RCA

Broadcast Equipment

[redacted]

BTF-40E1
FM Transmitter

ES-560606B

[redacted]

IB-8027533-2

Broadcast Equipment

studio/SPARE - Received 4/91 A.N.

Instructions

BTF-40E1

FM Transmitter

ES-560606B

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

PRINTED IN U.S.A.

MPL7114M/DL728M
1/78

IB-8027533-2A

A

LIST OF REVISED, ADDED OR DELETED PAGES

The following is a list of the pages in this Instruction Book that have been Revised, Added, or Deleted with their effective date of change:

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CHANGE SYMBOL

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CHANGED PAGES

Changed pages carry in the lower right hand corner of even numbered pages or in the lower left hand corner of odd numbered pages the change date.

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.

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, Communication 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.

TECH ALERT

Emergency 24 hour telephone consultation service for technical problems is available. Call TECH ALERT at 609-963-8000 extension PC3434.

OPERATING HAZARDS

This equipment is designed to fully safeguard all personnel from operating hazards. Labels and warning notices on the equipment and warning and caution notices in the Instruction Book clearly point out these potential hazards and hazards that necessarily exist.

Before operating this equipment, read the following comments and take the necessary precautions to protect operating personnel. Safe operating practices are the responsibility of the station personnel.

HIGH VOLTAGE

High Voltages are present in this equipment which can cause serious injury or loss of life. High voltage circuits are enclosed to prevent accidental contact by personnel and have interlock switch circuits which open the primaries of power supply transformers and discharge high voltage capacitors whenever access to the equipment is required.

MICROWAVE RADIATION

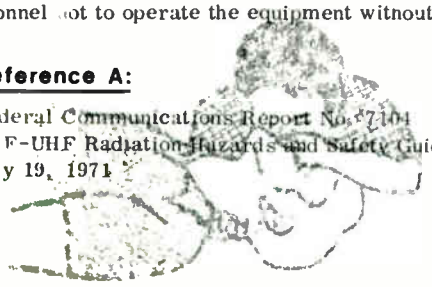
Exposure of the human body to microwave radiation in excess of 10 mW/cm^2 (See Ref. A) may be unsafe and can result in blindness or other injury. Personnel must be fully protected from the microwave energy which may radiate from tubes or transmission line connections. All input and output R F connections, gaskets, and flanges must be leakproof and properly installed. Unless connected to an antenna, NEVER OPERATE MICROWAVE RADIATING EQUIPMENT WITHOUT A RADIATION ENERGY ABSORBING LOAD ATTACHED. Personnel must be prevented from looking into an open antenna while the equipment is operating.

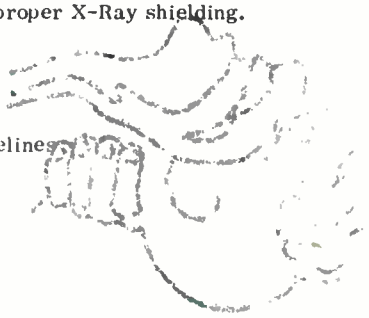
X-RAYS

X-Ray radiation may be produced by energized VHF and UHF equipment. Personnel must be protected by appropriate shielding. Adequate shielding on all sides of the tubes and equipment is provided as well as on the auxiliary equipment. X-Ray Warning signs or labels are permanently attached to the equipment (where necessary) directing personnel not to operate the equipment without proper X-Ray shielding.

Reference A:

Federal Communications Report No. 7104
VHF-UHF Radiation Hazards and Safety Guidelines
July 19, 1971





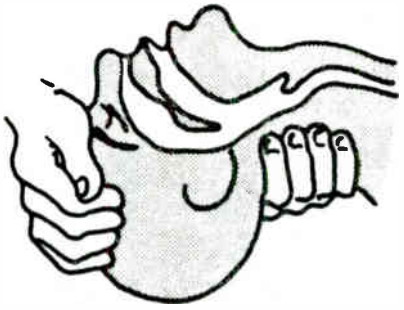
WARNING

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.

EMERGENCY FIRST AID INSTRUCTIONS

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



1. Find out if the person is breathing.

   You must find out if the person has stopped breathing. If you think he is not breathing, place him flat on his back. Put your ear close to his mouth and look at his chest. If he is breathing, you can feel the air on your cheek. You can see his chest move up and down. If you do not feel the air or see the chest move, he is not breathing.

2. If he is not, open the airway by tilting his head backward.

   Lift up his neck with one hand and push down on his forehead with the other. This opens the airway. Sometimes doing this will let the person breathe again by himself. If it does not, begin rescue breathing.

3. If he is still not breathing, begin rescue breathing:

   Keep his head tilted backward.
   Pinch his nose shut.
   Put your mouth tightly over his mouth.
   Blow into his mouth once every five seconds.
   Do Not Stop Rescue Breathing Until Help Comes.

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.

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	87.5 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, feet (meters)	Standard Blower	Optional Blower
60 Hz line	7500 (2286)	11,000 (3353)
50 Hz line	3000 (914)	6500 (1981)

Dimensions:

	Transmitter	Power Supply
Width, inches (cm)	114-1/4 (290.2)	32 (81.3)
Height, inches (cm)	77 (188.6)	45-1/2 (116)
Depth, inches (cm)	33-1/8 (84.1)	23-1/4 (59.1)

Shipping Weight per Unit (approx.), pounds (kg)	
Basic Transmitter, MI-560507A	1454 (660)
Power Determining Parts, MI-560510	220 (100)
Miscellaneous Items	136 (61.7)
Power Supply, MI-560342-6	236 (107)
Plate Transformer, MI-560341-7	486 (220)
Combining Equipment Rack, MI-560702B	686 (311)
Net Weight (approx.), pounds (kg)	
Transmitter, Less Power Supplies	3856 (1749)
Power Supply Only, Weight Each	676 (307)

[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-560606B

Quantity	Description	Reference
2	Basic Transmitter	MI-560507A
2	Power Determining Kit	MI-560510B
2	Blower	
	0-7500 Ft., 60 Hz Line Frequency or	
	0-3000 Ft., 50 Hz Line Frequency	MI-560347-A1
*	3000-6500 Ft., 50 Hz Line Frequency or	
	7500-11,000 Ft., 60 Hz Line Frequency	MI-560347-3
2	Rectifier	MI-560340-4
2	Plate Transformer	MI-560341-7
2	Power Supply	MI-560342-7
2	Side Panel	MI-560755
1	Door, Front	MI-560375-1
2	Installation Material (BTF-20E1)	MI-560515
1	Installation Material (BTF-40E1)	MI-560703A
1	Installation Assembly Material	MI-560727
1	Harmonic Filter, select as follows:	
	87.5 to 108 MHz Unpressurized	MI-561575
	87.5 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-28180A
*	Touch Up Finish Kit	MI-27660C
2	Blower Mounting Kit	
	If MI-560347-A1 Blower is Supplied	MI-560517
	If MI-560347-3 Blower is Supplied	MI-560705
2	Frequency Determining Parts, for customer's assigned frequency as follows:	
	ES NUMBER — FREQUENCY	
	ES-560272C-1 — 87.5 TO 89.9 MHz	
	ES-560272C-2 — 90.1 TO 91.9 MHz	
	ES-560272C-3 — 92.1 TO 93.9 MHz	
	ES-560272C-4 — 94.1 TO 95.9 MHz	
	ES-560272C-5 — 96.1 TO 97.9 MHz	
	ES-560272C-6 — 98.1 TO 99.9 MHz	
	ES-560272C-7 — 100.1 TO 101.9 MHz	
	ES-560272C-8 — 102.1 TO 103.9 MHz	
	ES-560272C-9 — 104.1 TO 105.9 MHz	
	ES-560272C-10 — 106.1 TO 107.9 MHz	
1	Coaxial Coupler, 40 kW	MI-561564
1	Combining Equipment Rack	MI-560702B
1	Set of Coaxial Components	MI-560704A
1	Misc. Coaxial Components (BTF-40E1)	MI-560706A
*	6-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-561579-*
*	3-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-27791K-*
*	1-5/8 in. O.D. 50 Ohm Transmission Line Components	MI-561565-*
1	Coaxial Coupler (10 kW per port)	MI-561537A
2	Directional Coupler	MI-561043-4
2	5 kW RF Load	MI-560723
1	Driver Stage Modification Kit	MI-560307-32
1	Set of Installation Drawings (see table 1)	3720423
2	Instruction Book, BTF-40E1	IB-8027533-2
2	Instruction Book Addenda, BTF-40E1	IB-8027533-2A
2	Instruction Book, BTF-20E1	IB-8027531-2
2	Instruction Book, BTE-15A FM Exciter	IB-8027524-2
*	Remote Control Panel	MI-561354
*	Automatic Power Control Panel	MI-561353
*	Automatic Power Control Installation Kit	MI-561358

*Supplied if and as specified on sales order.
**Supply two ES as specified on sales order.

INSTALLATION MATERIAL

MI-560703A

Quantity	Description			Reference
1	Suitable Container Containing Hardware:			
	Item	Quantity	Description	
	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:			
	Item	Quantity	Description	
	A	1	Line Section, 3-1/8 O.D.	3471729-6
	B	1	Element	3471729-5
1	Coupling Assembly, Reducer		3-1/8 to 1-5/8 O.D.	MI-561565-5A
2	Cable Assembly, Coax		RG-58/U	3467813-509
	Note: For reflectometer connections, Z3 to J6, Z3 to J7			
1	Cable Assembly, Coax		RG-58/U	3467813-510
	Note: For reject power connection, Z2 to J8			
2	Strap			3456250-1

COAXIAL COMPONENTS

MI-560704A

Quantity	Description		Reference
2	Transmission Line	3.12 O.D. x 16.05 long	3720345-40
	(A) Outer Conductor		3455588-15
	(B) Inner Conductor		3459893-1
14	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	3.12 O.D. x 17.43 long	3720345-41
	(A) Outer Conductor		3455588-16
	(B) Inner Conductor		3459893-2
1	Transmission Line	3.12 O.D. x 5.33 long	3720345-42
	(A) Outer Conductor		3455588-17
	(B) Inner Conductor		3459893-3
1	Transmission Line	3.12 O.D. x 34.67 long	3720345-43
	(A) Outer Conductor		3455588-18
	(B) Inner Conductor		3459893-4
1	Transmission Line	1.62 O.D. x 6.85 long	3720340-29
	(A) Outer Conductor		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

INSTALLATION ASSEMBLY MATERIAL

MI-560727

Quantity	Description	Reference
1	Bracket	3464057-001
1	Bracket	3726271-001
2	Support	8815365-007
1	Cap	3456159-001
1	Tubing 35.00 long	3720340-009
1	Tubing 10.00 long	3720340-010
1	Tubing 15.02 long	3720340-011
4	Coupling 90 miter	MI-561565-2A
3	Miter Elbow	3732668-001
1	Miter Elbow	3732668-002
13	Coupling Assembly	MI-561565-4A
4	Clamp	0443269-004
5	Clamp	0897258-006
1	Clamp	8856540-001
1	Clamp	0897258-005
1	Spacer	3453948-023
1	Installation Assembly Drawing (print)	3477369
1	Suitable Container Containing Hardware:	

Item	Quantity	Description		Reference
A	2	Bolt, Hex	10/32 x 0.5 long	0999963-113
B	2	Screw	10/32 x 0.62 long	0990140-165
C	8	Bolt, Hex	10/32 x 1.0 long	0999963-121
D	1	Bolt, Hex	10/32 x 1.0 long	8887744-105
E	2	Screw	1/4-20 x 0.5 long	0990089-163
F	4	Screw	8/32 x 0.5 long	0990108-163
G	8	Washer	10/32	0082278-159
H	1	Washer	3/8	0082278-160
J	10	Lockwasher	10/32	0093620-169
K	1	Lockwasher	3/8	0093620-172
L	2	Lockwasher	1/4	0093620-166
M	4	Lockwasher	#8	0093620-159
N	8	Nut, Hex	10/32 x 24	0999795-005
P	4	Nut, Hex	8/32	0057435-155
R	2	Lockwasher	#10	0093620-162
S	2	Washer	#10	0082278-156
T	2	Nut, Hex	10/32	0057435-156

MISCELLANEOUS COAXIAL COMPONENTS

MI-560706A

Quantity	Description	Reference
1	Line Section, 6.12 DD (Directional Coupler)	3469759-1
1	Monitor Assembly	3732695-502
2	Hose Clamp (6.12 Diameter)	MI-561579-4C
2	Straight Coupling (6.12 Diameter)	MI-561579-4A

SUGGESTED TEST EQUIPMENT

Description	RCA Reference	Other Reference
PA Dummy Load		Bird Model 8762 or Altronic Research Model 5750
Thruline Wattmeter		Bird Model 4805 (for unflanged 3-1/8 inch 50 ohm line)
Exciter Dummy Load and Wattmeter 0-15/60 Watts		Bird Electronic Corp. Model 611
Audio Generator		Hewlett-Packard Model 209A
Step Attenuator, 1dB and 10dB steps		Hewlett-Packard Model 350D
Distortion and Noise Meter		Hewlett-Packard Model 331A/334A
Oscilloscope		Tektronix Model 422
Senior VoltOhmist VTVM	WV-98C	
Volt-Ohm-Milliammeter	WV-38A	
Grid-Dip Meter		Measurements Corp. Model 59
Coaxial Components used for PA neutralizing:		
One 6 foot length of RG-8/AU Cable with type N connectors		
Reducer Cone (3-1/8" dia. coaxial line to type N connector)		
RG-8/U Cable (specify length)	MI-74A	
(2) Type N connectors	Stock No. 236025	
(1) Reducer Cone (3-1/8" dia. coaxial line to type N connector)	MI-27791K-5A	

OPTIONAL ACCESSORY EQUIPMENT

Description	Reference	Description	Reference
Set of Spare Semiconductors for BTE-15A FM Exciter	MI-560718	BW-75A Remote Metering Panel	MI-560736
Spare Crystal and Crystal Oven for BTE-15A FM Exciter (Specify channel frequency)	MI-560717-*	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
Spare Crystal Oven only, for BTE-15A Exciter	MI-560717A	Tower Lighting Unit	MI-27519
		BW-100B RF Amplifier for the BW-75A Monitor	MI-560738
BTE-15A FM Exciter Module	MI-560712		
BTS-1B Stereo Generator Module	MI-560713	AM Noise Reduction Kit (for low power operation)	MI-560307-31
Type BTX-1B Subcarrier Generator Module (Specify SCA Frequency)	MI-560714	Manometer Kit	MI-560307-36
5-kHz Filter (required when transmitting stereo and SCA; one filter normally supplied, installed, in each SCA generator)	MI-560721	Elapsed Time Indicator	
		60 Hz Line Frequency	MI-561018-2
		50 Hz Line Frequency	MI-561018-4
		Adapter Flange, adapts MI-27791K transmission line to MI-19089 Transmission line	MI-27988-4C
Type BTR-15B Remote Control System	MI-561187/ MI-561188		
Digital Automatic Data Printer (Logging Equipment)		Remote Control Panel for Combined Operation	MI-561354
Type BW-75A FM Monitor	MI-560735		

TUBE COMPLEMENT

Complement	Type	Function
4	7203/4CX250B	Driver
2	4CX15,000A	Power Amplifier
NOTE: Refer to BTE-15A FM Exciter Instruction Book, IB-8027524-1, for the exciter semi-conductor complement.		

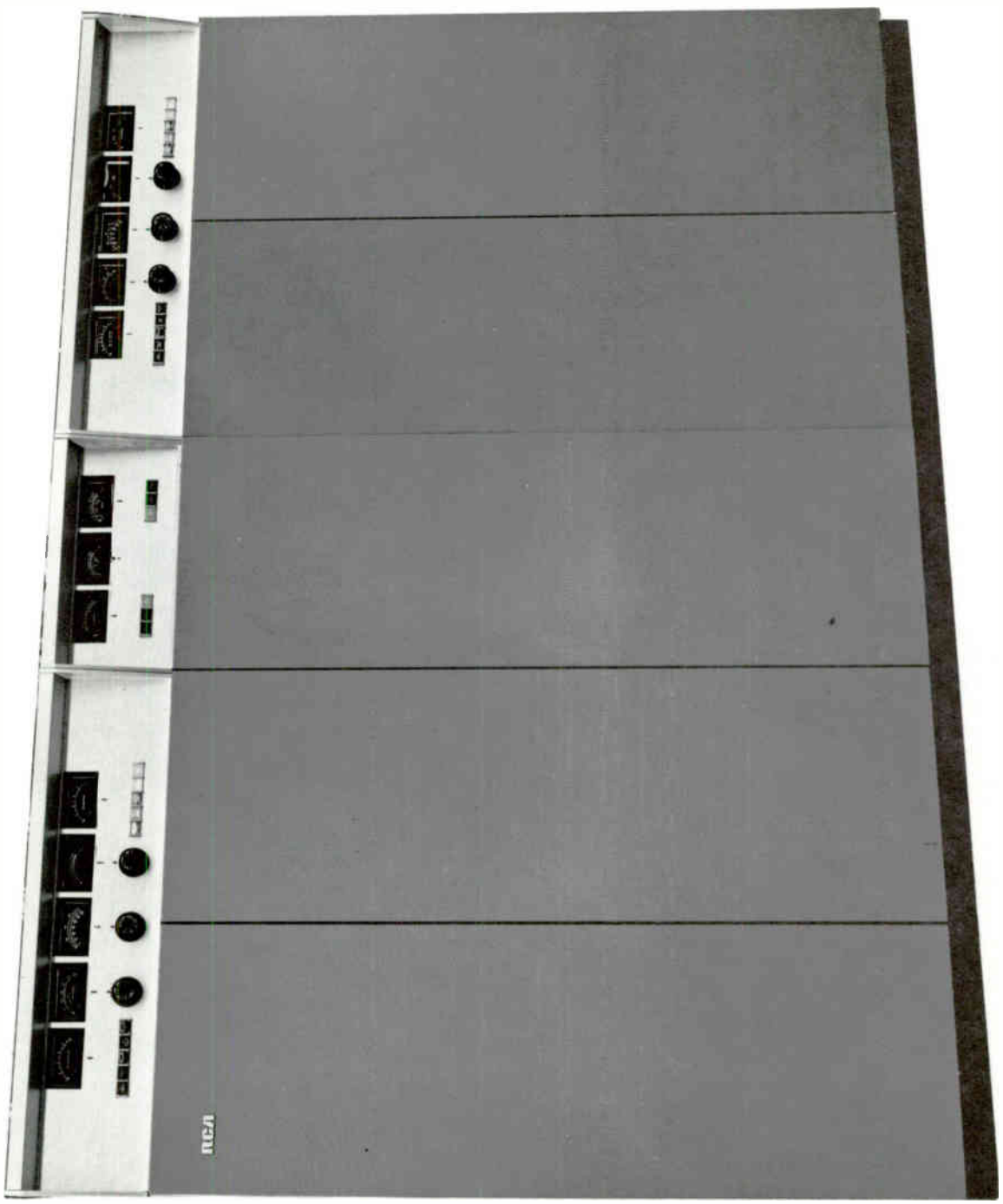

Figure 1. BTF-40E1 40 kW FM Transmitter

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, 87.5 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 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-8027524-1. 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 furnished in blue and charcoal gray textured vinyl with aluminum epoxy trim. 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-8027531-1.

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 20. 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-8027524-1. 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-560702B. 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-561575/561576. 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. The filter is constructed of coaxial transmission line and is the reflective type. Construction is shown in figures 27 and 28.

A detailed circuit description of the BTF-20E1 transmitter is given in IB-8027531-1. 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.

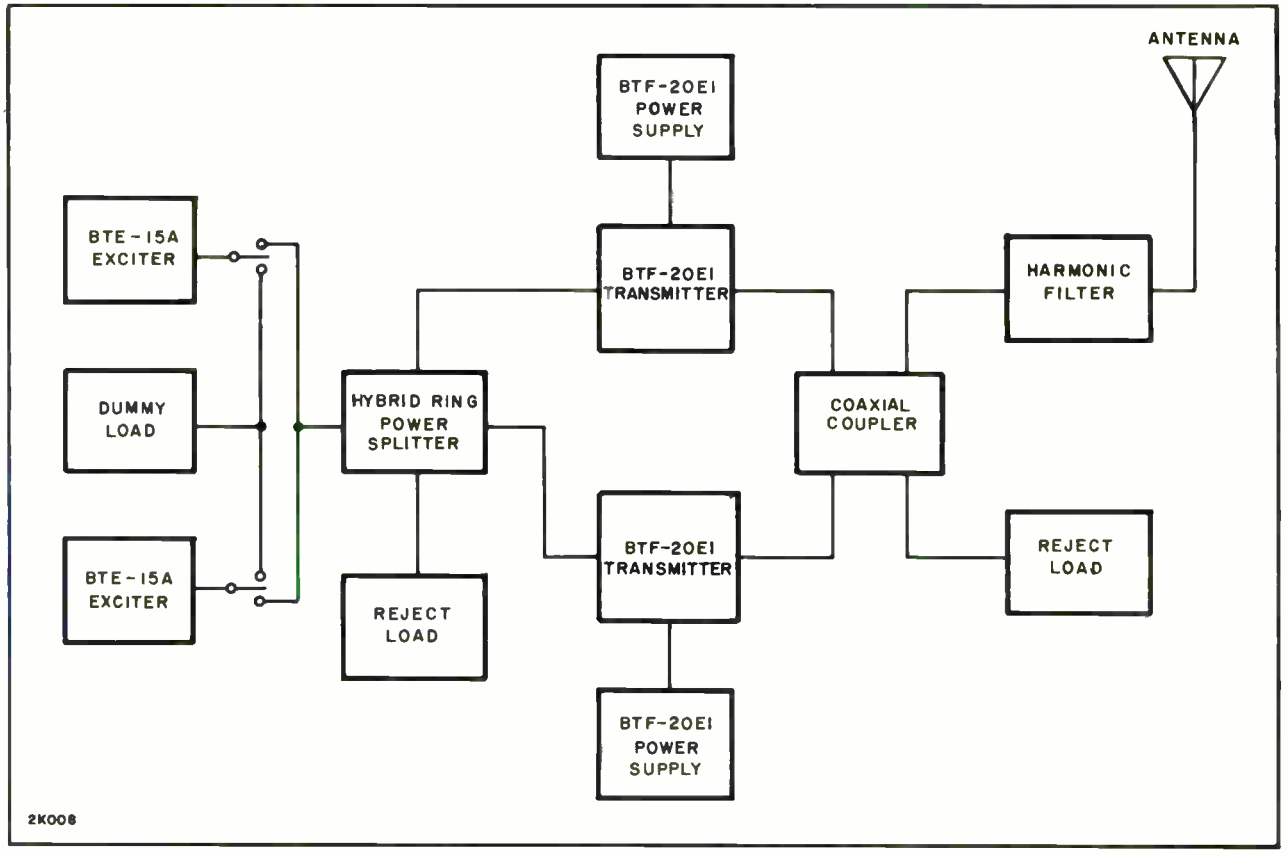

Figure 2. BTF-40E1 Simplified Block Diagram

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 AFC circuit falls out of lock.

The relays in the two exciters are interconnected by means of control relays K103 and K108 such that loss of AFC lock 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-15B Remote Control System, MI-561187 and MI-561188, 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 remote control of TRANSMITTER ON/OFF, HIGH VOLTAGE ON/OFF and OVERLOAD RESET by the use of the optional Remote Control Relay Panel MI-561354. See figures 6 and 17. Terminals are also provided for a remote meter reading of combined power output. Control of tower lights and monitoring of frequency and modulation are also possible at a remote location. Equipment for these features is listed as accessory items and are explained under EQUIPMENT WIRING in IB-8027531-1.

INSTALLATION

EQUIPMENT SUPPLIED

The RCA type BTF-40E1 FM Broadcast Transmitter is rated at 40 kW power output and operates in the 87.5 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-560606B.

To insure up-to-date drawings for installation planning, full-size prints as listed in table 1 are provided. If these drawings are not received soon after the equipment is ordered, they should be requested and used for installation planning and work. The drawings in this instruction book should be used for general reference only.

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

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.

The coaxial components installation drawing (3474643), figure 4, gives details concerning placement of coaxial line, harmonic filter etc. for a BTF-40E1 installation.

Coaxial components (pre-cut transmission line, elbows, transmission line couplings) required for the normal installation shown on the BTF-40E1 Typical Floor Plan drawing figure 3, but not necessarily required when a custom coaxial line arrangement is made, are supplied as MI-560704A (BTF-40E1 Coaxial Components).

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

Coaxial components required in the combined output line (6.12 inch outer diameter) are supplied as MI-560706A (Miscellaneous Coaxial Components

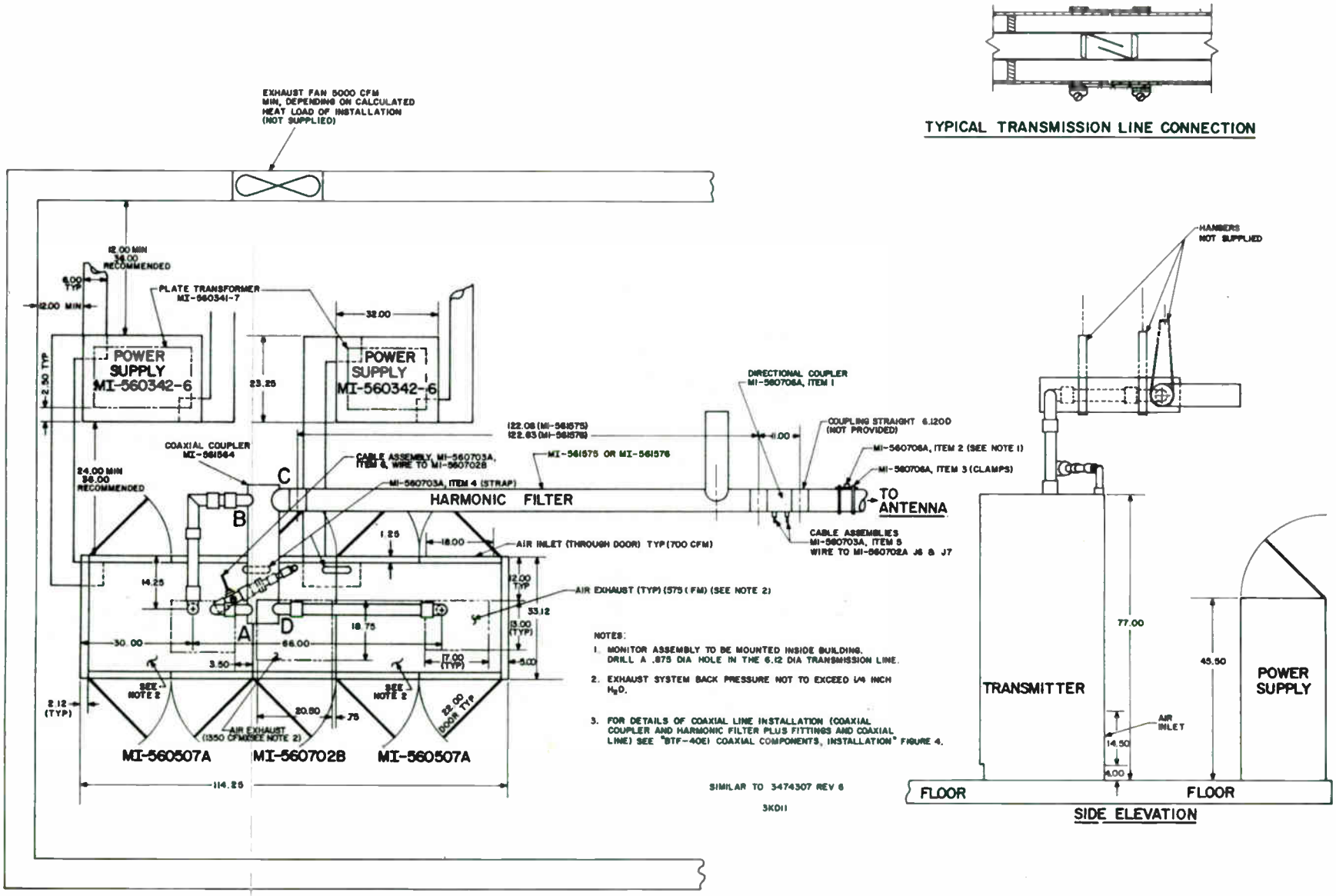

Figure 3. BTF-40E1 Typical Floor Plan

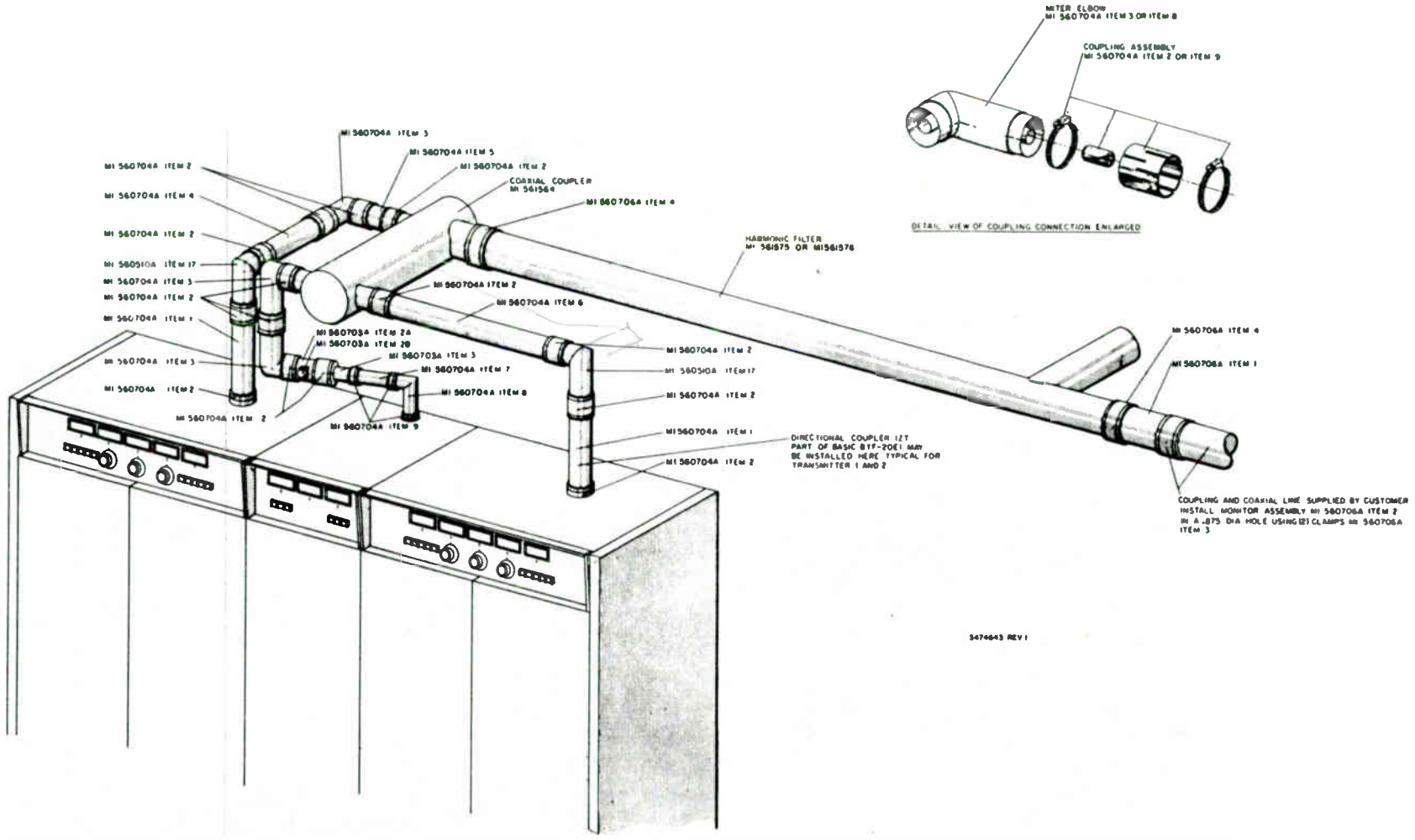

Figure 4. BTF-40E1 Coaxial Components, Installation

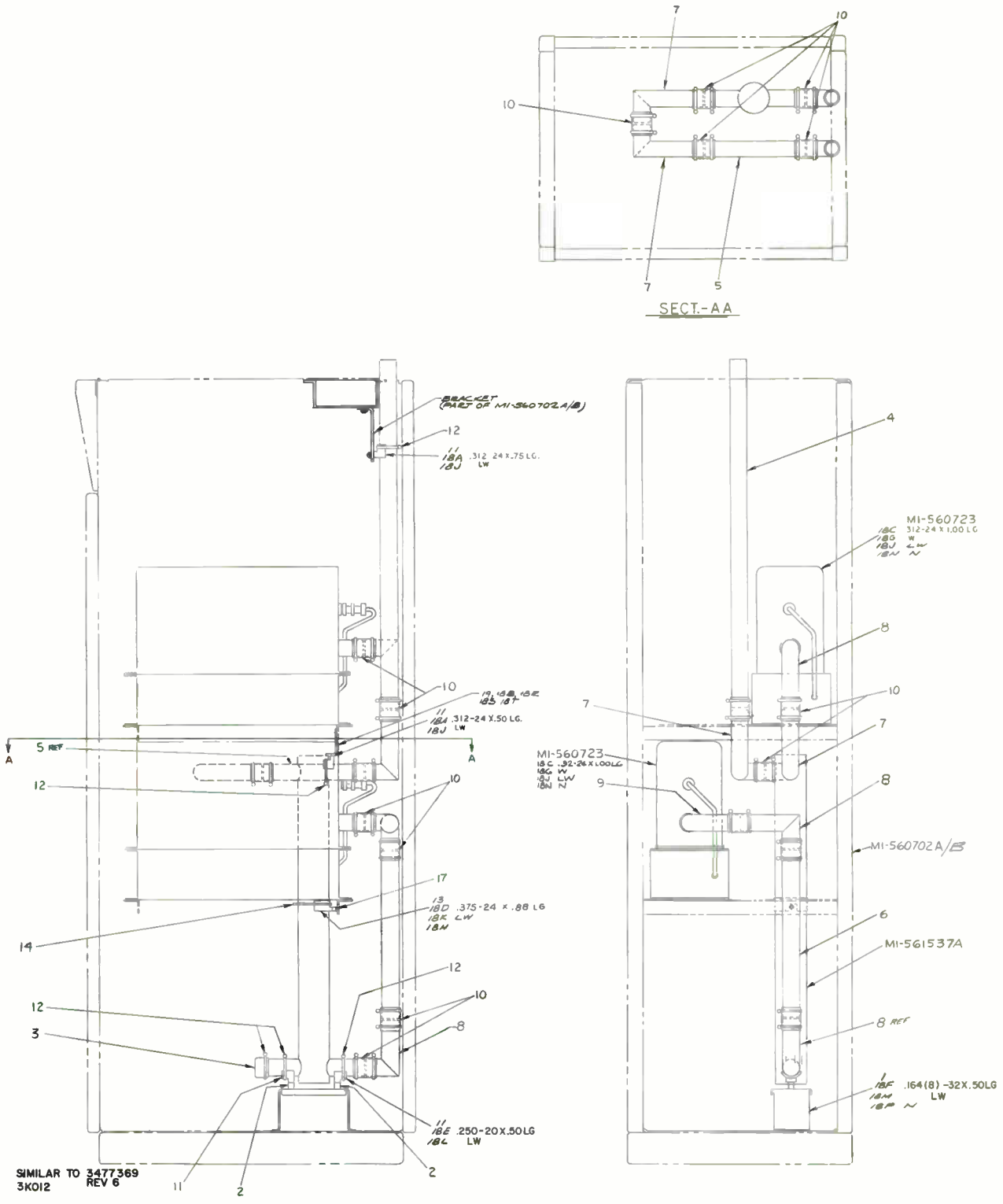

Figure 5. BTF-40E1 Combining Equipment, Installation Assembly

BTF-40E1). These parts are used when coaxial coupler MI-561564 is supplied.

Factory-tested transmitters are normally supplied with all required components mounted in the combining equipment cabinet, MI-560702B. When a transmitter is supplied not factory-tested, some of the components which are housed in the combining equipment cabinet are packed and shipped separately. In such cases the separate items must be installed, using the installation procedure listed.

UNPACKING

An understanding of the shipping system will be of assistance in unpacking the equipment and locating items. Each RCA shipment is accompanied by a shipping invoice which lists the complete contents of the shipment by "Master Item" or "MI" numbers. The shipping invoice is usually attached to one of the cartons, appropriately marked. Each master item (MI) containing two or more items normally contains a packing list (MI sheet).

The complete equipment for the BTF-40E1 FM Transmitter is listed on ES-560606B which references the major items of the shipment and their MI number.

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 required.

EQUIPMENT LAYOUT

A typical layout of the equipment is shown on the Typical Floor Plan drawing, 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 figure 3, the Coaxial Coupler (MI-561564) and Harmonic Filter (MI-561575 or MI-561576) may be conveniently ceiling mounted, using Hanger and Fastener components, available as RCA MI-27700. Hanger 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 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.

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 indi-

TABLE 1. BTF-40E1 INSTALLATION DRAWINGS
3720423

Drawing	Description
ES-560606B	List of Equipment
3474307	Installation Drawing
MI-560703A	Installation Material
3476761	Schematic Diagram
MI-560704A	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-561575 Harmonic Filter
8008008	Outline MI-561576 Harmonic Filter
8008045	Outline MI-561564 40kW Coaxial Coupler
8001400	Outline MI-561537 10kW Coaxial Coupler
MI-560507A	Basic Transmitter (BTF-20E1)
3477431	Schematic Diagram (BTF-20E1)
3721159	Installation Instructions Grid Modification
3474643	Typical Plumbing BTF-40E1

vidual power line from the main distribution panel to the tower lights is desirable.

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 installations 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.

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. The 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).

> NOTE: CFM requirements are at standard barometric pressure (29.9" mercury) and temperature (+15° centigrade).

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

Exhaust system shall have a system back pressure not to exceed 1/4-inch H_2O. The exhaust duct shall provide adequate noise attenuation without noise amplification. Allow adequate space below the ducting for ventilation of the cabinet area not cooled by the blower.

Also, any air-exhaust arrangement should be designed so 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 cabinet. The air-exhaust fitting should be approximately 13" x 17" and located as shown in figure 3 BTF-20E1 Instruction Book, IB-8027531-1 and note 2 of Typical Floor Plan, figure 3, this instruction book.

ASSEMBLY

Refer to the Typical Floor Plan drawing figure 3, 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-560507A) 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, is used.

3. Place the Combining Equipment Cabinet MI-560702B, at the right side of the basic transmitter No. 1 cabinet. The inter-rack wiring harness (Cable Assembly 3476762) 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-560703A.

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-560703A.

7. Mount all Doors (MI-560375 or MI-560372A) and Side Panels (MI-560755) if any have been previously removed.

8. The High-Voltage Power Supplies (MI-560342-6) 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 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 front sections of the power supply cabinets.

ITEMS REMOVED FOR SHIPMENT

In each BTF-20E1 several items are removed and shipped separately. These items include: 1L3, high-voltage filter reactor; 1Z7 directional coupler for remote power monitoring; two couplings, MI-27791-K-4A (used to connect to the harmonic filter); 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-8027531-1) 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.

INSTALLATION OF COMPONENTS IN COMBINING EQUIPMENT CABINET MI-560702B

On transmitters which are being installed in the field, the following installation procedure should be followed. For added information, refer to the BTF-40E1 typical floor plan Installation Assembly Drawing, figure 5, and Installation Assembly Material packing list (drawing MI-560727), in the front of this instruction book. Unless otherwise noted, the item numbers listed in the following installation procedure refer to items listed on MI-560727. Refer also to figure 11.

1. Install mounting bracket (item 1) on base of cabinet, using mounting holes provided. Use hardware provided (items 18F, 18M, 18P).

2. Mount a clamp (cast transmission line mount, item 11) on bracket, item 1, using support spacer (item 2) as shown in figure 5. Use hardware items 18E and 18L and mounting hole in item 1.

3. Repeat this procedure, mounting a second clamp (transmission line mount) and support spacer on top of item 1, using the other mounting hold provided. Both clamps (item 11) are dimensioned for use on 1.62 inch diameter transmission line.

4. Temporarily remove the exciter switching panel (see figure 13) and line stretcher panel (see figures 10 and 11) for better accessibility.

5. Install the two reject power resistor loads, each supplied as MI-560723 on the cross braces provided. Position as shown in figure 5, with RF connectors to rear of cabinet. Secure, using hardware items 18C, 18G, 18J and 18N.

6. Mount a clamp (transmission line mount, for 3.12 inch outer diameter transmission line), item 13, on the cross brace under the lower reject load, at rear of rack. Using hardware items 18D, 18K, and 18H, and spacer, item 17, assemble as shown in figure 5.

7. Mount the coaxial coupler MI-561537A using the three transmission line mounts previously installed. Use two flexible hose clamps (item 12) at the bottom of the coaxial coupler, and one larger hose clamp (for 3.12 inch diameter components), item 14, at the mount near the center of the coaxial coupler.

8. Install metal cap, item 3, on lower rear port of coaxial coupler. The cap is held in place by a hose clamp (item 12).

9. Connect the lower reject power load to the lower front port of the coaxial coupler (MI-561537A), using a special length 50.0 ohm miter elbow (item 9) at the reject load connector, a special length 50.0 ohm miter elbow (item 8) at the lower front coaxial coupler port, together with another special elbow (item 8) and a 15 inch length of 50.0 ohm transmission line (item 6), as shown in figure 5. Secure, using five transmission line couplings (item 10).

10. Connect the upper reject power load to the upper front port of the coaxial coupler (MI-561537A), using a special length miter elbow (item 8) and a standard 50.0 ohm miter elbow (item 7). Secure, using three transmission line couplings (item 10).

11. Assemble two standard 50.0 ohm miter elbows, item 7, in a "U" shaped configuration, connecting the two short ends with a transmission line coupling, item 10. See figure 5, sect. AA.

12. Assemble a 10 inch long section of 50.0 ohm transmission line (item 5) to the open end of one of the elbows using a transmission line coupling item 10.

13. Attach another standard 50.0 ohm miter elbow, item 7, at the open end of the 10 inch section of line, using a transmission line coupling, item 10. Orient as shown in figure 5.

14. Connect this assembly to the upper rear port of the coaxial coupler, MI-561537A, using transmission line coupling (item 10).

15. Mount bracket (item 19) to the upper reject load cross brace using hardware items 18B, 18R, 18S and 18T.

16. Using a clamp (cast transmission line mount, item 11) and hose clamp (item 12), the 10 inch long section of line installed in step 12 should now be mounted rigidly to the bracket installed in step 8, using hardware items 18A and 18J.

17. Connect the 35 inch length of 50.0 ohm transmission line (item 4) to the open end of the standard elbow installed in step 13, using a transmission line

coupling (item 10). The transmission line section should protrude through a hole in the wire duct at the top of the transmitter cabinet.

18. Mount clamp (item 11) to a bracket (part of the combining equipment cabinet) near the top of the cabinet using hardware items 18A and 18J.

19. Secure the upper end of the 35 inch section of transmission line in place by clamping it to item 11 with a hose clamp (item 12).

20. Remove the cover from the outlet box containing the ac power wires to the fan motors in each reject power load (MI-560723).

21. Connect the fan motor power leads in parallel and then to terminal board terminals 4TB1-17 and 4TB1-18 at the top of the combining equipment cabinet. Replace outlet box cover.

22. Reinstall the exciter switching panel and line stretcher panel removed in step 4.

COAXIAL COUPLER INSTALLATION

The following procedure is for a typical installation as shown in figure 3. Refer to the Typical Floor Plan, figure 3 and to Coaxial Components, Installation, figure 4.

> NOTE: Variations in the typical floor plan are not advisable if pre-cut Coaxial Components (MI-560704A) 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-560704A, item 2) including coupling inner connector on a 16 inch section of Transmission Line (MI-560704A, item 1). 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-560510A, item 17) and one Straight Coupling (MI-560704A, item 2), including the coupling inner connector 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-560510A, item 17.

4. Make a sub-assembly using one 17.4 inch section of Transmission Line (MI-560704A, item 4), one Elbow (MI-560704A, item 3), one 5.3 inch section of Transmission Line (MI-560704A, item 5), and four Straight Couplings (MI-560704A, 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 coaxial components installation drawings figure 4. The Coaxial Coupler (MI-561564) Outline Drawing is presented in figure 26.

5. Using the 34.6 inch length of 3-1/8 inch diameter Coaxial Line (MI-560704A, item 6) and two Straight Couplings (MI-560704A, 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-560704A, item 3) with one Straight Coupling (MI-560704A, item 2) on port A of the Coaxial Coupler. The long leg of the elbow should point down.

8. Install one Elbow (MI-560704A, item 3) with one Straight Coupling (MI-560704A, 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-560703A, item 2A), a 3-1/8 inch diameter to 1-5/8 diameter Reducer Coupling (MI-560703A item 3) a 6.8 inch length of Transmission Line (1-5/8 diameter, MI-560704A, 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-560704A, item 8. Use Straight Couplings (MI-560704A, 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. Check the inner conductors for proper placement before tightening the joints.

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

12. Install the Harmonic Filter, MI-561575 (see

figure 27) or MI-561576 (see figure 28). 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-560706A, item 4).

14. Install Combined Power Output Directional Coupler (6-1/8 inch diameter line section, MI-560706A item 1) at the output of the harmonic filter. A Transmission Line Coupling (MI-561579-4A) is supplied with MI-560706A.

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. 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 30.

CAUTION

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 in the power supply cabinet (a copper-flashed angle bracket 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-560507A. Two straps are provided for this purpose (MI-560703A, item 4). 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

Connect power supply high voltage rectifier connector designated HV+ 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. Use high voltage wire, MI-560515 item 6.

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-560702B) are supplied as Combining Equipment Cabinet, Main Cable Harness Assembly (drawing 3476762) figure 25. The

TABLE 3. AC POWER AND CONTROL CONNECTIONS

In Combining Equipment Cabinet, Connect Terminal	To Terminal	In Basic Transmitter No.*	Wire No. Cable Dwg. 3476762	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	
4TB101-5	1TB2-17	2	21	
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	

*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. 3476762	Supplementary Information
4TB101-2	1TB6-22	1	51	Pressure Type Connections, Tighten Hardware Securely
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	1TB1-24 1TB1-23	Ground Shield
Plug 4P129	4J106	Combining Equipment Cabinet (MI-560702B)	Wire 39 Red Wire 39 Blk	4TB1-23 4TB1-24	
Plug 4P130	4J107	Transmitter No. 2	Wire 38 Red Wire 38 Blk	1TB1-24 1TB1-23	
Plug 4P152	4J118	Transmitter No. 1	Wire 40 Red Wire 40 Blk	1TB1-20 1TB1-19	
Plug 4P153	4J119	Combining Equipment Cabinet (MI-560702B)	Wire 44 Red Wire 44 Blk	4TB1-27 4TB1-28	
Plug 4P154	4J120	Transmitter No. 2	Wire 47 Red Wire 47 Blk	1TB1-20 1TB1-19	
Plug 4P162	4J121	Transmitter No. 1	Wire 42 Red Wire 42 Blk	1TB1-22 1TB1-21	
Plug 4P163	4J122	Combining Equipment Cabinet (MI-560702B)	Wire 43 Red Wire 43 Blk	4TB1-25 4TB1-26	
Plug 4P149	4J123	Transmitter No. 2	Wire 46 Red Wire 46 Blk	1TB1-22 1TB1-21	
Plug 4P157	4J124	Transmitter No. 1	Wire 41 Red Wire 41 Blk	1TB1-18 1TB1-17	
Plug 4P158	4J125	Combining Equipment Cabinet (MI-560702B)	Wire 45 Red Wire 45 Blk	4TB1-29 4TB1-30	
Plug 4P159	4J126	Transmitter No. 2	Wire 48 Red Wire 48 Blk	1TB1-18 1TB1-17	

TABLE 5. AUDIO INPUT CONNECTIONS

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

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, MI-560702B. 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 (figure 25). 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 is desirable 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 6 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. An optional relay panel containing this circuitry is available as MI-561354 (Remote Control Relay Panel). See figure 17.

The Remote Control Relay Panel should be located on the right side of the combining equipment cabinet near the bottom with 4TB111 at the top of the panel. See figures 11 and 17. The panel should be mounted in the holes provided with 4 10-32 x 0.5 inch screws, 4 #10 split lock washers and 4 10-32 hex nuts (not supplied). Make the remote control connections as shown in table 6 using #18 AWG wire (not supplied). For the location of 4TB102, see figure 15. After wiring has been completed, the added wiring should be tied together and secured to the combining equipment cabinet.

Remote control connections for monitoring the PA plate voltage, PA plate current or power output of the individual BTF-20E1 transmitters is presented in table 2 of IB-8027531-1. A remote power monitoring directional coupler 1Z7 is supplied with each BTF-20E1 transmitter (part of MI-560510A). 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-560704A) 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. See figure 4.

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.

Connection 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.

Check for tightness of all connections to the plate transformer 3T1. Security of connections to 2Z1, 2TB1, 2K1, 2S1 and 2S2 should also be checked at this time.

CAUTION

The high voltage and current present can damage transmitter components by arcing or heating at loose connections. Tightness must be assured before application of power.

Connection of Primary Power (117, 208 or 240 Vac) to the BTE-15A FM Exciter

The BTE-15A may be operated from 117, 208 or 240 Vac 50/60 Hz. Refer to the BTE-15A Main Frame Schematic Diagram and the T1 Connection Drawing in IB-8027524-1 to determine or change the voltage input requirements of the exciter.

CAUTION

Be certain T1 is properly connected for the voltage to be applied to the exciter through J103 before applying power, or damage to the exciter may result.

RF MONITOR ASSEMBLY

An RF Monitor Assembly (sampling probe), item 2 of MI-560706A is provided for use in the transmitter combined output line. If the optional Coaxial Coupler MI-561535 is used, the monitor assembly will be item 2 of optional MI-560706D. In order to mount the monitor

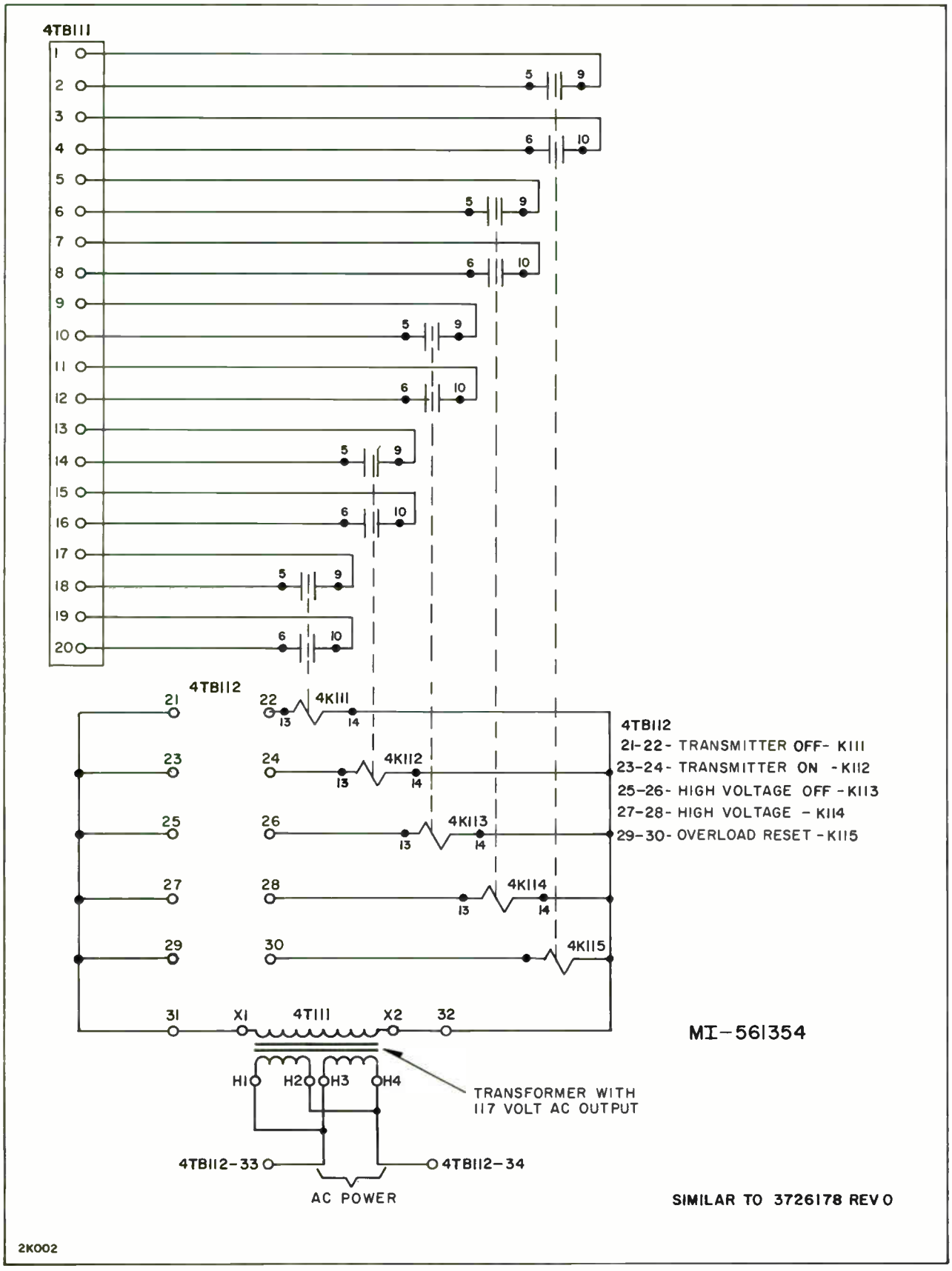

Figure 6. Remote Control Relay Panel (MI-561354) for BTF-40E1, Schematic Diagram

TABLE 6. REMOTE CONTROL OPERATION CONNECTIONS

For ganged operation (to be used with MI-561354 Remote Control Relay Panel):

Remote Control Function	Connect Momentary NO contact to	Connect	Connect
Transmitter OFF	4TB112-21, 4TB112-22	4TB111-19 to 4TB1-11 4TB111-20 to 4TB1-12	4TB111-17 to 4TB1-14 4TB111-18 to 4TB1-15
Transmitter ON	4TB112-23, 4TB112-24	4TB111-15 to 4TB1-11 4TB111-16 to 4TB1-13	4TB111-13 to 4TB1-14 4TB111-14 to 4TB1-16
High Voltage OFF	4TB112-25, 4TB112-26	4TB111-11 to 4TB1-4 4TB111-12 to 4TB1-5	4TB111-9 to 4TB1-8 4TB111-10 to 4TB1-9
High Voltage	4TB112-27, 4TB112-28	4TB111-7 to 4TB1-3 4TB111-8 to 4TB1-6	4TB111-5 to 4TB1-7 4TB111-6 to 4TB1-10
Overload Reset	4TB112-29, 4TB112-30	4TB111-3 to 4TB1-1 4TB111-4 to 4TB1-4	4TB111-1 to 4TB1-2 4TB111-2 to 4TB1-8

For remote power output adjustment of each transmitter	See table 2 in IB-8027531-1

For exciter switching status indication:

Exciter 1	Connect momentary NO contact to 4TB102-16 (common), 4TB102-17
Exciter 2	Connect momentary NO contact to 4TB102-16 (common), 4TB102-18

For remote metering:

Remote Metering Function	Connect to 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 μA)

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.

> 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, MI-560723

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. Each coaxial resistor (reject load) is capable of dissipating 5000 watts with the blower in operation.

PHASING AC INPUTS TO THE EXCITER SWITCHING RELAY PANEL, MI-560700 (FIGURE 15)

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. Also, phasing lights 4DS1 and/or 4DS2 will light. 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 1B-8027524-1.

The control circuit checkout and tuneup procedure for the BTF-20E1 transmitter is included in 1B-8027531-1.

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 87.5 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 figure 3 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 driver stage RF inputs.

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 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 7.

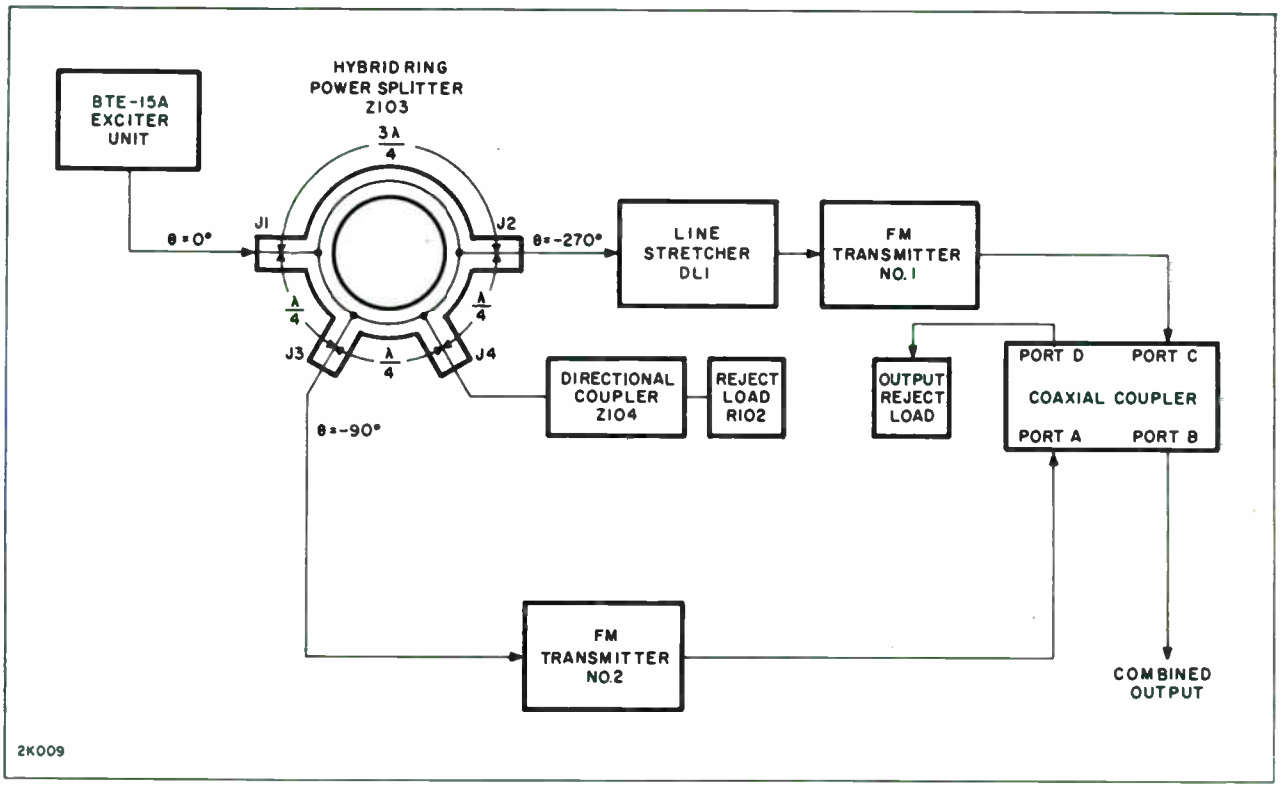

Figure 7. BTF-40E1 Transmitter, Functional Diagram

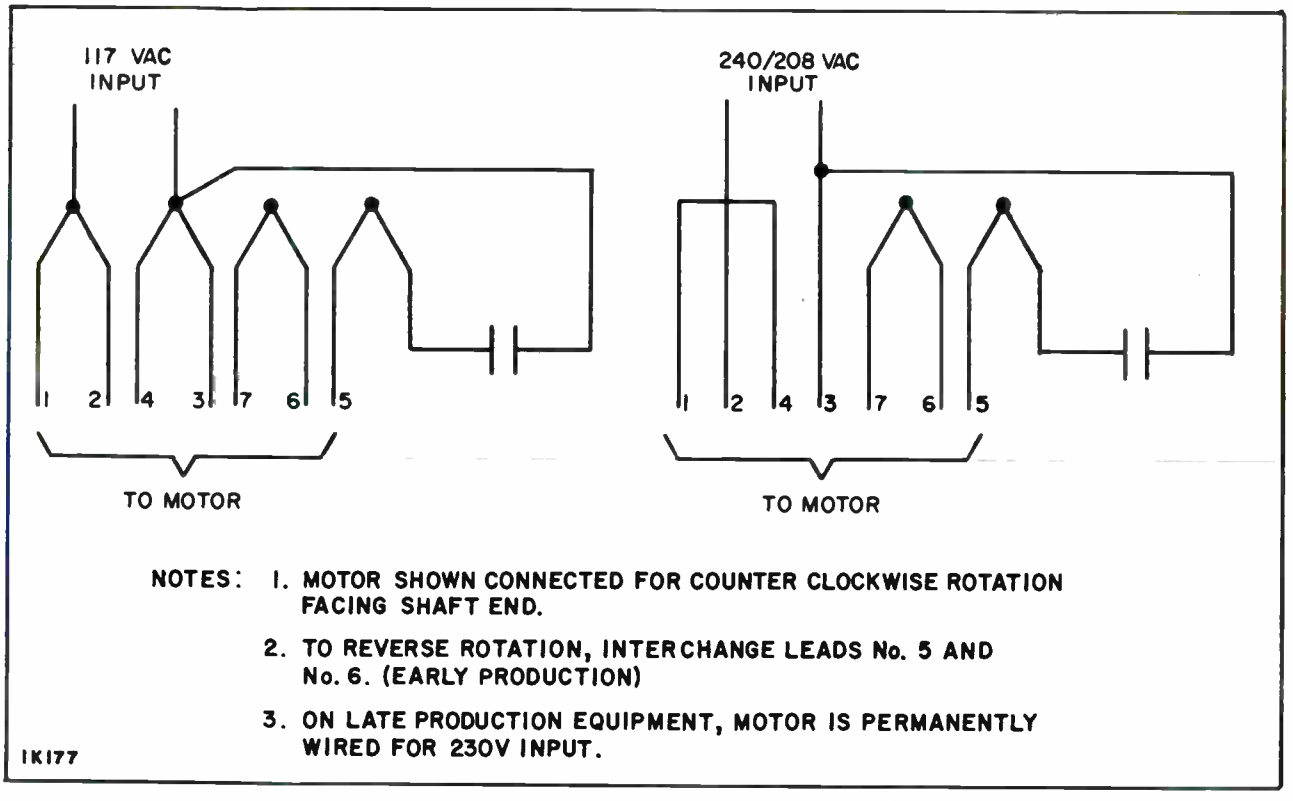

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Figure 8. Combining Cabinet Ventilation Motor, 4B1, Wiring Connections

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 ac power for each exciter is normally supplied from a 117 volt source independent of both BTF-20E1 units. AC power for the Remote Power relay K101 in both exciter units and the exciter switching circuit is normally supplied from the 240 volt circuit in transmitter No. 1. In the event of failure of primary power to transmitter No. 1, the control 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.

The exciter Remote Power relay K101 is included in each BTE-15A in order to remove exciter RF output when the transmitter is turned off.

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 8.

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 fans 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 PROTECTION 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.

Since status lights are provided on each BTF-20E1 transmitter, this status (light) information is not duplicated on the combining equipment cabinet, with the exception of the VSWR OVERLOAD light. Therefore, the TRANSMITTER OFF, TRANSMITTER ON, HIGH VOLTAGE OFF, HIGH VOLTAGE ON and OVERLOAD RESET pushbuttons on the combining equipment cabinet are not illuminated, although each of these switches is functional. The VSWR OVERLOAD status light on the combining equipment cabinet lights when the VSWR in the combined output line exceeds a preset value, initiating a VSWR overload, normally removing high voltage from each individual transmitter.

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 unless Remote Control Relay Panel MI-561354 is installed.

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.

WARNING

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 described in the following procedure:

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 1B-8027531-1 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 1_G 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: Loosen 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 proceeding 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 RG-213/U or RG-8/U 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% (10kW). 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% (20kW). 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: Remote power monitoring of the individual BTF-20E1 transmitters is not shown on figure 3. Individual power monitoring is not normally required however directional couplers (and accessory items) for this function are included with each BTF-20E1 (MI-560510A items 18, 22, and 23). 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. Set the VSWR PROTECTION switch 4S8 to the IN USE position. 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. Leave VSWR PROTECTION switch 4S8 set 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. Also, VSWR PROTECTION switch 4S8 should be set to the IN USE position. Note, however, that REFLECTOMETER switch 4S7 should not be switched unless 4S8 is set to the OUT positions. If this precaution is not followed, operation of 4S7 can cause spurious transmitter shutdown.

31. If a power output of less than 40 kW is desired, proceed as described in steps 1 through 20.

Then perform steps 21 through 31 except based on 100% output power at the desired power level.

EFFICIENCY FACTOR

The efficiency factor of each BTF-20E1 transmitter should be as shown on figure 8 of the BTF-20E1 Instruction Book, (IB-8027531-1). 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 6 may be employed. This Remote Control Relay Panel, MI-561354, is available as an optional item.

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-8027531-1, 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. Normal operation of this relay is as shown in table 7.

The control relay in the VSWR trip circuit is de-energized as long as the indication of 4M2 is below the set point. See table 7 for a summary of relay contact status vs various circuit conditions. For the control module schematic diagram, see figure 19.

TABLE 7. CONTROL MODULE 4Z1 SERVICING CHART

Condition	Set Point N. O. Relay Contacts 5-6, 12-13	Set Point N. C. Relay Contacts 4-5, 11-12
AC Power OFF	Open	Closed
AC Power ON, Indication Below Set Point	Open	Closed
AC Power ON, Indication Above Set Point	Closed	Open
AC Power ON, Meter Lamp Failure	Closed	Open

Notes: 1. Contact status (closed or open) versus circuit condition.
2. See figure 19 for Control Module schematic diagram and terminal identification.

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.

Extending Tube Life in FM Transmitters

Proper attention to the filament voltage of the individual PA tubes, type 4CX15,000A/8281 can greatly increase tube life of these tubes. For further information refer to "RCA Technical Bulletin TB334-3" in IB-8027531-1.

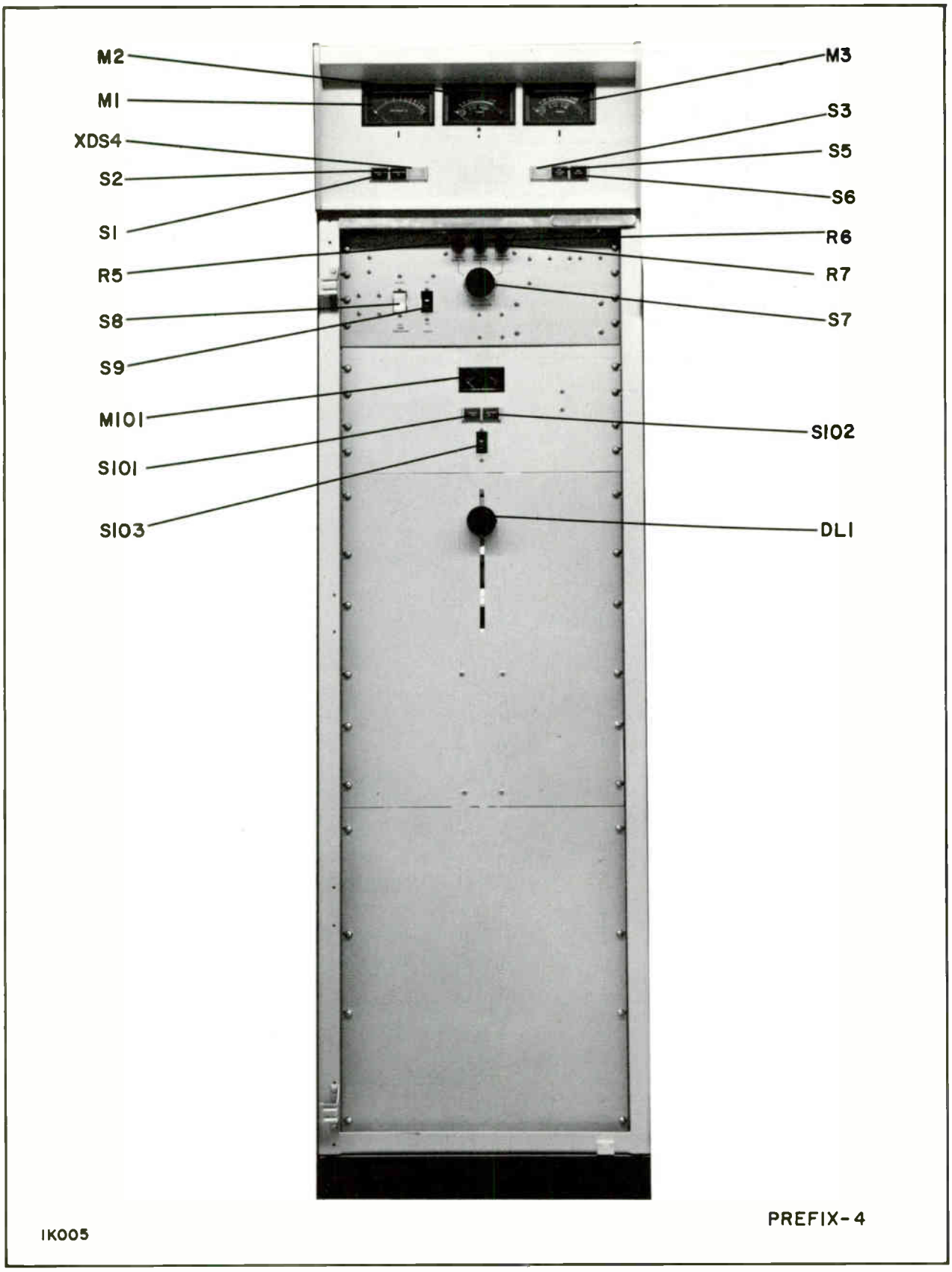

Figure 9. Combining Equipment (Prefix 4)

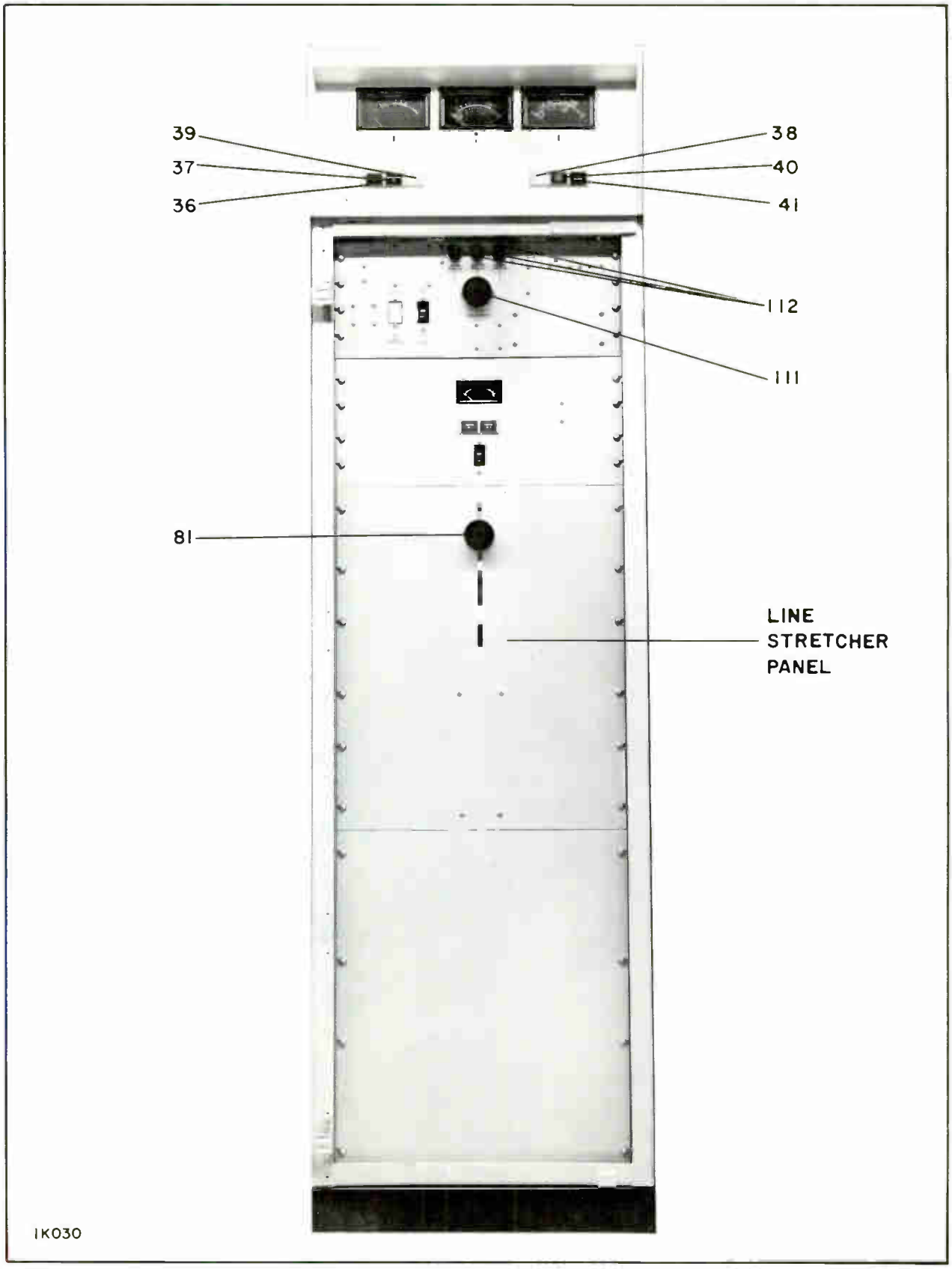

Figure 10. Combining Equipment Cabinet, Mechanical Parts, Front View

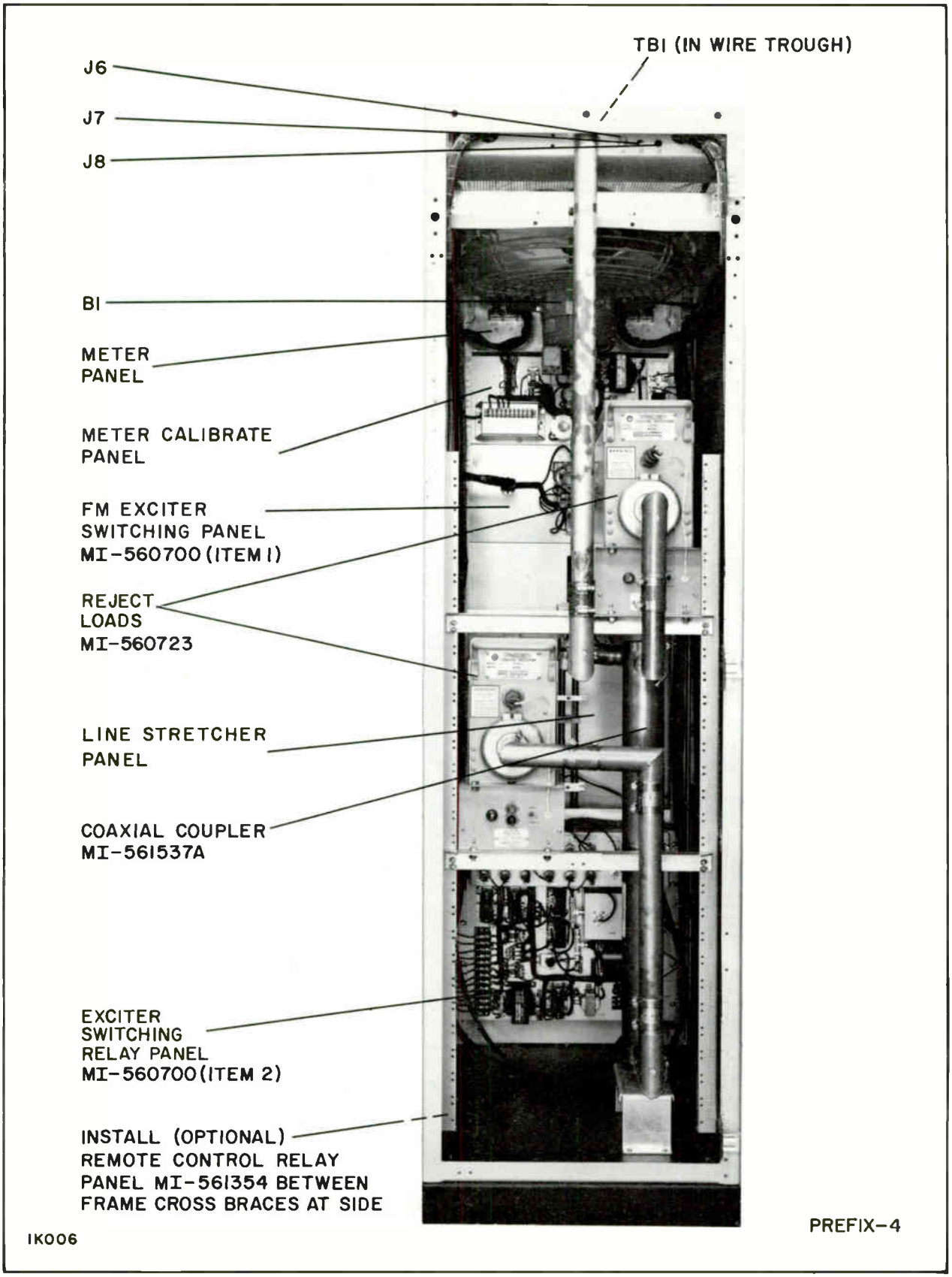

Figure 11. Combining Equipment Cabinet, Rear View (Prefix 4)

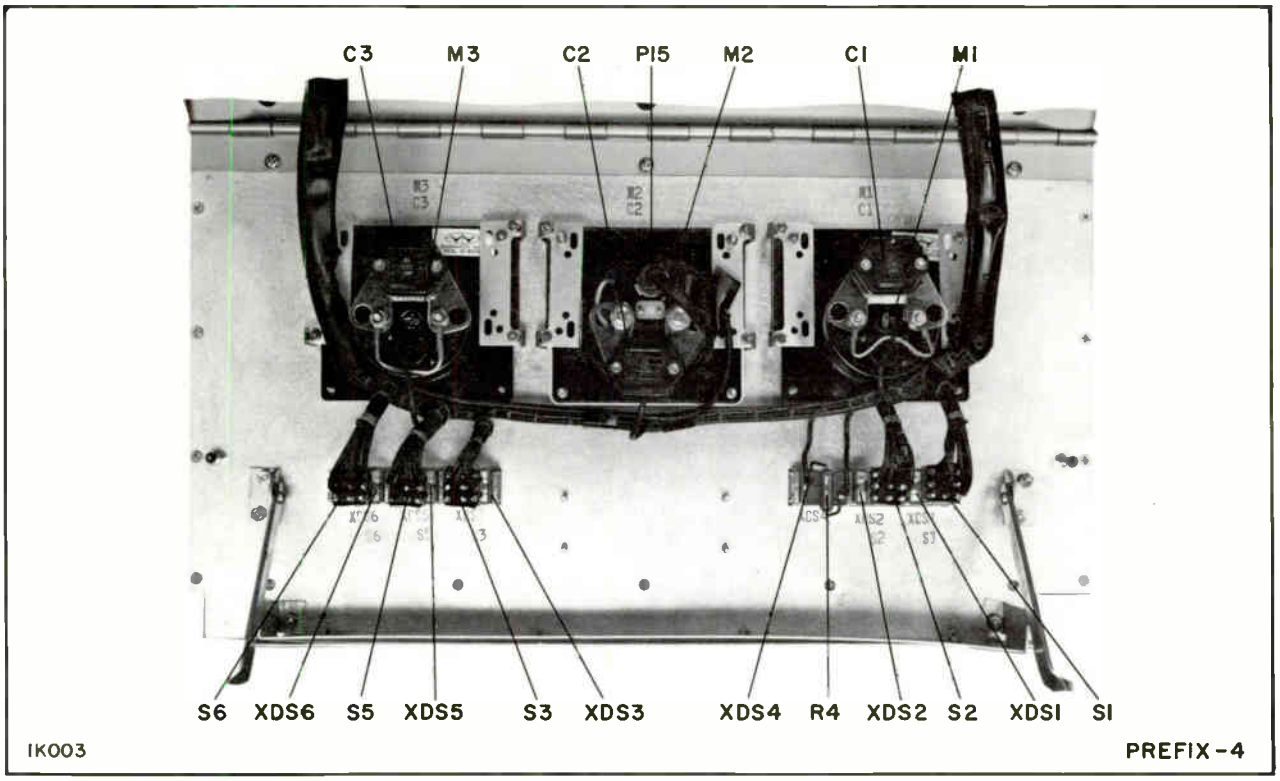

Figure 12. Meter Panel, Rear View (Prefix 4)

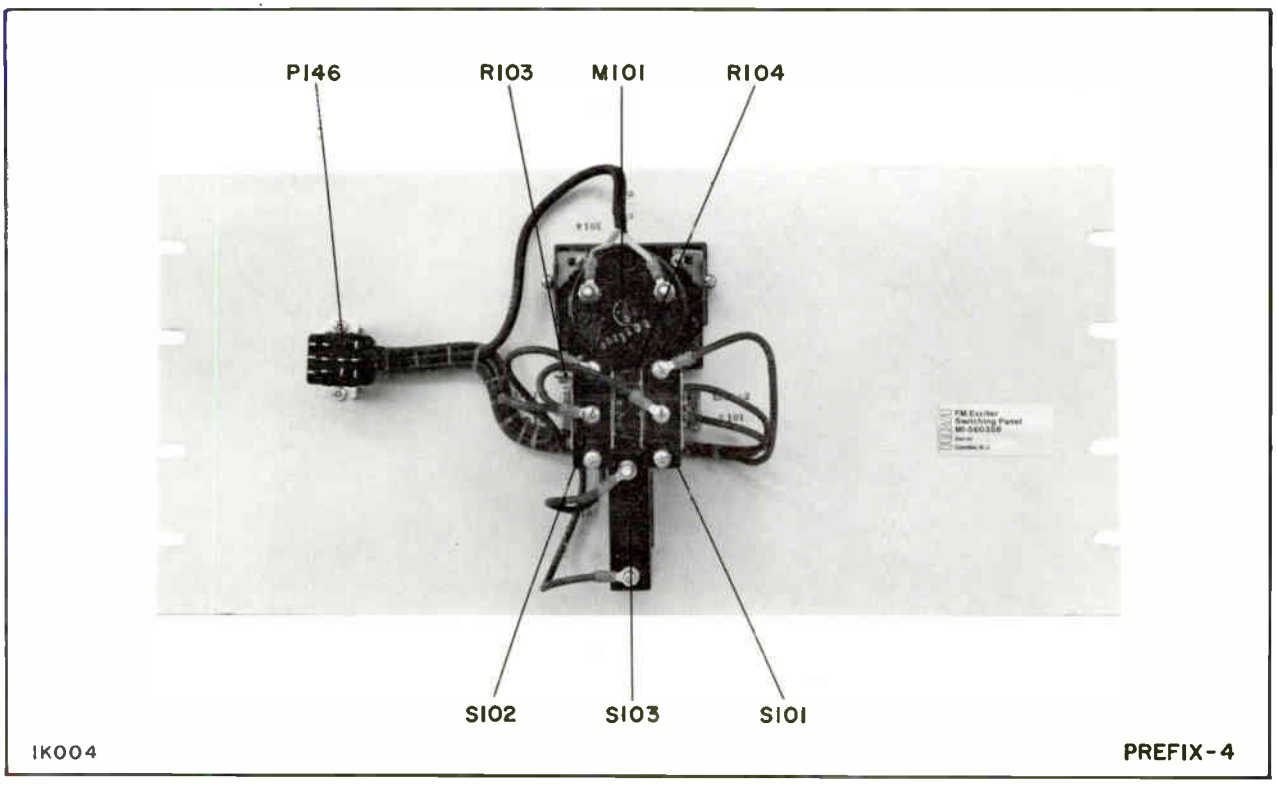

Figure 13. FM Exciter Switching Panel MI-560700 Item 1, Rear View (Prefix 4)

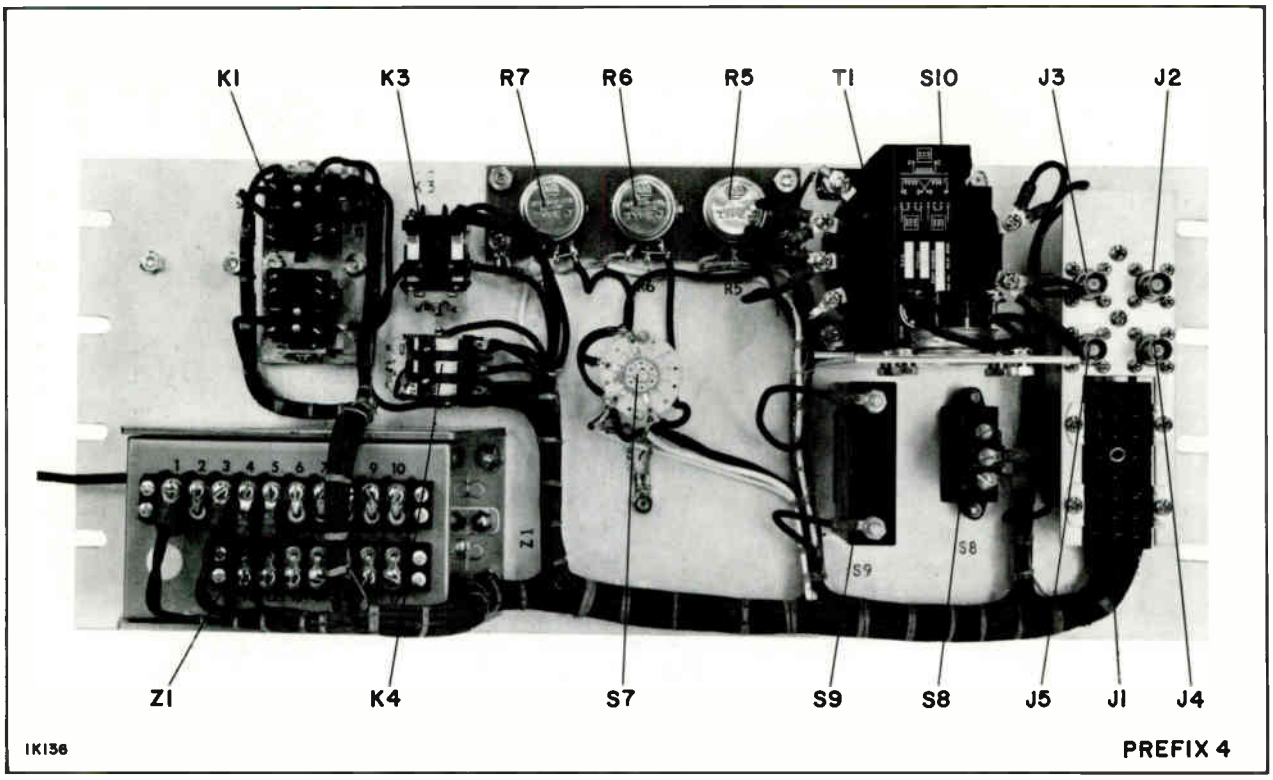

Figure 14. Meter Calibrate Panel, Rear View (Prefix 4)

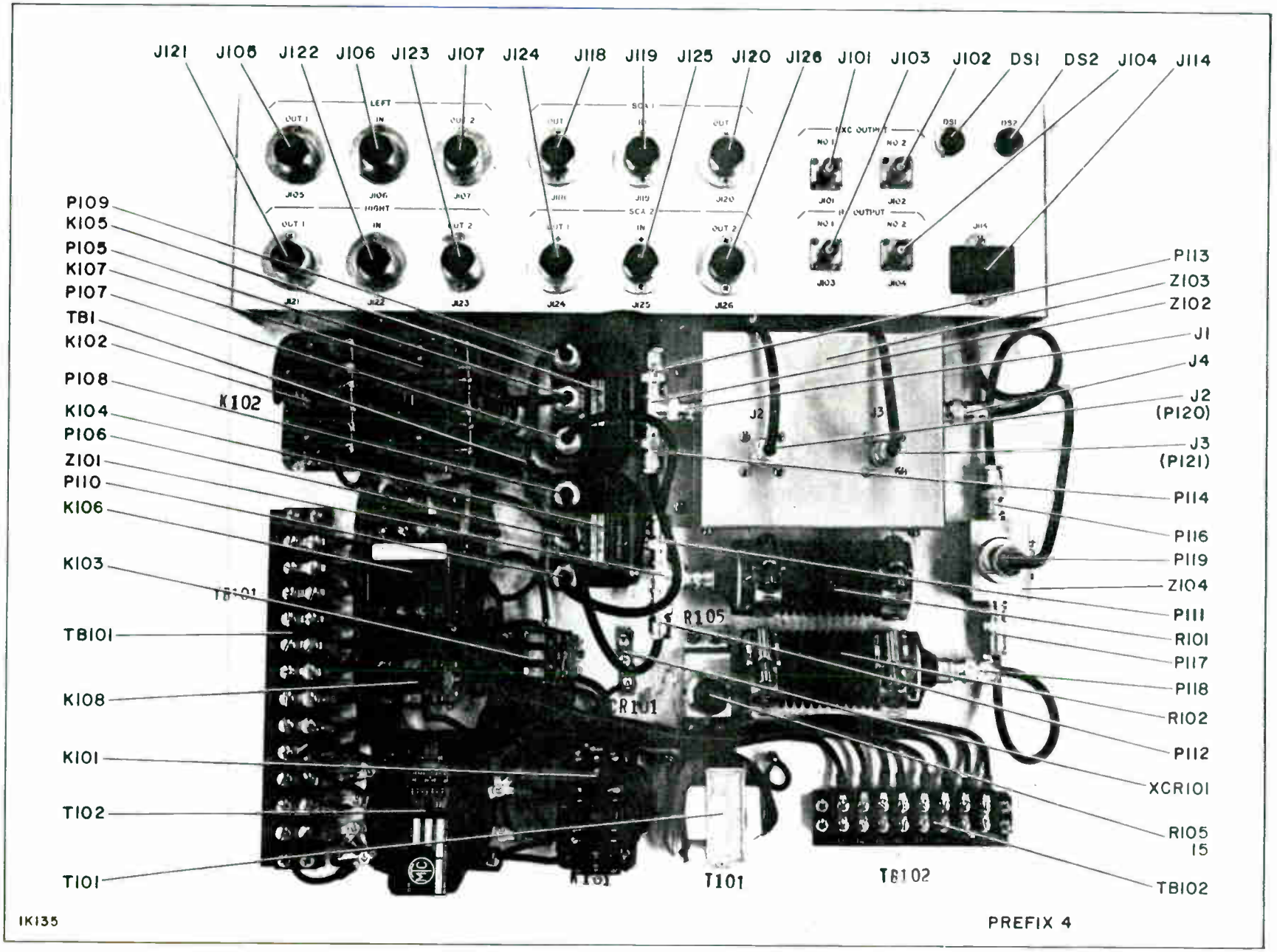

Figure 15. Exciter Switching Relay Panel MI-560700 Item 2, Rear View (Prefix 4)

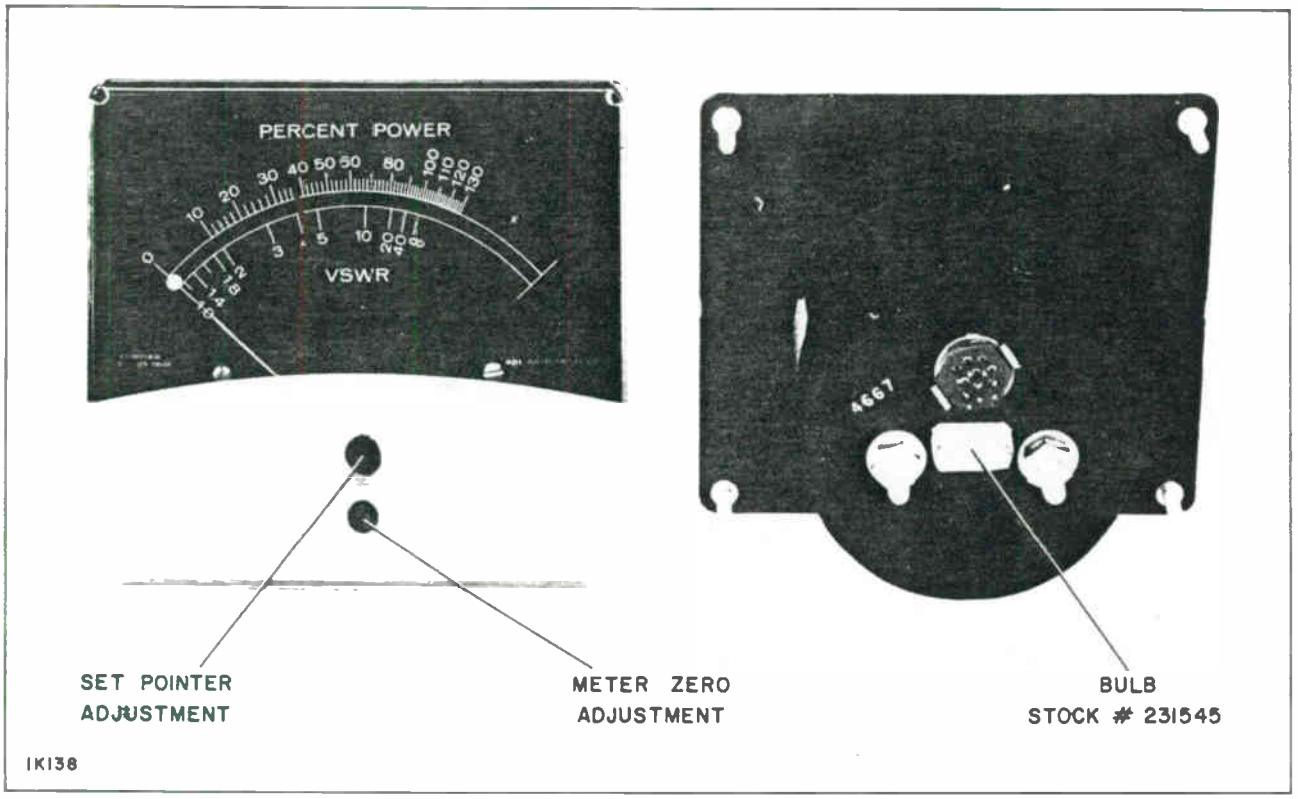

Figure 16. Panel Meter 4M2

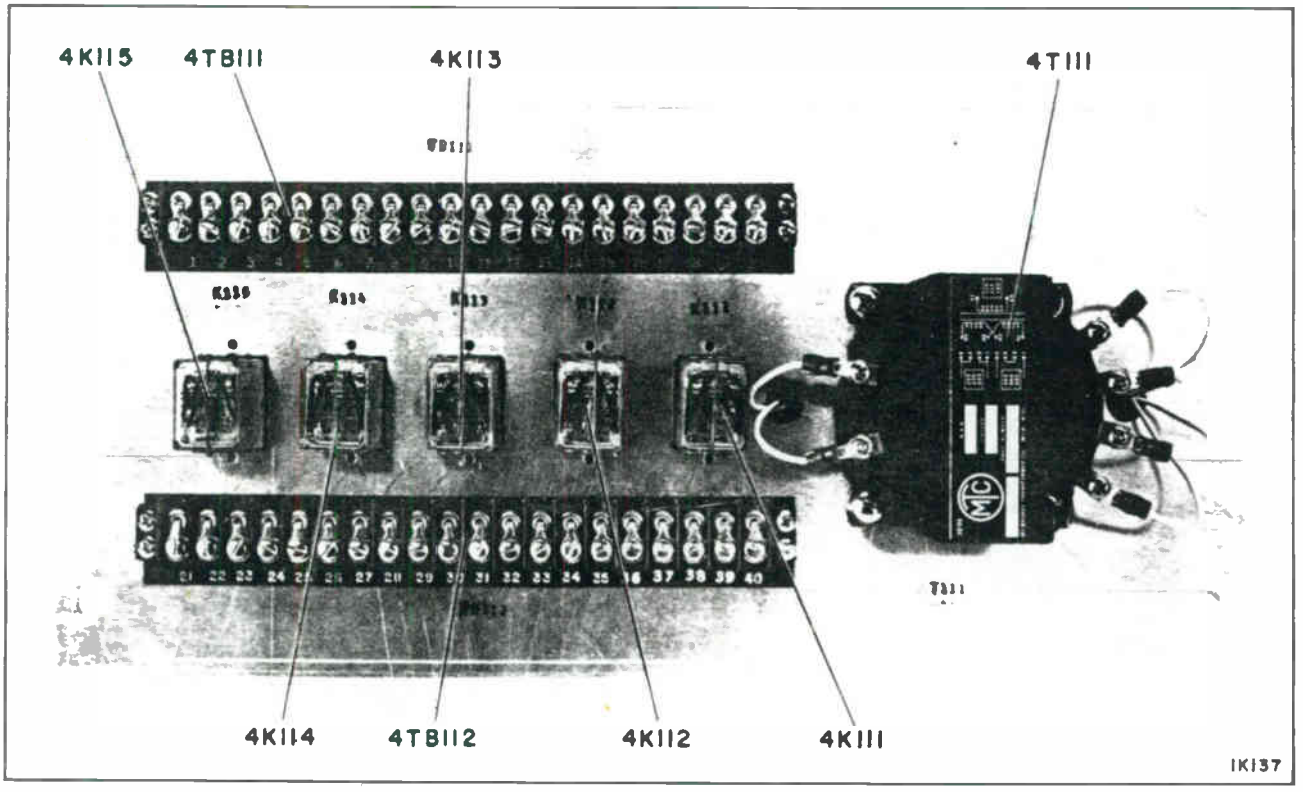

Figure 17. Remote Control Relay Panel MI-561354 (Prefix 4)

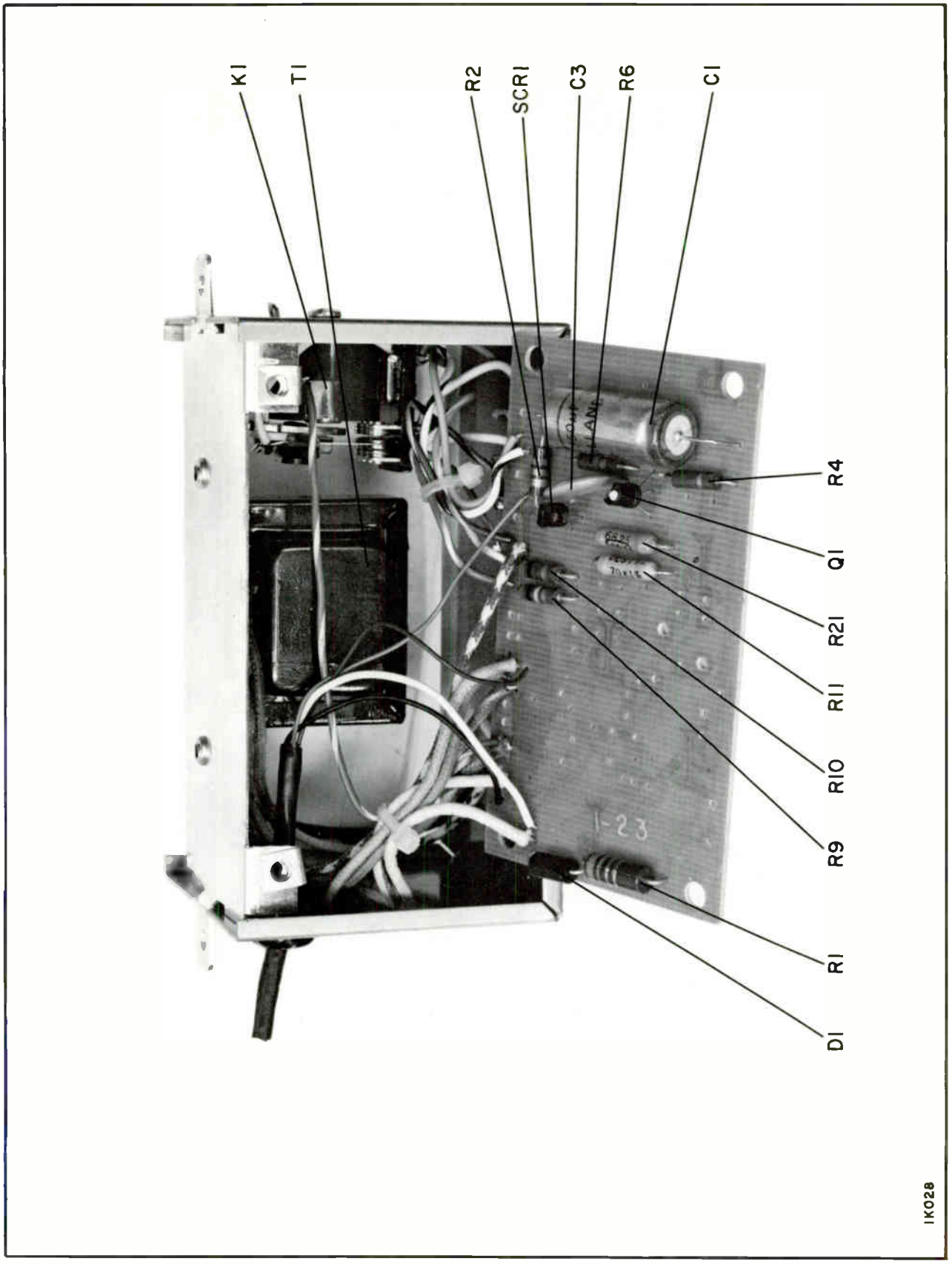

Figure 18. Control Module 4Z1, Parts Location

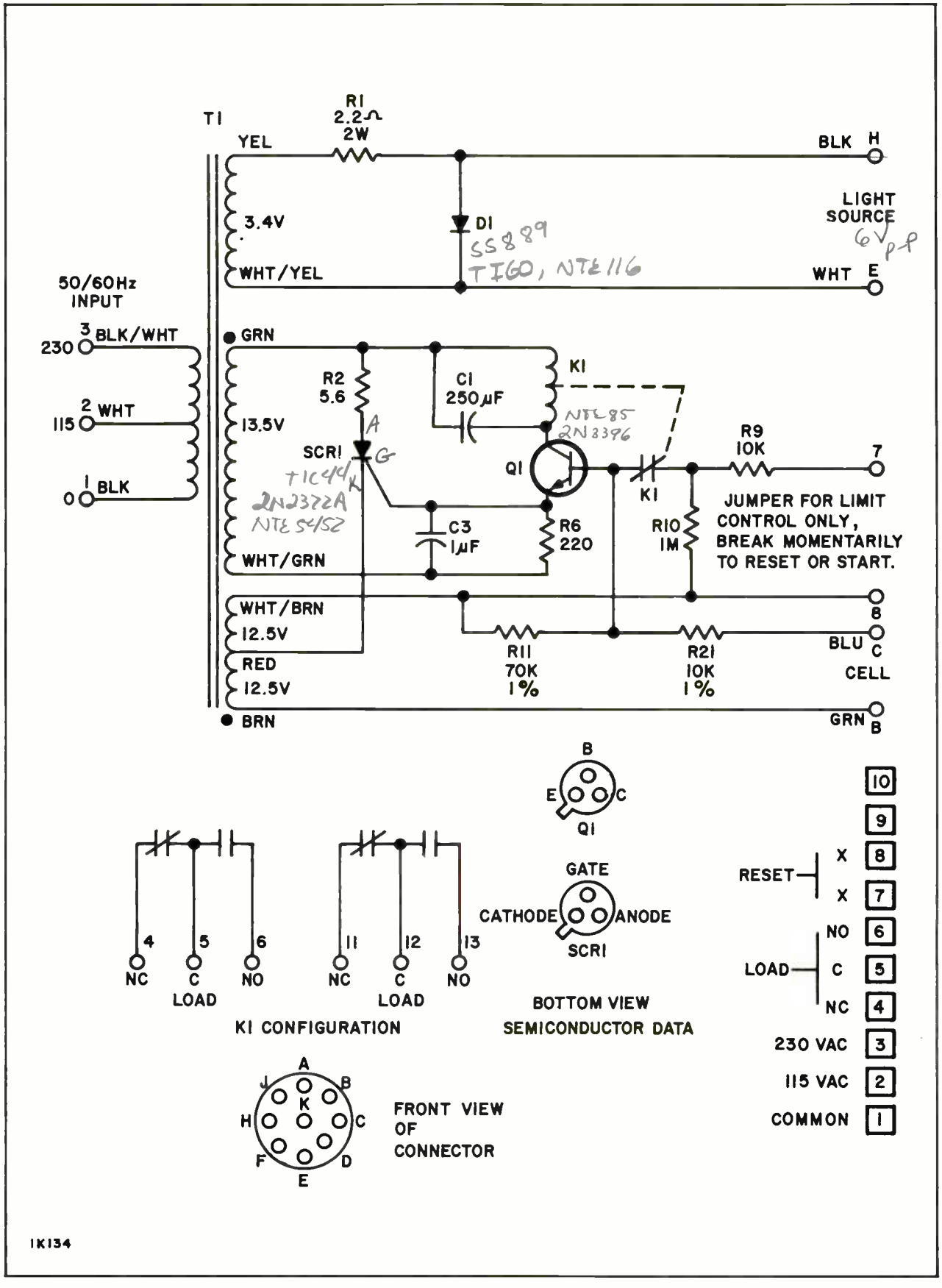

Figure 19. Control Module 4Z1, Schematic Diagram

PARTS ORDERING INFORMATION

REPLACEMENT PARTS

Replacement parts bearing a Stock Number should be ordered by Item, Description, and Stock Number from RCA, Distributor and Special Products Division, Deptford, New Jersey 08096. Items listed under a Master Item (MI) Number should be ordered from RCA, Commercial Communications Systems Division, Camden, NJ 08102.

Because of possible products modifications and/or the unavailability of parts, the item which will be supplied against an order for a replacement part may not be an exact duplicate of the original part. As a result, some of the replacement parts received may require a mounting modification of the customer's design. In some cases, parts and/or instructions for adapting the substitute parts will be supplied. In no way will the substitute parts impair the operation or performance of the equipment.

For information regarding the use of any parts received, write RCA, Tech Alert, Bldg. 2-8, Camden, NJ 08102, or call (609) 963-8000 Extension 3434.

EMERGENCY PART SERVICE

For emergency part service during working hours, contact RCA Distributor and Special Products Division, telephone 609-963-8000 extension 3434 or 609-848-5900 extension 263. After working hours (Eastern time) telephone 609-848-5900 extension 234 or 567.

LOCATION	ORDERING INSTRUCTIONS
Continental United States including Alaska and Hawaii, and the Dominion of Canada	Replacement Parts bearing a STOCK NUMBER should be ordered from RCA Distributor and Special Products Division – 2000 Clements Bridge Road, P. O. Box 100 – Deptford, NJ 08096. Replacement Parts bearing a MASTER ITEM (MI) NUMBER should be ordered from RCA, Commercial Communications Systems Division – Camden, NJ 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.
Outside of Continental United States, Alaska Hawaii, and the Dominion of Canada	Order from your local RCA Sales Representative or from: RCA Distributor and Special Products Division – 2000 Clements Bridge Road – P. O. Box 100 – Deptford, NJ 08096. Wire: RADIOINTER TWX: 510-686-8982 Emergency: Cable RADIOPARTS, DEPTFORD, NJ

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, 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 alphanumerical 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:

a. Determine in which major electrical assembly the part is physically located.

b. With the use of the illustrations, positively identify the part and note its symbol designation.

c. In the parts list, find the heading for the major electrical assembly.

d. 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:

a. Determine in which major mechanical assembly the part is physically located (RF Box, Basic Transmitter, Tube Socket Assembly, etc.).

b. With the use of the illustrations, identify the part and note its numerical symbol designation.

c. In the parts list, find the heading for the major mechanical assembly.

d. 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 8. COMPONENT PREFIX NUMBERS

Item	Symbol Prefix	Example	Item	Symbol Prefix	Example
Basic Transmitter (MI-560507A)	1	1K8	HV Plate Transformer	3	3T1
Power Supply (MI-560342-6)	2	2S1	Combining Equipment Cabinet	4	4S1

TABLE 9. COMPONENT SYMBOL DESIGNATIONS

Symbol Designation	Item	Symbol Designation	Item
AT	Attenuators	R	Resistors
B	Blowers, motors, phase shifters	RV	Thyrite assembly
C	Capacitors	S	Switches or interlocks
CR	Crystal or metallic rectifiers	SCR	Silicon controlled rectifier
D	Diode	T	Transformers
DS	Indicator Lamps	TB	Terminal boards
F	Fuses	U	Nonrepairable assembly
FL	RF interference filter	V	Tubes
HY	Circulator	VR	Voltage regulators
J	Connector jacks	XC	Sockets for capacitors
K	Relays or contactors	XDS	Sockets for indicating lamps
L	Inductors	XF	Sockets for fuses
M	Meters	XV	Sockets for tubes
P	Connector plugs	Y	Crystals (oscillating)
PCB	Printed circuit board	Z	Impedance networks and cavities
Q	Transistors		

REPLACEMENT PARTS

Symbol	Stock No.	Drawing No.	Description
			BTF-40E1 COMBINING EQUIPMENT MI-560702B
			CABINET
PREFIX 4			3724451-504 REV 8
B1	242514	3464044-002	PROPELLER FAN
C1 THRU			
C3		3724573-501	CAPACITOR ASSY, .01UF 250V
	205656		1510003-37 CAPACITOR ONLY MICA .01UF 250V
DS4A	426156	8890654-002	LAMP - INDICATOR
DS4B	426156	8890654-002	LAMP - INDICATOR
J6	241849	3456279-001	CONNECTOR - COAXIAL, UG-492 A/U
J7	241849	3456279-001	CONNECTOR - COAXIAL, UG-492 A/U
J8	241849	3456279-001	CONNECTOR - COAXIAL, UG-492 A/U
J9			CONNECTOR - COAXIAL, PART OF Z2
J10			CONNECTOR - COAXIAL, PART OF Z3
J11			CONNECTOR - COAXIAL, PART OF Z3
J12			CONNECTOR - COAXIAL, PART OF Z1
J101 THRU J115			CONNECTOR - PART OF MI-560358
M1	239277	993063-007	METER - REJECT POWER
M2	241749	8766828-005	METER - RELAY REFLECTED POWER
	231545	8766828 021	LAMP - REPLACEMENT FOR M2
	248673	8766828 022	PHOTOCELL - REPLACEMENT FOR M2
M3	241757	993064-008	METER - POWER OUTPUT
P1	95804	449653-004	CONNECTOR - MALE, 24 CONTACT
P2 THRU P5	214186	993147-021	CONNECTOR
P6			CONNECTOR - PART OF MI-560703A, IT. 5
P7			CONNECTOR - PART OF MI-560703A, IT. 5
P8			CONNECTOR - PART OF MI-560703A, IT. 6
P9	214186	932147-021	CONNECTOR
P10	214186	932147-021	CONNECTOR
P11	214186	932147-021	CONNECTOR - UG-88C/U
P12			CONNECTOR - COAXIAL, PART OF Z3
P13			CONNECTOR - COAXIAL, PART OF Z3
P14			CONNECTOR - COAXIAL, PART OF MI-560512 ITEM 15
P15, P101 THRU P104			CONNECTOR - NINE TERMINAL, PART OF M2
P105 THRU P120			CONNECTOR - COAXIAL, PART OF CABLE ASSY ITEM 137
P121			CONNECTOR - COAXIAL, PART OF MI-560358, MI-560700
P122			CONNECTOR - COAXIAL, PART OF MI-560358
P123 THRU P125			CONNECTOR - COAXIAL, PART OF CABLE ASSY ITEM 106
P126			CONNECTOR - COAXIAL, PART OF CABLE ASSY ITEM 137
P127			CONNECTOR - 8 TERMINAL, PART OF CABLE ASSY ITEM 137
P128			CONNECTOR - 8 TERMINAL, PART OF CABLE ASSY ITEM 137
P129			CONNECTOR - 2 TERMINAL, PART OF CABLE ASSY ITEM 137
P145			CONNECTOR - 2 TERMINAL, PART OF CABLE ASSY ITEM 137
			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	59941	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	426571	8522913-004	INDICATOR - TRANSMITTER OFF
XDS2	426571	8522913-004	INDICATOR - TRANSMITTER ON
XDS3	426571	8522913-004	INDICATOR - OVERLOAD, RESET
XDS4	426570	8522913-001	INDICATOR - VSWR OVERLOAD
XDS5	426571	8522913-004	INDICATOR - HIGH VOLTAGE OFF
XDS6	426571	8522913-004	INDICATOR - HIGH VOLTAGE
Z2			LINE SECTION, PART OF INST. MAT. MI-560512
Z3			LINE SECTION, PART OF INST. MAT. MI-560512
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	426290	8522915-001	MOUNTING BARRIER - SHORT
46	228974	99196-001	NUT PLATE
105		3464039-501	CABLE - ASSEMBLY, SWITCHING PANEL TO RELAY PANEL
	32057	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		757412-521	CABLE - ASSEMBLY, EXCITER 1 TO RELAY PANEL J101
	921359	1510013-101	CONNECTOR - COAXIAL, PLUG
110		757412-522	CABLE - ASSEMBLY, EXCITER 2 TO RELAY PANEL J102
	921359	1510013-101	CONNECTOR - COAXIAL, PLUG
			LINE STRETCHER PANEL
			3724451-503 REV 8
PREFIX 4			
J116	241751	3455466-002	ADAPTOR - G-R TO BNC, FOR LINE STRETCHER
J117	241751	3455466-002	ADAPTOR - G-R TO BNC, FOR LINE STRETCHER
70	236876	8537350-001	LINE STRETCHER
81	231047	1510923-017	KNOB
82	34300	8888539-123	SET SCREW - NO. 6-32 X 0.25 LONG
99	229156	990333-003	SPRING PIN
80	422657	8537343-005	SHAFT - LINE STRETCHER, FOR KNOB
			METER CALIBRATE PANEL
			3724451-502 REV 8
PREFIX 4			
J1	95559	458516-001	CONNECTOR - 24 CONTACT, FEMALE
J2 THRU J5	54890	1510013-161	CONNECTOR - JACK, UG-290 A/U

Symbol	Stock No.	Drawing No.	Description
K1	241750	3460918-009	RELAY - LATCHING
K3	235839	8958260-005	RELAY - AUX.
K4	217770	8958260-003	RELAY - OVER LOAD INDICATOR
R5	205064	8971860-835	RESISTOR, VARIABLE 10,000 OHMS, NORMAL POWER CAL.
R6	205064	8971860-835	RESISTOR, VARIABLE 10,000 OHMS, REFL. POWER CAL.
R7	206913	8971860-831	RESISTOR, VARIABLE 1000 OHMS, REMOTE POWER CAL.
S7	241843	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 SEC.
Z1	232780	8494401-004	CONTROL MODULE
C1	420824		CAPACITOR 250 MFD 25 V
C3	248662		CAPACITOR 1 MFD 3 V
D1	248663		DIODE, TYPE TI60
SCR1	420822		SILICON CONTROLLED RECTIFIER, TYPE 2N2322A
Q1	248664		TRANSISTOR 2N3396
K1	232416		RELAY, 2 FORM C CONTACTS, API PART NO. 1819-9
R1	420826		RESISTOR 2.2 OHMS, 2 W, 5%
R2	243443		RESISTOR 5.6 OHMS, 1/2 W, 5%
R4	502222		RESISTOR 2.2K, 1/2 W, 10%
R6	502122		RESISTOR 220 OHMS, 1/2 W, 10%
R9	502310		RESISTOR 10K, 1/2 W, 10%
R10	502510		RESISTOR 1 MEG, 1/2 W, 10%
R11	420827		RESISTOR 70K 1/2 W, 1%
R21	502310		RESISTOR 10K, 1/2 W, 10%
T1	248667		TRANSFORMER
111	427908	3724533-006	KNOB - SKIRTED
112	427907	3724536-003	KNOB
			FM EXCITER SWITCHING PANEL MI-560700
			3456096-501 REV 15
DS101A	426156	8890654-002	LAMP - INDICATOR
DS101B	426156	8890654-002	LAMP - INDICATOR
DS102A	426156	8890654-002	LAMP - INDICATOR
DS102B	426156	8890654-002	LAMP - INDICATOR
M101	240808	993103-005	METER - 0-100 UA
P146	19679	449613-016	CONNECTOR - MALE, 12 CONDUCTOR
R103	230163	993007-086	WIREWOUND, 1800 OHMS 5 W
R104	230163	993007-086	WIREWOUND, 1800 OHMS 5 W
S101	229798	8543376-001	SWITCH-SPDT MOMENTARY
S102	229798	8543376-001	SWITCH-SPDT MOMENTARY
S103	240816	8489397-005	CIRCUIT BREAKER
XDS101	426571	8522913-004	INDICATOR - EXCITER 1
XDS102	426571	8522913-004	INDICATOR - EXCITER 2
9	240814	8494089-066	DISPLAY - SCREEN
10	240815	8494089-067	DISPLAY - SCREEN
20	426290	8522915-001	MOUNTING - BARRIER, SHORT
			MISCELLANEOUS
15	229940	1510924-105	KNOB
51	216983	486041-005	TERMINAL - STUD

Symbol	Stock No.	Drawing No.	Description
			EXCITER SWITCHING RELAY PANEL MI-560700
			3456096-504 REV 15
PREFIX 4			
C101	92036	727866-171	MICA, .01 MF 300 V
C102	92036	727866-171	MICA, .01 MF 300 V
CR101	225592	3404510-030	DIODE - TYPE 1N3253
DS1	248035	3720198-001	LAMP - INDICATOR
DS2	248035	3720198-001	LAMP - INDICATOR
J101 THRU J104	54890	1510013-161	CONNECTOR - JACK, UG-290/U
J105	211510	481799-002	CONNECTOR - FEMALE, 2 CONDUCTOR
J106	211510	481799-002	CONNECTOR - FEMALE, 2 CONDUCTOR
J107	211510	481799-002	CONNECTOR - FEMALE, 2 CONDUCTOR
J114	56078	449613-001	CONNECTOR - FEMALE, 12 CONDUCTOR
J118 THRU J126	211510	481799-002	CONNECTOR - FEMALE, 2 CONDUCTOR
K101	240810	3464084-001	RELAY - LATCHING
K102	240810	3464084-001	RELAY - LATCHING
K103	248033	8958260-009	RELAY - DPDT SPECIAL CONTACTS, 115 VAC COIL
K104	240809	3455470-001	RELAY - COAXIAL
K105	240809	3455470-001	RELAY - COAXIAL
K106	426575	3459831-092	RELAY DPDT CONTACTS, 230 VAC COIL
K107	240810	3464084-001	RELAY - LATCHING
K108	235839	8958260-005	RELAY - DPDT CONTACTS, 115 VAC COIL
P101 THRU P118	921359	1510013-101	CONNECTOR - PLUG, MIL NUMBER UG-88C/U
P119			CONNECTOR - PLUG, PART OF Z104
P120 THRU P125	921359	1510013-101	CONNECTOR - PLUG, MIL NUMBER UG-88 C/U
P126	55808	727969-006	CONNECTOR - FEMALE, 8 CONTACT
P127	55808	727969-006	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	32057	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	95244	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
Z101	240807	1510013-211	CONNECTOR - TEE, MIL NUMBER UG-274 A/U
Z102	240807	1510013-211	CONNECTOR - TEE, MIL NUMBER UG-274 A/U
Z103			POWER SPLITTER
Z104	242042	3464019-001	DIRECTIONAL COUPLER, FOR 87.5 THROUGH 108 MHZ

Symbol	*Stock No.*	*Drawing No.*	*Description*
			COAXIAL COUPLER MI-561537A
	MI-561537A	8003221-504	COAXIAL COUPLER - 10 KW, 50 OHM, CROSSOVER TYPE
			40 kW COAXIAL COUPLER MI-561564
	MI-561564		COAXIAL COUPLER - 40 KW, 50 OHM, NON-CROSSOVER TYPE
			INSTALLATION MATERIAL MI-560703A
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
			OPTIONAL REMOTE CONTROL RELAY PANEL MI-561354
4K111 THRU 4K115	424242	3730089-008	RELAY - PLUG-IN
4T111	240872	3464008-001	TRANSFORMER - POWER
4XK111 THRU 4XK115	430531	8486479-001	SOCKET - RELAY

SUGGESTED STATION SPARES

Description	Symbol	Quantity	Stock No.
Relay, DPDT, 230 VAC Coil	4K106	1	246575
Relay, DPDT, 115 VAC Coil	4K108	1	235839
Meter, relay reflected power	4M2	1	241749
Lamp, replacement, for M2		1	231545
Photocell, replacement, for M2		1	248673
Switch, thermostat	4S10	1	209623

REPLACEMENT COAXIAL COMPONENTS

(Unflanged, unpressurized, 50 ohm)

COAXIAL TRANSMISSION LINE (Normally supplied in 20 foot sections)	
1-5/8" Nominal Diameter	MI-561565-1A
3-1/8" Nominal Diameter	MI-27791K-1A
*6-1/8" Nominal Diameter	MI-561579-1A
ELBOW, RIGHT ANGLE	
1-5/8" Nominal Diameter	MI-561565-2A
3-1/8" Nominal Diameter	MI-27791K-2A
6-1/8" Nominal Diameter	MI-561579-2A
COUPLING, TRANSMISSION LINE	
1-5/8" Nominal Diameter	MI-561565-4A
3-1/8" Nominal Diameter	MI-27791K-4A
6-1/8" Nominal Diameter	MI-561579-4A
REDUCER	
3-1/8" to 1-5/8" Diameter	MI-561565-5A
3-1/8" to type "N"	MI-27791K-5A
6-1/8" to 3-1/8" Diameter	MI-561579-5A
DIRECTIONAL COUPLER Z3 (40 kW)	
3-1/8" Nominal Diameter	MI-560708-E
6-1/8" Nominal Diameter	MI-560708-A
MONITOR ASSEMBLY	
For Use on 1-5/8" Diameter Line	MI-560707-A
For Use on 3-1/8" Diameter Line	MI-560707-B
For Use on 6-1/8" Diameter Line	MI-560707-C

*The inner conductor cutback should be 0.71" except for connection to coaxial coupler MI-561564, when the cutback must be $0.56^{+.03}_{-.00}$.

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REPLACEMENT PARTS

BASIC TRANSMITTER MI-560507A

(Excluding RF Box Assembly)

P/L 8541922-504 REV 20

Symbol	Stock No.	Drawing No.	Description
ELECTRICAL PARTS			
1B1			MOTOR PART OF 1T5 (REFER TO 1T5)
1B2			BLOWER SEE MI-560347A-1
1B2			BLOWER SEE MI-560347-3 (HIGH ALTITUDE)
			CAPACITORS
1C1	205656	3724573 501	CERAMIC, METER BYPASS - 0.01 MFD 500 V
1C2	229777	990196 049	PAPER, 10 MFD 1500 V
1C3	922050	990196 005	PAPER, 4 MFD 600 V
1C4	229777	990196 049	PAPER, 10 MFD 1500 V
1C5	229778	990193 087	PAPER, 6 MFD 2500 V
1C6	205656	3724573 501	CERAMIC, METER BYPASS - 0.01 MFD 500 V
1C7			PAPER, PART OF POWER DETERMINING KIT
1C8			PAPER, PART OF POWER DETERMINING KIT
1C9	205656	3724573 501	CERAMIC, METER BYPASS - 0.01 MFD 500 V
1C10			PAPER, PART OF POWER DETERMINING KIT
1C11	225532	990196 008	PAPER, 10 MFD 600 V
1C12			PAPER, PART OF 1T5
1C13	205656	3724573 501	CERAMIC, METER BYPASS - 0.01 MFD 500 V
1C14	043441	990196 011	PAPER, 20 MFD 600 V
1C15	205656	3724573 501	CERAMIC, METER BYPASS - 0.01 MFD 500 V
1DS1A	300449	8890654 002	LAMP - INDICATOR
1DS1B	300449	8890654 002	LAMP - INDICATOR
1DS1C	300449	8890654 002	LAMP - INDICATOR
1DS1D	300449	8890654 002	LAMP - INDICATOR
1DS2A	300449	8890654 002	LAMP - INDICATOR
1DS2B	300449	8890654 002	LAMP - INDICATOR
1DS3A	300449	8890654 002	LAMP - INDICATOR
1DS3B	300449	8890654 002	LAMP - INDICATOR
1DS3C	300449	8890654 002	LAMP - INDICATOR
1DS3D	300449	8890654 002	LAMP - INDICATOR
1DS4A	300449	8890654 002	LAMP - INDICATOR
1DS4B	300449	8890654 002	LAMP - INDICATOR
1DS5A	300449	8890654 002	LAMP - INDICATOR
1DS5B	300449	8890654 002	LAMP - INDICATOR
1DS6A	300449	8890654 002	LAMP - INDICATOR
1DS6B	300449	8890654 002	LAMP - INDICATOR
1E1	230869	8521386 003	GAP - SPARK
1HR1	243451	3456491 030	HEATER - ELEMENT, USED IN 1K22
1HR2	243451	3456491 030	HEATER - ELEMENT, USED IN 1K22
1K1	215504	754291 003	RELAY - LOW VOLTAGE OVERLOAD
1K2	215504	754291 003	RELAY - HIGH VOLTAGE OVERLOAD
1K3	229779	627511 073	RELAY - UNDERBIAS
1K4	215504	754291 003	RELAY - DRIVER OVERLOAD
1K5	219799	627511 038	RELAY - OVERLOAD INDICATOR
1K6	219799	627511 038	RELAY - OVERLOAD INDICATOR
1K7	219799	627511 038	RELAY - OVERLOAD INDICATOR
1K8	423655	627511 083	RELAY - OVERLOAD AUXILIARY
1K9	216988	8412197 003	CONTACTOR - LOW VOLTAGE RECTIFIER
1K10	217986	480003 005	RELAY - LATCHING, OVERLOAD
1K11	216991	480003 004	RELAY - LATCHING, PLATE ON-OFF
1K12	223897	8412197 006	CONTACTOR - FILAMENT
1K13	420054	8533702 003	RELAY - PLATE
1K14	229817	8544748 001	RELAY - BLOWER
1K15	243902	8707374 004	RELAY - MAGNETIC BLOWER STARTER
1K16	216991	480003 004	RELAY - LATCHING, ON-OFF
1K17			RELAY - OVERLOAD

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[20E PARTS]

Symbol	Stock No.	Drawing No.	Description
1K18	219799	627511 038	RELAY - OVERLOAD, INDICATOR
1K19	219799	627511 038	RELAY - OVERLOAD, INDICATOR
1K20	243452	3730704 002	RELAY - TIME DELAY
1K21	243453	3464157 003	RELAY - AUXILIARY
1K22	243454	3456490 001	RELAY - OVERLOAD, AUXILIARY
1L1	044559	901125 001	REACTOR - LOW VOLTAGE FILTER
1L2	095794	949476 001	REACTOR - LOW VOLTAGE FILTER
1L3			REACTOR - HIGH VOLTAGE FILTER, PART OF MI-560510A
1L4	093658	949251 001	REACTOR - BIAS
1M1	420835	993058 116	METER - 0-300 VOLTS AC
1M2	229782	993064 001	METER - MULTIMETER
1M3	235725	993053 177	METER - VOLT METER 3-10 KV DC
1M4			METER - PART OF POWER DETERMINING KIT MI-560510A
1M5	243455	3467962 001	METER - RELAY, REFLECTOMETER (SEE 1Z6 CONTROL MODULE)
1M6			INDICATOR - ELAPSED TIME (OPTIONAL)
	241749	8766828 005	INDICATOR - 60 HZ
	235342	8489369 004	INDICATOR - 50 HZ
1M7	241749	8766828 005	METER - RELAY, REFLECTED POWER (SEE 1Z6 CONTROL MOD)
	231545	8766828 021	REPLACEMENT LAMP FOR 1M5 OR 1M7
1P1	921359	1510013 101	CONNECTOR - COAXIAL PLUG
1P2	921359	1510013 101	CONNECTOR - COAXIAL PLUG
1P5	055808	727969 008	CONNECTOR - 8 TERM, FEMALE
1P6	054254	727969 018	CONNECTOR - 12 TERM, FEMALE
1P7	211509	481799 001	CONNECTOR - AUDIO INPUT, LEFT
1P8	211509	481799 001	CONNECTOR - AUDIO INPUT, RIGHT
1P9	211509	481799 001	CONNECTOR - SCA IN, 1
1P10	211509	481799 001	CONNECTOR - SCA IN, 2
1P11	032661	878243 001	CONNECTOR - EXCITER POWER
			RESISTORS - FIXED COMPOSITION, UNLESS NOTED
1R1	229786	8986541 010	WIRE WOUND, 34.5 OHMS 2 W
1R2	043783	99027 024	WIRE WOUND, 200 OHMS 5% 25 W
1R3	229787	8986541 011	WIRE WOUND, 1.94 OHMS 2 W
1R4	229786	8986541 010	WIRE WOUND, 34.5 OHMS 2 W
1R5	229788	8986541 013	WIRE WOUND, 1.67 OHMS 2 W
1R6	229789	8541901 001	WIRE WOUND, 600,000 OHMS 1/2 W
1R7	229789	8541901 001	WIRE WOUND, 600,000 OHMS 1/2 W
1R8	229788	8986541 013	WIRE WOUND, 1.67 OHMS 2 W
1R9	044394	99037 029	WIRE WOUND, 630 OHMS 5% 200 W
1R10	205064	433196 006	VARIABLE, 10,000 OHMS
1R11	417618	433196 014	VARIABLE, 10,000 OHMS
1R12	215733	433196 051	VARIABLE, 1,000 OHMS
1R13	054608	99037 039	WIRE WOUND, 6300 OHMS 5% 200 W
1R14	054608	99037 039	WIRE WOUND, 6300 OHMS 5% 200 W
1R15	044394	99037 029	WIRE WOUND, 630 OHMS 5% 200 W
1R16	044394	99037 029	WIRE WOUND, 630 OHMS 5% 200 W
1R17	019688	99027 039	WIRE WOUND, 6300 OHMS 5% 25 W
1R18	215540	890014 019	WIRE WOUND, 16,000 OHMS 150 W
1R19	229790	415457 020	VARIABLE, 750 OHMS 25 W
1R20	219047	993007 021	WIRE WOUND, 1.0 OHMS 5 W
1R21	220319	8702674 512	WIRE WOUND, 10 MEGOHM
1R22	217614	8871557 053	WIRE WOUND, 1250 OHMS 1 W
1R23	522415	99126 088	150,000 OHMS 20% 2 W
1R24			RELAY SHUNT PART OF POWER DET. KIT MI-560510A
1R25	206006	99037 008	WIRE WOUND, 5 OHMS 10% 200 W
1R26	206006	99037 008	WIRE WOUND, 5 OHMS 10% 200 W
1R27	206006	99037 008	WIRE WOUND, 5 OHMS 10% 200 W
1R28	044394	99037 029	WIRE WOUND, 630 OHMS 200 W
1R29	094885	993007 092	WIRE WOUND, 3500 OHMS 5 W
1R30			
TO			
1R37	059941	993007 086	WIRE WOUND, 1800 OHMS 5 W
1R38	243456	204777 024	VARIABLE, 8000 OHMS 50 W
1R39	243457	99027 020	WIRE WOUND, 80 OHMS 25 W
1R40	243457	99027 020	WIRE WOUND, 80 OHMS 25 W
1S1	229792	8494316 001	SWITCH - METER
1S2	229793	8494316 002	SWITCH - METER

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Symbol	Stock No.	Drawing No.	Description
1S3	229794	8494042 001	SWITCH - METER
1S4			NOT USED
1S5	229797	482740 006	BREAKER - CIRCUIT, FILAMENT
1S6	233450	3462708 001	BREAKER - CIRCUIT, LOW VOLTAGE
1S7	229798	8543376 001	SWITCH - TRANSMITTER ON
1S8	229798	8543376 001	SWITCH - TRANSMITTER OFF
1S9	229798	8543376 001	SWITCH - PLATE ON
1S10	229798	8543376 001	SWITCH - PLATE OFF
1S11	229798	8543376 001	SWITCH - RAISE
1S12	229798	8543376 001	SWITCH - LOWER
1S13	217989	449661 108	SWITCH - SINGLE MULTIPLE TRIP
1S14	054920	8881052 001	SWITCH - INTERLOCK
1S15	054920	8881052 001	SWITCH - INTERLOCK
1S16	054920	8881052 001	SWITCH - INTERLOCK
1S17	229799	8543375 001	SWITCH - OVERLOAD RESET (FOR BREAKDOWN SEE FIG. 47)
1S18	258043	8741338 018	BREAKER - CIRCUIT
1S19	229891	8486323 501	SWITCH - GROUNDING
1S20	229891	8486323 501	SWITCH - GROUNDING
1S21	234486	3467618 003	SWITCH - AIR INTERLOCK
1T1	215512	8412123 001	TRANSFORMER - DRIVER FILAMENT
1T2			TRANSFORMER - POWER AMPLIFIER FILAMENT PART OF MI-560510A
1T3	216993	8413463 001	TRANSFORMER - FILAMENT, BUCK BOOST
1T4	218276	457084 001	TRANSFORMER - VARIABLE FILAMENT
1T5		8763254 001	TRANSFORMER - VARIABLE, LOW VOLTAGE
	231816		BRUSH ASSEMBLY RB216. FOR SUPERIOR ELECTRIC POWERSTAT 30M216U-2
	423027		BRUSH ASSEMBLY RB216B, FOR POWERSTAT 30M216BU-2
	422787		DRIVE SHAFT FOR SUPERIOR ELECTRIC POWERSTAT
	231817		COIL - ONLY, WITH LEADS, FOR 30M216U-2 POWERSTAT
	428276		COIL - ONLY, WITH LEADS, FOR 30M216BU-2 POWERSTAT
	231818		MOTOR - 1T5
	922553		RESISTOR
1C12	231815		CAPACITOR
	922556		SWITCH - LIMIT
1T6	229800	8486317 001	TRANSFORMER - LOW VOLTAGE RECTIFIER
1T7	229801	8489386 001	TRANSFORMER - BIAS
1T8	229802	8489377 001	TRANSFORMER - CONTROL
1XDS1	226123	8522913 003	INDICATOR - DRIVER OVERLOAD/CARRIER OFF
1XDS2	270023	8522913 004	INDICATOR - POWER AMPLIFIER OVERLOAD
1XDS3	226123	8522913 003	INDICATOR - LOW VOLTAGE OVERLOAD/VSWR OVRLD
1XDS4	270023	8522913 004	INDICATOR - PLATE ON (FOR BREAKDOWN SEE FIG. 47)
1XDS5	269851	8522913 001	INDICATOR - DOOR INTERLOCK
1XDS6	270023	8522913 004	INDICATOR - TRANSMITTER ON
1XDS7	270023	8522913 004	INDICATOR - POWER RAISE
1XDS8	270023	8522913 004	INDICATOR - POWER LOWER
1XDS9	270023	8522913 004	INDICATOR - TRANSMITTER OFF
1XDS10	270023	8522913 004	INDICATOR - PLATE OFF
1Z1	229803	8483890 004	RECTIFIER - BIAS
1Z2		3462813 501	RECTIFIER ASSEMBLY
	230913	8498732 004	RECTIFIER - LESS PLATE
1Z3		3462813 501	RECTIFIER ASSEMBLY
	230913	8498732 004	RECTIFIER - LESS PLATE
1Z4		3462813 501	RECTIFIER ASSEMBLY
	230913	8498732 004	RECTIFIER - LESS PLATE
	1Z2, 1Z3 AND 1Z4 EACH CONSISTS OF 2 RECTIFIER MODULES MOUNTED ON AN INSULATED MOUNTING PLATE.		
1Z5	230078	8729668 003	DIRECTIONAL COUPLER - POWER OUTPUT/VSWR PART OF MI-560510A
1Z6	243753	3730764 001	CONTROL MODULE
1Z8	243778	3464019 003	DIRECTIONAL COUPLER - I.P.A. INPUT MATCH
	067876		DIODE - RECTIFIER TYPE 1N21B, FOR USE IN DIRECTIONAL COUPLERS
MECHANICAL PARTS			P/L 8521306-504REV 32
189	269689	8522915 001	BARRIER - SHORT, FOR DISPLAY SCREEN SWITCH
109	053325	99045 005	CLIP - FUSE, FOR 1R2, 1R17

FOR BREAKDOWN SEE FIGURE 47

10A2P CUNL #E-2-B&O

20E7

Symbol	Stock No.	Drawing No.	Description
108	052717	7862770 001	CLIP - FUSE, FOR 1R9, 1R13 THRU 1R16, 1R18, 1R25 THRU 1R28
71	225125	888488 005	FILTER - FOR DISPLAY SCREEN SWITCH
93	055081	426762 012	INSULATOR - STEATITE-CONICAL, 3 IN LG
96	211371	426766 006	INSULATOR - STEATITE,1/2 IN DIA X .75 IN LG
319	231640	426767 115	INSULATOR - STEATITE, 3/4 IN DIA X 2.5 IN LG
320	97458	426767 106	INSULATOR - STEATITE,3/4 IN DIA X 1.25 IN LG
124	208115	426765 009	INSULATOR - STEATITE,3/8 IN DIA X .75 IN LG
326	208116	426765 112	INSULATOR - STEATITE, 3/8 IN DIA X 1 IN LG
100	229806	8540155 001	KNOB - FOR 1T4
101	229807	1510900 008	KNOB - FOR 1R10
102	229808	1510900 017	KNOB - FOR 1R19 AND 1R38
266	246728	8765773 505	KNOB ASSEMBLY - FOR 1S2
267	419487	8765773 507	KNOB ASSEMBLY - FOR 1S1
265	246731	8765773 509	KNOB ASSEMBLY - FOR 1S3
265	246731	8765773 509	KNOB ASSEMBLY
266	246728	8765773 505	KNOB ASSEMBLY
267	246729	8765773 506	KNOB ASSEMBLY
169	233492 233493	8494328 001	METER - MANOMETER (OPTIONAL) OIL - MANOMETER
179	229809	8494089 001	SCREEN - DISPLAY DOOR INTERLOCKS
180	229810	8494089 002	SCREEN - DISPLAY TRANSMITTER OFF
181	229892	8494089 003	SCREEN - DISPLAY TRANSMITTER ON
182	229811	8494089 004	SCREEN - DISPLAY PLATE OFF
183	229893	8494089 005	SCREEN - DISPLAY PLATE ON
257	243449	3464091 008	SCREEN - DISPLAY, DRIVER OVRLD/CARRIER OFF
185	229813	8494089 007	SCREEN - DISPLAY POWER AMP OVERLOAD AND RESET
258	243450	3464091 009	SCREEN - DISPLAY, L.V. RECT. OVERLOAD/ VSWR OVERLOAD
187	229815	8494089 009	SCREEN - DISPLAY POWER LOWER
188	229816	8494089 010	SCREEN - DISPLAY POWER RAISE
178	233868	480368 006	STUD - FASTENER, METER PANEL
177	233869	8886047 003	WASHER - METER PANEL STUD

RF BOX ASSEMBLY

P/L 8543106-503 REV 9

ELECTRICAL PARTS

CAPACITORS

1C101	230423	8971908 003	VARIABLE, 4.5-102 MMF
1C102	214695	8821367 002	CERAMIC, 50 MMF 7500 V
1C103	214638	8864187 007	STANDOFF, 1000 MMF 500 V
1C104	214638	8864187 007	STANDOFF, 1000 MMF 500 V
1C105			PART OF 1XV101 (DRIVER TUBE SOCKET)
1C106	211196	459684 041	PAPER, .001 MF 600 V
1C107	211196	459684 041	PAPER, .001 MF 600 V
1C108	211196	459684 041	PAPER, .001 MF 600 V
1C109	211196	459684 041	PAPER, .001 MF 600 V
1C110	211148	8907717 001	FEED-THRU, .001 MF 5000 V
1C111	223209	8518096 001	CERAMIC, 0.001 MF 5000 V
1C112	217721	8849438 014	VACUUM, 3-30 MMF 10,000 V
1C113			PART OF POWER DETERMINING KIT MI-560510A
1C114	236759	8889785 002	FEED-THRU, 1000 MMF 2000 V
1C115	054643	8881825 001	PAPER, 0.01 MF 250 V
1C116	054643	8881825 001	PAPER, 0.01 MF 250 V
1C117			PART OF 1XV102 (PA TUBE SOCKET)
1C118	236759	8889785 002	FEED-THRU, 1000 MMF 2000 V
1C119	230419	8494421 001	FEED-THRU, 1500 MMF 15,000 V
1C120	076488	940173 102	CERAMIC, 500 MMF 30,000 V
1C121	211196	459684 041	PAPER, .001 MF 600 V
1C122	211196	459684 041	PAPER, .001 MF 600 V
1C123	230422	8849438 039	VARIABLE, 8-110 MMF 7.5 KV
1C124	235990	8521332 022	VACUUM, 25 MMF 7500 V, FOR FREQ 87.5 THRU 93.9 MHZ, MI-560355-1
1C125	235990	8521332 022	VACUUM, 25 MMF 7500 V, FOR FREQ 87.5 THRU 93.9 MHZ, MI-560355-1

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Symbol	Stock No.	Drawing No.	Description
1C126	227938	8521332 018	VACUUM, 40 MMF 7500 V, FOR FREQ 87.5 THRU 107.9 MHZ, MI-560355-2
1C124	227938	8521332 018	VACUUM, 40 MMF 7500 V, FOR FREQ 94.1 THRU 101.9 MHZ, MI-560355-2
1C125			NOT USED, FOR FREQ 94.1 THRU 107.9 MHZ
1C124	235990	8521332 022	VACUUM, 25 MMF 7500 V, FOR FREQ 102.1 THRU 107.9 MHZ, MI-560355-1
1C127	214638	8864187 007	STANDOFF, 1000 MMF 500 V
1C128	214638	8864187 007	STANDOFF, 1000 MMF 500 V
1C129	214638	8864187 007	STANDOFF, 1000 MMF 500 V
1C130	076488	940173 102	CERAMIC, 500 MMF 30,000 V
1C131			STANDOFF, 1000 MMF 500 V, PART OF POWER DETERMINING KIT MI-560510A
1C132			STANDOFF, 1000 MMF 500 V, PART OF POWER DETERMINING KIT MI-560510A
1C133			STANDOFF, 1000 MMF 500 V, PART OF POWER DETERMINING KIT MI-560510A
1C134			STANDOFF, 1000 MMF 500 V, PART OF POWER DETERMINING KIT MI-560510A
1C135			PART OF 1XV103 (DRIVER TUBE SOCKET)
1C136			STANDOFF, 1000 MMF 500 V, PART OF POWER DETERMINING KIT MI-560510A
1C137			STANDOFF, 1000 MMF 500 V, PART OF POWER DETERMINING KIT MI-560510A
1C138	214638	8864187 007	STANDOFF, 1000 MMF 500 V
1C139	214638	8864187 007	STANDOFF, 1000 MMF 500 V
1C140	232610	479060 009	CERAMIC, 500 MMF 5000 V
1C141	232610	479060 009	CERAMIC, 500 MMF 5000 V
1C142	232610	479060 009	CERAMIC, 500 MMF 5000 V
1C143	232610	479060 009	CERAMIC, 500 MMF 5000 V
1C144	209906	479060 006	CERAMIC, 1500 MMF 3500 V
1C145			PART OF 1XV102 (PA TUBE SOCKET)
1C146			NOT USED
1C147	236759	8889785 002	FEED-THRU, 1000 MMF 2000 V
1J101	054890	1510013 161	CONNECTOR - COAXIAL, FEMALE RECEPTACLE
1L101	239086	8448409 503	COIL
1L102	222952	8985525 501	COIL ASSEMBLY
1L103	211198	8914884 001	COIL
1L104	211198	8914884 001	COIL
1L105	243460	3467932 001	INDUCTANCE - VARIABLE, PART OF RF BOX ASSY
1L106	230435	8766920 501	INDUCTANCE - VARIABLE, PART OF RF BOX ASSY
1L107	243465	8494405 001	COIL - 11 1/2 TURNS COPPER WIRE 1 INCH ID
1L108			STRAP - PART OF RF BOX ASSEMBLY
1L109	243466	3455649 501	COIL - SOFT COPPER STRAP 1.25 ID X 4 " LG
1L110	243467	3455761 501	INDUCTANCE - DRIVER PLATE TUNING
1L111			INDUCTOR - PLATE, (SEE MECHANICAL RF BOX PARTS)
1L112			INDUCTOR - PLATE, (SEE MECHANICAL RF BOX PARTS)
1L113			INDUCTOR - VARIABLE, PA NEUTRALIZING PART OF 1XV102 (PA TUBE SOCKET)
1L114			NOT USED
1L115	423662	3721683 501	COIL ASSEMBLY
1R101	522247	99126 670	RESISTOR - COMPOSITION, 4700 OHMS 10% 2 W
1R102			NOT USED
1R103			NOT USED
1R104		3456512 501	RESISTOR ASSEMBLY
	243468	8954908 349	RESISTOR - FILM, 1000 OHMS 7 W
1R105	522147	99126 151	RESISTOR - COMPOSITION, 470 OHMS 2 W
1R106	922527	8849447 008	RESISTOR - 75 OHMS 10% 36 W
1R107	922527	8849447 008	RESISTOR - 75 OHMS 10% 36 W
1S101	230421	8833178 002	SWITCH
1S102	229891	8486323 501	SWITCH - GROUNDING ASSEMBLY
	209091	426767 012	INSULATOR - STEATITE, 2 IN LG X 3/4IN DIA
1XV101	243469	464586 005	SOCKET - 7203/4CX250B

Symbol	Stock No.	Drawing No.	Description
1XV102	236438	3471557 502	SOCKET ASSEMBLY - TUBE, 4CX1500A
1XV102-46	225091	8465194 501	CONTACT ASSEMBLY - SCREEN, GRID COLLET, 2 REQUIRED PER SOCKET
1XV102-03	220958	644382 004	CONTACT - CONTROL GRID
1XV102-04	220959	644382 005	CONTACT - OUTER FILAMENT
1XV102-05	220960	644382 006	CONTACT - INNER FILAMENT
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C117A | C117-DESIGNED
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C117B | C117-DESIGNED
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C117C | C117-DESIGNED
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C117D | C117-DESIGNED IN 4 SEGMENTS
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C145A | C145-DESIGNED
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C145B | C145-DESIGNED
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C145C | C145-DESIGNED
1XV102-15	225091	8446964 002	CAPACITOR - SILVER MICA, C145D | C145-DESIGNED IN 4 SEGMENTS
1XV102-49	232298	3462635 501	CONTACT ASSEMBLY - PART OF 1L113 SLIDING ADJUSTMENT
1XV102-45	236512	3467564 501	BASE ASSEMBLY, SCREEN GRID COLLET
1XV102-48	232301	3462634 001	SPACER PT OF 1L113 SEMI-FIXED ADJUSTMENT
1XV102-47	232302	3462634 002	SPACER PT OF 1L113 SEMI-FIXED ADJUSTMENT
1XV102-09	225106	8519978 001	RING - INSULATOR
1XV102-10	225087	8863044 007	WASHER - TEFLON BUSHING
1XV102-11	233405	8519977 004	INSULATOR - POST, 1/2 IN DIA X .656 IN LG
1XV102-16	097459	426763 003	INSULATOR - NS5X4001, BOTTOM OF SOCKET
1XV102-39	217719	426763 009	INSULATOR - NS5X4003, TOP OF SOCKET
1XV102-41	208115	426765 009	INSULATOR - NS5X0106
1XV1??			SOCKET - 7203/4CX250B, PART OF POWER DETERM. KIT
1Z101	419265	3456497 501	SUPPRESSOR NETWORK
1Z102	419265	3456497 501	SUPPRESSOR NETWORK - PART OF MI-560510A
			P/L 8541907-505 REV 24
MECHANICAL PARTS			
173	249529	3721194 009	SCREW - PAN HEAD .090(10)-32 x .75 LONG, PLASTIC, SECURES RING (ITEM 157) TO SHELF (ITEM 11)
11	230429	8761072 001	SHELF - UPPER, FOR C113
8	243458	8486379 001	SUPPORT - PLASTIC, MOUNTS SHELF, STOCK NO. 230429, RIGHT SIDE
10	243459	8486379 003	SUPPORT - PLASTIC, MOUNTS SHELF, STOCK NO. 230429, REAR
9	243473	8494379 001	SUPPORT - PLASTIC, MOUNTS SHELF, STOCK NO. 230429, LEFT SIDE
22	199933	464586 003	CHIMNEY - FOR 1XV101 (DRIVER TUBE)
161	243460	3467932 001	SHORTING - RAIL, PART OF 1L105
29	230433	8766808 002	PLATE - BACKING, PART OF 1L105
28	230432	8766808 001	PLATE - BACKING, PART OF 1L106
156	243471	3464209 503	LEAD SCREW ASSY - PART OF 1L105 OR 1L106
155	243462	3456357 001	GUIDE - STRIP, PART OF 1L105 OR 1L106
157	243461	3730738 001	RING - SPACER, USED UNDER 1C113
158	243463	3456428 001	BLOCK - SPACER, USED AT BOTTOM OF OUTPUT LINE ASSEMBLY
39	230424	8468301 501	CONTACT ASSEMBLY - FOR 1L105 AND 1L106
167	243472	69273 183	BRASS STUD - 1/4-20 X 2.75 LG, PART OF 1L105 AND 1L106
42	230435	8766820 501	OUTPUT LINE ASSEMBLY
159	211081	426767 018	INSULATOR - 2 REQD, 3/4 DIA X 3.00 IN LG PART OF 12106 HARMONIC SUPRESSOR
160	231640	426767 015	INSULATOR - STEAT., 3/4 IN DIA X 2.50 LG PART OF 12107 HARMONIC SUPRESSOR
54	233672	480368 007	STUD - FASTENER, DOOR UPPER
55	233869	8886047 003	WASHER - RETAINING, DOOR STUD
57	233871	480368 006	STUD - FASTENER, DOOR MIDDLE
58	233870	480368 010	STUD - FASTENER, DOOR BOTTOM
59	230430	8761074 501	CONTACT ASSEMBLY - DOOR, 15.75 LONG
60	230431	8761074 502	CONTACT ASSEMBLY - DOOR, 37.00 LONG
63	233834	433422 506	DIAL - ASSEMBLY
68	233835	748586 012	DRIVE - RIGHT ANGLE

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Symbol	Stock No.	Drawing No.	Description
		8494371 501	COUNTER ASSEMBLY
4	220304	8986503 002	COUNTER
7	097461	8827138 002	GEAR - MITER
8	212531	8914895 501	GEAR ASSEMBLY - INCLUDES MITER GEAR AND BRASS BUSHING
10	922202	8513284 001	JOINT - UNIVERSAL
117	235298	748586 013	DRIVE - RIGHT ANGLE, DRIVES 1L105, 1L106
70		8494371 502	COUNTER ASSEMBLY
11	220303	8986503 001	COUNTER
7	097461	8827138 002	GEAR - MITER
8	212531	8914895 501	GEAR ASSEMBLY - INCLUDES MITER GEAR AND BRASS BUSHING
10	922202	8513284 001	JOINT - UNIVERSAL
72	211297	8910643 002	JOINT - UNIVERSAL, ATTACHES TO RIGHT ANGLE DRIVE FOR 1L105 AND 1L106
75	235436	1510920 017	KNOB - PA PLATE TUNING OR PA OUTPUT LOADING
76	208711	8898610 001	COUPLING - INSULATED, FLEXIBLE
79	211370	426772 003	INSULATOR - STEAT. 1/2 IN SQ X .75 IN LG
80	211423	426765 003	INSULATOR - STEAT. 3/8 IN DIA X .50 IN LG
86	230425	8491388 503	CABLE ASSEMBLY - PA TUBE SOCKET CHIMNEY (CONNECTS 1XV102 TO 1C115 AND 1C116 - 2 REQUIRED)
87	230428	8544458 001	RETAINER
107	226714	3450782 003	CONTACT - FINGERS, DOOR
108	215854	8413444 501	CONTACT - ASSEMBLY, DOOR 4.88 INCHES LONG
	243444	8544435 502	JUMPER CABLE ASSY - JUMPERS DOOR HINGES
38	243890	8489378 501	PLATE - CONTACT FINGER MOUNTING, FOR 1L105 AND 1L106
33	243903	8494375 002	BLOCK - SPACER, FOR TOP OF 1L105
32	243904	8494375 001	BLOCK - SPACER, FOR TOP OF 1L106
52	243889	8543110 001	DOOR - HINGE, FOR RF BOX
1L111			INDUCTOR - VARIABLE, FRONT
101	243892	3455763 001	SHORTING BLOCK, 87.5 MHZ TO 101.9 MHZ
101	243891	3455763 002	SHORTING BLOCK, 102.1 MHZ TO 107.9 MHZ
102	243893	3455135 001	PLATE - GRID TUNING INDUCTOR, 87.5 MHZ TO 89.9 MHZ, MI-560356-5
102	243894	3455764 001	PLATE - GRID TUNING INDUCTOR, 90.1 MHZ TO 101.9 MHZ, MI-560356-1
102	243895	3462864 001	PLATE - GRID TUNING INDUCTOR, 102.1 MHZ TO 107.9 MHZ, MI-560356-3
1L112			INDUCTOR - VARIABLE, REAR
101	243892	3455763 001	SHORTING BLOCK, 87.5 MHZ TO 101.9 MHZ
101	243891	3455763 002	SHORTING BLOCK, 102.1 MHZ TO 107.9 MHZ
103	423694	3724280 001	PLATE - GRID TUNING INDUCTOR, 87.5 MHZ TO 89.9 MHZ, MI-560356-6
103	243895	3455764 002	PLATE - GRID TUNING INDUCTOR, 90.1 MHZ TO 101.9 MHZ, MI-560356-2
103	243896	3462864 001	PLATE - GRID TUNING INDUCTOR, 102.1 MHZ TO 107.9 MHZ, MI-560356-3
			HARMONIC SUPPESSOR, INCLUDES 1R106
134	243897	3455147 001	TUBING - 2 REQUIRED, 1 1/8 DIA x 8 3/8 LG
133	243898	3455156 001	CLAMP - 2 REQUIRED
			RESISTOR - 1R106, SEE ELECTRICAL PARTS
			HARMONIC SUPPESSOR, INCLUDES 1R107
134	243897	3455147 001	TUBING - 2 REQUIRED, 1 1/8 DIA x 8 3/8 LG
133	243898	3455156 001	CLAMP - 2 REQUIRED
160	231640	426767 015	INSULATOR - 2 REQD, 3/4 DIA X 2.50 IN LG
			RESISTOR - 1R107, SEE ELECTRICAL PARTS
			POWER DETERMINING COMPONENTS MI-560510A
1C7	230070	990194 061	PAPER, HV FILTER, 1.5 MF 10% 10,000 V
1C8	230070	990194 061	PAPER, HV FILTER, 1.5 MF 10% 10,000 V
1C10	205656	3724573 501	MICA, METER BYPASS .010 MFD 20%, 250 V
1C113	423771	8642607 507	P.A. BLOCKING
	230076	8761062 501	CONTACT ASSEMBLY (2 REQUIRED) PART OF 1C113

Symbol	Stock No.	Drawing No.	Description
			NOTE - SEVERAL CONTACTOR TYPES HAVE BEEN SUPPLIED FOR PLATE CONTACTOR 2K1. SELECT SPARE PARTS REQUIRED FROM THE FOLLOWING LISTING, DEPENDING ON CONTACTOR IN USE.
2K1	217766	8838005 012	CONTACTOR - PLATE, 110V COIL, WESTINGHOUSE CLASS 15-825 N4, STYLE 1490455, SIZE 4
	217767		COIL - 110 VAC
	097055		CONTACT MOVEABLE
	097056		CONTACT - STATIONARY
	097057		SPRING - CONTACT
2K1	247449	3732697 001	CONTACTOR - PLATE, 120V COIL, 150 A, WESTINGHOUSE CATALOG NO. A201K4CA, SIZE 4
	426552		COIL - 120 VAC
	426550		KIT-CONTACT - CONSISTS OF MOVING CONTACTS, STATIONARY CONTACTS AND SPRINGS.
2K1		3732697 001	CONTACTOR - PLATE, 120V COIL, 135 A, ALLEN BRADLEY CATALOG NO. 702EOD93, BULLETIN 702, SIZE 4
	426558		COIL - 120 VAC
	426557		CONTACT - STATIONARY, FRONT AND REAR
	426556		SET OF STATIONARY CONTACTS AND SPRINGS.
2K1			CONTACTOR - PLATE, 120V COIL, CLARK CONTROLLER TYPE NO. CY, CATALOG NO. 77U34, BULLETIN 7707
	426265		COIL - 120 VAC. (CLARK PART NO. TB105-1)
	426266		STATIONARY CONTACTS, MOVE- CLARK KIT NO. CY34-1 ABLE CONTACTS AND SPRINGS.
			NOTE: IF REPLACEMENT OF 2K1 IS NECESSARY, REPLACE WITH WESTINGHOUSE OR ALLEN-BRADLEY CONTACTOR LISTED.
1L3	230071	8486310 001	REACTOR - HIGH VOLTAGE FILTER
1M4	230072	993052 155	AMMETER - PLATE. 0-5 AMP
1R24	230073	8491308 001	RESISTOR - RELAY SHUNT, WIRE WOUND 0.167 OHMS 1% 90W
2S1	230081	8486384 001	BREAKER-CIRCUIT
1T2	230074	8486311 001	TRANSFORMER - P.A. FILAMENT
1Z5	230078	8729668 003	COUPLER - DIRECTIONAL
1Z7	243470	3467965 003	COUPLER - DIRECTIONAL
1Z102	419265	3456497 501	SUPPRESSOR NETWORK
9	230079	8491388 501	CONNECTOR - FILAMENT (CONNECTS 1T2 TO 1C115- 8 IN. LONG)
10	230080	8491388 502	CONNECTOR - FILAMENT (CONNECTS 1T2 TO 1C116 - 11 IN. LONG)
20	233726	897258 005	CLAMP - 3 1/16 TO 4 IN DIA
15		3730873 501	SOCKET ASSEMBLY - DRIVER TUBE
XV103	243469	464586 005	SOCKET
C131	214638	8864187 007	STAND-OFF, 1000 MMF 500 V
C132	214636	8864187 007	STAND-OFF, 1000 MMF 500 V
C133	214638	8864187 007	STAND-OFF, 1000 MMF 500 V
C134	214638	8864187 007	STAND-OFF, 1000 MMF 500 V
C136	214638	8864187 007	STAND-OFF, 1000 MMF 500 V
C137	214638	8864187 007	STAND-OFF, 1000 MMF 500 V
	099933	464586 003	CHIMNEY
	230428	8544458 001	RETAINER , CHIMNEY
			POWER SUPPLY MI-560342-6
			P L 3724456-501 REV 1
2B1	219272	8766831 001	FAN ONLY
	227686	8537176 001	INJECTOR (FOR OILING ROTRON FAN 2B1)
2DS1	426071	3724582 101	LAMP, INDICATOR
2K1			CONTACTOR-PLATE, 110 VOLTS, PART OF MI-560510A
2R1	059941	993007 086	RESISTOR - WIREWOUND, 1800 OHMS 5W
2S1			BREAKER -CIRCUIT, PART OF MI-560510A
2S2	229890	8434081 004	BREAKER - CIRCUIT, LOW POWER 30 A

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Symbol	Stock No.	Drawing No.	Description
2S3	425208	3724238 002	SWITCH - INTERLOCK
2S4			SWITCH - HV GROUNDING
29	427439	3724531 167	SPACER -GROUNDING SWITCH
31	427438	3720241 004	BAR - SHORTING
32	422682	3454962 501	STRAP - FLEXIBLE
?XDS1	426072	3724582 001	SOCKET - INDICATOR LIGHT
?Z1		MI-560340-4	RECTIFIER ASSEMBLY
23	211081	426767 118	INSULATOR - 3/4 IN. DIA x 3 IN. LONG
37	426164	890405 010	MOUNT - RESILIENT
			RECTIFIER MI-560340-4
			P/L 3746645-501 REV 1 (SEE FIGURE 41)
2Z1		3746645 501	RECTIFIER - ASSEMBLY, MI-560340-4
	208325	426767 121	INSULATOR - STEATITE 3/4 IN DIA x 4 IN LONG
	426162	3722794 007	RECTIFIER STACK - 9.6 KV PIV
	418002		MODULE-DIODE RIGHT HAND, QR2900
	418003	DIODE 1N1206A	MODULE-DIODE, LEFT HAND, QR2901
			BLOWER MI-560347A-1
1B2	426110	3746607 001	MOTOR ONLY
			BLOWER MI-560347-3
1B2	428277	8642662 011	MOTOR ONLY (USED ONLY IN HIGH ALTITUDE INSTALLATIONS)
			PLATE TRANSFORMER MI-560341-1
3T1	243888	8486314 001	TRANSFORMER - RECTIFIER 208/240V 3 PHASE 50/60 HERTZ
	249402		PRIMARY TERMINAL BOARD ONLY
			PLATE TRANSFORMER MI-560341-7
3T1	428279	3734100 001	TRANSFORMER - RECTIFIER 208/240V 3 PHASE 50/60 HERTZ 7500/6300V TAPS
			INSTALLATION MATERIAL MI-560515
1	057077	887449 501	ARM ASSEMBLY TUNING
2	070180	86183 502	TRIMMER ADJUSTING TOOL
3	230082	8535851 001	LAMP CHANGING TOOL
8	236025	1510020 103	CONNECTOR -COAXIAL
6	425769	2010853 141	WIRE - #14 AWG, 15,000 V WHITE (SPECIFY LENGTH IN FEET)
			1Z6 CONTROL MODULE
1Z6	243753	3730764 001	CONTROL MODULE
C1	300763		CAPICATOR-ELECTROLYTIC, 250 MFD 25V
C2	300763		CAPACITOR-ELECTROLYTIC, 250 MFD 25V
C3	248662		CAPACITOR-ELECTROLYTIC, 1 MFD 3 V
C4	248662		CAPACITOR-ELECTROLYTIC, 1 MFD 3 V
D1	248663		DIODE - TYPE SS889
K1	243445	3467962 001	RELAY - LOW POWER POINT
K2	241749	8766828 005	RELAY - HIGH POWER POINT
	248673	8766823 022	PHOTOCELL FOR M5 and M7
Q1	248664		TRANSISTOR - TYPE 2N3396
Q2	248664		TRANSISTOR - TYPE 2N3396
			RESISTORS - FIXED CARBON, UNLESS NOTED
R1	248665		WIREWOUND, 1.1 OHMS 5% 2 W

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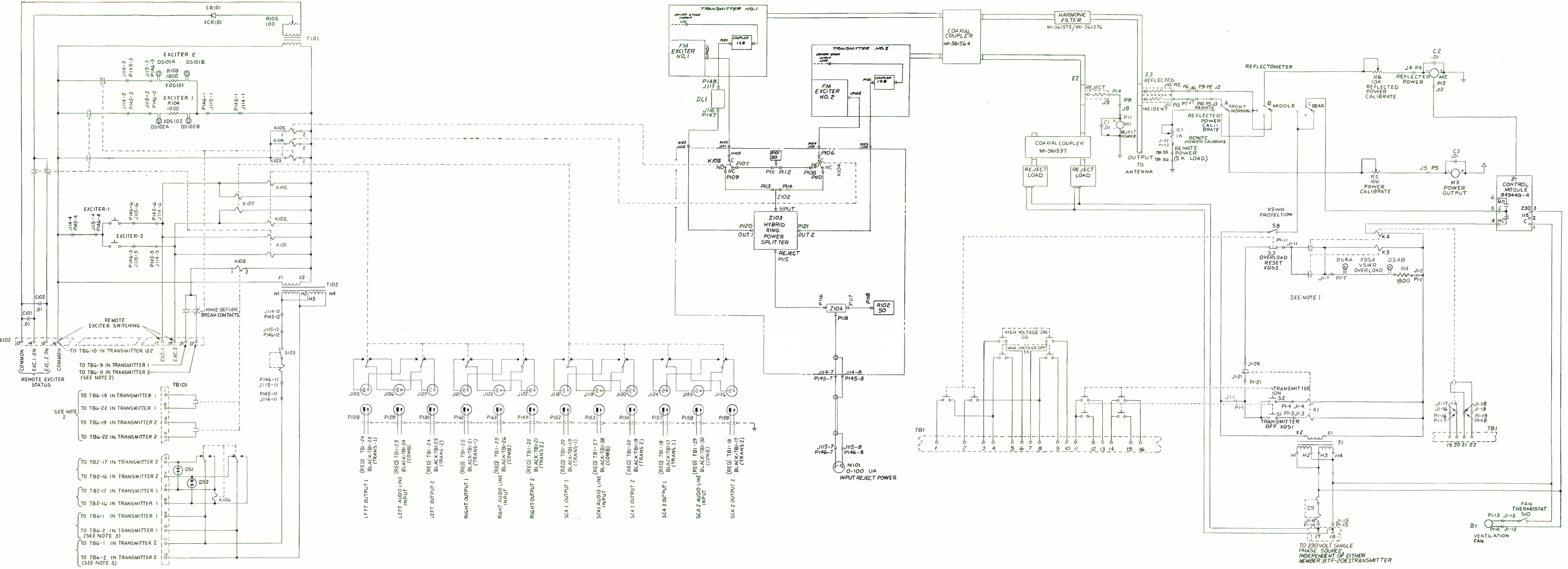
Symbol	Stock No.	Drawing No.	Description
R2	243448	82283 569	5.6 OHMS 5% 1/2 W 2.2
R3	243448	82283 569	5.6 OHMS 5% 1/2 W
R4	502222	82283 167	2200 OHMS 5% 1/2 W
R5	502222	82283 167	2200 OHMS 5% 1/2 W
R6	502122	82283 143	220 OHMS 5% 1/2 W
R7	502122	82283 143	220 OHMS 5% 1/2 W
R8	265507	990464 468	FILM, 49,900 OHMS 1% 1/2W
R9	502310	82283 183	10,000 OHMS 5% 1/2 W
R10	502510	82283 234	1,000,000 OHMS 5% 1 2 W
R11	265507	990464 468	FILM, 49,900 OHMS 1% 1/2 W
R12	502510	82283 231	1,000,000 OHMS 5% 1/2W
R13	502310	82283 183	10,000 OHMS 5% 1/2 W
R21	236087	990476 041	FILM, 10,000 OHMS 1% 1/2 W
R22	236087	990476 041	FILM, 10,000 OHMS 1% 1/2 W
SCR1	248666		SCR - TYPE 2N2322A
SCR2	248666		SCR - TYPE 2N2322A
PCB			PRINTED CIRCUIT BOARD-API PART NO.1649-41
T1	248667		TRANSFORMER - POWER
			BLOWER MOUNTING KIT MI-560517 (USED WITH STANDARD BLOWER MI-560347-A1)
2	248620	8820789 006	BOOT - 2 1/2 IN x 44 IN
5	248622	3730683 001	MOUNT - SHOCK, 6 LB
6	248623	3730683 006	MOUNT - SHOCK, 20 LB
			BLOWER MOUNTING KIT MI-560705 (USED WITH HIGH ALTITUDE BLOWER MI-560347-3)
	248623	3730683 006	MOUNT - SHOCK, 20 LB
	428280	3730683 009	MOUNT - SHOCK, 33 LB
	428281	8707374 103	RELAY, THERMAL OVERLOAD - PART OF MAGNETIC STARTER RELAY, 1K15
			AM NOISE REDUCTION KIT MI-560307-31
	225532	990196 008	CAPACITOR - 10 MF 600V
	413826	990196 011	CAPACITOR - 20 MF 600V
	43441	990193 071	CAPACITOR - 15 MF 200V
	93658	949251 001	REACTOR - FILTER, 10H
	95794	949476 001	REACTOR - FILTER, 4H
	419825	890015 022	RESISTOR - 630 OHMS 200W TAPPED
	94341	433464 009	RHEOSTAT - 10 OHMS 100 W
			PA NEUTRALIZING COMPONENTS
	MI-74A		CABLE - COAXIAL, RG/8U (SPECIFY LENGTH IN FEET)
	MI-27791K-5A		CONE - REDUCER, 3-1/8" dia. COAXIAL LINE TO TYPE N CONNECTOR
	236025	1510020 103	CONNECTORS - TYPE N

20E7

SUGGESTED STATION SPARES (BTF-20E1)

Description	Symbol	Quantity	Stock No.
Capacitor, ceramic, 500 uuF, 5000 V	1C140 thru 1C143	1	232610
Capacitor, ceramic, 1500 uuF, 3500 V	1C144	1	209906
Capacitor, feed-thru, 1000 uuF, 2000 V	1C114, 1C118, 1C147	1	236759
Capacitor, feed-thru, .001 uF, 5000 V	1C110	1	211148
Capacitor, feed-thru, 1500 uuF, 15,000 V	1C119	1	230419
Capacitor, paper, .001 uf, 600 V	1C106 thru 1C109 1C121, and 1C122	2	211196
Capacitor, paper, 6 uF, 2500 V	1C5	1	229778
Capacitor, paper, 1.5 uF, 10,000 V	1C7, 1C8	1	230070
Capacitor, silvered mica	1C117A thru D, 1C145A thru D (Part of 1XV102)	4	225081
Capacitor, stand-off, 1000 uuF, 500 V	1C103, 1C104, 1C127, 1C128, 1C129, 1C131, 1C132, 1C133, 1C134, 1C136 thru 1C139	6	214638
Capacitor, vacuum, 40 uuF, 7500 V	1C124*, 1C126*	1	227938
Capacitor, vacuum, 25 uuF, 7500 V	1C125, 1C126*	1	235990
Lamp (for use in optic meter relay)	Part of 1M5 or 1M7	3	231545
Capacitor, PA plate blocking	1C113	1	423771
Contact Assembly, PA plate blocking	Part of 1C113	2	230076
Contact, control grid	Part of 1XV102	1	220958
Contact, inner filament	Part of 1XV102	1	220960
Contact, outer filament	Part of 1XV102	1	220959
Contact, PA neutralizing slider	Part of 1L113	3	232298
Spacer (used with Stock No. 232298)	Part of 1L113	3	232301
Filter	Air filter for 1B2	3	225125
Lamp, indicator	1DS1A thru 1DS6B and 2DS1	3	300449
Lamp, indicator		3	42607-1
Rectifier Stack (9.6 kV PIV CR 307	Part of Rectifier 2Z1	1	426162
Individual diode module for 2Z1 (right hand)	Part of Rectifier 2Z1	6	418002
Individual diode module for 2Z1 (left hand)	Part of Rectifier 2Z1	6	418003
Rectifier, low voltage (Diode Module only)	1Z2, 1Z3, and 1Z4	3	230913
Rectifier, bias	1Z1	1	229803
Contact Assembly (contacts mounted on metal strip for 1L105, 1L106)	Part of 1L105, 1L106	4	230424

*Values of 1C124, 1C125, 1C126 vary with frequency.



INTERCONNECTIONS BETWEEN CONTROL UNIT AND INDIVIDUAL BTF-20E1 TRANSMITTERS		
CONNECT TERMINAL	TO TERMINAL	IN TRANSMITTER
TB1-1	1TB2-27	1
TB1-2	1TB2-27	2
TB1-3	1TB2-30	1
TB1-4	1TB2-24	1
TB1-5	1TB2-25	1
TB1-6	1TB2-26	1
TB1-7	1TB2-30	2
TB1-8	1TB2-24	2
TB1-9	1TB2-25	2
TB1-10	1TB2-26	2
TB1-11	1TB2-23	1
TB1-12	1TB2-21	1
TB1-13	1TB2-22	1
TB1-14	1TB2-23	2
TB1-15	1TB2-21	2
TB1-16	1TB2-22	2
TB1-17	TO 230 VOLT 1Ø LINE INDEPENDENT OF EITHER BTF-20E1	
TB1-18		
TB1-19	1K1-6	1
TB1-20	1K1-7	1
TB1-21	1K1-6	2
TB1-22	1K1-7	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:

1. CONTROL CIRCUIT SHOWN AS SHUT DOWN FROM FULL OPERATION BY DEPRESSING OF HIGH VOLTAGE OFF BUTTON AND TRANSMITTER OFF BUTTON.
2. IN BOTH TRANSMITTERS 1 AND 2, REMOVE THE JUMPERS ON TB6 CONNECTING TERMINALS 9 & 22, ALSO REMOVE THE JUMPER BETWEEN TERMINALS 10 & 19.
3. IN BOTH TRANSMITTERS 1 AND 2, REMOVE WIRE 108 FROM TB6-1 AND FROM T3-X1. ALSO REMOVE WIRE 107 FROM TB6-2. CUT OFF WIRE 108 WHERE IT LEAVES THE HARNESS (AT BOTH TB6-1 AND T3-X1). CUT OFF WIRE 107 WHERE IT LEAVES THE HARNESS (AT BOTH TB6-2 AND TB2-17).
4. ALL COMPONENTS ARE PREFIXED BY NUMERAL 4.

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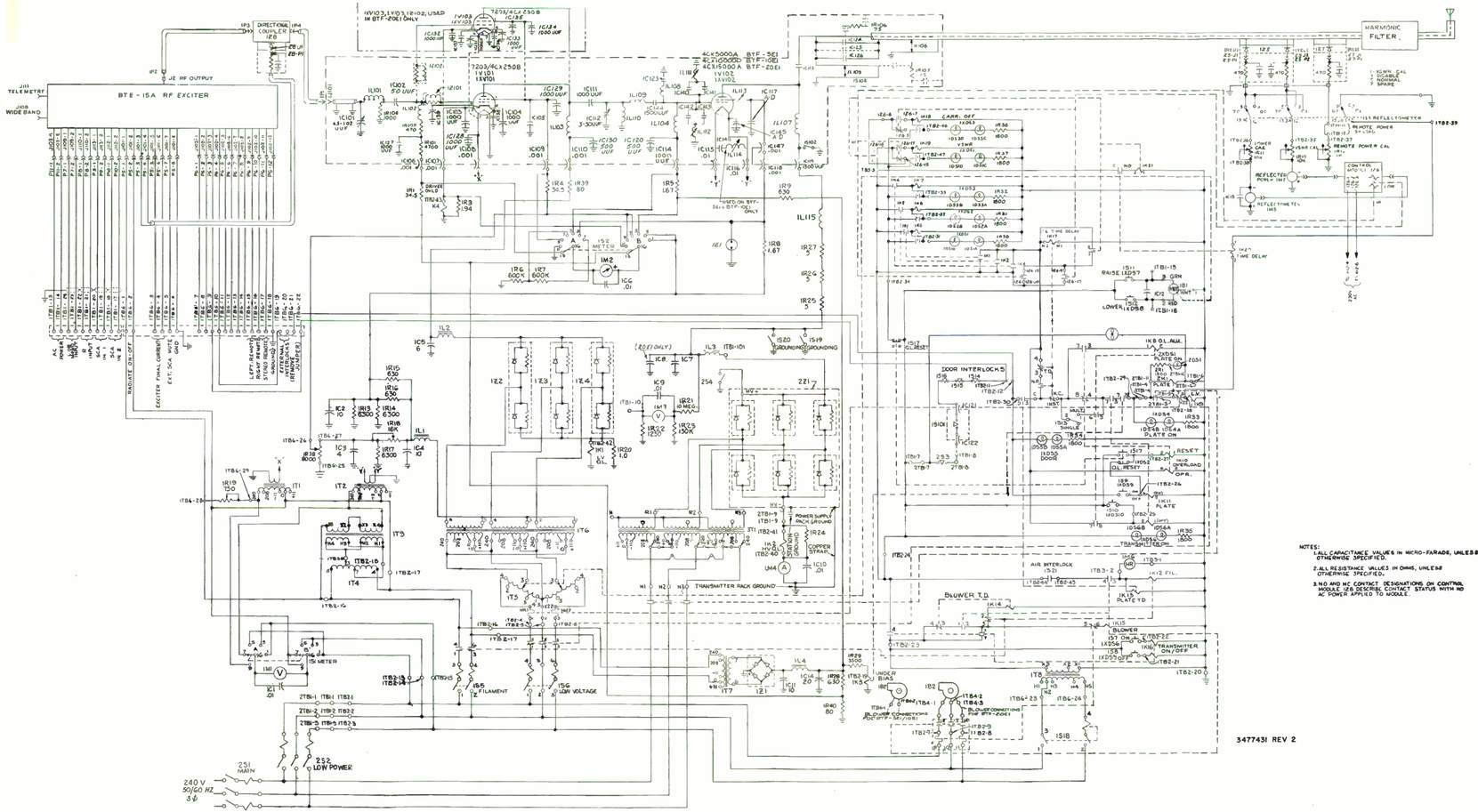
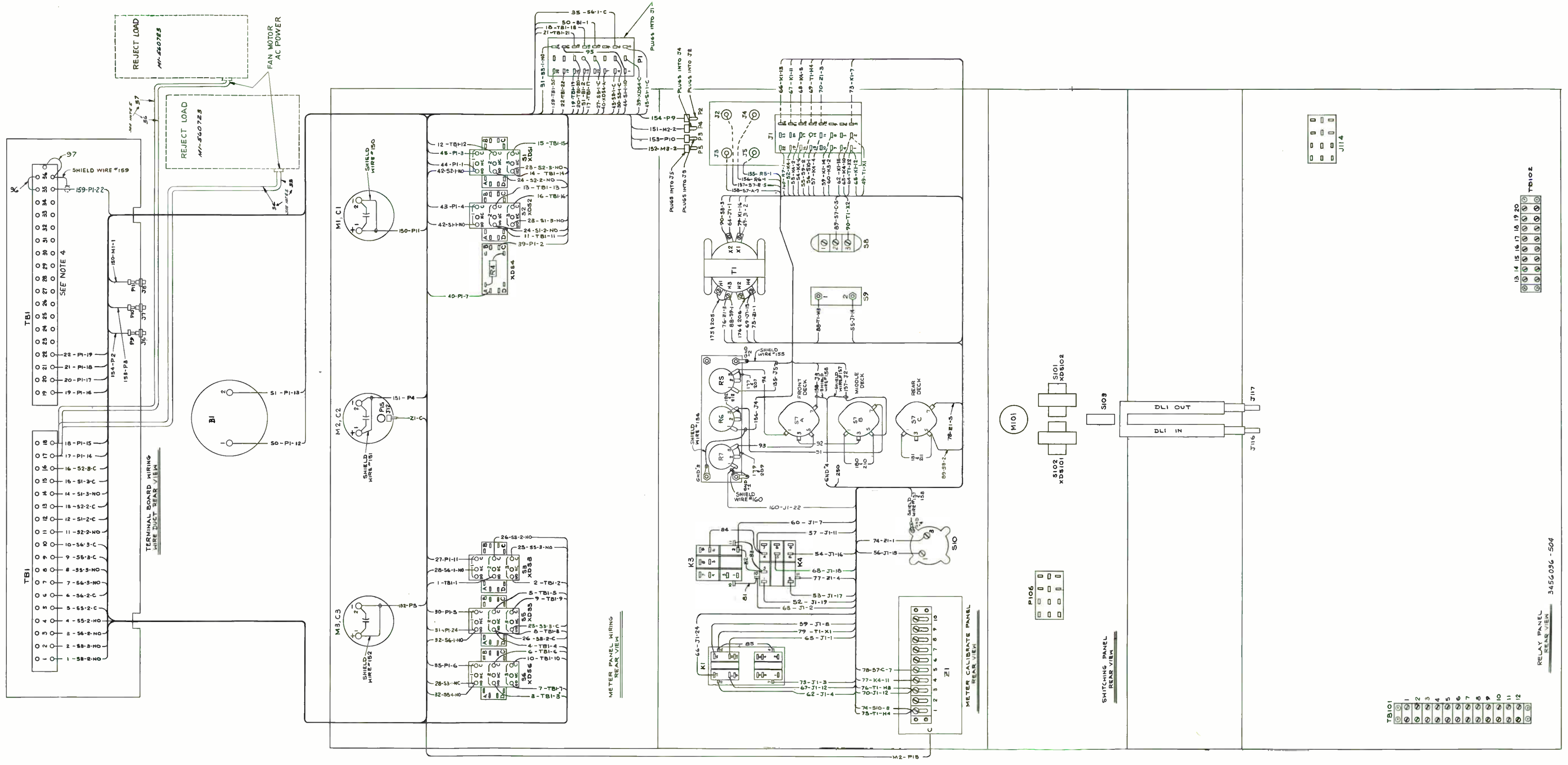
Figure 20. BTF-40E1 Schematic Diagram



NOTES:
1. ALL CAPACITANCE VALUES IN MICRO-FARADE, UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTANCE VALUES IN OHMS, UNLESS OTHERWISE SPECIFIED.
3. N.O. AND N.C. CONTACT DESIGNATIONS ON CONTROL MODULE (2E) DENOTE CONTACT STATUS WITH NO AC POWER APPLIED TO MODULE.

Figure 21. BTF-20E1 Wiring Diagram



WIRE TABLE			
WIRE NUMBERS	DESCRIPTION	ITEM NO'S	WIRE NO'S NOT USED
1 THRU 97 INCL	WIRE BLK 600 V #16 AWG	115	[illegible]
150 THRU 160 INCL	SHIELDED CABLE	116	
175 THRU 185 INCL	COPPER WIRE	117	178
205 THRU 212 INCL	SLEEVING	118	208
250	SLEEVING	119	

NOTES:

1- RUBBER STAMP .19 HIGH STANDARD CHARACTERS FOR ELECTRICAL SYMBOLS USING BLACK PRINTERS INK.

2- CABLE WIRES AS SHOWN AND LACE USING CORD ITEM- AT POINTS OF CABLE WHERE ABRASION TO WIRES OR ELECTRICAL SHORT TO SHIELD CABLE MIGHT OCCUR, WRAP CABLE WITH TAPE ITEM-

3- IN MAKING WIRE CONNECTIONS USE FOLLOWING TYPE TERMINALS AS BEST SUITED, UNLESS OTHERWISE SPECIFIED.

4- TB1 TERMINALS 23 THROUGH 30 ARE USED AS TIE POINTS BETWEEN AF INPUTS AND INTER-RACK CABLE ASSEMBLY.

5- TAPE WIRE ENDS; TO BE CONNECTED TO REJECT LOAD.

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Figure 22. BTF-40E1 Wiring Diagram

WIRE TABLE		
WIRE NO.	DESCRIPTION	PARTS LIST ITEM NO.
1 THRU 12	WIRE BLK. 600 V #18	26
13 THRU 14	WIRE TINNED COP. .040 DIA.	28
15 THRU 17	COAXIAL CABLE	29

TERMINAL DWG	PARTS	AWG #	INSULATION DIA MAX.	COLOR
8982998	1-6	22-26	.082	Yel.
8982998	10-21	18-22	.136	Red
8982998	25-32	14-16	.170	Blue
8982998	36-46	10-12	.275	Yel.
8982998	50-60	14-16	.275	Yel.

CAUTION:
TERMINAL SIZE MUST BE SELECTED BY REFERENCE TO BOTH AWG WIRE SIZE AND INSULATION DIAMETER, IN ACCORDANCE WITH THIS TABLE.

IF WIRING REQUIREMENTS CANNOT BE MET BY ABOVE, AN APPROVED SOLDER TYPE TERMINAL SHOULD BE USED.

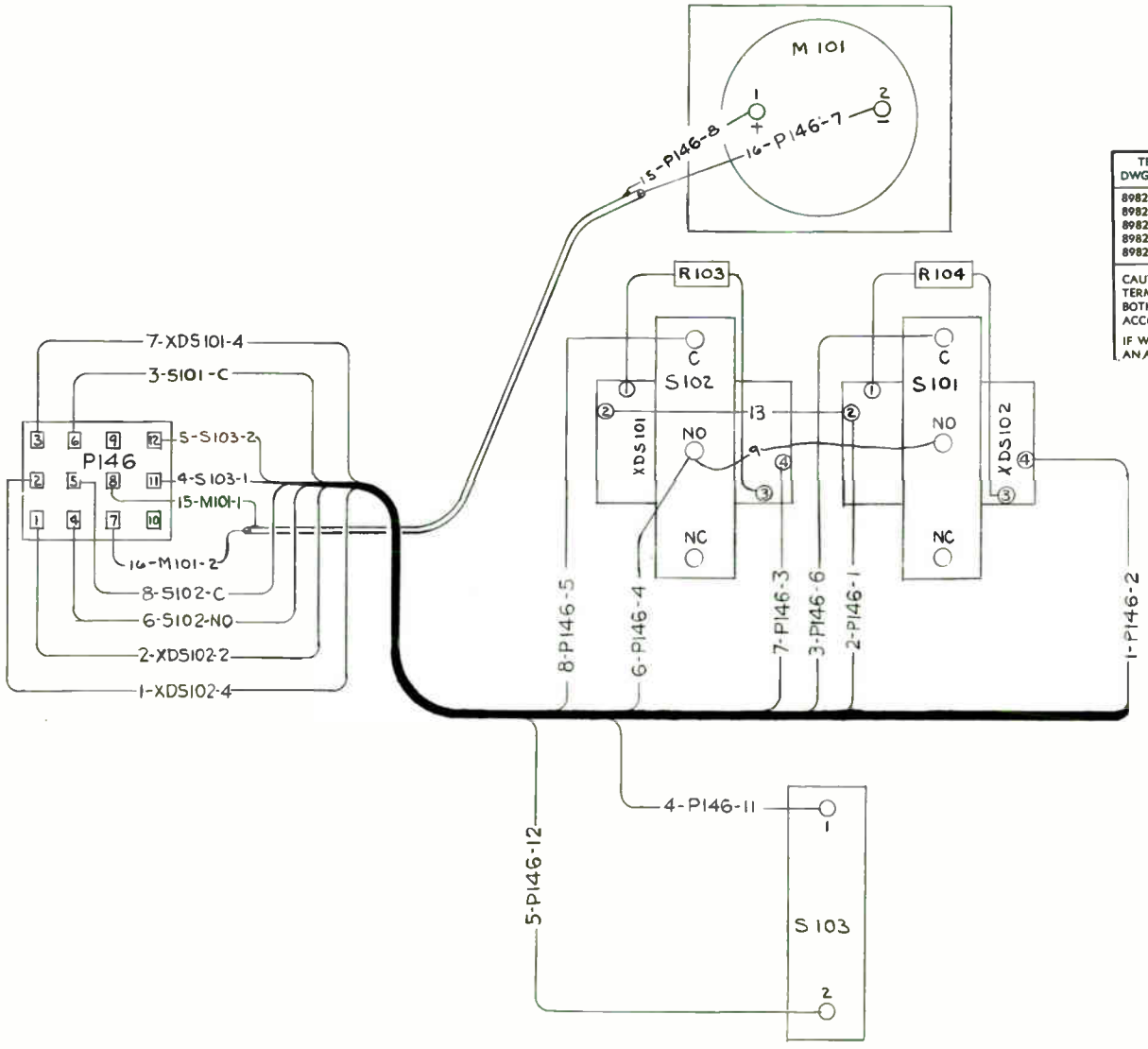

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Figure 23. FM Exciter Switching Panel MI-560700 Item 1, Wiring Diagram

WIRE TABLE			
WIRE NUMBER	DESCRIPTION	PARTS LIST ITEM NO	WIRE NO 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	104 THRU 108 NOT USED
110 THRU 121	WIRE BLK. 600V. #18	26	

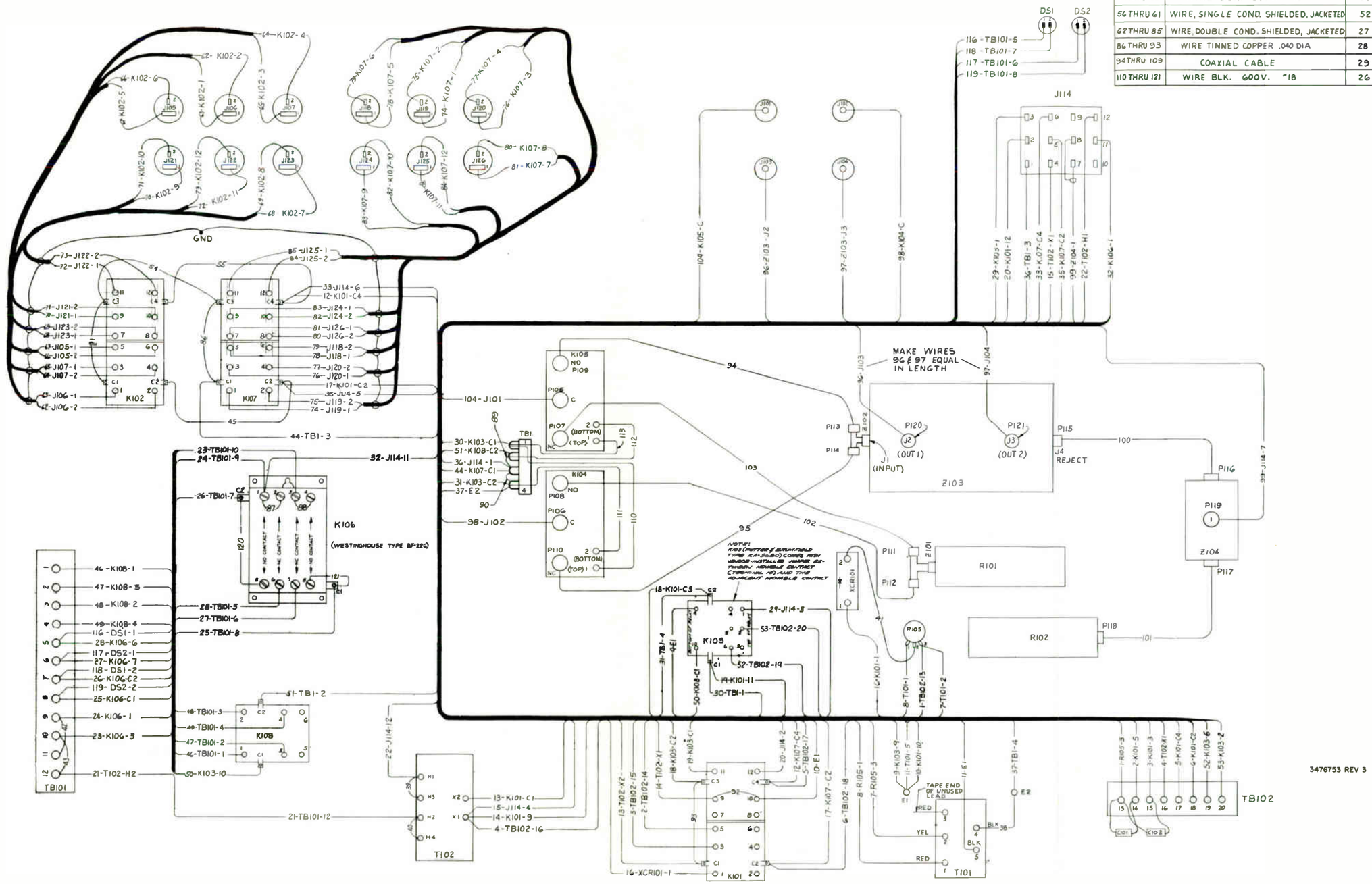
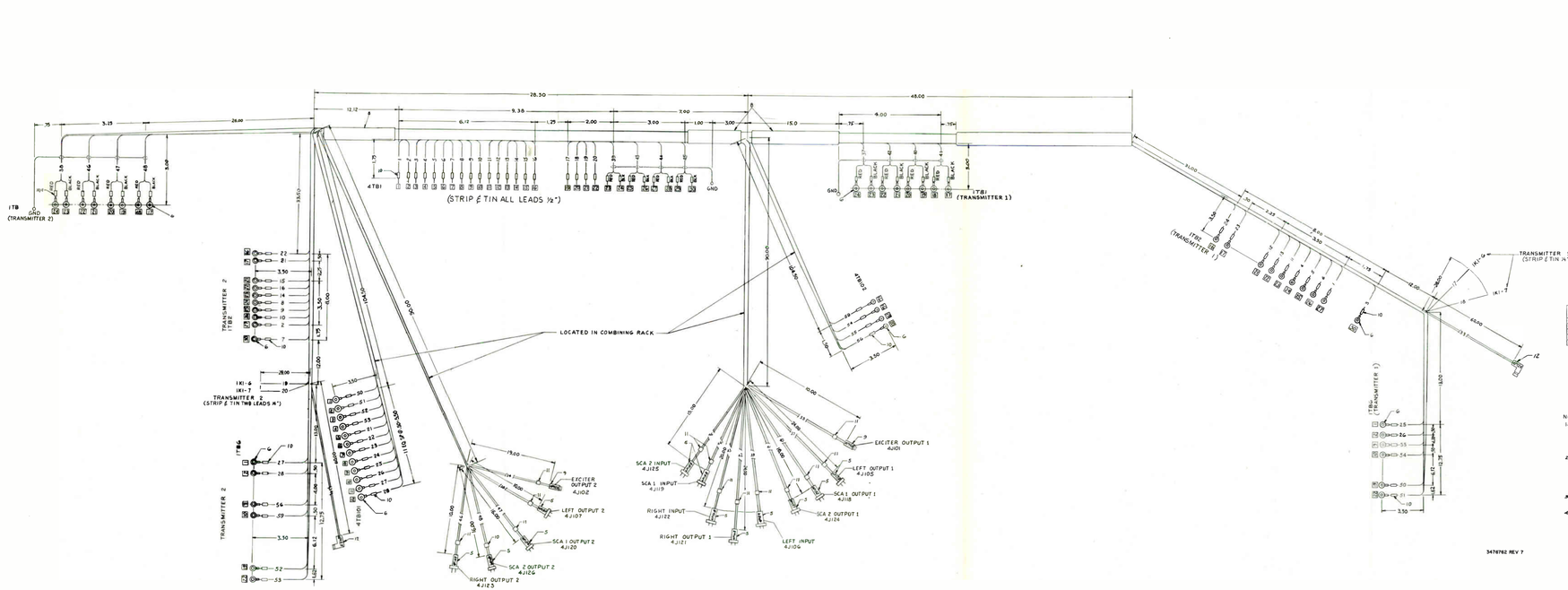


Figure 24. Exciter Switching Relay Panel MI-560700 Item 2, Wiring Diagram



WIRE NUMBER	DESCRIPTION	ITEM NO (THIS DWG)	CONNECTORS USED (Items no, Tock Item.)
1 TO 5	TWLAND 16DV BLK	1	8
10 TO 35	TWLAND 16DV BLK	2	8
39 TO 36	MIL-DTL-17 COAXIAL	3	ITEMS 9 & 12
37 TO 45	DOUBLE CONDUCTOR	4	7
50 TO 61	TWLAND 16DV BLK	6	8

NOTE:
1. WHEN WIRING CONNECTORS CONNECT AS FOLLOWS
   RED TO PIN 1 (+)
   BLACK TO PIN 2 (-)
   BRAID TO GROUND

LARGE WIRE MARKERS AROUND WIRE NUMBERS OR WIRE MARKERS TO UNDERGROUND TO WIRE IDENTIFICATION MARKERS (SMALL WIRE MARKERS) LOCATED AT ENDS OF WIRES.

2. ALL ITEMS WITH NUMBERS 1 ARE SUPPLIED AS PART OF CHASSIS ASSY CABINET ASSEMBLY-B.

3. ALL ITEMS WITH NUMBERS 2 ARE SUPPLIED AS PART OF ONE OF THE MONAURAL TRANSMITTER CABINETS.

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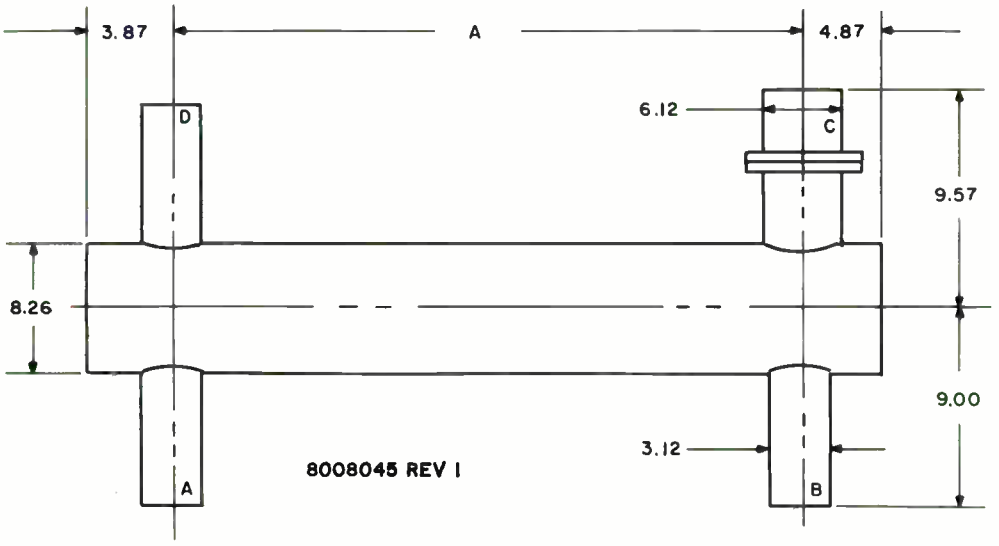
Figure 25. Combining Equipment Cabinet, Main Cable Harness Assembly



Broadcast Band	Frequency	MI Number	A	Unbalance
FM	87.5-108 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
Installation:	Inner conductor cutback for 6-1/8 OD transmission line MI-561579 at this coupler must be $0.56^{+.03}_{-.00}$".

	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)

IK029

Figure 26. 40 kW Coaxial Coupler MI-561564, Outline Drawing

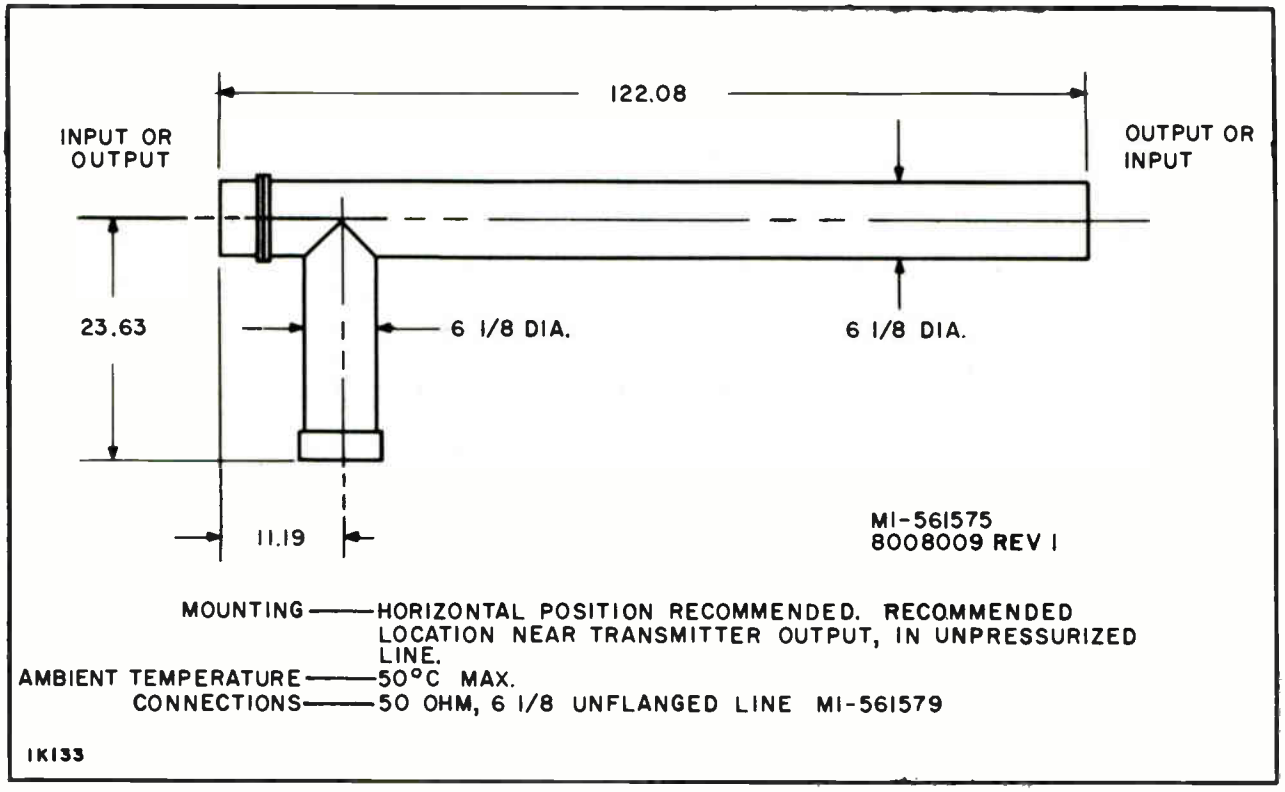


Figure 27. 40 kW Harmonic Filter, Unpressurized (MI-561575), Outline Drawing

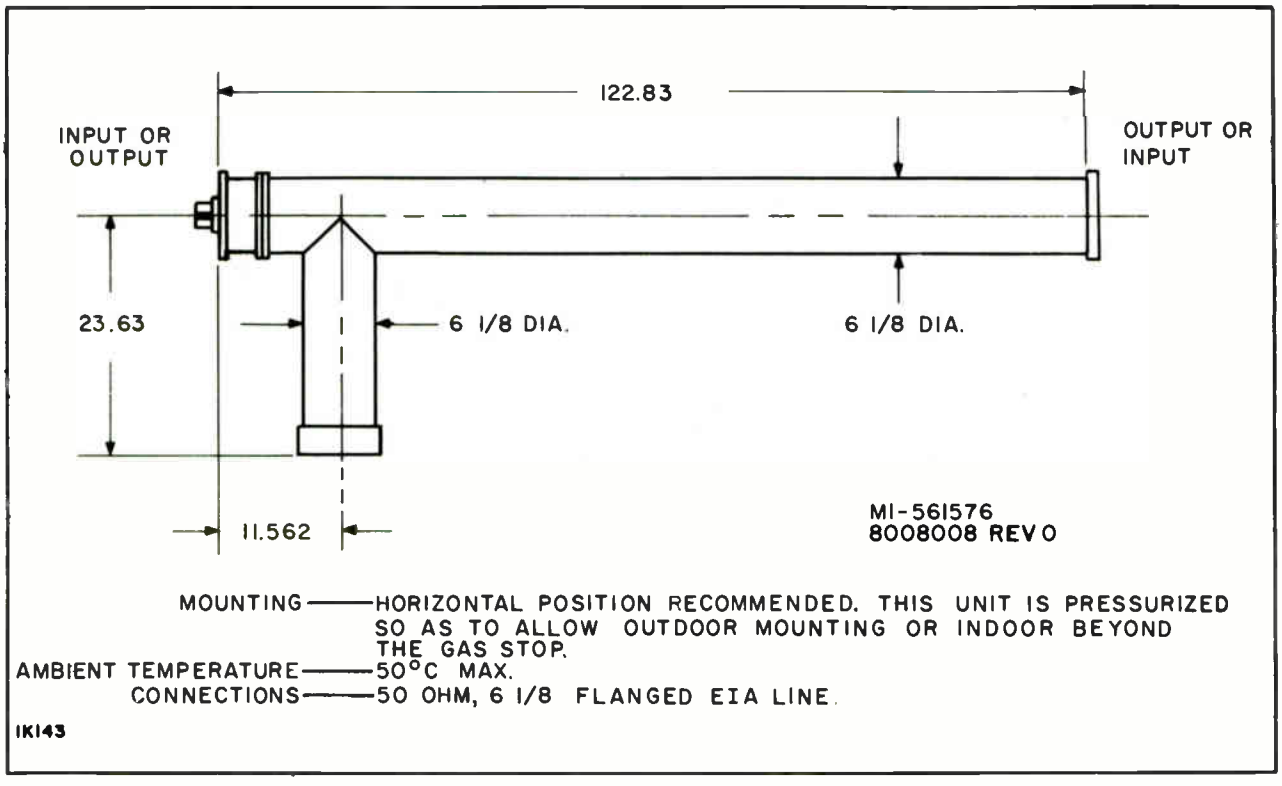


Figure 28. 40 kW Harmonic Filter, Pressurized (MI-561576), Outline Drawing

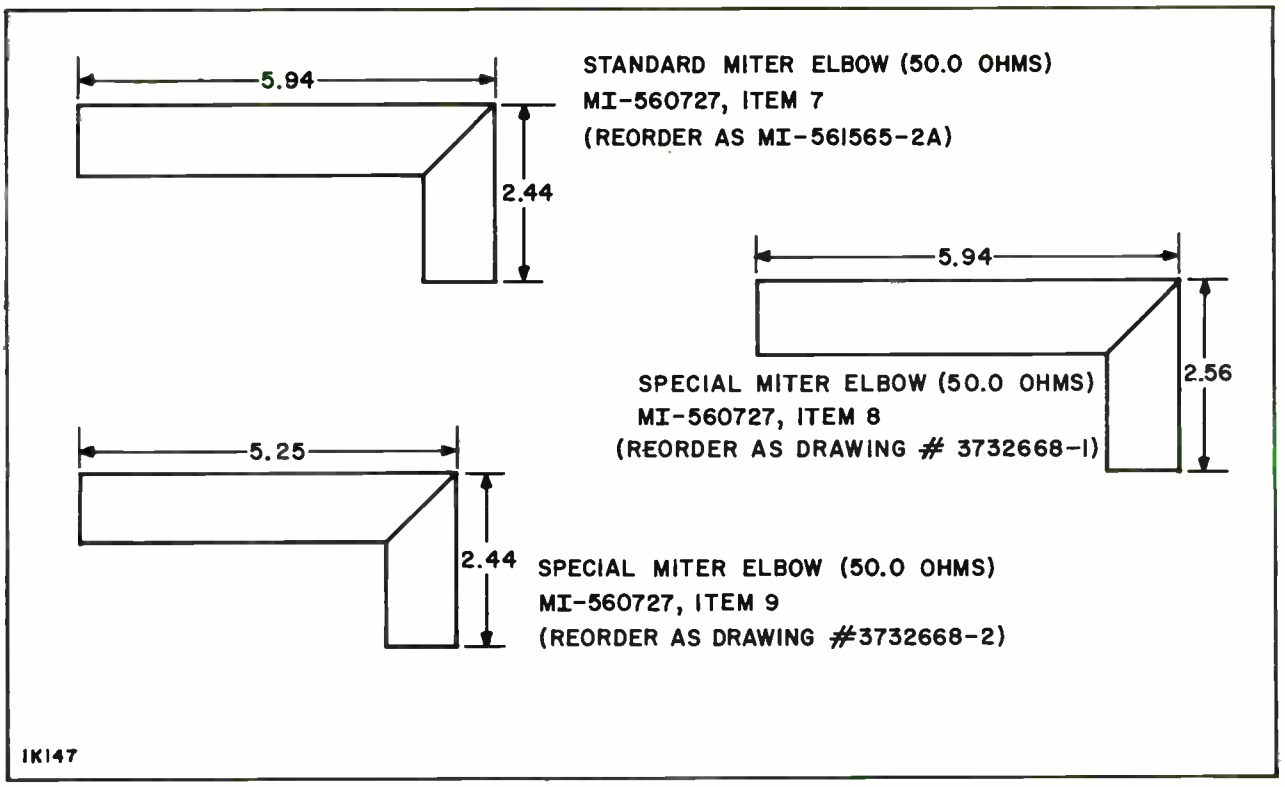


Figure 29. Coaxial Miter Elbows

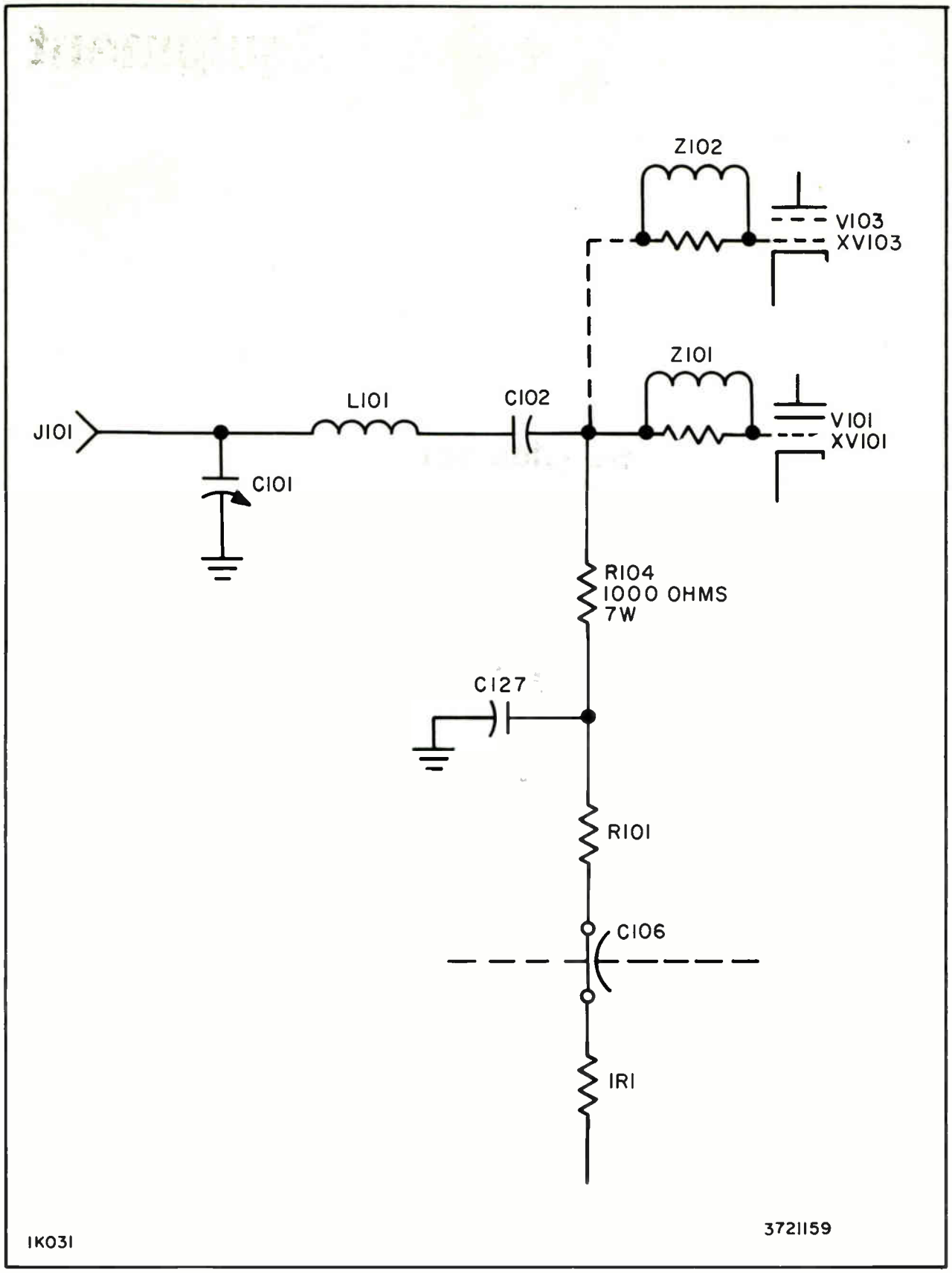


Figure 30. Driver Grid Circuit Modification, Schematic Diagram

Broadcast Equipment

Supplement

BTF-40E1 Alternate Configurations

ES-560606C, ES-560606D, ES-560606E

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

PRINTED IN U.S.A.

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LIST OF EQUIPMENT

BTF-40E1, 40kW FM TRANSMITTER
ES-560606C
BTF-40E1 WITH TWO HARMONIC FILTERS AND NO OUTPUT SWITCHING

Quantity	Description	Reference
2	Basic Transmitter	MI-560507A
2	Power Determining Kit	MI-560510B
2	Blower	
	0-7500 Ft., 60 Hz Line Frequency or	
	0-3000 Ft., 50 Hz Line Frequency	MI-560347-A1
*	3000-6500 Ft., 50 Hz Line Frequency or	
	7500-11,000 Ft., 60 Hz Line Frequency	MI-560347-3
2	Rectifier	MI-560340-4
2	Plate Transformer	MI-560341-7
2	Power Supply	MI-560342-7
2	Side Panel	MI-560755
1	Door, Front	MI-560375-1
2	Installation Material (BTF-20E1)	MI-560515
1	Installation Material (BTF-40E1)	MI-560703B
1	Installation Assembly Material	MI-560727
2	Harmonic Filter	MI-561509
**	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-28180A
*	Touch Up Finish Kit	MI-27660C
2	Blower Mounting Kit	
	If MI-560347-A1 Blower is Supplied	MI-560517
	If MI-560347-3 Blower is Supplied	MI-560705
2	Frequency Determining Parts, for customer's assigned frequency as follows:	
	ES NUMBER — FREQUENCY	
	ES-560272C-1 — 87.5 TO 89.9 MHz	
	ES-560272C-2 — 90.1 TO 91.9 MHz	
	ES-560272C-3 — 92.1 TO 93.9 MHz	
	ES-560272C-4 — 94.1 TO 95.9 MHz	
	ES-560272C-5 — 96.1 TO 97.9 MHz	
	ES-560272C-6 — 98.1 TO 99.9 MHz	
	ES-560272C-7 — 100.1 TO 101.9 MHz	
	ES-560272C-8 — 102.1 TO 103.9 MHz	
	ES-560272C-9 — 104.1 TO 105.9 MHz	
	ES-560272C-10 — 106.1 TO 107.9 MHz	
2	Directional Coupler	MI-561043-4
1	Coaxial Coupler, 40 kW	MI-561535
1	Combining Equipment Rack	MI-560702B
1	Set of Coaxial Components	MI-560704B
1	Misc. Coaxial Components (BTF-40E1)	MI-560706D
*	6-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-561579-*
*	3-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-27791K-*
*	1-5/8 in. O.D. 50 Ohm Transmission Line Components	MI-561565-*
1	Coaxial Coupler (10 kW per port)	MI-561537A
2	5 kW RF Load	MI-560723
*	RF Load and Wattmeter	MI-561735
1	Driver Stage Modification Kit	MI-560307-32
1	Set of Installation Drawings (see table 1)	3720423
2	Instruction Book, BTF-40E1	IB-8027533-2
2	Instruction Book Addenda, BTF-40E1	IB-8027533-2A
2	Instruction Book, BTF-20E1	IB-8027531-2
2	Instruction Book, BTE-15A FM Exciter	IB-8027524-2
*	Remote Control Panel	MI-561354
*	Automatic Power Control Panel	MI-561353
*	Automatic Power Control Installation Kit	MI-561358

*Supplied if and as specified on sales order.
**Supply two ES as specified on sales order.

LIST OF EQUIPMENT

BTF-40E1, 40kW FM TRANSMITTER
ES-560606D
BTF-40E1 WITH TWO HARMONIC FILTERS AND MANUAL OUTPUT SWITCHING

Quantity	Description	Frequency
2	Basic transmitter	MI-560507A
2	Power Determining Kit	MI-560510B
2	Blower	
	0-7500 Ft., 60 Hz Line Frequency or	
	0-3000 Ft., 50 Hz Line Frequency	MI-560347-A1
*	3000-6500 Ft., 50 Hz Line Frequency or	
	7500-11,000 Ft., 60 Hz Line Frequency	MI-560347-3
2	Rectifier	MI-560340-4
2	Plate Transformer	MI-560341-7
2	Power Supply	MI-560342-7
2	Side Panel	MI-560755
1	Door, Front	MI-560375-1
2	Installation Material (BTF-20E1)	MI-560515
1	Installation Material (BTF-40E1)	MI-560703B
1	Installation Assembly Material	MI-560727
2	Harmonic Filter	MI-561509
**	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-28180A
*	Touch Up Finish Kit	MI-27660C
2	Blower Mounting Kit	
	If MI-560347-A1 Blower is Supplied	MI-560517
	If MI-560347-3 Blower is Supplied	MI-560705
2	Frequency Determining Parts, for customer's assigned frequency as follows:	
	ES NUMBER — FREQUENCY	
	ES-560272C-1 — 87.5 TO 89.9 MHz	
	ES-560272C-2 — 90.1 TO 91.9 MHz	
	ES-560272C-3 — 92.1 TO 93.9 MHz	
	ES-560272C-4 — 94.1 TO 95.9 MHz	
	ES-560272C-5 — 96.1 TO 97.9 MHz	
	ES-560272C-6 — 98.1 TO 99.9 MHz	
	ES-560272C-7 — 100.1 TO 101.9 MHz	
	ES-560272C-8 — 102.1 TO 103.9 MHz	
	ES-560272C-9 — 104.1 TO 105.9 MHz	
	ES-560272C-10 — 106.1 TO 107.9 MHz	
2	Directional Coupler	MI-561043-4
1	Coaxial Coupler, 40 kW	MI-561535
1	Combining Equipment Rack	MI-560702B
1	Set of Coaxial Components	MI-560704C
1	Misc. Coaxial Components (BTF-40E1)	MI-560706D
*	6-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-561579-*
*	3-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-27791K-*
*	1-5/8 in. O.D. 50 Ohm Transmission Line Components	MI-561565-*
1	Coaxial Coupler (10 kW per port)	MI-561537A
2	5 kW RF Load	MI-560723
1	Driver Stage Modification Kit	MI-560307-32
1	Set of Installation Drawings (see table 1)	3720423
2	Instruction Book, BTF-40E1	IB-8027533-2
2	Instruction Book Addenda, BTF-40E1	IB-8027533-2A
2	Instruction Book, BTF-20E1	IB-8027531-2
2	Instruction Book, BTE-15A FM Exciter	IB-8027524-2
2	Manual Transfer Panel (4 Port)	MI-561080
1	Manual Transfer Panel (3 Port)	MI-27792-50
1	RF Load and Wattmeter	MI-561735

*Supplied if and as specified on sales order.
**Supply two ES as specified on sales order.

LIST OF EQUIPMENT

BTF-40E1, 40 kW FM TRANSMITTER
ES-560606E
BTF-40E1 WITH TWO HARMONIC FILTERS AND ELECTRICAL OUTPUT SWITCHING

Quantity	Description	Reference
2	Basic Transmitter	MI-560507A
2	Power Determining Kit	MI-560510B
2	Blower	
	0-7500 Ft., 60 Hz Line Frequency or	
	0-3000 Ft., 50 Hz Line Frequency	MI-560347-A1
*	3000-6500 Ft., 50 Hz Line Frequency or	
	7500-11,000 Ft., 60 Hz Line Frequency	MI-560347-3
2	Rectifier	MI-560340-4
2	Plate Transformer	MI-560341-7
2	Power Supply	MI-560342-7
2	Side Panel	MI-560755
1	Door, Front	MI-560375-1
2	Installation Material (BTF-20E1)	MI-560515
1	Installation Material (BTF-40E1)	MI-560703B
1	Installation Assembly Material	MI-560727
2	Harmonic Filter	MI-561509
**	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-28180A
*	Touch Up Finish Kit	MI-27660C
2	Blower Mounting Kit	
	If MI-560347-A1 Blower is Supplied	MI-560517
	If MI-560347-3 Blower is Supplied	MI-560705
2	Frequency Determining Parts, for customer's assigned frequency as follows:	
	ES NUMBER — FREQUENCY	
	ES-560272C-1 — 87.5 TO 89.9 MHz	
	ES-560272C-2 — 90.1 TO 91.9 MHz	
	ES-560272C-3 — 92.1 TO 93.9 MHz	
	ES-560272C-4 — 94.1 TO 95.9 MHz	
	ES-560272C-5 — 96.1 TO 97.9 MHz	
	ES-560272C-6 — 98.1 TO 99.9 MHz	
	ES-560272C-7 — 100.1 TO 101.9 MHz	
	ES-560272C-8 — 102.1 TO 103.9 MHz	
	ES-560272C-9 — 104.1 TO 105.9 MHz	
	ES-560272C-10 — 106.1 TO 107.9 MHz	
2	Directional Coupler	MI-561043-4
1	Coaxial Coupler, 40 kW	MI-561535
1	Combining Equipment Rack	MI-560702B
1	Set of Coaxial Components	MI-560704D
1	Misc. Coaxial Components (BTF-40E1)	MI-560706D
*	6-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-561579-*
*	3-1/8 in. O.D. 50 Ohm Transmission Line Components	MI-27791K-*
*	1-5/8 in. O.D. 50 Ohm Transmission Line Components	MI-561565-*
1	Coaxial Coupler (10 kW per port)	MI-561537A
2	5 kW RF Load	MI-560723
1	Driver Stage Modification Kit	MI-560307-32
1	Set of Installation Drawings (see table 1)	3720423
2	Instruction Book, BTF-40E1	IB-8027533-2
2	Instruction Book Addendum, BTF-40E1	IB-8027533-2A
2	Instruction Book, BTF-20E1	IB-8027531-2
2	Instruction Book, BTE-15A FM Exciter	IB-8027524-2
3	Coaxial Switch (Motor Driven)	MI-561562B
1	Control Panel, Four Mode Logic	MI-561767
1	RF Load and Wattmeter	MI-561735

*Supplied if and as specified on sales order.
**Supply two ES as specified on sales order.

DESCRIPTION

The BTF-40E1 is available in four configurations, designated ES-560606B, ES-560606C, ES-560606D, and ES-560606E. Basically similar, the four configurations differ in the output transmission line arrangement and output switching capability.

The BTF-40E1 configuration designated as ES-560606B utilizes one harmonic filter and does not include output switching. This version is described in the front section of this Instruction Book.

The version designated as ES-560606C employs two harmonic filters and does not include output switching.

ES-560606D employs two harmonic filters and includes provisions for output switching by means of manually operated coaxial switches (patch panels).

ES-560606E employs two harmonic filters and includes provisions for output switching by means of electrically operated coaxial switches.

In the case of either ES-560606B or ES-560606C, failure of one transmitter will result in a reduction of power output, to 25% of the normal value, accompanied by reject power equal to 25% of the normal transmitter power output. Details of ES-560606C are presented in figures 31 and 32.

The ES-560606D system uses two harmonic filters and manually operated output switching. Refer to figures 33 and 34 for the floor plan and installation drawing, and to figure 35 for the system block diagram. Upon failure of one transmitter, when using this system, the remaining transmitter output can be routed (through a harmonic filter) directly to the antenna. The power output of the remaining transmitter will be 50% of normal power output. Power output of the remaining transmitter may be increased to 20 kW if normal operation is below this level.

The ES-560606E system is similar to ES-560606D, except that electrically operated coaxial switches are used to select one of four output transmission line configurations. Output switching is controlled by pushbuttons on switcher panel MI-561767. Details of this system are shown in figures 33, 34, and 36. Each coaxial transfer switch incorporates an indicator which indicates the electrical position of the switch.

Note that, as viewed from the front, the left-hand transmitter is referred to as transmitter 1 and the right-hand transmitter is referred to as transmitter 2. On some of the system or switching drawings, transmitter 1 is referred to as transmitter A, and transmitter 2 is referred to as transmitter B.

OPERATION

ES-560606B

Operation of the BTF-40E1 supplied as ES-560606B is covered in the front section of this Instruction Book, and will not be repeated here. If one transmitter of this system fails, power output drops to 25% of the normal value. Power output of the transmitter remaining in operation remains the same, but half of its power is dissipated in the reject load.

WARNING

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 coaxial coupler to make repairs of this type dangerous.

ES-560606C

Operation of the BTF-40E1 designated as ES-560606C is identical with operation of the ES-560606B transmitter. The same precautions should be taken.

WARNING

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 coaxial coupler to make repairs of this type dangerous.

ES-560606D

Operation of this version of the BTF-40E1 is similar to operation of the previously described versions, except that the manually operated coaxial switches provided make it possible to connect either individual transmitter (through a harmonic filter) to the antenna. Thus, if one transmitter is out of service for maintenance or repairs, the remaining transmitter can be connected (to the antenna) to supply 50% (or possible adjusted for more than 50%) of the normal power output with parallel operation. Transmitter output must be turned off, by removing plate voltage from both transmitters, before manually operating the coaxial switches.

After installation and hookup of the coaxial transfer panels MI-27912-50 and MI-561680, the marker

plates adjacent to each port should be marked in accordance with figure 35 for ease of identification.

WARNING

"Hot-switching" the transmitter coaxial switches (operating any of the coaxial switches while either or both transmitter(s) are operating) may expose personnel to high potential rf or may damage the coaxial switches and must be avoided.

After the coaxial switches have been set to the required positions, plate voltage may be restored.

Note that four output switching modes can be obtained by operation of the manually operated coaxial switches (the required settings for each switch are included in the tabulation), as follows:

Switch	Mode 1 1 Air 2 Air	Mode 2 2 Air 1 Test	Mode 3 1 Air 2 Test	Mode 4 1 Test 2 Test
S1	Connect 1, 2 Connect 3, 4	Connect 1, 4 Connect 2, 3	Connect 1, 4 Connect 2, 3	Connect 1, 2 Connect 3, 4
S2	Connect 1, 3	Connect 1, 2	Connect 1, 2	Connect 1, 3
S3	Connect 1, 2 Connect 3, 4	Connect 1, 2 Connect 3, 4	Connect 1, 4 Connect 2, 3	Connect 1, 4 Connect 2, 3

Note that when the coaxial switches are positioned for either Mode 1 or Mode 4, the two transmitter power amplifiers are coupled through the output coaxial coupler and the following precaution must be taken.

WARNING

Do not attempt repairs on components of either PA rf unit while the other transmitter is in operation in parallel with the suspected defective transmitter, as is the case in Mode 1 or Mode 4. There may be sufficient rf feed-through by way of the output coaxial coupler to make repairs of this type dangerous.

When the coaxial switches are positioned for Mode 2, transmitter 1 is isolated from the "on-air" transmitter, and repairs on components in the transmitter 1 rf unit may be carried out, after transmitter 1 is shut down.

When the coaxial switches are positioned for Mode 3, transmitter 2 is isolated from the "on-air" transmitter, and repairs on components in the transmitter 2 rf unit may be carried out, after transmitter 2 is shut down.

Note that when switching to Mode 1 or Mode 4, the following precautions should be observed.

A. If the relative phase relationship between the two transmitter outputs is unknown (such as might be the case after repairs to one of the transmitters), remove plate voltage from both transmitters by depressing HIGH VOLTAGE OFF switch 4S5. Then make the desired mode change, to Mode 1 or Mode 4, by operating the coaxial switches to the required configuration. Check that on both transmitters the plate supply is deenergized. Refer to pages 33 through 36 of this Instruction Book; carry out steps 8 through 24 and step 31 of the COMBINED OPERATION procedure (pages 33 through 36).

B. If the relative phase relationship between the two transmitter outputs is known to be proper, the desired mode change to Mode 1 or Mode 4 may be carried out simply by operating the coaxial switches to the required configuration (with plate voltages off).

ES-560606E

Electrical output switching is provided in ES-560606E. Switching is by means of electrically actuated coaxial switches, controlled by switching panel MI-561767. In this configuration, any one of four output switching modes may be chosen by depressing the corresponding pushbutton (and holding it depressed until the corresponding display screen lights) on MI-561767. The output switching modes are as follows (the proper positions of coaxial switches S1, S2, and S3 are shown also):

	Mode 1 1 Air 2 Air	Mode 2 2 Air 1 Test	Mode 3 1 Air 2 Test	Mode 4 1 Test 2 Test
Switch 1	1	2	2	1
Switch 2	2	1	1	2
Switch 3	1	1	2	2

Note that when the coaxial switches are positioned for either Mode 1 or Mode 4, the two transmitter outputs are coupled through the output coaxial coupler and the following precaution must be taken.

WARNING

Do not attempt repairs on components of either PA rf unit while the other transmitter is in operation in parallel with the suspected defective transmitter, as is the case in Mode 1 or Mode 4. There may be sufficient rf feedthrough by way of the output coaxial coupler to make repairs of this type dangerous.

When the coaxial switches are set for Mode 2, transmitter 1 is isolated from the "on-air" transmitter, and repairs on components in the transmitter 1 rf unit may be carried out, after transmitter 1 is shut down.

When output switching is for Mode 3, transmitter 2 is isolated from the "on-air" transmitter, and repairs on components in the transmitter 2 rf unit may be carried out, after transmitter 2 is shut down.

Note that the control circuitry supplied as part of MI-561767 automatically removes plate voltage from both transmitters during mode switching, and restores plate voltage to both transmitters upon completion of the mode switch operation.

To change modes, depress the desired pushbutton, holding it depressed until its display screen illuminates, indicating the coaxial switching operation is completed. Releasing the pushbutton restores transmitter plate voltages. Releasing a mode pushbutton before its display screen lights will cause the coaxial switches to stop in between their normal positions, and transmitter plate voltage will remain off. Should this happen, depress the desired mode pushbutton until its display screen illuminates, then release the pushbutton.

Note that when switching to Mode 1 or Mode 4, the following precautions should be observed.

A. Is the relative phase relationship between the two transmitter outputs is unknown (such as might be the case after repairs to one of the transmitters), remove plate voltage from both transmitters by depressing HIGH VOLTAGE OFF switch 4S5. Then make the desired mode change, to Mode 1 or Mode 4, by operating the required mode change pushbutton.

   Check that on both transmitters the plate supply is deenergized. Refer to pages 33 through 36 of this instruction book; carry out steps 8 through 24 and step 31 of the COMBINED OPERATION procedure (pages 33 through 36).

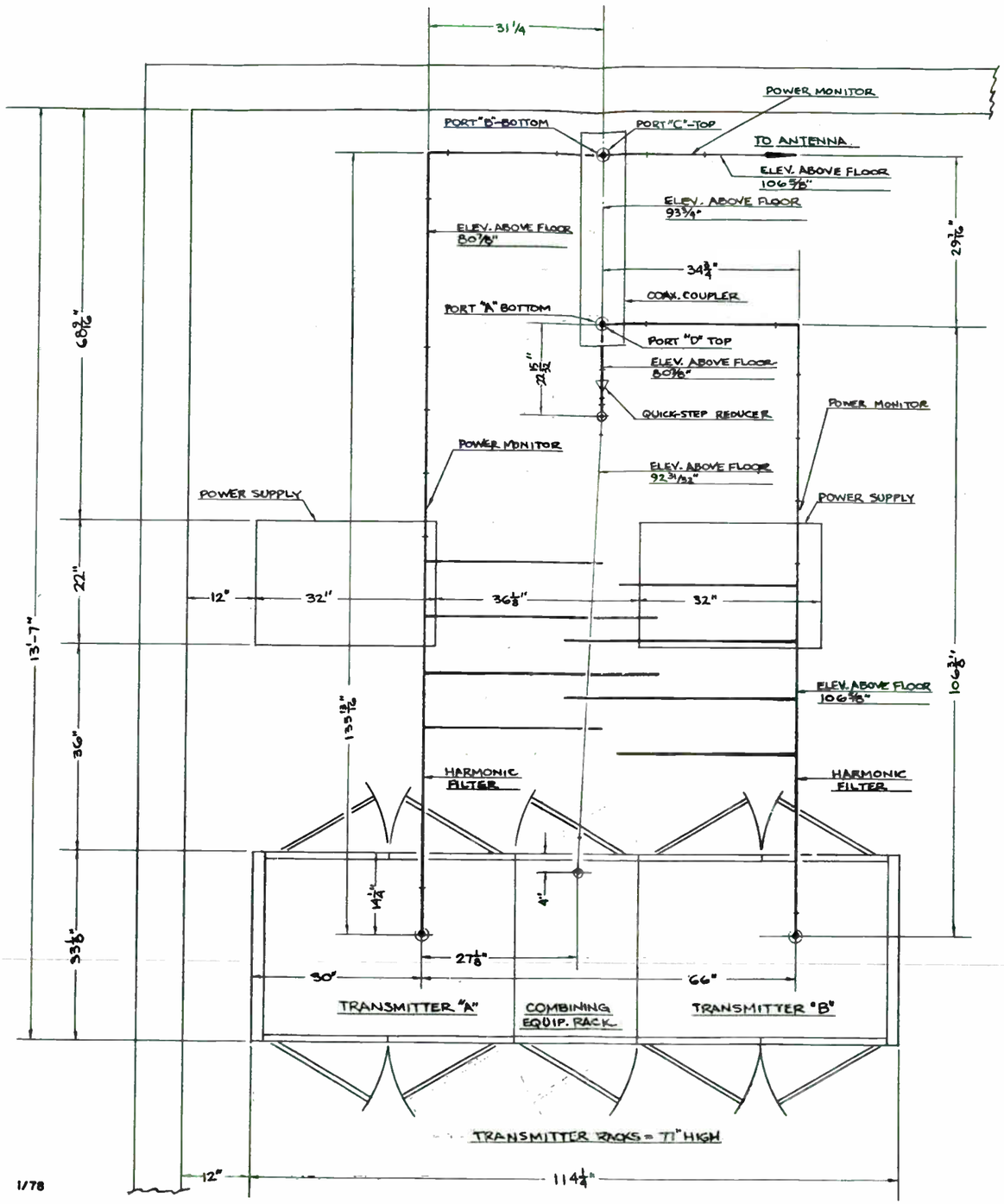
B. If the relative phase relationship between the two transmitter outputs is known to be proper, the desired mode change to Mode 1 or Mode 4 may be carried out simply by operating the required mode change pushbutton.

MAINTENANCE

The mechanical and electrical switching system is virtually maintenance free. However, a regular schedule of inspection and service as outlined in the BTF-40E1 Instruction Book MAINTENANCE section should be followed.

Heed the warning in the preceding OPERATION section concerning repairs within one transmitter while the other transmitter is "on air" in Mode 1 or Mode 4, for ES-560606D or ES-560606E.

The phasing procedure outlined in the Addenda OPERATION section should be performed if proper phasing is not assured, or following major repairs within either transmitter. Refer to the description of your particular transmitter configuration.



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NOTES:

1. THIS SYSTEM REQUIRES A MINIMUM CEILING HEIGHT OF 10'-0"
2. ALL ELEVATIONS ARE MEASURED FROM THE FINISHED FLOOR TO THE ℄ OF EQUIPMENT.
3. CUSTOMER TO SUPPLY SUITABLE SUPPORTS FOR TRANSMISSION LINE & COAXIAL COUPLER

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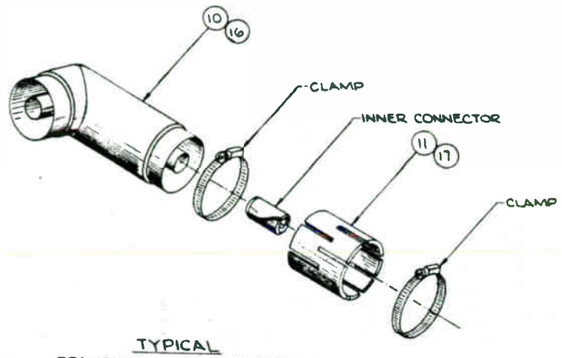
Figure 31. BTF-40E1 Floor Plan, Non-Switching System



TYPICAL
TRANSMISSION LINE CONNECTION

GROUP NO.						LIST OF PARTS		
504	503	502	501	ITEM OR SYMBOL	REFERENCE DRAWING OR SPECIFICATION	REFERENCE ITEM OR GROUP	DESCRIPTION
QUANTITY							
			X	1			ASSEMBLY
				2			
			2	3	MI-561509		HARMONIC FILTER
			1	4	MI-561535		COAXIAL COUPLER (NON-CROSSOVER)
			1	5	MI-560703-B	ITEM 3	QUICK-STEP REDUCER - 3⅛ TO 1⅝ - 50Ω
			2	6	MI-560810-A	ITEM 8	POWER MONITOR - *
			1	7	MI-560706-D	ITEM 1	POWER MONITOR
			6	8	MI-560810-A	ITEM 18	COUPLING (INCL. INNER CONNECTOR & CLAMPS)
			2	9	MI-560706-D	ITEM 6	COUPLING (INCL. INNER CONNECTOR & CLAMPS)
			3	10	MI-560704-B	ITEM 8	ELBOW - 1⅝ DIA - 50Ω - 90°
			6	11	MI-560704-B	ITEM 9	COUPLING (INCL. INNER CONNECTOR & CLAMPS)
				12			
			1	13	MI-560704-B	ITEM 10	TL - 1⅝ DIA - 50Ω X 11.03 LONG
			1	14	MI-560704-B	ITEM 11	TL - 1⅝ DIA - 50Ω X 59.50 LONG
			2	15	MI-560510-A	ITEM 17	ELBOW - 3⅛ DIA - 50Ω - 90°
			6	16	MI-560706-B	ITEM 1	ELBOW - 3⅛ DIA - 50Ω - 90°
			18	17	MI-560706-B	ITEM 2	COUPLING (INCL. INNER CONNECTOR & CLAMPS)
			1	18	MI-560703-B	ITEM 5	DIRECTIONAL COUPLER (REJECT POWER)
			1	19	MI-560704-B	ITEM 3	TL - 3⅛ DIA - 50Ω X 19.25 LONG
			1	20	MI-560704-B	ITEM 4	TL - 3⅛ DIA - 50Ω X 21.87 LONG
			1	21	MI-560704-B	ITEM 5	TL - 3⅛ DIA - 50Ω X 22.75 LONG
			1	22	MI-560704-B	ITEM 6	TL - 3⅛ DIA - 50Ω X 25.06 LONG
			4	23	MI-560704-B	ITEM 7	TL - 3⅛ DIA - 50Ω X 11.00 LONG (SEE NOTE)
				24			
			X	25	MI-561735		RF LOAD AND WATTMETER

NOTE: ITEM 23 (QTY 4) TO BE REMOVED AS REQUIRED TO PROVIDE INSTALLATION SPACE FOR POWER MONITORS USED WITH OPTIONAL SYSTEMS SUCH AS AUTOMATIC POWER OUTPUT CONTROL, ETC.

ALL QUANTITIES SHOWN ARE FOR REFERENCE ONLY - FOR ORDERING INFORMATION SEE BS-560606-C.

* NOTE: ON LATER PRODUCTION, ITEM 6 IS SUPPLIED AS MI-561043 *

(1) FOR TRANSMITTER ROOM SIZE, CEILING HEIGHT AND EQUIPMENT LOCATION SEE 8041100

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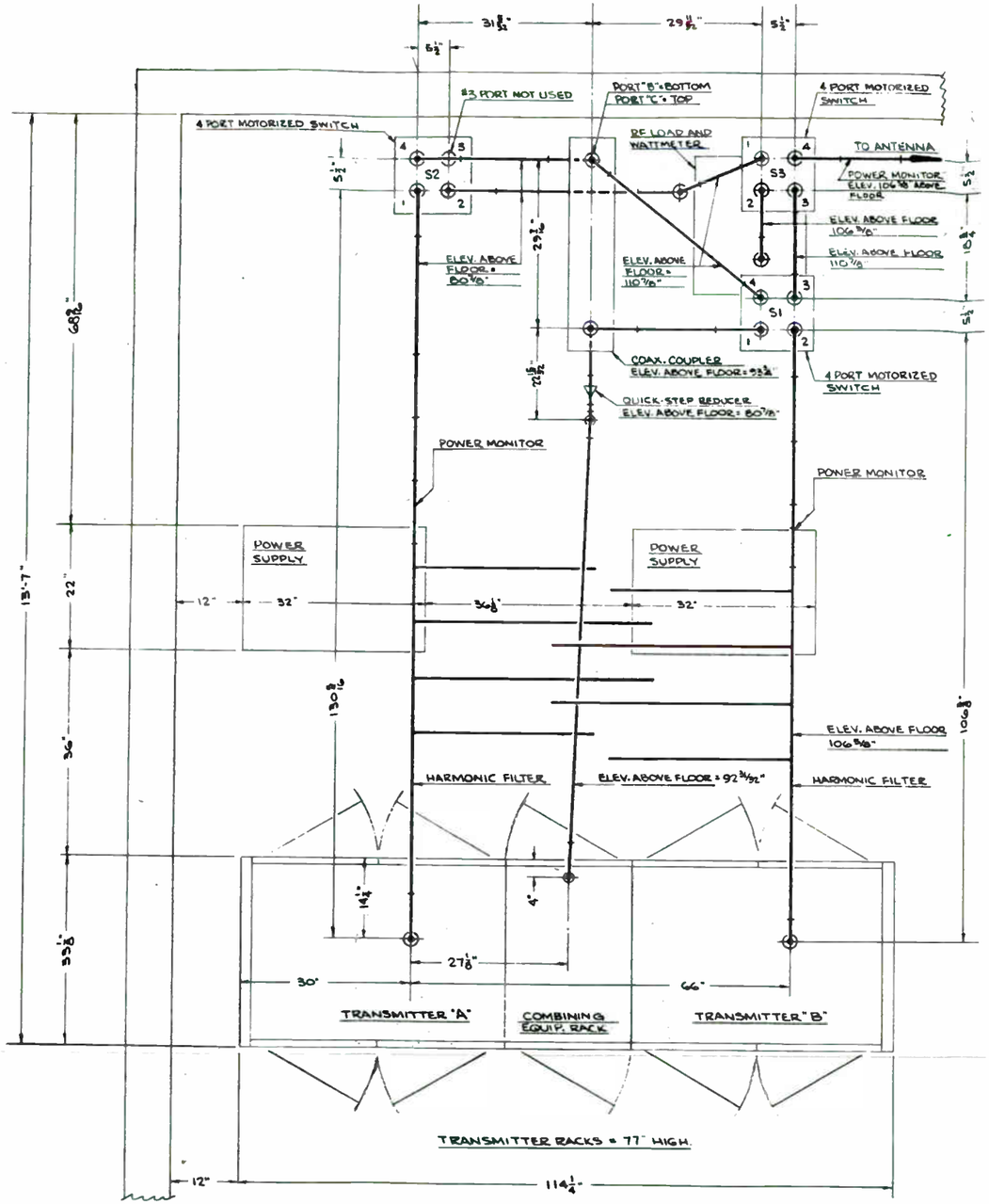
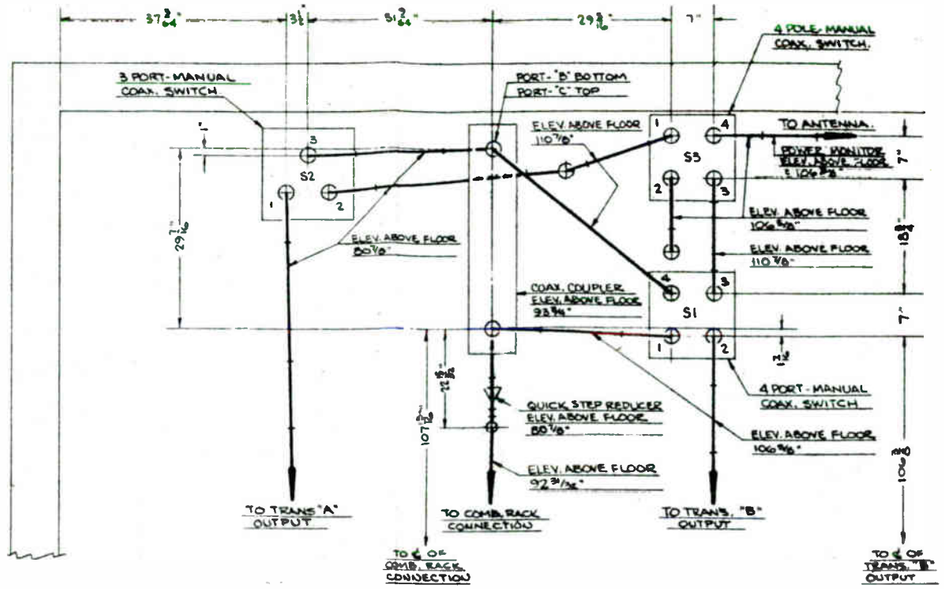
Figure 32. BTF-40E1 Installation, Non-Switching System



(1) ARRANGEMENT FOR MOTORIZED SWITCHES.
FOR INSTALLATION DRAWING & LIST OF PARTS SEE-8041098-501
USED ON ES-560606-E



(2) ARRANGEMENT FOR MANUAL SWITCHES
FOR INSTALLATION DRAWING & LIST OF PARTS SEE-8041098-502
EXCEPT AS SHOWN, OTHERWISE SAME AS PART 1
USED ON ES-560606-D

NOTES:
1- THIS SYSTEM REQUIRES A MINIMUM CEILING HEIGHT OF 10'-0"
2- ALL ELEVATIONS ARE MEASURED FROM THE FINISHED FLOOR TO THE ℄ OF THE EQUIPMENT
3- CUSTOMER TO SUPPLY SUITABLE SUPPORTS FOR THE TRANSMITTION LINE, SWITCHES, AND COAX. COUPLER.

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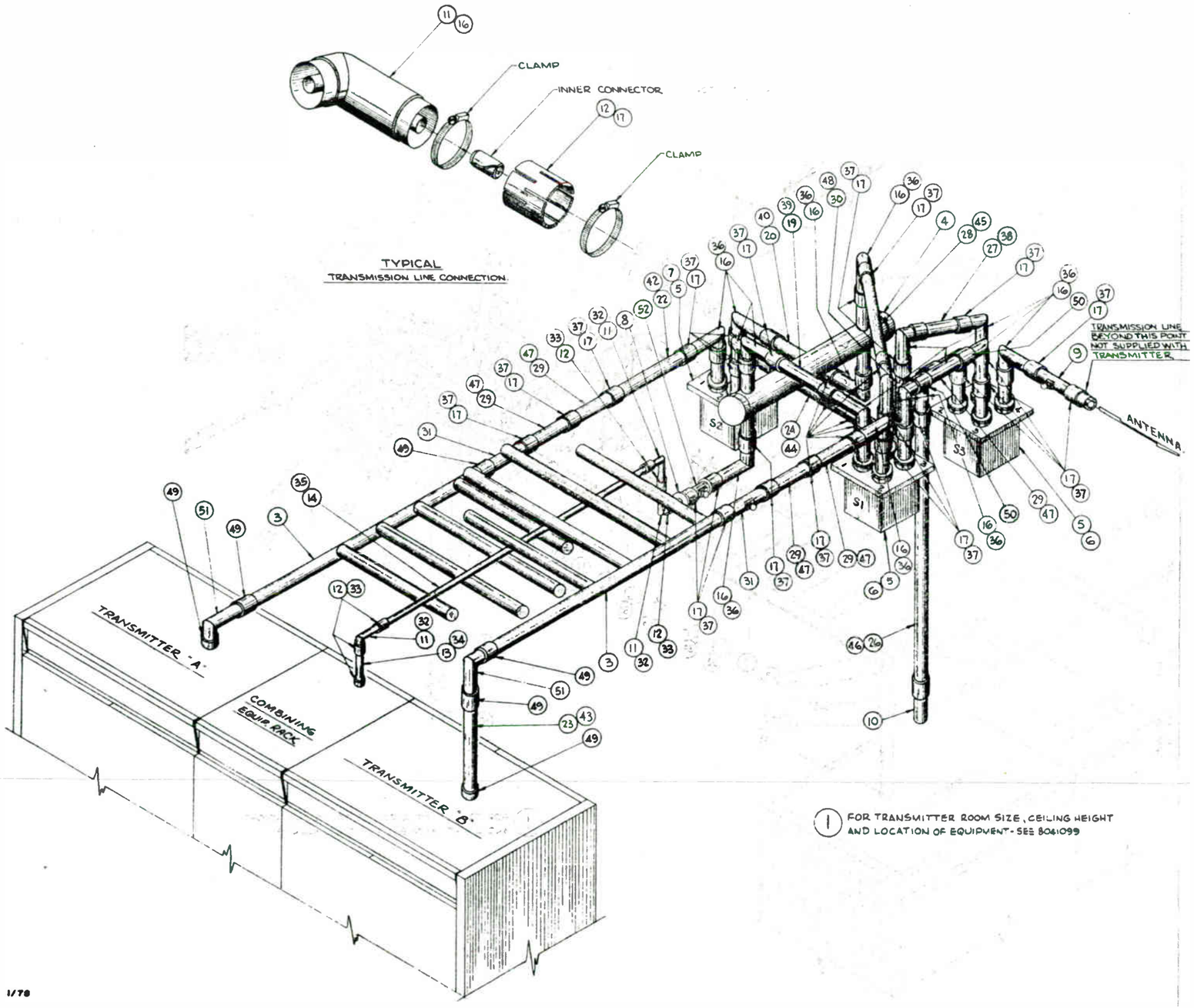
Figure 33. BTF-40E1 Floor Plan, Switching System



(1) FOR TRANSMITTER ROOM SIZE, CEILING HEIGHT AND LOCATION OF EQUIPMENT - SEE 8041099

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USE (Mark)	NO. REQUIRED	FIRST USED FOR	GROUP NO.	LIST OF PARTS
			504 503 502 501	
			QUANTITY	
	X	X	1	ASSEMBLY
			2	
	2	2	3	MI-561509 — HARMONIC FILTER
	1	1	4	MI-561535 — COAXIAL COUPLER (NON-CROSSOVER)
		3	5	MI-561562-B — COAXIAL SWITCH (MOTOR DRIVEN)
	2		6	MI-561680 — MANUAL TRANSFER PANEL (4 PORT)
	1		7	MI-27912-50 — MANUAL TRANSFER PANEL (3 PORT)
	1	1	8	MI-560703-B — ITEM 3 — QUICK STEP REDUCER - (3⅛ TO 1⅝ - 50Ω)
	1	1	9	MI-560706-D — ITEM 1 — POWER MONITOR
	1	1	10	MI-561755 — RF LOAD & WATTMETER
	3		11	MI-560704-C — ITEM 4 — ELBOW - 1⅝ DIA. - 50Ω - 90°
	6		12	MI-560704-C — ITEM 15 — COUPLING (INCL. INNER CONNECTOR & CLAMPS)
	1		13	MI-560704-C — ITEM 16 — T/L - 1⅝ DIA - 50Ω x 11.03 LONG
	1		14	MI-560704-C — ITEM 17 — T/L - 1⅝ DIA - 50Ω x 59.50 LONG
			15	
	18		16	MI-560704-C — ITEM 1 — ELBOW - 3⅛ DIA. - 50Ω - 90°
	40		17	MI-560704-C — ITEM 2 — COUPLING (INCL. INNER CONNECTOR & CLAMPS)
			18	
	1		19	MI-560704-C — ITEM 3 — T/L - 3⅛ DIA - 50Ω x 13.09 LONG
	1		20	MI-560704-C — ITEM 4 — T/L - 3⅛ DIA - 50Ω x 14.71 LONG
			21	
	1		22	MI-560704-C — ITEM 6 — T/L - 3⅛ DIA - 50Ω x 19.56 LONG
	1		23	MI-560704-C — ITEM 7 — T/L - 3⅛ DIA - 50Ω x 21.37 LONG
	1		24	MI-560704-C — ITEM 8 — T/L - 3⅛ DIA - 50Ω x 24.00 LONG
			25	
	1		26	MI-560704-C — ITEM 9 — T/L - 3⅛ DIA - 50Ω x 59.37 LONG
	1		27	MI-560704-C — ITEM 10 — T/L - 3⅛ DIA - 50Ω x 10.25 LONG
	1		28	MI-560704-C — ITEM 11 — T/L - 3⅛ DIA - 50Ω x 30.06 LONG
	5		29	MI-560704-C — ITEM 12 — T/L - 3⅛ DIA - 50Ω x 11.00 LONG (SEE NOTE)
	1		30	MI-560704-C — ITEM 13 — T/L - 3⅛ DIA - 50Ω x 19.12 LONG
	2	2	31	MI-560510-A — ITEM 8 — POWER MONITOR *
		3	32	MI-560704-D — ITEM 14 — ELBOW - 1⅝ DIA - 50Ω - 90°
		6	33	MI-560704-D — ITEM 15 — COUPLING (INCL. INNER CONNECTOR (CLAMPS)
		1	34	MI-560704-D — ITEM 16 — T/L - 1⅝ DIA - 50Ω x 11.03 LONG
		1	35	MI-560704-D — ITEM 17 — T/L - 1⅝ DIA - 50Ω x 59.50 LONG
		18	36	MI-560704-D — ITEM 1 — ELBOW - 3⅛ DIA - 50Ω - 90°
		40	37	MI-560704-D — ITEM 2 — COUPLING (INCL. INNER CONNECTOR (CLAMPS)
		1	38	MI-560704-D — ITEM 3 — T/L - 3⅛ DIA - 50Ω x 8.00 LONG
		1	39	MI-560704-D — ITEM 4 — T/L - 3⅛ DIA - 50Ω x 13.09 LONG
		1	40	MI-560704-D — ITEM 5 — T/L - 3⅛ DIA - 50Ω x 14.71 LONG
			41	
		1	42	MI-560704-D — ITEM 7 — T/L - 3⅛ DIA - 50Ω x 19.56 LONG
		1	43	MI-560704-D — ITEM 8 — T/L - 3⅛ DIA - 50Ω x 21.37 LONG
		1	44	MI-560704-D — ITEM 9 — T/L - 3⅛ DIA - 50Ω x 24.00 LONG
		1	45	MI-560704-D — ITEM 10 — T/L - 3⅛ DIA - 50Ω x 30.12 LONG
		1	46	MI-560704-D — ITEM 11 — T/L - 3⅛ DIA - 50Ω x 59.37 LONG
		5	47	MI-560704-D — ITEM 12 — T/L - 3⅛ DIA - 50Ω x 11.00 LONG (SEE NOTE)
		1	48	MI-560704-D — ITEM 13 — T/L - 3⅛ DIA - 50Ω x 19.12 LONG
	6	6	49	MI-560510-A — ITEM 18 — COUPLING (INCL. INNER CONNECTOR & CLAMPS)
	2	2	50	MI-560706-D — ITEM 4 — COUPLING (INCL. INNER CONNECTOR & CLAMPS)
	2	2	51	MI-560510-A — ITEM 17 — ELBOW - 3⅛ DIA - 50Ω - 90°
	1	1	52	MI-560703-B — ITEM 2 — DIRECTIONAL COUPLER (REJECT POWER)

ALL QUANTITIES SHOWN ARE FOR REFERENCE ONLY - FOR ORDERING INFORMATION SEE ES-560606-D & ES-560606-B

NOTE - ITEM 29 (QTY. 4) OR ITEM 47 (QTY 4) TO BE REMOVED AS REQUIRED TO PROVIDE INSTALLATION SPACE FOR POWER MONITORS USED WITH OPTIONAL SYSTEMS SUCH AS AUTOMATIC POWER OUTPUT CONTROL ETC.

* - ON LATER PRODUCTION, ITEM 31 IS SUPPLIED AS MI-561043-*

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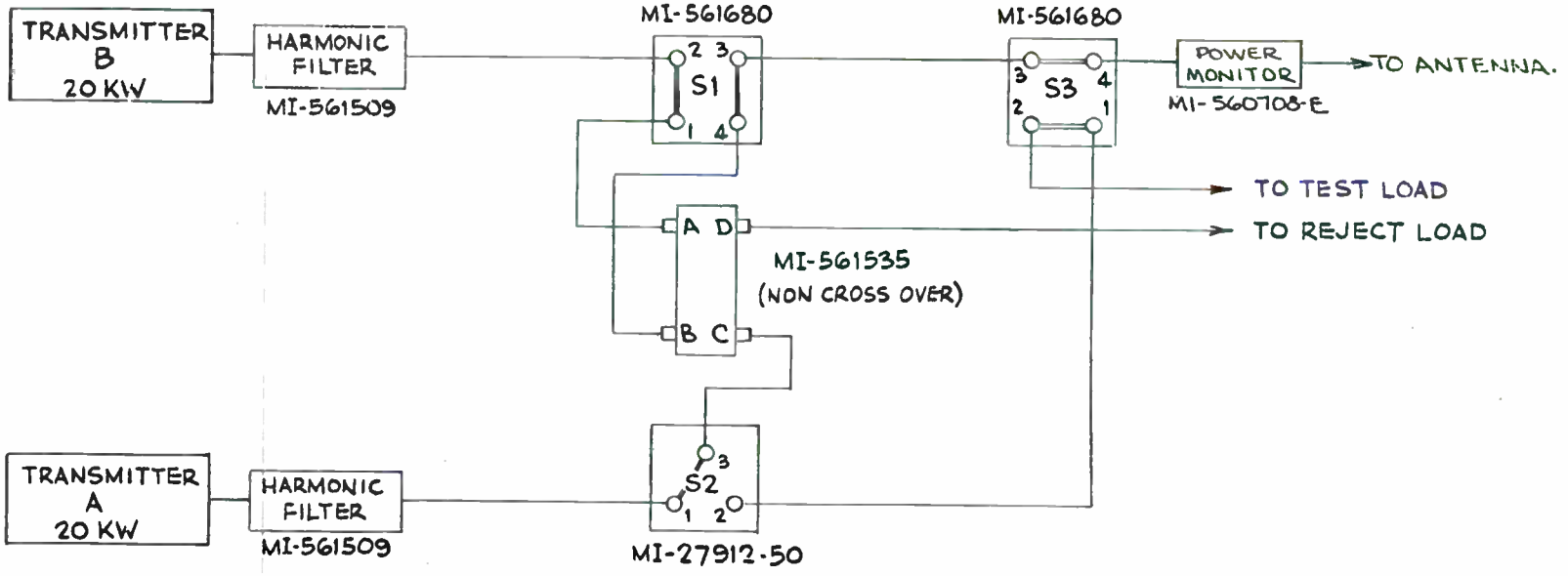
Figure 34. BTF-40E1 Installation, Switching System

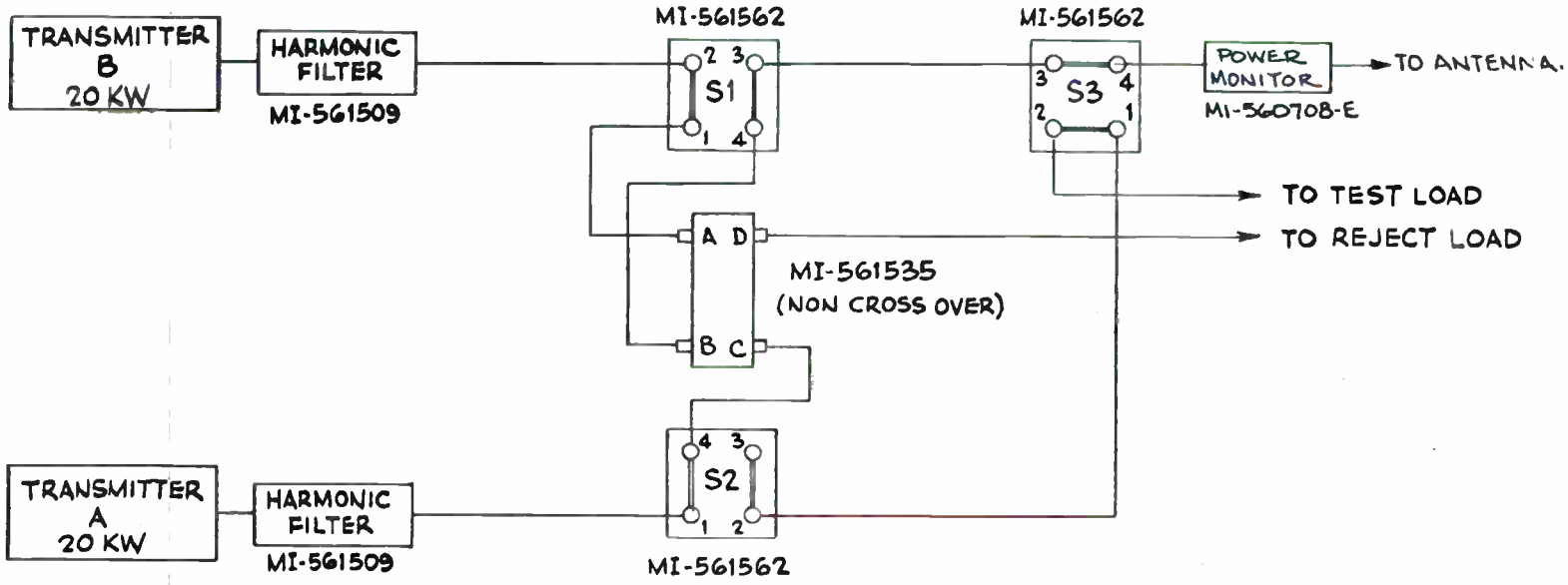


SWITCH	MODE 1 1 AIR 2 AIR	MODE 2 2 AIR 1 TEST	MODE 3 1 AIR 2 TEST	MODE 4 1 TEST 2 TEST
S1	CONNECT 1, 2 CONNECT 3, 4	CONNECT 1, 4 CONNECT 2, 3	CONNECT 1, 4 CONNECT 2, 3	CONNECT 1, 2 CONNECT 3, 4
S2	CONNECT 1, 3	CONNECT 1, 2	CONNECT 1, 2	CONNECT 1, 3
S3	CONNECT 1, 2 CONNECT 3, 4	CONNECT 1, 2 CONNECT 3, 4	CONNECT 1, 4 CONNECT 2, 3	CONNECT 1, 4 CONNECT 2, 3

USED ON ES-560606-D

8008633 REV I

Figure 35. BTF-40E1 4 Mode, Manually Operated RF Switches, Block Diagram



USED ON ES-560606-E

	SWITCHING MODE	RF SWITCH POSITIONS S1	S2	S3
1	A/B PARALLELED TO MAIN ANTENNA	1	2	1
2	B MAIN ANTENNA / A LOAD	2	1	1
3	A MAIN ANTENNA / B LOAD	2	1	2
4	A/B PARALLELED TO LOAD	1	2	2

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Figure 36. BTF-40E1 4 Mode, Electrically Operated RF Switches, Block Diagram

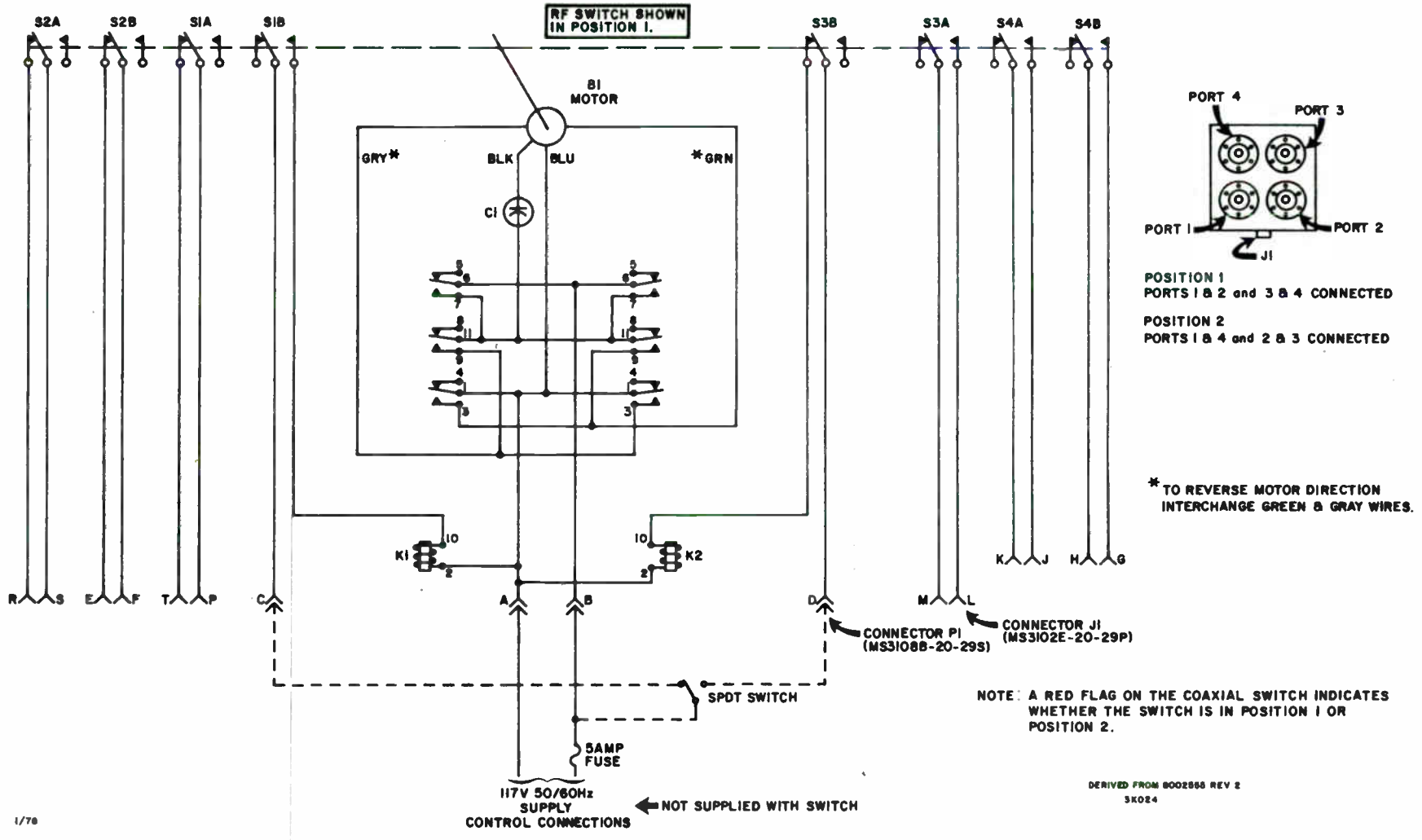
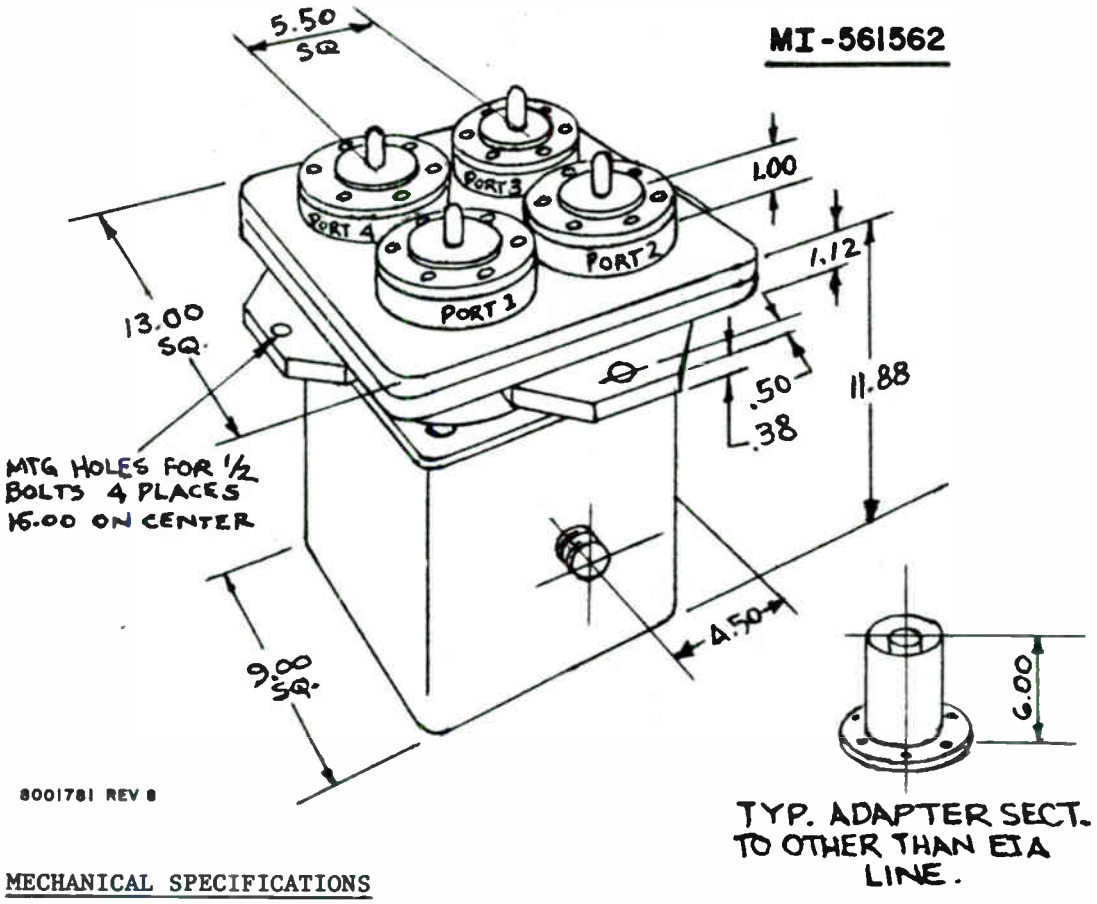


Figure 37. Coaxial Transfer Switch MI-561562, Schematic



MECHANICAL SPECIFICATIONS

WEIGHT (approx.)	65 pounds (29.5 kg)
MOUNTING	Any convenient position
CLEARANCE	12 inches (30.5 cm) for cover removal
CONNECTIONS	RF*: 3 1/8 inch EIA flange shown above - adapter sections to other terminations are 6 inches long.
CONTROL:	Quick disconnect - male and female supplied on switch; MS3102E-20-29P, MS3108B-20-29S on cable.

ELECTRICAL SPECIFICATIONS

FREQUENCY	*DC-900 MHz
IMPEDANCE	*50/51.5 ohms
POWER RATING	Same as transmission line used
VSWR	UHF: 1.03 to 1 maximum VHF: 1.05 to 1 maximum
INSERTION LOSS	0.05 dB maximum
ISOLATION	50-880 MHz 60 dB minimum
SWITCHING TIME	2 seconds nominal
DRIVING MOTOR	115 volts 50/60 hertz single phase 0.48 amps Run 2.0 amps Start
AUXILIARY CONTACTS	15 amp max. 250 volts AC

*RF operating frequency and mating coaxial transmission line connection to be specified with order.

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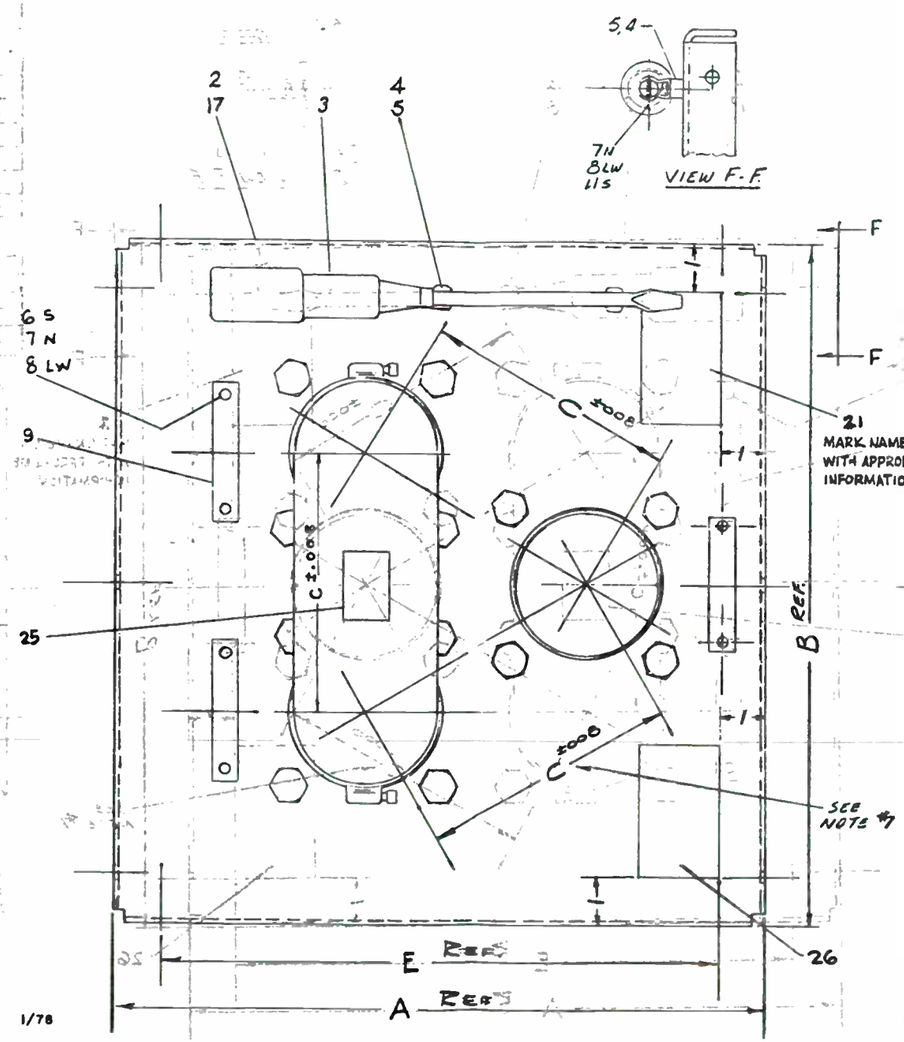
Figure 38. Coaxial Transfer Switch MI-561562, Outline

NOTE:

① ALL CENTER DISTANCES BETWEEN ADJACENT PAIRS OF PTS 16 TO BE HELD TO DIM. SHOWN AT ASSY.

GR	A	B	C	D	E	MI NO.
501	14	14½	5½	6¼	12	27336
502	15½	15½	7	OMIT	13½	27717
503	15½	15½	7	OMIT	13½	27912-50



504	503	502	501	GR. NO.	FIRST MADE FOR 27912-50 / 27717 / 27336			
QTY.	QTY.	QTY.	QTY.	ITEM	REFERENCE DRAWING	REFERENCE PART OR GROUP	DESCRIPTION	MATERIAL
	X	X	X	1			ASSEMBLY	
			1	2	752618	2	PANEL	
	1	1	1	3	8910655	1	SCREWDRIVER (YANKEE #90-6")	
	2	2	2	4	77850	140	SPACER	
	2	2	2	5	8895669	8	CLIP	
	6	6	6	6	57456	213	MACH. SCREW R.H. 6-32 x ½ LG.	STEEL
	8	8	8	7	57435	204	NUT HEX. 6-32	STEEL
	8	8	8	8	93618	607	LOCKWASHER #6	STEEL
	3	3	3	9	8817798	1	PLATE (MARKER)	
			1	10	752614	501	ELBOW ASSY.	
	2	2	2	11	57456	217	MACH. SCREW R.H. 6-32 x ¾ LG.	STEEL
	12	12	12	12	890051	26	BOLT HEX. HD. 5/16-18 x 5/8 LG.	DURONZE
	18	12	12	13	890053	2	NUT HEX. 5/16-18	DURONZE
	12	12	12	14	8898153	5	LOCKWASHER 5/16	DURONZE
	6	6	6	15	8824489	13	CLAMP	
	3	3	3	16	8929917	501	COUPLING ASSY.	
	1	1		17	752618	1	PANEL	
		1		18	752614	502	ELBOW ASSY.	
	1			19	8720758	501	ELBOW ASSY.	
				20	47793	8	DECALCOMANIA	
	1	1		21	8005763	1	DECALCOMANIA (NAMEPLATE)	
				22	46585	2	LABEL (LICENSE)	
	X	X		23	8906540		SPECIFICATION	
				24	2016114	2	LACQUER (CLEAR)	
	1	1		25	3415233	4	SAFETY LABEL (HAZARD)	
	1	1		26	3415234	3	SAFETY LABEL (CAUTION)	

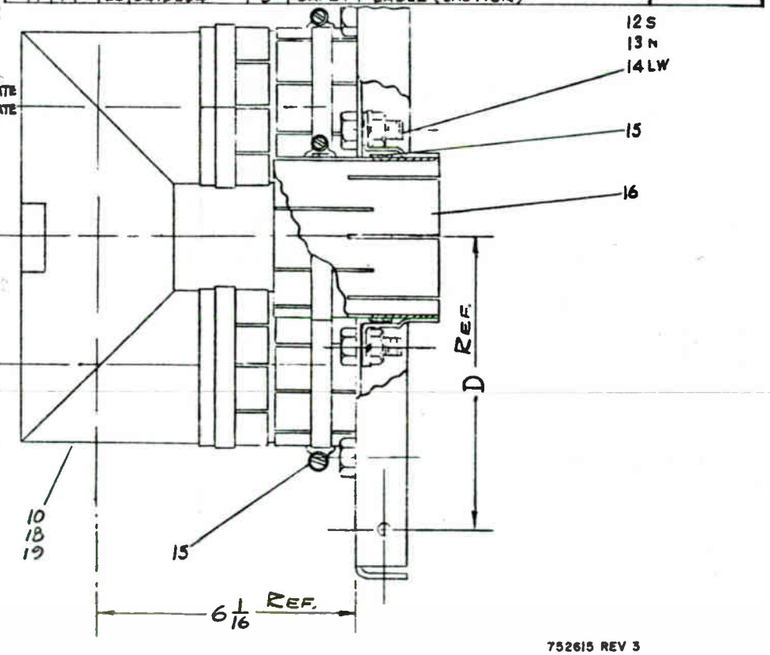


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Figure 39. Coaxial Transfer Switching Panel for MI-27912-50, Outline

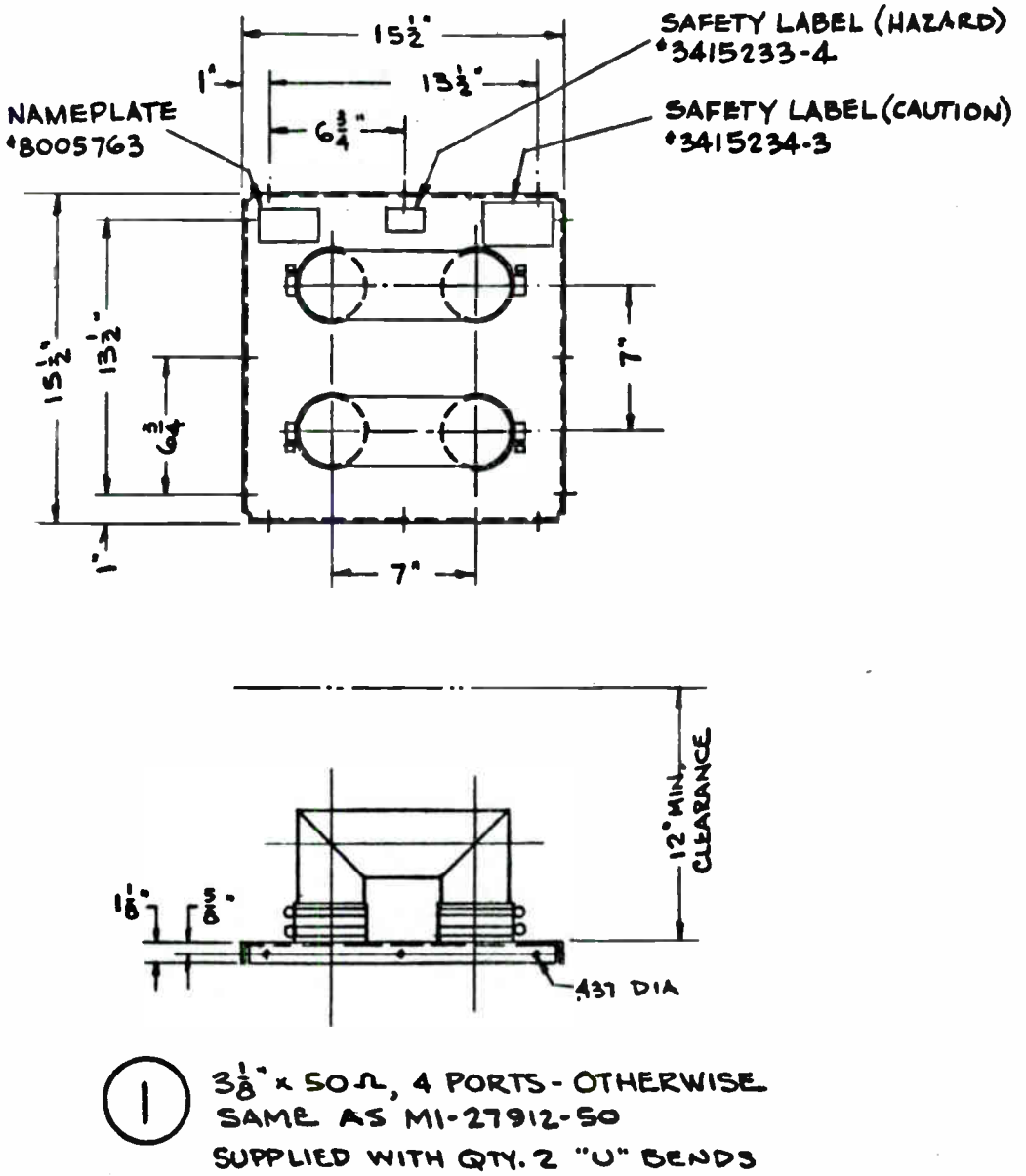

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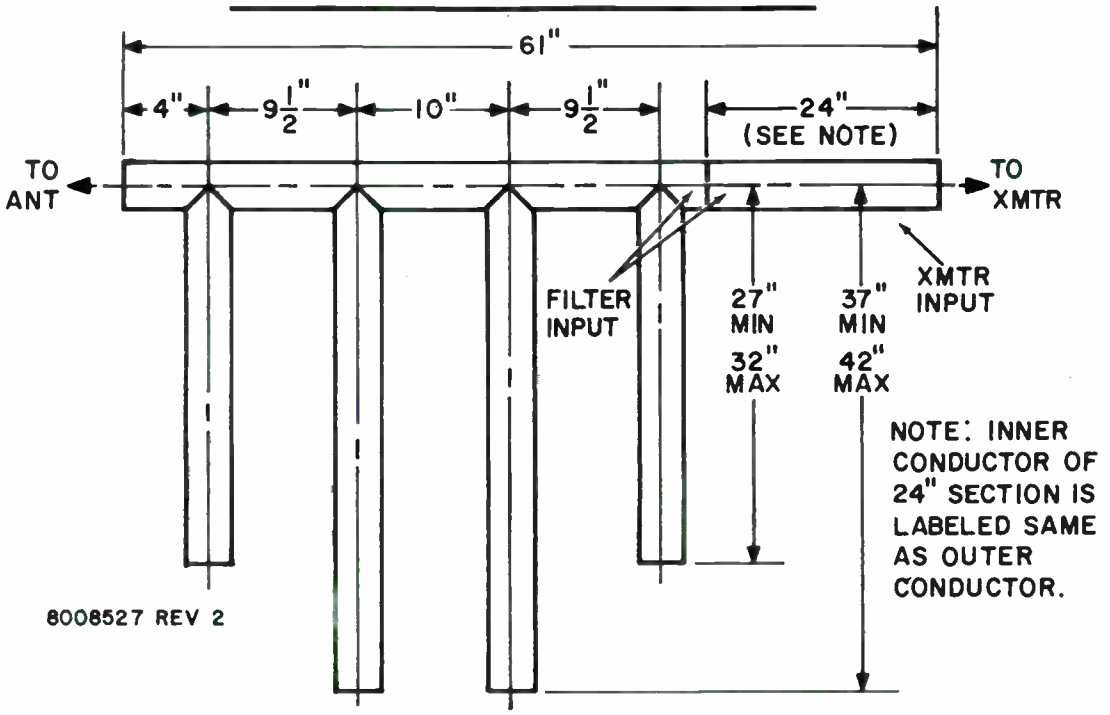
Figure 40. Coaxial Transfer Switching Panel for MI-561680, Outline

MI-561509 FM HARMONIC FILTER



SPECIFICATIONS

MOUNTING:	Horizontal position recommended, stubs vertical recommended location near transmitter output.
AMBIENT TEMPERATURE:	45°C maximum
WEIGHT:	40 pounds (18.1 kg)
FREQUENCY:	88 to 108 MHz (specify FM channel)
MAXIMUM POWER:	25 kW (7500 feet, 2286 m, maximum altitude)
INPUT & OUTPUT CONNECTIONS:	50 ohm, 3 1/8" unflanged coaxial line, MI-27791-K.
VSWR:	1.1 or better
ATTENUATION:	50 dB, 2nd Harmonic 60 dB, 3rd Harmonic 40 dB, 4th thru 7th Harmonic 50 dB, 8th Harmonic 25 dB, 9th & 10th Harmonic
EFFICIENCY AT ASSIGNED FM CHANNEL:	97%
ACCESSORIES:	Straight coupling for 3 1/8" 50 ohm line, MI-27791-K4A.

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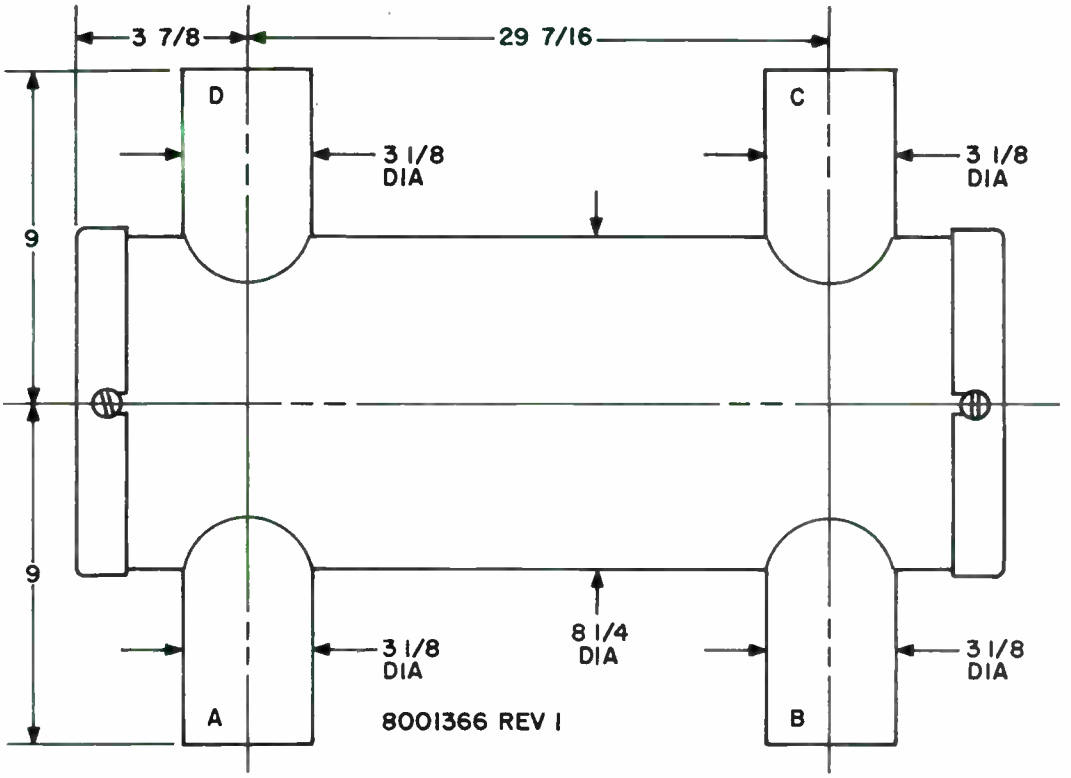
Figure 41. Harmonic Filter MI-561509, Outline

MI-561535



Broadcast Band	Frequency	MI Number	Unbalance
FM	87.5 -108 MHz.	MI-561535	±0.15 dB

Specifications

Weight:	(approx.) 80 lbs. (36.2 kg)
Mounting:	any position
Ambient Temperature:	45° Max to -20° Min
Max Power:	40 kW CW per port
VSWR:	1.05 or better when terminated in matched loads
Connection:	3 1/8 OD unflanged coaxial line (MI-27791-K)
Impedance:	50 ohm
Isolation:	See Table

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

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Figure 42. Coaxial Coupler MI-561535, Outline

MODE	FUNCTION
1	A/B PARALLEL
2	B AIR / A TEST
3	A AIR / B TEST
4	A/B TEST

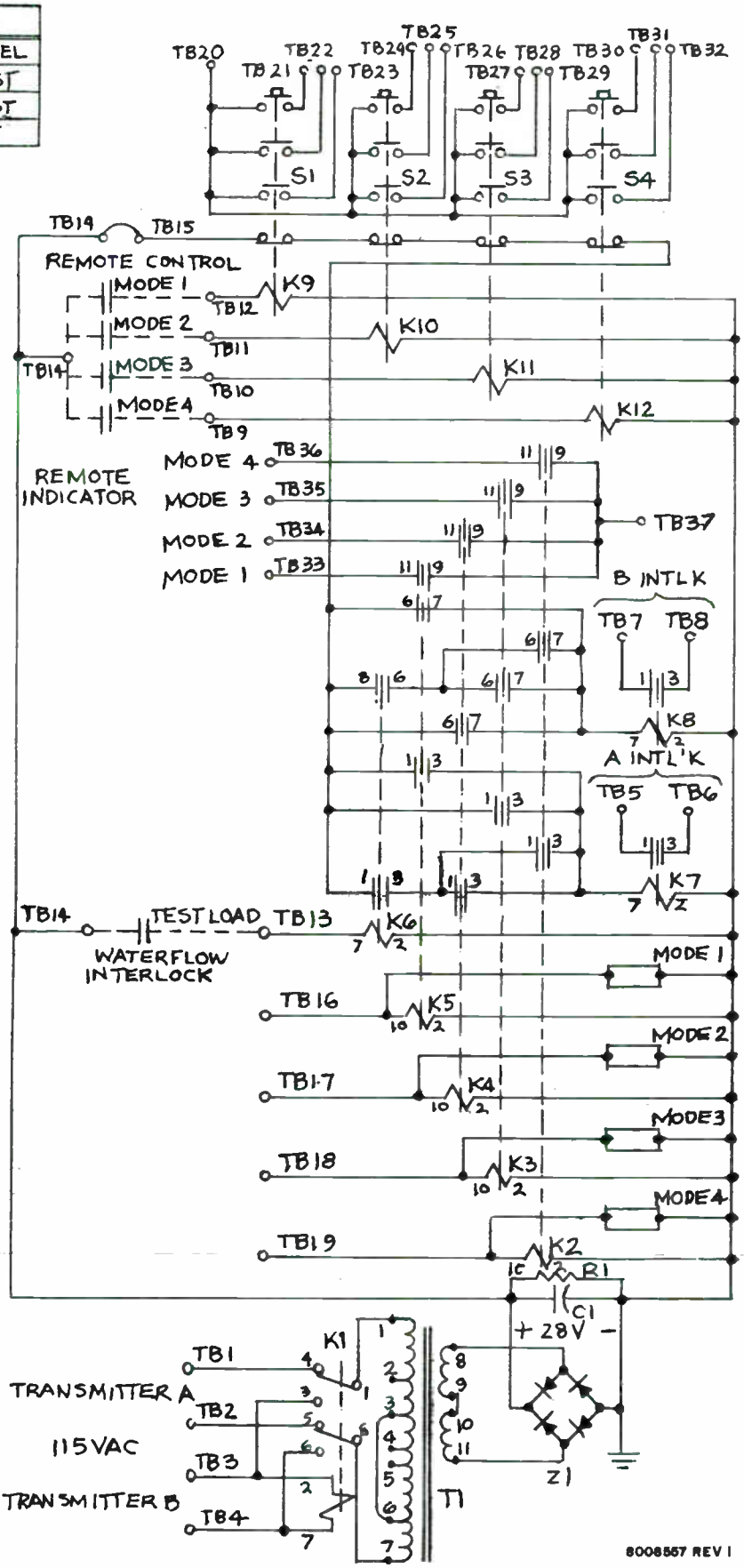

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Figure 43. Control Panel MI-561767, Schematic

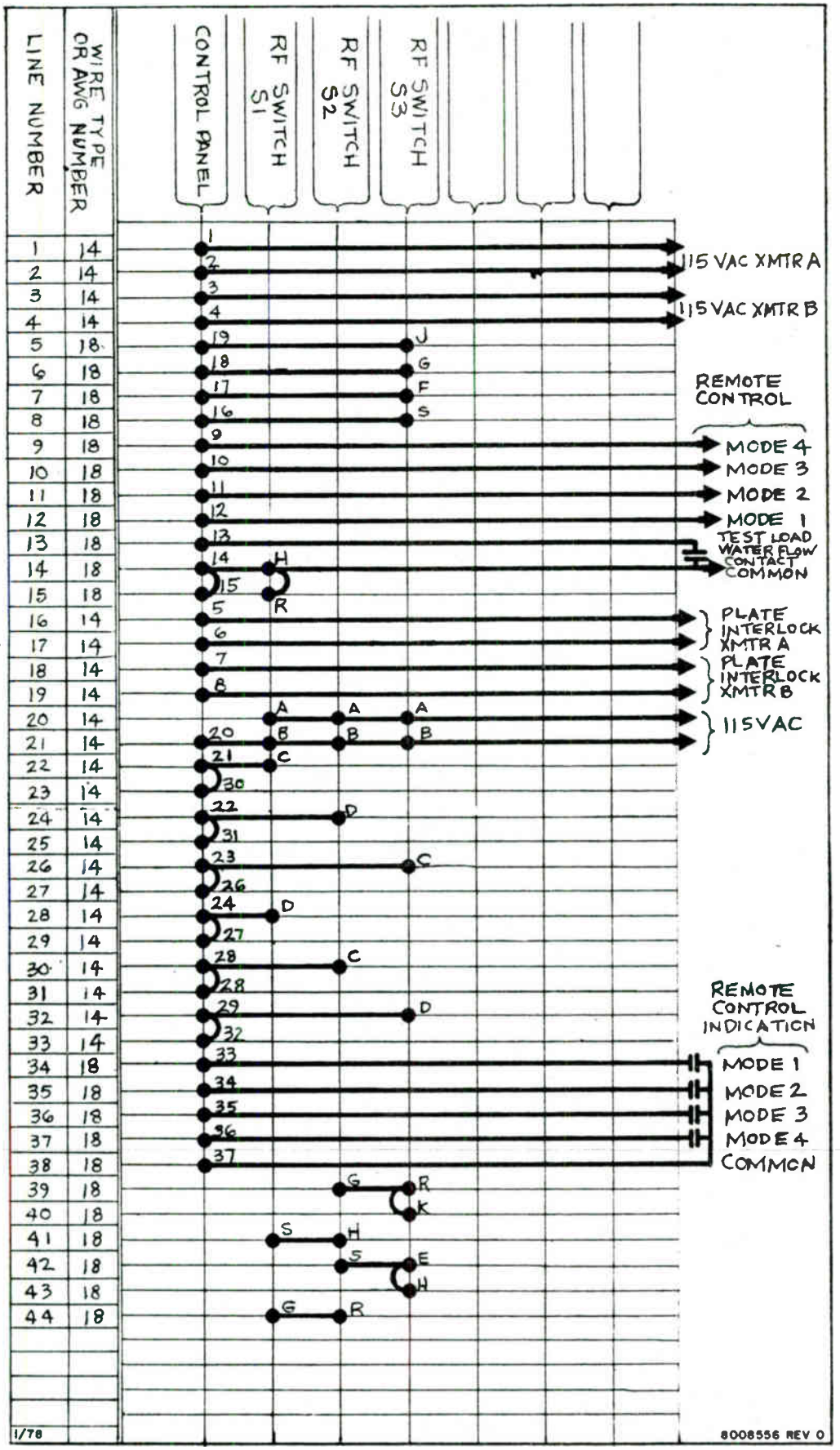

Figure 44. Control Panel MI-561767, Wire Chart

TRANSMISSION LINE AND FITTINGS
1-5/8 Inch (4.13 cm) 50 Ohms Unflanged

Description	MI Number
Transmission Line, 20 ft. (609.6 cm)	MI-561565-1A
Elbow, 90°	MI-561565-2A
Elbow, 45°	MI-561565-2B
Elbow, 90° Monitor	MI-561565-2C
Coupling Assembly, Consisting of 1 Sleeve, Outer MI-561565-4D 1 Connector, Inner MI-561565-4B 1 Clamp, Adjustable MI-561565-4C	MI-561565-4A
Connector, Inner	MI-561565-4B
Clamp, Adjustable	MI-561565-4C
Sleeve, Outer	MI-561565-4D
Reducer, Quick Step 3-1/8" to 1-5/8" Unflanged	MI-561565-5A
Reducer, 1-5/8" to Type N Jack	MI-561565-5B
Adapter, 1-5/8" Flanged to Unflanged	MI-561565-7A
Connector, Inner 1-5/8" 50 Ohms to 51.5 Ohms	MI-561565-8A

Figure 45. Transmission Line and Fittings, 1-5/8"

TRANSMISSION LINE AND FITTINGS
3-1/8 Inch (7.94 cm) 50 Ohms

Description	MI Number
Transmission Line, 20 ft. (609.6 cm)	MI-27791K-1A
Elbow, 90° Miter	MI-27791K-2A
Elbow, 45° Miter	MI-27791K-2B
Coupling, Consisting of 1 Sleeve, Outer MI-27791K-4D 1 Connector, Inner MI-27791K-4B 2 Clamp, Adjustable MI-27791K-4C	MI-27791K-4A
Connector, Inner	MI-27791K-4B
Clamp, Adjustable	MI-27791K-4C
Coupling Sleeve, Outer	MI-27791K-4D
Reducer, 3-1/8" to Type N Jack with Built-in Coupling	MI-27791K-5A
Adaptor, Female	MI-27791K-7A
Adaptor, Male	MI-27791K-7B
Coupler Mount Assembly	MI-27791K-9A
3-1/8 INCH ACCESSORIES	
Manual Transfer Panel, 3 Pole (with 1 Jack and Built-in Couplings)	MI-27912-50
Manual Coaxial Switch, 4 Port	MI-561680
Coaxial Transfer Switch, 4 Port	MI-561562-*

Figure 46. Transmission Line and Fittings, 3-1/8"

TRANSMISSION LINE AND FITTINGS
6-1/8 Inch (15.58 cm) 50 Ohms

Description	MI Number
Transmission Line, 20 ft. (609.6 cm)	MI-561579-1A
Elbow, 90°	MI-561579-2A
Elbow, 45°	MI-561579-2B
Coupling Assembly, Consisting of 1 Sleeve, Outer MI-561579-4D 1 Connector, Inner MI-561579-4B 2 Clamp, Adjustable MI-561579-4C	MI-561579-4A
Connector, Inner	MI-561579-4B
Clamp, Adjustable	MI-561579-4C
Sleeve, Outer (Including 2 Clamps)	MI-561579-4D
Reducer, 6-1/8" 50 Ohms to 3-1/8" 50 Ohms Unflanged (MI-27791K)	MI-561579-5A
Reducer, 6-1/8" 50 Ohms to 3-1/8" 50 Ohms EIA (MI-19089)	MI-561579-5B
Adapter, Transformer, 6-1/8" 50 Ohms to 6-1/8" 75 Ohms (MI-561579 to MI-27792D Female Outer) for Channels 2 and 3 (Specify Channel)	MI-561579-6R
Adapter, Transformer, 6-1/8" 50 Ohms to 6-1/8" 75 Ohms (MI-561579 to MI-27792D Female Outer) for Channels 4, 5 and 6 (Specify Channel)	MI-561579-6T
Adapter, Transformer, 6-1/8" 50 Ohms to 6-1/8" 75 Ohms (MI-561579 to MI-27792D Female Outer) for Channels 7 through 13 (Specify Channel)	MI-561579-6U
Adapter, 6-1/8" 50 Ohms Unflanged to 6-1/8" 51.5 Ohms (MI-561579 to MI-19314C)	MI-561579-7A
Adapter, 6-1/8" 50 Ohms MI-561669D Female to MI-561579 Unflanged	MI-561579-7B
Adapter, 6-1/8" 50 Ohms MI-561669D Male to MI-561579 Unflanged	MI-561579-7C
Connector, Inner 6-1/8" 50 Ohms to 6-1/8" 51.5 Ohms (MI-561579 to MI-19314C)	MI-561579-8A
Mount, Directional Coupler	MI-561579-9A

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Figure 47. Transmission Line and Fittings, 6-1/8"