

Federal Telephone and Radio Corporation 591 BROAD STREET, NEWARK 2, NEW JERSEY, U.S.A.



WATER COOLED

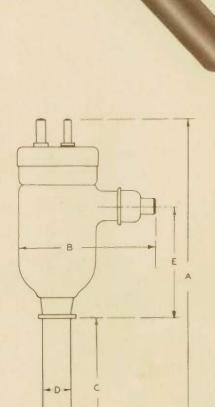
5 KW PLATE DISSIPATION

F-328-A

ТҮРЕ	F-328-A	F-328-B	129-В
DESCRIPTION	GENERAL PURPOSE	GENERAL PURPOSE	HIGH FREQ. R.F. AMPLIFIER
MAX. PLATE DISSIPATION	5 KW	5 KW	5 KW
MAX. PLATE INPUT	10 KW	10 KW	18 KW
MAX. D.C. PLATE VOLTAGE	8000 V	8000 V	12,000 V
MAX. D.C. PLATE CURRENT	1.5 A	1.5 A	2.0 A
MAX. FREQUENCY FOR MAX. RATINGS	3 MC	3 MC	50 MC
AMPLIFICATION FACTOR (MU)	16	16	26
FILAMENT VOLTAGE	21.5 V	21.5 V	18 ∨
DIMENSION A	17 11/16"	17 5/16"	13 5/8"
DIMENSION B	7 1/16″	7 1/16″	4 15/16"
DIMENSION C	7 3/16"	7 3/16"	4"
DIMENSION D	1.480″	1.480″	2.022″
DIMENSION E	6"	6"	4 5/16"

RATINGS FOR CLASS C TELEGRAPH OPERATION

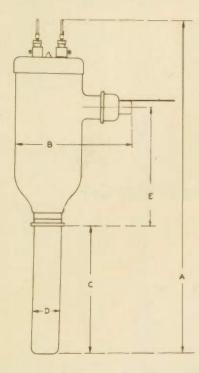
129-B

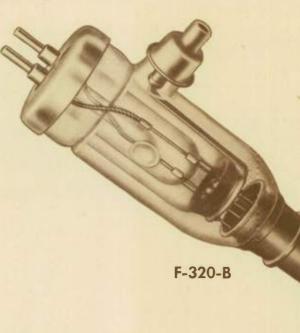


F-328-B

World Radio History

WATER COOLED 6 AND 10 KW PLATE DISSIPATION





F-207	
1 AM	
	M D
Y TOKY	N 1
NA CY	N V
MISHTY	M C
MAD//	M F(
	A F/
Star	FI V
	D
	D
F-863	D
F-848	DI
	DI

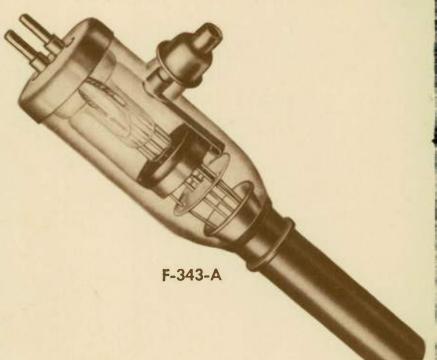
ТҮРЕ	F-207	F-207 F-848		F-320-B
DESCRIPTION	GENERAL PURPOSE	MODULATOR OR R.F. AMPLIFIER	R.F. AMPLIFIER OR CLASS B MODULATOR	GENERAL PURPOSE
MAX. PLATE DISSIPATION	10 KW	6 KW	10 KW	10 KW
MAX. PLATE INPUT	30 KW	18 KW	30 KW	22.5 KW
MAX. D.C. PLATE VOLTAGE	15,000 ∨	12,000 V	15,000 V	15,000 ∨
MAX. D.C. PLATE CURRENT	2.0 A	2.0 A	2.0 A	1.5 A
MAX. FREQUENCY FOR MAX. RATINGS	1.5 MC	1.6 MC	1.5 MC	4.0 MC
AMPLIFICATION FACTOR (MU)	20	8	50	40
FILAMENT VOLTAGE	22 V	22 V	22 V	21.5 V
DIMENSION A	27 5/16"	27 5/16"	27 5/16"	20″
DIMENSION B	7 1/16″	7 9/16"	7 9/16"	7 1/16"
DIMENSION C	8 1/16"	8 1/16″	8 1/16"	7 7/32"
DIMENSION D	1.580″	1.580″	1.580″	2.022"
DIMENSION E	7 9/16"	7 9#16"	7916"	7 17/32"

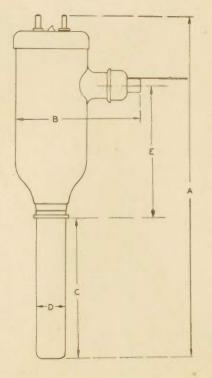
RATINGS FOR CLASS C TELEGRAPH OPERATION

WATER COOLED 6 AND 10 KW PLATE DISSIPATION

ТҮРЕ	F-343-A	F-891	F⊳892
DESCRIPTION	GENERAL PURPOSE		
MAX. PLATE DISSIPATION	10 KW	6 KW	10 KW
MAX. PLATE INPUT	25 KW	18 KW	30 KW
MAX. D.C. PLATE VOLTAGE	15,000 ∨	12,000 V	15,000 ∨
MAX. D.C. PLATE CURRENT	2.0 A	2.0 A	2.0 A
MAX. FREQUENCY FOR MAX. RATINGS	4.0 MC	1.6 MC	1.5 MC
AMPLIFICATION FACTOR (MU)	40	8	50
FILAMENT VOLTAGE	21.5 V	11/22 V	11/22 V
DIMENSION A	20 7/32"	19 7/8"	19 7/8"
DIMENSION B	7 1/16″	7 1/16"	7 1/16"
DIMENSION C	7 7/32"	8 1/16"	8 1/16"
DIMENSION D	2.022″	1.580″	1.580″
DIMENSION E	7 3/8"	7 9/16″	7 9/16"

RATINGS FOR CLASS C TELEGRAPH OPERATION

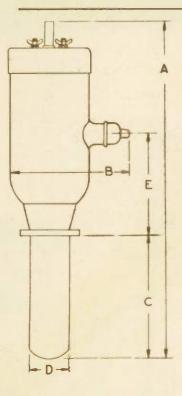




F-891

F-892

WATER COOLED 20 AND 25 KW PLATE DISSIPATION



F-893

TYPE	F-893	F-858	F-342-A	F-110-X
IIFS	F-075		1-942-8	
DESCRIPTION	GENERAL PURPOSE	OSCILLATOR OR R.F. AMPLIFIER	GENERAL PURPOSE	R.F. AMPLIFIER & OSCILLATOR
MAX. PLATE DISSIPATION	20 KW	20 KW	25 KW	25 KW
MAX. PLATE	70 KW	40 KW	50 KW	50 KW
MAX D.C. PLATE VOLTAGE	20,000 V	20,000 V	20,000 V	20,000 V
MAX. D.C. PLATE CURRENT	4.0 A	2.0 A	3.0 A	2.5 A
MAX. FREQUENCY FOR MAX. RATINGS	5 MC	1.5 MC	4.0 MC	3 MC
AMPLIFICATION FACTOR (MU)	36	42	40	40
FILAMENT VOLTAGE	10 V per strand	22 V	20 V	28 V
DIMENSION A	25 5/8"	24 1/2"	21 9/32"	23″
DIMENSION B	9 1/16″	8 1/4″	7 3/16″	7 1/16″
DIMENSION C	9 1/4"	9 1/4"	7 7 32"	8 3/4"
DIMENSION D	3 3/16‴	3 3/16″	2.022″	2.000″

F-858

RATINGS FOR CLASS C TELEGRAPH OPERATION

7 7/8"

9 9/16"

7 3/4"

DIMENSION E

F-110-X

61/4"

F-342-A

WATER COOLED 40 AND 100 KW PLATE DISSIPATION

ТҮРЕ	F-124-A	F-125-A*	F-862
DESCRIPTION	GENERAL PURPOSE	AUDIO AMPLIFIER	R.F. AMPLIFIER OR CLASS B MODULATOR
MAX. PLATE DISSIPATION	40 KW	40 KW	100 KW
MAX. PLATE INPUT	135 KW	100 KW	200 KW
MAX. D.C. PLATE VOLTAGE	20,000 V	15,000 ∨	20,000 V
MAX. D.C. PLATE CURRENT	7.0 A	10.0 A	10.0 A
MAX. FREQUENCY FOR MAX. RATINGS	20 MC		1.6 MC
AMPLIFICATION FACTOR (MU)	42	4.75	48
FILAMENT VOLTAGE	13.6 V per strand	13.6 V per strand	33 V
DIMENSION A	25 11/16"	25 11 16"	60 3/8"
DIMENSION B	8 7 / 8"	878"	10″
DIMENSION C	91/4"	91/4"	37 1 /4"
DIMENSION D	3 1 / 4"	3 1 4"	4 3 16"
DIMENSION E	7 3/4"	734"	13″

RATINGS FOR CLASS C TELEGRAPH OPERATION UNLESS OTHERWISE STATED.

*RATINGS FOR CLASS A-B MODULATOR.

F-125-A

F-124-A

+D+

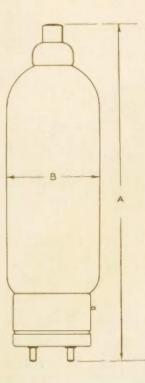
C

B

AIR COOLED

125 TO 400 W. PLATE DISSIPATION

F-127-A



F-123-A

F-212-E

F-84	9				
TYPE	F-123-A	F-127-A	F-204-A	F-212-E	F-849
DESCRIPTION	GENERAL PURPOSE	GENERAL PURPOSE	GENERAL PURPOSE	GENERAL PURPOSE	GENERAL PURPOSE
MAX. PLATE DISSIPATION	125 W	200 W	250 W	275 W	400 W
MAX. PLATE INPUT	375 W	950 W	690 W	700 W	875 W
MAX. D.C. PLATE VOLTAGE	2000 V	3000 V	2500 V	2000 V	2500 V
MAX. D.C. PLATE CURRENT	.250 A	.325 A	.275 A	.350 A	.350 A
MAX. FREQUENCY FOR MAX. RATINGS	30 MC	30 MC	3 MC	4.5 MC	3.0 MC
AMPLIFICATION FACTOR (MU)	14.5	38	23	16	19
FILAMENT VOLTAGE	10 V	10 V	11 V	14 V	11 V
DIMENSION A	8 1/2″	9 5/8"	14 1/4"	13 5/8"	14 1/4"
DIMENSION B	2 5/16"	3 1/32"	4 1/16"	3.421″	4 1/16"

RATINGS FOR CLASS C TELEGRAPH OPERATION

F

F-204-A

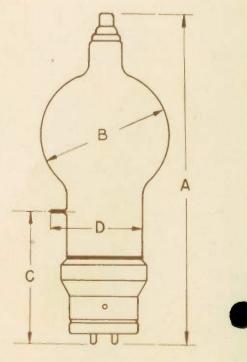
AIR COOLED 450 TO 700 W. PLATE DISSIPATION

TYPE	F-450 TH	F-128-A	F-132-A*
DESCRIPTION	GENERAL PURPOSE	OSCILLATOR OR R. F. AMPLIFIER	AUDIO AMPLIFIER
MAX. PLATE DISSIPATION	450 W	700 W	600 W
MAX. PLATE INPUT	2500 W	3000 W	
MAX. D.C. PLATE VOLTAGE	6000 V	3500 ∨	3500 V
MAX. D.C. PLATE CURRENT	.500 A	1.0 A	
MAX. FREQUENCY FOR MAX. RATINGS	40 MC	30 MC	
AMPLIFICATION FACTOR (MU)	38	36	10
FILAMENT VOLTAGE	7.5 V	11 V	11 V
dimension a	1278"	15 1 2"	1512"
DIMENSION B	5 1 32"		
DIMENSION C	5 1 16"	612"	9"
DIMENSION D		8″	8″

F-132-A

RATINGS FOR CLASS C TELEGRAPH OPERATION UNLESS OTHERWISE STATED

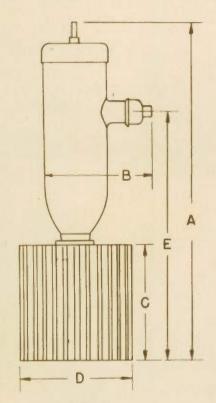
*MAXIMUM RATINGS FOR USE AS PUSH PULL CLASS A DRIVER FOR 2 TYPE F-125-A TUBES.



F-450 TH

AIR COOLED

4 TO 10 KW PLATE DISSIPATION



F-343-R



F-892-R





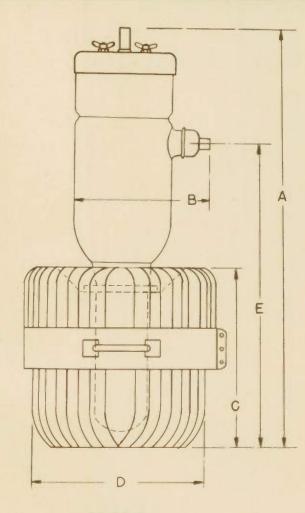
TYPE	F-129-R	F-891-R	F-892-R	F-343-R	F-342-R
DESCRIPTION	HIGH FREQUENCY R. F. AMPLIFIER	MODULATOR OR R. F. AMPLIFIER	R. F. AMPLIFIER OR CLASS B MODULATOR	GENERAL PURPOSE	GENERAL PURPOSE
MAX. PLATE DISSIPATION	5 KW	4 KW	4 KW	10 KW	10 KW
MAX. PLATE INPUT	18 KW	15 KW	18 KW	25 KW	50 KW
MAX. D.C. PLATE VOLTAGE	12,000 V	10,000 V	10,000 V	1 <i>5,</i> 000 V	20,000 V
MAX. D.C. PLATE CURRENT	2.0 A	2.0 A	2.0 A	2.0 A	3.0 A
MAX. FREQUENCY FOR MAX. RATINGS	50 MC	1.6 MC	1.5 MC	4.0 MC	4.0 MC
AMPLIFICATION FACTOR (MU)	26	8	50	40	40
FILAMENT VOLTAGE	18 V	11/ 22 V	11/22 V	21.5 V	20 V
DIMENSION A	14 1/18*	21 1/16"	21 1/16"	20 15/32"	21 17/32"
DIMENSION B	4 15/16"	7 1/16″	7 1/16"	7″	7″
DIMENSION C	5 1/2"	10″	10″	7 15/32"	7 15/32"
DIMENSION D	5 7 / 18'''	7 1/2″	7 1/2″	7 7/32"	7 7/32″
DIMENSION E	8 13/16"	16 13/16"	16 13 ⊮ 16″	14 27/32"	17 1/32"

RATINGS FOR CLASS C TELEGRAPH OPERATION

AIR COOLED

20 KW PLATE DISSIPATION

ТҮРЕ	F-893-R
DESCRIPTION	GENERAL PURPOSE
MAX. PLATE DISSIPATION	20 KW
MAX. PLATE INPUT	70 KW
MAX. D.C. PLATE VOLTAGE	20,000 V
MAX. D.C. PLATE CURRENT	4.0 A
MAX. FREQUENCY FOR MAX. RATINGS	5 MC
AMPLIFICATION FACTOR (MU)	36
FILAMENT VOLTAGE	10 V per strand
DIMENSION A	26 7/8″
DIMENSION B	9 1/16″
DIMENSION C	12 7/8″
DIMENSION D	11 5/8"
DIMENSION E	18 1/4"



F-893-R

RECTIFYING TUBES

MERCURY VAPOR

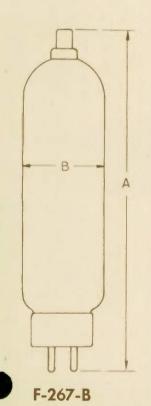
5 VOLT FILAMENT

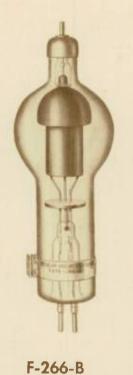
	TYPE	F ≕800 8	F-267-B	F-872-A	F-315-A	F-375-A	F-869-B	F-857-B	F-266-B
	MAX. PEAK INVERSE VOLTAGE	10,000 V	10,000 V	10,000 V	12,500 V	12,500 V	20,000 ∨	22,000 V	22,000 V
	MAX. PEAK CURRENT (Amperes)	5.00	5.00	5.00	7.00	7.00	10.00	40.00	40.00
	FILAMENT VOLTAGE	5 V	5 V	5 🗸	5 V	5 🗸	5 ∨	5 V	5 V
	LENGTH	8 3/4"	8 3/4"	8 1/2"	12 1/4"	10 1/2"	14 1/4"	19 7/8"	21 3/4"
Page 10	DIAMETER	2 1/4"	2 1/4"	2 1/4"	3 3/4" rld Radio History	3 3/4"	5 1/16"	7 1/8″	7 1/8″

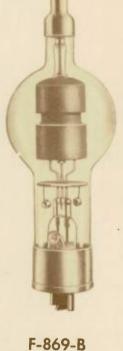
RECTIFYING TUBES

MERCURY VAPOR

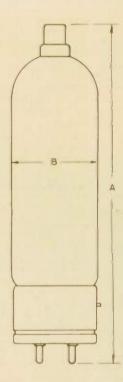
5 VOLT FILAMENT



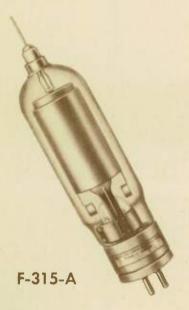


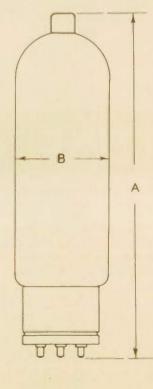






F-8008







F-872-A

World Radio History

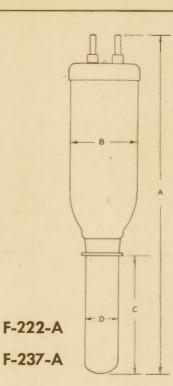
RECTIFYING TUBES

WATER COOLED

HIGH VACUUM

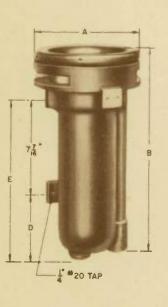
F-222-A	F-237-A	F-214-A
50,000 V	50,000 ∨	50,000 V
5.50	8.00	7.5
21.5 V	20 V	22 V
20″	20″	20″
4 1/16"	4 1/16"	<u>4</u> 1/16"
7 7/32″	7 7/32"	8 1/16"
2.022″	2.022″	1.580″
	50,000 ∨ 5.50 21.5 ∨ 20″ 4 1/16″ 7 7/32″	50,000 ∨ 50,000 ∨ 5.50 8.00 21.5 ∨ 20 ∨ 20" 20" 4 1/16" 4 1/16" 7 7/32" 7 7/32"

WATER JACKETS





F-214-A



WATER JACKET NUMBER		TUBE PES	Ā	В	DIMENSIONS C	D	P
1000	F-207 F-848 F-863-A	F-891 F-892 F-214-A	61/2"	12 5/8″	2 3/4″	1 1/2″	
1001		110-X	61/4"	12″	2 1/8″	11/2″	
1005	F-320-B F-222-A F-237-A	F-343-A F-342-A	61/4″	113/4″	2 9/16″	1 1/2″	
1006	F-328-A	F-328-B	5 13/16″	117/8″	2 1 / 4″	11/2″	
1010	F-124-A F-893	F-125-A F-858	7 1/2″	15 3/8″	37/8" ·	3 13/32″	
1012	F-129-B		5 3/8″	7 1/2″	27/8*		47/8"
DIMENSION	C = DISTA	NCE FROM	FACE OF M	OUNTING T	AB TO CENT	ER LINE OF	JACKET.

When Federal transmitting tubes are used in industrial heating oscillator applications the regular Class C Telegraph maximum ratings given in the catalog sheet will apply. THE "MAXIMUM RATINGS" SPECIFIED FOR ANY TUBE TYPE ARE ABSOLUTE MAXIMUM CONDITIONS THAT MUST NOT BE EXCEEDED UNDER ANY LOAD CON-DITION TO BE ENCOUNTERED IN THE FIELD. This means that in most industrial heating applications the "normal load" condition must be set at some level considerably below the rated maximum conditions. In practice the actual level of "normal" operation will be determined by the particular circuit design chosen and the protective features incorporated. Particular care should be given to limiting the grid current rise when the plate circuit load is removed as well as to limiting the plate dissipation to a value below the rated maximum for all load conditions to be encountered.

A guarantee can be given only on Federal tubes used in equipment observing the precautions mentioned above.



Federal Telephone and Radio Corporation 591 BROAD STREET, NEWARK 2, NEW JERSEY, U.S.A. World Radio History



Vacuum Tube Products

TUBE PRICE LIST

Effective April 1, 1946

ТҮРЕ	PRICE	DESCRIPTION	Maximum Plate Dissipation	Mu	Maximum Plate Input	Maximum DC Plate Voltage	Maximum Frequency for Maximum Ratings	Filament Voltage
F-328-A	\$249.00	General Purpose	5 KW	16	8 K W	8,000 V	3 MC	21.5 V
F-328-B	249.00	General Purpose	-		0	0.000		
5 100 B		(Two Phase Filament)	5	16	8	8,000	3	21.5
F-129-B	300.00	VHF Amplifier and Oscillator	5	26	18	12,000	50	18
F-889	160.00	VHF Amplifier	5	10		12,000	50	10
		and Modulator	5	21	16	8,500	50	11
F-891	170.00	Modulator or						
22		R.F. Amplifier	6	8	18	12,000	1.6	11/22
F-848	325.00	Modulator	6	8	18	12,000	1.6	22
F-207	220.00	General Purpose	10	20	30	15,000	1.5	22
F-320-B	290.00	General Purpose	10	40	22.5	15,000	4.0	21.5
F-343-A	290.00	General Purpose	10	40	25	15,000	4.0	21.5
F-863	325.00	Modulator or						1000
		R.F. Amplifier	10	50	30	15,000	1.5	22
F-892	170.00	R.F. Amplifier or	10	50	20	15.000		
5 000	450.00	Modulator	10	50	30	15,000	1.5	11/22
F-893 F-858	450.00	General Purpose	20	36	70	20,000	5	10 per strand
F-838	275.00	Oscillator or R.F. Amplifier	20	42	40	20,000	1.5	22
F-342-A	480.00	General Purpose	25	40	50	20,000	4.0	20
F-124-A	700.00	General Purpose	40	42	135	20,000	20	13.6 per strand
F-125-A	800.00	Audio Amplifier	40	4.75	100	15,000		13.6 per strand
F-862-A	750.00	R.F. Amplifier				-,		i i i e per i i una
		or Modulator	100	48	200	20,000	1.6	33

TRANSMITTING TUBES — WATER COOLED

WATER JACKETS

TYPE	DESCRIPTION	PRICE
F-1000	(For F-207, F-848, F-863, F-891, F-892)	\$ 50.00
F-1005	(For F-320-B, F-343-A, F-342-A, F-222-A, F-237-A)	50.00
F-1006	(For F-328-A, F-328-B)	50.00
F-1010	(For F-893, F-858, F-124-A, F-125-A)	150.00
F-1012	(For F-129-B)	50.00

Inquiries are invited concerning tubes for specific applications not included herein.

Copyright 1946, Federal Telephone and Radio Corporation

Vacuum Tube Products



TUBE PRICE LIST

Effective April 1, 1946

TRANSMITTING TUBES — AIR COOLED

ТУРЕ	PRICE	DESCRIPTION	Maximum Plate Dissipation	Mu	Maximum Plate Input	Maximum DC Plate Voltage	Maximum Frequency for Maximum Ratings	Filament Voltage
F-123-A	\$17.50	General Purpose	125 W	14.5	375 W	2,000 V	30 MC	10 V
F-127-A	40.00	General Purpose	200	38	950	3,000	30	10
F-204-A	85.00	Oscillator, R.F. Ampli-		- G -				
	2	fier, or Modulator	250	23	690	2,500	3	11
F-212-E	70.00	General Purpose	275	16	700	2,000	4.5	14
F-849	120.00	General Purpose	400	19	875	2,500	3.0	11
F-450TH	60.00	General Purpose	450	38	3 K W	6,000	40	7.5
F-128-A	150.00	Oscillator or R.F.						
		Amplifier	600	36	3	3,500	30	11
F-132-A	200.00	Audio Amplifier	600	10	18	3,500		11
7C 25	87.50	Industrial	2.5 KW	25	5.6	4,500	50	11
F-891-R*	315.00*	Modulator or R.F.						
		Amplifier	4	8	15	10,000	1.6	11/22
F-892-R	315.00*	R.F. Amplifier or						
		Modulator	4	50	18	10,000	1.5	11/22
F-129-R*	375.00*	High Frequency R.F.						
		Amplifier	5	26	18	12,000	50	18
F-889-R	280.00*	R.F. Amplifier and						
		Modulator	5	21	16	8,500	25	11
F-343-R	440.00*	General Purpose	10	40	25	15,000	4.0	21.5
F-342-R	630.00*	General Purpose	10	40	50	20,000	4.0	20
F-124-R	950.00*	General Purpose	20	42	100	20,000	20	13.6 per strand
F-893-R	800.00*	General Purpose	20	36	70	20,000	- 5	10 per strand

*Credit allowed for return of radiator and crate in good condition as follows: in case of F-129-R, F-889-R, \$50.00; in case of F-891-R and F-892-R, \$100.00; in case of F-342-R and F-343-R, \$125.00; in case of F-124-R and F-893-R, \$200.00.

RECTIFYING TUBES

ТҮРЕ	PRICE	DESCRIPTION	Maximum Peak Inverse Voltage	Maximum Peak Current (Amperes)	Filament Voltage
F-315-A	35.00	Mercury Vapor	15,000	6	5
F-575-A	30.00	Mercury Vapor	15,000	6	5
F-869-B	100.00	Mercury Vapor	20,000	10	5
F-857-B	160.00	Mercury Vapor	22,000	40	5
F-266-B	160.00	Mercury Vapor	22,000	40	5
F-873	12.00	Grid Controlled Mercury Vapor	10,000	10	5
F-214-A	250.00	Water Cooled-High Vacuum	50,000	7.5	22
F-222-A	220.00	Water Cooled-High Vacuum	50,000	5.5	21.5
F-237-A	435.00	Water Cooled-High Vacuum	50,000	8	20

Tubes are sold F.O.B. Factory or Warehouse, 2% — 10 days, net — 30 days. The foregoing prices do not exceed the applicable maximum prices, established by the O.P.A.

Federal Telephone and Radio Corporation

Vacuum Tube Products



Newark 4, New Jersey



Vacuum Tube Products

MERCURY VAPOR RECTIFIER TUBES

Suggestions for Use

PRINCIPLES OF OPERATION

The performance of the mercury vapor tube differs from that of the high vacuum thermionic tube principally in that the presence of the mercury vapor permits a comparatively low, and practically constant, voltage drop from anode to cathode in the conducting direction. This voltage drop will hereafter be referred to as the "space charge."

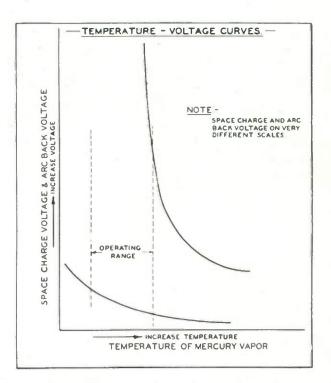
The space charge of the thermionic tube is dependent upon the configuration of the tube elements and the amount of current passing between the anode and cathode. These may result in variations of space charge from a few volts to several thousand volts. In the mercury vapor tube, however, the space charge is largely dependent upon the temperature of the mercury vapor which, within the allowable operating limits, may result in space charges of perhaps 8 to 20 volts regardless of the current drawn.

This space charge effect in the mercury vapor rectifier is, of course, negligible in comparison with the voltage output of a high voltage rectifier. It is important, therefore, only in connection with the effect this space charge may have on the tube itself.

In the lower curve shown in the accompanying illustration it is seen that the space charge is dependent upon the temperature of the mercury vapor in such a manner that the space charge increases as the temperature decreases. The heavy and comparatively immobile positively charged mercury vapor ions normally do not contribute to the space current, but if the vapor temperature becomes so low that the space charge exceeds what is considered a critical value of approximately 22 volts, the ions acquire sufficient velocity in the direction of the cathode to result in a damaging bombardment of the oxide coated cathode. This situation corresponds to a mercury vapor temperature somewhat less than 15°C.

If, on the other hand, the mercury vapor temperature is increased to avoid cathode disintegration, the effect of such increased temperature on the so-called "arcback" voltage must be considered. An arc-back is caused by the inverse voltage to which the tube is subjected during the non-conducting portion of the cycle.

The upper curve illustrated shows qualitatively the relation between mercury vapor temperature and the arc-



back voltage. This curve shows that as the temperature is increased beyond a point designated as the maximum allowable temperature, the arc-back voltage decreases very rapidly.

These curves do not have particular values of temperature or voltages noted since they are intended to apply generally to all sizes of mercury vapor tubes. The limiting conditions, however, can be taken from the published data for any particular type of tube.

In practice it is essential to know the relation between actual mercury vapor temperature and bulb temperature or, more specifically, the ambient temperatures and conditions of ventilation. It can be assumed that with unrestricted natural ventilation and with no other heat radiating bodies in the vicinity of the tube, the mercury vapor temperature will be approximately 15°C. higher than the ambient temperature for most tubes. With forced ventilation this difference in temperatures is considerably reduced.

Since most rectifier circuits involve the use of more than one tube, it usually becomes necessary to place one tube quite close to the other in order to conserve space. However, if the glass envelope of one tube is closer

Vacuum Tube Products



MERCURY VAPOR RECTIFIER TUBES

Suggestions for Use

than about 6" from that of any adjacent tube, heat radiation from both tubes is unfavorably affected and must be considered in relation to the range of ambient temperatures to which the rectifier will be subjected.

It is apparent from the two curves shown that if the temperature range is narrowed by the use of forced draft ventilation and control of air temperature, the factors of safety will be greatly increased. In certain applications forced ventilation is provided by simply using a propeller type fan. For installations where quite high voltages are involved, which is usually the case where the larger sizes of mercury vapor rectifier tubes are used, forced ventilation is best provided by a centrifugal blower whose output is distributed through metal tubing in such a manner that an air blast is directed on each tube in the vicinity of the glass just above the base.

To avoid distortion of the electrostatic field about the tubes, a piece of insulating tubing should be used for the section of pipe that is adjacent to the glass wall of each tube. Where several tubes are used, the air should be distributed evenly between the various outlets.

Since the presence of the ionized mercury vapor serves only to reduce the space charge, the source of electronic current must come from the cathode itself. The cathodes are designed to furnish ample emission for the peak current values published. If for any reason the emission is reduced, the space charge will increase as the actual emission is exceeded, and may result in disintegration of the cathode.

A more common cause of low filament emission is improper cathode temperature. Hence, it becomes extremely important that the filament shall always be maintained at its correct operating voltage when the plate voltage is applied. In installations where the source of power cannot be relied upon to maintain its voltage within plus or minus 5%, including the effect of regulation due to variations in load upon the rectifier, it is desirable to employ some form of automatic voltage regulator in the filament primary power supply.

The mercury vapor within the tubes is capable of ionization, not only by the electrostatic field between anode and cathode, but by electrostatic fields introduced by extraneous forces. These may have an objectionable effect upon the operation of the tube, particularly if they are due to a field varying at a radio frequency rate. Such a field may be produced either by direct radiation from a radio transmitter or antenna system, or by radio frequency currents introduced in leads involving the rectifier circuit. The installation of composite equipment consisting of the rectifier and some piece of radio equipment should be made, therefore, with provisions for shielding the mercury vapor tubes from radio frequency fields. Radio frequency filters should be installed where necessary to isolate the rectifier circuit from radio frequency clrcuits.

Installation

The tube should be mounted in a vertical position with the filament (large base) end down. It will fit readily into a standard socket. The mounting should be so arranged as to prevent mechanical shocks or vibration from being transmitted to the tube.

Except as otherwise noted the tube is designed to operate satisfactorily when the ambient temperature is not less than 15° C. (59° F.) and not more than 50° C. (122° F.). Ambient temperatures are measured, where a natural air circulation installation is made, with thermometers placed at various points opposite the filament base at distances of 3 to 6 feet.

If forced draft cooling is used, the ambient temperature is measured by a thermometer placed in the cooling air stream before the air reaches the tube. The glass bulb of the tube should not be near nor in contact with any metallic body or inflammable material, nor should it be subjected to drops or spray of any liquid.

Circuit Requirements

Proper overload protection against excessive currents, and safety interlock circuits to safeguard personnel should be employed in proportion to the power and voltage involved in the rectifier installation.

Proper overload protection involves the following relays which act to open the circuit breaker in the primary of the high voltage transformers: (1) Instantaneous overcurrent relays in the primary supply line which, in a three phase system, are placed in two of the three phase leads to insure operation when any one phase of the primary is overloaded, (2) an instantaneous over-



Vacuum Tube Products

MERCURY VAPOR RECTIFIER TUBES

current relay in the grounded side of the output (DC) circuit to operate in case of a 100% overload, and (3) a time delay overcurrent relay in the grounded side of the output circuit to operate on continued overload.

If the rectifier tubes are operated at peak inverse voltages exceeding 10,000 volts, the voltage to the primary of the high voltage transformers should be applied in steps. This may be accomplished through the use of an induction type regulator. As an alternate arrangement, the main high voltage contactor may close the primary circuit through a resistance bank which is subsequently shorted out, after a pre-determined period, by a second contactor operated by a delay relay whose delay should be set for at least 5 seconds.

The rectifier filaments should be maintained at constant voltage rather than at constant current. Adjustments of the filament voltage may be made with a rheostat in the primary circuit of the filament transformer while observing a filament voltmeter, which should be connected to a separate voltmeter winding, or across the primary terminals of the filament transformer. With the high voltage transformer primaries open circuited, the rectifier filament voltages should be measured directly at the tube terminals to make certain that the voltage measured is that which is actually across the filament. The relation between this voltage and the corresponding reading of the installed filament voltmeter should be noted. If possible, the filament voltage should be finally adjusted to its proper value for each individual tube when the rectifier is operating under normal conditions.

CAUTION: The rectifier filament terminals may be at high voltage to ground when the rectifier is in operation and hence direct measurements of filament voltage should not be made when the high voltage transformers are excited. The filament connections should be large in order to assure a good contact. A relay, operating from the filament supply circuit, should be installed so that it will open the high voltage primary circuit in case the filament voltage fluctuates beyond the limits of plus or minus 5%. This relay should have a time delay of not more than 2 seconds to avoid opening of the circuit on transients.

Suggestions for Use

When starting up the rectifier the filaments of the tubes must be lighted first, and the high voltage should not be applied until the filaments have had time to reach normal operating temperature. This condition is best obtained by the use of a time delay relay operating from the filament primary power supply and having a delay period adjustable to the value recommended for the particular type of tube used. The contact of this delay relay should be in series with the start circuit of the high voltage primary contactors. If it is necessary to decrease the heating time to a minimum, the time delay necessary for the particular installation may be determined in the following manner.

With the tube in the actual circuit under consideration, a DC voltage of at least 45 volts is connected between anode and cathode in series with a resistor sufficient to limit the current to .3 ampere. The anode is connected to the positive terminal of the DC voltage source and a voltmeter is connected between anode and cathode. The filament supply switch is closed and, assuming that the tube was cold at the start, the time required for the DC voltage drop across the tube to reach a constant value is noted. This time is measured for each of the rectifier tubes. The longest time measured is increased by 50% to give the shortest possible delay period permissible for the particular installation.

The space charge of a mercury vapor rectifier tube increases with age and this fact affords a means for anticipating the end of useful life of any particular tube. A record of the increase in space charge from day to day may be obtained by a simple arrangement in which a source of at least 20 volts direct current with a current capacity equal to that of the peak current rating of the rectifier tube can be connected to the anode of each tube in succession after the high voltage has been removed and the filament of the tube lighted at normal voltage. When the space charge reaches 18 to 20 volts, with the space current adjusted to the rated peak value, it may be an indication that the end of useful life for this tube is being approached.

The initial filament current when starting may be objectionably large if a current limiting reactor or resistance

Vacuum Tube Products



MERCURY VAPOR RECTIFIER TUBES

Suggestions for Use

is not used. It is recommended, therefore, that a time delay device be used so that the initial application of filament voltage can be made through a current limiting device which, in turn, is subsequently shorted out after a delay of a few seconds. The peak rms value of current through the filament should be limited to something less than twice the normal filament current rating.

Operation

When the tube is first received it will undoubtedly have mercury deposited on all parts within the tube due to handling in shipment. A deposit of mercury on the plate or filament reduces the arc-back voltage. To avoid permanent injury, therefore, a slow treating schedule should be followed.

The new tube should be tested as described herein, and the same tests should be followed each time the tube is handled in such manner as to cause mercury to be deposited on the plate or filament. After the mercury has been properly distributed by the slow treating schedule, the tube should be mounted in a rack in its operating position (the filament end down). It should not be laid on its side in the rectifier unit. The tube will then be ready for replacement use by simply operating at rated voltage for the length of time specified, for the particular tube used, before applying the operating voltage.

The treatment prescribed in the following paragraph is intended particularly for new tubes which are to be placed in operation for the first time. It is suggested that this treatment be applied also to new tubes not placed in immediate service, and that the treatment be repeated every three months on tubes held in storage. The same treatment applies also where a tube has been operated improperly and shows a tendency to arc-back, since its condition may be much improved thereby.

The filament must be lighted at rated voltage for 15 minutes without any applied plate voltage in order to distribute the mercury to the tube properly. The supply voltage should be reduced to give a peak inverse voltage of approximately 4,000 volts, the high voltage primary circuit closed, and the rectifier operated for 5 minutes, after which the output potential should be increased gradually during a 15 minute period to obtain the normal operating value.

If the equipment does not permit of this procedure, the full plate voltage should be applied intermittently until the tube operates normally. If the tube gives evidence of flashing, the treating period should be prolonged so that stable operation may be obtained without injury to the tube. Then the tube should be operated under normal conditions for 15 minutes.

The peak inverse voltage will vary with the type of circuit and the wave shape. It should always be evaluated from a knowledge of these factors. The maximum rating of the tube refers to the actual inverse voltage and not to the calculated values. Therefore a cathode ray oscillograph, or spark gap, connected across the tube should be used to determine the actual voltage conditions.

The maximum peak current and voltage ratings must not be exceeded during operation and rectifiers must be designed accordingly. Where higher voltages are required than can be secured without exceeding the rating of the tube it is recommended that independent rectifiers be connected in series. This practice is to be preferred to that of connecting the tubes in series, since the resistance of the tube in the reverse direction may be variable and thus prevent equal voltage distribution.

For greater output currents, tubes may be connected in parallel. Balancing resistors should then be placed in series with each tube so that each tube carries its share of the load.

The published ratings and basic tube information are based upon use at frequencies less than 150 cycles per second. For use at higher frequencies the manufacturer should be consulted.

The inside surfaces of the glass of most types of mercury vapor rectifier tubes tends to darken with age in service. Excessive blackening of the tube envelope, while not of itself an indication of approaching failure, is a signal to increase the frequency of voltage drop measurements as outlined above. Likewise, any sudden change in the color of the mercury vapor discharge will aid in judging when to remove a tube.

Federal Telephone and Radio Corporation

Vacuum Tube Products



Newark 4, New Jersey



Vacuum Tube Products

THERMIONIC RECTIFIER TUBES

Suggestions for Use

Installation

In accordance with generally accepted practice, tubes should be mounted with the filaments in a vertical position. It is highly desirable that tubes be stored in racks which are protected from vibration as well as from moisture and extreme temperature changes.

During operation, water cooled tubes are naturally held in the correct vertical position, with the glass end up, by the water jackets designed to protect the tubes and effectively cool the anodes.

Installation of water cooled tubes is fairly simple if accomplished with reasonable care. Three gaskets are supplied with each tube to obviate the necessity of ever using gaskets other than those supplied with the tube. After placing the proper gasket on the anode, the tube should be placed in the water jacket very carefully and turned gently to make sure that the flange seats properly in the jacket. The tube should then be secured in the jacket by tightening the clamps just enough to prevent any water leaks, otherwise the flange may be distorted.

Following correct adjustment and clamping of the tube in the jacket, the filament leads should be connected so that no strain is placed upon them. These leads should always be disconnected before unclamping the tube and removing it from the water jacket. The moving parts of the water jacket should be kept covered with a film of oil to prevent corrosion and sticking.

Cooling

A water circulating system capable of passing a sufficient quantity of water through the water jacket and returning it to the source for recooling must, of course, be provided for cooling the anode of the tube.

Where few water cooled tubes are in service, the cooling system may consist of a fan cooled radiator, a pump and the water jacket interconnected in a closed circulating system. Such a system is usually insulated from the ground and has a water gauge to indicate the height of water in the radiator as well as a thermometer for recording the water temperature at the outlet of the water jacket. Where many water cooled tubes are employed, water is usually obtained from a large storage tank, a well, or from water mains — whichever is available.

In order to insure an adequate supply, water is circulated under pressure through an interconnected piping system and lengths of rubber hose carry the water from a grounded position in the system to and from the water jackets. It is extremely important that the hose be of sufficient length to reduce to a minimum the possibility of current leakage. The hose (connected both at the inlet and outlet sections of the water jacket) should be not less than fifteen feet each in length.

It is recommended that a supply of water be used having a specific resistance of not less than 4000 ohms. Distilled water or rain water caught in a storage tank is highly recommended. Water obtained from wells or water mains should be analyzed to determine the amount of carbonates, sulphates, etc., it contains. When the hardness of the water flowing through the cooling system is greater than 10 grains per gallon and the plate dissipation, water flow and outlet water temperature are normal, there is always the possibility of scale formation on the anode of the tubes.

Scale formation prevents proper cooling of the tubes, and this may damage them. Scale should be eliminated by the use of distilled water or a water softener. In emergency cases where it is absolutely necessary to use water which forms a scale on the anode, a regular

Vacuum Tube Products



THERMIONIC RECTIFIER TUBES

Suggestions for Use

schedule should be adopted for cleaning the scale from the anode by means of dipping the anode in a 10% solution of hydrochloric acid until the scale is dissolved. Following this, the anode should be thoroughly rinsed in water. Care should be taken to prevent the acid solution from coming in 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 wherever possible.

The flow of water through the water jacket should consist of a thin stream evenly distributed over the anode to insure adequate cooling. It should be fast enough to prevent steam bubbles from forming on the surface of the anode. The water flowing through the water jacket should never reach the boiling point and in fact should never exceed 70°C. at the water outlet. The recommended flow is usually sufficient, but if a scale formation is present, better results will be obtained by a faster flow. A flowmeter may be installed, provided a location is selected in which air traps may be avoided. The filament and plate supply must always be interconnected with the water supply, so that in the case of water failure for any reason, the filament and plate voltages cannot be applied to the tubes. The heat from the filament alone is sufficient to cause serious damage.

In all cases the glass bulb of the tube should not be in contact with nor near any metallic body nor inflammable material, nor should it be subjected to drops or spray of any liquid.

Circuit Requirements

Inasmuch as the circuits in which these tubes operate comprise high powered, high voltage systems, proper overload protection against excessive currents and safety interlock circuits, to safeguard personnel, should be employed in proportion to the power and voltage involved in the rectifier installation. These involve relays described in pages featuring "Mercury Vapor Rectifier Tubes."

Since the filament circuit must carry a fairly large current, every precaution should be taken against voltage losses due to poor connections. Filament connections should be large, and securely fastened to insure good contacts. All wires and connections should be placed as far as possible from the glass of the tube in order to avoid the possibility of bulb puncture from corona discharges.

Operation

In order to insure satisfactory serviceability when needed, tubes should be tested and inspected immediately upon arrival. For tubes placed in storage this should be repeated approximately every three months. Best results are obtained by placing tubes in an actual working rectifier unit.

Essentially rectifier tubes are limited in two respects: First, by the maximum instantaneous peak current that the tube will pass. Second, by the maximum peak inverse voltage that can safely be applied while the tube is preventing the flow of current in the inverse direction.

Federal Telephone and Radio Corporation

Vacuum Tube Products



Newark 4, New Jersey



Vacuum Tube Products

WATER COOLED and AIR COOLED TUBES

Water Cooled Tubes

In accordance with generally accepted practice, tubes should be mounted with the filaments in a vertical position. It is highly desirable, therefore, that tubes be stored in racks which are protected from vibration as well as from moisture and extreme temperature changes. In the case of water cooled tubes with flexible leads, care should be taken to prevent the filament leads from striking the glass with the resultant possibility of breakage.

During operation these tubes are naturally held in the correct vertical position with the glass end up, by the water jackets, since these are designed to protect the tubes and effectively cool the anodes.

Installation of water cooled tubes is fairly simple if accomplished with reasonable care. Spare gaskets are supplied with each tube to obviate the necessity of ever using gaskets other than those supplied with the tube. After placing the proper gasket on the anode the tube should be placed in the water jacket very carefully and turned gently to make sure that the flange seats properly in the jacket. The tube should then be secured in the jacket by tightening the clamps just enough to prevent any water leaks, otherwise, the flange may be distorted.

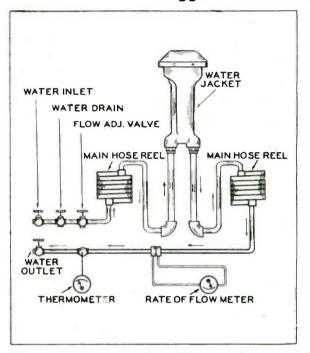
After correct adjustment and clamping of the tube in the jacket, the filament and grid leads should be connected in such a way that no strain is placed upon them. These leads should always be disconnected before unclamping the tube and removing it from the water jacket.

It is highly desirable that all the moving parts of the water jacket should be kept covered with a film of oil to prevent corrosion and sticking.

Cooling

A water circulating system capable of passing a sufficient quantity of water through the water jacket and returning it to the source for recooling must, of course, be provided for cooling the anode of the tube.

Where a small number of water cooled tubes is in service, the cooling system may consist of a fan cooled radiator, a pump and the water jacket interconnected in a closed circulating system. Such a system is usually insulated from the ground, and has a water gauge to indicate the height of water in the radiator as well as a thermometer for recording the water temperature at the outlet of the water jacket. **Suggestions for Use**



Where a number of water cooled tubes is employed, the water is usually obtained from a large storage tank, a well or from water mains, whichever is available. In order to insure an adequate supply, the water is circulated under pressure through an interconnected piping system and 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 be of sufficient length to reduce the possibility of current leakage to a minimum. It is suggested that the hose (connected both at the inlet and outlet sections of the water jacket) be not less than fifteen feet each in length.

It is recommended that a supply of water be used having a specific resistance of not less than 4000 ohms. Distilled water or rain water caught in a storage tank is highly recommended. Where water is obtained from wells or water mains, it is suggested that it be analyzed to determine the amount of carbonates, sulphates, etc. contained in it. When the hardness of the water flowing through the cooling system is greater than ten grains per gallon and the plate dissipation, water flow and outlet water temperature are normal, there is always the possibility of scale formation on the anode of the tubes.

Scale formation prevents proper cooling of the tubes and may result in damage to them. It should be avoided,

Copyright 1946, Federal Telephone and Radio Corporation

Vacuum Tube Products



WATER COOLED and AIR COOLED TUBES

Suggestions for Use

therefore, by the use of distilled water or a water softener. In emergency cases where it is absolutely necessary to use water which forms a scale on the anode, a regular schedule should be adopted for cleaning the scale from the anode by means of dipping the anode into a 10% solution of hydrochloric acid until the scale is dissolved. Following this the anode should be thoroughly rinsed in water.

Care should be taken to prevent the 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 wherever possible.

The flow of water through the water jacket should consist of a thin stream evenly distributed over the anode to insure adequate cooling, and the stream should be fast enough to prevent steam bubbles from forming on the surface of the anode. The water flowing through the water jacket should never reach the boiling point. In fact, it should never exceed 70°C. at the water outlet. Localized boiling may be detected by a singing noise.

The amount of water required will depend upon the design of the jackets used. Water jackets designed by Federal Telephone and Radio Corporation provide rates of flow as shown in the table below which may be used as a guide.

TABLE OF RECOMMENDED WATER FLOW

Tube Type	Water Jacket Type	Minimum Flow (Gal. per Min.)
F 207, F 848, F 863, F 891,		
F 892	F 1000	5
F 320 B, F 222 A, F 343 A	F 1005	5
F 237, F 342 A	F 1005	10
F 328 A, F 328 B	F 1006	3
F 124 A, F 125 A, F 858, F 89	3 F 1010	15
F 129 B	F 1012	3

The amount of pressure required may be approximated from the following formulas:

Pounds per sq. in. drop=Kf² per ft. length of hose f=water flow gal./min. K=.00065 for 1″ hose .00315 for ¾″ hose .0145 for ½″ hose .055 for water jacket The filament and plate supply must always be interconnected with the water supply so that in case of water failure the filament and plate voltages cannot be applied to the tubes. The heat from the filament alone is sufficient to cause serious damage.

In all cases the glass bulb of the tube should not be near nor in contact with any metallic body or inflammable material, nor should it be subjected to drops or spray of any liquid.

Circuit Requirements

The circuit in which this tube operates is a high powered, high voltage system and should be thoroughly protected in the proper manner for such systems. Proper overload protection to protect the tube and equipment against excessive currents, and safety interlocking means to protect personnel, should be installed.

An instantaneous overload relay should be in the ground lead of the plate return to protect the tube from drawing a large plate current. The relay should be set for slightly higher than normal plate current and will then operate to open the circuit in the rectifier transformer primary in case of an overload.

All wires and connections must be installed so that they are a proper distance from the glass of the tube, otherwise the bulb is almost certain to be punctured from corona discharges. All connections must be made so that there will be no strains on any of the metalglass seals.

The filament of the tube should be maintained at constant voltage rather than constant current. A rheostat or equivalent means of control should be provided in the primary of the filament transformer to facilitate maintaining correct supply voltage. The filament voltage should always be measured at the tube terminals making sure that the voltage measured is that which is actually across the filament. The filament clrcuit must carry a fairly large current. In consequence, every precaution should be taken against voltage losses due to poor connections. The filament connections should be large and be securely fastened to insure good contact.

In the case of multiphase tube types such as the F 893 and F 862 the phase voltages should not differ by more than 0.5% if maximum tube life is to be obtained. The

.....



Vacuum Tube Products

WATER COOLED and AIR COOLED TUBES

Suggestions for Use

hairpin type of multiphase filaments used in tube types F 124 A and F 125 A will permit a maximum phase voltage unbalance of 1.0%. Single phase operation of all multiphase filaments is recommended.

Operation

It is suggested that tubes be tested and inspected immediately upon arrival, and if in storage at periods of three months, in order to assure complete serviceability and availability when required for use. This is best done by operating the tube in the transmitter in the following manner: Light the filament and permit it to burn at rated voltage for five minutes before applying plate voltage. Reduce the plate supply voltage to as low a value as possible and apply it to the plate of the tube. Increase the plate voltage carefully and slowly to the desired operating value and permit the tube to operate under normal load conditions for a period of about thirty minutes.

The filament should always be operated at constant voltage, and its normal operating temperature always should be reached before applying plate voltage. When using the tube at reduced power the filament voltage may be reduced slightly, but care must be taken that sufficient electron emission is provided in order to insure stable operation and prevent the plate dissipation from being exceeded.

If the tube is to be removed from the circuit immediately after operation, time should be permitted for the inner electrodes to cool before shutting off the water. Extreme care must be exercised when removing the tube from the jacket so that no strains will be placed upon the metal-glass seals.

Whenever circuit adjustments are necessary it is desirable to begin by operating the tube at reduced plate voltage and to increase it in steps, always adjusting for optimum operating conditions at each step. Should the tube be severely overloaded and gassed while making circuit adjustments it is sometimes possible to effect electrical cleanup of the gas by operating the tube as an oscillator or radio frequency power amplifier at reduced plate voltage, gradually increasing the voltage to maximum after permitting the tube to reach stable operation on each step. Bright tungsten filaments do not lose their emission when overloaded and should operate satisfactorily with only slight emission reduction until actually burned out.

AIR COOLED TUBES

As previously mentioned, tubes not used immediately should be stored in suitable racks free from shock, vibration, moisture and excessive temperature changes. It is advisable to be particularly careful in handling tubes to avoid scratching the glass. A small scratch will weaken the glass envelope materially, possibly causing a crack during subsequent heating or cooling cycles.

Mountings should be constructed so that the tube itself is not under strain when installed. The tube should also be so located that the glass envelope cannot come into contact with any metallic body or inflammable material, nor be subject to drops or spray of any liquid.

Clips and sockets should be of such design that good contact is provided without undue force being necessary to install or remove the tube. When a mounting similar to a fuse clip is used on a single terminal, it is essential that the terminal should **not** be snapped into place. The resultant jar may be sufficient to break some of the internal tube parts and render it inoperative.

The contact surfaces on the bases and caps are designed large enough to provide for carrying currents both R.F. and DC within the rating of the tube, but the conditions of operation should be taken into consideration in order to allow sufficient current carrying capacity in the mounting connections to prevent undue heating. The wiring of associated circuits and the placing of associated parts should provide generous clearance to obvlate the possibility of corona discharges puncturing the glass envelope.

In designing a cooling system for forced-air cooled tubes, provision should be made for the immediate removal of all voltages from the tube elements when the flow of air falls below a safe minimum value. This can be accomplished by the use of a small vane or paddle mounted in the cooling air stream and mechanically connected to an interlock switch. Another very desirable safety precaution is to install a thermal cut-out on the tube fin or core assembly so that electrode voltages will be immediately removed if the tube temperature should exceed a predetermined value. Air flow should be started before application of any voltages and should continue for at least ten minutes after removal of all voltages.

Vacuum Tube Products



WATER COOLED and AIR COOLED TUBES

Suggestions for Use

Cooling

In designing equipment to use the larger sizes of air cooled tubes, it is essential that proper ventilation be provided. Artificial cooling means are not necessary if free circulation of air all around the tube is available. If it is necessary to enclose a tube in a compartment, however, two methods are left open; One to provide a forced draft from a fan so directed as to cool the entire tube as uniformly as possible; Two, to provide ventilation ducts to take full advantage of the chimney effect of the heat from the tube itself.

Circuit Requirements

The circuit in which tubes operate is a high powered, high voltage system and should be thoroughly protected. Proper overload protection (as previously described for the tubes and equipment) as well as safety interlocking means to protect personnel should be installed.

The entire plate circuit should be designed to minimize the effects of transients caused by interruptions or flash-overs.

The filament supply should be provided with means of adjusting and reading the filament voltage. If the circuit is metered elsewhere than directly at the terminals of the tube, correction for lead drops should be made.

Operation

It is suggested that tubes be inspected and tested immediately on receipt and, if in storage, at three month intervals to insure complete serviceability. The procedure is identical with that described for water cooled tubes.

In the case of bright tungsten filaments, an increase in life may be realized under light load conditions by operating the filament at reduced voltage. Bright tungsten filament tubes may be operated in such a manner that the required peak currents are practically equal to the emission available from the filament. Consequently, the filament voltage may be reduced until distortion or reduced power output is observed. In applications where the distortion is an important factor, great care should be exercised to avoid flattening of the plate current pulses due to lack of emission. The operation should always be performed in conjunction with accurate distortion measuring equipment. When on stand-by service, bright tungsten filaments may be operated at any reduced voltage that effects a good compromise between power economy and delay in arriving at the operating point. Under no circumstances should they be operated above the rated voltage. A slight increase in voltage will result in a marked decrease in life.

Thoriated tungsten filaments should always be operated at the rated voltage when other voltages are applied to the tube. No improvement in life may be expected by operating at reduced filament voltages. In fact, under-voltage is fully as deleterious to life as overvoltage. For satisfactory life results the filament voltage should not be allowed to vary more than plus or minus 5% during the time that plate voltage is applied.

In cases where lengthy stand-by periods are experienced, a reduced filament voltage may be used for power economy. In such cases the timing of the relay system should be such that the filaments are at full brilliance before the plate voltage is applied.

If at any time a thoriated filament tube should be severely overloaded, causing loss of emission, the filament may be reactivated by burning for several hours at rated voltage with no other voltages applied to the tube. If the overload has been sufficient to gas the tube appreciably, there is little chance of recovery. Small amounts of gas quickly destroy the emission of a thoriated filament when plate voltage is applied to the tube.

CAUTION: The glass envelopes on all transmitting tubes become quite hot during operation. If it should become necessary to remove a tube from its socket before it has had time to cool, care should be taken that it is not put down on any metallic, cold or heat conducting surface. The sudden temperature change may strain the glass to such a point that it will crack.

Federal Telephone and Radio Corporation invites further inquiries concerning the various applications to which these tubes may be adapted.

Federal Telephone and Radio Corporation

Vacuum Tube Products



Newark 4, New Jersey



Vacuum Tube Products

WATER JACKETS FOR WATER COOLED TUBES

DESIGN FEATURES

- Precision built of the finest materials.
- Designed to facilitate flow of fast, thin stream of water evenly over anode of tube to insure adequate cooling.
- Interior constructed to prevent the anode of the tube from contact with the jacket interior wall, thereby insuring free circulation of water at all times.
- Clamping ring used in mounting the tube in the water jacket designed to act also as corona shield.
- Both inlets and outlets for water placed at the bottom of the water jacket to facilitate connection with water supply.
- Connection with water hose is made with a union supplied with the water jacket to eliminate the necessity of breaking the hose in order to disconnect the water supply.
- Mounting pads, each with two tap holes to facilitate mounting, are an integral part of the casting.
- Water jacket proper consists of one piece of cast alloy to insure ruggedness and long life.





WATER JACKETS FOR WATER COOLED TUBES

Vacuum Tube Products

Minimum Flow Water Jacket Gal. per Min. Tubes 1000 5 F-207 5 F-848 5 F-863 5 F-891 5 F-892 1005 5 F-320-B 5 F-222-A 10 F-237-A 5 F-343-A 51. 10 F-342-A 10 9C23 1006 3 F-328-A 3 F-328-B 1010 15 F-124-A 15 F-125-A 15 F-858 15 F-893 3 1012 F-129-C

AVAILABLE TYPES OF WATER JACKET WITH RECOMMENDED FLOW

The amount of pressure required may be approximated from the following formulas:

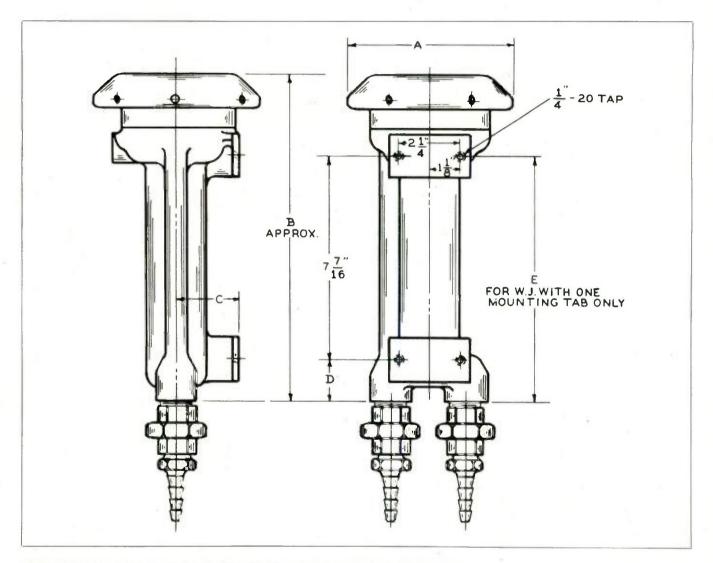
> Pounds per sq. in. drop = Kf^2 per ft. length of hose f = water flow gal./min. K = .00065 for 1" hose .00315 for $\frac{3}{4}$ " hose .0145 for $\frac{1}{2}$ " hose .055 for water jacket

> > World Radio History



Vacuum Tube Products

WATER JACKETS FOR WATER COOLED TUBES



MOUNTING DIMENSIONS OF STANDARD WATER JACKETS

REFERENCE TABLE

Water Jacket	A	В	С	D	E
1012	5 3/8 "	7 1/2 "	2 7/8 "		4 1/8 "
1010	7 1/2 "	15 3/8 "	3 7/8 "	3 13/32 "	
1006	513/16"	11 7/8 "	2 1/4 "	1 1/2 "	
1005	6 1/4 "	11 3/4 "	2%16"	1 1/2 "	
1000	6 1/2 "	12 5/8 "	2 3/4 "	1 1/2 "	

Hose nipples supplied with these water jackets are available in three sizes for $\frac{1}{2}$ inch, $\frac{3}{4}$ inch and 1 inch

hose respectively. Unless otherwise specified, nipples for $\frac{3}{4}$ inch hose are furnished.

Vacuum Tube Products



WATER JACKETS FOR WATER COOLED TUBES

APPROXIMATE NET WEIGHTS

1000	 lbs.
1005	 lbs.
1006	 lbs.
1010	 lbs.
1012	 lbs.

For further information see sheet entitled "Water Cooled and Air Cooled Tubes, Suggestions for Use."

Federal Telephone and Radio Corporation

Vacuum Tube Products



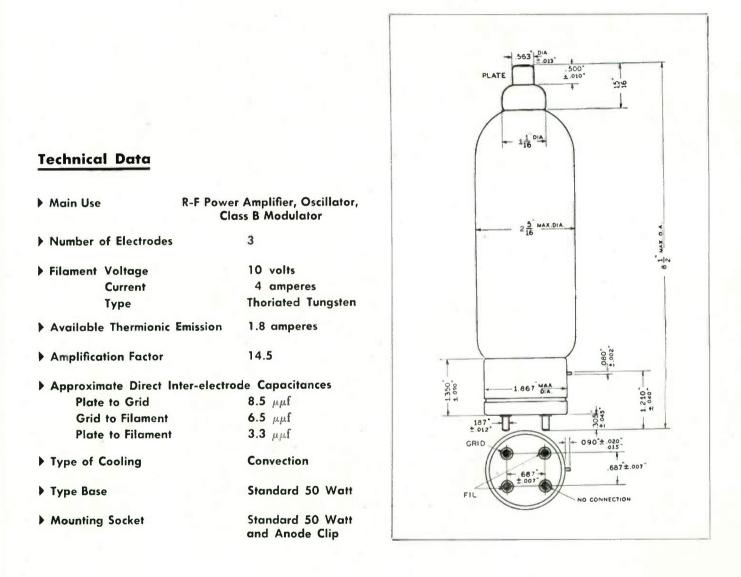
Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-123-A

125 Watts Plate Dissipation



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-123-A

2.000 volts

375 watts

125 watts

125 Watts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 30 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Max. Signal DC Plate Current 0.250 ampere

CLASS B R-F POWER AMPLIFIER — TELEPHONY

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage DC Plate Current R-F Grid Current Plate Input Plate Dissipation

Typical Operation

Filament Voltage DC Plate Voltage DC Grid Voltage Peak R-F Grid Input Voltage DC Plate Current DC Grid Current Driving Power* Load Impedance Power Output 2,000 volts 0.200 ampere 7.5 amperes 185 watts 125 watts

10 volts 1,500 volts -100 volts (approx). 108 volts (approx.) 0.120 ampere 0.001 ampere 6 watts (approx.) 3,680 ohms 65.5 watts (approx.)

At crest of A-F cycle

CLASS C R-F POWER AMPLIFIER TELEPHONY — PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation

Typical Operation

Filament Voltage DC Plate Voltage DC Grid Voltage Peak R-F Grid Input Voltage DC Plate Current DC Grid Current Driving Power Power Output

- 1,500 volts 0.250 ampere 0.070 ampere 7.5 amperes 240 watts 85 watts
- 10 volts 1,500 volts -290 volts (approx.) 410 volts (approx.) 0.160 ampere 0.025 ampere 10 watts (approx.) 200 watts (approx.)

Plate Dissipation Typical Operation

Maximum Ratings

DC Plate Voltage

Max. Signal Plate Input

Filament Voltage	10 volts
DC Plate Voltage	2,000 volts
DC Grid Voltage	-130 volts (approx.)
Peak A-F Grid Input Voltage	217 volts (approx.)
Zero Signal Plate Current	
(per tube)	0.030 ampere
Max. Signal Plate Current	
(per tube)	0.175 ampere
Max. Signal Plate Input	
(per tube)	350 watts
Max. Signal Driving Power	3.4 watts (approx.)
Effective Load	
(plate to plate)	13,800 ohms
Power Output (2 tubes)	522 watts (approx.)

t (2 tubes) 522 watts (approx.)

2,000 volts -500 volts

0.250 ampere

0.070 ampere

375 watts

125 watts

7.5 amperes

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR — TELEGRAPHY

(Key-down conditions per tube without modulation)*

Maximum Ratings

DC Plate Voltage
DC Grid Voltage
DC Plate Current
DC Grid Current
R-F Grid Current
Plate Input
Plate Dissipation

Typical Operation

10 vo
1,500 vo
-250 vo
400 vo
0.250 ar
0.030 ar
11 w
300 w

10 volts ,500 volts -250 volts (approx.) 400 volts (approx). .250 ampere .030 ampere 11 watts (approx.) 300 watts (approx.)

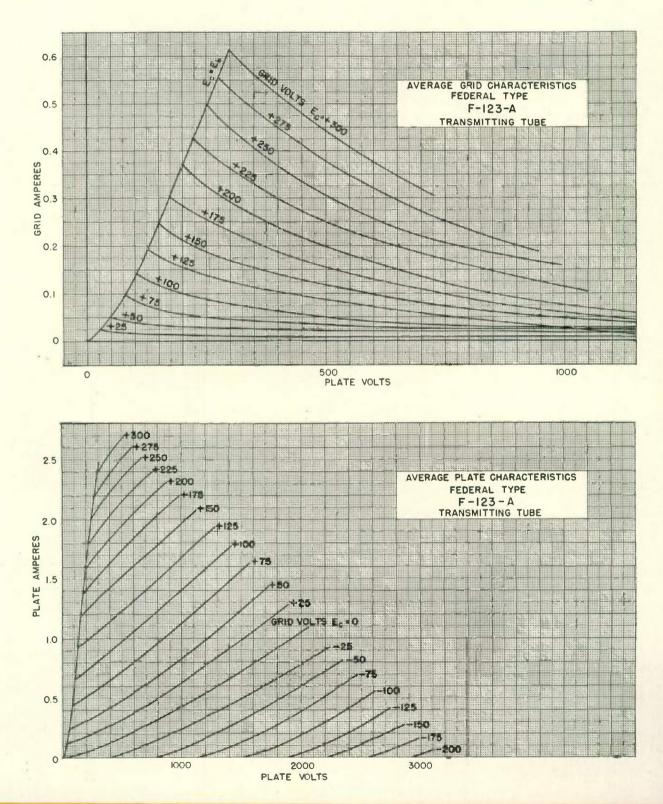
*Modulation essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-123-A

125 Watts Plate Dissipation

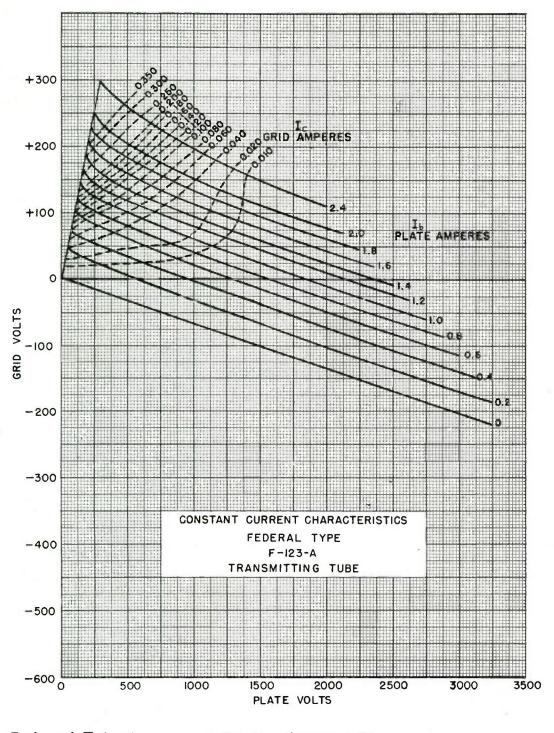


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-123-A

125 Watts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

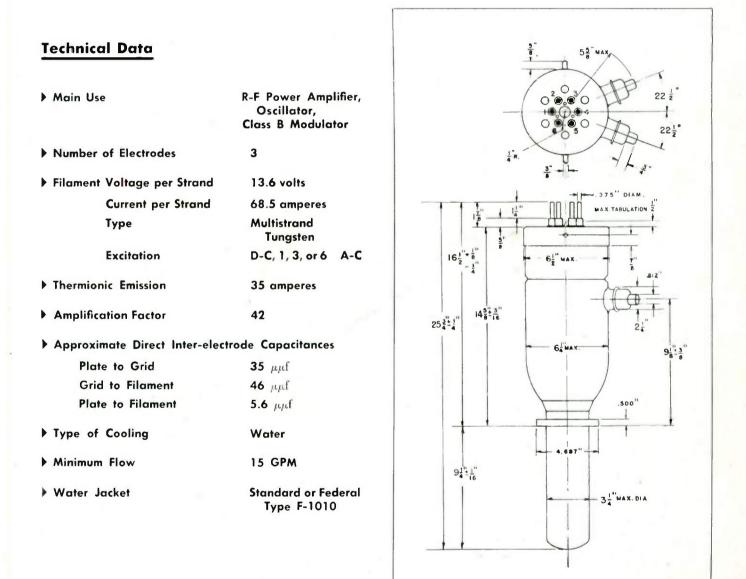
Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-124-A

40 Kilowatts Plate Dissipation



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-124-A

40 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 20 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

DC Plate Voltage Max. Signal DC Plate Current Max. Signal Plate Input **Plate Dissipation**

20,000 volts 5.0 amperes 50,000 watts 30,000 watts

4.5 amperes

1.0 amperes

50 amperes

CLASS C R-F POWER AMPLIFIER TELEPHONY-PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage	14,000 volts
DC Plate Current	4.5 amper
DC Grid Current	1.0 amper
R-F Grid Current	50 amper
Plate Input	60,000 watts
Plate Dissipation	30,000 watts

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Input Voltage DC Plate Current DC Grid Current **Driving Power** Power Output

12,000 volts -725 volts (approx.) 1,425 volts (approx.) 3.31 amperes 0.061 amperes 200 watts (approx.) 26,200 watts (approx.)

CLASS B R-F POWER AMPLIFIER TELEPHONY

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage **DC Plate Current R-F Grid Current** Plate Input **Plate Dissipation**

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Input Voltage **DC Plate Current** DC Grid Current Driving Power* Load Impedance Power Output *At crest of A-F cycle

50 amperes 60,000 watts 40,000 watts 17,500 volts

20,000 volts

3.5 amperes

-300 volts (approx.) 480 volts (approx.) 2.1 amperes -0.02 amperes 100 watts (approx.) 2,550 ohms 13,100 watts (approx.)

CLASS C R-F POWER AMPLIFIER AND **OSCILLATOR-TELEGRAPHY**

(Key-down conditions per tube without modulation)*

Maximum Ratings

DC Plate Voltage	20,000 volts
DC Grid Voltage	-3,000 volts
DC Plate Current	7.0 amperes
DC Grid Current	2.0 amperes
R-F Grid Current	50 amperes
Plate Input	135,000 watts
Plate Dissipation	40,000 watts

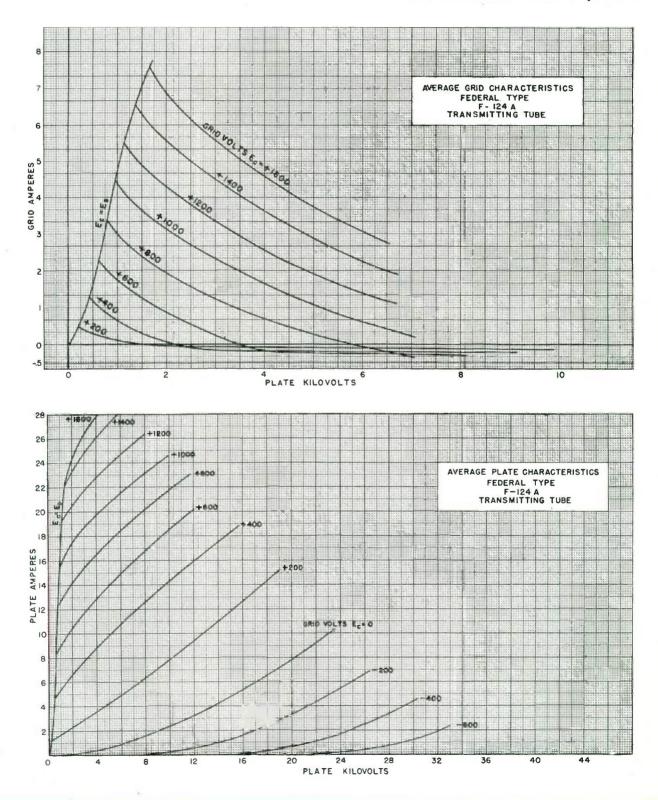
*Modulation essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-124-A

40 Kilowatts Plate Dissipation

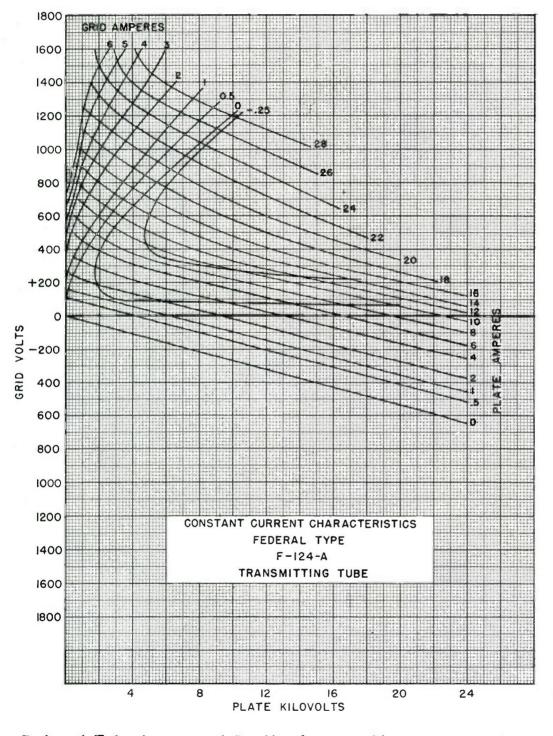


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-124-A

40 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

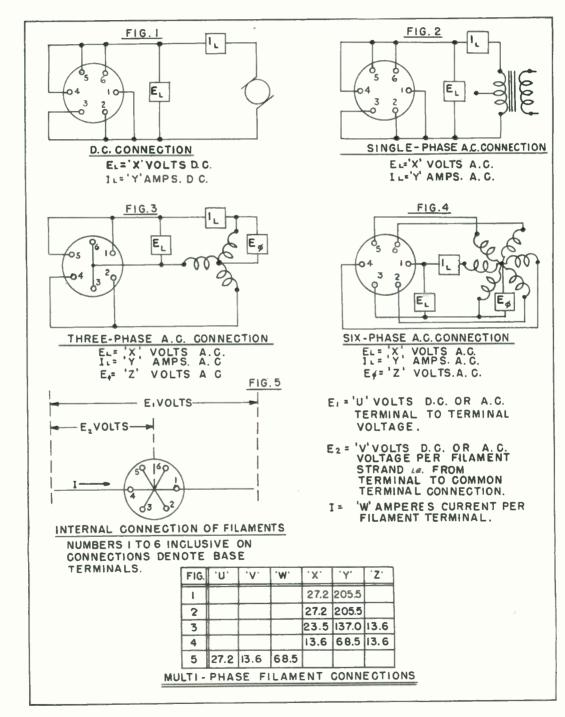
Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-124-A

40 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 4, New Jersey



World Radio History



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-124-R

20 Kilowatts Plate Dissipation

Main Use	R-F Power Amplifier, Oscillator, Class B Modulator
Number of Electrodes	3
Filament Voltage Per Strand	13.6 volts
Current Per Strand	68.5 amperes
Туре	Multistrand Tungsten
Excitation	D-C, 1, 3, or 6 A-C
Thermionic Emission	35 amperes
Amplification Factor	42
Approximate Direct Inter-elec	trode Capacitances
Plate to Grid	40 µµt
Grid to Filament	46 jujul
Plate to Filament	5.6 μμſ
Type of Cooling	Forced Air

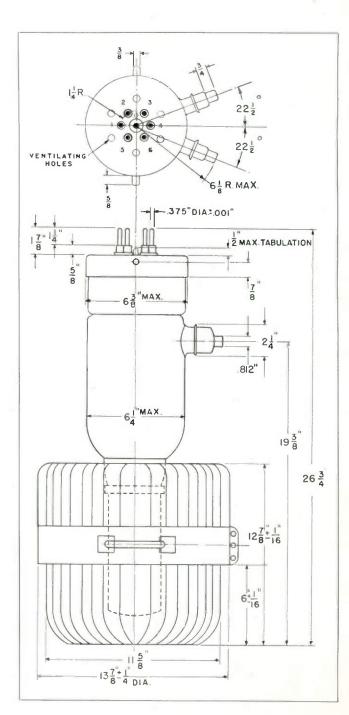
Technical Data

Air Requirements Per Tube

Anode Dissipation KW (1)	Minimum Recommended Air Flow Cu. Ft/Min.	Approx. Air Press. (2) In. of water	Air Velocity Through Fin. Assy. Ft. 'Min.	Approx. Temp. Rise of air Deg. Cent.
5	675	0.22	1365	30
10	950	0.43	1920	30
15	1500	1.10	3030	25
20	2100	2.15	5240	21

 This is the anode dissipation exclusive of filament power dissipated through anode.

(2) This pressure is measured at the base of tube mounting. Duct work must be considered to determine pressure against which blower must deliver required amount of air.



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-124-R

20 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 20 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

DC Plate Voltage Max. Signal DC Plate Current Max. Signal Plate Input Plate Dissipation 20,000 volts 5.0 amperes 50,000 watts 20,000 watts

CLASS C R-F POWER AMPLIFIER-

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation 14,000 volts 4.5 amperes 1.0 amperes 50 amperes 60,000 watts 15,000 watts

Typical Operation

Filament Voltage	13.6 volts per strand
DC Plate Voltage	12,000 volts
DC Grid Voltage	-900 volts (approx.)
Peak R-F Grid Input Voltage	1,630 volts (approx.)
DC Plate Current	2.8 amperes
DC Grid Current	0.18 ampere
Driving Power	275 watts (approx.)
Power Output	26,200 watts (approx.)

CLASS B R-F POWER AMPLIFIER TELEPHONY

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage	20,000 volts
DC Plate Current	3.5 amperes
R-F Grid Current	50 amperes
Plate Input	30,000 watts
Plate Dissipation	20,000 watts

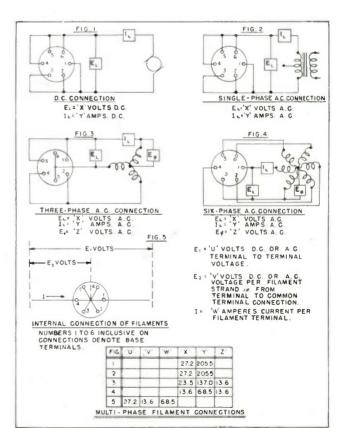
CLASS C R-F POWER AMPLIFIER AND OSCILLATOR-TELEGRAPHY

(Key-down conditions per tube without modulation)*

Maximum Ratings

DC Plate Voltage20,000 voltsDC Grid Voltage-3,000 voltsDC Plate Current7.0 amperesDC Grid Current1.0 amperesR-F Grid Current50 amperesPlate Input100,000 wattsPlate Dissipation20,000 watts

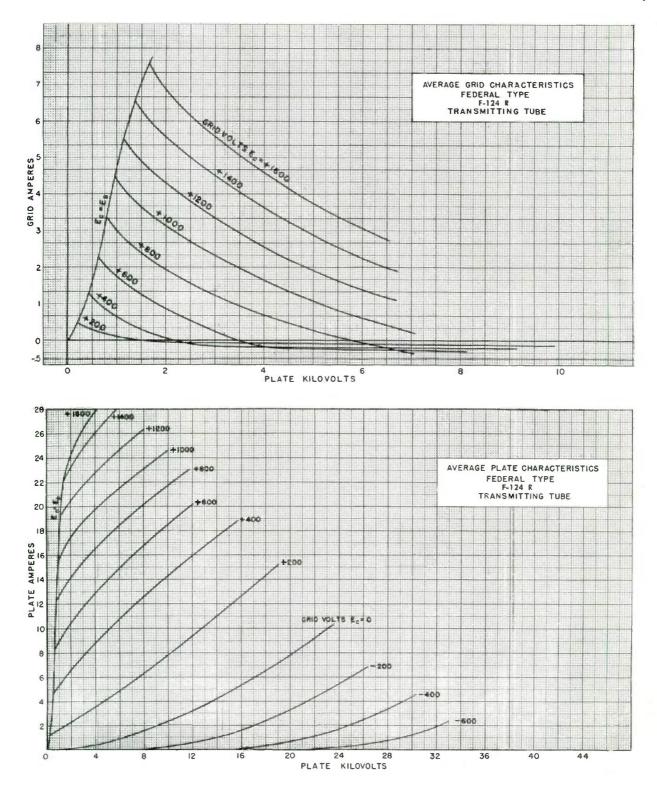
*Modulation essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.





Vacuum Tube Products

TRANSMITTING TUBE TYPE F-124-R

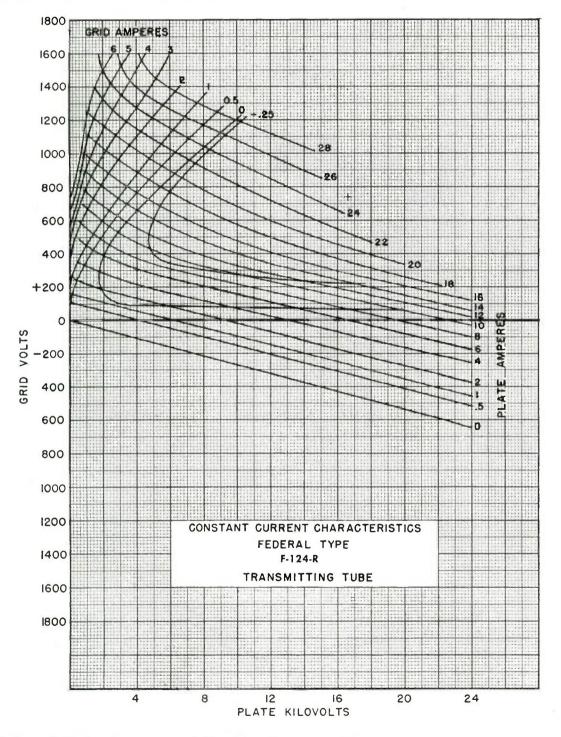


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-124-R

20 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 4, New Jersey



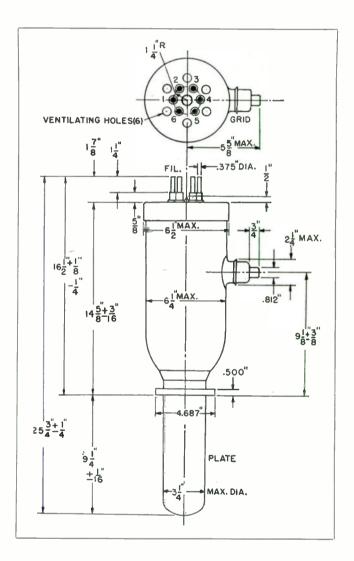
Vacuum Tube Products

TRANSMITTING TUBE TYPE F-125-A

40 Kilowatts Plate Dissipation

Technical Data

Main Use	Modulator
Number of Electrodes	3
Filament Voltage per strand Current per strand	13.6 volts 65.5 amperes
Туре	Multistrand Tungsten
Excitation	DC, 1, 3 or 6 Φ AC
• Thermionic Emission	35 amperes
Amplification Factor	4.75
Plate Resistance	300 ohms
Approximate Direct Inter-electro	de Capacitances
Plate to Grid	44 μμf
Grid to Filament	56 μμf
Plate to Filament	22 μμf
Type of Cooling	Water
Minimum Flow	15 G.P.M.
Water Jacket	Standard or Federal Type F-1010



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-125-A

40 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For audio frequency use only

Maximum Ratings DC Plate Voltage

Plate Input

Plate Dissipation

CLASS AB AUDIO FREQUENCY AMPLIFIER OR MODULATOR CLASS A AUDIO FREQUENCY AMPLIFIER OR MODULATOR

15,000 volts

40,000 watts 40,000 watts

Maximum Ratings

DC Plate Voltage	15,000	volts
Max. Signal DC Plate Current	10	amperes
Max. Signal Plate Input	100,000	watts
Plate Dissipation	40,000	watts

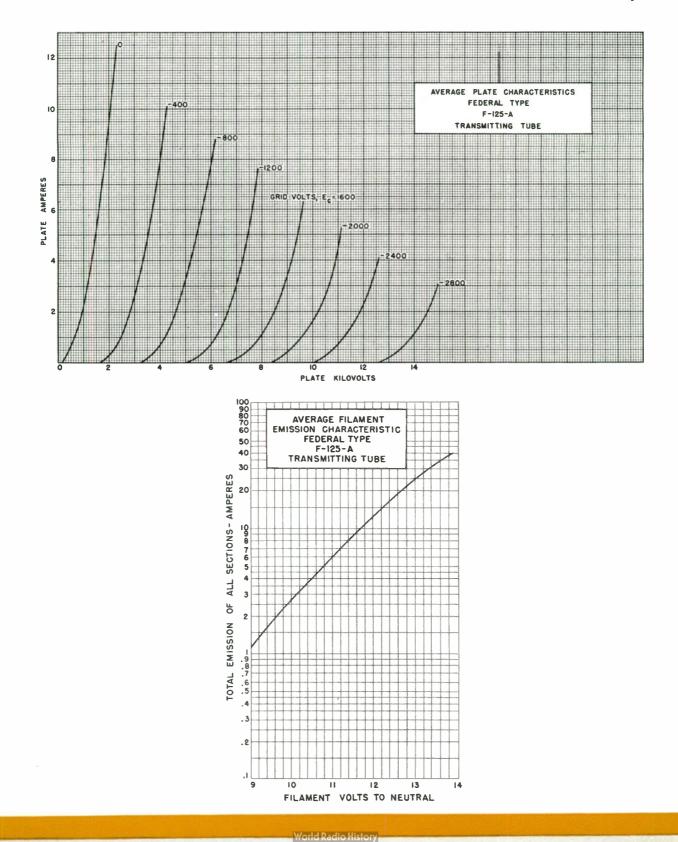
Typical Operation

DC Plate Voltage	10,000 volts	12,000 volts
DC Grid Voltage	-2,125 volts (approx.)	-2,600 volts (approx.)
Peak A-F Grid Input Voltage	2,110 volts (approx.)	2,580 volts (approx.)
Zero Signal Plate Current (per tube)	0.7 ampere	0.9 ampere
Max. Signal Plate Current (per tube)	3.05 amperes	2.64 amperes
Max. Signal Plate Input (per tybe)	30,500 watts	31,700 watts
Effective Load (plate to plate) 3,100 ohms	5,000 ohms
Power Output (2 tubes)	40,200 watts (approx.)	40,000 watts (approx.)



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-125-A

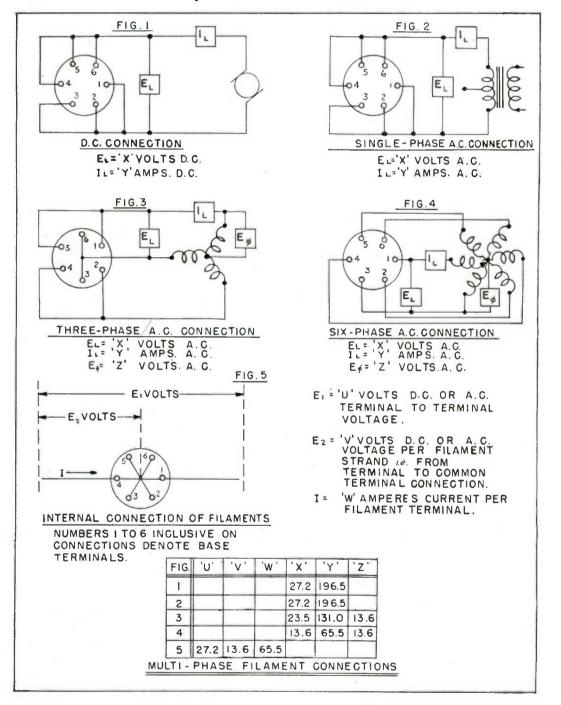


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-125-A

40 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Terr

Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-127-A

200 Watts Plate Dissipation

	PLATE HIN 1019
ass B Modulator	
3	31 MAX DIA.
10 volts	
6 amperes	
Thoriated Tungsten	بوامہ 14
2 amperes	14 Mao O
38	
de Capacitances	- 250 D
4 μμf	
13 μμf	
13 µµf	N X 0
Convection	
Standard 50 Watt	
Standard 50 Watt and Anode Clip	- - 3 36 DIA.(4)
	10 volts 6 amperes Thoriated Tungsten 2 amperes 38 ode Capacitances 4 μμf 13 μμf 13 μμf 13 μμf Standard 50 Watt

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-127-A

200 Watts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 30 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

3,000 volts
0.325 amperes
600 watts
200 watts

Typical Operation

(Key-down conditions per	tube without modulation)*
Filament Voltage	10 volts
DC Plate Voltage	2,800 volts
DC Grid Voltage	75 volts
Peak A-F Grid Input Volt	age 175 volts (approx.)
Zero Signal Plate Curren	t 0.010 amp. (per tube)
Max. Signal Plate Curre	nt 0.200 amp. (per tube)
Max. Signal Plate Input	560 watts (per tube)
Max. Signal Driving Pow	er 6.65 watts
Effective Load	16,600 ohms (plate to plate)
Power Output	820 watts (2 tubes, approx.)

CLASS C R-F POWER AMPLIFIER TELEPHONY-PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage
DC Plate Current
DC Grid Current
R-F Grid Current
Plate Input
Plate Dissipation

2,500 volts 0.275 amperes 0.070 amperes 7.50 amperes 550 watts 150 watts

Typical Operation

Filament Voltage
DC Plate Voltage
DC Grid Voltage
Peak R-F Grid Input Voltage
DC Plate Current
DC Grid Current
Driving Power
Power Output
Grid Resistor

10 volts 2,500 volts -300 volts (approx.) 450 volts (approx.) 0.200 amperes 0.058 amperes 25.2 watts (approx.) 420 watts (approx.) 5,000 ohms

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR-TELEGRAPHY

(Key-down conditions per tube without modulation)*

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation

3,000 volts -500 volts 0.325 amperes 0.070 amperes 7.50 amperes 950 watts 200 watts

Typical Operation

Filament Voltage	10 volts
DC Plate Voltage	3,000 volts
DC Grid Voltage	-250 volts (approx.)
Peak R-F Grid Input Voltage	400 volts (approx.)
DC Plate Current	0.250 amperes
DC Grid Current	0.047 amperes
Driving Power	18 watts (approx.)
Power Output	600 watts (approx.)

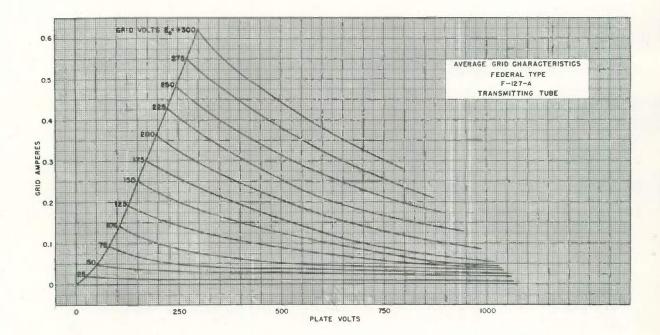
*Modulation essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier condition value.

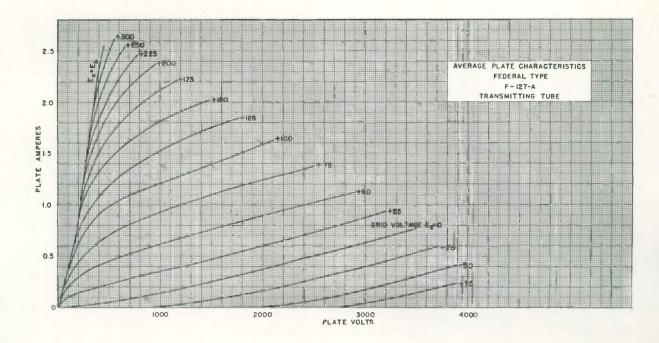


Vacuum Tube Products

TRANSMITTING TUBE TYPE F-127-A

200 Watts Plate Dissipation



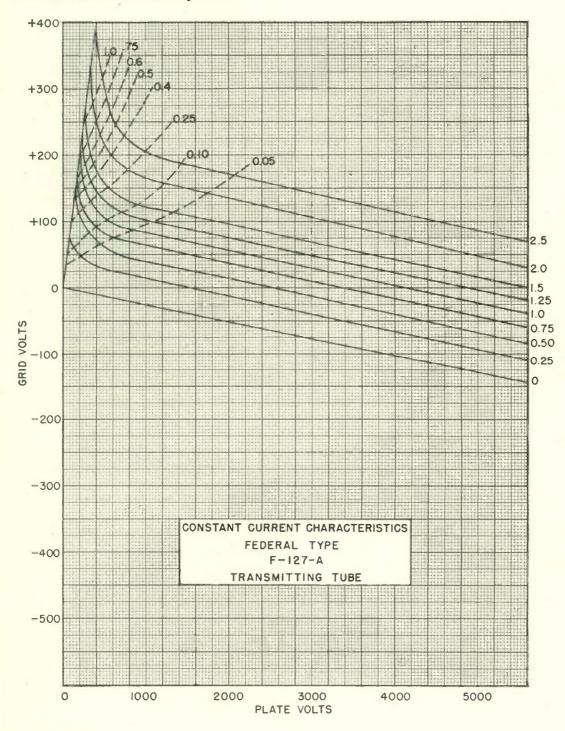


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-127-A

200 Watts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 1, New Jersey



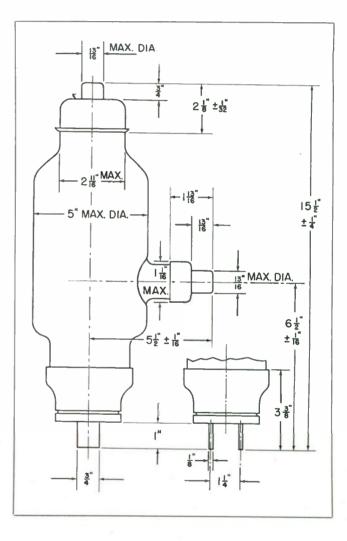
Vacuum Tube Products

TRANSMITTING TUBE TYPE F-128-A

600 Watts Plate Dissipation

Technical Data

Main Use	R-F Power Amplifier, Oscillator, Class B Modulator	
Number of Electrodes	3	
Filament Voltage	11 volts	
Current	13 amperes	
Туре	Thoriated Tungsten	
Available Thermionic	Emission 6 amperes	
Amplification Factor	36	
Approximate Direct In	ter-electrode Capacitances	
Plate to Grid	15.5 μμf	
Grid to Filament	12.0 μμf	
Plate to Filament	4.5 µµf	
Type of Cooling	Convection	
Type Base	Federal	
Mounting Socket	Federal Type 1003-A and Anode Clip	



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-128-A

600 Watts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 30 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

DC Plate Voltage	3,500 volts
Max. Signal DC Plate Current	0.600 ampere
Max. Signal Plate Input	1,800 watts
Plate Dissipation	600 watts

Typical Operation

DC Plate Voltage	3,000 volts
DC Grid Voltage	-80 volts (approx.)
Peak A-F Grid Input Voltage	250 volts (approx.)
Zero Signal Plate Current	
(per tube)	0.050 ampere
Max. Signal Plate Current	
(per tube) 🐂	¢ 0.600 ampere
Max. Signal Plate Input	
(per tube)	1,800 watts
Max. Signal Driving Power	8.5 watts (approx.)
Effective Load (plate to plate)	5,400 ohms
Power Output (2 tubes)	2,400 watts (approx.)

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR—TELEGRAPHY

(Key-down conditions per tube without modulation)*

Maximum Ratings

DC Plate Voltage	3,500 volts
DC Grid Voltage	-600 volts
DC Plate Current	1.000 ampere
DC Grid Current	0.175 ampere
R-F Grid Current	15 amperes
Plate Input	3,000 watts
Plate Dissipation+	700 watts

Typical Operation

DC Plate Voltage	3,500 volts
DC Grid Voltage	—400 volts (approx.)
Peak R-F Grid Input Voltage	680 volts (approx.)
DC Plate Current	0.854 ampere
DC Grid Current	0.107 ampere
Driving Power	73 watts (approx.)
Power Output	2,360 watts (approx.)

*Modulation essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.

[†]Duration of key-down conditions not to exceed five minutes.

CLASS B R-F POWER AMPLIFIER-TELEPHONY

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage
DC Plate Current
R-F Grid Current
Plate Input
Plate Dissipation

3,500 volts 0.500 ampere 15 amperes 900 watts 600 watts

Typical Operation

3,000 volts
-85 volts (approx.)
117 volts (approx.)
0.292 ampere
0 ampere
6.3 watts (approx.)
2,790 ohms
303 watts (approx.)

**At crest of A-F cycle Driver stage must have a tank circuit of good regulation and must be capable of delivering 235 volts at 0.200 amperes.

CLASS C R-F POWER AMPLIFIER—TELEPHONY —PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage	3,000 volts
DC Plate Current	0.700 ampere
DC Grid Current	0.150 ampere
R-F Grid Current	15 amperes
Plate Input	1,800 watts
Plate Dissipation	600 watts

Typical Operation

World Radio Histor

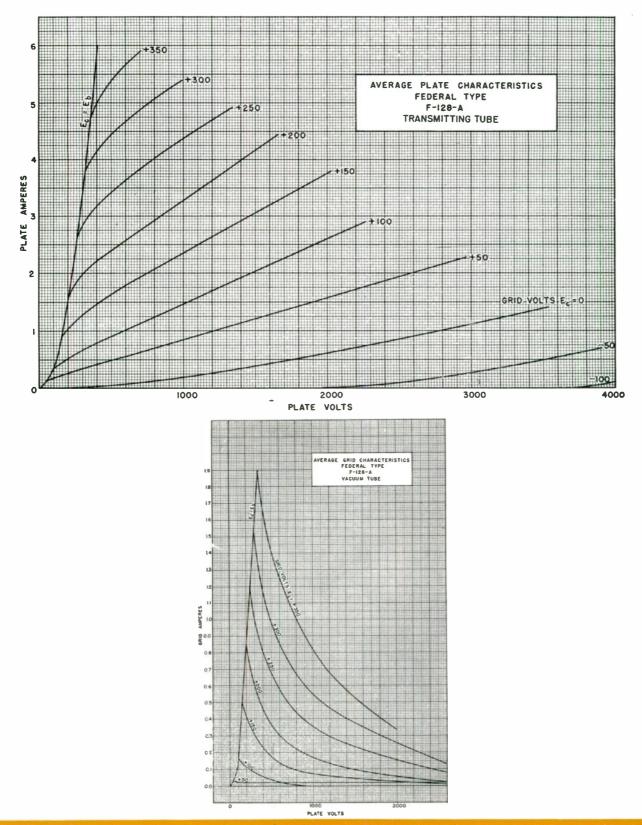
DC Plate Voltage DC Grid Voltage Peak R-F Grid Input Voltage DC Plate Current DC Grid Current Driving Power Power Output 3,000 volts -300 volts (approx.) 500 volts (approx.) 0.511 ampere 0.038 ampere 19 watts (approx.) 1,150 watts (approx.)



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-128-A

600 Watts Plate Dissipation



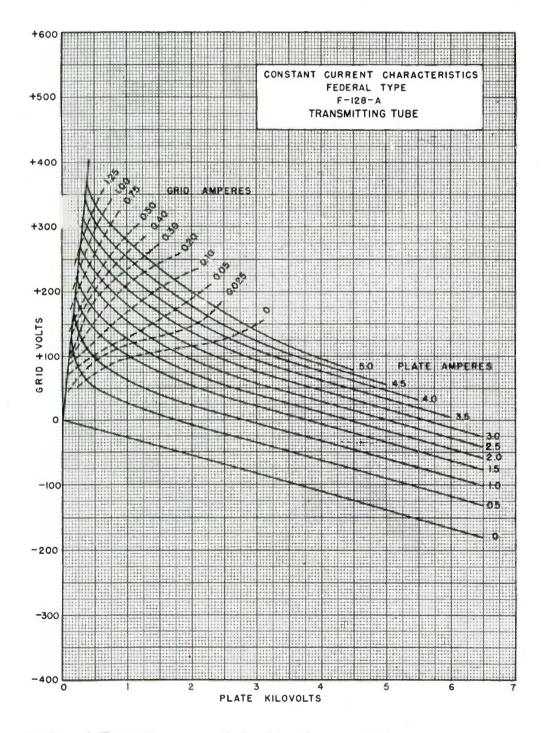
World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-128-A

600 Watts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

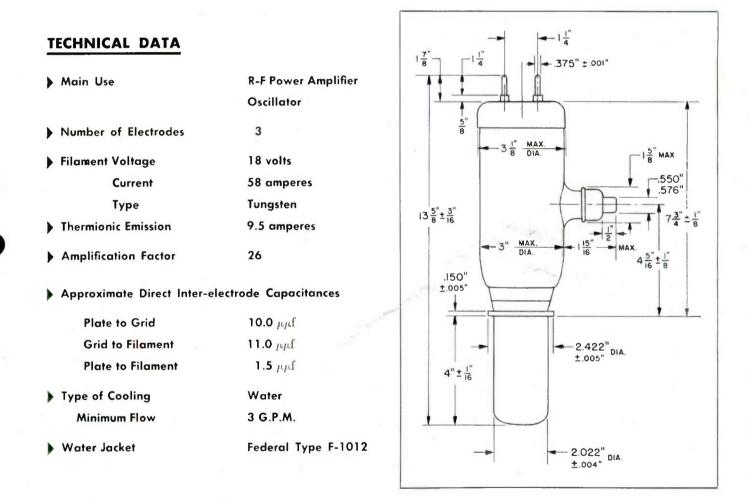
Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-129-B

5 KW Plate Dissipation



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-129-B

5 KW Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 50 megacycles

CLASS C R-F POWER AMPLIFIER-

(Carrier conditions per tube for use with modulation factor up to 1.0)

10,000 volts

1.5 amperes

30 amperes

0.25 amperes

9,000 watts 5,000 watts

Maximum Ratings

DC Plate Voltage

DC Plate Current

DC Grid Current

R-F Grid Current

Plate Dissipation

Plate Input

Maximum Ratings

Typical Operation

DC Plate Voltage

DC Plate Voltage	12,000 volts
DC Grid Voltage	-1,500 volts
DC Plate Current	2.0 amperes
DC Grid Current	0.25 amperes
R-F Grid Current	30 amperes
Plate Input	18,000 watts
Plate Dissipation	5,000 watts

CLASS C R-F POWER AMPLIFIER AND

OSCILLATOR-TELEGRAPHY (Key-down conditions per tube without modulation)*

12,000 volts

Typical Operation

		-	
DC Plate Voltage	8,000 volts	DC Grid Voltage	-1,300 volts (approx.)
DC Grid Voltage	—920 volts (approx.)	Peak R-F Grid Input Voltage	2,200 volts (approx.)
Peak R-F Grid Input		DC Plate Current	1.42 amperes
Voltage	Voltage 1,500 volts (approx.)	DC Grid Current	0.11 amperes
DC Plate Current	0.817 amperes	Driving Power	230 watts (approx.)
DC Grid Current	0.097 amperes	Power Output	12,000 watts (approx.)
Driving Power	140 watts (approx.)	 Modulation essentially negative, may be used if the positive positive for the audio frequency envelope does not exceed 115% of carrier condition value. 	
Power Output	5,260 watts (approx.)		

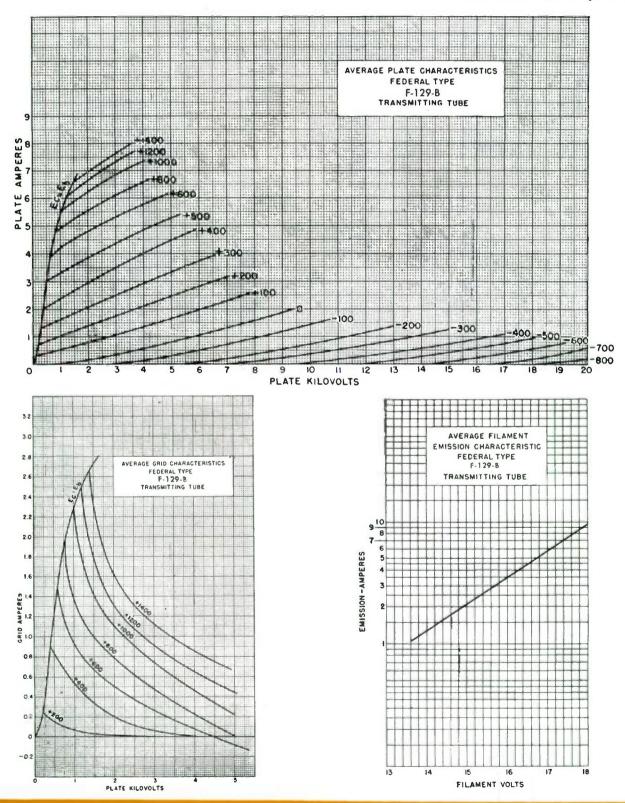
World Radio History



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-129-B

5 KW Plate Dissipation



World Radio History

Vacuum Tube Products

5 KW Plate Dissipation



TRANSMITTING TUBE TYPE F-129-B

+1800 I9 GRID +1600 MPERES +1400 +1200 +1000 +800 GRID VOLTS +600 +400 +200 Ip PLATE WPERE 0 -200 5 4 -400 23 2 -600 -800 Ō -1000 CONSTANT CURRENT CHARACTERISTICS FEDERAL TYPE F-129-B -1200 TRANSMITTING TUBE -1400 -1600 -1800 0 8 10 12 14 16 18 20 22 24 26 28 2 6 PLATE KILOVOLTS

Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 4, New Jersey



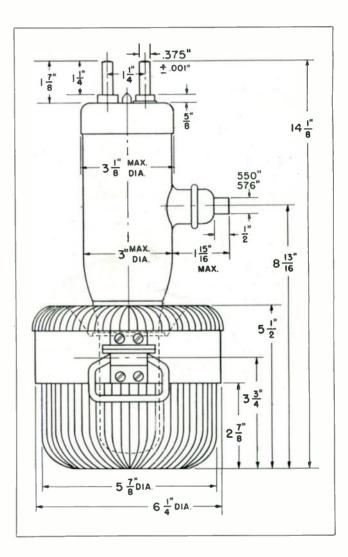
Vacuum Tube Products

TRANSMITTING TUBE TYPE F-129-R

5 Kilowatts Plate Dissipation

Technical Data

▶ Main Use	R-F Power Amplifier, Oscillator
Number of Electrodes	3
Filament Voltage	18 volts
Current	58 amperes
Туре	Tungsten
Thermionic Emission	9.5 amperes
Amplification Factor	26
Approximate Direct Inter-electro	de Capacitances
Plate to Grid	11.0 μμf
Grid to Filament	11.0 μμf
Plate to Filament	2.5 μμf
Type of Cooling	Forced Air
Mounting	Special



Vocuum Tube Products



TRANSMITTING TUBE TYPE F-129-R

5 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 50 megacycles

CLASS C R-F POWER AMPLIFIER-TELEPHONY-PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage10,000 voltsDC Plate Current1.5 amperesDC Grid Current0.25 amperesR-F Grid Current30 amperesPlate Input9,000 wattsPlate Dissipation5,000 watts

Typical Operation

DC Plate Voltage	8,000 volts
DC Grid Voltage	920 volts (approx.)
Peak R-F Grid Input Voltage	1,500 volts (approx.)
DC Plate Current	0.817 amperes
DC Grid Current	0.097 amperes
Driving Power	140 watts (approx.)
Power Output	5,260 watts (approx.)

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR-TELEGRAPHY

(Key-down conditions per tube without modulation)*

Maximum Ratings

DC Plate Voltage	12,000 volts
DC Grid Voltage	-1,500 volts
DC Plate Current	2.0 amperes
DC Grid Current	0.25 amperes
R-F Grid Current	30 amperes
Plate Input	18,000 watts
Plate Dissipation	5,000 watts

*Modulation essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.

Typical Operation

DC Plate Voltage	12,000 volts
DC Grid Voltage	-1,300 volts (approx.)
Peak R-F Grid Input Voltage	2,200 volts (approx.)
DC Plate Current	1.42 amperes
DC Grid Current	0.11 amperes
Driving Power	230 watts (approx.)
Power Output	12,000 watts (approx.)

Air Requirements Per Tube

Anode Dissipation K W {1}	Minimum Recommended Air Flow Cu. Ft./Min.	Approx. Air Press. (2) In. of water	Air Velocity Through Fin. Assy. Ft./Min.	Approx. Temp. Rise of air Deg. Cent.	Anode Dissipation K W (1)	Minimum Recommended Air Flow Cu. Ft./Min.	Approx. Air Press. (2) In. of water	Air Velocity Through Fin. Assy. Ft./Min.	Approx. Temp. Ris of air Deg. Cent
	INI	TAKE AIR TEMP	. 25°C			INT	AKE AIR TEMP	. 45°C	
3	300	.34	2550	17.6	3	400	.62	3400	14.1
4	450	.78	3820	15.7	4	575	1.29	4880	13.1
5	600	1.4	5090	14.7	5	800	2.5	6800	11.75

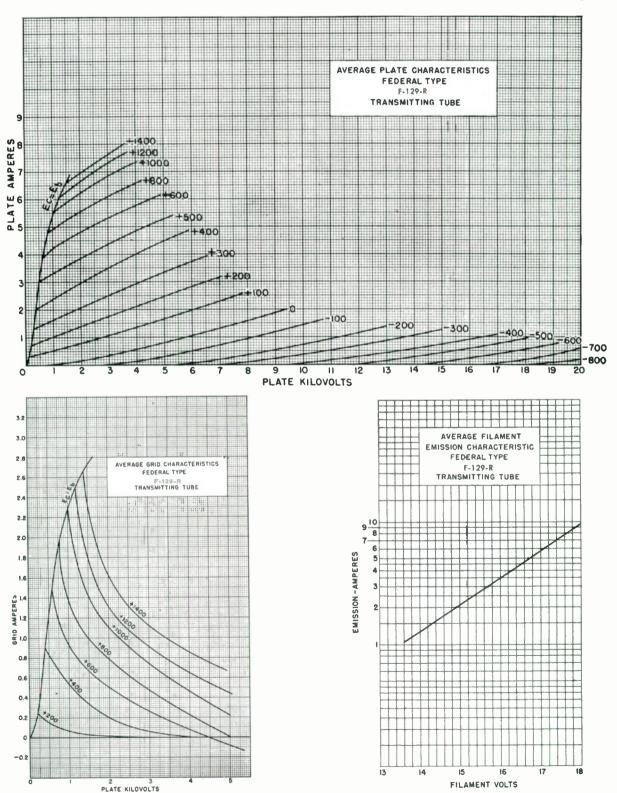
 This is the anode dissipation exclusive of filament power dissipated through anode. (2) This pressure is measured at the base of tube mounting. Duct work must be considered to determine pressure against which blower must deliver required amount of air.

World Radio History



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-129-R



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-129-R

+1800 I9 GRID +1600 MPERES +1400 +1200 +1000 +800 GRID VOLTS +600 +400 +200 TH PUATE 0 AMPERE -200 -400 2 -600 -800 Ô. -1000 CONSTANT CURRENT CHARACTERISTICS FEDERAL TYPE -1200 F-129-R TRANSMITTING TUBE -1400 -1600 -1800 ō 12 16 18 26 2 4 6 8 10 14 20 22 24 28 PLATE KILOVOLTS

5 Kilowatts Plate Dissipation

Federal Telephone and Radio Corporation

Vacuum Tube Products

ASSOCIAT

Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-132-A

Maximum Plate Dissipation

600 Watts Plate Dissipation

Technical Data		
▶ Main Use	Audio Amplifier	$\frac{5}{16} \begin{bmatrix} 1 & \frac{3}{6} \\ 1 & \frac{3}{6} \end{bmatrix} = \begin{bmatrix} 1 & \frac{3}{6} \\ 1 & \frac{3}{6} \end{bmatrix}$
Number of Electrodes	3	16 - + 1 + - 16
 Filament Voltage Current Type 	11 volts 13 amperes Thoriated Tungsten	
 Available Thermionic Emission 	6 amperes	3 <u>13</u> [°] DIA.
Average Characteristic Value	es calculated at	16 +I
E _b =3,000 volts, I _b =0.200 c Grid Voltage (approximate) – Amplification Factor		
Transconductance	6,250 micromhos	
Plate Resistance	1,600 ohms	
 Approximate Direct Inter-ele Plate to Grid Grid to Filament Plate to Filament 	ectrode Capacitances 15.0 μμf 12.0 μμf 5.5 μμf	$4\frac{3}{4} \pm \frac{1}{6}$
Type of Cooling	Convection	
Type Base	Standard 250 watt and Grid Cap	
Type of Mounting	Standard 250 watt and Grid Clip	- 13 DIA. 16 PLATE

Maximum Ratings and Typical Operation Data

3500 volts

Maximum Ratings

DC Plate Voltage

CLASS A AUDIO AMPLIFIER

600 watts

Typical Operation as push pull Class A driver for 2 Type F-125-A tubes.

ALL VALUES FOR TWO TUBES

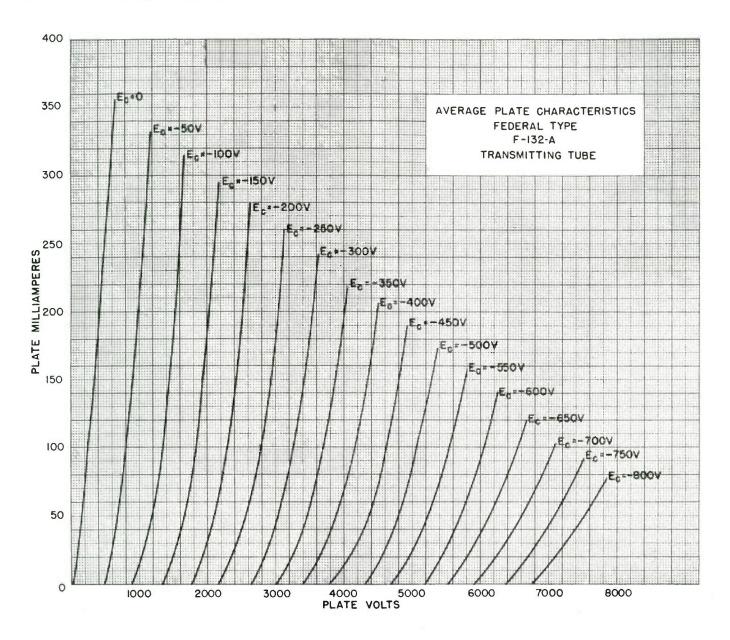
DC Plate Voltage	3500	2700 volts
DC Grid Voltage	-300	-225 volts
Zero Signal Plate Current	.308	.300 amperes
Max. Signal Plate Current	.317	.307 amperes
Peak Grid to Grid Signal Voltage	590	440 volts
Peak Plate to Plate Output Voltage	5700	4000 volts
Effective Plate to Plate Load Impedance	40,000	35,000 ohms
Output Transformer turns ratio	1:1	1:1.3
Total Harmonic Distortion	2	1 percent

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-132-A

600 Watts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-207

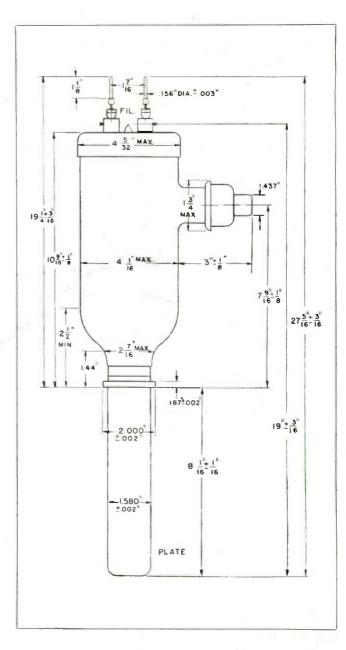
10 Kilowatts Plate Dissipation

Technical Data

Main Use	General Purpose		
Number of Electrodes	3		
Filament Voltage	22 volts		
Current	52 amperes		
Туре	Tungsten		
Thermionic Emission	10 amperes		
Amplification Factor	20		
Approximate Direct Inter-ele	ctrode Capacitances		
Plate to Grid	27 µµf		
Grid to Filament	18 µµf		
Plate to Filament	2 μμf		
▶ Type of Cooling	Water		
Minimum Flow	5 G.P.M.		
Water Jacket	Standard or Federal		
	Type F-1000		

Maximum Rating versus Operating Frequency

Operating	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input			
Frequency Megacycles	Class B Telephony	Class C Telephony	Class C Telegraphy	
1.6	100	100	100	
7.5	85	85	75	
20	76	75	50	



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-207

10 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 1.6 megacycles

CLASS B A-F POWER AMPLIFIER AND MODULATOR

Maximum Ratings

DC Plate Voltage Max. Signal DC Plate Current* Max. Signal Plate Input* Plate Dissipation*

2.0 amperes 20 kw 7.5 kw

15,000 volts

Typical Operation

(Unless otherwise specified, values are for 2 tubes)

DC Plate Voltage	12,500 volts
DC Grid Voltage	-575 volts
Peak A-F Grid-to-Grid	
Voltage	2,300 volts
Zero Signal DC Plate	
Current	0.4 amperes
Max. Signal DC Plate	
Current	2.8 amperes
Load Resistance (per tube)	2,500 ohms
Effective Load Resistance	
(plate to plate)	10,000 ohms
Max. Signal Driving Power	
Max. Signal Power Output	

*Averaged over any audio-frequency cycle.

CLASS B TELEPHONY R-F POWER AMPLIFIER

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

15,000 volts

15 kw

10 kw

1.0 amperes

24 amperes

Maximum Ratings

DC Plate Voltage DC Plate Current R-F Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current Driving Power** Power Output 14,000 volts -650 volts 730 volts 1.0 amperes 0 watts (approx.) 4 kw (approx.)

**At crest of a-f cycle with modulation factor of 1.0

CLASS C TELEPHONY PLATE-MODULATED R-F POWER AMPLIFIER

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

Maximum Ratings

- DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation
- 10,000 volts -3,000 volts 1.0 amperes 0.2 amperes 24 amperes 10 kw 6.6 kw

Typical Operation

- DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output
- 10,000 volts ~2,000 volts 2,660 volts 0.75 amperes
 - 0.07 amperes (approx.) 185 watts (approx.) 6 kw (approx.)

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation)†

Maximum Ratings

- DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation
- 15,000 volts -3,000 volts 2.0 amperes 0.2 amperes 30 amperes 30 kw 10 kw

Typical Operation

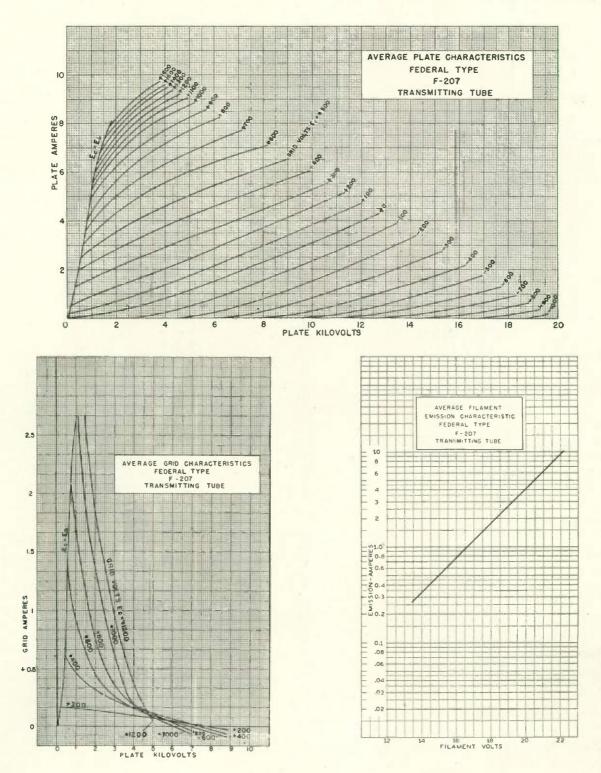
DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 12,000 volts -1,600 volts 2,650 volts 1.67 amperes 0.09 amperes (approx.) 235 watts (approx.) 15 kw (approx.)

[†]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions. .



Vacuum Tube-Producte

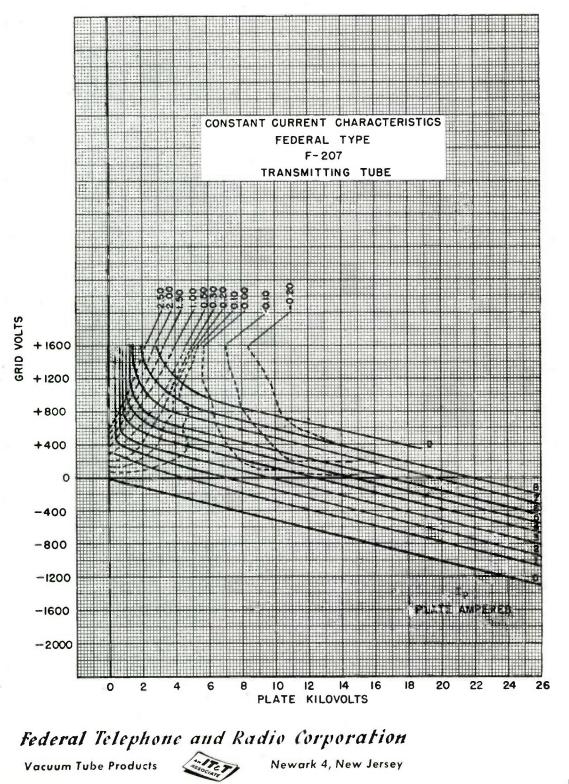
TRANSMITTING TUBE TYPE F-207



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-207

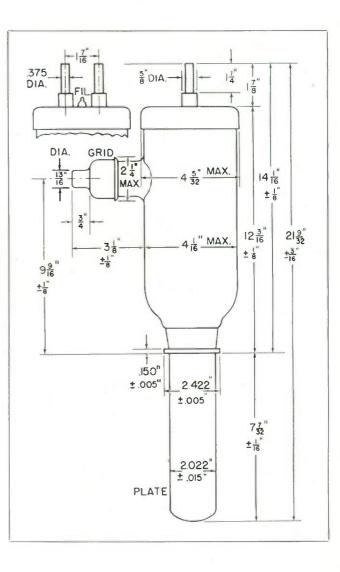




Vacuum Tube Products

TRANSMITTING TUBE TYPE F-320-B

General Purpose
3
21.5 volts
41 amperes
Tungsten
7.5 amperes
40
de Capacitances
26 μμf
20 µµí
3 µµf
Water
5 G.P.M.
Standard or Federal
Туре F-1005



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-320-B

10 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 4.0 megacycles

CLASS B R-F POWER AMPLIFIER — TELEPHONY

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage14,000 voltsDC Plate Current1.2 amperesR-F Grid Current30 amperesPlate Input14,000 wattsPlate Dissipation10,000 watts

Typical Operation

modulation factor up to 1.0)
12,000 volts
-275 volts (approx.)
1,080 volts (approx.)
0.630 ampere
0.081 ampere
80 watts (approx.)
5,400 ohms
2,500 watts (approx.)

*At crest of A-F cycle.

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR — TELEGRAPHY

(Key-down conditions per tube without modulation)*

Maximum Ratings

DC Plate Voltage	15,000 volts
DC Grid Voltage	-3,000 volts
DC Plate Current	1.5 amperes
DC Grid Current	0.30 ampere
R-F Grid Current	30 amperes
Plate Input	22,500 watts
Plate Dissipation	10,000 watts

*Modulation essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

DC Plate Voltage	15,000 volts
Max. Signal DC Plate Current	1.5 amperes
Max. Signal Plate Input	20,000 watts
Plate Dissipation	10,000 watts

Typical Operation

DC Plate Voltage	13,500 volts
DC Grid Voltage	-250 volts (approx.)
Peak A-F Grid-to-Grid	
Input Voltage	2,100 volts (approx.)
Zero Signal Plate Current	
(per tube)	0.125 ampere
Max. Signal Plate Current	
(per tube)	1.25 amperes
Max. Signal Plate Input	
(per tube)	16,875 watts
Max. Signal Driving Power	450 watts (approx.)
Effective Load	
(plate to plate)	12,000 ohms
Power Output (2 tubes)	24,000 watts (approx.)

CLASS C R-F POWER AMPLIFIER — TELEPHONY — PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage
DC Plate Current
DC Grid Current
R-F Grid Current
Plate Dissipation

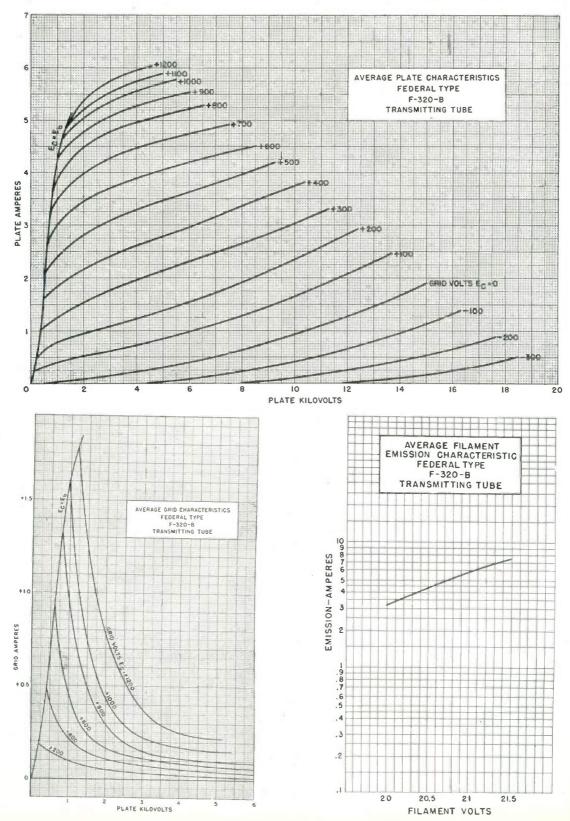
10,000 volts 1.1 amperes 0.25 ampere 30 amperes 8,000 watts



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-320-B

10 Kilowatts Plate Dissipation



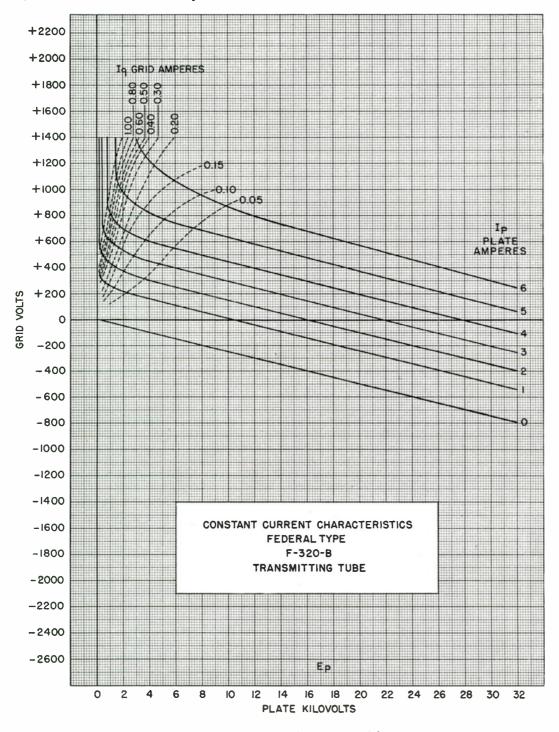
World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-320-B

10 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 4, New Jersey

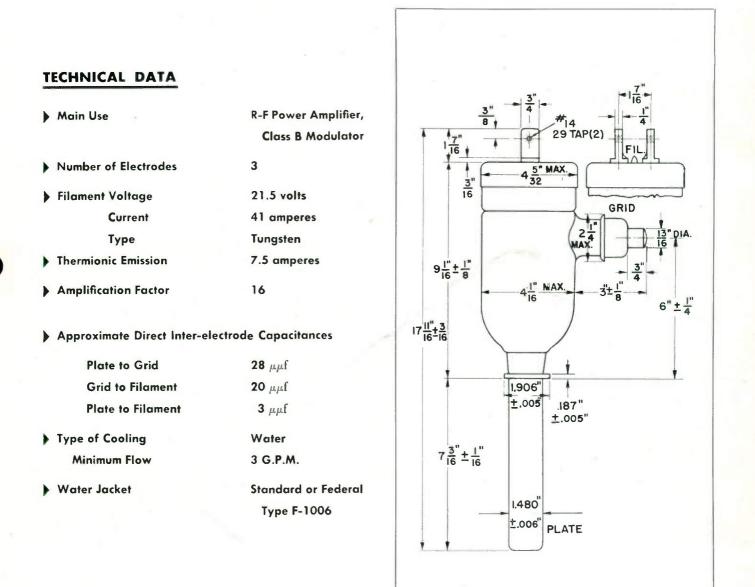
Printed in U.S.A. Form F-161



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-328-A

5 Kilowatts Plate Dissipation



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-328-A

5 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 3.0 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

DC Plate Voltage	8,000 volts
Max. Signal DC Plate Current	1.0 ampere
Max. Signal Plate Input	8,000 watts
Plate Dissipation	4,000 watts

CLASS B R-F POWER AMPLIFIER-

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage DC Plate Current R-F Grid Current Plate Input Plate Dissipation 8,000 volts 1.0 ampere 30 amperes 8,000 watts 5,000 watts

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage	5,000 volts
DC Plate Current	1.1 amperes
DC Grid Current	0.20 ampere
R-F Grid Current	30 amperes
Plate Input	5,000 watts
Plate Dissipation	3,500 watts

Typical Operation

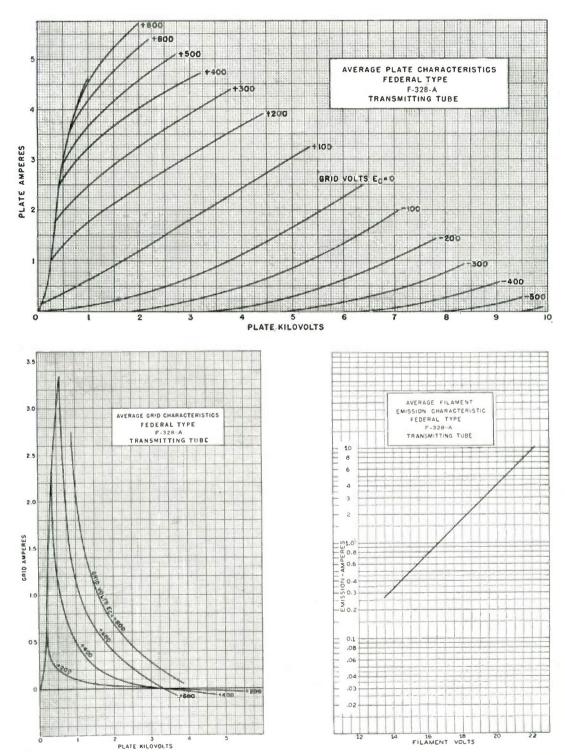
DC Plate Voltage	6,000 volts
DC Grid Voltage	-350 volts (approx.)
Peak R-F Grid Input Voltage	420 volts (approx.)
DC Plate Current	0.540 ampere
DC Grid Current	0.002 ampere
Driving Power*	83 watts (approx.)
Load Impedance	2,950 ohms
Power Output	1,060 watts (approx.)
*At crest of A-F cycle.	



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-328-A





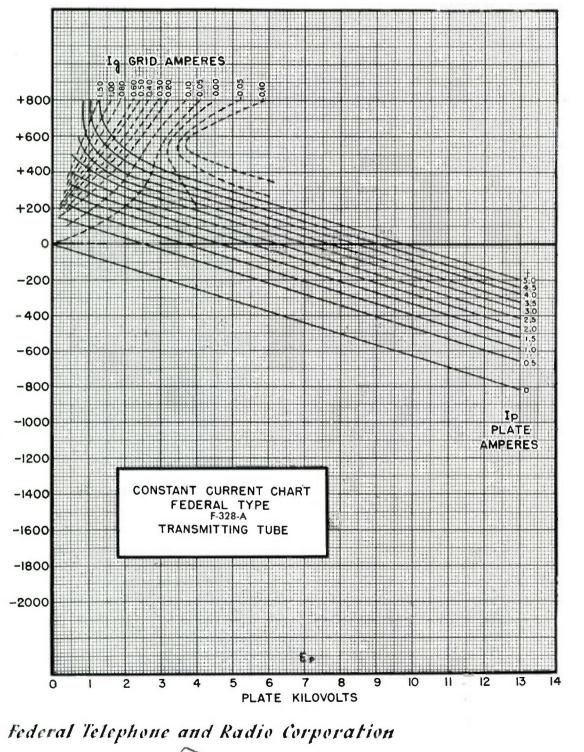
World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-328-A

5 Kilowatts Plate Dissipation



Vacuum Tube Products

Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-328-B

1.480^{**} ±.006^{**}

PLATE

5 Kilowatts Plate Dissipation

		B 233"R.
TECHNICAL DATA		
Main Use	R-F Power Amplifier,	C
	Class B Modulator	.500" -
Number of Electrodes	3	.500"- A B 437" ±.001" A C +.001"
Filament Voltage	21.5 volts	
Current	41 amperes	4 <u>5</u> " MAX.
Туре	Tungsten	4
Thermionic Emission	7.5 amperes	GRID
Amplification Factor	16	$9\frac{1''}{16}\pm\frac{1''}{8}$ $9\frac{1''}{16}\pm\frac{1''}{8}$ MAX.
Approximate Direct Inte	r-electrode Capacitances	$4\frac{1}{16}$ MAX. $3^{"}$
Plate to Grid	28 µµf	5" 3" [6] C"+ ["
Grid to Filament	20 <i>µµ</i> ſ	$17\frac{5''}{16}\pm\frac{3''}{16}$ $6''\pm\frac{1}{4}$
Plate to Filament	3 popul	
Type of Cooling	Water	
Minimum Flow	3 G.P.M.	1.906" ±.005" .187" +.005"
Water Jacket	Standard or Federal	+.005"
50	Type F-1006	$7\frac{3}{16} \pm \frac{1}{16}$

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-328-B

5 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 3.0 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

DC Plate Voltage	8,000 volts	
Max. Signal DC Plate		
Current	1.0 ampere	
Max. Signal Plate Input	8,000 watts	
Plate Dissipation	4,000 watts	

CLASS B R-F POWER AMPLIFIER-

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage DC Plate Current R-F Grid Current Plate Input Plate Dissipation 8,000 volts 1.0 ampere 30 amperes 8,000 watts 5,000 watts

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage	5,000 volts
DC Plate Current	1.1 amperes
DC Grid Current	0.20 ampere
R-F Grid Current	30 amperes
Plate Input	5,000 watts
Plate Dissipation	3,500 watts

Typical Operation

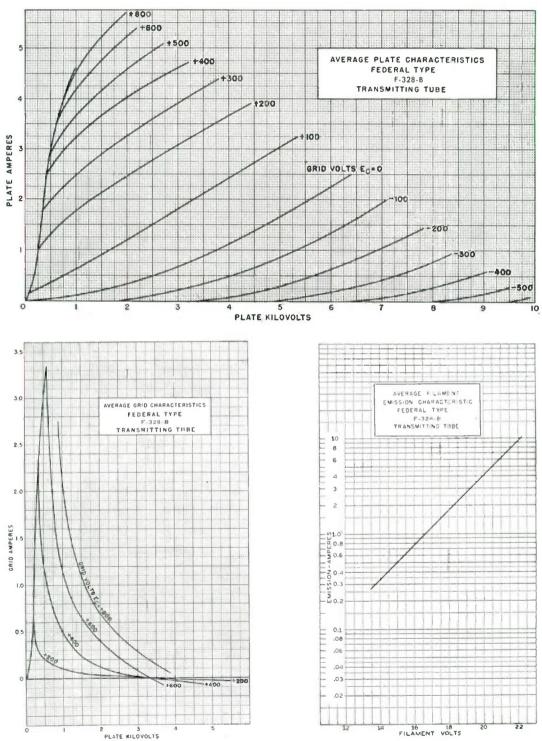
DC Plate Voltage	6,000 volts
DC Grid Voltage	-350 volts (approx.)
Peak R-F Grid Input Voltage	420 volts (approx.)
DC Plate Current	0.540 ampere
DC Grid Current	0.002 ampere
Driving Power*	83 watts (approx.)
Load Impedance	2,950 ohms
Power Output	1,060 watts (approx.)
*At crest of A-F cycle.	



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-328-B

5 Kilowatts Plate Dissipation

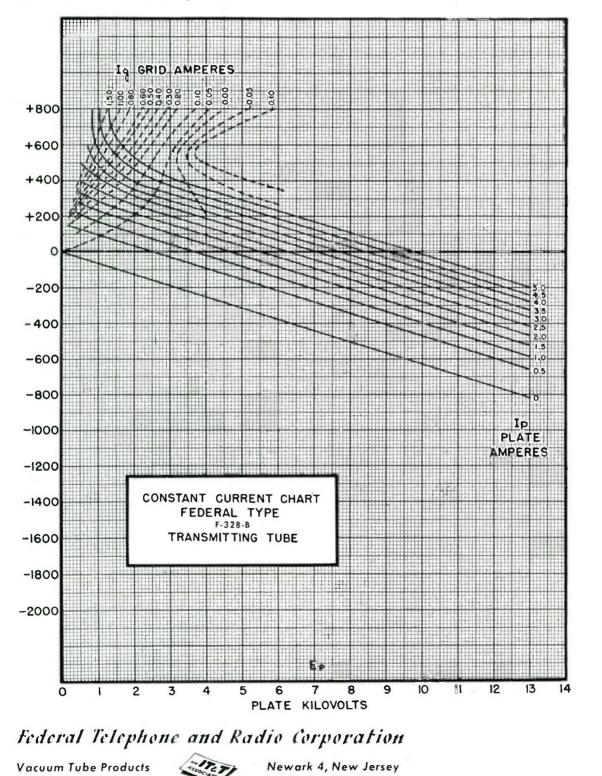


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-328-B

5 Kilowatts Plate Dissipation



World Radio History



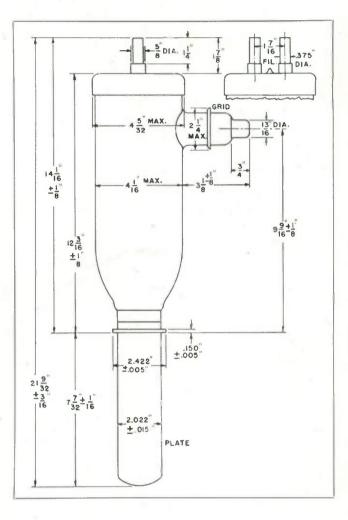
Vacuum Tube Products

TRANSMITTING TUBE TYPE F-342-A

25 Kilowatts Plate Dissipation

Technical Data

Main Use	R-F Power Amplifier, Oscillator	
Number of Electrodes	3	
Filament Voltrige	20 volts	
Current	71 amperes	
Туре	Tungsten	
Thermionic Emission	13.5 amperes	
Amplification Factor	40	
Approximate Direct Inter-e	electrode Capacitances	
Plate to Grid	27 µµf	
Grid to Filament	19 µµf	
Plate to Filament	2.5 µµf	
Type of Cooling	Water	
Minimum Flow	10 G.P.M.	
Water Jacket	Standard or Federal Type F-1005	



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-342-A

25 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 4.0 megacycles

CLASS B R-F POWER AMPLIFIER TELEPHONY

CLASS C R-F POWER AMPLIFIER TELEPHONY — PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0) (Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

Typical Operation

DC Plate Voltage	20,000 volts
DC Plate Current	2.0 amperes
R-F Grid Current	40 amperes
Plate Input	30,000 watts
Plate Dissipation	20,000 watts

Maximum Ratings

DC Plate Voltage	14,000 volts
DC Plate Current	2.0 amperes
DC Grid Current	0.30 ampere
R-F Grid Current	40 amperes
Plate Input	40,000 watts
Plate Dissipation	15,000 watts

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR — TELEGRAPHY

(Key-down conditions per tube without modulation)*

DC Plate Voltage	17,500 volts		
Ũ		Maximum Ratings	
DC Grid Voltage	-430 volts (approx.)	DC Plate Voltage	20,000 volts
Peak R-F Grid Input Voltag	je 760 volts (approx.)	DC Grid Voltage	-5,000 volts
DC Plate Current	1.55 amperes	DC Plate Current	3.0 amperes
DC Grid Current	0.021 amperes	DC Grid Current	0.30 ampere
Driving Power**	28 watts (approx.)	R-F Grid Current	40 amperes
Load Impedance	2,780 ohms	Plate Input	50,000 watts
Power Output	8,250 watts (approx.)	Plate Dissipation	25,000 watts

*Modulation essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.

**At crest of A-F cycle.

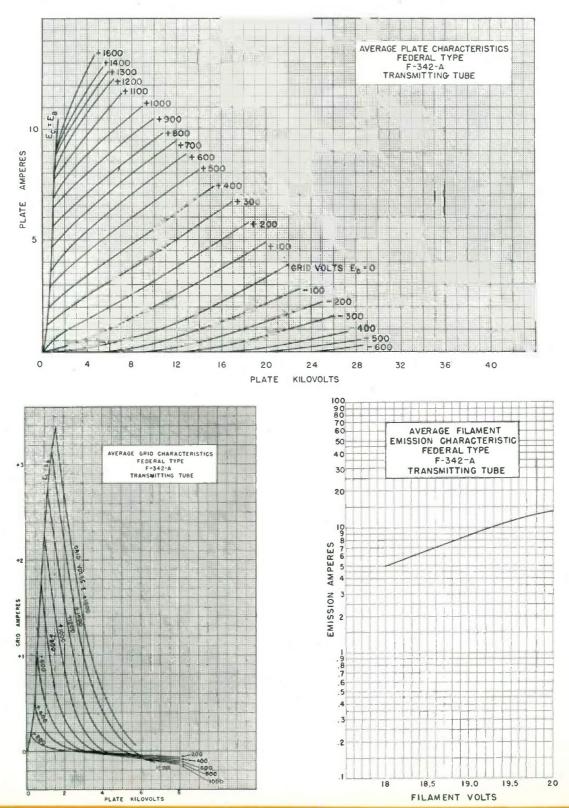
World Radio History



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-342-A

25 Kilowatts Plate Dissipation



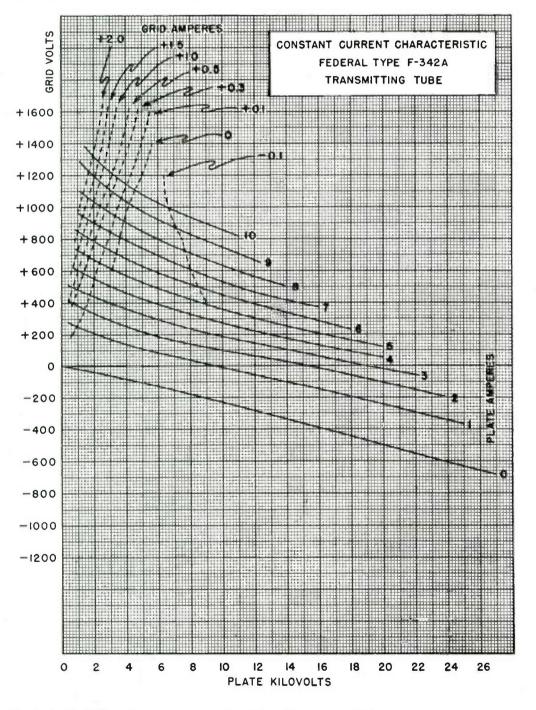
World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-342-A

25 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 4, New Jersey



Vacuum Tube Products

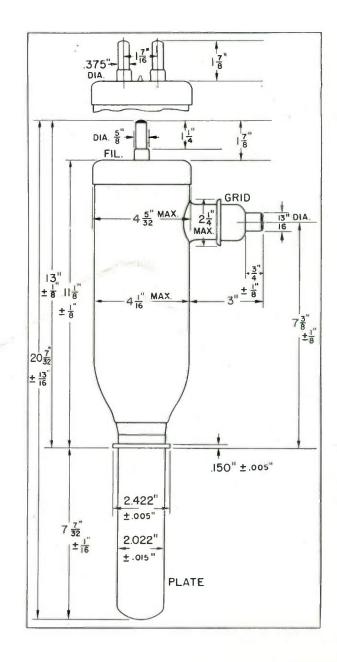
TRANSMITTING TUBE TYPE F-343-A

10 Kilowatts Plate Dissipation

Technical Data

Main Use **R-F Power Amplifier** Number of Electrodes 3 Filament Voltage 21.5 volts Current **58** amperes Type Tungsten Thermionic Emission 10 amperes Amplification Factor 40 Approximate Direct Inter-Electrode Capacitances **Plate to Grid** 25 µµf **Grid to Filament** 17 µµf **Plate to Filament** 2 ppf > Type of Cooling Water 5 G.P.M. Minimum Flow Water Jacket **Standard or Federal**

Type F-1005



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-343-A

10 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 4.0 megacycles

CLASS B AUDIO AMPLIFIER OR MODULATOR

Maximum Ratings

DC Plate Voltage	15,000	volts
Max. Signal DC Plate Current	2	amperes
Max. Signal Plate Input	25,000	watts
Plate Dissipation	10,000	watts

CLASS C R-F POWER AMPLIFIER-TELEPHONY-PLATE MODULATED

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Dissipation 10,000 volts 1.5 amperes 0.25 ampere 30 amperes 8,000 watts

Typical Operation

(Carrier conditions per tube for use with modulation factor up to 1.0)DC Plate Voltage9,000 voltsDC Grid Voltage-800 volts (approx.)Peak R-F Grid Input Voltage1,380 volts (approx.)DC Plate Current0.675 ampereDC Grid Current0.043 ampereDriving Power58 watts (approx.)Power Output5,000 watts (approx.)

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR—TELEGRAPHY

(Key-down conditions per tube without modulation)*

Maximum Ratings

World Radio History

DC Plate Voltage	15,000 volts
DC Grid Voltage	-3,000 volts
DC Plate Current	2.0 amperes
DC Grid Current	0.30 ampere
R-F Grid Current	30 amperes
Plate Input	25,000 watts
Plate Dissipation	10,000 watts

*Modulation, essentially negative, may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier condition value.

CLASS B R-F POWER AMPLIFIER-

TELEPHONT

(Carrier conditions per tube for use with modulation factor up to 1.0)

Maximum Ratings

DC Plate Voltage	14,000 volts
DC Plate Current	1.5 amperes
R-F Grid Current	30 amperes
Plate Input	15,000 watts
Plate Dissipation	10,000 watts

Typical Operation

(Carrier conditions per tube for use with modulation factor up to 1.0)

DC Plate Voltage	12,000 volts
DC Grid Voltage	-220 volts (approx.)
Peak R-F Grid Input Voltage	820 volts (approx.)
DC Plate Current	0.610 ampere
DC Grid Current	0.060 ampere
Driving Power*	47 watts (approx.)
Load Impedance	6,200 ohms
Power Output	2,500 watts (approx.)

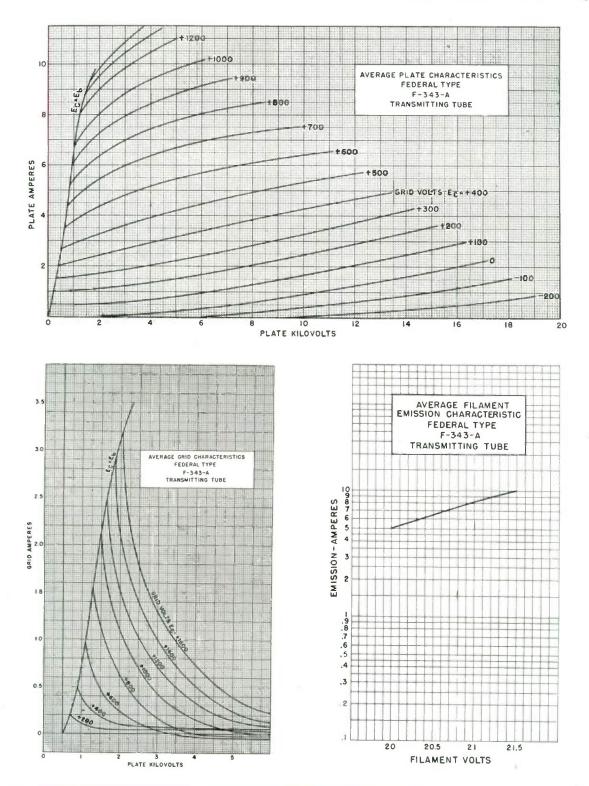
*At crest of A-F cycle.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-343-A

10 Kilowatts Plate Dissipation

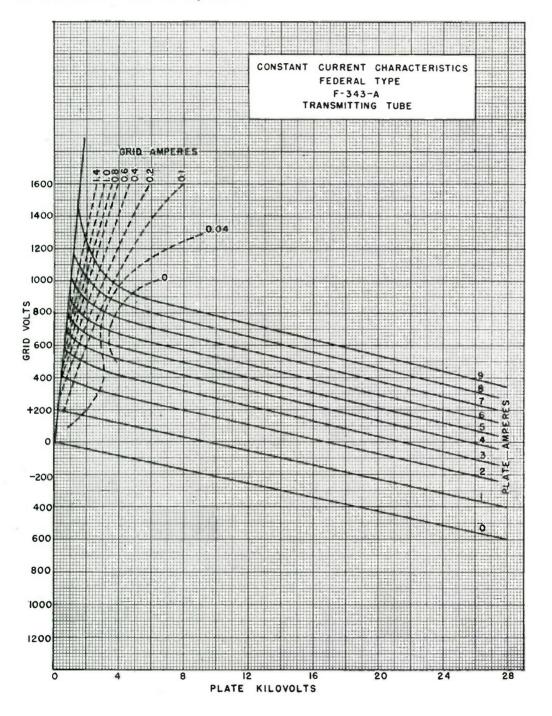


Vacuum Tube Products

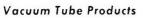


TRANSMITTING TUBE TYPE F-343-A

10 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation



Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-858

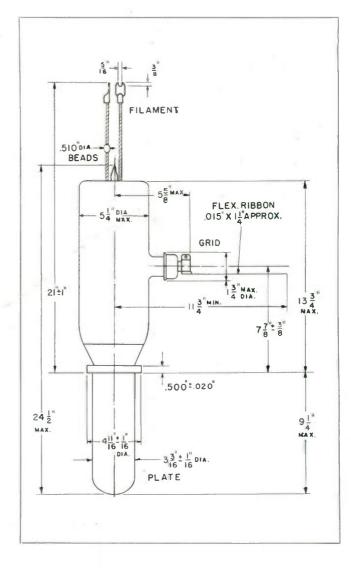
20 Kilowatts Plate Dissipation

Technical Data

Main Use	Oscillator or		
	R-F Amplifier		
Number of Electrodes	3		
Filament Voltage	22 volts		
Current	52 amperes		
Туре	Tungsten		
• Available Thermionic Emission	10 amperes		
Amplification Factor	42		
Approximate Direct Inter-electro	ode Capacitances		
Plate to Grid	18 μμf		
Grid to Filament	16 μμf		
Plate to Filament	2 μμf		
> Type of Cooling	Water		
Minimum Flow	15 G.P.M.		
Water Jacket	Federal Type F-1010		

Maximum Ratings versus Operating Frequency

Operating	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input			
Frequency Megacycles	Class B Telephony	Class C Telephony	Class C Telegraphy	
1.5	100	100	100	
20	85	75	75	
40	65	50	50	



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-858

20 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 1.5 megacycles

CLASS B A-F POWER AMPLIFIER

Maximum Ratings

DC Plate Voltage	20,000	volts
Max. Signal DC Plate		
Current*	2.0	amperes
Max. Signal DC Plate Input*	40	kw
Plate Dissipation*	20	kw

Typical Operation

(Unless otherwise specified values are for 2 tubes)

DC Plate Voltage	12,000	volts
DC Grid Voltage	-140	volts
Peak A-F Grid-to-Grid		
Voltage	2,600	volts
Zero Signal DC Plate		
Current	0.05	ampere
Max. Signal DC Plate		
Current	3.6	amperes
Load Resistance (per tube)	1,800	ohms
Effective Load Resistance		
(plate to plate)	7,200	ohms
Max. Signal Driving Power	115	watts (approx.)
Max. Signal Power Output	26.5	kw (approx.)

*Averaged over any audio-frequency cycle

CLASS B TELEPHONY R-F POWER AMPLIFIER

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

Maximum Ratings

DC Plate Voltage	20,000 volts
DC Plate Current	1.0 ampere
R-F Grid Current	48 amperes
Plate Input	20 kw
Plate Dissipation	15 kw

Typical Operation

DC Plate Voltage	18,000 volts
DC Grid Voltage	-300 volts
Peak R-F Grid Voltage	725 volts
DC Plate Current	0.9 ampere
Driving Power**	85 watts (approx.)
Power Output	5.6 kw (approx.)

**At crest of a-f cycle with modulation factor of 1.0

CLASS C TELEPHONY PLATE MODULATED R-F POWER AMPLIFIER

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

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output -3,000 volts 1.0 ampere 0.25 ampere 48 amperes 12 kw 10 kw

12,000 volts

12,000 volts -1,000 volts 1,950 volts 0.95 ampere 0.08 ampere (approx.) 150 watts (approx.) 8 kw (approx.)

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation*)

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 20,000 volts -3,000 volts 2.0 amperes 0.25 ampere 60 amperes 40 kw 20 kw

18,000 volts -1,200 volts 2,600 volts 1.8 amperes 0.10 ampere (approx.) 250 watts (approx.) 22.4 kw (approx.)

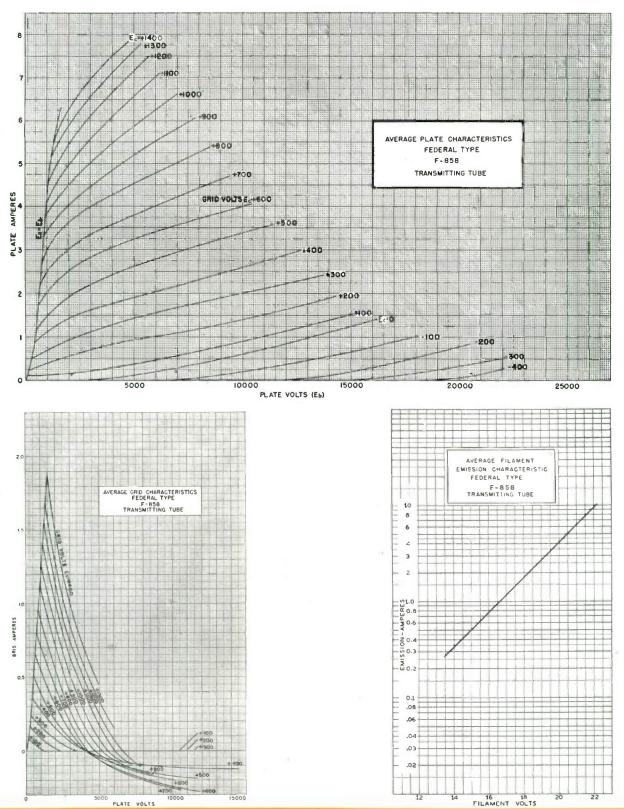
*Modulation essentially negative may be used if the positive peak of the audio-frequency envelape does not exceed 115% of the carrier conditions.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-858

20 Kilowatts Plate Dissipation



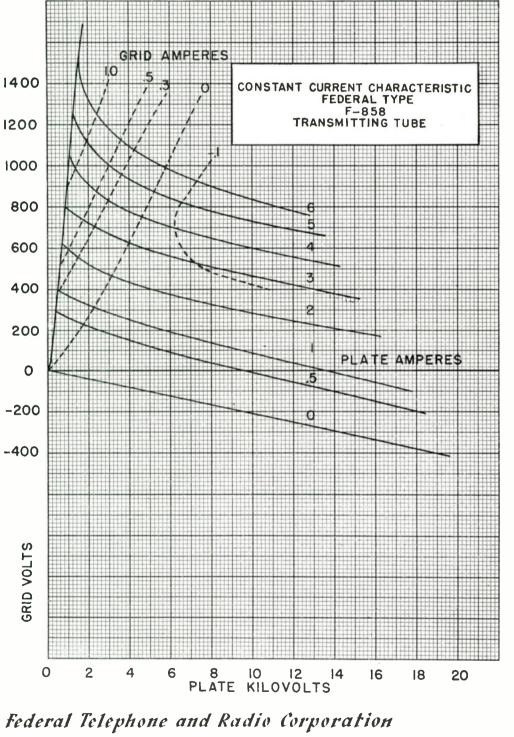
World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-858

20 Kilowatts Plate Dissipation



Vacuum Tube Products

ANTTET ASSOCIATE Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-893-RA

20 Kilowatts Plate Dissipation

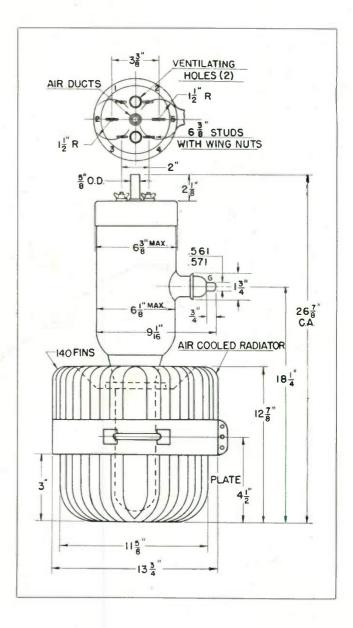
Technical Data

Main Use	R-F Power Amplifier
	Class B Modulator
Number of Electrodes	3
Filament Voltage Per Strand	10 volts
Current Per Terminal	61 amperes
Excitation	1, 3, or 6 A-C
Amplification Factor	36
Approximate Direct Inter-elect	rode Capacitances
Plate to Grid	33 <i>μ</i> μf
Grid to Filament	48 μμf
Plate to Filament	3.2 µµf
Mounting	Special
> Type of Cooling	Forced Air

A vertical air flow of at least 1800 cu. ft./min. should be delivered by a blower to the cooling radiator. An air flow of about 2 cu. ft./min. should be supplied to the air nozzle in the filament base. Cooling must be adequate to limit the glass temperature to not more than 150°C at the hottest part. Air flow must start before the application of any voltages.

Maximum Ratings versus Operating Frequency

Operating	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input			
Frequency Megacycles	Class B	Class C	Class C Telegraphy	
	Telephony T	Telephony	Volt	Input
5	100	100	100	100
12	86	81	81	75
25	74	65	65	50



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-RA

20.000 volts

4 amperes 60 kilowatts

20 kilowatts

20 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For a Maximum Frequency of 5 Megacycles

A-F POWER AMPLIFIER AND MODULATOR --- CLASS B

Maximum Ratings

DC Plate Voltage Max. Signal DC Plate Current Max. Signal Plate Input Plate Dissipation

Typical Operation

Unless otherwise specified, values are for 2 tubes DC Plate Voltage 18,000 volts -450 volts DC Grid Voltage Peak A-F Grid to Grid Voltage 1,720 volts Zero Signal DC Plate Current 0.8 amperes Max. Signal DC Plate Current 5.5 amperes Effective Load Resistance Plate to Plate 8,000 ohms 140 watts (approx.) Driving Power 70 kilowatts (approx.) Max. Signal Power Output

CLASS C R-F POWER AMPLIFIER TELEPHONY - PLATE MODULATED

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

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input **Plate Dissipation**

12,000 volts -3.000 volts 2 amperes 0.4 amperes 24 kilowatts 12 kilowatts

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output

12.000	volts
-1,000	
1,500	volts
2	amperes
0.14	amperes (approx.)
210	watts (approx.)
18	kilowatts (approx.)

20.000 volts

450

2 amperes 32 kilowatts

20 kilowatts

2 amperes

200 watts (approx.)

10 kilowatts (approx.)

CLASS B R-F POWER AMPLIFIER TELEPHONY

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

Maximum	Ratings
---------	---------

DC Plate	Voltage	
DC Plate	Current	
Plate Input		
Plate Dissipation		

Typical Operation

DC Plate Voltage 15,000 volts DC Grid Voltage -340 volts Peak R-F Grid Voltage DC Plate Current Driving Power** Power Output

** At crest of A-F cycle with modulation factor of 1.0

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR-TELEGRAPHY

(Key-down conditions per tube without modulation)

Maximum Ratings

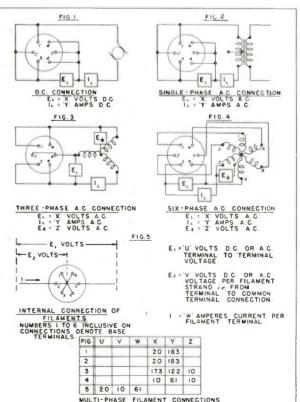
DC Plate Voltage DC Grid Voltage **DC Plate Current** DC Grid Current Plate Input **Plate** Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current **DC Grid Current Driving Power Power Output**

20.000 volts -3,000 volts 4 amperes 0.4 amperes 70 kilowatts 20 kilowatts

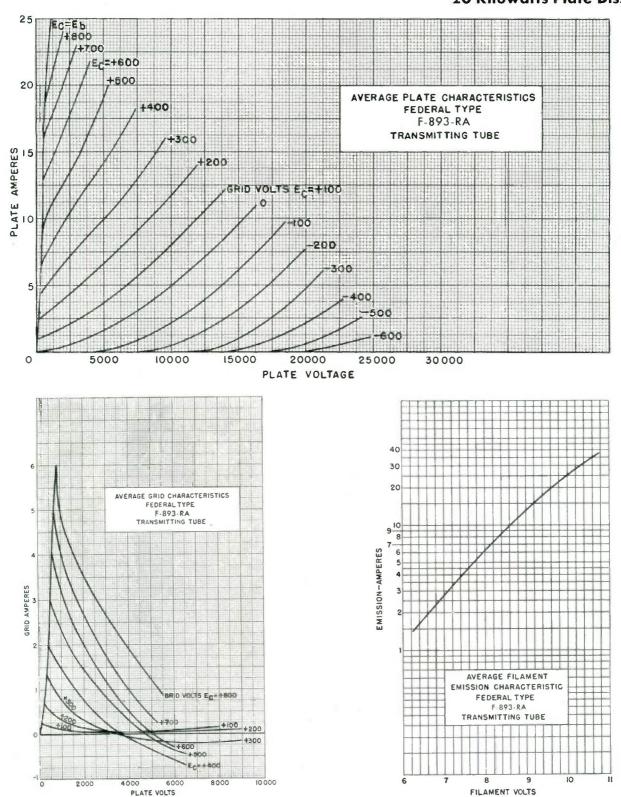
18,000 volts -1,000 volts 1,630 volts 3.6 amperes 0.21 amperes (approx.) 340 watts (approx.) 50 kilowatts (approx.)





Vacuum Tube Products

TRANSMITTING TUBE TYPE F-893-RA



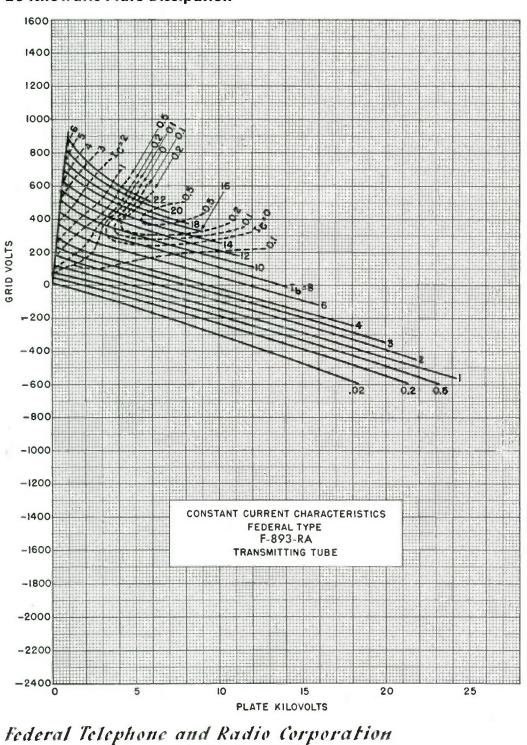
20 Kilowatts Plate Dissipation

World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-RA



20 Kilowatts Plate Dissipation

Vacuum Tube Products

Newark 4, New Jersey



Vacuum Tube Products

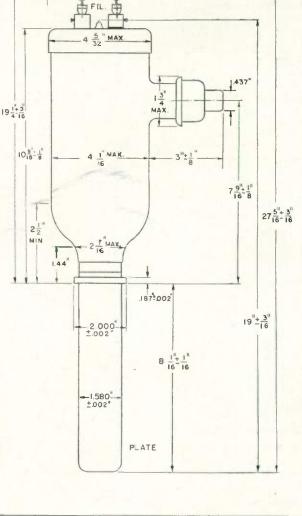
TRANSMITTING TUBE TYPE F-863

10 Kilowatts Plate Dissipation

Technical Data		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Main Use	R-F Amplifier or	FIL.
	Class B Modulator	
Number of Electrodes	3	$4\frac{5}{32}$ MAX.
Filament Voltage	22 volts	
Current	52 amperes	437"
Туре	Tungsten	19 ¹⁺³ 19 ¹⁺³ MAX.
Thermionic Emission	10 amperes	
Amplification Factor	50	$10\frac{9^{+}}{16}\frac{1}{8}$ $4\frac{1}{16}$ $4\frac{1}{16}$ $3^{+}\frac{1}{8}$
Approximate Direct Inter-ele	ectrode Capacitances	7 9 ° 1 ⁶ 8
Plate to Grid	27 μμf	2
Grid to Filament	18 μμf	
Plate to Filament	2 μμf	MIN 2 TIG MAX
Type of Cooling	Water	1.44
Minimum Flow	5 G.P.M.	1872002 ¹
Water Jacket	Standard or Federal	2 000 [*]
	Type F-1000	2 000" 19 - Te
		8 16+16
Maximum Rating versus		

Maximum Rating versus Operating Frequency

Operating	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Inpu		
Frequency Megacycles	Class B Telephony	Class C Telephony	Class C Telegraphy
1.6	100	100	100
7.5	85	85	75
20	76	75	50



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-863

10 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 1.6 megacycles

CLASS B A-F POWER AMPLIFIER AND MODULATOR

AMPEIRER AND MODULATOR

15,000 volts

Maximum Ratings

DC Plate Voltage Max. Signal DC Plate Current* Max. Signal Plate Input* Plate Dissipation*

2.0 amperes 20 kw 7.5 kw

Typical Operation

(Unless otherwise specified, values are for 2 tubes)

DC Plate Voltage	12,500	volts
DC Grid Voltage	-190	volts
Peak A-F Grid-to-Grid		
Voltage	1,530	volts
Zero Signal DC Plate		
Current	0.4	amperes
Max. Signal DC Plate		
Current	2.8	amperes
Load Resistance (per tube)	2,500	ohms
Effective Load Resistance		
(plate to plate)	10,000	ohms
Max. Signal Driving Power	420	watts (approx.)
Max. Signal Power Output	22	kw (approx.)

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

CLASS B TELEPHONY R-F POWER AMPLIFIER

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

15,000 volts

15 kw

1.0 amperes

24 amperes

Maximum Ratings

DC Plate Voltage DC Plate Current R-F Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current Driving Power** Power Output 10 kw 14,000 volts -210 volts 510 volts 0.95 amperes 30 watts (approx.)

4 kw (approx.)

**At crest of a-f cycle with modulation factor of 1.0

CLASS C TELEPHONY PLATE MODULATED R-F POWER AMPLIFIER

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

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation 10,000 volts -3,000 volts 1.0 amperes 0.25 amperes 24 amperes 10 kw 6.6 kw

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 10,000 volts -1,600 volts 2,400 volts 0.72 amperes 0.115 amperes (approx.) 260 watts (approx.) 6 kw (approx.)

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation)†

15,000 volts

-3,000 volts

2.0 amperes 0.25 amperes

30 amperes

30 kw

10 kw

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage12,000 voltsDC Grid Voltage-1,600 voltsPeak R-F Grid Voltage2,800 voltsDC Plate Current1.64 ampeDC Grid Current0.18 ampeDriving Power500 wattsPower Output14 kw (

12,000 volts -1,600 volts 2,800 volts 1.64 amperes 0.18 amperes (approx.) 500 watts (approx.) 14 kw (approx.)

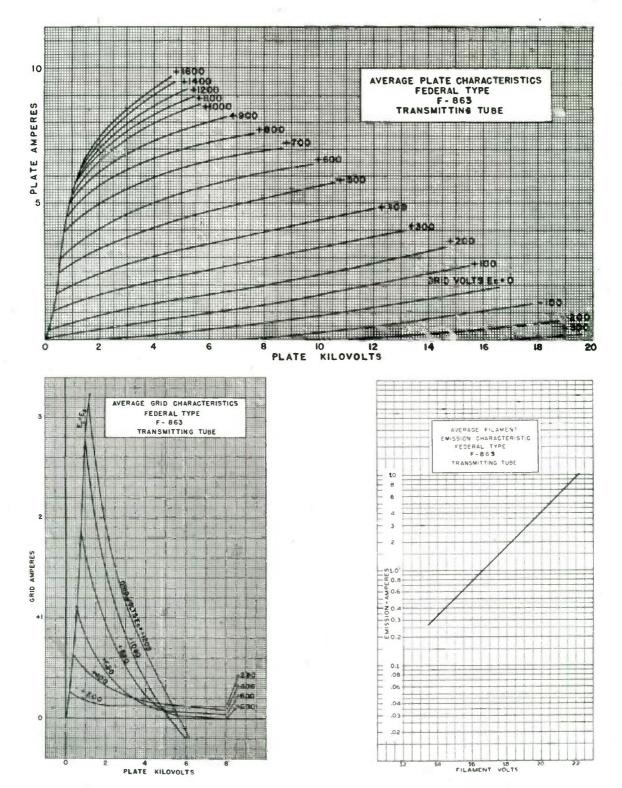
[†]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-863

10 Kilowatts Plate Dissipation



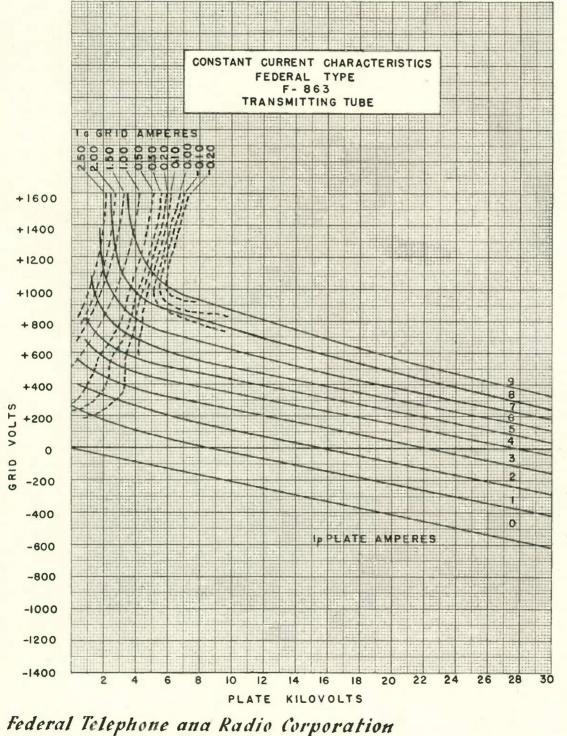
World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-863

10 Kilowatts Plate Dissipation



Vacuum Tube Products

Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-889-A

5 Kilowatts Plate Dissipation

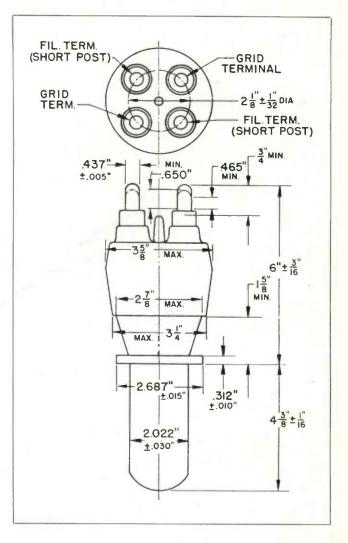
TECHNICAL DATA

Main Use	Modulator or R-F Amplifier
Number of Electrodes	3
Filament Voltage	11 volts
Current	125 amperes
Туре	Tungsten
Amplification Factor	21
Approximate Direct Inte	r-electrode Capacitances
Plate to Grid	17.8 µµf
Grid to Filament	19.5 μμf
Plate to Filament	2.5 µµf
> Type of Cooling	Water and Forced Air
Minimum Flow	5 G.P.M.
Water Jacket	Standard

Air flow of approximately 15 cu. ft./min. through 3-inch diameter nozzle directed at upper part of bulb is required to limit temperature of glass at hottest point to 150°C.

Maximum Ratings versus Operating Frequency

Operating		m Permissible Perc ted Plate Voltage c	
Frequency Megacycles	Class B Telephony	Class C Telephony	Class C Telegraphy
50	100	100	100
100	65	75	75
150	72	50	50



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-889-A

5 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For maximum frequency of 50 megacycles

		CLASS	В	
A-F	POWER	AMPLIFIER	AND	MODULATOR

Maximum Ratings

DC Plate Voltage	8,500	volts
Max. Signal DC Plate		
Current**	2	amperes
Max. Signal Plate Input**	12	kw
Plate Dissipation**	5	kw

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 ampere
Max. Signal DC Plate	
Current	3.2 amperes
Effective Load Resistance	
(plate to plate)	5,000 ohms
Max. Signal Driving Power	150 watts (approx.)
Max. Signal Power Output	15 kw (approx.)

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

CLASS B TELEPHONY R-F POWER AMPLIFIER

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

Maximum Ratings

DC Plate Voltage
DC Plate Current
Plate Input
Plate Dissipation

8,500 volts 1.0 ampere 7.5 kw 5 kw

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current Driving Power⁺ Power Output 7,500 volts -300 volts 1,000 volts 0.9 ampere 80 watts (approx.) 2 kw (approx.)

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

CLASS C TELEPHONY PLATE-MODULATED R-F POWER AMPLIFIER

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

Maximum Ratings

- DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input Plate Dissipation
- 6,000 volts -1,000 volts 1.0 ampere 0.25 ampere 6 kw 3 kw

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 6,000 volts -900 volts 1,420 volts 1.0 ampere 0.1 ampere (approx.) 140 watts (approx.) 4 kw (approx.)

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation)*

Maximum Ratings

- DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input Plate Dissipation
- 8,500 volts –1,000 volts 2 amperes 0.25 ampere 16 kw 5 kw

Typical Operation

World Radio History

DC Plate Voltage	7,500 volts
DC Grid Voltage	-800 volts
Peak R-F Grid Voltage	1,830 volts
DC Plate Current	2 amperes
DC Grid Current	0.24 ampere (approx.)
Driving Power	400 watts (approx.)
Power Output	10 kw (approx.)

*Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-889-A

5 Kilowatts Plate Dissipation

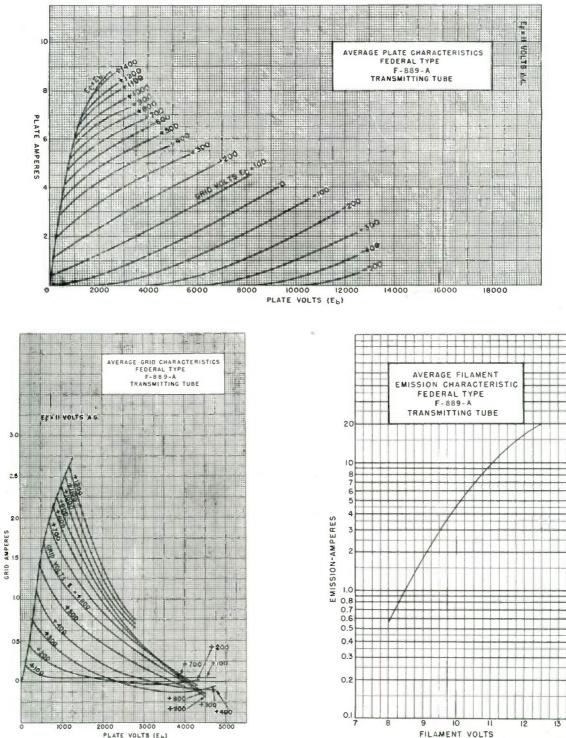


PLATE VOLTS (Eb)

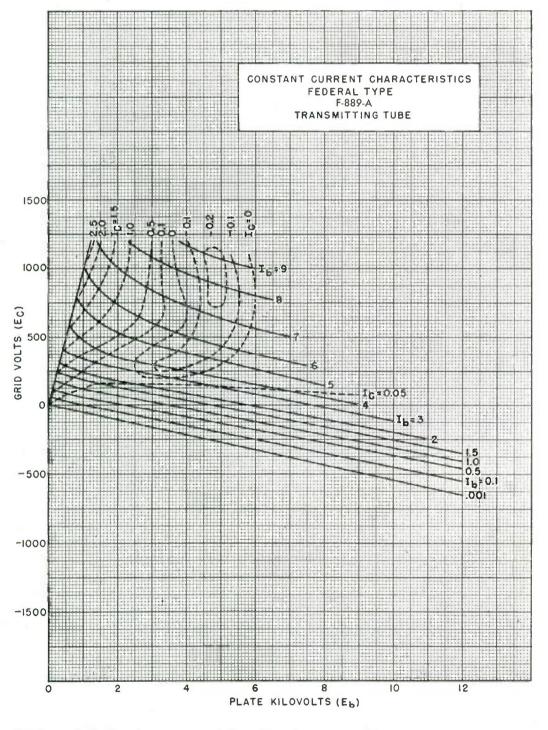
.

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-889-A

5 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products

Newark 4, New Jersey



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-893-RA

20 Kilowatts Plate Dissipation

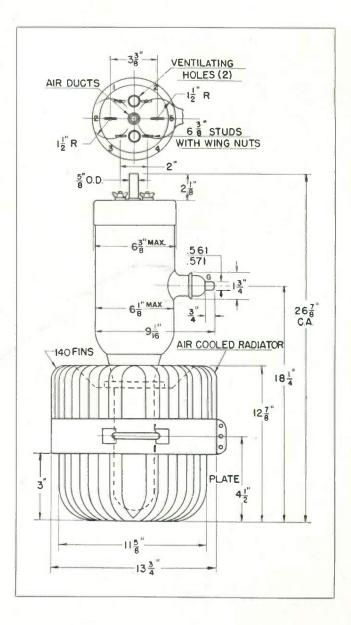
Technical Data

Main Use	R-F Power Amplifier
	Class B Modulator
Number of Electrodes	3
Filament Voltage Per Strand	10 volts
Current Per Terminal	61 amperes
Excitation	1, 3, or 6 A-C
Amplification Factor	36
Approximate Direct Inter-elect	rode Capacitances
Plate to Grid	33 <i>թ.</i> թ.ք
Grid to Filament	48 μμf
Plate to Filament	3.2 µµf
Mounting	Special
Type of Cooling	Forced Air

A vertical air flow of at least 1800 cu. ft./min. should be delivered by a blower to the cooling radiator. An air flow of about 2 cu. ft./min. should be supplied to the air nozzle in the filament base. Cooling must be adequate to limit the glass temperature to not more than 150 C at the hottest part. Air flow must start before the application of any voltages.

Maximum Ratings versus Operating Frequency

Operating Frequency Megacycles	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input				
	Class B Telephony	Class C Telephony	Class C Telegraphy		
			Volt	Input	
5	100	100	100	100	
12	86	81	81	75	
25	74	65	65	50	



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-RA

20.000 volts

4 amperes 60 kilowatts

20 kilowatts

20 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For a Maximum Frequency of 5 Megacycles

A-F POWER AMPLIFIER AND MODULATOR — CLASS B

Maximum Ratings

DC Plate Voltage Max. Signal DC Plate Current Max. Signal Plate Input Plate Dissipation

Typical Operation

Unless otherwise specified,	values are for 2 tubes
DC Plate Voltage	18,000 volts
DC Grid Voltage	-450 volts
Peak A-F Grid to Grid Voltage	1,720 volts
Zero Signal DC Plate Current	0.8 amperes
Max. Signal DC Plate Current	5.5 amperes
Effective Load Resistance Plate	
to Plate	8,000 ohms
Driving Power	140 watts (approx.)
Max, Signal Power Output	70 kilowatts (approx.)

CLASS C R-F POWER AMPLIFIER TELEPHONY ---- PLATE MODULATED

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

1

20.000 volts

2 amperes 32 kilowatts 20 kilowatts

World Radio History

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input Plate Dissipation 12,000 volts --3,000 volts 2 amperes 0.4 amperes 24 kilowatts 12 kilowatts

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output

2,000	volts
1,000	volts
1,500	volts
2	amperes
0.14	amperes (approx.)
210	watts (approx.)
18	kilowatts (approx.)

CLASS B R-F POWER AMPLIFIER TELEPHONY

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

Maximum Ratings

Plate	Voltage		
Plate	Current		
Plate Input			
Plate Dissipation			
	Plate e Inpi		

Typical Operation

 DC Plate Voltage
 15,000 volts

 DC Grid Voltage
 -340 volts

 Peak R-F Grid Voltage
 450

 DC Plate Current
 2 amperes

 Driving Power**
 200 watts (approx.)

 Power Output
 10 kilowatts (approx.)

**At crest of A-F cycle with modulation factor of 1.0

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR-TELEGRAPHY

(Key-down conditions per tube without modulation)

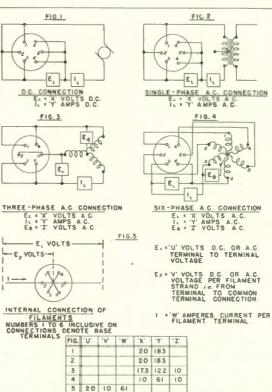
Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 20,000 volts –3,000 volts 4 amperes 0.4 amperes 70 kilowatts 20 kilowatts

18,000 volts –1,000 volts 1,630 volts 3.6 amperes 0.21 amperes (approx.) 340 watts (approx.) 50 kilowatts (approx.)

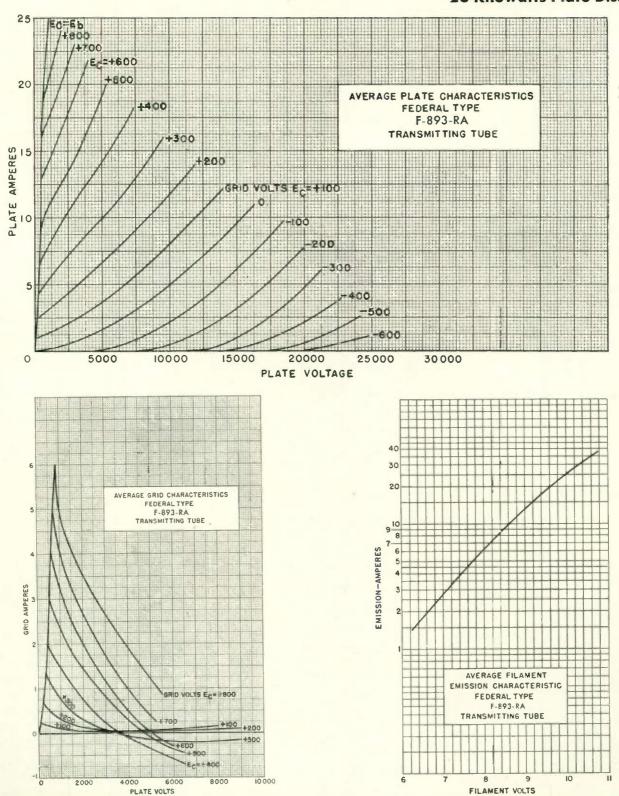


MULTI-PHASE FILAMENT CONNECTIONS



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-893-RA

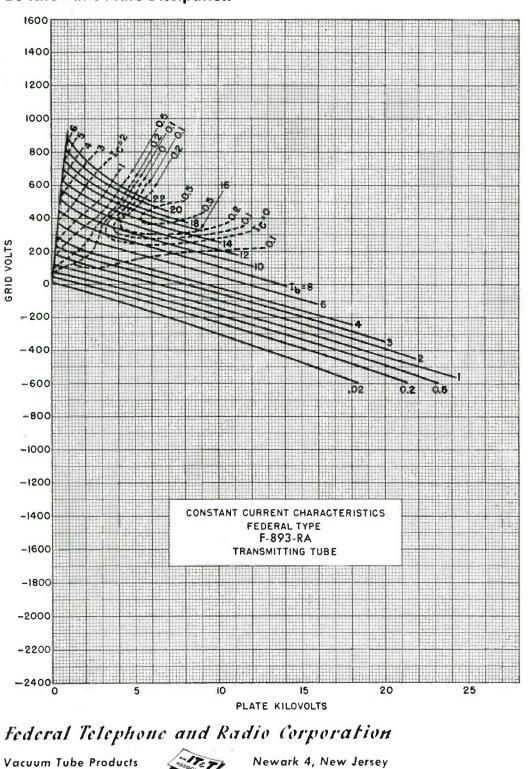


20 Kilowatts Plate Dissipation

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-RA



20 Kilowatts Plate Dissipation



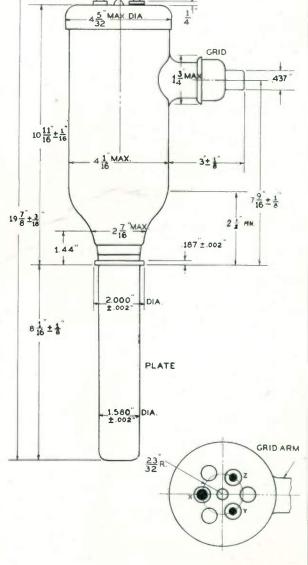
Vacuum Tube Products

TRANSMITTING TUBE TYPE F-891

7.5 Kilowatts Plate Dissipation

		500 ± 005
Technical Data		$\begin{array}{c c c c c c c c c c c c c c c c c c c $
Main Use	Modulator or R-F Amplifier	GRID
Number of Electrodes	3	1 <u>3</u> MAN 437
Filament Voltage	22 volts	
Current	60 amperes	
Туре	Tungsten, Two-Unit	$10\frac{11^{\circ}}{16}\pm\frac{1}{16}$
Excitation	DC, Single or	4 16 MAX. 3± 1
	Two Phase AC	$4\frac{1}{16}$ MAX. $3\frac{1}{2}\frac{1}{8}$
• Thermionic Emission	10 amperes	$7\frac{9}{16}\pm\frac{1}{8}$
Amplification Factor	8	$19\frac{7}{8}\pm\frac{3}{16}$
Approximate Direct Inte	r-electrode Capacitances	1.44" .187±.002"
Plate to Grid	27 μμf	
Grid to Filament	$\frac{18 \ \mu\mu f}{18}$	
Plate to Filament	2 μμf	2.000 ⁻ DIA.
Type of Cooling	Water	8 16 ± 18
Minimum Flow	5 G.P.M.	
Water Jacket	Standard or Federal	PLATE
	Type F-1000	
		1.580 DIA.
Maximum Ratings vers	sus	
Operating Frequency		23 R. GRID ARM

Operating	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input			
Frequency Megacycles	Class B Telephony	Class C Telephony	Class C Telegraphy	
1.6	100	100	100	
7.5	82	75	75	
20	72	65	50	



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-891

7.5 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 1.6 megacycles

		CLASS	A	
A-F	POWER	AMPLIFIER	AND	MODULATOR

Maximum Ratings

DC Plate Voltage Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage* Peak A-F Grid Voltage **DC Plate Current** Load Resistance U.P.O. (5% second harmonic)

8,000 volts -630 volts 700 volts 0.9 amperes

12,000 volts

7.5 kw

7.5 kw

5,200 ohms 2 kw

*The DC resistance in the grid circuit should not exceed 100,000 ohms when cathode bias is used, or 50,000 ohms with fixed bias.

CLASS B A-F POWER AMPLIFIER AND MODULATOR

Maximum Ratings

DC Plate Voltage 15.000 volts Max, Signal DC Plate Current** 2.0 amperes Max. Signal Plate Input** 20 kw Plate Dissipation** 5 kw **Typical Operation** Unless otherwise specified, values are for 2 tubes

Unless otherwise specified	, values c	re for 2 fubes
DC Plate Voltage	12,500	volts
DC Grid Voltage	-1,450	volts
Peak A-F Grid-to-Grid		
Voltage	3,960	volts
Zero Signal DC Plate		
Current	0.4	ampere
Max. Signal DC Plate		
Current	2.8	amperes
Load Resistance (per tube)	2,500	ohms
Effective Load Resistance		
(plate to plate)	10,000	ohms
Max. Signal Driving Power	350	watts (approx.)
Max. Signal Power Output	22	kw (approx.)

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

CLASS B TELEPHONY R-F POWER AMPLIFIER

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

10 kw

6 kw

Maximum Ratings	
DC Plate Voltage	15,000 volts
DC Plate Current	1.0 ampere
R-F Grid Current	24 amperes
Plate Input	10 kw

Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current Driving Powert Power Output

14,000 volts -1,600 volts 1,000 volts 0.56 ampere 0 watts (approx.) 2.28 kw (approx.)

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

CLASS C TELEPHONY

PLATE-MODULATED R-F POWER AMPLIFIER (Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

DC Plate Voltage DC Grid Voltage **DC Plate Current** DC Grid Current **R-F Grid Current** Plate Input **Plate Dissipation**

8,000 volts -3,000 volts 1.0 amperes 0.15 amperes 24 amperes 8 kw 4 kw

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage **DC Plate Current** DC Grid Current Driving Power Power Output

8,000 volts -2,400 volts 3,100 volts 0.78 amperes 0.08 amperes (approx.) 260 watts (approx.) 5 kw (approx.)

CLASS C TELEGRAPHY

R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation)*

Maximum Ratings DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current **R-F Grid Current Plate Input Plate Dissipation**

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current **Driving Power Power Output**

12,000 volts -3.000 volts 2.0 amperes 0.15 amperes 30 amperes 18 kw 6 kw



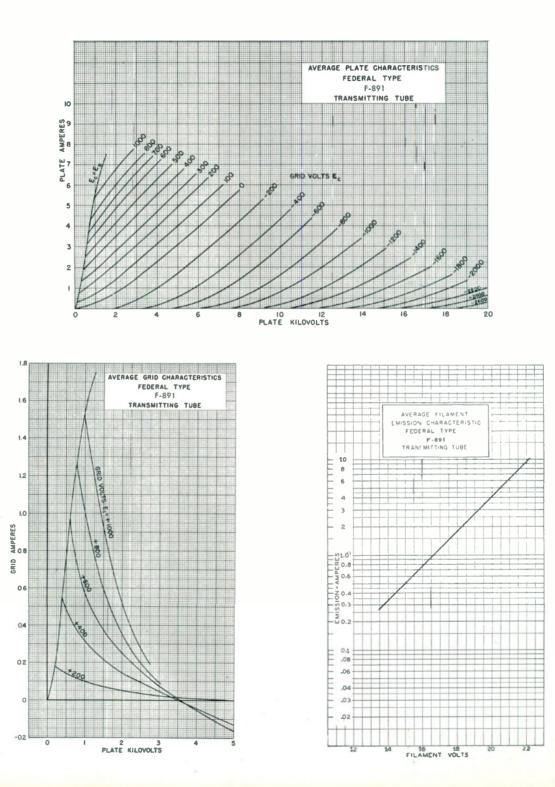
*Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-891

7.5 Kilowatts Plate Dissipation



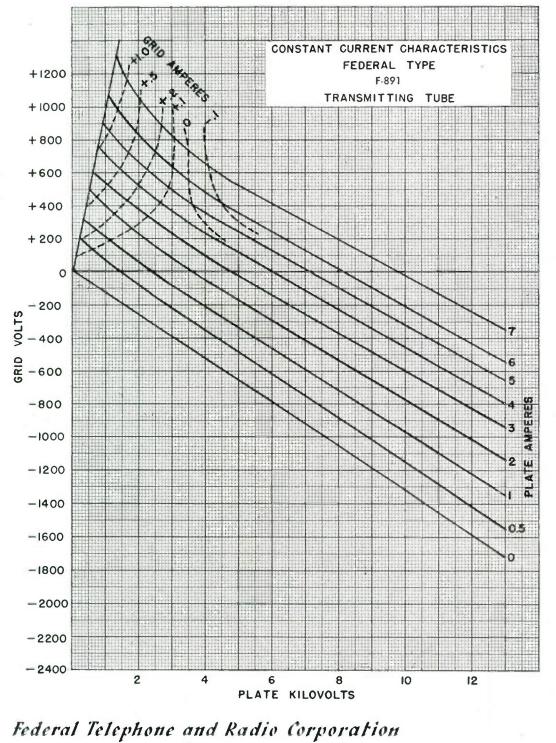
World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-891

7.5 Kilowatts Plate Dissipation



Vacuum Tube Products

ANTET SSOCIAST

Newark 4, New Jersey

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



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-891-R

4.0 Kilowatts Plate Dissipation

Technical Data

Main Use	Modulator or R.F. Amplifier
Number of Electrodes	3

- Filament Voltage
 Current
 Type
 Excitation
- 3 22 volts 60 amperes Tungsten, Two-Unit DC, Single or Two Phase AC
- Thermionic Emission 10 amperes
 Amplification Factor 8
- Approximate Direct Inter-electrode Capacitances

 Plate to Grid
 28.5 μμf
 Grid to Filament
 19 μμf
 Plate to Filament
 2.5 μμf

 Type of Cooling
 Forced Air
 Mounting
 Special

Maximum Rating versus Operating Frequency

Operating Frequency Megacycles	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input			
	Class B Telephony	Class C Telephony	Class C Telegraphy	
1.6	100	100	100	
7.5	83	75	75	
20	74	50	50	

Air Requirements per Tube

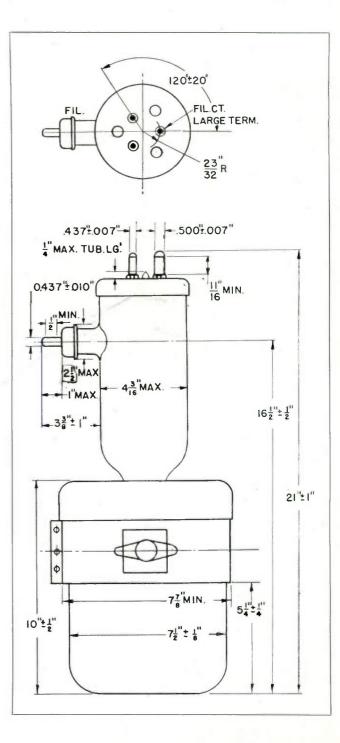
(Maximum Intake Temperature 40 C.)

Net Anode Dissipation K.W. (1)	Minimum Recom- mended Air Flow Cu. Ft./Min.	Approx. Air Pressure Inches Water (2)	Average Air Velocity Thru Fin. Assy. Ft./Min.	Approx. Air Temp. Rise Degrees Cent.
3	350	0.17	1560	16
4	480	0.32	2140	15.5

(1) This is anode dissipation exclusive of filament power dissipated through anode.

(2) This pressure is measured at the base of tube mounting. Duct work must be considered to determine pressure against which blower must deliver required amount of air.

World Radio History



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-891-R

4.0 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

CLASS B A-F POWER AMPLIFIER AND MODULATOR

Maximum Ratings

DC Plate Voltage	10,000 volts
Max. Signal DC Plate Current	2.0 amperes
Max. Signal Plate Input	10.5 kw
Plate Dissipation	3.5 kw

Typical Operation

(Unless otherwise specified values are for 2 tubes)

DC Plate Voltage	8,000 volts
DC Grid Voltage	-800 volts
Peak A-F Grid-to-Grid Voltage	2,400 volts
Zero Signal DC Plate Current	0.5 amperes
Max. Signal DC Plate Current	2.1 amperes
Effective Load Resistance	
(plate to plate)	7,400 ohms (approx.)
Max. Signal Driving Power	100 watts (approx.)
Max. Signal Power Output	10 kw (approx.)

CLASS B

TELEPHONY R-F POWER AMPLIFIER

(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 amperes
Plate Input	5.5 kw
Plate Dissipation	3.5 kw

Typical Operation

DC Plate Voltage	8,000 volts
DC Grid Voltage	-820 volts
Peak R-F Grid Voltage	700 volts
DC Plate Current	0.6 amperes
Driving Power*	0 watts (approx.)
Power Output	1.3 kw (approx.)

*At crest of A-F cycle with modulation factor of 1.0

CLASS C TELEPHONY PLATE-MODULATED R-F POWER AMPLIFIER

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

8,500 volts

1.0 amperes

0.15 amperes

8 kw

2.5 kw

-3,000 volts

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage6,000 voltsDC Grid Voltage-2,000 voltsPeak R-F Grid Voltage2,650 voltsDC Plate Current0.75 amperesDC Grid Current0.1 amperesDriving Power260 wattsPower Output3.5 kw (approx.)

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-Down conditions per tube without modulation)

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input Plate Dissipation 10,000 volts -3,000 volts 2.0 amperes 0.15 amperes 15 kw 4 kw

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current

Driving Power Power Output 10,000 volts -2,000 volts 2,900 volts 1.4 amperes 0.1 amperes (approx.) 310 watts (approx.) 10 kw (approx.)

[†]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

its Its

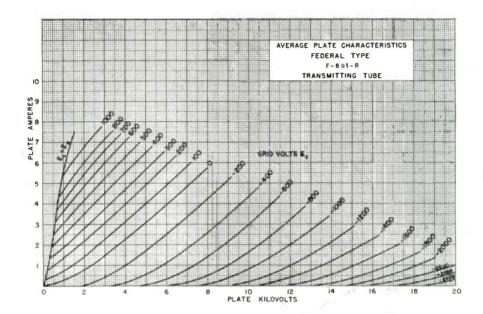


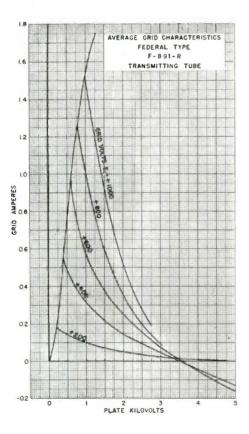


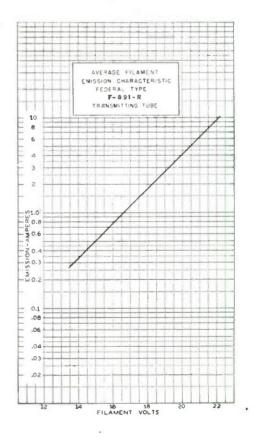
Vacuum Tube Products

TRANSMITTING TUBE TYPE F-891-R

4.0 Kilowatts Plate Dissipation





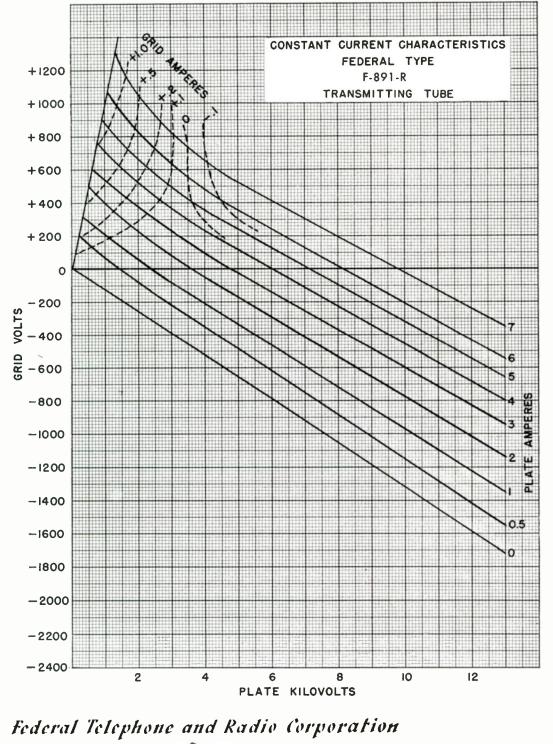


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-891-R

4.0 Kilowatts Plate Dissipation



Vacuum Tube Products

ASSOCIATE T



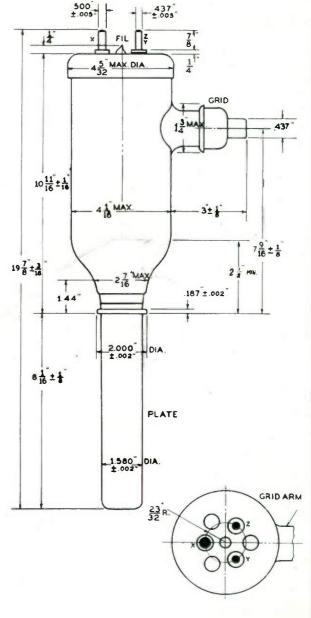
Vacuum Tube Products

TRANSMITTING TUBE TYPE F-892

10 Kilowatts Plate Dissipation

	ж. С	500 ±.005
Technical Data		$\frac{1}{2} \times 1 \text{ Fill} = \frac{1}{2} \frac{7}{8}$
Main Use	R-F Amplifier or Class B Modulator	
Number of Electrodes	3	1 <u>3</u> MAA 437 -
Filament Voltage per terminal Current per strand Type Excitation	11 volts 60 amperes Tungsten, Two-Unit DC, Single or Two Phase AC	$10\frac{11}{16}\pm\frac{1}{16}$
Thermionic Emission	10 amperes	$7\frac{9}{16}\pm\frac{1}{8}$
Amplification Factor	50	197 ± 12 - 27 MAX 2 - 100
Approximate Direct Inter-electro	de Capacitances	1.44" .187 ± .002"
Plate to Grid	27 μμf	
Grid to Filament	18 μμf	
Plate to Filament	2 μμf	2.000 DIA.
Type of Cooling	Water	8 16 ± 1
Minimum Flow	5 G.P.M.	
▶ Water Jacket	Standard or Federal Type F-1000	PLATE
		1.580 DIA.
Maximum Rating versus		
Operating Frequency		23 R. GRID ARM

Operating		n Permissible Perce d Plate Voltage a	Percentage of ge and Plate Input	
Frequency Megacycles	Class B Telephony	Class C Telephony	Class C Telegraphy	
1.6	100	100	100	
7.5	85	85	75	
20	76	75	50	



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-892

10 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 1.6 megacycles

CLASS B A-F POWER AMPLIFIER AND MODULATOR

Maximum Ratings

DC Plate Voltage 15,000 volts Max. Signal DC Plate Current* 2.0 amperes Max. Signal Plate Input* 20 kw Plate Dissipation* 7.5 kw

Typical Operation

(Unless otherwise specified	, values a	re for 2 tubes)
DC Plate Voltage	12,500	volts
DC Grid Voltage	-170	volts
Peak A-F Grid-to-Grid		
Voltage	1,530	volts
Zero Signal DC Plate		
Current	0.4	amperes
Max. Signal DC Plate		
Current		amperes
Load Resistance (per tube)	2,500	ohms
Effective Load Resistance		
(plate to plate)	10,000	
Max. Signal Driving Power		watts (approx.)
Max. Signal Power Output	22	kw (approx.)

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

CLASS B TELEPHONY R-F POWER AMPLIFIER

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

Maximum Ratings

DC Plate Voltage	15,000 volts
DC Plate Current	1.0 amperes
R-F Grid Current	24 amperes
Plate Input	15 kw
Plate Dissipation	10 kw

Typical Operation

DC Plate Voltage	14,000 volts
DC Grid Voltage	-190 volts
Peak R-F Grid Voltage	510 volts
DC Plate Current	0.95 amperes
Driving Power**	30 watts (approx.)
Power Output	4 kw (approx.)

**At crest of a-f cycle with modulation factor of 1.0

CLASS C TELEPHONY PLATE-MODULATED R-F POWER AMPLIFIER

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

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation 10,000 volts -3,000 volts 1.0 amperes 0.25 amperes 24 amperes 10 kw 6.6 kw (approx.)

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 10,000 volts -1,600 volts 2,400 volts 0.72 amperes 0.115 amperes (approx.) 260 watts (approx.) 6 kw (approx.)

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation) †

Maximum Ratings

DC Plate Voltage	15,000 volts
DC Grid Voltage	-3,000 volts
DC Plate Current	2.0 amperes
DC Grid Current	0.25 amperes
R-F Grid Current	30 amperes
Plate Input	30 kw
Plate Dissipation	10 kw

Typical Operation

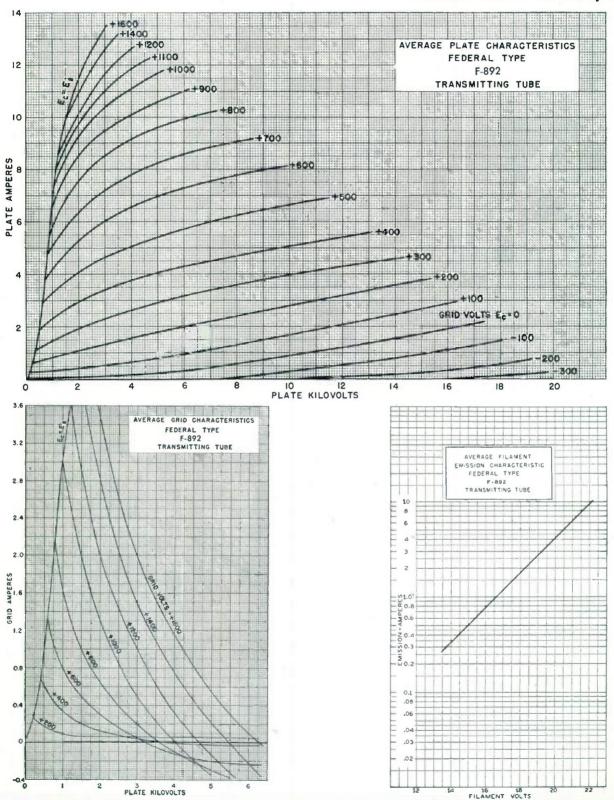
DC Plate Voltage	12,000 volts
DC Grid Voltage	-1,600 volts
Peak R-F Grid Voltage	2,800 volts
DC Plate Current	1.64 amperes
DC Grid Current	0.18 amperes (approx.)
Driving Power	500 watts (approx.)
Power Output	14 kw (approx.)

[†]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-892

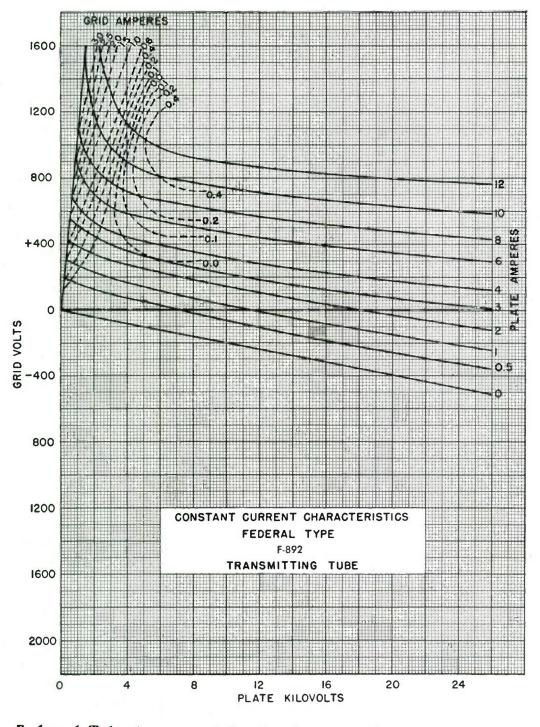


10 Kilowatts Plate Dissipation

Vacuum Tube Products

TRANSMITTING TUBE TYPE F-892

10 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-892-R

4 Kilowatts Plate Dissipation

Technical Data

Main Use	R.F. Power Amplifier, Oscillator, Class B Modulator		
Number of Electrode	s 3		
 Filament Voltage per Current per Type Excitation 			
• Thermionic Emission	10 amperes		
Amplification Factor	50		
 Approximate Direct I Plate to Grid Filament to Grid Plate to Filament 			
> Type of Cooling	Forced Air		
Mounting	Special		

Transmitting Tube Ratings versus Operating Frequency

	Maximum Permissible Percentage of Maximum Rated Plate Voltage and Plate Input			
Operating	Telephony		Telegraphy	
Frequency Megacycles Class C Grid or Suppressor Modulated	Class C Grid or Suppressor	Class C Plate- Modulated	Class C	
1.6	100	100	100	
7.5	85	75	75	
20	76	50	50	

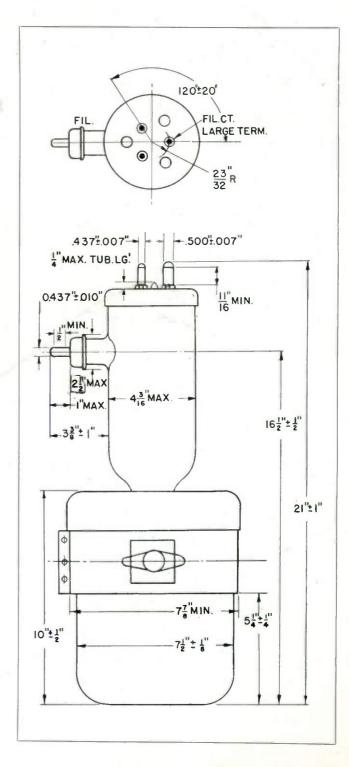
Air Requirements per Tube

(Maximum Intake Temperature 40° C.)

Minimum Recom- mended Air Flow Cu. Ft./Min.	Approx. Air Pressure Inches Water (2)	Average Air Velocity Thru Fin. Ass'y. Ft./Min.	Approx. Air Temp. Rise Degrees Cent.
350	0.17	1560	16
480	0.32	2140	15.5
650	0.60	2900	14
	Recom- mended Air Flow Cu. Ft./Min. 350 480	Recom- mended Air Air Flow Inches Cu. Ft./Min. Water (2) 350 0.17 480 0.32	Recom- mendedAir PressureAir Velocity Thru Fin.Air FlowInchesAss'y.Cu. Ft./Min.Water (2)Ft./Min.3500.1715604800.322140

 This is anode dissipation exclusive of filament power dissipated through anode.

(2) This pressure is measured at the base of tube mounting. Duct work must be considered to determine pressure against which blower must deliver required amount of air.



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-892-R

4 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operating Conditions

CLASS B A-F POWER AMPLIFIER AND MODULATOR

Maximum Ratings

DC Plate Voltage	12,500 volts
Max. Signal DC Plate Current	2.0 amperes
Max. Signal Plate Input	12 kw
Plate Dissipation	4 kw

Typical Operation

(Unless otherwise specified, values are for 2 tubes)

DC Plate Voltage	8,000 volts
DC Grid Voltage	-60 volts
Peak A-F Grid-to-Grid	
Voltage	1,000 volts
Zero Signal DC Plate Current	0.5 amperes
Max. Signal DC Plate Current	2.3 amperes
Effective Load Resistance	
(plate to plate) — — —	6,800 ohms
Max. Signal Driving Power	400 approx. watts
Max. Signal Power Output	10.5 approx. kw

CLASS B TELEPHONY R-F POWER AMPLIFIER

(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	1.0	amperes
Plate Input	6	kw
Plate Dissipation	4	kw

Typical Operation

DC Plate Voltage	8,000 volts
DC Grid Voltage	-40 volts
Peak R-F Grid Voltage	350 volts
DC Plate Current	0.71 amperes
Driving Power*	25 approx. watts
Power Output	1.7 approx. kw

*At crest of a-f cycle with modulation factor of 1.0

CLASS C TELEPHONY PLATE-MODULATED R-F POWER AMPLIFIER

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

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 10,000 volts -3,000 volts 1.0 amperes 0.25 amperes 10 kw 2.5 kw

8,000 volts -1,300 volts 2,000 volts 0.75 amperes 0.18 approx. amperes 350 approx. watts 5 approx. kw

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation)†

Maximum Ratings

+	
DC Plate Voltage	12,500 volts
DC Grid Voltage	-3,000 volts
DC Plate Current	2.0 amperes
DC Grid Current	0.25 amperes
Plate Input	18 kw
Plate Dissipation	4 kw

Typical Operation

DC Plate Voltage DC Grid Voltage

Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output

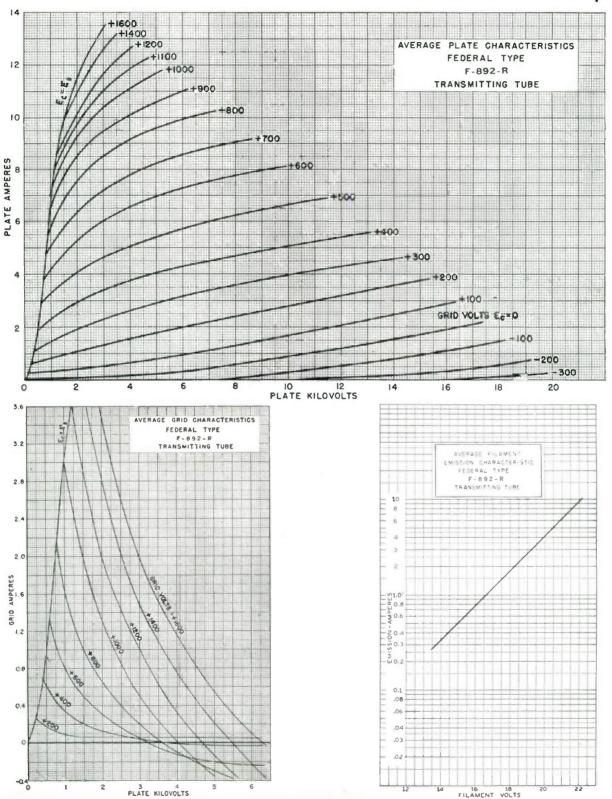
- 18 kw 4 kw 10,000 volts \-1,300 volts } 7,200 approx. ohms
 - 2,300 volts 1.4 amperes 0.18 approx. amperes 400 approx. watts 10 approx. kw

[†]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-892-R



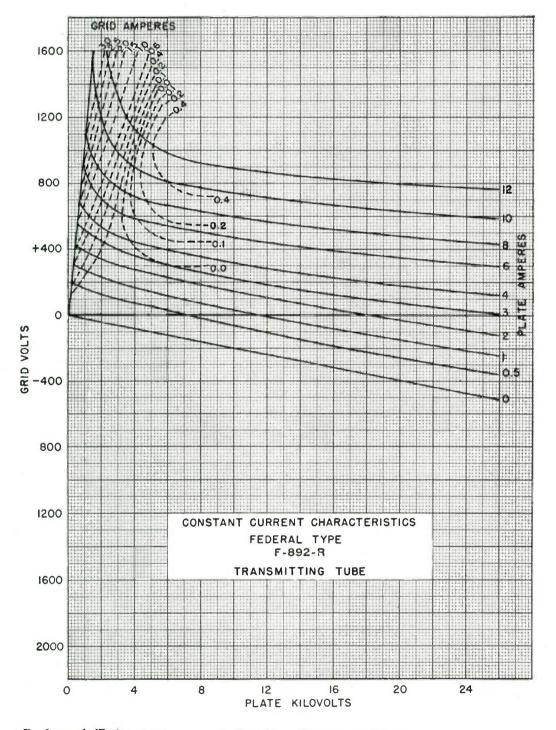
4 Kilowatts Plate Dissipation

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-892-R

4 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Products



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-893-A

20 Kilowatts Plate Dissipation

						► 2 ["] →	
						1 6 F	
Technical I	Data						
Main Use		Gener	al Purpose				WITH
Number of	Electrodes	3			1	3 4 8 WING	NUTS
				1 -	1		
Filament Vo	ltage per stra	ind 10 vol	ts		2 ¹ / ₈ ^{"±1}		-
Cu	rrent per terr			1.0			
Ту	pe	Tungs	len	1	Ī		-
Thermionic	Emission	25 am	peres			"MAX	
Amplificatio	n Factor	36			$14\frac{1}{4}^{\frac{1}{2}\pm\frac{1}{2}^{\nu}}$	6 <u>3</u> " <u>MAX.</u>	.561
Approximat	e Direct Inter-	-electrode Capa	icitances		4		£.57I"
Plate to		33 µ/		-			T
Grid to	Filament	48 µ;	ıſ	25	5 ±3"		
Plate to	Filament	3.2 µ/	ιf				
						1. 7.15	7 <u>3</u> 6 4
Type of Co	-	Water				3 <u>15</u> 16 + <u>1</u> "	
Minimum	Flow	15 G.	r.m.			" 6 ^{"2} •	{
Water Jack	ot	Stand	ard or Federal		2 3	480	
r mulei such			F-1010		-1		1
		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		113			
						4,655"	
Maximum R	latings vers	US			9 $\frac{\pm 1^{4}}{4}$	4.720"	
Operating F	requency				94		
Operating		n Permissible Perce ed Plate Voltage a	•				
Frequency	Class B	Class C	Class C			3.188 ±.062	

Copyright 1946, Federal Telephone and Radio Corporation

Telephony

Voltage Input

Megacycles

Telephony

Voltage Input

Telegraphy

Voltage Input

Vacuum Tube Products

Maximum Ratings

Current*

DC Plate Voltage

Plate Dissipation"

DC Plate Voltage

DC Grid Voltage

Peak A-F Grid-to-Grid

Zero Signal DC Plate

Max. Signal DC Plate

Typical Operation

Voltage

Current

Current

Max. Signal DC Plate

Max. Signal Plate Input*



TRANSMITTING TUBE TYPE F-893-A

20,000 volts

60 kw

20 kw

18,000 volts

-450 volts

4 amperes

1,720 volts (approx.)

0.8 amperes

5.5 amperes

8,000 ohms

20 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data For maximum frequency of 5 megacycles

CLASS B	A-F DOWED		-	MODULATOR
		CLASS	R	

Unless otherwise specified values are for 2 tubes

CLASS C TELEGRAPHY R-F POWER AMPLIFIER AND OSCILLATOR

(Key-down conditions per tube without modulation) †

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current R-F Grid Current Plate Input Plate Dissipation

sipation

Typical Operation

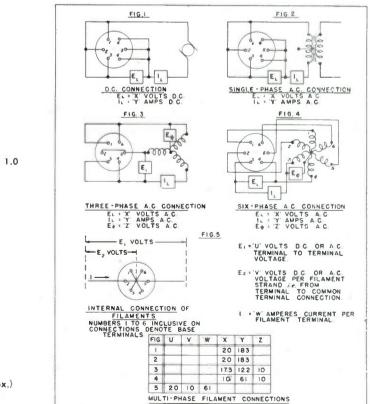
DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 4 amperes 0.4 amperes 60 amperes 70 kw 20 kw

20,000 volts

-3.000 volts

18,000 volts -1,000 volts 1,630 volts (approx.) 3.6 amperes 0.21 amperes (approx.) 340 watts (approx.) 50 kw (approx.)

[†]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.



Load Resistance (per tube) Effective Load Resistance (plate to plate) Max. Signal Driving Power

Max. Signal Driving Power Max. Signal Power Output *Averaged over any audio-frequency of sine-wave form. CLASS B TELEPHONY

R-F POWER AMPLIFIER

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

Maximum Ratings	'
DC Plate Voltage	20,000 volts
DC Plate Current	2.0 amperes
R-F Grid Current	48 amperes
Plate Input	32 kw
Plate Dissipation	20 kw
Typical Operation	
DC Plate Voltage	15,000 volts
DC Grid Voltage	-340 volts
Peak R-F Grid Voltage	450 volts (approx.)
DC Plate Current	2.0 amperes
Driving Power**	200 watts (approx.)
Power Output	10 kw (approx.)
**At crest of audio-frequency	cycle with modulation factor of 1.
CLASS C 1	TELEPHONY
PLATE MODULATED F	R-F POWER AMPLIFIER
(Carrier conditions per tu	be for use with a maximum
	factor of 1.0)
Maximum Ratings	
DC Plate Voltage	12,000 volts
DC Grid Voltage	-3,000 volts
DC Plate Current	2 amperes
DC Grid Current	0.4 amperes
R-F Grid Current	48 amperes
Plate Input	24 kw
Plate Dissipation	12 kw
Typical Operation	

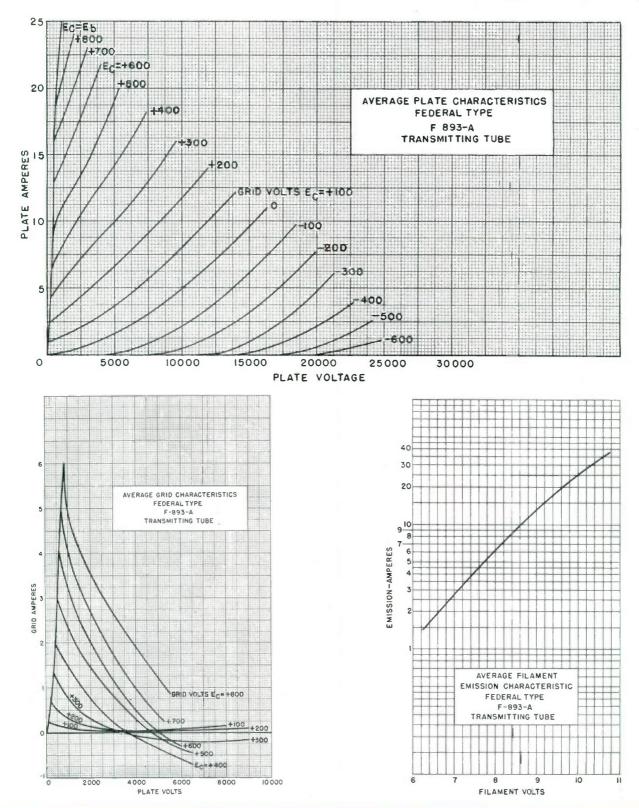
DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage DC Plate Current DC Grid Current Driving Power Power Output 12 kw 12,000 volts -1,000 volts 1,500 volts (approx.) 2.0 amperes 0.14 amperes (approx.) 210 watts (approx.) 18 kw (approx.)



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-893-A

20 Kilowatts Plate Dissipation

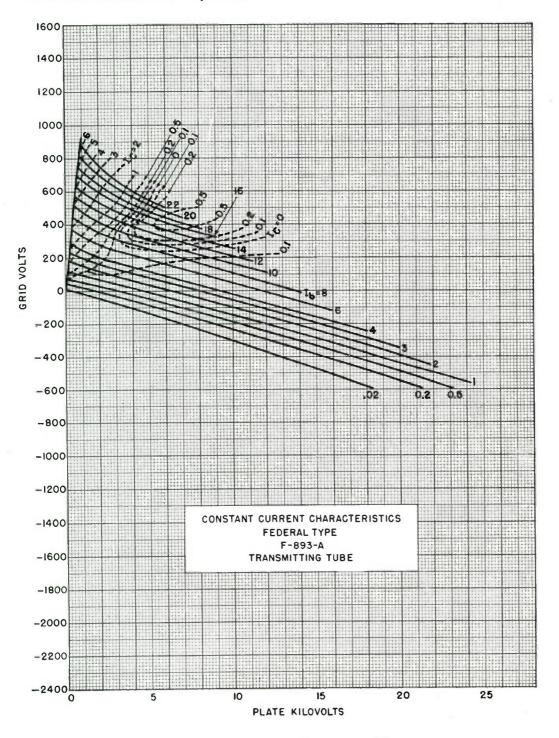


Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-A

20 Kilowatts Plate Dissipation



Federal Telephone and Radio Corporation

Vacuum Tube Division



Vacuum Tube Products

TRANSMITTING TUBE TYPE F-893-RA

20 Kilowatts Plate Dissipation

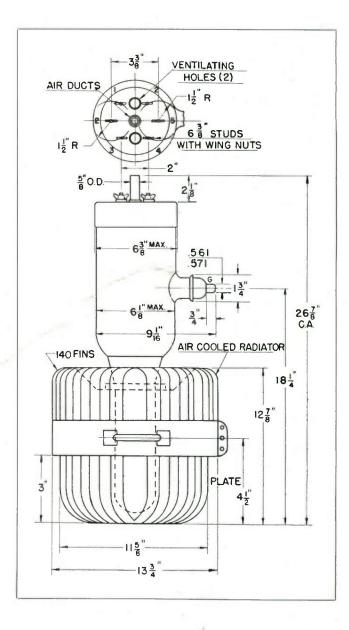
Technical Data

Main Use	R-F Power Amplifier
	Class B Modulator
Number of Electrodes	3
Filament Voltage Per Strand	10 volts
Current Per Terminal	61 amperes
Excitation	1, 3, or 6 A-C
Amplification Factor	36
Approximate Direct Inter-elect	rode Capacitances
Plate to Grid	33 µµf
Grid to Filament	48 µµf
Plate to Filament	3.2 μμf
Mounting	Special
Type of Cooling	Forced Air

A vertical air flow of at least 1800 cu. ft./min. should be delivered by a blower to the cooling radiator. An air flow of about 2 cu. ft./min. should be supplied to the air nozzle in the filament base. Cooling must be adequate to limit the glass temperature to not more than 150° C at the hottest part. Air flow must start before the application of any voltages.

Maximum Ratings versus Operating Frequency

Operating		um Permissible I ated Plate Volta		
Frequency Megacycles	Class B			iss C raphy
	Telephony		Volt	Input
5	100	100	100	100
12	86	81	81	75
25	74	65	65	50



Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-RA

20,000 volts

4 amperes 60 kilowatts

20 kilowatts

20 Kilowatts Plate Dissipation

Maximum Ratings and Typical Operation Data

For a Maximum Frequency of 5 Megacycles

A-F POWER AMPLIFIER AND MODULATOR - CLASS B

Maximum Ratings

DC Plate Voltage Max. Signal DC Plate Current Max. Signal Plate Input Plate Dissipation

Typical Operation

Unless otherwise specified, values are for 2 tubes DC Plate Voltage 18,000 volts DC Grid Voltage -450 volts Peak A-F Grid to Grid Voltage 1,720 volts Zero Signal DC Plate Current 0.8 amperes Max. Signal DC Plate Current 5.5 amperes Effective Load Resistance Plate 8,000 ohms to Plate Driving Power 140 watts (approx.) 70 kilowatts (approx.) Max. Signal Power Output

CLASS C R-F POWER AMPLIFIER TELEPHONY - PLATE MODULATED

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

Maximum Ratings

DC Plate Voltage DC Grid Voltage DC Plate Current DC Grid Current Plate Input **Plate** Dissipation

12,000 volts -3,000 volts 2 amperes 0.4 amperes 24 kilowatts 12 kilowatts

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage **DC** Plate Current DC Grid Current **Driving Power** Power Output

12,000	volts
-1,000	volts
1,500	volts
2	amperes
	amperes (approx.)
	watts (approx.)
18	kilowatts (approx.)

CLASS B R-F POWER AMPLIFIER TELEPHONY

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

Maximum Ratings	
DC Plate Voltage	20,000 volts
DC Plate Current	2 amperes
Plate Input	32 kilowatts
Plate Dissipation	20 kilowatts

Typical Operation

Destaure

DC Plate Voltage 15,000 volts DC Grid Voltage -340 volts Peak R-F Grid Voltage 450 DC Plate Current 2 amperes 200 watts (approx.) Driving Power** 10 kilowatts (approx.) Power Output

**At crest of A-F cycle with modulation factor of 1.0

CLASS C R-F POWER AMPLIFIER AND OSCILLATOR-TELEGRAPHY

(Key-down conditions per tube without modulation)

Maximum Ratings

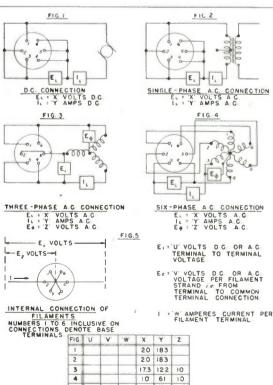
DC Plate Voltage DC Grid Voltage **DC Plate Current** DC Grid Current Plate Input Plate Dissipation

Typical Operation

DC Plate Voltage DC Grid Voltage Peak R-F Grid Voltage **DC Plate Current** DC Grid Current **Driving Power** Power Output

20,000 volts -3,000 volts 4 amperes 0.4 amperes 70 kilowatts 20 kilowatts

18,000 volts -1,000 volts 1,630 volts 3.6 amperes 0.21 amperes (approx.) 340 watts (approx.) 50 kilowatts (approx.)



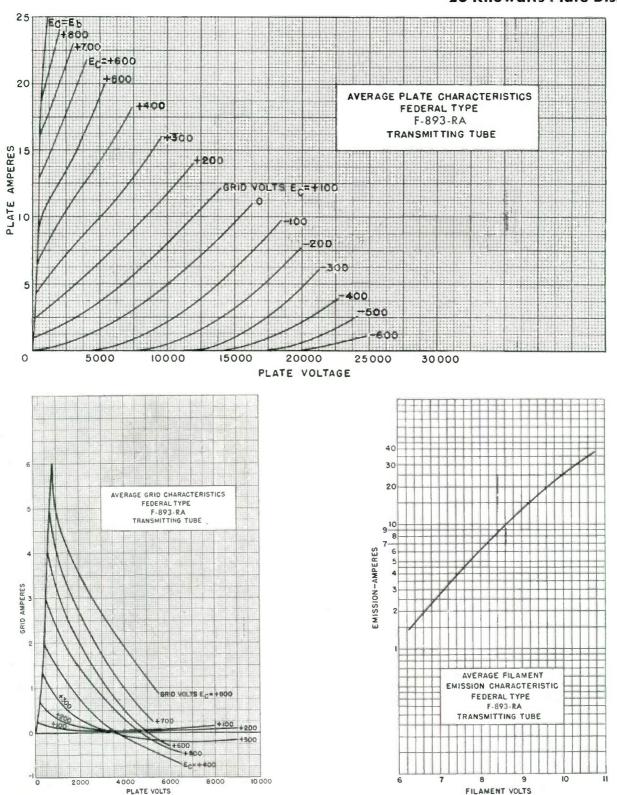
5 20 10 61

MULTI-PHASE FILAMENT CONNECTIONS

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-RA



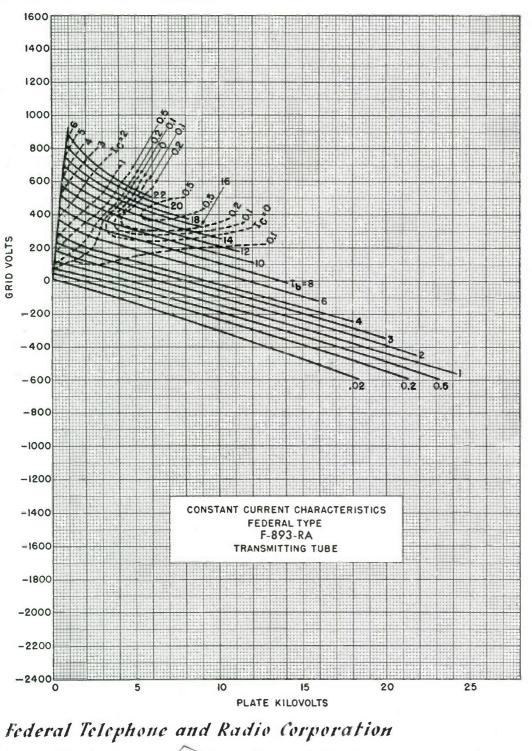
20 Kilowatts Plate Dissipation

World Radio History

Vacuum Tube Products



TRANSMITTING TUBE TYPE F-893-RA



20 Kilowatts Plate Dissipation

Vacuum Tube Products



Vacuum Tube Products

TRANSMITTING TUBE TYPE 6C22

0.4 µµf

Tentative Data

Filament Type	Thoriated Tungsten
Filament Voltage	6.5 Volts
Filament Current	
Available Peak Emission	5.0 Amperes
Approximate Characteristics	
Amplification Factor	9
Mutual Conductance	15,000 Umhos
Type of Cooling	Water
	0.5 GPM
Maximum Overall Dimensions	
Length	4 ½ Inches
Diameter	2 3/8 Inches
Approximate Direct Inter-Electrode Capacitances	
Plate to Grid	
Grid to Filament	6.5 μμf

Tentative Maximum Ratings and Typical Operation

Key-down conditions without amplitude modulation Maximum ratings for frequency of 600 MC

Plate to Filament...

DC Plate Voltage	2500 Volts
DC Plate Current	0.75 Amperes
DC Grid Current	.075 Amperes
Plate Input	1875 Watts
Plate Dissipation	

Typical operation — Self-excited oscillator

Frequency MC	Plate Voltage volts	Plate Current amperes	Power Output watts
300	2500	0.70	900
400	2500	0.65	800
500	2200	0.70	680
600	2000	0.65	500

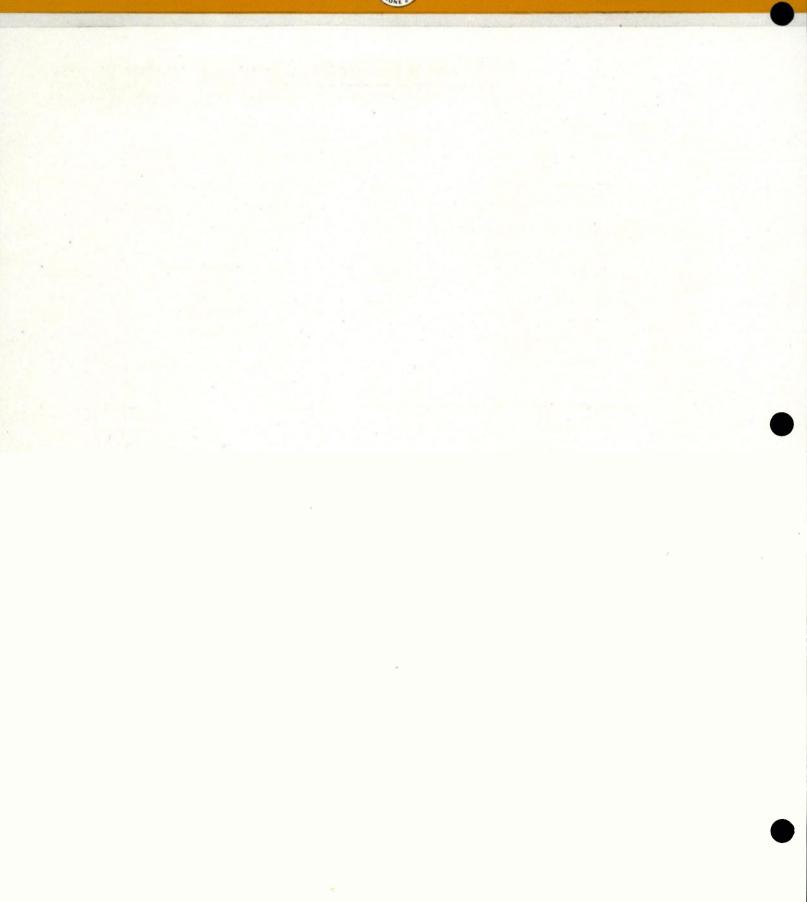
Federal Telephone and Radio Corporation

Newai

Newark 4, New Jersey

Vacuum Tube Products







Vacuum Tube Products

HIGH VACUUM TUBE TYPE F-214-A

1.580" ±.020"

Half Wave Rectifier

Technical Data		
No. of Electrodes	2	
▶ Filament Voltage — Max. Peak F	Plate Current	
22 volts	7.5 amperes	4 ³ ["] MAX
21.5 volts	6.5 amperes	
21 volts	5.5 amperes	=_IN
20.5 volts	4.5 amperes	+1
20 volts	3.4 amperes	
Filament Current	52 amperes	<u>କାଳ</u> ଆହ
Туре	Tungsten	$4\frac{1}{8}$ MAX \rightarrow 7
Maximum Peak Inverse Voltage	50,000 volts	ສຸດໄໝ +1
Type Base	Standard	27 <u>3</u> " 27 <u>3</u> "
Type of Cooling	Water	
Recommended Water Flow	10 gal. per min.	
Water Jacket	Standard or	
	Federal Type	±.005
	F-1000	2.003
		=-loo +-i
		=_1@
		00

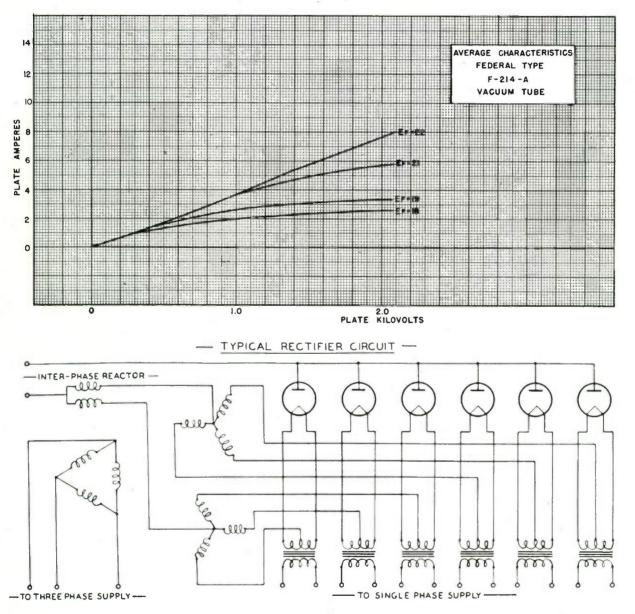
World Radio History

Vacuum Tube Products



HIGH VACUUM TUBE TYPE F-214-A

Half Wave Rectifier



Transformer secondary voltage per leg RMS	0.855
Transformer secondary current per leg RMS	0.289
Transformer secondary KVA	1.48
Transformer primary KVA	1.05
Peak inverse voltage across tubes	2.42
Peak current per tube	0.500

These values are given in terms of the average DC values and are based on the use of an input choke of sufficient inductance to hold the output current essentially constant. Tube voltage drop and transformer resistance are not taken into consideration in the above data. Tube voltage drop may be obtained from the above curves.

Federal Telephone and Radio Corporation

Vacuum Tube Products



Newark 4, New Jersey

World Radio History



Vacuum Tube Products

HIGH VACUUM TUBE TYPE F-222-A

Half Wave Rectifier

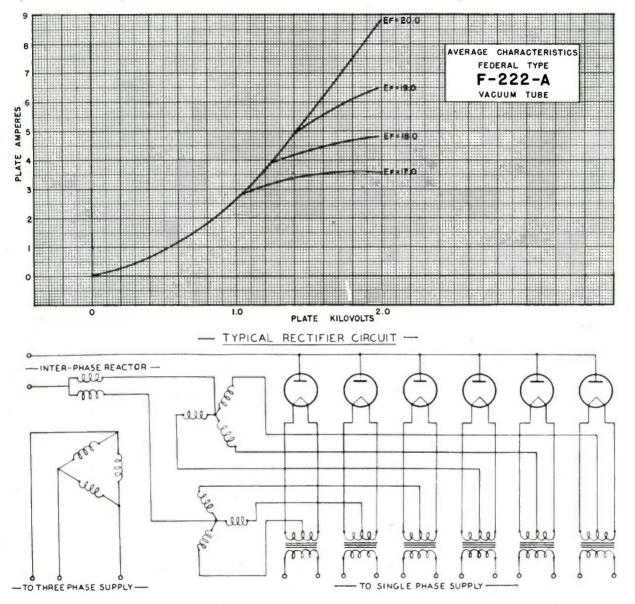
echnical Data		$\begin{array}{c c} & & & & & & \\ \hline & & & & & \\ \hline & & & & &$
No. of Electrodes	2	
Filament Voltage — Max. Pe	eak Plate Current	4 3 MAX
21.5 volts	5.5 amperes	4 16 1700
20 volts	4.5 amperes	
20.5 volts	3.5 amperes	$10\frac{29}{32} \pm \frac{1}{6}$
20 volts	2.8 amperes	
19.5 volts	2 amperes	$18\frac{3}{6} \pm \frac{3}{16}$ $12\frac{25}{32} \pm \frac{3}{16}$
Filament Current	41 amperes	4 1 MAX
Туре	Tungsten	20 " <u>+ 5</u>
Maximum Peak Inverse Volta	age 50,000 volts	
Type Base	Standard	.150 * ± .005*
Type of Cooling	Water	
Recommended Water Flow	8 gal. per min.	2 422 DIA.
Water Jacket	Standard or	±.023
	Federal Type	7.11
	F-1005	$7\frac{7}{32} \pm \frac{1}{6}$

Vacuum Tube Products



HIGH VACUUM TUBE TYPE F-222-A

Half Wave Rectifier



Transformer secondary voltage per leg RMS	0.855
Transformer secondary current per leg RMS	0.289
Transformer secondary KVA	1.48
Transformer primary KVA	1.05
Peak inverse voltage across tubes	2.42
Peak current per tube	0.500

These values are given in terms of the average DC values and are based on the use of an input choke of sufficient inductance to hold the output current essentially constant. Tube voltage drop and transformer resistance are not taken into consideration in the above data. Tube voltage drop may be obtained from the above curves.

Federal Telephone and Radio Corporation

Vacuum Tube Products



Newark 4, New Jersey

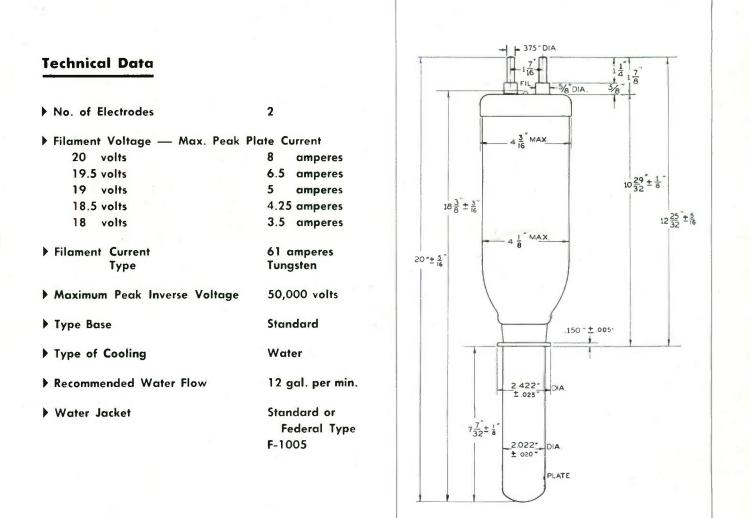
World Radio History



Vacuum Tube Products

HIGH VACUUM TUBE TYPE F-237-A

Half Wave Rectifier

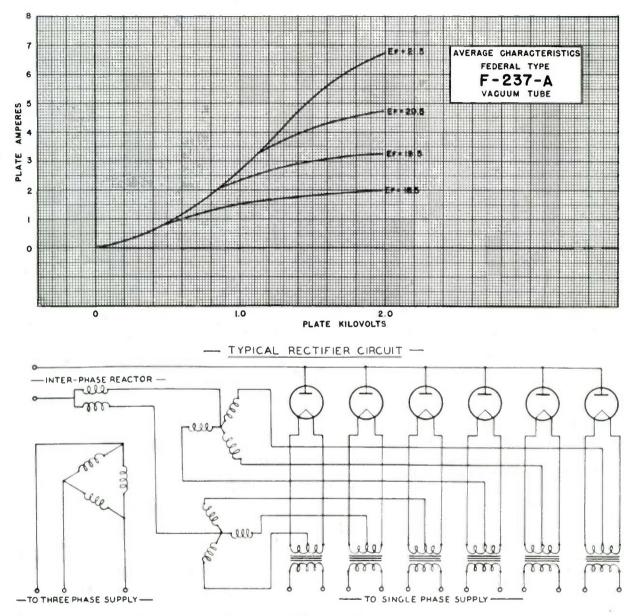


Vacuum Tube Products



HIGH VACUUM TUBE TYPE F-237-A

Half Wave Rectifier



Transformer secondary voltage per leg RMS	0.855
Transformer secondary current per leg RMS	0.289
Transformer secondary KVA	1.48
Transformer primary KVA	1.05
Peak inverse voltage across tubes	2.42
Peak current per tube	0.500

These values are given in terms of the average DC values and are based on the use of an input choke of sufficient inductance to hold the output current essentially constant. Tube voltage drop and transformer resistance are not taken into consideration in the above data. Tube voltage drop may be obtained from the above curves.

Federal Telephone and Radio Corporation

Vacuum Tube Products





Vacuum Tube Products

MERCURY VAPOR TUBE TYPE F-266-B

17

375

Half Wave Rectifier

No. of Electrodes	2	
Filament Voltage	5 volts	375"
Current	30 amperes	+ 005" <u>b</u>
Heating Time	120 seconds	215
Maximum Average Current	10 amperes	
Maximum Peak Current	40 amperes	- 2"014
Maximum Peak Inverse Voltage		
Ambient Temperature		
30°—40°C.	22,000 volts	
15°—50°C.	10,000 volts	
Type Base and Cap	Standard	rot
Mounting	Standard	
Recommended Condensed Mercury	Y	
Temperature Range	15° —50°C .	$11\frac{1}{1}^{+} \pm \frac{1}{3}^{+}$
* For plate potentials in excess of 10,000 V. regulated forced air cooling must be employed.		4"

NOTE: An increase in maximum average load current is permitted in some cases by quadrature connection of the tube filament. Inquiries on specific applications are invited.

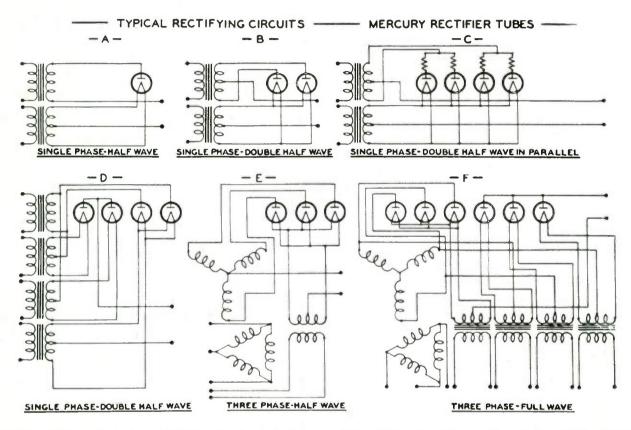
Technical Data

Vacuum Tube Products



MERCURY VAPOR TUBE TYPE F-266-B

Half Wave Rectifier



Typical rectifying circuits in which Type F-266-B 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	15,500 per tube	7,000	10
В	2	7,750 per tube	7,000	20
С	4	7,750 per tube	7,000	40
D	4	15,500 per 2 tubes	14,000	20
E	3	9,000 per leg	10,500	30
F	6	9,000 per leg	21,000	30

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.

Federal Telephone and Radio Corporation

Vacuum Tube Products





Vacuum Tube Products

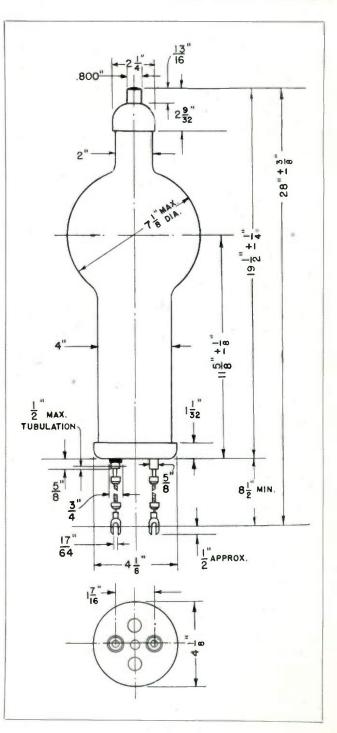
MERCURY VAPOR TUBE TYPE F-857-B

Half Wave Rectifier

Technical Data	
No. of Electrodes	2
Filament Voltage	5 volts
Current	30 amperes
Heating Time	120 seconds
Maximum Average Current	10 amperes
Maximum Peak Current	40 amperes
Maximum Peak Inverse Voltage*	
Ambient Temperature	
30°—40°C.	22,000 volts
25°—60°C.	10,000 volts
Type Base and Cap	Standard
Mounting	Standard
Recommended Condensed Mercury	
Temperature Range	25°—50° C .

* For plate potentials in excess of 10,000 V. peak inverse, temperature regulated forced air cooling must be employed.

NOTE: An increase in maximum average load current is permitted in some cases by quadrature connection of the tube filament. Inquiries on specific applications are invited.

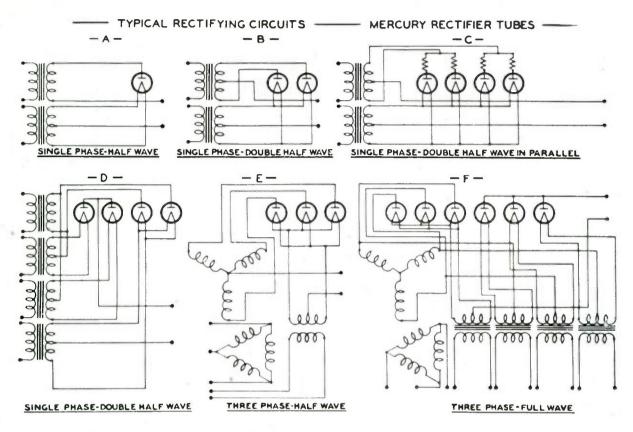


Vacuum Tube Products



MERCURY VAPOR TUBE TYPE F-857-B

Half Wave Rectifier



Typical rectifying circuits in which Type F-857-B 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	15,500 per tube	7,000	10
В	2	7,750 per tube	7,000	20
С	4	7,750 per tube	7,000	40
D	4	15,500 per 2 tubes	14,000	20
E	3	9,000 per leg	10,500	30
F	6	9,000 per leg	21,000	30

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.

Federal Telephone and Radio Corporation

Vacuum Tube Products





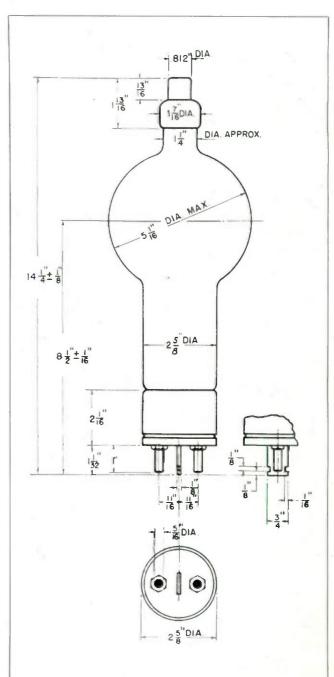
Vacuum Tube Products

MERCURY VAPOR TUBE TYPE F-869-B

Half Wave Rectifier

Technical Data	
No. of Electrodes	2
Filament Voltage	5 volts
•	
Current	20 amperes
Heating Time	60 seconds
Maximum Average Current	2.5 amperes
Maximum Peak Current	10 amperes
Maximum Peak Inverse Voltage	
Ambient Temperature	
30°-45°C.	20,000 volts
15°—50 ℃.	16,000 volts
Type Base and Cap	Standard
Mounting	Standard
Recommended Condensed Mercury	
Temperature Range	15°—50°C.

NOTE: An increase in maximum average load current is permitted in some cases by quadrature connection of the tube filament. Inquiries on specific applications are invited.

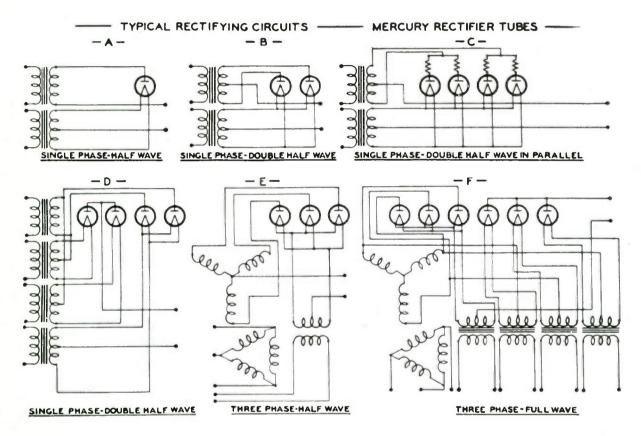


Vacuum Tube Products



MERCURY VAPOR TUBE TYPE F-869-B

Half Wave Rectifier



Typical rectifying circuits in which Type F-869-B 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		Input Voltage R.M.S.	Approx. DC Output	
	No. of Tubes		Volts	Amperes
A	1	14,000 per tube	6,300	2.5
В	2	7,000 per tube	6,300	5
C	4	7,000 per tube	6,300	10
D	4	14,000 per 2 tubes	12,500	5
E	3	8,250 per leg	9,500	7.5
F	6	8,250 per leg	19,200	7.5

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.

Federal Telephone and Radio Corporation

Vacuum Tube Products





Vacuum Tube Products

INDUSTRIAL TUBE TYPE 7C25

Tentative Data

Filament Type	Thoriated Tungsten
Filament Voltage	
Filament Current	
Available Peak Emission	10 Amperes
Characteristics at E_b =3000 Volts; 1 $_b$ =0.200 Amperes; E_f =11.0 Vol	ts
Grid Voltage (approx.)	-50 Volts
Amplification Factor	
Mutual Conductance	
Plate Resistance	5320 Ohms
Type of Cooling	Forced Air 150 CFM Minimum
Maximum Overall Dimensions	
Length	7 Inches
Diameter	
Net Weight	5 ¼ Pounds
Approximate Direct Inter-Electrode Capacitances	
Plate to Grid	12.0 μμf
Grid to Filament	12.5 μµf
Plate to Filament	1.7 μμf

Tentative Maximum Ratings for Maximum Frequency of 50 Megacycles

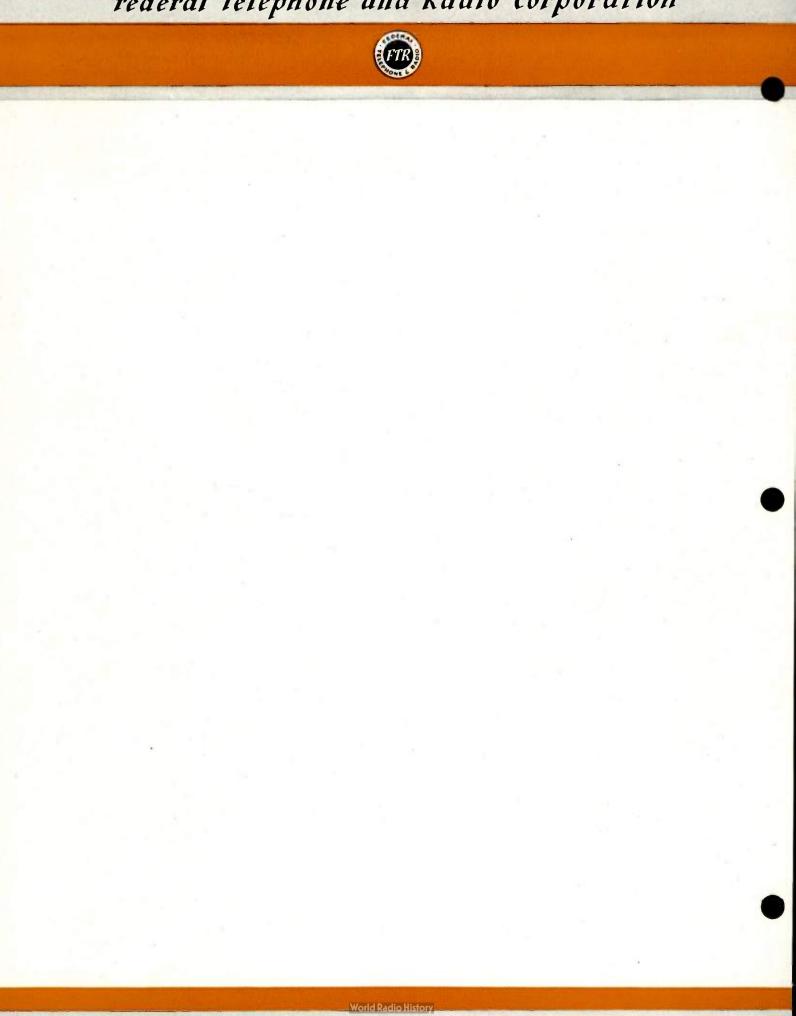
Class C Power Amplifier and Oscillator Key-down conditions without modulation

D-C Plate Voltage	4500 Volts
D-C Grid Voltage	-1000 Volts
D-C Plate Current	1.25 Amperes
D-C Grid Current	0.15 Amperes
Plate Input	5600 Watts
Plate Dissipation	2500 Watts
Anode Temperature	180° Centigrade

Federal Telephone and Radio Corporation

Vacuum Tube Products





INDEX TO FEDERAL PRODUCTS

AM Broadcast Transmitters **Aerial Navigation Equipment Course Markers Fan Markers Glide Path Systems** Landing Localizers Simultaneous Radio Range **Airborne Rectifier Equipment Auxiliary DC Power Regulated Rectifiers** Main DC Power Rectifiers **Portable Test Equipment Rectifier Relays** Voltage Regulators **Aircraft Ground Rectifier Equipment Battery Chargers and Eliminators Engine Starters Instrument Test Equipment** Laboratory and Production Regulated and **Filtered Test Equipment** Main Power for Complete Ground Test **Radio Power Supplies Aircraft Transformers** Amplifiers **Annunciator Wire** Antenna Lead-in Wire Antennas Assemblies, Cable **Audio Transformers** Auto Alarms (Marine) **Auto Transformers** Automatic Branch Exchanges, Private **Automatic Central Office Exchanges** Automatic Noiseless Telephone Battery Chargers **Aviation Instrument Landing Systems Aviation Radio Transmitters** Aviation U H F Radio Range Equipment

Battery Boxes **Battery Chargers and Eliminators** Aircraft Airport **Automatic Regulating Constant Current Constant Potential** Automatic Noiseless Telephone Automobile Bus **Fire Department** Industrial Truck Laboratory **Marine Service Noiseless Types for Floating Service** Portable

Railroad Station **Automatic** Manual Telegraph Automatic Two Rate Manual Two Rate Telephone Automatic Two Rate Manual Two Rate Industrial Truck (Two Rate Type) **Bays, Toll Test** Beacons, Radio Belt Ovens, MEGATHERM **Blocks**, Terminal **Branch Exchanges, Private Branch Exchanges, Private Automatic Bridle Wire Broadcast Equipment (Complete Systems) Broadcast Studio Equipment Bus Battery Chargers Bus Dispatching Systems**

Uable Assemblies (High Frequency) Cable, High Frequency (INTELIN) Antenna Lead-in Wire **Coaxial Air Spaced Coaxial Solid Dielectric Dual Coaxial Dual Conductor (Twinax) Spiral Delay Line** Cable, Multi-Conductor Power Cable Harnesses (High Frequency) **Carrier Telegraph Systems Carrier Telephone Systems Cathodic Protection Rectifiers Center Contact Construction Rectifier** Stacks Central Office Exchanges, Automatic **Central Office Protectors Central Office Switchboards** Automatic Manual **Chief Operator Desks Coaxial Air Spaced High Frequency Cable Coaxial Solid Dielectric High Frequency** Cable Coils Choke Induction Repeating Retardation **Combined Jacks and Drops Common Battery Switchboards**

Common Battery Telephones Communication Transmitters Compound, Filling Condensers Vacuum Variable **Connectors (for High Frequency Cable) Continuous Belt Ovens (MEGATHERM) Convertible Telephones** Cords Dial Telephone **Course Markers Crystal Detector Radio Receivers (Marine) Crystal Ovens (Temperature Controlled) Crystal Units** Aircraft **Broadcast (AM and FM)** Filter Marine Police Test **Standards Current Transformers**

Uesk Telephones

Desks **Chief Operator** Service Observation Wire Chief **Dial Cords Dial Instruction Cards, Telephone Dial Number Plates, Telephone Dials**, Telephone **Dielectric Heating Units DC** Power Supplies Filtered Regulated Unfiltered **Direction Finders** Aircraft Land Marine **Drainage Wire Rectifiers Drops and Jacks, Combined Dual Coaxial High Frequency Cable** Dual Conductor (Twinax) High Frequency Cable **Duct Wire Dynamotors**

Llectric Filters **Band-Pass Band-Stop By-Pass**

Channel Directional **High-Pass** Line Low-Pass **Power Supply Electroplating Rectifiers Engine Starters, Aircraft** Equalizers

FM Broadcast Transmitters Facsimile Equipment (Page and Tape) **Fixed Point-to-Point Fixed to Mobile Receivers Transmitters Fan Markers Field Intensity Meters Field Telephones Filament Transformers** Filling Compound (for High Tension Cable) **Filter Reactors** Filters, Electric (See Electric Filters) **Filtered DC Power Supply Fire Department Battery Chargers Fire Department Radio Equipment Fixed Station Receivers Fixed Station Transmitters Handy Talkies Mobile Receivers Mobile Transmitters** Flat Top Key Mountings **Flat Top Key Spaces Flush Key Mountings Forestry Mobile Radio Equipment Frequency Shift Key Units**

General Purpose Transformers Generators, Hand Telephone (Magnetos) **Glass Tube Selenium Rectifier Stacks Glide Path Systems** Goniometers

and Generators (Magnetos) Handsets **Handy Talkies** Harness, Cable **High Frequency Cable High Frequency Heating Units High Frequency Transmitters High Tension Wire High Vacuum Tubes Highway Mobile Communication Equipment** Hook-up Wire

Induction Coils Induction Heating Units Inductors Industrial AC to DC Rectifiers Industrial DC Electroplating Rectifiers **Industrial Truck Battery Chargers** Industrial Tubes Instruction Cards, Telephone Dial Instrument Landing Equipment **Instrument Test Equipment** Instrument Transformers INTELIN (see Cable) **Intermediate Frequency Transformers Intermediate Frequency Transmitters**

Jacketing Material (for Cable) Jacks Jacks and Drops, Combined

Key Mountings Key Spaces Keys, Lever Midget Universal Keys, Switching

Landing Localizers Lever Switches Lifeboat Radio Equipment Line, Artificial Line Amplifier Equipment **Line Finder Switches** Local Battery Manual Central Office **Switchboards** Localizer Equipment Low Frequency Transmitters

Magnetic Chuck DC Power Supplies **Magneto Telephones Marine Navigation Equipment Marine Radio Equipment** Auto Alarm **Crystal Detector Receivers** Lifeboat Radio Equipment Receivers **Transmitters** Marine Radio Units Measuring Sets, Transmission MEGATHERM **Dielectric Heating Units** Induction Heating Units Mechanization for H. F. Heating Equipment Ovens **Continuous Belt**

One Door Two Door **Quench Tables** Work Tables **Mercury Vapor Rectifier Tubes Micro-Wave Relay Systems Midget Lever Keys** Mobile Radio Equipment Police, Fire, Highway, Forestry and Conservation, Pipe Line, Bus, Taxi and **Truck Dispatching, Railroad** Mountings Key Protector Tube Multi-Conductor Cable

Navigation Equipment Aerial Marine Number Plates, Telephone Dial

Uvens (MEGATHERM)

Continuous Belt One Door **Two Door Ovens**, Crystal

Page Facsimile Equipment **Phase Changing Transformers Plastic Molding Plasticizers** Point-to-Point Transmitters Police Mobile Radio Equipment **Police Transmitters Portable DC Power Supplies Portable Radio Communication Equipment Portable Test Equipment Potential Transformers Power Boards Power Cable Power Plants** Power Supplies (AC to DC) **Battery Eliminator Cathodic Protection** Electroplating Filtered Portable DC Regulated **Power Supply Transformers Power Switchboards, Telephone Private Automatic Branch Exchanges Private Branch Exchanges Protector Mountings**

World Radio History

Protectors, Central Office Pulse Time Modulation Transmitters

Quartz Crystals **Optical blanks** Supersonic **Quench Tables (MEGATHERM)**

Kadiators, Vacuum Tube **Radio Beacons Radio Direction Finders** Aircraft Land Marine **Radio Ranges Radio** Receivers **Aviation Direction Finder** Marine **Radio Relay Systems** Radiophones **Radio-teletype Railroad Communication Equipment** Railway Battery Charging Selenium Rectifiers Reactors **Rectifiers**, Selenium Aircraft **Auxiliary Power Supply Battery Eliminator Main Power Supply Voltage Regulator Battery Charging Cathodic Protection DC Power Supplies** Electroplating **Filtered Power Supplies General Purpose Portable DC Power Supplies Railway Battery Charging Regulated and Filtered DC Power Supplies Rectifier Stacks, Selenium Rectifier Transformers Rectifiers**. Tube **Regulated and Filtered DC Power Supplies** Relays Rectifier **Telephone Type Remote Control Equipment** Repeaters Carrier Telegraph Telephone **Ringers, Voice Frequency Rotary Sequence Switches**

Selective Calling Systems **Selector Switches Selenium Rectifier Equipment** Selenium Rectifier Stacks Service Observation Desks **Service Transformers Shipboard Radio Equipment** Simultaneous Radio Range Spaces, Key **Spaces and Key Mountings Speech Input Equipment** "Speech-Plus-Duplex" Telegraph Terminals **Speech Privacy Equipment Spiral Delay Lines** Stacks, Selenium Rectifier Stacks, Selenium Rectifier Glass Tube **Standard Broadcast Transmitters Switchboards Central Office** Automatic **Common Battery, Manual** Local Battery, Manual Floor Type Wall Type Power Toll **Switches** Lever **Line Finder Rotary Sequence** Selector Step-by-Step Automatic Telephone Switching Keys Synchroscopes

ape Facsimile Equipment Taxi Dispatching Systems **Telegraph Battery Eliminators Telegraph Systems, Carrier Telegraph Transmitters Telephone Battery Chargers, Automatic** Noiseless **Telephone Battery Eliminators Telephone Cords Telephone Dial Instruction Cards Telephone Dial Number Plates Telephone Dials Telephone Drop Wire Telephone Hand Generators (Magnetos) Telephone Inside Wire Telephone Switchboards Telephone Systems, Carrier Telephone Terminal Strips Telephone Test Jack Strips**

Telephone Toli Test Boards Telephone Transmitters Telephones **Common Battery** Convertible Desk Field Maaneto **Television Transmitters Terminal Blocks Terminal Strips, Telephone** Terminals **Carrier Telegraph Carrier** Telephone Radiophone **Radio-teletype** "Speech-Plus-Duplex" Telegraph Telephone **Test Jack Strips, Telephone** Test Unit, Portable DC Power Supply **Testing Transformers Thermionic Rectifier Tubes Thyratron Tubes Toll Switchboards Toll Test Bays Toll Test Boards, Telephone Transformers** Aircraft Audio Auto **Current Input Filament Supply Filter Reactor General Purpose** Inductor Input Instrument **Intermediate Frequency** Interstage Line Output **Phase Changing** Potential **Power Supply** Rectifier Service Testing **Transmission Measuring Sets Transmitters** Aviation Communication **FM Broadcast FM Bus Dispatching FM Police and Fire FM Taxi Dispatching**

FM Truck Dispatching Facsimile **High Frequency** Intermediate Frequency Low Frequency Marine Point-to-Point Police **Pulse Time Modulation** Standard Broadcast Telegraph Telephone Television **Ultra High Frequency** Truck Battery Chargers, Industrial **Truck Dispatching Systems Tube Water Jackets** Tubes, Vacuum Industrial Rectifier **Thermionic Rectifier** Thyratron **Transmitting** Air Cooled Water Cooled Two Door Ovens (MEGATHERM)

Ultra High Frequency Transmitters **Universal Key Mountings Universal Lever Keys**

acuum Condensers Vacuum Tube Radiators **Vacuum Tubes** Variable Condensers Variometers **Voice Frequency Ringers Voltage Multipliers** Voltage Regulators (AC) Voltmeters

Water Jackets, Tube Waterproof Alarm Bells (Marine) Wavemeters Wire Annunciator Antenna Lead-in **Bridle** Duct **High Tension** Hook-up **Telephone Drop Telephone Inside** Wire Chief Desks

e Q

and the

.

.

.

World Radio History