ITT

COMPONENTS DIVISION

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

TECHNICAL MANUAL I

ITT D Nos.
Triodes + diodes

Type No.	Version	TPD	Mr. Roach	Condensed listing
D1008 (A+B)	T		X	
D1011	T		X	
D1022 (A+B)	D		X	
D1026	T		X	
D1027A	T	X	X	
D1028	T		X	
D1033	D		X	
D1037	T		X	
D1038	D		X	
D1041	T		X	
D1047	D			X
D1049 (A,B,C)	D			X

ENGLISH ELECTRIC VALVE CO.LTD.
Chelmsford, Essex, England.
PHYSICAL SOCIETY EXHIBITION, 1960.

ELECTRON BEAM PARAMETRIC AMPLIFIER

The English Electric Valve Company are showing at the Physical Society Exhibition a development sample of a Transverse Field Parametric Amplifier, Type N1036. This tube is characterised by its high gain and extremely low noise figure and represents the latest concept in low noise V.H.F. amplifiers. The N1036 is designed for operation at 200Mc/s.

Typical of the many applications for which the N1036 will be suitable are the input stages of radar receivers, radio astronomy and high frequency communications systems.

N1036 is a unilateral device and is therefore unconditionally stable. In addition, the tube "cuts-off" under large input signal conditions and thus gives complete protection to the following stages, a characteristic of particular importance in radar applications. Paralysis following the application of excessive input signals is virtually absent.

In the present stage of development, the tube operates at a very low beam current and voltage, 30 microamperes at 6 volts being typical values. A total cathode current of less than 5 milliamperes is required and the highest D.C. voltage in the tube is 100 volts.

The amplitude and frequency stability of the pumping signal are not critical and a simple triode oscillator operating at about twice the signal frequency can be used for this purpose, and output power of only a few milliwatts being required.

A similar tube for operation at 600Mc/s is also in development.

A brief summary of the N1036 characteristics is given below.

Signal Frequency	Pump Frequency	Magnetic Field	Gain	Bandwidth	Noise Figure	Saturated Power Output
200Mc/s	400Mc/s	70Gauss	20db	25Mc/s	2db	50μW

HARD TUBE MODULATORS - CONDENSED LISTING

E_{PX}	Type	Pulse Current Rated Fil. I_{PK}	Pulse Current Elevated Fil. I_{PK}	P_D	Cooling
75	D-1041	300	--	10	W
65	D-1037	650	1000	225	W
65	F-6398	400	550	225	W
65	F-7837	160	230	90	W
65	F-7838	160	230	25	A
65	F-7839	160	230	10	A
35	F-5918	140	200	80	W
35	F-6920	140	200	10	A
20	F-7328	100	160	20	A
18	F-7206	220	350	20	W
18	D-1008A	220	350	20	W
18	D-1008B	220	350	10	A
17.5	F-7012	40	65	2.5	A
17.5	F-5680	35	55	2.5	A
17.5	F-7C23	25	40	2.5	A

E_{PX} - Maximum Peak Inverse Voltage - Kilovolts
I_{PK} - Peak Cathode Current - Amperes
I_{DC} - Plate Current - Amperes
P_D - Plate Dissipation - Kilowatts
W - Water Cooled
A - Forced Air Cooled

HIGH VACUUM DIODES - CONDENSED LISTING

		Rectifier Operation		Clipper Operation		
E_{PX}	Type	I_{PK}	I_{DC}	I_{PK}	P_D	Cooling
100	D-1018	120	40	400	225	W
100	D-1049A	60	20	200	70	W
100	D-1049B	60	20	200	25	A
100	D-1049C	-	-	200	10	A
80	D-1022A	60	20	200	70	W
80	D-1022B	60	20	200	25	A
80	D-1022C	-	-	200	10	A
65	F-7869	21	4	100*	3.5	A
60	F-8109	36	12	150	20	W
60	F-8110	36	12	150	10	A
55	F-7975	21	5	100	3.5	A
50	F-7906	45	15	200*	50	W
50	F-7907	45	15	200*	20	A
45	D-1047	10**	3	-	20	W
40	D-1038	20	6	150*	5	A
40	F-7131	10	3	150*	3	A
30	F-7030	20	6	75*	2.5	A
30	F-7779	20	6	75	3	A
25	F-8034	20	3	70*	3	A

E_{PX} - Maximum Peak Inverse Voltage - Kilovolts
I_{PK} - Peak Plate Current - Amperes
I_{DC} - Plate Current - Amperes
P_D - Plate Dissipation - Kilowatts
W - Water Cooled
A - Forced Air Cooled
* - Elevated Filament Voltage
** - Limited Emission; Pure Tungsten Cathode

Supersedes data of 10-60

Equipment Manufacturers Price List

Electron Tubes

February 15, 1962

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

ITT Power Tubes

INDUSTRIAL AND TRANSMITTING TRIODES
OSCILLATORS, AMPLIFIERS, AND MODULATORS

Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price
F-3X2500A3	HF	$ —	$ 200.00	F-889RA	MF	$ 287.00	$ 375.00	F-6800	HF	$ 285.00	$ 400.00
F-3X2500F3	HF	—	205.00	F-891	MF	240.00	295.00	F-6801	HF	395.00	550.00
F-7C23	Pulse	158.00	192.00	F-891R	MF	380.00	440.00	F-6803	HF	1,055.00	1,275.00
F-7C25	HF	140.00	180.00	F-892A	MF	235.00	290.00	F-6804	HF	1,325.00	1,590.00
F-7C26	HF	245.00	275.00	F-892R	MF	365.00	435.00	F-6920	HTM	1,220.00	1,590.00
F-8C25	AF	498.00	610.00	F-898A	MF	1,470.00	1,712.00	F-6921	AF	585.00	740.00
F-9C23	HF	—	602.00	F-5604	HF	450.00	600.00	F-6925	HF	138.00	196.00
F-9C28	AF	—	1,320.00	F-5606A	MF	232.00	303.00	F-6926	HF	138.00	186.00
F-9C29	AF	—	1,740.00	F-5619	HF	350.00	475.00	F-6926J	HF	138.00	186.00
F-9C30	HF	—	1,300.00	F-5658	HF	495.00	595.00	F-7012	MF	188.00	218.00
F-9C31	HF	—	1,660.00	F-5666	HF	230.00	280.00	F-7185	AF	674.00	825.00
F-110X	HF	—	720.00	F-5667	HF	275.00	370.00	F-7206	HF	300.00	395.00
F-124A	HF	—	1,150.00	F-5668	MF	265.00	350.00	F-7207	AF	525.00	650.00
F-124R	HF	—	1,610.00	F-5669	MF	407.00	520.00	F-7328	HF	825.00	1,100.00
F-125A	AF	—	1,280.00	F-5680	HF	172.00	200.00	F-7532	AF	275.00	370.00
F-128A	HF	—	225.00	F-5771/356	HF	485.00	665.00	F-7820	AF	600.00	775.00
F-129B	HF	325.00	385.00	F-5874	AF	445.00	590.00	F-7831	HF	380.00	505.00
F-129R	HF	355.00	412.00	F-5918A	HF	900.00	1,115.00	F-7832	HF	540.00	715.00
F-132A	AF	—	282.00	F-5919	HF	1,165.00	1,430.00	F-7837	HF	975.00	1,200.00
F-134A	HF	2,650.00	3,025.00	F-5996	HF	190.00	220.00	F-7838	HF	1,285.00	1,660.00
F-134B	HF	2,650.00	3,025.00	F-6009	HF	194.00	240.00	F-7839	HF	1,240.00	1,600.00
F-212E	MF	—	245.00	F-6179	AF	1,070.00	1,270.00	F-8045	HF	975.00	1,200.00
F-220C/				F-6366	HF	125.00	170.00	F-8046	HF	1,285.00	1,660.00
320B	MF	385.00	480.00	F-6367	HF	125.00	185.00	F-8104	HF	120.00	190.00
F-220CA/				F-6379	AF	985.00	1,210.00	F-8104J	HF	135.00	205.00
320BA	MF	460.00	575.00	F-6398	HF	2,700.00	3,000.00	F-8131	HF	190.00	260.00
F-342A	MF	—	700.00	F-6399	HF	125.00	170.00	F-8132	HF	210.00	280.00
F-343A	MF	385.00	475.00	F-6400	HF	125.00	199.00	F-8133	HF	275.00	370.00
F-343AA	MF	460.00	600.00	F-6401	UHF	930.00	1,020.00	F-8145	HTM	1,470.00	1,960.00
F-631A	HF	—	690.00	F-6691	HF	560.00	740.00	F-8146	HF	545.00	720.00
F-862A	MF	1,470.00	1,712.00	F-6692	HF	488.00	615.00	F-8147	HF	680.00	905.00
F-880	HF	510.00	635.00	F-6696	HF	880.00	1,165.00	F-8148	AF	785.00	1,040.00
F-889A	MF	195.00	235.00	F-6697	HF	1,080.00	1,400.00				

POWER DIODES—RECTIFIERS

Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price
F-222A	HV	$ —	$ 390.00	F-7030	HV	$ 170.00	$ 202.00	F-7906	HV	$ 400.00	$ 525.00
F-575A	MV	15.75	22.15	F-7100	HV	172.00	230.00	F-7907	HV	450.00	600.00
F-673	MV	15.75	22.15	F-7131	HV	172.00	230.00	F-8034	HV	135.00	170.00
F-857B	MV	187.00	230.00	F-7656	HV	160.00	215.00	F-8109	HV	275.00	365.00
F-869B	MV	115.00	160.00	F-7779	HV	172.00	230.00	F-8110	HV	325.00	450.00
				F-7869	HV	250.00	300.00				

ITT Special Purpose Tubes

TRAVELING WAVE TUBES

Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price
F-6658	S-2	$ 850.00	$1,000.00	**F-7338**	S-1000	$1,480.00	$1,650.00	**D-2036**	S-10	$ 950.00	$1,110.00
F-6825	S-1000	1,050.00	1,200.00	**F-7340**	X-1000	1,500.00	1,675.00	**D-2037**	X-2	1,925.00	2,135.00
F-6826	S-1000	1,280.00	1,470.00	**F-7524**	X-5	1,800.00	2,000.00	**X-282**	C-10	1,800.00	2,000.00
F-6867	X-05	950.00	1,110.00	**F-7824**	BWO	990.00	1,250.00	**X-354**	X-5	2,475.00	2,730.00
F-6868	S-10	930.00	1,090.00	**F-7847**	C-10	3,000.00	3,250.00	**X-368**	X-05	1,800.00	2,000.00
F-6996	X-10	1,075.00	1,200.00	**F-7848**	C-2000	2,000.00	2,250.00	**X-370**	C-10	3,000.00	3,250.00
F-7066	X-05	1,650.00	1,830.00	**D-2009**	C-2	2,600.00	2,875.00				

STORAGE AND DISPLAY TUBES

Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price
F-6411	IRT	$ 110.00	$ 140.00	**F-7174**	4″ DVST	$1,050.00	—	**FW-211**	2½″ DVST	$1,665.00	$ —
F-6914	IRT	115.00	145.00	**F-7222**	5″ DVST	1,150.00	—	**FW-212**	5″ DVST	1,850.00	—
F-6929	IRT	110.00	140.00	**F-7423**	5″ DVST	880.00	—	**FW-223**	5″ DVST	1,850.00	—
F-7172	2½″ DVST	1,665.00	—	**D-3001**	5″ DVST	1,050.00	—	**FW-227**	4″ DVST	2,350.00	—
F-7173	4″ DVST	1,850.00	—	**FW-204**	5″ DVST	1,850.00	—	**FW-229**	4″ DVST	1,665.00	—
				FW-208	7½″ DVST	2,500.00	—				

KUTHE HYDROGEN THYRATRONS AND DIODES

Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price	Type	Description	Equipment Mfrs. Price	Users Price
3C45	HT	$ 11.75	$ —	**6130**	HT	$ 11.95	$ —	**7866/**			
3C45W	HT	26.00	—	**6587**	HT	43.75	—	**KU-274**	CHT	$1,800.00	$ —
4C35A	HT	23.60	—	**6777**	HT	19.60	—	**7890**	CHT	1,800.00	—
5C22	HT	27.50	—	**7322**	CHT	1,100.00	—	**E-38**	HT	55.50	—
1257	HT	*	—	**7390**	CHT	1,425.00	—	**KU-25**	HT	33.00	—
5948	HT	*	—	**7583/KU-82**	HT	27.45	—	**KU-51**	HD	45.00	—
5948A	HT	*	—	**7621/**				**KU-52**	HD	60.00	—
5949	HT	*	—	**KU-70B**	CHT	300.00	—	**KU-53**	HD	125.00	—
5949A	HT	*	—	**7665/KU-72**	CHT	275.00	—	**KU-92**	CHD	300.00	—
5956	HT	43.75	—	**7666/KU-73**	CHT	1,100.00	—	**KU-93**	CHD	700.00	—
5957	HT	43.75	—	**7667/KU-74**	CHT	1,425.00	—	**KU-94**	CHD	1,500.00	—
5958/E-40	HT	24.60	—	**7782/KU-71**	CHT	325.00	—	**KU-99**	HT	12.80	—
5959/E-41	HT	24.10	—					**SGR-1**	HT	23.60	—

*Prices on Request

SYMBOLS

POWER TUBES

AF — Audio Frequency
HF — High Frequency
MF — Medium Frequency
UHF — Ultra-High Frequency
HTM — Hard Tube Modulator
HV — High Vacuum
MV — Mercury Vapor

STORAGE TUBES

IRT — Infra-Red Tube
DVST — Direct View Storage Tube

KUTHE TUBES

HT — Hydrogen Thyratron
CHT — Ceramic Hydrogen Thyratron
HD — Hydrogen Diode
CHD — Ceramic Hydrogen Diode

ITT Accessories

TRAVELING WAVE TUBE SOLENOIDS

Tube Type	Solenoid No.	Cooling	Equipment Manufacturers Price	Users Price
F-6658	RT-90532	Water	$510.00	$ —
F-6825	RT-250,212	Air	630.00	—
F-6826	RT-250,449	Air	570.00	—
F-6867	RT-250,199	Air	600.00	—
F-6868	RT-90532	Water	510.00	—
F-6996	RT-250,447	Air	570.00	—
F-7066	—	Air	510.00	—
F-7338	RT-250,444	Water	540.00	—
F-7340	RT-250,451	Water	570.00	—
F-7524	RT-250,452	Water	600.00	—
F-7824 (BWO)	—	Air	500.00	—
F-7847	—	Air	580.00	—
D-2036	RT-90532	Water	510.00	—

AIR SOCKETS

Type	Used With	Equipment Manufacturers Price	Users Price
RT-53134-12 Type I	F-7C23, F-7C25, F-5680, F-5996, F-7012	$ 27.00	$ 38.00
RT-53134-12 Type II	F-6366	27.00	38.00
RT-53134-12 Type III	F-892R, F-5604	50.00	68.00
RT-53134-12 Type IV	F-6691, F-7185	86.00	110.00
RT-53892	F-5919, F-6804, F-7838, F-8046	117.00	152.00
RT-54452-1* Type I	F-8C25	50.00	68.00
RT-54452-1* Type II	F-7820	50.00	68.00
RT-54628-1* Type I	F-7328	86.00	110.00
RT-54628-1* Type II	F-7907	—	—
RT-54887-1* Type II	F-7100, F-7131, F-7656, F-7779	20.00	35.00
RT-54887-1* Type III	F-7869	—	—
RT-54891-1*	F-7030	20.00	35.00
RT-54893-1*	F-8034	20.00	35.00
RT-55001-1*	F-8132	20.00	35.00
RT-55098-1	F-6920, F-7839, F-8145	—	—

*Glass Base Epoxy Resin

WATER JACKETS

Type	Used With	Equipment Manufacturers Price	Users Price
RT-52903	F-891, F-892A, F-5606A	$ 62.00	$ 77.00
RT-53221-12 Type A	F-5668, F-7831	62.00	77.00
RT-53221-12 Type B	F-5666	62.00	77.00
RT-53221-12 Type C	F-5619, F-6800, F-7206, F-8109	62.00	77.00
RT-53335-12	F-9C28, F-9C30, F-124A, F-125A, F-6179	138.00	175.00
RT-53933-12	F-6399A, F-6400A, F-8104, F-6926	26.00	37.00
RT-54319-12 Type A	F-5918, F-6379, F-6803, F-7837, F-8045	138.00	175.00
RT-54319-12 Type B	F-6692, F-6921	138.00	175.00
RT-54319-12 Type C	F-7906, F-8148	138.00	175.00
RT-54320-1	F-880, F-5658, F-5668, F-5771	77.00	97.00
RT-54841-12	F-5874A	126.00	148.00
RT-55070-12	F-8146	105.00	130.00
RT-55113	F-134, F-134B, F-6398	350.00	410.00

ITT Accessories

CONNECTOR ASSEMBLIES

Type	Description	Used With	Equipment Manufacturers Price	Users Price
RT-52578	Connector. One required for each Grid and Filament Connection.	F-880, F-5604, F-5606A, F-5619, F-5658, F-5666, F-5668, F-5771, F-5918A, F-5919, F-6379, F-6398, F-6691, F-6692, F-6800, F-6801, F-6803, F-6804, F-6920, F-6921, F-7185, F-7206, F-7328, F-7837, F-7838, F-7839, F-7906, F-7907, F-8045, F-8046, F-8109, F-8110, F-8145, F-8148	$ 4.85	$ 6.25
RT-54410-1	Filament Connector	F-7C23, F-7C25, F-5680, F-6009, F-6366 F-6367, F-6399, F-6400, F-6925, F-6926 F-6926J, F-7012, F-7030, F-7100, F-7131, F-7532, F-7656, F-7779, F-8104	6.75	7.75
RT-54410-2	Filament Center-Tap Connector		6.75	7.75
RT-54410-3	Grid Connector		6.75	7.75
RT-54764	Filament Connector (Large)	F-7831, F-8146, F-8147	6.40	7.20
RT-54765	Filament Connector (Small)	F-7831, F-8146, F-8147	6.40	7.20
RT-54992	Connector Assembly	F-8131	25.00	30.00
RT-55052	Grid Ring Connector Assembly	F-7831, F-8146, F-8147	7.20	8.10

POWER TUBE RADIATOR AND CRATE CREDIT ALLOWANCES AGAINST THE PURCHASES OF RENEWAL TUBES*

Tube Type	Credit Allowance	Tube Type	Credit Allowance
F-7C25	$ 4.00	**F-6691**	$ 30.00
F-7C26	4.00	**F-6697**	50.00
F-8C25	15.00	**F-6801**	20.00
F-9C29	100.00	**F-7100**	4.00
F-9C31	100.00	**F-7131**	4.00
F-124R	100.00	**F-7656**	4.00
F-129R	20.00	**F-7779**	4.00
F-220CA/320BA	40.00	**F-7820**	15.00
F-343AA	40.00	**F-7838**	100.00
F-891R	30.00	**F-7839**	30.00
F-892R	30.00	**F-7869**	4.00
F-5604	45.00	**F-7907**	30.00
F-5667	20.00	**F-8034**	4.00
F-5669	30.00	**F-8046**	100.00
F-5919	100.00	**F-8047**	30.00
F-5996	4.00	**F-8110**	20.00
F-6398	50.00		

*These allowances apply when the old tube and shipping container are returned prepaid in good physical condition with a replacement order.

WARRANTY STATEMENT

When operated within specified ratings, the tubes listed herein are warranted against defects in workmanship and materials. A detailed Warranty Statement is provided with each shipment and copies are available upon request. No other warranties are given or implied.

PRICES

F.O.B. point of shipment and subject to withdrawal or change without notice. All prices refer to tubes under commercial specification and do not necessarily apply to tubes under Government specifications or with Government inspection. Terms: Net 30 days.

TRANSPORTATION

All orders will be shipped f.o.b. point of shipment with full transportation allowed on orders authorizing individual shipments having a billing value of $250.00 or more before cash discount. Title passes to purchaser at point of shipment when delivery is made to common carrier. If a purchaser specifies a method of delivery that involves unusual transportation or delivery expenses, such additional expenses will be billed to the purchaser.

Suggestions For Use: To Get The Most From Your Tube Investment

FORCED-AIR-COOLED POWER TUBES
By FEDERAL

Storage

Handling a transmitting tube requires care. The internal structure is liable to damage if the tube is subjected to shock or vibration. In general, and particularly in the case of the heavier and larger types, *tubes should not be lifted by the bulb* as the seals are apt to be damaged due to the weight of tube and radiator.

Federal recommends that tubes be stored in a vertical position, the radiator end down. The larger types may be stored in the shipping crate with the filament end up, and they should be protected from vibration, moisture, and extreme changes of temperature. In the case of tubes with flexible leads, care should be taken to prevent the leads from striking the glass to avoid possible breakage.

Installation

Upon receipt the tube should be tested in the equipment in which it is to be used. Standard mountings support the tube in the correct vertical position with the filament end up. Care must be taken to avoid subjecting the tube to vibration and shock during the installation or operation.

Connections

After mounting the tube in the socket, filament and grid leads should be connected in such a way as not to be taut, and should allow for some movement without placing a strain on the glass bulb. When making connections, care should be taken to exert as little bending movement as possible at the terminal pins. These leads always should be disconnected before unclamping the tube and removing it from the mounting.

The glass bulb should be clean and free of foreign matter. A soft rag may be used to clean the glass, or if it is excessively dirty, carbon tetrachloride may be used, making sure the glass is cold before it is applied. Care should be taken to remove all foreign matter from recessed or re-entrant areas used in the construction of the tube envelope or stem.

For the protection of personnel during the installation or removal of power tubes, face shields and gloves should be worn at all times.

Cooling

The air cooling system consists of a blower and a suitable air duct to the radiator of the tube. The cooling air must not contain any foreign matter. The cooling system should be electrically interlocked with the filament and plate supplies to prevent application of any voltages to the tube without suitable cooling. An air-flow interlock which removes plate and filament power, in event the air flow is insufficient or ceases, should be provided.

As specified on the data sheets, maximum glass and seal temperatures should not be exceeded. One method of checking these temperatures during operation is by the use of temperature-sensitive paints and crayons available. Usually, the bulb and stem of the tube can be cooled adequately by deflecting air from the air stream through the radiator by use of deflecting vanes.

Circuit Requirements

The circuit in which these tubes operate is a high power, high voltage system and *should be safeguarded in the proper manner with interlocking means to protect personnel.*

Installation of proper overload protection measures should be made to protect the tube and equipment against excessive currents. An instantaneous overload relay should be installed in the ground lead of the plate return, protecting the tube from drawing a large plate current. The relay, set for slightly higher than normal plate current, will open the circuit in the rectifier transformer primary in event of overload. Plate series protective resistors also should be provided. It must be seen that no high capacitance is connected directly across the tube in any manner that a disturbance within the tube will discharge appreciable energy from the capacitor. Suitable meters should be installed to read filament voltage, plate voltage, D-C plate current, and D-C grid current. A tube life recording meter should be provided.

All wires and connections should be so placed that they will not lie on or close to the glass, otherwise, the bulb is almost certain to be punctured by corona discharges. All connections should be so made that there are no strains on the metal-to-glass seals.

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FORCED-AIR-COOLED POWER TUBES
By FEDERAL

From the very moment you receive your new tube, *follow these instructions.* It will save you money.

Filament Circuit

The filament connectors should be large and make good contact since the filament circuit carries a low voltage at high current. The filament voltage always should be measured directly at the tube terminals. The filament should be maintained at constant voltage rather than constant current, and provision made for accurate setting and maintenance of this voltage. The high in-rush of filament current, when the switch is first closed, should be limited to the maximum value printed on the data sheets by some form of filament starter. This may be a resistance step method, high reactance transformer, or manual control. Filament power may be A-C or D-C. With A-C the grid and plate returns are connected to the center point of the filament supply. When D-C is used, these returns should be to the negative terminal. When D-C filament excitation is used, the leads should be reversed every 500 hours.

If two or more tubes are used in the circuit, controls should be provided so the plate currents drawn by each tube may be balanced.

In the case of multi-phase filaments, it is essential they be connected as shown on the data sheets to prevent possible bowing and failure of the filament. Single phase operation of all multi-phase filaments is recommended.

Operation

It is suggested that tubes be tested and inspected immediately upon their receipt. Recommended procedure when installing a new tube is to operate without plate voltage and at the rated filament voltage for a period of 15 minutes; then set the plate voltage at as low a value as possible, and operate for approximately 15 minutes at one-half the normal plate voltage. Increase the voltage slowly, if possible, to the normal voltage, and operate for an hour or more. Spare tubes should be given the schedule here outlined every three months.

Filament Voltage

The filament should be operated at constant voltage and its normal operating temperature reached before the plate voltage is applied. For operation at low output, where less than the normal emission of the filament is required, pure tungsten filaments may be operated at reduced filament voltage for longer life. This may be set by reducing the filament voltage in operation to a point where a reduction in output or increase in distortion can just be detected. The filament voltage then should be increased by an amount equivalent to the maximum percentage regulation of the filament supply voltage. A 5% reduction in filament voltage will result in almost doubling the filament life of the tube . . . conversely, operation at 5% over voltage will result in a 50% decrease in life. The foregoing indicates the advantages obtainable with good regulation of the filament supply voltage. Thoiated tungsten filaments should be operated within $\pm$ 5% of their rated value *for maximum life.*

For frequent standby periods, it is recommended that filaments be operated at reduced voltage to conserve life. Provision may be made to reduce voltage to 80% of normal for periods up to 2 hours on small pure tungsten types, up to 12 hours on large types. Where standby time exceeds 2 hours for small types, and 12 hours for large, voltage may be removed.

Gas Clean-up

When a new circuit is tried or adjustments are made, it is suggested the plate voltage be reduced to approximately one-half normal and increased in steps, adjusting for optimum operating conditions at each step. In the case of a severe overload and the resultant gassing of the tube, it is sometimes possible to effect clean-up of the gas by operating the tube as an oscillator or an RF power amplifier at reduced plate voltage, gradually increasing the voltage to maximum after permitting the tube to reach stable operation at each step. A series resistor may be used in the plate supply and cut-out in steps as stable operation is attained. If the tube has a thoriated tungsten filament, the gas liberated may have impaired the emission of the filament. It may be possible to restore the activity of the filament by operating at 150% of rated voltage for several minutes, then continuing for 15 minutes at 20% over rated voltage. As a last resort, it may be possible to restore the filament by operation at voltages up to 100% over ratings for several minutes followed by operation at 20% over rating for 15 minutes.

Printed in U. S. A.
Form FJ-459

DIVISION OF IT&T

Federal Telephone and Radio Company
100 Kingsland Road Clifton, New Jersey

Suggestions For Use: Recommended Procedure To Prolong Tube Life

WATER-COOLED POWER TUBES
By Federal

Storage

Handling a transmitting tube requires care. The internal structure is liable to damage if the tube is subjected to shock or vibration. In general, and particularly in the case of the heavier and larger types, *tubes should not be lifted by the bulb* as the seals are apt to be damaged due to the tube weight.

It is recommended that tubes be stored in racks with the filaments in a vertical position. The racks should be protected against vibration, moisture, and extreme changes of temperature. In the instance of tubes with flexible leads, special care should be taken to prevent the leads striking the glass, avoiding possible breakage.

Installation in Jacket

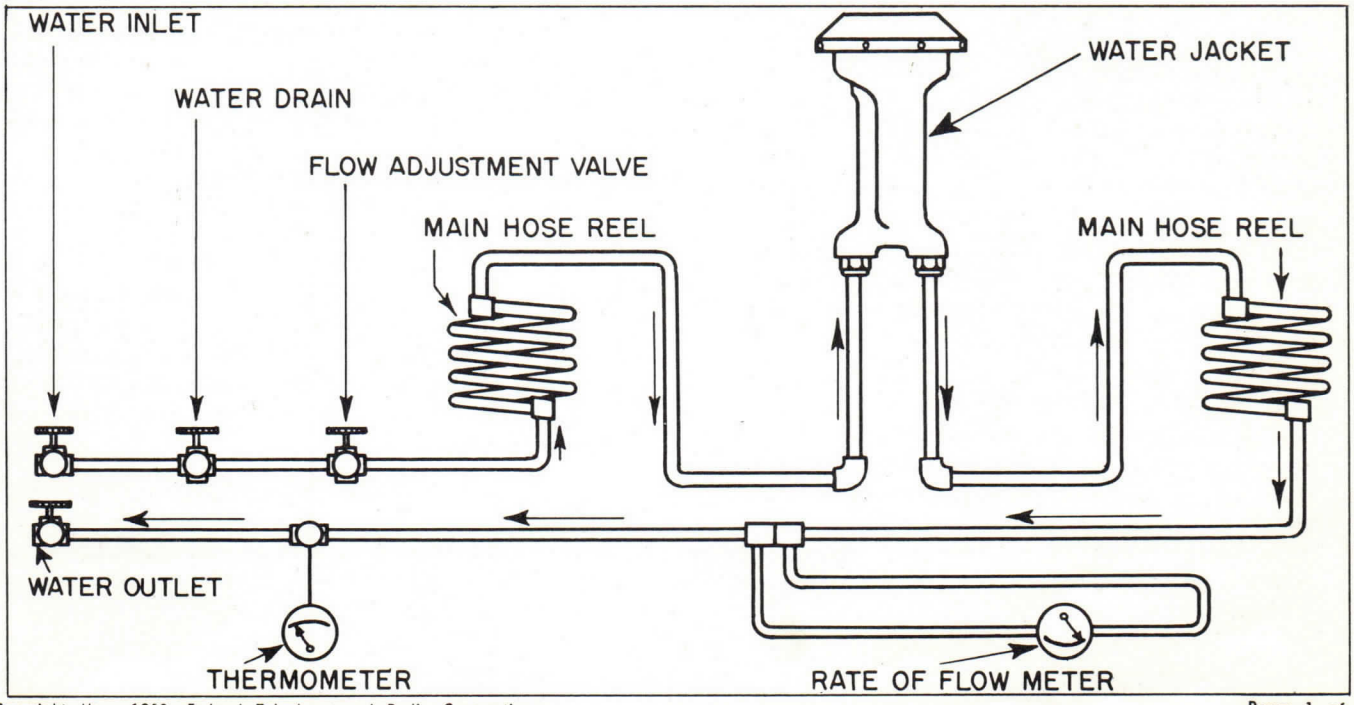
Installation of water-cooled tubes is fairly simple if accomplished with reasonable care. Spare gaskets are supplied with each tube. A new gasket should be used when a tube is placed in the socket. It is recommended that the gasket be coated with a thin film of Prodag to prevent sticking, and that all moving parts of the jacket be covered with a light film of oil to prevent corrosion and sticking. After placing the proper gasket on the anode, the tube should be inserted in the water jacket carefully, and turned gently to make sure the flange seats properly in the jacket. The clamping device first should be tightened with caution to prevent possible strain at the anode seal caused by improper seating of the flange. When preliminary adjustment indicates the tube is seated correctly, the jacket may be tightened securely. Do not tighten more than is needed to prevent water leaks, otherwise the flange may be distorted.

Connections

After clamping in the jacket, filament and grid leads should be connected in such a way as not to be taut, and should allow for some movement without placing a strain on the glass bulb. When making connections, care should be taken to exert as little bending movement as possible at the terminal pins. These leads always should be disconnected before unclamping the tube and removing it from the water jacket. Allow tube to cool before removal from socket, and do not place it on any cold, metallic or heat conducting surface. Sudden change of temperature may crack the glass.

The glass bulb should be clean and free of foreign matter. A soft rag may be used to clean the glass, or if it is excessively dirty, carbon tetrachloride may be used, making sure the glass is cold before it is applied. Care should be taken to remove all foreign matter from recessed or re-entrant areas used in the construction of the tube envelope or stem.

For the protection of personnel during the installation or removal of power tubes, face shields and gloves should be worn at all times.



Copyright May, 1950, Federal Telephone and Radio Corporation

WATER-COOLED POWER TUBES
By Federal

To get the greatest return from your tube investment, follow these instructions with attention and care.

Water Cooling Systems

In general, the water cooling system for the anode consists of a water source, a water jacket, and a feed-pipe system which carries the water to and from the jacket.

For a small number of tubes, the cooling system may consist of a fan-cooled radiator, a pump, and the water jacket interconnected in a closed circulating system. The system is usually insulated from ground, has a water gauge to indicate the height of water in the radiator, and a thermometer to record the water temperature at the jacket outlet.

Where a number of water-cooled tubes is employed, the water usually is obtained from a large storage tank, or from water mains, whichever is available. To assure an adequate supply, the water is circulated, under pressure, through an interconnected piping system. Lengths of rubber hose or ceramic pipes carry the water from a grounded position in the system to and from the water jackets. It is extremely important that the hose, connected at both inlet and outlet of the jacket, be of sufficient length to reduce leakage current to a minimum.

Distilled water is recommended for cooling. It greatly reduces the possibility of scale formation on the anode during life. A sample of the cooling water should be analyzed when planning the water system. In general, water which shows a hardness greater than 10 grains per gallon should not be used.

Scale Formation

Scale formation prevents proper cooling of the tubes and may damage them. Scale formation can be avoided by the use of distilled water or a water softener. In emergency cases, a 10% solution of hydrochloric acid will dissolve scale from the anode. Following the use of hydrochloric acid the anode should be rinsed thoroughly in water. Care also should be taken to prevent this acid solution from coming into contact with the anode near the region of the copper-to-glass seal. Since this procedure necessitates frequent removal of the tubes from the water jackets, and increases the danger of accidental breakage, it should be avoided whenever possible.

Water Flow Precautions

Use of an outlet thermometer and a water flowmeter are advisable. Water flowing through the jacket should never reach the point where it allows steam bubbles to form on the anode. The outlet water temperature should be limited to a maximum of 70°C. Localized boiling may be detected by a singing noise, or by the use of an improvised stethoscope.

The stethoscope may consist of six feet of insulating tubing . . . *with proper safety precautions taken.* The stethoscope is pressed at various points on the jacket while listening observations are made.

The piping system should be installed and operated properly to prevent any water hammer which might result in pressures high enough to damage the anode. In general, the pressure in the jacket should not exceed 80 pounds per square inch, and relief valves should be installed, when necessary, to prevent excessive pressure.

Proper functioning of the water cooling system is of the greatest importance. Even a momentary failure of the water system may result in the destruction of the tube. It is essential that water flow interlocks be used to open the filament and plate supplies whenever the flow stops or is insufficient. The heat alone from the filament is sufficient to cause serious damage.

Maximum glass and seal temperatures (as specified on data sheets) should not be exceeded. One method of checking these temperatures during operation is the use of temperature-sensitive paints or crayons.

Circuit Requirements

The circuit in which these tubes operate is a high power, high voltage system and *should be safeguarded in the proper manner with interlocking means to protect personnel.*

Installation of proper overload protection measures should be made to protect the tube and equipment against excessive currents. An instantaneous overload relay should be installed in the ground lead of the plate return, protecting the tube from drawing a large plate current. The relay, set for slightly higher than normal plate current, will open the circuit in the rectifier transformer primary in event of overload. Plate series protective resistors also should be provided. It must be seen that no high capacitance is connected directly across the tube in any manner that a disturbance within the tube will discharge appreciable energy from the capacitor. Suitable meters should be installed to read filament voltage, plate voltage, D-C plate current, and D-C grid current. A tube life recording meter should be provided.

All wires and connections should be so placed that they will not lie on or close to the glass, otherwise, the bulb is almost certain to be punctured by corona discharges. All connections should be so made that there are no strains on the metal-to-glass seals.

AN IT&T ASSOCIATE

These precautionary advices on safety, tube care and usage were prepared for you by Federal engineers.

WATER-COOLED POWER TUBES
By Federal

Filament Circuit

The filament connectors should be large and make good contact since the filament circuit carries a low voltage at high current. The filament voltage always should be measured directly at the tube terminals. The filament should be maintained at constant voltage rather than constant current, and provision made for accurate setting and maintenance of this voltage. The high in-rush of filament current, when the switch is first closed, should be limited to the maximum value printed on the data sheets by some form of filament starter. This may be a resistance step method, high reactance transformer, or manual control. Filament power may be A-C or D-C. With A-C the grid and plate returns are connected to the center point of the filament supply. When D-C is used, these returns should be to the negative terminal. When D-C filament excitation is used, the leads should be reversed every 500 hours.

If two or more tubes are used in the circuit, controls should be provided so the plate currents drawn by each tube may be balanced.

In the case of multi-phase filaments, it is essential they be connected as shown on the data sheets to prevent possible bowing and failure of the filament. Single phase operation of all multi-phase filaments is recommended.

Operation

It is suggested that tubes be tested and inspected immediately upon their receipt. Recommended procedure when installing a new tube is to operate without plate voltage and at the rated filament voltage for a period of 15 minutes; then set the plate voltage at as low a value as possible, and operate for approximately 15 minutes at one-half the normal plate voltage. Increase the voltage slowly, if possible, to the normal voltage, and operate for an hour or more. Spare tubes should be given the schedule here outlined every three months.

Filament Voltage

The filament should be operated at constant voltage and its normal operating temperature reached before the plate voltage is applied. For operation at low output, where less than the normal emission of the filament is required, pure tungsten filaments may be operated at reduced filament voltage for longer life. This may be set by reducing the filament voltage in operation to a point where a reduction in output or increase in distortion can just be detected. The filament voltage then should be increased by an amount equivalent to the maximum percentage regulation of the filament supply voltage. A 5% reduction in filament voltage will result in almost doubling the life due to filament burnout. Conversely, operation at 5% over voltage will result in a 50% decrease in life. The foregoing indicates the advantages obtainable with good regulation of the filament supply voltage. Thoriated tungsten filaments should be operated within $\pm 5\%$ of their rated value for *maximum life*.

For frequent standby periods, it is recommended that filaments be operated at reduced voltage to conserve life. Provision may be made to reduce voltage to 80% of normal for periods up to 2 hours on small pure tungsten types, up to 12 hours on large types. Where standby time exceeds 2 hours for small types, and 12 hours for large, voltage may be removed.

Gas Clean-up

When a new circuit is tried or adjustments are made, it is suggested the plate voltage be reduced to approximately one-half normal and increased in steps, adjusting for optimum operating conditions at each step. In the case of a severe overload and the resultant gassing of the tube, it is sometimes possible to effect clean-up of the gas by operating the tube as an oscillator or an RF power amplifier at reduced plate voltage, gradually increasing the voltage to maximum after permitting the tube to reach stable operation at each step. A series resistor may be used in the plate supply and cut-out in steps as stable operation is attained. If the tube has a thoriated tungsten filament, the gas liberated may have impaired the emission of the filament. It may be possible to restore the activity of the filament by operating at 150% of rated voltage for several minutes, then continuing for 15 minutes at 20% over rated voltage. As a last resort, it may be possible to restore the filament by operation at voltages up to 100% over ratings for several minutes followed by operation at 20% over rating for 15 minutes.

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100 Kingsland Road Clifton, New Jersey
AN IT&T ASSOCIATE

Federal Always Has
Made Better Tubes

Form FJ-214 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-3X2500F3
2.5 Kilowatts Plate Dissipation

Type F-3X2500F3 has Grid and Filament connectors attached, for the convenience of the equipment designer.

GENERAL DATA

DESCRIPTION:

FEDERAL'S Type F-3X2500F3 is a three-electrode tube designed for use in industrial and communications applications as an R-F amplifier, oscillator or modulator service. The anode, forced-air-cooled, is capable of dissipating 2.5 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles.

Electrical:

▶ Filament Voltage	7.5 Volts
▶ Filament Current	51 Amperes
▶ Filament Starting Current	100 Amps. max.
▶ Amplification Factor (average)	20
▶ Transconductance	
I_b = .830 amps.	
E_b = 3000 Volts	20,000 μmhos
▶ Interelectrode Capacitances	
Grid-Plate	20 $\mu\mu$f
Grid-Filament	36 $\mu\mu$f
Plate-Filament	1.2 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Anode Up or Down	
▶ Type of Cooling—Forced Air	
Maximum Incoming Air Temperature	45° C
▶ Required Air Flow on Anode (1)	
Plate Dissipation (Kilowatts)	2.5
Air Flow—Minimum Cubic Feet Per Min.	120
Pressure—Inches of Water	1.0
▶ Required Air Flow on Stem (2) —Cubic Feet Per Min.	6
▶ Maximum Glass Temperature	150° C
▶ Net Weight Approximate	7.5 Lbs.

NOTE 1: Cooling air to radiator and filament seals should be applied before filament power and should be continued for five minutes after removal of filament power.

NOTE 2: Minimum flow to be directed toward filament stem structure, between the inner and outer filament conductors.

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FEDERAL POWER TRIODE
Type F-3X2500F3
2.5 Kilowatts Plate Dissipation

Federal's longer tube life means lower costs. Increase the life of the tubes in your equipment, and unit costs per hour go down.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Frequencies below 30 Mc.)
Class-C FM or Telegraphy
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
ANODE-COOLER CORE TEMPERATURE	150 MAX. °C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION

(Frequencies below 30 Mc., per tube)

D-C Plate Voltage	4000	5000	6000	Volts
D-C Plate Current	2.5	2.5	2.08	Amps
D-C Grid Voltage	—300	—450	—500	Volts
D-C Grid Current	245	265	180	Ma.
Peak R. F. Grid Input Voltage	580	750	765	Volts
Driving Power (approx.)	142	197	136	Watts
Grid Dissipation	68	78	46	Watts
Plate Power Input	10,000	12,500	12,500	Watts
Plate Dissipation	2500	2500	2500	Watts
Plate Power Output	7500	10,000	10,000	Watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

(Frequencies below 30 Mc.)
Class-C Telephony
(Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
PLATE DISSIPATION	1670 MAX. WATTS
ANODE-COOLER CORE TEMPERATURE	150 MAX. °C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION

(Frequencies below 30 Mc., per tube)

D-C Plate Voltage	4000	4500	5000	Volts
D-C Plate Current	1.67	1.55	1.45	Amps
Total Bias Voltage	—450	—500	—550	Volts
Fixed Bias Voltage	—230	—325	—410	Volts
Grid Resistor	1500	1500	1400	Ohms
D-C Grid Current	150	120	100	Ma.
Peak R. F. Grid Input Voltage	680	720	760	Volts
Driving Power (approx.)	102	86	76	Watts
Grid Dissipation	35	26	21	Watts
Plate Power Input	6670	6970	7250	Watts
Plate Dissipation	1670	1670	1670	Watts
Plate Power Output	5000	5300	5580	Watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX.-SIGNAL D-C PLATE CURRENT, PER TUBE	2.5 MAX. AMPS
PLATE DISSIPATION, PER TUBE	2500 MAX. WATTS
ANODE-COOLER CORE TEMPERATURE	150 MAX. °C

TYPICAL OPERATION CLASS AB_2 (Two Tubes)

D-C Plate Voltage	4000	5000	6000	Volts
D-C Grid Voltage (approx.)*	—150	—190	—240	Volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4	Amps
Max.-Signal D-C Plate Current	4.0	3.2	3.0	Amps
Effective Load, Plate to Plate	2200	3600	4650	Ohms
Peak A-F Grid Input Voltage (per tube)	340	360	390	Volts
Max.-Signal Peak Driving Power	340	230	225	Watts
Max.-Signal Nominal Driving Power (approx.)	170	115	113	Watts
Max.-Signal Plate Power Output	11,000	11,000	13,000	Watts

*Adjust to give stated zero-signal plate current.

TYPICAL OPERATION CLASS AB_2 (Two Tubes)

Modulator service for 4000 and 5000 volt operation, to modulate one or two tubes, as shown under "Plate Modulated Radio Frequency Amplifier"

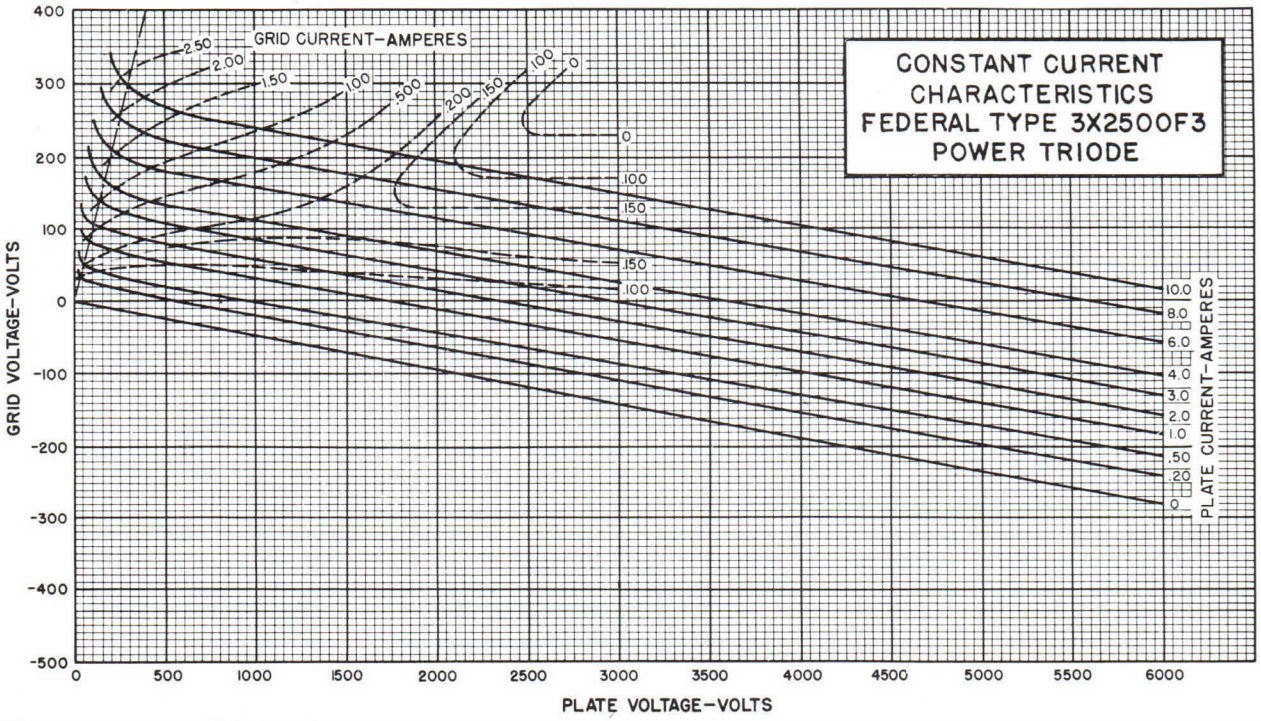
D-C Plate Voltage	4000	5000	4000	5000	Volts
D-C Grid Voltage (approx.)*	—155	—200	—145	—190	Volts
Zero-Signal D-C Plate Current	0.4	0.4	0.6	0.5	Amps
Max.-Signal D-C Plate Current	1.35	1.13	2.70	2.26	Amps
Effective Load, Plate to Plate	6600	10,000	3300	5000	Ohms
Peak A-F Grid Input Voltage (per tube)	240	275	285	310	Volts
Max.-Signal Peak Driving Power	42	40	134	118	Watts
Max.-Signal Nominal Driving Power (approx.)	21	20	67	59	Watts
Max.-Signal Plate Power Output	3700	4000	7400	8000	Watts
Will Modulate one Tube R. F. Final Input of	6670	7250			Watts
Will Modulate two Tubes R. F. Final Input of			13,340	14,500	Watts

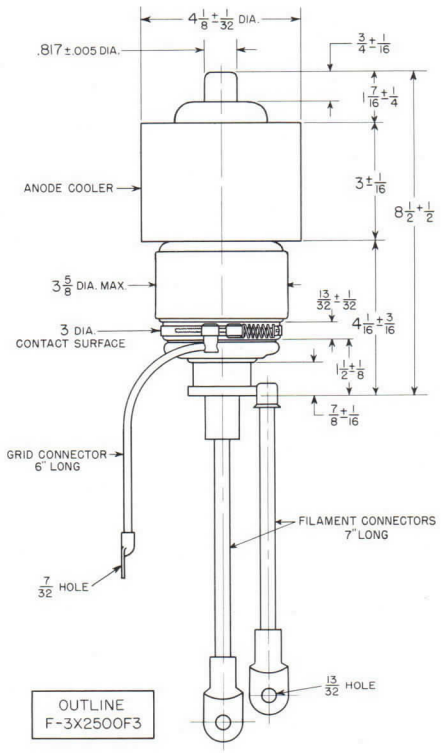
*Adjust to give stated zero-signal plate current.

DIVISION OF IT&T

Precision craftsmanship was initiated by Federal in the earliest days of tube manufacture, and has been maintained ever since.

FEDERAL POWER TRIODE
Type F-3X2500F3
2.5 Kilowatts Plate Dissipation





Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

DIVISION OF IT&T

Federal Always Has
Made Better Tubes

Form F-598 Printed in U. S. A.

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

DESCRIPTION:

THE F-7C23 IS A THREE-ELECTRODE TUBE DESIGNED FOR USE IN HIGH VOLTAGE PULSE OPERATION. THE ANODE IS FORCED AIR-COOLED AND CAPABLE OF DISSIPATING 1,200 WATTS. THE CATHODE IS A THORIATED TUNGSTEN FILAMENT. MAXIMUM RATINGS APPLY UP TO 5 MEGACYCLES.

ELECTRICAL:

FILAMENT VOLTAGE	11.0	VOLTS
FILAMENT CURRENT	29.0	AMPERES
FILAMENT STARTING CURRENT	58	AMPERES
AMPLIFICATION FACTOR, AT E_C = -50 V; I_B = 0.2 AMP.	25	
INTERELECTRODE CAPACITANCES		
GRID-PLATE	12.0	UUF
GRID-FILAMENT	12.5	UUF
PLATE-FILAMENT	1.7	UUF

MECHANICAL:

MOUNTING POSITION	VERTICAL,	ANODE DOWN
TYPE OF COOLING - FORCED AIR		
MAX. INCOMING AIR TEMPERATURE	45°	C
REQUIRED AIR FLOW ON ANODE		
CUBIC FEET PER MINUTE	75	
MAXIMUM GLASS TEMPERATURE	150°	C
NET WEIGHT, APPROXIMATE	5-1/4	POUNDS

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR - PULSED OPERATION

MAXIMUM RATINGS, ABSOLUTE VALUES:

DC PLATE VOLTAGE	17,500	VOLTS
DC GRID VOLTAGE	-2,000	VOLTS
DC PLATE CURRENT	0.100	AMPERE
DC GRID CURRENT	0.010	AMPERE
PLATE DISSIPATION	1,200	WATTS
MAX. PULSE WIDTH	90	u SECONDS
MAX. DUTY	0.005	

TYPICAL OPERATION:
(UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES)

DC PLATE VOLTAGE	15,000	VOLTS
DC PLATE CURRENT	.16	AMPERES
DC GRID CURRENT	1.25	MA
AVERAGE POWER OUTPUT	120	WATTS
PEAK POWER OUTPUT	120	KILOWATTS

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY

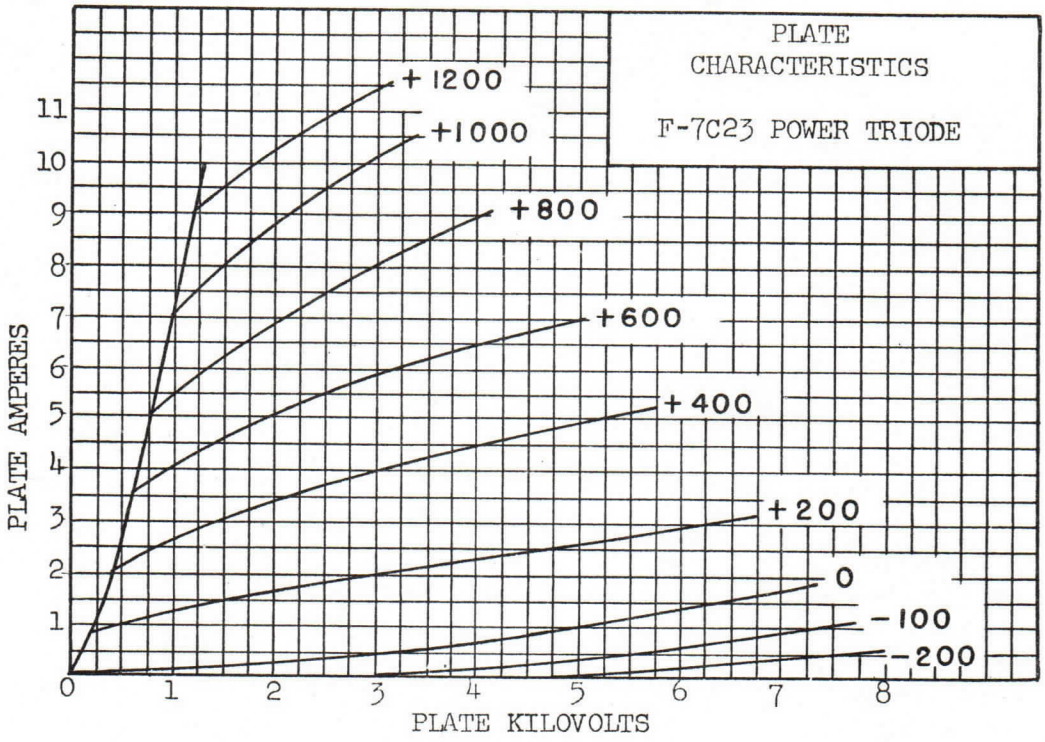
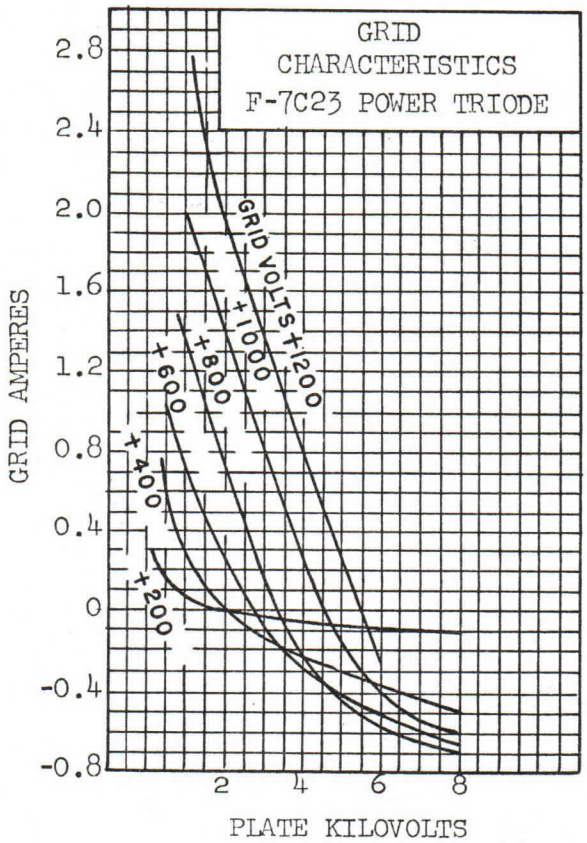
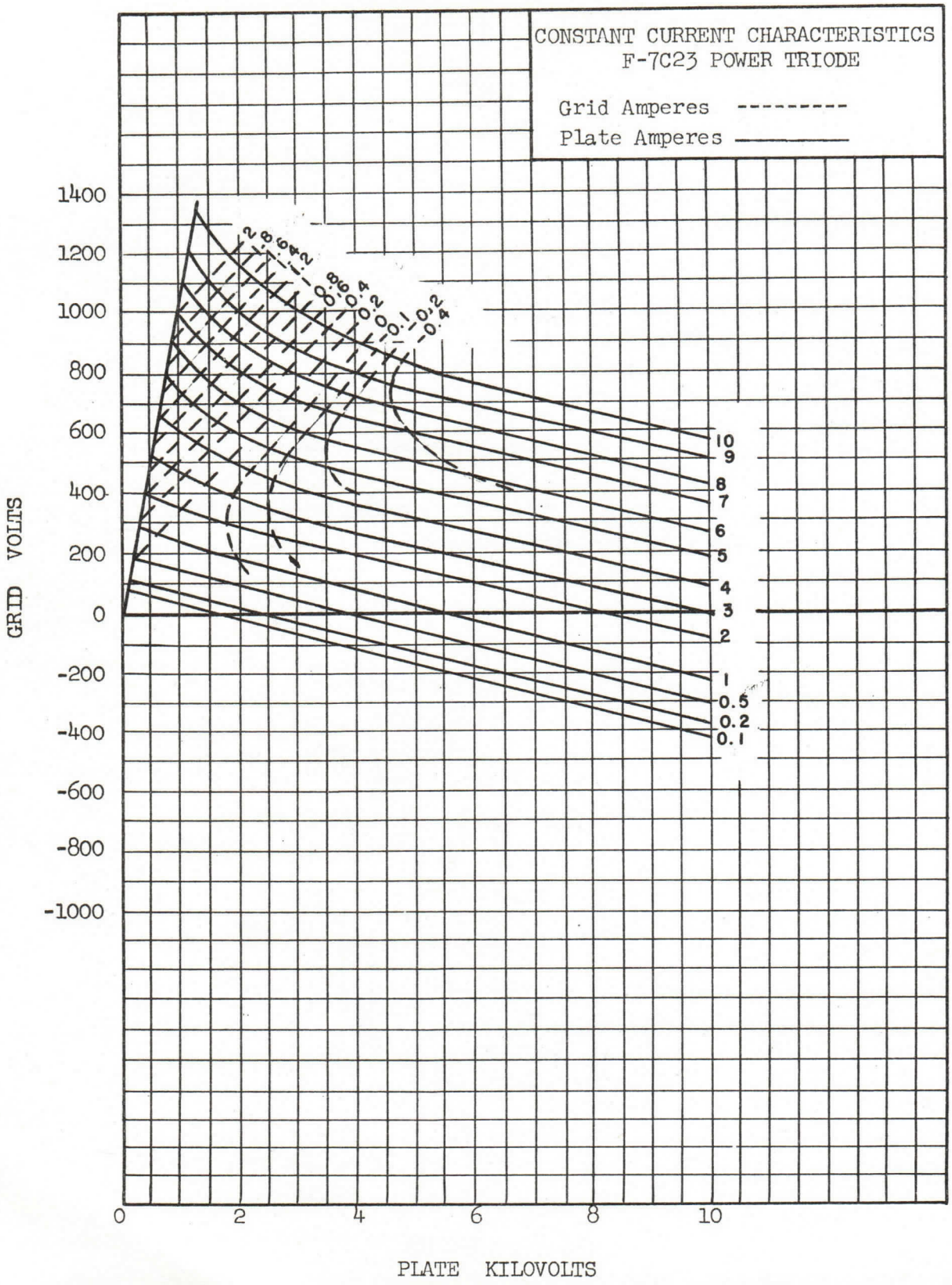


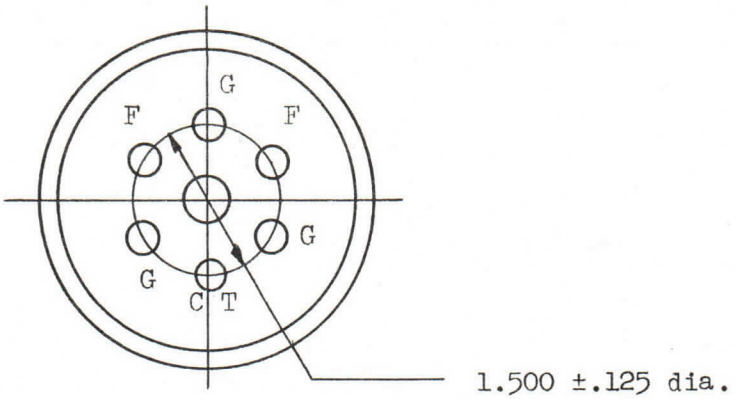
PLATE
CHARACTERISTICS
F-7C23 POWER TRIODE
+1200
+1000
+800
+600
+400
+200
0
-100
-200
PLATE AMPERES
PLATE KILOVOLTS
0
1
2
3
4
5
6
7
8
9
10
11


GRID
CHARACTERISTICS
F-7C23 POWER TRIODE
GRID VOLTS +1200
+1000
+800
+600
+400
+200
GRID AMPERES
PLATE KILOVOLTS
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0
-0.4
-0.8
2
4
6
8

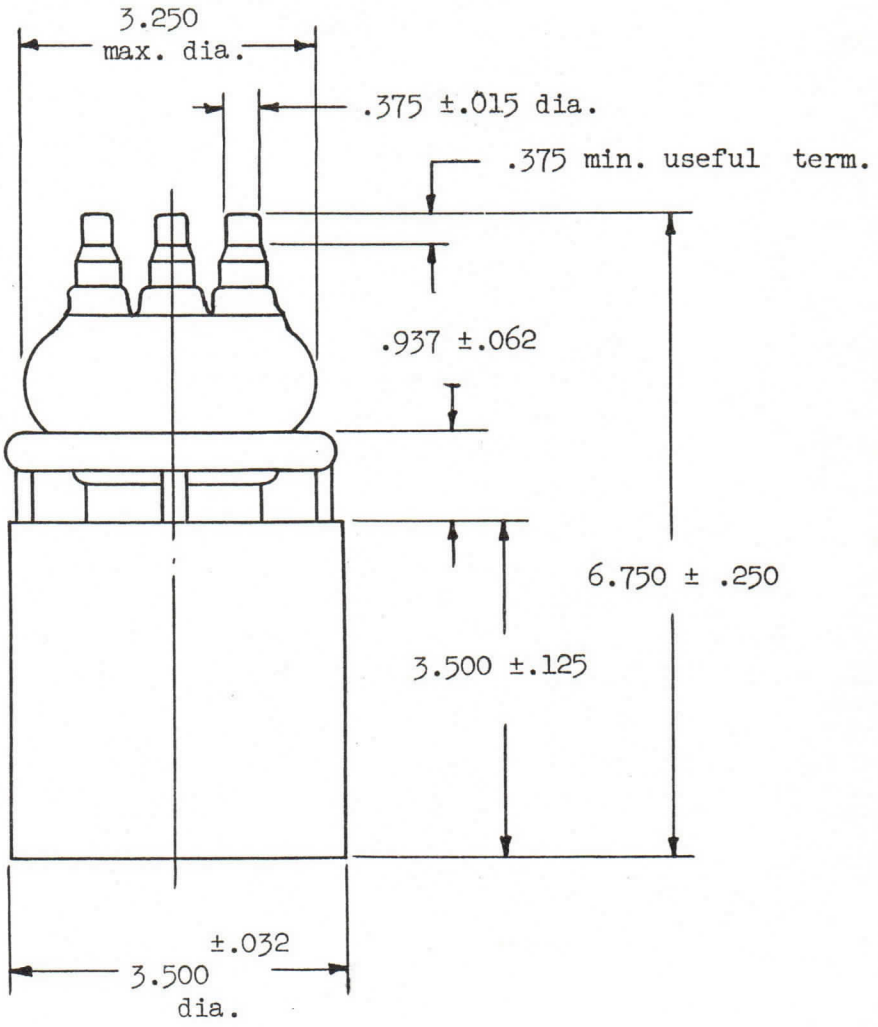

CONSTANT CURRENT CHARACTERISTICS
F-7C23 POWER TRIODE
Grid Amperes ---------
Plate Amperes ————————
GRID VOLTS
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
0
2
4
6
8
10
PLATE KILOVOLTS
10
9
8
7
6
5
4
3
2
1
0.5
0.2
0.1

Color Code

Fil. Term.	- Yellow
Fil. Center Term.	- Red
Grid Term.	- Black



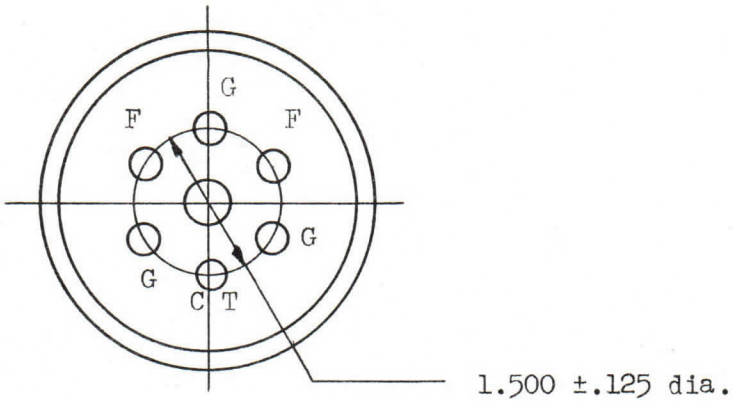
Tubulation tip off $\frac{1}{8}$ below top of terminals.



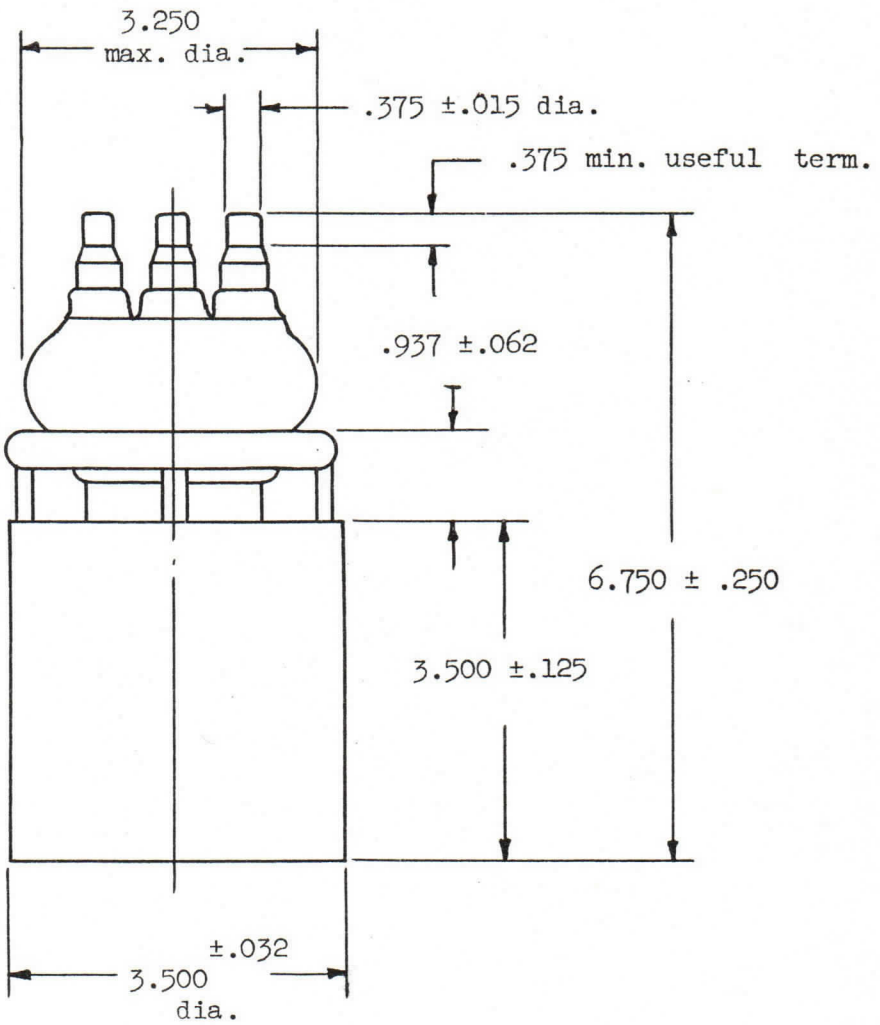
OUTLINE
F-7C23 POWER TRIODE

Color Code

Fil. Term.	- Yellow
Fil. Center Term.	- Red
Grid Term.	- Black

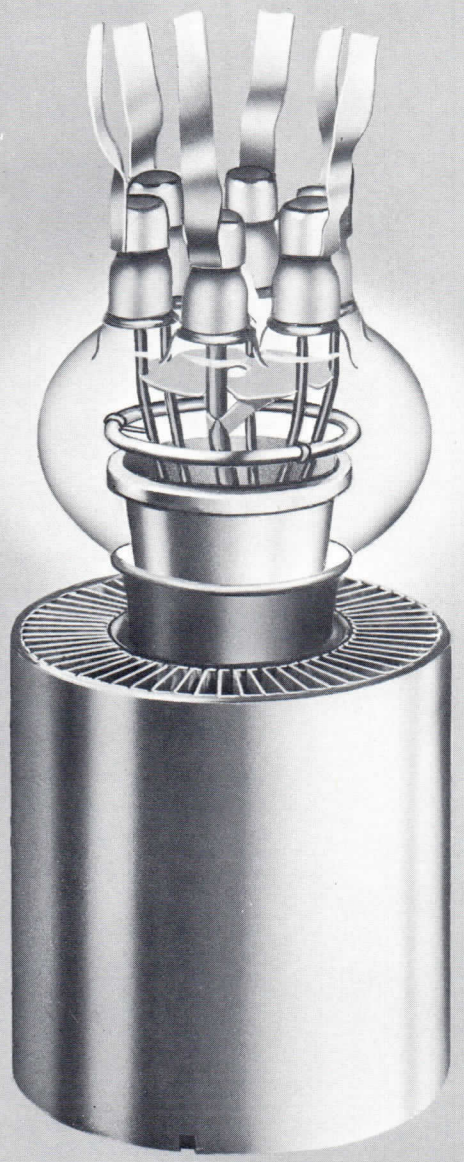


Tubulation tip off $\frac{1}{8}$ below top of terminals.



OUTLINE
F-7C23 POWER TRIODE

FEDERAL POWER TRIODE
Type F-7C25
2.5 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's Type F-7C25 is a three electrode tube designed for use in industrial applications. The relatively wide spacing between the elements, and the lack of internal insulators make this type meet the severe conditions of radio frequency heating service. The anode is air-cooled, capable of dissipating 2.5 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles.

Electrical:

▶ Filament Voltage	11 Volts
▶ Filament Current	28 Amperes
▶ Filament Starting Current	56 Amperes
▶ Filament Cold Resistance	.047 Ohms
▶ Peak Cathode Current	10 Amperes
▶ Amplification Factor, E_b=3,000 Volts, I_b=0.200 Amps.	25
▶ Interelectrode Capacitances	
Grid-Plate	13.2 $\mu\mu$f
Grid-Filament	14.5 $\mu\mu$f
Plate-Filament	1.7 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Anode Down			
▶ Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
▶ Required Air Flow on Anode			
Plate Dissipation (Kilowatts)	2.5	2.0	1.5
Air Flow—Cubic Feet Per Min.	150	120	90
Pressure—Inches Water	2.5	1.6	0.9
Maximum Glass Temperature			150° C
▶ Net Weight, Approximate			5 Pounds

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FEDERAL POWER TRIODE
Type F-7C25
2.5 Kilowatts Plate Dissipation

Federal's longer tube life means lower costs. Increase the life of the tubes in your equipment, and unit costs per hour go down.

Maximum Ratings and Typical Operating Conditions

For maximum frequency of 50 megacycles

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Maximum Ratings

DC Plate Voltage	5,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1.3 Amperes
DC Grid Current	0.150 Amperes
Plate Input	6.5 Kilowatts
Plate Dissipation	2.5 Kilowatts

Typical Operation

DC Plate Voltage	4,000	4,500	5,000 Volts
DC Grid Voltage	—400	—500	—600 Volts
Peak R-F Grid Voltage	1,000	1,150	1,300 Volts
DC Plate Current	1.0	1.2	1.2 Amperes
DC Grid Current	0.08	0.1	0.13 Amperes
Driving Power, Approx.	80	110	160 Watts
Power Output	2.5	3.1	4.0 Kilowatts

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

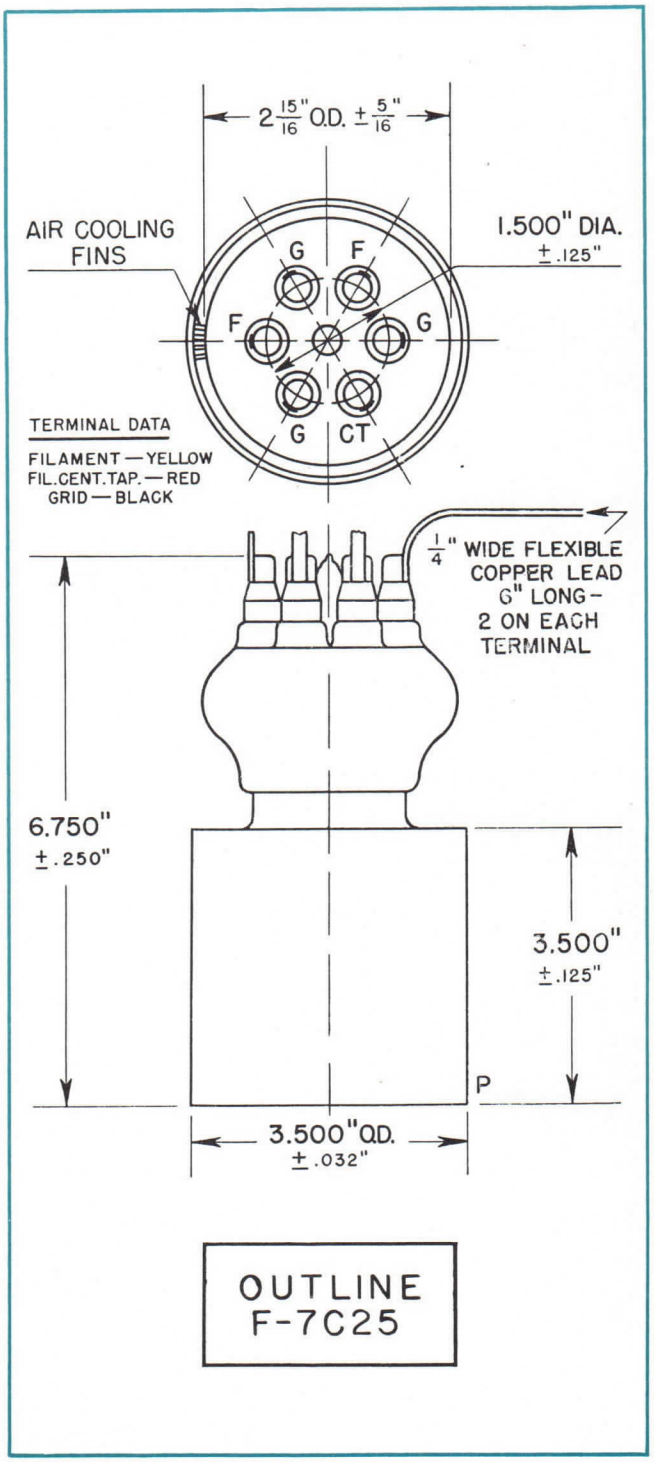
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	4,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1.0 Amperes
DC Grid Current	0.15 Amperes
Plate Input	4.0 Kilowatts
Plate Dissipation	1.6 Kilowatts

Typical Operation

DC Plate Voltage	3,500 Volts
DC Grid Voltage	—500 Volts
Peak R-F Grid Voltage	1,000 Volts
DC Plate Current	0.825 Amperes
DC Grid Current	0.110 Amperes
Driving Power, Approx.	100 Watts
Power Output	2 Kilowatts

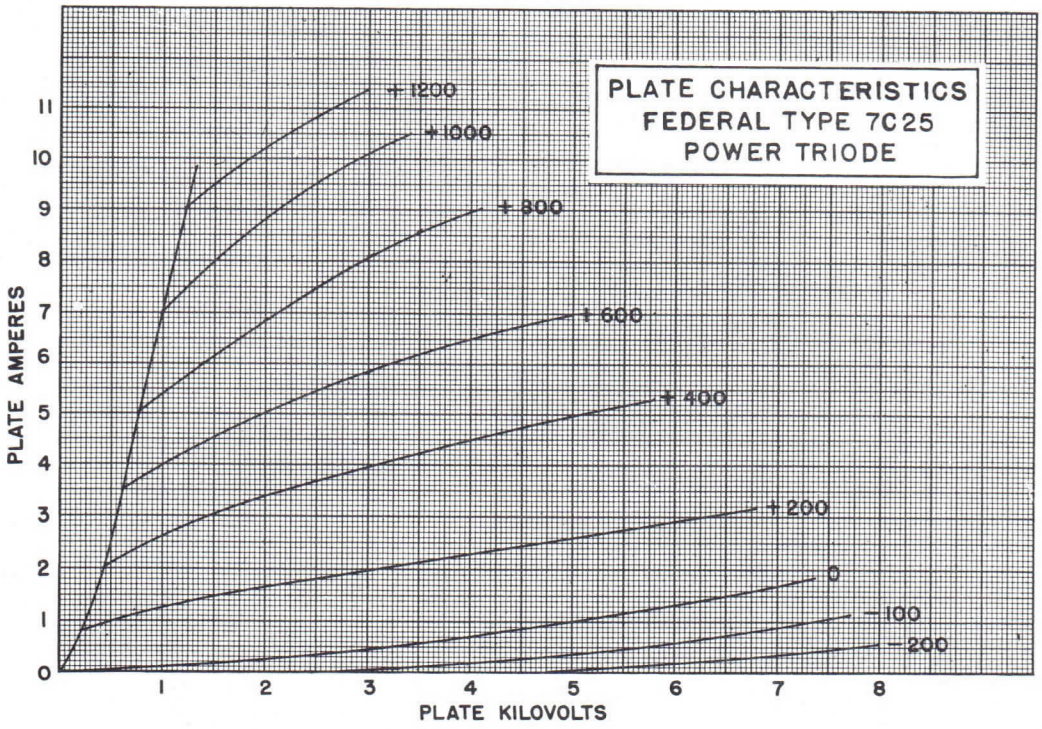


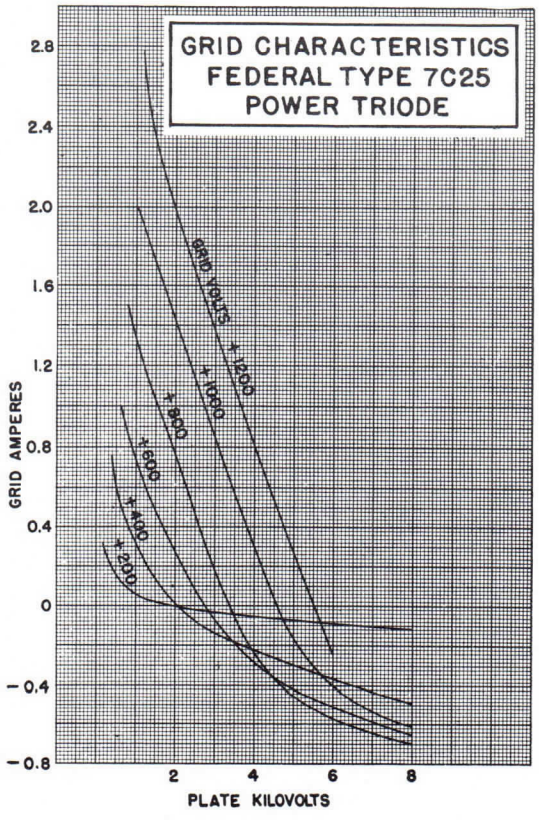
OUTLINE F-7C25

DIVISION OF I T & T

Federal's name on a tube signifies the best in design, engineering, materials, components and craftsmanship.

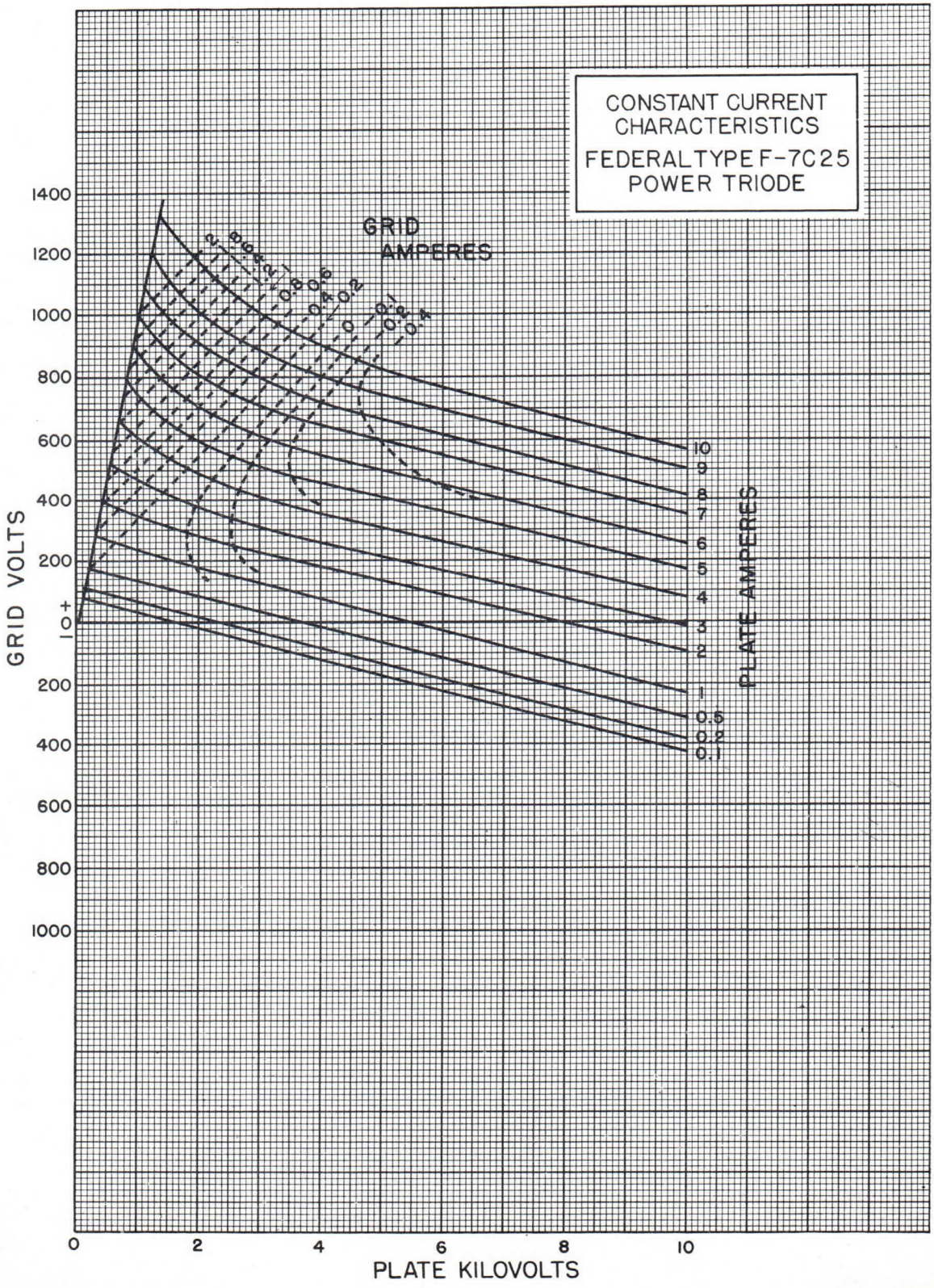
FEDERAL POWER TRIODE
Type F-7C25
2.5 Kilowatts Plate Dissipation





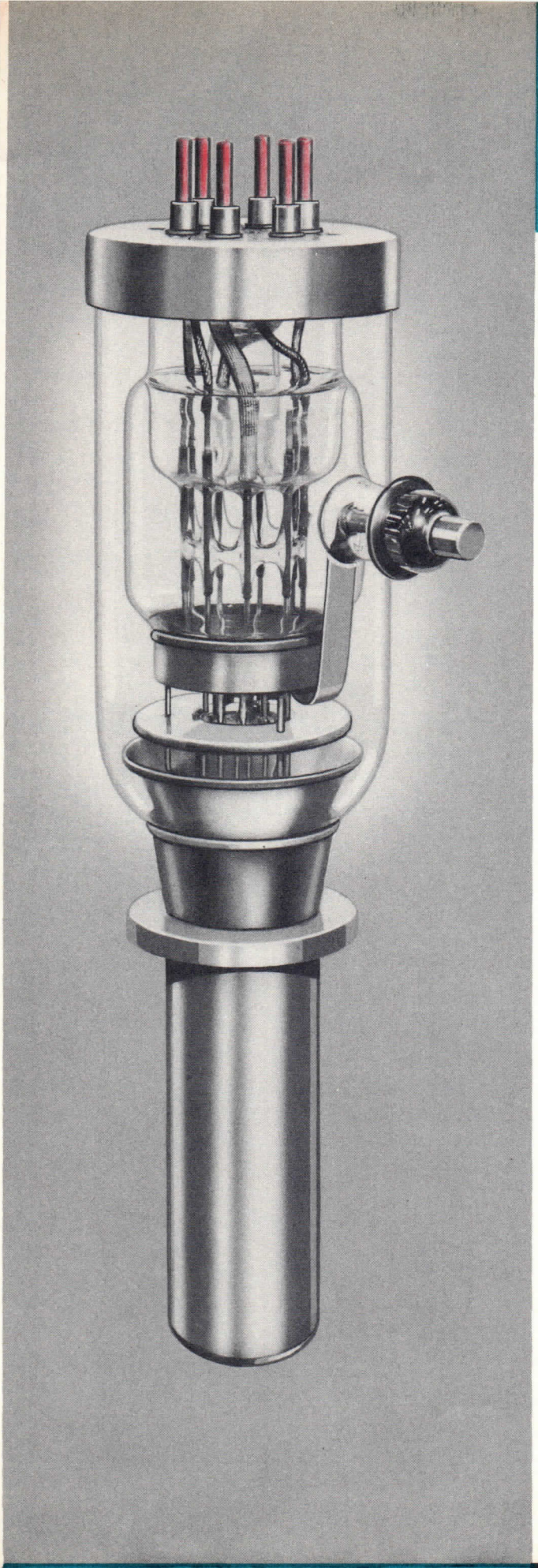
FEDERAL POWER TRIODE
Type F-7C25
2.5 Kilowatts Plate Dissipation

Federal tubes have always been known for their *plus values:* an extra rugged construction, a longer life of service.



Form F-593 Printed in U.S.A.

Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey



FEDERAL POWER TRIODE

Type F-9C28

40 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-9C28 is a three-electrode tube designed for use as a modulator in Class AB_1 circuits. The anode is water-cooled, capable of dissipating 40 kilowatts. The cathode is a thoriated tungsten multi-strand filament and may be operated on DC, 1ϕ, 3ϕ, or 6ϕ AC excitation. Maximum ratings apply for audio-frequency use only.

Electrical:

Filament Voltage§	15 Volts
Filament Current§	135 Amperes
Filament Starting Current§	200 Amps. max.
Filament Cold Resistance§	.019 Ohms
Peak Cathode Current	45 Amperes
Amplification Factor, $E_c = -1{,}600$ V; $I_b = 3.0$A	4.75
Interlectrode Capacitances	
Grid-Plate	45 $\mu\mu$f
Grid-Filament	56 $\mu\mu$f
Plate-Filament	20 $\mu\mu$f

§Single phase excitation.

Mechanical:

Mounting Position— Vertical, Anode Down	
Type of Cooling—Water	
Minimum Water Flow on Anode	20 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Net Weight, approx.	11½ Pounds

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FEDERAL POWER TRIODE

Type F-9C28

40 Kilowatts Plate Dissipation

The F-9C28 is Federal's thoriated tungsten filament low *mu* modulator tube for use in conjunction with the F-9C30.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS AB_1

Maximum Ratings, Absolute Values

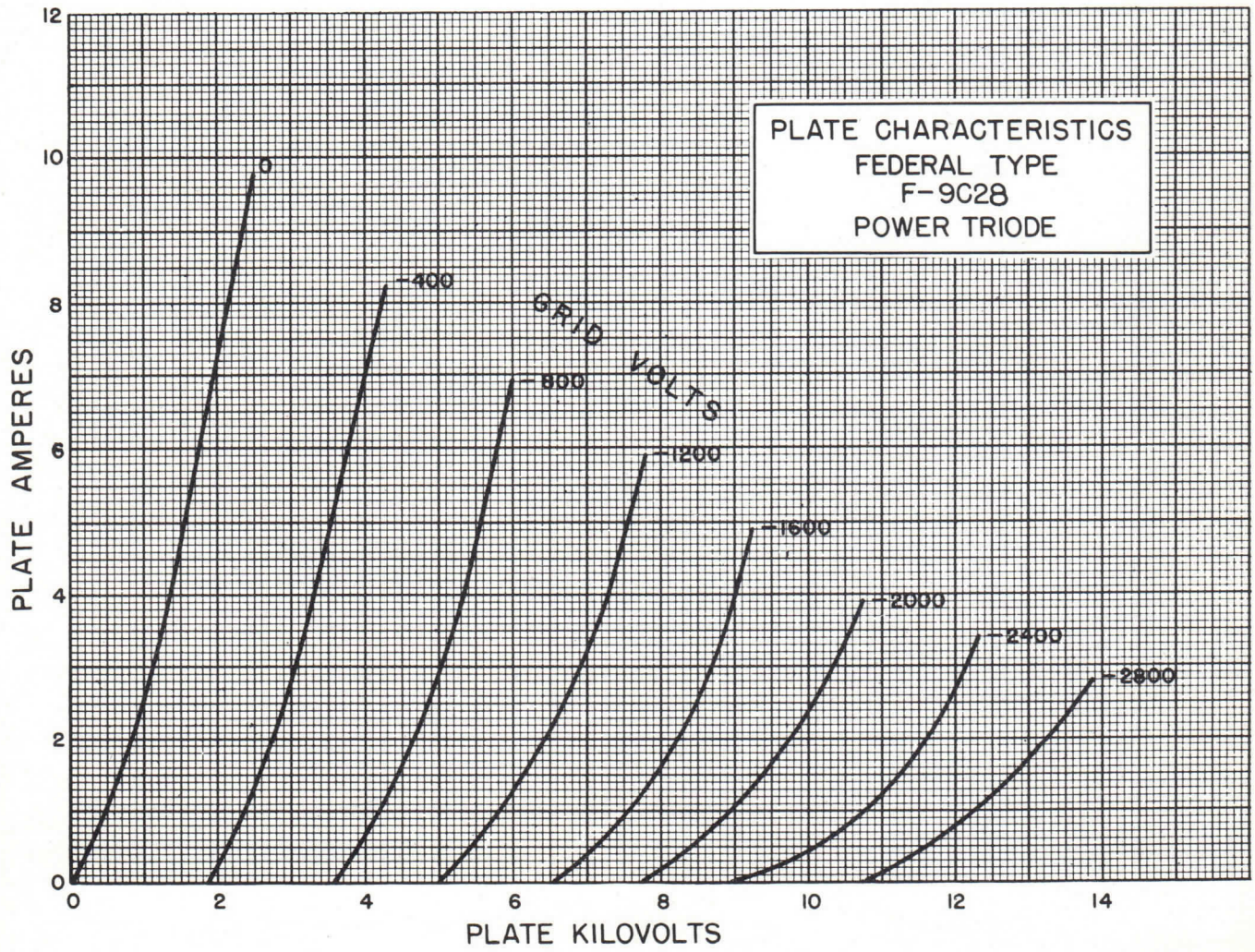
DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	10 Amperes
Maximum Signal Plate Input†	100 Kilowatts
Plate Dissipation†	40 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000	12,000 Volts
DC Grid Voltage	—2,200	—2,600 Volts
Peak A-F Grid to Grid Voltage	4,380	5,160 Volts
Zero-Signal DC Plate Current	1.2	1.4 Amperes
Maximum Signal DC Plate Current	7.2	5.6 Amperes
Effective Load Resistance, Plate to Plate	2,600	4,500 Ohms
Maximum Signal Driving Power	0	0 Watts
Maximum Signal Power Output	39	39 Kilowatts

†Averaged over any audio frequency cycle at sine-wave form.



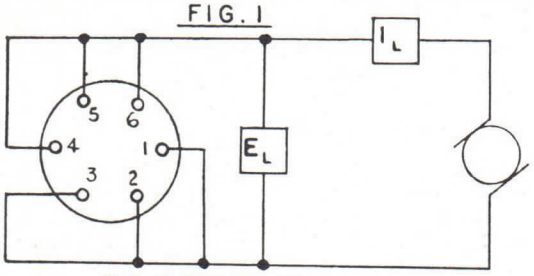
Up to 100 kilowatts of audio power is available . . . from *two* Federal F-9C28 tubes in a Class AB modulator.

FEDERAL POWER TRIODE

Type F-9C28

40 Kilowatts Plate Dissipation

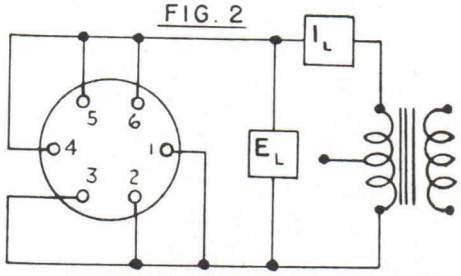
FIG. 1



D.C. CONNECTION

E_L = 'X' VOLTS D.C.
I_L = 'Y' AMPS. D.C.

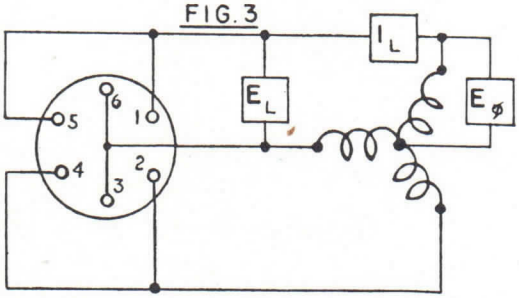
FIG. 2



SINGLE-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.

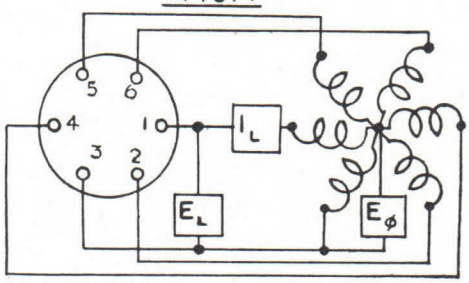
FIG. 3



THREE-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

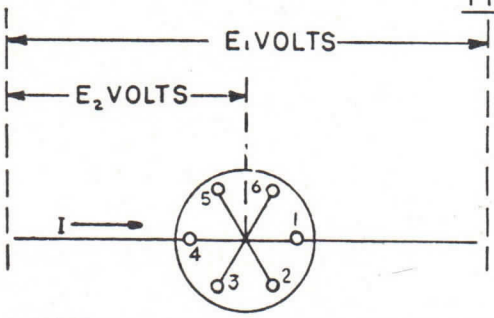
FIG. 4



SIX-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

FIG. 5



INTERNAL CONNECTION OF FILAMENTS

NUMBERS 1 TO 6 INCLUSIVE ON CONNECTIONS DENOTE BASE TERMINALS.

E_1 = 'U' VOLTS D.C. OR A.C. TERMINAL TO TERMINAL VOLTAGE.

E_2 = 'V' VOLTS D.C. OR A.C. VOLTAGE PER FILAMENT STRAND *i.e.* FROM TERMINAL TO COMMON TERMINAL CONNECTION.

I = 'W' AMPERES CURRENT PER FILAMENT TERMINAL.

FIG.	U	V	W	X	Y	Z
1				15	135	
2				15	135	
3				13	90	7.5
4				7.5	45	7.5
5	15	7.5	45			

MULTI-PHASE FILAMENT CONNECTIONS

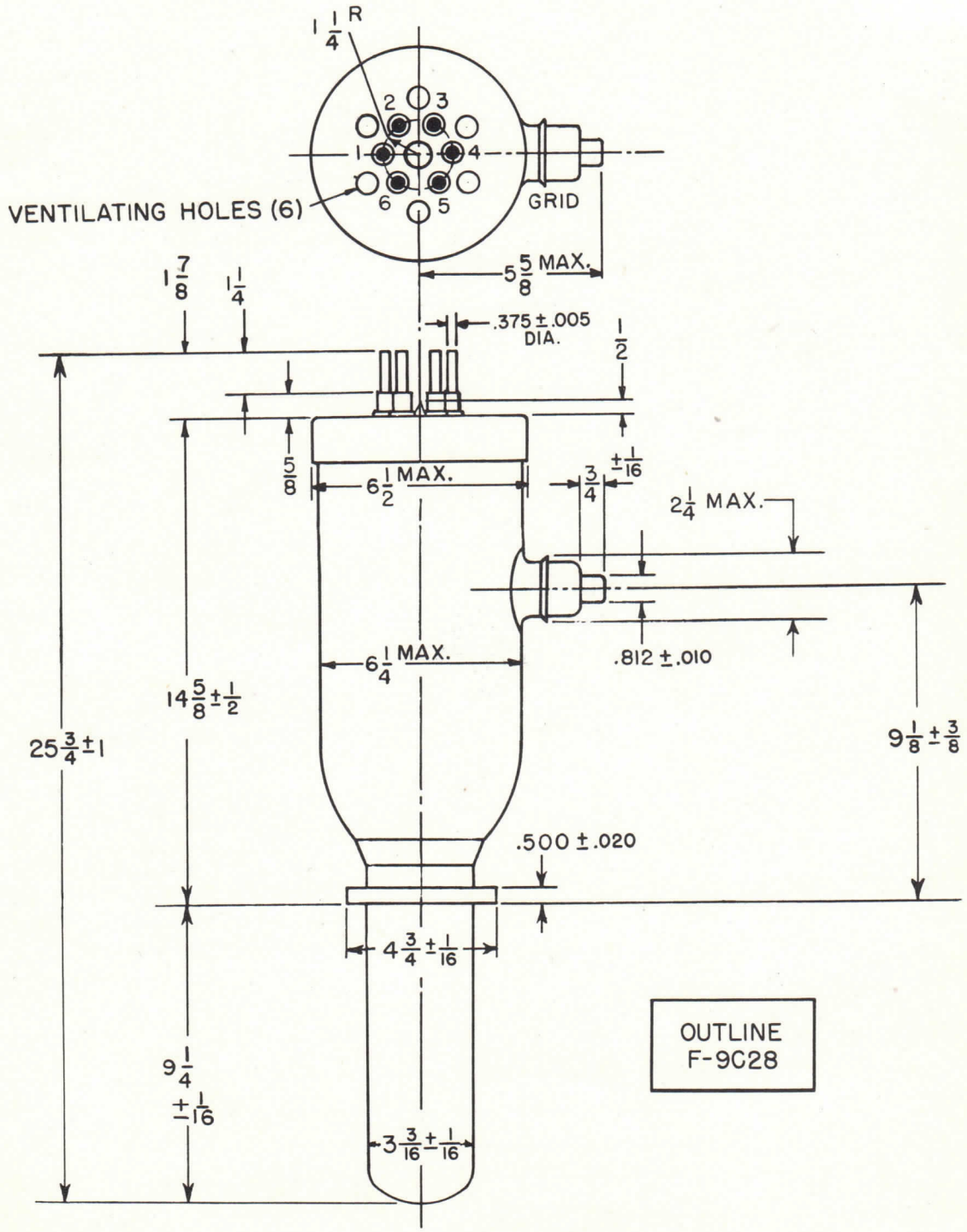
AN IT&T ASSOCIATE

FEDERAL POWER TRIODE

Type F-9C28

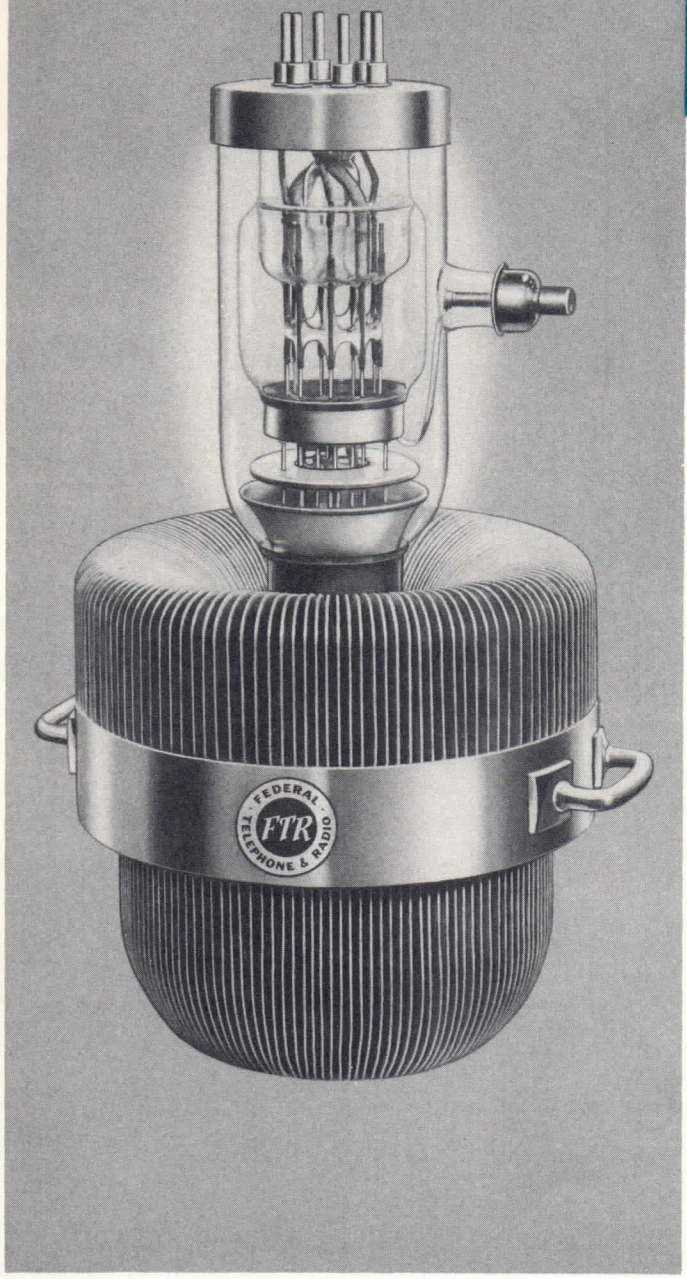
40 Kilowatts Plate Dissipation

One of the *first* to manufacture power tubes, Federal's experience goes back to the earliest days of the industry.



Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-9C29
20 Kilowatts Plate Dissipation



Federal's name on a tube means superior high vacuum processing, ratings commensurate with design and application, quality control of materials used in manufacture, and superior craftsmanship. *Federal always has made better tubes.*

GENERAL DATA

DESCRIPTION:

The F-9C29 by Federal is a three-electrode tube engineered for modulator use in Class AB_1 circuits. The anode, forced-air-cooled, is capable of dissipating 20 kilowatts. The cathode, a thoriated tungsten multistrand filament, may be operated on DC, 1Ø, 3Ø, or 6Ø AC excitation. Maximum ratings apply for audio-frequency use only.

Electrical:

Filament Voltage§	15 Volts
Filament Current§	135 Amperes
Filament Starting Current§	200 Amps. max.
Filament Cold Resistance§	.019 Ohms
Peak Cathode Current	45 Amperes
Amplification Factor, $E_c = -1600$ V; $I_b = 3.0$A	4.75
Interelectrode Capacitances	
Grid-Plate	50 $\mu\mu$f
Grid-Filament	56 $\mu\mu$f
Plate-Filament	20 $\mu\mu$f

§Single phase excitation.

Mechanical:

Mounting Position— Vertical, Anode Down	
Type of Cooling—Forced Air	
Maximum Incoming Air Temperature	45° C

Required Air Flow on Anode

Plate Dissipation (Kilowatts)	20	16	12
Air Flow—Cubic Feet per Min.	2,100	1,600	1,200
Pressure—Inches Water	2.15	1.24	0.70

Maximum Glass Temperature	150° C
Net Weight, approximate	202 Lbs.

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FEDERAL POWER TRIODE
Type F-9C29
20 Kilowatts Plate Dissipation

Federal's F-9C29, air-cooled version of the F-9C28, is designed for use as a modulator in conjunction with the F-9C31.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS AB_1

Maximum Ratings, Absolute Values

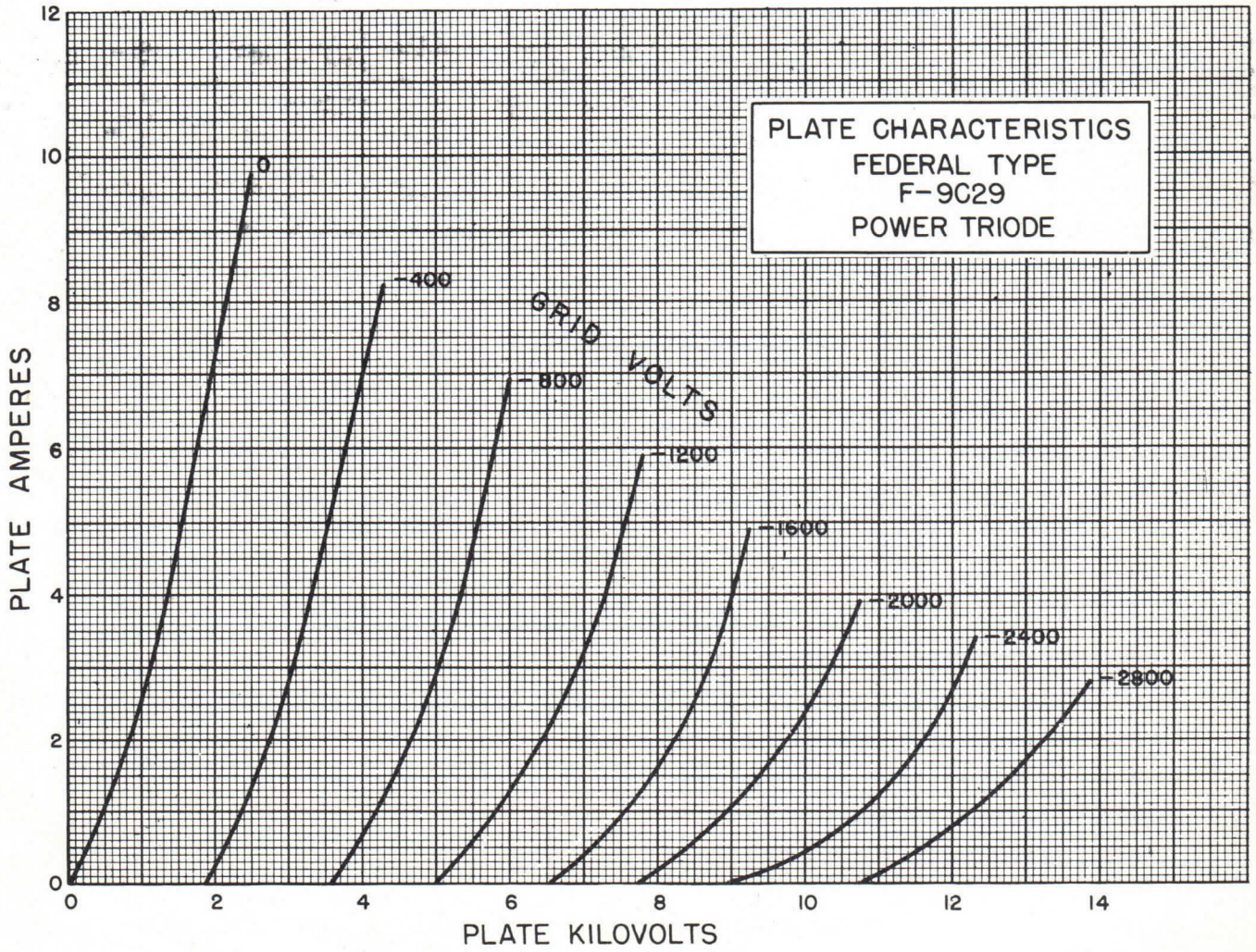
DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	10 Amperes
Maximum Signal Plate Input†	50 Kilowatts
Plate Dissipation†	20 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000	12,000 Volts
DC Grid Voltage	—2,200	—2,600 Volts
Peak A-F Grid to Grid Voltage	4,380	5,160 Volts
Zero-Signal DC Plate Current	1.2	1.4 Amperes
Maximum Signal DC Plate Current	7.2	5.6 Amperes
Effective Load Resistance, Plate to Plate	2,600	4,500 Ohms
Maximum Signal Driving Power	0	0 Watts
Maximum Signal Power Output	39	39 Kilowatts

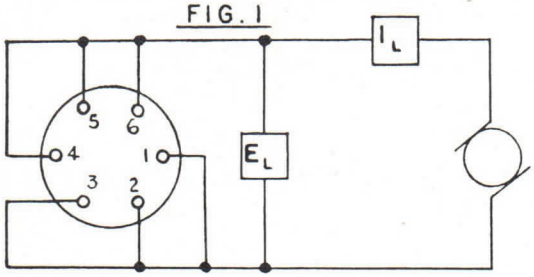
†Averaged over any audio-frequency cycle of sine-wave form.



The heavy wall anode of Federal's F-9C29 means a more uniform heat distribution, a more efficient performance.

FEDERAL POWER TRIODE
Type F-9C29
20 Kilowatts Plate Dissipation

FIG. 1



D.C. CONNECTION

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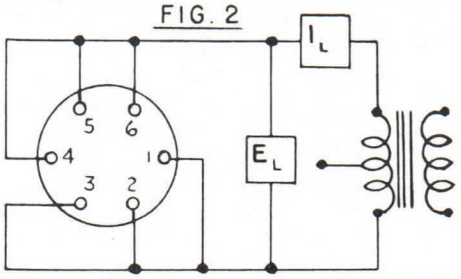
FIG. 2



SINGLE-PHASE A.C. CONNECTION

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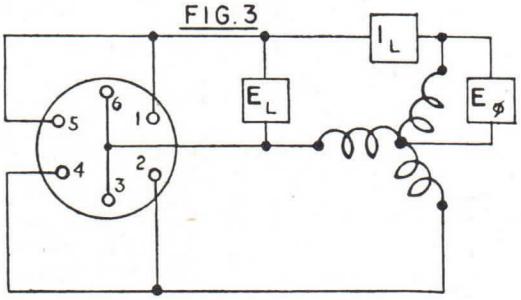
I_L = 'Y' AMPS. A.C.

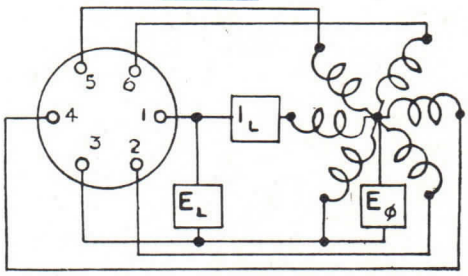
FIG. 3



THREE-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

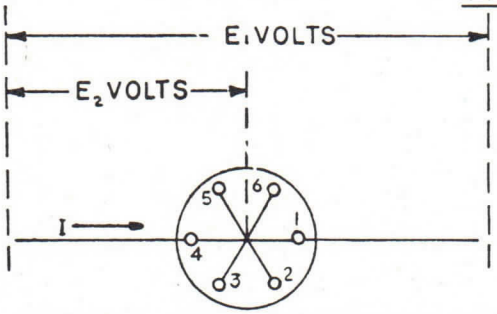
FIG. 4



SIX-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

FIG. 5



INTERNAL CONNECTION OF FILAMENTS

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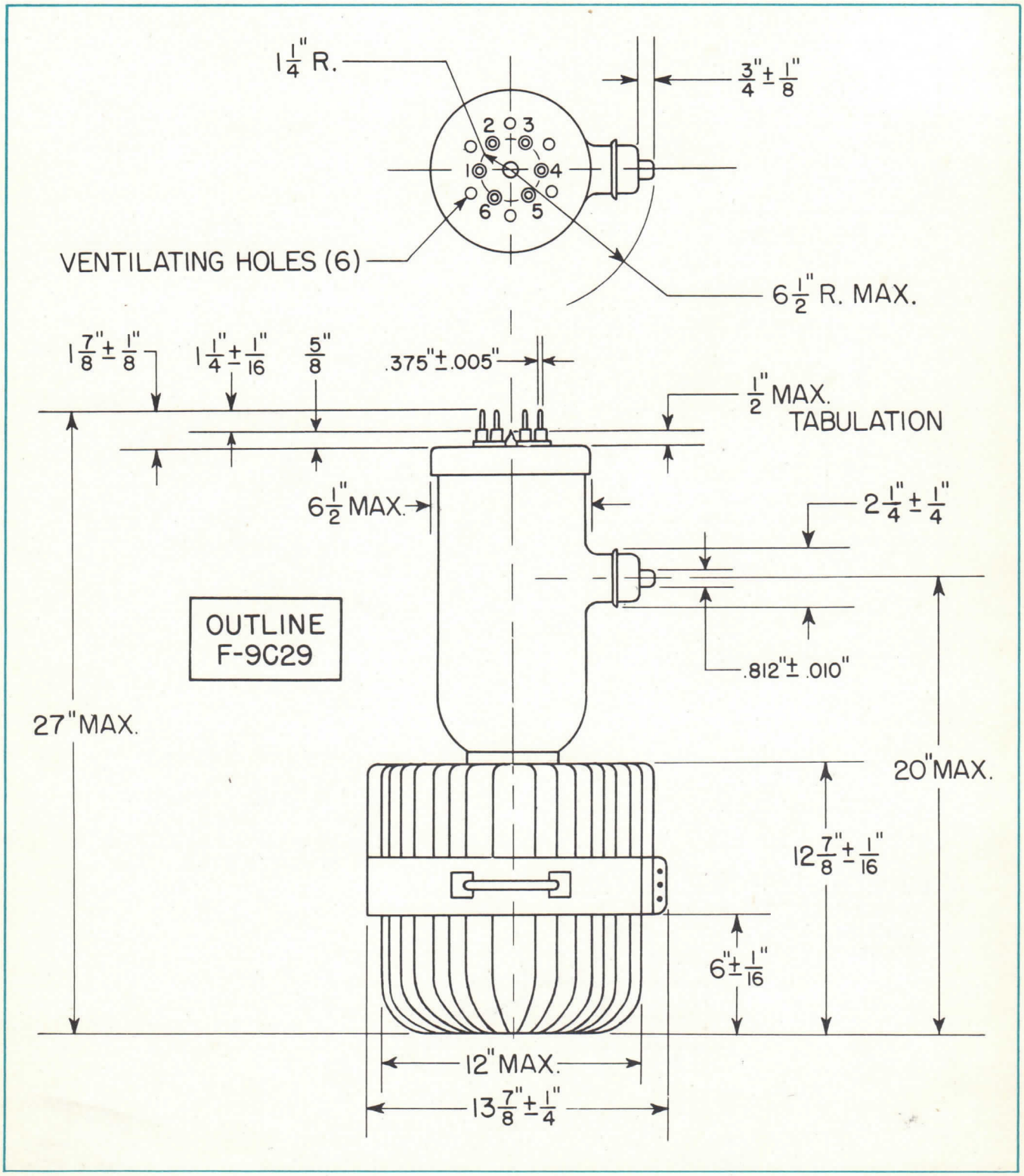
FIG.	U	V	W	X	Y	Z
1				15	135	
2				15	135	
3				13	90	7.5
4				7.5	45	7.5
5	15	7.5	45			

MULTI-PHASE FILAMENT CONNECTIONS

AN IT&T ASSOCIATE

FEDERAL POWER TRIODE
Type F-9C29
20 Kilowatts Plate Dissipation

Federal always has made tubes of the very finest quality.



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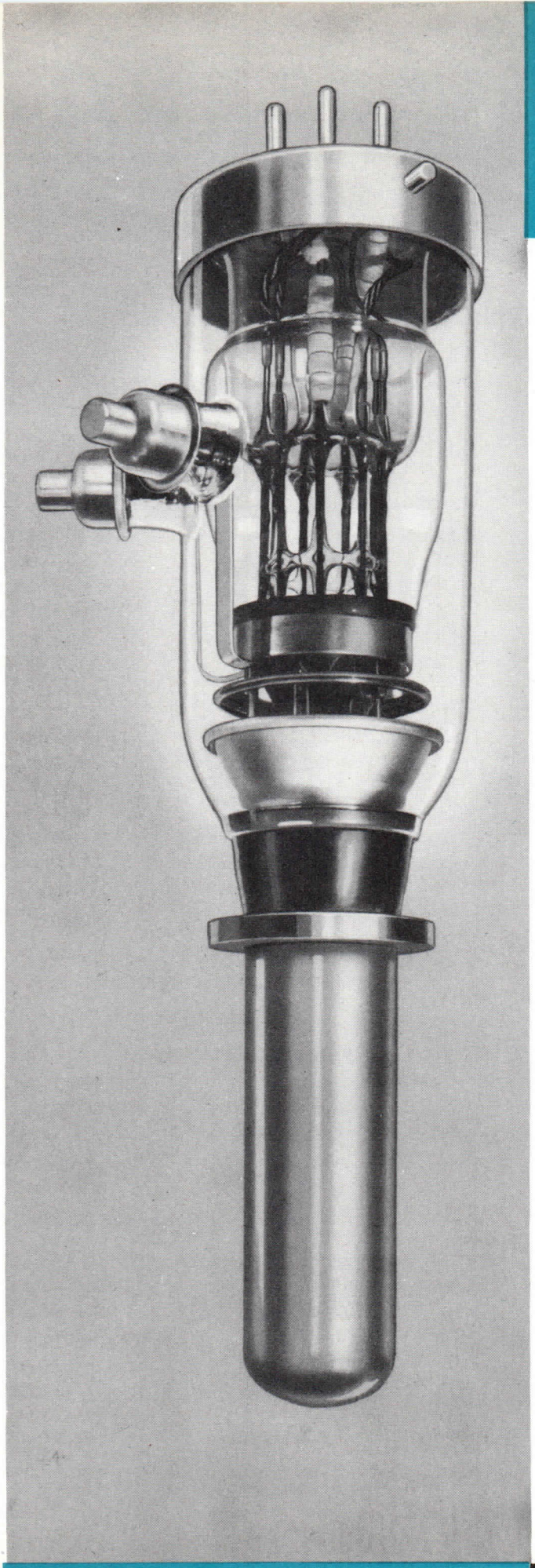
An IT&T Associate

Federal Telephone and Radio Corporation

100 Kingsland Road Clifton, New Jersey



FEDERAL POWER TRIODE
Type F-9C30
40 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

The F-9C30 is a three-electrode tube, Federal-designed, for use as a radio-frequency amplifier, oscillator, or Class B modulator. The anode, water-cooled, is capable of dissipating 40 kilowatts. The cathode is a thoriated tungsten multi-strand filament, and may be operated on direct current, single-phase, three-phase, or six-phase alternating current excitation. Maximum ratings apply up to 20 megacycles.

Electrical:

Filament Voltage§	15 Volts
Filament Current§	135 Amperes
Filament Starting Current§	200 Amperes max.
Filament Cold Resistance§	.019 Ohms
Peak Cathode Current	45 Amperes
Amplification Factor, at $E_c = -200V$ $I_b = 1.6A$	40.5
Interelectrode Capacitances	
Grid-Plate	35 $\mu\mu f$
Grid-Filament	46 $\mu\mu f$
Plate-Filament	5.6 $\mu\mu f$

§Single phase excitation.

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling—Water	
Minimum Water Flow on Anode	15 GPM.
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Net Weight, approximate	11½ Pounds

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Federal Telephone and Radio Corporation

FEDERAL POWER TRIODE
Type F-9C30
40 Kilowatts Plate Dissipation

Federal was *the first in the industry* to develop, engineer and produce thoriated tungsten filaments in high-power tubes.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	50 Kilowatts
Plate Dissipation†	30 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—200 Volts
Peak A-F Grid-to-Grid Voltage	1,600 Volts
Zero Signal DC Plate Current	0.5 Amperes
Maximum Signal DC Plate Current	6.0 Amperes
Effective Load Resistance, Plate to Plate	3,750 Ohms
Maximum Signal Driving Power, approximate	360 Watts
Maximum Signal Power Output, approximate	39 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
DC Plate Current	4 Amperes
Plate Input	60 Kilowatts
Plate Dissipation	40 Kilowatts

Typical Operation

DC Plate Voltage	15,000 Volts
DC Grid Voltage	—200 Volts
Peak R-F Grid Voltage	470 Volts
DC Plate Current	2.7 Amperes
DC Grid Current, approximate	0.0 Amperes
Driving Power, approximate‡	480 Watts
Power Output, approximate	13.7 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	4.5 Amperes
DC Grid Current	1 Ampere
Plate Input	54 Kilowatts
Plate Dissipation	30 Kilowatts

Typical Operation

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—750 Volts
Peak R-F Grid Voltage	1,510 Volts
DC Plate Current	3.1 Amperes
DC Grid Current, approximate	0.48 Amperes
Driving Power, approximate	700 Watts
Power Output, approximate	27.2 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	8 Amperes
DC Grid Current	1 Ampere
Plate Input	120 Kilowatts
Plate Dissipation	40 Kilowatts

Typical Operation

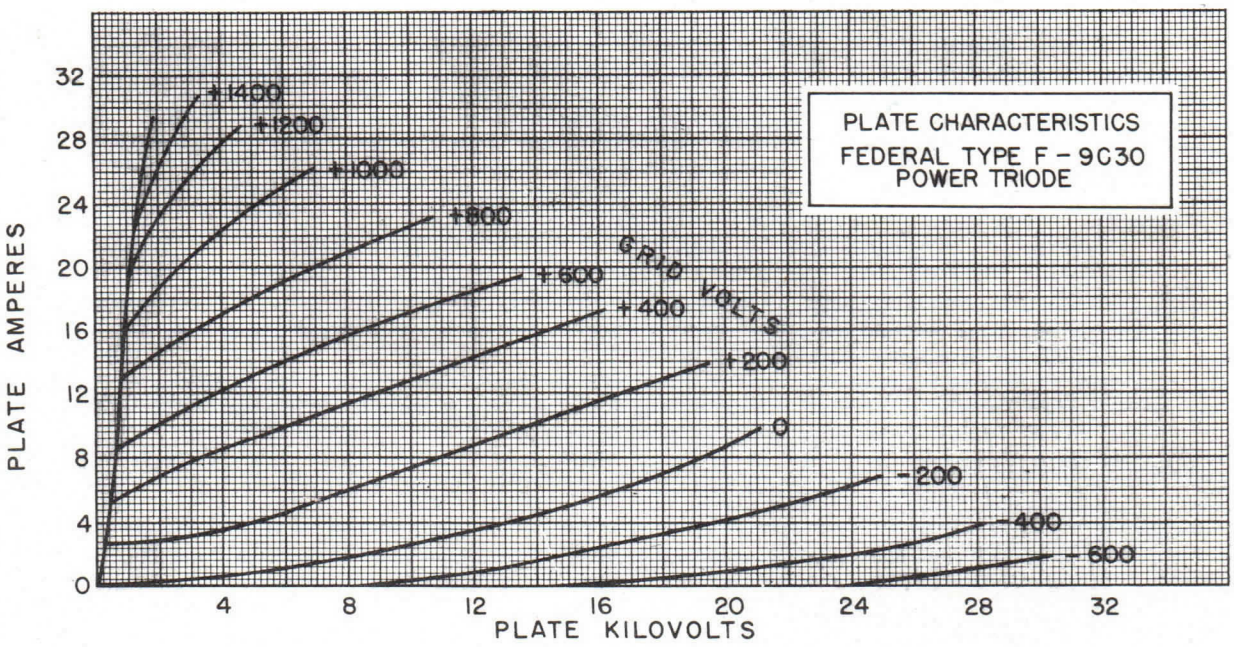
DC Plate Voltage	15,000 Volts
DC Grid Voltage	—900 Volts
Peak R-F Grid Voltage	1,940 Volts
DC Plate Current	4.7 Amperes
DC Grid Current, approximate	0.75 Amperes
Driving Power, approximate	1,350 Watts
Power Output, approximate	52 Kilowatts

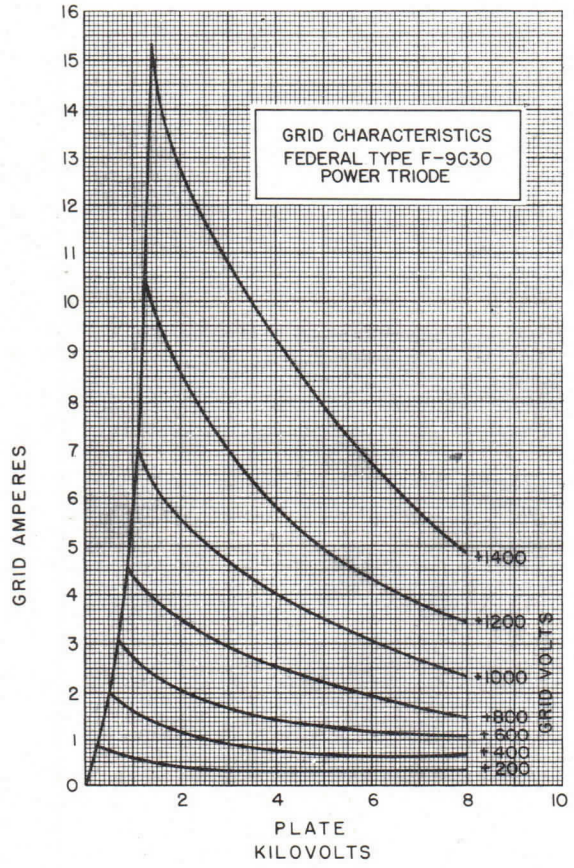
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

An IT&T Associate

FEDERAL POWER TRIODE
Type F-9C30
40 Kilowatts Plate Dissipation

Typical triodes using Federal thoriated tungsten filaments are F-9C30 and F-9C31 power amplifiers . . . F-9C28 and F-9C29 modulators.





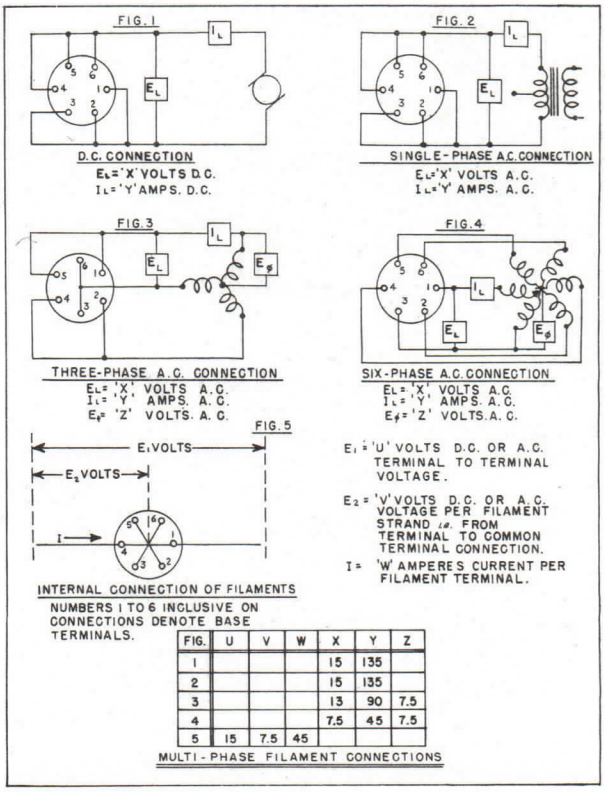


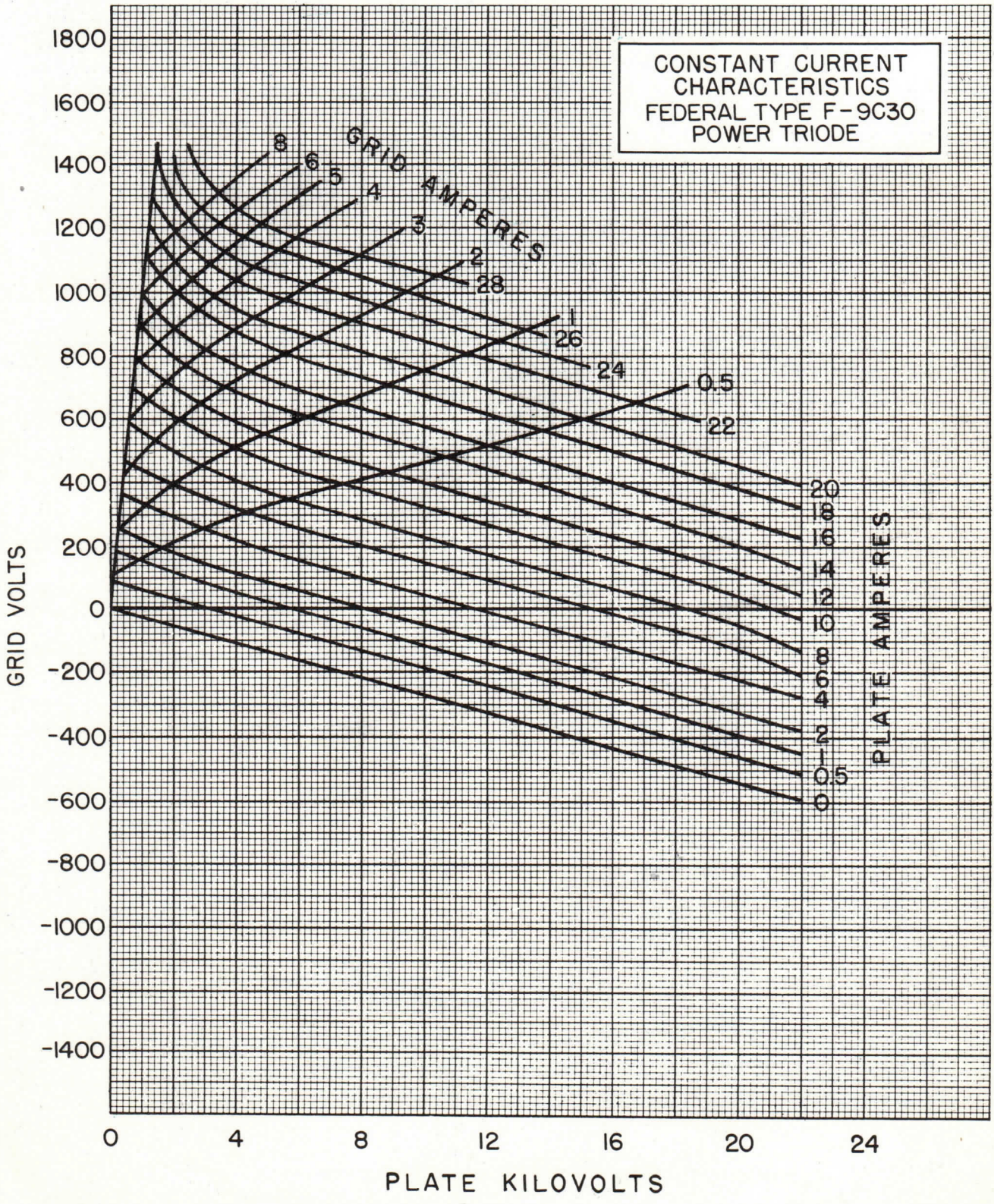
FIG.	U	V	W	X	Y	Z
1				15	135	
2				15	135	
3				13	90	7.5
4				7.5	45	7.5
5	15	7.5	45			

MULTI-PHASE FILAMENT CONNECTIONS

AN IT&T ASSOCIATE

FEDERAL POWER TRIODE
Type F-9C30
40 Kilowatts Plate Dissipation

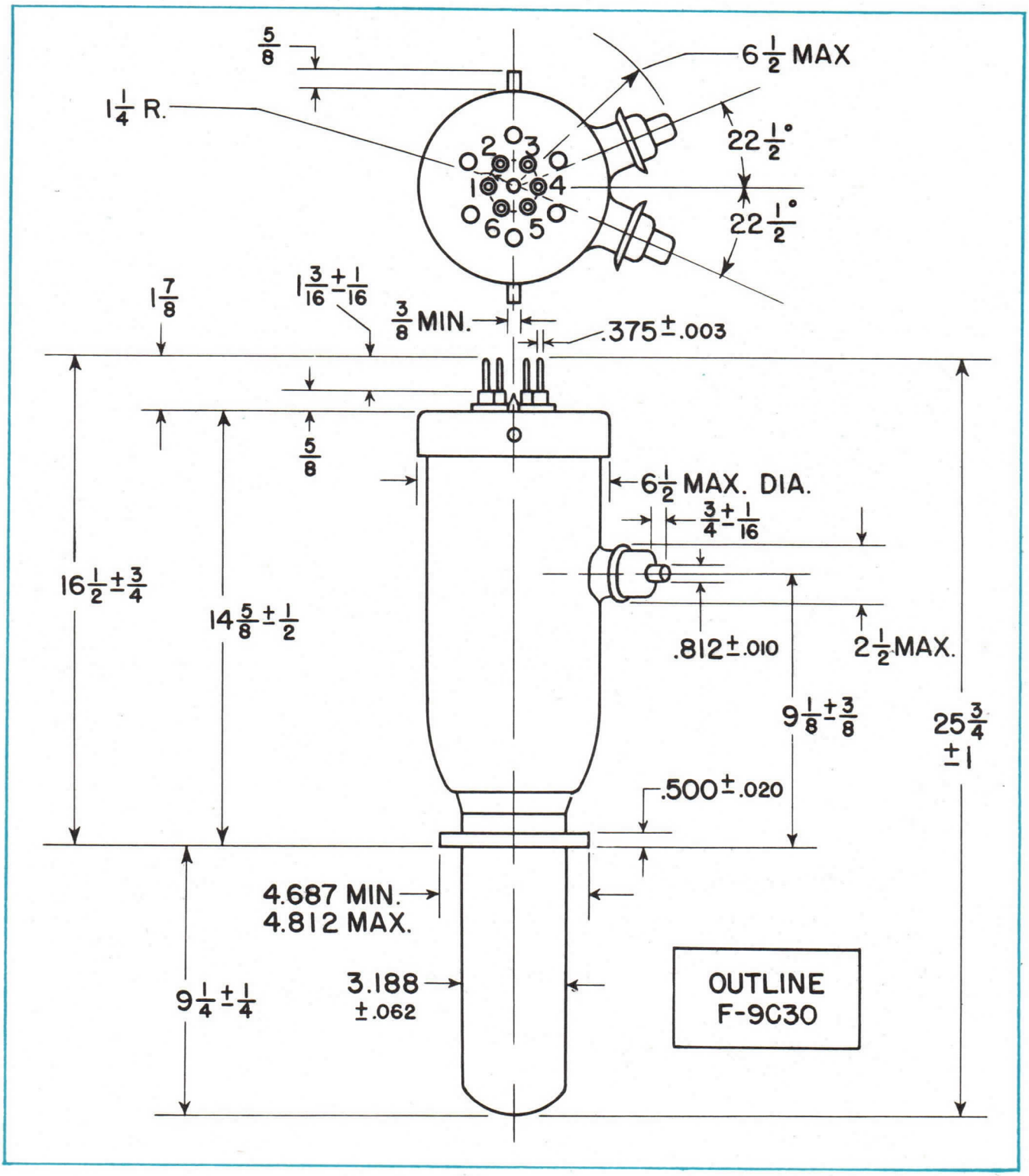
Federal's newest triodes for 50 KW transmitters . . . F-9C30 and F-9C28 . . . give greater electron emission with less filament power, lower hum level, and longer life.



An IT&T Associate

Federal's *introduction* of high-power tubes with thoriated tungsten filaments marked an epoch of new economies in filament power, and operating efficiencies.

FEDERAL POWER TRIODE
Type F-9C30
40 Kilowatts Plate Dissipation



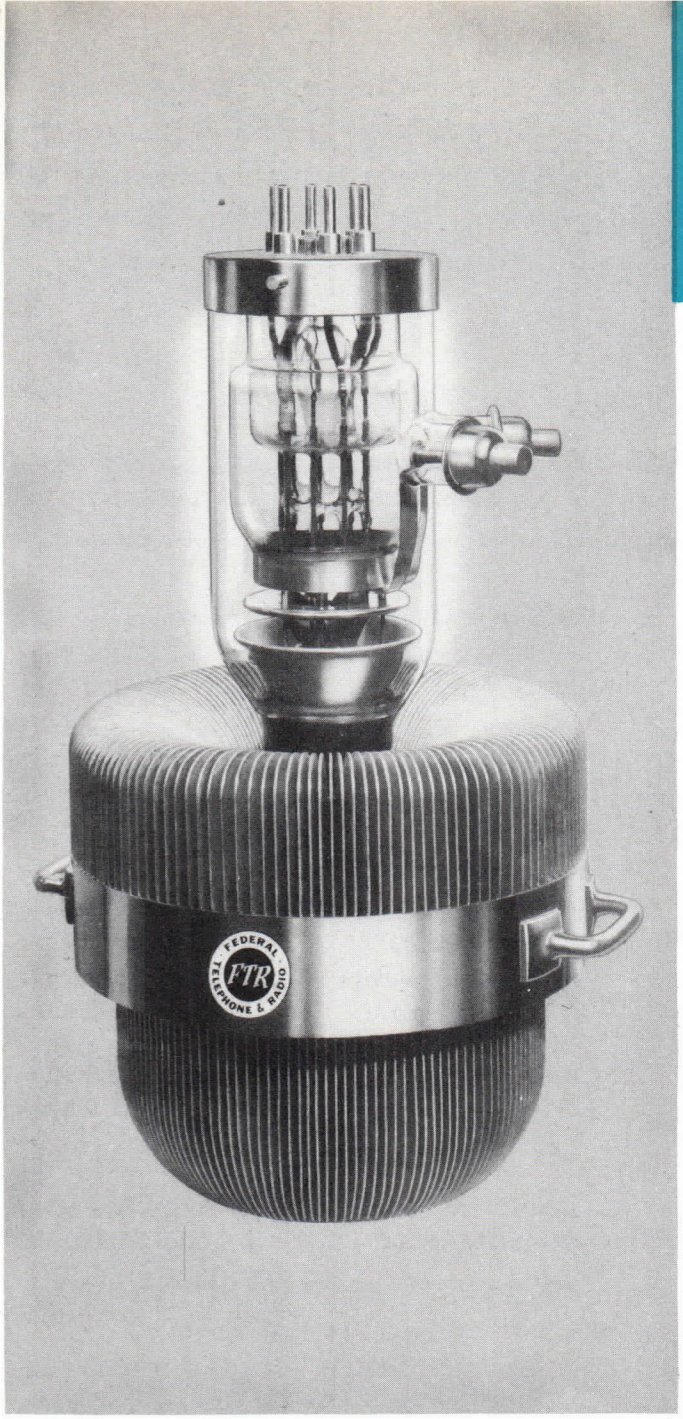
Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

An IT&T Associate

When you are developing projects wherein tubes are components, consult Federal's engineers, let them advise and assist you . . . no obligation is incurred.

Over the years, hundreds of manufacturers, designers, technicians have taken advantage of this Federal service . . . with benefit both to their products and services.

Form FJ-285 Printed in U. S. A.



FEDERAL POWER TRIODE
Type F-9C31
20 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-9C31 is a three-electrode tube engineered to serve as a radio-frequency amplifier, oscillator, or as a Class B modulator. The forced-air-cooled anode is capable of dissipating 20 kilowatts. The cathode is a thoriated tungsten multi-strand filament and may be operated on direct current, single-phase, three-phase, or six-phase alternating current excitation. Maximum ratings apply up to 20 megacycles.

Electrical:

Filament Voltage§	15 Volts
Filament Current§	135 Amperes
Filament Starting Current§	200 Amperes max.
Filament Cold Resistance§	.019 Ohms
Peak Cathode Current	45 Amperes
Amplification Factor, $E_c = -200V$ $I_b = 1.6A$	40.5
Interelectrode Capacitances	
Grid-Plate	40 $\mu\mu f$
Grid-Filament	46 $\mu\mu f$
Plate-Filament	5.6 $\mu\mu f$

§Single phase excitation.

Mechanical:

Mounting Position— Vertical, Anode Down			
Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation—Kilowatts	20	16	12
Minimum Air Flow—Cubic Feet per Minute	2,100	1,600	1,200
Pressure—Inches Water	2.15	1.24	0.70
Maximum Glass Temperature			150° C
Net Weight, approximate			202 Lbs.

Federal's Type F-9C31 maintains lower operating temperatures because of its thoriated tungsten filaments. The components keep cooler, last longer.

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FEDERAL POWER TRIODE
Type F-9C31
20 Kilowatts Plate Dissipation

The low filament temperature in F-9C31 permits the designer's use of grid materials which reduce grid emission. It's *in the design* where efficient performance gets its start.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	50 Kilowatts
Plate Dissipation†	20 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—200 Volts
Peak A-F Grid-to-Grid Voltage	1,600 Volts
Zero Signal DC Plate Current	0.5 Amperes
Maximum Signal DC Plate Current	6.0 Amperes
Effective Load Resistance, Plate to Plate	3,750 Ohms
Maximum Signal Driving Power, approximate	360 Watts
Maximum Signal Power Output, approximate	39 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
DC Plate Current	4 Amperes
Plate Input	30 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—200 Volts
Peak R-F Grid Voltage	450 Volts
DC Plate Current	2.1 Amperes
DC Grid Current, approximate	0.00 Amperes
Driving Power, approximate‡	400 Watts
Power Output, approximate	10 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	4.5 Amperes
DC Grid Current	1.0 Amperes
Plate Input	54 Kilowatts
Plate Dissipation	15 Kilowatts

Typical Operation

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—750 Volts
Peak R-F Grid Voltage	1,510 Volts
DC Plate Current	3.08 Amperes
DC Grid Current, approximate	0.48 Amperes
Driving Power, approximate	700 Watts
Power Output, approximate	27.2 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	8 Ampeers
DC Grid Current	1 Ampere
Plate Input	100 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

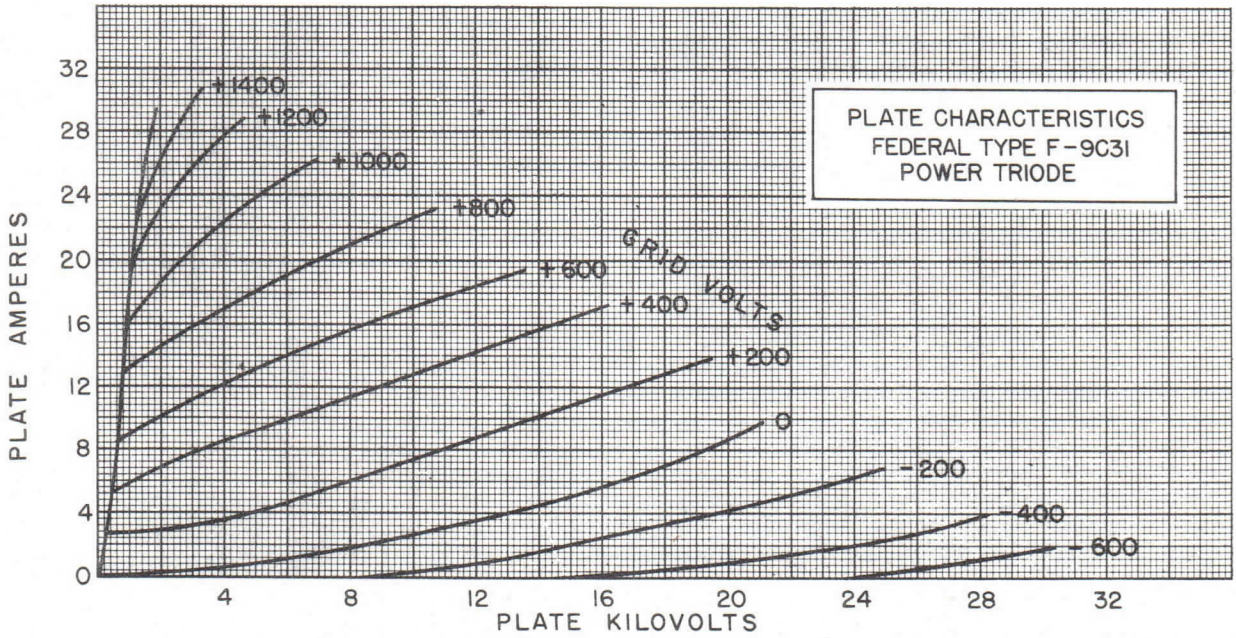
DC Plate Voltage	15,000 Volts
DC Grid Voltage	—900 Volts
Peak R-F Grid Voltage	1,940 Amperes
DC Plate Current	4.7 Amperes
DC Grid Current, approximate	0.75 Amperes
Driving Power, approximate	1,350 Watts
Power Output, approximate	52 Kilowatts

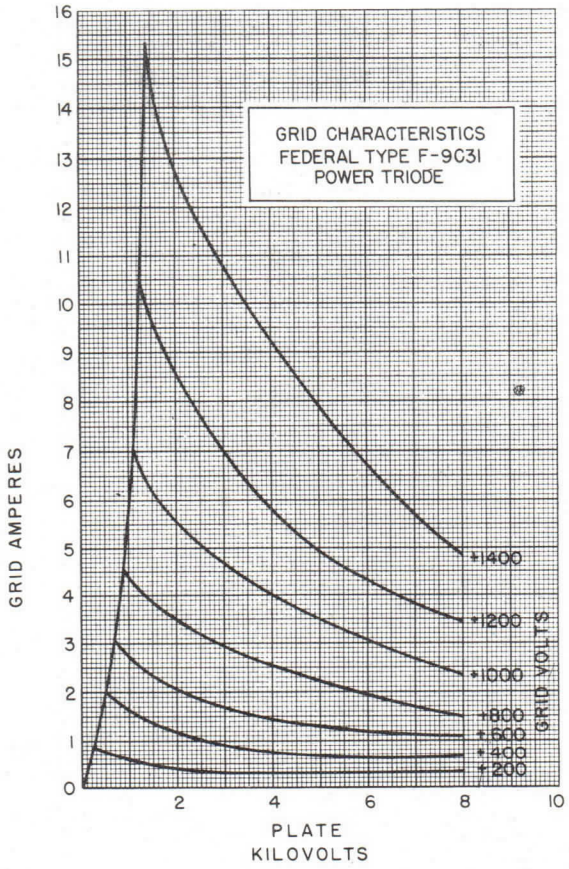
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

An IT&T Associate

Federal's F-9C31 shows the way to new economies. Consuming less filament power, it achieves appreciable savings in operating costs.

FEDERAL POWER TRIODE
Type F-9C31
20 Kilowatts Plate Dissipation





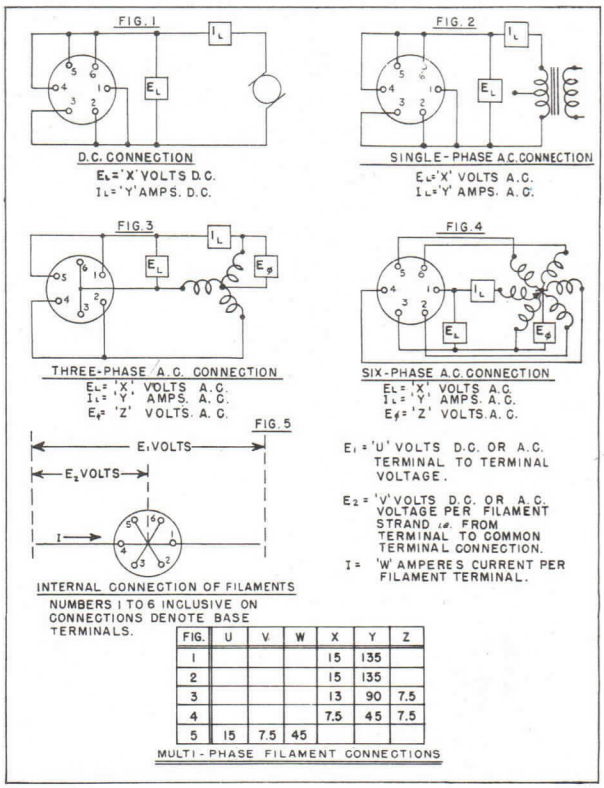
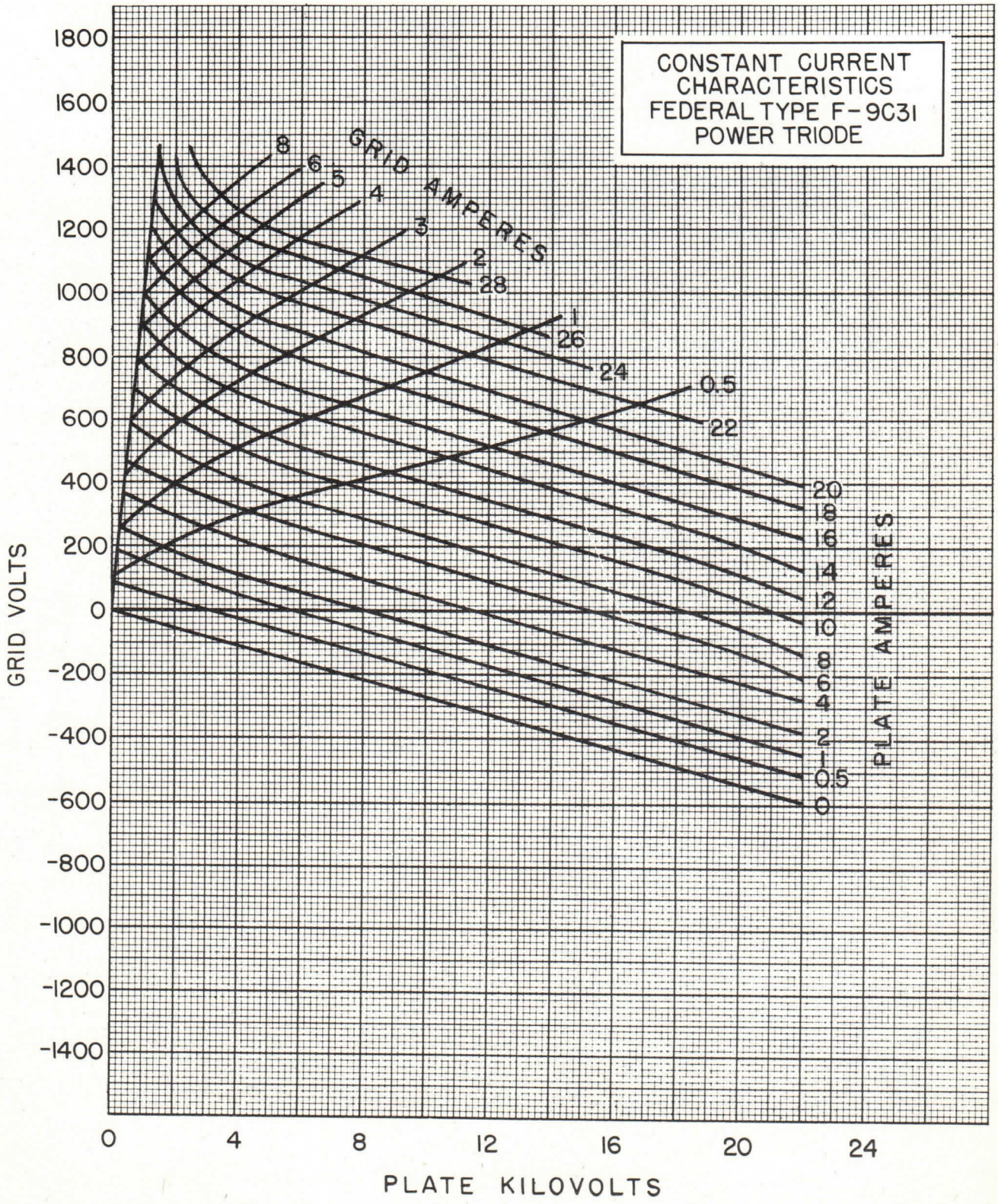


FIG.	U	V	W	X	Y	Z
1				15	135	
2				15	135	
3				13	90	7.5
4				7.5	45	7.5
5	15	7.5	45			

MULTI-PHASE FILAMENT CONNECTIONS

FEDERAL POWER TRIODE
Type F-9C31
20 Kilowatts Plate Dissipation

Federal's F-9C31 is designed for specific use in 50 kilowatt AM broadcast and short wave transmitters . . . custom-made for customer satisfaction.



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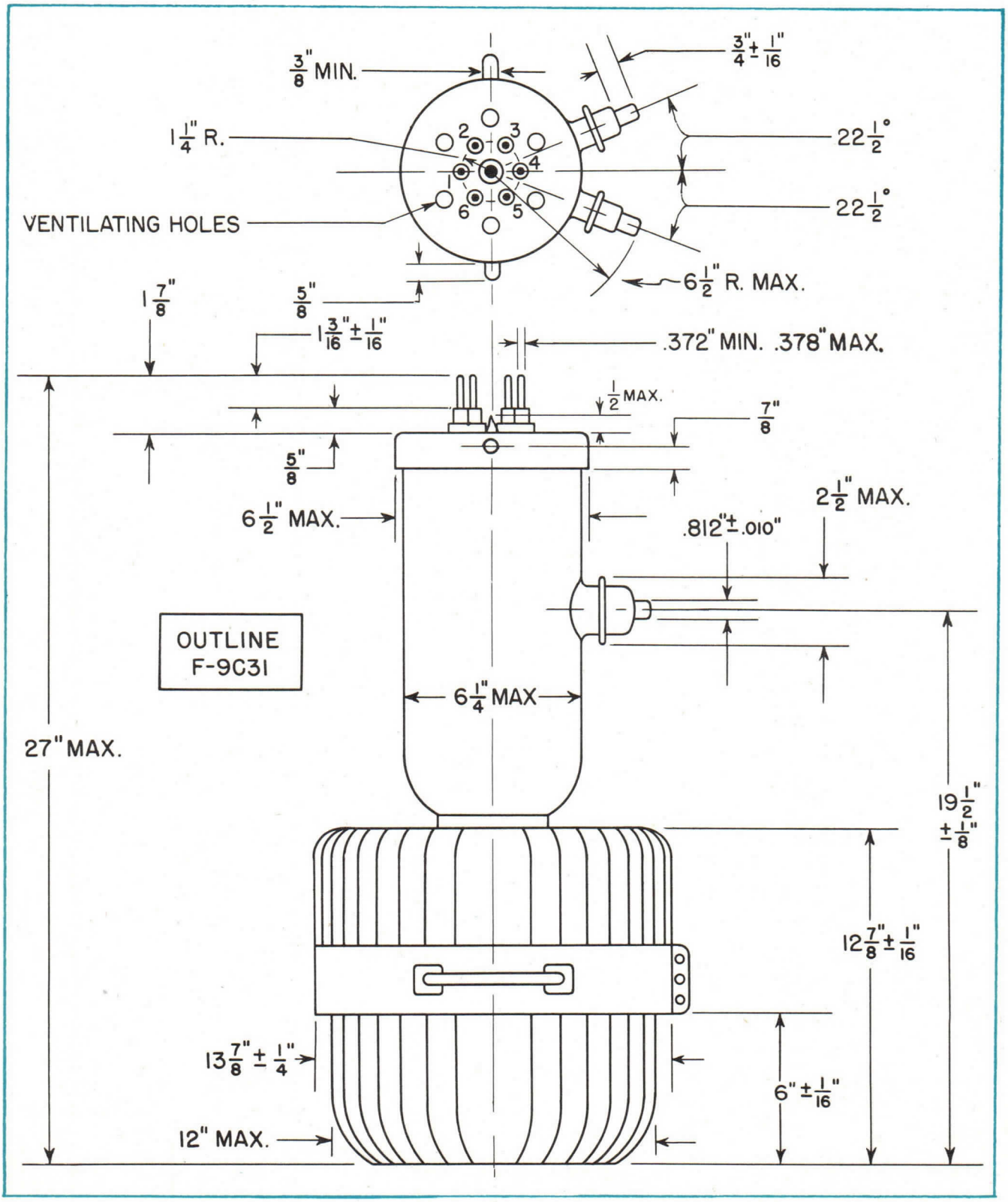
FEDERAL POWER TRIODE
Type F-9C31
20 Kilowatts Plate Dissipation

In Federal's latest 50 Kilowatt A.M. Transmitter, the F-9C31 is used in the R.F. Amplifier, the F-9C29 in the Modulator.



Federal Telephone and Radio Corporation

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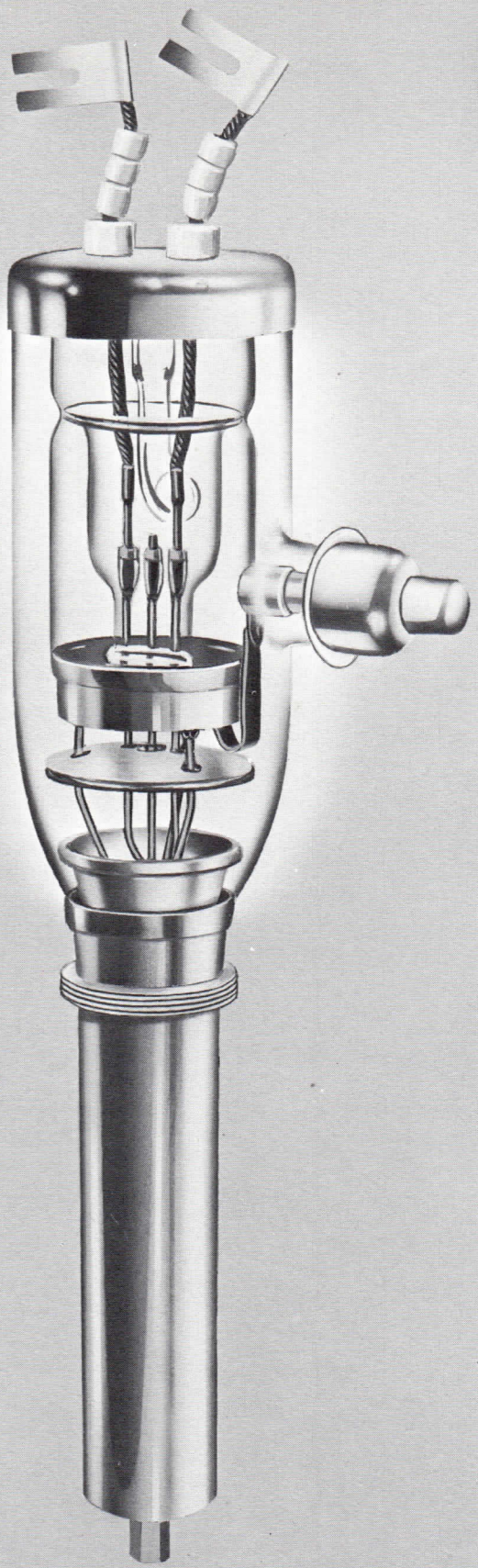
There is an extra margin of performance in every Federal tube.

Form FJ-286 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-110-X
25 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-110-X is a three-electrode tube designed for use as a radio-frequency power amplifier and oscillator. The anode is water-cooled, capable of dissipating 25 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 3 megacycles with operation permissible up to 20 megacycles at reduced ratings.

Electrical:

▸ Filament Voltage	28 Volts
▸ Filament Current	51 Amperes
▸ Filament Starting Current	102 Amperes
▸ Peak Cathode Current	12.5 Amperes
▸ Amplification Factor, at I_b=0.75 amp. E_c=—300 volts	40
▸ Interelectrode Capacitances	
Grid-Plate	30 $\mu\mu$f
Grid-Filament	20 $\mu\mu$f
Plate-Filament	2.7 $\mu\mu$f

Mechanical:

▸ Mounting Position— Vertical, Anode Down	
▸ Type of Cooling—Water	
Water Flow on Anode	10 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
▸ Net Weight, approximate	4 Pounds

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FEDERAL POWER TRIODE
Type F-110-X
25 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	3	20 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input Class C—Telegraphy	100	42 Per Cent

Maximum Ratings and Typical Operating Conditions

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

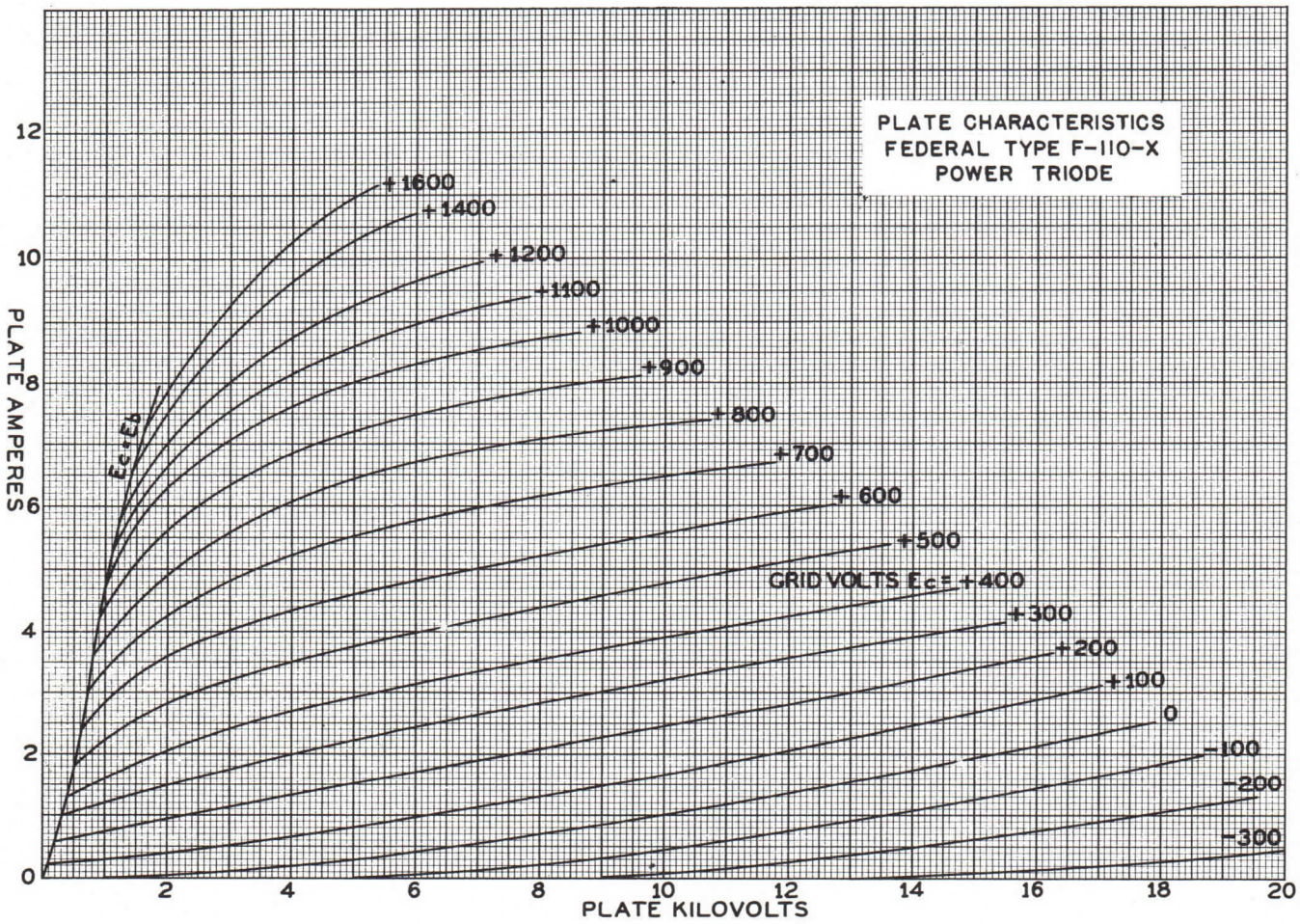
(Key-down conditions per tube without amplitude Modulation)

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Grid Voltage	—5,000 Volts
DC Plate Current	2.5 Amperes
DC Grid Current	0.5 Ampere
Plate Input	50 Kilowatts
Plate Dissipation	25 Kilowatts

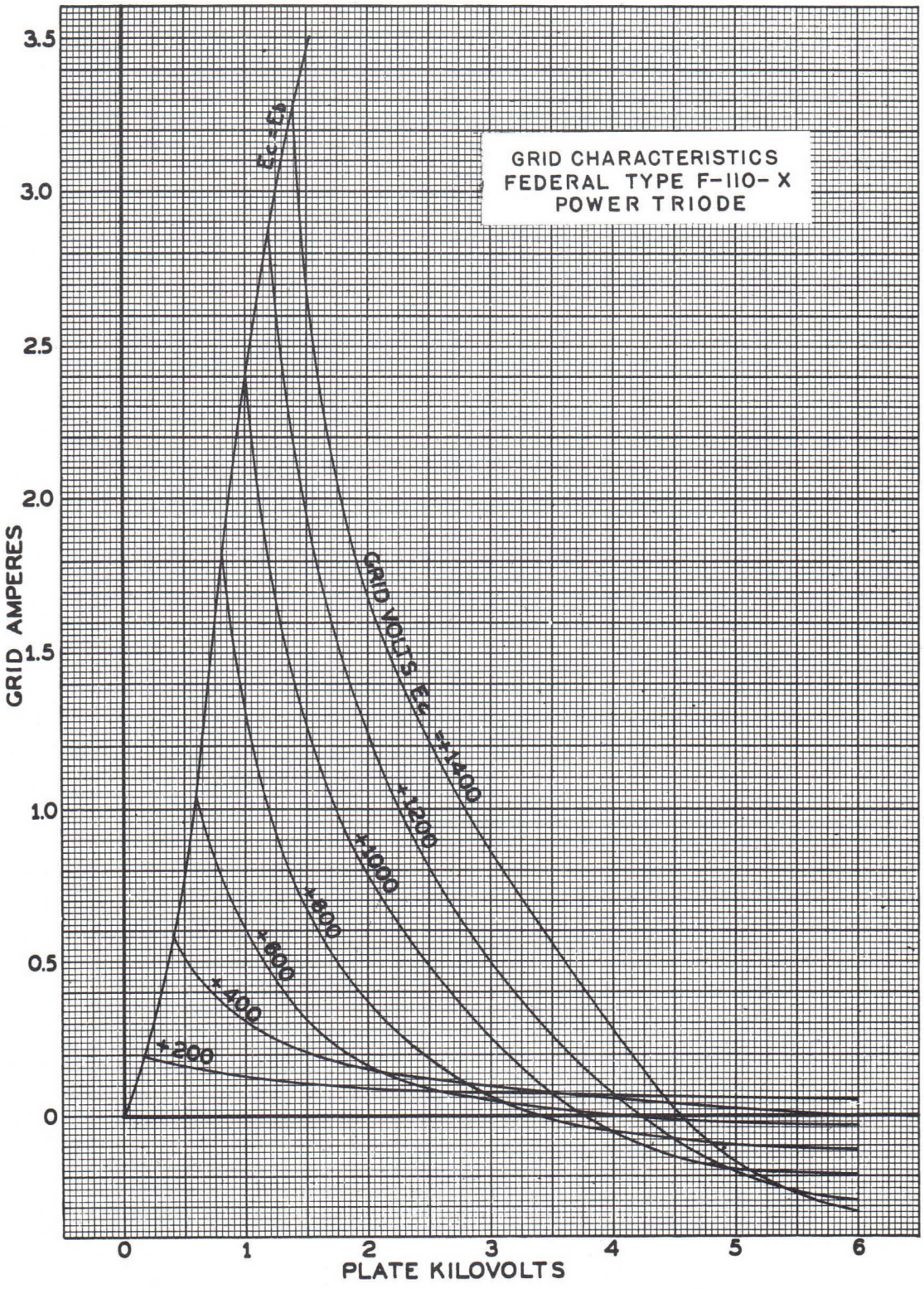
Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—360 Volts
Peak R-F Grid Voltage	1,760 Volts
DC Plate Current	2.5 Amperes
DC Grid Current, approx.	0.325 Ampere
Driving Power, approx.	550 Watts
Power Output, approx.	16.8 Kilowatts



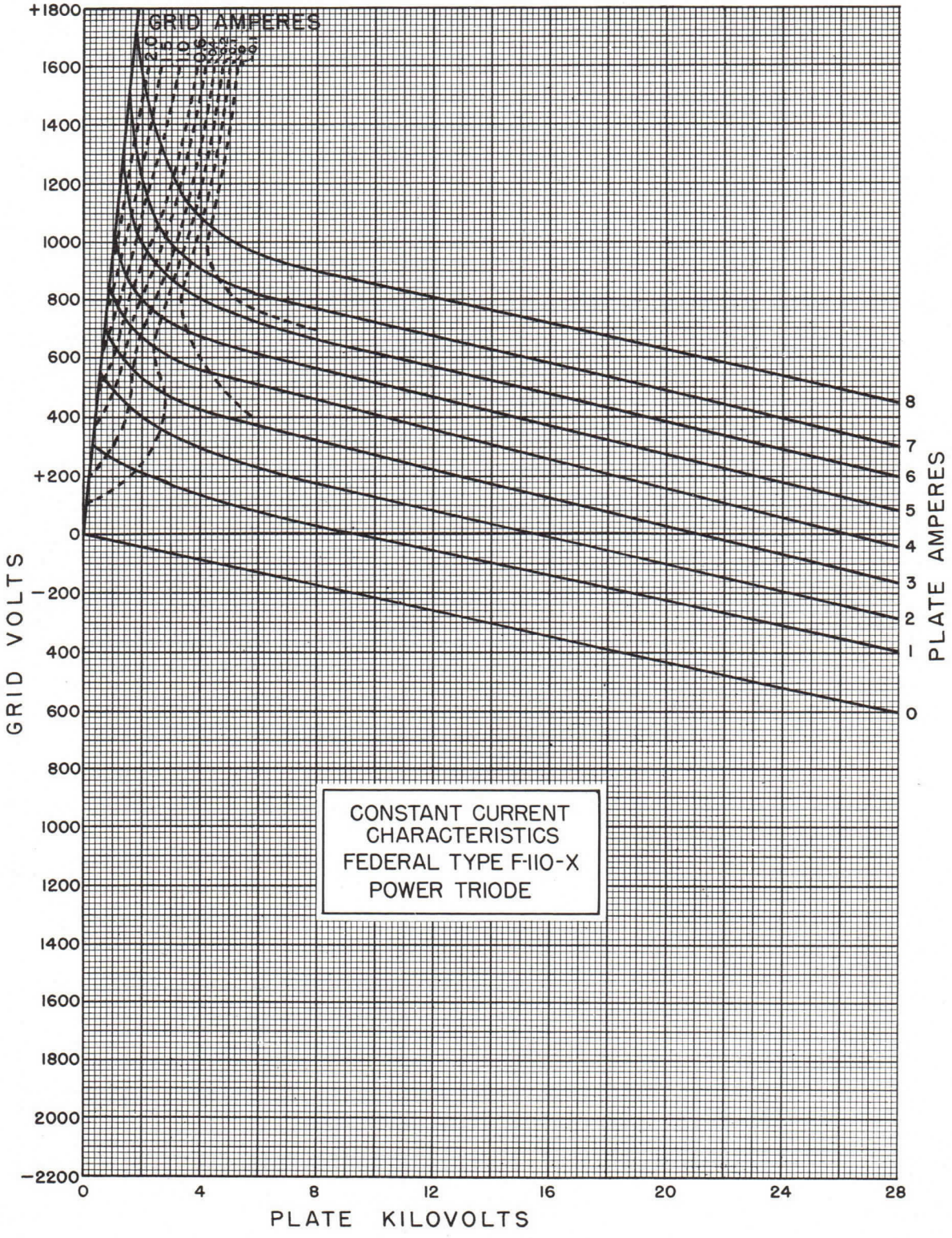
Buyers who specify "Federal" because they want *long-lived* tubes, know from experience they'll get what they want.

FEDERAL POWER TRIODE
Type F-110-X
25 Kilowatts Plate Dissipation



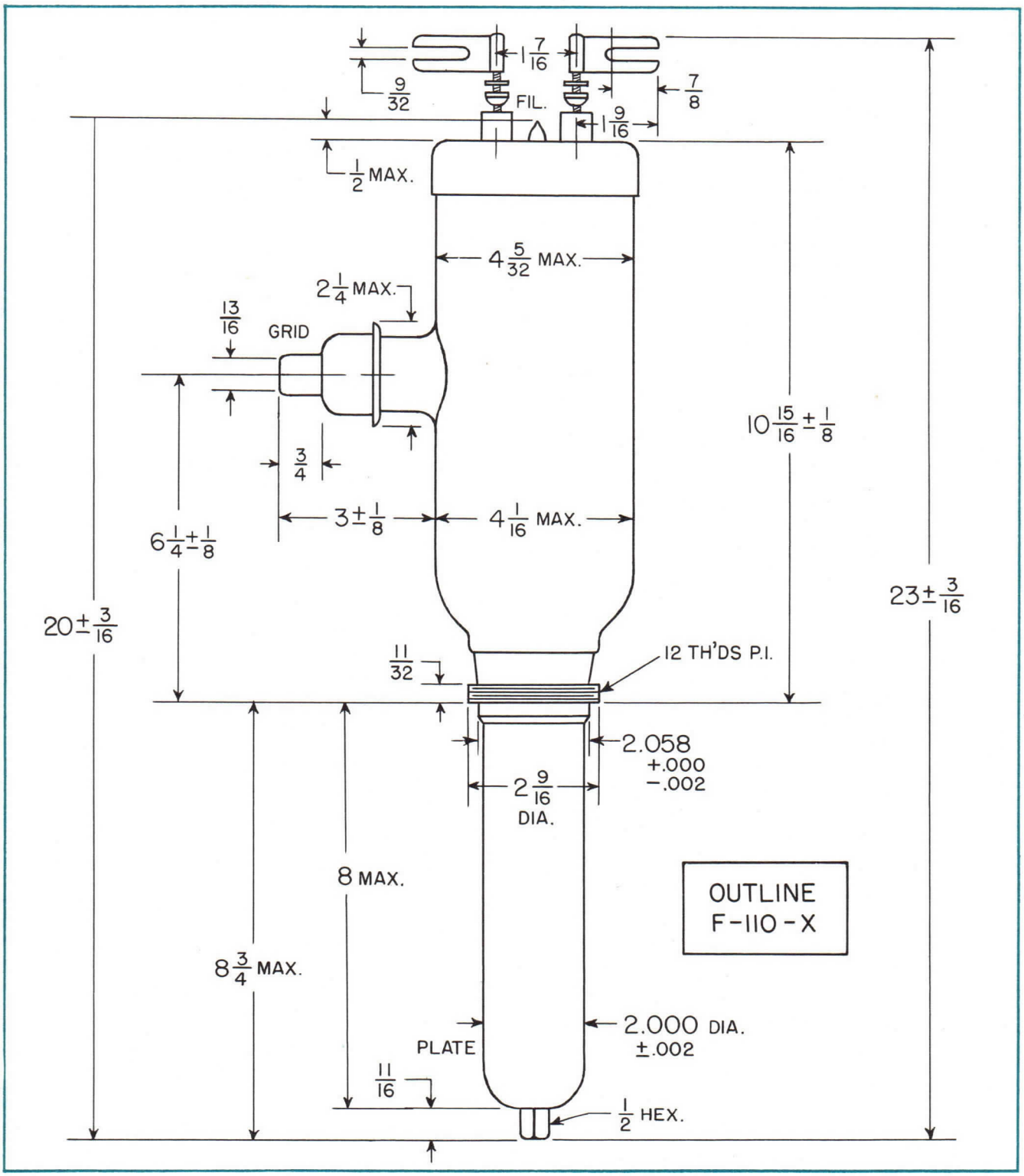
FEDERAL POWER TRIODE
Type F-110-X
25 Kilowatts Plate Dissipation

Federal always has made *first-quality* tubes, and the record goes back for more than 40 years.



Federal's name on a tube signifies the best in design, engineering, materials, components and craftsmanship.

FEDERAL POWER TRIODE
Type F-110-X
25 Kilowatts Plate Dissipation



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DIVISION OF IT&T

Federal Always Has
Made Better Tubes

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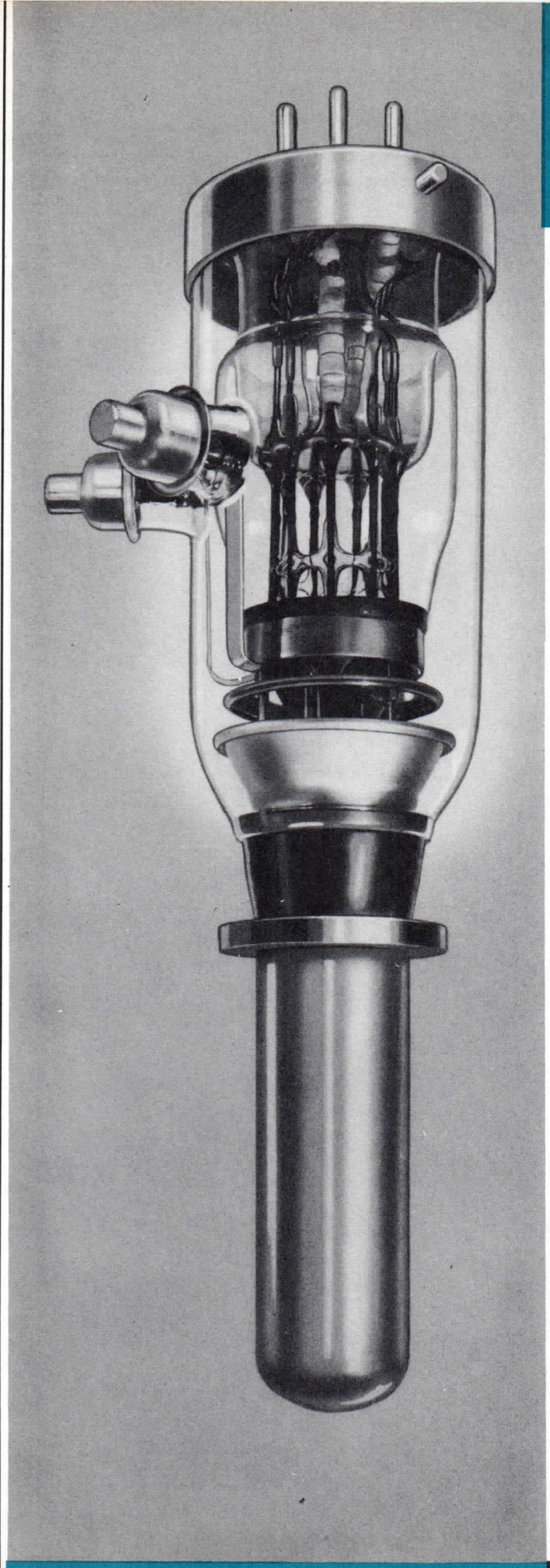

FEDERAL POWER TRIODE
Type F-124-A
40 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-124-A is a three-electrode tube designed for use as radio-frequency amplifier, oscillator, or Class B modulator. The anode is water-cooled, capable of dissipating 40 kilowatts. The cathode, a pure tungsten multi-strand filament, may be operated on DC, 1 Ø, 3 Ø, or 6 Ø AC excitation. Maximum ratings apply up to 20 megacycles.

Electrical:

Filament Voltage§	27.2 Volts
Filament Current§	205.5 Amperes
Filament Starting Current§	308 Amperes max.
Filament Cold Resistance	.015 Ohms
Peak Cathode Current	35 Amperes
Amplification Factor, at	
I_b = 1.6 amps	
E_c = —200 volts	40.5
Interelectrode Capacitances	
Grid-Plate	35 $\mu\mu$f
Grid-Filament	46 $\mu\mu$f
Plate-Filament	5.6 $\mu\mu$f

§Single phase excitation.

Mechanical:

Mounting Position—Vertical, anode down	
Type of Cooling—Water	
Water Flow on Anode	15 GPM Min.
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Net Weight, approximate	11½ Pounds

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FEDERAL POWER TRIODE
Type F-124-A
40 Kilowatts Plate Dissipation

For many years leading broadcast stations have chosen Federal's F-124-A for their 50 kilowatt transmitters . . . convincing evidence that F-124-A service satisfies.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	50 Kilowatts
Plate Dissipation†	30 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—200 Volts
Peak A-F Grid-to-Grid Voltage	1,600 Volts
Zero Signal DC Plate Current	0.5 Amperes
Maximum Signal DC Plate Current	6 Amperes
Effective Load Resistance, Plate to Plate	3,750 Ohms
Max. Sig. Driving Power, approx.	360 Watts
Max. Sig. Power Output, approx.	39 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Plate Current	3.5 Amperes
Plate Input	60 Kilowatts
Plate Dissipation	40 Kilowatts

Typical Operation

DC Plate Voltage	17,500 Volts
DC Grid Voltage	—300 Volts
Peak R-F Grid Voltage	480 Volts
DC Plate Current	2.1 Amperes
DC Grid Current	—0.02 Amperes
Driving Power, approximate‡	100 Watts
Power Output, approximate	13.1 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	3.5 Amperes
DC Grid Current	1 Ampere
Plate Input	60 Kilowatts
Plate Dissipation	30 Kilowatts

Typical Operation

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—725 Volts
Peak R-F Grid Voltage	1,425 Volts
DC Plate Current	3.31 Amperes
DC Grid Current	0.061 Amperes
Driving Power, approximate	200 Watts
Power Output, approximate	26.2 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

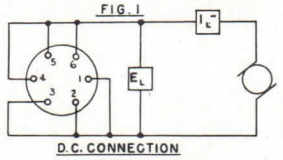
DC Plate Voltage	20,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	7 Amperes
DC Grid Current	1 Ampere
Plate Input	135 Kilowatts
Plate Dissipation	40 Kilowatts

Typical Operation

DC Plate Voltage	18,000 Volts
DC Grid Voltage	—1,100 Volts
Peak R-F Grid Voltage	2,420 Volts
DC Plate Current	6 Amperes
DC Grid Current, approximate	0.65 Amperes
Driving Power, approximate	1.5 Kilowatts
Power Output, approximate	80 Kilowatts

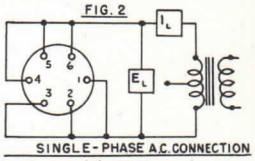
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

FIG. 1



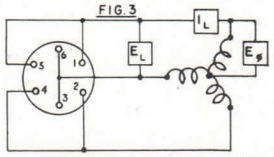
D.C. CONNECTION
E_L = 'X' VOLTS D.C.
I_L = 'Y' AMPS. D.C.

FIG. 2



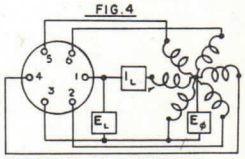
SINGLE-PHASE A.C. CONNECTION
E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.

FIG. 3



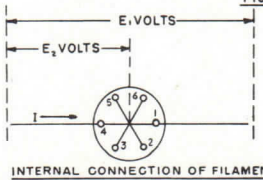
THREE-PHASE A.C. CONNECTION
E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

FIG. 4



SIX-PHASE A.C. CONNECTION
E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

FIG. 5



INTERNAL CONNECTION OF FILAMENTS

NUMBERS 1 TO 6 INCLUSIVE ON CONNECTIONS DENOTE BASE TERMINALS.

E_1 = 'U' VOLTS D.C. OR A.C. TERMINAL TO TERMINAL VOLTAGE.

E_2 = 'V' VOLTS D.C. OR A.C. VOLTAGE PER FILAMENT STRAND *i.e.* FROM TERMINAL TO COMMON TERMINAL CONNECTION.

I = 'W' AMPERES CURRENT PER FILAMENT TERMINAL.

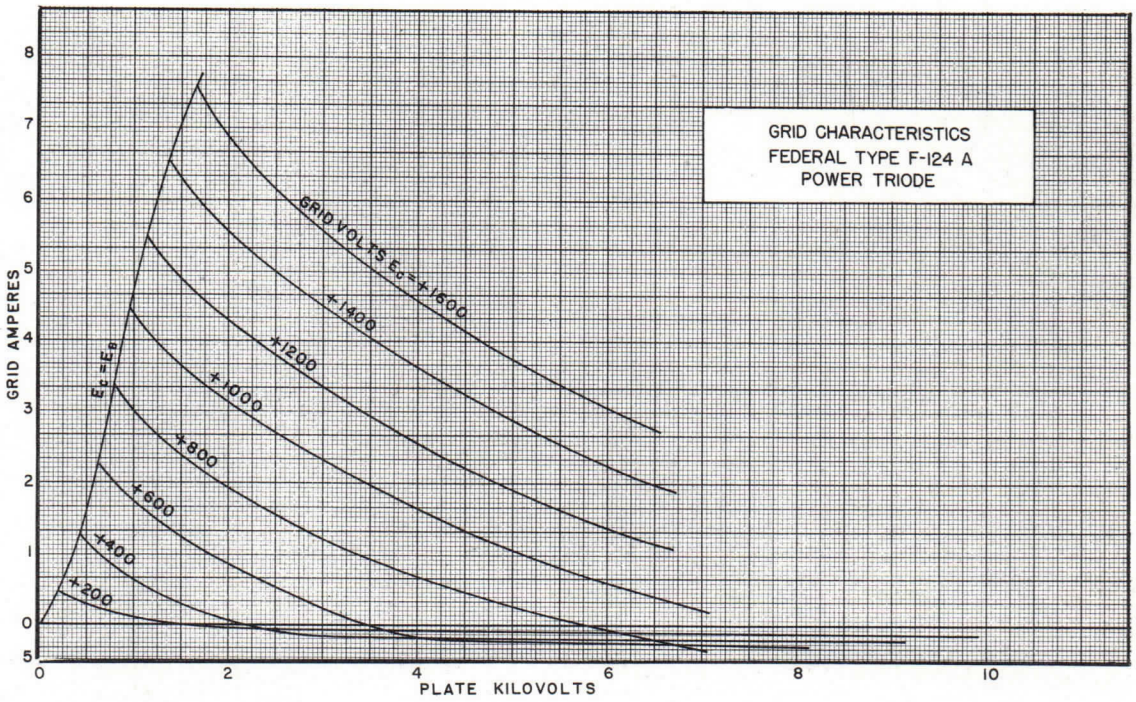
FIG.	'U'	'V'	'W'	'X'	'Y'	'Z'
1				27.2	205.5	
2				27.2	205.5	
3				23.5	137.0	13.6
4				13.6	68.5	13.6
5	27.2	13.6	68.5			

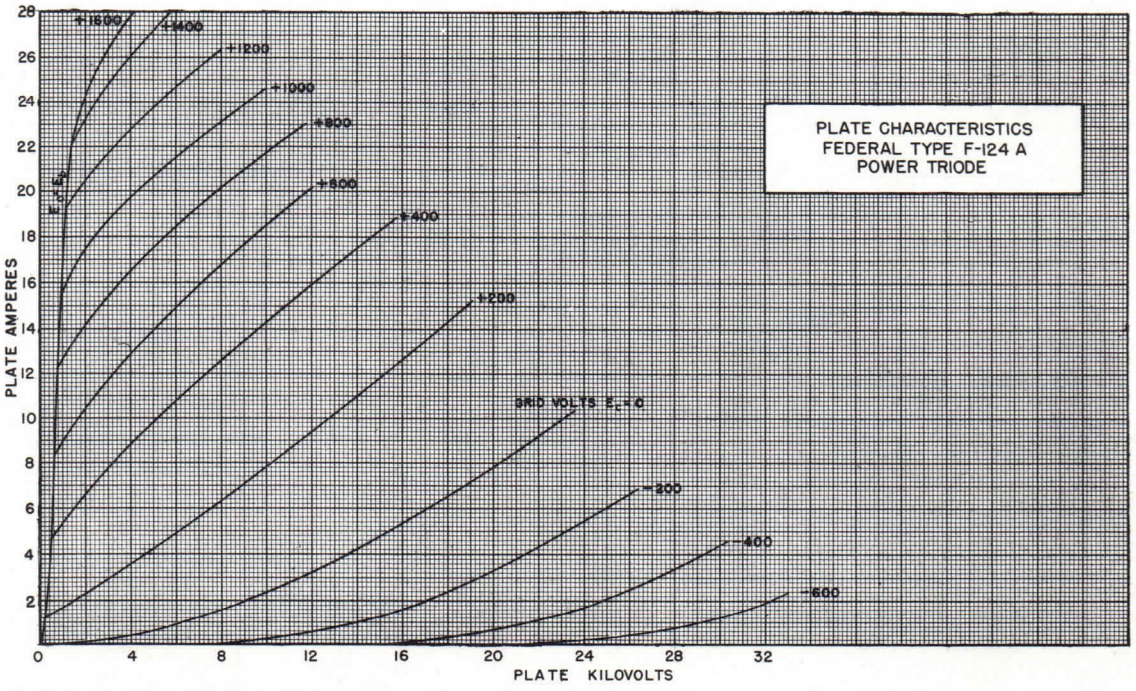
MULTI-PHASE FILAMENT CONNECTIONS

AN IT&T ASSOCIATE

FEDERAL POWER TRIODE
Type F-124-A
40 Kilowatts Plate Dissipation

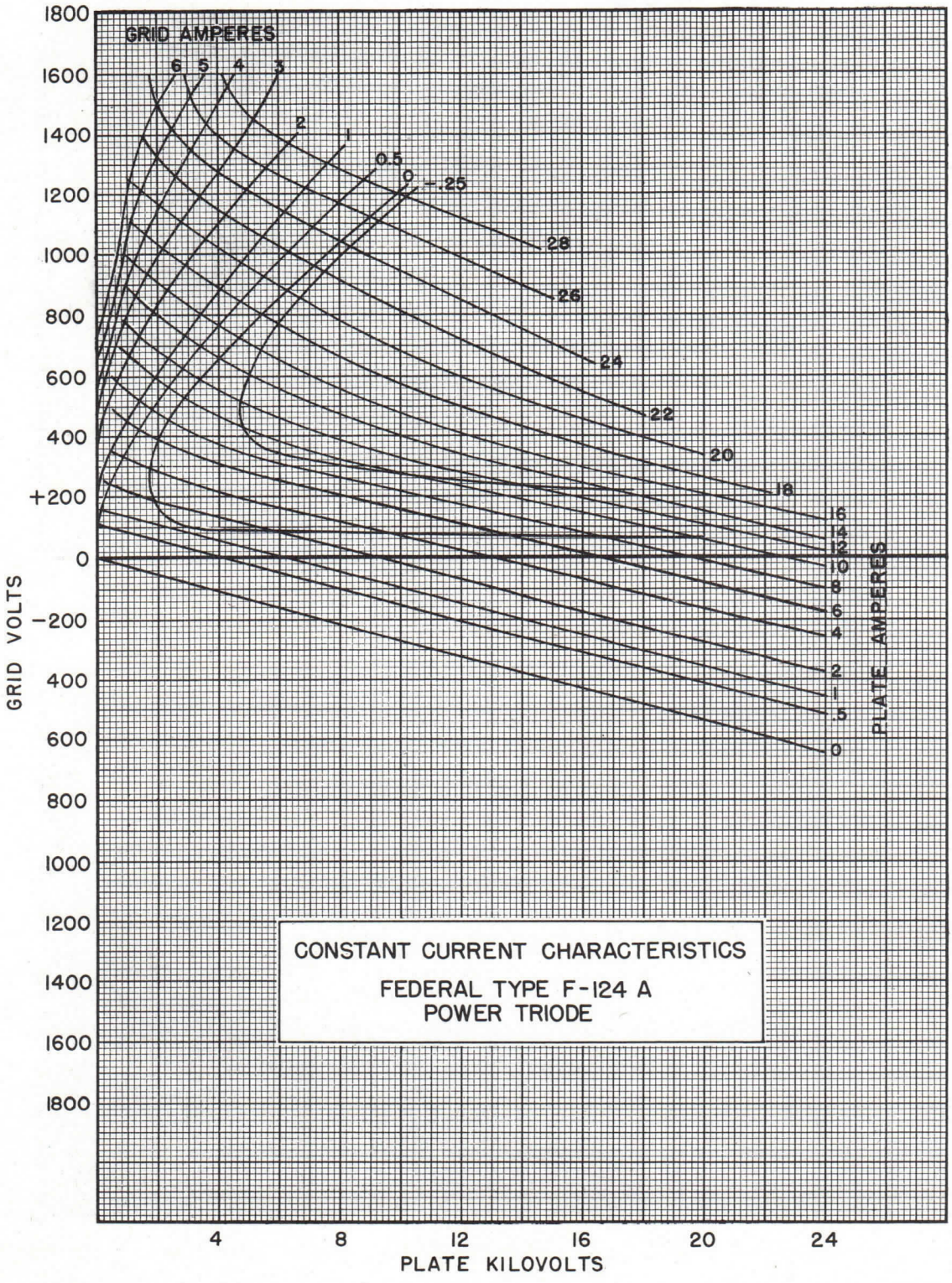
Federal's F-124-A is operative at full rating up to 20 megacycles. It has the staying qualities inherent in all tubes of Federal design and manufacture.





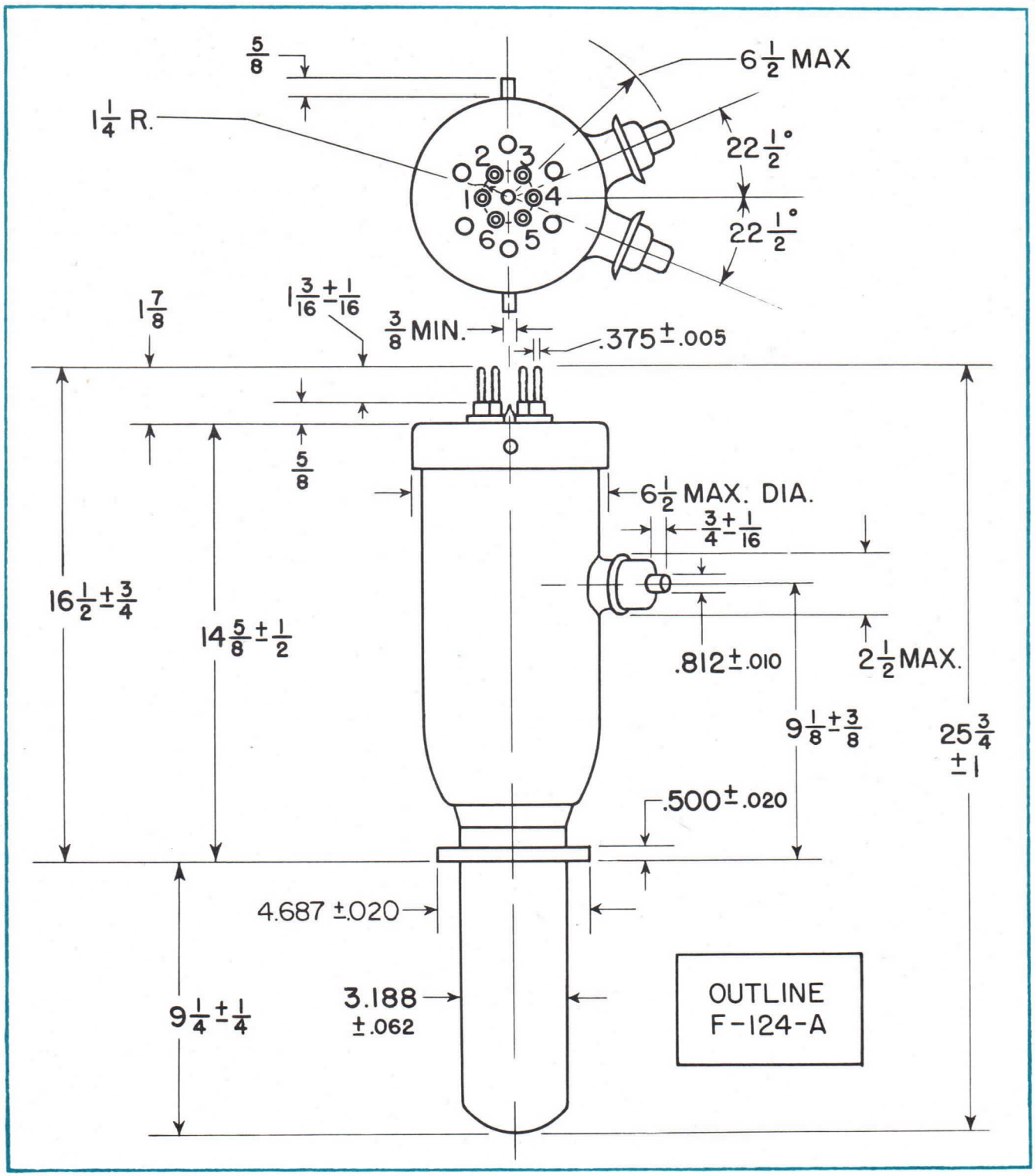
FEDERAL POWER TRIODE
Type F-124-A
40 Kilowatts Plate Dissipation

For ease in neutralization the F-124-A makes use of a dual grid terminal . . . Federal never overlooks an opportunity to improve each detail of design.



Federal's parts processing and exhaust techniques are reflected in the F-124-A, a typical example of *fine* craftsmanship in vacuum tube manufacture.

FEDERAL POWER TRIODE
Type F-124-A
40 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

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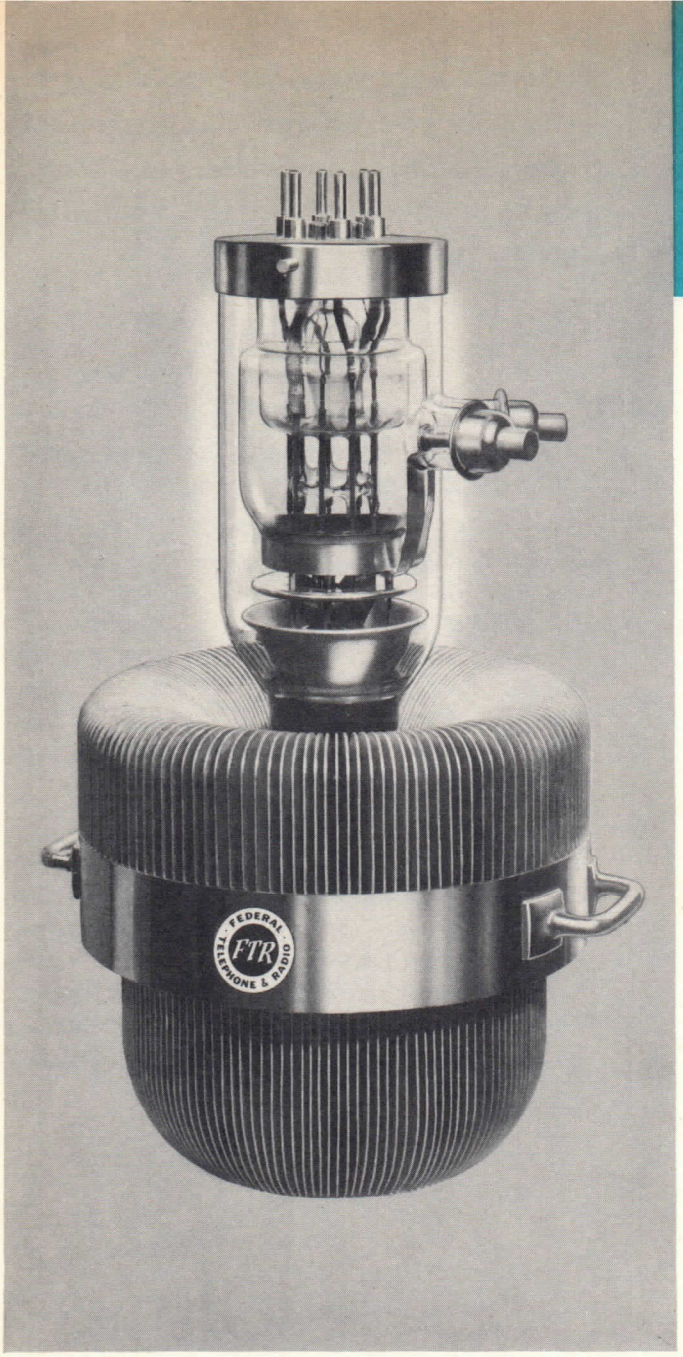
Federal Always Has
Made Better Tubes

Form FJ-132 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-124-R
20 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-124-R is a three-electrode tube engineered to serve as a radio-frequency amplifier, oscillator, or as a Class B modulator. The forced-air-cooled anode is capable of dissipating 20 kilowatts. The cathode is a pure tungsten multi-strand filament and may be operated on direct current, single-phase, three-phase, or six-phase alternating current excitation. Maximum ratings apply up to 20 megacycles.

Electrical:

Filament Voltage§	27.2 Volts
Filament Current§	205.5 Amperes
Filament Starting Current§	308 Amperes max.
Filament Cold Resistance§	.015 Ohms
Peak Cathode Current	35 Amperes
Amplification Factor, $E_c = -200V$ $I_b = 1.6A$	40.5
Interelectrode Capacitances	
Grid-Plate	40 $\mu\mu$f
Grid-Filament	46 $\mu\mu$f
Plate-Filament	5.6 $\mu\mu$f

§Single phase excitation.

Mechanical:

Mounting Position—Vertical, Anode Down			
Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation—Kilowatts	20	16	12
Minimum Air Flow—Cubic Feet per Minute	2,100	1,600	1,200
Pressure—Inches Water	2.15	1.24	0.70
Maximum Glass Temperature			150° C
Net Weight, approximate			202 Lbs.

It's in Federal's design where efficient tube performance gets its start. It's in the tube's performance *in service* where Federal's authentic design reveals its merits.

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FEDERAL POWER TRIODE
Type F-124-R
20 Kilowatts Plate Dissipation

Federal's engineers are ready to consult with you on the application of Federal tubes to your designs. Write, phone or wire to arrange your conference date.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	50 Kilowatts
Plate Dissipation†	20 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—200 Volts
Peak A-F Grid-to-Grid Voltage	1,600 Volts
Zero Signal DC Plate Current	0.5 Amperes
Maximum Signal DC Plate Current	6.0 Amperes
Effective Load Resist., Plate to Plate	3,750 Ohms
Max. Sig. Driving Power, approx.	360 Watts
Max. Sig. Power Output, approx.	39 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Plate Current	3.5 Amperes
Plate Input	30 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

DC Plate Voltage	17,500 Volts
DC Grid Voltage	—360 Volts
Peak R-F Grid Voltage	120 Volts
DC Plate Current	1.68 Amperes
DC Grid Current, approximate	0.00 Amperes
Driving Power, approximate‡	80 Watts
Power Output, approximate	10 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	3.5 Amperes
DC Grid Current	1.0 Amperes
Plate Input	60 Kilowatts
Plate Dissipation	15 Kilowatts

Typical Operation

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—900 Volts
Peak R-F Grid Voltage	1,630 Volts
DC Plate Current	2.8 Amperes
DC Grid Current, approximate	0.18 Amperes
Driving Power, approximate	275 Watts
Power Output, approximate	26.2 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	7 Amperes
DC Grid Current	1 Ampere
Plate Input	100 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

DC Plate Voltage	15,000 Volts
DC Grid Voltage	—1,000 Volts
Peak R-F Grid Voltage	2,040 Amperes
DC Plate Current	4.3 Amperes
DC Grid Current, approximate	0.47 Amperes
Driving Power, approximate	700 Watts
Power Output, approximate	50 Kilowatts

¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

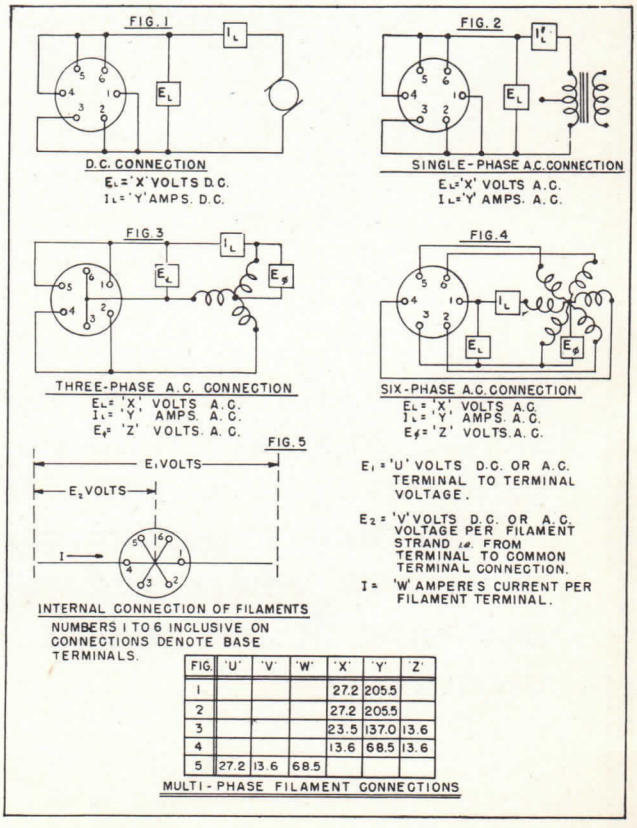


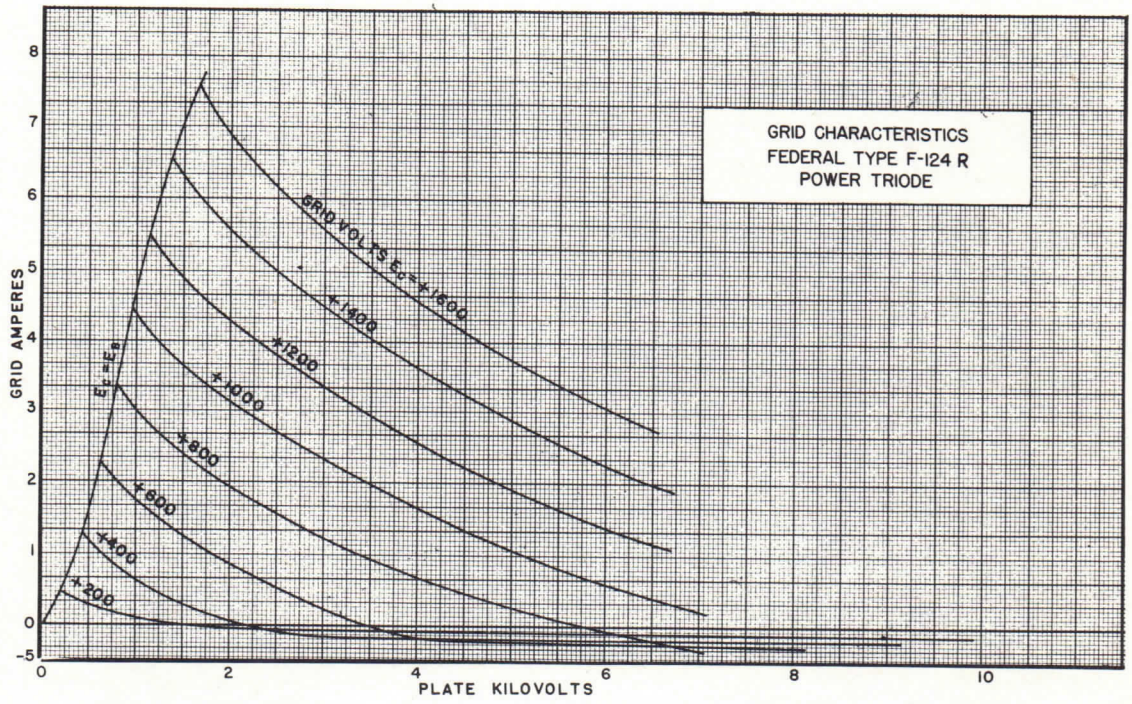
FIG.	'U'	'V'	'W'	'X'	'Y'	'Z'
1				27.2	205.5	
2				27.2	205.5	
3				23.5	137.0	13.6
4				13.6	68.5	13.6
5	27.2	13.6	68.5			

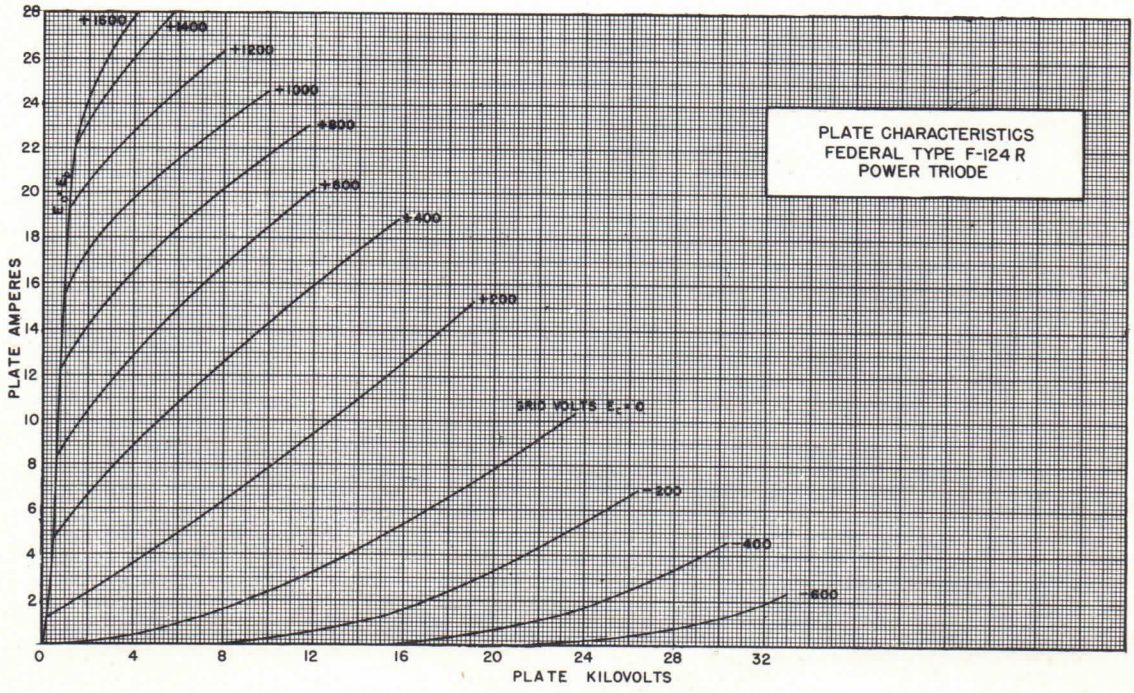
MULTI-PHASE FILAMENT CONNECTIONS

AN IT&T ASSOCIATE

Precision craftsmanship in the manufacture of power tubes was practiced by Federal at the birth of the industry; Federal has continued the habit ever since.

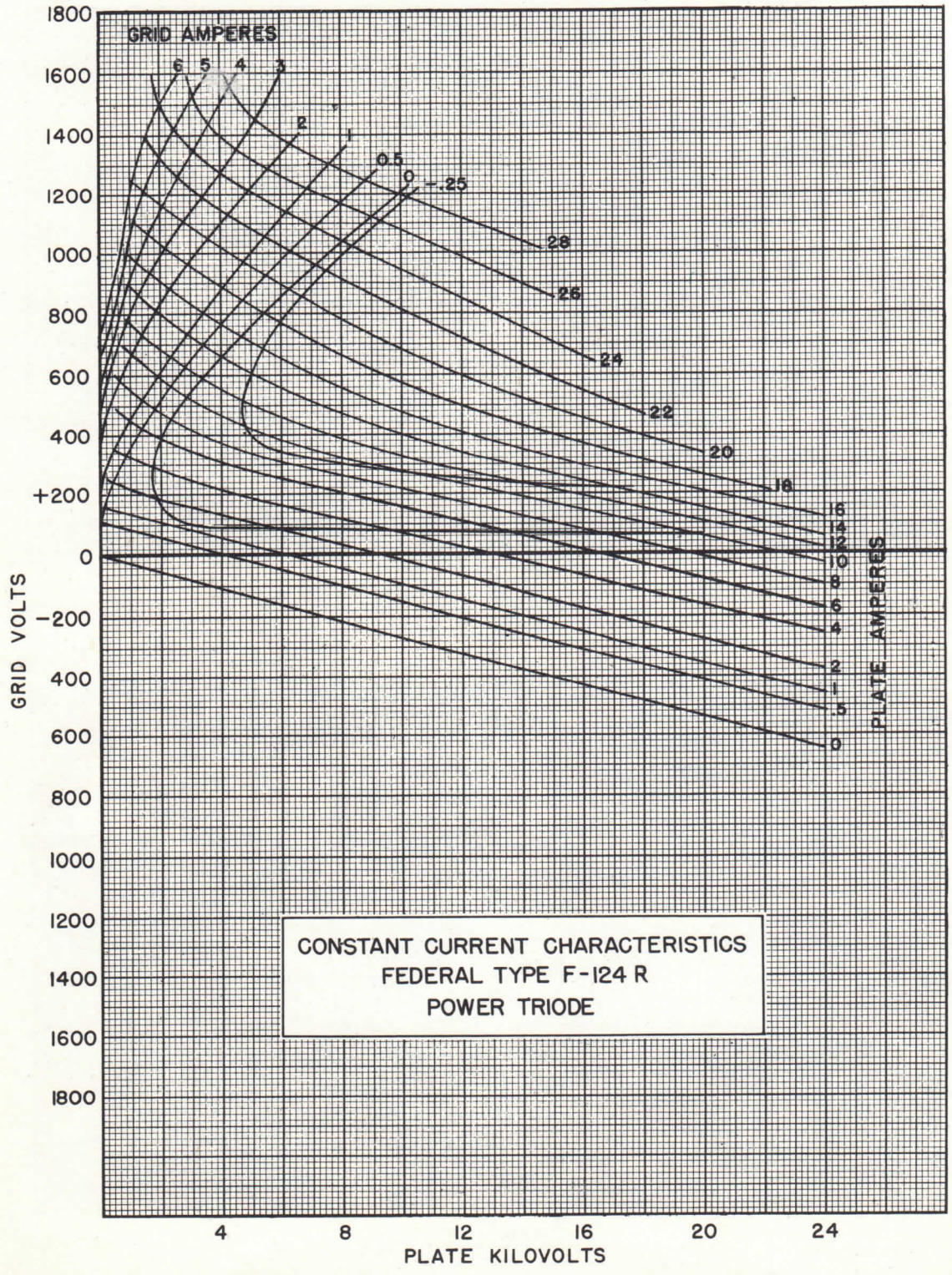
FEDERAL POWER TRIODE
Type F-124-R
20 Kilowatts Plate Dissipation





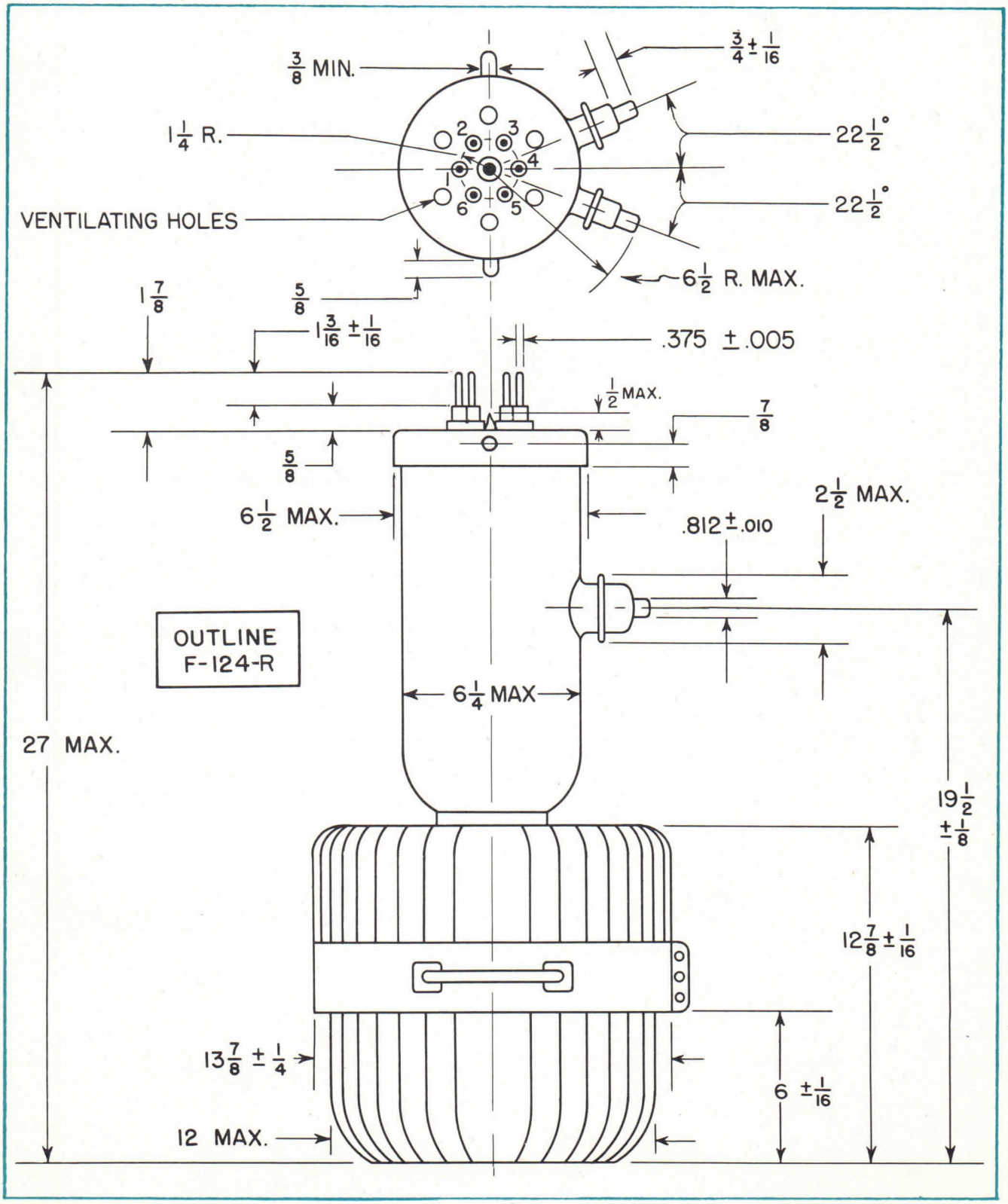
FEDERAL POWER TRIODE
Type F-124-R
20 Kilowatts Plate Dissipation

Over and over again, Federal *sales* tell the factual story of Federal's tube achievements and success in unusual applications.



Federal means longer tube life, finer performance, greater satisfaction, greater stretch of your purchase dollar.

FEDERAL POWER TRIODE
Type F-124-R
20 Kilowatts Plate Dissipation



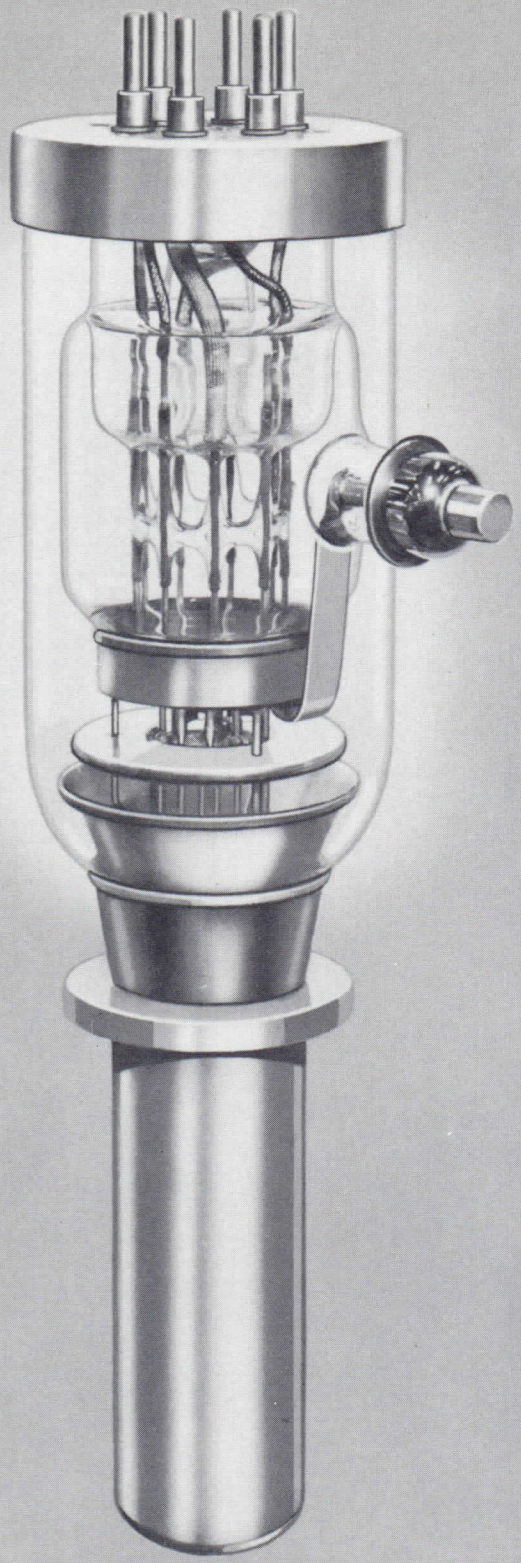
Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

An IT&T Associate

There is an extra margin of performance in every Federal tube.

Form FJ-163 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-125-A
40 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

The Type F-125-A by Federal is a three-electrode tube designed and engineered as a modulator. The electrical characteristics of this F-125-A make it especially suitable to Class AB modulator circuits. The anode is water-cooled, capable of dissipating 40 kilowatts. The cathode is a pure tungsten multi-strand filament which may be operated on DC, 1 Ø, 3 Ø, or 6 Ø AC excitation. Maximum ratings apply for audio-frequency use only.

Electrical:

Filament Voltage§	27.2 Volts
Filament Current§	196.5 Amperes
Filament Starting Current§	300 Amps. Max.
Filament Cold Resistance§	.015 Ohms
Amplification Factor, $E_c = -1600V$ $I_b = 3.0A$	4.75
Interelectrode Capacitances	
Grid-Plate	45 $\mu\mu$f
Grid-Filament	56 $\mu\mu$f
Plate-Filament	20 $\mu\mu$f

§Single phase excitation.

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling—Water	
Water Flow on Anode	15 GPM Min.
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Net Weight, approximate	11½ Pounds

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FEDERAL POWER TRIODE
Type F-125-A
40 Kilowatts Plate Dissipation

Federal's F-125-A serves the nation's broadcast transmitters as modulator for the 124-A for which it was specifically designed. It has set a *standard* in the industry.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS AB1

Maximum Ratings, Absolute Values

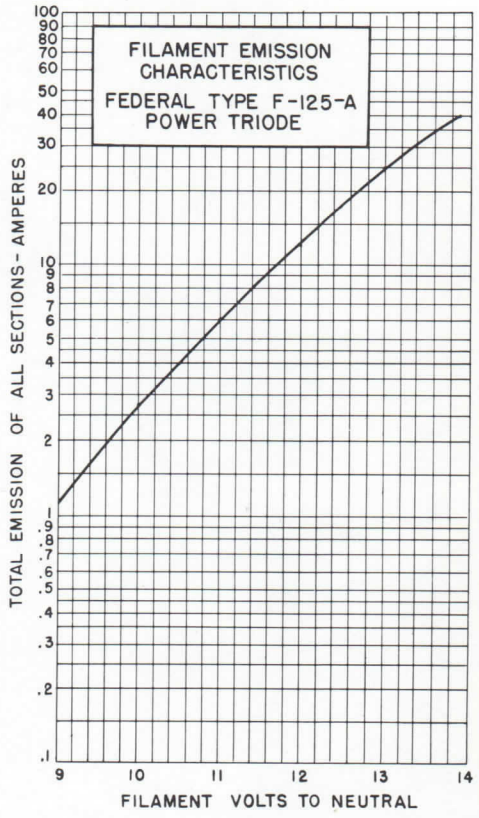
DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	10 Amperes
Maximum Signal Plate Input†	100 Kilowatts
Plate Dissipation†	40 Kilowatts

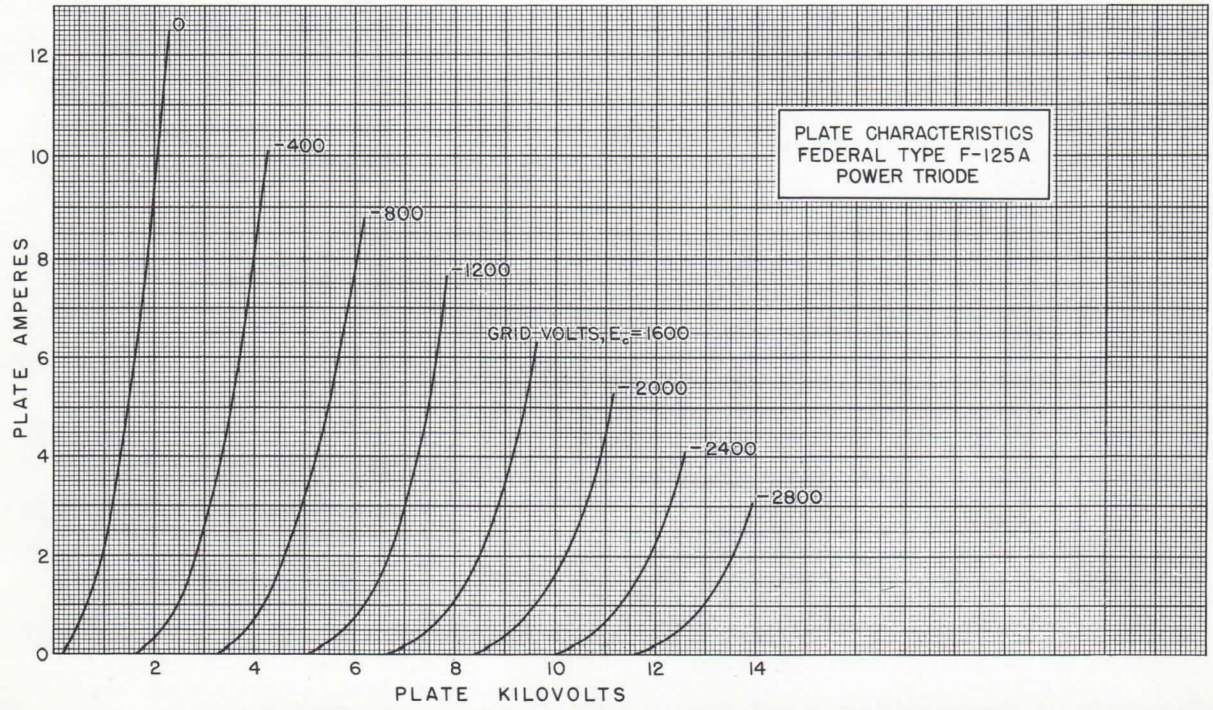
Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000	12,000 Volts
DC Grid Voltage	—2,125	—2,600 Volts
Peak A-F Grid to Grid Voltage	4,220	5,160 Volts
Zero-Signal DC Plate Current	1.4	1.8 Amperes
Maximum Signal DC Plate Current	6.1	5.3 Amperes
Effective Load Resistance, Plate to Plate	3,100	5,000 Ohms
Maximum Signal Driving Power	0	0 Watts
Maximum Signal Power Output	40	40 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.



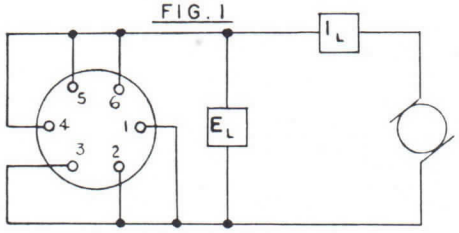


DIVISION OF IT&T

The low amplification factor in the F-125-A makes for easy attainment of high output in Class AB_1 modulators *without driving the grid positive.*

FEDERAL POWER TRIODE
Type F-125-A
40 Kilowatts Plate Dissipation

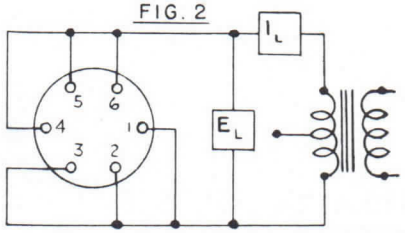
FIG. 1



D.C. CONNECTION

E_L = 'X' VOLTS D.C.
I_L = 'Y' AMPS. D.C.

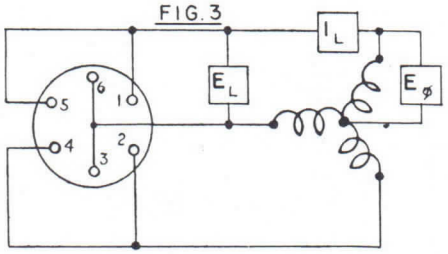
FIG. 2



SINGLE-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.

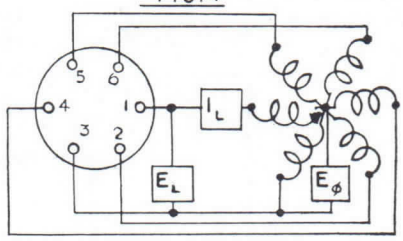
FIG. 3



THREE-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

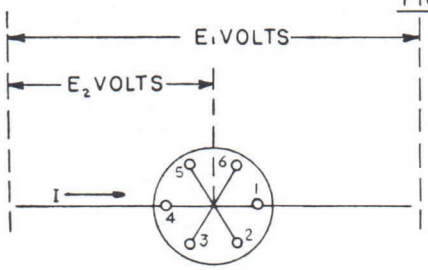
FIG. 4



SIX-PHASE A.C. CONNECTION

E_L = 'X' VOLTS A.C.
I_L = 'Y' AMPS. A.C.
E_ϕ = 'Z' VOLTS. A.C.

FIG. 5



INTERNAL CONNECTION OF FILAMENTS

NUMBERS 1 TO 6 INCLUSIVE ON CONNECTIONS DENOTE BASE TERMINALS.

E_1 = 'U' VOLTS D.C. OR A.C. TERMINAL TO TERMINAL VOLTAGE.

E_2 = 'V' VOLTS D.C. OR A.C. VOLTAGE PER FILAMENT STRAND *i.e.* FROM TERMINAL TO COMMON TERMINAL CONNECTION.

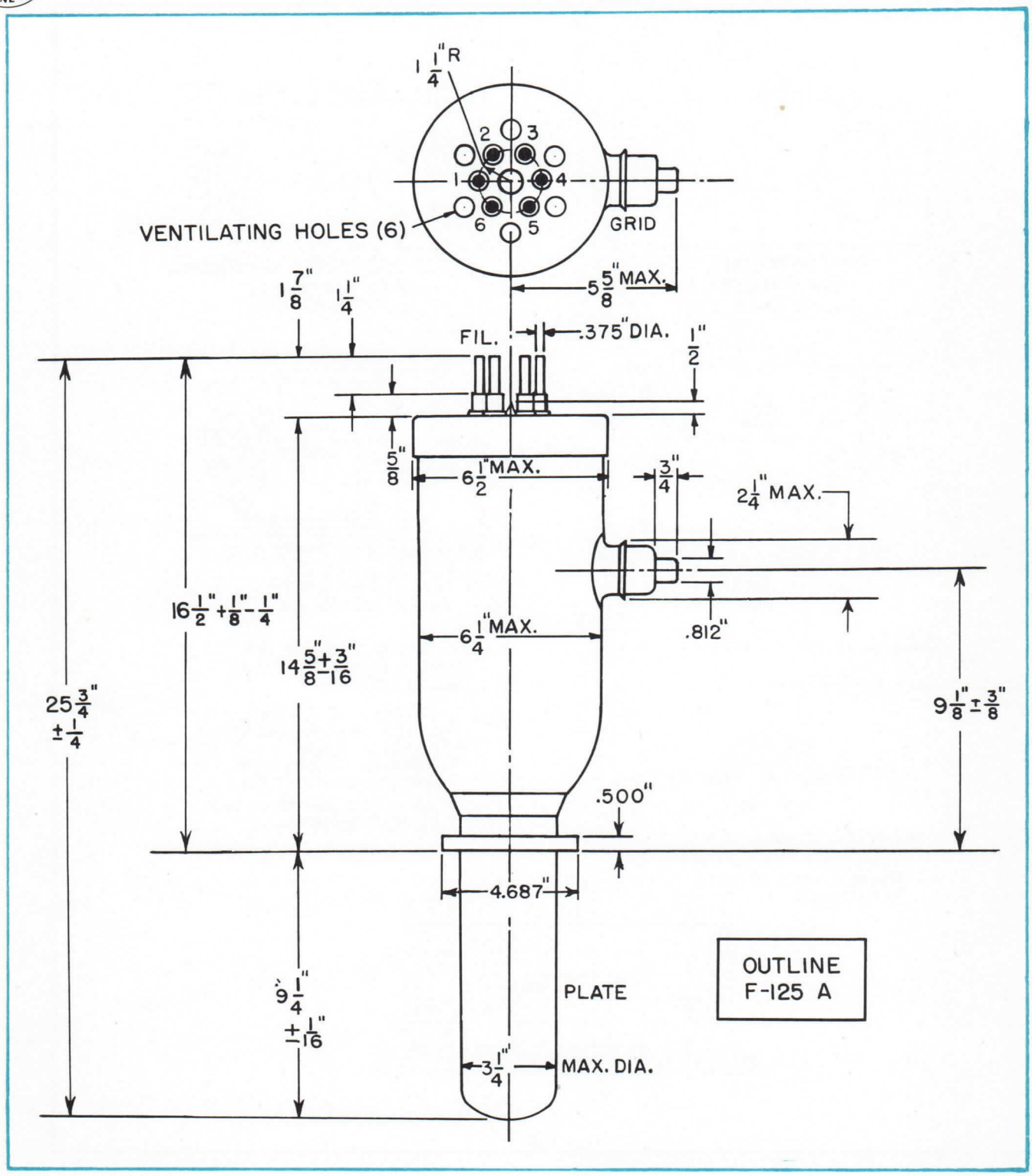
I = 'W' AMPERES CURRENT PER FILAMENT TERMINAL.

FIG.	'U'	'V'	'W'	'X'	'Y'	'Z'
1				27.2	196.5	
2				27.2	196.5	
3				23.5	131.0	13.6
4				13.6	65.5	13.6
5	27.2	13.6	65.5			

MULTI-PHASE FILAMENT CONNECTIONS

FEDERAL POWER TRIODE
Type F-125-A
40 Kilowatts Plate Dissipation

For nearly four decades the name *Federal* has been synonymous with leadership in tube development, design, manufacture and performance.

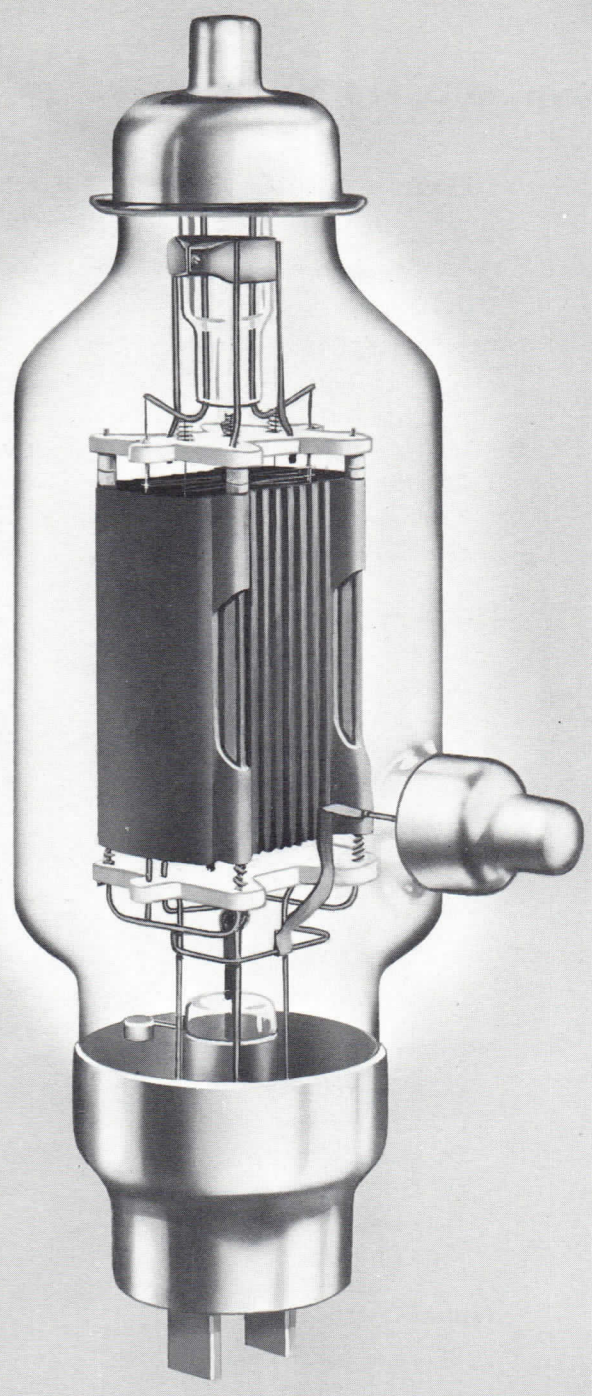


Form FJ-181 Printed in U. S. A.

DIVISION OF IT&T

Federal Telephone and Radio Company
100 Kingsland Road Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-128-A
600 Watts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-128-A is a three-electrode tube designed for use as a modulator, R-F, amplifier, and oscillator. The anode, radiation-cooled, is capable of dissipating 600 watts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles.

Electrical:

▶ Filament Voltage	11 Volts
▶ Filament Current	13 Amperes
▶ Amplification Factor, at I_b=0.200 amps. E_b=2,800 volts	36
▶ Interelectrode Capacitances	
Grid-Plate	15.5 $\mu\mu$f
Grid-Filament	12.0 $\mu\mu$f
Plate-Filament	4.5 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Base Down	
▶ Type of Cooling—Radiation	
▶ Net Weight, approximate	2 Pounds

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FEDERAL POWER TRIODE
Type F-128-A
600 Watts Plate Dissipation

Federal's engineers are ready to consult with you on the application of Federal tubes to your designs. Write, phone or wire to arrange your conference date.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	3,500 Volts
Maximum Signal DC Plate Current†	0.600 Ampere
Maximum Signal Plate Input†	1.8 Kilowatts
Plate Dissipation†	600 Watts

†Averaged over any audio-frequency cycle of sine-wave form.

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	3,000 Volts
DC Grid Voltage	—80 Volts
Peak A-F Grid Voltage	250 Volts
Zero Signal DC Plate Current	0.100 Ampere
Maximum Signal DC Plate Current	1.2 Amperes
Load Resistance, Plate to Plate	3,600 Ohms
Maximum Signal Driving Power, approx.	20 Watts
Maximum Signal Power Output, approx.	2.4 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	3,500 Volts
DC Plate Current	0.5 Ampere
Plate Input	900 Watts
Plate Dissipation	600 Watts

Typical Operation

DC Plate Voltage	3,000 Volts
DC Grid Voltage	—85 Volts
Peak R-F Grid Voltage	117 Volts
DC Plate Current	0.292 Ampere
DC Grid Current, approx.	0 Ampere
Driving Power, approx.‡	6.3 Watts
Power Output, approx.	303 Watts

‡At crest of audio-frequency cycle with modulation factor of 1.0

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	3,000 Volts
DC Grid Voltage	—600 Volts
DC Plate Current	0.700 Ampere
DC Grid Current	0.150 Ampere
Plate Input	1.8 Kilowatts
Plate Dissipation	600 Watts

Typical Operation

DC Plate Voltage	3,000 Volts
DC Grid Voltage	—300 Volts
Peak R-F Grid Voltage	500 Volts
DC Plate Current	0.511 Ampere
DC Grid Current, approx.	0.038 Ampere
Driving Power, Approx.	20 Watts
Power Output, approx.	1.15 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	3,500 Volts
DC Grid Voltage	—600 Volts
DC Plate Current	1 Ampere
DC Grid Current	0.175 Amperes
Plate Input	3 Kilowatts
Plate Dissipation	700 Watts

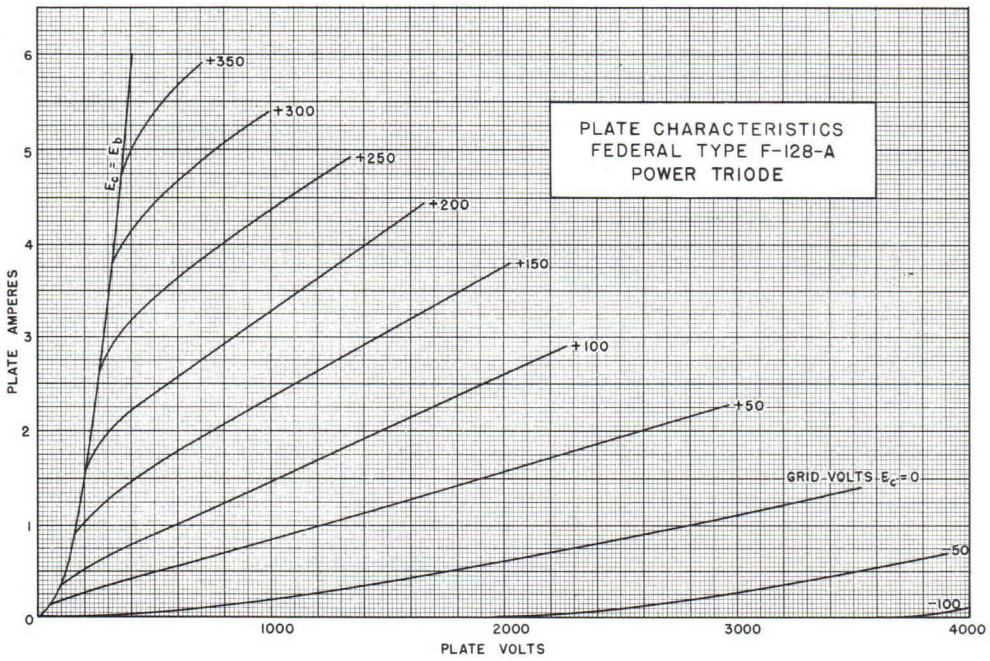
Typical Operation

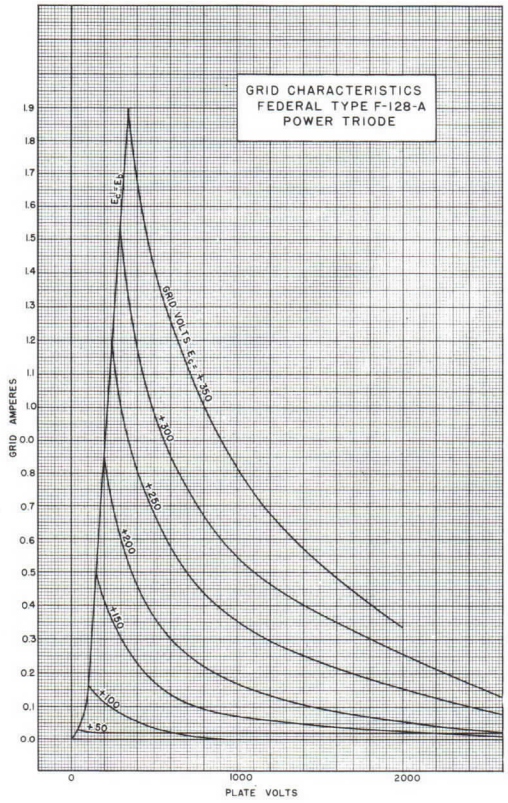
DC Plate Voltage	3,500 Volts
DC Grid Voltage	—400 Volts
Peak R-F Grid Voltage	680 Volts
DC Plate Current	0.854 Amperes
DC Grid Current, approx.	0.107 Ampere
Driving Power, approx.	70 Watts
Power Output, approx.	2.4 Kilowatts

¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

Federal's name on a tube signifies the best in design, engineering, materials, components and craftsmanship.

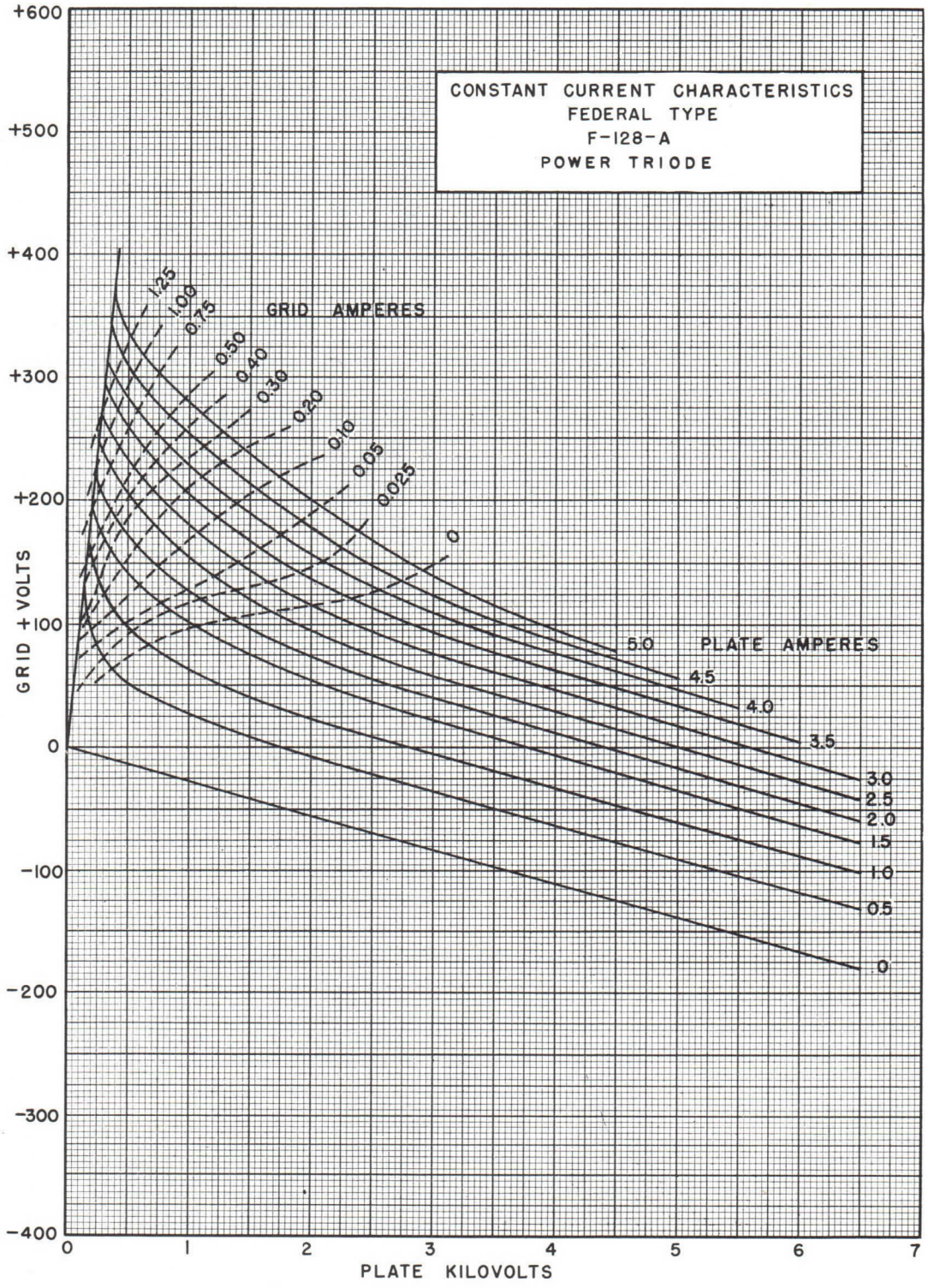
FEDERAL POWER TRIODE
Type F-128-A
600 Watts Plate Dissipation





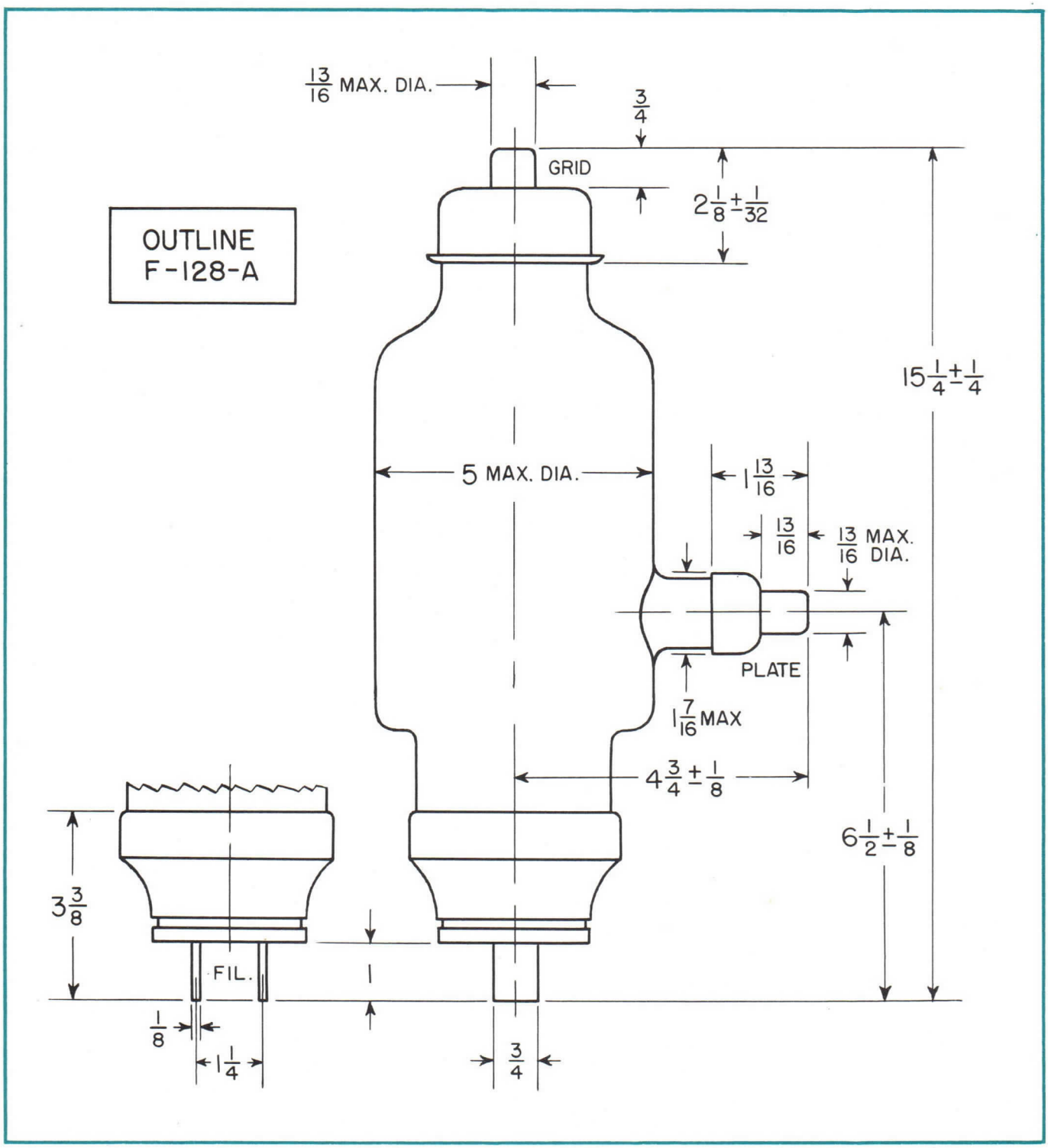
FEDERAL POWER TRIODE
Type F-128-A
600 Watts Plate Dissipatior

Federal's longer tube life means lower costs. Increase the life of the tubes in your equipment, and unit costs per hour go down.



Federal produces tubes of only the highest quality, satisfying the most exacting users.

FEDERAL POWER TRIODE
Type F-128-A
600 Watts Plate Dissipation



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100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

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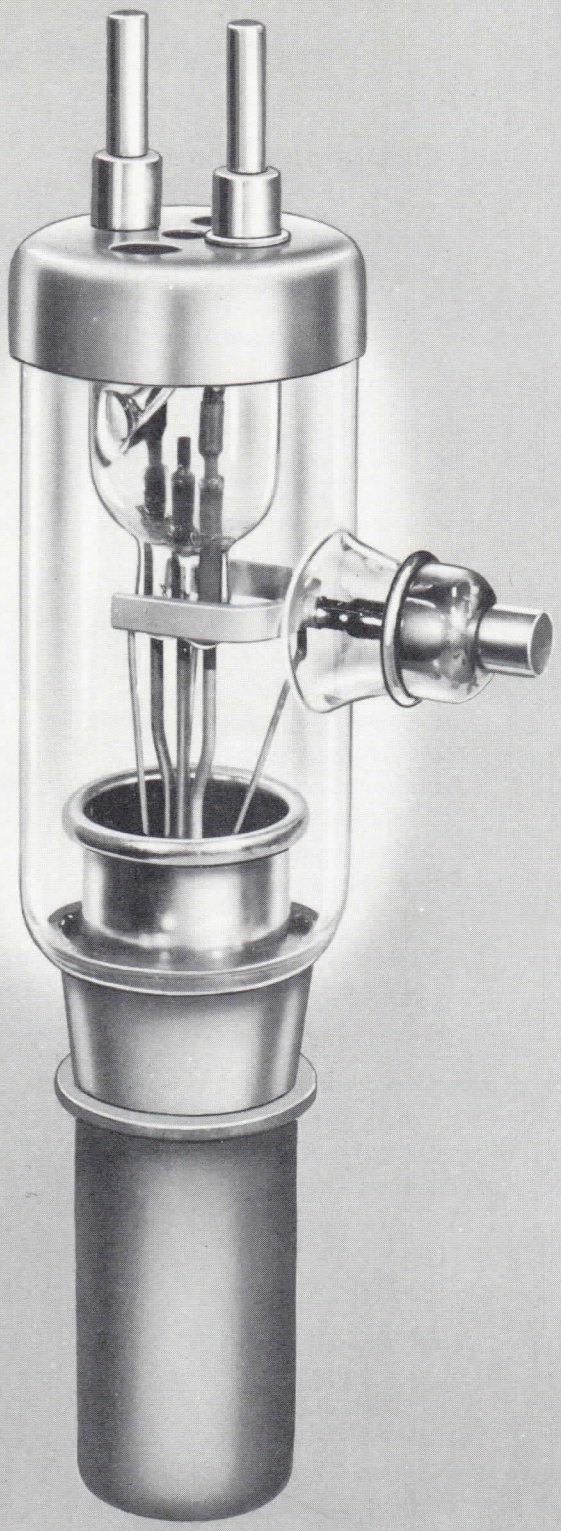
Form F-587 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-129-B
7.5 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-129-B is a three-electrode tube designed for use as a radio-frequency power amplifier, oscillator, or Class B modulator. The anode, water cooled, is capable of dissipating 7.5 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 30 megacycles.

Electrical:

Filament Voltage	18 Volts
Filament Current	58 Amperes
Filament Starting Current	115 Amperes Max.
Filament Cold Resistance	.024 Ohms
Peak Cathode Current	9.5 Amperes
Amplification Factor	
$I_b = 0.8$ Amp.; $E_c = -100$ Volts	26
Interelectrode Capacitances	
Grid-Plate	12.0 $\mu\mu f$
Grid-Filament	12.7 $\mu\mu f$
Plate-Filament	1.8 $\mu\mu f$

Mechanical:

Mounting Position—	
Vertical, Anode Down	
Type of Cooling—Water	
Minimum Water Flow on Anode	5 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Net Weight, approximate	2 Pounds

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FEDERAL POWER TRIODE
Type F-129-B
7.5 Kilowatts Plate Dissipation

Federal's F-129-B is operative at full ratings up to a frequency of 30 megacycles.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings

DC Plate Voltage	12,000 Volts
Max. Signal DC Plate Current†	2 Amperes
Max. Signal Plate Input†	16 Kilowatts
Plate Dissipation†	7.5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—350 Volts
Peak A-F Grid to Grid Voltage	700 Volts
Zero Signal DC Plate Current	0.3 Amperes
Maximum Signal DC Plate Current	1.15 Amperes
Effective Load Resistance (plate to plate)	20,000 Ohms
Maximum Signal Driving Power, approximate	100 Watts
Maximum Signal Power Output, approximate	8 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER —CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	12,000 Volts
DC Plate Current	1 Ampere
Plate Input	10 Kilowatts
Plate Dissipation	7.5 Kilowatts

Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—350 Volts
Peak R-F Grid Voltage	530 Volts
DC Plate Current	0.8 Amperes
Driving Power, approximate‡	80 Watts
Power Output, approximate	2.5 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1 Ampere
DC Grid Current	0.25 Ampere
Plate Input	9 Kilowatts
Plate Dissipation	5 Kilowatts

Typical Operation

DC Plate Voltage	8,000 Volts
DC Grid Voltage	—920 Volts
Peak R-F Grid Voltage	1,500 Volts
DC Plate Current	0.82 Amperes
DC Grid Current, approximate	0.097 Amperes
Driving Power, approximate	140 Watts
Power Output, approximate	5.3 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	2 Amperes
DC Grid Current	0.25 Amperes
Plate Input	18 Kilowatts
Plate Dissipation	7.5 Kilowatts

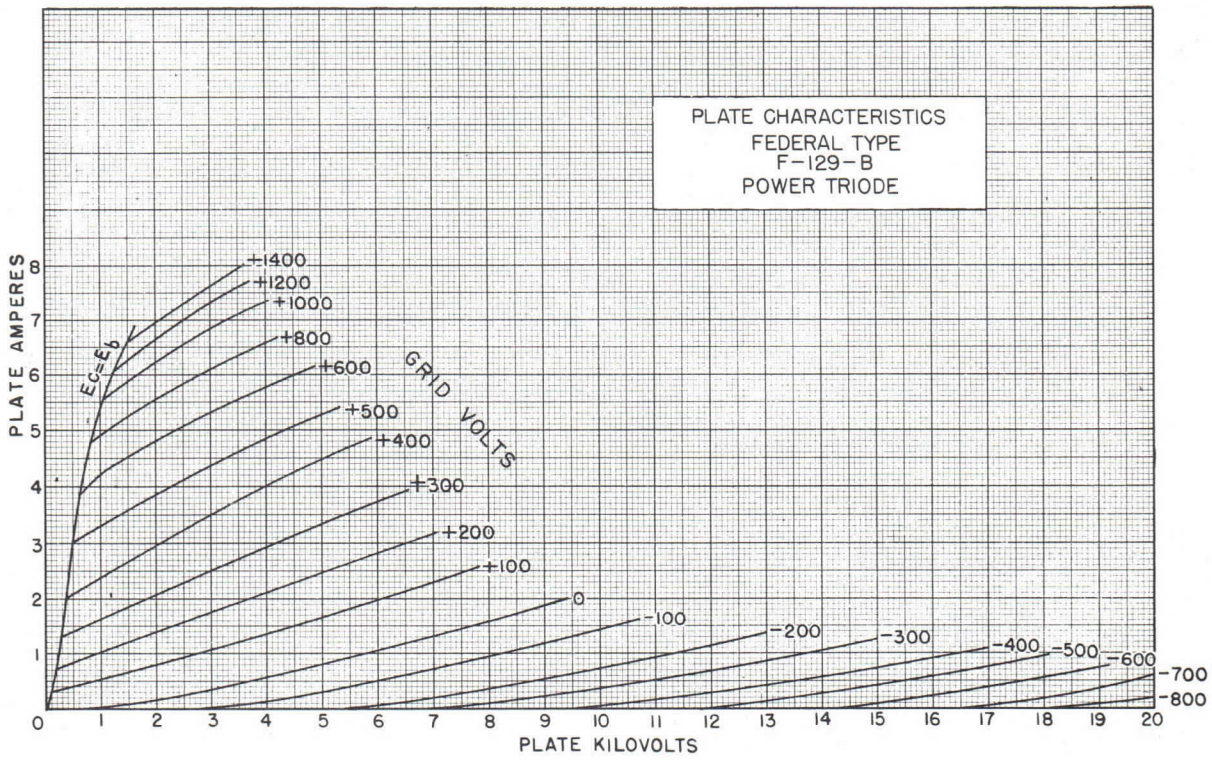
Typical Operation

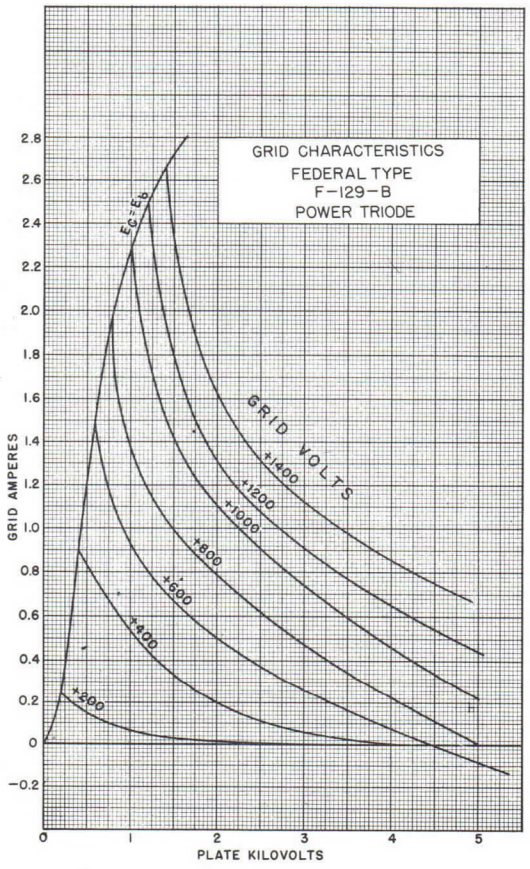
DC Plate Voltage	12,000 Volts
DC Grid Voltage	—1,300 Volts
Peak R-F Grid Voltage	2,200 Volts
DC Plate Current	1.42 Amperes
DC Grid Current, approximate	0.11 Amperes
Driving Power, approximate	230 Watts
Power Output, approximate	12 Kilowatts

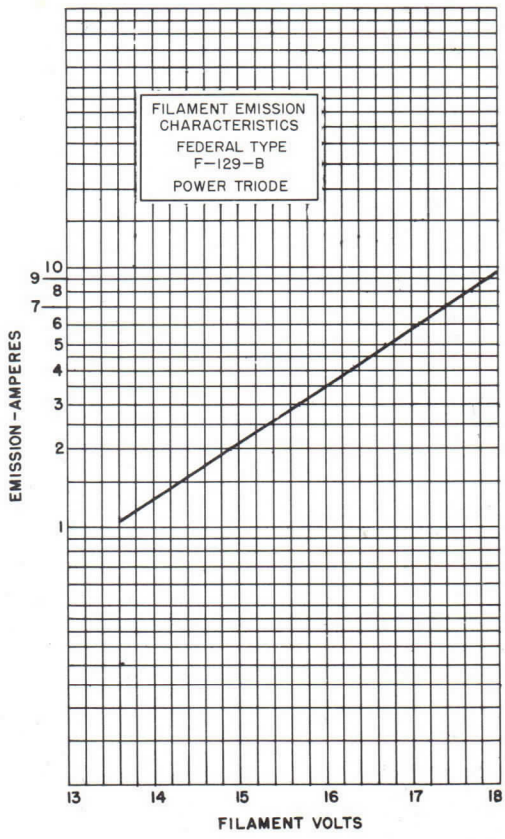
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

Precision craftsmanship was initiated by Federal in the earliest days of tube manufacture, and has been maintained ever since.

FEDERAL POWER TRIODE
Type F-129-B
7.5 Kilowatts Plate Dissipation

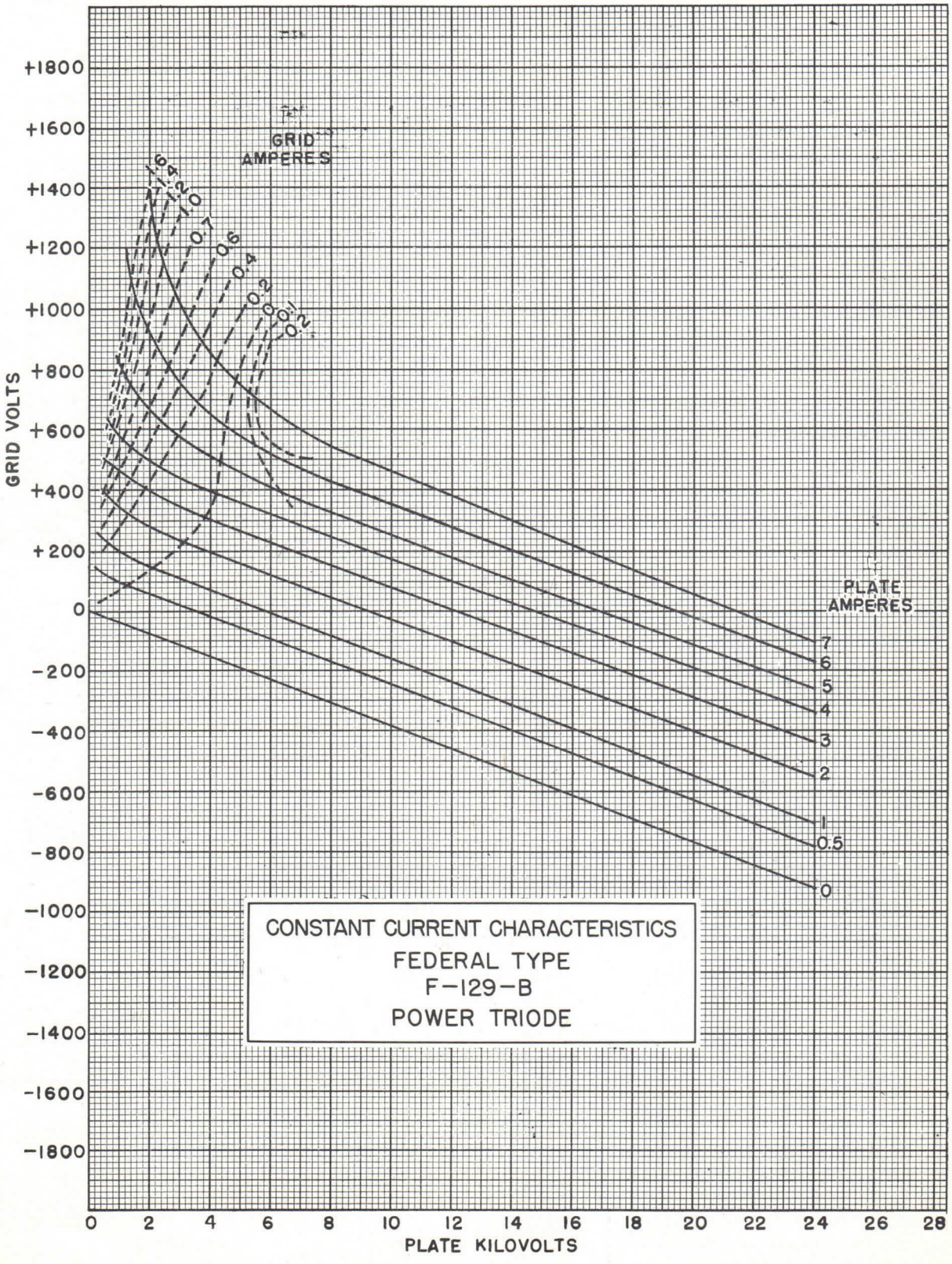






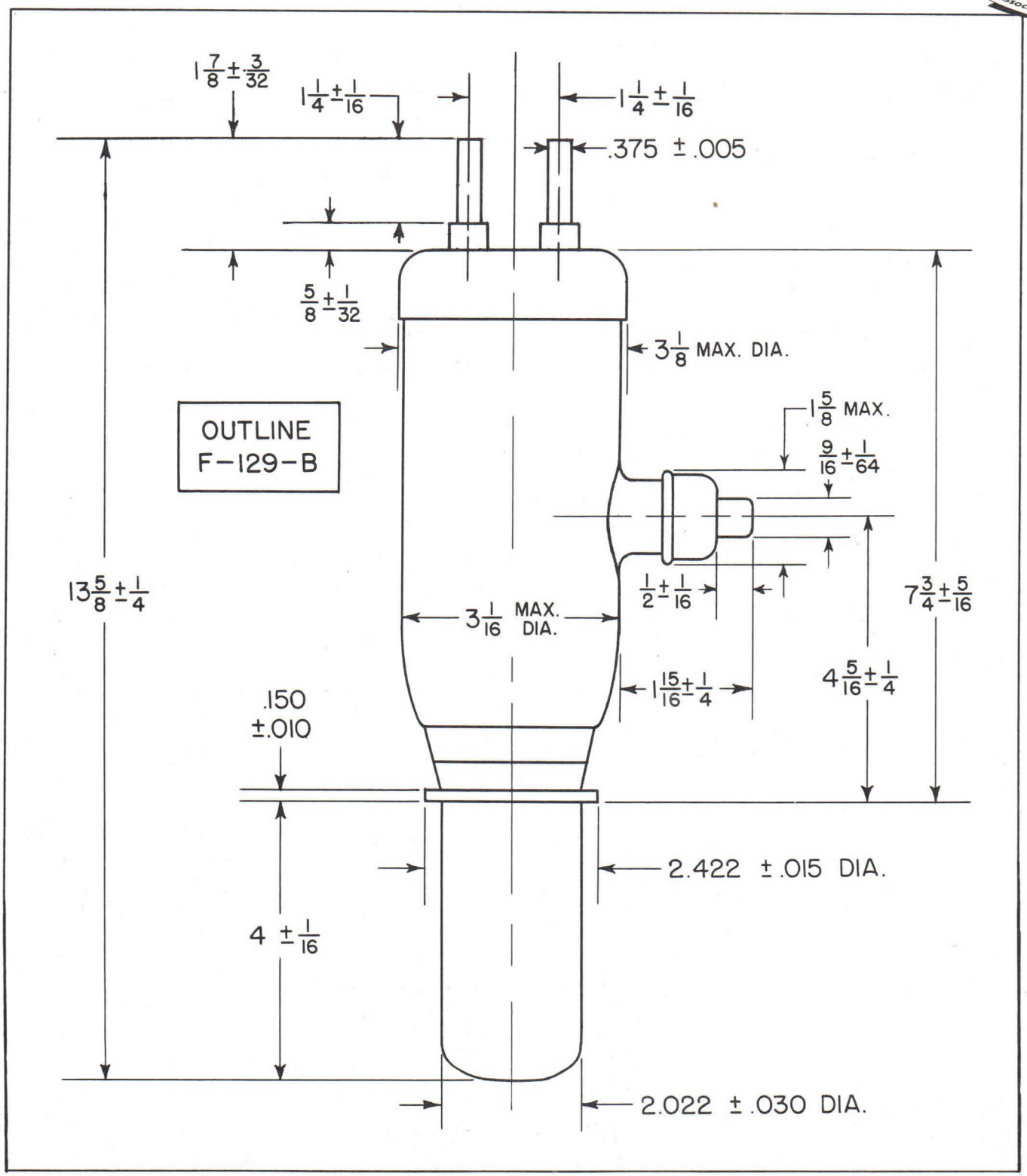
FEDERAL POWER TRIODE
Type F-129-B
7.5 Kilowatts Plate Dissipation

The development of new tubes for new applications always has been a Federal specialty. Why not tell us your needs?



One reason why Federal tubes are trade-marked, is to show the craftsman's pride and Federal's satisfaction in work well done.

FEDERAL POWER TRIODE
Type F-129-B
7.5 Kilowatts Plate Dissipation



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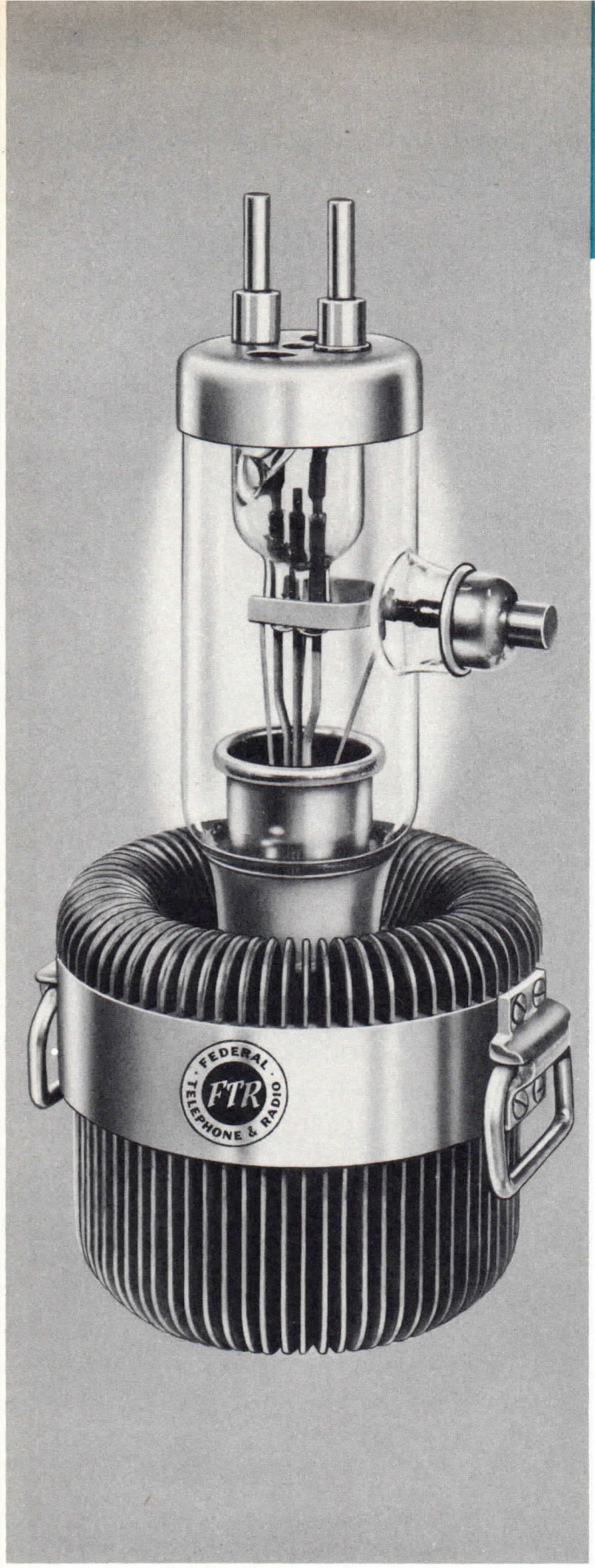
Form FJ-176 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-129-R
5 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

The F-129-R by Federal is a three-electrode tube designed for use as a radio-frequency power amplifier, oscillator, or Class B modulator. The anode is forced-air-cooled, capable of dissipating 5 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 30 megacycles.

Electrical:

Filament Voltage	18 Volts
Filament Current	58 Amperes
Filament Starting Current	115 Amperes Max.
Filament Cold Resistance	.024 Ohms
Peak Cathode Current	9.5 Amperes
Amplification Factor	
$I_b = 0.8$ Amp.; $E_c = -100$ Volts	26
Interelectrode Capacitances	
Grid-Plate	13.0 $\mu\mu$f
Grid-Filament	12.7 $\mu\mu$f
Plate-Filament	2.2 $\mu\mu$f

Mechanical:

Mounting Position—Vertical, Anode Down			
Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation—Kilowatts	5	4	3
Air Flow—CFM	800	575	400
Static Pressure—Inches Water	2.5	1.3	0.62
Maximum Glass Temperature			150° C
Net Weight, approx.			22 Pounds

The longer life in Federal tubes means lower operating costs.

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FEDERAL POWER TRIODE
Type F-129-R
5 Kilowatts Plate Dissipation

In *satisfying* the customer and winning his confidence, Federal has reduced tube selling to a formula.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings

DC Plate Voltage	12,000 Volts
Maximum Signal DC Plate Current†	2 Amperes
Maximum Signal Plate Input†	16 Kilowatts
Plate Dissipation†	5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—350 Volts
Peak A-F Grid to Grid Voltage	700 Volts
Zero Signal DC Plate Current	0.3 Amperes
Maximum Signal DC Plate Current	1.15 Amperes
Effective Load Resistance, Plate to Plate	20,000 Ohms
Maximum Signal Driving Power, approximate	100 Watts
Maximum Signal Power Output, approximate	8 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER —CLASS B TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	12,000 Volts
DC Plate Current	1 Ampere
Plate Input	7.5 Kilowatts
Plate Dissipation	5 Kilowatts

Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—300 Volts
Peak R-F Grid Voltage	460 Volts
DC Plate Current	0.7 Amperes
Driving Power, approximate‡	90 Watts
Power Output, approximate	2.3 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1 Ampere
DC Grid Current	0.25 Ampere
Plate Input	9 Kilowatts
Plate Dissipation	3 Kilowatts

Typical Operation

DC Plate Voltage	8,000 Volts
DC Grid Voltage	—920 Volts
Peak R-F Grid Voltage	1,500 Volts
DC Plate Current	0.82 Amperes
DC Grid Current, approximate	0.097 Amperes
Driving Power, approximate	140 Watts
Power Output, approximate	5.3 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	2 Amperes
DC Grid Current	0.25 Amperes
Plate Input	18 Kilowatts
Plate Dissipation	5 Kilowatts

Typical Operation

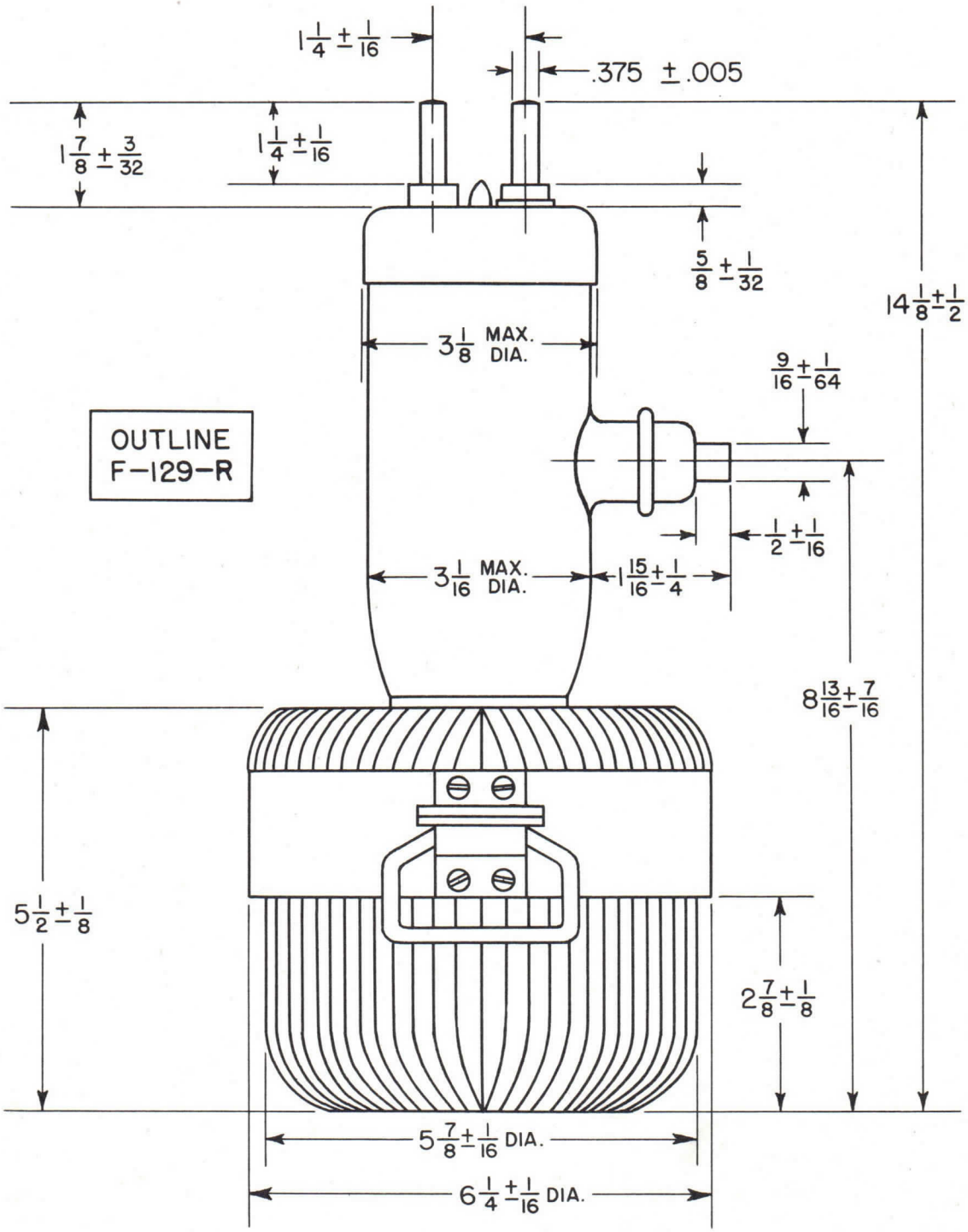
DC Plate Voltage	12,000 Volts
DC Grid Voltage	—1,300 Volts
Peak R-F Grid Voltage	2,200 Volts
DC Plate Current	1.42 Amperes
DC Grid Current, approximate	0.11 Amperes
Driving Power, approximate	230 Watts
Power Output, approximate	12 Kilowatts

¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

AN IT&T ASSOCIATE

Federal's longer tube life means lower costs. Increase the life of the tubes in your equipment, and unit costs per hour go down.

FEDERAL POWER TRIODE
Type F-129-R
5 Kilowatts Plate Dissipation



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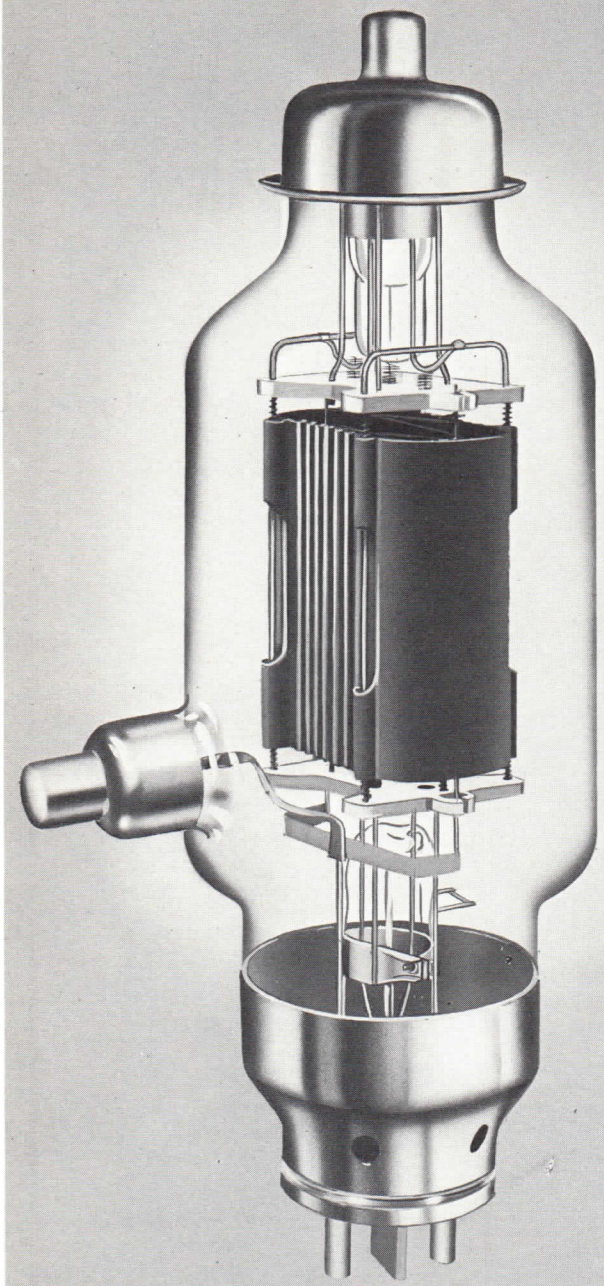
FEDERAL POWER TRIODE
Type F-132-A
600 Watts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-132-A is a three electrode tube designed for use as a modulator. The anode, radiation-cooled, is capable of dissipating 600 watts. The cathode is a thoriated tungsten filament.

Electrical:

▶ Filament Voltage	11 Volts
▶ Filament Current	13 Amperes
▶ Amplification Factor, at I_b=0.200 amps. E_b=3,000 volts	10
▶ Interelectrode Capacitances	
Grid-Plate	15.0 $\mu\mu$f
Grid-Filament	12.0 $\mu\mu$f
Plate-Filament	5.5 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Base Down	
▶ Type of Cooling—Radiation	
▶ Net Weight, approximate	2 Pounds

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FEDERAL POWER TRIODE
Type F-132-A
600 Watts Plate Dissipation

In *satisfying* the customer and winning his confidence, Federal has reduced tube selling to a formula.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER—CLASS A

Maximum Ratings, Absolute Values

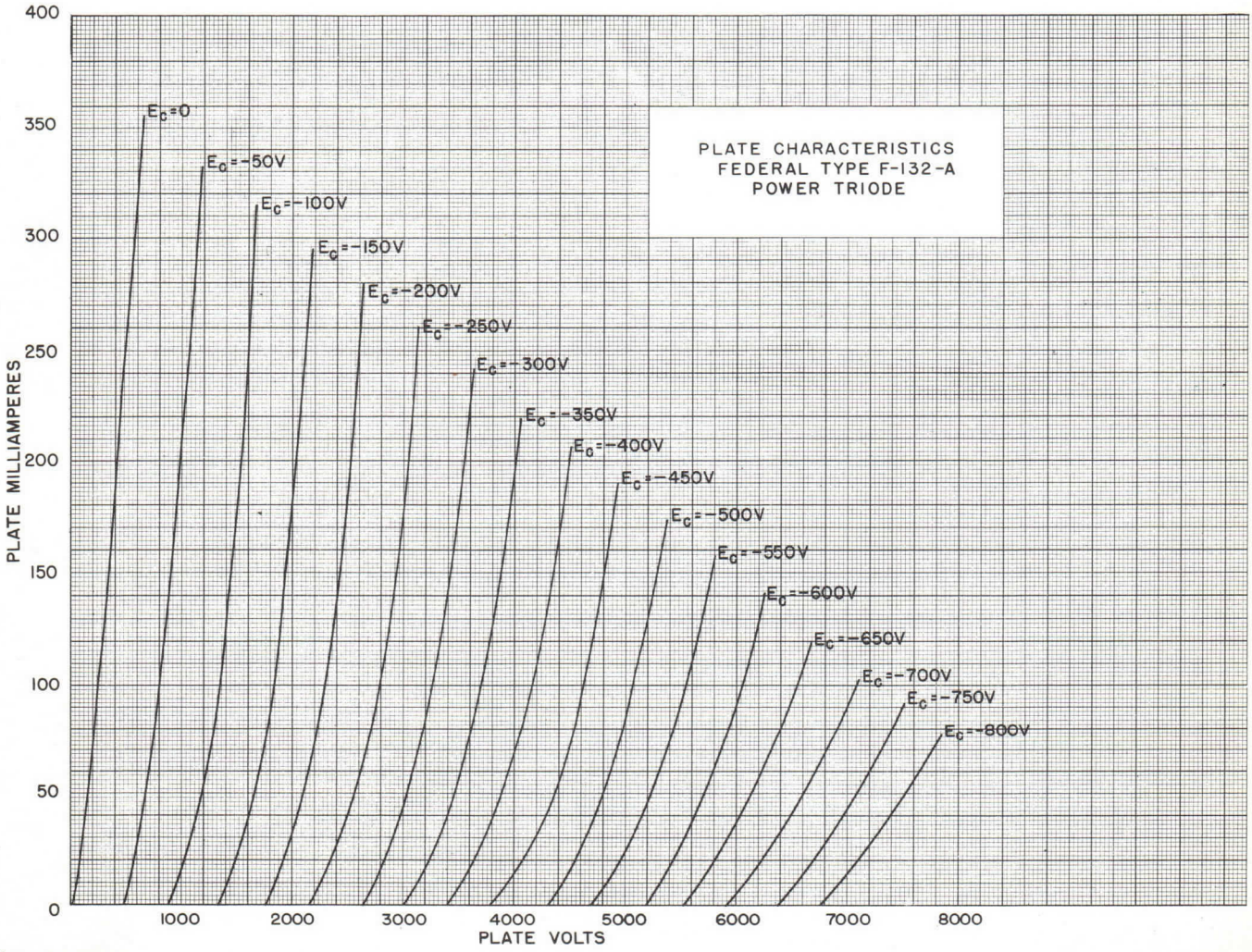
DC Plate Voltage	3,500 Volts
Plate Dissipation	600 Watts

Typical Operation

As push-pull Class A driver for 2 Type F-125-A tubes.

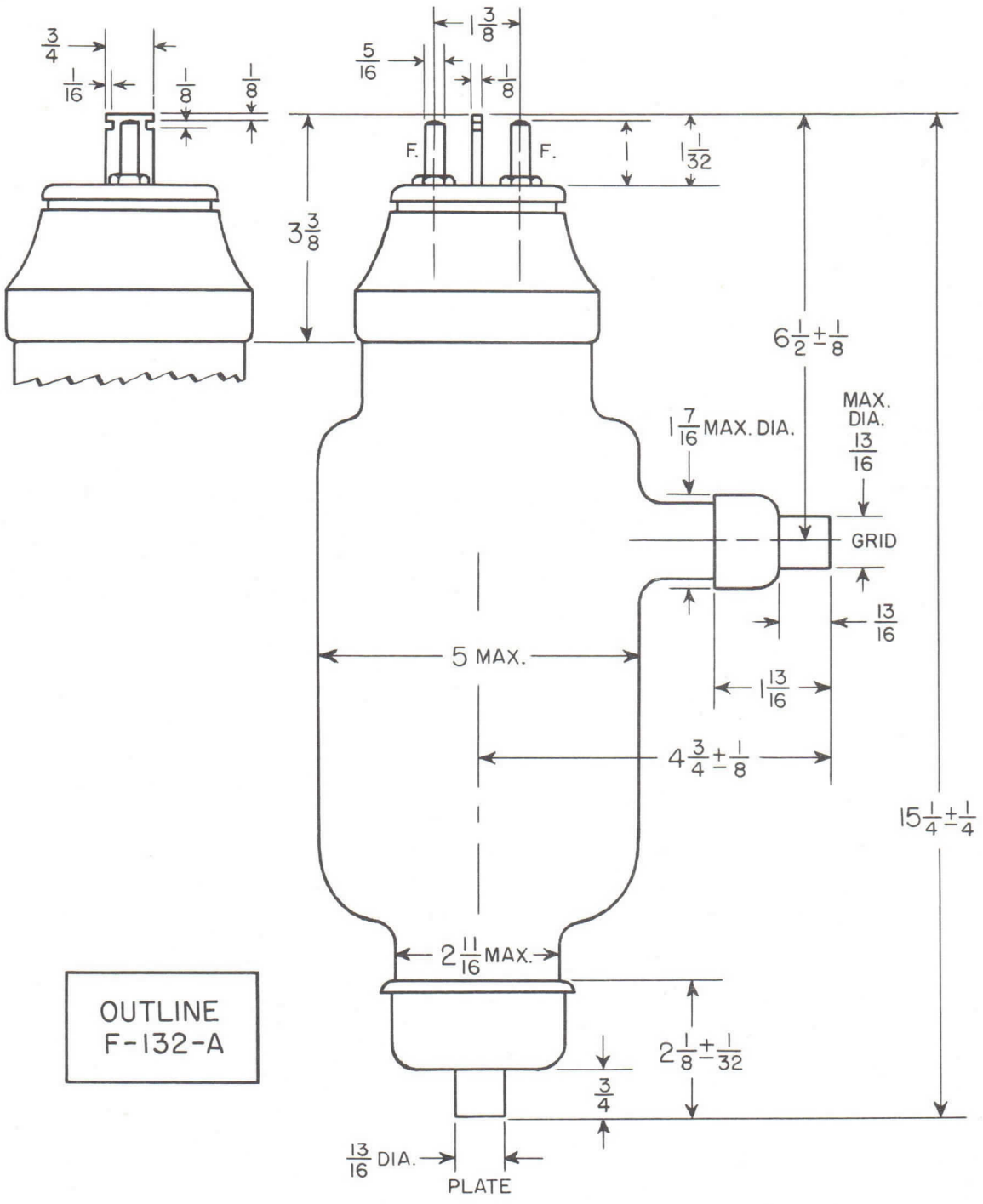
(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	3,500	2,700 Volts
DC Grid Voltage	—300	—225 Volts
Zero Signal Plate Current	0.308	0.300 Ampere
Maximum Signal Plate Current	0.317	0.307 Ampere
Peak Grid to Grid Signal Voltage	590	440 Volts
Peak Plate to Plate Output Voltage	5,700	4,000 Volts
Effective Plate to Plate Load Impedance	40,000	35,000 Ohms
Output Transformer turns ratio	1:1	1:1.3
Total Harmonic Distortion	2	1 Percent



One reason why Federal tubes are trade-marked, is to show the craftsman's pride and Federal's satisfaction in work well done.

FEDERAL POWER TRIODE
Type F-132-A
600 Watts Plate Dissipation



OUTLINE
F-132-A

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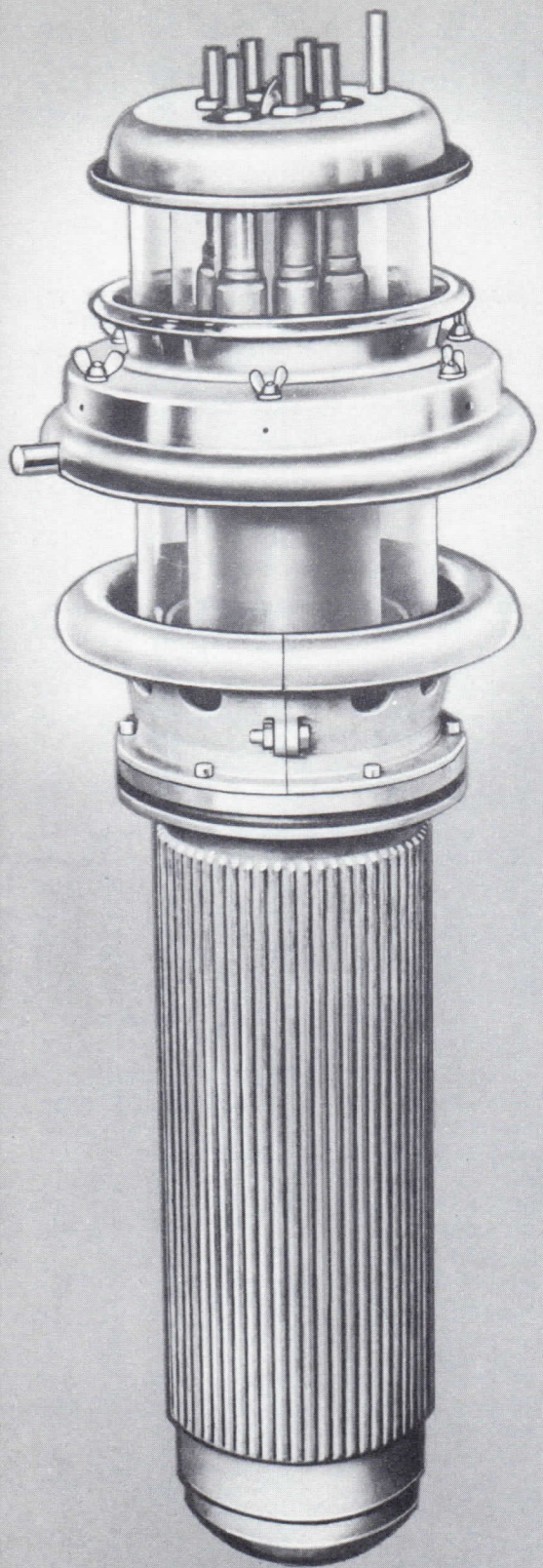
Form F-588 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-134
150 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Type F-134 is a three-electrode tube designed and manufactured by Federal for use as a radio-frequency amplifier, oscillator, or Class B modulator. The anode is water-cooled, capable of dissipating 150 Kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 22 megacycles.

Electrical:

Filament Voltage	25 Volts
Filament Current	650 Amperes
Filament Starting Current	1,000 Amperes max.
Filament Cold Resistance	.0022 Ohms
Peak Cathode Current	120 Amperes
Amplification Factor, at $E_c = -200V$ $I_b = 5A$	21
Interelectrode Capacitances	
Grid-Plate	105 $\mu\mu f$
Grid-Filament	140 $\mu\mu f$
Plate-Filament	4 $\mu\mu f$

Mechanical:

Mounting Position—Vertical, anode down	
Type of Cooling—Water and Forced Air (1)	
Minimum Water Flow on Anode	40 GPM.
Maximum Outgoing Water Temperature	70° C
Air Flow	
To Grid Air Ring (2)	80 CFM
To Filament Seals (3)	40 CFM
Maximum Glass Temperature	150° C
Net Weight, approx.	80 Pounds

(1) Water and air cooling should continue for 5 minutes after removal of power.

(2) Air pressure of 6 psi required to deliver 80 CFM at 14.7 psi and 20° C.

(3) Air pressure of 0.25 psi at entrance of 9-foot length of ⅜-inch I.D. hose to deliver 40 CFM at 14.7 psi and 20° C.

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FEDERAL POWER TRIODE
Type F-134
150 Kilowatts Plate Dissipation

Federal's F-134 has exhibited proven performance over a period of years in 200 KW high level modulated short-wave transmitters.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000	Volts
Maximum Signal DC Plate Current†	24	Amps.
Maximum Signal Plate Input†	400	KW
Plate Dissipation†	150	KW

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	12,000	14,000	14,000	Volts
DC Grid Voltage	—500	—600	—600	Volts
Peak A-F Grid-to-Grid Voltage	1,920	1,960	3,100	Volts
Zero Signal DC Plate Current	4.0	4.0	4.0	Amps.
Maximum Signal DC Plate Current	22	17.2	41	Amps.
Effective Load Resistance, Plate to Plate	2,600	4,300	680	Ohms
Max. Signal Driving Power, approx.	540	500	3,400	Watts
Max. Signal Power Output, approx.	155	155	355	KW

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000	Volts
DC Plate Current	12	Amps.
Plate Input	200	KW
Plate Dissipation	150	KW

Typical Operation

DC Plate Voltage	18,000	Volts
DC Grid Voltage	—600	Volts
Peak R-F Grid Voltage	1370	Volts
DC Plate Current	9.6	Amps.
DC Grid Current, approx.	0.0	Amps.
Driving Power, approx.‡	1.2	KW
Power Output, approx.	54	KW

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	14,000	Volts
DC Grid Voltage	—4,000	Volts
DC Plate Current	12	Amps.
DC Grid Current	2	Amps.
Plate Input	165	KW
Plate Dissipation	100	KW

Typical Operation, Grounded Filament Circuit

DC Plate Voltage	14,000	14,000	Volts
DC Grid Voltage	—1,600	—1,600	Volts
Peak R-F Grid Voltage	2,340	2,500	Volts
DC Plate Current	9.8	11.8	Amps.
DC Grid Current, approx.	0.6	1.0	Amps.
Driving Power, approx.	1.4	3.0	KW
Power Output, approx.	108	126	KW

Typical Operation, Grounded Grid Circuit

DC Plate Voltage	12,000	Volts
DC Grid Voltage	—1,400	Volts
DC Plate Current	10	Amps.
DC Grid Current, approx.	1.0	Amp.
Driving Power, approx.*	17.5	KW
Power Output**	105	KW

*The carrier of the driver modulated 100 per cent.
**Includes power transferred from driver stage.

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000	Volts
DC Grid Voltage	—4,000	Volts
DC Plate Current	24	Amps.
DC Grid Current	2	Amps.
Plate Input	450	KW
Plate Dissipation	150	KW

Typical Operation

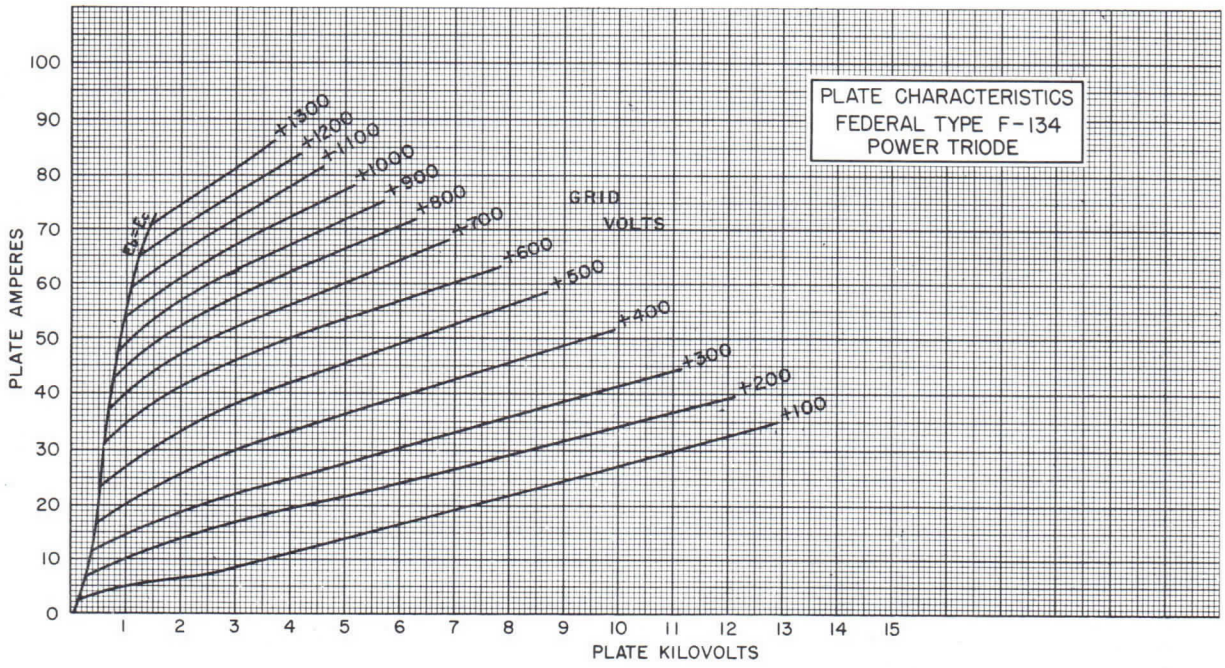
DC Plate Voltage	18,000	19,000	19,000	Volts
DC Grid Voltage	—2,000	—2,200	—2,200	Volts
Peak R-F Grid Voltage	3,000	3,400	3,600	Volts
DC Plate Current	14.5	17.8	20.1	Amps.
DC Grid Current, approx.	1.0	1.1	1.8	Amps.
Driving Power, approx.	3	3.8	6	KW
Power Output, approx.	200	250	300	KW

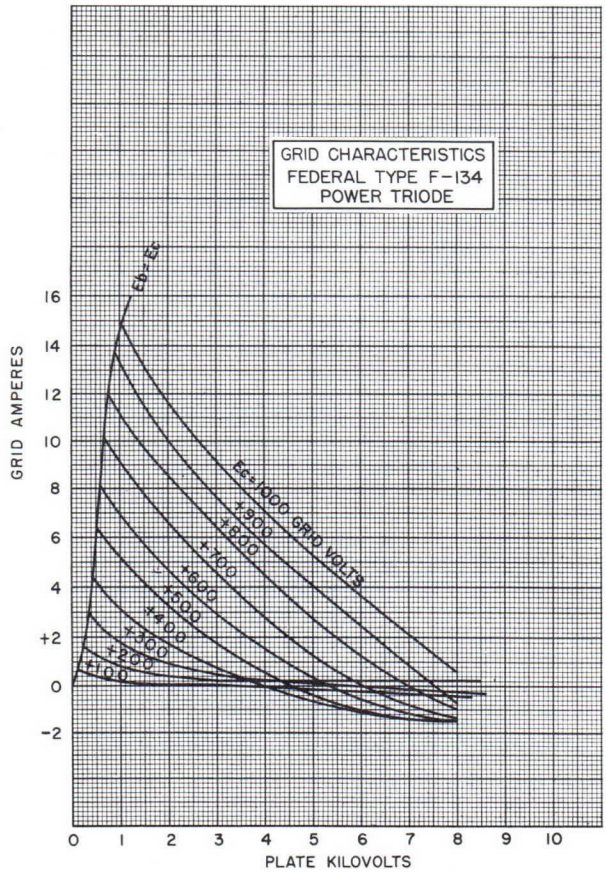
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

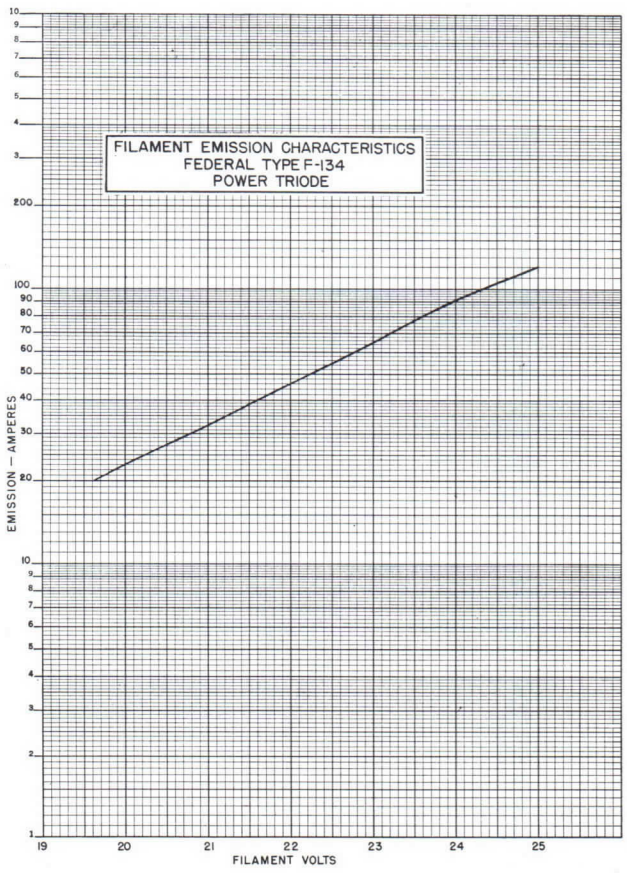
An IT&T Associate

FEDERAL POWER TRIODE
Type F-134
150 Kilowatts Plate Dissipation

Up to 300 KW of R-F power is available from a single F-134 tube—for use in industrial heating applications.

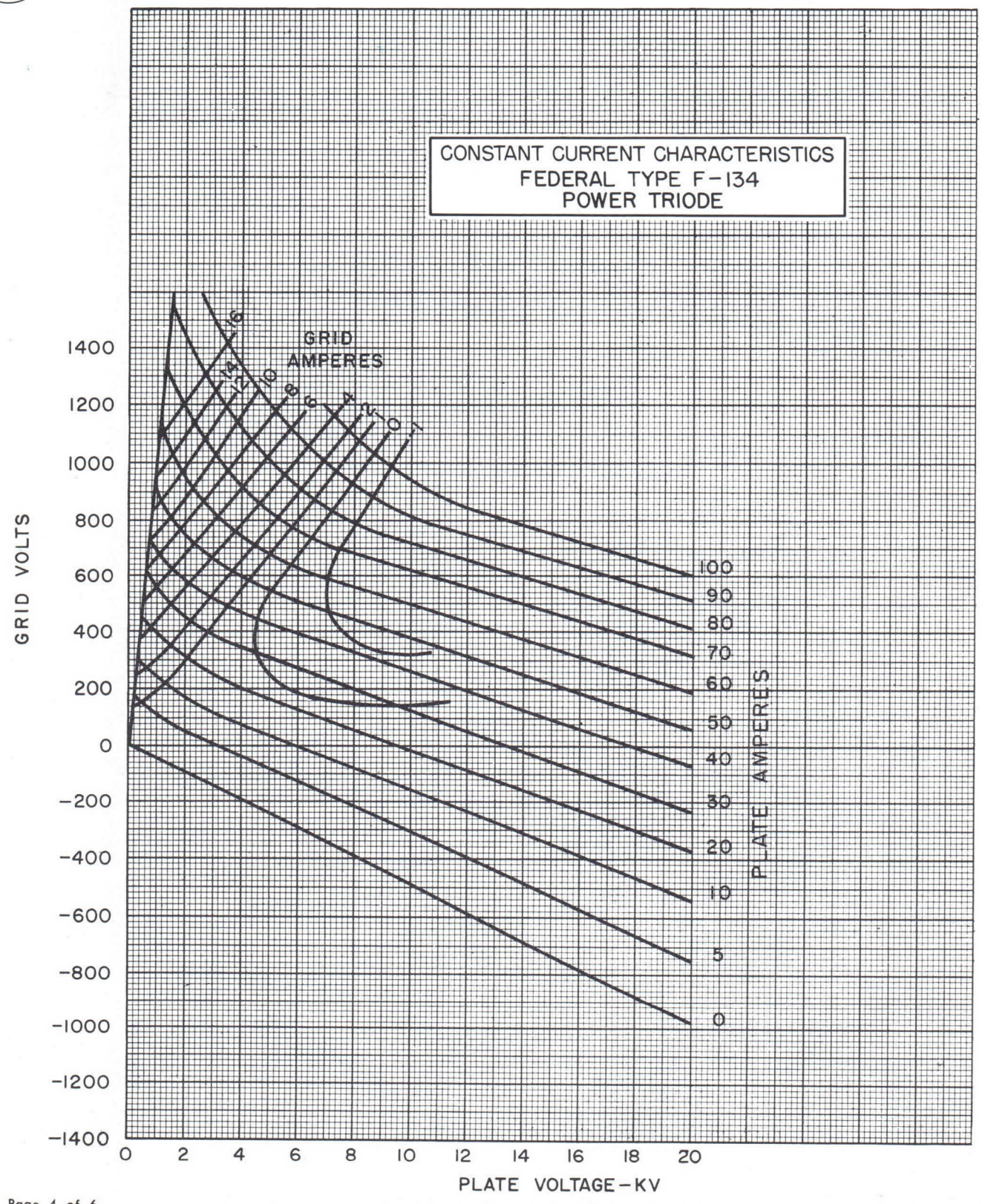






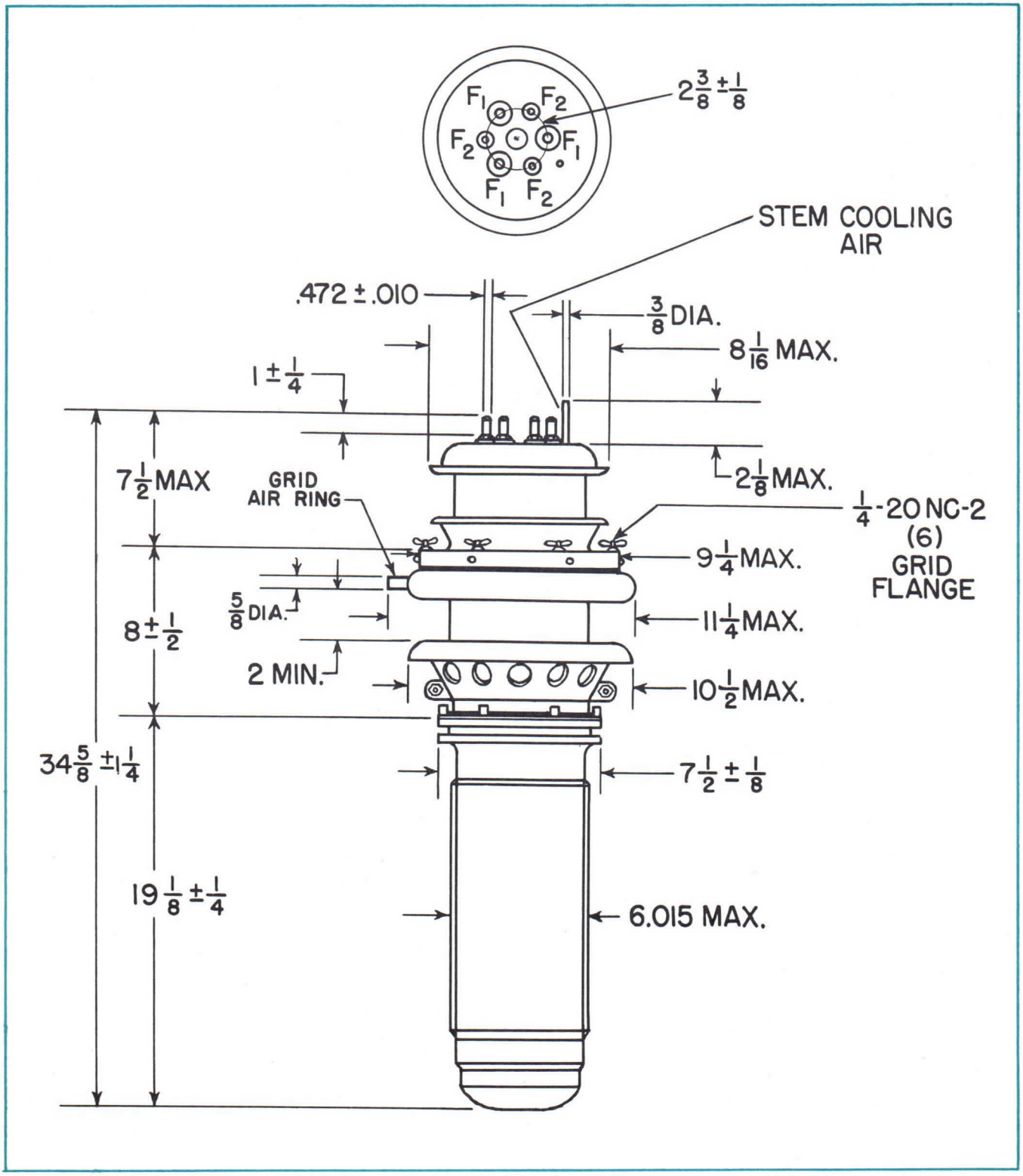
FEDERAL POWER TRIODE
Type F-134
150 Kilowatts Plate Dissipation

The ring seal grid connection in the F-134 provides a low inductance grid lead and adaptability to grounded grid circuits.



Federal tubes are produced under the most rigid standards of quality control. You can depend on Federal for top performance and long service life.

FEDERAL POWER TRIODE
Type F-134
150 Kilowatts Plate Dissipation

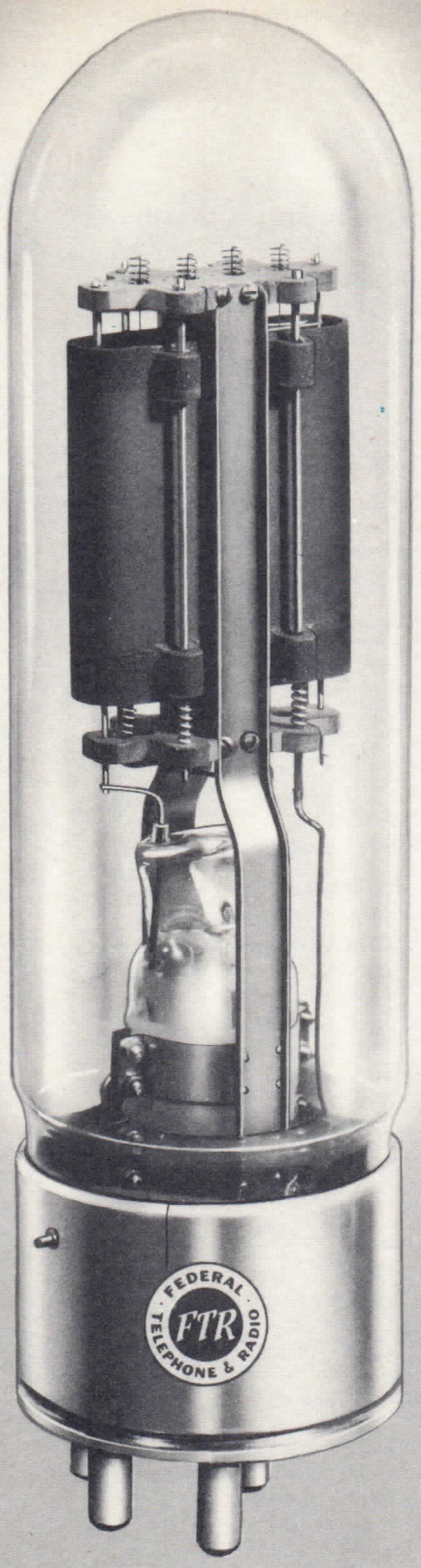


Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

Federal Always Has
Made Better Tubes

Printed in U. S.A.—Form FJ-329

FEDERAL POWER TRIODE
Type F-212-E
275 Watts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-212-E is a three-electrode tube designed for use as a modulator, R-F amplifier, and oscillator. The anode, radiation-cooled, is capable of dissipating 275 watts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 1.6 megacycles.

Electrical:

Filament Voltage	14 Volts
Filament Current	6 Amperes
Amplification Factor	
$I_b = 0.2$ Amp.;	
$E_b = 1500$ Volts	16
Interelectrode Capacitances	
Grid-Plate	19 $\mu\mu$f
Grid-Filament	14.5 $\mu\mu$f
Plate-Filament	8 $\mu\mu$f

Mechanical:

- Mounting Position— Vertical, Base Down
- Type of Cooling—Radiation
- Net Weight, approximate 1 Pound

Each F-212-E vacuum tube falls within one of four impedance classes and is stamped accordingly. These classifications are numbered 1, 2, 3 and 4, and are in no way a gradation of quality, but are to facilitate parallel operation in the ordinary system using a common grid bias. Where more than one tube is used, those of the same or adjacent classes should be employed so the load may be evenly distributed. When a single tube only is used, no one of the classes has any advantage over another. Tubes may not be ordered according to impedance classification.

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FEDERAL POWER TRIODE
Type F-212-E
275 Watts Plate Dissipation

Those who for the first time give Federal tubes a trial, usually come back for more. *Federal superiority shows itself over and over again.*

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS A

Maximum Ratings, Absolute Values

DC Plate Voltage	2,000 Volts
Plate Input	275 Watts
Plate Dissipation	275 Watts

Typical Operation

DC Plate Voltage	2,000 Volts
DC Grid Voltage	—95 Volts
Peak A-F Grid Voltage	95 Volts
DC Plate Current	0.13 Amperes
Effective Load Resistance	8,000 Ohms
Distortion (% Second Harmonic)	4 Per Cent
Power Output, approximate	75 Watts

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	2,000 Volts
Max. Signal DC Plate Current†	0.35 Amperes
Max. Signal Plate Input†	700 Watts
Plate Dissipation†	275 Watts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	2,000 Volts
DC Grid Voltage	—110 Volts
Peak A-F Grid Voltage	420 Volts
Zero Signal DC Plate Current	0.09 Amperes
Max. Signal DC Plate Current	0.60 Amperes
Load Resistance, Plate to Plate	7,600 Ohms
Max. Signal Driving Power, approx.	12 Watts
Max. Signal Power Output, approx.	840 Watts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	2,000 Volts
DC Plate Current	0.30 Amperes
Plate Input	400 Watts
Plate Dissipation	275 Watts

Typical Operation

DC Plate Voltage	1,600 Volts
DC Grid Voltage	—97 Volts
Peak R-F Grid Voltage	124 Volts
DC Plate Current	0.25 Amperes
DC Grid Current, approx.	0.003 Amperes
Driving Power, approx.‡	21 Watts
Power Output, approx.	137 Watts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	1,500 Volts
DC Grid Voltage	—500 Volts
DC Plate Current	0.30 Amperes
DC Grid Current	0.075 Amperes
Plate Input	450 Watts
Plate Dissipation	190 Watts

Typical Operation

DC Plate Voltage	1,500 Volts
DC Grid Voltage	—200 Volts
Peak R-F Grid Voltage	295 Volts
DC Plate Current	0.267 Amperes
DC Grid Current, approx.	0.009 Amperes
Driving Power, approx.	2.5 Watts
Power Output, approx.	285 Watts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	2,000 Volts
DC Grid Voltage	—500 Volts
DC Plate Current	0.35 Amperes
DC Grid Current	0.075 Amperes
Plate Input	700 Watts
Plate Dissipation	275 Watts

Typical Operation

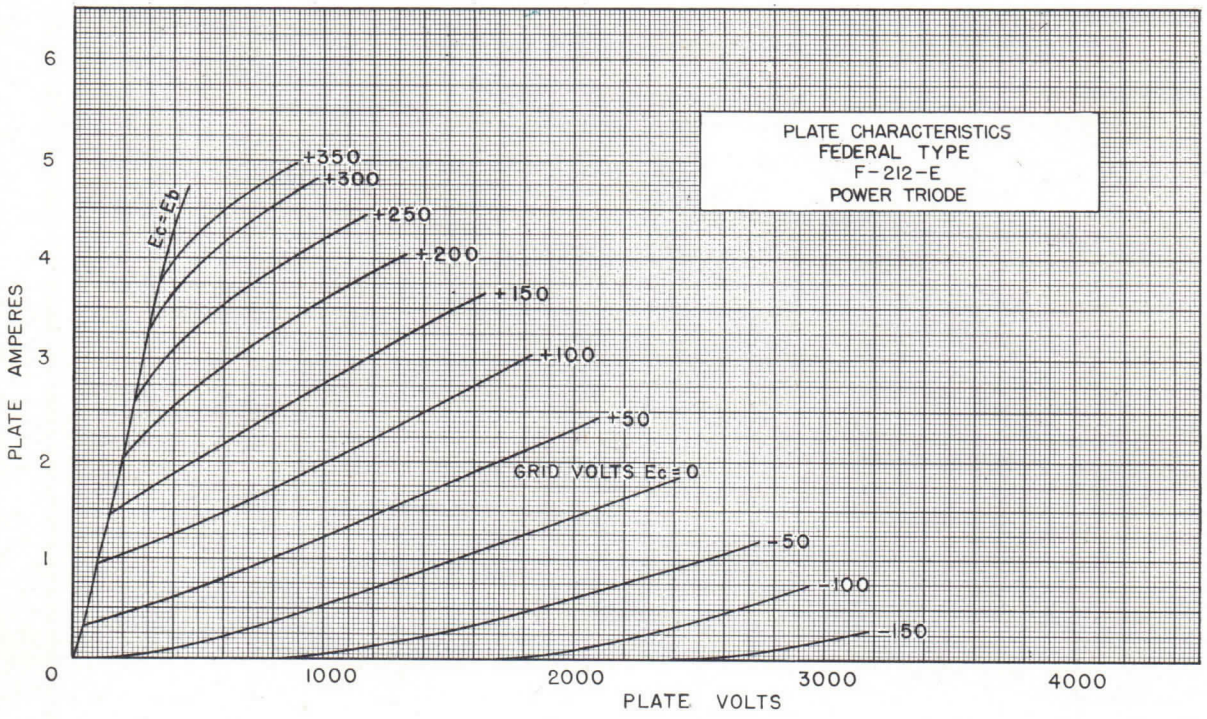
DC Plate Voltage	2,000 Volts
DC Grid Voltage	—250 Volts
Peak R-F Grid Voltage	380 Volts
DC Plate Current	0.325 Amperes
DC Grid Current, approx.	0.016 Amperes
Driving Power, approx.	6 Watts
Power Output, approx.	500 Watts

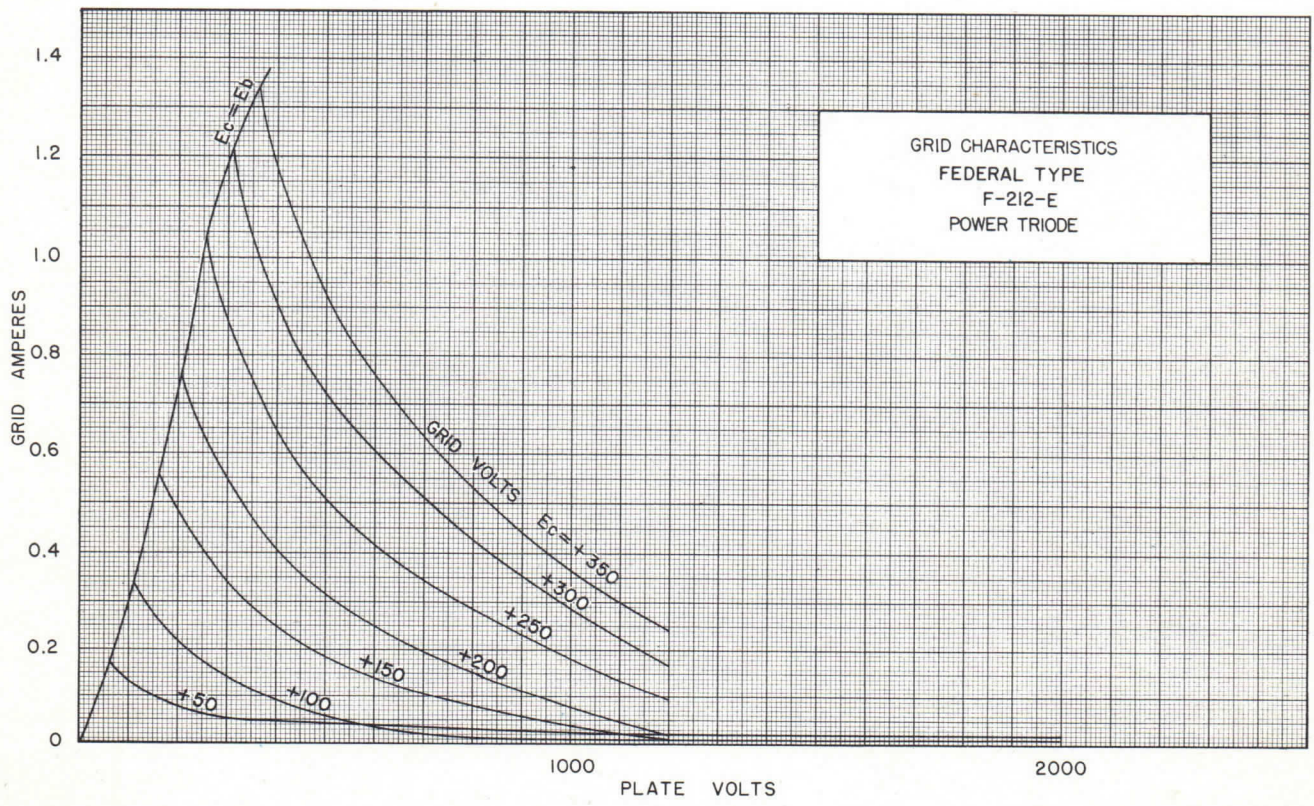
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

An IT&T Associate

Long-life is an outstanding characteristic of Federal tubes . . . and when they're old, they are still vigorous, still efficient.

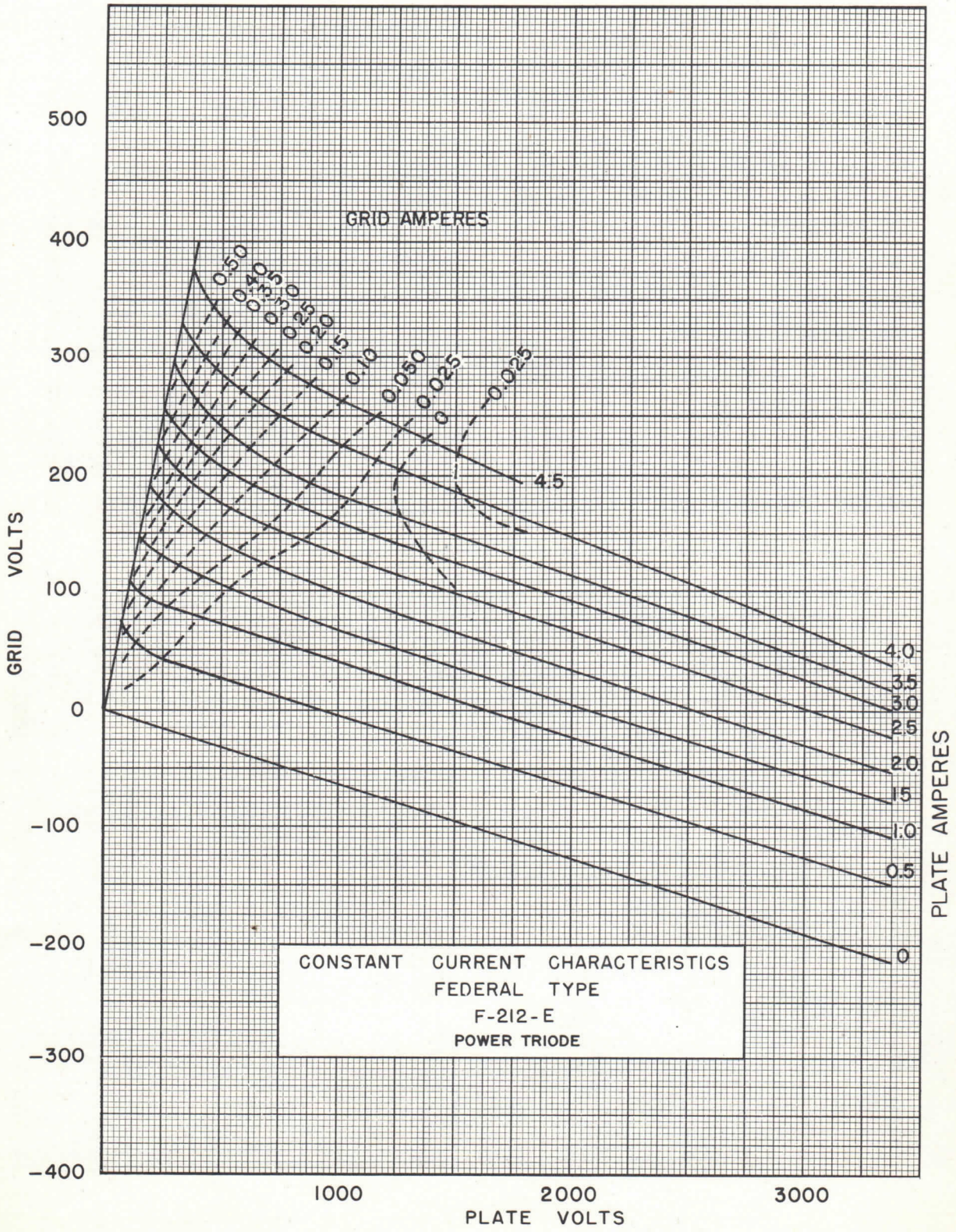
FEDERAL POWER TRIODE
Type F-212-E
275 Watts Plate Dissipation





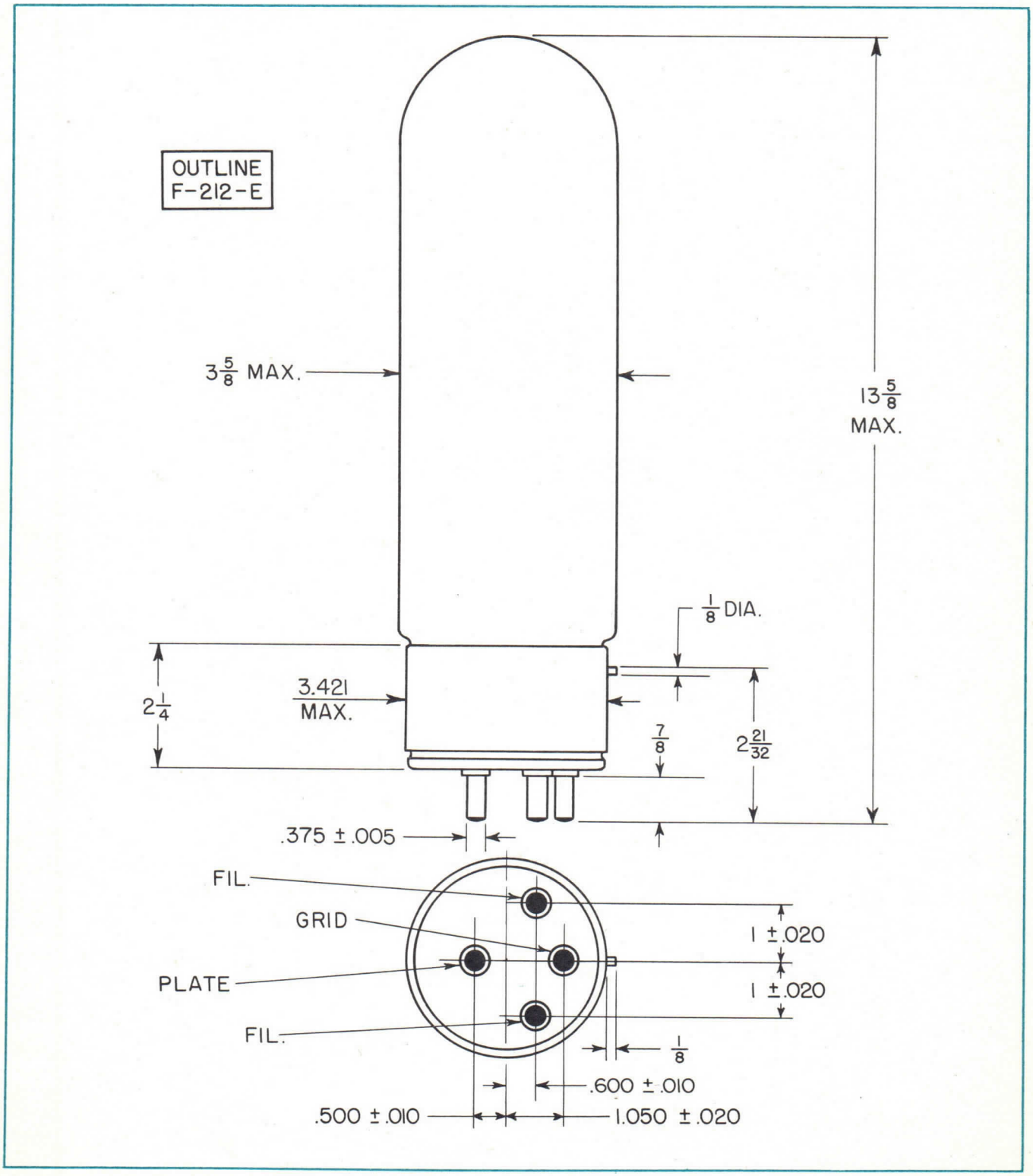
FEDERAL POWER TRIODE
Type F-212-E
275 Watts Plate Dissipation

Federal tube development is a long-drawn-out process of design, experiment, test and re-test. Result: the highly refined tube.



Customers habitually appraise Federal *values* by what they get (for their money) in tube performance, in the kind and length of service rendered.

FEDERAL POWER TRIODE
Type F-212-E
275 Watts Plate Dissipation



Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

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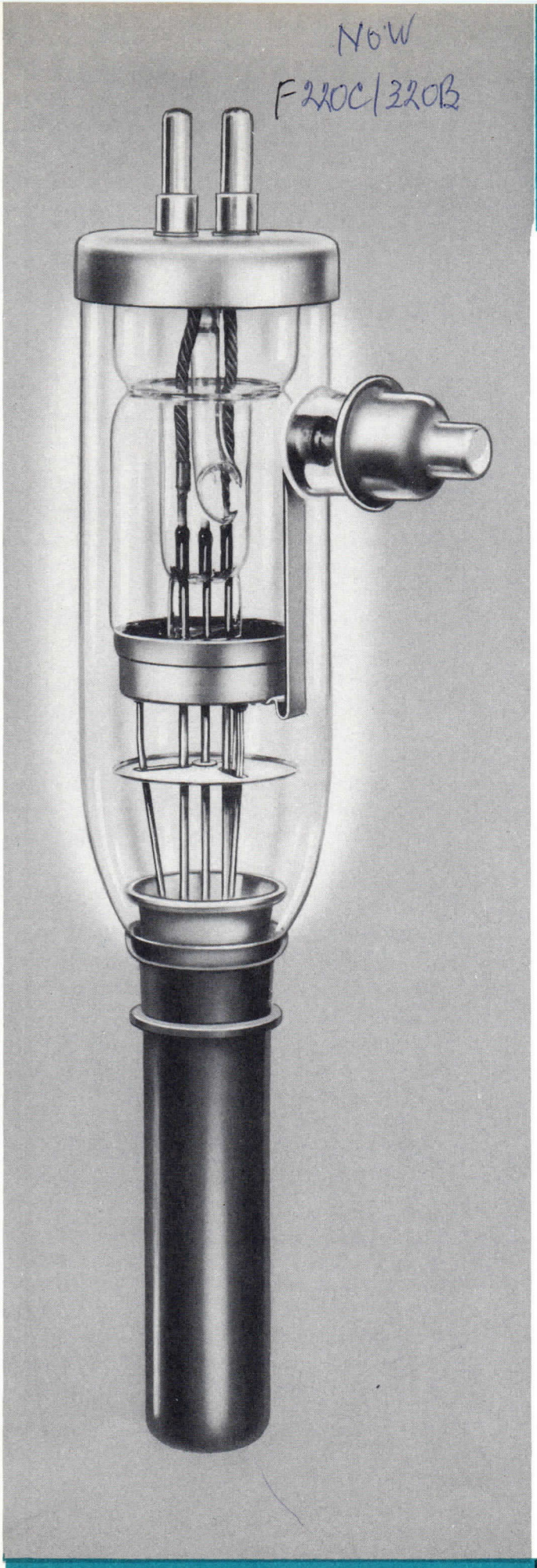
Federal Always Has
Made Better Tubes

Form FJ-228 Printed in U. S. A.

NOW
F220C/320B



FEDERAL POWER TRIODE
Type F-320-B
10 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-320-B is a three-electrode tube designed for use as an RF amplifier, oscillator or Class B modulator. The anode, water cooled, is capable of dissipating 10 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 4 megacycles.

Electrical:

Filament Voltage	21.5 Volts
Filament Current	41 Amperes
Filament Starting Current	82 Amperes max.
Filament Cold Resistance	0.080 Ohms
Amplification Factor, at I_b = 0.85 amps., E_c = —50 volts	40

Interelectrode Capacitances

Grid-Plate	23.5 $\mu\mu$f
Grid-Filament	16.5 $\mu\mu$f
Plate-Filament	2 $\mu\mu$f

Mechanical:

Mounting Position—
Vertical, anode down

Type of Cooling—Water

Minimum Water Flow on Anode	5 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C

Net Weight, approximate	4 Pounds

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FEDERAL POWER TRIODE
Type F-320-B
10 Kilowatts Plate Dissipation

Federal's F-320-B is interchangeable, electrically and mechanically, with the 220-C.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	1.5 Amperes
Maximum Signal Plate Input†	20 Kilowatts
Plate Dissipation†	10 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	13,500 Volts
DC Grid Voltage	—250 Volts
Peak A-F Grid-to-Grid Voltage	2,100 Volts
Zero Signal DC Plate Current	0.25 Amperes
Maximum Signal DC Plate Current	2.5 Amperes
Effective Load Resistance, Plate to Plate	12,000 Ohms
Maximum Signal Driving Power, approximate	450 Watts
Maximum Signal Power Output, approximate	24 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
DC Plate Current	1.2 Amperes
Plate Input	15 Kilowatts
Plate Dissipation	10 Kilowatts

Typical Operation

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—275 Volts
Peak R-F Grid Voltage	1,080 Volts
DC Plate Current	0.63 Amperes
DC Grid Current, approximate	0.08 Amperes
Driving Power, approximate‡	80 Watts
Power Output, approximate	2.5 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	1.1 Amperes
DC Grid Current	0.25 Amperes
Plate Input	10 Kilowatts
Plate Dissipation	6.6 Kilowatts

Typical Operation

DC Plate Voltage	9,000 Volts
DC Grid Voltage	—840 Volts
Peak R-F Grid Voltage	1,500 Volts
DC Plate Current	0.76 Amperes
DC Grid Current, approximate	0.04 Amperes
Driving Power, approximate	65 Watts
Power Output, approximate	5.1 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	1.5 Amperes
DC Grid Current	0.3 Amperes
Plate Input	22.5 Kilowatts
Plate Dissipation	10 Kilowatts

Typical Operation

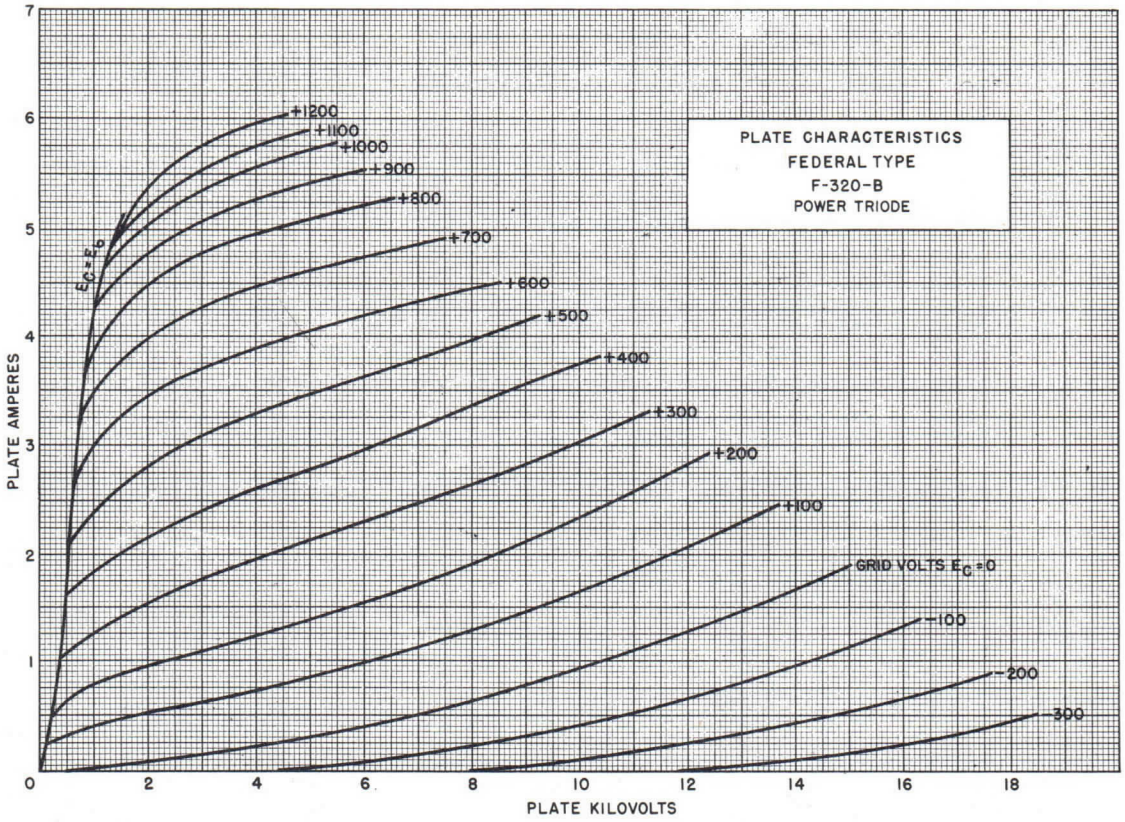
DC Plate Voltage	10,000 Volts
DC Grid Voltage	—500 Volts
Peak R-F Grid Voltage	1,500 Volts
DC Plate Current	1.5 Amperes
DC Grid Current, approximate	0.06 Amperes
Driving Power, approximate	90 Watts
Power Output, approximate	10 Kilowatts

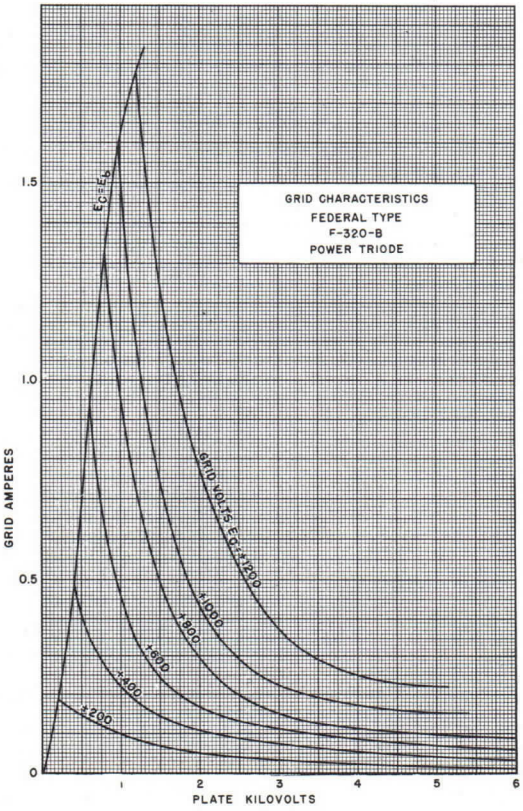
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

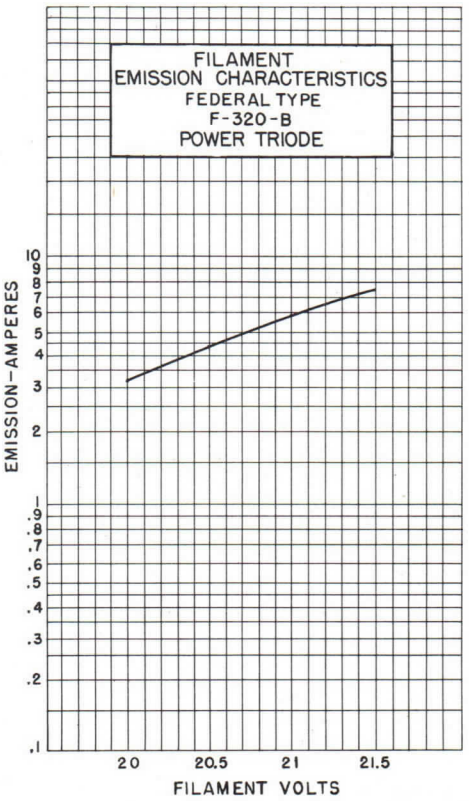
An IT&T Associate

Federal tubes of all types are in service around the world, delivering the high calibre performance for which they were designed.

FEDERAL POWER TRIODE
Type F-320-B
10 Kilowatts Plate Dissipation

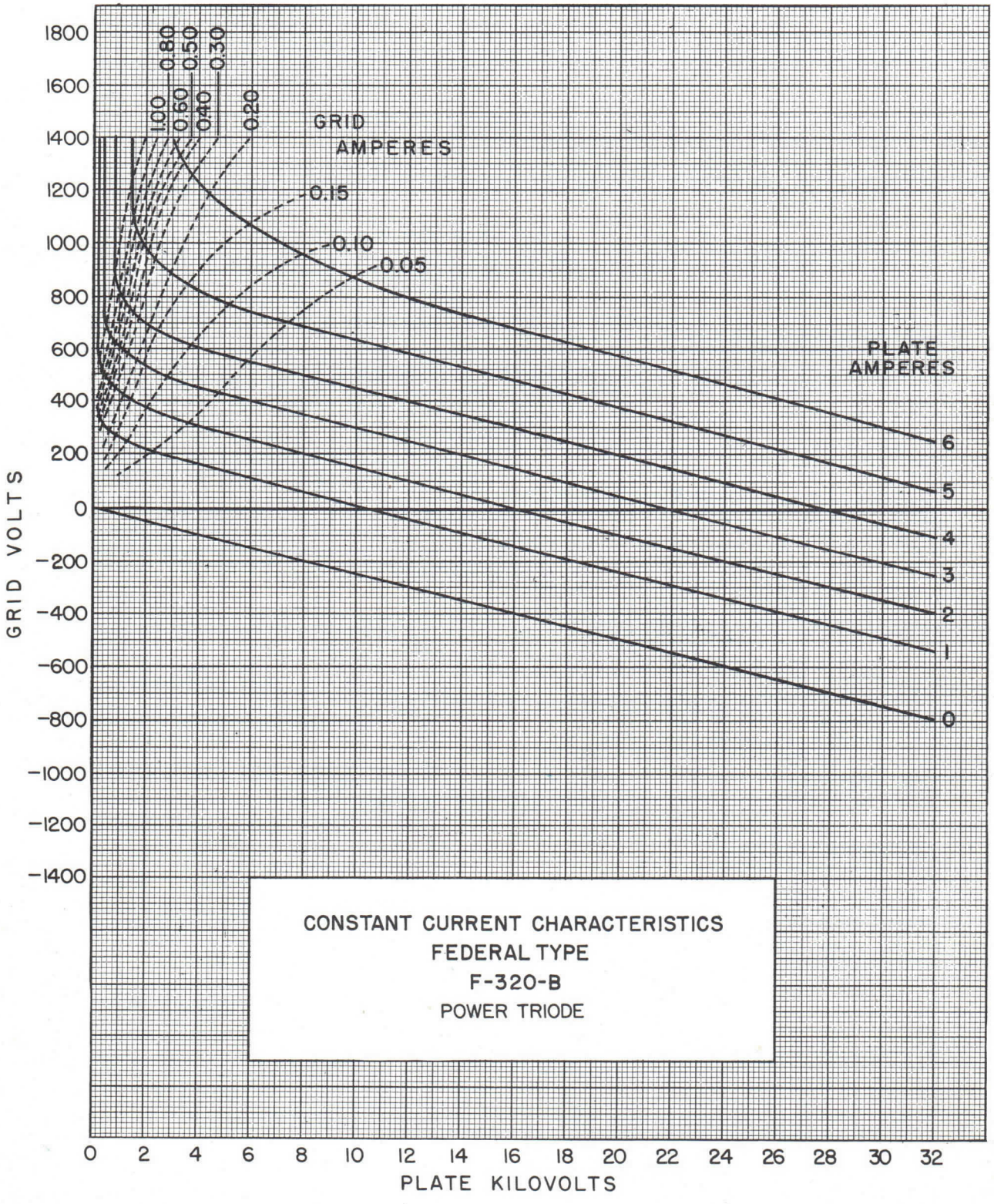






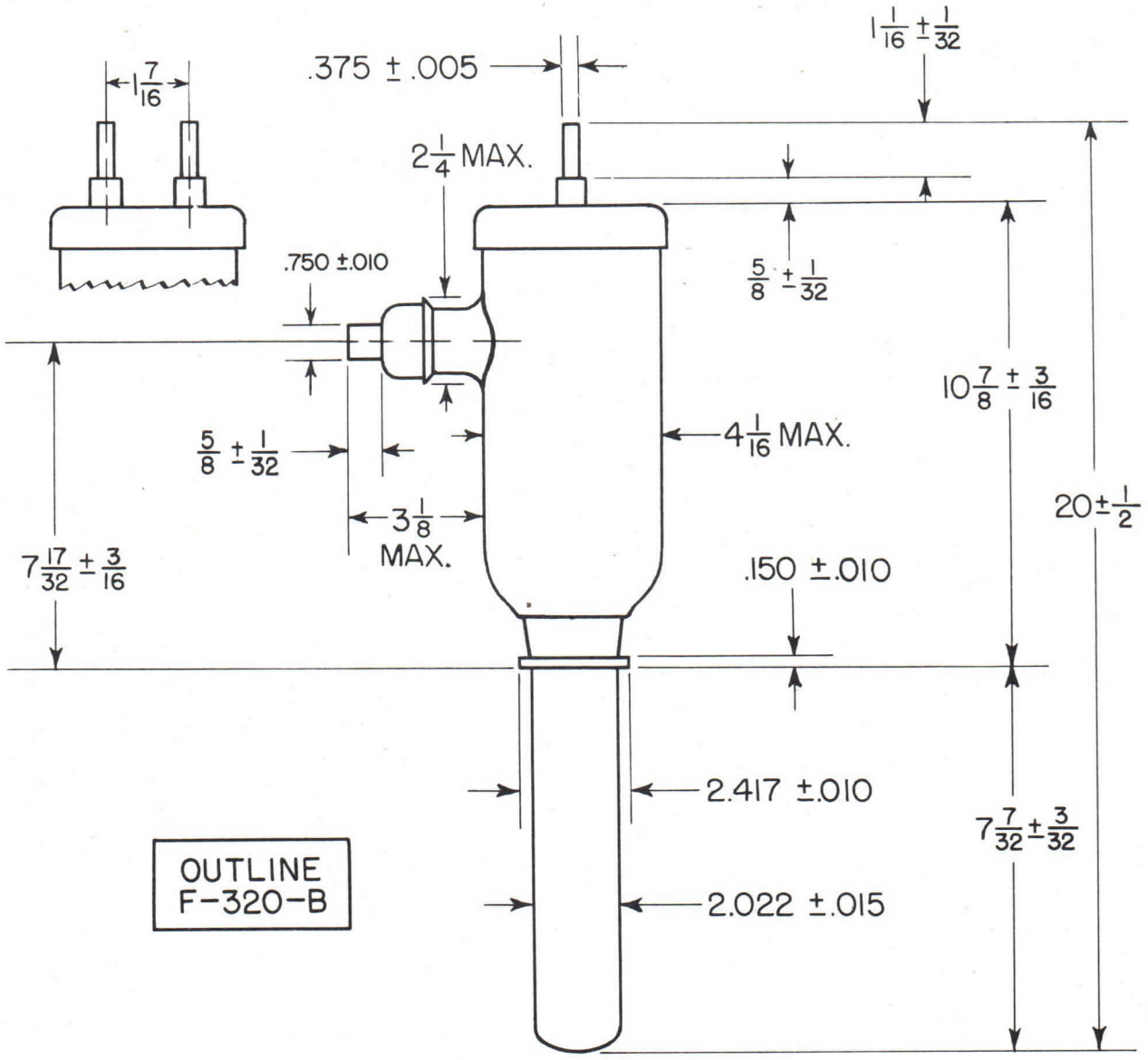
FEDERAL POWER TRIODE
Type F-320-B
10 Kilowatts Plate Dissipation

The high quality of materials and precision craftsmanship established by Federal in the early days of tube making have never been compromised.



Long life in a tube is not a chance result or circumstance. In Federal, long life is a part of the design.

FEDERAL POWER TRIODE
Type F-320-B
10 Kilowatts Plate Dissipation



OUTLINE
F-320-B

Federal Telephone and Radio Corporation
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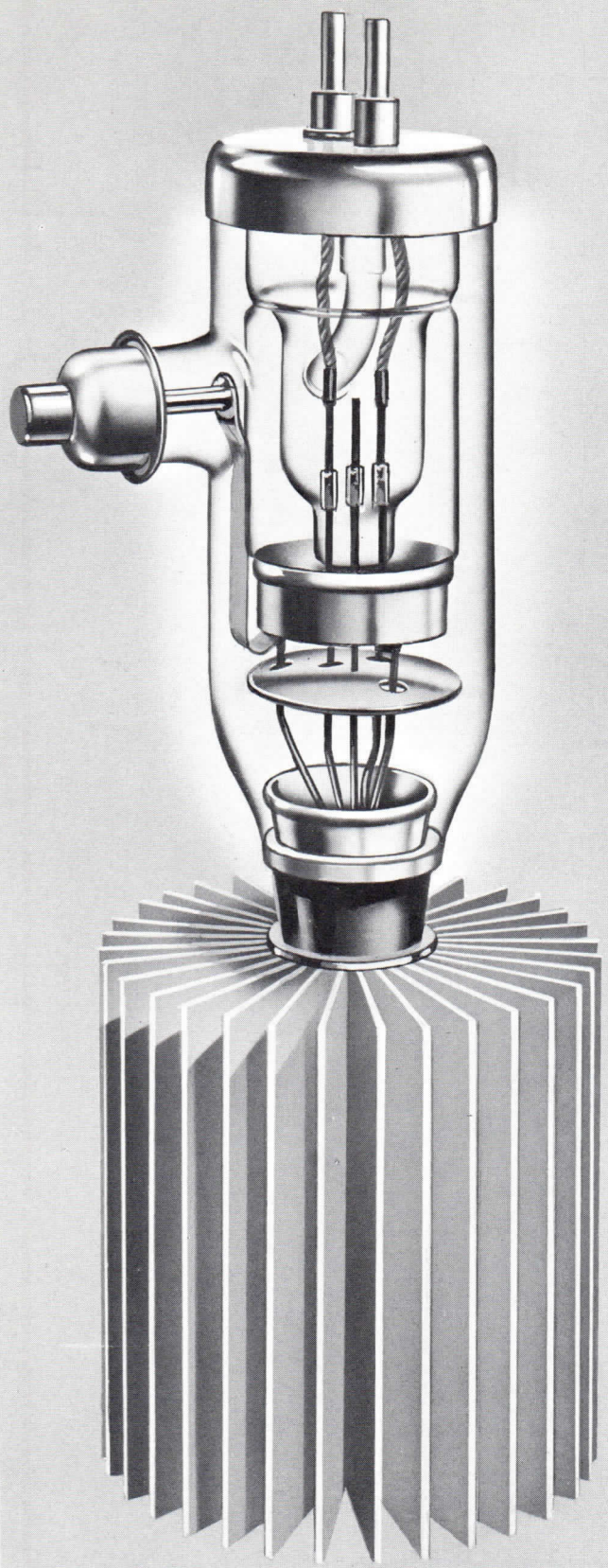
Federal Always Has
Made Better Tubes

Form FJ-161 Printed in U. S. A.

NOW
F 220CA/320BA



FEDERAL POWER TRIODE
Type F-320BA/220CA
5 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-320BA/220CA is a three-electrode tube designed for use as an R-F Amplifier, Oscillator, or Class B Modulator. The anode, forced air-cooled, is capable of dissipating 5 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 4 megacycles.

Electrical:

Filament Voltage	21.5 Volts
Filament Current	41.0 Amperes
Filament Starting Current	82.0 Amperes
Available Thermionic Emission	7.0 Amperes
Amplification Factor, at I_b=0.85 amps. E_c=—50 volts	40
Interelectrode Capacitances	
Grid-Plate	23.5 $\mu\mu$f
Grid-Filament	17.5 $\mu\mu$f
Plate-Filament	1.6 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, Anode Down	
Type of Cooling—Forced Air	
Required Air Flow on Anode Plate Dissipation (Kilowatts)	5
Air Flow—Cubic Feet Per Minute	600
Maximum Glass Temperature	150° C
Net Weight, approximate	35 Lbs.

For Characteristic Curves see F-320-B. Except for reduction of plate dissipation to 5KW, Maximum Ratings and Typical Operation of F-320-B apply.

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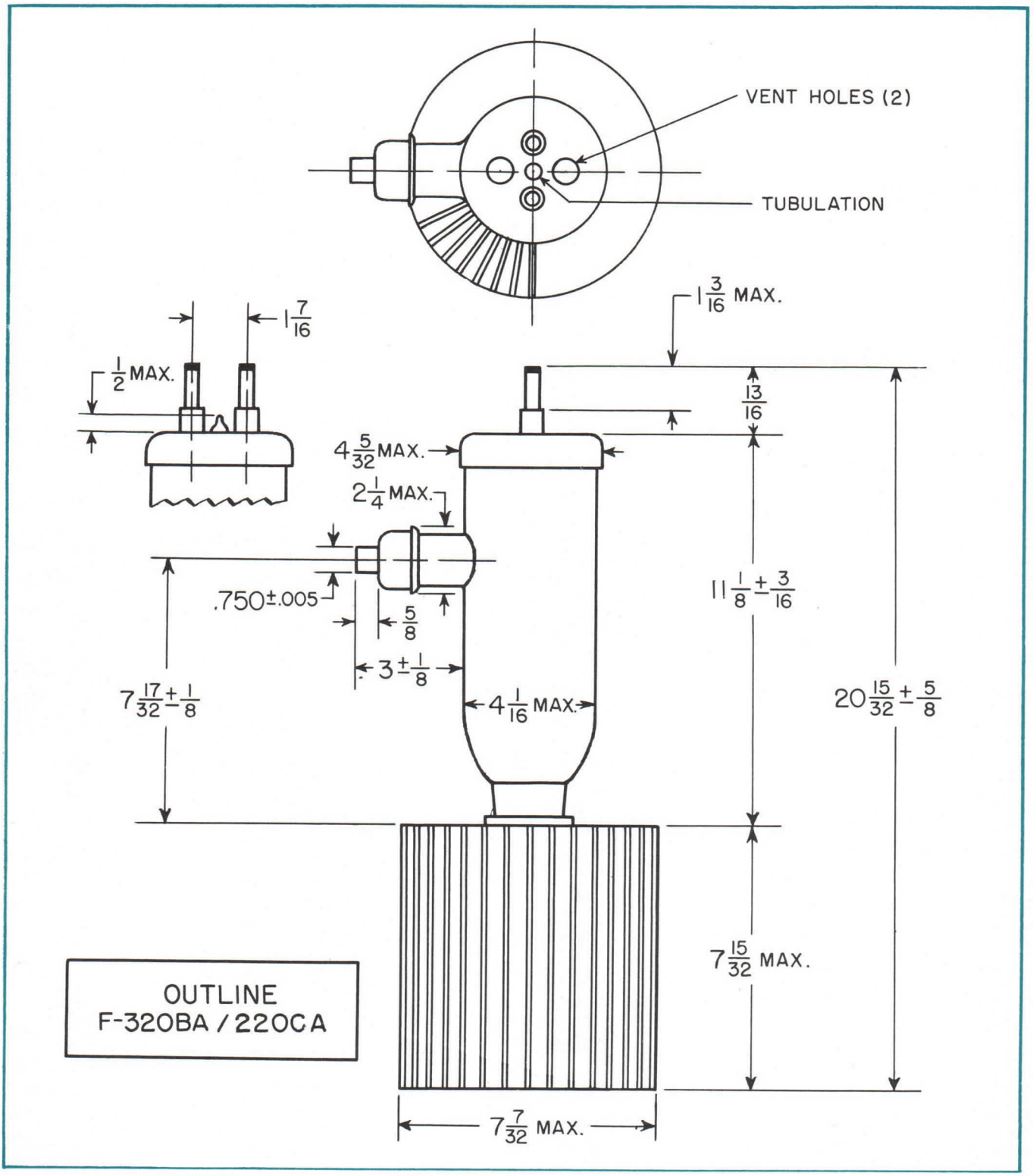
Federal Telephone and Radio Company

FEDERAL POWER TRIODE
Type F-320BA/220CA
5 Kilowatts Plate Dissipation

Precision craftsmanship was initiated by Federal in the earliest days of tube manufacture, and has been maintained ever since.



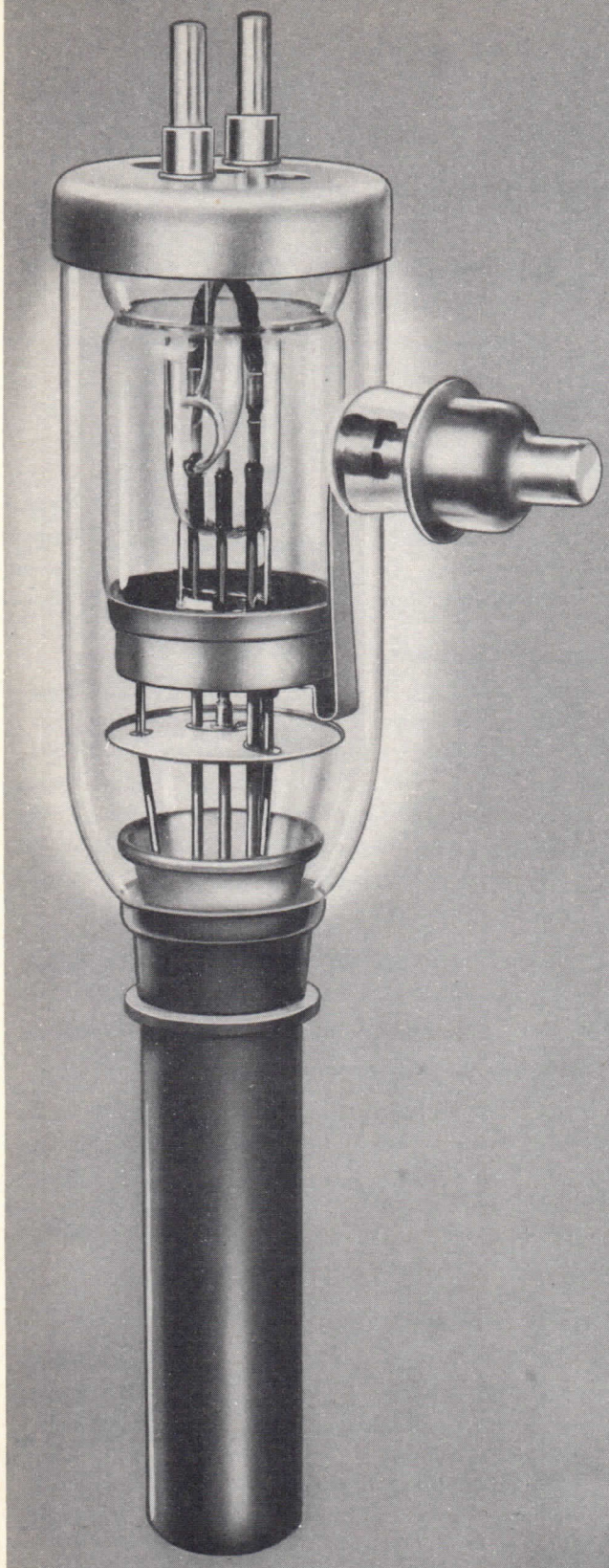
OUTLINE
F-320BA / 220CA

Form F-590 Printed in U. S. A.

DIVISION OF I T & T

Federal Telephone and Radio Company
100 Kingsland Road Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-342-A
25 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-342-A is a three-electrode tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. The anode, water-cooled, is capable of dissipating 25 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 4 megacycles. Operation up to 16 megacycles is permissible if the plate voltage and input are reduced to 50% of maximum.

Electrical:

Filament Voltage	20	Volts
Filament Current	71	Amperes
Filament Starting Current	142	Amperes max.
Filament Cold Resistance	0.021	Ohm
Peak Cathode Current	13.5	Amperes
Amplification Factor, at $E_c = -200V$ $I_b = 0.75A$	40	
Interelectrode Capacitances		
Grid-Plate	25	$\mu\mu f$
Grid-Filament	19	$\mu\mu f$
Plate-Filament	2.5	$\mu\mu f$

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling—Water	
Minimum Water Flow on Anode	10 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Net Weight, approximate	4 Pounds

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FEDERAL POWER TRIODE
Type F-342-A
25 Kilowatts Plate Dissipation

Buyers who specify "Federal" because they want *long-lived* tubes, know from experience they'll get what they want.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
Maximum Signal DC Plate Current†	3 Amperes
Maximum Signal Plate Input†	50 Kilowatts
Plate Dissipation†	25 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	15,000 Volts
DC Grid Voltage	—200 Volts
Peak A-F Grid-to-Grid Voltage	1,700 Volts
Zero Signal DC Plate Current	0.8 Ampere
Maximum Signal DC Plate Current	3.2 Amperes
Effective Load Resistance, Plate to Plate	9,600 Ohms
Maximum Signal Driving Power, approximate	200 Watts
Maximum Signal Power Output, approximate	30 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Plate Current	2 Amperes
Plate Input	30 Kilowatts
Plate Dissipation	25 Kilowatts

Typical Operation

DC Plate Voltage	17,500 Volts
DC Grid Voltage	—430 Volts
Peak R-F Grid Voltage	760 Volts
DC Plate Current	1.55 Amperes
DC Grid Current, approximate	0.0 Amperes
Driving Power, approximate‡	30 Watts
Power Output, approximate	8.25 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—5,000 Volts
DC Plate Current	1.5 Amperes
DC Grid Current	0.3 Ampere
Plate Input	20 Kilowatts
Plate Dissipation	15 Kilowatts

Typical Operation

DC Plate Voltage	12,500 Volts
DC Grid Voltage	—750 Volts
Peak R-F Grid Voltage	1,400 Volts
DC Plate Current	1 Ampere
DC Grid Current, approximate	0.05 Ampere
Driving Power, approximate	75 Watts
Power Output, approximate	10 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Grid Voltage	—5,000 Volts
DC Plate Current	3 Amperes
DC Grid Current	0.3 Ampere
Plate Input	50 Kilowatts
Plate Dissipation	25 Kilowatts

Typical Operation

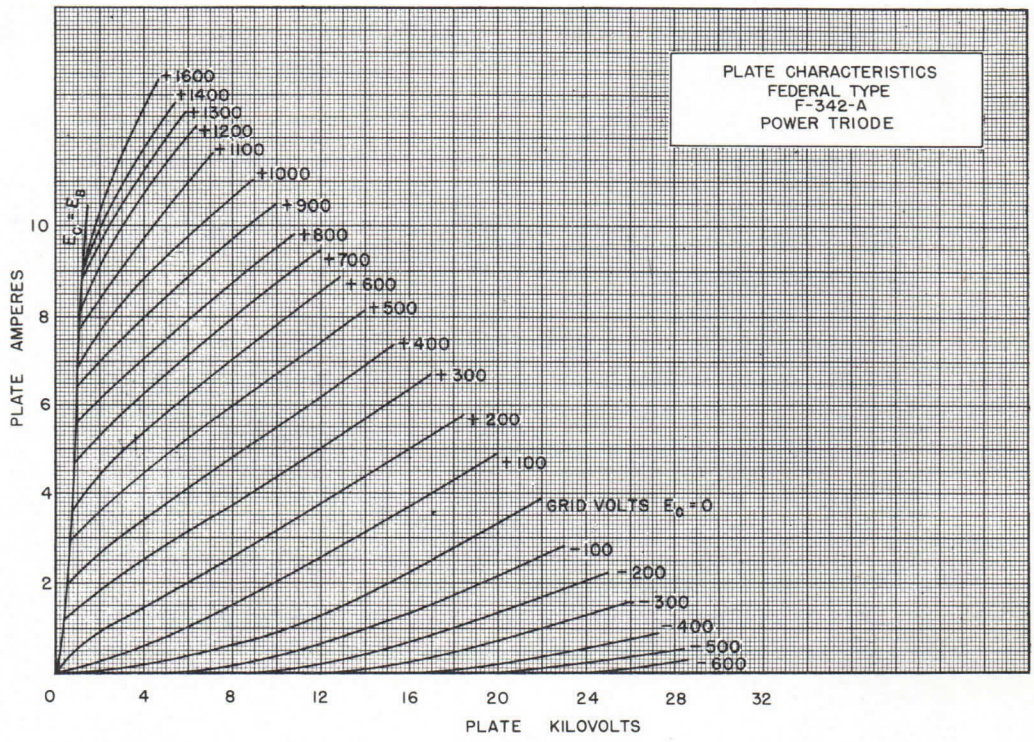
DC Plate Voltage	18,000 Volts
DC Grid Voltage	—1,000 Volts
Peak R-F Grid Voltage	2,300 Volts
DC Plate Current	2.6 Amperes
DC Grid Current, approximate	0.1 Ampere
Driving Power, approximate	200 Watts
Power Output, approximate	35 Kilowatts

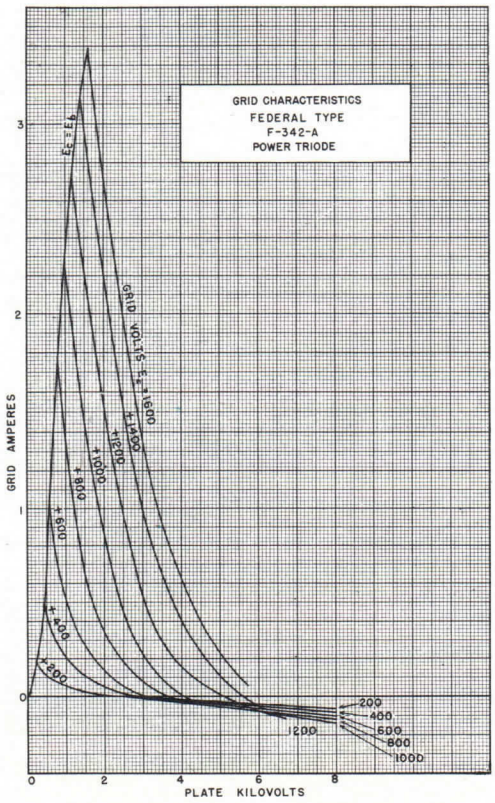
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

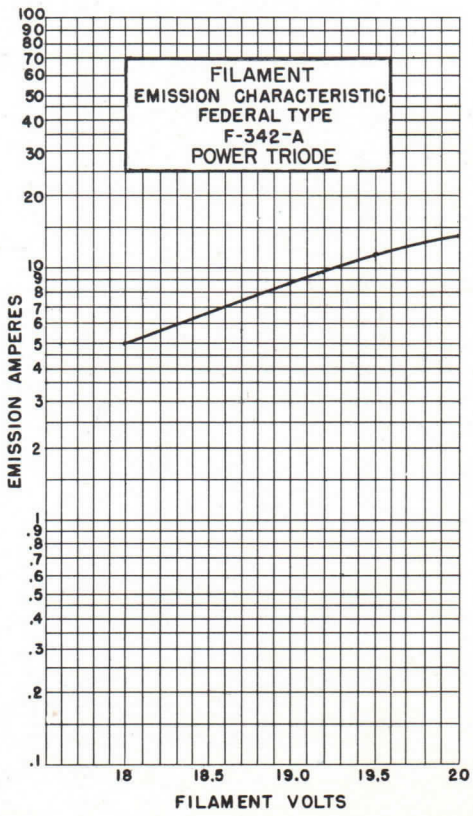
AN IT&T ASSOCIATE

Federal's name on a tube signifies the best in design, engineering, materials, components and craftsmanship.

FEDERAL POWER TRIODE
Type F-342-A
25 Kilowatts Plate Dissipation

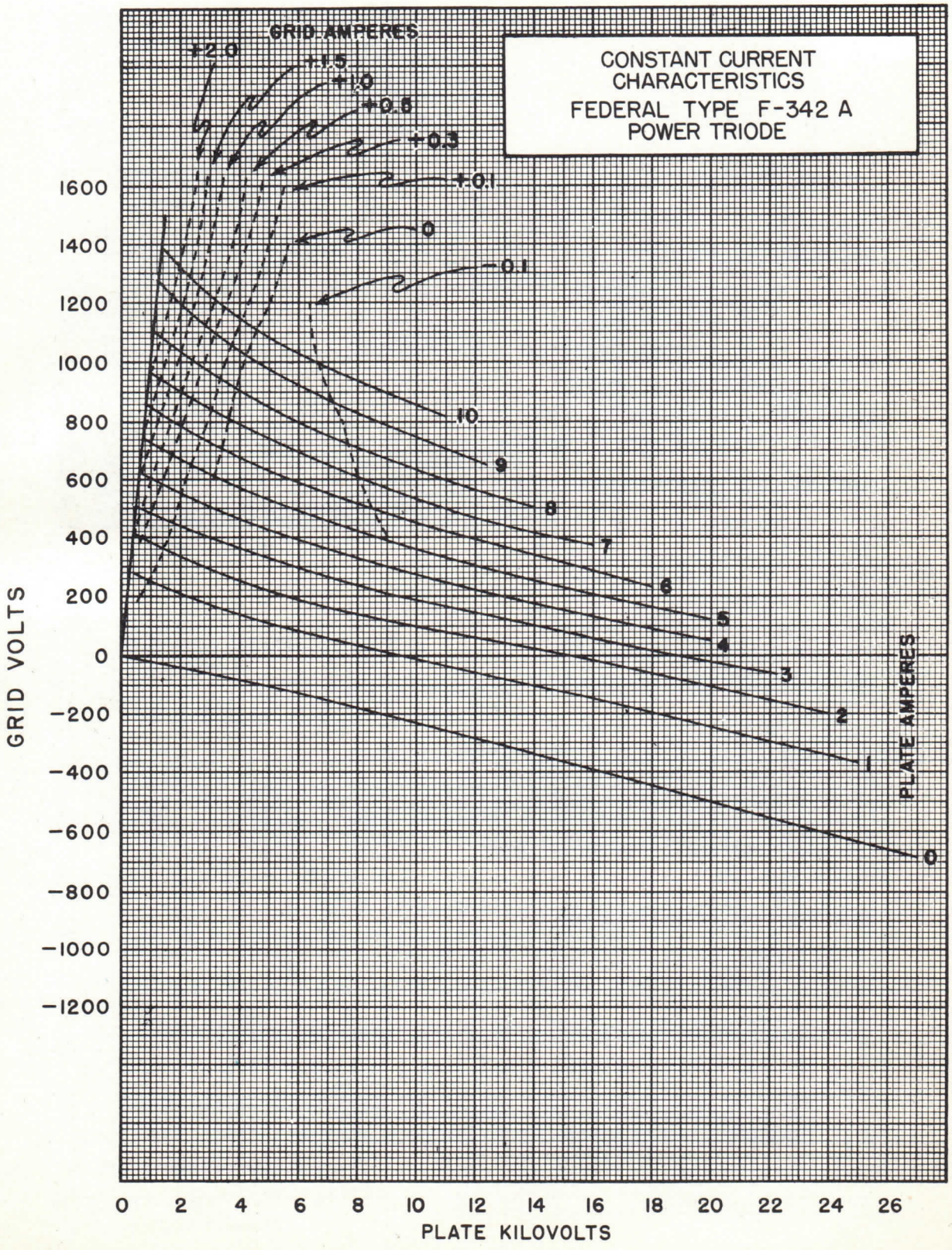






FEDERAL POWER TRIODE
Type F-342-A
25 Kilowatts Plate Dissipation

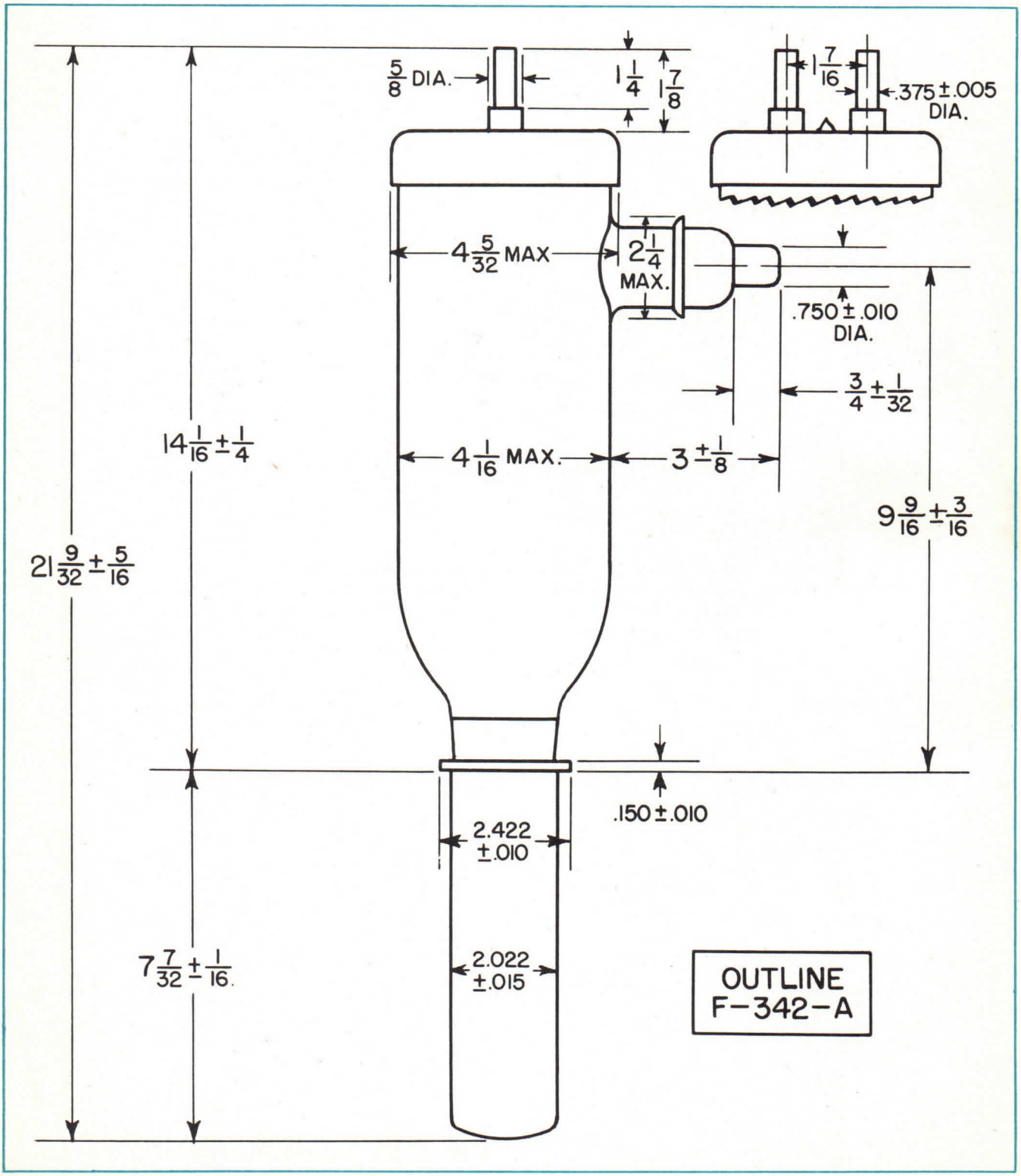
Federal always has made *first-quality* tubes, and the record goes back for more than 40 years.



AN IT&T ASSOCIATE

That Federal tubes, by their performance, largely sell themselves, is a tribute to the product and to the manufacturer.

FEDERAL POWER TRIODE
Type F-342-A
25 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

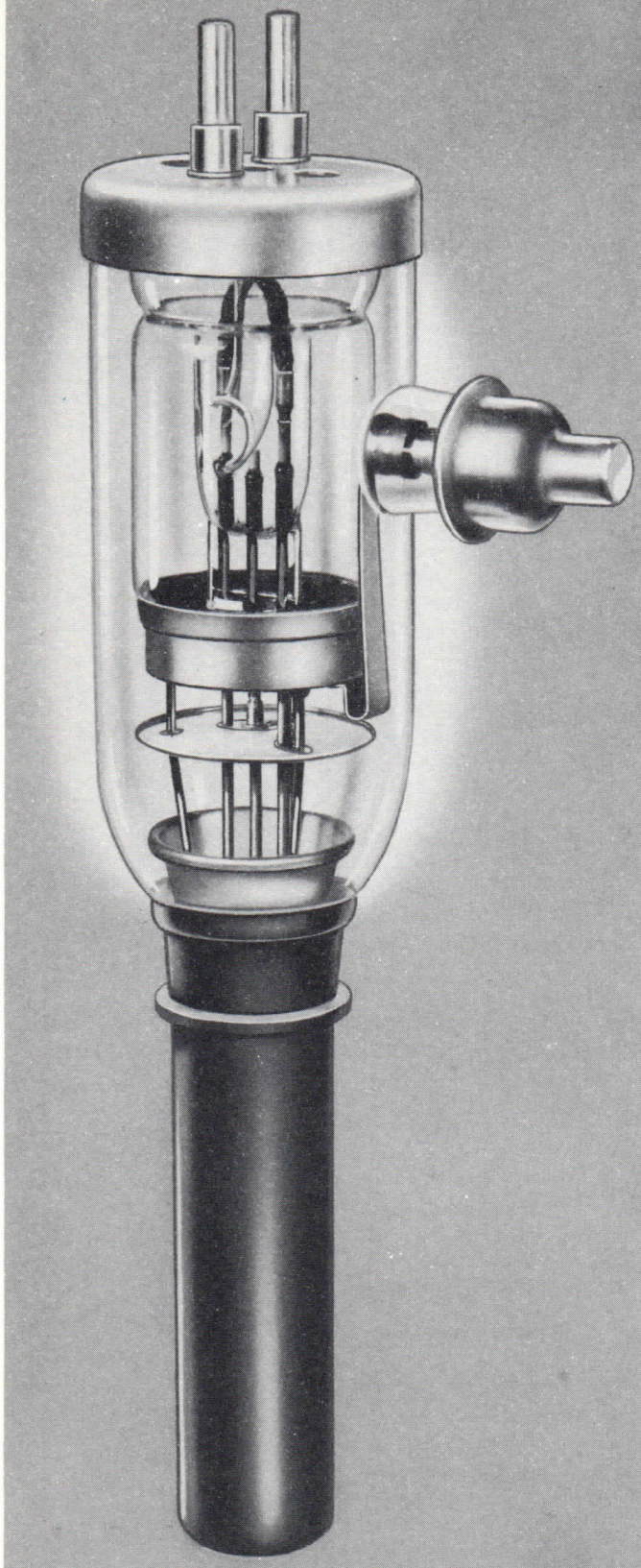
An IT&T Associate

When you are developing projects wherein tubes are components, consult Federal's engineers, let them advise and assist you . . . no obligation is incurred.

Over the years, hundreds of manufacturers, designers, technicians have taken advantage of this Federal service . . . with benefit both to their products and services.

Form FJ-185 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-343-A
10 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-343-A is a three-electrode tube designed for use as a radio-frequency amplifier, oscillator, or modulator. The anode, water-cooled, is capable of dissipating 10 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 4 megacycles.

Electrical:

▶ Filament Voltage	21.5	Volts
▶ Filament Current	57.5	Amperes
▶ Filament Starting Current	120	Amperes max.
▶ Filament Cold Resistance	.0375	Ohms
▶ Amplification Factor, at $I_b = 0.75$ amp., $E_c = -200$ volts	40	
▶ Interelectrode Capacitances		
Grid-Plate	24	$\mu\mu f$
Grid-Filament	17	$\mu\mu f$
Plate-Filament	1.8	$\mu\mu f$

Mechanical:

▶ Mounting Position— Vertical, anode down		
▶ Type of Cooling—Water		
Minimum Water Flow on Anode	3	GPM
Maximum Outgoing Water Temperature	70°	C
Maximum Glass Temperature	150°	C
▶ Net Weight, approximate	3.5	Pounds

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FEDERAL POWER TRIODE
Type F-343-A
10 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	4	10	16 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class B—	100	85	75 Per Cent
Class C—Telephony	100	85	75 Per Cent
Class C—Telegraphy	100	75	50 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	18,000 Volts
Maximum Signal DC Plate Current†	2 Amperes
Maximum Signal Plate Input†	30 Kilowatts
Plate Dissipation†	10 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000	12,000 Volts
DC Grid Voltage	—150	—200 Volts
Peak A-F Grid-to-Grid Voltage	1,380	1,380 Volts
Zero Signal DC Plate Current	0.44	0.5 Ampere
Maximum Signal DC Plate Current	2.6	2.6 Amperes
Effective Load Resistance, Plate to Plate	7,600	8,600 Ohms
Maximum Signal Driving Power, approximate	175	150 Watts
Maximum Signal Power Output, approximate	15	18 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	18,000 Volts
DC Plate Current	1.5 Amperes
Plate Input	15 Kilowatts
Plate Dissipation	10 Kilowatts

Typical Operation

DC Plate Voltage	12,500	15,000 Volts
DC Grid Voltage	—300	—350 Volts
Peak R-F Grid Voltage	550	550 Volts
DC Plate Current	0.7	0.7 Ampere
DC Grid Current, approximate	.008	.003 Ampere
Driving Power, approximate‡	25	13 Watts
Power Output, approximate	2.9	3.5 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	9,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1 Ampere
DC Grid Current	0.2 Ampere
Plate Input	9 Kilowatts
Plate Dissipation	5 Kilowatts

Typical Operation

DC Plate Voltage	5,000	7,500 Volts
DC Grid Voltage	—300	—400 Volts
Peak R-F Grid Voltage	870	950 Volts
DC Plate Current	1	1 Ampere
DC Grid Current, approximate	0.06	0.05 Ampere
Driving Power, approximate	50	50 Watts
Power Output, approximate	3.3	5 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	18,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	2 Amperes
DC Grid Current	0.2 Ampere
Plate Input	36 Kilowatts
Plate Dissipation	10 Kilowatts

Typical Operation

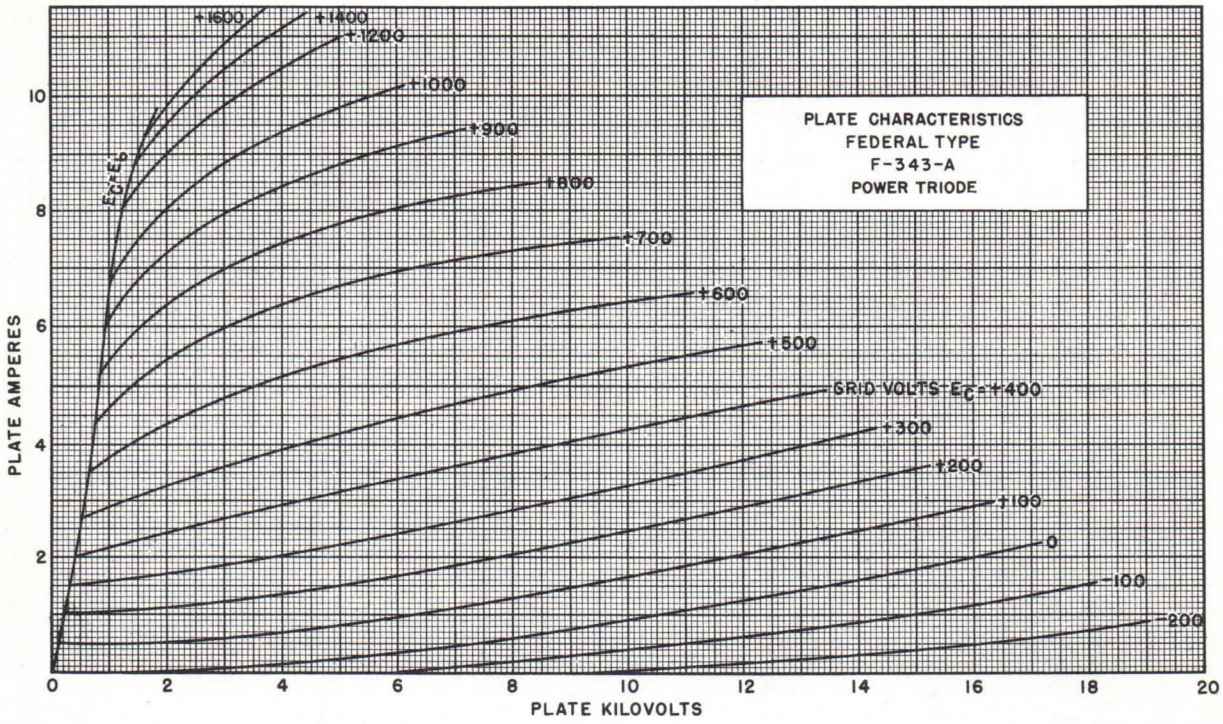
DC Plate Voltage	12,500	15,000 Volts
DC Grid Voltage	—600	—700 Volts
Peak R-F Grid Voltage	1,200	1,300 Volts
DC Plate Current	1.2	1.1 Amperes
DC Grid Current, approximate	.018	.018 Ampere
Driving Power, approximate	20	25 Watts
Power Output, approximate	9.5	12 Kilowatts

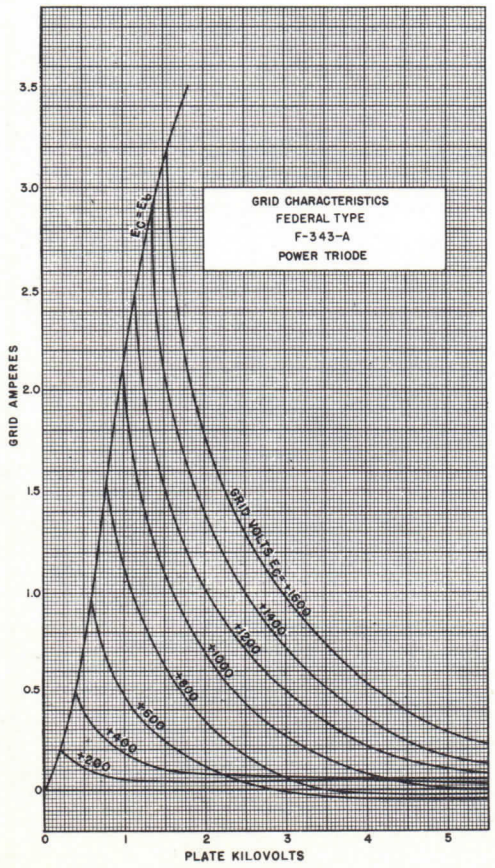
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

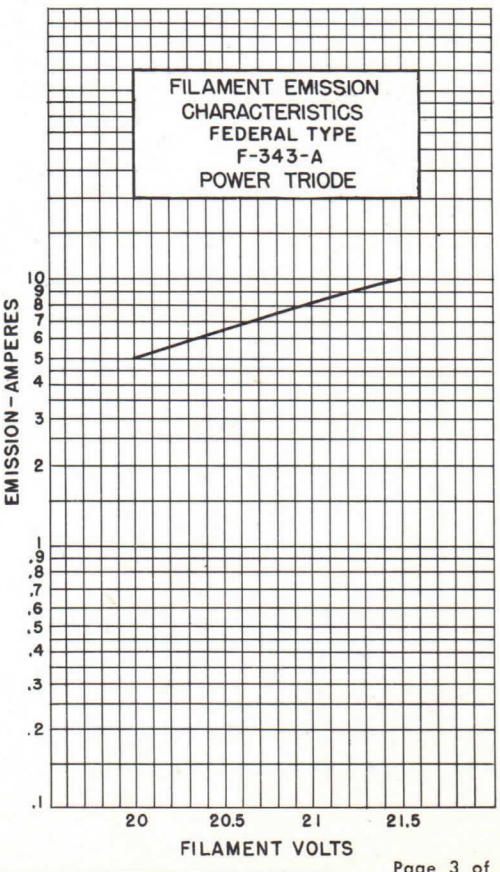
AN IT&T ASSOCIATE

Only the finest tubes give the finest service. Federal makes only *fine* tubes . . . fine from every standpoint of design and manufacture.

FEDERAL POWER TRIODE
Type F-343-A
10 Kilowatts Plate Dissipation

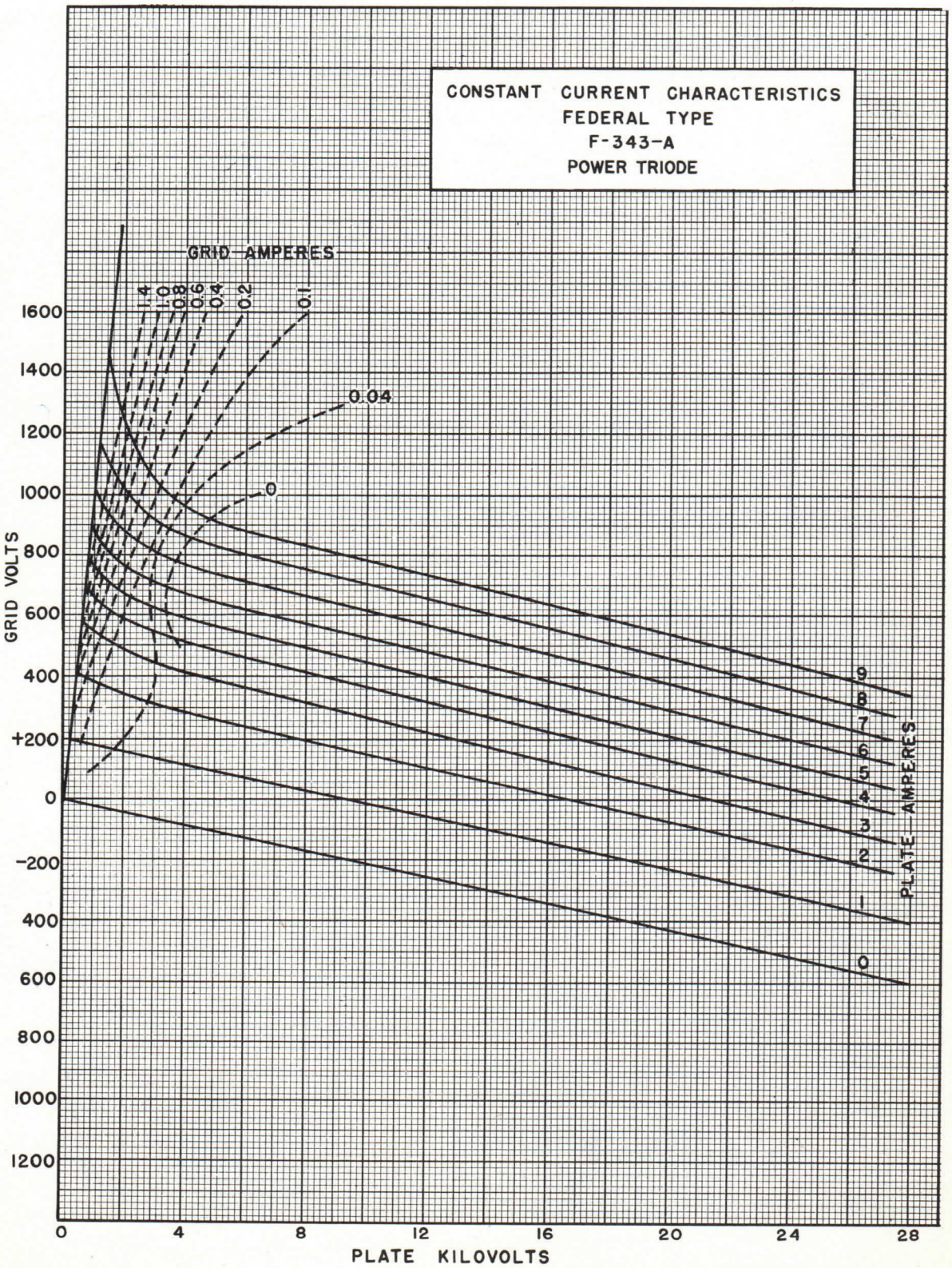






FEDERAL POWER TRIODE
Type F-343-A
10 Kilowatts Plate Dissipation

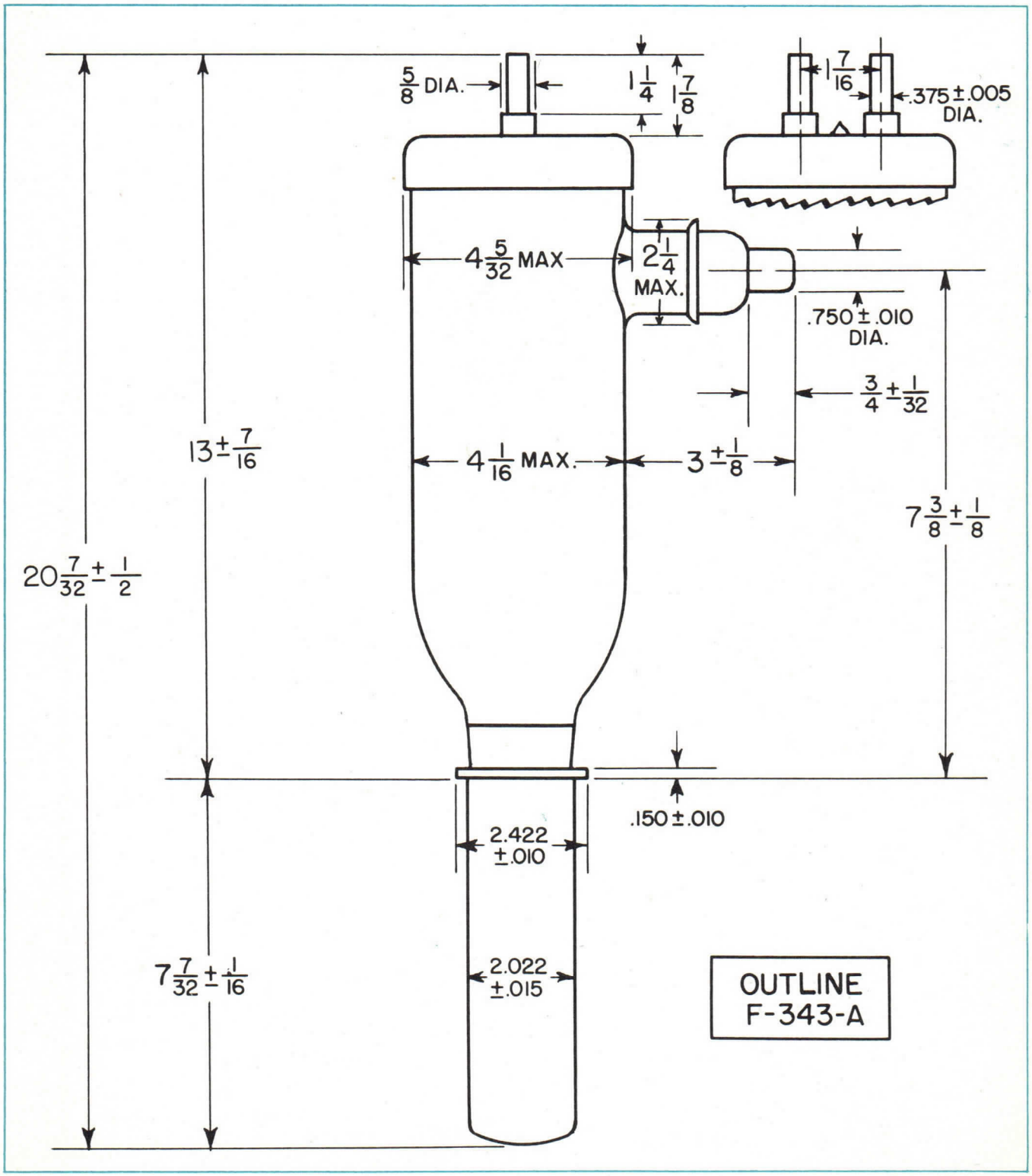
Extra Federal Values: Exceptionally sturdy construction; superior high vacuum processing; ratings commensurate with design and application.



An IT&T Associate

To assure tube *excellence*, all incoming materials are subjected to the vigorous tests and standards specified by Federal engineers.

FEDERAL POWER TRIODE
Type F-343-A
10 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

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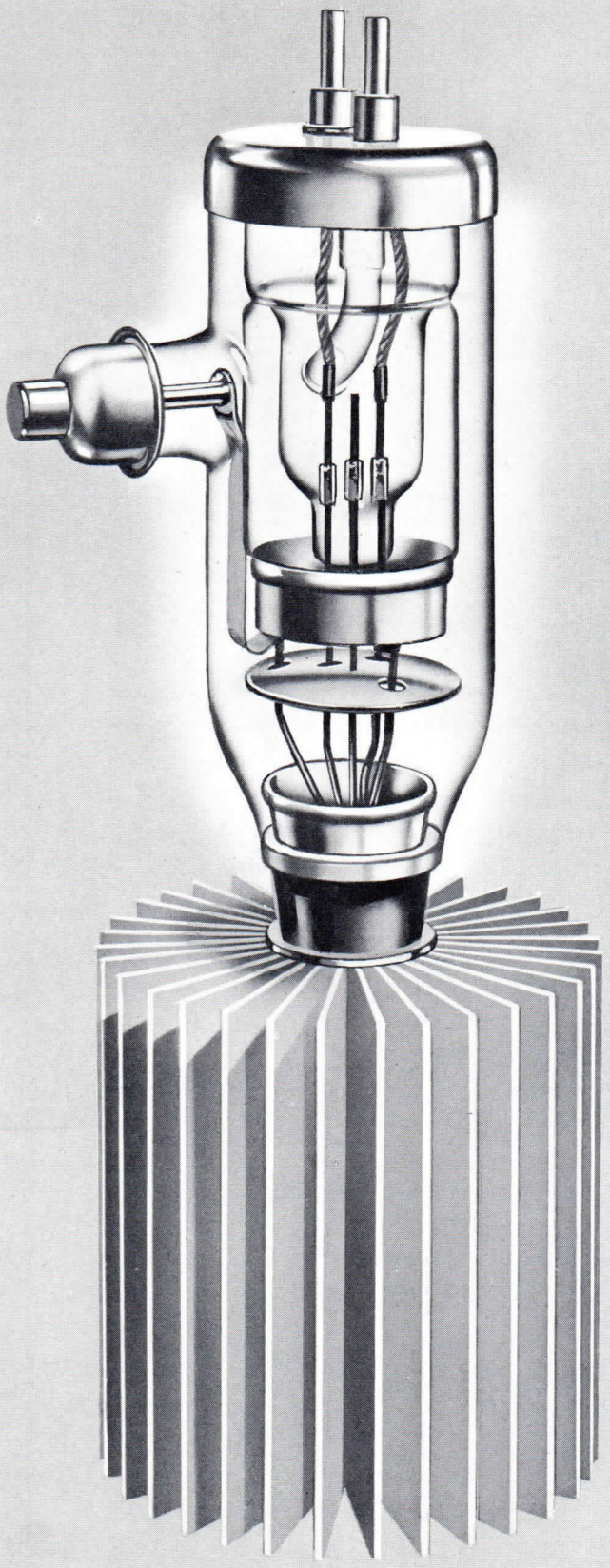
Federal Always Has
Made Better Tubes

Form FJ-184 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-343-AA
5 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

The Type F-343-AA made by Federal is a three-electrode tube designed for use as a R-F power amplifier, oscillator, and Class B modulator. The anode, cooled by forced air, is capable of dissipating 5 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 4 megacycles.

Electrical:

▶ Filament Voltage	21.5 Volts
▶ Filament Current	57.5 Amperes
▶ Filament Starting Current	115.0 Amperes
▶ Peak Cathode Current	8 Amperes
▶ Amplification Factor, at I_b=0.50 amp. E_b=10,000 volts	40
▶ Interelectrode Capacitances	
Grid-Plate	23.5 $\mu\mu$f
Grid-Filament	16.6 $\mu\mu$f
Plate-Filament	1.9 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Anode Down	
▶ Required Air Flow on Anode Plate Dissipation (Kilowatts)	5
Air Flow—Cubic Feet Per Min.	600
Maximum Glass Temperature	150° C
▶ Net Weight, approximate	45 Lbs.

For Characteristic Curves refer to Catalog Sheet F-343-A.

Except for reduction of plate dissipation to 5KW, Maximum Ratings and Typical Operation of F-343-A apply.

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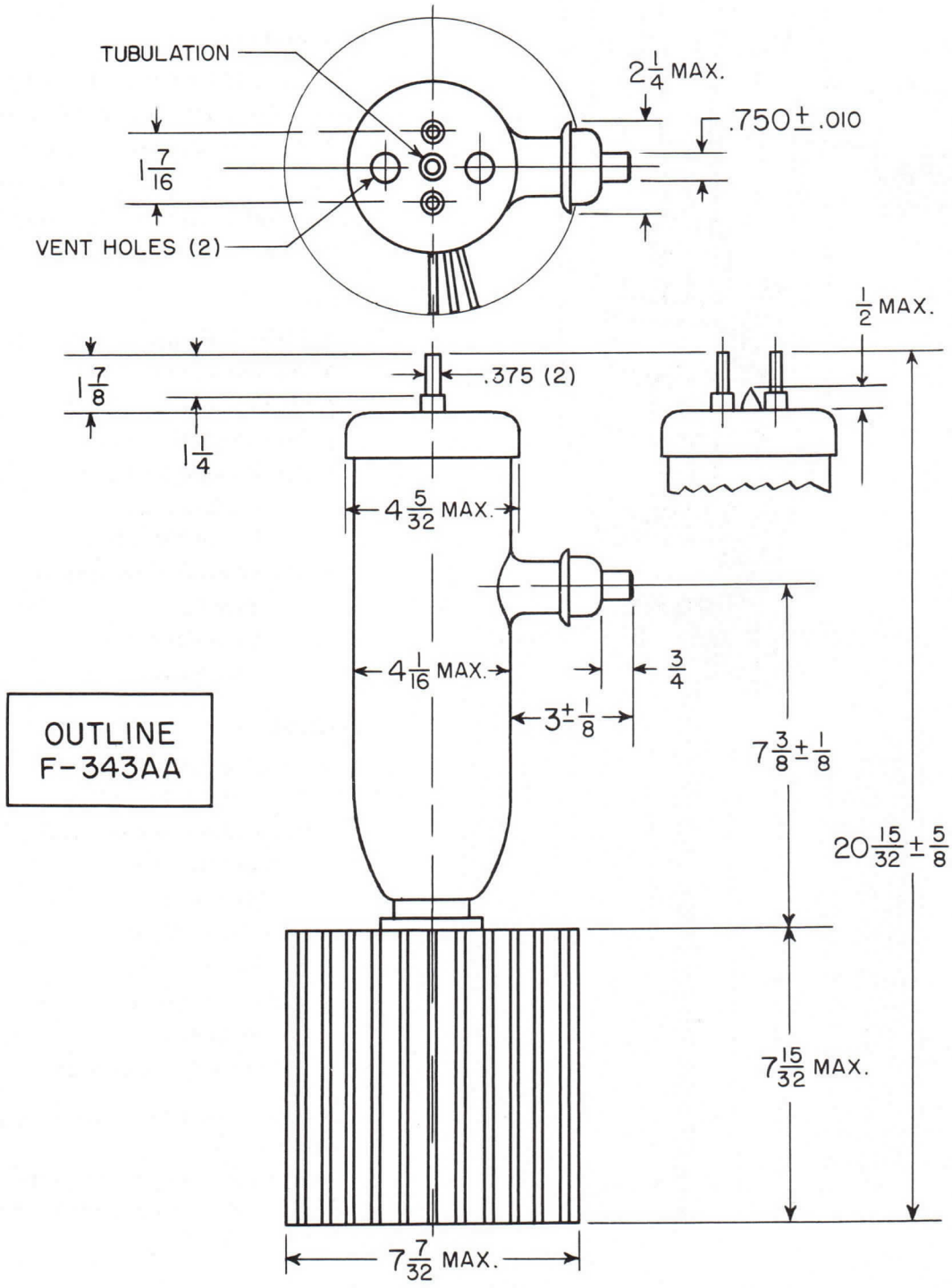
Federal Telephone and Radio Company

FEDERAL POWER TRIODE
Type F-343-AA
5 Kilowatts Plate Dissipation

Federal tubes have always been known for their *plus values:* an extra rugged construction, a longer life of service.



OUTLINE
F-343AA

Form F-591 Printed in U. S. A.

DIVISION OF I T & T

Federal Telephone and Radio Company

100 Kingsland Road VACUUM TUBE DEPARTMENT *Clifton, New Jersey*

FEDERAL MERCURY VAPOR HALF-WAVE RECTIFIER Type F-575-A

In all parts of the world, Federal Mercury Vapor Rectifier Tubes have, for many years, set the *standard* for fine performance. Compare F-575-A performance with any "best" you may have in mind.

GENERAL DATA

DESCRIPTION:

The Federal F-575-A is a mercury-vapor, half-wave rectifier for use in high voltage rectifier circuits.

Electrical:

Filament Voltage	5 Volts
Filament Current	10 Amperes
Cathode Heating Time	30 Seconds min.
Anode Voltage Drop, Typical	10 Volts
Critical Anode Voltage	50 Volts max.

Mechanical:

Type of Cooling	Convection
Equilibrium Condensed Mercury Temperature Rise over Ambient	
No load—approx.	12° C
Full load—approx.	20° C
Mounting Position	Vertical, base down
Net Weight, maximum	13 Ounces

Maximum Ratings, Absolute Values

Max. Peak Inverse Anode Voltage	10,000	15,000 Volts
Max. Cathode Current		
Peak	7	6 Amperes
Average	1.75	1.5 Amperes
Surge (max. duration 0.2 second)	60	60 Amperes
Max. Averaging Time	20	20 Seconds
Maximum Frequency	150	150 Cycles per second
Condensed-Mercury Temp. Limits*	20 to 60	20 to 50 degrees C

*To be measured within ¼" band immediately above base.

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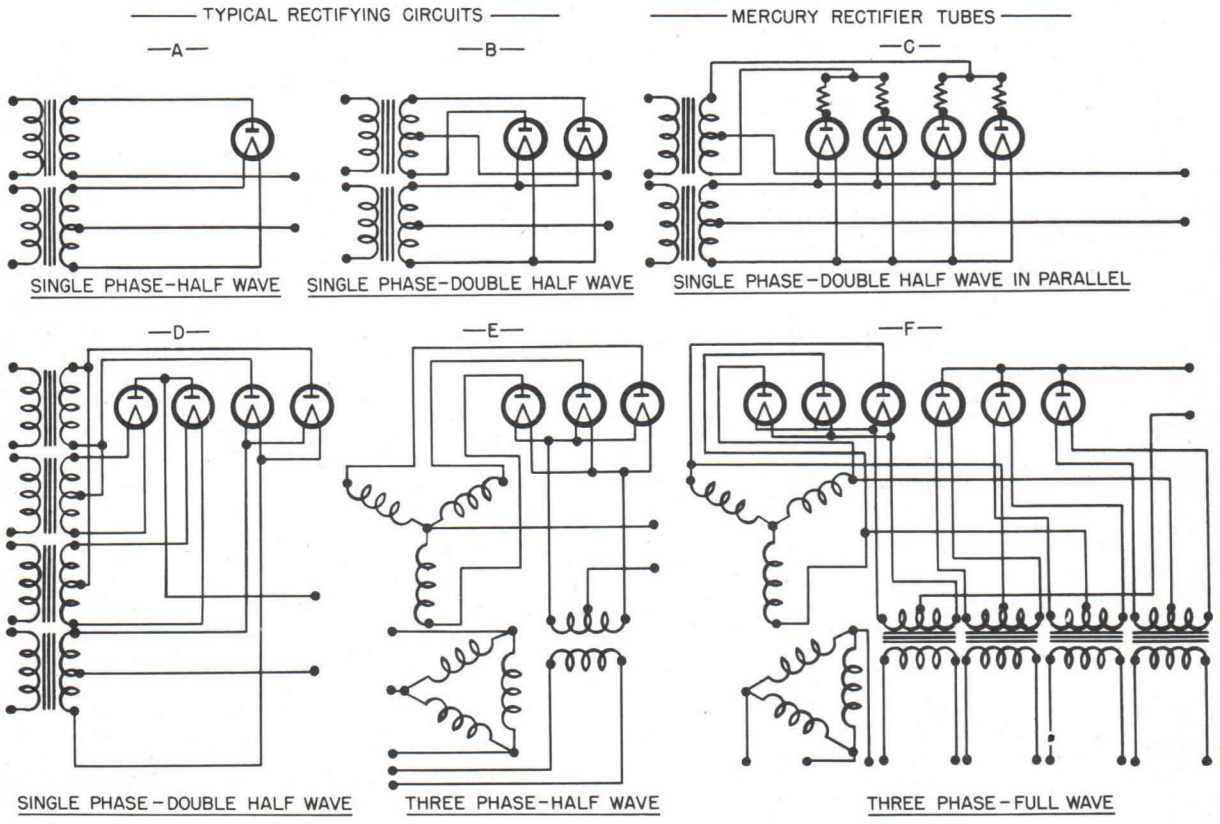
FEDERAL MERCURY VAPOR HALF-WAVE RECTIFIER Type F-575-A

Federal always has made better Rectifier tubes, better from the standpoint of *better service* rendered the user.



Typical rectifying circuits in which Federal's Type F-575-A may be employed are illustrated above. The approximate DC output current and voltage for each type of rectifying circuit shown, when tubes are operated at maximum permissible space current and inverse voltages, are given in the following table:

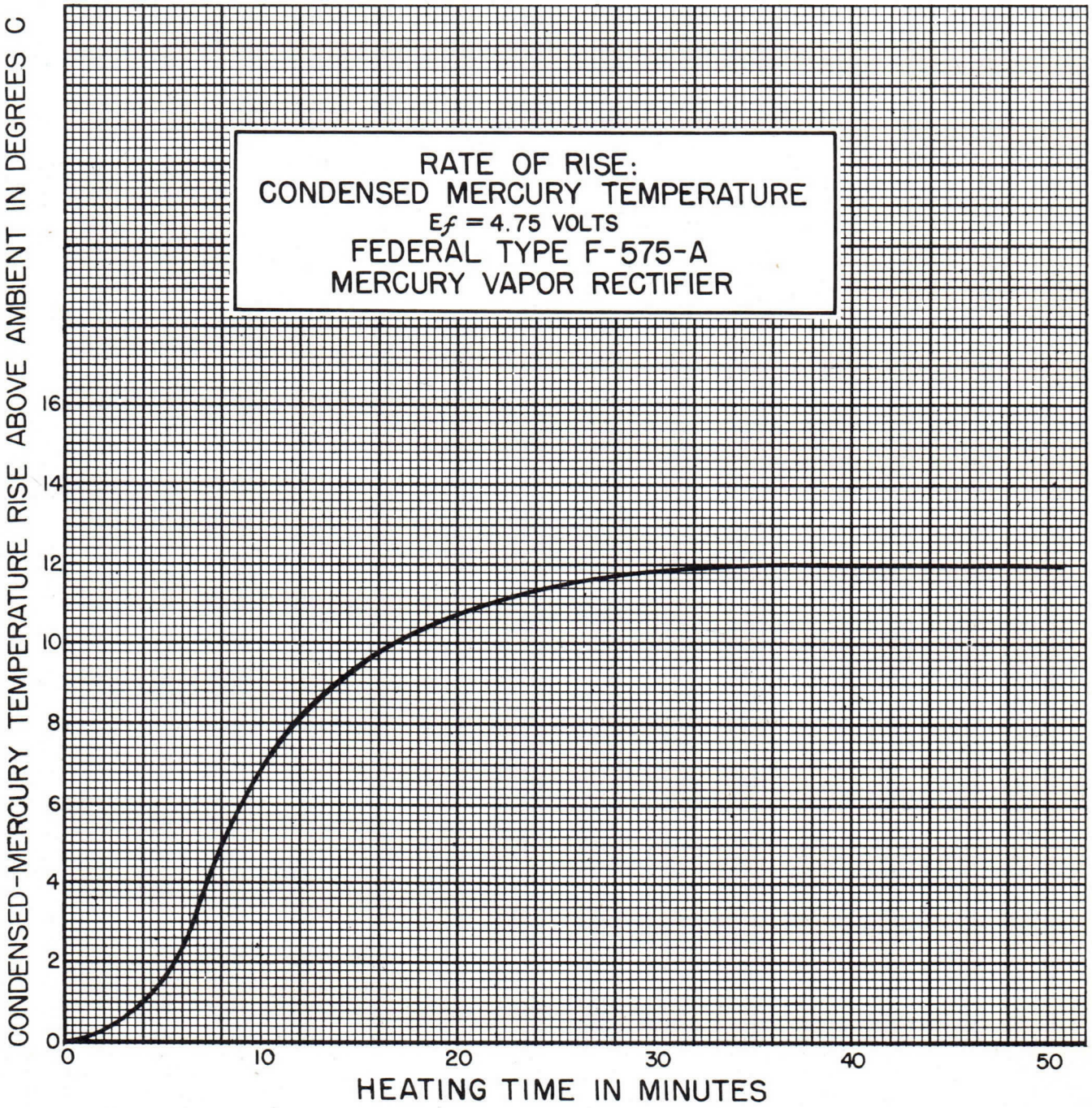
Circuit	*No. of Tubes*	*Input Voltage R.M.S.*	*Approx. DC Output*	
			Volts	*Amperes*
A	1	10,600 per tube	4,800	1.5
B	2	5,300 per tube	4,800	3.0
C	4	5,300 per tube	4,800	6.0
D	4	10,600 per 2 tubes	9,600	3.0
E	3	6,100 per leg	7,200	4.5
F	6	6,100 per leg	14,300	4.5

The above values are for rectifiers working into filters the input inductance of which, is sufficient to maintain the output current substantially constant. Pure sine waveform of the power source is assumed. Transformer regulation and voltage drops in tubes and filter are neglected.

An IT&T Associate

The F-575-A is engineered with the same painstaking care as the most costly tube manufactured by Federal.

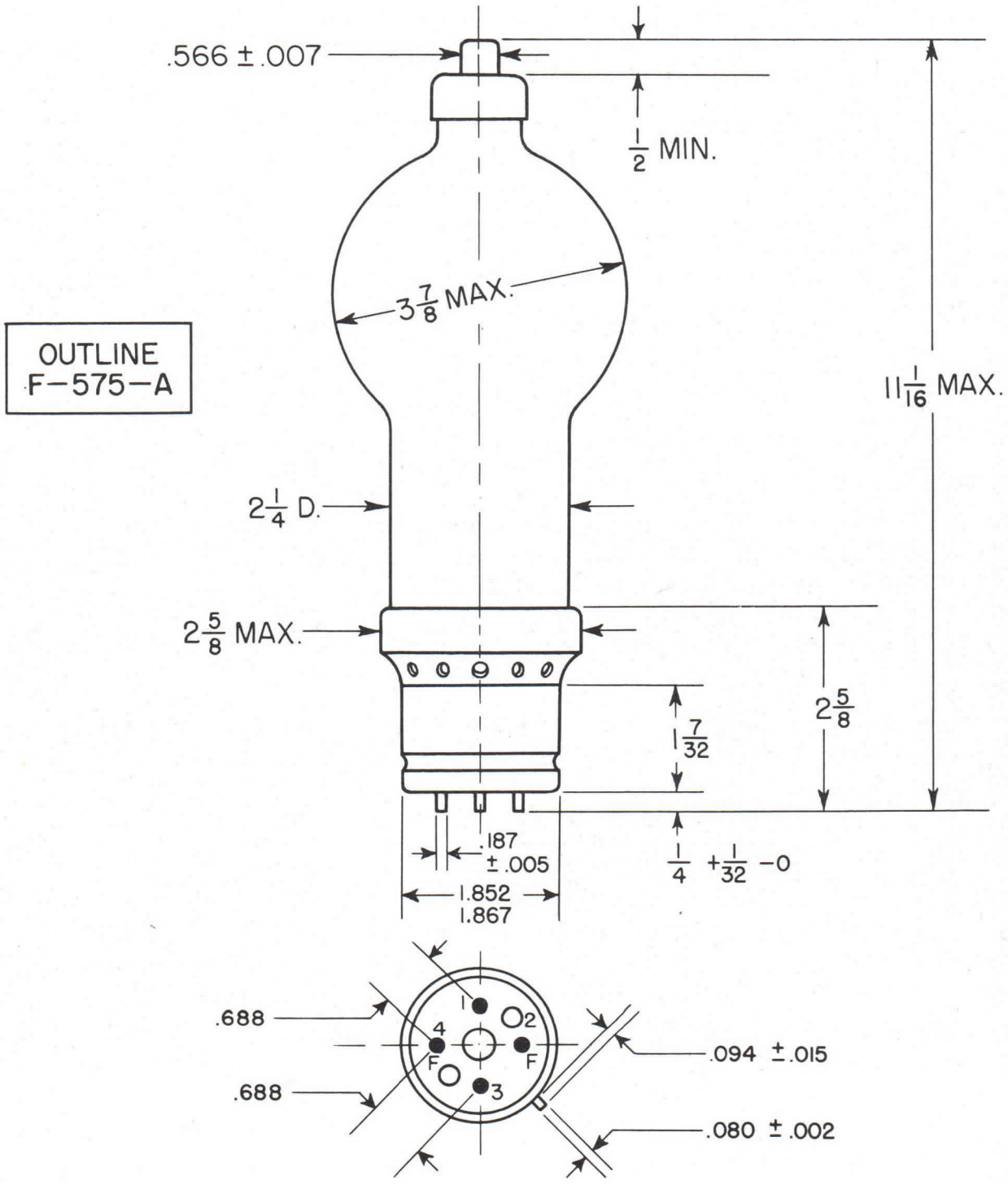
FEDERAL MERCURY VAPOR HALF-WAVE RECTIFIER Type F-575-A



AN IT&T ASSOCIATE

FEDERAL MERCURY VAPOR HALF-WAVE RECTIFIER Type F-575-A

Federal Rectifiers are not a mass-production item. Actually, they are custom-built . . . "the made-to-order tube."



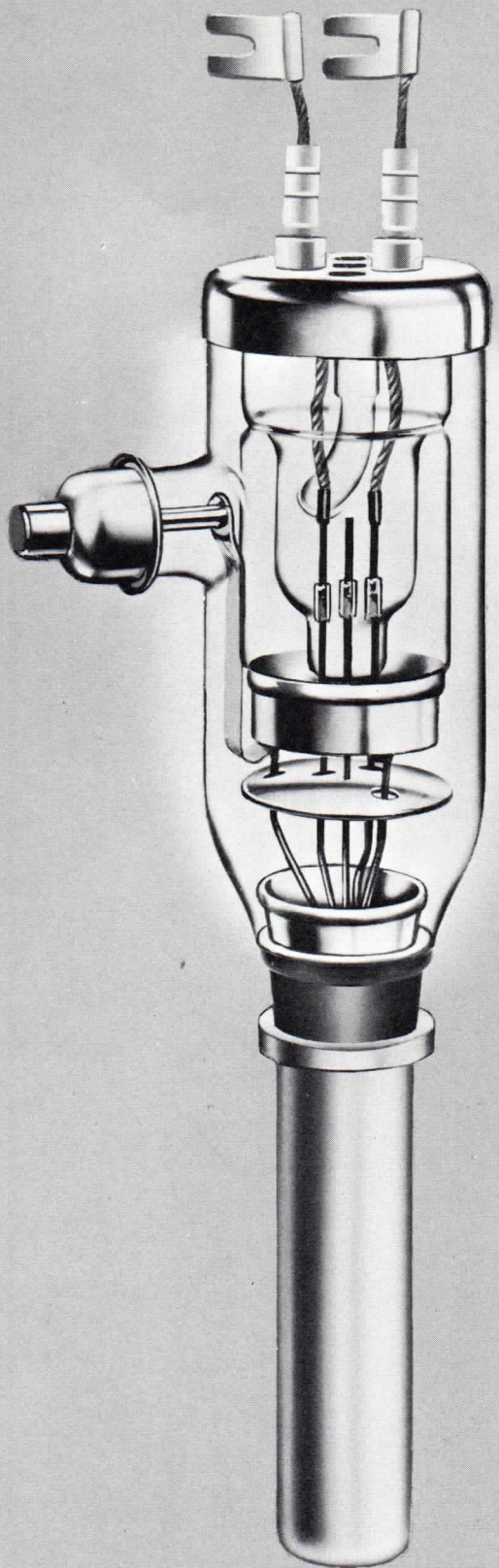
Form FJ-216. Printed in U. S. A.

AN IT&T ASSOCIATE

Federal Telephone and Radio Corporation

100 Kingsland Road Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-631-A
25 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-631-A is a three-electrode tube designed for use as a radio-frequency power amplifier and Oscillator. The anode is water-cooled, capable of dissipating 25 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 3 megacycles, with operation permissible up to 20 megacycles at reduced rating.

Electrical:

▶ Filament Voltage	28 Volts
▶ Filament Current	51 Amperes
▶ Filament Starting Current	102 Amperes
▶ Peak Cathode Current	12.5 Amperes
▶ Amplification Factor, at I_b=0.75 amp. E_c=—300 volts	40
▶ Interelectrode Capacitances	
Grid-Plate	30 $\mu\mu$f
Grid-Filament	20 $\mu\mu$f
Plate-Filament	2.7 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Anode Down	
▶ Type of Cooling—Water	
Water Flow on Anode	10 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
▶ Net Weight, approximate	4 Lbs.

For Maximum Ratings, Typical Operating Conditions and Characteristic Curves, see Type F-110-X.

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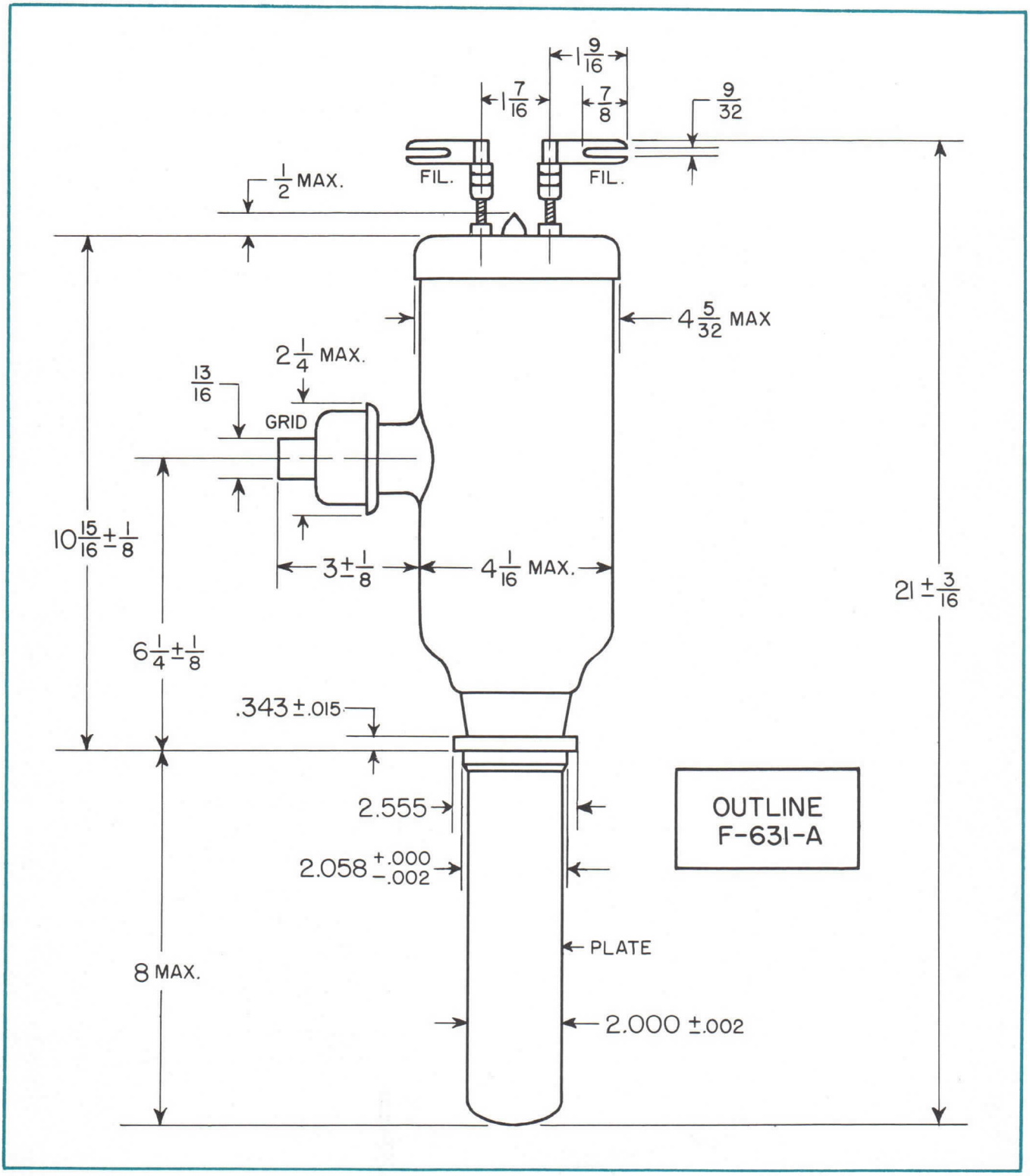
Federal Telephone and Radio Company

FEDERAL POWER TRIODE
Type F-631-A
25 Kilowatts Plate Dissipation

That Federal tubes, by their performance, largely sell themselves, is a tribute to the product and to the manufacturer.

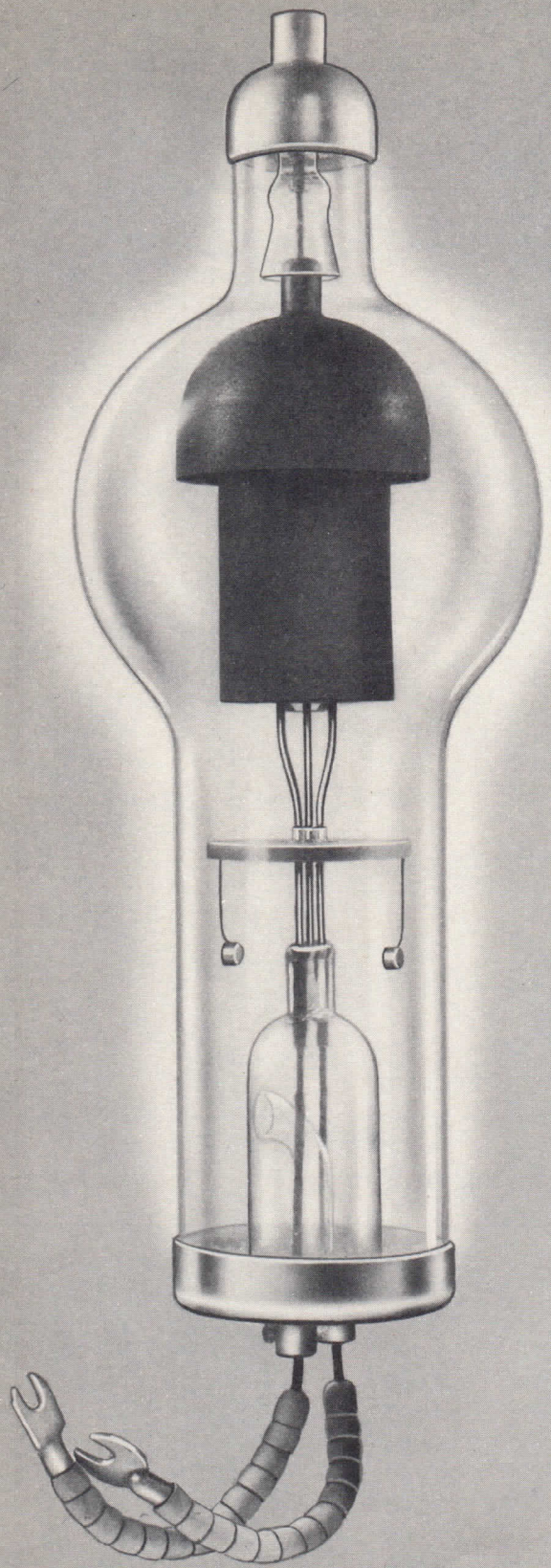


Form F-599 Printed in U. S. A.

DIVISION OF IT&T

Federal Telephone and Radio Company
100 Kingsland Road Clifton, New Jersey

FEDERAL MERCURY VAPOR Half-Wave Rectifier Type F-857-B



GENERAL DATA

DESCRIPTION:

Federal's F-857-B is a mercury vapor, half-wave rectifier for use in high-voltage rectifier circuits.

Electrical:

Filament Voltage	5 Volts
Filament Current	30 Amperes
Cathode Heating Time Required	60 Seconds
Anode Voltage Drop	15 Volts
Critical Anode Voltage	100 Volts

Mechanical

Type of Cooling—Convection or Forced Air	
Equilibrium Condensed Mercury Temperature Rise Over Ambient	
No Load—Approx.	11.5 Centigrade
Full Load—Approx.	15 Centigrade
Mounting Position—Vertical, Base Down	
Net Weight, Maximum	3.8 Pounds

Maximum Ratings, Absolute Values:

Maximum Peak Inverse Anode Voltage	10,000	22,000 Volts
Condensed Mercury Temperature Limits	25 to 60	30 to 40 Centigrade
Max. Cathode Current		
Peak	40	40 Amperes
Average	10	10 Amperes
Surge (maximum duration 0.2 sec.)	400	400 Amperes
Max. Averaging Time	30	30 Seconds
Max. Frequency	150	150 Cycles/sec.

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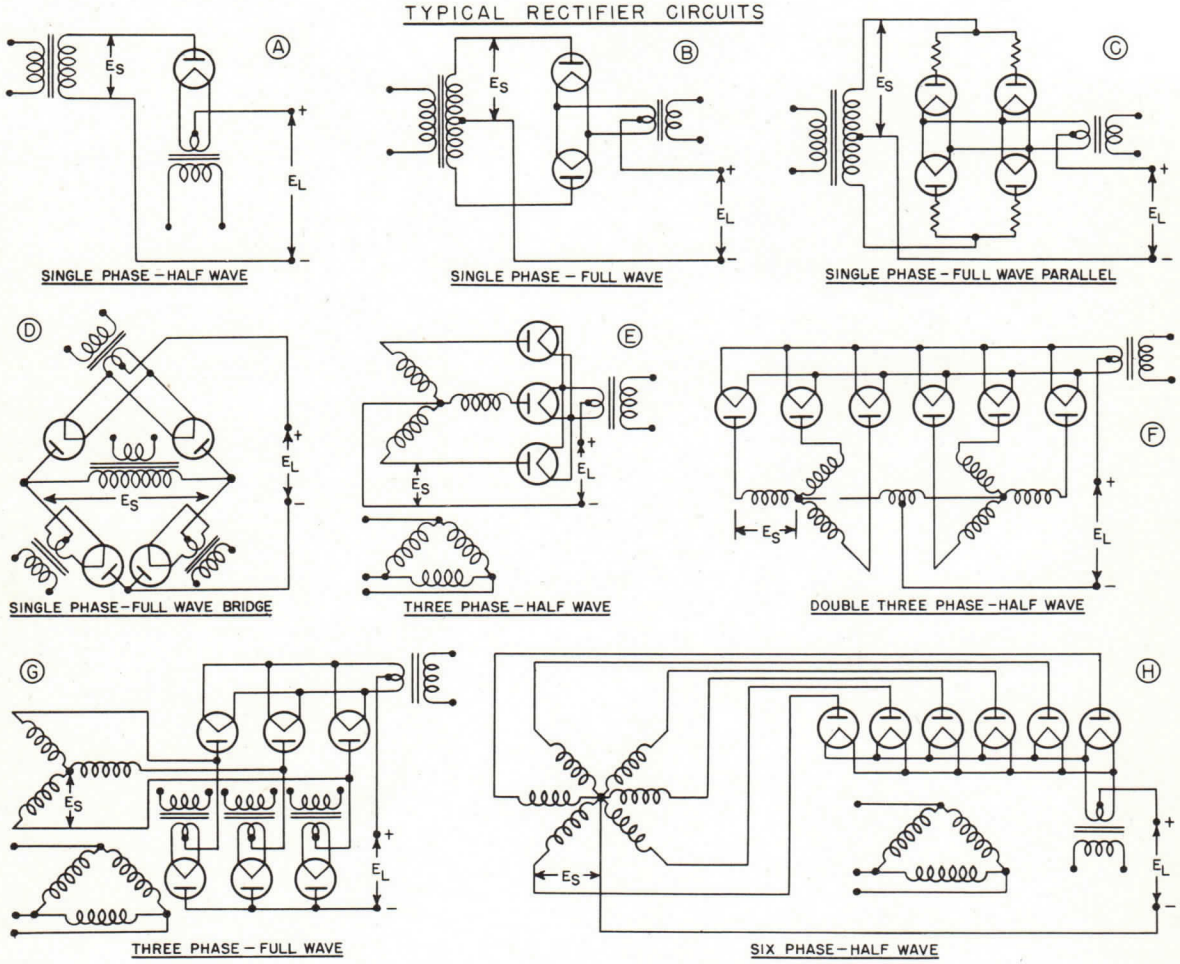
FEDERAL MERCURY VAPOR
Half-Wave Rectifier
Type F-857-B

To the complete satisfaction of the user, Federal tubes are doing the work they were designed to do, doing it longer, better, more economically.

TYPICAL RECTIFIER CIRCUITS



TYPICAL OPERATION FOR MAXIMUM OUTPUT*

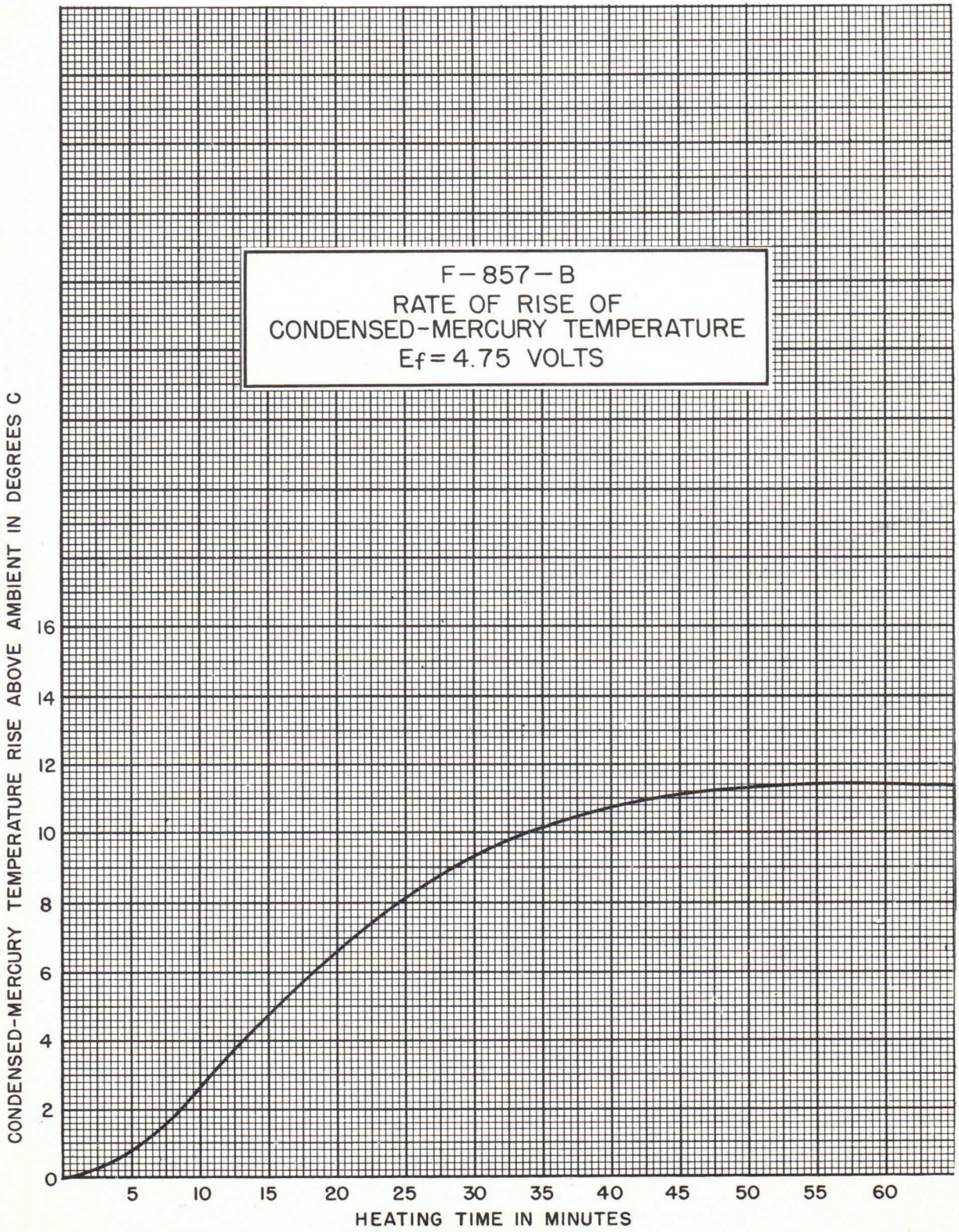
Circuit	*R.M.S Trans. Sec. Volt. (E_S)*	*DC Voltage to Filter (E_L)*	*Max. DC Load Current*
A	15,500	7,000	10
B	7,750	7,000	20
C	7,750	7,000	40
D	15,500	14,000	20
E	9,000	10,500	30
F	9,000	10,500	60
G	9,000	21,000	30
H	7,750	10,500	60

*For sine wave input and choke input filter to maintain output current substantially constant.

AN IT&T ASSOCIATE

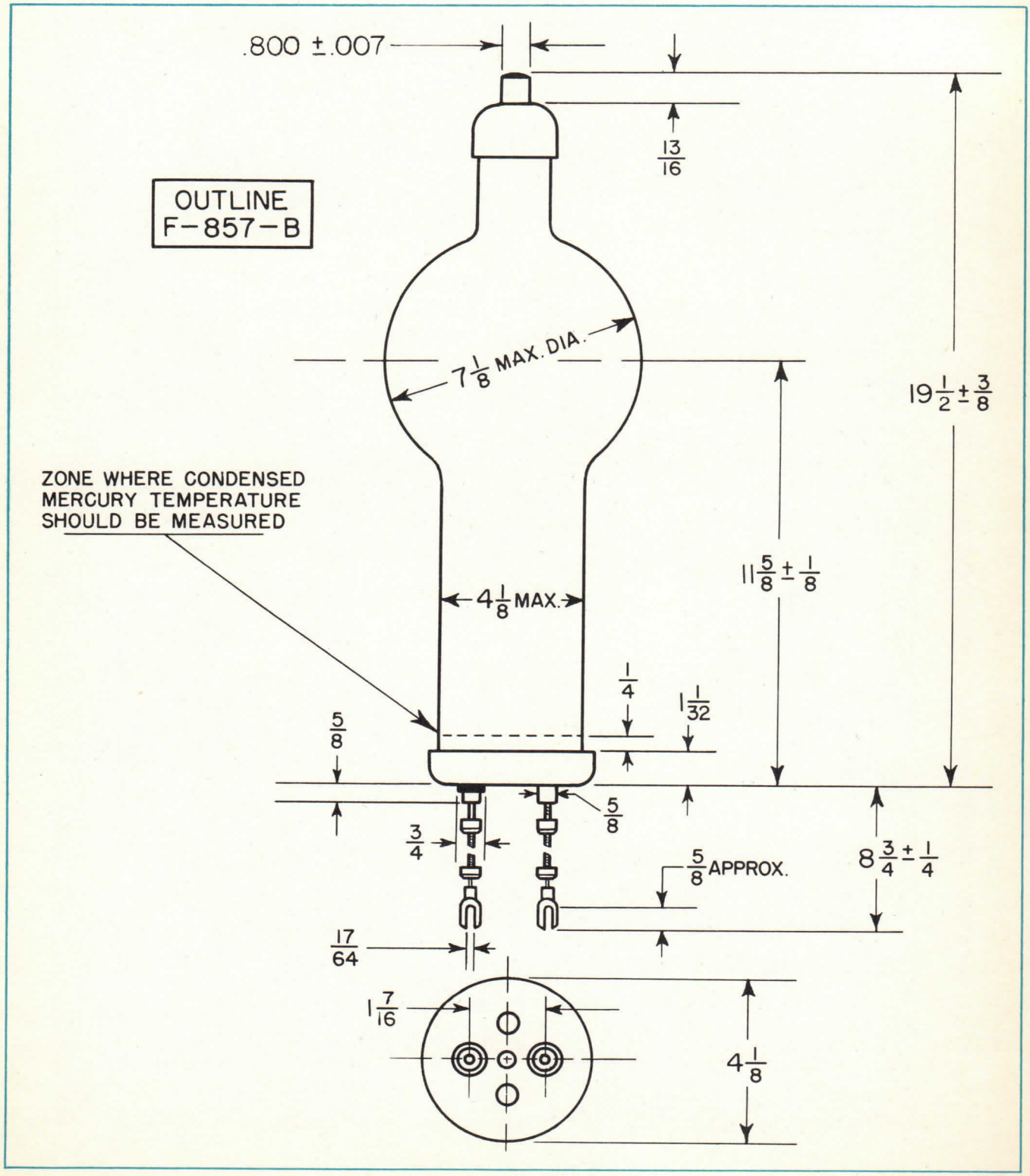
Tube performance is the yardstick by which most Federal customers measure the extent of their satisfaction. It is significant, that they are all "old" customers.

FEDERAL MERCURY VAPOR
Half-Wave Rectifier
Type F-857-B



FEDERAL MERCURY VAPOR
Half-Wave Rectifier
Type F-857-B

Authentic designs, finer materials, improved manufacturing processes, and an experienced personnel . . . these are the factors which tell why Federal always has made better tubes.



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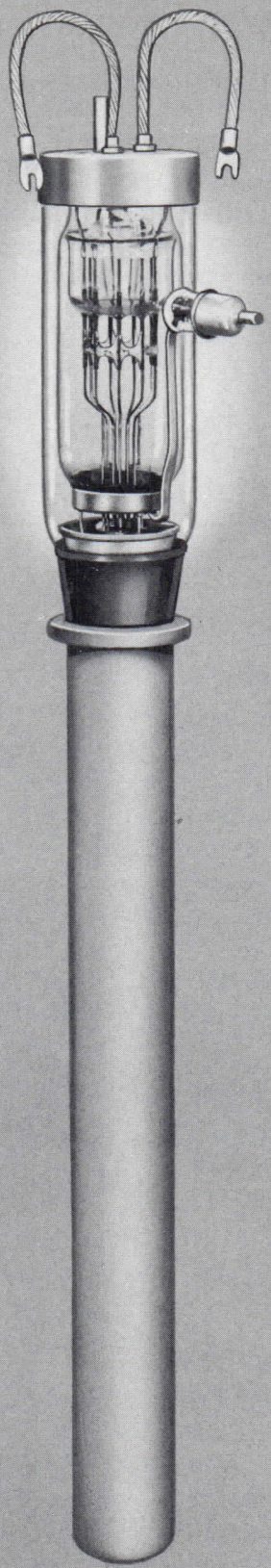
AN IT&T ASSOCIATE

Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-862-A
100 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-862-A is a three-electrode tube engineered for use as a radio-frequency amplifier, oscillator, or as a Class B modulator. The water-cooled anode is capable of dissipating 100 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 1.6 megacycles.

Electrical:

Filament Voltage	33 Volts
Filament Current	207 Amperes
Filament Starting Current	400 Amperes max.
Filament Cold Resistance	.014 Ohms
Amplification Factor, at I_b = 3 amps., E_c = —100 volts	45
Interelectrode Capacitances	
Grid-Plate	64 $\mu\mu$f
Grid-Filament	56 $\mu\mu$f
Plate-Filament	4.7 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling— Water and Forced Air	
Minimum Water Flow on Anode	20 GPM
Maximum Outgoing Water Temperature	70° C
Air Flow (to bulb and seals)	15 CFM
Maximum Glass Temperature	150° C
Net Weight, approximate	37 Pounds

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FEDERAL POWER TRIODE
Type F-862-A
100 Kilowatts Plate Dissipation

In all parts of the U. S. A. Federal's F-862-A is giving an excellent account of itself in 50 kilowatt, low level modulated transmitters.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
Max. Signal DC Plate Current†	7.5 Amperes
Max. Signal Plate Input†	100 Kilowatts
Plate Dissipation†	50 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	12,000 Volts
DC Grid Voltage	0 Volts
Peak A-F Grid-to-Grid Voltage	2,000 Volts
Zero Signal DC Plate Current	3 Amperes
Max. Signal DC Plate Current	13 Amperes
Effective Load Resistance (plate to plate)	1,800 Ohms
Max. Signal Driving Power, approx.	450 Watts
Max. Signal Power Output, approx.	90 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Plate Current	5.0 Amperes
Plate Input	100 Kilowatts
Plate Dissipation	75 Kilowatts

Typical Operation

DC Plate Voltage	18,000 Volts
DC Grid Voltage	—200 Volts
Peak R-F Grid Voltage	750 Volts
DC Plate Current	4.2 Amperes
Driving Power, approx.‡	1.1 Kilowatts
Power Output, approx.	25 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	5.0 Amperes
DC Grid Current	1.25 Amperes
Plate Input	60 Kilowatts
Plate Dissipation	50 Kilowatts

Typical Operation

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—800 Volts
Peak R-F Grid Voltage	2,000 Volts
DC Plate Current	5 Amperes
DC Grid Current, approx.	1 Ampere
Driving Power, approx.	2 Kilowatts
Power Output, approx.	45 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	20,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	10 Amperes
DC Grid Current	1.0 Ampere
Plate Input	200 Kilowatts
Plate Dissipation	100 Kilowatts

Typical Operation

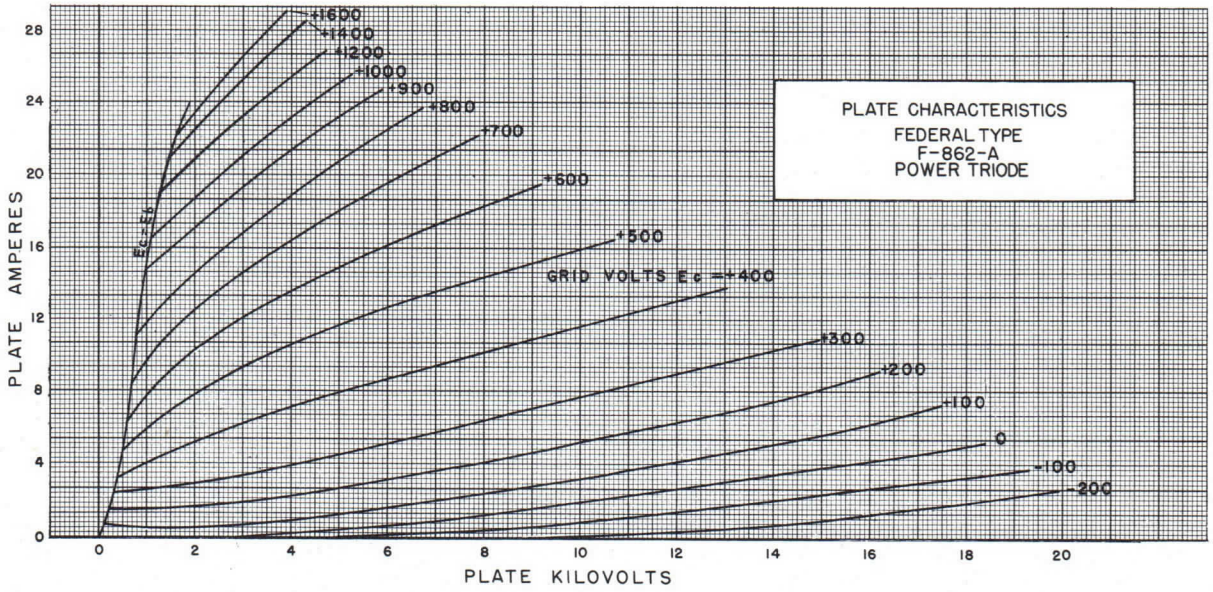
DC Plate Voltage	18,000 Volts
DC Grid Voltage	—1,000 Volts
Peak R-F Grid Voltage	2,550 Volts
DC Plate Current	8.33 Amperes
DC Grid Current, approx.	0.9 Amperes
Driving Power, approx.	2.4 Kilowatts
Power Output, approx.	100 Kilowatts

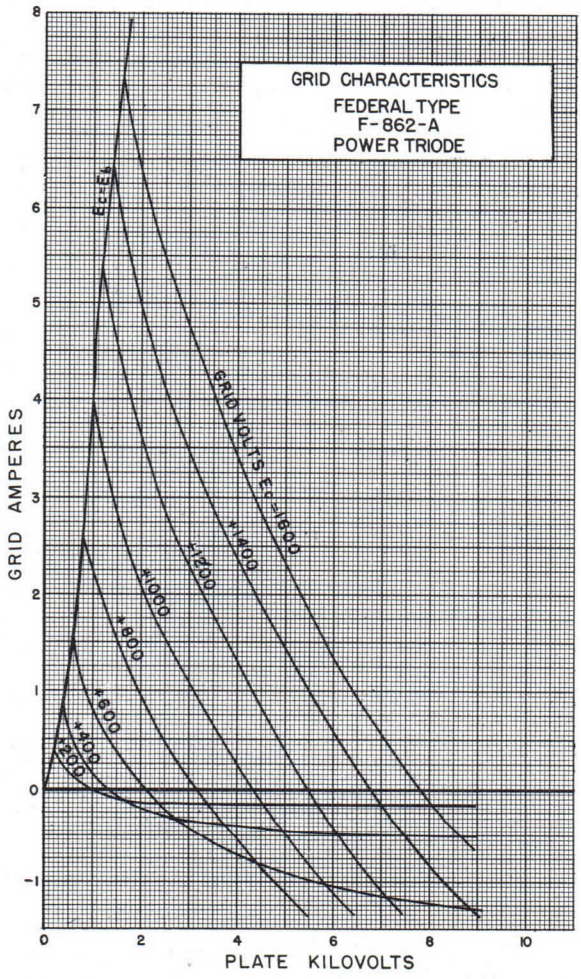
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

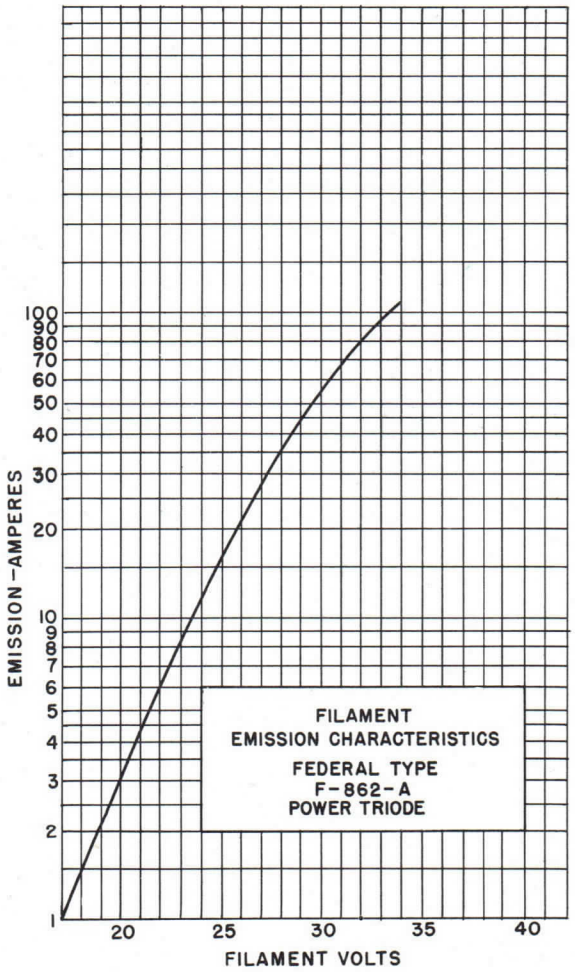
An IT&T Associate

FEDERAL POWER TRIODE
Type F-862-A
100 Kilowatts Plate Dissipation

It's the internal construction of the F-862-A and F-898-A which contributes to the *smoother* performance of these Federal tubes in 50 kilowatt Doherty amplifiers.

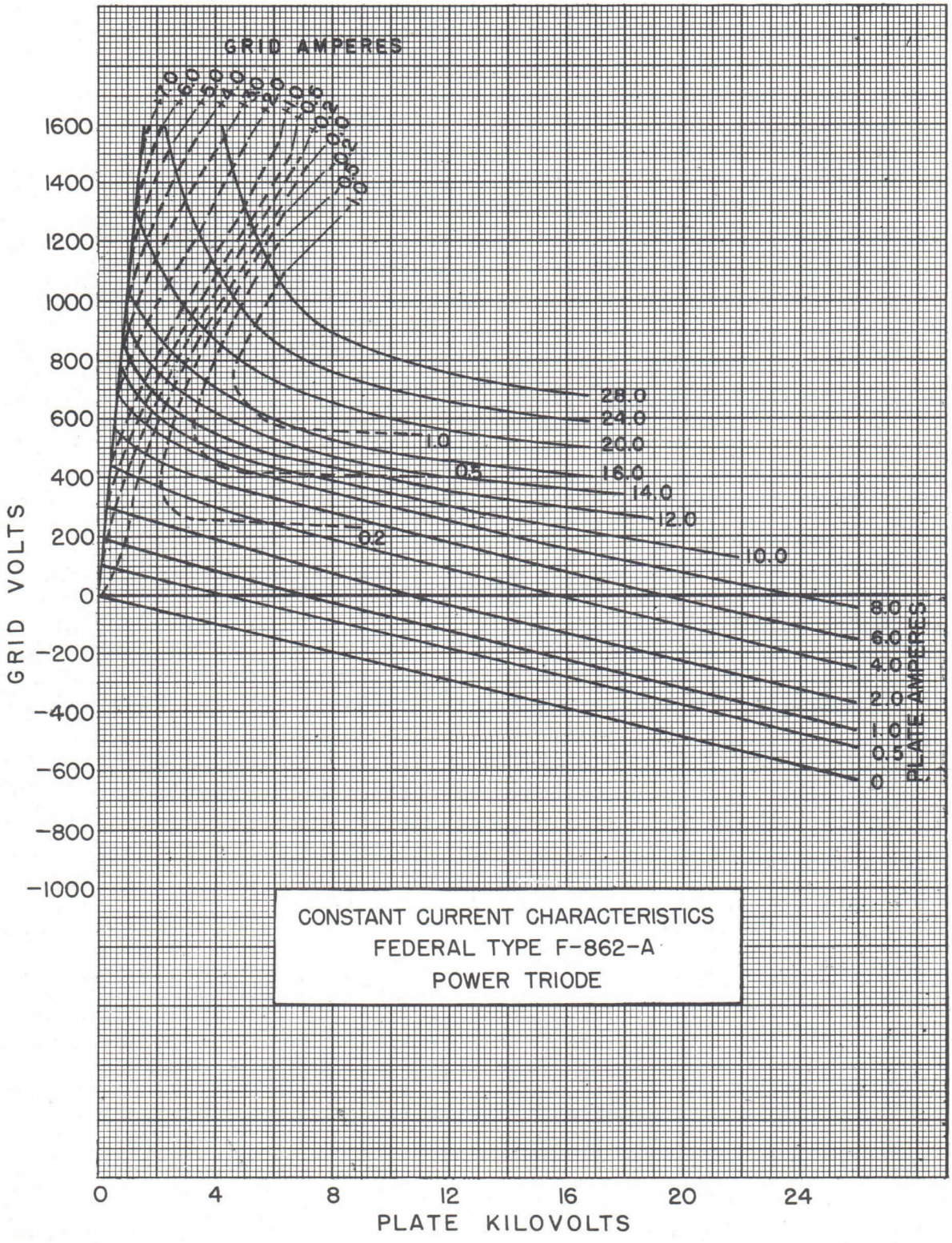






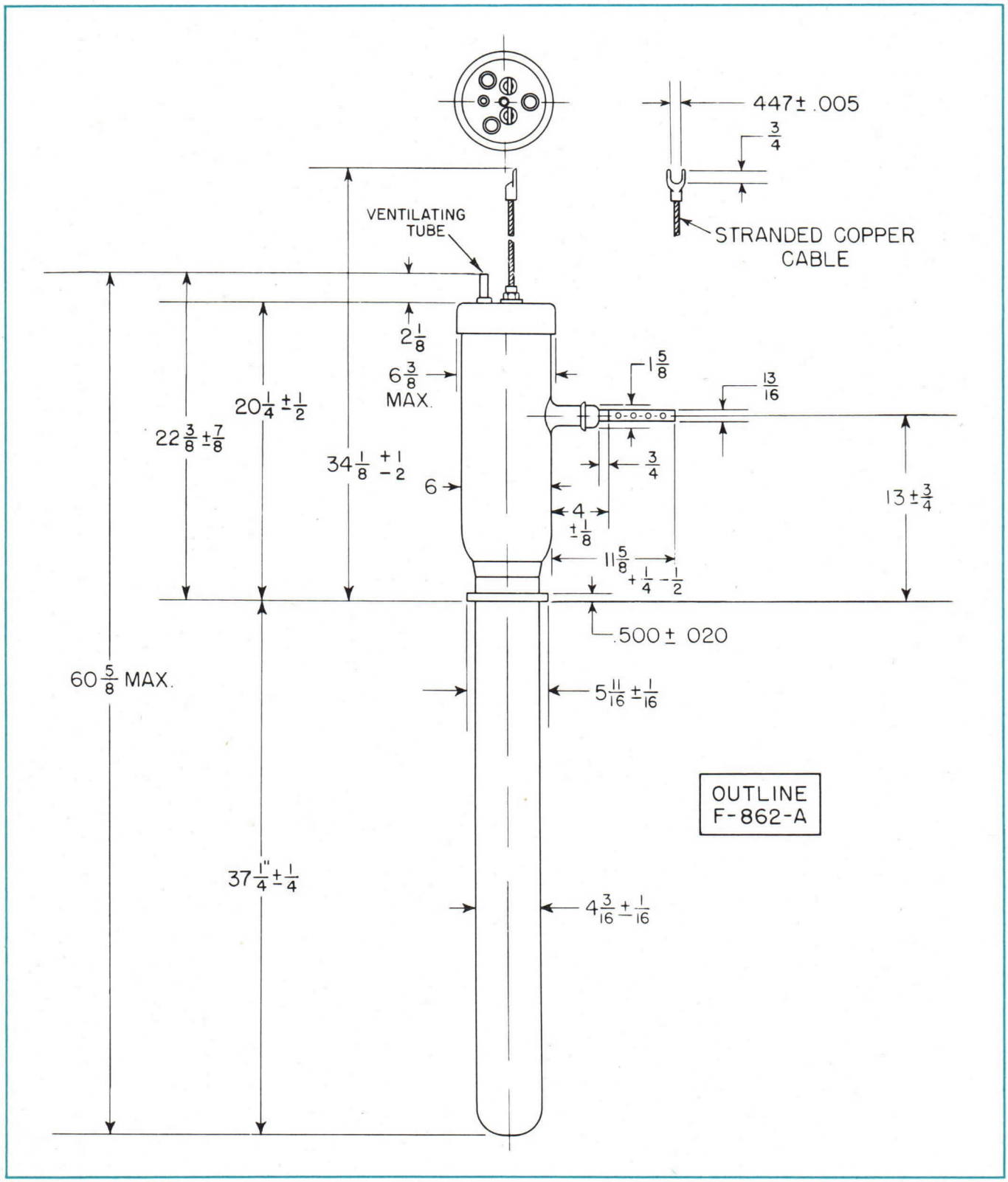
FEDERAL POWER TRIODE
Type F-862-A
100 Kilowatts Plate Dissipation

Federal tubes are precision-designed to meet the specific needs of communications and industrial applications . . . are produced under the most rigid standards of quality-control.



Federal's best tube advertisement is the tube itself, its performance, its service, its long life span.

FEDERAL POWER TRIODE
Type F-862-A
100 Kilowatts Plate Dissipation



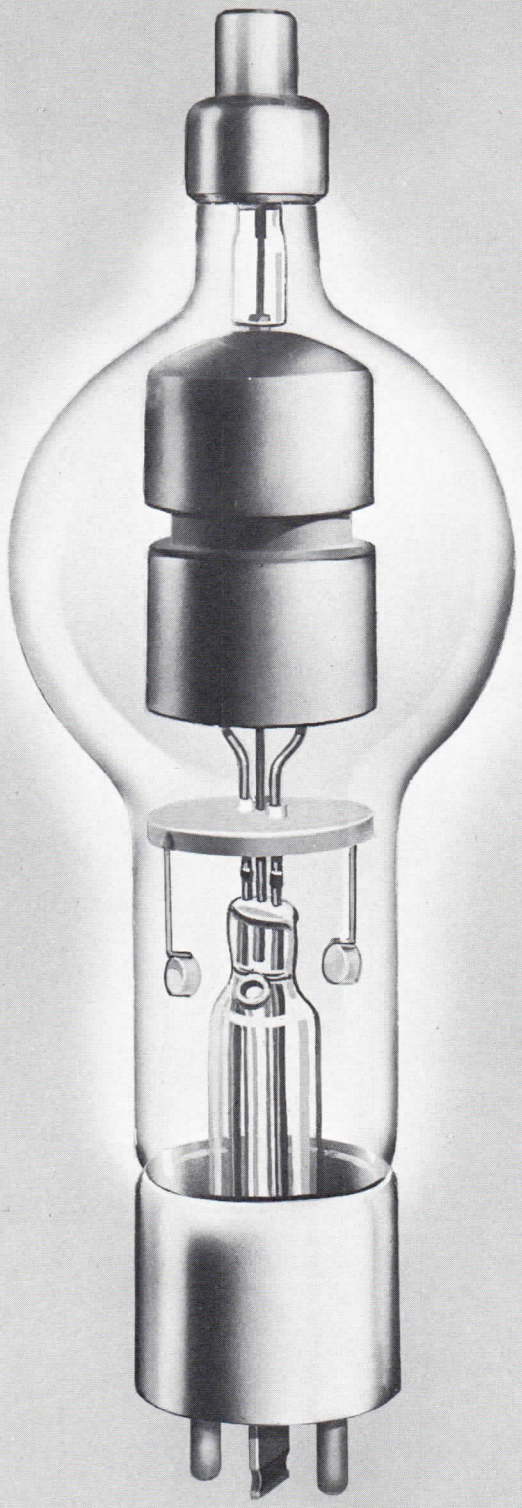
Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

AN IT&T ASSOCIATE

Federal Always Has
Made Better Tubes

Form FJ-156. Printed in U. S. A.

FEDERAL MERCURY VAPOR
Half-Wave Rectifier
Type F-869-B



GENERAL DATA

DESCRIPTION:

Federal's F-869-B is a mercury vapor, half-wave rectifier for use in high-voltage rectifier circuits.

Electrical:

▸ Filament Voltage	5 Volts
▸ Filament Current	20 Amperes
▸ Cathode Heating Time Required	60 Seconds
▸ Anode Voltage Drop	15 Volts
▸ Critical Anode Voltage	100 Volts

Mechanical:

▸ Type of Cooling—Convection or Forced Air	
▸ Equilibrium Condensed Mercury Temperature Rise Over Ambient	
No Load—Approx.	15°Centigrade
Full Load—Approx.	20°Centigrade
▸ Mounting Position—Vertical, Base Down	
▸ Net Weight, Maximum	3.8 Pounds

Maximum Ratings, Absolute Values

Maximum Peak Inverse Anode Voltage	15,000	20,000 Volts
Condensed Mercury Temperature Limits	30° to 50°	30° to 40° Centigrade
Max. Cathode Current		
Peak	10	10 Amperes
Average	2.5	2.5 Amperes
Surge (maximum duration 0.1 sec.)	100	100 Amperes
Max. Averaging Time	30	30 Seconds
Max. Frequency	150	150 Cycles/sec.

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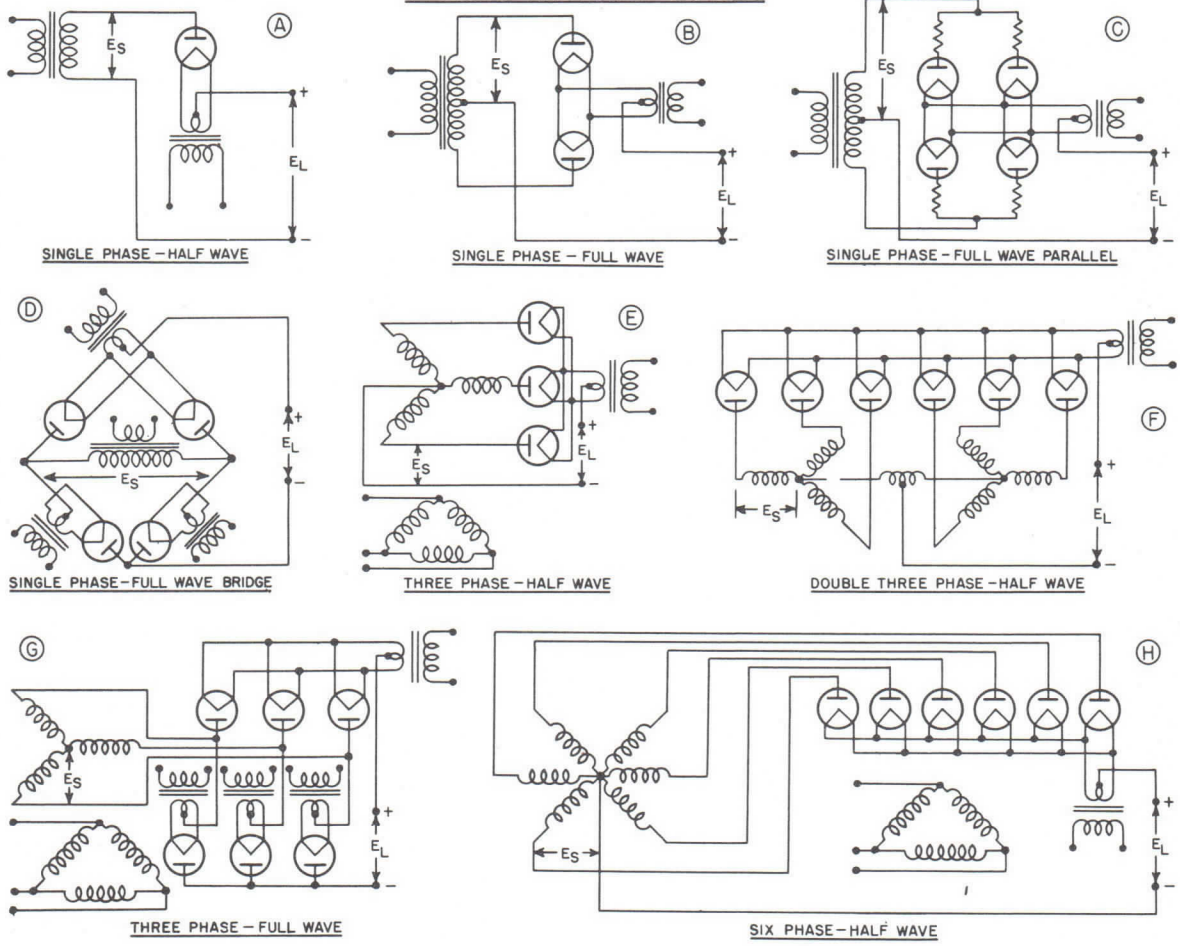
FEDERAL MERCURY VAPOR
Half-Wave Rectifier
Type F-869-B

Federal produces tubes of only the highest quality, satisfying the most exacting users.

TYPICAL RECTIFIER CIRCUITS



TYPICAL OPERATION FOR MAXIMUM OUTPUT*

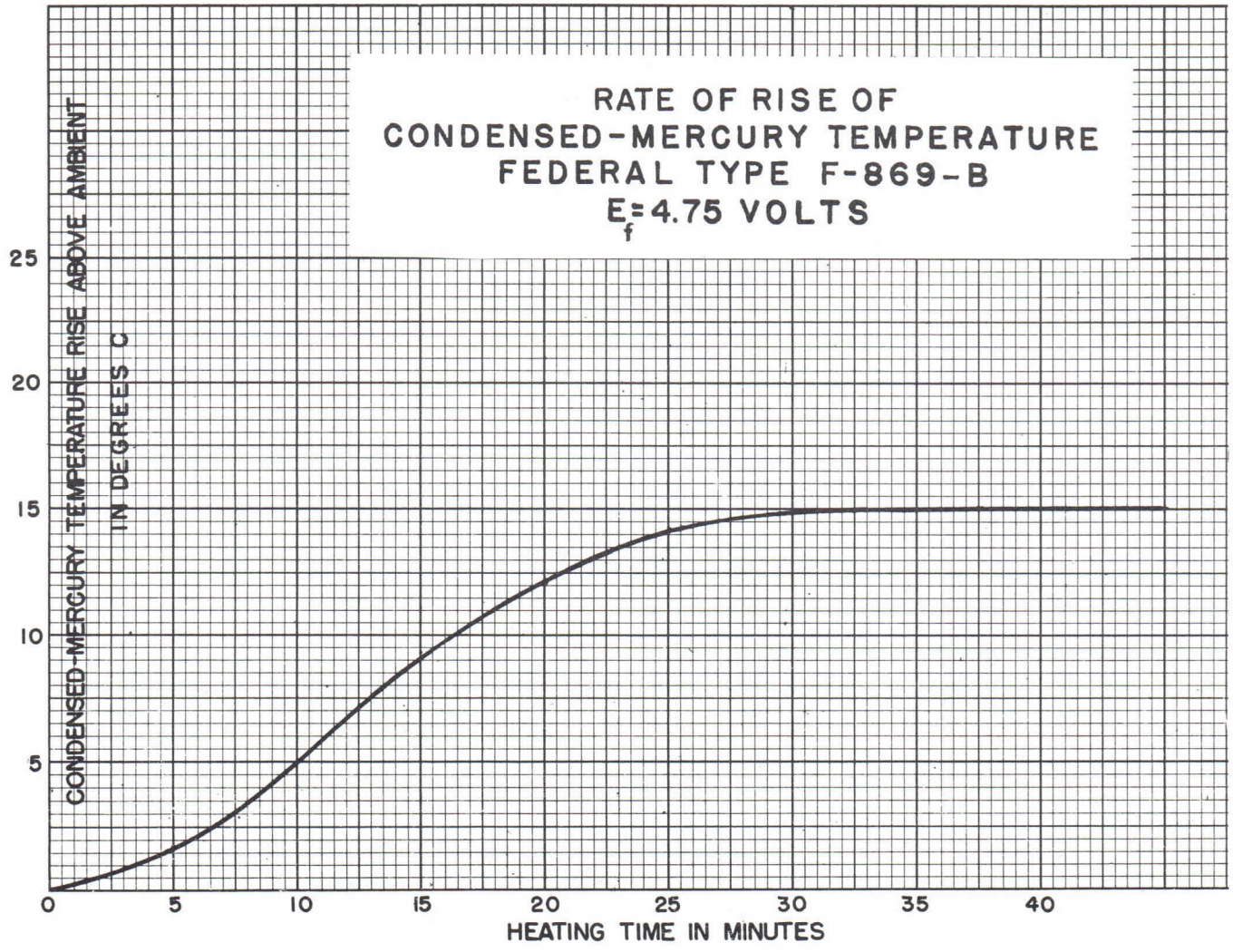
Circuit	*R.M.S. Trans. Sec. Volt (E_S)*	*DC Voltage to Filter (E_L)*	*Max. DC Load Current*
A	14,000	6,300	2.5
B	7,000	6,300	5.0
C	7,000	6,300	10.0
D	14,000	12,700	5.0
E	8,100	9,500	7.5
F	8,100	9,500	15
G	8,100	19,000	7.5
H	7,000	9,500	9.5

*For sine wave input and choke input filter to maintain output current substantially constant.

DIVISION OF IT&T

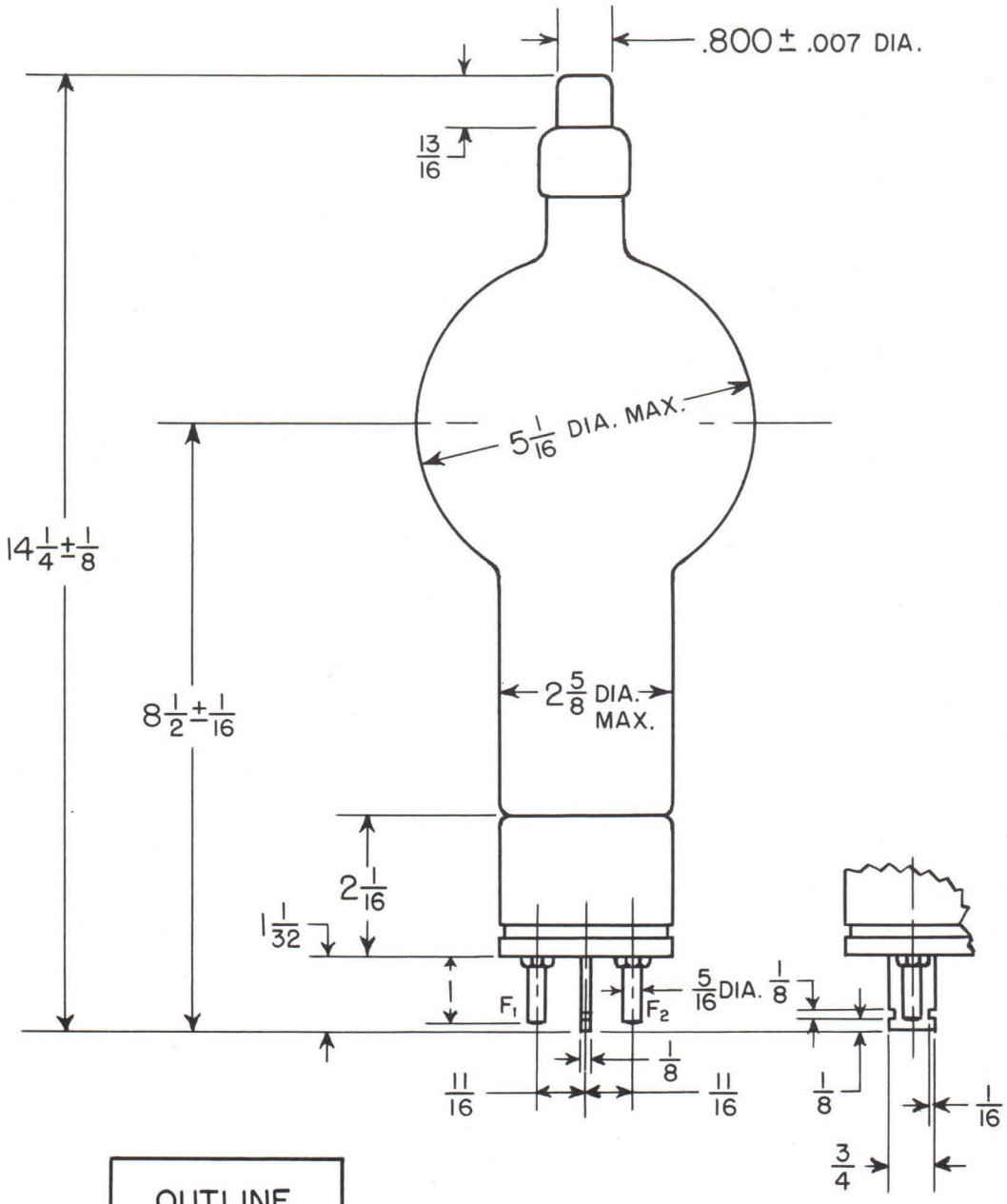
Federal's longer tube life means lower costs. Increase the life of the tubes in your equipment, and unit costs per hour go down.

FEDERAL MERCURY VAPOR
Half-Wave Rectifier
Type F-869-B



FEDERAL MERCURY VAPOR
Half-Wave Rectifier
Type F-869-B

In *satisfying* the customer and winning his confidence, Federal has reduced tube selling to a formula.



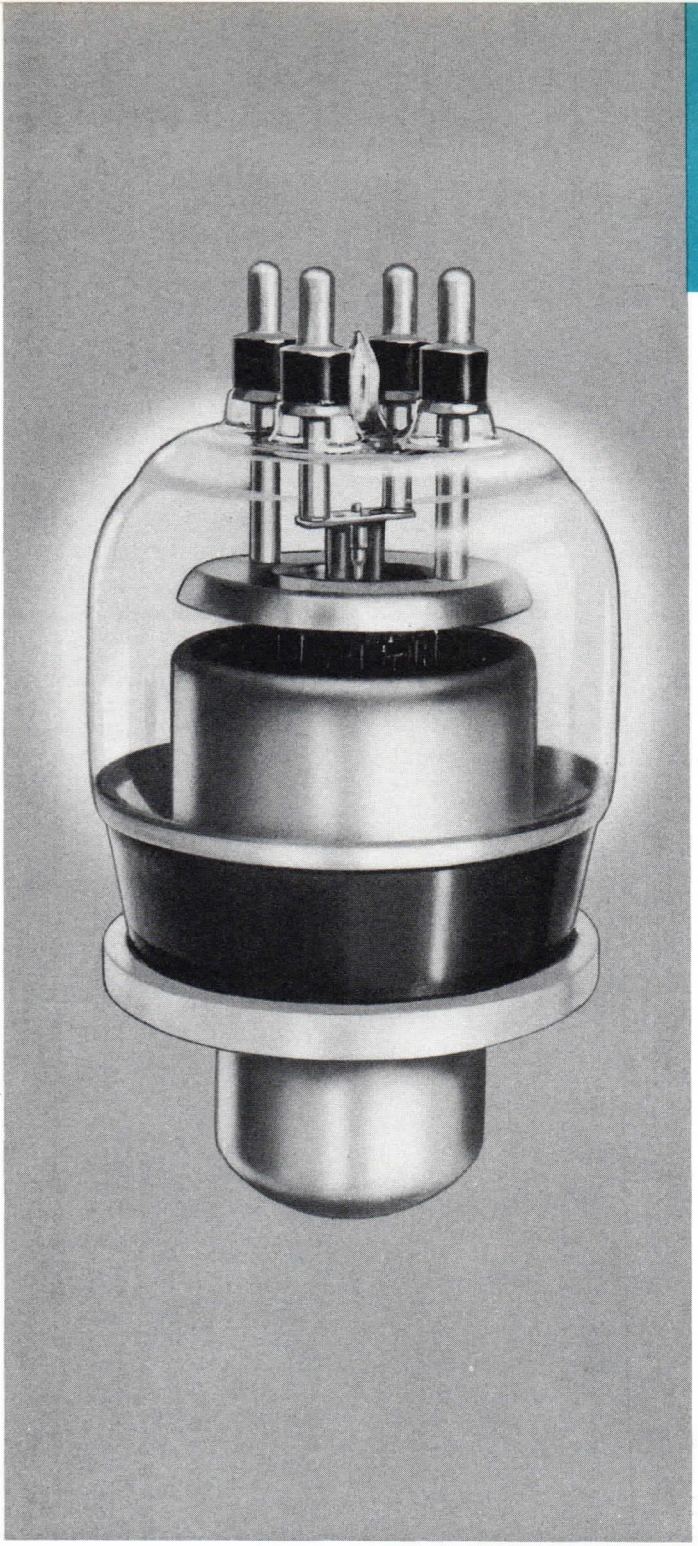
OUTLINE
F-869-B

Form F-597 Printed in U. S. A.

DIVISION OF I T & T

Federal Telephone and Radio Company
100 Kingsland Road Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-880
20 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-880 is a three-electrode tube built for use as a radio-frequency amplifier, oscillator, or a Class B modulator. The anode is water-cooled, capable of dissipating 20 kilowatts. The cathode is a pure tungsten filament of individual "hairpin" design, and is spring-loaded to prevent filament bowing. The design of the terminal mount connections and the re-entrant anode minimize lead inductance, make the tube particularly suitable for high-frequency applications up to 25 megacycles at full ratings, 100 megacycles at reduced ratings.

Electrical:

Filament Voltage	12.6 Volts
Filament Current	320 Amperes
Filament Starting Current	480 Amperes max.
Filament Cold Resistance	.003 Ohms
Amplification Factor, at I_b = 2.0 amps., E_c = —100 volts	20
Interelectrode Capacitances	
Grid-Plate	24 $\mu\mu$f
Grid-Filament	35 $\mu\mu$f
Plate-Filament	2 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling— Water and Forced Air	
Water Flow on Anode	20 GPM
Maximum Outgoing Water Temperature	70° C
Air Flow (to bulb and seals) from a 3-inch diameter nozzle	20 CFM
Maximum Glass Temperature	150° C
Net Weight, approximate	7 Pounds

In the development and production of vacuum tubes Federal carries on extensive laboratory experimentation: new techniques, new processes, new applications.

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FEDERAL POWER TRIODE
Type F-880
20 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	25	50	100 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class B—Max. Plate Voltage	100	80	60 Per Cent
Max. Plate Input	100	94	75 Per Cent
Class C—Plate Modulated	100	72	45 Per Cent
Class C—Unmodulated	100	75	50 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	10,500 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	40 Kilowatts
Plate Dissipation†	15 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	7,500	10,000 Volts
DC Grid Voltage	—340	—450 Volts
Peak A-F Grid-to-Grid Voltage	1,450	1,680 Volts
Zero Signal DC Plate Current	1.0	1.0 Amperes
Maximum Signal DC Plate Current	6.7	7.0 Amperes
Effective Load Resistance, Plate to Plate	2,300	3,100 Ohms
Maximum Signal Driving Power, Approx.	490	540 Watts
Maximum Signal Power Output, Approx.	31.5	46 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	10,500 Volts
DC Plate Current	4 Amperes
Plate Input	32 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

DC Plate Voltage	7,500	10,000 Volts
DC Grid Voltage	—340	—460 Volts
Peak R-F Grid Voltage	570	595 Volts
DC Plate Current	3.3	2.75 Amperes
DC Grid Current, approximate	.013	.009 Amperes
Driving Power, approximate‡	1,250	900 Watts
Power Output, approximate	8	9 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	10,500 Volts
DC Grid Voltage	—1,200 Volts
DC Plate Current	3.6 Amperes
DC Grid Current	0.8 Amperes
Plate Input	36 Kilowatts
Plate Dissipation	12 Kilowatts

Typical Operation

DC Plate Voltage	7,500	10,000 Volts
DC Grid Voltage	—1,000	—1,200 Volts
Peak R-F Grid Voltage	1,560	1,840 Volts
DC Plate Current	3.0	3.6 Amperes
DC Grid Current, approximate	0.57	0.64 Amperes
Driving Power, approximate	850	1,100 Watts
Power Output, approximate	16	27 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	10,500	15,000* Volts
DC Grid Voltage	—1,200	—1,600* Volts
DC Plate Current	6.0	4.5* Amperes
DC Grid Current	0.8	1.0* Amperes
Plate Input	60	67.5* Kilowatts
Plate Dissipation	20	20* Kilowatts

Typical Operation

DC Plate	7,500	10,000	10,000 Volts
DC Grid Voltage	—600	—800	—1,000 Volts
Peak R-F Grid Voltage	1,250	1,460	1,830 Volts
DC Plate Current	4.8	4.5	6.0 Amperes
DC Grid Current, approximate	0.79	0.78	0.8 Amperes
Driving Power, approximate	920	1,000	1,500 Watts
Power Output, approximate	24	33	40 Kilowatts

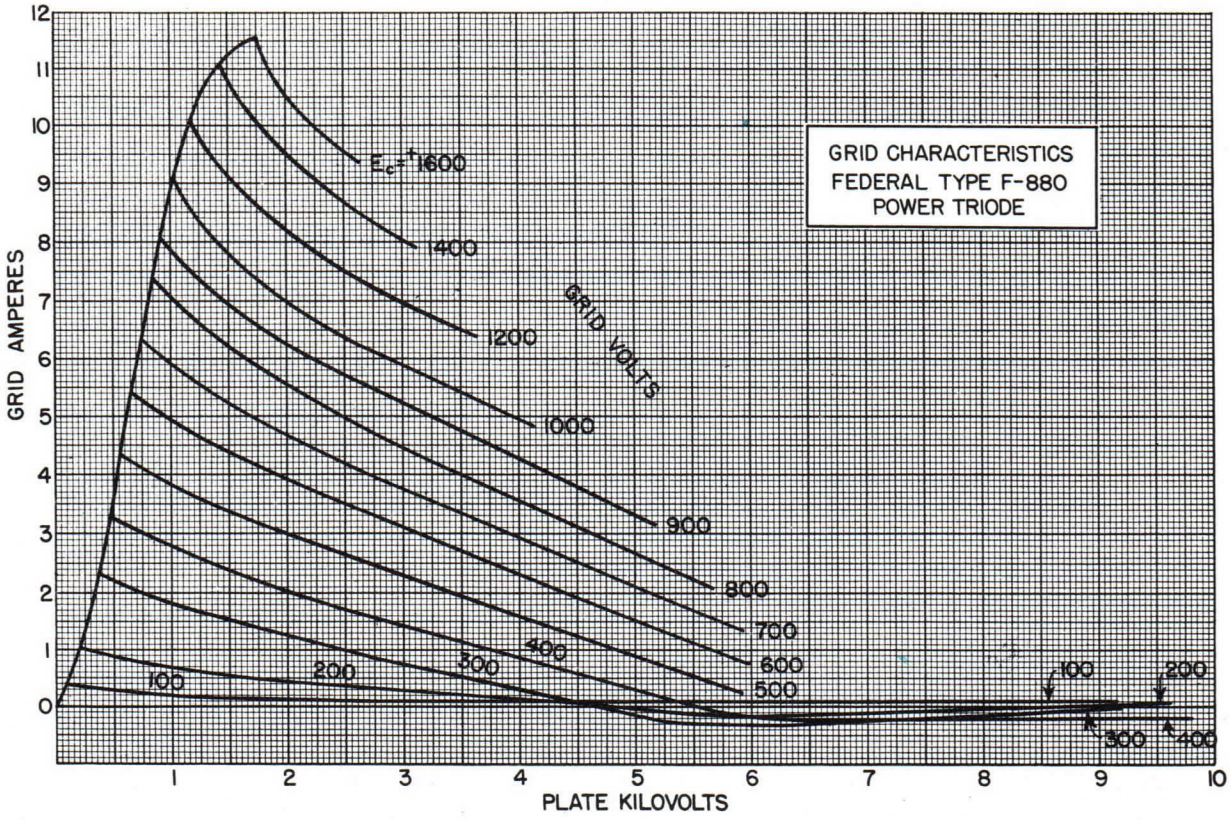
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

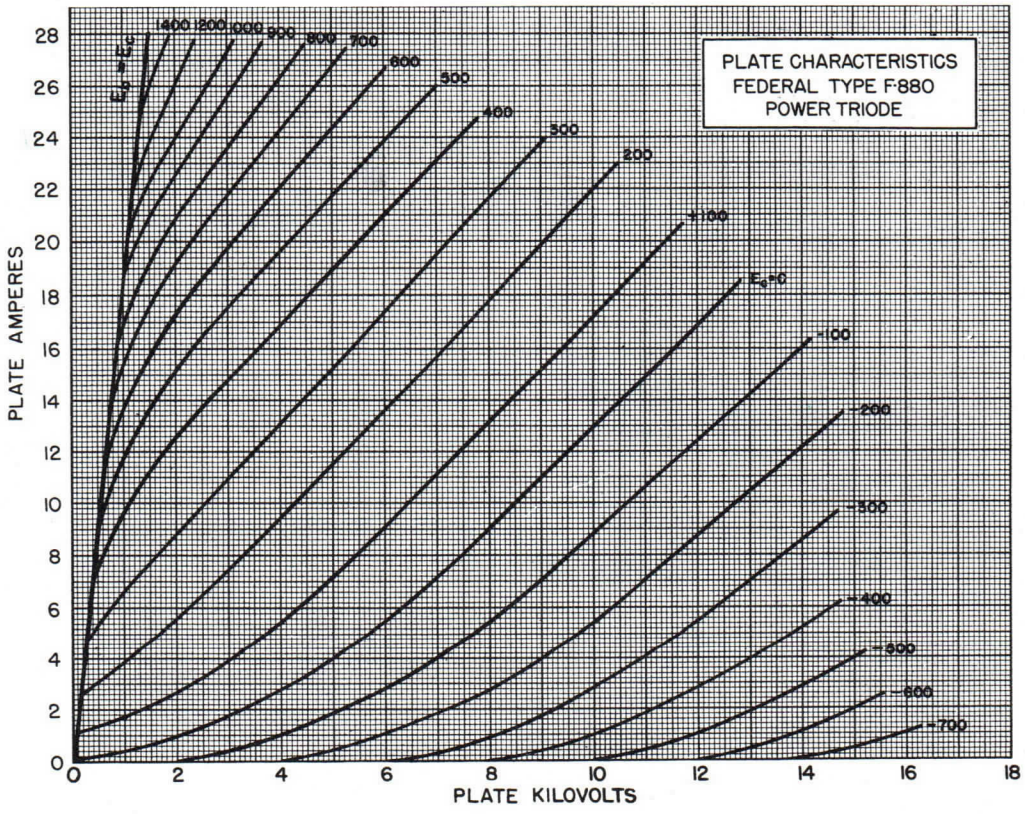
*These ratings apply only at a frequency of 1,500 kilocycles or less.

AN IT&T ASSOCIATE

FEDERAL POWER TRIODE
Type F-880
20 Kilowatts Plate Dissipation

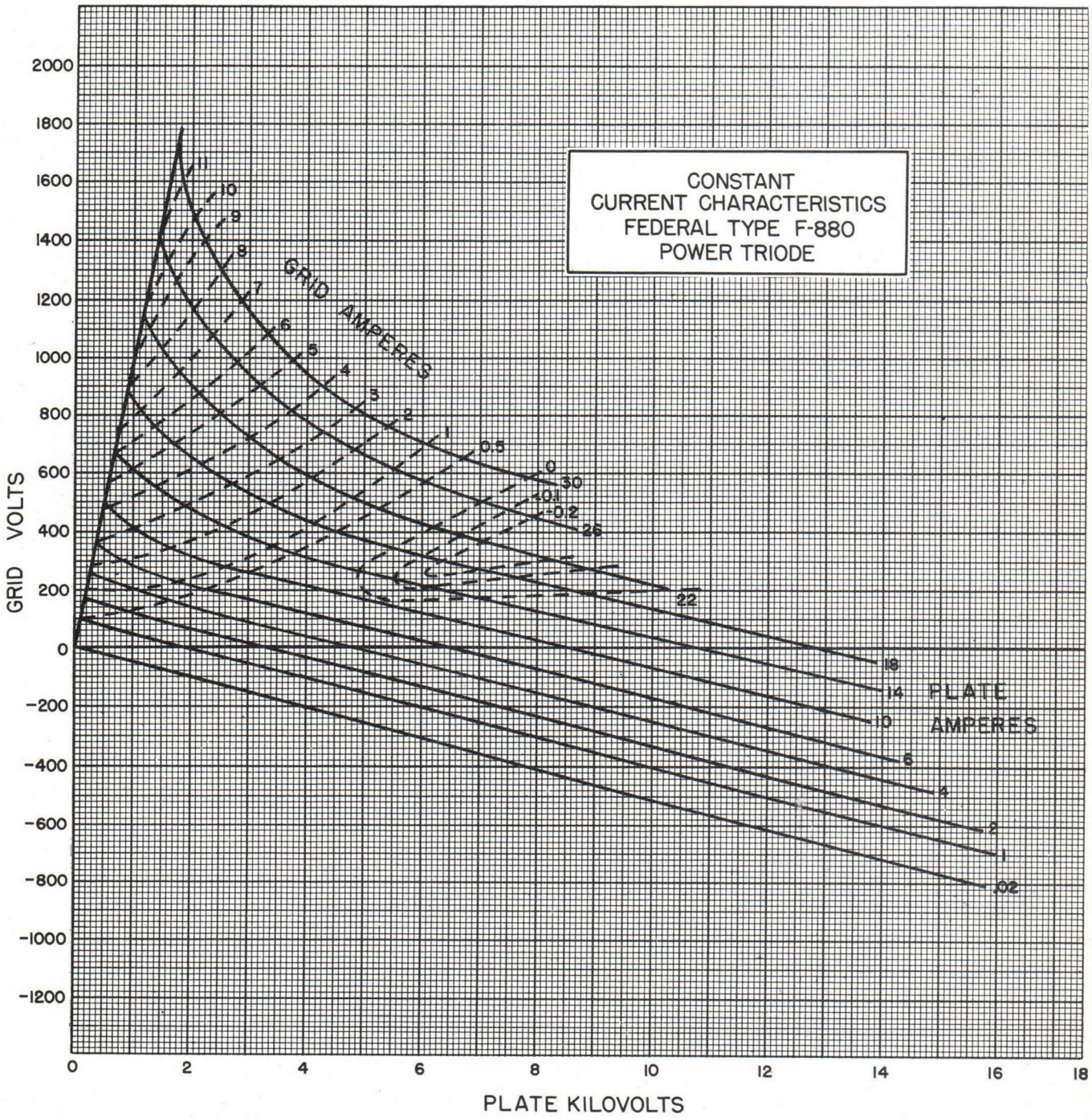
The new and improved filament design in Federal's Type F-880 reduces the tendency to filament bowing.





FEDERAL POWER TRIODE
Type F-880
20 Kilowatts Plate Dissipation

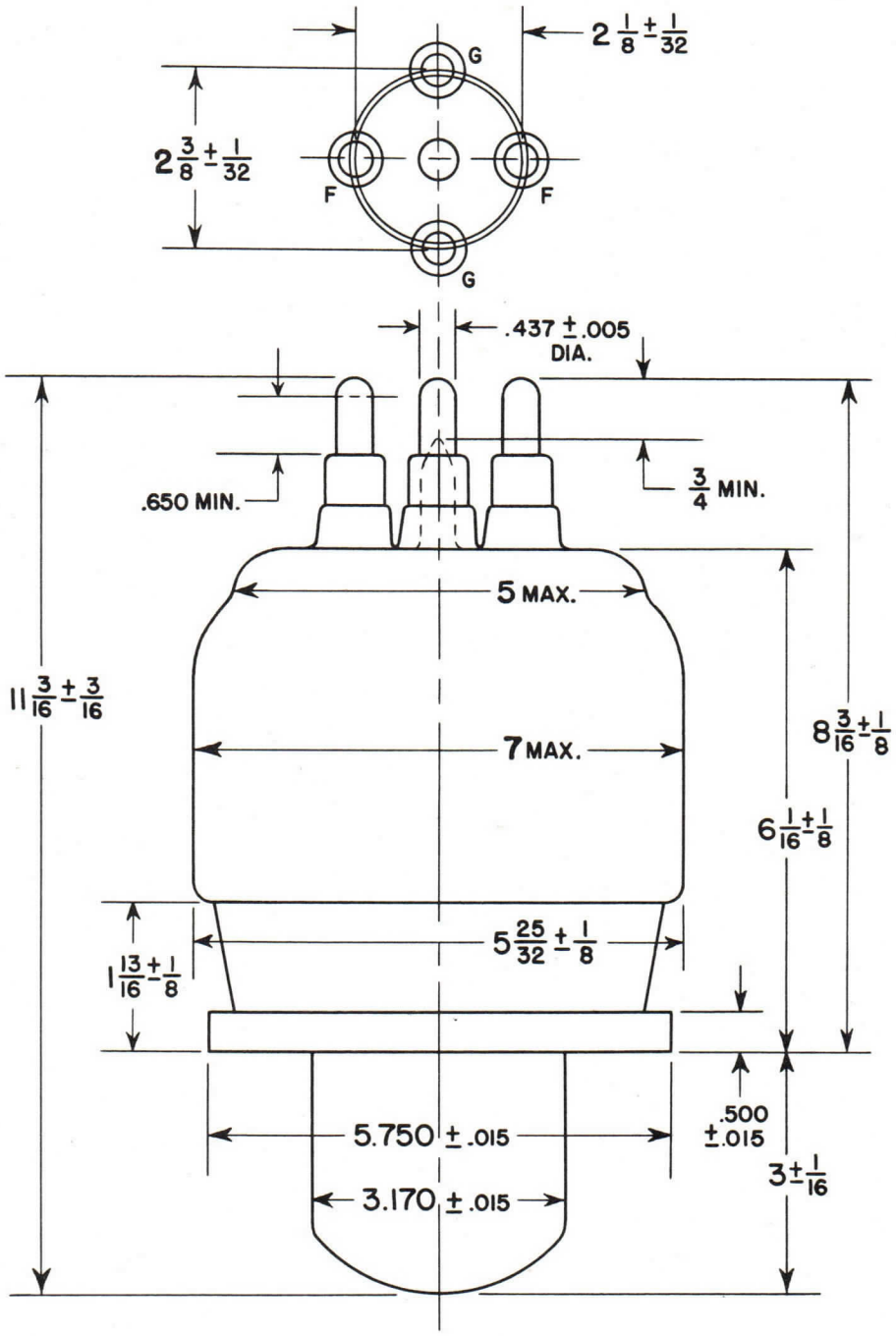
Backed by years of engineering and manufacturing experience, Federal tubes have consistently set the world's *standards of performance* in broadcast service.



AN IT&T ASSOCIATE

More than 100,000 letters requesting copies of Federal's *Handbook of Tube Operation* have been received from engineers in all parts of the world. Would *you* care for a copy?

FEDERAL POWER TRIODE
Type F-880
20 Kilowatts Plate Dissipation



OUTLINE DRAWING
F-880

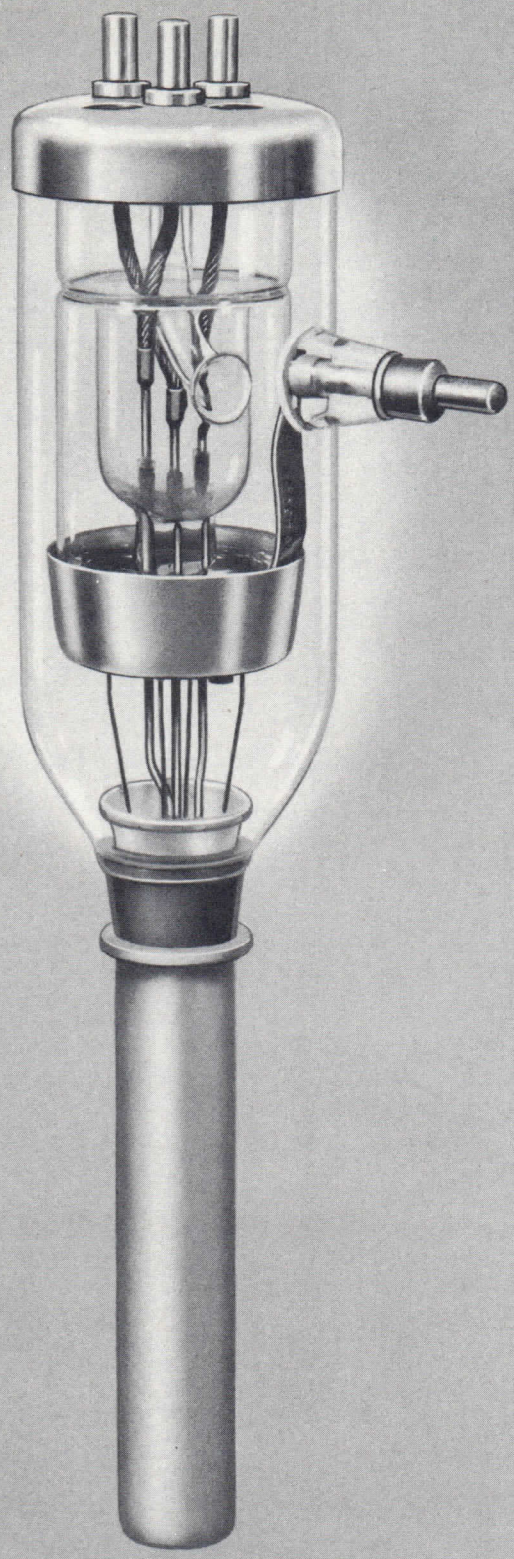
Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

An IT&T Associate

Federal Always Has
Made Better Tubes

Form FJ-415 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-891
6 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-891 is a three-electrode tube designed for use as a modulator, amplifier, and oscillator. The anode is water-cooled, capable of dissipating 6 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 1.6 megacycles, with operation up to 20 megacycles permissible at reduced ratings.

Electrical:

▶ Filament Voltage	22 Volts
▶ Filament Current	60 Amperes
▶ Filament Starting Current	120 Amperes max.
▶ Filament Cold Resistance	0.031 Ohms
▶ Peak Cathode Current	9 Amperes
▶ Amplification Factor, I_b = 0.75 amps., E_c = —500 volts	8.5
▶ Interelectrode Capacitances	
Grid-Plate	27 $\mu\mu$f
Grid-Filament	19 $\mu\mu$f
Plate-Filament	2 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, anode down	
▶ Type of Cooling—Water	
Minimum Water Flow on Anode	3 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
▶ Net Weight, approximate	3 ½ Pounds

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FEDERAL POWER TRIODE
Type F-891
6 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	1.6	7.5	20.0 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input Class C—Telegraphy	100	75	50 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	2.0 Amperes
Maximum Signal Plate Input†	20 Kilowatts
Plate Dissipation†	5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	6,000	10,000	12,500 Volts
DC Grid Voltage	—630	—1,100	—1,450 Volts
Peak A-F Grid to Grid Voltage	2,060	3,060	3,760 Volts
Zero Signal DC Plate Current	0.5	0.5	0.4 Amperes
Max. Signal DC Plate Current	2.5	2.4	2.5 Amperes
Effective Load Resistance (plate to plate)	5,000	10,000	12,000 Ohms
Max. Signal Driving Power, approx.	110	225	245 Watts
Max. Signal Power Output, approx.	8	16	22 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

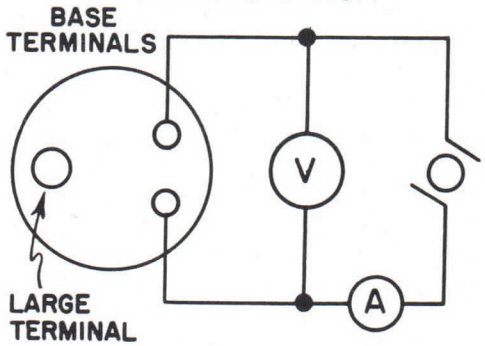
DC Plate Voltage	12,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	2.0 Amperes
DC Grid Current	0.15 Amperes
Plate Input	18 Kilowatts
Plate Dissipation	6 Kilowatts

Typical Operation

DC Plate Voltage	8,000	10,000 Volts
DC Grid Voltage	—1800	—2,000 Volts
Peak R-F Grid Voltage	2400	2,700 Volts
DC Plate Current	1.15	1.33 Amperes
DC Grid Current, approx.	0.09	0.14 Amperes
Driving Power, approx.	215	375 Watts
Power Output, approx.	6.5	10 Kilowatts

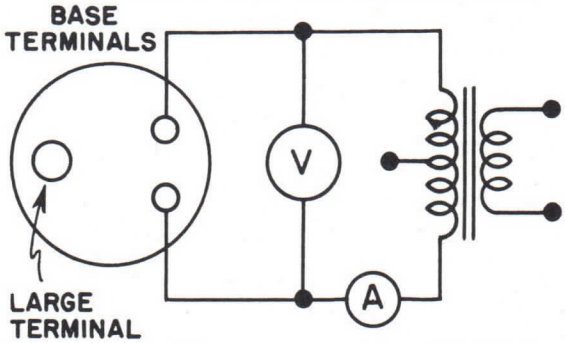
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

DC EXCITATION



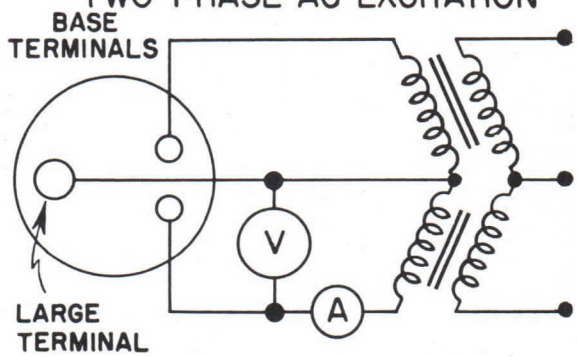
V = 22 VOLTS A = 60 AMPERES

SINGLE PHASE AC EXCITATION



V = 22 VOLTS A = 60 AMPERES

TWO PHASE AC EXCITATION



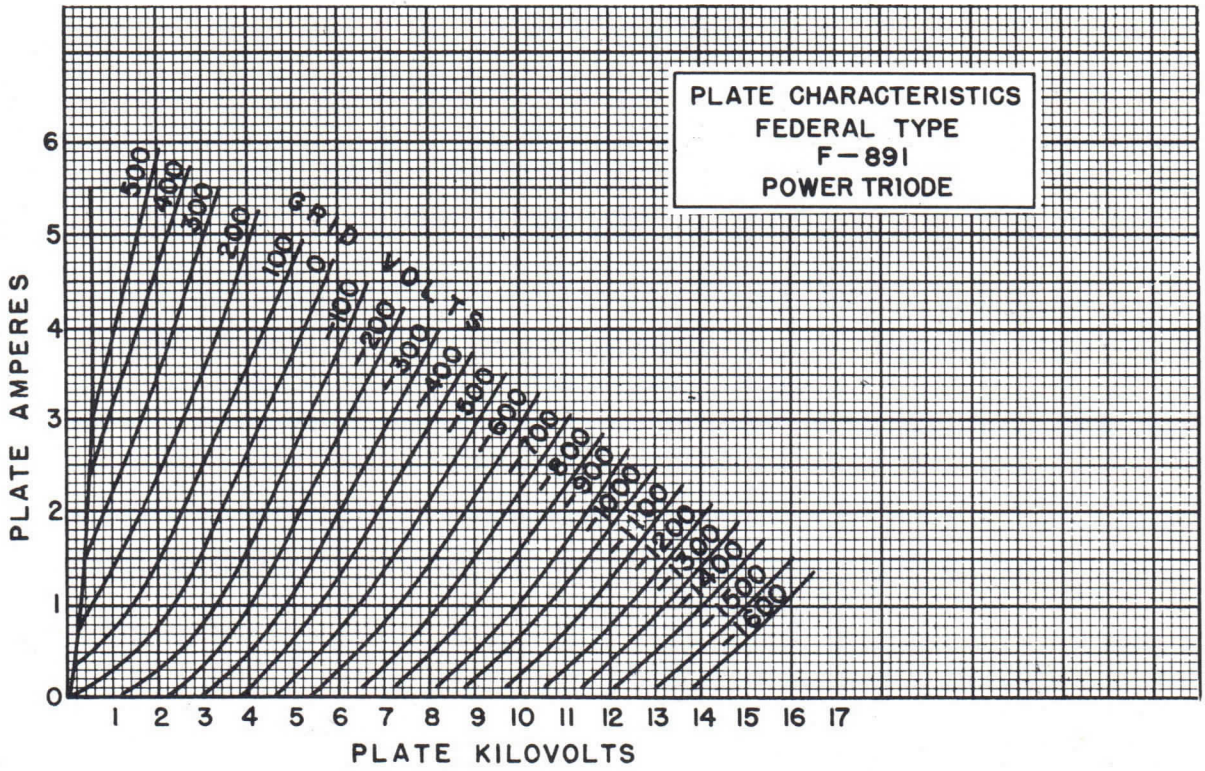
V = 11 VOLTS A = 60 AMPERES

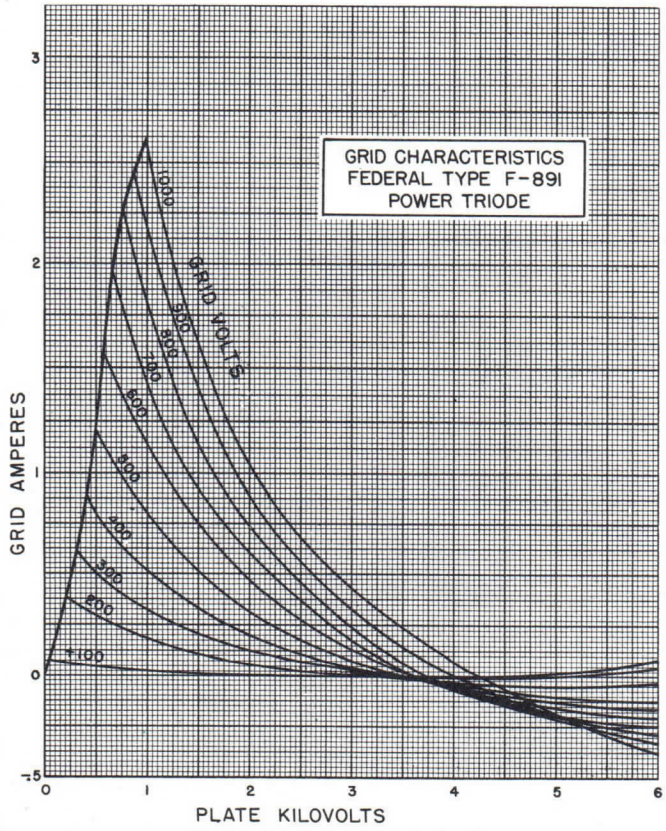
FEDERAL F—891
FILAMENT CONNECTIONS

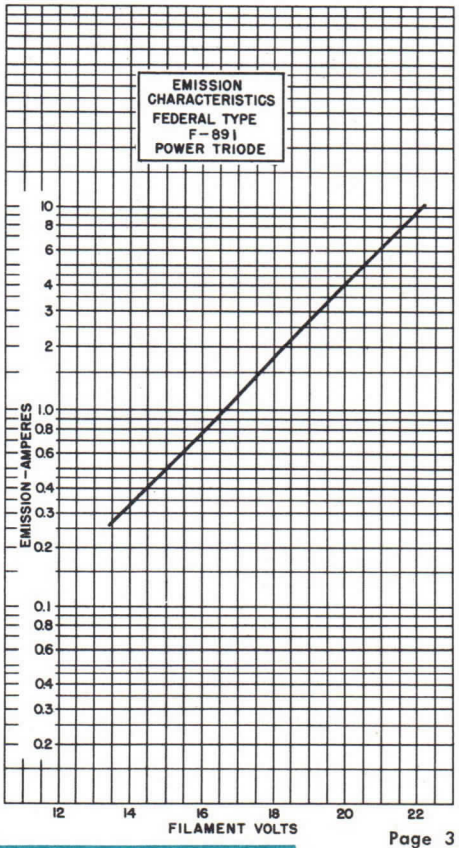
AN IT&T ASSOCIATE

Federal's tube experience goes back to the pioneer days . . . one of the oldest manufacturers in the industry.

FEDERAL POWER TRIODE
Type F-891
6 Kilowatts Plate Dissipation



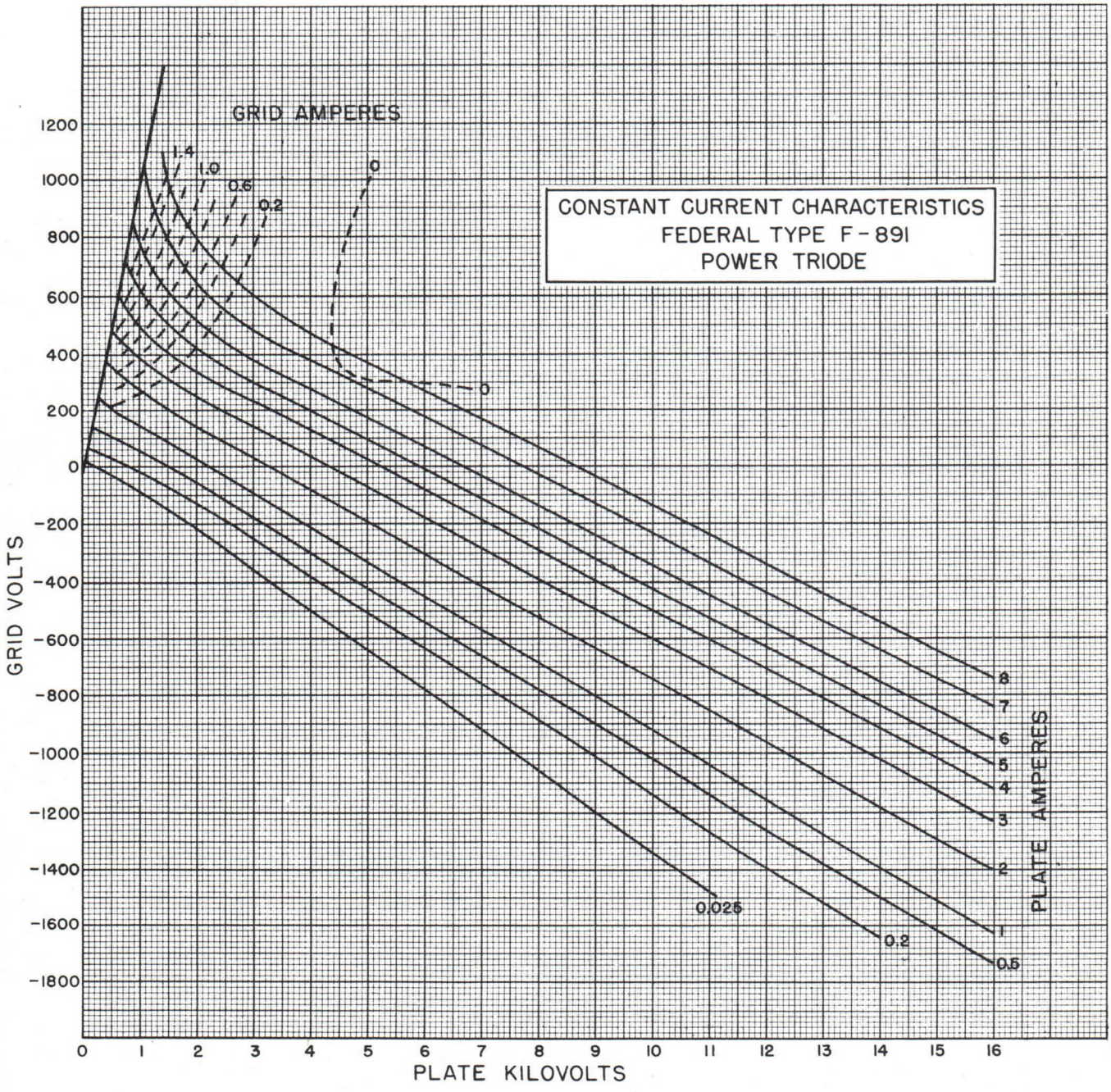




AN IT&T ASSOCIATE

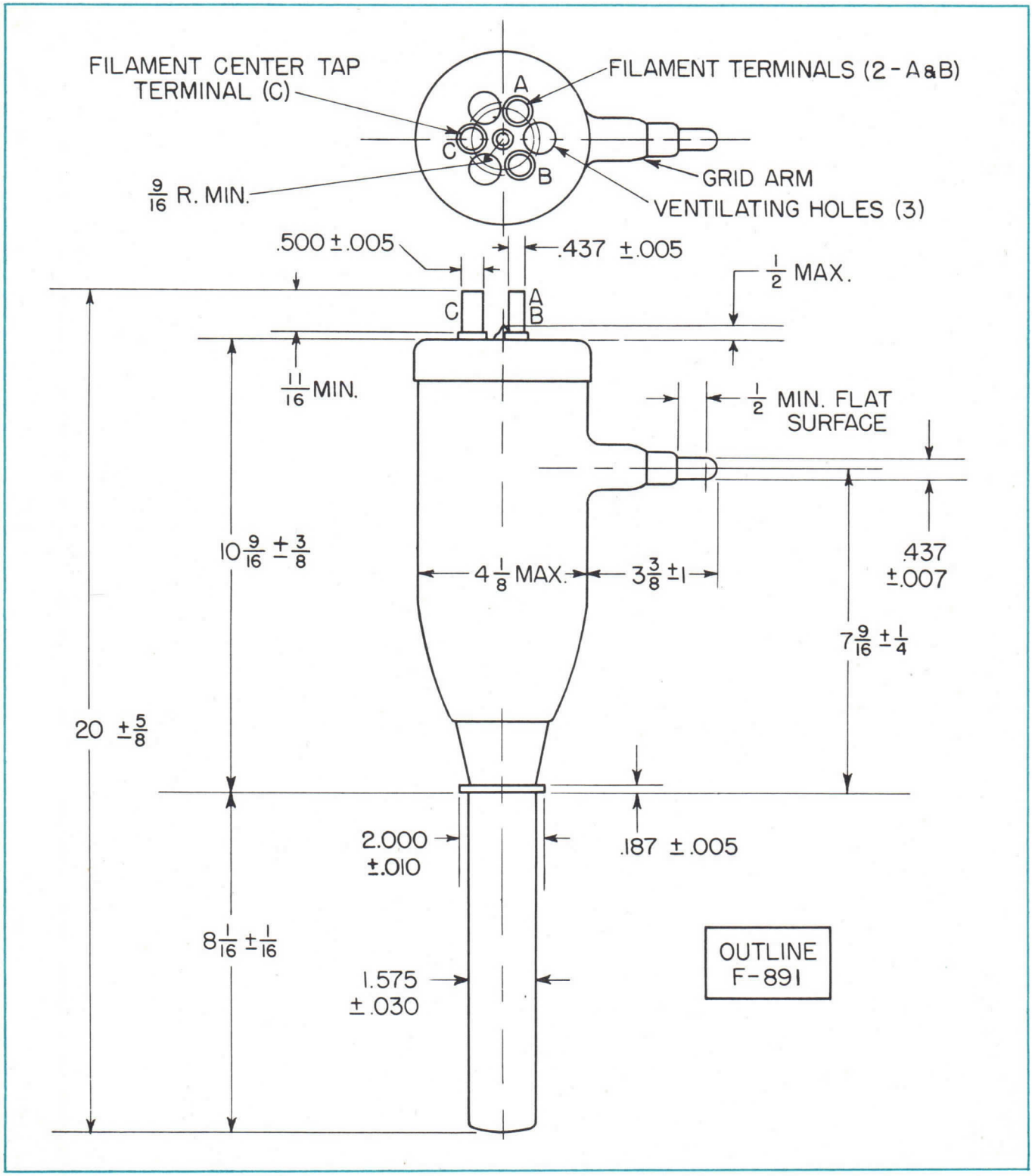
FEDERAL POWER TRIODE
Type F-891
6 Kilowatts Plate Dissipation

Federal tubes are in service around the world: Transmitting tubes, Industrial tubes, Rectifying tubes, Special Purpose tubes.



Long recognized as a maker of better tubes, Federal now leads with new production methods giving longer tube life.

FEDERAL POWER TRIODE
Type F-891
6 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

AN IT&T ASSOCIATE

Federal Always Has
Made Better Tubes

Form FJ-111. Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-891-R
4 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-891-R is a three-electrode tube engineered for use as a radio-frequency power amplifier, oscillator, and Class B modulator. The anode is forced-air-cooled, capable of dissipating 4 kilowatts. The cathode, a pure tungsten filament, is designed and built to permit operation from single-phase or two-phase alternating current, and from direct current. Maximum ratings apply up to 1.6 megacycles. Operation is permissible up to 20 megacycles at reduced ratings.

Electrical:

Filament Voltage	22 Volts
Filament Current	60 Amperes
Filament Starting Current	120 Amperes Max.
Filament Cold Resistance	.031 Ohms
Peak Cathode Current	9 Amperes
Amplification Factor, $E_c = -50$ V; $I_b = 0.45$ A	8.5
Interelectrode Capacitances	
Grid-Plate	28 $\mu\mu$f
Grid-Filament	19 $\mu\mu$f
Plate-Filament	2.5 $\mu\mu$f

Mechanical:

Mounting Position—Vertical, Anode Down			
Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation (Kilowatts)	4	3.2	2.4
Air Flow—Cubic Feet per Min.	450	380	300
Pressure—Inches Water	0.5	0.36	0.2
Maximum Glass Temperature			150° C
Max. Radiator Temperature (Measured in Well)			180° C
Net Weight, Approximate			46 Pounds

The name "Federal" always has been synonymous with *leadership* in tube development and construction.

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FEDERAL POWER TRIODE
Type F-891-R
4 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	10,000 Volts
Maximum Signal DC Plate Current†	2 Amperes
Maximum Signal Plate Input†	10.5 Kilowatts
Plate Dissipation†	3.5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	6,000	8,000 Volts
DC Grid Voltage	—630	—860 Volts
Peak A-F Grid-to-Grid Voltage	2,060	2,260 Volts
Zero Signal DC Plate Current	0.5	0.5 Amperes
Maximum Signal DC Plate Current	2.5	2.1 Amperes
Effective Load Resistance, Plate to Plate	5,000	8,000 Ohms
Maximum Signal Driving Power, Approx.	110	50 Watts
Maximum Signal Power Output, Approx.	8	10 Kilowatts

†Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	2 Amperes
DC Grid Current	0.15 Amperes
Plate Input	15 Kilowatts
Plate Dissipation	4 Kilowatts

Typical Operation

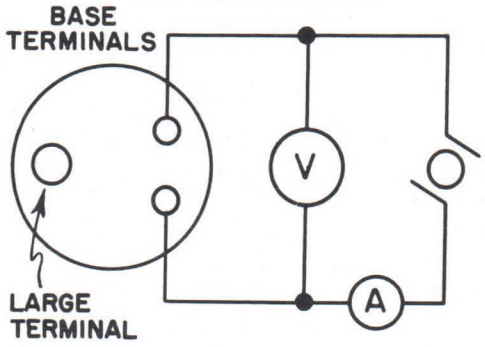
DC Plate Voltage	8,000	10,000 Volts
DC Grid Voltage	—1,800	—2,000 Volts
Peak R-F Grid Voltage	2,400	2,700 Volts
DC Plate Current	1.14	1.33 Amperes
DC Grid Current, approximate	0.09	0.14 Amperes
Driving Power, approximate	215	375 Watts
Power Output, approximate	6.5	10 Kilowatts

¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

Maximum Ratings vs. Operating Frequency

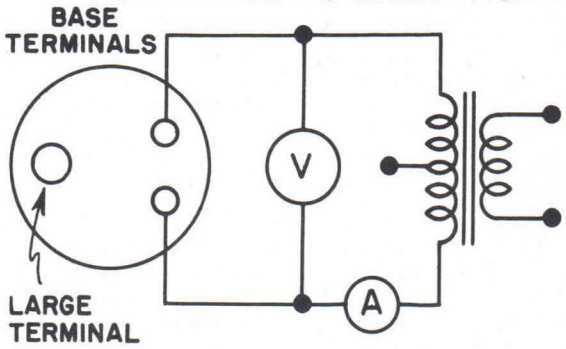
Frequency	1.6	7.5	20 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class C—Telegraphy	100	75	50 Per Cent

DC EXCITATION



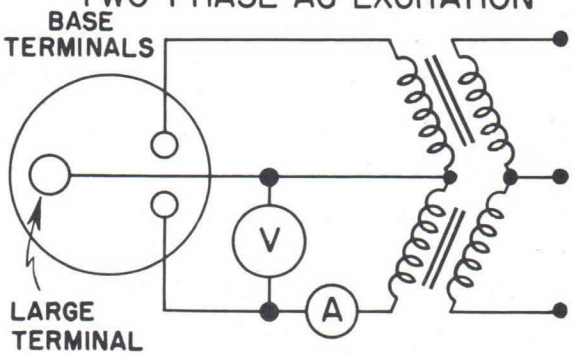
V = 22 VOLTS
A = 60 AMPERES

SINGLE PHASE AC EXCITATION



V = 22 VOLTS
A = 60 AMPERES

TWO PHASE AC EXCITATION



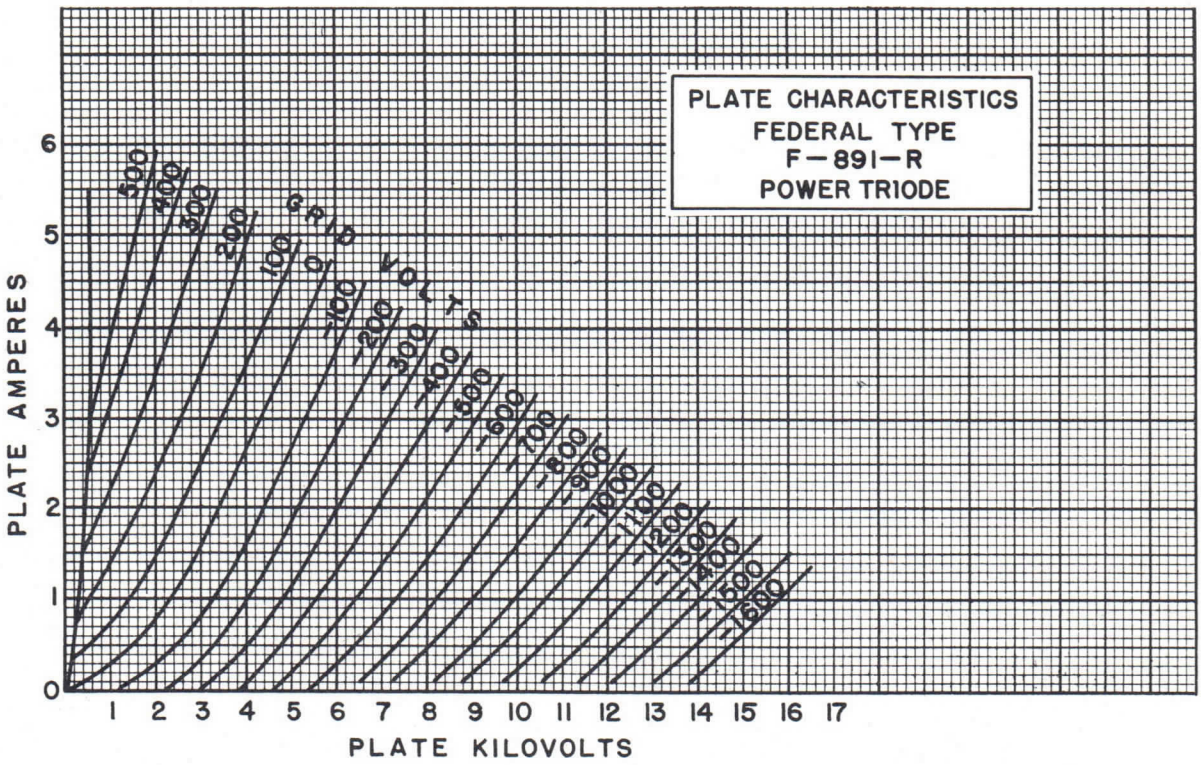
V = 11 VOLTS
A = 60 AMPERES

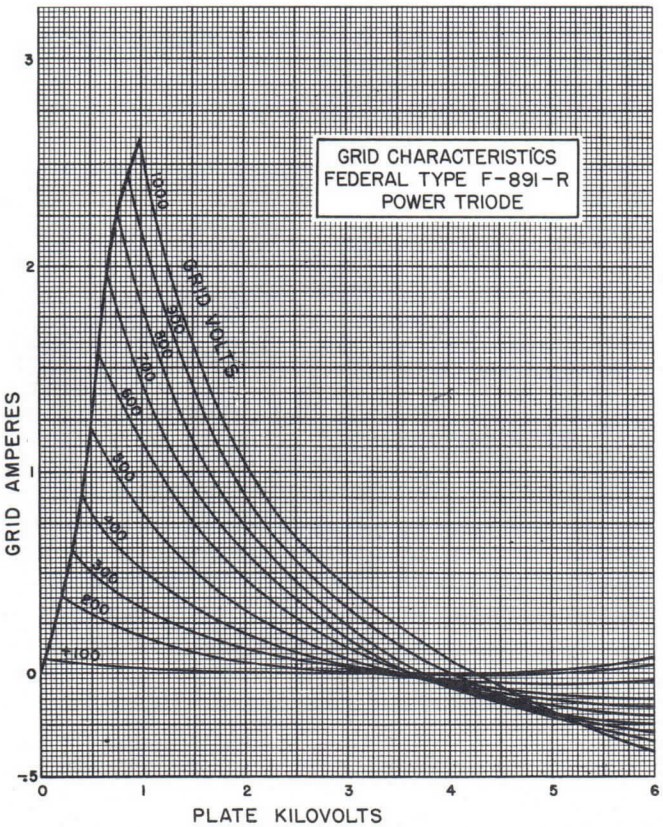
FEDERAL F—891-R
FILAMENT CONNECTIONS

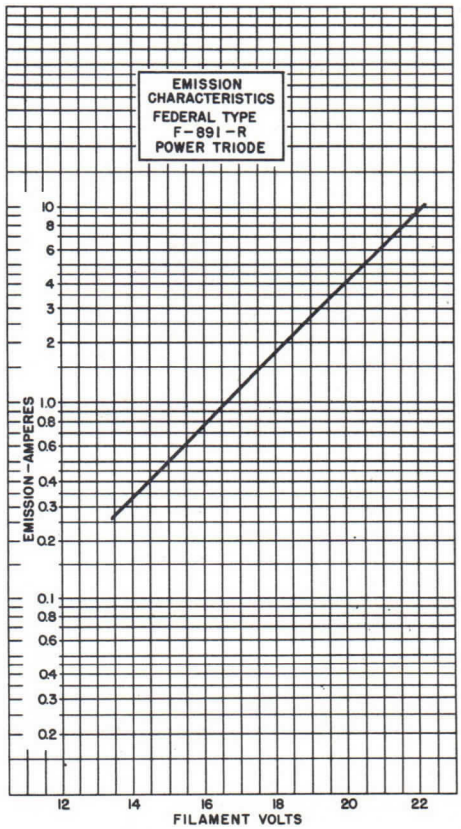
AN IT&T ASSOCIATE

As in other Federal types, the F-891-R is manufactured under the most rigid quality control, assuring continuous performance according to rating.

FEDERAL POWER TRIODE
Type F-891-R
4 Kilowatts Plate Dissipation



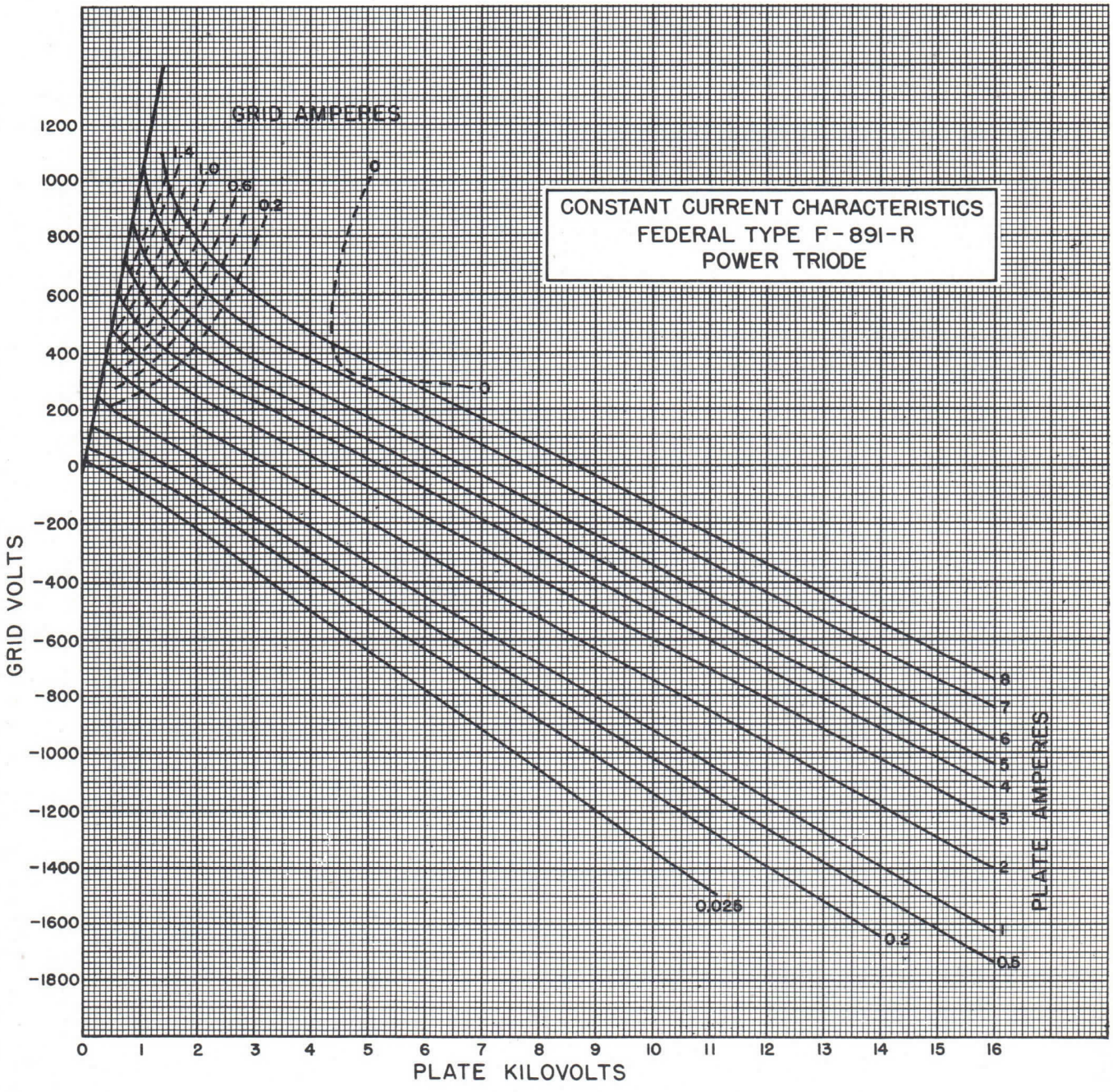




An IT&T Associate

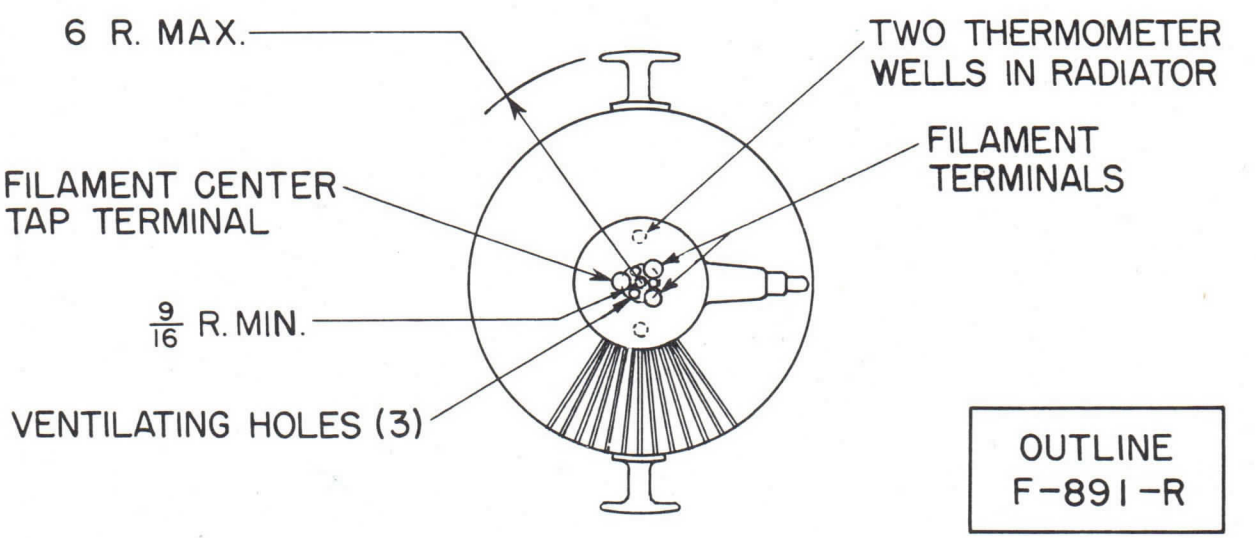
FEDERAL POWER TRIODE
Type F-891-R
4 Kilowatts Plate Dissipation

In nation-wide service as a modulator in low powered transmitters, Federal's F-891-R is proving its exceptional abilities *everywhere*, every day.

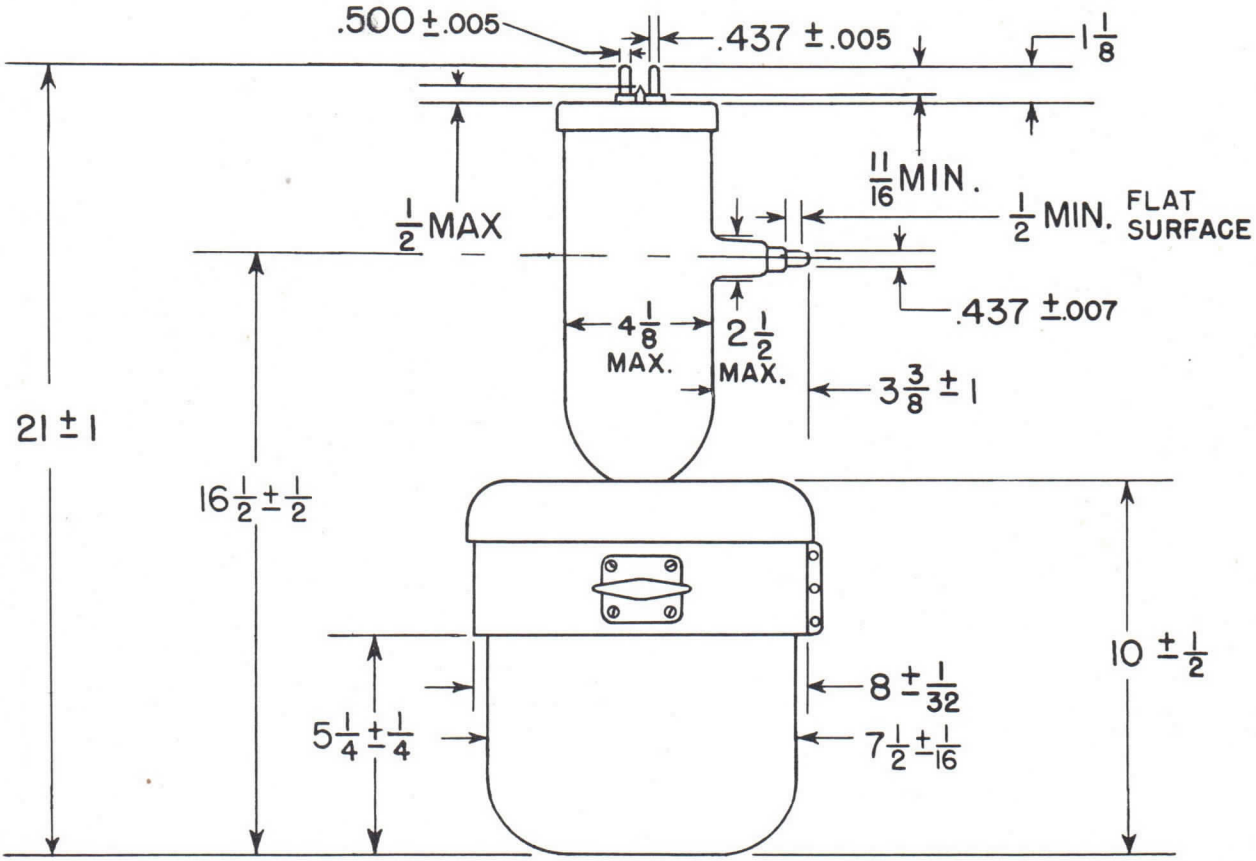


The all-round superiority of the F-891-R is due in part to the first-quality materials and components used *plus* first-rank engineering based on international experience.

FEDERAL POWER TRIODE
Type F-891-R
4 Kilowatts Plate Dissipation



OUTLINE F-891-R



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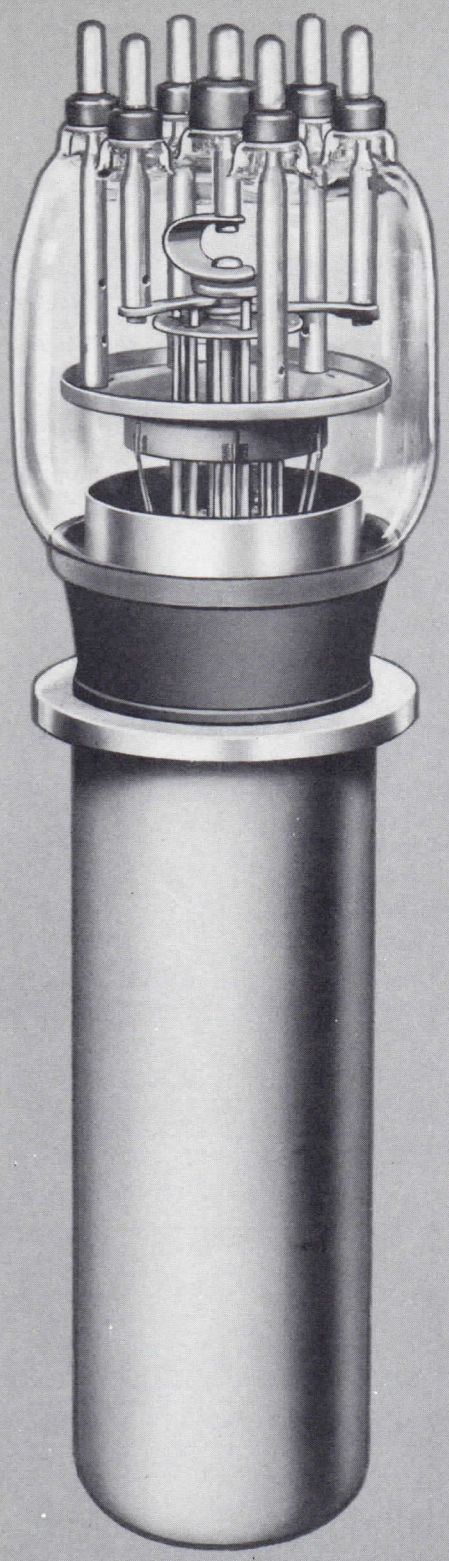
Form FJ-166. Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-895
40 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

The F-895 is a three electrode tube, designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. The anode, water-cooled, is capable of dissipating 40 kilowatts. The cathode is a pure tungsten filament, operated on three-phase, alternating current excitation. Maximum rating apply up to 6 megacycles, and operation is permissable up to 25 megacycles at reduced ratings.

Electrical:

Filament Voltage, to Neutral	19 Volts
Filament Current, per Phase	138 Amperes
Filament Starting Current	210 Amperes max.
Filament Cold Resistance	.013 Ohms
Peak Cathode Current	62 Amperes
Amplification Factor, at $E_c = -200V$ $I_b = 1.6A$	37
Interelectrode Capacitances	
Grid-Plate	40 $\mu\mu f$
Grid-Filament	80 $\mu\mu f$
Plate-Filament	8 $\mu\mu f$

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling—Water and Forced Air	
Minimum Water Flow on Anode	25 GPM.
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Air Flow on Grid and Filament Terminals	5 CFM.
Net Weight, approximate	25 Pounds

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FEDERAL POWER TRIODE
Type F-895
40 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	6	12	25 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class C—Plate Modulated	100	90	81 Per Cent
Class C—Unmodulated	100	85	70 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	17,000	Volts
Maximum Signal DC Plate Current†	9	Amperes
Maximum Signal Plate Input†	100	Kilowatts
Plate Dissipation†	40	Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000	10,000	Volts
DC Grid Voltage	—200	—200	Volts
Peak A-F Grid-to-Grid Voltage	800	1200	Volts
Zero Signal DC Plate Current	2.0	2.0	Amperes
Maximum Signal DC Plate Current	5.1	11.5	Amperes
Effective Load Resistance, Plate to Plate	3600	2100	Ohms
Maximum Signal Driving Power, approximate	75	600	Watts
Maximum Signal Power Output, approximate	30	70	Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500	Volts
DC Grid Voltage	—3,000	Volts
DC Plate Current	9	Amperes
DC Grid Current	1.5	Amperes
Plate Input	70	Kilowatts
Plate Dissipation	40	Kilowatts

Typical Operation

DC Plate Voltage	10,000	Volts
DC Grid Voltage	—1,500	Volts
Peak R-F Grid Voltage	2,000	Volts
DC Plate Current	3.35	Amperes
DC Grid Current, approximate	0.75	Amperes
Driving Power, approximate	1.3	Kilowatts
Power Output, approximate	25	Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

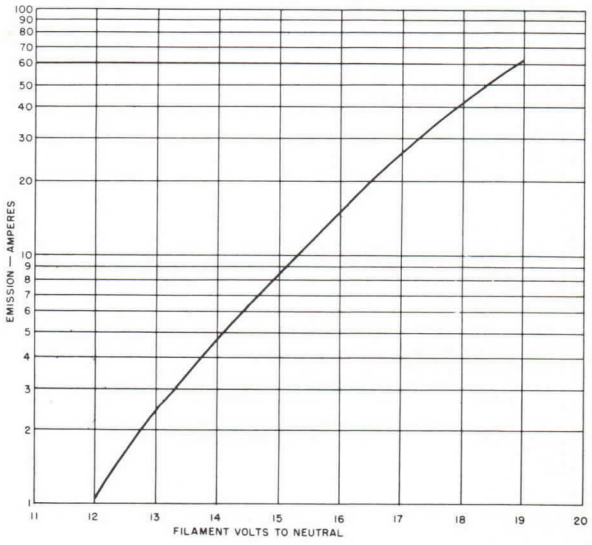
Maximum Ratings, Absolute Values

DC Plate Voltage	17,000	Volts
DC Grid Voltage	—3,000	Volts
DC Plate Current	9	Amperes
DC Grid Current	1.5	Amperes
Plate Input	140	Kilowatts
Plate Dissipation	40	Kilowatts

Typical Operation

DC Plate Voltage	10,000	17,000	Volts
DC Grid Voltage	—1,000	—1,000	Volts
Peak R-F Grid Voltage	1,700	1,700	Volts
DC Plate Current	7.15	7.5	Amperes
DC Grid Current, approximate	1.2	1	Ampere
Driving Power, approximate	1.9	1.7	Kilowatts
Power Output, approximate	50	100	Kilowatts

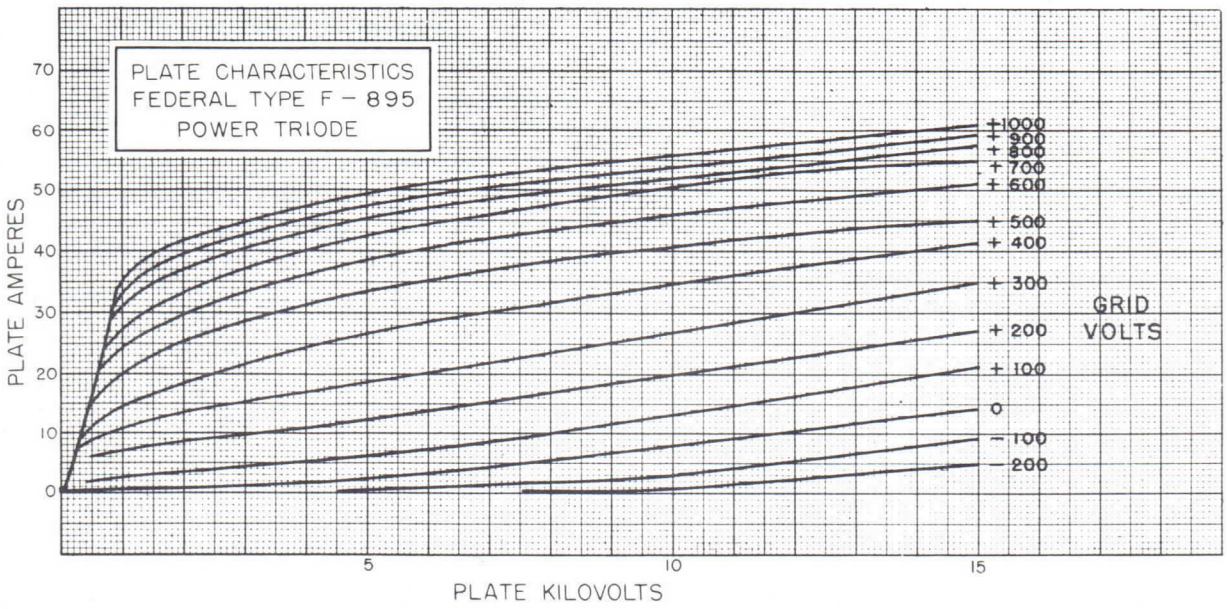
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

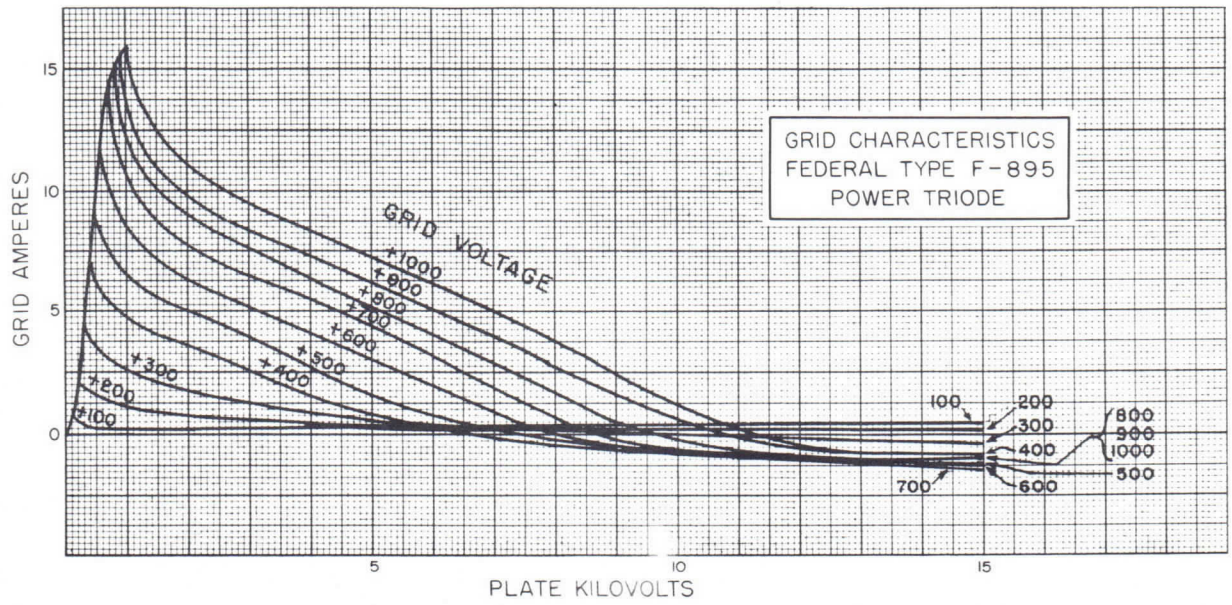


Filament Emission Characteristics
Federal Type F-895 Power Triode

Federal's engineers are ready to consult with you on the application of Federal tubes to *your* design. No obligation for consultation.

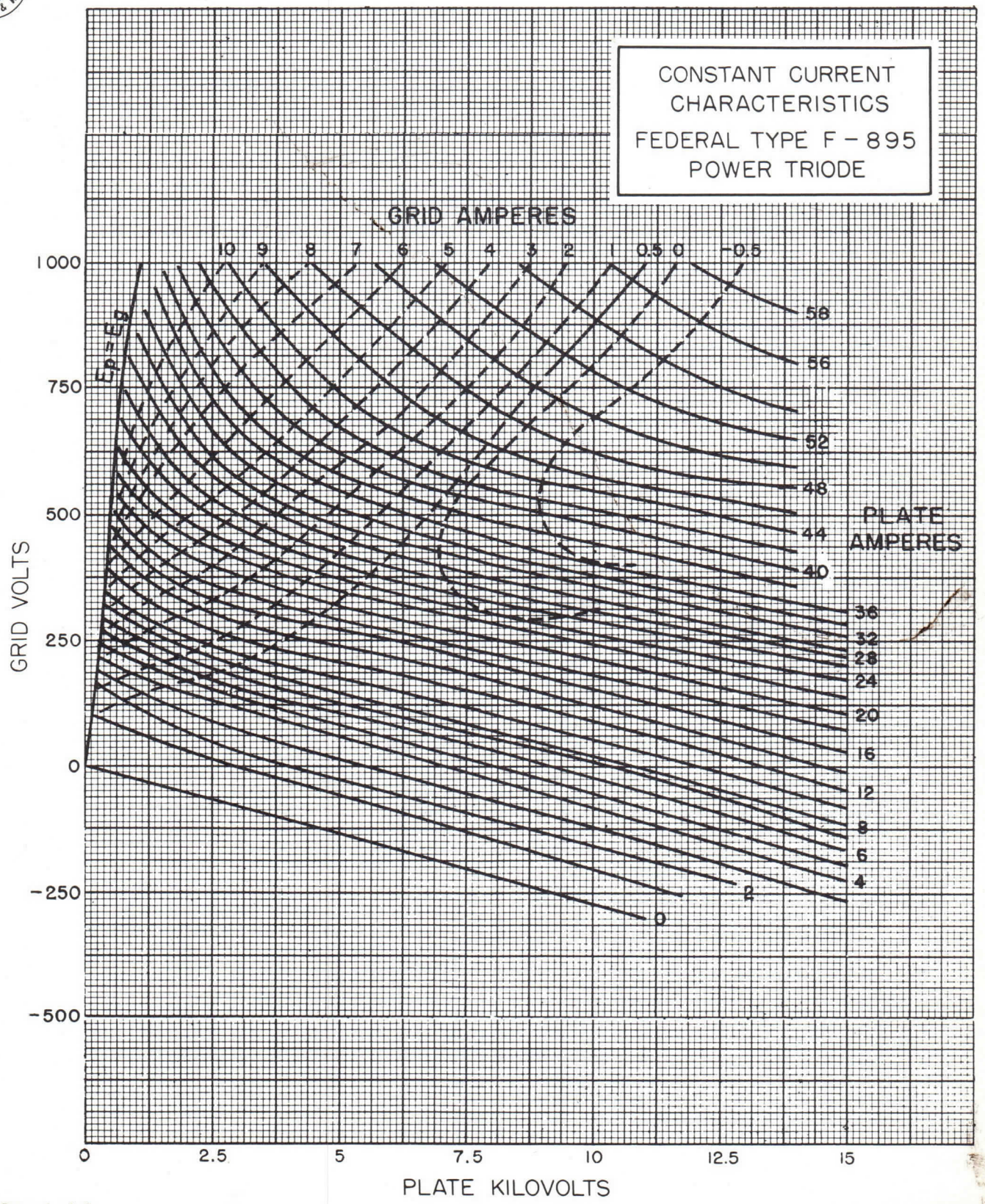
FEDERAL POWER TRIODE
Type F-895
40 Kilowatts Plate Dissipation





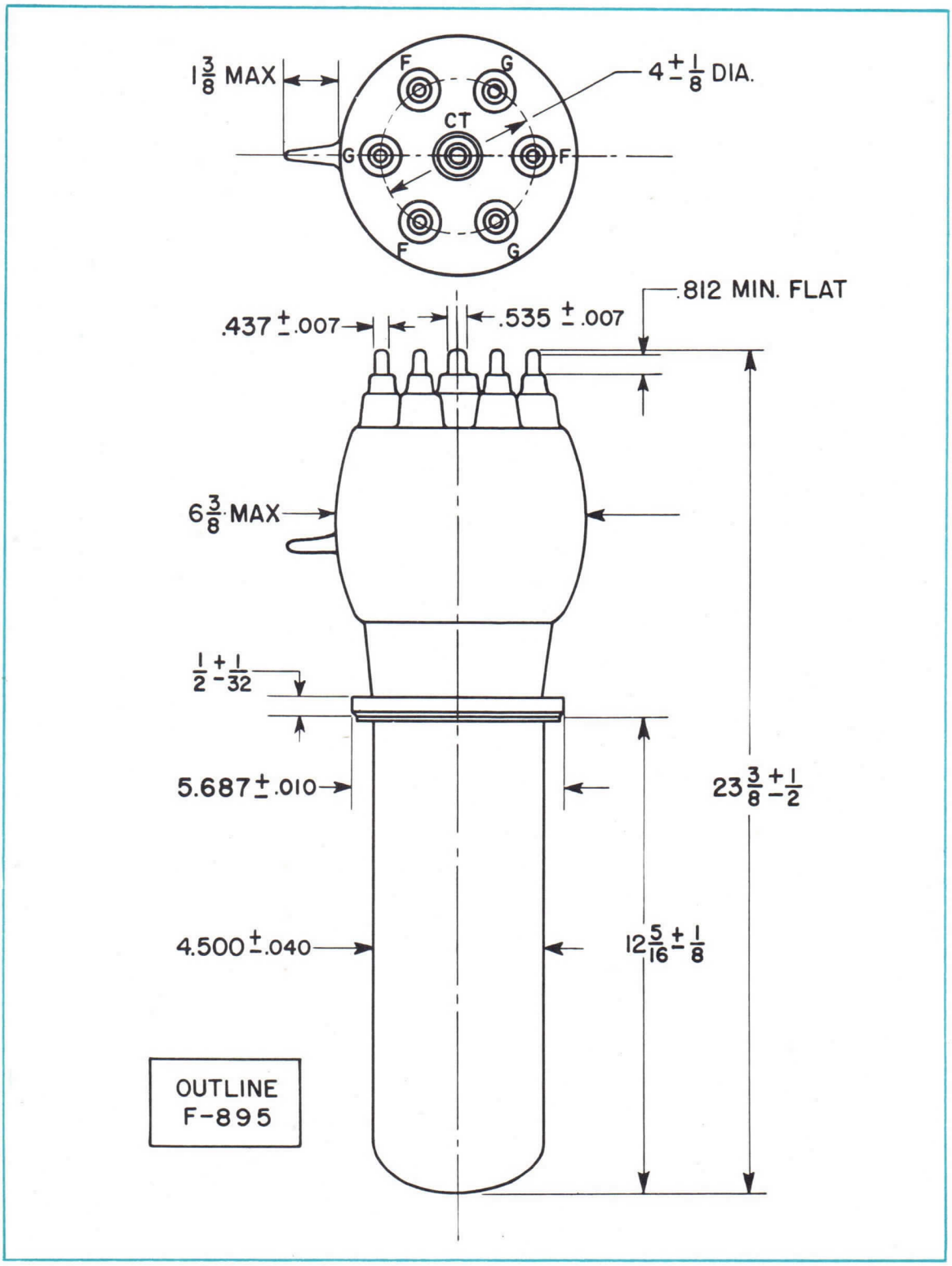
FEDERAL POWER TRIODE
Type F-895
40 Kilowatts Plate Dissipation

Federal has been distinguished for precision craftsmanship since the earliest days of tube manufacture. It's a tradition you can count on.



Federal's *Handbook of Tube Operation* offers a wealth of technical information on tubes—their characteristics, functions, applications. Write for your free copy.

FEDERAL POWER TRIODE
Type F-895
40 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

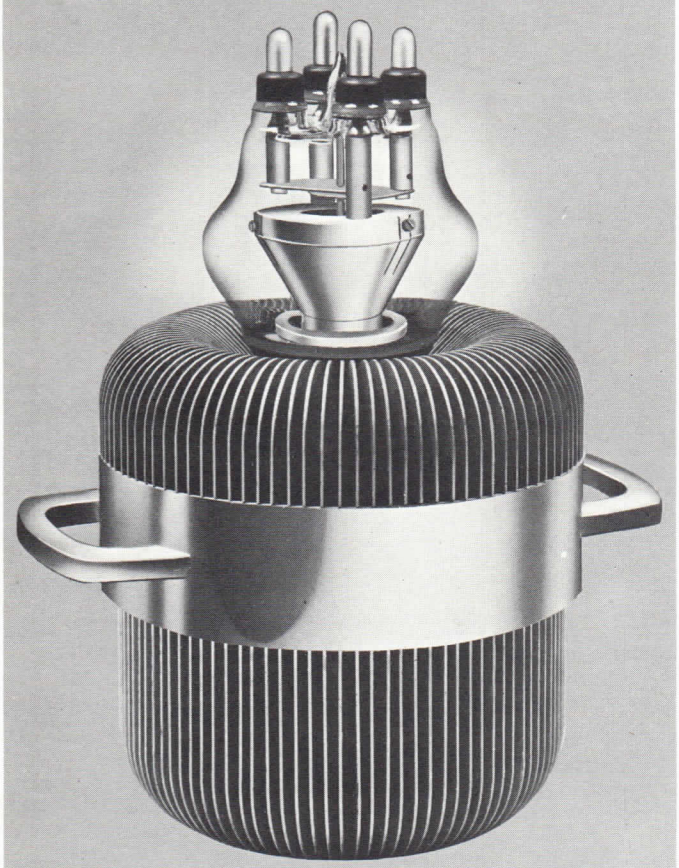
AN IT&T ASSOCIATE

When you are developing projects wherein tubes are components, consult Federal's engineers, let them advise and assist you . . . no obligation is incurred.

Over the years, hundreds of manufacturers, designers, technicians have taken advantage of this Federal service . . . with benefits both to their products and services.

Form F-511 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-5604
10 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's Type F-5604 is a three-electrode tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. It is ruggedly constructed to meet the severe conditions of radio-frequency heating service. The heavy wall anode is forced-air cooled, capable of dissipating 10 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 22.5 megacycles. Operation at 45 megacycles is permissible with plate voltage and input reduced to one-half maximum ratings.

Electrical:

Filament Voltage	11.0 Volts
Filament Current	176 Amperes
Filament Starting Current	270 Amperes max.
Peak Cathode Current	12.4 Amperes
Filament Cold Resistance	.0052 Ohms
Amplification Factor, I_b=1.25 Amp.; E_c=—100 Volts	19.5
Interelectrode Capacitances	
Grid-Plate	25 $\mu\mu$f
Grid-Filament	30 $\mu\mu$f
Plate-Filament	1.25 $\mu\mu$f

Mechanical:

Mounting Position—Vertical, Anode Down			
Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation—Kilowatts	10	8	6
Air Flow—CFM	750	525	350
Static Pressure—Inches Water	2	1	0.45
Maximum Anode Temperature			230° C
Required Air Flow on Bulb*			50 CFM
Maximum Glass Temperature			160° C
Net Weight, approx.			45 Pounds

*Operation at frequencies above 15 Mc/sec. may require air-flow on the dish center in order to hold the temperature of the seals and dish below 160° C. This flow may be obtained by deflection of the anode cooling air, or by means of a separate blower supplying 50 C.F.M. through a 3" nozzle.

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FEDERAL POWER TRIODE
Type F-5604
10 Kilowatts Plate Dissipation

Federal tubes have always been known for their *plus values*: an extra rugged construction, a longer life of service.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings

DC Plate Voltage	12,500 Volts
Max. Signal DC Plate Current**	2.75 Amperes
Max. Signal Plate Input**	32.5 Kilowatts
Plate Dissipation**	10 Kilowatts

Typical Operation

(Unless otherwise specified, values are for 2 tubes)

D C Plate Voltage	12,000 Volts
DC Grid Voltage	—600 Volts
Peak A-F Grid to Grid Voltage	2,380 Volts
Zero Signal DC Plate Current	0.6 Amperes
Maximum Signal DC Plate Current	4.5 Amperes
Effective Load Resistance (plate to plate)	5,900 Ohms
Maximum Signal Driving Power, approx.	160 Watts
Maximum Signal Power Output, approx.	36 Kilowatts

**Averaged over any audio-frequency cycle of a sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER —CLASS B TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	12,500 Volts
DC Plate Current	1.4 Amperes
Plate Input	16 Kilowatts
Plate Dissipation	10 Kilowatts

Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—500 Volts
Peak R-F Grid Voltage	490 Volts
DC Plate Current	0.8 Ampere
Driving Power, approx.†	70 Watts
Power Output, approx.	2.8 Kilowatts

†At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	10,500 Volts
DC Grid Voltage	—2,000 Volts
DC Plate Current	1.5 Amperes
DC Grid Current	0.45 Ampere
Plate Input	15 Kilowatts
Plate Dissipation	6.6 Kilowatts

Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,300 Volts
Peak R-F Grid Voltage	1,930 Volts
DC Plate Current	1.4 Amperes
DC Grid Current, approx.	0.15 Ampere
Driving Power, approx.	280 Watts
Power Output, approx.	11.9 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation¶

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
DC Grid Voltage	—2,000 Volts
DC Plate Current	3 Amperes
DC Grid Current	0.45 Ampere
Plate Input	32.5 Kilowatts
Plate Dissipation	10 Kilowatts

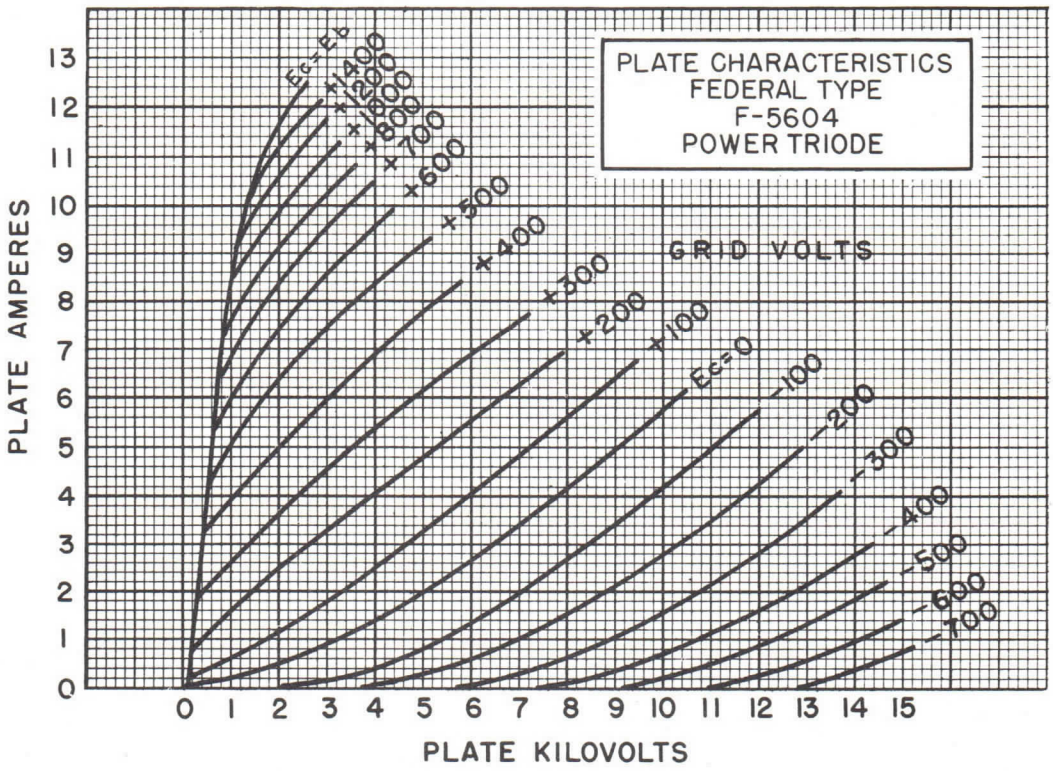
Typical Operation

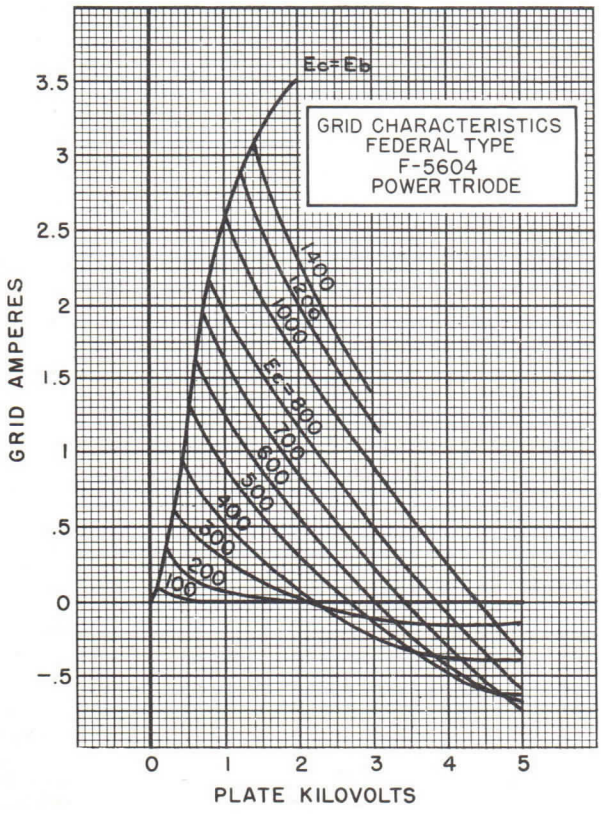
DC Plate Voltage	8,000	10,000	12,000 Volts
Filament Voltage	10.5	10.7	10.9 Volts
DC Grid Voltage	—680	—870	—1,170 Volts
Peak R-F Grid Voltage	1,300	1,620	2,130 Volts
DC Plate Current	1.5	2.0	2.5 Amperes
DC Grid Current, approx.	.19	.20	.22 Ampere
Driving Power, approx.	250	320	470 Watts
Power Output, approx.	9.2	15	22.5 Kilowatts

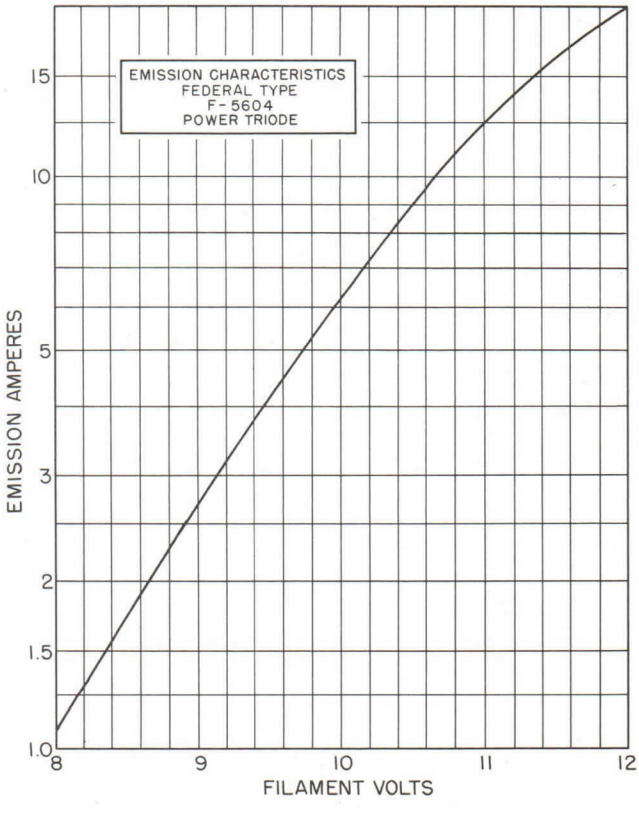
¶Modulation essentially negative; may be used if positive peak of the envelope does not exceed 115 percent of carrier conditions.

Federal's name on a tube signifies the best in design, engineering, materials, components and craftsmanship.

FEDERAL POWER TRIODE
Type F-5604
10 Kilowatts Plate Dissipation

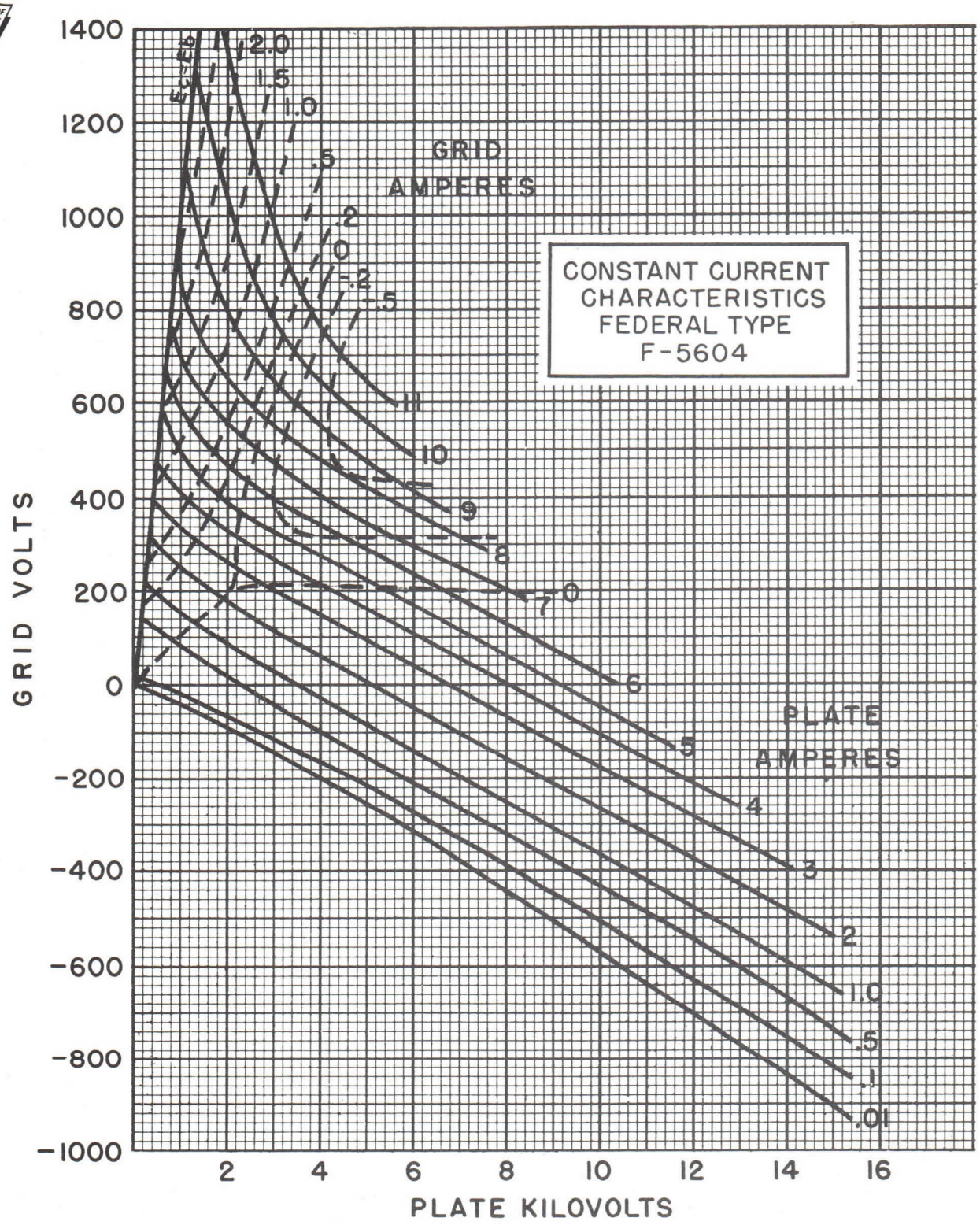






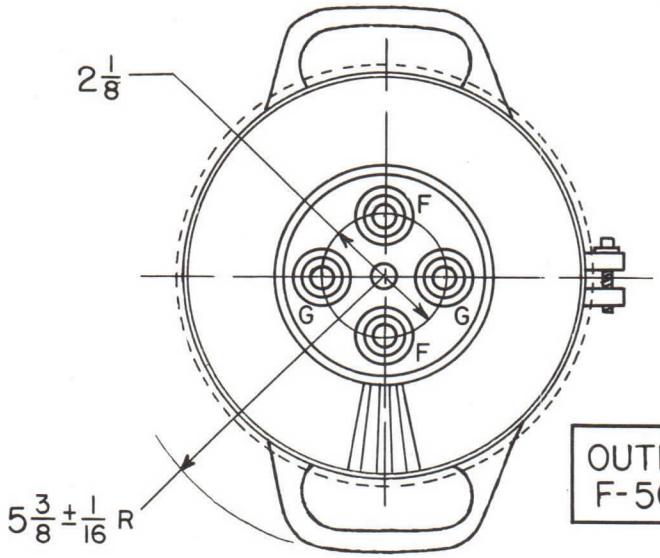
FEDERAL POWER TRIODE
Type F-5604
10 Kilowatts Plate Dissipation

One reason why Federal tubes are trade-marked, is to show the craftsman's pride and Federal's satisfaction in work well done.

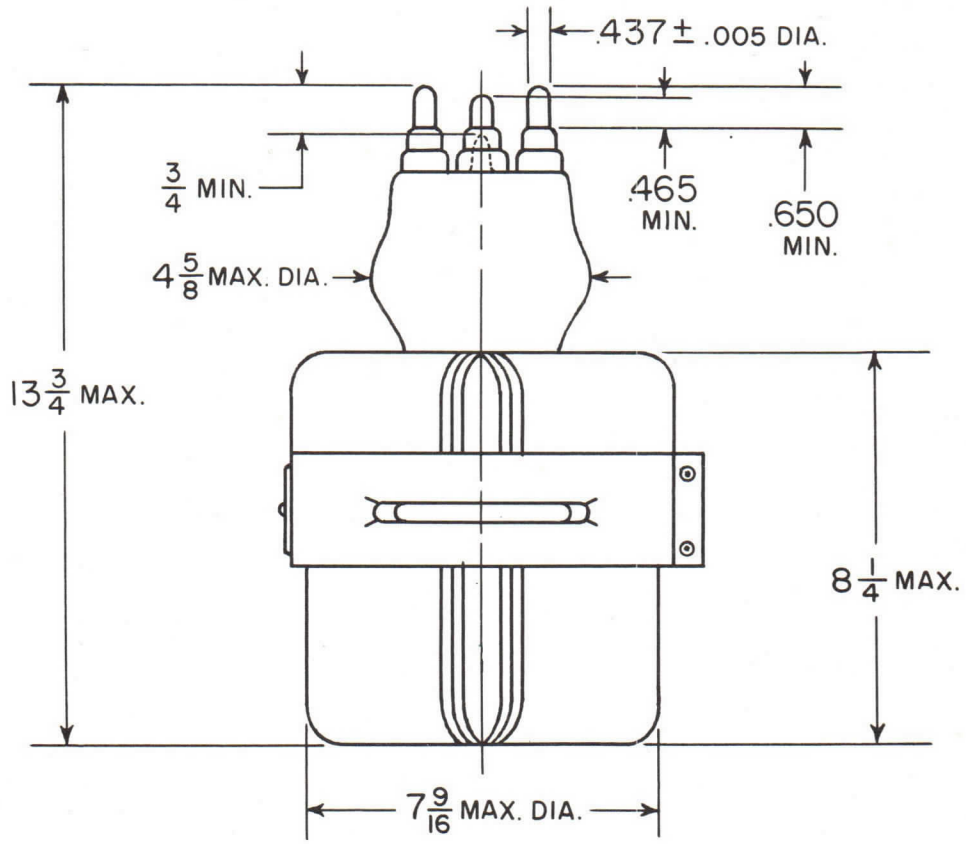


That Federal tubes, by their performance, largely sell themselves, is a tribute to the product and to the manufacturer.

FEDERAL POWER TRIODE
Type F-5604
10 Kilowatts Plate Dissipation



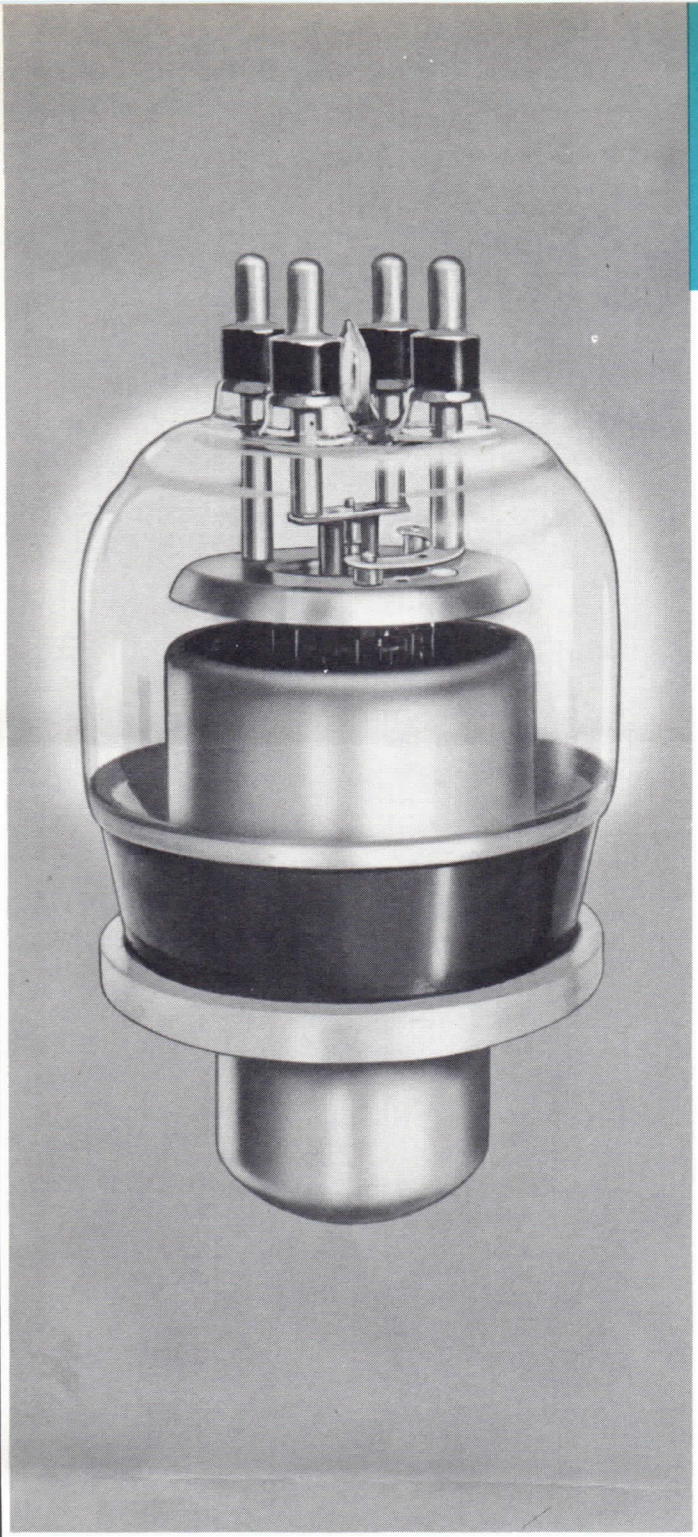
OUTLINE
F-5604



Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

Federal Always Has
Made Better Tubes

Form F-629 Printed in U. S. A.



FEDERAL POWER TRIODE
Type F-5658
20 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-5658 is a three-electrode tube built for use as a radio-frequency amplifier, oscillator, or a Class B modulator. The anode is water-cooled, capable of dissipating 20 kilowatts. The cathode is a pure tungsten filament. The design of the terminal mount connections and the re-entrant anode minimize lead inductance, make the tube particularly suitable for high-frequency applications up to 15 megacycles at full ratings, 45 megacycles at reduced ratings.

Electrical:

Filament Voltage	12 Volts
Filament Current	290 Amperes
Filament Starting Current	450 Amperes max.
Filament Cold Resistance	.0036 Ohms
Amplification Factor, at I_b = 2.0 amps., E_c = — 100 volts	20.5
Interelectrode Capacitances	
Grid-Plate	24 $\mu\mu$f
Grid-Filament	39 $\mu\mu$f
Plate-Filament	2 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling— Water and Forced Air	
Water Flow on Anode	15 GPM
Maximum Outgoing Water Temperature	70° C
Air Flow (to bulb and seals) from a 3-inch diameter nozzle	50 CFM
Maximum Glass Temperature	160° C
Net Weight, approximate	7 Pounds

In the development and production of vacuum tubes Federal carries on extensive laboratory experimentation: new techniques, new processes, new applications.

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FEDERAL POWER TRIODE
Type F-5658
20 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	15	30	45 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class C—Unmodulated	100	75	50 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	40 Kilowatts
Plate Dissipation†	15 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	7,500	10,000 Volts
DC Grid Voltage	—340	—450 Volts
Peak A-F Grid-to-Grid Voltage	1,450	1,680 Volts
Zero Signal DC Plate Current	1.0	1.0 Amperes
Maximum Signal DC Plate Current	6.7	7.0 Amperes
Effective Load Resistance, Plate to Plate	2,300	3,100 Ohms
Maximum Signal Driving Power, Approx.	490	540 Watts
Maximum Signal Power Output, Approx.	31.5	46 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
DC Plate Current	4 Amperes
Plate Input	32 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

DC Plate Voltage	7,500	10,000 Volts
DC Grid Voltage	—340	—460 Volts
Peak R-F Grid Voltage	570	595 Volts
DC Plate Current	3.3	2.75 Amperes
DC Grid Current, approximate	.013	.009 Amperes
Driving Power, approximate‡	1,250	900 Watts
Power Output, approximate	8	9 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	10,500 Volts
DC Grid Voltage	—1,600 Volts
DC Plate Current	3.6 Amperes
DC Grid Current	0.8 Amperes
Plate Input	36 Kilowatts
Plate Dissipation	12 Kilowatts

Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,200 Volts
Peak R-F Grid Voltage	1,840 Volts
DC Plate Current	3.6 Amperes
DC Grid Current, approximate	0.64 Amperes
Driving Power, approximate	1,100 Watts
Power Output, approximate	27 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
DC Grid Voltage	—1,600 Volts
DC Plate Current	5.0 Amperes
DC Grid Current	0.8 Amperes
Plate Input	60 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

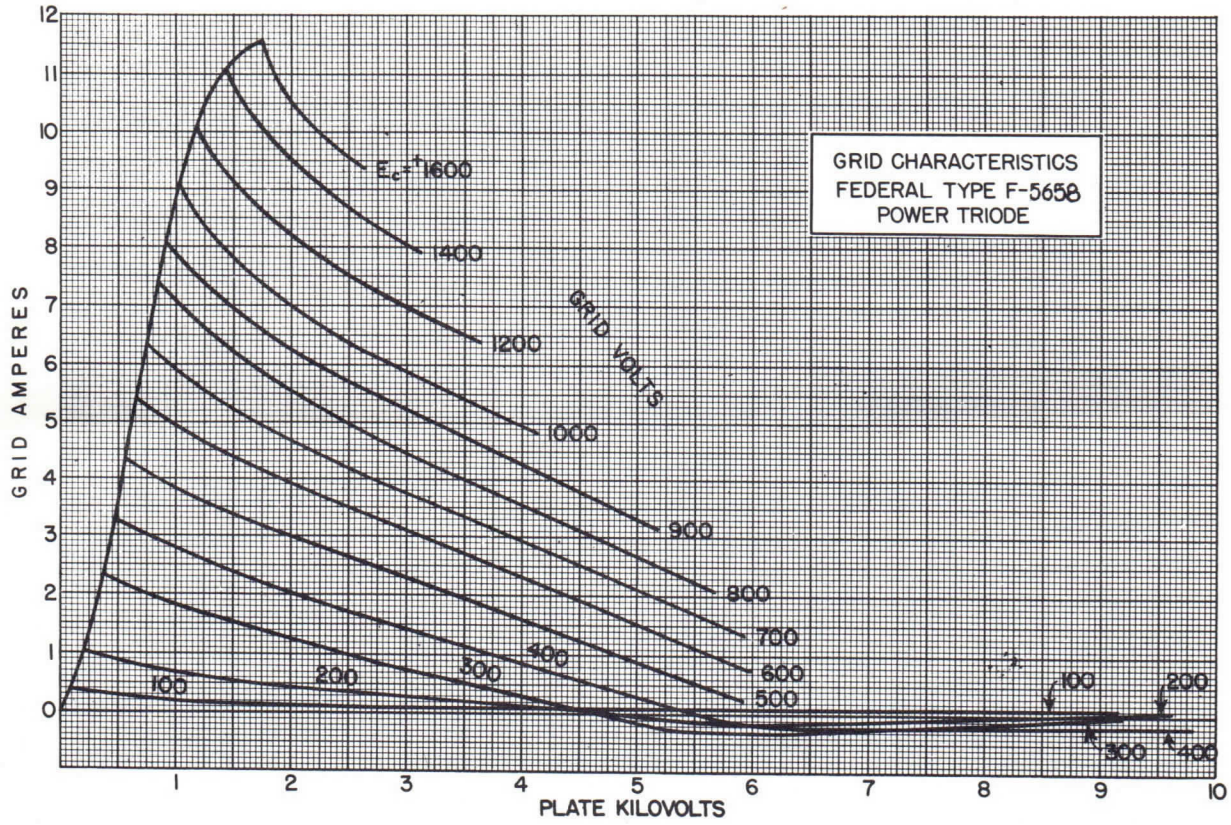
DC Plate Voltage	10,000	12,000 Volts
DC Grid Voltage	—710	—870 Volts
Peak R-F Grid Voltage	1,230	1,460 Volts
DC Plate Current	3.8	4.5 Amperes
DC Grid Current, approximate	0.5	0.55 Amperes
Driving Power, approximate	600	800 Watts
Power Output, approximate	28	40 Kilowatts

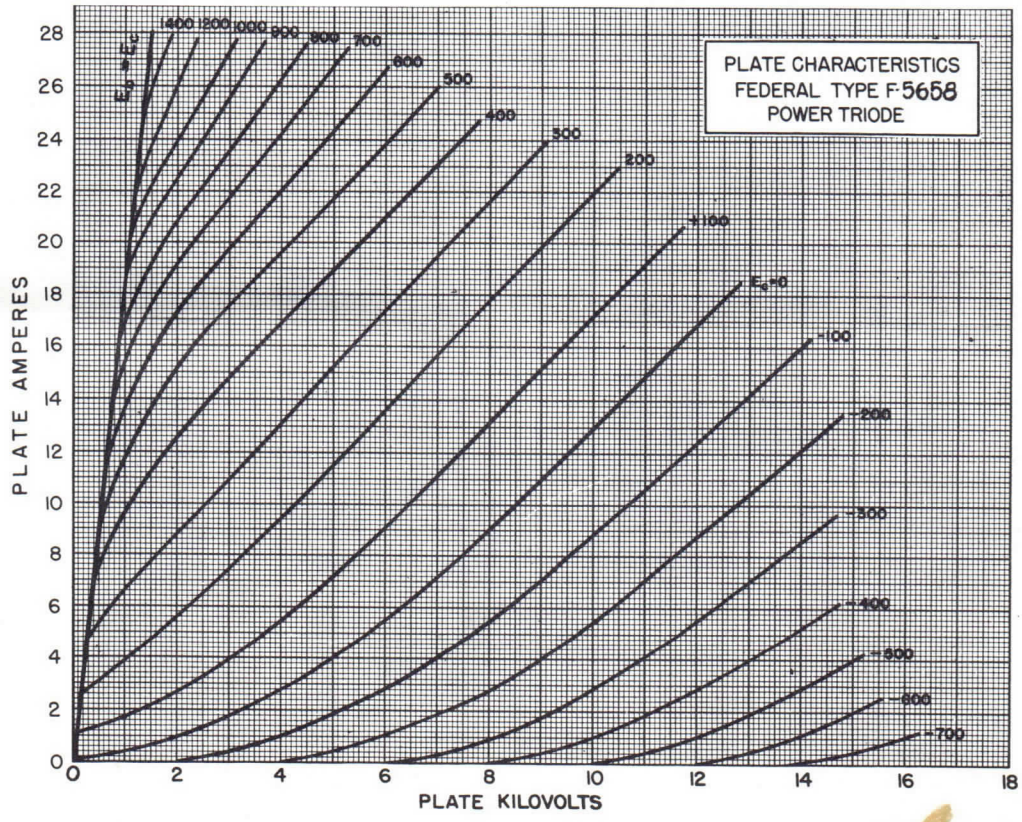
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

An IT&T Associate

FEDERAL POWER TRIODE
Type F-5658
20 Kilowatts Plate Dissipation

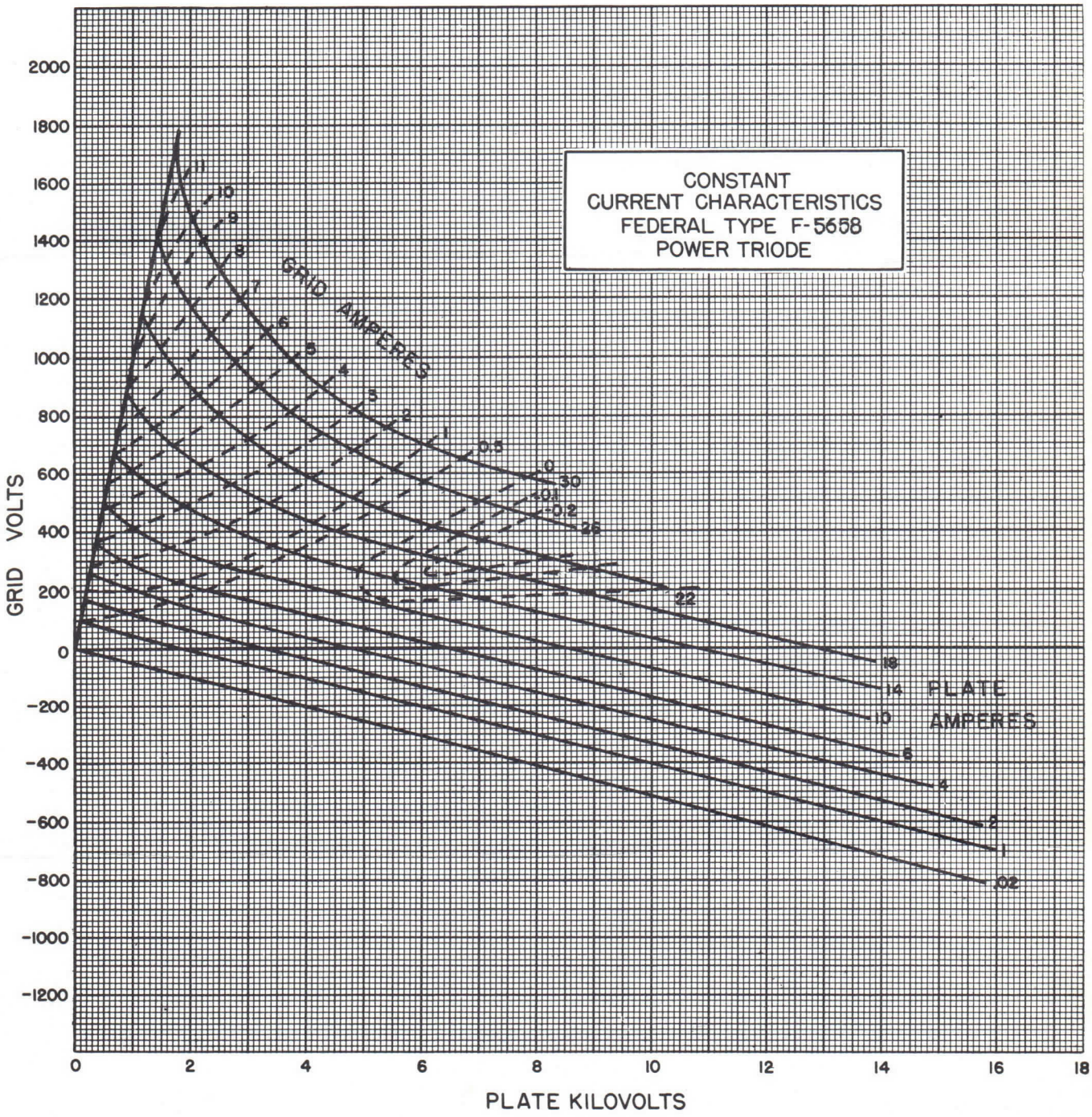
To satisfy the demand of industrial heating services, Federal's F-5658 uses rugged Kovar grid and filament seals.





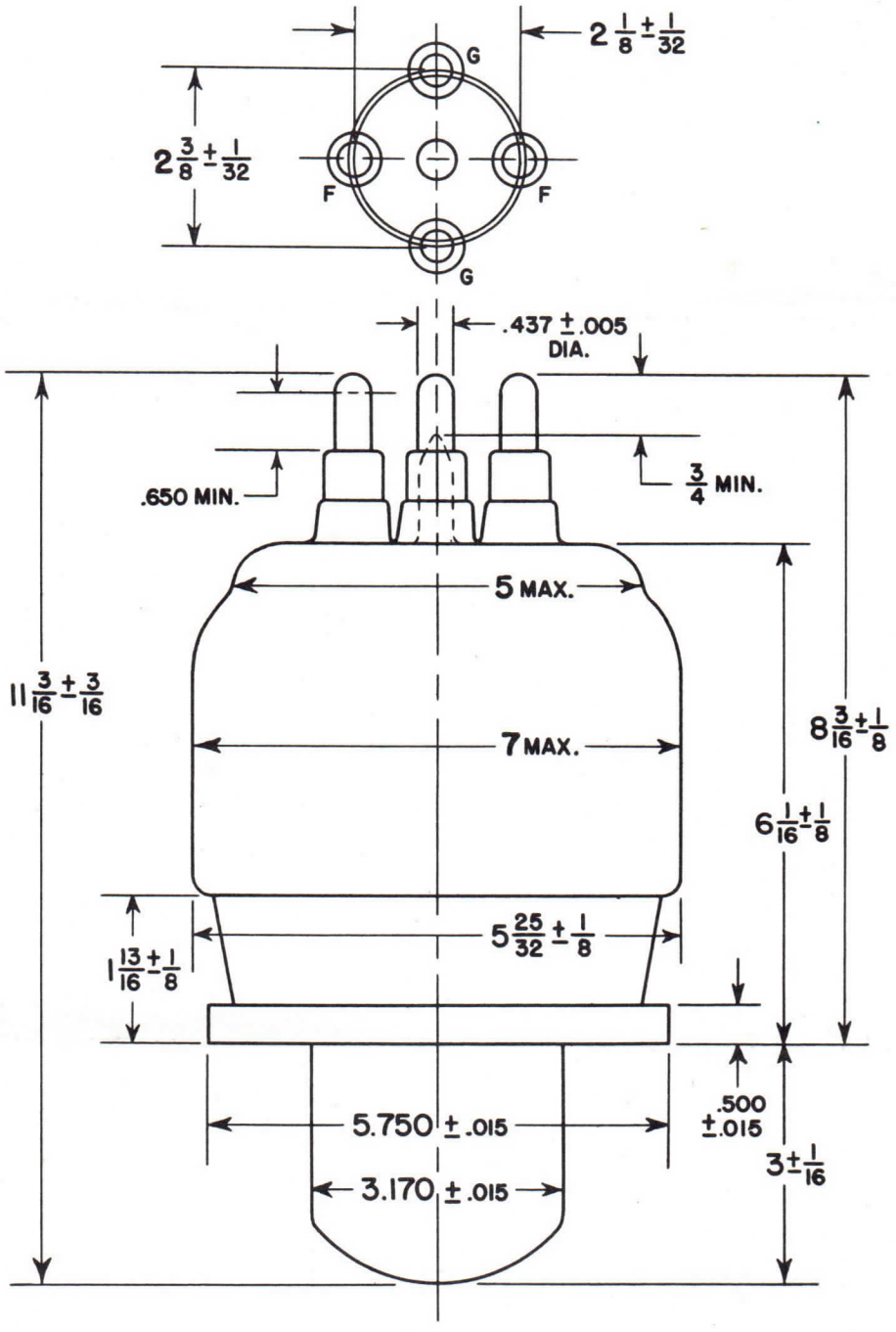
FEDERAL POWER TRIODE
Type F-5658
20 Kilowatts Plate Dissipation

Backed by years of engineering and manufacturing experience, Federal tubes have consistently set the world's *standards of performance* in broadcast service.



More than 100,000 letters requesting copies of Federal's *Handbook of Tube Operation* have been received from engineers in all parts of the world. Would you care for a copy?

FEDERAL POWER TRIODE
Type F-5658
20 Kilowatts Plate Dissipation



OUTLINE DRAWING
F-5658

Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

Federal Always Has
Made Better Tubes

Form FJ-528 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-5666
12.5 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

The F-5666 by Federal is a three-electrode tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. It is ruggedly constructed to meet the severe conditions of radio-frequency heating service. This special feature contributes to a better performance when the F-5666 is used to replace the Type 889-A. The anode (heavy wall design) is water-cooled, capable of dissipating 12.5 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 22.5 megacycles. Operation at 50 megacycles is permissible with plate voltage and input reduced to one-half maximum ratings.

Electrical:

▶ Filament Voltage	11.0 Volts
▶ Filament Current	120 Amperes
▶ Filament Starting Current	180 Amperes Max.
▶ Filament Cold Resistance	.0083 Ohms
▶ Peak Cathode Current	7.5 Amperes
▶ Amplification Factor $I_b = 1.0$ Amp.; $E_c = -100$ Volts	21
▶ Interelectrode Capacitances	
Grid-Plate	17.5 $\mu\mu$f
Grid-Filament	23.3 $\mu\mu$f
Plate-Filament	2.7 $\mu\mu$f

Mechanical:

▶ Mounting Position—Vertical, Anode Down	
▶ Type of Cooling—Water and Forced Air	
Water Flow on Anode	5 GPM
Maximum Outgoing Water Temperature	70° C
Air Flow on Bulb*	30 CFM
Maximum Glass Temperature	160° C
▶ Net Weight, Approx.	4 Pounds

*Operation at frequencies above 15 Mc may require air-flow onto the dish center in order to hold the temperature of the seals and dish below 160° C. The blower required should deliver 30 C.F.M. through a 3" nozzle.

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Federal Telephone and Radio Corporation

FEDERAL POWER TRIODE
Type F-5666
12.5 Kilowatts Plate Dissipation

Internal construction based on Federal's advanced designs and techniques makes for longer F-5666 life and finer performance.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings

DC Plate Voltage	10,000 Volts
Maximum Signal DC Plate Current**	2 Amperes
Maximum Signal Plate Input**	16 Kilowatts
Plate Dissipation**	12.5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	7,500 Volts
DC Grid Voltage	—300 Volts
Peak A-F Grid to Grid Voltage	1,700 Volts
Zero Signal DC Plate Current	0.4 Ampere
Maximum Signal DC Plate Current	3.2 Amperes
Effective Load Resistance, Plate to Plate	5,000 Ohms
Maximum Signal Driving Power, Approximate	150 Watts
Maximum Signal Power Output, Approximate	15 Kilowatts

**Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER —CLASS B TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	10,000 Volts
DC Plate Current	1.0 Ampere
Plate Input	10 Kilowatts
Plate Dissipation	12.5 Kilowatts

Typical Operation

DC Plate Voltage	9,000 Volts
DC Grid Voltage	—350 Volts
Peak R-F Grid Voltage	450 Volts
DC Plate Current	0.8 Ampere
Driving Power, Approximate†	110 Watts
Power Output, Approximate	2.5 Kilowatts

†At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	8,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1.0 Ampere
DC Grid Current	0.35 Ampere
Plate Input	8 Kilowatts
Plate Dissipation	7.5 Kilowatts

Typical Operation

DC Plate Voltage	6,000	7,500 Volts
DC Grid Voltage	—900	—1,200 Volts
Peak R-F Grid Voltage	1,420	1,700 Volts
DC Plate Current	1.0	.88 Ampere
DC Grid Current, approx.	0.1	.08 Ampere
Driving Power, approx.	140	140 Watts
Power Output, approx.	4	5 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

*(Key-down conditions per tube without modulation)**

Maximum Ratings

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	2 Amperes
DC Grid Current	0.35 Ampere
Plate Input	20 Kilowatts
Plate Dissipation	12.5 Kilowatts

Typical Operation

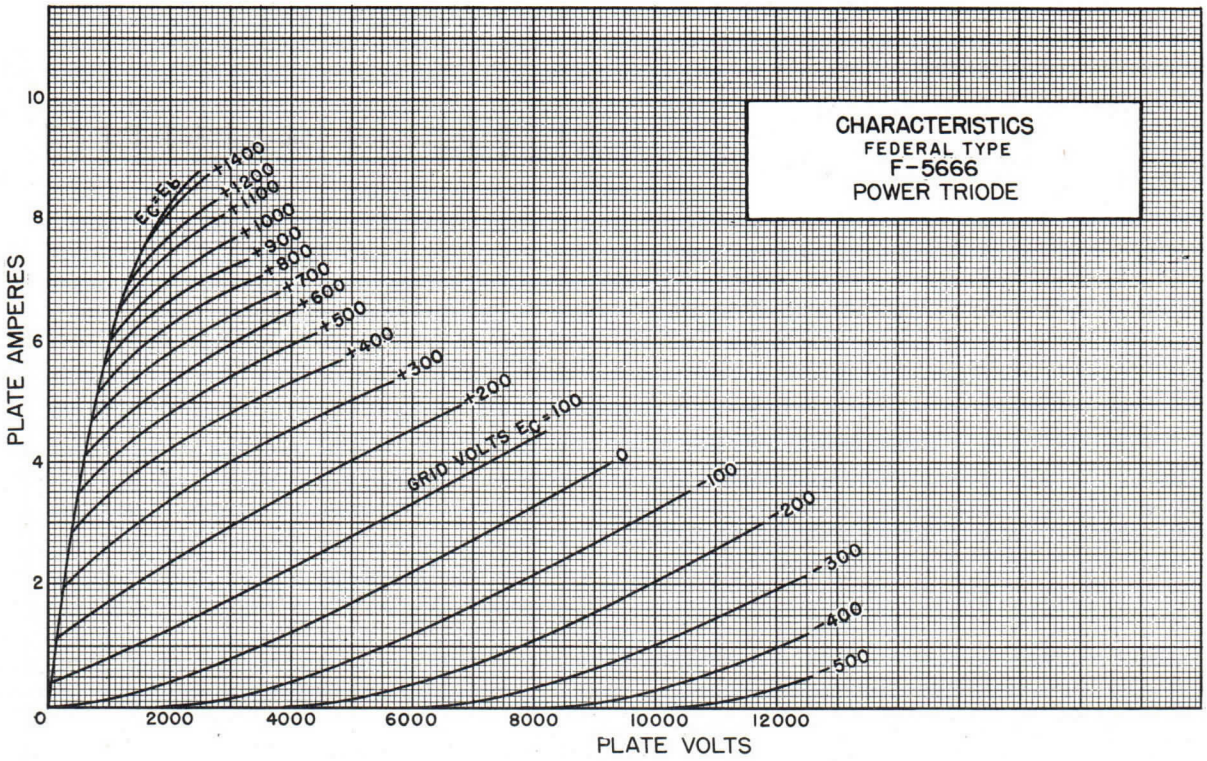
DC Plate Voltage	6,000	7,500	9,000 Volts
Filament Voltage	10.6	10.7	10.8 Volts
DC Grid Voltage	—500	—600	—750 Volts
Peak R-F Grid Voltage	1,200	1,400	1,700 Volts
DC Plate Current	1.6	1.8	2.0 Amps.
DC Grid Current, approx.	.19	.20	.21 Amps.
Driving Power, approx.	220	270	340 Watts
Power Output, approx.	6.3	8.9	12.2 K.W.

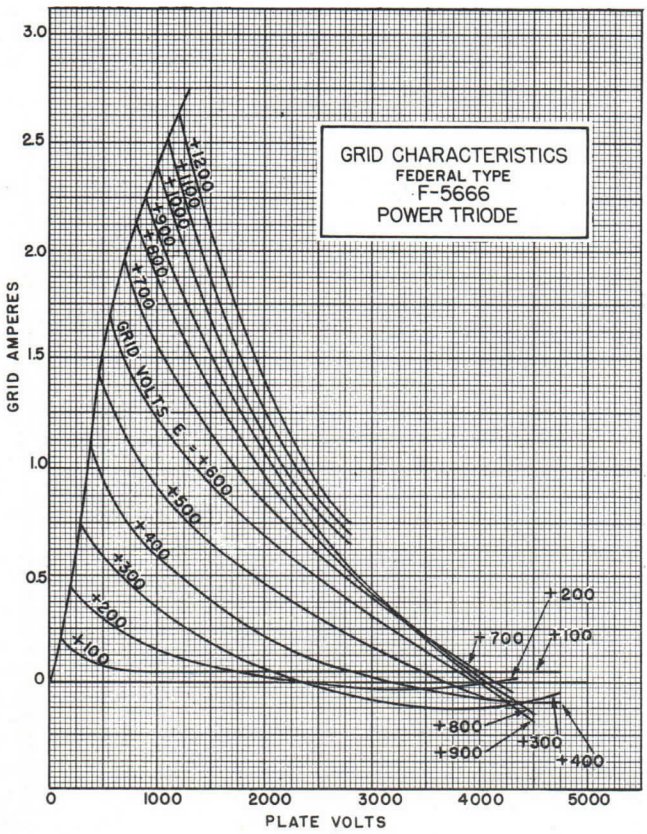
*Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

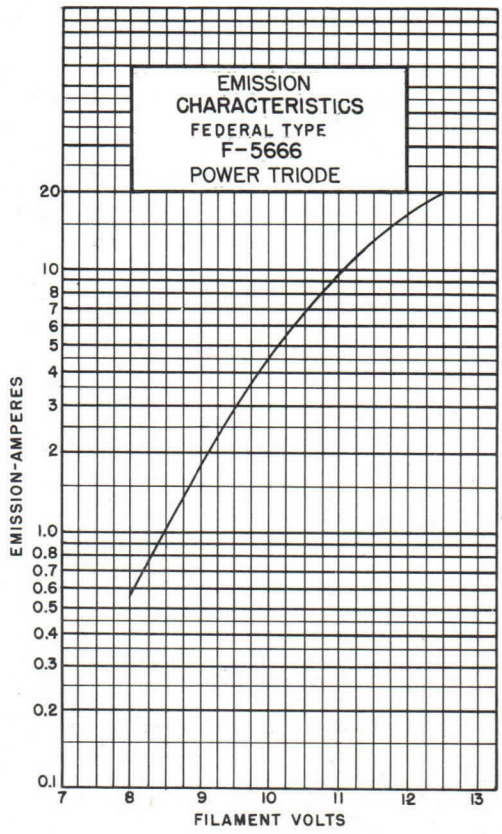
AN IT&T ASSOCIATE

Federal's F-5666 is a "must" for equipment manufacturers who have an eye for both *new* design and *new* operating economies.

FEDERAL POWER TRIODE
Type F-5666
12.5 Kilowatts Plate Dissipation



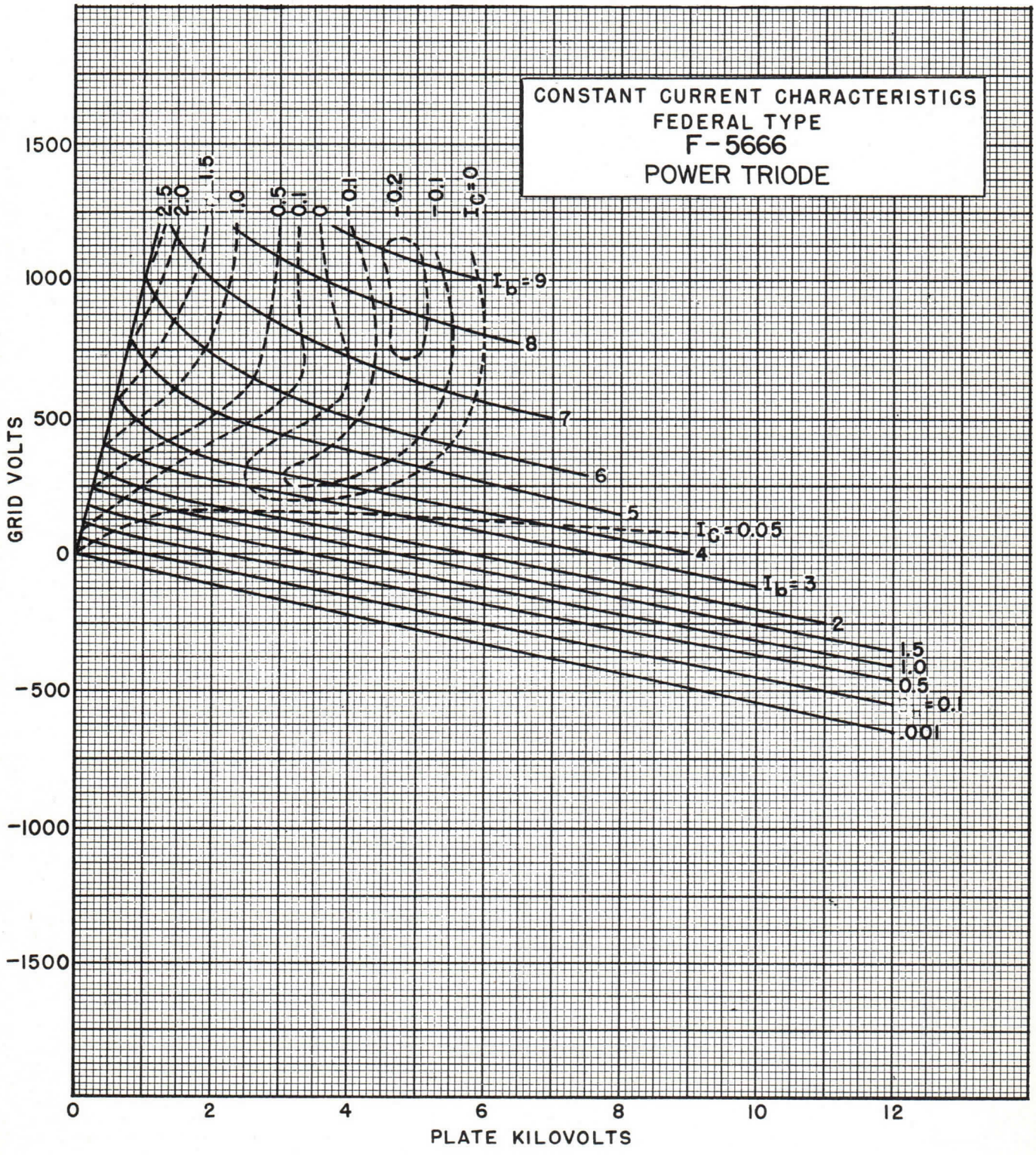




AN IT&T ASSOCIATE

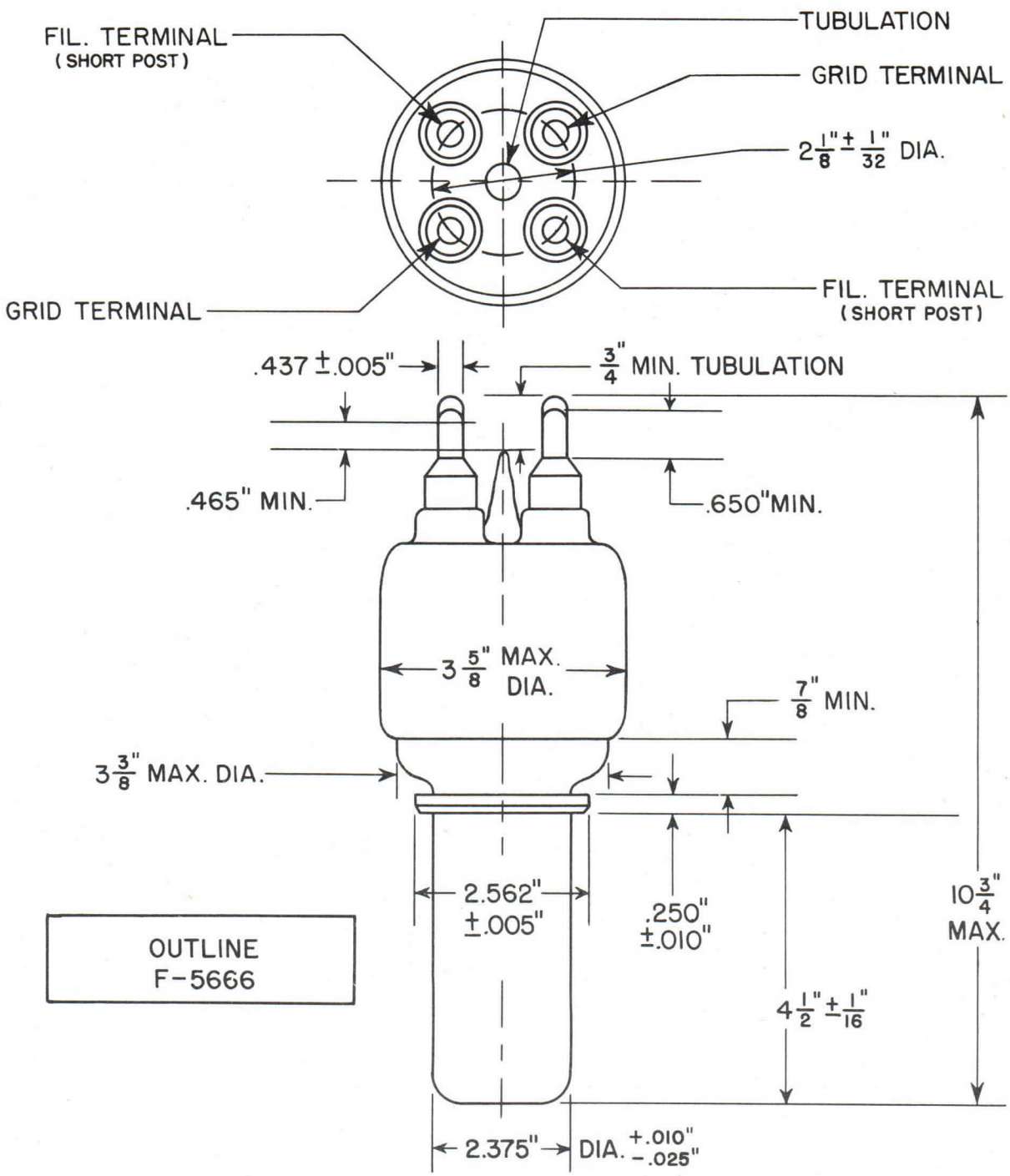
FEDERAL POWER TRIODE
Type F-5666
12.5 Kilowatts Plate Dissipation

Federal's F-5666 has the rugged design and structure indispensable to trouble-free operation in induction and dielectric applications.



The long life qualities of F-5666 are not accidental "by-products", but the result of Federal's objective research and development work.

FEDERAL POWER TRIODE
Type F-5666
12.5 Kilowatts Plate Dissipation



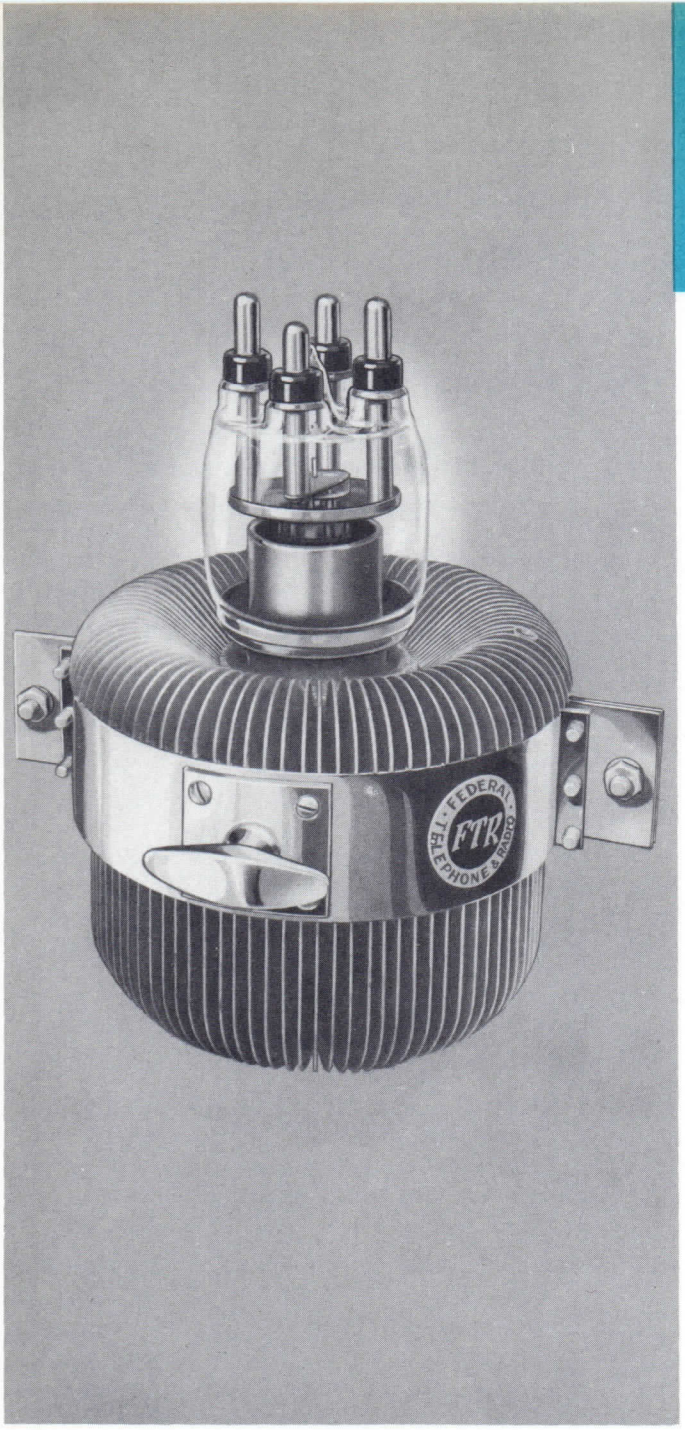
OUTLINE
F-5666

Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

Federal Always Has
Made Better Tubes

Form FJ-417 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-5667
7.5 Kilowatts Plate Dissipation



Federal's advanced techniques of design and processing are vital factors in achieving the superiority of F-5667 performance . . . as a radio frequency amplifier, oscillator, Class B modulator or as a replacement for the Type 889-RA in communications equipment.

GENERAL DATA

DESCRIPTION:

Federal's Type F-5667 is a three-electrode tube designed for use as a radio-frequency amplifier, oscillator, or Class B modulator. It is ruggedly constructed to meet the severe conditions of radio-frequency heating service. This special feature contributes to a superior performance when the F-5667 is used as a replacement for the Type 889-RA in communications equipment. The heavy wall anode is forced-air cooled, capable of dissipating 7.5 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply up to 22.5 megacycles. Operation at 50 megacycles is permissible with plate voltage and input reduced to one-half maximum ratings.

Electrical:

Filament Voltage	11.0 Volts
Filament Current	120 Amperes
Filament Starting Current	180 Amperes max.
Peak Cathode Current	7.5 Amperes
Filament Cold Resistance	.0083 Ohms
Amplification Factor, Ib = 1.0 Amp.; Ec = −100 Volts	21
Interelectrode Capacitances	
Grid-Plate	18.5 $\mu\mu$f
Grid-Filament	23.3 $\mu\mu$f
Plate-Filament	3.0 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, Anode Down			
Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation— Kilowatts	7.5	6.0	4.5
Air Flow—CFM	550	400	300
Static Pressure— Inches Water	0.7	0.4	0.2
Maximum Anode Temperature			230° C
Required Air Flow on Bulb*			30 CFM
Maximum Glass Temperature			160° C
Net Weight, approx.			40 Pounds

*Operation at frequencies above 15 Mc/sec. may require air-flow on the dish center in order to hold the temperature of the seals and dish below 160°C. This flow may be obtained by deflection of the anode cooling air, or by means of a separate blower supplying 30 C.F.M. through a 3" nozzle.

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Federal Telephone and Radio Company

FEDERAL POWER TRIODE
Type F-5667
7.5 Kilowatts Plate Dissipation

Federal's F-5667 is designed and engineered to meet the specific requirements of the makers of RF heating equipment.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings

DC Plate Voltage	10,000 Volts
Max. Signal DC Plate Current**	2 Amperes
Max. Signal Plate Input**	16 Kilowatts
Plate Dissipation**	7.5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for 2 tubes)

DC Plate Voltage	7,500 Volts
DC Grid Voltage	—300 Volts
Peak A-F Grid to Grid Voltage	1,700 Volts
Zero Signal DC Plate Current	0.4 Amperes
Maximum Signal DC Plate Current	3.2 Amperes
Effective Load Resistance (plate to plate)	5,000 Ohms
Maximum Signal Driving Power, approx.	150 Watts
Maximum Signal Power Output, approx.	15 Kilowatts

**Averaged over any audio-frequency cycle of a sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER —CLASS B TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	10,000 Volts
DC Plate Current	1.0 Ampere
Plate Input	10 Kilowatts
Plate Dissipation	7.5 Kilowatts

Typical Operation

DC Plate Voltage	9,000 Volts
DC Grid Voltage	—350 Volts
Peak R-F Grid Voltage	450 Volts
DC Plate Current	0.8 Ampere
Driving Power, approx.†	110 Watts
Power Output, approx.	2.5 Kilowatts

†At crest of a-f cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage	8,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1.0 Ampere
DC Grid Current	0.35 Ampere
Plate Input	8 Kilowatts
Plate Dissipation	5 Kilowatts

Typical Operation

DC Plate Voltage	6,000	7,500 Volts
DC Grid Voltage	—900	—1,200 Volts
Peak R-F Grid Voltage	1,420	1,700 Volts
DC Plate Current	1.0	.88 Ampere
DC Grid Current, approx.	0.1	.08 Ampere
Driving Power, approx.	140	140 Watts
Power Output, approx.	4	5 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key-down conditions per tube without amplitude modulation¶

Maximum Ratings, Absolute Values

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	2.0 Amperes
DC Grid Current	0.35 Amperes
Plate Input	20 Kilowatts
Plate Dissipation	7.5 Kilowatts

Typical Operation

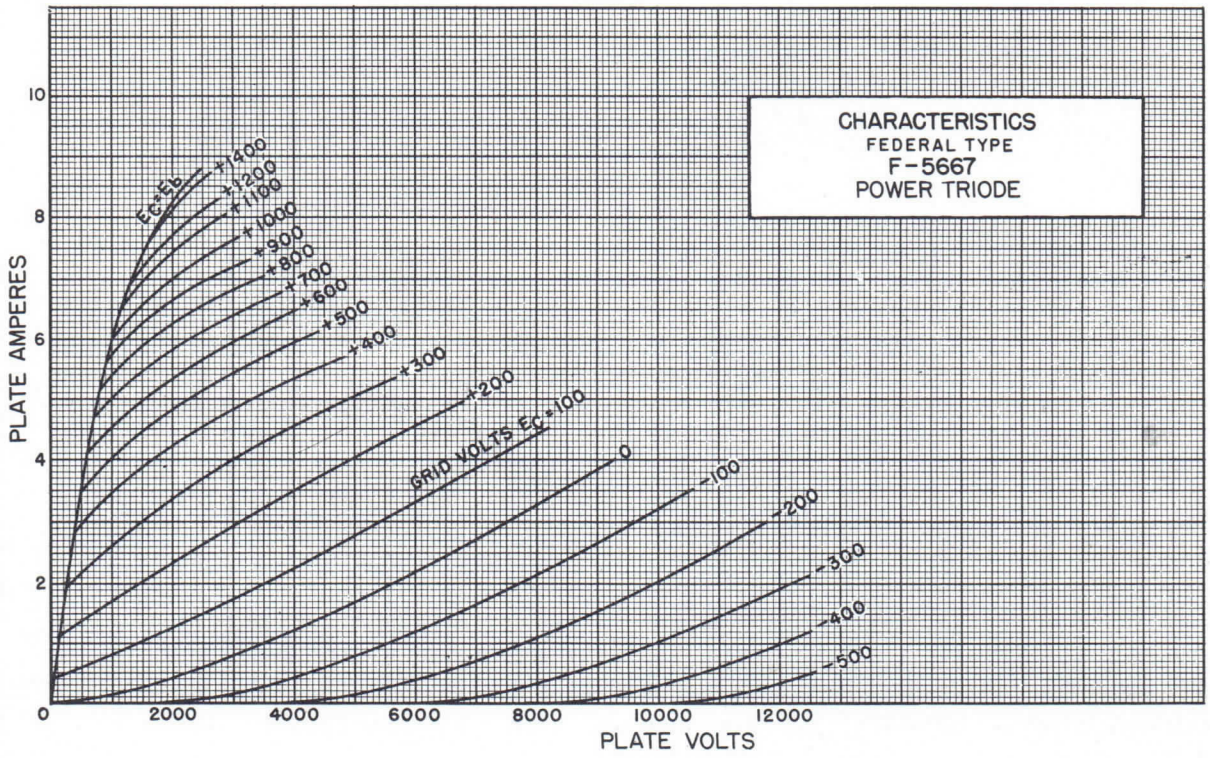
DC Plate Voltage	6,000	7,500	9,000 Volts
Filament Voltage	10.6	10.7	10.8 Volts
DC Grid Voltage	—500	—600	—750 Volts
Peak R-F Grid Voltage	1,200	1,400	1,700 Volts
DC Plate Current	1.6	1.8	2.0 Amperes
DC Grid Current, approx.	.19	.20	.21 Amperes
Driving Power, approx.	220	270	340 Watts
Power Output, approx.	6.3	8.9	12.2 Kilowatts

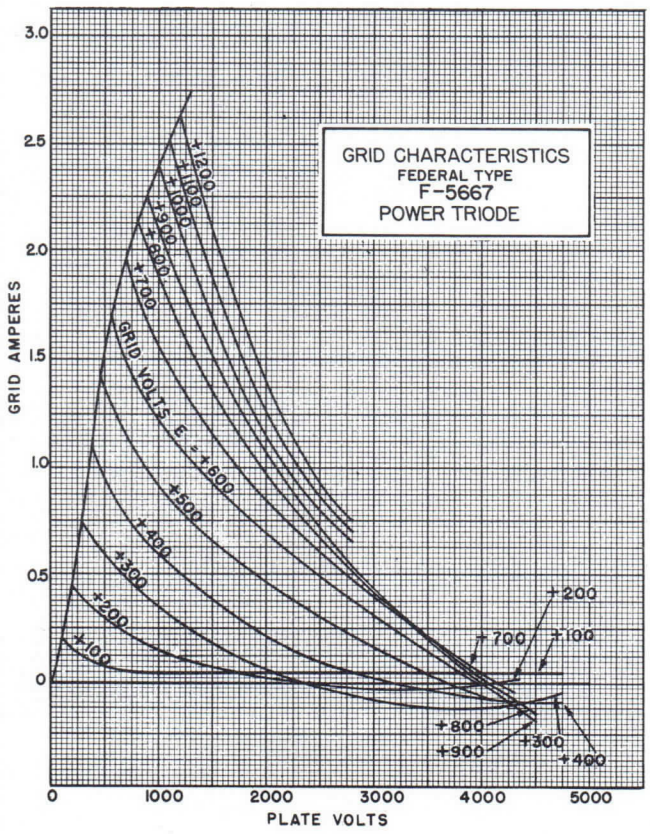
¶Modulation essentially negative; may be used if positive peak of the envelope does not exceed 115 percent of carrier conditions.

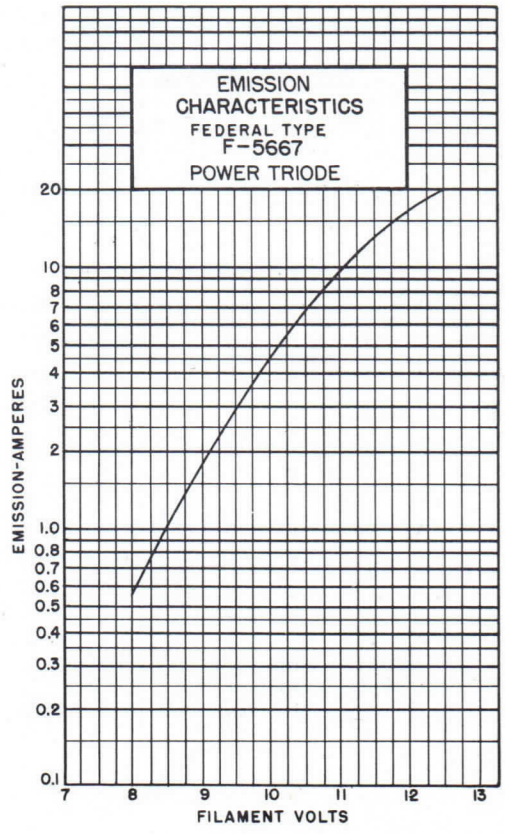
DIVISION OF IT&T

When interchanged with the 889-RA in communications equipment, Federal's F-5667 brings a finer, newer performance.

FEDERAL POWER TRIODE
Type F-5667
7.5 Kilowatts Plate Dissipation



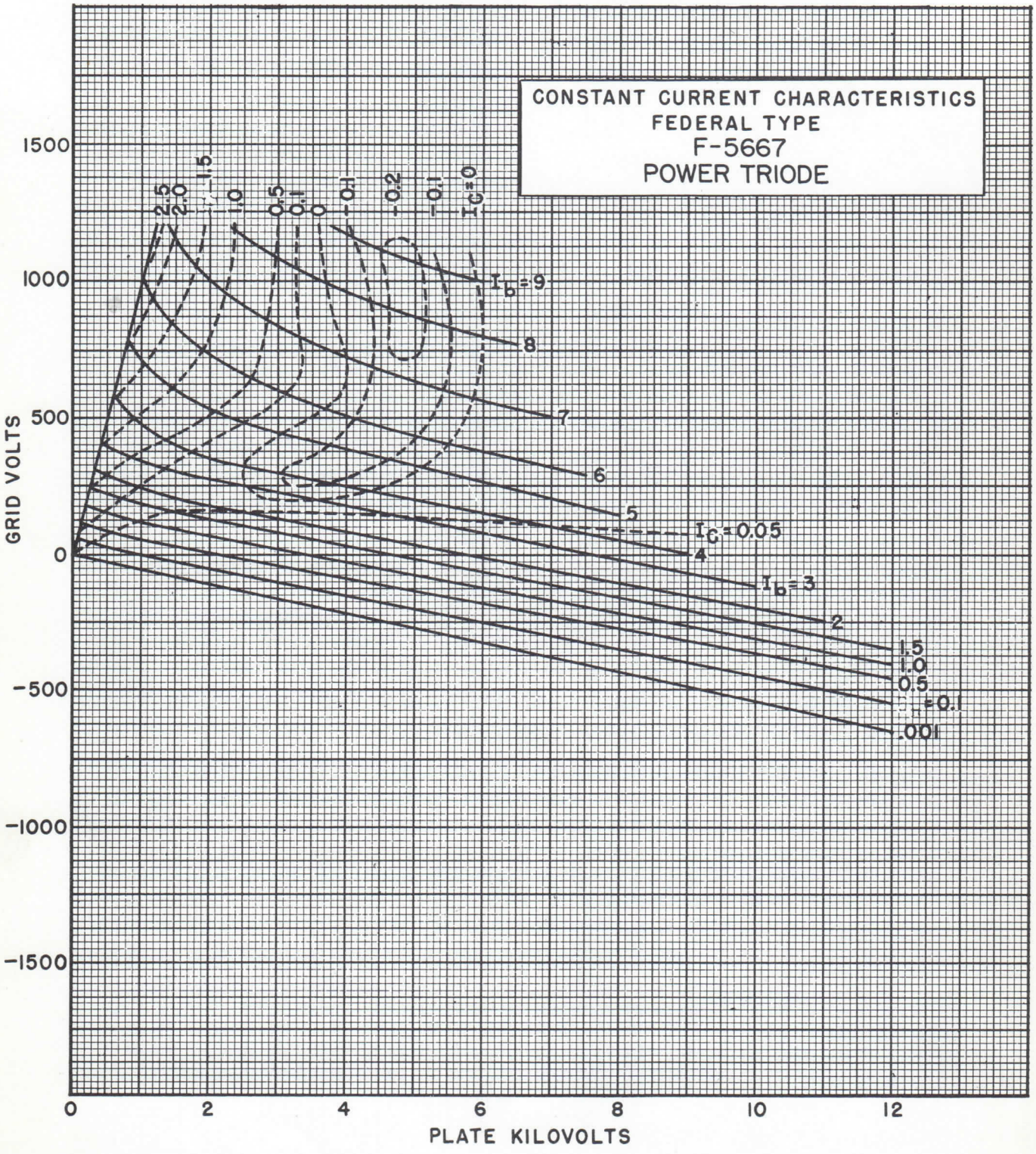




DIVISION OF IT&T

FEDERAL POWER TRIODE
Type F-5667
7.5 Kilowatts Plate Dissipation

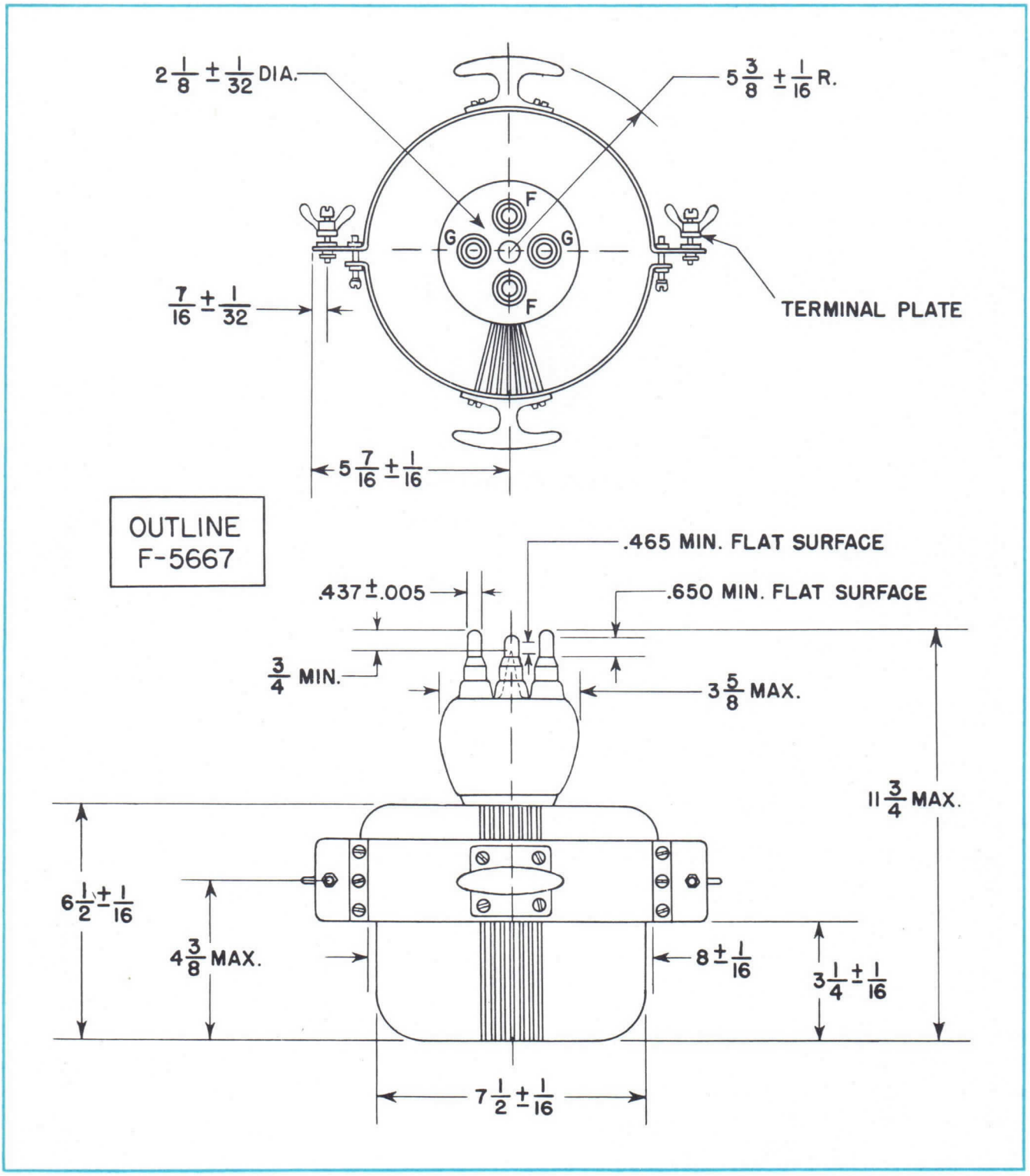
Federal's F-5667 is built to "stand-up" on the job, to absorb the wear and tear of a long service life.



DIVISION OF IT&T

Kovar-to-glass seals are used throughout the F-5667 contributing to the over-all ruggedness of Federal construction.

FEDERAL POWER TRIODE
Type F-5667
7.5 Kilowatts Plate Dissipation



Federal Telephone and Radio Company

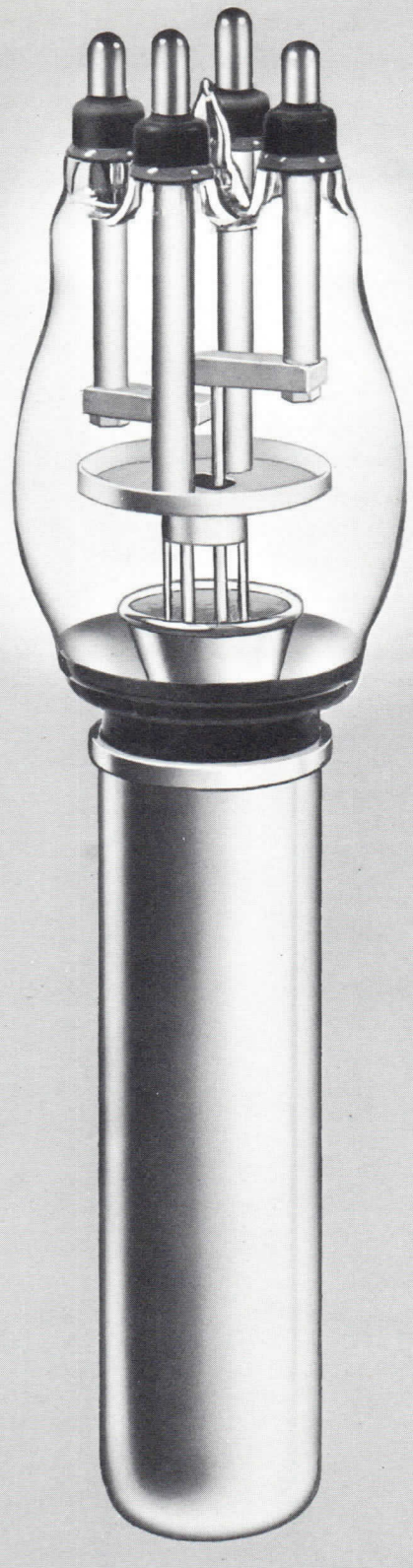
100 Kingsland Road Clifton, New Jersey

DIVISION OF IT&T

Federal Always Has
Made Better Tubes

Form FJ-416 Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-5668
20 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

The F-5668 is a 3-electrode tube designed specifically for radio frequency heating service. In industrial applications, it replaces the Type F-892 without equipment modifications, except for the water jacket. The heavy wall anode is water-cooled and capable of dissipating 20 kilowatts. The tube incorporates rugged kovar plate, grid, and filament seals. The cathode is a pure tungsten filament. Maximum ratings apply up to 5 megacycles with operation up to 20 megacycles permissible at reduced ratings.

Electrical:

Filament Voltage	22 Volts
Filament Current	60 Amperes
Filament Starting Current	120 Amps. max.
Filament Cold Resistance	.031 Ohms
Peak Cathode Current	9.4 Amperes
Amplification Factor, I_b=0.75 amps., E_c=—50 volts	50
Interelectrode Capacitances	
Grid-Plate	30 $\mu\mu$f
Grid-Filament	20 $\mu\mu$f
Plate-Filament	1.5 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, anode down	
Type of Cooling—Water	
Minimum Water Flow on Anode	3 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	160° C
Air Flow on bulb*	35 CFM
Net Weight, approximate	10 Pounds

*On center of dish from 3 inch nozzle.

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Federal Telephone and Radio Company

FEDERAL POWER TRIODE
Type F-5668
20 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	5	12.5	20 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class C — Telegraphy	100	75	50 Per Cent

Maximum Ratings and Typical Operating Conditions

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

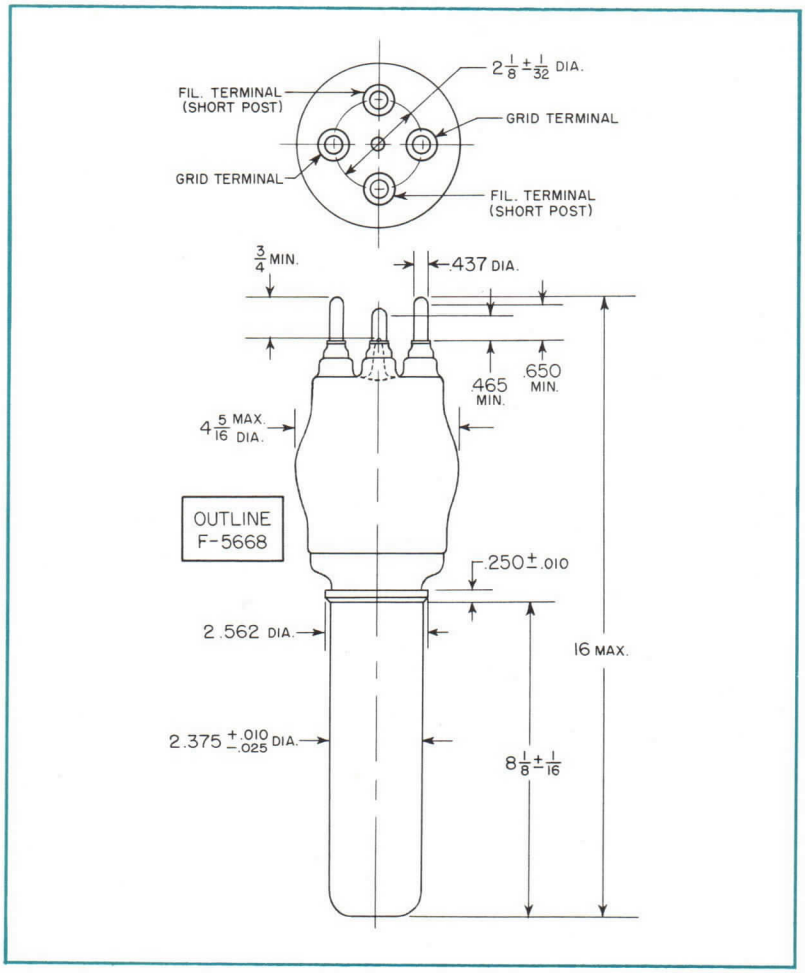
Maximum Ratings, Absolute Values

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	2.0 Amperes
DC Grid Current	0.4 Amperes
Plate Input	28 Kilowatts
Plate Dissipation	20 Kilowatts

Typical Operation

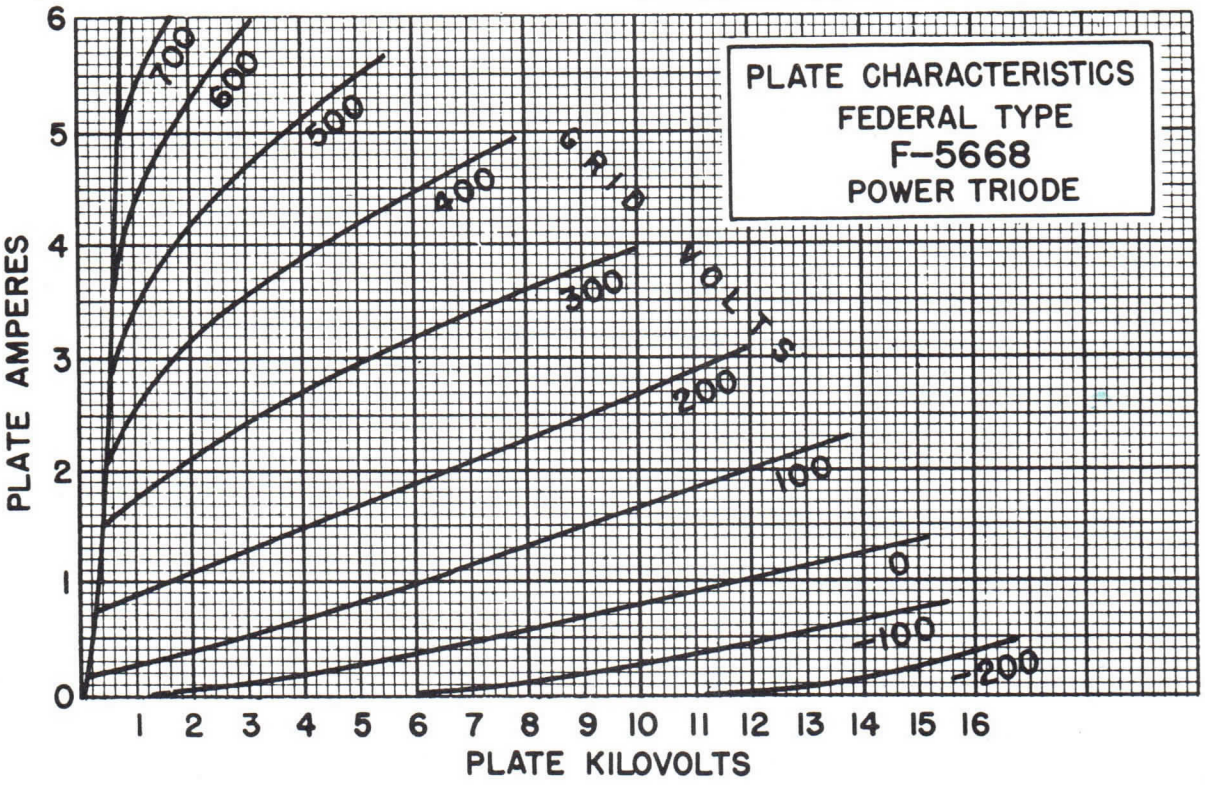
DC Plate Voltage	8,000	10,000	12,000 Volts
DC Grid Voltage	—300	—400	—500 Volts
Peak R-F Grid Voltage	1,000	1,200	1,400 Volts
DC Plate Current	1.6	1.8	2.0 Amperes
DC Grid Current, approximate	0.21	0.22	0.23 Amperes
Driving Power, approximate	200	250	300 Watts
Power Output, approximate	8.7	12.8	17.5 Kilowatts

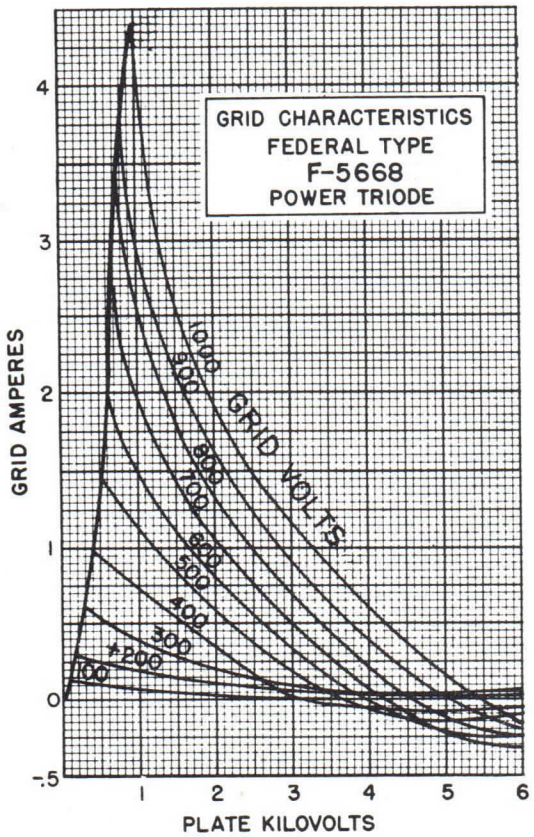
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

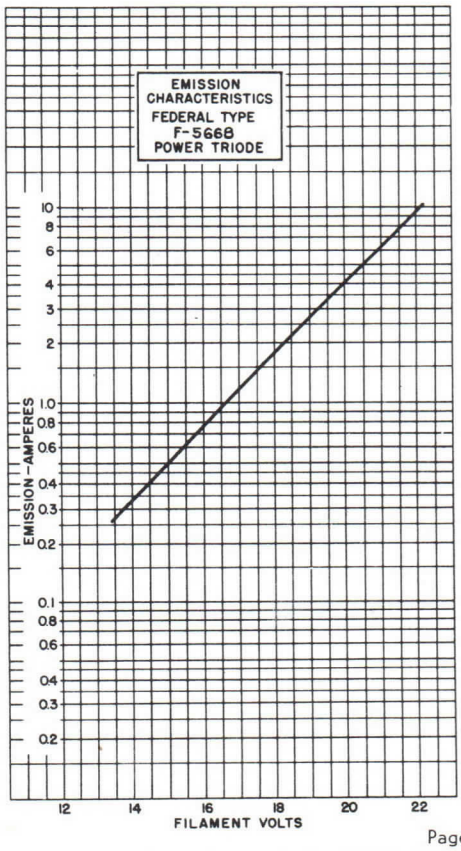


One of the *first* to manufacture power tubes, Federal's experience goes back to the earliest days of the industry.

FEDERAL POWER TRIODE
Type F-5668
20 Kilowatts Plate Dissipation

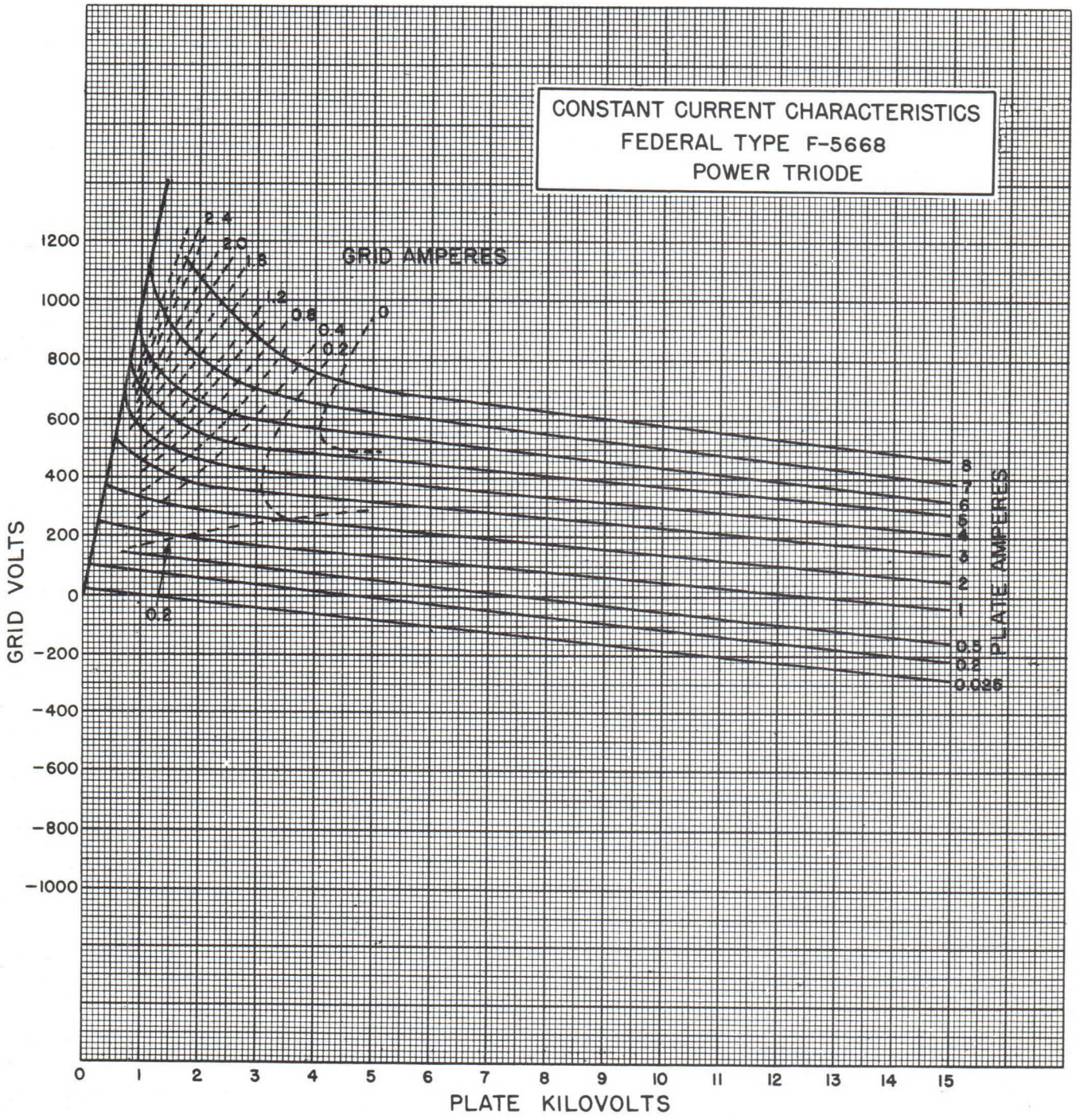






FEDERAL POWER TRIODE
Type F-5668
20 Kilowatts Plate Dissipation

Federal produces tubes of only the highest quality, satisfying the most exacting users.



Form F-610 Printed in U. S. A.

Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-5669
10 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

The F-5669 is a 3-electrode tube designed specifically for radio frequency heating service. In industrial applications, it replaces the Type F-892R without equipment modifications. The heavy wall anode is forced air-cooled and capable of dissipating 10 kilowatts. The tube incorporates rugged kovar plate, grid, and filament seals. The cathode is a pure tungsten filament. Maximum ratings apply up to 5 megacycles with operation up to 20 megacycles permissible at reduced ratings.

Electrical:

Filament Voltage	22 Volts
Filament Current	60 Amperes
Filament Starting Current	120 Amperes max.
Filament Cold Resistance	.031 Ohms
Peak Cathode Current	9.4 Amperes
Amplification Factor, at I_b=0.42 amps. E_c=—50 volts	50
Interelectrode Capacitances	
Grid-Plate	31 $\mu\mu$f
Grid-Filament	20 $\mu\mu$f
Plate-Filament	2 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, Anode Down			
Type of Cooling—Forced Air Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode Plate Dissipation			
(Kilowatts)	10	8	6
Air Flow—Cubic Feet Per Min.	700	500	350
Maximum Glass Temperature*			160° C
Max. Anode Temp.			230° C
Net Weight, Approximate			52 Pounds

*At frequencies above 3 MC/Sec air flow on the center of the dish by deflection of the anode cooling air or by a separate blower, which provides 35 CFM through a 3-inch diameter nozzle, may be required to keep the glass temperature below 160° C.

For Characteristic Curves see F-5668. Except for reduction of plate dissipation to 10 KW, Maximum Ratings and Typical Operation of F-5668 apply.

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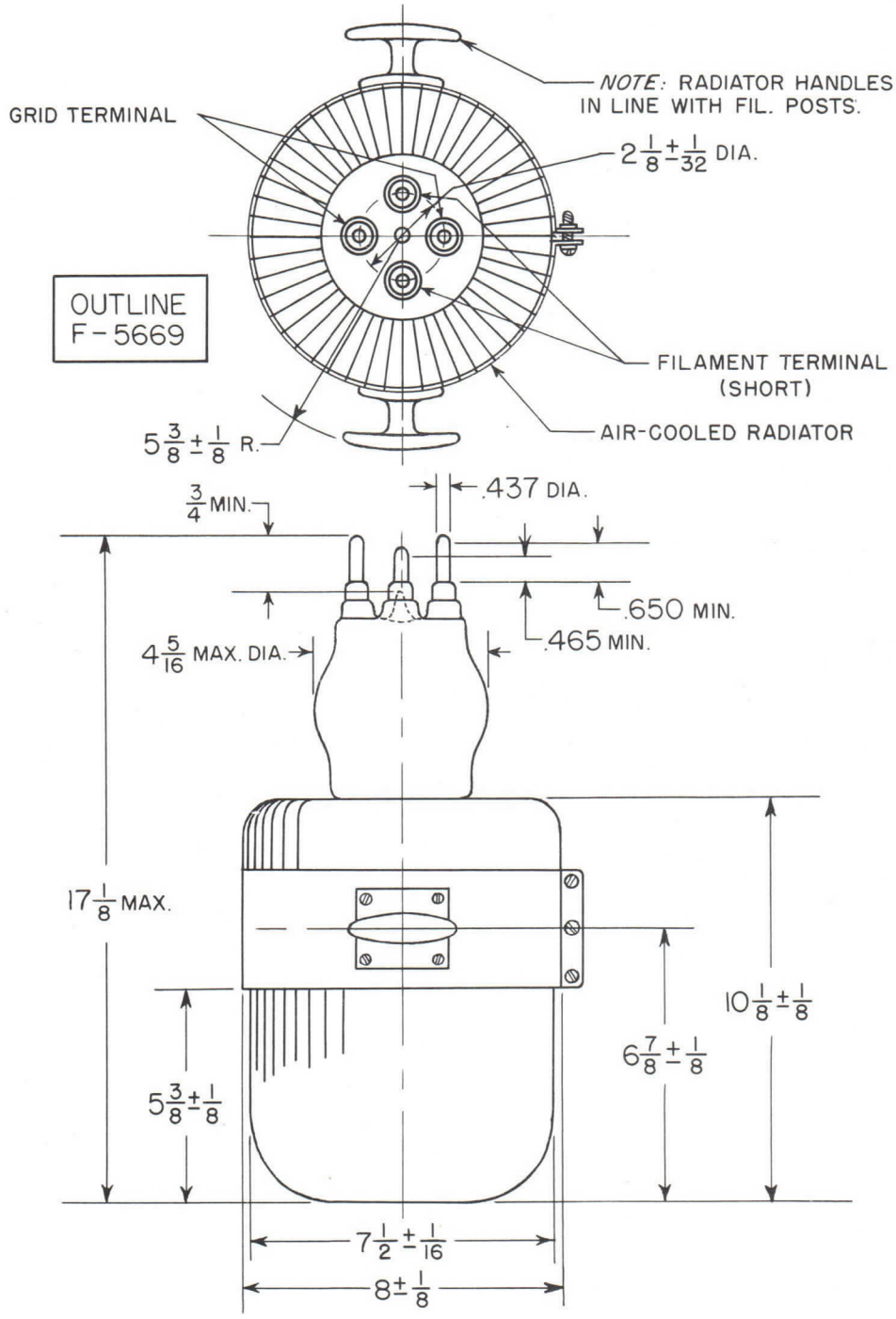
FEDERAL POWER TRIODE
Type F-5669
10 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	5	12.5	20 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class C — Telegraphy	100	75	50 Per Cent



Form F-611 Printed in U. S. A.

Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-5680
2.5 Kilowatts Plate Dissipation

up to date sheet held by Mr Roach

GENERAL DATA

DESCRIPTION:

Federal's Type F-5680 is a three-electrode tube designed for use as a modulator, amplifier and oscillator. The relatively wide spacing between the elements, and the lack of internal insulators make this type tube especially suitable for high voltage pulse applications. The anode is air-cooled, capable of dissipating 2.5 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles. Operation up to 50 megacycles is permissible at reduced ratings.

Electrical:

Filament Voltage	13.0 Volts
Filament Current	36 Amperes
Filament Starting Current	72 Amperes
Filament Cold Resistance	.040 Ohms
Amplification Factor, Ec = —200 V, Ib = 0.2A	25
Interelectrode Capacitances	
Grid-Plate	12.0 *uuf*
Grid-Filament	15.0 *uuf*
Plate-Filament	1.8 *uuf*

Mechanical:

Mounting Position— Vertical, Anode Down			
Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation (Kilowatts)	2.5	2.0	1.5
Air Flow—Cubic Feet Per Min.	150	120	90
Pressure—Inches Water	2.5	1.6	0.9
Maximum Glass Temperature			150° C
Net Weight, Approximate			5¼ Pounds

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FEDERAL POWER TRIODE
Type F-5680
2.5 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	30	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input Class C—Telegraphy	100	75 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	6,000 Volts
Maximum Signal DC Plate Current*	2.0 Amperes
Maximum Signal Plate Input*	6.0 Kilowatts
Plate Dissipation*	2.5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	5,000 Volts
DC Grid Voltage	—150 Volts
Peak A-F Grid-to-Grid Voltage	1,260 Volts
Zero Signal DC Plate Current	0.4 Amperes
Maximum Signal DC Plate Current	2.25 Amperes
Effective Load Resistance, Plate to Plate	4,000 Ohms
Maximum Signal Driving Power, Approximate	175 Watts
Maximum Signal Power Output, Approximate	7.2 Kilowatts

*Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	6,000 Volts
DC Plate Current	1.5 Amperes
Plate Input	3.75 Kilowatts
Plate Dissipation	2.5 Kilowatts

Typical Operation

DC Plate Voltage	6,000 Volts
DC Grid Voltage	—160 Volts
Peak R-F Grid Voltage	300 Volts
DC Plate Current	0.56 Amperes
DC Grid Current, Approximate	0.0 Amperes
Driving Power, Approximate**	47 Watts
Power Output, Approximate	1 Kilowatt

**At crest of audio-frequency cycle with modulation factor of 1.0

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	5,000 Volts
DC Grid Voltage	—2,000 Volts
DC Plate Current	1.5 Amperes
DC Grid Current	0.2 Amperes
Plate Input	7.5 Kilowatts
Plate Dissipation	1.6 Kilowatts

Typical Operation

DC Plate Voltage	5,000 Volts
DC Grid Voltage	—800 Volts
Peak R-F Grid Voltage	1,370 Volts
DC Plate Current	0.74 Amperes
DC Grid Current, Approximate	0.10 Amperes
Driving Power, Approximate	130 Watts
Power Output, Approximate	2.7 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)†

Maximum Ratings, Absolute Values

DC Plate Voltage	6,000 Volts
DC Grid Voltage	—2,000 Volts
DC Plate Current	2.0 Amperes
DC Grid Current	0.2 Amperes
Plate Input	12 Kilowatts
Plate Dissipation	2.5 Kilowatts

Typical Operation

DC Plate Voltage	6,000 Volts
DC Grid Voltage	—800 Volts
Peak R-F Grid Voltage	1,510 Volts
DC Plate Current	1.4 Amperes
DC Grid Current, Approximate	0.16 Amperes
Driving Power, Approximate	225 Watts
Power Output, Approximate	6 Kilowatts

†Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR—PULSED OPERATION

Maximum Ratings, Absolute Values

DC Plate Voltage	17,500 Volts
DC Grid Voltage	—5,000 Volts
Peak Cathode Current	35 Amperes
Plate Dissipation‡	1.2 Kilowatts
Duty Cycle	.030

‡Air Flow=75 CFM

Typical Operation

DC Plate Voltage	15,500 Volts
DC Grid Voltage (during pulse)	—750 Volts
DC Plate Current	0.20 Amperes
DC Grid Current	.013 Amperes
Duty Cycle	.023
Peak Power Output	90 Kilowatts

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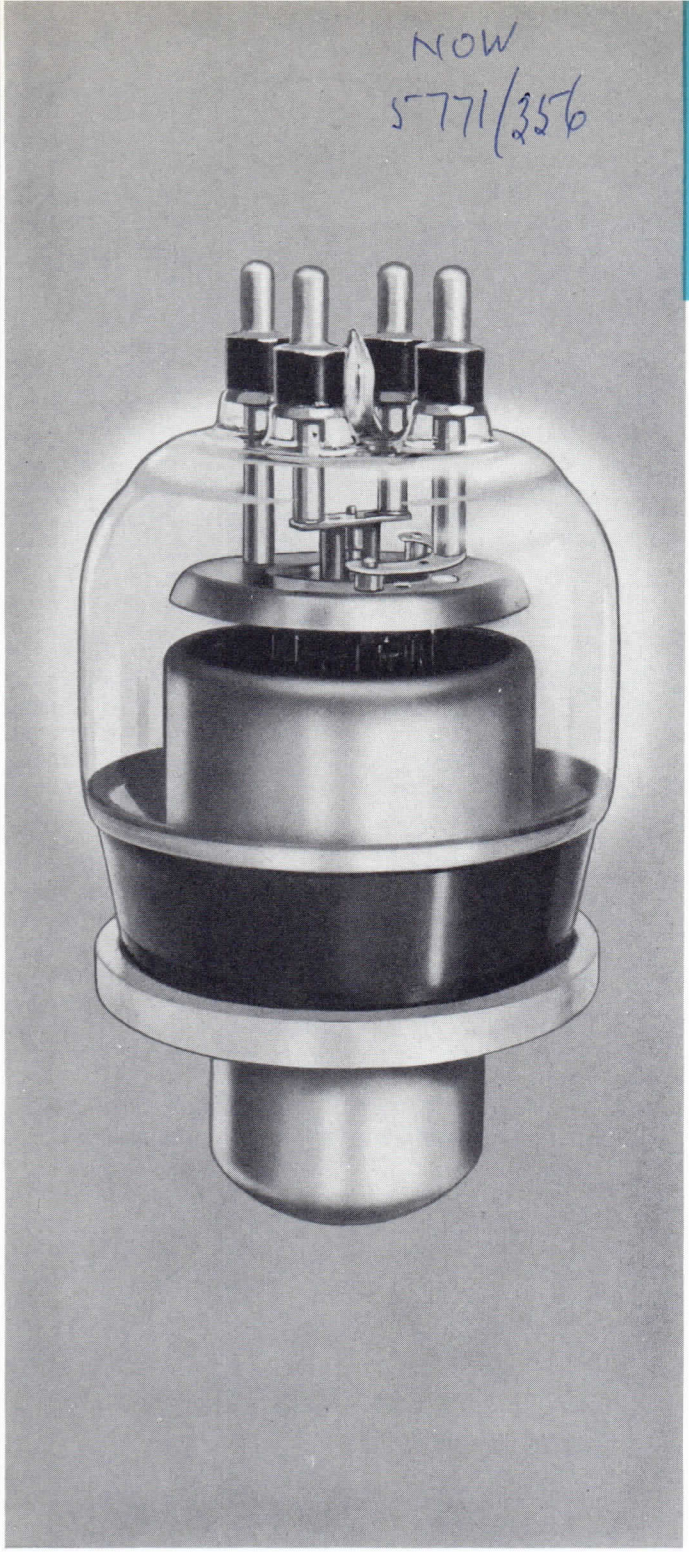
5771/356



FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-5771 is a three-electrode tube built for use as a radio-frequency amplifier, oscillator, or a Class B modulator. The anode is water-cooled, capable of dissipating 22.5 kilowatts. The cathode is a thoriated tungsten filament. The design of the terminal mount connections and the re-entrant anode minimizes lead inductance, makes the tube particularly suitable for high-frequency applications up to 25 megacycles at full ratings, 50 megacycles at reduced ratings.

Electrical:

Filament Voltage	7.5	Volts
Filament Current	170	Amperes
Filament Starting Current	800	Amperes max.
Filament Cold Resistance	.0055	Ohms
Amplification Factor, at I_b = 2.0 amps., E_c = —100 volts	20	
Interelectrode Capacitances		
Grid-Plate	24.5	$\mu\mu$f
Grid-Filament	47	$\mu\mu$f
Plate-Filament	3	$\mu\mu$f

Mechanical:

Mounting Position— Vertical, anode down		
Type of Cooling— Water and Forced Air		
Water Flow on Anode	20	GPM
Maximum Outgoing Water Temperature	70°	C
Air Flow (to bulb and seals) from a 3-inch diameter nozzle	20	CFM
Maximum Glass Temperature	180°	C
Maximum Seal Temperature	165°	C
Net Weight, approximate	7	Pounds

From raw materials to the finished product, every Federal vacuum tube is checked and double-checked to assure the utmost in electrical and mechanical perfection.

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Federal Telephone and Radio Corporation

FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	1.6	25	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class B—	100	100	75 Per Cent
Class C—Plate Modulated	100	100	75 Per Cent
Class C—Unmodulated			
Max. Plate Voltage	120	100	75 Per Cent
Max. Plate Input	112.5	100	75 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	45 Kilowatts
Plate Dissipation†	22.5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	12,500 Volts
DC Grid Voltage	—600 Volts
Peak A-F Grid-to-Grid Voltage	1,900 Volts
Zero Signal DC Plate Current	1.0 Amperes
Maximum Signal DC Plate Current	6.4 Amperes
Effective Load Resistance, Plate to Plate	4,400 Ohms
Maximum Signal Driving Power, approximate	430 Watts
Maximum Signal Power Output, approximate	55 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
DC Plate Current	4 Amperes
Plate Input	33 Kilowatts
Plate Dissipation	22.5 Kilowatts

Typical Operation

DC Plate Voltage	12,500 Volts
DC Grid Voltage	—625 Volts
Peak R-F Grid Voltage	625 Volts
DC Plate Current	2.4 Amperes
DC Grid Current, approximate	0 Amperes
Driving Power, approximate‡	1 Kilowatt
Power Output, approximate	12 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,600 Volts
DC Plate Current	4 Amperes
DC Grid Current	0.8 Amperes
Plate Input	40 Kilowatts
Plate Dissipation	15 Kilowatts

Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—840 Volts
Peak R-F Grid Voltage	1,440 Volts
DC Plate Current	3.8 Amperes
DC Grid Current, approximate	0.78 Amperes
Driving Power, approximate	1 Kilowatt
Power Output, approximate	29 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C —TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500	15,000*	Volts
DC Grid Voltage	—1,600	—1,600*	Volts
DC Plate Current	6	6*	Amperes
DC Grid Current	0.8	0.8*	Amperes
Plate Input	60	67.5*	Kilowatts
Plate Dissipation	22.5	22.5*	Kilowatts

Typical Operation

DC Plate Voltage	10,000	12,500	15,000	Volts
DC Grid Voltage	—770	—630	—990	Volts
Peak R-F Grid Voltage	1,440	1,230	1,620	Volts
DC Plate Current	6	4.8	4.5	Amperes
DC Grid Current, approximate	0.77	0.75	0.8	Amperes
Driving Power, approximate	1	1	1.2	Kilowatts
Power Output, approximate	40	44	53	Kilowatts

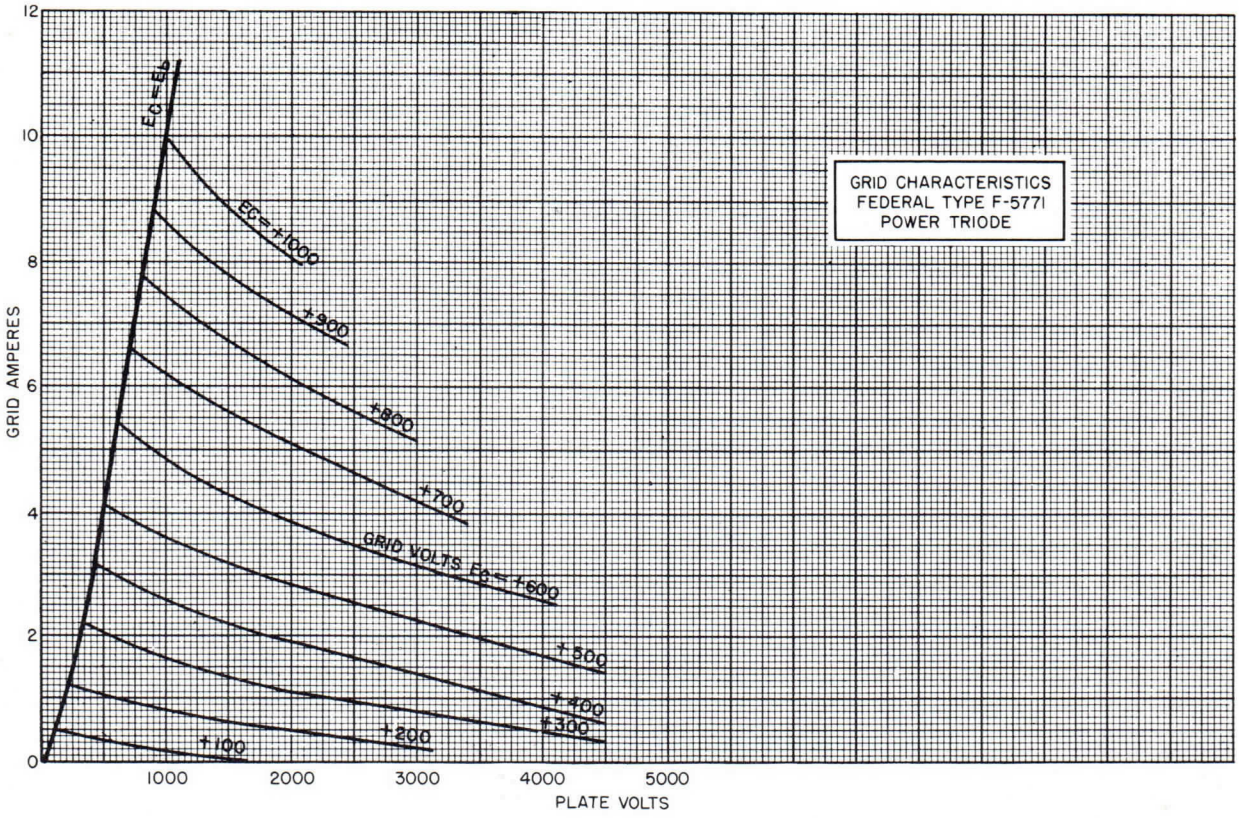
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

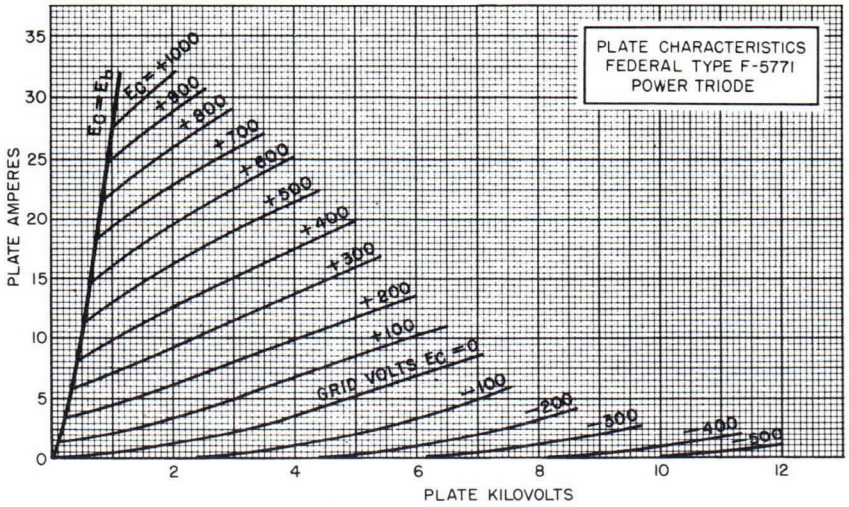
*These ratings apply only at a frequency of 1,500 kilocycles or less.

AN IT&T ASSOCIATE

Federal tubes of all types are in service around the world . . . delivering the high calibre performance for which they were designed.

FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation





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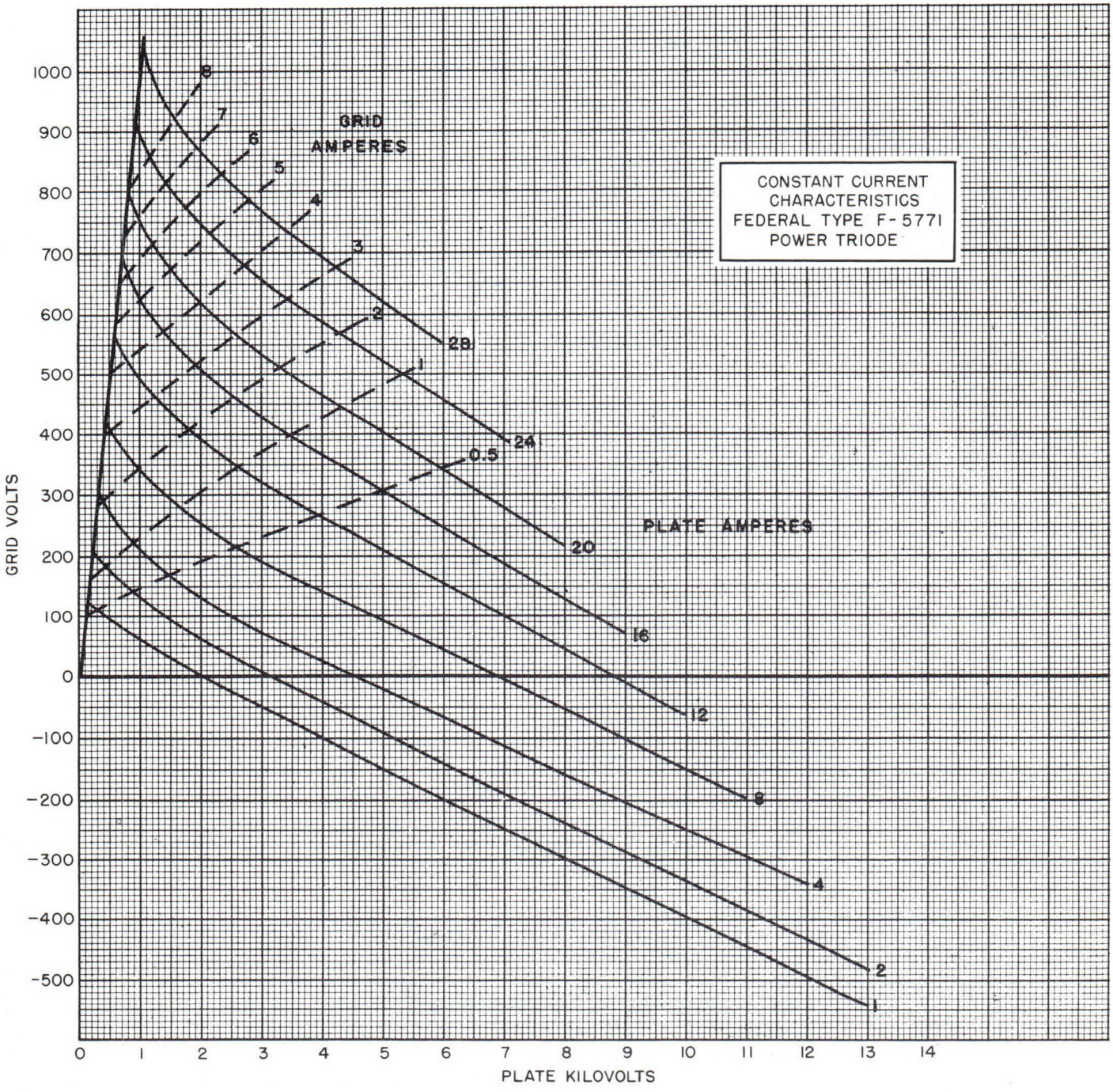
FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation

Backed by years of engineering and manufacturing experience, Federal tubes have consistently set the world's *standards of performance* in broadcast service.



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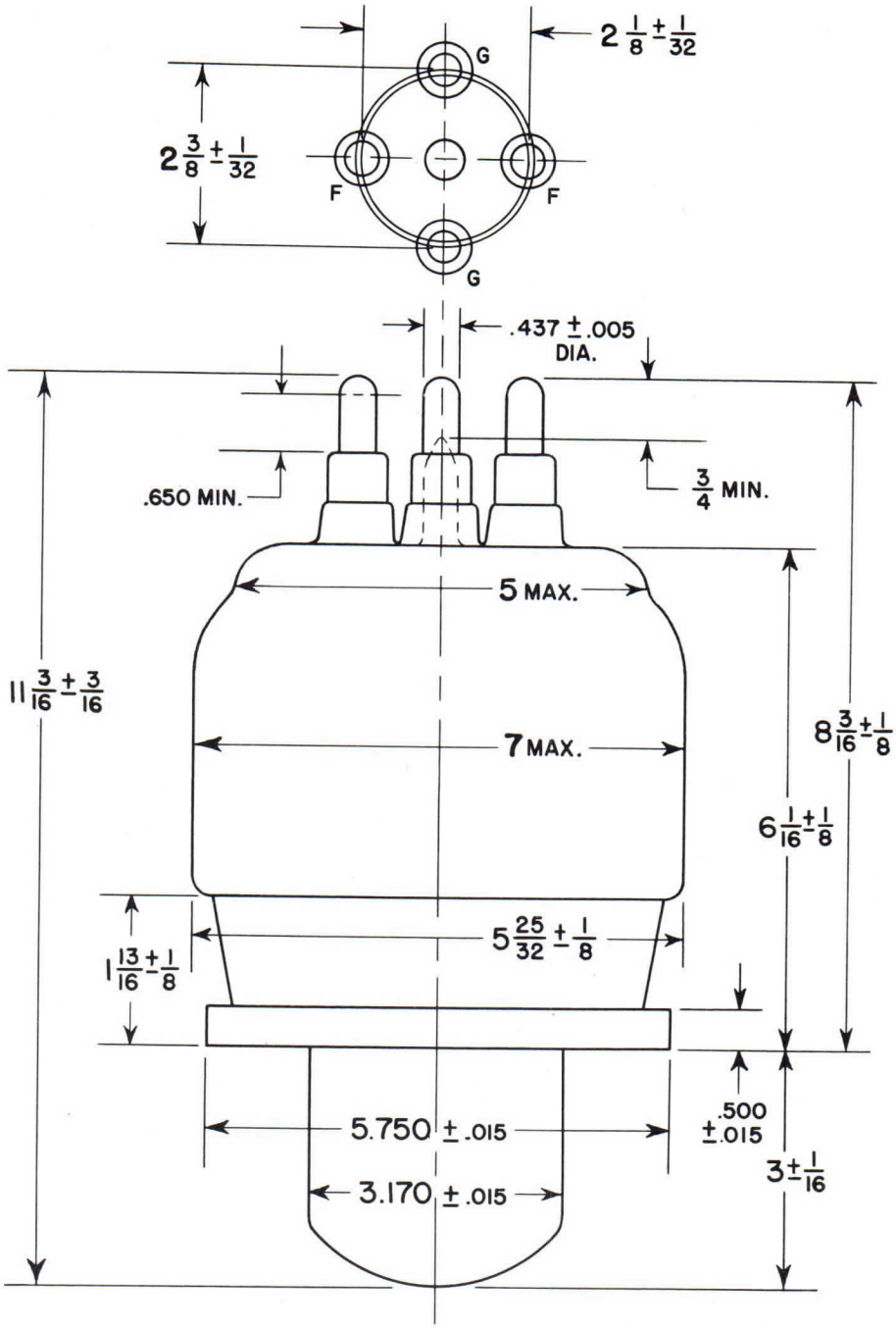
Federal vacuum tubes are designed for long service life and maintenance of original characteristics, and produced with all the care and precision of fine craftsmanship.

FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation



OUTLINE DRAWING
F – 5771

Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

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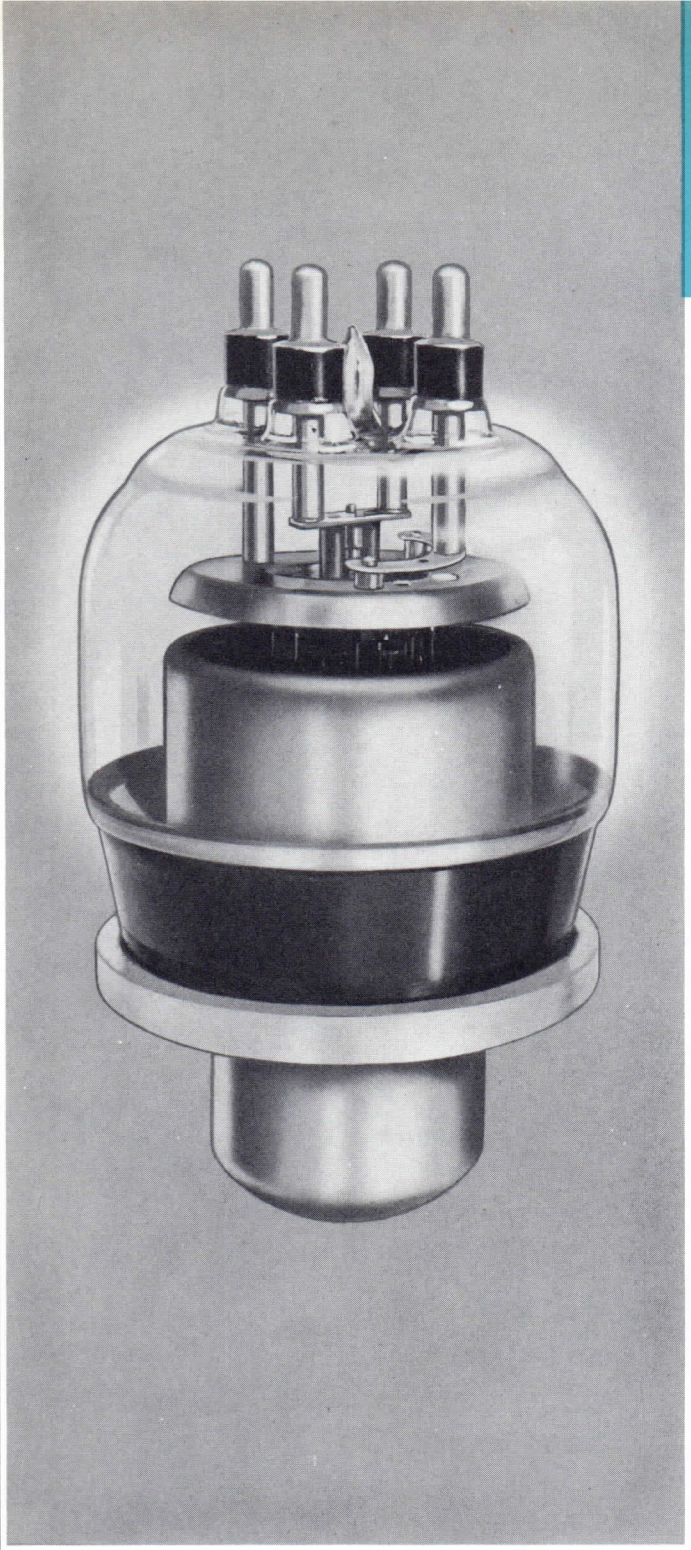
Federal Always Has
Made Better Tubes

Printed in U. S. A.—Form F-482



FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

Federal's F-5771 is a three-electrode tube built for use as a radio-frequency amplifier, oscillator, or a Class B modulator. The anode is water-cooled, capable of dissipating 22.5 kilowatts. The cathode is a thoriated tungsten filament. The design of the terminal mount connections and the re-entrant anode minimizes lead inductance, makes the tube particularly suitable for high-frequency applications up to 25 megacycles at full ratings, 50 megacycles at reduced ratings.

Electrical:

Filament Voltage	7.5	Volts
Filament Current	170	Amperes
Filament Starting Current	800	Amperes max.
Filament Cold Resistance	.0055	Ohms
Amplification Factor, at I_b = 2.0 amps., E_c = —100 volts	20	
Interelectrode Capacitances		
Grid-Plate	24.5	$\mu\mu$f
Grid-Filament	47	$\mu\mu$f
Plate-Filament	3	$\mu\mu$f

Mechanical:

Mounting Position— Vertical, anode down		
Type of Cooling— Water and Forced Air		
Water Flow on Anode	20	GPM
Maximum Outgoing Water Temperature	70°	C
Air Flow (to bulb and seals) from a 3-inch diameter nozzle	20	CFM
Maximum Glass Temperature	180°	C
Maximum Seal Temperature	165°	C
Net Weight, approximate	7	Pounds

From raw materials to the finished product, every Federal vacuum tube is checked and double-checked to assure the utmost in electrical and mechanical perfection.

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Federal Telephone and Radio Corporation

FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	1.6	25	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class B—	100	100	75 Per Cent
Class C—Plate Modulated	100	100	75 Per Cent
Class C—Unmodulated			
Max. Plate Voltage -	120	100	75 Per Cent
Max. Plate Input	112.5	100	75 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
Maximum Signal DC Plate Current†	5 Amperes
Maximum Signal Plate Input†	45 Kilowatts
Plate Dissipation†	22.5 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	12,500 Volts
DC Grid Voltage	—600 Volts
Peak A-F Grid-to-Grid Voltage	1,900 Volts
Zero Signal DC Plate Current	1.0 Amperes
Maximum Signal DC Plate Current	6.4 Amperes
Effective Load Resistance, Plate to Plate	4,400 Ohms
Maximum Signal Driving Power, approximate	430 Watts
Maximum Signal Power Output, approximate	55 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500 Volts
DC Plate Current	4 Amperes
Plate Input	33 Kilowatts
Plate Dissipation	22.5 Kilowatts

Typical Operation

DC Plate Voltage	12,500 Volts
DC Grid Voltage	—625 Volts
Peak R-F Grid Voltage	625 Volts
DC Plate Current	2.4 Amperes
DC Grid Current, approximate	0 Amperes
Driving Power, approximate‡	1 Kilowatt
Power Output, approximate	12 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,600 Volts
DC Plate Current	4 Amperes
DC Grid Current	0.8 Amperes
Plate Input	40 Kilowatts
Plate Dissipation	15 Kilowatts

Typical Operation

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—840 Volts
Peak R-F Grid Voltage	1,440 Volts
DC Plate Current	3.8 Amperes
DC Grid Current, approximate	0.78 Amperes
Driving Power, approximate	1 Kilowatt
Power Output, approximate	29 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C —TELEGRAPHY

(Key-down conditions per tube without amplitude Modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	12,500	15,000*	Volts
DC Grid Voltage	—1,600	—1,600*	Volts
DC Plate Current	6	6*	Amperes
DC Grid Current	0.8	0.8*	Amperes
Plate Input	60	67.5*	Kilowatts
Plate Dissipation	22.5	22.5*	Kilowatts

Typical Operation

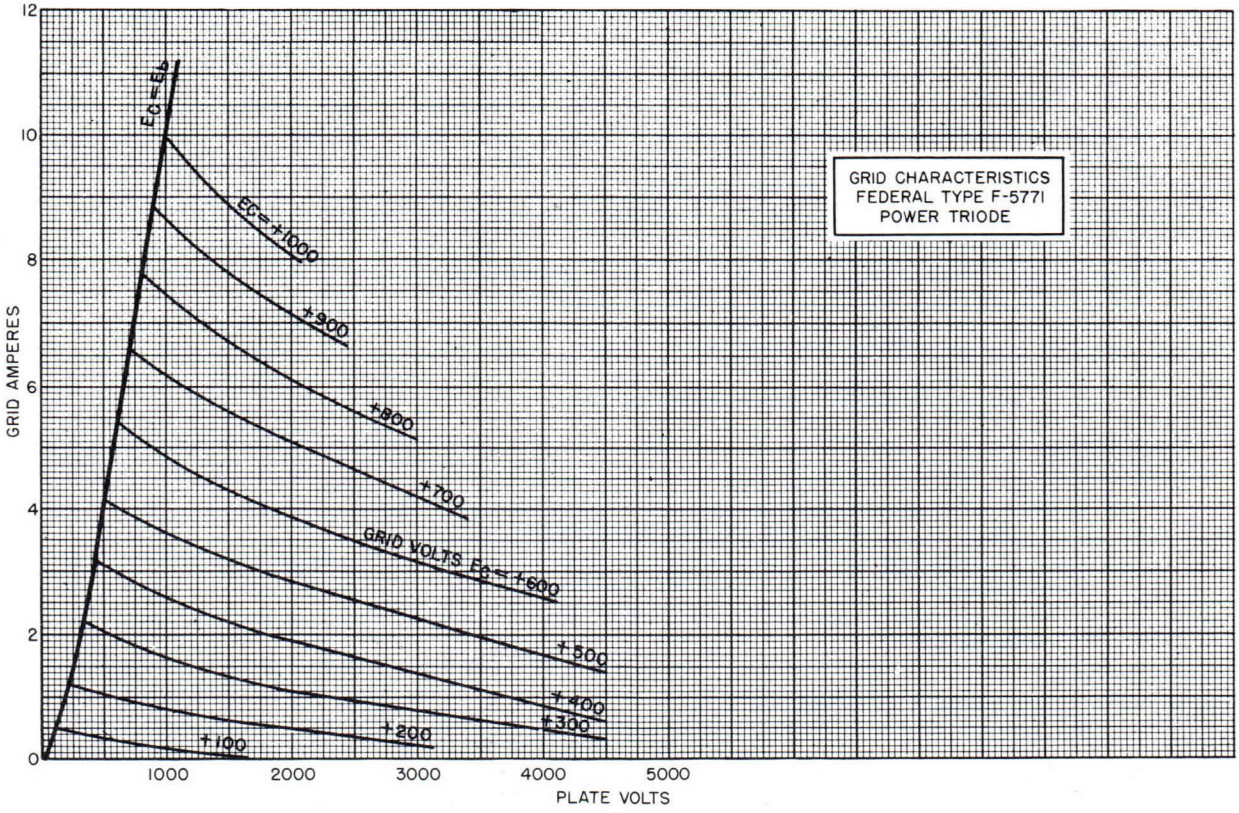
DC Plate Voltage	10,000	12,500	15,000	Volts
DC Grid Voltage	—770	—630	—990	Volts
Peak R-F Grid Voltage	1,440	1,230	1,620	Volts
DC Plate Current	6	4.8	4.5	Amperes
DC Grid Current, approximate	0.77	0.75	0.8	Amperes
Driving Power, approximate	1	1	1.2	Kilowatts
Power Output, approximate	40	44	53	Kilowatts

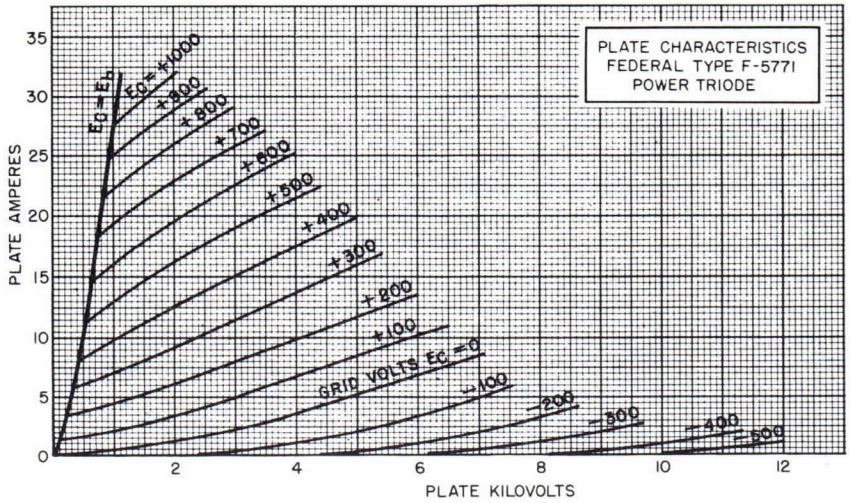
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

*These ratings apply only at a frequency of 1,500 kilocycles or less.

Federal tubes of all types are in service around the world . . . delivering the high calibre performance for which they were designed.

FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation

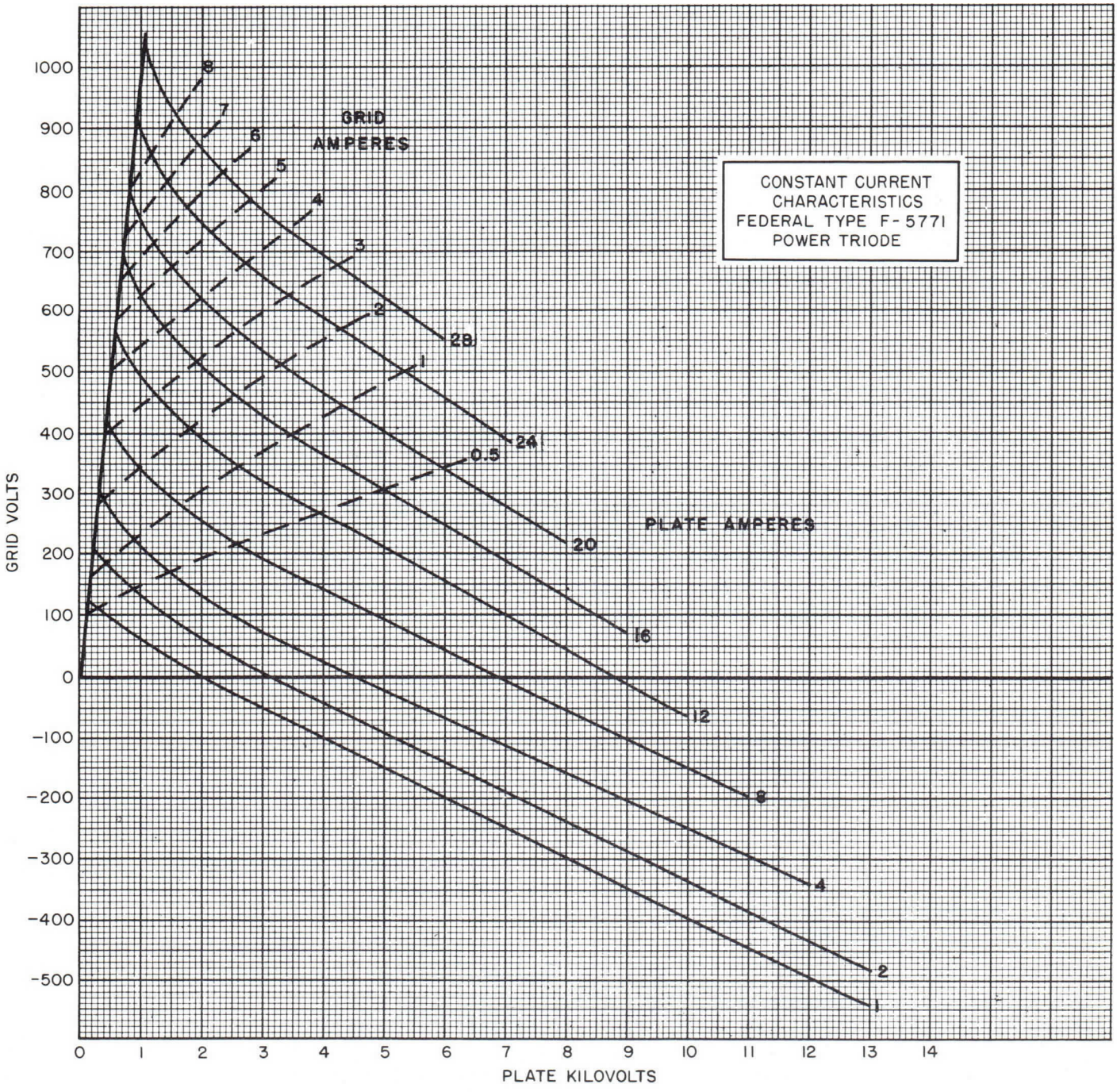




AN IT&T ASSOCIATE

FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation

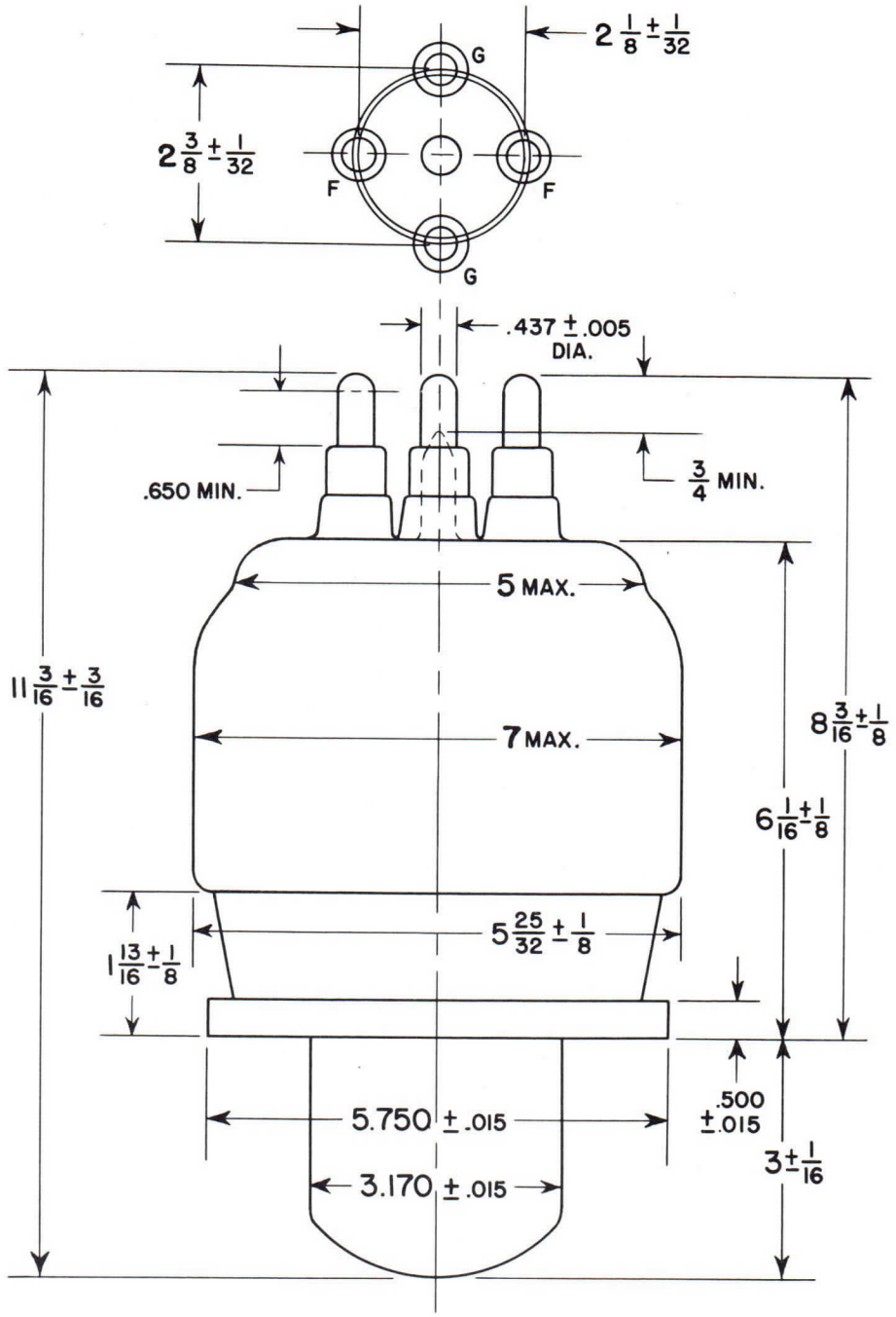
Backed by years of engineering and manufacturing experience, Federal tubes have consistently set the world's *standards of performance* in broadcast service.



AN IT&T ASSOCIATE

Federal vacuum tubes are designed for long service life and maintenance of original characteristics, and produced with all the care and precision of fine craftsmanship.

FEDERAL POWER TRIODE
Type F-5771
22.5 Kilowatts Plate Dissipation



OUTLINE DRAWING
F – 5771

Federal Telephone and Radio Corporation
100 Kingsland Road Clifton, New Jersey

Federal Always Has
Made Better Tubes

Printed in U. S. A.—Form F-482

5874A

See Mr. Roach's copy

internal dimensions).

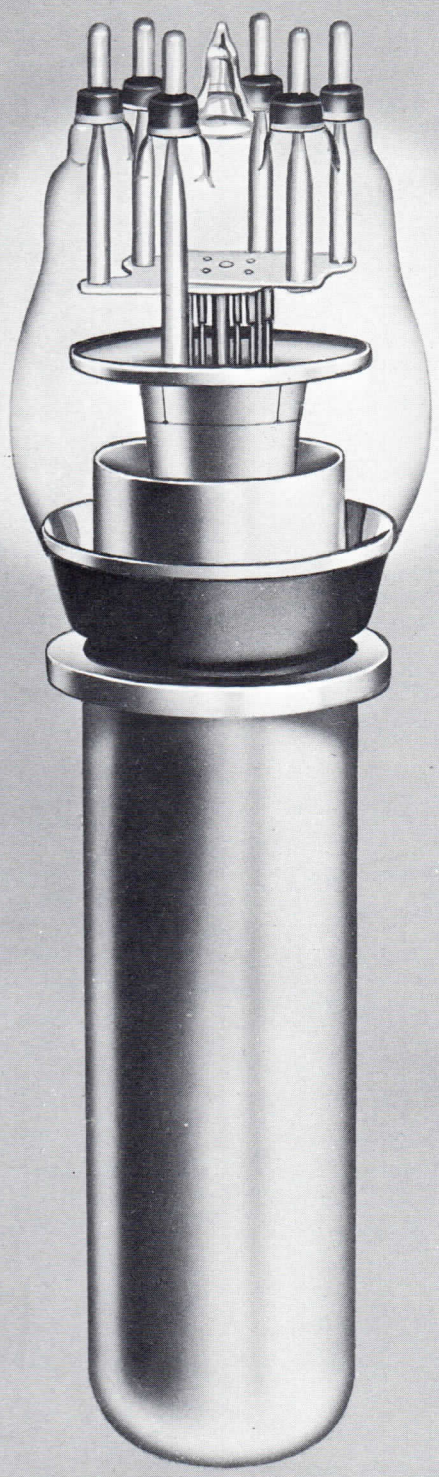
The K352 requires magnetic focusing and a water cooled focus mount, operating from an 80 volt, 40 ampere, supply (max) employed for this purpose. Forced-air cooling of the output window, which is of low loss glass construction, is required and water cooling is necessary for the body and collector.

The K352 is suitable for use with linear particle accelerators and may also be applied to high power radars.

Summary of Characteristics

Electrical		
Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	5	V Max.
Heater Current	110	A Max.
Mechanical		
Overall Length	48·25 inches Max.	
Overall Width	13·4 inches Max.	
Output Flange	5–5/16 inches diameter with 8 holes	
Mounting Position	Vertical, Cathode down.	
Typical Operating Conditions		
Beam Voltage (Peak)	195	kV
Beam Current (Peak)	90	A
Gain	30	db
Pulse Length	2·5 μsec	
Duty Cycle	0·0015	
Output Power (Peak)	6	MW
Output Power (Mean)	9	kW

FEDERAL POWER TRIODE
Type F-5918-A
70 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-5918-A is a three-electrode tube designed for use as radio-frequency amplifier, oscillator, or Class B modulator. The anode is water-cooled, capable of dissipating 70 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 22 megacycles.

Electrical:

Filament Voltage	11 Volts
Filament Current	285 Amperes
Filament Starting Current	1000 Amperes max.
Filament Cold Resistance	.005 Ohms
Peak Cathode Current	100 Amperes
Amplification Factor, at $I_b = 2$ amps. $E_b = -200$ volts	37
Interelectrode Capacitances	
Grid-Plate	34.5 $\mu\mu$f
Grid-Filament	75 $\mu\mu$f
Plate-Filament	2.4 $\mu\mu$f

Mechanical:

Mounting Position— Vertical, Anode Down	
Type of Cooling—Water	
Water Flow on Anode	30 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
Net Weight, approximate	25 Lbs.

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FEDERAL POWER TRIODE
Type F-5918-A
70 Kilowatts Plate Dissipation

The F-5918-A has given *proven* service in 200 KW plate modulated short-wave transmitters.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	17,500 Volts
Maximum Signal DC Plate Current†	15 Amperes
Maximum Signal Plate Input†	175 Kilowatts
Plate Dissipation†	70 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—300 Volts
Peak A-F Grid-to-Grid Voltage	1,600 Volts
Zero Signal DC Plate Current	2 Amperes
Maximum Signal DC Plate Current	16 Amperes
Effective Load Resistance, Plate to Plate	2,250 Ohms
Max. Sig. Driving Power, approx.	1,500 Watts
Max. Sig. Power Output, approx.	150 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	17,500 Volts
DC Plate Current	12 Amperes
Plate Input	100 Kilowatts
Plate Dissipation	70 Kilowatts

Typical Operation

DC Plate Voltage	15,000 Volts
DC Grid Voltage	—375 Volts
Peak R-F Grid Voltage	500 Volts
DC Plate Current	4.9 Amperes
DC Grid Current	0.0 Amperes
Driving Power, approximate‡	770 Watts
Power Output, approximate	25 Kilowatts

‡At crest of audio-frequency cycle with modulation factor of 1.0.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	12 Amperes
DC Grid Current	2 Amperes
Plate Input	165 Kilowatts
Plate Dissipation	47 Kilowatts

Typical Operation

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—800 Volts
Peak R-F Grid Voltage	1,550 Volts
DC Plate Current	10 Amperes
DC Grid Current	1.4 Amperes
Driving Power, approximate	2 Kilowatts
Power Output, approximate	104 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	17,500 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	18 Amperes
DC Grid Current	2 Amperes
Plate Input	300 Kilowatts
Plate Dissipation	70 Kilowatts

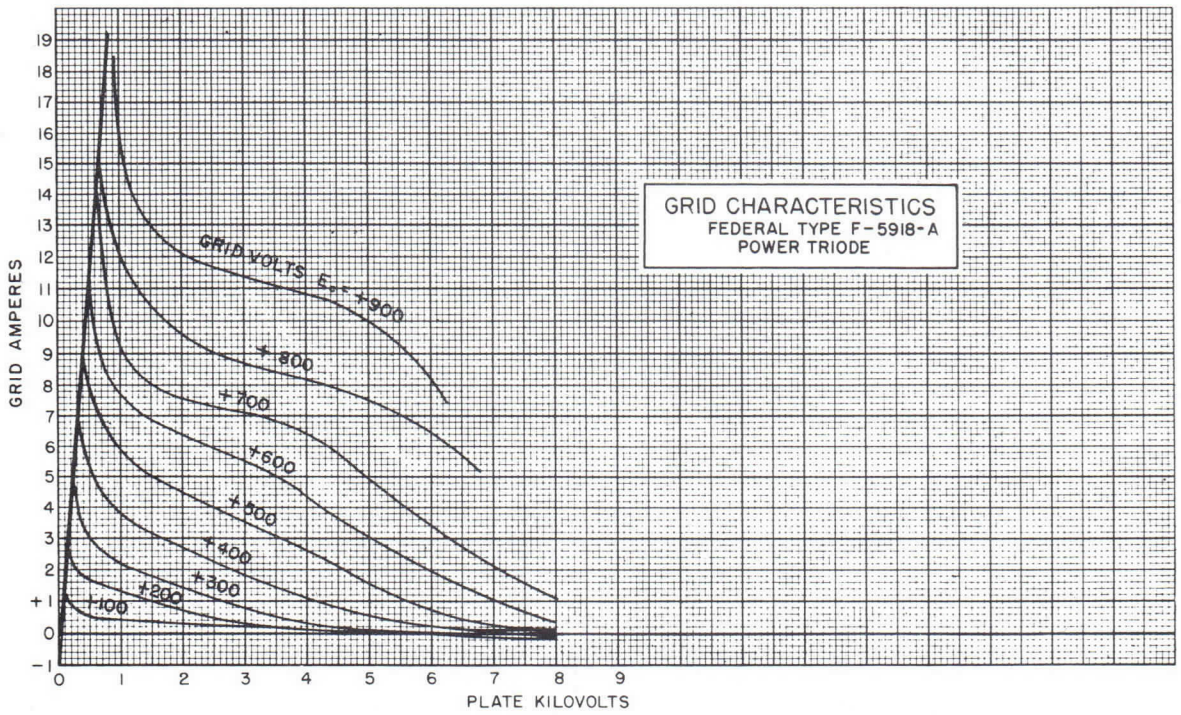
Typical Operation

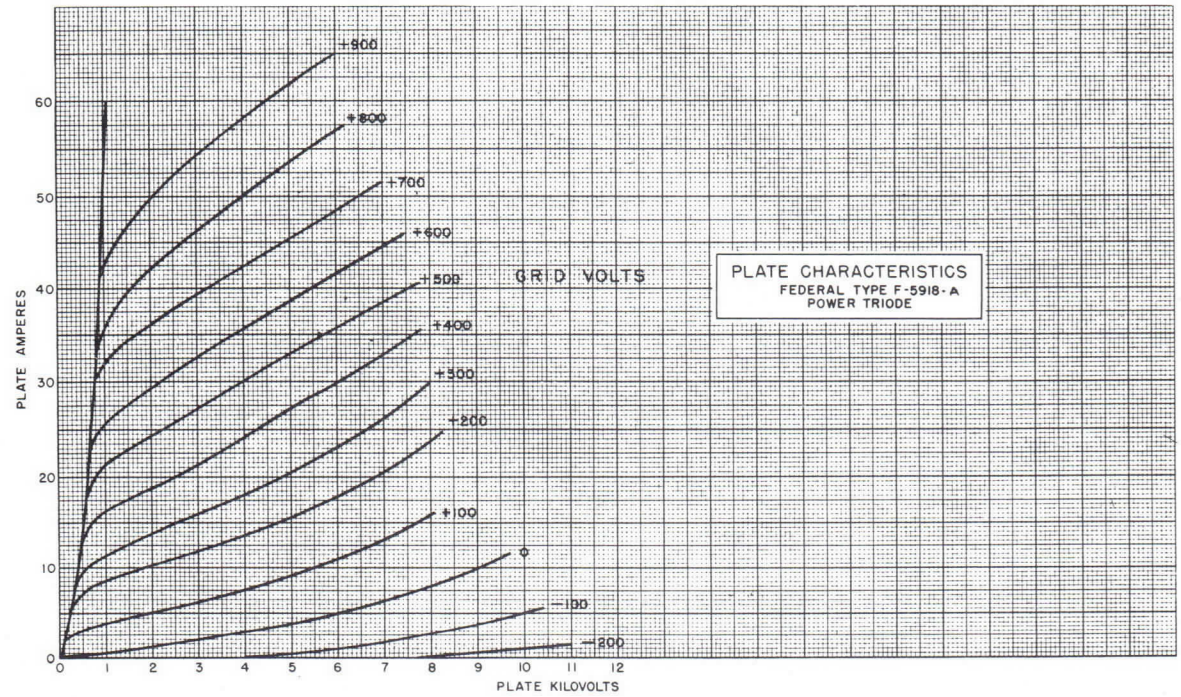
DC Plate Voltage	17,500 Volts
DC Grid Voltage	—1,000 Volts
Peak R-F Grid Voltage	1,960 Volts
DC Plate Current	13.8 Amperes
DC Grid Current, approximate	2 Amperes
Driving Power, approximate	3.6 Kilowatts
Power Output, approximate	180 Kilowatts

¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

The F-5918-A grid is especially treated for unusually high heat dissipation contributing to stability in operation.

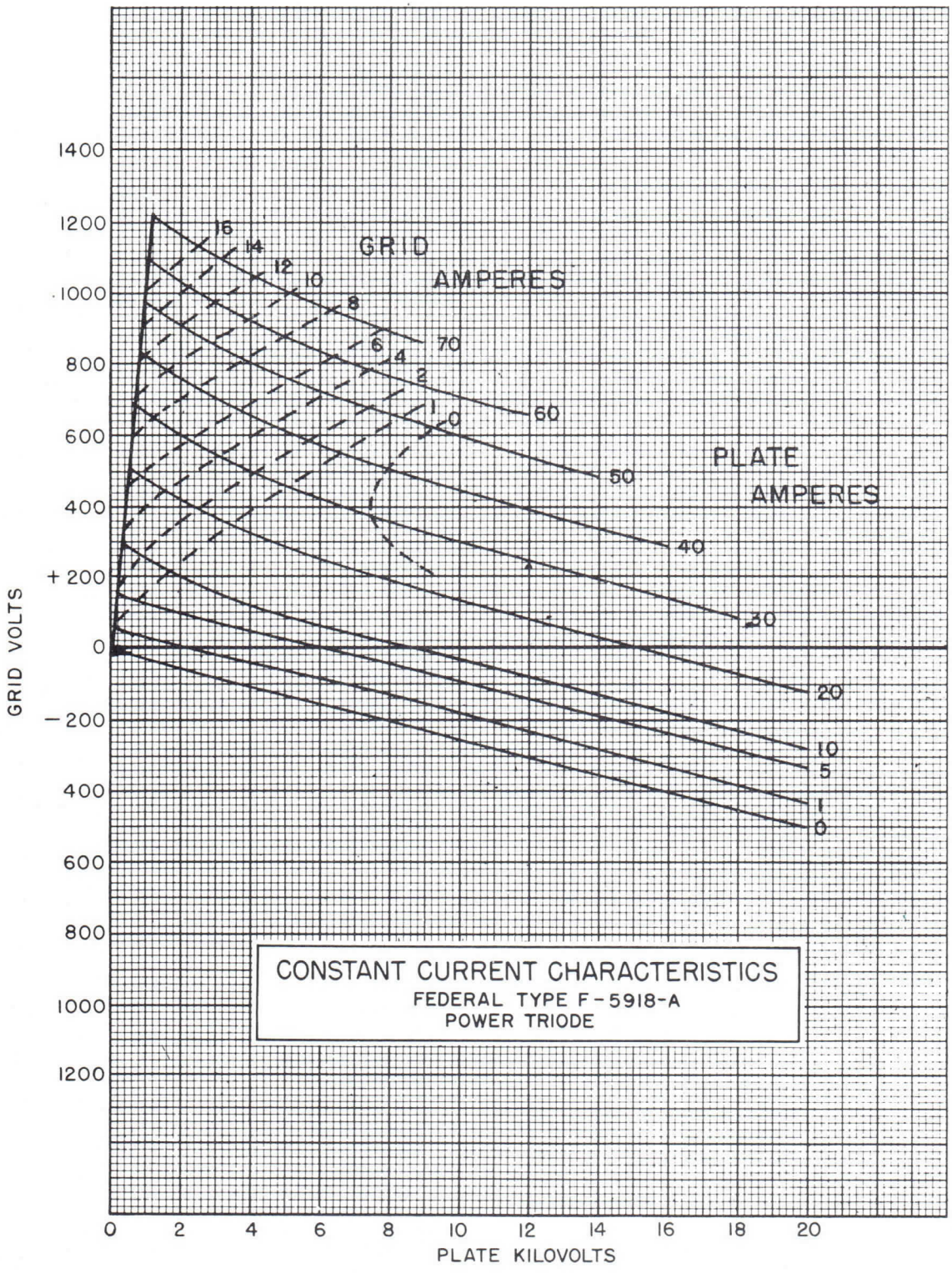
FEDERAL POWER TRIODE
Type F-5918-A
70 Kilowatts Plate Dissipation





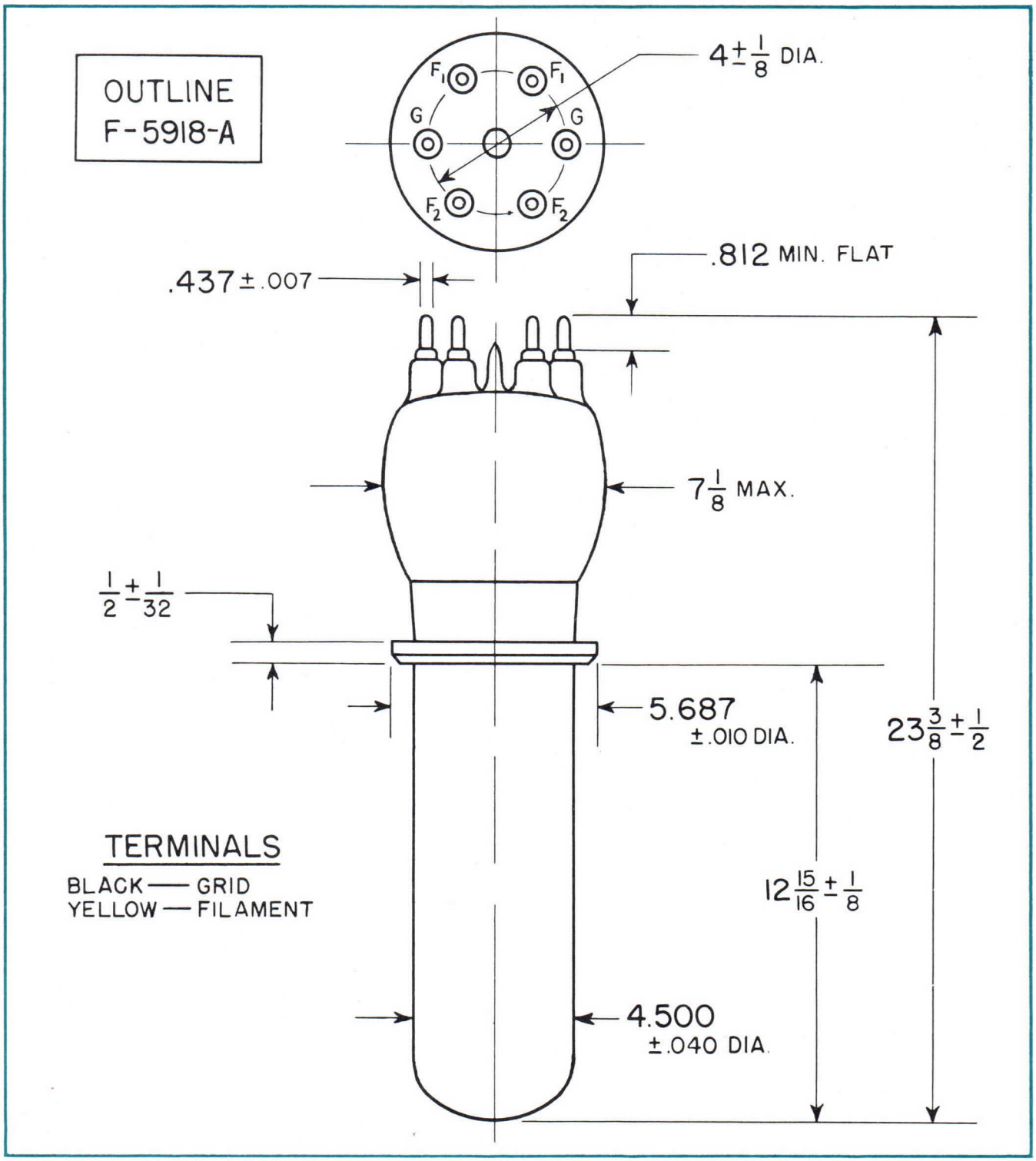
FEDERAL POWER TRIODE
Type F-5918-A
70 Kilowatts Plate Dissipation

Federal means longer tube life, finer performance, greater satisfaction, greater value for your tube dollar.



Kovar-to-glass seals throughout and heavy wall anode contribute to the electrical and mechanically rugged structure of the F-5918-A

FEDERAL POWER TRIODE
Type F-5918-A
70 Kilowatts Plate Dissipation



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100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

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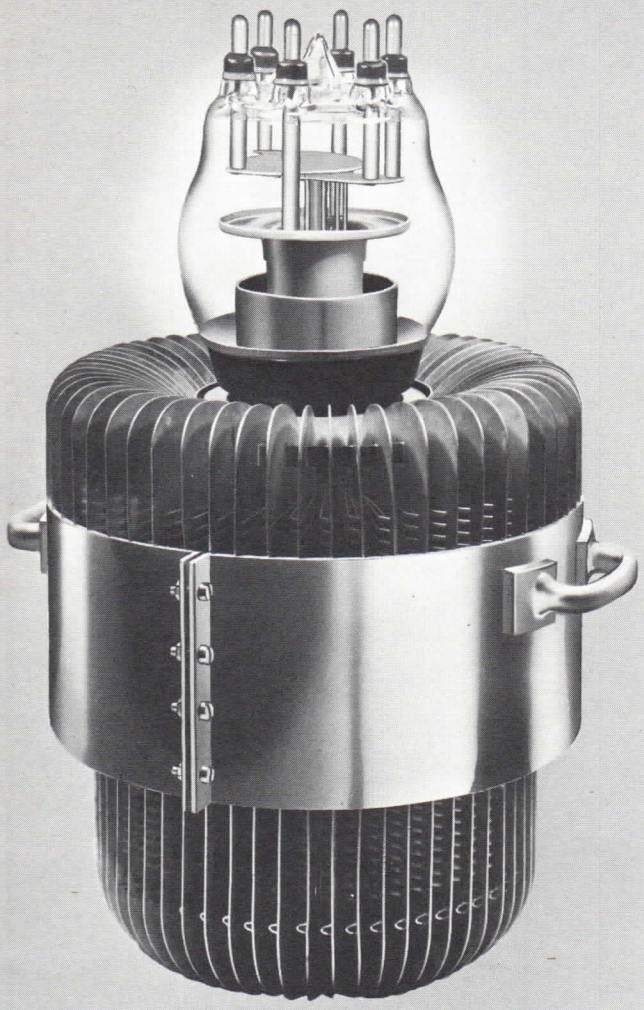
Form F-504-A Printed in U. S. A.

FEDERAL POWER TRIODE
Type F-5919
35 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's F-5919 is a three-electrode tube designed for use as radio-frequency amplifier, oscillator, or Class B modulator. The anode is forced air-cooled, capable of dissipating 35 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 22 megacycles.

Electrical:

▶ Filament Voltage	11 Volts
▶ Filament Current	285 Amperes
▶ Filament Starting Current	1,000 Amperes max.
▶ Filament Cold Resistance	.005 Ohms
▶ Peak Cathode Current	100 Amperes
▶ Amplification Factor, at I_b=2 amps. E_b=—200 volts	37
▶ Interelectrode Capacitances	
Grid-Plate	34.5 $\mu\mu$f
Grid-Filament	75 $\mu\mu$f
Plate-Filament	2.6 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Anode Down	
▶ Type of Cooling— Forced Air	
Air Flow	1800 CFM
Maximum Incoming Air Temperature	45° C
Maximum Glass Temperature	165° C

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FEDERAL POWER TRIODE
Type F-5919
35 Kilowatts Plate Dissipation

The F-5919 enables single-ended design for a full 50 Kilowatt output.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	17,500 Volts
Maximum Signal DC Plate Current†	14 Amperes
Maximum Signal Plate Input†	175 Kilowatts
Plate Dissipation†	35 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	10,000 Volts
DC Grid Voltage	—220 Volts
Peak A-F Grid-to-Grid Voltage	820 Volts
Zero Signal DC Plate Current	0.6 Ampere
Maximum Signal DC Plate Current	5.8 Amperes
Effective Load Resistance, Plate to Plate	3,600 Ohms
Max. Sig. Driving Power, approx.	820 Watts
Max. Sig. Power Output, approx.	37 Kilowatts

†Averaged over any audio frequency cycle of sine-wave form.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	14,000 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	12 Amperes
DC Grid Current	2 Amperes
Plate Input	100 Kilowatts
Plate Dissipation	24 Kilowatts

Typical Operation

DC Plate Voltage	10,000	11,000 Volts
DC Grid Voltage	—750	—900 Volts
Peak R-F Grid Voltage	1,360	1,500 Volts
DC Plate Current	6.6	5.7 Amperes
DC Grid Current	0.9	0.9 Ampere
Driving Power, approx.	1.2	1.3 Kilowatts
Power Output, approx.	50	50 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)¶

Maximum Ratings, Absolute Values

DC Plate Voltage	17,500 Volts
DC Grid Voltage	—3,000 Volts
DC Plate Current	14 Amperes
DC Grid Current	2 Amperes
Plate Input	175 Kilowatts
Plate Dissipation	35 Kilowatts

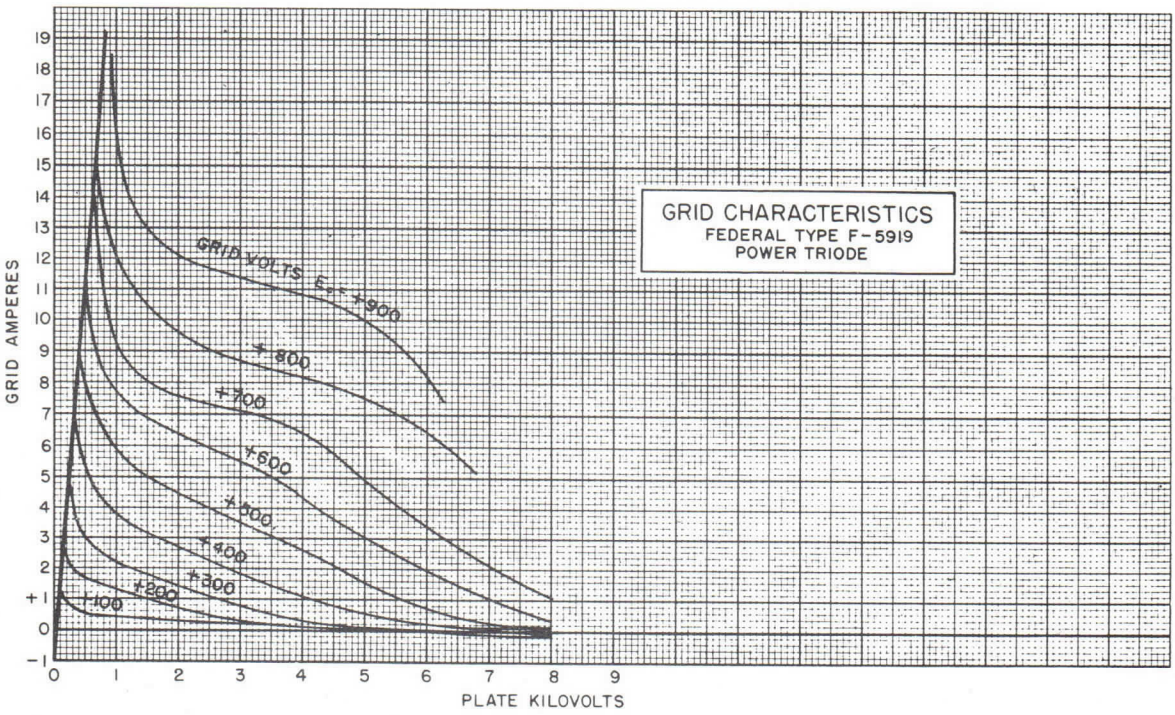
Typical Operation

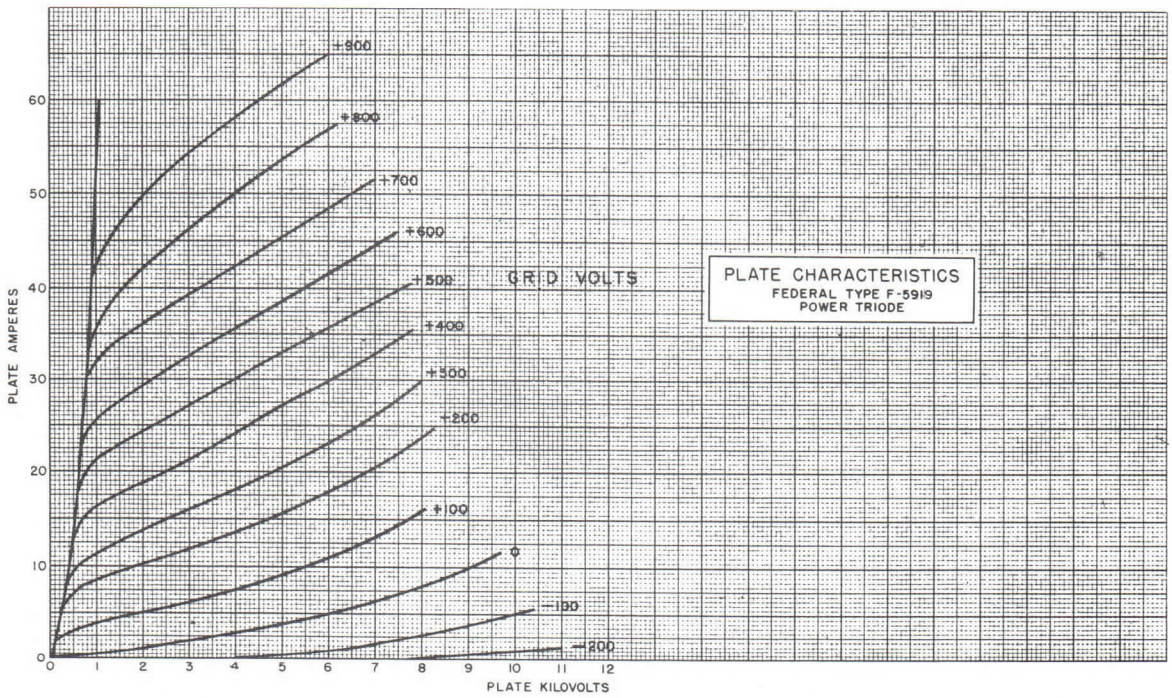
DC Plate Voltage	10,000 Volts
DC Grid Voltage	—1,000 Volts
Peak R-F Grid Voltage	1,675 Volts
DC Plate Current	6.4 Amperes
DC Grid Current, approximate	1.1 Amperes
Driving Power, approximate	1.7 Kilowatts
Power Output, approximate	50 Kilowatts

¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

The F-5919 grid is especially treated for unusually high heat dissipation contributing to stability in operation.

FEDERAL POWER TRIODE
Type F-5919
35 Kilowatts Plate Dissipation





FEDERAL POWER TRIODE
Type F-5919
35 Kilowatts Plate Dissipation

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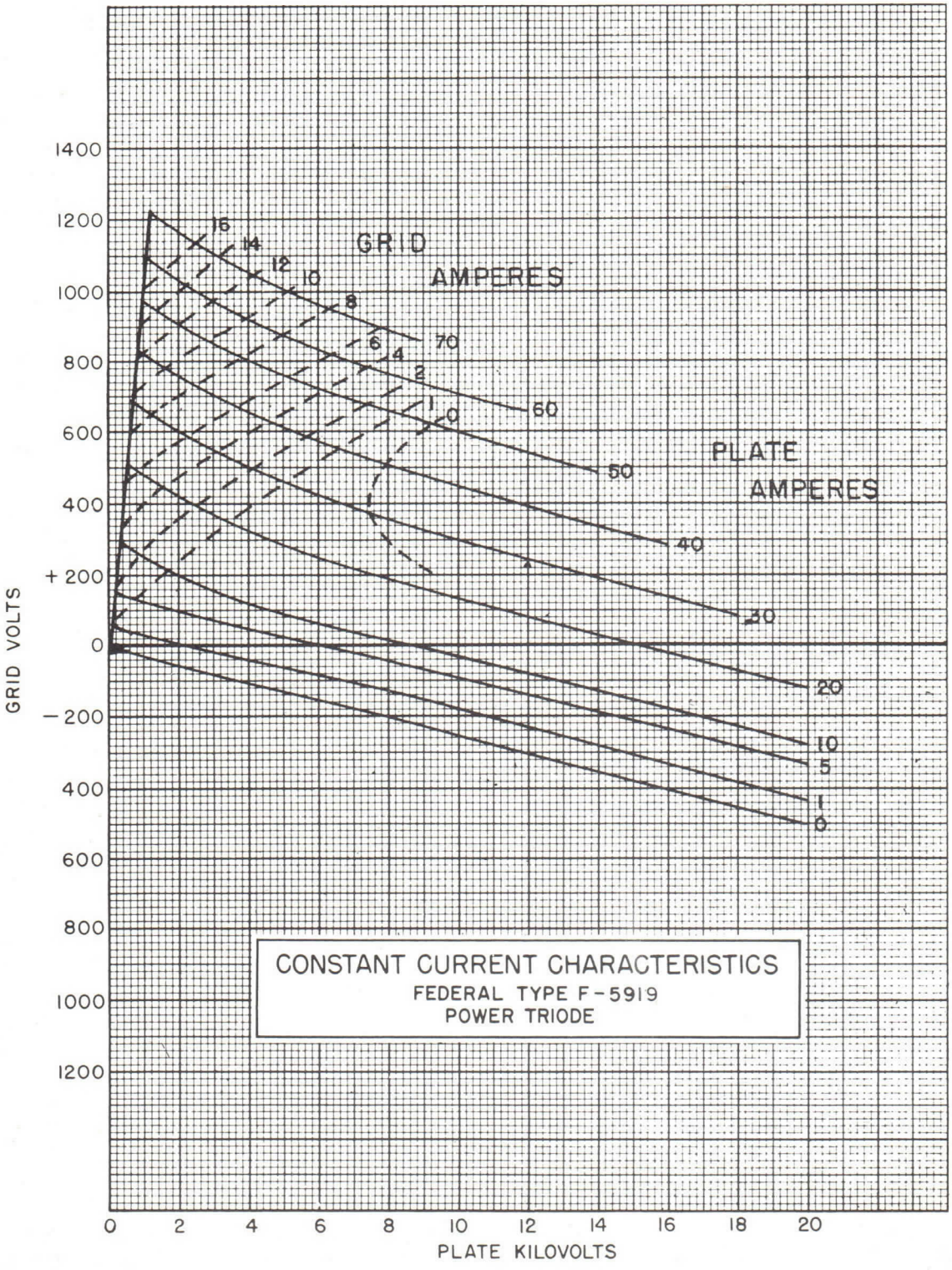
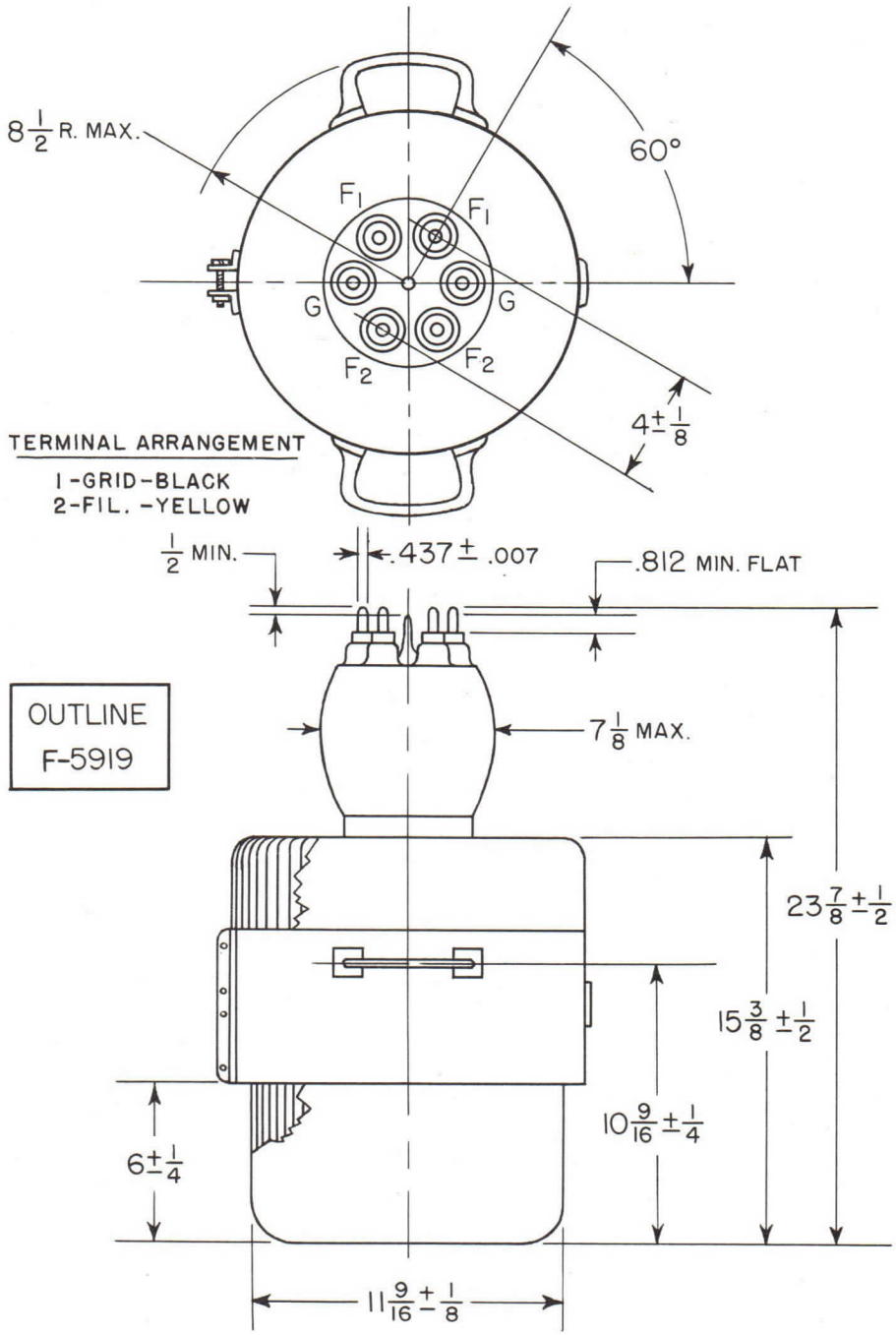


Kovar-to-glass seals throughout and heavy wall anode contribute to the electrical and mechanically rugged structure of the F-5919.

FEDERAL POWER TRIODE
Type F-5919
35 Kilowatts Plate Dissipation



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100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

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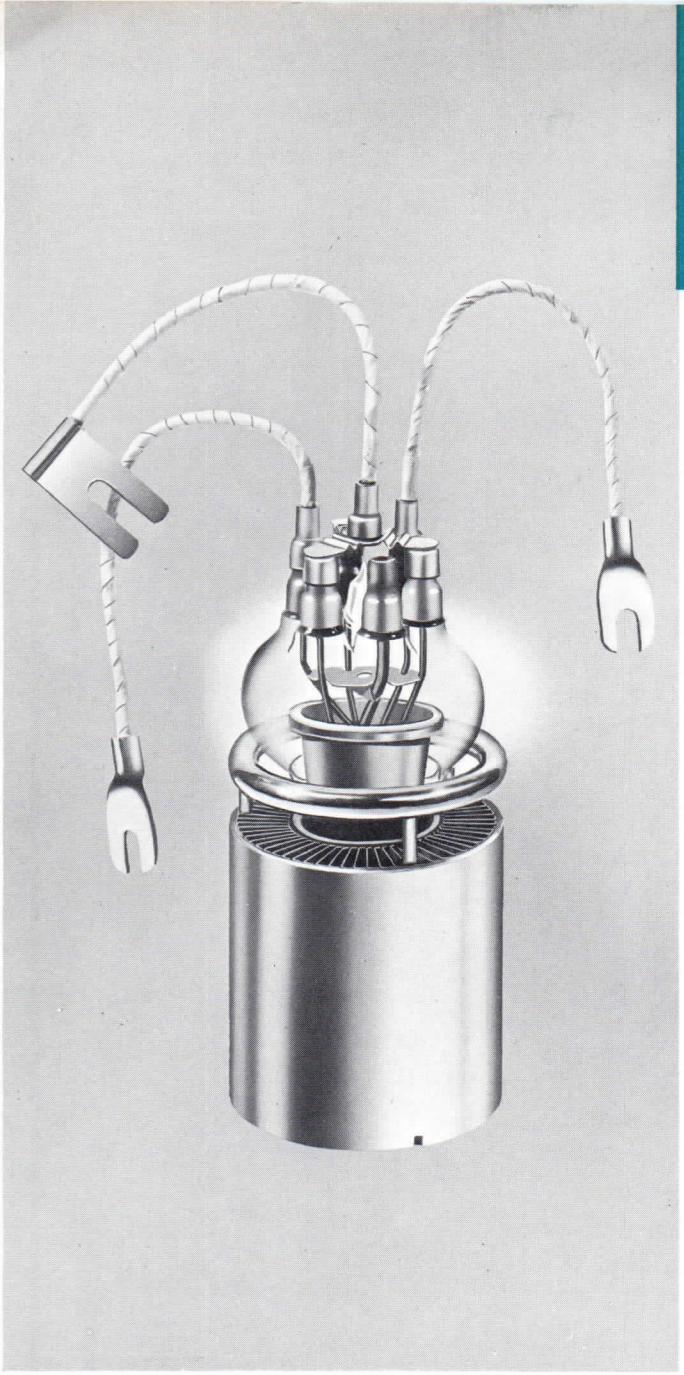
FEDERAL POWER TRIODE
Type F-5996
2.5 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's Type F-5996 is a three-electrode tube designed for use as an industrial oscillator. The anode is forced air-cooled, capable of dissipating 2.5 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles.

Electrical:

▸ Filament Voltage	13.0 Volts
▸ Filament Current	36 Amperes
▸ Filament Starting Current	72 Amperes
▸ Filament Cold Resistance	.040 Ohms
▸ Amplification Factor, E_c=—200 V, Ib=0.2A	25
▸ Interelectrode Capacitances	
Grid-Plate	12.0 $\mu\mu$f
Grid-Filament	15.0 $\mu\mu$f
Plate-Filament	1.8 $\mu\mu$f

Mechanical:

▸ Mounting Position— Vertical, Anode Down			
▸ Type of Cooling—Forced Air			
Maximum Incoming Air Temperature			45° C
▸ Required Air Flow on Anode			
Plate Dissipation (Kilowatts)	2.5	2.0	1.5
Air Flow—Cubic Feet Per Min.	150	120	90
Pressure—Inches Water	2.5	1.6	0.9
Maximum Glass Temperature			150° C
▸ Net Weight, Approximate			5¼ Pounds

For Maximum Ratings, Typical Operating Conditions, and Characteristic Curves, refer to Catalog Sheet F-5680. All values and ratings apply with the exception that the F-5996 is not recommended for pulsed operation.

Federal's Type F-5996 has been designed to meet the rugged operating conditions of industrial heating equipment.

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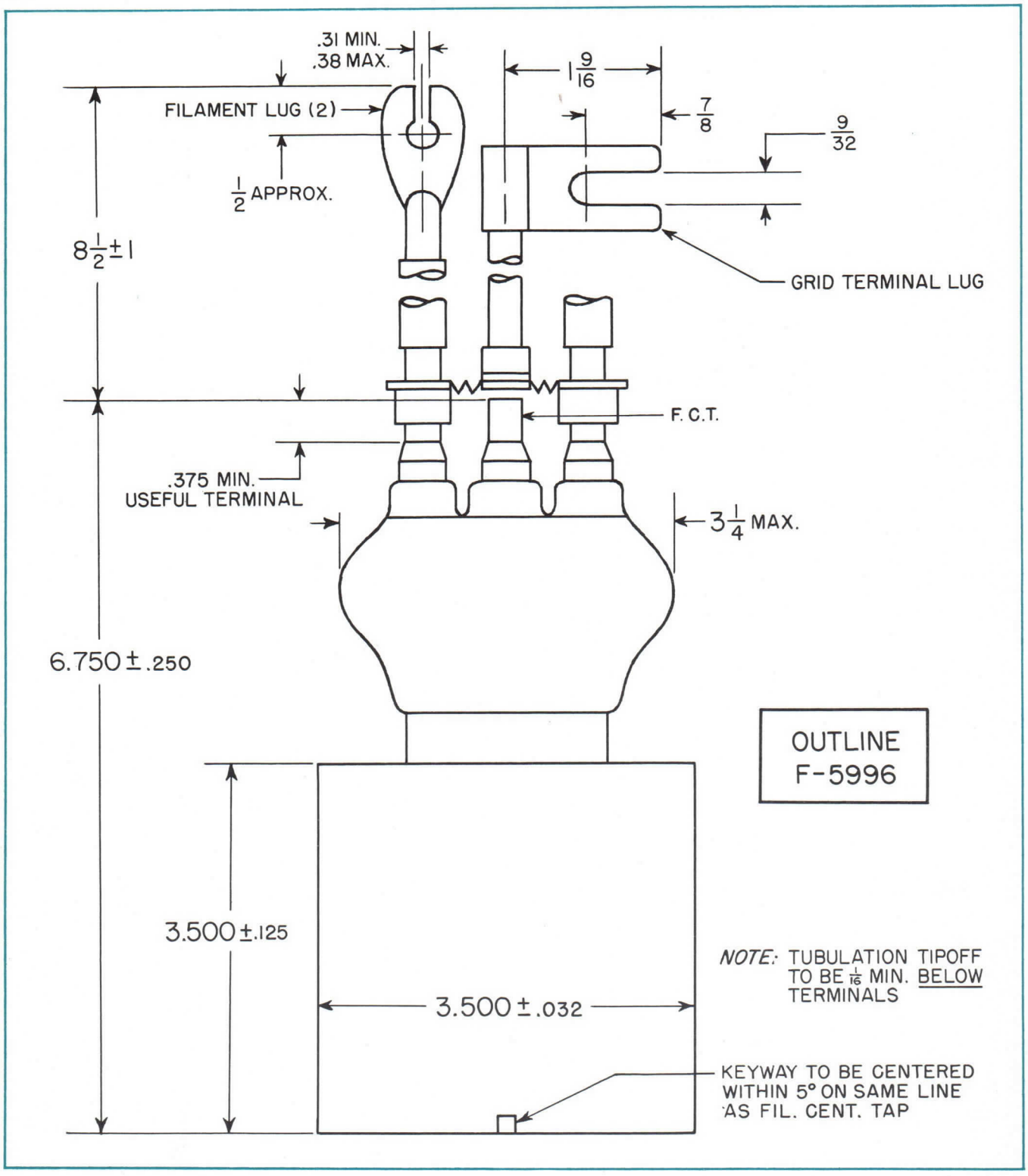
Federal Telephone and Radio Company

FEDERAL POWER TRIODE
Type F-5996
2.5 Kilowatts Plate Dissipation

Federal's name on a tube means the *best* in design, engineering, materials, components, and craftsmanship.



OUTLINE
F-5996

NOTE: TUBULATION TIPOFF TO BE 1/16 MIN. BELOW TERMINALS

Form F-594 Printed in U. S. A.

DIVISION OF IT&T

Federal Telephone and Radio Company

100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

FEDERAL VHF POWER TETRODE
Type F-6166
10 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

The F-6166 by Federal is a power tetrode designed for VHF service in television and CW service. The anode is forced air cooled, capable of dissipating 10 kilowatts. The coaxial stem construction minimizes lead inductance and provides for easy insertion into coaxial cylinder type circuits.

Electrical:

▶ Filament, Thoriated Tungsten:	
Voltage (AC or DC)*	5.0 ± 5% Volts
Current at 5 volts	175 Amperes
Minimum Heating Time	15 Seconds
Cold Resistance	0.0038 Ohm
▶ Mu-Factor, Grid No. 2 to Grid No. 1 for plate volts=2000, grid No. 2 volts=1000, and plate amps. =2	10
▶ Direct Interelectrode Capacitances:	
Grid No. 1 to Plate**	0.6 Max. μμf
Grid No. 1 to Filament	44 μμf
Plate to Filament**	0.08 Max. μμf
Grid No. 1 to Grid No. 2	60 μμf
Grid No. 2 to Plate	23 μμf

Mechanical:

▶ Mounting Position— Vertical, filament end up or down	
▶ Maximum Overall Length	11-5/8"
▶ Maximum Diameter	6-13/32"
▶ Terminal Connections	See Outline Drawing
▶ Radiator	Integral part of tube
▶ Air Flow:	

THROUGH RADIATOR—The specified flow of incoming air at a temperature of 45°C for various plate dissipations, as indicated in the tabulation below, should be delivered by a blower through the radiator before and during the application of any voltages. The air should enter the radiator at its plate-contact-surface end (see Outline Drawing). Filament power, plate power, and air flow may be removed simultaneously.

Percentage of Max. Rated Plate Dissipation for Each Class of Service	100	80	60	per cent
Minimum Air Flow	350	270	200	cfm
Static Pressure	3	2.1	1.3	in. of water

TO GRID-No. 2 TERMINAL:

Plate-Ring End	†	
Grid-No. 1—Terminal End	50 min.	cfm

† A sufficient quantity of the air flow to the radiator should be directed onto the plate end of the grid-No. 2 terminal so that its temperature does not exceed the specified value.

TO GRID-No. 1 TERMINAL AND FILAMENT SEALS 50 min. cfm

* Full rated filament voltage can be applied safely to the cold filament. It is not necessary to provide means for limiting the filament starting current.

** With external flat metal shield 12" square having center hole 4-5/16" diameter. Shield is located in plane of the grid—No. 2 terminal, perpendicular to the tube axis, and is connected to grid No. 2.

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FEDERAL VHF POWER TETRODE
Type F-6166
10 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	30	220	Mc
Max. Permissible Percentage of Max. Rated Plate Voltage and Plate Input:			
Class B Television Service	Full Ratings—54 to 216 Mc		
Class C Television Service	Full Ratings—54 to 216 Mc		
Class C Telephony Service, Plate-Modulated	100	90	%
Class C Telegraphy and FM Telephony	100	90	%

- Incoming—Air Temperature 45 Max. °C
- Radiator Temperature (Measured on the core at end away from incoming air) 180 Max. °C
- Glass Temperature (At hottest part) 180 Max. °C
- Seal Temperature: Filament, Grid No. 1, Grid No. 2, and Plate 180 Max. °C
- Weight (Approx.) 15 Pounds

Maximum Ratings and Typical Operating Conditions

RF POWER AMPLIFIER—CLASS B TELEVISION SERVICE

Synchronizing—level conditions per tube unless otherwise specified
(Voltages are referred to cathode unless otherwise specified)

Maximum CCS① Ratings, Absolute Values:

	54 to 216 Mc
DC Plate Voltage	6,000 Max. Volts
DC Grid—No. 2 (Screen) Voltage	2,000 Max. Volts
DC Plate Current	4 Max. Amps
Plate Input	22,000 Max. Watts
Grid—No. 2 Input	400 Max. Watts
Plate Dissipation	10,000 Max. Watts
Grid—No. 1 (Control—Grid) Dissipation	300 Max. Watts

Typical Operation in Grid-Drive Circuit:

	Bandwidth②of 8.5 Mc
DC Plate Voltage	5800 Volts
DC Grid—No. 2 Voltage	1200 Volts
DC Grid—No. 1 Voltage	—130 Volts
Peak RF Grid—No. 1 Voltage:	
Synchronizing Level	375 Volts
Pedestal Level	290 Volts
DC Plate Current:	
Synchronizing Level	3.45 Amps
Pedestal Level	2.60 Amps
DC Grid—No. 2 Current (Pedestal Level)	0.207 Amp
DC Grid—No. 1 Current (Approx.):	
Synchronizing Level	0.350 Amp
Pedestal Level	0.170 Amp
Driver Power Output (Approx.):③	
Synchronizing Level	800④ Watts
Pedestal Level	450 Watts
Power Output (Approx.):	
Synchronizing Level	12,000 Watts
Pedestal Level	6,800 Watts

Typical Operation in Cathode-Drive Circuit:

	Bandwidth②of 8.5 Mc
DC Plate Voltage	5,885 Volts
DC Grid—No. 2 Voltage	885 Volts
DC Cathode-to-Grid—No. 1 Voltage	85 Volts
Peak RF Cathode-to-Grid—No. 1 Voltage:	
Synchronizing Level	330 Volts
Pedestal Level	260 Volts
DC Plate Current:	
Synchronizing Level	3.45 Amps
Pedestal Level	2.60 Amps
DC Grid—No. 2 Current (Pedestal Level)	0.152 Amp
DC Grid—No. 1 Current (Approx.):	
Synchronizing Level	0.405 Amp
Pedestal Level	0.220 Amp
Driver Power Output (Approx.):⑤	
Synchronizing Level	1,300⑥ Watts
Pedestal Level	700 Watts
Power Output (Approx.):	
Synchronizing Level	12,000 Watts
Pedestal Level	6,800 Watts

BIAS-MODULATED RF POWER AMPLIFIER—CLASS C TELEVISION SERVICE

Synchronizing—level conditions per tube unless otherwise specified

Maximum CCS① Ratings, Absolute Values:

	54 to 216 Mc
DC Plate Voltage	6,000 Max. Volts
DC Grid—No. 2 (Screen) Voltage	2,000 Max. Volts
DC Grid—No. 1 (Control—Grid) Voltage (White Level)	—1,000 Max. Volts
DC Plate Current	4 Max. Amps
Plate Input	22,000 Max. Watts
Grid—No. 2 Input	400 Max. Watts
Plate Dissipation	10,000 Max. Watts
Grid—No. 1 Dissipation	300 Max. Watts

FEDERAL POWER TRIODE
Type F-6179
50 Kilowatts Plate Dissipation

GENERAL DATA

DESCRIPTION:

The F-6179 is a three-electrode tube designed for use as a modulator. The anode is water-cooled and capable of dissipating 50 kilowatts. The cathode is a pure tungsten filament. Maximum ratings apply for audio-frequency use only.

Electrical:

▶ Filament Voltage	27.2 Volts
▶ Filament Current	196.5 Amperes
▶ Filament Starting Current	300 Amperes
▶ Filament Cold Resistance	.015 Ohms
▶ Amplification Factor, at $E_c = -1{,}600$ V $I_b = 3.0$A	4.75
▶ Interelectrode Capacitances	
Grid-Plate	61 $\mu\mu$f
Grid-Filament	63 $\mu\mu$f
Plate-Filament	0.6 $\mu\mu$f

Mechanical:

▶ Mounting Position— Vertical, Anode Down	
▶ Type of Cooling—Water	
Water Flow on Anode	20 GPM
Maximum Outgoing Water Temperature	70° C
Maximum Glass Temperature	150° C
▶ Net Weight, approximate	10 Lbs.

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FEDERAL POWER TRIODE
Type F-6179
50 Kilowatts Plate Dissipation

Federal always has made *first-quality* tubes, and the record goes back for more than 40 years.

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS AB_1

Maximum Ratings, Absolute Values

DC Plate Voltage	15,000 Volts
Maximum Signal DC Plate Current†	10 Amperes
Maximum Signal Plate Input†	120 Kilowatts
Plate Dissipation†	50 Kilowatts

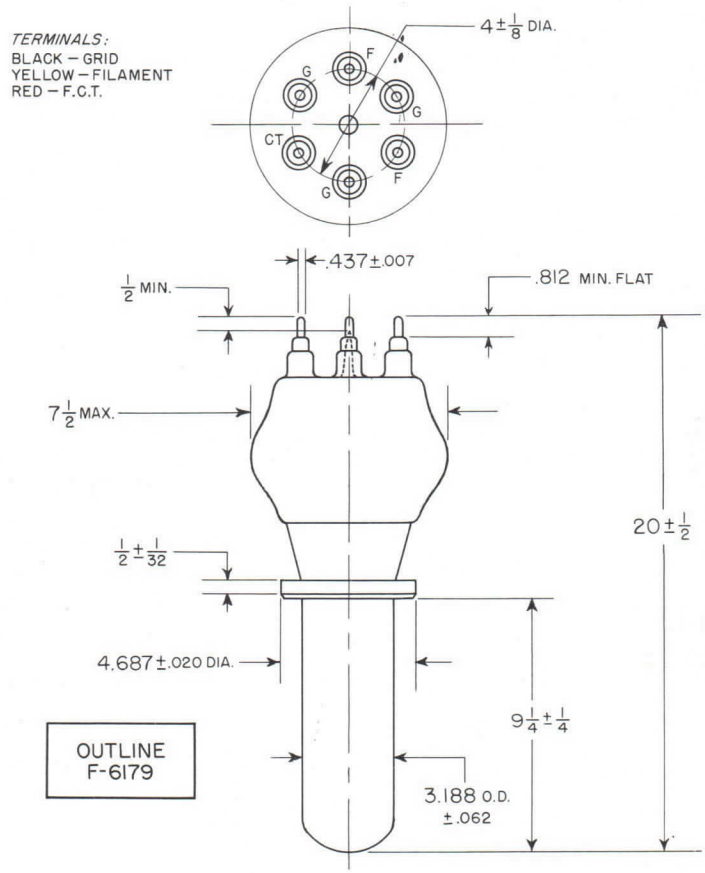
Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	12,000 Volts
DC Grid Voltage	—2,600 Volts
Peak A-F Grid to Grid Voltage	5,160 Volts
Zero Signal DC Plate Current	1.8 Amperes
Maximum Signal DC Plate Current	5.3 Amperes
Effective Load Resistance Plate to Plate	5,000 Ohms
Maximum Signal Driving Power	0 Watts
Maximum Signal Power Output	40 Kilowatts

For Characteristic Curves refer to Federal Type F-125-A.

†Averaged over any audio-frequency cycle of sine-wave form.



OUTLINE F-6179

Form F-596 Printed in U. S. A.

DIVISION OF IT&T

Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

Type F-6166 features high temperature gettering action that protects against momentary overloads.

FEDERAL VHF POWER TETRODE
Type F-6166
10 Kilowatts Plate Dissipation

Typical Operation in Grid-Drive Circuit:

	Bandwidth (2) of 8.5 Mc
DC Plate Voltage	5,800 Volts
DC Grid—No. 2 Voltage	1,200 Volts
DC Grid—No. 1 Voltage:	
Synchronizing Level	—130 Volts
Pedestal Level	—195 Volts
White Level	—350 Volts
Peak RF Grid—No. 1 Voltage	375 Volts
DC Plate Current:	
Synchronizing Level	3.45 Amps
Pedestal Level	2.42 Amps
DC Grid—No. 2 Current (Pedestal Level)	0.148 Amp
DC Grid—No. 1 Current (Approx.):	
Synchronizing Level	0.350 Amp
Pedestal Level	0.190 Amp
Driver Power Output (Approx.) (3) Synchronizing Level	800 (4) Watts
Power Output (Approx.):	
Synchronizing Level	12,000 Watts
Pedestal Level	6,800 Watts

PLATE-MODULATED RF POWER AMPLIFIER—CLASS C TELEPHONY

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum CCS (1) Ratings, Absolute Values: (7)

DC Plate Voltage	5,000 Max. Volts
DC Grid—No. 2 (Screen) Voltage	2,000 Max. Volts
DC Grid—No. 1 (Control—Grid) Voltage	—1,000 Max. Volts
DC Plate Current	2 Max. Amps
DC Grid—No. 1 Current	0.6 Max. Amp
Plate Input	10,000 Max. Watts
Grid—No. 2 Input	270 Max. Watts
Plate Dissipation	6,600 Max. Watts

Typical Operation in Grid-Drive Circuit:

	Up to 30 Mc
DC Plate Voltage	4,700 Volts
DC Grid—No. 2 Voltage (Modulated 100%) (8)	800 Volts
DC Grid—No. 1 Voltage (9)	—280 Volts
Peak RF Grid—No. 1 Voltage	485 Volts
DC Plate Current	1.56 Amps
DC Grid—No. 2 Current	0.217 Amp
DC Grid—No. 1 Current (Approx.)	0.300 Amp
Driver Power Output (Approx.)	180 (10) Watts
Power Output (Approx.)	5,500 Watts

RF POWER AMPLIFIER & OSCILLATOR—CLASS C TELEGRAPHY (11) and RF POWER AMPLIFIER—CLASS C FM TELEPHONY

Maximum CCS (1) Ratings, Absolute Values: (7)

DC Plate Voltage	6,600 Max. Volts
DC Grid—No. 2 (Screen) Voltage	2,000 Max. Volts
DC Grid—No. 1 (Control—Grid) Voltage	—1,000 Max. Volts
DC Plate Current	2.75 Max. Amps
DC Grid—No. 1 Current	0.6 Max. Amp
Plate Input	18,000 Max. Watts
Grid—No. 2 Input	400 Max. Watts
Plate Dissipation	10,000 Max. Watts

Typical Operation in Grid-Drive Circuit:

	At 216 Mc	
DC Plate Voltage	5,800	5,800 Volts
DC Grid—No. 2 Voltage (12)	1,200	1,200 Volts
DC Grid—No. 1 Voltage (13)	—130	—175 Volts
Peak RF Grid—No. 1 Voltage	230	370 Volts
DC Plate Current	1.8	2.6 Amps
DC Grid—No. 2 Current	0.1	0.267 Amp
DC Grid—No. 1 Current (Approx.)	0.1	0.222 Amp
Driver Power Output (Approx.) (3)	300 (14)	750 (15) Watts
Power Output (Approx.)	6,000	9,000 Watts

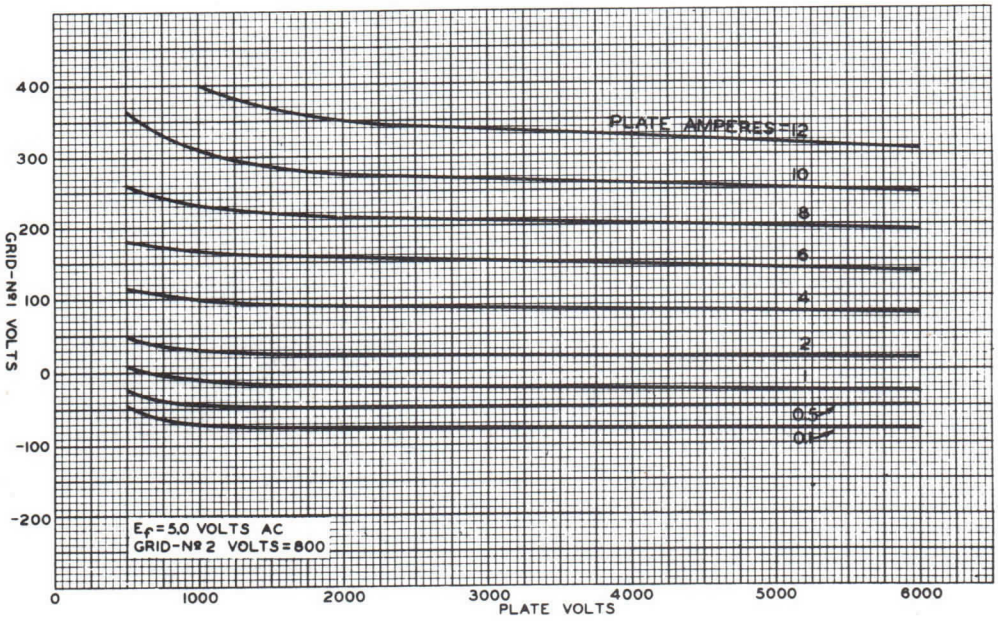
NOTES

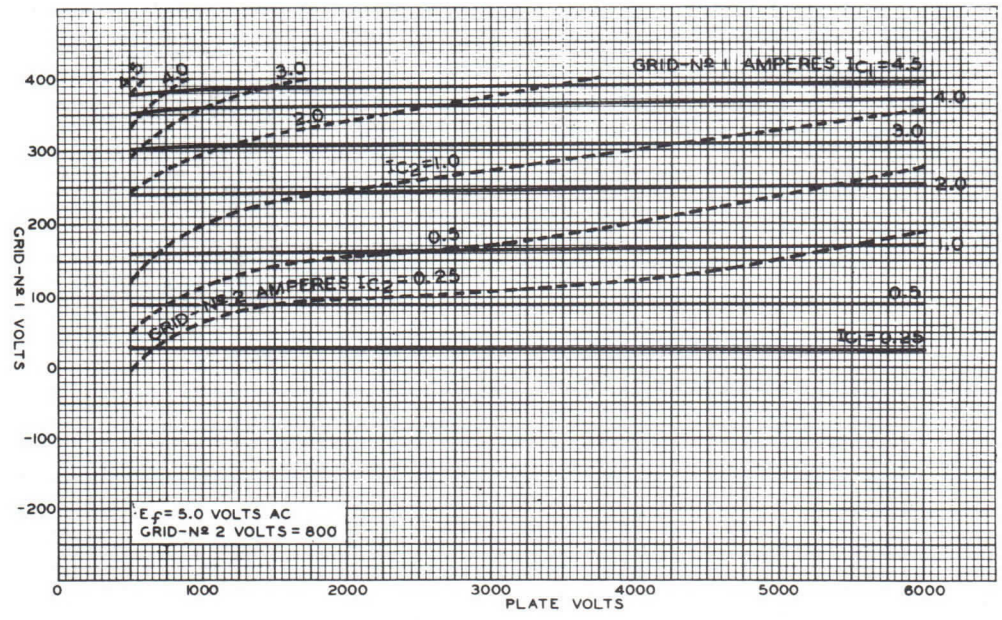
(1) Continuous Commercial Service.
(2) Computed between half-power points and based on tube output capacitance only.
(3) The driver stage is required to supply tube losses and rf circuit losses. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.
(4) This value includes 700 watts of rf circuit loss at 216 Mc.
(5) The driver stage is required to supply tube losses, rf circuit losses, and rf power added to plate circuit. The driver stage should be designed as indicated under (3).
(6) This value includes 300 watts of rf circuit loss at 216 Mc, and 900 watts added to plate circuit.
(7) These ratings hold for operation up to 30 Mc; for ratings at higher frequencies, see Maximum Ratings vs. Frequency Table.
(8) Obtained preferably from a separate source.
(9) Obtained preferably from a combination of 365-ohm grid-No. 1 resistor and —170-volt fixed bias.
(10) This value includes 50 watts of rf circuit loss at 30 Mc.
(11) Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
(12) Obtained preferably from a separate source, or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No. 2 resistor should not be used if the 6166 or a preceding stage is keyed. In this case, the regulation of the source should be sufficient to prevent the grid-No. 2 voltage from rising above 2000 volts under key-up conditions; and additional fixed grid-No. 1 bias must be provided to limit the plate current.
(13) Obtained from fixed supply, by grid-No. 1 resistor, by cathode resistor, or by combination methods.
(14) This value includes 270 watts of rf circuit loss.
(15) This value includes 675 watts of rf circuit loss.

FEDERAL VHF POWER TETRODE
Type F-6166
10 Kilowatts Plate Dissipation

That Federal tubes virtually sell themselves by their performance, is a tribute to the product and the manufacturer.

Average Constant-Current Characteristics of Federal Type F-6166 Power Tetrode

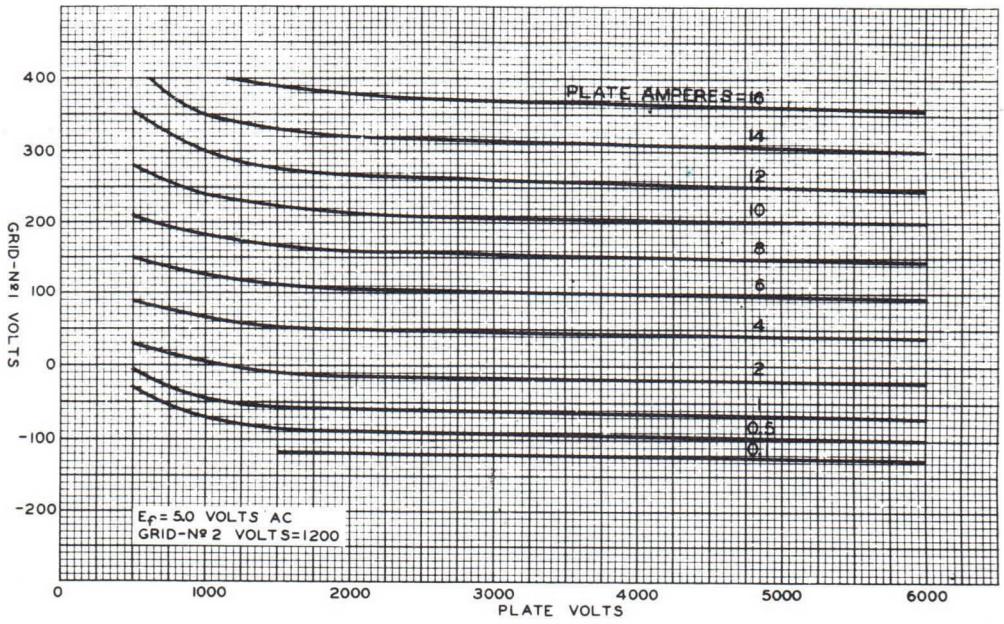


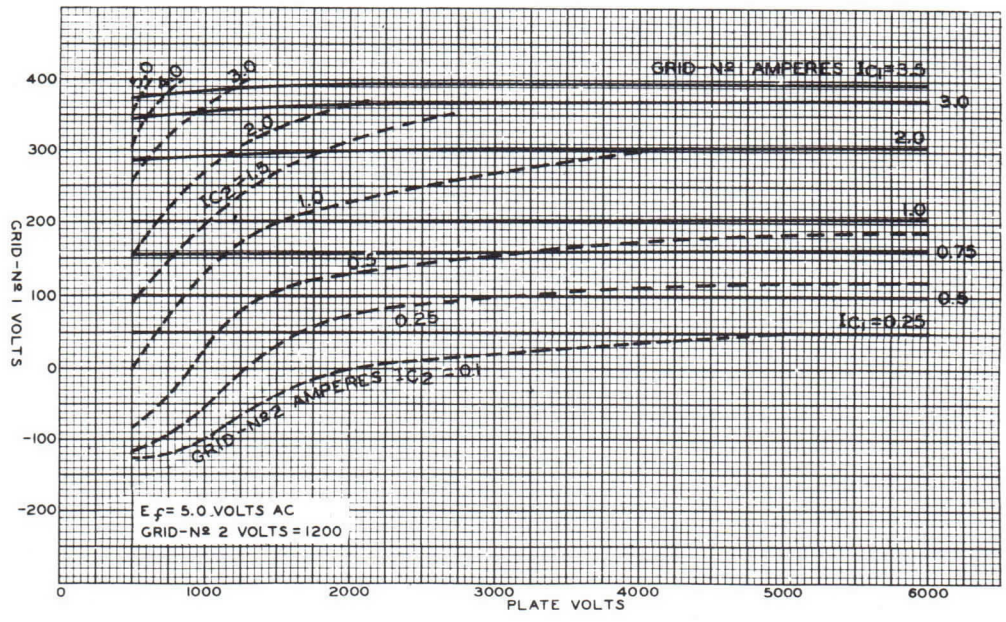


Federal's name on a tube signifies the best in design, engineering, materials, components and craftsmanship.

FEDERAL VHF POWER TETRODE
Type F-6166
10 Kilowatts Plate Dissipation

Average Constant-Current Characteristics of Federal Type F-6166 Power Tetrode

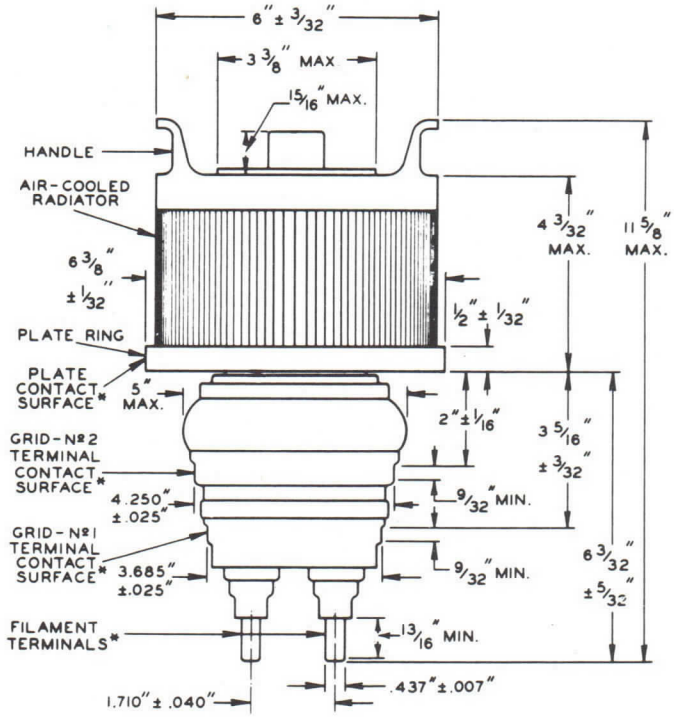




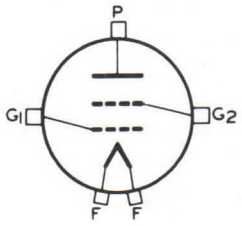
FEDERAL VHF POWER TETRODE
Type F-6166
10 Kilowatts Plate Dissipation

One of the first to manufacture power tubes, Federal experience goes back to the earliest days of the industry.

OUTLINE F-6166



*With the cylindrical surfaces of the Plate Ring, Grid-No. 2 Terminal, Grid-No. 1 Terminal, and Filament Terminals clean, smooth, and free of burrs, the tube will enter a gauge as shown in Sketch G_1. Proper entry of the tube in the gauge is obtained when the Plate Ring is entirely engaged by hole H_1.



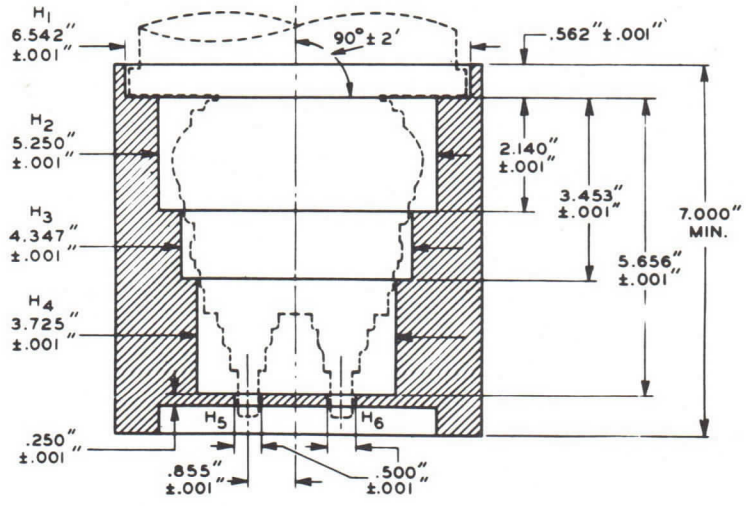
TERMINAL CONNECTIONS

F: FILAMENT POST

G_1: GRID-No. 1 TERMINAL (Adjacent to Filament Posts)

G_2: GRID-No. 2 TERMINAL (Between Grid-No. 1 Terminal and Grid-No. 2 Terminal)

P: PLATE TERMINAL (Ring of Radiator)

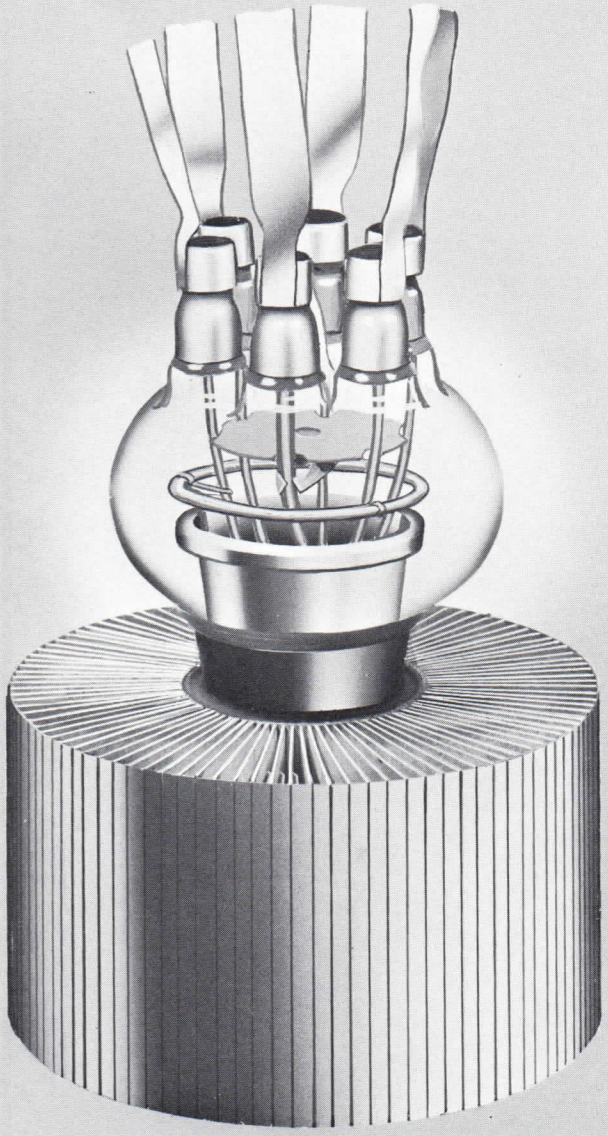


The four cylindrical holes H_1, H_2, H_3, and H_4 have axes coincident within 0.001". The holes H_5 and H_6 have axes parallel to the axes of H_1, H_2, H_3, and H_4 within 0° ± 2".

Form F-694 Printed in U.S.A.

Federal Telephone and Radio Company
A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
100 Kingsland Road — COMPONENTS DIVISION • VACUUM TUBE DEPARTMENT — Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-6366
3 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's Type F-6366 is a three-electrode tube designed for use as an industrial oscillator. The relatively wide spacing between the elements, and the lack of internal insulators make this type tube especially suitable for industrial applications. The anode is air-cooled, capable of dissipating 3 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles. Operation up to 50 megacycles is permissible at reduced ratings.

Electrical:

Filament Voltage	11 Volts
Filament Current	29 Amperes
Amplification Factor, Ec = — 200 V, Ib = 0.2A	25
Interelectrode Capacitances	
Grid-Plate	13 $\mu\mu$f
Grid-Filament	14.5 $\mu\mu$f
Plate-Filament	1.7 $\mu\mu$f

Mechanical:

Mounting Position — Vertical, Anode Down			
Type of Cooling — Forced Air			
Maximum Incoming Air Temperature			45° C
Required Air Flow on Anode			
Plate Dissipation (Kilowatts)	3	2.4	1.8
Air Flow — Cubic Feet Per Min.	190	125	75
Pressure — Inches Water	1.21	0.58	0.26
Maximum Glass Temperature			150° C
Net Weight, Approximate			5¼ Pounds

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Federal Telephone and Radio Company

FEDERAL POWER TRIODE
Type F-6366
3 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	30	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input Class C — Telegraphy	100	75 Per Cent

Maximum Ratings and Typical Operating Conditions

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR — CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)†

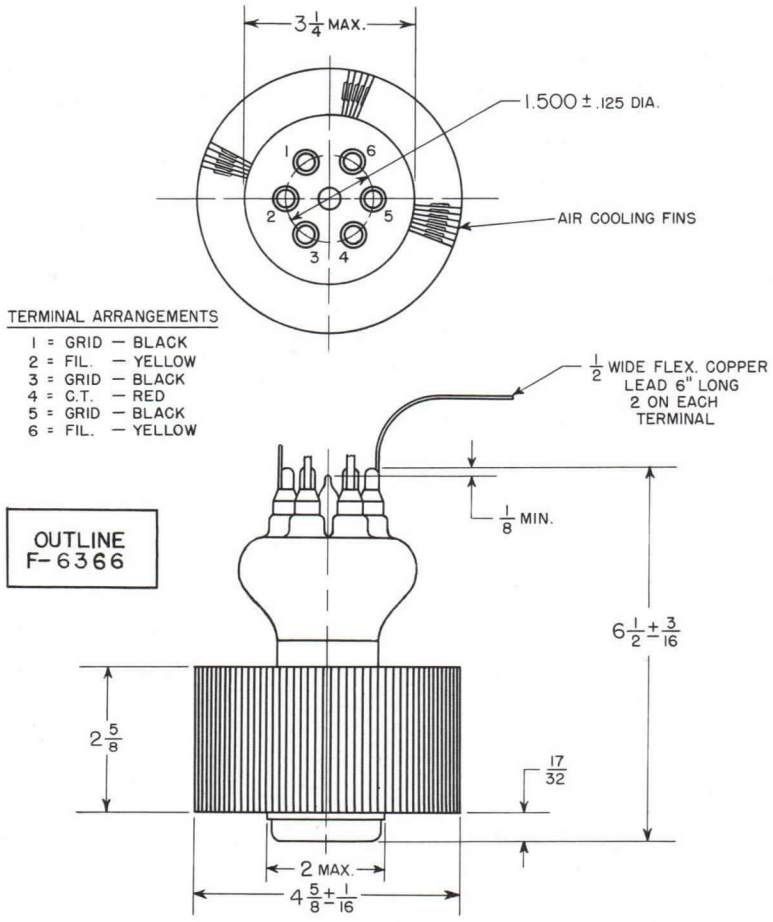
Maximum Ratings, Absolute Values

DC Plate Voltage	5,500 Volts
DC Grid Voltage	— 1,500 Volts
DC Plate Current	1.3 Amperes
DC Grid Current	0.15 Amperes
Plate Input	7 Kilowatts
Plate Dissipation	3 Kilowatts

Typical Operation

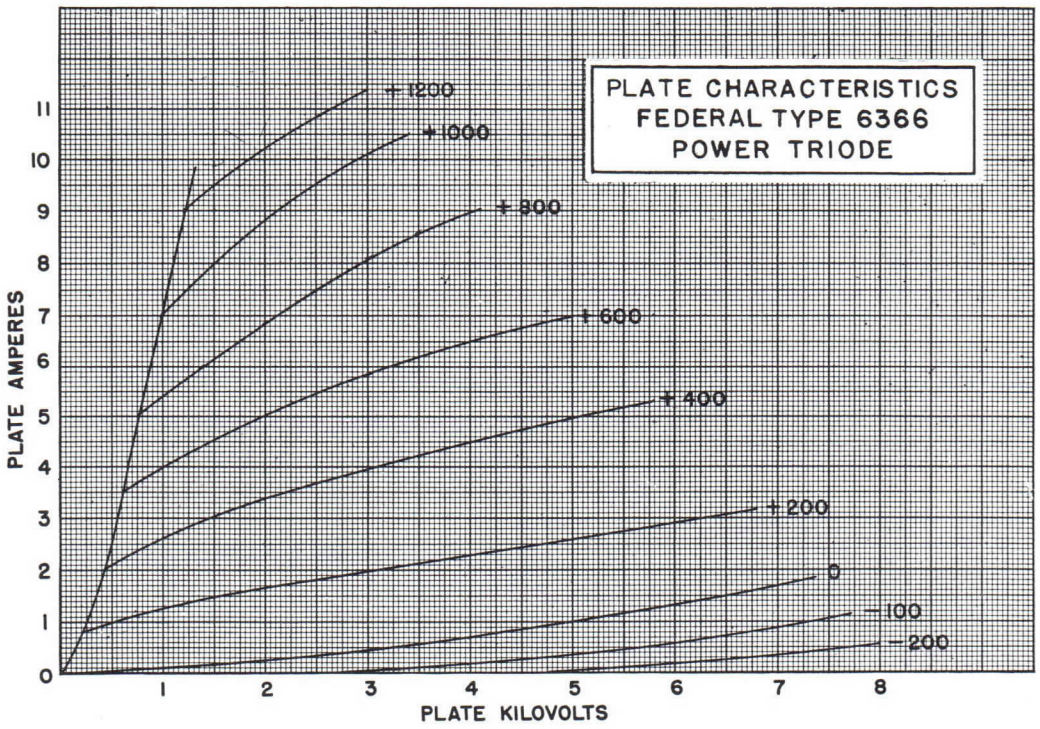
DC Plate Voltage	4,500	5,000 Volts
DC Grid Voltage	— 500	— 600 Volts
Peak R-F Grid Voltage	1,100	1,300 Volts
DC Plate Current	1.0	1.2 Amperes
DC Grid Current, Approximate	0.12	0.13 Amperes
Driving Power, Approximate	120	160 Watts
Power Output, Approximate	3	4 Kilowatts

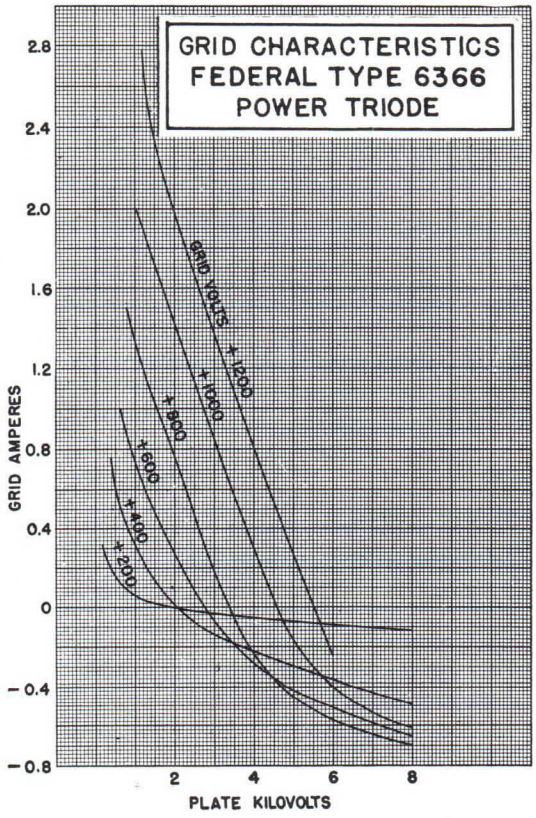
†Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.



High efficiency radiator allows reduced blower cost in new equipment design.

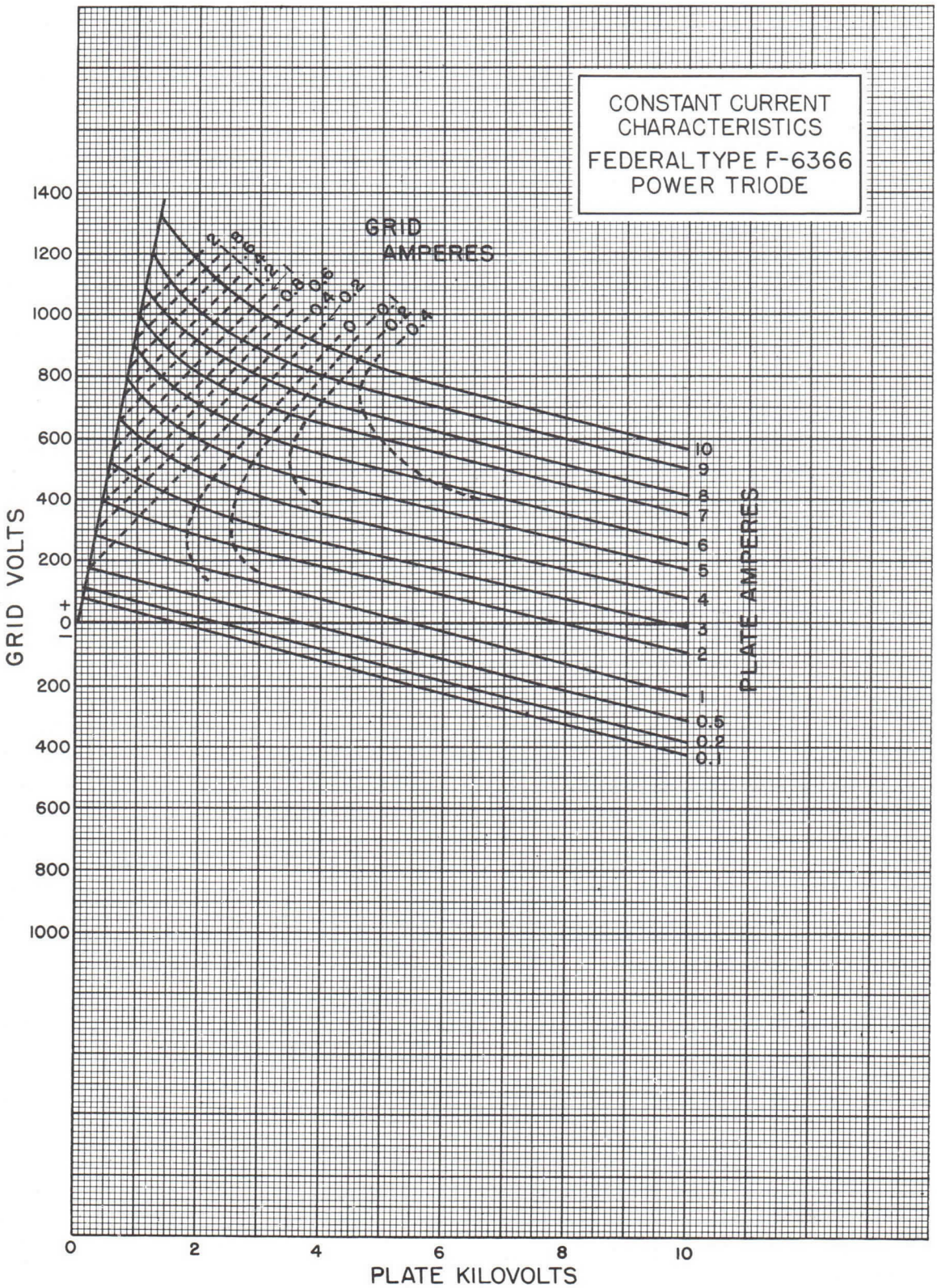
FEDERAL POWER TRIODE
Type F-6366
3 Kilowatts Plate Dissipation





FEDERAL POWER TRIODE
Type F-6366
3 Kilowatts Plate Dissipation

Grid and Filament leads attached for convenience of equipment designers.

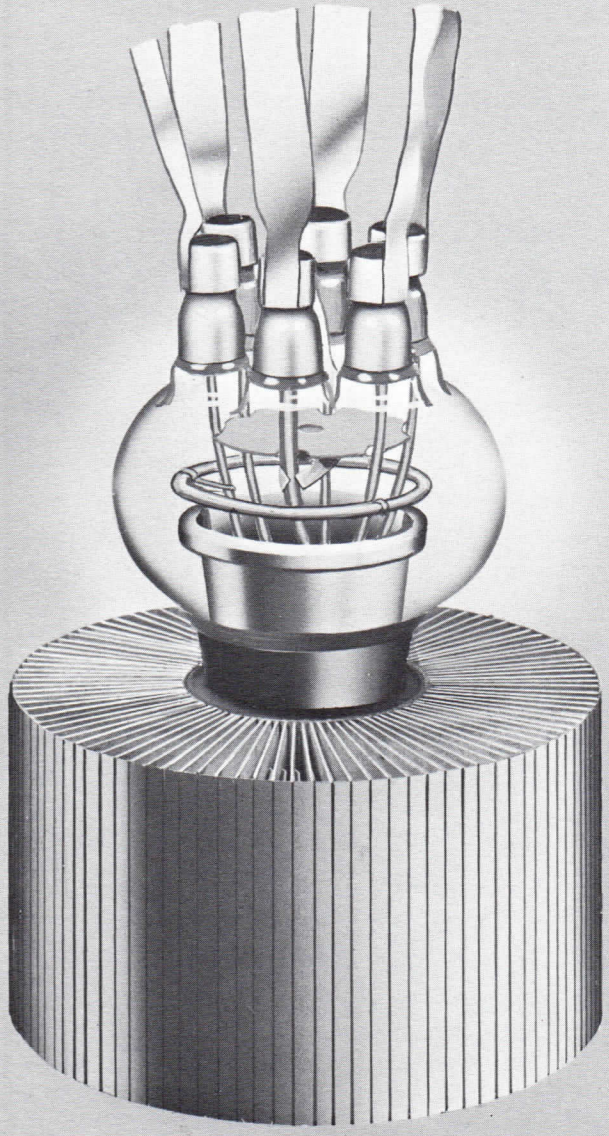


Form F-603 Printed in U. S. A.

DIVISION OF I T & T

Federal Telephone and Radio Company
100 Kingsland Road Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-6367
3 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's Type F-6367 is a three-electrode tube designed for use as a modulator, amplifier and oscillator. The relatively wide spacing between the elements, and the lack of internal insulators make this type tube especially suitable for industrial applications. The anode is air-cooled, capable of dissipating 3 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles. Operation up to 50 megacycles is permissible at reduced ratings.

Electrical:

▸ Filament Voltage	13.0 Volts
▸ Filament Current	36 Amperes
▸ Amplification Factor, Ec = — 200 V, Ib = 0.2A	25
▸ Interelectrode Capacitances	
Grid-Plate	14.7 $\mu\mu$f
Grid-Filament	14.5 $\mu\mu$f
Plate-Filament	1.7 $\mu\mu$f

Mechanical:

▸ Mounting Position — Vertical			
▸ Type of Cooling — Forced Air			
Maximum Incoming Air Temperature			45° C
▸ Required Air Flow on Anode			
Plate Dissipation (Kilowatts)	3	2.4	1.8
Air Flow — Cubic Feet Per Min.	190	125	75
Pressure — Inches Water	1.21	0.58	0.26
Maximum Glass Temperature			150° C
▸ Net Weight, Approximate			5¼ Pounds

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FEDERAL POWER TRIODE
Type F-6367
3 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	30	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input Class C — Telegraphy	100	75 Per Cent

Maximum Ratings and Typical Operating Conditions

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR — CLASS B

Maximum Ratings, Absolute Values

DC Plate Voltage	6,200 Volts
Maximum Signal DC Plate Current*	2.0 Amperes
Maximum Signal Plate Input*	6.0 Kilowatts
Plate Dissipation*	3 Kilowatts

Typical Operation

(Unless otherwise specified, values are for two tubes)

DC Plate Voltage	5,000 Volts
DC Grid Voltage	— 150 Volts
Peak A-F Grid-to-Grid Voltage	1,260 Volts
Zero Signal DC Plate Current	0.4 Amperes
Maximum Signal DC Plate Current	2.25 Amperes
Effective Load Resistance, Plate to Plate	4,000 Ohms
Maximum Signal Driving Power, Approximate	175 Watts
Maximum Signal Power Output, Approximate	7.2 Kilowatts

*Averaged over any audio-frequency cycle of sine-wave form.

RADIO-FREQUENCY POWER AMPLIFIER — CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	6,200 Volts
DC Plate Current	1.5 Amperes
Plate Input	4.5 Kilowatts
Plate Dissipation	3 Kilowatts

Typical Operation

DC Plate Voltage	6,000 Volts
DC Grid Voltage	— 160 Volts
Peak R-F Grid Voltage	300 Volts
DC Plate Current	0.56 Amperes
DC Grid Current, Approximate	0.0 Amperes
Driving Power, Approximate**	47 Watts
Power Output, Approximate	1 Kilowatt

**At crest of audio-frequency cycle with modulation factor of 1.0

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER — CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

DC Plate Voltage	5,000 Volts
DC Grid Voltage	— 1,500 Volts
DC Plate Current	1.5 Amperes
DC Grid Current	0.2 Amperes
Plate Input	7.5 Kilowatts
Plate Dissipation	2 Kilowatts

Typical Operation

DC Plate Voltage	5,000 Volts
DC Grid Voltage	— 800 Volts
Peak R-F Grid Voltage	1,370 Volts
DC Plate Current	0.74 Amperes
DC Grid Current, Approximate	0.10 Amperes
Driving Power, Approximate	130 Watts
Power Output, Approximate	2.7 Kilowatts

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR — CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)†

Maximum Ratings, Absolute Values

DC Plate Voltage	6,200 Volts
DC Grid Voltage	— 1,500 Volts
DC Plate Current	2.0 Amperes
DC Grid Current	0.2 Amperes
Plate Input	12 Kilowatts
Plate Dissipation	3 Kilowatts

Typical Operation

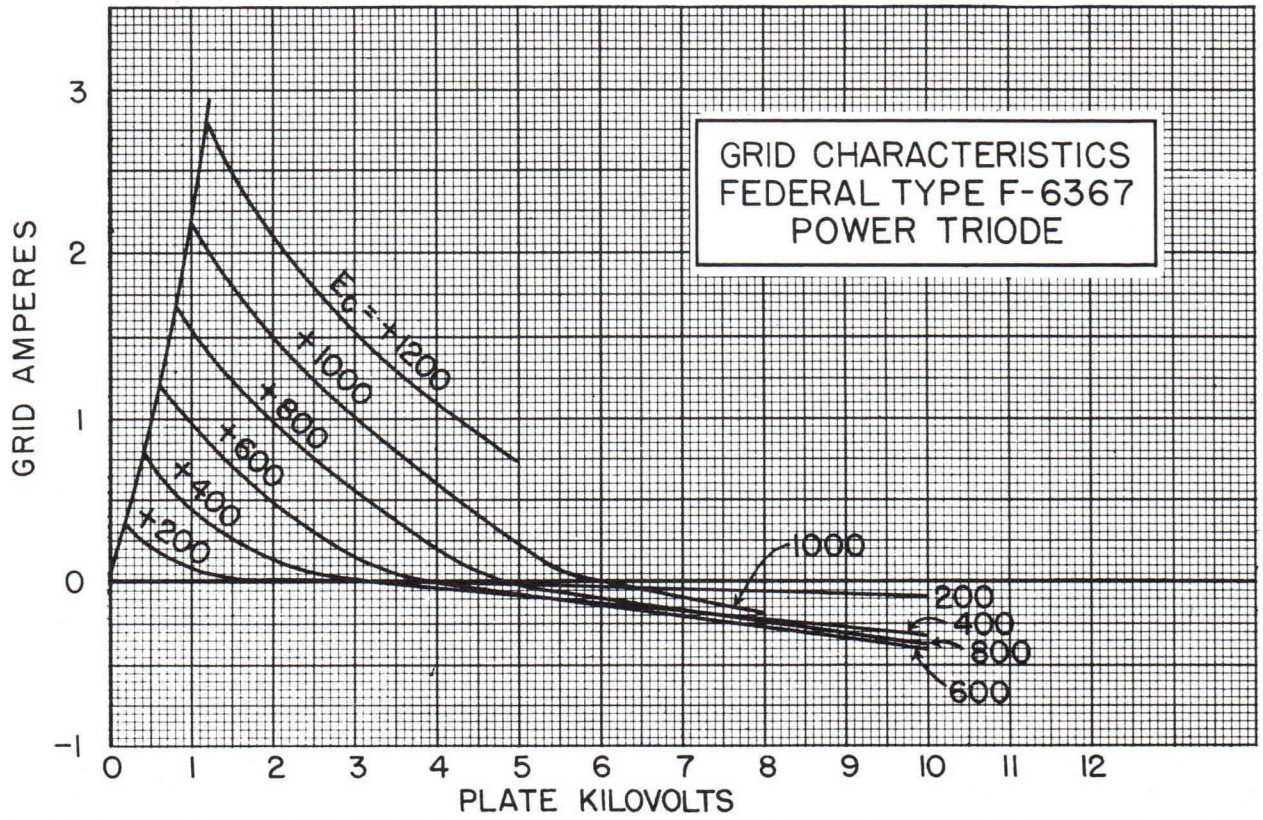
DC Plate Voltage	6,000 Volts
DC Grid Voltage	— 800 Volts
Peak R-F Grid Voltage	1,510 Volts
DC Plate Current	1.4 Amperes
DC Grid Current, Approximate	0.16 Amperes
Driving Power, Approximate	225 Watts
Power Output, Approximate	6 Kilowatts

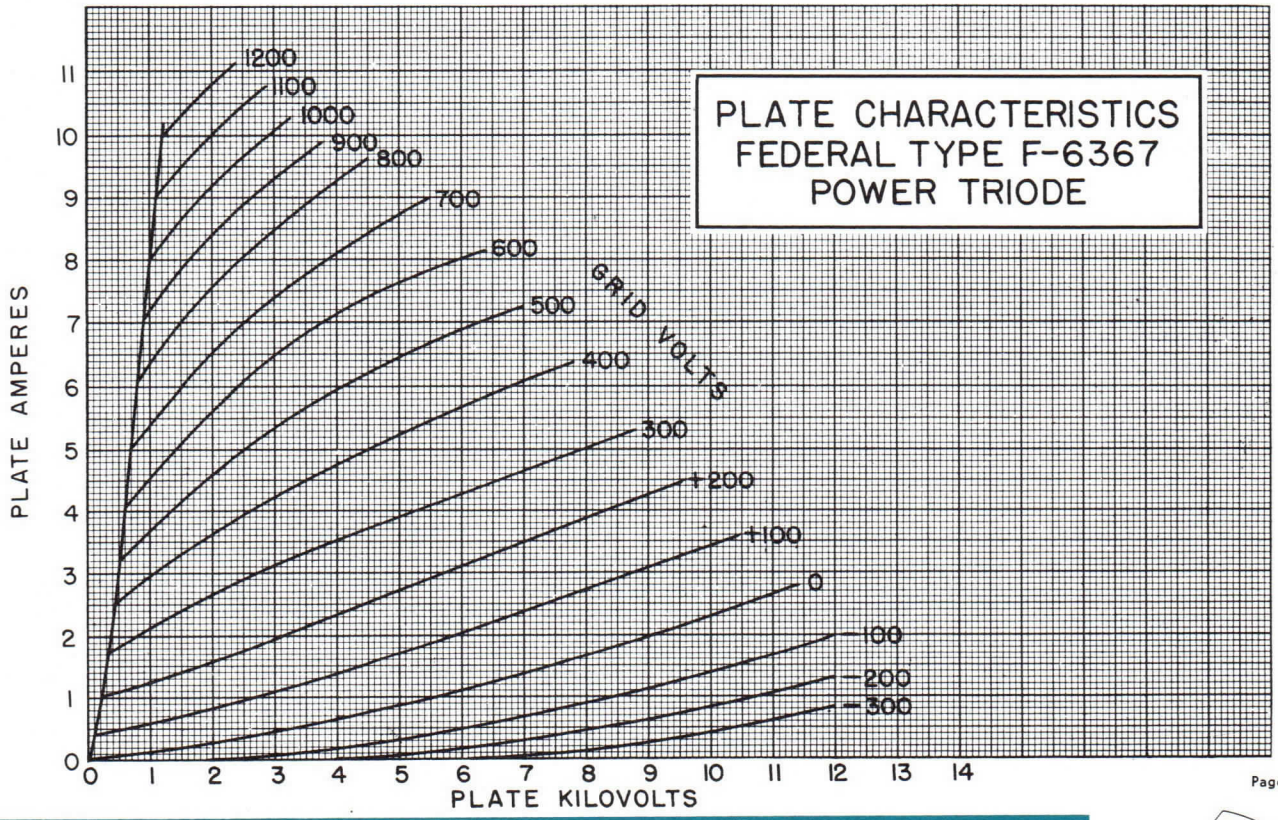
†Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

DIVISION OF IT&T

High efficiency radiator allows reduced blower cost in new equipment design.

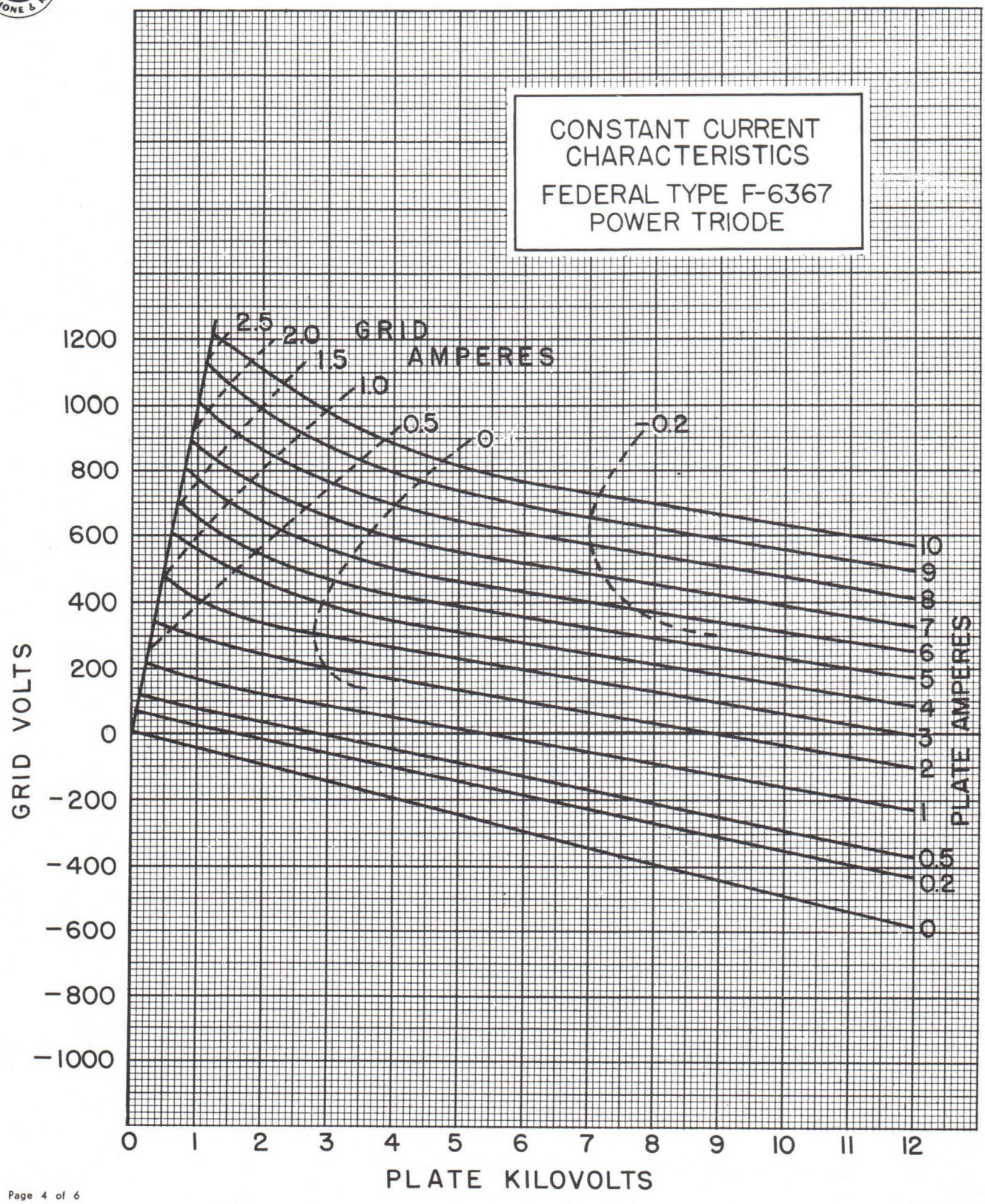
FEDERAL POWER TRIODE
Type F-6367
3 Kilowatts Plate Dissipation





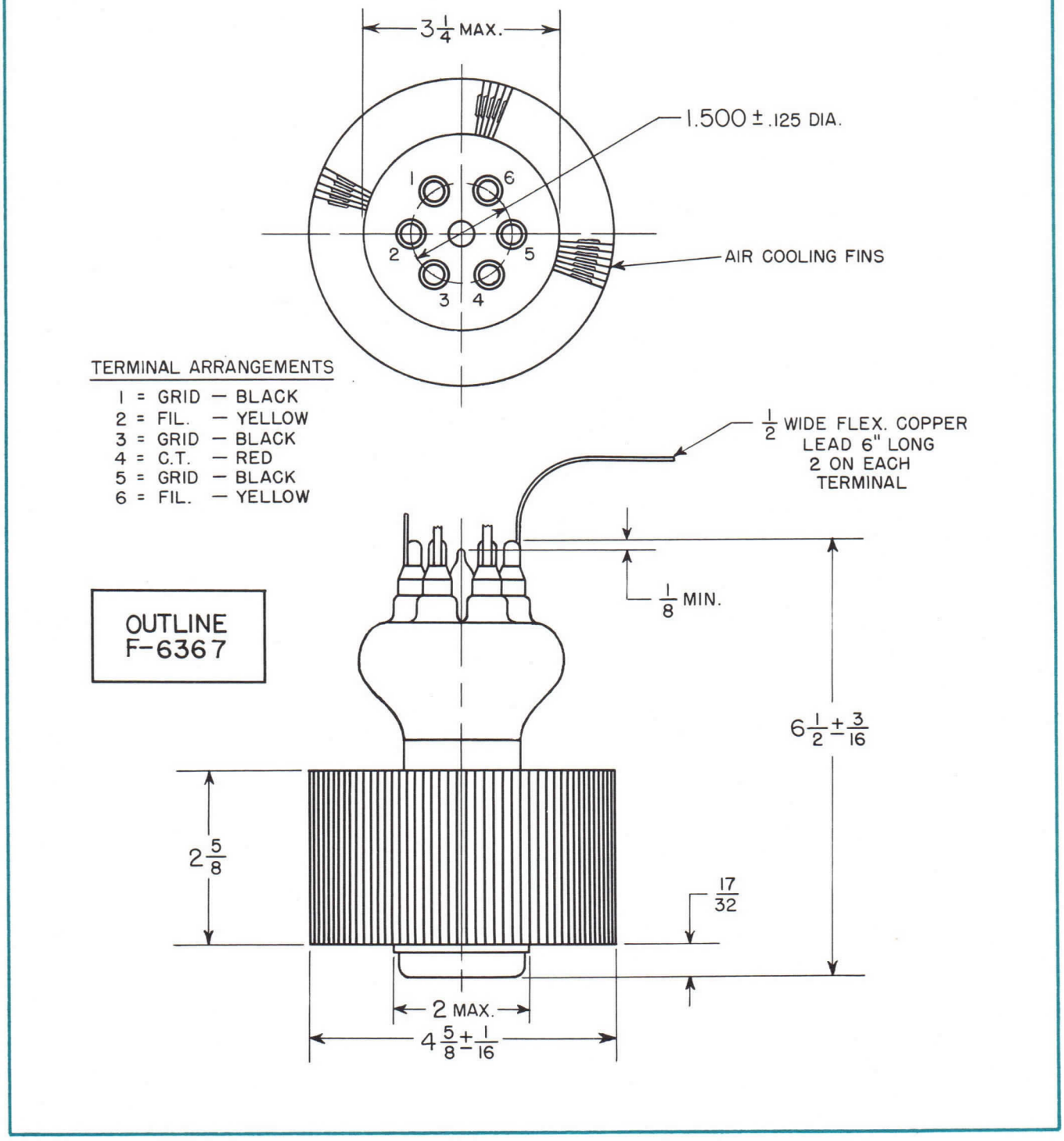
FEDERAL POWER TRIODE
Type F-6367
3 Kilowatts Plate Dissipation

Grid and Filament leads attached for convenience of equipment designers.



Kovar grid and filament seals and Helical type filament contribute to rugged tube design.

FEDERAL POWER TRIODE
Type F-6367
3 Kilowatts Plate Dissipation



Federal Telephone and Radio Company
100 Kingsland Road Clifton, New Jersey

Federal Always Has
Made Better Tubes

Form F-604 Printed in U. S. A.

F6379 ~~F6398~~, ~~F6399~~

See Ann Roark's copy

ENGLISH ELECTRIC VALVE CO. LTD.

Chelmsford, Essex, England.

PHYSICAL SOCIETY EXHIBITION, 1960.

ELECTRON BEAM PARAMETRIC AMPLIFIER

The English Electric Valve Company are showing at the Physical Society Exhibition a development sample of a Transverse Field Parametric Amplifier, Type N1036. This tube is characterised by its high gain and extremely low noise figure and represents the latest concept in low noise V.H.F. amplifiers. The N1036 is designed for operation at 200Mc/s.

Typical of the many applications for which the N1036 will be suitable are the input stages of radar receivers, radio astronomy and high frequency communications systems.

N1036 is a unilateral device and is therefore unconditionally stable. In addition, the tube "cuts-off" under large input signal conditions and thus gives complete protection to the following stages, a characteristic of particular importance in radar applications. Paralysis following the application of excessive input signals is virtually absent.

In the present stage of development, the tube operates at a very low beam current and voltage, 30 microamperes at 6 volts being typical values. A total cathode current of less than 5 milliamperes is required and the highest D.C. voltage in the tube is 100 volts.

The amplitude and frequency stability of the pumping signal are not critical and a simple triode oscillator operating at about twice the signal frequency can be used for this purpose, and output power of only a few milliwatts being required.

A similar tube for operation at 600Mc/s is also in development.

A brief summary of the N1036 characteristics is given below.

Signal Frequency	Pump Frequency	Magnetic Field	Gain	Bandwidth	Noise Figure	Saturated Power Output
200Mc/s	400Mc/s	70Gauss	20db	25Mc/s	2db	50μW

engineering TUBE DATA

F-6398
POWER TRIODE

ITT Components Division

Tentative Specification

Out of date

DESCRIPTION

The F-6398 is a three-electrode tube designed and manufactured by the Vacuum Tube Department of the I T & T Components Division for use as a radio frequency amplifier, oscillator, or Class B modulator. The anode is water cooled, capable of dissipating 225 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 22 megacycles.

ELECTRICAL

Filament Voltage	15.5 volts
Filament Current	420 amperes
Filament Starting Current	1000 max. amperes
Amplification Factor	
E_c = -200 volts; I_b = 5 amperes	21
Inter-electrode Capacitances	
Grid-Plate	125 μμf
Grid-Filament	140 μμf
Plate-Filament	4 μμf

MECHANICAL

Mounting Position	Vertical, anode down
Type of Cooling	Water and Forced Air
Maximum Outgoing Water Temperature	70 °C
Water Flow	40 gpm
Specified water flow must start upon application of any voltages and may be removed simultaneously with filament and plate power.	
Air Flow	
To air manifold	300 cfm min.
To filament seals	40 cfm min.
Cooling air to start with the application of any voltages and may be removed simultaneously with filament and plate power.	
Maximum Glass Temperature	180 °C
Net Weight	65 pounds, approx.

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER - CLASS C TELEPHONY
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

MAXIMUM RATINGS, ABSOLUTE VALUES

D-C Plate Voltage	20 kilovolts
D-C Grid Voltage	-4 kilovolts
D-C Plate Current	16.5 amperes
D-C Grid Current	5 amperes
Plate Input	320 kilowatts
Plate Dissipation	150 kilowatts

TYPICAL OPERATION

D-C Plate Voltage	17 kilovolts
D-C Grid Voltage	-2.5 kilovolts
Peak R-F Grid Voltage	3.55 kilovolts
Peak R-F Plate Voltage	14 kilovolts
D-C Plate Current	16 amperes
D-C Grid Current, approx.	2.2 amperes
Driving Power, approx.	7.9 kilowatts
Power Output, approx.	200 kilowatts

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR - CLASS B

MAXIMUM RATINGS, ABSOLUTE VALUES

D-C Plate Voltage	25 kilovolts
Maximum Signal D-C Plate Current*	20 amperes
Maximum Signal Plate Input*	500 kilowatts
Plate Dissipation*	225 kilowatts

TYPICAL OPERATION
(Unless otherwise specified, values are for two tubes)

D-C Plate Voltage	14	18 kilovolts
D-C Grid Voltage	-675	-830 volts
Peak A-F Grid-to-Grid Voltage	2760	3320 volts
Zero Signal D-C Plate Current	4	4 amperes
Maximum Signal D-C Plate Current	32	38 amperes
Effective Load Resistance Plate-to-Plate	960	1065 ohms
Maximum Signal Driving Power, approx.	2440	4500 watts
Maximum Signal Power Output, approx.	300	480 kilowatts

*Averaged over any audio frequency cycle of sine-wave form.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR - CLASS C TELEGRAPHY
(Key down conditions without AM)

MAXIMUM RATINGS, ABSOLUTE VALUES

D-C Plate Voltage	25 kilovolts
D-C Grid Voltage	-4 kilovolts
D-C Plate Current	25 amperes
D-C Grid Current	5 amperes
Plate Input	500 kilowatts
Plate Dissipation	225 kilowatts

TYPICAL OPERATION

D-C Plate Voltage	18 kilovolts
D-C Grid Voltage	-2.3 kilovolts
Peak R-F Grid Voltage	3.6 kilovolts
D-C Plate Current	24 amperes
D-C Grid Current, approx.	3.6 amperes
Driving Power, approx.	11 kilowatts
Power Out, approx.	325 kilowatts

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR - PULSED OPERATION

MAXIMUM RATINGS, ABSOLUTE VALUES

D-C Plate Voltage	30 kilovolts
D-C Grid Voltage	-8 kilovolts
Peak Cathode Current	400 amperes
Plate Dissipation	225 kilowatts
Pulse Length	.010 seconds
Duty Cycle	.03

TYPICAL OPERATION

D-C Plate Voltage	25 kilovolts
D-C Grid Voltage	-5 kilovolts
D-C Plate Current (during Pulse)	75 amperes
D-C Grid Current (during Pulse)	10 amperes
Peak Power Output	1300 kilowatts

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

MODULATOR TUBE - PULSED OPERATION
(Switch Tube Applications)

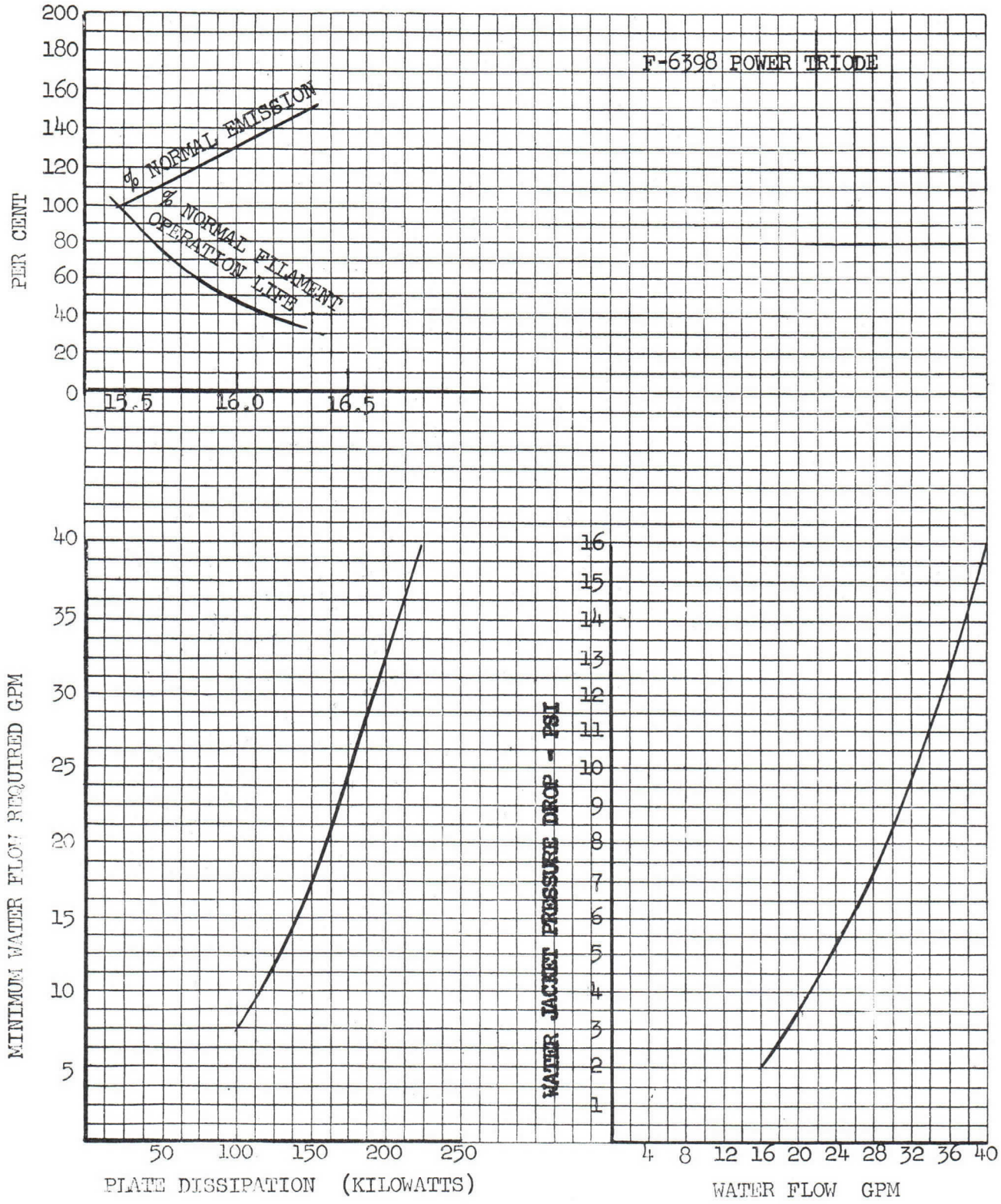
MAXIMUM RATINGS, ABSOLUTE VALUES

D-C Plate Voltage	65	65 max. kilovolts
Peak Positive Voltage (Instantaneous)	70	70 max. kilovolts
D-C Grid Voltage	-8	-8 max. kilovolts
Peak Positive Grid Voltage	8	8 max. kilovolts
Pulse Plate Current	350	**450 max. amperes
Pulse Grid Current	150	**250 max. amperes
Pulse Cathode Current	400	**550 max. amperes
Grid Dissipation	6	6 max. kilowatts
Duty Factor	.002	.002 max.
Pulse Length	15	15 max. μsec.

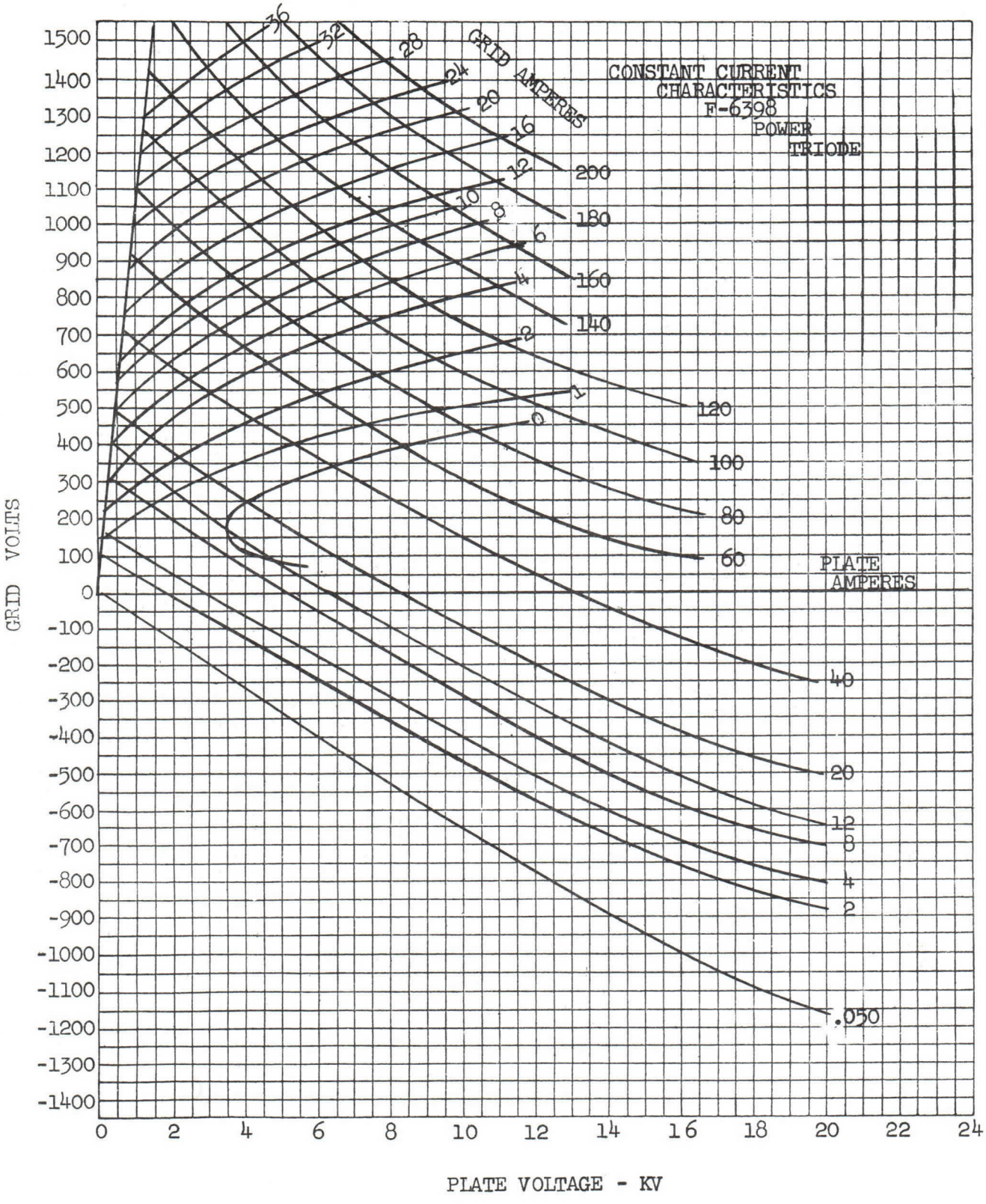
TYPICAL OPERATION

D-C Plate Voltage	50 kilovolts
Pulse Plate Current	300 amperes
D-C Grid Voltage	-4 kilovolts
Pulse Grid Current	90 amperes
Pulse Positive Grid Voltage	3 kilovolts
Duty Factor	.001
Pulse Length	10 μsec.
Plate Output Voltage	44 kilovolts

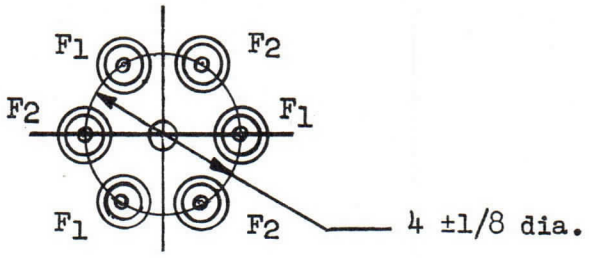
**These ratings apply only under elevated filament temperatures - E_f = 16.75 v.

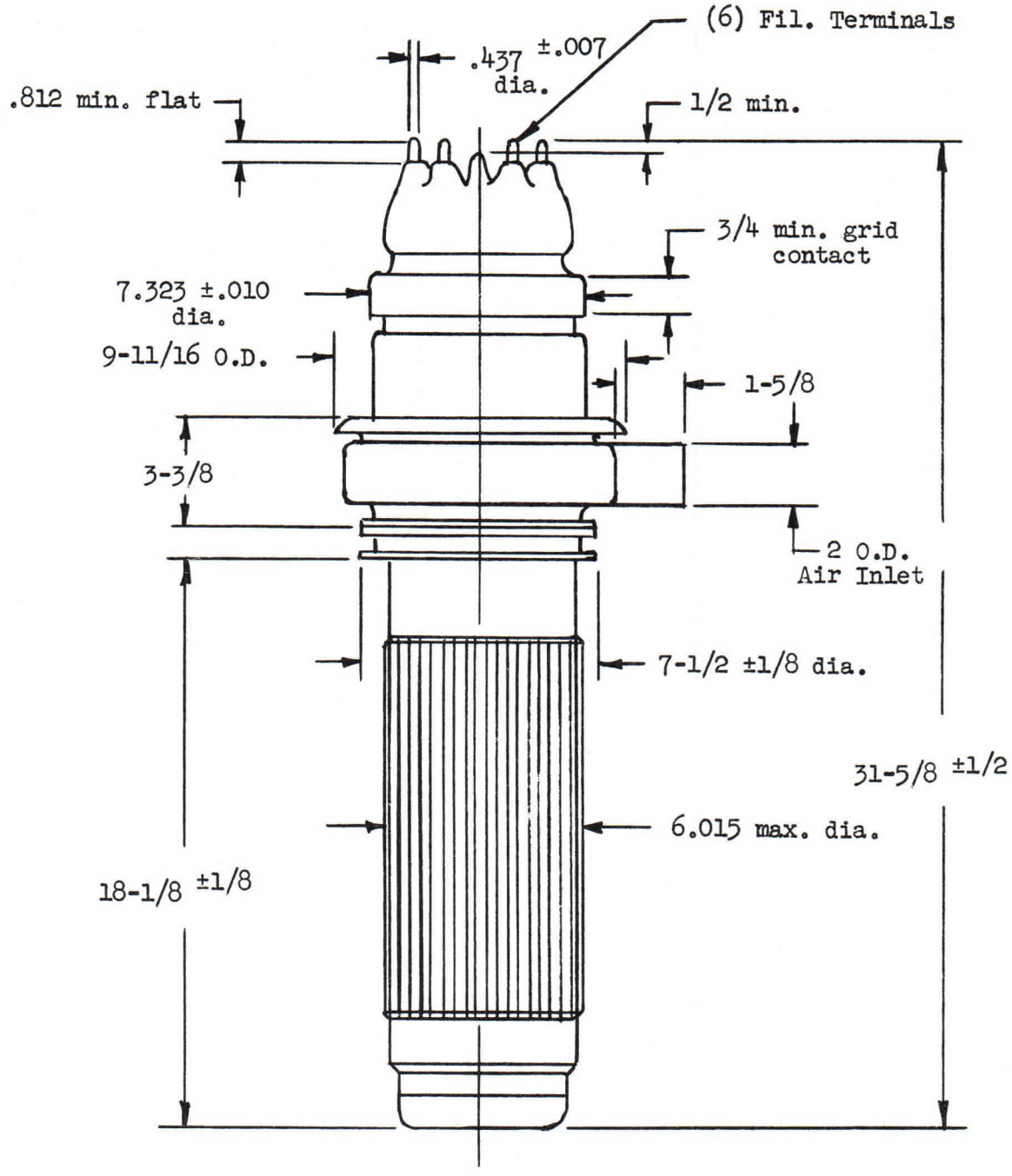


ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY


CONSTANT CURRENT
CHARACTERISTICS
F-6398
POWER
TRIODE
GRID AMPERES
36
32
28
24
20
16
12
10
8
6
4
2
1
0
PLATE
AMPERES
200
180
160
140
120
100
80
60
40
20
12
8
4
2
.050
GRID VOLTS
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
-1100
-1200
-1300
-1400
0
2
4
6
8
10
12
14
16
18
20
22
24
PLATE VOLTAGE - KV

FIL. #1 -- Yellow
FIL. #2 -- Red

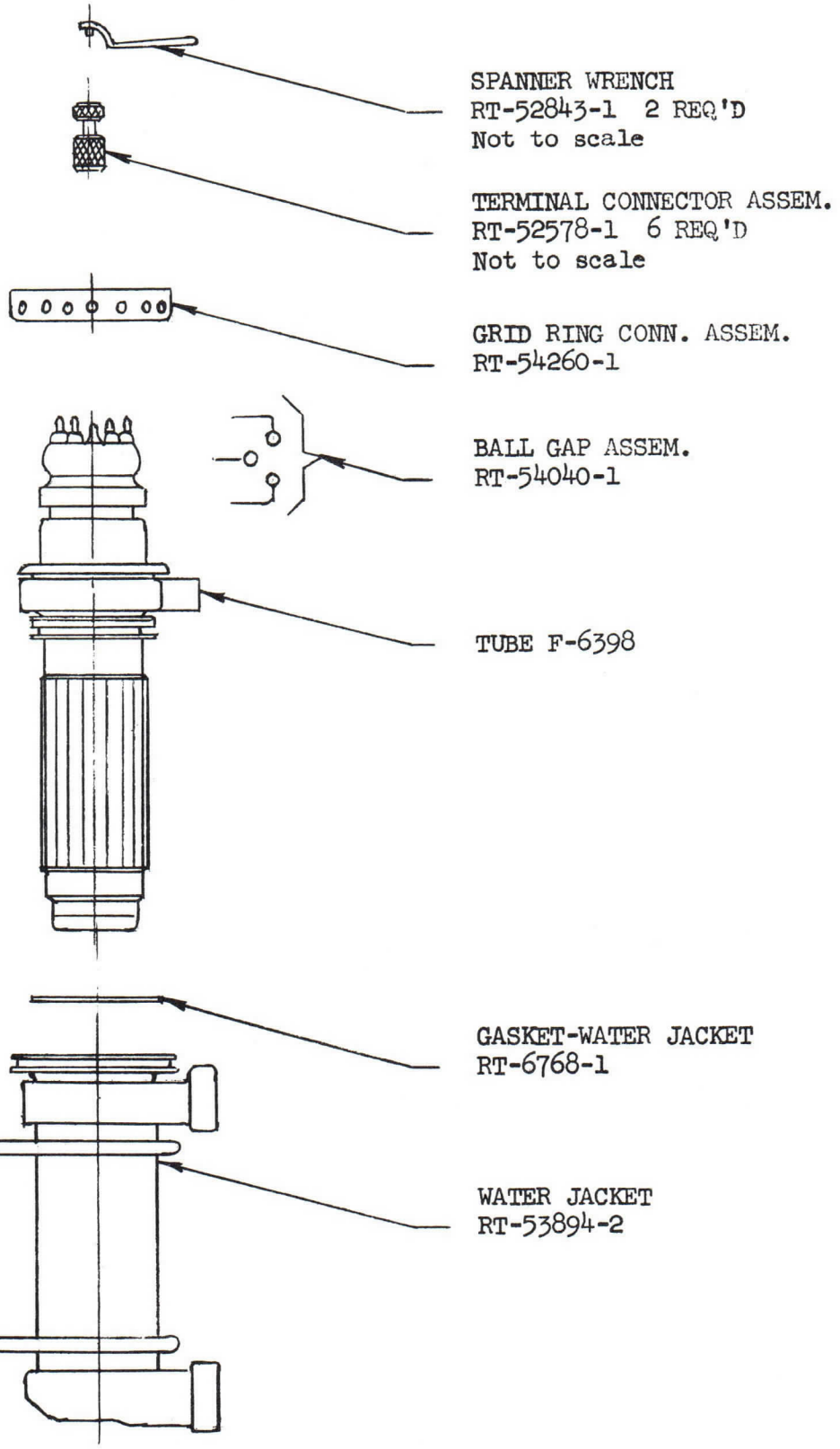




OUTLINE

F-6398 POWER TRIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY



SPANNER WRENCH
RT-52843-1 2 REQ'D
Not to scale

TERMINAL CONNECTOR ASSEM.
RT-52578-1 6 REQ'D
Not to scale

GRID RING CONN. ASSEM.
RT-54260-1

BALL GAP ASSEM.
RT-54040-1

TUBE F-6398

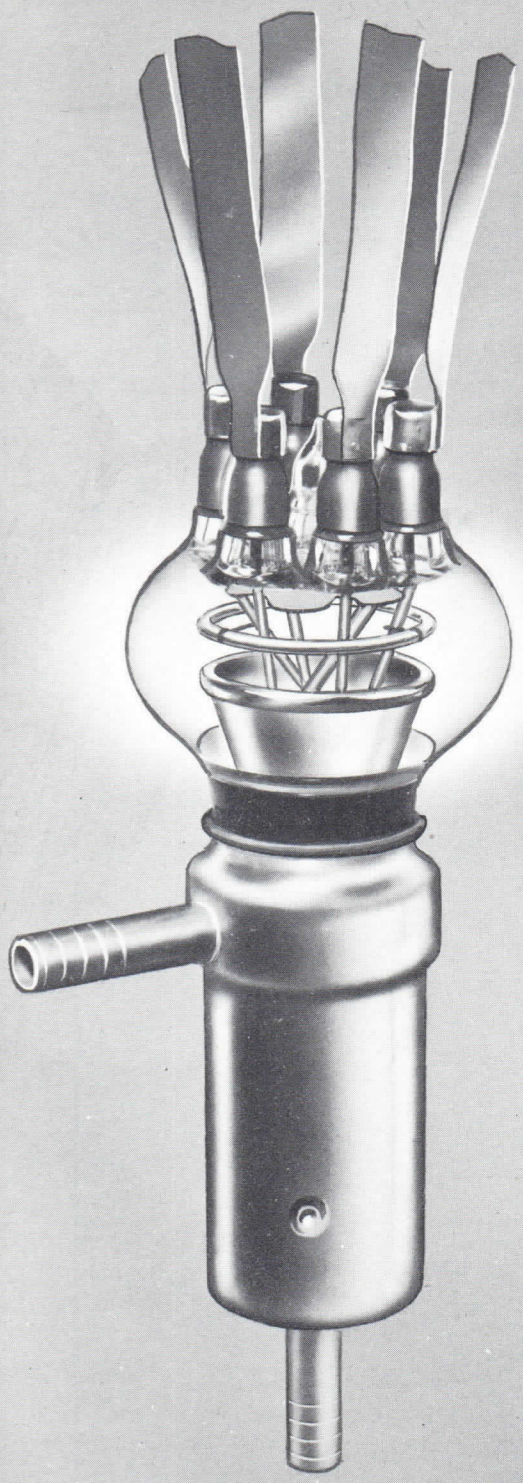
GASKET-WATER JACKET
RT-6768-1

WATER JACKET
RT-53894-2

ACCESSORIES

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

FEDERAL POWER TRIODE
Type F-6399
6 Kilowatts Plate Dissipation



Out of date

GENERAL DATA

DESCRIPTION:

Federal's Type F-6399 is a three-electrode tube designed for use as an industrial oscillator. The relatively wide spacing between the elements, and the lack of internal insulators make this type tube especially suitable for industrial applications. The anode is water-cooled with an integral water jacket, capable of dissipating 6 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles. Operation up to 50 megacycles is permissible at reduced ratings.

Electrical:

▶ Filament Voltage*	11 Volts
▶ Filament Current	29 Amperes
▶ Amplification Factor, $E_c = -200$ V, $I_b = 0.2$A	25
▶ Interelectrode Capacitances	
Grid-Plate	11.5 $\mu\mu$f
Grid-Filament	13.8 $\mu\mu$f
Plate-Filament	1.7 $\mu\mu$f

*Full rated voltage may be safely applied to the cold filament.

Mechanical:

▶ Mounting Position— Vertical, Anode Down	
▶ Type of Cooling—Water	
Water Flow	3.5 GPM
Max. Outgoing water Temperature	70° C
Maximum Glass Temperature	150° C
▶ Net Weight, Approximate	1¼ Pounds

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FEDERAL POWER TRIODE
Type F-6399
6 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency			
Frequency	30	50	Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class C — Telegraphy	100	75	Per Cent

Maximum Ratings and Typical Operating Conditions

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation)†

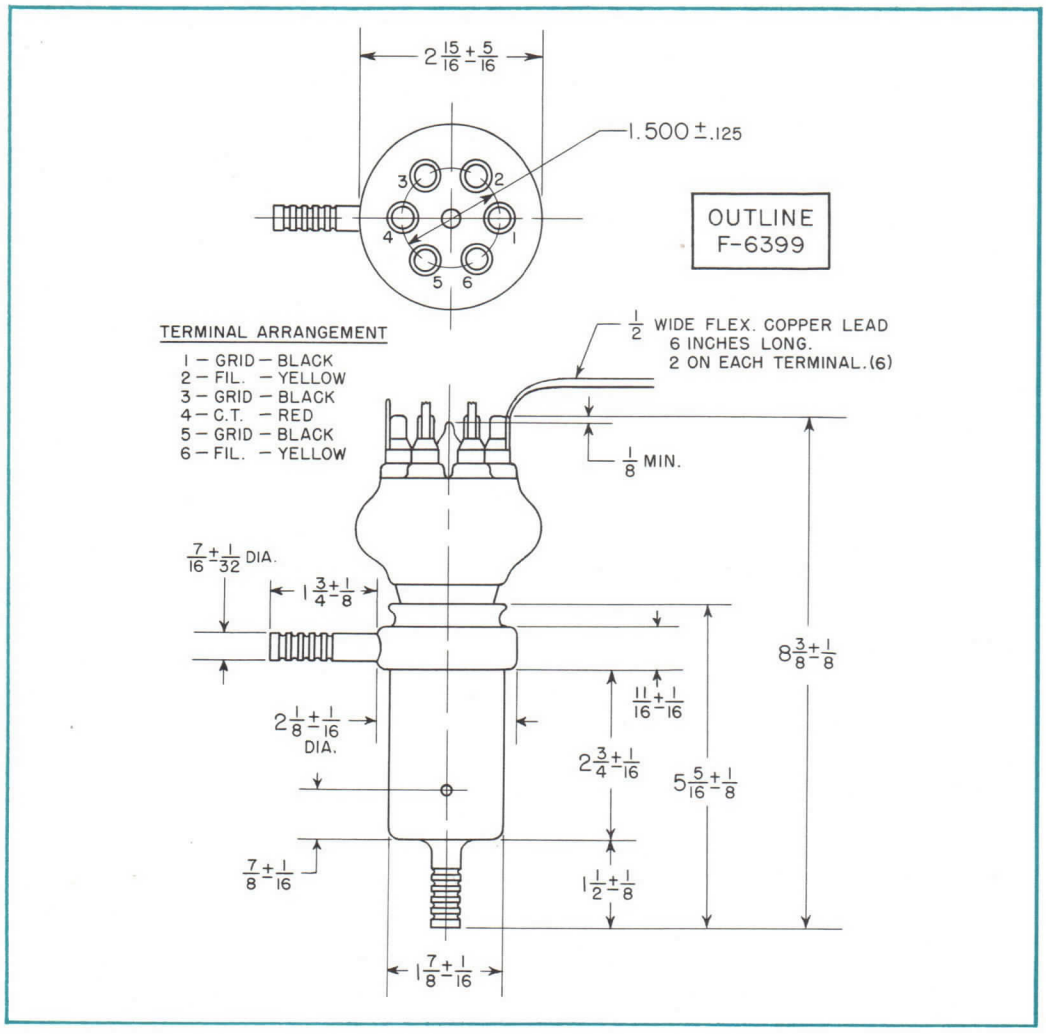
Maximum Ratings, Absolute Values

DC Plate Voltage	6,200 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	1.5 Amps.
DC Grid Current	0.16 Amps.
Plate Input	9 KW
Plate Dissipation	6 KW

Typical Operation

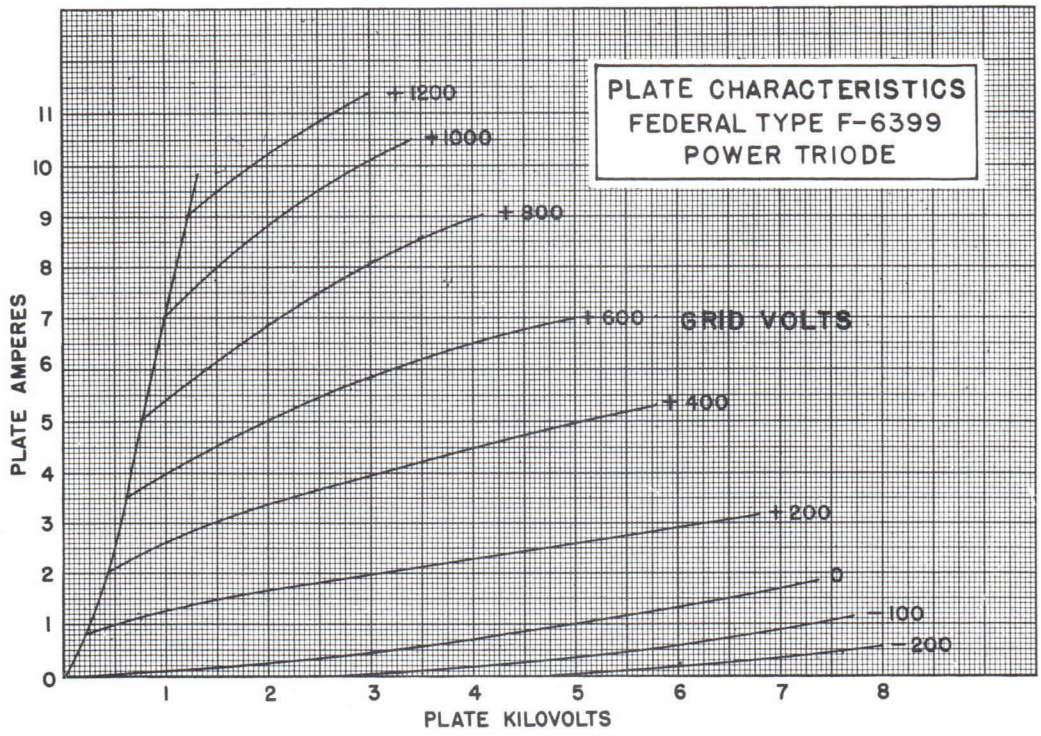
DC Plate Voltage	4,500	5,000	6,000 Volts
DC Grid Voltage	—500	—600	—800 Volts
Peak R-F Grid Voltage	1,100	1,300	1,500 Volts
DC Plate Current	1.0	1.2	1.4 Amps.
DC Grid Current, Approximate	0.12	0.13	0.15 Amps.
Driving Power, Approximate	120	160	210 Watts
Power Output, Approximate	3	4	6 KW

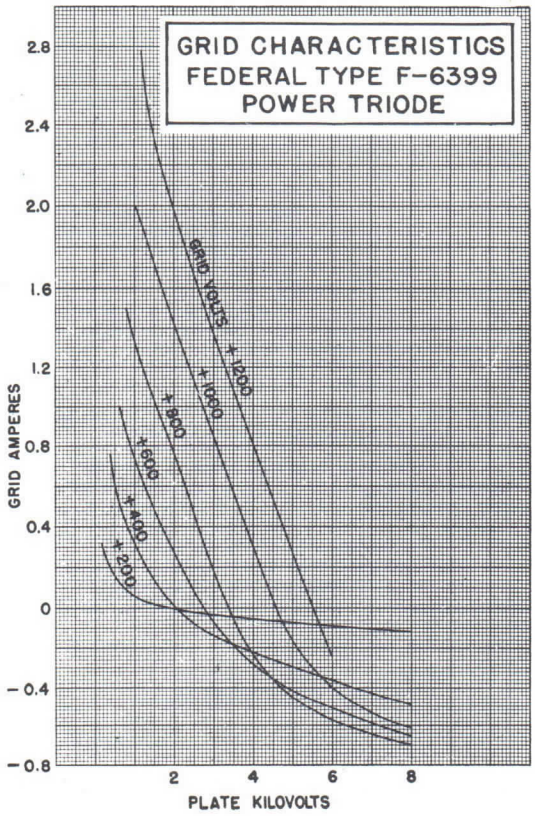
†Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.



FEDERAL POWER TRIODE
Type F-6399
6 Kilowatts Plate Dissipation

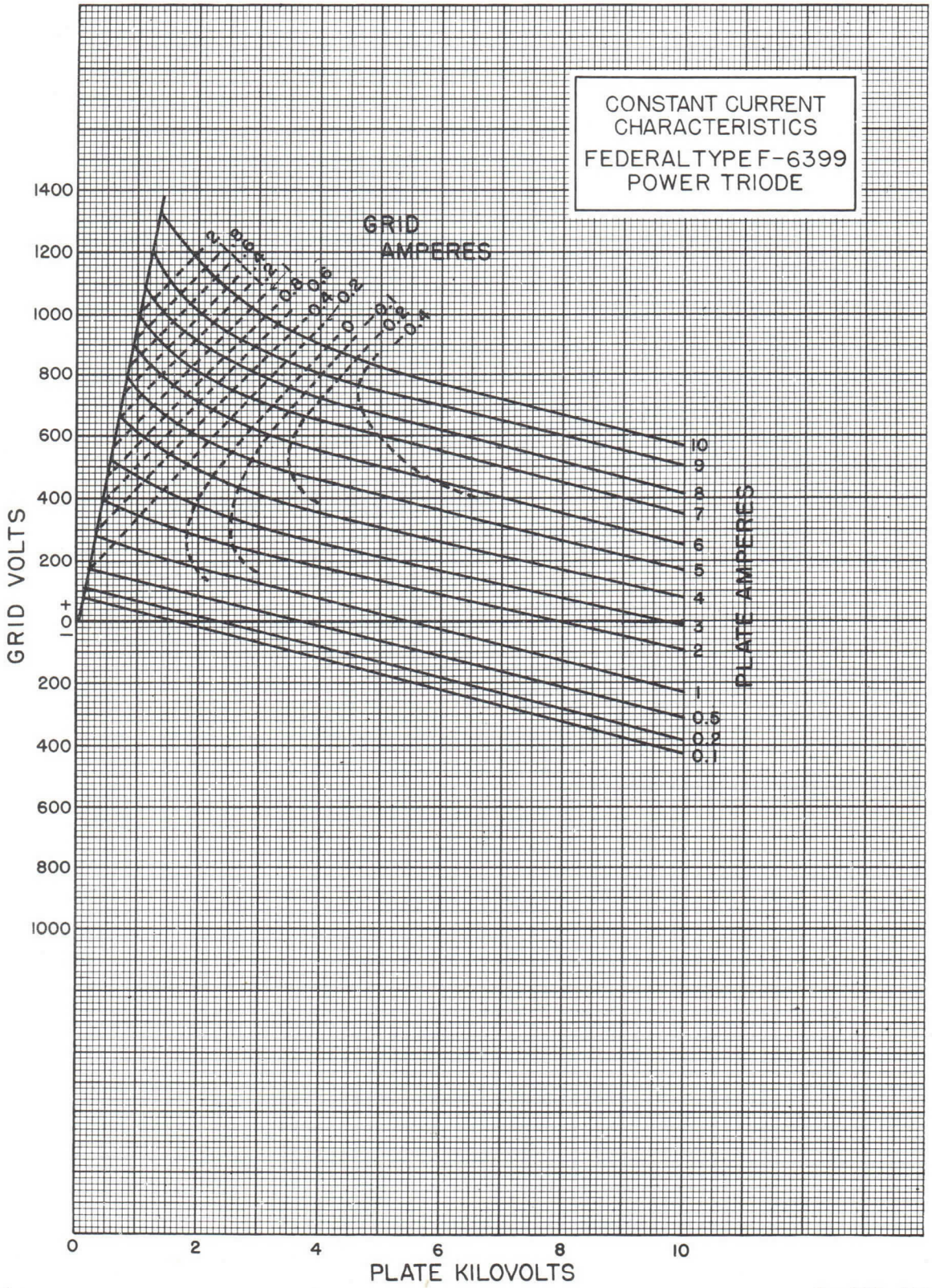
Integral water jacket incorporated in the tube design.





FEDERAL POWER TRIODE
Type F-6399
6 Kilowatts Plate Dissipation

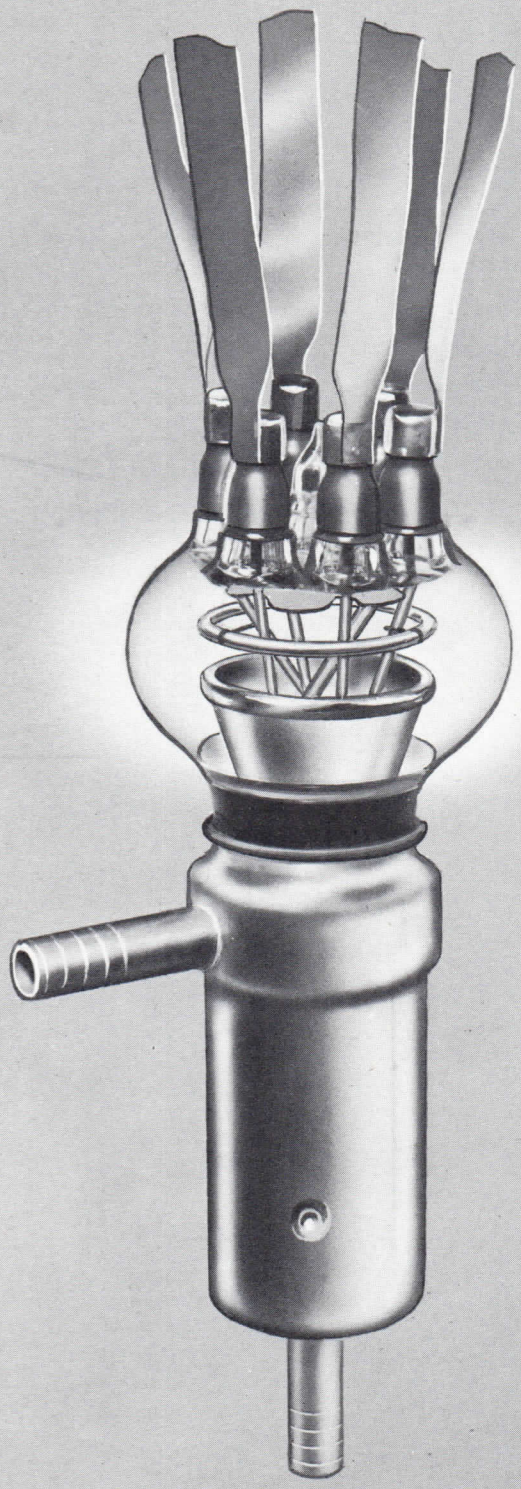
Grid and Filament leads attached for convenience of equipment designers.



Form F-612 Printed in U. S. A

Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's Type F-6400 is a three-electrode tube designed for use as a modulator, R-F amplifier and oscillator. The tube has an integral water jacket and is capable of dissipating 6 KW during continuous commercial service. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles. Operation up to 50 megacycles is permissible at reduced ratings.

Electrical:

▸ Filament Voltage	13 Volts
▸ Filament Current	36 Amperes
▸ Amplification Factor, E_c = −200 V, I_b = 0.2A	25
▸ Interelectrode Capacitances	
Grid-Plate	13.4 $\mu\mu$f
Grid-Filament	15.0 $\mu\mu$f
Plate-Filament	1.8 $\mu\mu$f

Mechanical:

▸ Mounting Position
Vertical, Anode Down

▸ Type of Cooling—
Water and Forced Air

▸ Required Water Flow

Plate Dissipation	2	4	6 KW
Minimum Water Flow	.5	2	3.5 GPM
Pressure Drop	.1	1	2 PSI

▸ Maximum Glass Temperature 180° C

▸ Net Weight,
Approximate 1 1/4 Pounds

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FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency

Frequency	30	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input Class C—Telegraphy	100	75 Per Cent

Maximum Ratings and Typical Operating Conditions

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

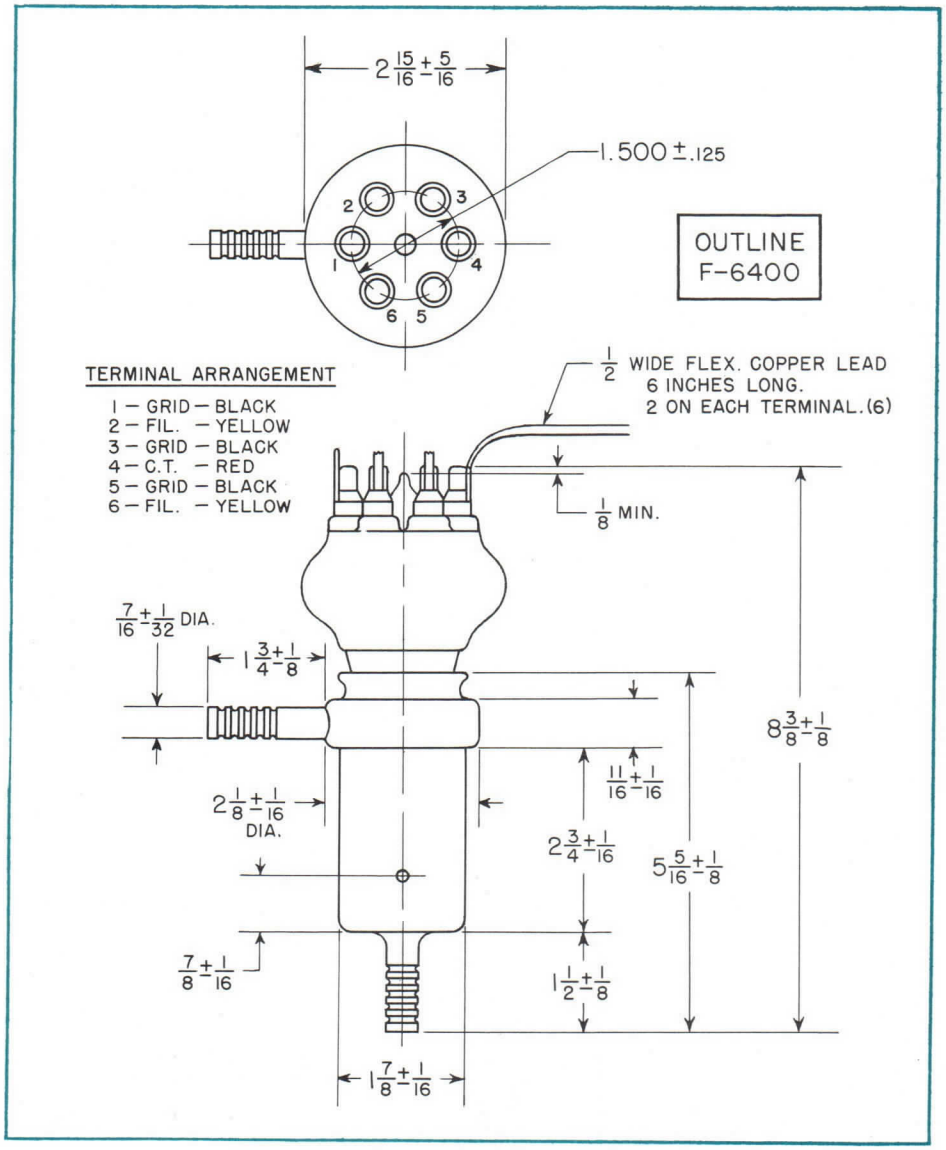
(Key down conditions per tube without amplitude modulation)

Maximum Ratings, Absolute Values

DC Plate Voltage	9,200 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	2.0 Amperes
DC Grid Current	.2 Amperes
Plate Input	18 Kilowatts
Plate Dissipation	6 Kilowatts

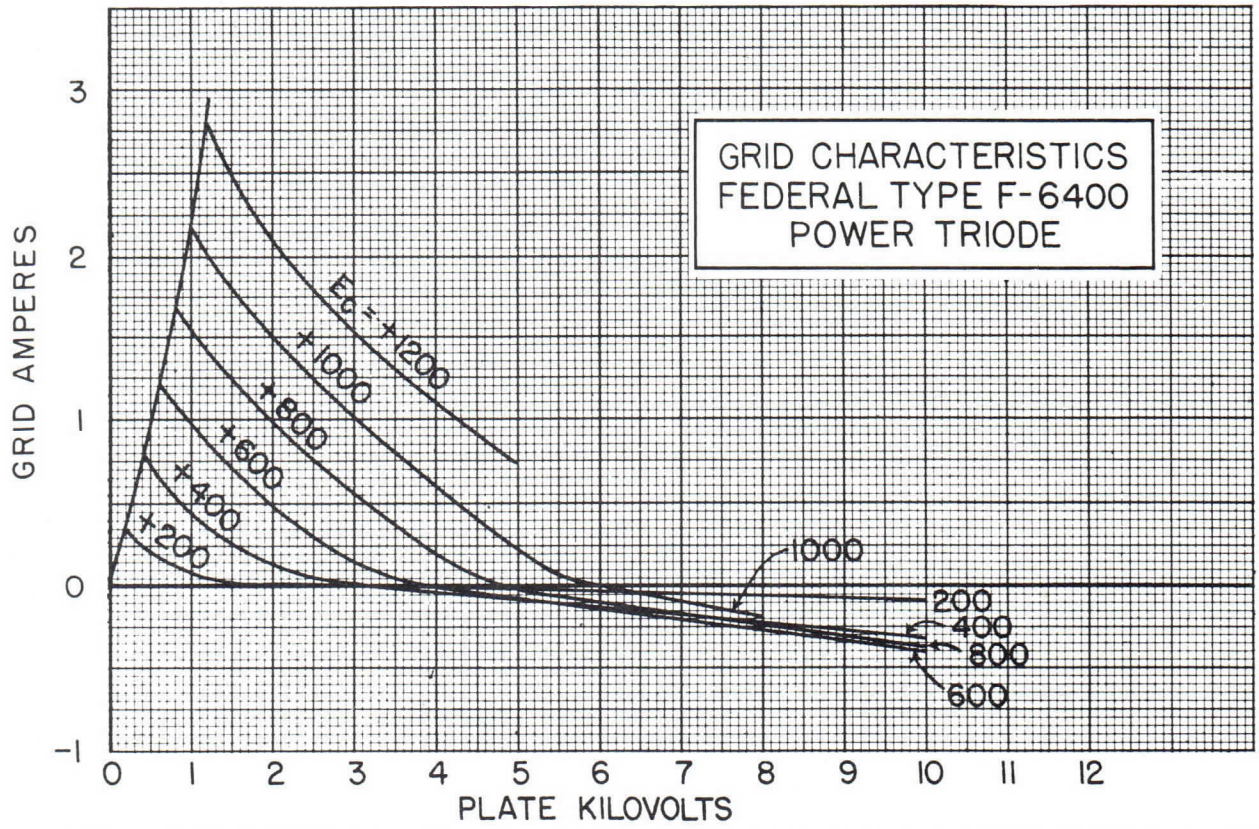
Typical Operation

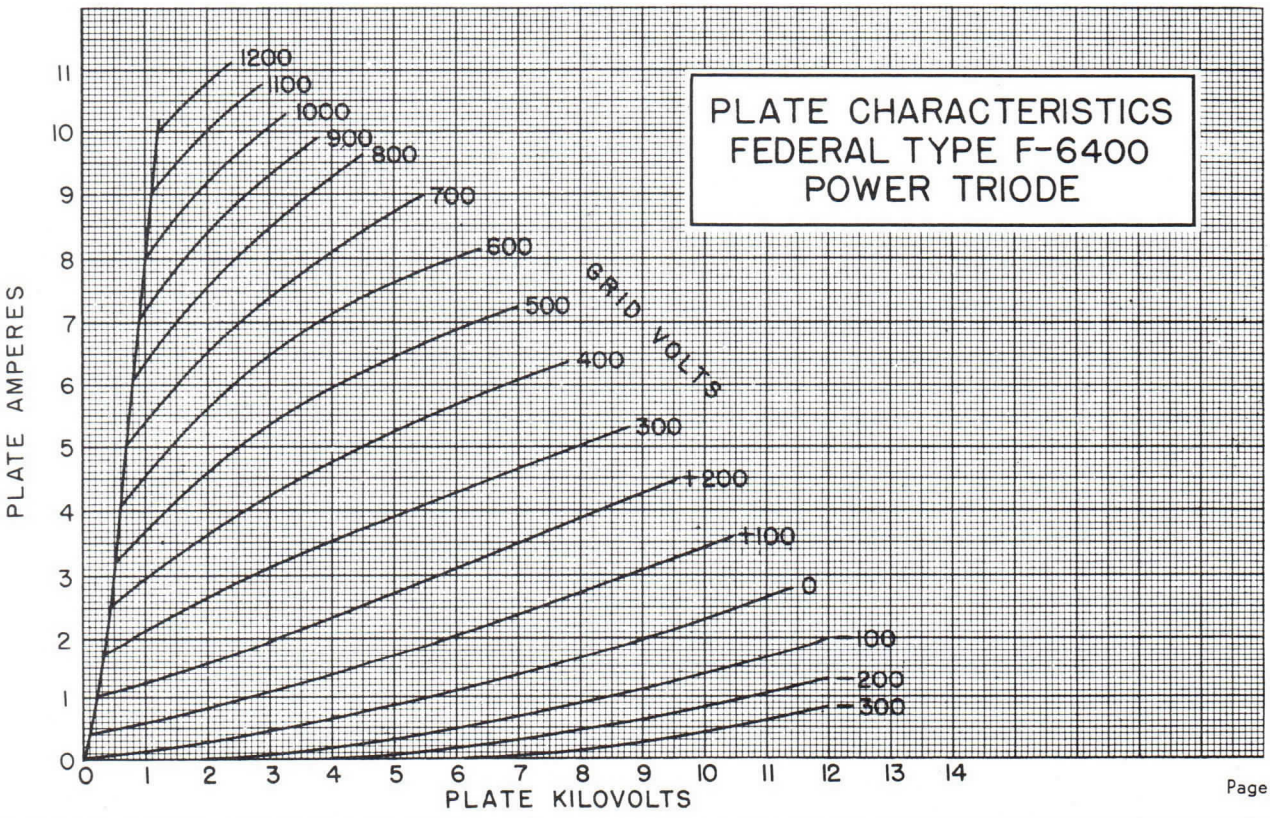
DC Plate Voltage	9,000 Volts
DC Grid Voltage	—800 Volts
Peak R-F Grid Voltage	1,510 Volts
DC Plate Current	2.0 Amperes
DC Grid Current, approx.	.150 Amperes
Driving Power, approx.	225 Watts
Power Output	12 Kilowatts



High efficiency radiator allows reduced blower cost in new equipment design.

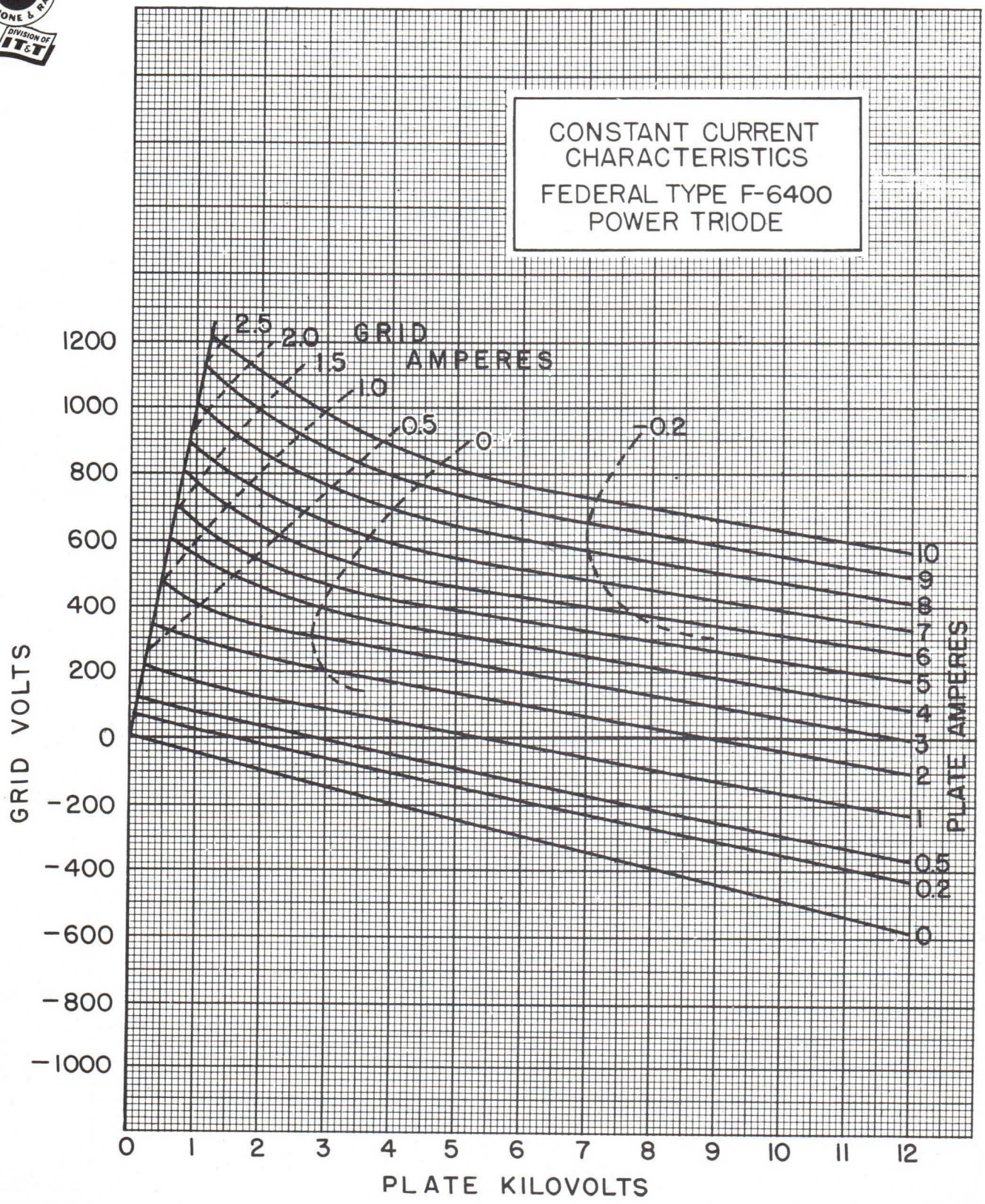
FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation





FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation

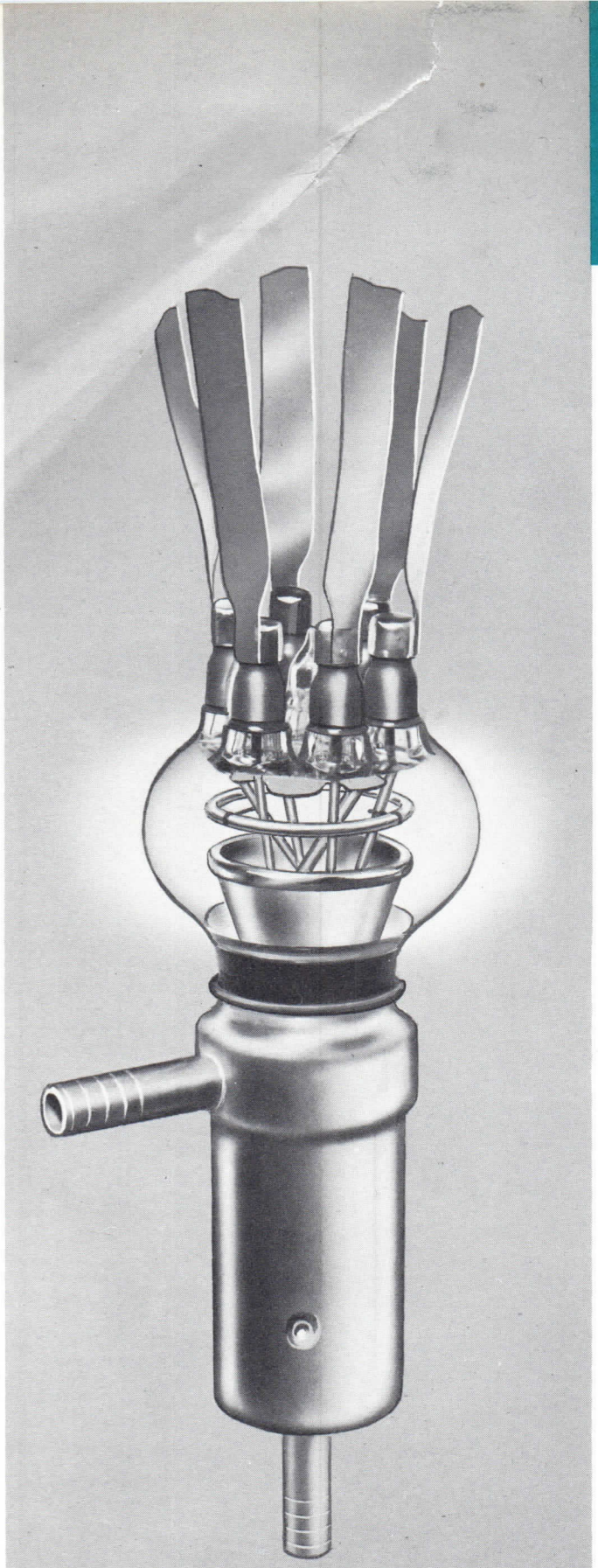
Grid and Filament leads attached for convenience of equipment designers.



Form F-628 Printed in U. S. A.

Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation



GENERAL DATA

DESCRIPTION:

Federal's Type F-6400 is a three-electrode tube designed for use as a modulator, R-F amplifier and oscillator. The tube has an integral water jacket and is capable of dissipating 6 KW during continuous commercial service. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 30 megacycles. Operation up to 50 megacycles is permissible at reduced ratings.

Electrical:

▶ Filament Voltage	13 Volts
▶ Filament Current	36 Amperes
▶ Amplification Factor, $E_c = -200$ V, $I_b = 0.2$A	25
▶ Interelectrode Capacitances	
Grid-Plate	13.4 $\mu\mu$f
Grid-Filament	15.0 $\mu\mu$f
Plate-Filament	1.8 $\mu\mu$f

Mechanical:

▶ Mounting Position
Vertical, Anode Down

▶ Type of Cooling—
Water and Forced Air

▶ Required Water Flow

Plate Dissipation	2	4	6 KW
Minimum Water Flow	.5	2	3.5 GPM
Pressure Drop	.1	1	2 PSI

▶ Maximum Glass Temperature 180° C

▶ Net Weight,
Approximate 1 1/4 Pounds

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FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation

Maximum Ratings vs. Operating Frequency		
Frequency	30	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input Class C—Telegraphy	100	75 Per Cent

Maximum Ratings and Typical Operating Conditions

RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

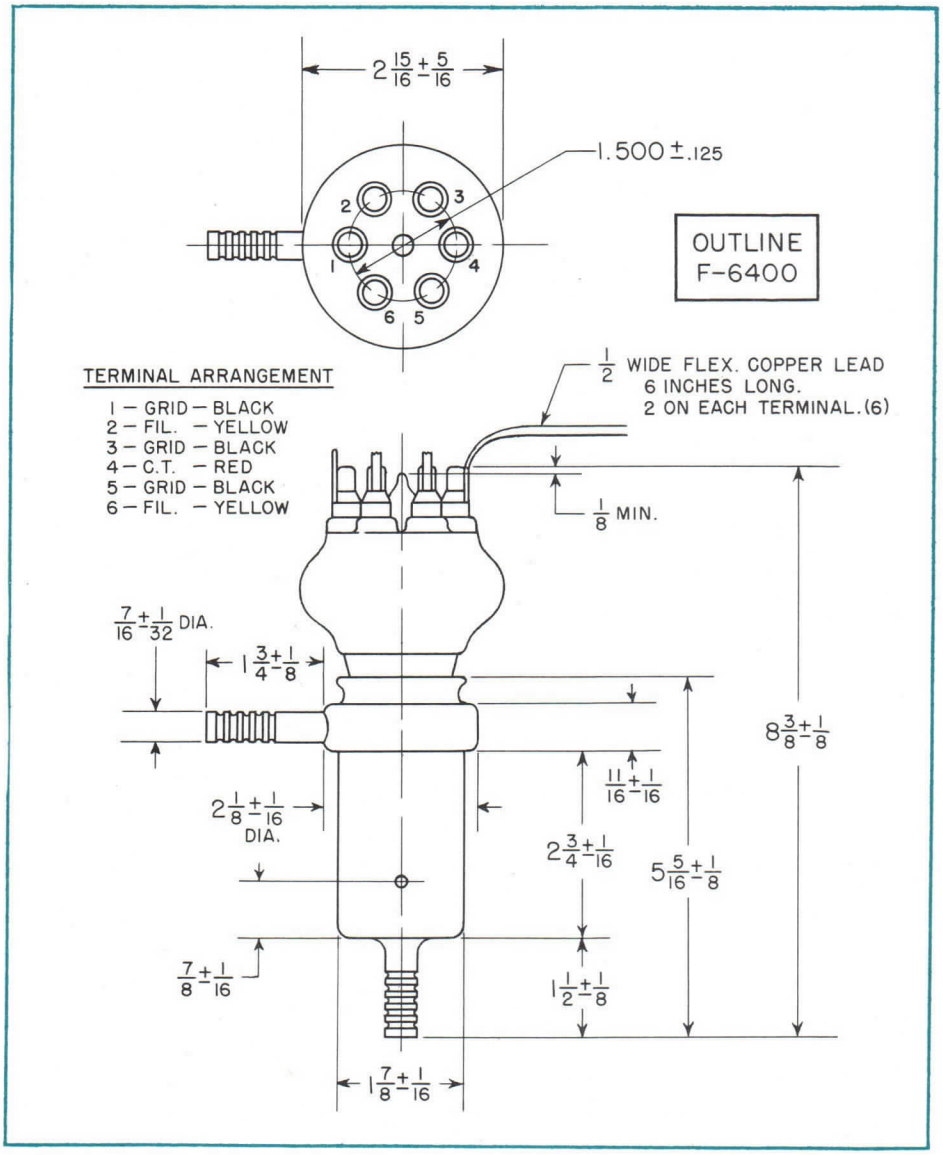
(Key down conditions per tube without amplitude modulation)

Maximum Ratings, Absolute Values

DC Plate Voltage	9,200 Volts
DC Grid Voltage	—1,500 Volts
DC Plate Current	2.0 Amperes
DC Grid Current	.2 Amperes
Plate Input	18 Kilowatts
Plate Dissipation	6 Kilowatts

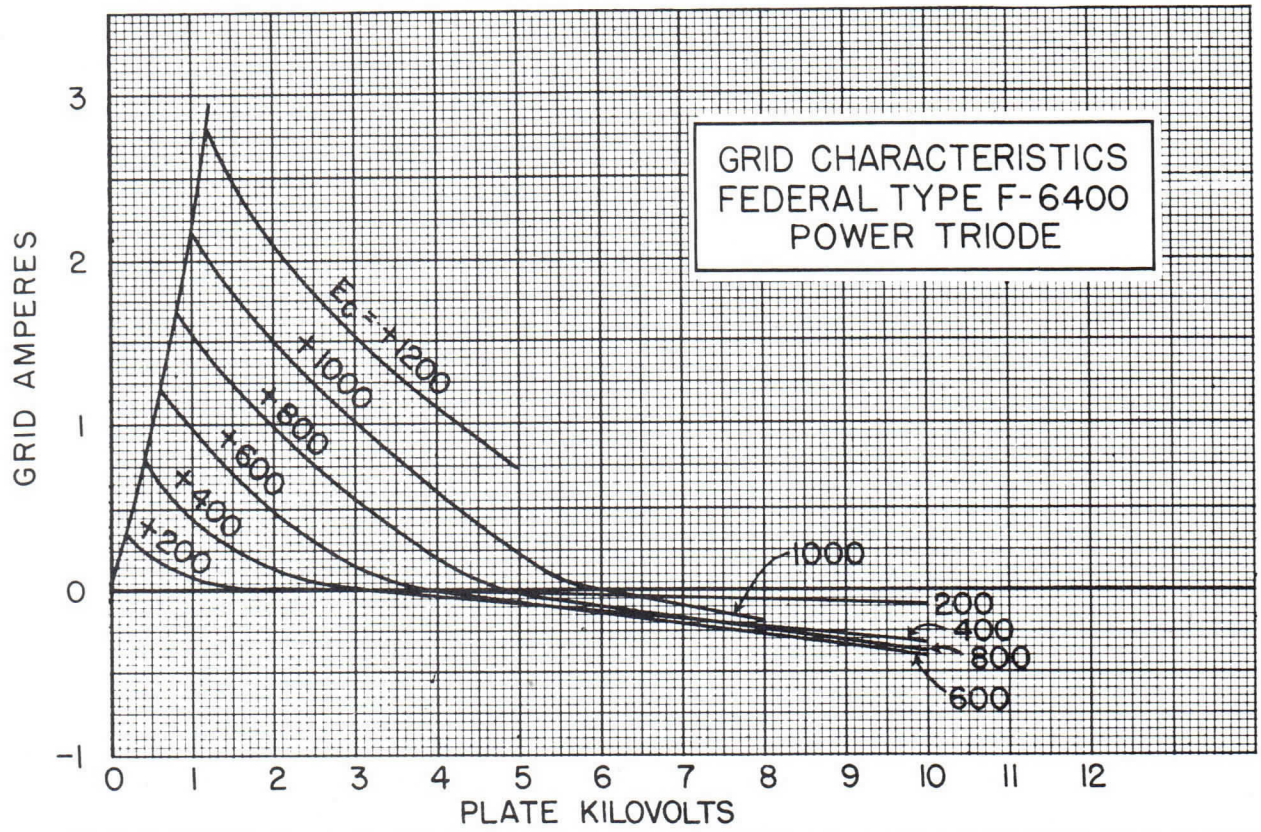
Typical Operation

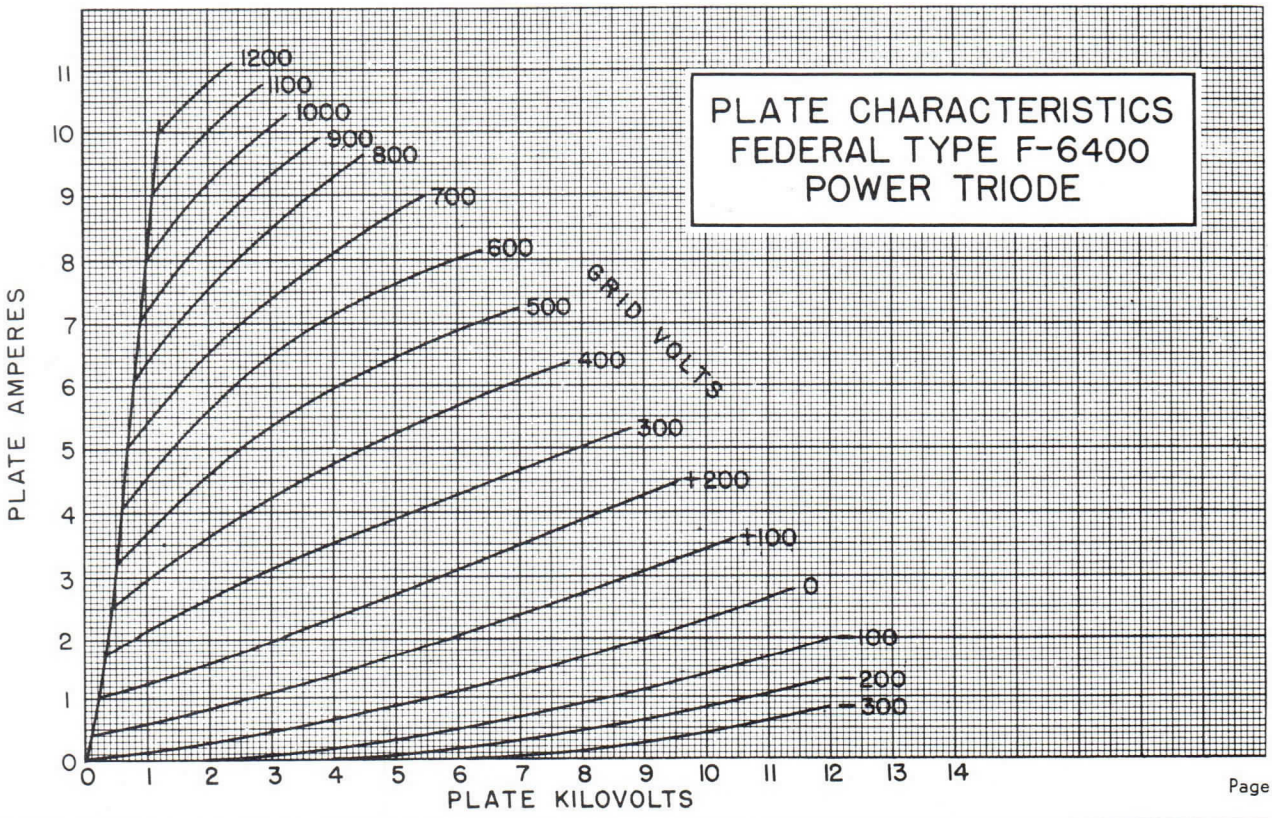
DC Plate Voltage	9,000 Volts
DC Grid Voltage	—800 Volts
Peak R-F Grid Voltage	1,510 Volts
DC Plate Current	2.0 Amperes
DC Grid Current, approx.	.150 Amperes
Driving Power, approx.	225 Watts
Power Output	12 Kilowatts



High efficiency radiator allows reduced blower cost in new equipment design.

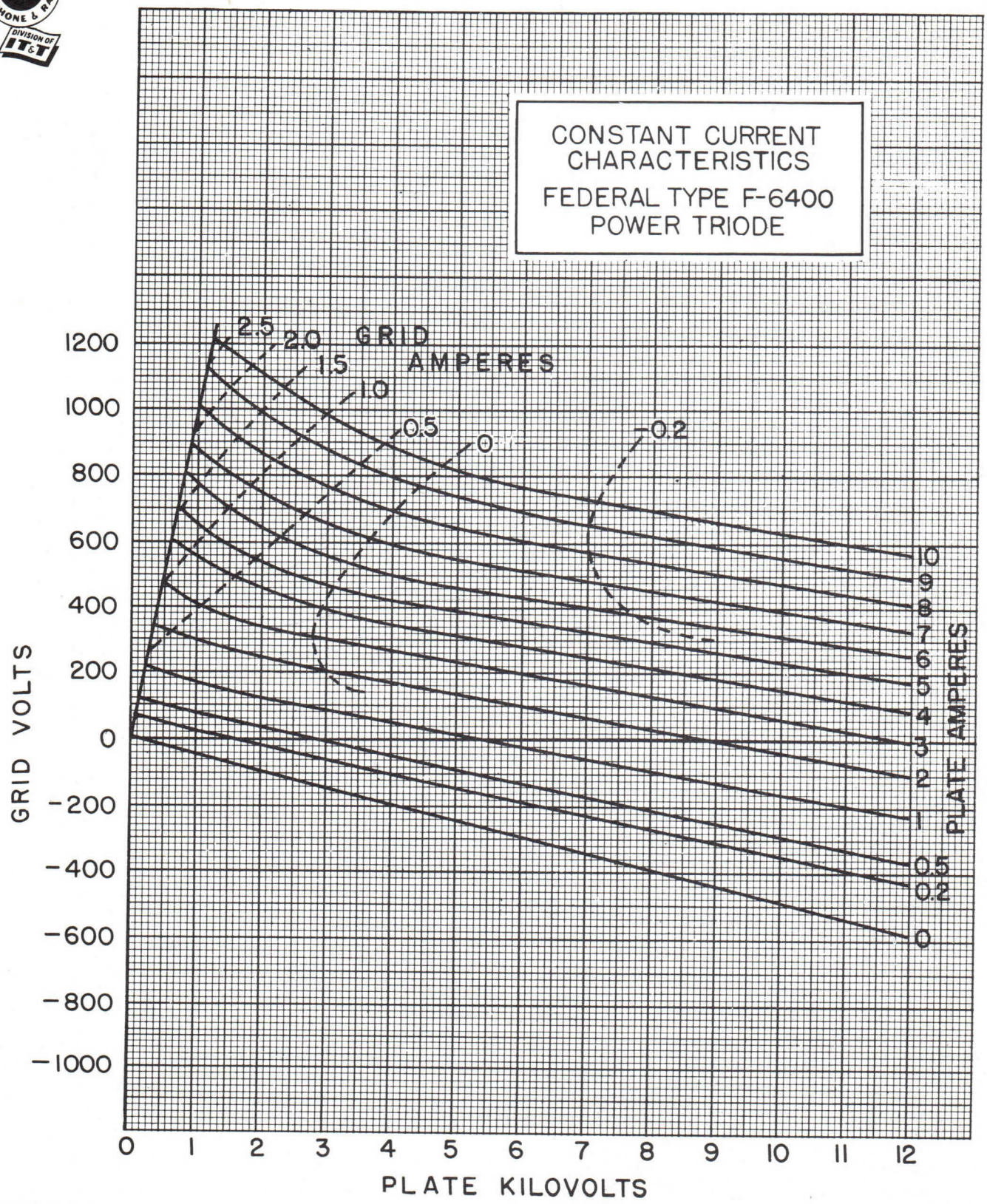
FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation





FEDERAL POWER TRIODE
Type F-6400
6 Kilowatts Plate Dissipation

Grid and Filament leads attached for convenience of equipment designers.



Form F-628 Printed in U. S. A.

Federal Telephone and Radio Company
100 Kingsland Road VACUUM TUBE DEPARTMENT Clifton, New Jersey

engineering TUBE DATA

F-6401
PULSE
TRIODE

ITT *Components Division*

DESCRIPTION

The F-6401 is a three-electrode tube designed for pulse operation as an oscillator or amplifier in the UHF region. The anode is capable of dissipating 1 kilowatt of plate power, exclusive of filament excitation power, during Continuous Commercial Service. Water cooling is used for the anode and forced-air cooling is required for the bulb and seals. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 600 megacycles.

ELECTRICAL

Filament Voltage	4.25 volts
Filament Current	400 amperes
Filament Starting Current	1000 amperes
Filament Cold Resistance	0.0018 ohms
Amplification Factor	
I_b = 10 amps; E_c = -100 volts	12
Peak Cathode Current	145 amperes
Direct Inter-electrode Capacitance	
Grid-Plate	25 μμf
Grid-Filament	36 μμf
Plate-Filament	2.1 μμf

MECHANICAL

Mounting Position	Vertical, Anode End Up or Down
Water Flow Required Anode (Note 1)	1 min. gpm
Outlet Water Temperature	70 max. °C
Air Flow Required (Note 2)	10 min. cfm
Net Weight, approximate	3-1/2 pounds
Maximum Glass Temperature	180°C

Note 1: A special water connection is required as specified on the outline drawing. Water cooling must be maintained for a period of 2 minutes after shutdown of filament power.

Note 2: Air flow on the cathode and grid terminals and on the bulb must be sufficient to limit the maximum temperature to 180°C.

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P.O. BOX 412, CLIFTON, NEW JERSEY

RATINGS

Grounded Grid Circuit
Plate Pulsed Oscillator and Amplifier

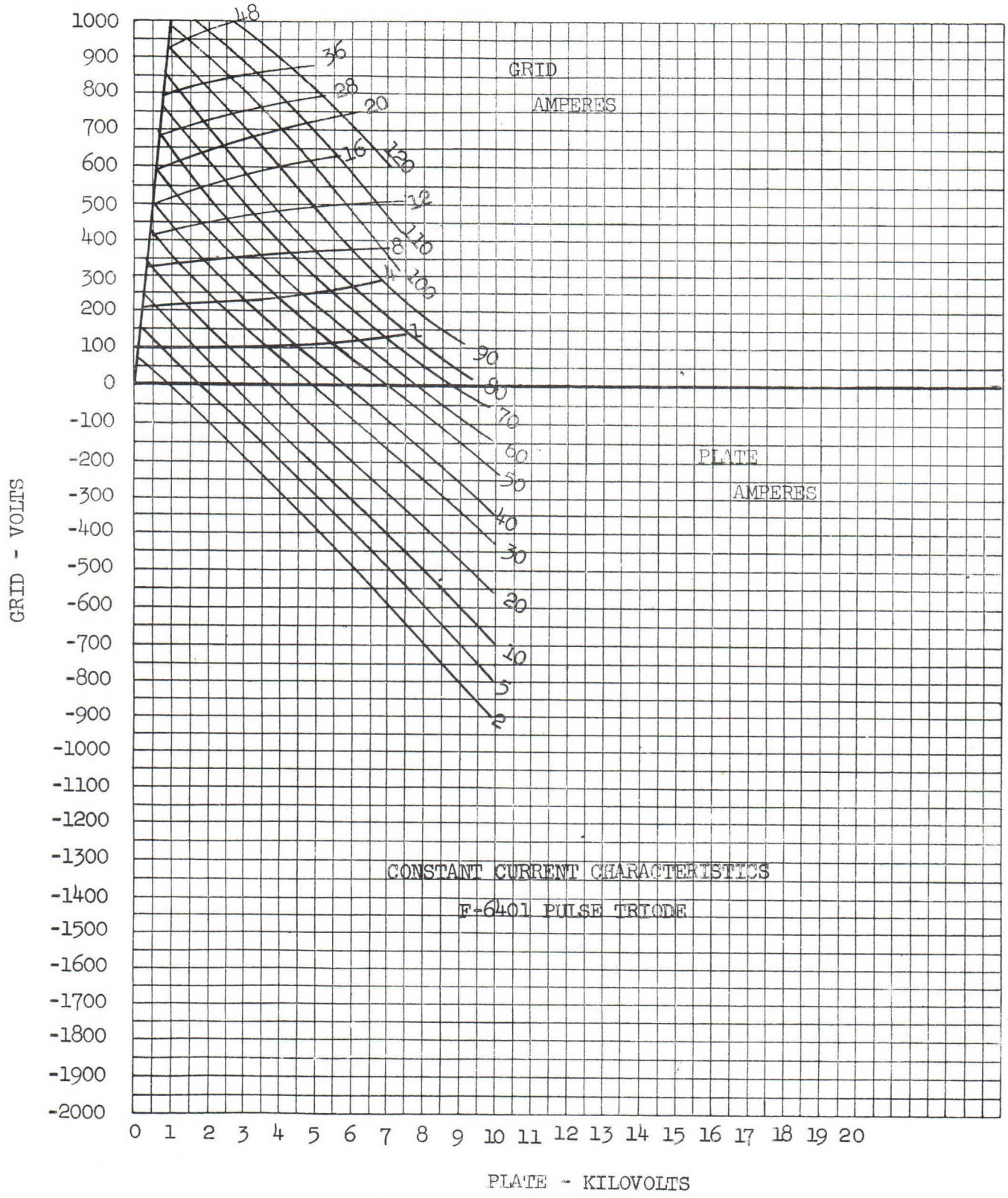
Maximum Ratings, Absolute Values

D-C Plate Voltage	17 max. kv
D-C Grid Voltage	-2 max. kv
D-C Plate Current (peak)	75 max. amperes
D-C Grid Current (peak)	5 max. amperes
Pulse Length	15 max. μsec.
Duty Factor	.002 max.
Plate Input	1.6 max. kw
Plate Dissipation	1.0 max. kw

The above are limiting values beyond which the serviceability of the tube will be impaired if exceeded. Each maximum rating must be considered in relation to every other to insure that under no conditions any maximum rating will be exceeded.

Typical Operation

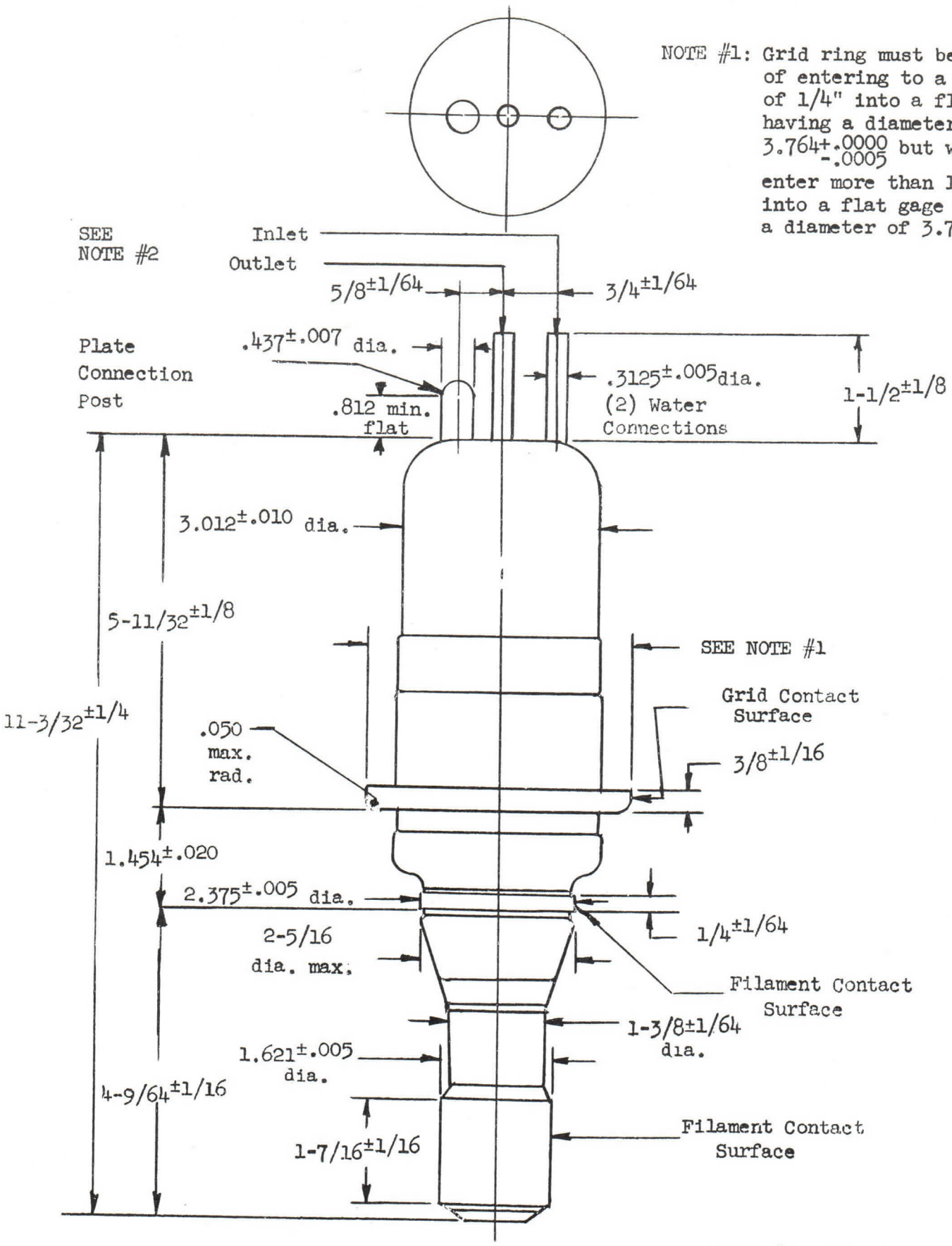
D-C Plate Voltage	12 kv
D-C Grid Voltage	-.5 kv
D-C Plate Current (average)	.090 amperes
D-C Grid Current (average)	.005 amperes
Pulse Length	15 μsec.
Duty Factor	.0015
Power Out (during Pulse)	250 kw
Power Gain	4



CONSTANT CURRENT CHARACTERISTICS

F-6401 PULSE TRIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY



NOTE #1: Grid ring must be capable of entering to a distance of 1/4" into a flat gage having a diameter of $3.764^{+.0000}_{-.0005}$ but will not enter more than 1/16" into a flat gage having a diameter of $3.744^{+.0005}_{-.0000}$

NOTE #2: If tube is operated anode down, reverse designations from those shown to apply to the inlet and outlet.

OUTLINE
F-6401 PULSE TRIODE

engineering TUBE DATA

F-6691
POWER TRIODE

ITT Components Division

DESCRIPTION

The F-6691 is a three electrode tube designed for use as an industrial oscillator. The anode is capable of dissipating 17 kilowatts during Continuous Commercial Service. Cooling is accomplished by forced air. The cathode is a thoriated tungsten filament and may be operated on d-c or single phase a-c. Maximum ratings apply up to 30 megacycles.

ELECTRICAL

Filament Voltage	5.0 volts
Filament Current	260 amperes
Filament Starting Current	1000 amperes
Filament Cold Resistance	.002 ohms
Filament Heating Time	15 seconds
Amplification Factor	
E_c = -100 v. I_b = 1.5 amps	21
Peak Cathode Current, Note 1	40 amperes
Direct Inter-electrode Capacitance	
Grid-Plate	55 μμf
Grid-Filament	57 μμf
Plate-Filament	5.0 μμf

Note 1: Represents maximum usable cathode current (plate current plus grid current) for any condition of operation.

MECHANICAL

Mounting Position			Vertical, anode down
Type of Cooling			Forced Air
Maximum Incoming Air Temperature			45 °C
Required Air Flow on Anode			
Plate Dissipation - kw	17	14	12
Air Flow - cfm	1000	800	700
Pressure - inches of water	3.5	2.3	1.7
Net Weight, approximate			39 lbs

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-Frequency Power Amplifier & Oscillator - Class C Telegraphy
(Key down conditions per tube without Amplitude Modulation)

Maximum CCS Ratings, Absolute Values:	Below 2 mc	2 mc to 30 mc
D-C Plate Voltage	15,000	12,500 max. volts
D-C Grid Voltage	-2,000	-2,000 max. volts
D-C Plate Current	6	6 max. amps
D-C Grid Current	.8	.8 max. amps
Plate Input	60	54 max. kw
Plate Dissipation	17	17 max. kw

Typical Operation

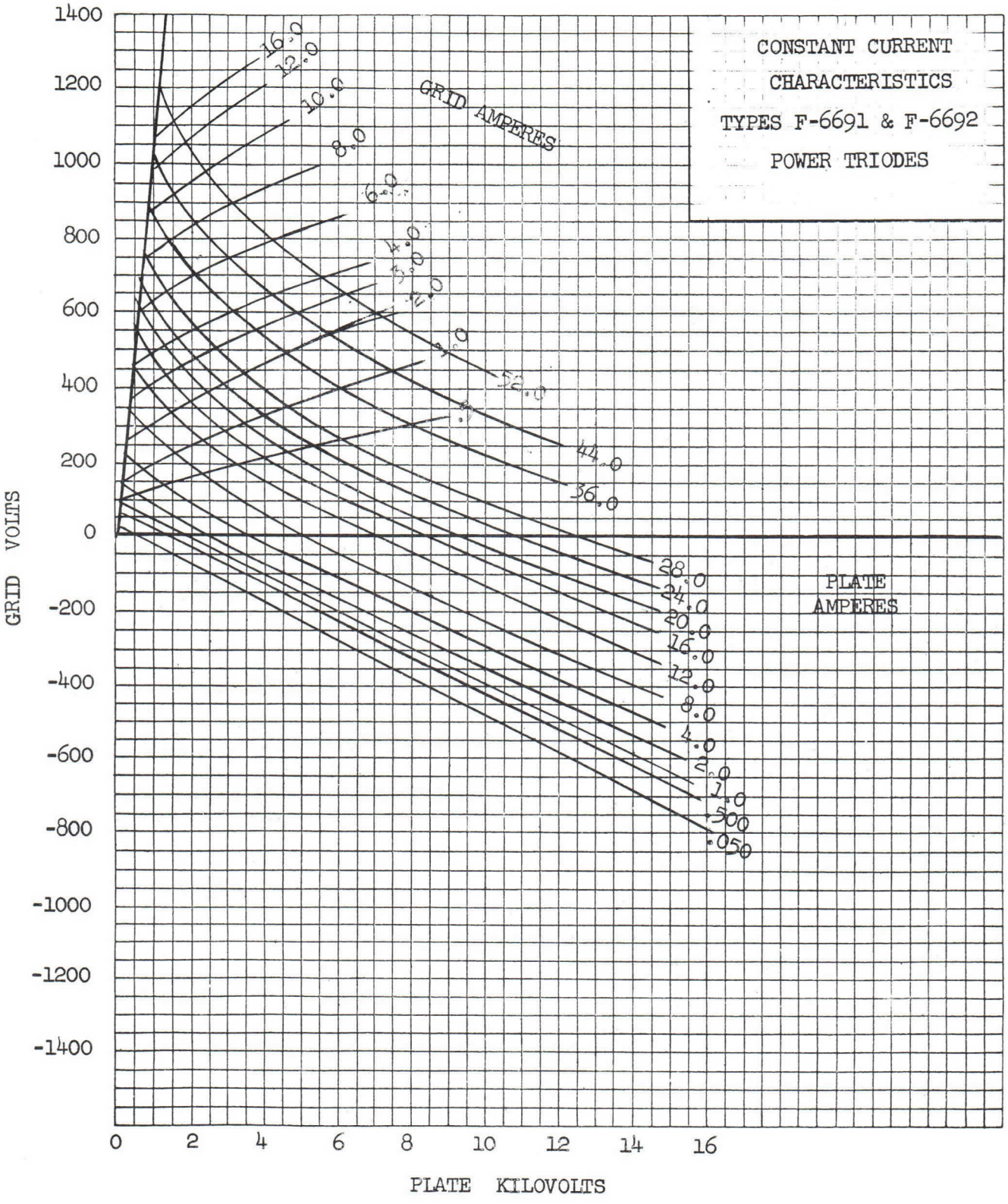
D-C Plate Voltage	15,000	12,500	10,000	7,500 volts
D-C Grid Voltage	-1,600	-1,300	-1,100	-800 volts
Peak R-F Grid Voltage	2140	1820	1600	1360 volts
D-C Plate Current	3.9	4.25	4.1	5.4 amps
D-C Grid Current, approx.	.570	.500	.750	.690 amps
Driving Power, approx.	1200	900	1200	935 watts
Power Output, approx.	47.0	42.0	32.5	30.0 kw

Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

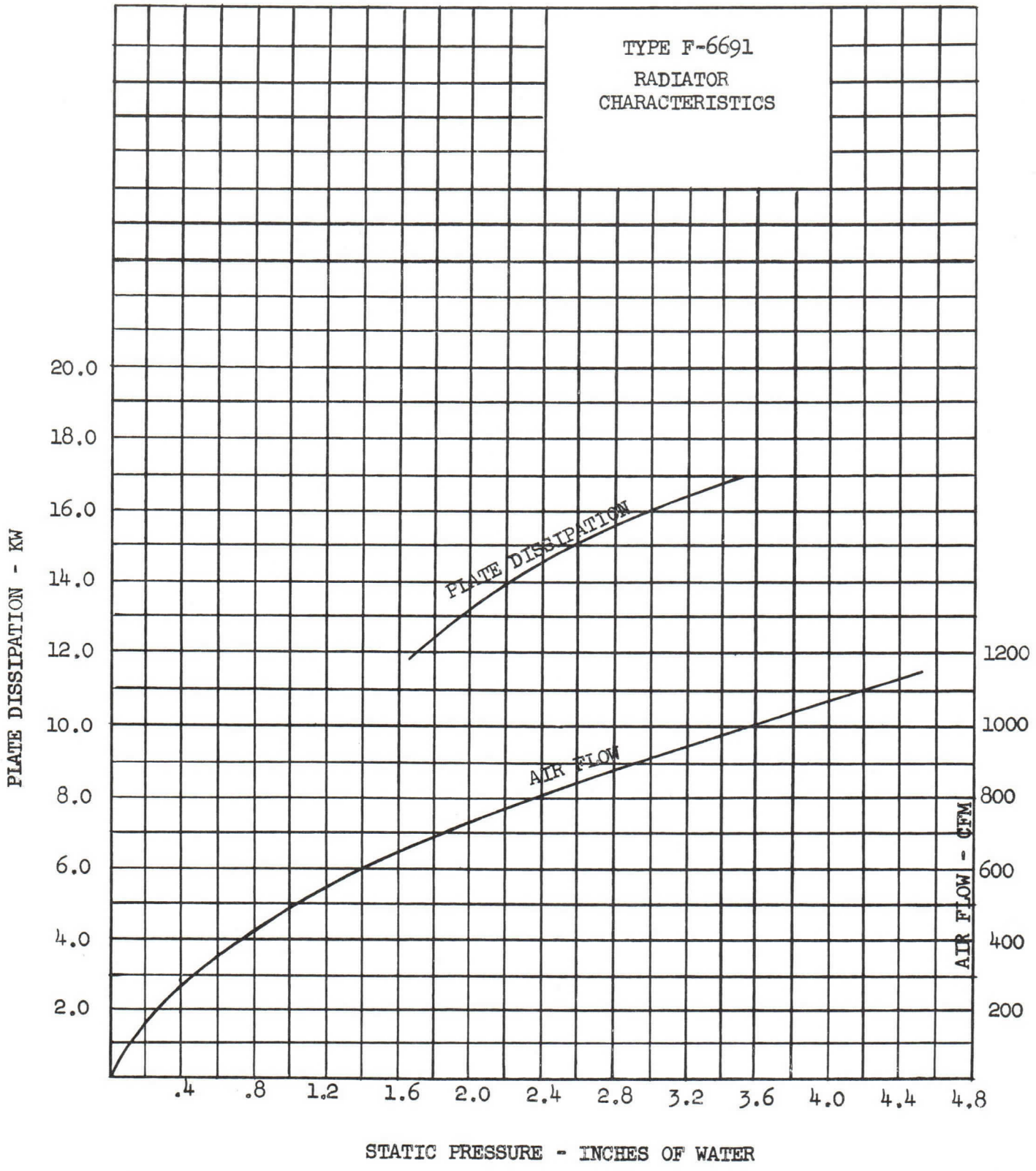
RATINGS VERSUS FREQUENCY

Maximum ratings apply up to 30 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	30	40	50 megacycles
Percentage of Maximum Rated Plate Voltage & Plate Input	100	80	50 per cent

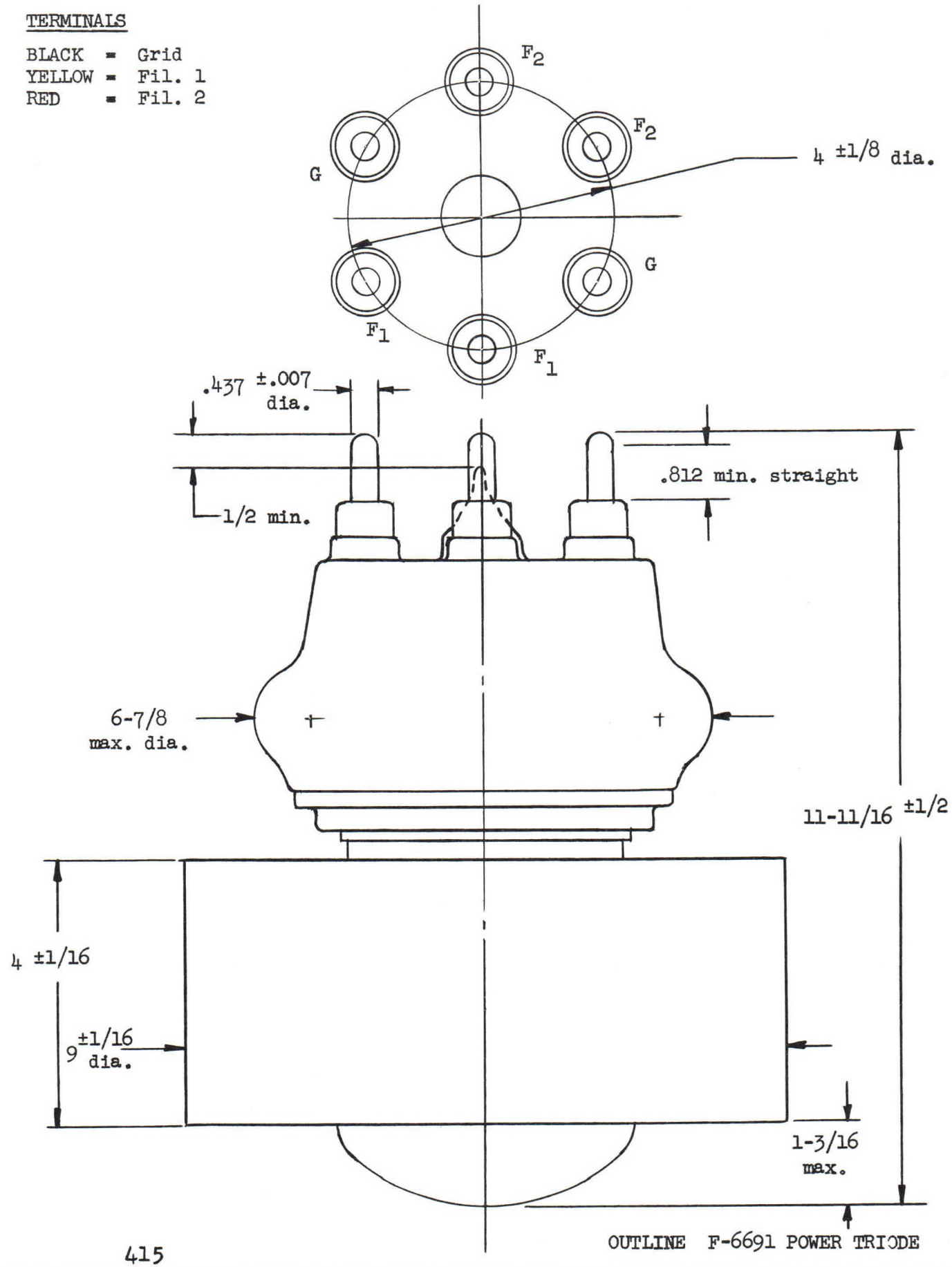


ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY


TYPE F-6691
RADIATOR
CHARACTERISTICS
PLATE DISSIPATION - KW
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
PLATE DISSIPATION
AIR FLOW
1200
1000
800
600
400
200
AIR FLOW - CFM
.4
.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
4.4
4.8
STATIC PRESSURE - INCHES OF WATER

TERMINALS

BLACK = Grid
YELLOW = Fil. 1
RED = Fil. 2



OUTLINE F-6691 POWER TRIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

DESCRIPTION

The F-6696 and F-6697 are three electrode tubes designed for use as radio frequency amplifiers, oscillators or Class B modulators. The rugged coaxial stem structure provides high dissipation, low inductance r-f electrode terminals. The cathode is a thoriated tungsten filament.

The F-6696 has a water cooled, heavy wall anode capable of 60 kw dissipation. The F-6697 has a forced-air cooled copper anode-radiator assembly of brazed construction capable of 35 kw dissipation.

ELECTRICAL

Filament Voltage	13	volts
Filament Current	205	amperes
Filament Starting Current	800	amperes
Filament Cold Resistance	.0073	ohms
Amplification Factor	20	
Inter-Electrode Capacitances		
Grid-Plate	55	μμf
Grid-Filament	76	μμf
Plate-Filament	2.7	μμf

MECHANCIAL

Mounting Position						Vertical, Anode down	
Max. Glass & Seal Temperature *						180°	C
	F-6696			F-6697			
Plate Dissipation	60	45	30	35	25	15	kilowatts
Water Flow	18	13	8	-	-	-	gpm
Water Jacket Pressure Drop	7	4	2	-	-	-	psi
Air Flow **	-	-	-	1700	1000	440	cfm
Static Air Pressure	-	-	-	8.0	2.8	.6	inches of water
Net Weight, approx.		17			37		lbs

* At the upper frequencies, special attention should be given to provide adequate cooling to the seals to limit the temperature to 180°C max.; up to 150 cfm air flow may be required.

** Maximum incoming air temperature of 50°C at sea level.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator - Class B

Maximum Ratings, Absolute Values

D-C Plate Voltage	16,000	volts
Max. Signal D-C Plate Current [a]	11	amperes
Max. Signal Plate Input [a]		
F-6696	120	kilowatts
F-6697	110	kilowatts
Plate Dissipation [a]		
F-6696	60	kilowatts
F-6697	35	kilowatts

Typical Operation
(Unless otherwise specified, values are for two tubes)

		F-6696	
D-C Plate Voltage	10,000	12,000	volts
D-C Grid Voltage	-450	-600	volts
Peak A-F Grid-to-Grid Voltage	1,750	2,120	volts
Peak A-F Plate-to-Plate Voltage	16,000	19,200	volts
Zero Signal D-C Plate Current	3.0	2.0	amperes
Max. Signal D-C Plate Current	17.4	20.0	amperes
Effective Load Resistance, Plate-to-Plate	1,170	1,230	ohms
Max. Signal Driving Power, approx.	550	600	watts
Max. Signal Power Output, approx.	110	152	kilowatts

[a] Averaged over any audio frequency cycle of sine-wave form

Radio-Frequency Power Amplifier - Class B
(Carrier conditions per tube for use with a max. modulation factor of 1.0)

Maximum Ratings, Absolute Values

D-C Plate Voltage	16,000	volts
D-C Plate Current	9.0	amperes
Plate Input		
F-6696	90	kilowatts
F-6697	55	kilowatts
Plate Dissipation		
F-6696	60	kilowatts
F-6697	35	kilowatts

Typical Operation		F-6696	
D-C Plate Voltage	12,000	12,000	volts
D-C Grid Voltage	-550	-550	volts
Peak R-F Grid Voltage	510	640	volts
D-C Plate Current	4.3	6.8	amperes
Peak R-F Plate Voltage	5,300	5,300	volts
D-C Grid Current	0	0	milliamperes
R-F Load Resistance	780	500	ohms
Driving Power, approx. ≠	450	1,500	watts
Power Output, approx.	18	28	kilowatts

≠ At crest of audio-frequency cycle
with modulation factor of 1.0

Plate-Modulated Radio-Frequency Power Amplifier - Class C Telephony
(Carrier conditions per tube for use with a max. modulation factor of 1.0)

Maximum Ratings, Absolute Values

D-C Plate Voltage	10,000	volts
D-C Grid Voltage	-3,200	volts
D-C Plate Current	8.5	amperes
D-C Grid Current	2.0	amperes
Plate Input	81	kilowatts
Plate Dissipation		
F-6696	40	kilowatts
F-6697	23	kilowatts

Typical Operation

D-C Plate Voltage	9,500	volts
D-C Grid Voltage	-1,600	volts
Peak R-F Grid Voltage	2,300	volts
Peak R-F Plate Voltage	7,800	volts
D-C Plate Current	8.4	amperes
D-C Grid Current	0.90	amperes
R-F Load Resistance	510	ohms
Driving Power, approx.	2.0	kilowatts
Power Output, approx.	60	kilowatts

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy
(Key down conditions per tube without amplitude modulation) ***

Maximum Ratings, Absolute Values

D-C Plate Voltage	16,000	volts
D-C Grid Voltage	-3,200	volts
D-C Plate Current	11	amperes
D-C Grid Current	2.0	amperes
Plate Input	120	kilowatts
Plate Dissipation		
F-6696	60	kilowatts
F-6697	35	kilowatts

Typical Operation

D-C Plate Voltage	10,000	15,000	volts
D-C Grid Voltage	-1,200	-1,600	volts
Peak R-F Grid Voltage	1,900	2,120	volts
Peak R-F Plate Voltage	8,000	12,500	volts
D-C Plate Current	10	7.0	amperes
D-C Grid Current, approx.	0.81	0.30	amperes
R-F Load Resistance	440	970	ohms
Driving Power, approx.	1.5	0.60	kilowatts
Power Output, approx.	72	80	kilowatts

*** Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions

MAXIMUM FREQUENCY RATINGS

Maximum ratings apply up to 30 mc except as noted. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below.

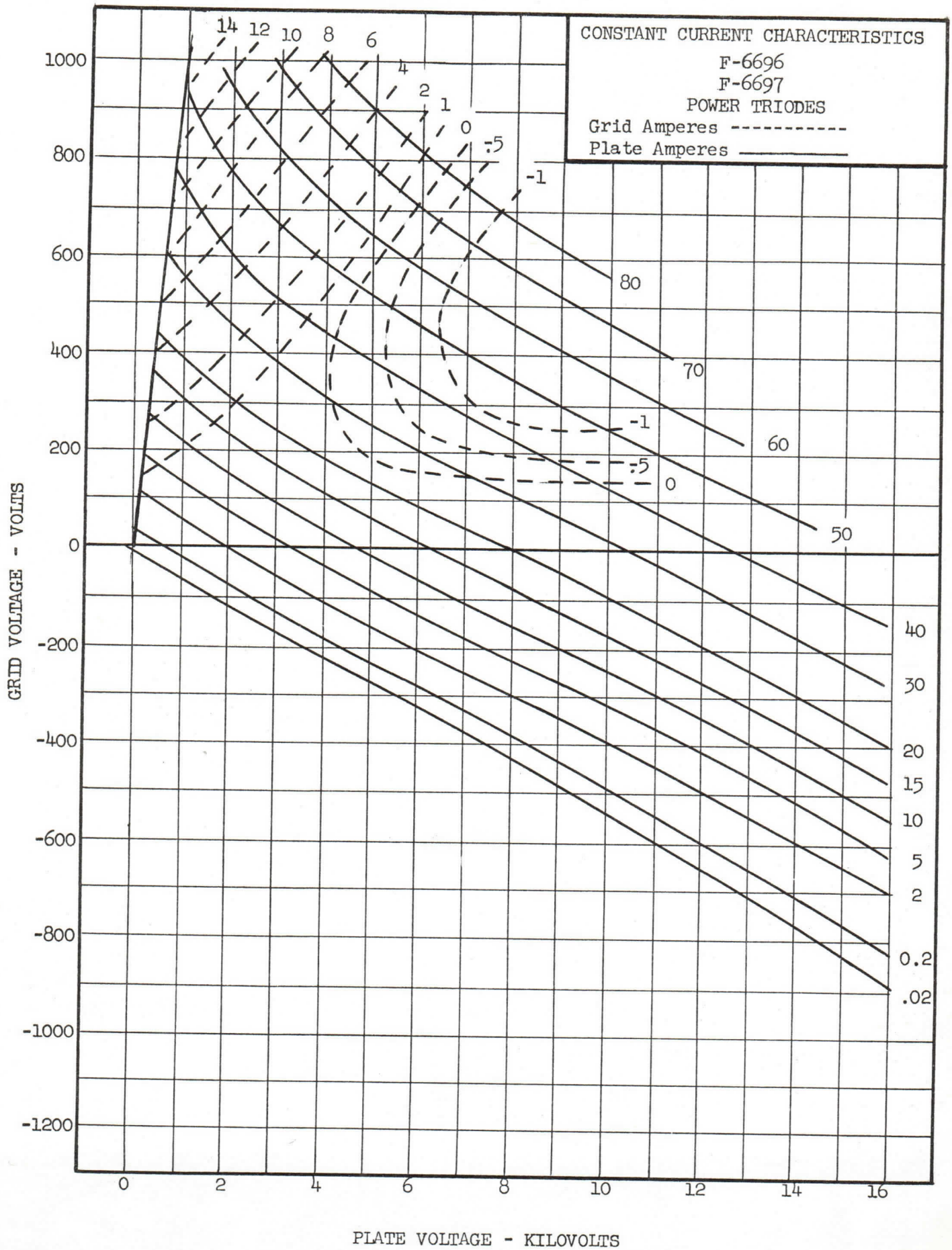
Frequency		30	50	70	megacycles
Max. Rated Plate Voltage and Plate Input:	Class B	100	80	55	per cent
	Class C	100	75	50	per cent

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

Characteristics	Conditions		Limits Min.	Bogey	Max.	
Grid Voltage	e_b = 1500 volts; i_b = 48 amps.	e_c:	-	-	1000	volts
Grid Current	e_b = 1500 volts; i_b = 48 amps.	i_c:	-	-	15	amps
Plate Voltage	E_c = 0 V d-c; I_b = 3.0 A d-c	E_b:	1.9	2.4	2.9	Kv d-c
Plate Voltage	E_c = -200 V d-c; I_b = 3.0 A d-c	E_b:	5.6	6.4	7.2	Kv d-c
Grid Voltage	E_b = 15.0 Kv d-c; I_b = 0.020 A d-c	E_c:	-700	-820	-940	V d-c
Plate Power Output	E_b = 15.0 Kv d-c; I_b = 7.0 A d-c; E_c = -1600 V d-c; I_c = 0.30 A d-c	Po:	68	-	-	Kw

Additional information for specific applications can be obtained from the:

ITT Components Division
Electron Tube Applications Section
P. O. Box 412
Clifton, New Jersey


CONSTANT CURRENT CHARACTERISTICS
F-6696
F-6697
POWER TRIODES
Grid Amperes ----------
Plate Amperes ——————
GRID VOLTAGE - VOLTS
PLATE VOLTAGE - KILOVOLTS
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
-1200
0
2
4
6
8
10
12
14
16
14
12
10
8
6
4
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-1
80
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30
20
15
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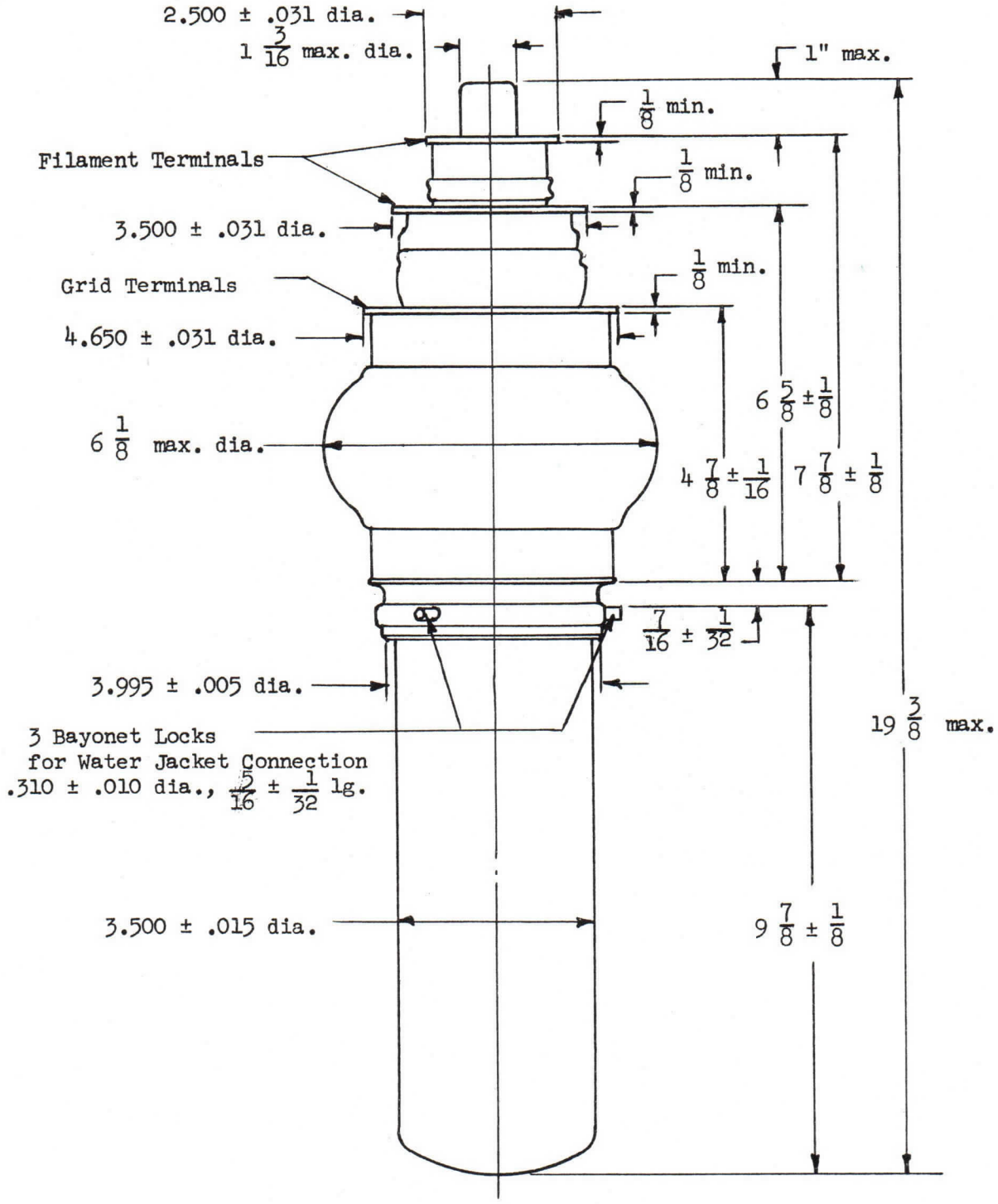
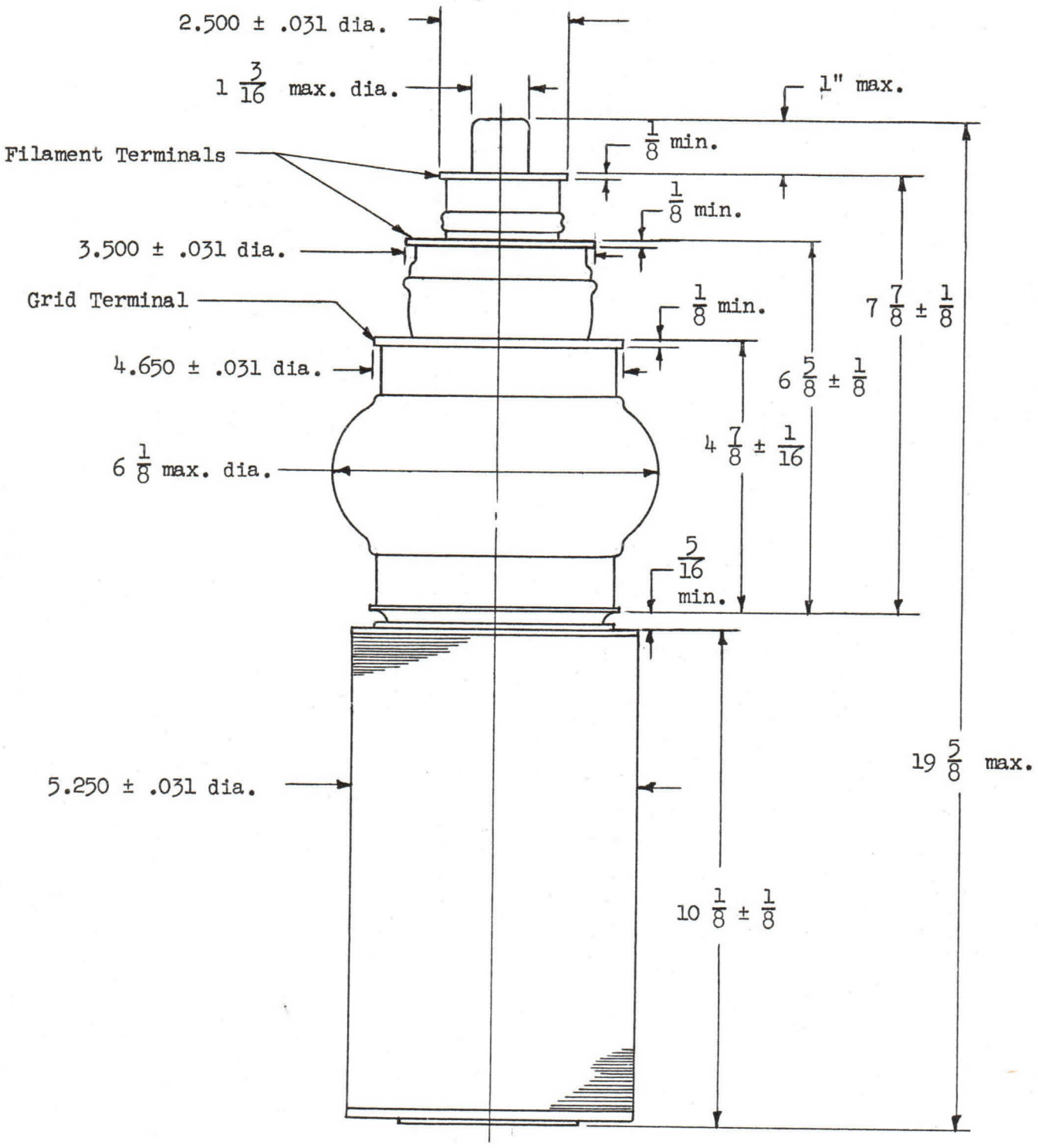
5
2
0.2
.02



OUTLINE
F-6696 POWER TRIODE

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



OUTLINE
F-6697 POWER TRIODE

engineering TUBE DATA

F-6800
POWER
TRIODE

ITT Components Division

out of date

DESCRIPTION

The F-6800 is a three electrode tube designed for use as an industrial oscillator. The anode is capable of dissipating 20 kilowatts during Continuous Commercial Service. Cooling is accomplished by circulating water. The cathode is a thoriated tungsten filament and may be operated on d-c or single phase a-c. Maximum ratings apply up to 22.5 megacycles and operation up to 50 megacycles is permissible at reduced ratings.

ELECTRICAL

Filament Voltage	7.5 volts
Filament Current	107 amperes
Filament Starting Current	300 amperes max.
Filament Cold Resistance	.01 ohms
Filament Heating Time	15 seconds min.
Amplification Factor	
E_c = -200 v. I_b = 1.25 amps	19.5
Direct Inter-electrode Capacitances	
Grid-Plate	26 μμf
Grid-Filament	25 μμf
Plate-Filament	1.0 μμf

MECHANICAL

Mounting Position	Vertical, anode down
Type of Cooling	Water and Forced Air
Water Flow on Anode	8 gpm
Maximum Outgoing Water Temperature	70° C.
Air Flow on Bulb, Note 1	50 cfm
Glass Temperature (at hottest part)	180° C. max.
Net Weight, approximate	6 pounds

Note 1: Operation at frequencies above 15 megacycles may require air flow onto the dish center in order to hold the temperature of the seals and dish below 180°C. The blower required should deliver 50 cfm through a 3" diameter nozzle.

413

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy
(Key down conditions per tube without Amplitude Modulation) Note 2

Maximum CCS Ratings, Absolute Values

D-C Plate Voltage	15,000 max. volts
D-C Grid Voltage	-1,800 max. volts
D-C Plate Current	3.5 max. amperes
D-C Grid Current	.50 max. amperes
Plate Input	45 max. kilowatts
Plate Dissipation	20 max. kilowatts

Typical Operation

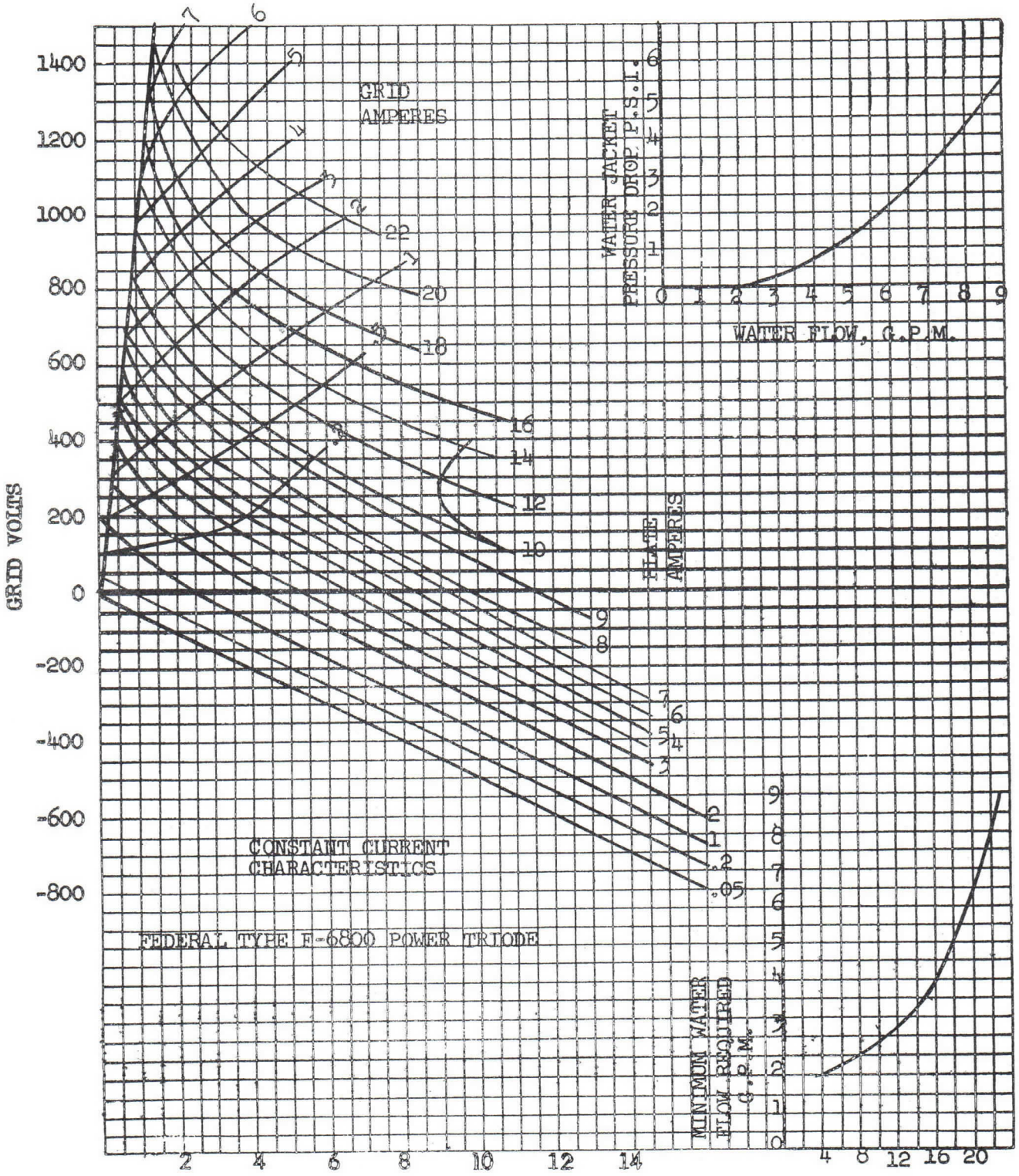
D-C Plate Voltage	12,500 volts
D-C Grid Voltage	-1,200 volts
Peak R-F Grid Voltage	2,100 volts
D-C Plate Current	3.5 amperes
D-C Grid Current, approximate	.45 amperes
Driving Power, approximate	900 watts
Power Output, approximate	33 kilowatts

Ratings versus Frequency

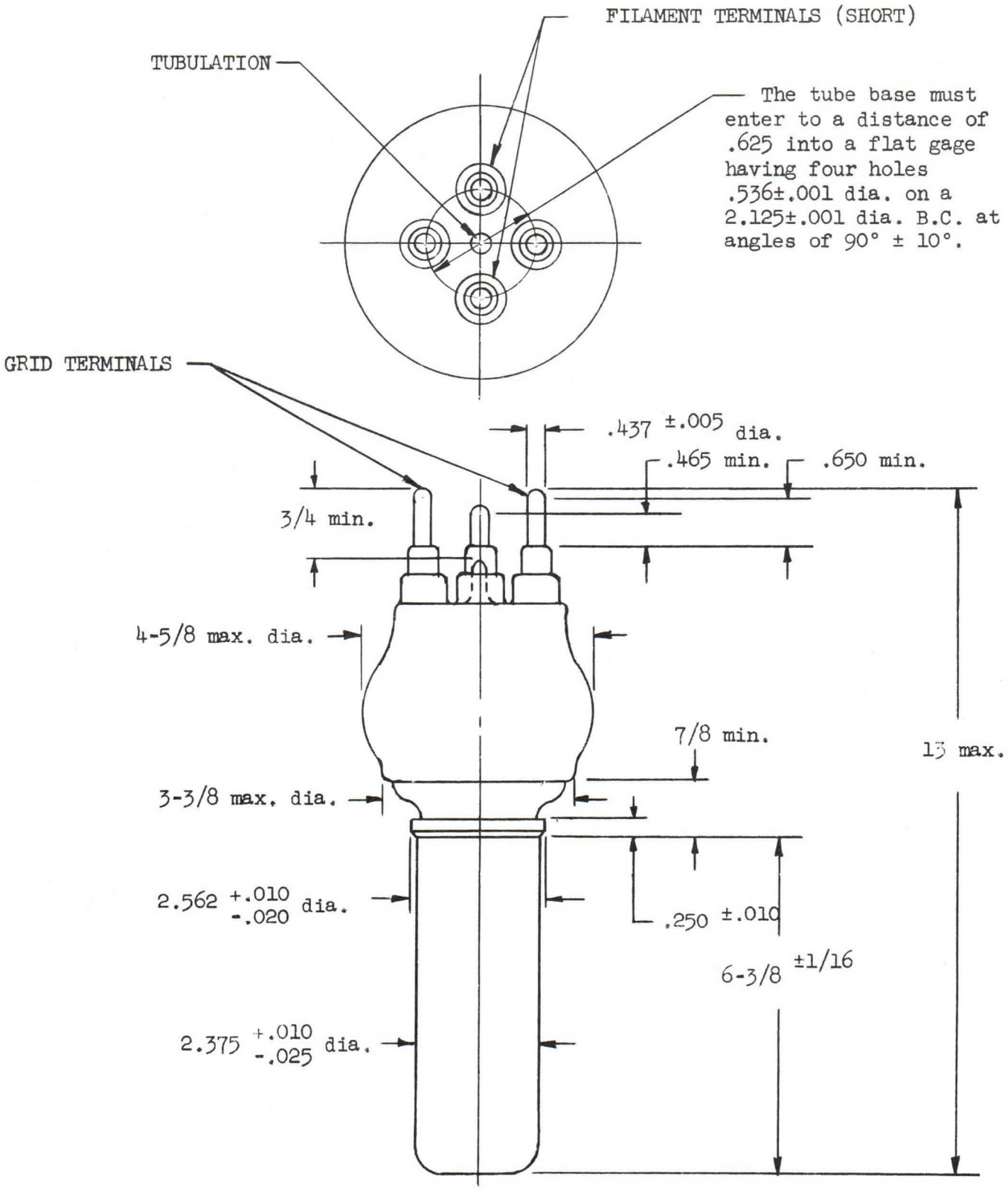
Maximum ratings apply up to 22.5 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	27.5	30	50 Megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input	100	80	50 Per Cent

Note 2: Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.



ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY



OUTLINE
F-6800 POWER TRIODE

engineering TUBE DATA

F-6801
POWER
TRIODE

ITT Components Division

out of date

DESCRIPTION

The F-6801 is a three electrode tube designed for use as an industrial oscillator. The anode is capable of dissipating 10 kilowatts during Continuous Commercial Service. Cooling is accomplished by forced air. The cathode is a thoriated tungsten filament of free-hung design and may be operated on d-c or single phase a-c. Maximum ratings apply up to 22.5 megacycles and operation up to 50 megacycles is permissible at reduced ratings.

ELECTRICAL

Filament Voltage	7.5 volts
Filament Current	107 amperes
Filament Starting Current	300 max. amperes
Filament Cold Resistance	.01 ohms
Filament Heating Time	15 seconds min.
Amplification Factor	
E_c = -200 v. I_b = 1.25 amps	19.5
Direct Inter-electrode Capacitances	
Grid-Plate	27 μμf
Grid-Filament	25 μμf
Plate-Filament	1.25 μμf

MECHANICAL

Mounting Position — Vertical, anode down

Air Flow

Through Radiator

The tabulation listed below indicates the required flow of incoming air, through the radiator, for the various plate dissipation values. Cooling air to be applied before the application of filament power and to continue for 3 minutes after removal of filament power.

Percentage of Maximum Rated Plate Dissipation for each Class of Service

	100% rating	80% rating	60% rating	
Air Flow	750	525	350	min. cfm
Static Pressure	2	1	.45	inches water
Radiator Temperature (measured on the core at end away from incoming air)			200	max. °C
Glass Temperature (at hottest part), Note 1			180	max. °C
Net Weight, approximate			45	pounds

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MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy
(Key down conditions per tube without Amplitude Modulation) Note 2

Maximum CCS Ratings, Absolute Values

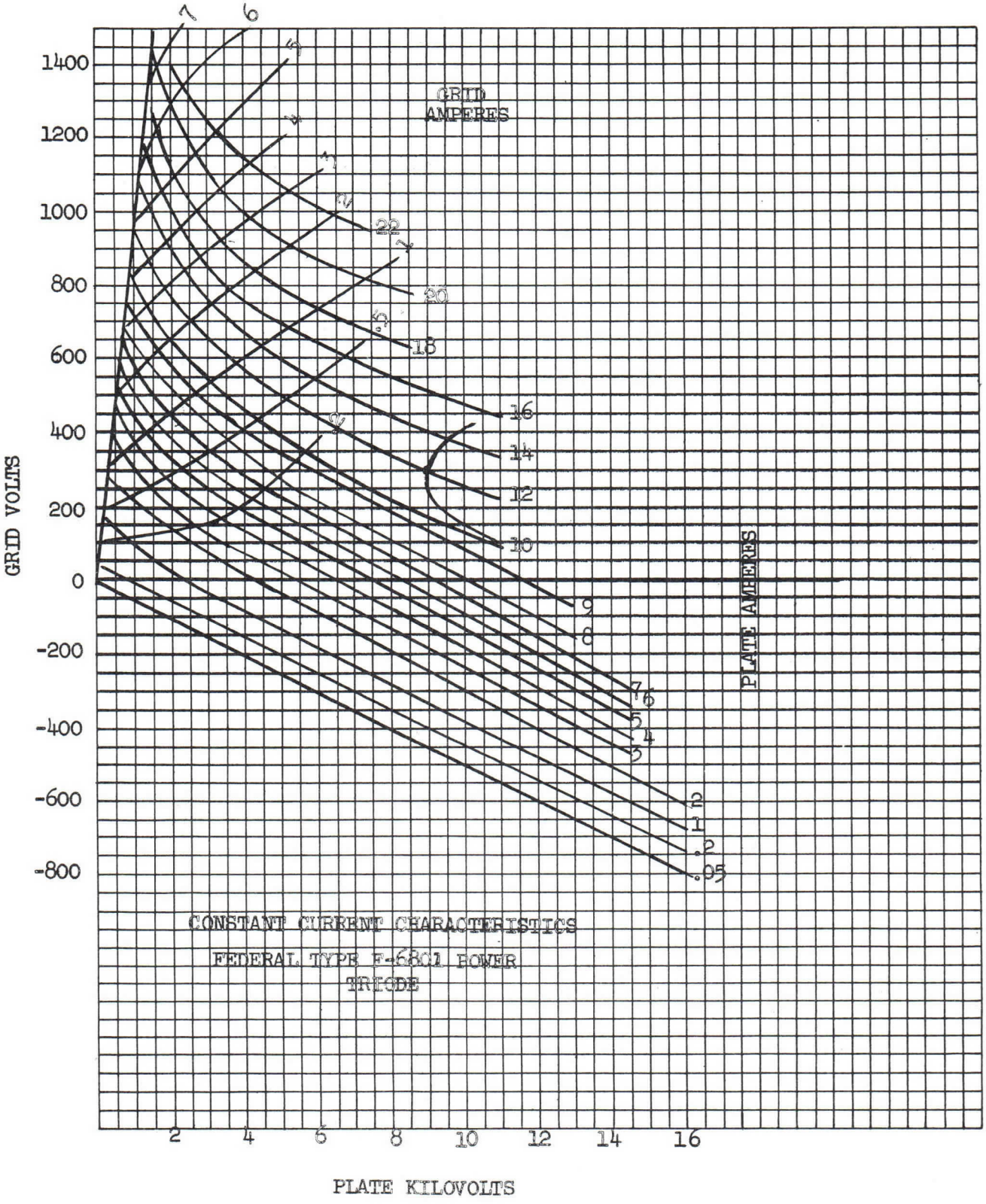
D-C Plate Voltage	15,000 max. volts
D-C Grid Voltage	-1800 max. volts
D-C Plate Current	3.5 max. amperes
D-C Grid Current	.5 max. ampere
Plate Input	40 max. kilowatts
Plate Dissipation	10 max. kilowatts

Typical Operation

D-C Plate Voltage	12,500 volts
D-C Grid Voltage	-1200 volts
Peak R-F Grid Voltage	2000 volts
D-C Plate Current	3.0 amperes
D-C Grid Current, approximate	.43 amperes
Driving Power, approximate	850 watts
Power Output, approximate	28 kilowatts

Note 1: Operation at frequencies above 15 mc may require air flow on the dish center in order to hold the temperature of the seals and dish below 180°C. This flow may be obtained by deflection of the anode cooling air, or by means of a separate blower supplying 50 cfm through a 3" diameter nozzle.

Note 2: Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.



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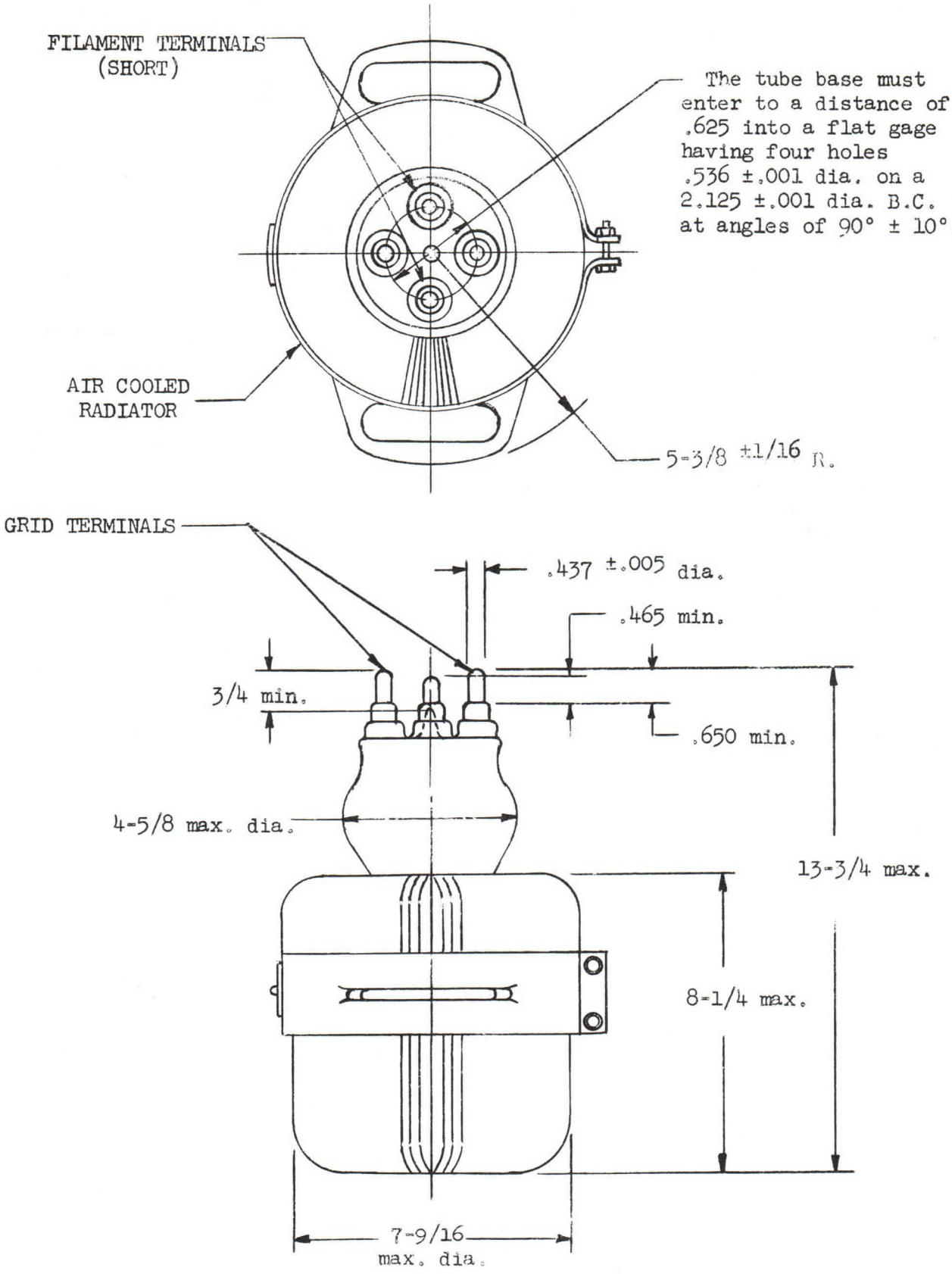

OUTLINE
F-6801 POWER TRIODE

engineering TUBE DATA

F-6803
POWER TRIODE

ITT Components Division

end of data

DESCRIPTION

The F-6803 is a three electrode tube designed for use as a radio frequency amplifier, oscillator, or Class b modulator. The anode is water cooled and is capable of dissipating 70 kilowatts during Continuous Commercial Service. The cathode is a thoriated tungsten filament of free hung design and filament excitation of 3 phase wye is required. Maximum ratings apply up to 22 megacycles.

ELECTRICAL

Filament Voltage, line to line	11.0 volts
Filament Current, per phase	190 amperes
Filament Starting Current	600 amperes
Filament Heating Time	15 seconds
Amplification Factor	
E_c = -100 v. I_b = 2.0 amperes	40
Peak Cathode Current, Note 1	100 amperes
Direct Inter-electrode Capacitances	
Grid-Plate	37 μμf
Grid-Filament	75 μμf
Plate-Filament	2.0 μμf

MECHANICAL

Mounting Position	Vertical, anode down
Type of Cooling	Water and Forced Air
Water Flow on Anode	30 gpm
Maximum Outgoing Water Temperature	70 °C
Air Flow on Bulb, Note 2	250 cfm
Glass Temperature (at hottest part)	180 °C, max.

Note 1: Represents maximum usable cathode current (plate current plus grid current) for any condition of operation.

Note 2: Operation at frequencies above 2 mc may require air flow onto the dish center in order to hold the temperature of the seals and dish below 180°C. The blower required should deliver up to 250 cfm through a 3" diameter nozzle.

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P. O. BOX 412, CLIFTON, NEW JERSEY

MECHANICAL (continued)

Net Weight, approximate	25 lbs
Accessories	
Water Jacket	RT-53402
Mounting Clamp	RT-53492
"O" Ring	RT-53836
Terminal Connector (6 required)	RT-52578
Connector Wrench (2 required)	RT-52843

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator--Class B

Maximum Ratings, Absolute Values

D-C Plate Voltage	19,000 volts
Max. Signal D-C Plate Current, Note 3	9 amperes
Max. Signal Plate Input, Note 3	150 kilowatts
Plate Dissipation, Note 3	70 kilowatts

Typical Operation
(Unless otherwise specified, values are for two tubes)

D-C Plate Voltage	14,000 volts
D-C Grid Voltage	-300 volts
Peak A-F Grid-to-Grid Voltage	1,600 volts
Zero Signal D-C Plate Current	2 amperes
Max. Signal D-C Plate Current	16 amperes
Effective Load Resistance, plate-to-plate	2,250 ohms
Max. Signal Driving Power, approx.	1,500 watts
Max. Signal Power Output, approx.	150 kilowatts

Radio-Frequency Power Amplifier--Class B
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

D-C Plate Voltage, Note 4	17,500 volts
D-C Plate Current	7 amperes
Plate Input	100 kilowatts
Plate Dissipation	70 kilowatts

Note 3: Averaged over any audio frequency cycle of sine-wave form.

Note 4: The tube may be operated up to 19,000 d-c plate volts at frequencies of 2 mc or less.

Typical Operation

D-C Plate Voltage	15,000 volts
D-C Grid Voltage	-375 volts
Peak R-F Grid Voltage	500 volts
D-C Plate Current	4.9 amperes
D-C Grid Current	0.0 amperes
Driving Power, approx. Note 5	770 watts
Power Output, approx.	25 kilowatts

Plate-Modulated Radio-Frequency Power Amplifier--Class C Telephony
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

D-C Plate Voltage	14,000 volts
D-C Grid Voltage	-3,000 volts
D-C Plate Current	12 amperes
D-C Grid Current	1.5 amperes
Plate Input	140 kilowatts
Plate Dissipation	47 kilowatts

Typical Operation

D-C Plate Voltage	14,000 volts
D-C Grid Voltage	-800 volts
Peak R-F Grid Voltage	1,550 volts
D-C Plate Current	10 amperes
D-C Grid Current	1.4 amperes
Driving Power, approx.	2 kilowatts
Power Output, approx.	104 kilowatts

Radio-Frequency Power Amplifier and Oscillator--Class C Telegraphy
(Key down conditions per tube without amplitude modulation) Note 6

Maximum Ratings, Absolute Values

D-C Plate Voltage, Note 7	17,500 volts
D-C Grid Voltage	-3,000 volts
D-C Plate Current	15 amperes
D-C Grid Current	1.5 amperes
Plate Input	175 kilowatts
Plate Dissipation	70 kilowatts

Note 5: At crest of audio-frequency cycle with modulation factor of 1.0

Note 6: Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

Note 7: The tube may be operated up to 19,000 d-c plate volts at frequencies of 2 mc or less.

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Typical Operation

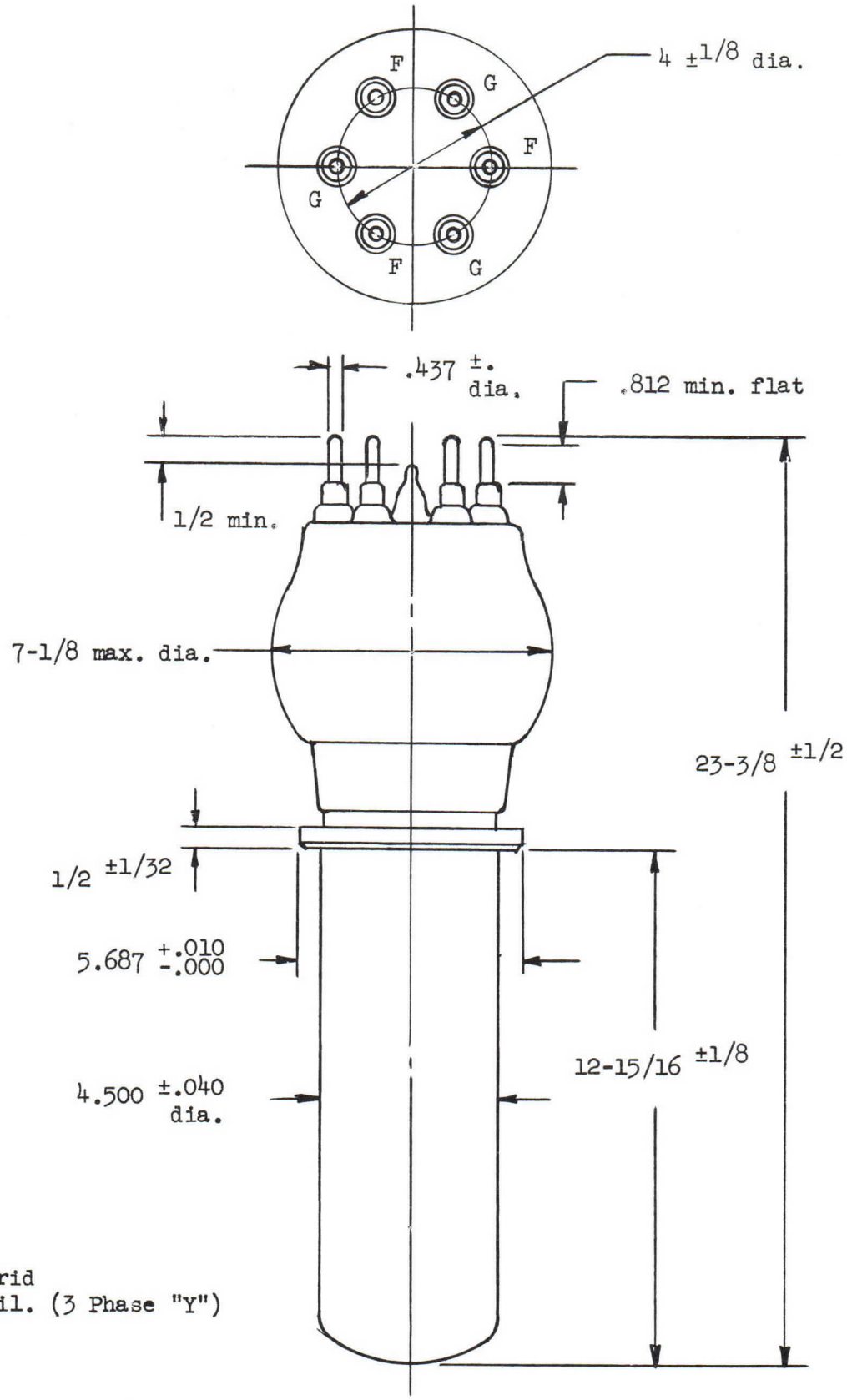
D-C Plate Voltage	14,500 volts
D-C Grid Voltage	2,250 volts
Peak R-F Grid Voltage	3,200 volts
D-C Plate Current	8.25 amperes
D-C Grid Current, approx.	1.5 amperes
Driving Power, approx.	5.0 kilowatts
Power Output, approx.	95 kilowatts

Ratings versus Frequency

Maximum ratings apply up to 22 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	22	30	40 megacycles
Percentage of Maximum Rated Plate Voltage & Plate Input	100	80	50 per cent

For tube characteristic curves, refer to F-5918-A catalog sheet.



TERMINALS

Black - Grid
Yellow - Fil. (3 Phase "Y")

OUTLINE
F-6803 POWER TRIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

engineering TUBE DATA

F-6804
POWER TRIODE

ITT Components Division

Out-of-date

DESCRIPTION

The F-6804 is a three electrode tube designed for use as a radio frequency amplifier, oscillator, or Class B modulator. The anode is forced air cooled and is capable of dissipating 25 kilowatts during Continuous Commercial Service. The cathode is a thoriated tungsten filament of free hung design and filament excitation of 3-phase wye is required. Maximum ratings apply up to 22 megacycles.

ELECTRICAL

Filament Voltage, line to line	11.0 volts
Filament Current, per phase	190 amperes
Filament Starting Current	600 amperes
Filament Heating Time	15 seconds
Amplification Factor	
E_c = -100 v. I_b = 2.0 amperes	40
Peak Cathode Current, Note 1	100 amperes
Direct Inter-electrode Capacitances	
Grid-Plate	37 μμf
Grid-Filament	75 μμf
Plate-Filament	2.2 μμf

MECHANICAL

Mounting Position — Vertical, anode down

Air Flow

Through Radiator

The tabulation listed below indicates the required flow of incoming air, through the radiator, for the various plate dissipation values. Cooling air to be applied before the application of filament power and to continue for 3 minutes after removal of filament power.

Percentage of Maximum Rated Plate Dissipation for each Class of Service	100% rating	80% rating	60 % rating	
Air Flow	1800	1450	1100	min. cfm
Static Pressure	2.2	1.5	.85	in. of water

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MECHANICAL (continued)

Radiator Temperature measured on the core at end away from incoming air	180 °C, max.
Glass Temperature at hottest part - Note 2	180 °C, max.
Net Weight, approx,	225 pounds
Accessories	
Terminal Connector (6 required)	RT-52578
Connector Wrench (2 required)	RT-52843

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier and Modulator--Class B

Maximum Ratings, Absolute Values

D-C Plate Voltage	19,000 volts
Max. Signal D-C Plate Current, Note 3	9 amperes
Max. Signal Plate Input, Note 3	150 kilowatts
Plate Dissipation, Note 3	25 kilowatts

Typical Operation
(Unless otherwise specified, values are for two tubes)

D-C Plate Voltage	10,000 volts
D-C Grid Voltage	-220 volts
Peak A-F Grid-to-Grid Voltage	820 volts
Zero Signal D-C Plate Current	.6 amperes
Max. Signal D-C Plate Current	5.8 amperes
Effective Load Resistance, Plate-to-Plate	3600 ohms
Max. Signal Driving Power, approx.	820 watts
Max. Signal Power Output, approx.	37 kilowatts

Plate-Modulated Radio-Frequency Power Amplifier--Class C Telephony
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

D-C Plate Voltage	14,000 volts
D-C Grid Voltage	-3,000 volts
D-C Plate Current	12 amperes
D-C Grid Current	1.5 amperes
Plate Input	85 kilowatts
Plate Dissipation	20 kilowatts

Typical Operation

D-C Plate Voltage	10,000	14,000 volts
D-C Grid Voltage	-750	-900 volts
Peak R-F Grid Voltage	1360	1,500 volts
D-C Plate Current	6.6	5.7 amperes
D-C Grid Current	.9	.9 amperes
Driving Power, approximate	1.2	1.3 kilowatts
Power Output, approximate	50	50 kilowatts

Radio-Frequency Power Amplifier and Oscillator--Class C Telegraphy
(Key down conditions per tube without amplitude modulation) Note 4

Maximum Ratings, Absolute Values

D-C Plate Voltage, Note 5	17,500 volts
D-C Grid Voltage	-3,000 volts
D-C Plate Current	15 amperes
D-C Grid Current	1.5 amperes
Plate Input	125 kilowatts
Plate Dissipation	25 kilowatts

Typical Operation

D-C Plate Voltage	10,000 volts
D-C Grid Voltage	-1,000 volts
Peak R-F Grid Voltage	1,675 volts
D-C Plate Current	6.4 amperes
D-C Grid Current, approximate	1.1 amperes
Driving Power, approximate	1.7 kilowatts
Power Output, approximate	50 kilowatts

Ratings versus Frequency

Maximum ratings apply up to 22 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	22	30	40 megacycles
Percentage of Maximum Rated Plate Voltage & Plate Input	100	80	50 per cent

For tube characteristic curves, refer to F-5918A catalog sheet.

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INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

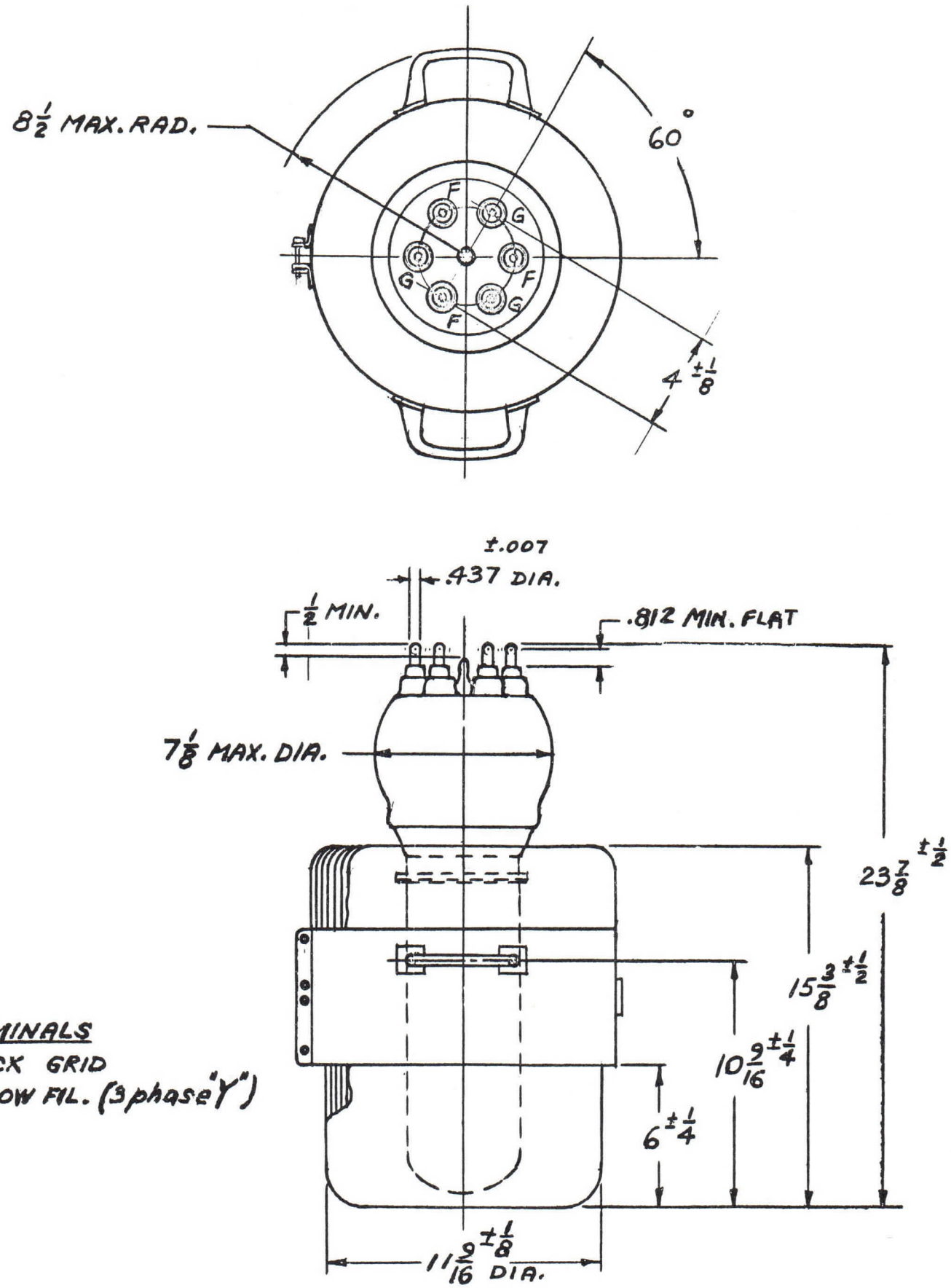
Note 1: Represents maximum usable cathode current (plate current plus grid current) for any condition of operation.

Note 2: Operation at frequencies above 2 mc may require air flow onto the dish center in order to hold the temperature of the seals and dish below 180°C. This flow may be obtained by deflection of the anode cooling air or by means of a separate blower.

Note 3: Averaged over any audio frequency cycle of sine-wave form.

Note 4: Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of carrier conditions.

Note 5: The tube may be operated up to 19,000 d-c plate voltage at frequencies of 2 mc or less.



TERMINALS
BLACK GRID
YELLOW FIL. (3 phase "Y")

403

FEDERAL TYPE-F-6804

engineering TUBE DATA

F-6920
PULSE
TRIODE

ITT Components Division

out of date

DESCRIPTION

The F-6920 is a three electrode tube designed for pulse applications as a hard tube modulator. The anode is capable of dissipating 10 kilowatts exclusive of filament power. Cooling is accomplished by forced air. The cathode is a thoriated tungsten filament.

ELECTRICAL

Filament Voltage	11 volts
Filament Current	285 amperes
Filament Starting Current	1000 amperes
Amplification Factor	
I_b = 2 amperes; E_c = -50 volts	41
Plate Cut-Off	
E_p = 30 kilovolts; E_g = -1 kilovolt	.1 max. ma
Direct Inter-electrode Capacitances	
Grid-Plate	34 μμf
Grid-Filament	75 μμf
Plate-Filament	2.6 μμf

MECHANICAL

Mounting Position			Vertical, Anode Down	
Type of Cooling			Forced Air	
Maximum Incoming Air Temperature			50°C	
Required Air Flow on Anode				
Plate Dissipation+	10	8	5	kilowatts
Air Flow	800	700	500	cfm
Static Pressure	2.75	2	1	inches of water
Maximum Glass Temperature			180°C	
Net Weight, approximate			60 pounds	

+This does not include filament excitation power.

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P. O. BOX 412, CLIFTON, NEW JERSEY

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum Ratings, Absolute Values

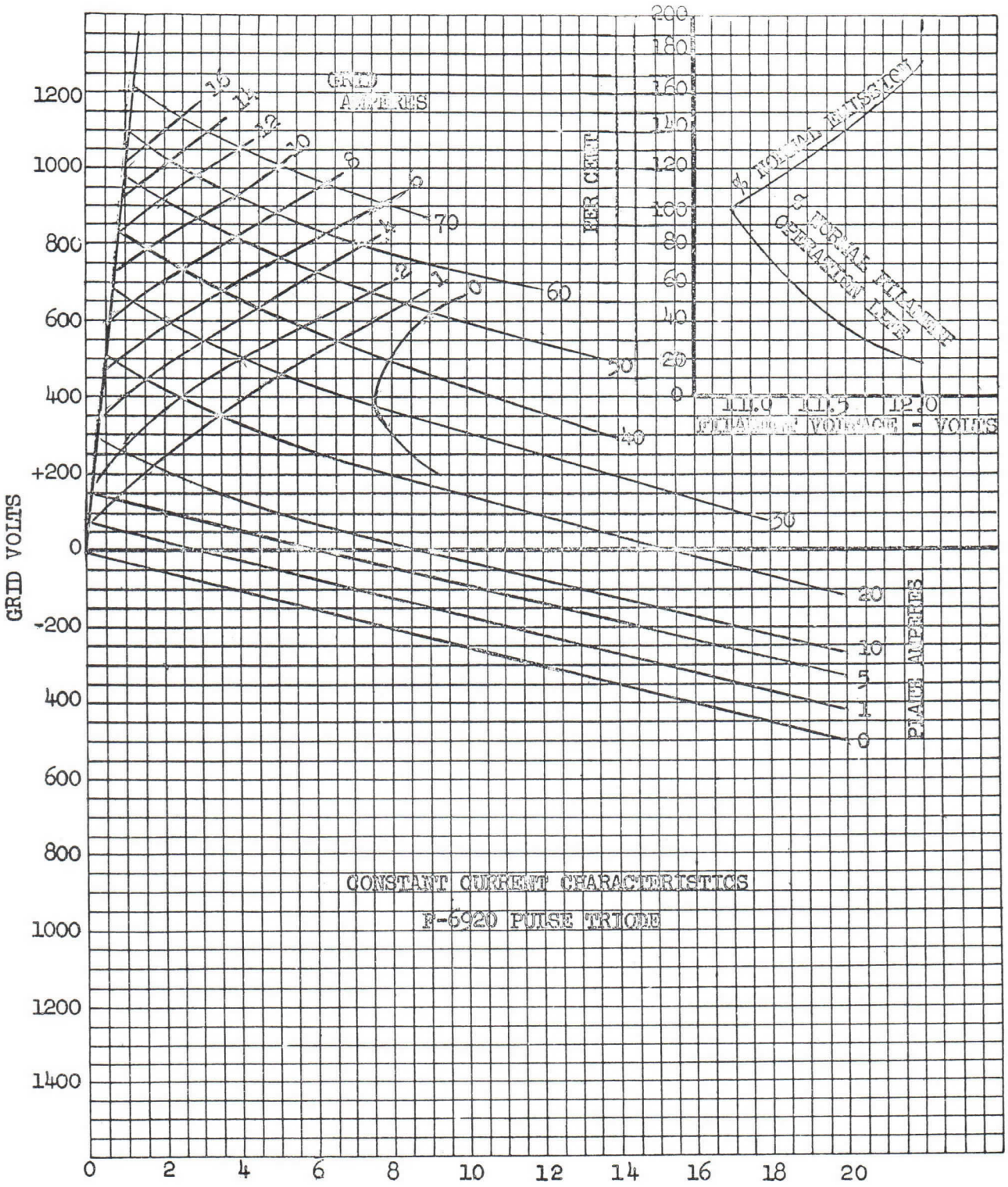
D-C Plate Voltage	35	35* max.	kilovolts
Peak Positive Plate Voltage (Instantaneous)	40	40* max.	kilovolts
D-C Grid Voltage	-2.0	-2.0* max.	kilovolts
Peak Positive Grid Voltage	5	5* max.	kilovolts
Pulse Plate Current	100	150* max.	amperes
Pulse Grid Current	65	100* max.	amperes
Plate Dissipation	10	10* max.	kilowatts
Grid Dissipation	2	2* max.	kilowatts
Duty Factor	.002	.002* max.	
Pulse Length	15	15* max.	μseconds
Pulse Cathode Current	140	200* max.	amperes

Typical Operation

D-C Plate Voltage	18	30*	kilovolts
Pulse Plate Current	90	150*	amperes
D-C Grid Voltage	-1.2	-1.0*	kilovolts
Pulse Grid Current	25	50*	amperes
Pulse Positive Grid Voltage	2.8	4*	kilovolts
Duty Factor	.0008	.001*	
Pulse Length	1	.25*	μseconds
Plate Output Voltage	16.5	27.5*	kilovolts

*These ratings apply only under elevated filament temperatures as specified as follows:

	Min.	Bogey	Max.	
Filament Voltage	11.5	11.9	12.3	volts
Filament Emission E_f = 11.6 v. $E_p = E_g$ = 3 kv.	170			amperes



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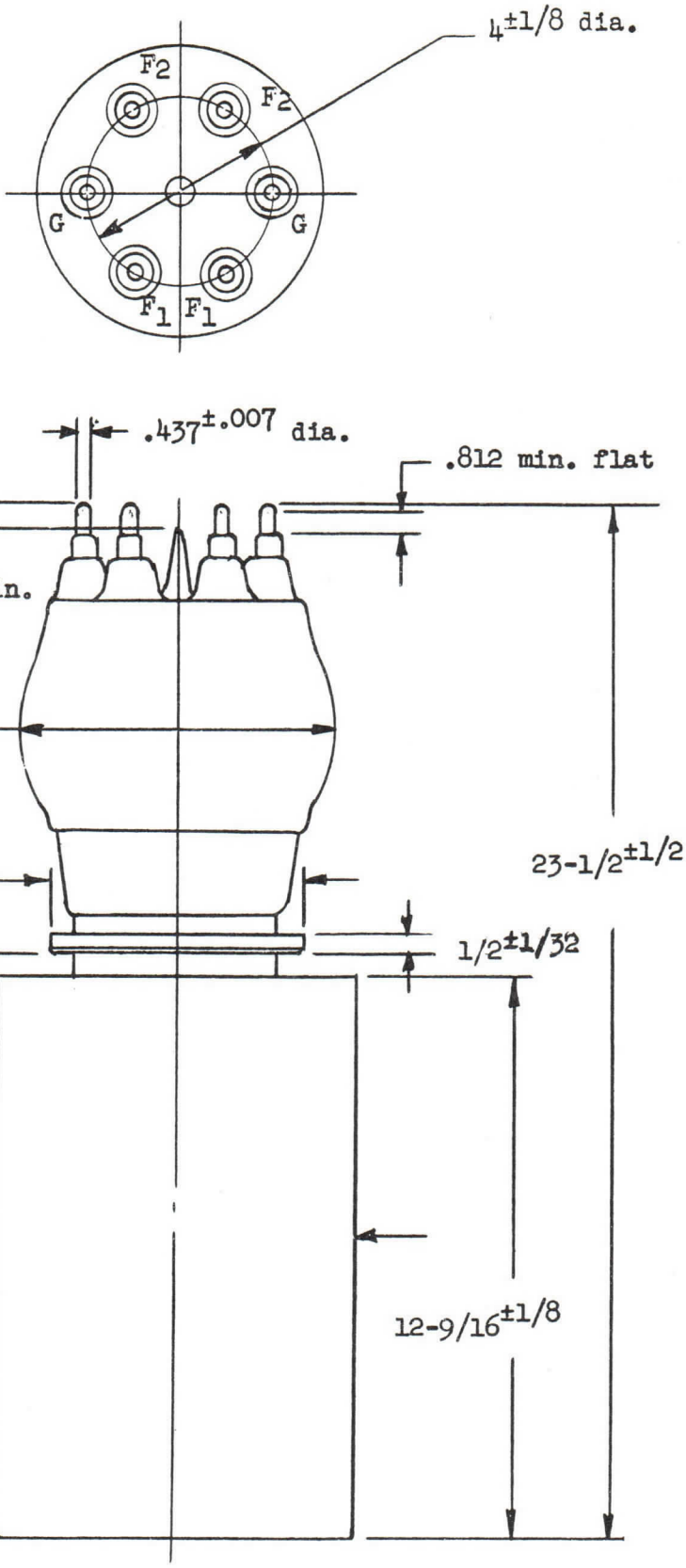
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

TERMINALS

BLACK - GRID
YELLOW- FIL. 1
RED - FIL. 2



OUTLINE

F-6920 PULSE TRIODE

engineering TUBE DATA

F-6921
POWER
TRIODE

ITT Components Division

DESCRIPTION

The F-6921 is a three-electrode tube designed for use as a modulator. The anode is capable of dissipating 30 kw during Continuous Commercial Service. Cooling is accomplished by circulating water. The cathode is a thoriated tungsten filament. Maximum ratings apply for audio frequency use only.

ELECTRICAL

Filament Voltage	5 volts
Filament Current	260 amperes
Amplification Factor	4.25
Inter-electrode Capacitance	
Grid-Plate	53 μμf
Grid-Filament	48 μμf
Plate-Filament	7.5 μμf

MECHANICAL

Mounting Position	Vertical, Anode Down
Type of Cooling	Water
Water Flow, minimum	30 gpm
Maximum Glass Temperature	180°C
Weight, approximate	12 lbs.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier and Modulator--Class AB_1

Maximum Ratings, Absolute Values

D-C Plate Voltage	15 max. kv
Maximum Signal D-C Plate Current*	10 amperes
Maximum Signal Plate Input*	60 kw
Plate Dissipation*	30 kw

*Averaged over any audio frequency cycle of sine-wave form.

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INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

F-6921
POWER
TRIODE

Typical Operation
(Unless otherwise specified, values are for two tubes)

D-C Plate Voltage	10,000 volts
D-C Grid Voltage	-2,400 volts
Peak A-F Grid-to-Grid Voltage	4,680 volts
Zero Signal D-C Plate Current	2.0 amperes
Maximum Signal D-C Plate Current	9.5 amperes
Effective Load, Resistance Plate-to-Plate	1870 ohms
Maximum Signal Driving Power	0 watts
Maximum Signal Power Output	52.5 kw

Random Noise Drive Conditions

D-C Plate Voltage	12,500 volts
D-C Grid Voltage	-3,200 volts
Peak A-F Grid-to-Grid Voltage	6,100 volts
Zero Signal D-C Plate Current	1.5 amperes
Maximum Signal D-C Plate Current	4.5 amperes
Effective Load Resistance Plate-to-Plate	7400 ohms
Maximum Signal Driving Power	0 watts
Output Crest Value	90,000 volt amperes
Duty Factor at Crest Value	.01
Load Power Factor	0 - 100%

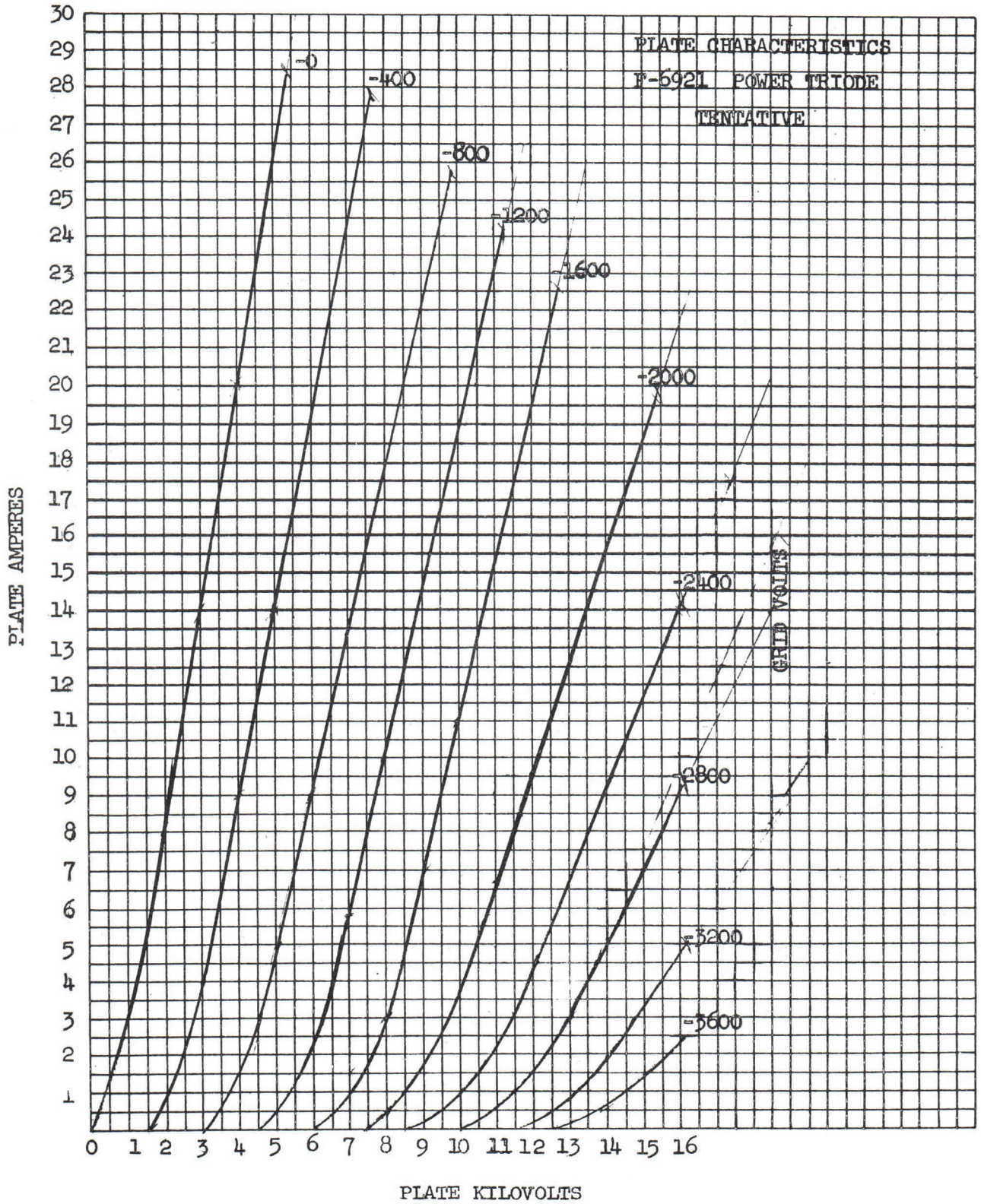
PLATE CHARACTERISTICS
F-5921 POWER TRIODE
TENTATIVE
PLATE AMPERES
PLATE KILOVOLTS
GRID VOLTS
0
-400
-800
-1200
-1600
-2000
-2400
-2800
-3200
-3600
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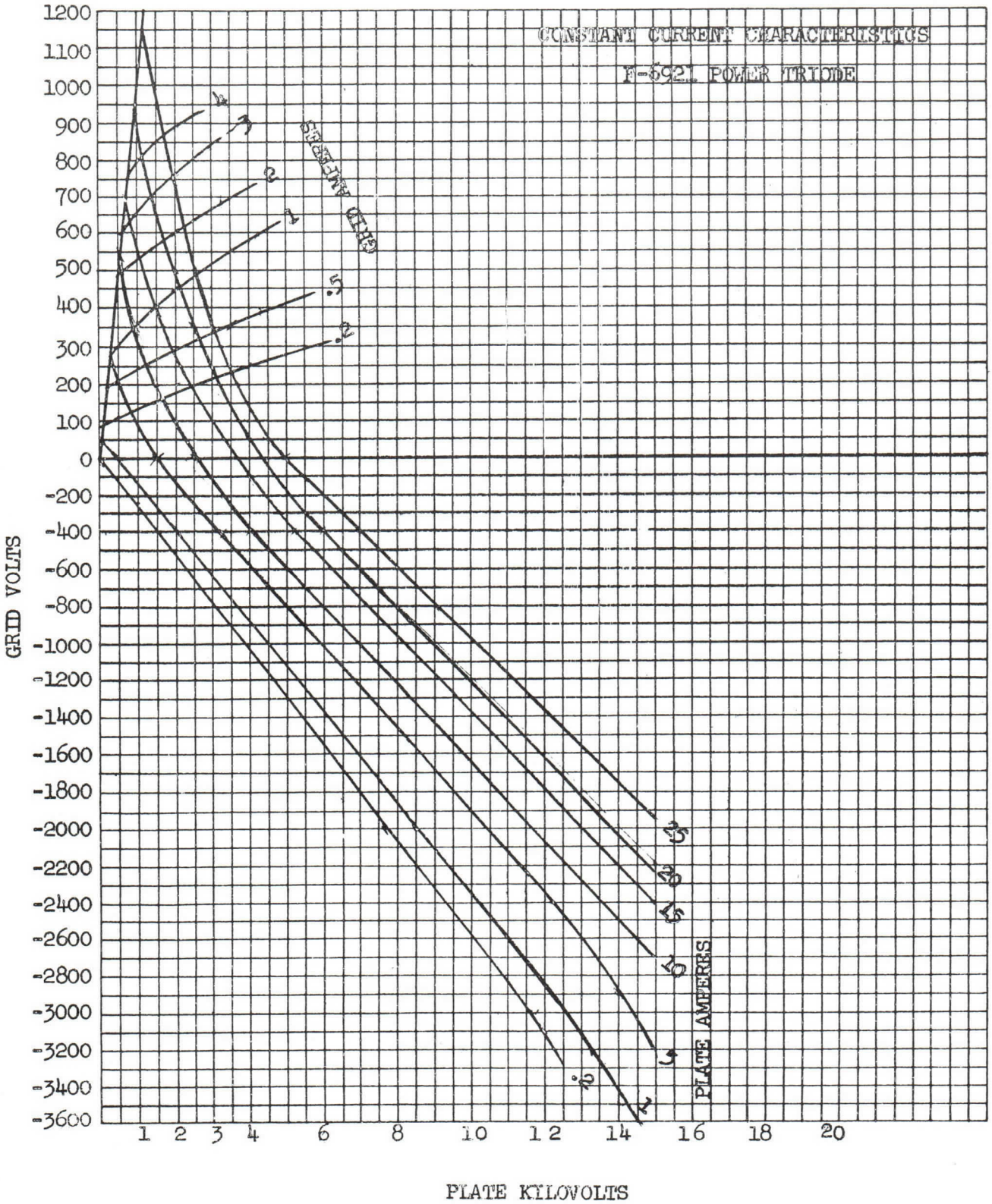
CONSTANT CURRENT CHARACTERISTICS
F-6921 POWER TRIODE
GRID AMPERES
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.2
.5
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2
3
4
PLATE AMPERES
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6
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14
16
18
20
1200
1100
1000
900
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700
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-200
-400
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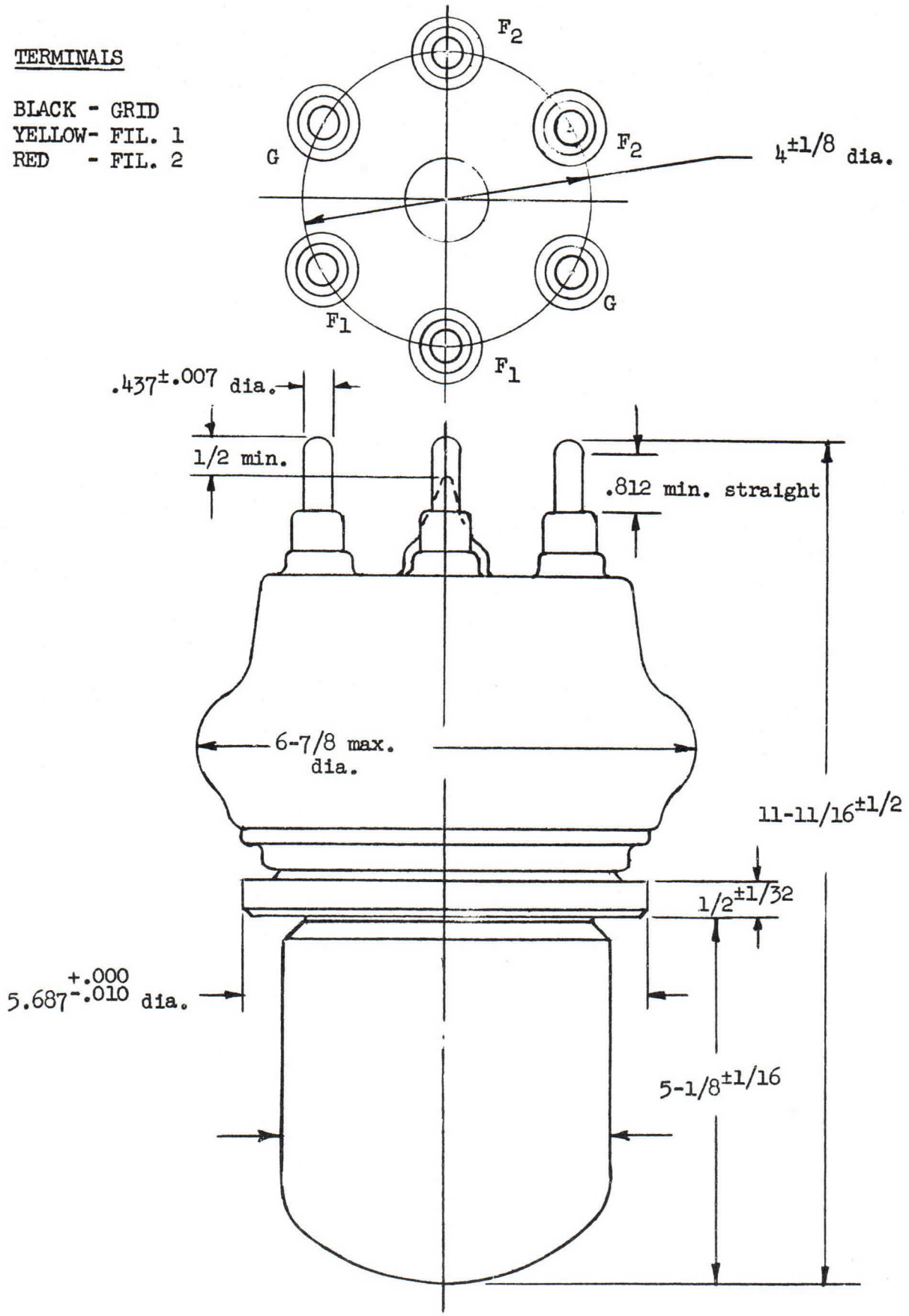
-800
-1000
-1200
-1400
-1600
-1800
-2000
-2200
-2400
-2600
-2800
-3000
-3200
-3400
-3600
GRID VOLTS
PLATE KILOVOLTS

TERMINALS

BLACK - GRID
YELLOW- FIL. 1
RED - FIL. 2



OUTLINE

F-6921 POWER TRIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

engineering TUBE DATA

F-6925
POWER TRIODE

ITT Components Division

out of date

DESCRIPTION

The F-6925 is a triode designed for use as a modulator, r-f amplifier, and oscillator. The anode is of heavy wall construction and is forced air cooled, capable of dissipating 3 kilowatts during Continuous Commercial Service.

ELECTRICAL

Filament Voltage	13 volts
Filament Current	36 amperes
Amplification Factor	17
Direct Inter-electrode Capacitance	
Grid-Plate	21 μμf
Grid-Filament	18 μμf
Plate-Filament	1.9 μμf

MECHANICAL

Mounting Position		Vertical, Anode up or down	
Type of Cooling		Forced Air	
Anode Air Flow Required			
Plate Dissipation - kw	3.0	2.4	1.8
Air Flow - cfm	190	125	75
Pressure - inches of water	1.21	.58	.26
Maximum Incoming Air Temperature			45°C
Maximum Glass Temperature			180°C

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

R-F Power Amplifier and Oscillator - Class C
(Key down conditions per tube without Amplitude Modulation)

Maximum Ratings, Absolute Values

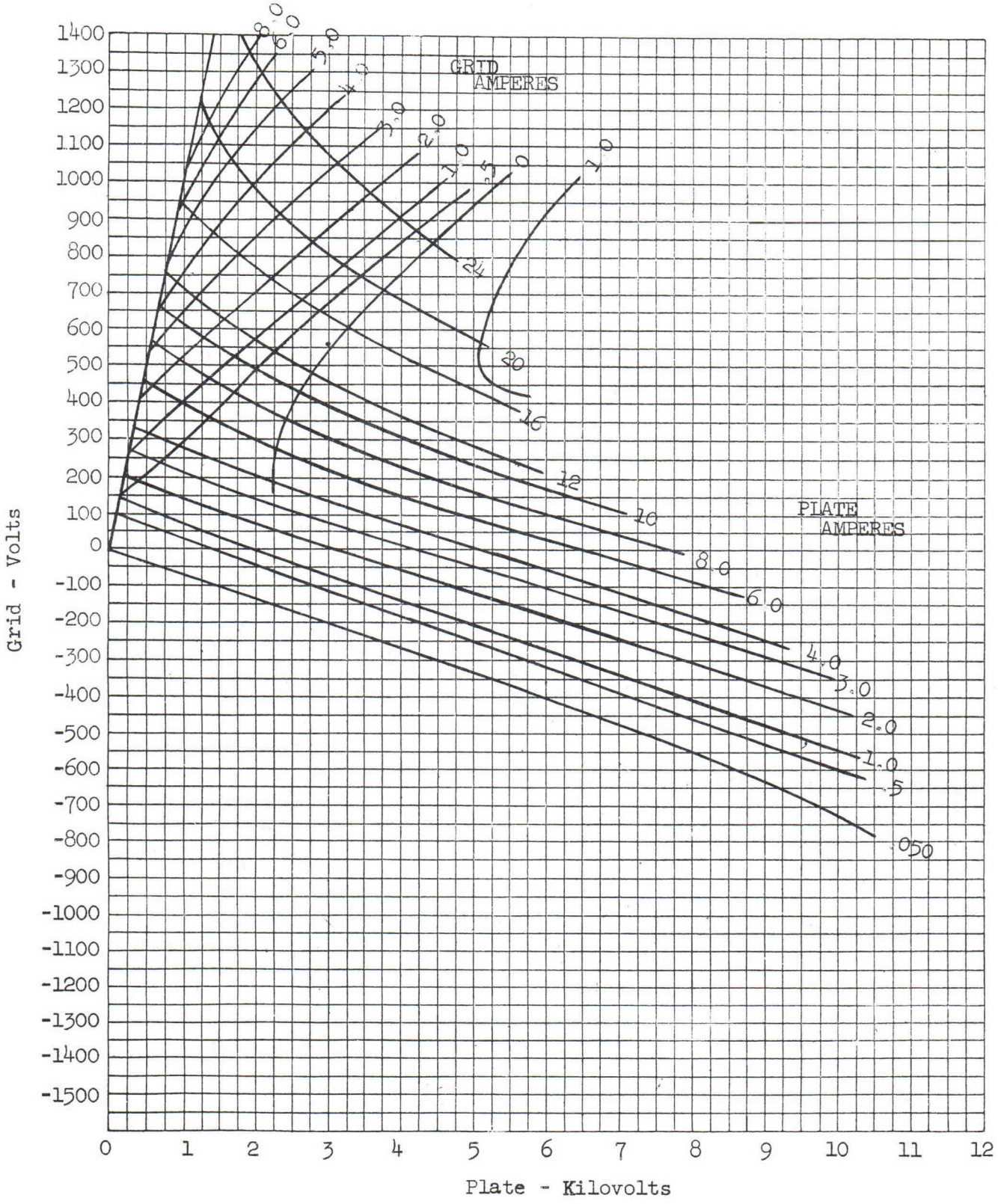
D-C Plate Voltage	6.5 max. kv
D-C Grid Voltage	-1.2 max. kv
D-C Plate Current	2.0 max. amperes
D-C Grid Current	.250 max. amperes
Plate Input	12 max. kw
Plate Dissipation	3 max. kw

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

Typical Operation

D-C Plate Voltage	2500	4000	6000	volts
D-C Grid Voltage	-600	-800	-1000	volts
Peak R-F Grid Voltage	1050	1300	1500	volts
Peak R-F Plate Voltage	1800	3000	5000	volts
D-C Plate Current	1.27	1.6	1.6	amperes
D-C Grid Current	.233	.230	.210	amperes
Driving Power, approx.	245	300	315	watts
Power Output, approx.	2.15	4.4	7.25	kw

This tube type is also available with 1/2" wide flexible copper leads, 6" long, attached two to a terminal.

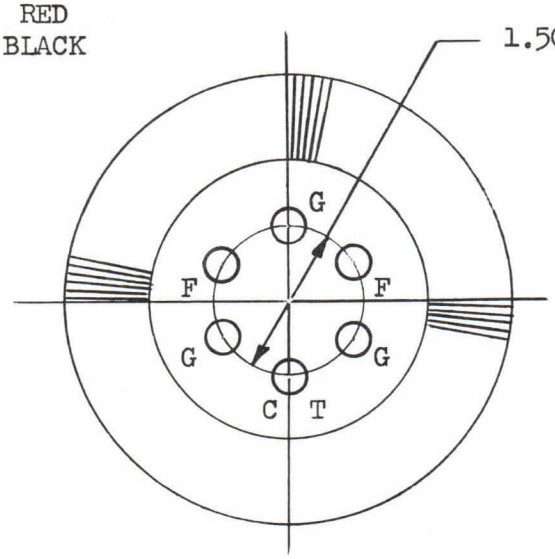


CONSTANT CURRENT CHARACTERISTICS

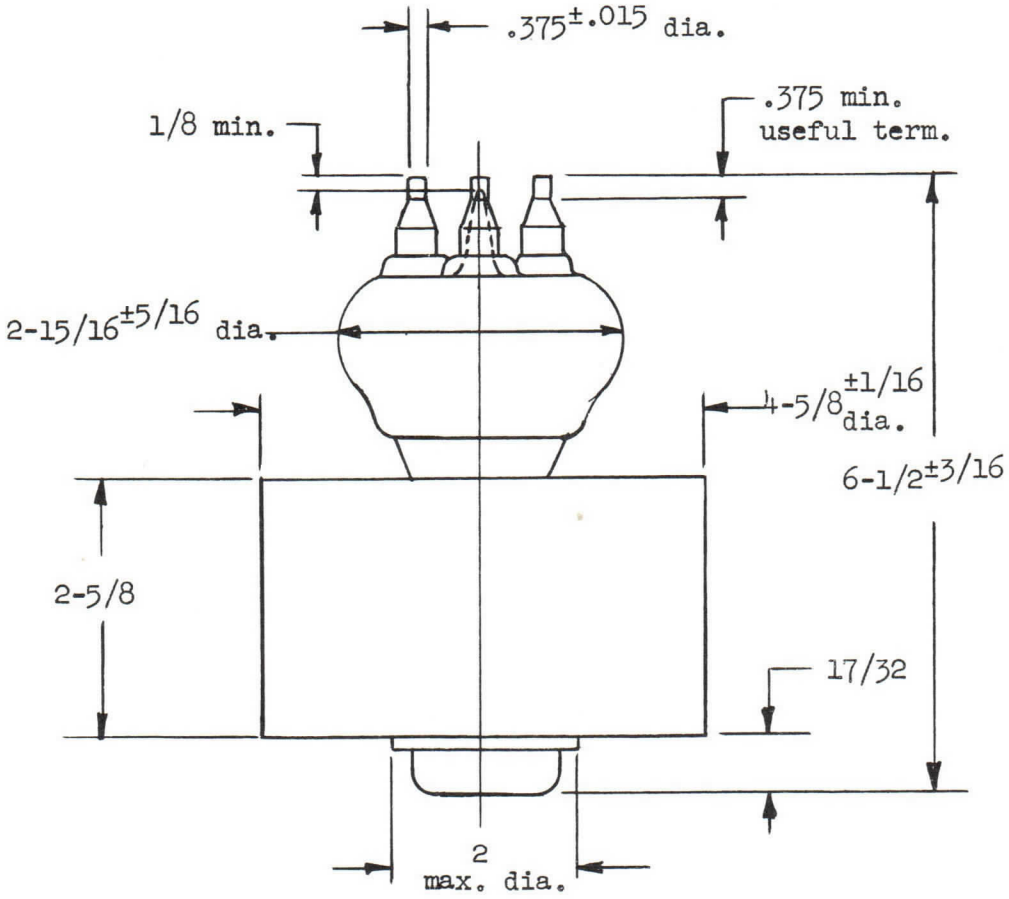
TYPES F-6925, F-6926 & F-6926J POWER TRIODES

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

FIL. TERM. --- YELLOW
FIL. TERM. CENT. --- RED
GRID TERM. --- BLACK



NOTE: 1/2" flexible copper lead 6" long available on each terminal upon request.



OUTLINE

TYPE F-6925 POWER TRIODE

F-6926 & F-6926-J
POWER TRIODES

ITT Components Division

DESCRIPTION

The F-6926 and F-6926-J are triodes designed for use as modulators, r-f amplifiers, and oscillators. The anodes are of heavy wall construction and are water cooled. 6 kilowatts of power may be dissipated during Continuous Commercial Service. F-6926-J is provided with an integral water jacket attached to the tube.

ELECTRICAL

Filament Voltage	13 volts
Filament Current	36 amperes
Amplification Factor	17
Direct Inter-electrode Capacitance	
Grid-Plate	20.5 μμf
Grid-Filament	18 μμf
Plate-Filament	1.9 μμf

MECHANICAL

Mounting Position	Vertical, anode down
Type of Cooling	Circulating Water
Anode Water Flow required	3.5 gpm
Water Pressure, max.	80 psi
Outlet Water Temperature, max.	70°C
Maximum Glass Temperature	180° C

MAXIMUM RATING AND TYPICAL OPERATING CONDITIONS

R-F Power Amplifier and Oscillator - Class C
(Key down conditions per tube without Amplitude Modulation)

Maximum Ratings, Absolute Values

D-C Plate Voltage	6.5 max. kv
D-C Grid Voltage	-1.2 max. kv
D-C Plate Current	2.0 max. amperes
D-C Grid Current	.250 max.amperes
Plate Input	12 max. kw
Plate Dissipation	6 max. kw

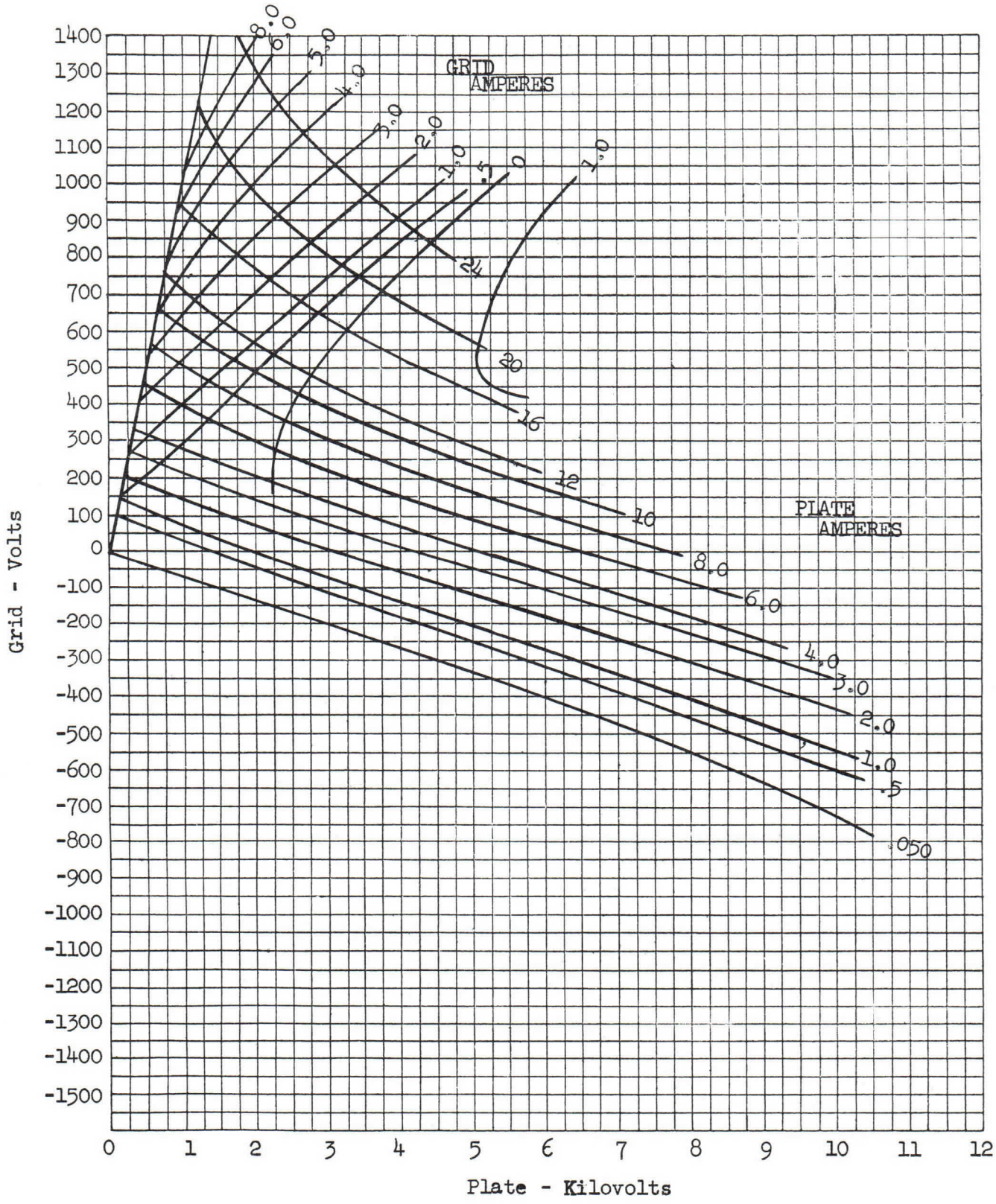
ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

F-6926
&
F-6926-J
POWER TRIODES

Typical Operation

D-C Plate Voltage	2500	4000	6000	volts
D-C Grid Voltage	-600	-800	-1000	volts
Peak R-F Grid Voltage	1050	1300	1500	volts
Peak R-F Plate Voltage	1800	3000	5000	volts
D-C Plate Current	1.27	1.6	1.6	amperes
D-C Grid Current	.233	.230	.210	amperes
Driving Power, approximate	245	300	315	watts
Power Output, approximate	2.15	4.4	7.25	kilowatts

These tube types are also available with 1/2 inch wide flexible copper leads, 6 inches long, attached two to a terminal.

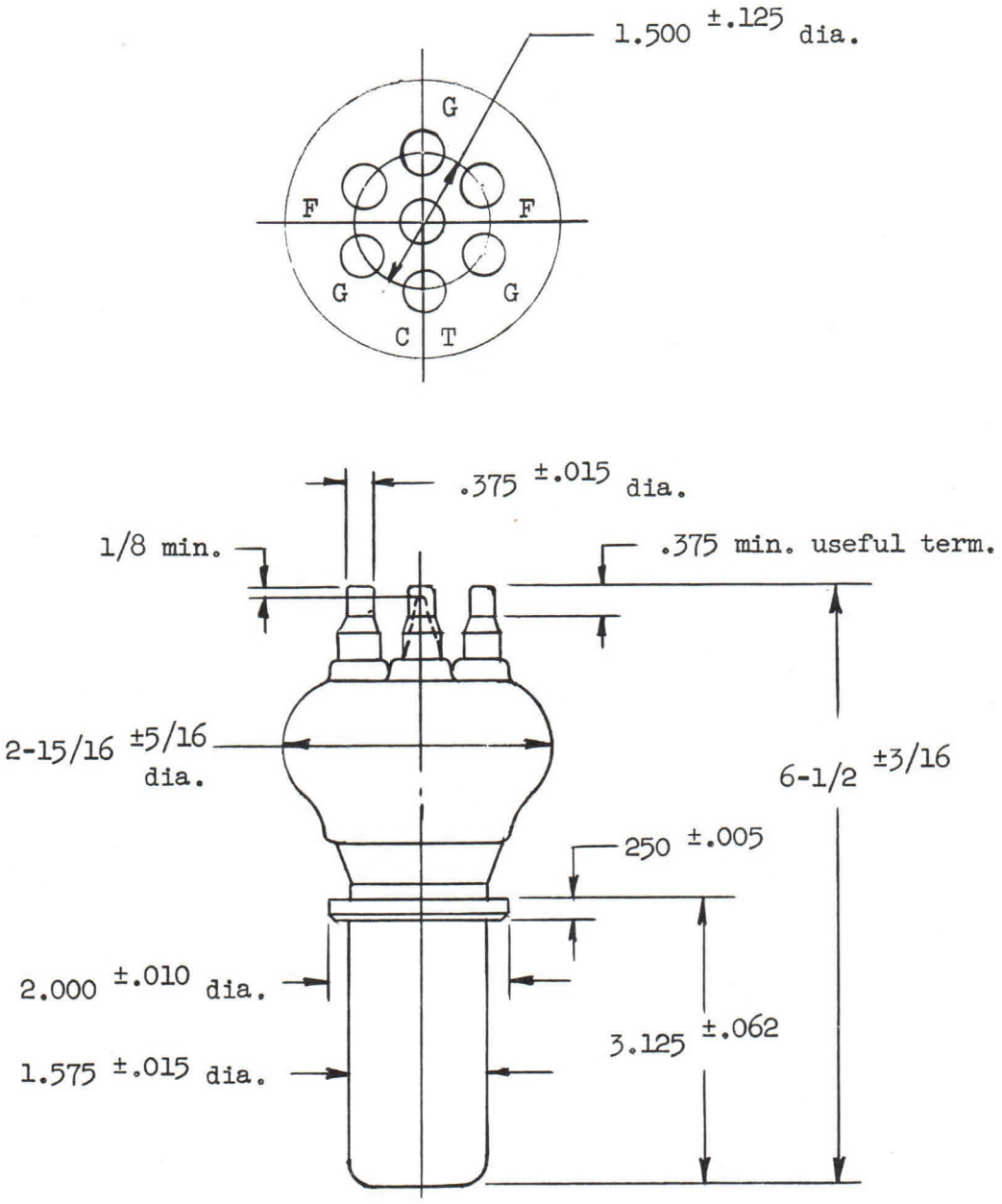


CONSTANT CURRENT CHARACTERISTICS

TYPES F-6925, F-6926 & F-6926J POWER TRIODES

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

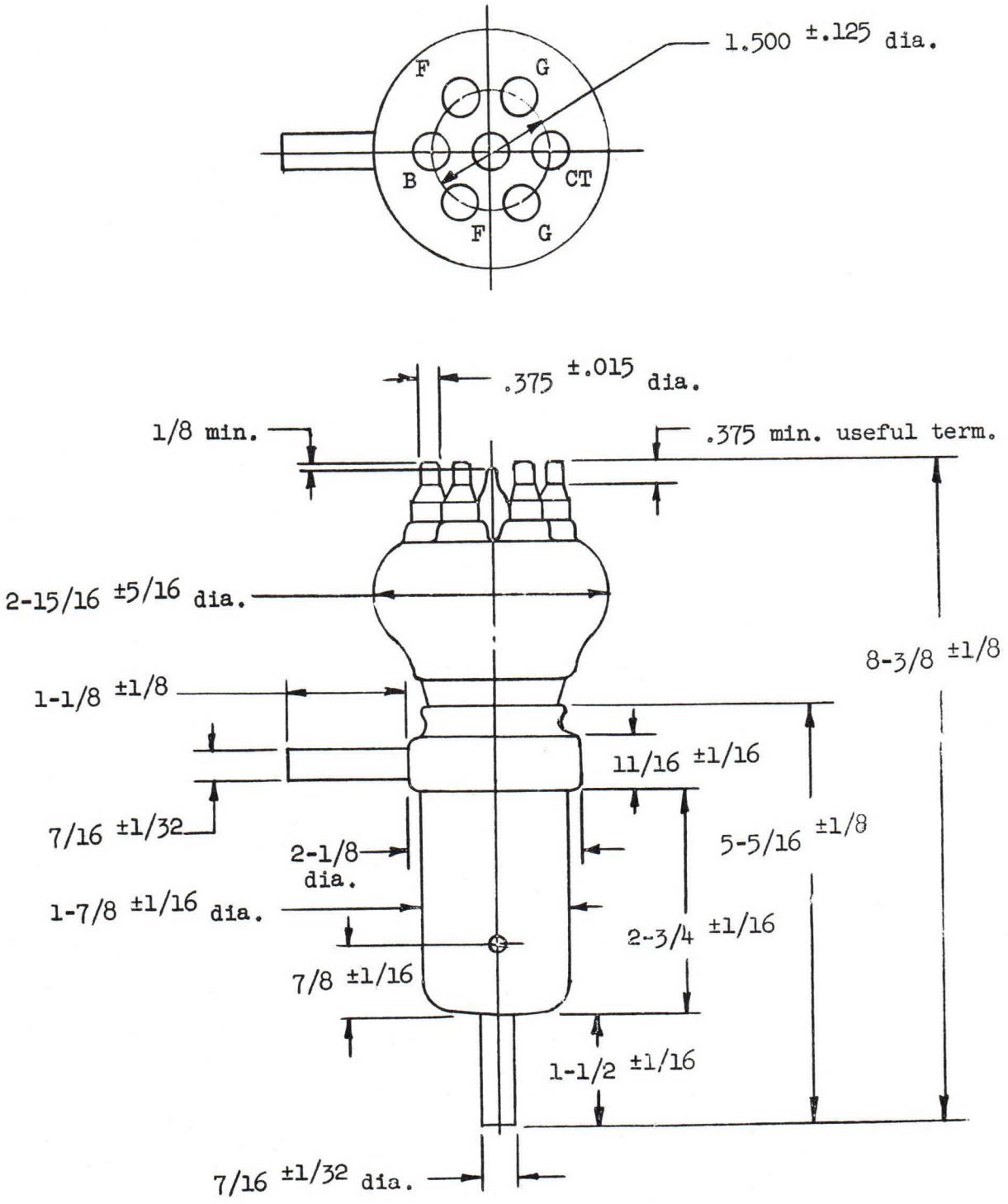
FIL. TERM. - YELLOW
FIL. CENT. TERM. - RED
GRID TERM. - BLACK



NOTE: 1/2" flexible copper lead 6" long available on each terminal upon request.

OUTLINE
F-6926 POWER TRIODE

FIL. TERM. - YELLOW
FIL. CENT. TERM. - RED
GRID TERM. - BLACK



NOTE: 1/2" flexible copper lead 6" long available on each terminal upon request.

OUTLINE
F-6926-J POWER TRIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

engineering TUBE DATA

F-7012
POWER
TRIODE

ITT Components Division

Out of date

DESCRIPTION

The F-7012 is a triode designed for use in high voltage pulse operation. The anode is forced air cooled, capable of dissipating 2.5 kilowatts during Continuous Commercial Service.

ELECTRICAL

Filament Voltage	15 volts
Filament Current	36 amperes
Filament Starting	72 amperes
Amplification Factor	
E_c = -200 v., I_b = .2 amps	25
Direct Inter-electrode Capacitance	
Grid-Plate	14.2 μμf
Grid-Filament	16.3 μμf
Plate-Filament	1.9 μμf

MECHANICAL

Mounting Position			Vertical, Anode Down	
Type of Cooling			Forced Air	
Anode Air Flow Required				
Plate Dissipation - kilowatts	2.5	2.0	1.5	
Air Flow - cfm	150	120	90	
Pressure - inches of water	2.5	1.6	.9	
Maximum Incoming Air Temperature			45°	C.
Maximum Glass Temperature			180°	C.
Net Weight Approximate			5-1/2	pounds

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

R-F Power Amplifier and Oscillator - Pulsed Operation

Maximum Ratings, Absolute Values

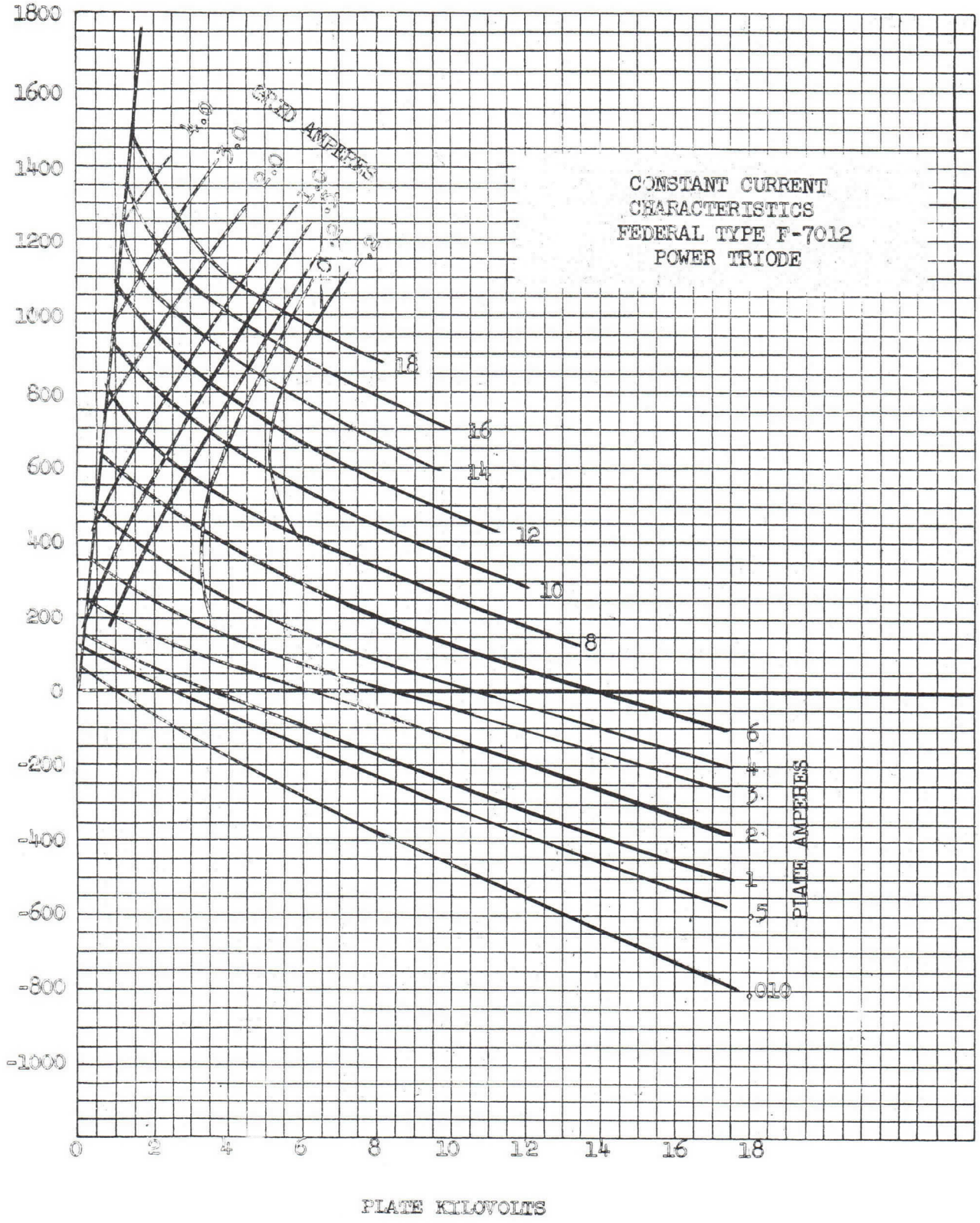
D-C Plate Voltage	17.5 kilovolts, max.
D-C Grid Voltage	-5.0 kilovolts, max.
Peak Cathode Current	40 amperes, max.
Duty Cycle	.030 maximum
Plate Dissipation‡	1.2 kilowatts

‡ Air Flow - 75 cfm

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

Typical Operation

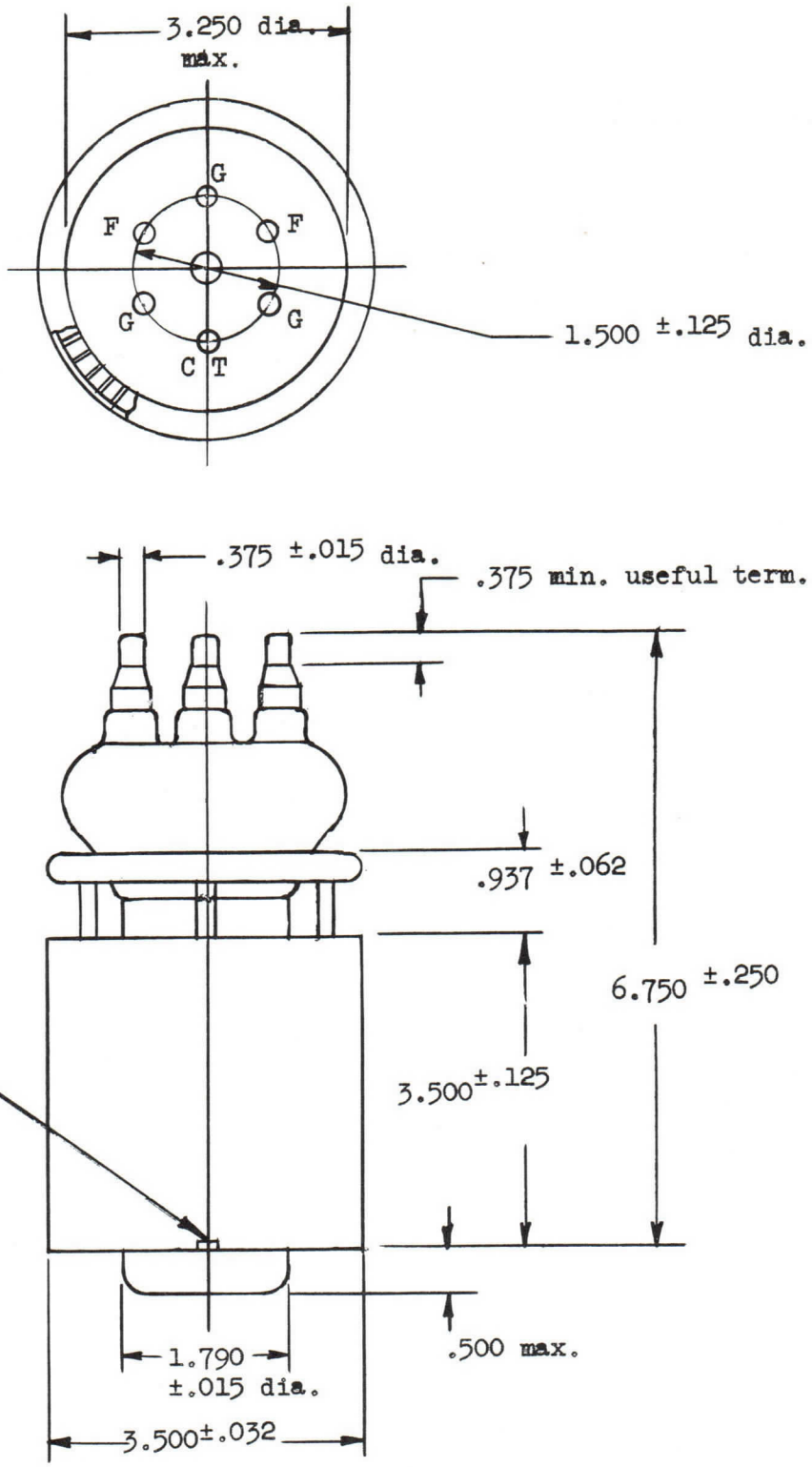
D-C Plate Voltage	15,500 volts
D-C Grid Voltage (during pulse)	-750 volts
D-C Plate Current	0.20 amperes
D-C Grid Current	.013 amperes
Duty Cycle	.023
Power Output, approximate	90 kilowatts



ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

COLOR CODE

Fil. Term. -- Yellow
Fil. C. Term. - Red
Grid ------- Black



OUTLINE
F-7012 POWER TRIODE

engineering TUBE DATA

F-7030
HIGH VACUUM
POWER DIODE

ITT Components Division

Tentative Specification

Out of date

DESCRIPTION

The F-7030 is a diode designed for rectifier service or in special applications in shunting or charging circuits. The exceptionally rugged construction, free of internal insulators, spring tensioning devices, and fragile elements, makes this type adaptable to a wide range of uses. The anode is forced air cooled and is capable of dissipating 2.5 kilowatts. The cathode is a thoriated tungsten bifilar helix.

ELECTRICAL

Filament Voltage	13 volts
Filament Current	36 amperes
Filament Starting Current	
Full rated filament voltage may be safely applied to the cold filament	
Rectifier Ratings	
Maximum Peak Inverse Voltage	25 kilovolts
Maximum Peak Plate Current	30 amperes
Maximum Average Plate Current	6 amperes
Shunt Diode Ratings	
Maximum Peak Inverse Voltage	25 kilovolts
Maximum Peak Plate Current	*75 amperes
Maximum Average Plate Current	*.7

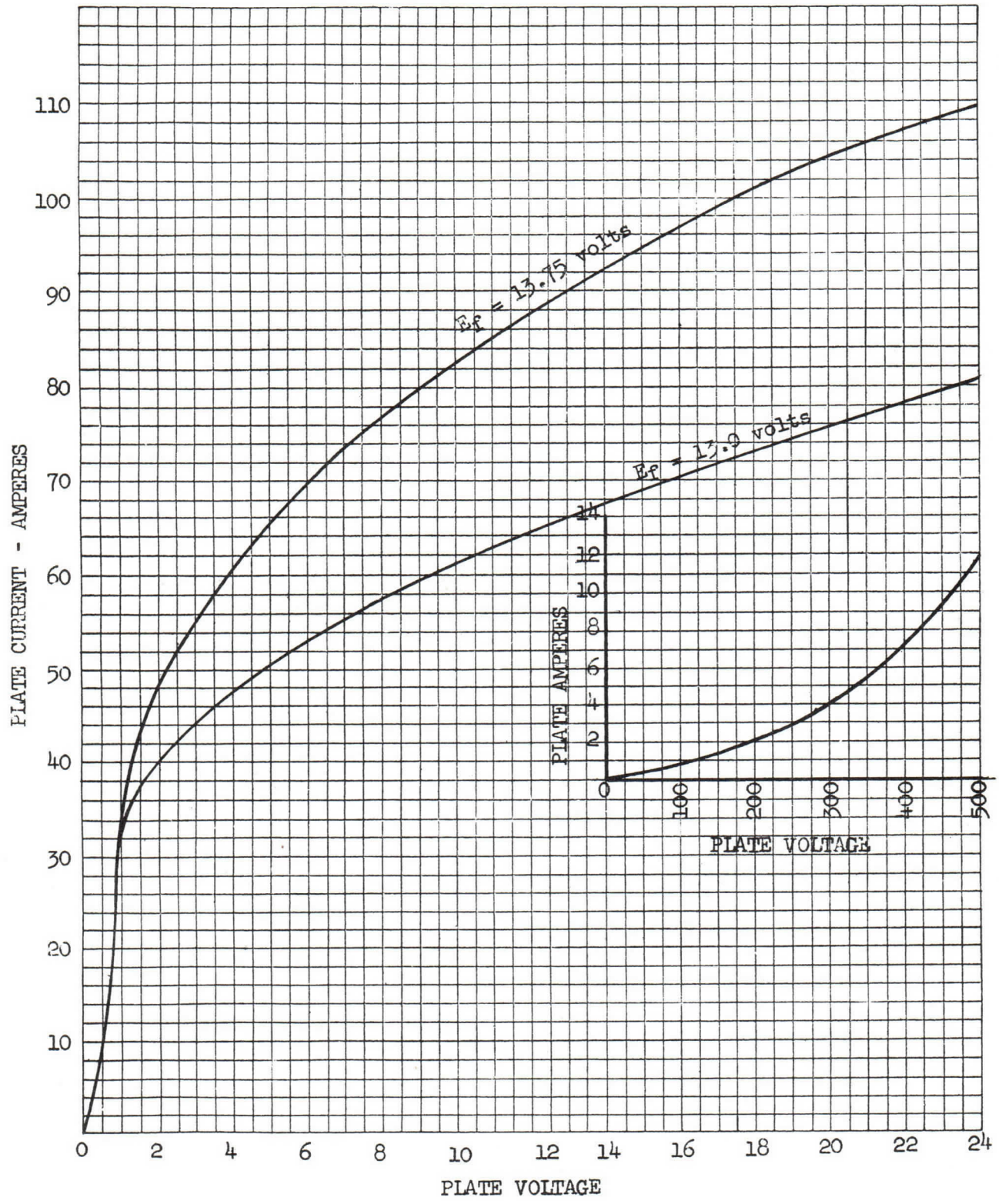
MECHANICAL

Mounting Position	Vertical, Anode up or down					
Type of Cooling	Forced Air					
Anode Air Flow Required						
Plate Dissipation - kilowatts	2.5	2.0	1.5	1.0	0.5	
Air Flow - cfm	150	120	90	65	50	
Pressure - inches of water	2.5	1.6	.9	.65	.5	
Maximum Incoming Air Temperature					45	°C
Maximum Glass Temperature					180	°C

*Maximum peak plate current and maximum average plate current of 75 and .7 amperes respectively are rated under conditions of filament excitation voltage of 13.75 volts.

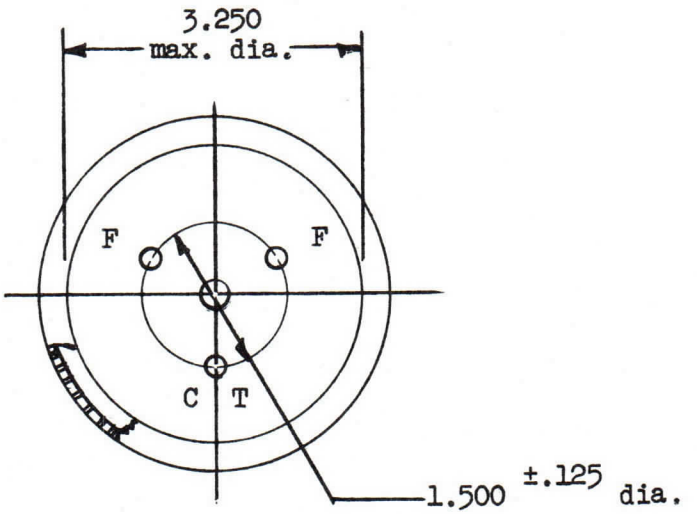
ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

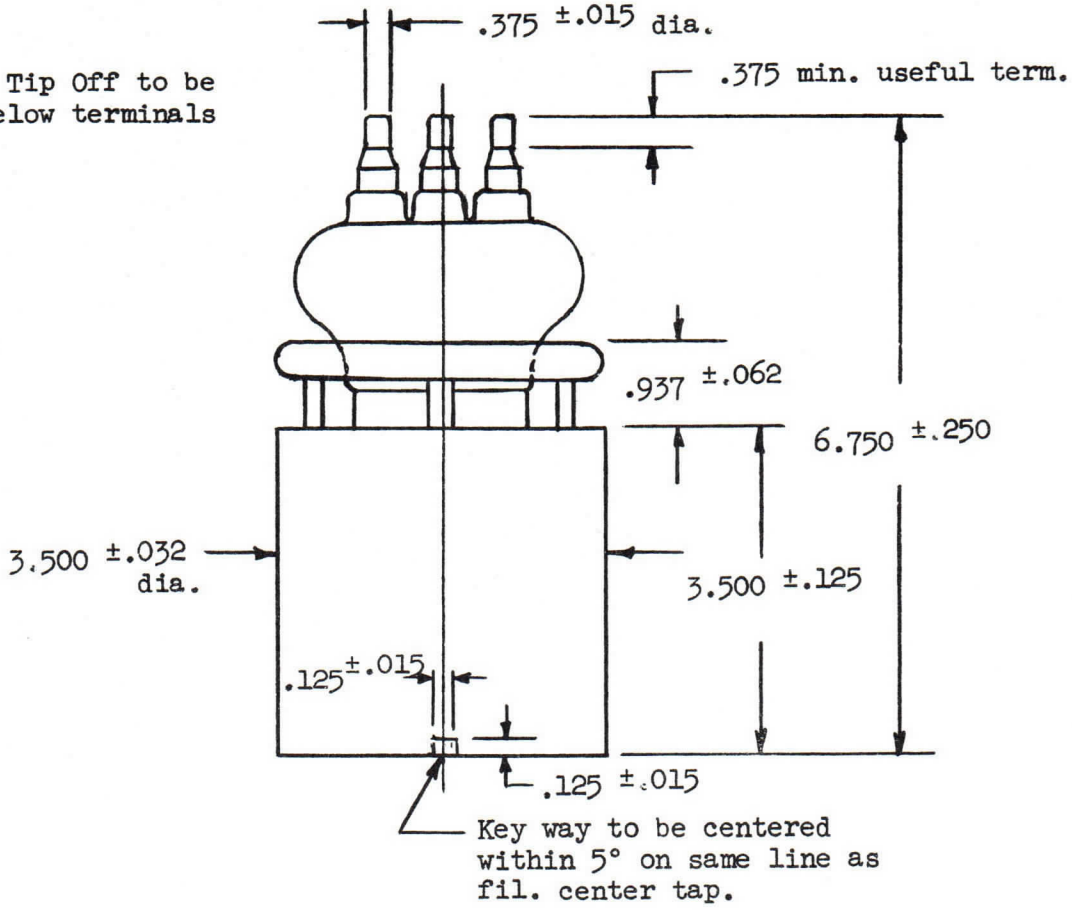
TYPE F-7030 POWER DIODE
PLATE CHARACTERISTICS



COLOR CODE

FIL. TERM. ---- YELLOW
FIL. C. TERM. - RED





OUTLINE
F-7030 POWER DIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

DESCRIPTION

The F-7100 is a diode designed for rectifier service or in special applications in shunting or charging circuits. The exceptionally rugged construction, free of internal insulators, spring tensioning devices, and fragile elements, make this type adaptable to a wide range of uses. The anode is forced air cooled and is capable of dissipating 3.5 kilowatts. The cathode is a thoriated tungsten bifilar helix.

ELECTRICAL

Filament Voltage			15	volts
Filament Current			36	amperes
Filament Starting Current				
Full rated filament voltage may be safely applied to the cold filament				
Maximum Ratings	Shunt	Charging	Rectifier	
Max. Peak Inverse Voltage - kv	30	30	30	
Max. Peak Plate Current - amps	100	7.5 rms	20	
Max. Plate Current - amps	-	-	6	avg.

MECHANICAL

Mounting Position			Vertical, anode up or down	
Type of Cooling			Forced Air	
Anode Air Flow Required				
Plate Dissipation - kw	3.5	2.8	2.4	
Air Flow - cfm	190	125	75	
Pressure - inches of water	1.6	.78	.35	
Max. Incoming Air Temperature			45	°C
Max. Glass & Seal Temperature			180	°C
Net Weight, approximate			7	lbs.

Additional information for specific applications can be obtained from:

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

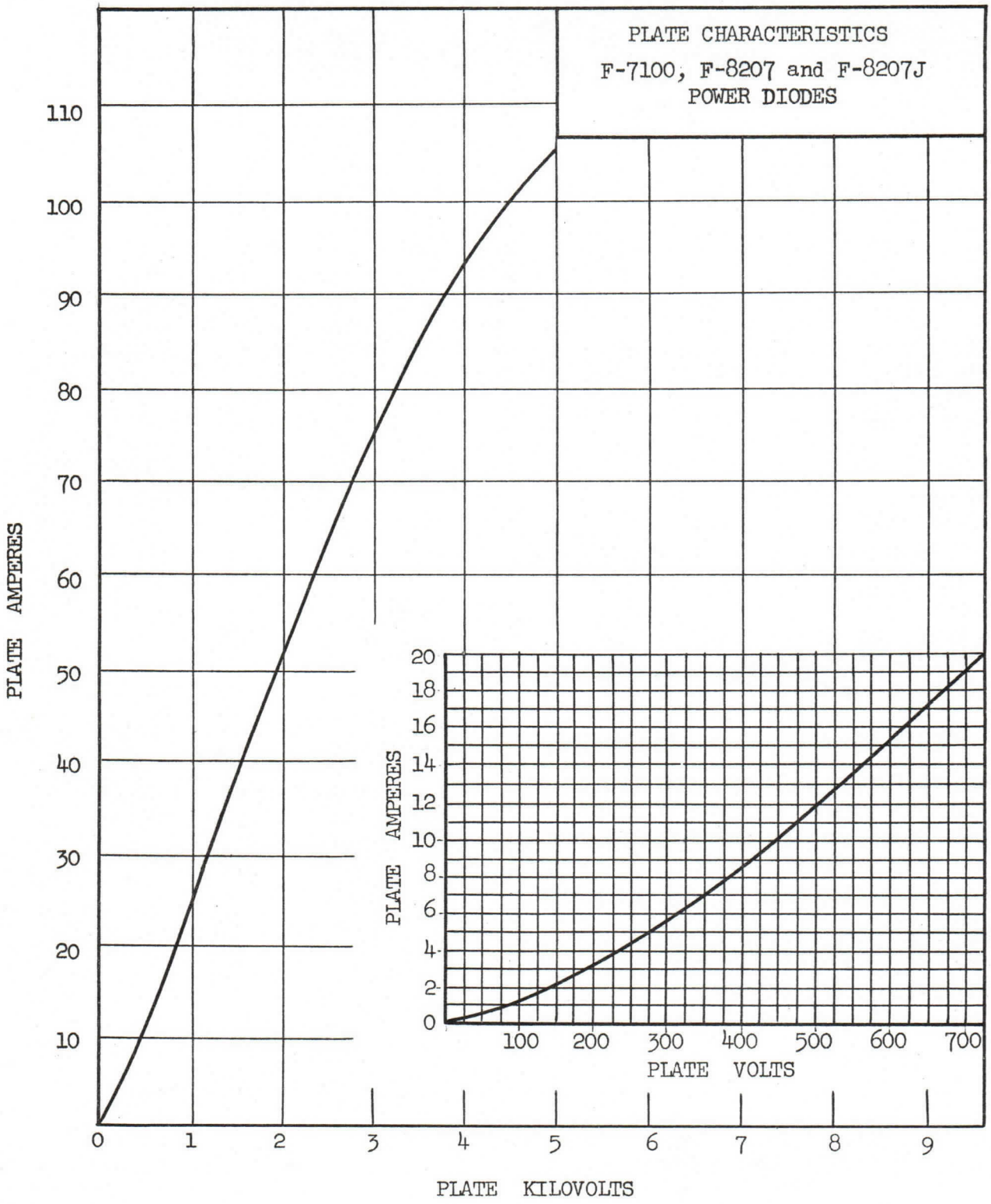
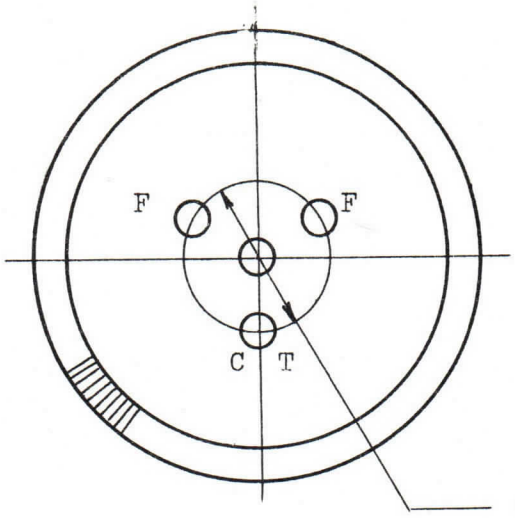


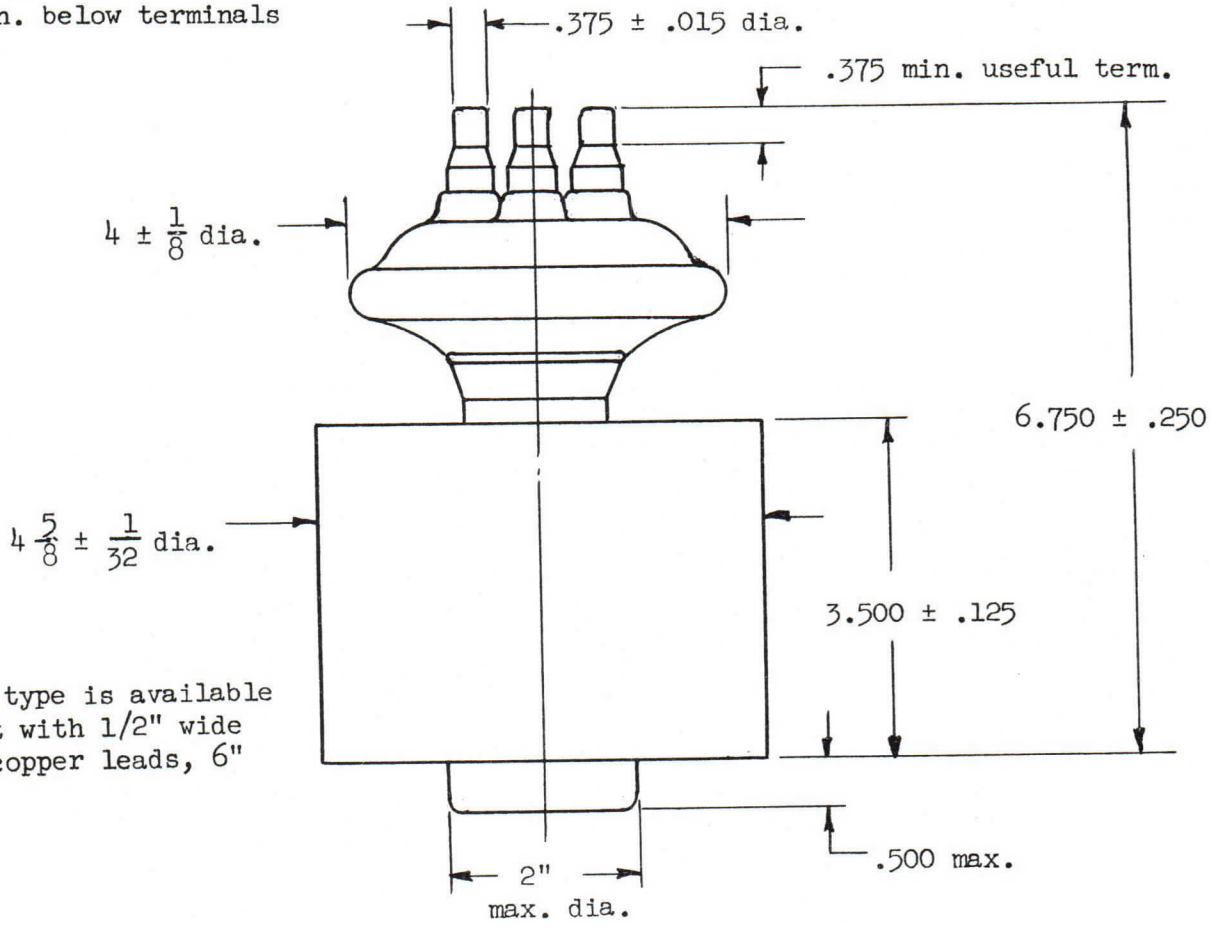
PLATE CHARACTERISTICS
F-7100, F-8207 and F-8207J
POWER DIODES
PLATE AMPERES
110
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
PLATE KILOVOLTS
PLATE AMPERES
20
18
16
14
12
10
8
6
4
2
0
100
200
300
400
500
600
700
PLATE VOLTS

Color Code

Fil. Terminal - Yellow
Fil. C. Term. - Red



Tubulation tip-off to be 1/8" min. below terminals



This tube type is available on request with 1/2" wide flexible copper leads, 6" long.

ACCESSORIES
Air Jacket - RT-54887 Type II

OUTLINE

F-7100 POWER DIODE

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

engineering TUBE DATA

F-7206
POWER TRIODE

ITT Components Division

out of date

TENTATIVE SPECIFICATION

DESCRIPTION

The F-7206 is a three-electrode tube designed for use as an industrial oscillator. The anode is capable of dissipating 20 kilowatts during Continuous Commercial Service. Cooling is accomplished by circulating water on the anode and forced air on the bulb and seals. The cathode is a thoriated tungsten filament of mesh cathode construction and may be operated on d-c or single phase a-c.

ELECTRICAL

Filament Voltage	7.5 volts
Filament Current	220 amperes
Filament Starting Current Full rated filament voltage may be safely applied to the cold filament	
Filament Heating Time, minimum	5 seconds
Amplification Factor E_c = 150 v. I_b = 4.0 amps	18
Peak Cathode Current (Note 1)	45 amperes
Direct Inter-electrode Capacitances	
Grid-Plate	55 μμf
Grid-Filament	42 μμf
Plate-Filament	3.0 μμf

Note 1: Represents maximum usable cathode current (plate current plus grid current) for any CW condition of operation.

MECHANICAL

Type of Cooling				Water and Forced Air
Water flow on Anode				
Plate Dissipation	8	12	16	20 kilowatts
Minimum Water Flow	2.6	3.3	4.6	7.2 gpm
Maximum Outgoing Water Temperature				70 °C
Air Flow (to bulb and seals) from a 3-inch diameter nozzle				50 cfm
Weight, approximate				6 lbs

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INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Radio-Frequency Power Amplifier and Oscillator--Class C Telegraphy
(Key down conditions per tube without Amplitude Modulation*)

Maximum CCS Ratings, Absolute Values

D-C Plate Voltage	12,500 volts max.
D-C Grid Voltage	-1,500 volts max.
D-C Plate Current	8 amperes max.
D-C Grid Current**	.6 amperes max.
Plate Input	70 kilowatts max.
Plate Dissipation	20 kilowatts max.

Typical Operation

D-C Plate Voltage	9,500	7,500	6,000 volts
D-C Grid Voltage	-1,300	-1,200	-1,000 volts
Peak R-F Grid Voltage	1,850	1,700	1,500 volts
D-C Plate Current	5.5	5.2	5.5 amperes
D-C Grid Current, approx.	.530	.53	.53 amperes
Driving Power, approx.	1,000	900	800 watts
Grid Dissipation, approx.	300	275	275 watts
Power Output, approx.	35	28	22 kilowatts

*Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

**The power dissipated by the grid must never exceed 600 watts. Grid dissipation approximates the product of peak positive grid voltage and d-c grid current. Peak positive grid voltage may be measured by means of a suitable peak voltmeter connected between grid and filament, or determined by calculations using the constant current characteristics of the tube.

RATINGS VERSUS FREQUENCY

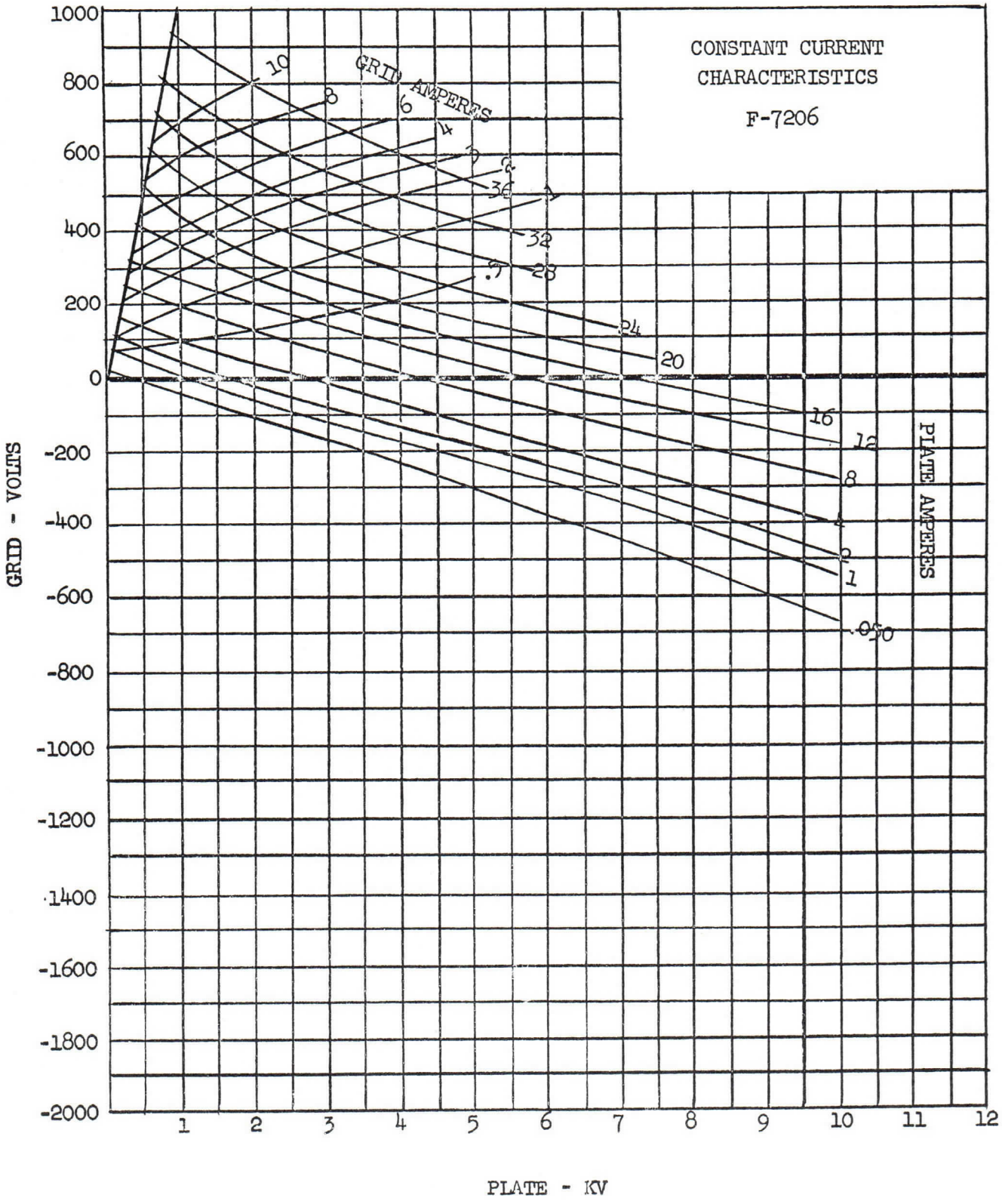
Maximum ratings apply up to 30 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tubulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	30	40	50 megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input	100	80	50 per cent

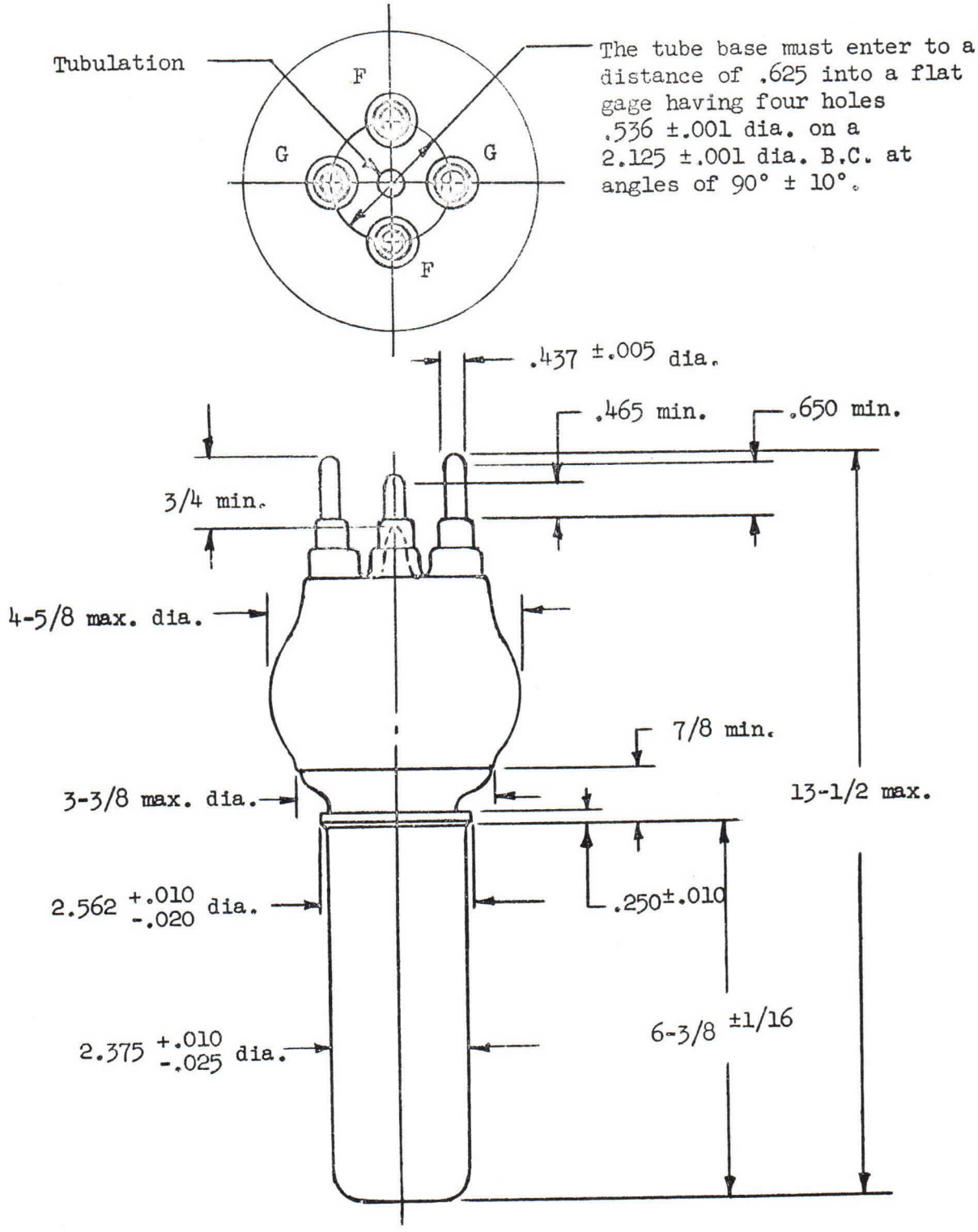
PULSE SERVICE OPERATIONS

In pulse service, it is possible to operate the tube under conditions not permissible in CW operation. Because of the wide variety of operating conditions, it is advisable that tube operation recommendations be obtained from our Engineering Department for specific conditions.

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

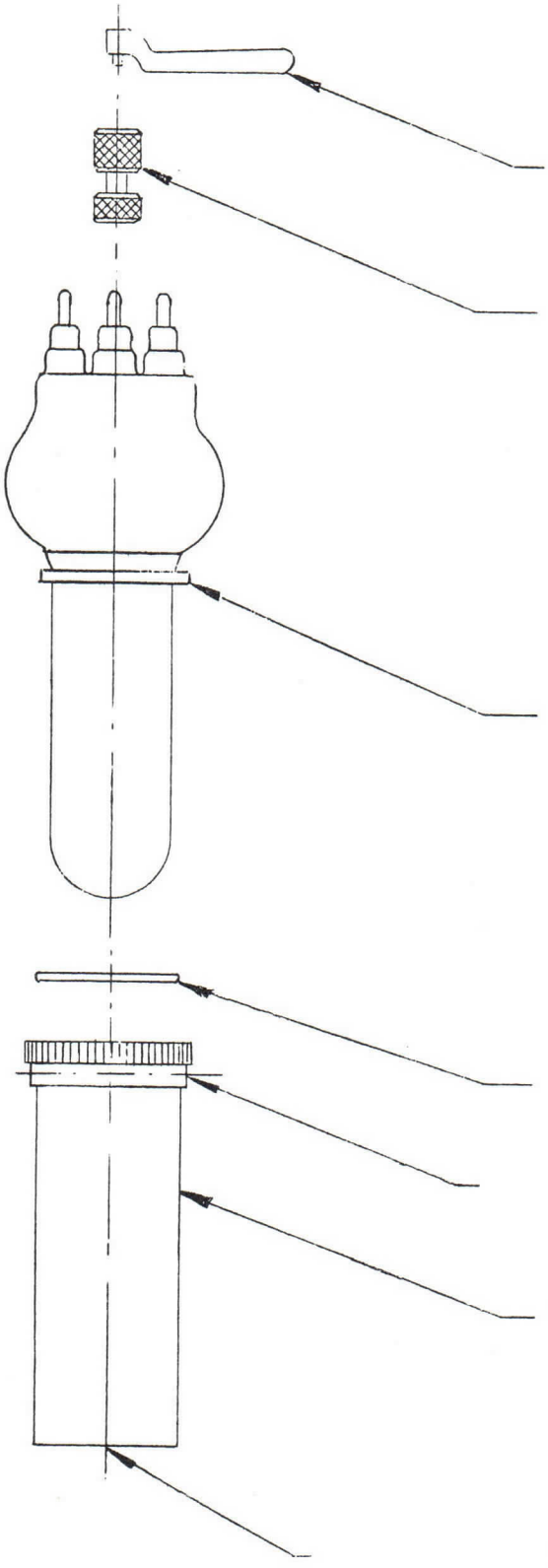

CONSTANT CURRENT
CHARACTERISTICS
F-7206
GRID AMPERES
10
8
6
4
2
1
.5
.25
.125
.050
32
28
24
20
16
12
8
4
2
1
.050
PLATE AMPERES
GRID - VOLTS
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
-1200
-1400
-1600
-1800
-2000
1
2
3
4
5
6
7
8
9
10
11
12
PLATE - KV

407



OUTLINE
F-7206 POWER TRIODE

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY



Spanner Wrench
RT-52843-1 - 2 req'd
(not to scale)

Terminal Connector Assem.
RT-52578-1 - 4 req'd
(not to scale)

Federal Tubes
Type F-5619
F-6800
F-5666
F-5668
F-7206

'O' Ring
RT-53836-1

3/8 N.P. Th'd
(Outlet)

Water Jacket
RT-53221-12
A - used with F-5668
B - used with F-5666
C - used with F-5619
F-6800
F-7206

3/8 N.P. Th'd
(Inlet)

ACCESSORIES

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

engineering TUBE DATA

F-7207
Power
Triode

ITT Components Division

out of date
See F-7207A

Tentative Specification

DESCRIPTION

The F-7207 is a three electrode tube designed for use as a modulator; its electrical characteristics making it particularly suitable for Class AB modulator circuits. The anode is air-cooled and capable of 17 kilowatts dissipation. The cathode is a thoriated tungsten filament. Maximum ratings apply for audio frequency use only.

ELECTRICAL

Filament Voltage	7.0 volts
Filament Current	110 amperes
Amplification Factor	
E_c = -200 v. I_b = 1.0 amps	6
Direct Inter-electrode Capacitance	
Grid-Plate	42 μμf
Grid-Filament	43 μμf
Plate-Filament	12 μμf

MECHANICAL

Mounting Position		Vertical, anode down	
Type of Cooling		Forced Air	
Maximum Incoming Air Temperature		45 °C	
Required Air Flow on Anode			
Plate Dissipation - kw	17	14	12
Air Flow - cfm	1000	800	700
Pressure - inches of water	3.5	2.3	1.7
Maximum Glass Temperature		180 °C	
Weight, approximate		45 lbs	

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator--Class AB_1

Maximum Ratings, Absolute Values

D-C Plate Voltage	10 kv
Maximum Signal D-C Plate Current*	5 amperes
Maximum Signal Plate Input*	30 kw
Plate Dissipation*	17 kw

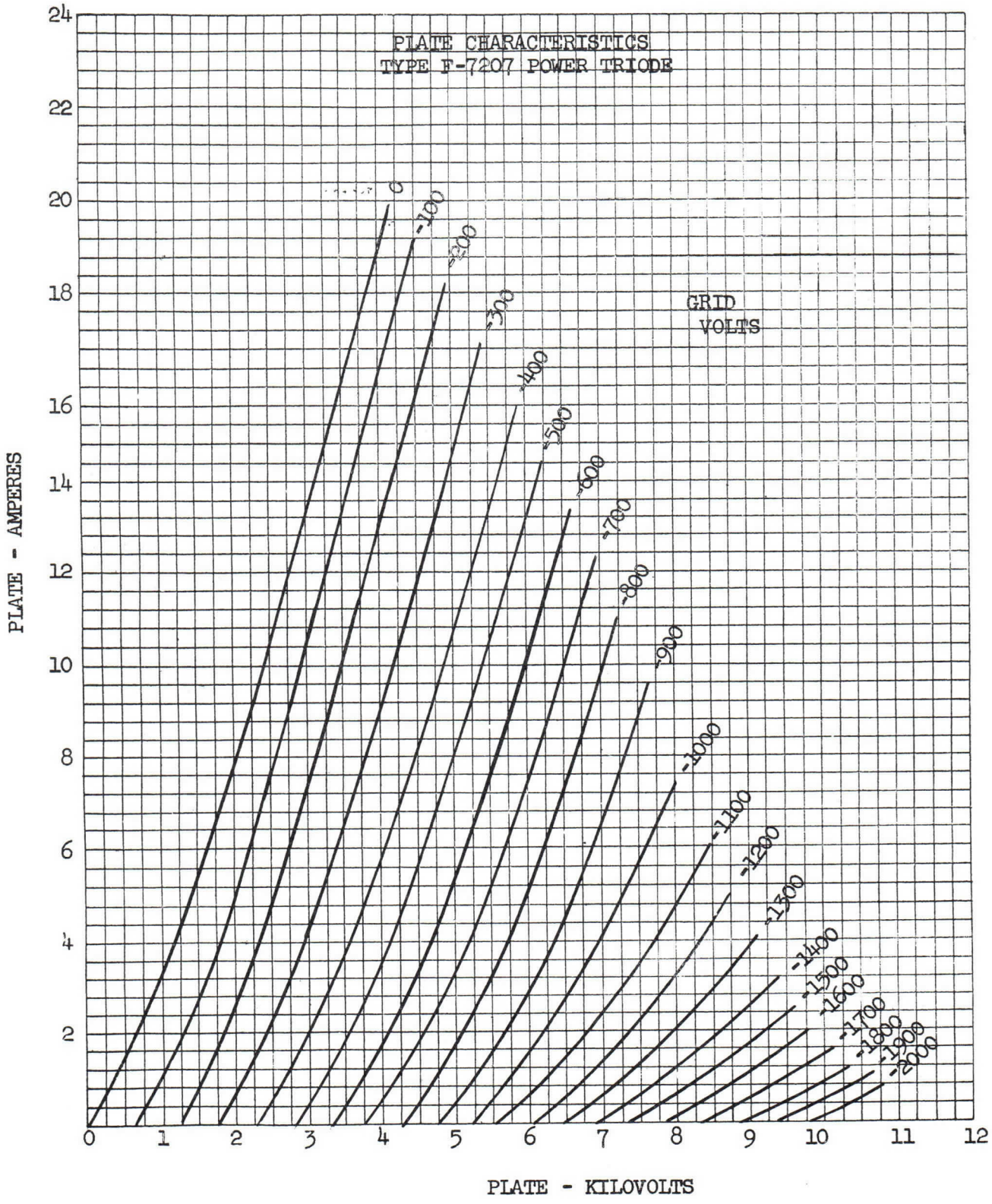
*Averaged over any audio frequency cycle of sine wave form.

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

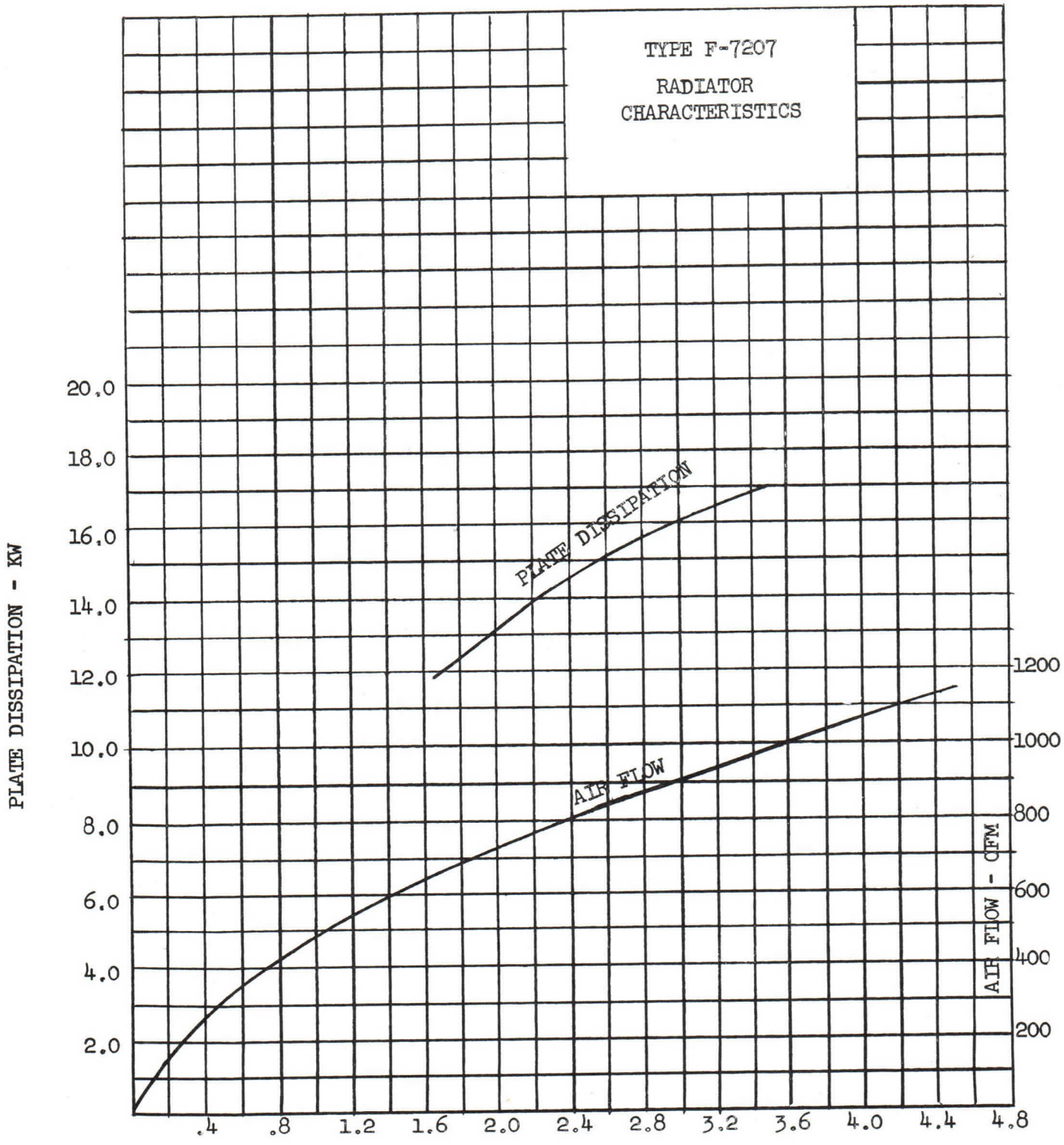
F-7207
Power
Triode

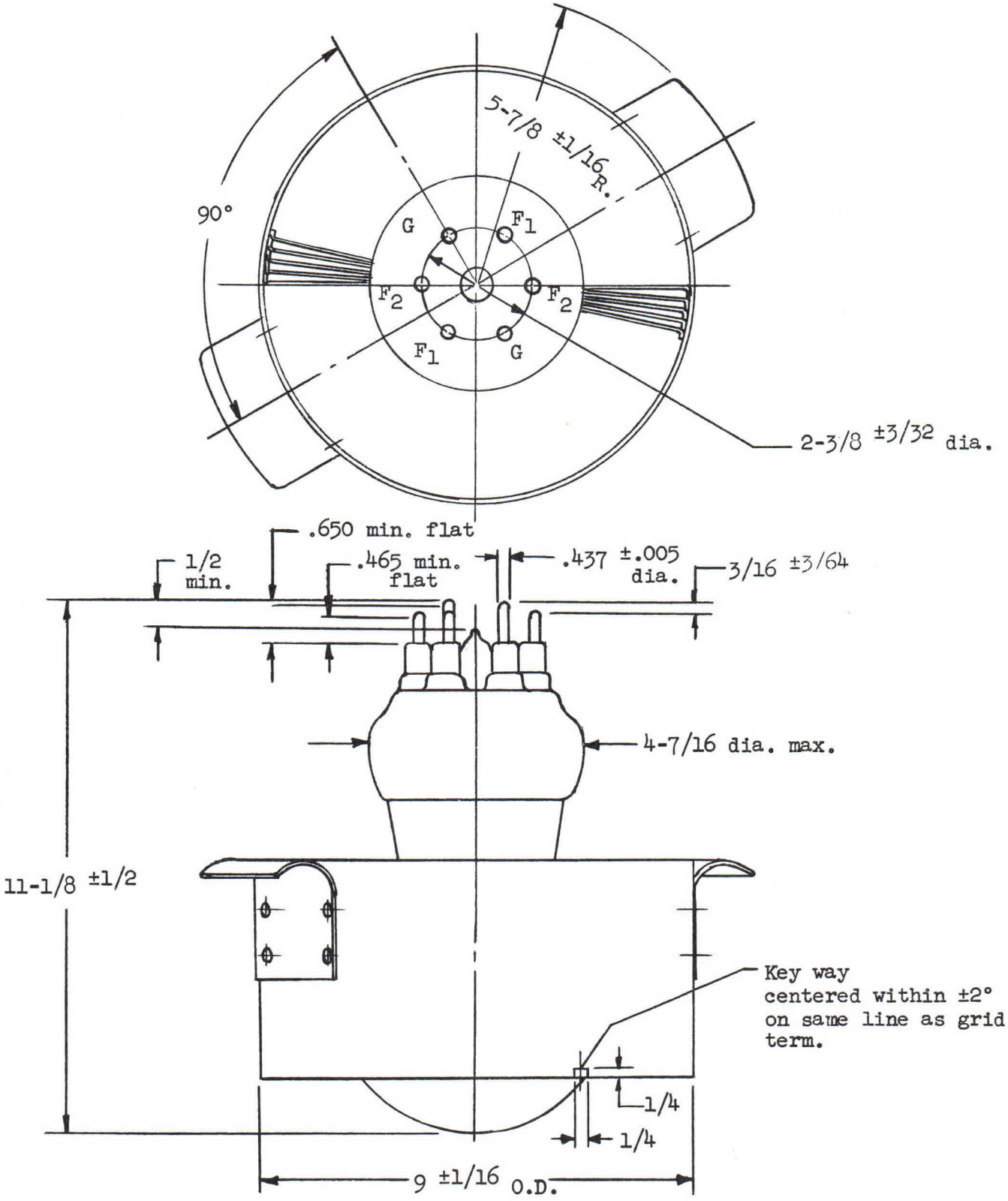
Typical Operation
(Unless otherwise specified, values are for two tubes)

D-C Plate Voltage	5000	7000	9000	volts
D-C Grid Voltage	-900	-1400	-1800	volts
Peak A-F Grid-to-Grid Voltage	1760	2740	3500	volts
Zero Signal D-C Plate Current	0.8	0.5	0.5	amperes
Maximum Signal D-C Plate Current	2.6	3.2	3.2	amperes
Effective Load Resistance Plate-to-Plate	3700	4600	5800	ohms
Maximum Signal Driving Power	0	0	0	watts
Maximum Signal Power Out	7.4	13.75	18	kw



ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY


TYPE F-7207
RADIATOR
CHARACTERISTICS
PLATE DISSIPATION - KW
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
PLATE DISSIPATION
AIR FLOW
1200
1000
800
600
400
200
AIR FLOW - CFM
.4
.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
4.4
4.8



OUTLINE
F-7207

ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

F7328B
F7532

See Mr Roach's Copy

F7656
F7779
F7820A
F7869 (D1039)
F7906
F7907

The High Vacuum Variable Capacitors being shown at the Physical Society Exhibition are development samples of entirely new products soon to be added to the Catalogue of the English Electric Valve Co. Ltd.

A special feature of these capacitors is their small physical size relative to their high voltage rating. This is made possible by the use of a vacuum dielectric which also enables the capacitors to stand breakdowns caused by temporary voltage overloads without damage.

Over the specified range, the capacitance of each type varies linearly with the rotation of the capacitor shaft and the precision of the construction ensures a high degree of accuracy in the capacitance change produced by each turn.

The capacitance range extends slightly above and below the limits specified below but the capacitance variation in the region below the bottom limit is not linear.

A summary of the major characteristics of each type is given below; additional information is available on request.

EEV Type	Linear Capacitance Range (pF)	Shaft Turns In Linear Capacitance Range	Maximum Peak R.F. Voltage (kV)	Maximum R.F. Current (A.r.m.s.)	Max. Length (ins.)	Max. Bulb Dia. (ins.)
U30/15	5 to 30	10·4	15	10(up to 30Mc/s)	6·500	2·000
U50/15	8 to 50	10·4	15	15(up to 30Mc/s)	6·500	2·750
U80/15	10 to 80	10·4	15	20(up to 30Mc/s)	6·500	3·187
U200/10	15 to 200	16	10	20(up to 20Mc/s)	9·250	2·500

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

F-7975 *
POWER
DIODE

DESCRIPTION

The F-7975 is a diode designed for rectifier service or in special applications in shunting or charging circuits. The construction is exceptionally rugged with a thoriated tungsten filamentary cathode of bifilar helical construction. The anode is forced air-cooled and is capable of dissipating 3.5 kw.

ELECTRICAL

Filament Voltage			15	volts
Filament Current			36	amperes
Filament Starting Current Full rated filament voltage may be safely applied to the cold filament				
Maximum Ratings	Shunt	Charging	Rectifier	
Max. Peak Inverse Voltage	55	55	46	kilovolts
Max. Peak Plate Current	100	100	21	amperes
Max. Average Plate Current	-	-	5	amperes
Max. Peak Inverse Voltage x Average Plate Current			165,000	
Inter-Electrode Capacitance			11.5	μμf

MECHANICAL

Mounting Position			Vertical, Anode up or down	
Max. Glass & Seal Temperature			180	°C
Type of Cooling			Forced	air
Anode Air Flow Required				
Plate Dissipation	3.5	2.8	2.4	kilowatts
Minimum Air Flow	190	125	75	cfm
Pressure--inches of water	1.6	.78	.35	
Max. Incoming Air Temperature			45	°C
Net Weight, approx.			7	lbs.

Additional information for specific applications can be obtained from the:

ITT Components Division
Electron Tube Applications Section
P.O. Box 412
Clifton, New Jersey

* Formerly the D-1042.

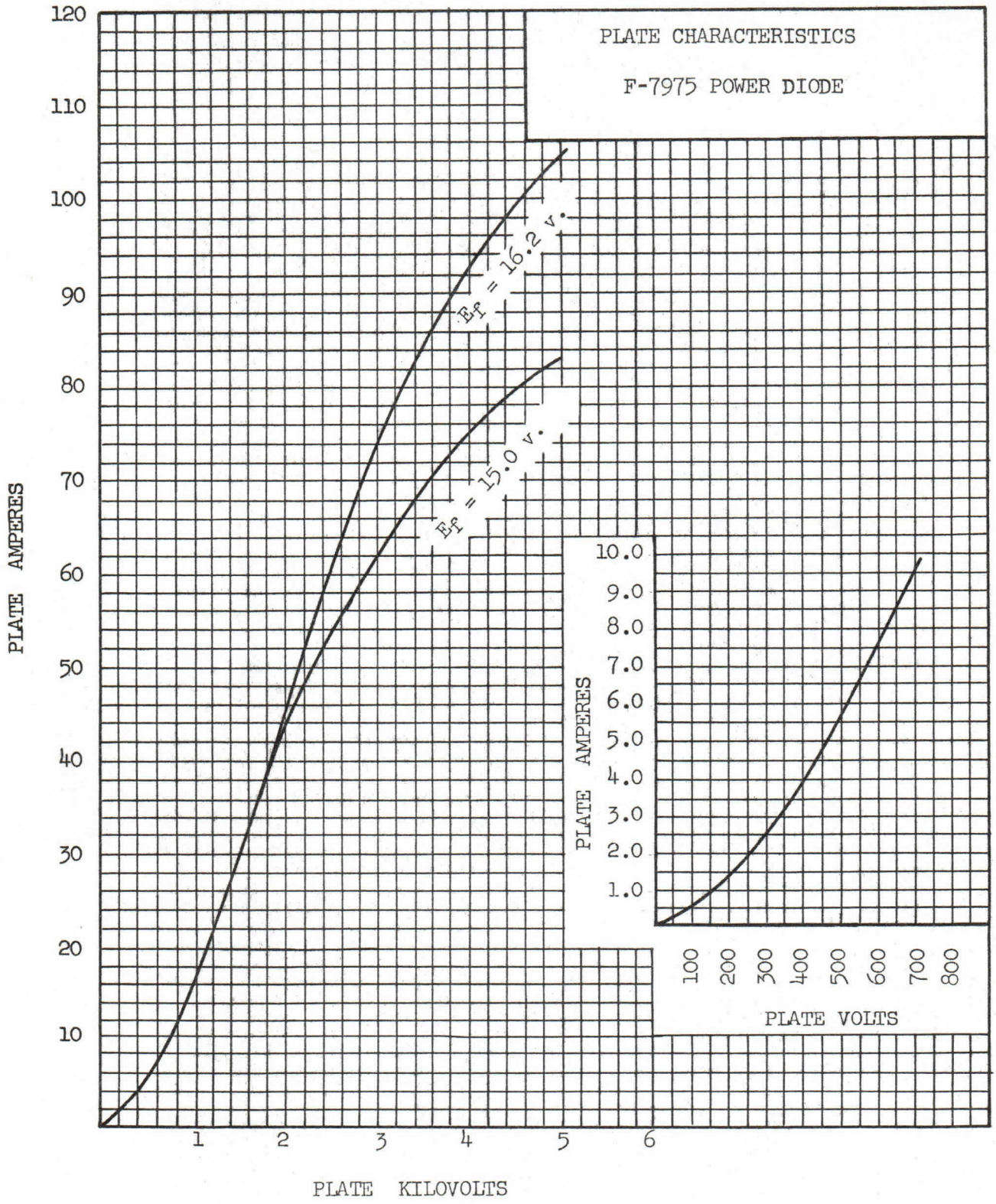
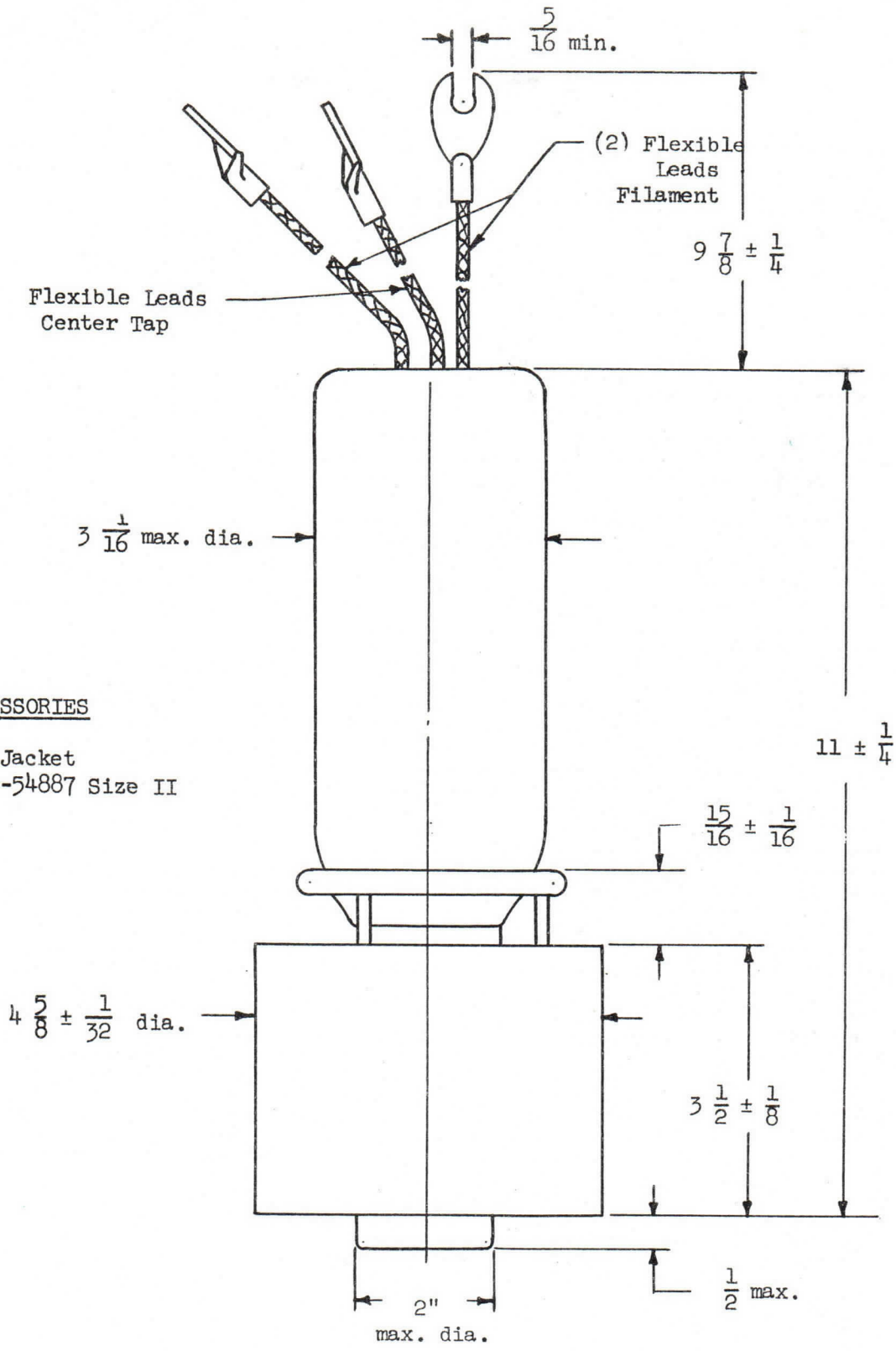


PLATE CHARACTERISTICS
F-7975 POWER DIODE
Ef = 16.2 v.
Ef = 15.0 v.
PLATE AMPERES
120
110
100
90
80
70
60
50
40
30
20
10
1
2
3
4
5
6
PLATE KILOVOLTS
PLATE AMPERES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
100
200
300
400
500
600
700
800
PLATE VOLTS



ACCESSORIES

Air Jacket
RT-54887 Size II

OUTLINE
F-7975 POWER DIODE

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

F8034

See Mr. Rourke's
Copy

A NEW 6 MW KLYSTRON AMPLIFIER

The English Electric Valve Company Limited announce the introduction of a new three cavity klystron amplifier, type K352, for high power pulsed operation in the range 2993 to 3003 Mc/s. This tube is capable of delivering a peak power output of 6 MW, at a mean level of 9 kW, with a gain of 30 db and an efficiency in excess of 35%. The cavities form an integral part of the valve envelope.

Coaxial R.F. input connections are employed and the output flange is designed for coupling to Waveguide No.10 (2.84 inches x 1.34 inches internal dimensions).

The K352 requires magnetic focusing and a water cooled focus mount, operating from an 80 volt, 40 ampere, supply (max) employed for this purpose. Forced-air cooling of the output window, which is of low loss glass construction, is required and water cooling is necessary for the body and collector.

The K352 is suitable for use with linear particle accelerators and may also be applied to high power radars.

Summary of Characteristics

Electrical		
Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	5	V Max.
Heater Current	110	A Max.
Mechanical		
Overall Length	48·25 inches Max.	
Overall Width	13·4 inches Max.	
Output Flange	5–5/16 inches diameter with 8 holes	
Mounting Position	Vertical, Cathode down.	
Typical Operating Conditions		
Beam Voltage (Peak)	195	kV
Beam Current (Peak)	90	A
Gain	30	db
Pulse Length	2·5 μsec	
Duty Cycle	0·0015	
Output Power (Peak)	6	MW
Output Power (Mean)	9	kW

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

* F-8104 AND F-8104-J POWER TRIODES

DESCRIPTION:

THE F-8104 AND F-8104-J ARE TRIODES DESIGNED FOR USE AS R-F AMPLIFIERS AND OSCILLATORS. THE ANODE IS WATER COOLED AND 8 KILOWATTS OF POWER MAY BE DISSIPATED DURING CONTINUOUS COMMERCIAL SERVICE. THE F-8104-J IS PROVIDED WITH AN INTEGRAL WATER JACKET ATTACHED TO THE TUBE.

ELECTRICAL:

FILAMENT VOLTAGE	15	VOLTS
FILAMENT CURRENT	36	AMPERES
AMPLIFICATION FACTOR	25	
DIRECT INTER-ELECTRODE CAPACITANCE		
GRID-PLATE	14.2	UUF
GRID-FILAMENT	16.3	UUF
PLATE-FILAMENT	1.9	UUF

MECHANICAL:

MOUNTING POSITION	VERTICAL, ANODE UP OR DOWN	
TYPE OF COOLING	CIRCULATING WATER	
ANODE WATER FLOW REQUIRED	3.5	GPM
WATER PRESSURE, MAXIMUM	80	PSI
OUTLET WATER TEMPERATURE, MAXIMUM	70	°C
MAXIMUM GLASS TEMPERATURE	180	°C
NET WEIGHT, APPROXIMATE	1-1/4	LBS.

* FORMERLY D-1040 AND D-1040-J

MAXIMUM RATING AND TYPICAL OPERATING CONDITIONS:

R-F POWER AMPLIFIER AND OSCILLATOR - CLASS C
(KEY DOWN CONDITIONS PER TUBE WITHOUT AMPLITUDE MODULATION)

MAXIMUM RATINGS, ABSOLUTE VALUES:

	2 MC TO 30 MC	BELOW 2 MC	
D-C PLATE VOLTAGE *	6.0	8.0	MAX. KV
D-C GRID VOLTAGE	-1500	-1500	MAX. KV
D-C PLATE CURRENT	2.2	2.5	MAX. AMPERES
D-C GRID CURRENT	.300	.300	MAX. AMPERES
PLATE INPUT	12	18	MAX. KW
PLATE DISSIPATION	8	8	MAX. KW

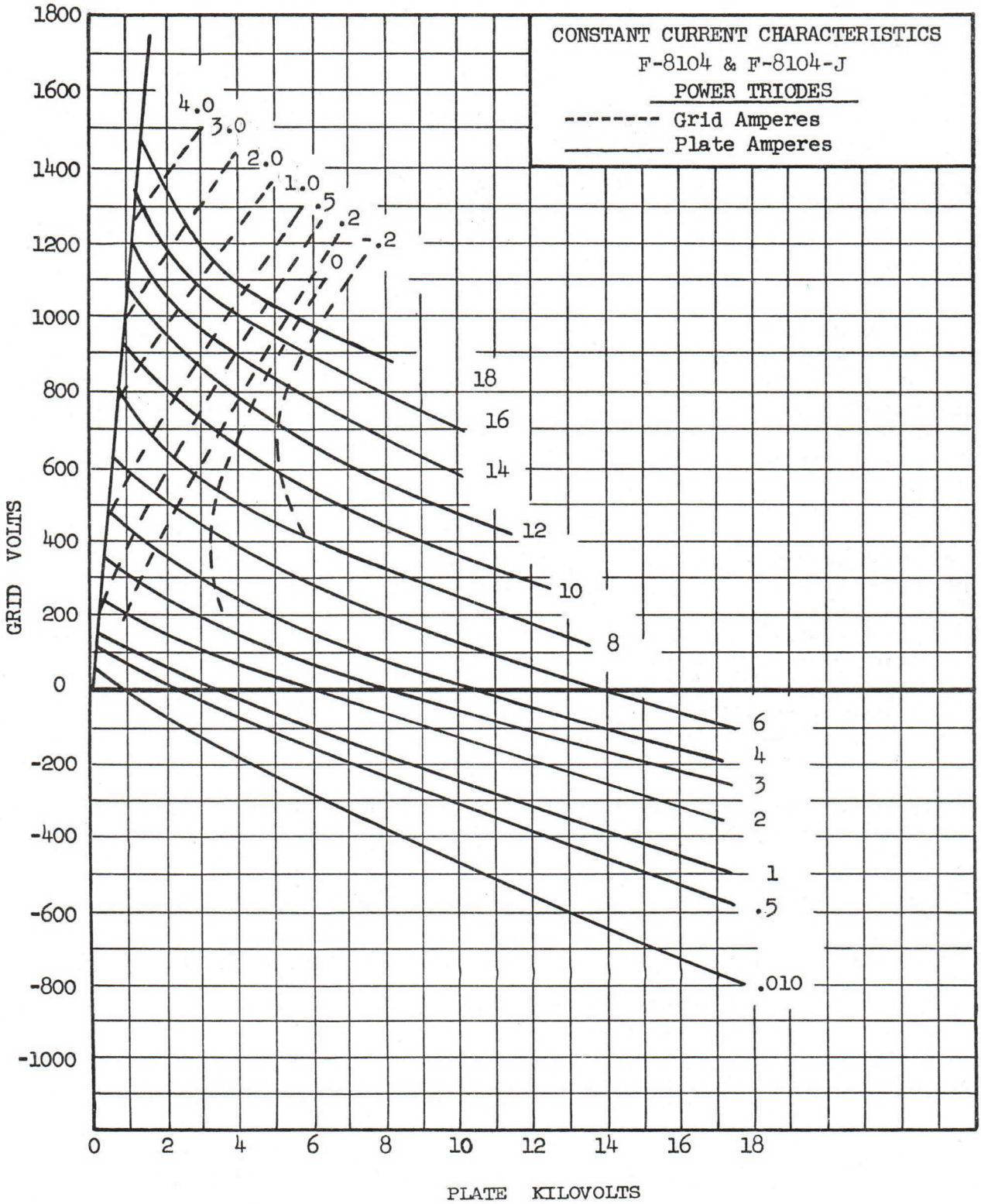
TYPICAL OPERATION:

D-C PLATE VOLTAGE	5.5	7.5	KV
D-C GRID VOLTAGE	-600	-800	VOLTS
PEAK R-F GRID VOLTAGE	1300	1600	VOLTS
D-C PLATE CURRENT	2.0	2.4	VOLTS
D-C GRID CURRENT, APPROXIMATE	.17	.15	AMPERES
DRIVING POWER, APPROXIMATE	220	240	WATTS
POWER OUTPUT, APPROXIMATE	6.8	11.5	KW
R-F LOAD RESISTANCE	1175	1300	OHMS

* RECTIFIED, UNFILTERED, THREE-PHASE, HALF-WAVE PLATE SUPPLY IS ACCEPTABLE.

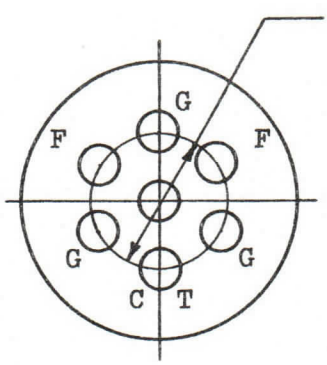
ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE:

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY



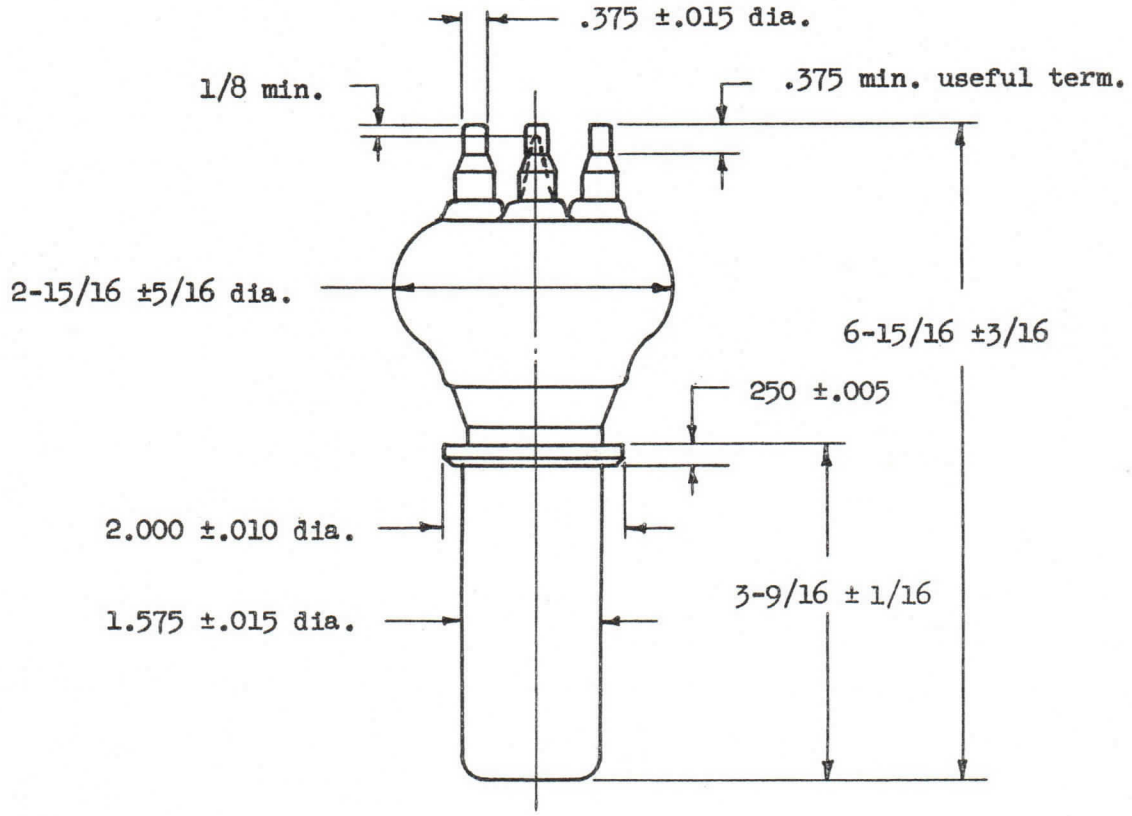
ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

Fil. Terminal - Yellow
Fil. Center Terminal - Red
Grid Terminal - Black



ACCESSORIES

Water Jacket
RT-53933-12 (Ordering #)
RT-54530-1 (Outline Dwg)
O-Ring
RT-53836-1 - Type "AA"

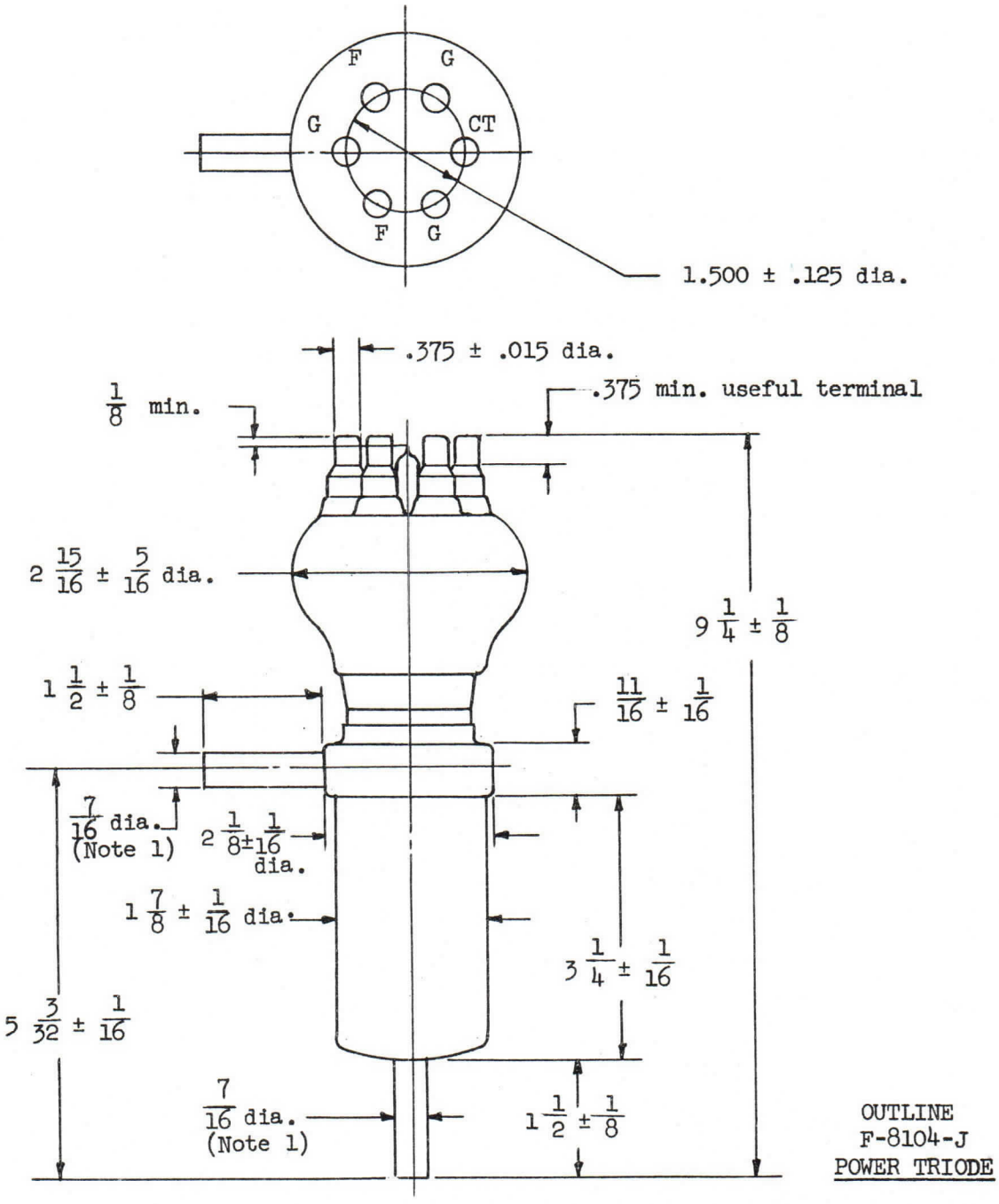


NOTE:
1/2" flexible copper lead, 6" long, available on each terminal upon request.

OUTLINE

F-8104 POWER TRIODE

Fil. Terminal - Yellow
Fil. Center Term. - Red
Grid Terminal - Black



OUTLINE
F-8104-J
POWER TRIODE

Note 1: Brass compression fittings are useful in making water connections.

Note 2: 1/2" flexible copper lead, 6" long, available on each terminal upon request.

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

F-8146 *
F-8147
POWER
TRIODES

Tentative Specification

DESCRIPTION

The F-8146 and F-8147 are general purpose metal and ceramic triodes for use as amplifiers, oscillators or Class B modulators under CW or pulsed conditions. The F-8146 has a water-cooled anode capable of dissipating 40 kilowatts. The F-8147 has a forced air-cooled, copper anode-radiator assembly of brazed construction capable of 20 kilowatts.

ELECTRICAL

Filament Voltage	11	volts
Filament Current	155	amperes
Filament Starting Current	500	amperes
Filament Cold Resistance	.008	ohms
Amplfication Factor		
E_c = -50 volts; I_b = 3 amperes	17	
Direct Inter-Electrode Capacitance		
Grid-Plate	53	μμf
Grid-Filament	58	μμf
Plate-Filament	3.0	μμf

MECHANICAL

Mounting Position	Vertical, anode up or down						
Ceramic and Seal Temperature, max. (see Notes 1 and 2)	250° C						
	F-8146			F-8147			
Plate Dissipation	40	30	20	20	15	10	kilowatts
Water Flow	20	15	10		-		gpm
Water Jacket Pressure Drop	18	10	5		-		psi
Air Flow (Note 3)		-		1000	600	300	cfm
Static Air Pressure		-		8	3	1	inches of water
Net Weight, approx.		8.5			22		lbs.

Note 1: Auxiliary air flow of up to 120 cfm may be required to limit the ceramic and seal temperature to less than the 250°C max.

Note 2: A temperature sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y. is convenient for this measurement.

Note 3: Maximum incoming air temperature, 45°C.

* Formerly our D-1030A & B.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS
(Values apply to both tubes unless otherwise specified)

Audio-Frequency Power Amplifier and Modulator - Class B

Maximum Ratings, Absolute Values

D-C Plate Voltage	11,000	volts
Maximum Signal D-C Plate Current **	8	amperes
Maximum Signal Plate Input **		
F-8146	80	kilowatts
F-8147	60	kilowatts
Plate Dissipation **		
F-8146	40	kilowatts
F-8147	20	kilowatts

Typical Operation
(Unless otherwise specified, values are for two tubes)

	F-8146	F-8146	
D-C Plate Voltage	10,500	8,500	volts
D-C Grid Voltage	-600	-520	volts
Peak A-F Grid-to-Grid Voltage	1,800	1,740	volts
Peak A-F Plate-to-Plate Voltage	16,000	14,000	volts
Zero Signal D-C Plate Current	1.8	1.2	amperes
Maximum Signal D-C Plate Current	15.2	12.8	amperes
Effective Load Resistance, Plate-to-Plate	1,330	1,400	ohms
Maximum Signal Driving Power, approx.	50	110	watts
Maximum Signal Power Output, approx.	95	70	kilowatts

Radio-Frequency Power Amplifier - Class B
(Carrier conditions per tube for use with a maximum modulator factor of 1.0)

Maximum Ratings, Absolute Values

D-C Plate Voltage	11,000	volts
D-C Plate Current	6	amperes
Plate Input		
F-8146	60	kilowatts
F-8147	30	kilowatts
Plate Dissipation		
F-8146	40	kilowatts
F-8147	20	kilowatts

** Averaged over any audio-frequency cycle of sine-wave form.

Typical Operation

	F-8146	F-8146	
D-C Plate Voltage	10,500	8,500	volts
D-C Grid Voltage	-550	-460	volts
Peak R-F Grid Voltage	600	520	volts
Peak R-F Plate Voltage	4,000	3,500	volts
D-C Plate Current	4.5	5.7	amperes
D-C Grid Current	0	0	amperes
R-F Load Resistance	550	380	ohms
Driving Power, approx. ++	200	575	watts
Power Output, approx.	14.5	16	kilowatts

Plate-Modulated Radio-Frequency Power Amplifier - Class C Telephony
(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

D-C Plate Voltage		8,500	volts
D-C Grid Voltage		-2,000	volts
D-C Plate Current		6	amperes
D-C Grid Current		.8	amperes
Plate Input		55	kilowatts
Plate Dissipation	F-8146	26	kilowatts
	F-8147	13	kilowatts

Typical Operation

D-C Plate Voltage	8,000	volts
D-C Grid Voltage	-1,400	volts
Peak R-F Grid Voltage	2,120	volts
Peak R-F Plate Voltage	7,000	volts
D-C Plate Current	5.6	amperes
D-C Grid Current	.6	amperes
R-F Load Resistance	680	ohms
Driving Power, approx.	1,250	watts
Power Output, approx.	36	kilowatts

++ At crest of audio frequency cycle
with modulation factor of 1.0

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy
(Key down conditions per tube without amplitude modulation ‡)

Maximum Ratings, Absolute Values

D-C Plate Voltage		11,000	volts
D-C Grid Voltage		-2,000	volts
D-C Plate Current		8	amperes
D-C Grid Current		.8	amperes
Plate Input		80	kilowatts
Plate Dissipation	F-8146	40	kilowatts
	F-8147	20	kilowatts

Typical Operation

	Cathode Drive	Grid Drive			
D-C Plate Voltage	7,500	10,500	9,500	7,500	volts
D-C Grid Voltage	-800	-1,500	-1,200	-800	volts
Peak R-F Grid Voltage	1,300	2,050	1,750	1,300	volts
Peak R-F Plate Voltage	6,000	9,000	8,000	6,000	volts
D-C Plate Current	7.5	6.7	7.8	7.5	amperes
D-C Grid Current	.45	.40	.45	.45	amperes
R-F Load Resistance	460	735	570	460	ohms
Driving Power, approx.	9,000	770	760	545	watts
Power Output, approx.	47	55	55	38	kilowatts

‡ Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

RATINGS VERSUS FREQUENCY

Maximum ratings apply up to 50 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same above). Special attention should be given to adequate ventilation of the ceramics and seals at these frequencies.

Frequency	50	110	megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input	100	70	per cent

PULSE SERVICE OPERATIONS

In pulse r-f amplifier service, it is possible to operate the tube under conditions not permissible in CW operation. Because of the wide variety of operating conditions, it is advisable that tube operation recommendations be obtained from our Engineering Department for specific conditions.

MODULATOR TUBE - PULSED OPERATION

Maximum Ratings, Absolute Values

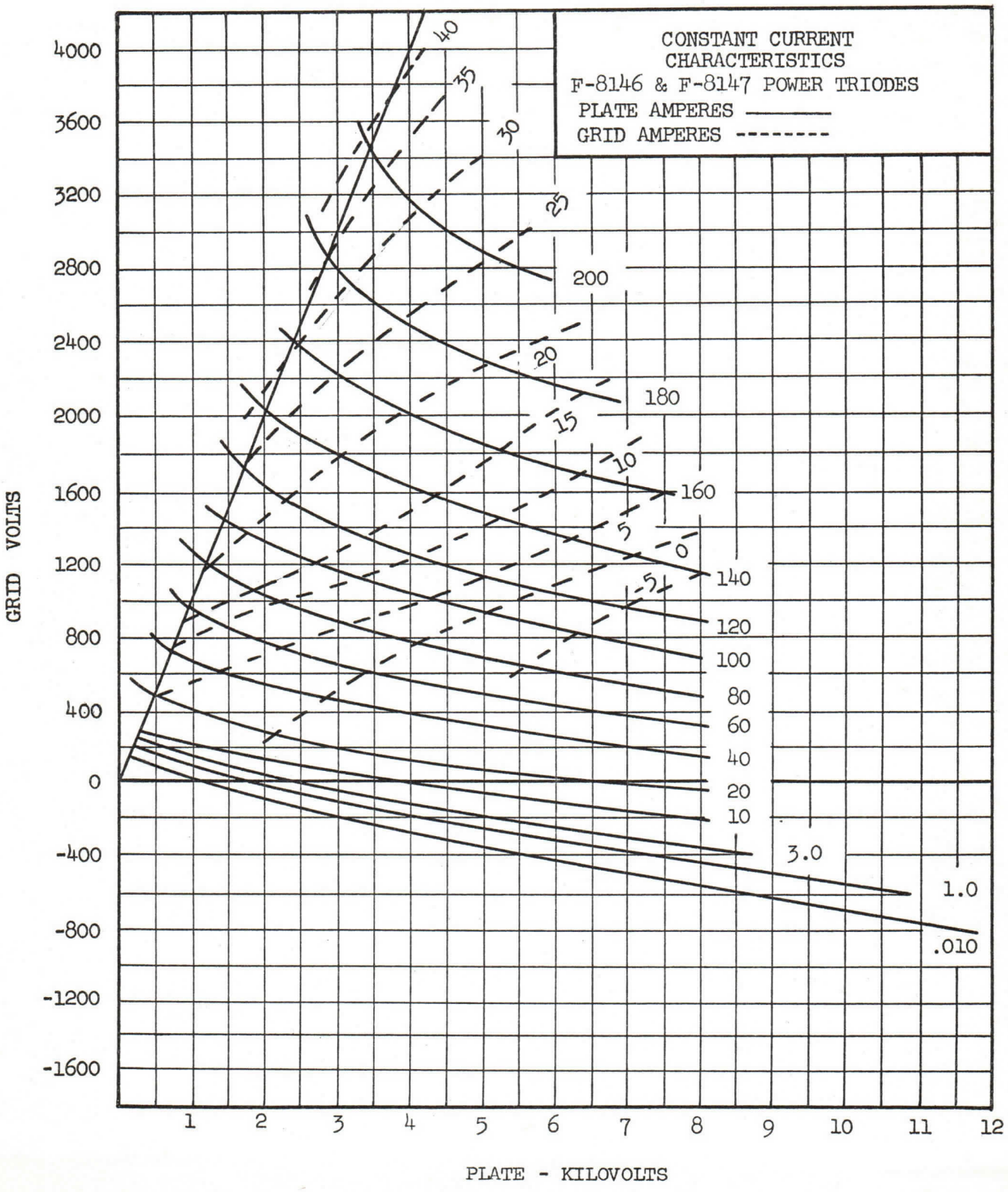
D-C Plate Voltage	18	kilovolts
Peak Plate Voltage (instantaneous)	20	kilovolts
D-C Grid Voltage	-2500	volts
Peak Positive Grid Voltage	4000	volts
Pulse Cathode Current	220	amperes
Grid Dissipation	800	watts
Pulse Length	2000	µsec.

Typical Operation

D-C Plate Voltage	16	kilovolts
Pulse Plate Current	120	amperes
D-C Grid Voltage	-1500	volts
Pulse Grid Current	40	amperes
Pulse Positive Grid Voltage	2200	volts
Duty Factor	.003	
Pulse Length	10	µsec.
Plate Output Voltage	13.5	kilovolts
Pulse Output Power	1.6	mw

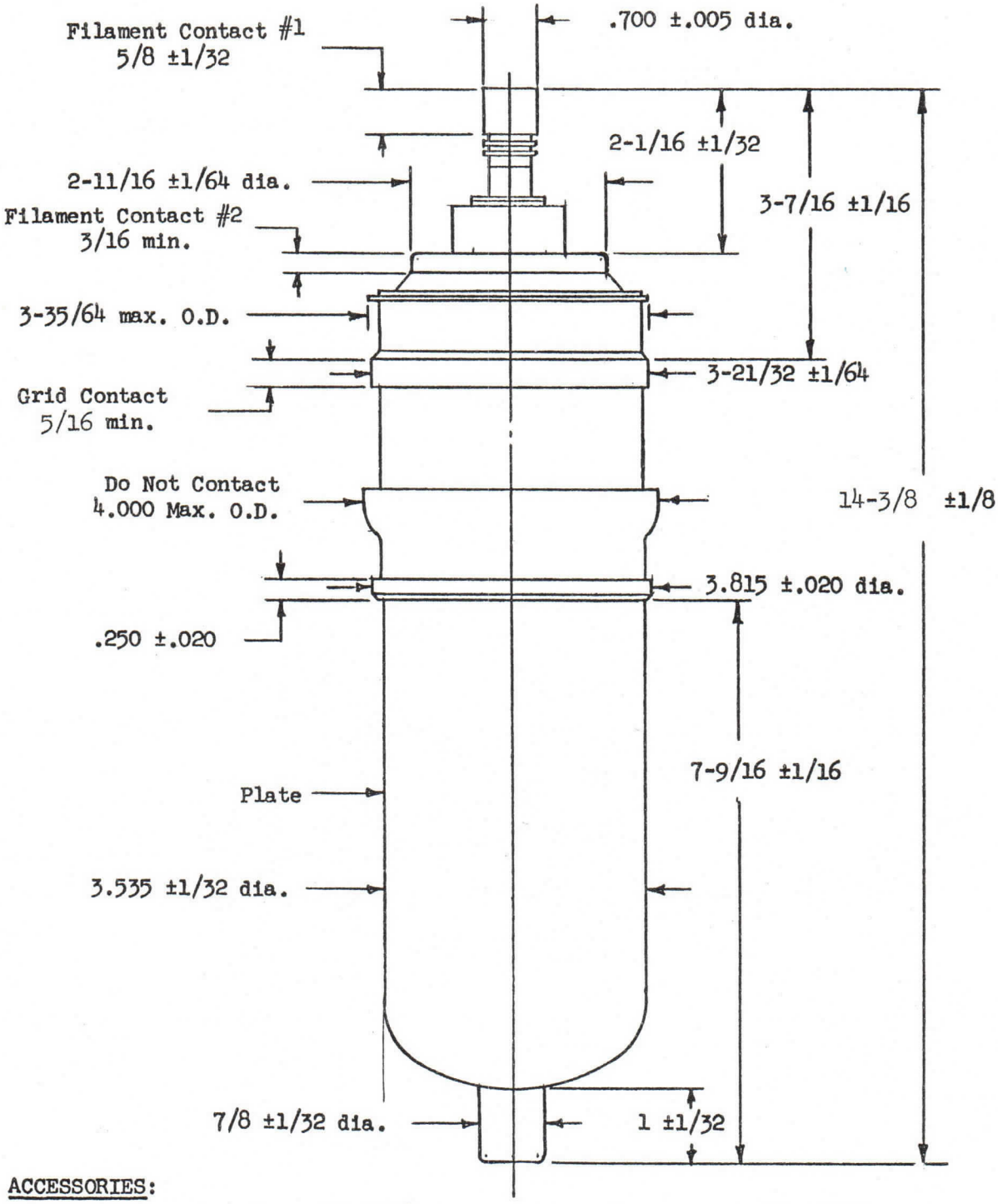
Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey


CONSTANT CURRENT
CHARACTERISTICS
F-8146 & F-8147 POWER TRIODES
PLATE AMPERES ———
GRID AMPERES --------
GRID VOLTS
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
-400
-800
-1200
-1600
40
35
30
25
200
20
180
15
10
160
5
0
140
-5
120
100
80
60
40
20
10
3.0
1.0
.010
1
2
3
4
5
6
7
8
9
10
11
12
PLATE - KILOVOLTS

NOTE: Contact areas are to be concentric within .025".

OUTLINE
F-8146 POWER TRIODE

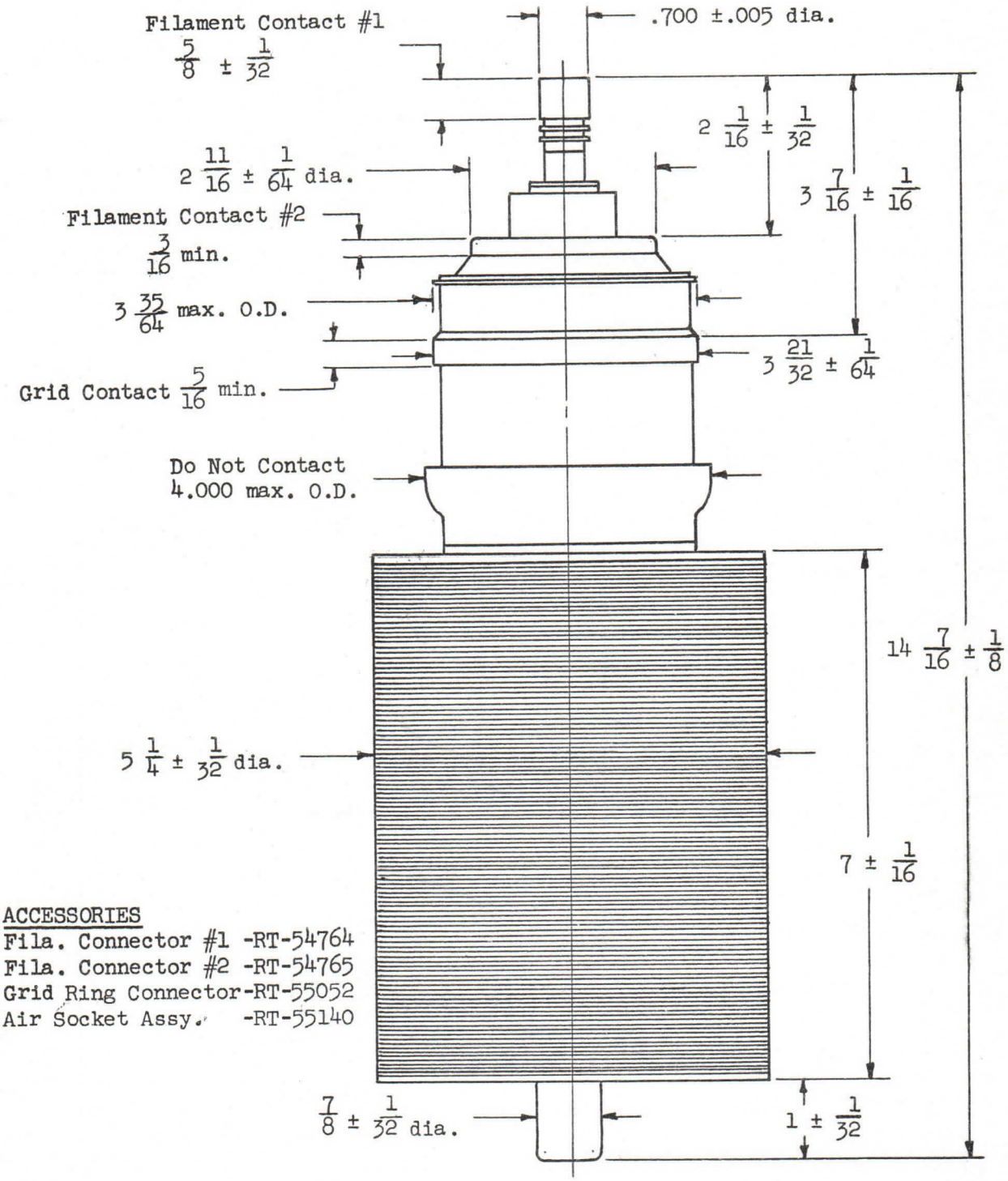


ACCESSORIES:

Filament Connector #1 - RT-54764
Filament Connector #2 - RT-54765
Grid Connector - RT-54763
Water Jacket - RT-55070

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

NOTE: Contact areas are to be concentric within .025"



ACCESSORIES

Fila. Connector #1 -RT-54764
Fila. Connector #2 -RT-54765
Grid Ring Connector-RT-55052
Air Socket Assy. -RT-55140

OUTLINE
F-8147 POWER TRIODE

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

F-8207 *
F-8207J
POWER DIODES

DESCRIPTION

Tube types F-8207 and F-8207J are diodes designed for rectifier service or in special applications in shunting or charging circuits. The exceptionally rugged construction, free of internal insulators, spring tensioning devices, and fragile elements, make these diodes adaptable to a wide range of uses. The heavy-wall, water-cooled anode is capable of dissipating up to 8 kilowatts at 3.5 gpm. The F-8207J is provided with an integral water jacket and the inlet and outlet water connections are male fittings for quick-connect coupling without tools.

ELECTRICAL

Filament Voltage			15	volts
Filament Current			36	amperes
Filament Starting Current				
Full rated filament voltage may be safely applied to the cold filament				
Maximum Ratings	Shunt	Charging	Rectifier	
Max. Peak Inverse Voltage	30	30	30	kilovolts
Max. Peak Plate Current	100	7.5 rms	20	amperes
Max. Plate Current	-	-	6	avg. amperes

MECHANICAL

Mounting Position		Vertical, Anode up or down		
Type of Cooling		Circulating water		
Plate Dissipation	8	6	4	kilovolts
Water Flow	3.5	2.3	1.0	gpm
Water Jacket Pressure Drop ‡				
Water Pressure, max.			80	psig
Outlet Water Temperature, max.			70	°C
Max. Glass and Seal Temperature			180	°C
Net Weight, approx.			2	lbs.

‡ The pressure drop across the jacket is negligible compared to the drop in the associated plumbing.

Additional information for specific applications can be obtained from:

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

3-62

* Formerly our D-1050 and D-1050J

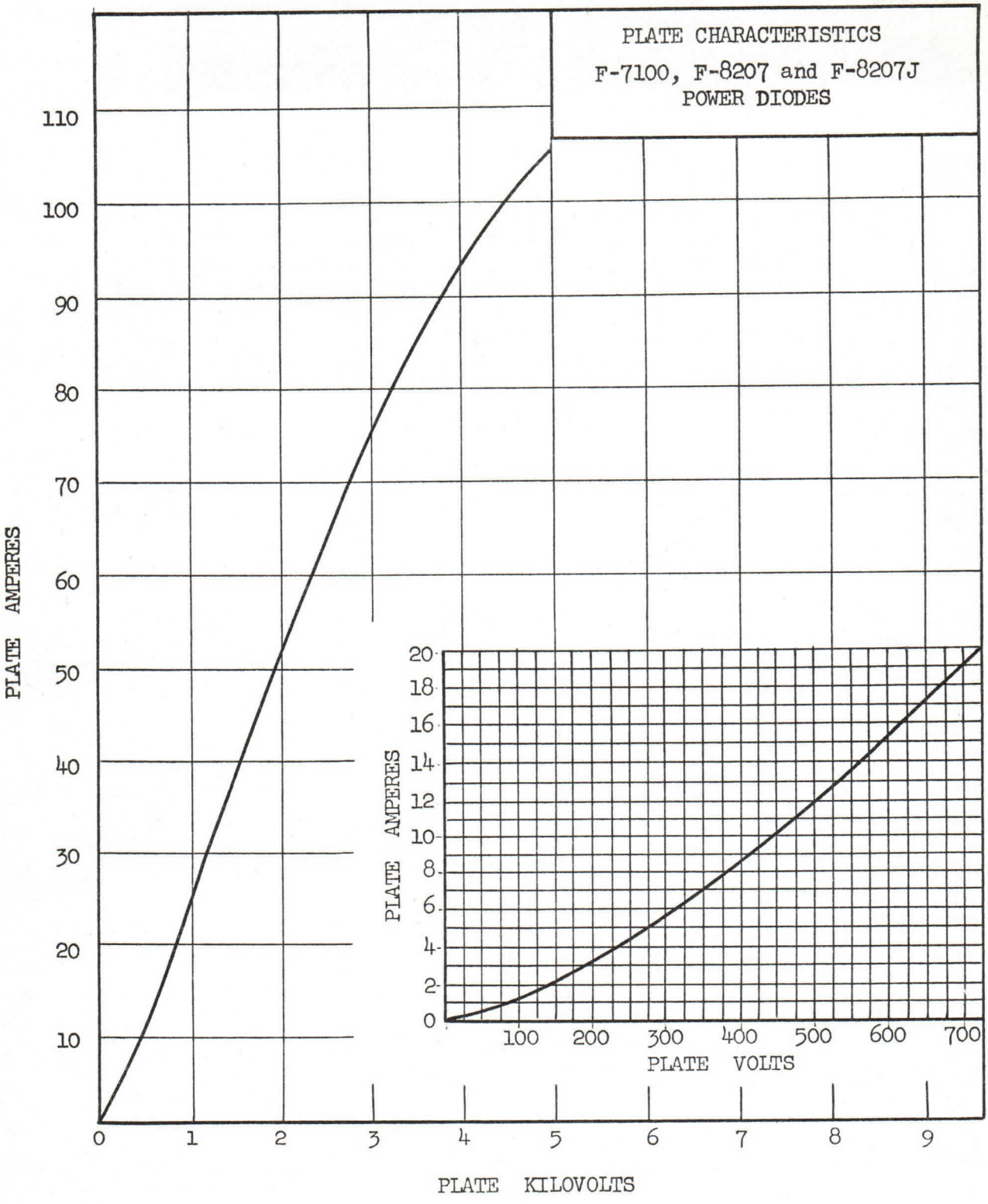


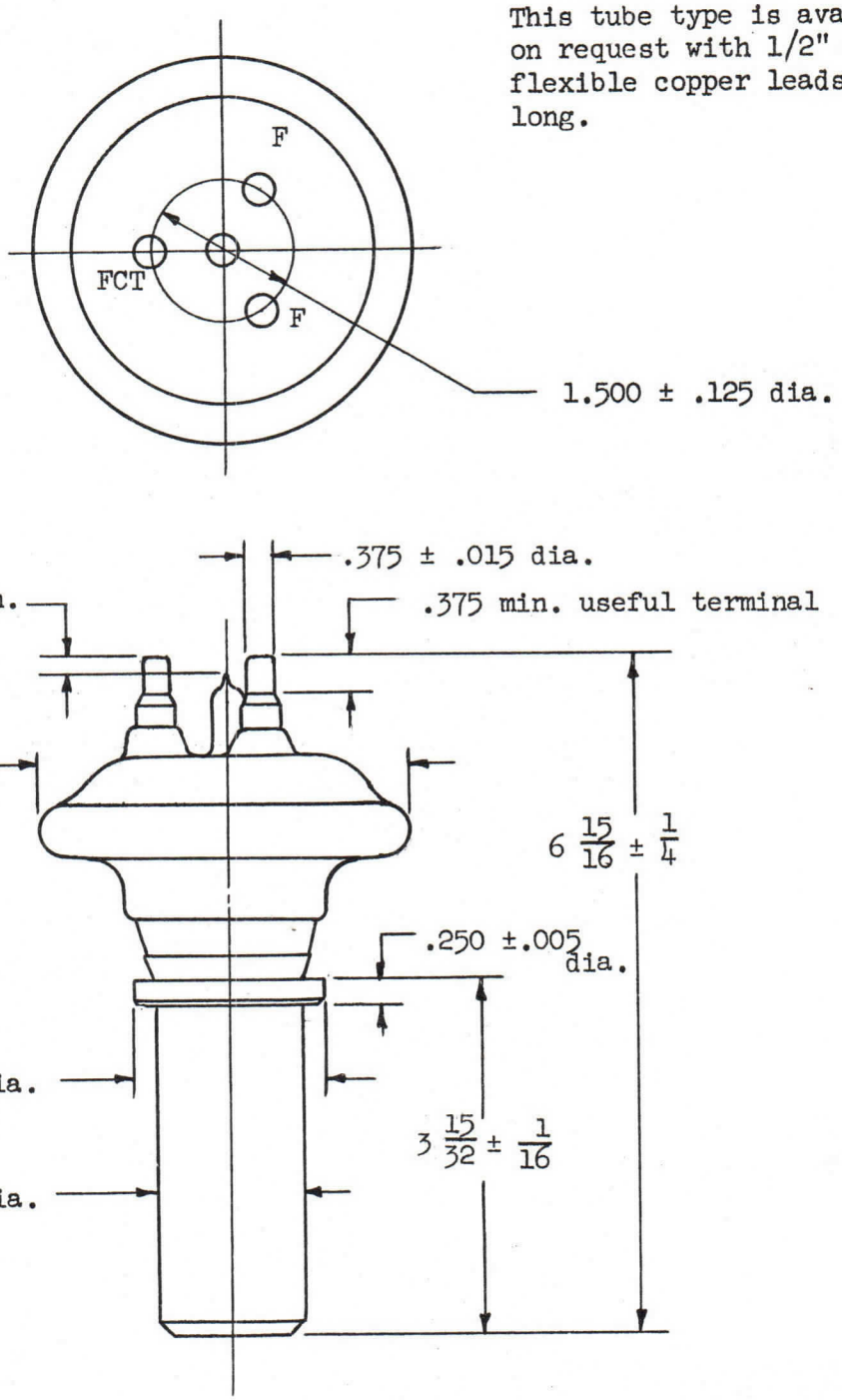
PLATE CHARACTERISTICS
F-7100, F-8207 and F-8207J
POWER DIODES
PLATE AMPERES
110
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
PLATE KILOVOLTS
PLATE AMPERES
20
18
16
14
12
10
8
6
4
2
0
100
200
300
400
500
600
700
PLATE VOLTS

3-62

Color Code

Fil. Term. - Yellow
Fil. C. Term. - Red

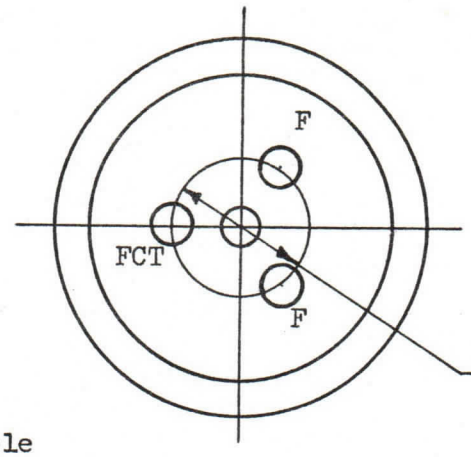
This tube type is available on request with 1/2" wide flexible copper leads, 6" long.



OUTLINE
F-8207 POWER DIODE

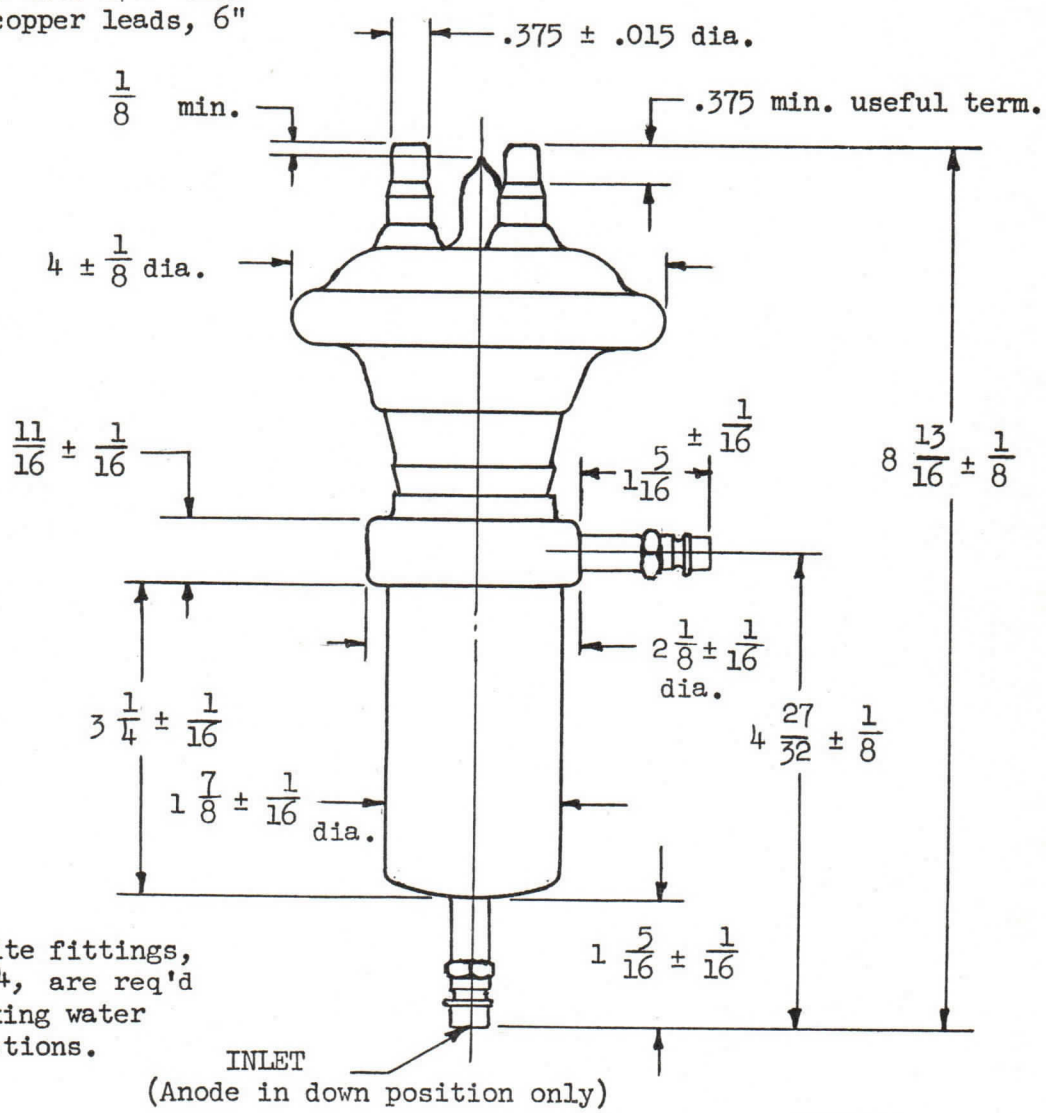
Color Code

Fil. Term. - Yellow
Fil. C. Term. - Red



1.500 ± .125 dia.

This tube type is available on request with 1/2" wide flexible copper leads, 6" long.



NOTE-Snaptite fittings, BPHC-4, are req'd in making water connections.

OUTLINE
F-8207J POWER DIODE

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

F-8208 *
POWER
DIODE

DESCRIPTION

The F-8208 is a high vacuum diode designed for rectifier service or in special circuits wherever the limited emission characteristics of the pure tungsten cathode is desirable. The anode is cooled with circulating water and is capable of dissipating 20 kilowatts during Continuous Commercial Service. The high thermal inertia of the heavy wall external anode protects against tube damage during momentary overload conditions. The cathode is a pure tungsten filament of rugged bifilar helix construction.

ELECTRICAL

Filament Voltage	22	volts
Filament Current	60	amperes
Filament Starting Current, max.	120	amperes
Filament Cold Resistance	.031	ohms
Inter-Electrode Capacitance	13	μμf

MECHANICAL

Mounting Position	Vertical, Anode down	
Type of Cooling	Circulating water	
Min. Water Flow on Anode	4	gpm
Max. Outgoing Water Temperature	70	°C
Max. Glass and Seal Temperature ++	180	°C
Net Weight, approx.	4.5	lbs.

++ Air flow up to 35 cfm may be required to hold the temperature of the glass and seals below 180°C. A temperature sensitive lacquer manufactured by the Tempil Corporation, 132 West 22nd St., New York 11, New York, is convenient for this measurement.

* Formerly our D-1047

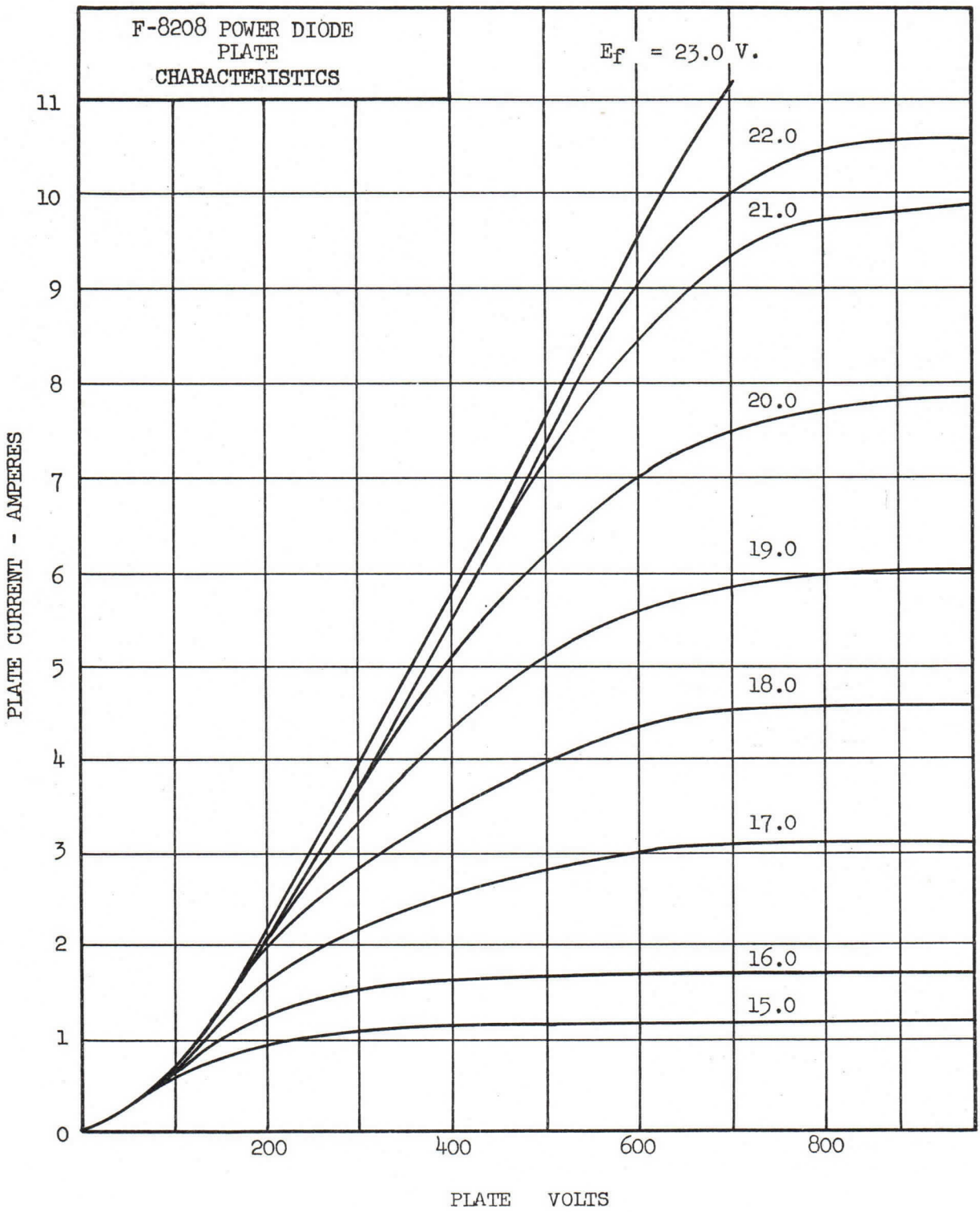
F-8208
POWER
DIODE

MAXIMUM RATINGS	Surge Limiting Diode Operation	Rectifier	
Peak Inverse Voltage	45	45	kilovolts
Peak Plate Current	10	10	amperes
Average Plate Current	-	3	amperes
Average Plate Dissipation	20	20	kilowatts
Peak Forward Voltage	50	-	kilovolts
Peak Plate Dissipation **	40	40	kilowatts

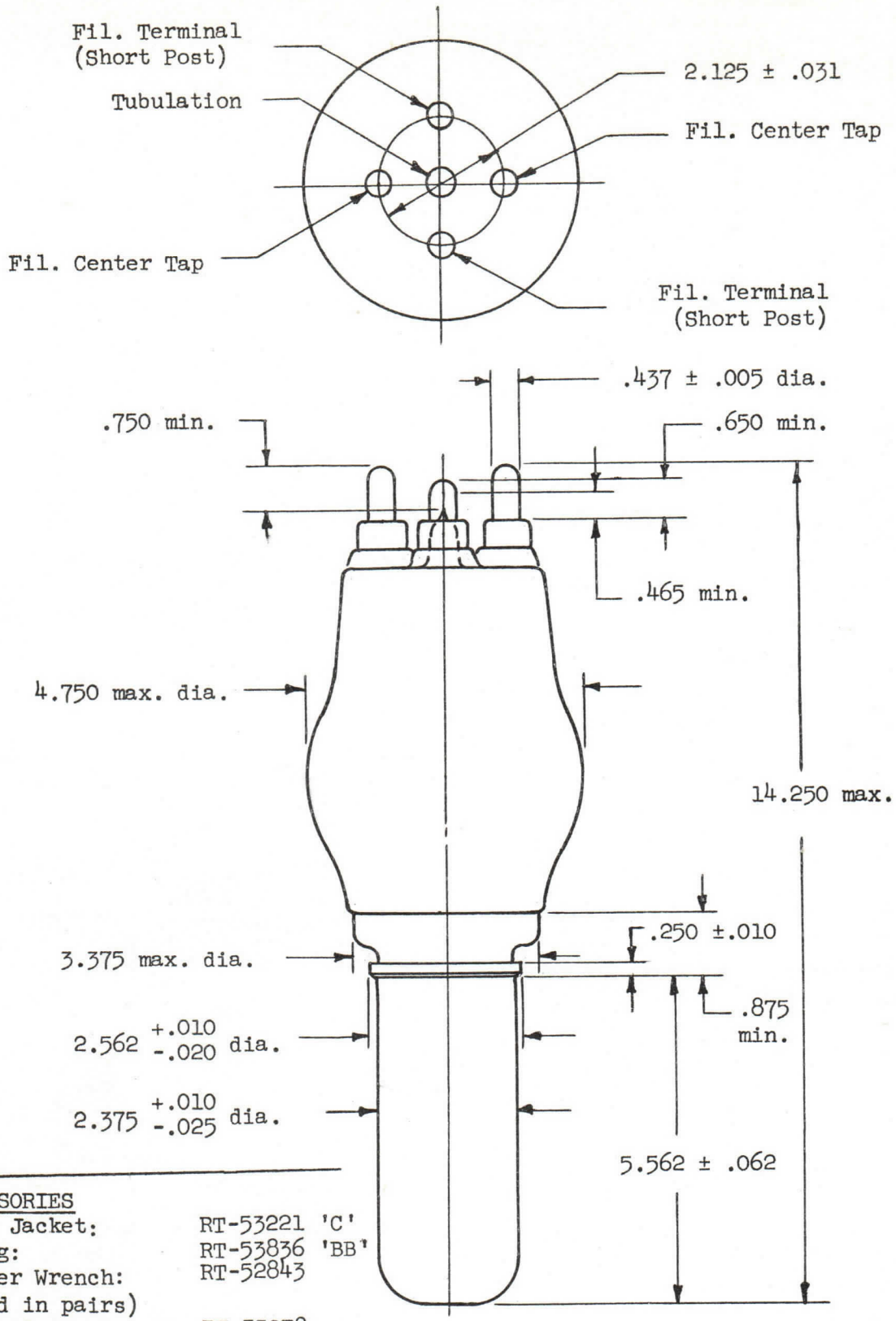
** Shall not exceed 5 seconds in duration.

Additional information for specific applications can be obtained from:

ITT Components Division
Electron Tube Applications Section
P.O. Box 412
Clifton, New Jersey



ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



ACCESSORIES

Water Jacket:	RT-53221 'C'
O-Ring:	RT-53836 'BB'
Spanner Wrench: (used in pairs)	RT-52843
Terminal Connector: (2 required)	RT-53978

OUTLINE
F-8208 POWER DIODE

D1008
D1011
D1022
D1026
D1028
D1033
D1037
D1038
D1041

Dr. Ann-Roach's copy

ENGLISH ELECTRIC VALVE CO.LTD.

Chelmsford, Essex, England.

PHYSICAL SOCIETY EXHIBITION, 1960.

HIGH VACUUM VARIABLE CAPACITORS

The High Vacuum Variable Capacitors being shown at the Physical Society Exhibition are development samples of entirely new products soon to be added to the Catalogue of the English Electric Valve Co. Ltd.

A special feature of these capacitors is their small physical size relative to their high voltage rating. This is made possible by the use of a vacuum dielectric which also enables the capacitors to stand breakdowns caused by temporary voltage overloads without damage.

Over the specified range, the capacitance of each type varies linearly with the rotation of the capacitor shaft and the precision of the construction ensures a high degree of accuracy in the capacitance change produced by each turn.

The capacitance range extends slightly above and below the limits specified below but the capacitance variation in the region below the bottom limit is not linear.

A summary of the major characteristics of each type is given below; additional information is available on request.

EEV Type	Linear Capacitance Range (pF)	Shaft Turns In Linear Capacitance Range	Maximum Peak R.F. Voltage (kV)	Maximum R.F. Current (A.r.m.s.)	Max. Length (ins.)	Max. Bulb Dia. (ins.)
U30/15	5 to 30	10·4	15	10(up to 30Mc/s)	6·500	2·000
U50/15	8 to 50	10·4	15	15(up to 30Mc/s)	6·500	2·750
U80/15	10 to 80	10·4	15	20(up to 30Mc/s)	6·500	3·187
U200/10	15 to 200	16	10	20(up to 20Mc/s)	9·250	2·500

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

D-1027A
POWER
TRIODE

PRELIMINARY SPECIFICATION

DESCRIPTION

The D-1027A is a general purpose metal and ceramic triode for use as an amplifier, oscillator or Class B modulator under CW or pulsed conditions. The anode is capable of dissipating 60 kilowatts during Continuous Commercial Service. Cooling is accomplished by circulating water on the anode and forced air on the ceramic and coaxial seals. The cathode is thoriated tungsten of mesh construction and may be operated on d-c or single phase a-c.

ELECTRICAL

Filament Voltage	11	volts
Filament Current	210	amperes
Filament Starting Current	800	amperes
Filament Heating Time, minimum	15	seconds
Amplification Factor		
E_c = -50 volts; I_b = 3 amperes	17	
Direct Inter-Electrode Capacitance		
Grid-Plate	65	μμf
Grid-Filament	90	μμf
Plate-Filament	5.5	μμf

MECHANICAL

Mounting Position			Vertical	
Type of Cooling			Water and Forced Air	
Water Flow on Anode				
Plate Dissipation	20	40	60	kilowatts
Minimum Water Flow	8	20	30	gpm
Water Jacket Pressure Drop	2	8	15	psi
Max. Outgoing Water Temperature			70°	C
Max. Water Pressure			80	psi
Ceramic and Seal Temperature, max. (Note 1 & 2)			250°	C
Weight, approx.			23	lbs.

Note 1: Auxiliary air flow of up to 150 cfm may be required to limit the ceramic and seal temperature to less than the 250° C maximum.

Note 2: A temperature sensitive lacquer manufactured by the Tempil Corporation, 132 West 22nd St., New York 11, N.Y. is convenient for this measurement.

Radio-Frequency Power Amplifier and Oscillator - Class C Telegraphy
(Key down conditions per tube without amplitude modulation *)

Maximum Ratings, Absolute Values

D-C Plate Voltage	14,000	volts
D-C Grid Voltage	-3,000	volts
D-C Plate Current	12	amperes
D-C Grid Current	1.6	amperes
Plate Input	120	kilowatts
Plate Dissipation	60	kilowatts

Typical Operation	Cathode Drive	Grid Drive		
D-C Plate Voltage	10,000	10,000	12,500	volts
D-C Grid Voltage	-1,100	-1,100	-1,300	volts
Peak R-F Grid Voltage	1,475	1,475	1,650	volts
Peak R-F Plate Voltage	8,000	8,000	10,000	volts
D-C Plate Current	7.4	7.4	7.9	amperes
D-C Grid Current	1.0	1.0	.85	amperes
R-F Load Resistance	690	580	700	ohms
Driving Power, approx.	11,600	1,475	1,400	watts
Power Output, approx.	65	55	72	kilowatts

* Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

RATINGS VERSUS FREQUENCY

Maximum ratings apply up to 50 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as above). Special attention should be given to adequate ventilation of the ceramics and seals at these frequencies.

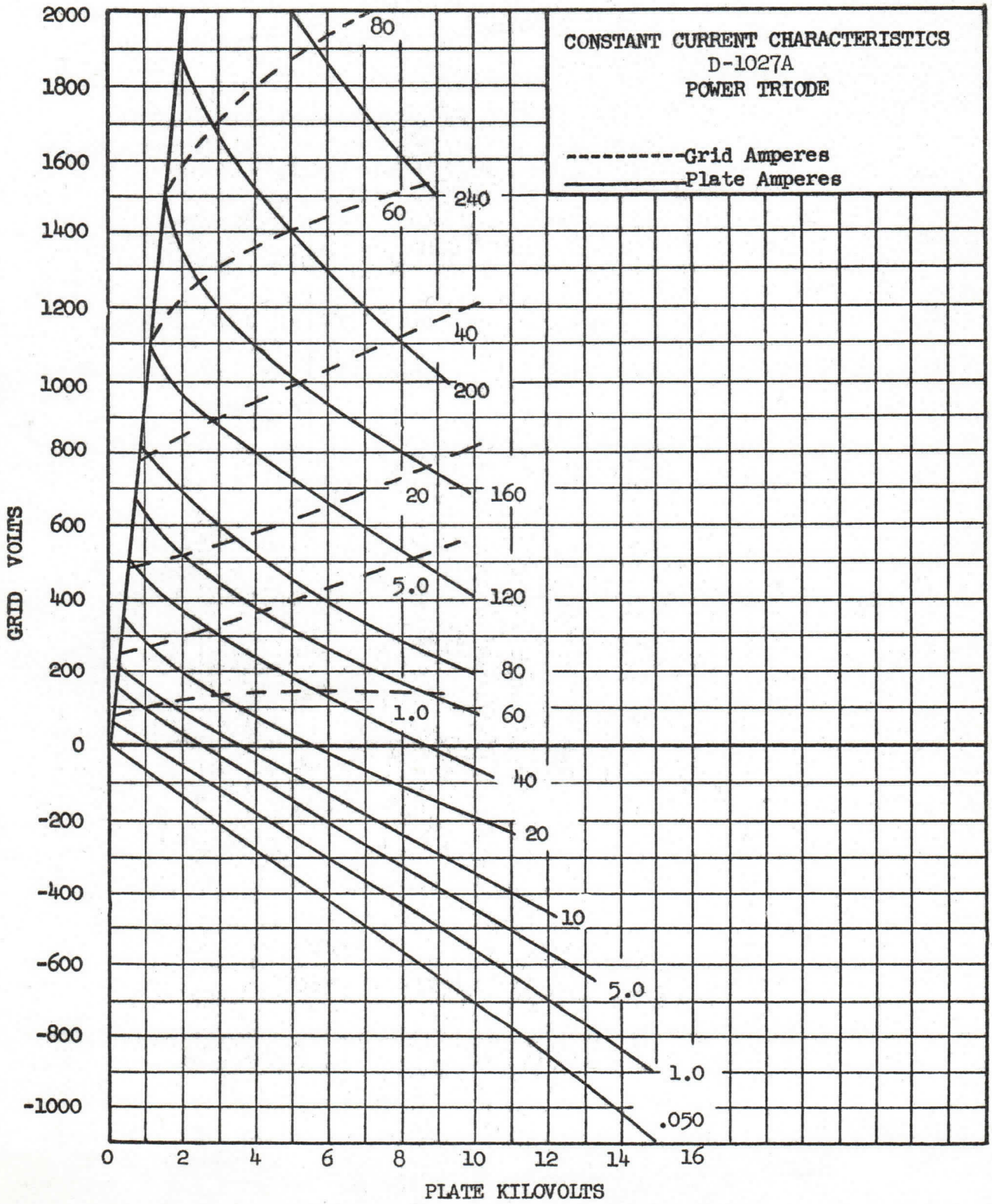
Frequency	50	110	megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input	100	70	per cent

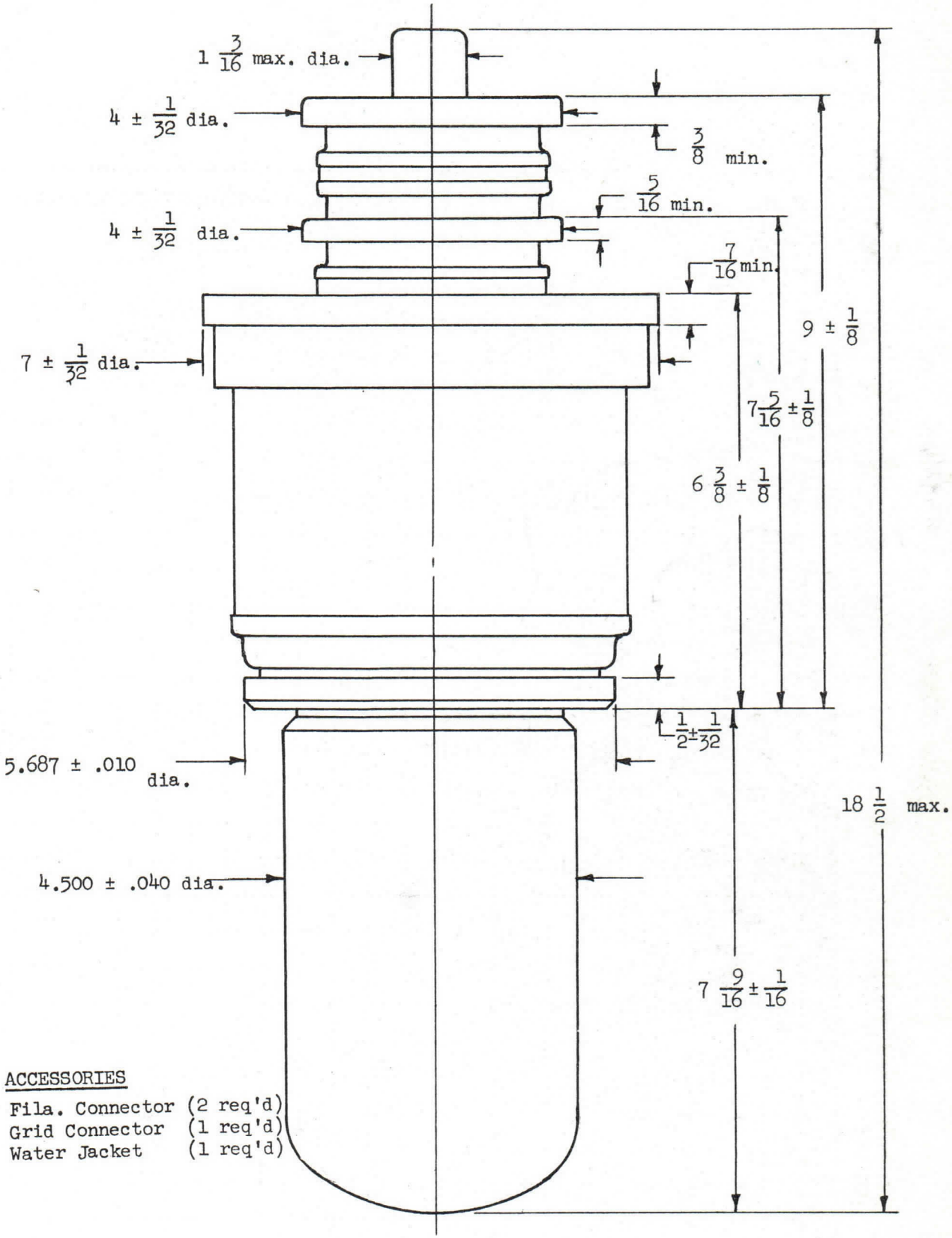
PULSE SERVICE OPERATIONS

In pulse r-f amplifier service, it is possible to operate the tube under conditions not permissible in CW operation. Because of the wide variety of operating conditions, it is advisable that tube operation recommendations be obtained from our Engineering Department for specific conditions.

Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey


CONSTANT CURRENT CHARACTERISTICS
D-1027A
POWER TRIODE
----------Grid Amperes
_____Plate Amperes
GRID VOLTS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
0
2
4
6
8
10
12
14
16
PLATE KILOVOLTS
80
60
240
40
200
20
160
5.0
120
80
1.0
60
40
20
10
5.0
1.0
.050



ACCESSORIES

Fila. Connector	(2 req'd)
Grid Connector	(1 req'd)
Water Jacket	(1 req'd)

OUTLINE
D-1027A POWER TRIODE

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY