

Instructions

50-KW HIGH-CHANNEL TELEVISION AMPLIFIER

MODELS 4TF5A1, 2

EBI-3295

GENERAL  ELECTRIC

INSTRUCTIONS

**50-KW HIGH-CHANNEL
TELEVISION AMPLIFIER**

MODELS 4TF5A1, 2

EBI-3295

INDUSTRIAL ELECTRONICS DIVISION

GENERAL  ELECTRIC

ELECTRONICS PARK, SYRACUSE, N. Y.

INSERTS

EBI-3310	Harmonic Filter, Model 4PY25F1
EBI-3389	Vestigial-Sideband Filter, PL-7776403-G1, -G2
GEC-972	Small-Motor Service Station Plan
GEF-3506	Renewal Parts, Type AK-1-15 and AK-1-25 Air Circuit Breakers
GEH-790	Horizontal Polyphase Induction Motors
GEH-1790	Instantaneous Current Relays, Type PJC
GEH-1807	Air Circuit Breakers, Types AK-1-15-3 and AK-1-25-3
Form 7674-F	Installation and Operating Instructions for Motor Pump Types JCS and GS Shaft Seal (Ingersoll-Rand Co.)
Form 7720-E	The Cameron Standard Duty Motorpump: Instructions for Installation and Operation and List of Parts (Ingersoll-Rand Co.).
ET-T1165	GL-6251, Description and Rating

SAFETY TO HUMAN LIFE

Personnel are protected from accidental contact with high voltages dangerous to human life by shielding, interlocks, and shorting switches. The cubicles are fitted with control circuit interlocks and high-voltage a-c and d-c shorting switches actuated by the rear access doors. The interlocks open the rectifier contactors, while one shorting switch connects the positive and negative terminals of the rectifier and the other shorts the three secondary terminals of the high-voltage transformer. Thus, double protection against contact with high-voltage circuits is afforded operating personnel.

While every practicable safety precaution has been incorporated in this equipment, the following rules should be strictly observed:

1. **KEEP AWAY FROM LIVE CIRCUITS.** Under no circumstances should any person be permitted to reach within, or in any manner gain access to, the cubicles with interlocked doors closed (or with power supply line switches to the equipment closed); or to approach or handle any portion of the equipment which is supplied with power; or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any noninterlocked portion of the shielding or enclosure is removed or opened.

2. **DO NOT SERVICE OR ADJUST ALONE.** Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

3. **DO NOT TAMPER WITH INTERLOCKS.** Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with.

4. **FIRST AID.** Study first aid procedures in handling electrical shock.

CONTENTS

	Page
INTRODUCTION	1
TECHNICAL SUMMARY	1
Electrical.	1
Tube Complement	9
Mechanical	9
EQUIPMENT	9
DESCRIPTION	10
Construction	10
Visual Amplifier	12
Aural Amplifier	15
Control System	15
Cooling System	15
External Equipment	17
Power Feed.	17
Drawings and Symbols	17
INSTALLATION	17
Unpacking	17
Location	20
Installation of Output Tuning Assembly.	23
Wiring	23
Installation of Plumbing	23
50-Cycle Operation	24
Tube Installation	24
Interlocks with Driving Transmitter	27
External Safety Switch	28
Remote Meters.	28
Protective Gaps	28
Initial Lubrication	29
OPERATION	29
Preparation for Use	29
Aural Amplifier	32
Visual Amplifier.	37
Aural and Visual Amplifiers.	39
Routine Operation	40
Typical Meter Readings.	40
General Operating Instructions.	40
Safety Inspection	41
MAINTENANCE	42
Preventive	42
General	42
Daily	42
Weekly	43
Semi-annual	45
Maintenance of Powerstat	45

	Page
Maintenance of Blowers, Pump, and Air Filters	45
Targets	47
Water System.	47
Use of Solvents in Flushing the Water System	47
Corrective	48
Ordering Replacement Parts	48
Cavity Construction	48
 THEORY AND CIRCUIT ANALYSIS	 51
Control Circuits	51
General	51
Control Circuit Components and Their Functions	51
Starting Sequence.	64
Stopping Sequence	65
Automatic Reclosure	65
Emergency Starting.	66
Independent Operation of Aural and Visual Amplifiers	67
Filament Time-Delay Status Lights	67
Supervisory Light Circuits.	67
Visual Amplifier.	67
Power Amplifier	67
Output Circuit	68
Input Circuit.	69
Sweep Generator	69
Power Supplies.	71
Vestigial-Sideband Filter and Harmonic Filters.	71
Aural Amplifier	71
Power Amplifier	71
Output Circuit	71
Input Circuit.	72
Sweep Generator	72
Aural Rectifier Circuits	72
High-Voltage Rectifier	72
 PARTS LIST	 73
Electrical.	73
Mechanical	89
 SUPPLEMENT A	 121
Correct Loading of the Visual Amplifier.	121
Interlocks with G-E 10-KW High-Channel Television Transmitter, Type TT-32-B	121
Water System	122
Care of Painted Surfaces	122
Installation of 5T1, 5L7, 5L8	122
 SUPPLEMENT B	 123
GL-6251 Filament Life	123
Reduction of GL-6251 Screen Dissipation	123
Type TT-36-A Transmitter Interconnection with Type TC-46-A Console	124

INDEX

ILLUSTRATIONS

	Page
Fig. 1 Front View of 50-KW High-Channel Television Amplifier, Model 4TF5A1,2 (4-3821)	viii
Fig. 2 Outline Drawing: Over-all Physical Dimensions (C-7775337, Sheet 1).	2
Fig. 3 Outline Drawing: Terminal Board Locations (C-7775337, Sheet 2)	3
Fig. 4 Outline Drawing: Input Line Stretcher, Reflectometer, Motor and Blower (C-7775337, Sheet 3).	4
Fig. 5 Outline Drawing: Circuit Breaker (5S1), Sweep Diodes, Resistor Box, Delta-Wye Switch (C-7775337, Sheet 4)	5
Fig. 6 Outline Drawing: Heat Exchanger, Motor Pump, Circuit Breaker (5K1), Water Tank, Mason-Neilon Strainer (C-7775337, Sheet 5)	6
Fig. 7 Outline Drawing: Reactors, Plate Transformer, Fine Matcher (C-7775337, Sheet 6)	7
Fig. 8 Suggested Station Layout, TT-32-B Driver (D-7967418)	8
Fig. 9 Front View of Visual Amplifier Cubicle with Access Doors Open (4-3490).	10
Fig. 10 Rear View of Visual Amplifier Cubicle (4-6802)	11
Fig. 11 Rear and Right Wall View of Visual Amplifier Cubicle (4-6800)	12
Fig. 12 Rear and Left Wall View of Visual Amplifier Cubicle (4-6797)	12
Fig. 13 Front View of Aural Amplifier Cubicle with Access Doors Open (4-3488)	13
Fig. 14 Rear and Right Wall View of Aural Amplifier Cubicle (4-6804)	14
Fig. 15 Rear and Left Wall View of Aural Amplifier Cubicle (4-6805)	16
Fig. 16 Front View of Rectifier Cubicle with Access Doors Open (4-3489)	17
Fig. 17 Rear View of Rectifier and Control Cubicle (4-6801)	18
Fig. 18 Rear and Right Wall View of Rectifier and Control Cubicle (4-6798)	19
Fig. 19 Rear and Left Wall View of Rectifier and Control Cubicle (4-6799)	20
Fig. 20 Detail View of Rectifier and Control Cubicle Showing Grounding Switches (4-6803)	21
Fig. 21 Suggested Station Layout, Type TT-6-E Driver (D-7668454, Sheet 1)	22
Fig. 22 Output Circuit Assembly, PL&D-7669025-G1 (4-4796).	23
Fig. 23 Top Assembly of Output Circuit (4-4788)	23
Fig. 24 Cavity Connection to Output Circuit Assembly, Covers Removed (4-4787)	24
Fig. 25 Bottom Support for Output Circuit Assembly (4-4791)	24
Fig. 26 Output Coupling Connection (A-7991230)	24
Fig. 27 Layout of External Transmission-Line Elements (D-7668454, Sheet 2)	25
Fig. 28 Piping Diagram (A-7145325).	26
Fig. 29 Heat Exchanger, Water Tank, Water Pump (4-4899)	26
Fig. 30 Tube Installation - A (4-4897).	27
Fig. 31 Tube Installation - B (4-4900).	27
Fig. 32 Tube Installation - C (4-4898).	28
Fig. 33 Graph of Water Flow versus Pressure (A-7991217)	30
Fig. 34 "Spike" Showing Only Plate Circuit of Aural Amplifier Tuned.	32
Fig. 35 Aural Amplifier: Correct Bandpass But Too Little Coupling	32
Fig. 36 Aural Amplifier: Correct Bandpass But Too Much Coupling	33
Fig. 37 Aural Amplifier: Correct Bandpass, Lower Marker 1.5 MC Below and Upper Marker 1.5 MC Above Carrier.	33
Fig. 38 Graph of Plate Transformer Tap Connections (A-7991262).	34
Fig. 39 Quarter-Phasing Connections (A-7991263).	35

	Page
Fig. 40 Incorrect Quarter Phasing	35
Fig. 41 Correct Quarter Phasing	35
Fig. 42 Aural Amplifier: Correct Bandpass with 500-Foot Transmission-Line Feed to Antenna	36
Fig. 43 Visual Amplifier: Sweep Detector No. 1, Correct Bandpass Before VSB Filter, But Too Little Coupling	37
Fig. 44 Visual Amplifier: Sweep Detector No. 1, Correct Bandpass Before VSB Filter, But Too Much Coupling	37
Fig. 45 Visual Amplifier: Sweep Detector No. 1, Correct Bandpass Before VSB Filter, Lower Marker 0.75 MC Below and Upper Marker 4.2 MC Above Carrier	38
Fig. 46 Visual Amplifier: Sweep Detector No. 2, Correct Bandpass After VSB Filter, Lower Marker 0.75 MC Below Carrier	38
Fig. 47 Visual Amplifier: Sweep Detector No. 2, Correct Bandpass After VSB Filter, Lower Marker 1.25 MC Below Carrier	38
Fig. 48 Visual Amplifier: Correct Bandpass with 500-Foot Transmission-Line Feed to Antenna	39
Fig. 49 Cavity in Process of Construction: Contact Assemblies Lacking, Rear View (4-4785).	43
Fig. 50 Cavity in Process of Construction: Contact Assemblies Lacking, Bottom View (4-4797).	44
Fig. 51 Cavity in Process of Construction: Screen Grid and Control Grid Contact Assembly in Place, Rear View (4-4795)	45
Fig. 52 Cavity in Process of Construction: Screen Grid and Control Grid Contact Assembly in Place, Bottom View (4-4798)	46
Fig. 53 Cavity in Process of Construction: View of Coupling Loop (4-4786)	47
Fig. 54 Cavity in Process of Construction: Anode Contact Assembly and Shield in Place, One Tube Installed, Rear View (4-4789)	49
Fig. 55 Cavity in Process of Construction: Anode Contact Assembly and Shield in Place, Tubes Lacking, Bottom View (4-4799)	50
Fig. 56 Visual and Aural Amplifier Output Tuning Assembly Mechanical- Elementary Diagram (A-7991254, Sheet 1)	68
Fig. 57 Input Matcher Assembly, Visual and Aural Amplifier Cavities, PL&C-7775419-G1 (4-4793)	69
Fig. 58 Visual and Aural Amplifier Input Circuit Mechanical-Elementary Diagram (A-7991254, Sheet 2)	69
Fig. 59 Sweep Response with Markers	71
Fig. 60 Sweep Response with Markers and Blanking	71
Fig. 61 Interconnection Diagram (DD-7668694)	91
Fig. 62 Visual Amplifier Connection Diagram (D-7668736, Sheet 1)	93
Fig. 63 Visual Amplifier Connection Diagram (D-7668736, Sheet 2)	94
Fig. 64 Screen Regulator Connection Diagram (B-7948274)	95
Fig. 65 Visual Amplifier Elementary Diagram (EE-7335681)	97
Fig. 66 Aural Amplifier Connection Diagram (D-7667977, Sheet 1).	99
Fig. 67 Aural Amplifier Connection Diagram (D-7667977, Sheet 2).	100
Fig. 68 Aural Amplifier Elementary Diagram (EE-7335682)	101
Fig. 69 Rectifier and Control Connection Diagram (D-7667978, Sheet 1)	103
Fig. 70 Rectifier and Control Connection Diagram (D-7667978, Sheet 2)	104
Fig. 71 Rectifier and Control Connection Diagram (D-7667978, Sheet 3)	105
Fig. 72 Rectifier and Control Elementary Diagram (E-7353337)	107
Fig. 73 Simplified Control Circuit Elementary Diagram (EE-7353683)	109
Fig. 74 Plate Transformer Connections Elementary Diagram (B-7948271).	111

	Page
Fig. 75 Sweep Generator Elementary Diagram (D-7667845)	113
Fig. 76 Preparation of Cable and Assembly of "UHF" Set-Screw Type Connector, Amphenol 83-1-SPN (3-3950).	115
Fig. 77 Preparation of Cable and Assembly of "UHF" Coupling Ring Type Connector, Amphenol 83-1-SP (3-3951).	116
Fig. 78 Preparation of Cable and Assembly of Type BNC Connector (3-3956)	117
Fig. 79 Preparation of Cable and Assembly of Type N Connector (3-3954)	118
Fig. 80 Aural Efficiency Factor Graph	119
Fig. 81 Interconnection Diagram, Type TT-36-A Transmitter and Type TC-46-A Console (FE-7354314).	125

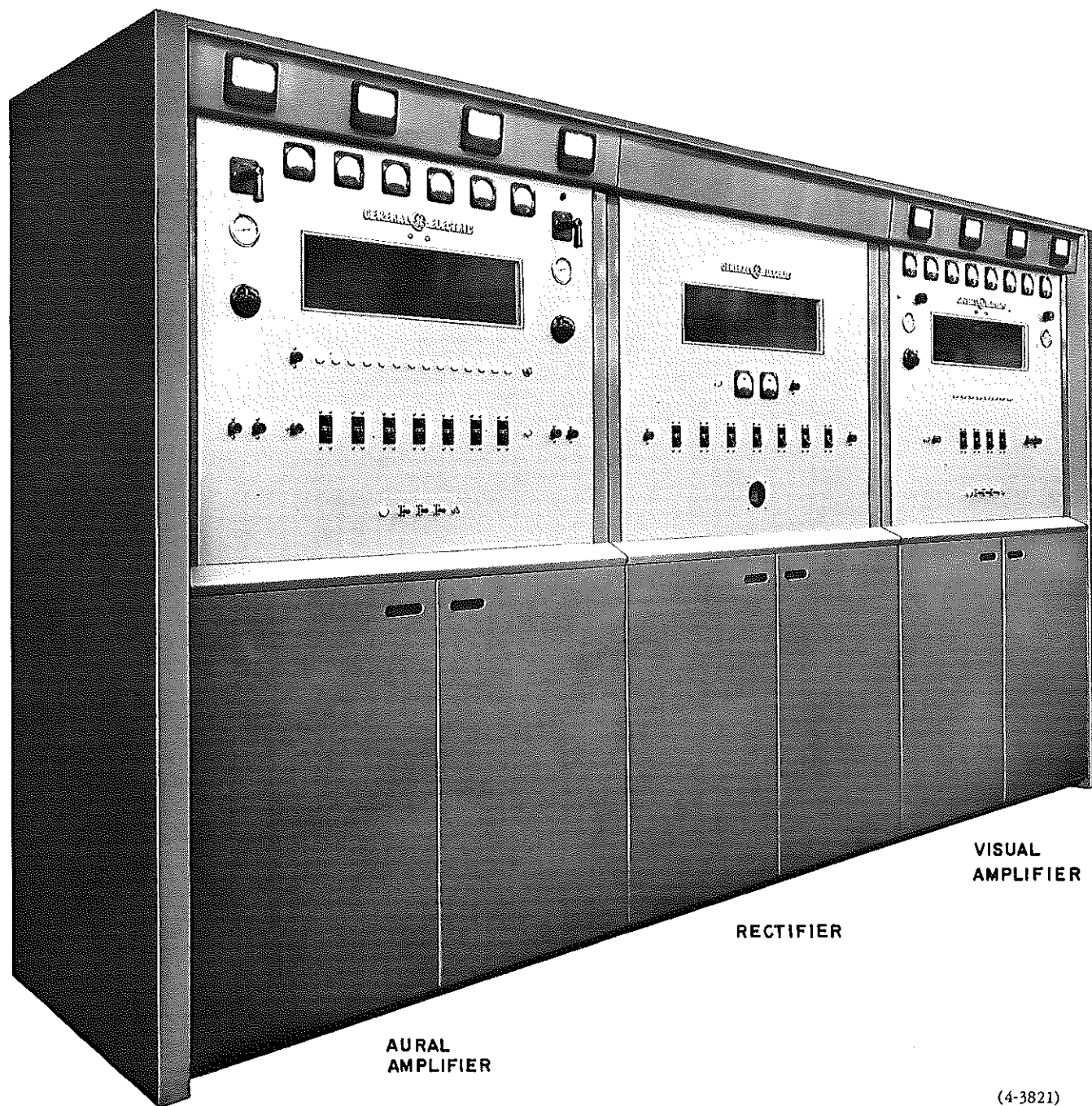


Fig. 1 Front View of 50-KW High-Channel Television Amplifier, Models 4TF5A1,2

INTRODUCTION

The General Electric 50-KW High-Channel Television Amplifier (Fig. 1), Models 4TF5A1,2, is an air- and water-cooled television amplifier designed to provide the broadcaster with modern equipment capable of high quality performance at low operating cost through amplification of the RF output of a 5-KW television transmitter to 50 KW. The Amplifier will supply a 50-KW synchronizing peak television visual signal and a 26.6-KW television aural frequency-modulated signal in any one of the high-channel VHF television channels 7 through 13 when driven by a transmitter normally rated at an output of 5 KW.

The Type TF-5-A Amplifier when used with the General Electric Type TT-6-E 5-KW Television Transmitter becomes the Type TT-26-A 50-KW Transmitter. The Type TF-5-A Amplifier when used with the General Electric Type TT-32-B Television Transmitter becomes the Type TT-36-A 50-KW Transmitter.

It is the purpose of this instruction book to provide detailed information concerning the circuits employed, the method for their adjustment, and the maintenance procedures to be followed so that long and satisfactory service can be had from the equipment.

TECHNICAL SUMMARY

ELECTRICAL

	<u>Aural Amplifier</u>	<u>Visual Amplifier</u>
Type of Emission:	FM	AM
Frequency Range:	(Carrier Freq.)	(Carrier Freq.)
Channel 7	179.75	175.25
Channel 8	185.75	181.25
Channel 9	191.75	187.25
Channel 10	197.75	193.25
Channel 11	203.75	199.25
Channel 12	209.75	205.25
Channel 13	215.75	211.25
Power Output:	26.6-KW maximum (14.249 dbk)	50-KW maximum peak (16.99 dbk)
Input Impedance:	50.0 ohms with VSWR of 1.2 to 1 or less. (1-5/8" rigid line)	50.0 ohms with VSWR of 1.1 to 1 or less at the center frequency. (1-5/8" rigid line)
Load Impedance Required:	50.0 ohms with VSWR of 1.75 to 1 or less. (3-1/8" rigid line)	50.0 ohms with VSWR of 1.1 to 1 or less. (3-1/8" rigid line)
RF Power Requirements:	Approx. 2.5 KW for full output	Approx. 5.0 KW peak for full output
Lower-Sideband Attenuation:		More than -20 db with the 200-kc sideband as a reference for a modulating frequency greater than 1.25 mc and more than -42 db for a modulating frequency of 3.58 mc when the exciter is a General Electric Type TT-6-D or TT-6-E Transmitter or equivalent
Upper-Sideband Attenuation:		Determined by the characteristic of the driving transmitter

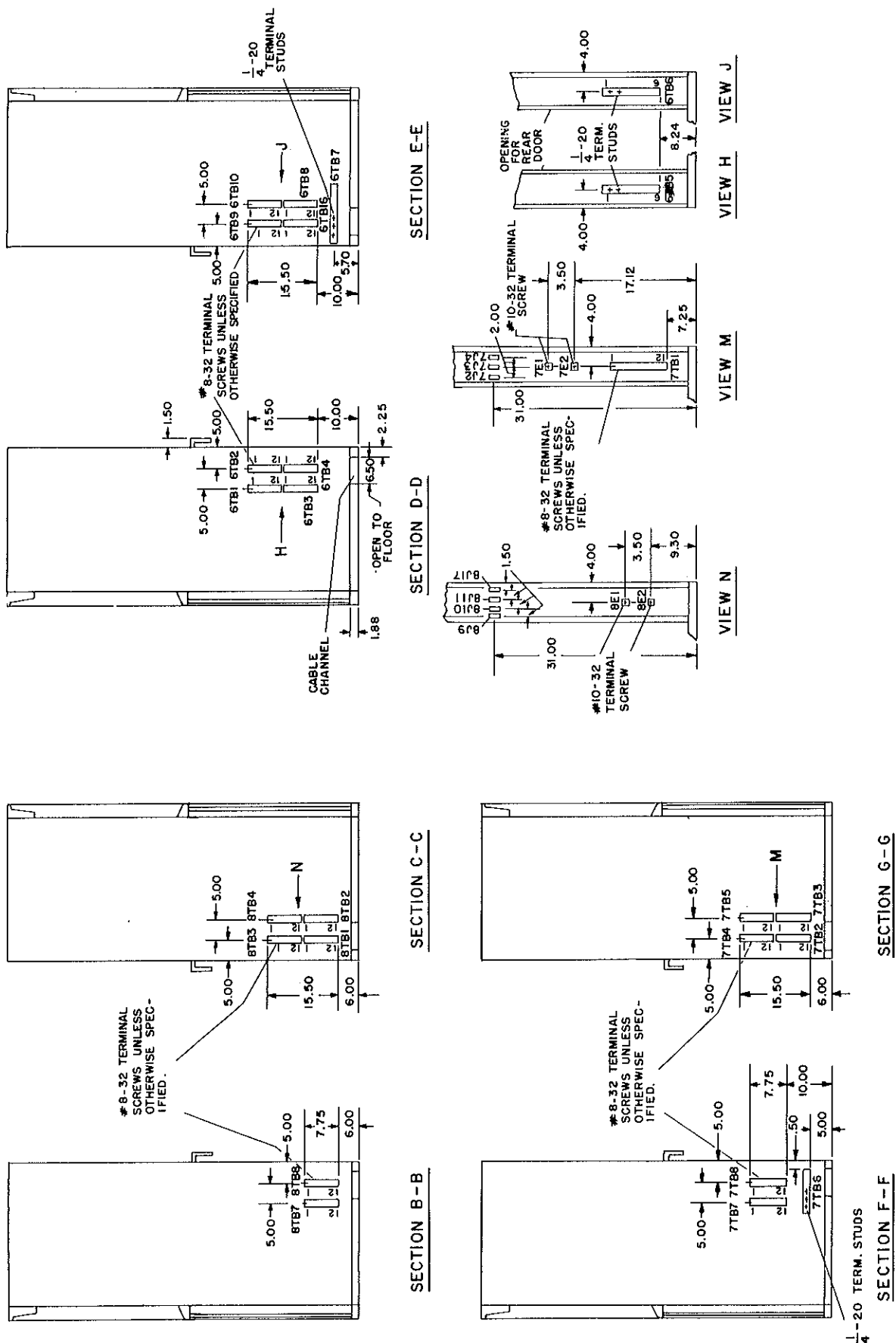
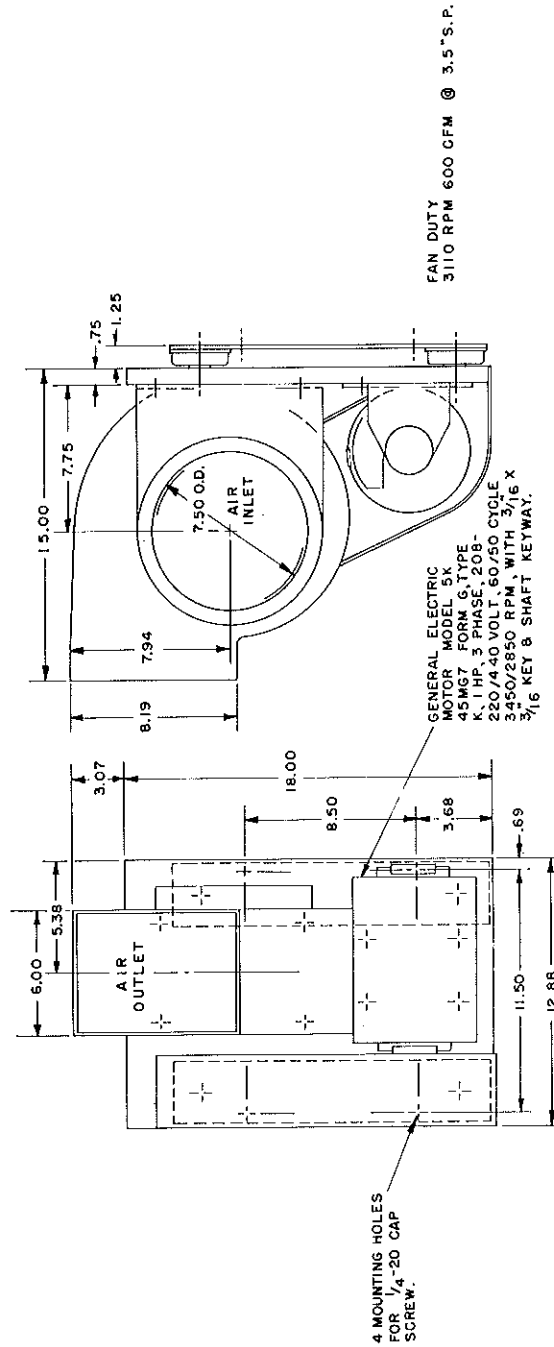
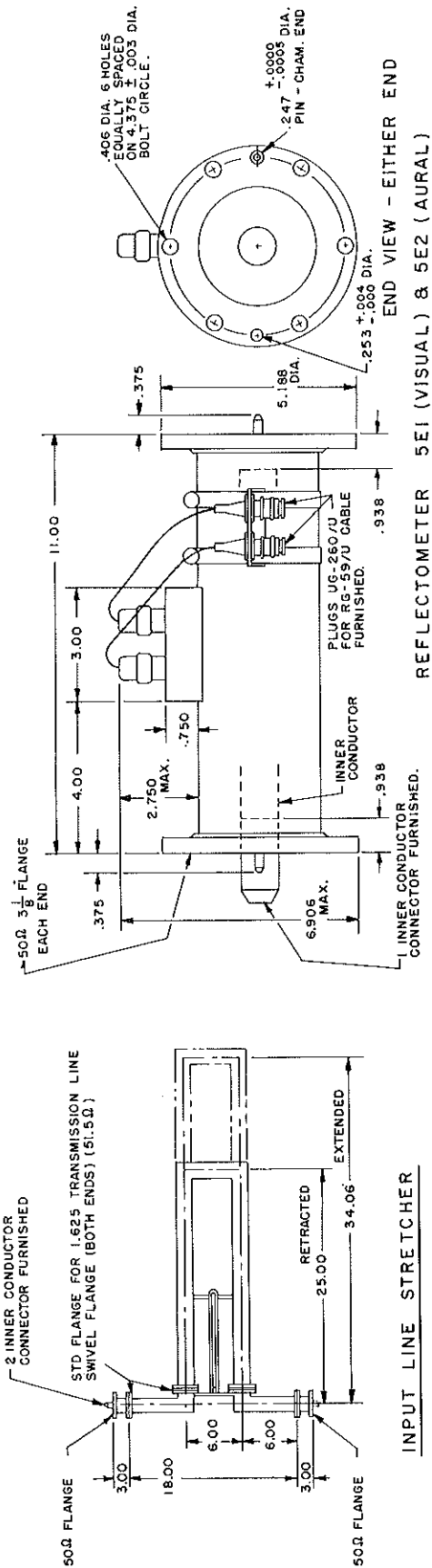


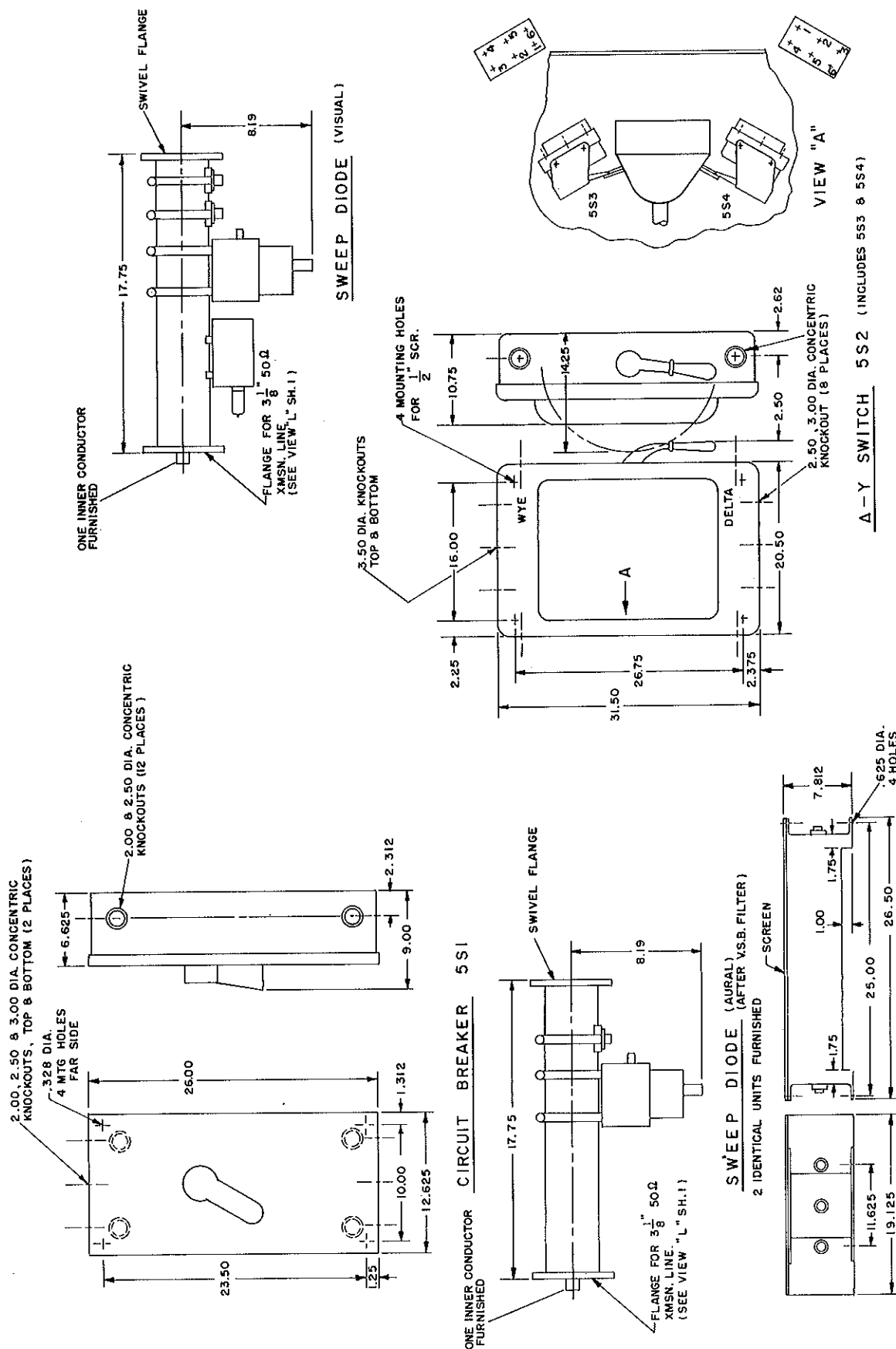
Fig. 3 Outline Drawing: Terminal Board Locations



(C-775337, Sheet 3, Rev. 1)

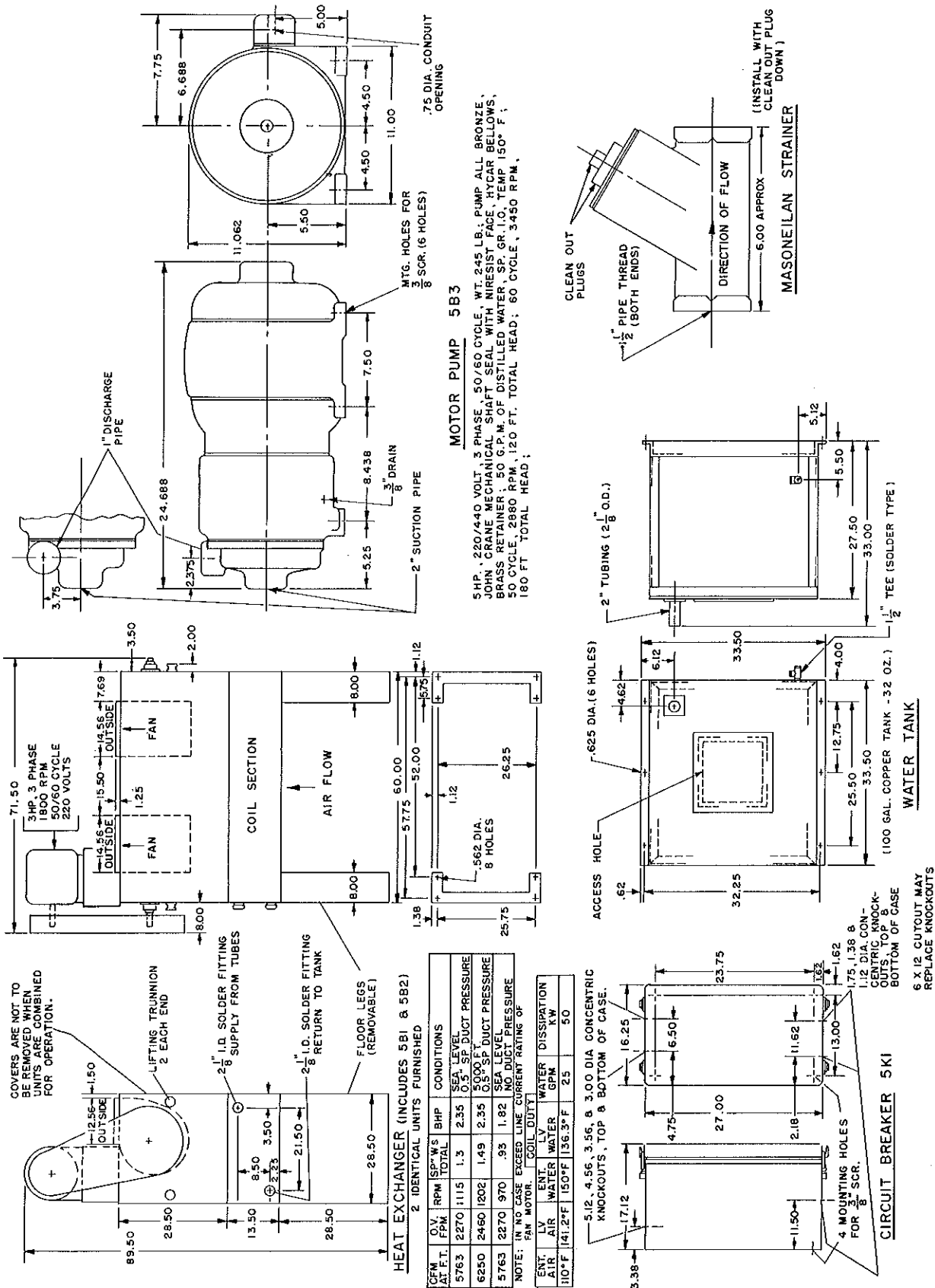
Fig. 4 Outline Drawing: Input Line Stretcher, Reflectometer, Motor and Blower

(C-7775337, Sheet 4)



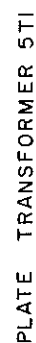
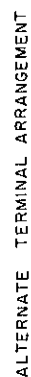
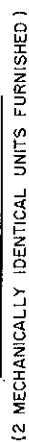
RESISTOR BOX 5R9

Fig. 5 Outline Drawing: Circuit Breaker (5S1), Sweep Diodes, Resistor Box, Delta-Wye Switch



(C-7775337, Sheet 5)

Fig. 6 Outline Drawing: Heat Exchanger, Motor Pump, Circuit Breaker (5K1), Water Tank, Mason-Neilon Strainer



W1 2400
SEE ALTERNATE VIEW OF 5TI

Fig. 7 Outline Drawing: Reactors, Plate Transformer, Fine Matcher

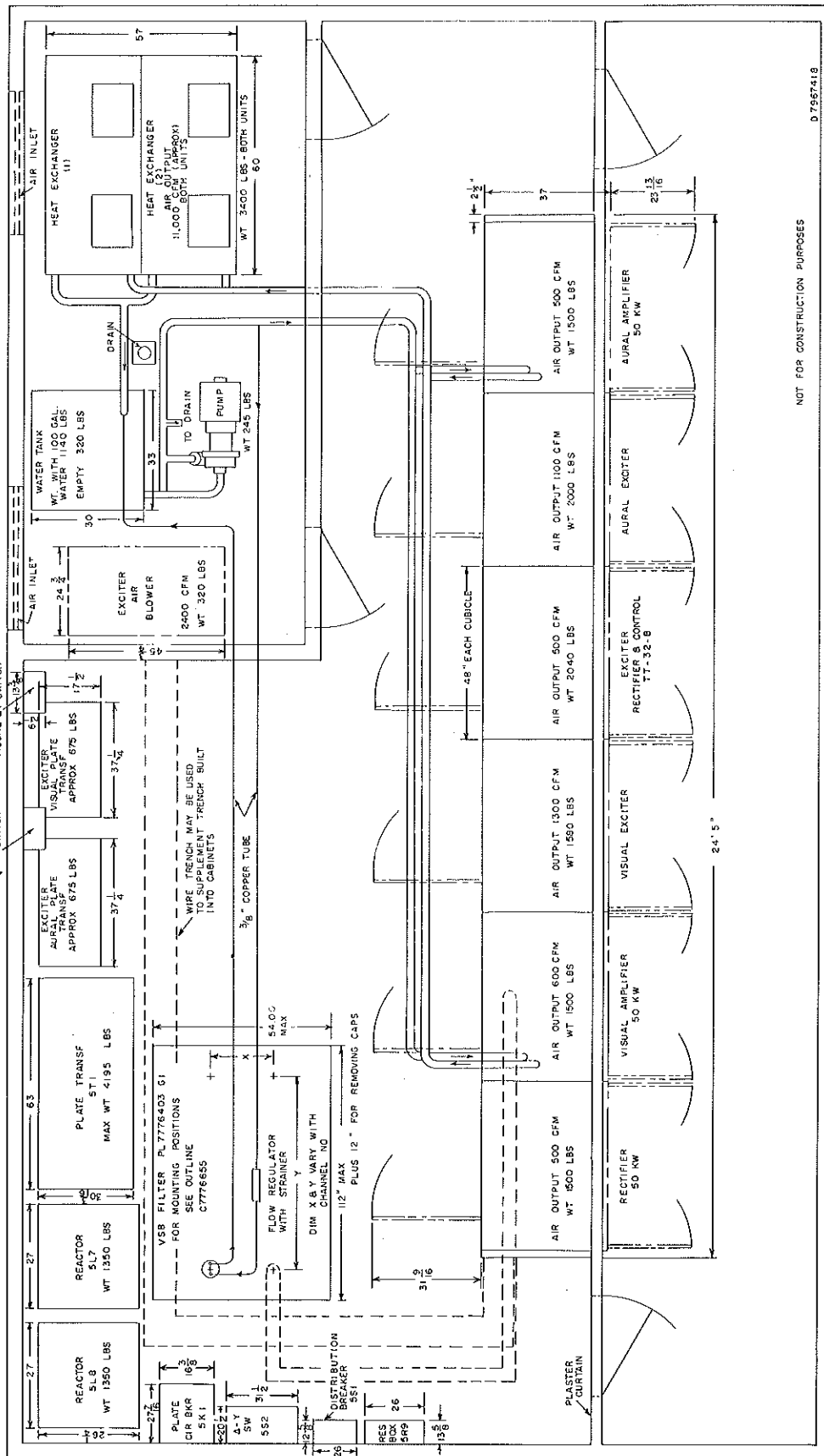


Fig. 8 Suggested Station Layout, TT-32-B Driver

(D-7967418, Rev. 3)

	<u>Aural Amplifier</u>	<u>Visual Amplifier</u>
Noise Level:		
AM Noise (RMS):	50 db (below carrier)*	40 db (below sync peak)*
Visual Output Variation:		Less than 5% of the average of the peak signal amplitude*
Harmonic Output:	The harmonic output from this equipment is attenuated more than 60 db at all harmonic frequencies	
Power Requirements:		
Line Voltage -	208/230 volts \pm 5%	
Phase -	3	
Frequency -	60 cps (50 cps available on special order).	
Power Consumption -	Approximately 156 KW at black level	
Power Factor -	90%	
Convenience Outlets and Cabinet Lights -	117 volts, 50/60-cycle, single-phase	

TUBE COMPLEMENT

	<u>Aural Amplifier</u>	<u>Visual Amplifier</u>	<u>Rectifier</u>
RF Power Amplifier	2 Type GL-6251	2 Type GL-6251	
Screen Grid Supplies		4 Type 6AS7-G 1 Type 12AU7 1 Type 6AK5 3 Type GL-OC3/VR105	4 Type GL-8008
Sweep Generator	1 Type GL-832-A 1 Type 6BK7 2 Type 6U8	1 Type GL-832-A 1 Type 6BK7 2 Type 6U8	
Sweep Generator Power Supply	1 Type 5R4GY		
Reflectometer Amplifier	1 Type 6SN7-GT		
High-Voltage Rectifier			6 Type GL-869B
Arc-Back Indicator			6 Type 5823
External Equipment: Peak Reading Diode -	1 Type 6AL5		

MECHANICAL

Refer to Figs. 2 through 7.

EQUIPMENT

The General Electric 50-KW High-Channel Television Amplifier, discussed in this instruction book and identified by the Model Numbers 4TF5A1,2, consists of the following items which are furnished:

<u>Item</u>	<u>Quantity</u>	<u>Designation</u>	<u>Item</u>	<u>Quantity</u>	<u>Designation</u>
Visual Cubicle	1	PL-7353376G1 (Cubicle 8)	Rectifier Cubicle	1	PL-7353375G1 (Cubicle 6)
			Aural Cubicle	1	PL-7353377G1 (Cubicle 7)
			Electronic Tubes	1 set	PLA-7142778G1
			Heat Exchangers	2	C-7774270P1
			Water Tank	1	C-7774662P1
			Plate Transformer	1	B-7487257P1
			Visual Reactor	1	B-7487258P1
			Aural Reactor	1	B-7487258P1

* When the driving transmitter betters this by a reasonable margin.

Item	Quantity	Designation	Item	Quantity	Designation
Solenoid Closing Circuit Breaker	1	C-7773783P2	Reflectometer (1 for Visual and 1 for Aural)	2	PL-7488443G1
Motorpump * (Water Pump)	1	B-7487967P1	Resistor Box	1	A-7143544G1
Sweep Diode Assembly (Visual)	1	A-7145086G2	Strainer	1	Mason-Neilon Strainer, Brass, 1-1/2 IPS
Sweep Diode Assembly (Visual)	1	A-7145085G1	Line Stretcher, 1-5/8 inch	1	PL-7774758G1
Sweep Diode Assembly (Aural)	1	PLA-7145086G1	Delta-Wye Switch	1	B-7486898G1
Adapters (1-5/8 inch 50-ohm to 1-5/8 inch 51.5-ohm)	2	A-7145080G1	Harmonic Filter	2	4PY25F1
Connector	2	A-7144652P1	Vestigial-Sideband Filter	1	PL-7776403-G1
			Circuit Breaker	1	C-7775284P1
			Accessories	1 set	MLK-7134491G1

DESCRIPTION

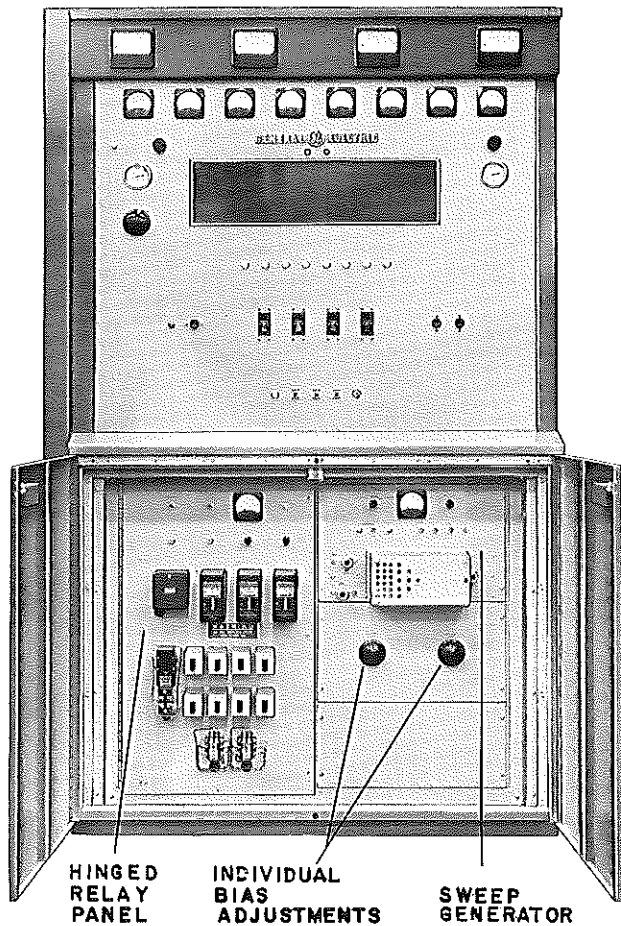


Fig. 9 Front View of Visual Amplifier Cubicle with Access Doors Open

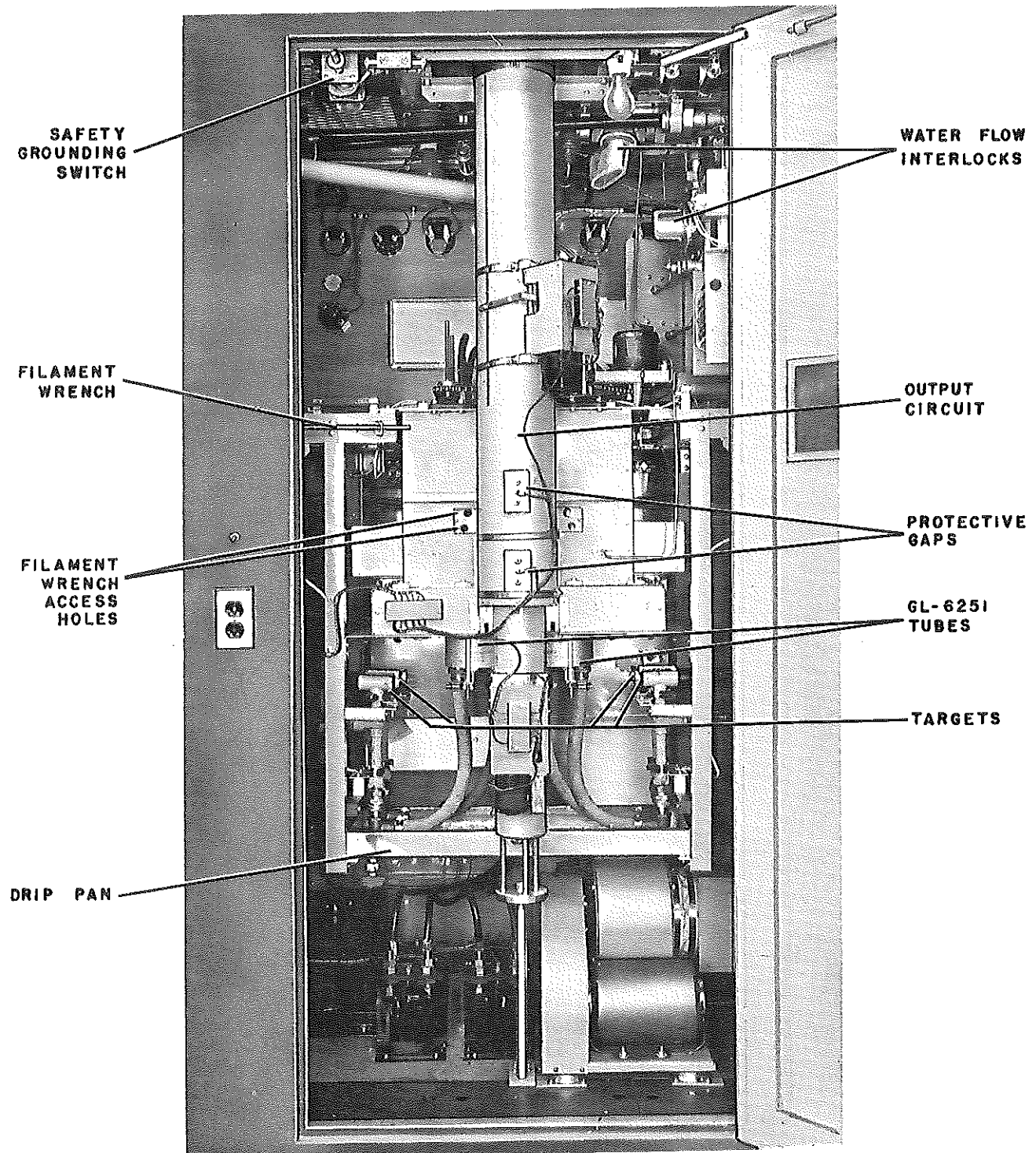
* Registered U. S. Patent Office

CONSTRUCTION

The General Electric 50-KW High-Channel Television Amplifier, Models 4TF5A1,2, consists of three cubicles and the external equipment listed in this book under EQUIPMENT.

The cubicles may be placed in any physical relationship to each other or to the driving transmitter; however, it is advisable to keep the Visual Amplifier reasonably close to the Visual driver. Two or more cubicles can be bolted together in a line. Two removable end caps are provided for the end cubicles of a series. The upper front panels of the cubicles on which the frequently used controls, meters, supervisory lights, and viewing windows are located are exposed for easy accessibility. The lower front panels are recessed behind access doors. On these panels are mounted the sweep generators, the low-voltage supply for the sweep generators, BIAS and CATHODE BALANCE adjustments for the Amplifiers, and the control circuit relays. The control circuit relays are mounted on hinged panels so that access may be had to either side of the telephone-type relays mounted on them. These hinged panels are interlocked to remove high voltage if the panels are opened. Contactors carrying 230 volts are located within the cubicle for safety.

A recessed kick cove is provided along the front of each cubicle to prevent scuffing of the finish. Convenience outlets and a switch to turn on the interior lighting of the cabinet are provided on the rear of each cubicle. Convenience outlets and a switch for the interior lighting of the cabinet are also supplied inside



(4-6802)

Fig. 10 Rear View of Visual Amplifier Cubicle

the front access doors of the Visual and Aural cubicles. A wiring trench is provided in the rear of each cubicle for intercubicle wiring. On the top rear left-hand corner of the Visual and Aural cubicles and the top rear right- and left-hand corners of the Rectifier cubicle there are provided cover plates which may be removed to allow for connection of a standard 4-inch square wiring duct for running the external wiring to the three cubicles from the top of the cubicle if desired.

VISUAL AMPLIFIER

See Figs. 9 through 12.

The Visual Amplifier consists of an RF power amplifier, a screen regulator, a selenium rectifier bias supply, a sweep generator, and the associated control equipment. The radio-frequency amplifier utilizes two General Electric Type GL-6251 tetrodes which operate in a grounded-grid or grid-separation circuit. In normal operation, plate tuning, the output circuit tuning, and the output circuit loading are adjust-

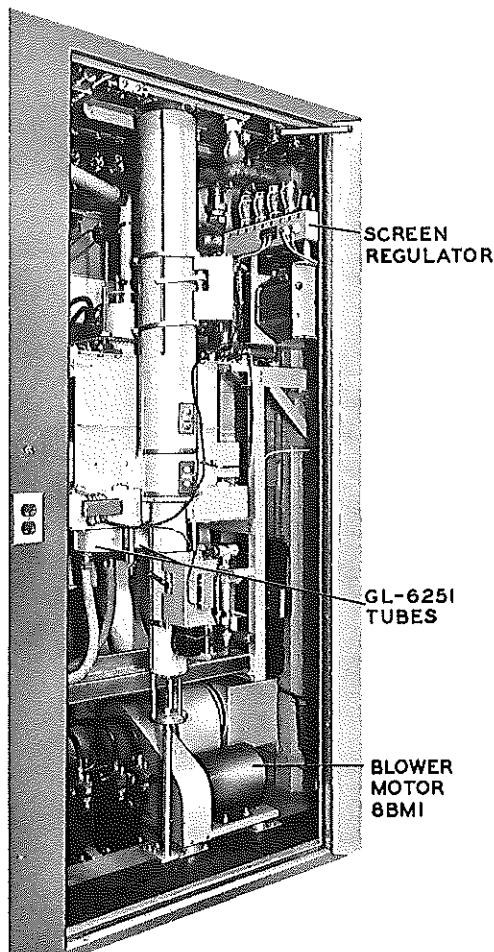
able. The input circuit consists of suitable matching to obtain approximate termination of the 50-ohm input transmission line at the center of the band of frequencies used. The two controls for adjusting the matching of the input circuit are available on the front panel for adjustment but are locked for normal operation.

The Vestigial-Sideband Filter is a constant-impedance device which is mounted externally to the Visual Amplifier cubicle.

The screen regulator is an electronically regulated power supply.

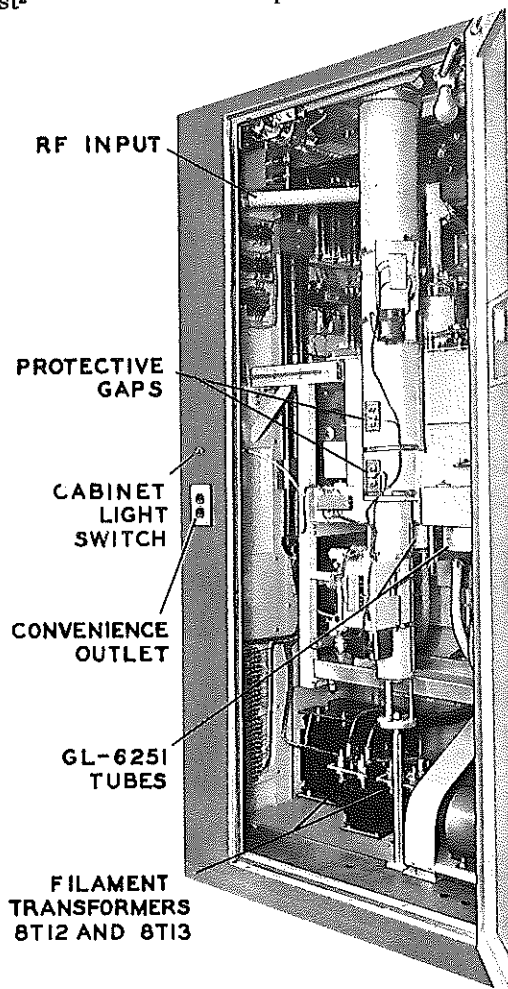
The bias supply is a selenium rectifier heavily loaded, so that the bias voltage does not vary appreciably with the grid current.

The sweep generator provides a constant RF voltage swept over a wide frequency range for use in adjusting the bandwidth of the radio-frequency power amplifier. It is also useful in checking antenna and transmission-line performance.



(4-6800)

Fig. 11 Rear and Right Wall View of Visual Amplifier Cubicle



(4-6797)

Fig. 12 Rear and Left Wall View of Visual Amplifier Cubicle

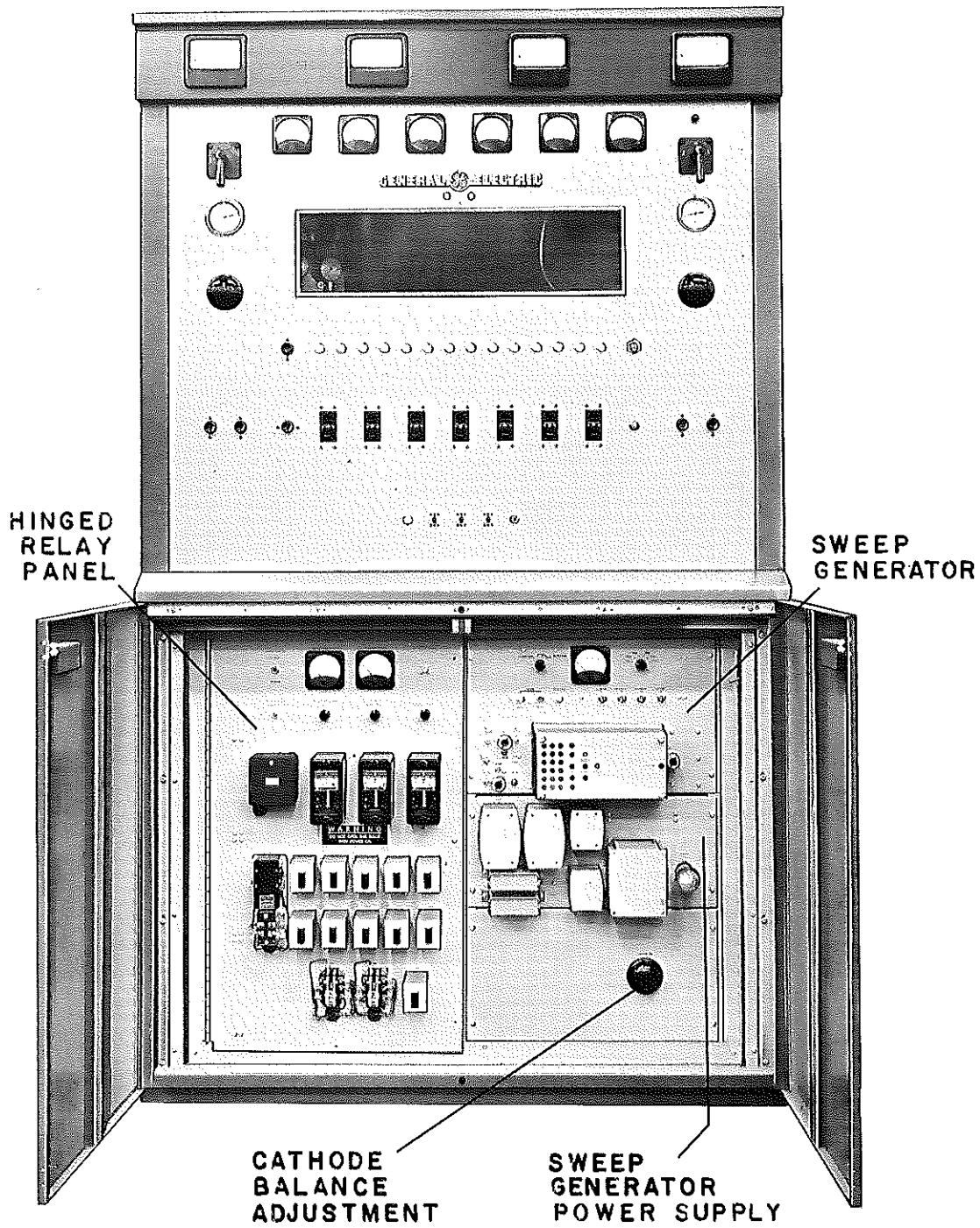
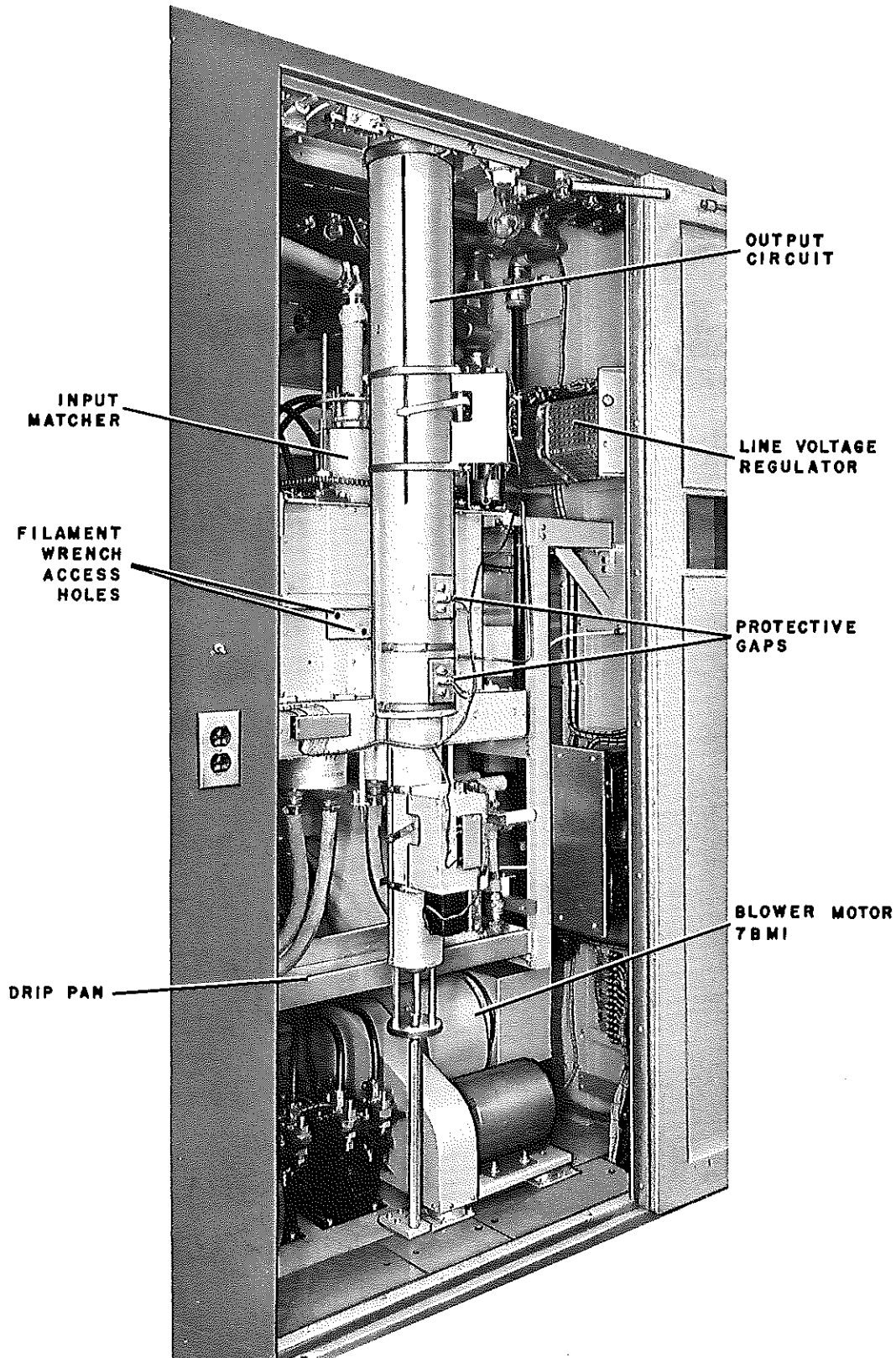


Fig. 13 Front View of Aural Amplifier Cubicle with Access Doors Open

(4-3488)



(4-6804)

Fig. 14 Rear and Right Wall View of Aural Amplifier Cubicle

The high-voltage rectifier supplying the screen regulator is located in the Rectifier cubicle.

AURAL AMPLIFIER

See Figs. 13 through 15.

The Aural Amplifier consists of the input matching circuit, the Amplifier proper, a sweep generator, and the associated power supplies and controls.

The Amplifier circuit is fundamentally identical to that of the Visual Amplifier.

The input circuit is the same as that of the Visual Amplifier.

The Aural screen grid supply is located in the Rectifier cubicle.

The control grid protective bias supply is located in the Aural Amplifier cubicle.

The reflectometer amplifier operates in conjunction with the Aural reflectometer to remove both Aural and Visual power in the event of an antenna or transmission-line fault which increases the VSWR on the transmission line.

The Aural Amplifier Sweep Generator is supplied to facilitate output tuning and loading so that the optimum load impedance will be presented to the Amplifier tubes.

CONTROL SYSTEM

See Figs. 16 through 19.

The several functions of the control system include those of starting and stopping the Amplifier conveniently, properly maintaining the starting sequence, protecting the equipment from self-destruction, and protecting station personnel from accidental contact with the high-voltage circuits. The rear access doors are equipped with interlocks which remove the primary power from the rectifier transformer when the doors are opened. In addition, these doors actuate switches which mechanically ground the high-voltage a-c and d-c buses (see Fig. 20.) The relay panels are also interlocked.

Quick acting d-c overload relays and magnetically operated a-c switches protect the equipment against electrical overload. In case of a plate circuit overload, two plate reclosures will automatically occur before lockout. In addition, the Amplifier will recycle for power-line failures of less than two seconds.

AC protection is afforded the Rectifier by the use of an air circuit breaker, electrically operated, which serves as the primary contactor for the Rectifier. The breaker provides over-load protection of three types: (1) long time, which protects against sustained overloads but has sufficient inverse-time characteristic in order not to trip on transformer inrush currents; (2) short time, which will trip in 8 cycles at currents

greater than five times rated (this reinforces the Rectifier d-c short-circuit protection); and (3) instantaneous, which will trip in less than 2 cycles for currents exceeding 15 times the breaker rating, thus providing protection against accidental short circuits or rectifier transformer failure. The electrical trip, actuated by the fast d-c overload relays, will clear the breaker in a maximum of two cycles. The breaker also has undervoltage protection. AC protection is furnished for the units mounted in cubicles by a disconnect switch mounted externally. The maximum short-circuit current that may be caused by a short circuit in the cubicles is limited by a resistance box mounted externally.

Although both Visual and Aural Amplifiers operate from a common high-voltage rectifier, d-c switches permit operation of either as desired. The Aural Amplifier can be operated with the rear door of the Visual Amplifier cubicle open; conversely, the Visual Amplifier can be operated with the rear door of the Aural Amplifier cubicle open. This allows tube replacement and minor servicing to be done on one section while the other is being operated. For a detailed discussion of the control system, see THEORY AND CIRCUIT ANALYSIS, CONTROL CIRCUITS section.

COOLING SYSTEM

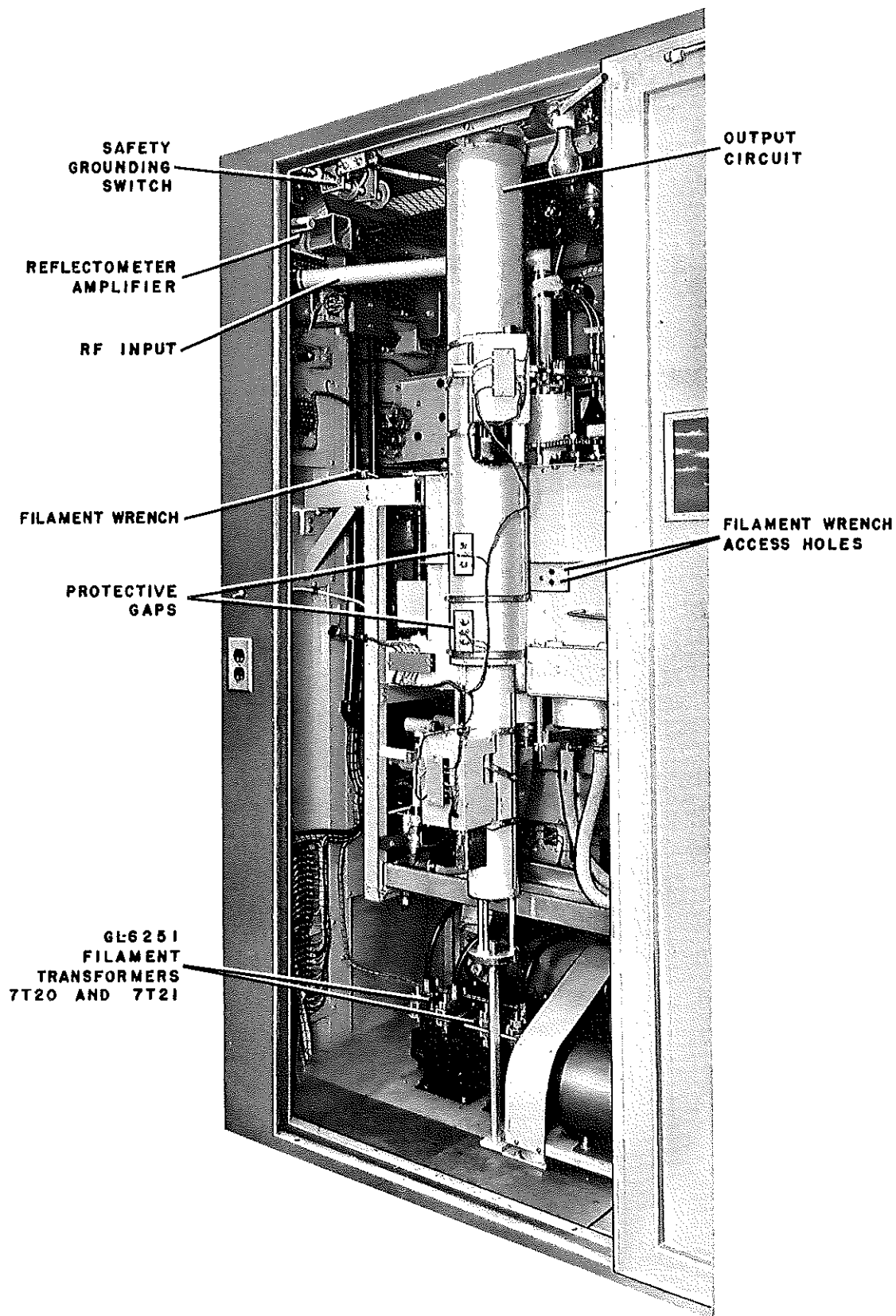
Forced air is used for tube seal and cubicle cooling. Internal blowers are provided for seal and cubicle cooling in the Visual and Aural Amplifier cubicles. The customer may remove these blowers and mount them externally if it is desired to minimize air noise. See Fig. 8 for the alternate mounting of these blowers and for drawings of the extra duct work required.

The anodes of the Amplifier tubes are cooled by water. The circulating pump and heat exchangers are externally mounted.

The Rectifier cubicle is cooled by two exhaust fans located in the roof which draw cooling air through a filter in the rear door. In addition, there are two small blowers which direct air at the bases of the GL-829-B rectifiers to aid in mercury condensation.

A combined exhaust duct for all units can be used for the removal of warm air provided that an exhaust fan is installed in the duct. This fan should be capable of moving approximately 1800 cfm of air against the duct resistance to prevent back pressure in the duct from retarding or unbalancing the exhaust air flow from the cubicles.

The blowers supplied in the Visual and Aural Amplifier cubicles are a belt-driven type. Adjustable shives permit changing the speed of the fan to compensate for 50-cycle or high-altitude operation.



(4-6805)

Fig. 15 Rear and Left Wall View of Aural Amplifier Cubicle

EXTERNAL EQUIPMENT

In addition to the water pump and heat exchangers, the external equipment consists of the plate transformer, Visual and Aural filter reactors, delta-wye switch, main plate circuit breaker, resistor box, Vestigial-Sideband Filter, Harmonic Filters, Visual and Aural reflectometers, and transmission-line elements designed to measure the response of the Amplifiers and monitoring points required for the proper operation of the equipment.

The transformer, filter reactors, resistor box, plate circuit breaker, cubicle power disconnect switch, and delta-wye switch are enclosed in sheet metal cases for safety protection to personnel.

An externally mounted constant-impedance line stretcher is supplied as part of the Visual Amplifier input circuit.

POWER FEED

The 208/230-volt three-phase power for the plates of the high-voltage rectifier does not go directly to the cubicles because the air circuit breaker and transformer are external. Since the air circuit breaker has an interrupting capacity of 25,000 amperes, it may in most cases be connected directly to the incoming power lines without additional protection.

The externally mounted switch 5S1 which carries the remainder of the incoming power has an interrupting capacity of 15,000 amperes and, therefore, in most cases may also be connected directly to the incoming power lines without additional protection.

DRAWINGS AND SYMBOLS

A list of the drawings, numbered and titled, in the order in which they are included may be found in the front of this book.

A letter, preceded and followed by a number, designated the circuit components according to type, as, for example, C for capacitor, R for resistor, etc. The number preceding the type letter indicates the cubicle in which the component is located (5 designating external items, 6 the Rectifier cubicle, 7 the Aural cubicle, and 8 the Visual cubicle). An exception to this

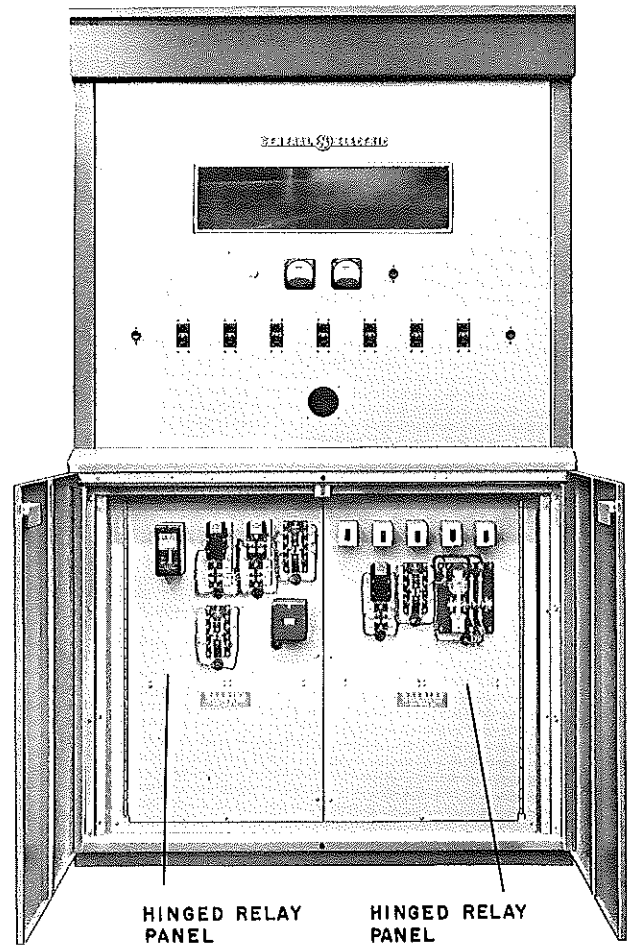


Fig. 16 Front View of Rectifier Cubicle with Access Doors Open (4-3489)

is the Sweep Generator which is identical in both Visual and Aural units and carries the prefix 8. The number following the type letter indicates the number of the part in that unit. All parts are listed alphabetically by symbol numbers in the Parts List, which also includes a description and a drawing number for each. Terminal board numbers are followed by a dash and the particular terminal number.

All controls on the Amplifier are labeled by name. All components in the Amplifier, wherever possible, are stamped with their symbol numbers for easy identification and are similarly identified in drawings.

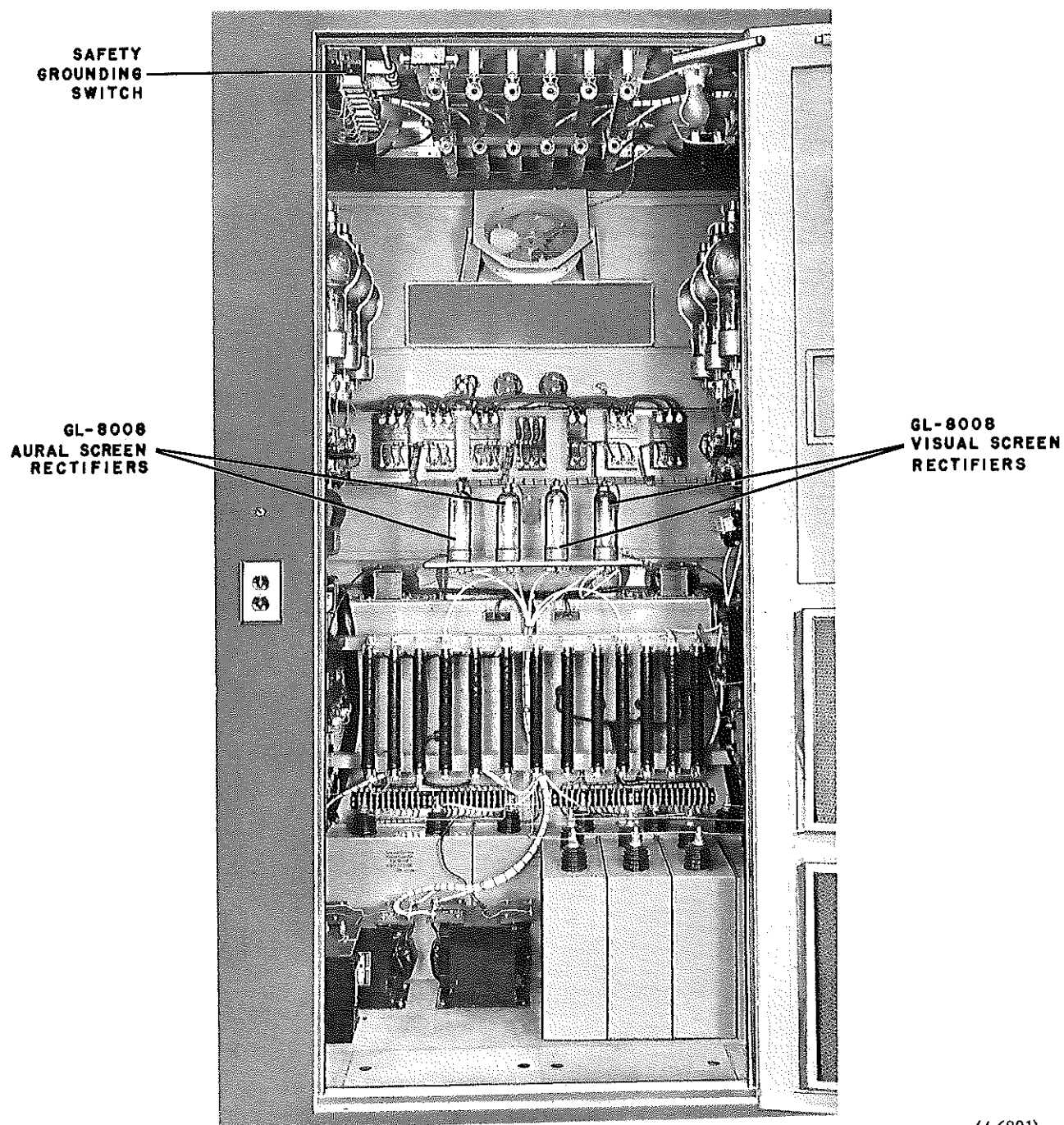
INSTALLATION

UNPACKING

Inspect each package as it is received for possible shipping damage. Claims for damaged equipment must be filed against the carrier within ten days of delivery or the carrier will not accept the claim. When the equipment is delivered to the carrier by the General

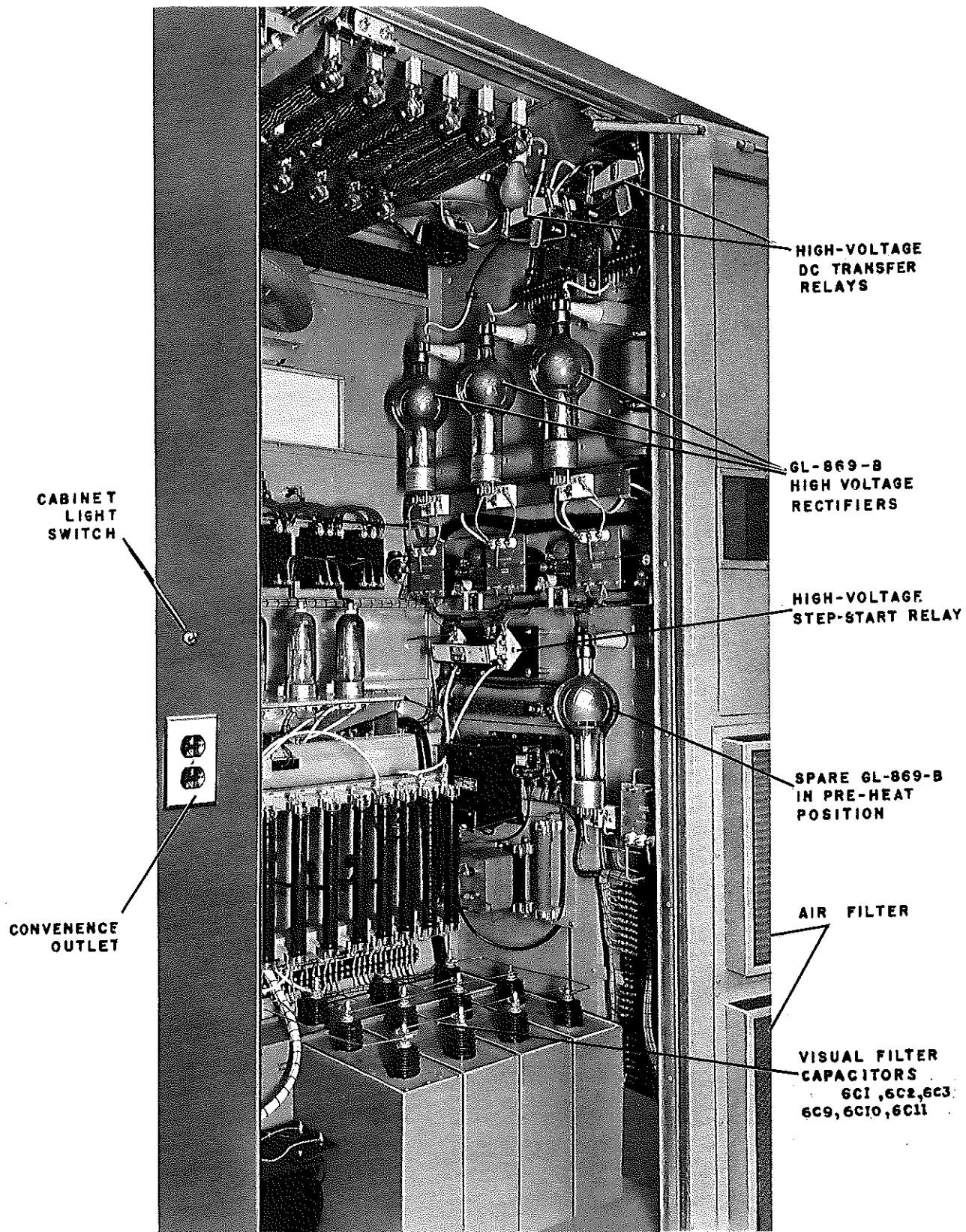
Electric Company, it becomes the property of the customer.

Check the equipment received against the shipping list. The packing cases of all units are stenciled with a number. If there is a shipping error or if, because of damage, replacement equipment must be ordered, notify the General Electric Company representative.



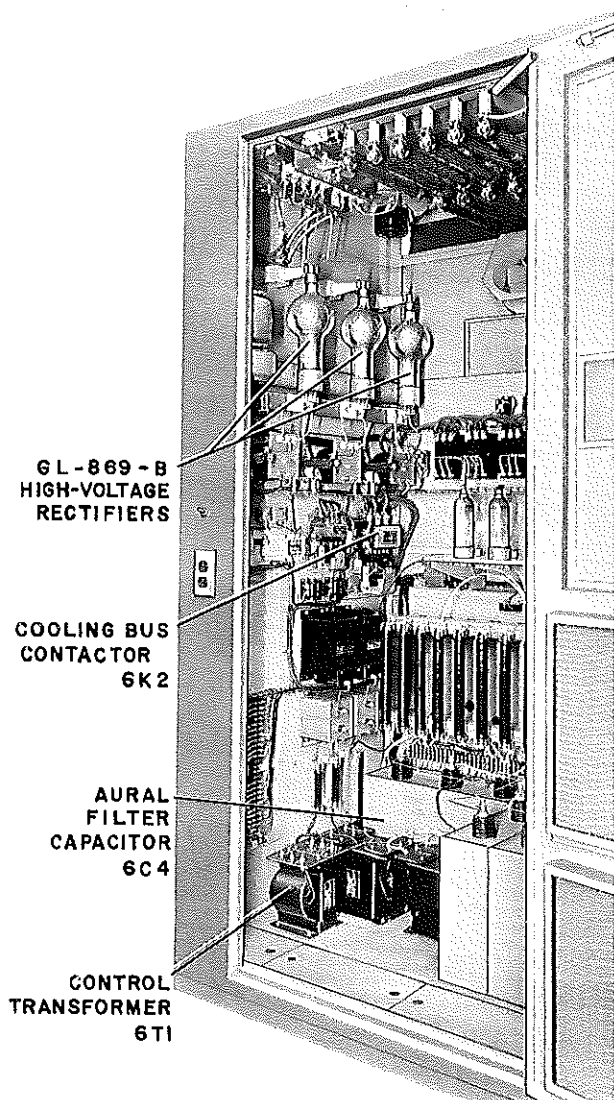
(4-6801)

Fig. 17 Rear View of Rectifier and Control Cubicle



(4-6798)

Fig. 18 Rear and Right Wall View of Rectifier and Control Cubicle



(4-6799)

Fig. 19 Rear and Left Wall View of Rectifier and Control Cubicle

The shipping list designates the various boxes by number and the contents by name, symbol number, and drawing or model number, thus permitting positive location and identification of all units.

All tubes and crystals are separately packed and listed on the shipping list by type and symbol number for ease in identification when they are installed. All loose items such as contactor arms are securely tied. Inspect these points and remove the fastenings. Any disassembled part which required the removal of screws, nuts, and other fastenings, has these parts attached either to the assembly or sub-assembly to insure ease in their location in the installation. The best procedure, however, is to locate the Amplifier cubicles permanently before reinstalling any of the components that have been removed to facilitate shipping.

Be sure to remove the wooden shipping support with care from inside the cavity.

Handle all electronic tubes and quartz crystals with care.

If the Amplifier site is not completed by the time the equipment is received, leave the units packed and place the boxes in a safe, dry place. This will prevent dust and dirt raised by sweeping, plastering, or drilling from settling into the electrical components, thereby causing serious maintenance problems later.

LOCATION

The three cubicles of the Amplifier may be placed in any physical relationship to each other or to the driving transmitter with the exception that it is best to locate the Visual Amplifier cubicle as close to the Visual driver as possible. Two removable end caps are provided for the end cubicles of a series. It is not necessary to locate the Rectifier cubicle where it may be seen during operation. Figs. 8 and 21 show possible floor plans of the Amplifier when used with General Electric drivers. Wiring ducts or conduits should be provided between the cubicles and between the Rectifier cubicle and the external equipment. See Figs. 61 and 81 for wire sizes and amount of wiring required between the various units. At the customer's option the interconnecting wires may be run through 4-inch square ducts overhead, since cutouts for this type of wiring duct are provided in the roof of each cubicle.

Other factors to be considered in laying out the station are the following: provision for incoming power supply lines and good ground connection; proper transmission-line, diplexer, and vestigial-sideband filter supports; and proper illumination. Sufficient space must be left in the front and the rear of the cubicles to permit the opening and closing of the cubicle doors.

If this equipment is to be operated in a locality where weather below freezing is expected, provision must be made to protect the piping of the cooling system, the heat exchangers, and the water tank from freezing. Attention should be given to the problem of preventing the air which circulates through the heat exchangers from dropping below the freezing point even during operation, since it is possible to freeze the water in the heat exchangers while the equipment is operating.

If a cubicle is to be hoisted, it should be left boxed until it has been approximately located in the over-all layout. If, however, the cubicle has been uncrated, it can be lifted by making use of the removable screw lifting lugs located in the top corners of each cubicle. To give a straight upward pull, use a spreader bar when lifting. The front door assemblies and end pieces are removable.

If the stainless steel trim strips above the front doors are out of line, loosen the four screws located

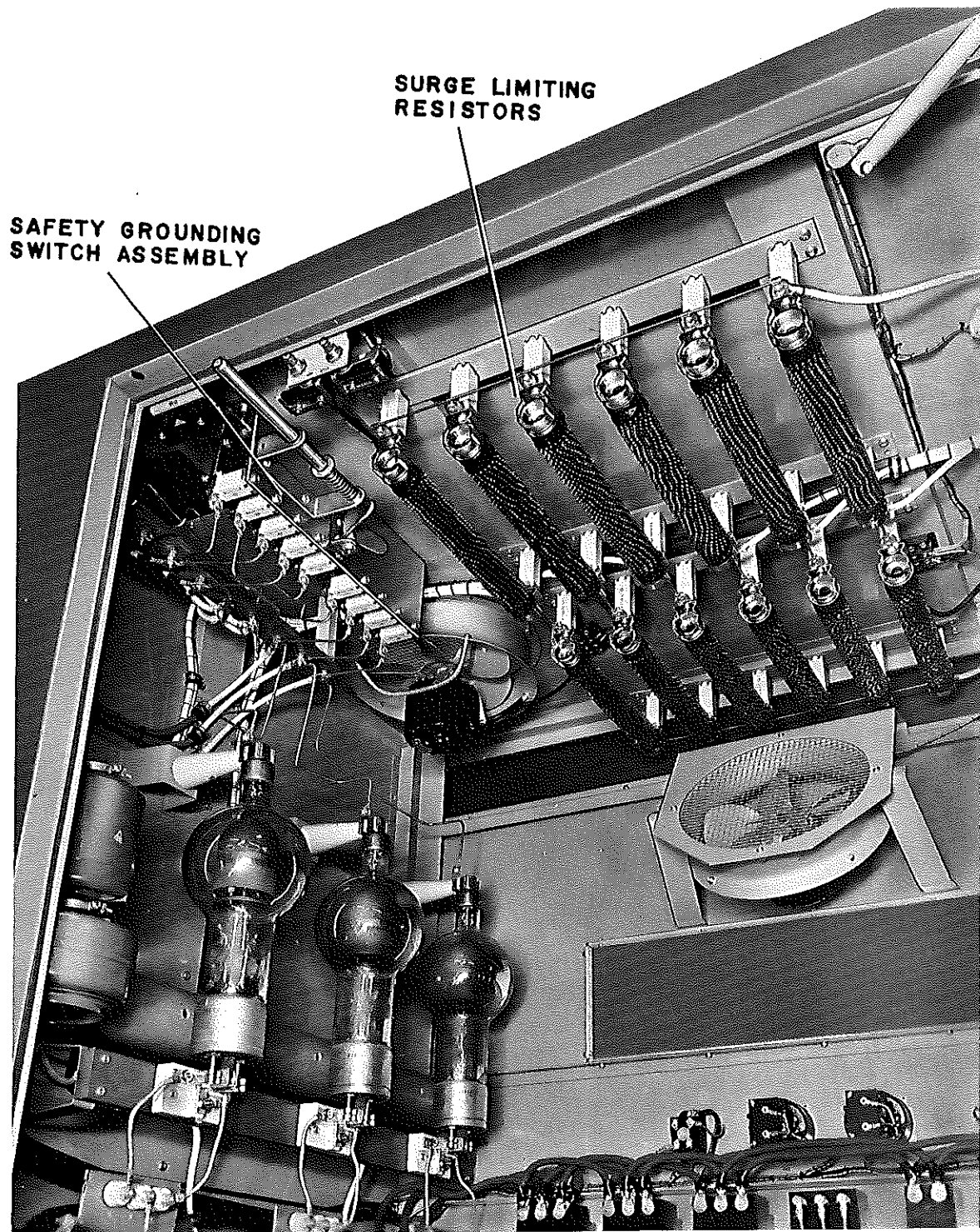


Fig. 20 Detail View of Rectifier and Control Cubicle Showing Grounding Switches

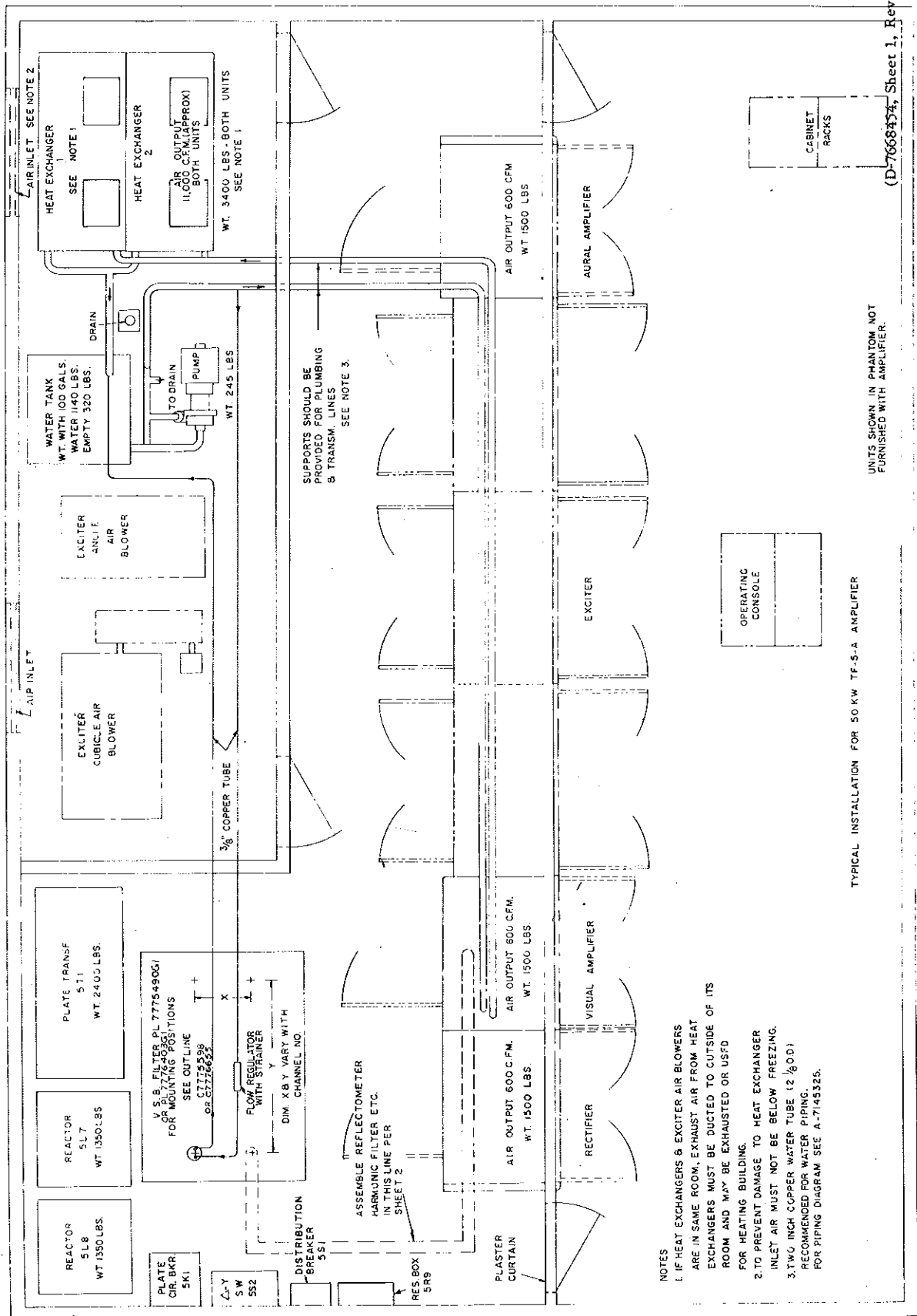


Fig. 21 Suggested Layout, TT-6-E Driver

near the front door hinges. The trim strip can then be adjusted until it is properly aligned.

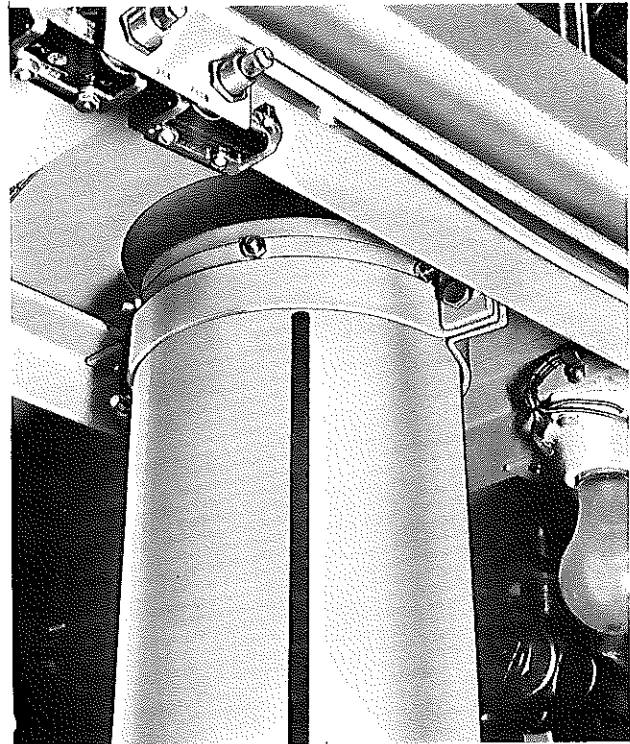
INSTALLATION OF OUTPUT TUNING ASSEMBLY

See Fig. 22.

To prevent damage during shipment, the output tuning assembly is removed from the Amplifier cubicles and separately packaged.

Refer to Figs. 23 through 25, which show the method of assembly of this unit to the RF cavity. Fig. 26 shows the location of the screws which connect the output tuning assembly to the Amplifier cavity. A box-end ratchet wrench is supplied to facilitate the adjustment of the 1/4-20 hex-head bolts shown in Fig. 26.

The bottom of the output circuit rests on a screw arrangement to allow precise alignment of the height of the assembly in the cubicle. The assembly should be pushed in snugly against the cavity. Two shield covers are supplied to cover the opening on each side of the coupling loop. These covers are secured to the cavity proper by two Phillips-head screws for each



(4-4788)

Fig. 23 Top Assembly of Output Circuit.

cover and to the barrel of the output tuning assembly by two wrap-around clamps.

WIRING

All external wiring is normally supplied by the customer. Refer to Figs. 61 and 81 for interconnections and wire sizes.

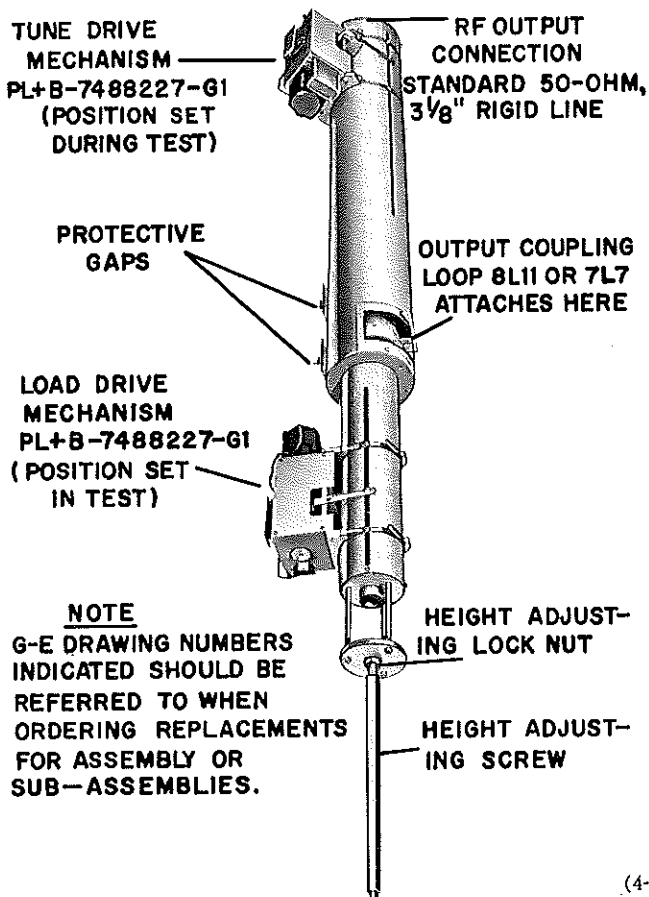
The RF input lines to both Amplifiers are RETMA standard 50-ohm, 1-5/8 inch standard line. Two adapters to connect from 1-5/8 inch, 50-ohm, to 1-5/8 inch, 51.5-ohm line are supplied with this equipment. The RF output lines of both Amplifiers are RETMA standard 50-ohm, 3-1/8 inch transmission line. The amount of external transmission line and transmission-line fittings needed is determined by the relative location of the diplexer, Vestigial-Sideband Filter, dummy load, driving transmitter, and antenna and is normally supplied by the customer. See Fig. 27 for the proper connection sequence of the transmission-line elements.

INSTALLATION OF PLUMBING

The plumbing in the Aural and Visual Amplifier cubicles was thoroughly cleaned inside when the Amplifier was in test at the factory.

The coils of the heat exchanger, and the water pump, were cleaned by the manufacturer.

To prevent contamination of the water system care should be taken when installing the interconnecting



(4-4796)

Fig. 22 Output Circuit Assembly, PL&D-7669025-G1

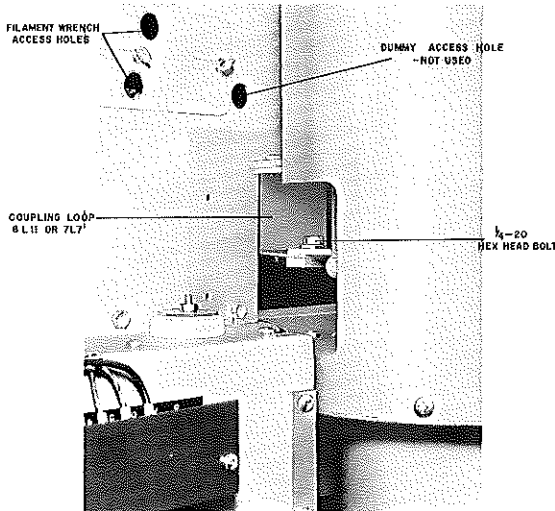


Fig. 24 Cavity Connection to Output Circuit Assembly,
Covers Removed (4-4787)

plumbing. All pipes and fittings must be copper or brass and must be clean inside. Care should be taken to prevent solder flux from getting inside the piping. Pipe joint cement should be used only on the male threads of the threaded pipe fittings. If these precautions are taken during installation, the procedures listed under Preparation for Use of the OPERATION section will result in a clean system without further difficulty. See Figs. 28 and 29 for the installation sequence and the location of components.

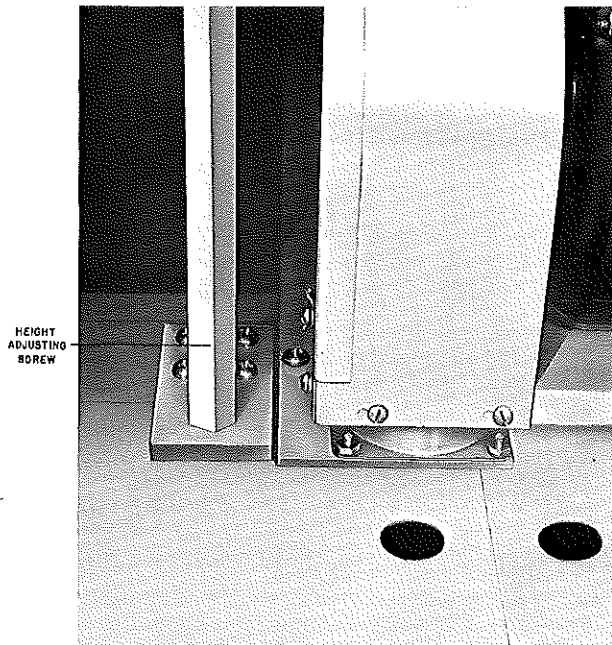


Fig. 25 Bottom Support for Output Circuit Assembly (4-4791)

50-CYCLE OPERATION

The Amplifier as shipped is connected for 60-cycle operation. The following changes must be made for 50-cycle operation.

1. The wire on terminal X3 of the control transformer 6T1 should be moved to X2. This changes the control circuit voltage from 115 volts to 96 volts for proper operation of a-c relays and contactors.

2. Two 50-cycle filament time meters (G-E Drawing P-3R142-P6) should be ordered and installed in place of the 60-cycle meters, 6M1 and 6M2.

3. Move the lead on 7T21-terminal 2 to 7T21-terminal 3. Move the lead on 7T20-terminal 2 to 7T20-terminal 1 and 7T20-terminal 4 to 7T20-terminal 5.

Move the lead on 8T13-terminal 2 to 8T13-terminal 3. Move the lead on 8T12-terminal 2 to 8T12-terminal 1 and 8T12-terminal 4 to 8T12-terminal 5.

4. Refer to Fig. 6. On the chart under the outline of the heat exchanger there is given the RPM for various conditions of operation. Set the adjustable shives on this unit to obtain the correct RPM on the fan shaft.

5. Refer to Fig. 4. The speed of the blower unit shown in this figure should be set at 3110 RPM by means of the adjustable shives in the Visual and Aural Amplifier cubicles.

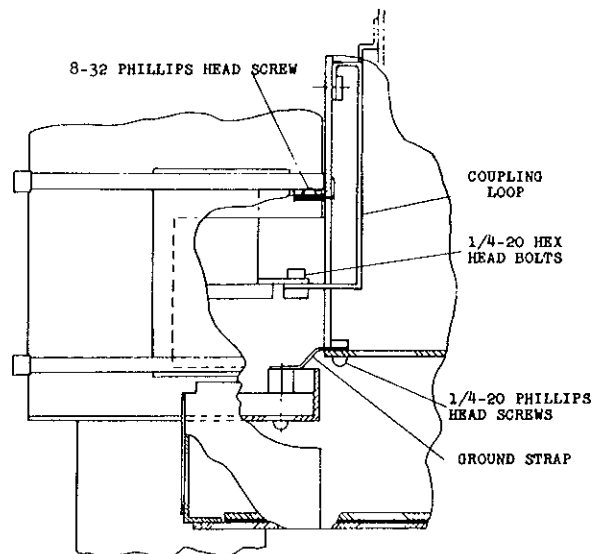


Fig. 26 Output Coupling Connection (A-7991230)

TUBE INSTALLATION

See Figs. 30 through 32.

All tubes with the exception of the General Electric Type GL-6251 are installed in the normal manner.

The sockets for the Type GL-6251 amplifier tubes are plug-in except for the filament connectors. Clamp

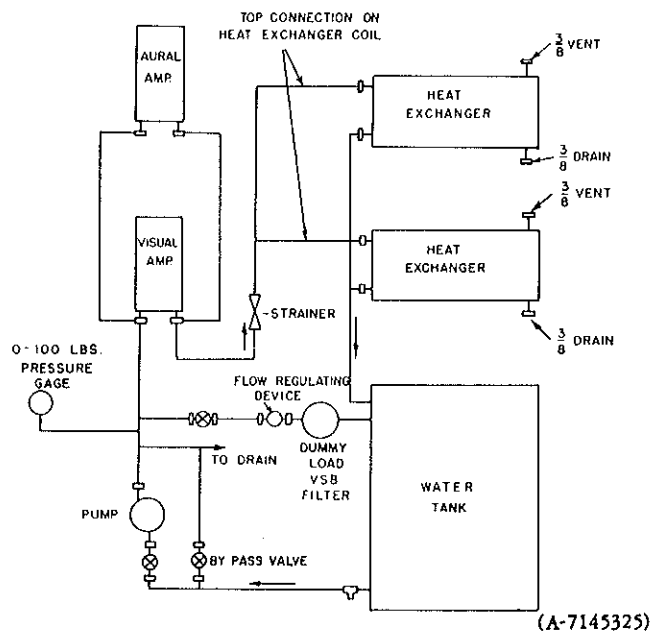


Fig. 28 Piping Diagram

type filament connectors are used to eliminate the possibility of contact heating due to high contact resistance.

When installing the GL-6251 tubes in their sockets, push them up into the socket with a slight clockwise rotation (to make for a good contact and to prevent damage to the springs). A line drawn through the water connections must be parallel with the front of the cavity. The clamping block hanging from the front of the cavity is then placed between the water connections and tightened by means of the wing nut on the supporting post on the rear of the cavity. When the tube is in place, it will be resting on the clamping block.

To tighten the filament connectors, insert the filament wrench through the hole in the side of the circuit exposed by pushing back the corner plate and turn it slowly until it engages the Allen cap screw. It is necessary to tighten the tube filament connector only until it is firm. Excessive pressure may damage the clamp. There are two connectors per tube that must be tightened.

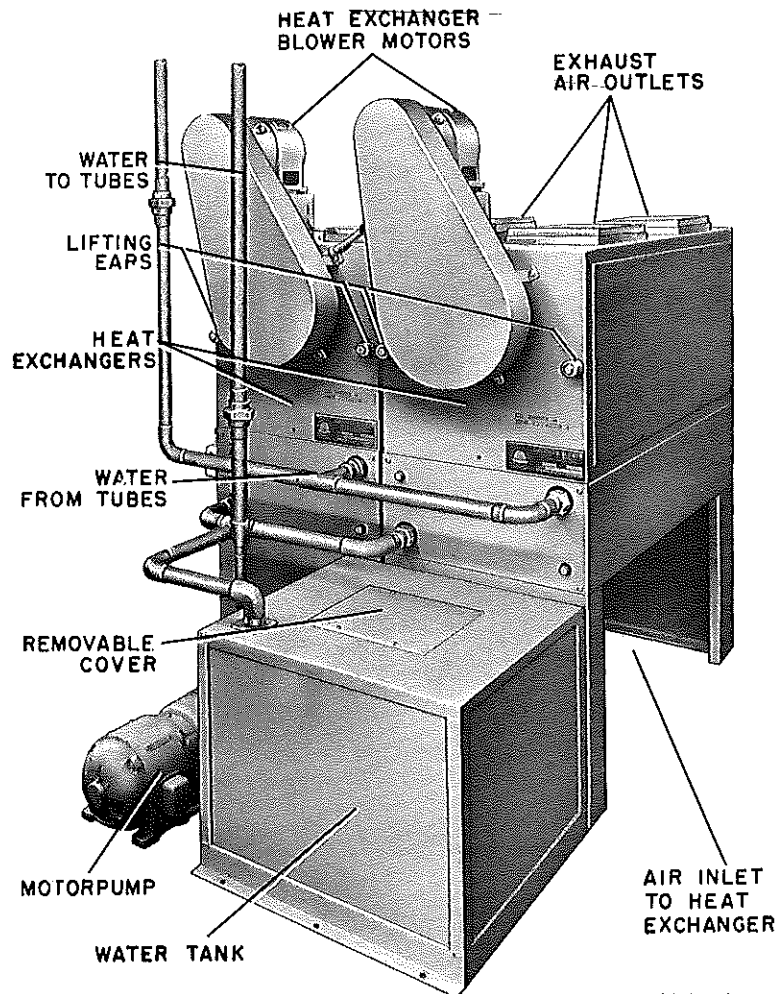


Fig. 29 Heat Exchanger, Water Tank, Water Pump

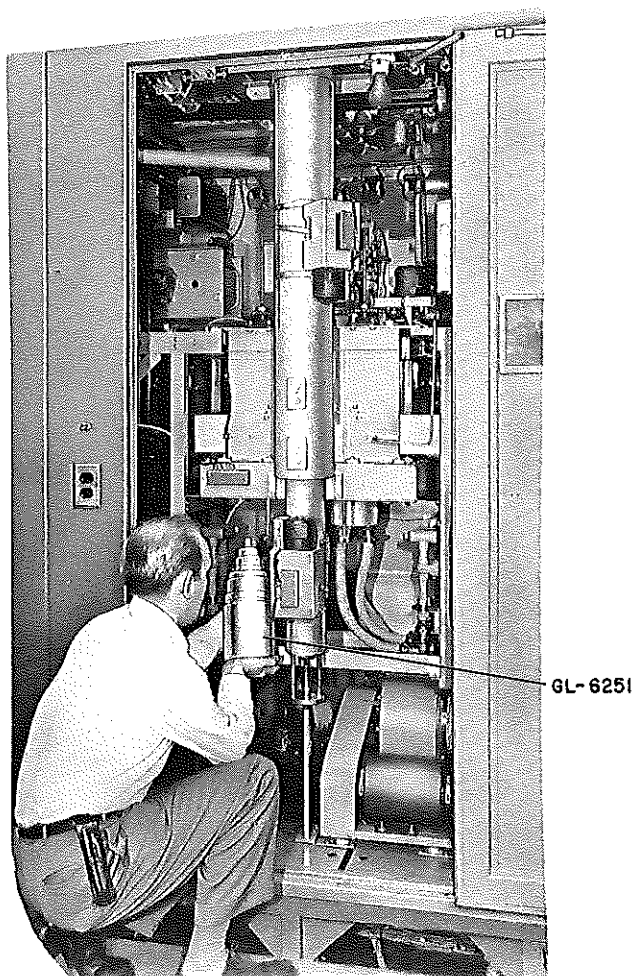


Fig. 30 Tube Installation - A

(4-4897)

The water connections to the anode are made with quick disconnect fittings to the mating connections on the tube. Make certain that the fittings are firmly seated on each connection before turning on the water. The correct direction of flow must be observed. The tube jacket is labeled IN for the water inlet. As observed from the rear of the cubicle the label IN on the tube should be on the left. The inlet and outlet connections are labeled at the valves.

When removing a tube, first shut off both water valves associated with the tube to be removed, shutting off the inlet valve first. Remove the hoses supplying water to the tubes at the quick disconnect fitting immediately underneath the shut-off valves and allow the water in the tube to drain into the drain pan. Then insert the filament wrench and loosen both filament clamps. Ordinarily it is necessary only to loosen the clamp screw. If the connector tends to hold when the tube is lowered, it may be necessary to back the clamp screw out to the point where the filament clamp is slightly spread apart. Back the screw only sufficiently to release the filament. The holding clamp bar

is then loosened from the post on the rear of the cavity and allowed to drop clear. The tube may then be removed by turning it slightly clockwise (to prevent damage to the spring) as it is lowered.

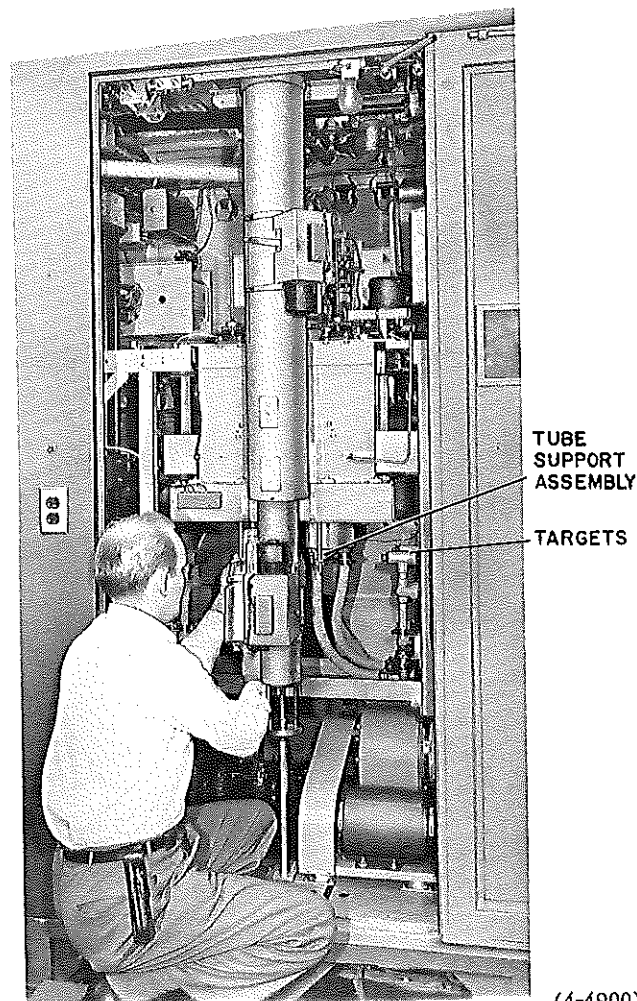


Fig. 31 Tube Installation - B

(4-4900)

INTERLOCKS WITH DRIVING TRANSMITTER

Since the Amplifier operates grounded-grid, there is no load on the exciter until the Amplifier plate voltage is on and the plate current is flowing. It is therefore necessary to interlock the exciter so that there will be no power output unless there is plate voltage on the Amplifier.

It is also necessary to provide interlocks so that there can be no excitation power to either Aural or Visual Amplifier when either SWEEP-OPERATE switch is in the SWEEP position. This will prevent accidental burn-out of the germanium sweep diodes on the Amplifier output transmission lines.

The necessary interlocking between the Type TF-5-A Amplifier and the G-E Type TT-6-E Transmitter

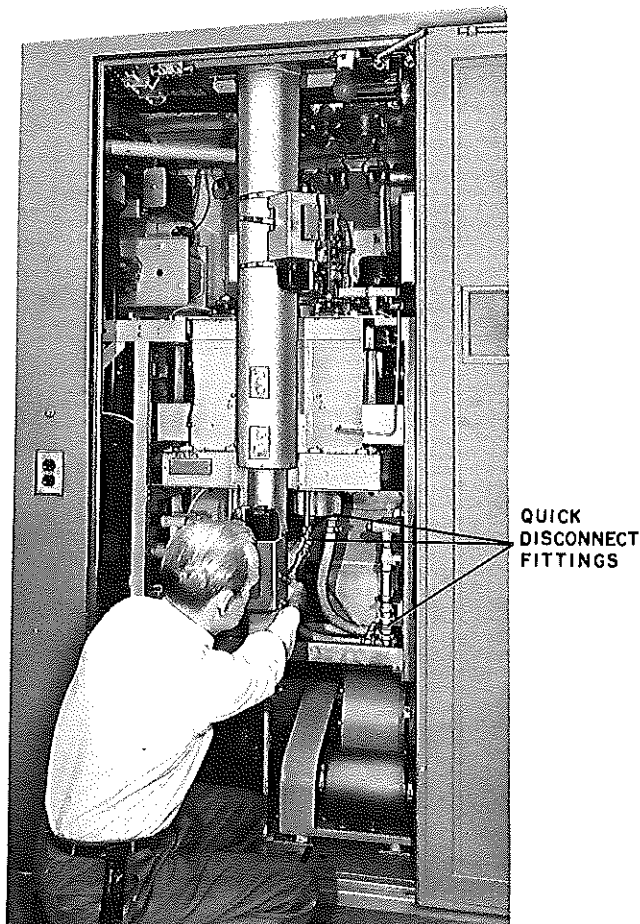


Fig. 32 Tube Installation - C

(4-4898)

used as a driver is as follows (all wires should be 16-gauge, 600 volts d-c):

- REMOVE wire from 2TB501-8 and 1TB311-1 (in the intercubicle harness of the Type TT-6-E Transmitter).
- CONNECT from 5K1-7 to 1TB311-1
8TB7-5 to 2TB501-8
8TB7-6 to 7TB2-9.
(Removes plate power from the Visual exciter on the TT-6-E when the Visual Amplifier is in the SWEEP position or plate voltage is not on the Visual Amplifier.)
- REMOVE internal wire going to 3T802-3 and
- CONNECT this wire to 3TB3-2.
- CONNECT from 3TB3-5 to 3T802-3
5K1-9 to 3TB3-2
7TB2-7 to 3TB3-5.
(Removes drive to the Aural Amplifier when plate voltage is not applied to the Aural Amplifier.)

- CONNECT from 7TB1-5 to 3TB2-3
7TB1-6 to 3TB2-4
7TB1-5 to 8TB7-9
7TB1-6 to 8TB7-10.

(Turns Aural driver off when either the Aural or Visual Amplifier is in the SWEEP position.)

- CONNECT from 1TB307-9 to 7TB1-3
1TB307-1 to 7TB1-2.

(Turns off the Visual driver when the Aural Amplifier is in the SWEEP position.)

If another type transmitter is used as the exciter, ways and means must be found to provide the same interlocking functions as those described above.

EXTERNAL SAFETY SWITCH

Electrical codes generally require that a visible disconnect switch be located adjacent to any rotating machinery in order to disable the machinery during servicing operations. Refer to Note 20 on the Interconnection Diagram, Fig. 61. If desired by the customer, a switch may be placed in the same location as the heat exchangers and water pump and connected between 6TB9-12 and 6TB10-4 in place of the jumper called for. As may be seen from the Rectifier Elementary Diagram, Fig. 72, interrupting this circuit at this point will prevent the closing of 6K2, the cooling contactor. No voltage can be supplied to the motors until 6K2 closes.

REMOTE METERS

The leads on the ground side of 7M10, the Aural power level meter, and 8M12, the Visual power level meter, have been brought out to terminal boards to facilitate the installation of remote indicating meters if so desired. Referring to Fig. 68 for the Aural Amplifier cubicle, it will be seen that removing the jumper between 7TB2-2 and 7TB2-1 and installing a 200-microampere meter in its place will allow a remote indicating meter to be placed wherever desired. Referring to Fig. 65 for the Visual Amplifier cubicle, the jumper is between 8TB3-2 and 8TB3-1. Meters identical to those used in the Amplifier may be ordered by specifying G-E Drawing P-3R91-P12.

PROTECTIVE GAPS

Protective gaps are provided at various points in this equipment. The following spacing is set at the factory and is given here for the customer's reference:

Plate Transformer - Spherical Gaps, 0.463 inch
 Reactor - Gaps, 0.1875 inch
 Plate Lead Protective Gap on Cavity (see Fig. 55),
 0.180 inch
 Screen Contact Plate Protective Gap Inside Cavity
 (see Fig. 54), 0.020 inch
 Protective Gaps on Output Tuning Assembly (see
 Figs. 10 and 22), adjusting screw projects 0.8 inch
 from the mounting plate

INITIAL LUBRICATION

Before the equipment is first operated, the following points should be lubricated, using the "General Electric Grease for Ball and Roller Bearing Motors." A one-pound can of this grease is supplied with the equipment.

"Motorpump" Water Pump - Remove the relief plugs from each end of the motor and grease the motor, using a grease gun until grease appears at the relief plug holes. Do not replace the relief plugs until the pump has run for 15 minutes.

Motors on the Heat Exchanger Blowers - Remove the relief plugs from each end of the motor and grease as described above.

Bearings on the Heat Exchanger Fan Shaft - Grease with General Electric Grease, using a low-pressure grease gun. Two strokes of the gun will be sufficient. Do not use a high-pressure gun or over-grease these bearings, since the grease seals may be ruptured.

All other bearings and motors are initially lubricated.

See the MAINTENANCE section for routine lubrication.

OPERATION

PREPARATION FOR USE

1. Wire check all interconnecting cables.
2. Inspect the installation for cleanliness.
3. Install all tubes (see Tube Installation under INSTALLATION) and the sweep generator crystals (refer to the Parts List).
4. Place all of the Amplifier breakers and the AUTO RECLOSER switch in the OFF position.
5. Turn the REG LINE VOLTAGE control as far counterclockwise as it will go.
6. Close the external disconnect switch 5S1, energizing the power input to the cubicles.
7. Close the REG LINE switch 7S7 on the front panel of the Aural Amplifier cubicle.
8. Check the regulated line voltage on the REG LINE VOLTAGE meter 7M8 (in conjunction with the REG LINE VOLTAGE switch 7S16). Adjust the regulated line voltage by means of the REG LINE VOLTAGE control 7T14 to an average phase voltage of 230 volts.
9. Close the CONTROL breaker 7S12. The green AMPLIFIER START push button and the AUTO RECLOSER switch supervisory lights should be illuminated.
10. Press the AMPLIFIER START push button. The Aural and Visual AIR supervisory lights should come on, indicating no air flow to the tube.
11. Momentarily close the AURAL BLOWER switch mounted on the Rectifier panel and observe the rotation of the Aural blower as it coasts to a stop. Looking at the blower from the pulley end, the shaft should be rotating in a clockwise direction. If the rotation is incorrect, reverse the leads going to terminal 6TB7-1

and 6TB7-2. Check the rotation of the Aural blower again as described above. It will now be correct.

Momentarily close the VISUAL BLOWER switch and observe the rotation of the Visual blower as it coasts to a stop as described above. If the corrections have been correctly made, this motor rotation should be correct. If it is not, reverse the intercubicle leads going to 8TB8-10 and 8TB8-11.

Close the AURAL and VISUAL BLOWER switches located on the front panel of the Rectifier cubicle. The main blowers should come up to speed, and the AIR supervisory lights should be extinguished, indicating that air flow to the tubes has been established. If the supervisory lights are not extinguished, the following conditions may exist:

a. The filament-wrench interlock may be open because the filament-wrench has not been restored to its storage position.

b. The air interlock switch may be defective.

12. Momentarily close the BLOWER 1 switch on the Rectifier cubicle panel and observe the rotation of the blower on the heat exchanger as it coasts to a stop. The rotation as viewed from the pulley end should be counterclockwise. If the rotation is incorrect, reverse the interconnection leads going to 6TB1-1 and 6TB1-2. Repeat the above procedure to check for proper rotation.

13. Momentarily close the BLOWER 2 switch on the Rectifier cubicle panel and observe the blower on the heat exchanger as it coasts to a stop. The rotation observed should be the same as that indicated in step 12 above. To reverse the rotation of this unit, reverse the leads going to 6TB1-4 and 6TB1-5.

14. Open all the water valves in the Visual and

Aural cubicles. Check to make sure that all the quick disconnect fittings are properly seated. Open the bypass valve on the water pump all the way. Fill the water tank half full with ordinary tap water. Momentarily close the WATER PUMP switch on the Rectifier cubicle panel and observe the rotation of the water pump as it coasts to a stop. The correct rotation for this unit is indicated by an arrow on the nameplate of the pump. If the rotation observed is incorrect, reverse the leads in the interconnection cable going to 6TB1-7 and 6TB1-8. Turn on the WATER PUMP switch. Without closing the bypass valve on the water pump, inspect the plumbing system for leaks. Start closing the bypass valve on the water pump slowly and continue to inspect the plumbing for leaks. Add tap water to the water tank to replace the water used in filling the system.

Looking through the window of the Visual and Aural Amplifier cubicles, note the readings on the water pressure meters labeled LEFT WATER, RIGHT WATER, and OUTLET WATER. The reading on the

LEFT WATER and RIGHT WATER pressure meters will be higher than that on the OUTLET WATER pressure meter. Continue closing the bypass valve on the water pump until the pressure difference between LEFT WATER or RIGHT WATER and OUTLET WATER is 7.2 pounds in each Amplifier cubicle. These pressure meters are connected across each water flow interlock, and, referring to the graph in Fig. 33, it can be seen that a 7.2-pound difference across the flow interlock corresponds to a water flow of 12 gallons per minute through the tube.

After the procedure described above has been completed, both WATER supervisory lights on the front panels of the Visual and Aural Amplifier cubicles should be extinguished.

15. Close the RECT BLOWER switch. The Rectifier cubicle exhaust and tube blowers should start.

16. Close the RECT FILAMENT switch. The Rectifier filaments should light.

17. Close the MAIN FILAMENT and LP FILAMENT switches on both the Visual and Aural Amplifier cubi-

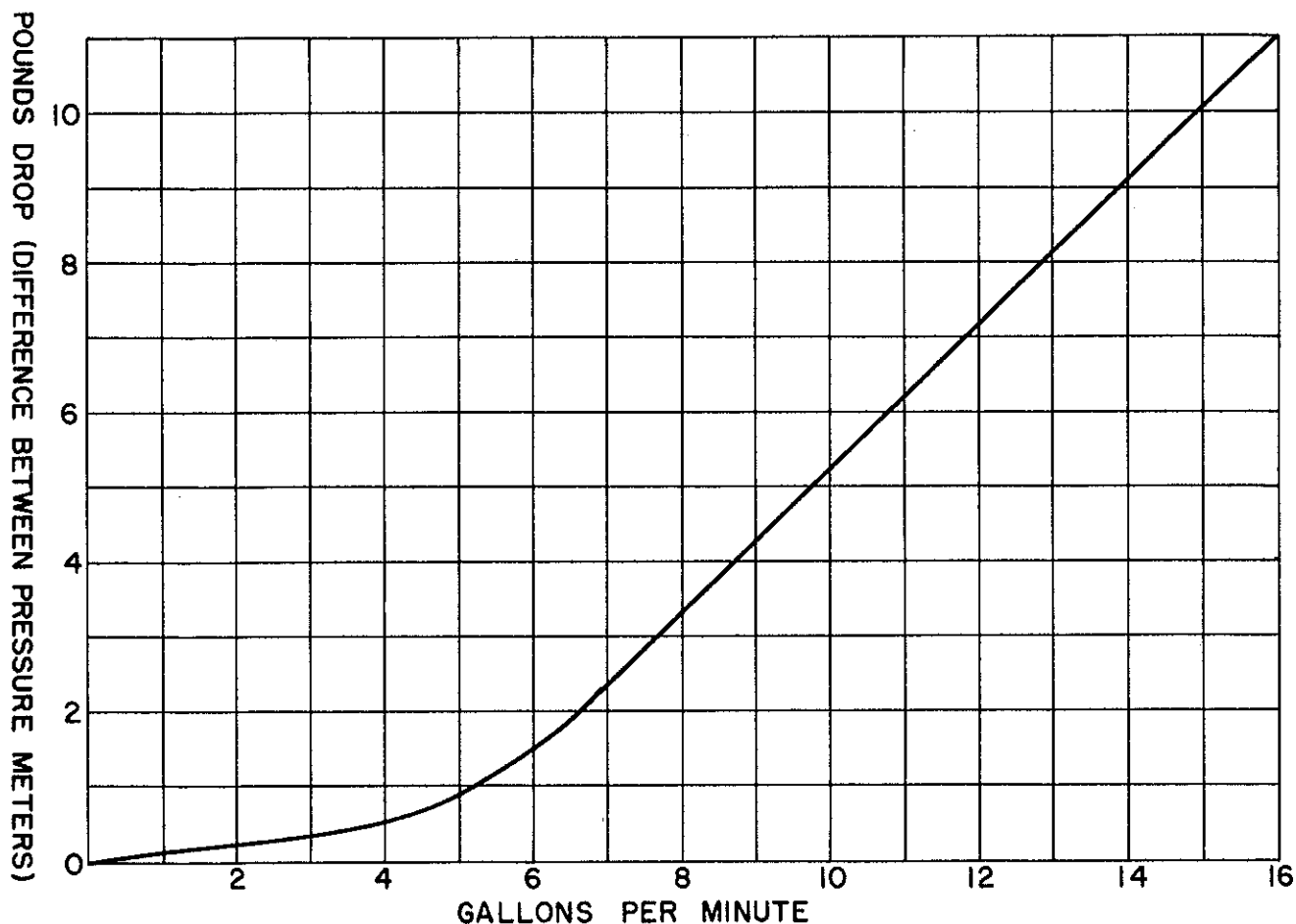


Fig. 33 Graph of Water Flow versus Pressure

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**TABLE SHOWING TRANSFORMER TAPS
FOR FILAMENT TRANSFORMER
VOLTAGE CONTROL**

8T9 Secondary					8T10 Secondary		
8T12 Sec. Voltage	Terminal Numbers For Wires Lettered				8T13 Sec. Voltage	Terminal Numbers For Wires Lettered	
	A	B	C	D		E	F
-4.55%	4	8	9	13	-4.55%	3	7
-2.27%	4	7	9	12	-2.27%	3	6
5.5 volts	4	6	9	11	5.5 volts	3	5
+2.27%	4	5	9	10	+2.27%	3	4
+4.55%	4	4	9	9	+4.55%	3	3
+6.82%	5	4	10	9	+6.82%	4	3
+9.1%	6	4	11	9	+9.1%	5	3
+11.35%	7	4	12	9	+11.35%	6	3
+13.65%	8	4	13	9	+13.65%	7	3

cles. All the filaments in the Visual and Aural Amplifier cubicles should be illuminated. Check the filament voltage on the GL-6251 tubes in the Visual and Aural Amplifier cubicles by means of the PA FILAMENT VOLTAGE meter and the PA FILAMENT-LEFT-RIGHT switch located behind the front access door on the left panel of each cubicle. The voltage should be 5.5 volts ± 0.15 volt for each tube when the regulated line Powerstat* is set to give a regulated line voltage of 230 volts average on all three phases as measured on the REG LINE VOLTAGE meter. The filament voltage may be adjusted by means of the "buck-boost" transformers 7T18 and 7T19 in the Aural Amplifier cubicle.

The amplifier filaments are provided with separate means of control so that their voltage may be adjusted independently. A FILAMENT VOLTAGE meter with a selector switch is provided so that each tube may be metered independently. The filament voltage of each tube should be adjusted as nearly as possible to the nominal rating of 5.5 volts. By use of taps on the secondaries of the two Scott-connected "buck-boost" transformers 8T9 and 8T10 sufficient variation of voltage may be obtained to correct for transformer winding tolerance, filament wiring voltage drop, or voltage unbalance on the input line. A change of taps on 8T9 affects the filament voltage of the left tube; a change of the taps on 8T10 affects the filament voltage of the right tube.

If the voltage is slightly off after a tube change during operation, it may be reset after normal shutdown.

The preceding discussion concerning the Visual Amplifier also applies to the Aural Amplifier, 7T18

and 7T19 being equivalent to 8T9 and 8T10, respectively.

18. Open the valve and allow the water to circulate through the dummy load on the Vestigial-Sideband Filter. Correct flow is insured by the flow regulating strainer supplied with the Vestigial-Sideband Filter.

19. With the HEAT EXCHANGER BLOWER 1 and BLOWER 2 off, allow the equipment to operate until the water has been heated by the filaments of the GL-6251 tubes to a temperature of 120 degrees as indicated by the temperature meters on the Visual and Aural Amplifier cubicles. Hold the water temperature to around 120 degrees by turning on either the BLOWER 1 or BLOWER 2 switch intermittently. After the equipment has been running for half an hour, push the AMPLIFIER STOP push button. After the blowers and pump time out in three minutes, drain the water from the system. Clean out any bits of solder that may be found in the water tank and refill the system with ordinary tap water.

20. Push the AMPLIFIER START button and repeat step 19 except for refilling the water tank.

21. After draining the system, clean out any bits of solder found in the water tank, clean the water strainers, and fill the tank three-quarters full with distilled water.

22. Push the AMPLIFIER START button, turn on the BLOWER 1 and BLOWER 2 switches on the front panel of the Rectifier cubicle. Maintain a supply of distilled water in the water tank to three-fourths of its full capacity. During the first week of operation, skim off any film that may appear on the surface of the water in the tank. It will be noted that the readings of the water pressure meters in the Visual and Aural Amplifier cubicles will "bounce" when the equipment is

* Registered U. S. Patent Office

placed in service for the first time. This results from the air trapped in the lines to the pressure gauges; the "bounce" will diminish and disappear during the first weeks of operation.

AURAL AMPLIFIER

1. Operate the DC SWITCH to the AURAL position.
2. The following switches should be closed on the Aural Amplifier cubicle: REG LINE, CONTROL, MAIN FILAMENT, and LP FILAMENT. The rear door of the Aural Amplifier and Rectifier cubicles must be closed. The Aural time-delay relay 7K2 should have timed out one minute after the MAIN FILAMENT and LP FILAMENT switches were closed, and the Aural FIL TD STATUS and Aural BIAS supervisory lights should be illuminated.

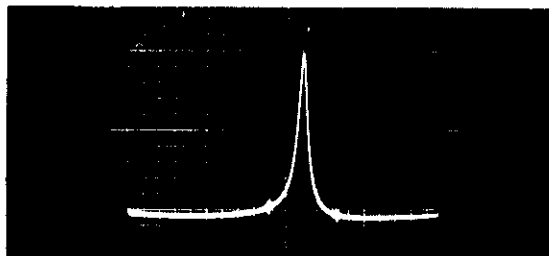


Fig. 34 "Spike" Showing Only Plate Circuit of Aural Amplifier Tuned

3. Close the Aural BIAS switch. The Aural BIAS supervisory light should be extinguished, indicating that Aural bias voltage has been established. Simultaneously, the lamps in the green RECTIFIER ON push buttons of the Aural and Visual Amplifier cubicles and the green RECT ON push button of the Rectifier cubicle should be illuminated.

4. Operate the BLANKING, MARKERS, FILAMENT, and MOTOR switches on the sweep generator panel to the ON position.

5. Close the SWEEP switch and operate the OPERATE-SWEEP switch to the SWEEP position. This will apply power to the sweep generator.

6. Normally the sweep generator will be adjusted before shipment from the factory and will need little, if any, further adjustment. If adjustment is necessary, align the sweep generator as described in the THEORY AND CIRCUIT ANALYSIS, VISUAL AMPLIFIER section. Refer to the Parts List for the correct sweep marker crystals to be used in the Aural sweep generator.

7. Connect a high-gain oscilloscope such as a G-E Type ST-2-A to the SCOPE INPUT jack on the sweep generator panel and place the Sweep Generator scope input selector switch in the first DETECTOR position.

8. Align the output circuit of the Amplifier as follows with the Aural output connected to a dummy load:

- a. Place the TUNING motor POWER switch 7S32 in the ON position. The TUNING motor POWER super-

visory light 7I15 should be illuminated, indicating that power is available for operating the tuning motors.

- b. Operate the PLATE TUNING switch 7S29 to resonate the plate circuit. Unless the TUNE (7S30) or output tuning happens to be in resonance, the response obtained by tuning the plate circuit will be a single response which can be tuned to a frequency midway between the marker signals (1.5 megacycles above and below the aural carrier frequency); see Fig. 34.

- c. Operate the TUNE switch 7S30 to resonate the output circuit. Depending upon the output coupling and loading, the resultant response will be either a broader "single-humped" response or a "double-humped" response.

- d. Adjust the LOAD switch 7S31 to obtain a response similar to that shown in Fig. 35, 36, or 37. The correct bandpass is shown in Fig. 37. If the bandpass is too narrow, as shown in Fig. 35, or too wide, as shown in Fig. 36, the coupling must be adjusted. To do this, remove the shield covers on the output circuit on each side of the coupling loop. Then, using the box-end ratchet wrench supplied with this equipment, loosen the 1/4-20 hexhead bolts connecting the coupling loop to the output circuit. If the bandpass was found to be too narrow, the coupling loop should be pushed slightly into the cavity to increase the coupling. If the bandpass was found to be too wide, the coupling should be pulled back toward the output circuit to decrease the coupling. Tighten the hexhead 1/4-20 bolts securely and replace the shield covers before proceeding.

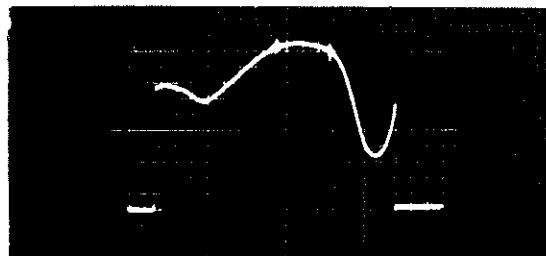


Fig. 35 Aural Amplifier: Correct Bandpass but Too Little Coupling

- e. At this point, mention should be made of the Amplifier neutralization. The neutralization control is located on the front of the plate cavity in the center just above the sweep termination on box (see Fig. 50). The access hole is covered by a small plate which must be moved to make the adjustment.

The neutralization of the Amplifier is not critical, since there is very little feed-through in the tetrode tubes with both grids at ground potential. The neutralizing adjustment is set during factory test and should need no further adjustment. However, if for any reason adjustment is necessary, the following procedure should be used.

With plate and screen voltage off but with grid

bias voltage on (the rear door of the cubicle must be closed), the output circuit response as observed on the oscilloscope may show a small, sharp "nick". This is due to the resonance within the band of the input line between the exciter and the Amplifier. Being unloaded under these conditions, this circuit comprises a high-Q circuit coupled to the plate circuit very lightly through the cathode-plate capacitance in the tubes. Note that resonance of the input line may or may not occur in the bandpass, depending upon its length. Also, all power, including filaments, should be off in the exciter, since this might "load" the input line so that a sharp resonant condition could not be obtained. The nick in the response should be minimized by rotating the neutralizing loop. A special tool is supplied to make this adjustment (G-E Drawing A-7145267-P1).

If no nick is found, the input line is not resonant in the band, and it will be necessary to change its length by disconnecting or substituting lengths of line until resonance is obtained.

f. When the output coupling and loading are correct and the circuits tuned, the response as shown on the oscilloscope should be approximately that shown in Fig. 37.

9. Refer to Fig. 38 and connect the main plate transformer primary leads to the proper primary terminals for a rectifier output voltage as near 6500 volts as possible.

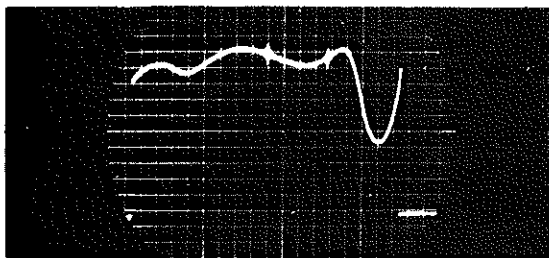


Fig. 36 Aural Amplifier: Correct Bandpass but Too Much Coupling

Check the holding bias on each tube. It should be approximately 20 volts when measured at 7C20 and 7C21 on top of the cavity.

10. Place the DELTA-WYE switch in the WYE position.

11. Turn the Aural PA SCREEN VOLTAGE control to the full counterclockwise position and operate the SCREEN switch to the ON position.

12. Make sure that the GL-869-B mercury vapor rectifiers in the Rectifier cubicle have been "cooked in" for at least 30 minutes with filament voltage and then depress the RECTIFIER ON push button. The main plate breaker should close, followed by the step-start contactor 6K10 in approximately one second. When the main breaker closes, plate voltage will be established and should be approximately sixty percent of 6500

volts, or 3900 volts.

13. Turn the PA SCREEN VOLTAGE control in the clockwise direction until the SCREEN VOLTAGE is 500 to 700 volts. As the screen voltage increases, the plate current should increase to approximately 2.5 amperes.

14. The six GL-869-B mercury vapor rectifiers used in this equipment must be quarter-phased to obtain maximum tube life. This procedure must be followed for each new installation of this equipment. Refer to Fig. 39 for the schematic connection of the equipment required for this adjustment. The oscilloscope used for this procedure may be any service-type unit, since the measurement is made at 60 cycles. The oscilloscope should be checked by applying 6 volts a-c to the vertical and horizontal amplifier inputs simultaneously, and by noting that the presentation on the screen of the oscilloscope is a straight line at an angle of 45 or 135 degrees. This indicates that there is no phase shift in the oscilloscope which will interfere with the accuracy of the following measurements. Most oscilloscopes will meet this requirement.

The transformer required may be any transformer having a 220- to 500-volt winding together with a low-voltage filament winding. Most small transformers used in receiver power supplies meet this specification.

The phase of the current pulse through the resistor in the cathode of each GL-869-B tube is compared to the phase of the filament voltage of the tube. In making this adjustment IT IS NOT NECESSARY TO INTERFERE WITH THE INTERLOCKS. DO NOT TAMPER WITH ANY SAFETY DEVICE IN THE RECTIFIER.

Insulated test lead wire rated at 10,000 volts should be used in making the following hookup. The leads may be brought from inside the Rectifier cubicle by removing the cover plate over the convenience outlet and feeding the wires through this opening. Disconnect the leads going to 6T10, the SPARE HEAT POSITION transformer and connect as shown in Fig. 39. The leads from terminals 3 and 5 of 6T10 should be long enough to reach all of the six resistors listed. Refer to Fig. 72 for the Elementary Diagram of the Rectifier and Figs. 69 through 71 for the location of

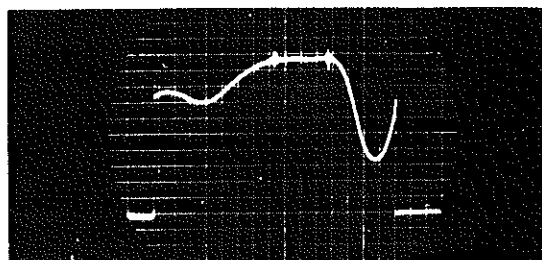
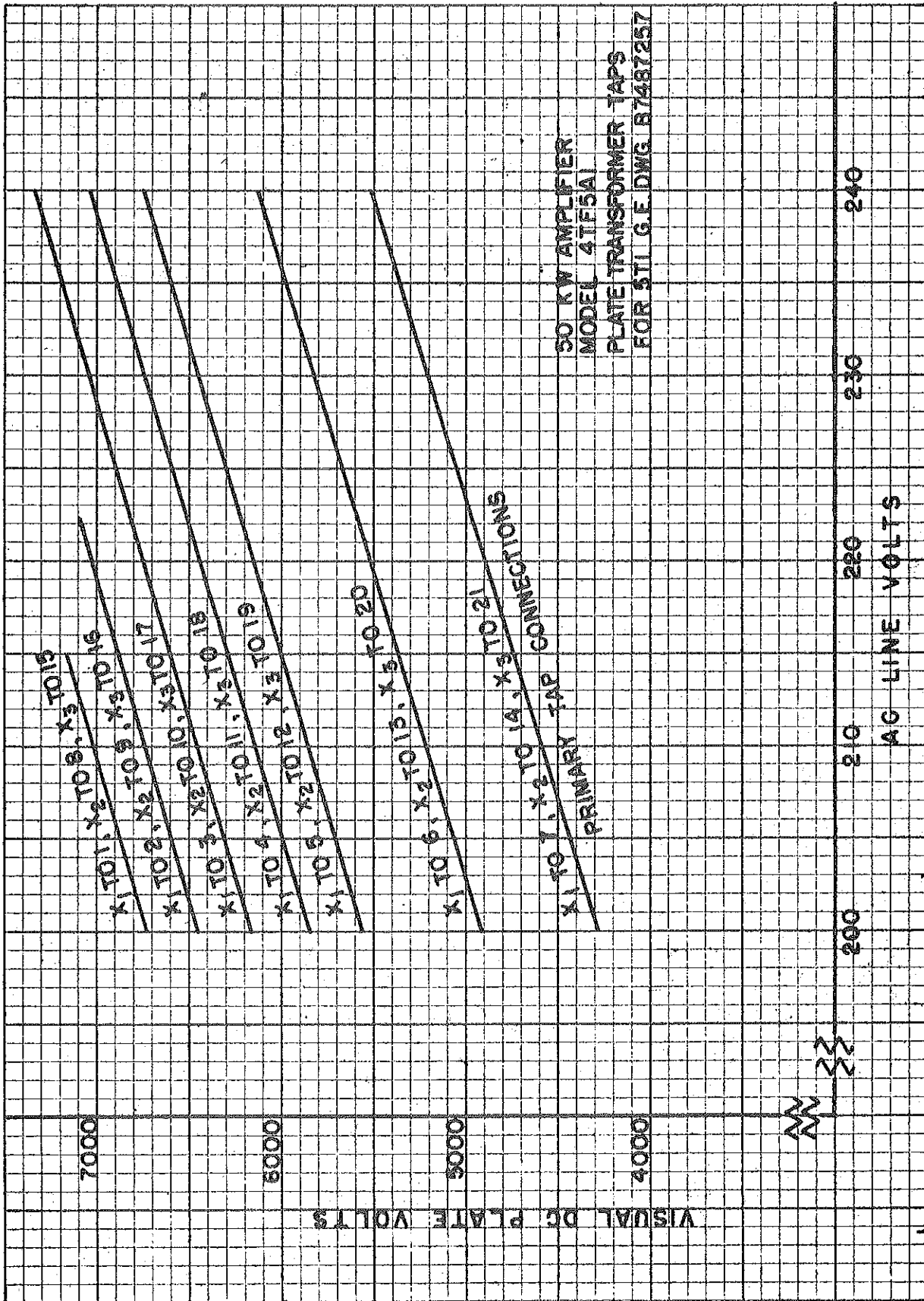


Fig. 37 Aural Amplifier: Correct Bandpass, Lower Marker 1.5 MC Below and Upper Marker 1.5 MC Above Carrier



(A-7991262)

Fig. 38 Graph of Plate Transformer Tap Connections

the parts in the cubicle. The other transformer used should be placed on the floor of the Rectifier cubicle, and the leads from the high-voltage winding should be long enough to reach the primaries of the Rectifier filament transformers listed. The oscilloscope should be placed outside the Rectifier cubicle. Be sure to ground the set-up as shown in Fig. 39. Connect the equipment to the resistor and transformer associated with one tube, for example, 6T6 and 6R5.

Place the DELTA-WYE switch 5S2 in the DELTA position and apply plate voltage with the VISUAL-BOTH-AURAL DC transfer switch in the AURAL position. Increase the screen voltage by means of the SCREEN VOLT ADJUSTMENT until a plate current of 2.5 amperes is read on the PLATE CURRENT meter.

Observe the pattern on the oscilloscope. It will be like that shown in Fig. 40 or 41.

The correct quarter-phasing condition is shown in Fig. 41. If the pattern observed on the oscilloscope is correct, turn off the PLATE VOLTAGE by depressing the RECT OFF push button and move the leads to the next resistor and transformer, and repeat. If the pattern is again like that shown in Fig. 41, move the leads to the next resistor and transformer combination.

If three tubes on one side show correct phasing, the three tubes on the opposite side will be found to be correctly phased. If one side is correctly phased and one tube on the other side shows incorrect phasing, the high-voltage wiring from the secondary of 5T1 is in error.

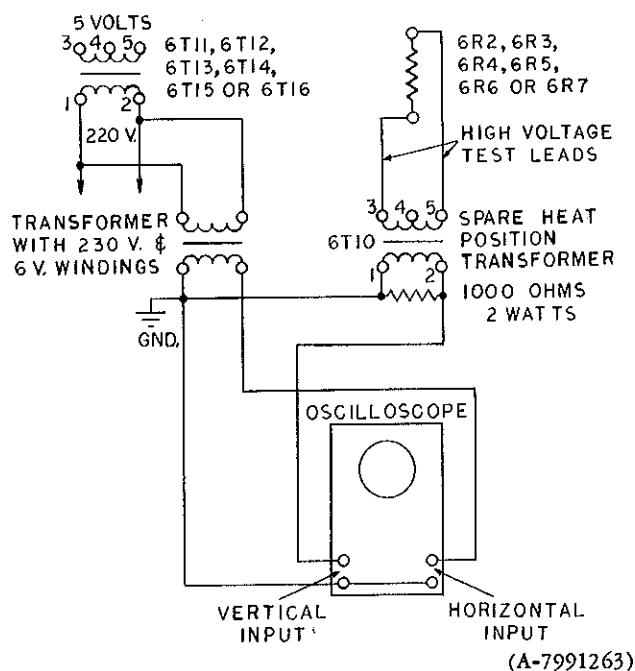


Fig. 39 Quarter-Phasing Connections

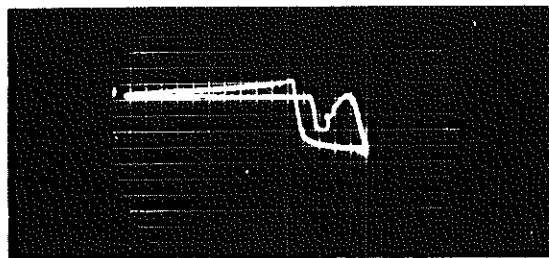


Fig. 40 Incorrect Quarter Phasing

If incorrect phasing is found when checking the first three tubes, the phasing of the Rectifier filament line must be changed. Refer to the Rectifier Elementary Diagram, Fig. 72. The three-phase input to the rectifier filaments are on 6TB2-4, 6TB2-5, and 6TB2-6.

When an incorrect phase is shown for one of the first three tubes, change the leads in the intercubicle connection going to 6TB2-4, 6TB2-5, and 6TB2-6. There are six possible combinations for connecting these three intercubicle wires to the three terminals on the Rectifier terminal board. One combination will give correct phasing for all six tubes. When the correct phasing is obtained for all six rectifier tubes, the equipment is correctly quarter-phased.

15. Adjust the CATHODE BALANCE control 7R9 to obtain the best balance of RIGHT and LEFT CATHODE currents. The currents should be balanced within $\pm 5\%$.

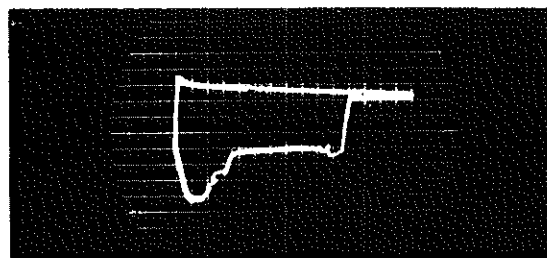


Fig. 41 Correct Quarter Phasing

16. Place the REFLECTOMETER FORWARD-REVERSE switch on the lower panel in the FORWARD position. Rotate the REFLECTOMETER AMP GAIN control 7R34 in the direction to obtain minimum reflectometer relay current as indicated by the REFLECTOMETER RELAY current meter 7M7. Place the DELTA-WYE switch 5S2 in the WYE position.

17. The Aural Amplifier is now ready for the application of driving power. Apply power gradually from the exciter. When sufficient excitation has been applied to cause the plate current to increase to approximately 6 amperes, watch the RF OUTPUT meter and operate the PLATE TUNING switch to maximize this reading. The power output at this point should be 5 to 10 kilowatts, and the screen currents should be

less than 50 milliamperes with the screen voltage at 500 to 700 volts.

18. Remove excitation power and operate the Aural RECTIFIER OFF push button to remove Amplifier plate power. Operate the transformer DELTA-WYE switch to the DELTA position.

19. Re-apply plate power to the Amplifier by depressing the Aural RECTIFIER ON push button. Gradually apply excitation power to the Amplifier. Increase the screen voltage to 600 volts. When sufficient drive power has been applied to bring the Amplifier plate current up to 9.5 amperes, the measured power output should be approximately 27 kilowatts. The PLATE TUNING should be checked to be sure that the RF OUTPUT is maximized, since there is some plate detuning resulting from change of tube capacitance as the tube heats up.

20. Proper tube loading is important. If the tubes are too lightly loaded (bandpass too narrow), the plate voltage swing will be abnormally high, and the tube's ceramic and plate and grid seals will overheat. Prolonged operation under these conditions will cause failure of the tube. If the tube loading is too heavy, that is, the tube load impedance is too low (bandpass too wide), the efficiency of the amplifier will be too low. The correct load impedance is obtained when the sweep response is approximately like that shown in Fig. 37. If the plate current required for 27 kilowatts is greater than 9.75 amperes, the bandpass must be narrowed by reducing the coupling and loading and re-tuning the output. The Aural Amplifier loading is adjusted to give a certain specified efficiency which is a compromise between the too heavy and too light conditions referred to above. The PLATE tuning switch should be used to maximize the RF OUTPUT meter readings under drive.

21. Under full power operating conditions, it may be necessary to adjust the CATHODE BALANCE control 7R9 to obtain the best balance of RIGHT and LEFT CATHODE currents. The cathode unbalance relay will operate when the unbalance between right and left cathode currents exceeds 10%.

22. With the Amplifier delivering the desired power into the dummy load and the REFLECTOMETER FORWARD-REVERSE switch 7S14 in the FORWARD position, adjust the REFLECTOMETER SENSITIVITY control 7R24 to obtain a reference deflection of 100 on the RF OUTPUT meter. This reference deflection is used as the standard reading for rated power output when the Amplifier is connected to the antenna and will correspond closely with the rated power output determined by the graph of aural efficiency (see Fig. 80) when the correct load impedance is obtained for this Amplifier.

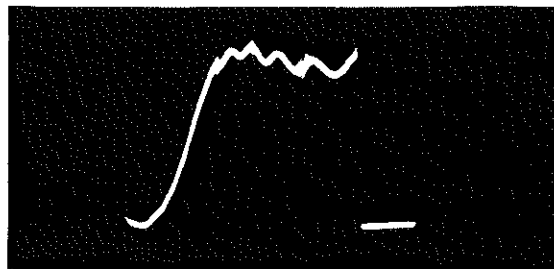


Fig. 42 Aural Amplifier: Correct Bandpass with 500-Foot Transmission-Line Feed to Antenna

23. With power removed, transfer the Amplifier output to the diplexer and the antenna. Check the alignment with the sweep generator to be sure that the Amplifier load is essentially the same as the dummy load. Power may then be re-applied, and the new loading condition should be observed to see whether a slight change of SWR on the output transmission line has changed the tube loading condition. If so, the loading may be slightly readjusted as described above, but this is not usually necessary unless the SWR changes considerably.

See Fig. 42 for the bandpass obtained when feeding an antenna with 500 feet of transmission line. The "wrinkles" on the bandpass are caused by the VSWR of the antenna itself as it is transformed down the length of the transmission line. The amplitude of the wrinkles is a function of the VSWR of the antenna, and the number of wrinkles in the pass band is a function of the actual length of transmission line between the Amplifier and the antenna. A record should be made of the sweep response obtained for each particular installation at the time of original installation. Any major change in the amplitude of the wrinkles indicates trouble in the antenna system.

24. Finally, with the Amplifier delivering rated power and the REFLECTOMETER FORWARD-REVERSE switch 7S14 in the FORWARD position, adjust the REFLECTOMETER AMP GAIN control 7R34 in the direction to obtain a reflectometer relay current of approximately 2.5 milliamperes as indicated by the REFLECTOMETER RELAY meter 7M7. This relay, 7K17, will pick up at a current of 3.5 to 4 milliamperes and will remove plate power. Under this adjustment, if the transmission-line SWR increases appreciably because of antenna or transmission-line fault, the reflectometer REVERSE voltage will increase, causing 7K17 to pick up, thus protecting the Amplifier and the antenna or transmission line.

25. The Aural Amplifier is now adjusted for normal operation. It is recommended that the shutdown procedure be that of removing drive power before removing plate power from the Amplifier.

VISUAL AMPLIFIER

1. Operate the DC SWITCH 7S8 to the Visual position.

2. The following switches should be closed on the Visual Amplifier cubicle: MAIN FILAMENT and LP FILAMENT. The rear door of the Visual Amplifier and Rectifier cubicles must be closed. The Visual time-delay relay 8K2 will time out one minute after the MAIN FILAMENT and LP FILAMENT switches are closed, and the Visual BIAS and FIL TD STATUS lights should be illuminated.

3. Close the Visual BIAS switch. The Visual BIAS supervisory light should be extinguished, indicating that the Visual bias voltage has been established. Adjust the BIAS ADJUST rheostats 8R38 and 8R39 to give a bias of 20 volts on the right and left amplifier tubes as read on 8M3, the BIAS voltmeter. The lamps in the green RECTIFIER ON push buttons on the Visual and Aural Amplifier cubicles and in the green RECT ON push button on the Rectifier cubicle should be illuminated.

4. Operate the BLANKING, MARKERS, FILAMENT, and MOTOR switches on the sweep generator panel to the ON position.

5. Close the SWEEP switch and operate the OPERATE-SWEEP switch to the SWEEP position. This will apply power to the sweep generator and energize the relays in Sweep Detectors No. 1 and No. 2.

6. Normally the sweep generator will be adjusted before shipment from the factory and will need little, if any, further adjustment. If adjustment is necessary, align the sweep generator as described in the THEORY AND CIRCUIT ANALYSIS, VISUAL AMPLIFIER section. Refer to the Parts List for the correct marker crystals to be used in the Visual sweep generator.

7. Connect a high-gain oscilloscope, such as the G-E Type ST-2-A, to the SCOPE INPUT jack on the sweep generator panel and place the sweep generator 'scope input selector switch in the first DETECTOR position. When the 'scope input selector switch is in this first DETECTOR position, the bandpass of the Visual Amplifier is observed ahead of the Vestigial-

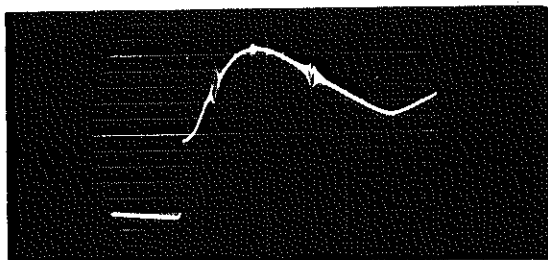


Fig. 43 Visual Amplifier: Sweep Detector No. 1, Correct Bandpass Before VSB Filter, But Too Little Coupling

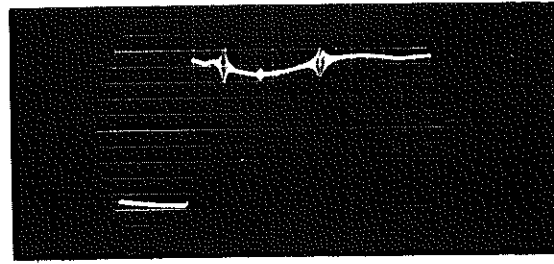


Fig. 44 Visual Amplifier: Sweep Detector No. 1, Correct Bandpass Before VSB Filter, But Too Much Coupling

Sideband Filter. When the 'scope input switch is in the second DETECTOR position, the bandpass is observed after the Vestigial-Sideband Filter. Refer to the Visual Amplifier Elementary Diagram, Fig. 65. For a complete description of and adjustment procedure for the Vestigial-Sideband Filter, refer to EBI-3326 which is included as an insert in this book.

8. Align the output circuit of the Amplifier as follows. Refer to Fig. 27. The output of the Visual Amplifier cubicle should be connected to the external transmission-line elements, the Vestigial-Sideband Filter, and the Sweep Detector assemblies as shown. A dummy load capable of dissipating 30 kilowatts of RF power should be connected following the Sweep Detector No. 2 assembly.

a. Place the TUNING motor POWER switch 8S29 in the ON position. The TUNING motor POWER supervisory light 8I8 should be illuminated, indicating that power is available for operating the tuning motors.

b. Operate the PLATE TUNING switch 8S28 to resonate the plate circuit. Unless the TUNE (8S27) or output tuning happens to be in resonance, the response obtained by tuning the plate circuit will be a single response which can be tuned to a frequency midway between the marker signals (0.75 megacycles below and 4.2 megacycles above the carrier frequency), a condition similar to that shown in Fig. 34.

c. Operate the TUNE switch 8S27 to resonate the output circuit. Depending upon the output coupling and loading, the resultant response will be either a broader "single-humped" response or a "double-humped" response.

d. Adjust the LOAD switch 8S28 to obtain a response similar to that shown in Fig. 43, 44, or 45. The correct bandpass is shown in Fig. 45. If the bandpass is too narrow, as shown in Fig. 43, or too wide, as shown in Fig. 44, the coupling must be adjusted. To do this, remove the shield covers on the output circuit on each side of the coupling loop. Then, using the box-end ratchet wrench supplied with this equipment, loosen the 1/4-20 hex-head bolts connecting the coupling loop to the output circuit. If the bandpass is found to be too narrow, the coupling loop should be

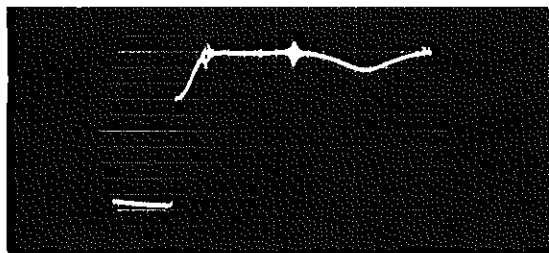


Fig. 45 Visual Amplifier: Sweep Detector No. 1, Correct Bandpass Before VSB Filter, Lower Marker 0.75 MC Below and Upper Marker 4.2 MC Above Carrier

pushed slightly into the cavity to increase the coupling. If the bandpass is found to be too wide, the coupling should be pulled back toward the output circuit to decrease the coupling. Tighten the hex-head 1/4-20 bolts securely and replace the shield covers before proceeding.

e. Place the sweep generator 'scope input selector switch in the second DETECTOR position. The response should be like that shown in Fig. 46 or 47. The adjustment of the Vestigial-Sideband Filter is carefully set and locked at the factory before shipment so that no further adjustment should be required. See EBI-3326 for complete information about this unit.

f. The neutralization of the Visual Amplifier is the same as that of the Aural Amplifier; therefore, refer to the Aural Amplifier subsection for the complete neutralization procedure.

9. Check the bias on the right and left tubes by means of the GRID VOLTAGE meter 8M3 and the transfer switch 8S30.

10. Place the DELTA-WYE switch in the WYE position.

11. Turn the SCREEN REG SUPPLY Powerstat and the SCREEN VOLTAGE CONTROL adjustment to the extreme counterclockwise position. Operate the SCREEN switch to the ON position.

12. Depress the RECTIFIER ON push button. The main plate breaker 5K1 should close, followed by the step-start contactors 6K10 and 6K9 in approximately one second. When the main breaker closes, plate volt-

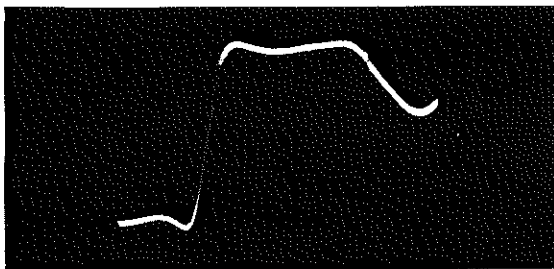


Fig. 46 Visual Amplifier: Sweep Detector No. 2, Correct Bandpass After VSB Filter, Lower Marker 0.75 MC Below Carrier

age will be established and should be approximately 60 percent of 6500 volts, or 3900 volts.

13. Rotate the SCREEN REG switch to the VOLTAGE position. In this position the SCREEN REG meter reads the voltage drop across the Type 6AS7G screen regulator tubes. Slowly rotate the SCREEN REG SUPPLY control in the "increase" direction. It will be noted that the SCREEN REG voltage will increase as this control is advanced up to approximately 150 to 200 volts and will suddenly drop to zero as the gas-discharge tubes in the screen regulator break down. As the control is increased the SCREEN VOLTAGE will increase to approximately 600 volts. At this point, as the SCREEN REG SUPPLY control is further increased, the SCREEN REG VOLTAGE should start to increase and the SCREEN VOLTAGE should remain constant. If not, adjust the SCREEN VOLT ADJUST control until this condition is met. With a SCREEN VOLTAGE of 600 volts the SCREEN REG VOLTAGE should be 125 to 150 volts.

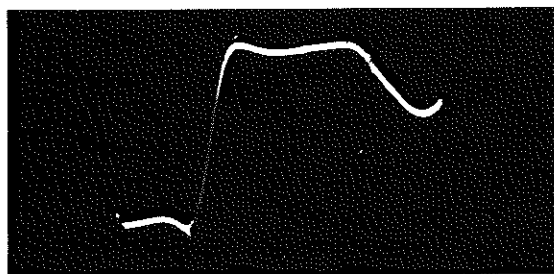


Fig. 47 Visual Amplifier: Sweep Detector No. 2, Correct Bandpass After VSB Filter, Lower Marker 1.25 MC Below Carrier

14. Note the RIGHT and LEFT CATHODE currents and set the RIGHT and LEFT BIAS ADJUST. rheostats 8R39 and 8R38 to give a cathode current of 1.25 amperes for each tube.

15. The Visual Amplifier is now ready for the application of excitation power. With normal power supply voltages as described above, the VSWR on the input line to the Amplifier will be 1.2 to 1 or less at the center of the particular channel.

The only remaining circuit adjustment which should be made is the adjustment of the external 1-5/8 inch line stretcher.

The exciter may be adjusted to operate into a dummy load with good SWR and its output then connected to the Amplifier input. Then the Amplifier input may be used in exactly the same way as the dummy load. If the adjustment of the driving transmitter includes the use of a sweep generator to align its circuit, the transmitter may be aligned in the normal manner using the Amplifier input as its load. In this case, either the sweep diode detector at the output of the exciter or at the output of the Amplifier may be

used. When the Amplifier output sweep diode detector is used, the oscilloscope should be connected in the same way as when aligning the Amplifier output circuit, and the Amplifier sweep generator should be made inoperative by placing the sweep generator FILAMENT switch in the OFF position. This prevents the Amplifier sweep generator from superimposing its voltage upon the sweep generator voltage from the exciter.

When the output circuits of the driving transmitter are being adjusted by means of a sweep generator, the oscilloscope should be used to determine whether the indicated circuit response is essentially the same at the exciter output as at the Amplifier output. If one has a definite "tip" or "slope" to what should be the "flat" part of the bandpass, adjust the input line stretcher to make the two responses as nearly alike as possible in this respect.

The two matching adjustments on the front panel of the Amplifier may also be adjusted to give the same bandwidth as obtained with the driving transmitter connected to a dummy load. To use these adjustments it will be necessary to unlock the matcher drive assembly by loosening the nuts holding the push rods actuating the plate on the input matcher. The screwdriver adjustment may then be made from the front panel by removing the two plug buttons above the General Electric nameplate on the front panel.

When a sweep generator is being used to align the exciter, such as would be the case with the G-E Type TT-6-E 5-KW Transmitter, the Amplifier SWEEP-OPERATE switch must be in the SWEEP position when the last two or three stages are being adjusted and when the Amplifier sweep diode detector is being used. However, when the first two or three circuits are being adjusted, the RF level at the Amplifier output resulting from the exciter sweep generator will be high enough to damage the germanium diode detector unless the Amplifier SWEEP-OPERATE switch is in the OPERATE position. In this position the diode is disconnected from the transmission line by a relay. There will be sufficient feed-through in this position to allow the use of this diode under the higher RF drive conditions.

16. Place the Amplifier SWEEP-OPERATE switch in the OPERATE position, the PEAK POWER-REFLECTOMETER switch in the REFLECTOMETER position, and the reflectometer FORWARD-REVERSE switch in the FORWARD position.

17. Gradually apply a black picture (picture at pedestal level) from the exciter and check the average power output into the Amplifier dummy load. Increase the excitation level until a power output of 30 kilo-

watts is reached. Note the indication of the RF OUTPUT meter. This is the reflectometer "forward" indication which corresponds to this power load.

18. Use an RF output waveform monitor which will accurately measure sync percentage and adjust the exciter sync control to obtain a 25% synchronizing pulse (pedestal level at 75% of synchronizing pulse). Operate the Amplifier PEAK POWER-REFLECTOMETER switch to the PEAK POWER position and observe the indication on the RF OUTPUT meter. Adjust the PEAK POWER ADJUST control until the RF OUTPUT meter reads 100. This is now the reference reading corresponding to 50-KW synchronizing pulse power. This meter reading should be used for normal monitoring of the Visual power output.

19. It is recommended that after the Amplifier has been operating at black level power for two or three minutes the excitation be removed and the Amplifier output circuit alignment be checked.

20. If it is found that there is some unbalance of the CATHODE currents under operating conditions, the individual grid bias may be adjusted for a closer balance (the average of the two cathode currents under a no-excitation condition should be 1.25 amperes).

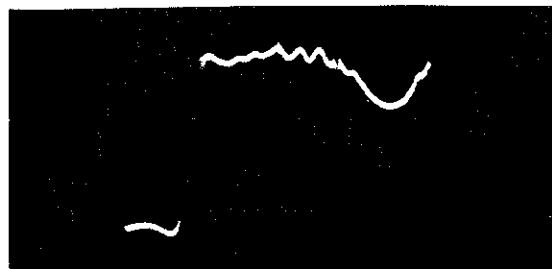


Fig. 48 Visual Amplifier: Correct Bandpass with 500-Foot Transmission-Line Feed to Antenna

21. The Visual Amplifier is now ready for normal operation into the antenna. It may or may not be desirable to make minor readjustments of the circuit alignment when changing from the dummy load to the antenna, depending upon the particular standing-wave ratios which are encountered. See Fig. 48 for the correct bandpass when feeding an antenna with 500 feet of transmission line.

22. It is recommended that the shutdown procedure consist always of removing drive power before removing plate power on the Amplifier.

AURAL AND VISUAL AMPLIFIER

For simultaneous operation of the Aural and Visual Amplifiers, place the DC SWITCH 7S8 on the Aural Amplifier panel in the BOTH position. Plate voltage will now be applied to both Amplifiers simultaneously.

Excitation power may be applied to either or both Amplifiers without effect on the other.

If automatic-plate-reclosure operation is desired in the event of a fault, place the AUTO-RECLOSER switch in the ON position.

ROUTINE OPERATION

During routine operation, it is intended that all power switches on the cubicles be left in the ON position. Power should be removed from the cubicles during the time that the transmitter is shut down by means of the external disconnect switch 5S2.

STARTING PROCEDURE

1. Close the external disconnect switch 5S2, energizing the control circuit.
2. Press the green illuminated AMPLIFIER START push button.
3. After one minute the green RECTIFIER ON push buttons on the Visual and Aural Amplifier cubicles and the green RECT ON push button on the Rectifier cubicle will be illuminated, indicating that the Amplifiers are ready for operation.
4. Press any one of the push buttons mentioned in 3, above, thus applying Amplifier plate power.
5. Apply excitation power to both Amplifiers.

STOPPING PROCEDURE

1. Remove excitation power from both Amplifiers.
2. Press either of the red illuminated RECTIFIER OFF push buttons on the Visual and Aural Amplifier cubicles or the red illuminated RECT OFF push button on the Rectifier cubicle, thus removing plate voltage.
3. Press the red illuminated AMPLIFIER STOP push button on the Aural Amplifier cubicle. The anode blowers will continue to run for three minutes.
4. After the blowers have stopped, open the external disconnect switch 5S2.

TYPICAL METER READINGS

AURAL AMPLIFIER (26.6-KW OUTPUT)

Plate Voltage	6500 volts
Plate Current	9.75 amperes
Grid Current	800 milliamperes
Right Cathode Current	5.4 amperes
Left Cathode Current	5.4 amperes
Right Screen Current	100 milliamperes
Left Screen Current	100 milliamperes
Screen Voltage	700 volts
Regulated Line Voltage (Average)	230 volts

Grid Supply Voltage (Zero Grid Current)	20 volts
Sweep Generator Power Supply	345 volts
Reflectometer Relay Current	2.5 milliamperes

VISUAL AMPLIFIER (50-KW SYNC AND PEDESTAL-BLACK PICTURE)

Plate Voltage	6600 volts
Plate Current	11.5 amperes
Grid Current	1.15 amperes
Right Cathode Current	6.35 amperes
Left Cathode Current	6.35 amperes
Right Screen Current	50 milliamperes
Left Screen Current	50 milliamperes
Screen Voltage	700 volts
Screen Regulated Voltage	150 volts
Right Grid Bias Voltage	22 volts
Left Grid Bias Voltage	22 volts

SWEEP GENERATOR

Oscillator (Blanking Off)	0.38
Oscillator (Blanking On)	0.26
Amplifier (Blanking Off)	0.52
Amplifier (Blanking On)	0.52
MK 1	0.28
MK 2	0.28
Crystal 1	0.35
Crystal 2	0.35

ARC-BACK INDICATOR SUPPLY

175 volts d-c

REFLECTOMETER AMPLIFIER SUPPLY

Approximately 330 volts d-c

GENERAL OPERATING INSTRUCTIONS

The following general comments are intended either to emphasize items covered elsewhere in this book or to supplement them.

1. Since all filaments and low-voltage supplies are controlled by the regulated line voltage, this voltage should be monitored at all times and maintained as nearly as possible at 230 volts. This consideration is important to tube life and to the proper operation of the equipment.

2. The Visual SCREEN REG voltage (anode-to-cathode voltage of the Type 6AS7-G tubes in the screen grid supply) should be maintained in the range of 100 to 150 volts. This voltage will decrease as the screen current increases. It may be adjusted by means of the SCREEN REG SUPPLY control.

3. The Visual SCREEN REG switch and the SCREEN REG meter may be used to measure the individual

cathode currents of the series regulator tubes in the regulated screen supply.

4. It is recommended that new power amplifier tubes be first tested with the plate voltage lowered by placing the DELTA-WYE switch in the WYE position before operating at full power. If the tube has been damaged in shipment or in handling, there is less likelihood of damage to the equipment or to tubes at the reduced voltage.

5. Never operate the SWEEP-OPERATE switch of either Amplifier from the OPERATE to SWEEP positions when excitation power is being applied. Time decay of the exciter power supply voltage may cause burn-out and may necessitate the replacement of the Amplifier sweep diode detector germanium crystals.

6. Note that each reflectometer has a spare crystal mounted adjacent to the forward and reverse couplers. The crystals may be checked by rotating them in the forward coupler. All should give approximately the same reading on the RF OUTPUT meter.

7. The phase of the sweep generator blanking may be adjusted with respect to the image trace by loosening the coupling between the sweep motor 8B101 and the sweep capacitor 8C106 and shifting the angular position of one with respect to the other slightly.

8. In order to obtain reasonable tube efficiency commensurate with best tube plate loading for good tube life, the Visual Amplifier is operated under conditions which will give approximately 5% to 7% compression of sync peak RF voltage. In other words, 30% to 32% sync will be required at the exciter output to produce 25% sync at the Amplifier output (50-KW level). Less compression can be obtained only by heavier plate loading, which reduces efficiency and increases plate current and dissipation.

9. In case of a failure and necessary replacement of a GL-6251 tube, generally the only Amplifier circuit readjustment required will be the PLATE TUNING. In the Aural Amplifier this adjustment can be quickly made by adjusting the PLATE TUNING for maximum RF OUTPUT under operating conditions after tube replacement. (Approximate adjustment should be made under reduced excitation conditions before proceeding to full-power operation.)

In the Visual Amplifier the same procedure may be followed for an approximate circuit adjustment after tube replacement if it is necessary to re-establish operation in a minimum amount of time. However, adjusting for maximum RF OUTPUT may result in the bandpass response being tipped up at the low-frequency or carrier end. This will be indicated by higher than normal screen grid current and by loss of "sync percentage" (sync compression) at the Amplifier output.

To remedy this situation, operate the PLATE TUNING control in the up position momentarily (thus adjusting the plate circuit to higher frequency) to obtain as nearly as possible normal sync percentage and screen grid current simultaneously with normal output. Do not adjust the TUNE or LOAD tuning without benefit of the sweep generator.

Check the circuit alignment in the normal manner at the earliest opportunity.

10. Adequate cooling of the power amplifier anodes should be maintained at all times. Refer to the MAINTENANCE section for the daily inspection to be made for this Amplifier.

SAFETY INSPECTION

The Amplifier was designed with the safety of the operating personnel as a prime consideration. All protective circuits were designed to "FAIL SAFE." To insure the proper operation of all interlocks a periodic check should be scheduled and should include the following considerations:

CHECK OF AMPLIFIER INTERLOCKS

1. With all power removed from the equipment, inspect each safety grounding switch for easy operation. Check all connections on the grounding switches for tightness. Make sure that all grounding washers and contacts are firmly seated when the doors are open. Place the DELTA-WYE switch in its neutral position and connect a jumper from 5S3-3 to 5S3-6 inside the DELTA-WYE switch assembly. Turn off the SCREEN switches on the Visual and Aural Amplifier cubicles.

2. Start the Amplifier, and after it times out, proceed to check the electrical interlocks as follows:

Push the green RECTIFIER ON push button. 5K1 will operate, but since the DELTA-WYE switch is in its neutral position there will be no plate voltage on the Amplifier. The screen voltage was initially removed by turning off the SCREEN switches.

Open the rear door of the Visual Amplifier cubicle. 5K1 should drop out.

Close the rear door of the Visual Amplifier cubicle. 5K1 should not come back on.

Repeat the above procedure, checking the rear door interlock operation of the Aural Amplifier and Rectifier cubicles.

Push the green RECTIFIER ON push button. 5K1 should be activated. Open each hinged panel (behind the front access doors of the Visual and Aural Amplifier cubicles) by removing the five screws which hold them secure. 5K1 should drop out each time an individual hinged panel is opened, and the UNDERVOLT-

AGE supervisory light on the Aural Amplifier cubicle should be illuminated. (5K1 will come back on when the door is closed).

The above procedures will check all of the electrical interlocks of the Amplifier.

CHECK OF INTERLOCKS WITH DRIVING TRANSMITTER

Refer to the INSTALLATION section under Interlocks with Driving Transmitter. The following procedure will check these interlocks when the driver used is a General Electric Type TT-6-E Transmitter; a similar procedure should be followed when another type of driving transmitter is used.

1. Turn off the RECTIFIER NO. 1, NO. 2, and NO. 3 circuit breakers located on the front panel of the center cubicle of the Type TT-6-E Transmitter.
2. Turn off the MODULATOR PLATE circuit breaker of the Aural cubicle of the Type TT-6-E Transmitter.
3. Place the SWEEP-OPERATE switches of both Visual and Aural Amplifier cubicles in the OPERATE position.
4. Push a RECTIFIER ON push button on the Amplifier. 5K1 should latch in.
5. Start the Type TT-6-E Transmitter with the circuit breakers mentioned in 1 and 2 above, in the OFF position.
6. After the Type TT-6-E Transmitter times out, push the MAIN ON push button on the Rectifier cubicle and the AURAL PLATE ON push button of the Transmitter each time the interlocks drop them out.

When the SWEEP-OPERATE switch on the Aural Amplifier cubicle is turned to the SWEEP position,

a. The MAIN OFF push button on the TT-6-E Visual Rectifier cubicle is electrically operated and the main Visual plate breaker drops out.

b. The PLATE OFF push button on the Aural cubicle of the TT-6-E is electrically operated and the main Aural plate contactor drops out.

When the SWEEP-OPERATE switch on the Visual Amplifier cubicle is tuned to the SWEEP position,

a. The plate voltage is removed from the Visual exciter in the center cubicle of the TT-6-E.

b. The PLATE OFF push button on the Aural cubicle of the TT-6-E is electrically operated and the main Aural plate contactor drops out.

With the SWEEP-OPERATE switches on both Visual and Aural Amplifier cubicles in the OPERATE position, push a RECTIFIER OFF push button on the Amplifier and observe the following:

a. Plate voltage should be removed from the Visual exciter in the center cubicle of the TT-6-E.

b. Plate voltage should be removed from the second stage Aural of the TT-6-E.

Place the switches turned off in steps 1 and 2, above, in the ON position.

Remove the jumper from 5S3-3 to 5S3-6. Place the DELTA-WYE switch of the Amplifier in the DELTA position. Turn on the SCREEN switches on the Visual and Aural Amplifier cubicles.

The equipment is now ready for normal operation.

MAINTENANCE

PREVENTIVE

GENERAL

When the Amplifier was installed and put into operation, it was in good operating condition. During the final test at the factory, a very careful check is made to make certain that all adjustments are optimum for both peak performance and conservative operation of components, so that with proper care the equipment will give years of reliable service.

Proper care requires the establishment of a definite program of preventive maintenance. This involves a daily, weekly, and semi-annual routine of inspection and adjustment which will maintain the equipment for a period of years at the same efficiency and quality of picture as at the time of installation.

The following sections give general suggestions for caring for the equipment as well as for preventing trouble from developing while on the air.

DAILY

While the Amplifier is on the air, the operator should be continually alert to any change in meter readings, temperatures, and even odors. Periodically he should look for anything unusual on the various meters. At this time he should also reset the REG LINE VOLTAGE to 230 volts. A good operator will immediately notice the characteristic odor of a resistor or transformer as he moves past each cubicle; he is thus likely to be warned of an unusual condition of operation. Upon finding anything unusual, he can look into every circuit from the front and, if necessary, observe components through the windows in the rear doors of the cubicles. If he is able to localize a minor difficulty in this way, he can decide whether or not the equipment can be operated for the remainder of the program without damage.

The readings on the LEFT WATER, RIGHT WATER, and OUTLET WATER pressure meters should be ob-

served to assure that sufficient waterflow is going through each tube. See Fig. 33 for a graph of pressure difference versus water flow. The flow interlock will trip out at 8 gpm or 3.3 pounds difference. Check the reading of the air pressure meter. A pressure of 2.1 inches (water) must be available at all times to adequately cool the seals of the Amplifier tubes.

The power meter reading on the Vestigial-Sideband Filter dummy load should be noted and its value compared to previous readings. This reading will vary with picture content and will be very small.

The level of water in the water tank should be checked.

The cathode currents of the screen regulator tubes should be monitored by means of the front panel switch on the upper left corner of the Visual Amplifier cubicle. These currents will vary with picture content, but unbalance between cathodes of a single 6AS7G tube may be detected, or the lack of emission.

WEEKLY

Once a week the over-all alignment should be checked by following the procedure described in the OPERATION section. This will normally take only a minute or two and will verify proper operation of the Amplifier.

In addition to this operational check, a routine inspection should be made WITH ALL POWER OFF and where repair is needed, it should be made immediately to avoid future trouble. Dust off all surfaces, inspect terminal boards for loose connections and the blower belt for proper tension. Inspect the air filters. Examine all filament connections for evidence of overheating. Tight connections and good contact will help prevent trouble.

Observe all mercury-vapor rectifier tubes while operating. A clear blue glow is characteristic of a good tube; a greenish color indicates that the tube is nearing the end of its useful life.

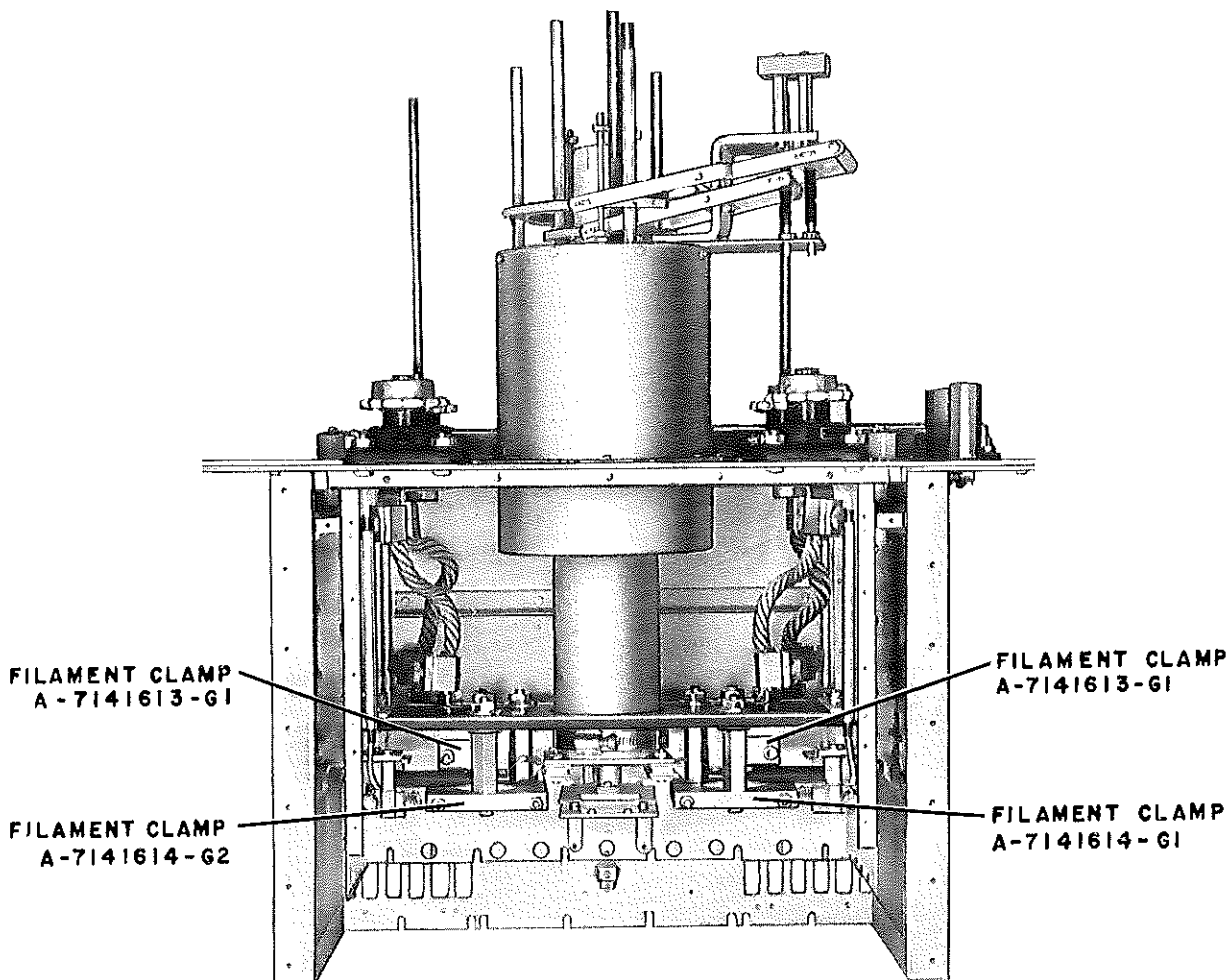
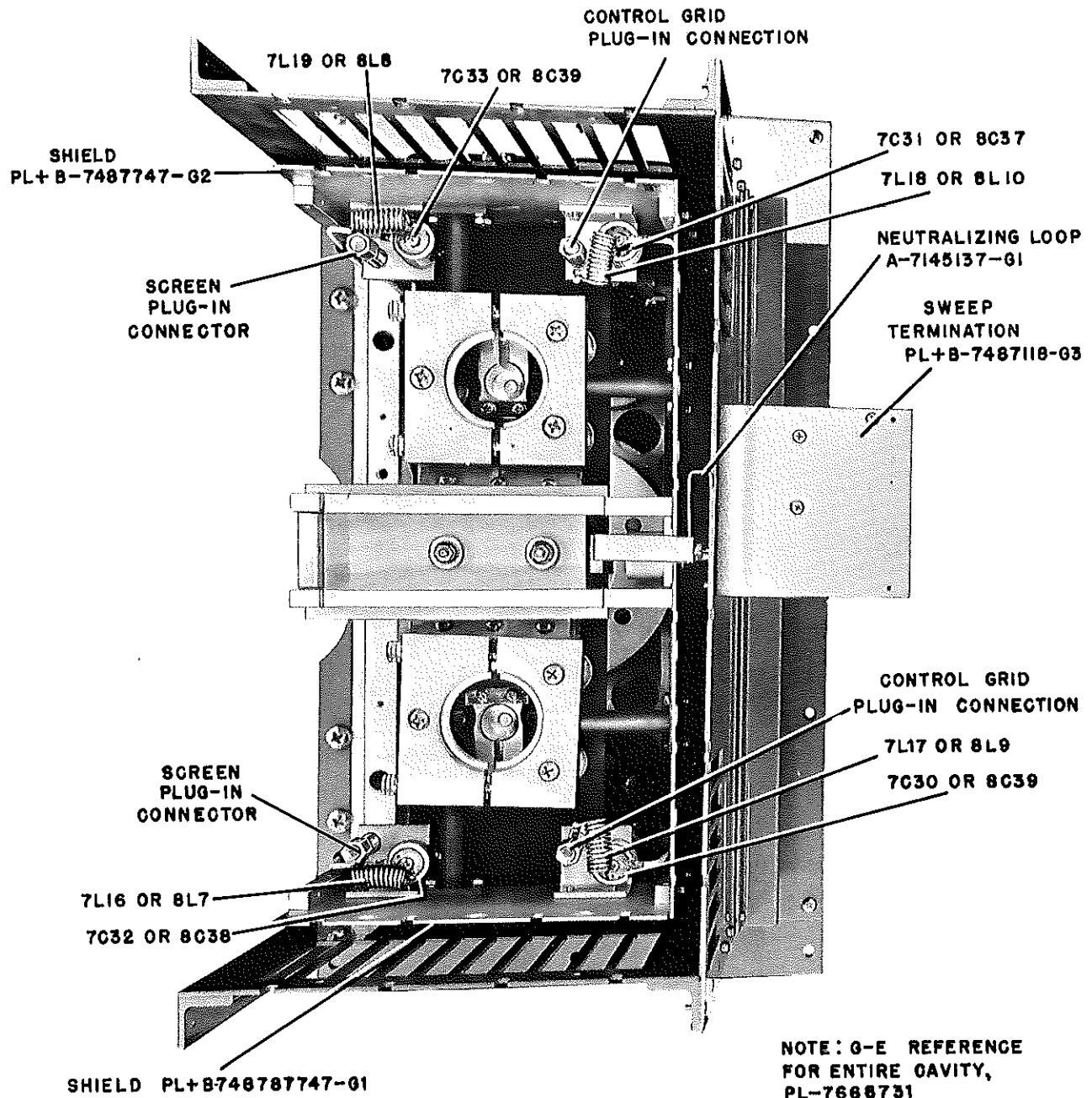


Fig. 49 Cavity in Process of Construction: Contact Assemblies Lacking, Rear View

(4-4785)



(4-4797)

Fig. 50 Cavity in Process of Construction: Contact Assemblies Lacking, Bottom View

SEMI-ANNUALLY

At least twice a year the following maintenance should be performed:

1. Remove and test all receiving-type tubes in a reliable tube checker.
2. Inspect and clean the contacts on all switches, contactors, and relays. Contacts should be dressed if pitted. Use a burnishing tool to clean contacts on all telephone-type relays, the sweep-diode relays on the output transmission lines, and the sweep-termination relays on the front of the PA cavities.

MAINTENANCE OF THE POWERSTAT

Maintain the Powerstat as follows:

CAUTION

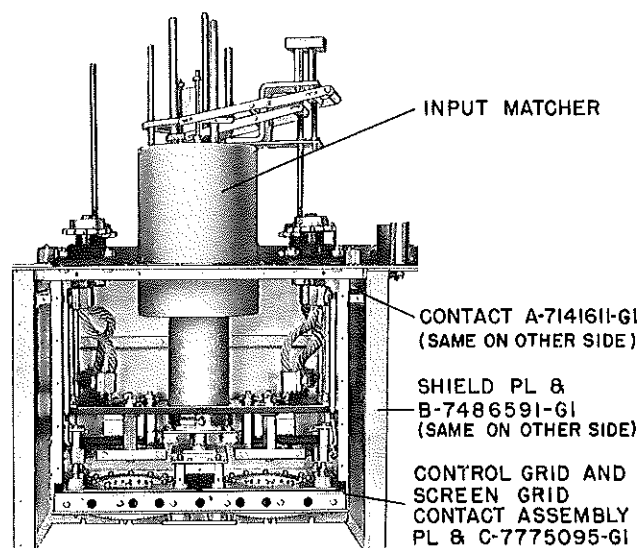
A Powerstat variable transformer is essentially a continuously tapped auto-transformer. The rotor should not be slammed against the stop. Such a practice tends to damage and weaken the entire structure of the Powerstat.

If ordinary care is accorded the Powerstat, the brushes are the only element that might require replacement if arcing takes place or if they are badly worn. To replace the brushes proceed in the following manner:

1. Remove the perforated screen.
2. Take out the brushes by removing the brush springs which are held in place by the binding head screws.
3. Insert new brushes obtained from the Superior Electric Company at Bristol, Connecticut. Do not attempt to replace brushes with ordinary grades of carbon, since the brush material used is of special material. Tighten the screws holding the brush springs.
4. Push a screwdriver blade or wood wedge under one brush spring to raise the brushes slightly off the commutator surface. Then place a strip of crocus cloth or very fine sandpaper about one inch wide and 3-1/2 inches long on the commutator and the abrasive surface against the brush.
5. Use some implement to hold the crocus cloth flat against the commutator surface. While holding the cloth tightly in place remove the wedge under the springs and carefully rotate the brush holder assembly over a short arc. Blow out excess carbon particles.
6. Again raise the brush springs and remove the crocus cloth.
7. Rotate the entire assembly many times over the normal full range. This procedure will work in the brushes. After working the brushes in, remove the knob. The brushes should fit flat over the entire commutator range and light should not be visible between the brushes and the commutator surface.

8. Replace the screen, and the Powerstat is again set for service.

Whenever trouble is encountered regarding mechanical or electrical difficulties in the operation of the Powerstat, consult the Superior Electric Company at Bristol, Connecticut.



(4-4795)

Fig. 51 Cavity in Process of Construction: Screen Grid and Control Grid Contact Assembly in Place, Rear View

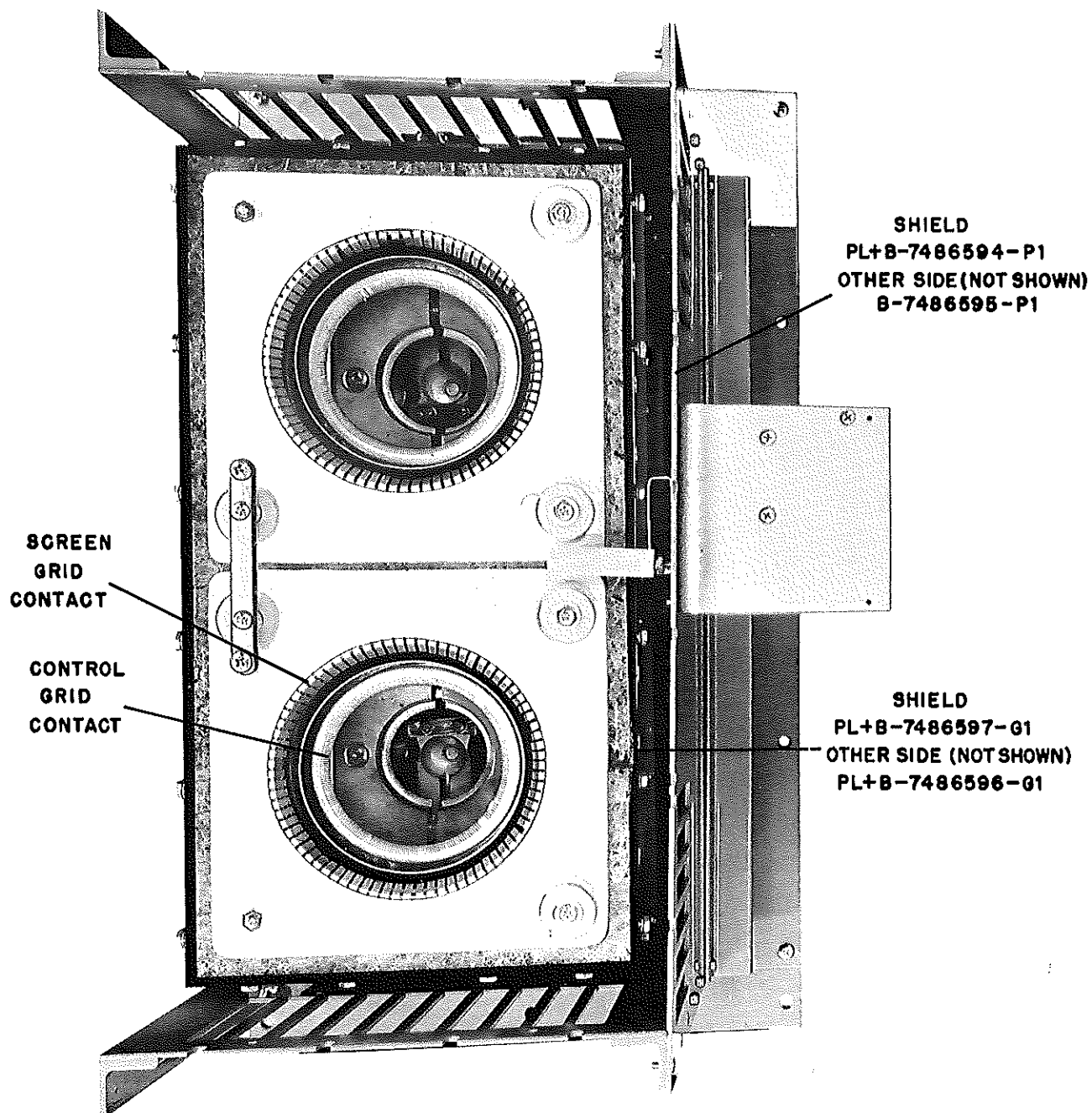
MAINTENANCE OF BLOWERS, PUMP, AND AIR FILTERS

Maintain the blowers, pump, and air filters as described in the following as often as required (semi-annually for ordinary installations).

Oil the motor bearing on the blower motors in the Visual and Aural cubicles. Add one-half teaspoon of electric motor oil or SAE-#10. Grease the bearings on the fan shaft of the blower and heat exchangers with General Electric Grease for Ball and Roller Bearing Motors, using a low-pressure gun. A very small amount of grease will be required. Do not overgrease.

The General Electric Tri-Clad Motors used on the heat exchangers and the water pump are greased as follows. Remove the relief plugs under the bearings to be lubricated. There is a relief plug at each end of each motor. The relief plug for the pump end of the water pump is found underneath the pump, directly under the bearing on the motor. Pump the General Electric grease specified above into the grease fitting until the grease which escapes from the relief hole runs clear. Run the motor with the relief plug out for 15 minutes before replacing the relief plug.

The air filters used on top of the Aural and Visual Amplifier cubicles and in the rear door of the Rectifier cubicle are made by the Farr Company of Los Angeles,



(4-4798)

Fig. 52 Cavity in Process of Construction: Screen Grid and Control Grid Contact Assembly in Place, Bottom View

California, with offices in the principal cities of the United States and Canada.

In general, filters should be cleaned whenever the pressure drop across the filter reaches 1/4 inch of water. Under ordinary conditions Farr-Air filters may be cleaned with hot or cold water. For this cleaning a garden hose and nozzle can be used.

After the filter has been cleaned, it must be oiled by either spraying or dipping. Allow excess oil to drop out of the filter before replacing it.

The Farr Company will service the filters periodically for a nominal fee if the customer so desires. Offices are located in the principal cities of the United States and Canada.

TARGETS

Refer to Fig. 10.

Targets are used on the high-voltage side of each insulating column to prevent electrolytic corrosion of the plumbing fittings used on this equipment. Each target assembly consists of a brass pipe plug to which a brass rod and a platinum wire 0.040 inch in diameter and 3 inches long have been silver-soldered. The platinum wire extends into the insulating tubing and is the point where all electrolytic corrosion will occur. The rate of disintegration of this platinum wire depends upon the leakage current in the insulating columns. The length of the target should be checked semi-annually. In order to do this, it will be necessary to drain the water system and to remove and inspect the target assembly. The targets should be replaced when the remaining length of platinum is less than 3/8 of an inch. FAILURE TO REPLACE THE TARGET BEFORE THE PLATINUM SECTION IS COMPLETELY GONE WILL RESULT IN SERIOUS ELECTROLYTIC CORROSION OF THE PLUMBING FITTINGS.

WATER SYSTEM

The WATER LEAKAGE meter 8M14 reads the current flowing in one of the insulated columns through the water. When the system is clean and uncontaminated, the current will be less than 8 milliamperes. When the current rises to 20 milliamperes, the distilled water in the system should be changed. The system should be flushed twice with tap water each time it becomes necessary to change the distilled water. See steps 19 through 21 under Initial Operation of the OPERATION section.

USE OF SOLVENTS IN FLUSHING THE WATER SYSTEM

It is generally not advisable to use any solvent in cleaning the plumbing in this equipment. Experience

has shown that considerable difficulty can be caused by deposits left in the system by the cleaning agent. If it is deemed necessary, because of the hardness of the water obtainable in certain localities, to clean with a solvent, the procedure which follows is suggested.

The only solvent recommended for cleaning this type of plumbing is "Oakite." Use a standard 10-ounce package, obtainable at any grocery store. Before removing the distilled water which has shown increased leakage, add the contents of one package of "Oakite" to the water tank. Run the equipment without applying plate voltage, and heat the water to 120 degrees Fahrenheit by means of filament power only. Keep the temperature of the water at 120 degrees by intermittently turning the HEAT EXCHANGER BLOWERS on. After one-half hour, open the drain on the plumbing system and run tapwater into the water tank. Keep running the tap water into the tank while draining the system until the water running out of the drain is completely clear. Close the drain and heat the water to 120 degrees for another one-half hour. Remove the water through the drain. Refill the system with tap water and let it run for one-half hour after the temperature of the water reaches 120 degrees. Drain the system and refill with distilled water. If the water in your locality is reasonably soft, the system is now ready for operation. If it is not soft, the distilled water should be run for one-half hour at 120 degrees in order to dissolve the minerals left by the tap water and

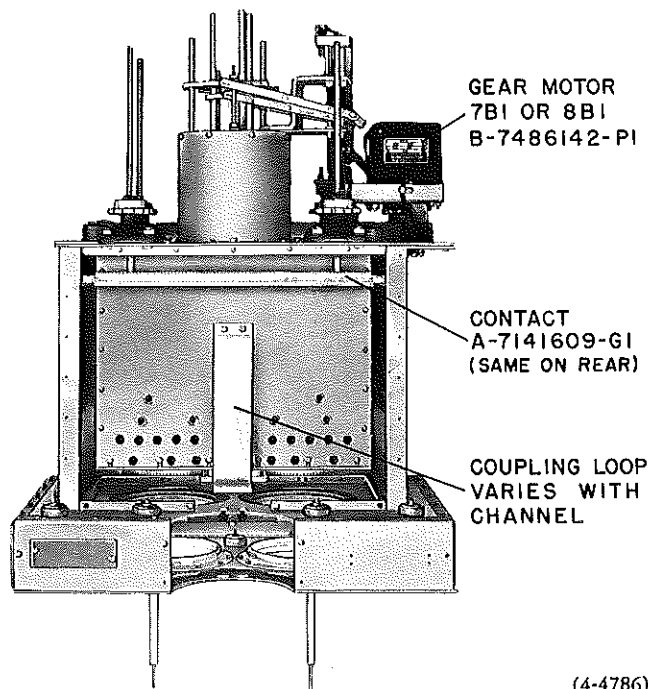


Fig. 53 Cavity in Process of Construction: View of Coupling Loop

should then be discarded. After refilling with distilled water, the system is ready for normal operation.

CORRECTIVE

Effective corrective maintenance depends to a large extent on two factors: properly trained operators and spare parts. It should be the operator's unremitting duty to prepare himself to analyze any possible situation which may cause a failure of the equipment. Because of the expense and complexity of the equipment, it is not usually feasible to have complete standby units; therefore, if a failure should occur, the operator must be prepared to get the Transmitter back on the air with a minimum of delay. In case of failure, the following general procedure is recommended:

1. Notice all the unusual conditions and try to remember them accurately.
2. If possible, analyze the evidence and decide what the trouble must be.
3. Take whatever measures are necessary to get the equipment back on the air, on either a regular or emergency basis, in order to finish the program.

WARNING

During the excitement of getting a failure isolated and repaired the operator must be extremely careful to observe all safety regulations.

In addition to being unusually cautious from the standpoint of personal safety, the operator should be reasonably certain that he has diagnosed the trouble properly before changing a large component which will involve considerable work and time.

It is assumed that the operator will familiarize himself with the control and rectifier circuits sufficiently to know what to do immediately if any supervisory lamp is energized or if any tube or tubes are extinguished.

CAUTION

Whenever about to enter a cubicle to make an adjustment or changes, always open the external disconnect switch so that all voltage (except 115 volts) is disconnected. The input 208/230-volt studs have a current capacity of approximately 60 amperes. Dropping a metal tool across this bus will cause a flash which may cause a severe burn as well as cause damage to the equipment.

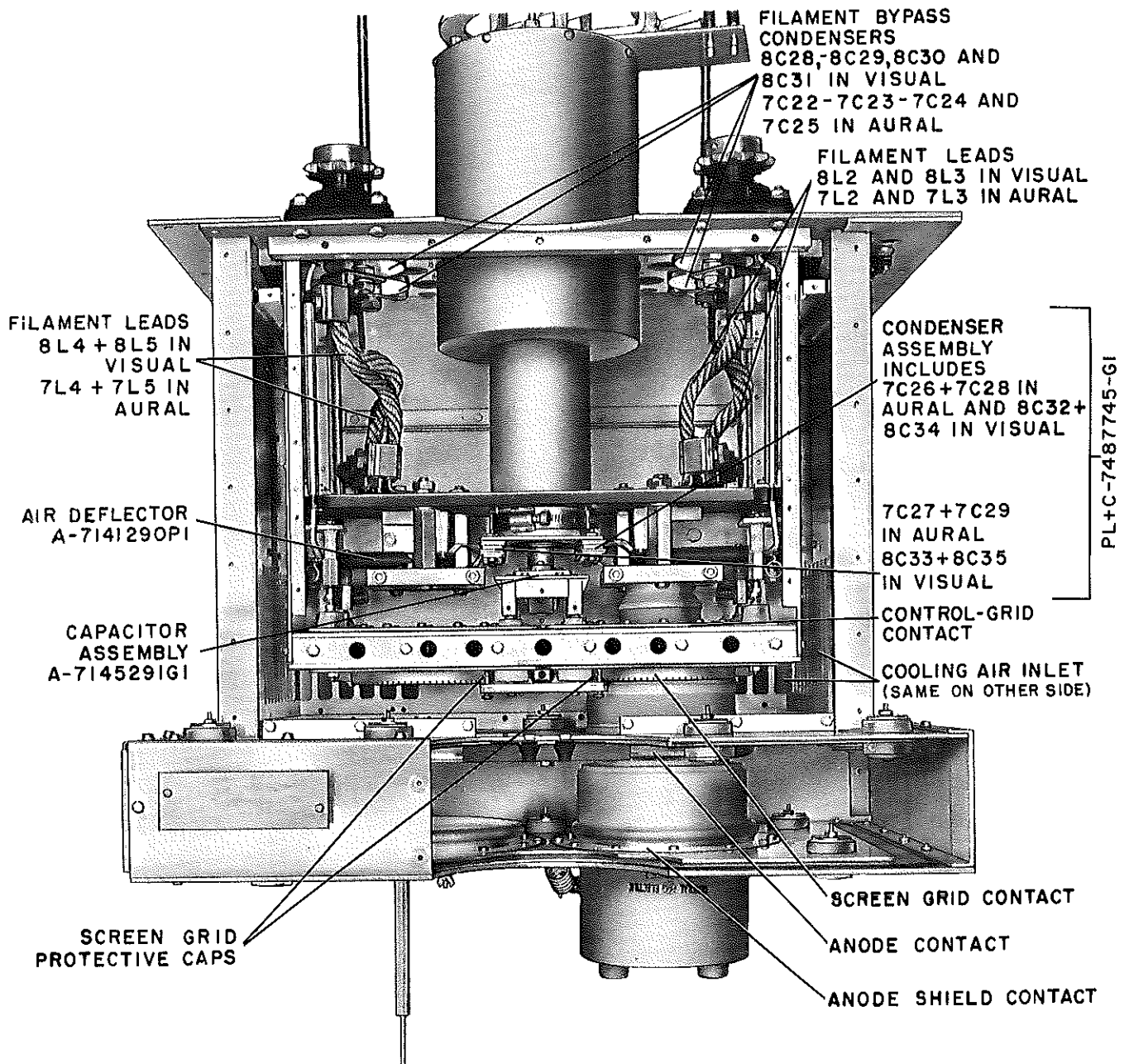
ORDERING REPLACEMENT PARTS

In general, parts listed in the Parts List will be stocked and made available from the General Electric Company, Electronics Division, Syracuse, New York. To expedite delivery, the parts requested should be identified by the G-E drawing number where known. Certain mechanical items of the cavity and plumbing are listed in a Mechanical Parts list following the Parts List of electrical components; these may be ordered by the G-E drawing number indicated. Other items are called out in the various photographic illustrations appearing throughout this instruction book and may be ordered by description and by reference to the figure number of the illustration in which they appear. Cavity assembly items are further called out in the photographic illustrations referred to in the sub-section which follows, Cavity Construction, and may be ordered by the appropriate G-E drawing number.

Included in this instruction book there will be found inserts which deal with major components of this equipment, such as motors, water pump, relays, and main contactor. The Electronics Division of the General Electric Company in Syracuse will be happy to supply replacement parts for any of these items, but faster service may be obtained by dealing directly with the nearest service office listed in the applicable insert. Special attention is called to the insert titled "General Electric Small Motor Service Station Plan." All the motors used in this equipment may be supplied with parts by contacting the nearest service shop in this insert. The main plate contactor 5K1 is a General Electric Type AK-1-25 Air Circuit Breaker. The insert dealing with this breaker (GEH-1807) lists the service shops throughout the United States where expert service and spare parts may be quickly obtained. The apparatus shops listed in this insert can also give fast service on any large transformer or reactor used in this equipment.

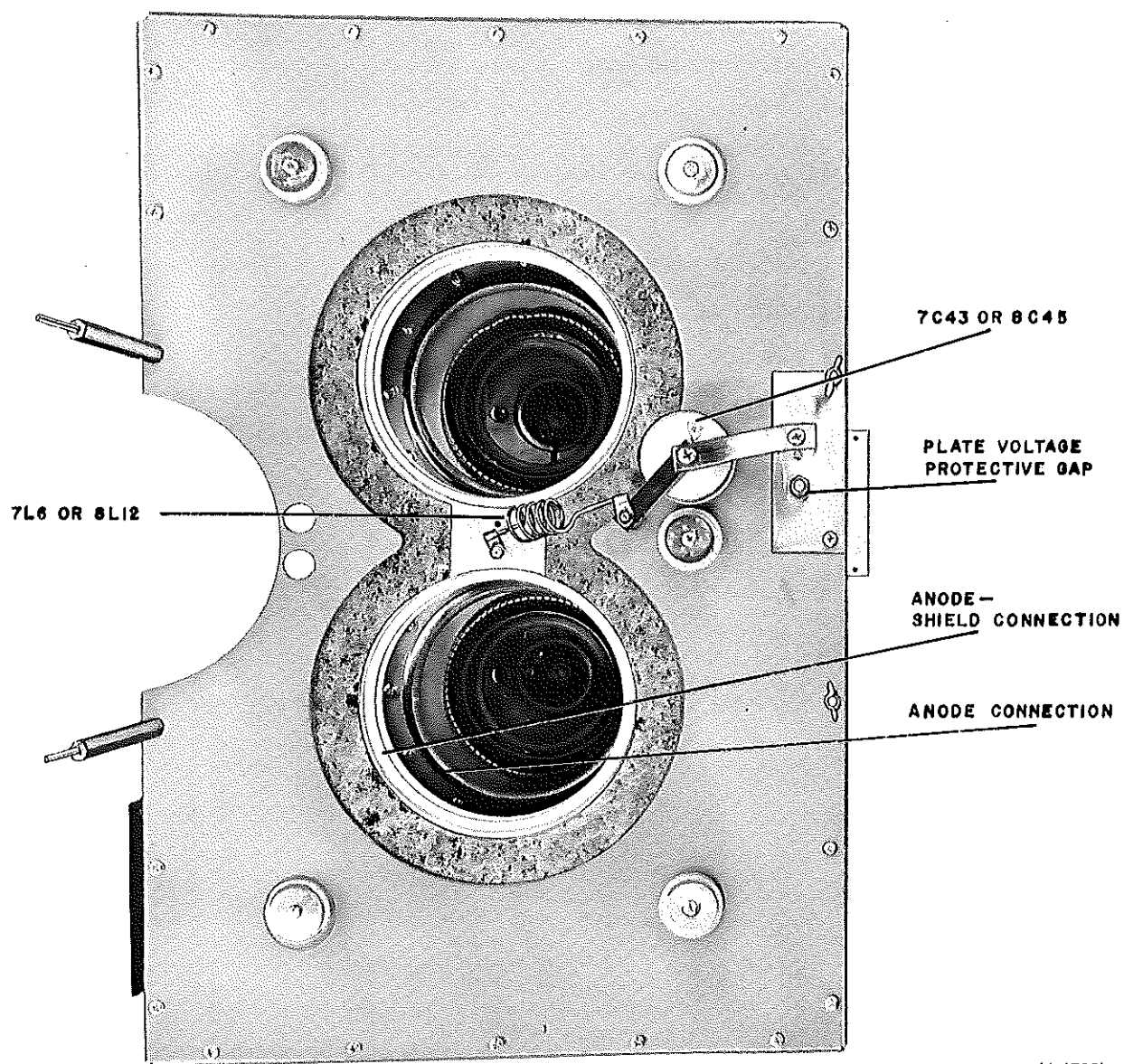
CAVITY CONSTRUCTION

The Cavity Assembly, G-E Drawing PL-7668731-G1, is identical in the Visual and Aural Amplifiers. Figs. 49 through 55 are photographs taken during the assembly of a cavity. They are supplied here for the convenience of the customer in identifying the various parts of the cavity and in ordering replacement parts by reference to the G-E drawing numbers supplied.



(4-4789)

Fig. 54 Cavity in Process of Construction: Anode Contact Assembly and Shield in Place,
One Tube Installed, Rear View



(4-4799)

Fig. 55 Cavity in Process of Construction: Anode Contact Assembly and Shield in Place, Tubes Lacking, Bottom View

THEORY AND CIRCUIT ANALYSIS

CONTROL CIRCUITS

GENERAL

In the design of the control circuits, particular attention has been given to safety of personnel, protection of the equipment, and reliability of operation.

Front-of-panel operation is provided for the filament and low-voltage supplies. Adjustment of the high-voltage plate supply is accomplished by primary tap-changing of the high-voltage transformer 5T1.

All relays and contactors, with the exception of overload relays, filament interlock relays, and the main close coil of the circuit breaker 5K1, operate from a 115-volt control transformer, 6T1, with one side grounded. All overload relays are d-c operated; the filament interlock relays operate from the controlled-voltage source for all filaments and low-voltage supplies; and the main close coil of the plate circuit breaker is operated from the main transmitter supply voltage. All relays with more than 115 volts on their terminals are located within the cubicles and are not accessible when the transmitter is in operation.

The rear doors of all the cubicles are equipped with suitable interlocks to remove power from all power supplies. In addition, high-voltage grounding switches short the high-voltage supplies to ground and short circuit the secondary winding of the high-voltage plate transformer.

Circuit protection is provided by direct-current over-current relays and magnetically operated circuit breakers. A system of supervisory lights indicates the operation of the d-c overload relays as well as certain other circuit conditions.

Amplifier start-stop and rectifier on-off push buttons

are supplied with internal lights to indicate circuit status.

The indicating-light color selection is such that green always indicates ready. It shows that power is available and that the starting sequence has been completed up to that point. Red shows that the circuit is energized and in operation. White indicates an abnormal condition, such as an overload, open door, etc.

Automatic power failure restart and plate overload reclosure with automatic reset are provided for both the Aural and Visual sections.

All a-c operated relays must have their coil voltages reduced to 5/6 of the 60-cps value if operated from a 50-cps power source. This is accomplished by changing a tap on the control transformer 6T1 as described in the INSTALLATION section.

Relays 6K1, 6K5, and 6K14 are latching-type relays. When the latch-in coil is momentarily energized, the operating mechanism is held in the closed position by a mechanical latching device. When the reset coil is momentarily energized, the mechanical latching device is tripped, opening the relay.

The reclosure relay 6K15 is the cycling type. Each time the cycling coil is momentarily energized the relay advances one step until the final step is reached. There are four stepping positions. When the reset coil is energized, the relay returns to its starting position.

Note that the Simplified Control Circuit Elementary Diagram, Fig. 73, shows all relay contacts in their normally energized position, and all latch-type relays in the reset position, with the exception of 6K14. Relay 6K14 is shown in the latched-in position, since this is the normal position, the reset coil being energized only when a plate circuit reclosure is in order.

CONTROL CIRCUIT COMPONENTS AND THEIR FUNCTIONS

<u>Component</u>	<u>Name</u>	<u>Function</u>
6I2	Rectifier DOOR supervisory light	6I2 is energized when the Rectifier door interlock switch 6S11 is closed, indicating that the Rectifier door is open.
6IS1	RECTifier ON push button	Momentary contact of 6IS1 energizes the latch coil of the Rectifier-on latch relay 6K5 and energizes the reclosure reset relay 6K16.
6IS2	RECTifier OFF push button	Momentary contact of 6IS2 energizes the reset coil of the Rectifier-on latch relay 6K5.
6IS3	ARC BACK RESET indicator push button	The normally closed contact opens when 6IS3 is depressed, removing plate power from the arc-back indicating tubes 6V10 through 6V15.

<u>Component</u>	<u>Name</u>	<u>Function</u>
6K1	Amplifier start-stop latch relay	6K1 energizes the blower contactor 6K2, the Visual air contactor 8K8, the Aural air contactor 7K8, the Visual water indicator light relay 8K9, the Aural water indicator light relay 7K9, and the Rectifier filament contactor 6K4. In the reset position, 6K1 energizes the shutdown time-delay relay 6K3 and the lamp in the green AMPLIFIER START push button 7IS2.
6K2	Blower contactor	6K2 energizes the Rectifier blower motors 6BM1 through 6BM4, the Aural blower 7BM1, the Visual blower 8BM1, the Aural blower interlock relay 6K31, the Visual blower interlock relay 6K32, the main water pump, and the two heat exchanger blowers.
6K3	Shutdown time-delay relay	6K3 provides a three-minute time delay in de-energizing 6K2 after the filaments have been de-energized by operating the AMPLIFIER STOP push button.
6K4	Rectifier filament contactor	6K4 energizes the filaments of the high-voltage rectifier tubes 6V1 through 6V6.
6K5	Rectifier-on latch relay	6K5 energizes the auxiliary close solenoid of the main Rectifier breaker 5K1 when in the latch position. In the reset position, 6K5 energizes the shunt trip solenoid of 5K1.
6K6	Restart auxiliary time-delay relay	6K6 delays the reapplication of power to the main Rectifier breaker auxiliary close solenoid after plate power off-on operation.
6K7	Lockout relay	When energized through the normally open auxiliary contact on the main Rectifier breaker, 6K7 removes power from the breaker auxiliary close solenoid and the cutoff-device circuit after a short time delay. 6K7 also provides time delay for the step-start run contactor 6K10 and the Rectifier reclosure auxiliary latch relay 6K14.
6K9	Screen voltage step-start run contactor	6K9 short circuits the step-start resistors in series with the filter capacitors for both Aural and Visual screenvoltage supplies a short time after the Rectifier breaker 5K1 closes. These resistors prevent a heavy charging surge through the rectifier tubes.
6K10	High-voltage step-start run contactor	6K10 short circuits the step-start resistors in series with the high-voltage power supply filter capacitors for both Aural and Visual sections of the high-voltage power supply a short time after Rectifier breaker 5K1 closes. These resistors prevent a heavy charging surge through the high-voltage rectifier tubes.
6K11	DC switch transfer relay	6K11 is energized only when the DC switches are in the position specified by the multi-contact selector switch 7S8. When energized, 6K11 ener-

<u>Component</u>	<u>Name</u>	<u>Function</u>
6K12	Visual HV DC switch	gizes the red DC SWITCH STATUS supervisory light 7I16 and the restart time-delay relay 6K6. When in the closed position, 6K12 connects the output of the high-voltage rectifier to the Visual HV rectifier filter. When 6K12 is in the open position, the filter is disconnected and grounded. Auxiliary contacts on 6K12 remove power from the momentary-duty transfer solenoids and energize the DC switch transfer relay 6K11 upon completion of the transfer operation.
6K13	Aural HV DC switch	When in the closed position, 6K13 connects the output of the high-voltage rectifier to the Aural rectifier filter. When 6K13 is in the open position, the filter is disconnected and grounded. Auxiliary contacts on 6K13 remove power from the momentary-duty transfer solenoids and energize the DC switch transfer relay 6K11 upon completion of the transfer operation.
6K14	Rectifier reclosure auxiliary latch relay	6K14 de-energizes the lockout relay 6K7 and the restart auxiliary time-delay relay 6K6, and energizes the reclosure coil of the reclosure relay 6K15 when the reset coil of 6K14 is energized. This reset coil is energized whenever the main Rectifier breaker is tripped out and the Rectifier-on latch relay 6K5 is in the latch position, which will be its condition if an overload relay is operated. Note that the contacts of 6K14 are shown in the Elementary Diagram to be in the latch position, which is the normal operating position.
6K15	Rectifier reclosure relay	6K15 operates through one latch position each time the auxiliary relay 6K14 operates to the reset position, resetting 6K14 to the latch position twice and remaining in the reset or lockout position after the third operation.
6K16	Rectifier reclosure manual reset relay	6K16 operates when a RECT ON push button is depressed. It energizes the reset coil of the Rectifier reclosure relay 6K15 and the latch coil of the Rectifier reclosure auxiliary latch relay 6K14.
6K17	Rectifier reclosure automatic reset relay	6K17 is energized when the Rectifier reclosure relay 6K15 is in either the 2nd or 3rd position. After a delay of approximately ten seconds, the contact closes, energizing the reset coil on the Rectifier reclosure relay 6K15.
6K20	Rectifier arc-back supervisory light relay	6K20 is energized by anyone of the arc-back indicator tubes 6V1 through 6V6. It energizes the ARC BACK supervisory light 7I12 on the front panel of the Aural Amplifier cubicle.
6K21	Rectifier arc-back relay	When operated, 6K21 energizes the starter anode of the arc-back indicator tube 6V2 and the shunt trip solenoid of the main breaker 5K1.

<u>Component</u>	<u>Name</u>	<u>Function</u>
6K22	Rectifier arc-back relay	When operated, 6K22 energizes the starter anode of the arc-back indicator tube 6V4 and the shunt trip solenoid of the main breaker 5K1.
6K23	Rectifier arc-back relay	When operated, 6K23 energizes the starter anode of the arc-back indicator tube 6V6 and the shunt trip solenoid of the main breaker 5K1.
6K24	Rectifier arc-back relay	When operated, 6K24 energizes the starter anode of the arc-back indicator tube 6V5 and the shunt trip solenoid of the main breaker 5K1.
6K25	Rectifier arc-back relay	When operated, 6K25 energizes the starter anode of the arc-back indicator tube 6V3 and the shunt trip solenoid of the main breaker 5K1.
6K26	Rectifier arc-back relay	When operated, 6K26 energizes the starter anode of the arc-back indicator tube 6V1 and the shunt trip solenoid of the main breaker 5K1.
6K27	Rectifier DC overload relay	When energized, 6K27 energizes the main breaker shunt trip solenoid and its associated supervisory light relay 7K11.
6K30	Rectifier filament interlock relay	6K30 is energized by the high-voltage rectifier filament circuit. It prevents the application of power to the filament time-delay relays 8K2 and 7K2 and interlocks the main breaker undervoltage circuit before the filament circuit is energized.
6K31	Aural blower interlock relay	6K31 is energized by the Aural blower motor circuit. It prevents the application of power to the Aural filament contactor 7K1 before the Aural blower motor is energized.
6K32	Visual blower interlock relay	6K32 is energized by the Visual blower motor circuit. It prevents the application of power to the Visual filament contactor 8K1 before the Visual blower motor is energized.
6S8	Rectifier panel interlock	6S8 de-energizes the main breaker undervoltage (UV) solenoid when the relay panel is opened, causing the breaker to fall out.
6S9	Rectifier panel interlock	Same as 6S8, above.
6S10	Rectifier door interlock	6S10 de-energizes the main breaker undervoltage (UV) solenoid when the rear door of the cubicle is opened, causing the breaker to fall out.
6S11	Rectifier door interlock	The normally closed contacts on 6S11 energize the reset coil of the Rectifier-on latch relay 6K5 and the Rectifier DOOR supervisory light 6I2 when the rear door of the cubicle is opened.
7I1	Aural AIR supervisory light	7I1 is energized when the Aural air interlock switch 7S1 or the filament-wrench switch 7S21 is open, preventing the Aural filament contactor 7K1 from operating.
7I2	Aural WATER supervisory light	7I2 is energized when the water flow interlocks 7S33 and 7S34 or the water temperature inter-

50-KW TELEVISION AMPLIFIER

EBI-3295

<u>Component</u>	<u>Name</u>	<u>Function</u>
		locks 7S35 and 7S36 are open, preventing the Aural filament contactor 7K1 from operating.
7I3	Aural DOOR supervisory light	7I3 is energized when the Aural door interlock switch 7S2 is open, preventing the Aural bias contactor 7K4 from operating.
7I4	Aural BIAS supervisory light	7I4 is energized when the Aural bias undervoltage relay 7K12 is not energized, preventing the application of Aural plate voltage. It indicates failure of the bias voltage.
7I5	Aural CATHODE UNBALANCE supervisory light	7I5 is energized when the Aural cathode unbalance relay 7K22 operates. It indicates when the cathode currents of the Aural amplifier tubes differ by more than 10 percent.
7I6	Aural CATHODE (LEFT) overload supervisory light	7I6 is energized after each operation of the Aural cathode overload relay 7K15. It indicates momentary abnormal current in the Aural PA tube 7V7.
7I7	Aural CATHODE (RIGHT) overload supervisory light	7I7 is energized after each operation of the Aural cathode overload relay 7K16. It indicates momentary abnormal current in the Aural PA tube 7V6.
7I8	Aural SCREEN overload supervisory light	7I8 is energized after each operation of the Aural screen overload relay 7K14. It indicates momentary abnormal load on the Aural screen power supply.
7I9	RF OUTPUT supervisory light	7I9 is energized after each operation of the Aural antenna relay 7K17, the Aural output protection relay 7K21, or the Visual output protection relay 8K19. It indicates excessive standing wave ratio in the Aural or Visual transmission line.
7I10	Rectifier DC (HV) supervisory light	7I10 is energized after each operation of the Rectifier DC overload relay 6K27. It indicates momentary abnormal d-c load on the HV plate supply.
7I11	Main breaker UNDER VOLTAGE circuit supervisory light	7I11 is energized by the normally closed contacts of the undervoltage circuit supervisory light relay 7K19 which is not energized when the main breaker undervoltage circuit is open.
7I12	Rectifier ARC BACK supervisory light	7I12 is energized by the Rectifier arc-back supervisory light relay 6K20. It indicates that an arc back has occurred in a HV rectifier tube and that one of the Rectifier arc-back tubes has been ignited.
7I13	Rectifier reclosure LOCK OUT supervisory light	7I13 is energized when the Rectifier reclosure auxiliary latch relay 6K14 is in the reset position. It indicates either that the reclosure relay 6K15 has been operated three times in less than 10 seconds and is in its final position, or that the AUTO RECLOSER switch 7S5 is in the OFF

<u>Component</u>	<u>Name</u>	<u>Function</u>
		position, preventing 6K15 from operating and that 6K14 is preventing subsequent closing of the main Rectifier breaker 5K1.
7I14	AUTO RECLOSER SWITCH supervisory light	7I14 is energized when the AUTO RECLOSER switch 7S5 is in the OFF position. It indicates that the reclosure relay 6K15 has been disconnected, so that no plate reclosures can occur following an overload condition.
7I15	TUNING motor POWER supervisory light	7I15 is energized when the TUNING motor POWER switch 7S32 is closed. It indicates that power is available to operate the tuning motors 7B1, 7B2, and 7B3 whenever TUNING controls 7S29 (PLATE), 7S30 (TUNE), and 7S31 (LOAD) are operated.
7I16	DC SWITCH STATUS supervisory light	7I16 is energized when the DC switch transfer relay 6K11 is operated. It indicates that the DC switches 6K12 and 6K13 have properly operated in accordance with the position of the VISUAL-BOTH-AURAL DC SWITCH 7S8.
7I17	Aural FIL TD STATUS supervisory light	7I17 is energized when the Aural filament time-delay relay 7K2 has timed out or when the EMERGENCY START push button 7S3 has been operated. It indicates that sufficient filament heating time has elapsed to apply HV plate power safely.
7IS1	AMPLIFIER STOP push button	Momentary contact of 7IS1 energizes the reset coil of the latch relay 6K1.
7IS2	AMPLIFIER START push button	Momentary contact of 7IS2 energizes the latch coil of the latch relay 6K1.
7IS3	RECTIFIER ON push button	Momentary contact of 7IS3 energizes the latch coil of the Rectifier-on latch relay 6K5 and the reclosure reset relay 6K16.
7IS4	RECTIFIER OFF push button	Momentary contact of 7IS4 energizes the reset coil of the Rectifier-on latch relay 6K5.
7IS5	Supervisory light RESET push button	The normally closed contact of 7IS5 de-energizes the supervisory light relays 7K5, 7K6, 7K7, 7K10, 7K11, and 8K5, 8K6, 8K7 when 7IS5 is depressed.
7K1	Aural filament contactor	7K1 energizes the filaments of all tubes in the Aural section of the Amplifier.
7K2	Aural filament time-delay relay	7K2 delays the application of plate power for approximately one minute after the application of filament power.
7K3	Aural filament time-delay bypass time-delay relay	7K3 provides a two-second delay in drop-out of the filament time-delay circuit should a momentary power failure occur. It permits instant re-application of plate power within this time.
7K4	Aural bias contactor	7K4 energizes the aural bias supply.

50-KW TELEVISION AMPLIFIER

EBI-3295

<u>Component</u>	<u>Name</u>	<u>Function</u>
7K5	Aural cathode supervisory light relay	7K5 is energized by the supervisory light relay 7K15. It locks in, energizing the Aural CATHODE (LEFT) overload supervisory light 7I6.
7K6	Aural cathode supervisory light relay	7K6 is energized by the supervisory light relay 7K16. It locks in, energizing the Aural CATHODE (RIGHT) overload supervisory light 7I7.
7K7	Aural screen supervisory light relay	7K7 is energized by 7K14. It locks in, energizing the Aural SCREEN overload supervisory light 7I8.
7K8	Aural air interlock relay	7K8 prevents the application of filament power to the Aural Amplifier before the Aural blower is operating.
7K9	Aural water interlock relay	7K9 prevents the application of filament power to the Aural Amplifier before the Aural water is circulating.
7K10	RF output supervisory light relay	7K10 is energized by 7K17. It locks in, energizing the RF OUTPUT supervisory light 7I9.
7K11	Rectifier DC supervisory light relay	7K11 is energized by 6K27. It locks in, energizing the rectifier DC (HV) supervisory light 7I10.
7K12	Aural bias undervoltage relay	7K12 prevents the application of plate power to the Aural Amplifier before bias voltage is established.
7K13	Aural filament interlock relay	7K13 is energized by the Aural Amplifier filament circuit. It prevents the application of power to the Aural filament time-delay relay 7K2 and interlocks the main breaker 5K1 before the filament circuit is energized.
7K14	Aural screen overload relay	When energized, 7K14 energizes the main breaker shunt trip solenoid and energizes its associated supervisory light relay 7K7.
7K15	Aural cathode overload relay (left)	When energized, 7K15 de-energizes the main breaker under-voltage solenoid, energizes the main breaker shunt trip solenoid, and energizes its associated supervisory light relay 7K5.
7K16	Aural cathode overload relay (right)	When energized, 7K16 energizes the main breaker shunt trip solenoid and energizes its associated supervisory light relay 7K6.
7K17	Aural RF output relay	When energized, 7K17 de-energizes the main breaker under-voltage solenoid, energizes the main breaker shunt trip solenoid, and energizes the associated supervisory light relay 7K10.
7K18	Aural cathode unbalance supervisory light relay	7K18 is energized by 7K22. It locks in, energizing the CATHODE UNBALANCE supervisory light 7I5.
7K19	Main breaker undervoltage circuit supervisory light relay	7K19 is energized simultaneously with the main breaker undervoltage circuit. When energized, 7K19 de-energizes the main breaker UNDER VOLTAGE circuit supervisory light 7I11.

<u>Component</u>	<u>Name</u>	<u>Function</u>
7K20	Aural sweep termination relay	When energized by the OPERATE-SWEEP switch 7S20 (on the lower front panel), 7K20 connects the Aural sweep termination to the plate circuit RF probe.
7K21	Aural RF output protective relay	When energized, 7K21 energizes the main breaker shunt trip solenoid and energizes the associated supervisory light relay 7K10.
7K22	Aural cathode unbalance relay	When energized, 7K22 energizes the main breaker shunt trip solenoid and energizes its associated supervisory light relay 7K18.
7K23	Aural and Visual screen supply contactor	When energized by the main breaker interlock, 7K23 energizes the Aural and Visual Amplifier screen supply.
7S1	Aural air interlock switch	7S1 is an air-velocity operated switch which prevents operation of the Aural filament contactor 7K1 until there is tube-cooling air flowing past the Aural PA tubes.
7S2	Aural door interlock switch	7S2 prevents the application of power to the Aural bias contactor 7K4 when the rear door of the Aural Amplifier cubicle is open.
7S3	Aural EMERGENCY START push button	Momentary contact of 7S3 bypasses the Aural time-delay relay 7K2, sealing in the bypass time-delay relay 7K3. This permits emergency application of plate power in less than one minute after a power failure.
7S4	Aural door interlock switch	7S4 energizes the reset coil of the Rectifier-on latch relay 6K5 when the rear door of the Aural Amplifier cubicle is open, unless 7S8 is in the VISUAL position.
7S5	Plate reclosure switch (AUTO RECLOSER switch)	When in the OFF position, 7S5 prevents the reclosure relay 6K15 from operating and energizes the reclosure switch supervisory light transformer 7T11.
7S8	VISUAL-BOTH-AURAL DC SWITCH	<p>This multiple-contact switch performs all the switching necessary to enable operation of either the Aural or Visual Amplifier separately, or both simultaneously from a common high-voltage rectifier while maintaining all control circuit features and safety provisions in all three positions. The specific functions of its contacts, numbered below as they appear on the Power Distribution and Control Elementary Diagram, Fig. 76, are as follows:</p> <p>(1) In the AURAL position, this contact permits the application of power to the latch coil of the Rectifier-on relay 6K5 when the Visual filament interlock relay 8K10 and the Visual bias undervoltage relays 8K12 and 8K13 are de-energized.</p>

50-KW TELEVISION AMPLIFIER

EBI-3295

<u>Component</u>	<u>Name</u>	<u>Function</u>
		(2) In the VISUAL position, this contact permits the application of power to the latch coil of the Rectifier-on latch relay 6K5 when the Aural filament interlock relay 7K13 and the Aural bias undervoltage relay 7K12 are de-energized.
		(3) In the AURAL position, this contact prevents the Visual door interlock 8S3 from energizing the reset coil of the Rectifier-on latch relay 6K5 when the rear door of the Visual Amplifier cubicle is open.
		(4) In the VISUAL position, this contact prevents the Aural door interlock 7S4 from energizing the reset coil of the Rectifier-on latch relay 6K5 when the rear door of the Aural Amplifier cubicle is open.
		(5) In the VISUAL position, this contact prevents the Aural cathode overload relays 7K15 and 7K16, the Aural screen overload relay 7K14, and the Aural RF output relay 7K17 from energizing the shunt trip solenoid of the main breaker 5K1.
		(6) In the AURAL position, this contact prevents the Visual cathode overload relays 8K14 and 8K15, the Visual screen overload relay 8K11, and the Visual cathode unbalance relay 8K13 from energizing the shunt trip solenoid of the main breaker 5K1.
		(7) In the AURAL position, this contact shorts out the contacts of the Visual interlocking and overload relays 8K10, 8K12, 8K13 and the Visual panel interlock switch 8S11, preventing them from de-energizing the undervoltage solenoid of the main breaker 5K1.
		(8) In the VISUAL position, this contact shorts out the contacts of the Aural interlocking and overload relays 7K12, 7K13, 7K17 and the Aural panel interlock switch 7S22, preventing them from de-energizing the undervoltage solenoid of the main breaker 5K1.
		(9) This contact opens the main breaker undervoltage solenoid circuit when 7S8 is between the main positions of AURAL only, BOTH, or VISUAL only. This insures that there can be no transfer switching with HV plate power on.
		(10) When closed in the VISUAL or BOTH position, this contact energizes the close solenoid on the Visual HV DC switch 6K12.

<u>Component</u>	<u>Name</u>	<u>Function</u>
		(11) When closed in the AURAL position, this contact energizes the open solenoid on the Visual HV DC switch 6K12.
		(12) When closed in the AURAL or BOTH position, this contact energizes the close solenoid on the Aural HV DC switch 6K13.
		(13) When closed in the VISUAL position, this contact energizes the open solenoid on the Aural HV DC switch 6K13.
		(14) and (15) When open in the AURAL position, these contacts prevent the application of power to the Visual screen supply.
		(16) and (17) When open in the VISUAL position, these contacts prevent the application of power to the Aural screen supply.
		(18) When open in the AURAL position, this contact interlocks the Visual exciter control circuit to prevent the application of excitation power to the Visual Amplifier.
		(19) When open in the VISUAL position, this contact interlocks the Aural exciter control circuit to prevent the application of excitation power to the Aural Amplifier.
		(20) and (21) These contacts operate in conjunction with the auxiliary contacts on the HV DC switches 6K12 and 6K13 to insure that the transfer auxiliary relay 6K11 will be energized only when 6K12 and 6K13 have properly transferred to the positions called for by the transfer switch 7S8.
7S21	Aural filament wrench interlock switch	When the Aural filament wrench is not in its proper storage position, 7S21 de-energizes the Aural air interlock relay 7K8, preventing the Aural filament contactor 7K1 from operating.
7S22	Aural relay panel interlock switch	7S22 prevents the application of power to the undervoltage solenoid of the main breaker 5K1.
7S33	Aural water flow interlock switch (left)	When the water flow drops below 8 gallons per minute, 7S33 de-energizes the Aural water interlock relay 7K9, preventing the Aural filament contactor 7K1 from operating.
7S34	Aural water flow interlock switch (right)	When the water flow drops below 8 gallons per minute, 7S34 de-energizes the Aural water interlock relay 7K9, preventing the Aural filament contactor 7K1 from operating.
7S35	Aural water temperature interlock switch (left)	When the Aural water temperature exceeds 70 C (158F), 7S35 de-energizes the Aural water interlock 7K9, preventing the Aural filament contactor 7K1 from operating.

50-KW TELEVISION AMPLIFIER

EBI-3295

<u>Component</u>	<u>Name</u>	<u>Function</u>
7S36	Aural water temperature interlock switch (right)	When the Aural water temperature exceeds 70C (158F), 7S36 de-energizes the Aural water interlock 7K9, preventing the Aural filament contactor 7K1 from operating.
8I1	Visual AIR supervisory light	8I1 is energized when the Visual air interlock switch 8S8 or the Visual filament-wrench interlock 8S18 is open, preventing the Visual filament contactor 8K1 from operating.
8I2	Visual DOOR supervisory light	8I2 is energized when the Visual door interlock 8S1 is open, preventing the Visual bias contactor 8K4 from operating.
8I3	Visual BIAS supervisory light	8I3 is energized when the Visual bias undervoltage relay 8K12 is not energized, preventing the application of Visual plate voltage. It indicates bias voltage failure.
8I4	Visual CATHODE overload supervisory light (RIGHT)	8I4 is energized after each operation of the Visual cathode overload relay 8K14. It indicates momentary abnormal cathode current in the Visual PA tube 8V11.
8I5	Visual CATHODE overload supervisory light (LEFT)	8I5 is energized after each operation of the Visual cathode overload relay 8K15. It indicates momentary abnormal cathode current in the Visual PA tube 8V10.
8I6	Visual SCREEN supervisory light	8I6 is energized after each operation of the Visual screen overload relay 8K11. It indicates momentary abnormal screen current to the PA.
8I7	Visual FIL TD STATUS supervisory light	8I7 is energized when the Visual filament time-delay relay 8K2 has timed out, or when the EMERGENCY START push button 8S2 has been operated. It indicates that sufficient filament heating time has elapsed to apply HV plate power safely.
8I8	TUNING motor POWER supervisory light	8I8 is energized when the TUNING motor POWER switch 8S29 is closed. It indicates that power is available to operate the tuning motors, 8B1, 8B2, and 8B3 whenever the tuning controls 8S26, 8S27, and 8S28 are operated.
8I9	Visual WATER supervisory light	8I9 is energized when the water flow interlocks 8S31 and 8S32 or the water temperature interlocks 8S33 and 8S34 are open, preventing the Visual filament contactor 8K1 from operating.
8I10	Visual CATHODE UNBALance supervisory light	8I10 is energized when the Visual cathode unbalance relay 8K13 operates. It indicates when the cathode currents of the Visual PA tubes differ by more than 10 percent.
8IS1	Visual RECTIFIER ON push button	Momentary contact of 8IS1 energizes the latch coil of the Rectifier-on latch relay 6K5 and energizes the reclosure reset relay 6K16.
8IS2	Visual RECTIFIER OFF push button	Momentary contact of 8IS2 energizes the reset coil of the Rectifier-on latch relay 6K5.

<u>Component</u>	<u>Name</u>	<u>Function</u>
8K1	Visual filament contactor	8K1 energizes the filaments of all tubes in the Visual section of the Amplifier.
8K2	Visual filament time-delay relay	8K2 delays the application of plate power for approximately one minute after the application of filament power.
8K3	Visual filament time-delay bypass time-delay relay	8K3 provides a two-second delay in the drop-out of the filament time-delay circuit should a momentary power failure occur. It permits instant re-application of plate power within this time.
8K4	Visual bias contactor	8K4 energizes the Visual bias supply.
8K5	Visual cathode supervisory light relay (right)	8K5 is energized by 8K14. It locks in, energizing the Visual CATHODE (RIGHT) overload supervisory light 8I4.
8K6	Visual cathode supervisory light relay (left)	8K6 is energized by 8K15. It locks in, energizing the Visual CATHODE (LEFT) overload supervisory light 8I5.
8K7	Visual screen supervisory light relay	8K7 is energized by 8K11. It locks in, energizing the Visual SCREEN overload supervisory light 8I6.
8K8	Visual air interlock	8K8 prevents the application of filament power to the Visual Amplifier before the Visual blower is operating.
8K9	Visual water interlock relay	8K9 prevents the application of filament power to the Visual Amplifier before Visual water is circulating.
8K10	Visual filament interlock relay	8K10 is energized by the Visual Amplifier filament circuit. It prevents the application of power to the Visual filament time-delay relay 8K2 and interlocks the main breaker 5K1 before the filament circuit is energized.
8K11	Visual screen overload relay	When energized, 8K11 de-energizes the main breaker undervoltage solenoid, energizes the main breaker shunt trip solenoid, and energizes its associated supervisory light relay 8K7.
8K12	Visual bias undervoltage relay	8K12 interlocks the main breaker 5K1 and prevents the application of plate power to the Visual Amplifier before the bias voltage is established.
8K13	Visual cathode unbalance relay	When energized, 8K13 energizes the main breaker shunt trip solenoid and energizes its associated supervisory light relay 8K16.
8K14	Visual cathode overload relay (right)	When energized, 8K14 energizes the main breaker shunt trip solenoid and energizes its associated supervisory light relay 8K5.
8K15	Visual cathode overload relay (left)	When energized, 8K15 energizes the main breaker shunt trip solenoid and energizes its associated supervisory light relay 8K6.

50-KW TELEVISION AMPLIFIER

EBI-3295

<u>Component</u>	<u>Name</u>	<u>Function</u>
8K16	Visual cathode unbalance supervisory light relay	8K16 is energized by 8K13. It locks in, energizing the CATHODE UNBALANCE supervisory light 8I10.
8K17	Visual overdrive relay	8K17 is energized by an excessive flow of screen current. It will close its normally closed contacts much faster than the screen overload relay 8K11 operates. If the excessive screen current was caused by excessive drive and the contacts of 8K17 are connected back to the driving transmitter in a circuit to reduce the drive, it will prevent a screen overload. Relay 8K17 need not be connected when using a driving transmitter rated at 5 kilowatts. 8R3 adjusts the operating point of this relay.
8K18	Visual sweep termination relay	When energized by the OPERATE-SWEEP switch 8S17 (on the lower front panel), 8K18 connects the Visual sweep termination to the plate circuit RF probe.
8K19	Visual RF output protective relay	When energized, 8K19 energizes the main breaker shunt trip solenoid and energizes the associated supervisory light relay 7K10.
8S1	Visual door interlock switch	8S1 prevents the application of power to the Visual bias contactor when the rear door of the Visual Amplifier cubicle is open.
8S2	Visual EMERGENCY START push button	Momentary contact of 8S2 bypasses the Visual filament time-delay relay 8K2, sealing in the bypass time-delay relay 8K3. This permits emergency application of plate power in less than one minute after a power failure.
8S3	Visual door interlock switch	8S3 energizes the reset coil of the Rectifier-on latch relay 6K5 when the rear door of the Visual Amplifier cubicle is open, unless 7S8 is in the Aural position.
8S8	Visual air interlock switch	8S8 is an air-velocity operated switch which prevents operation of the Visual filament contactor 8K1 until there is tube-cooling air flowing past the Visual PA tubes.
8S11	Visual relay panel interlock switch	8S11 prevents the application of power to the undervoltage solenoid of the main breaker 5K1.
8S18	Visual filament wrench interlock switch	When the Visual filament wrench is not in its proper storage position, 8S18 de-energizes the Visual filament contactor 8K1.
8S31	Visual water flow interlock switch (left)	When the water flow drops below 8 gallons per minute, 8S31 de-energizes the Visual water interlock relay 8K9, preventing the Visual filament contactor 8K1 from operating.
8S32	Visual water flow interlock switch (right)	When the water flow drops below 8 gallons per minute, 8S32 de-energizes the Visual water interlock relay 8K9, preventing the Visual filament contactor 8K1 from operating.

<u>Component</u>	<u>Name</u>	<u>Function</u>
8S33	Visual water temperature interlock switch (left)	When the Visual water temperature exceeds 70C (158F), 8S33 de-energizes the Visual water interlock relay 8K9, preventing the Visual filament contactor 8K1 from operating.
8S34	Visual water temperature interlock switch (right)	When the Visual water temperature exceeds 70C (158F), 8S34 de-energizes the Visual water interlock relay 8K9, preventing the Visual filament contactor 8K1 from operating.

STARTING SEQUENCE

Assuming that all circuit breakers and the doors of all cubicles are closed, the starting sequence is as follows:

Pressing the green AMPLIFIER START push button 7IS2 on the front panel of the Aural Amplifier cubicle energizes the latch coil of the Amplifier start-stop latch relay 6K1, which mechanically latches in. Relay 6K1 energizes the cooling contactor 6K2, applying power to the blower and water pump motors, de-energizes the shutdown time-delay relay 6K3, de-energizes the lamp in 7IS2, energizes the lamp in the red AMPLIFIER STOP push button 7IS1, energizes the Rectifier filament contactor 6K4, which applies power in the Rectifier and Control cubicle, partially completes the circuit of the Aural (7K8) and Visual (8K8) air interlock relays and the Aural (7K9) and Visual (8K9) water interlock relays. The blower interlock relays 6K31 and 6K32 are energized as soon as power is applied to the blower motors. As soon as the Aural and Visual blower motors come up to speed and the proper air flow is established, air interlock switches 7S1 and 8S8 close. The Aural (7K8) and Visual (8K8) air interlock relays are then energized, partially closing the circuit to their respective filament contactors 7K1 and 8K1 and de-energizing the Aural (7I1) and Visual (8I1) AIR supervisory lights. The Aural (7K9) and Visual (8K9) water interlock relays are energized when the proper water flow is established, completing the circuit to their respective filament contactors 7K1 and 8K1 and de-energizing the Aural (7I2) and Visual (8I9) WATER supervisory lights.

Filament power having been applied, the Rectifier filament interlock relay 6K30, the Visual filament interlock relay 8K10, and the Aural filament interlock relay 7K13 are all energized. These in turn energize the filament time-delay relays 8K2 and 7K2, partially complete the circuits of the latch coil of the Rectifier-on latch relay 6K5, and partially complete the undervoltage solenoid circuit of the main breaker 5K1. When the contacts of 8K2 and 7K2 close, the filament time-delay bypass time-delay relays 8K3 and 7K3 are energized, closing their contacts; the lamps in the filament

time-delay status lights 8I7 and 7I17 are energized; the Visual and Aural BIAS supervisory lights 8I3 and 7I4 are energized; the Visual and Aural DOOR supervisory lights 8I2 and 7I3 are energized; and the bias contactors 8K4 and 7K4 are energized. Energizing 8K4 and 7K4 immediately de-energizes the DOOR supervisory lights 8I2 and 7I3 and applies power to the Visual and Aural bias supplies. As soon as bias voltages are established, the bias undervoltage relays 8K12 and 7K12 are energized. Contacts on these relays de-energize the BIAS supervisory lights 8I3 and 7I4, partially complete the circuit of the latch coil of the Rectifier-on latch relay 6K5, energize the green RECTIFIER ON push buttons 7IS3 and 8IS1 and the green RECT ON push button 6IS1, energize the restart auxiliary relay 6K6 through a normally closed (NC) contact of 6K14 and a normally open (NO) contact of the transfer auxiliary relay 6K11 (relay 6K11 is energized in normal operation), and complete the undervoltage solenoid circuit of the main breaker 5K1.

Note that the BIAS supervisory lights are energized only when the bias contactors 8K4 and 7K4 are closed and the bias undervoltage relays have not operated. Also, the DOOR supervisory lights are energized only when the bias contactors are not energized because of an open door interlock.

Both the Visual and Aural sections of the Amplifier are now ready for the application of HV plate power. Depressing the RECTIFIER ON push buttons 8IS1, 7IS3 or the RECT ON push button 6IS1 momentarily energizes the latch coil of 6K5 and the reclosure reset relay 6K16. Relay 6K5 latches in mechanically. One of its normally closed (NC) contacts in the main breaker shunt trip circuit opens, and the other normally open (NO) contact in the auxiliary close solenoid circuit closes, applying power to the auxiliary close solenoid of 5K1.

The main breaker auxiliary close relay completes the circuit of the main close solenoid (assuming that the main close switch 5S1 is closed), causing the main breaker to operate. Power is then applied to the main plate transformer 5T1 and to both the Visual and Aural screen supplies. Auxiliary contacts in the main break-

er also de-energize the lamps in the green push buttons 6IS1, 7IS3, and 8IS1, complete the interlock circuits for the power supplies of the Aural and Visual sections of the exciter, energize the lockout relay 6K7, close in series with the breaker shunt trip circuit, open the solenoid circuits of DC switches 6K12 and 6K13, and open in series with the reset coil of the reclosure auxiliary latch relay 6K14. Breaker 5K1 mechanically latches in, and the contacts of the cutoff device are transferred mechanically by the up-stroke of the solenoid, the normally closed (NC) contact opening the auxiliary close solenoid, which de-energizes the main close solenoid.

When the lockout relay 6K7 is energized, one of its normally open (NO) contacts closes immediately in parallel with the auxiliary contact of 5K1 which initially energized 6K7, sealing it in; a second normally closed (NC) contact with time-delay opening opens after a short time and de-energizes the auxiliary close solenoid and the cutoff device circuit; and a third normally open (NO) contact with time-delay closing closes, energizing the Rectifier step-start run contactor 6K10 and the Aural and Visual step-start run contactor 6K9, energizes the lamps in the red RECTIFIER OFF push buttons 8IS2 and 7IS4 and in the red RECT OFF push button 6IS2, and partially completes the circuit of the reset coil of the Rectifier reclosure auxiliary latch relay 6K14. This completes the application of HV plate power to both sections of the Amplifier.

STOPPING SEQUENCE

Rectifier Off

Depressing either one of the red RECTIFIER OFF push buttons 7IS4 or 8IS2, or the red RECT OFF push button 6IS2 energizes the reset coil of the Rectifier-on latch relay 6K5. When 6K5 resets, a normally closed (NC) contact energizes the shunt trip solenoid of 5K1 through one of its normally open (NO) auxiliary contacts, which opens as soon as 5K1 drops out. The other contact of 6K5, which is a normally open (NO) contact, opens and de-energizes the lockout relay 6K7. Simultaneously, the step-start run contactors 6K9 and 6K10 are de-energized, and the lamps in the RECTIFIER OFF pushbuttons 7IS4 and 8IS2 and in the RECT OFF push button 6IS2 are extinguished.

When 5K1 drops out, plate power is removed. Auxiliary contacts remove both the Aural and Visual screen supply voltages, close in series with the reset coil of 6K14 (this circuit is already de-energized by the drop-out of 6K5), close in series with the high-voltage d-c switches 6K12 and 6K13, open across the instantaneous normally open (NO) contact of 6K7, open the control circuit interlocks for both the Aural and Visual ex-

citer power supplies, and close, energizing the Aural and Visual green RECTIFIER ON push button lights 7IS3 and 8IS1 and the green RECT ON push button light 6IS1.

Amplifier Stop

Depressing the red AMPLIFIER STOP pushbutton 7IS1 momentarily energizes the reset coil of 6K1, allowing it to drop out. When 6K1 is in the reset position, the Rectifier filament contactor 6K4, the water and air interlock relays 8K8, 7K8, 8K9, 7K9, and the shutdown relay 6K3 are first de-energized. The filament contactors 8K1 and 7K1 are de-energized by the water and air interlock relays. The lamp in the red AMPLIFIER STOP push button 7IS1 is de-energized; the filament time-delay relays 8K2 and 7K2 are de-energized; the filament time-delay bypass time-delay relays 8K3 and 7K3 are de-energized; the bias contactors 8K4 and 7K4 are de-energized; the bias under-voltage relays 8K12 and 7K12 are de-energized; the filament time-delay status lights 8I7 and 7I17 are de-energized; the lamps in the green push buttons 7IS3, 8IS1, and 6IS1 are de-energized; and the transfer auxiliary relay 6K11 and the restart auxiliary relay 6K6 are energized. Also, the shutdown time-delay relay 6K3 is energized, and the normally open (NO) contact of 6K1 which energized the blower contactor 6K2 during the AMPLIFIER START procedure opens. The blower contactor 6K2, however, is sealed in through its own normally open (NO) interlock and the normally closed (NC) time-delay opening contact of 6K3. This contact of 6K3 opens after approximately one minute, breaking the seal of 6K2, allowing it to fall out, which action de-energizes the blower motors.

All the circuits have now been returned to the initial off position.

AUTOMATIC RECLOSURE

Automatic Plate Overload Reclosure

The automatic plate reclosure circuit is designed to energize the main plate breaker and to reclose it whenever it drops out for any reason other than an intended plate-off operation (which resets 6K5). On repeated drop-out, the breaker will reset twice and will remain in the lockout position after the third drop-out if all these occur within a 10-second interval. If there are less than three drop-outs in 10 seconds, the reclosure cycling relay 6K15 is automatically reset and the count is removed. This is accomplished as follows:

If 5K1 drops out because of the operation of one of the overload relays which operate its shunt trip circuit as well as de-energize its undervoltage circuit or because of the operation of the over-current trip circuits

in the breaker, one of its auxiliary normally closed (NC) contacts will close and energize the reset coil of the latch relay 6K14. Note that the normal position of 6K14 is the "latched in" position and also that its reset coil can be energized only when 6K5 is latched in and when the normally open (NO) time-closing contact of 6K7 is closed. Energizing the reset coil of 6K14 allows it to fall out, energizing the lockout supervisory light (LOCK OUT) 7I13 and the reclosure coil of the reclosure relay 6K15 and de-energizing the restart auxiliary relay 6K6 and the lockout relay 6K7. When the reclosure coil of 6K15 is energized through the reclosure switch 7S5 (AUTO RECLOSER SWITCH) and one of the contacts of 6K15, a ratchet-cam mechanism moves to the second position. The OCCO* contact of 6K15 is then closed, the CCCO† contact remaining closed. The third or instantaneous contact of 6K15, which closes each time the reclosure coil of 6K15 is energized, energizes the latch coil of 6K14 through the OCCO contact and one section of 7S5. Energizing the latch coil of 6K14 latches it in, removing power from 7I13 and from the reclosure coil of 6K15 and re-applying power to the restart auxiliary relay 6K6. When power is removed from the reclosure coil of 6K15, the instantaneous contact opens, de-energizing the latch coil of 6K14.

Approximately one second after the coil of 6K6 is energized, its normally open (NO) time-closing contact closes, energizing the auxiliary close circuit of 5K1. Breaker 5K1 then closes as during a normal Rectifier-on operation, re-applying plate power.

If a second drop-out of 5K1 occurs, the operation described above will be repeated, and the reclosure relay 6K15 will move to the third position and power will be re-applied a second time.

A third drop-out will cause 6K15 to move to the fourth and last position. The OCCO contact is then in the open position, preventing the latch coil of 6K14 from being energized. 6K14 then remains in the reset position, preventing the re-application of plate power. Note that in this position the LOCK OUT supervisory light 7I13 is energized, indicating that the reclosure circuit is in the lockout position.

After the first and second drop-outs, when the OCCO contact of 6K15 is closed, the coil of the automatic-reset relay 6K17 is energized. This time-delay relay energizes the reset coil of 6K15 approximately 10 seconds after being energized. Operating the reset coil of 6K15 allows the sequence mechanism to move back to the starting position. Thus, if not more than two drop-outs have occurred in any 10-second interval, the automatic reclosure circuit is automatically reset. De-

pressing either RECTIFIER ON push button (7IS3 or 8IS1) or the RECT ON push button (6IS1) energizes the reset relay 6K16. The reset relay 6K16 energizes the reset coil of 6K15 and the latch coil of 6K14. Thus, the reclosure circuit is manually reset each time a RECTIFIER ON or RECT ON push button is operated.

If it is desired that there be no reclosure of 5K1, the reclosure switch 7S5 (AUTO RECLOSER SWITCH) may be placed in the OFF position. This prevents energizing of the reclosure and latch coils of 6K15 and energizes the reclosure switch supervisory light 7I14 to indicate visually that the switch is in the off position.

Two-Second Power Failure Restart

Using the mechanical latch relays permits the transmitter to return automatically to whatever operating condition preceded a failure of the main power supply. For momentary power failures of less than two seconds, the bypass time-delay relays 7K3 and 8K3 permit instantaneous re-application of plate power. A mechanical time-delay device delays the bypass time-delay relay contacts from opening for two seconds after their coils are de-energized. These contacts are in shunt with the contacts of the filament time-delay relays and maintain the circuits during the two-second delay. If power is re-applied during this time, the circuits remain sealed in, and plate power is immediately re-established. Otherwise, the filament time-delay relays 7K2 and 8K2 will fall out and will reclose only after a one-minute time delay.

EMERGENCY STARTING

The EMERGENCY START push buttons 7S3 and 8S2 permit bypassing of the one-minute time-delay relays 7K2 and 8K2 when starting under emergency conditions. For example, assume that a power failure of sufficiently long duration occurs such that the automatic power failure restart circuit will not automatically re-apply plate power. Under this condition the rectifier tubes are still moderately hot and do not need the full one-minute time delay. A good rule to follow in this instance is to allow for as much heating time before operating the EMERGENCY START switch as the time-off interval in order to avoid long program delay.

This circuit should not be used in normal operation since severe damage may result to the rectifier tubes if plate power is applied without proper filament heating time delay when the tubes are cold.

It should be noted that a spare socket, 6XV7, for a Type GL-869-B rectifier tube is provided in the Rectifier and Control cubicle. By maintaining a spare rectifier tube with heated filament, replacement can be made with a minimum of lost time in the event of failure of one of the operating tubes.

*Open closed closed open

†Closed closed closed open

INDEPENDENT OPERATION OF AURAL AND VISUAL AMPLIFIERS

Although plate power for both the Aural and Visual Amplifiers is supplied by a single high-voltage Rectifier, it is possible to operate either Amplifier independently while most necessary servicing, such as tube changing, is being done in the other. This is accomplished by use of the VISUAL-BOTH-AURAL multi-contact DC SWITCH 7S8 and the d-c high-voltage contactors 6K12 and 6K13. When operated to any one of its three positions, switch 7S8 performs all the necessary control circuit switching as described in the CONTROL CIRCUIT COMPONENTS AND THEIR FUNCTIONS division of this section to allow independent and simultaneous operation. Contactors 6K12 and 6K13 properly connect the output of the high-voltage Rectifier.

If 7S8 is operated when the plate power is off, the proper solenoids of 6K12 and 6K13 will be energized to accomplish the desired switching. As soon as the switching is properly accomplished, the DC SWITCH STATUS light 7I16 (and the transfer relay 6K11) will be energized through a combination of contacts on 7S8 and interlocks on 6K12 and 6K13 to indicate this.

It will be noted that a normally open (NO) auxiliary contact on plate breaker 5K1 prevents the d-c contactors 6K12 and 6K13 from being energized when 5K1 is closed. Also, a contact of 7S8 (contact number 9) in the undervoltage solenoid circuit of 5K1 opens at positions of 7S8 midway between the three main operating positions. Thus, if 7S8 is operated when plate power is on, Rectifier breaker 5K1 first drops out because of the interruption of power in its undervoltage circuit, d-c contactor 6K12 or 6K13 transfers, and transfer relay 6K11 is again energized. Now, since the breaker drop-out was not due to a normal Rectifier-off operation (which would have reset latch relay 6K5), the automatic plate reclosure circuit will operate (if 7S5 is in the automatic position, that is, AUTO RECLOSER ON) and plate power will be re-applied automatically. Plate power is therefore interrupted only during the transfer of the d-c contactors.

FILAMENT TIME-DELAY STATUS LIGHTS

The lights in the green RECTIFIER ON (7IS3 and 8IS1) and RECT ON (6IS1) push buttons are energized during a start operation only after the proper filament time-delay relay has timed out. If switch 7S8 is in the BOTH position, these lights are energized only when both the Aural and Visual filament time-delay relays have timed out (and bias voltage has been established on both Amplifiers). If, however, 7S8 is in the AURAL or VISUAL position, 6IS1, 7IS3, and 8IS1 will be energized after the corresponding time-delay relay has

timed out. Now, if one of the Amplifiers is in operation and the other has been off (for example, for a tube change), the RECTIFIER ON and RECT ON green push buttons cannot be used as an indication of the status of the time-delay relay for the Amplifier which is not in use. For this reason, the separate filament time-delay status lights (FIL TD STATUS) 7I16 and 8I7 have been provided to give a positive indication of the filament time-delay status for each Amplifier, regardless of whether or not the other Amplifier is being operated.

SUPERVISORY LIGHT CIRCUITS

The AIR, WATER, DOOR, BIAS, AUTO RECLOSER SWITCH, and LOCK OUT supervisory lights illuminate only as long as the particular circuit condition which they indicate exists. All remaining supervisory lights indicate momentary overload conditions and remain illuminated until the RESET push button 7IS5 is depressed to break the seal on the corresponding light relay (except for the ARC BACK supervisory light 7I12 on the Aural Amplifier cubicle front panel which is reset by the ARC BACK RESET push button 6IS3 on the front panel of the Rectifier and Control cubicle). When any of the overload indicating lights is energized, the lamp in the corresponding red RESET push button is also energized. Thus, if the red push button alone is illuminated, it is an indication that one of the overload supervisory lights is burned out and requires replacement.

VISUAL AMPLIFIER

POWER AMPLIFIER

The Visual Amplifier fundamentally consists of two Type GL-6251 tetrode tubes operating in parallel in a grounded-grid or grid-separation circuit. In this circuit both the screen grid and the control grid are maintained as nearly as possible to RF ground potential, the plate or load circuit being connected between the anode and screen grid and the excitation voltage being applied between the filament and control grid.

Not shown on the Elementary Diagram is a neutralizing loop (see Fig. 50) which is coupled magnetically to the anode circuit and is connected to the junction between the filaments of the two tubes. By this means a voltage is introduced to the filaments from the anodes of a proper phase and amplitude to neutralize the effect of anode-to-filament feedback through the very small anode-to-filament capacitance.

Another part of the circuit not shown on the Elementary Diagram is a resistive element necessary to prevent spurious oscillations in the amplifier tubes. With tetrode tubes such as the Type GL-6251, a spurious

Colpitts-type oscillation can take place between the filament, the control grid, and the screen grid, with the screen grid acting as the anode in the production of the oscillations. The frequency-determining circuit in the production of these oscillations is the unavoidable circuit between the control and screen grids. It is necessary to the proper operation of the tube that this circuit does not resonate within the band of frequencies over which the Amplifier operates. Fortunately, in this Amplifier the resonant frequency of this circuit is well above the operating range. Since the circuit between screen and control grids is all within the tubes, with the exception of the bypass capacitors 8C40, 8C41, 8C42, and 8C43, and the ground connections between these capacitors, it is obvious that the only way to prevent these oscillations is to introduce a damping or loading resistance in this external ground connection sufficient to prevent the oscillations from starting. This has been accomplished by placing a group of small low-value resistors in a circle around each tube shunted by low-inductance leads in the form of short pieces of bus bar. These resistors are all in shunt with the ground connections between the bypass capacitors. By this means sufficient circuit loading has been obtained to eliminate the spurious oscillations under normal operating conditions.

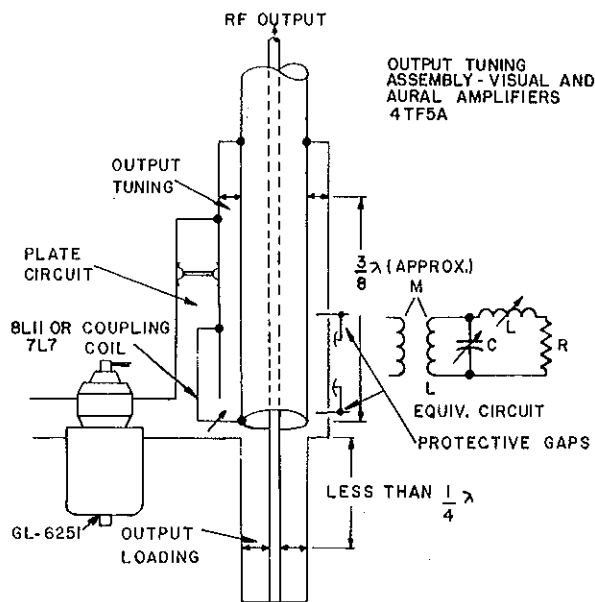
ing a motor-driven sliding short for tuning and which is shortened by the output capacitance of the tube. The output coupling circuit consists of an inductive loop, 8L11, which is resonated by means of a concentric transmission line approximately three-eighths wavelength long having a motor-driven sliding short. The input impedance of a shorted transmission line is capacitive when the length is between a quarter and three-eighths of a wave long. The output load or transmission line is coupled to the output circuit through a shorted section of concentric line which is shorter than a quarter wave. The input impedance of a shorted line less than a quarter wave long is inductive (see Fig. 56). Two protective gaps are installed on the output circuit assembly. One is placed at the point of minimum spacing and the other approximately at the point of maximum voltage gradient. These gaps will break down in the event of a high VSWR on the RF load for this Amplifier and will operate 8K19 which will remove plate voltage from the Amplifier and cause the RF OUTPUT supervisory light to be illuminated.

The output circuit is coupled and loaded to the plate circuit in normal operation to make the bandwidth of the plate and output circuits sufficiently broad. In order to assure sufficient lower-sideband attenuation the Vestigial-Sideband Filter (supplied with the Model 4TF5A1 Amplifier) is required in the output transmission line to the antenna.

Adjustment of the bandpass characteristic is effected by means of a sweep generator and an oscilloscope. The sweep generator output voltage which is developed across terminating resistors 8R48 and 8R78 is loosely coupled to the plate circuit by means of a capacitance probe. (Relay 8K18 is energized when the SWEEP-OPERATE switch is in the SWEEP position.) The oscilloscope is connected to the output of one of the two sweep detector circuits. Sweep detector No. 1 consists of capacitor 5C1, germanium diode 5CR1, resistor 5R1, compensating coil 5L4, and the RF decoupling circuit 5C2, 5R1, 5R3, and 5L5. Sweep detector No. 2 is the same as sweep detector No. 1 except for the symbol numbers.

Sweep detector No. 1 is mounted on the output transmission line preceding the Vestigial-Sideband Filter, and sweep detector No. 2 is mounted on the output transmission line following the Vestigial-Sideband Filter. Thus, by means of the oscilloscope trace the bandpass characteristic may be observed and adjusted before and after the Vestigial-Sideband Filter. By observing the oscilloscope trace when connected to sweep detector No. 2, the Lower-Sideband Filter may be checked.

A reflectometer and a peak reading RF voltmeter are located on the output transmission line. Crystal recti-



(A-7991254, Sheet 1)

Fig. 56 Visual and Aural Amplifier Output Tuning Assembly Mechanical-Elementary Diagram

OUTPUT CIRCUIT

See Figs. 22 and 56.

The plate circuit, 8L6, is a quarter-wave cavity hav-

fiers in the reflectometer 5E1 provide two d-c voltages, one proportional to the forward-traveling wave in the transmission line and the second proportional to the reverse-traveling or reflected wave. These voltages are proportional to the average value of RF voltage and are therefore proportional to average RF power.

The peak reading RF voltmeter produces a d-c voltage which is proportional to the RF transmission-line voltage during the synchronizing pulse intervals. This is accomplished by operating the RF rectifier tube 5V1 into the time-constant circuit 5C5 and 5R4-8R96. The time constant of this circuit is long enough so that the capacitor 5C5 does not discharge appreciably between sync pulses. Tube 5V1, therefore, conducts only during the sync pulse interval and the d-c voltage produced is proportional to the amplitude of the sync pulses.

INPUT CIRCUIT

Refer to Figs. 57 and 58.

Fundamentally, the input circuit of the Amplifier, which is not shown on the Elementary Diagram, transforms the impedance seen between the filaments and the control grids to approximately 50 ohms resistance at the midband of the television channel used which will provide a satisfactory load for the driving transmitter.

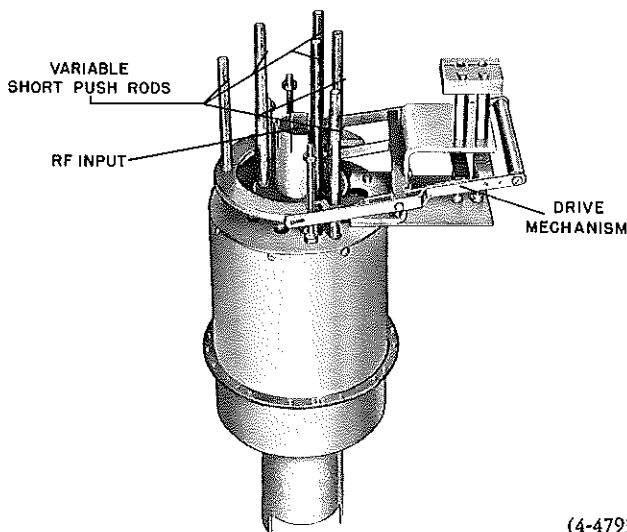


Fig. 57 Input Matcher Assembly, Visual and Aural Amplifier Cavities, PL&C-7775419-G1

Progressing from the filaments of the amplifier tubes back toward the input terminal, the circuit required to do this consists of a capacitance C (22 mmfd ± 1.5 mmfd), an inductance $L1$ which is a manually adjustable length of concentric line $1/16$ wavelength or less, a fixed 20-ohm concentric-line matching section, inductance $L2$ which is a manually adjustable length of concentric line 0.2 wavelength or less,

SWEEP GENERATOR

Circuit Analysis

The sweep generator is a device for generating a constant voltage swept over a band of frequencies approximately 8 megacycles wide and centered on the television channel for which the wide-band, Class B, linear radio-frequency amplifier is to be aligned. The sweep voltage is delivered at the RF OUTPUT jack 8J101. The output is then connected to a termination which is coupled by means of a small capacitance probe to the plate circuit of the Amplifier. Thus, this voltage drives the circuit to be adjusted. By placing a suitable detector on the output transmission line the frequency response of the Amplifier output circuit can be displayed on an oscilloscope.

The sweep generator consists of a 6BK7 oscillator 8V101, a GL-832-A wide-band amplifier 8V102, and two marker oscillators 8V103 and 8V104 (Type 6U8). The frequency of the 6BK7 oscillator is swept by capacitor 8C106 which is driven by the synchronous motor 8B101. Energy from the oscillator circuit is inductively coupled to the grid of the GL-832-A amplifier by the untuned coupling 8L102. The plate circuit of the amplifier is a double-tuned circuit, loaded and coupled to give a flat response over a large part of the range of frequencies generated by the oscillator.

Switch 8S103 connects the SCOPE INPUT jack 8J104

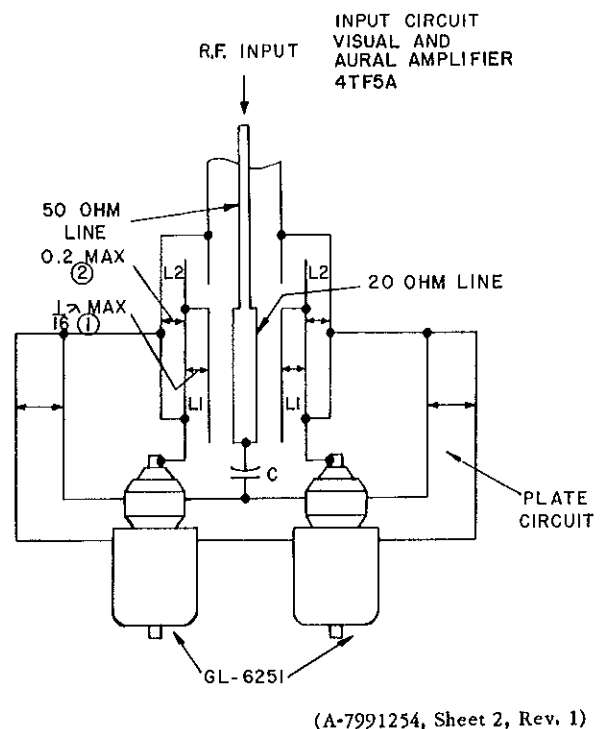


Fig. 58 Visual and Aural Amplifier Input Circuit Mechanical-Elementary Diagram

to either the RF output termination detector or any of the three detector input jacks, 8J102, 8K103 or 8J105.

RF energy from the two marker crystals is coupled to the marker mixer diode 8CR101 through coupling capacitance 8C138A and 8C138B. Energy from the Amplifier output circuit is also coupled to 8CR101 through 8C124. Thus a "beat note" is produced across 8CR101 whenever the sweep frequency coincides with one of the marker oscillator frequencies. The "beat" or "marker" is coupled to the oscilloscope input jack through coupling capacitor 8C123. The marker beats are therefore superimposed on the oscilloscope trace to show the band extremities.

The markers are crystal-controlled by high-frequency crystals of the overtone type. Refer to the Marker Oscillator No. 1. The anode of the triode section of 8V103 is coupled by 8C133 to the control grid of the pentode section. The control grid of the triode section is grounded and the cathode of that section is coupled to the cathode of the pentode section by the crystal 8Y101. It is seen that oscillation will occur if the series impedance of the crystal becomes low (as at its resonant frequency or overtone), and at the same time, there is appreciable load impedance in the plate circuit of the triode section (8L113 and output capacitance of the triode section at parallel resonance). The pentode section performs an additional function as a tripler of the oscillation frequency, since the circuit 8L112 and 8C131 is tuned to threetimes the oscillation frequency.

An 1800-rpm, 60-cycle, synchronous motor is used to turn the rotor of the oscillator tank capacitor 8C106. This means that the sweep moves from one end of its range to the other and returns during one-half revolution. It is the purpose of blanking to reduce the RF output of the sweep generator to zero during at least a part of the return trace (less than one-half revolution of the motor). This is accomplished by impressing a 60-cycle voltage across the divider 8R138, 8R139, and 8R140. A part of this voltage is impressed on the selenium rectifier 8CR102 which passes current only during one-half of the cycle. Half-cycle pulses of voltage therefore appear across 8R141. The low potential end of grid resistors 8CR101 and 8R102 is connected to the junction of 8CR102 and 8R141. The pulses of voltage (negative in polarity) are therefore impressed on the oscillator tube 8V101 grids, causing it to stop oscillating during the desired interval of time.

Switch 8S102 permits monitoring the plate currents of the oscillator, the amplifier, the marker oscillator pentode sections, and the grid voltage of the marker oscillator triode sections.

Sweep Alignment

To align the sweep, connect a high-gain oscillo-

scope such as a General Electric Type ST-2-A to the SCOPE INPUT jack 8J104 and set the switch 8S103 to the TERMINATION position.

Assuming that the Amplifier cubicle filaments and the sweep generator power supply are on, place the OPERATE-SWEEP switch in the SWEEP position. Place the MARKERS, FILAMENT, and MOTOR switches in the ON position, thus energizing the sweep generator tubes and the sweep motor.

With the marker crystals in their sockets and meter switch 8S103 in the XTAL 1 position, start adjusting 8L113 clockwise from its full counterclockwise position while observing the tuning meter 8M101. When the oscillator starts oscillating, the meter reading will suddenly increase. Adjust 8L113 for maximum reading on the meter. Repeat this process for the XTAL 2 position, adjusting 8L116.

The sweep oscillator must now be adjusted to the proper frequency range and the output circuit of the amplifier adjusted to produce a constant RF voltage over the desired frequency band at the terminations. The frequency of the oscillator may be adjusted by means of a shorting bar on the plate circuit transmission line 8L101. The section of this line near the shorted end has much wider spacing than the rest of the line. Moving the sliding short the length of this expanded section will change the oscillator tuning sufficiently to cover all channels from 7 through 13. At channel 7 the sliding short will be almost at the end of the line. At channel 13 the sliding short will be almost at the opposite end of the expanded section. Other channels between 7 and 13 will fall proportionately between these limits.

The input circuit of the amplifier consists of the shorted transmission line 8L102 which is inductively coupled to the oscillator plate line 8L101. This circuit operates untuned. At channel 7 the sliding short on 8L102 should be near the end of the transmission line. At channel 13 the short should be moved from the end to within about one-half inch of the beginning of the expanded section of 8L101. If line 8L102 is too short at any particular frequency, it may be too near resonance and the amplifier may be unstable and tend to oscillate.

Now with the oscilloscope sweep set for approximately 60 cycles, a pattern of four sweep traces, two of which are mirror images, can be synchronized. If there is little or no oscilloscope deflection, tune the primary of the output circuit by means of 8C117 until a single-humped response is obtained. It may be necessary to move the shorting bar on 8L106 to obtain full resonance.

At this point the BLANKING switch may be placed in the ON position. This will cause the major portion

of the mirror traces to disappear, since the oscillator is prevented from oscillating during this time. The base line during this time is the reference or zero-voltage line. It will be noted that there are two positions at which the synchronous sweep motor 8B101 may "lock in" with respect to the blanking voltage. For this reason it may be necessary when starting the sweep generator to snap the MOTOR switch off and on a time or two until the motor "locks in" on the desired trace. In this way the sweep frequency can always be increasing or decreasing as the oscilloscope trace moves from left to right as desired.

The secondary of the output circuit should then be tuned to resonance by means of capacitor 8C121 and the sliding short on 8L107. When properly tuned, the response should be a double-coupled response just slightly over critical coupling. This results in a response essentially flat over the desired range of frequencies. In order to obtain the desired flatness, it will be necessary to adjust the coupling between 8L106 and 8L107 and the secondary loading by means of loading capacitors 8C120 and 8C129. The capacitors should be adjusted together in order to maintain approximately the same capacitance in each. When adjustment is made to adjust the loading, there must be a compensating change in the secondary tuning capacitor 8C121.

Adjust 8C131 and 8C140 to obtain a maximum height of the marker beat seen on the oscilloscope trace. Adjust 8L113 and watch the marker beat it controls. Set 8L113 for a point where small adjustments do not move the marker. This indicates that the marker is oscillating at a frequency controlled by its crystal. Repeat this procedure for the other marker, adjusting 8L116. When this procedure has been followed, the oscilloscope trace will be like that shown in Figs. 59 and 60.

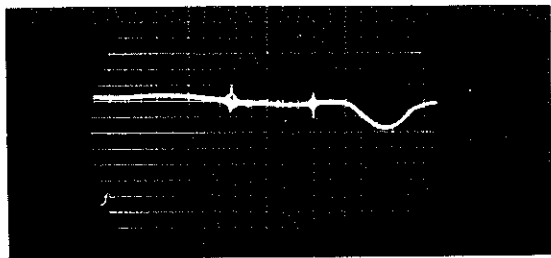


Fig. 59 Sweep Response with Markers

POWER SUPPLIES

Screen grid power for the Visual Amplifier is obtained through high-voltage rectifier tubes 6V16 and 6V17. This power is regulated electronically as follows: a bridge circuit consisting of 8V21, 8V22, 8V23, 8R62, 8R69, 8R61, 8R57, 8R56, and 8R68 is connected across the output of the regulator. An error voltage is obtained between the arm of 8R57 and the junction of

8R62 to 8V21 and is applied between grid and cathode of 8V13. The amplified error voltage at the anode of 8V13 is applied to the grid of the amplifier tube 8V14. The amplified signal at the anode of 8V14 is applied to the grids of the series regulating tubes 8V15, 8V16, 8V17, and 8V20, which operate in series with the load to maintain the voltage essentially constant across the bridge circuit from which the error voltage was originally obtained. Screen voltage is adjusted by means of the variable transformer 8T8. The screen regulator is loaded by 8R58 to maintain proper operation when the screen current of the GL-6251 runs negative.

Control grid voltage is obtained from a three-phase, full-wave rectifier utilizing selenium rectifiers.

Individual bias voltages are controlled by rheostats 8R38 and 8R39.

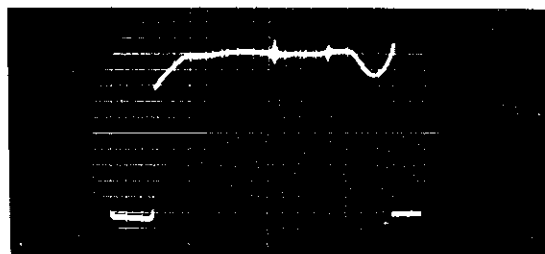


Fig. 60 Sweep Response with Markers and Blanking

VESTIGIAL-SIDEBAND FILTER AND HARMONIC FILTERS

Refer to the instruction books included as inserts in this book for information pertaining to these units: EBI-3326, Vestigial-Sideband Filter, PL-7775490, and EBI-3310, Harmonic Filter, Model 4PY25F1.

AURAL AMPLIFIER

POWER AMPLIFIER

The Aural Amplifier is essentially identical to the Visual Amplifier with the few exceptions which are described in the following.

OUTPUT CIRCUIT

See Fig. 56.

The output circuit of the Aural Amplifier is identical to that of the Visual Amplifier except that no peak power reading diode is required. Instead, the forward-wave indication of reflectometer 7E1 is used as a relative power output indication. The reverse-wave voltage of this reflectometer is amplified by reflectometer amplifier 7V10 to operate relay 7K17 whenever its magnitude becomes greater than a predetermined value such as would occur in the case of a transmission-line

or antenna fault. When 7K17 is operated, it causes plate power to be removed from the Amplifier, thus protecting the equipment.

INPUT CIRCUIT

See Fig. 58.

The Aural input circuit accomplishes the necessary impedance transformation in the same manner as the Visual Amplifier input circuit.

The input presents a corrected impedance which terminates the input transmission line so that it has a VSWR of 1.25 to 1 or better at the aural carrier frequency.

SWEEP GENERATOR

The sweep generator of the Aural Amplifier is identical to that of the Visual Amplifier.

AURAL RECTIFIER CIRCUITS

Screen power is obtained from a conventional single-phase, full-wave rectifier circuit using rectifier tubes 6V18 and 6V19. Screen voltage is adjusted by means of the variable transformer 7T17.

Protective bias voltage to prevent excessive plate current and excessive plate dissipation when RF drive power is reduced or not present is obtained from an unfiltered three-phase, full-wave rectifier consisting of selenium rectifiers 7CR5 through 7CR10. During normal operation, self bias is produced by the grid current flowing through the grid resistor 7R1. This voltage is greater than the protective bias rectifier voltage; therefore, the bias rectifier does not conduct during normal operation of the Amplifier.

HIGH-VOLTAGE RECTIFIER

The Rectifier and Control Cubicle contains the high-voltage Rectifier, high-voltage filter capacitors, and the associated control equipment. The high-voltage Rectifier is a three-phase, full-wave circuit utilizing Type GL-869-B tubes, 6V1 through 6V6. The output of the Rectifier divides through two paths, one for the Aural Amplifier and the other for the Visual Amplifier. DC isolation switches 6K12 and 6K13 make it possible to isolate either Amplifier. Reactor 5L7 and capacitor 6C4 form the high-voltage filter for the Aural section. Reactor 5L8 and capacitors 6C1, 6C2, and 6C3 form the high-voltage filter for the Visual section.

A capacitor-resistance type of rectifier step-start is used to prevent high initial inrush of current through

rectifier tubes upon the application of power. This consists of resistors 6R12 and 6R13 for the Aural and 6R10 and 6R11 for the Visual in conjunction with step-start contactor 6K10. Contactor 6K10 is delayed in closing upon the application of rectifier power. Thus, the filter capacitors charge up slowly through the resistors. When almost fully charged, after approximately one second, contactor 6K10 closes, shorting out the resistors and thereafter allowing the filter to operate in the normal manner.

Since the arc-back indicator circuit of all the rectifier tubes is identical, it is necessary to describe the operation of only one. In normal operation, current in rectifier tube 6V1 flows from anode to cathode and through resistor 6R2. Selenium rectifier 6CR5 is so poled that the voltage drop across 6R2 will not cause current to flow through 6CR5 and 6K26. However, when an arc back occurs, reverse current flows through the tube; the voltage across 6R2 reverses and current will flow in the coil of the fast-acting relay 6K26, causing it to operate.

The arc-back indicator tubes 6V10 through 6V15 are cold-cathode, glow-discharge triodes. In normal operation the glow discharge between main anode and cathode will not start until a certain minimum voltage is impressed upon the "starter" or auxiliary anode. After the discharge starts, it continues regardless of whether or not the initiating voltage remains in the starter anode. The glow discharge is visible, providing a means of determining its presence.

Suppose that arc-back relay 6K26 is actuated by an arc back through 6V1. One contact closes and actuates a trip coil in the main circuit breaker to remove high-voltage power as soon as possible. A second contact closes and puts a positive voltage from the supply consisting of 6T4, rectifiers 6CR1 through 6CR4, and filter capacitor 6C5 across the series resistors 6R31 and 6R32. Since the junction of these resistors is connected to the starter anode of 6V10, a part of this voltage is applied to it sufficient enough to start the glow discharge in 6V10, indicating that 6V1 has had an arc back. The glow-discharge current through resistor 6R30 immediately causes the voltage to drop sufficiently so that if there are subsequent arc backs in any of the rectifier tubes, the starter anodes of the corresponding glow-discharge tubes will not have enough voltage impressed on them to ignite those tubes. Thus, only one glow-discharge tube can ignite and it will indicate which rectifier tube arced back first.

The arc-back indicator can be reset by depressing push button switch 6IS3, which removes voltage from the anode of all the glow-discharge tubes, causing the glow discharge to be extinguished.

PARTS LIST

ELECTRICAL

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
MOTORS			MOTORS (CONT'D)		
5B1 and 5B2	Heat exchanger motors, 200 v, 3 phase, 50/60 cycles, 1800 rpm, 3 hp, 1800 rpm, open, ball bearings. G-E Motor Type K, frame 225.		6BM4	American Blower Corp. Type 00, Sirocco utility set Size 30. Includes G-E open, shaded pole motor Cat. #5KSP11DG69, 230 v, 0.025 hp, 50/60 cycles, sleeve bearings lubricated for life, LH discharge. G-E Dwg. No. for motor only is B-7409263-P4.	C-7707201-P4
5B3	Ingersoll-Rand Cat. #RVNL-5HP motor pump, Model D, 220/440 v, 3 phase, 50/60 cycles, includes G-E standard open motor.	B-7487967-P1	6BM5	Blower motor, Rotron Model C, Type 3L; includes FA Smith motor frame 6H, shaded pole, 4 pole, totally enclosed, ball bearings, 220 v, 1 phase, 50/60 cycles, 1600 rpm.	M-7483607-P3
7B1	Gear motor: 115 v, 1 phase, 50/60 cycles, 45/55 rpm, full load current 0.5 amp approx, 240 in-oz torque, includes 3.75 mfd Pyranol* capacitor 7C46. Holtzer-Cabot Type RBC-3712.	B-7486142-P1	7BM1 and 8BM1	Blower and motor assemblies. Includes: Blower: 3110 rpm, 600 cfm at 3.5 sp. American Blower Corp. Cat. #75 SISW Sirocco fan Series 81. Ball bearings: 11/16" dia Fafnir "LAK". Ball bearings: 11/16" dia Fafnir "LCJ". Motor: G-E Model 5K45MG7, Form G, Type K, 1 hp, 3 phase, 208-220/440 v, 60/50 cycle, 3450/2850 rpm, with 3/16" x 3/16" key and shaft keyway. Belt: matched pair. Browning Mfg. Co. Cat. #4L350, "A" section.	PL-7775116-G1
7B2 and 7B3	Gear motors, reversible: input 115 v, 60 cycles; output 47.5 rpm, torque 100 oz-in, 30/1 gear ratio; includes 3.75 mfd Pyranol capacitors 7C47 and 7C48. Holtzer-Cabot Cat. #RBC-2510.	B-7484282-P2	CAPACITORS		
8B1	Gear motor: 115 v, 1 phase, 50/60 cycles, 45/55 rpm, full load current 0.5 amp approx, 240 in-oz torque, includes 3.75 mfd Pyranol capacitor 8C50. Holtzer-Cabot Type RBC-3712.	B-7486142-P1	5C1 and 5C2	Silvermica, 27 mmfd, $\pm 10\%$, 500 v d-c w.	P-3R122-P11
8B2 and 8B3	Gear motors, reversible: input 115 v, 60 cycles; output 47.5 rpm; torque 100 oz-in, 30/1 gear ratio, includes 3.75 mfd Pyranol capacitors 8C48 and 8C49. Holtzer-Cabot #RBC-2510.	B-7484282-P2	5C4	Ceramic high K disk, 0.005 mfd $+100\% -0\%$, 500 v d-c w.	C-7774750-P11
8B101	Synchronous, split phase motor, Bodine Cat. #2246, frame size NSY-12, 115 v, 60 cycles, sleeve bearings, 1/75 hp, 1800 rpm.	B-7485982-P1	5C5	Pyranol, 2.0 mfd $\pm 10\%$, 600 v d-c w. G-E Cat. #22F419.	C-3R143-P36
6BM1 and 6BM2	Rotron Model C Type 3L blower motors. Includes FA Smith motor, frame 6H, shaded pole, 4 pole, totally enclosed, ball bearings, 220 v, 1 phase, 50/60 cycles, 1600 rpm.	M-7483607-P3	5C6	Consists of probe A-7138547-G1 and 3-1/8 inner line.	
6BM3	American Blower Corp. Type 00, Sirocco utility set Size 30. Includes G-E open, shaded pole motor Cat. #5KSP11DG71, 230 v, 0.025 hp, 50/60 cycles, sleeve bearings lubricated for life, discharge may be adjusted to any angle. G-E Dwg. No. for motor only is B-7409263-P2.	C-7707201-P2	5C10 and 5C12	Silver mica, 27 mmfd $\pm 10\%$, 500 v d-c w.	P-3R122-P11
			5C13 and 5C15	Silver mica, 27 mmfd, $\pm 10\%$, 500 v d-c w.	P-3R122-P11

* Registered U. S. Patent Office

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
CAPACITORS (CONT'D)			CAPACITORS (CONT'D)		
5C16 thru 5C18	Part of basic construction.		8C3	Mica, 220 mmfd $\pm 10\%$, 2500 v d-c w. RETMA Type RCM55B221K.	P-3R32-P7
6C1 thru 6C4	Pyranol, 9.0 mfd $\pm 10\%$, 7500 v d-c w. G-E Cat. #14F422.	P-7770283-P14	8C4	Pyranol, 1.0 mfd $\pm 10\%$, 1000 v d-c w. G-E Cat. #23F359.	P-3R88-P6
6C5	Pyranol, 10.0 mfd $\pm 10\%$, 600 v d-c w. G-E Cat. #23F876.	P-3R88-P19	8C5 thru 8C8	Mica, 220 mmfd $\pm 10\%$, 2500 v d-c w. RETMA Type RCM55B221K.	P-3R32-P7
6C6 thru 6C8	Pyranol, 10.0 mfd $\pm 10\%$, 2000 v d-c w. G-E Cat. #23F386.	P-3R87-P4	8C9 and 8C10	Paper, molded plastic; 0.01 mfd $\pm 20\%$, 600 v d-c w. Sprague Cat. #109P10306.	B-7491096-P47
6C9 thru 6C11	Pyranol, 9.0 mfd $\pm 10\%$, 7500 v d-c w. G-E Cat. #14F422.	P-7770283-P14	8C11 and 8C12	Mica, 220 mmfd $\pm 10\%$, 2500 v d-c w. RETMA Type RCM55B221K.	P-3R32-P7
7C2 thru 7C10	Mica, 220 mmfd $\pm 10\%$, 2500 v d-c w. RETMA Type RCM55B221K.	P-3R32-P7	8C13 and 8C14	Pyranol, 10.0 mfd $\pm 10\%$, 600 v d-c w. G-E Cat. #23F876.	P-3R88-P19
7C13	Pyranol, 10.0 mfd $\pm 10\%$, 600 v d-c w. G-E Cat. #23F876.	P-3R88-P19	8C15 and 8C16	Mica, 220 mmfd $\pm 10\%$, 2500 v d-c w. RETMA Type RCM55B221K.	P-3R32-P7
7C14 thru 7C17	Ceramic high K disk, 0.01 mfd $+100\% -0\%$, 500 v d-c w.	C-7774750-P13	8C17	Pyranol, 1.0 mfd $\pm 10\%$, 7500 v d-c w. G-E Cat. #23F428.	P-3R87-P20
7C18 thru 7C21	Ceramic, double cup, 500 mmfd min, 10,000 peak v d-c w. Erie Type 401-02, Hi-K.	K-7119854-P1	8C20 and 8C21	Pyranol, 2.0 mfd $\pm 10\%$, 1500 v d-c w. G-E Cat. #23F371.	P-3R88-P11
7C22 thru 7C29	Part of basic construction of Cavity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.		8C22	Pyranol, 2.0 mfd $\pm 10\%$, 600 v d-c w. G-E Cat. #22F419.	P-3R143-P36
7C30 thru 7C33	Ceramic, double cup, 500 mmfd min, 10,000 peak v d-c w. Erie Type 401-02, Hi-K.	K-7119854-P1	8C23 thru 8C26	Ceramic, double cup, 500 mmfd min, 10,000 peak v d-c w. Erie Type 401-02, Hi-K.	K-7119854-P1
7C34 thru 7C39	Part of basic construction of Cavity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.		8C27	Pyranol, 2.0 mfd $\pm 10\%$, 600 v d-c w. G-E Cat. #22F419.	P-3R143-P36
7C43	Ceramic, double cup, 390 mmfd $\pm 10\%$, 8000 peak v d-c w, -750 temp coef. Erie Type 742B.	K-7119383-P6	8C28 thru 8C35	Part of basic construction of Cavity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.	
7C44 and 7C45	Pyranol, 10.0 mfd $\pm 10\%$, 600 v d-c w. G-E Cat. #23F876.	P-3R88-P19	8C36 thru 8C39	Ceramic, double cup, 500 mmfd min, 10,000 peak v d-c w. Erie Type 401-02, Hi-K.	K-7119854-P1
7C46	Pyranol, 3.75 mfd $\pm 10\%$, 330 v a-c w at 60 cycles. G-E Cat. #21F403-G2. Part of 7B1.	P-7770037-P4	8C40 thru 8C44	Part of basic construction of Cavity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.	
7C47 and 7C48	Pyranol, 3.75 mfd $\pm 10\%$, 330 v a-c w at 60 cycles. G-E Cat. #21F403-G2. Part of 7B2 and 7B3.	P-7770037-P4	8C45	Ceramic, double cup, 390 mmfd $\pm 10\%$, 8000 peak v d-c w, -750 temp coef. Erie Type 742B.	K-7119383-P6
8C1	Pyranol, 50 mfd $\pm 10\%$, 330 v a-c w, 600 v d-c w. G-E Cat. #23F710.	P-7769244-P2	8C48 and 8C49	Pyranol, 3.75 mfd $\pm 10\%$, 330 v a-c w at 60 cycles. G-E Cat. #21F403-G2. Part of 8B2 and 8B3.	P-7770037-P4
8C2	Paper, molded plastic; 0.0068 mfd $\pm 20\%$, 600 v d-c w. Sprague Cat. #109P68206.	B-7491096-P46	8C50	Pyranol, 3.75 mfd $\pm 10\%$, 330 v a-c w at 60 cycles. G-E Cat. #21F403-G2. Part of 8B1.	P-7770037-P4
			8C51	Mica, 220 mmfd $\pm 10\%$, v d-c w. RETMA Type RCM55B221K.	P-3R32-P7

50-KW TELEVISION AMPLIFIER

EBI-3295

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
CAPACITORS (CONT'D)			CAPACITORS (CONT'D)		
8C52	Part of basic construction of Cavity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.		8C129	Variable, ceramic, 5 to 20 mmfd, 500 v d-c w. Erie Type TS2A-N300.	M-7484389-P4
8C53 thru 8C54	Paper, dielectric, hermetically sealed, tubular, mineral oil impregnated, 0.5 mfd +30% - 10%, 600 v d-c w. Sprague Cat. #PPX24B22.	P-7768969-P38	8C130	Ceramic, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 332 Hi-K.	M-7483722-P7
8C101	Ceramic high K disk, 0.005 mfd +100% -0%, 500 v d-c w.	C-7774750-P11	8C131	Variable, air, miniature, 1.8 to 8.7 mmfd. Johnson Cat. #160-104-43.	M-7481115-P2
8C102 and 8C103	Ceramic, temp compensating, 10 mmfd ± 1.0 mmfd, 500 v d-c w.	P-3R93-P7	8C132	Ceramic, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 332 Hi-K.	M-7483722-P7
8C104 and 8C105	Ceramic, temp compensating, 8 mmfd ± 1.0 mmfd, 500 v d-c w.	P-3R93-P5	8C133	Ceramic, temp compensating tube type; 47 mmfd $\pm 10\%$, 500 v d-c w.	P-7770468-P17
8C106	Variable, air, 4.4 to 15.5 mmfd. Hammarlund Type BFC Special.	K-7121107-P1	8C134 thru 8C136	Ceramic, 470 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 331 Hi-K.	M-7483722-P5
8C107 and 8C108	Ceramic high K disk, 0.01 mfd +100% -0%, 500 v d-c w.	C-7774750-P13	8C137	Ceramic, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 332 Hi-K.	M-7483722-P7
8C110 and 8C111	Ceramic, standoff type, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 326.	A-7138472-P9	8C138A	Includes RG-59/U cable and 8L112.	
8C112	Mica, Class C; 100 mmfd $\pm 10\%$, 500 v d-c w. RETMA Type RCM20C101K.	P-3R141-P44	8C138B	Includes RG-59/U cable and L115.	
8C113 thru 8C115	Ceramic high K disk, 0.005 mfd +100% -0%, 500 v d-c w.	C-7774750-P11	8C139	Ceramic, feed thru type, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 327.	B-7485975-P19
8C116	Ceramic, standoff type, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 326.	A-7138472-P9	8C140	Variable, air, miniature, 1.8 to 8.7 mmfd. Johnson Cat. #160-104-43.	M-7481115-P2
8C117	Variable, air, miniature dual butterfly type, 2.7 to 10.8 mmfd. Johnson Cat. #160-211-43.	M-7481115-P8	8C141	Ceramic, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 332 Hi-K.	M-7483722-P7
8C118	Ceramic, temp compensating tube type; 47 mmfd $\pm 10\%$, 500 v d-c w.	P-7770468-P17	8C142	Ceramic, temp compensating tube type; 47 mmfd $\pm 10\%$, 500 v d-c w.	P-7770468-P17
8C120	Variable, ceramic, 5 to 20 mmfd, 500 v d-c w. Erie Type TS2A-N300.	M-7484389-P4	8C143 and 8C144	Ceramic, 470 mmfd $\pm 10\%$, 500 v d-c w. Erie Style 331 Hi-K.	M-7483722-P5
8C121	Variable, ceramic, 3 to 12 mmfd, 500 v d-c w. Erie Type TS2A-NPO.	M-7484389-P2	8C145 and 8C146	Ceramic, feed thru type, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 327.	B-7485975-P19
8C122	Ceramic, feed thru type, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 327.	B-7485975-P19	8C147	Ceramic, 470 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 331 Hi-K.	M-7483722-P5
8C123	Ceramic, 100 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 331 Hi-K.	M-7483722-P1	8C150	Ceramic high K disk, 0.01 mfd +100% -0%, 500 v d-c w.	C-7774750-P13
8C125 thru 8C127	Ceramic, feed thru type, 1000 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 327.	B-7485975-P19	RECTIFIERS		
8C128	Ceramic, 470 mmfd $\pm 20\%$, 500 v d-c w. Erie Style 331 Hi-K.	M-7483722-P5	5CR1 thru 5CR3	Germanium diodes, RETMA Type 1N63.	
			6CR1 thru 6CR4	Selenium, peak current 2000 ma, max d-c current 200 ma. Federal Tel. and Radio Type 1006.	M-7480225-P4
			6CR5 thru 6CR10	Selenium, half wave, rating at 35° C new 31 v, max 36 v, d-c output 12 v, current 0.25 amp. G-E Model 6RS12A1.	A-7136264-P1
			7CR1 thru 7CR10	Selenium, 300 v max, peak current 750 ma, max d-c output 200 ma. Federal Tel. and Radio Type 1006.	M-7480225-P4

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
RECTIFIERS (CONT'D)			PUSH-BUTTON SWITCHES AND INDICATING LIGHTS (CONT'D)		
7CR13	Germanium diode. RETMA Type 1N63.	B-7488234-P1	8IS1	Green cap, includes G-E lamp #46.	A-7135306-G2
8CR1	Selenium, input when new 50 v, aged 52 v; d-c output 62 v at 7.05 amp, 3 phase full wave budge connection, 2 cells per arm. G-E Cat. #6RS5JH53.		8IS2	Red cap, includes G-E lamp #46.	A-7135306-G1
8CR2	Diode, germanium. RETMA Type 1N63.		JACKS AND RECEPTACLES		
8CR101	Diode, germanium. G-E Type G7A.		5J1	Series BNC receptacle, Type UG-290/U.	M-7468506-P1
8CR102	Selenium, peak current 900 ma, max d-c output 75 ma. Federal Tel. and Radio Type 1003.	M-7480225-P1	5J2 and 5J3	Jacks. Included in Probe Assembly, PL-7141294-G2 as Part 4.	
MISCELLANEOUS ELECTRICAL PARTS			5J4 and 5J5	Series BNC, receptacles Type UG-290/U. Included in Connector Bracket Assem. A-7145074-G1 as Part 4.	M-7468506-P1
5E1 and 5E2	Coupler unit; Similar to M.C. Jones Model 442A10. 0 - 40 kw power rating for operation over freq range 50 to 216 mc, includes silicon crystal Type 1N21. (For replacement use 1N21B.)	B-7488365-P1	5J10	Series BNC receptacle Type UG-290/U.	M-7468506-P1
FUSES			5J11 and 5J12	Series BNC receptacles Type UG-290/U. Included in Connector Bracket Assem. A-7145074-G1 as Part 4.	M-7468506-P1
7F1 thru 7F3	3 amp, 250 v. G-E Cat. #3167.	K-1R11-P1	5J13	Jack. Included in Probe Assembly PL-7141294-G2 as Part 4.	
LAMPS			5J14	Series BNC receptacle Type UG-290/U.	M-7468506-P1
6I2	6 - 8 v, 0.15 amp. G-E Cat. #47.		5J15	Jack. Included in Probe Assembly PL-7141294-G2 as Part 4.	
7I1 thru 7I17	6 - 8 v, 0.15 amp. G-E Cat. #47.		6J1	Twin outlet; G-E Cat. #GE4060-1. Harvey Hubbell Cat. #5252.	B-7488131-P1
8I1 thru 8I10	6 - 8 v, 0.15 amp. G-E lamp #47.		7J2 thru 7J4	Receptacles: BNC series panel jacks, Type UG-624/U.	A-7010955-P1
PUSH-BUTTON SWITCHES AND INDICATING LIGHTS			7J5	Receptacle, Type UG-704/U.	M-7403898-P1
6IS1	Green cap, includes G-E lamp #46.	A-7135306-G2	7J6 and 7J7	Twin outlets. G-E Cat. #GE4060-1. Harvey Hubbell Cat. #5252.	B-7488131-P1
6IS2 and 6IS3	Red cap, includes G-E lamp #46.	A-7135306-G1	7J11	BNC series panel jack, Type UG-291/U.	B-7411435-P1
7IS1	Red cap, includes G-E lamp #46.	A-7135306-G1	8J9 thru 8J11	BNC series panel jacks, Type UG-624/U.	A-7010955-P1
7IS2 and 7IS3	Green cap, includes G-E lamp #46.	A-7135306-G2	8J12 and 8J13	Twin outlets. G-E Cat. #GE4060-1. Harvey Hubbell Cat. #5252.	B-7488131-P1
7IS4 and 7IS5	Red cap, includes G-E lamp #46.	A-7135306-G1	8J14	BNC series panel jack, Type UG-191/U	B-7411435-P1
			8J16	Receptacle, Type UG-604/U.	M-7403898-P1
			8J17	BNC series panel jacks, Type UG-624/U.	A-7010955-P1
			8J101 thru 8J105	Receptacles: BNC panel jacks Type UG-624/U.	A-7010955-P1
			8J106	Receptacle: BNC keyed, Type UG-625/U.	A-7010954-P1

50-KW TELEVISION AMPLIFIER

EBI-3295

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
RELAYS			RELAYS (CONT'D)		
5K1	Circuit breaker, G-E Type AK1-25, rated 400 amp, 600 v, 60 cycles. Electrically operated with: 1. Closing solenoid rated 230 v, 60 cycles; 2. Aux closing relay rated 115 v, 60 cycles; Breakers are furnished with EC-1 trip containing: 1. Instantaneous trip 5000 amp; 2. Short time trip rated 800 amp, trip in 0.133 sec with 250% of load; 3. Long time delay trip rated 400 amp, adjustable from 80 to 160% of rating, trips in 5 sec at 600% of rating. Additional trips: 1. Mechanical trip; 2. Under-voltage trip, 115 v, 60 cycles, instantaneous; 3. Shunt trip, 115 v, 60 cycles, instantaneous Aux. switches, 5 NO. and 5 NC.	C-7773783-P2	6K9	115 v $\pm 10\%$, 60 cycle coil; dpst NO. contacts. Similar to Ward Leonard Type 81-6520 except mounted on larger base.	M-7484759-P1
5K2 thru 5K4	Solenoids: 117 v a-c $\pm 10\%$ -20%, 60 cycles; resistance 25 ohms $\pm 10\%$ at 25°C; seated 0.32 amp at 25°C, extended 1" 3.5 amp at 25°C; pull 7 lbs. Dormeyer Cat. #230 Special.	A-7144707-P1	6K10	Contactors, RF: dpst, NO. cold break contactor rated 15 amp, 5000 v; 115 v $\pm 10\%$, 60 cycle coil, front connected for mtg on 1/8" panel. Similar to Monitor Controller Type SP2001.	A-7136262-P1
6K1	115 v $\pm 10\%$, 50/60 cycle operating and reset coils; 2pst NO. and 2pst NC contacts. Struthers Dunn Type 51BXB102.	M-7484875-P2	6K11	115 v, 50/60 cycle coil, 3 form A contacts.	P-7770291-P3
6K2	Contactors: 110 v $\pm 10\%$, 60 cycle coil reference 22D156-G2; 3 main poles, 1 NO. and 1 NC left interlock. G-E Model CR-2810-D11AB1H2.	P-7773535-P3	6K12 and 6K13	Contactors, RF: spst with 4 micro-switches; 110 v, 60 cycle operation, 2 solenoids. EF Johnson Type 145-101.	B-7485962-P1
6K3	Time delay relay: 115 v, 60 cycle coil; 3 min ± 12 sec time delay. Price Brothers Type 4052.	M-7478040-P5	6K14	115 v $\pm 10\%$, 60 cycle operating and reset coils; 2pst NO. and 2pst NC contacts. Struthers Dunn Type 51BXB102.	M-7484875-P2
6K4	Contactors: 110 v $\pm 10\%$, 60 cycle coil; 3 pole. G-E Type CR-2810-C11AB1A2.	P-7773089-P2	6K15	Reclosure relay, elec. reset, both coils rated 115 v $\pm 10\%$, 60 cycles, one OCCO, one CCCO, and one NO. auxiliary contact which closes when operating coil is energized. Struthers Dunn Type 99AXA115.	M-7474991-P3
6K5	115 v $\pm 10\%$, 50/60 cycle operating and reset coils; 2pst NO. and 2pst NC contacts; Struthers Dunn Type 51BXB102.	M-7484875-P2	6K16	115 v, 50/60 cycle coil, 3 form A contacts.	P-7770291-P3
6K6	Time delay relay: 115 v $\pm 10\%$, 60 cycle coil; "on delay"-time delay after coil is energized, 1 NO. and 1 NC time delay. Allen Bradley Bulletin #849 Style A.	B-7485292-P1	6K17	Time delay relay: 115 v $\pm 10\%$, 60 cycle coil; "on delay"-time delay after coil is energized, 1 NO. and 1 NC time delay contact. Allen Bradley Bulletin #849-Style A.	B-7485292-P1
6K7	Time delay relay: 115 v $\pm 10\%$, 60 cycle coil; "on delay"-time delay after coil is energized; 1 NO. and 1 NC time delay contact plus 1 NO. and 1 NC instantaneous contact. Allen Bradley Bulletin #849-Style AX.	B-7485292-P3	6K20	Pull in 10 ma ± 2 ma, 1 form A contact.	C-7773760-P19
			6K21 thru 6K26	Pickup 0.5 to 1.5 amp, 2 form A contacts, 10,000 v d-c working coil to contacts. Approx resistance 0.4 ohm, CP Clare Type E.	C-7773776-P1
			6K27	40 amp continuous, 20 - 80 range. G-E Model 12PJCI1A6.	B-7487929-P6
			6K30	Coil rated 230 v a-c $\pm 10\%$, 50/60 cycles, or 5 - 6 v amp d-c; dpst NO. contacts. Struthers Dunn Type SD-BIBXX.	M-7484872-P1
			6K31 and 6K32	208/230 v, 50/60 cycle coil; 2 form A contacts.	C-7773750-P11
			7K1	Contactors: 110 v $\pm 10\%$, 60 cycle coil; 3 pole, 1 NC left external interlock. G-E Type CR-2810-C11AB1D2.	P-7773089-P9
			7K2	Time delay relay: 115 v, 60 cycle coil; 63 sec ± 3 sec time delay. Price Brothers Type 4052.	M-7478040-P4

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
RELAYS (CONT'D)			RELAYS (CONT'D)		
7K3	Time delay relay, adjustable: 115 v $\pm 10\%$, 60 cycle coil; off delay-time delay after coil is de-energized, 1 NO. and 1 NC time delay contact. Allen Bradley Bulletin #849 Style B.	B-7485292-P2	8K1	Contact: 110 v $\pm 10\%$, 60 cycle coil; 3 pole, 1 NC left external interlock. G-E Type CR-2810-C11AB1D2.	P-7773089-P9
7K4	Contact, size 00, 4 poles, 3 NO. and 1 NC; 110 v $\pm 10\%$, 60 cycle coil reference F22D135G2. G-E Type CR-2810-A11AK2.	P-7772368-P2	8K2	Time delay relay: 115 v, 60 cycle coil; 63 sec ± 3 sec time delay. Price Brothers Type 4052.	M-7478040-P4
7K5 thru 7K7	115 v, 50/60 cycle coil, 3 form A contacts.	P-7770291-P3	8K3	Time delay relay, adjustable: 115 v $\pm 10\%$, 60 cycle coil; off delay-time delay after coil is de-energized, 1 NO. and 1 NC time delay contact. Allen Bradley Bulletin #849 Style B.	B-7485292-P2
7K8 and 7K9	115 v a-c $\pm 10\%$, 60 cycle, dpdt. Struthers Dunn Type BIXBX or Ward Leonard Type 110-6522.	M-7484872-P4	8K4	Contact, size 00, 4 poles, 3 NO. and 1 NC; 110 v $\pm 10\%$, 60 cycle coil, reference F22D135G2. G-E Type CR-2810-A11AK2.	P-7772368-P2
7K10 and 7K11	115 v, 50/60 cycle coil, 3 form A contacts.	P-7770291-P3	8K5 thru 8K7	115 v, 50/60 cycle coil, 3 form A contacts.	P-7770291-P3
7K12	Telephone type, pickup less than 20 v, dropout more than 15 v, 2 form A, 1 form B contacts.	P-7769664-P51	8K8 and 8K9	115 v a-c $\pm 10\%$, 60 cycle, dpdt. Struthers Dunn Type BIXBX or Ward Leonard Type 110-6522.	M-7484872-P4
7K13	230 v $\pm 10\%$, 60 cycle coil, 3pdt, Struthers Dunn Type BIXCX.	M-7484871-P3	8K10	230 v $\pm 10\%$, 50/60 cycle coil, 3pdt. Struthers Dunn Type BIXCX.	M-7484871-P3
7K14	5 amp continuous, 0.5 - 2 range. G-E Model 12PJC11A1.	B-7487929-P1	8K11	5 amp continuous, 0.5 - 2 range. G-E Model 12PJC11A1.	B-7487929-P1
7K15 and 7K16	12 amp continuous, 4 - 16 range. G-E Model 12PJC11A4.	B-7487929-P4	8K12	Telephone type, pickup less than 20 v, dropout more than 15 v, 2 form A, 1 form B contacts.	P-7769664-P51
7K17	Pull-in 4 ma or less, dropout 2 ma or more, resistance 5000 ohms or less, twin 2 form A, 1 form B contacts.	P-7773402-P19	8K13	Double wound coil, 2 similar, electrically separate coils, each to carry continuously up to 6 amp d-c simultaneously, coils are wound differentially, relay picks up on an unbalance of currents of less than 2.0 amp and more than 1.25 amp; 2 form A, 2 form B contacts.	P-7773421-P7
7K18	115 v, 50/60 cycle coil, 3 form A contacts.	P-7770291-P3	8K14 and 8K15	12 amp continuous, 4 - 16 range. G-E Model 12PJC11A4.	B-7487929-P4
7K19	115 v, 50/60 cycle coil, 2 form A, 1 form B contacts.	P-7770291-P6	8K16	115 v, 50/60 cycle coil, 3 form A contacts.	P-7770291-P3
7K20	110 v $\pm 10\%$, 50 - 60 cycles; spst double break, NO. contacts. Leach Type 1521.	M-7485293-P3	8K17	Telephone type, pickup 550 ma or less, dropout 350 ma or more, resistance less than 0.75 ohm, 2 form A, 1 form B contacts.	P-7769664-P47
7K21	Telephone type, pickup less than 20 v, dropout more than 15 v, 2 form A, 1 form B contacts.	P-7769664-P51	8K18	110 v $\pm 10\%$, 50 - 60 cycles; spst double break, NO. contacts. Leach Type 1521.	M-7485293-P3
7K22	Double wound coil, 2 similar electrically separate coils, each to carry continuously up to 6 amp d-c simultaneously, coils are wound differentially, relay picks up on an unbalance of currents of less than 2.0 amp and more than 1.25 amp, 2 form A, 2 form B contacts.	P-7773421-P7	8K19	Telephone type, pickup less than 20 v, dropout more than 15 v, 2 form A, 1 form B contacts.	P-7769664-P51
7K23	Contact: 110 v $\pm 10\%$, 60 cycle coil; 3 pole, 1 NC left external interlock. G-E Type CR-2810-C11AB1D2.	P-7773089-P9	8K20	115 v a-c $\pm 10\%$, 60 cycle, dpdt. Struthers Dunn Type BIXBX or Ward Leonard Type 110-6522.	M-7484872-P4

50-KW TELEVISION AMPLIFIER

EBI-3295

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
INDUCTORS			INDUCTORS (CONT'D)		
5L1 and 5L2	Coils. Included in Probe Assembly A-7141294-G2 as Part 5.		7L2 thru 7L5	Inductances consisting of cable assemblies each of which includes: 7.0" \pm 0.02" of round, extra flexible bare tinned copper 7/7/95/0.005 wire, G-E Spec B11Y3C21; 2 cable connectors Ilsocon Cat. No. SLU-225, G-E Dwg. No. A-7143465-P1. (Part of Cavity Assembly PL-7668731-G1.)	A-7141619-G1
5L3	RF choke coil; inductance 0.84 uh, current 1000 ma, freq range 160 - 350 mc. Ohmite Cat. # Z-235.	P-7772834-P6			
5L4	Coil: (Channels 7 thru 10 only) 6-1/4 turns, 0.30" ID at 0.11" pitch, of 0.064" dia B11B10A5 wire.	A-7145557-P1			
5L4	Coil: (Channels 11 thru 13 only) 4-1/4 turns, 0.30" ID at 0.18" pitch, of 0.064" dia B11B10A5 wire.	A-7145557-P2	7L6	Coil assembly. Includes 5 full turns equally spaced, 13/16" O.D., of 0.080" dia wire G-E Spec # B11B10A5. (Part of Cavity Assembly PL-7668731-G1.)	A-7139494-G1
5L5	RF choke coil; inductance 0.84 uh, current 1000 ma, freq range 160 - 350 mc. Ohmite Cat. # Z-235.	P-7772834-P6	7L7	Coupling loop, part of cavity construction. When reordering specify channel of operation.	
5L7	Reactor: min inductance 1.5 h at 9.0 amp d-c, less than 10 ohms d-c resistance at 25° C.	B-7487259-P1	7L13 and 7L14	Reactors: inductance 10 h min at 0.175 amp, d-c resistance 132 ohms.	M-7475693-P1
5L8	Reactor: min inductance 1.0 h at 12.0 amp d-c, less than 4 ohms d-c resistance at 25° C.	B-7487258-P1	7L16 and 7L17	Coils: include 11 turns, equally spaced right-hand wound, 0.38" ID, of 0.064" dia B11B10A5 bus wire.	A-7143897-P2
5L10	Coil: (Channels 7 thru 10 only) 6-1/4 turns, 0.30" ID at 0.11" pitch, of 0.064" dia B11B10A5 wire.	A-7145557-P1	7L18 and 7L19	Coils: include 11 turns, equally spaced left-hand wound, 0.38" ID, of 0.064" dia B11B10A5 bus wire.	A-7143897-P1
5L10	Coil: (Channels 11 thru 13 only) 4-1/4 turns, 0.30" ID at 0.18" pitch, of 0.064" dia B11B10A5 wire.	A-7145557-P2	8L1	Reactor: inductance 0.6 h min at 7.0 amp, d-c resistance less than 1.5 ohm.	B-7487242-P1
5L11	RF choke coil; inductance 0.84 uh, current 1000 ma, freq range 160 - 350 mc. Ohmite Cat. # Z-235.	P-7772834-P6	8L2 thru 8L5	Inductances consisting of cable assemblies each of which includes: 7.0" \pm 0.02" of round, extra flexible bare tinned copper 7/7/95/0.005 wire, G-E Spec B11Y3C21; 2 cable connectors Ilsocon Cat. No. SLU-225, G-E Dwg. No. A-7143465-P1. (Part of Cavity Assembly PL-7668731-G1.)	A-7141619-G1
5L12	Coil. Included in Probe Assembly A-7141294-G2 as Part 5.				
5L13	Coil: (Channels 7 thru 10 only) 6-1/4 turns, 0.30" ID at 0.11" pitch, of 0.064" dia B11B10A5 wire.	A-7145557-P1			
5L13	Coil: (Channels 11 thru 13 only) 4-1/4 turns, 0.30" ID at 0.18" pitch, of 0.064" dia B11B10A5 wire.	A-7145557-P2	8L6	Part of basic construction of Cavity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.	
5L14	RF choke coil; inductance 0.84 uh, current 1000 ma, freq range 160 - 350 mc. Ohmite Cat. # Z-235.	P-7772834-P6	8L7	Coil: includes 11 turns, equally spaced right-hand wound, 0.38" ID, of 0.064" dia B11B10A5 bus wire.	A-7143897-P2
5L15	Coil. Included in Probe Assembly A-7141294-G2 as Part 5.		8L8	Coil: includes 11 turns, equally spaced left-hand wound, 0.38" ID, of 0.064" dia B11B10A5 bus wire.	A-7143897-P1
6L1 thru 6L3	Reactor: inductance 10 h at 0.65 amp d-c, 50 ohms d-c resistance.	M-7475694-P1	8L9	Coil: includes 11 turns, equally spaced right-hand wound, 0.38" ID, of 0.064" dia B11B10A5 bus wire.	A-7143897-P2
7L1	Part of basic construction of Cavity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.				

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
INDUCTORS (CONT'D)			METERS (CONT'D)		
8L10	Coil: includes 11 turns, equally spaced left-hand wound, 0.38" ID, of 0.064" dia B11B10A5 bus wire.	A-7143897-P1	7M5	200-0-600 ma d-c, terminal resistance 0.063 ohm approx, calibrated for use on nonmagnetic panel. G-E Type DO-71.	B-7488225-P3
8L11	Coupling loop, part of cavity construction. When reordering specify channel of operation.		7M6	1.5 kv, calibrated for use on nonmagnetic panel. G-E Type DO-71.	P-3R124-P21
8L12	Coil assembly. Includes 5 full turns equally spaced, 13/16" ID, of 0.080" dia wire G-E Spec # B11B10A5. (Part of Cavity Assembly PL-7668731-G1.)	A-7139494-G1	7M7	10 ma d-c, nom resistance 3.0 ohms $\pm 20\%$, calibrated for use on nonmagnetic panel. G-E Type DO-71.	P-3R128-P26
8L101	Inductor.	A-7137816-G1	7M8	300 v a-c. G-E Type AO-72.	P-3R136-P15
8L102	Inductor.	A-7137864-G1	7M9	200-0-600 ma d-c, terminal resistance 0.063 ohm approx, calibrated for use on nonmagnetic panel. G-E Type DO-71.	B-7488225-P3
8L103 thru 8L105	RF choke coils: inductance 0.84 uh, current 1000 ma, freq range 160-350 mc. Ohmite Cat. #Z-235.	P-7772834-P6	7M10	200 microamp, approx terminal resistance 300 ohms, linear scale, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P12
8L106	Inductor.	A-7137852-G1	7M11	8 kv, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P22
8L107	Inductor.	A-7137596-G1	7M12	8 v a-c. G-E Type AO-72.	P-3R136-P5
8L108	RF choke: inductance 1.8 uh, current 1000 ma, freq range 75 - 190 mc. Ohmite Cat. #Z-144.	P-7772834-P5	8M1	200-0-600 ma d-c, terminal resistance 0.063 ohm approx, calibrated for use on nonmagnetic panel. G-E Type DO-71.	B-7488225-P3
8L110 and 8L111	RF choke coils: inductance 0.84 uh, current 1000 ma, freq range 160-350 mc. Ohmite Cat. #Z-235.	P-7772834-P6	8M2	1.5 amp, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P15
8L112	Coil: 1-1/2 turns, 1/2" ID, right-hand wound, of 0.064" dia copper wire.	A-7137883-P2	8M3	80 v d-c, calibrated for use on nonmagnetic panel. G-E Type DO-71.	P-3R124-P11
8L113	Variable coil.	A-7137895-G1	8M4	20 amp d-c, approx terminal resistance 0.0025 ohm, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P30
8L114	RF choke: inductance 3.0 uh $\pm 20\%$.	M-7475057-P4	8M5 and 8M6	10 amp d-c, calibrated for use on nonmagnetic panel. G-E Type DO-71.	P-3R126-P7
8L115	Coil: 1-1/2 turns, 1/2" ID, left-hand wound, of 0.064" dia copper wire.	A-7137883-P1	8M7	1.0 ma d-c, internal resistance 100 ohms $\pm 1\%$, dual scale 0 - 500 v d-c and 0 - 500 ma d-c, calibrated for use on nonmagnetic panel. G-E Type DO-71.	P-7769632-P9
8L116	Coil.	A-7137895-G1			
8L117	RF choke: inductance 3.0 uh $\pm 20\%$.	M-7475057-P4			
METERS					
6M1 and 6M2	Hour meters: 230 v, 60 cycles.	P-3R142-P2	8M8	200-0-600 ma d-c, terminal resistance 0.063 ohm approx, calibrated for use on nonmagnetic panel. G-E Type DO-71.	B-7488225-P3
7M1	1.5 amp, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P15	8M9	8 v a-c. G-E Type AO-72.	P-3R136-P5
7M2 and 7M3	8 amp d-c, calibrated for use on nonmagnetic panel. G-E Type DO-71.	P-3R126-P6	8M10	8 kv, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P22
7M4	15 amp d-c, approx terminal resistance 0.0033 ohm, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P29	8M11	1.5 kv, calibrated for use on nonmagnetic panel. G-E Type DO-71.	P-3R124-P21
			8M12	200 microamp, approx terminal resistance 300 ohms, linear scale, calibrated for use on magnetic panel. G-E Type DO-78.	P-3R91-P12

50-KW TELEVISION AMPLIFIER

EBI-3295

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
METERS (CONT'D)			RESISTORS (CONT'D)		
8M14	30 ma d-c, nom resistance 1.66 ohms $\pm 20\%$, calibrated for use on magnetic panel. G-E Type DO-71.	P-3R127-P29	5R10	Composition, 0.10 megohm $\pm 10\%$, 1 w.	C-3R78-P104K
8M101	1 ma d-c movement, nom resistance 67.7 ohms $\pm 20\%$, calibrated for use on nonmagnetic panels. G-E Type DO-71.	P-3R128-P20	5R11 thru 5R15	Composition, 1000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P102K
PLUGS			6R1	Wirewound, 1.0 ohm $\pm 10\%$, 375 w. Ward Leonard Type #10-1/2 D.	M-7484196-P4
5P1	BNC series, Type UG-260/U.	M-7468567-P1	6R2 thru 6R7	Wirewound, 0.06 ohms $\pm 10\%$, 110 w. Ward Leonard Type #4-1/2 B.	M-7484196-P2
5P2 and 5P3	N series, Type UG-21B/U.	B-7404649-P1	6R8	Wirewound, 50 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F50.	M-2R14-P18
5P4 and 5P5	BNC series, Type UG-260/U.	M-7468567-P1	6R10 thru 6R13	Wirewound, ferrule type, 1000 ohms $\pm 5\%$, 200 w.	M-2R71-P31
5P10 thru 5P12	BNC series, Type UG-260/U.	M-7468567-P1	6R14 thru 6R16	Wirewound, ferrule type, 50,000 ohms $\pm 5\%$, 200 w.	M-2R71-P48
5P13	N series, Type UG-21B/U.	B-7404649-P1	6R17	Wirewound, ferrule type, 50 ohms $\pm 5\%$, 200 w.	M-2R71-P18
5P14	BNC series, Type UG-260/U.	M-7468567-P1	6R18 and 6R19	Wirewound, ferrule type, 3.15 ohms $\pm 5\%$, 200 w.	M-2R71-P6
5P15	N series, Type UG-21B/U.	B-7404649-P1	6R20 thru 6R22	Wirewound, ferrule type, 50,000 ohms $\pm 5\%$, 200 w.	M-2R71-P48
7P2 thru 7P4	BNC series, Type UG-260/U.	M-7468567-P1	6R23	Wirewound, ferrule type, 63 ohms $\pm 5\%$, 60 w.	M-7464827-P19
7P7	BNC series, Type UG-260/U.	M-7468567-P1	6R24	Wirewound, ferrule type, 20,000 ohms $\pm 5\%$, 115 w.	M-7464826-P44
7P10	BNC series, Type UG-88/U.	M-7476889-P1	6R25	Wirewound, ferrule type, 1000 ohms $\pm 5\%$, 60 w.	M-7464827-P31
8P12 and 8P13	BNC series, Type UG-260/U.	M-7468567-P1	6R26	Wirewound, ferrule type, 40,000 ohms $\pm 5\%$, 115 w.	M-7464826-P47
8P14	BNC series, Type UG-88/U.	M-7476889-P1	6R27	Wirewound, ferrule type, 1000 ohms $\pm 5\%$, 60 w.	M-7464827-P31
8P15 thru 8P18	BNC series, Type UG-260/U.	M-7468567-P1	6R29	Composition, 2700 ohms, $\pm 10\%$, 2 w.	C-3R79-P272K
RESISTORS			6R30	Wirewound, 5000 ohms $\pm 5\%$, 5 w. Sprague Type 5 KT with pigtail leads and Style C mtg.	M-7478711-P98
5R1	Composition, 0.10 megohm $\pm 10\%$, 1 w.	C-3R78-P104K	6R31	Composition, 0.12 megohm $\pm 5\%$, 1 w.	C-3R78-P124J
5R3	Composition, 1000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P102K	6R32	Composition, 47,000 ohms, $\pm 5\%$, 1 w.	C-3R78-P473J
5R4	Composition, 0.10 megohm $\pm 5\%$, 2 w.	C-3R79-P104J	6R33	Composition, 0.12 megohm $\pm 5\%$, 1 w.	C-3R78-P124J
5R5 and 5R6	Composition, 1000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P102K	6R34	Composition, 47,000 ohms $\pm 5\%$, 1 w.	C-3R78-P473J
5R9	Resistor box assembly. Includes: Resistor box. Industrial Control Type CR-9143-SG, Schenectady Wks Dwg. No. 283A332 or G-E Syracuse Dwg. No. B-7488220-P1; 2 side covers, G-E Cat. #194800 1 top cover, G-E Cat. #194799.	A-7143544-G1	6R35	Composition, 0.12 megohm $\pm 5\%$, 1 w.	C-3R78-P124J
			6R36	Composition, 47,000 ohms $\pm 5\%$, 1 w.	C-3R78-P473J

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
RESISTORS (CONT'D)			RESISTORS (CONT'D)		
6R37	Composition, 0.12 megohm $\pm 5\%$, 1 w.	C-3R78-P124J	7R18	Wirewound, ferrule type, 4000 ohms $\pm 5\%$, 200 w, 9 taps equally spaced.	B-7491515-P1
6R40	Composition, 47,000 ohms $\pm 5\%$, 1 w.	C-3R78-P473J	7R20A and 7R20B	Multiplier, precision, 4.0 megohm $\pm 0.5\%$, 4000 v. Jan Type MFA405.	M-7470483-P11
6R41	Composition, 0.12 megohm $\pm 5\%$, 1 w.	C-3R78-P124J	7R23	Composition, 5100 ohms $\pm 5\%$, 2 w.	C-3R79-P512J
6R42	Composition, 47,000 ohms $\pm 5\%$, 1 w.	C-3R78-P473J	7R24	Potentiometer, composition: 7500 ohms $\pm 20\%$, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P53
6R43	Composition, 0.12 megohm $\pm 5\%$, 1 w.	C-3R78-P124J	7R30	Composition, 10,000 ohms $\pm 10\%$, 1 w.	C-3R78-P103K
6R44	Composition, 47,000 ohms $\pm 5\%$, 1 w.	C-3R78-P473J	7R31	Composition, 0.10 megohm $\pm 10\%$, 1 w.	C-3R78-P104K
6R45	Wirewound, 5000 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F5000.	M-2R14-P38	7R32	Composition, 27 ohms $\pm 10\%$, 1 w.	C-3R78-P270K
6R46	Rheostat, wirewound: 1000 ohms $\pm 10\%$, 25 w, linear taper. Ohmite Model H, Cat. #0158.	M-2R33-P42	7R33	Composition, 470 ohms $\pm 10\%$, 1 w.	C-3R78-P471K
6R47	Wirewound, 5.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F5.	M-2R14-P8	7R34	Potentiometer, composition: 1500 ohms $\pm 20\%$, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P9
6R50 thru 6R55	Wirewound, 20.0 ohms $\pm 10\%$, 375 w. Ward Leonard Type #10-1/2 D.	M-7484196-P6	7R35 and 7R36	Wirewound, 6300 ohms $\pm 5\%$, 10 w. Sprague Type 10 KT with tab terminals and Style C mtg.	M-7478633-P99
6R56 thru 6R61	Wirewound, 31.5 ohms $\pm 10\%$, 375 w. Ward Leonard Type #10-1/2 D.	M-7484196-P5	7R37	Composition, 0.27 megohm $\pm 10\%$, 1 w.	C-3R78-P274K
7R1	Wirewound, ferrule type, 160 ohms, 9 taps $\pm 10\%$, 160 w.	M-2R54-P23	7R38	Composition, 220 ohms $\pm 5\%$, 2 w.	C-3R79-P221J
7R2	Wirewound, 5.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F5.	M-2R14-P8	7R39	Composition, 180 ohms $\pm 5\%$, 1/2 w.	C-3R77-P181J
7R3 and 7R4	Wirewound, 10.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F10.	M-2R14-P11	7R40	Wirewound, 5.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F5.	M-2R14-P8
7R5	Wirewound, ferrule type, 1.0 ohm $\pm 5\%$, 60 w.	M-7464827-P1	7R41	Wirewound, 10,000 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F10000.	M-2R14-P41
7R6	Multiplier, precision, 1.5 megohm $\pm 0.5\%$, 1500 v. Jan Type MFB155.	M-7470483-P5	7R45 and 7R46	Composition, 130 ohms $\pm 5\%$, 1 w.	C-3R78-P131J
7R7	Wirewound, ferrule type, 1.0 ohm $\pm 5\%$, 60 w.	M-7464827-P1	7R47	Rheostat, wirewound; 750 ohms $\pm 10\%$, 75 w, linear taper. Ohmite Model "G", Cat. #1116.	M-2R35-P17
7R8	Wirewound, 10.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F10.	M-2R14-P11	8R1	Wirewound, 10.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F10.	M-2R14-P11
7R9	Rheostat, wirewound, dual: each section rated 5.0 ohms $\pm 10\%$, 225 w. Ohmite Type 6605.	P-7769823-P5	8R3	Rheostat, wirewound: 6 ohms $\pm 10\%$, linear taper, 25 w. Ohmite Model H, Cat. #0143.	M-2R33-P50
7R10	Wirewound, 3.15 ohms $\pm 10\%$, 375 w. Ward Leonard Type 10-1/2 D.	M-7484196-P7	8R31 thru 8R34	Wirewound, noninductive, ferrule type, 4.0 ohms $\pm 5\%$, 160 w.	M-7472341-P7
7R11 and 7R12	Wirewound, ferrule type, 1.0 ohm $\pm 5\%$, 60 w.	M-7464827-P1	8R36 and 8R37	Wirewound, ferrule type, 1.0 ohm $\pm 5\%$, 60 w.	M-7464827-P1
7R13 and 7R14	Wirewound, 1.0 ohm $\pm 5\%$, 25 w. Ward Leonard Cat. #25F1.	M-2R14-P1	8R38 and 8R39	Rheostat, wirewound: 10 ohms $\pm 10\%$, linear taper, 225 w. Ohmite Model P, Cat. #1256.	M-2R38-P7
7R15 and 7R16	Wirewound, 10.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F10.	M-2R14-P11	8R40 and 8R41	Wirewound, ferrule type, 4.0 ohms $\pm 5\%$, 115 w.	M-7464826-P7
7R17	Composition, 0.10 megohm $\pm 10\%$, 2 w.	C-3R79-P104K			

50-KW TELEVISION AMPLIFIER

EBI-3295

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
RESISTORS (CONT'D)			RESISTORS (CONT'D)		
8R42	Wirewound, 5.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F5.	M-2R14-P8	8R89	Composition, 0.22 megohm $\pm 5\%$, 2 w.	C-3R79-P224J
8R43	Wirewound, 3.15 ohms $\pm 10\%$, 375 w. Ward Leonard Type 10-1/2 D.	M-7484196-P7	8R90	Composition, 0.39 megohm $\pm 5\%$, 2 w.	C-3R79-P394J
8R44 and 8R45	Wirewound, ferrule type, 1.0 ohm $\pm 5\%$, 60 w.	M-7464827-P1	8R91 and 8R92	Composition, 0.10 megohm $\pm 5\%$, 2 w.	C-3R79-P104J
8R46 and 8R47	Wirewound, 1.0 ohm $\pm 5\%$, 25 w. Ward Leonard Cat. #25F1.	M-2R14-P1	8R93A and 8R93B	Multiplier, precision, 4.0 megohm $\pm 0.5\%$, 400 v. Jan Type MFA405.	M-7470483-P11
8R48	Composition, 130 ohms $\pm 5\%$, 1 w.	C-3R78-P131J	8R94	Multiplier, precision, 1.5 megohm $\pm 0.5\%$, 1500 v. Jan Type MFB155.	M-7470483-P5
8R49	Wirewound, 10.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F10.	M-2R14-P11	8R96	Potentiometer, composition: 250,000 ohms $\pm 20\%$, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P62
8R50 thru 8R53	Wirewound, noninductive, ferrule type, 1.0 ohm $\pm 5\%$, 60 w.	M-7472343-P1	8R97	Composition, 11,000 ohms $\pm 5\%$, 2 w.	C-3R79-P113J
8R55	Composition, 30,000 ohms $\pm 5\%$, 2 w.	C-3R79-P303J	8R98	Composition, 10,000 ohms $\pm 5\%$, 2 w.	C-3R79-P103J
8R56	Composition, 10,000 ohms $\pm 5\%$, 2 w.	C-3R79-P103J	8R101 and 8R102	Composition, 22,000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P223K
8R57	Potentiometer, composition: 100,000 ohms $\pm 20\%$, 2.25 w, linear taper. Allen Bradley Type J.	M-2R73-P20	8R103	Composition, 5600 ohms $\pm 10\%$, 2 w.	C-3R79-P562K
8R58	Wirewound, 4000 ohms $\pm 5\%$, 200 w, 9 taps equally spaced.	B-7491515-P1	8R104 and 8R105	Composition, 560 ohms $\pm 5\%$, 2 w.	C-3R79-P561J
8R59	Wirewound, ferrule type, 40,000 ohms $\pm 5\%$, 115 w.	M-7464826-P47	8R104	Composition, 22,000 ohms $\pm 10\%$, 2 w.	C-3R79-P223K
8R60	Wirewound, 10.0 ohms $\pm 5\%$, 25 w. Ward Leonard Cat. #25F10.	M-2R14-P11	8R107 and 8R108	Composition, 75,000 ohms $\pm 5\%$, 1 w.	C-3R78-P753J
8R61	Composition, 56,000 ohms $\pm 5\%$, 2 w.	C-3R79-P563J	8R109	Composition, 5600 ohms $\pm 10\%$, 2 w.	C-3R79-P562K
8R62	Wirewound, ferrule type, 20,000 ohms $\pm 5\%$, 60 w.	M-7464827-P44	8R110	Composition, 56,000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P563K
8R63 thru 8R65	Composition, 0.10 megohm $\pm 5\%$, 2 w.	C-3R79-P104J	8R111	Composition, 1000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P102K
8R66	Composition, 0.33 megohm $\pm 5\%$, 2 w.	C-3R79-P334J	8R112	Composition, 56,000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P563K
8R67	Composition, 0.22 megohm $\pm 5\%$, 2 w.	C-3R79-P224J	8R113	Composition, 0.12 ohms $\pm 10\%$, 1 w.	C-3R78-P124K
8R68	Composition, 0.10 megohm $\pm 5\%$, 2 w.	C-3R79-P104J	8R114	Composition, 820 ohms $\pm 10\%$, 1/2 w.	C-3R77-P821K
8R69	Composition, 56,000 ohms $\pm 5\%$, 2 w.	C-3R79-P563J	8R115	Composition, 0.10 megohm $\pm 10\%$, 1/2 w.	C-3R77-P104K
8R70 thru 8R77	Composition, 1000 ohms $\pm 5\%$, 1 w.	C-3R78-P102J	8R116	Composition, 620 ohms $\pm 5\%$, 1/2 w.	C-3R77-P621J
8R78	Composition, 130 ohms $\pm 5\%$, 1 w.	C-3R78-P131J	8R117	Composition, 820 ohms $\pm 5\%$, 1/2 w.	C-3R77-P821J
8R79	Composition, 180 ohms $\pm 5\%$, 1/2 w.	C-3R77-P181J	8R118	Composition, 51,000 ohms $\pm 5\%$, 1/2 w.	C-3R77-P513J
8R80 thru 8R87	Wirewound, 200 ohms $\pm 5\%$, 5 w. Sprague Type 5 KT with pigtail leads.	M-7478711-P24	8R119	Composition, 1000 ohms $\pm 5\%$, 1/2 w.	C-3R77-P102J
8R88	Composition, 220 ohms $\pm 5\%$, 2 w.	C-3R79-P221J			

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
RESISTORS (CONT'D)			SWITCHES (CONT'D)		
8R120	Composition, 10,000 ohms $\pm 10\%$, 1 w.	C-3R78-P103K	6S3 and 6S4	Circuit breakers: 5 amp, 3 pole, time overload curve #1. Heinemann Cat. #3363S-5.	P-7768830-P1
8R121	Composition, 0.12 megohm $\pm 10\%$, 1 w.	C-3R78-P124K	6S5	Toggle type, spst, 3 amp at 250 v. Arrow Hart and Hegeman Type 20994-WJB.	M-7478623-P1
8R122	Composition, 820 ohms $\pm 10\%$, 1/2 w.	C-3R77-P821K	6S6	Door interlock, with actuator: max current 10 amp, 125 v a-c. Similar to Micro Switch actuator #MCD2711 with micro switch #DT-2R-A7 installed.	B-7487976-P1
8R123	Composition, 0.10 megohm $\pm 10\%$, 1/2 w.	C-3R77-P104K	6S7	Grounding switch.	ML-7487877-G1
8R124	Composition, 620 ohms $\pm 5\%$, 1/2 w.	C-3R77-P621J	6S8 thru 6S10	Door interlocks.	ML-7460330-G4
8R125	Composition, 820 ohms $\pm 5\%$, 1/2 w.	C-3R77-P821J	6S11	Door interlock, with actuator: max current 10 amp, 125 v a-c. Similar to Micro Switch actuator #MCD2711 with dpdt micro switch #DT-2R-A7 installed; operating force 2.5 lbs, release force 0.25 lb.	B-7487976-P1
8R126	Composition, 10,000 ohms $\pm 10\%$, 1 w.	C-3R78-P103K	6S12	Circuit breaker: 3 amp, 2 pole, time overload curve #1. Heinemann Cat. #2263S-3.	P-7768829-P23
8R127 thru 8R129	Composition, 56,000 ohms $\pm 10\%$, 1/2 w.	C-3R77-P563K	6S13 and 6S14	Circuit breakers: 15 amp, 3 pole, time overload curve #1. Heinemann Cat. #3363S-15.	P-7768830-P3
8R130 and 8R131	Composition, 100 ohms $\pm 5\%$, 1 w.	C-3R78-P101J	6S15	Circuit breaker: 25 amp, 3 pole, time overload curve #1. Heinemann Cat. #3363S-25.	P-7768830-P5
8R132 and 8R133	Composition, 5100 ohms $\pm 5\%$, 1/2 w.	C-3R77-P512J	7S1	Airflow switch: spdt, vertical up airstream, actuates on increasing at 1600 fpm, de-actuates on decreasing at 1350 fpm.	B-7487948-P3
8R134	Composition, 100 ohms $\pm 5\%$, 1 w.	C-3R78-P101J	7S2	Door interlock.	ML-7460330-G4
8R135	Composition, 5100 ohms $\pm 5\%$, 1/2 w.	C-3R77-P512J	7S3	Push button type, green cap.	A-7135306-G2
8R136	Composition, 100 ohms $\pm 5\%$, 2 w.	C-3R79-P101J	7S4	Door interlock, with actuator: max current 10 amp, 125 v a-c. Similar to Micro Switch actuator #MCD2711 with dpdt micro switch #DT-2R-A7 installed; operating force 2.5 lbs, release force 0.25 lb.	B-7487976-P1
8R137	Composition, 15,000 ohms $\pm 5\%$, 1/2 w.	C-3R77-P153J	7S5	Toggle type, dpdt omitting positive off center position, 10 amp at 125 v, 5 amp at 250 v. Arrow Hart and Hegeman Cat. #80638.	K-7116628-P1
8R138 and 8R139	Composition, 6800 ohms $\pm 10\%$, 2 w.	C-3R79-P682K	7S6	Circuit breaker: 1 amp, time overload curve #3. Heinemann Cat. #3363S-1.	P-7768830-P32
8R140	Composition, 1800 ohms $\pm 10\%$, 2 w.	C-3R79-P182K	7S7	Circuit breaker: 50 amp, time overload curve #3. Heinemann Cat. #3363S-50.	P-7768830-P21
8R141	Composition, 4700 ohms $\pm 10\%$, 1 w.	C-3R78-P472K	7S8	Lever switch. G-E Type 16SB1NB504LSM2P.	C-7773780-P1
SWITCHES					
5S1	Circuit breaker: 3 pole, normal current 100 amp, a-c voltage 600 v, instant trip 500 amp. Trumbull Type AT225 amp J frame, Cat. #AT39100G.	C-7775284-P1			
5S2	Safety switch: 3pdt, 230 v a-c, 400 amp. Trumbull Elec. Cat. #35325.	B-7485967-P1			
5S3 and 5S4	Sensitive switch: dpdt, an assembly of Micro Switch Co. actuator Cat. #ADD3721R and switch Cat. #DT-2R-A7.	M-7405603-P1			
6S1	Circuit breaker: 5 amp, 3 pole, time overload curve #3. Heinemann Cat. #3363S-5.	P-7768830-P15			

50-KW TELEVISION AMPLIFIER

EBI-3295

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
SWITCHES (CONT'D)			SWITCHES (CONT'D)		
7S9	Circuit breaker: 3 amp, time over-load curve #2. Heinemann Cat. #2263S-3.	P-7768829-P28	7S37	Toggle type, spst, 3 amp at 250 v. Arrow Hart and Hegeman Type 20994-WJB.	M-7478623-P1
7S10	Circuit breaker: 15 amp, time over-load curve #2. Heinemann Cat. #3363S-15.	P-7768830-P10	8S1	Door interlock.	ML-7460330-G4
7S11 and 7S12	Circuit breakers: 5 amp, time over-load curve #3. Heinemann Cat. #2263S-5.	P-7768829-P15	8S2	Push button type, green cap.	A-7135306-G2
7S13	Safety ground switch.	PL-7486297-G1	8S3 and 8S4	Door interlocks, with actuator: max current 10 amp, 125 v a-c. Similar to Micro Switch actuator #MCD2711 with dpdt microswitch #DT-2R-A7 installed; operating force 2.5 lbs, release force 0.25 lb.	B-7487976-P1
7S14	Toggle type, dpdt, 1 amp at 250 v, 3 amp at 125 v. Arrow Hart and Hegeman Type 20905-WJB.	M-7478623-P4	8S5	Toggle type, spst, 3 amp at 250 v. Arrow Hart and Hegeman Type 20994-WJB.	M-7478623-P1
7S15	Rotary type, 2 sections, 1 pole per section, 2 - 12 positions, non-shorting. Oak Type HC.	C-7773781-P3	8S6	Circuit breaker: 10 amp, time over-load curve #3. Heinemann Cat. #2263S-10.	P-7768829-P16
7S16	Lever switch. G-E Cat. #16SB1CF1 modified.	A-7144995-P1	8S7	Circuit breaker: 15 amp, time over-load curve #2. Heinemann Cat. #3363S-15.	P-7768830-P10
7S17	Toggle type, spst, 3 amp at 250 v, Arrow Hart and Hegeman Type 20994-WJB.	M-7478623-P1	8S8	Airflow switch: spdt, vertical up airstream, actuates on increasing at 1600 fpm, de-actuates on decreasing at 1350 fpm. Rotron Type 1600.	B-7487948-P3
7S18	Door interlock, with actuator: max current 10 amp, 125 v a-c. Similar to Micro Switch actuator #MCD2711 with dpdt microswitch #DT-2R-A7 installed; operating force 2.5 lbs, release force 0.25 lb.	B-7487976-P1	8S9	Circuit breaker: 3 amp, time over-load curve #2. Heinemann Cat. #2263S-3.	P-7768829-P28
7S19	Circuit breaker: 1 amp, time over-load curve #3. Heinemann Cat. #2263S-1.	P-7768829-P32	8S10	Circuit breaker: 1 amp, time over-load curve #3. Heinemann Cat. #3363S-1.	P-7768830-P32
7S20	Rotary type, 2 sections, 5 poles, 2 positions, nonshorting. Oak Type DHC.	P-7703271-P4	8S11	Door interlock.	ML-7460330-G4
7S21	Limit switch: 1 NO. and 1 NC circuit, solder lug terminals. G-E Cat. #CR-1070D122C3.	K-7132529-P1	8S12	Rotary type, 1 section, 1 pole, 2 - 12 positions, nonshorting. Oak Type HC.	C-7773781-P1
7S22	Door interlock.	ML-7460330-G4	8S13	Safety grounding switch.	PL-7486297-G1
7S23 thru 7S28	Limit switches: 1 NO. and 1 NC circuit, solder lug terminals. G-E Cat. #CR-1070D122C3.	K-7132529-P1	8S15 and 8S16	Toggle type, dpdt, 1 amp at 250 v, 3 amp at 125 v. Arrow Hart and Hegeman Type 20905-WJB.	M-7478623-P4
7S29 thru 7S31	Lever type, 4 form A contacts, nonlocking, in each section. CP Clare Cat. #A-28308.	P-7769218-P10	8S17	Rotary type, 2 sections, 5 poles, 2 positions, nonshorting. Oak Type DHC.	P-7703271-P4
7S32	Toggle type, dpdt, 1 amp at 250 v, 3 amp at 125 v. Arrow Hart and Hegeman Type 20905-WJB.	M-7478623-P4	8S18	Limit switch: 1 NO. and 1 NC circuit, solder lug terminals. G-E Cat. #CR-1070D122C3.	K-7132529-P1
7S33 and 7S34	Flow switches, interlock: contact point OFF at 8 gpm, the actual switch is a normally closed device held in an actuated position when no water is flowing. Hays Cat. #2600-3011.	B-7488111-P1	8S19	Rotary type, 2 sections, 1 pole per section, 2 - 12 positions, nonshorting. Oak Type HC.	C-7773781-P3
7S35 and 7S36	Thermometers, remote: NC contact opens at 158° F. US Gauge Cat. #921S.	M-7480264-P2	8S20 thru 8S25	Limit switches: 1 NO. and 1 NC circuit, solder lug terminals. G-E Cat. #CR-1070D122C3.	K-7132529-P1
			8S26 thru 8S28	Lever type, 4 form A contacts, nonlocking, in each section. CP Clare Cat. #28308.	P-7769218-P10

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
SWITCHES (CONT'D)			TUBES (CONT'D)		
8S29	Toggle type, dpdt, 1 amp at 250 v, 3 amp at 125 v. Arrow Hart and Hegeman Type 20905-WJB.	M-7478623-P4	8V15 thru 8V17	Type 6AS7G.	
8S30	Rotary type, 1 section, 1 pole, 2 - 12 positions, nonshorting. Oak Type HC.	C-7773781-P1	8V20	Type 6AS7G.	
8S31 and 8S32	Flow switches, interlock: contact point OFF at 8 gpm, the actual switch is a normally closed device held in an actuated position when no water is flowing. Hays Cat. #2600-3011.	B-7488111-P1	8V21 thru 8V23	Type GL-OC3/VR105.	
8S33 and 8S34	Thermometers, remote: NC contact opens at 158° F. U.S. Gauge Cat. #921S.	M-7480264-P2	8V101	Type 6BK7.	
8S35	Toggle type, spst, 3 amp at 250 v. Arrow Hart and Hegeman Type 20994-WJB.	M-7478623-P1	8V102	Type GL-832A.	
8S101	Toggle type, spst, 3 amp at 250 v. Arrow Hart and Hegeman Type 20994-WJB.	M-7478623-P1	8V103 and 8V104	Type 6U8.	
8S102	Rotary type, 2 sections, 1 pole per section, 2 - 12 positions, nonshorting. Oak Type HC.	P-7773781-P3	TRANSFORMERS		
8S103	Rotary type, 1 section, 1 pole, 5 positions, shorting. Oak Type DHC.	M-7480297-P1	5T1	3 phase plate transformer and interphase reactor.	B-7487257-P1
8S104 thru 8S106	Toggle type, spst, 3 amp at 250 v. Arrow Hart and Hegeman Type 20994-WJB.	M-7478623-P1	6T1	Pri: 208/230 v, 50/60 cycles; sec: 115 v, 6 amp or 96 v, 7.2 amp, never both simultaneously.	M-7477718-P1
TUBES			6T2 and 6T3	Indicating light transformers. Pri: 115 v, 50/60 cycles; sec: 4 v, 0.003 kva.	M-7467402-P1
5V1	Type 6AL5.		6T4	Single phase plate transformer. Pri: 230 v, 50/60 cycles; sec: 210 v/105 v, 0.075 amp.	M-7483271-P1-
6V1 thru 6V6	Type GL-869B.		6T6	Single phase plate transformer. Pri: 230 v, 50/60 cycles; sec: 2920/1460 v, 0.65 amp.	M-7486322-P1
6V10 thru 6V15	Type 5823.		6T7	Filament transformer. Pri: 230 v, 50/60 cycles; sec: 5/2.5 v, 15 amp.	M-7486324-P1
6V16 thru 6V19	Type GL-8008.		6T8	Single phase plate transformer. Pri: 230 v, 50/60 cycles; sec: 2920/1460 v, 0.65 amp.	M-7486322-P1
7V6 and 7V7	Type GL-6251.		6T9	Filament transformer. Pri: 230 v, 50/60 cycles; sec: 5/2.5 v, 15 amp.	M-7486324-P1
7V10	Type 6SN7-GT.		6T10 thru 6T16	Filament transformers. Pri: 230 v, 50/60 cycles; sec: 5/2.5 v + 4% - 0%, 20 amp.	B-7485598-P1
7V11	Type 5R4GY.		7T1 thru 7T6	Indicating light transformers. Pri: 115 v, 50/60 cycles; sec: 4 v, 0.003 kva.	M-7467402-P1
8V10 and 8V11	Type GL-6251.		7T7	Filament transformer. Pri: 115/230 v, 50/60 cycles; sec: 5 v, 1.5 amp.	M-7467883-P1
8V13	Type 6AK5.		7T8	Indicating light transformers. Pri: 115 v, 50/60 cycles; sec: 4 v, 0.003 kva.	M-7467402-P1
8V14	Type 12AU7.		7T10 and 7T11	Indicating light transformers. Pri: 115 v, 50/60 cycles; sec: 4 v, 0.003 kva.	M-7467402-P1

50-KW TELEVISION AMPLIFIER

EBI-3295

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
TRANSFORMERS (CONT'D)			TRANSFORMERS (CONT'D)		
7T12	3 phase plate transformer. Pri phase voltage: 230 v, 50/60 cycles, delta connected; sec phase voltage: 37 v under load.	B-7487241-P1	8T8	Powerstat. Input: 230 v, 50/60 cycles; output: 0 - 270 v, 9 amp, 2.4 kva. Similar to Superior Elec. Type 1226 modified by tapping 3 holes 1/2 - 13.	K-7121422-P3
7T14	Powerstat. Input: 190-250 v, 50/60 cycles, 3 phase; output 220 v, 3 phase, 25 amp, 9.5 kva. Similar to Superior Elec. Type 1226L2 (S766P) modified by tapping 3 holes 1/2 - 13.	K-7121422-P2	8T9	Filament and plate transformer. Pri: 230 v, 50/60 cycles; sec #1: 2.5/5/7.5/10 v $\pm 2\%$; sec #2: 2.5/5/7.5/10 v $\pm 2\%$.	D-7668104-P1
7T15 and 7T16	Filament transformers. Pri: 100 v, 50/60 cycles; sec: 37.5 v, 20 amp.	B-7486396-P1	8T10	Filament and control transformer. Pri: 199.2 v, 50/60 cycles; sec: 4.33/8.66/12.99/17.32 v $\pm 2\%$, 0.166 kva.	D-7668104-P2
7T17	Powerstat. Input: 230 v, 50/60 cycles; output 0-270 v, 9 amp, 2.4 kva. Superior Elec. Type 1226 modified.	ML-7123885-G3	8T11	Filament transformer. Pri: 230 v, 50/60 cycles; sec #1: 6.3 v, 10.0 amp; sec #2: 6.3 v, 0.3 amp; sec #3: 6.3 v, 0.3 amp.	M-7486326-P1
7T18	Filament and control transformer. Pri: 230 v, 50/60 cycles; sec #1: 2.5/5/7.5/10 v $\pm 2\%$; sec #2: 2.5/5/7.5/10 v $\pm 2\%$, 0.134 kva.	D-7668104-P1	8T12	Filament and control transformer. Pri: 220 v, 50/60 cycles; sec: 5.5/2.75 v $\pm 4\%$, 190 amp.	D-7668104-P3
7T19	Filament and control transformer. Pri: 199.2 v, 50/60 cycles; sec: 4.33/8.66/12.99/13.32 v $\pm 2\%$, 0.116 kva.	D-7668104-P2	8T13	Filament and control transformer. Pri: 190.5 v, 50/60 cycles; sec: 5.5/2.75 v $\pm 4\%$, 190 amp.	D-7668104-P4
7T20	Filament and control transformer. Pri: 220 v, 50/60 cycles; sec: 5.5/2.75 v $\pm 4\%$, 190 amp.	D-7668104-P3	8T14	Filament transformer. Pri: 208/230 v, 50/60 cycles; sec: 6.3 v, 3 amp.	M-7477912-P1
7T21	Filament and control transformer. Pri: 190.5 v, 50/60 cycles; sec: 5.5/2.75 v $\pm 4\%$, 190 amp.	D-7668104-P4	8T16	Pri: 115/230 v, 50/60 cycles; sec: 6.3/3.15 v, 0.60 amp.	M-7470685-P1
7T23	Pri: 115/230 v, 50/60 cycles; sec: 6.3/3.15 v, 0.60 amp.	M-7470685-P1	LAMP SOCKETS AND DIAL LIGHTS		
7T24	Single phase plate transformer. Pri: 230 v, 50/60 cycles; sec: 210/105 v, 0.075 amp.	M-7483271-P1	6XI1	Lamp socket: 660 w, 250 v. G-E Cat. #9402.	K-7108411-P1
7T25	Filament transformer. Pri: 208/230 v, 50/60 cycles; sec: 6.3 v, 3 amp.	M-7477912-P1	6XI2	Dial light: translucent white jewel. Dial Light Co. Cat. #95410-975.	K-7117809-P1
7T26	Single phase plate transformer. Pri: 230 v, 50/60 cycles; sec: 935/467.5 v, 0.165 kva.	M-7483273-P1	7XI1 thru 7XI15	Dial lights: translucent white jewel. Dial Light Co. Cat. #95410-975.	K-7117809-P1
7T27	Filament transformer. Pri: 208/230 v, 50/60 cycles; sec: 5/2.5 v, 2.0 amp.	M-7477793-P1	7XI16	Dial light: translucent dark red jewel. Dial Light Co. Cat. #95410-971.	K-7117809-P5
8T1 thru 8T5	Indicating light transformers. Pri: 115 v, 50/60 cycles; sec: 4 v, 0.003 kva.	M-7467402-P1	7XI17	Dial light: translucent light green jewel. Dial Light Co. Cat. #95410-952.	K-7119809-P4
8T7	3 phase plate transformer. Pri phase voltage: 230 v, 50/60 cycles, delta connected; sec phase voltage: 46.5 v under load.	B-7487240-P1	7XI18 and 7XI19	Lamp sockets: 660 w, 250 v. G-E Cat. #9402.	K-7108411-P1
			8XI1 thru 8XI6	Dial lights: translucent white jewel. Dial Light Co. Cat. #95410-975.	K-7117809-P1
			8XI7	Dial light: translucent light green jewel. Dial Light Co. Cat. #95410-952.	K-7117809-P4

Symbol	Description	G-E Drawing	Symbol	Description	G-E Drawing
LAMP SOCKETS AND DIAL LIGHTS (CONT'D)			TUBE SOCKETS (CONT'D)		
8XI8 thru 8XI10	Dial lights: translucent white jewel. Dial Light Co. Cat. #95410-975.	K-7117809-P1	8XV10 and 8XV11	Part of basic construction of Cav- ity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.	
8XI11 and 8XI12	Lamp sockets: 660 w, 250 v. G-E Cat. #9402.	K-7108411-P1	8XV13	Mica filled phenolic, 7 pin minia- ture. RETMA Type TSE7T201.	P-7768887-P9
TUBE SOCKETS			8XV14	Mica filled phenolic, 9 pin minia- ture, tube shield base. RETMA Type TSE9T201.	M-7480532-P3
5XV1	Mica filled phenolic, 7 pin minia- ture. RETMA Type TSE7T201.	P-7768887-P9	8XV15 thru 8XV17	Mica filled phenolic, octal. Cinch Type 9886.	K-7103053-P1
6XV1 thru 6XV7	Tube mountings: porcelain base, special grid end assembly. John- son Cat. #23.53-2.	M-7484157-P2	8XV20 thru 8XV23	Mica filled phenolic, octal. Cinch Type 9886.	K-7103053-P1
6XV10 thru 6XV15	Mica filled phenolic 7 pin minia- ture, bottom mount flat top, 4 ground lugs.	P-7768887-P14	8XV101	Mica filled phenolic 9 pin minia- ture, 4 ground ears.	M-7480532-P8
6XV16 thru 6XV19	Ceramic 4 pin wafer type sockets for superjumbo based tubes. EF Johnson Cat. #122-244-5.	K-7115212-P2	8XV102	7 pin steatite. Similar to Ucinite Part #115342 except omitting spring clips.	M-7478654-P1
7XV6 and 7XV7	Part of basic construction of Cav- ity Assembly PL-7668731-G1. Refer to Mechanical parts list and photographs.		8XV103 and 8XV104	Mica filled phenolic 9 pin minia- ture, 4 ground ears.	M-7480532-P8
7XV10 and 7XV11	Mica filled phenolic, octal. Cinch Type 9886.	K-7103053-P1	CRYSTAL SOCKETS		
			8XY101 and 8XY102	2 pin steatite. Type CR-7, HH Eby Cat. #9006.	K-7128948-P1

CRYSTALS

8Y101
and
8Y102

When reordering, in addition to Drawing Number and Part Number give channel of operation, function, and exact frequency. In the tabulation the functions are abbreviated as follows:

VL: Visual Lower Marker (visual carrier frequency minus 0.75 mc)
 AL: Aural Lower Marker (aural carrier frequency minus 1.0 mc)
 AU: Aural Upper Marker (aural carrier frequency plus 1.0 mc)
 VS: Visual Lower-Sideband Limit (visual carrier frequency minus 1.25 mc)
 VU-C: Visual Upper Marker (visual carrier frequency plus 4.2 mc)

Channel	Crystal Frequency in MC	Output Freq. (3X Crystal Frequency)	Function	G-E Drawing
7	58.167	174.50	VL	G-7774471-P1
7	59.417	178.25	AL	-P2
7	60.417	181.25	AU	-P4
7	58.000	174.00	VS	-P29
7	59.817	179.45	VU-C	-P36
8	60.167	180.50	VL	G-7774471-P5
8	61.417	184.25	AL	-P6
8	62.417	187.25	AU	-P8
8	60.000	180.00	VS	-P30
8	61.817	185.45	VU-C	-P37

50-KW TELEVISION AMPLIFIER

EBI-3295

CRYSTALS (CONT'D.)

<u>Channel</u>	<u>Crystal Frequency in MC</u>	<u>Output Freq. (3X Crystal Frequency)</u>	<u>Function</u>	<u>G-E Drawing</u>
9	62.167	186.50	VL	C-7774471-P9
9	63.417	190.25	AL	-P10
9	64.417	193.25	AU	-P12
9	62.000	186.00	VS	-P31
9	63.817	191.45	VU-C	-P38
10	64.167	192.50	VL	C-7774471-P13
10	65.417	196.25	AL	-P14
10	66.417	199.25	AU	-P16
10	64.000	192.00	VS	-P32
10	65.817	197.45	VU-C	-P39
11	66.167	198.50	VL	C-7774471-P17
11	67.417	202.25	AL	-P18
11	68.417	205.25	AU	-P20
11	66.000	198.00	VS	-P33
11	67.817	203.45	VU-C	-P40
12	68.167	204.50	VL	C-7774471-P21
12	69.417	208.25	AL	-P22
12	70.417	211.25	AU	-P24
12	68.000	204.00	VS	-P34
12	69.817	209.45	VU-C	-P41
13	70.167	210.50	VL	C-7774471-P25
13	71.417	214.25	AL	-P26
13	72.417	217.25	AU	-P28
13	70.000	210.00	VS	-P35
13	71.817	215.45	VU-C	-P42

MECHANICAL

<u>Description or Name</u>	<u>Quantity*</u>	<u>G-E Drawing</u>
Targets	8	A-7141305-G1
"V" belts for heater exchanger (in matched sets of two). Goodyear #A64, or equivalent matched sets of two. †	2 sets	
"V" belts for cubicle blowers (in matched sets of two). Browning Cat. #4L350 "A" section, matched sets of two. †	2 sets	
Waterpressure gauges. Ashcroft #2-1000, 0-30 lb. scale, bottom connected.†	6	
J.C.S. mechanical seal used on "Motorpump" water pump. Order from nearest Ingersoll-Rand distributor as listed on last page of "Motorpump" book inserted in this book, specifying "J.C.S. Shaft Seal for 1RVNL-5 Motor Pump."	1	
Mica insulator, 2.50 OD x .375 ID x .005 thk clear mica, used on filament bypasses 7C22, 7C23, 7C24, 7C25, 8C28, 8C29, 8C30, and 8C31.	16	D-7668731-P63
Composition bushing used on 7C22, 7C23, 7C24, 7C25, 8C28, 8C29, 8C30 and 8C31.	8	D-7668731-P64
Insulating sheet composition mica used on bottom anode bypass 7C39 and 8C52.	2	A-7145087-G2
Insulating sheet composition mica used on top anode bypass 7C38 and 8C44.	2	A-7145087-G1
Insulating sheet composition mica used on screen bypass 7C34, 7C35, 8C40 and 8C41.	2	A-7145088-G1
Insulating sheet composition mica used on control grid bypass 7C36, 7C37, 8C42, and 8C43.	2	B-7486578-P1
Mica sheets used as part of 7C26, 7C27, 7C28, 7C29, 8C32, 8C33, 8C34, and 8C35.	12 and 4	A-7141543-P1 A-7141544-P1

* Quantity used per equipment.

† May be obtained from local hardware supply houses.

<u>Description</u>	<u>Quantity *</u>	<u>G-E Drawing</u>
Insulator, ceramic, 1.38 OD, used on anode bypass assemblies 7C38, 7C39, 8C44, and 8C52.	64	A-7144055-P1
Insulator, ceramic, 1.00 OD, used on screen bypass assemblies 7C34, 7C35, 8C40, and 8C41.	12	A-7144055-P3
Insulator, ceramic, 0.69 OD, used on control grid bypass assemblies 7C36, 7C37, 8C42, and 8C43.	12	A-7144055-P2
Insulator, composition, 0.408 OD, used on assembly of 7C26, 7C27, 7C28, 7C29, 8C32, 8C33, 8C34, and 8C35.	24	PL-7487745-P8
Insulator, fused quartz, part of capacitor assembly A-7145291-G1.	2	A-7145646-P2

* Quantity used per equipment.

APPLE SAUCE HOSE

GATES RUBBER PRODUCT # 3119-32

3/4" - 19 W-B 4 PLY HOSE

IA MACHINERY & SUPPLY

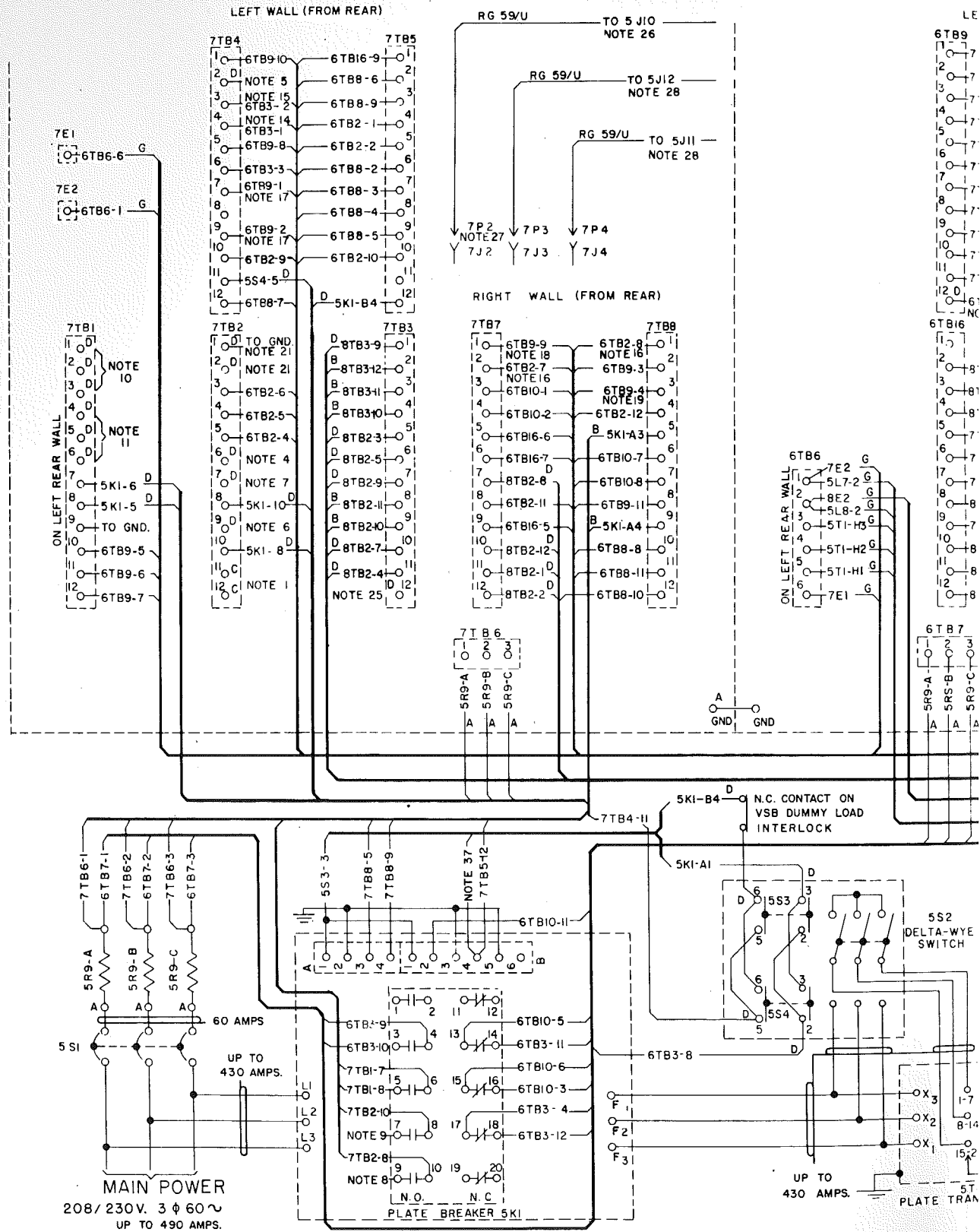
288-0123 CAN SUPPLY

GASKETS

~~M-7484~~
7162846-P10

GASKETS ONLY FOR QUICK DISCONNECTS

AURAL CUBICLE



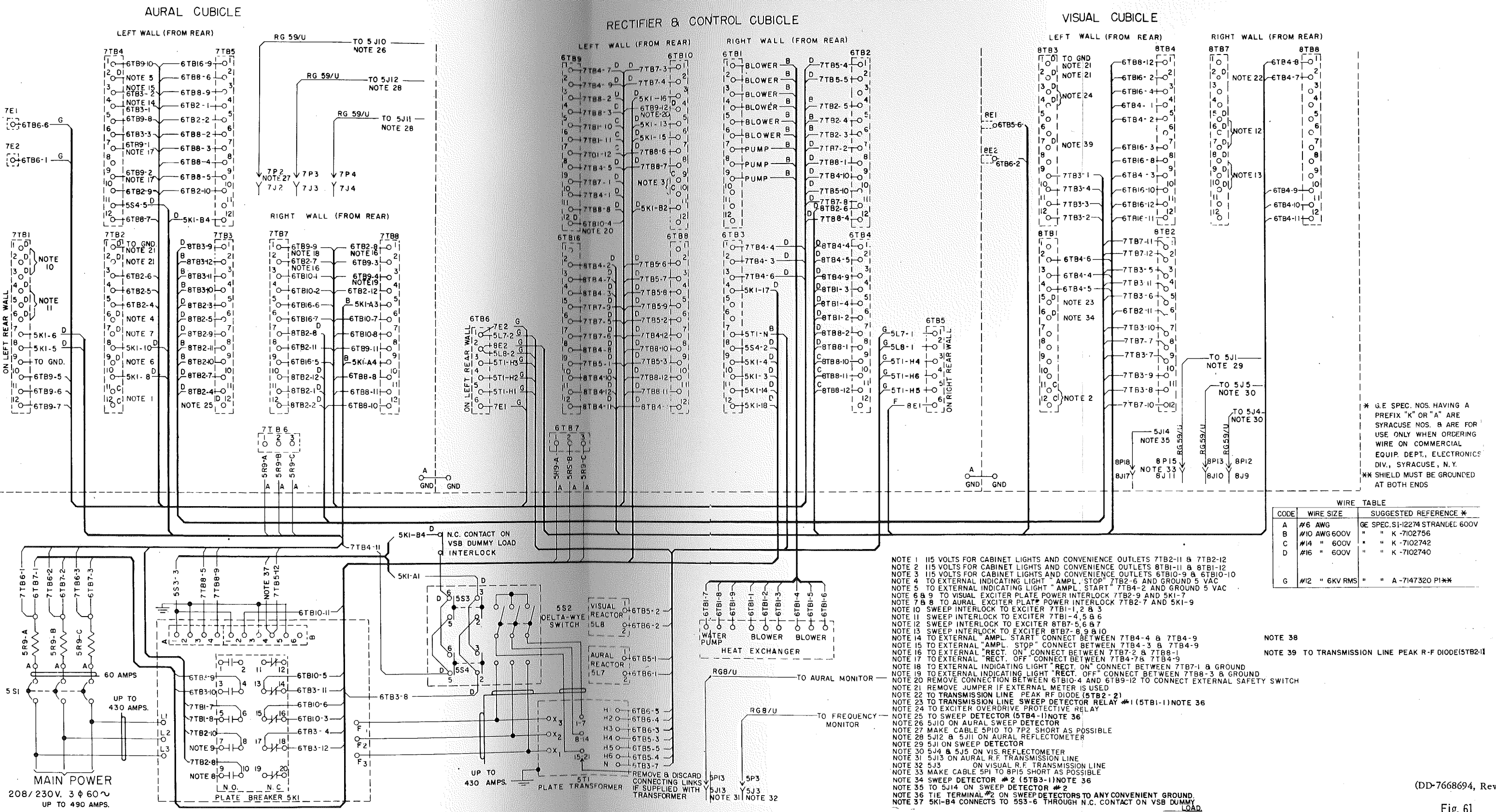


Fig. 61 Interconnection Diagram

(DD-7668694, Rev. 6)

Fig. 61
Interconnection

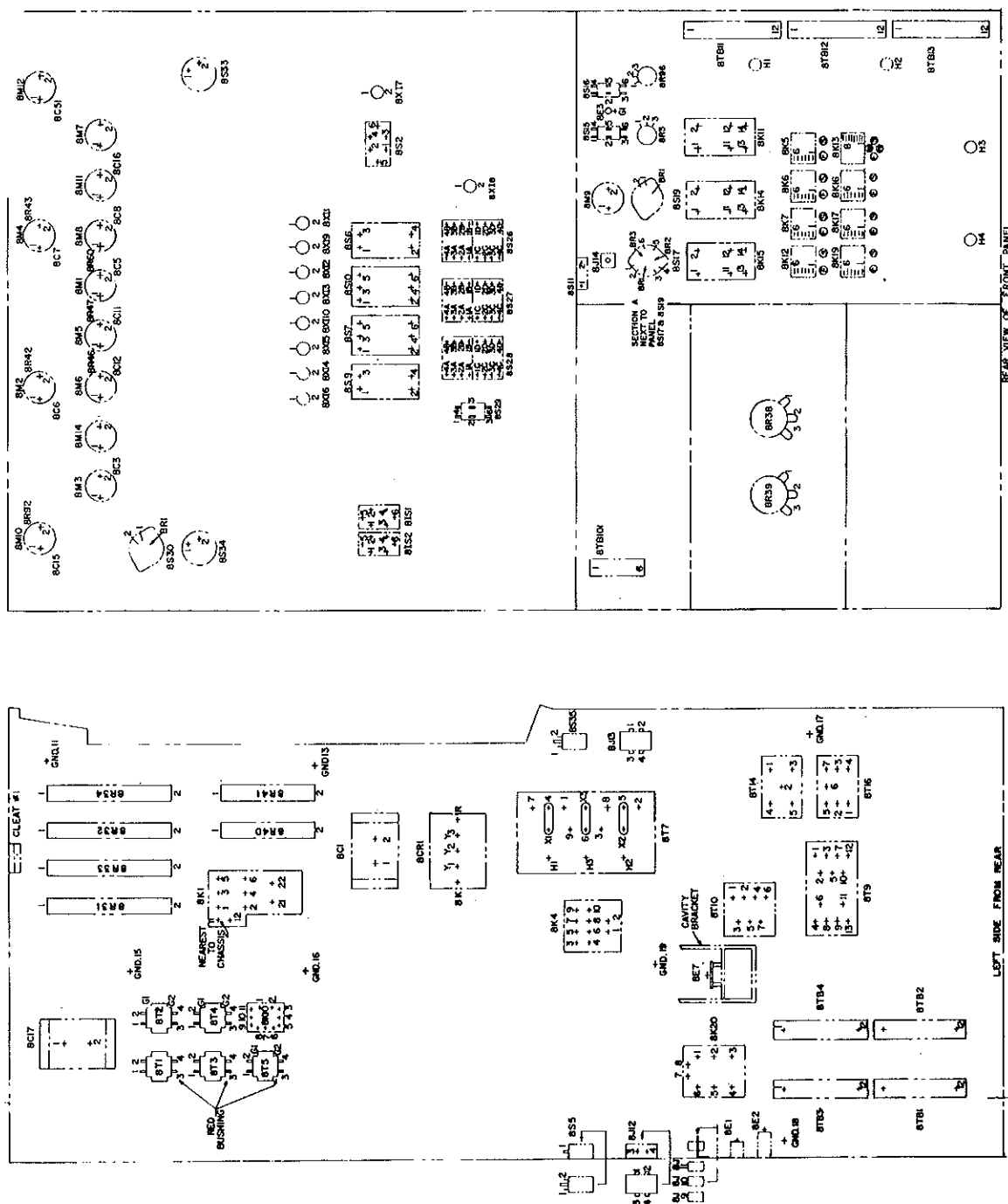


Fig. 62 Visual Amplifier Connection Diagram

(D-7668736, Sheet 1, Rev. 2)

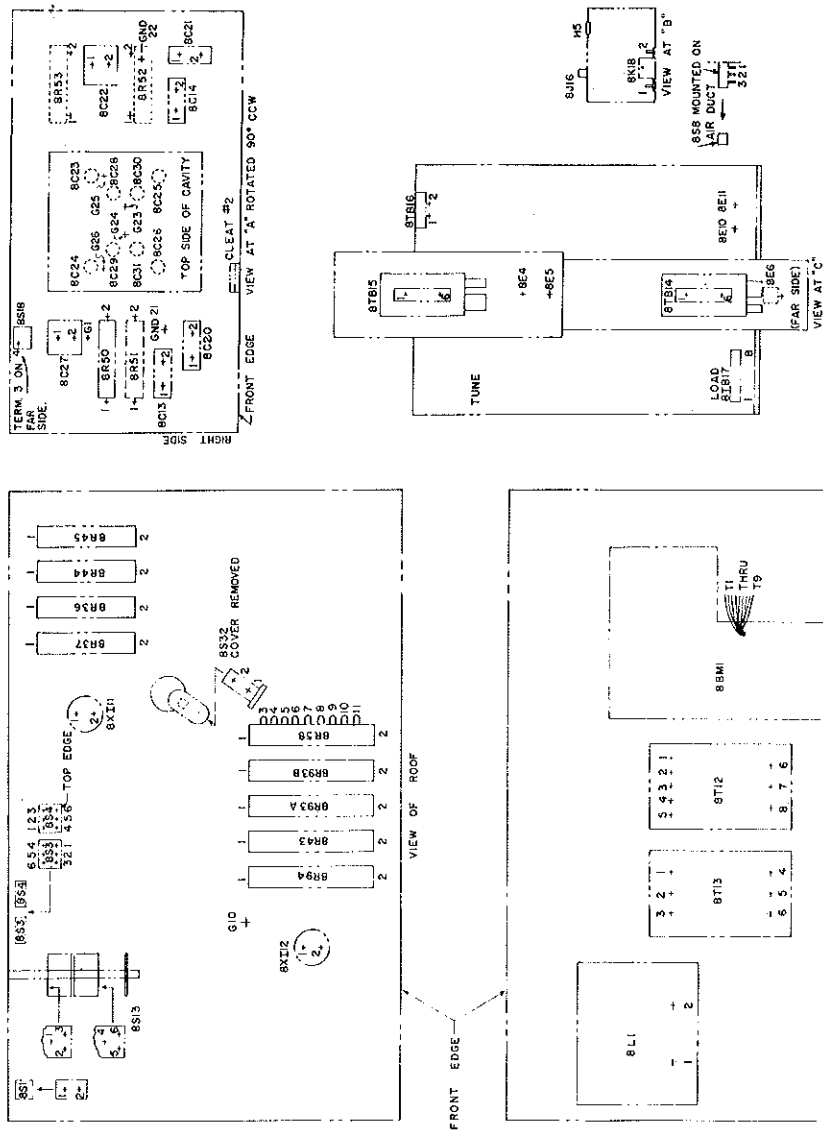
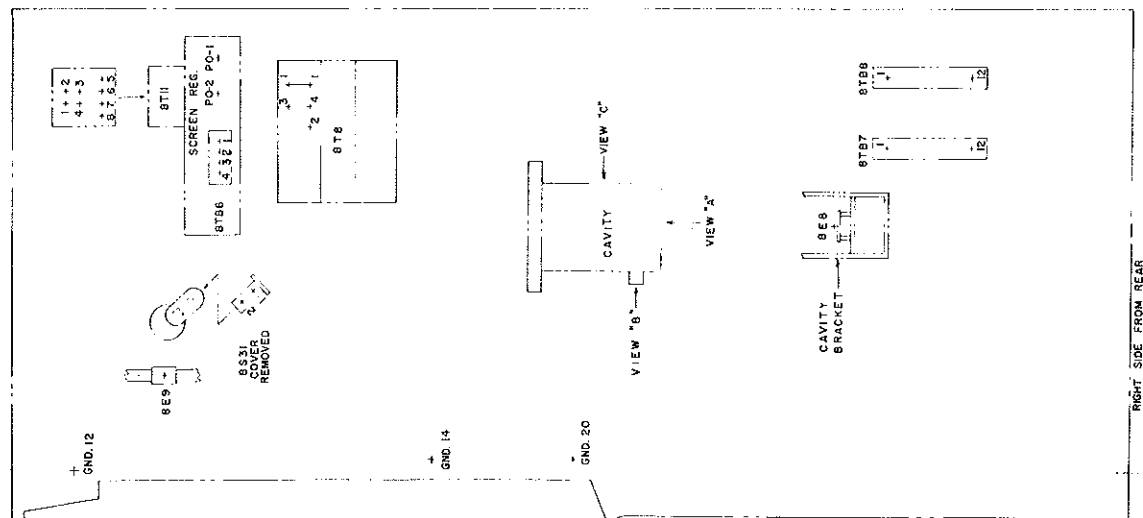
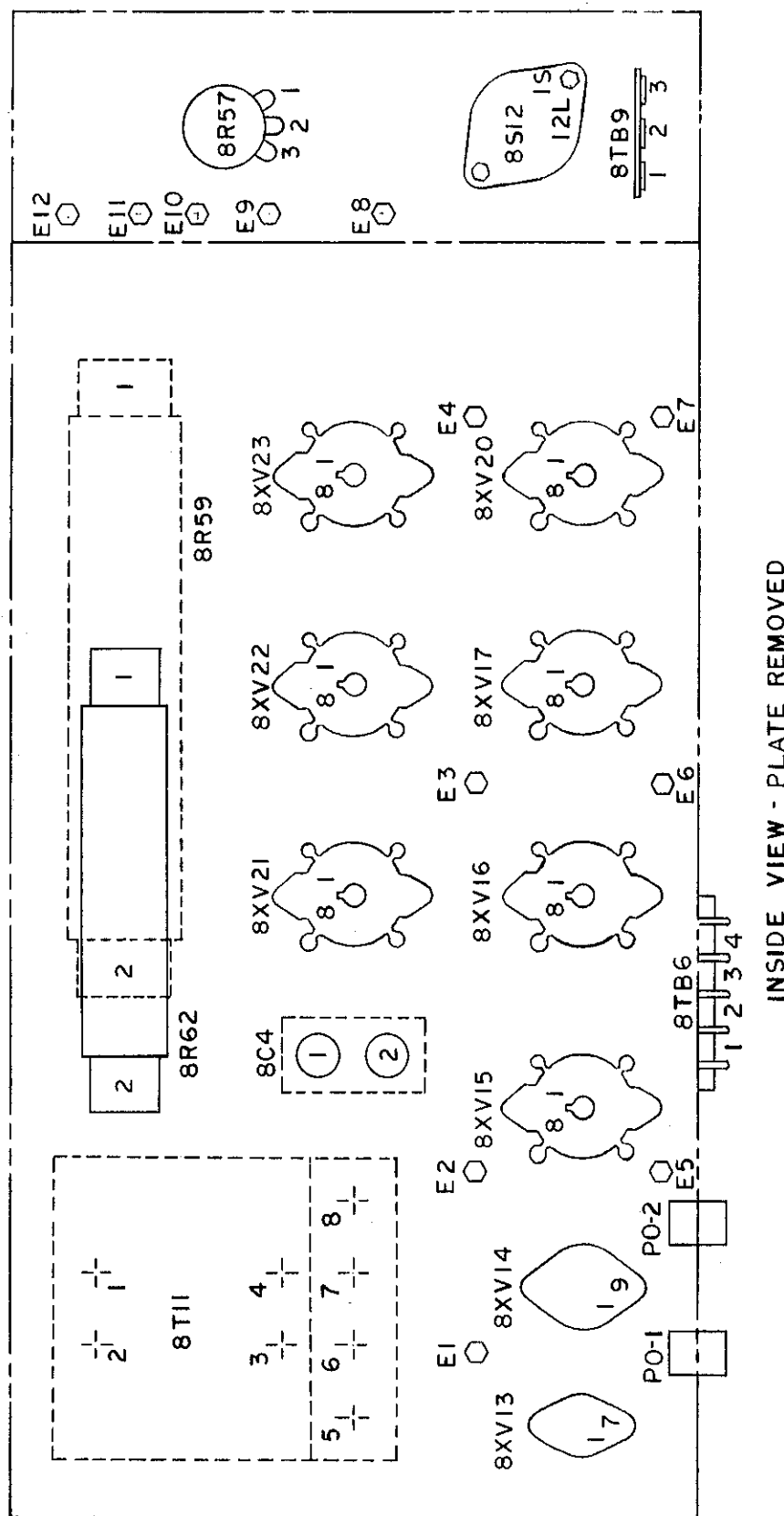


Fig. 63 Visual Amplifier Connection Diagram



(B-7948274)

Fig. 64 Screen Regulator Connection Diagram

C

C

C

C

C

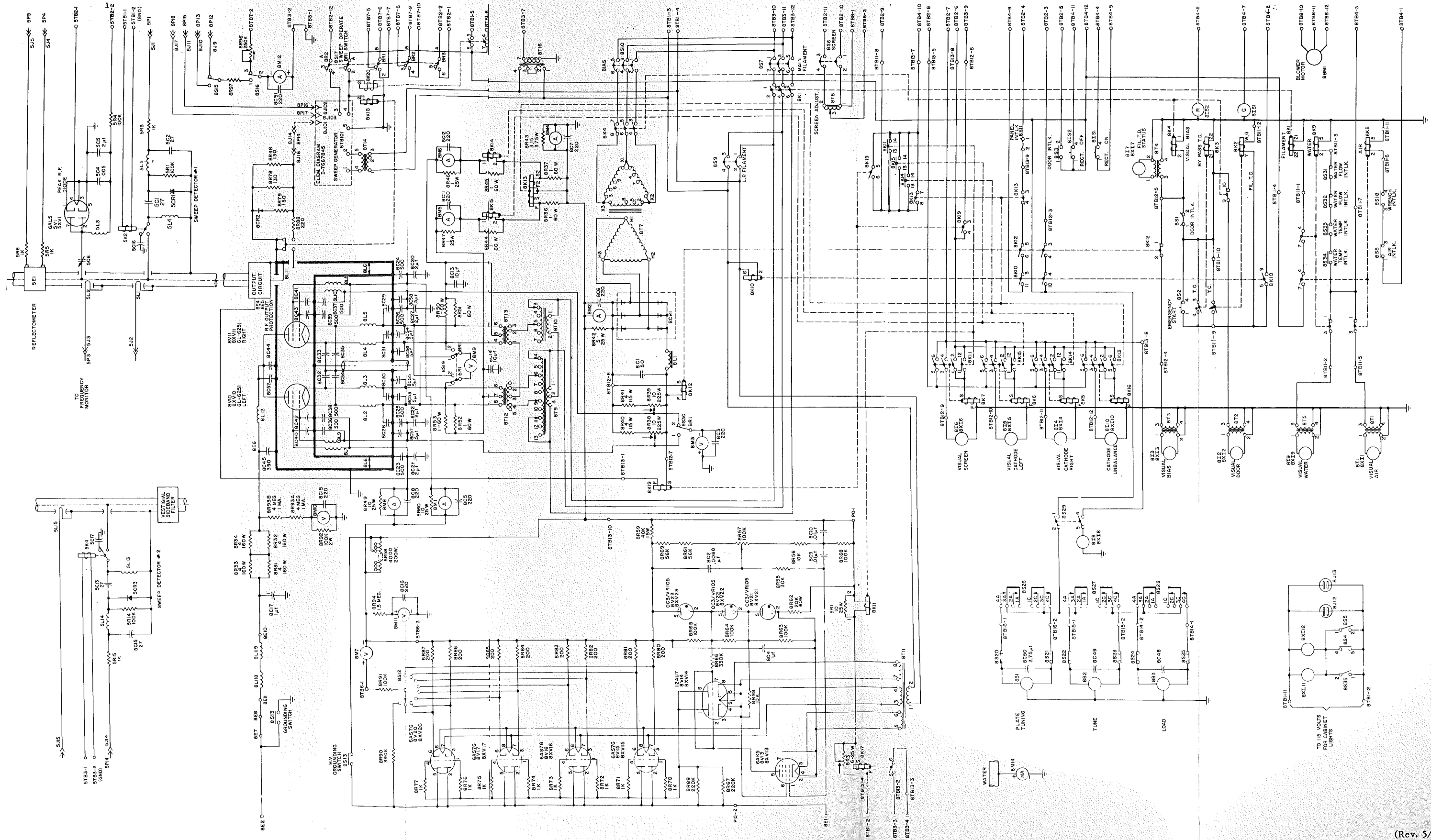
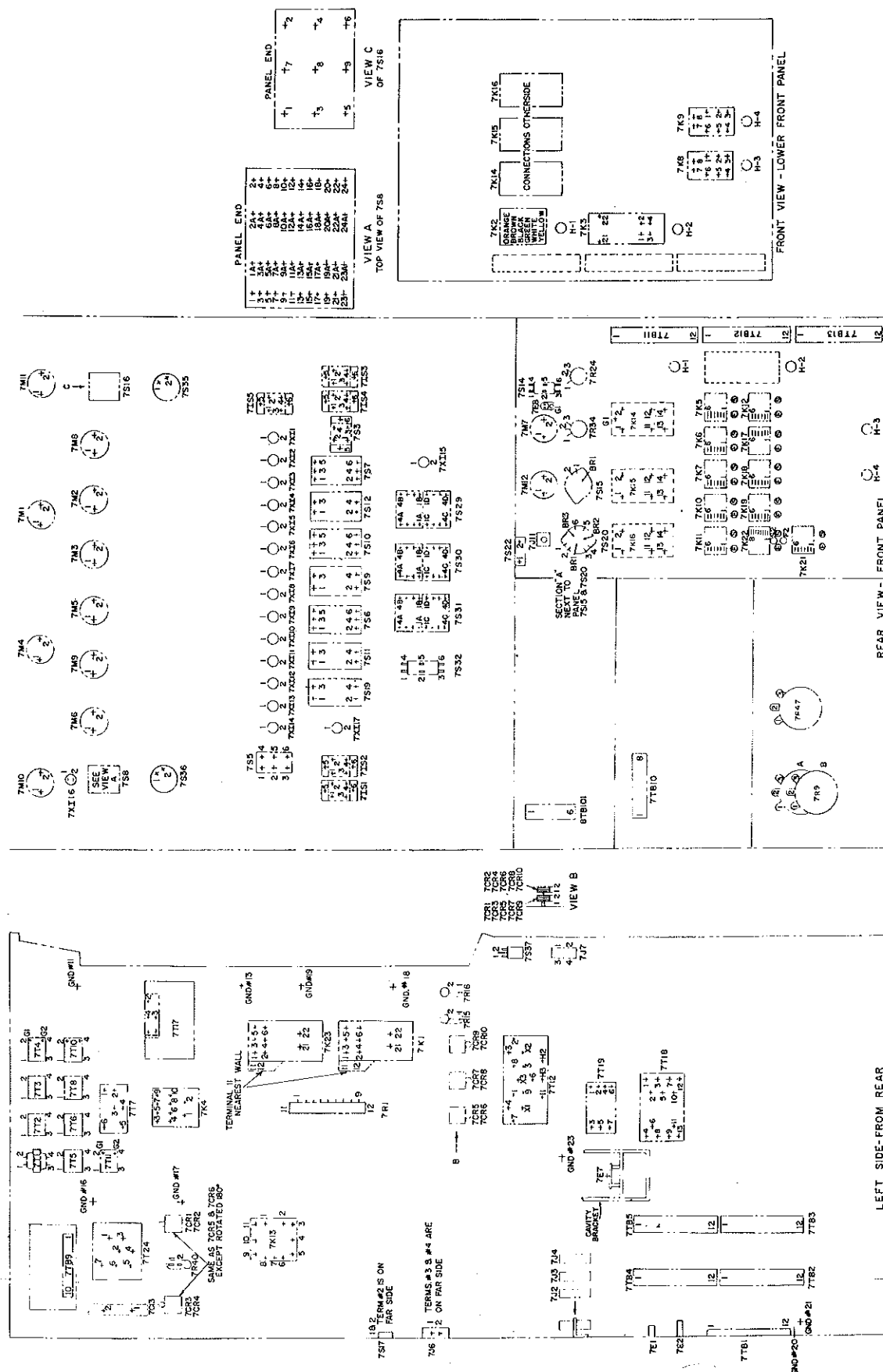
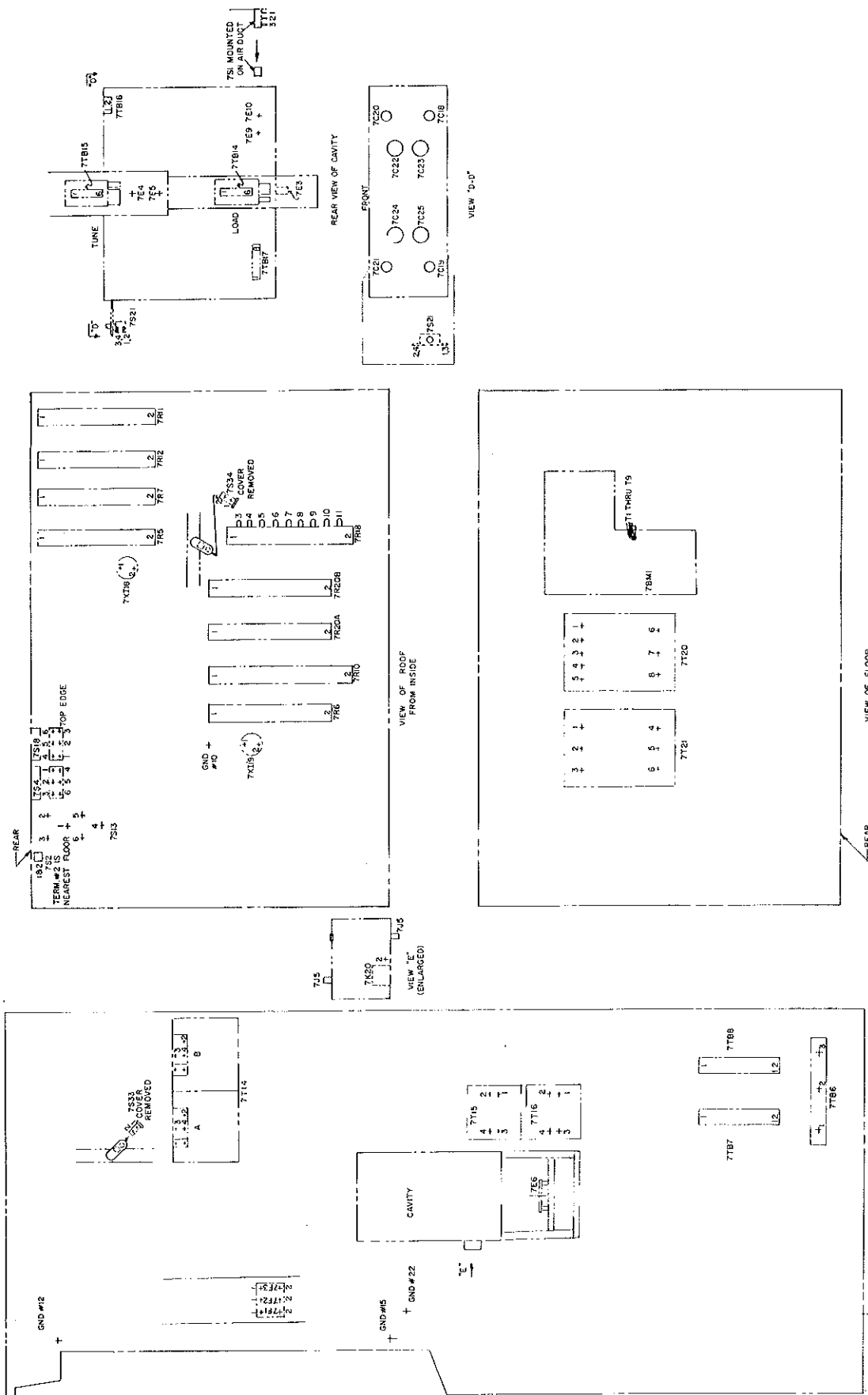


Fig. 65 Visual Amplifier Elementary Diagram

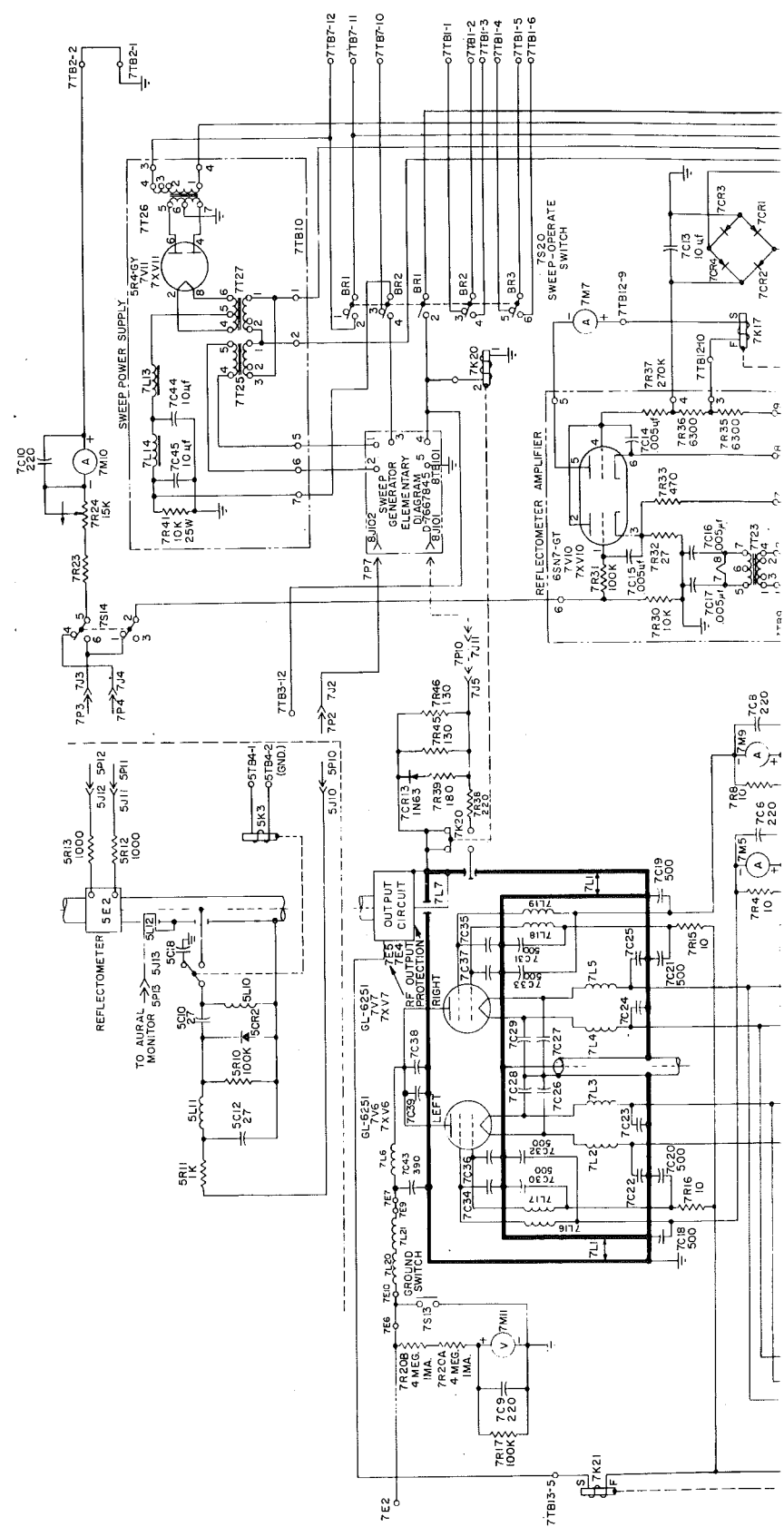
(EE-733681, Rev. 8)

(D-7667977, Sheet 1, Rev. 3)





(D-7667977, Sheet 2, (Rev. 7)



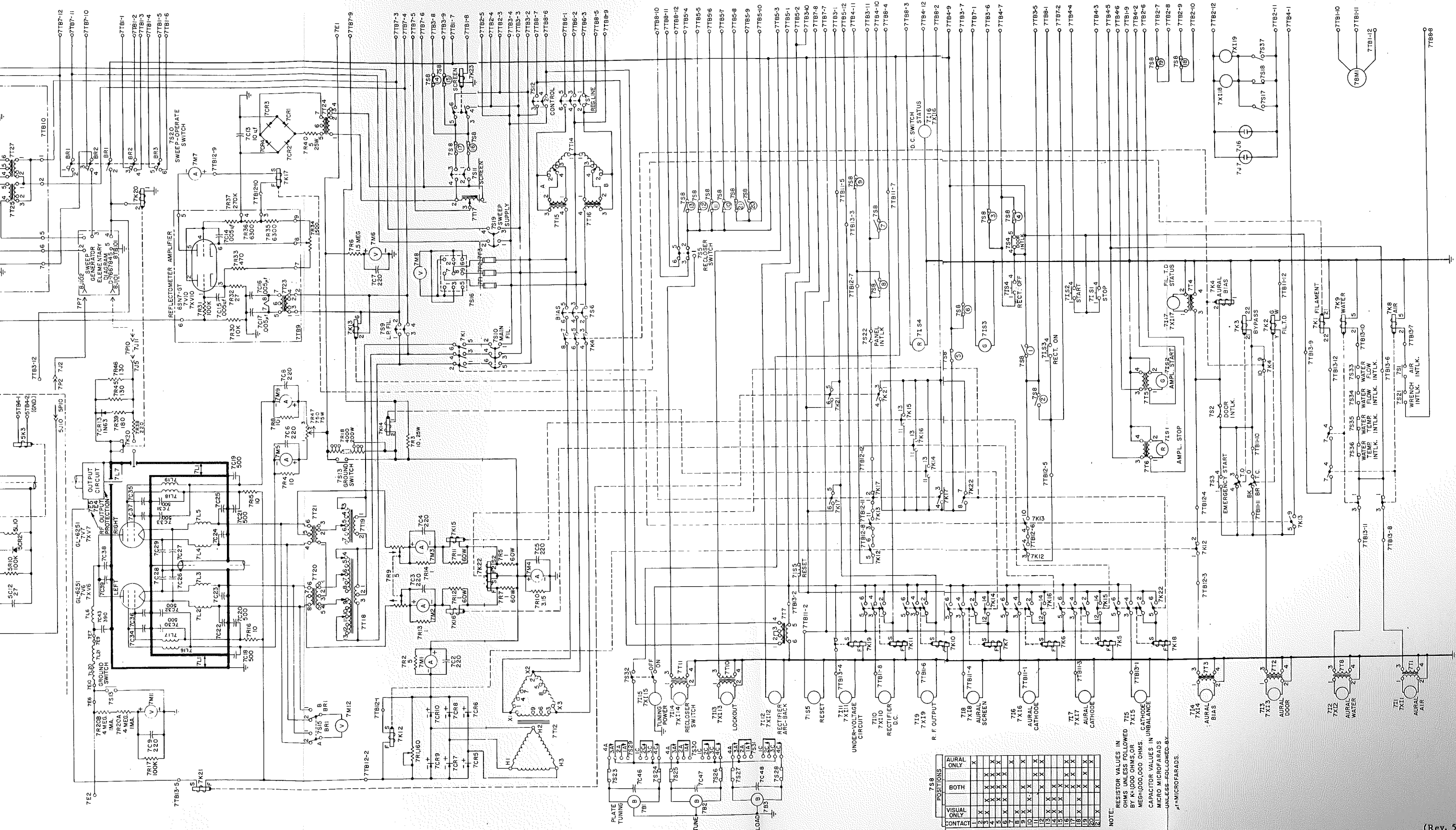
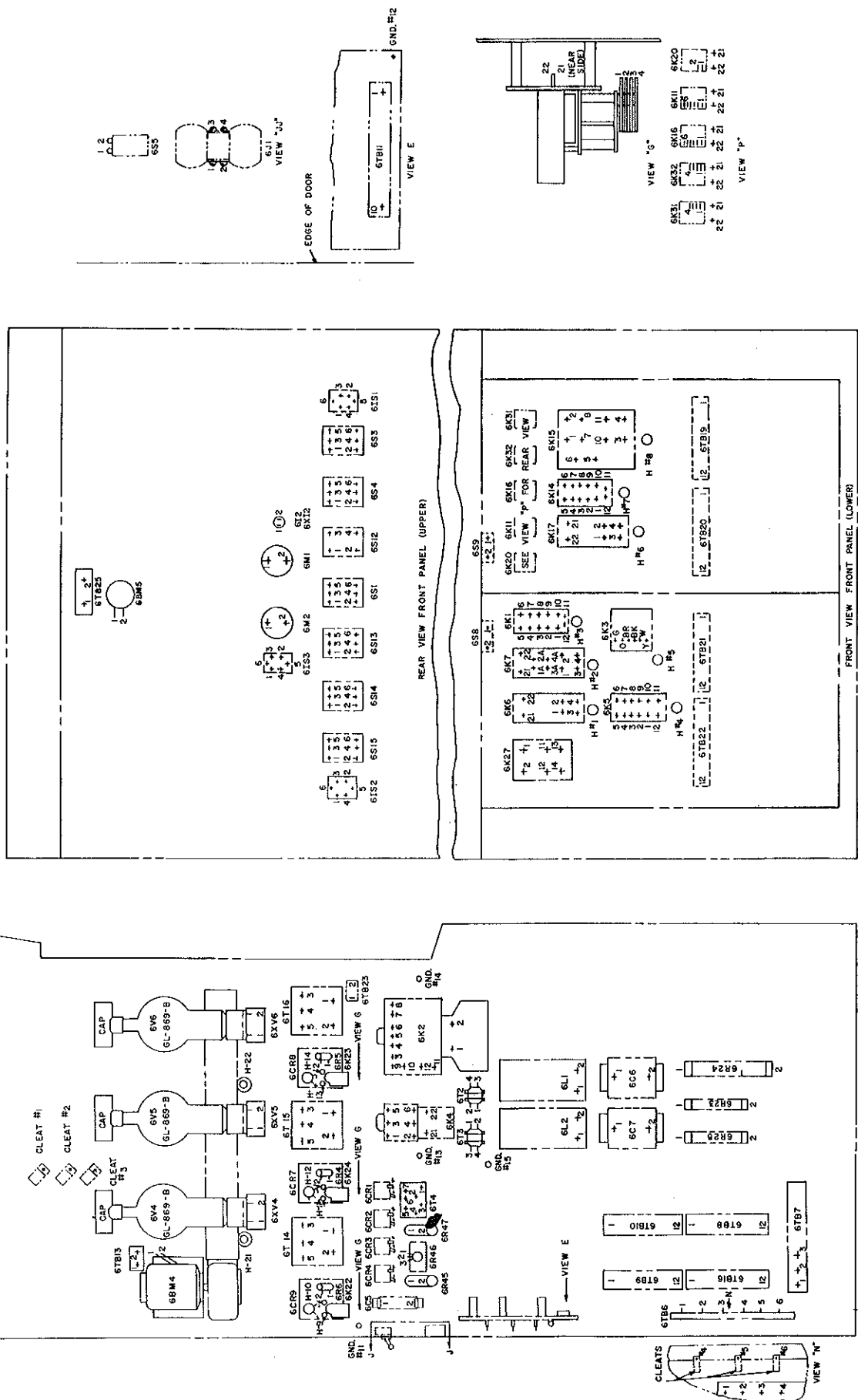


Fig. 68 Aural Amplifier Elementary Diagram



(D-7667978, Sheet 1, Rev. 1)

Fig. 69 Rectifier and Control Connection Diagram

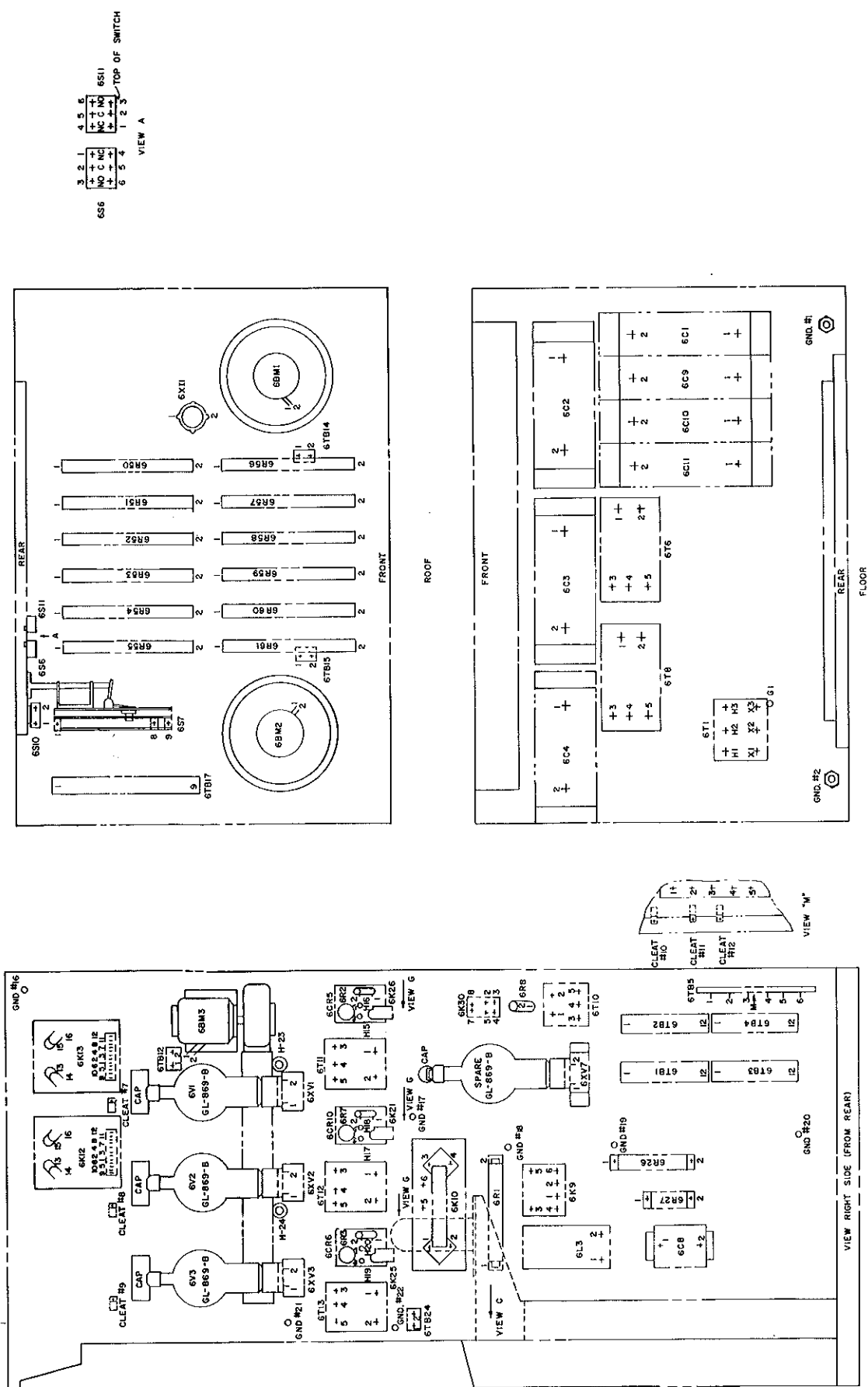
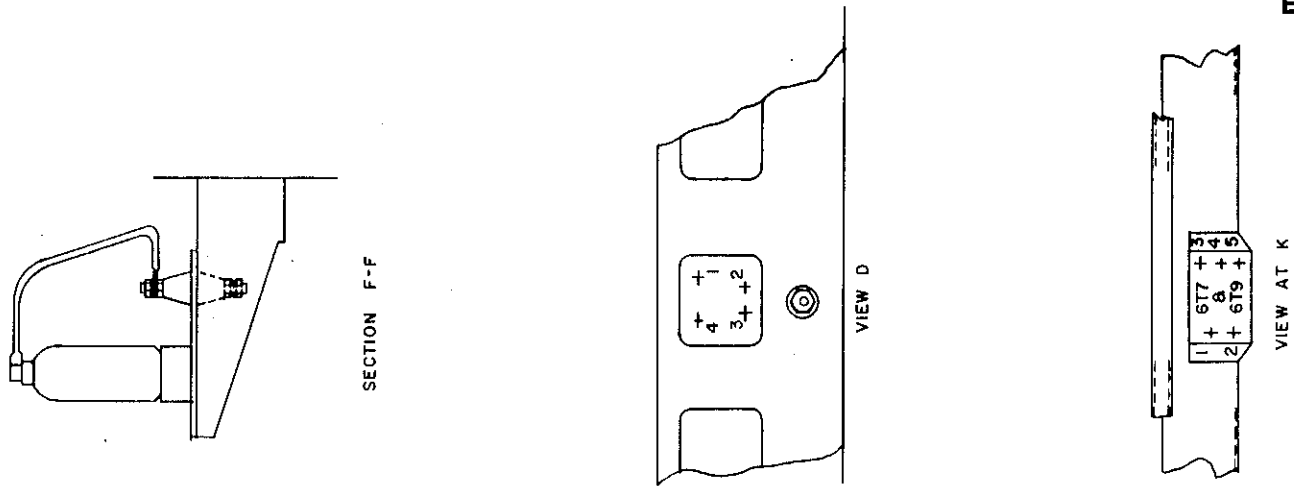
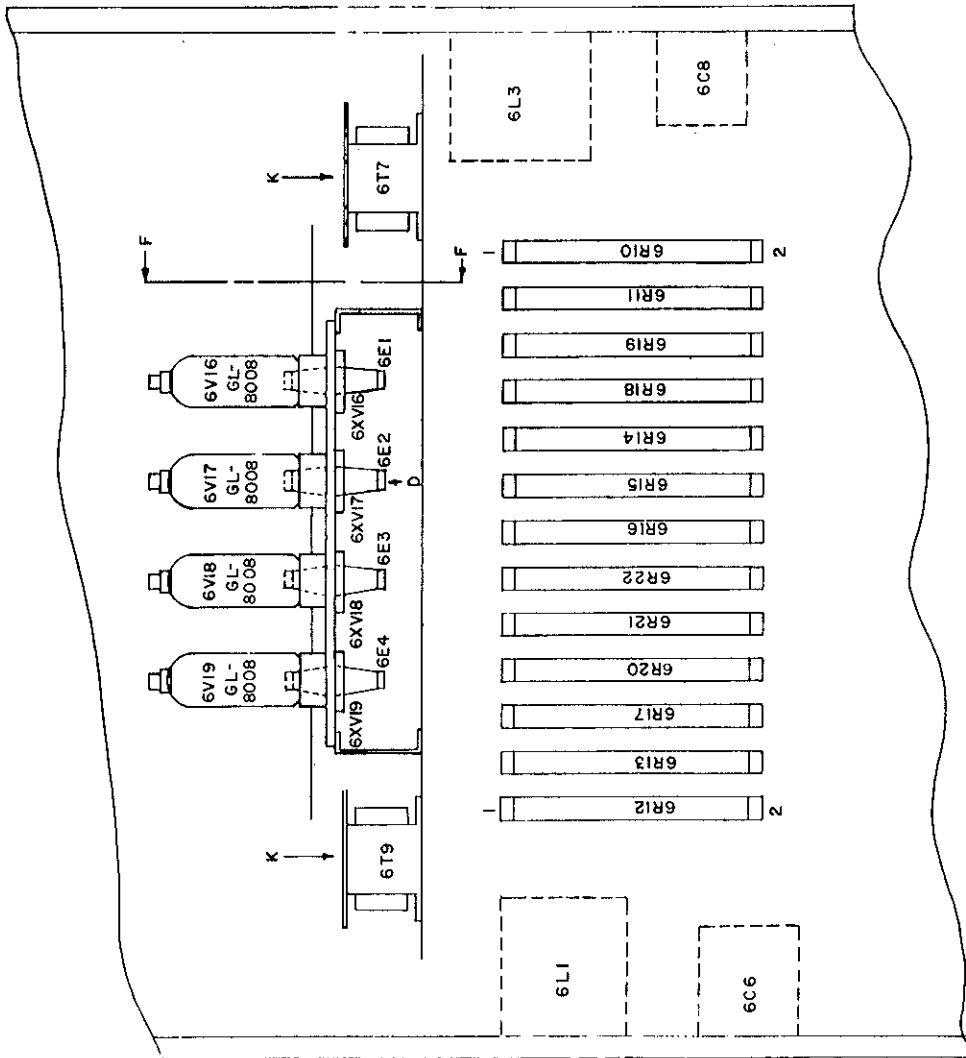


Fig. 70 Rectifier and Control Connection Diagram

(D-7667978, Sheet 2, Rev. 1)



(D-7667978, Sheet 3, Rev. 1)



INSIDE VIEW FROM REAR - "C"

Fig. 71 Rectifier and Control Connection Diagram



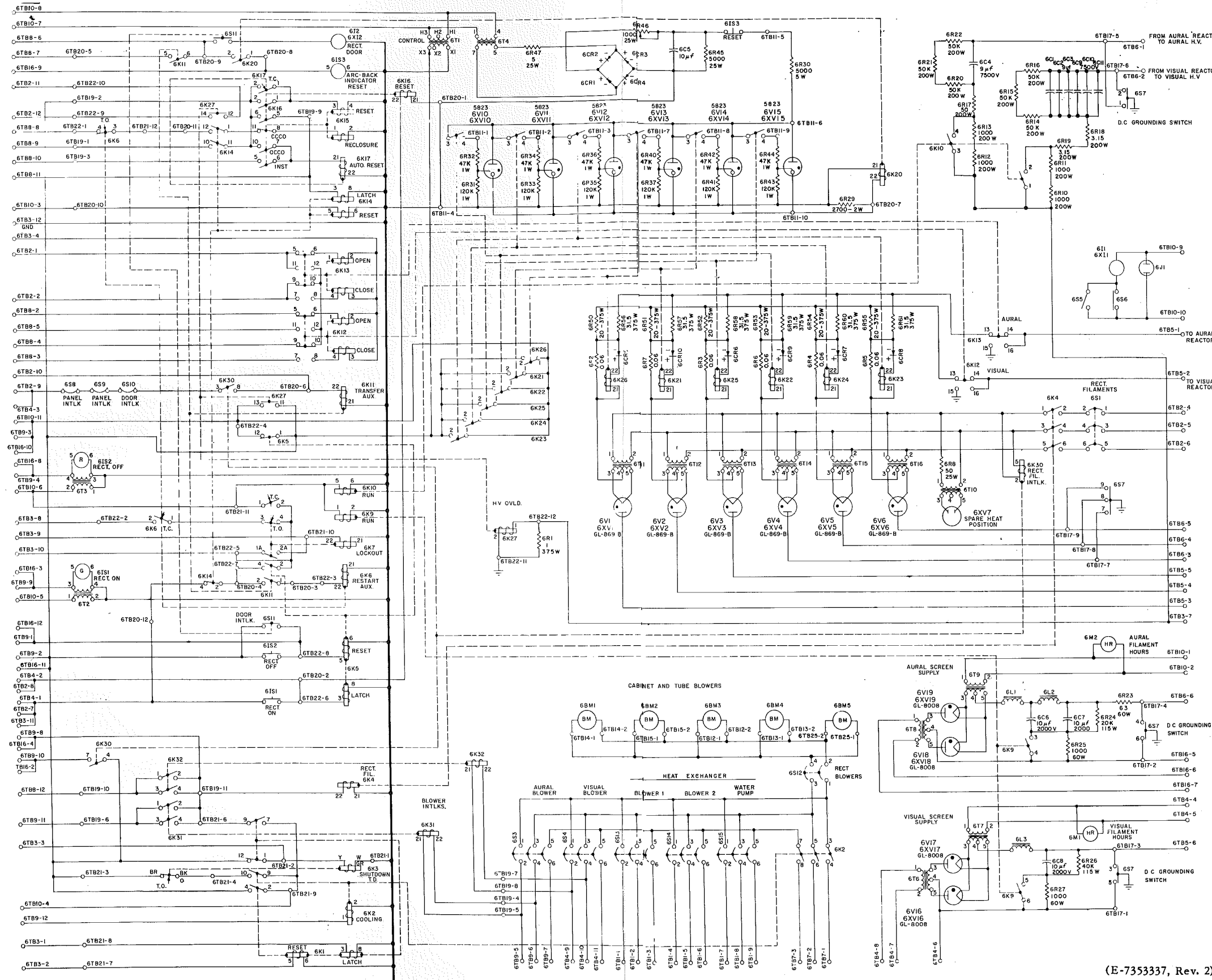
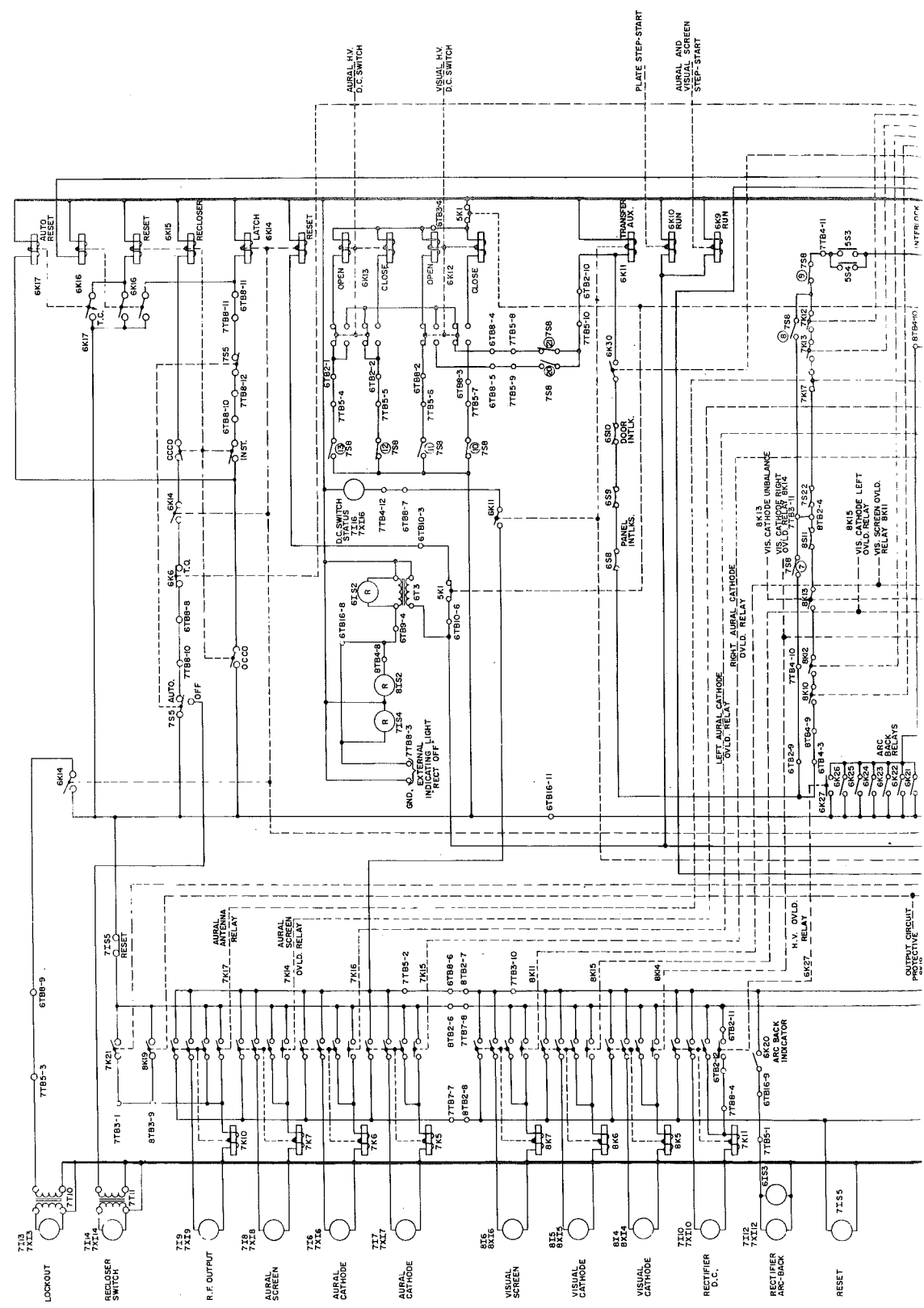
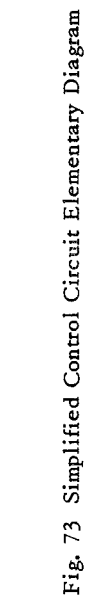


Fig. 72 Rectifier and Control Elementary Diagram

(E-7353337, Rev. 2)

Fig. 72
Elementary





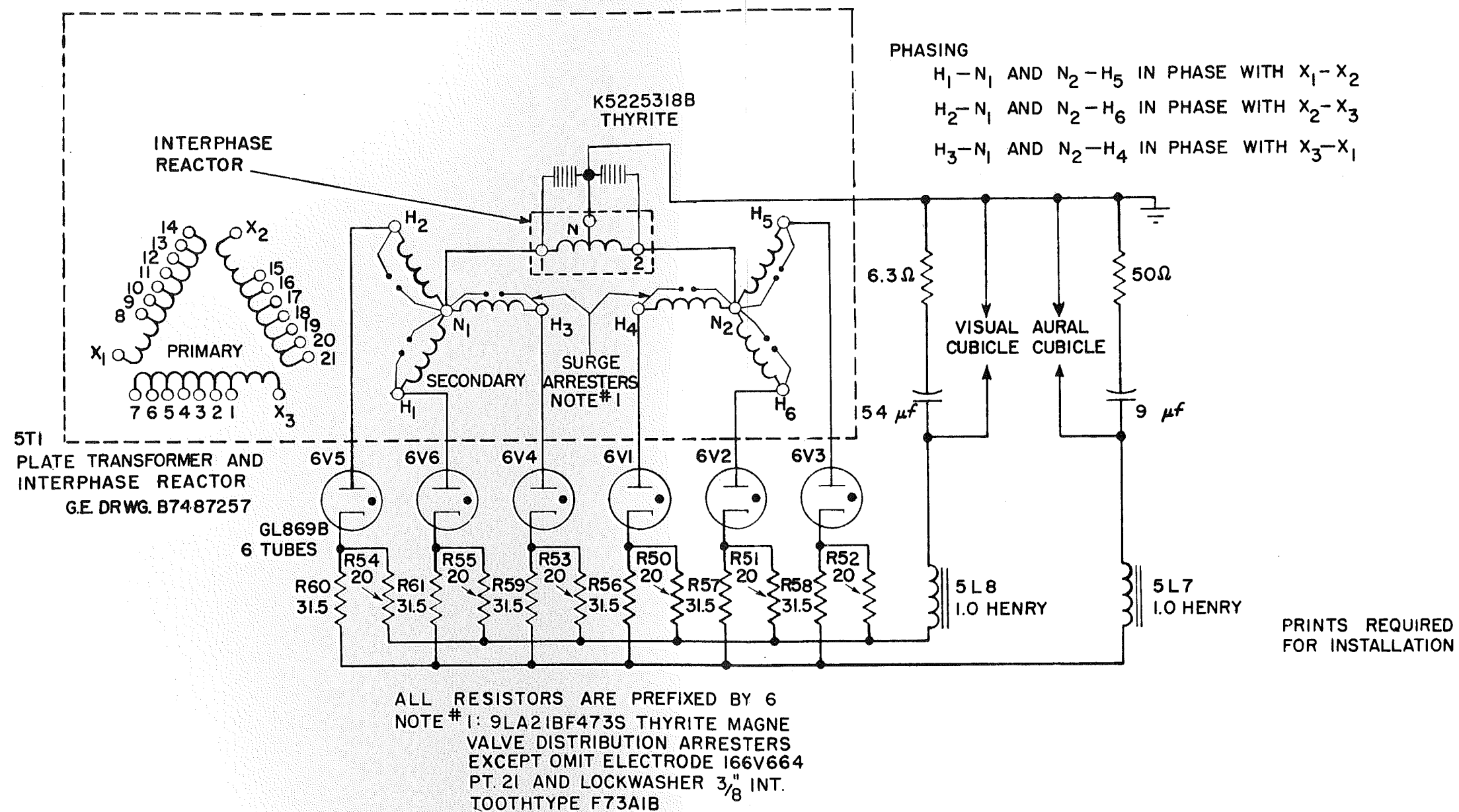


Fig. 74 Plate Transformer Connections Elementary Diagram

(B-7948271, Rev. 4)

Fig. 74
Elementary

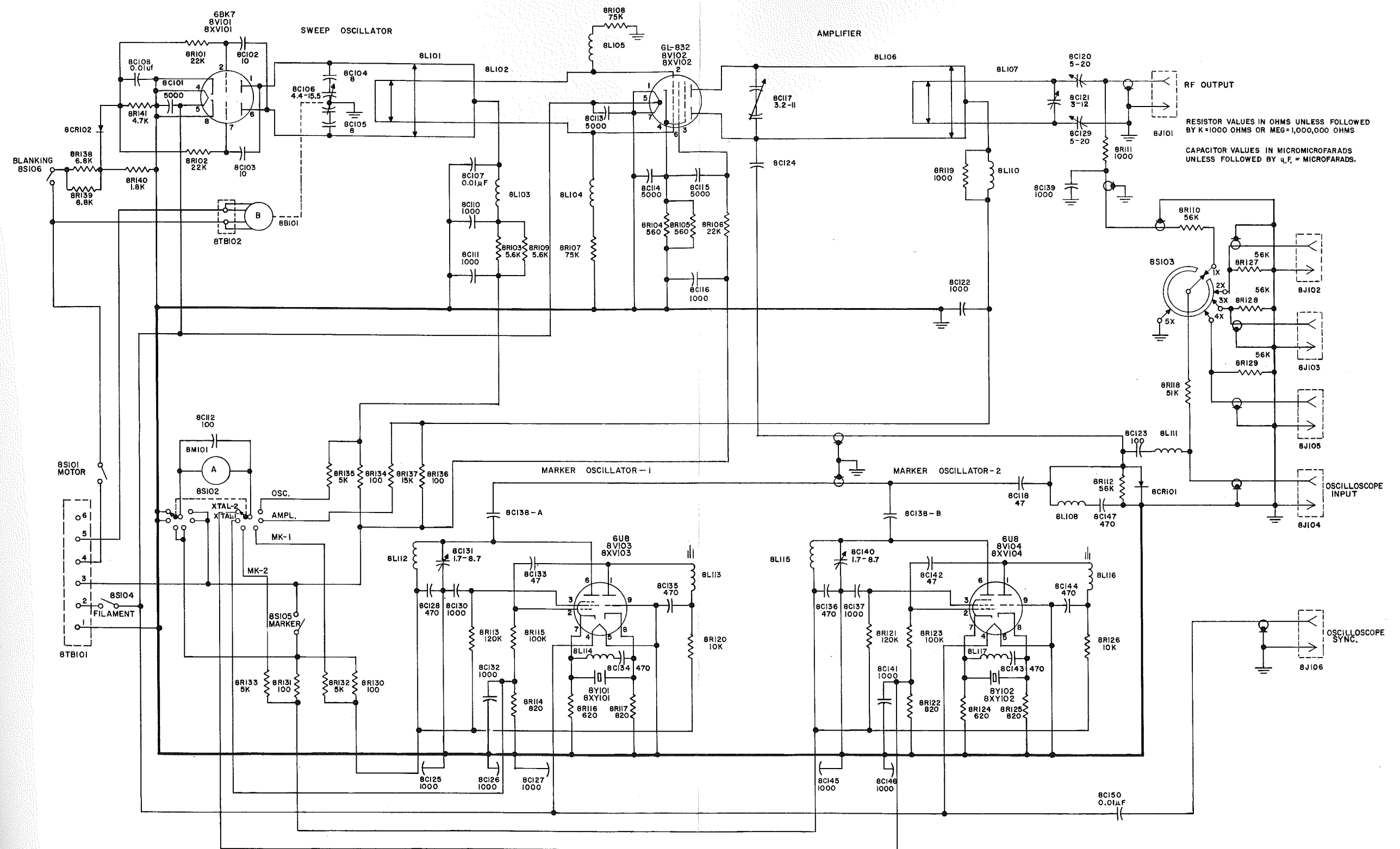
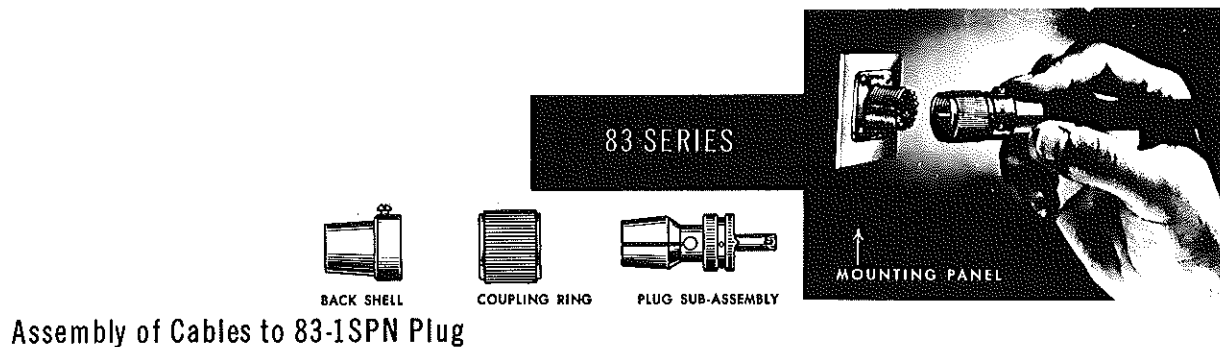


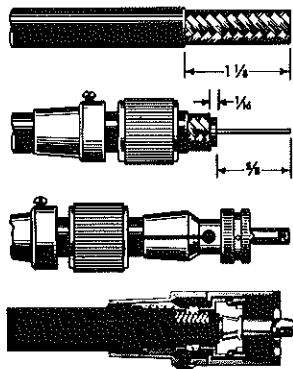
Fig. 75 Sweep Generator Elementary Diagram

(D-7667845, Rev. 3)

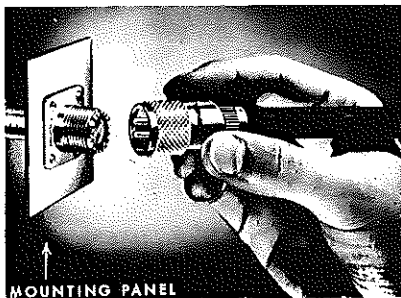
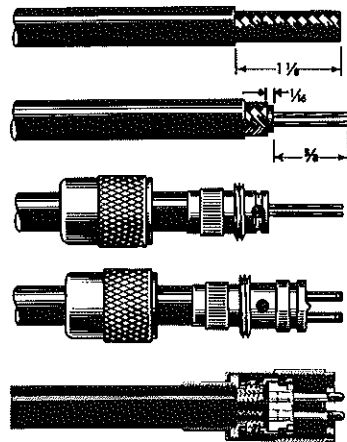
Fig. 75
Elementary



Assembly of Cables to 83-1SPN Plug



Assembly of Twinax Cables to 83-22SP Plug

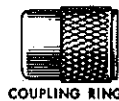


Cut end of cable even. Remove vinyl jacket $1\frac{1}{4}$ ".

Bare $\frac{5}{8}$ " of center conductor. Tin exposed conductor and braid. Slide back shell and coupling ring on cable.

Screw the plug sub-assembly on cable. Solder this assembly to braid through solder holes. Solder center conductor to contact. Do not use excessive heat.

For final assembly, slide coupling ring over plug sub-assembly, then position back shell with sufficient clearance to permit free rotation of coupling nut and tighten set screw.



COUPLING RING



BACK SHELL



FRONT SHELL

Cut end of cable even. Remove vinyl jacket $1\frac{1}{4}$ ".

Bare $\frac{5}{8}$ " of conductors. Tin exposed conductors and braid.

Slide coupling ring on cable. Screw back shell on cable. Solder hole should align with conductors as shown.

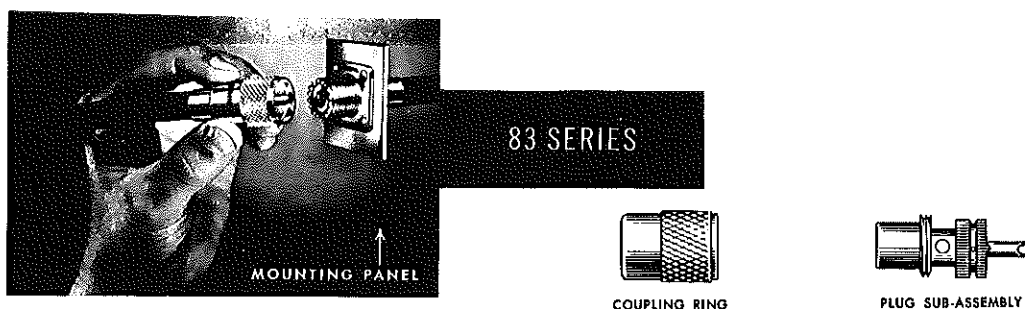
Assemble front shell to back shell. Solder holes in both front and back shells should align. Solder braid to shells through solder holes. Solder conductors to contacts. Do not use excessive heat.

(Plugs 83-2SP and 83-21SP are assembled as shown except remove vinyl jacket $1\frac{1}{4}$ ".)

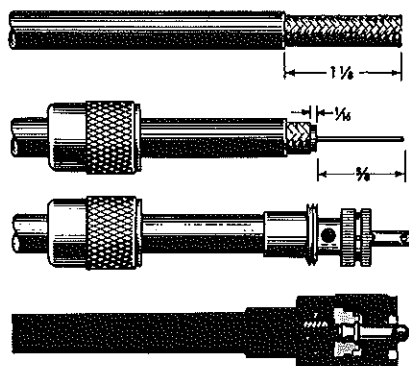
For final assembly screw coupling ring on back shell.

Fig. 76 Preparation of Cable and Assembly of "UHF" Set-Screw Type Connector, Amphenol 83-1-SPN (Courtesy of American Phenolic Corp.)

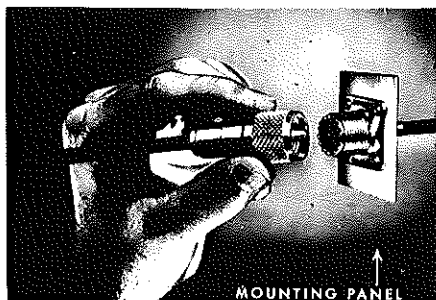
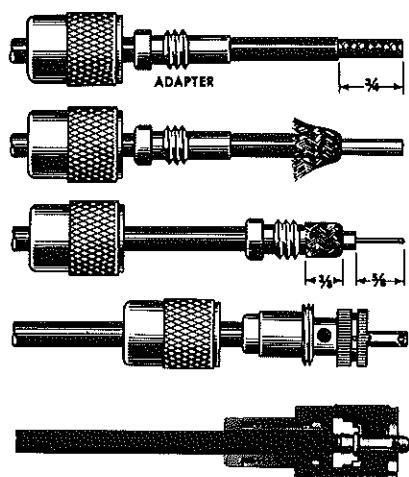
(3-3950)



Assembly of Cables to 83-1SP Plug



Assembly of Cables to 83-1SP Plug using Adapter 83-168 or 83-185



Cut end of cable even. Remove vinyl jacket $1\frac{1}{8}$ ".

Bare $\frac{5}{8}$ " of center conductor. Trim braided shield. Slide coupling ring on cable. Tin exposed center conductor and braid.

Screw the plug sub-assembly on cable. Solder assembly to braid through solder holes. Use enough heat to create bond of braid to shell. Solder center conductor to contact.

For final assembly, screw coupling ring on plug sub-assembly.

Cut end of cable even. Remove vinyl jacket $\frac{3}{4}$ ". Slide coupling ring and adapter on cable.

Fan braid slightly and fold back as shown.

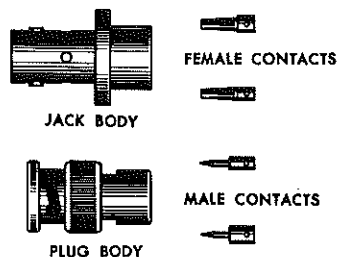
Position adapter to dimension shown. Press braid down over body of adapter and trim to $\frac{3}{8}$ ". Bare $\frac{5}{8}$ " of conductor. Tin exposed center conductor.

Screw plug sub-assembly on adapter. Solder braid to shell through solder holes. Use enough heat to create bond of braid to shell. Solder conductor to contact.

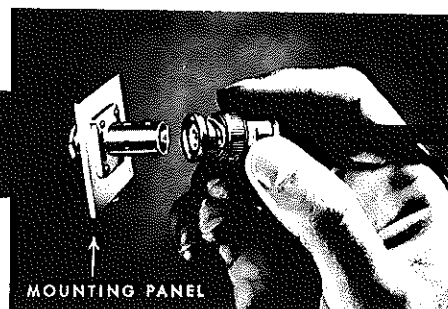
For final assembly, screw coupling ring on plug sub-assembly.

(3-3951)

Fig. 77 Preparation of Cable and Assembly of "UHF" Coupling Ring Type Connector, Amphenol 83-1-SP (Courtesy of American Phenolic Corp.)



TYPE BNC



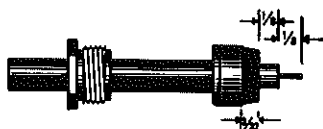
Trim jacket $\frac{1}{4}$ " for RG-58/U, $\frac{5}{16}$ " for RG-59/U or $\frac{1}{4}$ " for RG-71/U.



Fray shield and strip inner dielectric $\frac{1}{8}$ ". Tin center conductor.



Taper braid and slide nut, washer, gasket and clamp over braid. Clamp is inserted so that its inner shoulder fits squarely against end of cable jacket.



With clamp in place, comb out braid, fold back smooth as shown and trim $\frac{3}{32}$ " from end.



Slip contact in place, butt against dielectric and solder. Remove excess solder from outside of contact. Be sure cable dielectric is not heated excessively and swollen so as to prevent dielectric from entering into connector body.

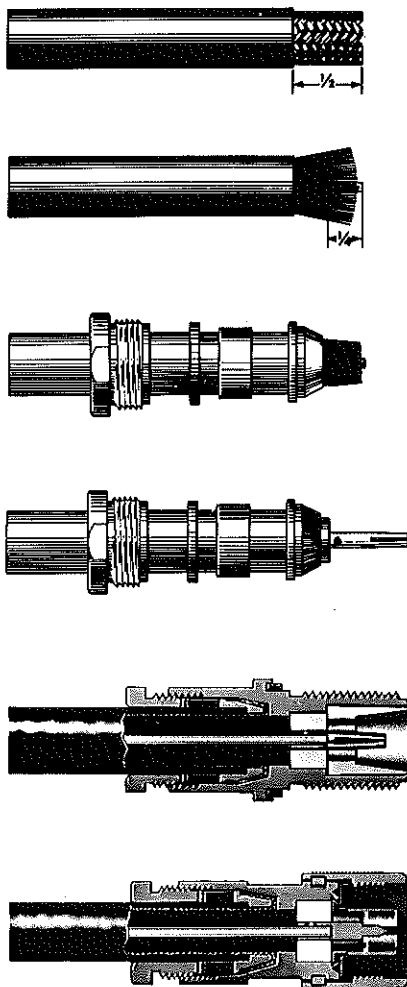
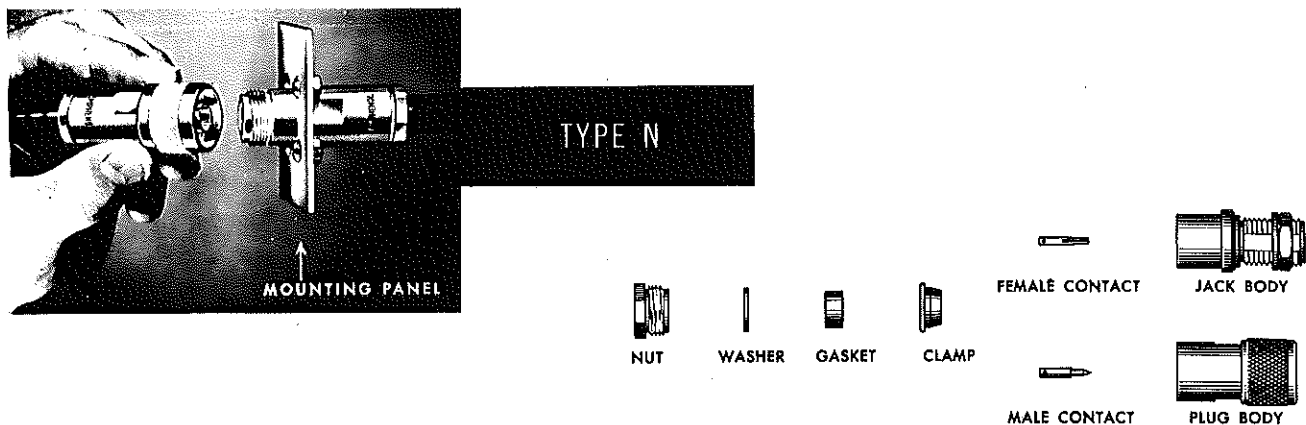


Push assembly into body as far as it will go. Slide nut into body and screw in place with wrench until tight. For this operation, hold cable and shell rigid and rotate nut.



Fig. 78 Preparation of Cable and Assembly of Type BNC Connector
(Courtesy of American Phenolic Corp.)

(3-3956)



Remove $\frac{1}{2}$ " of vinyl jacket. When using double shielded cable, remove $\frac{3}{16}$ " of vinyl jacket.

Comb out copper braid as shown. Cut off dielectric $\frac{1}{4}$ " from end. Tin center conductor.

Taper braid as shown. Slide nut, washer and gasket over vinyl jacket. Slide clamp over braid with internal shoulder of clamp flush against end of vinyl jacket.

Smooth braid back over clamp and trim. Soft solder contact to center conductor. Avoid use of excessive heat and solder. See that end of dielectric is clean. Contact must be flush against dielectric. Outside of contact must be free of solder.

Slide body into place carefully so that contact enters hole in insulator. Face of dielectric must be flush against insulator. Slide completed assembly into body by pushing nut. When nut is in place, tighten with wrenches until sufficiently tight.

(3-3954)

Fig. 79 Preparation of Cable and Assembly of Type N Connector
(Courtesy of American Phenolic Corp.)

INDEX

- Adapters, designation, 10
- Aural Amplifier (see Figs. 13, 14, 15)
 - description, 15
 - designation, cubicle, 9
 - detector (see sweep diode)
 - emergency starting, 66
 - filament transformer taps, 31
 - frequency, carrier, 1
 - general instructions, 40, 41
 - harmonic filter, 10, insert EBI-3310
 - initial operation, 32, 33, 35, 36
 - input circuit, 69, Figs. 57, 58
 - input impedance, 1
 - load impedance required, 1
 - meter readings, 40
 - neutralization, 32, 33
 - noise level, 9
 - outlet, convenience, 9, 10, 11
 - power amplifier, RF output, 1, 68, 69
 - driving power required, 1
 - reactor, designation, 9, Fig. 7
 - reflectometer, designation, 10, Fig. 4
 - routine operation, 40
 - simultaneous operation, 39, 40
 - specifications, electrical, 1, 9
 - sweep diode (detector), designation, 10, Fig. 5
 - sweep generator, 69, 70, 71, Fig. 59, 60
 - theory and circuit analysis, 54 thru 61
 - tube complement, 9
 - tube installation, 24, 26, 27, Figs. 30, 31, 32
- Cavity, construction, 48, Figs. 49 thru 55
- Circuit Breaker (5K1)
 - designation, 10, Fig. 6, inserts GEH-1807, GEH-3506
- Circuit Breaker (5S1), 5
 - designation, 10
- Connector, designation, 10
- Construction, 10
- Convenience outlets, 10, 11
- Cooling System — Air
 - blowers, installation, Fig. 4
 - blowers, alternate installation, Fig. 8
 - description, 15
- Cooling System — Water
 - designation, 10
 - flow vs. pressure, Fig. 33
 - flushing, 47
 - heat exchanger, designation, 9, Fig. 6, inserts Form 7674F, Form 7720E
 - installation, 23, 24, Figs. 28, 29
 - solvents in, 47
 - strainer, designation, 10, Fig. 6
 - tank, designation, 9, Fig. 6
 - water pump, Fig. 6
- Delta-Wye Switch, designation, 10, Fig. 5
- Drawings and symbols
 - description, 17
- Emergency starting, 66
- External equipment, 17
- Frequency, carrier, 1
- Installation, 17, 20, 23
 - external safety switch, 28
 - 50-cycle operation, 24
 - initial lubrication, 29
 - interlocks with driving transmitter, 27
 - location of equipment, 20
 - output tuning assembly, 23, Figs. 22, 23, 24, 25, 26
 - plumbing, 23, 24, Figs. 28, 29
 - remote meters, 28
 - suggested station layout, Fig. 21
 - terminal board location, Fig. 3
 - transmission-line elements, Fig. 27
 - tube installation, 24, 26, 27, Figs. 30, 31, 32
 - wiring, 23, Figs. 27, 61
- Line Stretcher, Input
 - Designation, 10, Fig. 4
- Lubrication, initial, 29
- Lubrication, routine, 45
- Maintenance, preventive, 42, 43, 45, 47, 48
- Meter readings, 40
- Operation
 - preparation for use, 29 thru 40
- Physical dimensions, 3
- Power requirements (a-c), 9
 - description, 17
- Protective gaps, 28, 29
- Quarter-Phasing, 33, 35, Figs. 38, 39, 40, 41
- Rectifier and Control, (see Figs. 16 thru 21)
 - description, 15
 - designation, cubicle, 9
 - high-voltage rectifier, 72
 - outlets, convenience, 10
 - switches, grounding, 21
 - theory and circuit analysis, 51, 52, 53, 54, 64, 65, 66, 67
 - tubes, 9, 24, 26, 27, Figs. 30, 31, 32
- Reflectometer, 4, 10, 40 (see Aural or Visual section)
- Replacement Parts, 48
- Resistor box, designation, 10, Fig. 5
- Routine Operation, 40
- Safety, ii
 - inspection, 41, 42
- Simultaneous operation, 39, 40
- Sweep Diodes, (see Aural or Visual section)
- Theory and Circuit Analysis, 51 thru 72
- Transformer, Plate, designation, 9, Figs. 7, 38, 74
- Tubes, 9, 24, 26, 27, Figs. 30, 31, 32
- Visual Amplifier (see Figs. 9, 10, 11, 12)
 - description, 12
 - designation, cubicle, 9
 - detector (see sweep diode)
 - emergency starting, 66
 - filament transformer taps, 31
 - frequency, carrier, 1
 - general instructions, 40, 41
 - harmonic filter

Visual Amplifier (Cont'd) (see Figs. 9, 10, 11, 12)

- designations, 10, insert EBI-3310
- initial operation, 37, 38, 39
- input circuit, 69, Figs. 57, 58
- input impedance, 1
- load impedance required, 1
- meter readings, 40
- neutralization, 32, 33
- noise level, 9
- outlet, convenience, 9, 10, 11
- power amplifier, RF output, 1, 68, 69
 - driving power required, 1
- reactor, designation, 9, Fig. 7
- reflectometer, designation, 10, Fig. 4
- routine operation, 40
- simultaneous operation, 39, 40
- specifications, electrical, 1, 9
- sweep diode (detector), designation, 10, Fig. 5
- sweep generator, 69, 70, 71, Figs. 59, 60
- theory and circuit analysis, 62, 63, 64, 67, 68
- tubes, 9, Figs. 30, 31, 32
 - installation 24, 26, 27
- vestigial sideband, insert EBI-3326
 - designations, 10
 - lower, 1
 - upper, 1

SUPPLEMENT A

Whenever possible, additions, corrections, or new information affecting the Type TF-5-A Television Amplifier will be added to existing books by reprinting the pertinent pages of EBI-3295. When this cannot be effectively accomplished, such information will from time to time be incorporated in supplements to EBI-3295, these supplements to be distributed for insertion in the instruction books. The present Supplement A includes the first of such additional material.

CORRECT LOADING OF THE VISUAL AMPLIFIER

Proper loading on the Visual Amplifier is important. In addition to the procedures outlined on pages 37 through 39, the following criteria must also be considered in determining correct loading on the Amplifier. These indications are to be observed even if the final sweep termination varies slightly from those shown in Figs. 45 through 48.

Refer to page 40 for typical meter readings.

If there is insufficient loading (coupling too light),

1. Plate current will be low for full power output.
2. Sync compression between the driver and the Amplifier output will be in excess of the allowable 7 to 8 percent.
3. Grid current may run higher than normal.
4. The driver power output required for full power output from the Amplifier will be low.
5. Screen currents will run high.

The cure for this condition is to increase the coupling. See page 37, paragraph 8 (d), for the procedure.

If the Amplifier is too heavily loaded (too much coupling),

1. Plate current will be excessive for full power output.
2. Grid current will be higher than normal because of the excessive driving power required.
3. Sync compression between the driver output and the Amplifier output will be less than the allowable 7 to 8 percent normal.
4. Screen current will be lower than normal.
5. The driver power required will be high.

The cure for this condition is to decrease the coupling. See page 37, paragraph 8 (d), for the correct procedure.

In general, operating this Amplifier too lightly loaded, in addition to causing sync compression, will cause the peak voltage between screen and anode to rise toward an unsafe value. This may cause excessive dielectric heating of the plate screen ceramic and thereby adversely affect tube life.

Too heavy loading may shorten tube life because of the higher plate currents drawn by the Amplifier tubes and the resulting loss of plate efficiency.

INTERLOCKS WITH THE GENERAL ELECTRIC 10-KW HIGH-CHANNEL TELEVISION TRANSMITTER, TYPE TT-32-B

The necessary interlocking between the Type TF-5-A Amplifier and the Type TT-32-B Transmitter used as a driver is as follows (all wires should be 16-gauge, 600 volts d-c):

DISCONNECT the wire in the intercubicle interconnection cable going from 2TB8-3 to 1TB8-3 in the Type TT-32-B Transmitter.

CONNECT 2TB8-3 to 8TB7-5
1TB8-3 to 8TB7-6.

(Removes plate voltage from the Visual Exciter of the TT-32-B when the Visual Amplifier is in the SWEEP position.)

REMOVE the jumper between 2TB1-13 and 2TB1-12 in the Rectifier and Control cubicle of the TT-32-B.

CONNECT 7TB2-9 to 2TB1-12
5K1-7 to 2TB1-13.

(Removes plate and screen voltage from the PA, IPA, and Modulated Stage of the TT-32-B when plate voltage is not on the Visual Amplifier.)

REMOVE the jumper between 2TB1-14 and 2TB1-15.

CONNECT 5K1-9 to 2TB1-14
7TB2-7 to 2TB1-15.

(Removes plate and screen voltages from the Aural PA and 2nd IPA of the TT-32-B when plate voltage is not on the Aural Amplifier of the TF-5-A.)

CONNECT 7TB1-5 to 8TB7-9
7TB1-6 to 8TB7-10
7TB1-5 to 2TB10-9
7TB1-6 to 2TB10-10.

(Turns off the plate voltage on the Aural section of the TT-32-B when

the Visual or Aural Amplifier of the TF-5-A is in the SWEEP position.)

CONNECT 7TB1-3 to 2TB1-7
7TB1-2 to 2TB1-6

(Turns off the plate voltage on the Visual section of the TT-32-B when the Aural Amplifier of the TF-5-A is in the SWEEP position.)

WATER SYSTEM

Care should be taken to prevent a restriction in the outlet water line from the Amplifiers. The water jackets on the GL-6251 tubes are rated for 80 pounds of pressure, and this rating could be exceeded if sufficient restriction is present in the water outlet line. If the plumbing is installed according to Figs. 28 and 29, no appreciable restriction will be present. Also see Fig. 21, Note 3, for recommended sizes of pipe.

CARE OF PAINTED SURFACES

The outside surfaces of this equipment have been carefully finished in lacquer. Minor scratches may be touched up by using a brush and the paint sup-

plied. Major scratches and gouges, however, require the use of special equipment for the correct application of paint. This special equipment and the personnel familiar with its operation are usually available at an auto body repair shop.

The "furniture finish" outside lacquer on this equipment may be preserved and polished with any good lacquer polish. Care should be taken not to use a combination "cleaner-polish" containing an abrasive. This type of cleaner may remove the markings from the panel.

The decorative trim used is brushed stainless steel, which may be cleaned with a chromium cleaner such as that used on automobiles.

An acid type chrome cleaner should not be used.

INSTALLATION OF 5T1, 5L7, 5L8

The main plate transformer 5T1 and the Aural and Visual filter reactors 5L7 and 5L8 are air cooled, dry-type units. Care must be taken when locating them to allow for free convection of air through the unit. The room should be dry and well ventilated. Do not install these units against a wall which would obstruct the cooling louvers in the cases.

SUPPLEMENT B

GL-6251 FILAMENT LIFE

It is extremely important to accurately maintain correct filament voltage on thoriated tungsten filament tubes such as the GL-6251 if maximum filament life is to be obtained.

It has been common knowledge in the past that the filament life of pure tungsten filament tubes is a function of the evaporation rate of tungsten and, therefore, of the filament temperature. Since bright tungsten filaments may be operated at complete emission saturation without damage, increased filament life can be obtained by reducing filament voltage to the point where just exactly enough emission is obtained for proper circuit operation.

A similar relation between filament life and filament voltage is now known to hold for thoriated-tungsten filament tubes provided that the filament is never operated at or near emission saturation. Unlike pure tungsten filament tubes, the temperature of thoriated-tungsten filaments is such that tungsten evaporation is negligible. The source of emission is a thin layer of thorium on the filament surface. During operation the thorium in this layer is constantly being removed by evaporation and is constantly being replenished from within the wire by a thoria reduction process. The rate of thoria reduction depends upon the filament temperature and, therefore, upon the filament voltage. Longest filament life will be obtained when the supply of thorium provided by the thoria reduction process just equals the loss by evaporation from the filament surface. In order to maintain the balance between the loss and the replacement of an active layer of thorium, therefore, operation within a comparatively narrow range of temperature is required.

The filament voltage corresponding to this temperature can best be determined for a specific application by the tube designer. Unusually short filament life may result from the operation of thoriated filaments much below or much above this value.

Recent tests have been made which show that the filament voltage of the GL-6251 tubes as applied in the Type TF-5-A 50-KW High-Channel Television Amplifier should be held as closely as possible to 5.25 volts for maximum filament life. It should be noted that this is approximately 5% lower than the nominal 5.5 volts indicated in the tube specification. This voltage must be maintained as accurately as possible, preferably within $\pm 1\%$. In order to be sure that this is done, the following steps should be taken:

1. The GL-6251 filament voltmeters in the Visual

and Aural Amplifiers should be accurately checked with a standard meter, such as a calibrated G-E Type DP-3AC Voltmeter or its equivalent, after installation of the TF-5-A Amplifier. The filament voltmeters supplied in the TF-5-A have an initial accuracy of $\pm 2\%$. When calibrated, however, the zero can be offset slightly to provide much better accuracy at normal operating voltage.

2. When checking meter accuracy, the actual tube filament voltage should be measured by using long, insulated test leads for the standard voltmeter inserted through the circuit cavity walls via the filament clamp holes to actually measure the voltage at the filament clamps. The voltage at this point should normally be only about 0.05 volt less than the filament line voltage at the bypass points on top of the circuit where the Transmitter voltmeters are connected.

3. With the REGULATED LINE VOLTAGE adjusted for 230 volts, choose the filament transformer taps as described on page 31 to give the nearest possible voltage on each tube to 5.25 volts. If the nearest tap gives a filament voltage less than 5.2 volts, choose the tap for the next higher voltage.

4. Maintain the REGULATED LINE VOLTAGE as nearly as possible to 230 volts during normal operation. This should be checked by the operator and adjusted, if necessary, at regular intervals.

5. As tubes age, if there is evidence of decreasing emission, the operation may be improved by increasing the filament voltage slightly. In no event, however, should the voltage be increased to a value greater than 5.5 volts.

REDUCTION OF GL-6251 SCREEN DISSIPATION

Life experience with GL-6251 tubes indicates that the possibility of internal grid shorts can be reduced by operation that reduces the screen dissipation to a minimum. Although a value of 700 volts is shown under TYPICAL METER READINGS on page 40 for both Visual and Aural screen voltages, it has been found that power can be maintained at a value considerably less than this. In many instances the Aural screen voltage may be as low as 500 volts, resulting in a very substantial reduction of screen dissipation, since the screen current is usually also somewhat reduced. It is therefore recommended that the screen voltage be reduced as much as possible, particularly that of the Aural Amplifier, consistent with maintenance of the required output power.

When the resistance of the screen supply bleeder

resistors, 7R18 and 8R58, is not low enough, the screen rectifiers may tend to cut off, so that the negative screen current of some GL-6251 tubes supplies the screen voltage. Since 7R18 and 8R58 are tapped resistors, their resistance can be reduced merely by use of a jumper wire to short out sufficient sections of the resistor. However, in order not to exceed dissipation on the resistor, do not exceed the following voltages:

<u>Maximum Screen Supply Voltage (DC)</u>	<u>Sections of Resistor in Use</u>
850 v	10 (all)
765 v	9 (1 shorted out)
680 v	8 (2 shorted out)
595 v	7 (3 shorted out)
510 v	6 (4 shorted out)

A means is also provided to balance the GL-6251 screen currents in the Aural Amplifier in order to

avoid excessive screen dissipation in the event of appreciable unbalance. It will be noted that adjustment of the SCREEN BALANCE potentiometer, 7R47, changes the series screen resistance between the tubes and, therefore, adjusts the screen voltage for best current balance. Adjustment of the screen balance may affect the cathode balance to some extent. Adjust each of them until the best compromise is made between cathode and screen current balances.

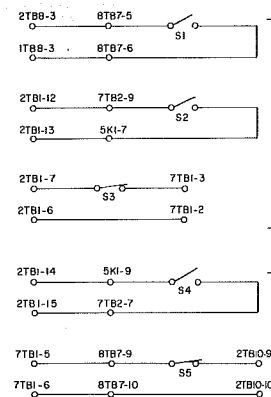
TYPE TT-36-A TRANSMITTER INTERCONNECTION WITH TYPE TC-46-A CONSOLE

For interconnection of the Type TT-36-A Transmitter, which consists of the Type TF-5-A Amplifier and the Type TT-32-B 10-KW Transmitter used as the driver, with the Type TC-46-A Television Transmitter Control Console, refer to Fig. 81 following this Supplement.

AURAL CUBICLE (AMPLIFIER)

AURAL CUBICLE (DRIVER)

INTERLOCK DISABLING SWITCHES
IF REQUIRED (TO BE SUPPLIED BY CUSTOMER)

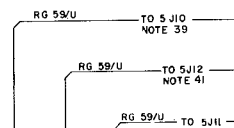
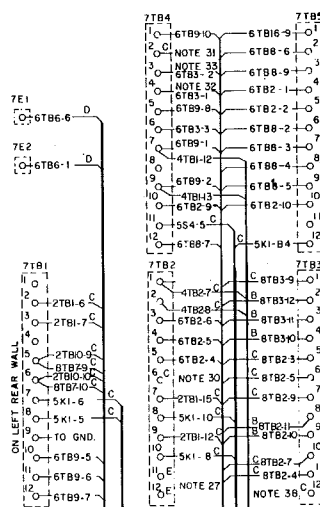


SEE EBI-3295 P121
FOR DESCRIPTION OF INTERLOCKS

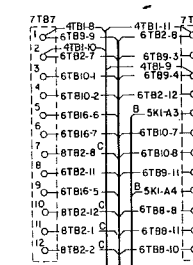
VISUAL
DRIVER
INTERLOCK

AURAL
DRIVER
INTERLOCK

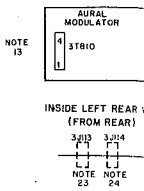
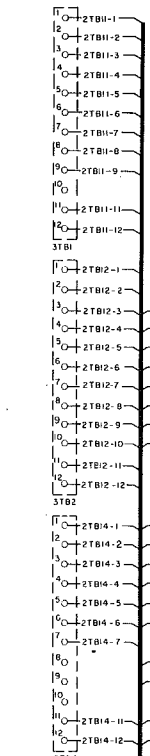
LEFT WALL (FROM REAR)



RIGHT WALL (FROM REAR)

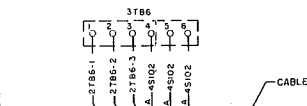
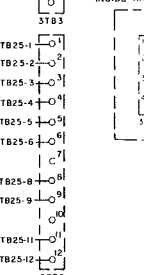


LEFT WALL (FROM REAR)



INSIDE LEFT REAR W.
(FROM REAR)

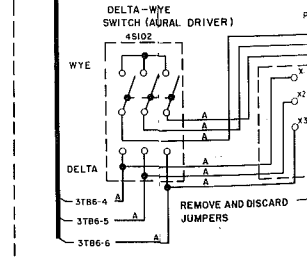
RIGHT WALL (FROM REAR)



REMOVE AND DISCARD
JUMPERS

AUDIO-VIDEO CONTROL PANEL
PART OF 4TC46A

TRANSMITTER POWER CONTROL PANEL
PART OF 4TC46A



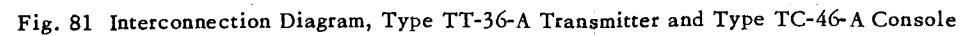


Fig. 81
interconnections

INSTRUCTIONS

HARMONIC FILTER

MODEL 4PY25F1

EBI-3310A

ELECTRONICS DIVISION

GENERAL  ELECTRIC

ELECTRONICS PARK, SYRACUSE, N. Y.

CONTENTS

	Page
Introduction.	1
Technical Summary	1
Installation.	2
Operating Notes.	2
Theory.	2

ILLUSTRATIONS

Fig. 1 Harmonic Filter, Model 4PY25F1 (4-5774)	1
Fig. 2 Outline Drawing (A-7143976)	1
Fig. 3 Internal Arrangement of Filter Sections (A-7991291, Sheet 2)	2
Fig. 4 Equivalent Electrical Circuit (A-7991291, Sheet 2)	2

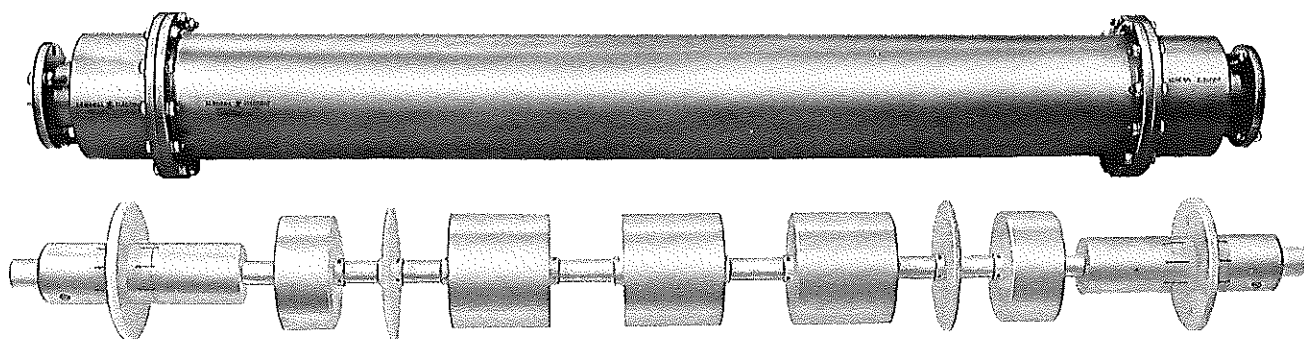


Fig. 1 Harmonic Filter, Model 4PY25F1

(4-5774)

INTRODUCTION

The General Electric Harmonic Filter (Fig. 1), Model 4PY25F1 (comprising a 4PY31C1 Filter and 4PY30B1 Adapter), is designed for use with a VHF 50-kilowatt high-channel system (channels 7 through

13) to provide a high order of harmonic attenuation with negligible attenuation in the television channel. The Filter simply replaces a corresponding length of transmission line and requires no adjustments.

TECHNICAL SUMMARY

ELECTRICAL

POWER

The Filter is designed for use with television transmitters having a power output up to and including 50 kilowatts (peak) when operating into a transmission line having a standing wave ratio no greater than 1.10. The Model 4PY25F1 Filter has an average power rating of 30 kilowatts.

FREQUENCY

The Model 4PY25F1 Filter is fixed-tuned for any channel in the range of 174 to 216 megacycles (channels 7 through 13).

ATTENUATION

Harmonic attenuation is in excess of 60 db up to and including the fifth harmonic. There are no spurious pass bands in this range. Attenuation in the pass band is negligible.

INPUT AND OUTPUT IMPEDANCE

50.0 ohms nominal, 6-1/8 inch line reduced by Model 4PY30B1 Adapter (supplied) from 6-1/8 inch to 3-1/8 inch, 50.0 ohm line.

STANDING WAVE RATIO

The VSWR is under 1.07 over the specified channel. Note that the VSWR will not exceed 1.15 for the balance of the channels in the range of channels 7 through 13.

PHYSICAL DIMENSIONS

The length of the Filter from flange to flange (adapters included) is 60 inches. Refer to Fig. 2.

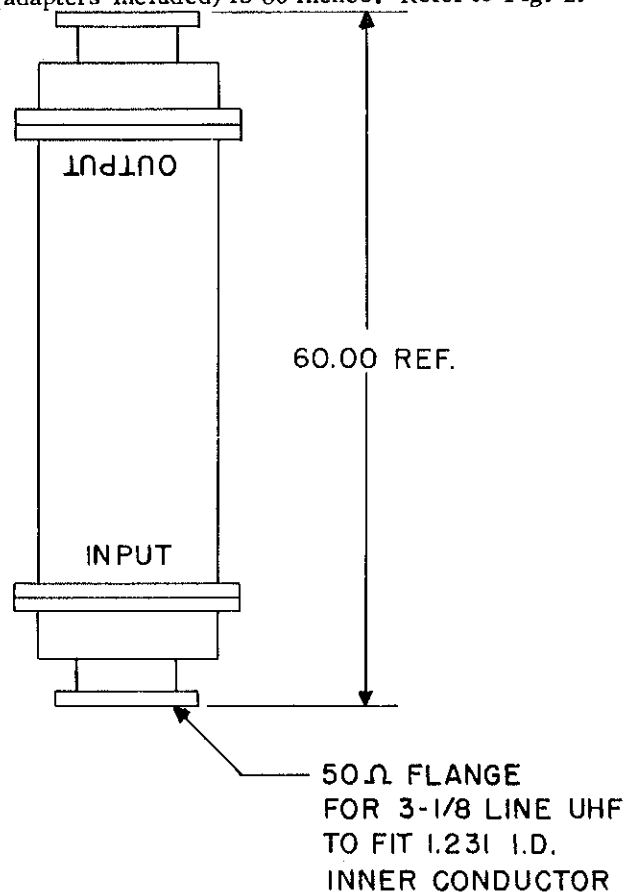


Fig. 2 Outline Drawing

(A-7143976)

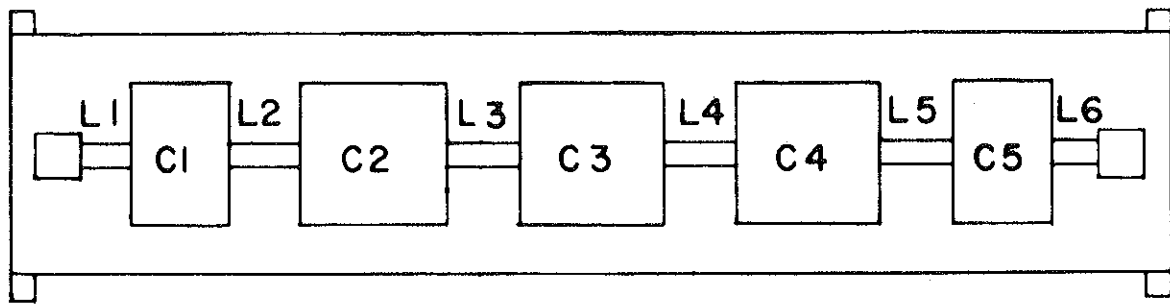


Fig. 3 Internal Arrangement of Filter Sections

(A-7991291, Sheet 2)

INSTALLATION

The Model 4PY25F1 Filter is designed to be inserted in a standard 3-1/8 inch, 50.0-ohm transmission line (using adapters supplied) between the transmitter and the antenna. If used beyond the diplexer, one unit is required for each transmission line and should be located as close to the diplexer as possible. If used between the transmitter and the diplexer, one unit each is required in the visual and

aural lines. UHF flange-type connectors with UHF bullet connectors and "O" rings are provided. The Filter is air tight but will pass air as required in a pressurized system.

To install the unit, simply replace a section of transmission line with the Filter and make connections in the standard manner. In the installation observe the INPUT and OUTPUT markings on the Filter.

OPERATING NOTES

The temperature rise of the Filter is slightly greater than that of the standard transmission line. Forced air cooling is not required.

No adjustments of the Filter are required in the field. Replacement of the unit is made in terms of the whole assembly.

THEORY

The Filter consists of a series of constant-K type mid-sections with a constant-K half-section at the input and the output to provide an impedance match to the 50-ohm transmission line. The constant-K sections have been designed according to conventional filter theory and assembled as shown in Fig. 3; the equivalent electrical circuit is shown in Fig. 4. The mid-sections have a cutoff frequency of 220 megacycles, while the half-sections are designed with a slightly higher cutoff frequency to provide a good impedance match over the range of 174 to 216 megacycles.

The L and C circuit elements are made up of lengths of coaxial transmission line. A section of low Z_0 line is used for C, while a section of high Z_0 line is used for L, as illustrated by Fig. 3.

The Filter has a VSWR under 1.15 for the frequency range of 174 to 216 megacycles. During test of the unit, the positions of the C sections are adjusted slightly to obtain a VSWR under 1.07 for a specified customer's channel. The Filter will still operate over the entire range of channels 7 through 13 but will give best performance on the specified channel.

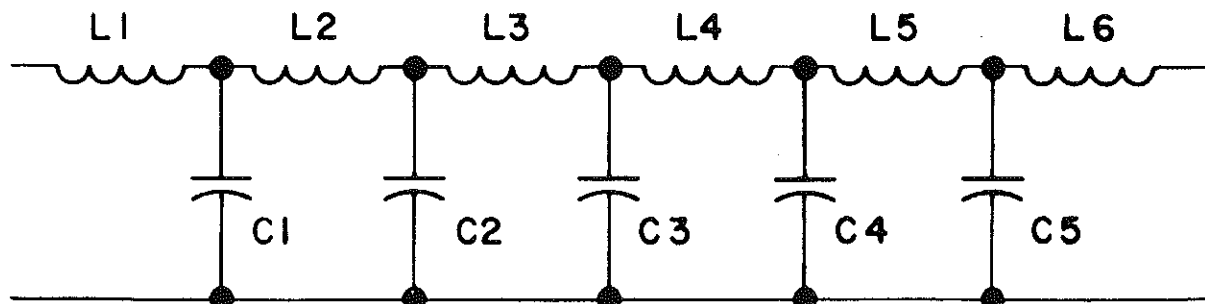


Fig. 4 Equivalent Electrical Circuit

(A-7991291, Sheet 2)

INSTRUCTIONS

VESTIGIAL-SIDEBAND FILTER

PL - 7776403-G1, -G2

EBI—3389

ELECTRONICS DIVISION

GENERAL  ELECTRIC

ELECTRONICS PARK, SYRACUSE, N. Y.

CONTENTS

	Page
Introduction	1
Technical Summary	1
Installation	2
Operation	3
Theory	3

ILLUSTRATIONS

Fig. 1 Vestigial-Sideband Filter, PL-7776403-G1 (6-1495) .	1
Fig. 2 Vestigial-Sideband Filter, PL-7776403-G2 (6-1494) .	2
Fig. 3 Top View of Mounting Foot (A-7991275)	3
Fig. 4 Dimensional View of Flow Regulator with	
Strainer (A-7991275)	3
Fig. 5 Diagram of Basic VSB Filter Circuit	
(A-7991275)	4

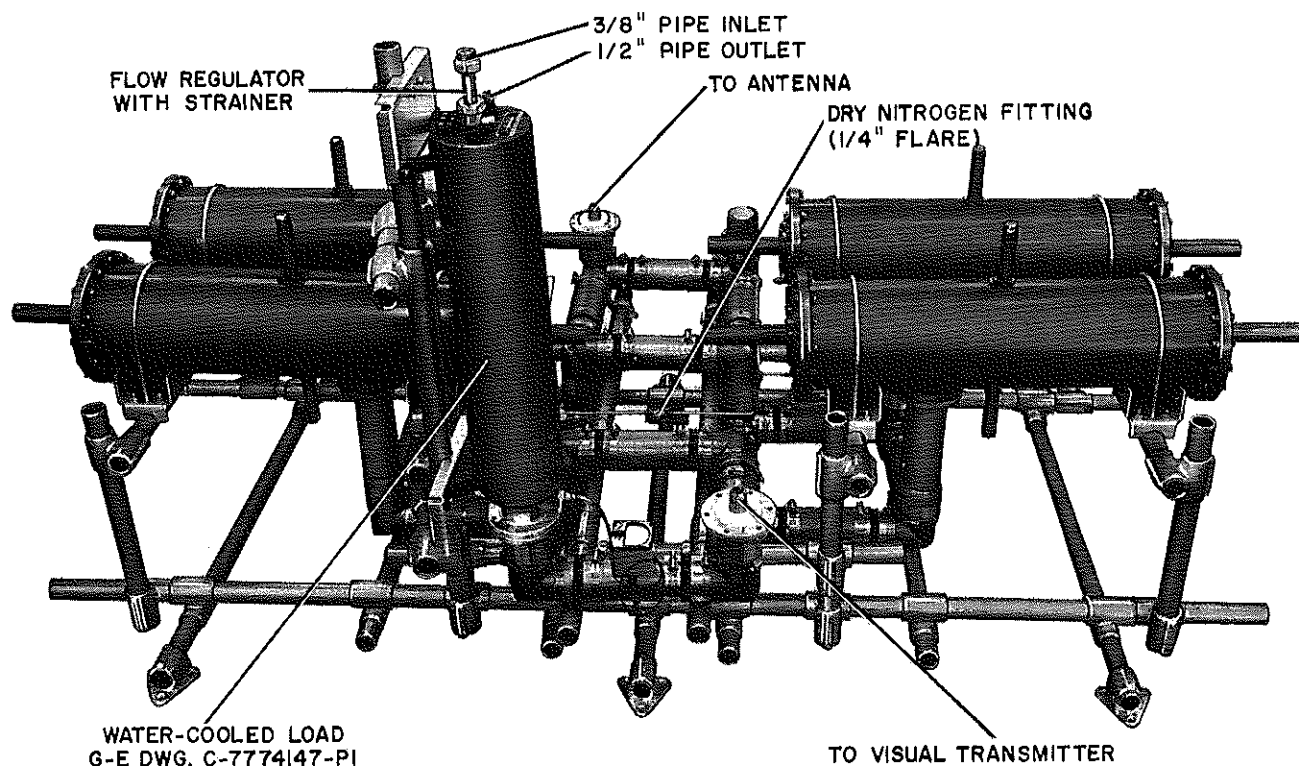


Fig. 1 Vestigial-Sideband Filter, PL-7776403-G1 (6-1495)

INTRODUCTION

The General Electric Vestigial-Sideband Filter (Figs. 1 and 2), PL-7776403-G1, -G2, is a constant-impedance device designed to add to the response characteristic of a television transmitter operating in the range of channels 7 through 13 a sufficient additional attenuation such that the over-all characteristic will comply with the FCC specification for lower-sideband attenuation.

The Vestigial-Sideband Filter identified as PL-7776403-G1 (Fig. 1) is used with and supplied as part of the General Electric 50-KW High-Channel Television Amplifier, Model 4TF5A2. The Filter identified as PL-7776403-G2 (Fig. 2) is used with and supplied as part of the General Electric 10-KW High-Channel Television Transmitter, Model 4TT32B3.

TECHNICAL SUMMARY

Electrical

Power Rating: The Group 1 Filter is designed to accept 50 kilowatts (peak) of visual power; the Group 2, 20 kilowatts.

VSWR: The input VSWR is 1.1 or under at the visual carrier and the visual pass band.

RF Connections: The input and output are 3-1/8 inch, 50-ohm coaxial transmission line.

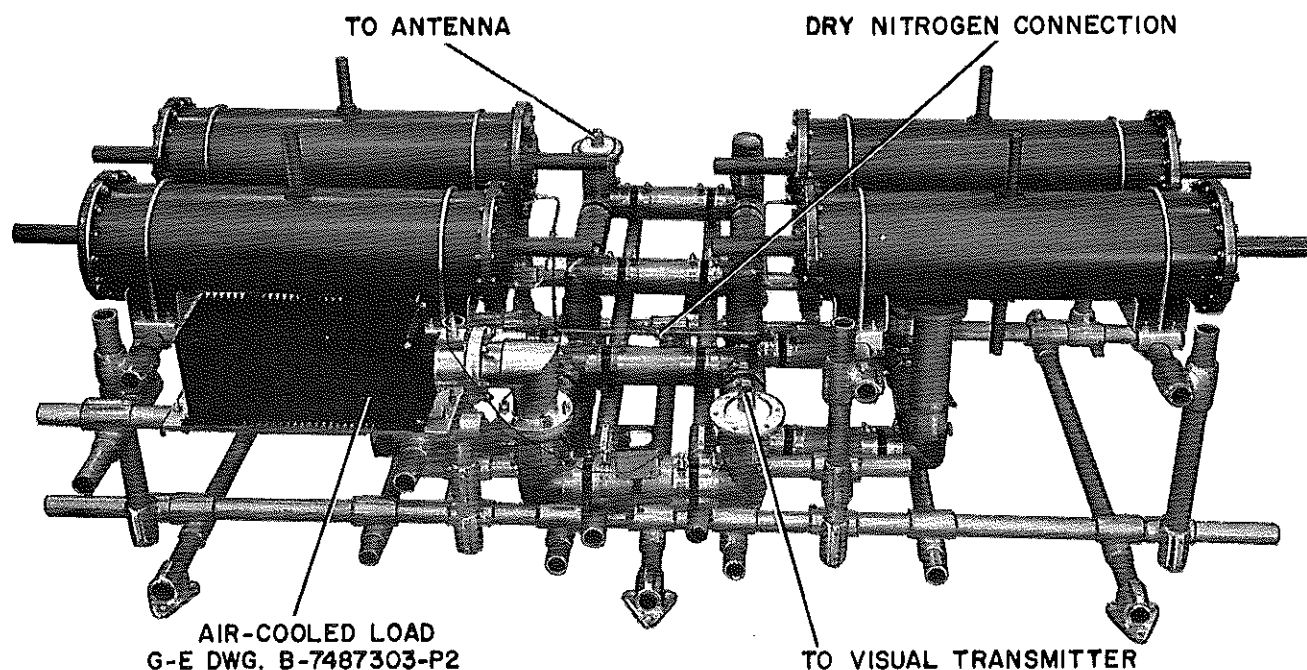


Fig. 2 Vestigial-Sideband Filter, PL-7776403-G2 (6-1494)

Lower Sideband Attenuation: The unit is designed to complement the transmitter response so that the over-all system response will meet FCC and RETMA specifications.

Insertion Loss: The insertion loss at the visual carrier frequency is in the order of 0.2 db. Of this loss, about 0.1 db is mismatch loss and corresponds to the VSWR of 1.1. The remaining loss results from loss in the cavities.

Mechanical

The Vestigial-Sideband Filter is manufactured for operation on a specified channel in the VHF high-channel range of 174 to 216 megacycles.

Pressurization: The filter is so designed that the cavities only may be pressurized. It is recommended that dry nitrogen at about one pound per square inch be maintained in the cavities.

Dimensions:

Over-all Length:	112 inches maximum, plus 12 inches for removing cavity caps
Width:	54 inches maximum
Height:	60 inches maximum for Group 1 Filter 36 inches maximum for Group 2 Filter
Weight:	Approximately 1000 pounds

INSTALLATION

The VSB Filter is designed for floor or platform mounting. The final mounting of the Filter at the installation should not be designed until the delivery of the unit, since all dimensions are subject to change in final assembly and test.

When the Filter is received, it should be examined for any damage which may have occurred during shipment.

Install the Filter close to the transmitter and preceding the diplexer. It is recommended that a harmonic filter (the G-E Model 4PY25F1 Harmonic Filter for the G-E 50-KW Amplifier, Model 4TF5A2, and the G-E Model 4PY1F1 Harmonic Filter for the G-E 10-KW Transmitter, Model 4TT32B3) be installed between the transmitter and the VSB Filter. Adequate clearance should be allowed for ac-

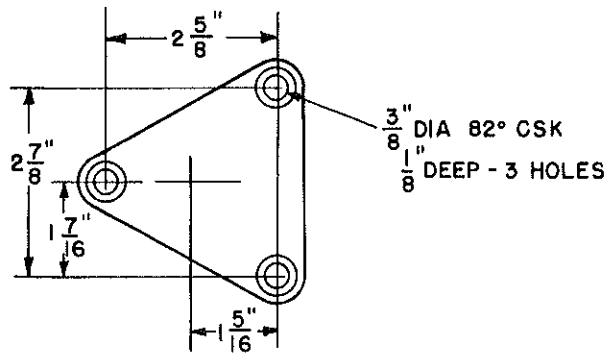


Fig. 3 Top View of Mounting Foot
(A-7991275)

cess to the tuning adjustments. It is desirable to arrange the plumbing to the input and output terminals in such a way that the 3-1/8 inch coaxial lines may be disconnected and test equipment connected in their place. Fig. 3 shows the dimensions of the mounting foot used for the supporting frame of the Filter.

The loads supplied with the Filter may be removed to some other point in the installation as long as they remain in the proper orientation. The water-cooled load supplied with the Group 1 Filter (water flow of one

gallon per minute) must be mounted in a vertical position with the water connections on top. The fins of the air-cooled load supplied with the Group 2 Filter must be in a vertical plane. Fig. 4 is a dimensional view of the flow regulator with strainer used with the water-cooled load (see Fig. 1).

If wall or ceiling mounting of the Filter is desired, it is recommended that the unit be mounted in a horizontal position on a pair of supporting members hung from the ceiling.

Care should be taken to see that the unit is adequately ventilated.

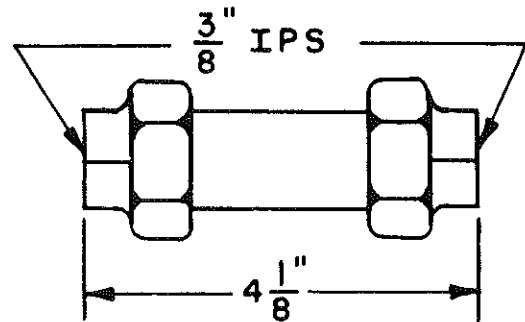


Fig. 4 Dimensional View of Flow Regulator
with Strainer (A-7991275)

OPERATION

The VSB Filter is adjusted at the factory for the customer's allocated channel of operation. After it has been installed and connections made, the Filter tuning should be checked by a field engineer from the General Electric Company before power is applied. Should retuning of the Filter become necessary, it should be done only by a General Electric field representative who has the nec-

essary training and equipment to make the adjustments.

The Filter should not be pressurized with nitrogen in excess of 10 pounds per square inch. The dry nitrogen connection is a 1/4-inch flare fitting; it is recommended that the tubing connected to this point be 1/4-inch copper. A pressure relief valve set at 15 pounds per square inch is supplied.

THEORY

The Vestigial-Sideband Filter is a constant-impedance device designed to add sufficient attenuation to the transmitter reference characteristic so that the over-all characteristic will meet the FCC specification for lower-sideband attenuation.

The band reject characteristic is obtained by the use of two filters, each tuned in an identical fashion and connected in parallel by the use of two hybrid rings. Refer to Fig. 5.

Power incident at the visual input at the pass frequencies, that is, the visual passband, divides equally between the two lines containing the filters and enters the output ring. In the output ring this power re-combines and leaves at the antenna terminal. The fourth terminal of the output ring is isolated by about 30 to 40 db and is merely capped. Any power reflected from the antenna retraces the same path and returns to the transmitter. This

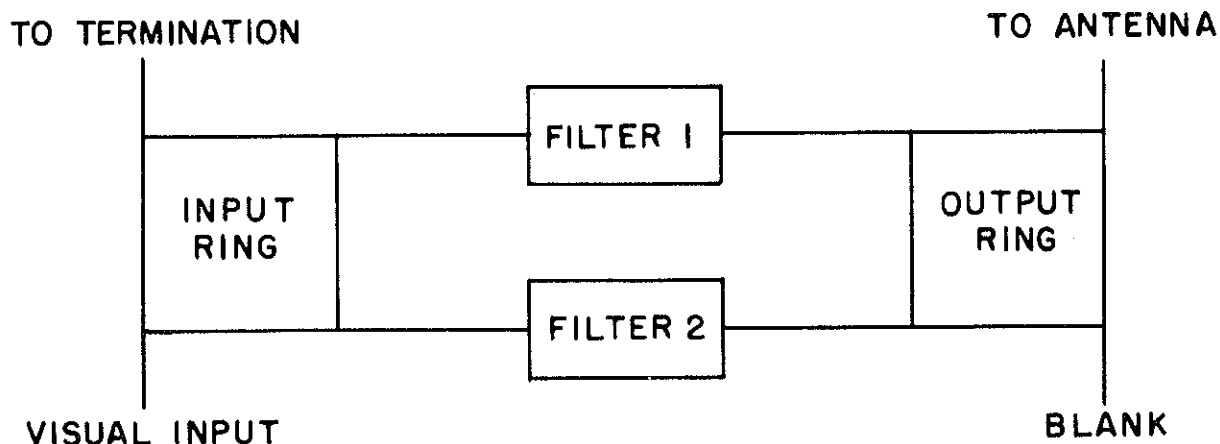


Fig. 5 Diagram of Basic VSB Filter Circuit (A-7991275)

may result in a ghost, but the trouble is caused by antenna mismatch and cannot be corrected by the Filter.

Power incident at the visual input at the reject frequencies, that is, the vestigial sideband, divides equally between the two lines containing the filters and is reflected by the filters to the input ring. This power re-combines in the input ring and leaves at the terminal that is terminated and is dissipated in the termination. Since all power entering the visual input is accepted and passed either to the antenna terminal or to the termination, the device is said to be a constant-impedance device. Note that power in the pass band that is reflected by the filters because of the mismatch of the Filter itself is also dissipated in the termination.

The termination of the Group 1 Filter is a water-cooled wattmeter rated at 6 kilowatts continuous. The termination of the Group 2 Filter is an air-cooled wattmeter rated at 600

watts continuous. The manufacturer's specification for VSWR is 1.1 maximum. Any power reflected from this termination will retrace the same path and appear at the visual input terminal and will be reflected through the Filter back again to the termination.

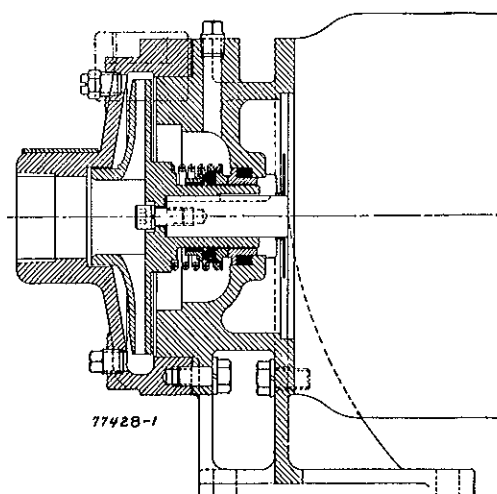
The individual filter consists of two cavities and a hybrid ring. Each cavity is a double-tuned cavity. The response of one cavity is added in quadrature to that of the other double-tuned cavity so that the reactance slopes compensate on the high-frequency side to give the desired cutoff from -0.75 mc to -1.25 mc and to provide an impedance match at the visual frequency. The coupling of the cavities to the hybrid ring is loose enough to keep the conductance at the visual frequency small. This is required in order to prevent excessive insertion loss at the visual frequency; the coupling, however, is sufficiently tight to provide the required attenuation in the reject band.

INSTALLATION and OPERATING INSTRUCTIONS

for

MOTORPUMP TYPES JCS and GS SHAFT SEAL

Type JCS and GS shaft seals are supplied as standard equipment in KRVS, KRVSP and RVNP pumps. Seals can be furnished from stock for installation in other pumps of the RV line which are normally equipped with packed type stuffing boxes. For commercial reasons seals of two makes are stocked and, although they are fully interchangeable basic physical dimensions and materials, they are designated as types JCS and GS for shop identification and record purposes—Sectional assembly drawings of each seal type are shown. Ingersoll-Rand will furnish either type seal at their option depending on availability at time it is required.



KRVS Assembly

SERVICE

JCS and GS Shaft Seals are intended for use on the CAMERON Motorpump for handling relatively clear liquids which will not destroy Hycar or Neoprene sealing members.

Stock Seals are furnished of materials to give service commensurate with that of the pumps in which they are used. Stock Seal materials follow:

Part	Reg. Fitted	Iron	Bronze
Floating Seat	Bronze	Ni-Resist	Ceramic
Rotating Washer	Carbon	Carbon	Carbon
Spring	Stainless	Stainless	Stainless
Retainer	Brass	Steel	Brass
Packing Ring	Neoprene	Hycar	Hycar
Bellows	Neoprene	Hycar	Hycar

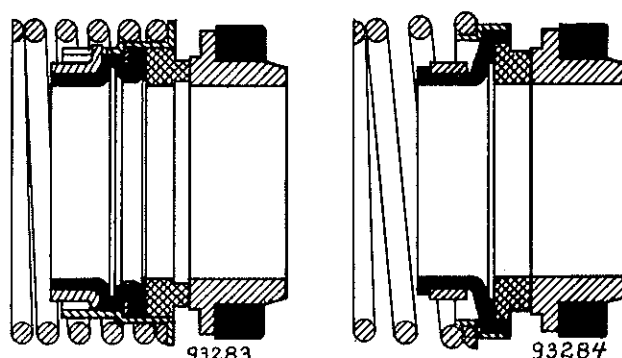
Do not use regular fitted seals on hydrocarbons such as gasoline, etc.

Stock Seals may be used for vacuum service up to 20" Hg. on the Stuffing Box, and for pressures up to 75 P.S.I.G.

Normal temperature limits range from minus 30° to plus 180°F. When handling abnormal liquids such as strong acids or alkalies, the maximum operating temperature must be limited. Refer to Ingersoll-Rand for recommendations.

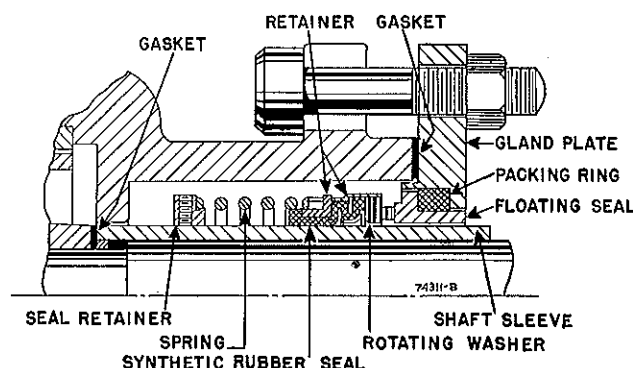
CONSTRUCTION

JCS and GS shaft seals are precision equipment and as



TYPE-JCS

TYPE - GS



RV Assembly

such should be handled accordingly. Refer to the cut showing installation of this seal in the Motorpump. Sealing takes place between the floating seat and a carbon rotating washer. Through the proper choice of materials for the floating face it is possible to maintain highly polished rubbing surfaces and thus insure a tight seal. The carbon rotating face is sealed against leakage along the shaft by a synthetic rubber sealing ring which is held in place by the retainer. Because of the use of synthetic rubber at this point it is evident that the unit is very flexible and the rotating washer is practically self aligning. A spring provides the thrust necessary to maintain the proper contact between the sealing faces.

ASSEMBLY—RV PUMPS

Seals may be installed in pumps already in the field or may be furnished in new pumps. For installation in the field in pumps having 1 1/8" O.D. Shaft Sleeves, the original standard Sleeves may be used if not worn below 1.122" O.D. at any point of contact with the synthetic rubber seal. (See cut). For pumps having larger Shaft Sleeves, a special Sleeve is furnished. With the exception of the 1MRVN Model A pump, all standard pump stuffing boxes will accommodate these seals. Before inserting this seal in a 1MRVN Model A pump, the box must be bored through at the original diameter.

With the 1 1/8" Seal, a separate retaining ring is furnished, and, as shown in cut, a setting of 1 9/32" from outside of Gland must be made. To obtain this setting, the Stuffing

Box and Shaft Sleeve are placed in their proper location on the pump. A line is scribed on the Shaft Sleeve directly under end of the Stuffing Box. The Stuffing Box is then removed and Seal parts—Gland and Gasket, put on the Sleeve in the relationship shown in the cut. The retaining ring may then be set $1\frac{1}{32}$ " from the scribed mark on the Shaft Sleeve. After locating retaining ring, set screws should be firmly tightened and threads "peened over". Pump may then be assembled.

With Sleeves larger than $1\frac{1}{8}$ " O.D., seal setting is automatically established by the shoulder machined on the special Shaft Sleeve furnished. This sleeve has a smaller diameter than that used in a packed box and the keyway is omitted. As there is little frictional drag from the seal, the omission of the shaft sleeve key is satisfactory.

Details of assembly and disassembly of each particular pump are given in pump instruction manual 7720-E, 7721-E and 7758-B. Before assembling the seal in a pump all parts should be thoroughly cleaned. The rubber packing ring and floating seat should be installed in the gland plate before assembly on the shaft sleeve. Oil the rubber portion and be sure the floating seat is firmly and squarely in place. Avoid cramping and distorting the seating surface.

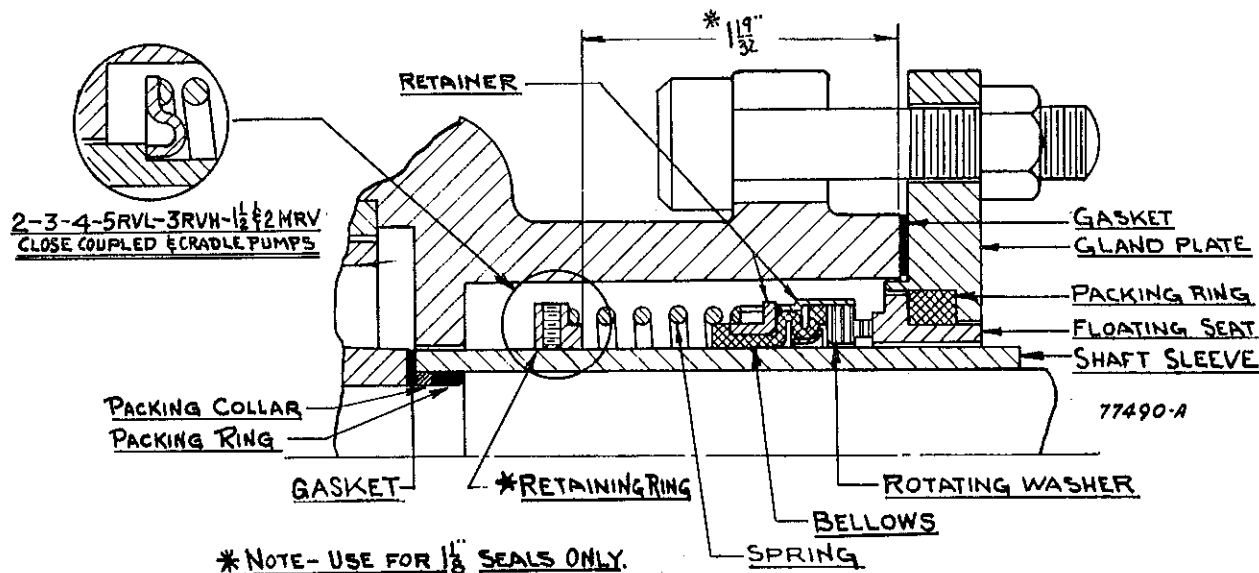
Be sure shaft on which seal is placed is polished clean and free from any foreign material. Oil shaft so that portion of seal fitting snugly to shaft can be pushed over it to location without undue force. The seal should be pushed on the shaft sleeve until the ends of the spring rest firmly against the supporting shoulders on the sealing member and the retainer.

Final compression of the spring takes place when the gland is bolted in place. The sealing faces will then automatically establish themselves in the correct operating position.

After mounting the seal on the shaft sleeve, the pump may be reassembled using particular care not to mar the sealing surfaces. Faces should be carefully cleaned before they are brought in contact. Oil should be placed on the rubbing surfaces to avoid abrasion of seat and washer faces when starting.

The use of the Seal in a dead ended box is not recommended. A small circulation thru and around the seal should be provided to prevent excessive temperatures at the seal. "All RV heavy duty pumps, having cored internal seal passages, are shipped with a special fixed orifice type internal seal when a mechanical seal is used. The fixed orifice will allow passage of sufficient liquid for best seal operation. In ordering seal parts for conversion from packed stuffing box in the field, a fixed orifice bushing should be specified." On the RVN standard duty it is suggested that the external seal connection be piped to one of the vents on the casing. If the liquid has dirt in suspension, a suitable strainer in this line will contribute to longer seal life. On KRVS pumps, to prevent air binding and dry seal operation, the $\frac{1}{8}$ " pipe plug in the supporting head should be unscrewed to vent air from the seal chamber when starting.

After pumps have been in service they should not be drained and allowed to stand dry for extended periods. Pumps should be kept full of liquid to avoid shrinkage of synthetic members in seals. This applies particularly on hydrocarbon service.



ASSEMBLY: KRVS PUMPS

On this pump the seal is assembled on the impeller hub instead of a shaft sleeve. The floating seat is pressed into the supporting head instead of the gland plate. The technique of installation is the same as described above. Details of the assembly of the KRVS pump is covered in Form 7707E.

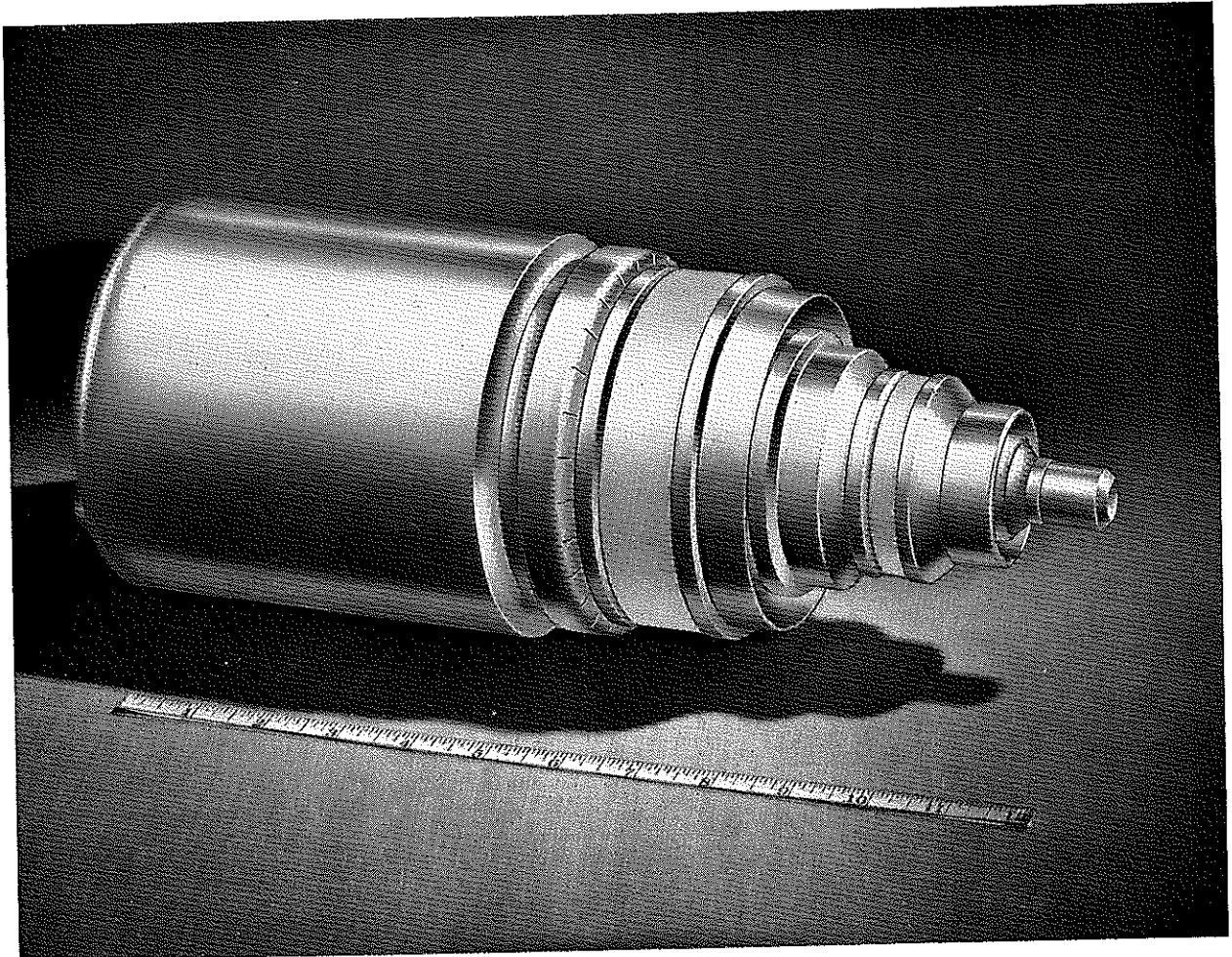
OPERATION

The seals may leak a few drops per minute when just started, but this should stop after a few hours operation. Vent seal chamber on KRVS pumps when starting.

Excessive seal leakage may be due to improper assembly, worn sealing faces, improper sealing ring fit, broken carbon ring, etc.

The compression of the friction rings should take care of any wear that occurs over an extended period. If excessive wear is encountered, it may be due to the following:

1. Corrosion of seal faces due to character of liquid pumped.
2. Excessive amounts of abrasive material in liquid causing an accumulation around the rotating assembly which results in faces opening up and allowing grit between them.
3. Improper spring load caused by spring itself or improper setting of retaining ring.
4. Dry seal operation and subsequent scoring of seal faces due to improper venting or circulation through seal chamber.



TETRODE

**25-KILOWATTS VHF TELEVISION OUTPUT
VHF TETRODE
GROUNDED-GRID CIRCUITS**

**WATER COOLED
METAL AND CERAMIC
GAIN IN EXCESS OF 10**

The GL-6251 is a four-electrode, water-and-forced-air-cooled transmitting tube for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating twenty-five kilowatts. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 220 megacycles.

In Class B grounded-grid broadband television amplifier service this tube has a useful synchroniz-

ing peak-power output of twenty-five kilowatts at 220 megacycles. Because of its ratings, the tube is also well adapted to use in dielectric-heating equipment.

High operating efficiency is assured because of the close spacing of the tube electrodes, the ring-seal construction, and the low-loss factor due to the silver-plated external parts and the ceramic insulator. The ring-seal design permits quick plug-in installation. In addition, the grounded-grid construction eliminates the necessity for neutralization in a properly designed circuit.

GENERAL  ELECTRIC

TECHNICAL INFORMATION

GENERAL

Electrical	Minimum	Bogey	Maximum
Filament Voltage.....	5.25	5.5	5.75 Volts
Filament Current at 5.5 Volts.....	....	190	.... Amperes
Filament Starting Current.....	....	....	360 Amperes
Filament Cold Resistance.....	....	0.004	.... Ohms
Filament Heating Time.....	30	....	.... Seconds
Amplification Factor, G_2 to G_1			
$E_b = 1000$ Volts, $I_b = 0.1$ Amperes.....	....	20	....
Peak Cathode Current*.....	....	....	30 Amperes
Direct Interelectrode Capacitances			
Grounded-Grid Circuit			
Cathode-Plate†.....	....	0.06	.... $\mu\mu f$
Input.....	....	75	.... $\mu\mu f$
Output.....	....	27	.... $\mu\mu f$
Mechanical			
Mounting Position—Vertical			
Net Weight, approximate.....	....	15	Pounds
Thermal			
Type of Cooling—Water and Forced Air			
Water Cooling			
Water Flow			
Anode.....	12 Min		Gallons per Minute
Water Pressure.....	80 Max		Pounds per Square Inch
Pressure Drop at Rated Flow.....	13		Pounds per Square Inch
Outlet Water Temperature.....	70 Max		C
Air Cooling			
Air Flow			
Anode Seal.....	30 Min		Cubic Feet per Minute
Filament Seal.....	15 Min		Cubic Feet per Minute
Grid-to-Grid Seal.....	10 Min		Cubic Feet per Minute
Ceramic Temperature.....	200 Max		C

MAXIMUM RATINGS AND TYPICAL OPERATION

RADIO-FREQUENCY AMPLIFIER—CLASS B TELEVISION SERVICE

Synchronizing-Level Conditions Per Tube Unless Otherwise Specified

Maximum Ratings, Absolute Values

DC Plate Voltage.....	7000 Max	Volts
⊕ DC Grid-No. 2 Voltage.....	750 Max	Volts
DC Plate Current.....	.8 Max	Amperes
Plate Input.....	50 Max	Kilowatts
⊕ Grid-No. 2 Input†.....	350 Max	Watts
□ DC Grid-No. 2 Current.....	0.250 Max	Amperes
Plate Dissipation.....	25 Max	Kilowatts
Grid-No. 1 Dissipation.....	150 Max	Watts
□ DC Grid-No. 1 Current.....	0.7 Max	Amperes

Typical Operation—Grounded-Grid Circuit up to 216 Megacycles

Bandwidth 7 Megacycles, 1 Decibel Voltage		
⊕ DC Plate Voltage.....	6800	Volts
⊕ DC Grid-No. 2 Voltage.....	700	Volts
⊕ DC Grid-No. 1 Voltage.....	—20	Volts
Peak RF Plate Voltage		
⊕ Synchronizing Level.....	4800	Volts
⊕ Pedestal Level.....	3600	Volts
Peak RF Driving Voltage		
⊕ Synchronizing Level.....	350	Volts
⊕ Pedestal Level.....	250	Volts

TECHNICAL INFORMATION (CONT'D)

Typical Operation (Cont'd)

DC Plate Current		
⊕ Synchronizing Level.....	7.5	Amperes
⊕ Pedestal Level.....	5.8	Amperes
DC Grid-No. 2 Current.....	0.05	Amperes
⊕ Pedestal Level§		
DC Grid-No. 1 Current		
⊕ Synchronizing Level.....	0.90	Amperes
⊕ Pedestal Level.....	0.55	Amperes
Driving Power at Tube, approximate		
⊕ Synchronizing Level.....	2.3	Kilowatts
⊕ Pedestal Level.....	1.3	Kilowatts
Power Output, approximate		
⊕ Synchronizing Level π	25	Kilowatts
⊕ Pedestal Level π	15	Kilowatts

* Maximum usable cathode current (plate current plus current to each grid) for any condition of operation.

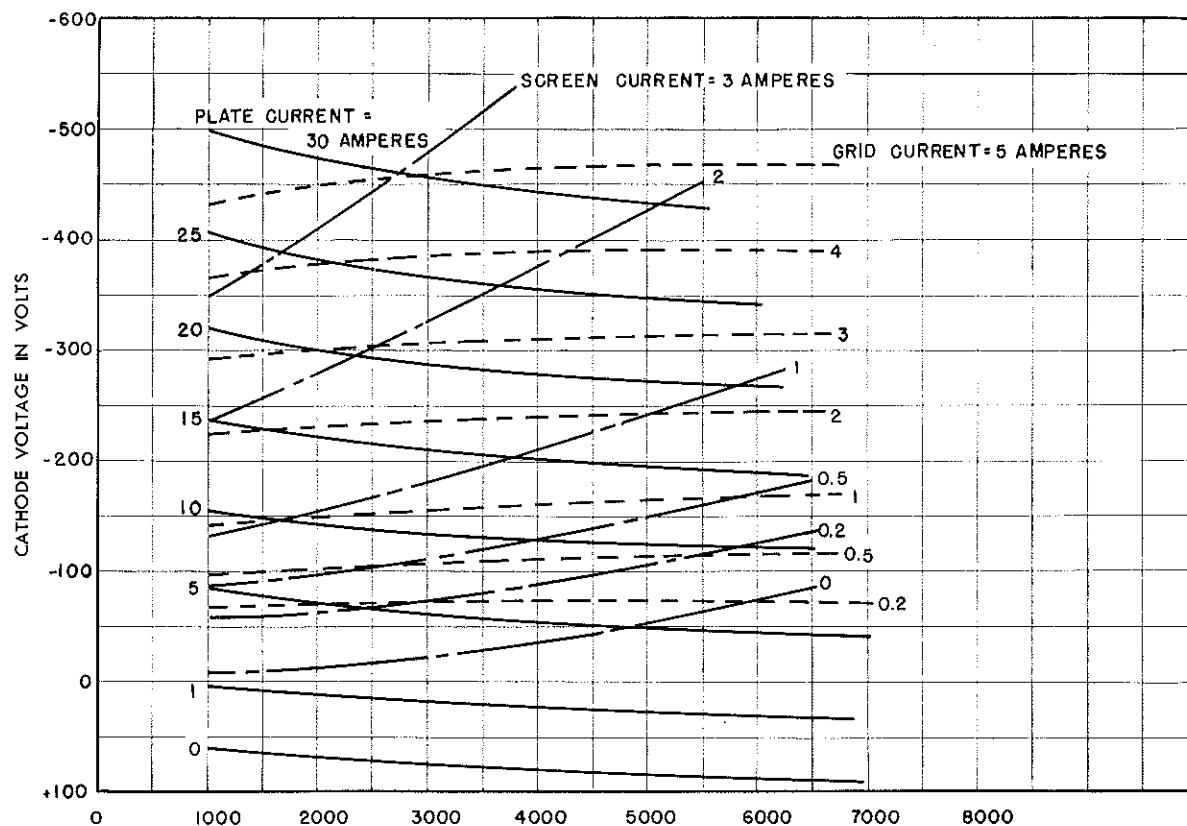
† Measured with 12-inch diameter flat metal disk attached to the screen-grid terminal and grounded.

‡ Calculated from characteristic curve only. This value includes dissipation transferred from driving power. Maximum allowable screen input as indicated by measured DC current and voltage is much lower because of secondary screen emission.

§ May vary considerably due to slight changes in load impedance. Negative values of screen current are frequently encountered.

π Useful power output including power transferred from driver stage.

⊕ Denotes a change. □ Denotes an addition.



K-69087-72A680

CONSTANT CURRENT CHARACTERISTICS
SCREEN VOLTAGE=700 VOLTS, CONTROL-GRID GROUND
ELECTRODE VOLTAGES MEASURED TO GROUND

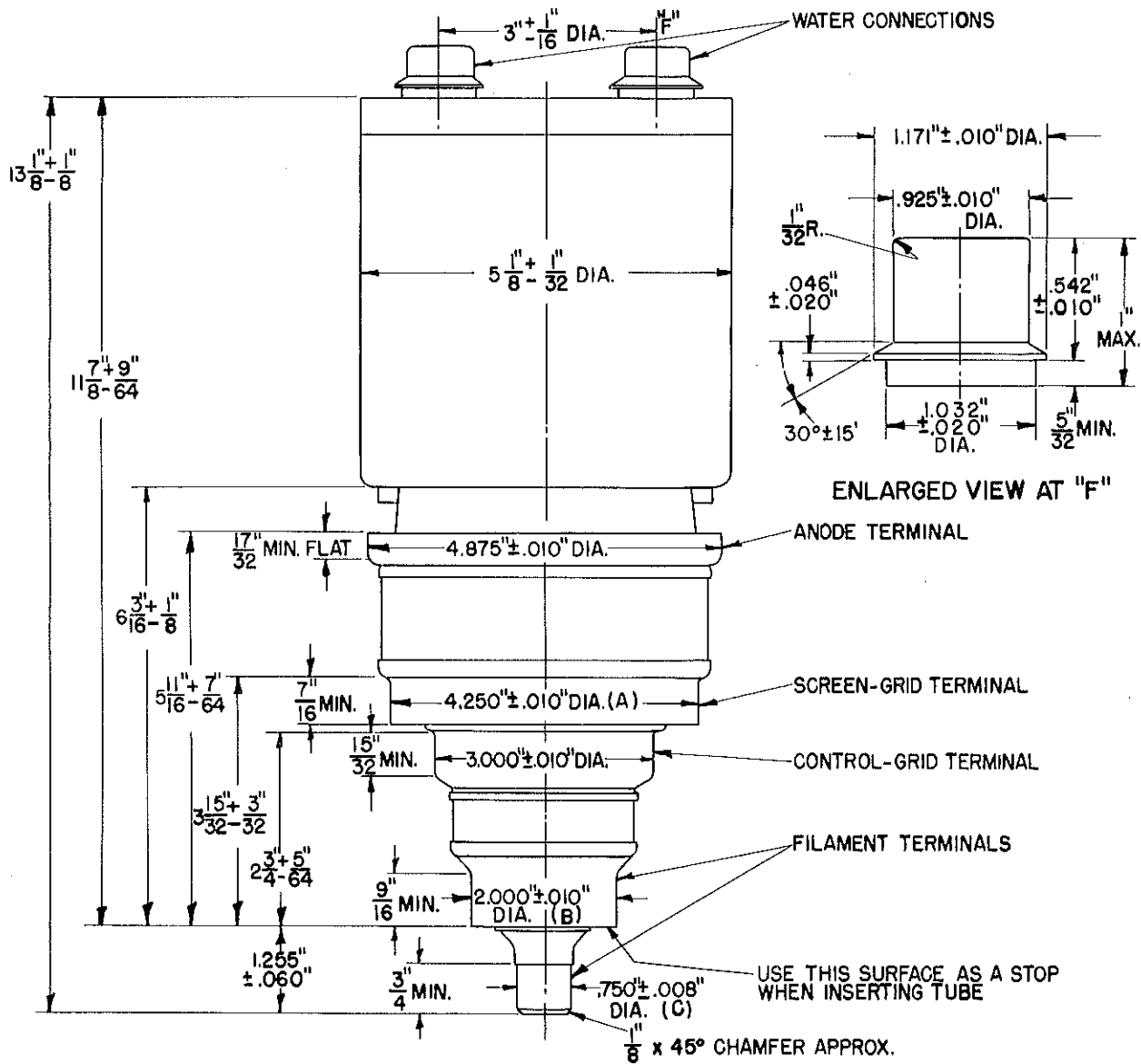
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GL-6251

ET-T1165

Page 4

12-54



(A) MAX. ECCENTRICITY .040"
 (B) MAX. ECCENTRICITY .040"
 (C) MAX. ECCENTRICITY .050"
 WITH RESPECT TO CENTERLINE DETERMINED BY CENTERS OF
 ANODE TERMINAL & CONTROL-GRID TERMINAL.

N-20726AZ

12-28-54

TUBE DEPARTMENT

GENERAL ELECTRIC

Schenectady 5, N. Y.

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INDEX

- Adapters, designation, 10
- Aural Amplifier (see Figs. 13, 14, 15)
 - description, 15
 - designation, cubicle, 9
 - detector (see sweep diode)
 - emergency starting, 66
 - filament transformer taps, 31
 - frequency, carrier, 1
 - general instructions, 40, 41
 - GL-6251 filament life, 123
 - harmonic titer, 10, insert EBI-3310
 - initial operation, 32, 33, 35, 36
 - input circuit, 69, Figs. 57, 58
 - input impedance, 1
 - load impedance required, 1
 - meter readings, 40
 - neutralization, 32, 33
 - noise level, 9
 - outlet, convenience, 9, 10, 11
 - power amplifier, RF output, 1, 68, 69
 - driving power required, 1
 - reactor, designation, 9, Fig. 7
 - reduction of GL-6251 screen dissipation, 123
 - reflectometer, designation, 10, Fig. 4
 - routine operation, 40
 - simultaneous operation, 39, 40
 - specifications, electrical, 1, 9
 - sweep diode (detector), designation, 10, Fig. 5
 - sweep generator, 69, 70, 71, Fig. 59, 60
 - theory and circuit analysis, 54 thru 61
 - tube complement, 9
 - tube installation, 24, 26, 27, Figs. 30, 31, 32
- Cavity, construction, 48, Figs. 49 thru 55
- Circuit Breaker (5K1)
 - designation, 10, Fig. 6, inserts GEH-1807, GEH-3506
- Circuit Breaker (5S1), 5
 - designation, 10
- Connector, designation, 10
- Construction, 10
- Convenience outlets, 10, 11
- Cooling System - Air
 - blowers, installation, Fig. 4
 - description, 15
- Cooling System - Water
 - designation, 10
 - flow vs. pressure, Fig. 33
 - flushing, 47
 - heat exchanger, designation, 9, Fig. 6, inserts Form 7674F, Form 7720E
 - installation, 23, 24, 122, Figs. 28, 29
 - solvents in, 47
 - strainer, designation, 10, Fig. 6
 - tank, designation, 9, Fig. 6
 - water pump, Fig. 6
- Delta-Wye Switch, designation, 10, Fig. 5
- Drawings and symbols
 - description, 17
- Emergency starting, 66
- External equipment, 17
- Frequency, carrier, 1
- Installation, 17, 20, 23
 - external safety switch, 28
 - 50-cycle operation, 24
 - filter reactors 5L7 and 5L8, 122
 - initial lubrication, 29
 - interlocks with driving transmitter, 27, 121
 - location of equipment, 20
 - main plate transformer 5T1, 122
 - output tuning assembly, 23, Figs. 22, 23, 24, 25, 26
 - plumbing, 23, 24, Figs. 28, 29
 - remote meters, 28
 - suggested station layout, Figs. 8 and 21
 - terminal board location, Fig. 3
 - transmission-line elements, Fig. 27
 - tube installation, 24, 26, 27, Figs. 30, 31, 32
 - wiring, 23, Figs. 27, 61, 81
- Line Stretcher, Input
 - Designation, 10, Fig. 4
- Lubrication, initial, 29
- Lubrication, routine, 45
- Maintenance, preventive, 42 thru 48
 - air filters, 45
 - blowers, 45
 - daily, 42
 - general, 42
 - GL-6251 filament life, 123
 - painted surfaces, 122
 - Powerstat, 45
 - pump, 45
 - reduction of GL-6251 screen dissipation, 123
 - semi-annual, 45
 - solvents, use of, 47
 - targets, 47
 - water system, 47, 122
 - weekly, 43
- Meter readings, 40
- Operation
 - preparation for use, 29 thru 40
- Physical dimensions, 3
- Power requirements (a-c), 9
 - description, 17
- Protective gaps, 28, 29
- Quarter-Phasing, 33, 35, Figs. 38, 39, 40, 41
- Rectifier and Control, (see Figs. 16 thru 21)
 - description, 15
 - designation, cubicle, 9
 - high-voltage rectifier, 72
 - outlets, convenience, 10
 - switches, grounding, 21
 - theory and circuit analysis, 51, 52, 53, 54, 64, 65, 66, 67
 - tubes, 9, 24, 26, 27, Figs. 30, 31, 32
- Reflectometer, 4, 10, 40 (see Aural or Visual section)
- Replacement Parts, 48
- Resistor box, designation, 10, Fig. 5
- Routine Operation, 40
- Safety, ii
 - inspection, 41, 42
- Simultaneous operation, 39, 40
- Sweep Diodes, (see Aural or Visual section)

Theory and Circuit Analysis, 51 thru 72

Transformer, Plate, designation, 9, Figs. 7, 38, 74

Tubes, 9, 24, 26, 27, Figs. 30, 31, 32, insert ET-T1060

Visual Amplifier (see Figs. 9, 10, 11, 12)

correct loading, 121

description, 12

designation, cubicle, 9

detector (see sweep diode)

emergency starting, 66

filament transformer taps, 31

frequency, carrier, 1

general instructions, 40, 41

GL-6251 filament life, 123

harmonic filter

designation, 10, insert EBI-3310

initial operation, 37, 38, 39

input circuit, 69, Figs. 57, 58

input impedance, 1

load impedance required, 1

meter readings, 40

neutralization, 32, 33

noise level, 9

outlet, convenience, 9, 10, 11

power amplifier, RF output, 1, 68, 69

driving power required, 1

reactor, designation, 9, Fig. 7

reduction of GL-6251 screen dissipation, 123

reflectometer, designation, 10, Fig. 4

routine operation, 40

simultaneous operation, 39, 40

specifications, electrical, 1, 9

sweep diode (detector), designation, 10, Fig. 5

sweep generator, 69, 70, 71, Figs. 59, 60

theory and circuit analysis, 62, 63, 64, 67, 68

tubes, 9, Figs. 30, 31, 32

installation 24, 26, 27

vestigial sideband, insert EBI-3389

designation, 10

lower, 1


upper, 1



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Small-motor Service Station Plan

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Dodge Elec. Co., 211 S. Lansing

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Eugene
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Medford
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Roseburg
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Williamsport
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Keystone Elec. Mtr., 51 Delaware St.
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G.E. Service Shop, 841 Oak St.
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G.E. Service Shop, 6519 Penn. Ave.
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Prior and Sallada Co., Inc., 231 Pine St.
G.E. Service Shop, 54 N. Harrison St.

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J & H Elec. Co., 200 Richmond St.

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Rotureau Elec. Co., 1823 Main St.

South Dakota

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Nashville
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Tri-State Arm. & Elec. Wks., 321 E. Butler
Nashville Arm. Wks., 303 8th Ave. South

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Houston
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G.E. Service Shop, 3202 Manor Way
Elec. Mtr. Co., 1517 Wyoming St.
Central Elec. Co., 712 N. Main St.
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Longview Elec. Motor Co., 317 E. Cotton St.
Lubbock Elec. Co., 1944 Texas Ave.
Rudd Mtr. Co., 109 E. Burleson St.
McAllen Armature Works, 1306 Chicago Ave.
San Ant. Arm. Wks., Inc., 637 N. Flores St.
United Elec. Serv. Co., 11th & Scott Sts.

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Tri-Co. Elec. Works, Inc., Indiana and "A" Sts.
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G.E. Service Shop, S. 155 Sherman St.
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Harold Elec. Co., 211 E. Alder St.
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Wyoming

Casper
Elec. Serv. Co., 1120 East B St.

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In Canada, any requests for in-warranty service can be referred to the following addresses where shipping information for inoperative motors can be obtained. For service on fractional-hp shaded-pole motors in Canada, refer to the device manufacturer.

For shipping instructions for in-warranty service repairs, address requests to:

Product Service Manager
Wholesale Division
Canadian General Electric Company, Ltd.

at the following locations*:

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Calgary
Edmonton
502 11th Ave., West
10147 104th St.

British Columbia

Vancouver
Victoria
1095 Pender St., West
711 Broughton St.

Manitoba

Winnipeg
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401 2nd Ave., North

* On motors larger than 60-diameter frame (7 1/2-in. diameter), refer to the addresses in Montreal, Toronto and Vancouver, and to 945 St. James Street, Winnipeg.

For further information, contact your nearest G-E Apparatus Sales Office

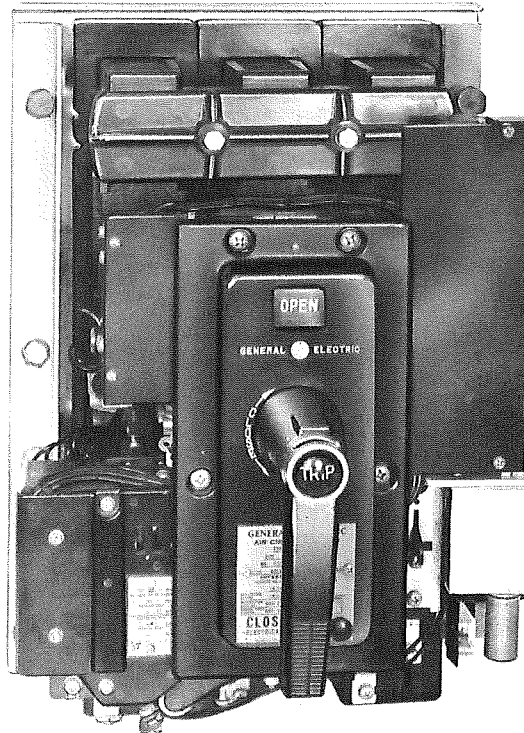


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RENEWAL PARTS

TYPE AK-1-15 AND AK-1-25 AIR CIRCUIT BREAKERS TYPE AKF-1 FIELD BREAKERS



(PHOTO 8007142)

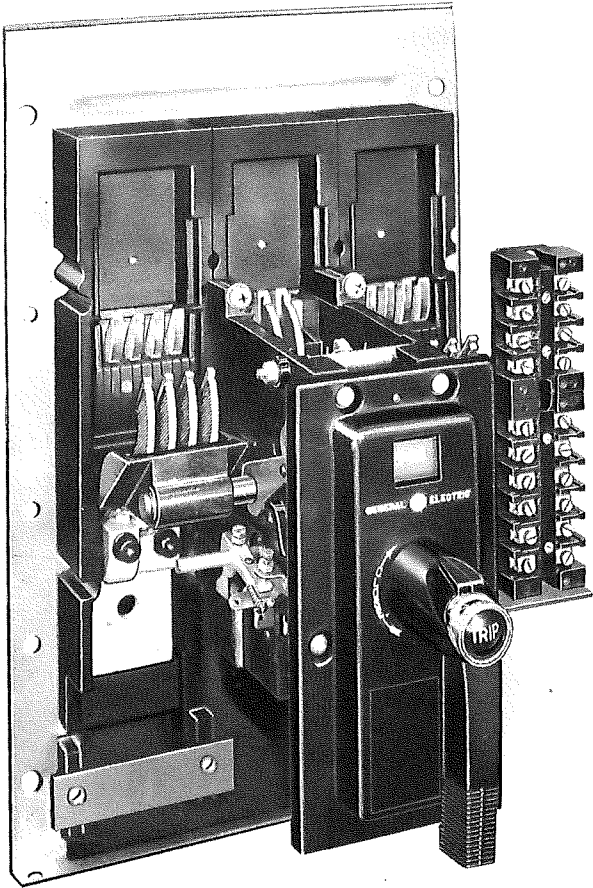
**Fig. 1. Type AK-1-15 air circuit breaker with time-delay
undervoltage tripping device, front view**

NOTE: All reference to "right" and "left" designate the location of the part when facing the operating mechanism end of the breaker.

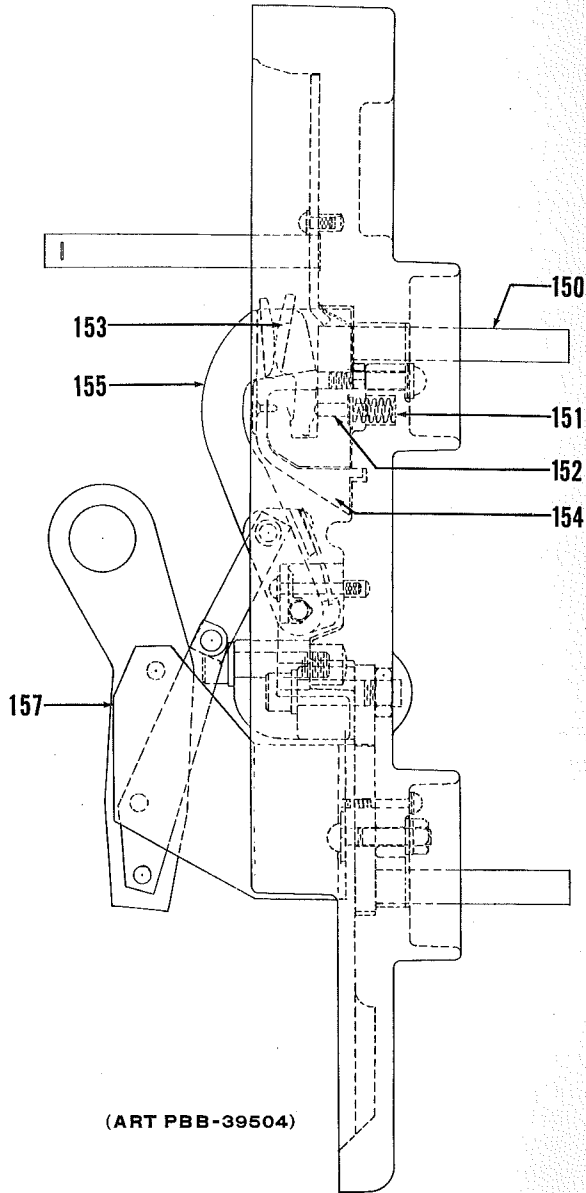
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1. Always specify the complete nameplate data of the breaker.
2. Specify the quantity, catalog number (if listed), reference number (if listed), description, and this bulletin number.
3. CAUTION: When local facilities for breaker recalibration are not available, the breaker should be forwarded to the nearest G-E Service Shop, or to the General Electric Company, 6901 Elmwood Ave., Philadelphia 42, Pa.
4. Standard hardware, such as screws, bolts, nuts, washers, etc., is not listed in this bulletin. Such items should be purchased locally.
5. For prices, refer to the nearest office of the General Electric Company.

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(PHOTO 8005192)
Fig. 21. Type AKF-1 field breaker



(ART PBB-39504)
Fig. 22. Center pole unit

NOTE: Except for the parts listed below, the Type AKF Field Breaker has the same renewal parts as listed for the Type AK-1-25 breakers.

Ref. No.	Catalog No.		No. Per Breaker	Description
	Center Pole	Outside Pole		
150	6403109G4	6403109G4	3	Upper stud
151	6403324	6372917	#	Stationary contact spring
152	6248887P2	6248887P2	10	Spring pin
153	6372777G2	6372777G2	#	Stationary contact finger
154	6403687P2	6403687P2	3	Upper stud cap
155	6317995G3	6317995G2	¶	Movable contact assembly
*156	6444433P1	6317719P3	¶	Insulator
157	6319474G1	-----	1	Switch mechanism assembly
*158	6403321	-----	1	Switch mechanism spring

* Not illustrated.
2 furnished on center pole; 4 furnished on each outside pole.
¶ 1 furnished on center pole; 2 furnished on each outside pole.

LOW VOLTAGE SWITCHGEAR DEPARTMENT, GENERAL ELECTRIC COMPANY, PHILADELPHIA, PA.

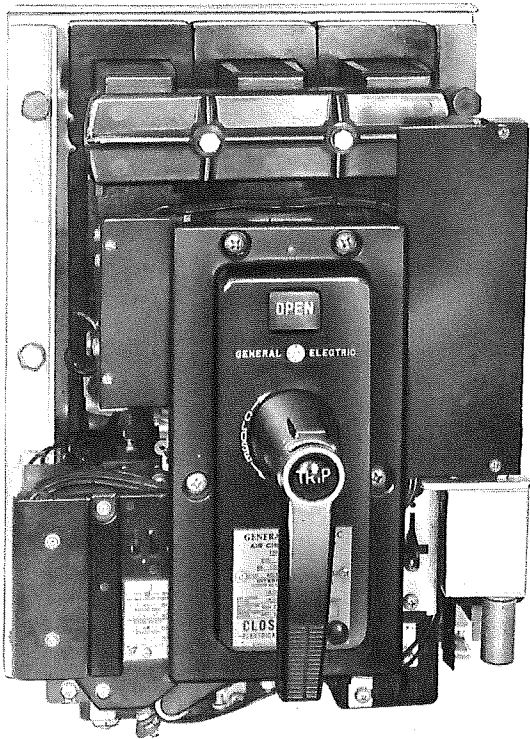
8-54 (8M)
10-54 (8M)

Handbook Ref. 6726



RENEWAL PARTS

TYPE AK-1-15 AND AK-1-25
AIR CIRCUIT BREAKERS
TYPE AKF-1 FIELD BREAKERS



(PHOTO 8007142)
Fig. 1. Type AK-1-15 air circuit breaker with time-delay undervoltage tripping device, front view

NOTE: All reference to "right" and "left" designate the location of the part when facing the operating mechanism end of the breaker.

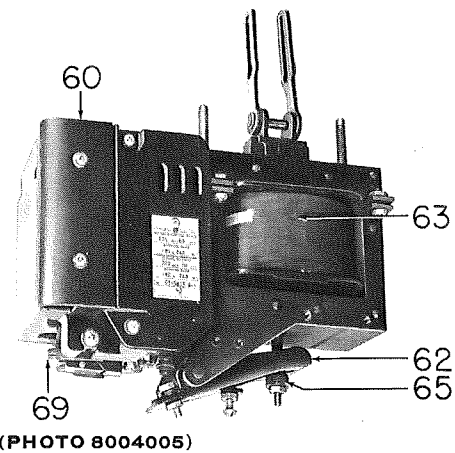
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2. Specify the quantity, catalog number (if listed), reference number (if listed), description, and this bulletin number.
3. CAUTION: When local facilities for breaker recalibration are not available, the breaker should be forwarded to the nearest G-E Service Shop, or to the General Electric Company, 6901 Elmwood Ave., Philadelphia 42, Pa.
4. Standard hardware, such as screws, bolts, nuts, washers, etc., is not listed in this bulletin. Such items should be purchased locally.
5. For prices, refer to the nearest office of the General Electric Company.

GENERAL  ELECTRIC

Data subject to change without notice.

TYPE AK-1-15 AND AK-1-25 AIR CIRCUIT BREAKERS



INSTRUCTIONS

for Installation and Operation
and
List of Parts

The Cameron

Standard Duty

MOTOR PUMP

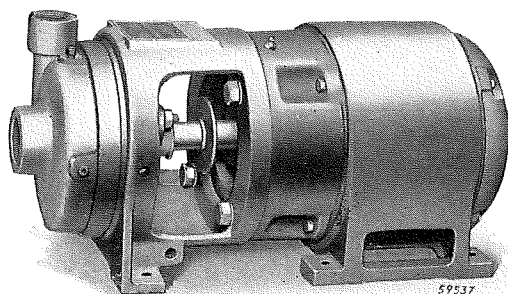
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GEZ-85R

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Alexandria, La.....720 Murray St.
Allentown, Pa.....1014 Hamilton St.
Amarillo, Texas.....719 Amarillo Bldg.
Appleton, Wisc.....531 W. College Ave.
Atlanta 3, Ga.....Peachtree Rd. at 28th St., N.W.
Augusta, Ga.....423 Masonic Bldg.
Augusta, Me.....15 Grove St.
Bakersfield, Calif.....211 E. 18th St.
Baltimore 1, Md.....111 Park Ave.
Bangor, Maine.....77 Central St.
Battle Creek, Mich.....25 W. Michigan Ave.
Beaumont, Texas.....1385 Calder Ave.
Binghamton, N. Y.....19 Chenango St.
Birmingham 3, Ala.....1804 Seventh Ave., N.
Bismarck, N. Dak.....117 1/2 Fifth St.
Bluefield, W. Va.....P.O. Box 447, Appalachian Bldg.
Boston 1, Mass.....140 Federal St.
Buffalo 3, N. Y.....535 Washington St.
Butte, Mont.....P.O. Box 836, 103 N. Wyoming St.
Canton 2, Ohio.....700 Tuscarawas St., W.
Cedar Rapids, Iowa.....210 Second St., S.E.
Charleston 28, W. Va.....306 MacCorkle Ave., S.E.
Charlotte 1, N. C.....112 S. Tryon St.
Charlottesville, Va.....123 E. Main St.
Chattanooga 2, Tenn.....832 Georgia Ave.
Chicago 80, Ill.....P.O. Box 5970A, 840 S. Canal St.
Cincinnati 2, Ohio.....215 W. Third St.
Cleveland 4, Ohio.....4966 Woodland Ave.
Columbia 1, S.C.....P.O. Box 1434, 1420 Lady St.
Columbus 15, Ohio.....40 S. Third St.
Corpus Christi, Texas.....205 N. Chaparral
Dallas 2, Texas.....1801 N. Lamar St.
Davenport, Iowa.....511 Pershing Ave.
Dayton 2, Ohio.....118 W. First St.
Denver 2, Colo.....650 Seventeenth St.
Des Moines 9, Iowa.....505 W. Fifth Ave.
Detroit 2, Mich.....700 Antoinette St.
Duluth 2, Minn.....14 W. Superior St.
Elmira, N. Y.....Main and Woodlawn Aves.
El Paso, Texas.....109 N. Oregon St.
Erie, Pa.....1001 State St.
Eugene, Ore.....29 W. Eleventh St.
Evansville 19, Ind.....123 N.W. Fourth St.
Fairmont, W. Va.....310 Jacobs Bldg., P.O. Box 1626
Fergus Falls, Minn.....108 N. Court Ave., P.O. Box 197
Flint 3, Mich.....653 S. Saginaw St.

Fort Wayne 2, Ind.....127 W. Berry St.
Fort Worth 2, Texas.....408 W. Seventh St.
Fresno 1, Calif.....407 Patterson Bldg.
Grand Rapids 2, Mich.....148 Monroe Ave., N.W.
Greensboro, N. C.....301 S. Elm St.
Greenville, S. C.....108 W. Washington St.
Hagerstown, Md.....Professional Arts Bldg.
Harrisburg, Pa.....300 N. Second St.
Hartford 3, Conn.....410 Asylum St.
Houston 1, Texas.....1312 Live Oak St.
Huntsville, Ala.....1107 Times Bldg.
Indianapolis 4, Ind.....110 N. Illinois St.
Jackson, Mich.....120 W. Michigan Ave.
Jackson 1, Miss.....203 W. Capitol St.
Jacksonville 2, Fla.....700 E. Union St.
Jamestown, N. Y.....P.O. Box 548, 2 Second St.
Johnson City, Tenn.....321-323 W. Walnut St.
Johnstown, Pa.....841 Oak St.
Joplin, Mo.....P.O. Box 931, 220 1/2 W. Fourth St.
Kansas City 6, Mo.....106 W. Fourteenth St.
Knoxville 08, Tenn.....602 S. Gay St.
Lansing 8, Mich.....106 W. Allegan St.
Lexington, Ky.....First National Bank Bldg.
Lincoln 8, Nebr.....1001 "O" St.
Little Rock, Ark.....103 W. Capitol Ave.
Los Angeles 54, Calif.....212 N. Vignes St.
Louisville 2, Ky.....455 S. Fourth St.
Macon, Ga.....682 Cherry St.
Madison 3, Wisc.....16 N. Carroll St.
Manchester, N. H.....875 Elm St.
Medford, Ore.....P.O. Box 1349, 205 W. Main St.
Memphis 3, Tenn.....8 N. Third St.
Miami 32, Fla.....25 S.E. Second Ave.
Milwaukee 3, Wisc.....940 W. St. Paul Ave.
Minneapolis 3, Minn.....12 S. Sixth St.
Mobile 13, Ala.....54 St. Joseph St.
Montgomery 4, Ala.....205 Montgomery St.
Nashville 3, Tenn.....234 Third Ave., N.
Newark 2, N. J.....744 Broad St.
New Haven 6, Conn.....129 Church St.
New Orleans 12, La.....837 Gravier St.
New York 22, N. Y.....570 Lexington Ave.
Niagara Falls, N. Y.....253 Second St.
Norfolk 10, Va.....229 W. Bute St.
Oakland 12, Calif.....409 Thirtieth St.
Oklahoma City 2, Okla.....119 N. Robinson St.
Omaha 2, Nebr.....409 S. Seventeenth St.
Paducah, Ky.....P.O. Box 1001, 231 S. Fourth St.
Pasco, Wash.....421 W. Clark St.
Peoria 2, Ill.....309 Jefferson Bldg.

Philadelphia 2, Pa.....1405 Locust St.
Phoenix, Ariz.....P.O. Box 4037, 303 Luhrs Tower
Pittsburgh 22, Pa.....535 Smithfield St.
Portland 3, Maine.....477 Congress St.
Portland 7, Ore.....920 S.W. Sixth Ave.
Portsmouth, Ohio.....P.O. Box 37, 721 Sixth St.
Providence 3, R. I.....Industrial Trust Bldg.
Raleigh, N. C.....336 Fayetteville St.
Reading, Pa.....31 N. Sixth St.
Richmond 17, Va.....700 E. Franklin St.
Riverside, Calif.....3808 Main St.
Roanoke 16, Va.....920-924 S. Jefferson St.
Rochester 4, N. Y.....89 E. Ave.
Rockford, Ill.....110 S. First St.
Rutland, Vt.....38 1/2 Center St.
Sacramento 14, Calif.....626 Forum Bldg.
Saginaw, Mich.....501 Bearinger Bldg.
St. Louis 2, Mo.....112 N. Fourth St.
Salt Lake City 9, Utah.....200 S. Main St.
San Antonio 5, Texas.....310 S. St. Mary's St.
San Diego 1, Calif.....1240 Seventh Ave.
San Francisco 6, Calif.....235 Montgomery St.
San Jose 10, Calif.....460 Park Ave.
Savannah, Ga.....4 E. Bryan St.
Seattle 4, Wash.....710 Second Ave.
Shreveport, La.....910 Shelby Bldg.
Sioux City 13, Iowa.....572 Orpheum Electric Bldg.
Sioux Falls, S. D.....306 South Phillips Ave.
South Bend 1, Ind.....112 W. Jefferson Blvd.
Spokane 8, Wash.....S. 162 Post St.
Springfield, Ill.....607 E. Adams St.
Springfield 3, Mass.....1387 Main St.
Stockton, Calif.....11 So. San Joaquin St.
Syracuse 2, N. Y.....113 S. Salina St.
Tacoma 1, Wash.....1202 Washington Bldg.
Tampa 6, Fla.....1206 North A St.
Toledo 4, Ohio.....420 Madison Ave.
Trenton 8, N. J.....214 E. Hanover St.
Tulsa 3, Okla.....320 S. Boston Ave.
Tucson, Ariz.....P.O. Box 710, 650 N. Sixth Ave.
Utica 2, N. Y.....258 Genesee St.
Washington 5, D.C.....777-14th St., N.W.
Waterbury 89, Conn.....111 W. Main St.
Waterloo, Iowa.....206 W. 4th St.
Wenatchee, Wash.....328 N. Wenatchee Ave.
Wheeling, W. Va.....40 Fourteenth St.
Wichita 2, Kan.....200 E. First St.
Williamston, N. C.....115 E. Main St.
Wilmington 98, Del.....1326 N. Market St.
Worcester 8, Mass.....507 Main St.
York, Pa.....56 N. Harrison St.
Youngstown 5, Ohio.....272 E. Indianola Ave.

Hawaii: American Factors, Ltd., P. O. Box 3230, Honolulu 1 Canada: Canadian General Electric Company, Ltd., Toronto

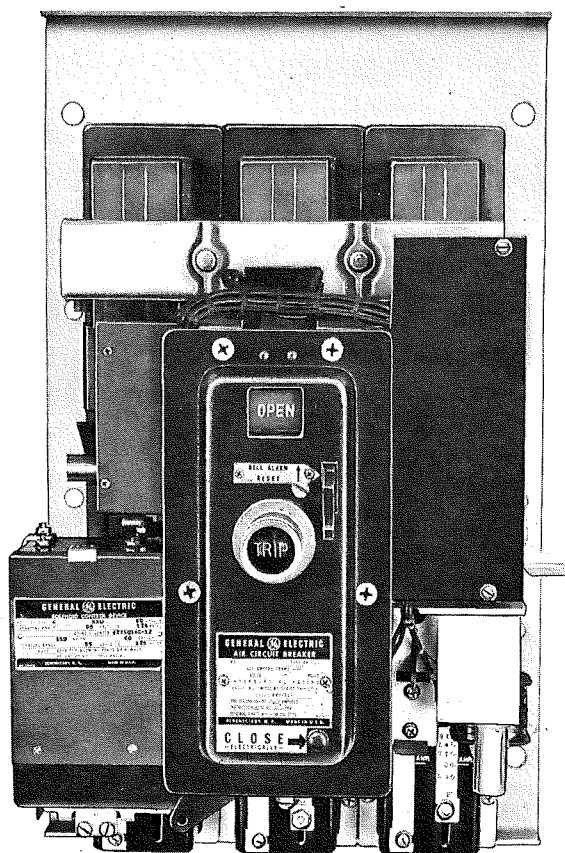
GENERAL  ELECTRIC

INSTRUCTIONS

Switchgear

AIR CIRCUIT BREAKERS

**Types
AK-1-15 and AK-1-25
Electrically Operated**



GENERAL  **ELECTRIC**

WHEN YOU NEED SERVICE

GEZ-85R

IF YOU NEED TO REPAIR, recondition, or rebuild any electric apparatus, a G-E service shop near you is available day and night, seven days a week, for work in the shops or on your premises. Latest factory methods and genuine G-E renewal parts are used to maintain the original performance of your G-E equipment. For full information about these services, contact the nearest service shop or sales office listed below:

APPARATUS SERVICE SHOPS

Atlanta—Chamblee, Ga. 4639 Peachtree Indus. Blvd.
Baltimore 30, Md. 920 E. Fort Ave.
Boston—Medford 55, Mass. Mystic Valley Pkwy.
Buffalo 11, N. Y. 318 Urban St.
Charleston 28, W. Va. 306 MacCorkle Ave., S.E.
Charlotte, N. C. 2328 Thrift Road
Chicago 80, Ill. 849 S. Clinton St.
Cincinnati 2, Ohio 444 W. Third St.
Cleveland 4, Ohio 4966 Woodland Ave.
Columbus 15, Ohio 213 Cozzens St.
Dallas 9, Texas 3202 Manor Way
Denver 5, Colo. 3353 Larimer St.
Detroit 2, Mich. 5950 Third Ave.
Houston 20, Texas 5534 Harvey Wilson Drive
Johnstown, Pa. 841 Oak St.
Kansas City 8, Mo. 819 E. 19th St.
Los Angeles 1, Calif. 6900 Stanford Ave.
Milwaukee 3, Wisc. 940 W. St. Paul Ave.
Minneapolis 12, Minn. 2025 49th Ave., N.
New York 14, N. Y. 416 W. 13th St.
Philadelphia 23, Pa. 429 N. Seventh St.
Pittsburgh 6, Pa. 6519 Penn Ave.
Portland 18, Oregon 2727 N.W. 29th Ave.
Richmond 24, Va. 1403 Ingram Ave.
St. Louis 10, Mo. 1115 East Road
San Francisco 3, Calif. 1098 Harrison St.



For service outside the United States, Canada, and Hawaii, consult the nearest office of the International General Electric Company.

Salt Lake City 4, Utah. 301 S. Seventh West St.
Seattle 4, Wash. 3422 First Ave., S.
Spokane 3, Wash. S. 155 Sherman St.

Toledo 4, Ohio. 1 So. St. Clair St.
York, Pa. 54 N. Harrison St.
Youngstown 5, Ohio. 272 E. Indianola Ave.

APPARATUS SALES OFFICES

Abilene, Texas. 442 Cedar St.
Akron 8, Ohio. 335 S. Main St.
Albany 7, N. Y. 90 State St.
Albuquerque, N. Mex. 323 Third St., S.W.
Alexandria, La. 720 Murray St.
Allentown, Pa. 1014 Hamilton St.
Amarillo, Texas. 719 Amarillo Bldg.
Appleton, Wisc. 531 W. College Ave.
Atlanta 3, Ga. Peachtree Rd. at 28th St., N.W.
Augusta, Ga. 423 Masonic Bldg.
Augusta, Me. 15 Grove St.
Bakersfield, Calif. 211 E. 18th St.
Baltimore 1, Md. 111 Park Ave.
Bangor, Maine. 77 Central St.
Battle Creek, Mich. 25 W. Michigan Ave.
Beaumont, Texas. 1385 Calder Ave.
Binghamton, N. Y. 19 Chenango St.
Birmingham 3, Ala. 1804 Seventh Ave., N.
Bismarck, N. Dak. 117 1/2 Fifth St.
Bluefield, W. Va. P.O. Box 447, Appalachian Bldg.
Boston 1, Mass. 140 Federal St.
Buffalo 3, N. Y. 535 Washington St.
Butte, Mont. P.O. Box 836, 103 N. Wyoming St.
Canton 2, Ohio 700 Tuscarawas St., W.
Cedar Rapids, Iowa. 210 Second St., S.E.
Charleston 28, W. Va. 306 MacCorkle Ave., S.E.
Charlotte 1, N. C. 112 S. Tryon St.
Charlottesville, Va. 123 E. Main St.
Chattanooga 2, Tenn. 832 Georgia Ave.
Chicago 80, Ill. P.O. Box 5970A, 840 S. Canal St.
Cincinnati 2, Ohio 215 W. Third St.
Cleveland 4, Ohio 4966 Woodland Ave.
Columbia 1, S.C. P.O. Box 1434, 1420 Lady St.
Columbus 15, Ohio 40 S. Third St.
Corpus Christi, Texas. 205 N. Chaparral
Dallas 2, Texas. 1801 N. Lamar St.
Davenport, Iowa. 511 Pershing Ave.
Dayton 2, Ohio 118 W. First St.
Denver 2, Colo. 650 Seventeenth St.
Des Moines 9, Iowa. 505 W. Fifth Ave.
Detroit 2, Mich. 700 Antoinette St.
Duluth 2, Minn. 14 W. Superior St.
Elmira, N. Y. Main and Woodlawn Aves.
El Paso, Texas. 109 N. Oregon St.
Erie, Pa. 1001 State St.
Eugene, Ore. 29 W. Eleventh St.
Evansville 19, Ind. 123 N.W. Fourth St.
Fairmont, W. Va. 310 Jacobs Bldg., P.O. Box 1626
Fergus Falls, Minn. 108 N. Court Ave. P.O. Box 197
Flint 3, Mich. 653 S. Saginaw St.

Fort Wayne 2, Ind. 127 W. Berry St.
Fort Worth 2, Texas. 408 W. Seventh St.
Fresno 1, Calif. 407 Patterson Bldg. Tulare and Fulton St.
Grand Rapids 2, Mich. 148 Monroe Ave., N.W.
Greensboro, N. C. 301 S. Elm St.
Greenville, S. C. 108 W. Washington St.
Hagerstown, Md. Professional Arts Bldg.
Harrisburg, Pa. 300 N. Second St.
Hartford 3, Conn. 410 Asylum St.
Houston 1, Texas. 1312 Live Oak St.
Huntsville, Ala. 1107 Times Bldg.
Indianapolis 4, Ind. 110 N. Illinois St.
Jackson, Mich. 120 W. Michigan Ave.
Jackson 1, Miss. 203 W. Capitol St.
Jacksonville 2, Fla. 700 E. Union St.
Jamestown, N. Y. P.O. Box 548, 2 Second St.
Johnson City, Tenn. 321-323 W. Walnut St.
Johnstown, Pa. 841 Oak St.
Joplin, Mo. P.O. Box 931, 220 1/2 W. Fourth St.
Kansas City 6, Mo. 106 W. Fourteenth St.
Knoxville 08, Tenn. 602 S. Gay St.
Lansing 8, Mich. 106 W. Allegan St.
Lexington, Ky. First National Bank Bldg.
Lincoln 8, Nebr. 1001 "O" St.
Little Rock, Ark. 103 W. Capitol Ave.
Los Angeles 54, Calif. 212 N. Vignes St.
Louisville 2, Ky. 455 S. Fourth St.
Macon, Ga. 682 Cherry St.
Madison 3, Wisc. 16 N. Carroll St.
Manchester, N. H. 875 Elm St.
Medford, Ore. P.O. Box 1349, 205 W. Main St.
Memphis 3, Tenn. 8 N. Third St.
Miami 32, Fla. 25 S.E. Second Ave.
Milwaukee 3, Wisc. 940 W. St. Paul Ave.
Minneapolis 3, Minn. 12 S. Sixth St.
Mobile 13, Ala. 54 St. Joseph St.
Montgomery 4, Ala. 205 Montgomery St.
Nashville 3, Tenn. 234 Third Ave., N.
Newark 2, N. J. 744 Broad St.
New Haven 6, Conn. 129 Church St.
New Orleans 12, La. 837 Gravier St.
New York 22, N. Y. 570 Lexington Ave.
Niagara Falls, N. Y. 253 Second St.
Norfolk 10, Va. 229 W. Bute St.
Oakland 12, Calif. 409 Thirteenth St.
Oklahoma City 2, Okla. 119 N. Robinson St.
Omaha 2, Nebr. 409 S. Seventeenth St.
Paducah, Ky. P.O. Box 1001, 231 S. Fourth St.
Pasco, Wash. 421 W. Clark St.
Peoria 2, Ill. 309 Jefferson Bldg.

Philadelphia 2, Pa. 1405 Locust St.
Phoenix, Ariz. P.O. Box 4037, 303 Luhrs Tower
Pittsburgh 22, Pa. 535 Smithfield St.
Portland 3, Maine. 477 Congress St.
Portland 7, Ore. 920 S.W. Sixth Ave.
Portsmouth, Ohio. P.O. Box 37, 721 Sixth St.
Providence 3, R. I. Industrial Trust Bldg.
Raleigh, N. C. 336 Fayetteville St.
Reading, Pa. 31 N. Sixth St.
Richmond 17, Va. 700 E. Franklin St.
Riverside, Calif. 3808 Main St.
Roanoke 16, Va. 920-924 S. Jefferson St.
Rochester 4, N. Y. 89 E. Ave.
Rockford, Ill. 110 S. First St.
Rutland, Vt. 38 1/2 Center St.
Sacramento 14, Calif. 626 Forum Bldg.
Saginaw, Mich. 501 Bearinger Bldg.
St. Louis 2, Mo. 112 N. Fourth St.
Salt Lake City 9, Utah. 200 S. Main St.
San Antonio 5, Texas. 310 S. St. Mary's St.
San Diego 1, Calif. 1240 Seventh Ave.
San Francisco 6, Calif. 235 Montgomery St.
San Jose 10, Calif. 460 Park Ave.
Savannah, Ga. 4 E. Bryan St.
Seattle 4, Wash. 710 Second Ave.
Shreveport, La. 910 Shelby Bldg.
Sioux City 13, Iowa. 572 Orpheum Electric Bldg.
Sioux Falls, S. D. 306 South Phillips Ave.
South Bend 1, Ind. 112 W. Jefferson Blvd.
Spokane 8, Wash. S. 162 Post St.
Springfield, Ill. 607 E. Adams St.
Springfield 3, Mass. 1387 Main St.
Stockton, Calif. 11 So. San Joaquin St.
Syracuse 2, N. Y. 113 S. Salina St.
Tacoma 1, Wash. 1202 Washington Bldg.
Tampa 6, Fla. 1206 North A St.
Toledo 4, Ohio. 420 Madison Ave.
Trenton 8, N. J. 214 E. Hanover St.
Tulsa 3, Okla. 320 S. Boston Ave.
Tucson, Ariz. P.O. Box 710, 650 N. Sixth Ave.
Utica 2, N. Y. 258 Genesee St.
Washington 5, D.C. 777-14th St., N.W.
Waterbury 89, Conn. 111 W. Main St.
Waterloo, Iowa. 206 W. 4th St.
Wenatchee, Wash. 328 N. Wenatchee Ave.
Wheeling, W. Va. 40 Fourteenth St.
Wichita 2, Kan. 200 E. First St.
Williamston, N. C. 115 E. Main St.
Wilmington 98, Del. 1326 N. Market St.
Worcester 8, Mass. 507 Main St.
York, Pa. 56 N. Harrison St.
Youngstown 5, Ohio. 272 E. Indianola Ave.

Hawaii: American Factors, Ltd., P. O. Box 3230, Honolulu 1

Canada: Canadian General Electric Company, Ltd., Toronto

GENERAL ELECTRIC



INSTRUCTIONS

GEH-790Q
Supersedes GEH-790P

HORIZONTAL, POLYPHASE INDUCTION MOTORS

SQUIRREL CAGE AND WOUND ROTOR—OPEN AND SPLASHPROOF
FRAMES 203 TO 579 INCLUSIVE AND FRAMES 6323 TO 6359 INCLUSIVE

INSTALLATION

Location

1. **OPEN MOTORS.** Install in a clean, well-ventilated place. If motors are stored, store in a clean, dry place.

2. **SPLASHPROOF MOTORS.** Where a choice of locations is possible, locate the motor so that it will be subjected to the least amount of splashing.

Lifting

When lifting a motor, it is advisable to lift by means of slings placed under the bearing housings.

Floor Mounting

1. **FOUNDATION** should be rigid and solid. Level the motor base (or motor). A motor base on a concrete foundation should be grouted in place.

Wall or Ceiling Mounting

1. **OIL-LUBRICATED, SLEEVE-BEARING MOTORS** (may be identified by spring-cover sight hole on top of bearing housing): End shields should be located with oil-filler gage in horizontal position below the center of the shaft.

2. **GREASE-LUBRICATED, BALL-BEARING MOTORS** (may be identified by pressure-grease fitting on top of bearing housing): End shields should be located with pressure-gun fitting on top as close to vertical as the bolt holes permit.

Note: Screenless open-type textile motors are not designed to permit end shield rotation for wall or ceiling mounting.

Tilted and Vertical Mounting

1. **SLEEVE-BEARING, OIL-LUBRICATED MOTORS** should always be mounted with the shaft horizontal.

2. **GREASE-LUBRICATED, BALL-BEARING MOTORS** in Frames 203-505 (incl) may be operated in any position, provided excessive thrust loads are not imposed.

Motors in Frames 6323 and larger should have the bearings modified for vertical operation.

Face or Flange Mounting

Carefully align the motor with the driven unit and securely bolt into place.

Alignment

Always align accurately with the driven unit. When aligning an adjustable base, allow for movement, and locate the adjusting screwhead away from the driven unit.

Coupled Drive

When the motor and driven unit together have four or more bearings, flexible couplings may be used to facilitate alignment. Three-bearing construction requires rigid coupling.

Belt and Chain Drives

To avoid overstressing of motor bearings and belts, or chains, use pulley sheaves or sprockets no smaller than those recommended by belt or chain manufacturers and the General Electric Company.

Flat Belt Drive

Arrange the location of the driving and driven shaft so that they are parallel. Adjust belt tension just enough to prevent slippage; excess tension unnecessarily loads the bearings. Avoid a vertical drive; an angle of 45 degrees or less

between the line of shaft centers and the horizontal is desirable. Distance between centers should be at least $2\frac{1}{2}$ times the diameter of the larger pulley unless a belt-tightener attachment is used. Pulley ratio should not exceed 5 to 1. Belt speed should not exceed 5000 feet per minute. If possible, make the lower side of belt the driving side. Run the grain or smooth side of the belt on the pulleys.

"V" Belt Drive

Align the sheaves carefully to avoid axial thrust on the bearings. Adjust belt tension just enough to prevent excessive bow of the slack side. "V" belts do not require as much tension as flat belts. If possible, make the lower side of belt the driving side. Pulley ratio should not exceed 8 to 1. Belt speeds should not exceed 5000 feet per minute, unless otherwise recommended by belt manufacturer.

Chain Drive

Align sprockets and adjust chain just enough to permit a slight sag on the slack side. Avoid vertical drive; an angle of 45 degrees or less between the line of shaft centers and the horizontal is desirable. The distance between shaft centers should not be less than the diameter of the larger sprocket plus the radius of the smaller. Consult the chain manufacturer for maximum ratio speed and lubrication of the chain.

Gear Drive

Motor should be ball-bearing type for helical gear since they impose axial thrust on the bearings. The pinion diameter should not be less than that recommended by the General Electric Company. When quiet gear drive is desired, Textolite* pinions with helical teeth should be used.

* Reg. trade-mark of General Electric Company.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

GENERAL  ELECTRIC

service, the brushes should be set down on the collector surface; clean off slush before seating brushes.

Keep the rings clean and maintain their polished surfaces. Ordinarily the rings will require only occasional wiping with a piece of canvas or nonlinting cloth. Do not let dust or dirt accumulate between the collector rings.

Brushes (Wound-rotor Motors Only)

See that the brushes move freely in the holders and at the same time make firm, even contact with the collector rings. The pressure should be between 2 and 3 pounds per square inch of brush surface.

When installing new brushes, fit them carefully to the collector rings. Be sure that the copper pigtail conductors are securely fastened to, and make good contact with, the brush holders.

Locating Troubles

If trouble is experienced in the operation of a motor, make sure that:

1. The bearings are in good condition and are lubricated properly.
2. There is no mechanical obstruction preventing rotation.
3. The air gap is substantially uniform.
4. All bolts and nuts are tightened securely.

In checking for electrical troubles, be sure:

1. That voltage is actually available in all phases at the motor terminals.
2. That line voltage and frequency correspond to the values stamped on the motor nameplate. (Refer to paragraph on "Allowable Voltage and Frequency Range.")

3. That the overload protective devices are in proper condition.

4. That all connections and contacts are properly made in the circuits between the control apparatus and the motor.

5. That the motor is not excessively overloaded. This may be checked by comparing line amperes with the full-load ampere rating stamped on the nameplate.

RENEWAL PARTS

When ordering renewal parts give quantity, catalog number if available, description of each item required, and the model number of the motor.

Requests for additional copies of these instructions or inquiries for specific information should be addressed to the nearest sales office of the General Electric Company.

MEDIUM INDUCTION MOTOR DEPARTMENT

GENERAL  **ELECTRIC**

SCHENECTADY, N. Y.