

OFFICE
COPY

RCA

Broadcast Equipment



**BTF-40E1
FM Transmitter**

ES-560606



IB-8027533

Broadcast Equipment

GE Support Services

1-609-866-3147 2/91 RZ

Instructions

BTF-40E1

FM Transmitter

ES-560606

Line Stretcher General Radio



Commercial Electronic Systems Division/Front and Cooper Streets/Camden, New Jersey, U.S.A., 08102

SUP740M

If You Didn't Get This From My Site,
Then It Was Stolen From...
www.SteamPoweredRadio.Com

IB-8027533

EMERGENCY FIRST AID INSTRUCTIONS

WARNING

VOLTAGES THAT ARE DANGEROUS TO LIFE ARE INVOLVED IN THE OPERATION OF THIS ELECTRONIC EQUIPMENT. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH VOLTAGES APPLIED. DANGEROUS CONDITIONS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM TO AVOID PERSONAL INJURY OR LOSS OF LIFE.

Personnel engaged in the installation, operation, or maintenance of this equipment or similar equipment are urged to become familiar with the following rules both in theory and practice. It is the duty of all operating personnel to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

RESCUE BREATHING

GENERAL INFORMATION

A. START IMMEDIATELY, SECONDS COUNT

Do not move victim unless absolutely necessary to remove from danger. Do not wait or look for help or stop to loosen clothing. Warm the victim or apply stimulants. The main purpose is to GET AIR INTO THE VICTIM'S LUNGS.

B. WIPE OUT VICTIM'S MOUTH

Wipe out quickly any mucus, food, or any foreign matter in the victim's mouth using your fingers or a cloth wrapped around your fingers.

C. LOOSEN CLOTHING - KEEP WARM

Do this when the victim is breathing by himself or help is available. Keep him quiet as possible and from becoming chilled. Otherwise, treat him for shock.

D. DON'T GIVE UP

Continue emergency rescue breathing without interruption until victim is breathing without help or until all hope of reviving him as determined by a physician is gone.

E. CALL A PHYSICIAN

Have someone summon medical aid since respiratory and other disturbances may develop as an aftermath. A physician is necessary during the recovery period.

PROCEDURE

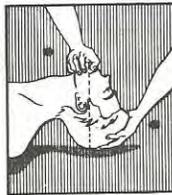


FIG. A



FIG. B



FIG. C

TILT HEAD BACK - Lift neck and point chin up to open air passage.

EXTEND JAW - Pull or push jaw into jutting out position (Fig. A).

PINCH NOSE - Close nostrils to prevent air leakage, or close mouth when using mouth-to-nose breathing.

BLOW - Seal victim's mouth or nose with your mouth. (Fig. B) Blow until chest rises.

REMOVE MOUTH - Listen for exchange of air; if none, check throat for obstruction. To remove it, place victim in position shown in Fig. C, and slap sharply between shoulder blades.

REPEAT - 12 times per minute for adults; at least 20 times per minute for children.

BURNS

SKIN REDDENED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with clean sheet or cloth to keep away air. Consult a physician.

SKIN BLISTERED OR FLESH CHARRED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to Hospital.

EXTENSIVE BURN-SKIN BROKEN: Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

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TECHNICAL SUMMARY

ELECTRICAL SPECIFICATIONS

Type of Emission	F3 and F9
Frequency Range	88 to 108 MHz
Power Output	40 kW
Output Impedance	50 ohms
Frequency Deviation for 100% Modulation	±75 kHz
Modulation Capability	±100 kHz min.
Carrier Frequency Stability	±1000 Hz max.
Audio Input Impedance	600/150 ohms ¹
Audio Input Level (100% modulation)	+10 ±2 dBm ²
Audio Frequency Response (30-15,000 Hz)	±1 dB max. ³
Harmonic Distortion (30-15,000 Hz)	0.5% or less ⁴
FM Noise Level (referred to 100% FM modulation)	-65 dB max.
AM Noise Level (referred to 100% AM modulation)	-50 dB max.
SCA Subcarrier Input Level (100% modulation of carrier)	-15 to +10 dBm, adjustable
SCA Subcarrier Input Impedance	600/150 ohms bal.
Pre-Emphasis Network Time Constant	.75 or 50 usec, as desired
Main-to-Subchannel Crosstalk	-50 dB ⁵
Sub-to-Main Channel Crosstalk	-60 dB ⁶

POWER LINE REQUIREMENTS

Transmitter:

Line	240/208 volt, 3 phase, 50/60 Hz
Combined Line Voltage Variation and Regulation	±5%
Power Consumption	72,000 watts (approx.)
Power Factor (approx.)	90%

FM Exciter:

Line	117V/208V/240V ±5% 50/60 Hz
Power Consumption including BTS-1B Stereo Generator and BTX-1B SCA Generator	80 watts

PHYSICAL SPECIFICATIONS

Maximum Altitude	7500 feet
Ambient Temperature Range	-20° to +45°C
Heat Dissipation	32 kW, 1820 BTU/MIN, or <u>9.2 tons</u> of refrigeration

Dimensions:

Transmitter:

Width	114-1/4"
Height	77"
Depth	33-1/8"

Power Supply

Width	64"
Height	49"
Depth	23"

Weight:

Transmitter	2950 lbs. (approx.)
Power Supply	2050 lbs. (approx.)

¹ Audio pre-emphasis 75 microseconds (50 microseconds if desired).

² Level measured at input jack J1 with 400 Hz tone applied.

³ Audio frequency response referred to 50 or 75 microsecond pre-emphasis curve.

⁴ Distortion includes all harmonics up to 30 kHz and is measured following a standard 50 or 75 microsecond de-emphasis network.

⁵ Relative to ±6.0 kHz deviation of the subcarrier by a 400 Hz tone; main channel modulated 70% by 50 to 15,000 Hz tones (monophonic mode) and 30% by subcarrier, using a narrowband detector.

⁶ Relative to ±75 kHz deviation of the main carrier by a 400 Hz tone; subcarrier modulated ±4.0 kHz by 30 to 5000 Hz tones, main carrier modulated 30% by subcarrier, using a narrowband detector.

LIST OF EQUIPMENT

BTF-40E1 40kW FM TRANSMITTER ES-560606

Quantity	Description	Reference																						
2	Basic Transmitter	MI-560507																						
2	Power Determining Kit	MI-560510																						
2	Blower (do not use on 50 Hz above 3000 ft. altitude)	MI-560347-1																						
2	Rectifier	MI-560340																						
2	Plate Transformer	MI-560341-1																						
2	Power Supply	MI-560342-3																						
1	Set of Side Panels	MI-560373																						
2	Installation Material (BTF-20E1)	MI-560515																						
1	Installation Material (BTF-40E1)	MI-560703																						
1	Harmonic Filter, select as follows:																							
	88 to 108 MHz Unpressurized	MI-561575																						
	88 to 108 MHz Pressurized	MI-561576																						
**	BTE-15A Exciter System, Mono	ES-560631																						
**	BTE-15A Exciter System, Mono and 1 SCA	ES-560632																						
**	BTE-15A Exciter System, Mono and 2 SCA	ES-560633																						
**	BTE-15A Exciter System, Stereo	ES-560634																						
**	BTE-15A Exciter System, Stereo and 1 SCA	ES-560635																						
**	BTE-15A Exciter System, Stereo and 2 SCA	ES-560636																						
1	Set of Operating Tubes	ES-560613																						
*	Set of Spare Tubes (100%)	ES-560613																						
1	Nameplate	MI-28180-A																						
*	Touch Up Finish Kit	MI-27660-C																						
2	Blower Mounting Kit	MI-560517																						
2	Frequency Determining Parts, for customer's assigned frequency as follows:																							
	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">ES NUMBER</th> <th style="text-align: left;">FREQUENCY</th> </tr> </thead> <tbody> <tr> <td>ES-560272-1</td> <td>88.1 TO 89.9 MHz</td> </tr> <tr> <td>ES-560272-2</td> <td>90.1 TO 91.9 MHz</td> </tr> <tr> <td>ES-560272-3</td> <td>92.1 TO 93.9 MHz</td> </tr> <tr> <td>ES-560272-4</td> <td>94.1 TO 95.9 MHz</td> </tr> <tr> <td>ES-560272-5</td> <td>96.1 TO 97.9 MHz</td> </tr> <tr> <td>ES-560272-6</td> <td>98.1 TO 99.9 MHz</td> </tr> <tr> <td>ES-560272-7</td> <td>100.1 TO 101.9 MHz</td> </tr> <tr> <td>ES-560272-8</td> <td>102.1 TO 103.9 MHz</td> </tr> <tr> <td>ES-560272-9</td> <td>104.1 TO 105.9 MHz</td> </tr> <tr> <td>ES-560272-10</td> <td>106.1 TO 107.9 MHz</td> </tr> </tbody> </table>	ES NUMBER	FREQUENCY	ES-560272-1	88.1 TO 89.9 MHz	ES-560272-2	90.1 TO 91.9 MHz	ES-560272-3	92.1 TO 93.9 MHz	ES-560272-4	94.1 TO 95.9 MHz	ES-560272-5	96.1 TO 97.9 MHz	ES-560272-6	98.1 TO 99.9 MHz	ES-560272-7	100.1 TO 101.9 MHz	ES-560272-8	102.1 TO 103.9 MHz	ES-560272-9	104.1 TO 105.9 MHz	ES-560272-10	106.1 TO 107.9 MHz	
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ES-560272-8	102.1 TO 103.9 MHz																							
ES-560272-9	104.1 TO 105.9 MHz																							
ES-560272-10	106.1 TO 107.9 MHz																							
1	Coaxial Coupler, 40 kW	MI-561564																						
1	Combining Equipment Rack	MI-560702																						
*	Set of Coaxial Components	MI-560704																						
*	Set of 6-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-561579-*																						
*	Set of 1-5/8 in. O.D. 50 Ohm Transmission Line Components	MI-561565-*																						
1	Coaxial Coupler (10 kW per port)	MI-561537																						
2	Instruction Book, BTF-40E1	IB-8027533																						
2	Instruction Book, BTF-20E1	IB-8027531																						
2	Instruction Book, BTE-15A FM Exciter	IB-8027524																						

*Supplied if and as specified on sales order.

**Supply two ES as specified on sales order.

INSTALLATION MATERIAL

MI-560703

Quantity	Description	Reference																												
1	Suitable Container Containing Hardware:																													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Item</th> <th style="text-align: center;">Quantity</th> <th style="text-align: center;">Description</th> <th style="text-align: center;">Reference</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">16</td> <td>Screw, 10/32 x 0.62 long</td> <td style="text-align: center;">990140-165</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">16</td> <td>Washer, #10</td> <td style="text-align: center;">82278-156</td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">16</td> <td>Washer, Lock #10</td> <td style="text-align: center;">93620-162</td> </tr> <tr> <td style="text-align: center;">D</td> <td style="text-align: center;">16</td> <td>Nut, Hex 10/32</td> <td style="text-align: center;">57435-156</td> </tr> <tr> <td style="text-align: center;">E</td> <td style="text-align: center;">4</td> <td>Screw 1/4-20 x 1/2 in. long</td> <td style="text-align: center;">990139-163</td> </tr> <tr> <td style="text-align: center;">F</td> <td style="text-align: center;">4</td> <td>Lockwasher, 1/4 in.</td> <td style="text-align: center;">93620-166</td> </tr> </tbody> </table>	Item	Quantity	Description	Reference	A	16	Screw, 10/32 x 0.62 long	990140-165	B	16	Washer, #10	82278-156	C	16	Washer, Lock #10	93620-162	D	16	Nut, Hex 10/32	57435-156	E	4	Screw 1/4-20 x 1/2 in. long	990139-163	F	4	Lockwasher, 1/4 in.	93620-166	
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A	16	Screw, 10/32 x 0.62 long	990140-165																											
B	16	Washer, #10	82278-156																											
C	16	Washer, Lock #10	93620-162																											
D	16	Nut, Hex 10/32	57435-156																											
E	4	Screw 1/4-20 x 1/2 in. long	990139-163																											
F	4	Lockwasher, 1/4 in.	93620-166																											
1	Line Section Consisting of:																													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Item</th> <th style="text-align: center;">Quantity</th> <th style="text-align: center;">Description</th> <th style="text-align: center;">Reference</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">1</td> <td>Line Section, 3-1/8 O.D.</td> <td style="text-align: center;">3471729-2</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">1</td> <td>Element</td> <td style="text-align: center;">3471729-5</td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">2</td> <td>Adapter</td> <td style="text-align: center;">8869063-2</td> </tr> </tbody> </table>	Item	Quantity	Description	Reference	A	1	Line Section, 3-1/8 O.D.	3471729-2	B	1	Element	3471729-5	C	2	Adapter	8869063-2													
Item	Quantity	Description	Reference																											
A	1	Line Section, 3-1/8 O.D.	3471729-2																											
B	1	Element	3471729-5																											
C	2	Adapter	8869063-2																											
1	Coupling Assembly, Reducer 3-1/8 to 1-5/8 O.D.	MI-561565-5A																												
1	Line Section, 6-1/8 O.D. (Directional Coupler)	3469759-1																												
2	Cable Assembly, Coax RG-58/U	3467813-509																												
	Note: For reflectometer connections, Z3 to Z6, Z3 to Z7																													
1	Cable Assembly, Coax RG-58/U	3467813-510																												
	Note: For reject power connection, Z2 to J8																													
1	Monitor Assembly	8442950-504																												
2	Hose Clamp (6-1/8 diameter)	MI-561579-4C																												
2	Strap	3456250-1																												

COAXIAL COMPONENTS

MI-560704

Quantity	Description	Reference
2	Transmission Line (A) Outer Conductor	3.12 O.D. x 16.05 long 3455588-15
	(B) Inner Conductor	3459893-1
13	Coupling, Straight	3.12 O.D. MI-27791-K-4A
3	Coupling, 90° Miter, No Flange	3.12 O.D. MI-27791-K-2A
1	Transmission Line (A) Outer Conductor	3.12 O.D. x 17.43 long 3455588-16
	(B) Inner Conductor	3459893-2
1	Transmission Line (A) Outer Conductor	3.12 O.D. x 5.33 long 3455588-17
	(B) Inner Conductor	3459893-3
1	Transmission Line (A) Outer Conductor	3.12 O.D. x 34.67 long 3455588-18
	(B) Inner Conductor	3459893-4
1	Transmission Line (A) Outer Conductor	1.62 O.D. x 6.85 long 8812986-82
	(B) Inner Conductor	8811028-82
1	Coupling, 90° Miter, No Flange	1.62 O.D. MI-561565-2A
2	Coupling, Straight	1.62 O.D. MI-561565-4A
1	Connector, Inner 1-5/8, 50 ohms to 51.5 ohms	MI-561565-7A
1	Coupling, Straight	6.12 O.D. MI-561579-4A

RECOMMENDED TEST EQUIPMENT

Description	RCA Reference	Other Reference
PA Dummy Load		Bird Model 8762 or Altronic Research Model 5750
Thru-line Wattmeter		Bird Model 460 (for unflanged line)
Exciter Dummy Load and Wattmeter 0-15/60 Watts		Bird Electronic Corp. Model 611
Audio Generator		Hewlett-Packard Model 209A
Step Attenuator		Hewlett-Packard Model 350D
Distortion and Noise Meter		Hewlett-Packard Model 331A/334A
Oscilloscope		Tektronix Model 535A/535B
AM Noise Measuring Adapter		McMartin Model AM25
Reducer Cone (3-1/8" dia. coaxial line to type N connector)	MI-19113-C58	
Vacuum Tube Voltmeter (VoltOhmyst)	WV-98C	
Grid-Dip Meter		Measurements Corp. Model 59
One 6 foot length of RG-8/U Cable with type N connectors		

OPTIONAL ACCESSORY EQUIPMENT

Description	Reference
Set of Spare Semiconductors for BTE-15A FM Exciter	MI-560718
Spare Crystal for BTE-15A FM Exciter (Specify chan- nel frequency)	MI-560717-*
BTE-15A FM Exciter Module	MI-560712
BTS-1B Stereo Generator Module	MI-560713
Type BTX-1B Subcarrier Generator Module (Specify SCA Frequency)	MI-560714
5-kHz Filter (required when transmitting stereo and SCA)	MI-560721
Type BTR-20C Remote Control System	MI-27526A/ 27530-A
Type BTG-10AL/AR Auto- matic Logging Equipment	ES-561486/ 561489
Type BW-75A FM Monitor	MI-560735
BW-75A Remote Metering Panel	MI-560736
Type BW-85A FM Stereo Monitor	MI-560740
BW-85A Remote Metering Panel	MI-560741
Type BW-95A SCA and Modulation Monitor	MI-560745
BW-95A Remote Metering Panel	MI-560746
Tower Lighting Unit	MI-27519
BW-100B RF Amplifier for the BW-75A Monitor	MI-560738

TUBE COMPLEMENT

Complement	Type	Function
4	7203/4CX250B	Driver
2	4CX15,000A	Power Amplifier

NOTE: Refer to BTE-15A FM Exciter Instruction Book,
IB-8027524, for the exciter semi-conductor complement.

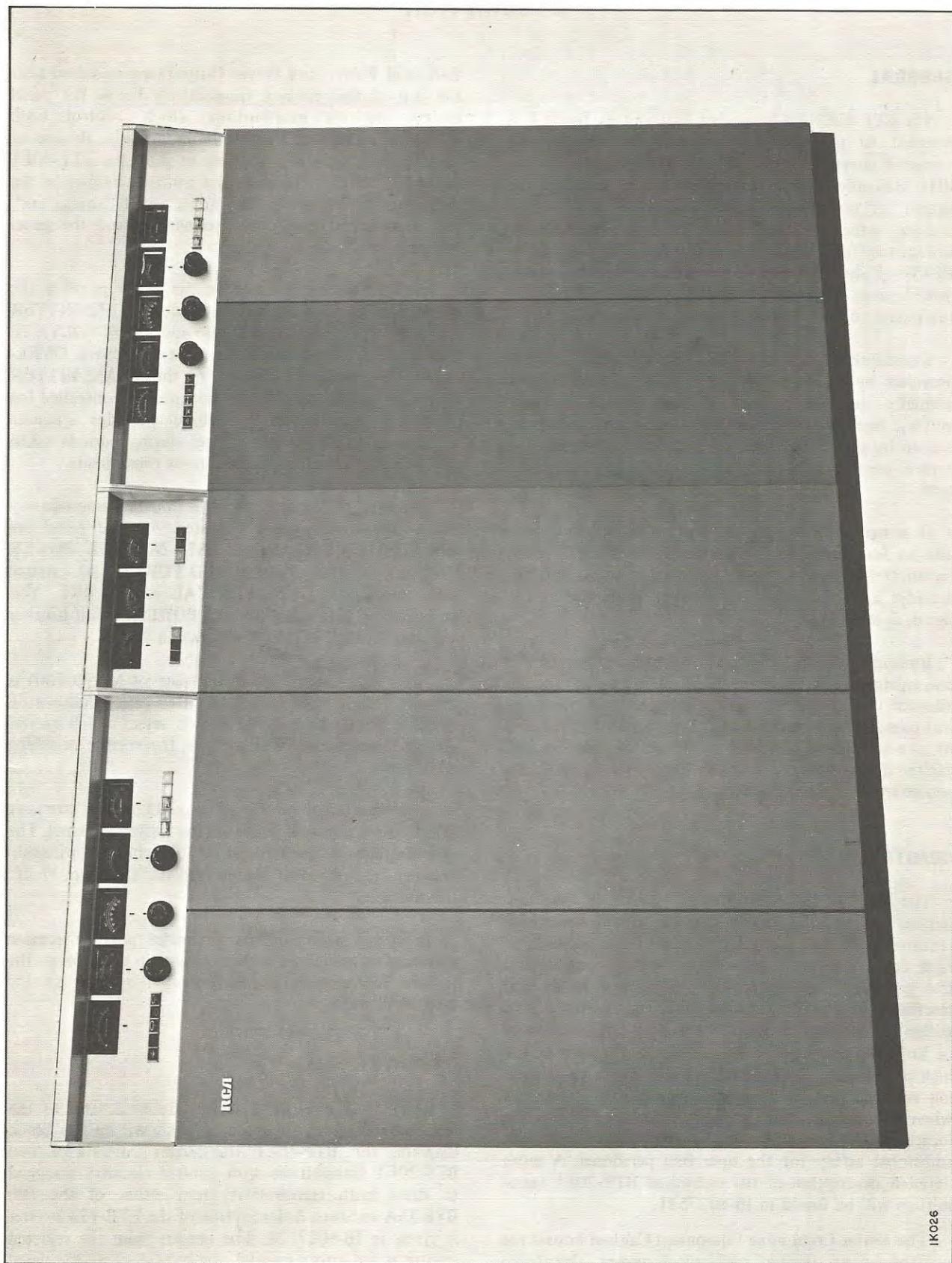


Figure 1. BTF-40E1 40 kW FM Transmitter

DESCRIPTION

GENERAL

The BTF-40E1 FM Broadcast Transmitter, figure 1, is designed to provide high power and reliability for increased coverage in the standard FM band, 88 to 108 MHz. Basically, this is accomplished by combining the output of two BTF-20E1 transmitters in a coaxial coupler, which feeds a single antenna. This parallel arrangement of two 20 kW transmitters provides up to 40 kW of output power. A conveniently located center rack houses the mutual controls which enable the equipment to be operated as a single transmitter.

Excitation for the BTF-40E1 transmitter is normally provided by either of two BTE-15A exciters (one is normally supplied as part of each BTF-20E1 transmitter). See IB-8027524. Exciter selection is accomplished by simply depressing a pushbutton located on a control panel located in the center combining equipment rack.

It is necessary to split the output from the exciter unit to feed the amplifier chains in the two BTF-20E1 transmitters. The FM exciter switching unit, MI-560700, includes a coaxial ring hybrid which splits the exciter signal, as required.

Built-in redundancy is an outstanding feature of this transmitter: If a fault develops in either of the 20 kilowatt units, only that unit is affected, and operation will continue uninterrupted, with power output reduced to one-quarter of the normal value. If the "on-air" exciter should fail, the stand-by exciter may be put into service by depressing a pushbutton.

CONSTRUCTION

The BTF-40E1 transmitter is housed in five aluminum and steel cabinets finished in two-tone blue textured vinyl. Swing-out doors on the front and back of each cabinet provide accessibility to the controls and test points of the equipment. All electron tubes and electrical components in high voltage circuits are located within the cabinets, behind electrically interlocked doors or interlocked panels. Doors and access panels in the high power amplifier cabinets are provided with grounding switches that discharge the high voltage capacitors when the cabinets are opened. Grounding hooks are located at the front and rear of these cabinets to provide additional safety for the operating personnel. A more detailed description of the individual BTF-20E1 transmitters will be found in IB-8027531.

The center Combining Equipment Cabinet houses the control relays, wiring, and reject power absorption devices (a power splitting device and two air cooled load resistors). In addition, three panel meters (Reject Power,

Reflected Power and Power Output) are mounted near the top of this cabinet. Immediately below the panel meters are six pushbuttons which control both BTF-20E1 transmitter units simultaneously. By use of these pushbuttons it is possible to place the BTF-40E1 in service without operating the control circuitry of the individual 20 kW units. The meter panel "swings out" for improved access to components behind the panel meters.

The pushbuttons located on the meter panel in the combining equipment rack include: TRANSMITTER OFF/ON, OVERLOAD RESET and HIGH VOLTAGE OFF/ON. In addition, a status light and VSWR OVERLOAD, is mounted adjacent to the TRANSMITTER OFF/ON pushbuttons. A thermostatically controlled fan located in the top of the cabinet provides adequate ventilation for cooling purposes during periods when appreciable power is dissipated in the reject loads.

A meter calibration panel is located immediately below the meter panel. Located on this panel are REFLECTOMETER switch 4S7, NORMAL POWER CAL control 4R5, REFLECTED POWER CAL control 4R6 and REMOTE POWER CAL control 4R7. Also mounted on this panel are the POWER circuit breaker 4S9 and VSWR PROTECTION switch 4S8.

The exciter switching panel (part of MI-560700) is mounted below the meter calibration panel. Pushbutton switches 4S101 and 4S102, which select which exciter unit is in service, are mounted on the exciter switching relay panel.

A variable length section of coaxial line (line stretcher 4DL1) is located below the exciter switching panel. The line stretcher is used to adjust the phase relationship between the rf drive signals fed to the two "half" transmitters.

Terminals are provided to make possible remote metering of combined power output, in addition to the remote metering functions provided as part of the BTF-20E1 units.

CIRCUITS

Refer to the block diagram, figure 2, and to the schematic diagram, figure 15. As shown on the block diagram, the BTF-40E1 transmitter consists of two BTF-20E1 transmitters with control circuitry arranged to drive both transmitters from either of the two BTE-15A exciters. A description of the BTE-15A exciter is given in IB-8027524. The output from the selected exciter is fed into a coaxial ring hybrid where the signal is equally divided. A reject load absorbs any reflected power which may exist during tuning procedures.

The outputs from the two BTF-20E1 transmitters must be 90° phase displaced in order that combining will take place in the coaxial coupler. To achieve this displacement, the cable lengths to the two transmitter inputs (from the ring hybrid) are purposely made different. A variable delay line (line stretcher) is included in the cable to transmitter number 1. The adjustment for the line stretcher is located on the front panel of the combining equipment cabinet and must be adjusted for minimum (near zero) reject power.

The output of each BTF-20E1 transmitter is fed to a coaxial coupler, MI-561564, located above the combining equipment cabinet MI-560702. The output from each transmitter is fed into two diagonally opposite ports of the coaxial coupler. A third port feeds the combined output to the antenna via the harmonic filter, MI-561575 or MI-561576. If an amplitude imbalance exists between the two BTF-20E1 transmitters, or the phase relationship is not as described above, a fourth port feeds reject power into two oil immersed air cooled load resistors situated in the combining equipment cabinet. Under normal operating conditions, reject power is near zero. The coaxial coupler acts in such a way that should one transmitter fail, a reduced power output (25%) is fed to the antenna without interruption of signal. In addition, a protective unit is included which shuts down both transmitters in the event of a sustained high VSWR in the output transmission line.

The harmonic filter provides a broad passband with a sharp high-frequency cut-off and excellent attenuation of frequencies above the passband. Electrically, the filter consists of an M-derived half-T section, several low pass filter sections, and a constant-K half-T section as shown in figures 21 and 22. The filter is constructed of coaxial transmission line and is the reflective type.

A detailed circuit description of the BTF-20E1 transmitter is given in IB-8027531. The operation is essentially the same in this application.

Although the two BTF-20E1 transmitters are combined to operate as a single transmitter, the overload protection (with the exception of the VSWR protection) and door interlock systems are separate. The cooling system of each BTF-20E1 transmitter also operates independently.

OFF FREQUENCY INTERLOCK CIRCUIT

The modern, all solid-state BTE-15A FM Exciter is used in the BTF-40E1. Normally, two exciters are supplied, one mounted in each 20 kW unit. The resulting spare exciter gives increased reliability (the spare exciter is put into operation by pressing a pushbutton).

In each exciter, an off-frequency detector circuit operates a control relay when the exciter center fre-

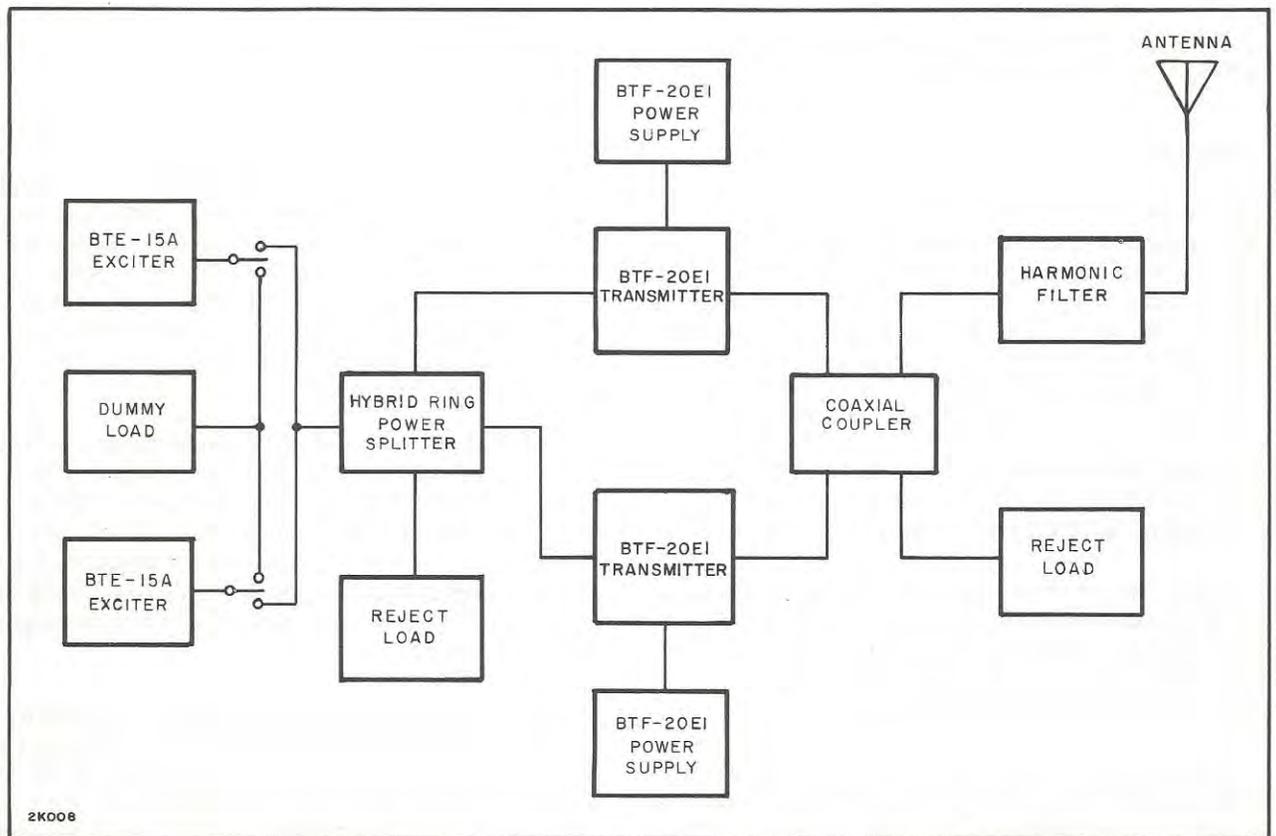


Figure 2. BTF-40E1 Simplified Block Diagram

quency error exceeds a prescribed value. The relays in the two exciters are interconnected with control relays K103 and K108 such that excessive center frequency error in the "on air" exciter will remove transmitter high voltage. Center frequency errors in the "spare" exciter will not trip off transmitter high voltage. In addition, relay K103 incorporates "make before break" contacts to prevent transmitter trip-off during exciter switching.

REMOTE CONTROL

Provisions are made to control the BTF-40E1 transmitter from a remote location by the installation of a

standard RCA Type BTR-20C Remote Control System, MI-27530-A and MI-27526-A, supplied as an accessory item. In addition to the standard remote control functions of the individual BTF-20E1 transmitters, the BTF-40E1 transmitter includes connections for combined remote control of TRANSMITTER ON/OFF, HIGH VOLTAGE ON/OFF and OVERLOAD RESET. Terminals are also provided for a remote meter reading of combined power output. Control of tower lights and monitoring of frequency and modulation is also possible at a remote location. Equipment for these features is listed as accessory items and are explained under EQUIPMENT WIRING in IB-8027531.

INSTALLATION

EQUIPMENT SUPPLIED

The RCA type BTF-40E1 FM Broadcast Transmitter is rated at 40 kW power output and operates in the 88 MHz to 108 MHz frequency band. The BTF-40E1 transmitter consists of the five equipment cabinets shown in figure 3, and the following associated equipment:

Harmonic Filter MI-561575 or MI-561576
Coaxial Coupler MI-561564

A list of the equipment supplied for a complete installation is shown on ES-560606.

GENERAL

The first step in the installation of the BTF-40E1 transmitter is to plan the equipment layout and provide the necessary utilities and external connections. After the necessary layout space is available, the equipment can be unpacked, assembled, and wired as specified. Some items are covered by separate instruction books, and the detailed installation procedures for these units will not be repeated in this manual. These books are:

BTF-20E1 FM Transmitter	IB-8027531
BTE-15A FM Exciter, BTS-1B Stereo Generator, and BTX-1B SCA Generator	IB-8027524

The location for the transmitter should include space for the coaxial coupler in addition to the harmonic filter and necessary coaxial transmission line. Also, space for immediate or future addition of optional items should not be overlooked in the initial planning.

The Installation Drawing (3474307) delineates the components of the overall system and should be used as a guide for installation. The items specified on this drawing, by MI number, are shipped separately and must be handled individually in the installation procedure.

Coaxial components (pre-cut transmission line, elbows, transmission line couplings) required for the nominal installation shown on Installation Drawing 3474307, but not necessarily required when a custom coaxial line arrangement is made, are supplied as MI-560704 (BTF-40E1 Coaxial Components). This item is optional, depending on station planning.

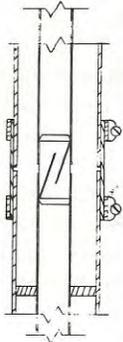
Certain coaxial components, normally required at all installations, are supplied as part of BTF-40E1 Installation Material, MI-560703.

UNPACKING

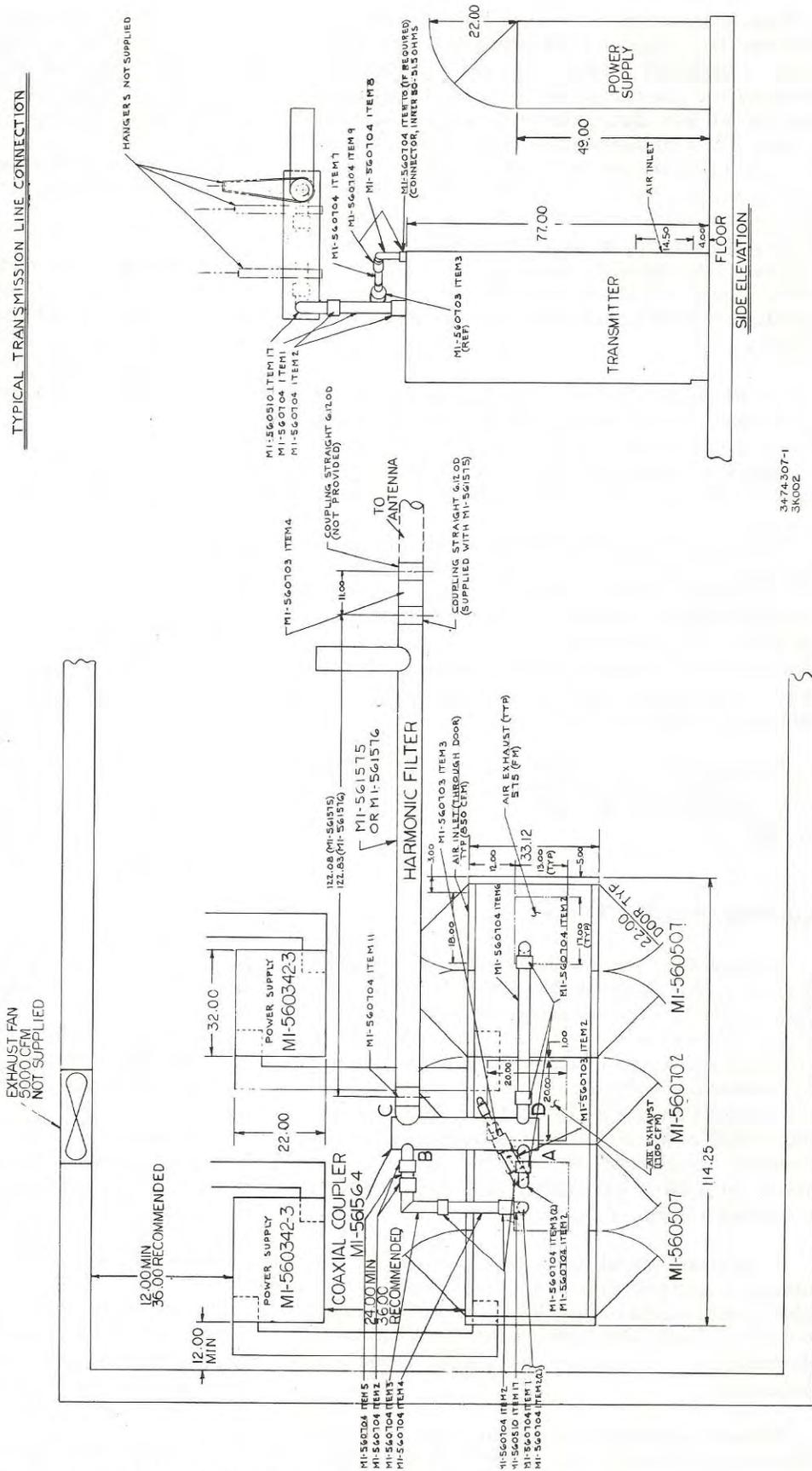
When the equipment is delivered, the carrier will present a shipping receipt for signature. This receipt should not be signed without first inspecting each container for visible damage and counting the number of containers for comparison with the quantities shown on the shipping papers. If visible damage is apparent or a shortage exists, a notation to that effect should be made on the shipping papers before signing. Then file the proper claim with the carrier.

The equipment should be carefully unpacked and inspected to make certain that no damage has been incurred during shipment. Any damage or shortages should be reported immediately to RCA and to the transportation company so that lost or damaged material can be recovered. Tubes should not be unpacked until all equipment is installed and all preliminary adjustments have been made.

An understanding of the overall shipping system will be of assistance in unpacking the equipment and locating items. Each RCA equipment is accompanied by a shipping voucher which lists the complete contents of the shipment by "master item" or "MI" numbers. This shipping voucher is usually packed in one of the smaller cardboard cartons, appropriately marked.



TYPICAL TRANSMISSION LINE CONNECTION



3474307-1
3K002

Figure 3. BTF-40E1 Typical Floor Plan

Some components are packed separately for safe shipment. Instructions for reinstalling these parts appear under ASSEMBLY, Items Removed for Shipment, following the instructions for fastening the equipment together. All such material carries a specific MI and item number. These MI sheets are essentially packing lists and are packed with the equipment. Where there are two or more boxes to a major unit, the box containing the MI sheet is identified by stenciling. Thus it is possible to identify the contents of each box and plan the overall uncrating systematically. All items listed on the MI sheets should be located before crates or boxes are destroyed, to avoid loss of small items overlooked during unpacking.

The MI sheets, as noted, are merely packing lists and are of value only in locating items for assembly. The MI Sheets should not be used for installation sequence nor for installation details. Refer to the appropriate drawings and the following notes for this information.

Due to continuing refinements in design, some of the information in this book may vary slightly with respect to information shown on drawings (such as installation drawings) shipped with the transmitter, but they will serve as an overall guide to the material in the transmitter. If the packing lists (MI's) are filed, they will provide an accurate, permanent record of the material supplied, for future reference.

The equipment may now be unpacked. Tubes should not be unpacked until required. The List of Equipment is numbered ES-560606 and is reproduced at the front of this book.

EQUIPMENT LAYOUT

A typical floor plan for the layout of the equipment is shown on Installation Drawing 3474307, figure 3. This drawing provides recommended minimum access clearances, dimensions for the equipment and required interconnections, and applicable transmission line coupling between all units. As shown on drawing 3474307, the Coaxial Coupler (MI-561564) and Harmonic Filter (MI-561575 or MI-561576) may be conveniently ceiling mounted, using Hangar and Fastener components, available as RCA MI-27700. Hangar and fastener items are not included as part of the transmitter.

A minimum clearance of 24 inches for the door opening is required at the front of the transmitter, and a similar space should be provided at the rear for access to transmitter components and circuits. The locations and dimensions of the air intake and exhaust openings are indicated.

Below-floor-level wire ducts are recommended for the interconnections and power wiring. If floor alterations cannot be made in an existing building a false floor may be built to provide protection and routing for cables, or

conduit may be run overhead to the transmitter wire duct at the top of the cabinet. If floor ducts are used, they should be laid out so that cables can leave the duct and enter (conduit) notches provided at both the top and bottom of the side panels.

Disconnect switches should be installed for such units as the transmitter room exhaust fan and other auxiliary items.

No material is provided for the antenna lighting circuit. If flashing tower lights are to be installed, the power for them should not be obtained from the same source that feeds the low-level input equipment. An individual power line from the main distribution panel to the tower lights is desirable.

TABLE 1. BTF-40E1 INSTALLATION DRAWINGS

Drawing	Description
ES-560606	List of Equipment
3474307	Installation Drawing
MI-560703	Installation Material
3476761	Schematic Diagram
MI-560704	Coaxial Components
MI-560515	Installation Material (BTF-20E1)
3476776	Wiring Diagram
3476753	Wiring Diagram, Relay Panel
3467834	Wiring Diagram, Exciter Switching Panel
3476762	Cable Assembly
8008009	Outline MI-561565 Harmonic Filter
8008008	Outline MI-561576 Harmonic Filter
8008045	Outline MI-561564 40kW Coaxial Coupler
8001400	Outline MI-561537 10kW Coaxial Coupler
MI-560507	Basic Transmitter (BTF-20E1)
3476712	Schematic Diagram (BTF-20E1)
3721159	Installation Instructions, Grid Modification

To insure up-to-date drawings for installation work, full-size prints as listed in table 1 are supplied with the equipment. The drawings in this instruction book should be used for general reference only.

The instructions in this book shall not supersede any applicable local code. Where these instructions conflict with a local code, the local code should be followed.

The room in which the transmitter is installed should be well ventilated and provided with an abundant supply of clean, dry air. The maximum ambient temperature for proper operation of the transmitter is 45° Centigrade. The station building facilities must provide sufficient air supply to the blower intake.

If any area in the transmitter room is to be air-conditioned, it is generally more economical to enclose the transmitter and to ventilate it with outside air, thus relieving an excessive burden from the air-conditioning equipment.

An exhaust fan with a minimum capacity of 5000 CFM should be used in the exhaust system. This fan capacity is based on one exhaust port at a remote point

in the operating room. This ventilation is for cooling the transmitter only. Additional cooling should be provided for the personnel area in the room. The exhaust fan must be able to circulate enough air to maintain the room temperature below 45°C (113°F).

If an air-exhaust hood and duct arrangement is to be used with the transmitter, it should be designed and assembled so that minimum back pressure is developed.

Also, any air-exhaust hood arrangement should be arranged such that heated exhaust air from the rf box assembly is routed directly into the exhaust ducts and is not permitted to be recirculated through the transmitter cool air intakes. The air-exhaust hood should be approximately 13" x 17" and located as shown in figure 3, BTF-20E1 Instruction Book, IB-8027531.

ASSEMBLY

Refer to the installation drawing (Dwg. Number 3474307) and perform the various assembly operations in the following suggested sequence:

1. During the following sequence, all items are described as viewed from the front, and the left-hand basic transmitter unit (MI-560507) is referred to as transmitter No. 1, while the right-hand basic transmitter is referred to as transmitter No. 2.

2. Place the left-hand basic transmitter (No. 1) in the desired location, taking care to situate it such that the conduit notches provided in the left side panel are accessible from floor wiring duct, if used.

3. Place the Combining Equipment Cabinet, MI-560702, at the right side of the basic transmitter No. 1 cabinet. The inter-rack wiring harness (Cable Assembly 3476762-501) is normally shipped as part of the combining equipment cabinet, with its connections to the two basic transmitters disconnected and tagged. Care should be taken not to damage this cable assembly during transmitter assembly. As each rack is installed, the proper cable portion should be dressed into the wire trough provided at the top rear of each rack.

4. Bolt the two racks together, using hardware provided as item 1 of Installation Material, MI-560703.

5. Place the No. 2 basic transmitter cabinet in place at the right of the combining equipment rack. Dress cable into wire trough as previously described.

6. Bolt the No. 2 basic transmitter cabinet to the combining equipment cabinet, using hardware supplied as item 1 of Installation Material, MI-560703.

7. Mount all Doors and Side Panels (MI-560373), if any have been previously removed.

8. The High-Voltage Power Supplies (MI-560342-3) may be located in any convenient place in the station,

preferably reasonably close to the incoming power line. This will reduce the amount of high current wiring that will be needed. Any desired station switch gear should be near the two power supply units.

9. After a location for the power supplies has been chosen, place the two high-voltage plate transformers (3T1) in the chosen positions and fasten them to the floor. Hardware or fasteners for this use are not supplied as part of the transmitter. The two power supply cabinets are then moved into position over the plate transformers. This is easily done by removing the lower rear and front sections of the power supply cabinets and sliding them into place over the transformers and then fasten the cabinets securely to the floor (hardware not supplied). Replace the lower rear and front sections of the power supply cabinets.

ITEMS REMOVED FOR SHIPMENT

In each individual BTF-20E1 several items are removed and shipped separately. These items include: 1L3, high-voltage filter reactor; 1Z7, directional coupler for remote power monitoring; one coupling, MI-27791-K-4A (used to mount 1Z7 in output transmission line); one transmission line elbow with monitor assembly and two adjustable clamps attached; and a length of shielded jacketed wire, used to connect the dc output of 1Z7 to transmitter circuitry.

The filter reactors should now be installed using BTF-20E1 rear view photograph (IB-8027531) for guidance in locating the units.

Lay the remaining items aside. Installation of these items is covered as part of the Coaxial Coupler (MI-561564) installation procedure.

COAXIAL COUPLER INSTALLATION

The following procedure is for a typical installation as shown on Installation Drawing 3474307. Refer to the Typical Floor Plan, figure 3 and to Coaxial Components, Installation, figure 24.

NOTE: Variations in the typical floor plan are not advisable if pre-cut Coaxial Components (MI-560704) are supplied. However, it is not mandatory that the harmonic filter be positioned exactly as shown.

Suspend the Coaxial Coupler, MI-561564, from the ceiling over the center control cabinet and position it according to the station layout.

1. Loosely install a Straight Coupling (MI-560704, item 2) on a 16 inch section of Transmission Line (MI-560704, item 1) and insert the Coupling Inner Conductor (part of MI-560704, item 2) in place. Install the assembly on the transmission line stub projecting from the top of transmitter No. 1 and clamp loosely.

2. In a similar manner, install a 90° (3-1/8 inch diameter) Miter Elbow (supplied as MI-560510, item 17) and one Straight Coupling (MI-560704, item 2), including the coupling inner conductor, on the line assembled in step 1. The long leg of the elbow should be pointing down and the short leg pointing to the rear of the transmitter.

3. Repeat steps 1 and 2 for transmitter No. 2. In this case the short leg of the elbow should point to the left (toward the coaxial coupler). Again, the required elbow is supplied as MI-560510, item 17.

4. Make a sub-assembly using one 17.4 inch section of Transmission Line (MI-560704, item 4), one Elbow (MI-560704, item 3), one 5.3 inch section of Transmission Line (MI-560704, item 5), and four Straight Couplings (MI-560704, item 2). When completed, this sub-assembly will connect the transmission line of step 2 with port B of the Coaxial Coupler, MI-561564. For the location of each item, refer to the typical floor plan, figure 3.

5. Using the 34.6 inch length of 3-1/8 inch diameter Coaxial Line (MI-560704, item 6) and two Straight Couplings (MI-560704, item 2), connect the elbow installed in step 3 to port D of the Coaxial Coupler, MI-561564.

6. If necessary, readjust the position of the coaxial coupler to relieve any mechanical strain on the transmission line joints.

7. Install one 3-1/8 inch diameter Elbow (MI-560704, item 3) with one Straight Coupling (MI-560704, item 2) on port A of the Coaxial Coupler. The long leg of the elbow should be pointing down.

8. Install one Elbow (MI-560704, item 3) with one Straight Coupling (MI-560704, item 2) on the elbow of step 7. The long leg of this elbow should point up. The short leg should point toward the reject load input located at the top rear of the combining equipment cabinet.

9. Make a sub-assembly consisting of a line section (Directional Coupler, MI-560703, item 2), a 3-1/8 inch diameter to 1-5/8 diameter Reducer Coupling (MI-560703, item 3) a 6.8 inch length of Transmission Line (1-5/8 diameter, MI-560704, item 7) and a 1-5/8 diameter 90° miter Elbow Coupling (connect the short leg of the 1-5/8 diameter elbow to the 6.8 inch length of line). The 1-5/8 diameter elbow is supplied as MI-560704, item 8. Use Straight Couplings (MI-560704 items 2 and 9) as required for assembly.

10. Install the sub-assembly of step 9 between the elbow of step 8 and the reject load input on the top of the center cabinet. Use special inner connector 50 to 51.5 ohms (MI-560704, item 10) at the reject load input at the top of the combining equipment cabinet. Check the inner conductors for proper placement before tightening the joints.

11. Insert the Line Section Element (MI-560703, item 2b) into the Line Section (MI-560703 item 2a) with the arrow pointing in the direction of the reject load input.

12. Install the Harmonic Filter (MI-561575 or MI-561576). First, mount the filter at the preferred location. A horizontal mounting position is recommended. Provide the necessary support from the ceiling to relieve strain on the connecting transmission line.

13. Connect port C, the output port, of the Coaxial Coupler (MI-561564) to the input port of the harmonic filter, using a 6-1/8 inch diameter Straight Coupling (MI-560704, item 11).

14. Install Combined Power Output Directional Coupler (6-1/8 inch diameter line section, MI-560703, item 4) at the output of the harmonic filter. A Transmission Line Coupling (MI-561579-4A) is supplied with the harmonic filter and may be used to make this connection.

15. Check all connections made to this point to ensure that they are properly made and tighten all coupling clamps. Dimples are provided on the inner surface of the outer sleeve and on the outer surface of the inner connector of the transmission line couplings, such as MI-27791-K-4A. These dimples automatically provide a 1/8 inch gap between transmission line sections.

16. If necessary, readjust the position of the coaxial coupler to relieve any mechanical strain on the joints of the transmission line. Check to ascertain that all coupling clamps are securely tightened.

EQUIPMENT WIRING

General

The equipment wiring consists of first providing an adequate ground system, then making the necessary transmitter cabinet and power supply cabinet connections, and finally, connections to any remote control equipment that may be used.

In order to increase the drive level to each driver amplifier stage, a modification kit (MI-560703-32) is normally installed at the factory. If insufficient driver grid current is experienced, the driver grid circuits in each BTF-20E1 should be checked. See figure 23.

NOTE: Prior to application of power, all connections should be checked for tightness. The high voltage and current present can damage transmitter components by arcing or heating at loose connections. A properly installed transmitter will be easier to set-up and maintain. The process of checking for tight connections provides the opportunity to familiarize the operator with the transmitter and also to double-check that the transmitter is properly assembled and wired.

Equipment Grounding

Great care should be taken to provide an adequate ground system for the BTF-40E1. Before power is applied to the equipment the following ground connections must be completed.

Connect each power supply cabinet to its mating transmitter cabinet using the 1-1/2 inch wide Copper Strap (item 7 of Installation Material, MI-560515). This connection should be made from ground No. 2 in the power supply cabinet (a stud mounted on the side of the cabinet below the rectifier mounting shelf) to a hole in one of the copper-flashed side channels in the main transmitter rack.

Connect each main transmitter cabinet to the station ground using 1-1/2 inch wide Copper Strap (item 7 of MI-560515). It is also advisable to connect each power supply cabinet to the station ground using 1-1/2 inch wide Copper Strap or equivalent.

To insure that all three front-line racks are at the same potential, straps should be connected from the combining equipment rack to each basic transmitter rack, MI-560507. Two straps are provided for this purpose (MI-560703, item 9). These straps should be connected at the top of the racks between adjacent portions of the wire trough which is continued from rack to rack. Holes are provided in each wire trough section for use in making these connections.

After the above connections have been completed, check each ground connection for continuity. If any soldered joints are involved, each should be tested for mechanical strength as well as continuity.

Interconnections Between Transmitter Cabinets and Power Supply Cabinets

Make the necessary connections between each transmitter cabinet and its power supply cabinet by referring to the BTF-20E1 schematic diagram and to table 2. Use item 4 of Installation Material, MI-560515, for all connections.

TABLE 2. TRANSMITTER-POWER SUPPLY INTERCONNECTIONS

(Connections to be made from each basic transmitter unit to its power supply)

From Power Supply Terminal	To Transmitter Terminal
2TB1-1	1TB1-1
2TB1-2	1TB1-2
2TB1-3	1TB1-3
2TB1-4	1TB1-4
2TB1-5	1TB1-5
2TB1-6	1TB1-6
2TB1-7	1TB1-7
2TB1-8	1TB1-8
2TB1-9	1TB1-9

TABLE 3. AC POWER AND CONTROL CONNECTIONS

In Combining Equipment Cabinet, Connect Terminal	To Terminal	In Basic Transmitter No. *	Wire No. Cable Dwg. 3476801	Supplementary Information
4TB1-1	1TB2-27	1	1	Pressure Type Connections, Tighten Hardware Securely
4TB1-2	1TB2-27	2	2	
4TB1-3	1TB2-30	1	3	
4TB1-4	1TB2-24	1	4	
4TB1-5	1TB2-25	1	5	
4TB1-6	1TB2-26	1	6	
4TB1-7	1TB2-30	2	7	
4TB1-8	1TB2-24	2	8	
4TB1-9	1TB2-25	2	9	
4TB1-10	1TB2-26	2	10	
4TB1-11	1TB2-23	1	11	
4TB1-12	1TB2-21	1	12	
4TB1-13	1TB2-22	1	13	
4TB1-14	1TB2-23	2	14	
4TB1-15	1TB2-21	2	15	
4TB1-16	1TB2-22	2	16	
4TB1-17	To 230 Volt Single Phase Line Independent of Either Basic Transmitter		Combining Equipment Control Circuit Power Input Leads	
4TB1-18				
4TB1-19	1K1-6	1	17	Refer to Wiring Diagram, Control Panel (BTF-20E1 Instruction Book) Solder to Relay Terminals Designated
4TB1-20	1K1-7	1	18	
4TB1-21	1K1-6	2	19	
4TB1-22	1K1-7	2	20	

* Front view: Basic transmitter No. 1 on left
Basic transmitter No. 2 on right

TABLE 3. AC POWER AND CONTROL CONNECTIONS (Cont.)

In Combining Equipment Cabinet, Connect Terminal	To Terminal	In Basic Transmitter No. *	Wire No. Cable Dwg. 3476801	Supplementary Information
4TB101-5	1TB2-17	2	21	Pressure Type Connections, Tighten Hardware Securely
4TB101-6	1TB2-16	2	22	
4TB101-7	1TB2-17	1	23	
4TB101-8	1TB2-16	1	24	
4TB101-9	1TB6-1	1	25	
4TB101-10	1TB6-2	1	26	
4TB101-11	1TB6-1	2	27	
4TB101-12	1TB6-2	2	28	
4TB101-1	1TB6-19	1	50	
4TB101-2	1TB6-22	1	51	
4TB101-3	1TB6-19	2	52	
4TB101-4	1TB6-22	2	53	
4TB102-13 4TB102-14 4TB102-15	REMOTE CONTROL (EXCITER STATUS)			
4TB102-16	1TB6-10	1	54	
4TB102-16	1TB6-10	2	59	
4TB102-16 4TB102-17 4TB102-18	REMOTE CONTROL (EXCITER SWITCHING)			
4TB102-19	1TB6-9	1	55	
4TB102-20	1TB6-9	2	56	

* Front view: Basic transmitter No. 1 on left
Basic transmitter No. 2 on right

TABLE 4. AUDIO SIGNAL INTERCONNECTIONS

In Combining Equipment Cabinet Connect	To	And In	Connect	To	Supplementary Information
Plug 4P128	4J105	Transmitter No. 1	Wire 37 Red Wire 37 Blk	4TB1-24 4TB1-23	Ground Shield
Plug 4P129	4J106	Combining Equipment Cabinet (MI-560702)	Wire 39 Red Wire 39 Blk	4TB1-23 4TB1-24	
Plug 4P130	4J107	Transmitter No. 2	Wire 38 Red Wire 38 Blk	4TB1-24 4TB1-23	
Plug 4P152	4J118	Transmitter No. 1	Wire 40 Red Wire 40 Blk	4TB1-20 4TB1-19	
Plug 4P153	4J119	Combining Equipment Cabinet (MI-560702)	Wire 44 Red Wire 44 Blk	4TB1-27 4TB1-28	
Plug 4P154	4J120	Transmitter No. 2	Wire 47 Red Wire 47 Blk	4TB1-20 4TB1-19	
Plug 4P162	4J121	Transmitter No. 1	Wire 42 Red Wire 42 Blk	4TB1-22 4TB1-21	
Plug 4P163	4J122	Combining Equipment Cabinet (MI-560702)	Wire 43 Red Wire 43 Blk	4TB1-25 4TB1-26	
Plug 4P149	4J123	Transmitter No. 2	Wire 46 Red Wire 46 Blk	4TB1-22 4TB1-21	
Plug 4P157	4J124	Transmitter No. 1	Wire 41 Red Wire 41 Blk	4TB1-18 4TB1-17	
Plug 4P158	4J125	Combining Equipment Cabinet (MI-560702)	Wire 45 Red Wire 45 Blk	4TB1-29 4TB1-30	
Plug 4P159	4J126	Transmitter No. 2	Wire 48 Red Wire 48 Blk	4TB1-18 4TB1-17	

TABLE 5. AUDIO INPUT CONNECTIONS

In Combining Equipment Cabinet Connect	To Terminals	Supplementary Information
Left Audio Input	4TB1-23 4TB1-24	Use double conductor shielded cable such as ALPHA Wire Corporation Part No. 1736
Right Audio Input	4TB1-25 4TB1-26	If Used
SCA Channel 1 Input (Audio)	4TB1-27 4TB1-28	If Used
SCA Channel 2 Input (Audio)	4TB1-29 4TB1-30	If Used

Connect jack 2J2 in each power supply cabinet to 1TB1-101, the high-voltage terminal in the upper right hand corner of transmitter cabinet (viewed from the rear), using item 6 of MI-560515.

NOTE: Make the above connection between transmitter No. 1 and power supply No. 1, then between transmitter No. 2 and power supply No. 2. Do not cross-connect.

Interconnections Between Combining Equipment Cabinet and Individual Transmitters

The required connections between the two individual BTF-20E1 transmitters and the combining equipment contained in the center rack (MI-560702) are supplied as a Prefabricated Cable Assembly (RCA drawing 3476762-501). The connections made by this cable fall into two main groups:

1. AC power or control circuit wiring
2. Signal (audio or low-level rf) leads

This cable is normally shipped as part of (and connected to) the combining equipment cabinet, MI560702. The connections to the two basic transmitters are shipped disconnected but tagged as to proper destination. Refer to table 2 while reconnecting these leads. If necessary, refer to Cable Drawing 3476762-501. After all connections have been made and checked for accuracy, the new harness should be neatly laced to the existing wiring in each rack.

Connections to Remote Control Equipment and Accessories

If the BTF-40E1 is remote controlled it will be necessary to incorporate additional relays so that control sequences in the two BTF-20E1 control circuits will be correlated. The main consideration is that high voltage should be applied (or removed) simultaneously (or essentially simultaneously) to the two units.

To implement ganged operation of transmitters, the circuitry presented in figure 4 may be used. Using this method, relay contacts are connected momentarily in parallel with TRANSMITTER OFF/ON, HIGH VOLTAGE/HIGH VOLTAGE OFF and OVERLOAD RESET switch terminals.

In the event of a VSWR overload in the combined output line, holding relay 4K3 will keep VSWR OVERLOAD light 4DS4A in the combining equipment cabinet lighted until OVERLOAD RESET pushbutton 4S3 is depressed. This tally light will not be operable in remote operation unless the following procedure is followed before leaving transmitter site: (1) Depress TRANSMITTER ON pushbutton 4S2 in combining equipment cabinet, (2) Depress TRANSMITTER OFF pushbutton 1S8 in each BTF-20E1.

Connections of Primary Power (240/208 VAC) to Power Supply Cabinets

Primary ac power (240/208 volts) wiring may now be connected to the input terminals (studs) 1, 2, and 3 of main circuit breakers 2S1 in each transmitter power supply. High current wire AWG #2/0 (similar to MI-560515, item 5) should be used for these connections (wire for this purpose is not supplied). Any wiring to switchgear external to the transmitter may be made at this time.

RF MONITOR ASSEMBLY

An rf Monitor Assembly (sampling probe) is supplied as MI-560703 item 7, for use in the transmitter combined output line. In order to mount the monitoring assembly, it will be necessary to drill a single 0.72 diameter hole in the outer conductor of the output transmission line (at a point beyond the harmonic filter). Remove all drill shavings from the coaxial line.

To install the rf Monitor Assembly, position the rf Pickup Saddle Assembly over the hole in the output transmission line so that the rf pickup coil enters the hole without touching the sides. Position and secure the saddle clamps around the transmission line.

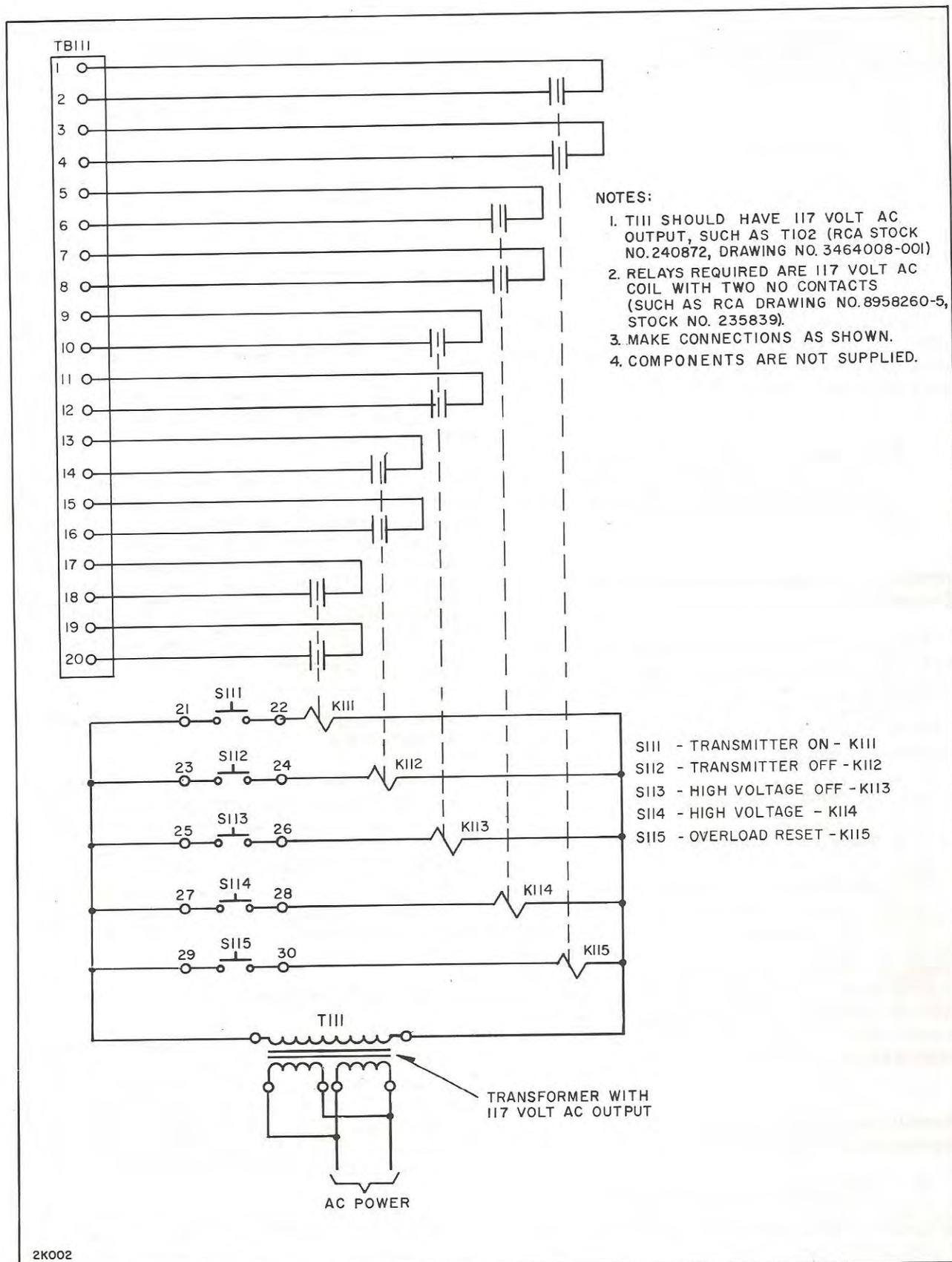


Figure 4. Remote Operation Control Circuit for BTF-40E1, Schematic Diagram

TABLE 6. REMOTE CONTROL OPERATION CONNECTIONS

Remote Control Function	Connect Momentary NO contact to	Connect	Connect
Transmitter ON	4TB111-21, 4TB111-22	4TB111-19 to 4TB1-11 4TB111-20 to 4TB1-13	4TB111-17 to 4TB1-14 4TB111-18 to 4TB1-16
Transmitter OFF	4TB111-23, 4TB111-24	4TB111-15 to 4TB1-11 4TB111-16 to 4TB1-12	4TB111-13 to 4TB1-14 4TB111-14 to 4TB1-15
✓ High Voltage OFF	4TB111-25, 4TB111-26	4TB111-11 to 4TB1-4 4TB111-12 to 4TB1-5	4TB111-9 to 4TB1-8 4TB111-10 to 4TB1-9
✓ High Voltage <i>ON</i>	4TB111-27, 4TB111-28	4TB111-7 to 4TB1-3 4TB111-8 to 4TB1-6	4TB111-5 to 4TB1-7 4TB111-6 to 4TB1-10
✓ Overload Reset	4TB111-29, 4TB111-30	4TB111-3 to 4TB1-1 4TB111-4 to 4TB1-4	4TB111-1 to 4TB1-2 4TB111-2 to 4TB1-8
Power output of each transmitter is adjusted by connections to (in each transmitter)			
Power Output	Connect Momentary NO contact to		
Raise	1TB2-24, 1TB1-15		
Lower	1TB2-24, 1TB1-16		
Exciter Status	Remote Exciter Switching		
Exciter 1 On	Connect Momentary NO contact to		
Exciter 2 On	4TB102-16 (common), 4TB102-17 4TB102-16 (common), 4TB102-18		
	Remote Metering		
Remote Metering Function	Terminals	Indication	
Exciter 1 On	4TB102-13 (common -), 4TB102-14 (+)	1 volt dc	
Exciter 2 On	4TB102-13 (common -), 4TB102-15 (+)	1 volt dc	
Combined Power Output	4TB1-35 (-), 4TB1-36 (+) (remove jumper)	(0-200 uA)	
In addition, remote metering for the following functions is provided as part of the individual BTF-20E1 transmitters:			
Remote Metering Function	Terminals (in each transmitter)		
PA Plate Voltage	1TB1-10 (+), 1TB1-6 (-)		
PA Plate Current	1TB1-6 (+), 1TB1-9 (-)		
*Individual Power Output	1TB1-12 (+), 1TB1-11 (-) (remove jumper)		

* Remote power monitoring directional coupler 1Z7 is supplied with each BTF-20E1 transmitter (part of MI-560510). Since remote operation is not desired in all cases, 1Z7 is not shown on figure 3 (BTF-40E1 Typical Floor Plan) and the pre-cut coaxial line (MI-560704) supplied with the transmitter has no provision for mounting the couplers. If this monitoring function is desired, remove 11-1/4 inches of transmission line at the desired location (in each 20 kW transmitter output line) and install the 1Z7 couplers provided.

NOTE: The rf pickup coil may be positioned for desired signal pickup by removing the four screws which hold the coaxial connection in place, then rotate it in either direction for maximum pickup (consistent with alignment of mounting holes). If necessary, the pickup coil may be altered by removing or adding turns to obtain the required signal.

REJECT LOAD

Remove the red hex plug from each reject load and retain it for further use. Install in its place the pressure

relief valve supplied with the reject loads. The Bird Electronics Corporation coaxial resistor (reject load) Model No. 8895 is capable of dissipating 5000 watts with the blower in operation.

PHASING AC INPUTS TO THE EXCITER SWITCHING RELAY PANEL, MI-560700

The 240/208 volt ac inputs must be phased correctly for proper operation. The following checks will ensure proper phasing. AC power must be applied to the transmitter in the following sequence or K106 may be damaged.

1. Turn off main power switch 2S1 on both No. 1 and No. 2 transmitters.
2. Apply 240 volts power to the No. 1 transmitter, by closing main power switch 2S1.
3. Apply 240 volts power to the No. 2 transmitter.
4. Locate the exciter switching relay panel at the bottom of the combining equipment cabinet. This panel is identified by its twelve audio jacks, 4 rf jacks (4J101 through 4J104) and the rectangular jack (4J114).
5. With a meter capable of measuring 250 Vac, carefully measure the voltage between terminals 5 and 7 of 4TB101. Also carefully measure the voltage between terminals 6 and 8.
6. If both measurements show no voltage, then the phasing is correct. Proceed to step 12.

7. Incorrect phasing will result in approximately 240 Vac being measured in either or both measurements of step 5. Steps 8 through 11 will correct improper phasing.

8. Remove 240 Vac power from the No. 2 transmitter.

9. Locate terminal board 1TB2 in the No. 2 transmitter.

10. Interchange the 240 Vac mains connected to terminals 1 and 2 of 1TB2. Then, interchange the 240 Vac mains connected to terminals 2 and 3 of 1TB2.

11. Repeat Steps 5 through 10 as required (until no voltage is measured in Step 5).

12. Refer to BTF-20E1 instruction book, and check the blower rotation in both transmitters. This completes phasing checks for the exciter switching relay panel.

TUNING

GENERAL

Tuning of the BTF-40E1 transmitter is dependent upon the efficient combination of the outputs from two BTF-20E1 transmitters. Therefore, it is necessary to perform certain preliminary procedures on each BTF-20E1 transmitter as follows:

1. Control circuit check of individual (BTF-20E1) transmitters.
2. Complete tuneup of rf circuits, including operation at rated power output, into a dummy load.

Circuit descriptions and tuning procedures for the BTE-15A Exciter, BTS-1B Stereo Generator and BTX-1B SCA Generator are included in IB-8027524.

The control circuit checkout and tuneup procedure for the BTF-20E1 transmitter is included in IB-8027531.

WARNING

Before applying power, remove the red hex plugs from the top of the coaxial load resistors and install the pressure relief vent. The hex plugs should be retained.

The BTF-40E1 transmitter is basically two BTF-20E1 20 kW FM transmitters combined to give a total output capability of 40 kW at any frequency between 88 and 108 MHz. All additional circuitry is contained in a separate combining equipment cabinet which is located between the two transmitters. The outputs are combined in a coaxial coupler usually located immediately above the combining equipment cabinet. The coupler acts in such a way that should one transmitter fail, a reduced

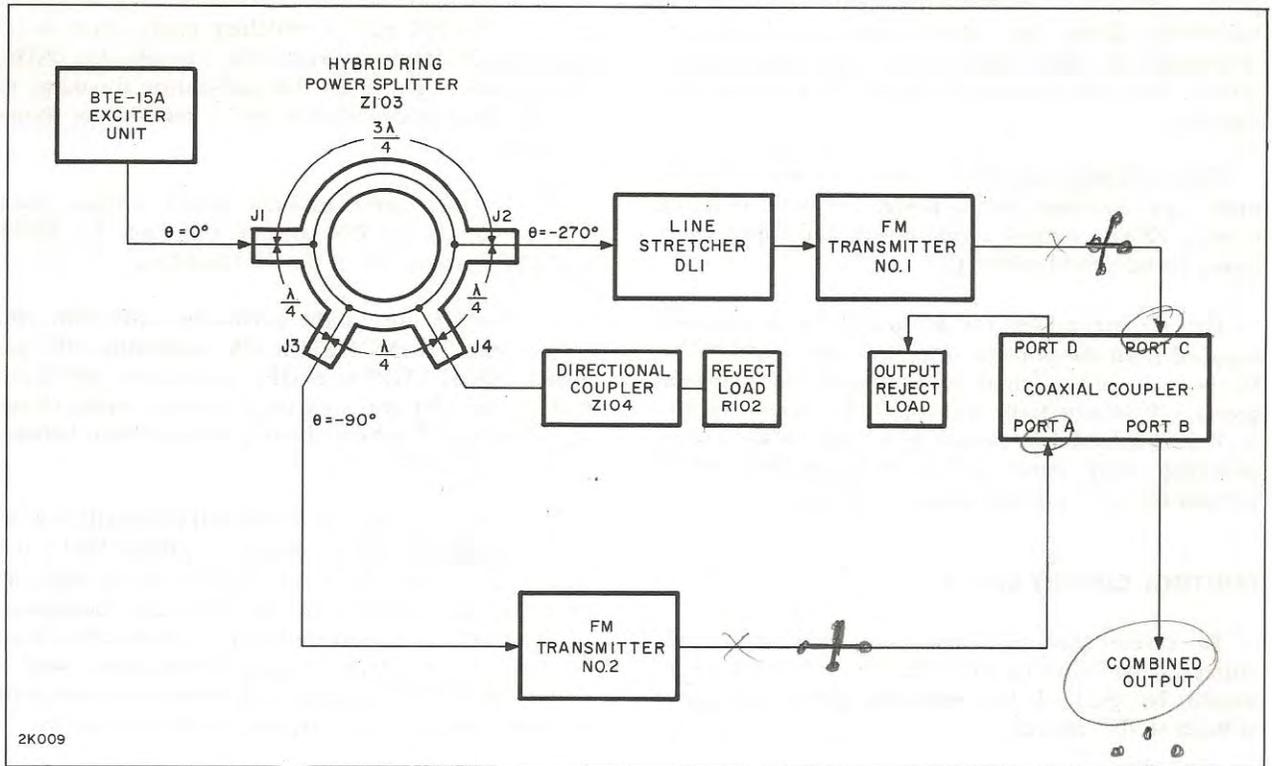
power output (25%) is fed to the antenna without interruption of the signal. In addition, a protective unit is included to shut down both transmitters in the event of a sustained high VSWR in the combined output line.

The two 20 kW outputs are fed to opposite input ports of the four port coaxial coupler. The two input signals (to the coupler) must be identical in frequency, but phase displaced by 90° (one quarter wavelength). The output port feeds the combined output to the antenna via the harmonic filter. The fourth port feeds reject power into two oil immersed air cooled loads situated in the combining equipment rack. Under normal operating conditions, reject power is near zero. Should an imbalance exist between the two transmitters, reject power will rise. The maximum reject power would be 10 kW with one transmitter delivering no power and the other delivering 20 kW.

Since the rf output of both transmitters must be of identical frequency, the rf inputs are derived from a common exciter unit. The operational exciter may be in either transmitter, selectable locally or remotely. The selected exciter feeds rf into a power splitter providing two identical outputs, one fed to each transmitter.

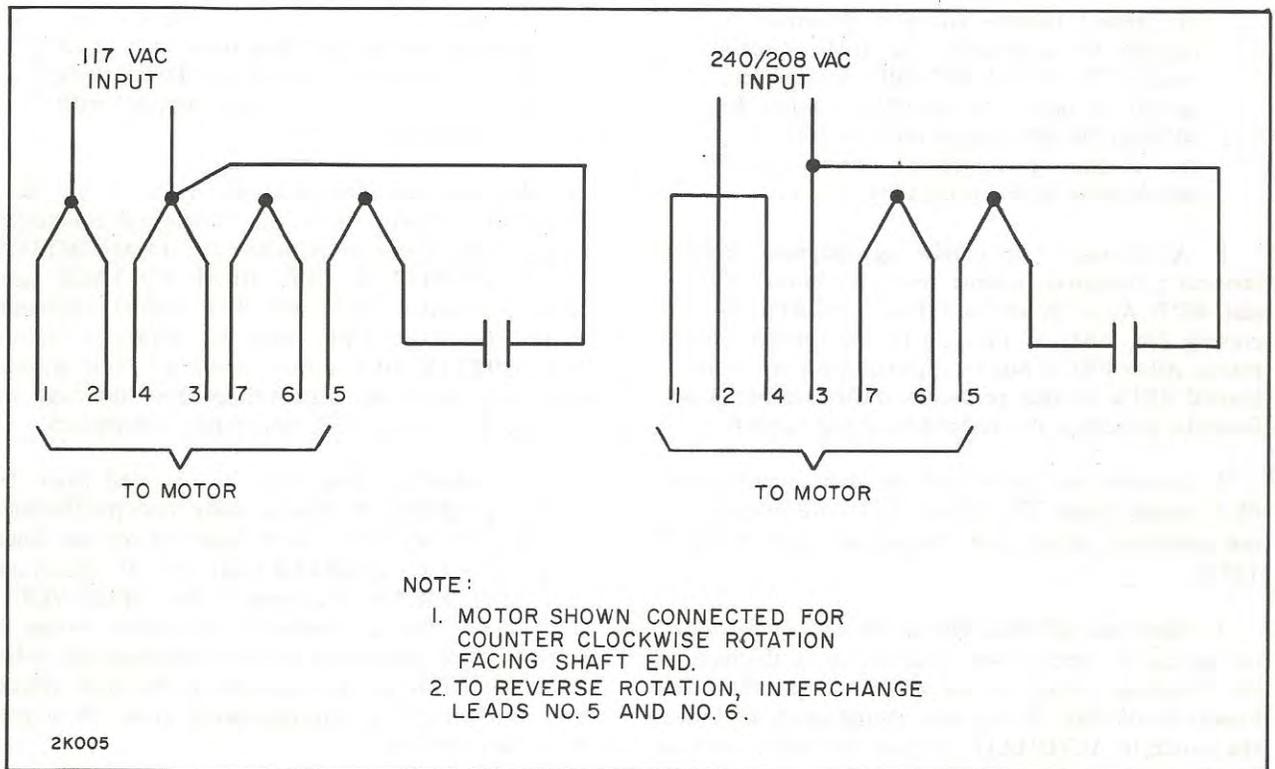
If the typical installation delineated on Installation Drawing 3474307 is made, the electrical lengths of the feed lines between the transmitter outputs and the inputs to the coaxial coupler are made equal. The 90° phase displacement is achieved in the cabling between the (input) power splitter and the transmitter rf outputs.

The cable to transmitter No. 1 is made one quarter wavelength longer than the cable to transmitter No. 2. A variable delay line is included in the cable to transmitter No. 1 to permit adjustment of the phase displacement. The delay line is normally adjusted for minimum reject



2K009

Figure 5. BTF-40E1 Transmitter, Functional Diagram



2K005

Figure 6. Combining Cabinet Ventilation Motor, 4B1, Wiring Connections

power. The match between the splitter and the two transmitter driver stage input circuits is checked by observing the reject power from the hybrid power splitter. The reject indication should be near zero. See figure 5.

The combining equipment cabinet provides for the metering of combined output power, combined reflected power, VSWR, output reject power and input reject power (from hybrid splitter).

The 60 Hz power for both exciters is normally supplied from the primary circuits of transmitter No. 1. In the event of the failure of transmitter No. 1, exciter power will automatically be supplied by transmitter No. 2. This is achieved by means of a relay on the exciter switching relay panel, which is deenergized should transmitter No. 1 primary power be removed.

CONTROL CIRCUIT CHECK

To ensure that all connections have been made correctly, the following BTF-40E1 control circuit checks should be made before applying plate and screen voltages to the transmitter.

WARNING

To prevent possible injury to personnel or damage to equipment, the MAIN circuit breaker 2S1 of both BTF-20E1 transmitters should be turned to the OFF position. In addition, be sure that no power is applied to the combining equipment cabinet until called for in the following steps.

1. At the rear of the combining equipment cabinet, connect a temporary jumper across the blower thermostat, 4S10. Apply power to 4TB1-17 and 4TB1-18. The cooling fan, 4B1, at the top of the cabinet, should rotate. Allow 4B1 to run for approximately ten minutes. Should 4B1's internal protective device remove power from the fan, check the motor wiring. See figure 6.

2. Remove the power and the short circuit across 4S10. Apply power. The thermostat should be open (fan not operating) unless room temperature is in excess of 128°F.

3. Place the AUTOMATIC/MANUAL switch located on the upper reject power load resistor in the back of the combiner cabinet in the MANUAL position. The blower in the base of the unit should operate. Return the switch to AUTOMATIC. Repeat the same procedure for the lower reject load resistor.

4. With power removed, check that all cables are in place on the back of the FM exciter switching relay panel.

5. Apply power to the combining equipment cabinet. On the FM exciter switching panel, place switch 4S103 to ON. Depress exciter No. 1 pushbutton 4S101. The indicator light under this pushbutton should go on and the light under exciter No. 2 pushbutton should extinguish.

6. On the meter calibrate panel, switch power breaker 4S9 to the ON position and place the VSWR PROTECT switch 4S8 in the OUT position.

7. Near the top of the combining equipment cabinet, depress TRANSMITTER ON pushbutton 4S2 and depress HIGH VOLTAGE OFF pushbutton 4S5. Relay 4K1 on the relay switching panel should operate, closing its contacts. 115 volts ac should now be present between 4J1-11 and 4T1-X1.

8. Remove ac power. TRANSMITTER OFF switch 4S1, TRANSMITTER ON switch 4S2, HIGH VOLTAGE OFF switch 4S5, HIGH VOLTAGE switch 4S6, and OVERLOAD RESET switch 4S3 are momentary switches used in conjunction with latching relays. These switches may be checked for proper operation (with ac power removed) by making continuity checks across the pertinent terminals and depressing the pushbuttons, in turn.

CAUTION

Remove the red hex plug from each reject load and retain for further use. Install in its place the pressure relief vent supplied with each reject load.

Under normal circumstances, both transmitters should be operated from the combining equipment cabinet using the four pushbuttons: TRANSMITTER ON, TRANSMITTER OFF, HIGH VOLTAGE, and HIGH VOLTAGE OFF. For four button operation HIGH VOLTAGE OFF must be depressed before TRANSMITTER OFF during shutdown. This ensures that during switch-on, plate voltage does not come on until the HIGH VOLTAGE pushbutton is depressed.

The transmitters may both be operated from the combining equipment cabinet using two pushbuttons only. With this operation, the transmitters are shut down by operating TRANSMITTER OFF only. To switch on, TRANSMITTER ON is depressed. The "HIGH VOLTAGE" circuit has a "memory" and plate voltage is applied to each transmitter once its individual time delay has elapsed. Due to the tolerance in the time delays, both transmitters do not necessarily come on at precisely the same time.

It is possible to operate either BTF-20E1 transmitter individually while repairs are being made on the other. This can be done by depressing the TRANSMITTER OFF pushbutton, 1S8, on the transmitter to be repaired.

CAUTION

Do not attempt repairs on components of either PA rf unit while the other transmitter is in operation. There may be sufficient rf feedthrough by way of the output coaxial coupler to make repairs of this type dangerous.

After repairs have been completed, except in those cases where the repairs were of a minor nature, it will be necessary to reduce the power output of the operating transmitter to 4 kW and depress the POWER LOWER pushbutton until powerstat 1T5 reaches the end of its travel on the repaired transmitter before restoring the plate power. Plate power may then be applied and power output and phase adjustments performed as follows.

COMBINED OPERATION

The next series of adjustments require that each transmitter has been individually tuned and checked. Each transmitter should have been adjusted for optimum performance into a dummy load. It now remains to combine them into the coaxial coupler and adjust transmitter phasing.

CAUTION

No traces of instability can be tolerated in the combined operation used, since the phase relationship between transmitters must be maintained. For this reason, optimum neutralization of each transmitter should be performed before combined operation is attempted. Refer to IB8027531 for neutralization procedure.

1. On the combining equipment cabinet depress TRANSMITTER ON pushbutton 4S2. Both transmitters should energize. Depress the HIGH VOLTAGE OFF pushbutton 4S5. Depress the TRANSMITTER OFF pushbutton 4S1. Both transmitters should deenergize (except for the blowers which have a time delay). The blower in each transmitter should run for approximately two minutes and then shut off.

2. In each transmitter, inductor 1L101 should be a 5-1/4 turn coil on a slug tuned form, with taps. The position of the tap is normally selected during factory tuning procedures and there will typically be two to three turns in use.

It is necessary to check the tuning of the driver grid

circuits, mainly the input match, because of the installation of Driver Stage Modification Kit, 560307-32.

3. Perform the following adjustments on the driver grid circuit of the No. 1 transmitter, with the exciter in use set for maximum power output using RF POWER ADJUST control R101:

a. The BTE-15A includes an ac power line circuit breaker/switch. This circuit breaker is located near the top of the exciter, inside the exciter main frame. Open the exciter power supply access door on each exciter and set the breaker/switch to the ON position.

b. Set the RF OUTPUT switch on each BTE-15A to the ON position.

c. Depress TRANSMITTER ON pushbutton 4S2 and HIGH VOLTAGE OFF pushbutton 4S5 on the combining equipment cabinet meter panel. Note that due to the use of exciter relay K101, there will be no exciter power output unless the TRANSMITTER ON pushbutton is depressed. *Check that on both transmitters the plate supply is deenergized.*

4. Allow time for exciters to reach a stable operating temperature and check drive to both transmitters.

5. Rotate the driver input loading capacitor 1C101 to its midposition. Adjust driver input tuning variable inductor 1L101 for a maximum reading on MULTIMETER 1M2 with MULTIMETER switch 1S2 in the DRIVER IG position. If no indication of resonance is obtained, the position of the tap on 1L101 should be changed.

6. Set the EXCITER MULTIMETER switch to the EXTERNAL METERING position. With this setting, the indication on exciter meter M101 is a measure of reflected energy in the coaxial line between exciter output and transmitter input jack 1J101. Note the reading on M101. The VSWR in this line should now be minimized by using the following procedure:

a. Make a small change in the setting of 1C101 in the direction of less capacitance.

b. Reset 1L101 for maximum driver grid current. If the reflected energy indication is less than the initial value, and there is no significant change in grid current, this procedure should be repeated until the VSWR is optimized. If the reflected energy indication is higher than the initial value, adjust 1C101 in the direction of more capacitance and proceed as described above. If necessary, use a different number of turns on inductor 1L101. The driver grid current should be approximately 2-3 mA with the RF POWER ADJUST control fully clockwise.

7. Repeat steps 3 through 6 for the No. 2 transmitter.

8. On the combining equipment cabinet meter calibrate panel, set VSWR PROTECTION switch 4S8 to the OUT position.

On each transmitter meter panel, set REFLECTOMETER switch 1S3 to the DISABLE position to prevent protection circuit operation during tuning procedures.

9. On transmitter No. 1 depress POWER LOWER pushbutton 1S12 until powerstat 1T5 reaches the end of its travel.

10. On transmitter No. 1 check to ascertain that REFLECTOMETER switch 1S3 is set to the DISABLE position.

11. On transmitter No. 1 depress PLATE ON pushbutton 1S9. Depress POWER RAISE pushbutton 1S11 to bring power up to 20% (4 kW) as read on the REFLECTOMETER (1M5).

12. On the combining equipment cabinet observe meter 4M1, REJECT POWER. This should read approximately 2 kW. Observe POWER OUTPUT meter 4M3 with REFLECTOMETER switch 4S7 in the NORMAL POWER CAL position. This should read approximately 5%. If necessary, adjust POWER CAL control to obtain this reading.

13. On transmitter No. 1 note the indication on REFLECTED POWER meter 1M7. The reading should be near zero.

14. On transmitter No. 2 repeat steps 9, 10 and 11.

15. With transmitters 1 and 2 each delivering 4 kW observe REJECT POWER meter 4M1. If the relative phase at the outputs of the two BTF-20E1 transmitters is close to the desired value (90°), the indication should be lower than that observed in step 12 above. Also, the reading on 4M3 (POWER OUTPUT) will be higher than noted in step 12. Make a slight adjustment in the output power of one transmitter to give a minimum reading of REJECT POWER.

If the phase is nearly reversed from the desired relationship, reject power will approach twice the value observed in step 12, and power output from the coaxial coupler (POWER OUTPUT meter 4M3) will be low.

16. Now adjust line stretcher 4DL1 for optimum phasing as follows: Slacken the large knob at the center of the combining equipment cabinet by rotating counterclockwise 1/2 turn. Carefully move slider up and then down in slot, observing the REJECT POWER meter indication. Adjust positioning for minimum reject power. It should be possible to reduce reject power to a very low value, near zero.

WARNING

A minimum *must* be achieved before pro-

ceeding further. Failure to reach a minimum indicates that the transmitters are not correctly phased. Note also that REJECT POWER should never exceed 10 kW under any conditions. The reject power loads are rated for 10 kW total dissipation, with load cooling fans in operation.

If, for any reason, the previous procedure will not yield a suitably low reject power, it will be necessary to make a coarse phase adjustment before making the optimizing setting described above. To do this (with transmitter power off) add a short (1/8 to 1/4 wave length) length of coaxial line in one of the two driver stage feedlines as follows:

a. If the phase is found to be initially such that 4DL1 tends toward its maximum length, the added line should be put in series with 4DL1.

b. If phase appears more nearly optimum with 4DL1 set at minimum length, the added line should be installed in the feedline to transmitter No. 2.

c. The preceding adjustment of line stretcher 4DL1 should then be carried out. If necessary, step 16 should be repeated until optimum phasing is realized with 4DL1 set in the middle third of its travel.

17. Check the driver stage input match on each transmitter. If the match has changed appreciably, repeat steps 4, 5, 6, 7 and 16.

18. When step 16 has been satisfactorily completed, increase the output of each transmitter to 50% (10 kW). The POWER OUTPUT indication should rise to approximately 50%, reject power should remain low. REFLECTED POWER meter 4M2 should read near zero.

19. On transmitter No. 1 depress PLATE OFF pushbutton 1S10. POWER OUTPUT meter 4M3 should drop to an indication of approximately 12%. REJECT POWER should be 5 kW. Depress PLATE ON pushbutton 1S9 to restore original condition.

20. Repeat step 19 for transmitter No. 2.

21. Increase output power of each transmitter to 100% (20 kW). Combined output power should now be approximately 100% (40 kW) and REJECT POWER should remain near zero.

22. On each transmitter in turn carefully make fine adjustments of PA OUTPUT LOADING and PA PLATE TUNING for maximum efficiency as described in the BTF-20E1 tuneup instructions. Only minor adjustments should be made at this point since all the transmitter tuning controls will also change the phasing relationship established in step 16.

23. Make a slight adjustment in the output power of

one transmitter to give a minimum reading of REJECT POWER.

24. Make a final adjustment of the line stretcher 4DL1 for a minimum reject power, which should be in the order of 50-100 watts. Tighten moving slider of line stretcher by rotating line stretcher control knob clockwise.

25. With combining equipment cabinet REFLECTOMETER switch 4S7 in the NORMAL POWER CAL position, adjust POWER CAL control 4R5 for a reading of 100% on 4M3.

26. With REFLECTOMETER SWITCH 4S7 in the REFLECTED POWER CAL POSITION, adjust REFLECTED POWER CAL control 4R6 for 100% reading on 4M2. Set 4S7 to the NORMAL POWER CAL POSITION and observe VSWR indication on 4M2. This indication is the approximate VSWR in the combined output line to the dummy load or antenna.

27. If remote power monitoring is to be used, turn REFLECTOMETER SWITCH 4S7 to the REMOTE POWER CAL position and adjust REMOTE POWER CAL CONTROL 4R7 for 100% on remote meter. Return to NORMAL POWER CAL position.

NOTE: Although remote power monitoring of the individual BTF-20E1 transmitters is not shown on Installation Drawing 3474307, since individual power monitoring is not required, directional couplers (and accessory items) for this function are included with each BTF-20E1 (MI-560510 items 22, 23, 18). If desired, this function may also be utilized by inserting the directional couplers in each BTF-20E1 output line.

28. The following procedure may be used to check for proper operation of the combined output line VSWR protection circuitry:

a. With the transmitter operating normally, at the desired power output, note the indication on 4M2 (REFLECTED POWER). If the indication is appreciable (VSWR indication of 1.3 or higher), the circuitry may be checked by simply moving the set-point on meter 4M2 to progressively lower scale positions. When the set-point pointer reaches the same position as the VSWR pointer, the normal transmitter overload sequence should be initiated. Tripping should reoccur after each (manual) resetting, until the set-point is readjusted to a value higher than the VSWR indication.

b. If the VSWR indication is less than 1.3, the procedure described may still be used by varying the zero set adjustment on 4M2 for a higher meter reading.

c. After completion of the test, 4M2 should be re-zeroed (with transmitter power off), and the set-point pointer reset to the desired value.

CAUTION

It is recommended that the protection circuitry (optical meter-relays) be checked periodically (weekly) to be certain the protection is operative. Vary the set point adjustment on each optical meter-relay to induce an overload; then reset to normal setting.

29. Operate combining equipment cabinet HIGH VOLTAGE OFF pushbutton 4S5 to remove plate voltage from both transmitters. Operate Combiner Rack pushbutton 4S6 HIGH VOLTAGE to restore plate voltage. This completes the initial checkout for combined operation. Restore VSWR PROTECTION switch 4S8 to the IN USE position.

30. On each BTF-20E1 transmitter meter panel, set REFLECTOMETER switch 1S3 to the NORMAL position to restore "carrier-off" protection.

CAUTION

After calibration or tune-up is carried out, it is mandatory that the REFLECTOMETER switch 1S3 be set to the NORMAL position and left at this setting permanently on each BTF-20E1 transmitter. In any other position of 1S3 the protection circuit is disabled and the transmitter may be subjected to serious damage.

31. If a power output of less than 40 kW is desired, proceed as follows:

- a. Decrease the power output of each transmitter to one half of the desired power output.
- b. Repeat steps 23 and 24.

EFFICIENCY FACTOR

The efficiency factor of each BTF-20E1 transmitter should be as shown on figure 7 of the BTF-20E1 Instruction Book, IB-8027531. The efficiency of the MI-561564 Coaxial Coupler is 0.99 with zero reject power. Therefore, each transmitter should be adjusted for 20.2 kW in order to realize 40 kW combined power output when using the indirect method for power output determination.

OPERATION

FOUR BUTTON OPERATION

Start Up

On the combining equipment cabinet, depress TRANSMITTER ON pushbutton 4S2, then depress HIGH VOLTAGE pushbutton 4S6. Each transmitter will apply plate voltage when its delay has elapsed.

Shutdown

On the combining equipment cabinet, depress HIGH VOLTAGE OFF pushbutton 4S5 then depress TRANSMITTER OFF pushbutton 4S1.

TWO BUTTON OPERATION

Start Up

On the combining equipment cabinet, depress

TRANSMITTER ON pushbutton 4S2. Each transmitter will apply plate voltage when its delay has elapsed.

Shutdown

On the combining equipment cabinet, depress TRANSMITTER OFF pushbutton 4S1.

REMOTE OPERATION

For remote operation, it is necessary to apply and remove high voltage simultaneously (or essentially simultaneously) to both units. To implement ganged operation of the transmitters, the circuitry presented in figure 4 may be employed.

MAINTENANCE

GENERAL

The combining equipment rack of the BTF-40E1 is virtually maintenance free. However, a regular schedule of inspection and service as outlined in the BTF-20E1 Instruction Book, IB-8027531, should be followed.

WARNING

Always open the line circuit breaker, and discharge circuits with a grounding stick before touching any component inside the transmitter.

CIRCUIT BREAKERS AND RELAYS

Circuit breakers and relays should be inspected periodically, and at such time contacts should be cleaned and adjusted if necessary. Relay contacts should be cleaned with Chlorothene applied with a soft brush, after which they should be burnished with a tool, such

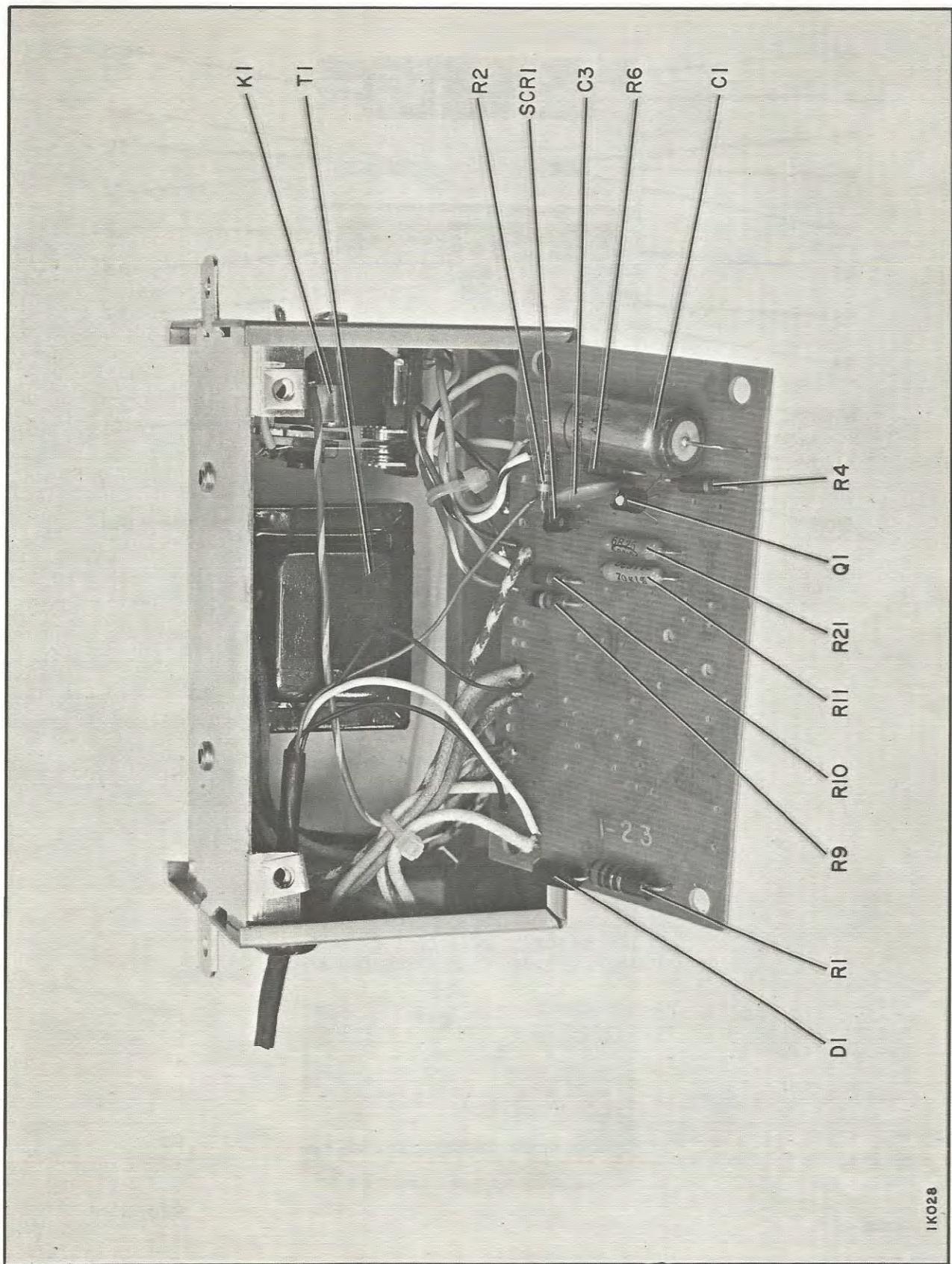
as the RCA Stock No. 22963 Contact Cleaning Tool. Finally, contacts should be wiped with a clean piece of bond paper.

CONTROL MODULE

The control module works in conjunction with 4M2 to remove the transmitter plate power when the VSWR indication exceeds the set point value on 4M2. The control relay in the VSWR trip circuit is de-energized as long as the indication of 4M2 is below the set point. For the control module schematic diagram, see figure 6.

FAN LUBRICATION

The fan used to ventilate the combining equipment cabinet will provide reliable performance for 3 to 5 years under favorable conditions of temperature and vibration without the necessity of lubricating. The bearings are factory packed with a general purpose bearing lubricant and require no further attention.



1K028

Figure 7. Control Module, Parts Location

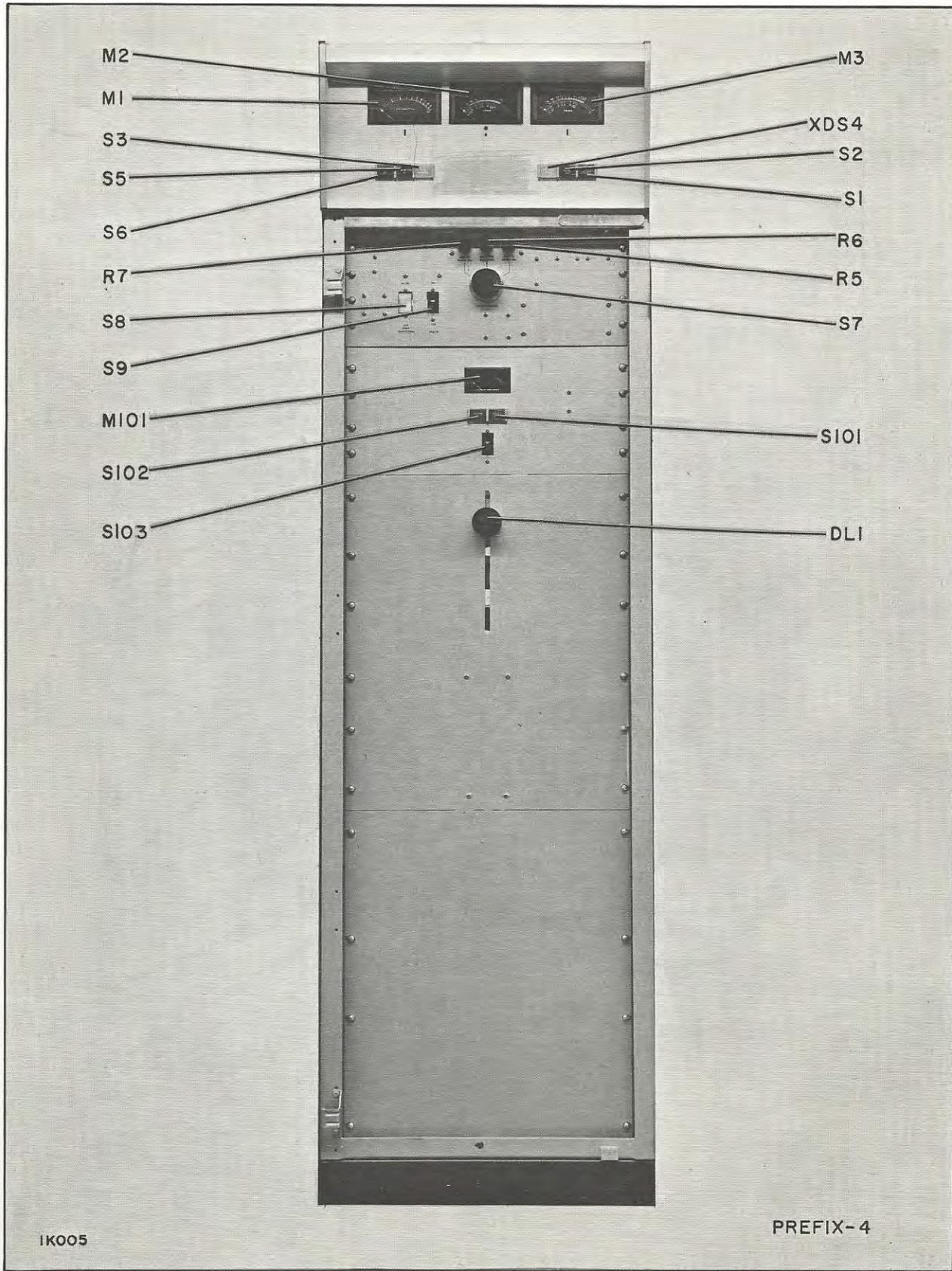


Figure 8. Combining Equipment Cabinet, Electrical Parts, Front View

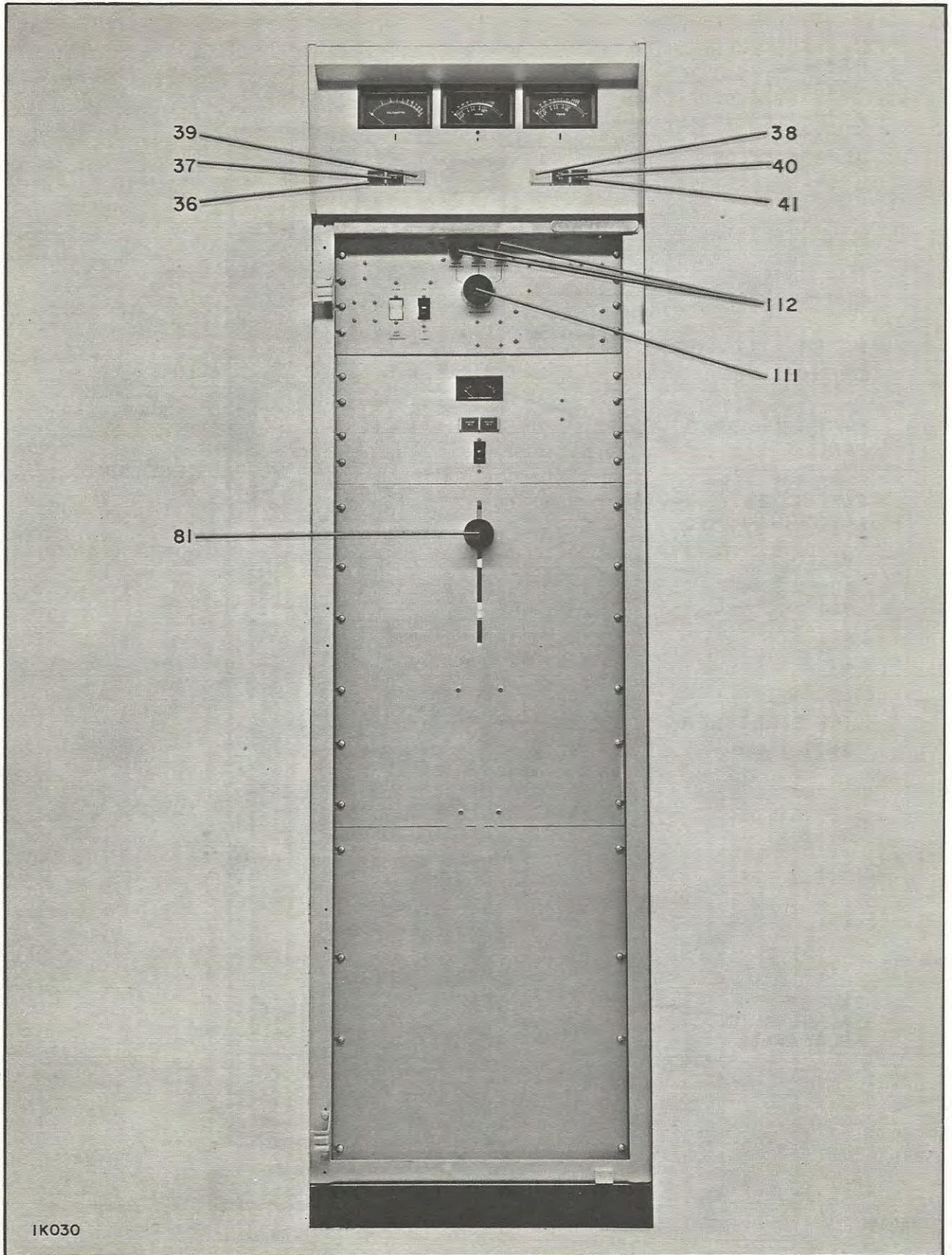


Figure 9. Combining Equipment Cabinet, Mechanical Parts, Front View

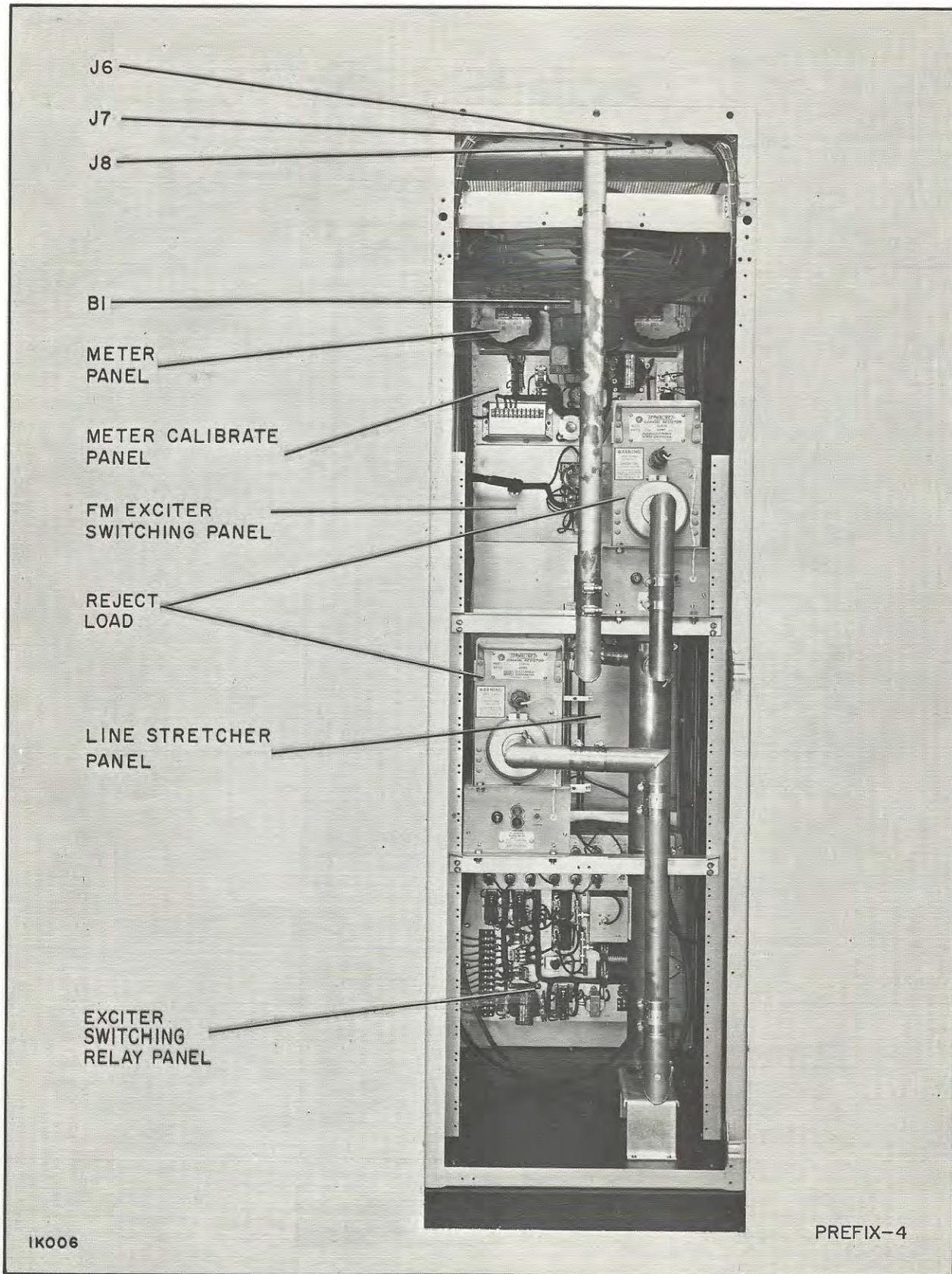


Figure 10. Combining Equipment Cabinet, Rear View

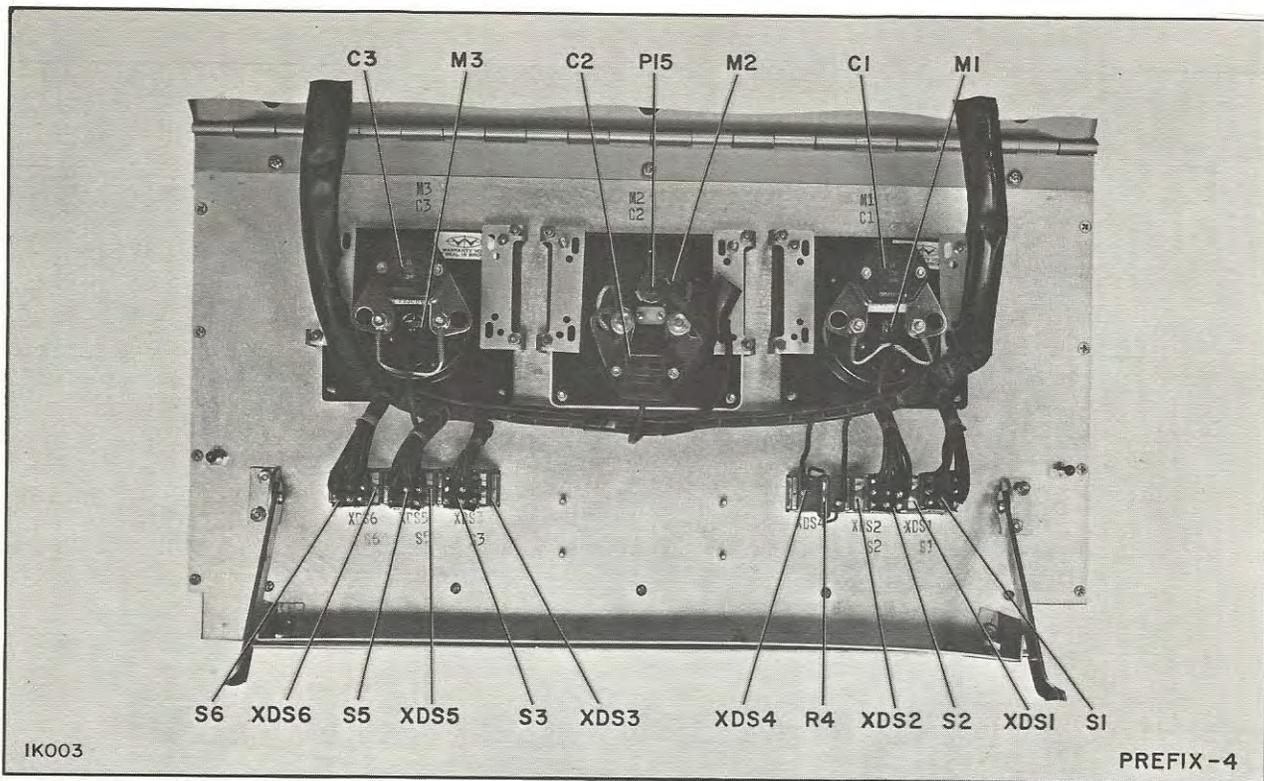


Figure 11. Meter Panel, Rear View

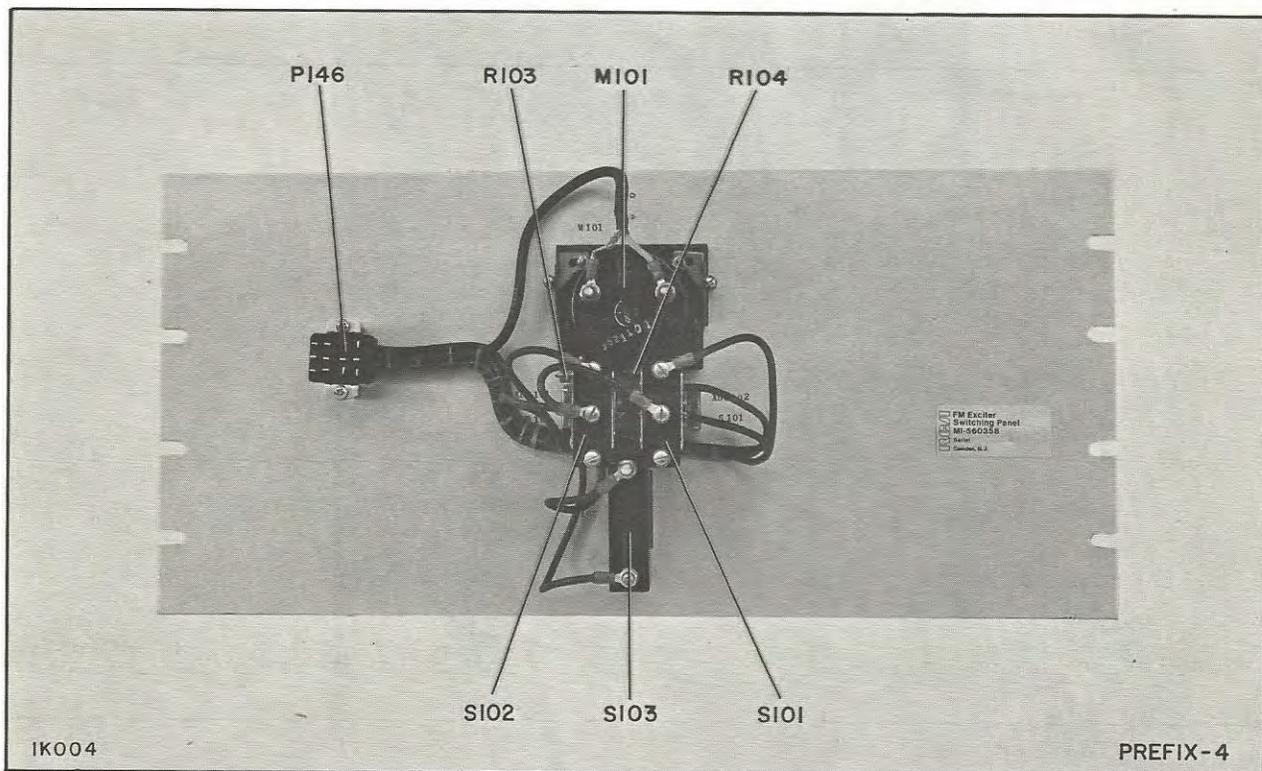


Figure 12. FM Exciter Switching Panel, Rear View

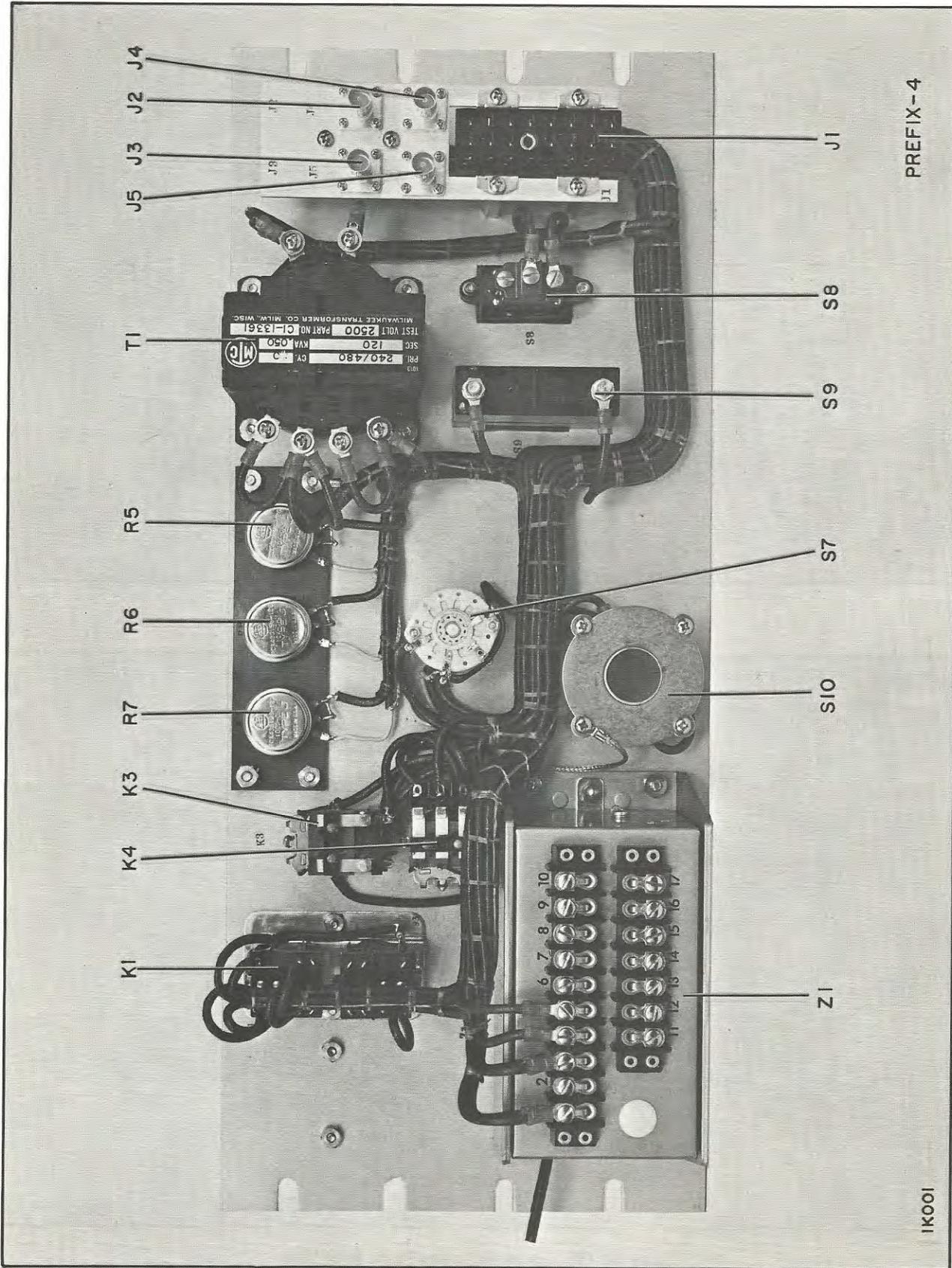


Figure 13. Meter Calibrate Panel, Rear View

If You Didn't Get This From My Site,
Then It Was Stolen From...

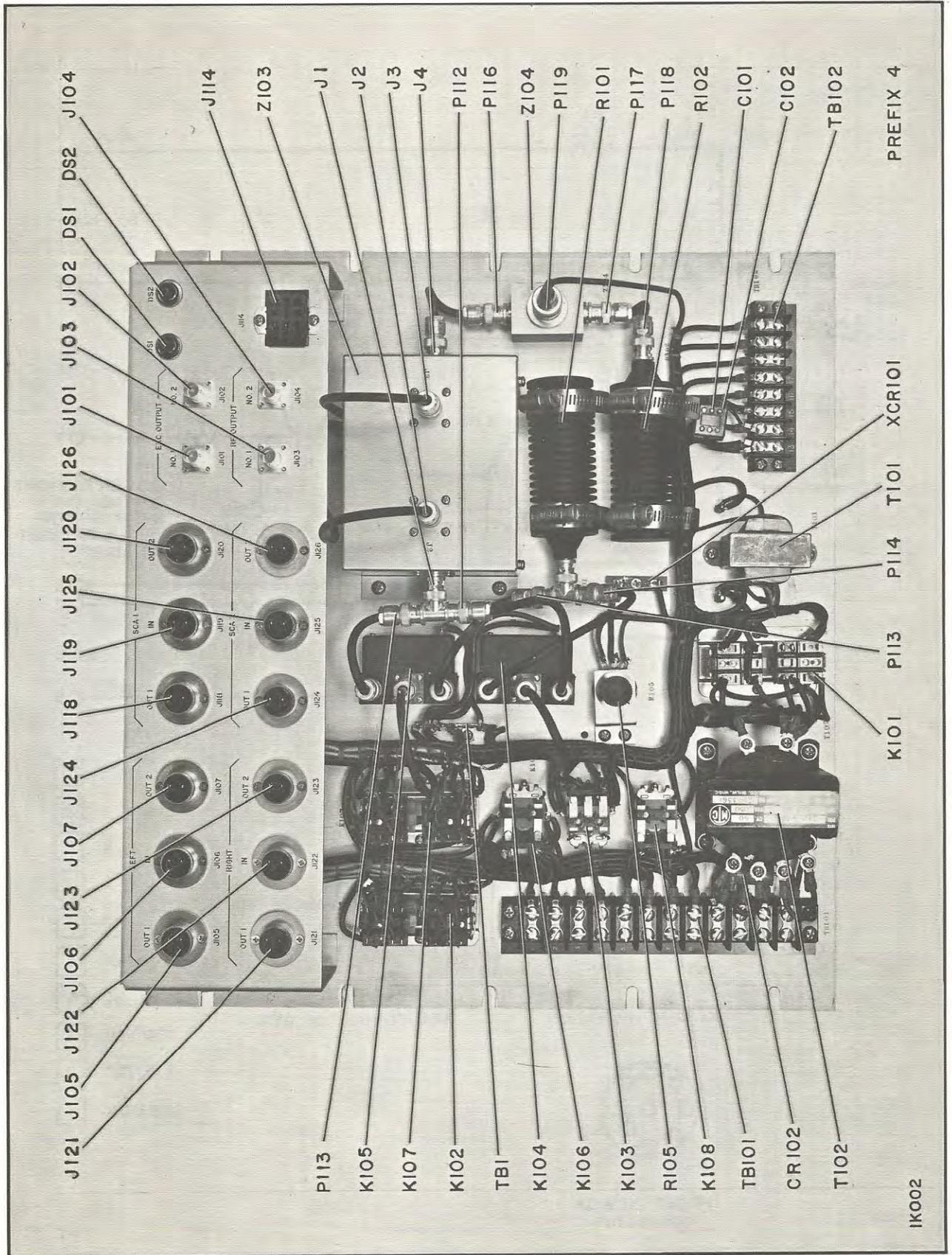


Figure 14. Exciter Switching Relay Panel, Rear View

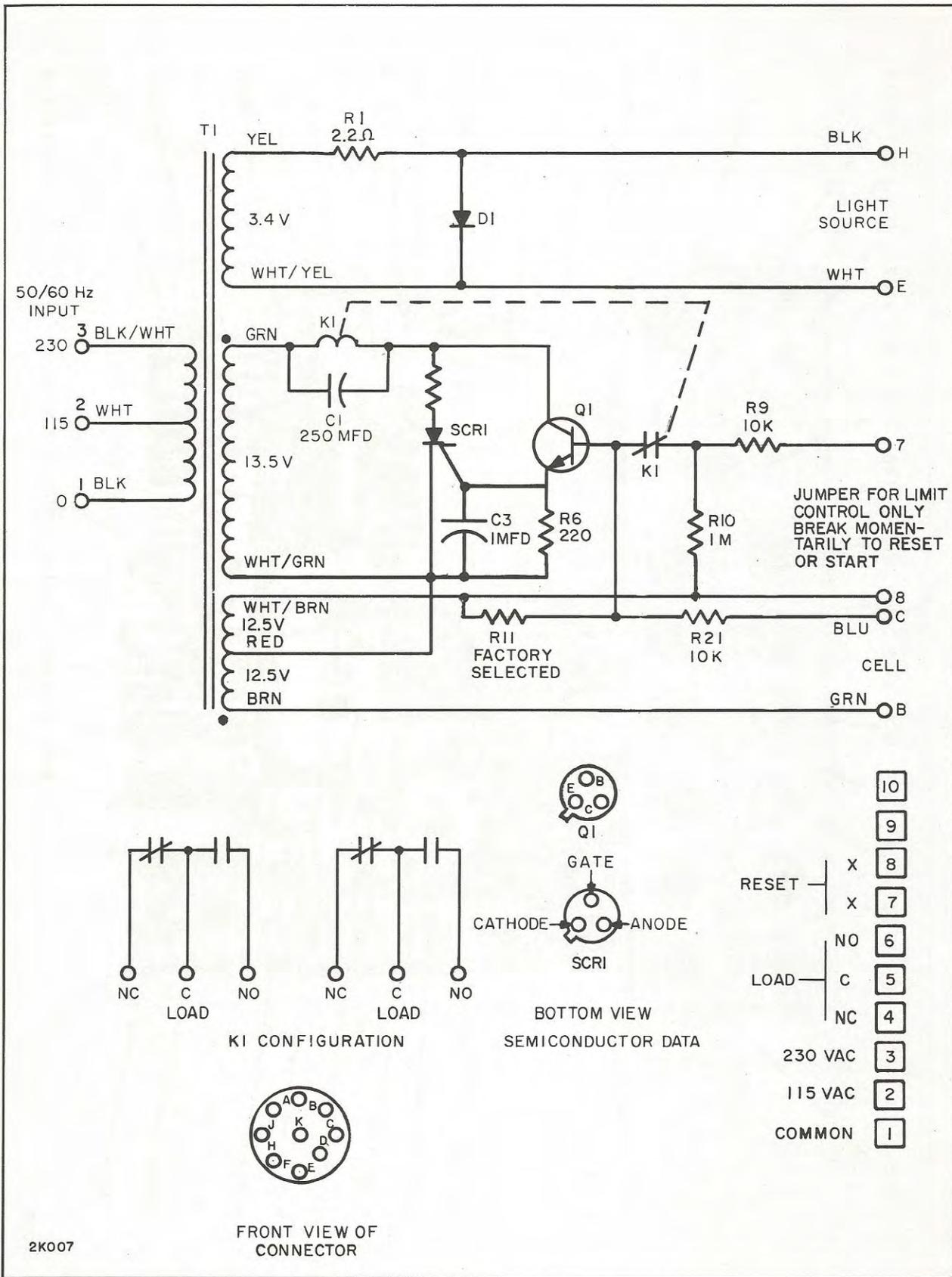


Figure 14a. Control Module, Schematic Diagram

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or if evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is

discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Report all shortages and damages to RCA, Commercial Electronic Systems Division – Camden, New Jersey 08102.

RCA will file all claims for loss and damage on this equipment so long as the inspection report is obtained. Disposition of the damaged item will be furnished by RCA.

FIELD ENGINEERING SERVICE

RCA Field Engineering Service is available at current rates. Requests for field engineering service may be addressed to your RCA Broadcast Field Representative or the RCA Service

Company, Incorporated – Broadcast Service Division – Camden, New Jersey 08102. Telephone 609-963-8000.

WARRANTY ITEMS

Particular parts and/or equipment covered by warranty are specifically stated as such in the warranty or contract given to the customer at the time of sale. The warranty or contract also stipulates the conditions under which the warranty may be exercised.

To obtain a new replacement for such warranty items, contact

your local RCA sales office and please supply Product Identification (including the Original Invoice Number, MI Number, Type Number, Model Number, and Serial Number) and Replacement Part Identification (including Stock Number and Description). Requests for warranty replacements may be unduly delayed if all this information is not supplied.

REPLACEMENT PARTS

When ordering replacement parts, please give Stock or Master Item (MI) Number, Description, and Symbol of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such

differences will in no way impair the operation of the equipment.

Emergency Service:

For emergency service after working hours, contact RCA Parts and Accessories, Telephone 609-963-8000 or 609-848-5900.

LOCATION	ORDERING INSTRUCTIONS
Continental United States, including Alaska and Hawaii	Replacement Parts bearing a STOCK NUMBER should be ordered from RCA Parts and Accessories – 2000 Clements Bridge Road – Deptford, New Jersey 08096. Replacement Parts bearing a MASTER ITEM (MI) NUMBER should be ordered from RCA, Commercial Electronic Systems Division – Attention Commercial Service – Camden, New Jersey 08102 or your nearest RCA Regional Office. Replacement Parts with NO STOCK or MASTER ITEM (MI) NUMBER are standard components. They are not stocked by RCA and should be obtained from your local electronics distributor.
Dominion of Canada	Order from your local RCA Sales Representative or his office or from: RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec.
Outside of Continental United States, Alaska, Hawaii, and the Dominion of Canada	Order from your local RCA Sales Representative or from: RCA International Division, Clark, New Jersey – U.S.A. – Wire: RADIOINTER Emergency: Cable RADIOPARTS, DEPTFORD, N.J.

RETURN OF ELECTRON TUBES

If for any reason it is desired to return tubes, please return them through your local RCA tube distributor, RCA Victor Company Limited, or RCA International Division, depending on your location.

Please do not return tubes directly to RCA without authorization and shipping instructions.

It is important that complete information regarding each tube (including type, serial number, hours of service and reason for its return) be given. When tubes are returned, they should be shipped to the address specified on the Return Authorization form. A copy of the Return Authorization and also a Service Report for each tube should be packed with the tubes.

LOCATION	ORDERING INSTRUCTIONS
Continental United States, including Alaska and Hawaii	Local RCA Tube Distributor.
Dominion of Canada	Order from your local RCA Sales Representative or his office or from: RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec.
Outside of Continental United States, Alaska, Hawaii, and the Dominion of Canada	Local RCA Tube Distributor or from: RCA International Division, Clark, New Jersey, U.S.A., Wire: RADIOINTER Emergency: Cable RADIOPARTS, DEPTFORD, N.J.

BTE-M5

PARTS IDENTIFICATION INFORMATION

GENERAL

The components listed in the parts list are identified by one of two methods depending on whether the component is a mechanical or electrical part. Mechanical parts are assigned a numerical symbol (12, 34, 233, 1XV102-14 etc.) that corresponds to the item number on the mechanical assembly drawing where that particular part is located. Electrical parts are assigned a standard electrical symbol and are listed in an alphanumeric sequence by major electrical assemblies (RF Assembly, Driver Assembly, Modulator Assembly, etc.). The illustrations in this book are keyed so that electrical and mechanical parts that are "called out" in the illustrations should always be consulted so that positive identification of the part can be made before referring to the parts list.

ELECTRICAL PARTS

In order to locate an electrical part in the parts list the following procedure is recommended:

- Determine in which major electrical assembly the part is physically located.
- With the use of the illustrations, positively identify the part and notate its symbol designation.
- In the parts list, find the heading for the major electrical assembly.

- Under the heading in "c" above, find the symbol designation in the Symbol column of the parts list. All pertinent ordering information and a brief description of the item will be found to the right of the symbol designation.

MECHANICAL PARTS

In order to locate a mechanical part in the parts list the following procedure is recommended:

- Determine in which major mechanical assembly the part is physically located (RF Box, Basic Transmitter, Tube Socket Assembly, etc.).
- With the use of the illustrations, identify the part and notate its numerical symbol designation.
- In the parts list, find the heading for the major mechanical assembly.
- Under the heading in "c" above, find the numerical symbol designation in the Symbol column of the parts list. All pertinent ordering information and a brief description of the item will be found to the right of the symbol designation.

TABLE 7. COMPONENT PREFIX NUMBERS

Item	Symbol Prefix	Example
Basic Transmitter (MI-560507)	1	1K8
Power Supply (MI-560342-3)	2	2S1

Item	Symbol Prefix	Example
HV Plate Transformer	3	3T1
Combining Equipment Cabinet	4	4S1

TABLE 8. COMPONENT SYMBOL DESIGNATIONS

Symbol Designation	Item
AT	Attenuators
B	Blowers, motors, phase shifters
C	Capacitors
CR	Crystal or metallic rectifiers
D	Diode
DS	Indicator lamps
F	Fuses
FL	RF interference filter
HY	Circulator
J	Connector jacks
K	Relays or contactors
L	Inductors
M	Meters
P	Connector plugs
PCB	Printed circuit board
Q	Transistors

Symbol Designation	Item
R	Resistors
RV	Thyrone assembly
S	Switches or interlocks
SCR	Silicon controlled rectifier
T	Transformers
TB	Terminal boards
U	Nonrepairable assembly
V	Tubes
VR	Voltage regulators
XC	Sockets for capacitors
XDS	Sockets for indicating lamps
XF	Sockets for fuses
XV	Sockets for tubes
Y	Crystals (oscillating)
Z	Impedance networks and cavities

REPLACEMENT PARTS

Symbol	Stock No.	Drawing No.	Description
			BTF-40E1
			COMBINING EQUIPMENT MI-560702
			P/L 3456063-504 REV 9
B1	242514	3464044 001	PROPELLER FAN
C1	810004-4	36091 523	MICA, .01 MF 250 V
C2	810004-4	36091 523	MICA, .01 MF 250 V
C3	810004-4	36091 523	MICA, .01 MF 250 V
DS4A	300449	8890654 002	LAMP - INDICATOR
DS4B	300449	8890654 002	LAMP - INDICATOR
J6	241849	3456279 001	CONNECTOR - COAXIAL, UG-492A/U
J7	241849	3456279 001	CONNECTOR - COAXIAL, UG-492A/U
J8	241849	3456279 001	CONNECTOR - COAXIAL, UG-492A/U
J9			CONNECTOR - COAXIAL, PART OF Z2
J10			CONNECTOR - COAXIAL, PART OF Z3
J11			CONNECTOR - COAXIAL, PART OF Z3
J12			CONNECTOR - COAXIAL, PART OF Z3
J101			
T0			
J107			CONNECTOR - PART OF MI-560700
J114			CONNECTOR - PART OF MI-560700
J115			CONNECTOR - PART OF MI-560700
M1	239277	993063 007	METER - REJECT POWER
M2	241749	8766828 005	METER - RELAY REFLECTED POWER
M3	241757	993064 008	METER - POWER OUTPUT
P1	095804	449653 004	CONNECTOR - MALE, 24 CONTACT
P2 TO			
P7	921359	1510013 101	CONNECTOR - UG-88 C/U
P8			CONNECTOR - COAXIAL PT OF MI-560703 ITEM 6
P9	921359	1510013 101	CONNECTOR - UG-88 C/U
P10	921359	1510013 101	CONNECTOR - UG-88 C/U
P11	921359	1510013 101	CONNECTOR - UG-88 C/U
P12			CONNECTOR - COAXIAL, PART OF Z3
P13			CONNECTOR - COAXIAL, PART OF Z3
P14			CONNECTOR - COAXIAL, PART OF MI-560703 ITEM 6
P15			CONNECTOR - NINE TERMINAL, PART OF M2
P101			
T0			
P104			CONNECTOR - COAXIAL, PART OF CABLE ASSY ITEM 137
P105			
T0			
P120			CONNECTOR - COAXIAL, PART OF MI-560700
P121			CONNECTOR - COAXIAL, PART OF MI-560700
P122			CONNECTOR - COAXIAL, PART OF CABLE ASSY ITEM 106
P123			
T0			
P125			CONNECTOR - COAXIAL, PART OF CABLE ASSY ITEM 137
P126			CONNECTOR - 8 TERMINAL, PART OF CABLE ASSY ITEM 137
P127			CONNECTOR - 8 TERMINAL, PART OF CABLE ASSY ITEM 137
P128			CONNECTOR - 2 TERMINAL, PART OF CABLE ASSY ITEM 137
P129			CONNECTOR - 2 TERMINAL, PART OF CABLE ASSY ITEM 137
P130			CONNECTOR - 2 TERMINAL, PART OF CABLE ASSY ITEM 137
P145			CONNECTOR - 12 TERMINAL, PART OF CABLE ASSY ITEM 105

Symbol	Stock No.	Drawing No.	Description
P149	211509	481799 001	CONNECTOR - MALE, 2 CONTACT PT. OF ITEM 137
P152	211509	481799 001	CONNECTOR - MALE, 2 CONTACT PT. OF ITEM 137
P153	211509	481799 001	CONNECTOR - MALE 2 CONTACT, PT. OF ITEM 137
P154	211509	481799 001	CONNECTOR - MALE 2 CONTACT, PT. OF ITEM 137
P157	211509	481799 001	CONNECTOR - MALE 2 CONTACT, PT. OF ITEM 137
P158	211509	481799 001	CONNECTOR - MALE 2 CONTACT, PT. OF ITEM 137
P159	211509	481799 001	CONNECTOR - MALE 2 CONTACT, PT. OF ITEM 137
P162	211509	481799 001	CONNECTOR - MALE 2 CONTACT, PT. OF ITEM 137
P163	211509	481799 001	CONNECTOR - MALE 2 CONTACT, PT. OF ITEM 137
R4	059941	993007 086	WIREWOUND, 1800 OHMS 5 W
S1	241752	3455458 103	SWITCH - TRANSMITTER OFF
S2	241752	3455458 103	SWITCH - TRANSMITTER ON
S3	241752	3455458 103	SWITCH - OVERLOAD, RESET
S5	241752	3455458 103	SWITCH - HIGH VOLTAGE OFF
S6	241752	3455458 103	SWITCH - HIGH VOLTAGE
XDS1	270023	8522913 004	INDICATOR - TRANSMITTER OFF
XDS2	270023	8522913 004	INDICATOR - TRANSMITTER ON
XDS3	270023	8522913 004	INDICATOR - OVERLOAD, RESET
XDS4	269851	8522913 001	INDICATOR - VSWR OVERLOAD
XDS5	270023	8522913 004	INDICATOR - HIGH VOLTAGE OFF
XDS6	270023	8522913 004	INDICATOR - HIGH VOLTAGE
Z2			LINE SECTION, PART OF INST. MAT.
Z3			LINE SECTION, PART OF INST. MAT.
36	229810	8494089 002	DISPLAY SCREEN - TRANSMITTER OFF
37	229892	8494089 003	DISPLAY SCREEN - TRANSMITTER ON
38	231159	8494089 026	DISPLAY SCREEN - OVERLOAD RESET
39	241747	8494089 070	DISPLAY SCREEN - VSWR OVERLOAD
40	231161	8494089 028	DISPLAY SCREEN - HIGH VOLTAGE OFF
41	241748	8494089 091	DISPLAY SCREEN - HIGH VOLTAGE
42	269289	8522915 001	MOUNTING BARRIER - SHORT
46	228974	99196 001	NUT PLATE
57	242043	3471729 001	R.F. LOAD - 5 KW
58			COUPLING - 90 DEGREE MITER, MI-19112 18 NF
69	056964	897258 006	CLAMP - HOSE
86	233726	897258 005	HOSE CLAMP
87			COAXIAL COUPLER - MI-561537-1
105		3464039 501	CABLE - ASSEMBLY, SWITCHING PANEL TO RELAY PANEL
	032057	449614 003	CONNECTOR - MALE, 12 CONTACT
	216740	449614 004	CONNECTOR - FEMALE, 12 CONTACT
106		3467813 511	CABLE - ASSEMBLY, RELAY PANEL TO LINE STRETCHER
	921359	1510013 101	CONNECTOR - COAXIAL, PLUG
109		3467813 512	CABLE - ASSEMBLY, LINE STRETCHER TO TRANSMITTER 1
	921359	1510013 101	CONNECTOR - COAXIAL, PLUG
110		3467813 513	CABLE - ASSEMBLY, RELAY PANEL TO TRANSMITTER 2
	921359	1510013 101	CONNECTOR - COAXIAL, PLUG
			EXCITER SWITCHING RELAY PANEL
			P/L 3456096-504 REV 11
C101	092036	724866 171	MICA, .01 MF 300 V
C102	092036	724866 171	MICA, .01 MF 300 V
CR101	225592	3404510 030	DIODE - TYPE 1N3253
CR102	248034	3720202 309	TRANSIENT SUPPRESSOR
DS1	248035	3720198 001	LAMP - INDICATOR
DS2	248035	3720198 001	LAMP - INDICATOR
J101			
T0			
J104	054890	1510013 161	CONNECTOR - JACK, UG-290/U
J105	211510	481799 002	CONNECTOR - FEMALE, 2 CONDUCTOR

Symbol	Stock No.	Drawing No.	Description
J106	211510	481799 002	CONNECTOR - FEMALE, 2 CONDUCTOR
J107	211510	481799 002	CONNECTOR - FEMALE, 2 CONDUCTOR
J114	056078	449613 001	CONNECTOR - FEMALE, 12 CONDUCTOR
J118 TO			
J126	211510	481799 002	CONNECTOR - FEMALE, 2 CONDUCTOR
K101	240810	3464084 001	RELAY - LATCHING
K102	240810	3464084 001	RELAY - LATCHING
K103	240833	8958260 009	RELAY - DPDT SPECIAL CONTACTS, 115 VAC COIL
K104	240809	3455470 001	RELAY - COAXIAL
K105	240809	3455470 001	RELAY - COAXIAL
K106	240832	8958260 006	RELAY - DPDT CONTACTS, 230 VAC COIL
K107	240810	3464084 001	RELAY - LATCHING
K108	235839	8958260 005	RELAY - DPDT CONTACTS, 115 VAC COIL
M101	240808	993103 005	METER - 0-100 MICROAMPERES
P101 TO			
P118	921359	1510013 101	CONNECTOR - PLUG, MIL NUMBER UG-88C/U
P119			CONNECTOR - PLUG, PART OF Z104
P120 TO			
P125	921359	1510013 101	CONNECTOR - PLUG, MIL NUMBER UG-88C/U
P126	055808	724969 008	CONNECTOR - FEMALE, 8 CONTACT
P127	055808	724969 008	CONNECTOR - FEMALE, 8 CONTACT
P128	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P129	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P130	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P145	032057	449614 003	CONNECTOR - MALE, 12 CONTACT
P149	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P152	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P153	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P154	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P157	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P158	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P159	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P162	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
P163	211509	481799 001	CONNECTOR - MALE, 2 CONTACT
R101	240871	8460363 008	RESISTOR - LOAD, 50 OHMS 20 WATTS
R102	240871	8460363 008	RESISTOR - LOAD, 50 OHMS 20 WATTS
R105	095244	433196 118	RESISTOR - VARIABLE, 100 OHMS
T101	237407	890222 001	TRANSFORMER - 6.3 VOLT, 1.2 AMP
T102	240872	3464008 001	TRANSFORMER - 240/480 V PRI, 120 V SEC.
XCR101	218920	8980029 501	HOLDER - CRYSTAL DIODE
Z101	240807	1510013 211	CONNECTOR - TEE, MIL NUMBER UG-274A/U
Z102	240807	1510013 211	CONNECTOR - TEE, MIL NUMBER UG-274A/U
Z103			POWER SPLITTER
Z104	242042	3464019 001	DIRECTIONAL COUPLER, FOR 88 TO 108 MHZ
15	229940	1510924 105	KNOB
51	216983	486041 005	TERMINAL - .STUD
			METER CALIBRATE PANEL
			P/L 3456063-505 REV 9
J1	095559	458516 001	CONNECTOR - 24 CONTACT, FEMALE
J2 TO			
J5	054890	1510013 161	CONNECTOR - JACK, UG-290A/U
K1	241750	3460918 009	RELAY - LATCHING
K3	235839	8958260 005	RELAY - AUX.
K4	217770	8958260 003	RELAY - OVER LOAD INDICATOR
R5	205064	8971860 835	VARIABLE, 10,000 OHMS, REMOTE POWER CAL.
R6	205064	8971860 835	VARIABLE, 10,000 OHMS, REFL. POWER CAL.
R7	206913	8971860 831	VARIABLE, 1000 OHMS, NORMAL POWER CAL.
S7	241643	3464213 001	SWITCH - REFLECTOMETER
S8	230828	8498764 004	SWITCH - VSWR PROTECTION
S9	241746	8489397 004	CIRCUIT BREAKER
S10	209623	8868062 005	SWITCH - THERMOSTAT
T1	240872	3464008 001	TRANSFORMER - CONTROL 240/480 V PRI 120 V
Z1	232780	8494401 004	CONTROL MODULE

Symbol	Stock No.	Drawing No.	Description
111 112	261112 241753	1510924 117 1510923 008	KNOB - SKIRTED KNOB
			LINE STRETCHER PANEL
			P/L 3456063-503 REV 9
J116 J117	241751 241751	3455466 002 3455466 002	ADAPTOR - G-R TO BNC, FOR LINE STRETCHER ADAPTOR - G-R TO BNC, FOR LINE STRETCHER
70 81 82 99	236876 231047 034300 229156	8537350 001 1510923 017 8888539 123 990333 003	LINE STRETCHER <i>UGD 40</i> KNOB SET SCREW - NO. 6-32 X 0.25 LONG SPRING PIN
			40 kW COAXIAL COUPLER MI-561564
			INSTALLATION MATERIAL MI-560703
5		3467813 509	CABLE ASSEMBLY, COAX RG-58/U (FOR REFLECT- OMETER CONNECTIONS; Z3 to J6 and Z3 to J7)
	921359	1510013 101	CONNECTOR, MIL NUMBER UG-88C/U
6		3467813 510	CABLE ASSEMBLY, COAX RG-58/U (FOR REJECT POWER CONNECTION; Z2 to J8)
	236875	3471729 004	DC CONNECTOR PLUG ONLY, FOR DIRECTIONAL COUPLERS Z2 and Z3
			4Z1 CONTROL MODULE
4Z1	232780		CONTROL MODULE
C1	300763		CAPACITOR, ELECTROLYTIC, 250 MFD 25 V
C3	131077		CAPACITOR, 1 MFD 3 V
D1			DIODE, API PART NO. 6916
K1			RELAY, 2 FORM C CONTACTS, API PART NO. 1819-9
M2	241749	8766828 005	METER RELAY, REFLECTED POWER
	231545	8766828 021	LAMP, REPLACEMENT FOR M2
	248673	8766828 022	PHOTOCELL, REPLACEMENT FOR M2
Q1			TRANSISTOR, TYPE 2N3306
R1	227532		RESISTOR, WIREWOUND, 2.2 OHMS 5%, 2W
R2	243448	82283 530	RESISTOR, 5.6 OHMS 10% 1/2 W
R4	502222	82283 066	RESISTOR, 2200 OHMS 10% 1/2 W
R6	502122	82283 054	RESISTOR, 220 OHMS 10% 1/2 W
R9	502310	82283 074	RESISTOR, 10,000 OHMS 10% 1/2 W
R10	502510	82283 098	RESISTOR, 1 MEG OHMS 10% 1/2 W
R11			RESISTOR, FILM 1% 1/2 W FACTORY SELECTED
R21	258101		RESISTOR, FILM 10,000 OHMS 1% 1/2 W API PART NO. 6825
SCR1			SILICON CONTROLLED RECTIFIER, API PART NO. 6916
T1	248667		TRANSFORMER, POWER, API PART NO. 2060-73

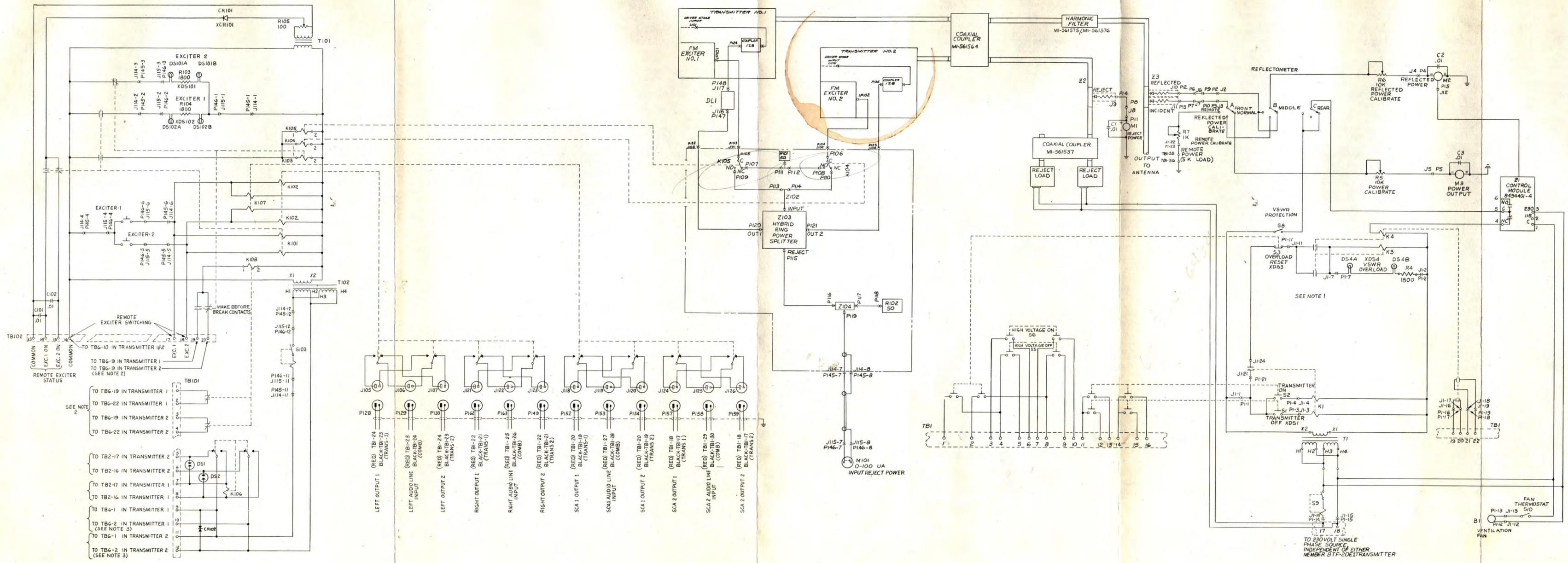
RECOMMENDED STATION SPARES

Description	Symbol	Quantity	Stock No.
Relay, DPDT, 230 VAC Coil	K106	1	248032
Relay, DPDT, 115 VAC Coil	K108	1	235839
Meter, relay reflected power	M2	1	241749
Lamp, replacement, for M2		1	231545
Photocell, replacement, for M2		1	248673
Switch, thermostat	S10	1	209623

NOTES

RECOMMENDED STATION SPARES

Part No.	Description	Quantity	Remarks
10000
10001
10002
10003
10004
10005
10006
10007
10008



INTERCONNECTIONS BETWEEN CONTROL UNIT AND INDIVIDUAL BTF-20E1 TRANSMITTERS

CONNECT TERMINAL	TO TERMINAL	IN TRANS-MITTER
TB1-1	ITB2-27	1
TB1-2	ITB2-27	2
TB1-3	ITB2-30	1
TB1-4	ITB2-24	1
TB1-5	ITB2-25	1
TB1-6	ITB2-26	1
TB1-7	ITB2-30	2
TB1-8	ITB2-24	2
TB1-9	ITB2-25	2
TB1-10	ITB2-26	2
TB1-11	ITB2-23	1
TB1-12	ITB2-21	1
TB1-13	ITB2-22	1
TB1-14	ITB2-23	1
TB1-15	ITB2-21	2
TB1-16	ITB2-22	2
TB1-17	TO 230-VOLT 1Ø LINE INDEPENDENT OF EITHER BTF-20E1	
TB1-18	IK1-6	1
TB1-19	IK1-6	1
TB1-20	IK1-7	1
TB1-21	IK1-6	2
TB1-22	IK1-7	2

FRONT VIEW:
TRANSMITTER 1 ON LEFT
TRANSMITTER 2 ON RIGHT

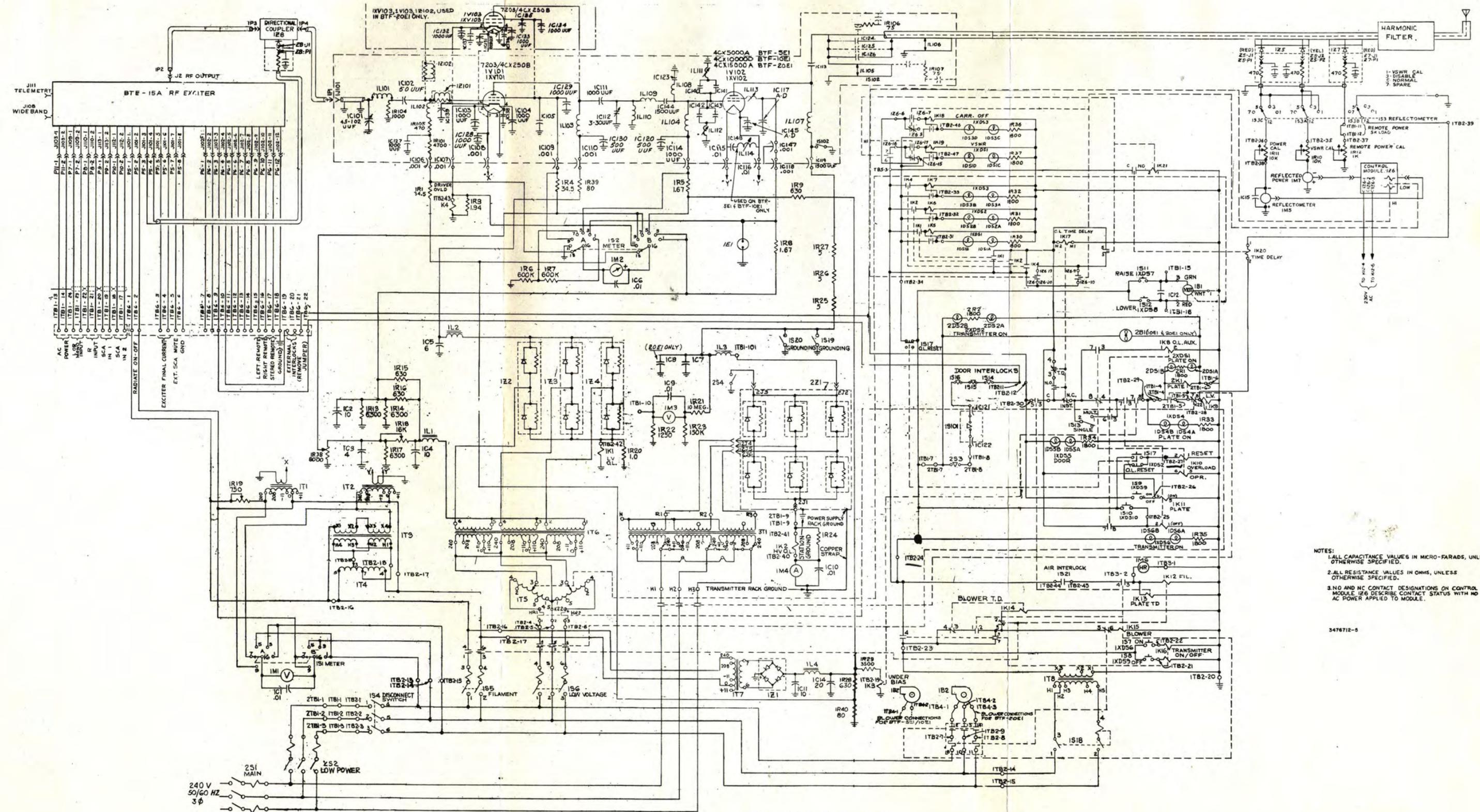
AUDIO INPUT CONNECTIONS ON COMBINING EQUIPMENT RACK

CONNECT TERMINAL	TO
TB1-23	LEFT RED
TB1-24	LEFT BLACK
TB1-25	RIGHT RED
TB1-26	RIGHT BLACK
TB1-27	SCA 1 RED
TB1-28	SCA 1 BLACK
TB1-29	SCA 2 RED
TB1-30	SCA 2 BLACK

- NOTES:
- CONTROL CIRCUIT SHOWN AS SHUT DOWN FROM FULL OPERATION BY DEPRESSING OF HIGH VOLTAGE OFF BUTTON AND TRANSMITTER OFF BUTTON.
 - IN BOTH TRANSMITTERS 1 AND 2, REMOVE THE JUMPERS ON TB6 CONNECTING TERMINALS 9 & 22, ALSO REMOVE THE JUMPER BETWEEN TERMINALS 10 & 19.
 - IN BOTH TRANSMITTERS 1 AND 2, REMOVE WIRE 108 FROM TB6-1 AND FROM TB3-11. ALSO REMOVE WIRE 107 FROM TB6-2. CUT OFF WIRE 108 WHERE IT LEAVES THE HARNESS (AT BOTH TB6-1 AND TB3-11). CUT OFF WIRE 107 WHERE IT LEAVES THE HARNESS (AT BOTH TB6-2 AND TB2-17).
 - ALL COMPONENTS ARE PREFIXED BY NUMERAL 4.

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Figure 15. BTF-40E1 Schematic Diagram

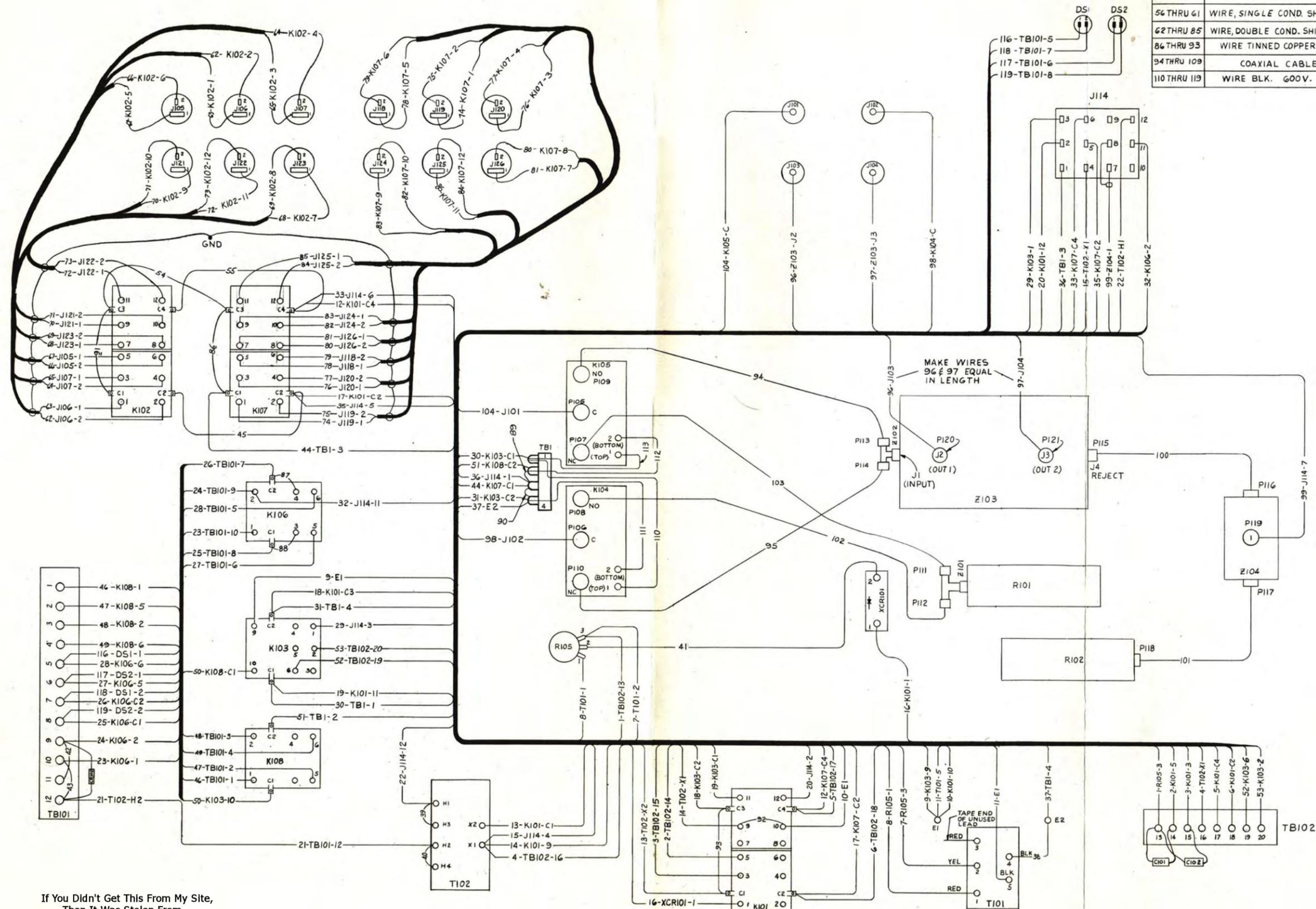


NOTES:
 1. ALL CAPACITANCE VALUES IN MICRO-FARADS, UNLESS OTHERWISE SPECIFIED.
 2. ALL RESISTANCE VALUES IN OHMS, UNLESS OTHERWISE SPECIFIED.
 3. NO AND NC CONTACT DESIGNATIONS ON CONTROL MODULE (26) DESCRIBE CONTACT STATUS WITH NO AC POWER APPLIED TO MODULE.

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Figure 16. BTF-20E1 Schematic Diagram

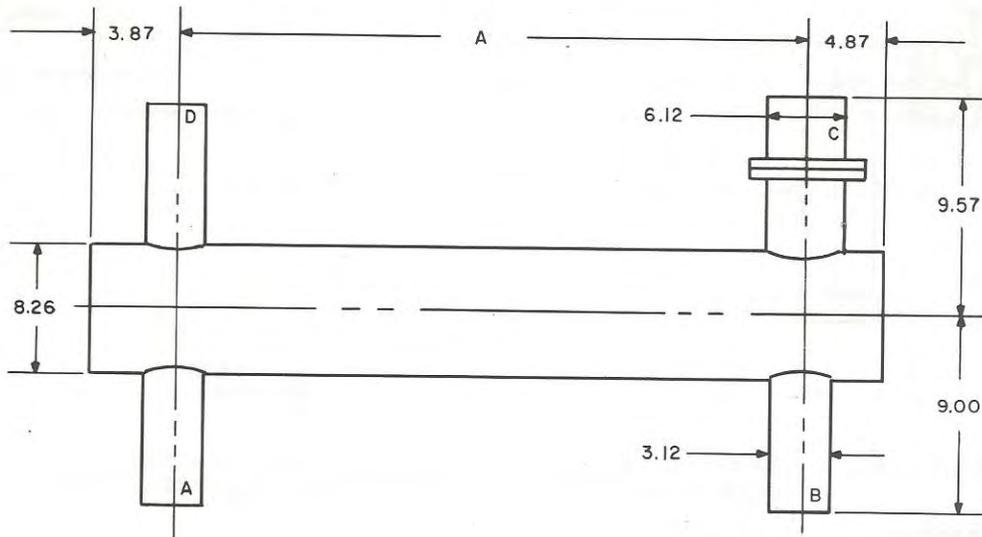


WIRE TABLE			
WIRE NUMBER	DESCRIPTION	PARTS LIST ITEM NO	WIRE NOT USED
1 THRU 55	WIRE BLK. 600V. #18	26	
56 THRU 61	WIRE, SINGLE COND. SHIELDED, JACKETED	52	
62 THRU 85	WIRE, DOUBLE COND. SHIELDED, JACKETED	27	
86 THRU 93	WIRE TINNED COPPER .040 DIA	28	
94 THRU 109	COAXIAL CABLE	29	105-106 107-108
110 THRU 119	WIRE BLK. 600V. #18	26	

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Figure 19. Exciter Switching Relay Panel, Wiring Diagram



Broadcast Band	Frequency	MI Number	A	Unbalance
FM	88-108 MHz.	MI-561564	29.44	± 0.15 dB

Specifications

Weight: (approx.) 85 lbs.
 Mounting: any position
 Ambient Temperature: 45° Max to -20° Min
 Max Power: 40 kW CW per 3 1/8 port
 VSWR: 1.05 or better when terminated in matched loads.
 Connection: Ports A, B, & D - 3 1/8 OD unflanged coaxial line (MI-27791-K)
 Ports C - 6 1/8 OD unflanged coaxial line (MI-561579)
 Impedance: 50 ohm
 Isolation: See Table

	Input Port	Output Port	Reject Port	Requirements for 30 dB isolation or better
If used as power splitter	C	B, D	A	Output loads 1.03 or better
If used as power combiner	B, D	C	A	2 input signals 90° out of phase (equal frequency and amplitude) (D leads B)

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Figure 20. 40 kW Coaxial Coupler, Outline Drawing

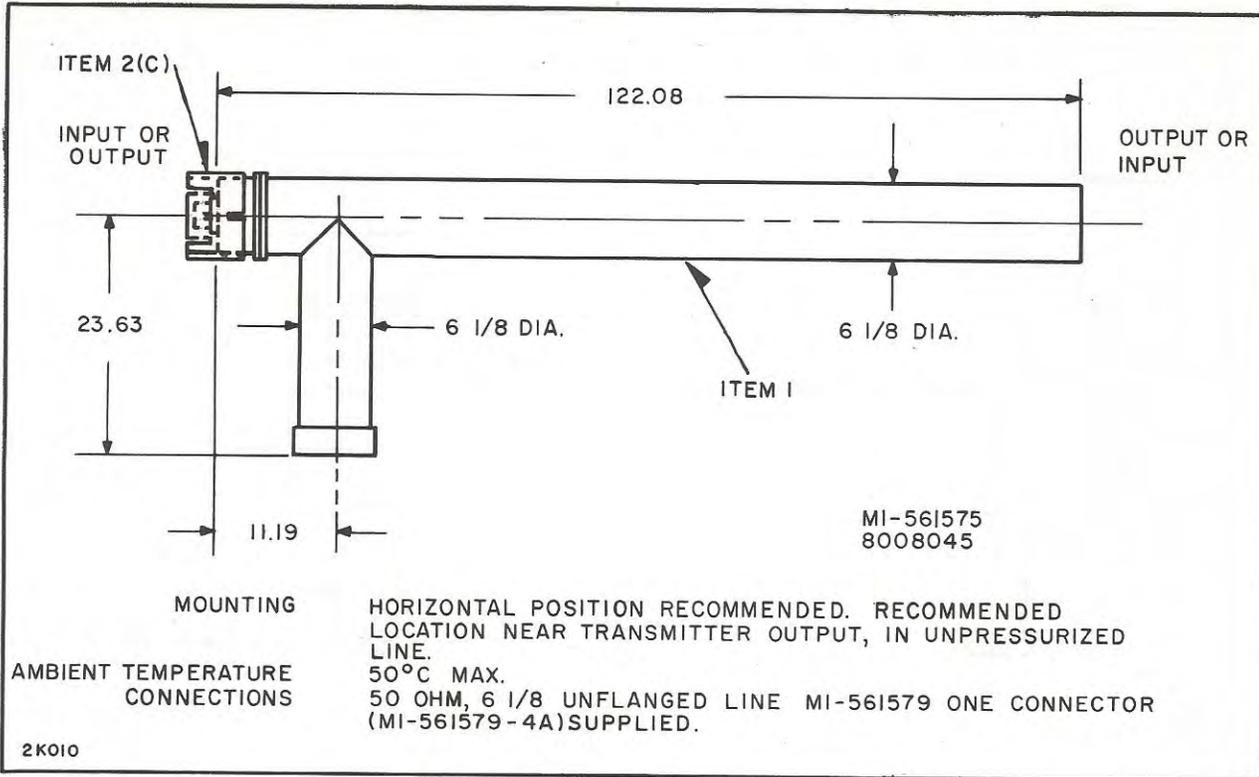


Figure 21. 40 kW Harmonic Filter, Unpressurized, with Item 2 (C) Coupling Attached, Outline Drawing

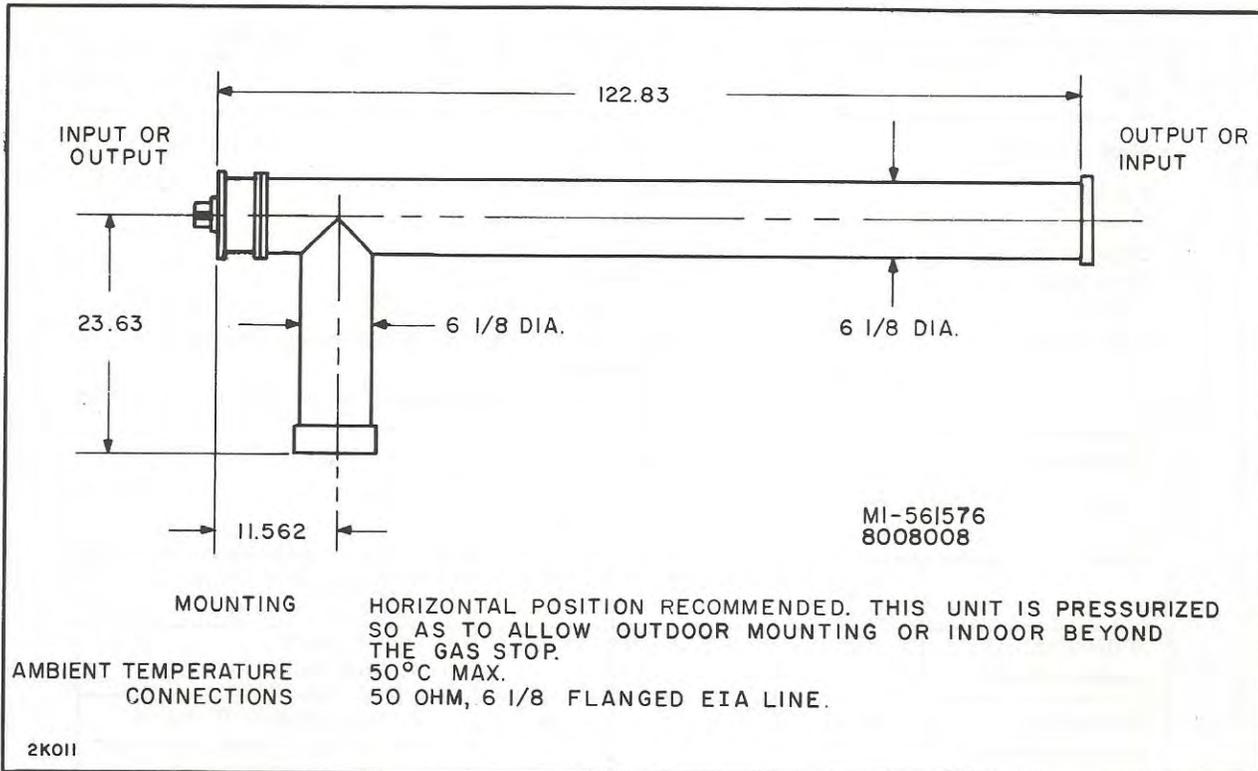
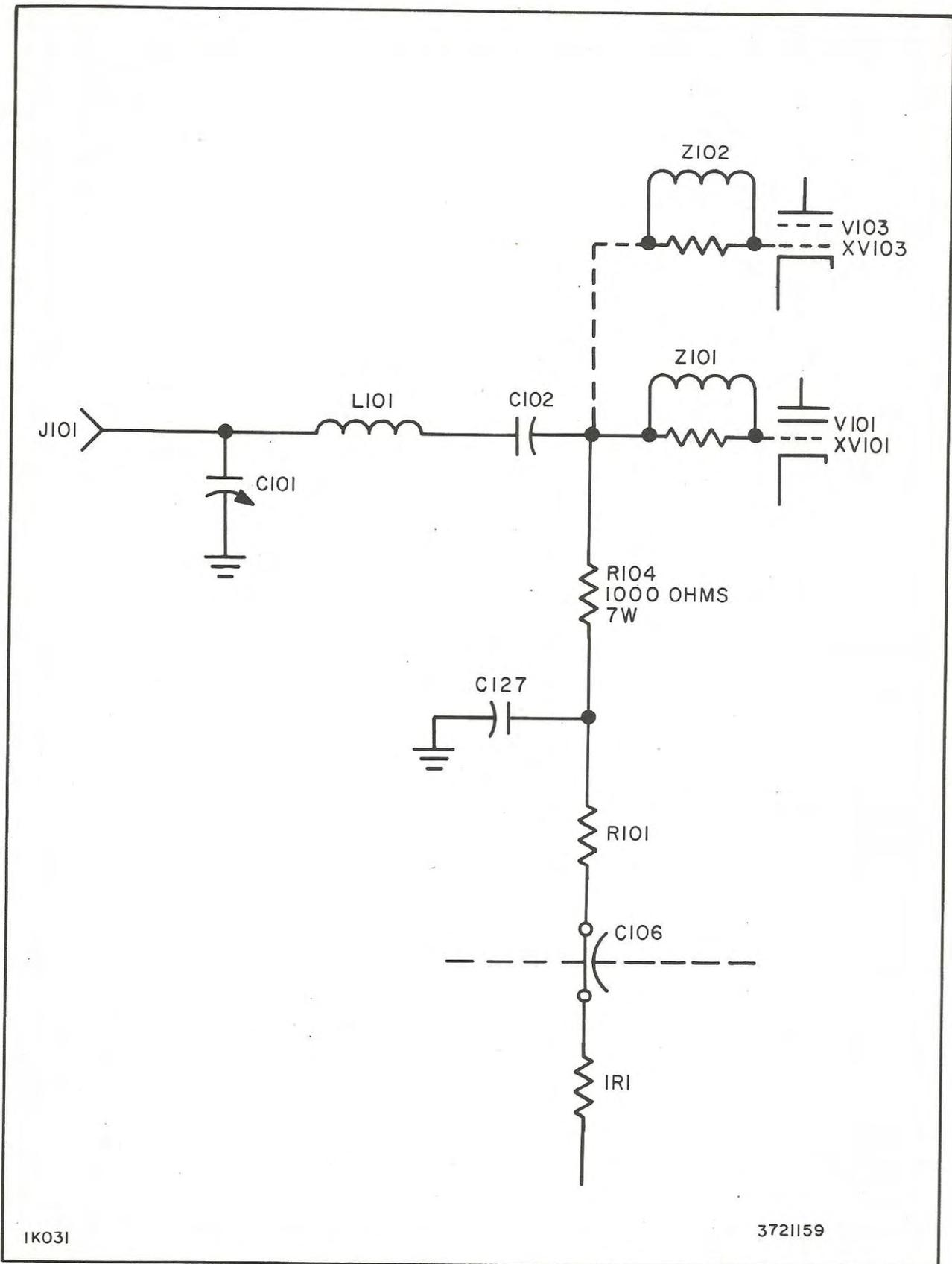


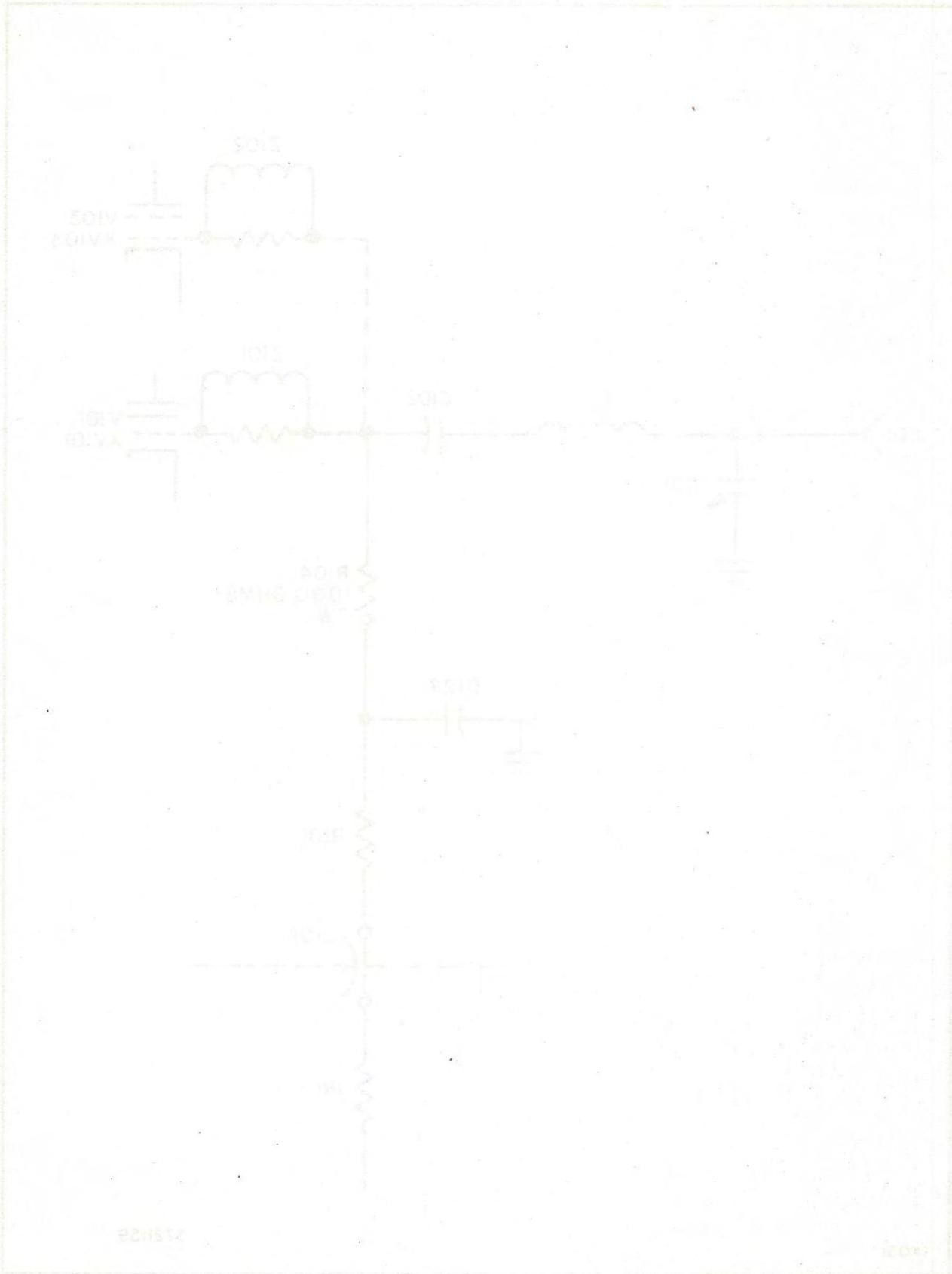
Figure 22. 40 kW Harmonic Filter, Pressurized, Outline Drawing

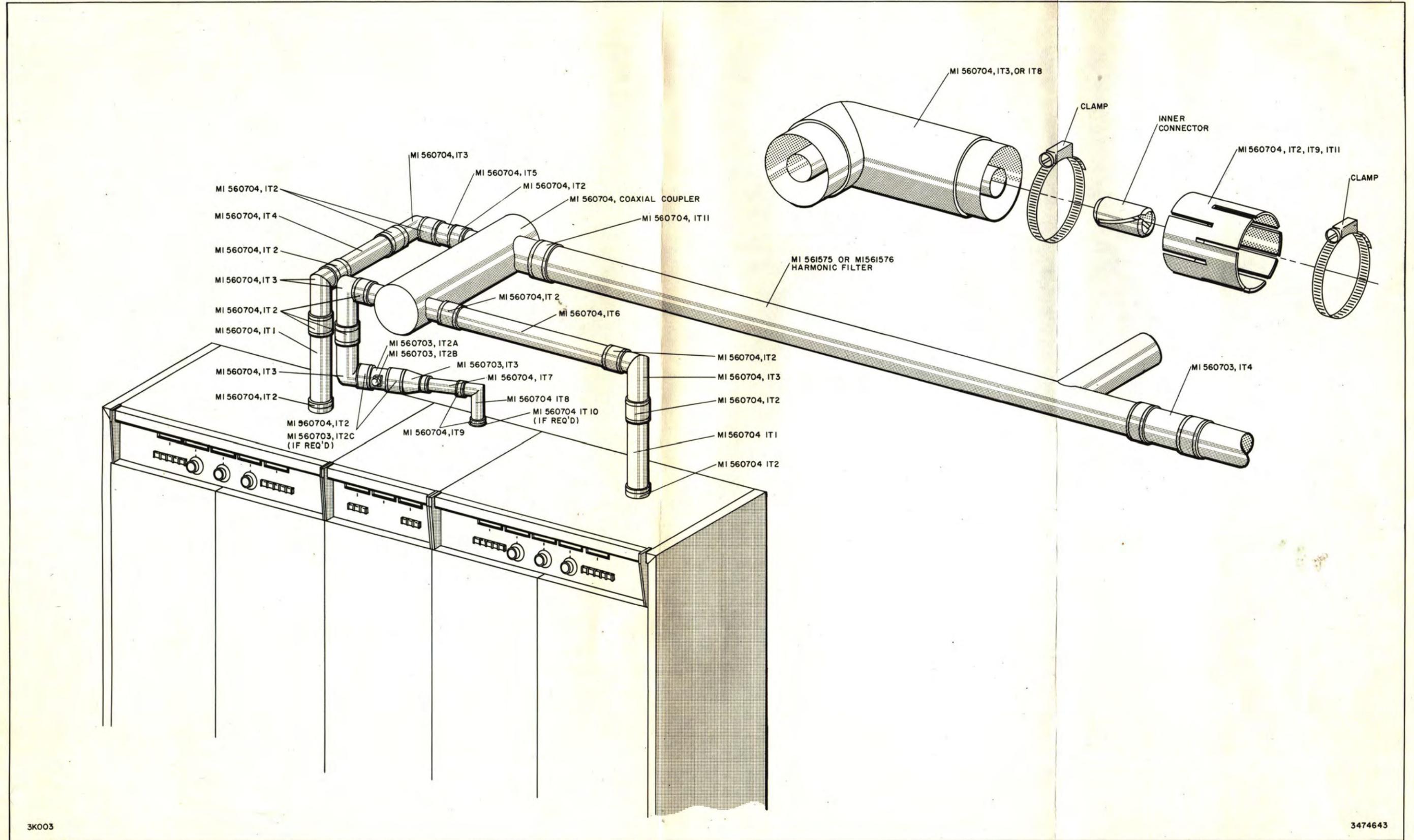


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Figure 23. Driver Grid Circuit Modification, Schematic Diagram





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Figure 24. BTF-40E1 Coaxial Components, Installation