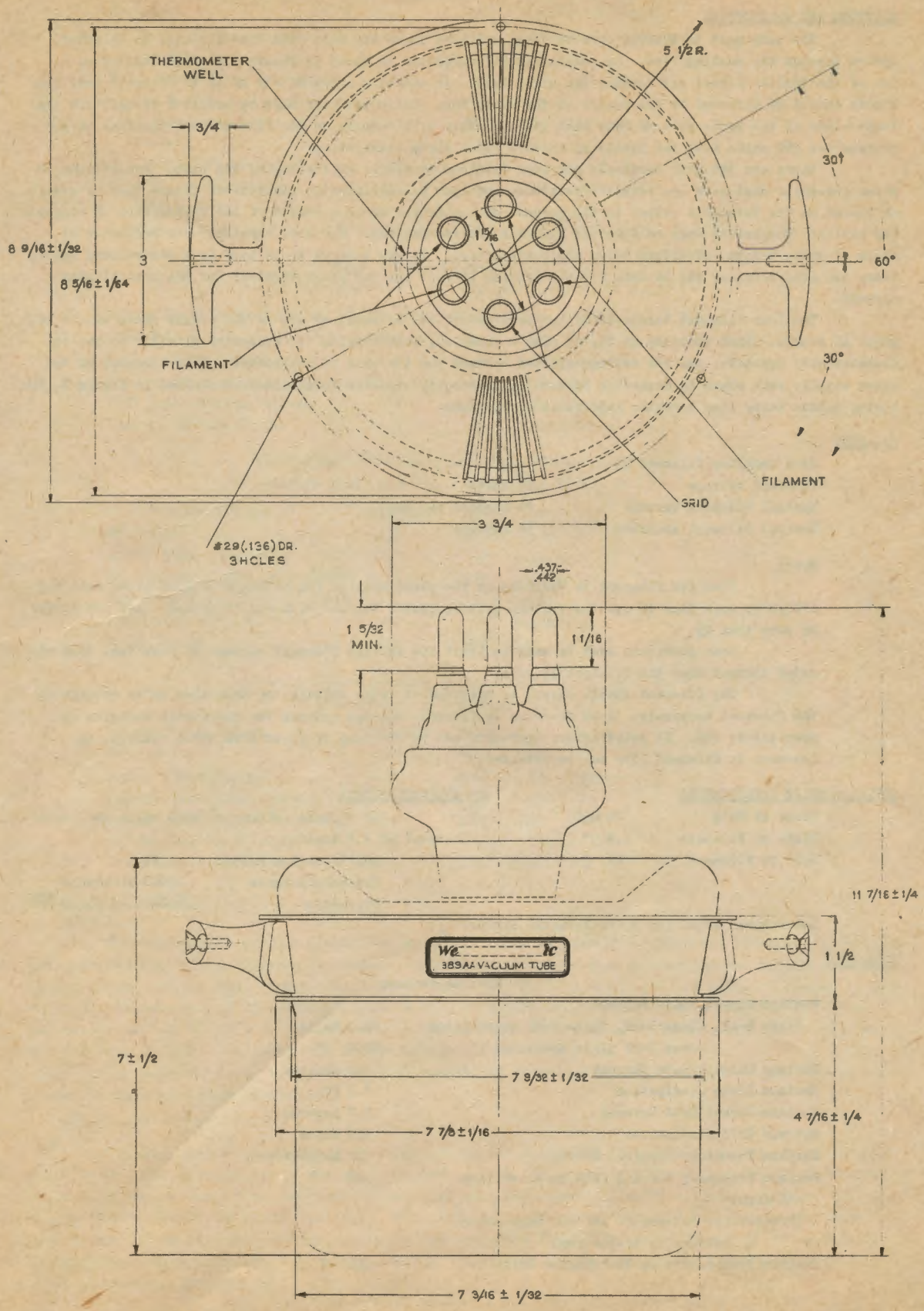
TECHNICAL INFORMATION

WESTERN ELECTRIC 389 AA VACUUM TUBE



CLASSIFICATION

The 389AA Vacuum Tube is a high vacuum filamentary forced-air-cooled triode intended for use as an oscillator or amplifier at high radio frequencies.

MOUNTING AND CONNECTIONS

The tube must be mounted in a vertical position in an air duct such that air will be directed upward through the cooling fins. An additional air deflector as shown in Figure 1 must be mounted on top of the fins to direct air against the glass bulb. In addition a jet of air of 15 to 20 cubic feet per minute should be directed to the center of the glass top. Sufficient air must be provided to maintain the temperature of the anode core at less than 160° C. This will require an air flow through the fins of approximately 500 cubic feet per minute at maximum rated plate dissipation.

There are two grid terminals and four filament terminals at the top of the bulb. Connections to these terminals must have low contact resistance and must be sufficiently flexible to insure that no strain is placed on the terminals either in the process of connecting or as a result of the disposition of connecting cables. Connectors such as shown in Figure 2 are recommended. The grid terminals are indicated by means of white painted shoulders below the contact area. If the tube is to be used as a neutralized amplifier, one grid terminal may be used for the driving circuit and the other terminal for the neutralizing circuit.

The four filament terminals allow operation of the filament on either DC, single phase AC, or two phase AC supply. When operated on DC, or single phase AC, each terminal is connected directly to the one diametrically opposite, and the voltage applied between the two sets of connectors. When operated on two phase supply, each phase is connected between diametrically opposite terminals as indicated in Figure 3, the center points being tied together internally in the tube.

FILAMENT

Pure tungsten filament	
Filament voltage	11 Volts
Nominal filament current	75 Amperes per leg
Nominal filament emission	10 Amperes

Note:

When the filament is operated on two phase supply, the voltages of each phase must not differ by more than 5% and the voltage between center tap and each end of a phase must not differ by more than 5%.

Some provision must be made to limit the initial filament current to less than 150% of rated current when the filament is cold.

The filament should always be operated at rated voltage, or less than rated voltage at the filament terminals. A 5% decrease in filament voltage reduces the thermionic emission approximately 35%. If satisfactory operation can be obtained at lower than rated voltage, an increase in filament life may be obtained.

INTERELECTRODE CAPACITANCES

Plate to Grid	26 mmf
Plate to Filament	1.8 "
Grid to Filament	25 "

CHARACTERISTICS

At a plate voltage of 5000 volts and plate current of 1.5 Amperes

Amplification Factor	22
Transconductance	16000 Micromhos
Perveance	0.001 Amp/Volts $^{3/2}$

See Figures 4-5-6 for Characteristic curves.

OPERATION

Maximum Ratings

Maximum Direct Plate Voltage	
Class B-AF, Class B-RF, Class C-RF unmodulated	8500 Volts
Class C-RF plate modulated	6000 "
Maximum Direct Plate Current	2.5 Amperes
Maximum Plate Dissipation	7.5 KW
Maximum Direct Grid Current	0.3 Amperes
Maximum Grid Dissipation	150 Watts
Maximum Frequency for Full Ratings	50 Megacycles
Maximum Frequency for 1/2 full plate voltage and Input (Frequencies between 50 and 100 megacycles, ratings in proportion)	100 "
Maximum Temperature in Thermometer Well	160° C

TYPICAL OPERATION

Class B Audio Amplifier or Modulator for Balanced 2 Tube Circuit

Direct Plate Voltage	8500 Max.	7500	6000	5000 Volts
Grid Bias	-350	-280	-200	-160 Volts
No Signal Plate Current per Tube	0.35	0.40	0.50	0.50 Amperes
Max. Signal Plate Current per Tube	2.0	2.0	2.1	1.5 Amperes
Load Impedance, Plate to Plate	4300	3700	2750	3600 Ohms
Max. Signal Power Output	22	19	14	9 KW
Peak AF Driving Voltage, Grid to Grid	1500	1300	1150	850 Volts
Approximate Driving Power	190	165	145	90 Watts

Class B Radio-Frequency Amplifier Carrier Conditions for Modulation Factor of 1.0

Direct Plate Voltage	8500 Max.	7500	6000	Volts
Grid Bias	-350	-300	-250	Volts
Direct Plate Current	1.0	0.95	0.85	Amperes
Carrier Power Output	2.75	2.4	1.7	KW
Peak Grid Driving Voltage	400	350	325	Volts
Approx. Driving Power	40	45	50	Watts

Class C Radio-Frequency Amplifier - Plate - Modulated Carrier Conditions for a Modulation Factor of 1.0

Direct Plate Voltage	6000 Max.	5000	Volts
Grid Bias	-850	-700	Volts
Direct Plate Current	1.2	1.0	Amperes
Approximate Direct Grid Current	0.12	0.08	Amperes
Approximate Peak RF Grid Voltage	1300	1100	Volts
Approximate Driving Power	150	90	Watts
Power Output	4.5	3.0	KW

Class C Radio-Frequency Oscillator or Power Amplifier - Unmodulated or Frequency Modulated

Direct Plate Voltage	8500 Max.	7500	6000	Volts
Grid Bias	-700	-600	-500	"
Direct Plate Current	2.10	2.10	1.95	Amperes
Approx. Direct Grid Current	0.20	0.21	0.17	"
Approx. Peak RF Grid Voltage	1350	1250	1050	Volts
Approx. Driving Power	255	250	170	Watts
Power Output	13.5	11.5	8.25	KW

OPERATING PRECAUTIONS

Mechanical

The tube should not be subjected to mechanical shock or excessive vibration. Mechanical vibration may cause breakage of the tungsten filaments. Care should always be used in handling the tube to prevent bending of the cooling fins. Badly bent fins can constrict the flow of air so that adequate cooling is not obtained. The adequacy of air cooling should be checked periodically by inserting a thermometer in the thermometer well in the core at the base of the cooling fins. A non-metallic thermometer capable of reading 160° C should be used. The glass bulb should be kept clean at all times.

Provision should be made for automatic removal of plate and filament voltages if the flow of air to the cooling fins become sub-normal.

Electrical

Overload protection should be provided for the plate circuit. A suitable fuse or circuit breaker should remove the plate voltage if the plate current exceeds 3.5 amperes. Although the tube is sufficiently rugged to withstand short time overloads, a prolonged overload caused by inefficient adjustment or failure of part of the circuit may damage the tube. When adjusting a new circuit or installing a new tube means must be provided in the plate voltage supply so that excessive plate dissipation cannot be obtained while making preliminary adjustments. If the filament is operated on direct current, the filament connections should be reversed periodically.

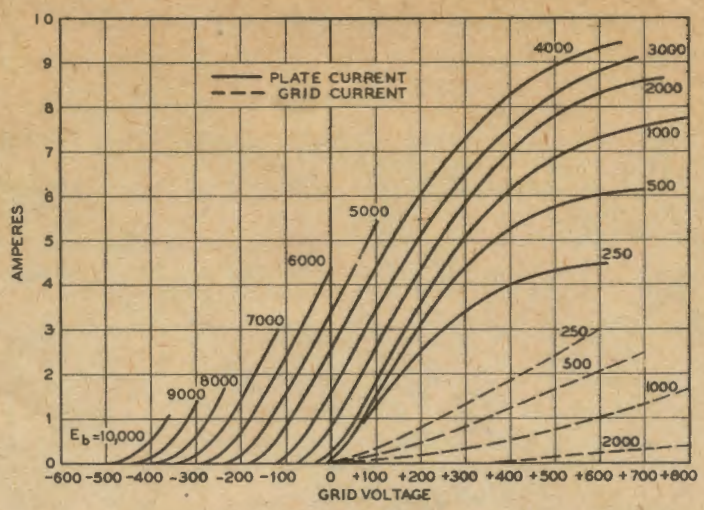


FIG. 4

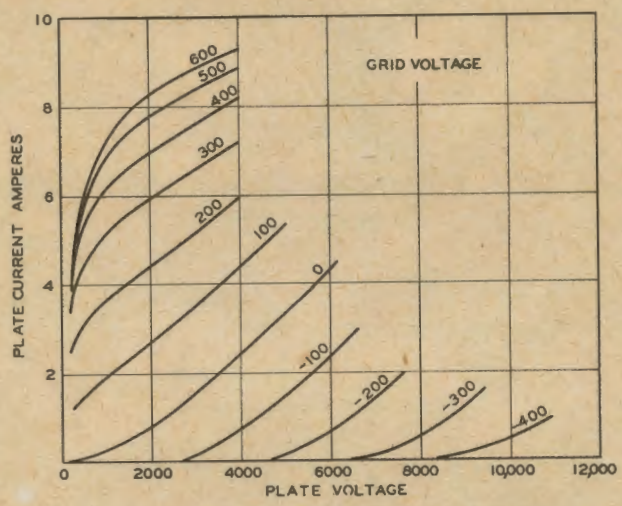


FIG. 5

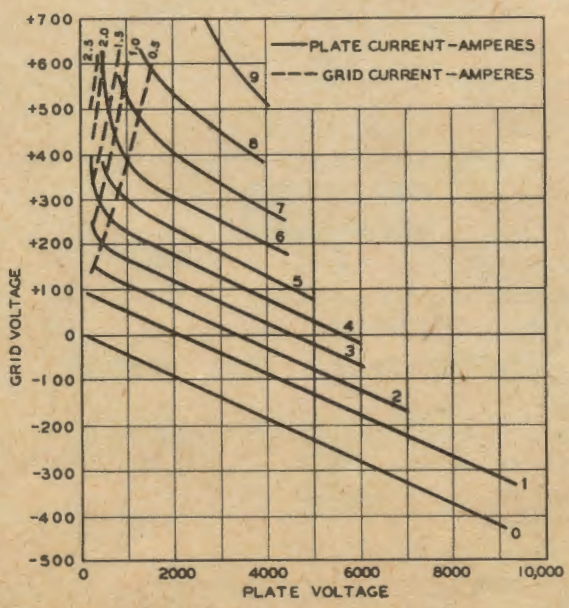


FIG. 6