GENERAL ELECTRIC

DESCRIPTIVE SPECIFICATION

RA-3331-C

50-KW FREQUENCY-MODULATION

BROADCAST AMPLIFIER

G-E MODEL 4AF4A1

FN-412 (3-38)

DESCRIPTIVE SPECIFICATION

RA-3331-C

50-KW FREQUENCY-MODULATION BROADCAST AMPLIFIER

G-E MODEL 4AF4A1

FREQUENCY RANGE

40 TO 50 MEGACYCLES

GENERAL ELECTRIC CO.
SCHENECTADY, N.Y.

NOVEMBER 1943

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I. INTRODUCTORY

These specifications cover the necessary units of radio transmitting equipment and associated apparatus for amplifying frequency-modulated radio-frequency power, obtained from a driver stage, to an output level of 50 kilowatts, and for taking power from a suitable alternating-current supply line to furnish this output. Reference should be made to Photograph 578502 and block diagram K-7876469 attached.

The units of radio transmitting equipment described herein are as follows:

50-Kw Amplifier Unit
Rectifier Unit
Control Unit
Control Console

The following external apparatus is also included:

Main-rectifier Plate Transformer
Water-cooling Unit

II. TUBE COMPLEMENT

Quantity	Type	Function
2	GL-880	50-Kw R-F Amplifier
6*	GL-869-B	Main Rectifier
2	GL-866-A	Bias Rectifier
1	83-V	Carrier Rectifier
1	83	Feed-back Rectifier
1	6AC7	Feed-back Amplifier
2	6L6	Feed-back Modulator

*Mounting is provided for an additional inactive GL-869-B tube in the "heater" position.

The Type GL-880 vacuum tube is a recent General Electric development and is specially designed for high-power, high-frequency operation. This tube is shown in the enclosed Photograph 569597 and the

ratings are given in the enclosed Description and Rating GET-918-A.

III. POWER SUPPLY

This amplifying equipment is designed to operate from a 230-volt, 60-cycle, 3-phase, 3-wire supply. The line voltage should not vary more than ±5 per cent, due to regulation and other causes. Approximately 109 kw total input power is required at 95 per cent power factor, not including power for exciter and IPA units.

It is required that the customer provide a disconnect switch or circuit breaker, with inverse-time overload protection, in the input power circuit external to the transmitter and such other apparatus as may be required by local underwriter's regulations. This will permit all power to be readily removed from the equipment when desired. This switch (or switches) should remove all power from the station except for lights and small auxiliaries.

It is assumed that all substation equipment and power-line metering will be external to the transmitter; such equipment is not covered by these specifications.

IV. PERFORMANCE SPECIFICATIONS

A. Output Power

The rated power output of this equipment is 50 kw. The output remains the same as that of the unmodulated carrier for all percentages of modulation from 0 to 100 per cent. This rating differs from that used for amplitude modulation; in the latter case the unmodulated carrier power is used for the nominal rating and the peak power capability of the output R-F stage for 100 per cent modulation must be four times the carrier power.

B. Output Frequency Range

This amplifying equipment is designed to operate on a single mean frequency in the range from 40 to 50 mc, but all tuned circuits can be

adjusted to operate at any frequency within this band. The frequency stability is the same as that of the customer's R-F driver unit.

C. R-F Driving Power

This amplifying equipment is designed to operate successfully with 3000 watts of frequency-modulated R-F driving power at the grid input terminals.

D. Percentage Modulation (Frequency Deviation)

The amount of deviation of the carrier frequency to produce frequency modulation is determined in the R-F driver unit. This amount of deviation is unchanged by the 50-kw amplifier stage. ±75 kc deviation has been standardized as "100 per cent modulation."

E. Audio-frequency Response and Harmonic Distortion

Both of these characteristics are determined by the R-F driver unit, and are not appreciably affected by the 50-kw amplifier stage.

F. Carrier Noise Level

The residual carrier-noise "hum" level, with no applied modulation, must be considered in two parts: that due to undesired frequency modulation and that due to undesired amplitude modulation.

The frequency-modulated carrier noise is produced in or ahead of the frequency modulator and is not affected by the 50-kw amplifier stage.

Residual amplitude-modulated carrier noise or hum is at least 60 DB below 100 per cent amplitude modulation. It is to be noted that amplitude-modulated noise will be completely inaudible on a frequency-modulation receiver using a limiter.

G. R-F Harmonics

The kva/kw ratio of the output tank circuit is sufficient to reduce radiated harmonics in accordance with good engineering practice. The use of a push-pull output stage minimizes all even-order harmonics. Due to the difficulty of measuring harmonic field intensities at ultra-high-frequencies and due to their dependence on installation conditions inherent to a particular location, no harmonic intensity values can be given herein.

H. R-F Coupling Circuits

The grid excitation power for the 50-kw amplifier should be introduced at the left of the unit over a balanced line consisting of two concentric lines having a surge impedance of 120 to 200 ohms, or a 2-wire shielded line having equivalent characteristics.

The PA output transmission line should be connected either through the top or back of the 50-kw unit and should be a balanced line consisting of two concentric lines having a combined surge impedance of 120 to 200 ohms, or a 2-wire shielded line having equivalent characteristics. Two 2 5/8 in. concentric R-F lines are recommended.

V. ECONOMICS OF OPERATION

The economies resulting from the use of frequency modulation, as compared to any conventional system, are nowhere better demonstrated than in the use of transmitting equipment operating at comparatively high power level. Among these economies are the following:

A. Lower power consumption from power line (109 kw for amplifier) and smaller transformer capacity in substation, because:

1. No high-level modulator is required.

2. R-F amplifier tubes operate at Class "C" telegraph rating, resulting in higher plate efficiency.

B. Initial and replacement tube costs are lower, because:

1. No high-level modulator is required.

2. Smaller R-F tubes can be used for a given power output because of high plate efficiency and high power output per tube possible when operating at Class "C" telegraph rating.

C. A smaller cooling system is required due to low plate dissipation when operating tubes at Class "C" telegraph rating.

D. The transmitter as a whole is smaller, simpler and hence more reliable due to the design features noted above.

VI. CONTINUITY OF SERVICE

Precautions have been taken in the design of this equipment to provide conservative operation of all components, reliability, simplicity of operation and control, flexibility, and means of quickly locating and correcting troubles.

Protective devices are provided throughout the equipment so that apparatus is protected both against severe overload and against transient phemomena which may be caused by power line surges. Visual indicators and instruments make it possible to observe conditions in the radio, control and power circuits.

The automatic recloser for the main-rectifier plate circuit, described in Section VIII-C, provides for a minimum of lost time in case of a-c or d-c rectifier overloads.

Two solenoid-operated DPDT switches make it possible to operate using the output of the driver unit, should it become necessary to service any of the PA equipment during normal operation. The solenoids are operated by a switch located on the control console.

Mounting for a spare "heater" tube is provided in the main rectifier so as to minimize the lost time in case a rectifier tube must be changed during operation.

VII. MECHANICAL CONSTRUCTION

A. General

The appearance of the front panels of a complete G-E Type GF-150-B 50-kw transmitter is shown in attached Photograph 578502. The tube mountings and associated apparatus are built into units with metal front panels on which are mounted indicating instruments and controls. The R-F unit is completely shielded. The rectifier and PA units are enclosed on all sides to prevent accidental contact with high voltage.

Considerable flexibility is permitted in the location of transmitter units to meet installation requirements. The units which are provided with panels should, however, be placed in line, or on two sides of a rectangle if desired.

The units having front panels are as follows:

50-Kw Amplifier Unit
Rectifier Unit
Control Unit

The approximate over-all dimensions of all units are shown on "Installation requirements" Drawing T-7661373 attached. This drawing also includes dimensions of the 250-watt exciter and 3-kw IPA with the 50-kw amplifier so as to form a complete Type GF-150-B transmitter.

B. 50-Kw Amplifier Unit

The 50-kw amplifier is a completely enclosed unit containing tube mountings with their associated R-F circuits, air blower, meters, R-F controls, filament supply water-flow and temperature interlocks, valves and overload relays.

This unit is provided with two full-length access doors, both front and rear. These doors are provided with safety interlocks and with safety grounding switches described in the section on SAFETY TO OPERATING PERSONNEL. The tuning controls are operable from the front of the panel with power on, but are concealed behind small drop doors during normal operation.

C. Rectifier Unit

The Rectifier Unit contains six tube mountings for the active GL-869-B rectifier tubes, with individual filament transformers and arc-back indicators, and also the small bias rectifier.

A mounting for a spare Type GL-869-B tube is also provided. The spare-tube mounting is furnished so that a rectifier tube may be kept at operating temperature ready for immediate substitution for any active rectifier tube.

Access to active tubes is through full-length doors. However, only the spare tube is accessible with power on (without high-voltage hazard). All tubes and arc-back indicators are visible through grills with power applied. The arc-back indicators may be reset from the front panel with power on. The access doors are provided with safety interlocks and safety-grounding switches. The functions of these safety devices are described in the section on SAFETY TO OPERATING PERSONNEL.

D. Control Unit

Circuit-breaker type switches for the various low-current branch circuits operating at 230 volts are mounted behind small drop doors. This type of switch combines adequate overload protection, convenience and ease of operation by manual reset. No fuses are used in the equipment. The various control and timing relays associated with the automatic control circuit are located on insulating panels.

The rectifier-starter contains the rectifier "start", "step" and "run" contactors, plate-starting resistors, current transformers and overload relays for a-c overcurrent protection of the rectifier.

E. Plate Transformer

The main rectifier plate transformer is designed for outdoor service. It is provided with three low-voltage, tap-changing switches with handles brought out. High-voltage and low-voltage air-filled junction boxes are provided on opposite sides of the tank with wiping sleeves for three-conductor high-voltage cable and three single-conductor low-voltage cables. The approximate dimensions are 57 in. by 32 in. by 71 in. high, and the approximate weight is 3200 lb with oil, or 60 in. by 38 in. by 75 in. high with an approximate weight of 4500 lb with Pyranol. When Pyranol is used, this transformer may be mounted indoors without use of a special fire vault, because Pyranol is noninflammable. The Pyranol transformer will be furnished at a slight increase in price.

F. Water Cooling and Circulating Apparatus

A closed-circuit cooling system is used for carrying away the heat dissipated by the water-cooled tubes in the 50-kw amplifier.

All the units of the water circulating and cooling system are mounted in a single, compact assembly, the approximate dimensions and weight of which is shown on attached Drawing T-7661373. This assembly contains a water pump and motor, a radiator-blower type heat exchanger with driving motor and a 100-gallon copper water-storage tank. Provision is made in the assembly for mounting and connecting a spare pump (material not furnished except on special order). All the necessary internal piping, valves and wiring are included.

External pipe and fittings are to be supplied by the customer. Streamlined copper pipe and fittings are recommended. It is assumed that the temperature of the water will be maintained above freezing at all times to protect the water system.

G. Control Console

This unit consists of a metal desk on which are mounted the most-used transmitter controls and monitoring devices conveniently accessible to the operator. The Control Console is designed to harmonize in appearance with the other units of transmitting equipment.

VIII. CIRCUITS

A. 50-Kw Amplifier

The 50-Kw Amplifier operates Class "C" and utilizes two Type GL-880 water-cooled tubes in a balanced push-pull circuit, enabling power to be supplied to the output tank circuit during each half of the radio-frequency cycle. This type of circuit, used with a quarter-wave, resonant-line plate-tank circuit, results in high plate efficiency. A similar resonant line is used for the grid-tank circuit.

The following R-F circuit controls are provided:

Vernier grid-line tuning
Vernier plate-line tuning
Neutralizing (2)
Output coupling
Output tuning

A low-power feed-back amplifier is used to realize an amplitude-modulated carrier noise at least 60 DB below 100 per cent amplitude modulation. By use of this system, it is still possible to use alternating current for heating of the PA tube filaments.

The initial inrush of filament current is limited to a safe value by the use of suitable high-reactance filament transformers, one per tube. A plate-overload relay is used for each tube. Individual tube water-flow and water-temperature indicators with electrical interlocks are provided.

Instruments are provided to indicate individual plate currents, individual grid currents, R-F transmission-line current, filament voltage and tube hours.

B. Power and Rectifier Circuits

The main 230-volt, 3-phase incoming power circuit is connected through the rectifier plate starter to the plate transformer primary. A low-current branch of the incoming power circuit is connected to a distribution panel, where feeders to the various auxiliaries are connected through switches. Switches permit manual step-by-step starting and stopping of the equipment without fully automatic control circuit operation, when desired.

The main rectifier uses six Type GL-869-B hot cathode, mercury-vapor rectifier tubes in a three-phase, full-wave circuit to give a d-c output of approximately 7.5 kv. Three tap switches on the primary of the plate transformer provide a means of changing the d-c output voltage in steps which are approximately 50, 75, 95, 100, and 105 per cent of normal. The step-starter prevents full plate voltage from being suddenly applied to the rectifier tubes when loaded.

A bias rectifier for the 50-kw amplifier is located in the Rectifier Unit. This bias rectifier uses two Type GL-866-A hot-cathode, mercury-vapor tubes in a single-phase, full-wave circuit.

There are two filament circuits in this equipment, one for the R-F tubes and one for the rectifier tubes, since the latter require a longer heating time before operation. Each circuit has a master filament voltmeter, filament voltage control and tube-life meter. Rheostats associated with the R-F filament supply are located in the PA Unit and those for the rectifier are in the Rectifier Unit.

A PA plate voltmeter, PA total plate ammeter, grid bias voltmeter, line voltmeter and rectifier line ammeter are, also, included on the rectifier panel.

C. Control Circuits

All units of the amplifier equipment are interconnected and operated by a control system which permits either manual step-by-step manipulation, semi-automatic control or completely automatic control. In the second case, one "start" and one "stop" button control all circuits up to the main rectifier plate. A second "start" and "stop" button control the application of the plate voltage to the main rectifier. The various circuits are interlocked so that each successive operation takes place in proper sequence. Complete protection to apparatus and operating personnel is provided by the control system.

Protective devices guard against rectifier filament undervoltage, overheated cooling water, stoppage of cooling water, failure of blower, main rectifier and R-F uniter overloads and improper circuit adjustments. Indicating lights and instruments in the various circuits afford means for detecting unusual conditions.

The main-rectifier plate-starting control circuit is provided with an automatic-reclosing relay. This relay will provide one immediate reclosure if the plate contactor is opened due to a-c or d-c overload, provided that plate voltage has been applied at least 15 seconds. If the overload relays again open the plate contactor, plate voltage may be reapplied manually by pushing the "plate on" switch; however, if no overload occurs within 15 seconds of the reclosure, the reclosing relay is automatically ready for another reclosure in case of overload. A d-c over-current relay is provided for each R-F tube and two a-c over-current relays are provided in the main rectifier three-phase supply line.

A pick-up circuit loosely coupled to the 50-kw amplifier tank, using a Type 83-V rectifier tube, furnishes rectifier power for operation of a "carrier-off" alarm signal; contacts are provided for the connection of external "carrier-off-time" electric clocks which are located in the control console.

5. Control Console

In this unit controls and indicator devices are provided for the following functions:

1. Master transmitter control "start-stop" push-button switches for fully automatic operation.

2. 3 sets of plate "on-off" push-button switches for exciter, driver and 50-kw PA.

3. "Step-by-step" control transfer switch.

4. "Automatic semi-automatic" control transfer switch.

5. A cut-back control switch to shift the R-F output transmission lines from the 50-kw PA to the 3-kw driver unit in case of PA outage.

6. Monitor-amplifier audio-level control.

7. A three-position, audio monitor input selector switch.

8. Transmitter starting and stopping status indicator lights.

9. Three Telechron clocks are provided connected so that one indicates standard time, one indicates time of carrier failure and the third indicates total time of carrier-off in case of an outage of the set during operation. A reset push button is provided to restart the "time-of-carrier-failure" clock.

The indicator light associated with each push-button switch is located inside the push button. The push buttons are appropriately colored and semitransparent.

IX. SAFETY TO OPERATING PERSONNEL

The grounded-metal front panels and complete enclosure of the units with grounded metal effectively prevent the operating personnel from coming in contact with dangerous voltages. As a further safety precaution, lead-covered cable (rather than copper tubing) is to be

used for the high-voltage connections from the plate transformer to the main rectifier.

Each access door on the R-F amplifier and rectifier units is equipped with a "safety-switch." When a door is opened, the switch operates to ground or short-circuit all potentials within the unit greater than 230 volts. In addition, each of these doors is provided with an interlock which serves to remove the source of power from all high voltage equipment in case the door is inadvertently opened with power on.

The various door interlocks may be conveniently connected so as to remove plate voltage in the customer's R-F driver unit when any door in the amplifying equipment is opened.

X. MAIN-RECTIFIER A-C INTERFERENCE (T.I.F.)

A rectifier draws a nonsinusoidal wave of current from the a-c supply line. This phenomena is inherent in all rectifiers. These nonsinusoidal waves of current and voltage in the a-c system contain harmonics which may cause interference in wire-line communication circuits so located as to be exposed to the a-c line.

It will generally be found advisable to install a rectifier without specific co-ordinative measures and then observe conditions. Experience to date indicates that specific co-ordinative measures will not be necessary in the majority of cases, particularly on as small a rectifier as is required for this application. However, there have been a few cases in which the customer has found it necessary to provide an a-c filter. Such a filter, if required, must be specially designed for each installation, and is, therefore, not a part of the equipment offered herein.

XI. INSTALLATION AND TEST

It is assumed that this equipment is to be initially tested for compliance with these specifications after installation in the field, and that such tests are to be performed under the supervision of

a General Electric engineer. It is also assumed that, in familiarizing themselves with the equipment, the customer's operating staff will be available to carry out the necessary tests under the G-E engineer's direction.

If preferred, the equipment may be purchased with complete factory test at increased price and longer delivery time.

It is assumed that the mechanical installation and wiring will be performed by the customer, in accordance with suitable drawings and instruction books furnished with the equipment, without G-E supervisory service other than a conference at the station site to discuss the drawings and make recommendations.

XII. DRAWINGS AND INSTRUCTION BOOKS

Two sets of installation drawings and photographs are furnished. These are in sufficient detail to permit reassembly of any parts disassembled for shipment. They also show over-all dimensions of units and location of terminal boards, R-F line connections, and pipe connections. The external connection diagram or running list shows all interunit wiring and recommended wire size, insulation and terminals. The water-piping schematic diagram shows all external piping, valves, etc., together with recommended sizes.

Two copies of the instruction book are furnished. This book contains the following information:

Description of equipment
Installation instructions
Analysis of operation
Safety precautions
Initial adjustments
List of renewal parts
Descriptive bulletins on component parts
Vacuum tube pamphlets
Complete schematic diagram
Internal and external wiring diagrams or running lists.

XIII. APPARATUS TO BE FURNISHED BY CUSTOMER

The following apparatus is to be furnished by the customer:

1. Substation and associated apparatus. (See Section III of these specifications.)
2. A-c interference (T.I.F.) filter, if needed. (See Section X of these specifications.)
3. 3-kw frequency-modulated R-F driver and input R-F transmission lines to the 50-kw amplifier.
4. R-F output transmission lines, matching networks and antenna.
5. External cable and terminals.
6. Water piping and hardware.
7. Frequency monitoring equipment.

The General Electric Company is in a position to furnish recommendations and quotations on any or all of the above items. However, the nature of each depends on local conditions and customer's preference. Such recommendations and quotations will be promptly furnished on receipt of customer's requirements.

XIV. COMPLIANCE WITH F.C.C. "GOOD ENGINEERING PRACTICE" REQUIREMENTS

The equipment covered by these specifications fully complies with the Federal Communications Commission STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING HIGH FREQUENCY BROADCAST STATIONS issued June 29, 1940.

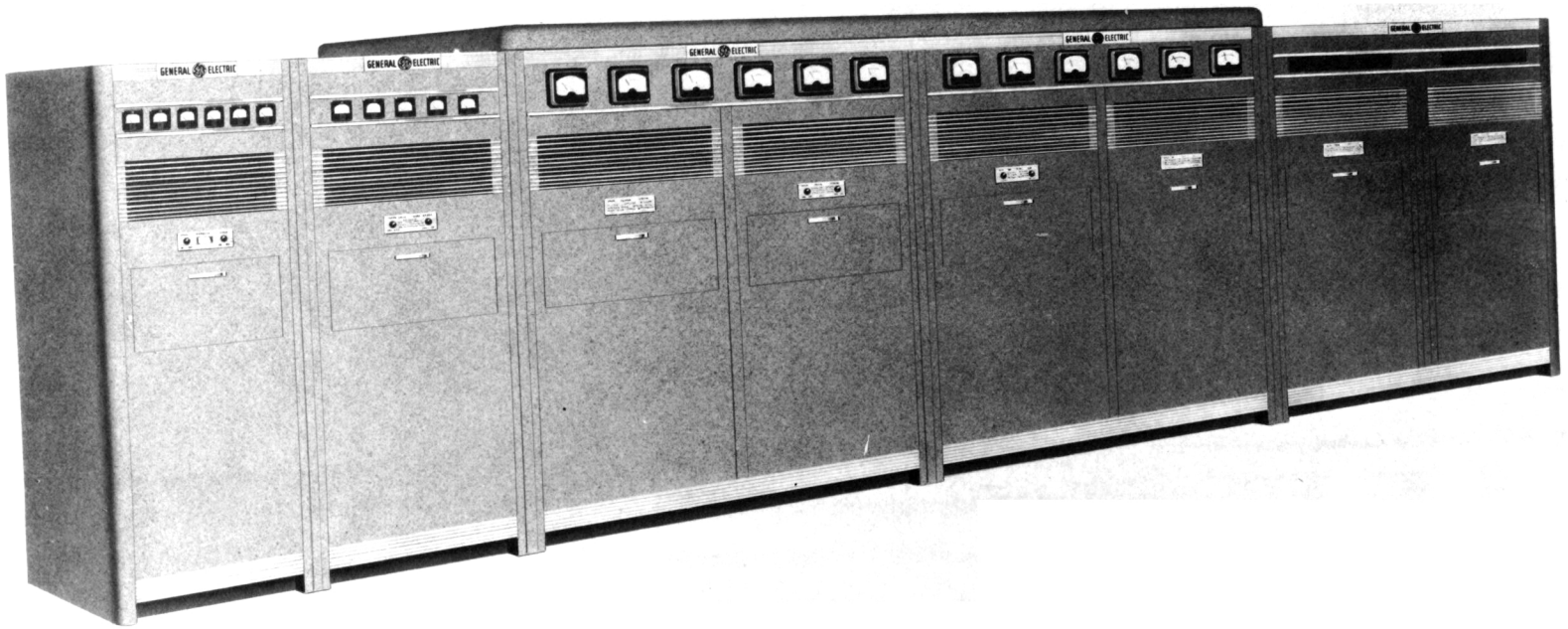
XV. SCOPE OF SPECIFICATION

In the construction of the equipment described above, the full intent of these specifications will be met. However, it is assumed that any departures from it, desirable for reasons of improved design or operation, will be permissible.

XVI. ENCLOSURES

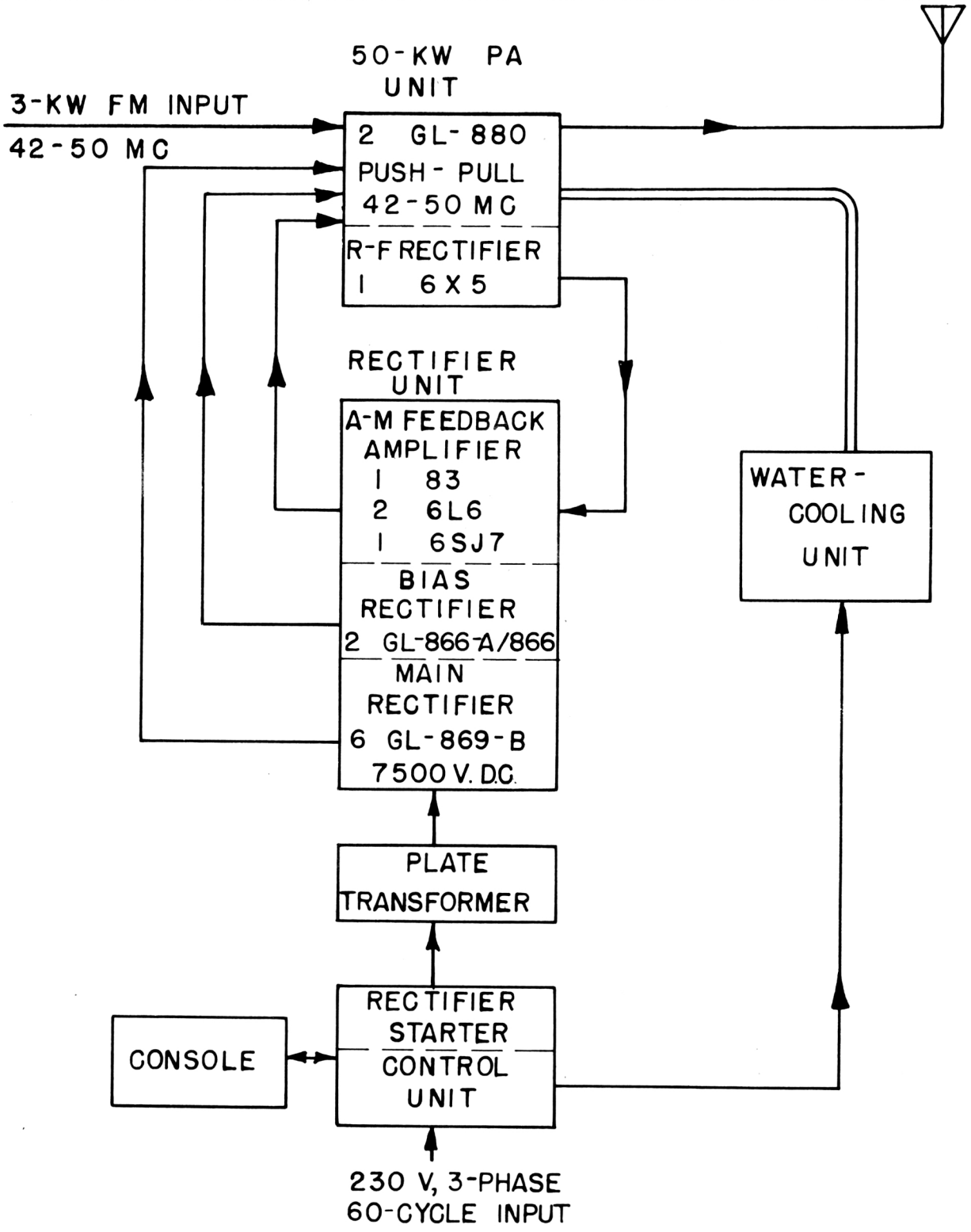
The following enclosures form a part of this specification:

578502	Photograph, complete G-E 50-Kw F-M Transmitter, Type GF-150-B (9-25-40).
K-7876469	Block Diagram (11-11-40).
T-7661373	Installation requirements drawing for complete G-E 50-Kw F-M Transmitter, Type GF-150-B (11-11-40).
GET-918-A	Description and Rating, G-E Transmitting Tube, Type GL-880 (7-40).
569597	Photograph, G-E Transmitting Tube, Type GL-880 (4-21-39).



578502 G-E FREQUENCY-MODULATION (FM) RADIO BROADCAST TRANSMITTER, 50,000 WATTS, TYPE GF-150-D. OBLIQUE FRONT VIEW (FROM LEFT).

FILING NO.6914 621.384 C 9-25-40



50-KW FM BROADCAST AMPLIFIER EQUIPMENT

G-E TYPE AF-4-A

K-78 76469

3 Jan 5, 1942 J B Rolfe GR 5818 REVISIONS	MADE BY H L FRANK JAN. 5, 1940	RE INSPECTED BY Jan 6, 1942.	R
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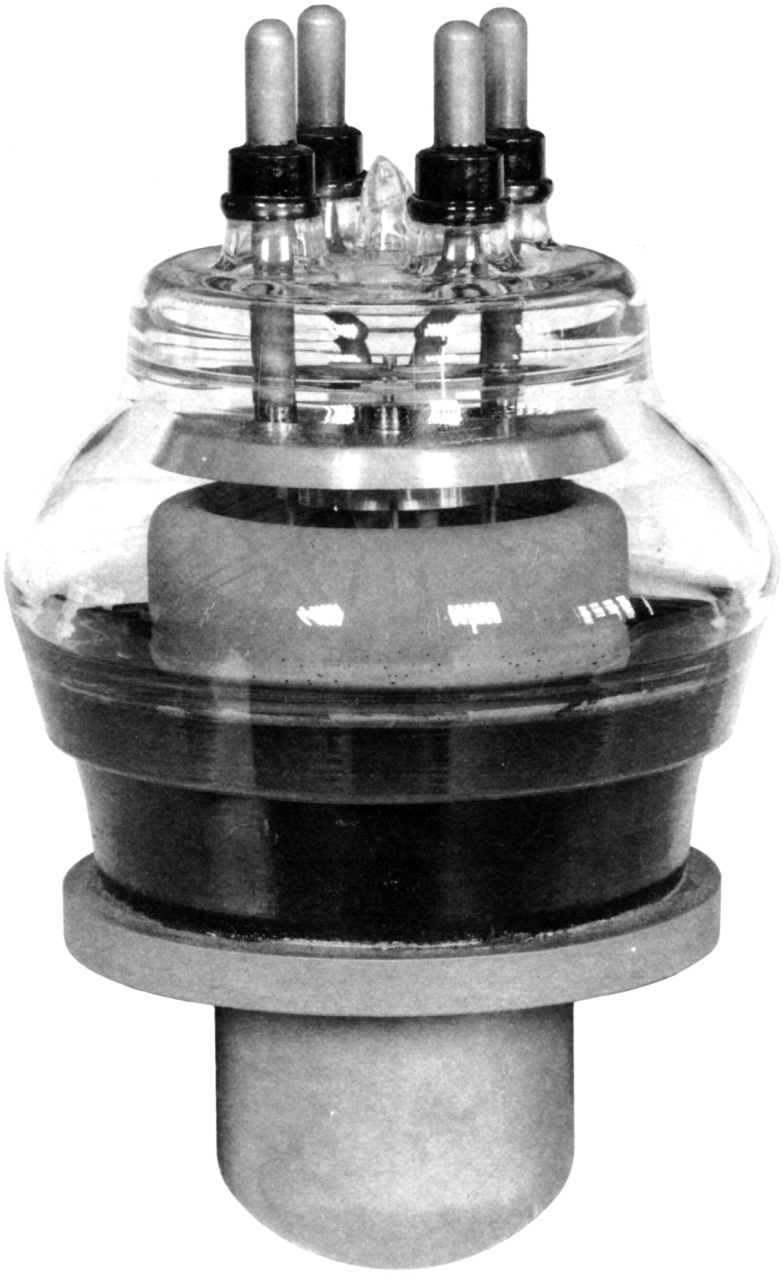
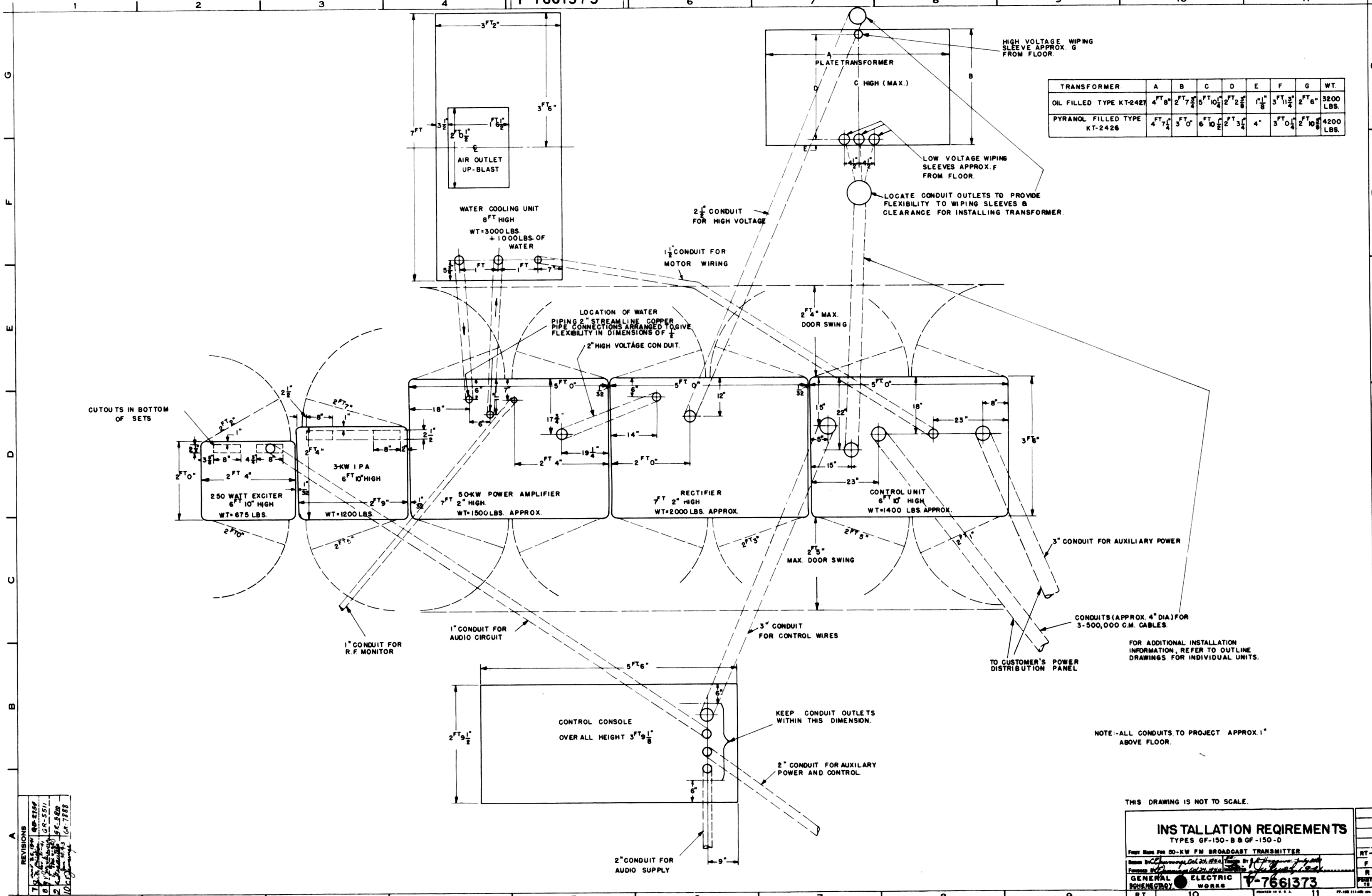


569597

G-E PLIOTRON TUBE, TYPE GL-880.

FILING NO. 8850 E339 4-21-39



TRANSFORMER	A	B	C	D	E	F	G	WT.
OIL FILLED TYPE KT-2427	4FT 8"	2FT 7 3/4"	5FT 10 1/4"	2FT 2 3/8"	1 1/8"	3FT 11 3/4"	2FT 6"	3200 LBS.
PYRANOL FILLED TYPE KT-2426	4FT 7 1/4"	3FT 0"	6FT 10 1/2"	2FT 3 1/4"	4"	3FT 0 1/4"	2FT 10 5/8"	4200 LBS.

FOR ADDITIONAL INSTALLATION INFORMATION, REFER TO OUTLINE DRAWINGS FOR INDIVIDUAL UNITS.

NOTE:- ALL CONDUITS TO PROJECT APPROX. 1" ABOVE FLOOR.

THIS DRAWING IS NOT TO SCALE.

INSTALLATION REQIREMENTS
TYPES GF-150-B & GF-150-D
First Made For 50-KW FM BROADCAST TRANSMITTER

GENERAL ELECTRIC
SCHENECTADY WORKS

T-7661373

GENERAL ELECTRIC

Transmitting Tube GL-880 - - Description and Rating

TECHNICAL INFORMATION

The 880 is a three-electrode power tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. The plate is water-cooled and is capable of dissipating 12 to 20 kw, depending upon the class of service. The design of the terminal mount connections and the introverted anode minimize lead inductance and make the tube particularly suitable for high-frequency applications.

These data are for reference only. For design information see the specifications.

GENERAL CHARACTERISTICS:

ELECTRICAL	
Filament Voltage	12.6 Volts
Filament Current	320 Amperes
Amplification Factor	20
Grid-plate Transconductance, I_b = 2.0	21000 Micromhos
Direct Interelectrode Capacitances, mmfd	
Grid-plate	26
Grid-filament	29
Plate-filament	2.6
MECHANICAL	
Gasket	Cat. No. P5182028P1
Type of Cooling	Water and Forced Air
Water Flow	12-20 Gallons per minute
Air Flow	
To Bulb, from a 3-inch Diam Nozzle	20 Cubic feet per minute
Net Weight	7 Pounds
Shipping Weight, approx	21 Pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

CLASS B A-F POWER AMPLIFIER (TWO TUBES):

	Typical Operation		Maximum* Ratings	
D-c Plate Voltage	7500	10000	10500	Volts
Max Signal Plate Current (per tube)†			5	Amperes
D-c Max Signal Plate Input (per tube)†			40	Kilowatts
Plate Dissipation (per tube)†			15	Kilowatts
D-c Grid Voltage	-300	-430		Volts
Peak A-f Grid Input Voltage	1450	1690		Volts
Zero Signal Plate Current	1.0	1.0		Ampere
Max Signal Plate Current	7.0	7.0		Amperes
Max Signal Plate Input†	52	70		Kilowatts
Max Signal Driving Power, approx	250	225		Watts
Effective Load (plate-to-plate)	2200	3200		Ohms
Max Signal Plate Power Output	30	45		Kilowatts

	Typical Operation		Maximum* Ratings	
CLASS B R-F POWER AMPLIFIER:				
Carrier conditions per tube for use with a max modulation factor of 1.0				
D-c Plate Voltage	7500	10000	10500	Volts
D-c Grid Voltage	-310	-430		Volts
D-c Plate Current	3.5	3	4	Amperes
Plate Input			32	Kilowatts
Plate Dissipation			20	Kilowatts
Peak R-f Grid Input Voltage	450	550		Volts
Driving Power‡, approx	500	500		Watts
Plate Power Output	8	10		Kilowatts
CLASS C R-F POWER AMPLIFIER AND OSCILLATOR - PLATE-MODULATED:				
Carrier conditions per tube for use with a max modulation factor of 1.0				
D-c Plate Voltage	7500	10000	10500	Volts
D-c Grid Voltage	-1000	-1200	-1200	Volts
D-c Plate Current	3.0	3.6	3.6	Amperes
D-c Grid Current, approx	0.3	0.5	0.6	Ampere
Plate Input			36	Kilowatts
Plate Dissipation			12	Kilowatts
Peak R-f Grid Input Voltage, approx	1550	1770		Volts
Driving Power, approx	460	880		Watts
Plate Power Output	16	28		Kilowatts

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR:					
Key-down conditions per tube without modulation§					
D-c Plate Voltage	7500	10000	10000	10500	Volts
D-c Grid Voltage	-600	-800	-800	-1200	Volts
D-c Plate Current	5	4.5	6	6	Amperes
D-c Grid Current, approx	0.45	0.4	0.5	0.6	Ampere
Plate Input				60	Kilowatts
Plate Dissipation				20	Kilowatts
Peak R-f Grid Input Voltage, approx	1250	1400	1500		Volts
Driving Power, approx	560	550	750		Watts
Plate Power Output	27	34	45		Kilowatts

† Averaged over any audio-frequency cycle.
‡ At crest of audio-frequency cycle.
§ Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

APPLICATION NOTES

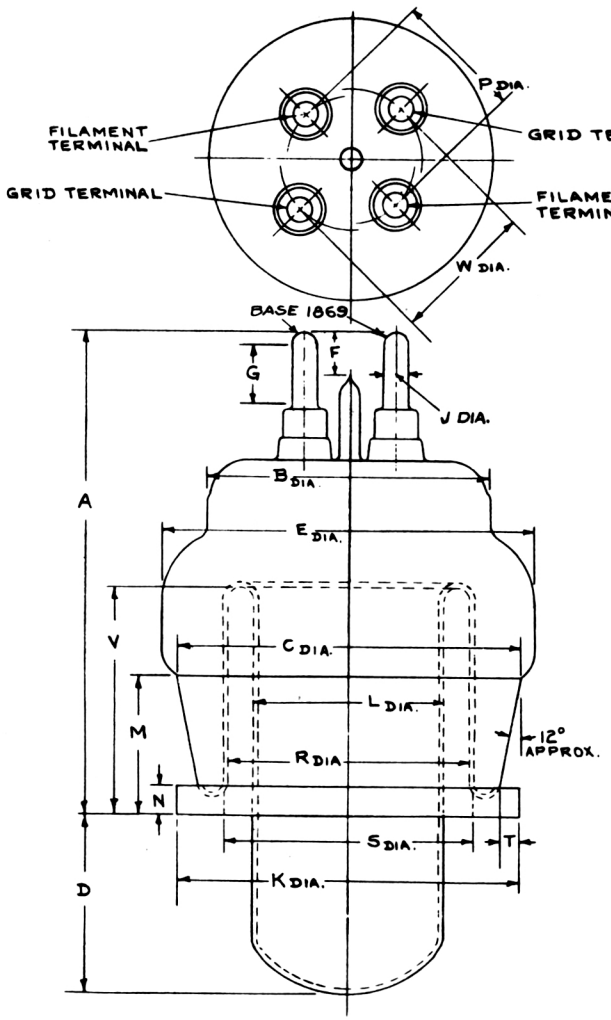
* The GL-880 can be operated at maximum ratings in all classes of service at frequencies as high as 25 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. (Other maximum ratings are the same as shown above.) The tabulation below shows the highest percentage of maximum plate voltage and power input that can be used up to 100 megacycles for the various classes of service. Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency - Mc	25	50	75	100
Class B R-f				
Per Cent Max Plate Voltage	100	80	68	60
Per Cent Max Plate Input	100	94	85	75

Class C Plate-modulated				
Per Cent Max Plate Voltage and Plate Input	100	72	56	45
Class C				
Per Cent Max Plate Voltage and Plate Input	100	75	62	50

Plate Series Protective Resistors (See paragraph describing plate circuit under Installation in the Instructions)

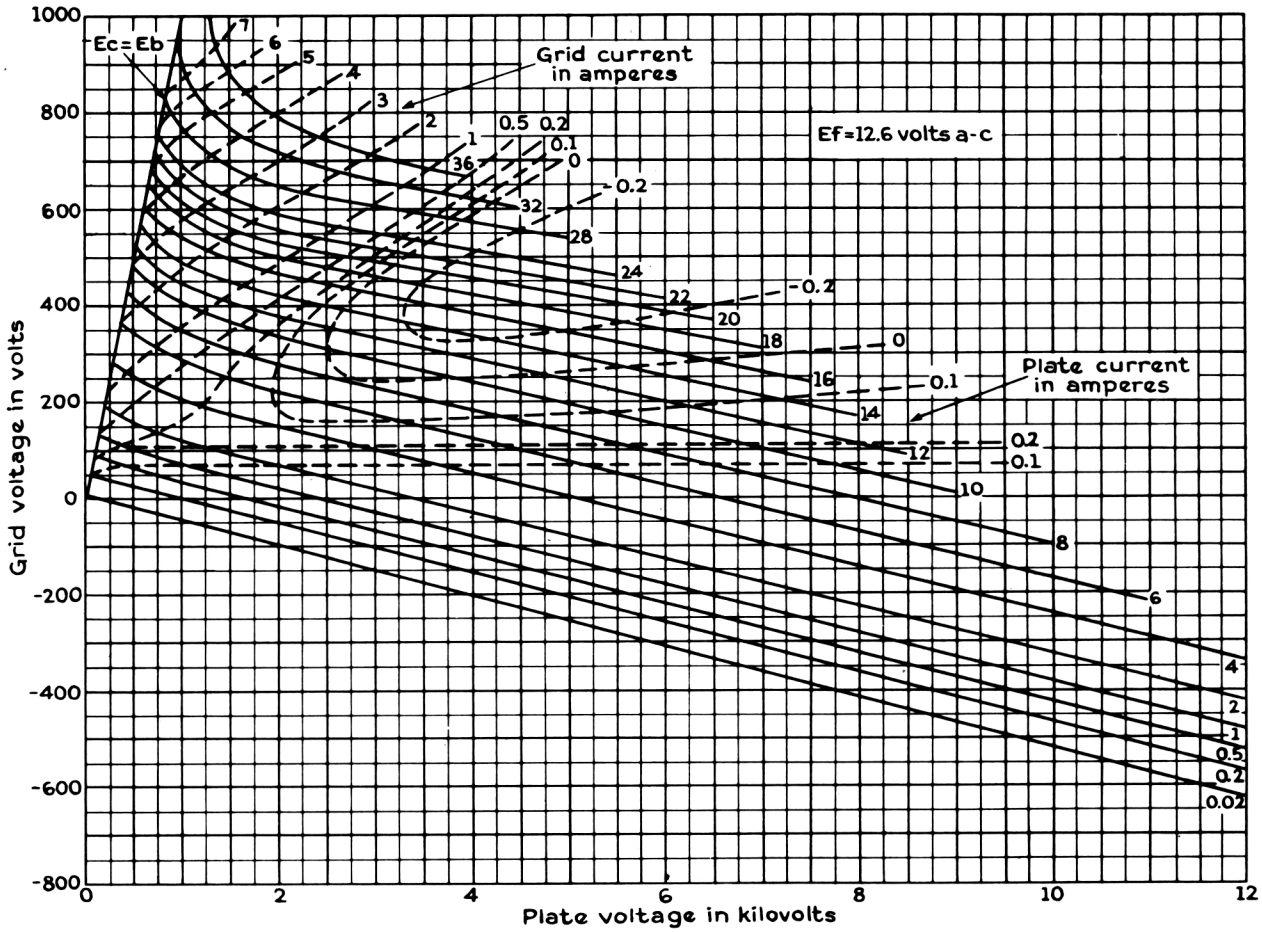
Series Resistor, ohms	10	15	20	30
Maximum Power Output of Rectifier, kilowatts	40	100	250	640



	Max	Min
A	8 3/8	8
B	5	-
C	5 15/16	5 5/8
D	3 1/8	2 7/8
E	7	-
F	-	3/4
*G	-	.650
J	.442	.432
K	5.782	5.718
L	3.225	3.135
M	2 5/8	2
N	.520	.480
P	2 5/32	2 3/32
R	4.107	4.017
S	4.219	4.155
T	-	1/4
V	3 15/16	3 13/16
W	2 1/2	2 1/4

*Available straight side

Outline Transmitting Tube
GL-880
K-5965320 6-18-41



Characteristic Curve
K-7050613 9-1-38

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Supersedes GET-918A

11-41 (3M)
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