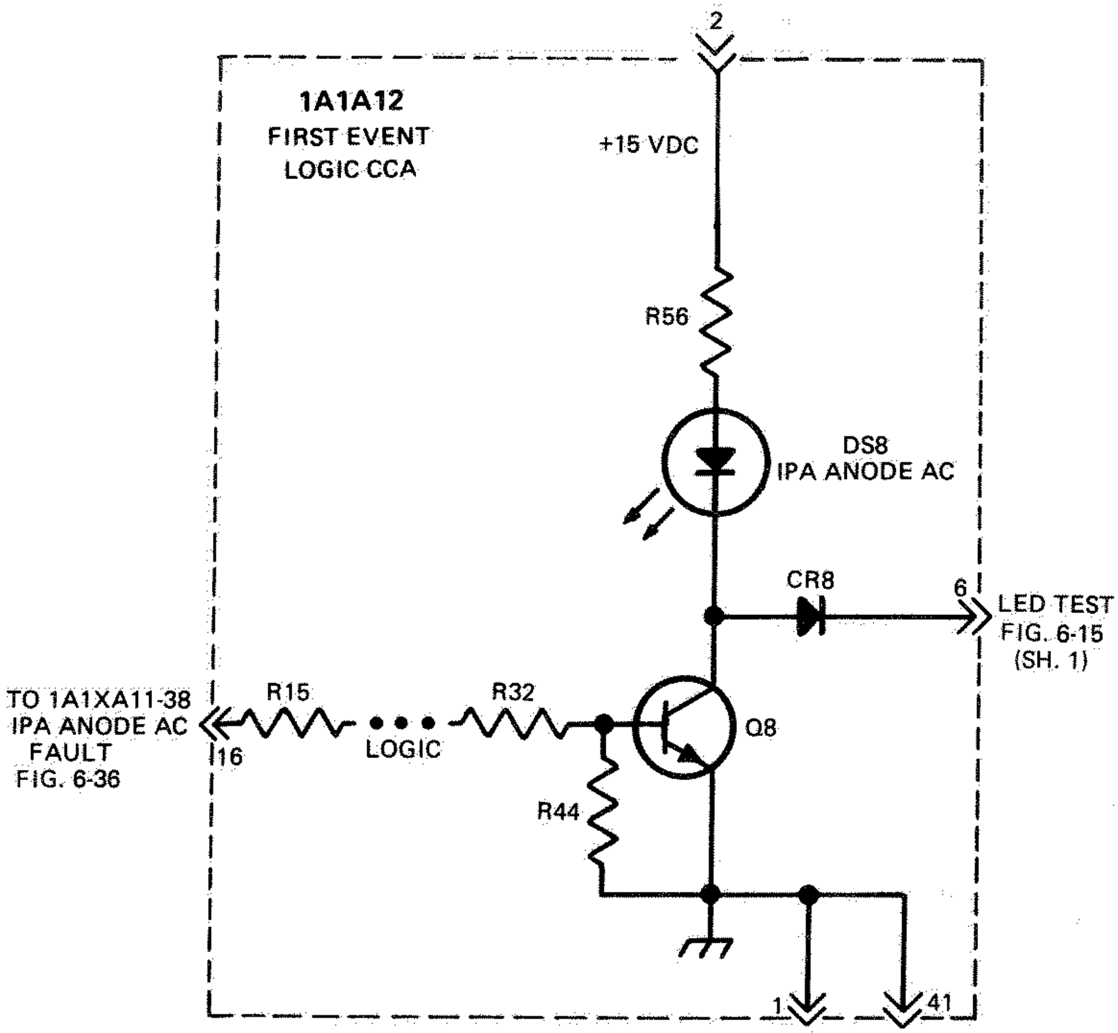


Figure 6-39. IPA A (Anode) AC First Event Logic Control Diagram

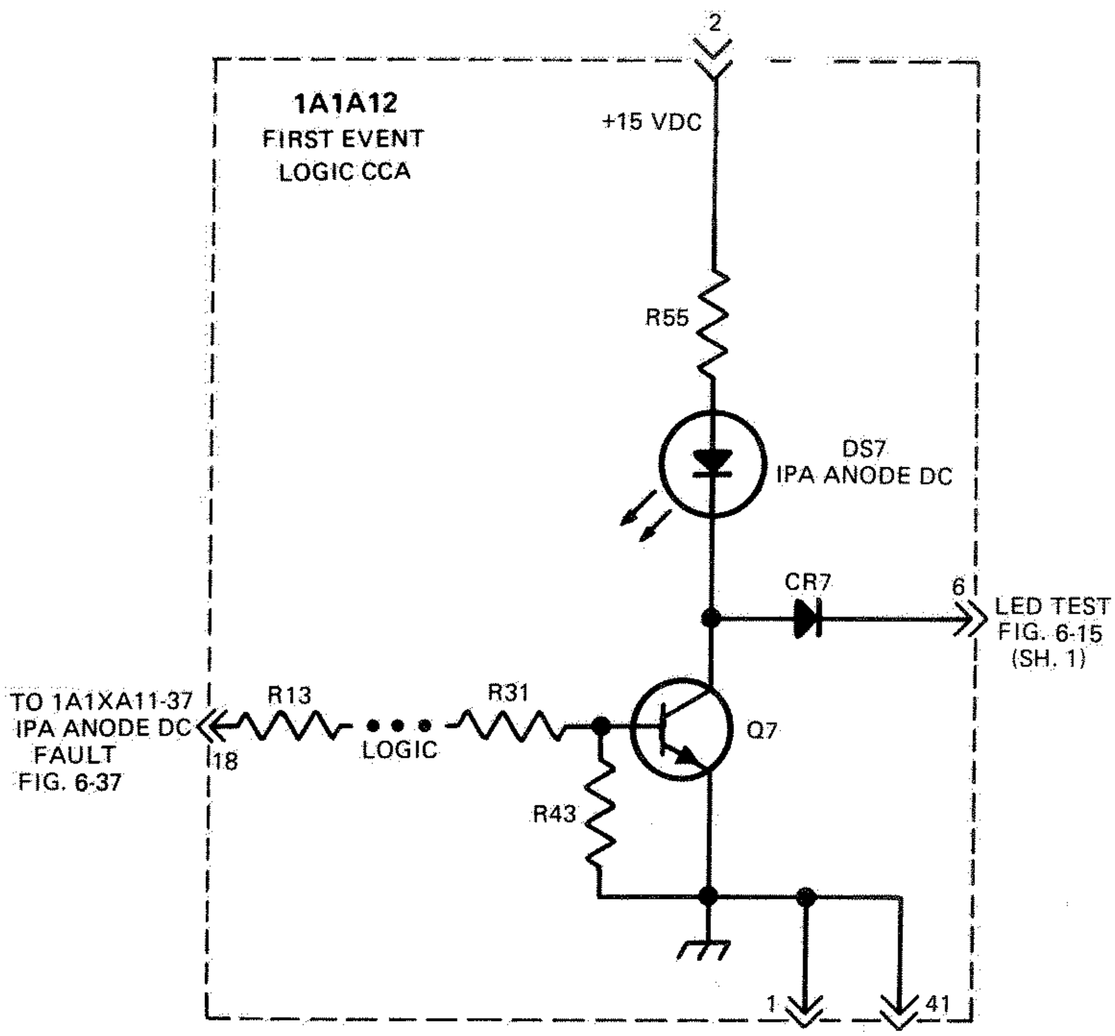


Figure 6-40 IPA A (Anode) DC First Event Logic Control Diagram

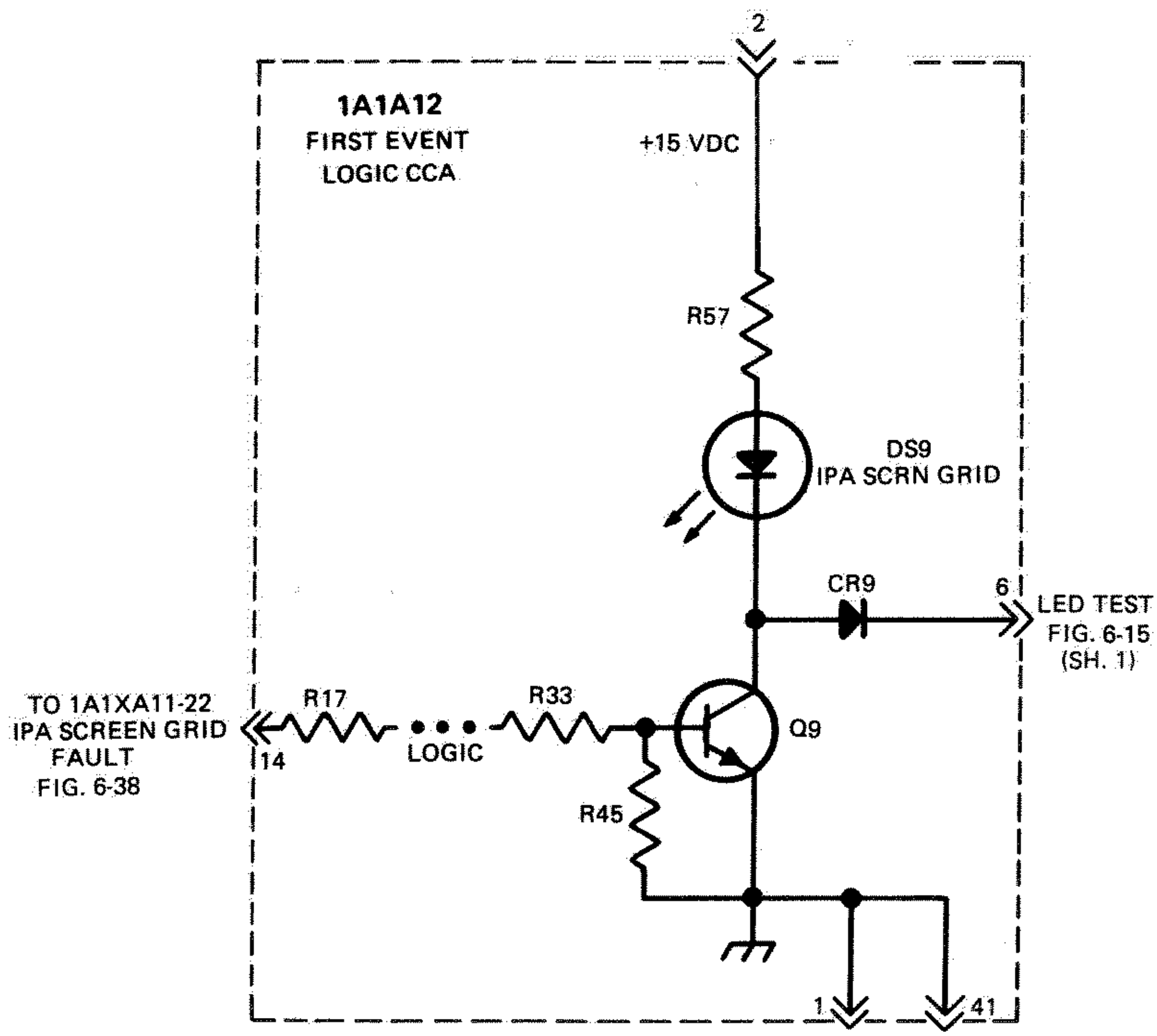


Figure 6-41. IPA SCRN (Screen Grid)
First Event Logic Control Diagram

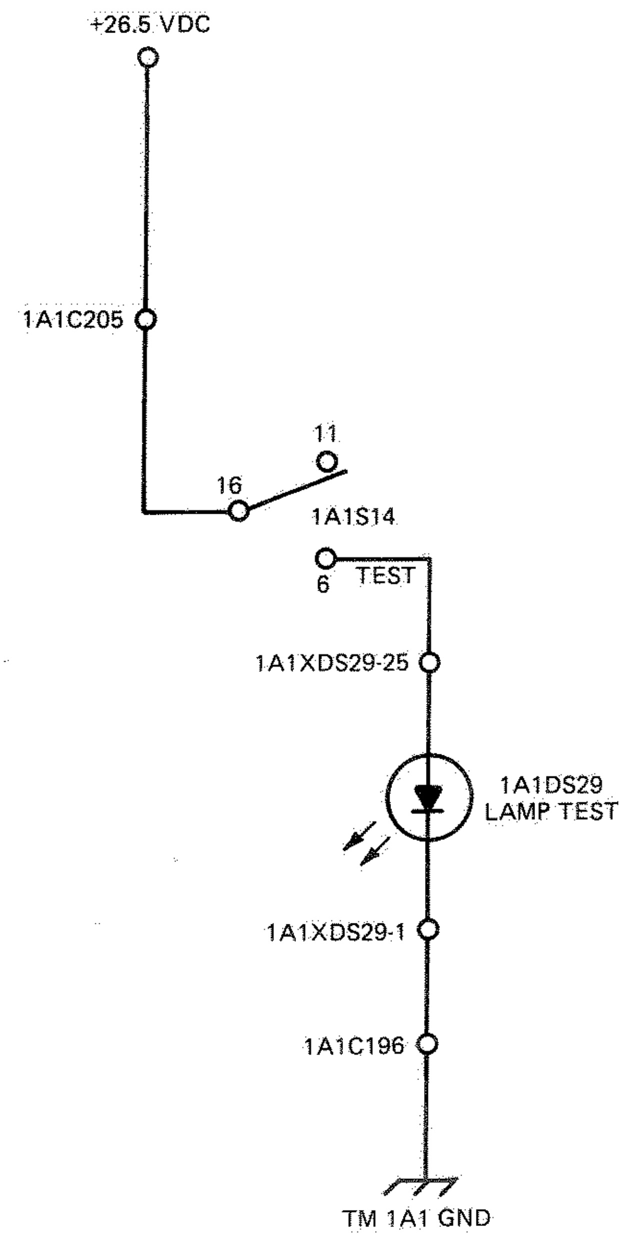


Figure 6-42. LAMP TEST Control Diagram

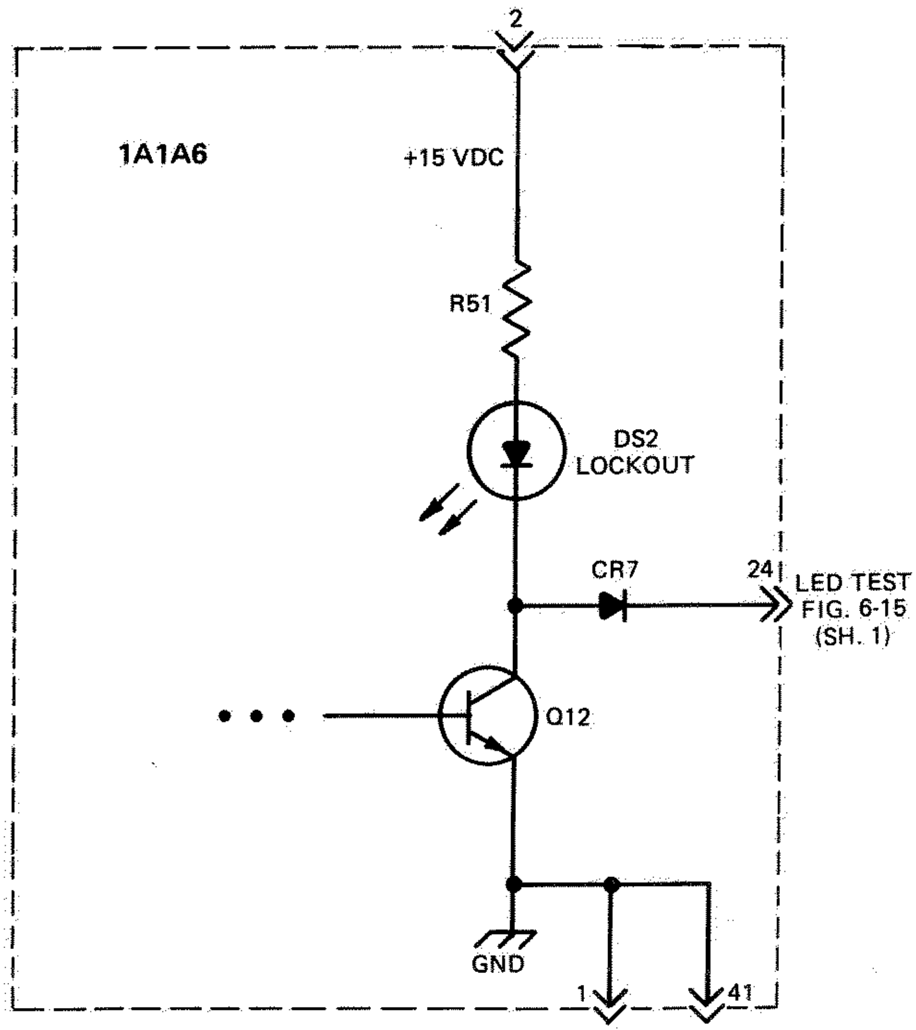


Figure 6-43. LOCKOUT Control Diagram

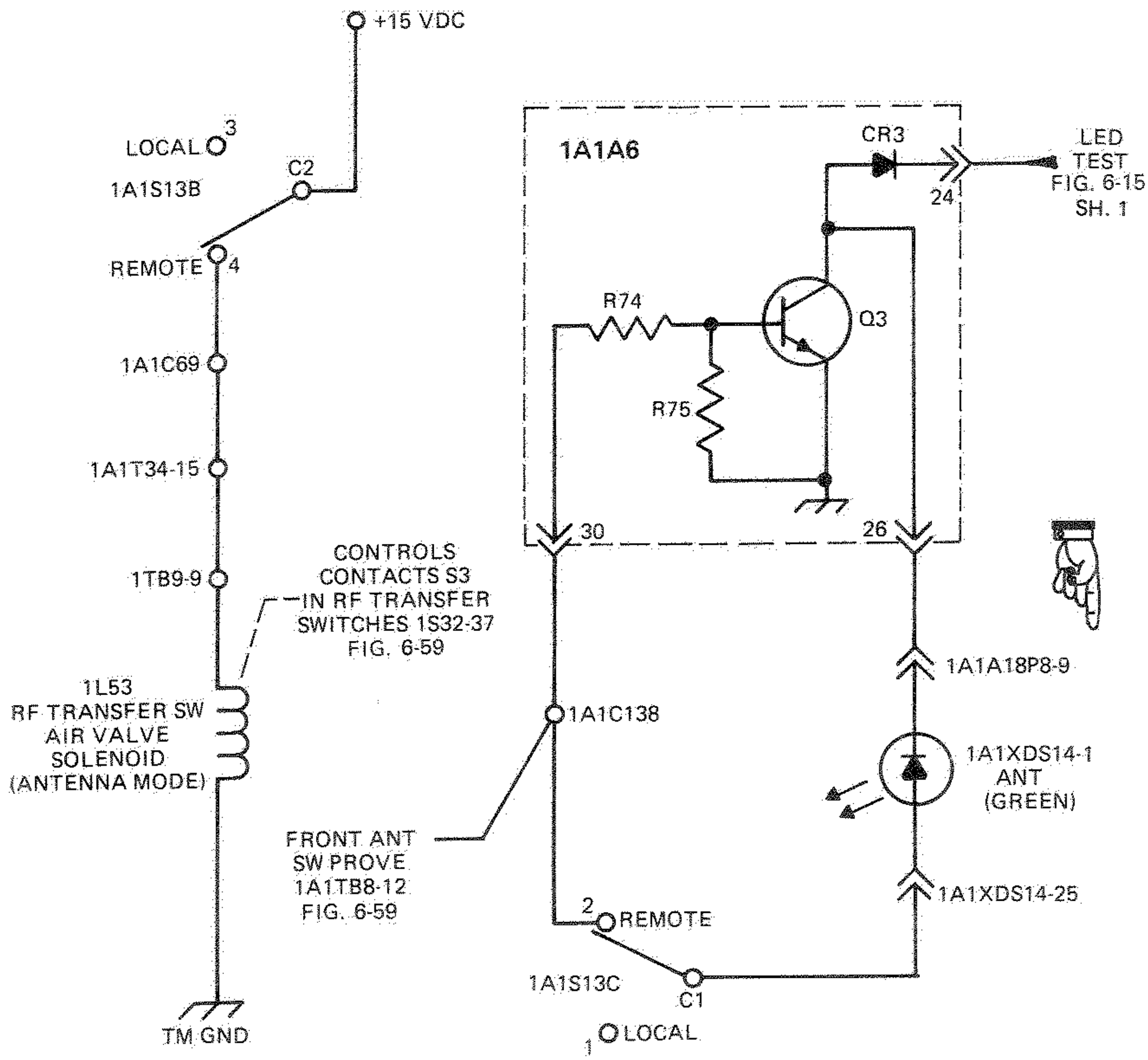


Figure 6-44. OUTPUT CONTROL (ANTENNA LOAD)
Control Diagram

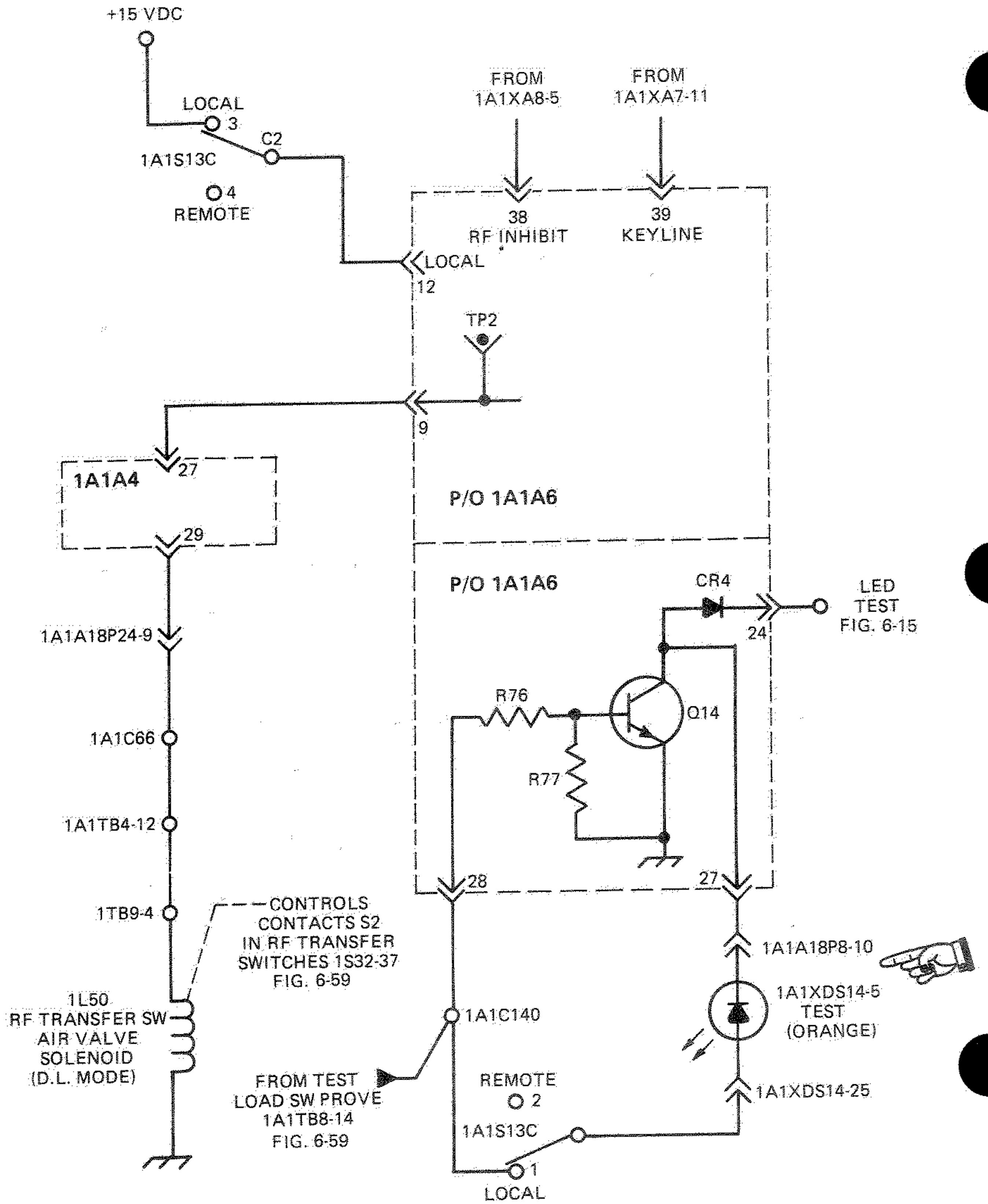


Figure 6-45. OUTPUT CONTROL (TEST LOAD)
Control Diagram

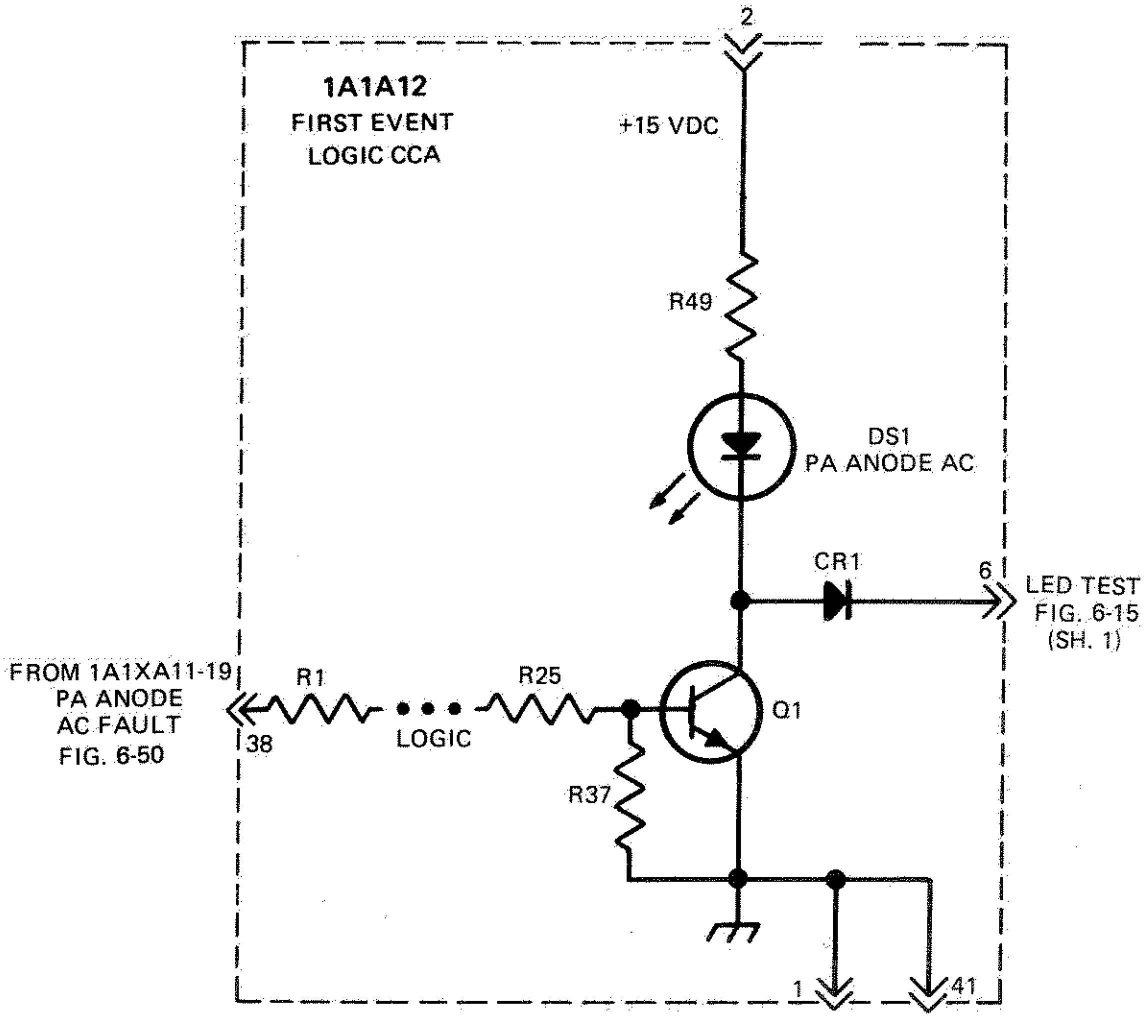


Figure 6-46. PA A (Anode) AC First Event Logic Control Diagram

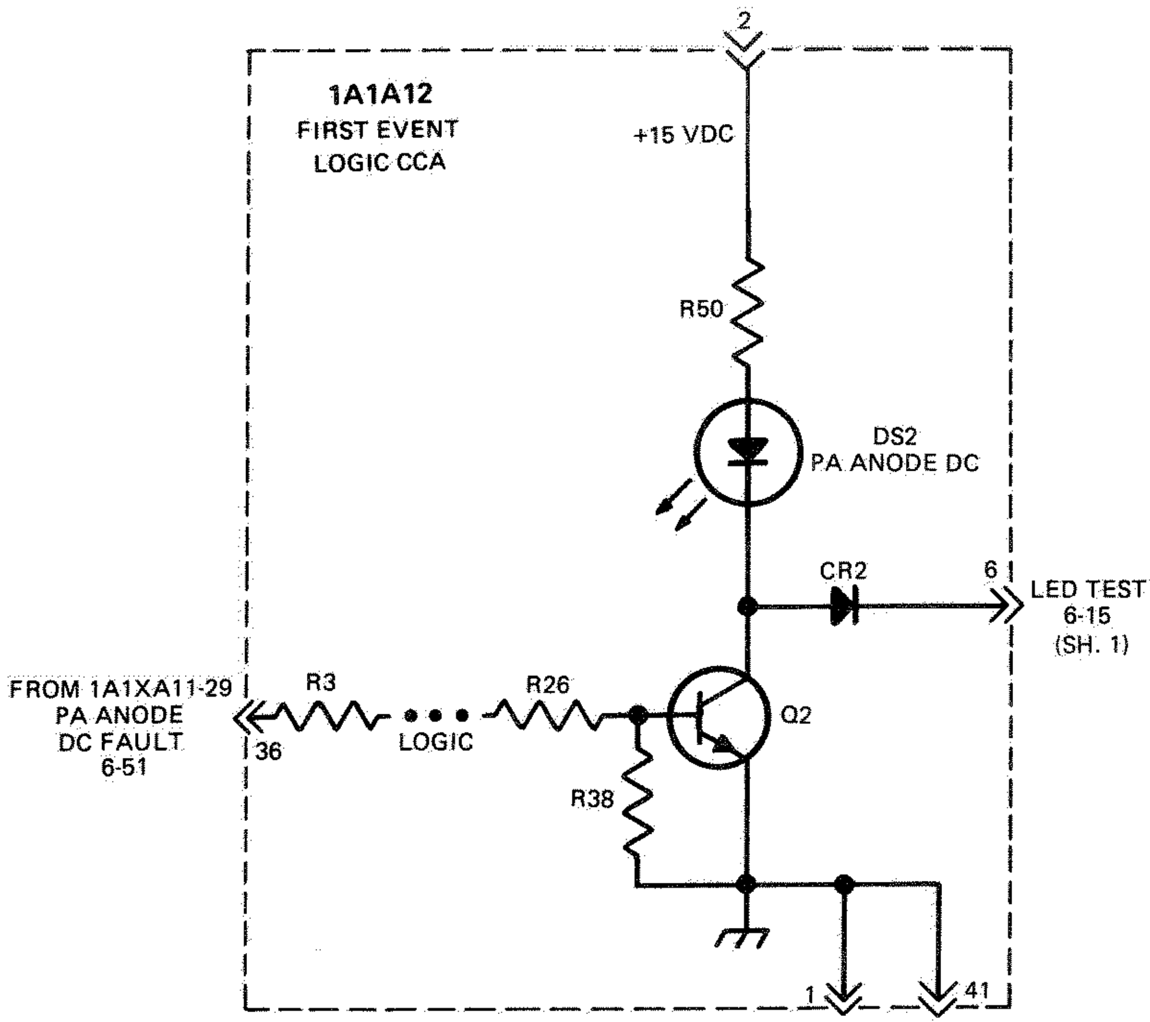


Figure 6-47. PA A (Anode) DC First Event Logic Control Diagram

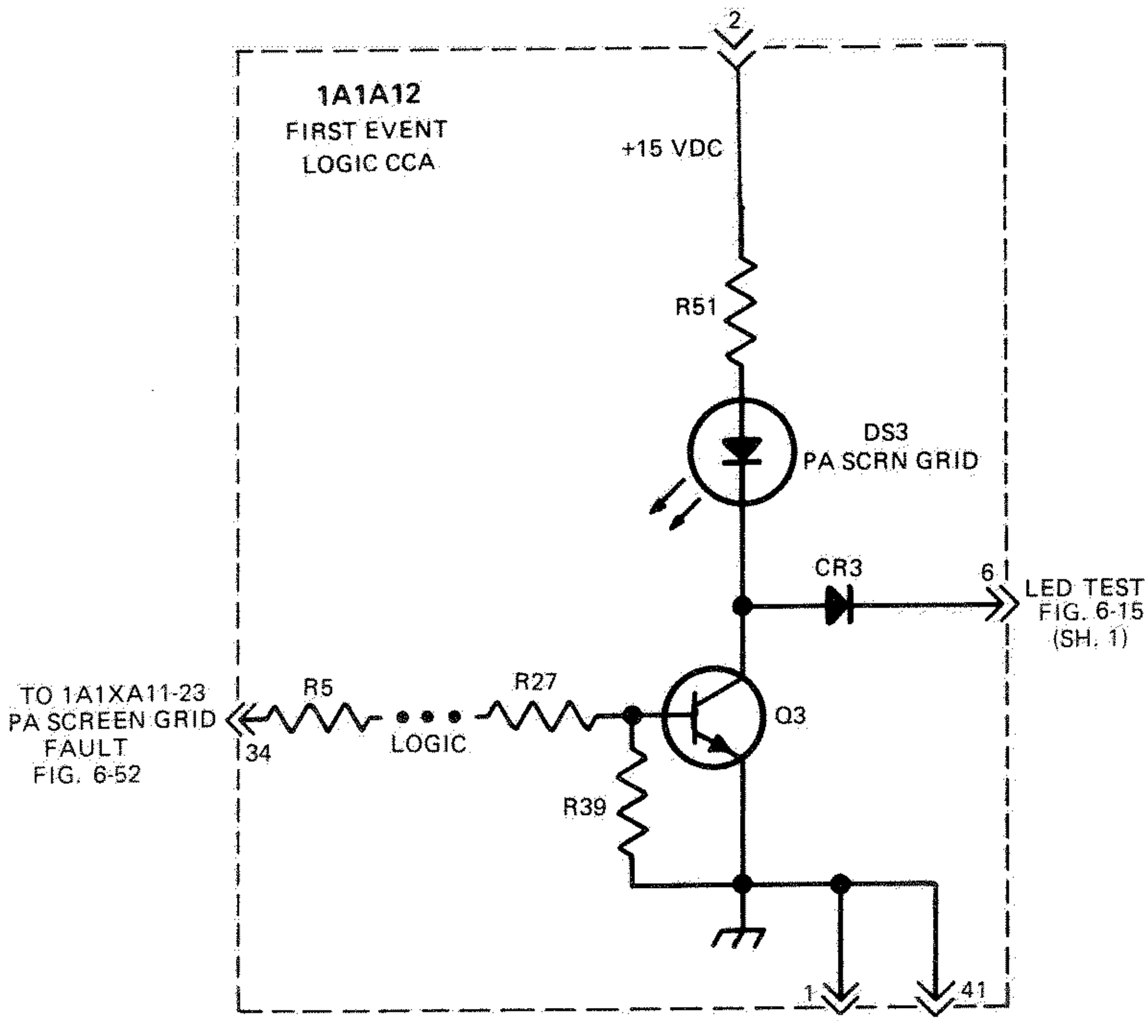


Figure 6-48. PA SCRN (Screen Grid) First Event Logic Control Diagram

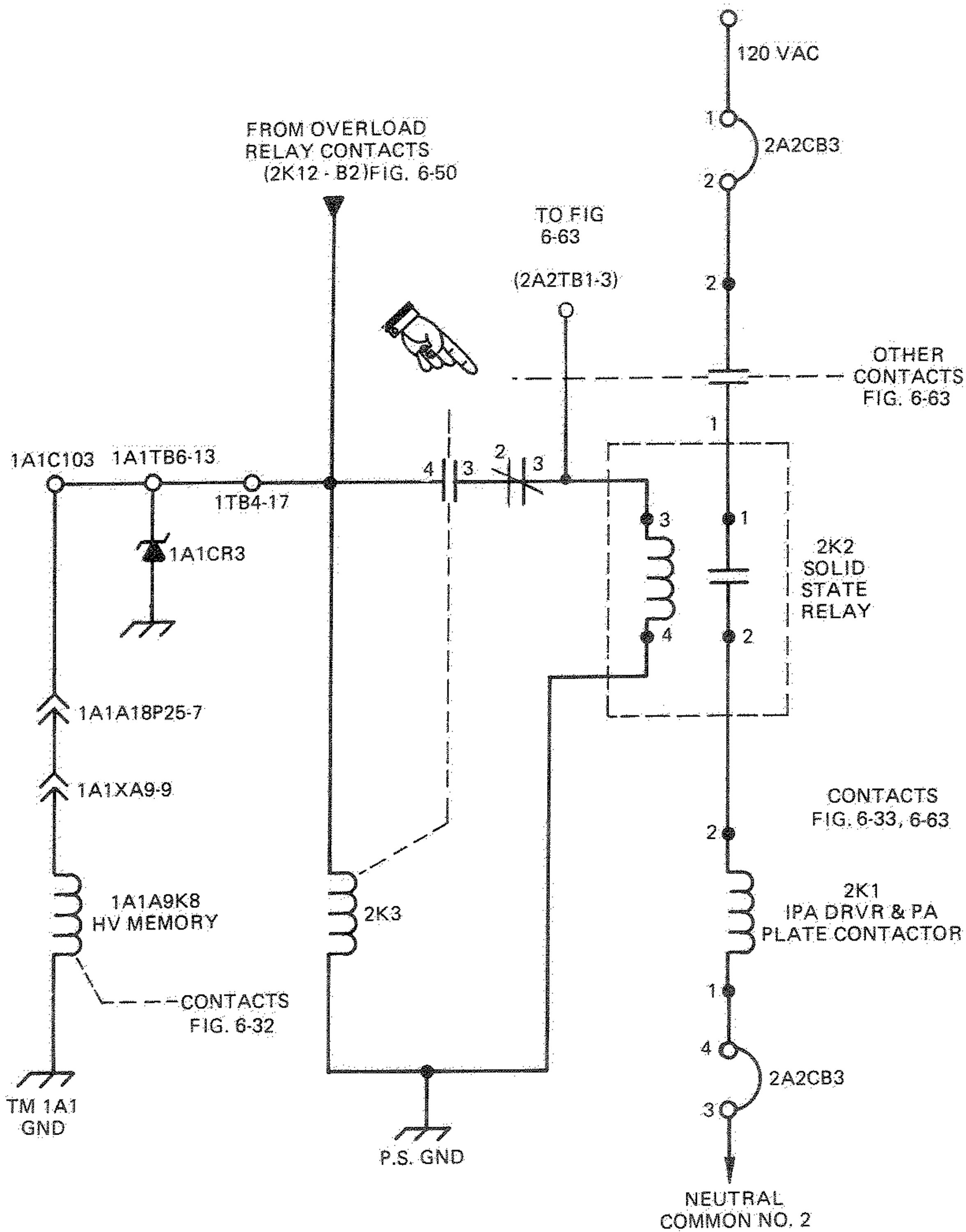


Figure 6-49. Plate Contactor Relay Control Diagram

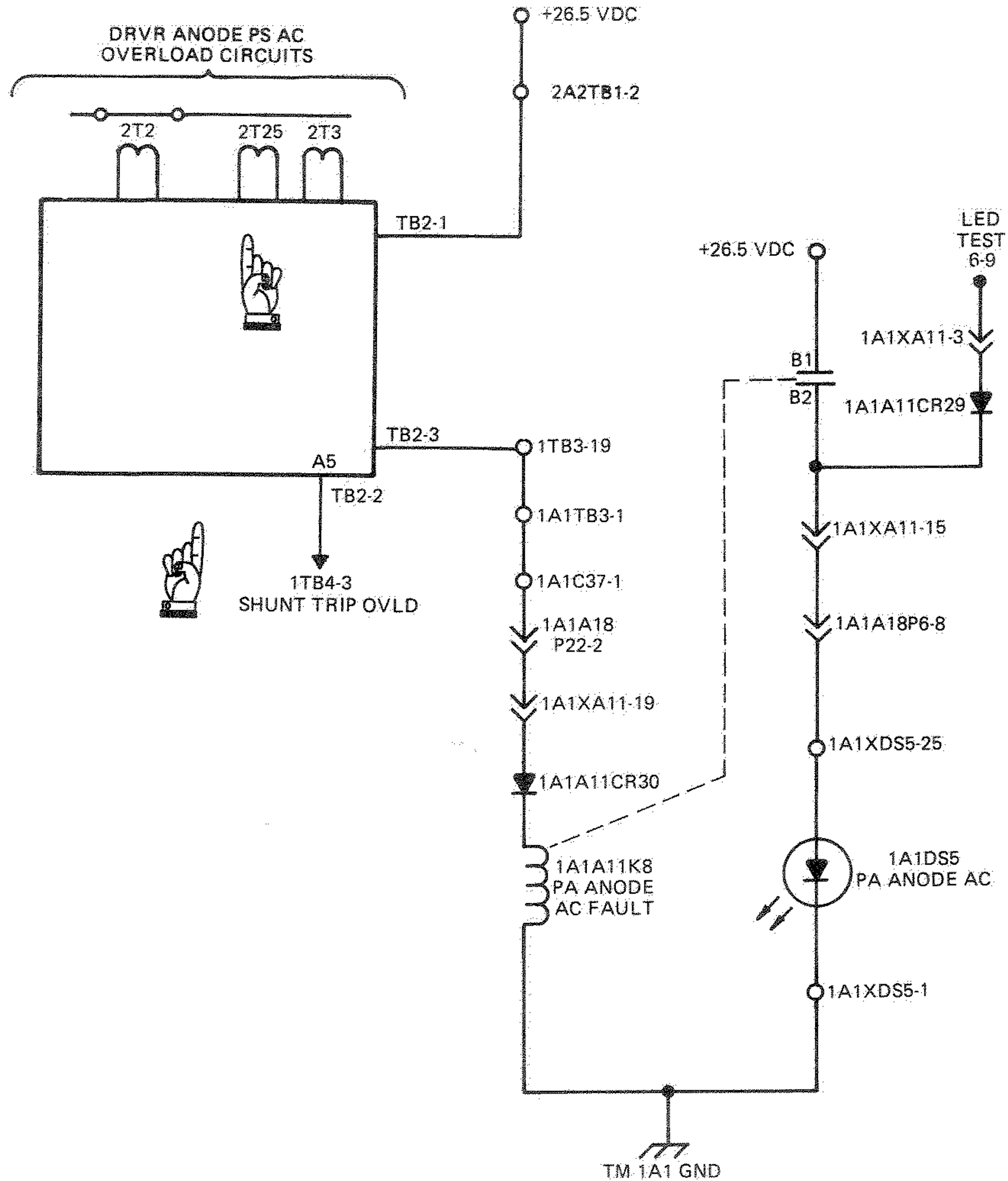


Figure 6-50. PA ANODE AC Overload Control Diagram

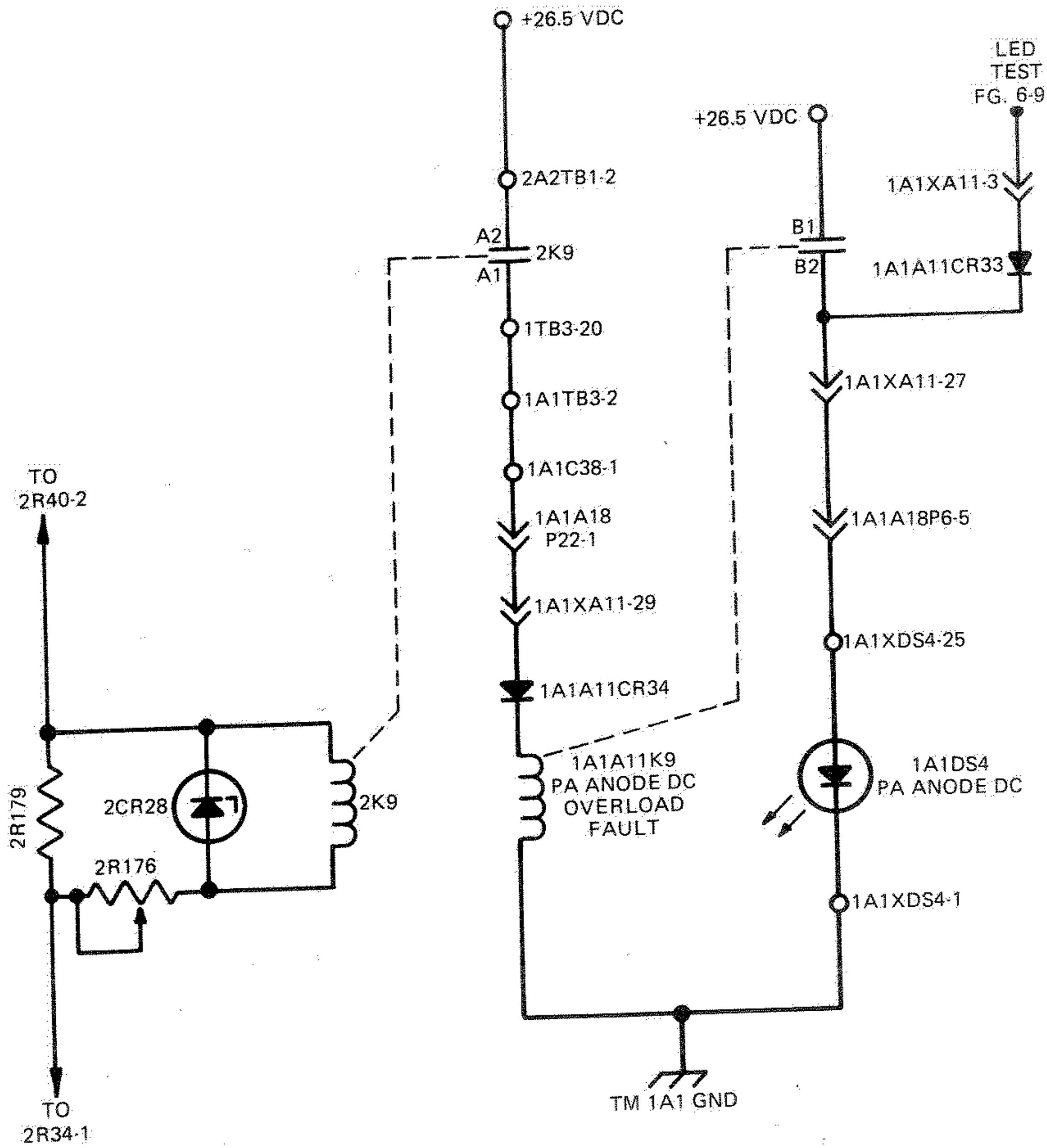


Figure 6-51. PA ANODE DC Overload Control Diagram

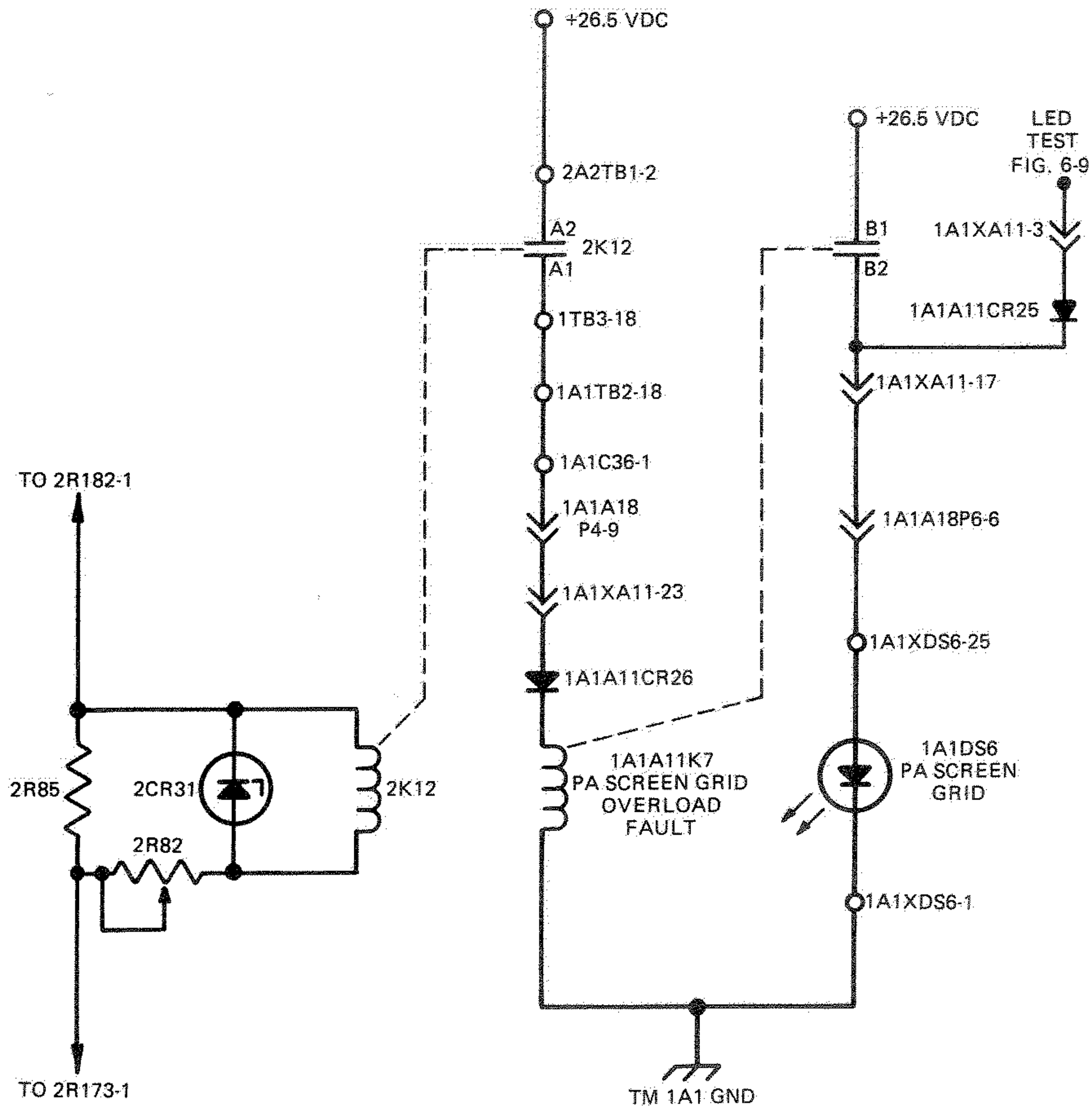


Figure 6-52. PA SCREEN GRID DC Overload Control Diagram

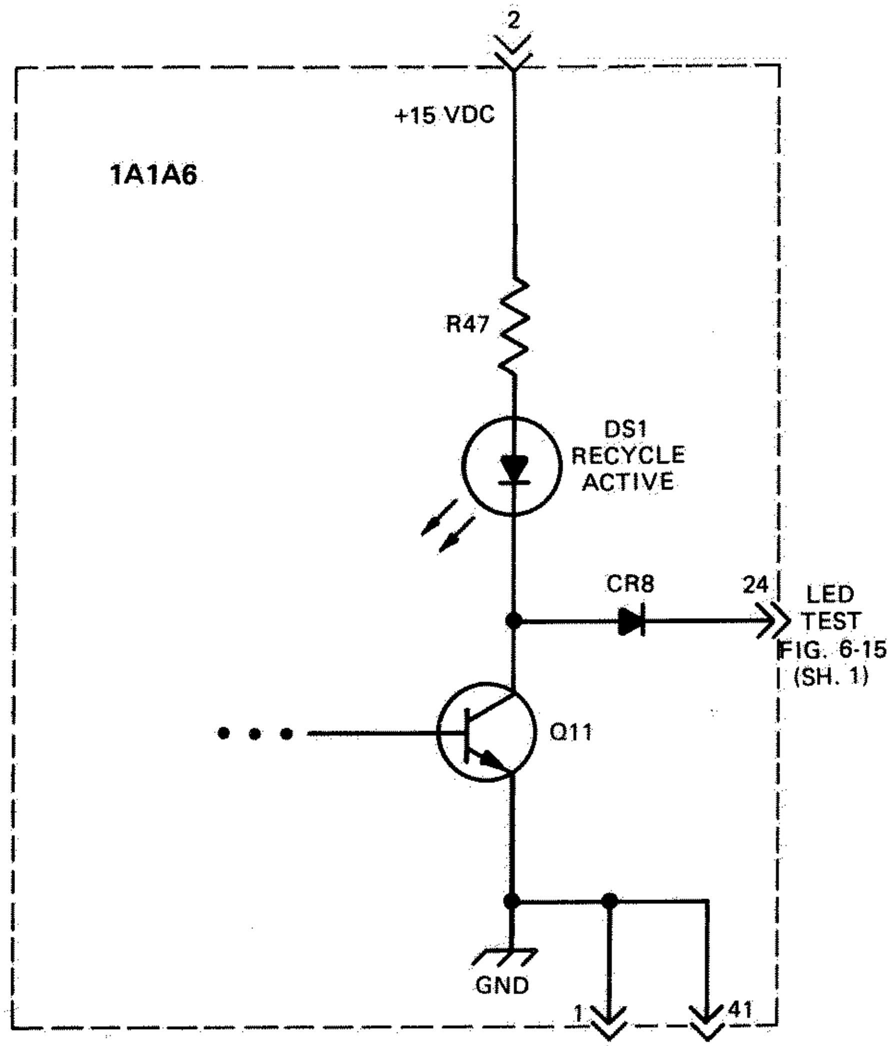


Figure 6-53. RECYCLE ACTIVE Control Diagram

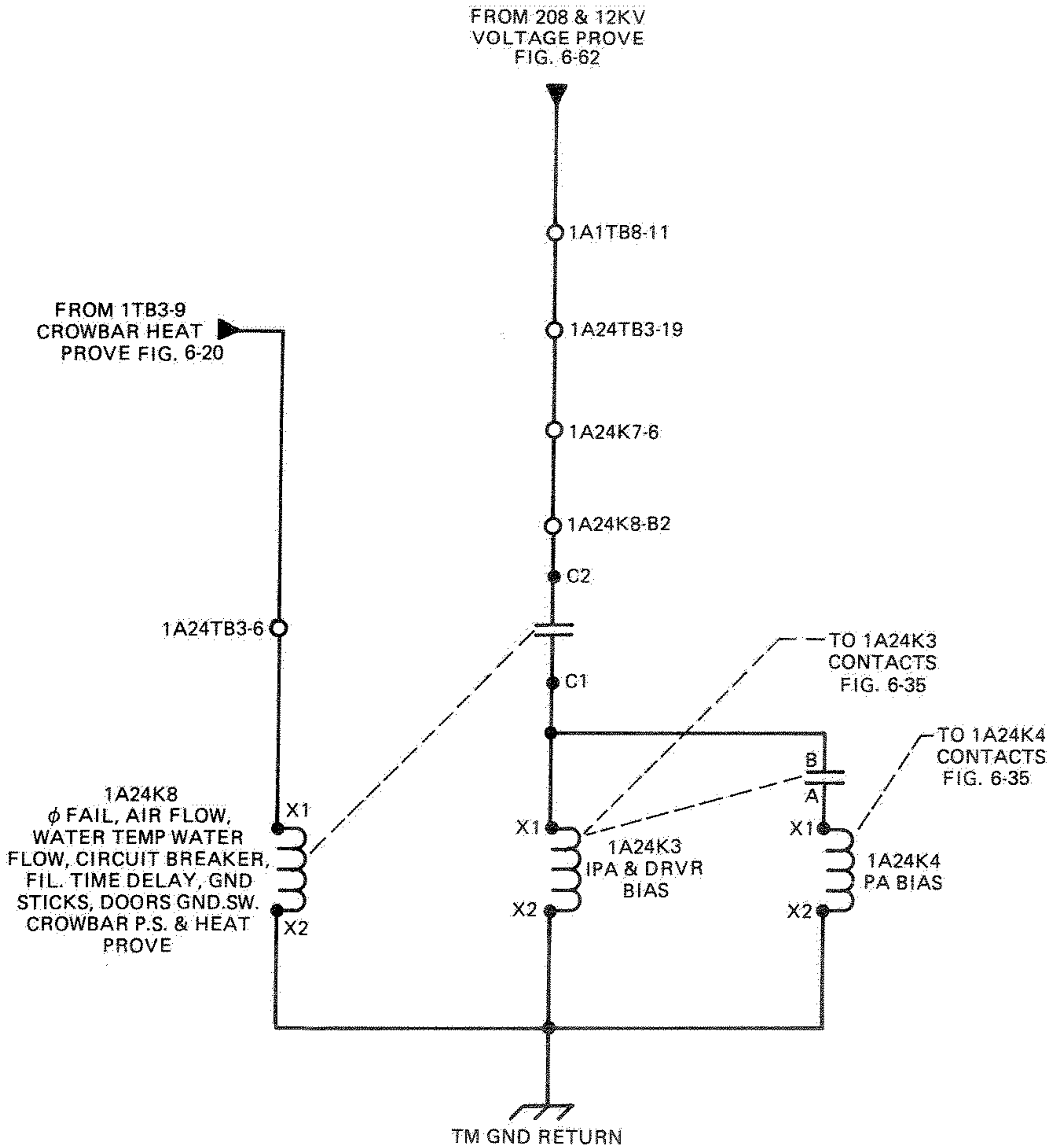


Figure 6-54. Relays 1A24K3, K4, and K8
Control Diagram

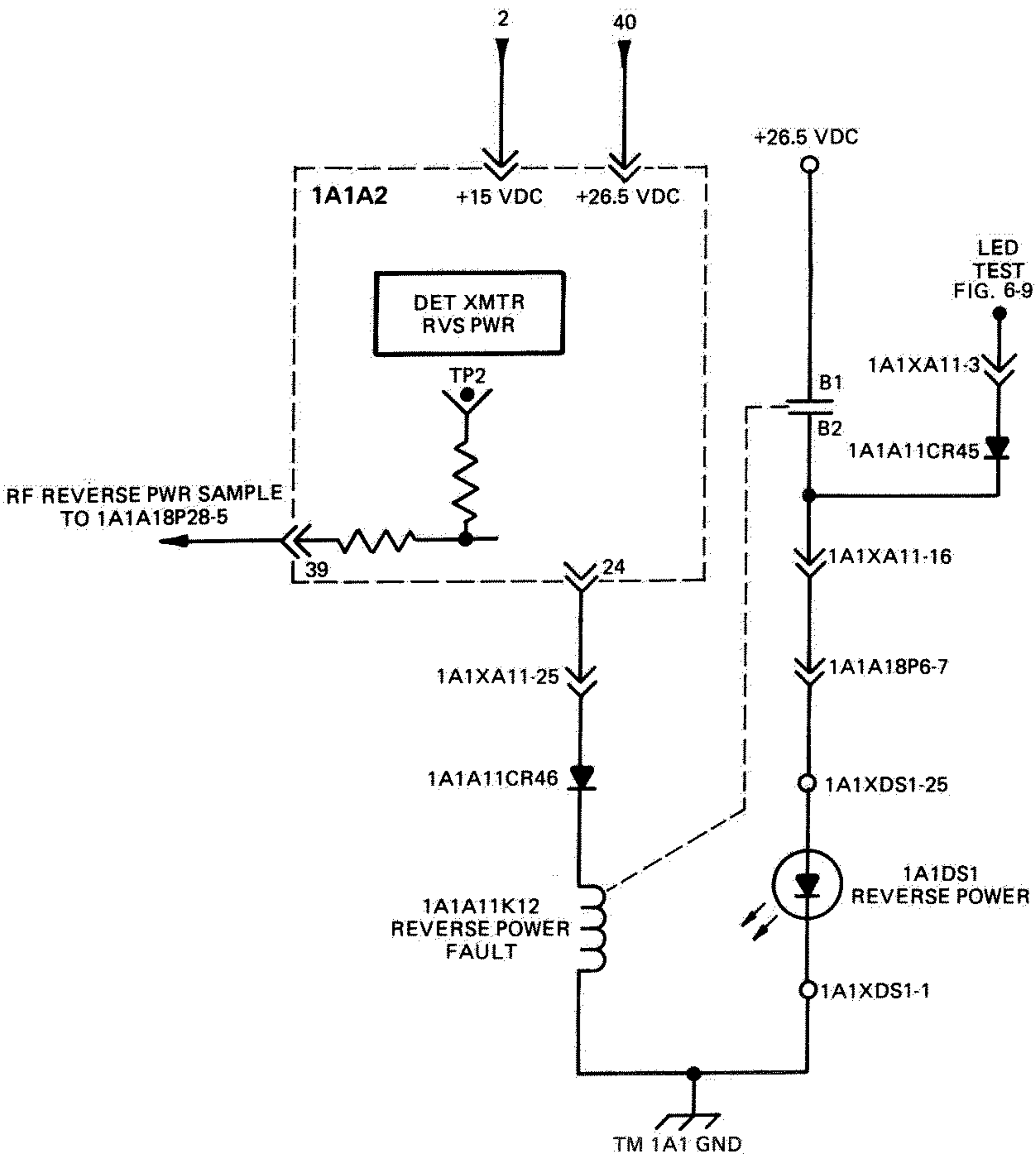


Figure 6-55. REVERSE POWER Control Diagram

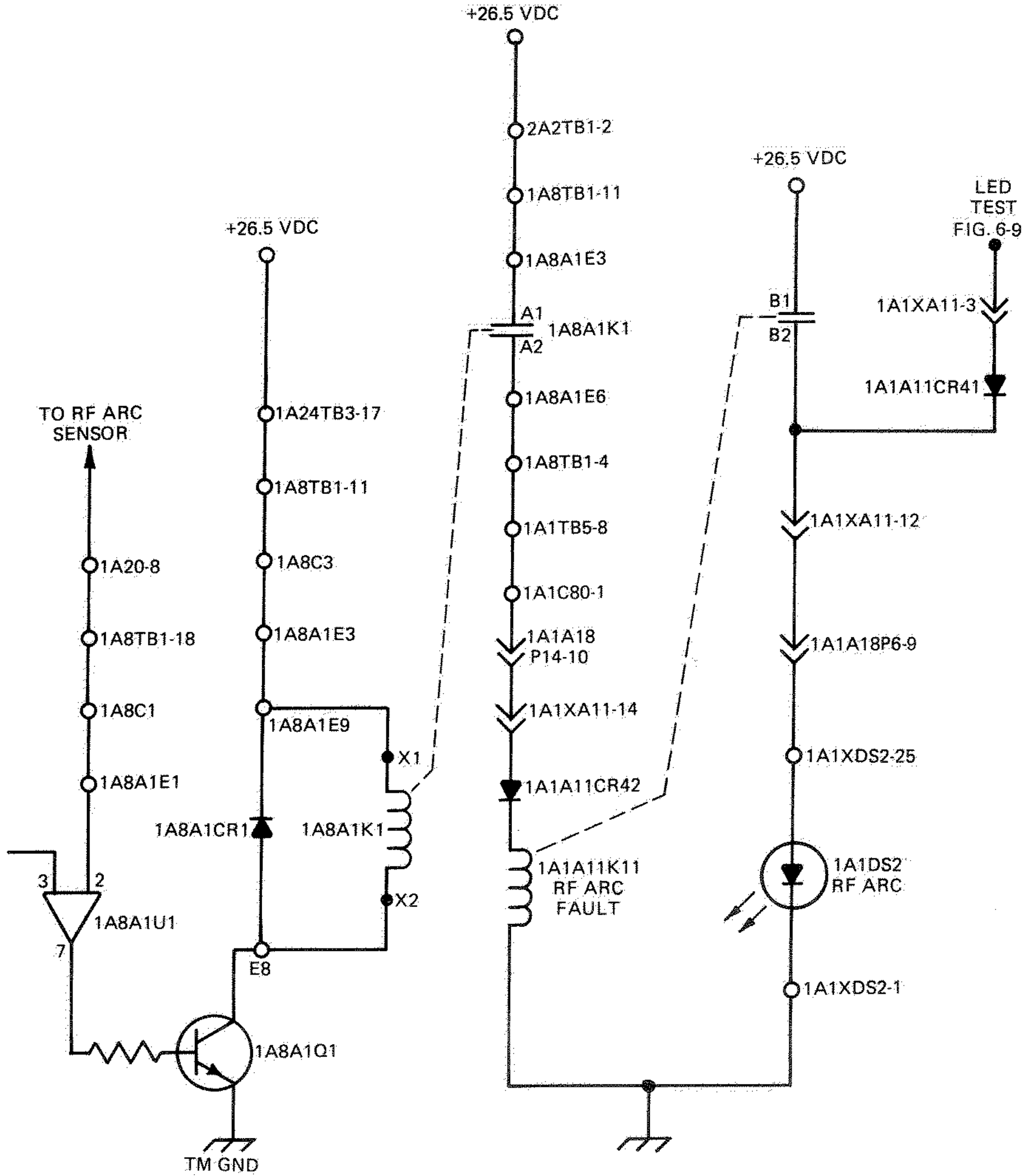


Figure 6-56. RF ARC Control Diagram

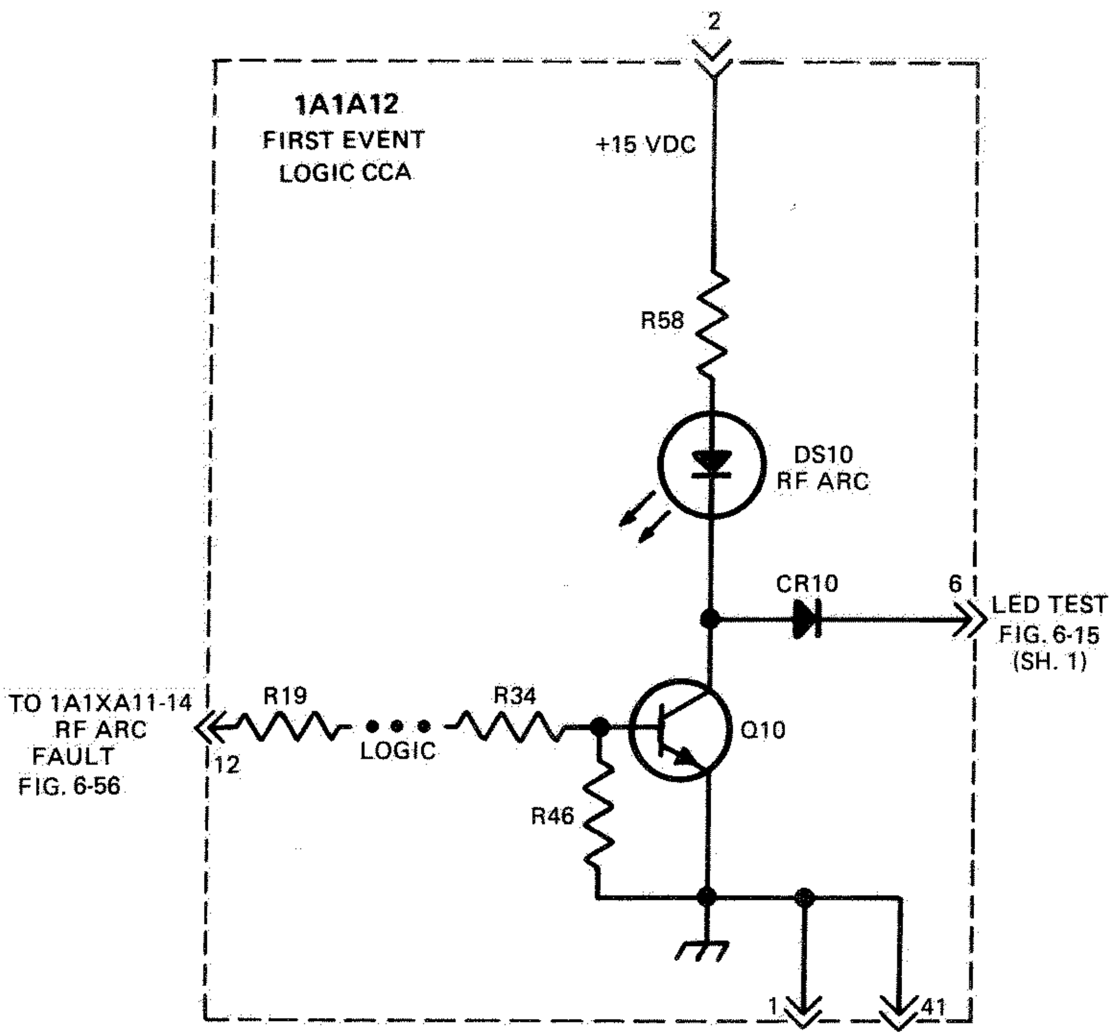


Figure 6-57. RF ARC First Event Logic Control Diagram

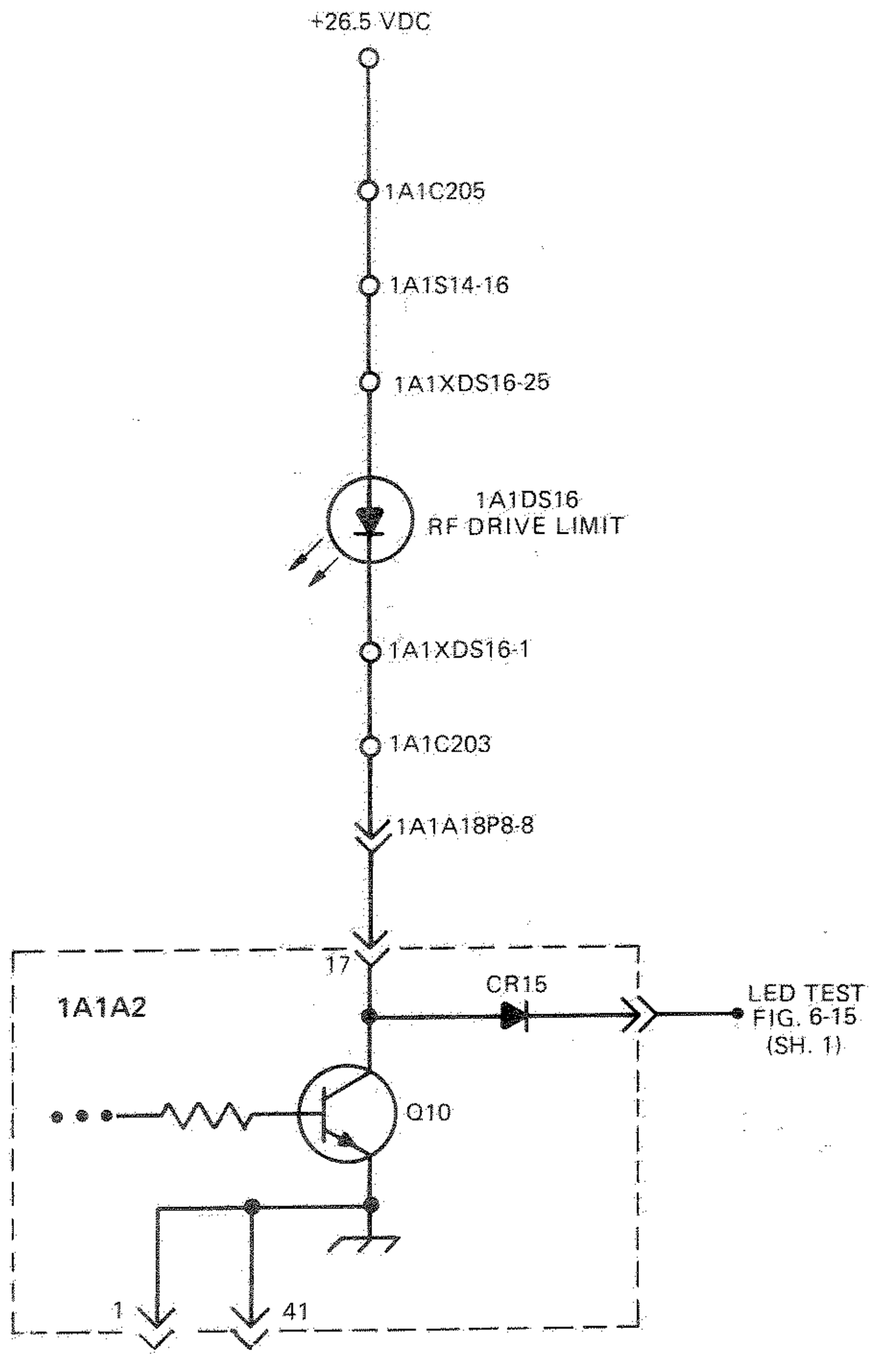


Figure 6-58. RF DRIVE LIMIT Control Diagram

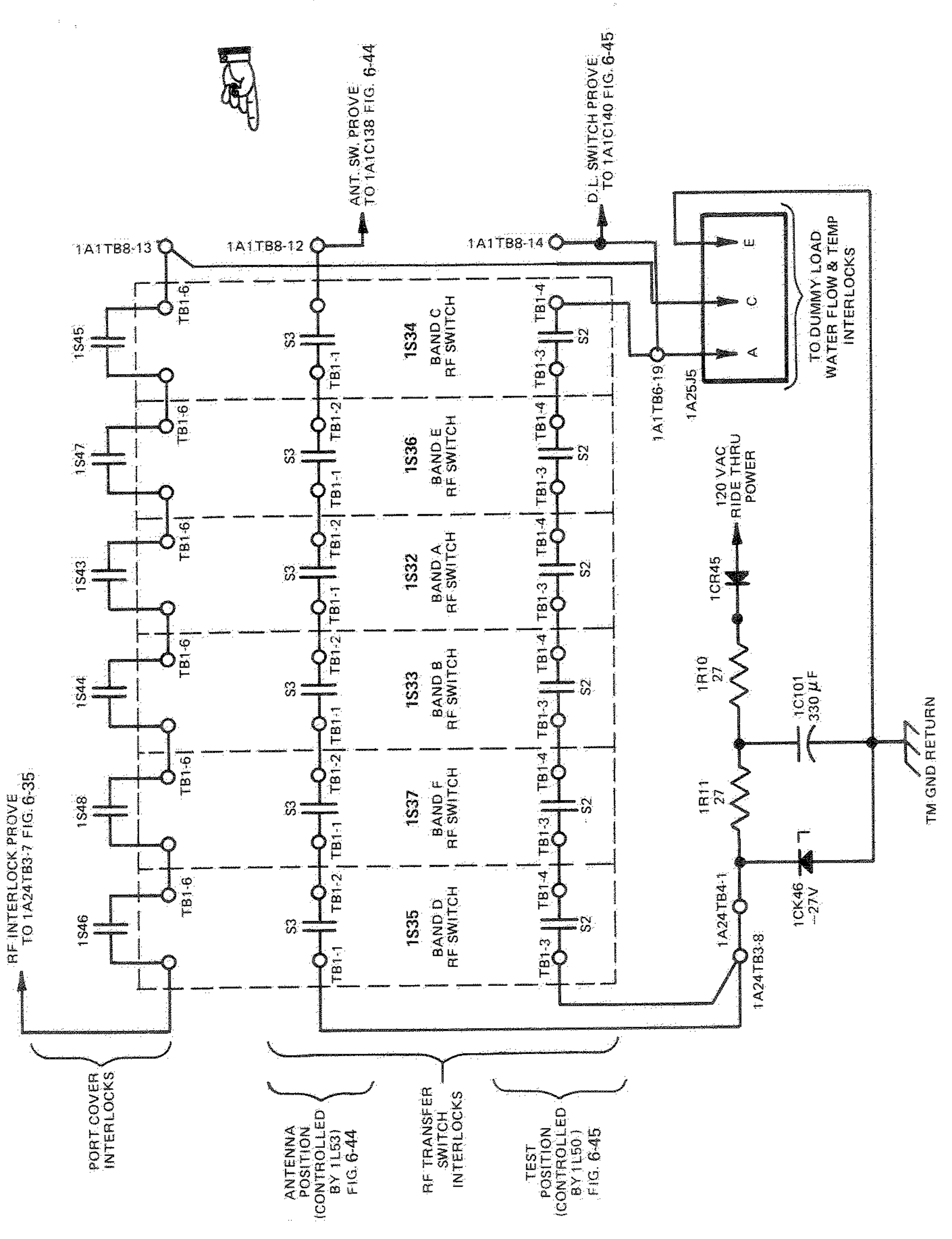


Figure 6-59. RF Interlock Prove Control Diagram

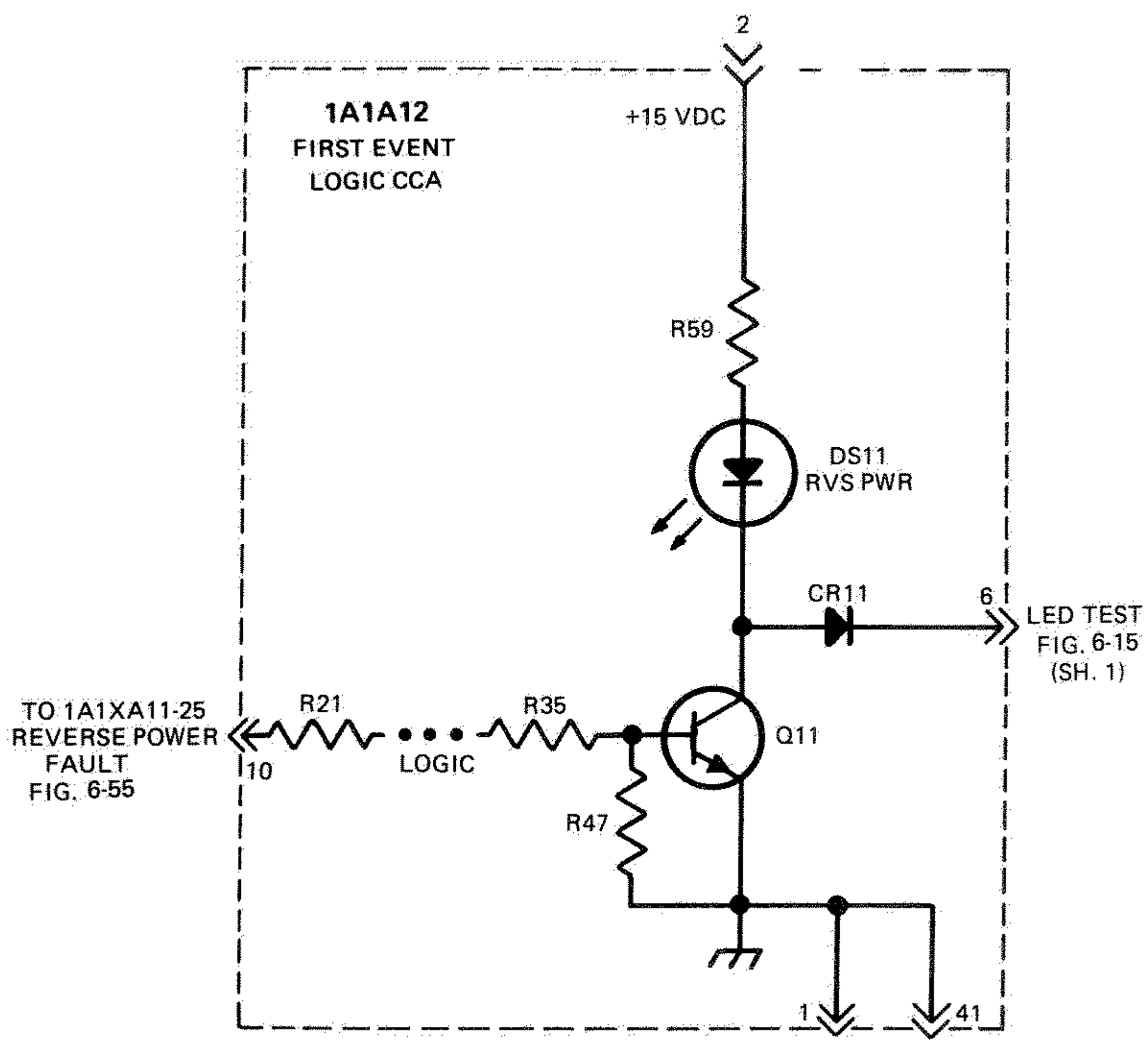


Figure 6-60. RVS PWR First Event
Logic Control Diagram

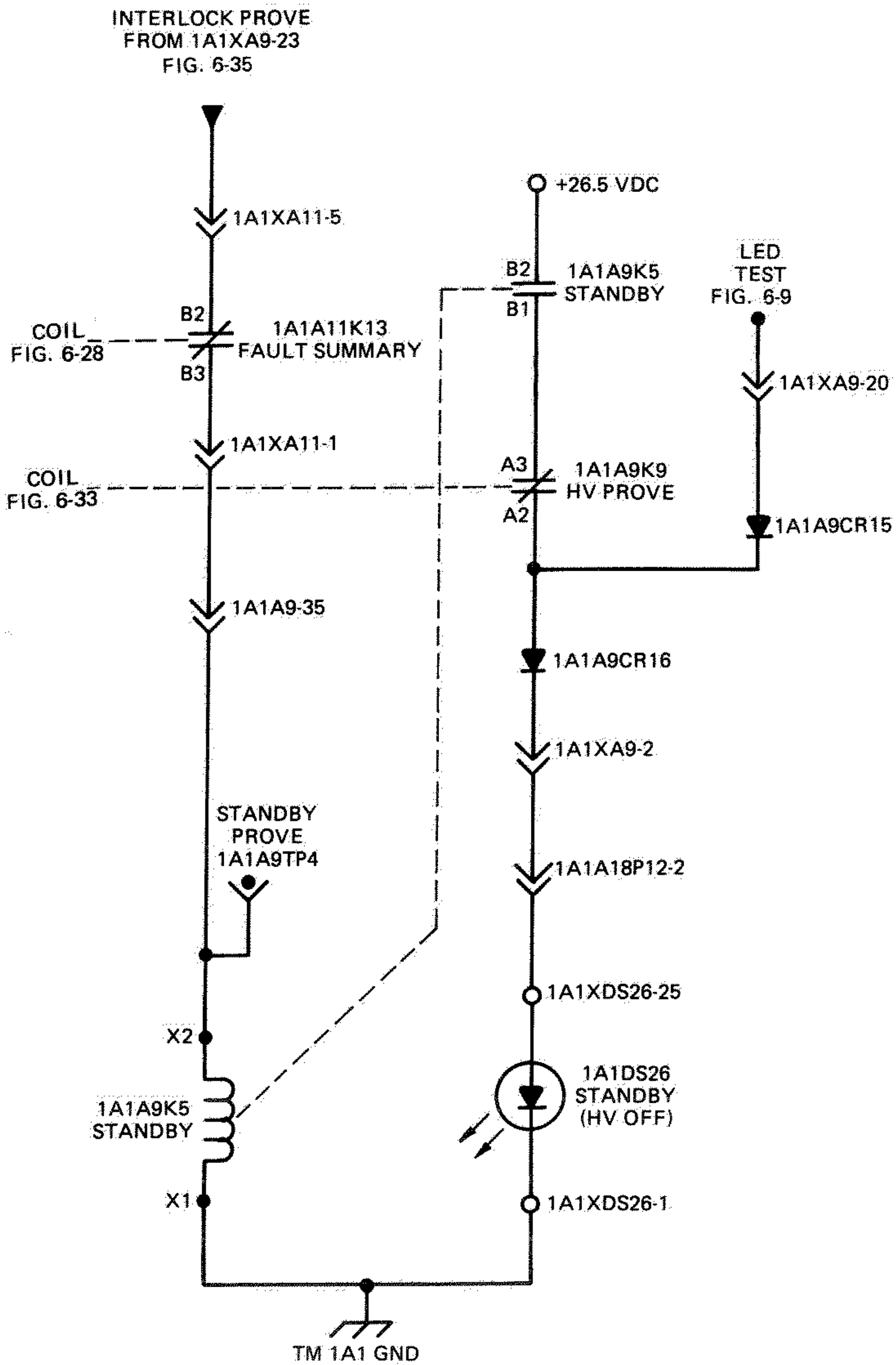


Figure 6-61. STANDBY (HV OFF) Control Diagram

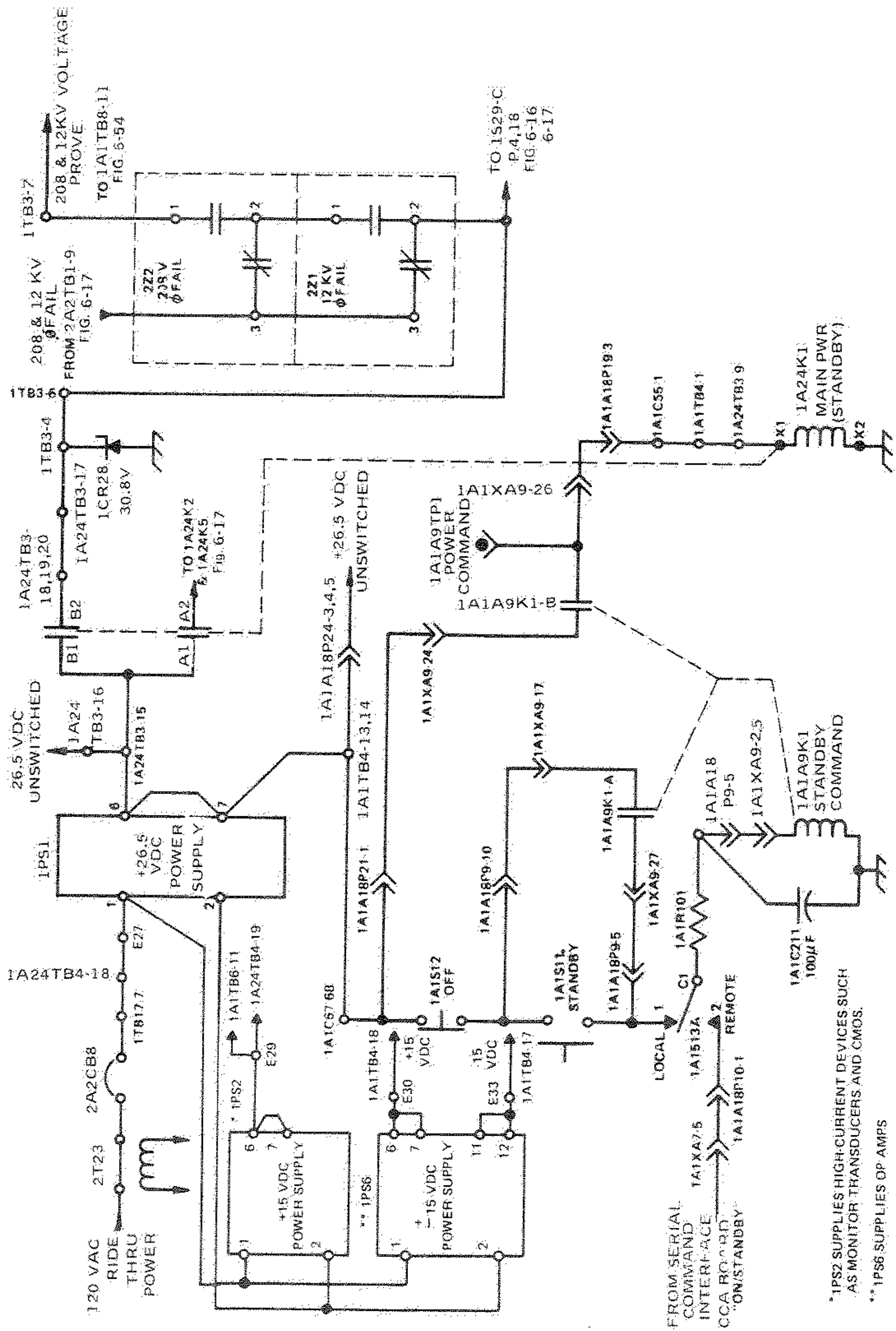


Figure 6-62. Standby Power Control Diagram

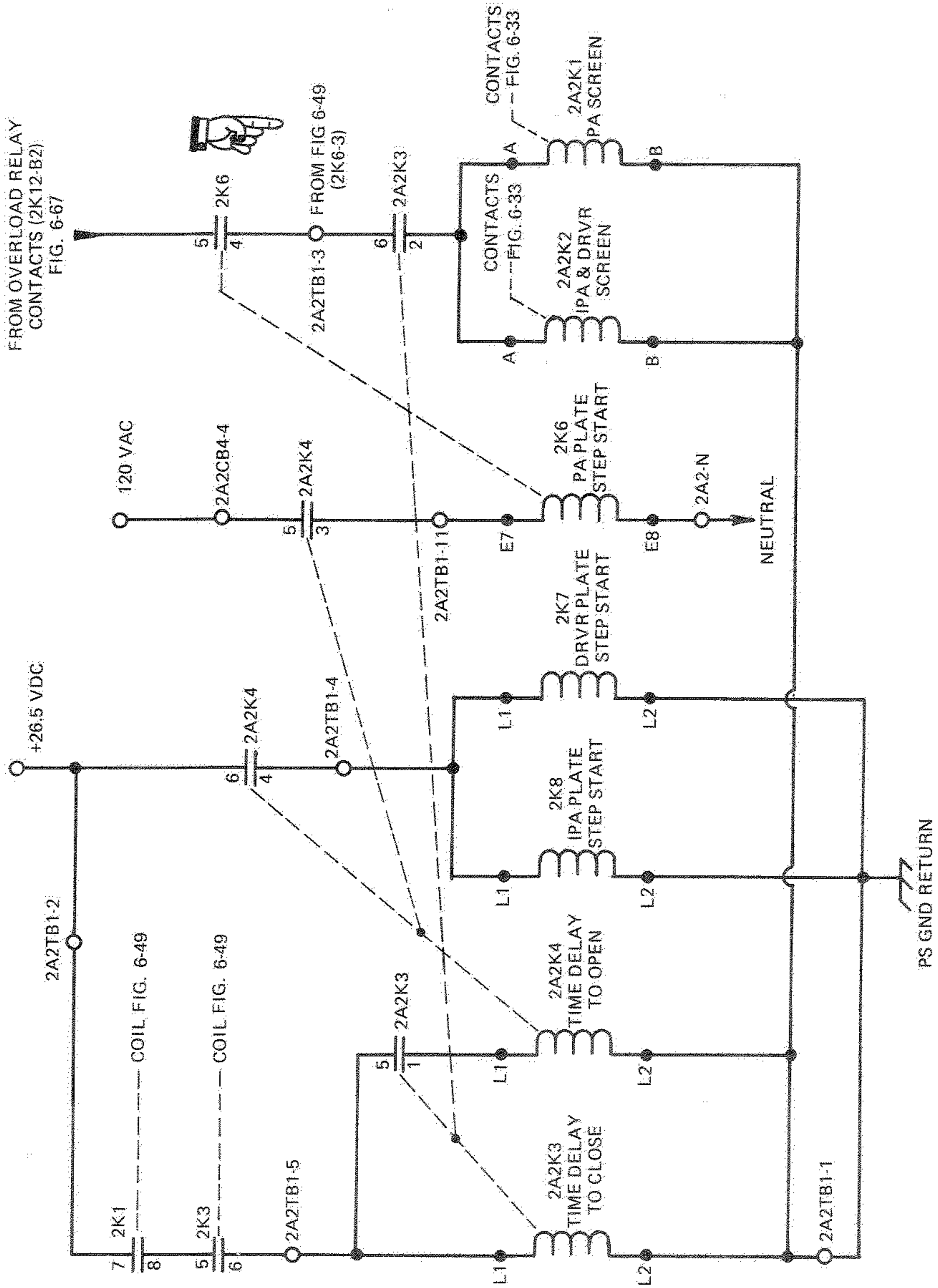


Figure 6-63. Time Delay Relays Control Diagram

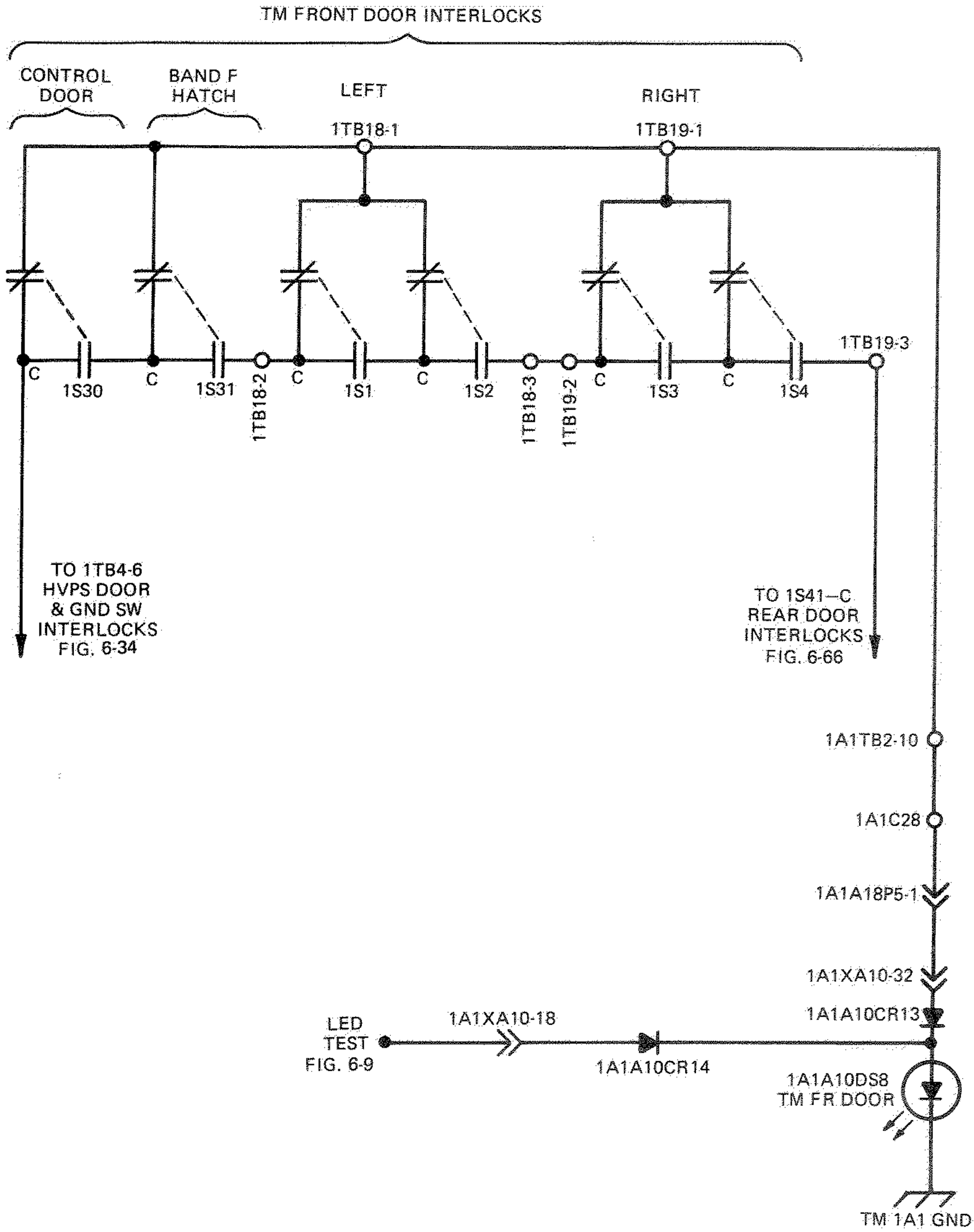


Figure 6-64. TM FR DOOR Control Diagram

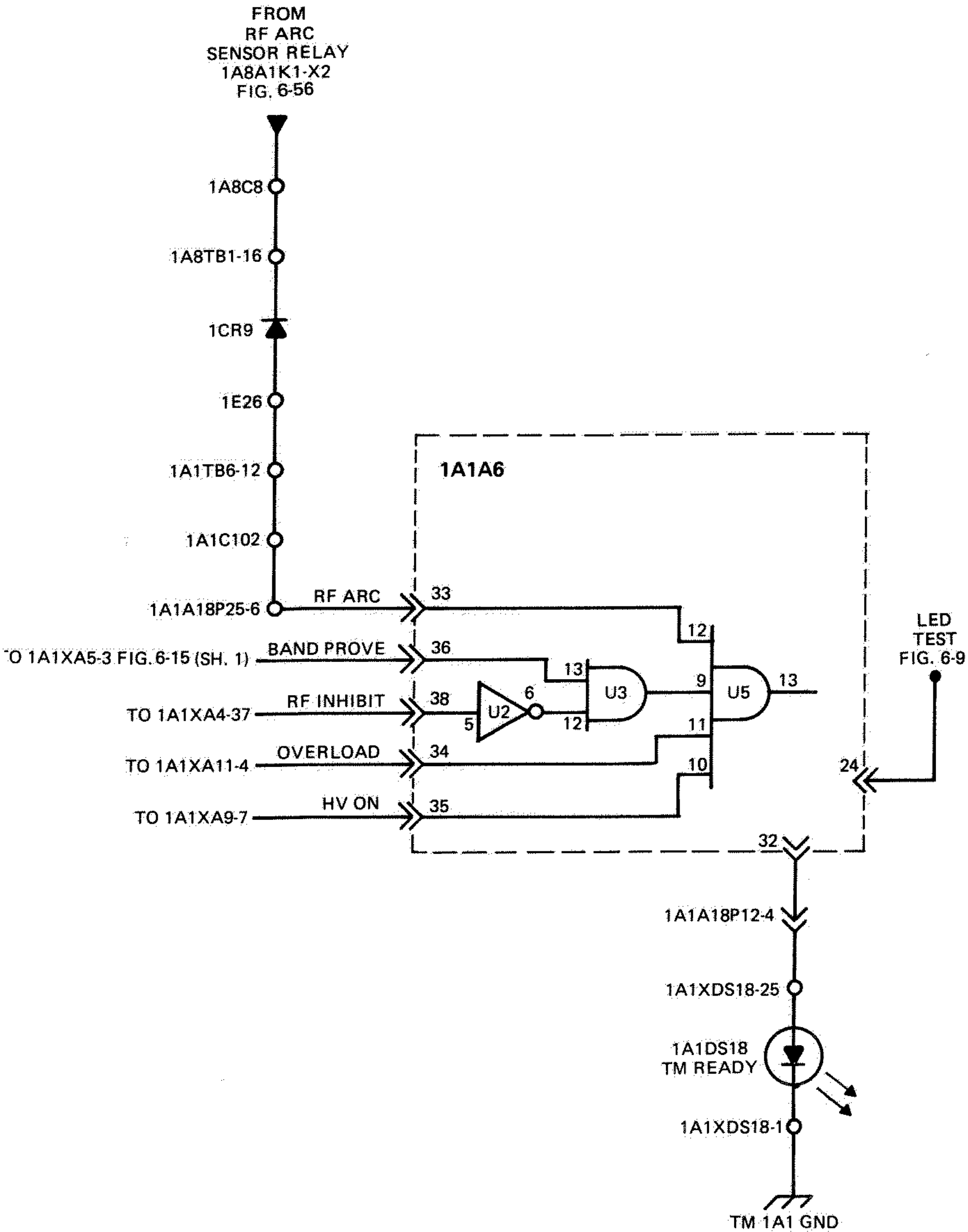


Figure 6-65. TM READY Control Diagram

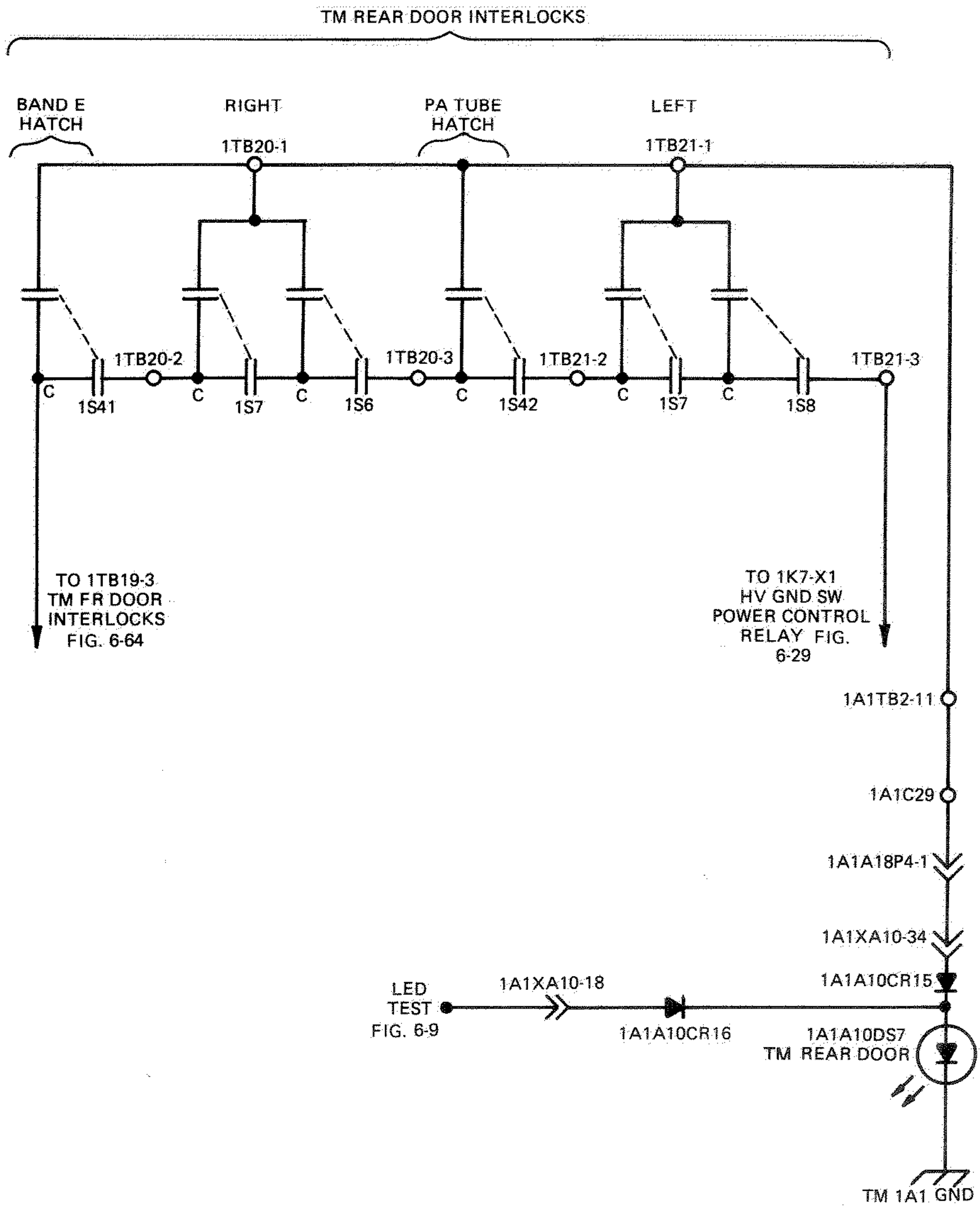


Figure 6-66. TM REAR DOOR Control Diagram

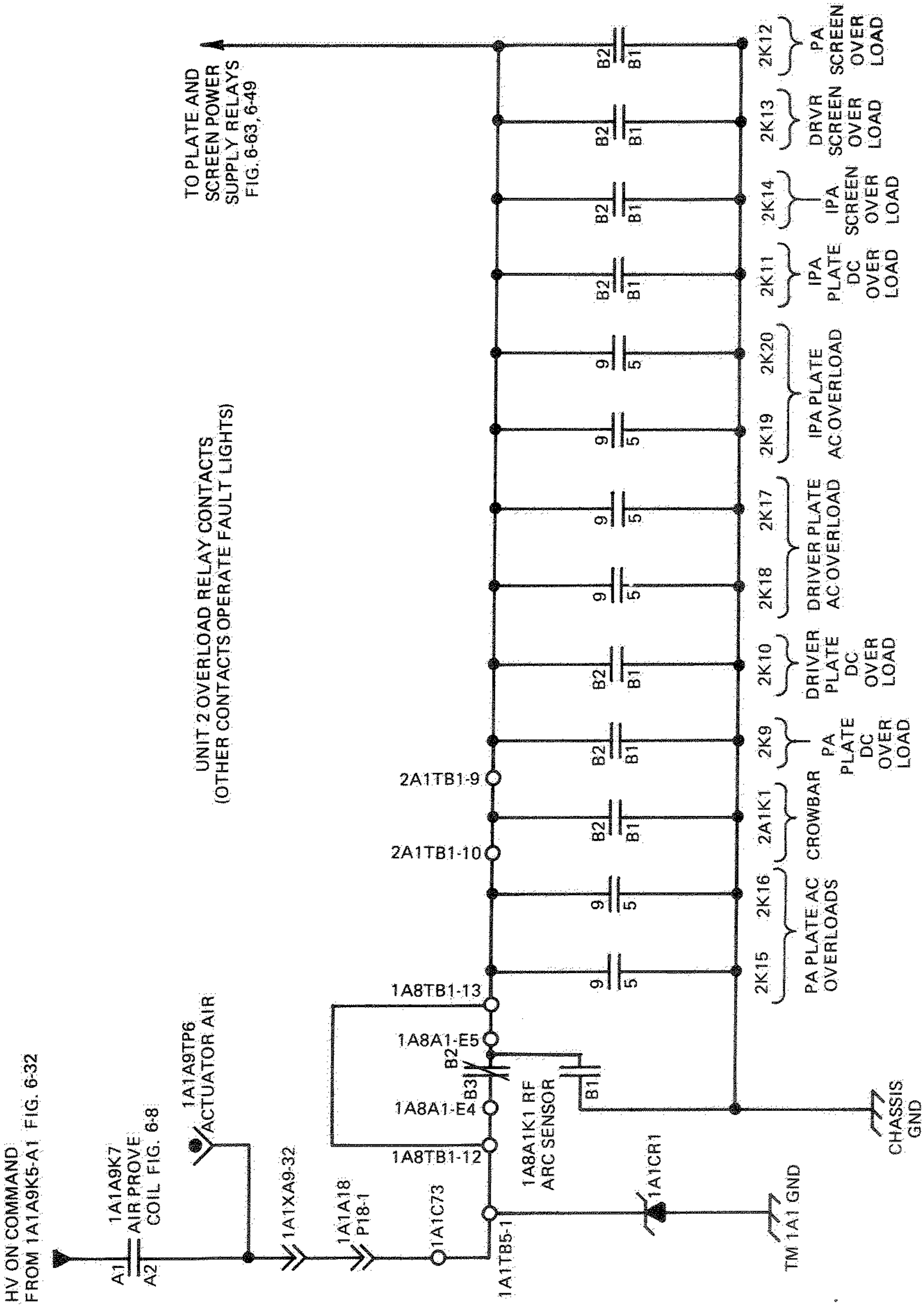


Figure 6-67. Unit 2 Overload Relay Contacts Control Diagram

6-5 GENERAL REMOVAL AND INSTALLATION PROCEDURES.

Table 6-7 is an index of removal and installation procedures. Procedures are written to the LRU level and do not cover removal and installation of fuses, lamps, and such standard components.

6-5.1 Introduction. Removal and installation of LRUs and certain discrete components are arranged by cabinet number. Procedures shall be performed in the exact order written for both removal and installation. Safety procedures at the front of this manual, as well as standard shop safety practices, shall be observed. Special lifting equipment is required for removal and installation of heavy and/or bulky LRUs. If it is necessary to remove the transmitter from service to remove an LRU, allow an approximate 2 to 3 minute cool-down period with cooling water and system air running.

6-5.2 Control/Status Cards. The card assembly panel (Figure 6-68) is part of CONTROL/STATUS Panel 1A1. It contains 13 plug-in circuit card assemblies (CCA), 1A1A1 through 1A1A13. It also provides storage for the CCA extended circuit adapter. A CCA location diagram is located inside the hinged cover panel.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	9e	Wrist Strap, Grounding

6-5.2.1 Control/Status Card Assembly Card Removal. To remove a CCA, refer to Figure 6-68 and perform the following.

1. Notify TMC operator to remove (DISABLE) RF drive for transmitter. Verify by reading of zero on POWER (KW) meter 1A13M1 and broadband amplifier wattmeter 1AR1M1. Follow procedures in paragraph 4-6.2.2 Steps 1 through 4.

WARNING

HIGH VOLTAGE HAZARD

One person observes HVPS circuit breaker panel 2A2 while other person performs maintenance. Circuit breakers opened in following step must remain open until procedure directs otherwise. Failure to comply may result in injury or death.

CAUTION

Ensure transmitter is in local mode with HV off before turning off 120 and 208 V ac power.

2. Open 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers at HVPS Cabinet 2.

CAUTION

EQUIPMENT DAMAGE HAZARD

CCAs are electrostatic sensitive devices. Personnel shall wear grounding wrist strap during this procedure.

3. Open card assembly panel front cover door by rotating cover latch handle 1/4-turn in either direction and pulling.

4. Turn knurled locking screw ccw at top edge of CCA to disengage captive nut.

5. Grasp pull tab at bottom edge of CCA and pull outward until edge connector is disengaged and CCA clears card guides.

6-5.2.2 Control/Status Card Assembly Card Installation. To install a CCA, refer to Figure 6-68 and perform the following.

CAUTION

EQUIPMENT DAMAGE HAZARD

CCAs are electrostatic sensitive devices. Personnel wear grounding wrist strap during this procedure.

NOTE

Check the following CCAs for adjustment after replacement. With the exception of 1A1A13, install CCA in transmitter on extender service card (Figure 6-68). Then perform procedure in the following paragraph reference.

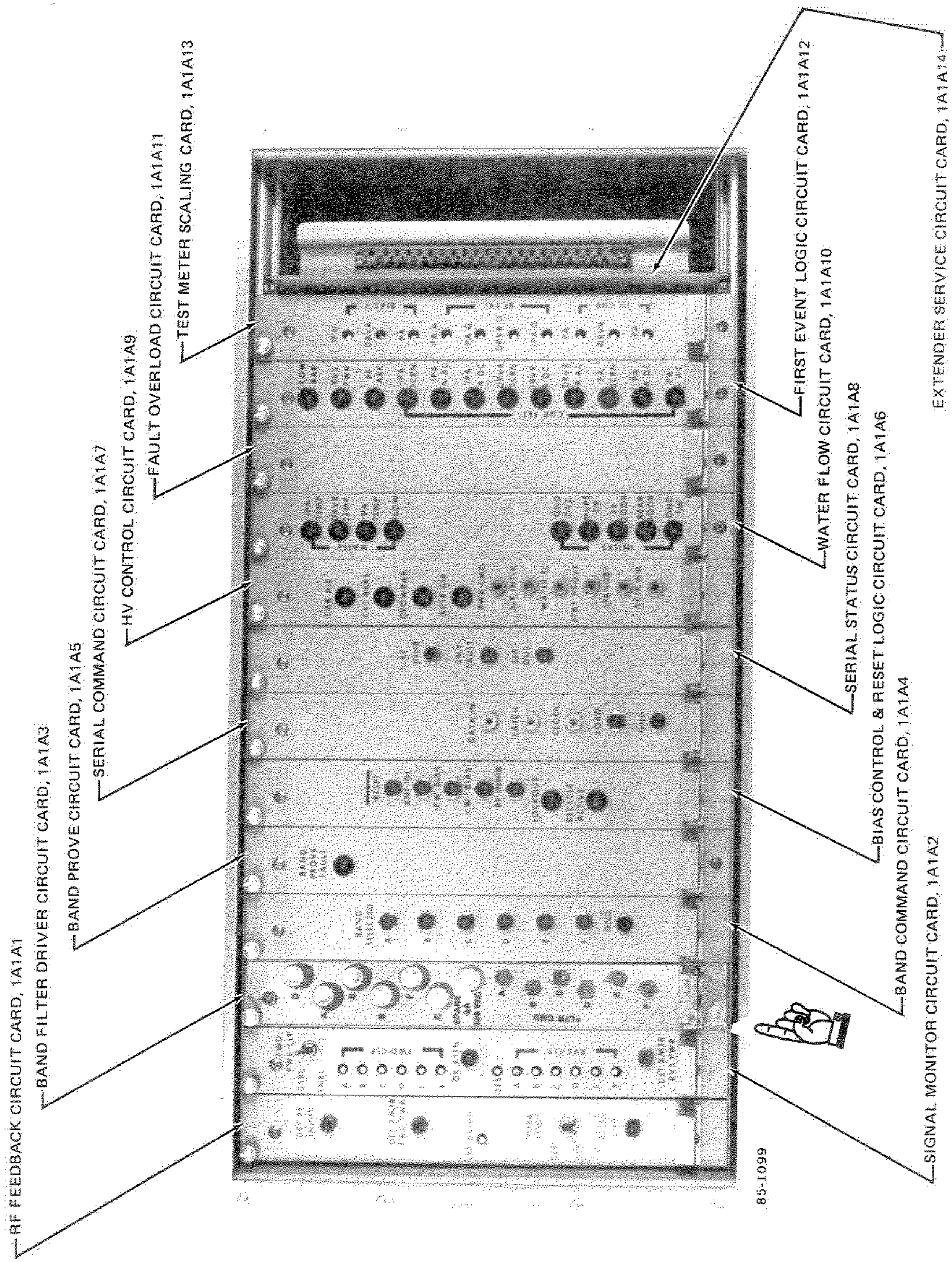


Figure 6-68. Control/Status Card Assembly Panel

Table 6-7. Removal and Installation Index

Reference Designator	Description	Paragraph
	TRANSMITTER CABINET 1	
1A1A1 - 1A1A13	Control/Status CCAs	6-5.2
1A8	RF Arc Sensor	6-5.5
1A8A1	RF Arc Sensor CCA	6-5.5
1K6	Coaxial Relay	6-5.7
1L17	PA Filament PS Inductor	6-5.21
1L31	IPA Filament PS Inductor	6-5.10
1L36	Driver Filament PS Inductor	6-5.15
1S32 - 1S37	RF Transfer Switches	6-5.24
1S38	Grounding Switch	6-5.20
1T1	Driver Filament PS Transformer	6-5.15
1T2	PA Filament PS Transformer	6-5.21
1T3	IPA Filament PS Transformer	6-5.10
1V1	IPA Vacuum Tube	6-5.11
1V2	Driver Vacuum Tube	6-5.16
1V3	PA Vacuum Tube	6-5.22
1AR1	Broadband Amplifier	6-5.3
1AT1	IPA Grid Dummy Load	6-5.8
1AT2	Driver Grid Dummy Load	6-5.13
1AT3	PA Grid Dummy Load	6-5.18

Table 6-7. Removal and Installation Index - CONT.

Reference Designator	Description	Paragraph
1CR1	Driver Filament PS Diode Assy	6-5.15
1CR2	PA Filament PS Diode Assy	6-5.21
1CR12	IPA Filament PS Diode Assy	6-5.10
1DC3 - 1DC8	Directional Couplers	6-5.25
1FL1 - 1FL3	IPA Grid Bandpass Filters	6-5.6
1FL4, 1FL5	Driver Grid Bandpass Filters	6-5.12
1FL7 - 1FL9	PA Grid Bandpass Filters	6-5.17
1FL10 - 1FL15	PA Output Filters	6-5.23
1PS1, 1PS2	Control Voltage PS	6-5.4
1PS3	IPA Bias Power Supply	6-5.9
1PS4	Driver Bias PS	6-5.14
1PS5	PA Bias PS	6-5.19
1PS6	Control Voltage PS	6-5.4
1XV1	IPA Vacuum Tube Socket	6-5.11
1XV2	Driver Vacuum Tube Socket	6-5.16
1XV3	PA Vacuum Tube Socket	6-5.22
	HIGH VOLTAGE POWER SUPPLY, CABINET 2	
2A1	Electronic Crowbar	6-5.26
2A4	Electronic Motor Controller	6-5.27
2C4 - 2C11	Capacitors	6-5.30
2C12	Capacitor	6-5.31
2C17	Capacitor	6-5.32
2C18	Capacitor	6-5.32

Table 6-7. Removal and Installation Index - CONT.

Reference Designator	Description	Paragraph
2C19	Capacitor	6-5.31
2C23, 2C24	Capacitors	6-5.32
2C25	Capacitor	6-5.31
2CR1 - 2CR3	Rectifier Assemblies	6-5.33
2CR4 - 2CR6	Rectifier Assemblies	6-5.34
2CR7 - 2CR12	Rectifier Assemblies	6-5.35
2K1	Relay	6-5.36
2K2	Relay	6-5.37
2K3	Relay	6-5.38
2K6	Relay	6-5.39
2L1	Reactor	6-5.40
2L2	Reactor	6-5.41
2L3, 2L4	Reactors	6-5.53
2L5	Reactor	6-5.41
2L6, 2L7	Reactors	6-5.53
2L8	Reactor	6-5.41
2R38	Resistor	6-5.42
2R39	Resistor	6-5.43
2S2	Grounding Lever Switch	6-5.28
2T1	Transformer	6-5.44
2T2, 2T3, 2T25	Transformers	6-5.45
2T4	Transformer	6-5.47
2T5	Transformer	6-5.48

Table 6-7. Removal and Installation Index - CONT.

Reference Designator	Description	Paragraph
2T6, 2T7, 2T26	Transformers	6-5.46
2T8	Transformer	6-5.47
2T9	Transformer	6-5.49
2T10, 2T11, 2T27	Transformers	6-5.46
2T12	Transformer	6-5.47
2T14, 2T15	Transformers	6-5.50
2T16, 2T17	Transformers	6-5.51
2T20 - 2T23	Transformers	6-5.52
2T24	Transformer	6-5.27
2Z1, 2Z2	Phase Monitors	6-5.29
	HIGH VOLTAGE AC SWITCH, CABINET 3	
	Operator Drive Chain	6-5.54

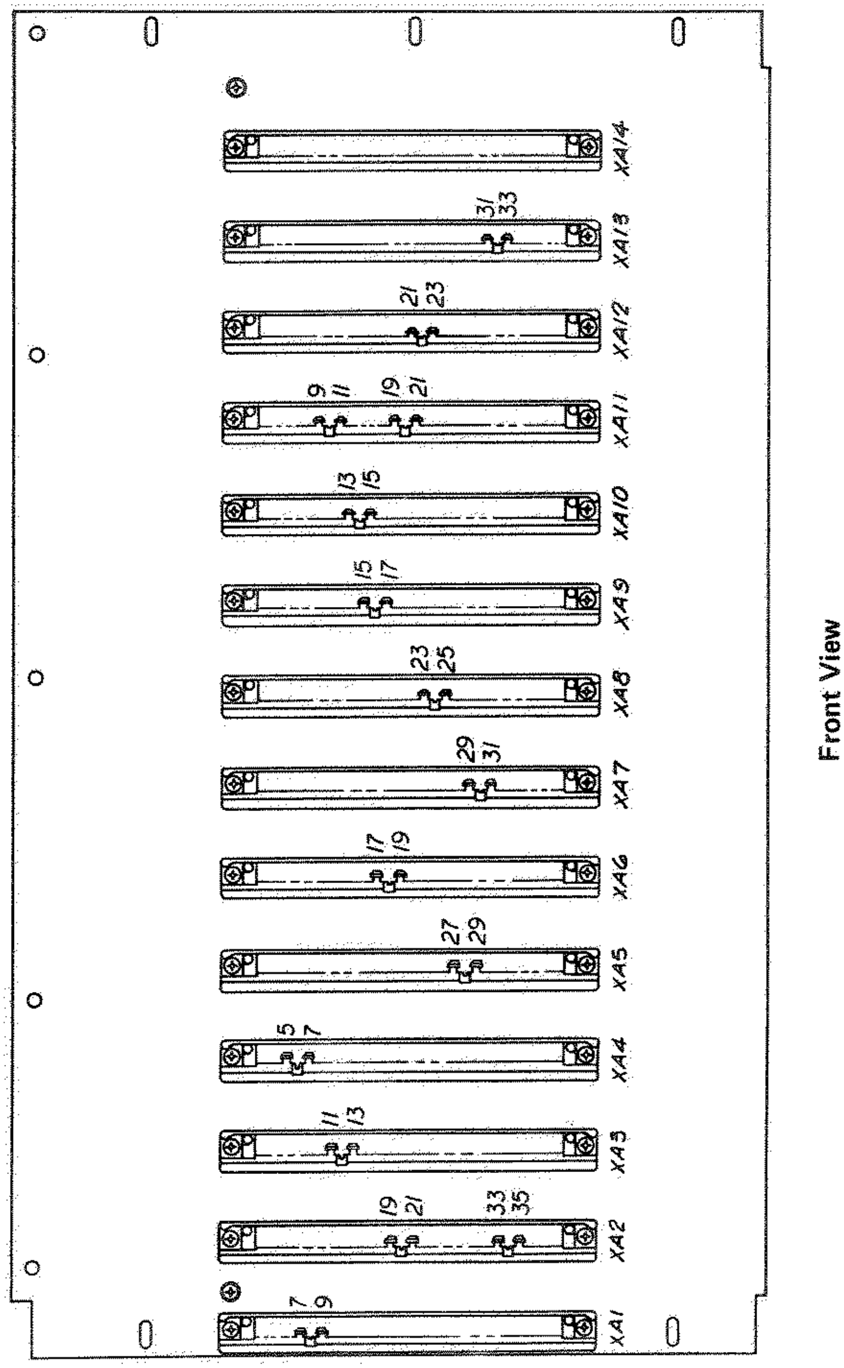


Figure 6-69. Card Slot Polarization

CCA	Paragraph
1A1A1	6-6.3.3
1A1A2	6-6.3.4
1A1A5	6-6.3.5
1A1A10	6-6.3.6
1A1A13	6-6.3.7

WARNING
HIGH VOLTAGE HAZARD

One person observes HVPS circuit breaker panel 2A2 while other person performs maintenance. Circuit breakers verified open in following step must remain open until procedure directs otherwise. Failure to comply may result in injury or death.

1. Verify 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers on HVPS are open.

2. Ensure CCA polarization pins are as shown in Figure 6-69.

3. Install CCA in socket by pressing firmly on upper and lower edges. Once CCA is seated, finger-tighten knurled locking screw at top edge.

CAUTION

Ensure transmitter is in local mode with HV off before turning on 120 and 208 V ac power.

4. Close 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers at HVPS Cabinet 2.

5. If installed CCA requires checkout, proceed to appropriate paragraph. Otherwise, close panel door and notify TMC operator that transmitter can be brought to mission-ready status in accordance with TO 31P6-2FPS118-71.

6-5.3 Broadband Amplifier. Broadband amplifier is part of cabinet 1 controls section (Figure 4-6). Access is through left end door.

6-5.3.1 Broadband Amplifier 1AR1 Removal. Refer to Figure 6-70 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1e	Heavy component handling lift
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove protective cover from Relay Panel 1A24 by removing four screws.

3. Remove protective cover from System Protection Panel 1A23 by removing four screws.

4. Tag and disconnect power cable from 1A24TB2-1, TB2-2, and TB2-3 by loosening screws and removing lugs.

5. Disconnect KEYLINE input by removing TNC connector.

6. Disconnect RF INPUT by removing N-type connector.

7. Remove 90° coupling from OUTPUT jack.

8. Remove eight retaining screws from front of panel.

9. Extend amplifier on chassis slides until they lock. Release chassis slide locks by pressing releases down on each side.

10. Two persons remove amplifier and place it on heavy component handling lift.

6-5.3.2 Broadband Amplifier 1AR1 Installation. Refer to Figure 6-70 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1e	Heavy component handling lift
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver

NOTE

Ensure front panel handles are installed on replacement amplifier if handles are detached for shipment.

1. Two persons lift amplifier into place for installation. Engage chassis rack-slide section with center section of transmitter rack slide. Push amplifier into cabinet slide until rack slides snap into first lock position.

2. Connect power cable to 1A24TB2-1, -2, and -3 and tighten screws. Remove tags.

3. Replace protective cover on panel 1A23 and install four screws.

NOTE

Ensure 1AR1 power cable is behind 1A24 panel cover and between upper mounting posts of panel cover.

4. Replace protective cover on Relay Panel 1A24. Install four screws.

5. Release rack slide safety catches and slide amplifier into cabinet.

6. Connect RF INPUT and KEYLINE cabling and RF OUTPUT 90° coupler.

7. Install eight retaining screws around front panel.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

8. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.3.3 Variable Bandpass Capacitors 1C2, 1C14, 1C16, 1C28, 1C30 & 1C43 Removal and Installation.

Tool & Text Equipment Required

Qty	Item No.	Description
1	11	Capacitance Meter

WARNING
HIGH VOLTAGE, RF, X-RAY AND AIR PRESSURE HAZARDS.

1. Perform procedures in paragraph 6-2.2.1 To access cabinet.

2. Removal and Installation of the capacitors is self-evident; however before installing a replacement capacitor it must be adjusted, (outside the circuit) using the capacitance meter, to the values given in Table 6-7.1.

3. Perform procedures in paragraph 6-2.2.2 to exit the cabinet.

TABLE 6-7.1 Bandpass Capcaitor Adjustment Values

Capacitor	Value
IPA 1C2	11.2pf
Driver 1C14	7.0pf
Driver 1C16	7.4pf
PA Grid 1C28	10.8pf
PA Grid 1C30	8.4pf
PA Output 1C43	9.1pf

6-5.4 Control Voltage Power Supplies. Control Voltage Power Supplies (CVPS) consist of 1PS1 (+26 V dc Supply), 1PS2 (+15 V dc supply), and 1PS6 ($\pm$15 V dc supply). They are located in cabinet 1 controls compartment (Figure 6-71).

6-5.4.1 +26 V DC Control Power Supply 1PS1 Removal. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7g	Phillips Offset Screwdriver Tip

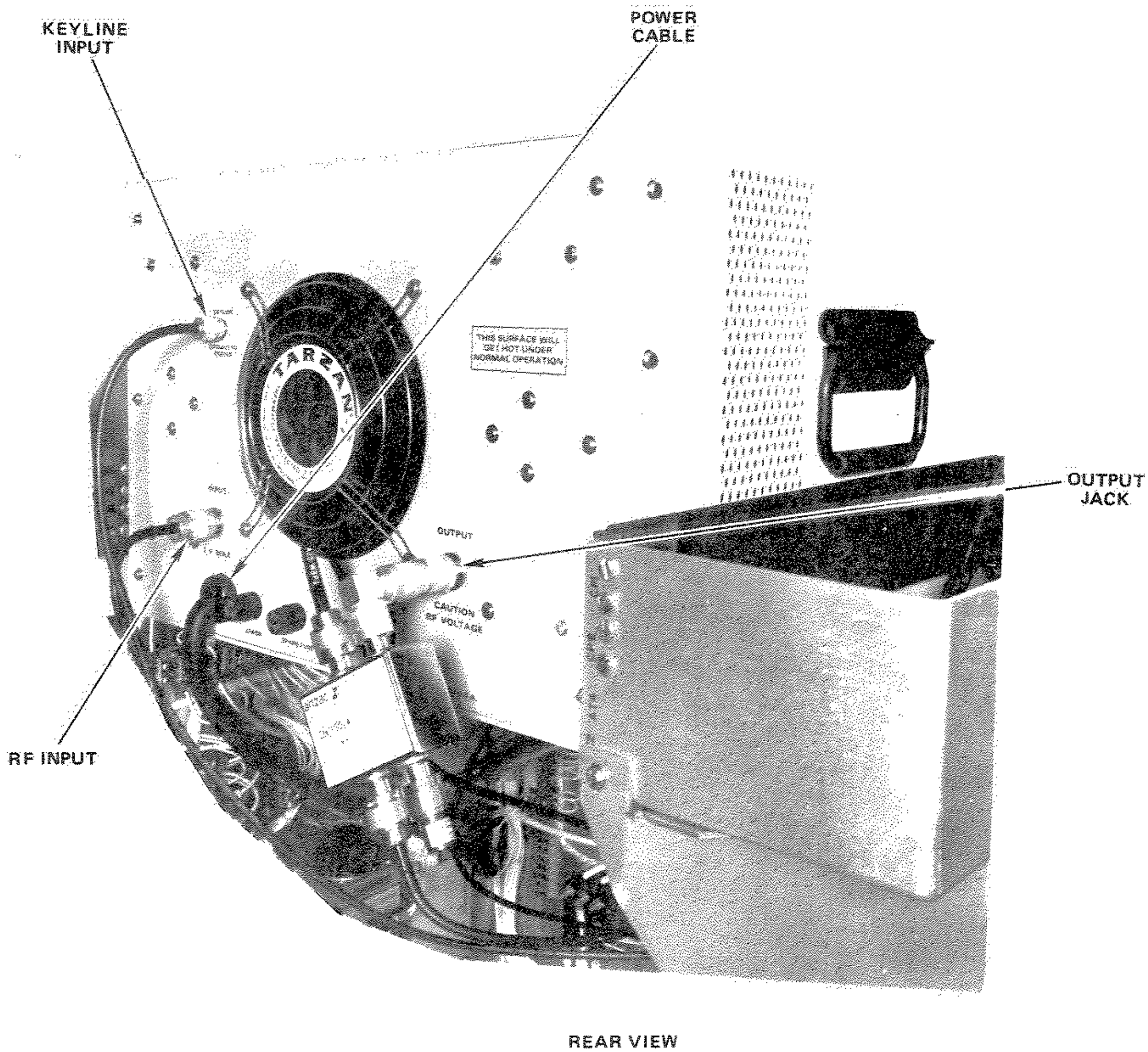


Figure 6-70. Broadband Amplifier

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove protective warning shield from left (terminal end) of power supply by removing two screws.

3. Loosen screws that secure input and output wiring lugs. Tag wires and remove by pulling lugs away from terminal strip. Retain power supply transformer strapping for installation on replacement unit.

4. Remove four mounting screws from bottom of power supply. Lift power supply from bracket and remove from cabinet.

6-5.4.2 <u>+26 V DC Control Power Supply 1PS1 Installation</u>. Refer to Figure 6-71 and perform the following.

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7g	Phillips Tip Offset Screwdriver

1. Place power supply in cabinet and install four mounting screws in bracket.

2. Connect input and output wiring lugs to terminal strip with screws and remove tags. Install transformer strapping.

3. Install protective warning shield at left (terminal end) of power supply by installing two screws.

4. Follow procedure in paragraph 6-6.3.1 for power supply alignment.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.4.3 +15 V DC Control Power Supply 1PS2 Removal. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7d	Phillips Screwdriver

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove protective shield from front (terminal end) of power supply by removing two screws.

3. Loosen screws that secure input and output wiring lugs. Tag wires and remove by pulling lugs away from terminal strip.

4. Remove four mounting screws from bottom of power supply. Lift and remove power supply.

6-5.4.4 +15 V DC Control Power Supply 1PS2 Installation. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7d	Phillips Screwdriver

1. Place power supply in cabinet and install four mounting screws in bracket.

2. Install screws to connect input and output wiring lugs to terminal strip. Remove tags.

3. Install protective shield at front (terminal end) of power supply by installing two screws.

4. Follow procedure in paragraph 6-6.3.1 to align power supply.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.4.5 Dual 15 V DC Control Power Supply 1PS6 Removal. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7d	Phillips Screwdriver

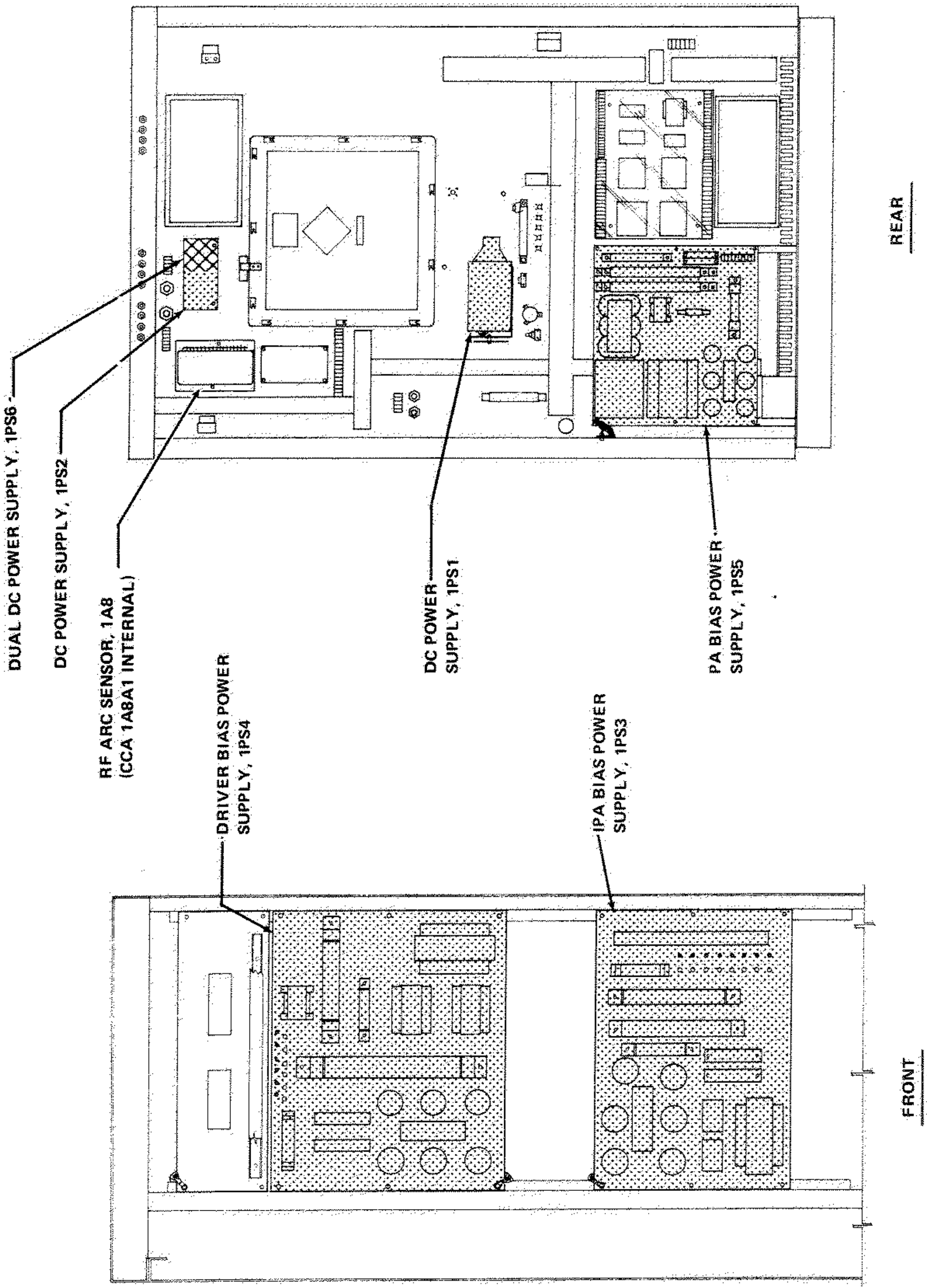


Figure 6-71. Cabinet 1 Controls Compartment

WARNING
HIGH VOLTAGE, RF, X-RAY,
AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove protective warning shield from front (terminal end) of power supply by removing two screws.

3. Loosen screws that secure input and output wiring lugs to terminal strip. Tag wires and remove by pulling lugs away from terminal strip.

WARNING
PERSONNEL INJURY HAZARD

Be careful when performing the next step. With screws removed, power supply could fall from mounting standoffs. Failure to comply may result in injury to personnel and damage to equipment.

4. Support power supply and by hand and remove four mounting screws from bottom. Lift power supply from bracket.

6-5.4.6 Dual 15 V DC Control Power Supply 1PS6 Installation. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7d	Phillips Screwdriver

WARNING
PERSONNEL INJURY HAZARD

Be careful when performing the next step. Unless supported, power supply could fall from standoffs. Failure to comply may result in injury or equipment damage.

1. Position power supply with four stand-offs for installation. Support by hand and install four mounting screws in bracket.

2. Connect wiring lugs to terminal strip and secure with screws. Remove tags.

3. Install protective warning shield on front (terminal end) of power supply with two screws.

4. Follow procedure in paragraph 6-6.3.1 to align power supply.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.5 RF Arc Sensor and Internal CCA. RF Arc Sensor 1A8 and internal CCA 1A8A1 are located in cabinet 1 controls compartment (Figure 6-71).

6-5.5.1 RF Arc Sensor 1A8 Removal. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7w	Ratchet
1	7x	Ratchet Extension
1	7zb	3/8" Socket

WARNING
HIGH VOLTAGE, RF, X-RAY,
AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag external wires to TB1. Remove wires.

3. Remove four screws from front of sensors. Remove cover.

CAUTION
EQUIPMENT DAMAGE HAZARD

Support unit by hand while removing mounting hardware; it can fall free. Failure to comply may result in damage to equipment.

4. Remove four nuts holding sensor to mounting plate.

6-5.5.2 RF Arc Sensor 1A8 Installation. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7d	Phillips Screwdriver
1	7h	Open End Wrench

1. Position sensor on mounting plate and support by hand while installing four nuts.

2. Place cover on front of sensor. Install four screws.

3. Connect external wires to TB1. Remove tags.

4. Perform arc sensor sensitivity adjustment according to paragraph 6-6.1

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.5.3 RF Arc Sensor CCA 1A8A1 Removal. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7a	Needlenose pliers
1	7d	Phillips Screwdriver
1	9b	Soldering Iron
	(from Table 6-1)	
1	8	Solder

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove four screws from front of sensor. Remove cover.

3. Tag and unsolder wires from E1 through E8 on CCA.

4. Unscrew and remove four standoffs holding CCA in place. Remove CCA from enclosure.

6-5.5.4 RF Arc Sensor CCA 1A8A1 Installation. Refer to Figure 6-71 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7a	Needlenose pliers
1	7d	Phillips Screwdriver
1	9b	Soldering Iron
	(from Table 6-1)	
1	8	Solder

1. Place CCA inside sensor enclosure. Install four standoffs to hold CCA

2. Solder wires to E1 through E8. Remove tags.

3. Place cover on front of sensor and install four screws.

4. Perform arc sensor sensitivity adjustmen according to paragraph 6-6.1.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.6 IPA Grid Bandpass Filters. Filters 1FL1, 1FL2, and 1FL3 are accessed through cabinet 1 left front doors. Removal and installation procedures are identical.

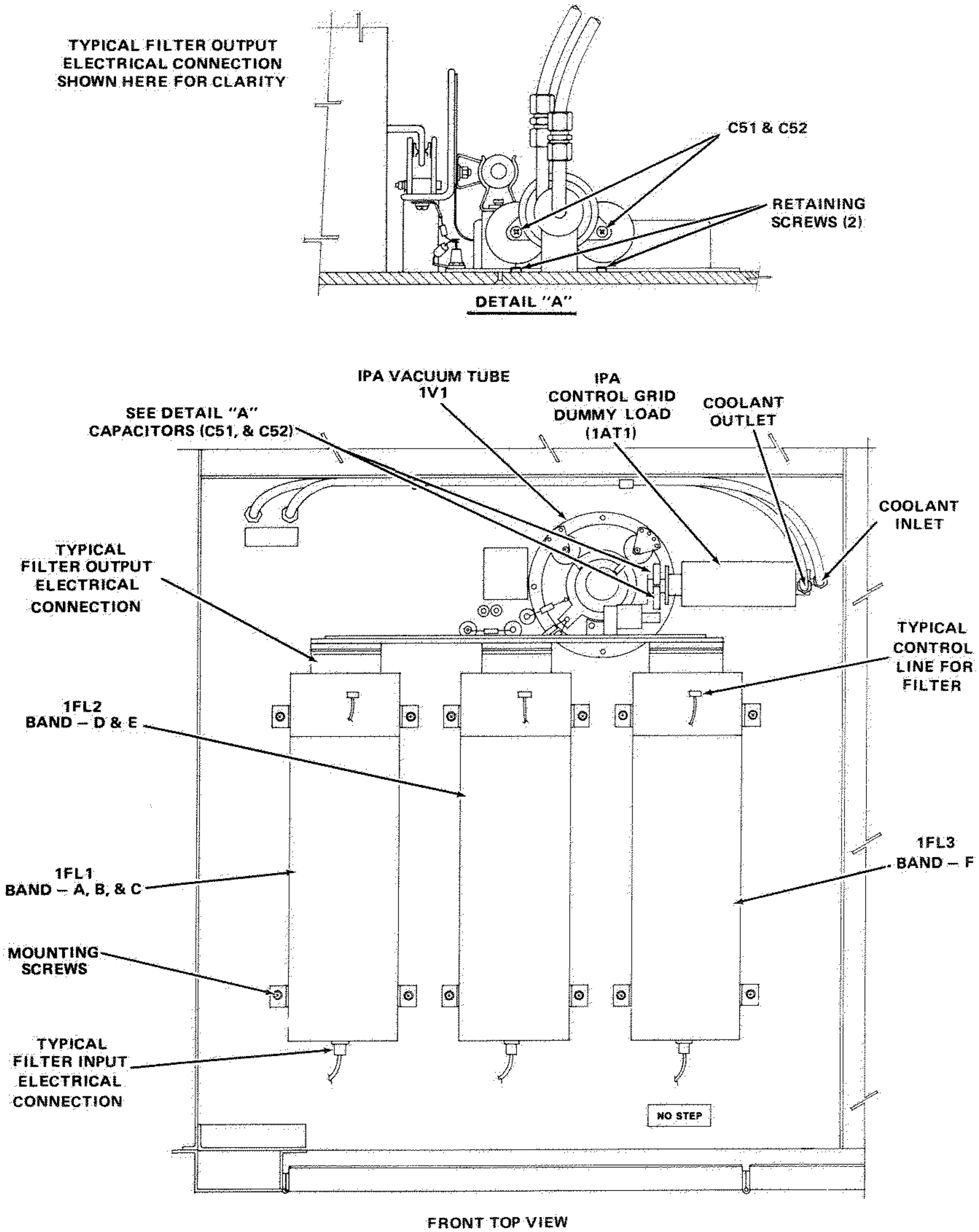


Figure 6-72. IPA Grid Components

6-5.6.1 IPA Grid Bandpass Filters 1FL1, 1FL2, and 1FL3 Removal. Refer to Figure 6-72 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.
2. Disconnect RF INPUT at J1 by removing N-type coaxial connector.
3. Move lock-slides that hold D-type connector in place. Disconnect CONTROL lines by removing D-type connector.
4. Remove four mounting screws.
5. Lift up rear of filter to disengage electrical connection between filter and IPA grid input circuit. Slide filter forward and remove from cabinet.

6-5.6.2 IPA Grid Bandpass Filters 1FL1, 1FL2, and 1FL3 Installation. Refer to Figure 6-72 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver

CAUTION

EQUIPMENT DAMAGE HAZARD

When installing filter, be careful not to damage finger stock electrical contacts.

1. Lift up rear of filter and slide it in place for installation. Lower rear of filter to engage electrical connection between filter and IPA grid input circuit.
2. Install four mounting screws.
3. Connect CONTROL lines by installing D-type connector and closing lockslides that hold connector in place.
4. Connect RF INPUT at J1 by connecting N-type coaxial connector.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.7 Coaxial Relay 1K6. Relay is bulkhead-mounted above IPA Grid Bandpass Filter 1FL1. Access is through left front doors.

6-5.7.1 Coaxial Relay 1K6 Removal. Refer to Figure 6-4, sheet 1, and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7d	Phillips Screwdriver

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.
2. Remove connectors from J1, J2, J3, and J4.
3. Remove four screws from corners of relay cover.

4. Carefully lift cover from enclosure. Straighten out internal wiring as necessary.

5. Tag and remove wires from lugs 1 through 3 on terminal board on left side of relay.

6. Remove two screws that hold enclosure to bulkhead. Remove relay from cabinet.

6-5.7.2 Coaxial Relay 1K6 Installation. Refer to Figure 6-4, sheet 1, and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7d	Phillips Screwdriver

1. Remove four screws from corners of relay cover.

2. Carefully lift cover from enclosure. Straighten out internal wiring as necessary.

3. Install two screws that hold relay to bulkhead.

4. Install wires on lugs 1 through 3 on terminal board on left side of relay. Remove tags.

5. Place cover on enclosure and install four screws.

6. Install connectors at J1, J2, J3, and J4.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

7. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.8 IPA Control Grid Dummy Load. The IPA Control Grid Dummy Load 1AT1 is accessed through the left front doors of cabinet 1.

6-5.8.1 IPA Control Grid Dummy Load 1AT1 Removal. Refer to Figure 6-72 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	7e	Phillips Screwdriver
1	7g	Phillips-Tip Offset Screwdriver
2	7s	Open End Wrench
1	9f	6-foot Water Hose
1	9h	Drain Pan
		(from Table 6-1)
AR	5	Cotton Wiping Rags

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Follow procedure in paragraph 6-2.3.1 to turn off cooling water supply and drain cabinet 1.

CAUTION

EQUIPMENT DAMAGE HAZARD

When removing cooling water lines from LRU, be careful not to splash water into IPA tube socket.

3. Place rags beneath cooling water lines where they connect to dummy load. Loosen two ferrule hex nuts and remove water lines. Drain lines into container.

4. Loosen (do not remove) two retaining screws that secure left end of dummy load to tube socket (Figure 6-72, Detail A).

CAUTION

EQUIPMENT DAMAGE HAZARD

Be very careful when removing dummy load from mount and from cabinet. It contains water that will spill if assembly is tilted. Failure to comply may result in extensive down-time.

5. One person support dummy load while second person removes mounting screw from beneath deck at right end of dummy load. Slide assembly away from loosened retaining screws and carefully remove from cabinet.

6. Remove two screws that secure two capacitors to end of dummy load (Figure 6-72, Detail A). Retain capacitors, bracket, and mounting hardware for installation on replacement dummy load.

6-5.8.2 IPA Control Grid Dummy Load 1AT1 Installation. Refer to Figure 6-72 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
1	7g	Phillips-Tip Offset Screwdriver
2	7s	Open End Wrench

1. Install mounting bracket and two capacitors on end of dummy load with two screws.

2. One person position dummy load and support it while second person installs mounting screw from beneath deck at right end of dummy load.

3. Tighten down retaining screws at left end of dummy load.

CAUTION

EQUIPMENT DAMAGE HAZARD

Be careful not to break inlet/outlet tubes when attaching cooling water lines.

4. Attach water lines to inlet and outlet tubes of dummy load. Tighten ferrule hex nut on each line.

5. Follow procedure in paragraph 6-2.3.2 to turn on cooling water to cabinet. After, verify rags have been removed from cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

6. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.9 IPA Bias Power Supply 1PS3. 1PS3 is located in cabinet 1 controls compartment (Figure 6-71).

6-5.9.1 IPA Bias Power Supply 1PS3 Removal. Refer to Figures 6-71 and 6-73 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
2	7o	Open End Wrench
1	7t	Open End Wrench

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove external wiring from TB1.

3. Tag external wiring connected to E1 through E8. Remove eight hex nuts from E1 through E8 and remove wiring.

4. Remove wire duct cover and lift external wiring from wire duct. Fold wiring harness away from power supply and secure it to prevent damage to insulation during removal of power supply.

5. One person support power supply while second person removes six hex nuts that attach power supply to mounting rails. Removing hex nut at upper left corner also releases ground strap.

6-5.9.2 IPA Bias Power Supply 1PS3 Installation. Refer to Figures 6-71 and 6-73 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
2	7o	Open End Wrench
1	7t	Open End Wrench

1. One person position and support power supply. Second person position ground strap at upper left corner and install one of six hex nuts that secure power supply to mounting rails. Install remaining five hex nuts.

2. Fold wiring harness onto power supply and into wire duct. Install wire duct cover.

3. Connect wiring to E1 through E8 by installing eight hex nuts. Remove tags.

4. Connect wiring to TB1. Remove tags.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.10 IPA Filament Power Supply. The power supply assembly is located at the rear of cabinet 1 (Figure 6-4, sheet 2). To repair the assembly, it is necessary to remove and replace discrete components.

6-5.10.1 Transformer 1T3 Removal and Installation.

6-5.10.1.1 Transformer 1T3 Removal. Refer to Figure 6-74 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
2	7o	Open End Wrench

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove three transformer cables from Diode Assembly 1CR12.

3. Remove protective cover strip from top of transformer.

4. Tag and remove wires from TB1.

5. Remove four hex nuts that hold transformer in place.

6-5.10.1.2 Transformer 1T3 Installation. Refer to Figure 6-74 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
2	7o	Open End Wrench

1. Position transformer and install four hex nuts.

2. Install wires on TB1. Remove tags.

3. Install protective cover strip over TB1.

4. Connect three transformer cables to Diode Assembly 1CR12. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.10.2 Inductor 1L31 Removal and Installation.

6-5.10.2.1 Inductor 1L31 Removal. Refer to Figure 6-74 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
2	7o	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7zc	Socket

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove four hex nuts that secure base of inductor to cabinet deck.

3. Move inductor forward to allow clearance of wrench. Tag and remove four wires from inductor.

6-5.10.2.2 Inductor 1L31 Installation. Refer to Figure 6-74 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
2	7o	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7zc	Socket

1. Position inductor on chassis to provide clearance for wrench. Connect four wires and remove tags.

2. Align mounting holes and install four hex nuts.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

3. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.10.3 Diode Assembly Removal And Installation.

6-5.10.3.1 Diode Assembly 1CR12 Removal. Refer to Figure 6-74 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
2	7o	Open End Wrench

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove five cables from diode assembly.

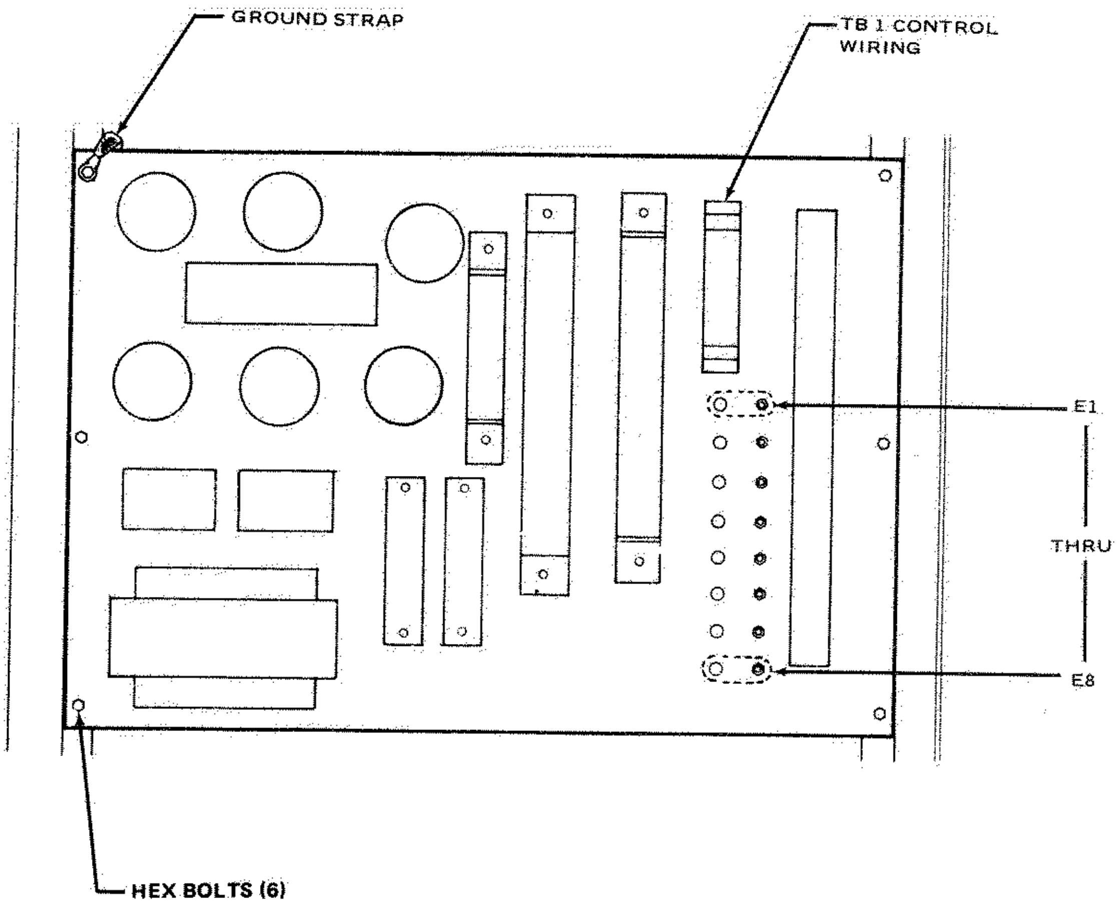


Figure 6-73. IPA Bias Power Supply

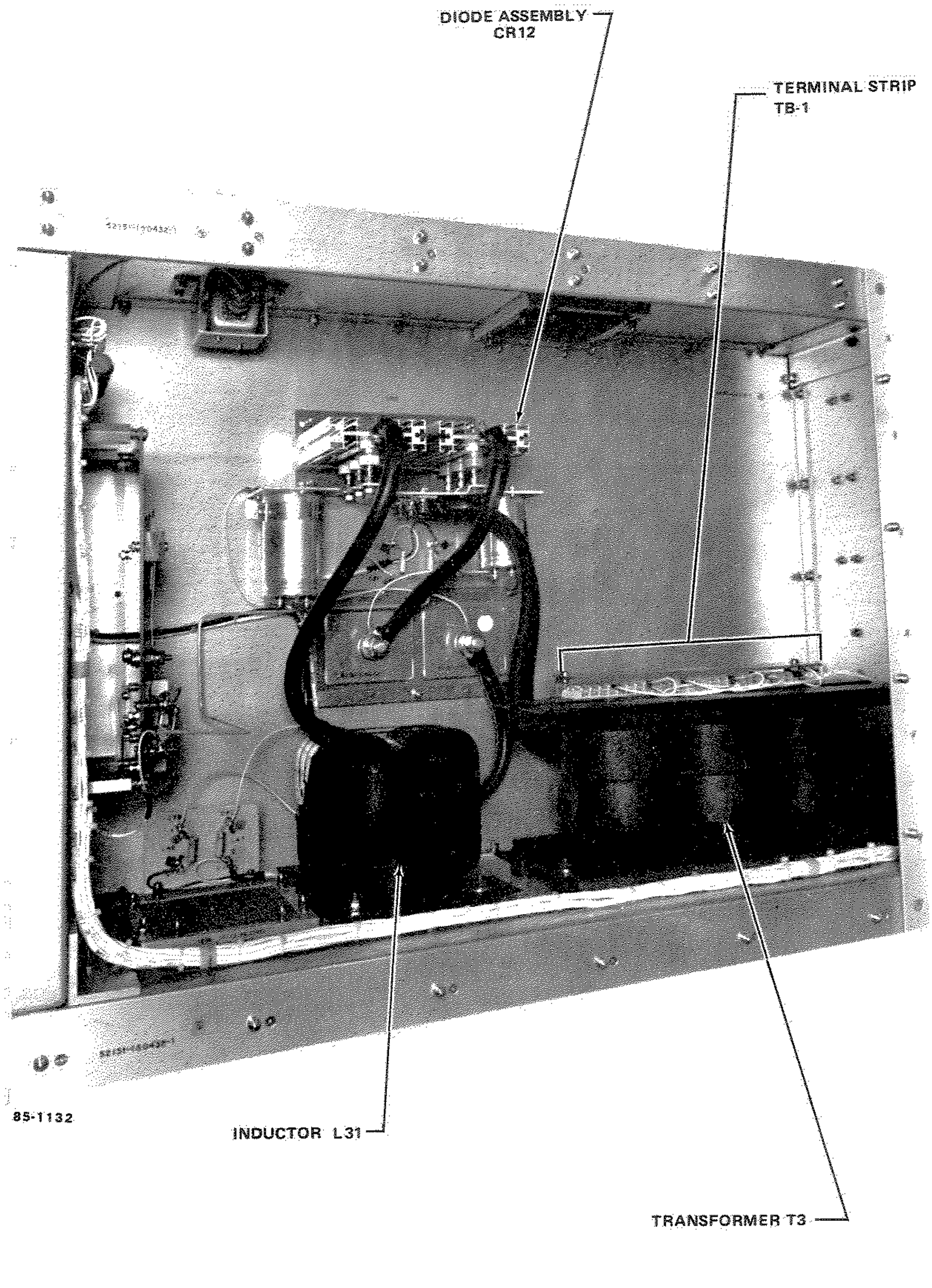


Figure 6-74. IPA Filament Power Supply

3. One person support assembly while second person removes four hex nuts from backside of bulkhead.

6-5.10.3.2 Diode Assembly 1CR12 Installation. Refer to Figure 6-74 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
2	7o	Open End Wrench

1. One person position diode assembly for installation and hold in place while second person installs four hex nuts at backside of bulkhead.

2. Install five cables on diode assembly and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

3. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.11 IPA Vacuum Tube and Socket. Refer to Figure 6-72 for location of IPA tube 1V1. Access is through left front and right rear doors, and front and rear lower protective covers.

6-5.11.1 IPA Vacuum Tube 1V1 Removal. Refer to Figures 6-72 and 6-75 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	9c	Trouble Light
1	7m	Open End Wrench
1	7t	Open End Wrench
1	9f	6-ft. Water Hose
1	9h	Drain Pan
	(from Table 6-1)	
AR	5	Cotton Wiping Rags

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Follow procedure in paragraph 6-2.3.1 to turn off cooling water and drain cabinet.

CAUTION
EQUIPMENT DAMAGE HAZARD

When removing cooling water lines from IPA tube, be careful not to splash water into tube socket. Failure to comply may result in extensive transmitter down-time.

3. At lower end of vacuum tube, place rags beneath cooling water line connections. Disconnect fittings from both water lines and drain water into container.

4. Remove nut securing jumpers from 1L2 to one of knurled locking pins located near top of tube assembly.

5. Loosen water-line connector (Figure 6-77). Remove top screw from support bracket. Pull off heat sink assembly from tube and move out of way.

6. While supporting tube from bottom, remove three knurled locking pins located near top of tube assembly.

7. Lower tube and contact ring from socket and remove from cabinet.

CAUTION
EQUIPMENT DAMAGE HAZARD

Do not allow fittings to rotate when loosening colant line nuts.

8. If new tube will be installed, remove quick-disconnect fittings from tube and set aside. Carefully remove electrical contact ring and set aside.

6-5.11.2 IPA Vacuum Tube 1V1 Installation. Refer to Figures 6-72 and 6-75 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	7m	Open End Wrench
1	7t	Open End Wrench
1	7zg	6 inch ruler
1	9c	Trouble Light
	(from Table 6-1)	
AR	1	Denatured Alcohol
AR	5	Cotton Wiping Rags
AR	7	Thermal Joint Compound

CAUTION
EQUIPMENT DAMAGE HAZARD

When installing IPA tube in socket assembly, be careful not to damage finger stock electrical contacts.

1. Thoroughly clean all ceramic areas of tube and electrical contact ring with rag and alcohol.

2. Apply thin coating of thermal compound to center of cathode.

CAUTION
EQUIPMENT DAMAGE HAZARD

Do not allow fittings to rotate when loosening colant line nuts.

3. If new tube is being installed, install quick disconnect fittings on tube. Install contact ring on tube. Verify orientation and dimensions of ring are in proper relation to tube cooling water input and output lines, as shown in Figure 6-75.

NOTE

Step 4 may have to be repeated several times to obtain contact ring strap alignment.

4. Visually align contact ring strap with insulators having knurled locking pins. Ensure water line connectors are aligned to proper water hoses. Carefully push tube base-first up into capacitor in direction of the socket. Make sure base is centered in socket and contact ring straps are aligned before pushing tube into socket. If alignments are correct, firmly seat tube in socket. While supporting tube, reinstall heat sink at back of socket assembly.

5. Support tube from bottom and install three knurled locking pins near top of tube assembly. Replace jumper from 1L2 on appropriate locking pin and secure with nut.

6. Connect two quick-disconnect water fittings to tube assembly. Replace heat sink water lines in connector and secure.

7. Follow procedure in paragraph 6-2.3.2 to turn on cooling water supply. After, verify rags are removed from cabinet.

CAUTION
EQUIPMENT DAMAGE HAZARDS

If new tube has been installed, it must be operated for 200 hours with filament voltage as specified by manufacturer. Refer to paragraph 6-6.3.10.3. Failure to follow approved exit procedure may result in equipment damage.

8. After installation of a new IPA tube, set static current according to paragraph 6-6.3.11.

9. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.11.3 IPA Vacuum Tube Socket 1XV1 Removal. Access is through left front door and lower left protective cover. Refer to Figures 6-76 and 6-77 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
	(from Table 1-4)	
1	7d	Phillips Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
1	7n	Open End Wrench
1	7o	Open End Wrench
1	7s	Open End Wrench
1	7t	Open End Wrench
1	9c	Trouble Light
	(from Table 6-1)	
AR	6	Masking Tape

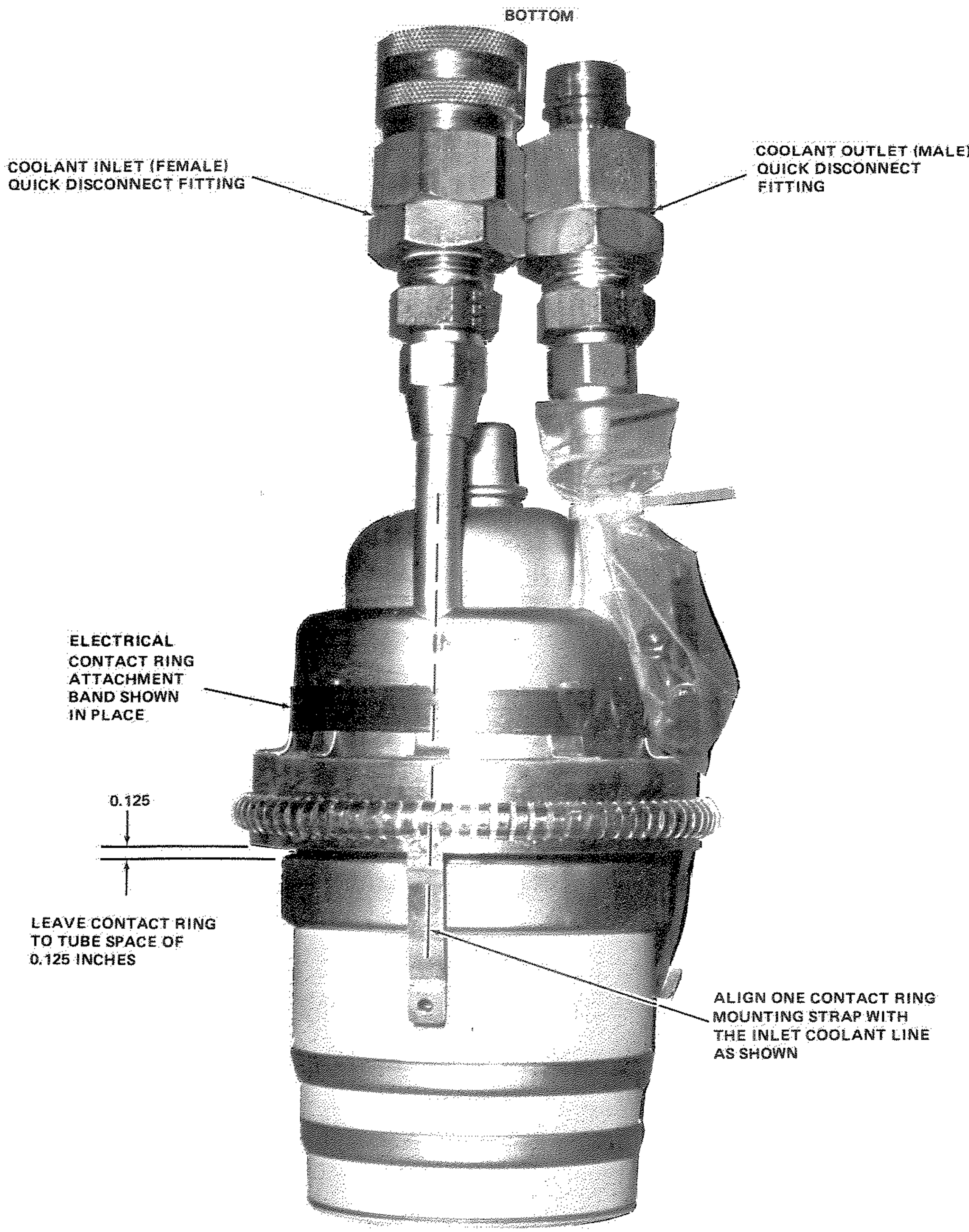


Figure 6-75. IPA Tube Configuration

1. Follow procedure in paragraph 6-5.11.1 to remove tube 1V1.

2. Above chassis, remove two nuts from metal posts and remove filament leads that connect inductors L4 and L5 to tube socket.

3. Remove capacitor C51/C52 bracket from tube socket and remove C51 and C52 from bracket on 1AT1.

4. At bottom of bar capacitor 1C1, remove two screws securing metal tongue to tube socket. Gently bend metal tongue away from socket.

5. Remove wires that connect resistor R1 and grid detector A2 to tube socket by removing screw.

6. Remove resistor R2 and capacitor C2 from mounting bracket clips.

7. Remove capacitor C14 attached with clips to blocking capacitor C13.

8. While supporting blocking capacitor, remove 5 nuts, washers and lockwashers, and 3 screws with washers, lockwashers and barrel nuts, from mounting posts.

CAUTION

EQUIPMENT DAMAGE HAZARD

The following step must be properly performed, or electrical finger stock could fall from tube socket.

9. Carefully tie three pieces of string (14 to 16 inches long) in a crossing pattern through tube socket to hold contact fingers in place during removal of C8.

10. Remove four screws, lockwashers, washers and spacers that secure capacitor C8 contact tabs to tube socket.

NOTE

Screws and retainers to be removed in following step are of varied sizes. Tag each item as it is removed to ensure proper replacement during installation task.

11. Beneath chassis, support capacitor C8. Remove screws securing C46 and small standoff; then hold each of 10 screws that secure C8 to chassis while removing 10 retainers above chassis. Cover of grid detector A2 must be removed to access one nut. Remove C8 from cabinet. Loosely replace 4 screw, lock-washers, washers, and spacers at tube side of socket.

12. Beneath chassis, hold each of eight flathead screws that secure socket to chassis while removing seven nuts and one metal post with clip above chassis.

CAUTION

EQUIPMENT DAMAGE HAZARD

Be extremely careful not to damage electrical finger stock while removing tube socket.

13. Grasp tube socket firmly by center shaft. Lift it up to where it can be hand-supported and remove it from cabinet.

6-5.11.4 <u>IPA Vacuum Tube Socket 1XV1 Installation</u>. Refer to Figures 6-76 and 6-77 and perform the following.

<u>Tools and Test Equipment Required:</u>

Qty	Item No.	Description
	(from Table 1-4)	
1	7d	Phillips Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
1	7n	Open End Wrench
1	7o	Open End Wrench
1	7s	Open End Wrench
1	7t	Open End Wrench
1	9c	Trouble Light
	(from Table 6-1)	
AR	6	Masking Tape

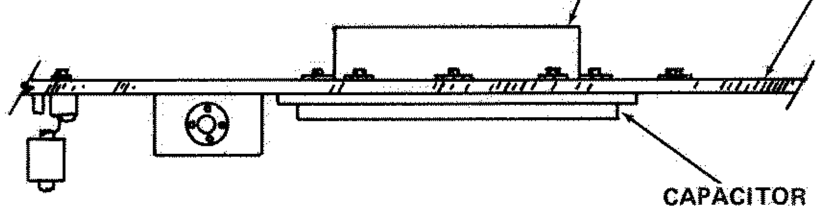


Figure 6-76. IPA Tube Socket 1XV1

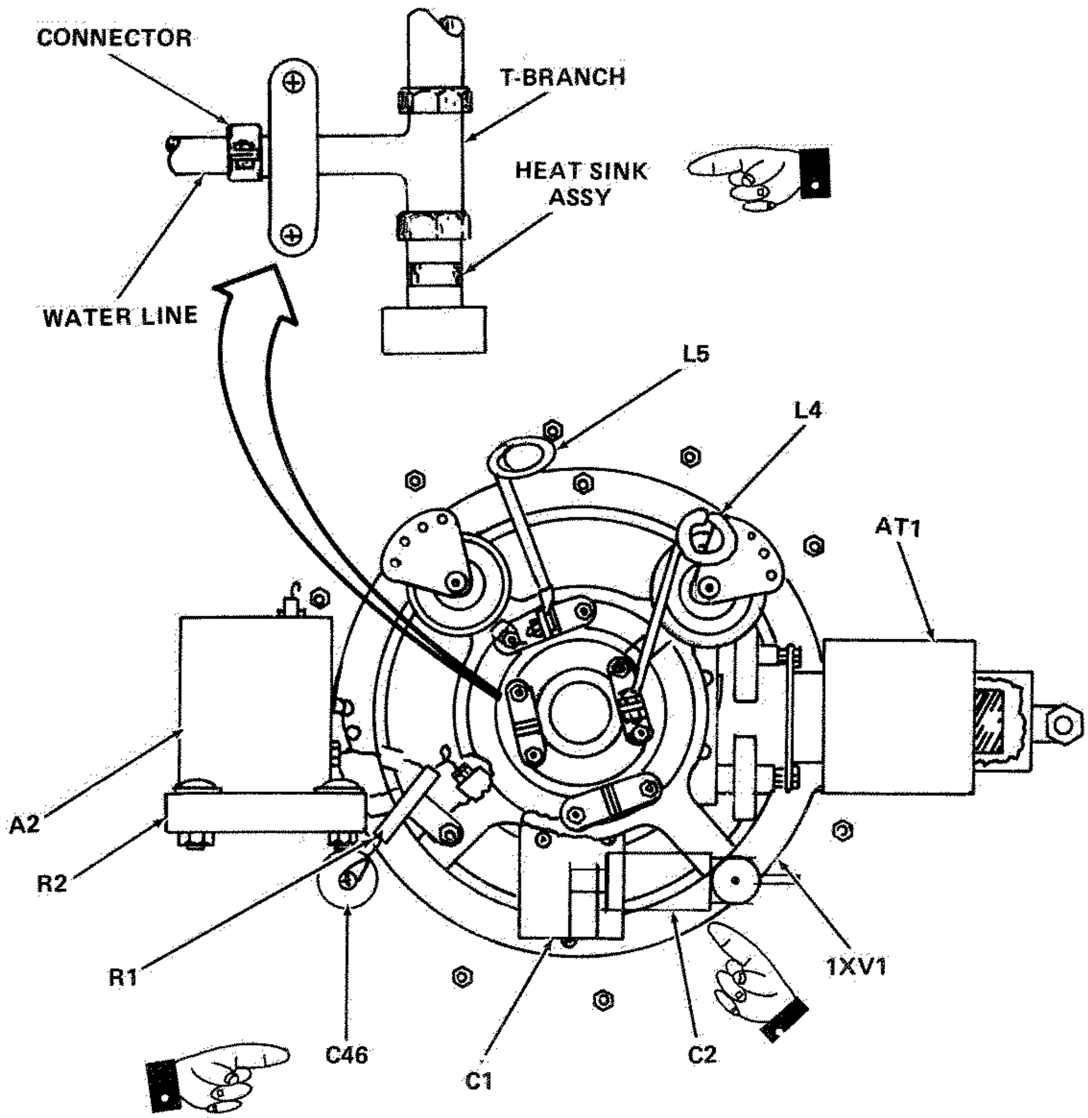


Figure 6-77. IPA Tube Socket 1XV1, Top View

1. If new socket is to be installed, lay old socket and new socket on bench, bottom side up, and orient both in same position. Transfer to new socket, bus bars, components and brackets one at a time. At top of socket, transfer to new socket, (but do not tighten) four screws, lockwashers, washers, and spacers for C8 tabs. At side of socket, if it exists, check that plastic insulator for strap from top finger contacts is fully inserted in frame. Check that screw and nut are tightened to compress plastic so that is firmly anchored and does not move. Make sure strap does not touch metal frame.

CAUTION
EQUIPMENT DAMAGE HAZARD

If the following step is not properly performed, electrical finger stock could fall from tube socket during installation of C8.

2. Carefully tie 3 pieces of string (14 to 16 inches each) in a crossing pattern through socket to hold finger contacts in place during installation of tube socket.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be extremely careful not to damage electrical finger stock while cleaning or installing socket.

3. Carefully clean electrical finger stock with rag and denatured alcohol and position tube socket in cabinet. Orient socket so dummy load 1AT1 connection will be on the righthand side.

4. Install and hold eight flathead screws from beneath chassis and seven nuts, washers, and lockwashers from above to secure tube socket to chassis. Install metal post clip on eighth screw.

5. Remove 4 screws, lockwashers, washers, and spacers on tube side of socket. Position circular capacitor C8 for installation and support in place. Install 10 screws from beneath chassis and 10 retainers from above to secure C8 to chassis. Remove tags. Secure C46 and small standoff with remaining screws.

6. Loosely install four spacers, screws, washers and lockwashers that secure capacitor C8 contact tabs to tube socket.

CAUTION
EQUIPMENT DAMAGE HAZARD

Do not overtighten screws in following step or ceramic standoffs in socket will break.

7. Gently tighten 4 screws for C8 tabs until compression starts to occur; then tighten 1/4 turn more. Remove strings from socket.

8. Above chassis, install C2 and R2 in mounting bracket.

9. Install wires that connect resistor R1 and grid detector A2 to tube socket by installing screw.

10. At bottom of bar capacitor C1, gently bend metal tongue toward socket. Install two screws to secure metal tongue to tube socket.

11. Install filament leads that connect inductors L4 and L5 to tube socket by installing two nuts on metal posts.

12. Reinstall capacitor C51/C52 bracket to tube socket and C51/C52 to bracket on end of 1AT1.

13. While supporting blocking capacitor, secure with 5 nuts, washers, and lockwashers and with 3 screws washers, lockwashers and barrel nuts.

14. Reinstall capacitor C14 in clips attached to blocking capacitor and ground post clip.

15. Follow procedure in paragraph 6-5.11.2 to install vacuum tube 1V1.

6-5.12 <u>Driver Grid Bandpass Filters</u>. Filters 1FL4 (Figure 6-4, sheet 2) and 1FL5 (Figure 6-4, sheet 1) are located in cabinet 1. Filter 1FL4 is accessed through right rear doors and lower right protective panel. Filter 1FL5 is accessed through left front doors and lower left protective panel.

6-5.12.1 <u>Driver Grid Bandpass Filter 1FL4 Removal</u>. Refer to Figure 6-78 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7d	Phillips Screwdriver
1	7o	Open End Wrench

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet. Turn off transmitter RPIE compressed air supply.

2. Disconnect ferrule nut fittings and remove air supply lines from filter.

3. Disconnect Bands A, B, and C CONTROL lines by removing D-type connector.

4. Support filter from beneath and remove four mounting screws from mounting panel. Lower filter from electrical connections and remove from cabinet.

6-5.12.2 Driver Grid Bandpass Filter 1FL4 Installation. Refer to Figure 6-78 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7d	Phillips Screwdriver
1	7o	Open end wrench

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful not to damage electrical contacts when mating filter with tube assembly.

1. Raise filter into position beneath mounting deck. Align mounting holes and install four screws.

2. Connect CONTROL lines by installing D-type connector. Close slide fasteners that hold connector in place.

3. Connect ferrule nut fittings of air supply lines to filter and turn on transmitter pneumatic air supply.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

4. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.12.3 Driver Grid Bandpass Filter 1FL5 Removal. Refer to Figure 6-78 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1m	Filter Removal/ Installation Tool
1	7b	Flat Blade Screwdriver, small
1	7d	Phillips Screwdriver
1	7g	Phillips Offset Screwdriver
1	7o	Open End Wrench
1	9c	Trouble Light

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet. Turn off transmitter RPIE compressed air supply.

2. Tag and disconnect ferrule nut fittings and remove air supply lines from filters 1FL5 and 1FL4. Tie lines up out of way (above bottom of filters).

3. Disconnect Bands D, E, and F CONTROL lines by removing D-type connector on 1FL5, J1 and J2.

4. Remove 2 bolts, lockwashers, and washers from floor plates at rear of cabinet under 1FL4.

5. Remove wing screws, lockwashers, washers and both clamp brackets from filter removal/installation tool (Figure 6-77.1).

6. With ramp leg folded, install filter tool from front of cabinet with support structure oriented toward rear of cabinet.

7. Carefully slide support structure to rear of cabinet avoiding floor bolts and screws or air switches protruding from filters.

8. Center support structure of filter tool under 1FL4 at very rear of floor pan.

9. Install clamp brackets beneath and behind 1FL4 and secure to outside of support structure with wing screws, lockwashers and washers.

10. Raise ramp to horizontal position and secure with ramp leg. Make sure filter locator cutouts on ramp are centered under ramp guides of filter 1FL5.

11. Remove four Phillips-head screws, lockwashers, and washers from deck above filter. Pull filter down to disengage electrical contacts. Make sure filter ramp guides engage ramp.

12. Fold ramp leg and slowly lower ramp while pulling down on filter, if necessary, to continue disengaging electrical contacts at both ends of filter.

13. With ramp completely lowered, slide filter down ramp, lifting as required, so that ramp guides on filter clear filter locator cutout on ramp as filter is removed.

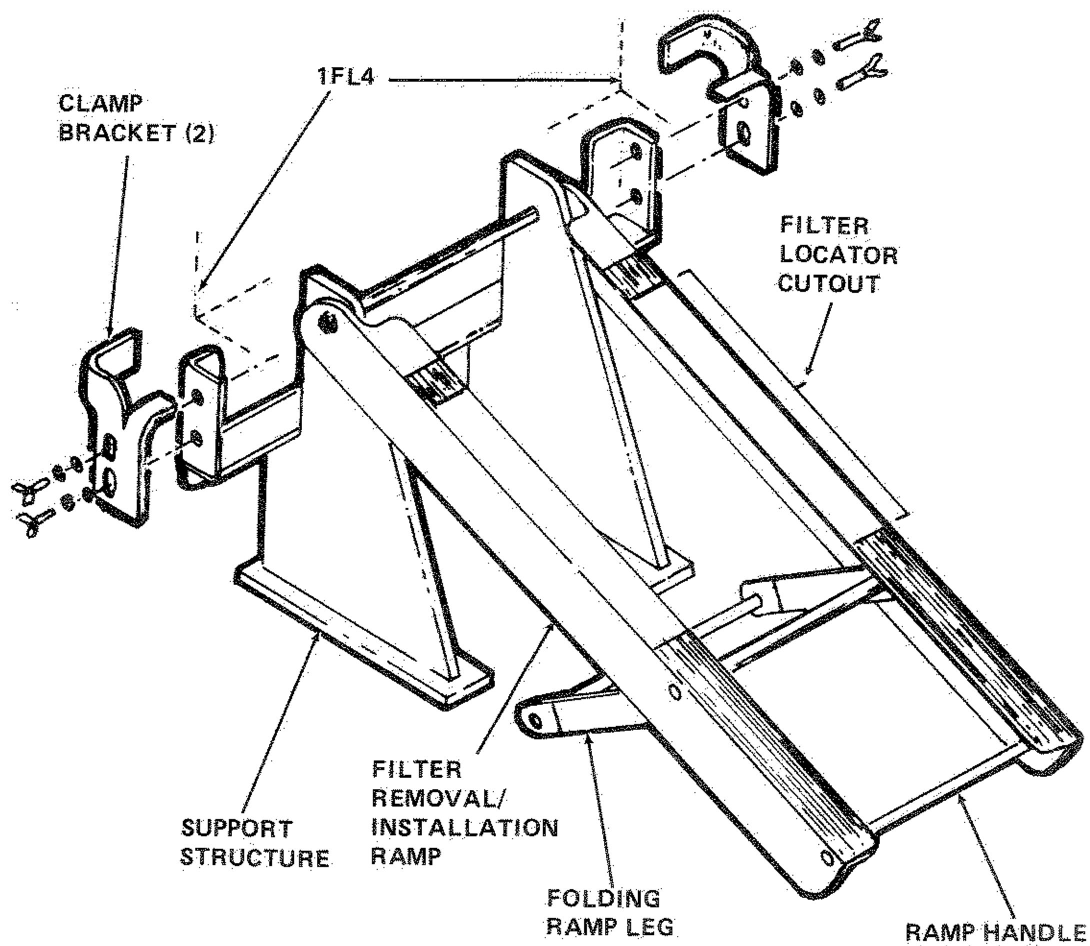


Figure 6-77.1 Filter Removal/installation Tool

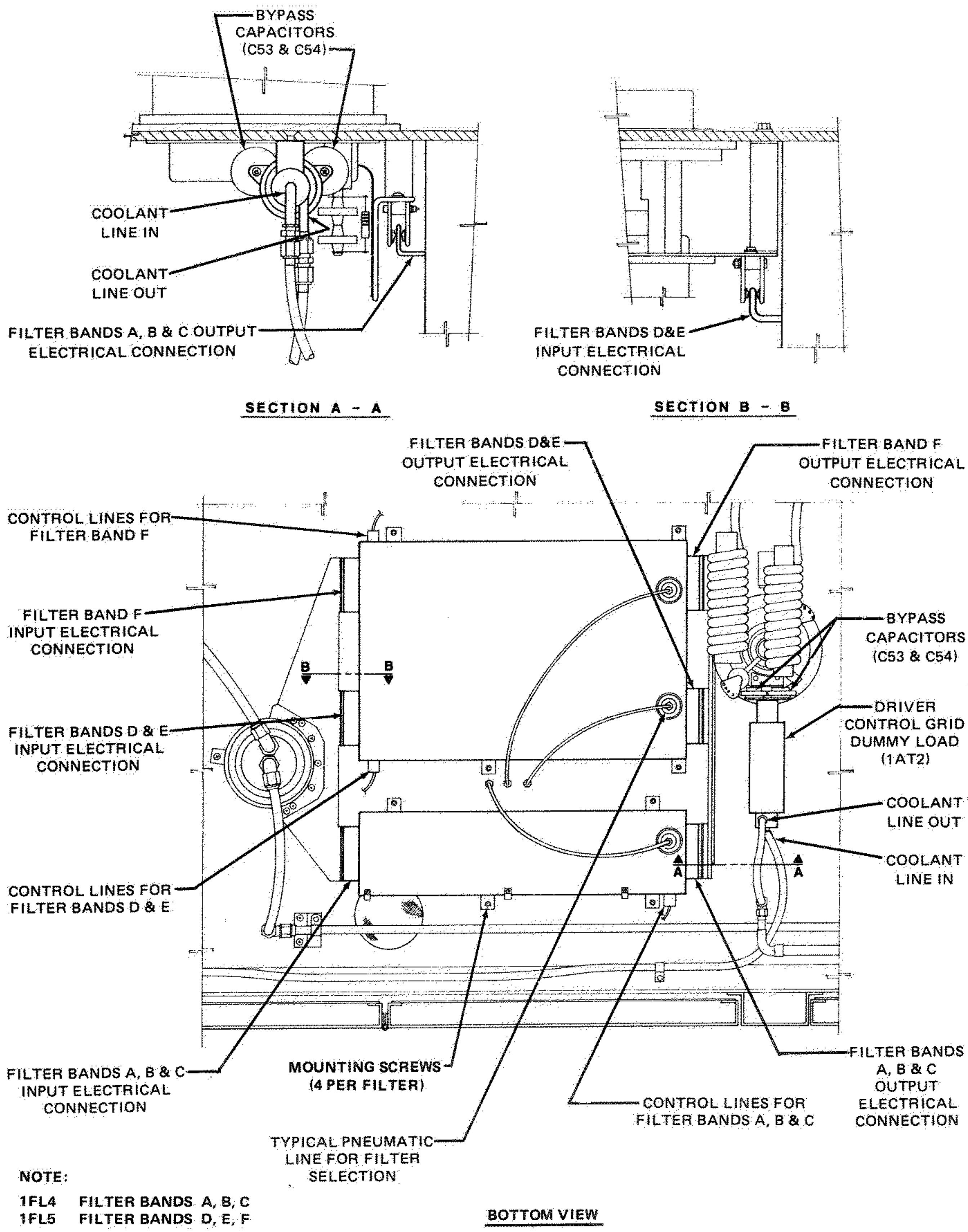


Figure 6-78. Driver Grid Components

6-5.12.4 Driver Grid Bandpass Filter 1FL5 Installation. Refer to Figure 6-78 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1m	Filter Removal/ Installation Tool
1	7d	Phillips Screwdriver
1	7g	Phillips Offset Screwdriver
1	7o	Open End Wrench
1	9c	Trouble Light

1. Place filter on ramp with J1 at the front and to the left.

2. Slide filter up ramp and center in filter locator cutout of ramp.

CAUTION
EQUIPMENT DAMAGE HAZARD

Take care not to damage electrical contacts when installing filter.

3. Slowly raise ramp and observe electrical contacts mate correctly at both ends of filter. Continue raising ramp until ramp is horizontal and filter is seated against deck. Secure ramp with ramp leg.

4. Move filter front or rear slightly if necessary, to align mounting screw holes and secure with four Phillips head screws, lockwashers and washers.

5. Lower ramp, remove brackets and carefully remove filter tool from cabinet.

6. Reinstall floor plate bolts, lockwashers, and washers at rear of cabinet.

7. Connect CONTROL lines by installing D-type connector on 1FL5J1 and J2. Close lock-slide fasteners that secure connector.

8. Connect ferrule nut fittings of air supply lines to filters 1FL4 and 1FL5 and turn on transmitter pneumatic air supply.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

9. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.13 Driver Control Grid Dummy Load. See Figure 6-4, sheet 1, for location of dummy load 1AT2. Access through left rear doors and lower protective cover plate.

6-5.13.1 Driver Control Grid Dummy Load 1AT2 Removal. Refer to Figure 6-78 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	7e	Phillips Screwdriver
1	7g	Phillips-Tip Offset Screwdriver
2	7o	Open End Wrench
1	9f	6-ft. Water Hose
1	9h	Drain Pan
		(from Table 6-1)
AR	5	Cotton Wiping Rags

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Follow procedure in paragraph 6-2.3.1 to turn off cooling water supply and drain cabinet.

CAUTION
EQUIPMENT DAMAGE HAZARD

When removing cooling water lines, be careful not to splash water into compartment.

3. Position rags beneath water lines to be disconnected. Loosen ferrule hex nuts from inlet and outlet connections and remove water lines from dummy load.

4. Drain water from lines into pan.

5. At vacuum tube end of dummy load, loosen two screws that attach dummy load to tube socket 1XV2.

6. Refer to Figure 6-4, sheet 2, for location of filter 1FL7. One person shall support filter 1FL7 for the remainder of this procedure.

7. Loosen four screws in slots at sides of mounting bracket at bottom of filter.

8. Remove four hex nuts from base of bracket. Slide bracket up and tighten four screws in slots at sides to hold in place.

9. Support dummy load from beneath with one hand and use Phillips-tip offset screwdriver to remove flathead mounting screw. Screw head is above deck, made accessible by removal of filter bracket.

10. Lower dummy load and remove from cabinet.

11. If replacement dummy load is to be installed immediately, do not perform remainder of this procedure. Instead, proceed directly to step 4 of paragraph 6-5.13.2.

12. Loosen four screws in slots at side of filter mounting bracket and slide bracket down into position. Align mounting holes and install four hex nuts in base of bracket. Tighten four screws in slots at sides of bracket.

6-5.13.2 Driver Control Grid Dummy Load 1AT2 Installation. Refer to Figure 6-78 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
1	7g	Phillips-Tip Offset Screwdriver
2	7o	Open End Wrench

1. Refer to Figure 6-4, sheet 2, for location of filter 1FL7. One person shall support filter 1FL7 until step 5 has been completed.

2. Loosen four screws in slots at sides of mounting bracket at bottom of filter.

3. Remove four hex nuts from base of bracket. Slide bracket up and tighten four screws in slots at sides to hold in place.

4. Raise dummy load into position beneath mounting deck and hold in place with one hand. Align mounting holes and use Phillips-tip offset screwdriver to install flathead mounting screw from above mounting deck.

5. Loosen four screws in slots at sides of filter bracket and position bracket to support filter. Align mounting holes and install four hex nuts in base of bracket. Tighten four screws in slots at sides of bracket to hold in place.

6. Tighten two screws that secure dummy load to tube socket 1XV2.

CAUTION

EQUIPMENT DAMAGE HAZARD

When connecting cooling water lines, be careful not to break tubing from dummy load.

7. Connect inlet and outlet cooling water supply lines to dummy load and tighten ferrule hex nuts.

8. Follow procedure in paragraph 6-2.3.2 to turn on cooling water supply. After, verify rags have been picked up and removed from cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

9. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.14 Driver Bias Power Supply. Refer to Figure 6-71 for location of power supply 1PS4 in cabinet 1 controls compartment.

6-5.14.1 Driver Bias Power Supply 1PS4 Removal. Refer to Figures 6-71 and 6-79 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
2	7o	Open End Wrench
1	7t	Open End Wrench

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and disconnect external wiring from TB1.

3. Tag and remove external wiring from E1 through E5 by removing five hex nuts.

4. Remove wire duct cover and lift wiring from duct. Fold wiring harness away from power supply and secure it to avoid damaging insulation during LRU removal.

5. One person support power supply while second person removes six hex nuts that attach power supply to mounting rails. Note that removing hex nut at lower left corner releases ground strap.

6-5.14.2 Driver Bias Power Supply 1PS4 Installation. Refer to Figures 6-71 and 6-79 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
2	7o	Open End Wrench
1	7t	Open End Wrench

1. One person position power supply for installation and hold in place. Second person position ground strap at lower left corner and install hex nut. Install remaining five hex nuts to secure power supply to mounting rails.

2. Place wiring into duct and replace duct cover. Connect wiring to TB1 and remove tags.

3. Connect external wiring to E1 through E5 by installing five hex nuts. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

4. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.15 Driver Filament Power Supply. The driver filament power supply is located at the front of cabinet 1. Access is through right front doors and lower right protective cover plate. The driver power supply is an assembly that requires removal of discrete components for repair.

6-5.15.1 Transformer 1T1 Removal. Refer to Figure 6-4, sheet 1, Figure 6-80, and Figure 6-81 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Heavy Component Lift (Short Reach)
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
2	7o	Open End Wrench
1	9k	Nylon Sling

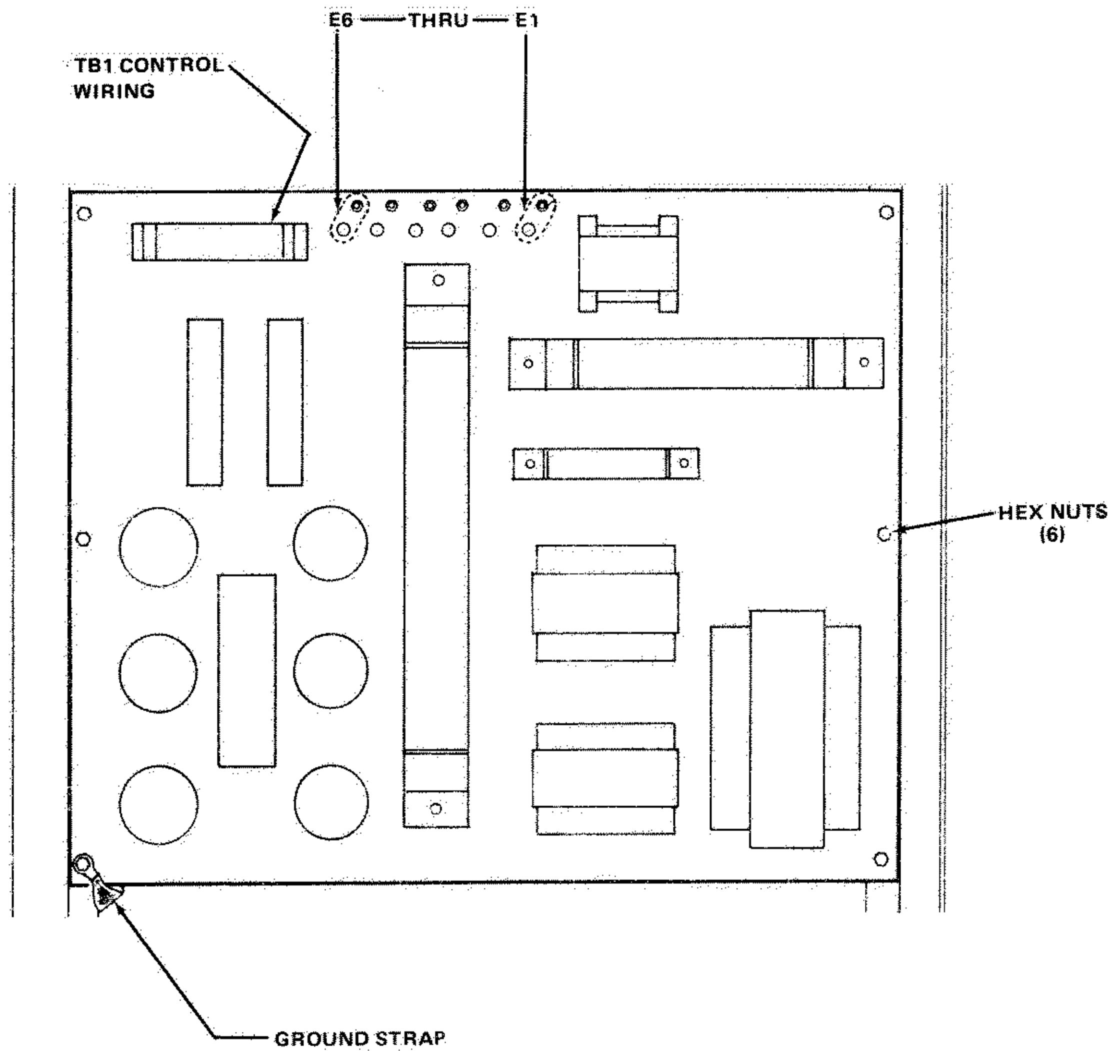


Figure 6-79. Driver Bias Power Supply

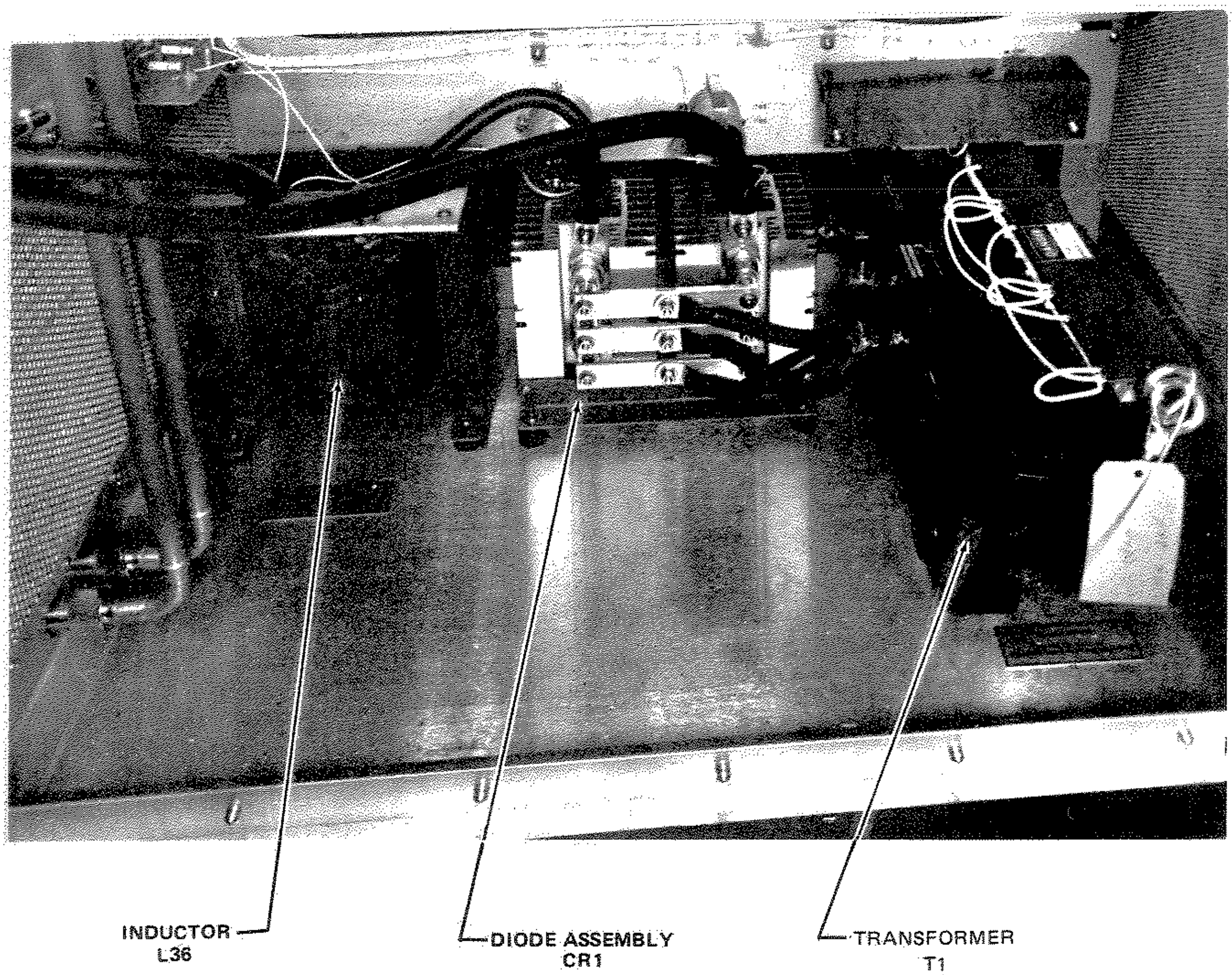


Figure 6-80. Driver Filament Power Supply

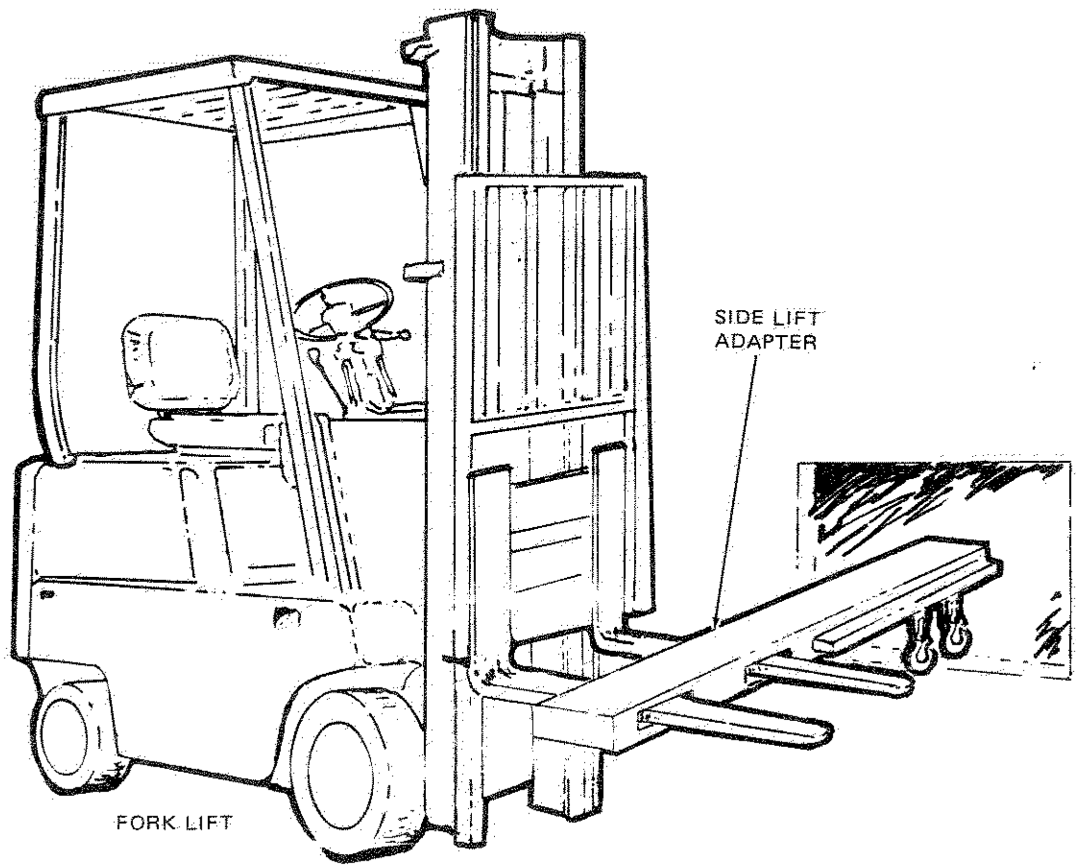


Figure 6-81. Side Lift Adapter

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Remove 2 screws securing shield over R8 and K7 and remove shield. Remove screws, washers, and/or nuts securing R8 and K7. Position R8 and K7 out of way.

3. Tag and remove three cables from three transformer terminals.

4. Remove protective cover strip from top of transformer by moving cover to the right and sliding it from spring clips.

5. Tag and remove wires from TB1 at top of transformer.

6. Remove four hex nuts that secure transformer to chassis.

7. Position forklift truck and install side lift adapter fully on forks to extend into cabinet and over top of transformer.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care when raising equipment to avoid damage to electrical wires in cabinet.

8. One person signal forklift operator to carefully adjust height of side lift adapter for removal of transformer. Stretch nylon sling across both transformer lifting eyes. Couple hooks of side lift adapter to center of sling.

9. Carefully lift transformer free of mounting bolts. Carefully slide transformer out of cabinet. Move forks away from cabinet.

10. Carefully lower transformer onto short reach component lift. Remove nylon sling and transformer.

6-5.15.2 Transformer 1T1 Installation. Refer to Figures 6-80 and 6-81 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Lift (Short Reach)
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
2	7o	Open End Wrench
1	9k	Nylon Sling

1. Position transformer under side lift adapter. Stretch sling across transformer lifting eyes and attach side lift adapter hooks to center of sling.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care when raising equipment to avoid damage to electrical wires in cabinet.

2. One person signal fork lift operator to carefully adjust height of side lift adapter so transformer can be slid into cabinet over mounting bolts. Carefully lower transformer onto mounting bolts and shock mounts. Remove sling and side lift adapter.

3. Reinstall R8 and K7 using screws washers, lockwashers, and/or nuts. Replace shield and secure with 2 screws.

4. Install four hex nuts to secure transformer to chassis. Tighten nuts finger tight.

5. Connect wires to TB1 at top of transformer. Remove tags.

6. Install protective cover strip on TB1. Slide cover to left to engage spring clips over wiring harness.

7. Install three cables on terminals and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

8. Remove forklift and component lift. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.15.3 Inductor 1L36 Removal. Refer to Figures 6-80 and 6-81 and perform the following.

Tools and Test Equipment Required:

(Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Lift (Short Reach)
1	1g	Lift Plate
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
2	7q	Open End Wrench
1	7w	Ratchet wrench
2	7x	Ratchet Extension
1	7zc	7\16 Socket
1	9k	Nylon Sling

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove two cables from terminals 1 and 2.

3. Tag and remove wire from terminal 1.

4. Tag and remove two wires from terminal 2.

5. Remove 2 screws, lockwashers, washers, and nuts securing component assembly above and left of the inductor and move out of way.

6. Remove four hex nuts that secure inductor to shock mounts.

7. Position forklift truck and install side lift adapter fully on forks to extend into cabinet and over top of inductor.

8. Remove hooks and shackles from side-lift adapter.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care when raising equipment to avoid damage to electrical equipment in cabinet.

9. One person signal forklift operator to carefully adjust height of side lift adapter for removal of inductor. Couple inductor to side lift adapter using nylon sling with both ends connected to one trolley. Tighten sling snugly around inductor.

10. Carefully lift inductor free of mounting bolts and high enough to clear cables in front of inductor. Carefully slide inductor out of cabinet.

11. Carefully lower inductor onto short reach component lift and lift plate. Remove nylon sling and inductor.

6-5.15.4 Inductor 1L36 Installation. Refer to Figures 6-80 and 6-81 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Lift (Short Reach)
1	1g	Lift Plate
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
2	7q	Open End Wrench
1	7w	Ratchet Wrench
2	7x	Ratchet Extension
1	7zc	7\16 Socket
1	9k	Nylon Sling

1. Position transformer under side lift adapter. Couple to single trolly using nylon sling. Tighten sling snugly.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care when raising equipment to avoid damage to electrical components in cabinet.

2. One person signal fork lift operator to carefully adjust height of side lift adapter so inductor can be slid into cabinet over mounting bolts. Carefully lower inductor onto mounting bolts and shock mounts. Remove sling and side lift adapter.

3. Reinstall component assembly above inductor at the left side with 2 screws, washers, lockwashers and nuts.

4. Install four hex nuts to secure inductor to chassis. Tighten nuts finger tight.

5. Connect two wires and cable to terminal 2. Remove tags.

6. Connect wire and cable to terminal 1. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Remove forklift and component lift and follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.15.5 Diode Assembly 1CR1 Removal. Refer to Figure 6-80 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
2	7o	Open End Wrench

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove three cables from terminals A,B, and C.

3. Tag and remove cable from left-hand terminal (D).

4. Tag and remove cable and wire from right-hand terminal (E). Tag and remove C92/C93.

5. Remove four hex nuts that secure diode assembly to shock mounts. Lift diode assembly and remove from cabinet.

6-5.15.6 Diode Assembly 1CR1 Installation. Refer to Figure 6-80 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
2	7o	Open End Wrench

1. Position diode assembly and install four hex nuts to secure to shock mounts. Tighten nuts finger tight.

2. Install C92/C93. Connect wire and cable to right-hand terminal (E). Remove tags.

3. Connect cable to left-hand terminal (D) and remove tag.

4. Connect three cables to terminals A, B, and C. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.16 Driver Vacuum Tube and Socket. Refer to Figure 6-4, sheet 1, for location of tube 1V2. Access is through the right front doors and lower right protective cover.

6-5.16.1 Driver Vacuum Tube 1V2 Removal. Refer to Figure 6-4, sheet 1, and Figure 6-82. Perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	7b	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
2	7ua	Open End Wrench
1	9f	6-foot Water Hose
1	9h	Drain Pan
		(from Table 6-1)
AR	5	Cotton Wiping Rags

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Follow procedure in 6-2.3.1 to turn off cooling water supply and drain cabinet.

3. Loosen clamp and remove plastic cover from around top of vacuum tube.

CAUTION
EQUIPMENT DAMAGE HAZARD

When disconnecting cooling water lines, be careful not to splash water in driver tube compartment. Failure to comply may result in extensive transmitter down-time.

4. At top of vacuum tube, place rags beneath both cooling water lines. Disconnect lines.

5. Disconnect anode electrical connection bus strap from L9.

6. Remove C28 from clips.

7. Beneath tube socket, remove screw and nut securing water line clamp to support bracket. Pull down on heat sink assembly to remove from tube. Move out of way. (See similar connection on figure 6-77).

8. Remove 3 screws, lockwashers and wahers securing capacitor, C27.

9. Pull straight up on contact ring handle and blocking capacitor to disengage tube from socket and capacitor electrical contact fingers; then remove tube and capacitor from cabinet.

10. Pull tube and contact ring out of capacitor.

CAUTION
EQUIPMENT DAMAGE HAZARD

Do not allow elbows to turn when loosening nuts on tube coolant lines.

11. If new tube is to be installed, note orientation of elbows and remove elbow assemblies by loosening nut at base of each elbow. Remove elbows and then push tube out of contact ring. Retain contact ring and elbow assemblies.

6-5.16.2 Driver Vacuum Tube 1V2 Installation. Refer to Figure 6-82 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	7b	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
2	7ua	Open End Wrench
		(from Table 6-1)
AR	1	Denatured Alcohol
AR	5	Cotton Wiping Rags
AR	7	Thermal Joint Compound

1. Use rag and denatured alcohol to clean all areas of electrical contact ring and Ceramic area of replacement vacuum tube. Apply thin coating of thermal joint compound to cathode center pin at center of tube base.

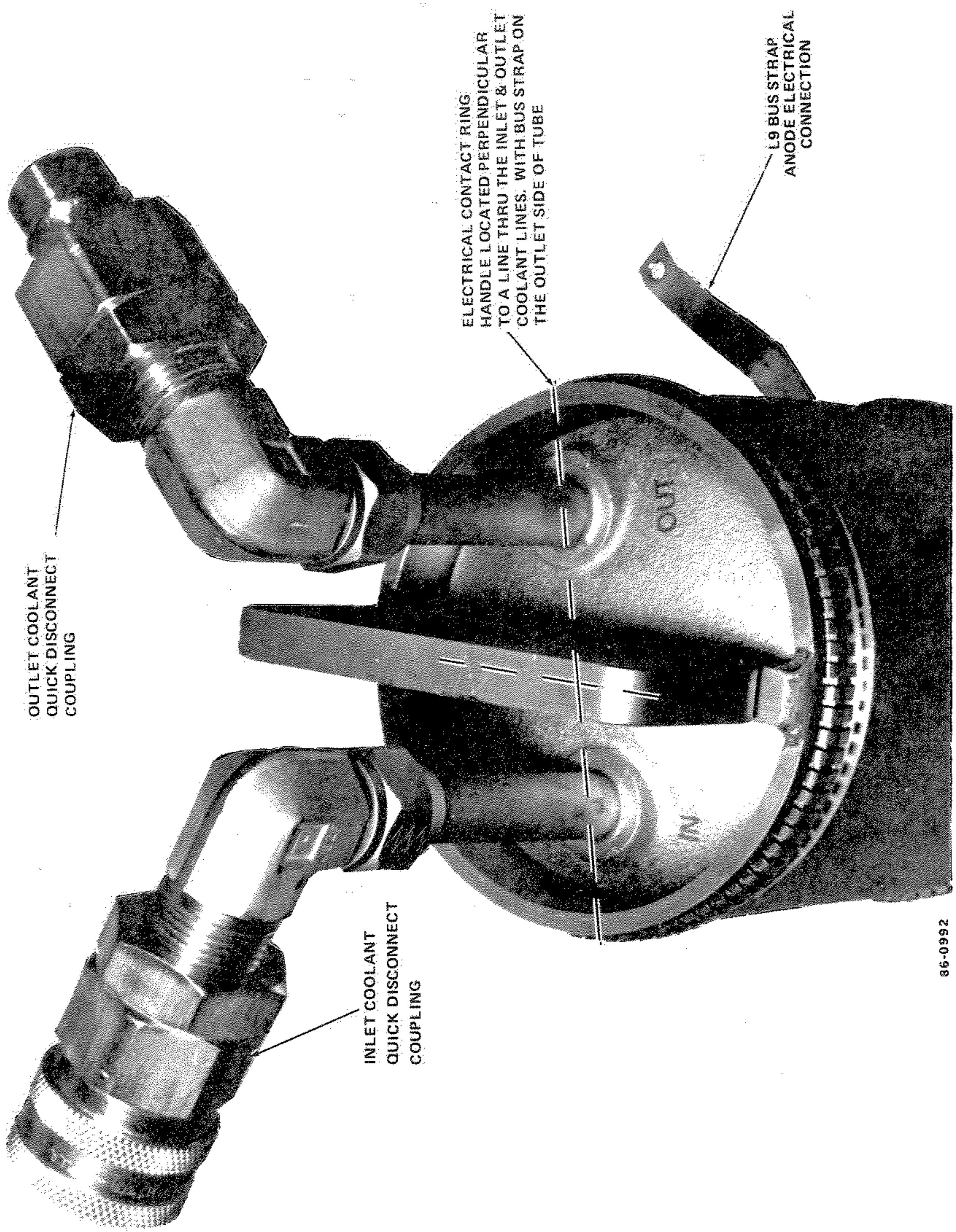


Figure 6-82. Driver Vacuum Tube 1V2

CAUTION
EQUIPMENT DAMAGE HAZARD

Do not allow elbows to turn when tightening tube coolant line nuts.

2. If new tube is being installed, place contact ring on tube oriented as shown in Figure 6-82, Reinstall elbow assemblies oriented as noted or as shown in Figure 6-82, and tighten.

3. Push tube and contact ring into top of blocking capacitor until water lines contact capacitor.

CAUTION
EQUIPMENT DAMAGE HAZARD

When inserting tube into socket, be careful not to damage socket contact fingers.

4. Place capacitor and tube assembley into cabinet. In a vertical position, guide tube base into socket and set in socket. Make sure contact ring strap does not enter socket hole.

5. Slide capacitor down to engage electrical contacts. Seat capacitor on standoffs and electrical contacts. Secure with three screws, lockwashers, washers, and barrel nuts.

6. Rotate contact ring to line up strap with inductor L9 connection.

7. Carefully rotate tube to orient cooling line connections.

8. Push tube and contact ring down until tube is firmly seated in socket. Observe that contact ring strap does not enter socket.

9. Connect contact ring strap to inductor L9. Reinstall capacitor C28 in clips.

10. Reconnect water lines to coupler on tube.

11. Reinstall cathode heat sink assembly on tube and firmly seat; then secure water line connector to bracket. Push down on tube to recheck that it is firmly seated in socket.

12. Place rags under water lines on top of tube. Follow procedure in paragraph 6-2.3.2 to turn on cooling water supply. After, verify rags have been removed from cabinet.

13. Install plastic cover around top of tube and tighten clamp to secure it.

CAUTION
EQUIPMENT DAMAGE HAZARDS

If new tube has been installed, it must be operated for 200 hours with filament voltage as specified by manufacturer. Refer to paragraph 6-6.3.10.3.

Failure to follow approved exit procedure may result in equipment damage.

14. After installation of a new driver tube, set static current according to paragraph 6-6.3.11.

15. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.16.3 <u>Driver Vacuum Tube Socket 1XV2 Removal</u>. Tube socket 1XV2 is accessed from right and left front doors and right and left lower protective covers. Refer to Figures 6-83 and 6-84 and perform the following.

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	7d	Phillips Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
1	7i	Open End Wrench
1	7n	Open End Wrench
1	7s	Open End Wrench
1	7t	Open End Wrench
1	7ga	Screw Starter

1. Follow procedure in paragraph 6-5.16.1 to remove Driver Vacuum Tube 1V2.

2. At top of tube socket, remove four screws that secure circular capacitor C22 contact tabs to tube socket.

3. Underneath socket, remove R4 from clips and 16 from clips. Disconnect L7 from cable stantdoff terminal.

4. While holding bracket and clip assembly for R4 and L7, locate and note position of socket head screw in outer edge of C22 at top of tube socket. Remove socket head and R4/L7 bracket assembly.

5. Disconnect capacitor C53/C54 assembly from bracket at 1AT2 dummy load and at tube socket, then remove.

6. At top of tube assembly, remove remaining 11 screws, nuts, washers and lockwashers securing C22 to chassis and remove C22 from cabinet. Loosly install 4 screws, washers, lockwashers, and C22 spacers into socket.

7. At top of bar capacitor C15, remove two screws that secure metal tongue to tube socket. Gently bend tongue away from socket.

8. Note location and unscrew metal standoff with clip for C16 from socket screw.

9. Remove two nuts from metal mounting posts and remove two filament leads that connect inductors L10 and L11 to tube socket.

10. Remove screw from tube socket and remove bus wires that connect inductor L6 and grid detector A3 to socket.

NOTE

When removing tube socket, use extreme care not to damage electrical finger stock.

11. While supporting socket, hold each of seven remaining flathead screws while removing nuts from beneath chassis. Lower socket through hole in chassis and remove it from cabinet.

6-5.16.4 Driver Vacuum Tube Socket 1XV2 Installation. Refer to Figures 6-83 and 6-84 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7d	Phillips Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
1	7i	Open End Wrench
1	7n	Open End Wrench
1	7s	Open End Wrench
1	7t	Open End Wrench
1	7ga	Screw Starter

1. If new socket is to be installed, lay old socket and new socket on bench bottom side up and orient both in same position. Transfer bus bars, components, and brackets one at a time, to new socket. At top of socket, transfer, but do not tighten, four screws, washers lockwashers, and spacers for C22 tabs to new socket. At side of socket, check that plastic insulator for strap from top finger contacts is fully inserted in frame and that screw and nut are tightened to compress plastic so that it is firmly anchored and does not move. Make sure strap does not touch metal frame.

2. Position socket for installation so that it will mate with bar capacitor C15 tongue, and so that capacitor C53/C54 bracket mounting holes are adjacent to 1AT2 dummy load.

3. Support socket and install 8 flathead screws from top of chassis. While holding screws, install 7 washers, lockwashers, and nuts and secure. Install C16 metal standoff with clip on eighth screw and secure.

4. Remove 4 screws, lockwashers, and washers from top of socket. Leave spacers in place.

5. Carefully place C22 in place after orienting position of cap screw hole. Make sure spacers are in position under four tabs of C22 on top of socket. Install 11 screws only in outer edge of C22.

Loosly install 4 screws, lockwashers, and washers through tabs and spacers into socket. Shift C22 slightly to prevent any binding of the 4 screws. Install 11 nuts, lockwashers, and washers and secure. With R4/L7 bracket assembly held in place under socket, install cap screw and secure.

CAUTION

EQUIPMENT DAMAGE HAZARD

Do not overtighten screws securing C22 to socket or ceramic standoffs in socket will break.

6. Gently tighten 4 screws in top of socket until compression starts to occur, then tighten an additional 1/4 turn.

7. Reinstall C53/C54 assembly on tube socket and 1AT2 dummy load.

8. Install screw to connect bus wires from inductor L6 and grid detector A3 to tube socket.

9. Connect two filament leads from inductors L10 and L11 to tube socket by installing two nuts on metal mounting posts.

10. At top of bar capacitor C15, gently bend metal tongue toward tube socket. Install two screws to secure metal tongue to sockot.

11. Reinstall resistor R4 and capacitor C16 in clips and reconnect L7 to cable standoff terminal.

12. Follow procedure in paragraph 6-5.16.2 to install driver vacuum tube.

6-5.17 <u>PA Grid Bandpass Filters</u>. Figure 6-4, sheet 1, shows location of filter 1FL8 and sheet 2 shows location of 1FL7 and 1FL9. 1FL7 and 1FL9 are accessed through left rear doors and lower left protective panel. 1FL8 is accessed through right front doors and lower right protective panel.

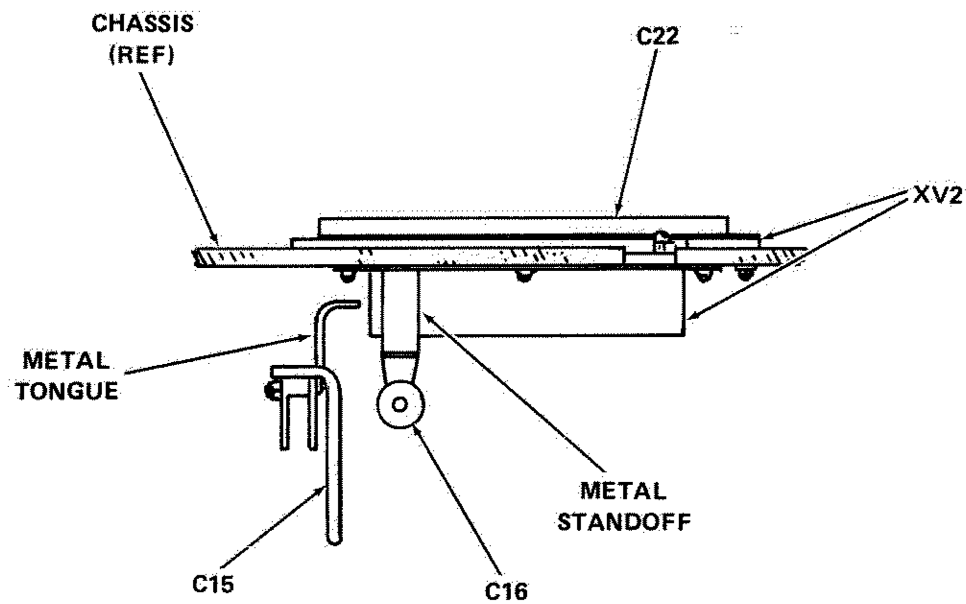


Figure 6-83. Driver Tube Socket 1XV2

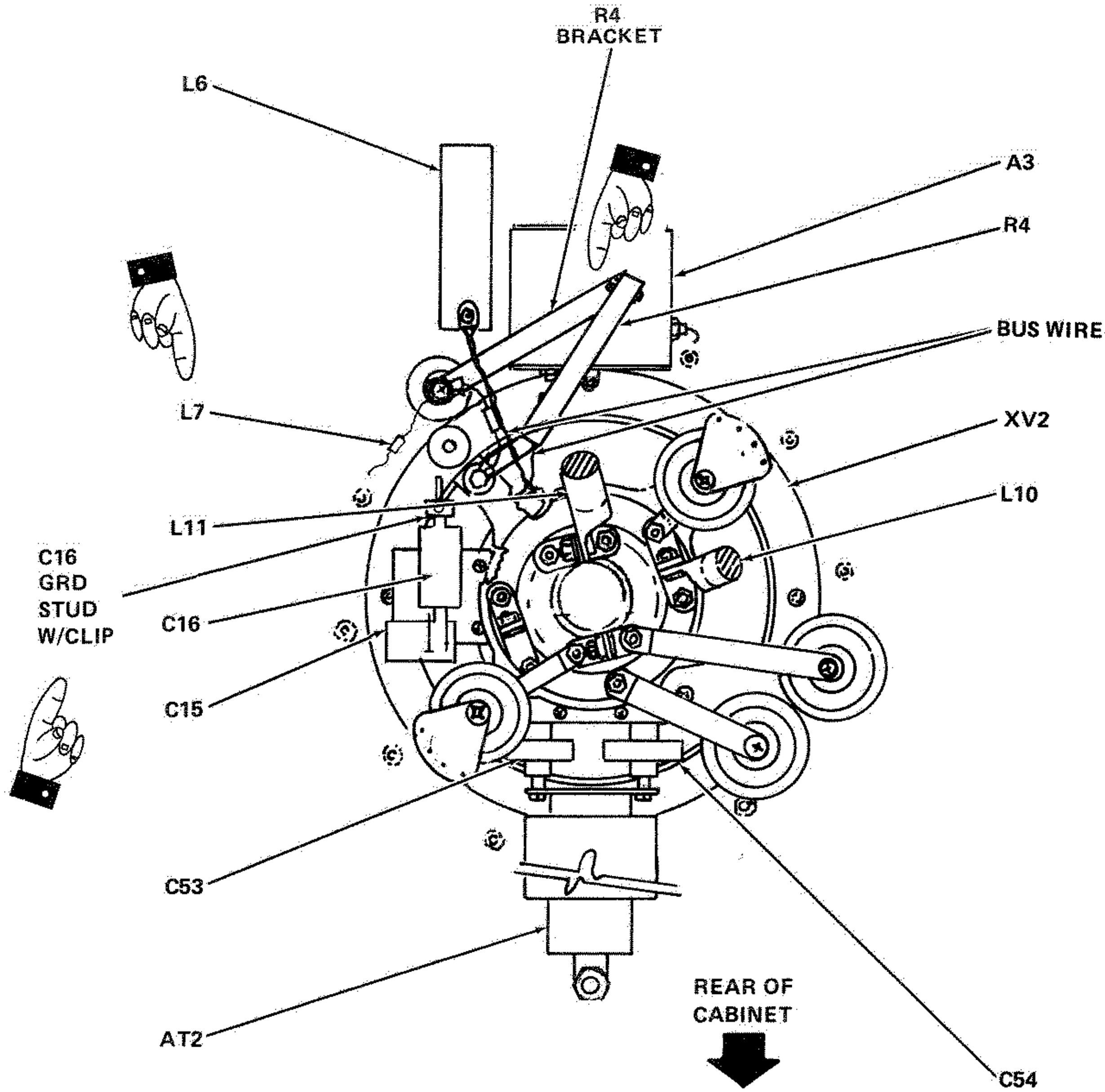


Figure 6-84. Driver Tube Socket 1XV2, Bottom View

6-5.17.1 PA Grid Bandpass Filter 1FL7, 1FL8, or 1FL9 Removal. Refer to Figures 6-4 and 6-85 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	7e	Phillips Screwdriver
1	7g	Offset Phillips Screwdriver
1	71	Open End Wrench
1	9f	6-foot Water Hose
1	9h	Drain Pan
		(from Table 6-1)
AR	5	Cotton Wiping Rags

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Follow procedure in paragraph 6-2.3.1 to turn off cooling water supply and drain cabinet.

3. Turn off transmitter RPIE compressed air supply.

4. Disconnect ferrule nut fittings and remove air supply lines from filter.

CAUTION

EQUIPMENT DAMAGE HAZARD

When removing cooling water fittings, be careful not to splash water into compartment. Failure to comply may result in extensive transmitter down-time.

5. Place rags beneath cooling water line connections. Disconnect cooling water inlet and outlet lines from filter. Drain water from lines into container.

6. Disconnect CONTROL Lines by removing D-type connector.

7. Support filter and remove screws from mounting brackets on each side of filter.

8. Continue supporting filter and remove two screws from top of filter. Lower filter from electrical connections and remove from cabinet.

6-5.17.2 PA Grid Bandpass Filter 1FL7, 1FL8, or 1FL9 Installation. Refer to Figure 6-85 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
1	71	Open End Wrench
1	7g	Offset Phillips Screwdriver

CAUTION

EQUIPMENT DAMAGE HAZARD

When positioning filter on deck plate, be careful not to damage electrical contacts.

1. Place filter in cabinet, align mounting holes, and install two flathead screws to secure filter to deck plate.

2. Install screws to secure mounting brackets to base of filter at each side.

3. Connect CONTROL lines by installing D-type connector. Latch slide-lock device that holds connector in place.

4. Connect cooling water input and output lines to filter.

5. Follow procedure in paragraph 6-2.3.2 to turn on cooling water supply. After, verify rags have been removed from cabinet.

6. Connect air supply lines to filter and tighten ferrule nuts. Turn on RPIE compressed air supply.

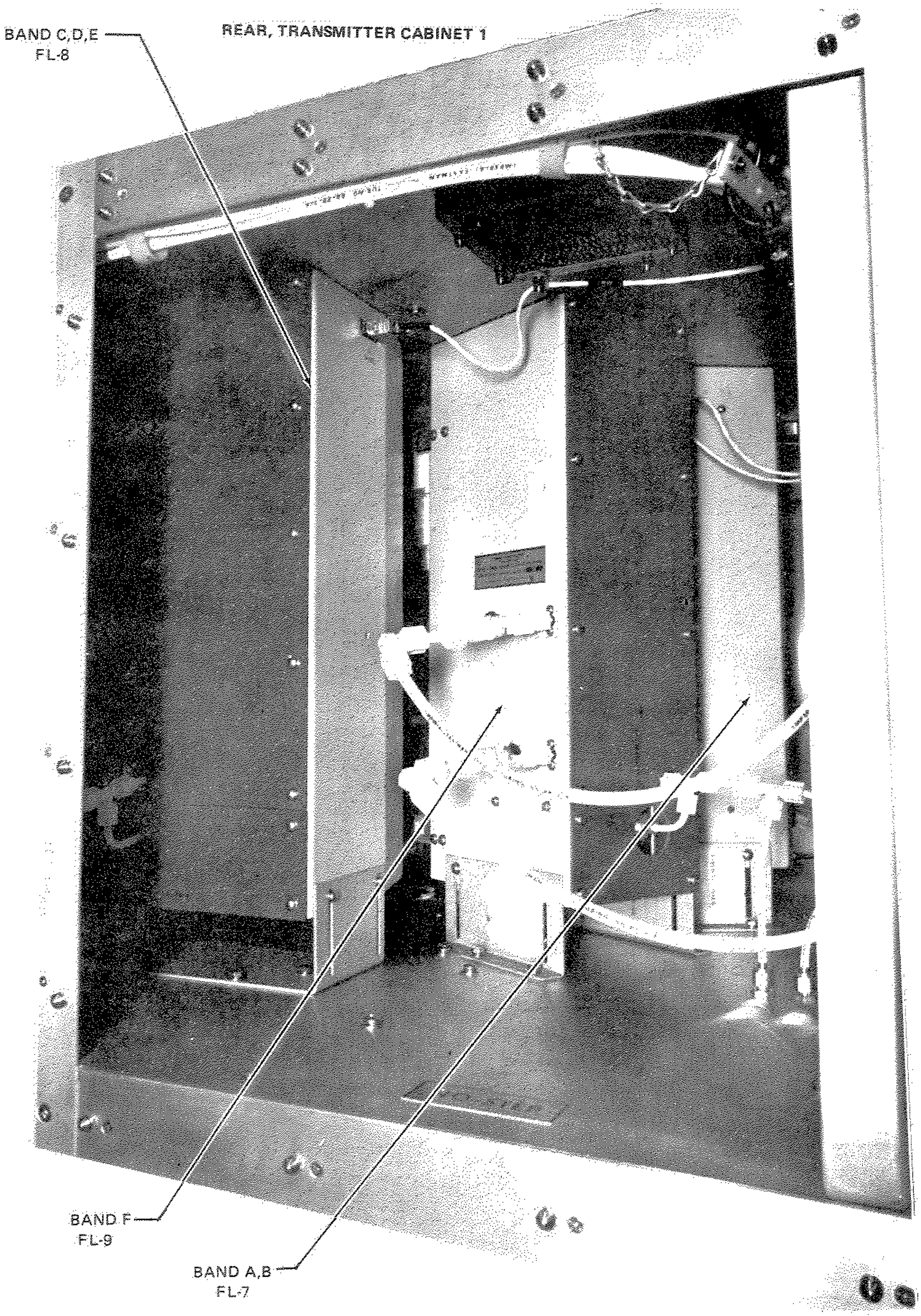


Figure 6-85. PA Grid Bandpass Filters

7. Check for air leaks at ferrule nut fittings and take corrective action as required.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

8. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.18 PA Control Grid Dummy Load. Figure 6-4, sheet 1, shows location of Dummy Load 1AT3. Access is through right rear doors and lower right protective cover plate.

6-5.18.1 PA Control Grid Dummy Load 1AT3 Removal. Refer to Figure 6-4, sheet 1, and Figure 6-86 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	7e	Phillips Screwdriver
1	7g	Phillips-Tip Offset Screwdriver
2	7m	Open End Wrench
1	9f	6-ft. Water Hose
1	9h	Drain Pan
		(from Table 6-1)
AR	5	Cotton Wiping Rags

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Follow procedure in paragraph 6-2.3.1 to turn off cooling water and drain cabinet.

CAUTION

EQUIPMENT DAMAGE HAZARD

When disconnecting cooling water lines, be careful not to splash water into compartment. Failure to comply may result in extensive transmitter down-time.

3. Place rags beneath dummy load cooling water line connections. Remove two ferrule hex nuts from dummy load cooling water input and output lines. Drain water from lines into container.

4. Remove three screws attaching dummy load at vacuum tube end.

5. Remove C30 from bracket.

6. Support dummy load from beneath. From above deck, remove three screws, one at right end of dummy load and two at left end.

6-5.18.2 PA Control Grid Dummy Load 1AT3 Installation. Refer to Figure 6-86 and perform the following.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	7e	Phillips Screwdriver
1	7g	Phillips-Tip Offset Screwdriver
2	7m	Open End Wrench

1. Position dummy load for installation and support from beneath. From above deck, install three screws, one at right end of dummy load and two at left end.

2. Install C30 in bracket.

3. Install three screws at vacuum tube end of dummy load.

CAUTION

EQUIPMENT DAMAGE HAZARD

When connecting cooling water lines, be careful not to damage lines or break off tubing.

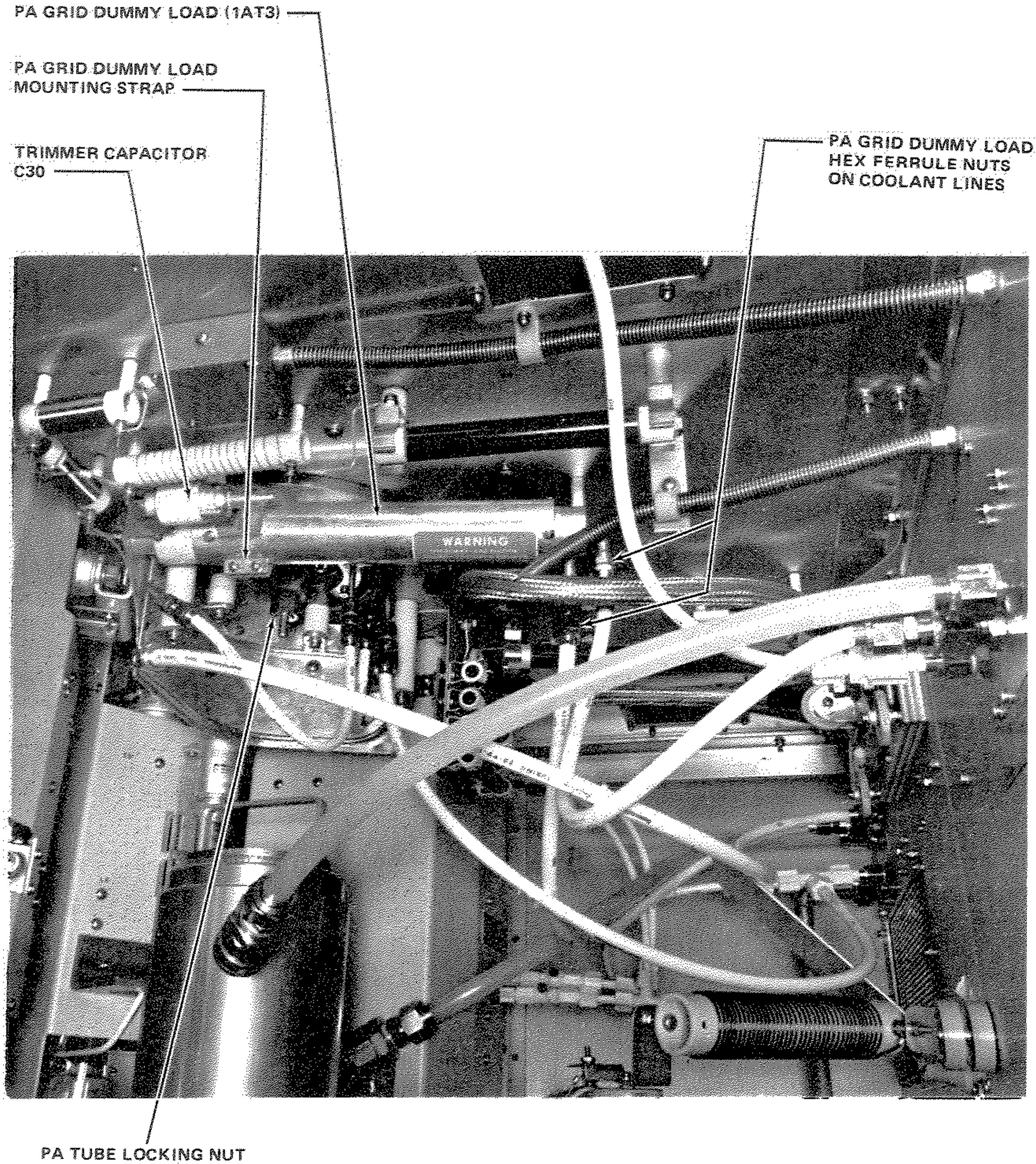


Figure 6-86. PA Tube Component Location

4. Connect inlet and outlet cooling water lines to dummy load. Tighten ferrule hex nuts.

5. Follow procedure in paragraph 6-2.3.2 to turn on cooling water supply. After, verify rags are removed from cabinet.

6. Connect air supply lines to filter and tighten ferrule nuts. Turn on RPIE compressed air supply.

7. Check for air leaks at ferrule nut fittings and take corrective action as required.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

8. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.19 PA Bias Power Supply. Figure 6-71 shows location of power supply 1PS5 in cabinet 1 controls compartment.

6-5.19.1 PA Bias Power Supply 1PS5 Removal. Refer to Figures 6-71 and 6-87 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1f	Heavy Component Lift (Short Reach)
1	1h	Material Handling Platform
1	1n	PA Bias Power Supply Removal Tool
1	7c	Flat Blade Screwdriver
1	7t	Open End Wrench
1	7w	Ratchet Wrench
1	7x	Ratchet Extension
1	7zc	7\16 Socket

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet. Roll rubber mat back in cabinet and place only material handling ramp at door. Remove 3 bolts and door stop from cabinet floor.

2. Remove panhead screws from TB1. Tag and disconnect external wiring.

3. Remove five nuts from E1 through E5. Tag and disconnect external wiring.

4. Fold wiring harness away from power supply and secure to prevent damage to insulation during removal of supply.

5. Install power supply removal tool, see figure 6-87, on base of transformer at upper left corner of supply. Make sure V-notch engages bottom edges of power supply.

6. Move short reach lift into controls compartment and under lower channels of removal tool. Balance power supply by hand while it is being removed from cabinet.

NOTE

It may be necessary to lift up on power supply removal tool and L-bracket on supply to insert short reach lift in step 6 below.

7. Remove six hex nuts that hold power supply to mounting rails. Removing hex nut at upper left corner releases ground strap.

6-5.19.2 PA Bias Power Supply 1PS5 Installation. Refer to Figure 6-87 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1f	Heavy Component Lift (Short Reach)
1	1h	Material Handling Platform
1	1n	PA Bias Power Supply Removal Tool
1	7c	Flat Blade Screwdriver
1	7t	Open End Wrench
1	7w	Ratchet Wrench
1	7x	Ratchet Extension
1	7zc	7/16 Socket

1. Using short reach lift, move power supply installed on removal tool inside cabinet and in position for installation.

2. Attach braided grounding strap to upper left corner by installing hex nut. Install remaining five hex nuts. Remove power supply removal tool and short reach lift from cabinet.

3. Fold wiring harness onto power supply and install panhead screws to connect wiring terminals to TB1 and remove tags.

4. Connect external wiring to E1 through E5 by installing five hex nuts and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Roll rubber mat back into place, remove material handling platform ramp, and replace door stop using 3 bolts.

6. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.20 Grounding Switch 1S38. Switch 1S38 is bulkhead-mounted at the rear of cabinet 1 (Figure 6-4, sheet 2). Access is through left rear doors.

6-5.20.1 Grounding Switch 1S38 Removal. Refer to Figure 6-4, sheet 2, and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7j	Open End Wrench
1	7o	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7y	Socket

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove external wires from terminal board at top of switch.

3. Tag and remove six cables from beneath lower plate.

4. Tag and remove six wires from bottom of middle plate.

5. Remove hex capnuts from top of middle and lower plates and remove four braided grounding straps.

6. Remove four nuts that hold grounding switch mount to chassis.

6-5.20.2 Grounding Switch 1S38 Installation. Refer to Figure 6-4, sheet 2, and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7j	Open End Wrench
1	7o	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7y	Socket

1. Position grounding switch and install four nuts that hold switch mount to chassis.

2. Install two braided grounded straps on top of middle plate, two others on top of lower plate.

3. Install wires on bottom of middle plate and remove tags.

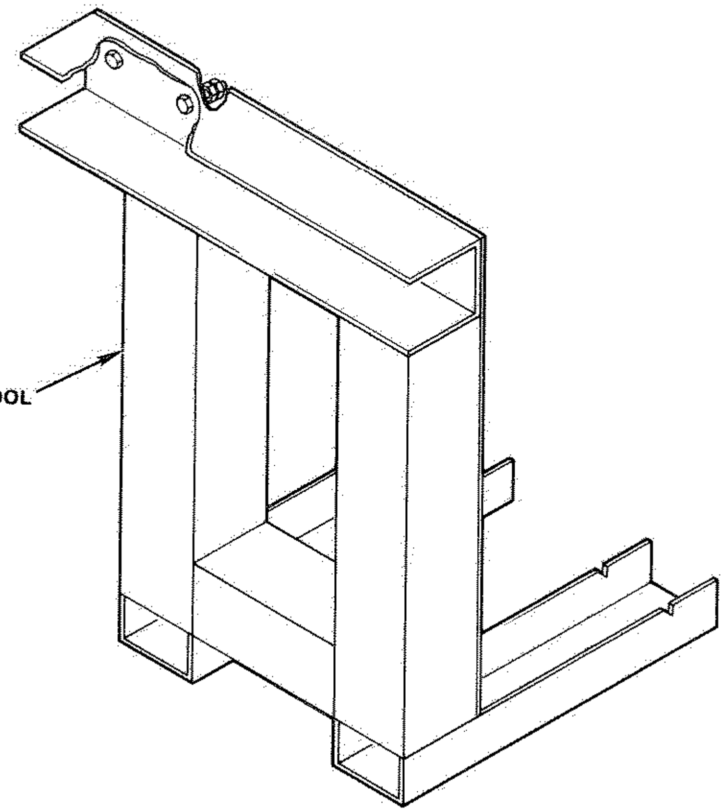
4. Install six cables on bottom of lower plate and remove tags.

5. Install wires on terminal board at top of switch. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

6. Follow procedure in paragraph 6-2.2.2 to exit cabinet.



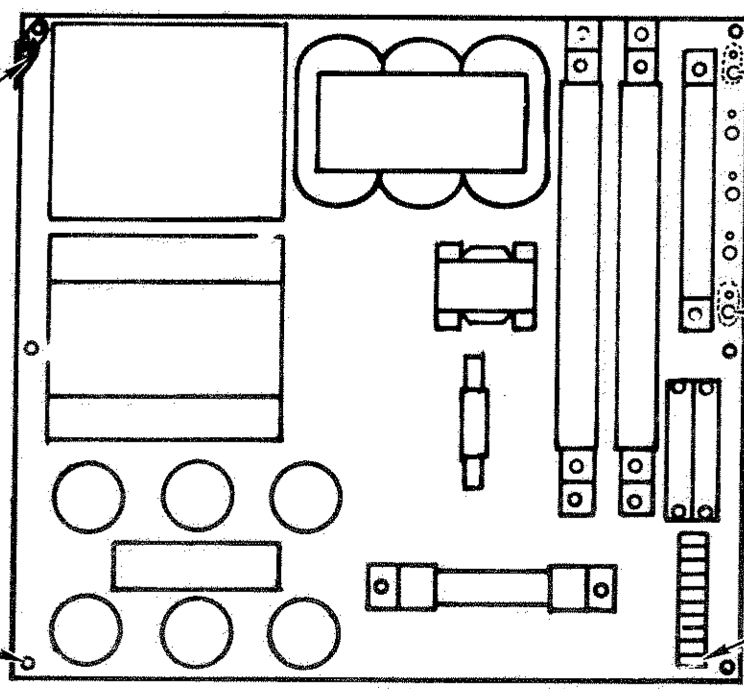


Figure 6-87. PA Bias Power Supply

6-5.21 PA Filament Power Supply. Figure 6-4, sheet 2, shows location of PA filament power supply at left rear of cabinet 1. Access is through left double doors and lower left protective cover plate. The power supply is an assembly that requires removal of discrete components for repair.

6-5.21.1 Transformer 1T2 Removal. Refer to Figure 6-4, sheet 2, Figure 6-81, and Figure 6-88 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Heavy Component Handling Lift (Short Reach)
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
1	7o	Open End Wrench
2	7p	Open End Wrench
1	9c	Trouble Light

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove three cables from transformer terminals.

3. Remove protective cover strip from top of transformer by moving cover to the left and sliding it from spring clips.

4. Tag and remove wires from right side of TB1 at top of transformer.

5. Remove four hex bolts and four nuts that secure transformer to shock mounts.

6 Position forklift truck and install side lift adapter (Figure 6-81) to extend into cabinet and over top of transformer. Make sure adapter is installed on forks as far as possible.

7. Remove hooks and shackles from side lift adapter.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care when raising equipment to avoid damage to cooling water pipes in cabinet.

8. One person signal forklift operator to carefully adjust height of side lift adapter for removal of transformer. Couple side lift adapter to transformer lifting eyes with shackles.

9. Carefully lift transformer free of mounting bolts and then slide transformer out of cabinet.

10. Carefully lower transformer until side lift adapter is down as far as possible. Use short reach lift under transformer to remove weight from adapter. Remove shackles and remove transformer.

6-5.21.2 Transformer 1T2 Installation. Refer to Figures 6-81 and 6-88 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Heavy Component Handling Lift (Short Reach)
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
1	7o	Open End Wrench
2	7p	Open End Wrench
1	9c	Trouble Light

1. Using short reach lift, position transformer under side lift adapter. Couple side lift adapter to transformer lifting eyes using shackles.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care when raising equipment to avoid damage to cooling water pipes in cabinet.

2. One person signal fork lift operator to carefully adjust height of adapter so transformer can be slid into cabinet over mounting bolts. Carefully lower transformer onto

mounting bolts and shock mounts. Remove shackles and side lift adapter. Reinstall hooks and shackles on side lift adapter.

3. Install four hex nuts to secure transformer to shock mounts. Tighten nuts finger tight.

4. Install wires on right side of TB1 and remove tags.

5. Install protective cover strip on transformer top by moving cover to right and sliding it onto spring clips.

6. Install three cables on transformer terminals. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Remove forklift and follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.21.3 Inductor 1L17 Removal. Refer to Figures 6-81 and 6-88 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Heavy Component Handling Lift (Short Reach)
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
1	7o	Open End Wrench
2	7p	Open End Wrench
1	9c	Trouble Light
1	9k	Nylon Sling

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove two cables from terminals 1 and 2.

3. Tag and remove wire from terminal 1.

4. Tag and remove wire from terminal 2.

5. Remove four hex nuts that secure inductor to shock mounts.

6. Position forklift truck and install side lift adapter (Figure 6-81) to extend into cabinet over top of inductor. Make sure adapter is installed on forks as far as possible.

7. Remove hooks and shackles from side lift adapter

CAUTION
EQUIPMENT DAMAGE HAZARD

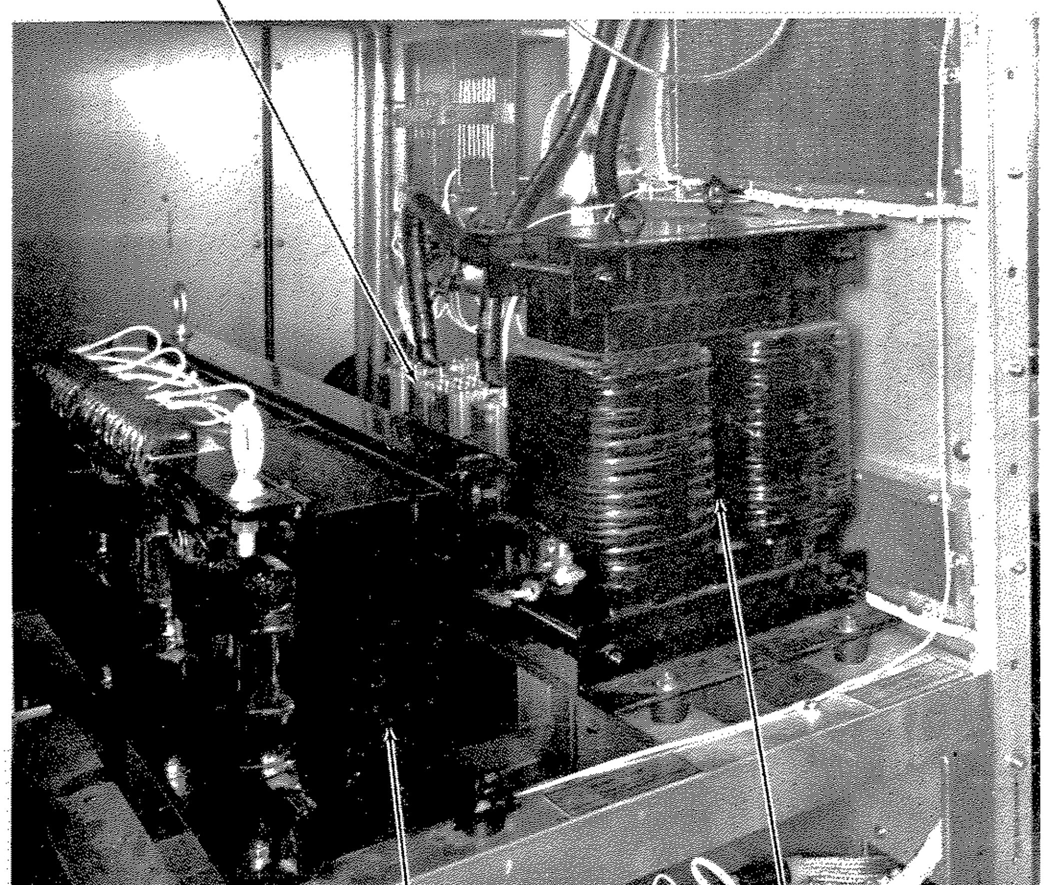
Use care when raising equipment to avoid damage to cooling water pipes in cabinet.

8. One person signal forklift operator to carefully adjust height of side lift adapter for removal of inductor. Position trollys of adapter on both sides of inductor and down as far as possible. Connect nylon sling through top center of inductor and connect to trollys of adapter. Tighten sling as much as possible.

9. Carefully lift inductor free of mounting bolts and then slide inductor out of cabinet.

10. With short reach lift positioned under inductor, carefully lower inductor as far as possible or until short reach lift can be raised to remove weight from adapter. Remove nylon sling and remove inductor.

DIODE
ASSEMBLY
1CR2



85-1141

TRANSFORMER 1T2

INDUCTOR 1L-17

Figure 6-88. PA Filament Power Supply

6-5.21.4 Inductor 1L17 Installation. Refer to Figures 6-81 and 6-88 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1a	Side Lift Adapter
1	1f	Heavy Component Handling Lift (Short Reach)
1	1q	Forklift Truck
1	7c	Flat Blade Screwdriver
1	7o	Open End Wrench
2	7p	Open End Wrench
1	9c	Trouble Light
1	9k	Nylon Sling

1. Using short-reach lift, position inductor under side-lift adapter. Connect nylon sling through top center of inductor to adapter trollys. Tighten sling.

CAUTION
EQUIPMENT DAMAGE HAZARD

Use care when raising equipment to avoid damage to water pipes.

2. One person signal forklift operator to carefully adjust height of adapter so inductor can be slid into cabinet over mounting bolts. Carefully lower inductor onto mounting bolts and shock mounts. Remove nylon sling and side-lift adapter. Reinstall hooks and shackles on side lift adapter.

3. Install four hex nuts to secure inductor to shock mounts. Tighten finger tight.

4. Install two wires and two cables on terminals 1 and 2. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Remove fork lift truck and follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.21.5 Diode Assembly 1CR2 Removal. Refer to Figure 6-88 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
2	7j	Open End Wrench
2	7o	Open End Wrench

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Tag and remove three cables from terminals A, B, and C.

3. Tag and remove cable from terminal D, and from terminal E.

5. Tag and remove wire from term. E.

6. Remove four bolts and four nuts that secure diode assembly to shock mounts.

6-5.21.6 Diode Assembly 1CR2 Installation. Refer to Figure 6-88 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
2	7j	Open End Wrench
2	7o	Open End Wrench

1. Position diode assembly and install four nuts and four bolts to secure to shock mounts.

2. Install wire then cable on terminal E. Remove tags.

3. Install cable on terminal D and remove tag.

4. Install three cables on terminals A, B, and C and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.22 PA Vacuum Tube and Socket. Vacuum tube 1V3 is located in cabinet 1. Bottom components are accessed through right front doors and lower right protective cover.

6-5.22.1 PA Vacuum Tube 1V3 Removal. Refer to Figures 6-89, 6-90, 6-91, and 6-92. Perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Tube/Capacitor Electric Hoist
1	1j	Tube Removal Support Hoist
1	1k	Filter/Tube Servicing Lift Table
1	1r	Ladder
1	7b	Screwdriver, Flatblade
1	7d	Screwdriver, Phillips
1	7j	Open End Wrench
1	7n	Open End Wrench
1	7w	Ratchet
2	7ua	Open End Wrench
1	7za	Socket
1	9f	6-ft. Water Hose
1	9h	Drain Pan

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Follow procedure in paragraph 6-2.3.1 to turn off cooling water and drain cabinet.

3. Loosen clamp and remove plastic cover from top of driver tube.

4. Cover top of driver tube and around socket with rags. Cover PA tube under water lines with rags.

CAUTION
EQUIPMENT DAMAGE HAZARD

When disconnecting cooling water line fittings, be careful not to splash water into PA and driver vacuum tube compartment.

5. Disconnect cooling water inlet and outlet lines at top of tube. Remove red bracket supporting hoses. Move bracket and hoses out of way.

WARNING
PERSONNEL INJURY HAZARD

Remain aware of overhanging obstacles such as light fixtures, etc. Failure to comply may result in injury to personnel and damage to equipment.

6. At top front of cabinet, remove retaining pins and slide safety rails to open position.

7. Loosen slide-lock fasteners on pneumatic enclosure cover panel at top of cabinet and remove cover (Figure 6-89).

8. At top of PA tube circular access panel, disconnect arc sensor by removing cannon connector.

9. Remove circular access panel.

10. At top of tube, remove rags and disconnect both ends of anode B+ lead by removing hex nuts and screws. Remove anode lead with 1L30

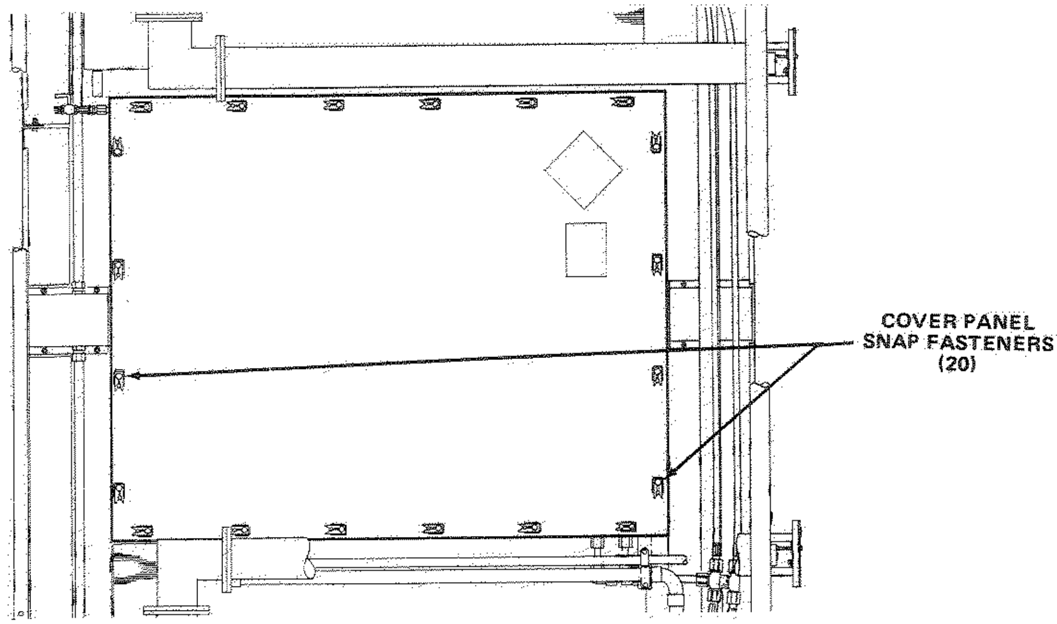
11. Remove and retain nut from center stud of electrical contact ring and lift ring from tube and capacitor 1C42. See Figure 6-90.

12. Install tube removal hoist support assembly over air matrix compartment. Install electric hoist in carrier channel of hoist support assembly (Figure 6-91).

WARNING
FALLING EQUIPMENT HAZARD

When removing or replacing lift bar on electric hoist, make sure chain is hooked over hardened pin in acorn halves before reasembling halves.

13. Remove lift bar (150791-1) from end of electric hoist chain by removing 2 Phillips head screws from acorn halves. Next, remove bar from pivot and reassemble pivot, acorn halves, and chain, then secure with 2 screws. Make sure chain is hooked over hardened steel pin in acorn half before securing halves together.



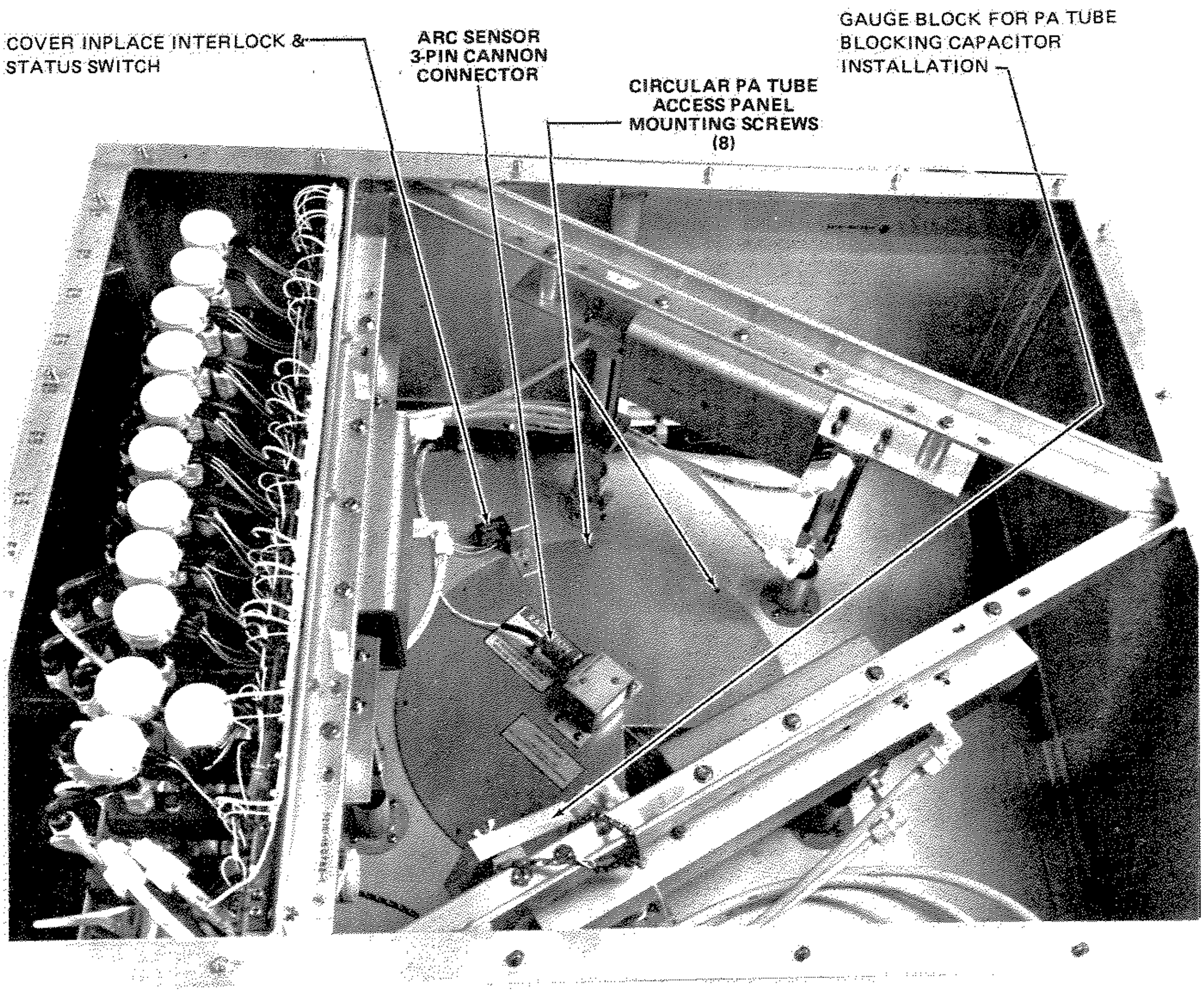


Figure 6-89. PA Tube Compartment Top Access Panels

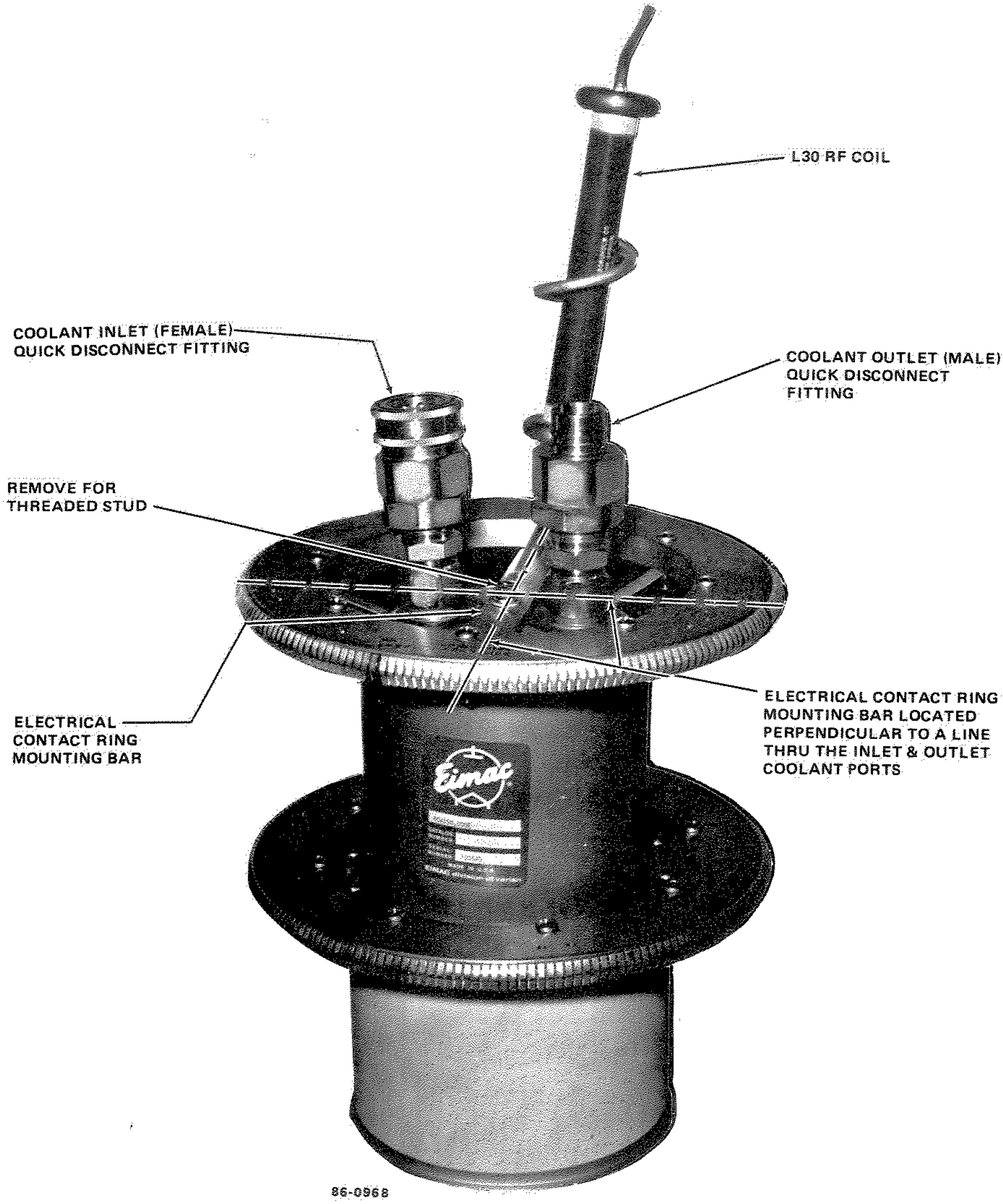
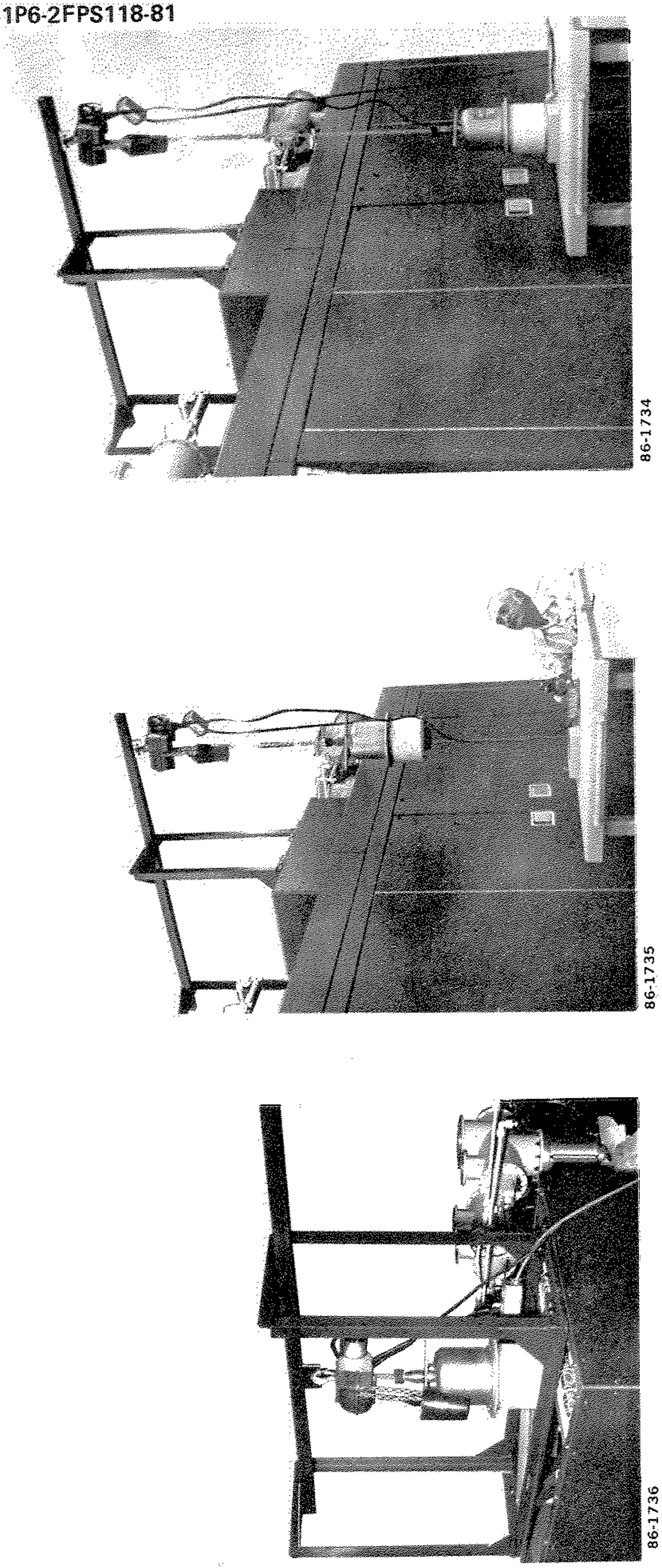


Figure 6-90. PA Tube Configuration



VIEW (C)
PA TUBE POSITIONED IN TUBE
HOLDER ON TUBE LIFT TABLE

VIEW (B)
LOWERING PA TUBE ONTO
TUBE LIFT TABLE

VIEW (A)
RAISING PA TUBE FROM SOCKET

Figure 6-91. PA Tube Removal Sequence Using Electric Hoist

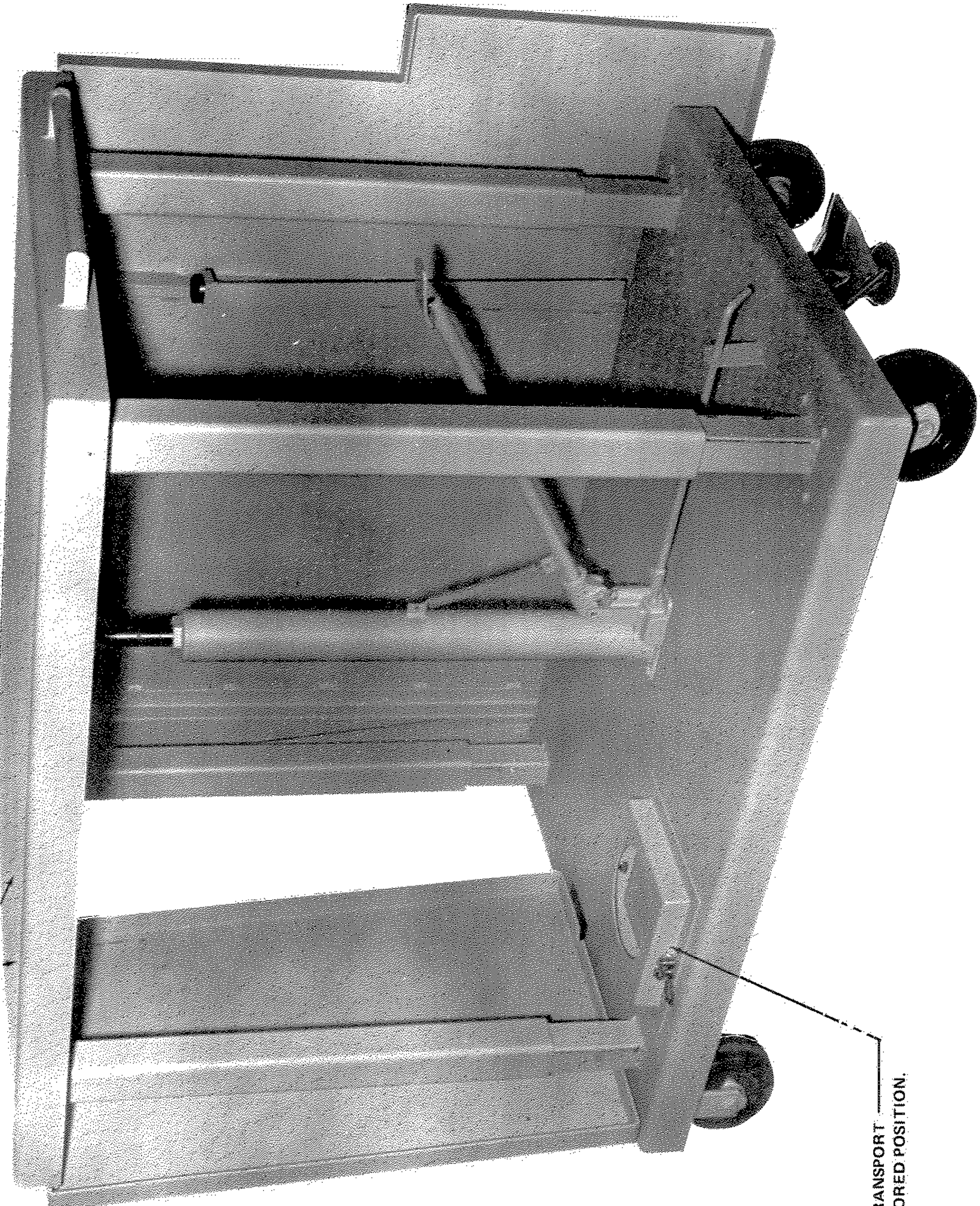


Figure 6-92. Filter/Tube Servicing Lift Table

14. Lower electric hoist and secure tube to hoist for lifting. Screw lifting assembly onto threaded stud in top center of tube.

15. At bottom center of tube, using 1 inch deep well socket and ratchet, loosen nut completely until plunger is no longer engaged by nut.

CAUTION

EQUIPMENT DAMAGE HAZARD

If tube is not unlocked from socket, both tube and socket may be seriously damaged.

16. One person view base of tube from beneath to verify socket is unlocked before hoisting action begins. Use hand pressure and lift gently on tube to verify it is disengaged from nut. If not, immediately terminate procedure and perform step 15 again.

17. Person on top of cabinet activate hoist and slowyly lift tube from socket. Third person guide tube up and into removal chute by hand. Before lifting completly up chute, remove plunger from cathode end of tube by pushing plunger toward tube and rotating 1\4 turn CCW.

18. When tube is raised clear of compartment carefully move hoist, in its channel track, beyond front of cabinet and slowly lower tube onto lift table (Figure 6-91).

CAUTION

EQUIPMENT DAMAGE HAZARD

When loosening quick-disconnect fittings, do not allow fittings to rotate on tube cooling lines.

19. If new tube is to be installed, remove quick disconnect fittings by loosening nut on tube cooling line at back of fitting.

6-5.22.2 PA Vacuum Tube 1V3 Installation. Refer to Figures 6-89, 6-90, 6-91, and 6-92. Perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Tube/Capacitor Electric Hoist
1	1j	Tube Removal Support Hoist
1	1k	Filter/Tube Servicing Lift Table
1	1r	Ladder
1	7c	Screwdriver, Flatblade
1	7f	Screwdriver, Phillips
1	7j	Open End Wrench
1	7n	Open End Wrench
1	7w	Ratchet
2	7ua	Open End Wrench
1	7za	Socket
		Other
3	NA	Spacer Block, Mfg Locally See Figure 6-93 for dimensions

CAUTION

EQUIPMENT DAMAGE HAZARD

When tightening quick-disconnect fittings, do not allow fittings to rotate on tube cooling lines.

1. If new tube is being installed, reinstall quick disconnect fittings on tube as shown in figure 6-90.

2. Clean ceramic base and contact ring of vacuum tube with rag and denatured alcohol.

3. Place three spacer blocks (Figure 6-93) around capacitor C42. Person on top of cabinet activate hoist and slowly lift vacuum tube. Center tube over pneumatic enclosure and carefully lower it part way down chute. Before seating tube, install plunger on cathode and turn 1\4 turn CW. Then continue lowering tube.

4. Second person hold onto tube by water line connections and guide down chute. Verify water lines are in proper positions for hookup after tube is seated.

CAUTION
EQUIPMENT DAMAGE HAZARD

When lowering vacuum tube into socket, be careful not to damage electrical contacts while correctly seating vacuum tube.

If PA vacuum tube locking nut is over-tightened, damage to the tube may result.

5. Third person observe proper seating of tube in socket. Disconnect tube from hoist. Using hand (or ratchet if necessary) and 1" deep socket on nut at bottom of tube and tighten down firmly until tube base seats on four spacer blocks on top of deck plate. Do not over-tighten.

6. Remove spacer blocks from around C42.

7. Install electrical contact ring over tube and level ring visually to capacitor 1C42. Secure to threaded stud using nut retained from removal procedure.

8. Reinstall anode B+ lead to top of vacuum tube by installing hex nuts and screws.

9. Connect cooling water inlet and outlet lines at top side of vacuum tube. Place rags under water lines.

10. Follow procedure in paragraph 6-2.3.2 to turn on cooling water supply and check for leaks.

11. Remove electric hoist from carrier channel of hoist support assembly. Remove hoist support assembly from top of cabinet.

12. Replace circular access panel over vacuum tube and install eight Phillips-head screws.

13. Connect cannon connector to arc sensor mounted on top of circular access panel.

14. Replace cover panel on top of pneumatic enclosure and fasten slidelock fasteners.

CAUTION
EQUIPMENT DAMAGE HAZARD

If new tube has been installed, it must be operated for 200 hours with filament voltage as specified by manufacturer. Refer to paragraph 6-6.3.10. Failure to follow approved exit procedure may result in equipment damage.

15. If no leaks have occurred, remove rags from PA and driver tube areas and replace plastic cover at top of driver tube blocking capacitor.

WARNING
FALLING EQUIPMENT HAZARD

When removing or replacing lift bar on electric hoist, make sure chain is hooked over hardened pin in acorn halves before reassembling halves.

16. Disassemble acorn halves on end of electric hoist chain by removing 2 phillips head screws. Place lift bar on pivot and reassemble pivot, acorn halves and chain, then secure with 2 screws. Make sure chain is hooked over hardened steel pin in acorn half before securing acorn halves together.

17. After installation of a new PA tube, set static current according to paragraph 6-6.3.11

18. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

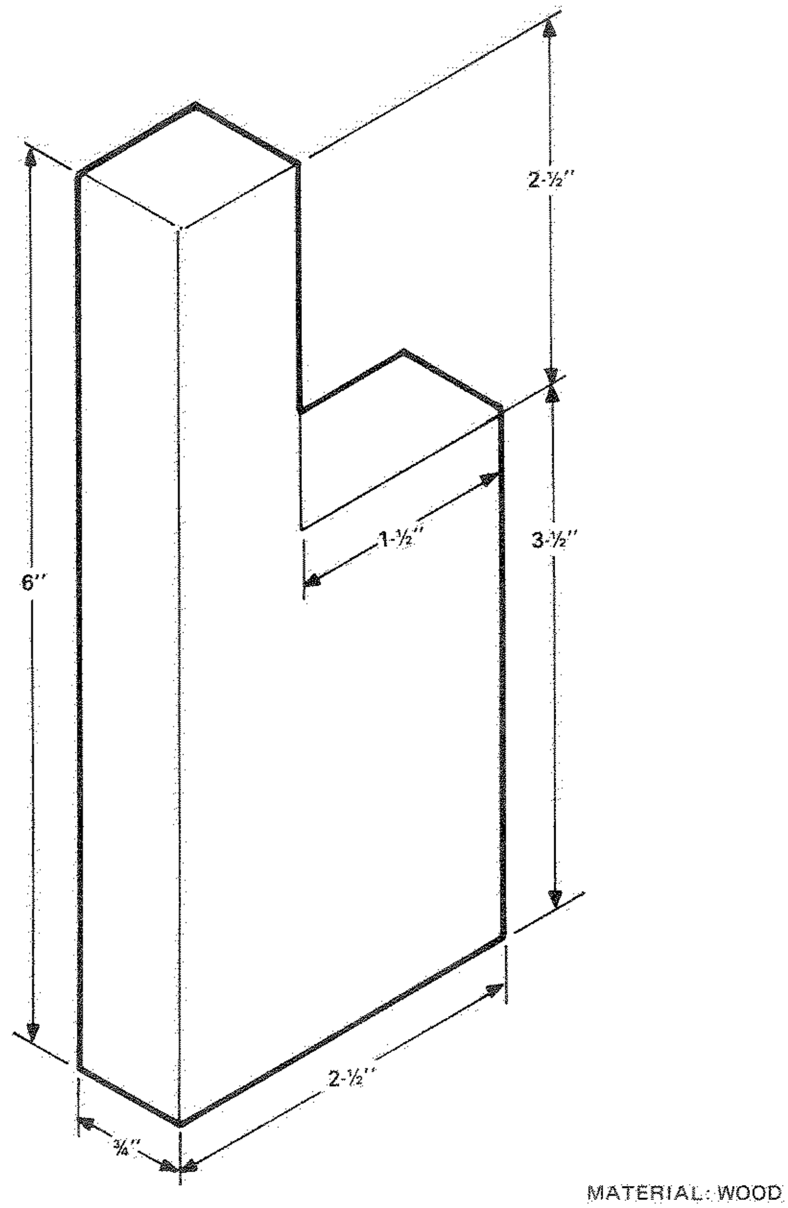


Figure 6-93. Spacer Block Dimensions

6-5.22.3 PA Vacuum Tube Socket 1XV3 Removal. Access for tube socket 1XV3 removal is through right and left front doors. Refer to Figures 6-94 and 6-95 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7d	Phillips Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
2	7j	Open End Wrench
1	7l	Open End Wrench
1	7m	Open End Wrench
1	7n	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7q	Open End Wrench
1	7t	Open End Wrench
		Other
3	NA	Spacer Block, Locally Mfg. See Figure 6-93

1. Follow procedure in paragraph 6-5.22.1 to remove PA vacuum tube and paragraph 6-5.23.1 to remove the D-Band PA output filter 1FL13.

2. At top of tube socket, remove capacitor 1C43 from bracket and small upper contact ring. Remove two screws that secure bracket to chassis and remove bracket from cabinet.

3. Remove screw from top of ceramic post that supports capacitor 1C67 and remove ceramic post from cabinet. Gently bend 1C67 clear of tube socket.

4. Position three spacer blocks equidistant around bottom of blocking capacitor 1C42 for support.

5. Remove D-Band plunger assembly (Leftmost of two plungers at front of cabinet):

   a. On back side of assembly, remove two outer screws that secure upper contact arm to bar support posts.

   b. Remove three Allen-head screws that secure upper contact arm to metal ring.

   c. On front side of assembly, remove two bolts from beneath lower contact arm.

   d. At top of plunger assembly, hold turnbuckle with wrench and loosen bottom locknut. Turn plunger ccw by hand until free of turnbuckle. Lift plunger assembly clear and remove from cabinet.

6. On remaining five plunger assemblies:

   a. Remove two outer screws that secure upper contact arms to bar support posts.

   b. Remove three Allen-head screws that secure upper contact arms to metal rings. Swivel loosened contact arms to move hardware away from metal rings.

7. Lift blocking capacitor 1C42 and tilt as necessary to remove from cabinet through space gained by removal of plunger assembly.

8. At bottom of tube socket, tag and disconnect all cooling water lines.

9. Remove bus wire connected from resistor 1R6 to tube socket by removing screw from tube socket connection.

10. Remove 1C30 from two mounting brackets.

11. Remove resistor bank, 1R21 through R24, and two shielded filament cables by removing two bolts and two nuts from metal mounting brackets.

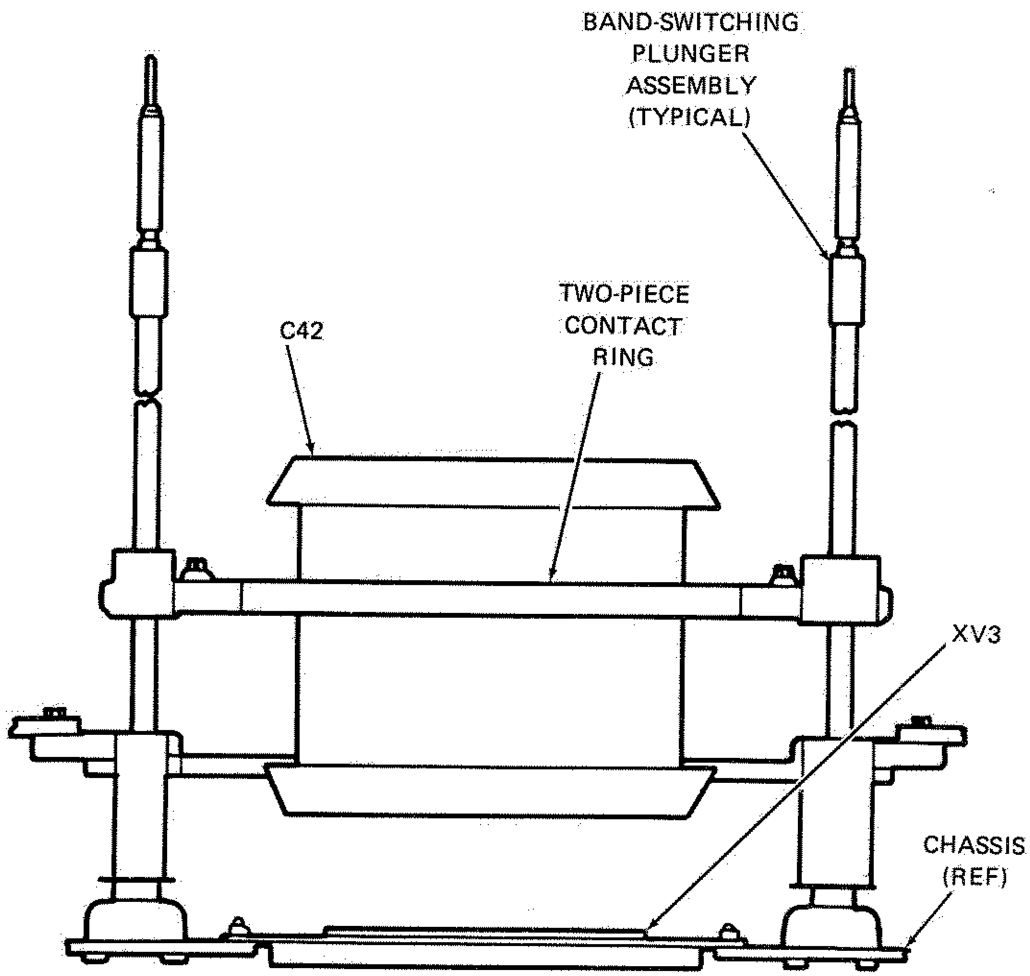


Figure 6-94. Tube Socket 1XV3

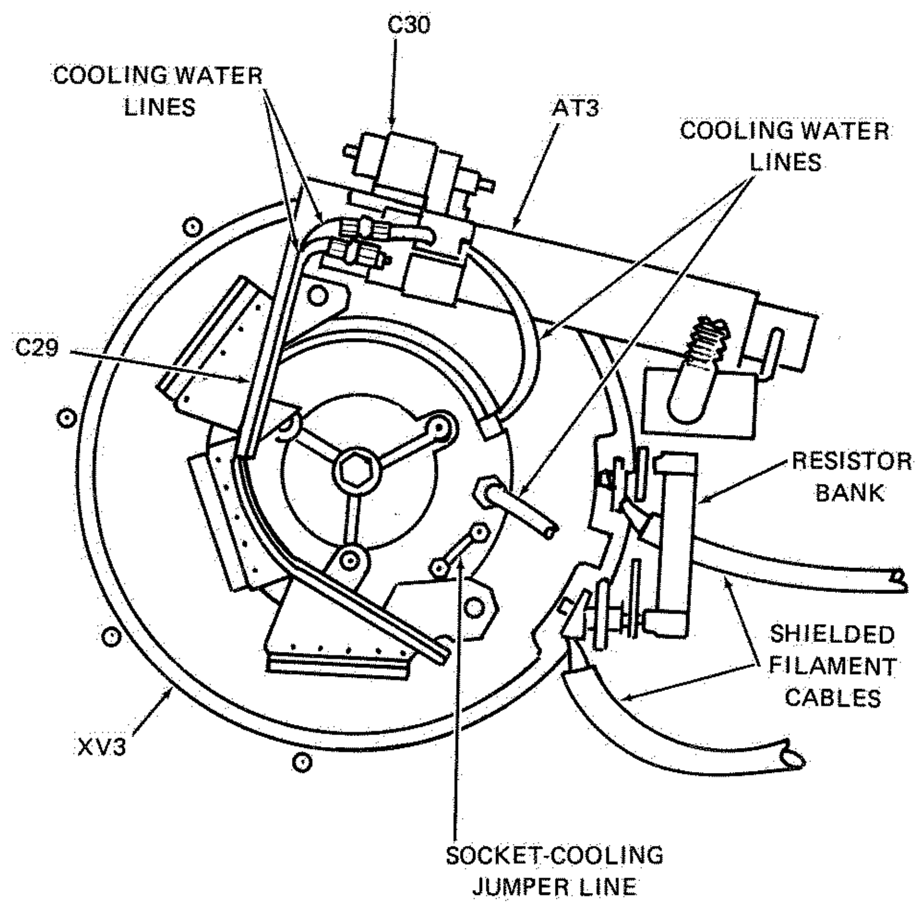


Figure 6-95. Tube Socket 1XV3, Bottom View

12. Remove four screws from four standoffs and remove four nuts (part of PA grid element of socket) that secure 1C29 to tube socket.

13. At top of tube socket, locate circle of eight capnuts at outer edge of largest of two metal rings. From beneath chassis, one person hold Phillips-head screws in place while person above removes capnuts.

14. Remove 3 screws holding PA tube socket control grid element to top of socket. Remove plastic insulators from holes and retain.

CAUTION
EQUIPMENT DAMAGE HAZARD

When removing tube socket, be extremely careful not to damage finger stock electrical contacts.

15. Remove socket control grid element from cabinet by manueuvering the socket as required.

16. Grasp tube socket firmly by center shaft and work it upward to where it can be hand-supported. Remove tube socket from cabinet.

6-5.22.4 PA Vacuum Tube Socket 1XV3 Installation. Refer to Figures 6-94 and 6-95 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7d	Phillips Scewdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
2	7j	Open End Wrench
1	7l	Open End Wrench
1	7m	Open End Wrench
1	7n	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7q	Open End Wrench
1	7t	Open End Wrench
		Other
3	NA	Spacer Block, Locally Mfg. See Figure 6-93 for dimensions

1. If new socket is to be installed, lay old socket and new socket on bench, bottom side up and orient in same position. Transfer any components, bus bars, and brackets from old socket to new socket as required. On new socket, remove 3 screws holding PA tube socket control grid element to top of socket. Remove plastic insulators from holes and retain for installation. Reinstall old control grid on old socket with 3 screws and insulators retained during removal.

CAUTION
EQUIPMENT DAMAGE HAZARD

When installing tube socket, be extremely careful not to damage finger stock electrical contacts.

2. Place tube socket in cabinet. Verify two metal mounting brackets on bottom of socket are oriented toward bulkhead on which capacitors 1C20, C40, and C69 are mounted. Gently lower socket through hole in chassis.

3. Maneuver socket as required and install control grid element to top of scoket. Secure with 3 screws and insulators.

4. One person install Phillips-head screw from beneath chassis and hold while second person installs capnut from top of tube socket. Repeat for remaining screws and capnuts.

5. Secure 1C29 to socket with 4 nuts and install four screws in four standoffs to secure capacitor to tube socket.

6. At bottom of tube socket install resistor bank, 1R21 through R24, and two shielded filament cables by installing two bolts and two nuts on metal mounting brackets.

7. Install 1C30 in two brackets.

8. Install bus wire from resistor 1R6 to tube socket by installing screw in tube socket connection.

9. Connect all cooling water lines (including socket jumper).

10. At top of tube socket, position three spacer blocks (Figure 6-93) around socket for support of blocking capacitor 1C42. Tilt 1C42 as necessary and move into place.

11. On five installed band-switch plunger assemblies:

    a. Swivel loosened contact arms back into position for plunger operation.

    b. Install three Allen-head screws to secure upper contact arms to metal rings.

    c. Install two outer screws to secure upper contact arms to bar support posts.

12. Position D-Band plunger assembly for installation and:

    a. Turn plunger cw by hand to connect to turnbuckle. Hold turnbuckle with wrench and tighten bottom locknut.

    b. On front side of assembly, install two bolts at bottom of lower contact arm.

    c. Install three Allen-head screws to secure upper contact arm to metal ring.

    d. On back side of plunger assembly, install two screws to secure upper contact arm to metal posts.

13. Remove capacitor spacer blocks.

14. Bend 1C67 slightly toward socket. Install ceramic post. Install screw through 1C67 mounting bracket into top of ceramic post.

15. Position 1C43 bracket and install two screws to secure it to chassis. Install 1C43 in small contact ring and in bracket. Make sure 1C43 is alligned vertically in bracket.

16. Follow procedure in paragraph 6-5.22.2 to install PA vacuum tube.

17. Follow procedure in paragraph 6-6.3.9.1 to adjust D-Band plunger assembly.

18. Follow procedure in paragraph 6-5.23.2 to install D-Band PA output filter 1FL13.

6-5.23 <u>PA Output Filters</u>. Figure 6-96 shows locations of filters 1FL10 through 1FL15 (Bands A through F, respectively) in cabinet 1.

6-5.23.1 <u>PA Output Filters 1FL10 Through 1FL15 Removal</u>. Refer to Figure 6-96 and Table 6-8 and perform the following.

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	1r	Ladder
1	1k	Filter/Tube Servicing Lift Table
1	7aa	Vise-Grip Pliers
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
1	7m	Open End Wrench
2	7o	Open End Wrench
2	7p	Open End Wrench
1	7v	Allen Wrench
1	7va	Allen Wrench
1	7zc	Socket
1	7w	Ratchet
1	7x	Ratchet extension
1	9c	Trouble Light
1	9f	6-ft. Water Hose

(from Table 1-6)

Qty	Item No.	Description
AR	5	Cotton Wiping Rags

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

Table 6-8. PA Output Filter Access

Filter	Band	Access
1FL10	A	Right front doors and upper right protective cover plate
1FL11	B	Right rear doors and upper right protective cover plate
1FL12	C	Left rear doors and upper left protective cover plate
1FL13	D	Left front doors and upper left protective cover plate
1FL14	E	Hinged port on right end of transmitter and right front doors and upper right protective cover plate
1FL15	F	Protective cover plate in control section and left front doors and upper left protective cover plate

2. Follow procedure in paragraph 6-2.3.1 to turn off cooling water supply and drain cabinet.

CAUTION
EQUIPMENT DAMAGE HAZARD

When disconnecting cooling water lines, be careful not to spill water into compartment.

3. Place rags beneath cooling line fittings to catch any water spillage. Remove ferrule nut fittings and disconnect cooling water inlet and outlet lines from filter.

4. For 1FL14, place rags beneath fittings and disconnect water lines at base of filter just inside hatch. Move lines aside to allow clearance for filter removal.

5. Remove three Phillips-head screws from electrical connection at vacuum tube end of filter.

WARNING
PERSONNEL INJURY HAZARD

RF connector band in next step springs apart forcefully when final retaining screw is removed. Failure to use vise-grip pliers as stated may result in injury.

6. Attach vise-grip pliers to joining lips of RF connector band at output end of filter. Tighten down vise-grips enough to hold band firmly together. remove three Phillips-head screws from RF connector band, then carefully loosen vise-grips and remove connector band.

NOTE

Coaxial clamp in next step separates into two pieces when retaining bolt is removed.

7. Remove coaxial clamp exposed upon removal of RF connector band at output end of filter. Separate filter from directional coupler.

NOTE

Do not remove RF elbow or flange (on FL 14 or 15) from output end of filter. That action is covered later in procedure.

8. Remove mounting hardware from each end of filter.

9. Remove flat bus grounding strap from vacuum tube end of filter.

10. Position lift table (Figure 6-92) so top is level with base of filter. For 1FL14, Band E filter, table shall be placed at right end of cabinet. For 1FL15, Band F filter, table shall be placed at left end of cabinet with end leaf raised and extended through opened door. Lock only one of the table wheels in place.

11. Two persons shall move filter onto table.

12. Remove output RF elbow or flange (on FL 14 or 15). Install elbow on replacement filter.

6-5.23.2 <u>PA Output Filters 1FL10 Through 1FL15 Installation</u>. Refer to Figure 6-96 and Table 6-8 and perform the following.

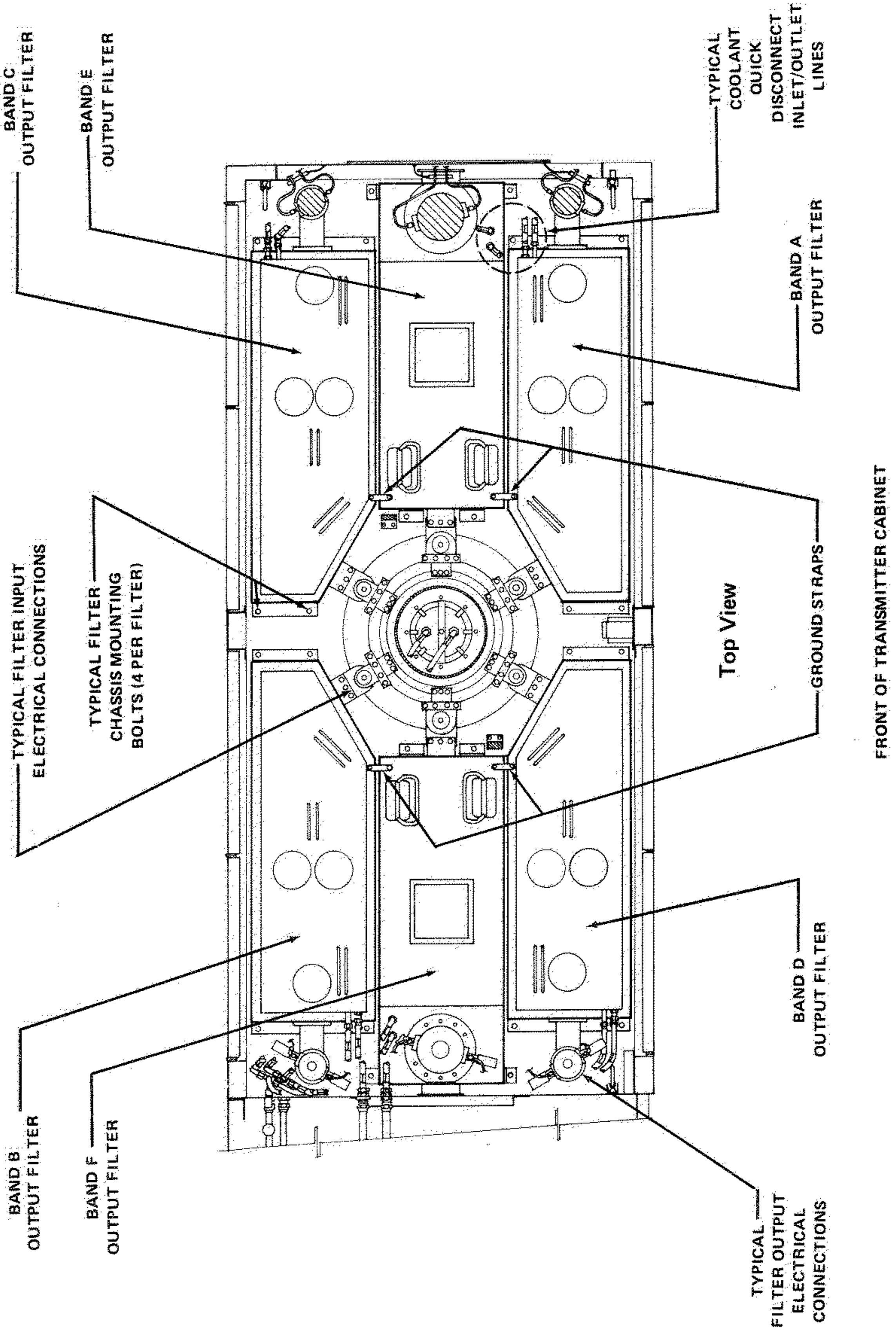


Figure 6-96. PA Output Filters

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1r	Ladder
1	1k	Filter/Tube Servicing Lift Table
1	7aa	Vise-Grip Pliers
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
1	7m	Open End Wrench
2	7o	Open End Wrench
2	7p	Open End Wrench
1	7v	Allen Wrench
1	7va	Allen Wrench
1	7w	Ratchet
1	7x	Ratchet extension
1	7zc	Socket
1	9c	Trouble Light

1. Two persons shall move filter from lift table into cabinet and align mounting holes.

2. Attach flat bus grounding strap to vacuum tube end of filter.

3. Install mounting hardware at each end of filter.

4. Install two-piece coaxial clamp (short side down) that mates filter to directional coupler. Flex RF connector band and place it on output end of filter. One person push lips of connector band close together while second person attaches vise-grip pliers and tightens pliers down to hold band together. Install ground strip and three Phillips-head screws in band, then remove vise-grips.

5. Install three Phillips-head screws in electrical connection at vacuum tube end of filter.

6. Connect cooling water input and output lines to filter. For 1FL14 reconnect water lines just inside hatch.

7. Follow procedure in paragraph 6-2.3.2 to turn on water supply.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage and transmitter down-time.

8. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-5.24 RF Transfer Switches. Figure 6-97 shows locations of switches 1S32 through 1S37 and identifies their frequency bands.

6-5.24.1 RF Transfer Switches 1S32 Through 1S37 Removal. Refer to Figure 6-97 and perform the following.

Tools and Test Equipment Required:
(from Table 1-4)

Qty	Item No.	Description
1	1k	Filter/Tube Servicing Lift Table
1	1r	Platform Ladder
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
2	7o	Open End Wrench
2	7p	Open End Wrench
1	7t	Open End Wrench 11\32
1	7ab	Pliers, Diagonal Cut
		(from Table 6-1)
AR	11	2"x 4"x 6' plank

WARNING
AIR PRESSURE HAZARD

Exercise care to perform step 1 as written. Failure to comply may result in injury to personnel.

1. Turn off RPIE compressed air supply to cabinet 1. Open card cage panel 1A1 access door. Slowly step transmitter through frequency-band selection until ACTR AIR lamp on front of CCA 1A1A9 lights up.

WARNING
HIGH VOLTAGE, RF, AND
X-RAY HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

2. Follow steps 1 through 3 of paragraph 6-2.2.1 to access cabinet. Ensure all other site transmitters are disabled to prevent RF radiation in accordance with antenna field access procedures in TO 31P6-2FPS118-71.

WARNING

Hard hats must be worn when working above transmitter.

CAUTION
EQUIPMENT DAMAGE HAZARD

Some ceiling-mounted components are positioned such that care must be exercised not to damage them while performing maintenance tasks. Failure to comply may result in extensive down-time.

3. Loosen and disconnect all air inlet and outlet lines to switch. Remove pipe to tubing adaptors from the pneumatic cylinder. Save for reinstallation.

4. Tag and remove wires from terminal block of switch.

5. Remove two nylon clamps and lower cables from switch.

6. Remove hex bolts from flange fittings that attach antenna and dummy load transmission lines to switch outputs. Remove coaxial dummy load clamps. Rock coaxial lines side-to-side while lifting up on lines. Move coaxial lines aside. If necessary, support lines with planks laid across lower rails.

7. Remove two wires from switch to associated water-cooled dummy load interlock. Cut tie-wraps to allow wires to be removed with switch.

8. Remove hex nuts from bottom side of input flange fitting of switch.

9. While third person lifts vertical line for clearance, two persons lift switch from mount and transfer to person on ladder at side of cabinet, then move to service table. (Figure 6-91).

6-5.24.2 RF Transfer Switches 1S32 Through 1S37 Installation. Refer to Figure 6-97 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1k	Filter/Tube Servicing Lift Table
1	1r	Platform Ladder
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
2	7o	Open End Wrench
2	7p	Open End Wrench

Qty	Item No.	Description (cont)
1	7t	Open End Wrench 11\32
	(from Table 6-1)	
AR	10	Teflon Tape, Sealing
AR	11	Plank, 2" X 4" X 6 '

1. Move switch from table to ladder beside transmitter cabinet. Two persons lift and move switch to mounting position at flange.

NOTE

Verify switch is positioned for pneumatic air lines to be connected before tightening down bolts in next two steps. There is very little tolerance, and this verification can be time saving.

2. Install hex nuts in bottom side of switch input flange fitting.

3. Install hex bolts in flange fitting that attaches antenna and dummy load to switch outputs. Install coaxial dummy load clamps to hold coaxial line in position.

4. Connect two wires from switch to associated dummy load interlock. Tie down neatly with tie-wraps.

5. Attach two cables to switch with two nylon clamps.

6. Install wires on terminal block of switch. Remove tags.

7. Remove plastic plugs and install pipe to tubing adaptors. Attach all air inlet and outlet lines to switch and tighten ferrule nuts. Turn on RPIE compressed air supply. Using soapy water solution, check for air leaks at couplings.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

8. Follow procedure in paragraph 6-2.2.2 to exit cabinet and procedure in TO 31P6-2FPS118-71 to restore full segment operation.

9. Perform Transmitter Module RF Radiation Hazard check according to paragraph 6-10.1.11.

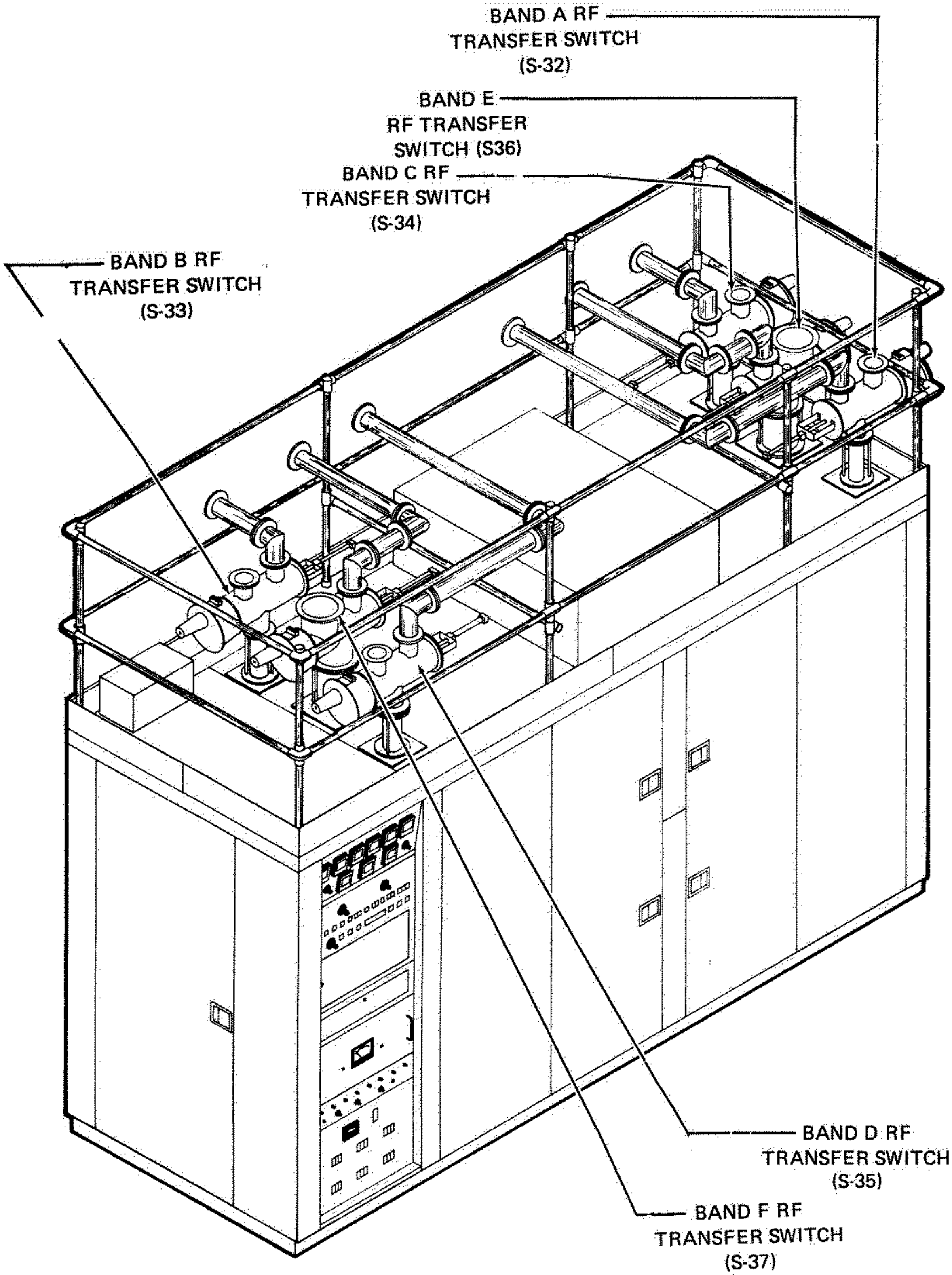


Figure 6-97. RF Transfer Switches

Table 6-9. Directional Coupler Access

Coupler	Band	Access
1DC3	A	Right front doors and upper right protective cover plate
1DC4	B	Right rear doors and upper right protective cover plate
1DC5	C	Left rear doors and upper left protective cover plate
1DC6	D	Left front doors and upper left protective cover plate
1DC7	E	Right front doors and upper right protective cover plate and open Band E access hatch cover.
1DC8	F	Protective cover plate in control section. Open left front doors and remove upper left protective cover plate

6-5.25 Directional Couplers. Figure 6-98 shows locations of Directional Couplers 1DC3 through 1DC8 and identifies their frequency bands.

6-5.25.1 Directional Couplers 1DC3 Through 1DC8 Removal. Refer to Figure 6-98 and Table 6-9 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1r	Platform Ladder
1	7aa	Vise-Grip Pliers
1	7c	Flat Blade Screwdriver
1	7f	Phillips Screwdriver
1	7e	Phillips Screwdriver
2	7o	Open End Wrench
2	7p	Open End Wrench
1	7v	Allen Wrench
	(from Table 6-1)	
AR	11	Plank 2" X 4" X 6'

1. Perform procedures in paragraph 6-2.2.1 and use Table 6-9 to access cabinet.

2. At RF transfer switch directly above directional coupler, loosen and disengage J-hooks securing transmission line for dummy load port.

3. Remove hex nuts from side of flange connecting switch to coupler.

4. Lift switch up until it disengages from directional coupler. Using blocks of 2" X 4" wood, support switch above coupler.

5. If Band-E or F coupler is being removed, remove Band-E or F PA output filter according to procedures in paragraph 6-5.23.1 and then proceed with step 7 below.

6. If Bands-A through D coupler is being removed, attach vise-grip pliers to joining lips of RF connector band at output end of filter. Tighten down vise grips to hold band firmly together.

WARNING

RF connector band in next step will spring apart forcefully when final retaining screw is removed unless secured by vise-grip pliers.

7. Remove three Phillips-head screws from RF connector band at input end of coupler. Carefully loosen vise-grip pliers, flex band apart and remove it.

8. To allow de-coupling of PA output filter from coupler, remove coaxial clamp exposed by removal of RF connector band. Remove coaxial clamp by separating into two pieces.

9. Remove four attenuator assemblies from coupler. These will be installed on replacement coupler.

10. Remove four N-type coaxial connectors from coupler and fold cables out of the way.

11. Access directional coupler housing on top of cabinet. Using double nuts on stablizer rods, back all-thread studs out of stabilizer.

12. Rotate two stabilizer rods ccw and remove them from mounting flange of coupler.

13. Remove four hex bolts from the two parts of collar assembly at upper end of coupler.

14. Support coupler from bottom side. Remove two Allen-head screws from upper collar assembly and move two collar pieces away from coupler housing.

15. Remove ten hex bolts; five from each of two adapter plates attached to roof of cabinet. Move plates from coupler housing.

16. Remove coupler through appropriate cabinet door.

6-5.25.2 Directional Couplers 1DC3 Through 1DC8 Installation. Refer to Figure 6-98 and Table 6-9 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1r	Platform Ladder
1	7aa	Vise-Grip Pliers
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7f	Phillips Screwdriver
2	7o	Open End Wrench
2	7p	Open End Wrench
1	7v	Allen Wrench

1. Place coupler inside cabinet and lift through hole at top. One person shall support coupler from bottom while person on roof installs mounting hardware.

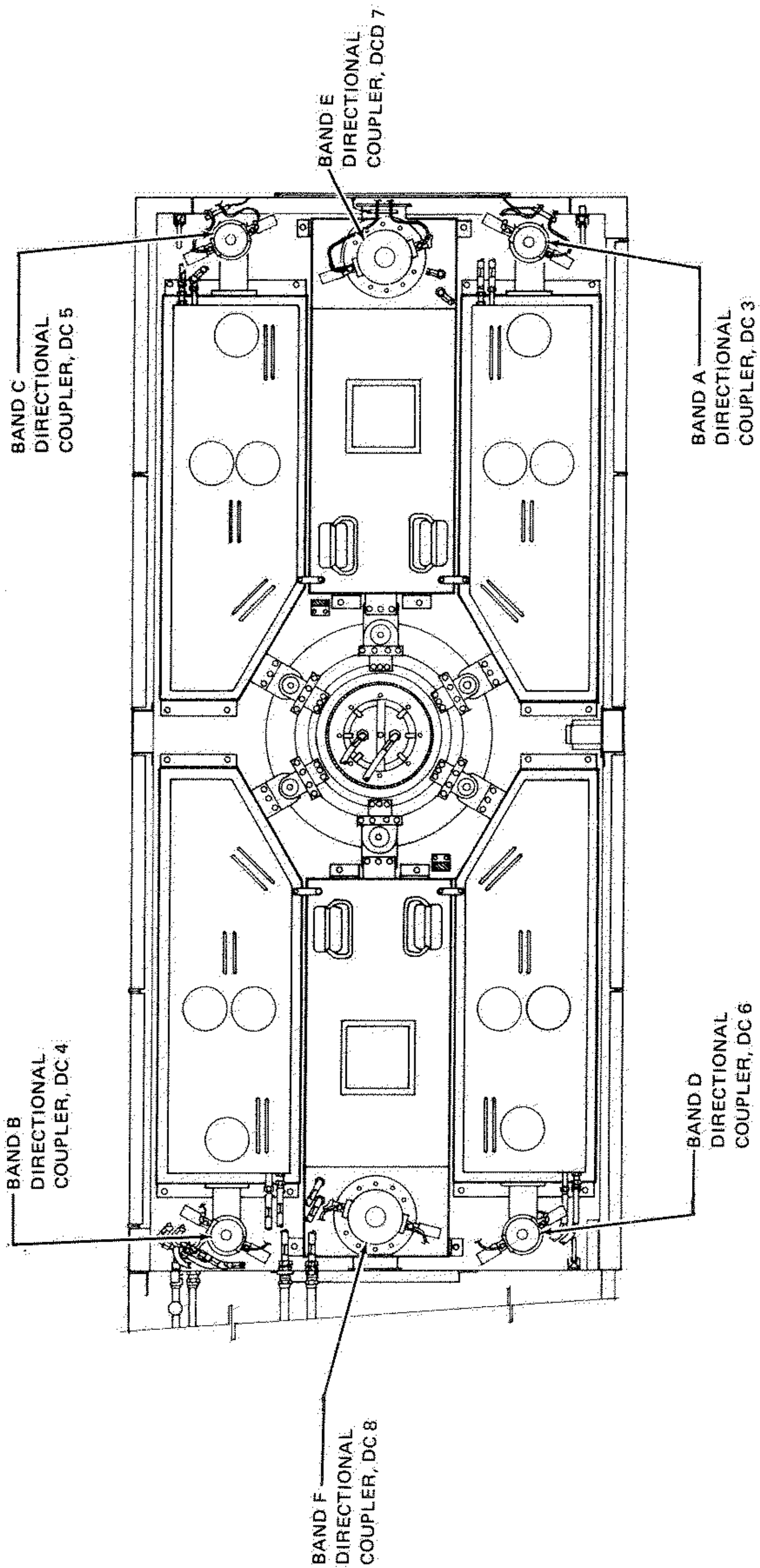


Figure 6-98. Directional Couplers

2. Move two adapter plates against upper coupler housing and align mounting holes. Install and finger-tighten ten hex bolts, five in each adapter plate. Install two Allen-head screws in the two-piece collar assembly. Tighten down ten hex bolts.

3. Install four hex bolts in two parts of collar assembly.

4. Rotate two stabilizer rods cw and install them on mounting flange of coupler.

5. Install all-thread studs in two stabilizer rods and remove double hex nuts.

6. Support at bottom of coupler may be terminated.

7. Install four N-type coaxial connectors on coupler.

8. Attach four attenuator assemblies to coupler.

9. If Band-E or F coupler was replaced, reinstall Band-E or F filter according to paragraph 6-5.23.2 steps 1 through 7, then proceed to step 11.

10. If Bands-A through D coupler was replaced, install coaxial clamps (short side down) to attach output filter to coupler. Flex RF band apart and place it around coupler and filter flanges. Secure with vise-grip pliers and install three Phillips head screws in band.

11. While supporting RF transfer switch, remove wood blocks and carefully position switch onto studs on coupler flange. Replace and tighten hex nuts securing transfer switch to coupler.

12. Re-engage J-hooks on dummy load port transmission line and tighten.

13. Follow procedure in paragraph 6-2.2.2 to exit cabinet. Perform RF Radiation Hazard Check per paragraph 6-10.1 at transfer switch bottom flange and at coupler penetration area on top of cabinet.

6-5.26 <u>HVPS Electronic Crowbar</u>. Electronic Crowbar 2A1 is mounted against the inner rear wall of cabinet 2.

6-5.26.1 <u>Electronic Crowbar 2A1 Removal</u>. Refer to Figure 6-99 and perform the following.

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
2	7o	Open End Wrench
1	7t	Open End Wrench
1	7u	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

WARNING
PERSONNEL BURN HAZARD

Either allow time for Heat Lamp HR1 to cool down or use heat-resistant gloves while removing bulb. Failure to do so may result in painful burns.

2. Turn heat lamp bulb ccw and remove from socket.

3. Tag and disconnect wiring lugs from TB1. Remove wiring harness and fold it away from crowbar chassis.

4. Disconnect bus lead from top of vacuum tube V1.

5. Disconnect coaxial cable from J1 and disconnect cable clamp from side of crowbar.

6. Remove ground bus from E2 on right side of crowbar.

7. One person supports the crowbar chassis. Second person removes four hex nuts from rear wall.

6-5.26.2 Electronic Crowbar 2A1 Installation. Refer to Figure 6-99 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
2	7o	Open End Wrench
1	7t	Open End Wrench
1	7u	Open End Wrench

CAUTION
EQUIPMENT DAMAGE HAZARD

When handling crowbar assembly, keep assembly upright and handle gently to avoid splashing mercury in tube 2A1V1.

1. Lift crowbar chassis onto mounting post. One person shall support chassis while second person installs four hex nuts.

2. Connect bus lead to top of vacuum tube V1.

3. Connect ground bus to E2 on right side of crowbar.

4. Connect coaxial cable to J1 and cable clamp to side of crowbar.

5. Connect wiring harness to TB1 and remove tags.

6. Screw heat lamp cw into socket.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Follow procedure in steps 1 through 4 of paragraph 6-2.4.2 to exit cabinet.Perform steps 7 and 8 of paragraph 4-6.1.

8. Perform procedures in steps 1 through 8 of paragraph 4-6.2.2 to operate transmitter in LOCAL mode in Band C.

NOTE

If crowbar fires immediately when HV is applied, wait 15 to 30 minutes for crowbar heat lamp to heat the tube 2A1V1 before re-applying HV.

9. Select POWER AMPL (PA) position of SCREEN/ANODE HVDC switch 2A2S3 on HVPS cabinet 2. After warmup delay, press HV ON switch on CONTROL/STATUS panel

10. While observing DC POWER SUPPLIES-ANODE (KV) meter 2A3M5, another person momentarily presses CROWBAR TEST switch 1A9S1 at cabinet 1. ANODE (KV) meter should immediately drop to zero (crowbar tube fired) and sound of HV contactor opening in cabinet 2 should be heard. If indications are not obtained refer to trouble-shooting in paragraph 6-8.6. In addition at cabinet 1, CROWBAR light 1A1DS3 should be on. If not, perform step 1 of paragraph 6-5.26.1 and adjust 2A1R12 on electronic crowbar chassis slightly cw.

11. Repeat steps 7 through 10 until CROWBAR light comes on. If adjustment limit is reached and light still will not light, refer to troubleshooting paragraph 6-8.6.

12. Refer to paragraph 4-6.2 to restore desired transmitter operation.

6-5.27 HVPS Electronic Motor Controller and Variable Transformer. Electronic Motor Controller 2A4 and Variable Transformer 2T24 are located in cabinet 2, mounted near the right door.

6-5.27.1 Electronic Motor Controller 2A4 Removal. Refer to Figure 6-100 and perform the following.

Tools and Test Equipment Required:
(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7o	Open End Wrench
1	7t	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

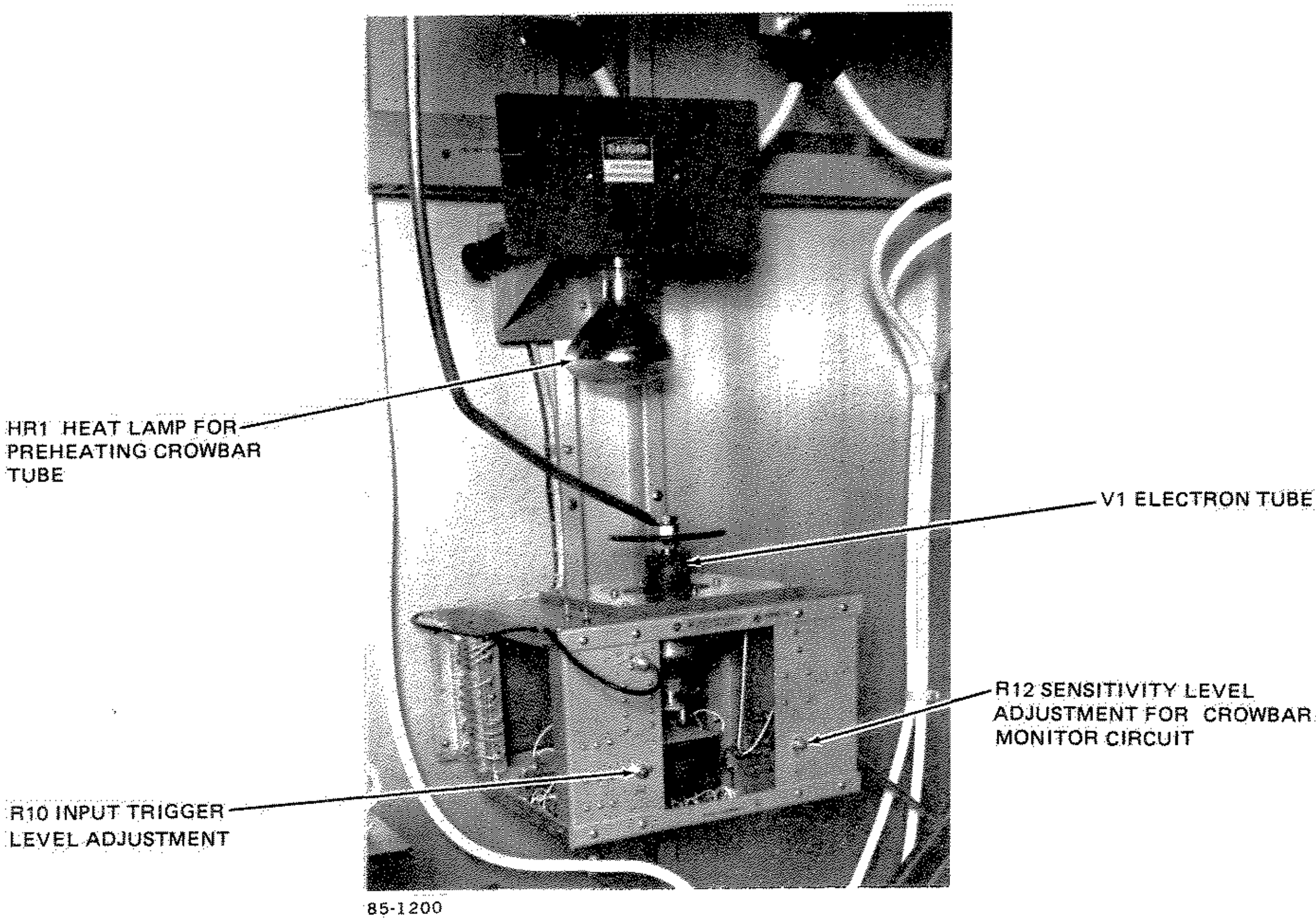


Figure 6-99. Electronic Crowbar

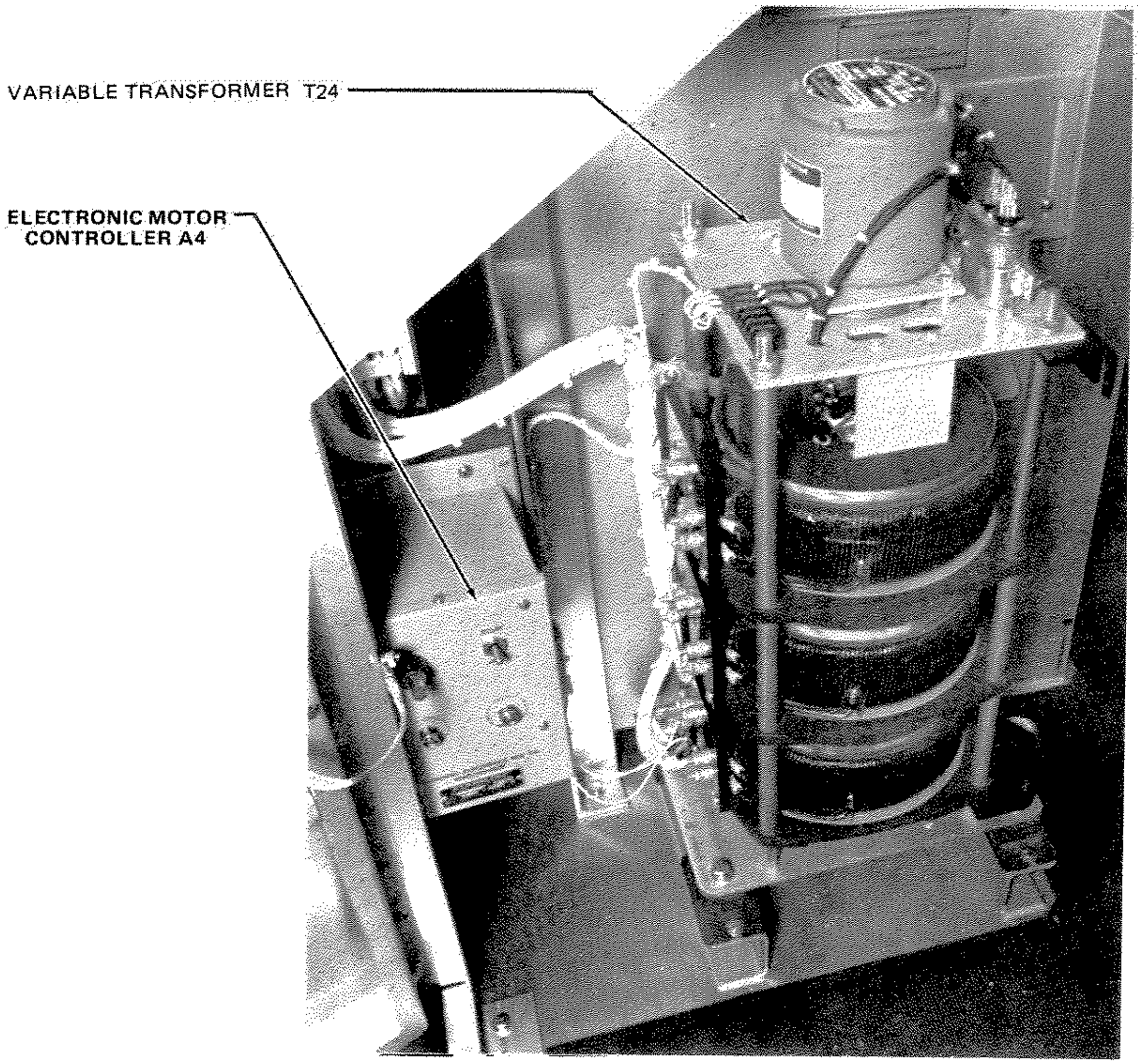


Figure 6-100. HVPS Electronic Motor Controller and Variable Transformer

2. Disconnect control wiring harness. Tag and remove three wires from bottom of transformer.

3. Tag and remove four wires from top of transformer.

4. Remove two cable clamps from right side of controller.

5. Remove two screws that secure controller to railing.

6. Remove four screws from flanges of controller chassis and lift from wall mounting rails.

6-5.27.2 Electronic Motor Controller 2A4 Installation. Refer to Figure 6-100 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7o	Open End Wrench
1	7t	Open End Wrench

1. Position controller against wall mounting rails and install four screws.

2. Install two screws to secure controller to railing.

3. Connect control wiring harness. Install four wires on top of transformer and remove tags.

4. Install three wires on bottom of transformer and remove tags.

5. Install two cable clamps on right side of controller.

6. Perform alignment procedures in paragraph 6-6.3.2.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.27.3 Variable Transformer 2T24 Removal. Refer to Figure 6-100 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
2	7o	Open End Wrench
1	7p	Open End Wrench
1	1p	Hand truck

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove four wires from terminal board at top.

3. Tag and remove all cables and wires from left side.

4. Remove three cable clamps from left side.

5. Disconnect grounding strap from bottom right side.

6. Remove four hex-head bolts securing transformer to mounting plate. Place transformer on hand truck and remove.

6-5.27.4 Variable Transformer 2T24 Installation. Refer to Figure 6-100 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
2	7o	Open End Wrench
1	7p	Open End Wrench
1	1p	Hand truck

1. Place transformer on mounting plate. Align mounting holes and install four hex-head bolts.

2. Connect grounding strap to bottom right side.

3. Install four wires on terminal board at top. Remove tags.

4. Install all wires and cables on left side of transformer. Remove tags.

5. Install three cable clamps on left side.

6. Perform alignment procedure in paragraph 6-6.3.2.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

4. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.27.5 Transformer Current Monitor circuit Card Assembly 2A5,2A6 or 2A2 Removal and Installation

WARNING
HIGH VOLTAGE HAZARD

FAILURE TO FOLLOW APPROVED ACCESS PROCEDURE MAY RESULT IN DEATH OR INJURY TO PERSONNEL.

1. Follow procedures in paragraph 6-2.4.1 to access cabinet.

2. Removal and installation of circuit card assembly in holder is self-evident.

3. Perform appropriate AC overload test (paragraph 6-6.3.1.2.2)

4. Perform procedures in paragraph 6-2.4.2 to exit the cabinet and restore transmitter operation.

6-5.28 HVPS Grounding Lever Switch. Switch 2S2 is located in cabinet 2. It is mounted on an overhead bracket near the left front door. Figure 6-101 shows the switch in the operating condition, with doors closed and contacts open.

6-5.28.1 Grounding Lever Switch 2S2 Removal. Refer to Figure 6-101 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
1	7n	Open End Wrench
2	7o	Open End Wrench
1	7t	Open End Wrench

WARNING

HIGH VOLTAGE HAZARD

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove wires from center section of switch.

3. Disconnect four grounding straps from metal rails.

4. At end of switch nearest door, remove capnut and disconnect switch from chain.

5. Support switch and remove four screws that hold two sections nearest door to ceiling. Remove switch.

6-5.28.2 Grounding Lever Switch 2S2 Installation. Refer to Figure 6-101 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

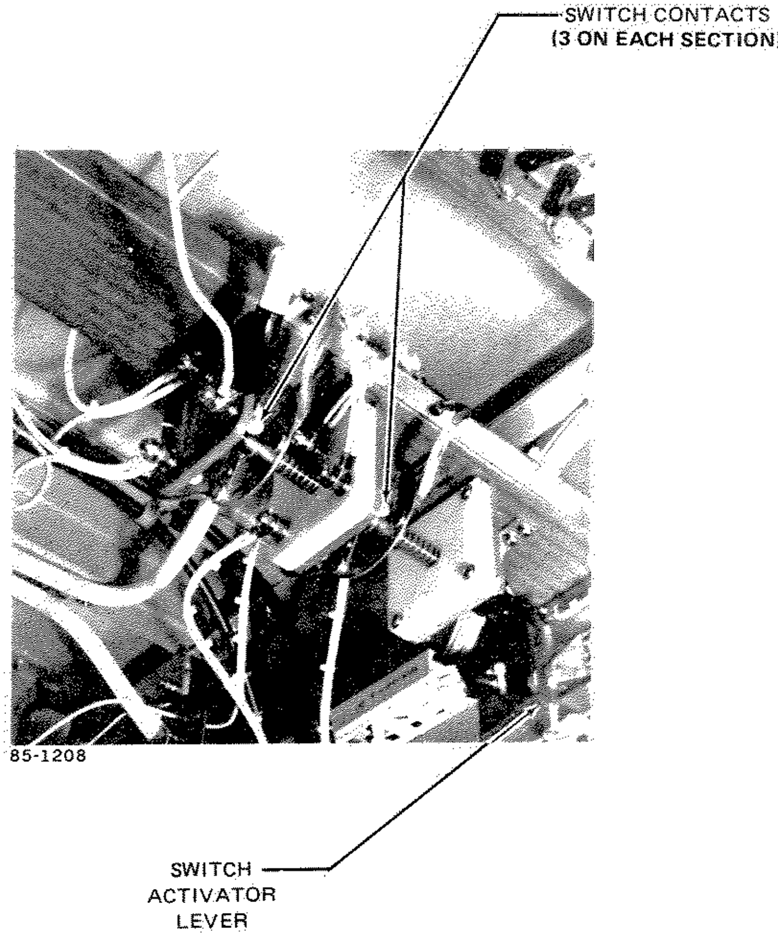
Qty	Item No.	Description
1	7e	Phillips Screwdriver
1	7n	Open End Wrench
2	7o	Open End Wrench
1	7t	Open End Wrench

1. Position and support switch and install four screws that secure two switch sections to ceiling.

2. Connect four grounding straps to metal rails.

3. At end nearest door, connect chain to switch by installing capnut.

4. Install wires on center section of switch and remove tags.



(Shown in the Operate Position)

Figure 6-101. HVPS Grounding Lever Switch

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.29 HVPS Phase Monitors. The two phase monitors are located in cabinet 2, attached to an overhead mounting bracket near the right end. Removal and installation requirements are identical for Primary Phase Monitor 2Z1 and Auxiliary Phase Monitor 2Z2. A typical set of procedures is provided.

6-5.29.1 Phase Monitor 2Z1 or 2Z2 Removal. Refer to Figure 6-102 and perform the following.

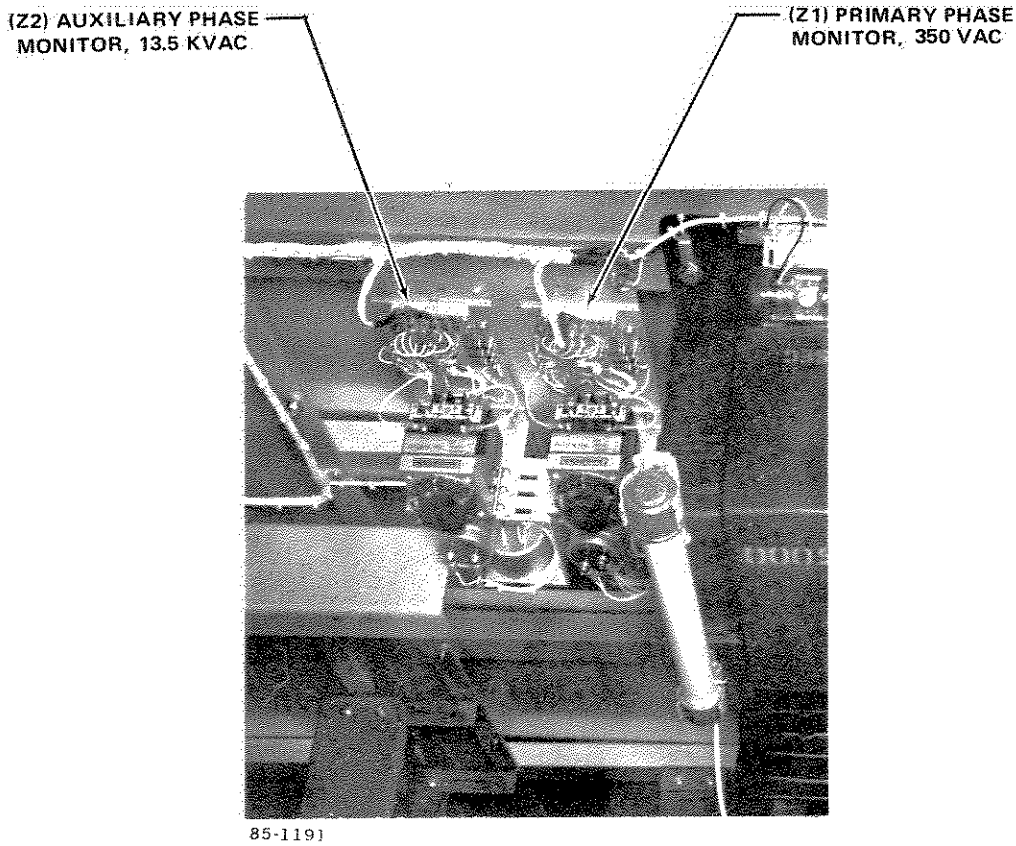


Figure 6-102. HVPS Phase Monitors

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove wires from metal capacitor. Loosen plastic clamp and remove capacitor.

3. Tag and remove wires from two terminal boards.

4. Support monitor and remove four screws that hold monitor to ceiling then remove monitor.

6-5.29.2 Phase Monitor 2Z1 or 2Z2 Installation. Refer to Figure 6-102 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7c	Flat Blade Screwdriver
1	7e	Phillips Screwdriver

1. Lift phase monitor to mounting bracket and align mounting holes. Install four screws.

2. Connect wires to two terminal boards and remove tags.

3. Loosen plastic clamp, as necessary, and install metal capacitor. Install wires on capacitor and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

4. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.30 Capacitors 2C4-2C11. Capacitors 2C4 through 2C11 are floor-mounted, between 2L1 and 2T1.

6-5.30.1 Capacitors 2C4-2C11 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	1p	Hand truck
1	7k	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7w	Ratchet Wrench
1	7zc	7\16 Socket

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Position ramp portion of platform at right door. Remove four bolts and remove doorstop from cabinet floor.

3. Disconnect dual-resistor assembly from upper mounting bus bar.

4. Remove nut, lockwasher, and washer that secure dual-resistor assembly to outside capacitor terminal. Remove dual-resistor assembly.

5. Disconnect L-bracket from lower mounting bus bar.

6. Remove nut, lockwasher, and washer that secure L-bracket to inside capacitor terminal. Remove L-bracket.

NOTE

Perform step 7 only if capacitor 2C8 is being removed.

7. Disconnect cable from bus bar that is routed to 2K6 and fold out of way.

NOTE

Perform step 8 only if capacitor 2C7 is being removed.

8. Remove bus between Electronic Crowbar 2A1 and lower mounting bus bar to provide clearance for removal of 2C7. Tie back cables connected to 2L1.

9. Disconnect leads from 2CR1 through 2CR4 as required to provide clearance for travel of hoist.

10. Remove bolt that secures capacitor to cabinet floor.

11. Position component replacement rail at installation slot (Figure 6-103). Install hoist roller assembly in rail and secure rail to cabinet.

12. Install bus strap (minimum 30-gauge wire) across base of capacitor terminals. Install lift bar on capacitor terminals with two lockwashers, two washers, and two nuts. Tighten nuts down firmly; do not apply excessive force.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when raising and moving capacitor. Components in cabinet are close-fitting and failure to comply may result in damage.

13. Lift capacitor with hoist. Rotate capacitor then move and lower capacitor to hand truck.

14. Remove two nuts, two washers, and two lockwashers from capacitor terminals and remove lift bar.

6-5.30.2 Capacitors 2C4-2C11 Installation.
Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	1p	Hand truck
1	7k	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench

1. Move capacitor into cabinet with hand truck. Install lift bar on capacitor terminals with two lockwashers, two washers, and two nuts. Tighten nuts down firmly; do not use excessive force.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when raising and moving capacitor. Components in cabinet are close-fitting and failure to comply may result in equipment damage.

2. Lift capacitor with hoist and move into position. Remove handling lift from cabinet.

3. Remove lift bar from capacitor terminals.

4. Install bolt to secure capacitor to cabinet floor.

5. Check capacitor terminals for bus strap. If one exists, remove it. Install L-bracket on inside capacitor terminal with lockwasher, washer, and nut. Tighten nut down firmly; do not use excessive force.

NOTE

For 2C7 installation only, replace bus between Electronic Crowbar and lower bus bar that was removed in order to access 2C7. Release tied back cables to 2L1.

6. Connect L-bracket to lower mounting bar.

7. Install dual-resistor assembly on outside capacitor terminal with lockwasher, washer, and nut. Tighten nut down firmly; do not use excessive force.

8. Connect dual-resistor assembly to upper mounting bar.

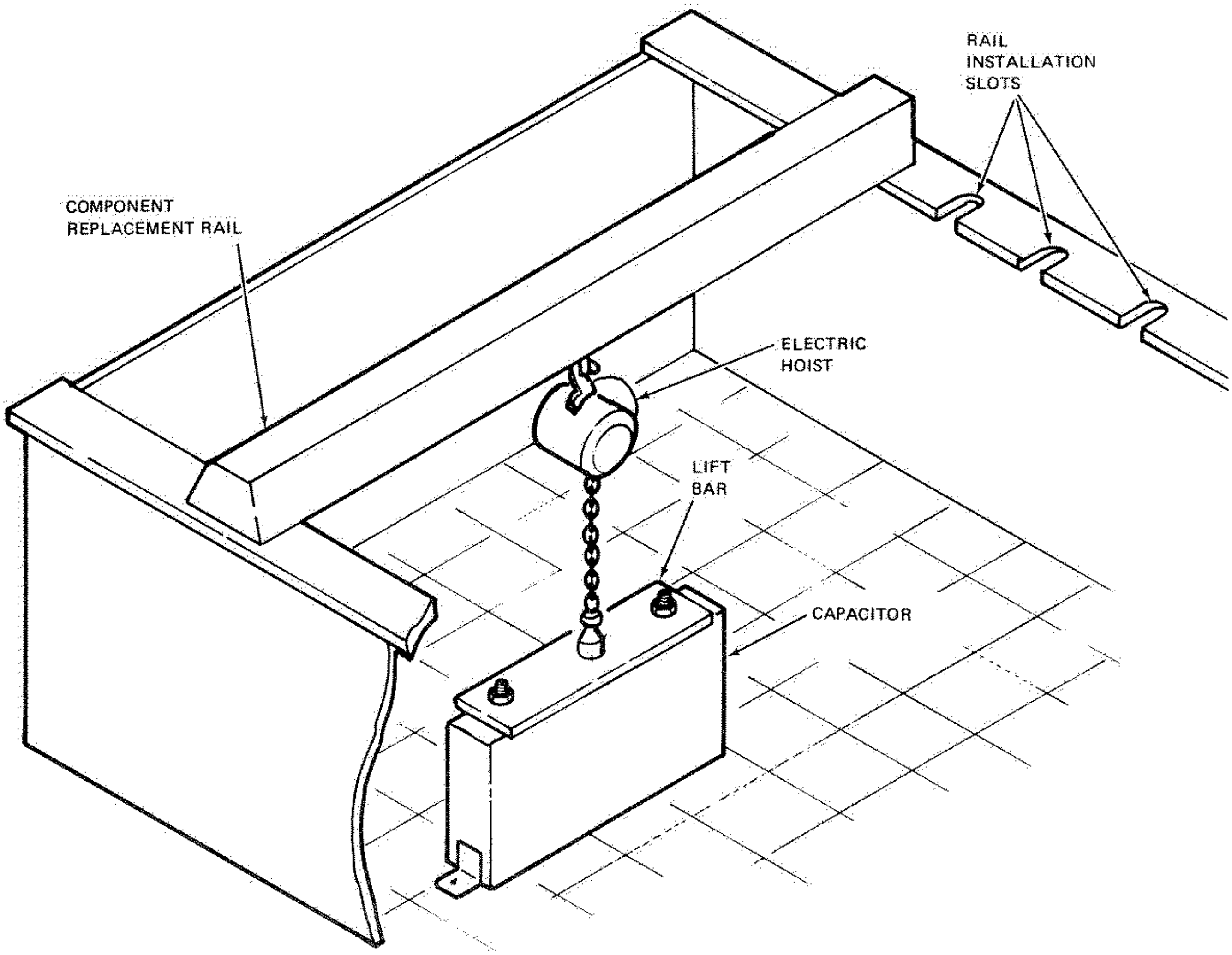


Figure 6-103. Component Replacement Rail Usage (Typical)

9. Remove hoist from rail. Remove platform ramp. Install door-stop on floor.

10. Reconnect leads from 2CR1 through 2CR4 which were removed to allow travel of hoist.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

11. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.31 Capacitors 2C12, 2C19, and 2C25. Capacitors 2C12, 2C19, and 2C25 are shelf-mounted on wall to immediate right as left door is entered.

6-5.31.1 Capacitors 2C12, 2C19, and 2C25 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7k	Open End Wrench
1	7o	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove two wires from left terminal. Tag and remove three wires from right terminal.

3. Remove nut, washer, and lockwasher from bottom of threaded rod. Push rod up through retaining bracket and set aside. Repeat at opposite side. Install bus strap (30-gauge wire) across base of capacitor terminals.

4. Two persons slide capacitor forward until it can be supported from beneath by hand. Lift and remove capacitor.

6-5.31.2 Capacitors 2C12, 2C19, and 2C25 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7k	Open End Wrench
1	7o	Open End Wrench

1. Two persons lift capacitor onto shelf and move into position.

2. Check terminals for bus strap. If one exists, remove it. Install wires on left and right terminals. Remove tags.

3. Insert threaded rod, capnut up, through top of retaining bracket and down through hole in shelf. Install lockwasher, washer, and nut on bottom of rod. Finger-tighten nut. Repeat at opposite side.

4. Tighten nuts at bottoms of threaded rods with wrench until firm against shelf. Do not over-tighten.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.32 Capacitors 2C17, 2C18, 2C23, and 2C24. Capacitors 2C17, 2C18, 2C23, and 2C24 are mounted in equipment rack on left side of cabinet, near rear wall.

6-5.32.1 Capacitors 2C17, 2C18, 2C23, and 2C24 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	1p	Hand truck
1	7k	Open End Wrench
1	7p	Open End Wrench
1	7w	Ratchet Wrench
1	7zc	7\16 Socket
1	7zf	9\16 Socket

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Position ramp portion of platform at left door. Remove four bolts and remove doorstop from cabinet floor.

3. Tag wires on terminals. Remove two nuts, two lockwashers, two washers, and wires.

4. Remove nut, washer, and lockwasher from bottom of threaded rod. Push rod up through retaining bracket and set aside. Repeat at opposite side.

5. Position component replacement rail at installation slot (Figure 6-103). Install hoist roller assembly in rail and secure rail to cabinet.

6. Install bus strap (30-gauge wire) across base of capacitor terminals. Install lift bar on terminals with two lockwashers, two washers, and two nuts. Tighten nuts down firmly; do not apply excessive force.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when raising and moving capacitor. Components in cabinet are close-fitting and failure to comply may result in equipment damage.

7. Lift capacitor with hoist. Move and lower capacitor to hand truck.

8. Remove lift bar from terminals.

6-5.32.2 Capacitors 2C17, 2C18, 2C23, and 2C24 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	1p	Hand truck
1	7k	Open End Wrench
1	7p	Open End Wrench
1	7w	Ratchet Wrench
1	7zc	7\16 Socket
1	7zf	9\16 Socket

1. Move capacitor into cabinet with hand truck. Install lift bar on terminals with two lockwashers, two washers, and two nuts. Tighten nuts down firmly; do not use excessive force.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when raising and moving capacitor. Components in cabinet are close-fitting and failure to comply may result in equipment damage.

2. Lift capacitor with hoist and move into position for installation.

3. Remove lift bar from terminals. Check terminals for bus strap. If one exists, remove it. Remove hand truck from cabinet.

4. Insert threaded rod, capnut up, through top of retaining bracket and down through hole in rack. Install lockwasher, washer, and nut on bottom of rod. Finger-tighten nut. Repeat at opposite side.

5. Alternately tighten nuts at bottoms of threaded rods until firm against rack. Do not over-tighten.

6. Install wires on terminals with two lockwashers, two washers, and two nuts. Tighten nuts down firmly; do not use excessive force.

7. Remove hoist from component replacement rail. Remove platform ramp. Install door-stop on floor with four bolts.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

8. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.33 Rectifiers 2CR1-2CR3. Rectifiers are suspended from ceiling in a line, left to right, in order listed. First rectifier, 2CR1, is above crowbar 2A1.

6-5.33.1 Rectifier Assemblies 2CR1-2CR3 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7k	Open End Wrench
2	7o	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove cables from front (-) and rear (+) ends of rectifier.

3. One person support rectifier. Second person remove two nylon nuts from rear bracket, then two nuts and two bolts from front bracket. Remove rectifier.

6-5.33.2 Rectifier Assemblies 2CR1-2CR3 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7k	Open End Wrench
2	7o	Open End Wrench

CAUTION
EQUIPMENT DAMAGE HAZARD

If (-) end of rectifier is not installed nearest front of cabinet, equipment damage may result.

1. Position rectifier for installation. One person support rectifier while second person installs two nuts and two bolts on front bracket, then two nylon nuts on rear bracket.

2. Install cables at rear (+) and front (-) ends of rectifier. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

3. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.34 Rectifiers 2CR4-2CR6. Rectifiers are suspended from ceiling in a line, left to right, in order listed. Rectifier 2CR6 is near right end wall.

6-5.34.1 Rectifiers 2CR4-2CR6 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7k	Open End Wrench
2	7o	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove cables from front (+) and rear (-) ends of rectifier.

3. One person support rectifier. Second person remove two nylon nuts from rear bracket, then two nuts and two bolts from front bracket. Remove rectifier.

6-5.34.2 Rectifiers 2CR4-2CR6 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7k	Open End Wrench
2	7o	Open End Wrench

CAUTION
EQUIPMENT DAMAGE HAZARD

If (+) end of rectifier is not installed nearest front of cabinet, equipment damage may result.

1. Position rectifier for installation. One person support rectifier while second person installs two nut and two bolts on front bracket, then two nylon nuts on rear bracket.

2. Install cables at front (+) and rear (-) ends of rectifier. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

3. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.35 Rectifiers 2CR7 Through 2CR12. Rectifiers are on two vertical mounts on equipment rack at left side of cabinet, near rear wall.

6-5.35.1 Rectifiers 2CR7 Through 2CR12 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7i	Open End Wrench
1	7k	Open End Wrench
1	7g	Phillips Screwdriver, offset

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove wires from front (+) and rear (-) ends of rectifier.

3. Tag and remove wire from bottom of rectifier.

4. Loosen nut at each end, then remove rectifier.

6-5.35.2 Rectifiers 2CR7 Through 2CR12 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7k	Open End Wrench
1	7i	Open End Wrench
1	7g	Phillips, Screwdriver, Offset

CAUTION
EQUIPMENT DAMAGE HAZARD

If (+) end of rectifier is not installed nearest front of cabinet, equipment damage may occur.

1. Position rectifier with (+) end nearest cabinet front. Tighten nut at (+) end to secure to mount.

2. Install wire at bottom of rectifier and remove tag.

3. Install wires at (+) and (-) ends and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

4. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.36 Relay 2K1. Relay 2K1 is mounted on right end wall, above 2T1 and left of 2K2 and 2K3.

6-5.36.1 Relay 2K1 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7ac	Socket

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove eight wires from terminal board on right side of relay.

3. Tag and remove cables from relay.

4. Remove eight bolts, eight lockwashers, and eight washers that secure four support brackets to mounting strip. Remove four support brackets.

5. One person support relay. Second person remove four nuts, four lockwashers, and four washers that secure relay to mounting strip. Remove relay.

6-5.36.2 Relay 2K1 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7w	Ratchet
1	7x	Ratchet Extension
1	7ac	Socket

1. Position relay. One person support relay while second person installs four washers, four lockwashers, and four nuts to secure base of relay to mounting strip.

2. Position support bracket and install two bolts, two washers, and two lockwashers. Repeat for remaining three support brackets.

3. Install cables on relay. Remove tags.

4. Install eight wires on terminal board on right side of relay. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.37 Relay 2K2. Relay 2K2 is mounted on right end wall, above 2T1.

6-5.37.1 Relay 2K2 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
1	7b	Flat Blade Screwdriver

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.
2. Tag and remove seven wires from relay.
3. Support relay and remove two screws that secure relay to mounting board.

6-5.37.2 Relay 2K2 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7e	Phillips Screwdriver
1	7b	Flat Blade Screwdriver

1. Position and support relay. Install two screws to secure relay to mounting board.
2. Install seven wires on relay and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

3. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.38 Relay 2K3. Relay 2K3 is mounted on right end cabinet wall, above 2T1 and to right of 2K2.

6-5.38.1 Relay 2K3 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7e	Phillips Screwdriver

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.
2. Tag and remove four wires from left side of relay.
3. Tag and remove three wires from top of relay.
4. Tag and remove three wires from bottom of relay.
5. Support relay and remove two screws that secure relay to mounting board.

6-5.38.2 Relay 2K3 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7e	Phillips Screwdriver

1. Position and support relay. Install two screws to secure it to mounting board.
2. Install three wires on bottom of relay and remove tags.
3. Install three wires on top of relay and remove tags.
4. Install four wires on left side of relay and remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.39 Relay 2K6. Relay 2K6 is mounted on rear wall, far right side.

6-5.39.1 Relay 2K6 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7i	Open End Wrench
1	7o	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove cables from relay.

3. Tag and remove ten wires from terminal board on left side of relay.

4. Remove two bolts, two washers, and two lockwashers and two nuts that secure support bracket to mounting strip at left side of relay base plate. Remove support bracket. Repeat for opposite side.

5. Support relay and remove four nuts, four lockwashers, and four washers that secure base plate to mounting strip. Remove relay and base plate from mounting strip.

6. Remove four nuts, four lock-washers, four bolts, and four washers that secure relay to base plate. Retain base plate for use on replacement relay.

6-5.39.2 Relay 2K6 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7i	Open End Wrench
1	7o	Open End Wrench

1. Position relay on base plate and install four bolts, four washers, four lockwashers, and four nuts to secure relay to base plate.

2. Position relay on mounting strip. Support relay and install four washers, four lockwashers, and four nuts to secure base plate to mounting strip.

3. Position support bracket on left side of base plate and install two washer, two lockwashers, and two bolts to secure bracket to mounting strip. Repeat for opposite side.

4. Install ten wires on terminal board on left side of relay. Remove tags.

5. Install cables on front and back of relay. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

6. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.40 Reactor 2L1. Reactor 2L1 is floor-mounted near rear wall, beneath Electronic Crowbar 2A1.

6-5.40.1 Reactor 2L1 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1f	Heavy Component Handling Lift (Short-Reach)
1	1h	Material Handling Platform
1	1q	Forklift
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
2	7o	Open End Wrench
2	7p	Open End Wrench
2	9k	Nylon Sling

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet. Roll up rubber floor mats inside and outside of cabinet.

2. Position platform at left door. Remove four bolts and remove door-stop from cabinet floor.

3. Tag and remove two wires from terminals at upper right side of reactor.

4. Remove six bolts, washers, lockwashers, and nuts and remove ground strap at lower right side of reactor.

5. Remove four nuts, four lock-washers, four bolts, and four washers that secure base of reactor to shock mounts.

6. Position heavy component handling lift so left fork slides under reactor inside left mounting rail and right fork is aligned outside right mounting rail. (See Figure 6-154).

7. Lift reactor from shock mounts with handling lift.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving reactor from cabinet. Components in cabinet are close-fitting and failure to comply may result in equipment damage. Do not roll equipment down access ramp.

8. Move handling lift and reactor out of cabinet and onto platform and remove from handling lift with fork lift and slings.

6-5.40.2 Reactor 2L1 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1f	Heavy Component Handling Lift (Short-Reach)
1	1h	Material Handling Platform
1	1q	Forklift
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
2	7o	Open End Wrench
2	7p	Open End Wrench
2	9k	Nylon Sling

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving reactor into position for installation. Components in cabinet are close-fitting and failure to comply may result in equipment damage.

1. Move reactor into position with heavy component handling lift. Verify four rubber shock mounts are lined up with holes in mounting rails.

2. Lower reactor until barely touching shock mounts. Install four washers, four bolts, four lock-washers, and four nuts. Finish lowering reactor and tighten down hardware finger tight to secure base to mounting rails.

3. Remove handling lift from cabinet.

4. Install two wires on terminals at upper right side. Remove tags.

5. Reinstall ground strap with six bolts, washers, lockwashers, and nuts.

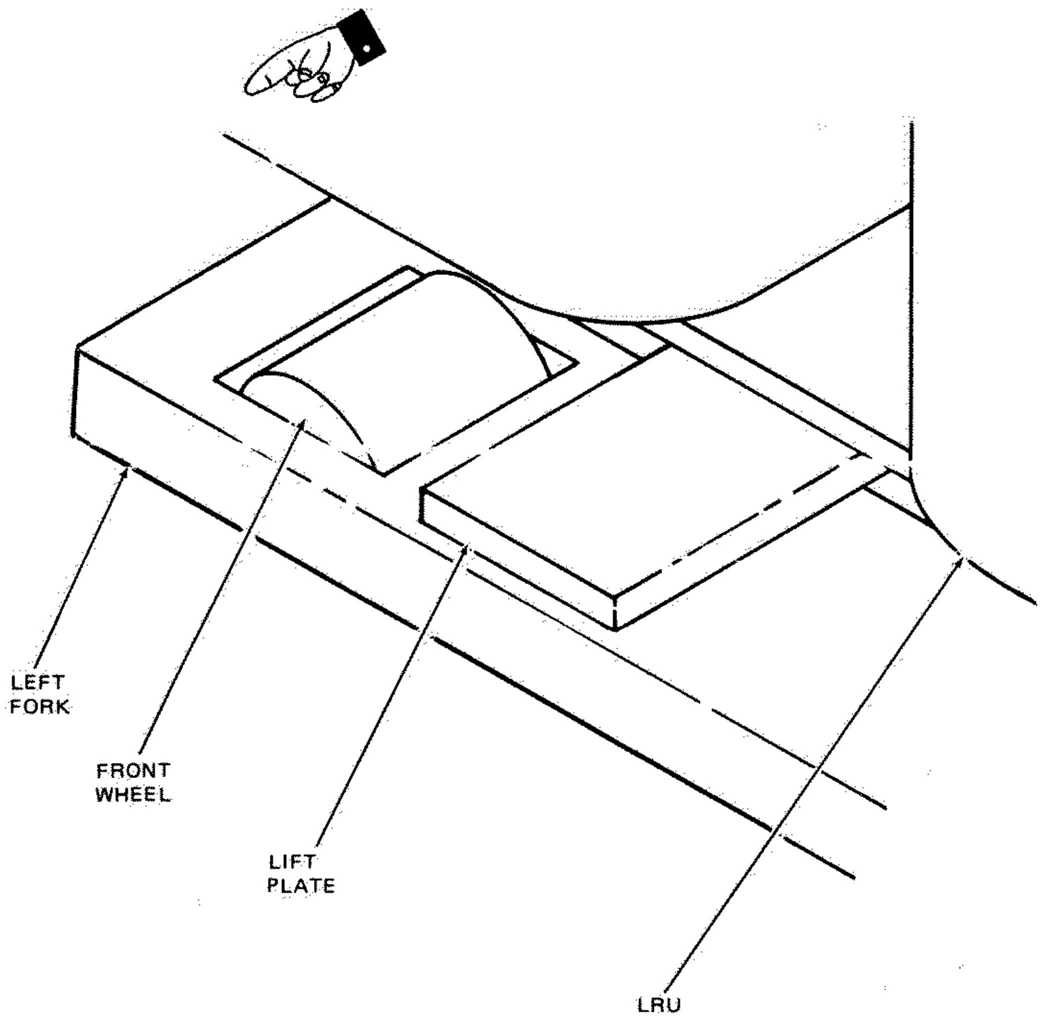


Figure 6-104. Lift Plate Installation

6. Remove platform. Position door-stop and install four bolts to secure to cabinet floor.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Reposition rubbers mats inside and outside cabinet. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.41 Reactors 2L2, 2L5, and 2L8. Reactors 2L2, 2L5, and 2L8 are located just inside the left door and to the right.

6-5.41.1 Reactors 2L2, 2L5, and 2L8 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver (2L2 only)
1	7e	Phillips Screwdriver (2L5, 2L8 only)
1	7i	Open End Wrench (2L5, 2L8 Only)
1	7o	Open End Wrench (2L2 Only)

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove wires from terminals on left and right sides of reactor.

3. Support reactor and remove four nuts, four lockwashers, four washers, and four bolts from base.

6-5.41.2 Reactors 2L2, 2L5, and 2L8 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7i	Open End Wrench (2L5, 2L8 Only)
1	7o	Open End Wrench (2L2 Only)

1. Position and support reactor. Install four bolts, four lockwashers, four washers, and four nuts to secure reactor base to mounting plate.

2. Install wires on terminals on left and right sides of reactor. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

3. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.42 Resistor 2R38. Resistor 2R38 is ceiling-mounted, left of Rectifier 2CR1.

6-5.42.1 Resistor 2R38 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove cable from end of resistor nearest rear wall.

3. Tag cable at front of resistor. Remove cable and metal bar.

4. Support resistor by hand and loosen retaining nut at each end. Move forward end of resistor downward and pull toward front of cabinet to remove.

6-5.42.2 Resistor 2R38 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench

1. Position and support resistor. Tighten retaining nut at each end.

2. Install cable on end of resistor nearest rear wall and remove tag.

3. Install cable and metal bar on front of resistor. Remove tag.

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit may result in equipment damage.

4. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.43 Resistor 2R39. Resistor 2R39 is ceiling-mounted, left of Rectifier 2CR1 and forward of Resistor 2R38.

6-5.43.1 Resistor 2R39 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench

WARNING

HIGH VOLTAGE HAZARD

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove cable from rear of resistor (end nearest 2R38).

CAUTION

EQUIPMENT DAMAGE HAZARD

Support resistor by hand while performing next step. Resistor flexes with force applied and failure to comply may result in damage to equipment.

3. Tag and remove two cables from front of resistor.

4. Loosen nut at each end of resistor. Move forward end downward and pull toward front of cabinet to remove.

6-5.43.2 Resistor 2R39 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench

1. Position and support resistor. Tighten retaining nut at each end to secure to mounts.

2. Install cable on rear of resistor and remove tag.

CAUTION

EQUIPMENT DAMAGE HAZARD

Support resistor by hand while performing next step. Resistor flexes with force applied and failure to comply may result in damage to equipment.

3. Install two cables on front end of resistor. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

4. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.44 Transformer 2T1. Transformer 2T1 is floor-mounted near right end wall.

6-5.44.1 Transformer 2T1 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1e	Heavy Component Handling Lift with 2 lift plates
1	1h	Material Handling Platform
1	1q	Forklift
1	7k	Open End Wrench
2	7o	Open End Wrench
1	9m	Tape, Rule
	from Table 6-1	
12	12	2" X 4" X 1' plank

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet. Pin right cabinet door open.

2. Position platform at right door. Center platform between cabinet 1 and adjacent support column. Remove four bolts and remove door-stop from cabinet floor.

3. Tag and remove three cables from upper left side of transformer.

4. Tag and remove four cables from upper right side of transformer.

5. Remove 3 bolts, washers, lockwashers and nuts securing grounding strap from lower right side of transformer. Fold completly under edge of cabinet mounting rail.

6. Remove four bolts, washers, lockwashers and nuts that secure base of transformer to shock mounts on mounting rails.

7. Using heavy component handling lift with a lifting plate across front of forks, lift front of transformer approximately 1 inch. Insert second lifting plate between mounting rail and transformer and center it at 35 inches from front of transformer. Make sure lifting plate is also centered under transformer from side to side. Lower front of transformer and remove lifting plate from front of forks.

8. Position handling lift so forks straddle transformer mounting rails and are centered under lifting plate from side to side. Move handling lift forward until firm against transformer.

9. Verify lift plate is behind front wheel of forks, is centered across forks and is lined up straight across forks (Figure 6-104).

10. Lift transformer from shock mounts with handling lift.

WARNING
WEIGHT HAZARD
EQUIPMENT DAMAGE HAZARD

All personnel shall stand clear when transformer is moved or raised in following steps. Be careful when moving transformer from cabinet. Components in cabi-net are close-fitting and failure to comply may result in equipment damage.

11. Move handling lift and transformer out of cabinet and onto platform.

12. Position handling lift so that front steering wheels are 2 inches from front of platform. Raise transformer as required and insert 2 stacks, 3 pieces each, of 1 foot long 2" X 4" wood stock at each end of transformer. Center the wood crossways under core and

rails of transformer. Lower lift until transformer is supported by wood blocking, then remove lift.

13. Remove ramp and position fork lift and forks so that forks stradle wood blocks with about 1 inch of clearance. Place a lifting plate across forks at extreme rear of forks. Carefully extend forks until lift guard is firmly against transformer.

14. Insert second lifting plate under transformer on forks so that it is centered no less than 31 inches from front edge of transformer against forklift. Also make sure that plate is centered across forks.

15. Raise lift until both lift plates contact transformer. Tilt forks back until rear of transformer lifts 6 inches from wood blocks; then raise forks to clear front blocks. Remove transformer from handling platform.

6-5.44.2 Transformer 2T1 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1e	Heavy Component Handling Lift with 2 lift plates
1	1h	Material Handling Platform
1	1q	Forklift
1	7k	Open End Wrench
2	7o	Open End Wrench
1	9m	Tape, Rule
		(from Table 6-1)
12	11	2" X 4" plank

WARNING
WEIGHT HAZARD
EQUIPMENT DAMAGE HAZARD

All personnel shall stand clear when transformer is moved or raised in following steps. Be careful when moving transformer into cabinet. Componets are close-fitting and failure to comply may result in equipment damage.

1. Load replacement transformer on forklift using same method as described in paragraph 6-5.44.1 steps 13 through 15.

2. Move transformer to material platform and extend forks to position transformer far enough onto platform so that handling lift, when used, will have all wheels resting on platform.

3. Tilt lift forward until transformer is level with platform. Position 2 stacks, 3 pieces each, of 2" X 4" stock 1 foot long under each end of transformer. Position pieces centered crossways under core and rails of transformer. Lower transformer until it is supported by wood blocks. Remove forklift.

4. Replace material platform ramp and position handling lift so that forks straddle mounting rail and wood blocks. Move handling lift forward until firm against transformer. Make sure all wheels are on platform.

5. Insert lift plate slightly behind front wheels of lift, centered on forks from side to side and lined up straight across forks (Figure 6-104).

6. Lift transformer with handling lift and remove wood blocks.

7. Place rubber shock mounts over mounting holes in mounting rail in cabinet.

WARNING
PERSONNEL INJURY HAZARD

Person stationed at side of transformer is at risk of injury. Transformer weighs approximately 3000 pounds and must be moved slowly and carefully.

8 One person shall be stationed at side rear of transformer mounting position. That person's task is to notify person operating heavy component handling lift when holes in transformer base line up with holes in rubber shock mounts.

9. Verify holes in rubber shock mounts line up with holes in mounting rails.

10. Move transformer into position with handling lift. Lower transformer until just touching rubber shock mounts. Install three accessible washers, lockwashers, nuts and bolts, but do not tighten; then complete lowering of transformer.

11. Back handling lift out to front end of transformer and place a lifting plate across front of forks. Carefully lift front of transformer slightly in order to remove lifting plate at rear of transformer. Then lower transformer and remove handling lift.

12. Install fourth (right rear) mounting bolt, washers, lockwashers and nuts. Finger tighten all four mounting bolt nuts.

13. Connect grounding strap to base of transformer.

14. Install four cables on upper right side of transformer. Remove tags.

15. Install three cables on upper left side of transformer. Remove tags.

16. Remove platform. Position door-stop and install four bolts to secure to cabinet floor.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

17. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.45 Transformers 2T2, 2T25 and 2T3. Transformers 2T2 , 2T25 and 2T3 are located on right end wall toward rear of cabinet.

6-5.45.1 Transformers 2T2 and 2T3 Removal.
Tools and Test Equipment Required:
(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove two wires and two diodes from two upper left terminals. Observe polarity of diodes for reinstallation.

3. Tag and remove two wires at black resistor to right of transformer.

4. Support transformer and remove three nuts that secure transformer to mounting board.

6-5.45.2 Transformers 2T2, 2T25 and 2T3 Installation.
Tools and Test Equipment Required:
(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7o	Open End Wrench
1	7p	Open End Wrench

1. Position and support transformer. Install three nuts to secure to mounting board.

2. Install two wires on black resistor at right of transformer. Remove tags.

3. Install two wires and two diodes on two upper left terminals. Observe polarity of diodes during installation.

4. Perform AC overload test (paragraph 6-6.3.1.2.2.1)

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.46 Transformers 2T6, 2T26, 2T7, 2T10, 2T27 and 2T11. Transformers 2T6 2T26 and 2T7 are located on left end wall, above 2L3. Transformers 2T10, 2T27 and 2T11 are located on rear wall, left end, above 2C18 and 2C24.

6-5.46.1 Transformers 2T6, 2T26, 2T7, 2T1 2T27, and 2T11 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7i	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove two wires and two diodes from two terminals at upper left corner of transformer. Observe polarity of diodes for reinstallation.

3. Tag two wires running from bottom of transformer to cabinet wall. Disconnect wires from wall.

4. Tag and remove four wires from two insulated studs at right of transformer.

5. Support transformer and remove three nuts that secure transformer to mounting board.

6-5.46.2 Transformers 2T6, 2T26, 2T7, 2T10, 2T27 and 2T11 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	7i	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench

1. Position and support transformer. Install three nuts to secure to mounting board.

2. Install four wires on two insulated studs at right of transformer. Remove tags.

3. Connect two wires from bottom of transformer to cabinet wall. Remove tags.

4. Install two wires and two diodes on two upper left terminals. Observe polarity of diodes.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

5. Perform, as applicable, AC overload test. (paragraph 6-6-3.1.2.2.2 or .3)

6. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.47 Transformers 2T4, 2T8, and 2T12. Transformers 2T4, 2T8, and 2T12 are wall-mounted. They are located just inside right door, above 2T24.

6-5.47.1 Transformers 2T4, 2T8, and 2T12 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Screwdriver
1	7o	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove three wires from three terminals on right side of transformer.

3. Tag and remove wires and jumpers from terminal board on front of transformer.

4. Support transformer and remove four bolts, four lockwashers, and four washers that secure transformer to wall.

6-5.47.2 Transformers 2T4, 2T8, and 2T12 Installation. To install 2T4, 2T8, or 2T12, perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Screwdriver
1	7o	Open End Wrench

1. Position and support transformer. Install four bolts, four washers, and four lockwashers to secure to wall.

2. Install three wires on three terminals on right side of transformer. Remove tags.

3. Install wires and jumpers on terminal board on front of transformer. Remove tags.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

3. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.48 Transformer 2T5. Transformer 2T5 is floor-mounted beneath equipment rack, near left end wall.

6-5.48.1 Transformer 2T5 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1e	Heavy Component Handling Lift\ 2 Lift Plates
1	1h	Material Handling Platform
1	1q	Forklift
1	7i	Open End Wrench
2	7o	Open End Wrench
2	7p	Open End Wrench
1	7t	Open End Wrench
1	9k	Nylon Sling

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet. Roll up rubber mats inside and outside cabinet.

2. Position platform at left door. Remove four bolts and remove door-stop from cabinet floor.

3. Tag and remove four wires from terminals at upper left side of transformer.

4. Tag and remove three cables from upper right side of transformer.

5. Disconnect grounding strap from base of transformer, right side.

6. Remove four bolts, washers and nuts that secure base of transformer to mounting rails.

CAUTION
EQUIPMENT DAMAGE HAZARD

When positioning heavy component handling lift, be careful not to move forks over cable trough running along rear of cabinet. When weight of transformer is on lift, trough could be crushed.

7. Position heavy component handling lift so forks straddle mounting rails and lift is centered with transformer.

8. Position lift plate behind front wheel of left fork of lift (Figure 6-104). Slide plate under transformer base, onto right fork. Verify plate is behind front wheel of right fork, positioned straight across two forks. Install second lift plate to balance load.

9. Lift transformer from mounting rails with handling lift.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving transformer from cabinet. Components in cabinet are close-fitting and failure to comply may result in equipment damage.

10. Move handling lift and transformer out of cabinet and onto platform. Remove from handling lift with forklift and slings.

6-5.48.2 Transformer 2T5 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1e	Heavy Component Handling Lift\ 2 Lift Plates
1	1h	Material Handling Platform
1	1q	Forklift
1	7i	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7t	Open End Wrench
1	9k	Nylon Sling

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving transformer into position for installation. Components in cabinet are close-fitting. If forks of handling lift extend over cable trough along rear of cabinet, trough could be crushed when transformer is lowered into place.

1. Move transformer into position with heavy component handling lift. Verify lift forks do not extend over cable trough running along rear wall.

2. Lower transformer onto mounting rails. Install four washers, bolts and nuts to secure base of transformer to mounting rails. Tighten nuts finger tight.

3. Remove handling lift from cabinet.

4. Connect grounding pad to base of transformer.

5. Install three cables on terminals at upper right side of transformer. Remove tags.

6. Install four wires on terminals at upper left side of transformer. Remove tags.

7. Remove platform. Position door-stop and install four bolts to secure to cabinet floor.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

8. Reposition rubber mats and follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.49 Transformer 2T9. Transformer 2T9 is floor-mounted beneath equipment rack, to right of 2T5.

6-5.49.1 Transformer 2T9 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1e	Heavy Component Handling Lift\ 2 Lift Plates
1	1q	Forklift
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	7i	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7t	Open End Wrench
3	9k	Nylon Sling

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet. Roll up rubber mats inside and outside cabinet.

2. Position platform at left door. Remove four bolts and remove door-stop from cabinet floor.

3. Position component replacement rail at installation slot (Figure 6-103) nearest right edge of equipment rack containing 2L3, 2C17. Install hoist roller in rail and secure rail to cabinet.

4. Position hoist over right forward edge of equipment rack. Attach rope, chain, or nylon strap from equipment rack right forward edge railing to lift bar at bottom of hoist. Operate hoist carefully to just remove weight from right front support leg with upper bolts removed. Remove right front leg including lower angle bracket from equipment rack and set aside.

5. Tag and remove four wires from terminals at upper right side of transformer.

6. Tag and remove six cables from upper left side of transformer.

7. Disconnect grounding pad from base of transformer, left side.

8. Remove four bolts, washers and nuts that secure base of transformer to mounting rails.

CAUTION
EQUIPMENT DAMAGE HAZARD

When positioning heavy component lift, be careful not to move forks over cable trough at rear of cabinet. When weight of transformer is on lift, trough could be crushed.

9. Position heavy component lift so forks straddle mounting rails and lift is centered with transformer.

10. Position lift plate behind front wheel of left fork of lift (Figure 6-104). Slide plate under transformer base, onto right fork. Verify plate is behind front wheel of right fork, straight across two forks. Install second lift plate to balance load.

11. Lift transformer from mounting rails with handling lift.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving transformer from cabinet. Components in cabinet are close. Failure to comply may result in equipment damage.

12. Move handling lift and transformer out of cabinet and onto platform. Remove from handling lift with forklift and nylon slings.

6-5.49.2 Transformer 2T9 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1e	Heavy Component Handling Lift\ 2 Lift Plates
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	1q	Forklift
1	7i	Open End Wrench
1	7o	Open End Wrench
1	7p	Open End Wrench
1	7t	Open End Wrench
3	9k	Nylon Sling

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving transformer into position for installation. Components in cabinet are close. If forks of handling lift extend over cable trough along rear of cabinet, trough could be crushed when transformer is set in place.

1. Move transformer into position for installation with heavy component handling lift. Verify lift forks do not extend over cable trough running along rear wall.

2. Lower transformer onto mounting rails. Install four washers,

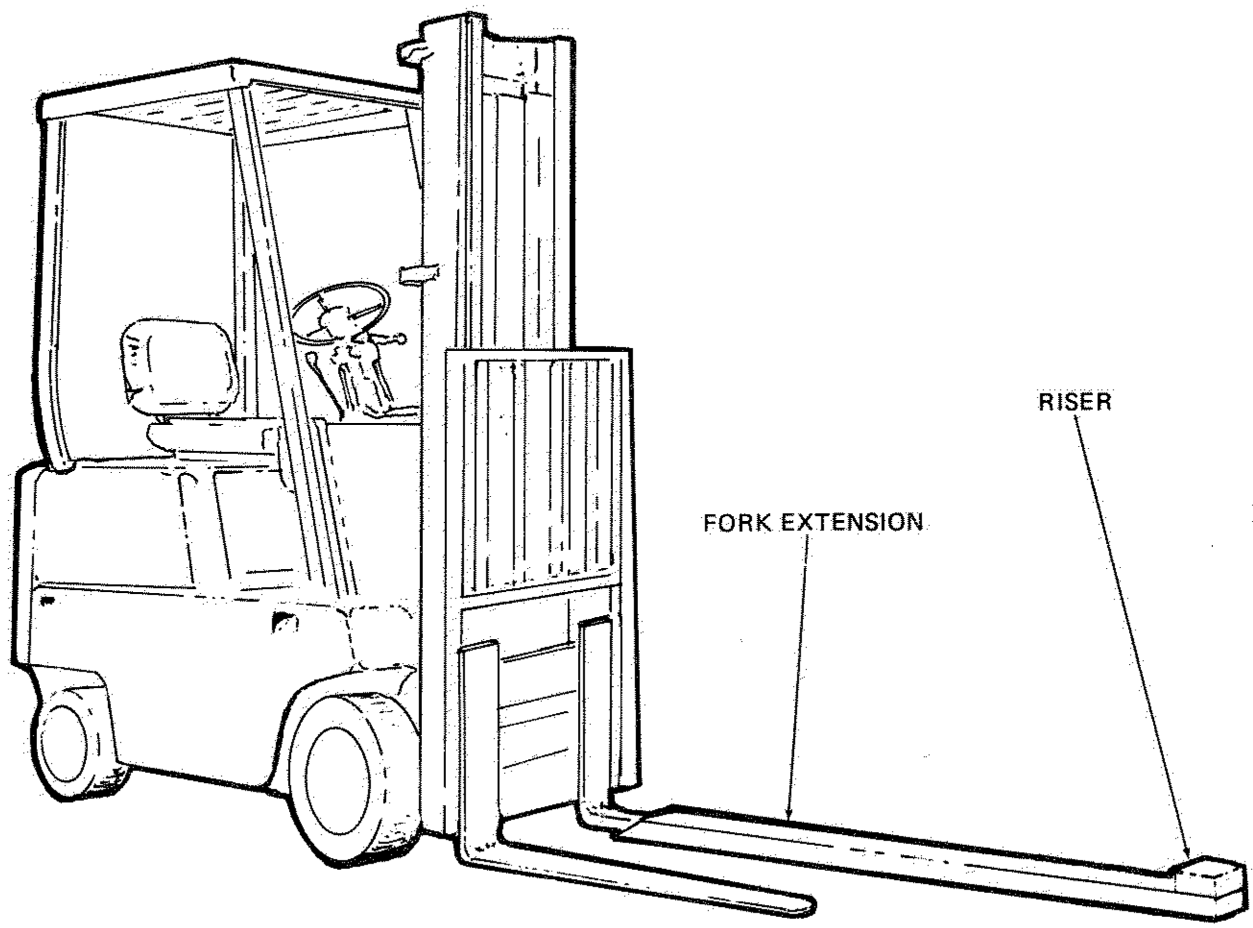


Figure 6-105. Fork Extension with Riser

bolts, and nuts to secure base of transformer to mounting rails.

3. Remove handling lift from cabinet.

4. Install leg on equipment rack. Remove support device and hoist.

5. Connect grounding pad to base of transformer.

6. Install six cables on terminals at upper left side of transformer. Remove tags.

7. Install four wires on terminals at upper right side of transformer. Remove tags.

8. Remove platform. Position door-stop. Install four bolts to secure to cabinet floor.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

9. Reposition rubber mats and follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.50 <u>Transformers 2T14 and 2T15.</u> Transformers 2T14 and 2T15 are ceiling-mounted just inside right door.

6-5.50.1 <u>Transformers 2T14 and 2T15 Removal.</u>

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	1c	Fork Extension With Riser
1	1q	Forklift
1	7b	Flat Blade Screwdriver
1	7j	Open End Wrench
2	7p	Open End Wrench
1	7w	Ratchet Wrench
1	7x	Ratchet Extension
1	7zf	9\16 Socket
1	9k	Nylon Sling

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Remove two fuses and fuse brackets and set aside.

3. Turn silver knob ccw and remove plastic cover. Tag four wires attached to terminal board beneath plastic cover. Remove wires. Re-install plastic cover and turn knob cw until secure. Cut tie wraps if necessary and move wire harness above transformer.

4. Tag and remove all wires from terminals at back of transformer.

5. Install fork extension on one fork of forklift (Figure 6-105).

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving fork extension into cabinet. Components in cabinet are close and failure to comply may result in damage.

6. Position forklift with fork extension under transformer. Slowly raise fork. Make necessary adjustments until riser makes firm contact with transformer.

7. Remove four nuts, four lock-washers, eight washers, and four bolts that secure transformer base to mounting strips. Strap transformer to fork extension with nylon sling.

8. Two persons hold transformer steady on riser while forklift operator lowers fork extension and backs clear of cabinet.

6-5.50.2 <u>Transformers 2T14 and 2T15 Installation.</u>

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	1c	Fork Extension\Riser
1	1q	Forklift
1	7b	Flat Blade Screwdriver
1	7j	Open End Wrench
2	7p	Open End Wrench
1	7w	Ratchet Wrench
1	7x	Ratchet Extension
1	7zf	9\16 Socket
1	9k	Nylon Sling

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when moving fork extension into cabinet and raising/lowering. Components in cabinet are close and failure to comply may result in equipment damage.

1. Position forklift so fork extension riser (Figure 6-105) is in place for transformer lift.

2. Two persons lift transformer and place on fork extension riser with base of transformer upward. Make sure terminal strip is oriented away from cabinet. Strap transformer to extension with nylon sling. Two persons support transformer while fork extension is raised and positioned for installation.

3. Install four bolts, lockwashers, nuts, and eight washers, to secure base of transformer to ceiling. Lower fork extension and remove forklift from area.

4. Install wires on terminals at back of transformer. Remove tags.

5. Turn silver knob ccw. Remove plastic cover from transformer front. Install four wires on terminal board. Remove tags. Reinstall cover and turn silver knob cw until secure.

6. Install two fuses in brackets.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.51 <u>Transformers 2T16 and 2T17.</u> Transformers 2T16 and 2T17 are ceiling-mounted near right end wall.

6-5.51.1 <u>Transformers 2T16 and 2T17 Removal.</u>

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
2	7k	Open End Wrench
2	7p	Open End Wrench
1	9k	Nylon Sling

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Tag and remove wires and cables from two terminals.

3. Unscrew four butterfly nuts and remove access panel from front of transformer. Tag and remove wires. Reinstall access panel.

4. Hook sling over edges of transformer mounting strips and under center of transformer. Tighten sling.

5. One person hold transformer. Second person remove four nuts, lockwashers, bolts and eight washers, that secure base of transformer to mounting strips. Two persons lower transformer from ceiling after releasing sling.

6-5.51.2 <u>Transformers 2T16 and 2T17 Installation.</u>

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
2	7k	Open End Wrench
2	7p	Open End Wrench
1	9k	Nylon Sling

1. Position transformer and secure with nylon sling. One person hold transformer and second person install four bolts, lockwashers, nuts and eight washers, to secure transformer to mounting strips.

2. Install wires and cables on two terminals. Remove tags.

3. Unscrew four butterfly nuts and remove access panel from front of transformer. Install wires, remove tags. Reinstall access panel.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

4. Follow procedure in paragraph

6-2.4.2 to exit cabinet.

6-5.52 Transformers 2T20 Through 2T23. Transformers 2T20, 2T21, 2T22, and 2T23 are mounted on left end wall behind protective panel.

6-5.52.1 Transformers 2T20 Through 2T23 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
2	7k	Open End Wrench
2	7o	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet.

2. Support protective cover and remove four bolts, four lockwashers, and four washers. Remove cover.

3. Turn silver knowb ccw and remove plastic cover. Tag two wires on left side of transformer. Remove wires from terminal board. Reinstall plastic cover and turn silver knob cw until secure.

4. Tag and remove wire from top terminal.

5. Tag and remove wire from bottom terminal.

6. Support transformer and remove four bolts, four lockwashers, and four washers that secure transformer to mounting plate.

6-5.52.2 Transformers 2T20 Through 2T23 Installation.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
2	7k	Open End Wrench
2	7o	Open End Wrench

1. Position and support transformer. Install four bolts, washers, and four lockwashers to secure transformer to mounting plate.

2. Install wire on bottom terminal and remove tag.

3. Install wire on top terminal and remove tag.

4. Turn silver knob ccw and remove plastic cover. Install two wires on terminal board and remove tags. Replace plastic cover and turn silver knob until cover is secure.

5. Position and support protective cover. Install four bolts, four washers, and four lockwashers to secure to wall.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

6. Follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.53 Reactors 2L3, 2L4, 2L6, and 2L7. Reactors 2L3, 2L4, 2L6, and 2L7 are located in equipment rack at left rear of cabinet.

6-5.53.1 Reactors 2L3, 2L4, 2L6, and 2L7 Removal.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1g	Plate, Lift Set
1	1f	Heavy Component Handling Lift, Short Reach
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	1q	Forklift
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
1	7l	Open End Wrench
1	7o	Open End Wrench
1	7w	Ratchet Wrench
1	7zc	7\16 Socket
1	9c	Trouble Light
1	9I	Extension Cord
2	9k	Nylon Sling
1	9m	Chain, Lift

WARNING
HIGH VOLTAGE HAZARD
Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.4.1 to access cabinet. Turn off RPIE 120 V ac utility powr to cabinet 2.

NOTE

Step 2 and 3 required for 2L3 and 2L4 only.

2. At protective cover over 2T20 through 2T23, remove four bolts, washers and lockwashers. Remove cover. Remove metal standoffs that hold up protective cover.

3. Remove circuit card from holder above 2L3. At card holder, remove two Phillips screws, washers, lockwashers and nuts securing holder to panel. Remove ground wire from holder to upper left ground stud on panel. Carefully rotate holder to a vertical position and tie off with string or masking tape.

NOTE

Step 4 required for 2L4 only

4. Tag and remove wires from center taps of 2CR7 through 2CR9. Remove 2 clamps. Fold wires out of way.

5. Position ramp portion of platform at left door. Remove four bolts and remove doorstop from cabinet floor.

NOTE

If only 2L4 is to be removed, perform steps 6 through 10 for 2L3 first and then repeat for 2L4

6. Tag and remove wires from front and back terminals.

7. Remove two bolts and disconnect grounding pad from reactor base.

8. Remove four bolts that secure base of reactor to mounting rails.

9. Position component replacement rail at installation slot (Figure 6-103). Install hoist roller assembly in rail and secure rail to cabinet. If 2L3 or 2L4 is being removed, connect holist to roller with a chain lift.

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when raising and moving reactor. Components in cabinet are close-fitting and failure to comply may result in equipment damage.

10. Connect hoist to lifting rings on top of reactor by placing a sling through two lifting eyes on one end of reactore and to one end of lifting bar of hoist. Repeat for other end of reactor. Adjust slings for equal length.

11. Lift reactor only as much as necessary to move reactor; then slide reactor out and lower to handling lift. Disconnect slings from hoist bar.

12. Move handling lift to door opening and remove reactor with forklift and slings.

6-5.53.2 <u>Reactors 2L3, 2L4, 2L6, and 2L7 Installation.</u>

<u>Tools and Test Equipment Required:</u>
(from Table 1-4)

Qty	Item No.	Description
1	1d	Electric Hoist
1	1f	Heavy Component Handling Lift, Short Reach
1	1g	Plate, Lift Set
1	1h	Material Handling Platform
1	1o	Component Replacement Rail
1	1q	Forklift
1	7e	Phillips Screwdriver
1	7i	Open End Wrench
1	7l	Open End Wrench
1	7o	Open End Wrench
1	7w	Ratchet Wrench
1	7zc	Socket
1	9c	Trouble Light
2	9k	Nylon Sling
1	9l	Extension Cord
1	9m	Chain, Lift

CAUTION
EQUIPMENT DAMAGE HAZARD

Be careful when raising and moving reactor. Components in cabinet are close-fitting. failure to comply may result in equipment damage.

1. Move reactor into cabinet onto handling lift. Attach electric hoist to reactor according to paragraph 6-5.53.1 step 10. Lift reactor and move into position for installation. Use two of the mounting bolts as guides when lowering reactor into position.

2. Install remaining two bolts to secure base of reactor to mounting rail.

3. Install two bolts to connect grounding pad to base of reactor.

4. Install wires on front and back terminals. Remove tags.

5. If 2L4 is being installed, repeat steps 1 through 4 for 2L3.

NOTE

Perform the following step only if 2L4 is being installed.

6. Reconnect wires to 2CR7 through 2CR9; then position wiring harness and secure to vertical mount with two clamps.

NOTE

Perform step 7 and 8 only if 2L3 or 2L4 was replaced

7. Rotate circuit card holder back into position and secure with two screws, washers, lockwashers, and nuts. Reconnect ground wire to panel mounting stud. Reinstall circuit card in holder.

8. Install four metal standoffs that hold up protective cover and replace protective cover using four bolts, washers, and lockwashers.

9. Remove hoist from component replacement rail. Remove ramp portion of handling lift from cabinet. Position doorstop and install four bolts to secure to cabinet floor.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

10. Turn on RPIE 120 V ac utility power and follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-5.54 High Voltage AC Switch Operator Drive Chain. The High Voltage AC Switch Operator Drive Chain is located in High Voltage AC Switch Cabinet 3.

6-5.54.1 High Voltage AC Switch Operator Drive Chain Removal. Refer to Figure 6-106 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7a	Needle Nose Pliers
1	7ab	Diagonal Cutter Pliers
1	7e	Phillips Screwdriver
1	7i	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.5.1 to access cabinet.

2. Remove four screws and remove cover assembly.

3. Remove safety wire from top and bottom turnbuckles. Rotate turnbuckles to loosen chain.

4. Remove two cotter pins from steel sleeve, one from each end.

5. Remove chain from steel sleeve and lift it over top of switch sprocket.

6-5.54.2 High Voltage AC Switch Operator Drive Chain Installation. Refer to Figure 6-106 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7a	Needle Nose Pliers
1	7ab	Diagonal Cutter Pliers
1	7e	Phillips Screwdriver
1	7i	Open End Wrench

1. Verify the two sections of chain to be installed are 27.75 inches long, and each end terminates with a narrow master link.

2. Feed one chain section through steel sleeve. Secure sleeve to chain with two cotter pins so that the end of the sleeve is approximately 0.75 inches from the chain end. Place this chain section over top of switch sprocket.

3. Use master links to attach a turnbuckle to each end of chain section just installed.

4. Arrange chain over switch sprocket so the distance from a centerline through switch sprocket and chain end of turnbuckle is approximately 1.25 inches, when switch contacts are closed.

5. Place other chain section over handle sprocket and attach upper end to turnbuckle nearest switch sprocket. Attach lower end to chain already installed, and end nearest steel sleeve.

6. Follow procedure in paragraph 6-6.3.8 to adjust chain.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. Follow procedure in paragraph 6-2.5.2 to exit cabinet.

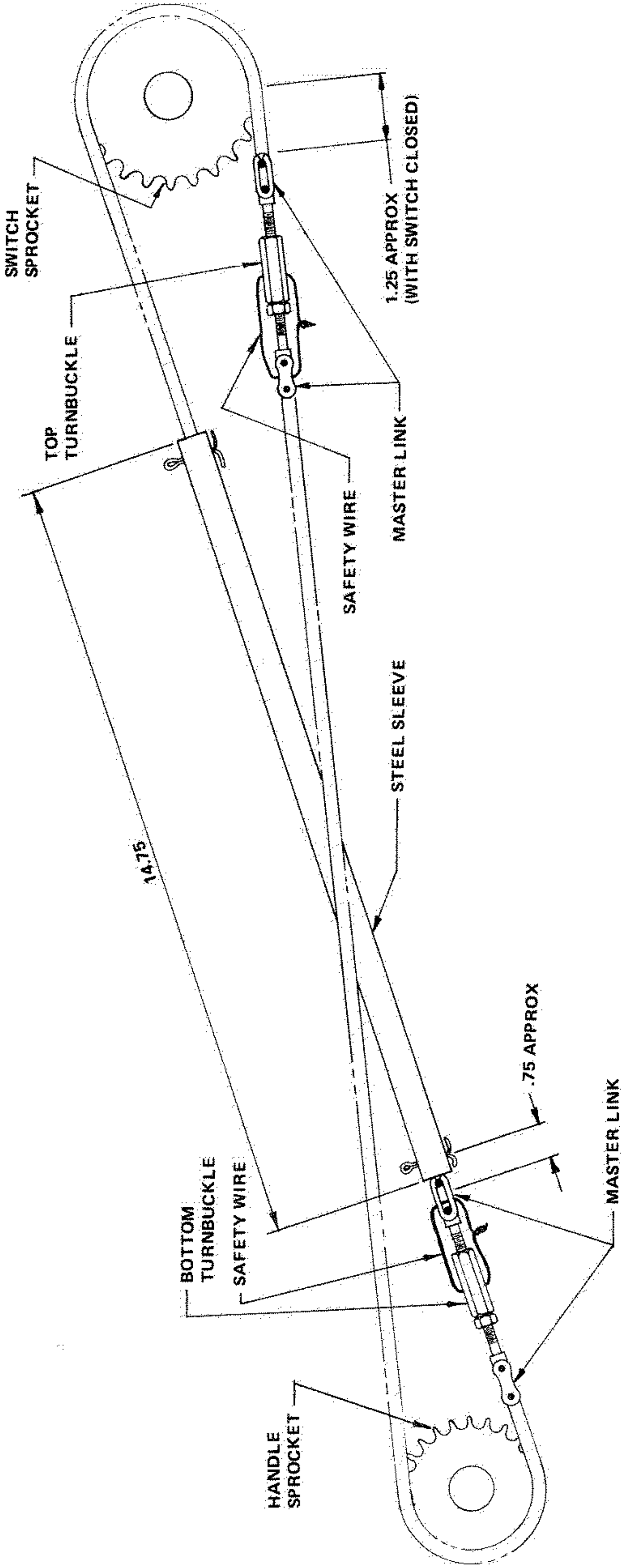


Figure 6-106. High Voltage Switch Drive Chain

6-6 ELECTRICAL CHECKS, TESTS, AND ALIGNMENT PROCEDURES.

6-6.1 Arc Sensor Sensitivity Adjustment. Externally adjustable resistor 1A8A1-R3, located in center of case of 1A8, is used to adjust arc detection sensitivity for filters 1FL10 through 1FL15. See Figure 6-71 for Arc Sensor 1A8 location.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	9c	Light, Trouble
1	9t	1.2 kohm 1 W resistor
1	9u	3.9 kohm 1 W resistor

NOTE

If adjustment is result of failing test in paragraph 6-3.2.4.3, proceed directly to step 2.

1. Notify TMC operator to remove (DISABLE) RF drive for transmitter. Verify RF drive not present by reading zero on POWER (KW) meter 1A13M1 and Broadband Amplifier 1AR1M1.

CAUTION
EQUIPMENT DAMAGE HAZARD

When changing position of OUTPUT CONTROL switch, LOAD indicator shall be closely watched. If lamp for selected (ANTENNA/TEST) position does not light up within 3 seconds, immediately move OUTPUT CONTROL switch back to original position.

2. Set LOCAL/REMOTE switch S13 on control panel to LOCAL. Press STANDBY switch S11.

3. Set 208 VAC input circuit breaker CB1 on unit 2 to OFF.

4. Open card assembly panel door.

5. Set 120 VAC RIDE THRU INPUT circuit breaker CB8 on Cabinet 2 to OFF.

WARNING
PERSONNEL SHOCK HAZARD

High voltage is present in controls compartment of cabinet 1. Take care not to make contact with exposed terminals, components. Failure to comply may result in injury or death.

6. Enter cabinet 1 controls compartment through left end door. Temporarily install 1200 ohm resistor between 1A8TB1-8 and -9 and temporarily install 3.9 kohm resistor between 1A8TB1-9 and -10. Locate Arc Sensor 1A8. Resistor 1A8A1-R3 is in center of case, and directions for adjustment are labeled on case.

7. Set 120 VAC RIDE THRU INPUT circuit breaker on HVPS Cabinet 2 to closed (ON) position.

8. Gradually increase sensitivity by turning R3 ccw until RF ARC lamp on First Event Logic CCA 1A1A12 lights up.

9. Set 120 VAC RIDE THRU INPUT circuit breaker CB8 to OFF and remove parts installed in step 6.

10. Set 120 VAC RIDE THRU INPUT circuit breaker CB8 to ON. Perform procedure in paragraph 6-3.2.4.3, steps 4 and 5.

6-6.2 RF Band Output Test.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	2a	RF Power Meter
1	4a	RF Signal Generator
1	2i	Coax Tee, part of HP 11570A
1	7b	Flat Blade Screwdriver
1	7n	Open End Wrench

1. Follow procedure in 4-6.2.2, steps 1 through 4 to change from remote to local control. Condition transmitter to operate in CW mode in Band C.

2. Open card assembly panel 1A1 access door. See Figure 4-6.

CAUTION
EQUIPMENT DAMAGE HAZARD

Ensure transmitter is in local mode with high voltage off before turning off 120 and 208 V ac.

3. Press STAND-BY switch. Open 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers on HVPS, Cabinet 2. Attach Maintenance-in-Progress tags to breakers.

WARNING
HIGH VOLTAGE HAZARD

One person position self to guard against circuit breakers on HVPS being turned on while second person accesses cabinet 1. Noncompliance may result in injury or death.

4. Open left end door of cabinet 1. Before entering controls compartment use grounding shorting stick to short out high-voltage and potential-storing components.

CAUTION
EQUIPMENT DAMAGE HAZARD

If signal generator is not set for minimum output before being turned on, equipment damage may result.

5. For each band, calibrate all test cables for cable loss using frequencies listed in Table 6-10.

6. Close 120 VAC RIDE THRU INPUT circuit breaker at HVPS.

7. Disconnect coaxial cable W30 from variable attenuators 1A1AT9 through 1A1AT14. Connect signal generator output in place of cable W30 to 1A1AT11. Set, as a benchmark meter reading, its output for 10.54 MHz with an output level of +20 dBm (100 mW). Select Band C.

8. Set meter switch 1A13S2 to ON. Set RF POWER meter switch 1A13S1 to FWD.

9. Observe POWER (KW) panel meter 1A13M1 and adjust attenuator 1A1AT11 for a reading of 100 kW.

10. Remove signal generator from attenuator.

11. Repeat steps 7 through 10 for bands A, B, D, E, and F, using the data in Table 6-10.

12. Reconnect cables to 1A1AT9 through 1A1AT14.

13. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-6.3 Alignment Procedures. The following alignment procedures must be performed when applicable components or assemblies are replaced.

6-6.3.1 Power Supply Tests/Adjustments. If supply voltages are too high, damage to transmitter components may result. The following procedures provide test and adjustments of power supplies used in control circuits and power supplies used in RF stages.

6-6.3.1.1 Control Power Supplies Tests/Adjustments. Only the +5 V dc power supply is not adjustable.

6-6.3.1.1.1 +5 V DC Power Supply.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	9e	Wrist Strap, Grounding

CAUTION
EQUIPMENT DAMAGE HAZARD

CCA involved in this procedure is an electrostatic sensitive device. Grounding wrist strap shall be worn. Failure to comply may result in equipment damage.

1. Remove Serial Status CCA 1A1A8 per paragraph 6-5.2.1.

2. Install 1A1A8 in extender service card 1A1A14 and reinstall in transmitter for maintenance. Leave CCA access panel and HVPS circuit breakers open.

CAUTION
EQUIPMENT DAMAGE HAZARD

If voltage measures more than +5.4 V dc, damage to equipment may occur if 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers on HVPS are not immediately opened.

3. One person measure voltage between A1XA8-39 and 1A1XA8-41 while second person closes 120 VAC RIDE THRU and 208 VAC INPUT circuit breakers on HVPS. If voltage exceeds +5.4 V dc, immediately open the breakers.

4. Voltage range of +4.6 V dc to +5.4 V dc is normal.

5. Open 120 VAC RIDE THRU and 208 VAC INPUT circuit breakers on HVPS. Remove CCA 1A1A8 and extender card. Stow extender card in slot. Reinstall 1A1A8 and close access door.

6. If no further maintenance is required, follow procedure in paragraph 4-6.2.1 to restore transmitter to mission-ready status.

6-6.3.1.1.2 +26 V DC Power Supply 1PS1. Refer to Figure 6-71 for location of 1PS1 in cabinet 1 controls compartment.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	7b	Flatblade Screwdriver

1. Follow procedure in paragraph 4-6.3. to shut down transmitter.

WARNING
HIGH VOLTAGE HAZARD

Verify cabinet 1 controls compartment protective cover assemblies are in place. High voltage is present on terminal board lugs and other devices. Do not make contact with these.

2. Ensure high voltage warning is heeded. Open cabinet 1 left end door and enter controls compartment. Locate 1A1TB4 wall-mounted above Broadband Amplifier 1AR1.

NOTE

Ensure 120 VAC RIDE THRU INPUT Circuit Breakers are set closed and 28 V dc is set on.

3. Measure voltage between 1A1TB4-14 and chassis ground for reading of +26.5 ±0.4 V dc. If measurement is correct, proceed to step 6.

4. Adjust pot labeled VOLTAGE ADJUST on power supply 1PS1 until multimeter reads +26.5 ±0 V dc.

5. Verify TEST METER 1A13M9 at front of cabinet, top of controls section, reads within ± 5% of multimeter.

6. If no further maintenance is required, perform procedure in paragraph 4-6.2.1 to restore transmitter to mission-ready status.

6-6.3.1.1.3 +15 V DC Power Supply 1PS2. Refer to Figure 6-71 for location of 1PS2 in cabinet 1 controls compartment.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	7b	Flatblade Screwdriver

1. Follow procedure in paragraph 4-6.3. to shut down transmitter.

WARNING
HIGH VOLTAGE HAZARD

Verify cabinet 1 controls compartment protective cover assemblies are in place. High voltage is present on terminal board lugs and other devices. Do not make contact with these.

2. Ensure high voltage warning is heeded. Open cabinet 1 left end door and enter controls compartment. Locate 1A1TB6 wall-mounted above Broadband Amplifier 1AR1.

NOTE

Ensure 120VAC RIDE THRU INPUT Circuit Breakers are set closed and 28 V dc is set on.

3. Measure voltage between 1A1TB6-11 and chassis ground for reading of +15.0 ±0.1 V dc. If correct, proceed directly to step 6.

4. VOLTAGE ADJUST pot is labeled on 1PS2. Adjust pot until multimeter reads +15.0 ±0 V dc.

5. Verify TEST METER 1A13M9 at front of cabinet, top of controls section, reads within ± 5% of multimeter.

6. If no further maintenance is required, perform procedure in paragraph 4-6.2.1 to restore transmitter to mission-ready status.

6-6.3.1.1.4 +/-15 V DC Power Supply 1PS6. Refer to Figure 6-71 for location of 1PS6 in cabinet 1 controls compartment.

Tools and Test Equipment Required:
(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	7b	Flat blade Screwdriver

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

WARNING
HIGH VOLTAGE HAZARD

Verify cabinet 1 controls compartment protective cover assemblies are in place. High voltage is present on terminal board lugs and other devices. Do not make contact with these.

2. Ensure high voltage warning is heeded. Open cabinet 1 left end door and enter controls compartment. Locate 1A1TB4 wall-mounted above Broadband Amplifier 1AR1.

NOTE

Ensure 120 VAC RIDE THRU INPUT circuit breakers are set closed and 28 V dc is set on.

3. Measure voltage between 1A1TB4-18 and chassis ground for reading of +15 ±0.4 V dc. If measurement is correct, proceed to step 9.

4. VOLTAGE ADJUST pot is labeled on 1PS6. Adjust pot until multimeter reads +15 ±0 V dc.

5. Verify TEST METER 1A13M9 at front of cabinet, top of controls section, reads within ± 5% of multimeter.

6. Measure voltage at 1A1TB4-17 for reading of -15 ±0.4 V dc. If measurement is correct, proceed directly to step 9.

7. (-) VOTAGE ADJUST pot is labeled on 1PS6. Adjust pot until multimeter reads -15 ±0 Vdc.

8. Verify TEST METER 1A13M9 at from of cabinet, top of controls section, reads within ± 5% of multimeter.

9. If no further maintenance is required, perform procedure in paragraph 4-6.2.1 to restore transmitter to mission-ready status.

6-6.3.1.2 RF Stages Power Supplies. The following procedures provide dc and ac overload adjustments for power supplies used in RF stages.

6-6-3.1.2.1 RF STAGES POWER SUPPLY DC OVERLOAD ADJUSTMENT. Setting of the IPA, Driver and PA power supplies overload trip points and their respective meter calibration points are set in the following procedures.

6-6.3.1.2.1.1 IPA SCREEN GRID OVERLOAD ADJUST

Tools and test equipment required
(from Table 1-4)

QTY	ITEM NO.	DESCRIPTION
1	2b	Multimeter
1	7b	Flatblade Screw driver
1	1w	Power Supply

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF except 120 VAC outlets (CB9).

4. Follow procedure in paragraph 6-2.4.1 to access HVPS.

5. Open right door from within. Close left door for protection of personnel.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

6. With power supply turned off, connect power supply negative output to junction of IPA Screen Supply resistor 2R84 and 2R87. See Figure 6-106.1.

7. Connect multimeter in line with the Power supply to monitor current as shown in Figure 6-106.1.

8. Connect power supply positive output via multimeter to IPA Screen Supply 150983-3 ground connection.

9. Set RPIE and 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON

10. Ensure LOCAL/REMOTE switch 1A1S13 is set to LOCAL.

11. Set transmitter to standby by depressing STANDBY switch S11 on transmitter control panel.

12. Condition power supply for miminum voltage and current output. Then turn power supply on.

13. Gradually increase current/voltage output of power supply until either the current meter indicates 0.15 ±5%. A dc or IPA SCREEN DC OVERLOAD lights, whichever occurs first.

14. As necessary, decrease power supply output slightly, depress transmitter FAULT (RESET) switch and adjust 2R84 on IPA SCREEN power supply slightly. Repeat step 13 and 14 until indicator lights at the current meter reading given in step 13.

15. Set transmitter to OFF by pressing POWER (OFF) switch S12 on transmitter Control Panel.

16. Set RPIE 120 VAC RIDE THRU circuit breaker to OFF.

17. Set all 1A23 and 2A2 panel circuit breakers to ON.

18. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter to mission ready status.

6-6.3.1.2.1.2 DRIVER SCREEN GRID OVERLOAD ADJUST

Tools and test equipment required (from Table 1-4)

QTY	ITEM NO.	DESCRIPTION
1	2b	Digital Multimeter
1	7b	Flatblade Screw driver
1	1w	Power Supply

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF except 120 VAC OUTLETS (CB9).

4. Follow procedure in paragraph 6-2.4.1 to access HVPS.

5. Open right door from within. Close left door for protection of personnel.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

6. With power supply turned off, connect power Supply negative output to junction of Driver Screen Supply resistor 2R83 and 2R86. See Figure 6-106.1.

7. Connect multimeter in line with the power supply to monitor current as shown in Figure 6-106.1.

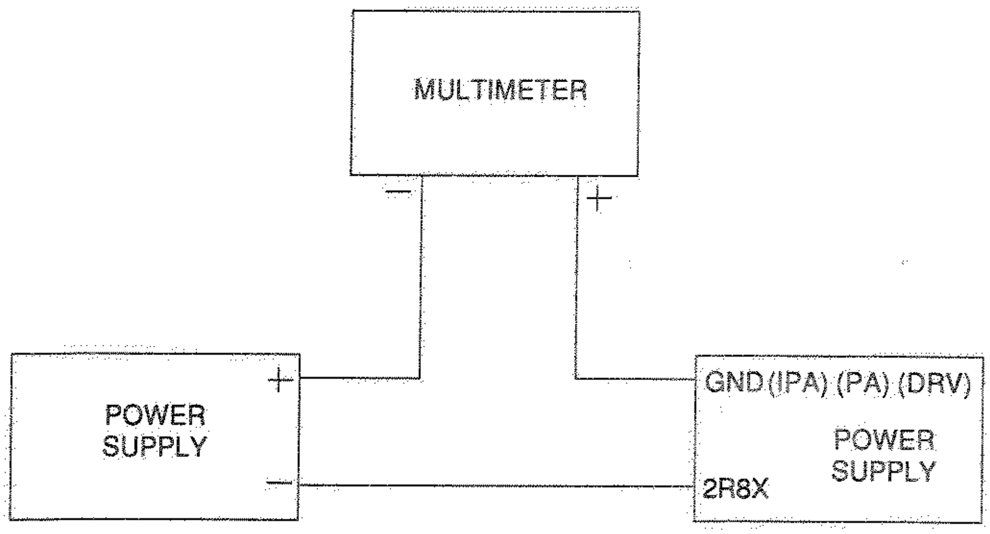


Figure 6-106.1. Screen DC Overload Adjustment Connection Diagram

8. Connect power supply positive output via multimeter to Driver Screen Supply 150983-2 ground connection.

9. Set RPIE and 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON.

10. Ensure LOCAL/REMOTE switch 1A1S13 is set to LOCAL.

11. Set transmitter to standby by depressing STANDBY switch S11 on transmitter control panel.

12. Condition power supply for minimum voltage and current output. Then turn power supply on.

13. Gradually increase current/voltage output of power supply until current meter indicates 0.27 ±5% A dc or DRIVER SCREEN DC OVERLOAD lights, whichever occurs first.

14. As necessary, decrease power supply output slightly, depress transmitter FAULT (RESET) switch and adjust 2R83 on DRIVER SCREEN power supply slightly. Repeat step 13 and 14 until indicator lights at the current meter reading given in step 13.

15. Set transmitter to OFF by pressing POWER (OFF) switch S12 on transmitter Control Panel.

16. Set RPIE 120 VAC RIDE THRU circuit breaker to OFF.

17. Set all 1A23 and 2A2 panel circuit breakers to ON.

18. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter to mission ready status.

6-6.3.1.2.1.3 <u>PA SCREEN GRID OVERLOAD ADJUST</u>

Tools and test equipment required (from Table 1-4)

QTY	ITEM NO.	DESCRIPTION
1	2b	Multimeter
1	7b	Flatblade Screw driver
1	1w	Power Supply

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF except 120 VAC OUTLETS (CB9).

4. Follow procedure in paragraph 6-2.4.1 to access HVPS.

5. Open right door from within. Close left door to protect personnel.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

6. With power supply turned off, connect power supply negative output to the junction of PA Screen Supply resistor 2R82 and 2R85. See Figure 6-106.1.

7. Connect multimeter in line with the Power supply to monitor current as shown in Figure 6-106.1.

8. Connect power supply positive output via multimeter to PA Screen Supply 150983-1 ground connection.

9. Set RPIE and 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON.

10. Ensure LOCAL/REMOTE switch 1A1S13 is set to LOCAL.

11. Set transmitter to standby by depressing STANDBY switch S11 on transmitter control panel.

12. Condition power supply for minimum voltage and current output. Then turn power supply on.

13. Gradually increase current/voltage output of power supply until either current meter indicates 1.2 ±5%. A dc or PA SCREEN DC OVERLOAD lights, whichever occurs first.

14. As necessary, decrease power supply output slightly, depress transmitter FAULT (RESET) switch and adjust 2R82 on PA SCREEN power supply slightly. Repeat step 13 and 14 until indicator lights at the current meter reading given in step 13.

15. Set transmitter to OFF by pressing POWER (OFF) switch S12 on transmitter Control Panel.

16. Set RPIE 120 VAC RIDE THRU circuit breaker to OFF.

17. Set all 1A23 and 2A2 panel circuit breakers to ON.

18. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter operation.

6-6.3.1.2.1.4 IPA ANODE POWER SUPPLY OVERLOAD ADJUST

Tools and test equipment required (from Table 1-4)

QTY	ITEM NO.	DESCRIPTION
1	2k	Current Meter
1	7b	Flatblade Screw driver
1	1z	Power Supply

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF except 120 VAC OUTLETS, (CB9).

4. Follow procedure in paragraph 6-2.4.1 to access HVPS.

5. Open right door from within. Close left door to protect personnel.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

6. With power supply turned off, connect power supply negative output to junction of 2R181-1 and 2R178-1. See Figure 6-106.2.

7. Connect multimeter in line with the power supply to monitor current as shown in Figure 6-106.2.

8. Connect power supply positive output via meter to unit 2 chassis ground.

9. Set RPIE and 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON.

10. Ensure LOCAL/REMOTE switch 1A1S13 is set to LOCAL.

11. Set transmitter to standby by depressing STANDBY switch S11 on transmitter control panel.

12. Condition power supply for minimum voltage and current output. Then turn power supply on.

13. Gradually increase current/voltage output of power supply until either current meter indicates 4.5 ±5%. A dc or IPA ANODE DC OVERLOAD lights, whichever occurs first.

14. As necessary, decrease power supply output slightly, depress transmitter FAULT (RESET) switch and adjust 2R178 on IPA anode power supply slightly. Repeat step 13 and 14 until indicator lights at the current meter reading given in step 13.

15. Set transmitter to off by pressing POWER (OFF) switch S12 on transmitter control panel.

16. Set RPIE 120 VAC RIDE THRU circuit breakers to OFF.

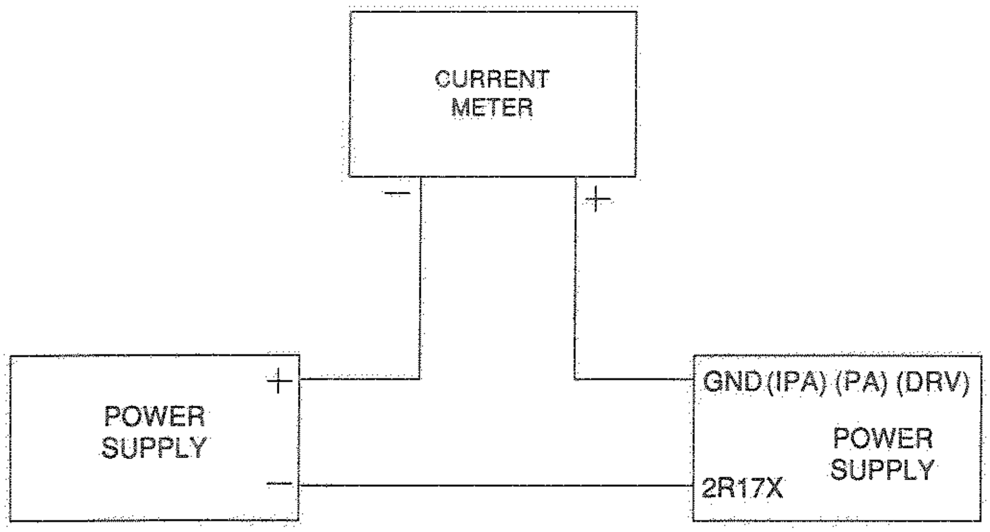


Figure 6-106.2. Anode DC Overload Adjustment Connection Diagram

17. Set all 1A23 and 2A2 Panel circuit breakers to ON.

18. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter to mission ready status.

6-6.3.1.2.1.5 DRIVER ANODE POWER SUPPLY OVERLOAD ADJUST

Tools and test equipment required (from Table 1-4)

QTY	ITEM NO.	DESCRIPTION
1	2k	Current Meter
1	7b	Flatblade Screw driver
1	1z	Power Supply

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF except 120 VAC OUTLETS (CB9).

4. Follow procedure in paragraph 6-2.4.1 to access HVPS.

5. Open right door from within. Close left door for protection of personnel.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

6. With power supply turned off connect power supply negative output to junction of 2R177 and 2R180. See Figure 6-106.2.

7. Connect multimeter in line with the power supply to monitor current as shown in Figure 6-106.2.

8. Connect power supply positive output via meter to unit 2 chassis ground connection.

9. Set RPIE and 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON.

10. Ensure LOCAL/REMOTE switch S13 is set to LOCAL.

11. Set transmitter to standby by depressing STANDBY switch S11 on transmitter control panel.

12. Condition power supply for minimum voltage and current output. Then turn power supply on.

13. Gradually increase current/voltage output of power supply until either current meter indicates 6.5 ±5%. A dc or DRIVER ANODE DC OVERLOAD lights, whichever occurs first.

14. As necessary, decrease power supply output slightly, depress transmitter FAULT (RESET) switch and adjust 2R177 on DRIVER ANODE power supply slightly. Repeat step 13 and 14 until indicator lights at the current meter reading given in step 13.

15. Set transmitter to off by pressing POWER (OFF) switch S12 on transmitter control panel.

16. Set RPIE 120 VAC RIDE THRU circuit breaker to OFF.

17. Set all 1A23 and 2A2 panel circuit breakers to ON.

18. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter to mission ready status.

6-6.3.1.2.1.6 PA ANODE POWER SUPPLY OVERLOAD ADJUST

Tools and test equipment required (from Table 1-4)

QTY	ITEM NO.	DESCRIPTION
1	2k	Current Meter
1	7b	Flatblade Screw driver
1	1z	Power Supply

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF except 120 VAC OUTLETS (CB9).

4. Follow procedure in paragraph 6-2.4.1 to access HVPS.

5. Open right door from within. Close left door for protection of personnel.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

6. With power supply turned off, connect power supply negative output to junction of 2R176 and 2R179. See Figure 6-106.2.

7. Connect current meter in line with power supply to monitor current as shown in Figure 6-106.2

8. Connect power supply positive output via meter to unit 2 chassis ground.

9. Set RPIE and 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON.

10. Ensure LOCAL/REMOTE switch S13 is set to LOCAL.

11. Set transmitter to standby by depressing STANDBY switch S11 on transmitter control panel.

12. Condition power supply for minimum voltage and current output. Then turn power supply on.

13. Gradually increase current/voltage output of power supply until current meter indicates 22 ±5% A dc or PA ANODE DC OVERLOAD lights, whichever occurs first.

14. As necessary, decrease power supply output slightly, depress transmitter FAULT (RESET) switch and adjust 2R176 on PA anode power supply slightly. Repeat step 13 and 14 until indicator lights at the current meter reading given in step 13.

15. Set transmitter to off by pressing POWER (OFF) switch S12 on transmitter control panel.

16. Set RPIE 120 VAC RIDE THRU circuit breaker to OFF.

17. Set all 1A23 and 2A2 Panel circuit breakers to ON.

18. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter to mission ready status.

6-6.3.1.2.2 <u>RF Stages Power Supply AC Overload Adjustment</u>. IPA, Driver and PA power supplies overload trip points and their respective meter calibration points are set in the following procedures.

6-6.3.1.2.2.1 <u>PA AC Current Overload Test</u>. Tools and test equipment required (from Table 1-4)

Qty	Item No.	Description
2	1e	Open End Wrench
1	1y	AC Current Test Set
1	9d	Alignment Tool Kit
1	9l	Extension cord
1	9s	Jumper Test Lead
1	2b	Multimeter
3	9q	8/32 Nut
3	9r	8/32 Bolt

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 panel circuit breakers to OFF.

3. Set all 2A2 panel circuit breakers to OFF.

4. Follow procedure in paragraph 6-2.4.1 to access HVPS.

5. Open right door from within.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

6. Route AC Current Test Set A phase lead through center of 2T3 current transformer. (See Figure 6-106.3)

7. Couple A phase output leads together by joining lead through 2T3 with second A phase lead using 8/32 hut and bolt. Tighten connections with open end wrenches.

8. Repeat steps 6 and 7 for B phase and C phase leads through transformers 2T25 and 2T2 respectively.

9. Turn controls on AC Current Overload Test Set fully CCW and then turn on test set circuit breakers. Set AC Current Test Set to 15.0 amp output per phase.

10. Connect negative lead of multimeter to 2A5TP24.

11. Set RPIE 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON.

12. Verify LOCAL/REMOTE switch 1A1S13 is set to LOCAL.

13. On transmitter control panel, press STANDBY switch S11.

14. With multimeter positive lead, measure dc voltage level at 2A5TP8, TP9, and TP10.

15. If readings in step 14 are within 3% of each other, proceed to step 20. If readings are not within 3% of each other, proceed to step 16.

16. With positive lead connected to 2A5TP8, adjust 2A5R13 clockwise until voltage no longer increases.

17. Connect multimeter positive lead to 2A5TP9 and adjust 2A5R27 clockwise until voltage reading at TP9 no longer increases.

18. Connect multimeter positive lead 2A5TB10 and adjust 2A5R28 clockwise until voltage reading at TP10 no longer increases.

19. Readjust R13 and/or R27 and/or R28 as appropriate until the two highest voltages match the lowest voltage level from steps 16, 17 and 18. Voltages must vary from one to the other by no more than 3%.

20. Reduce the phase currents from AC Current Test Set to zero.

21. On transmitter control panel, press FAULT RESET switch S13 to reset any faults resulting from previous steps.

NOTE

In the following steps, whenever a fault occurs, three indicator lamps will light. For example an AC PA curent overload will light POWER AMPLIFIER ANODE AC CURRENT OVERLOAD and FAULT (RESET) on Control Panel and PA A AC on 1ST, Event Logic Card, 1A1A12.

22. On AC Current Test Set, raise phase A current until PA AC overload fault is indicated on transmitter control panel.

23. Verify that current reading on test set shows fault indicator was tripped by current of 19.3 to 20.0 amps.

24. Reduce Phase A current to zero and reset fault indicators by pressing FAULT (RESET) switch S3 on transmitter control panel.

25. On AC Current Test Set, raise phase B current until PA AC overload fault is indicated on transmitter control panel.

26. Verify that current reading on test set shows fault indicator was tripped by current of 19.3 to 20.0 amps.

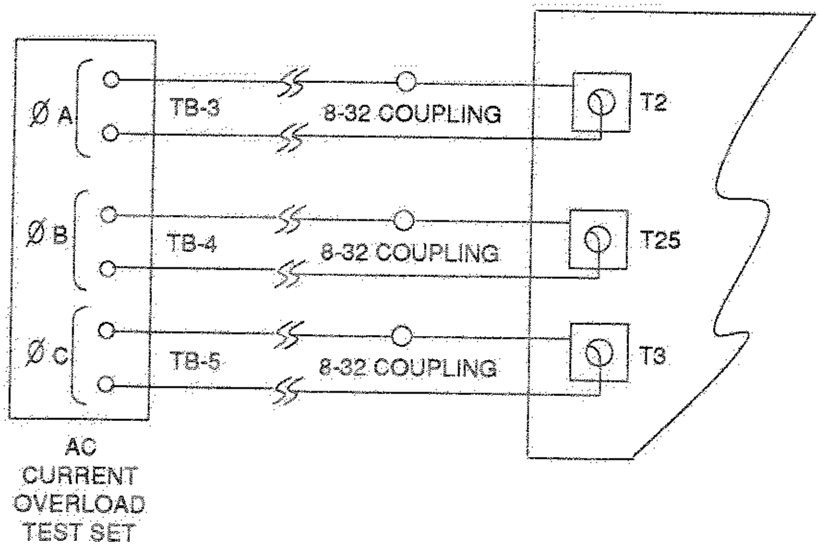


Figure 6-106.3. PA AC Current Overload Test

27. Reduce phase B current to zero and reset fault indicators by pressing FAULT (RESET) switch S3 on transmitter control panel.

28. On AC Current Test Set, raise phase current until PA AC overload fault is indicated on transmitter control panel.

29. Verify that current reading on test set shows fault indicator was tripped by current of 19.3 to 20.0 amps.

30. Reduce phase C current to zero and reset fault indicators by pressing FAULT (RESET) switch 1A1S3 on transmitter control panel.

31. If all phases tripped above or below 19.3 to 20.0 amps range, adjust 2A5R24 slightly clockwise to cause the trip point to occur at a higher level or slightly counterclockwise to cause the trip point to occur at a lower level.

32. Repeat steps 20 through 31 if 2A5-R24 must be adjusted.

WARNING

PERSONNEL INJURY HAZARD.

Failure to follow procedure could result in injury or death.

33. Remove voltage from Transmitter Phase monitor card 2A5 by pressing POWER (OFF) switch S12 on transmitter control panel.

CAUTION

EQUIPMENT DAMAGE HAZARD.

Failure to follow approved procedure may result in equipment damage.

34. On Transformer Current Monitor Card 2A5, add external jumper test lead between positive terminal of C16 and cathode (+) terminal of VR7.

35. On transmitter control panel press STANDBY switch S11.

NOTE

With jumper added in step 34, HV ON indicator lamp will light. Disregard indication.

36. On AC Current Test Set, set current supplied to all three phases to 15.0 amps. Reset any faults on the control panel by pressing FAULT (RESET) switch S3.

37. On AC Current Test Set, slowly lower phase A current until PA AC overload fault is indicated on transmitter control panel.

38. Verify that PA AC overload fault indication occurred between 11 and 13.5 amps on the AC Current Test Set phase A current meter.

39. On AC Current Test Set, return phase A to 15.0 amps.

40. On transmitter control panel, reset fault indication by pressing FAULT (RESET) switch S3.

41. On AC Current Test Set, slowly lower phase B current until PA AC overload fault is indicated on transmitter control panel.

42. Verify that PA AC overload fault indication occurred between 11 and 13.5 amps on the AC Current Test Set phase B current meter.

43. On AC Current Test Set, return phase B to 15.0 amps.

44. On transmitter control panel, reset fault indication by pressing FAULT, RESET switch S3.

45. On AC Current Test Set, slowly lower phase C current until PA AC overload fault is indicated on transmitter control panel.

46. Verify that PA AC overload fault indication occurred between 11 and 13.5 amps on the AC Current Test Set phase C current meter.

47. On AC Current Test Set, lower all three phases to zero amps, and turn off power to test set.

48. On transmitter control panel, press POWER (OFF) switch S12. .

49. Remove test lead from 2A5 installed in step 34.

50. Disconnect and remove test cables through 2T3, 2T25 and 2T2.

51. Set RPIE 120 VAC RIDE THRU circuit breaker to OFF.

52. Set all 1A23 and 2A2 Panel circuit breakers to ON.

53. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter operation.

6-6.3.1.2.2.2 Driver AC Current Overload Test. Tools and test equipment required (from Table 1-4).

Qty	Item No.	Description
1	9d	Alignment Tool Kit
2	71	Open End Wrench
1	1y	AC Current Test Set
1	9s	Jumper Test Lead
1	1A1A14	Extender Board
3	9v	10-32 Nuts
1	2b	Multimeter
2	91	Extension Cord

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF.

4. Verify LOCAL/REMOTE switch S13 is set to LOCAL.

5. Follow procedure in paragraph 6-2.4.1 to access HVPS.

6. Open right door from within.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

7. Remove 2A6 Transformer Current Monitor card from X2A6.

8. Insert extender card 1A1A14 from card cage, into X2A6 and install 2A6 into extender card.

9. On T6H1 and H2 standoffs remove cap nuts.

10. From AC Current Test Set connect one end of a phase A lead (W1) to T6H1 using extra 10-32 nuts. See Figure 6-106.4.

11. Connect the other phase A lead to T6H2 using 10-32 nuts.

12. On T26H1 and H2 standoffs, remove cap nuts.

13. From AC Current Test Set, connect one end of a phase B lead (W2) to T26H1 using extra 10-32 nuts.

14. Connect the other phase B lead to T26H2 using 10-32 nuts.

15. On T7H1 and H2 standoffs, remove cap nuts.

16. On AC Current Test Set, connect one end of a phase C lead (W3) to T7H1 using extra 10-32 nuts.

17. Connect the other phase C lead to T7H2 using extra 10-32 nuts.

18. Set RPIE and 2A2CB8 120 VAC RIDE THRU INPUT circuit breakers to ON. At transmitter control panel press STANDBY switch S11.

19. Check that all controls are fully CCW; then turn power on to AC Current Test Set.

20. Set AC Current Test Set to 4.0 amp output per phase.

21. Connect negative lead of multimeter to 2A6TP24.

22. With DVM positive lead, measure DC voltage level at 2A6TP8, TP9, and TP10.

23. If readings in step 22 are within 3% of each other, proceed to step 28. If readings are not within 3% of each other, proceed to step 24.

24. With DVM positive lead connected to 2A6TP8, adjust 2A6R13 clockwise until voltage no longer increases.

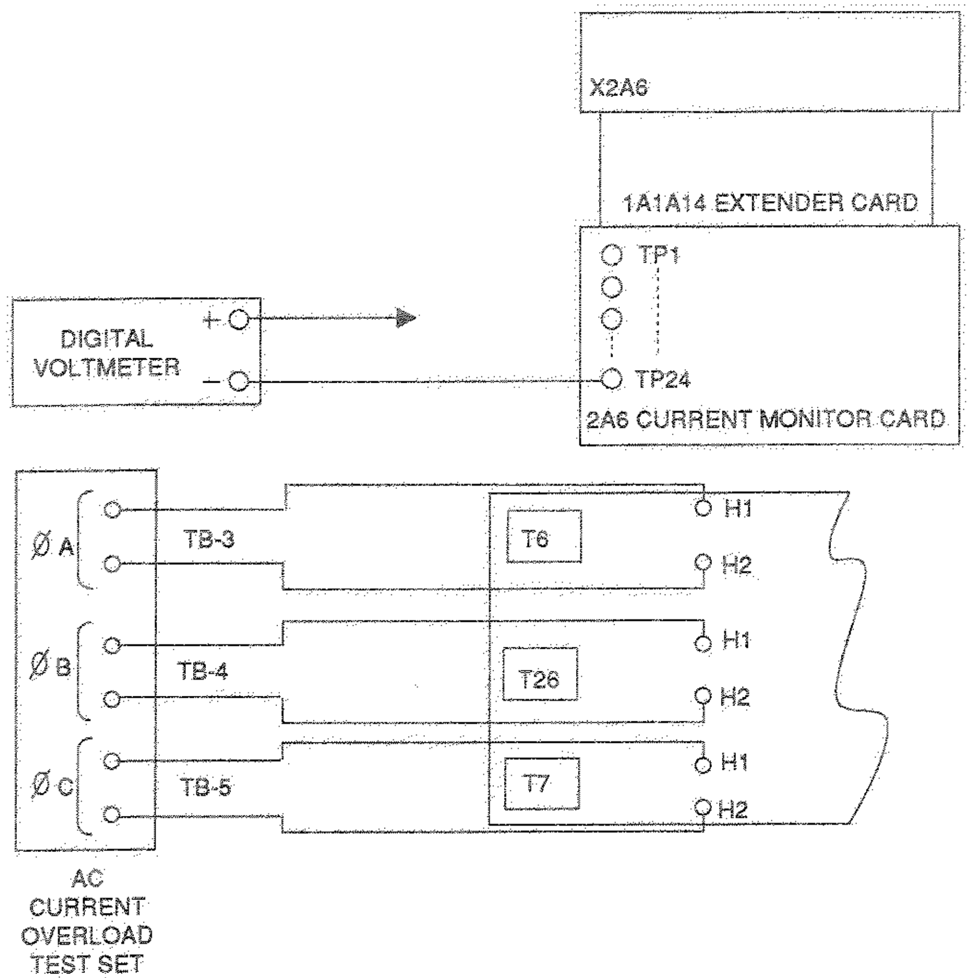


Figure 6-106.4. DRVR AC Current Overload Test

25. Connect DVM positive lead to 2A6-TP9 and adjust 2A6R27 clockwise until voltage reading at TP9 no longer increases.

26. Connect DVM positive lead 2A6TP10 and adjust 2A6R28 clockwise until voltage reading at TP10 no longer increases.

27. Readjust R13 and/or R27 and/or R28, as appropriate, until the two highest voltages match the lowest voltage level from steps 24, 25 and 26. Voltages may vary from one to the other by no more than 3%.

28. Reduce the phase currents from AC current test set to zero.

29. On transmitter control panel, press FAULT (RESET) switch S3 to reset any faults resulting from previous steps.

NOTE

In the following steps, whenever an overload fault occurs, three indicator lamps will light: the DRIVER AMPLIFIER-ANODE-AC-CURRENT OVERLOAD indicator and FAULT (RESET) indicator located on the Control Panel and the DRVR A AC indicator on the 1A1A12 circuit card.

30. On AC Current Test Set, raise phase A current until driver AC overload fault is indicated on transmitter control panel.

31. Verify that current reading on test set shows fault indicator was tripped by current of 4.5 to 4.75 amps.

32. Reduce phase A current to zero and reset fault indicators by pressing FAULT (RESET) switch S3 on transmitter control panel.

33. On AC Current Test Set, raise phase B current until driver AC overload fault is indicated on transmitter control panel.

34. Verify that current reading on test set shows fault indicator was tripped by current of 4.5 to 4.75 amps.

35. Reduce phase B current to zero and reset fault indicators by pressing FAULT (RESET) switch 1A1S3 on transmitter control panel.

36. On AC Current Test Set, raise phase C current until driver AC overload fault is indicated on transmitter control panel.

37. Verify that current reading on test set shows fault indicator was tripped by current of 4.5 to 4.75 amps.

38. Reduce phase C current to zero and reset fault indicators by pressing FAULT (RESET) switch S3 on transmitter control panel.

39. If all phases tripped above or below 4.5 to 4.75 amps range, adjust 2A6R24 slightly clockwise to cause the trip point to occur at a higher level or slightly counterclockwise to cause the trip point to occur at a lower level.

40. Repeat steps 28 through 39 if 2A6R24 must be adjusted.

WARNING

PERSONNEL INJURY HAZARD.

Failure to follow procedure could result in injury or death.

41. Remove voltage from Transmitter Phase Monitor Card 2A6 by pressing POWER (OFF) SWITCH S12 on transmitter control panel.

42. On Transformer Current Monitor Card 2A6, install jumper test lead between positive terminals of C16(+) and VR7 cathode (+).

43. On transmitter control panel press STANDBY switch S11.

NOTE

With jumper added from step 42, HV ON indicator will be lighted. Disregard indication.

44. On AC Current Test Set, set current supplied to all three phases to 4.0 amps. Reset any faults on the control panel by pressing FAULT (RESET) switch S3.

45. On AC Current Test Set, slowly lower phase A current until driver AC overload fault is indicated on transmitter control panel.

46. Verify that overload fault indication occurred between 3.0 and 3.6 amps on the AC Current Test Set phase A current meter.

47. On AC Current Test Set, return phase A to 4.0 amps.

48. On transmitter control panel, reset fault indication by pressing FAULT (RESET) switch S3.

49. On AC Current Test Set, slowly lower phase B current until driver AC overload fault is indicated on transmitter control panel.

50. Verify that overload fault indication occurred between 3.0 and 3.6 amps on the AC Current Test Set phase B current meter.

51. On AC Current Test Set, return phase B to 4.0 amps.

52. On transmitter control panel, reset fault indication by pressing FAULT (RESET) switch S3.

53. On AC Current Test Set, slowly lower phase C current until driver AC overload fault is indicated on transmitter control panel.

54. Verify that overload fault indication occurred between 3.0 and 3.6 amps on the AC Current Test Set phase C current meter.

55. On AC Current Test Set, lower all three phases to zero amps, and turn off power to test set.

56. On transmitter control panel, press POWER (OFF) switch S12.

57. Remove test lead installed on 2A6 in step 42.

58. Remove 2A6 from extender card and reinsert 2A6 into X1A6 connector.

59. Remove test cable and 10-32 nuts to 2T6, 2T26 and 2T7.

60. Install cap nuts onto 2T6H1 and H2, 2T26, H1 and H2 and 2T7H1 and H2.

61. Set RPIE 120 VAC RIDE THRU circuit breaker to OFF.

62. Set all 1A23 and 2A2 panel circuit breakers to ON.

63. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter operation.

6-6.3.1.2.2.3 IPA AC Current Overload Test. Tools and test equipment required (from Table 1-4)

Qty	Item No.	Description
1	9d	Alignment Tool Kit
2	71	Open End Wrench
1	1y	AC Current Test Set
1	9s	Jumper Test Lead
1	1A1A14	Extender Board
6	9v	10/32 Nuts
1	2b	Multimeter
1	91	Extension Cord

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 4-6.3 to shut down transmitter.

2. Set all 1A23 Panel Circuit Breakers to OFF.

3. Set all 2A2 Panel Circuit Breakers to OFF.

4. Verify LOCAL/REMOTE switch S13 is set to LOCAL.

5. Follow procedure in paragraph 6-2.4.1 to access HVPS.

6. Open right door from within.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow polarities when making connections may result in equipment damage.

7. Remove 2A7 transformer over current monitor card from X2A7.

8. Insert extender card 1A1A14 from card cage, into X2A7 and install 2A7 into extender card.

9. On T10 H1 & H2 standoffs remove cap nuts.

10. On AC current test set connect one end of a phase A lead (W1) to T10H1 using 10-32 nut. See Figure 6-106.5.

11. Connect the other phase A lead to T10H2 using 10-32 nut.

12. On T27 and H2 standoffs, remove cap nuts.

13. On AC current test set, connect one end of a phase B lead (W2) to T27H1 using 10-32 nut.

14. Connect the other phase B lead to T27H2 using 10-32 nut.

15. On T11 H1 and H2 standoffs remove cap nuts.

16. On AC current test set, connect one end of a phase C lead (W3) to T11H1 using 10-32 nut.

17. Connect the other phase C lead to T11H2 using 10-32 nut.

18. On transmitter control panel press STANDBY switch S11.

19. Check that all controls are fully CCW; then turn power on to AC current test set.

20. Set AC current test set to 3.0 amp output per phase.

21. Connect negative lead of multimeter to 2A7 TP24.

22. With DVM positive lead, measure and record DC voltage level at 2A7TP8, TP9, and TP10.

23. If readings in step 22 are within 3% of each other, proceed to step 28. If readings are not within 3% of each other proceed to step 24.

24. With DVM positive lead connected to 2A7TP8, adjust 2A7R13 clockwise until voltage no longer increases and record lowest voltage level.

25. Connect DVM positive lead to 2A7-TP9 and adjust 2A7R27 clockwise until voltage reading at TP9 no longer increases. Record the lowest voltage level.

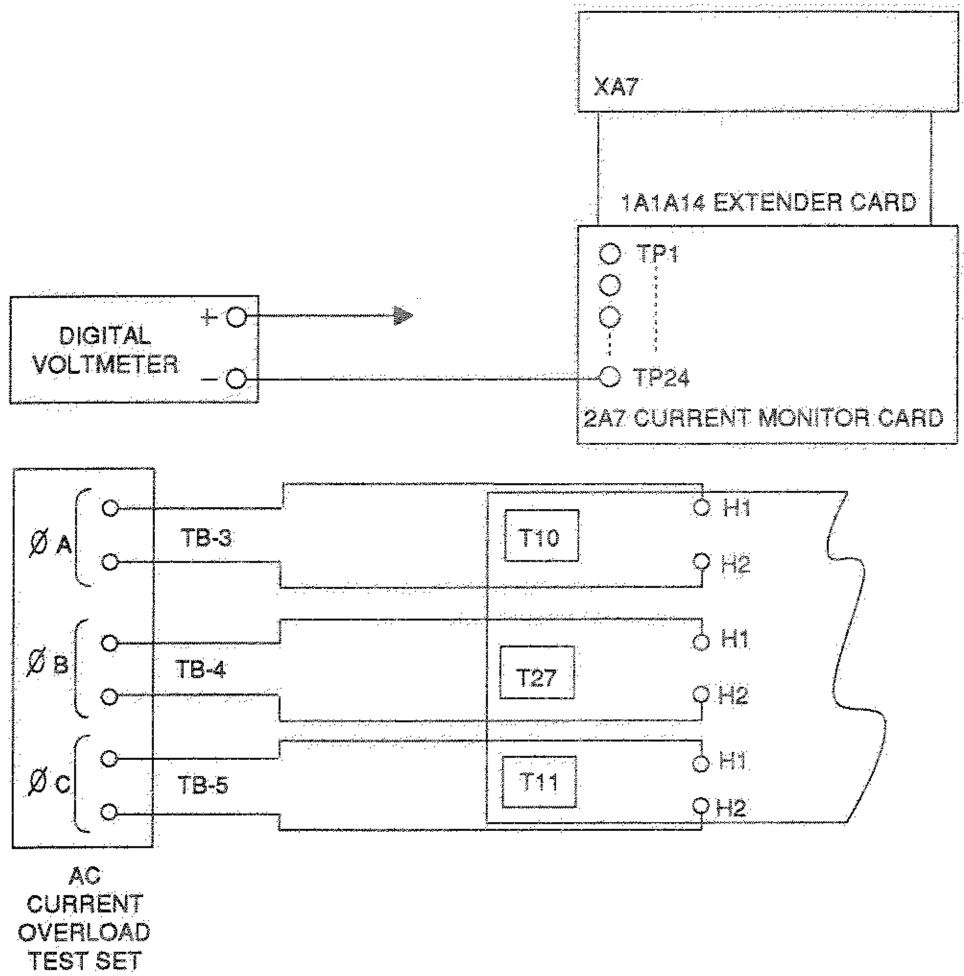


Figure 6-106.5. IPA AC Current Overload Test

26. Connect DVM positive lead to 2A7TB10 and adjust 2A7R28 clockwise until voltage reading at TP10 no longer increases. Record voltage level.

27. Examine recorded voltage levels and readjust R13 and/or R27 and-/or R28 as appropriate until the two highest voltages match the lowest recorded voltage level from steps 24, 25 and 26. Voltages must vary from one to the other by no more than 3%.

28. Reduce the phase currents from AC current test set to zero.

29. On transmitter control panel, press FAULT (RESET) switch S3 to reset any faults resulting from previous steps.

NOTE

In the following steps, whenever an overload fault occurs, three indicator lamps will light: the INTERMEDIATE POWER AMPLIFIER,ANODE,AC,CURRENT OVERLOAD indicator and the FAULT (RESET) indicator located on the Control Panel and the IPA A AC indicator on the 1A1A12 circuit card.

30. On AC current test set, raise Phase A current until IPA AC overload fault is indicated on transmitter control panel.

31. Verify that current reading on test set shows fault indicator was tripped by current of 2.25 to 2.7 amps.

32. Reduce phase A current to zero and reset fault indicators by pressing FAULT (RESET) S3 on transmitter control panel.

33. On AC current test set, raise phase B current until IPA AC overload fault is indicated on transmitter control panel.

34. Verify that current reading on test set shows fault indicator was tripped by current of 2.25 to 2.7 amps.

35. Reduce phase B current to zero and reset fault indicators by pressing FAULT (RESET) switch S3 on transmitter control panel.

36. On AC Current Test Set, raise phase C current until IPA AC overload fault is indicated on transmitter control panel.

37. Verify that current reading on test set shows fault indicator was tripped by current of 2.25 to 2.7 amps.

38. Reduce phase C current to zero and reset fault indicators by pressing FAULT (RESET) switch S3 on transmitter control panel.

39. If all phases tripped above or below 2.25 to 2.7 amps range, adjust 2A7R24 slightly clockwise to cause the trip point to occur at a higher level or slightly counterclockwise to cause the trip point to occur at a lower level.

40. Repeat steps 28 through 39 if 2A7R24 must be adjusted.

WARNING
PERSONNEL INJURY HAZARD

Failure to follow proceure could result in injury or death.

41. Remove voltage from Transmitter Phase monitor card 2A7 by pressing POWER (OFF) switch S12 on Transmitter Control Panel.

42. On transformer current monitor card 2A7, adjust jumper test lead between positive terminal of C16 and cathode terminal of VR7.

43. On Transmitter Control Panel press STANDBY switch S11.

NOTE

With jumper added from step 42, HV ON indicator lamp will be lighted. Disregard indication.

44. On AC current test set, set current supplied to all three phases to 3.0 amps. Reset any faults on the control panel by pressing FAULT (RESET) switch S3.

45. On AC current test set, slowly lower Phase A current until IPA AC overload fault is indicated on transmitter control panel.

46. Verify that overload fault indication occurred between 2.25 and 2.7 amps on the AC current test set phase A current meter.

47. On AC Current Test Set, return phase A to 3 amps.

48. On transmitter control panel, reset fault indication by pressing FAULT (RESET) switch S3.

49. On AC Current Test Set, slowly lower Phase B current until IPA AC overload fault is indicated on transmitter control panel.

50. Verify that overload fault indication occurred between 2.25 and 2.7 amps on the AC Current Test Set phase B current meter.

51. On AC Current Test Set, return Phase B to 3 amps.

52. On Transmitter Control Panel, reset fault indication by pressing FAULT (RESET) switch S3.

53. On AC Current Test Set, slowly lower Phase C current until IPA AC overload fault is indicated on transmitter control panel.

54. Verify that overload fault indication occurred between 2.25 and 2.7 amps on the AC CURRENT TEST SET phase C current meter.

55. On AC Current Test Set, lower all three phases to zero amps, and turn off power to test set.

56. On Transmitter Control Panel, press POWER (OFF) switch S12.

57. Remove clip lead from 2A7.

58. Remove 2A7 from extender card and reinsert 2A7 into X2A7 connector.

59. Remove test cable and 10-32 nuts to 2T7, 2T27 and 2T11.

60. Install cap nuts onto 2T7 H1 and H2, 2T27, H1 and H2 and 2T11 H1 and H2.

61. Set RPIE 120 VAC RIDE THRU circuit breaker CB8 to OFF.

62. Set all 1A23 and 2A2 panel circuit breakers to ON.

63. If no further adjustments are required, perform procedure in paragraph 6-2.4.2 to restore transmitter operation.

6-6.3.2 Variable Transformer 2T24 Adjustment. Refer to Figure 6-100 and perform the following.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	7b	Flatblade Screw driver

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in injury or death.

1. Follow procedure in paragraph 6-2.4.1 to access HVPS.

2. Open right door from within. Close left door to protect personnel.

WARNING
HIGH VOLTAGE HAZARD

High voltage is present on exposed terminals and other devices during this procedure.

3. Connect multimeter between the terminal 3s of any two phase coils.

4. Remove Maintenance-in-Progress warning signs from RPIE 208 VAC and 120 VAC RIDE THRU circuit breakers and turn them on.

5. On Electronic Motor Controller 2A4, adjust lower right-hand pot for reading of 209 to 210 V ac on digital multimeter.

Hold DELAY switch down to OFF and adjust lower left-hand pot cw for sensitivity. When transformer begins to oscillate, adjust pot ccw 1/8-turn.

6. If further maintenance is required, turn off RPIE 208 VAC and 120 VAC RIDE THRU circuit breakers. Tag with Maintenance-in-Progress warning signs.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

7. If no further maintenance is required, follow procedure in paragraph 6-2.4.2 to exit cabinet.

6-6.3.3 <u>RF Feedback Control CCA 1A1A1 and Signal Monitor CCA 1A1A2 Test/Adjustment.</u> The following adjustments require the removal of the CCAs from the card cage.

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	1b	Dummy Load
1	11	Spectral Purity Test Set
1	2a	RF Power Meter
1	2b	Digital Multimeter
1	5a	Power Sensor
1	7e	Phillips Screwdriver
1	9d	Tuning Wand, part of 8280
1	9e	Wrist Strap, Grounding

CAUTION
EQUIPMENT DAMAGE HAZARD

The CCA involved in this procedure is an electrostatic sensitive device. Personnel shall wear grounding wrist strap while handling CCA. Electrical adjustments shall be made using electronic tuning wand.

NOTE

Power meter requires calibration whenever unit is turned off and back on. Signal generator output should be verified after. Unless otherwise noted, alignment is performed with transmitter POWER (OFF). Anytime control circuit cards are removed from the 1A1 card cage or the extender board, the 120 ride through voltage must be turned off and a wrist strap must be used.

1. Place transmitter in local and condition for Band_C according to the procedures in paragraph 4-6.2.3.2. Check that METERS switch 1A13S2 is set to ON.

2. Calibrate FWD PWR METER according to the following procedure.

   a. Place 1A1A1 on extender card, according to the procedure in paragraphs 6-5.2.1 and 6-5.2.2

   b. Select Band-C.

   c. Set FWD/REV selector switch 1A13-S1 to FWD.

   d. Adjust signal generator for 10.54 MHz at 20 dBm.

   e. Disconnect 1A1-W4 from 1A1-HY2 input.

   f. Connect signal generator to input of 1A1-HY2.

   g. Adjust 1A1A1-R39 for a FWD/REV PWR meter indication of 100 kW.

   h. Remove signal generator input and reconnect 1A1-W4 to 1A1-HY2.

   i. Reinstall 1A1A1 card and instal 1A1A2 on extender card according to procedure in paragraphs 6-5.2.1 and 6-5.2.2.

3. Calibrate REV PWR METER according to the following procedure.

   a. Set FWD/REV selector switch 1A13-S1 to REV.

   b. Disconnect 1A1-W9 from 1A1-HY3 input.

   c. Adjust signal generator for 10.54 MHz at 20 dBm.

   d. Connect signal generator to input of 1A1-HY3.

e. Adjust 1A1A2-R104 for 10 kW indication on FWD/REV PWR meter.

f. Remove signal generator input and reconnect 1A1-HY3.

4. Adjust OFS according to the following procedure.

a. Set FWD PWR CLP switch 1A1A2S1 to DSBL.

b. Disconnect 1A1-W12 from 1A1-HY1 input.

c. Adjust signal generator for 10.54 MHz at 17 dBm.

d. Connect POWER SENSOR TO 1A1-W12.

e. Connect generator to TM LOCAL RF INPUT SIGNAL SOURCE 1A25W5-J1 on front panel.

f. Adjust OFS 1A1A2-R52 for 20 dBm power meter indication.

g. Using digital multimeter, monitor and record DR ATTEN 1A1A2-TP1. Multimeter should indicate 5.0 to 6.7 V dc.

h. Disconnect signal generator from 1A23W5-J1.

i. Disconnect power sensor from 1A1-W12 and reconnect 1A1-W12 to 1A1-HY1 input.

j. Set FWD PWR CLP switch 1A1A2-S1 to ENABLE.

5. Align FWD PWR CHANNEL accordiing to the following procedure.

a. Remove two screws holding the 1 inch panel located under meter panel 1A13.

b. Disconnect coax cables AT9 through AT14.

c. Place transmitter in Band-C.

d. Set FWD/REV PWR selector switch 1A13-S1 to FWD.

e. Adjust signal generator for 10.54 MHz at 20 dBm.

f. Connect generator to 1A1AT11.

g. Adjust 1A1-AT11 for 100 kW ion D/REV PWR meter.

6. Align FWD PWR CLAMP PROTECTION according to the following:

a. Place transmitter in STBY.

b. Adjust signal generator for FWD PWR meter indication of 110 kW (V1 90 kW in Band-F).

c. Band-C only: Monitor DR ATTEN test point on 1A1A2 for about 6.1 V dc. Adjust 1A1A2-R9 until the voltage decreases by 50 mv, then adjust 1A1A2-R61 until DRIVE LIMIT lights.

d. Repeat steps 5 and 6 according to Table 6-10 for Bands-A, B, D, E, and F.

e. Remove signal generator and reconnect all coax cables to 1A1AT9-1A1AT14.

7. Align REV PWR CHANNEL according to the following procedure.

a. Disconnect coax cables from AT15 through AT20.

b. Place transmitter in Band-C.

c. Place FWD/REV PWR switch (1A13-S1) to REV.

d. Adjust signal generator for 10.54 MHz at 20 dBm.

e. Connect signal generator to 1A1-AT17.

NOTE

Adjust 1A1-AT5 in Band-C only.

f. Adjust 1A1-AT5 for a REV PWR meter indication of 10 kW.

g. Adjust REV PWR trip point for all bands according to Table 6-10. Increase signal generator to 20 dBm to check full scale (10 kW +/-1 kW), then reduce signal generator output so power meter is at REV PWR KW trip point. Adjust resistor to trip at that point. Fault reset may need to be reset several times while adjusting trip points.

NOTE

REV PWR panel meter should indicate 10 kW +/- 1kW in all bands at 20 dBm.

h. Remove signal generator and reconnect all coax cables.

8. Align LOW LEVEL CHANNEL according to the following procedure.

a. Adjust signal generator for 10.54 MHz at 17 dBm and connect to LOCAL RF INPUT 1A25-J1.

b. Disconnect 1A1-W14 from 1A1-AT3.

c. Connect power sensor to 1A1-W14.

d. Set RF INPUT SELECTOR 1A25-S2 to LOCAL.

e. Verify that FWD PWR CLP switch (1A1A2-S1) is in DSBL.

f. Adjust 1A1-AT2 for a power meter indication of 14.5 mW.

g. Reconnect 1A1-W14 to 1A1-AT3 input.

h. Set FDBK LOOP 1A1A1-S1 to TEST.

i. Disconnect wire 1A1-W4 from low level amp input, and connect power sensor to wire 1A1-W4.

j. Adjust RF DRIVE 1A1A1-R25 for a power meter indication of 0.5 mW.

k. Using digital multimeter, monitor ATTEN VDC 1A1A1-TP3 for 1.5 to 4.0 V dc.

l. Remove power sensor from 1A1-W4 and reconnect 1A1-W4 to input of low level amplifier.

9. Perform GAIN AND CLOSED LOOP alignment according to the following procedures.

a. Place 1A1A1 on extender care, and install the 1A1A2 card according to procedures in paragraphs 6-5.2.1 and 6-5.2.2.

b. Place transmitter in HVON.

c. Adjust each amplifier stage bias control on 1A9 panel to read as follows.

CW		ICW	
IPA Ik	1.2A	IPA Ik	1.5A
DVR Ik	1.3A	DVR Ik	2.0A
PA Ik	3.5A	PA Ik	5.0A

d. Set BIAS/RF switch to CUTOFF.

e. Verify FWD PWR CLP switch (1A1A2-S1) is set to ENABLE.

f. Set FDBK LOOP switch 1A1A1-S1 to TEST.

g. Recalibrate power meter.

h. Adjust signal generator for 10.54 MHz at 17 dBm.

i. Connect power sensor to DEDICATED FORWARD POWER SAMPLE W67-J1 with 21 foot coax cable.

j. Place transmitter in Band-C.

k. Connect signal generator to LOCAL RF INPUT 1A25-J1.

l. Set BIAS switch to CW.

m. Readjust 1A1-AT2 for a power meter indication of 19.07 dBm.

n. If necessary, adjust 1A1-AT11 for a FWD PWR meter indication of 100 kW.

o. Monitor 1A1A1-E4 and adjust 1A1A1-R5 for 0 V dc +0.010.

p. Set FDBK LOOP switch 1A1A1-S1 to OPR.

q. FWD PWR meter should remain at 100 kW and power meter should remain at 19.07 dBm. If not repeat steps m through p until correct results are obtained.

r. Place transmitter in STBY.

s. Reinstall 1A1A1 card and place the 1A1A2 card on the extender card following the procedure in paragraphs 6-5.2.1 and 6.5.2.2.

10. Align AUTO-DISIPATION LIMITER circuit according to the following procedure.

a. Set FWD PWR CLP switch on 1A1A2 card to DSBL.

b. Select Band-C.

c. Place a jumper wire between the junction of 1A1A2-R45, 46, 47 and GND.

d. Using the digital multimeter, monitor DR ATTEN 1A1A2-TP1. DVM should indicate the same value established in the OFS adjustment step 4g, (5.0 to 6.7 V dc).

e. Adjust signal generator for 10.54 MHz.

f. Place transmitter to HVON.

g. Adjust signal generator RF output until FWD PWR meter indicates 50 kW. Observe the following indications:

PA Ik	11 to 13A
Power Meter	16.07 dBm
FWD PWR Meter	45 to 55 kW

h. Adjust ADL THRESHOLD 1A1A2-R43 until the voltage at 1A1A2-TP1 just begins to decrease and DRIVE LIMIT light comes on.

i. Remove jumper installed in step c, DRIVE LIMIT light should go out and multimeter should return to its quiescent state established in step d (5.0 to 6.5 V dc)

j. Return FWD PWR CLP switch on 1A1A2 card to ENBL.

11. Perform final alignment of other 5 bands according to the following procedure.

a. Align the other bands in the follwoing sequence for minimum movement of the dummy load: from C to E, from E to A, from A to D, from D to F and from F to B. Move the dummy load according to the procedure of paragraph 4-6.4.3.

b. With FDBK LOOP switch on 1A1A1 card in OPR position, operate the transmitter in Bands-A, B, D, E, and F in accordance with Table 6-10. Adjust 1A1-AT9 through AT14 if necessary to obtain required output.

NOTE

Adjustment of 1A1AT9 through 1A1AT14 in the TEST position changes FWD PWR meter with no change in output power.

Adjustment of 1A1AT9 through 1A1AT14 in the OPR position changes output power with no change in the FWD PWR meter.

c. Place transmitter in STBY.

d. Reinstall 1A1A2 card according to the porocedure in paragraph 6-5.2.2.

e. Condition transmitter to REMOTE according to the procedure in paragraph 4-6.2.3.1.

f. Return equipment to normal operation.

THIS FIGURE DELETED

Figure 6-107. (Deleted)

Table 6-10. RF Band Output Data

BAND	FREQ (MHz)	INPUT (DBM)	TRIP POINT	1A1 ATTEN	PWR (KW)	1A1A2 ADJ	PWR MTR dBm
STEP 6 FWD PWR CLAMP PROTECTION							
A	5.83	+20	110	AT9	100	R7	
B	7.82	+20	110	AT10	100	R8	
D	14.21	+20	110	AT12	100	R10	
E	19.15	+20	110	AT13	100	R11	
F	24.93	19(V1)+20(V2)	090(V1)110(V2)	AT14	80(V1)100(V2)	R12	
STEP 7 REV PWR CHANNEL ALIGNMENT							
A	5.83			AT15	8.5 REV	R73	
B	7.82			AT16	8.5 REV	R74	
C	10.54			AT17	8.5 REV	R75	
D	14.21			AT18	8.5 REV	R76	
E	19.15			AT19	8.5 REV	R77	
F	24.93			AT20	6.5(V1)8.5(V2) REV	R78	
STEP 11 FINAL RF ALIGNMENT OF OTHER 5 BANDS							
E	19.15	+17		AT13	100 FWD		18.76
A	5.83	+17		AT9	100 FWD		19.24
D	14.21	+17		AT12	100 FWD		19.17
F	24.93	+16(V1)+17(V2)		AT14	80(V1)100(V2) FWD		17.61
B	7.82	+17		AT10	100 FWD		19.42

6-6.3.4 (Deleted)

6-6.3.5 <u>Band Prove CCA 1A1A5 Test. Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	9e	Wrist Strap, Grounding

CAUTION

EQUIPMENT DAMAGE HAZARD

The CCA involved in this procedure is an electrostatic sensitive device. Personnel shall wear grounding wrist strap while handling CCA.

NOTE

If procedure is being performed as result of CCA replacement per paragraph 6-5.2, proceed directly to step 2.

1. Follow procedure in paragraph 6-5.2 to remove CCA 1A1A5 and install in transmitter on extender service card.

2. Verify 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers are closed on HVPS cabinet.

3. Check wiper arms of potentiometers 1A1A5R27 through 1A1A5R29 for 6.2 V dc and adjust if necessary.

4. For each frequency band, measure + V dc at 1A1A5-E1 through 1A1A5-E13, as shown in Table 6-11. Compare multimeter readings to values listed in Table 6-11. If readings vary more than ± 0.75 V dc, replace monitor transducer (MT) associated with test point.

NOTE

MT1 through MT13 are located at front of pneumatic enclosure on top of cabinet 1. They are labeled for identification.

5. If no further maintenance is required, open 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers on HVPS.

6. Follow procedure in paragraph 6-5.2 to reinstall CCA and bring transmitter back to mission-ready

3. Check wiper arms of potentiometers 1A1A5R27 through 1A1A5R39 for 6.2 V dc and adjust if necessary.

Table 6-11. Air Pressure Monitors Test

Test Point	Assigned Function	A Band + V dc	B Band + V dc	C Band + V dc	D Band + V dc	E Band + V dc	F Band + V dc
E1 Air (MT20)	Pres. Prove	7.0	7.0	7.0	7.0	7.0	7.0
E2 (MT21)	PA Grid AB Filt.	7.0	7.0	3.5	3.5	3.5	3.3
E3 (MT11)	B+ Decpl. Band EF	3.5	3.5	3.5	3.5	6.5	7.0
E4 (MT10)	B+ Decpl. Band CDEF	3.5	3.5	7.0	6.5	6.5	7.0
E5 (MT9)	PA Grid CD Filt.	3.5	3.5	7.0	6.5	3.5	3.5
E6 (MT8)	PA Grid, Drvr Output F Filt.	3.5	3.5	3.5	3.5	3.5	7.0
E7 (MT7)	PA Grid, Output E Filt.	3.5	3.5	3.5	3.5	7.0	3.5
E8 (MT6)	Output D Filt.	3.5	3.5	3.5	7.0	3.5	3.5
E9 (MT5)	Drvr Grid DE Filt.	3.5	3.5	3.5	7.0	6.5	3.5
E10 (MT4)	Output C Filt.	3.5	3.5	7.0	3.5	3.5	3.5
E11 (MT3)	Output B Filt.	3.5	7.0	3.5	3.5	3.5	3.5
E12 (MT2)	Output A Filt.	7.0	3.5	3.5	3.5	3.5	3.5
E13 (MT1)	Drvr Grid ABC Filt.	7.0	7.0	6.5	3.5	3.5	3.5

NOTE: tolerance for all voltage readings is ± 0.75 V dc.

6-6.3.6 Water Flow CCA 1A1A10 Test/Adjustment. Adjust and monitor cooling water pressure according to the following procedure.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	9d	Tuning Wand, part of 8280
1	9e	Wrist Strap, Grounding

CAUTION
EQUIPMENT DAMAGE HAZARD

The CCA involved in this procedure is an electrostatic sensitive device. Personnel shall wear grounding wrist strap while handling CCA.

NOTE

If procedure is being performed as result of CCA replacement per paragraph 6-5.2, proceed directly to step 2.

1. Follow procedure in paragraph 6-5.2 to remove CCA 1A1A10 and install in transmitter on extender service card.

2. Verify 120 VAC RIDE THRU INPUT circuit breaker is closed on HVPS cabinet.

3. Measure voltages at 1A1A10E25 through 1A1A10E32, as shown in Table 6-12. Compare multimeter readings to DVM Reading column. For out of tolerance readings, replace transducer. If problem persists, search for blockage in cooling system. Measure voltages at 1A1A10E9 through 1A1A10E24 for out of tolerance readings as compared to DVM READING column on Table 6-13. Adjust 1A1A10R17 through R32 if tolerance exceeds +\- 0.05 V dc as indicated on DVM.

4. Slowly close RPIE inlet water valve. Verify WATER FLOW lamp on front panel of 1A1A10 lights up. If lamp does not light within 1 minute:

   a. Restore water pressure to normal (Inlet 80 to 88 psig; Outlet 5 to 9 psig).

   b. Replace 1A1A10 per paragraph 6-5.2, then perform this procedure again.

5. Slowly open cooling water valve until pressure returns to normal (Inlet 80 to 88 psig; Outlet 5 to 9 psig). Verify WATER FLOW lamp goes out.

6. If no further maintenance is required, open 120 VAC RIDE THRU INPUT circuit breaker on HVPS.

7. Follow procedure in paragraph 6-5.2 to reinstall CCA and bring transmitter back to mission-ready status.

6-6.3.7 Test Meter Scaling CCA 1A1A13 Test/Adjustment.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1b	Dummy Load
1	4a	RF Signal Generator
1	9d	Tuning Wand, part of 8280
1	9e	Wrist Strap, Grounding

CAUTION
EQUIPMENT DAMAGE HAZARD

The CCA involved in this procedure is an electrostatic sensitive device. Personnel shall wear grounding wrist strap while handling CCA.

1. Follow procedure in paragraph 4-6.2.3.2 to change to local operation and condition transmitter for CW mode in Band C.

2. Open card assembly panel 1A1 access door and locate CCA 1A1A13.

Table 6-12. Water Pressure Monitors Test

Test Point	DVM Reading	Monitor Transducer
E25	+4.5 to +6.2	MT12
E26	+6.0 to +7.9	MT13
E27	+5.5 to +6.5	MT14
E28	+3.8 to +5.2	MT15
E29	+5.8 to +6.8	MT19
E30	+3.8 to +5.5	MT18
E31	+4.5 to +5.6	MT17
E32	+5.35 to +6.2	MT16

Table 6-13. Water Pressure Transducer Adjustment

Monitor Transducer		Test Jack	Adj	DVM Reading	ET Function
MT12	(HIGH)	E9	R17	+6.7	IPA ANODE
	(LOW)	E10	R18	+4.3	
MT13	(HIGH)	E11	R19	+8.1	IPA & DRVR
	(LOW)	E12	R20	+5.7	AMPL GRID
MT14	(HIGH)	E13	R21	+6.4	PA GRID, FIL,
	(LOW)	E14	R22	+5.4	& GRID FILTERS
MT15	(HIGH)	E15	R23	+5.3	DRIVER AMP
	(LOW)	E16	R24	+3.7	ANODE
MT18	(HIGH)	E17	R25	+5.9	PA GRID
	(LOW)	E18	R26	+3.7	D.L.
MT19	(HIGH)	E19	R27	+7.05	OUTPUT
	(LOW)	E20	R28	+5.4	FILTERS (CEA)
MT17	(HIGH)	E21	R29	+6.3	PA ANODE
	(LOW)	E22	R30	+4.2	
MT16	(HIGH)	E23	R31	+6.4	OUTPUT
	(LOW)	E24	R32	+5.25	FILTERS (BFD)

3. Connect output of RF signal generator to RF INPUT SIGNAL SOURCE jack on RF SIGNAL MONITORS panel 1A25. Set 1A25S2 RF INPUT SELECTOR to LOCAL position.

4. On Meter Assembly panel 1A13, position RF POWER switch to FWD and METERS switch to ON.

5. Condition signal generator to operate at 10.54 MHz. Adjust generator output level for 100 kW transmitter RF power out as indicated by POWER (KW) meter 1A13M1.

6. On CONTROL/STATUS Panel 1A1, position right-hand test meter switch to PA ANODE RF LEVEL, 10 scale. On front of CCA, adjust RF LVL PA A pot for reading of 75 on right-hand TEST METER.

7. Position right-hand test meter switch to PA GRID RF LEVEL, 10 scale. Adjust RF LVL PA G pot for reading of 50 on right-hand TEST METER.

8. Position right-hand test meter switch to DRVR GRID RF LEVEL, 10 scale. Adjust RF LVL DRVR G pot for reading of 40 on right-hand TEST METER.

9. Position right-hand test meter switch to IPA GRID RF LEVEL, 10 scale. Adjust RF LVL IPA G pot for reading of 30 on right-hand TEST METER.

10. If no further maintenance is required, follow procedure in paragraph 4-6.2.3.1 to bring transmitter back to mission-ready status.

6-6.3.8 <u>High Voltage AC Switch Operator Drive Chain Adjustment</u>. Refer to Figure 6-106 and perform the following.

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	7a	Needle Nose Pliers
1	7ab	Diagonal Cutter Pliers
1	7i	Open End Wrench

WARNING
HIGH VOLTAGE HAZARD

Failure to follow access procedure may result in death or injury.

1. Follow procedure in paragraph 6-2.5.1 to access cabinet.

WARNING
INJURY HAZARD

Personnel shall exit cabinet and close door before performing the next step. Switch blades move with sufficient force to cause serious injury.

2. Obtain spare key from Site Supervisor. Unlock 12.47 kV disconnect lever. Move it to CLOSED position.

3. Place chain assembly top turnbuckle as near as possible to switch sprocket. Bottom turnbuckle will then be near handle sprocket.

4. Tighten bottom turnbuckle to ensure chain engages sprocket. Tighten top turnbuckle finger tight.

WARNING
INJURY HAZARD

Personnel shall exit cabinet and close door before performing the next step. Switch blades move with sufficient force to cause serious injury.

5. Verify cabinet is cleared of personnel. Pull 12.47 kV disconnect lever down to OPEN. If switch operates properly, verify its operation from OPEN to CLOSED and back to OPEN. If switch tests good, proceed directly to step 8.

6. Loosen bottom turnbuckle and tighten top turnbuckle.

7. Check switch operation by repeating step 5. Repeat steps 5 and 6, until switch checks good.

8. Secure both turnbuckles with safety wire through holes.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow exit procedure may result in equipment damage.

9. Follow procedure in paragraph 6-2.5.2 to exit cabinet. Return spare key to Site Supervisor.

6-6.3.9 PA Band Switches Adjustment. Switches 1A1S18 through 1A1S23 are located at the bottom of vacuum tube 1V3 in cabinet 1. The switches are configured as plunger assemblies and are accessed for maintenance through both left and right front doors and left and right rear doors.

6-6.3.9.1 Bands A, B, C, and D Adjustment. To adjust band switches for Bands A, B, C, or D, refer to Figures 6-108 through 6-110 and perform the following.

Tools and Test Equipment Required:

Qty	Item No. (from Table 1-4)	Description
1	2i	Frequency Counter
1	1w	Variable Power Supply
1	1x	Resistor 100 Ohm 2W
1	7d	Phillips Screwdriver
1	7b	Flat Blade Screwdriver
1	7i	Open End Wrench
1	1r	Platform Ladder

1. Turn off RPIE compressed air supply to pneumatic enclosure on top of cabinet 1. Allow pressure to bleed down, then follow procedure in paragraph 6-2.2.1 to access cabinet. Switch band select 1 to band 4 and back. Observe sound of air bleed-off. Switch again until no air bleed-off is heard.

CAUTION

EQUIPMENT DAMAGE HAZARD

The following adjustments are extremely critical. If not performed properly, contacts will be damaged when RF is applied to transmitter.

2. Verify nut at plunger contact end is tightened (Figure 6-110).

3. On top of cabinet, loosen 20 slide-lock fasteners and remove pneumatic enclosure cover panel.

4. At top of PA vacuum tube circular access panel, remove 3-pin cannon connector from arc sensor. Remove eight Phillips-head screws and remove circular access panel.

5. To adjust Bands A, B, C, and D pneumatic cylinders (Figure 6-108), turn upper speed adjustment screw cw until it bottoms out, then ccw one full turn. Turn lower speed adjustment screw cw until it bottoms out, then ccw 5/8-turn. Turn both upper and lower cushion adjustment screws cw until they bottom out, then ccw one full turn.

6. At right side of air matrix compartment, remove wingnut that secures brass gage block to angle-iron frame. Lower gage block on attached chain through circular access to PA band switch compartment.

7. Manually raise shaft assembly plunger until small contact meets with upper ring contact.

8. Maintain upward pressure on shaft assembly plunger and insert brass gage block (Figure 6-111) between lower ring contact and upper ring contact.

9. If spacing between upper ring contact and lower ring contact prevents brass gage block from being inserted, loosen set screws on contact ring clamp. Slide lower ring contact down until block can be inserted but fits snugly, with no lateral movement. Keep block in place and re-tighten contact ring clamp set screws. See Figure 6-109 for location of ring contacts.

10. Remove and reinsert brass gage block a minimum of two times to ensure contact spacing is correct. If not, repeat step 9 until proper spacing is achieved.

11. Verify bar support is screwed down to secure contact arm.

12. Verify set screw of contact arm is tightened.

13. Verify all six screws for small contact are tightened into shorting plunger.

14. Loosen both upper and lower locknuts on turnbuckle. Pull down on shaft assembly plunger until pneumatic cylinder is fully extended (bottomed out).

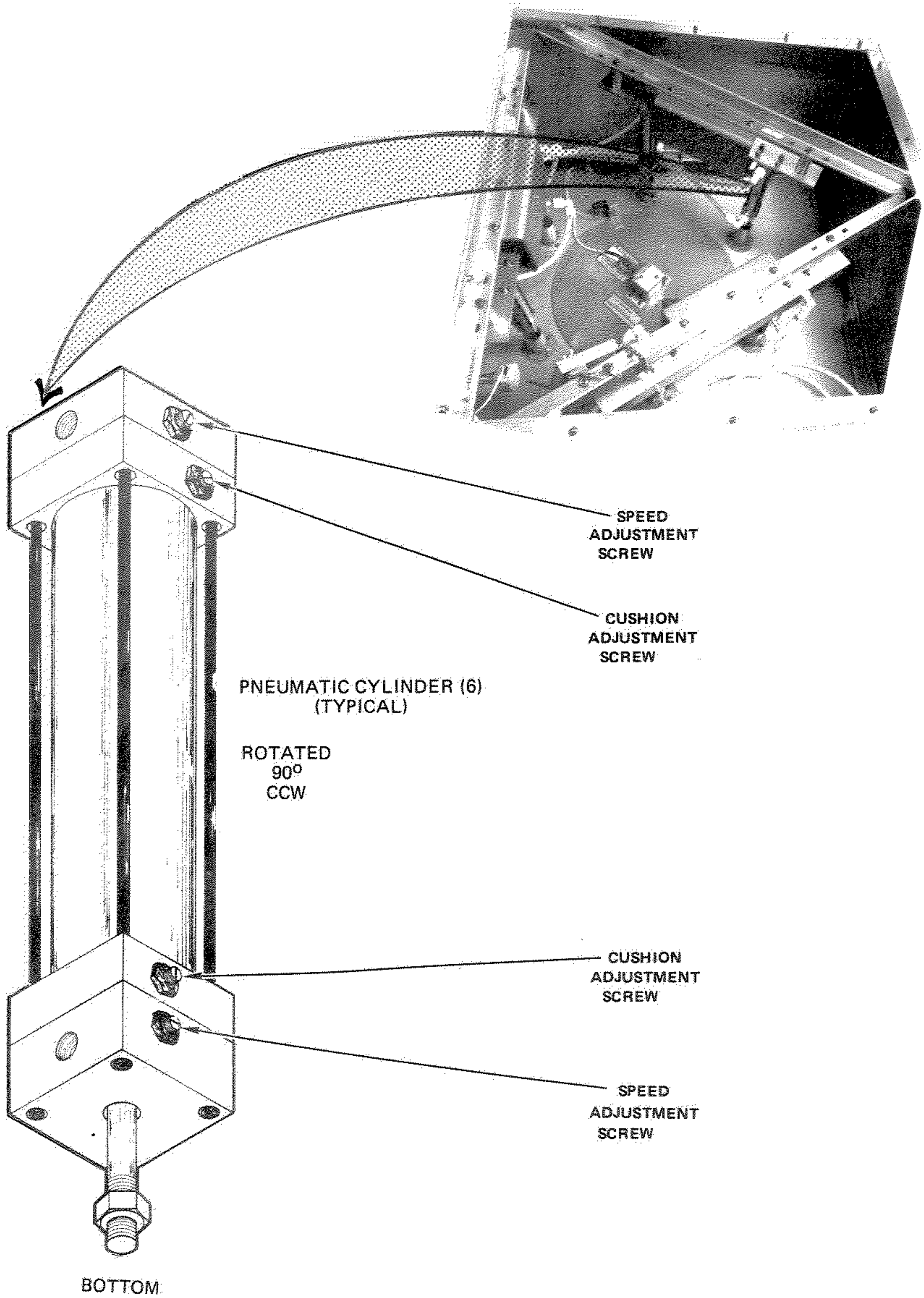


Figure 6-108. PA Band Switch Pneumatic Cylinders

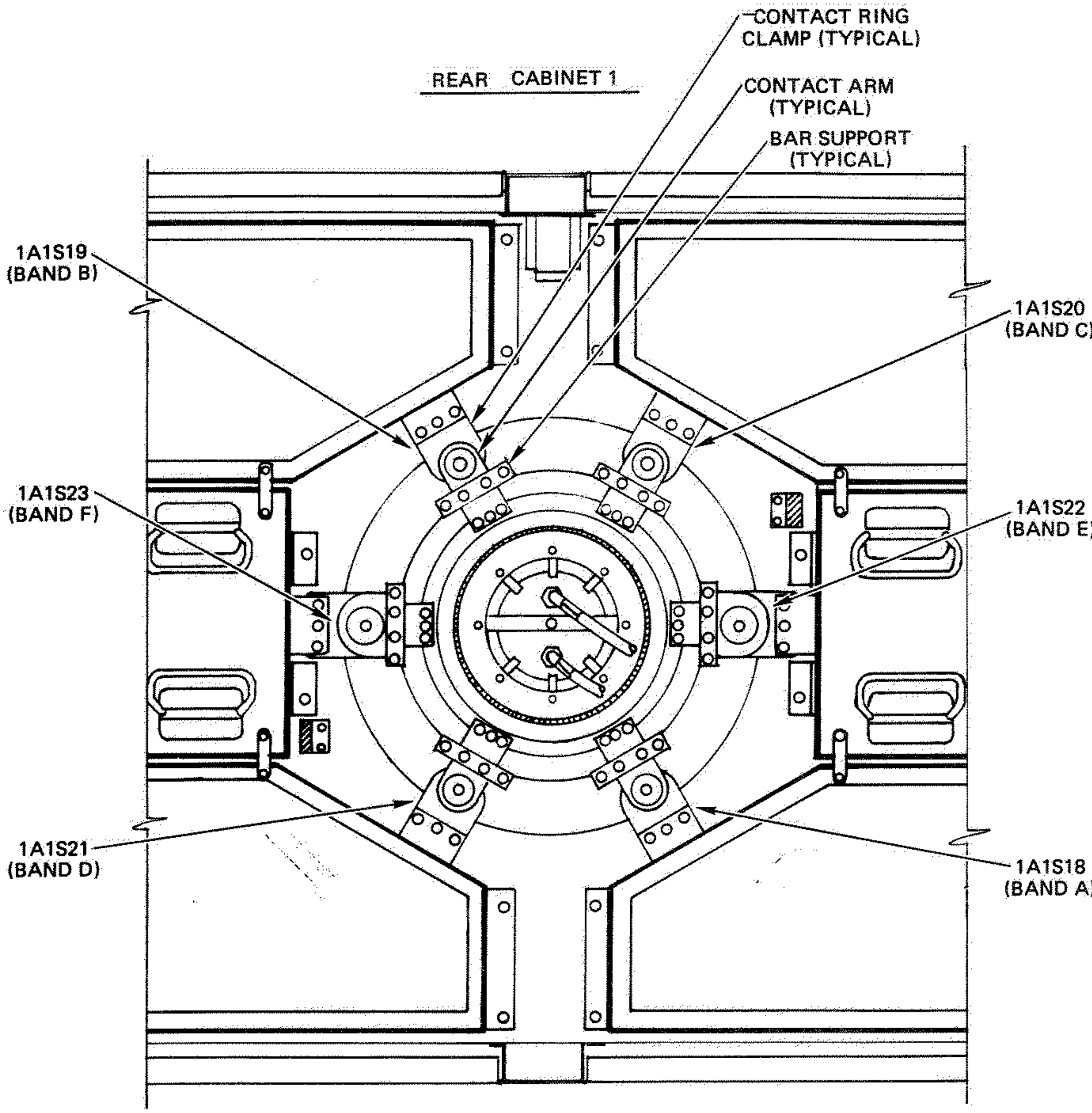


Figure 6-109. PA Band Switch Location, Top View

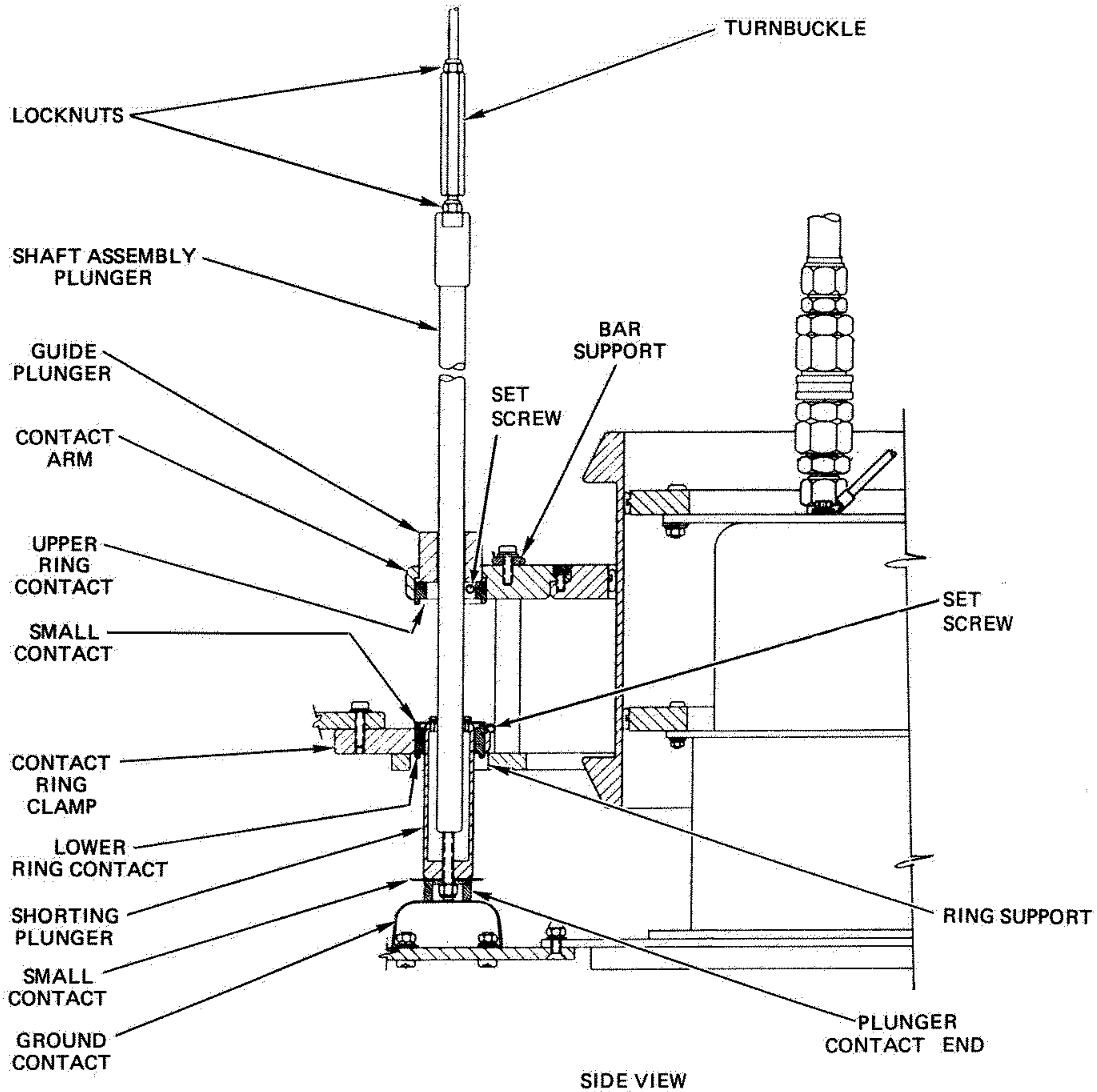
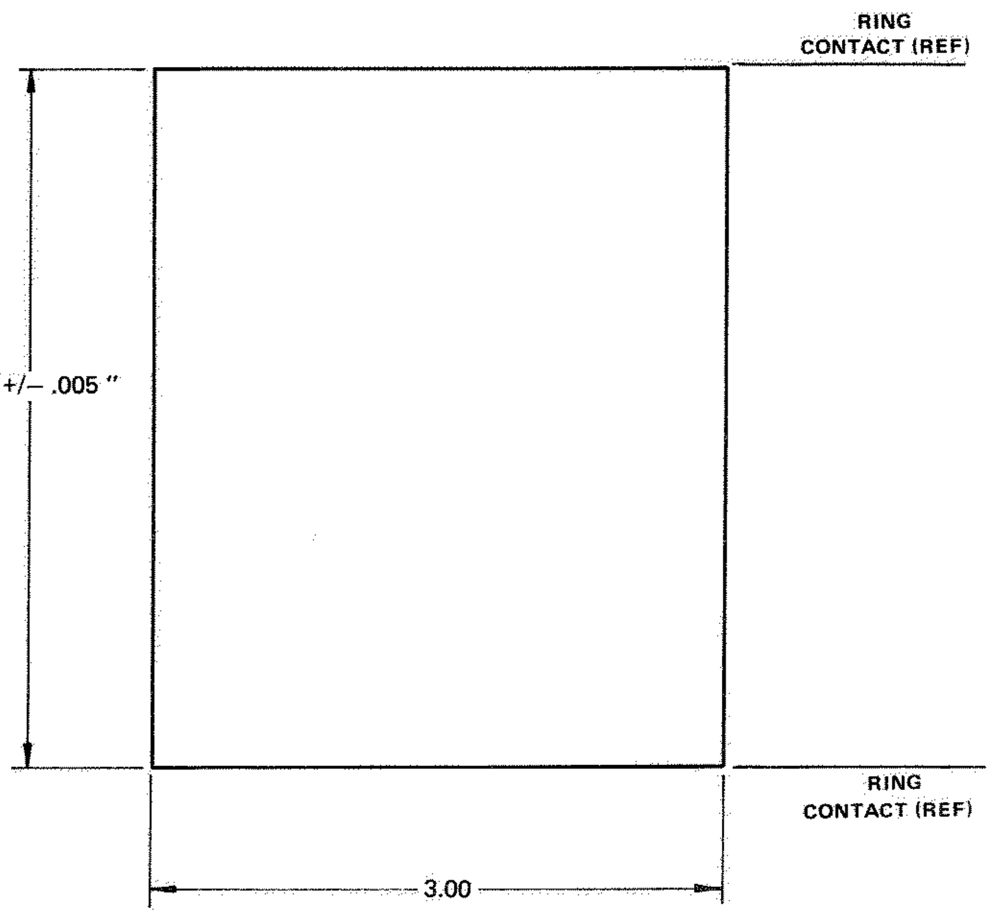


Figure 6-110. PA Band Switch Component Location, Bands A, B, C, and D



NOTE

Dimensions are in inches

Figure 6-111. Brass Gage Block

15. Holding turnbuckle in place with wrench, turn shaft assembly plunger cw by hand until small contact meets with lower ring contact.

16. Tighten upper locknut on turnbuckle.

17. Turn turnbuckle ccw by hand so it travels upward approximately 0.15-inch (about three turns). Verify split-fingers of small contact do not move from lower ring contact while turnbuckle adjustment is being made.

18. Tighten lower locknut on turnbuckle.

19. Verify plunger contact end meets with ground contact. If not, reshape ground contact by hand until proper contact is achieved.

CAUTION
EQUIPMENT DAMAGE HAZARD

Nominal air pressure to shaft assembly is 35 ±3 psig. If more than 40 psig is applied, damage to contacts may result and further damage may be suffered when RF is applied to transmitter.

20. Ensure shaft assembly plunger is in down position.

21. Turn on air pressure. Verify shaft assembly plunger moves between contact rings in a single, smooth motion and does not bounce up and down when contact is made. If bouncing action does occur, shut off pneumatic pressure. Perform entire adjustment procedure again, paying special attention to adjustment of pneumatic cylinders. If bouncing action occurs again, replace pneumatic cylinder(s).

NOTE

If band switch for Bands E or F are to be adjusted, proceed directly to paragraph 6-6.3.9.2.

22. Return brass gage block to storage and install wingnut.

NOTE

The following steps verify time-of-travel of plunger. Person on top of cabinet 1 remain in place to make any required adjustments. Second person monitor frequency counter and perform appropriate steps.

23. Refer to Figure 6-112 to set up test equipment. Connect (A) INPUT of frequency counter to the + terminal of power supply through a 100 ohm, 2 Watt resistor. Clip parallel lead from (A) INPUT to bar support screw of plunger assembly for band under test.

24. Condition power supply for 5 ±1 V dc output as indicated on the built-in panel meter.

25. Set frequency counter RISE/FALL A to ON; RANGE HOLD to ON; MIN (no delay) to ON; CYCLE to NORM.

26. Remove Maintenance-in-Progress warning sign and turn on RPIE circuit breaker for 120 V ac Ride Thru to cabinet 2.

27. At HVPS, turn on 120 VAC RIDE THRU INPUT circuit breaker.

28. Select a band other than one under test.

29. Select band under test and measure travel time on frequency counter. Travel time must measure 450 ± 50 milliseconds within the following guidelines. If correct, proceed directly to step 31.

    a. Adjustments interact slightly. When speed or cushion adjustments are made, verify other has not been affected before proceeding.

    b. Cushion effect prevents plunger from bottoming out. If cushion is inadequate, a metal-on-metal noise will be heard and more cushion is required.

30. Make slight screwdriver adjustment to appropriate screw, then repeat step 29. Refer to Figure 6-108 and the following guidelines for location and effect.

    a. Adjustment screw at top of cylinder controls plunger speed on down-stroke. Turning ccw increases speed and slightly decreases cushion.

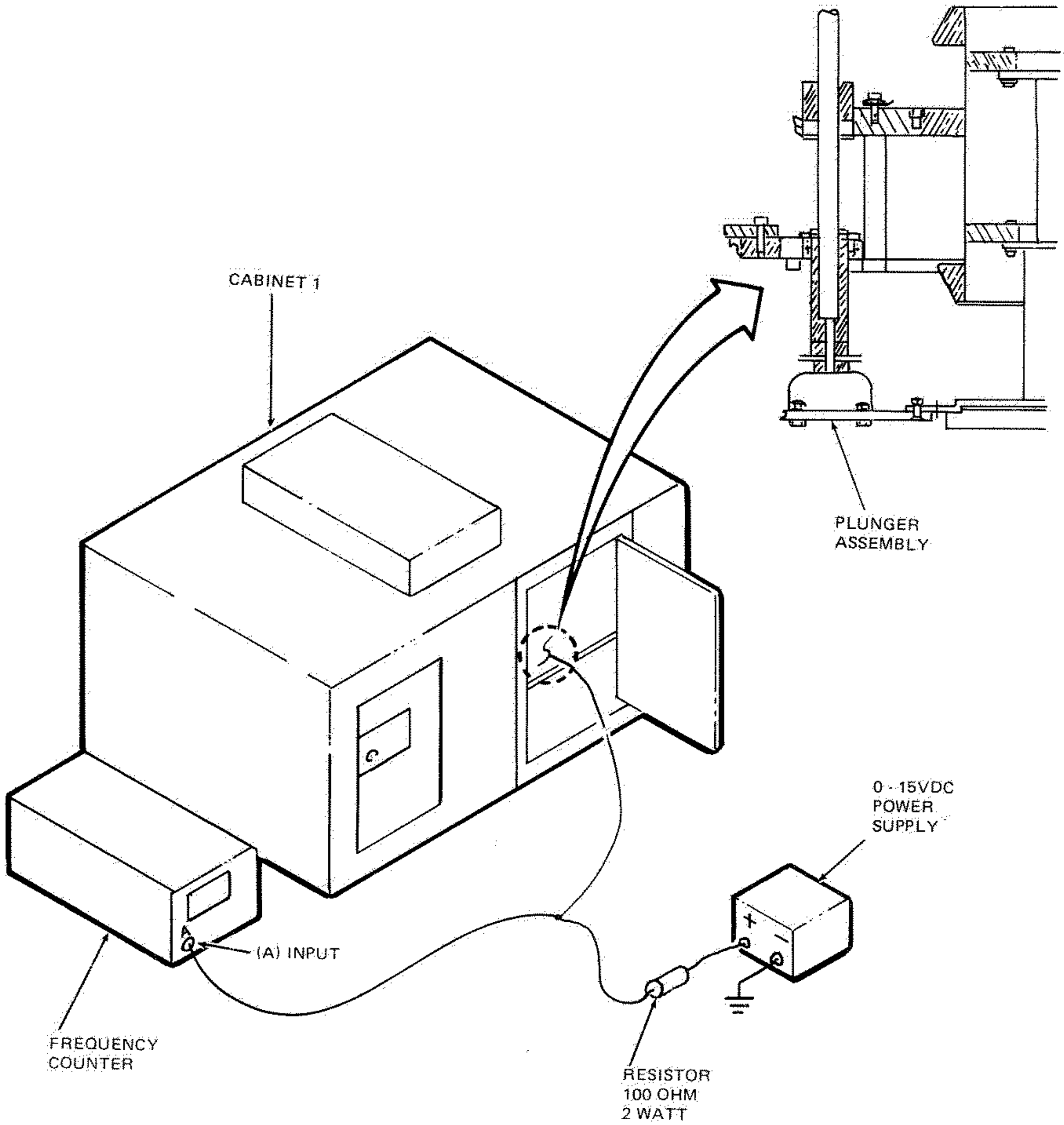


Figure 6-112. Plunger Adjustment Verification

- Speed adjustment screw at bottom of cylinder controls plunger speed on up-stroke. Turning ccw increases speed and slightly decreases cushion.
- Cushion adjustment screw at top of cylinder controls cushion effect on up-stroke. Turning ccw increases cushion and slightly decreases plunger speed.
- Cushion adjustment screw at bottom of cylinder controls cushion effect on down-stroke. Turning ccw increases cushion and slightly decreases plunger speed.

31. If other bands are to be tested, repeat steps 28 through 30 as necessary.

32. Replace access panels. Disconnect test equipment and restore system to original configuration.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

33. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-6.3.9.2 Bands E and F Adjustment. To adjust band switches for Bands E or F, refer to Figures 6-108, 6-109, 6-111, and 6-113. Perform the following.

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

CAUTION
EQUIPMENT DAMAGE HAZARD

The following adjustments are extremely critical. If not performed properly, contacts will be damaged when RF is applied to transmitter.

2. Verify nut at plunger contact end is tightened (Figure 6-113).

3. On top of cabinet, loosen 20 slide-lock fasteners and remove pneumatic enclosure cover panel.

4. At top of PA vacuum tube circular access panel, remove 3-pin cannon connector from arc sensor. Remove eight Phillips-head screws and remove circular access panel.

5. Adjust Bands E and F pneumatic cylinders (Figure 6-113). Turn upper speed adjustment screw cw until it bottoms out, then ccw one full turn. Turn lower speed adjustment screw cw until it bottoms out, then ccw 5/8-turn. Turn both upper and lower cushion adjustment screws cw until they bottom out, then ccw one full turn.

6. At right side of air matrix compartment, remove wingnut that secures brass gage block to angle-iron frame. Lower gage block on attached chain through circular access to PA band switch compartment.

7. Manually raise shaft assembly plunger until large contact meets with upper ring contact.

8. Maintain upward pressure on shaft assembly plunger and insert brass gage block (Figure 6-110) between lower ring contact and upper ring contact. Refer to Figure 6-112 for location of ring contacts.

9. If spacing between upper ring contact and lower ring contact prevents brass gage block from being inserted, loosen set screws on contact ring clamp. Slide lower ring contact down until block can be inserted but fits snugly, with no lateral movement. Keep block in place and re-tighten contact ring clamp set screws.

10. Remove and reinsert brass gage block a minimum of two times to ensure contact spacing is correct. If not, repeat step 9 until proper spacing is achieved.

11. Verify bar support is screwed down to secure contact arm.

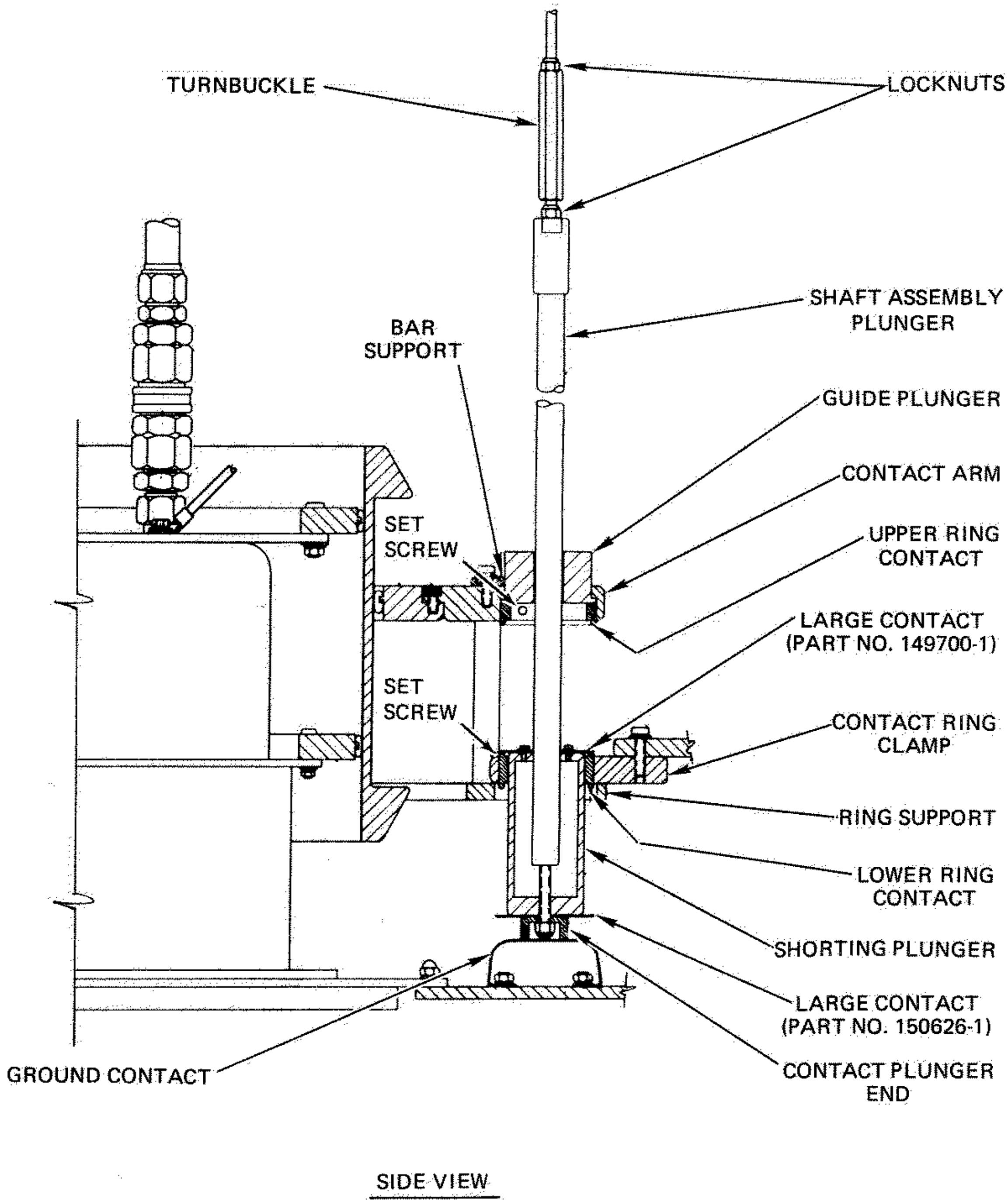


Figure 6-113. PA Band Switch Component Location, Bands E and F

12. Verify set screw of contact arm is tightened.

13. Verify all six screws for large contact are tightened into shorting plunger.

14. Loosen both upper and lower locknuts on turnbuckle. Pull down on shaft assembly plunger until pneumatic cylinder is fully extended (bottomed out).

15. Hold turnbuckle in place with wrench and turn shaft assembly plunger cw by hand until large contact meets with lower ring contact.

16. Tighten upper locknut on turnbuckle.

17. Turn turnbuckle ccw by hand so it travels upward approximately 0.15-inch (about three turns). Verify split-fingers of large contact do not move from lower ring contact while turnbuckle adjustment is being made.

18. Tighten lower locknut on turnbuckle.

19. Verify plunger contact end meets with ground contact. If not, reshape ground contact by hand until proper contact is achieved.

CAUTION

EQUIPMENT DAMAGE HAZARD

Nominal air pressure to shaft assembly is 35 ± 3 psig. If more than 40 psig is applied, damage to contacts may result and further damage may be suffered when RF is applied to transmitter.

20. Ensure shaft assembly plunger is in down position.

21. Turn on air pressure. Verify shaft assembly plunger moves between contact rings in a single, smooth motion and does not bounce up and down when contact is made. If bouncing action does occur, shut off pneumatic pressure. Perform entire adjustment procedure again, paying special attention to adjustment of pneumatic cylinders. If bouncing action occurs again, replace pneumatic cylinder(s).

22. Return brass gage block to storage and install wingnut.

NOTE

The following steps verify time-of-travel of plunger. Person on top of cabinet 1 remain in place to make any required adjustments. Second person monitor oscilloscope and perform appropriate steps.

23. Refer to Figure 6-112 to set up test equipment. Connect (A) INPUT of frequency counter to the positive terminal of power supply through a 100 ohm, 2 Watt resistor. Clip parallel lead from (A) INPUT to bar support screw of plunger assembly for band under test.

24. Conndition power supply for 5 ± 1 V dc output as indicated on the built-in panel meter.

25. Condition frequency counter for RISE/FALL A to ON; RANGE HOLD to ON; MIN (no delay) to ON; CYCLE to NORM.

26. Remove Maintenance-in-Progress warning sign and turn on RPIE circuit breaker for 120 VAC RIDE THRU to cabinet 2.

27. At HVPS, turn on 120 VAC RIDE THRU INPUT circuit breaker.

28. Select a band other than one under test.

29. Select band under test and measure travel time on frequency counter. Travel time must measure 450 $\pm$ 50 milliseconds within the following guidelines. If correct, proceed directly to step 31.

NOTE

- Adjustments interact slightly. When speed or cushion adjustments are made, verify other has not been affected before proceeding.
- Cushion effect prevents plunger from bottoming out. If cushion is inadequate, a metal-on-metal noise will be heard and more cushion is required.

30. Refer to Figure 6-108 and the following list for adjustment screw location and effect. Make slight adjustment, then repeat step 29.

    a. Speed adjustment screw at top of cylinder controls plunger speed on down-stroke. Turning ccw increases speed and slightly decreases cushion.

    b. Speed adjustment screw at bottom of cylinder controls plunger speed on up-stroke. Turning ccw increases speed and slightly decreases cushion.

    c. Cushion adjustment screw at top of cylinder controls cushion effect on up-stroke. Turning ccw increases cushion and slightly decreases plunger speed.

    d. Cushion adjustment screw at bottom of cylinder controls cushion effect on down-stroke. Turning ccw increases cushion and slightly decreases plunger speed.

31. If other bands are to be tested, repeat steps 28 through 30.

32. Replace access panels. Disconnect test equipment and restore system to original configuration.

CAUTION
EQUIPMENT DAMAGE HAZARD

Failure to follow approved exit procedure may result in equipment damage.

33. Follow procedure in paragraph 6-2.2.2 to exit cabinet.

6-6.3.10. Filament Voltage Management. The operational lifespan of the three vacuum tubes can be extended through proper management of filament voltages.

6-6.3.10.1 Guidelines. The following guidelines are engineered to minimize filament operating temperatures, yet provide adequate emission to support transmitter requirements.

CAUTION
EQUIPMENT DAMAGE HAZARD

Tubes shall never be operated at filament voltages lower than the following: V1, 4CW10,000B, 6.2 volts; V2, 4CW25,000B, 5.4 volts; V3, 4CW150,000E, 14.5 volts. Failure to comply will result in depletion of thorium, the emitting element.

1. A new tube requires a 200-hour burn-in period operating at manufacturer specifications. Those specifications are:

NOTE

In order to achieve the specified filament voltage for V2, variable transformer 2T24 must be adjusted for 208 V ac on V2 filament transformer primary. Also, all connections between the transformer and filament terminal on tube socket must be tight.

TUBE	FILAMENT VOLTAGE
V1 4CW10,000B	7.13 - 7.87 V
V2 4CW25,000	6.00 - 6.60 V
V3 4CW150,000E	14.75 - 16.25 V

2. Record operating filament voltage for each new tube. After 24-hours of operation, check voltage to ensure specifications are still met.

3. After the 200-hour burn-in, filament voltage should be lowered in 2.5% steps so far as transformer taps will allow and still achieve the levels listed below according to the procedure in paragraphs 6-6.3.10.2, 6-6.3.10.3, and 6-6.3.10.4.

NOTE

If any tube adversely affects transmitter operation while operating near the lower end of allowable filament voltage range, raise voltage by one 2.5% tap change. Verify transmitter operation meets requirements or raise voltage again if necessary.

TUBE	FILAMENT VOLTAGE
V1 4CW10,000B	6.60 - 7.20 V
V2 4CW25,000	5.70 - 6.30 V
V3 4CW150,000E	14.60 - 15.20 V

6-6.3.10.2 Driver Filament Adjustment. Adjust the driver filament voltage levels according to the guidelines of paragraph 6-6.3.10.1 and the following procedures. Refer to Figure 6-80.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	2c	Multimeter
2	9i	Patch cord

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Ensure filament lead terminals have been cleaned.

3. Connect multimeter to driver filament socket terminals L10 and L11 (Figure 6-84) using patch cords and place multimeter outside cabinet.

4. Being careful not to damage patch cords, close outer doors of cabinet and turn on RPIE blowers. Then set RPIE 208 VAC and 120 VAC RIDE-THRU circuit breaker and, if necessary, 208 VAC INPUT circuit breaker 2A2CB1 to ON and press STANDBY switch on cabinet 1.

5. Multimeter shall indicate 5.70 to 6.3 V dc. If satisfactory, proceed to step 8. If not satisfactory, set 208 VAC INPUT circuit breaker to OFF and turn off RPIE blowers.

6. Open cabinet doors and raise or lower applied filament voltage by disconnecting driver filament leads from driver filament transformer T1 tap. See Figure 6-80 and reconnect to appropriate terminal of transformer T1 as identified on the terminal block.

7. Repeat steps 4 through 7 as necessary to remeasure voltage at socket terminals L10 and L11.

8. Turn off RPIE 208 VAC and 120 VAC RIDE-THRU circuit breakers, turn off RPIE blowers, open cabinet doors, remove test equipment and exit cabinet as described in paragraph 6.2.2.2.

9. Perform maintenance operation of transmitter as described in paragraph 4-6.

NOTE

If filament level of tube adversely affects transmitter operation while operating near the lower end of allowable filament voltage rage, raise voltage by one 2.5% tap change. Verify transmitter operation meets requirements or raise voltage again if necessary.

6-6.3.10.3 IPA Filament Adjustment. Adjust the driver filament voltage levels according to the guidelines of paragraph 6-6.3.10.1 and the following procedures. Refer to Figure 6-74.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	2c	Multimeter
2	9i	Patch cord

WARNING
HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Ensure filament lead terminals have been cleaned.

3. Connect multimeter to IPA filament socket terminals L5 and L4 (Figure 6-77) using patch cords and place multimeter outside cabinet.

4. Being careful not to damage patch cords, close outer doors of cabinet and turn on RPIE blowers. Then set RPIE 208 VAC and 120 VAC RIDE-THRU circuit breaker and, if necessary, 208 V ac INPUT circuit breaker 2A2CB1 to ON and press STANDBY switch on cabinet 1.

5. Multimeter shall indicate 6.60 to 7.20 V dc. If satisfactory, proceed to step 8. If not satisfactory, set 208 VAC INPUT circuit breaker to OFF and turn off RPIE blowers.

6. Open cabinet doors and raise or lower applied filament voltage by disconnecting IPA filament leads from IPA filament transformer 1T3 tap. See figure 6-74 and reconnect to appropriate terminal of transformer 1T3 as identified on the terminal block.

7. Repeat steps 4 through 7 as necessary to remeasure voltage at socket terminals L5 and L4.

8. Turn off RPIE 208 VAC and 120 VAC RIDE-THRU circuit breaker, turn off RPIE blower, open cabinet doors, remove test equipment and exit cabinet as described in paragraph 6.2.2.2.

NOTE

If filament level of tube adversely affects transmitter operation while operating near the lower end of allowable filament voltage range, raise voltage by one 2.5% tap change. Verify transmitter operation meets requirements or raise voltage again if necessary.

9. Perform maintenance operation of transmitter as described in paragraph 4-6.

6-6.3.10.4 PA Filament Adjustment. Adjust the driver filament voltage levels according to the guidelines of paragraph 6-6.3.10.1 and the following procedures. Refer to Figure 6-88.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver
1	2c	Multimeter
2	9i	Patch Cord

WARNING

HIGH VOLTAGE, RF, X-RAY, AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in death or injury to personnel.

1. Follow procedure in paragraph 6-2.2.1 to access cabinet.

2. Ensure filament lead terminals have been cleaned.

3. Connect multimeter to PA tube shielded filament cable (Figure 6-95) using patch cords and place multimeter outside cabinet.

4. Being careful not to damage patch cords, close outer doors of cabinet and turn on RPIE blowers. Then set RPIE 208 VAC and 120 VAC RIDE-THRU circuit breaker and, if necessary, 208 VAC INPUT circuit breaker 2A2CB1 to ON and press STANDBY switch on cabinet 1.

5. Multimeter shall indicate 14.6 to 15.20 V dc. If satisfactory, proceed to step 8. If not satisfactory, set 208 VAC INPUT circuit breaker to OFF and turn off RPIE blowers.

6. Open cabinet doors and raise or lower applied filament voltage by disconnecting PA filament leads from PA filament transformer 1T2 tap. See figure 6-88 and reconnect to appropriate terminal of transformer 1T2 as identified on the terminal block.

7. Repeat steps 4 through 7 as necessary to remeasure voltage at shielded filament cable terminals.

8. Turn off RPIE 208 VAC and 120 VAC RIDE-THRU circuit breakers, turn off RPIE blowers, open cabinet doors, remove test equipment and exit cabinet as described in para-

NOTE

If filament level of tube adversely affects transmitter operation while operating near the lower end of allowable filament voltage range, raise voltage by one 2.5% tap change. Verify transmitter operation meets requirements or raise voltage again if necessary.

9. Perform maintenance operation described in paragraph 4-6.

6-6.3.11 <u>Static Tube Current Adjust.</u> After tube replacement, static operation checks of the appropriate tube cathode current (I_k) must be made with the transmitter operating in the CW mode and in the ICW mode. The CW mode adjustments must be made before the ICW mode adjustments. Refer to the following list while performing these procedures after tube replacement.

TUBE	(V)2 CW MODE	(V)1 CW MODE
PA I_k	1.0 ±.1 amps	3.5 ±.1 amps
DRVR I_k	1.5 ±.1 amps	1.3 ±.1 amps
IPA I_k	1.4 ±.2 amps	1.2 ±.2 amps

TUBE	(V)2 ICW MODE	(V)1 ICW MODE
PA I_k	2.0 ±.1 amps	5.0 ±.1 amps
DRVR I_k	2.0 ±.1 amps	2.0 ±.1 amps
IPA I_k	2.0 ±.2 amps	1.5 ±.2 amps

1. Close 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers at HVPS Cabinet 2. Close 12.47 KV switch on cabinet 3.

NOTE

Ensure no excitation is to be applied to the transmitter during this test by setting AC POWER switch on low level broadband amplifiers to OFF.

2. Follow procedure in paragraph 4-6.2.2 to condition transmitter for local operation. Set AC POWER switch on low level broadband amplifier to OFF.

3. Position BIAS switch 1A25S3 located on the control panel in CW position. Adjust the I_k control, located immediately below the control panel, for the appropriate tube. Level identified in the list is indicated on the BIAS meter above control panel.

4. Position BIAS switch 1A25S3 to ICW position and adjust the I_k control, located immediately below the control panel, for the appropriate tube. The level identified in the list is indicated on the BIAS meter above the control panel.

6-6.3.12 <u>Pressure Switch Adjustment.</u>

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	7b	Flat Blade Screwdriver

WARNING
HIGH VOLTAGE AND AIR PRESSURE HAZARDS

Failure to follow approved access procedure may result in injury or death.

CAUTION
EQUIPMENT DAMAGE HAZARD

When changing position of OUTPUT CONTROL switch, LOAD indicator shall be closely watched. If lamp for selected position (ANTENNA/TEST) does not light up within 3 seconds, immediately move OUTPUT CONTROL switch back to original position.

1. Set LOCAL/REMOTE switch S13 on control panel to LOCAL. Press STANDBY switch S11. Observe that the air switch is functioning by observing that CAB AIR indicator on 1A1A9 is off.

2. Set 208 VAC INPUT circuit breaker CB1 on unit 2 to OFF.

3. Turn off transmitter air by setting RPIE blower switch to off.

4. Verify CAB AIR light illuminates after a few seconds.

5. If the CAB AIR light does not come on, proceed with steps 6 through 11.

6. Open left side door of transmitter cabinet to gain access.

7. Locate air pressure switch. See figure 6-113.1.

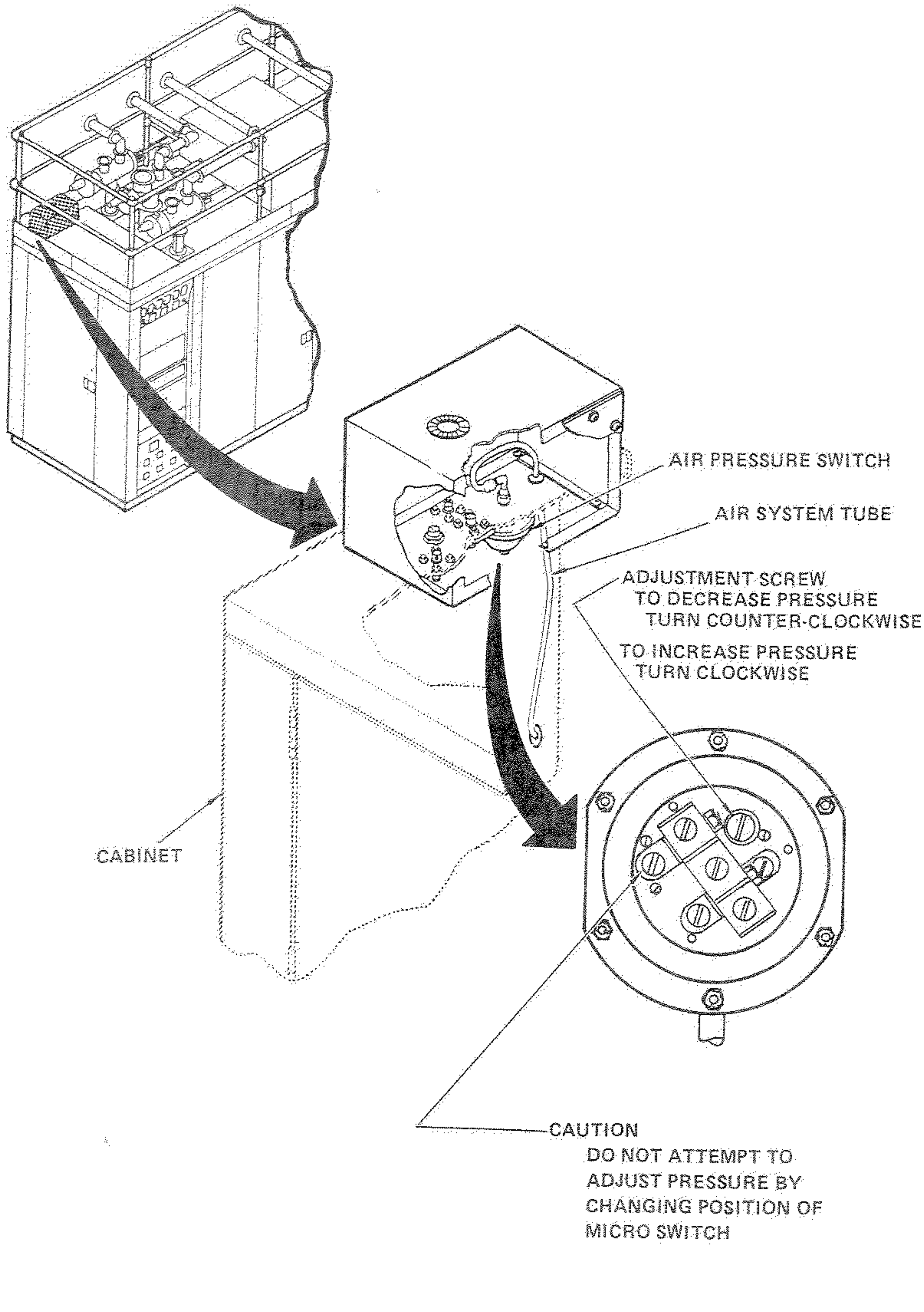


Figure 6-113.1. Pressure Switch Adjustment

CAUTION
EQUIPMENT DMAGE HAZARD

Do not attempt to adjust any other screw on pressure switch in following step. Doing so will result in damage to switch.

8. Adjust the air pressure switch by turning the adjustment screw CW, see figure 6-113.1, 22 until air interlock light illuminates. Then turn adjustment screw CW 1/8 of a turn more.

9. Close left side door of cabinet and turn transmitter air on. Verify that air interlock test light extinguishes when the air flow is operating at normal pressure.

10. Recheck that pressure switch is operating satisfactory by turning off the RPIE blowers, and observing that the CAB AIR light illuminates.

11. Repeat step 8 thru 10 until correct results are obtained.

Section II. SPECIAL MAINTENANCE

6-7 INTRODUCTION.

This section provides amplified maintenance information on designated LRUs, including:

1. Bench-test procedures.

2. Troubleshooting and repair guidance.

3. Disassembly and reassembly procedures.

6-8 ANALOG AND MECHANICAL ASSEMBLY BENCH-TEST PROCEDURES.

6-8.1 <u>Dummy Load 1AT1, 1AT2, or 1AT3 Performance Test.</u>

6-8.1.1 <u>Purpose.</u> This test is designed to verify performance of a dummy load prior to its installation in the transmitter.

6-8.1.2 <u>Safety and Equipment Handling Precautions.</u> Observe standard shop safety practices when performing test procedures.

CAUTION

EQUIPMENT DAMAGE HAZARD

When testing dummy load for water-tight integrity, take care not to exceed stated water pressures. Failure to comply may result in ruptured seals.

6-8.1.3 <u>Test Equipment.</u>

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	2g	Flowmeter
2	2h	Pressure Gage
1	1s	Adapter
1	1t	Union

6-8.1.4 <u>Test Procedures.</u> Refer to Table 6-14 and Figure 6-114 and perform the test procedure, complying with all WARNINGS and CAUTIONS. Required performance standards are keyed to footnotes that provide troubleshooting assistance. If repair is required, return to step 1 when UUT is again serviceable and perform the entire procedure.

6-8.2 <u>IPA Bias Power Supply 1PS3 Performance Test.</u>

6-8.2.1 <u>Purpose.</u> This test is designed to verify performance of the IPA Bias Power Supply prior to its installation in the transmitter.

6-8.2.2 <u>Safety and Equipment Handling Precautions.</u>

WARNING

HIGH VOLTAGE HAZARD

High voltages are present on exposed wires, terminals, and other devices during test. Avoid contact with these. Failure to comply may result in death or injury.

6-8.2.3 <u>Reference Materials.</u>

1. Paragraph 5-15.1, Theory of Operation.

2. TO 31P6-2FPS118-83, Circuit Diagrams Manual, Figure 1-31.

6-8.2.4 <u>Test Equipment.</u>

<u>Tools and Test Equipment Required:</u>

(from Table 1-4)

Qty	Item No.	Description
1	2b	Digital Multimeter
1	1u	26 V dc power supply

6-8.2.5 <u>Test Procedures.</u> Refer to Table 6-15, Figures 6-115, 6-116 and perform the test procedure, complying with all WARNINGS and CAUTIONS. Required performance standards are keyed to footnotes that refer to specific items of Table 6-16, an assistance to troubleshooting. If repair is required, return to step 1 when UUT is again serviceable and perform the entire procedure.

Table 6-14. Performance Test, 1AT1, 1AT2, or 1AT3 (Sheet 1 of 2)

Step	Connection of Test Equipment	Point of Test	Performance Standards
1	Condition digital multimeter meter to measure resistance. Connect one meter probe to each end of UUT. Observe meter.	End to end of UUT	1AT1 - 95 to 105 ohms[1] 1AT2 - 48.5 to 51.5 ohms[1] 1AT3 - 27.44 to 28.56 ohms[1]

CAUTION
EQUIPMENT DAMAGE HAZARD

Do not exceed stated water pressures. Failure to comply may result in rupturing of watertight seals.

NOTE

If pressure of water source will not allow accomplishment of step 2, proceed to step 4 and accomplish the alternative performance test.

Step	Connection of Test Equipment	Point of Test	Performance Standards
2	Connect cooling water per Figure 6-114. Open OUTLET valve fully. Slowly open INLET valve until inlet gage shows about 40 psig. Slowly close OUTLET valve until outlet gage shows about 8 psig. Adjust both valves to obtain 47.5 to 52.5 psig inlet pressure and 13.5 to 16.5 psig outlet pressure, with water flow of 3.8 to 4.2 gpm.	Internal seals and packing	
3	Observe UUT for a minimum of 1 minute.		No water leaks[2]

NOTE

Step 4 is an alternative performance test where pressure of water source will not allow accomplishment of step 2.

Table 6-14. Performance Test, 1AT1, 1AT2, or 1AT3 - (Sheet 2 of 2)

Step	Connection of Test Equipment	Point of Test	Performance Standards
	WARNING **AIR PRESSURE HAZARD** Avoid directing high pressure air stream toward personnel or loose components on the work surface.		
4	Connect cooling water per Figure 6-114. Open OUTLET valve fully. Slowly open INLET valve and allow water to flow freely through dummy load. Close OUTLET valve and then close INLET valve, trapping water in dummy load. Apply air pressure through air valve (see Figure 6-114) until inlet pressure meter reads 40 to 60 PSI.	Internal seals and packing	
5	Observe UUT for a minimum of 3 minutes.		No water leaks[2]

[1]If standard not met, replace resistor R1 per paragraph 6-9.1 (1AT1) or paragraph 6-9.2 (1AT2 or 1AT3).
[2]If standard not met, replace gaskets and/or preformed packing per paragraph 6-9.1 (1AT1) or paragraph 6-9.2 (1AT2 or 1AT3).

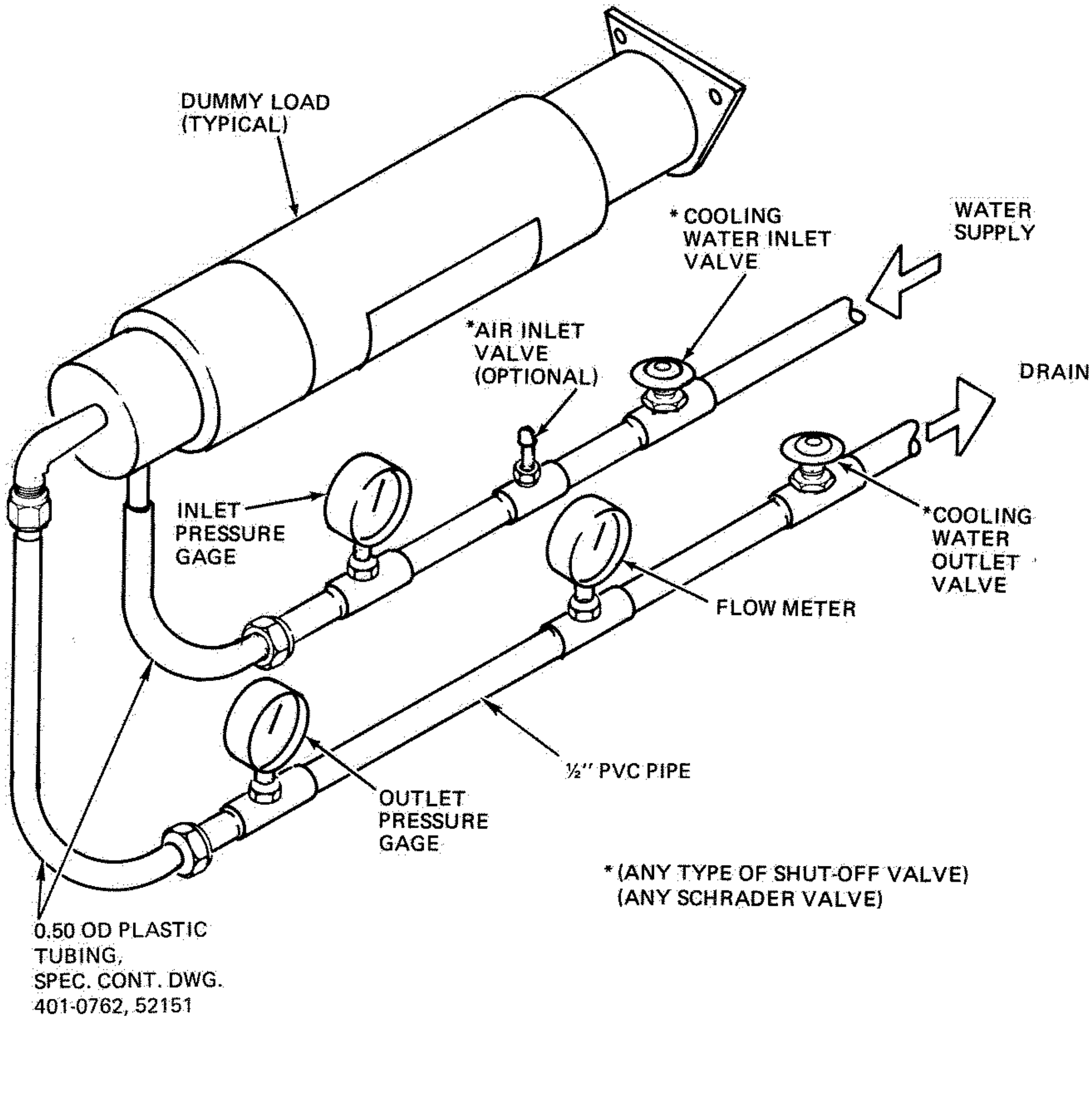


Figure 6-114. Test Setup, 1AT1 through 1AT3

i. Driver Amplifier Bias Power Supply Circuit Breaker. Turn off DRIVER AMPL BIAS SUPPLY circuit breaker.

j. PA Bias Power Supply Circuit Breaker. Turn off PA BIAS SUPPLY circuit breaker.

NOTE
The circuit breakers in the following steps are located on HVPS Circuit Breaker Panel, 2A2.

k. PA Screen Grid Power Supply Circuit Breaker. Turn off PA SCREEN GRID SUPPLY breaker.

l. Driver Amplifier Screen Grid Power Supply Circuit Breaker Turn off DRVR AMPL SCREEN GRID SUPPLY circuit breaker.

m. IPA Screen Grid Power Supply Circuit Breaker. Turn off IPA SCREEN GRID SUPPLY circuit breaker.

n. Crowbar Power Supply Circuit Breaker. Turn off CROWBAR POWER SUPPLY breaker.

o. 208 V ac to High-Voltage Contactor Circuit Breaker. Turn off HV CONTACTOR circuit breaker.

p. 208 VAC Regulator Circuit Breaker. Turn off 208 VAC REGULATOR circuit breaker.

7. Using the Transmitter Ground Stick near 1S38, perform the following checks of the interlock circuits.

a. Turn off 208 VAC INPUT circuit breaker. Attach Maintenance-in-Progress tags to circuit breaker.

WARNING
HIGH VOLTAGE HAZARD
One person position self to guard against HVPS circuit breakers being closed while second person accesses controls compartment of cabinet 1. Failure to comply may result in injury or death.

b. Open 120 VAC RIDE THRU INPUT circuit breaker at HVPS. Open cabinet 1 left rear door and remove cover.

c. Using Grounding Stick, short out switch 1S38 high voltage contacts on both levels of the switch. Then observe that ground switch contact plates are making contact with all three terminals on both levels of the switch

d. Do not contact any exposed terminals or components, and lay grounding stick on compartment floor. Close door. Close circuit breakers on HVPS. Press FAULT RESET and verify 1A1A10 GND DVC light is on because ground stick is not in holder.

e. Open 208 VAC INPUT and 120 VAC RIDE THRU INPUT breakers on HVPS and open cabinet 1 left end door. Replace grounding stick in holder.

f. Replace cover then close door. Close HVPS circuit breakers. Then press FAULT RESET switch.

8. Test cabinet 1 door interlocks as follows. Sequentially open and close each of the 5 cabinet 1 doors ensuring the appropriate 1A1A10 door lamp lights for each one. Press the FAULT RESET SWITCH after closing each door.

9. Test the F band output filter hatch cover interlock as follows. Remove F band output filter hatch cover. Close door, press FAULT RESET SWITCH to do test. Ensure the correct 1A1A10 door lamp lights. Install F band output filter hatch cover and press the FAULT RESET switch.

10. Repeat step 9 for BAND E output filter hatch.

11. Check CROWBAR 1A9DS4 according to the following procedure.

a. Cause Crowbar to be not ready by removing the Crowbar heat lamp (paragraph 6-5.26.1, steps 1 and 2).

b. Exit HVPS Cabinet 2 by performing paragraph 6-2.4.2 steps 1 through 5.

c. Turn on 120 VAC RIDE THRU INPUT and 208 VAC INPUT breakers. Press FAULT RESET and STAND-BY switches.

d. After FIL DELAY timeout, check 1A1A9DS4 CROWBAR is lit.

e. Reinstall heat lamp as described in paragraph 6-5.26.2 steps 6 and 7.

6-10.2.7 Output Power Amplitude Test. Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1b	Dummy Load
2	2a	RF Power Meter
1	4a	RF Signal Gen
2	5a	Power Sensors

CAUTION
EQUIPMENT DAMAGE HAZARD

Prior to applying RF excitation signal to transmitter, ensure dummy load is connected to selected band switch.

1. Follow procedure in paragraph 4-6.2.3.2 to change mode of operation from remote to local and condition transmitter to operate in CW mode in Band A.

2. Set up equipment per Figure 6-161 and connect RF signal generator output to RF INPUT SIGNAL SOURCE jack on RF SIGNAL MONITORS panel. Set 1A25S2, RF INPUT selection, to local position.

3. At top of cabinet 1, left end, rear corner, remove cover from metal box. Connect power sensor input to FORWARD POWER SAMPLE jack W67J1. Connect output of power sensor RF power meter.

NOTE

Use of test data sheet referenced in step 4 is recommended, as data will be used in mathematical computations. Comparison with future data will aid in early detection of system performance degradation.

4. Record data shown on Figure 6-162.

5. On Signal Monitors Card 1A1A2, verify FWD PWR CLIP Switch S1 is positioned to DSLB.

CAUTION
EQUIPMENT DAMAGE HAZARD

Increase RF drive gradually when performing the next steps. POWER (KW) meter 1A13M1 shall not exceed reading of forward power of 110 kW. Failure to comply may result in equipment damage.

6. Follow procedure in paragraph 4-6.1 to start up transmitter. Operate transmitter in local control per paragraph 4-6.2.2, in CW mode, at center frequency for selected band.

7. Adjust signal generator for 17 dBm + 1 dBm for 100 kW output.

8. (V)1 For Bands A through E, adjust RF input for minimum RF output power of 110 kW. For Band F, adjust for minimum of 80 kW. Operate for at least 5 minutes.

(V)2 Adjust RF input for minimum RF output power of 110 kW, all bands.

9. Record dummy load inlet coolant temperature, average outlet coolant temperature, and coolant flow rate. Record forward RF output power as indicated by panel meter and power meter connected to directional coupler forward port.

10. Calculate load power in kW =

$.264 \times (T_{out} - T_{in}) \times \text{Flow Rate}$

Temperatures are measured in degrees centigrade and flow rate is gallons per minute of coolant.

NOTE

(V)1 Calculated power in load shall be at least 110 kW for Bands A through E and at least 80 kW for Band F.

(V)2 Calculated power in load shall be at least 110 kW in all bands.

11. Record calculated power.

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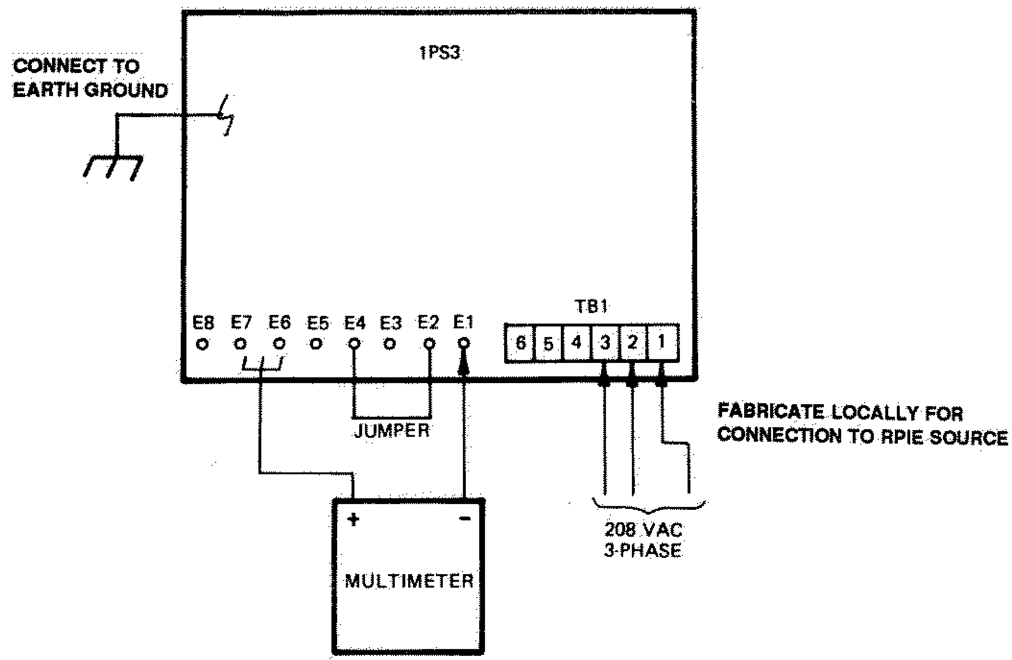

Figure 6-115. Initial Test Setup, 1PS3

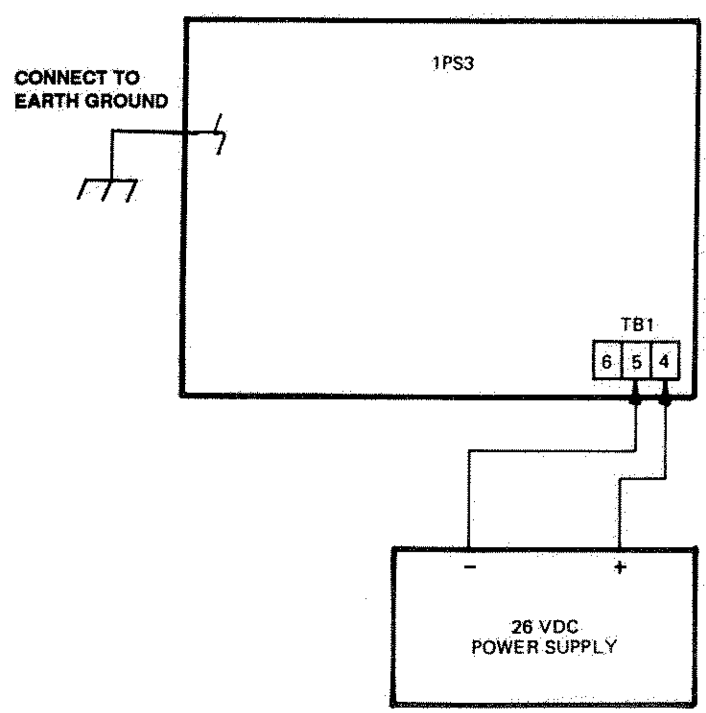

Figure 6-116. 26VDC Power Supply Connection to 1PS3

Table 6-16. Troubleshooting Power Supply 1PS3

ITEM NUMBER[1]	SYMPTOMS	PROBABLE DEFECTIVE COMPONENT
1	No voltage	a. T1 b. L1, L2 c. R7
2	Voltage present, but not as specified	a. T1 b. CR1, CR2, CR3, CR4, CR5, CR6 c. C1, C2, C3, C4, C5, C6 d. R7 e. L1, L2
3	No voltage	R9
4	Voltage present, but not as specified	a. R9 b. R8 c. R10
5	No voltage/voltage not as specified	R15, R8, R16
6	No voltage	K1
7	No voltage	K2
8	Resistance not adjustable to performance standard	R16

[1]Item Numbers are assigned to identify failures to achieve "Performance Standards" during LRU performance test. Refer to Table 6-15, "Performance Standards" column and footnotes at the end of the table for further understanding of Item Numbers.

6-8.3 Driver Amplifier Bias Power Supply 1PS4 Performance Test.

6-8.3.1 Purpose. This test is designed to verify performance of the Driver Amplifier Bias Power Supply prior to its installation in the transmitter.

6-8.3.2 Safety and Equipment Handling Precautions.

WARNING

HIGH VOLTAGE HAZARD

High voltages are present on exposed wires, terminals, and other devices during test. Avoid contact with these. Failure to comply may result in death or injury to personnel.

6-8.3.3 Reference Materials.

1. Paragraph 5-15.2, Theory of Operation.
2. TO 31P6-2FPS118-83, Circuit Diagrams Manual, Figure 1-32.

6-8.3.4 Test Equipment.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1u	26 V dc Power Supply
1	2b	Digital Multimeter

6-8.3.5 Test Procedures. Refer to Table 6-17 and Figures 6-117 and 6-118 and perform the test procedure, complying with all WARNINGS and CAUTIONS. Required performance standards are keyed to footnotes that refer to specific items of Table 6-18, an assistance to troubleshooting. If repair is required, return to step 1 when UUT is again serviceable and perform the entire procedure.

6-8.4 PA Bias Power Supply 1PS5 Performance Test.

6-8.4.1 Purpose. This test is designed to verify performance of the PA Bias Power Supply prior to its installation in the transmitter.

6-8.4.2 Safety and Equipment Handling Precautions.

WARNING

HIGH VOLTAGE HAZARD

High voltages are present on exposed wires, terminals, and other devices during this test. Avoid contact with these. Failure to comply may result in death or injury to personnel.

6-8.4.3 Reference Materials.

1. Paragraph 5-15.3, Theory of Operation.
2. TO 31P6-2FPS118-83, Circuit Diagrams Manual, Figure 1-33.

6-8.4.4 Test Equipment.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1u	26 V dc Power Supply
1	2b	Digital Multimeter

6-8.4.5 Test Procedures. Refer to Table 6-19 and Figures 6-119 and 6-120 and perform the test procedure, complying with all WARNINGS and CAUTIONS. Required performance standards are keyed to footnotes that refer to specific items of Table 6-20, an assistance to troubleshooting. If repair is required, return to step 1 when UUT is again serviceable and perform the entire procedure.

Table 6-17. Performance Test, 1PS4 (Sheet 1 of 2)

WARNING
HIGH VOLTAGE HAZARD

High voltages are present on exposed wires, terminals, and other devices during test. Avoid physical contact. Failure to comply may result in death or injury.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Connect test equipment per Figure 6-117. Condition digital multimeter to measure V dc on 1000 V scale. Verify (-) meter lead to E1 and (+) lead to chassis ground. Verify E2 is jumpered to E4. Turn on 208 V ac and observe meter.	E1 to ground		-667 to -757 V dc[1]
2	Turn off 208 V ac. Move (-) meter lead to E2. Turn on 208 V ac and observe meter.	E2 to ground		-235 to -295 V dc[2]
3	Turn off 208 V ac. Connect 26 V dc per Figure 6-118. Move (-) meter lead to E1. Move (+) lead to chassis ground. Turn on 208 V ac and 26 V dc. Observe meter.	E1 to ground; K1 energized		-375 to -425 V dc[3]
4	Turn off 208 V ac and 26 V dc. Move 26 V dc (-) output to TB1-6. Move (-) meter lead to E3. Turn on 208 V ac and 26 V dc. Observe meter.	E3 to ground; K2 energized		-667 to -757 V dc[4]

Table 6-17. Performance Test, 1PS4 (Sheet 2 of 2)

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
5	Remove all power from UUT. Condition meter to read resistance. Connect meter leads between E5 and chassis ground. Observe meter.	E5 to ground	If necessary, adjust R20 of UUT for proper resistance.	1.3 ohms[5]
6	Remove jumper from between E2 and E4.			

[1]For troubleshooting, refer to Table 6-18, Item 1 or 2.
[2]For troubleshooting, refer to Table 6-18, Item 3 or 4.
[3]For troubleshooting, refer to Table 6-18, Item 5 or 6.
[4]For troubleshooting, refer to Table 6-18, Item 7.
[5]For troubleshooting, refer to Table 6-18, Item 8.

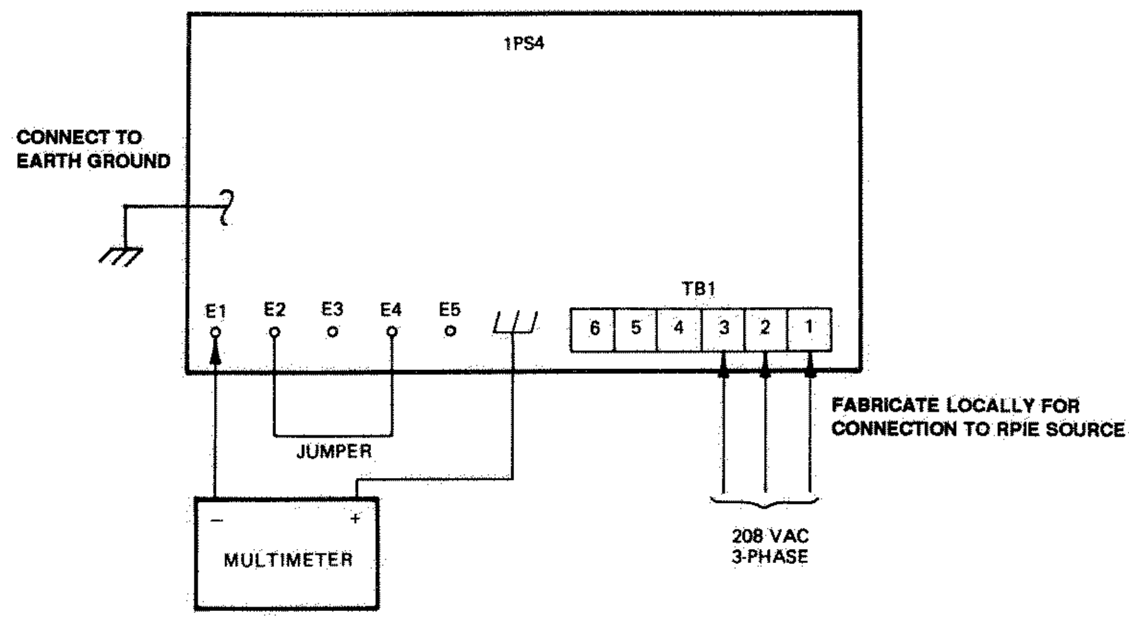

Figure 6-117. Initial Test Setup, 1PS4

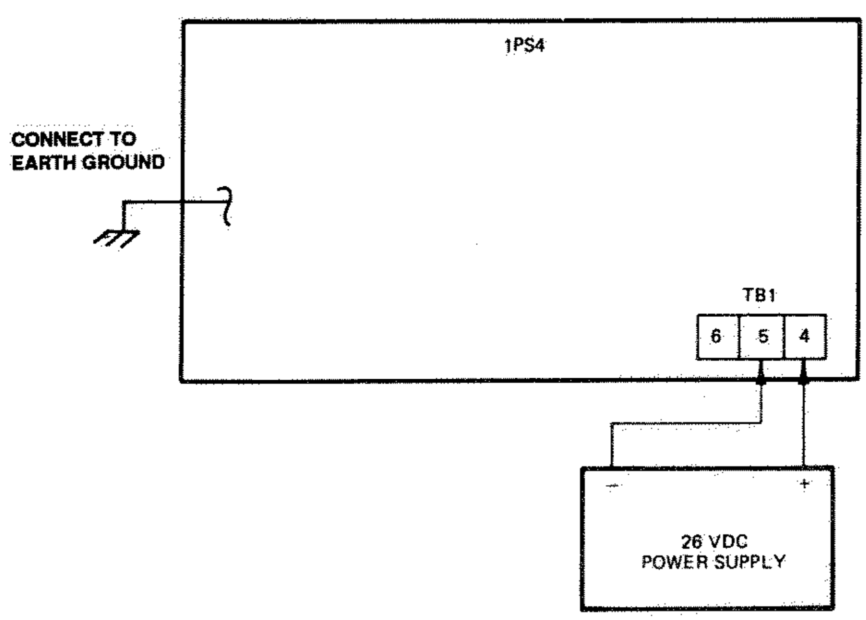

Figure 6-118. 26 VDC Power Supply Connection to 1PS4

Table 6-18. Troubleshooting Power Supply 1PS4

ITEM NUMBER[1]	SYMPTOMS	PROBABLE DEFECTIVE COMPONENT
1	No voltage	T1
2	Voltage present, but not as specified	a. T1 b. CR1, CR2, CR3, CR4, CR5, CR6 CR7, CR8, CR9, CR10, CR11, CR12 c. C1, C2, C3, C4, C5, C6 d. L1, L2, L3
3	No voltage	T1
4	Voltage present, but not as specified	a. R18 b. R19
5	Voltage 667 V dc to 757 V dc	K1
6	Voltage not as specified	R6, R7
7	No voltage	K2
8	Resistance not adjustable to performance standard	R20

[1]Item Numbers are assigned to identify failures to achieve "Performance Standards" during LRU performance test. Refer to Table 6-17, "Performance Standards" column and footnotes at the end of the table for further understanding of Item Numbers.

Table 6-19. Performance Test, 1PS5 (Sheet 1 of 2)

WARNING
HIGH VOLTAGE HAZARD

High voltages are present on exposed wires, terminals, and other devices during test. Avoid physical contact. Failure to comply may result in death or injury.

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Connect test equipment per Figure 6-119. Condition digital multimeter to measure V dc on 1000 V scale. Verify (-) meter lead to E1 and (+) lead to chassis ground. Turn on 208 V ac and observe meter.	E1 to ground		-775 to -885 V dc[1]
2	Turn off 208 V ac. Connect 26 V dc per Figure 6-120. Turn on 208 V ac and 26 V dc. Observe meter.	E1 to ground; K1 energized		-470 to -530 V dc[2]
3	Turn off 208 V ac and 26 V dc. Move 26 V dc (-) output to TB1-6. Move meter (-) lead to E3. Turn on 208 V ac and 26 V dc. Observe meter.	E3 to ground; K2 energized		-775 to -885 V dc[3]
4	Remove all power from UUT. Condition digital multimeter to read resistance. Connect meter leads between E4 and chassis ground. Observe meter.	E4 to ground		5320 to 5880 ohms[4]
5	Connect meter leads between R23-1 and chassis ground. Observe meter.	R23-1 to ground	If necessary, adjust R23 of UUT for proper resistance.	0.5 ohms[5]

Table 6-19. Performance Test, 1PS5 (Sheet 2 of 2)

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
6	Connect meter leads between E5 and chassis ground. Observe meter.	E5 to ground		2565 to 2835 ohms[6]

[1]For troubleshooting, refer to Table 6-20, Item 1 or 2.
[2]For troubleshooting, refer to Table 6-20, Item 3.
[3]For troubleshooting, refer to Table 6-20, Item 4.
[4]For troubleshooting, refer to Table 6-20, Item 5.
[5]For troubleshooting, refer to Table 6-20, Item 6.
[6]For troubleshooting, refer to Table 6-20, Item 7.

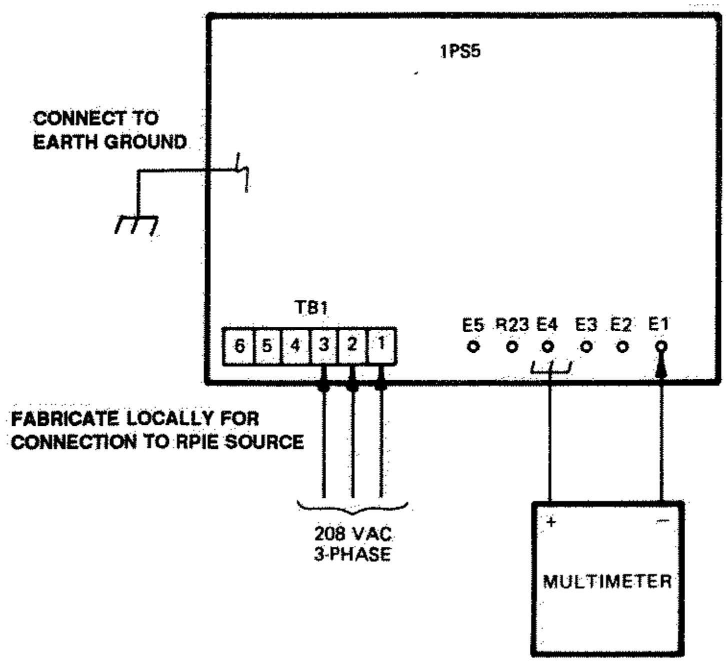

Figure 6-119. Initial Test Setup, 1PS5

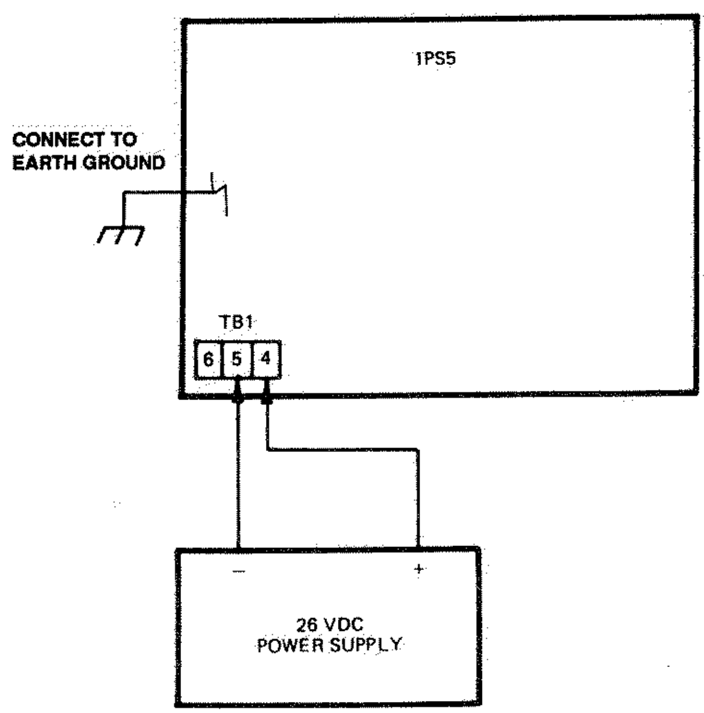

Figure 6-120. 26 VDC Power Supply Connection to 1PS5

Table 6-20. Troubleshooting Power Supply 1PS5

ITEM NUMBER[1]	SYMPTOMS	PROBABLE DEFECTIVE COMPONENT
1	No voltage	T1
2	Voltage present, but not as specified	a. T1 b. CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR8, CR9, CR10, CR11, CR12 c. C1, C2, C3, C4, C5, C6 d. L1, L2, L3
3	Voltage 775 V dc to 885 V dc	K1
4	No voltage	K2
5	Resistance not as specified	R22
6	Resistance not adjustable to performance standard	R23
7	Resistance not as specified	R24

[1]Item Numbers are assigned to identify failures to achieve "Performance Standards" during LRU performance test. Refer to Table 6-19, "Performance Standards" column and footnotes at the end of the table for further understanding of Item Numbers.

6-8.5 Arc Sensor Probe 1A14 Through 1A20, A26 and A27 Performance Test.

6-8.5.1 Purpose. This test is designed to verify performance of an arc sensor probe prior to its installation in the transmitter.

6-8.5.2 Safety and Equipment Handling Precautions. Observe standard shop safety practices when performing test procedures.

6-8.5.3 Test Equipment.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1v	Test Cable
1	2b	Digital Multimeter

6-8.5.4 Test Procedures. Refer to Table 6-21 and Figure 6-121 and perform the test procedure. Required performance standards are keyed to footnotes that provide troubleshooting assistance. If repair is required, return to step 1 when UUT is again serviceable and perform the entire procedure.

6-8.6 Electronic Crowbar 2A1 Performance Test.

6-8.6.1 Purpose. This test is designed to verify performance of the Electronic Crowbar prior to its installation in the High Voltage Power Supply.

6-8.6.2 Safety and Equipment Handling Precautions.

WARNING

HIGH VOLTAGE HAZARD

High voltages are present on exposed wires, terminals, and other devices during test. Avoid contact with these. Failure to comply may result in death or injury to personnel.

CAUTION

EQUIPMENT DAMAGE HAZARD

Keep electronic crowbar assembly upright to prevent splashing of mercury within the tube.

6-8.6.3 Reference Materials.

1. Paragraph 5-16.6, Theory of Operation.

2. TO 31P6-2FPS118-83, Circuit Diagrams Manual, Figure 1-35.

6-8.6.4 Test Equipment.

(from Table 1-4)

Qty	Item No.	Description
1	1u	26 V dc Power Supply
1	2b	Digital Multimeter
1	3a	Oscilloscope
1	4b	Pulse Generator
1	6a	Single Pole Push-Button Switch
1	6b	Circuit Breaker
1	7zd	Gap Tool (0.003 inch)
1	7ze	Spark Plug

6-8.6.5 Test Procedures. Refer to Table 6-22, Figure 6-99, and Figure 6-122 and perform the test procedure, complying with all WARNINGS and CAUTIONS. Required performance standards are keyed to footnotes that refer to specific items of Table 6-23, an assistance to troubleshooting. If repair is required, return to step 1 when UUT is again serviceable and perform the entire procedure.

Table 6-21. Performance Test, 1A14 Through 1A20, A26 and A27

Step	Connection of Test Equipment	Point of Test	Performance Standards
1	Connect test equipment per Figure 6-121. Condition multimeter to measure resistance. Place dark cover over input sensor opening.	J1	> 1 megohm[1]
2	Remove dark cover.	J1	< 15 kilohms[2]

[1]If resistance is too low, verify dark cover prevents light from entering sensor opening. If standard still cannot be achieved, replace R1 per paragraph 6-9.6.

[2]If resistance is too high, shine a typical two-cell flashlight directly into input sensor. If standard is then achieved, UUT is serviceable. If standard cannot be achieved, replace R1 per paragraph 6-9.6.

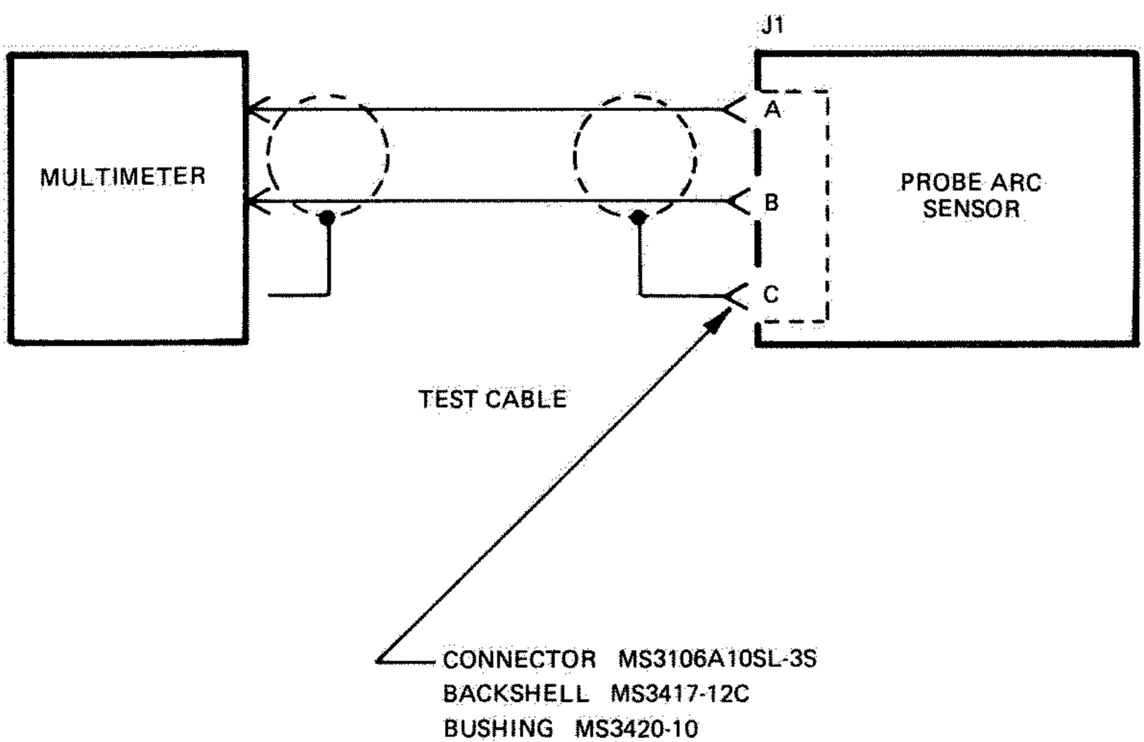

Figure 6-121. **Test Setup,** 1A14 through 1A20, A26 and A27

Table 6-22. Performance Test, 2A1 (Sheet 1 of 2)

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Disconnect V1 from T2 by removing screw from T2-3. Bend wire away from transformer.			
	NOTE Proper gapping of spark plug is critical to successful testing of UUT.			
2	Gap spark plug to 0.003 inch. Connect test equipment per Figure 6-122. Condition digital multimeter to read resistance.	TB1-6 to TB1-7		< 0.1 ohm[1]
3	Connect meter leads between TB1-9 and TB1-10.	TB1-9 to TB1-10		< 0.1 ohm[2]
	WARNING **HIGH VOLTAGE HAZARD** High voltages are present on exposed wires, terminals, and other devices during test. Avoid physical contact. Failure to comply may result in death or injury.			
4	Connect meter leads between TB1-5 and TB1-6. Close 3-amp circuit breakers and apply 208 V ac.	TB1-5 to TB1-6		< 0.1 ohm[3]

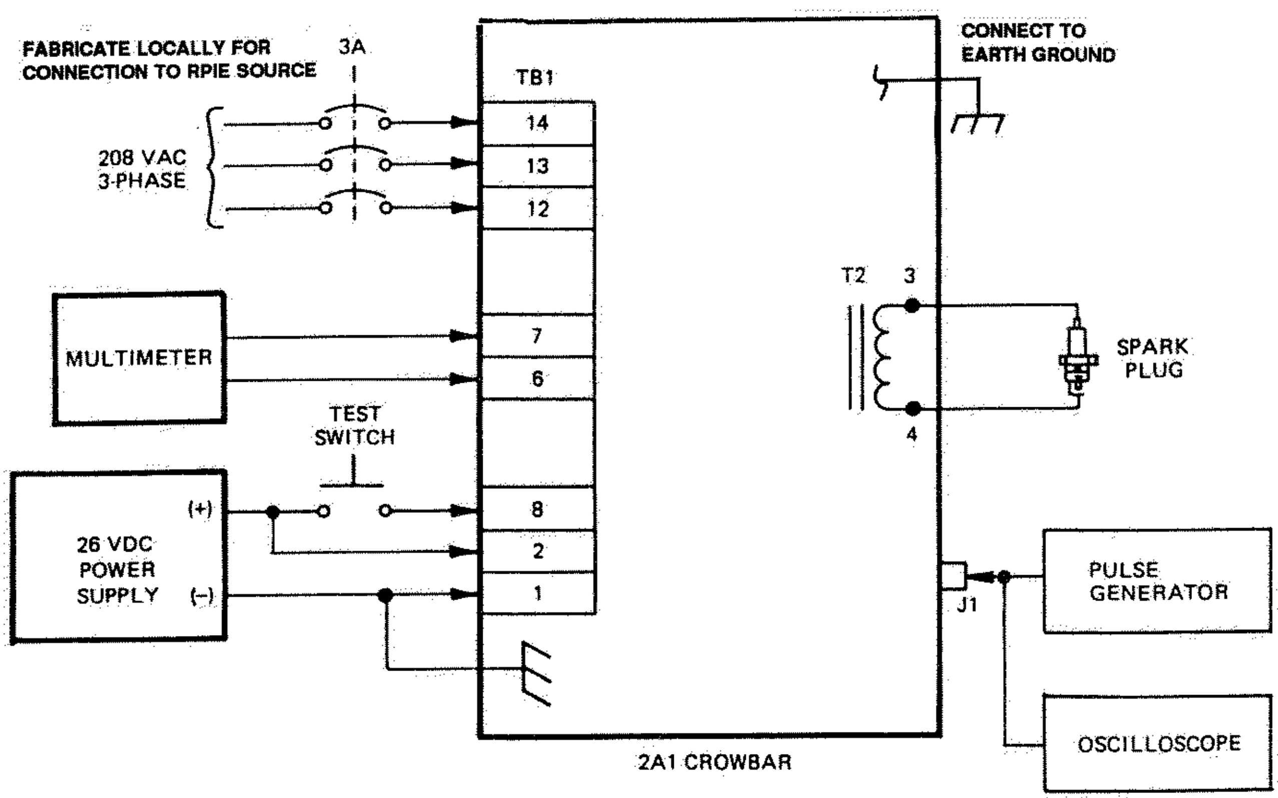

Figure 6-122. Pulse Generator Performance Test Setup, 2A1

Table 6-22. Performance Test, 2A1 (Sheet 2 of 2)

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
5	Connect pulse generator per Figure (6-122). Condition pulse generator for 10 V peak, negative-going one-shot of 10-microsecond pulse width. Observe spark plug.	Secondary of T2	If necessary, adjust R10 cw until spark plug fires. Adjust R10 ccw until plug just stops firing.	Spark plug fires[4]
	NOTE It may be necessary to repeat steps 5, 6 and 7 to achieve performance standard.			
6	Increase output of pulse generator to 11 V peak and observe spark plug.	Secondary of T2		Spark plug fires[5]
7	Decrease output of pulse generator to 10 V and verify spark plug does not fire. If spark plug does fire, repeat steps 5 through 7.	Secondary of T2		
8	Disconnect pulse generator. Apply 26 V dc per Figure 6-122 Push and hold test switch and observe spark plug.	Crowbar test circuitry		Spark plug fires[6]
9	Remove all power.		Adjust R12 fully CW, then 1/8 turn CCW.	
10	Reinstall in equipment and test IAW paragraph 6-5.26.2.			a. Observe ANODE (KW) meter 2A3M5[7] b. CROWBAR lamp lites 1A1DS3[8]

[1]For troubleshooting, refer to Table 6-23, Item 1 or 2.
[2]For troubleshooting, refer to Table 6-23, Item 3.
[3]For troubleshooting, refer to Table 6-23, Item 4 or 5.
[4]For troubleshooting, refer to Table 6-23, Item 6.
[5]For troubleshooting, refer to Table 6-23, Item 6.
[6]For troubleshooting, refer to Table 6-23, Item 7.
[7]For troubleshooting, refer to Table 6-23, Item 8.
[8]For troubleshooting, refer to Table 6-23, Item 9.

Table 6-23. Troubleshooting Electronic Crowbar 2A1

ITEM NUMBER[1]	SYMPTOMS	PROBABLE DEFECTIVE COMPONENT
1	Open circuit	a. Open wire between K1A2 and TB1-6 or K1A3 and TB1-7 b. K1
2	Resistance too high	K1
3	Open circuit	External jumper missing between TB1-9 and TB1-10
4	Open circuit	a. K1 b. T1 c. R1, R2, or R3 d. C1
5	Resistance too high	K1
6	Spark plug does not fire	a. Spark plug gap improper b. R10
7	Spark plug does not fire	K3
8	Meter drops off slowly.	a. V1 b. R11 and R12
9	Lamp does not light.	a. K2 b. CR11 through CR13 c. R12

[1]Item Numbers are assigned to identify failures to achieve "Performance Standards" during LRU performance test. Refer to Table 6-22, "Performance Standards" column and footnotes at the end of the table for further understanding of Item Numbers.

6-8.7 Electromagnetic Relay 1K6 Performance Test.

6-8.7.1 Purpose. This test is designed to verify performance of the electromagnetic relay prior to its installation in the transmitter.

6-8.7.2 Safety and Equipment Handling Precautions.

WARNING

HIGH CURRENT HAZARD

Low-voltage, high-current dc is present on exposed wires, terminals, and other devices during test. Avoid contact with these. Take care not to short dc voltage to chassis ground.

6-8.7.3 Reference Materials. TO 31P6-2FPS118-83, Circuit Diagrams Manual, Figure 1-1, sheet 5.

6-8.7.4 Test Equipment.

(from Table 1-4)

Qty	Item No.	Description
1	1u	26 V dc Power Supply
1	2b	Digital Multimeter
1	6c	3-Position Test Switch

6-8.7.5 Test Procedures. Refer to Table 6-24 and Figure 6-123 and perform the test procedure, complying with all WARNINGS and CAUTIONS. Required performance standards are keyed to footnotes that refer to specific items of Table 6-25, an assistance to troubleshooting. If repair is required, return to step 1 when UUT is again serviceable and perform the entire procedure.

Table 6-24. Performance Test, 1K6

Step	Connection of Test Equipment	Point of Test	Control Settings/ Equipment Operation	Performance Standards
1	Connect test equipment per Figure 6-123. Do not turn on 26 V dc supply. Condition digital multimeter to read resistance.	J4 center connector to chassis ground		Open circuit (infinity)[1]
2	Move meter probe from J4 to J1.	J1 center connector to chassis ground		< 0.1 ohm[2]
3	Move meter probe from J1 to J2.	J2 center connector to chassis ground		< 0.1 ohm[3]
4	Move meter probe from J2 to J3.	J3 center connector to chassis ground		< 0.1 ohm[4]
	WARNING **HIGH-CURRENT HAZARD** 26 V dc is present on exposed terminals and other devices. Avoid physical contact.			
5	Connect one meter probe to J1 and the other to J4. Verify test switch to position 1. Turn on 26 V dc.	J1 center connector to J4 center connector		< 0.1 ohm[5]
6	Move meter probe from J1 to J2. Position test switch to position 2.	J2 center connector to J4 center connector		< 0.1 ohm[6]
7	Move meter probe from J2 to J3. Position test switch to position 3.	J3 center connector to J4 center connector		< 0.1 ohm[7]

[1]For troubleshooting, refer to Table 6-25, Item 1.
[2]For troubleshooting, refer to Table 6-25, Item 2.
[3]For troubleshooting, refer to Table 6-25, Item 3.
[4]For troubleshooting, refer to Table 6-25, Item 4.
[5]For troubleshooting, refer to Table 6-25, Item 5.
[6]For troubleshooting, refer to Table 6-25, Item 6.
[7]For troubleshooting, refer to Table 6-25, Item 7.

Table 6-25. Troubleshooting Electromagnetic Relay 1K6

ITEM NUMBER[1]	SYMPTOMS	PROBABLE DEFECTIVE COMPONENT
1	Circuit not open	a. K1, K2, or K3 b. Wire from J4 to K1, K2, or K3 shorted to ground
2	Resistance > 0.1 ohm	K1
3	Resistance > 0.1 ohm	K2
4	Resistance > 0.1 ohm	K3
5	Resistance > 0.1 ohm	a. K1 b. CR1
6	Resistance > 0.1 ohm	a. K2 b. CR2
7	Resistance > 0.1 ohm	a. K3 b. CR3

[1]Item Numbers are assigned to identify failures to achieve "Performance Standards" during LRU performance test. Refer to Table 6-24, "Performance Standards" column and footnotes at the end of the table for further understanding of Item Numbers.

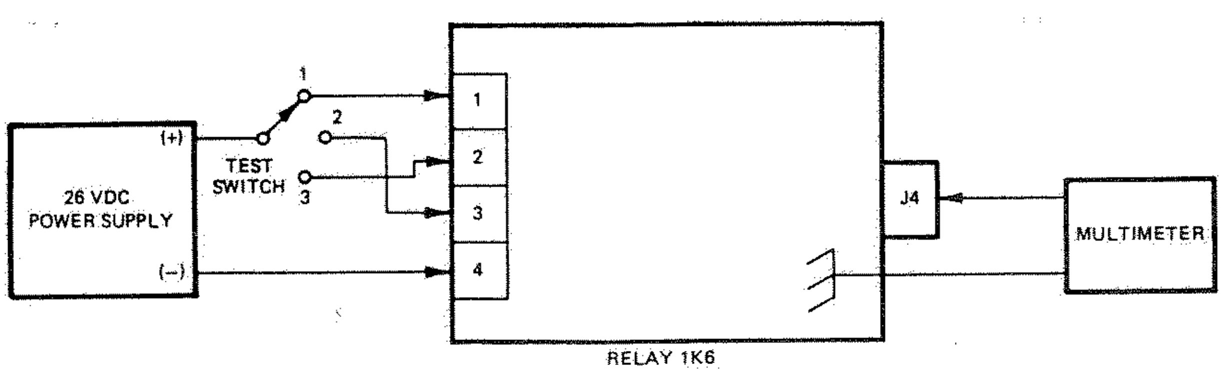

Figure 6-123. Test Setup, 1K6

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6-9 DISASSEMBLY AND REASSEMBLY

The following paragraphs provide disassembly and reassembly procedures in support of special maintenance for specified LRUs. Accompanying illustrations show parts in proper relationship for disassembly/reassembly.

6-9.1 Dummy Load 1AT1 Disassembly and Reassembly.

NOTE

Set aside all serviceable screws, washers, etc. for use in reassembly.

1. To disassemble 1AT1, refer to Figure 6-124 and perform the following.

   a. Top contact (1) removal.

      (1) Remove screw (2), two flat washers (3), and lockwasher (4); three places.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating top contact (1) ccw may result in damage to spring (17).

      (2) Hold dummy load envelope (6) securely. Gently rotate top contact (1) cw while pulling it away from envelope with firm but gentle force.

      (3) Remove top contact.

   b. Envelope (6) removal.

      (1) Remove screw (7), two flat washers (8), and lockwasher (9); three places.

      (2) Remove envelope.

   c. Resistor R1 (10) removal.

WARNING

RESPIRATORY HAZARD

Resistor R1 (10) contains Beryllium Oxide. Do not drop or otherwise damage R1. If it is broken or crushed, avoid breathing dust and fumes. Clear the immediate area of personnel. Cleanup shall be performed wearing protective mask.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating resistor R1 (10) ccw could result in damage to spring (12).

      (1) Hold bottom contact (11) securely. Slowly rotate resistor (10) cw while pulling it away from bottom contact with firm but gentle force.

      (2) Remove resistor (10) from bottom contact (11).

      (3) Remove tube center (15).

   d. Top Contact (1) disassembly.

      (1) Remove screw (19).

      (2) Remove retainer (20) and washer (21).

2. To reassemble 1AT1, refer to Figure 6-124 and perform the following.

   a. Bottom contact (11) installation.

      (1) Visually inspect spring (12), gasket (13), and preformed packing (14) for serviceability. Look for nicks, indentations, or other such abnormalities. Replace parts as necessary.

      (2) Install tube center (15).

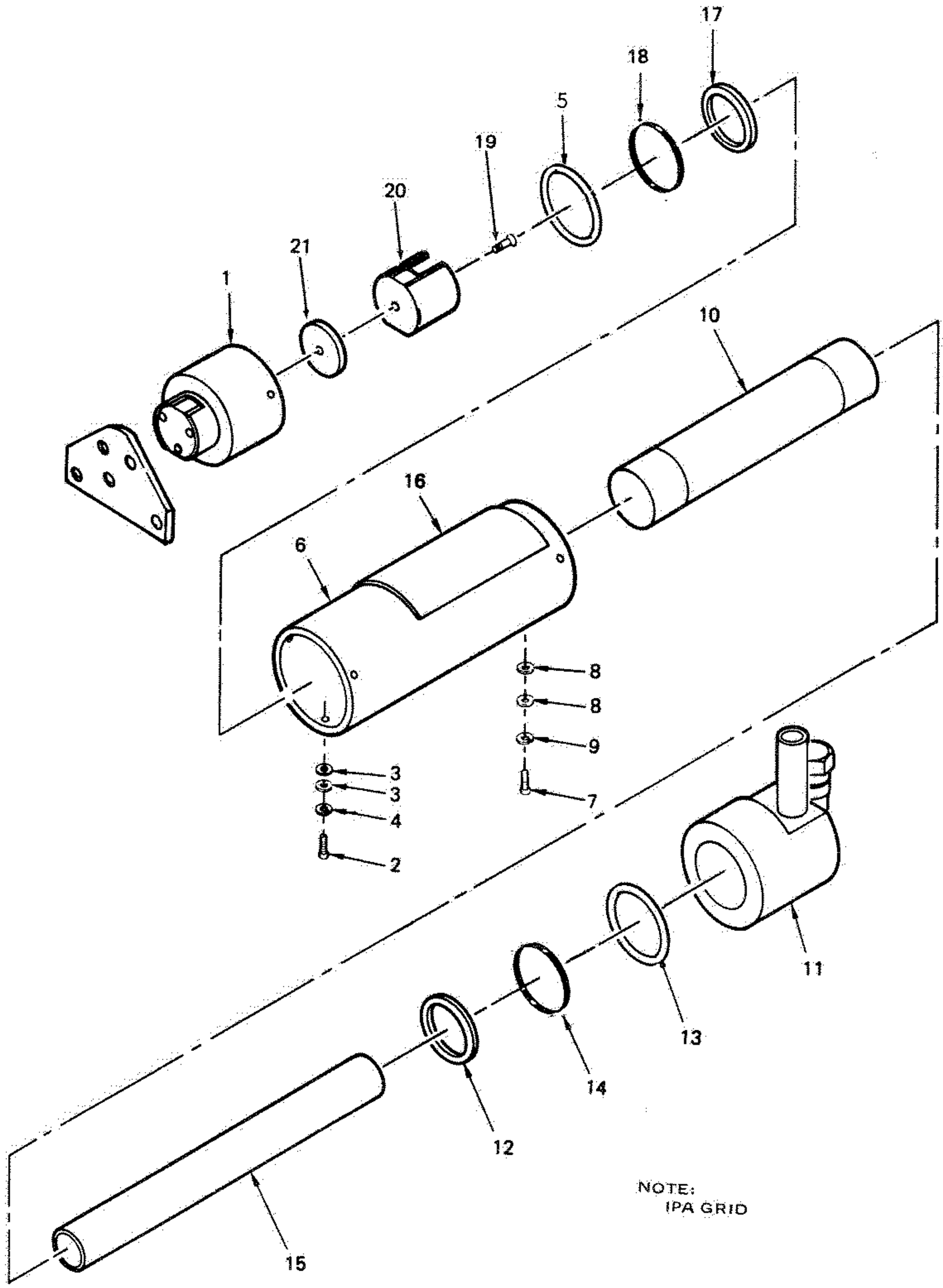


Figure 6-124. 1AT1 Disassembly/Reassembly

WARNING

RESPIRATORY HAZARD

Resistor R1 (10) contains Beryllium Oxide. Do not drop or otherwise damage R1. If it is broken or crushed, avoid breathing dust and fumes. Clear the immediate area of personnel. Cleanup shall be performed wearing protective mask.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating resistor R1 (10) ccw could result in damage to spring (12).

b. Resistor R1 (10) installation. Hold bottom contact (11) securely. Slide resistor (10) over center tube (15) and into bottom contact (11). Slowly rotate resistor cw while pushing it into bottom contact with firm but gentle force.

c. Envelope (6) installation.

(1) Position envelope (6) so WARNING decal (16) is as shown in Figure 6-124. Slide envelope over resistor (10) and line up screw holes with those of bottom contact (11).

(2) Install lockwasher (9), two flat washers (8), and screw (7); three places.

d. Top contact (1) reassembly.

(1) Install washer (21) and retainer (20).

(2) Install screw (19).

e. Top contact (1) installation.

(1) Visually inspect spring (17), gasket (5), and preformed packing (18) for serviceability. Look for nicks, indentations, or other such abnormalities. Replace parts as necessary.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating top contact (1) ccw could result in damage to spring (17).

(2) Hold envelope (6) securely. Slowly rotate top contact (1) cw while pushing it onto resistor (10) with firm but gentle pressure. Line up screw holes with those of envelope (6).

(3) Install lockwasher (4), two flat washers (3), and screw (2); three places.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.1.

6-9.2 <u>Dummy Load 1AT2 or 1AT3 Disassembly and Reassembly.</u> Though slightly different in size, 1AT2 and 1AT3 are disassembled and reassembled in the same manner. The following is a typical set of procedures.

NOTE

Set aside all serviceable screws, washers, etc. to be installed during reassembly.

1. To disassemble 1AT2 or 1AT3, refer to Figure 6-125 and perform the following.

a. Top contact (1) removal.

(1) Remove screw (2), two flat washers (3), and lockwasher (4); three places.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating top contact (1) ccw could result in damage to spring (22).

(2) Hold dummy load envelope (6) securely. Slowly rotate top contact (1) cw while pulling it away from envelope with firm but gentle force.

(3) Remove top contact (1).

b. Envelope (6) removal.

(1) Remove screw (13), two flat washers (14), and lockwasher (15); three places.

(2) Remove envelope.

c. Insulating sleeve (7) removal.

(1) Remove nut (8), lockwasher (9), and flat washer (10); three places.

(2) Remove screw (11) and flat washer (12); three places.

(3) Remove insulating sleeve.

d. Resistor R1 (16) removal.

WARNING

RESPIRATORY HAZARD

Resistor R1 (16) contains Beryllium Oxide. Do not drop or otherwise damage R1. If it is broken or crushed, avoid breathing dust and fumes. Clear the immediate area of personnel. Cleanup shall be performed wearing protective mask.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating resistor R1 (16) ccw could result in damage to spring (19).

(1) Hold bottom contact (17) securely. Slowly rotate resistor (16) cw while pulling it away from bottom contact with firm but gentle force.

(2) Remove resistor (16) from bottom contact (17).

(3) Remove tube center (21).

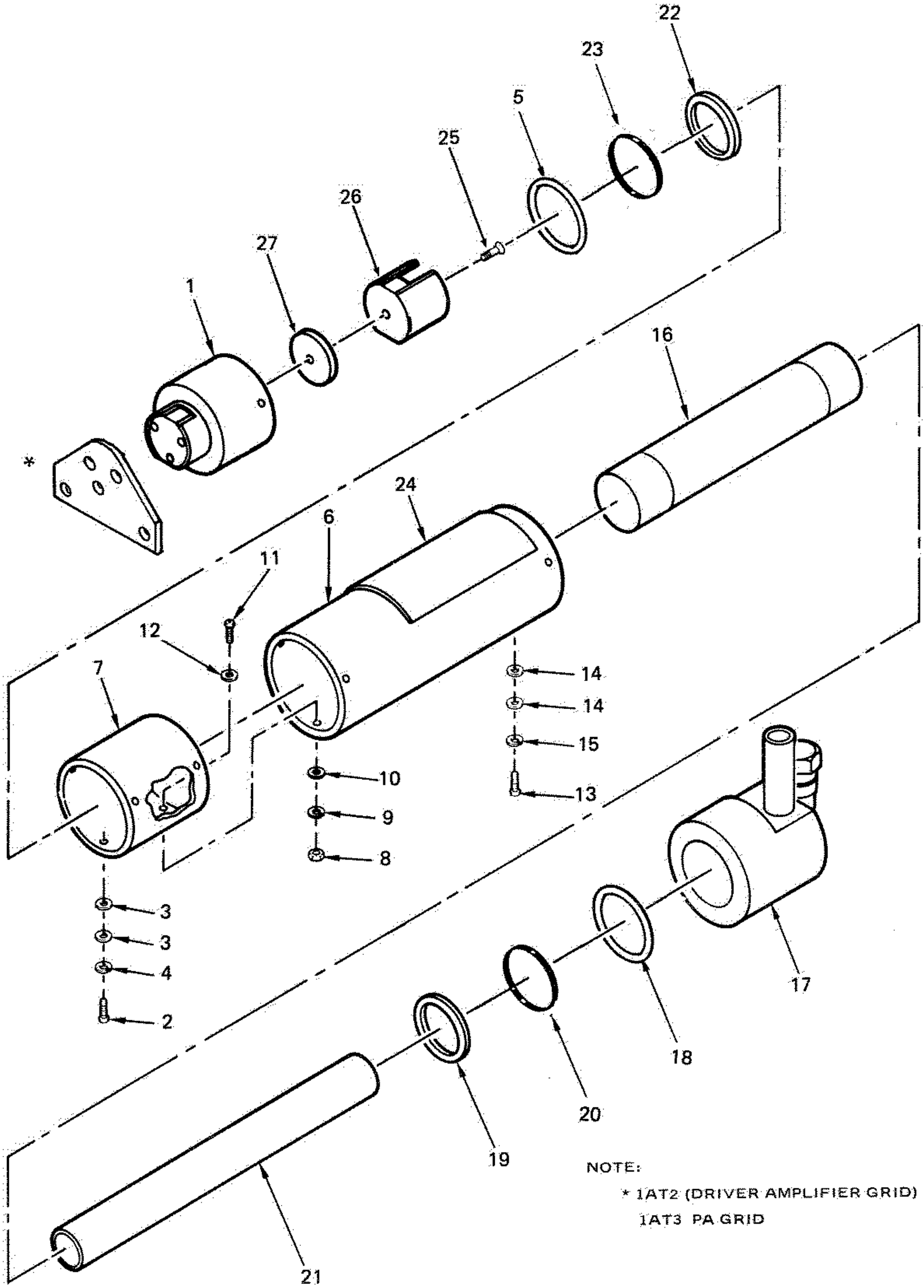


Figure 6-125. 1AT2, 1AT3 Disassembly/Reassembly

e. Top contact (1) disassembly.

(1) Remove screw (25).

(2) Remove retainer (26) and washer (27).

2. To reassemble 1AT2 or 1AT3, refer to Figure 6-125 and perform the following.

a. Bottom contact (17) installation.

(1) Visually inspect spring (19), gasket (18), and preformed packing (20) for serviceability. Look for nicks, indentations, or other such abnormalities. Replace parts as necessary.

(2) Install tube center (21).

WARNING

RESPIRATORY HAZARD

Resistor R1 (16) contains Beryllium Oxide. Do not drop or otherwise damage R1. If it is broken or crushed, avoid breathing dust and fumes. Clear the immediate area of personnel. Cleanup shall be performed wearing protective mask.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating resistor R1 (16) ccw could result in damage to spring (19).

b. Resistor R1 (16) installation. Hold bottom contact (17) securely. Slide resistor (16) over center tube (21) and into bottom contact (17). Slowly rotate resistor cw while pushing it into bottom contact with firm but gentle force.

c. Insulating sleeve (7) installation.

(1) Place insulating sleeve (7) inside envelope (6). Install flat washer (12) and screw (11); three places.

(2) Install lockwasher (9), flat washer (10), and nut (8); three places.

d. Envelope (6) installation.

(1) Position envelope (6) so WARNING decal (24) is as shown in Figure 6-128. Slide envelope over resistor (16) and line up screw holes with those of bottom contact (17).

(2) Install lockwasher (15), two flat washers (14), and screw (13); three places.

e. Top contact (1) reassembly.

(1) Install washer (27) and retainer (26).

(2) Install screw (25).

f. Top contact (1) installation.

(1) Visually inspect spring (22), gasket (5), and preformed packing (23) for serviceability. Look for nicks, indentations, or other such abnormalities. Replace parts as necessary.

CAUTION

EQUIPMENT DAMAGE HAZARD

Exercise caution while performing the following step. Rotating top contact (1) ccw could result in damage to spring (22).

(2) Hold envelope (6) securely. Slowly rotate top contact (1) cw while pushing it onto resistor (16) with firm but gentle pressure. Line up screw holes with those of envelope (6).

(3) Install lockwasher (4), two flat washers (3), and screw (2); three places.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.1.

6-9.3 <u>IPA Bias Power Supply 1PS3.</u> This power supply is an electronic LRU with a number of replaceable components. Disassembly and reassembly consists of removal and installation of those components. Obvious and routine tasks, such as soldering and unsoldering of standard, clearly identified resistors and diodes are not addressed.

6-9.3.1 <u>K1 or K2 Removal.</u> Refer to Figure 6-126 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from terminals at top of relay.

2. Remove two screws (1), two flat washers (2), and two lockwashers (3).

3. Remove relay from chassis.

6-9.3.2 <u>K1 or K2 Installation.</u> Refer to Figure 6-126 and perform the following.

1. Position relay on chassis. Install two lockwashers (3), two flat washers (2), and two screws (1).
2. Solder wires to terminals at top of relay. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

6-9.3.3 <u>C1 Through C6 Removal.</u> Refer to Figure 6-126 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing two screws (4) and two lockwashers (5).

2. Loosen nut (6) on mounting bracket.

3. Remove capacitor.

6-9.3.4 <u>C1 Through C6 Installation.</u> Refer to Figure 6-126 and perform the following.

1. Position capacitor into mounting bracket and tighten nut (6).

2. Connect wires to top of capacitor by installing two lockwashers (5) and two screws (4). Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

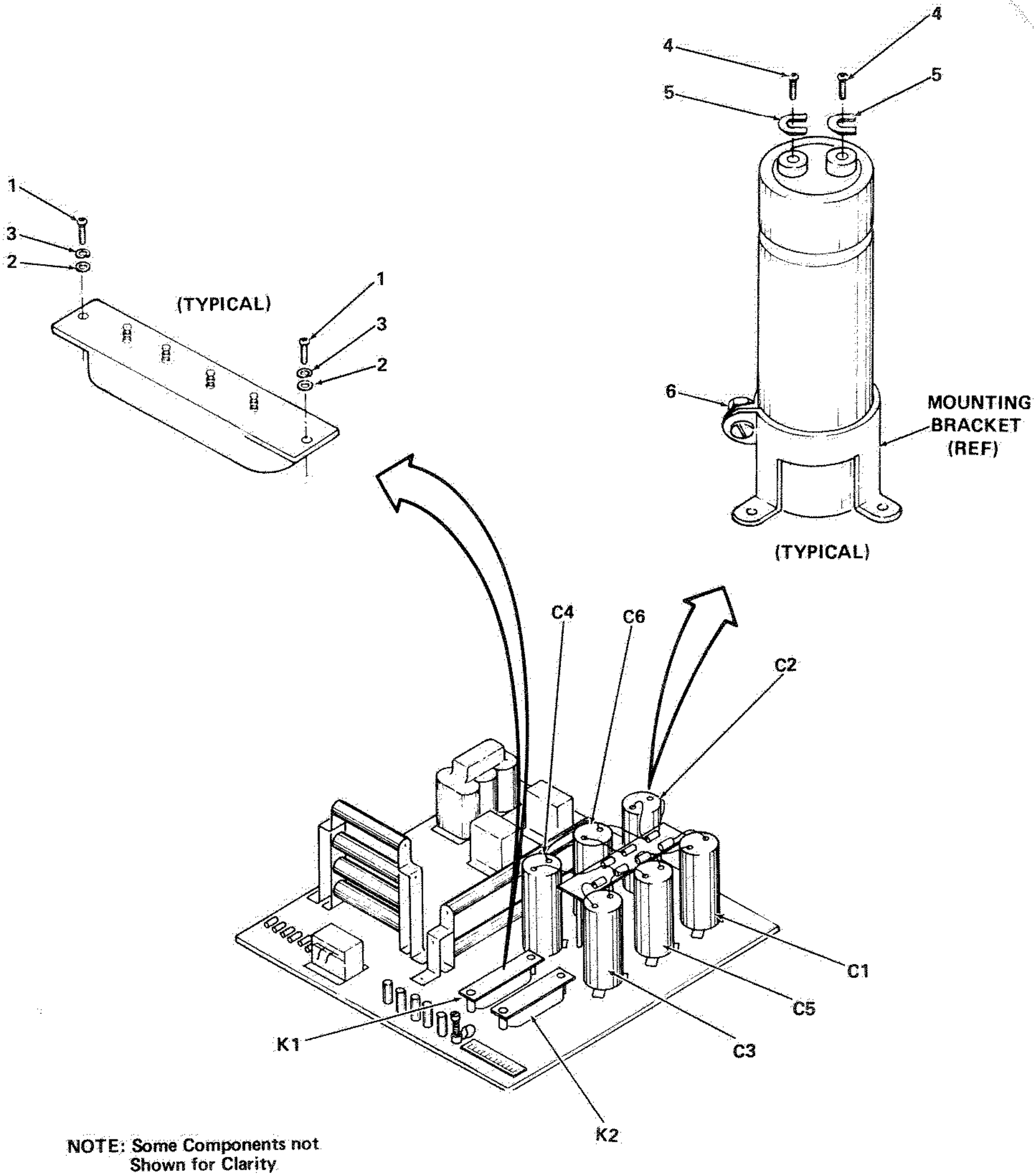


Figure 6-126. K1 or K2 and C1 through C6 Removal/Installation

6-9.3.5 R16 Removal. Refer to Figure 6-127 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove nut (4), lockwasher (5), and two flat washers (6).

3. Remove resistor from chassis by sliding it up and off threaded stud.

6-9.3.6 R16 Installation. Refer to Figure 6-127 and perform the following.

1. Slide resistor down over threaded stud until it meets with chassis.

2. Install two flat washers (6), lockwasher (5), and nut (4).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

6-9.3.7 Terminal Board Removal. Refer to Figure 6-127 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from terminal board.

2. Remove two screws (1), two flat washers (2), and two lockwashers (3).

3. Remove terminal board from metal posts.

6-9.3.8 Terminal Board Installation. Refer to Figure 6-127 and perform the following.

1. Position terminal board on metal posts. Install two lockwashers (3), two flat washers (2), and two screws (1).

2. Solder wires to terminal board. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

6-9.3.9 R7, R8, or R9 Removal. Refer to Figure 6-128 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two nuts (2), two lock washers (3), and two flat washers (4).

3. Remove resistor and two mounting brackets (5) from chassis.

4. Remove two nuts (6) from ends of resistor. Remove resistor from mounting brackets (5).

6-9.3.10 R7, R8, or R9 Installation. Refer to Figure 6-128 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).

2. Position mounting brackets (5) on chassis. Install two screws (1), two flat washers (4), two lock-washers (3), and two nuts (2).

3. Solder wires to resistor and remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

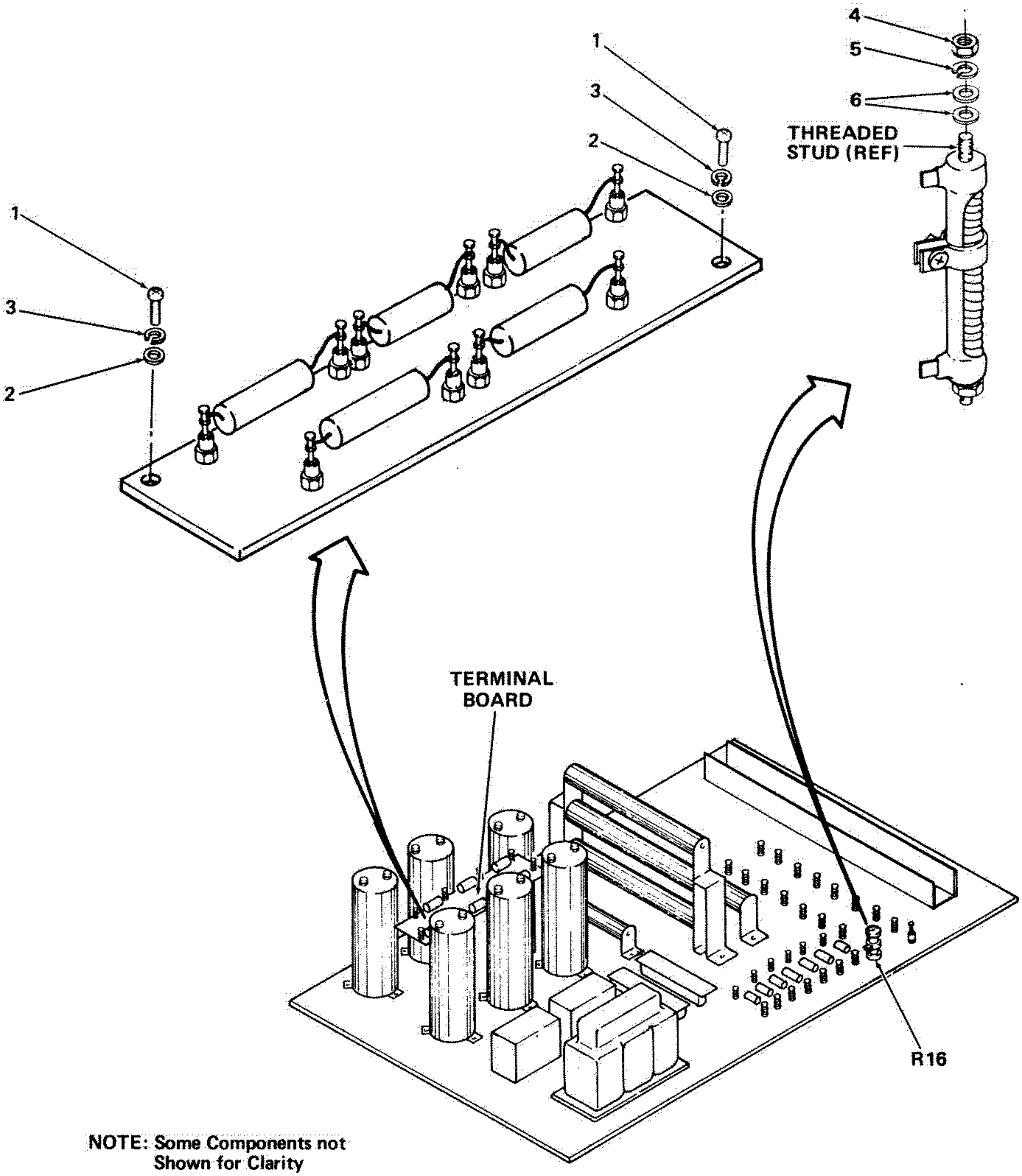


Figure 6-127. R16 and Terminal Board Removal/Installation

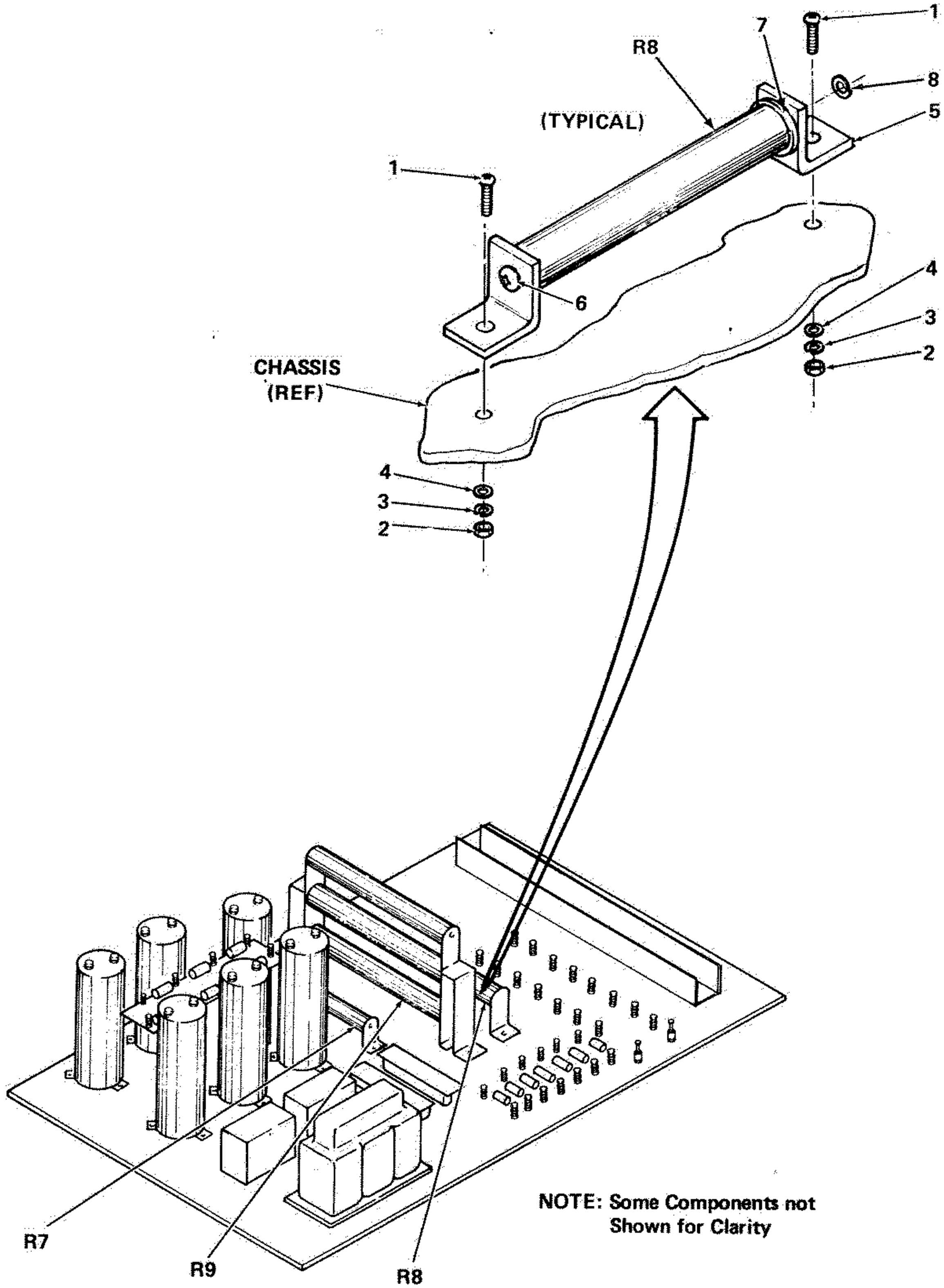


Figure 6-128. R7, R8 or R9 Removal/Installation

6-9.3.11 <u>L1 or L2 Removal.</u> Refer to Figure 6-129 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from inductor.
2. Remove screw (1) and flat washer (2) from base of inductor; four places.
3. Remove inductor from chassis.

6-9.3.12 <u>L1 or L2 Installation.</u> Refer to Figure 6-129 and perform the following:

1. Position inductor on chassis and install flat washer (2) and screw (1); four places.
2. Solder wires to inductor and remove tags.
3. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

6-9.3.13 <u>T1 Removal.</u> Refer to Figure 6-129 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing six screws from transformer terminals.
2. Remove nut (3), lockwasher (4), and flat washer (5) from base of transformer; four places.
3. Lift transformer from four threaded mount studs and remove from chassis.

6-9.3.14 <u>T1 Installation.</u> Refer to Figure 6-129 and perform the following.

1. Position transformer on four threaded mount studs. Install flat washer (5), lockwasher (4), and nut (3); four places.
2. Connect wires to transformer terminals by installing six screws. Remove tags.
3. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

6-9.3.15 <u>R10 or R15 Removal.</u> Refer to Figure 6-130 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.
2. Remove two screws (1), two nuts (2), two lockwashers (3), and two flat washers (4).
3. Remove resistor and two mounting brackets (5) from large mounting brackets.
4. Remove two nuts (6) from ends of resistor and remove resistor from mounting brackets (5).

6-9.3.16 <u>R10 or R15 Installation.</u> Refer to Figure 6-130 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).
2. Position mounting brackets (5) onto large mounting brackets. Install two screws (1), two flat washers (4), two lockwashers (3), and two nuts (2).
3. Solder wires to resistor. Remove tags.
4. Follow-on maintenance: Conduct performance test, paragraph 6-8.2.

6-9.4 <u>Driver Amplifier Bias Power Supply 1PS4.</u> This bias power supply is an electronic LRU with a number of replaceable components. Disassembly and reassembly consists of removal and installation of those components. Obvious and routine tasks, such as unsoldering and soldering of standard, clearly identified resistors and diodes are not addressed.

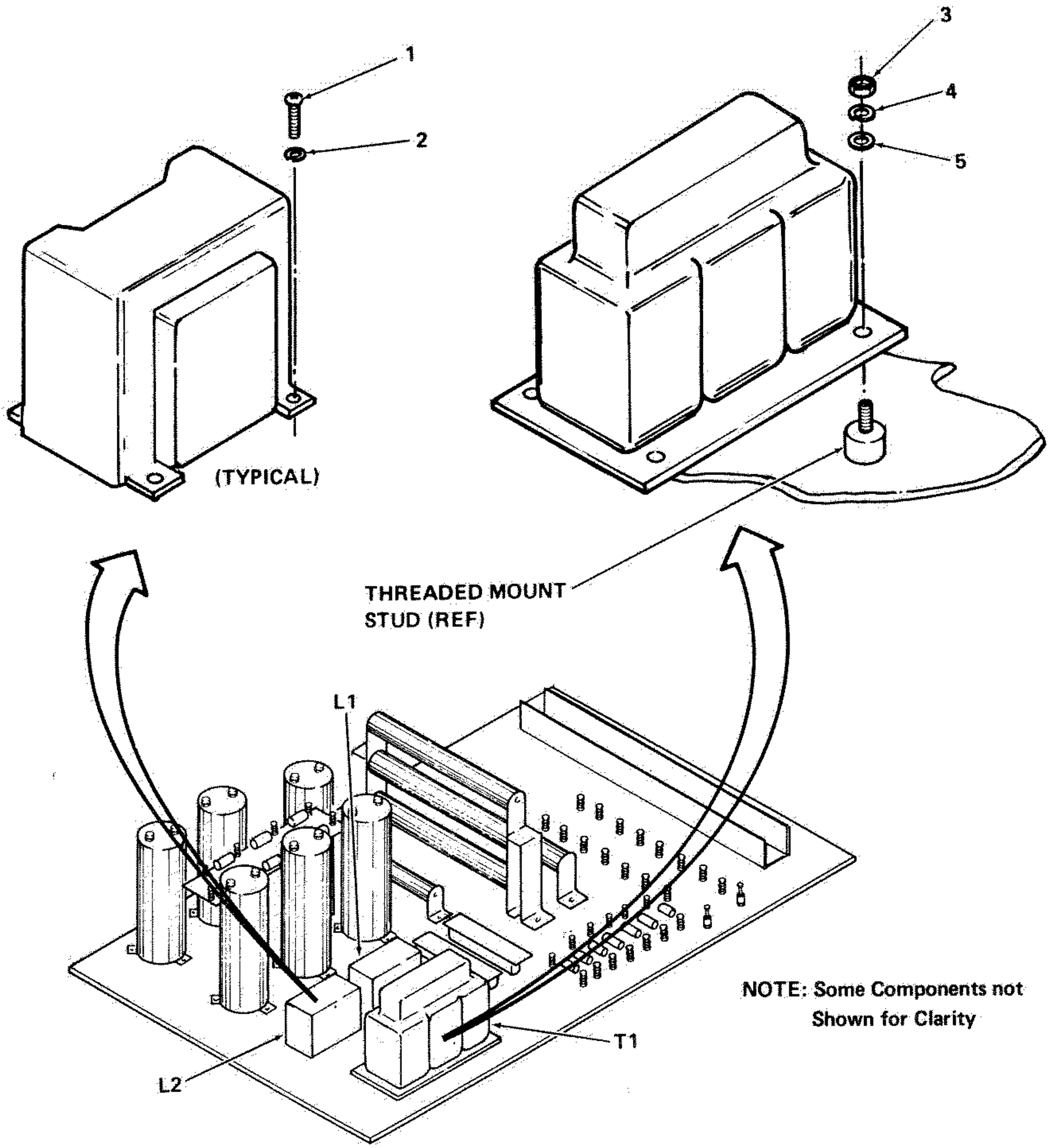


Figure 6-129. L1 or L2 and T1 Removal/Installation

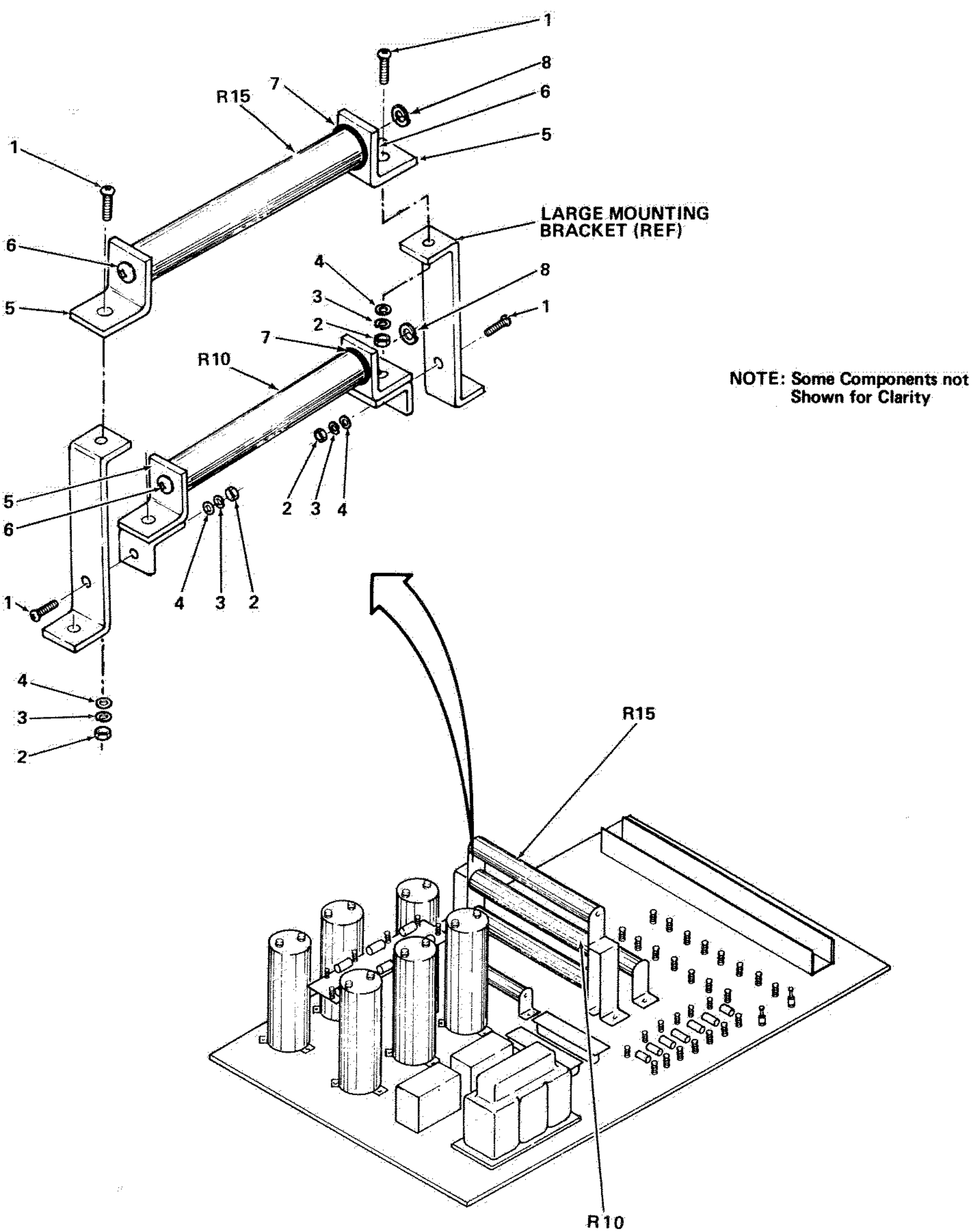


Figure 6-130. R10 and R15 Removal/Installation

6-9.4.1 K1 or K2 Removal. Refer to Figure 6-131 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from terminals at top of relay.

2. Remove two screws (1), two flat washers (2), and two lockwashers (3).

3. Remove relay from chassis.

6-9.4.2 K1 or K2 Installation. Refer to Figure 6-131 and perform the following.

1. Position relay on chassis. Install two lockwashers (3), two flat washers (2), and two screws (1).

2. Solder wires to terminals at top of relay. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.3 C1 Through C6 Removal. Refer to Figure 6-131 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing two screws (4) and two lockwashers (5).
2. Loosen nut (6) on mounting bracket.

3. Remove capacitor from chassis.

6-9.4.4 C1 Through C6 Installation. Refer to Figure 6-131 and perform the following.

1. Position capacitor into mounting bracket and tighten nut (6).

2. Connect wires to top of capacitor by installing two lockwashers (5) and two screws (4). Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.5 T1 Removal. Refer to Figure 6-132 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing nine screws from transformer terminals.

2. Remove nut (4), lockwasher (5), and flat washer (6) from base of transformer; four places.

3. Lift transformer from four threaded mount studs and remove from chassis.

6-9.4.6 T1 Installation. Refer to Figure 6-132 and perform the following.

1. Position transformer on four threaded mount studs. Install flat washer (6), lockwasher (5), and nut (4); four places.

2. Connect wires to transformer terminals by installing nine screws. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.7 Terminal Board Removal. Refer to Figure 6-132 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from terminal board.

2. Remove two screws (1), two flat washers (2), and two lockwashers (3).

3. Remove terminal board from metal posts.

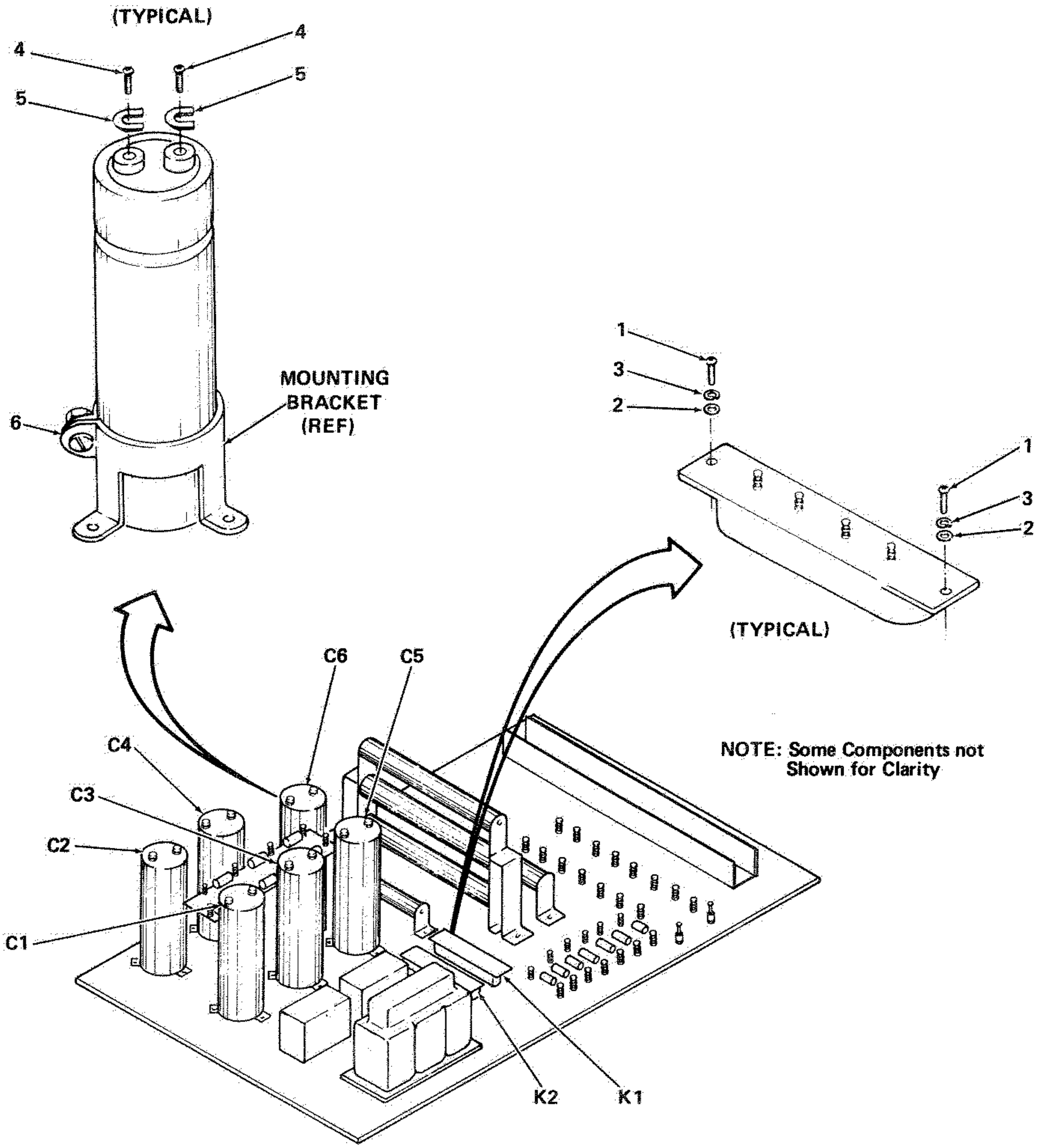


Figure 6-131. K1 and K2 or C1 through C6 Removal/Installation

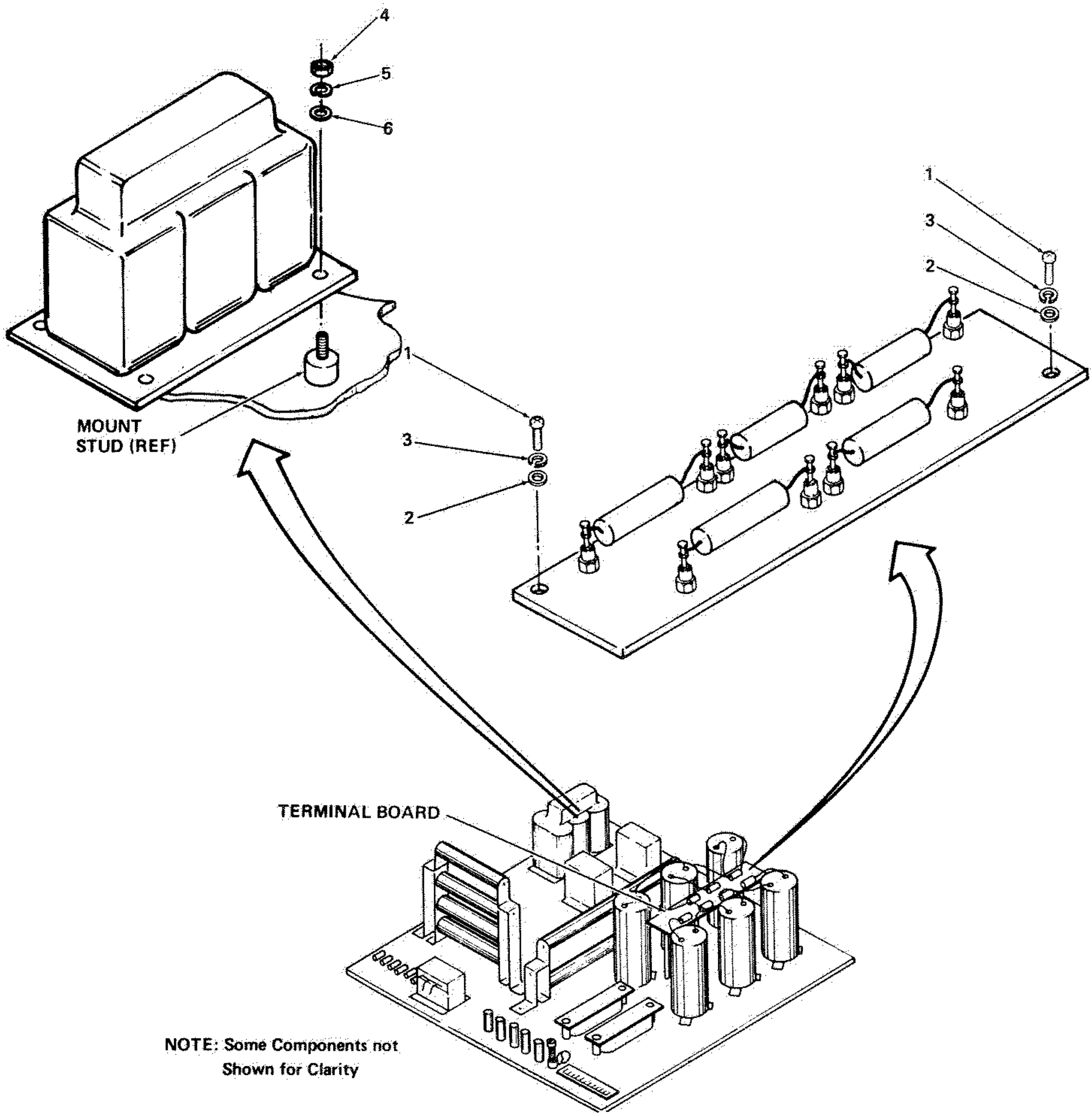


Figure 6-132. T1 or Terminal Board Removal/Installation

6-9.4.8 Terminal Board Installation. Refer to Figure 6-132 and perform the following.

1. Position terminal board on metal posts. Install two lockwashers (3), two flat washers (2), and two screws (1).

2. Solder wires to terminal board. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.9 R3 Removal. Refer to Figure 6-133 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two flat washers (2), and two lockwashers (3).

3. Remove resistor and two mounting brackets (4) from chassis.

4. Remove two nuts (5) from ends of resistor.

5. Remove resistor from mounting brackets (4).

6-9.4.10 R3 Installation. Refer to Figure 6-133 and perform the following.

1. Position resistor into mounting brackets (4) and install two nuts (5).

2. Position mounting brackets (4) on chassis. Install two lockwashers (3), two flat washers (2), and two screws (1).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.11 R4 Removal. Refer to Figure 6-133 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two nuts (6), two lockwashers (7), two flat washers (8), and two screws (9).

3. Remove resistor and two mounting brackets (10) from chassis.

4. Remove two nuts (11) from ends of resistor.

5. Remove resistor from mounting brackets (10).

6-9.4.12 R4 Installation. Refer to Figure 6-133 and perform the following.

1. Position resistor into mounting brackets (10) and install two nuts (11).

2. Position mounting brackets (10) on chassis. Install two screws (9), two flat washers (8), two lockwashers (7), and two nuts (6).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.13 R5, R18, or R19 Removal. Refer to Figure 6-134 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two nuts (2), two lockwashers (3), and two flat washers (4).

3. Remove resistor and two mounting brackets (5) from large mounting brackets.

4. Remove two nuts (6) from ends of resistor. Remove resistor from mounting brackets (5).

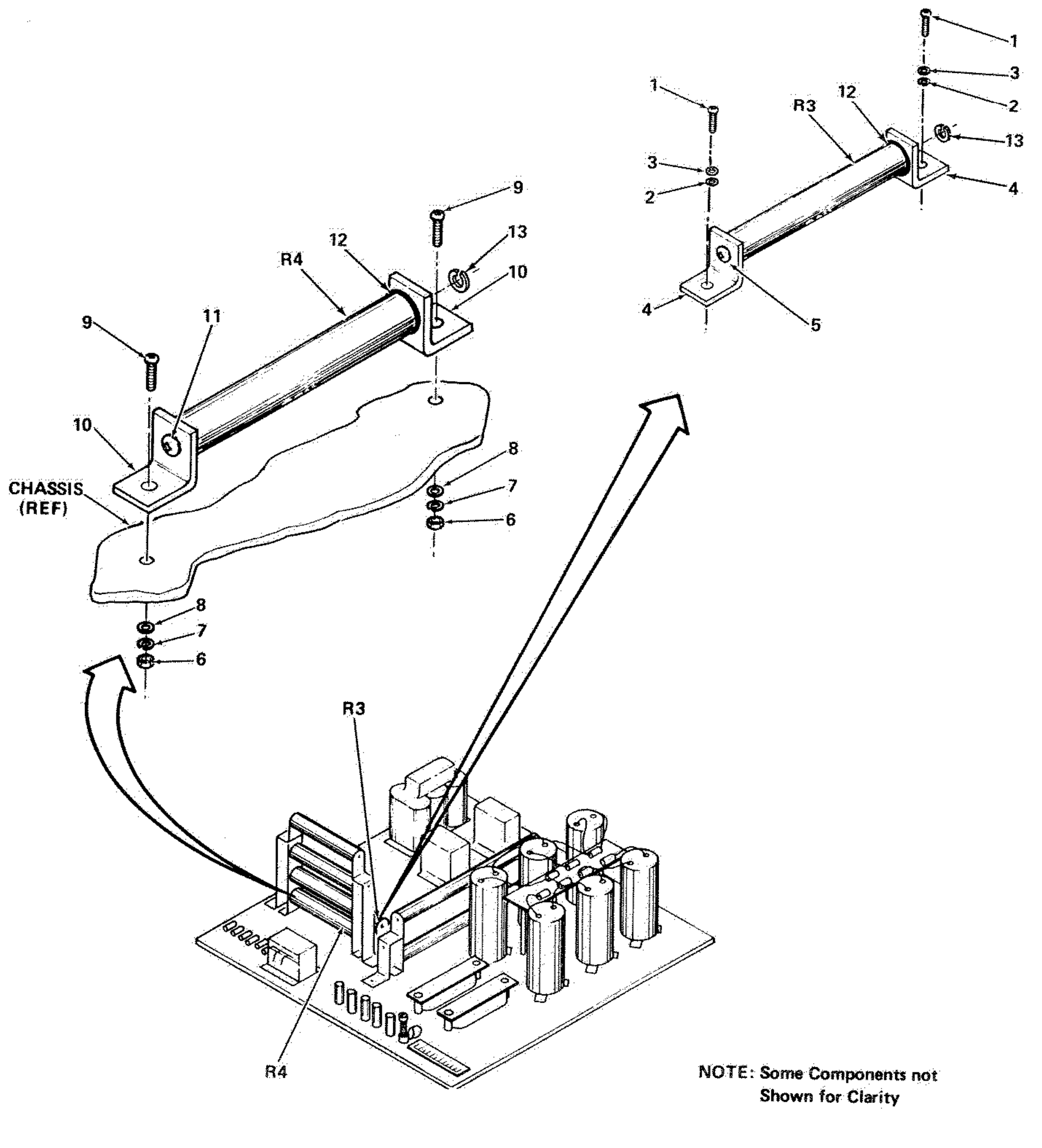
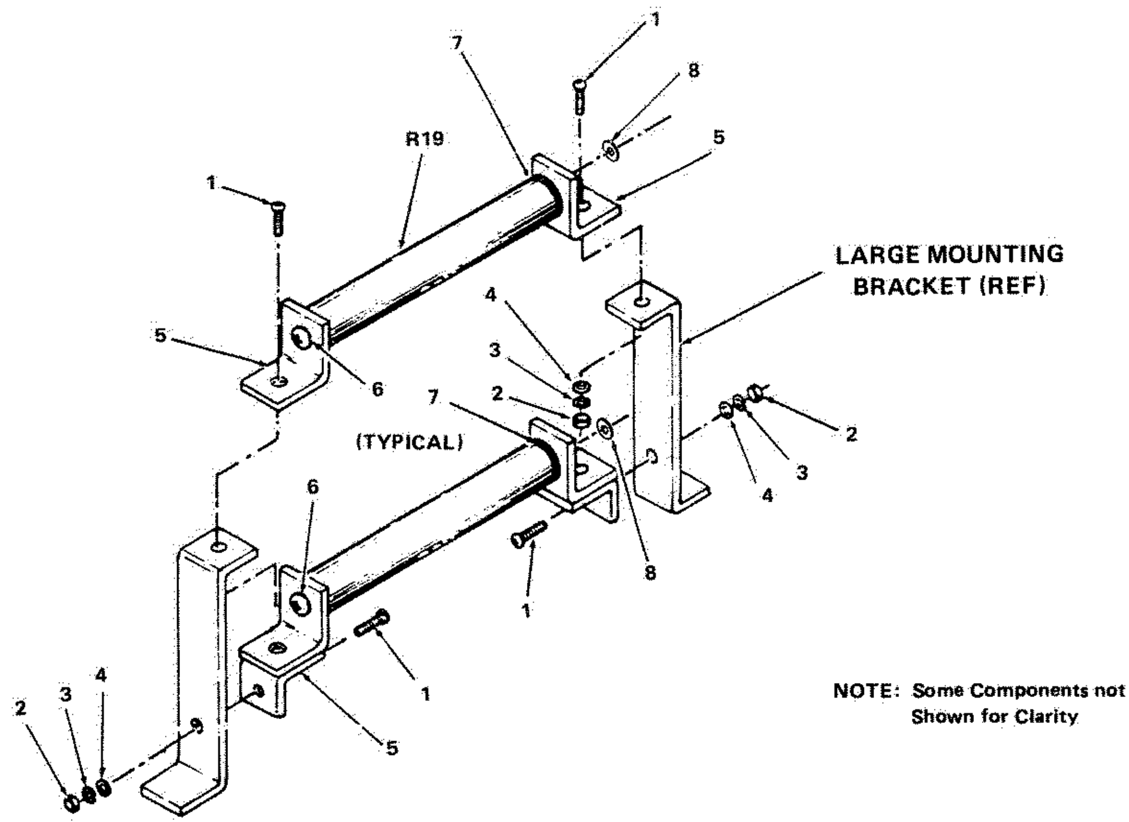


Figure 6-133. R3 or R4 Removal/Installation



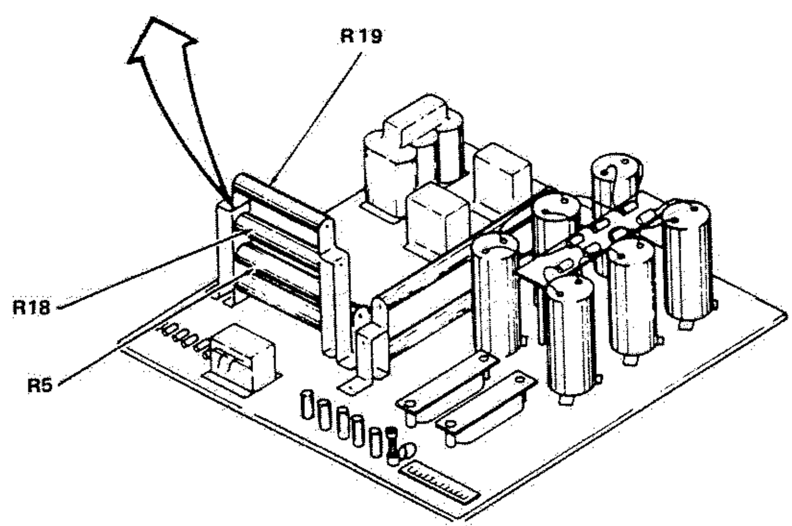


Figure 6-134. R5, R18 or R19 Removal/Installation

6-9.4.14 R5, R18, or R19 Installation. Refer to Figure 6-134 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).

2. Position mounting brackets (5) onto large mounting brackets. Install two screws (1), two flat washers (4), two lockwashers (3), and two nuts (2).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.15 R12 Removal. Refer to Figure 6-135 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two nuts (2), two lockwashers (3), and two flat washers (4).

3. Remove resistor and two mounting brackets (5) from chassis.

4. Remove two nuts (6) from ends of resistor. Remove resistor from mounting brackets (5).

6-9.4.16 R12 Installation. Refer to Figure 6-135 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).

2. Position mounting brackets (5) on chassis. Install two screws (1), two flat washers (4), two lock-washers (3) and two nuts (2).

3. Solder wires to resistor and remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.17 R20 Removal. Refer to Figure 6-135 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove nut (7), lockwasher (8), and two flat washers (9).

3. Remove resistor from chassis by sliding it up and off threaded stud.

6-9.4.18 R20 Installation. Refer to Figure 6-135 and perform the following.

1. Slide resistor down over threaded stud until it meets with chassis.

2. Install two flat washers (9), lockwasher (8), and nut (7).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.19 R13 Removal. Refer to Figure 6-136 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two nuts (2), two lockwashers (3), and two flat washers (4).

3. Remove resistor and two mounting brackets (5) from large mounting brackets.

4. Remove two nuts (6) from ends of resistor and remove resistor from mounting brackets (5).

6-9.4.20 R13 Installation. Refer to Figure 6-136 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).

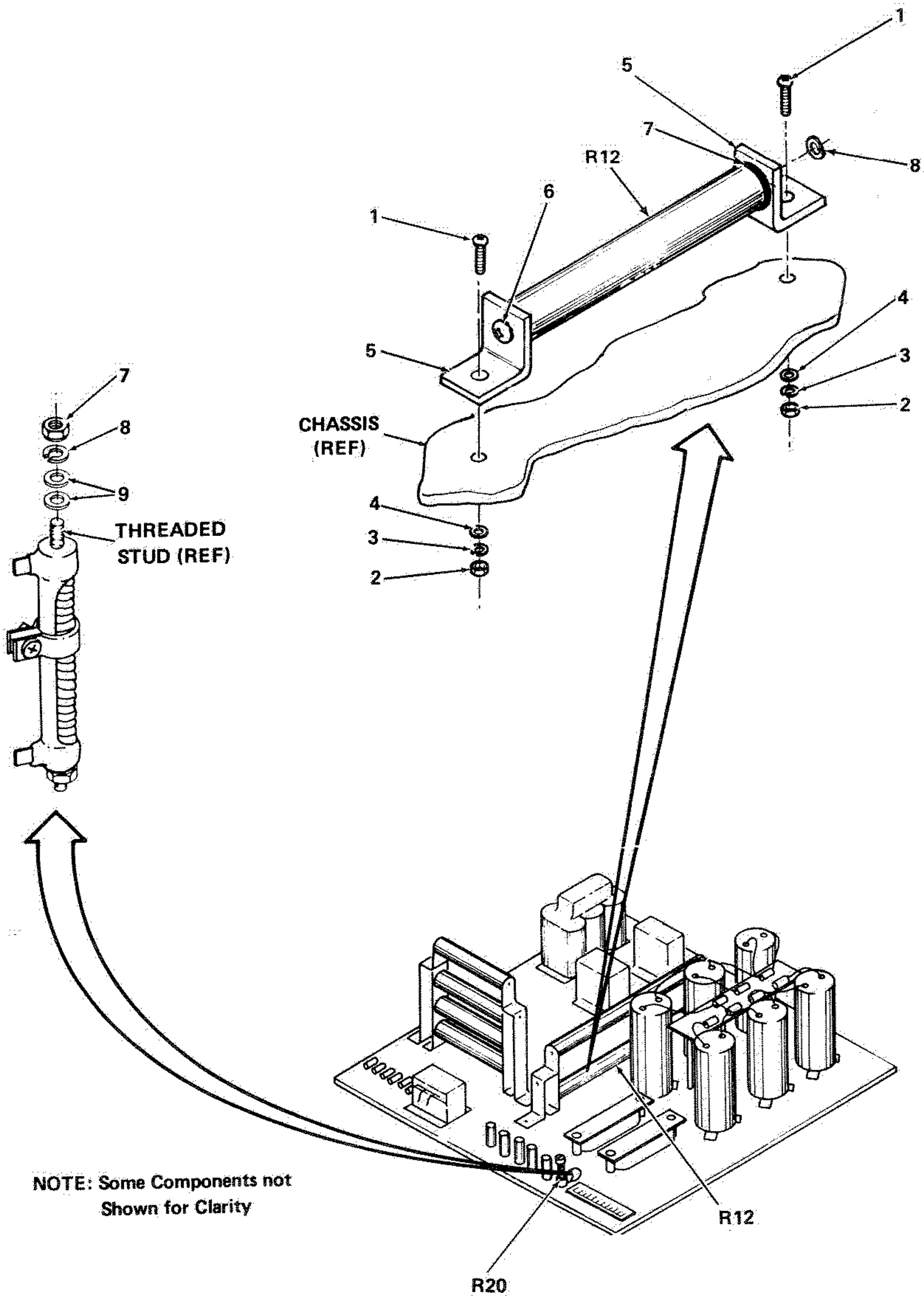


Figure 6-135. R12 or R20 Removal/Installation

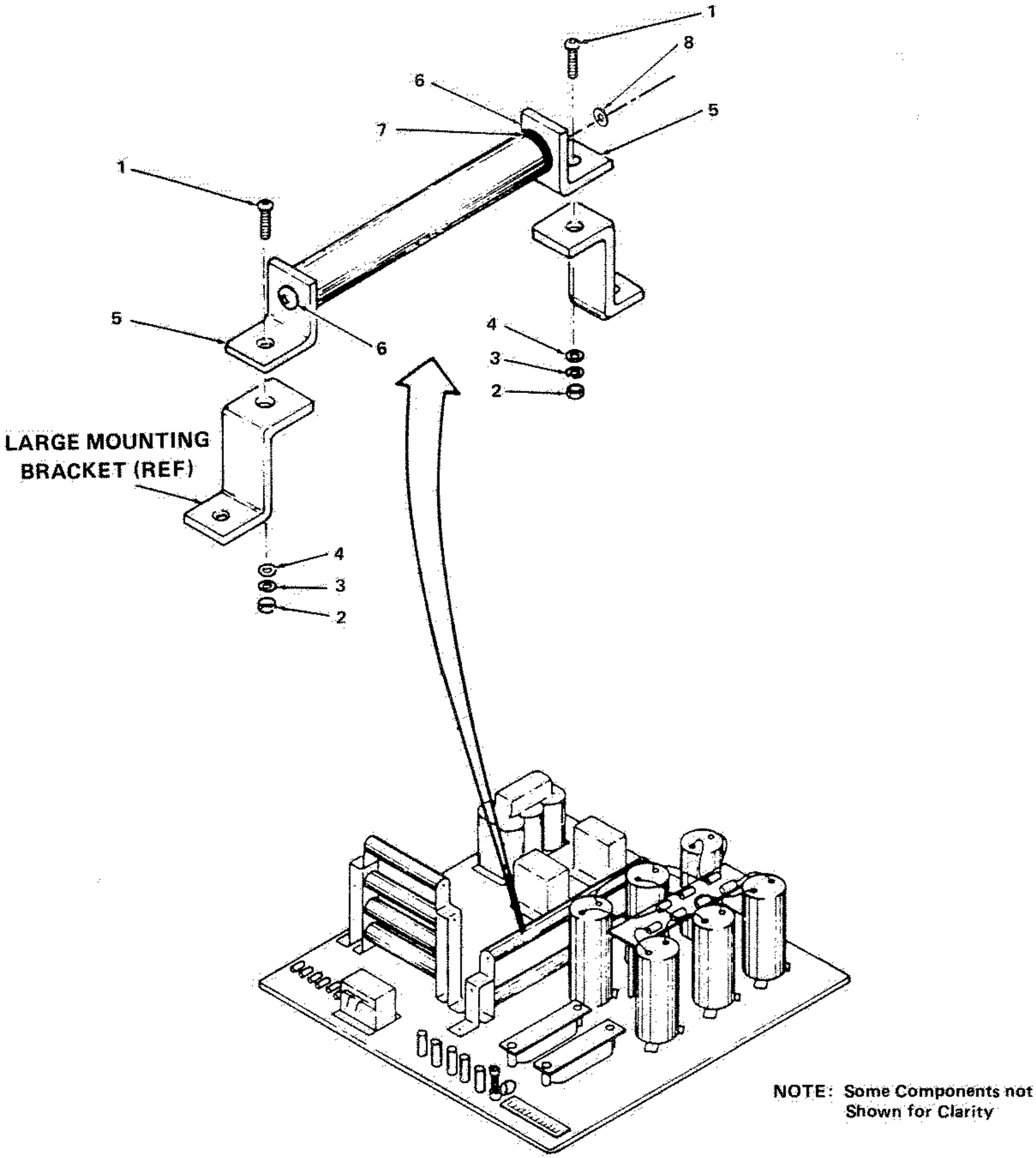


Figure 6-136. R13 Removal/Installation

2. Position mounting brackets (5) onto large mounting brackets. Install two screws (1), two flat washers (4), two lockwashers (3), and two nuts (2).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.21 L1 Removal. Refer to Figure 6-137 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from inductor.

2. Remove screw (1), flat washer (2), and lockwasher (3) from base of inductor; four places.

3. Remove inductor from chassis.

6-9.4.22 L1 Installation. Refer to Figure 6-137 and perform the following.

1. Position inductor on chassis and install lockwasher (3), flat washer (2), and screw (1); four places.

2. Solder wires to inductor and remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.4.23 L2 or L3 Removal. Refer to Figure 6-137 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing two screws from inductor terminals.

2. Remove screw (4), flat washer (5), and lockwasher (6) from base of inductor; four places.

3. Remove inductor from chassis.

6-9.4.24 L2 or L3 Installation. Refer to Figure 6-137 and perform the following.

1. Position inductor on chassis and install lockwasher (6), flat washer (5), and screw (4); four places.

2. Connect wires to inductor terminals by installing two screws. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.3.

6-9.5 PA Bias Power Supply 1PS5. This bias power supply is an electronic LRU with a number of replaceable components. Disassembly and reassembly consists of removal and installation of those components. Obvious and routine tasks, such as unsoldering and soldering of standard, clearly identified resistors and diodes are not addressed.

6-9.5.1 K1 or K2 Removal. Refer to Figure 6-138 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from terminals at top of relay.

2. Remove two screws (1), two flat washers (2), and two lockwashers (3).

3. Remove relay from chassis.

6-9.5.2 K1 or K2 Installation. Refer to Figure 6-138 and perform the following.

1. Position relay on chassis. Install two lockwashers (3), two flat washers (2), and two screws (1).

2. Solder wires to terminals at top of relay. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.5.3 C1 Through C6 Removal. Refer to Figure 6-138 and perform the following.

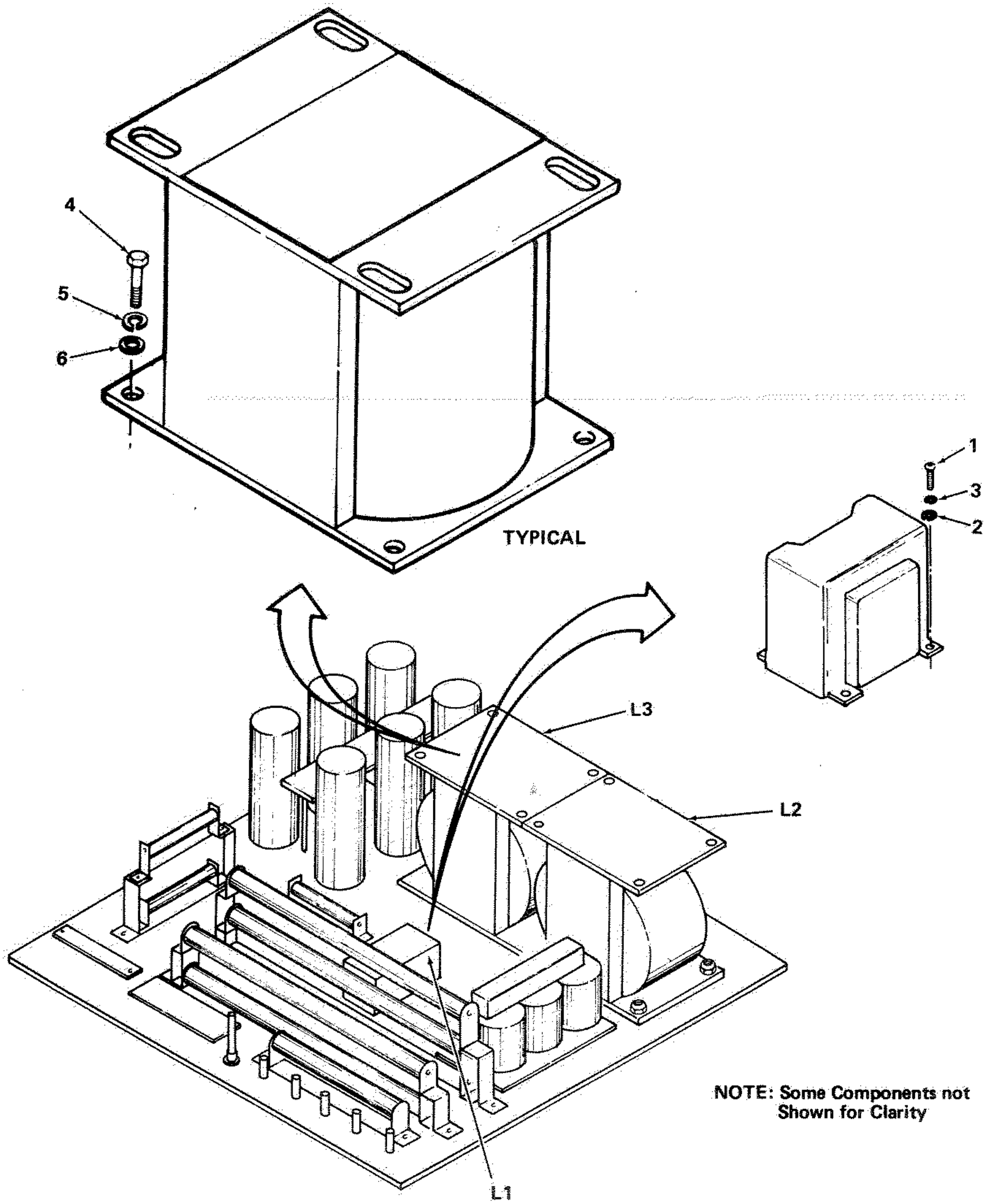


Figure 6-137. L1 or L2 and L3 Removal/Installation

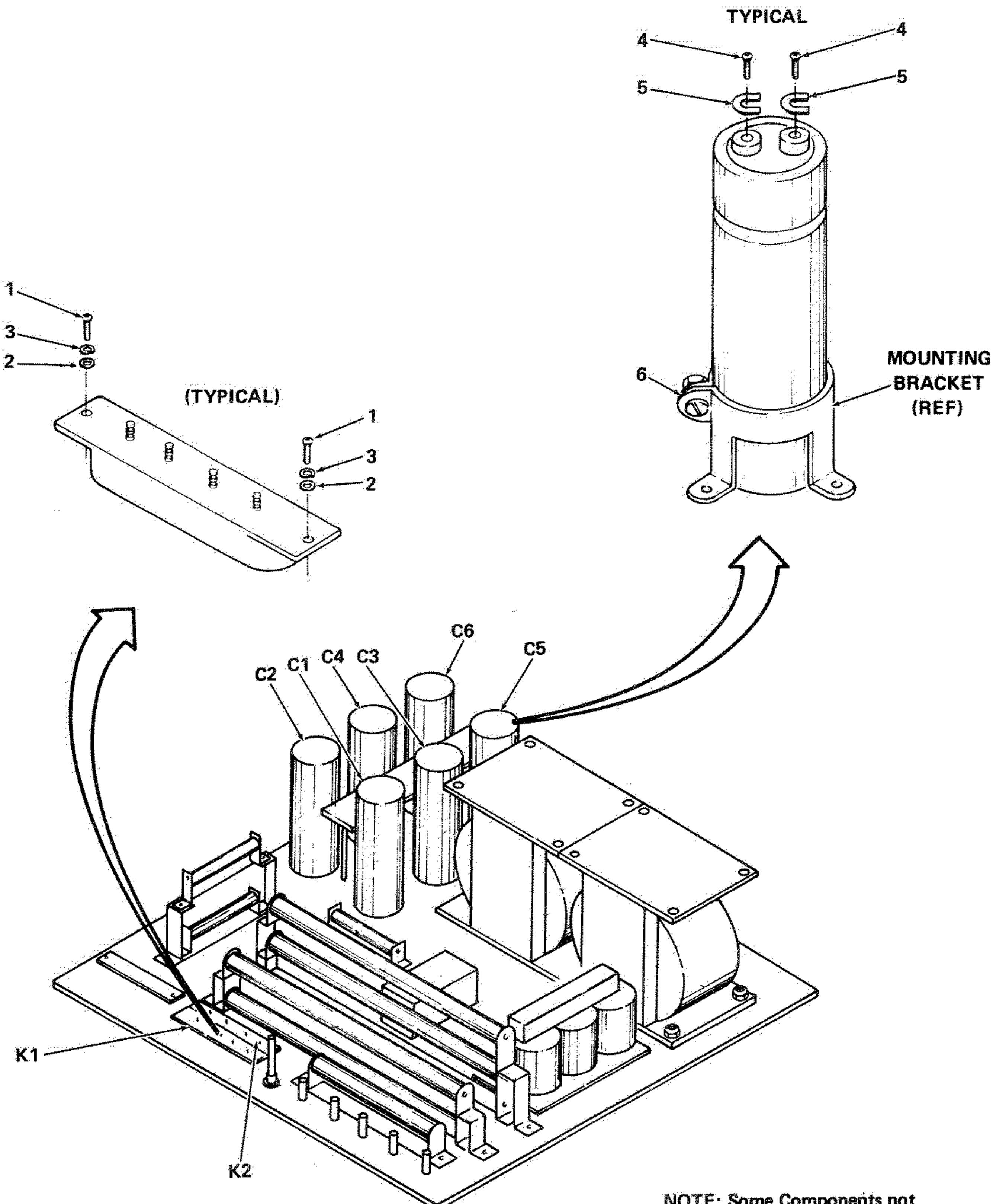


Figure 6-138. K1 or K2, C1 through C6 Removal/Installation

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing two screws (4) and two lockwashers (5).

2. Loosen nut (6) on mounting bracket.

3. Remove capacitor from chassis.

6-9.5.4 C1 Through C6 Installation. Refer to Figure 6-138 and perform the following.

1. Position capacitor into mounting bracket and tighten nut (6).

2. Connect wires to top of capacitor by installing two lockwashers (5) and two screws (4). Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.5.5 Terminal Board Removal. Refer to Figure 6-139 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from terminal board.

2. Remove two screws (1), two flat washers (2), and two lockwashers (3).

3. Remove terminal board from metal posts.

6-9.5.6 Terminal Board Installation. Refer to Figure 6-139 and perform the following.

1. Position terminal board on metal posts. Install two lockwashers (3), two flat washers (2), and two screws (1).

2. Solder wires to terminal board. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.5.7 R4, R5, R18, R20, or R22 Removal. Refer to Figure 6-140 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two nuts (2), two lockwashers (3), and two flat washers (4).

3. Remove resistor and mounting brackets (5) from chassis.

4. Remove two nuts (6) from ends of resistor. Remove resistor from mounting brackets (5).

6-9.5.8 R4, R5, R18, R20, or R22 Installation. Refer to Figure 6-140 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).

2. Position mounting brackets (5) on chassis. Install two screws (1), two flat washers (4), two lock-washers (3), and two nuts (2).

3. Solder wires to resistor and remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

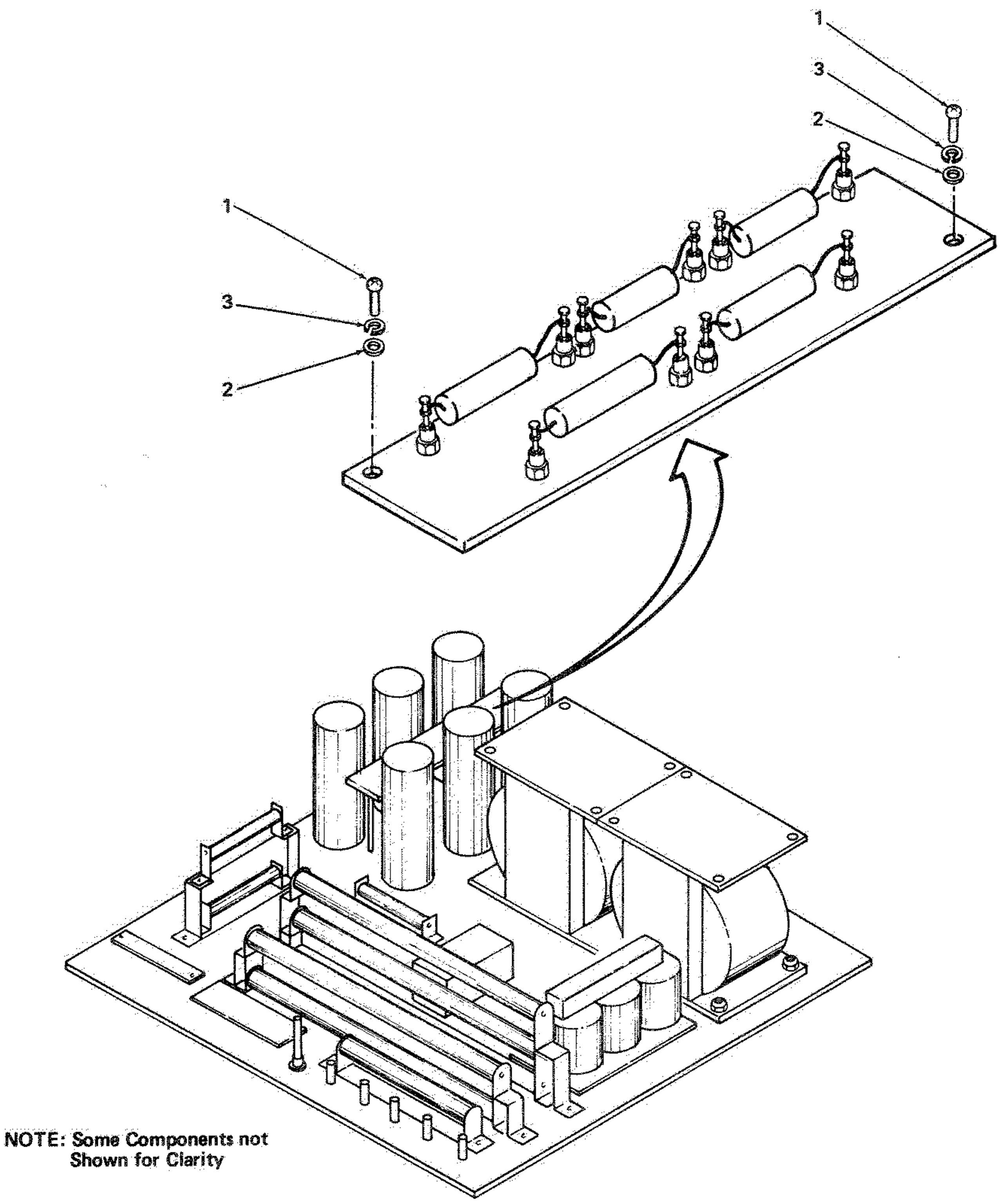


Figure 6-139. Terminal Board Removal/Installation

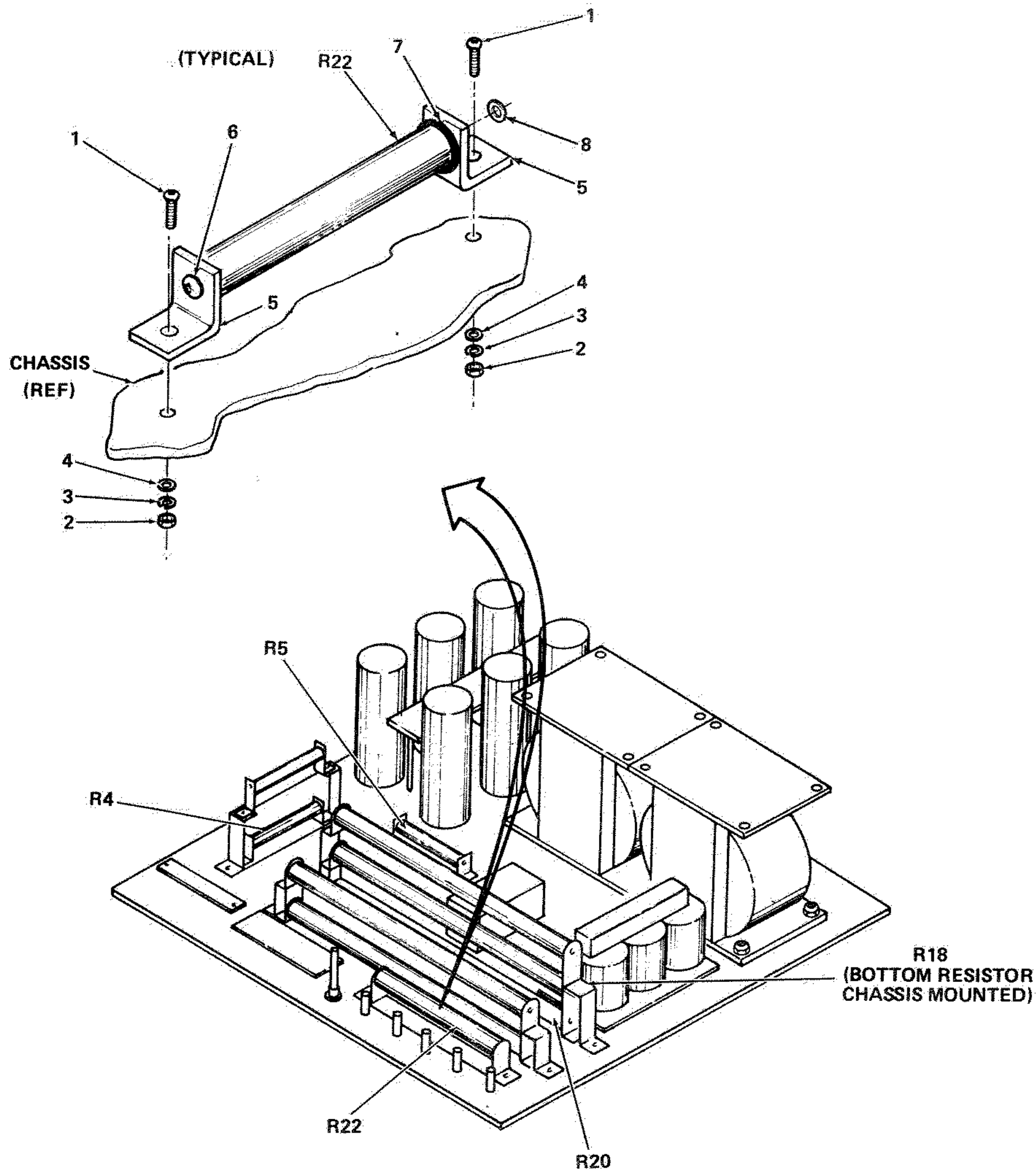


Figure 6-140. R4, R5, R18, R20, or R22 Removal/Installation

6-9.5.9 R3, R16, or R19 Removal. Refer to Figure 6-141 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two nuts (2), two lockwashers (3), and two flat washers (4).

3. Remove resistor and mounting brackets (5) from large mounting brackets.

4. Remove two nuts (6) from ends of resistor and remove resistor from mounting brackets (5).

6-9.5.10 R3, R16, or R19 Installation. Refer to Figure 6-141 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).

2. Position mounting brackets (5) onto large mounting brackets. Install two screws (1), two flat washers (4), two lockwashers (3), and two nuts (2).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.5.11 R17 Removal. Refer to Figure 6-142 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove two screws (1), two nuts (2), two lockwashers (3), and two flat washers (4).

3. Remove resistor and mounting brackets (5) from large mounting brackets.

4. Remove two nuts (6) from ends of resistor and remove resistor from mounting brackets (5).

6-9.5.12 R17 Installation. Refer to Figure 6-142 and perform the following.

1. Position resistor into mounting brackets (5) and install two nuts (6).

2. Position mounting brackets (5) onto large mounting brackets. Install two screws (1), two flat washers (4), two lockwashers (3), and two nuts (2).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.5.13 L1 Removal. Refer to Figure 6-143 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from inductor.

2. Remove screw (1), flat washer (2), and lockwasher (3) from base of inductor; four places.

3. Remove inductor from chassis.

6-9.5.14 L1 Installation. Refer to Figure 6-143 and perform the following.

1. Position inductor on chassis and install lockwasher (3), flat washer (2), and screw (1); four places.

2. Solder wires to inductor and remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

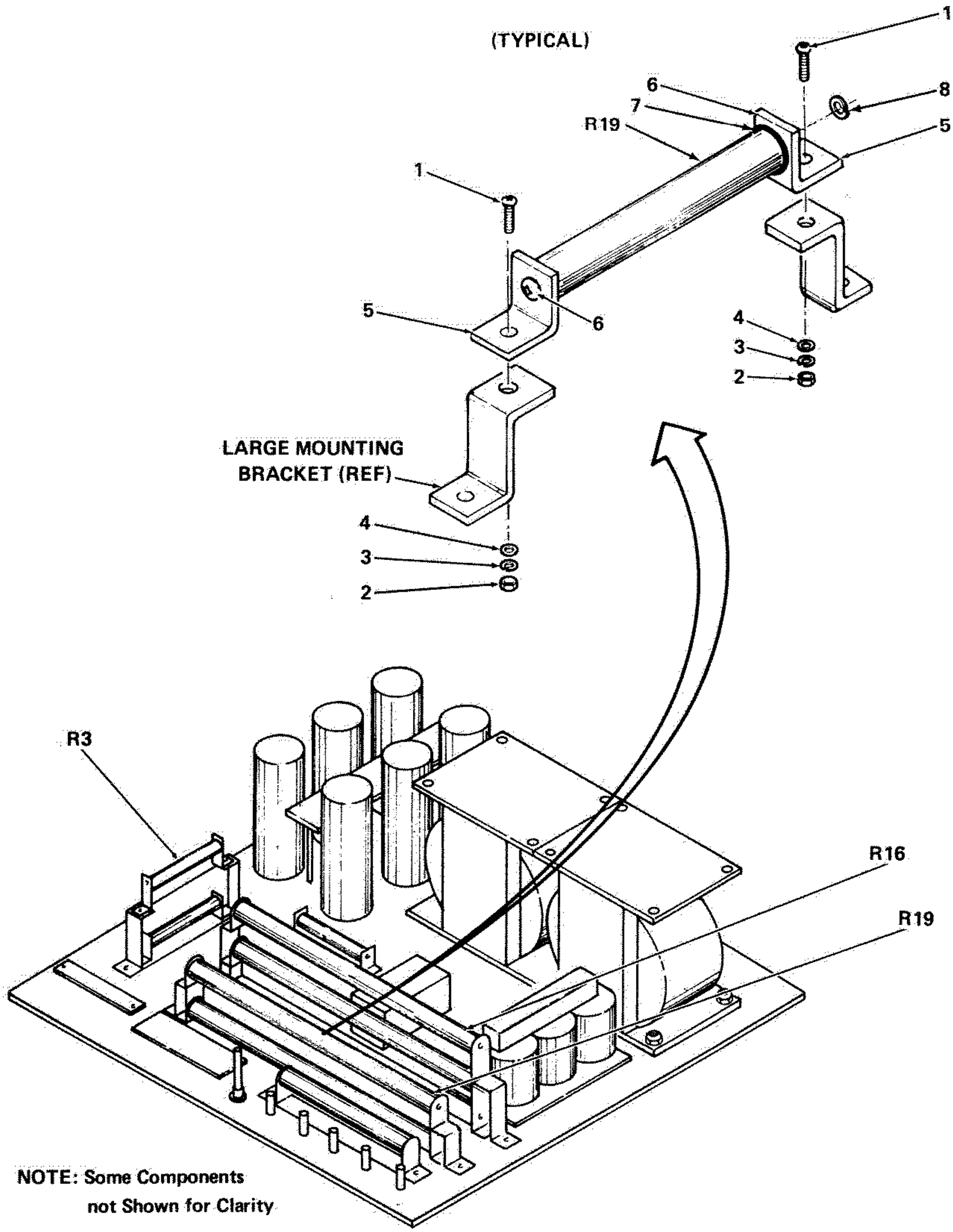


Figure 6-141. R3, R16, or R19 Removal/Installation

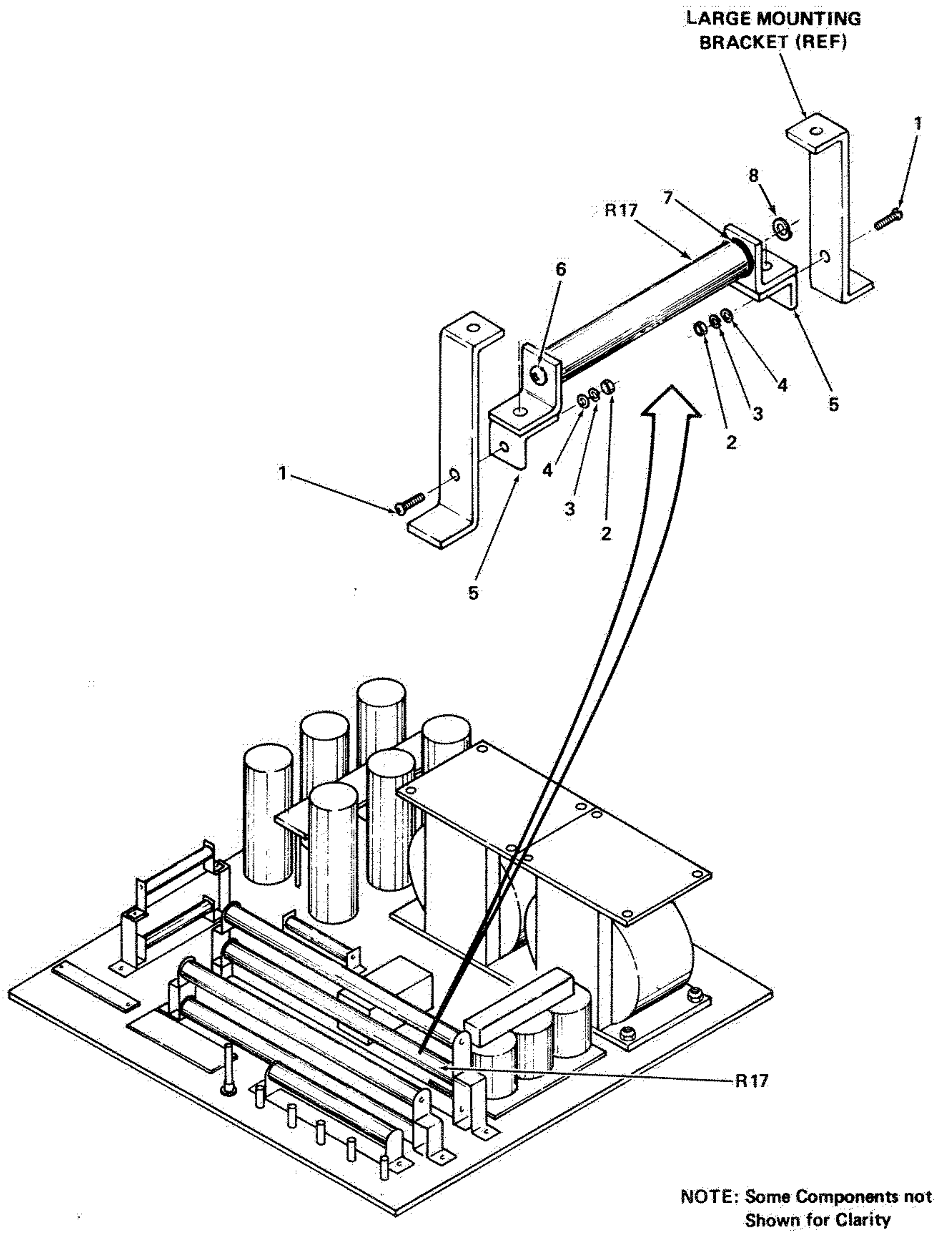


Figure 6-142. R17 Removal/Installation

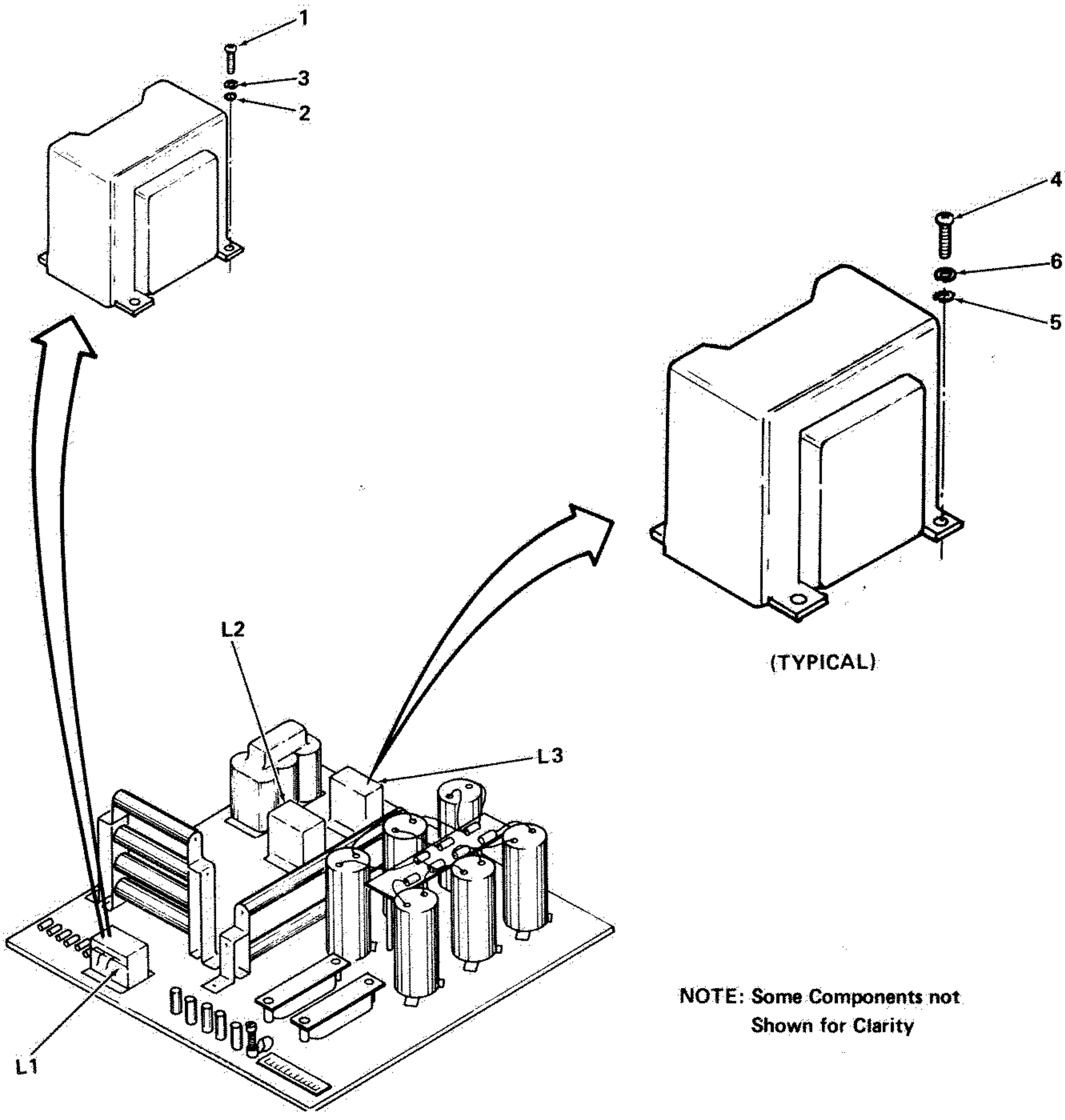


Figure 6-143. L1, L2 or L3 Removal/Installation

6-9.5.15 L2 or L3 Removal. Refer to Figure 6-143 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing two screws from inductor terminals.

2. Remove bolt (4), flat washer (5), and lockwasher (6) from base of inductor; four places.

3. Remove inductor from chassis.

6-9.5.16 L2 or L3 Installation. Refer to Figure 6-143 and perform the following.

1. Position inductor on chassis and install lockwasher (6), flat washer (5), and bolt (4); four places.

2. Solder wires to inductor and remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.5.17 R23 Removal. Refer to Figure 6-144 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor.

2. Remove nut (1), lockwasher (2), and two flat washers (3).

3. Remove resistor from chassis by sliding it up and off threaded stud.

6-9.5.18 R23 Installation. Refer to Figure 6-144 and perform the following.

1. Slide resistor down over threaded stud until it meets with chassis.

2. Install two flat washers (3), lockwasher (2), and nut (1).

3. Solder wires to resistor. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.5.19 T1 Removal. Refer to Figure 6-144 and perform the following.

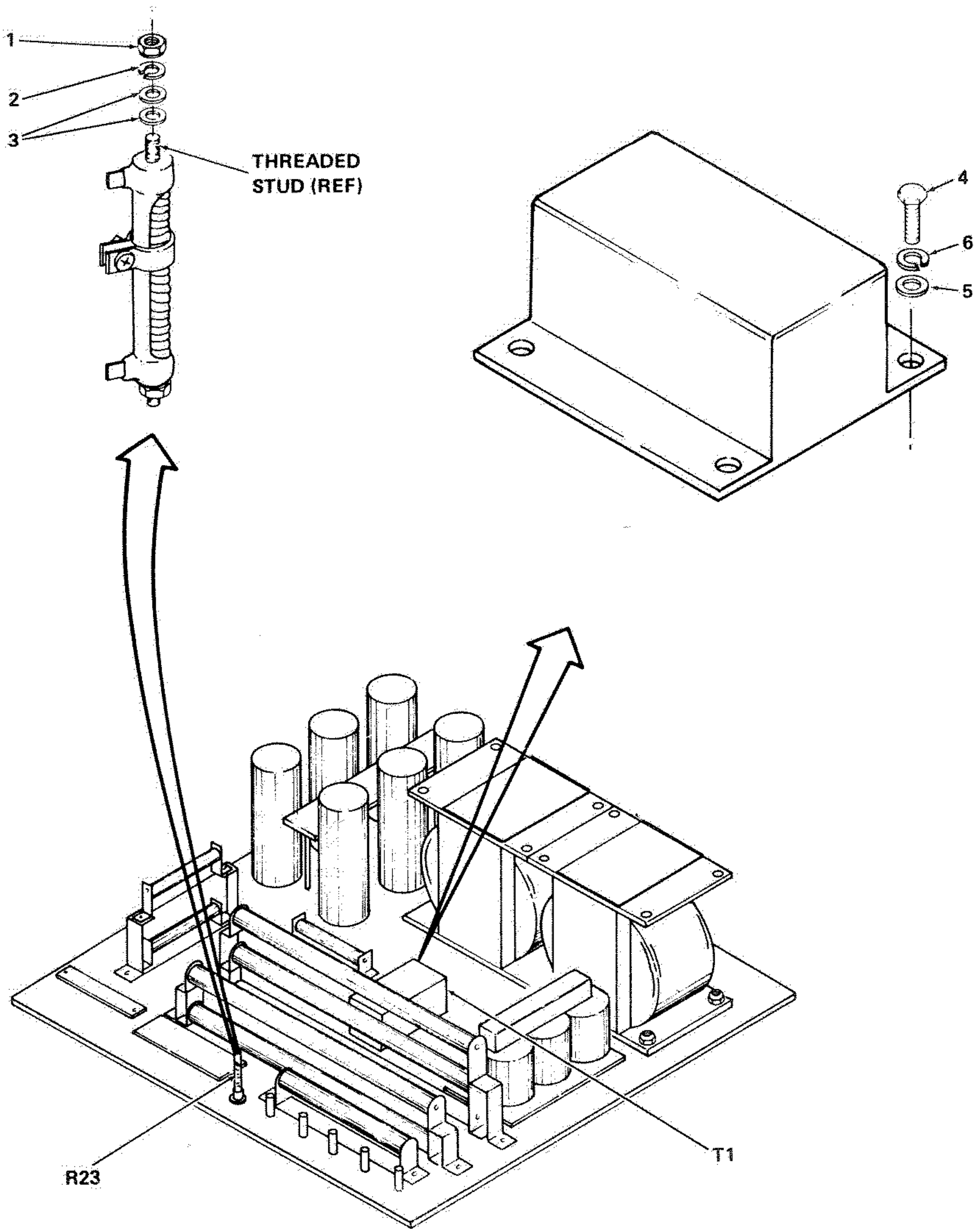
NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing nine screws from transformer terminals.

2. Remove bolt (4), flat washer (5), and lockwasher (6) from base of transformer; four places.

3. Remove transformer from chassis.



NOTE: Some Components not Shown for Clarity

Figure 6-144. T1 or R23 Removal/Installation

6-9.5.20 T1 Installation. Refer to Figure 6-144 and perform the following.

1. Position transformer on chassis. Install lockwasher (6), flat washer (5), and bolt (4); four places.

2. Connect wires to transformer terminals by installing nine screws. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.4.

6-9.6 Arc Sensor Probe 1A14 Through 1A20, A26 and A27. The seven arc sensor probes are identical. They are simplistic in design, containing only three electronic components: a photoelectric cell and two capacitors. Once the cover and photoelectric cell are removed, disassembly and reassembly are obvious, routine tasks. The following is a typical set of procedures.

6-9.6.1 R1 Removal. Refer to Figure 6-145 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

In performing step 1, be sure to locate correct two screws. Do not attempt removal of upper right-hand or lower left-hand screws.

1. Remove two screws (1) from cover. Lift and remove cover and attached honeycomb shield and gasket from enclosure.

2. Remove R1 (2) from plug-in socket.

6-9.6.2 R1 Installation. Refer to Figure 6-145 and perform the following.

1. Plug R1 (2) into socket. Position cover on enclosure and install two screws (1).

2. Follow-on maintenance: Conduct performance test, paragraph 6-8.5.

6-9.7 Electronic Crowbar 2A1. The Electronic Crowbar contains a number of replaceable electronic components. Disassembly and reassembly consists of removal and installation of those components.

CAUTION

Ensure V1 tube is kept in a vertical position to prevent liquid mercury from splashing within the tube.

6-9.7.1 V1 Removal. Refer to Figure 6-146 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Loosen set screw (1) and remove ignitor (2) from ignitor terminal of V1 (3).

2. Hold upper end of V1 (3) firmly and unscrew anode terminal (4) from top of V1.

3. Remove plate (5) and anode terminal (4) as a single unit.

4. Hold V1 (3) by upper end and loosen clamp (6).

5. Remove V1 (3).

6-9.7.2 V1 Installation. Refer to Figure 6-146 and perform the following.

1. Position V1 (3) so ignitor terminal is as shown in Figure 6-145.

2. Place V1 (3) into socket as shown in Figure 6-146. Hold by upper end and tighten clamp (6).

3. Hold upper end of V1 (3) firmly and install plate (5) and anode terminal (4) by screwing anode terminal onto top of V1.

4. Install ignitor (2) on ignitor terminal and tighten set screw (1).

5. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

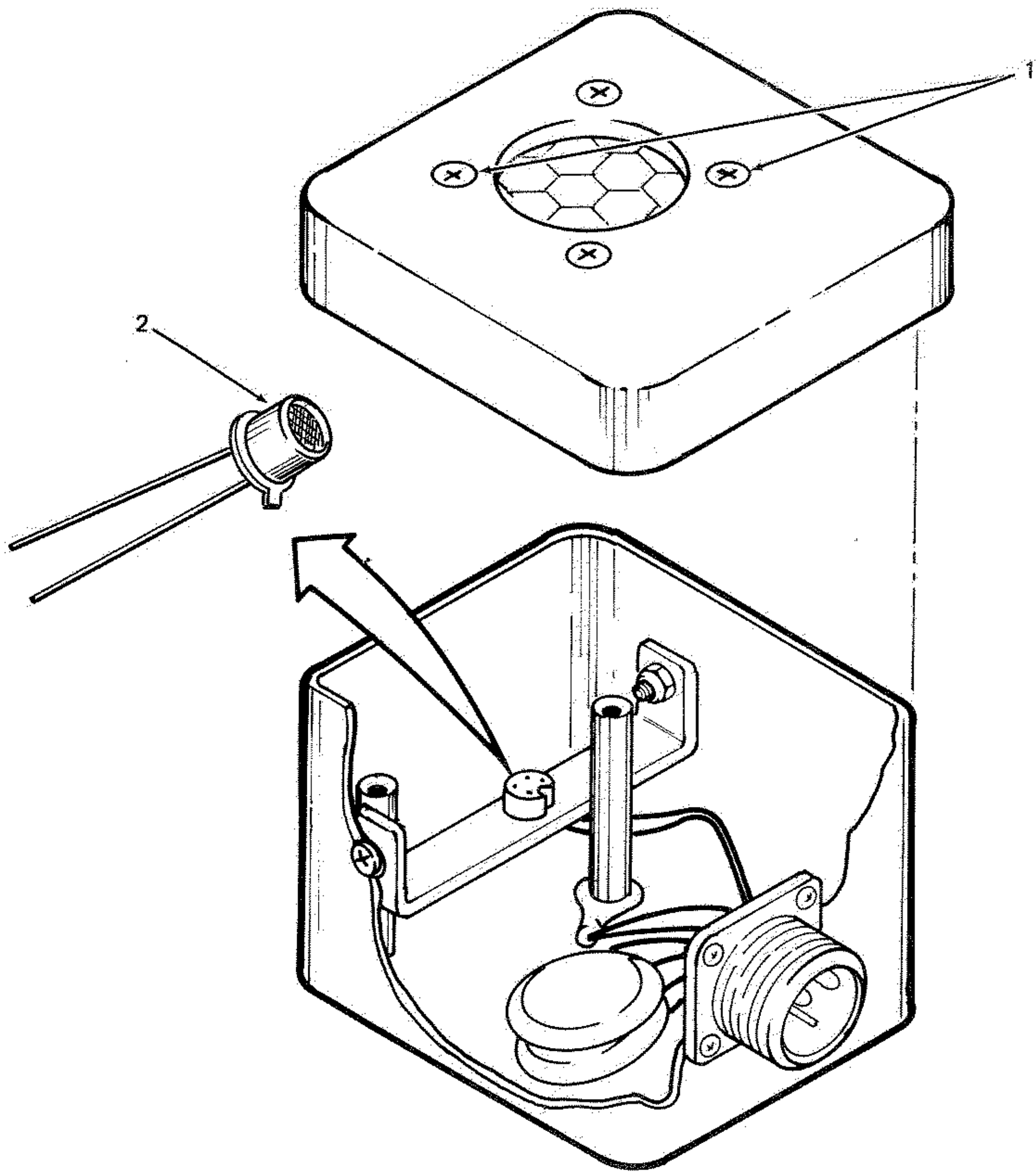


Figure 6-145. R1 Removal/Installation

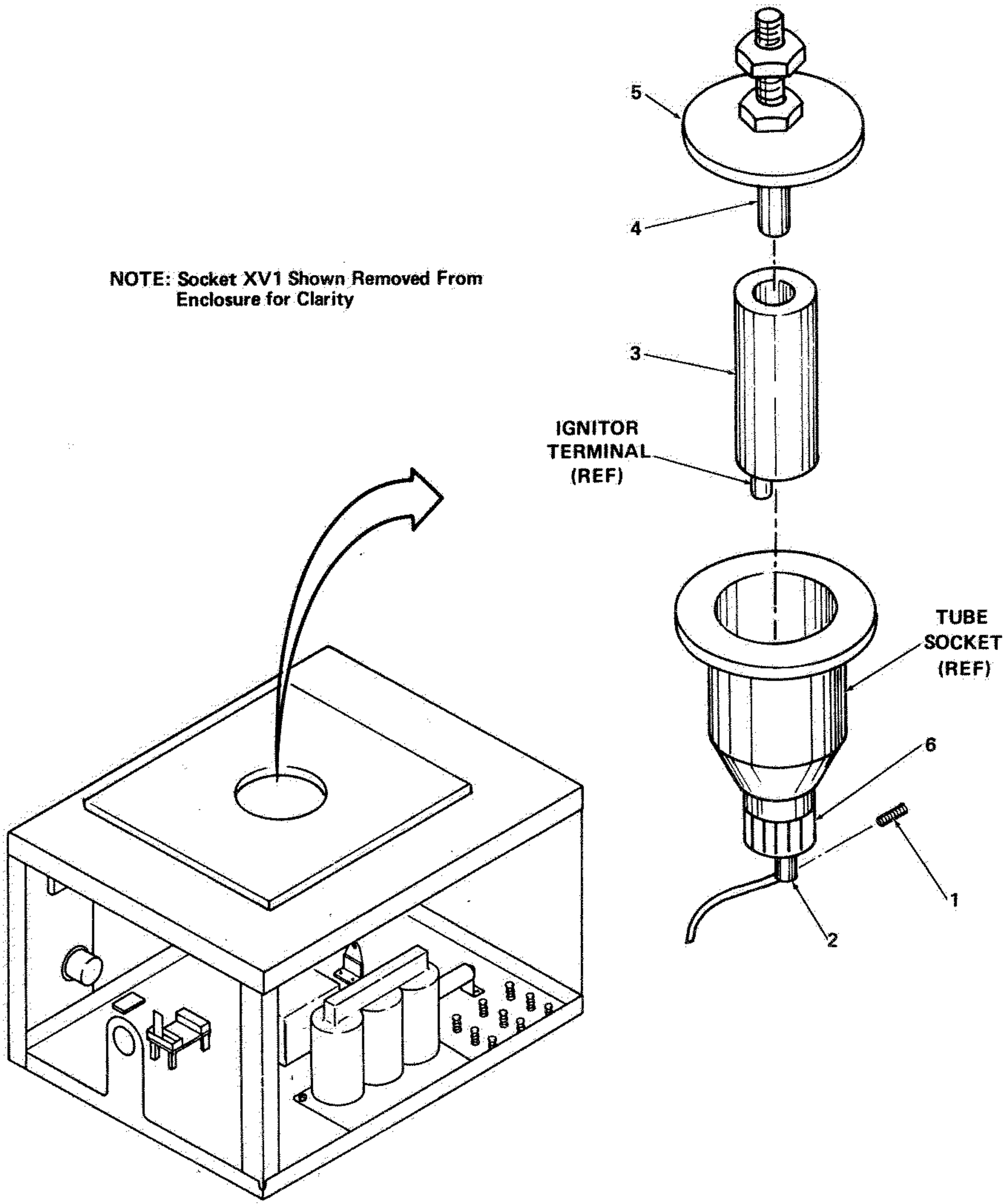


Figure 6-146. V1 Removal/Installation

6-9.7.3 XV1 Removal. Refer to Figure 6-147 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Perform procedures of paragraph 6-9.7.1 to remove ignitron tube V1.

2. Remove screw (1), nut (5), flat washer (7), and lockwasher (6); four places.

3. Remove screw (8), nut (9), flat washer (11), and lockwasher (10); four places.

4. Lift mounting plate (12) and remove from chassis.

5. Remove XV1 (3) from mounting plate.

6-9.7.4 XV1 Installation. Refer to Figure 6-147 and perform the following.

1. Place XV1 (13) on mounting plate (9).

2. Install two screws (1), flat washer (3), lockwasher (2).

3. Position mounting plate onto chassis. Install screw (8), lockwasher (10), and nut (9); four places.

4. Install screw (4), lockwasher (7), flat washer (6), and nut (5); two places.

5. Follow-on maintenance: None required.

6-9.7.5 R1 Removal. Refer to Figure 6-148 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires from resistor (1) by removing one nut from each of two terminal lugs.

2. Remove screw (2), nut (3), lock-washer (4), and washer (5); two places.

3. Lift resistor (1) and mounting brackets (6) from chassis.

4. Remove nut (7) and lockwasher (8); two places. Remove resistor (1) from mounting brackets (6).

6-9.7.6 R1 Installation. Refer to Figure 6-148 and perform the following.

1. Position resistor (1) into mounting brackets (6). Install lockwasher (8) and nut (7); two places.

2. Position mounting brackets (6) onto chassis. Install screw (2), flat washer (5), lockwasher (4), and nut (3); two places.

3. Connect wires to resistor by installing one nut on each of two terminal lugs. Remove tags.

4. Follow-on maintenance: None required.

6-9.7.7 T2 Removal. Refer to Figure 6-148 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing four screws.

2. Remove screw (9), lockwasher (10), and flat washer (11); four places.

3. Remove transformer from chassis.

6-9.7.8 T2 Installation. Refer to Figure 6-148 and perform the following.

1. Position transformer onto chassis. Install lockwasher (10), flat washer (11), and screw (9); four places.

2. Connect wires by installing four screws. Remove tags.

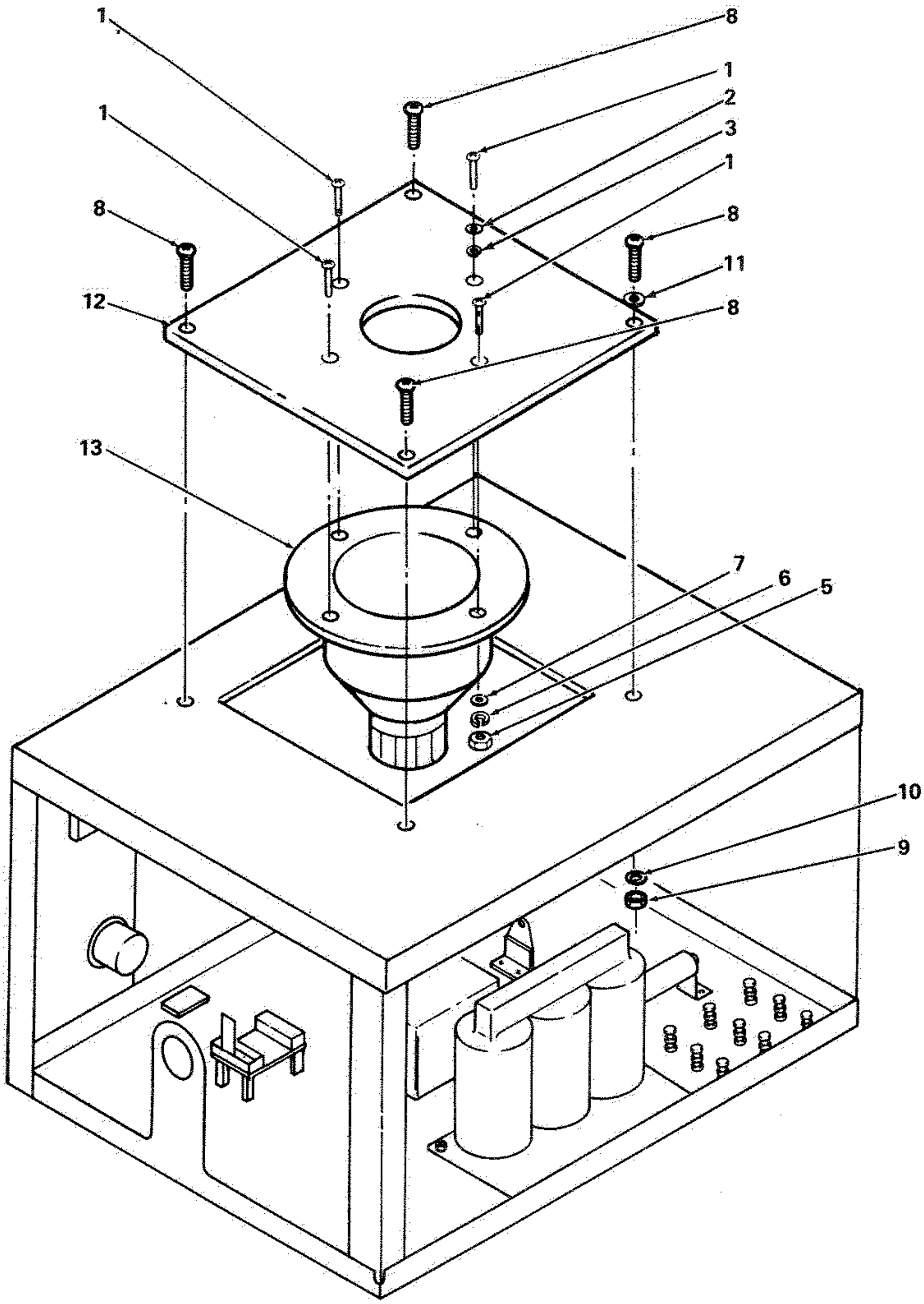


Figure 6-147. XV1 Removal/Installation

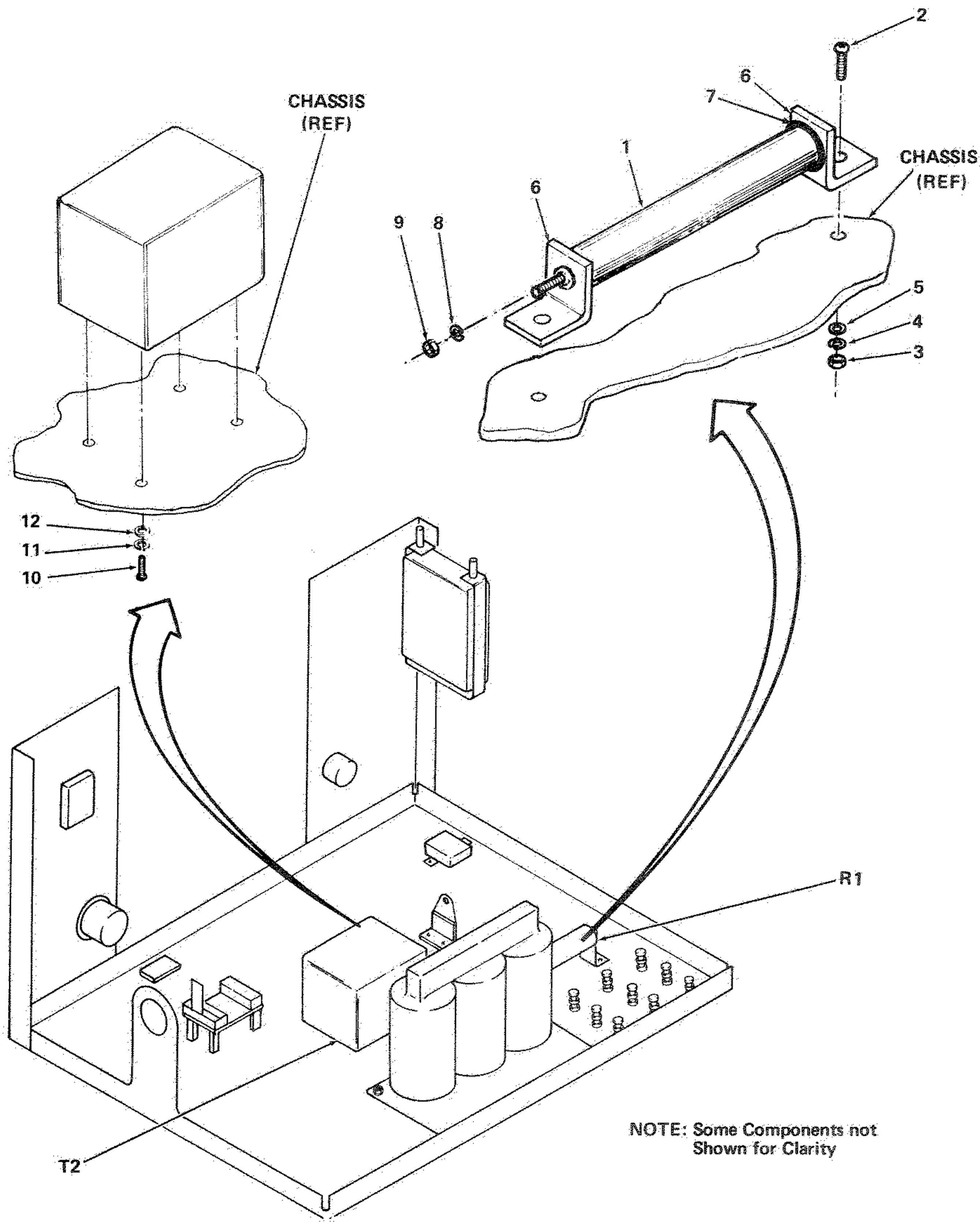


Figure 6-148. R1 or T2 Removal/installation

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

6-9.7.9 T1 Removal. Refer to Figure 6-149 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove wires by removing six screws from terminals.

2. Remove nut (1), lockwasher (2), flat washer (3), and screw (4); four places.

3. Remove transformer from chassis.

6-9.7.10 T1 Installation. Refer to Figure 6-149 and perform the following.

1. Position transformer onto chassis.

2. Install screw (4), flat washer (3), lockwasher (2), and nut (1); four places.

3. Connect wires to terminals by installing six screws. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

6-9.7.11 T3 Removal. Refer to Figure 6-149 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from transformer terminals.

2. Remove screw (5), lockwasher (6), and flat washer (7); two places.

3. Remove transformer from chassis.

6-9.7.12 T3 Installation. Refer to Figure 6-149 and perform the following.

1. Position transformer onto chassis. Install lockwasher (6), flat washer (7), and screw (5); two places.

2. Solder wires to transformer terminals. Remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.6

6-9.7.13 K1 Removal. Refer to Figure 6-150 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove shrink tubing and unsolder wires from relay.

2. Remove nut (1), lockwasher (2), flat washer (3), and screw (4); two places.

3. Remove relay from chassis.

6-9.7.14 K1 Installation. Refer to Figure 6-150 and perform the following.

1. Position relay onto chassis and install screw (4), flat washer (3), lockwasher (2), and nut (1); two places.

2. Replace shrink tubing on wires. Solder wires to relay and remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

6-9.7.15 K2 or K3 Removal. Refer to Figure 6-150 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove shrink tubing from wires and unsolder wires from relay.

2. Remove nut (5), lockwasher (6), and flat washer (7); two places.

3. Remove relay from chassis.

6-9.7.16 K2 or K3 Installation. Refer to Figure 6-150 and perform the following.

1. Position relay onto chassis and install flat washer (7), lockwasher (6), and nut (5); two places.

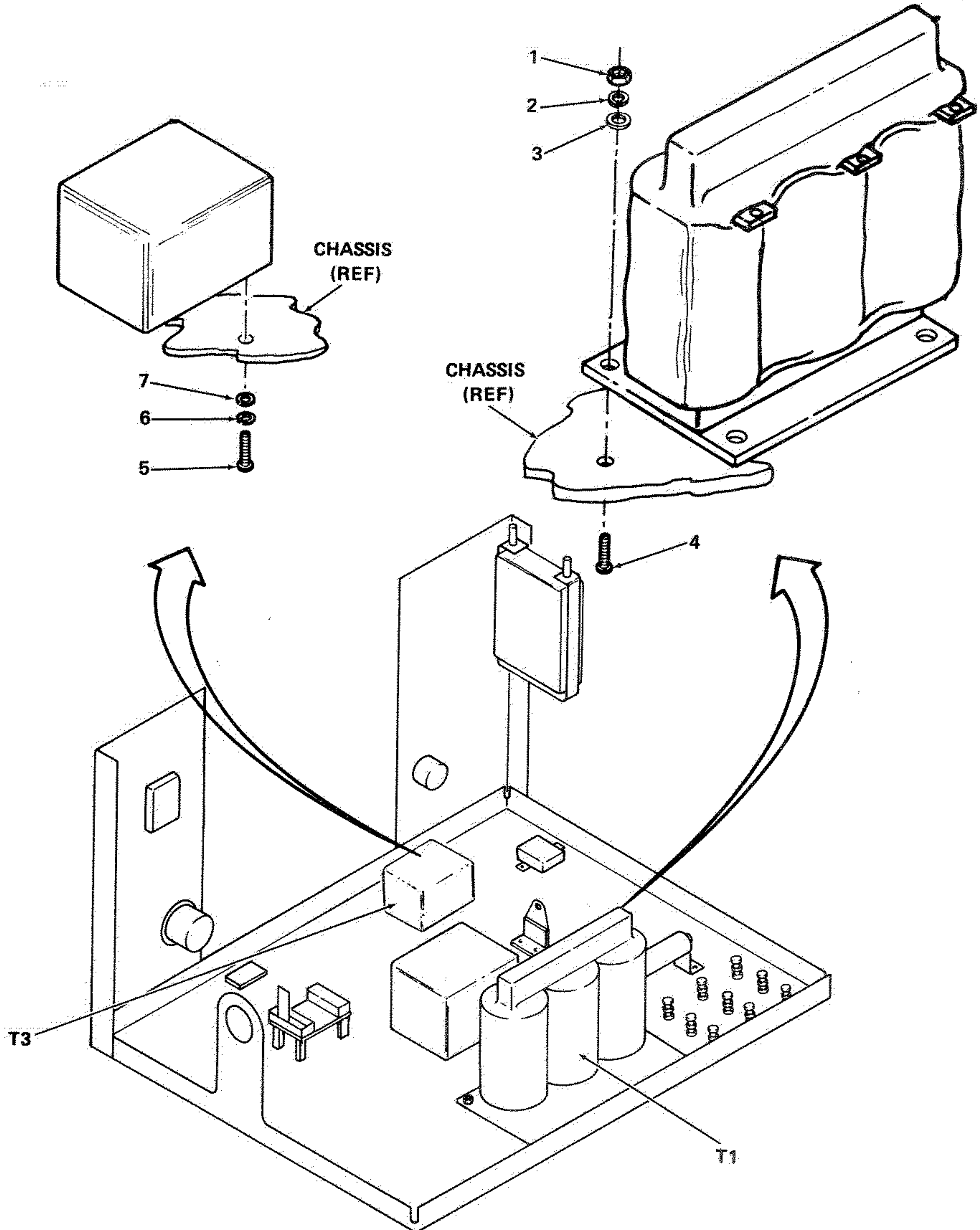


Figure 6-149. T1 or T3 Removal/Installation

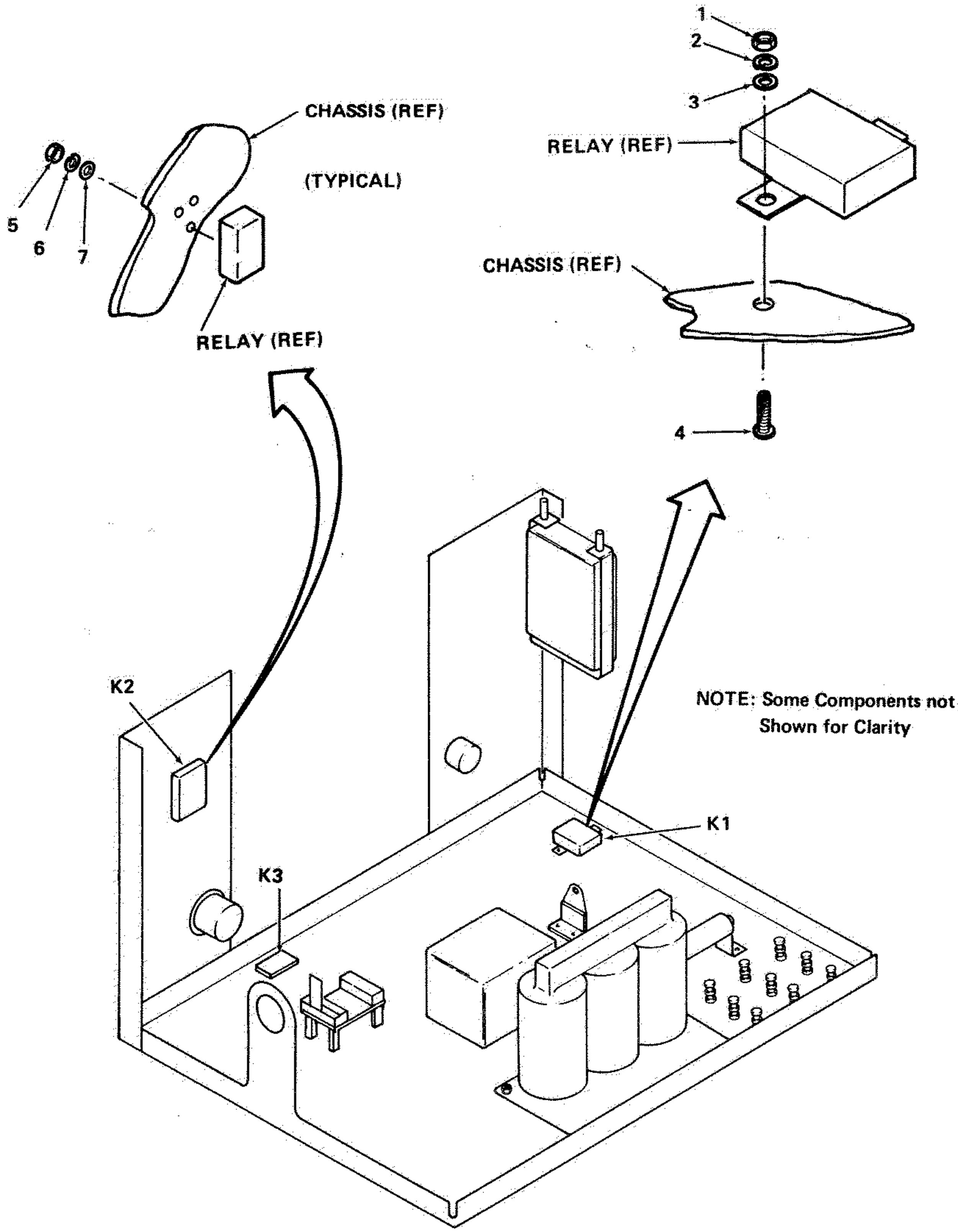


Figure 6-150. K1, K2, K3 Removal/Installation

2. Replace shrink tubing on wires. Solder wires to relay and remove tags.

3. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

6-9.7.17 R11 Removal. Refer to Figure 6-151 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Remove two bolts (1), two flat washers (2), and two lockwashers (3).

2. Remove two screws (4), two flat washers (5), and two lockwashers (6).

3. Remove resistor from mounting board.

6-9.7.18 R11 Installation. Refer to Figure 6-151 and perform the following.

1. Position resistor onto mounting board and position wires for reinstallation.

2. Install two lockwashers (6), two flat washers (5), and two screws (4).

3. Install two lockwashers (3), two flat washers (2), and two bolts (1).

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.6

6-9.7.19 R10 or R12 Removal. Refer to Figure 6-152 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Tag wires for reinstallation. Unsolder wires from resistor terminals.

2. Remove two nuts (1) and lockwasher (2).

3. Remove resistor from chassis.

6-9.7.20 R10 or R12 Installation. Refer to Figure 6-152 and perform the following.

1. Position resistor onto chassis.

2. Install lockwasher (2) and two nuts (1).

3. Solder wires to resistor terminals. Remove tags.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

6-9.7.21 C1 Removal. Refer to Figure 6-152 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Remove two nuts (1) and two flat washers (2). Remove wire from outboard capacitor terminal.

2. Unsolder wire and diode from insulated terminal stud (3).

3. Remove screw (4), flat washer (5), and lockwasher (6).

4. Remove terminal stud (3) from chassis and mounting brace (7).

5. Support capacitor and remove two nuts (8), two lockwashers (9), and two flat washers (10).

6. Remove capacitor (11) and two mounting brackets (12) from chassis.

6-9.7.22 C1 Installation. Refer to Figure 6-152 and perform the following.

1. Position capacitor (11) and mounting brackets (12) onto chassis. Install two flat washers (10), two lockwashers (9), and two nuts (8).

2. Place mounting brace (7) over inboard capacitor terminal. Install insulated terminal stud (3), flat washer (5), lockwasher (6), and screw (4).

3. Solder wire and diode to insulated terminal stud (3).

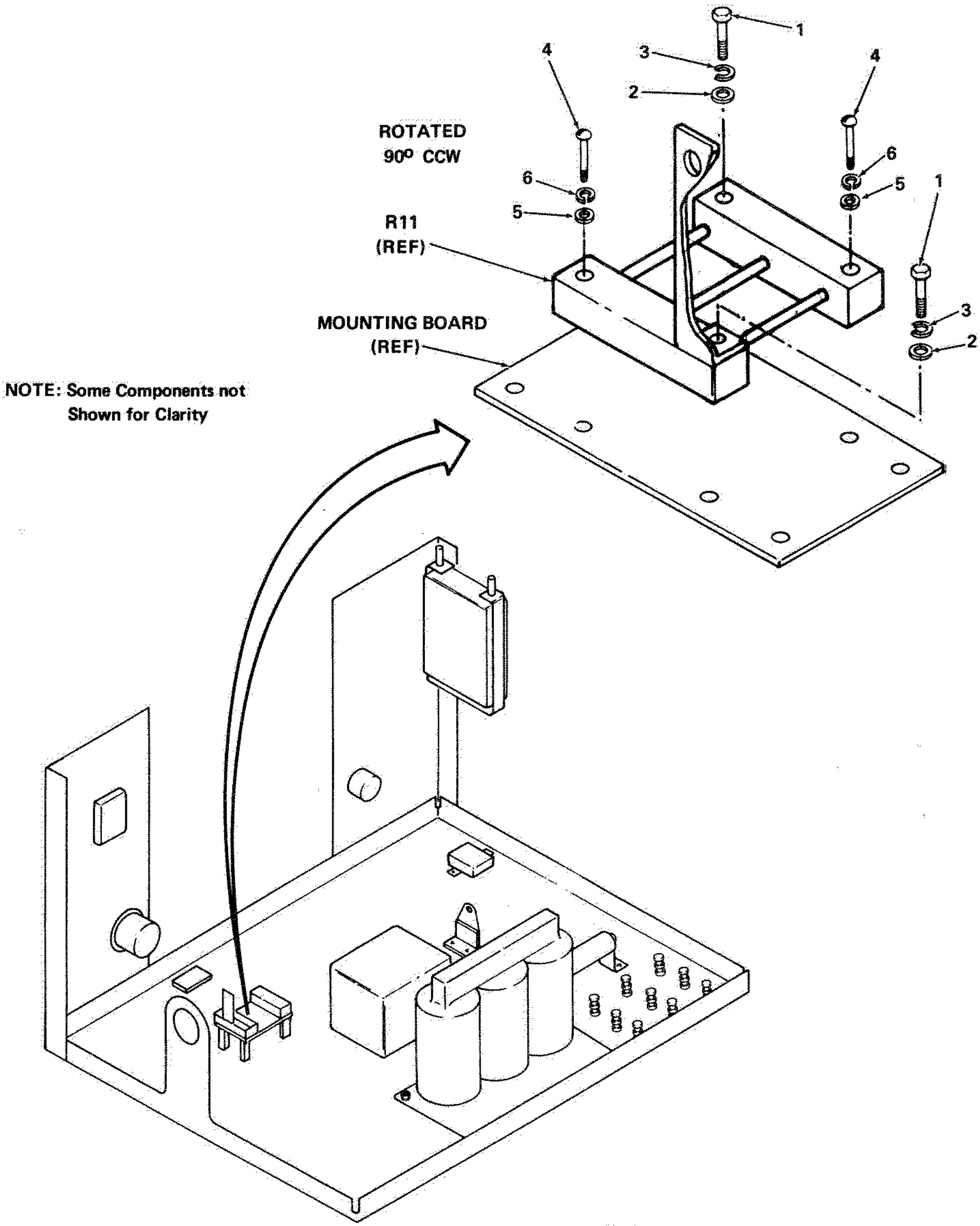


Figure 6-151. R11 Removal/Installation

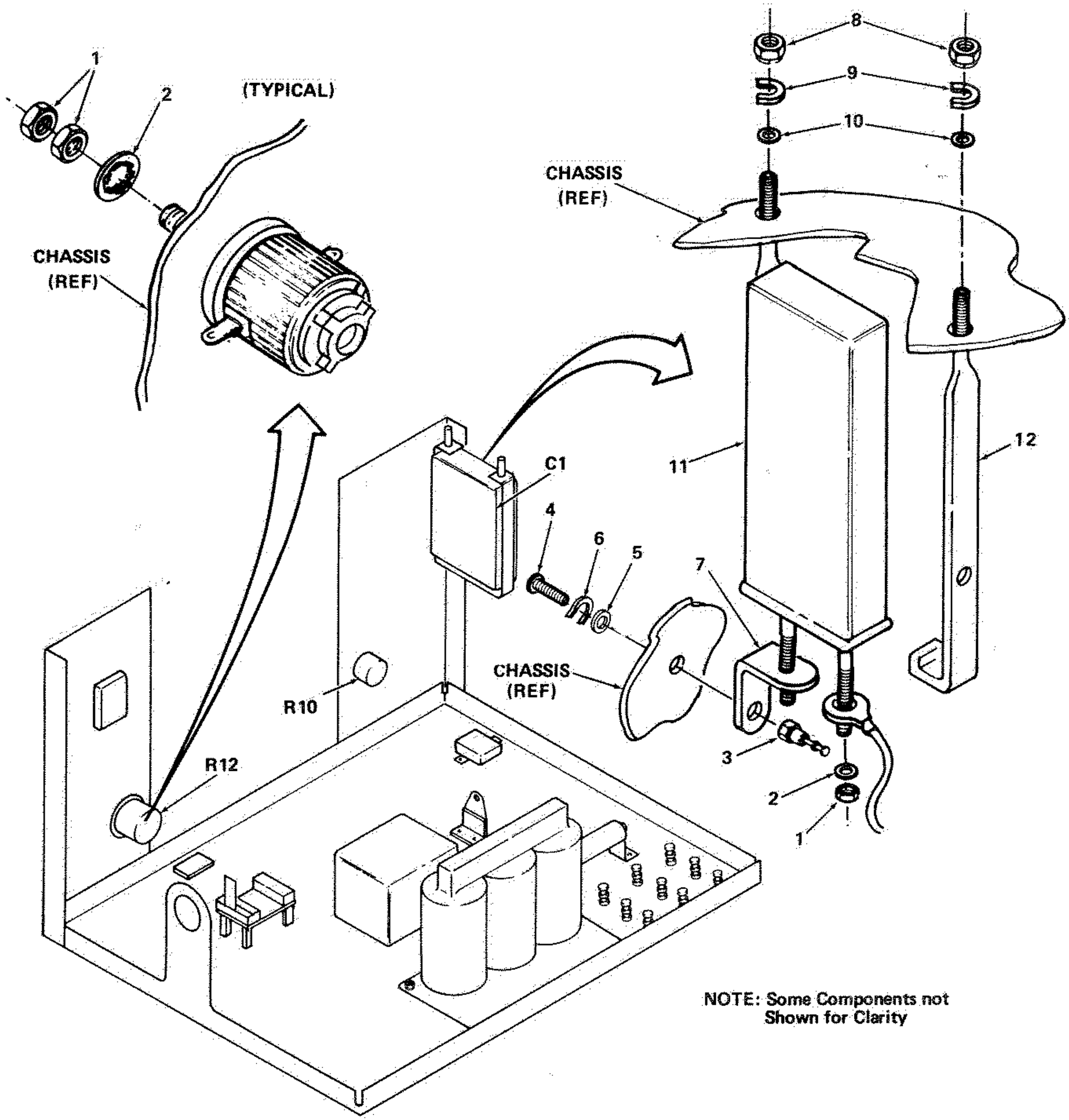


Figure 6-152. R10, R12, C1 Removal/Installation

4. Position wire on outboard capacitor terminal. Install two flat washers (2) and two nuts (1).

5. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

6-9.7.23 Q1 Removal. Refer to Figure 6-153 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Unsolder wire from small terminal of transistor.

2. Disconnect wire from large terminal of transistor by removing screw from lug.

3. Remove nut (1) and washer (2).

4. Remove transistor from mounting bracket.

6-9.7.24 Q1 Installation. Refer to Figure 6-153 and perform the following.

1. Position transistor into mounting bracket. Install washer (2) and nut (1).

2. Connect wire to large terminal by installing screw into lug.

3. Solder wire to small terminal.

4. Follow-on maintenance: Conduct performance test, paragraph 6-8.6.

6-9.8 Electromagnetic Relay 1K6. Relay 1K6 is simplistic in design. Except for removal and installation of three vacuum relays and attached diodes, disassembly and reassembly are obvious, routine tasks.

6-9.8.1 K1, K2, or K3 Removal. Refer to Figure 6-154 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Remove four screws (1) from corners of cover (2).

2. Slowly lift cover from enclosure. Straighten out connecting wires as necessary.

NOTE

K1, K2, and K3 are mounted directly beneath J1, J2, and J3, respectively.

3. Tag wires for reinstallation. Unsolder diode (3) and wires that connect to TB1.

4. Unsolder relay tab (4) from tab on backside of J1, J2, or J3.

5. Remove nut (5), lockwasher (6), flat washer (7), lug terminal (8), and screw (9).

6. Unsolder grounding strap from relay tab (10).

7. Remove relay from electrical clip.

6-9.8.2 K1, K2, or K3 Installation. Refer to Figure 6-154 and perform the following.

1. Position relay into electrical clip.

2. Solder grounding strap to relay tab (10).

3. Connect grounding strap to chassis ground by installing screw (9), lug terminal (8), flat washer (7), lockwasher (6), and nut (5).

4. Solder relay tab (4) to tab on backside of J1, J2, or J3.

5. Solder diode (3) and wires to end of relay. Remove tags.

6. Fold wires into enclosure and position cover (2) for installation. Install four screws (1).

7. Follow-on maintenance: Conduct performance test, paragraph 6-8.7.

6-9.8.3 CR1, CR2, or CR3 Removal. Refer to Figure 6-154 and perform the following.

NOTE

Set aside all serviceable screws, washers, etc. to be reused for component installation.

1. Remove four screws (1) from corners of cover (2).

2. Slowly lift cover from enclosure. Straighten out connecting wires as necessary.

3. Unsolder diode (3) from relay.

6-9.8.4 CR1, CR2, or CR3 Installation. Refer to Figure 6-154 and perform the following.

1. Solder diode (3) to relay.

2. Fold wires into enclosure. Position cover (2) for installation.

3. Install four screws (1).

4. Follow-on maintenance: None required.

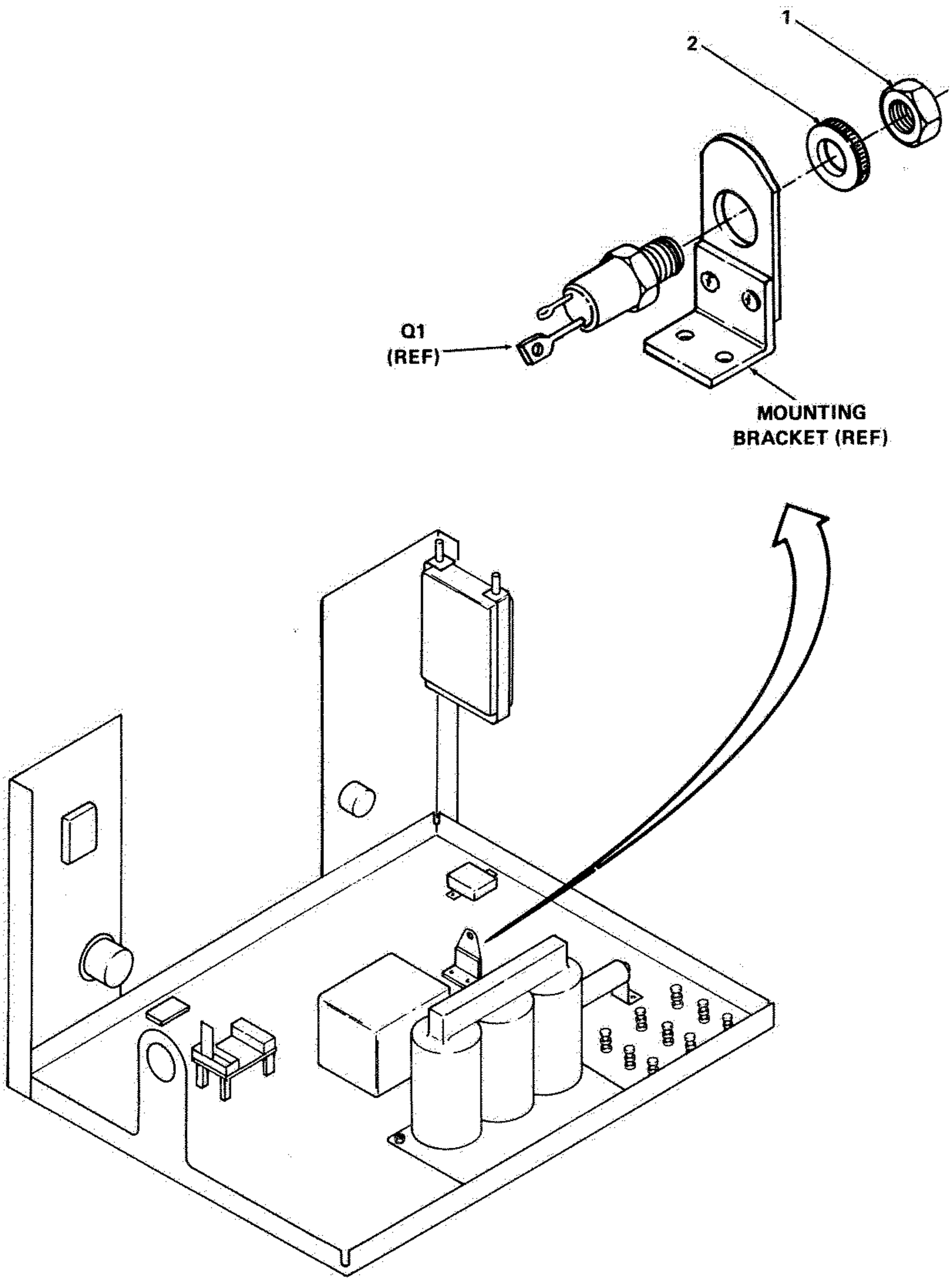


Figure 6-153. Q1 Removal/Installation

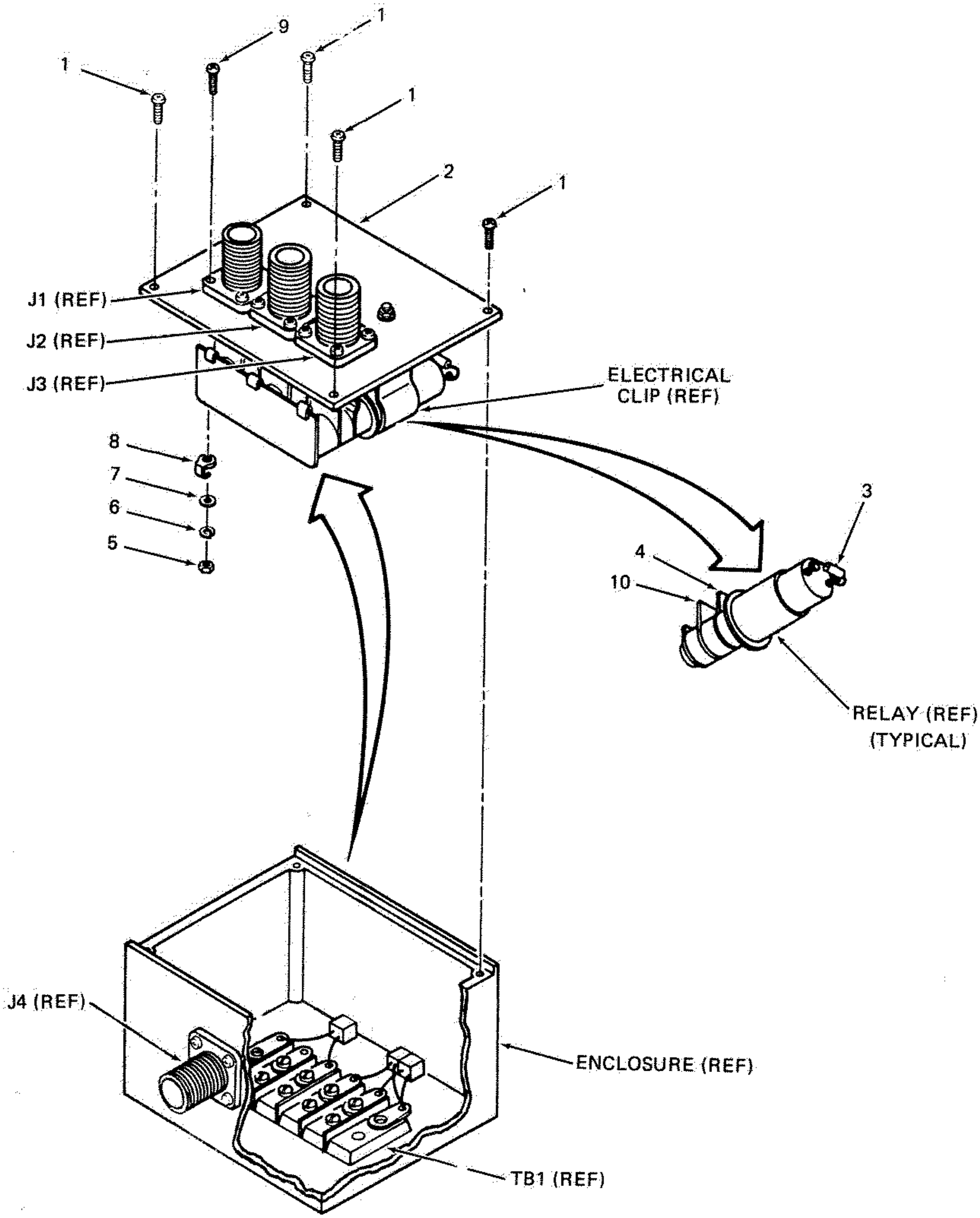


Figure 6-154. 1K6K1, K2 and K3 Removal/Installation

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Section III. PERFORMANCE TEST CHECKS

6-10 INTRODUCTION.

Performance test checks are scheduled Preventive Maintenance procedures. Those test checks, performed randomly or on a site-determined schedule, will keep supervisory personnel apprised of overall transmitter performance, as well as that of certain individual subassemblies. All procedures apply to both East Coast Radar Site (V)1 and West Coast Radar Site (V)2 unless prefixed by (V)1 or (V)2.

6-10.1 Transmitter Performance Check Routines. The following paragraphs refer maintenance personnel to applicable procedures within the Preventive Maintenance Schedule. Procedures include illustrated test equipment setups and, where beneficial, sample test data sheets.

6-10.1.1 Input Overdrive. To evaluate performance of Automatic Overdrive limitation and monitor circuits, refer to paragraph 6-10.2.1.

6-10.1.2 RF Power Gain. To verify overall gain of transmitter is within specifications, refer to paragraph 6-10.2.2.

6-10.1.3 Output Power Flatness. To verify across-the-band response of transmitter, refer to paragraph 6-10.2.3.

6-10.1.4 Automatic Recycle. To verify transmitter capability of an orderly recycle following an arc, refer to paragraph 6-10.2.4.

6-10.1.5 Reverse Power Trip. To check transmitter for proper operation of Reverse Power Trip circuits, refer to paragraph 6-10.2.5.

6-10.1.6 Interlock Circuits. To check transmitter for interlock circuit operation, refer to paragraph 6-10.2.6.

6-10.1.7 Output Power Amplitude. To check transmitter for Output Power Amplitude, refer to paragraph 6-10.2.7.

6-10.1.8 Transmitter Performance Monitors. To check transmitter Performance Monitors, refer to paragraph 6-10.2.8.

6-10.1.9 Spectral Purity. To check transmitter for Spectral Purity, refer to paragraph 6-10.2.9.

6-10.1.10 Transmitter Module X-Ray Radiation Hazard. To check the Transmitter Module for x-ray radiation hazard, refer to paragraph 6-10.2.10.

6-10.1.11 Transmitter Module RF Radiation Hazard. To check the transmitter Module for RF radiation hazard, refer to paragraph 6-10.2.11.

6-10.2.1 Input Overdrive Test.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	1b	Dummy Load
1	2a	RF Power Meter HP 11570A
1	4a	RF Signal Generator
1	5a	Power Sensor

1. Follow procedure in paragraph 4-6.2.3.2 to change mode of operation from remote to local and condition transmitter to operate in Band-C and CW mode.

2. Set up equipment per Figure 6-155. Connect RF signal generator output to RF INPUT SIGNAL SOURCE jack on RF SIGNAL MONITORS panel. Set RF INPUT SELECTOR switch 1A25S2 to LOCAL position.

3. Open card assembly panel 1A1. Verify FWD PWR CLIP switch on Signal Monitor CCA 1A1A2 is to ENBL.

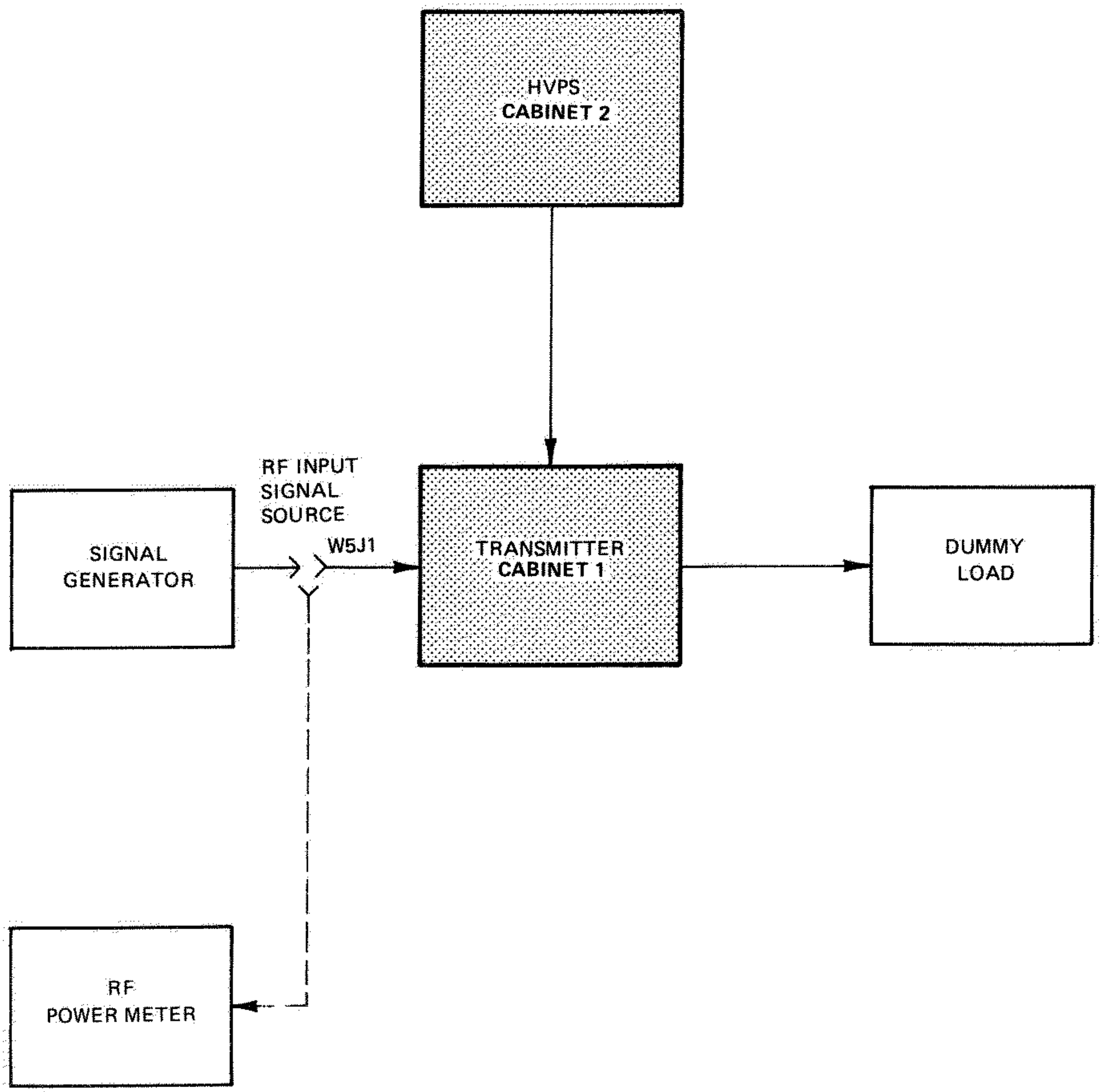

Figure 6-155. Input Overdrive Equipment Setup

NOTE

All bands are to be tested at their center frequency. Center frequencies for bands are:

- Band A - 5.83 MHz
- Band B - 7.82 MHz
- Band C - 10.54 MHz
- Band D - 14.21 MHz
- Band E - 19.15 MHz
- Band F - 24.93 MHz

4. Turn on RF signal generator. Condition generator to operate at middle of selected band with RF drive power level of + 17 dBm.

CAUTION

EQUIPMENT DAMAGE HAZARD

Increase RF drive gradually when performing the next steps. POWER (KW) meter 1A13M1 shall not exceed reading of forward power of 110 kW. Failure to comply may result in equipment damage.

NOTE

RF DRIVE LIMIT lamp will light up when forward power clamp functions and output power meter will hold at level for which set. If required performance is not met in following steps, perform procedure in paragraph 6-6.3.4. Setting may be less than 110 kW depending on settings used in paragraph 6-6.3.4.

5. Gradually increase RF drive power level until limit occurs or RF power meter reading begins to drop. Observe output power meter and RF DRIVE LIMIT lamp. Verify power clamp functions at or less than 110 kW.

NOTE

(V)1 If band F is to be tested, proceed to step 10 after moving the dummy load.

6. If all bands have not been tested, press BAND SELECT switch for next test.

7. Reposition dummy load per paragraph 4-6.4.3.

8. Repeat steps 5 through 8 until all bands have been tested before proceeding to next step.

9. If no further maintenance is to be performed, follow procedure in paragraph 4-6.2.3.1 to restore transmitter to mission-ready status.

10. (V)1 Condition signal generator to operate at 24.93 MHz with RF drive power level of +16 dBm.

CAUTION

EQUIPMENT DAMAGE HAZARD

Increase RF drive gradually when performing the next steps. POWER (KW) meter 1A13M1 shall not exceed reading of forward power of 80 kW. Failure to comply may result in equipment damage.

NOTE

RF DRIVE LIMIT lamp will light up when forward power clamp functions and output power meter will hold at level for which set. If required performance is not met in following steps, perform procedure in paragraph 6-6.3.4.

Gradually increase RF drive power level until limit occurs or RF power meter reading begins to drop. Verify power clamp functions at 80 kW.

6-10.2.2 RF Power Gain Test.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1b	Dummy Load
1	2a	RF Power Meter
1	4a	RF Signal Generator
1	7e	Phillips Screwdriver
1	9d	Tuning Wand, part of 8280

1. Follow procedure in paragraph 4-6.2.3.2 to change mode of operation from remote to local and condition transmitter to operate in selected band.

2. Set up equipment per Figure 6-156. Connect RF signal generator output to RF INPUT SIGNAL SOURCE jack on RF SIGNAL MONITORS panel. Set switch 1A25S2, RF INPUT SELECTOR to LOCAL position.

3. Open card assembly panel 1A1. Verify FWD PWR CLIP switch on Signal Monitor CCA 1A1A2 is to ENBL. Leave panel open.

NOTE

All bands are to be tested at their center frequency. Center frequencies for bands are:

- Band A - 5.83 MHz
- Band B - 7.82 MHz
- Band C - 10.54 MHz
- Band D - 14.21 MHz
- Band E - 19.15 MHz
- Band F - 24.93 MHz

4. Set RF POWER switch 1A13S1 to FWD position. Set METERS switch 1A13S2 to ON position.

5. Adjust signal generator for an output of 10.54 MHz at 17 dBm.

6. Connect power meter with 21 foot coax cable to W67-J1 (FORWARD POWER SAMPLE).

7. Place transmitter in Band-C.

8. Connect signal generator to LOCAL RF INPUT 1A25-J1.

9. Set BIAS switch to CW, RF input to LOCAL and HVON.

10. Verify gain of transmitter is (V1) 19.07 dBm, (V2) 19.37 dBm.

11. Repeat steps 4 through 10 and according to the following values until all bands are completed.

	(V1)		(V2)	
BAND	INPUT	PWR MTR	INPUT	PWR MTR
E	17	18.76	17	19.12
A	17	19.24	17	19.52
D	17	19.17	17	19.39
F	16	17.61	17	19.23
B	17	19.42	17	19.59

12. If no further maintenance is to be performed, close card assembly panel. Perform procedure in paragraph 4-6.2.3.1 to restore transmitter to mission-ready status.

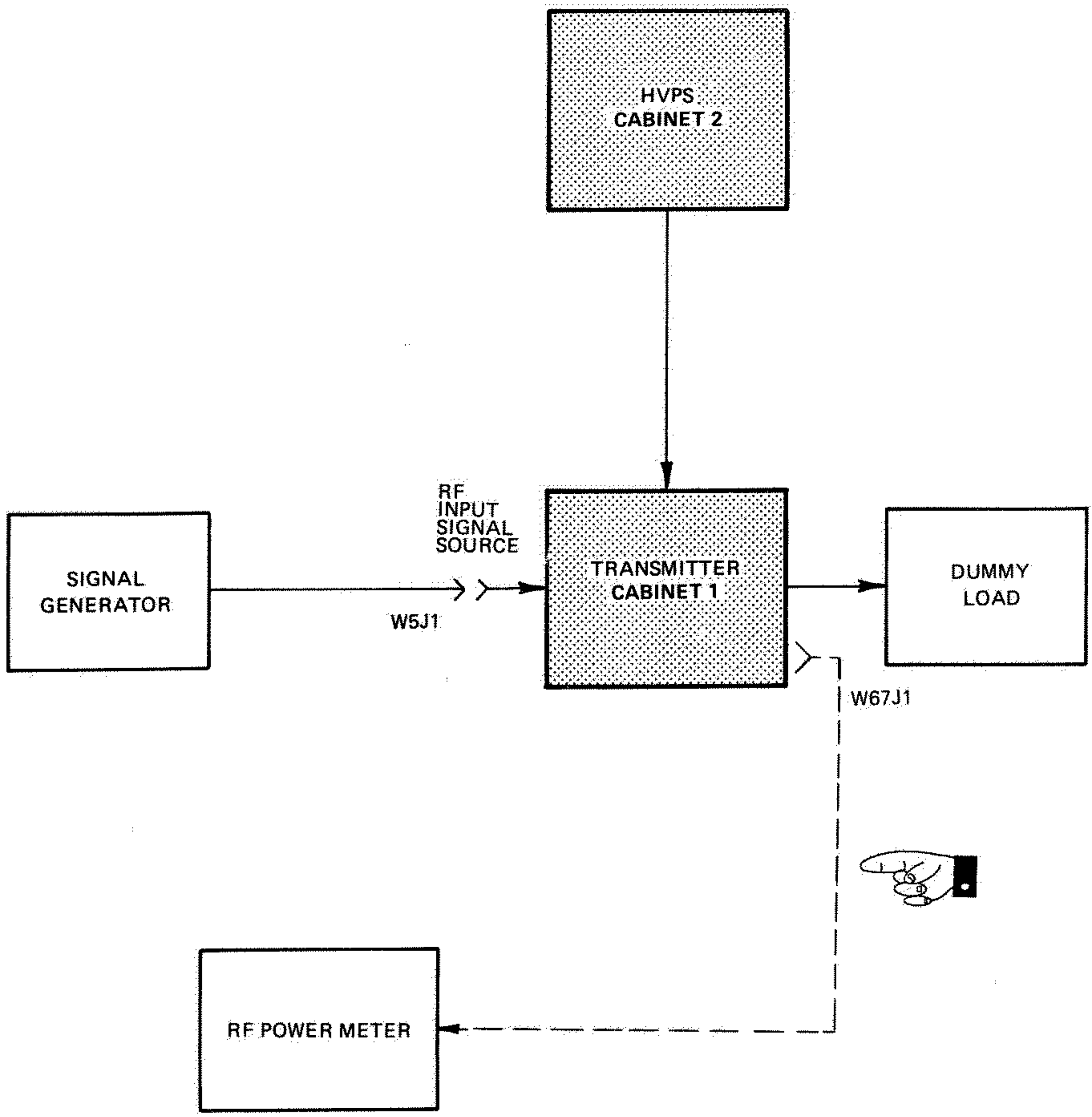

Figure 6-156. Power Gain Equipment Setup

6-10.2.3 Output Power Flatness Test.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1b	Dummy Load
2	2a	RF Power Meter
1	4a	RF Generator
2	5a	Power Sensor
1	7e	Phillips Screwdriver

1. Follow procedure in 4-6.2.3.2 to change mode from remote to local and condition transmitter to operate in CW mode in Band A.

2. Set up test per Figure 6-157 and connect RF signal generator output to RF INPUT SIGNAL SOURCE jack on RF SIGNAL MONITORS panel. Set 1A25S2, RF INPUT SELECTOR, to LOCAL position. Set 1A13S2 METERS switch to ON and 1A13S1 RF POWER switch to FWD.

3. At top of cabinet 1, left end, rear corner, remove cover from metal box. Connect power sensor input to FORWARD POWER SAMPLE jack W67J1. Connect output of power sensor to second RF power meter.

NOTE

Recording of test data on sample data sheet, Figure 6-158, is recommended. Comparison with future tests may provide early detection of system degradation.

4. Set signal generator for minimum RF drive output level. Turn signal generator on and condition to operate at frequency to be tested (see sample data sheet).

5. Gradually increase RF drive power level. Observe POWER (KW) meter 1A13M1 and RF DRIVE LIMIT lamp on CONTROL/STATUS panel. Verify power clamp functions at 110 kW. Lamp will light up when clamp functions and meter will hold at level for which set. If required performance is not met, perform procedure in paragraph 6-6.3.4.

6. Adjust signal generator for RF drive of +17 dBm as shown on RF power meter. Verify POWER (KW) meter indicates 100 kW output. If not, adjust signal generator to achieve 100 kW output.

7. Record on test data sheet:

   - Panel meter forward power (kW)
   - Input power level (mW)
   - Forward power sample (dBm)

8. Turn off signal generator. If all frequencies within a band have been tested, proceed to step 9. If not, perform steps 4 through 7 until all frequencies within a band have been tested and results recorded.

9. Press BAND SELECT switch for next band to be tested. Reposition dummy load per paragraph 4-6.4.3. (V)1 If Band F is to be tested, proceed directly to step 14 after repositioning dummy load.

10. Perform steps 3 through 9 until all bands have been tested and data recorded before proceeding.

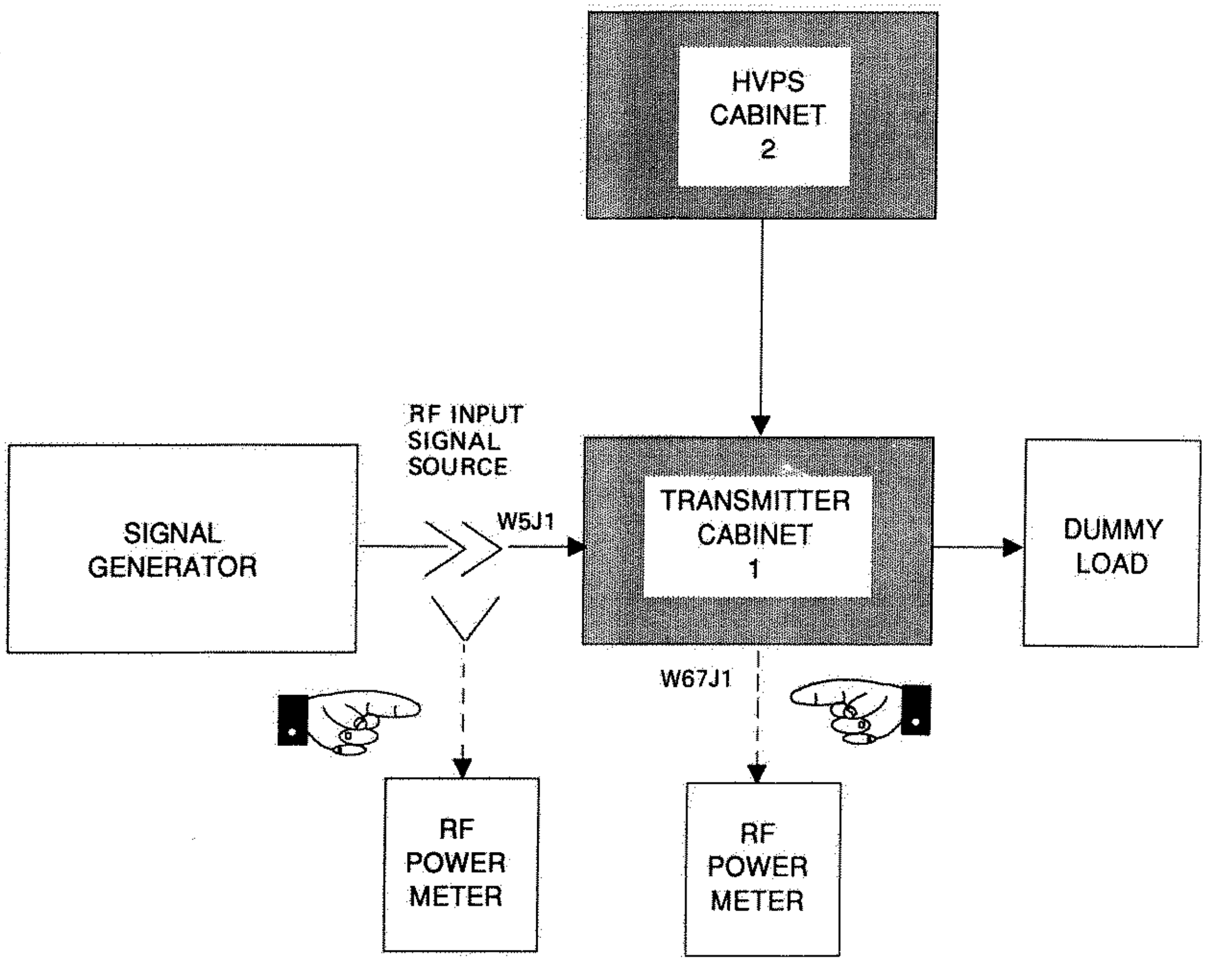

Figure 6-157. **Output Power Flatness Equipment Setup**

BAND	EXCITER FREQUENCY (MHz)	TRANSMITTER INPUT POWER		PANEL METER FORWARD POWER (kW)	STEP ATTEN. (dB)	(A) DEDICATED PORT FORWARD POWER (dBm)	(B) DEDICATED COUPLER △dB FROM CENTER FREQ	(C) △COUPLER CORRECTION FACTOR NOTE * (dB)	(B-C) FLATNESS (dB)
		(mW)	(dBm)						
(A)	5.83						0.0	0.0	0
A	5.00							-1,334	
A	5.40							-0.665	
A	6.29							+0.660	
A	6.79							+1.324	
(B)	7.82						0.0	0.0	0
B	6.69							-1.356	
B	7.23							-0.681	
B	8.45							+0.673	
B	9.14							+1.355	
(C)	10.54						0.0	0.0	0
C	9.04							-1.333	
C	9.76							-0.668	
C	11.39							+0.674	
C	12.30							+1.341	
(D)	14.21						0.0	0.0	0
D	12.20							-1.325	
D	13.17							-0.660	
D	15.34							+0.665	
D	16.55							+1.324	
(E)	19.15						0.0	0.0	0
E	16.45							-1.320	
E	17.75							-0.659	
E	20.67							+0.663	
E	22.30							+1.323	
(F)	24.93						0.0	0.0	0
F	22.20							-1.007	
F	23.53							-0.502	
F	26.42							+0.504	
F	28.00							+1.009	

Figure 6-158. Output Power Flatness Sample Test Data Sheet

NOTE

Center frequency for each band is first frequency listed on test data sheet.

11. Calculate and record in Column (B) of test data sheet dedicated coupler change (DCC) from center frequency in dB for all frequencies tested. Use this formula:

FPC - FPO = DCC

In the formula, FPC is forward power sample at center frequency of band and FPO is forward power sample at other frequencies within same band. If FPC is greater than FPO, change in dB (DCC) is a negative value. If FPC is less than FPO, DCC is a positive value. The following examples use Band A:

a. At 5.83 MHz, FPC = 18.00 dBm
At 5.00 MHz, FPO = 17.00 dBm

DCC = -1.00

b. At 5.83 MHz, FPC = 18.00 dBm
At 5.00 MHz, FPO = 19.00 dBm

DCC = +1.00

NOTE

An RF output flatness of ± 0.3 dB across each band is acceptable.

12. Algebraically subtract the coupler correction factor, $20\log_{10}$ (F/FO), in column (C) from change dB in column (B) and record the resulting flatness (dB) in Columns (B-C).

13. If no further maintenance is to be performed, follow procedure in paragraph 4-6.2.3.1 to restore transmitter to mission-ready status.

14. (V)1 Set signal generator for minimum RF drive output level. Turn signal generator on and condition to operate at frequency to be tested (see sample data sheet).

15. Gradually increase RF drive power level. Observe POWER (KW) meter 1A13M1 and RF DRIVE LIMIT lamp on CONTROL/STATUS panel. Verify power clamp functions at 80 kW. Lamp will light up when clamp functions and meter will hold at level for which set. If required performance is not met, perform procedure in paragraph 6-6.3.4.

16. Adjust signal generator for RF drive of +16 dBm as shown on RF power meter. Verify POWER (KW) meter indicates 80 kW output. If not, adjust signal generator to achieve 80 kW output.

17. Return to step 7.

6-10.2.4 Automatic Recycle Test.

Tools and Test Equipment Required:

Qty	Item No.	Description
		(from Table 1-4)
1	1i	TCMG Simulator
1	6a	Push-button Switch
1	7e	Phillips Screwdriver
		(Other)

2 10-Ft. Lengths 20- to 24-Gauge Wire
2 Insulated Alligator Clips

1. Shut down transmitter per paragraph 4-6.3.1.

2. At HVPS Cabinet 2, open 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers. Attach Maintenance-in-Progress tags to circuit breakers.

3. At top of cabinet 1, left end, rear corner, remove cover plate from metal box. Disconnect the TCMG interface cable from jack J1. Connect TCMG Simulator per Figure 6-159 and connect TCMG Simulator cable REMOTE INTERFACE jack J1. Disconnect the RF input coaxial from W1J1.

4. Construct test rig from push-button switch, wires, and insulated alligator clips. Connect one end of each wire to one terminal of push-button switch and the other end to an alligator clip.

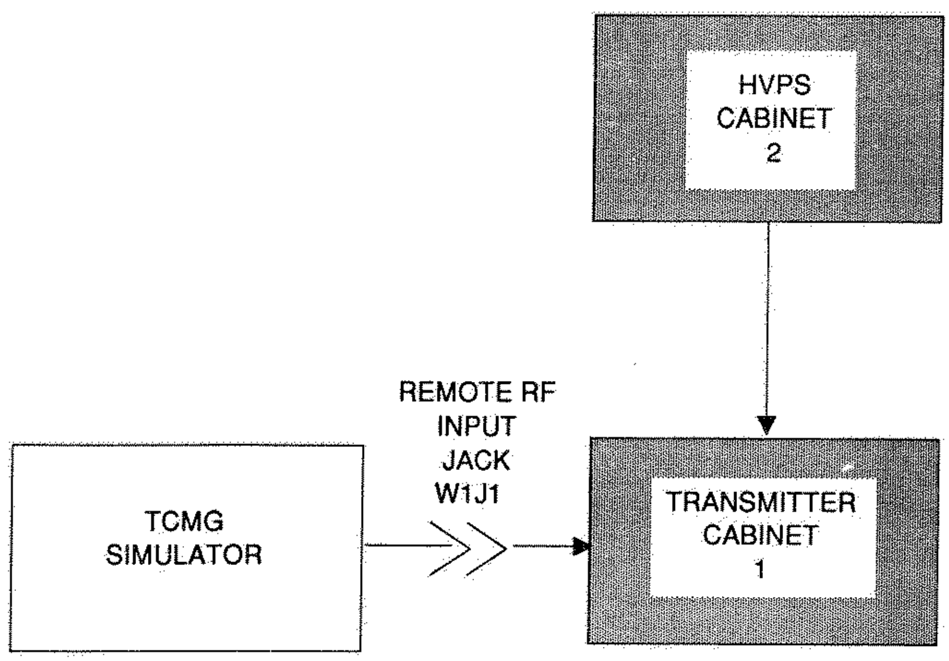

Figure 6-159. Automatic Recycle Equipment Setup

WARNING
HIGH-VOLTAGE HAZARD

Position one person to guard against HVPS circuit breakers being closed while second person accesses transmitter cabinet. Failure to comply may result in injury or death.

5. Open left end door of cabinet 1. Before entering controls compartment, use grounded shorting stick to short out high-voltage and potential-storing components.

6. Open Card Assembly panel 1A1 access door (Figure 4-6). Route alligator clip end of one wire through rectangular opening to left of CCA rack.

7. Locate Arc Sensor 1A8 on rear wall, upper left corner. Connect clip to buss at 1A8TB1-16.

8. Exit controls compartment and close door. Connect other alligator clip to chassis ground.

9. Close 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers on HVPS Cabinet 2.

10. Move OUTPUT CONTROL switch to ANTENNA (REMOTE). Press FAULT RESET switch on CONTROL/STATUS panel.

11. Turn on TCMG Simulator. Bring transmitter to HV ON, TM READY status in CW mode, any frequency band. Refer to TO 33D7-47-128-1 for simulator operation.

NOTE

After each simulated arc, MANUAL RF INHIBIT switch on TCMG simulator shall be placed in MANUAL RF INHIBIT until TM READY lights up, then, immediately move switch out of MANUAL RF INHIBIT.

12. Wait 3 minutes after HV ON for TM READY status to allow system timers to reset. Press push-button switch three times within 2 minutes to simulate three RF arcs. Verify RF ARC lamps on both TCMG Simulator and CONTROL/STATUS panel 1A1 light up with each of first two arcs, then go out when transmitter recycles. Verify RECYCLE LAMP on CCA1A1A6 lights and stays lit after second arc.

13. After third fault, verify RF ARC fault lamps light and stay lit. Verify LOCKOUT lamp on 1A1A6 lights and stays lit. Verify transmitter be cannot controlled remote using TCMG simulator.

14. Press FAULT RESET switch to enable transmitter recycle. Operate transmitter for 3 minutes before proceeding to next step.

15. Simulate RF arc twice within 2 minutes and verify transmitter automatically recycles each time. Wait 3 minutes from time of first arc, then simulate a third. Verify transmitter recycles.

16. Turn off TCMG Simulator. Follow procedure in paragraph 4-6.2.2 to condition transmitter for local operation, CW mode, any band.

17. Turn on TCMG Simulator and simulate RF arc and verify transmitter does not recycle.

18. Press FAULT RESET switch. If no further maintenance is required on top of cabinet 1, disconnect the simulator cable and reconnect the TCMG interface cable to J1 and the RF input coaxial to W1J1. Next, follow procedure in 4-6.2.3.1.

6-10.2.5 Reverse Power Trip Test.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	2a	RF Power Meter
1	4a	Signal Generator
1	5a	Power Sensor
1	9d	Tuning Wand, part of 8280

1. Follow procedure in 4-6.2.3.2 to change from remote to local control. Condition transmitter to operate in CW mode in Band A.

2. Open Card Assembly panel 1A1 access door (Figure 4-6).

CAUTION

Ensure transmitter is in local mode with HV off before turning off 120 and 208 V ac power.

3. If necessary, press STAND-BY switch to turn off HV. Open 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers on HVPS Cabinet 2. Attach Maintenance-in-Progress tags to breakers.

WARNING
HIGH VOLTAGE HAZARD

One person position self to guard against circuit breakers on HVPS being turned on while second person accesses cabinet 1. Noncompliance may result in injury or death

4. Open left end door of cabinet 1. Before entering controls compartment, use grounded shorting stick to short out high-voltage and potential-storing components.

CAUTION
EQUIPMENT DAMAGE HAZARD

If signal generator is not set for minimum output before being turned on, equipment damage may result.

5. For each band, calibrate all test cables using list in step 6.

6. Use the following list to perform the next steps. At top of card cage, left side near front, locate attenuators 1A1AT15 through AT20. Disconnect cable from attenuator for band under test. Set up Reverse Power Trip Equipment test per Figure 6-160. Route cable through opening to left side of card cage to attenuators and RF power meter.

Band	Attenuator	Freq(MHz)
A	1A1AT15	5.83
B	1A1AT16	7.82
C	1A1AT17	10.54
D	1A1AT18	14.21
E	1A1AT19	19.15
F	1A1AT20	24.93

7. Exit controls compartment. Close door to complete interlock circuit. Close 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers on Cabinet 2.

8. Press FAULT RESET and STANDBY switch on CONTROL/STATUS panel.

9. Bring transmitter back to HV ON, TM READY status.

10. Verify RF signal generator is set for minimum output. Turn on generator and set to operate at freq-listed for band under test.

11. Set METER switch 1A13S2 to ON and set RF POWER METER switch 1A13S1 to RVS. Adjust signal generator to 20 dBm. Check that POWER (KW) meter reads 10 kW. Reset signal generator for minimum output. If the HV contactor has tripped and the REVERSE POWER light has lit, press FAULT RESET switch.

12. Gradually increase generator output level until REVERSE POWER indicator lights on control/status panel and (if not triggered in step 11), the sound of the HV contactor tripping is heard. That should occur at or just prior to 8.5 kW as indicated on RF power meter and near 8 dB on the generator. [(V)1] For Band F, trip should occur at or prior to 6.5 kW with about 7 dB generator output. If correct trip does not occur, refer to step 17.

13. With reverse power tripped, verify the following are lit: RVS PWR, REVERSE POWER, and FAULT (RESET).

14. Set generator for minimum output. Press FAULT RESET switch. Press BAND SELECT switch for next test.

15. Repeat steps 3 through 8 and 12 through 14 until all bands have been tested. If no further maintenance is required, turn off signal generator. Access cabinet 1 controls compartment per steps 3 and 4. Remove signal generator cable from attenuator and re-install original cable. Exit compartment and close door.

16. Close 120 VAC RIDE THRU INPUT and 208 VAC INPUT circuit breakers at HVPS. Bring transmitter to HV ON,

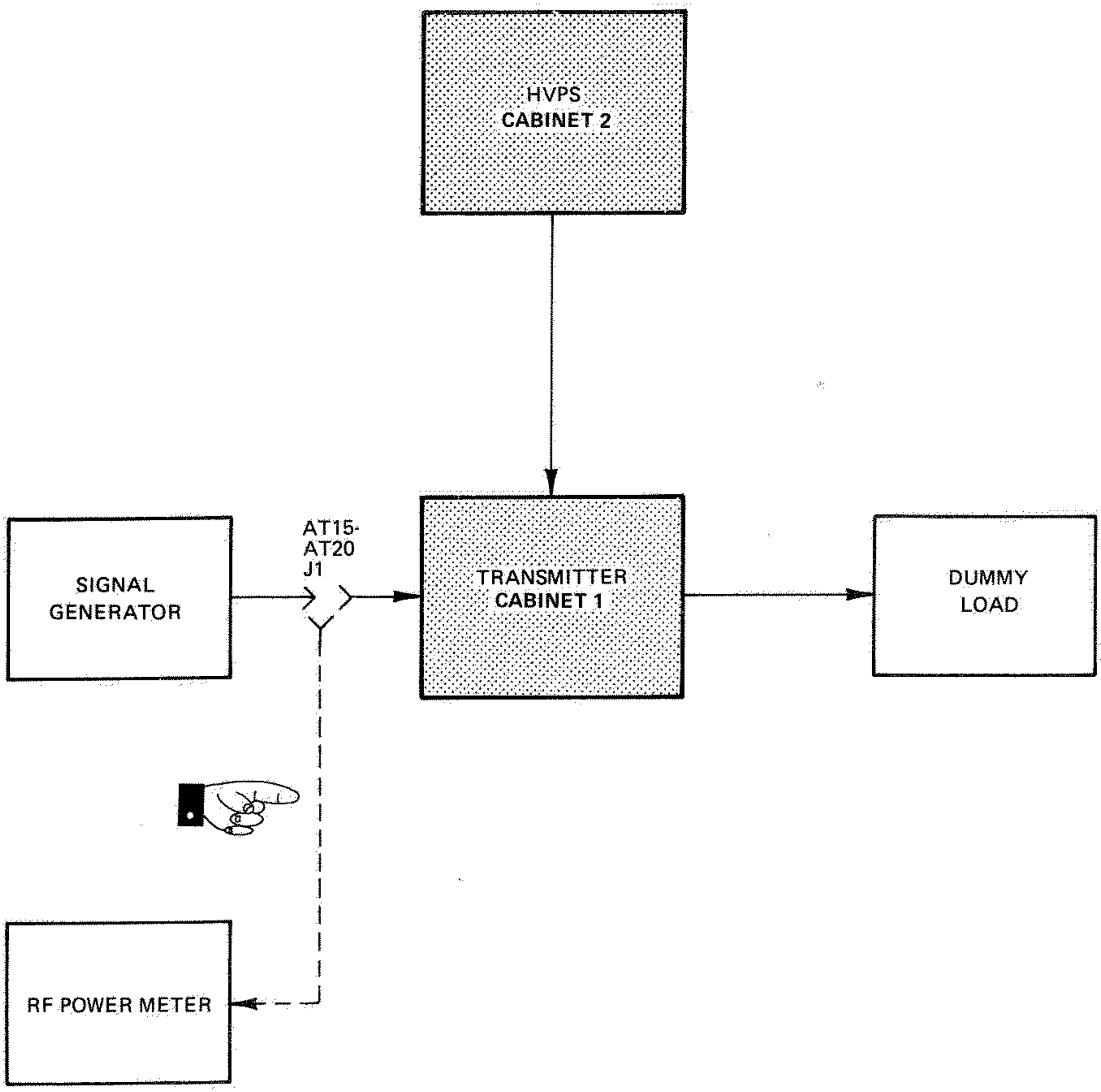

Figure 6-160. Reverse Power Trip Equipment Setup

TM READY status. Follow procedure in paragraph 4-6.2.3.1, starting with step 2, to bring transmitter to mission-ready status.

17. Adjust RF signal generator for output level of 8.5 kW at about 8 dB generator output. (V)1 For Band F, adjust for output level of 6.5 kW at about 7 dB signal generator output. Locate RVS CLP pot for band under test, near bottom of front panel of Signal Monitors CCA 1A1A2 Slowly adjust pot (using FAULT RESET switch as necessary) until RVS PWR, REVERSE POWER and FAULT RESET lamps light at correct value. Return to step 14.

NOTE

If adjustment can not be made, replace CCA 1A1A2.

6-10.2.6 Interlock Circuits Test. Cabinet 1 is designed to prohibit operation with doors or protective covers removed. Annual check-out of the interlock circuits shall be conducted.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1b	Dummy Load

1. Follow procedure in paragraph 4-6.2.3.2 to change from remote to local control.

2. Press STANDBY (HVOFF) switch. STANDBY (HVOFF) will light up; HV ON and TM READY will go out.

3. Press FAULT RESET switch. Verify INTERLOCK OPEN lamp is not lit up. Any INTERLOCK OPEN fault must be corrected before this procedure can be performed.

4. Press LAMP TEST switch and verify all indicators light up except POWER (OFF).

5. Open Card Assembly Panel of 1A1.

CAUTION

Ensure transmitter is in local mode with HV off.

6. Perform the following tests of interlock circuits. Verify in each instance that the appropriate fault indicator(s) on 1A1A9, A10, or A12 CCA's light up. Refer to Table 4-10 for description of fault indicators. Immediately after verifying, restore circuit to normal operating condition and press FAULT RESET switch.

   a. Power Phase. There is no safe way to simulate a Power Phase failure. Do not try.

   b. Air Flow. Turn off RPIE blowers using switch on support column adjacent to cabinet 1.

   c. Water Flow. Slowly close water inlet valve until interlock light comes on at or before about 50 psig of inlet pressure. Open valve to restore flow.

      Inlet 80 to 88 psig.
      Outlet 5 to 9 psig.

NOTE

Circuit breakers called out in the following steps are located on Electronic Circuit Breaker Protection Panel 1A23.

   d. IPA Filament Power Supply Circuit Breaker. Turn off IPA FILAMENT SUPPLY circuit breaker.

   e. Driver Filament Power Supply Circuit Breaker. Turn off DRIVER AMPL FILAMENT SUPPLY circuit breaker.

   f. PA Filament Power Supply Circuit Breaker. Turn off PA FILAMENT SUPPLY breaker.

   g. Low Level Broadband Amplifier Circuit Breaker. Turn off LOW LEVEL AMPLIFIER circuit breaker.

   h. IPA Bias Power Supply Circuit Breaker. Turn off IPA BIAS SUPPLY breaker.

i. Driver Amplifier Bias Power Supply Circuit Breaker. Turn off DRIVER AMPL BIAS SUPPLY circuit breaker.

j. PA Bias Power Supply Circuit Breaker. Turn off PA BIAS SUPPLY circuit breaker.

NOTE
The circuit breakers in the following steps are located on HVPS Circuit Breaker Panel, 2A2.

k. PA Screen Grid Power Supply Circuit Breaker. Turn off PA SCREEN GRID SUPPLY breaker.

l. Driver Amplifier Screen Grid Power Supply Circuit Breaker Turn off DRVR AMPL SCREEN GRID SUPPLY circuit breaker.

m. IPA Screen Grid Power Supply Circuit Breaker. Turn off IPA SCREEN GRID SUPPLY circuit breaker.

n. Crowbar Power Supply Circuit Breaker. Turn off CROWBAR POWER SUPPLY breaker.

o. 208 V ac to High-Voltage Contactor Circuit Breaker. Turn off HV CONTACTOR circuit breaker.

p. 208 VAC Regulator Circuit Breaker. Turn off 208 VAC REGULATOR circuit breaker.

7. Using the Transmitter Ground Stick near 1S38, perform the following checks of the interlock circuits.

a. Turn off 208 VAC INPUT circuit breaker. Attach Maintenance-in-Progress tags to circuit breaker.

WARNING
HIGH VOLTAGE HAZARD
One person position self to guard against HVPS circuit breakers being closed while second person accesses controls compartment of cabinet 1. Failure to comply may result in injury or death.

b. Open 120 VAC RIDE THRU INPUT circuit breaker at HVPS. Open cabinet 1 left rear door and remove cover.

c. Using Grounding Stick, short out switch 1S38 high voltage contacts on both levels of the switch. Then observe that ground switch contact plates are making contact with all three terminals on both levels of the switch

d. Do not contact any exposed terminals or components, and lay grounding stick on compartment floor. Close door. Close circuit breakers on HVPS. Press FAULT RESET and verify 1A1A10 GND DVC light is on because ground stick is not in holder.

e. Open 208 VAC INPUT and 120 VAC RIDE THRU INPUT breakers on HVPS and open cabinet 1 left end door. Replace grounding stick in holder.

f. Replace cover then close door. Close HVPS circuit breakers. Then press FAULT RESET switch.

8. Test cabinet 1 door interlocks as follows. Sequentially open and close each of the 5 cabinet 1 doors ensuring the appropriate 1A1A10 door lamp lights for each one. Press the FAULT RESET SWITCH after closing each door.

9. Test the F band output filter hatch cover interlock as follows. Remove F band output filter hatch cover. Close door, press FAULT RESET SWITCH to do test. Ensure the correct 1A1A10 door lamp lights. Install F band output filter hatch cover and press the FAULT RESET switch.

10. Repeat step 9 for BAND E output filter hatch.

11. Check CROWBAR 1A9DS4 according to the following procedure.

a. Cause Crowbar to be not ready by removing the Crowbar heat lamp (paragraph 6-5.26.1, steps 1 and 2).

b. Exit HVPS Cabinet 2 by performing paragraph 6-2.4.2 steps 1 through 5.

c. Turn on 120 VAC RIDE THRU INPUT and 208 VAC INPUT breakers. Press FAULT RESET and STAND-BY switches.

d. After FIL DELAY timeout, the exit procedure, check 1A1A9DS4 CROWBAR is lit.

e. Reinstall heat lamp as described in paragraph 6-5.26.2 steps 6 and 7.

6-10.2.7 Output Power Amplitude Test. Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1b	Dummy Load
2	2a	RF Power Meter
1	4a	RF Signal Gen
2	5a	Power Sensors

CAUTION
EQUIPMENT DAMAGE HAZARD

Prior to applying RF excitation signal to transmitter, ensure dummy load is connected to selected band switch.

1. Follow procedure in paragraph 4-6.2.3.2 to change mode of operation from remote to local and condition transmitter to operate in CW mode in Band A.

2. Set up equipment per Figure 6-161 and connect RF signal generator output to RF INPUT SIGNAL SOURCE jack on RF SIGNAL MONITORS panel. Set 1A25S2, RF INPUT selection, to local position.

3. At top of cabinet 1, left end, rear corner, remove cover from metal box. Connect power sensor input to FORWARD POWER SAMPLE jack W67J1. Connect output of power sensor RF power meter.

NOTE

Use of test data sheet referenced in step 4 is recommended, as data will be used in mathematical computations. Comparison with future data will aid in early detection of system performance degradation.

4. Record data shown on Figure 6-162.

5. On Signal Monitors Card 1A1A2, verify FWD PWR CLIP Switch S1 is positioned to DSLB.

CAUTION
EQUIPMENT DAMAGE HAZARD

Increase RF drive gradually when performing the next steps. POWER (KW) meter 1A13M1 shall not exceed reading of forward power of 110 kW. Failure to comply may result in equipment damage.

6. Follow procedure in paragraph 4-6.1 to start up transmitter. Operate transmitter in local control per paragraph 4-6.2.2, in CW mode, at center frequency for selected band.

7. Adjust signal generator for 17 dBm + 1 dBm for 100 kW output.

8. (V)1For Bands A through E, adjust RF input for minimum RF output power of 110 kW. For Band F, adjust for minimum of 80 kW. Operate for at least 5 minutes.

(V)2Adjust RF input for minimum RF output power of 110 kW, all bands.

9. Record dummy load inlet coolant temperature, average outlet coolant temperature, and coolant flow rate. Record forward RF output power as indicated by panel meter and power meter connected to directional coupler forward port.

10. Calculate load power in kW =

$.264 \times (T_{out} - T_{in}) \times \text{Flow Rate}$

Temperatures are measured in degrees centigrade and flow rate is gallons per minute of coolant.

NOTE

(V)1Calculated power in load shall be at least 110 kW for Bands A through E and at least 80 kW for Band F.

(V)2Calculated power in load shall be at least 110 kW in all bands.

11. Record calculated power.

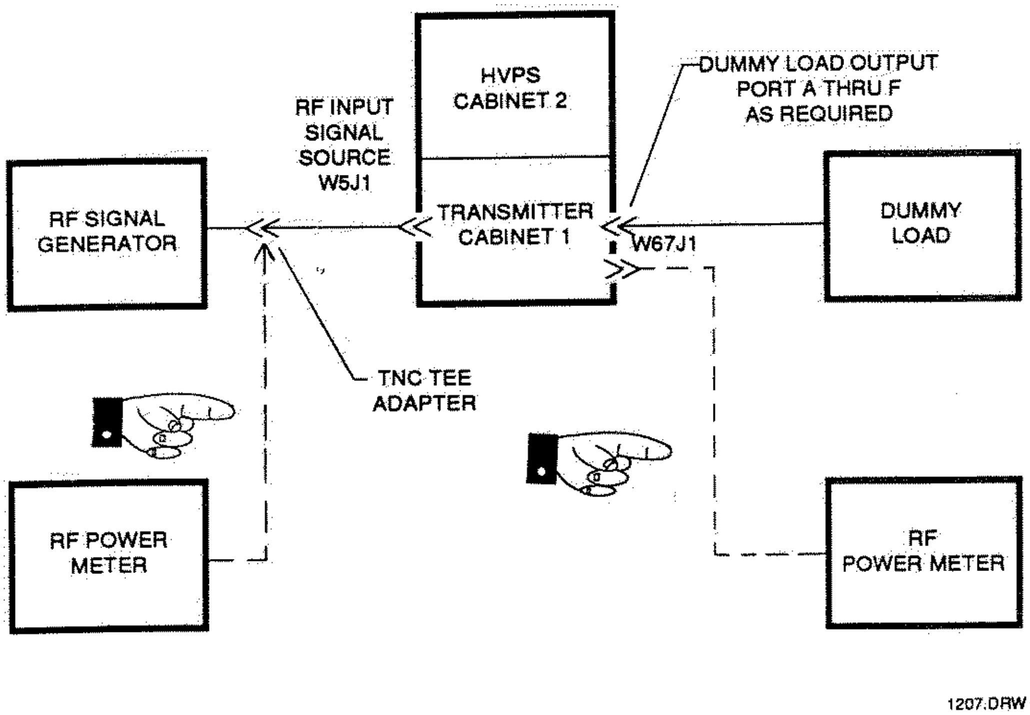

Figure 6-161. Output Power Amplitude Equipment Setup

BAND	EXCITER FREQUENCY (MHz)	OPERATING MODE	DUMMY LOAD				PANEL METER FORWARD RF POWER OUTPUT (KW)	POWER METER READING DEDICATED PORT FORWARD RF POWER (dBm)
			INLET TEMP° C	OUTLET TEMP° C	FLOW RATE GPM	CALC POWER (KW)		
A	5.83	FM/CW						
B	7.82	FM/CW						
C	10.54	FM/CW						
D	14.21	FM/CW						
E	19.15	FM/CW						
F	24.93	FM/CW						

1207.DRW

Figure 6-162. Output Power Amplitude Sample Test Data Sheet

12. Refer to Figure 6-162 for operating frequencies. Repeat steps 6 through 9 in CW mode, until all bands have been tested.

13. Position FWD PWR CLP switch S1 on signal monitors card to ENBL.

14. Return transmitter to normal operation as described in paragraph 4-6.2.

6-10.2.8 Performance Monitor Test.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	1i	TCMG Simulator
1	3a	Oscilloscope

1. Follow procedure in paragraph 4-6.3.1 to shut down transmitter.

2. At the top of cabinet 1, left end, rear corner, remove cover plate from metal box. Disconnect the TCMG interface cable from jack J1. Set up the TCMG Simulator as per Figure 6-163 and connect TCMG simulator cable to J1. Disconnect the remote RF feed line from REMOTE RF INPUT jack W1J1 to ensure no RF excitation.

3. If transmitter is set up to operate under local control, follow procedure in paragraph 4-6.2.3 to change mode of operation to remote control.

4. Use TCMG Simulator (TO 33D7-47-128-1) to bring the transmitter up to READY in Band A, in CW mode, with no power out.

5. Verify transmitter can change to all six bands as commanded from the TCMG Simulator.

6. Verify remote status signals are present at TCMG Simulator.

7. Verify transmitter accepts and responds to each digital format control function from simulator.

8. Verify transmitter accepts, RF INHIBIT on a separate line.

9. If there is a problem in steps 5 through 8, an oscilloscope can be used connected to TP2 through TP6 as necessary to isolate the problem. Refer to TO 33D7-47-128-1 as necessary. With oscilloscope connected as shown in Figure 6-163, measure and record:

   a. Pulse rise and fall time. Both shall be less than 150 nanoseconds.

   b. Voltage difference between signal and return lines for Logic 1 pulse that indicates position of OUTPUT CONTROL switch shall be a minimum of 0.6 volts, with signal line positive in respect to return line.

CAUTION

EQUIPMENT DAMAGE HAZARD

When changing position of OUTPUT CONTROL switch, LOAD indicator shall be closely watched. If lamp for selected position (ANTENNA/TEST) does not light up within 3 seconds, immediately move OUTPUT CONTROL switch back to original position and:

- At TCMG, inhibit RF for all transmitters.
- Position OUTPUT CONTROL switch to desired setting. Troubleshoot pneumatic transfer switches at top of cabinet 1 and determine malfunctioning switch.
- Ensure all site transmitters are disabled in accordance with antenna field access procedures in TO 31P6-2FPS-118-71.
- Repair/replace bad switch.

10. Position OUTPUT CONTROL switch to TEST LOAD (LOCAL) as described in 4-6.2.2. Connect dummy load as described in 4-6.4.1. Attempt to control transmitter from TCMG Simulator. Transmitter should not respond to simulator commands.

11. If step 10 is good, remove TCMG simulator from jack J1. Reconnect the TCMG interface cable to J1 and remote RF feed coaxial to W1J1.

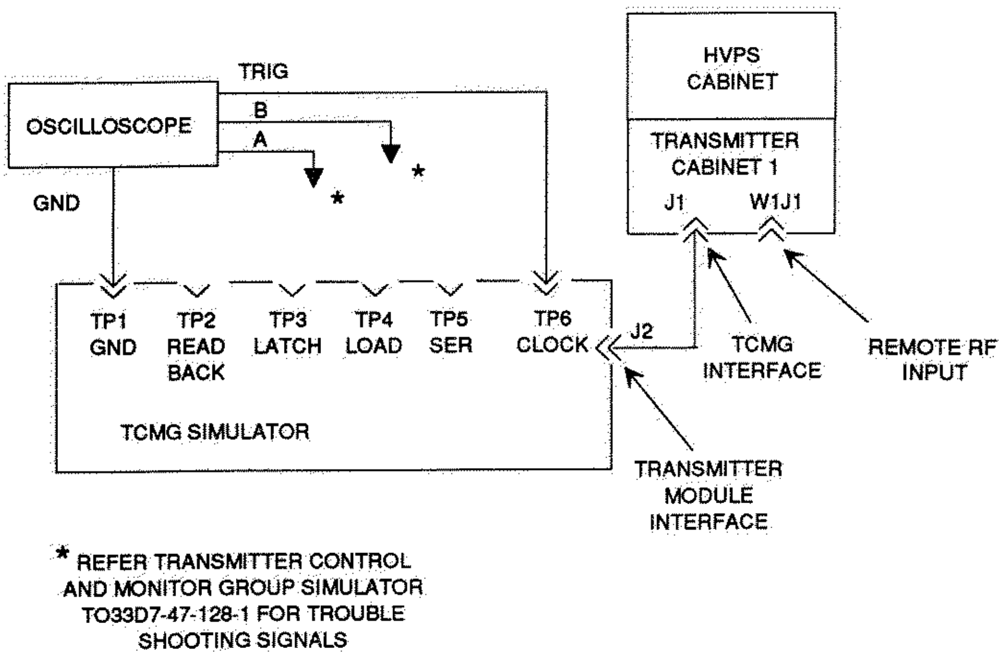

Figure 6-163. Performance Monitoring Equipment Setup

12. Replace the cover on top of the box on top of cabinet 1 and return transmitter to normal operation as described in paragraph 4-6.2.

6-10.2.9 Spectral Purity.

6-10.2.9.1 Spectral Purity Test. When the Receiver Site reports excessive noise levels and/or major maintenance is performed on the transmitter which will affect spectral purity, the following test should be performed. See Figure 6-164 for test setup.

Grouping certain operational parameters can require a classification rating that exceeds this technical order. Figure 6-165 illustrates phase and amplitude plots of acceptable operation parameters.

Tools and Test Equipment Required:

(from Table 1-4)

Qty	Item No.	Description
1	11	Spectral Purity Test Set
1	1b	Dummy Load

For details about set up, plot data, and test procedure, refer to TO (TBS).

1. Perform procedure in paragraph 4-6.2.3.2 to change mode of operation from remote to local and condition transmitter for desired frequency band.

2. Connect coaxial cable from Spectral Purity Test Set RF TO XMTR jack to transmitter RF INPUT jack 1A25J1. Set 1A25S2, RF INPUT SELECTOR to LOCAL.

3. Connect cable from test set XMTR OUTPUT jack to transmitter FWD POWER SAMPLE jack 1A25W2J1.

4. On the Spectral Purity Test Set, position rotary switch to right of test set Analyzer to XMTR OUTPUT.

5. Power up Oscilloscope, Analyzer, and both synthesizers of test set.

6. Set Oscilloscope Channel A and B to 50 ohms at .5 volts per division. Set 3-position switch to right of Oscilloscope to OPERATE.

7. Signal Analyzer:

   a. Push PRESET, then INPUT, then AC COUPLE (soft key on display).

   b. Push FORMAT, then SINGLE (soft key).

   c. Push MKR, then MKR OFF (soft key).

   d. Push FREQ, then DEFINE START (soft key). Enter frequency of 0 Hz. Push DEFINE SPAN (soft key). Enter frequency of 100 Hz.

8. Apply specified frequency by adjusting test set Frequency Synthesizer. Set each Synthesizer frequency the same, but add 10 Hz to Calibrate Synthesizer. E.G., if Source Synthesizer is set to 10,540,000 Hz, Calibrate Synthesizer should be set to 10,540,010 Hz.

9. PHASE SHIFTER/DETECTOR of SPECTRAL TEST SET:

   a. Position both Phase Attenuators fully ccw.

   b. With scope set to Channel B, Push REF SIG. Adjust Source Synthesizer to 10 to 12 dBm. Adjust REF SIG Attenuator for reading of 2-volts peak-to-peak on Oscilloscope.

   c. Apply RF drive to transmitter. Adjust RF OUTPUT LEVEL Attenuator for 90 to 100 kW.

   d. With scope set to Channel B, push CAL SIG. Adjust Cal Synthesizer output level for 2-volts peak-to-peak on Oscilloscope.

   e. With scope set to Channel B, push TST SIG. Adjust TGT SIG Attenuator for 2-volts peak-to-peak on Oscilloscope.

   f. Push SA.

10. Signal Analyzer of Spectral Purity Test Set:

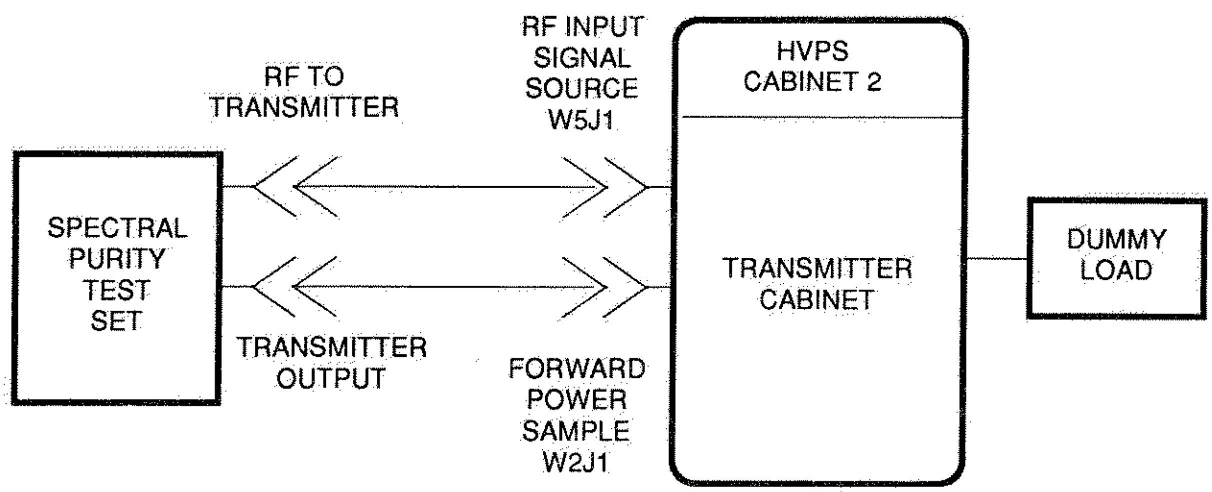

Figure 6-164. Spectral Purity Test Setup

15. On PHASE SHIFTER/DECTOR, push AMPTD TST. Signal Analyzer will now display amplitude plots. For amplitude tests and plots, perform Step 14c with PHASE SHIFTER/DETECTOR in AMPTD TST.

6-10.2.9.2 (Remains the same)

ADD:

11. Press plot on signal analyzer. Then press plot (soft key on spectrum analyzer display) to plot a copy of signal analyzer display.

NOTE

Take care to enter negative (-) value when performing following:

a. Push VERT SCALE. Push DEFINE FULL SCL (soft key), then enter -11 dBV. Within a few seconds, a signal will appear at 10 Hz (full scale).

NOTE

Top of scale is 0 dB below carrier. Signal Analyzer will display calibration plot from 0 to 100 Hz.

b. Set up Plotter per paragraph 6-10.2.9.2 to obtain calibration plot. See Figure 6-165, sheet 1.

c. Push PLOT, then push PLOT (soft key).

11. Repeat steps 9b and 9e.

12. Set scope to Channel A.

13. PHASE SHIFTER/DETECTOR OF SPECTRAL PURITY TEST SET:

a. Push DET ZERO.

b. Verify both DET ZERO Attenuators are fully ccw.

c. Move one of two toggle switches located between DET ZERO Attenuators to up position. Adjust one attenuator for 0-V dc signal on Oscilloscope. Make final 0-V dc adjustment with Oscilloscope set to 10 mv/cm scale.

d. Repeat steps 9b, 9d, and 9e.

NOTE

If necessary, perform steps 12, 13.c., 13.d. until 0-V dc is obtained.

e. Push PH TST.

14. Signal Analyzer of Spectral Purity Test Set:

NOTE

Take care to enter negative (-) value when performing the following step.

a. Push VERT SCALE, then push DEFINE FULL SCL (soft key). Enter -61 dBV, dBV=soft key.

b. Obtain phase plot printout of 0-Hz to 100-Hz. Push PLOT, then push PLOT (soft key). See Figure 6-165, sheets 2 and 3.

c. Perform step 14.b for phase tests and plots for the following frequencies (see Figure 6-165, sheets 4-11):

- 0 Hz to 500 Hz
- 500 Hz to 1000 Hz
- 1000 Hz to 1500 Hz
- 1500 Hz to 2000 Hz

To accomplish this push FREQ, then push DEFINE START (soft key). Enter frequency for low end of test. Push DEFINE SPAN (soft key on display), then enter frequency for high end of test.

15. On PHASE SHIFTER/DETECTOR, push AMPTD TST. Signal Analyzer will now display amplitude plots.

6-10.2.9.2 Spectral Purity Plotter Setup. Perform the following steps to set up Plotter to obtain copies of Signal Analyzer displays.

1. Power up Plotter.

2. Push LCL on Signal Analyzer, then push TLK-ON (soft key).

3. Push PLOT on Signal Analyzer. Push GRID-OFF (soft key), then ANNOTATE-ON (soft key).

4. Install CED graph paper.

5. Push LEFT (1) on Plotter.

6. Push P1 on Plotter, then PEN-DOWN. Align pen to cross-hairs on CED graph paper, using ARROW key..

7. Push ENTER, hold while pushing P1.

8. Push P2, then PEN-DOWN. Align pen to cross-hairs, using ARROW key.

9. Push ENTER, hold while pushing P2.

10. Verify P1 and P2 positions. Repeat steps 6 through 9 if necessary.

6-10.2.10 Transmitter Module X-Ray Radiation Hazard.

(from Table 1-4)

Qty	Item No.	Description
1	2e	Radiation Meter
1	2f	Radiation Probe

1. Ensure all panels, covers, and doors on transmitter are secured.

2. The maximum acceptable x-ray reading is 2 milliroentgens per hour.

3. Station one technician at the front panel of transmitter module to monitor output power of transmitter. The other technician is to perform scans of transmitter.

NOTE

During scans, if an area of equipment exceeds acceptable limits, identify area for investigation at termination of scans.

4. Using the probe, carefully scan the doors, seams, RF output switches, and coaxial connection points on the transmitter module.

5. If any measurements exceed maximum acceptable readings,

   a. Power down transmitter module in accordance with paragraph 4-6.3.

   b. Check area of noncompliance for loose connections, missing parts, defective components and repair as necessary.

   c. Perform this procedure again to verify problem was corrected.

   d. If, after repair of equipment, measurements still exceed acceptable limits:

      1) Power down transmitter module in accordance with paragraph 4-6.3.

      2) Notify appropriate safety personnel of hazard.

6-10.2.11 Transmitter Module Radio Frequency Radiation Hazard.

(from Table 1-4)

Qty	Item No.	Description
1	2d	Field Strength Meter

1. Ensure all panels, covers, and doors on transmitter are secured.

NOTE

The transmitter module must be transmitting near full power.

2. Reference Table 6-26 for maximum acceptable E and H field readings.

3. Station one technician at the front panel of transmitter module to monitor output power and which band the transmitter is operating in. The other technician is to perform scans of transmitter.

NOTE

During E and H field scans, if an area of equipment exceeds acceptable limits, identify area for investigation at termination of E and H field scans.

4. With the field strength meter, carefully scan the doors, seams, RF output switches, and coaxial connection points on the transmitter module for E field readings.

5. With the field strength meter, carefully scan the doors, seams, RF output switches, and coaxial connection points on the transmitter module for H field readings.

6. If any measurements exceed maximum acceptable readings:

   a. Power down transmitter module in accordance with paragraph 4-6.3.1.

b. Check area of noncompliance for loose connections, missing parts, defective components, and repair as necessary.

c. Perform this procedure again to verify problem was corrected.

d. If after repair of equipment, measurements still exceed acceptable limits:

1) Power down transmitter module in accordance with paragraph 4-6.3.1.

2) Notify appropriate safety personnel of hazard.

Table 6-26. Maximum Acceptable Readings for RF Leak Check

BAND	E FIELD	H FIELD	POWER DENSITY
A	103,595	0.65	25.90
B	57,465	0.36	14.37
C	31,620	0.20	7.90
D	17,422	0.11	4.35
E	9,590	0.06	2.40
F	5,714	0.35	1.43

NOTE

CENTER FREQUENCY OF EACH BAND WAS USED TO CALCULATE ACCEPTABLE READINGS

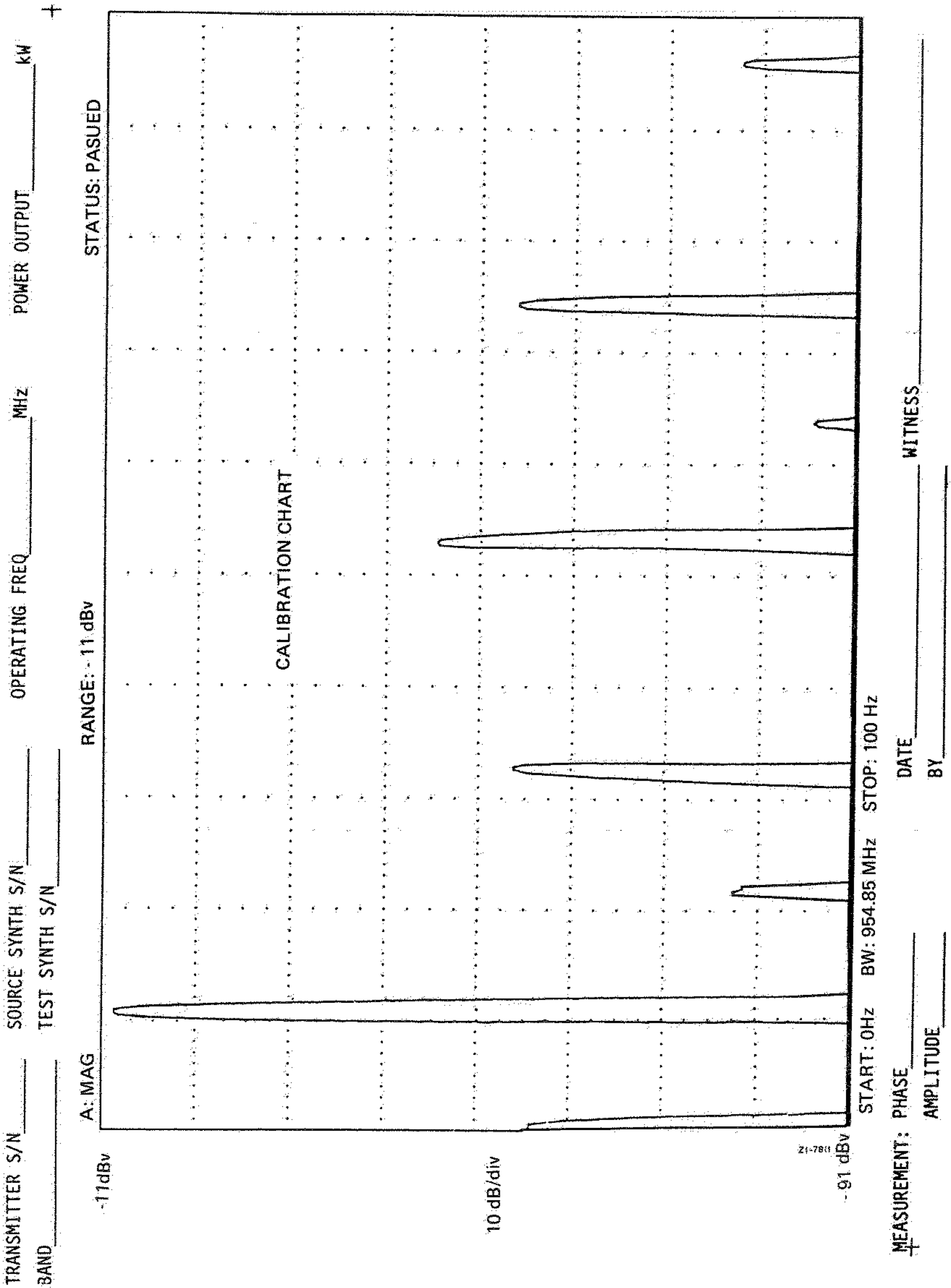

Figure 6-165. Spectral Purity Test Plots (Sheet 1 of 11)

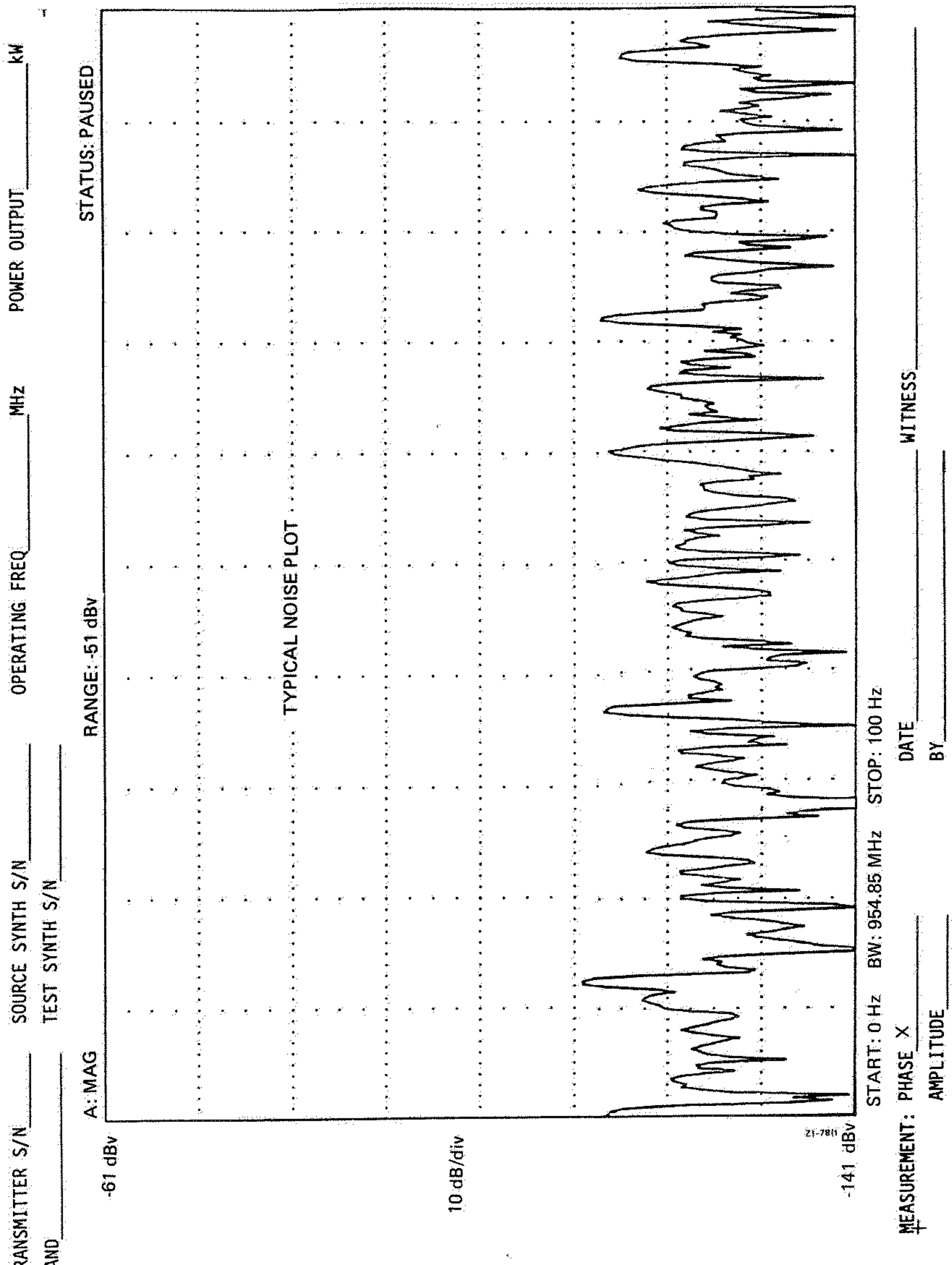

Figure 6-165. Spectral Purity Test Plots (Sheet 2 of 11)

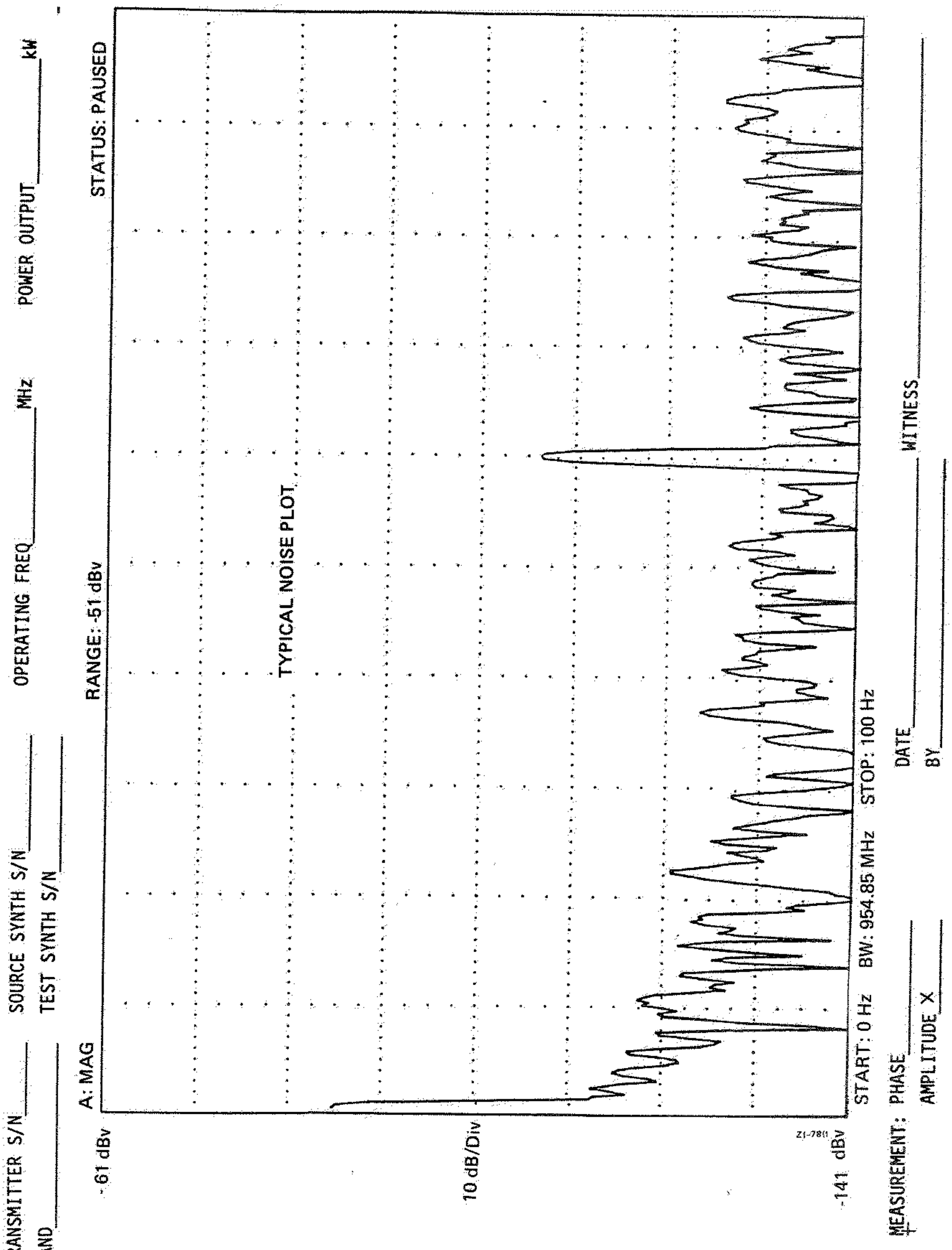

Figure 6-165. Spectral Purity Test Plots (Sheet 3 of 11)

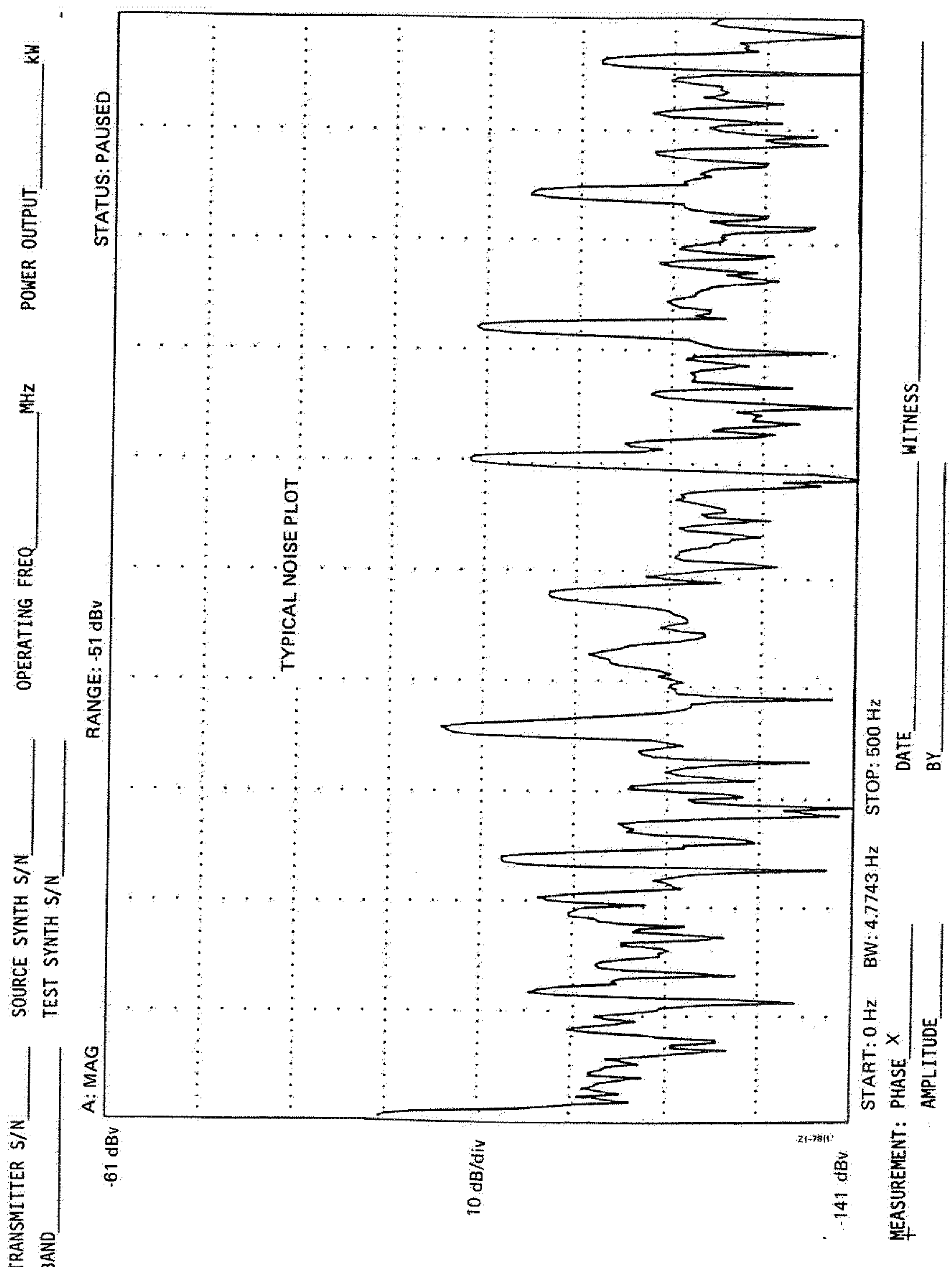

Figure 6-165. Spectral Purity Test Plots (Sheet 4 of 11)

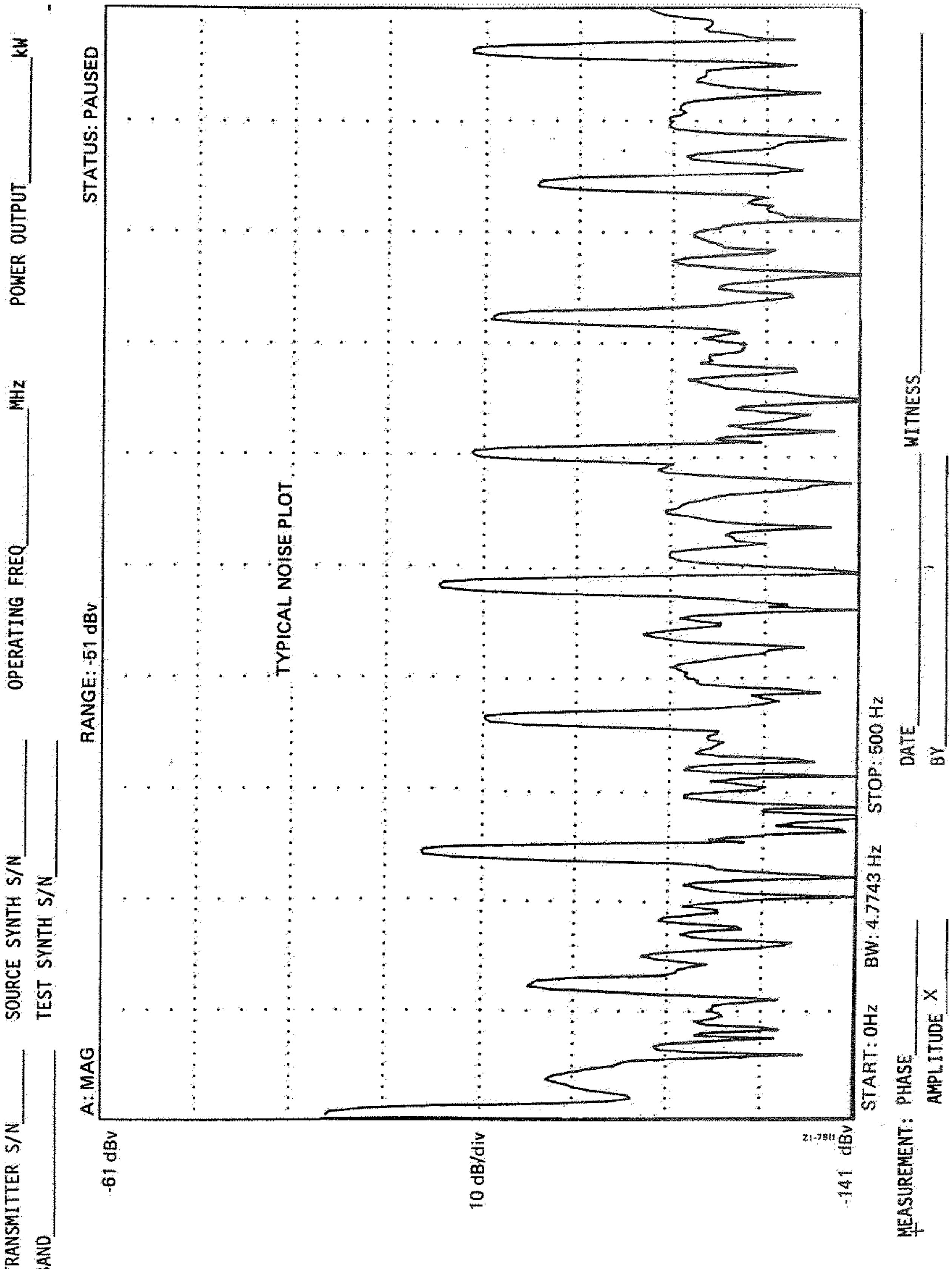

Figure 6-165. Spectral Purity Test Plots (Sheet 5 of 11)

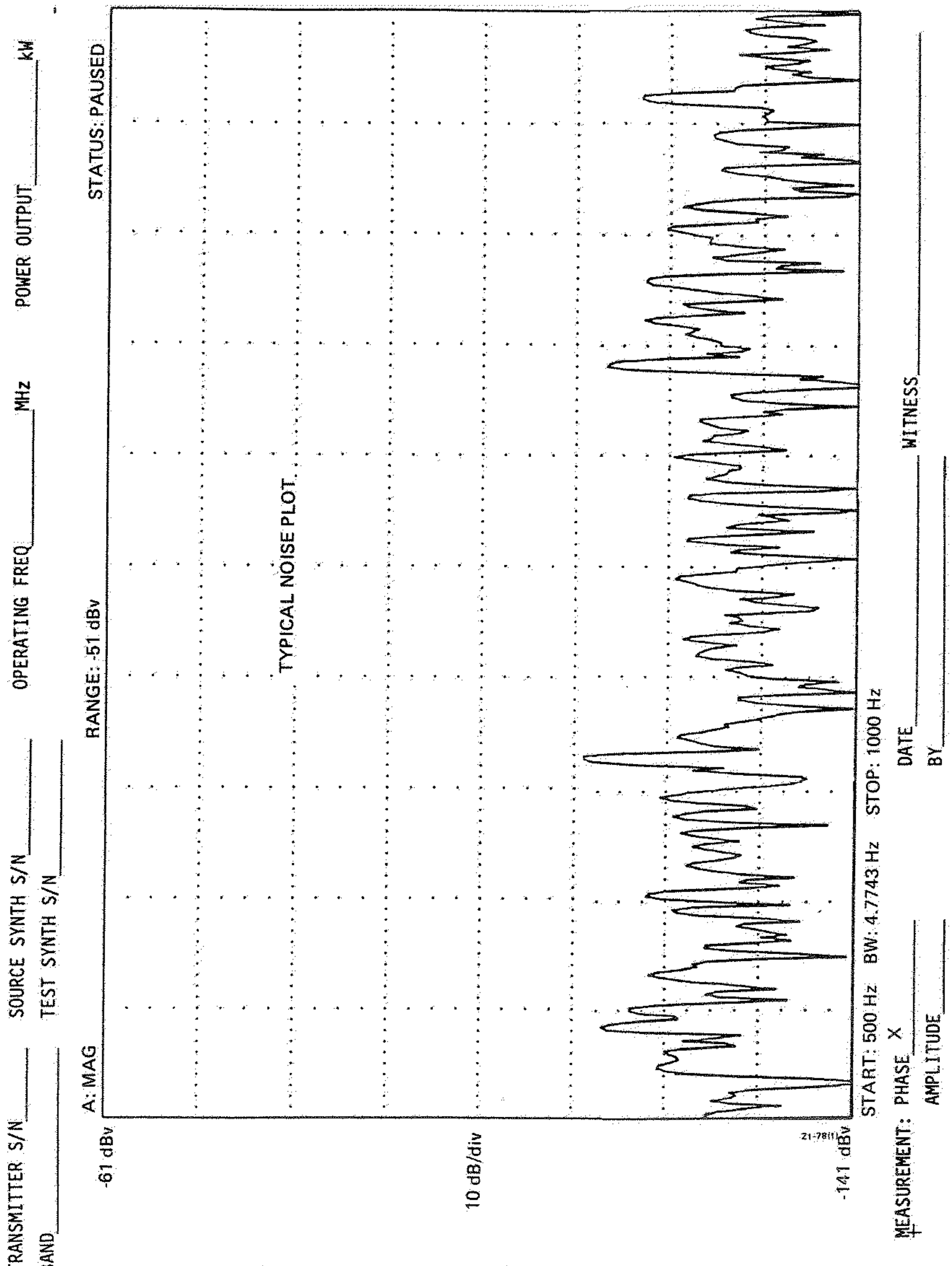

Figure 6-165. Spectral Purity Test Plots (Sheet 6 of 11) of 11

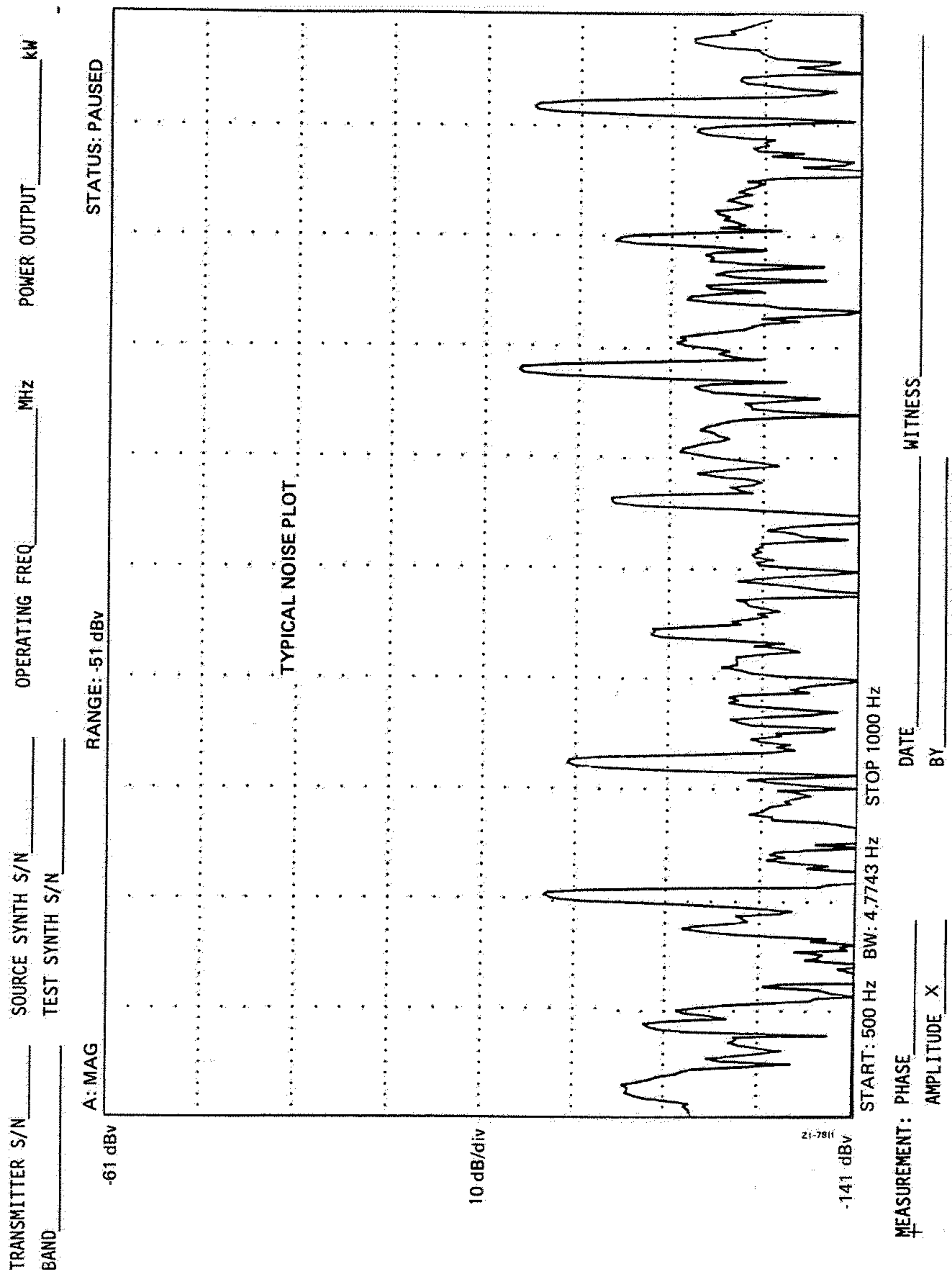

Figure 6-165. Spectral Purity Test Plots (Sheet 7 of 11)

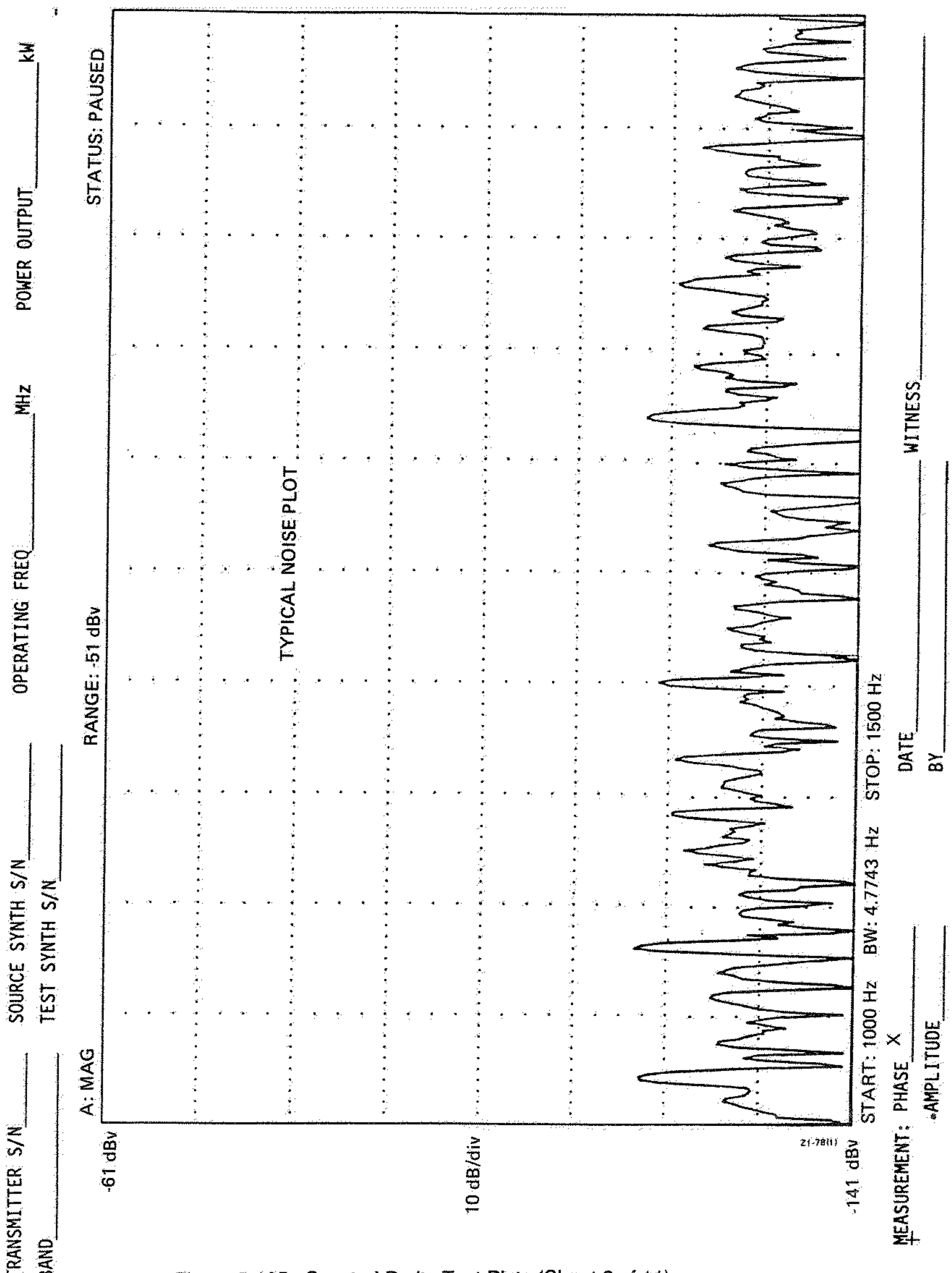

Figure 6-165. Spectral Purity Test Plots (Sheet 8 of 11)

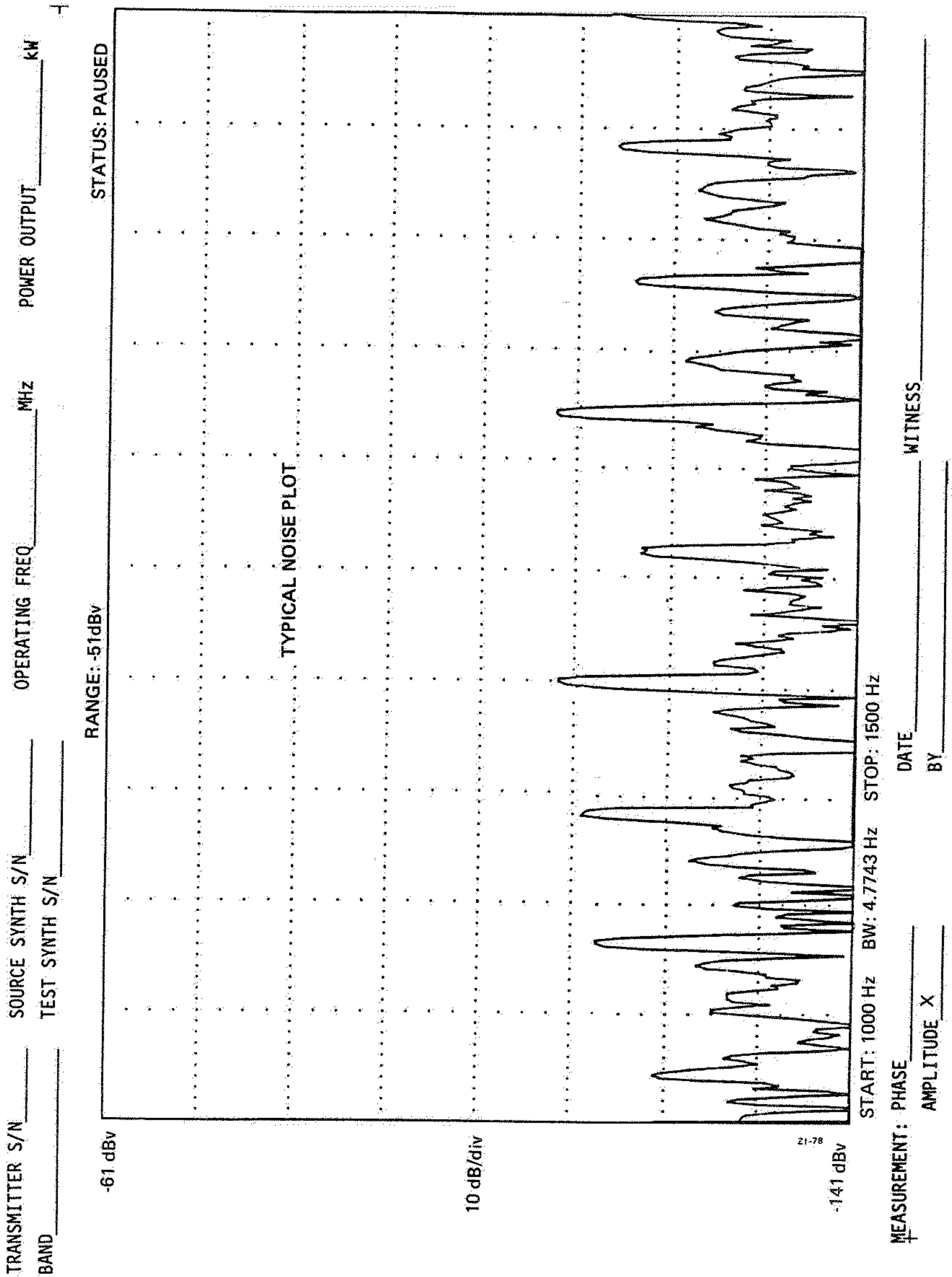

Figure 6-165. Spectral Purity Test Plots (Sheet 9 of 11)

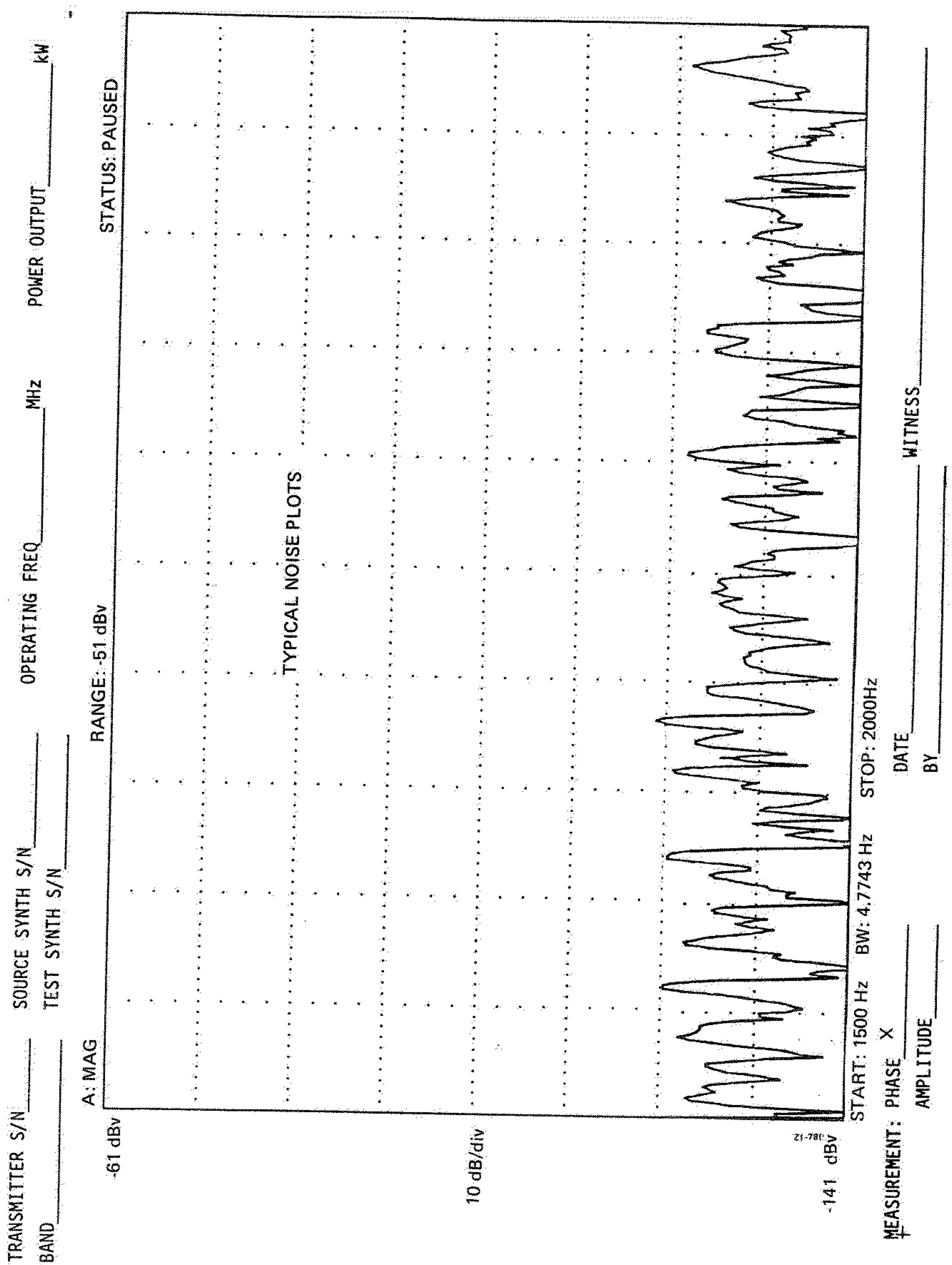

Figure 6-165. Spectral Purity Test Plots (Sheet 10 of 11)

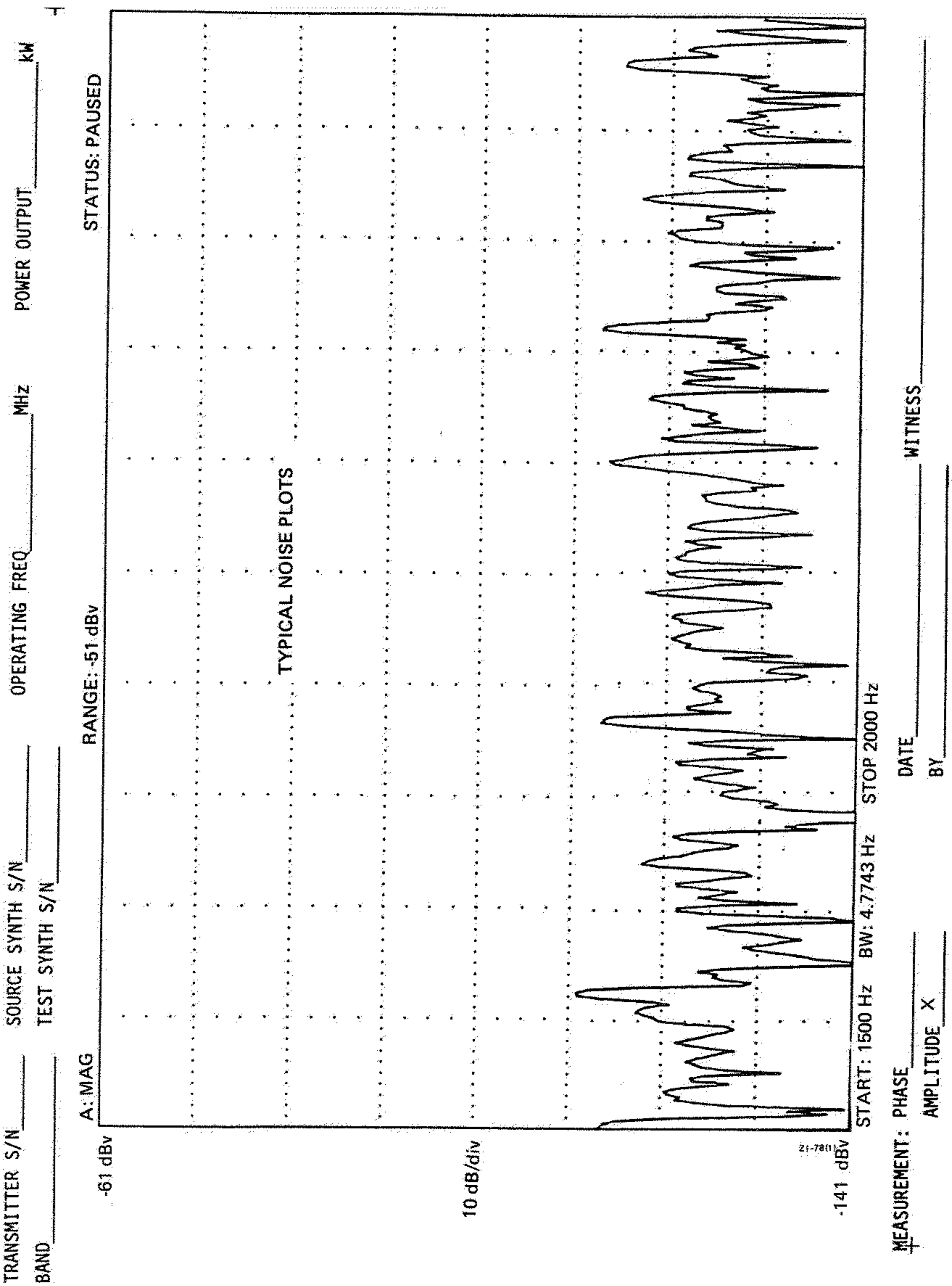

Figure 6-165. Spectral Purity Test Plots (Sheet 11 of 11)

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Subject	Paragraph, Figure, or Table Reference

A

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Subject	Paragraph, Figure, or Table Reference

Subject	Paragraph, Figure, or Table Reference
Process, Performance Monitoring and Fault Location	6-4.1
Protection Panel, Electronic System (1A23)	5-11, F 4-7

R

Subject	Paragraph, Figure, or Table Reference

LIST OF ACRONYMS/ABBREVIATIONS

Acronym/Abbreviation	Interpretation
HVPS	High Voltage Power Supply
RPIE	Real Property Installed Equipment
LOAPS	List of Applicable Publications
HVAC	High Voltage AC
CCA	Circuit Card Assembly
HV	High Voltage
IPA	Intermediate Power Amplifier
PA	Power Amplifier
TCMG	Transmit Control and Monitor Group
LVAC	Low Voltage AC
HVDC	High Voltage DC
XMTR	Transmitter
TMC	Transmit Maintenance Console
LRU	Line Replaceable Unit
CVPS	Control Voltage Power Supply
DCC	Dedicated Coupler Change
FPC	Forward Power Sample, center of band frequency
FPO	Forward Power Sample, other frequencies of same band
DRVR	Driver
DVC	Device
CKT BRKR	Circuit Breaker
TXG	Transmit Group
UUT	Unit Under Test