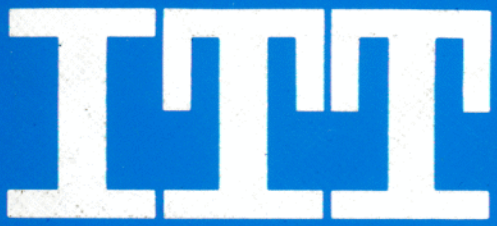


ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION CLIFTON NEW JERSEY

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

NOTE

THE DATA SHEETS INCLUDED HEREIN, REPRESENT RECOMMENDED TYPES FOR NEW EQUIPMENT DESIGN AND SHOULD NOT BE CONSTRUED AS AN INCLUSIVE CATALOG OF OUR COMPLETE TUBE LINE.

TECHNICAL DATA ON REPLACEMENT TYPES ARE AVAILABLE UPON REQUEST.

FOR YOUR FURTHER INFORMATION PLEASE REFER TO THE FOLLOWING SECTION WHICH PROVIDES A CONDENSED LISTING OF OUR TUBE PRODUCTS.

TRAVELING WAVE TUBES - CONDENSED LISTING

Frequency KMC	Type	Power Output (Watts)	Duty	Style	Remarks
1.7 - 4.0	F-6658	2	CW	L	
1.7 - 4.0	F-6868	10	CW	L	
2.0 - 4.0	F-6825	1000	P	L	
2.0 - 4.0	F-6826	1000	P	L	Gridded
2.0 - 4.0	F-7338	1000	P	L	40 db Gain F-6826
2.0 - 4.0	F-7347	1000	P	S	Gridded
4.0 - 8.0	D-2023	1000	P	S	Gridded
4.0 - 8.0	X-370	10	CW	P	
4.0 - 8.0	X-282	10	CW	S	
4.0 - 8.0	D-2009	2	P	Pk	
5.0 - 6.0	F-7848	2000	P	S	
5.0 - 6.0	F-7847	10	CW	S	
8.0 - 12.0	X-354	5	CW	P	
8.0 - 12.0	F-7524	5	CW	S	
8.0 - 12.0	F-7525	5	CW	Pk	
8.0 - 12.0	F-7067	1	P	S	
8.0 - 12.0	X-368	.05	CW	P	
8.0 - 12.0	F-7066	.05	CW	S	
8.0 - 12.0	F-7526	.05	CW	Pk	
8.0 - 9.6	F-7340	1000	P	L	Gridded
8.0 - 9.6	D-95A	1000	P	L	Waveguide 7340
8.0 - 9.6	D-95B	1000	P	L	Flying Lead 7340
8.0 - 9.6	D-2014	1000	P	L	Special 7340
8.0 - 9.6	F-6996	10	CW	L	
8.0 - 9.6	D-2013	10	CW	L	Special 6996
8.0 - 9.6	D-2020	10	CW	L	Flying Lead 6996
8.0 - 9.6	D-2024	10	CW	L	Waveguide 6996
8.0 - 9.6	F-7341	5	CW	L	Gridded
8.0 - 9.6	F-6867	0.1	CW	L	
8.5 - 9.6	F-7339	1000	P	L	

Style Code

L - Large diameter (both R-F leads at same end)
S - Small diameter (both R-F leads at opposite ends)
Pk - Packaged with solenoid as integral part
P - PPM focused

TRAVELING WAVE TUBE SOLENOIDS - CONDENSED LISTING

Tube Type	Solenoid Number	Gauss	Voltage (Volts)	Current (Amps)	Cooling	Case Dimensions H	W	L	Weight (Lbs)
6658	RT-250,446	750	84	3.5	Water	4-7/8	4-7/8	6-3/4	25
6658	RT-250,447	750	46	4.0	Air*	9-1/32	5-23/32	6-3/4	15
6658	RT-90537	750	60	3.3	Air*	5-3/16	5-3/16	6-13/16	14
6658	RT-90532	750	46	3.75	Water	6-3/8	6-3/8	6-13/16	22
6825	RT-250,212	1200	85	8.3	Air*	9	5-5/8	9-21/32	21
6826	RT-250,449	1200	25	25	Air**	9-1/8	5-3/4	9-21/32	22
7338	RT-250,448	1200	84	8.8	Water	6-3/4	8-1/8	11-3/16	25
7338	RT-250,444	1200	80	8.5	Water	4-1/8	4-1/4	9-21/32	20
6867	RT-90549	1300	86	5	Air*	10-1/4	6-1/8	5	17
6867	RT-250,199	1300	86	5.1	Air***	10-1/4	6-1/8	6-3/8	15
6868	RT-90537	1000	80	4.4	Air*	5-3/16	5-3/16	6-13/16	14
6868	RT-90532	1000	62	5.0	Water	6-3/8	6-3/8	6-13/16	22
6868	RT-250,447	1000	62	5.3	Air*	9-1/32	5-23/32	6-3/4	15
6868	RT-250,446	1000	115	4.6	Water	4-7/8	4-7/8	6-3/4	25
6996	RT-250,447	1300	80	6.9	Air*	9-1/32	5-23/32	6-3/4	15
7341	RT-90532	1300	80	6.5	Water	6-3/8	6-3/8	6-13/16	22
D-2013	RT-90532	1300	80	6.5	Water	6-3/8	6-3/8	6-13/16	22
D-2020	RT-90532	1300	80	6.5	Water	6-3/8	6-3/8	6-13/16	22
D-2024	RT-90532	1300	80	6.5	Water	6-3/8	6-3/8	6-13/16	22
7340	RT-250,451	2400	91	13	Water	5-1/4	5-1/4	6-3/4	13
7339	RT-250,451	2400	91	13	Water	5-1/4	5-1/4	6-3/4	13
D-95A	RT-250,451	2400	91	13	Water	5-1/4	5-1/4	6-3/4	13
D-95B	RT-250,451	2400	91	13	Water	5-1/4	5-1/4	6-3/4	13
D-2014	RT-250,451	2400	91	13	Water	5-1/4	5-1/4	6-3/4	13
7347	RT-250,445	1200	115	4	Water	4-1/4	4-1/8	9-1/2	18
7524	RT-250,452	1200	87	3.2	Water	4-1/4	4-1/8	6-5/16	13

* - 400 cycle - 115 VAC Blower
** - 25 Amp. - DC Blower
*** - 60 Cycle - 115 VAC Blower

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

D-95B
TRAVELING
WAVE TUBE

GENERAL DESCRIPTION:

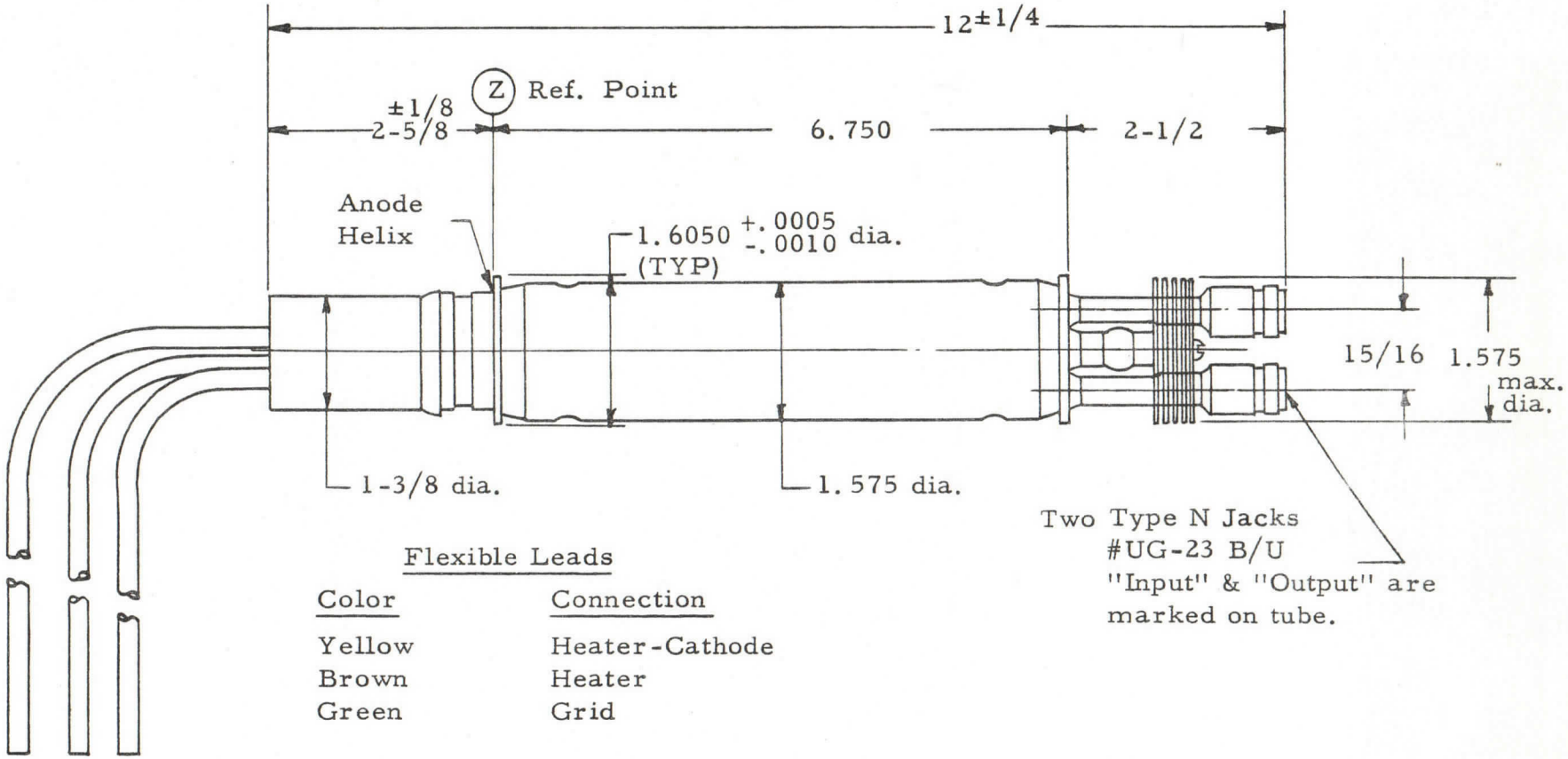
Type D-95B is a mechanically modified version of type D-95. Silicone rubber insulated flying leads attached to the tube with Silastic insulation are provided for altitude operation, in place of the Small Shell Duodecal 5 pin base.

Capacitance of control grid to all other elements is increased to 13 μμfd by the base and lead configuration.

All other characteristics are the same as type D-95 and additional information can be obtained by referring to the D-95 data sheet.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey



Flexible Leads

Color	Connection
Yellow	Heater-Cathode
Brown	Heater
Green	Grid

Lead Length = 18 inches, min. measured from ref. point Z to end of lead.

TRAVELING WAVE TUBE TYPE D-95B

TENTATIVE

DESCRIPTION:

The D-2009 is a pulse traveling wave amplifier tube mounted integral with a solenoid which provides the magnetic field required to define the path of the electron beam.

The tube is designed for use as a pulsed r-f amplifier in the frequency range of 3950 to 8000 megacycles per second and includes a control grid for pulsing the electron beam.

The D-2009 is of all-metal shell construction and is provided with input and output coaxial cables and connectors for r-f connections.

ELECTRICAL:

Heater for oxide-coated, unipotential cathode		
Voltage	6.3 ±10%	volts
Current	2.5	amperes
Frequency	3950 to 8000	mc
Gain (Note 1)	33	db
Peak Power Output (Note 1)	2	watts
Inter-electrode Capacitance		
Grid to all other electrodes	25	μμfd

MECHANICAL:

Mount		Special
Mounting Position		Any
Base	Moulded Rubber	Flexible Leads
R-F Circuit Connectors		TNC Male
Type of Cooling		Air

MAXIMUM RATINGS:

Cathode Voltage with respect to ground (Note 2)	-2500	volts
Peak Cathode Current	65	ma
Grid Voltage with respect to cathode (Note 3)		
for cut-off (10 db loss minimum through tube)	0	volts, min.
for beam-on	+150	volts, max.
Helix Current (Note 4)	1	ma average
Beam on Duty Cycle	.04	
R-F Power Input	1.0	watt avg.

TYPICAL OPERATION:

Frequency	4500	mc
Cathode Voltage with respect to ground	2350	volts
Peak Cathode Current	55	ma
Grid Voltage with respect to cathode		
Beam cut-off	0	volts
Beam-on	+115	volts
Peak Helix-Current	6	ma
Peak Shell Current	53	ma
Beam on Duty Cycle	.03	
Peak Power Output	4	watts
Gain	35	db
Solenoid voltage	26	volts
Solenoid current	9	amps
Air flow	0.4	lbs/min.

Note 1: Minimum performance over the frequency band of 3950 to 5850 mc is 35 db gain; 25 db gain from 3950 to 8000 mc.

Note 2: Anode and collector are connected internally to the shell, and the outer coaxial conductor of the r-f connections is also at shell potential. The helix is connected to the center conductor of the coax line and a d-c connection to the helix must be provided externally in the r-f circuitry.

Note 3: Positive voltage must not be applied to the grid in the absence of anode voltage.

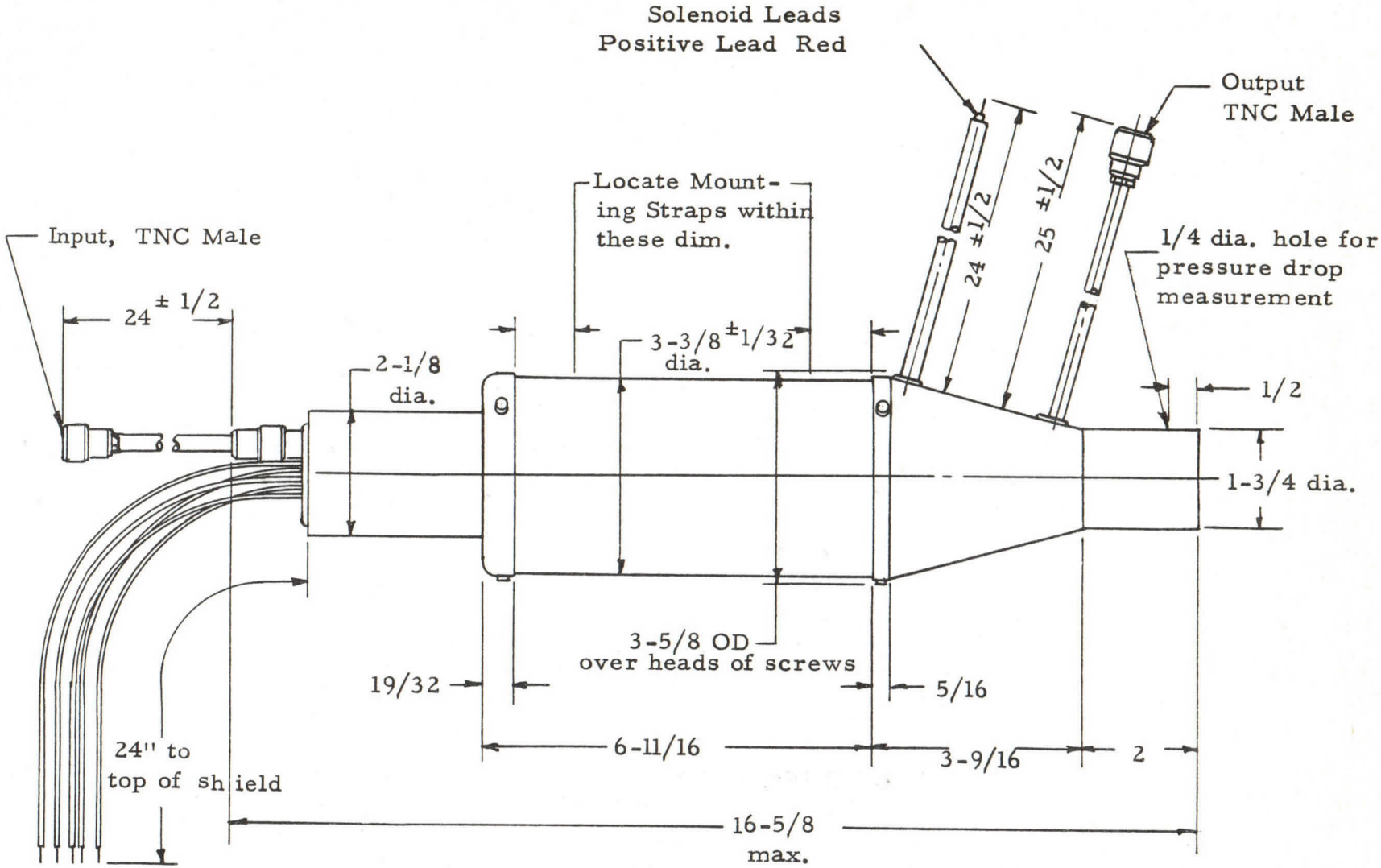
Note 4: Initial adjustments of voltage and magnetic field may be made at low duty cycles. 1 ma average helix current must not be exceeded at maximum duty cycle (.04).

CAUTION: The solenoid must be in operation before the beam voltage is applied.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Box 412
Clifton, New Jersey

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



Color	Conn.
Green	Grid
	N. C.
Yellow	Cathode
Brown	Heater
Brown	Heater
Black	Anode, Capsule, Collector

Center conductor of r-f output cable is conn. to the helix

TRAVELING WAVE TUBE
TYPE D-2009

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

TENTATIVE

DESCRIPTION:

THE D-2013 IS A 5 WATT CW TRAVELING WAVE AMPLIFIER TUBE HAVING 33 DB GAIN AND 8000 TO 9600 MC FREQUENCY RANGE. IT IS CONSTRUCTED IN A RUGGED METAL ENVELOPE WITH A HELIX-TYPE SLOW WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH TYPE "N" CONNECTORS. THE TUBE IS SELF-ALIGNING IN THE EXTERNAL SOLENOID WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE IMPREGNATED CATHODE ARE USED. THE TUBE IS SUITABLE FOR EITHER CW OR PULSE SERVICE.

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3 (±10%)	VOLTS
HEATER CURRENT	2.3	AMPERES
MAXIMUM FREQUENCY	9600	MC
MINIMUM FREQUENCY	8000	MC
MINIMUM COLD TRANSMISSION LOSS	50	DB
CAPACITANCE		
CONTROL ELECTRODE TO ALL OTHER ELEMENTS	10	UUFD
ALL GUN ELEMENTS TO SHELL	4.8	UUFD
SMALL SIGNAL VS GAIN CHARACTERISTIC (SEE CURVE, SHEET 4)		
POWER GAIN WITHIN 6 DB OF SMALL SIGNAL GAIN AT ANY FREQUENCY FROM 8.0 TO 9.6 KMC		
NOISE FIGURE	35	DB MAX.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

MAXIMUM ANODE VOLTAGE (NOTE 1)	3400	VOLTS
MAXIMUM SHELL CURRENT (NOTE 2)	3	MA
MAXIMUM COLLECTOR VOLTAGE (NOTE 3)	3500	VOLTS
MAXIMUM COLLECTOR DISSIPATION (NOTE 4)	200	WATTS
MAXIMUM CONTROL ELECTRODE VOLTAGE (NOTE 5)	-250	VOLTS

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential	
Base, Small Shell Duodecal, 5 Pin	JEDEC Designation B5-57	
Type of Envelope		Metal
Magnetic Field Strength (Nominal)	1300	Gauss
Length of Magnetic Field	6.75	Inches Uniform
Mounting Position		Any
Weight (not including solenoid)	1 pound	7 ounces
R-F Connections	50 ohm coax with type "N" Jack UG-23B/U	
Type of Cooling		Forced Air
Glass Temperature	160°C	max.
Cooling Air Required (Note 4)	70	cfm

TYPICAL OPERATION AS POWER AMPLIFIER:

Anode Voltage	3200	Volts
Shell Current	1	ma
Collector Voltage	3300	Volts
Collector Current	50	ma
Control Electrode Voltage	-15	Volts
Power Output	5	Watts Minimum
Gain	33	db min.
Duty Cycle		
R-F	Variable to 1.0	
Beam	1.0	

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at ground potnetial and the D-C connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between the cathode current and collector current. This current should be minimized and must be less than the maximum rating. It is desirable to monitor the current from shell to ground during operation and it is recommended that overload protection be provided to remove high voltage if the shell current exceeds 3 ma.

Note 3: It is generally recommended that the collector be operated at 50 to 100 volts positive with respect to shell, and the potential difference between collector and shell be limited to 300 volts maximum.

Note 4: Forced air cooling of collector is required when average collector power is in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 200 watts, a minimum air flow of 70 cfm through the cooling fins is required.

NOTE 5: THE CONTROL ELECTRODE VOLTAGE IS ADJUSTED FOR MAXIMUM BEAM TRANSMISSION (COLLECTOR CURRENT/CATHODE CURRENT).

OPERATING PROCEDURE:

1. INSERT TUBE IN SOLENOID, SECURE IN PLACE WITH STOPS PROVIDED, MAKE CONNECTIONS.

2. TURN ON COOLING AIR, SOLENOID VOLTAGE (ADJUST TO APPROXIMATELY 1300 GAUSS), HEATER VOLTAGE, COLLECTOR VOLTAGE (IF USED), CONTROL ELECTRODE VOLTAGE (APPROXIMATELY -20 VOLTS).

3. RAISE HIGH VOLTAGE TO DESIRED VALUE, ADJUSTING SOLENOID VOLTAGE AND CONTROL ELECTRODE VOLTAGE FOR MAXIMUM COLLECTOR CURRENT, AND OBSERVING CARE NOT TO EXCEED 3 MA SHELL CURRENT. IT MAY BE NECESSARY TO ROTATE THE TUBE IN THE SOLENOID TO THE POINT GIVING BEST TRANSMISSION.

4. THE ABOVE PROCEDURE IS NOT REQUIRED AFTER INITIAL SET UP; HOWEVER, HEATER VOLTAGE SHOULD BE APPLIED ONE MINUTE BEFORE APPLYING HIGH VOLTAGE, AND PROPER MAGNETIC FIELD AND CONTROL ELECTRODE VOLTAGE MUST BE APPLIED BEFORE APPLYING HIGH VOLTAGE. OBSERVANCE OF THE 3 MA MAXIMUM LIMIT ON SHELL CURRENT IS ESSENTIAL TO PREVENT TUBE DAMAGE.

5. HEATER WARM UP OF 2 MINUTES BEFORE APPLYING HIGH VOLTAGE IS RECOMMENDED.

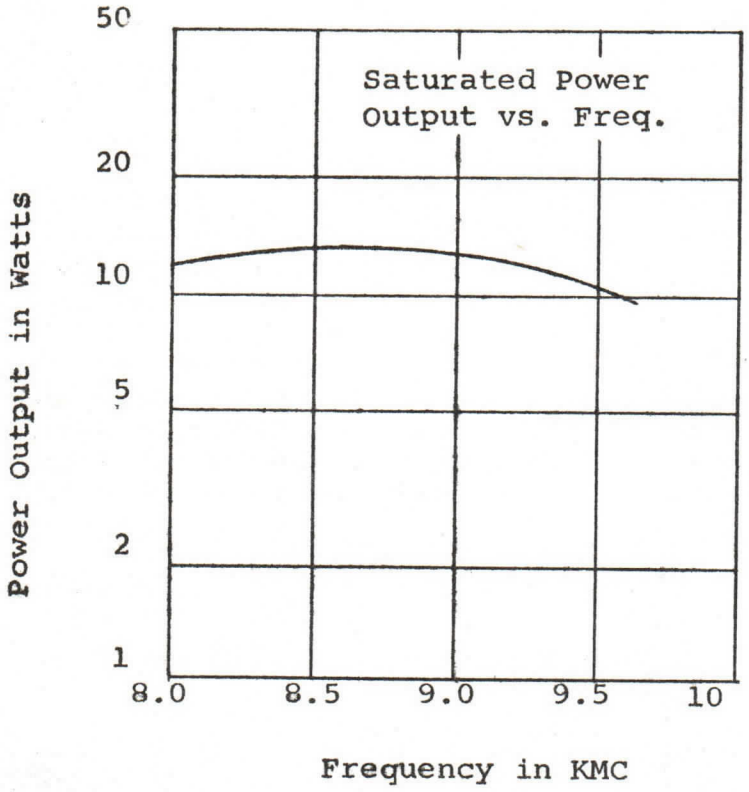
STANDARD SOLENOIDS TO OPERATE THIS TUBE ARE AVAILABLE, AND SOLENOIDS DESIGNED FOR PARTICULAR APPLICATIONS CAN BE SUPPLIED.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE:

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 7065
ROANOKE, VIRGINIA

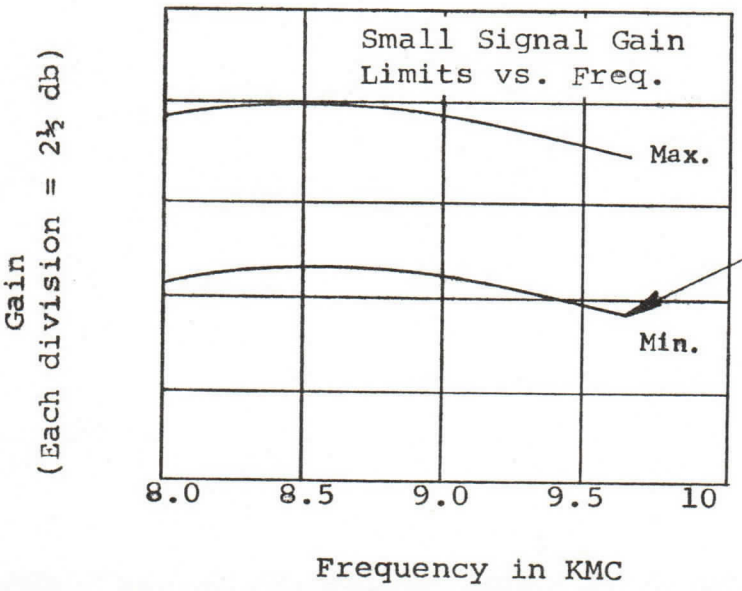
ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

TYPICAL CHARACTERISTICS

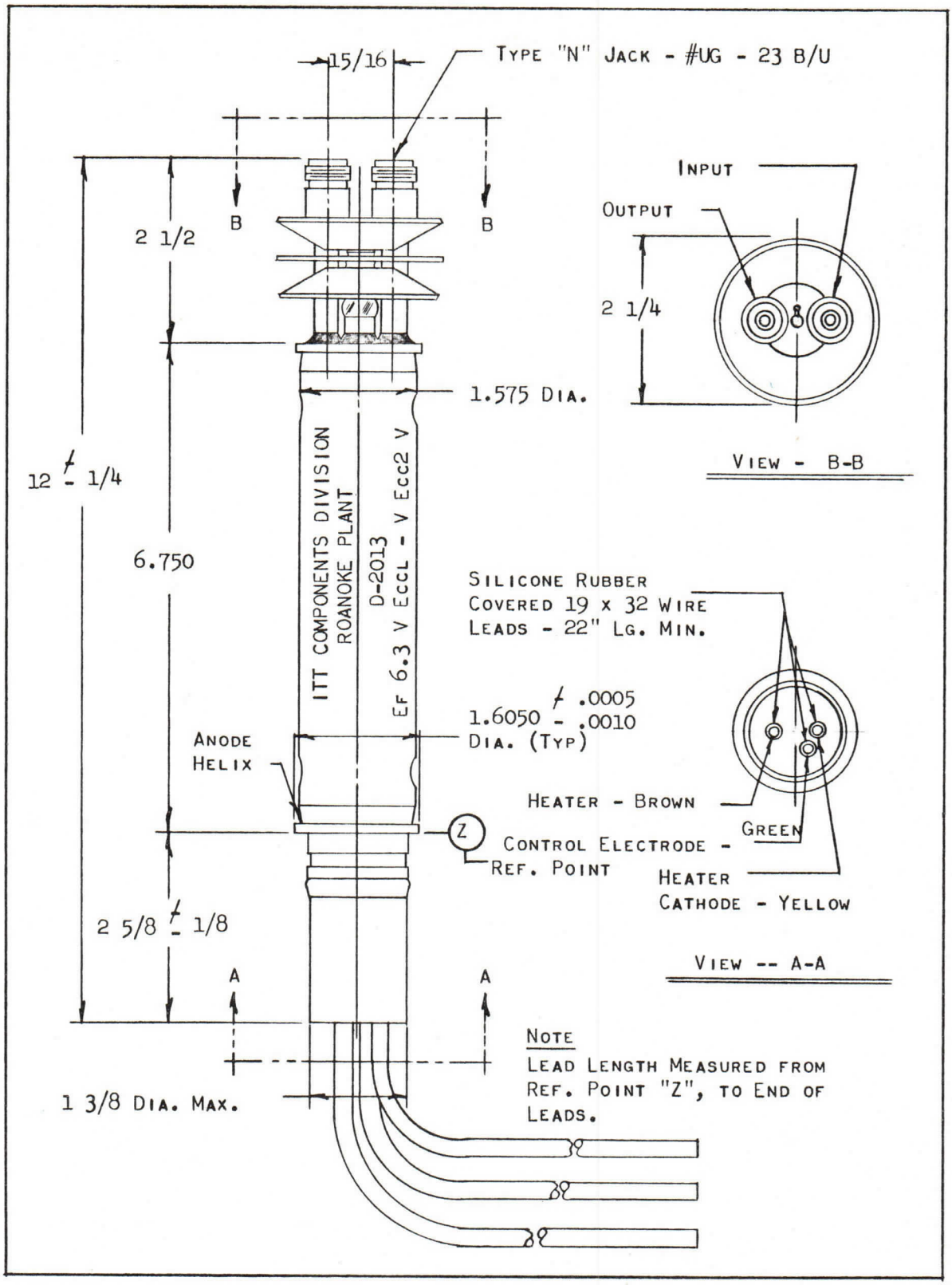


Magnetic field and control electrode voltage set for best transmission.

Voltage set at approximately 3200 volts.



This point 9.6 KMC
33 db or greater.



OUTLINE - D-2013

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

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

D-2014 TRAVELING WAVE TUBE

DESCRIPTION:

THE D-2014 IS A 1 KILOWATT PULSE TRAVELING WAVE AMPLIFIER TUBE HAVING 33 DB GAIN AND 8000 TO 9600 MC FREQUENCY RANGE. IT IS CONSTRUCTED IN A RUGGED METAL ENVELOPE WITH A HELIX TYPE SLOW WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH TYPE 'N' CONNECTORS. THE TUBE IS SELF-ALIGNING IN THE EXTERNAL SOLENOID WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE IMPREGNATED CATHODE ARE USED. DUTY CYCLES UP TO .005 AND PULSE LENGTHS UP TO 10 MICROSECONDS CAN BE USED. SMALL SIGNAL GAIN (/13 DBM INPUT) VARIATIONS WITHIN THE BAND DO NOT EXCEED ± 2 DB. POWER GAIN (1.0 KW OUTPUT) IS WITHIN 6 DB OF SMALL SIGNAL GAIN.

A CONTROL GRID SUITABLE FOR GRID PULSING IS PROVIDED.

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3 (±5%)	VOLTS
HEATER CURRENT	5.2	AMPERES
MAXIMUM FREQUENCY (NOTE 1)	9600	MC
MINIMUM FREQUENCY (NOTE 1)	8000	MC
MINIMUM TRANSMISSION LOSS AT GRID BIAS = -200 VOLTS	60	DB
CAPACITANCE CONTROL GRID TO ALL OTHER ELEMENTS	13	UUFD

ELECTRICAL RATINGS, ABSOLUTE VALUES:

MAXIMUM ANODE VOLTAGE (NOTE 2)	12,000	VOLTS
MAXIMUM SHELL CURRENT	1.5	AMPERE PEAK
MAXIMUM COLLECTOR DISSIPATION (NOTE 3)	180	WATTS AVERAGE
MAXIMUM R-F INPUT POWER	10	WATTS AVERAGE
MAXIMUM R-F OUTPUT POWER	10	WATTS AVERAGE
MAXIMUM DUTY CYCLE	.005	
MAXIMUM PULSE WIDTH	10	U SECONDS
MAXIMUM CATHODE CURRENT	3.0	AMPERES PEAK
MAXIMUM GRID VOLTAGE		
NEGATIVE	-300	VOLTS
POSITIVE (NOTE 4)	/450	VOLTS
MAXIMUM GRID CURRENT	.27	AMPERES PEAK

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential	
Base	Molded Silicone Rubber Base with Flying Leads	
Type of Nevelope		Metal
Magnetic Field Strength	2400	Gauss
Length of Magnetic Field	6.75	Inches uniform
Mounting Position		Any
Weight of Tube	1 lb.	7 oz.
R-F Connections	Type N Jack	UG-23 B/U
Type of Cooling		Forced Air
Air Flow on Collector Radiator (Note 3)	300	cfm
Maximum Glass Temperature	160	°C

TYPICAL OPERATION AS POWER AMPLIFIER:

Center Frequency	9000	mc
Anode Voltage (Note 2)	9600	volts
Cathode Current	1.8	amperes peak
Power Output (at center frequency)	1.8	kw peak
Bandwidth	8.0 to 9.6	kmc
Gain (Note 5)	33	db Min.
Duty	.001	
Pulse Width	2.0	u seconds
Grid Bias (for cut-off)	-100	volts
Grid Voltage during Pulse (Note 6)	+350	volts
Grid Current during Pulse	0.1	ampere peak

Note 1: Useful gain and power output exists below 8000 mc and above 9600 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

Note 2: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The center conductor coax. terminals have an internal dc connection to shell. The shell is normally operated at ground potential and connection is made to the shell of the solenoid.

Note 3: Forced air cooling is required when average collector power is in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 150 watts, a minimum air flow of 30 cfm through the cooling fins is required.

NOTE 4: POSITIVE VOLTAGE MUST NOT BE APPLIED TO THE GRID IN THE ABSENCE OF ANODE VOLTAGE.

NOTE 5: THIS GAIN IS OBTAINED OVER THE 8.0 TO 9.6 KMC BANDWIDTH AT 1 KW POWER OUTPUT. SMALL SIGNAL GAIN IS WITHIN 6 DB OF THE POWER GAIN AT ANY PARTICULAR FREQUENCY.

NOTE 6: THE POSITIVE GRID VOLTAGE PULSE SHOULD BE THE MINIMUM CONSISTENT WITH NORMAL POWER OUTPUT.

SPECIAL NOTE:

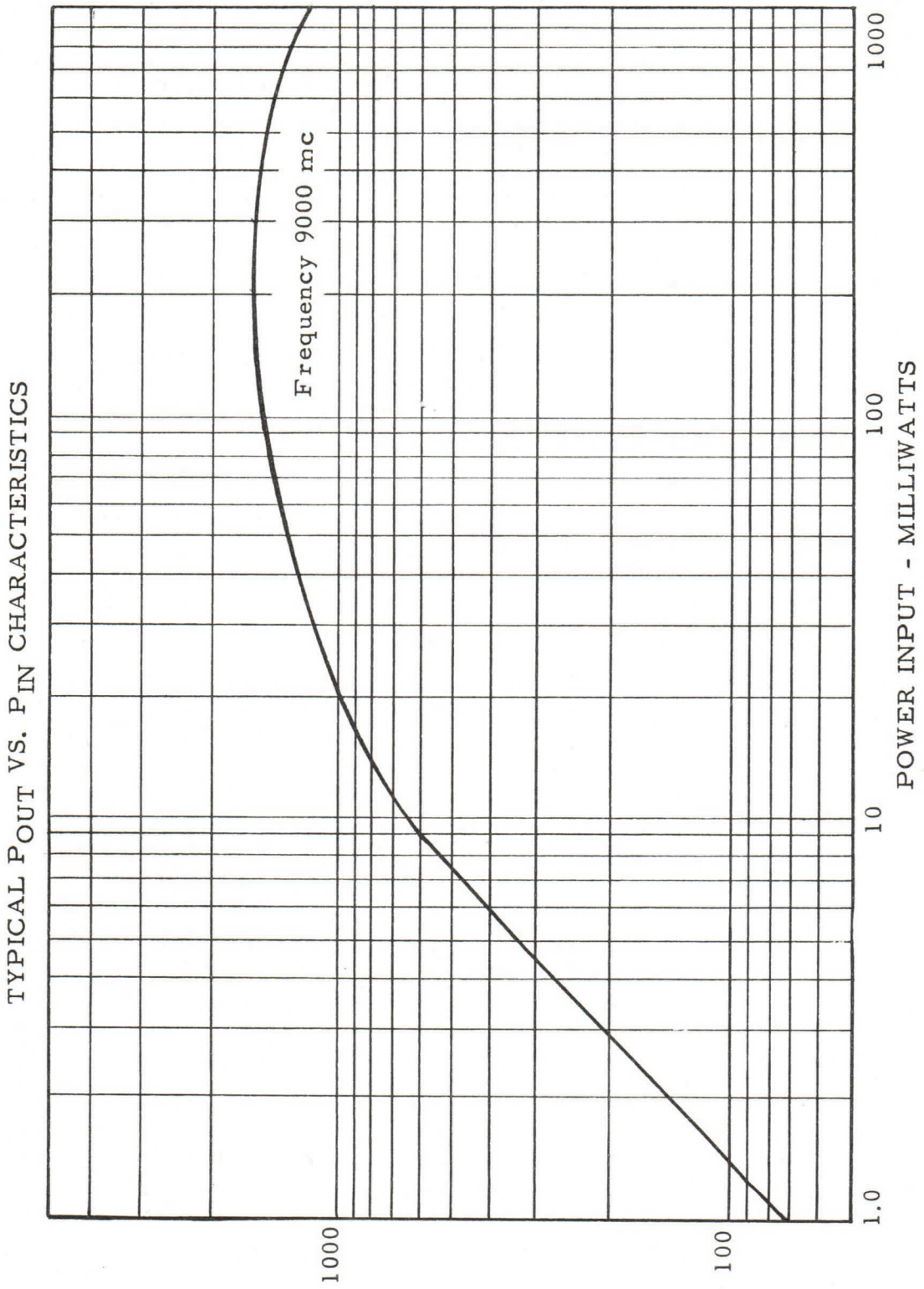
MISMATCH UP TO AND INCLUDING A SHORT CIRCUIT IN INPUT OR OUTPUT LINES WILL NOT CAUSE OSCILLATION.

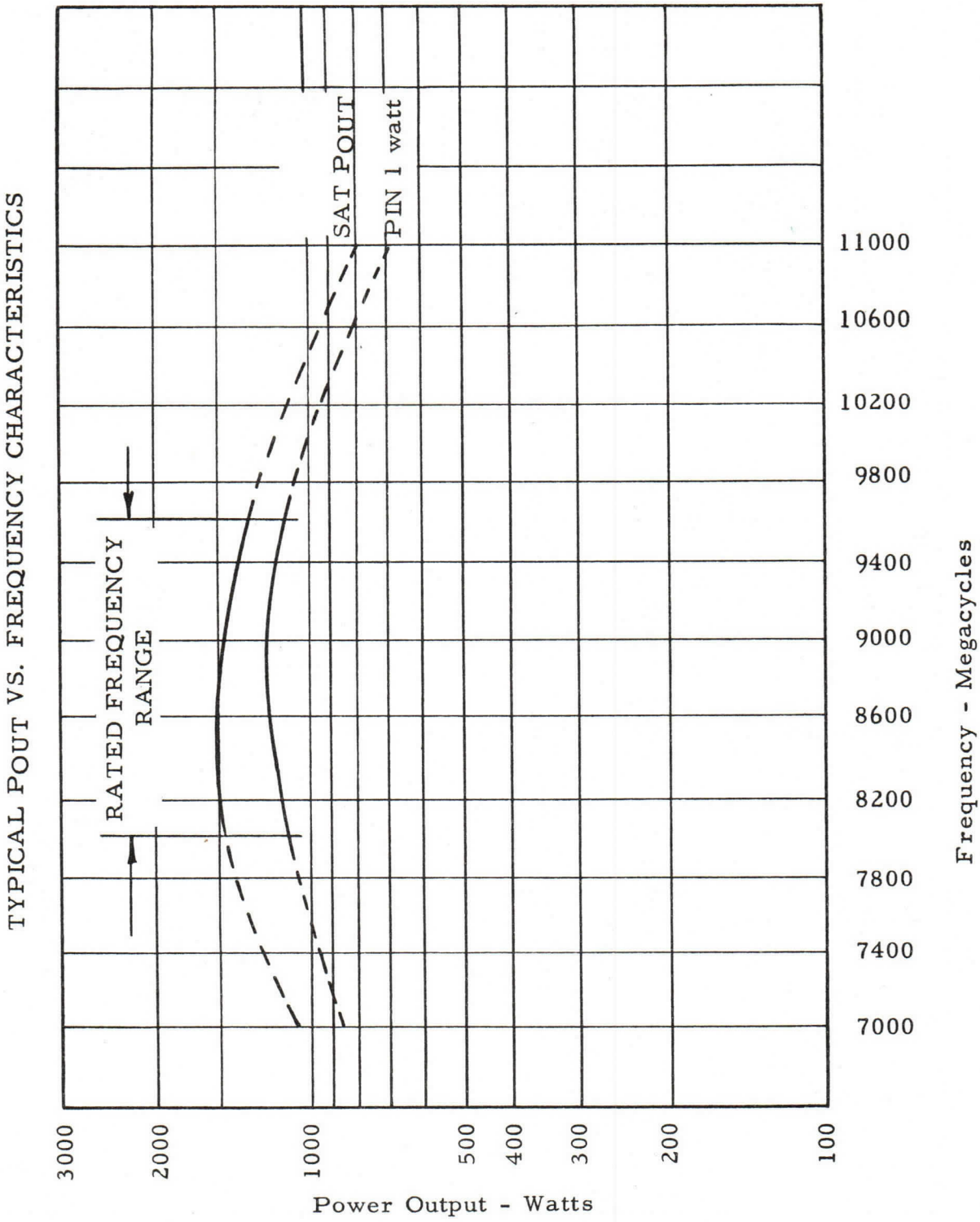
GENERAL OPERATING INSTRUCTIONS:

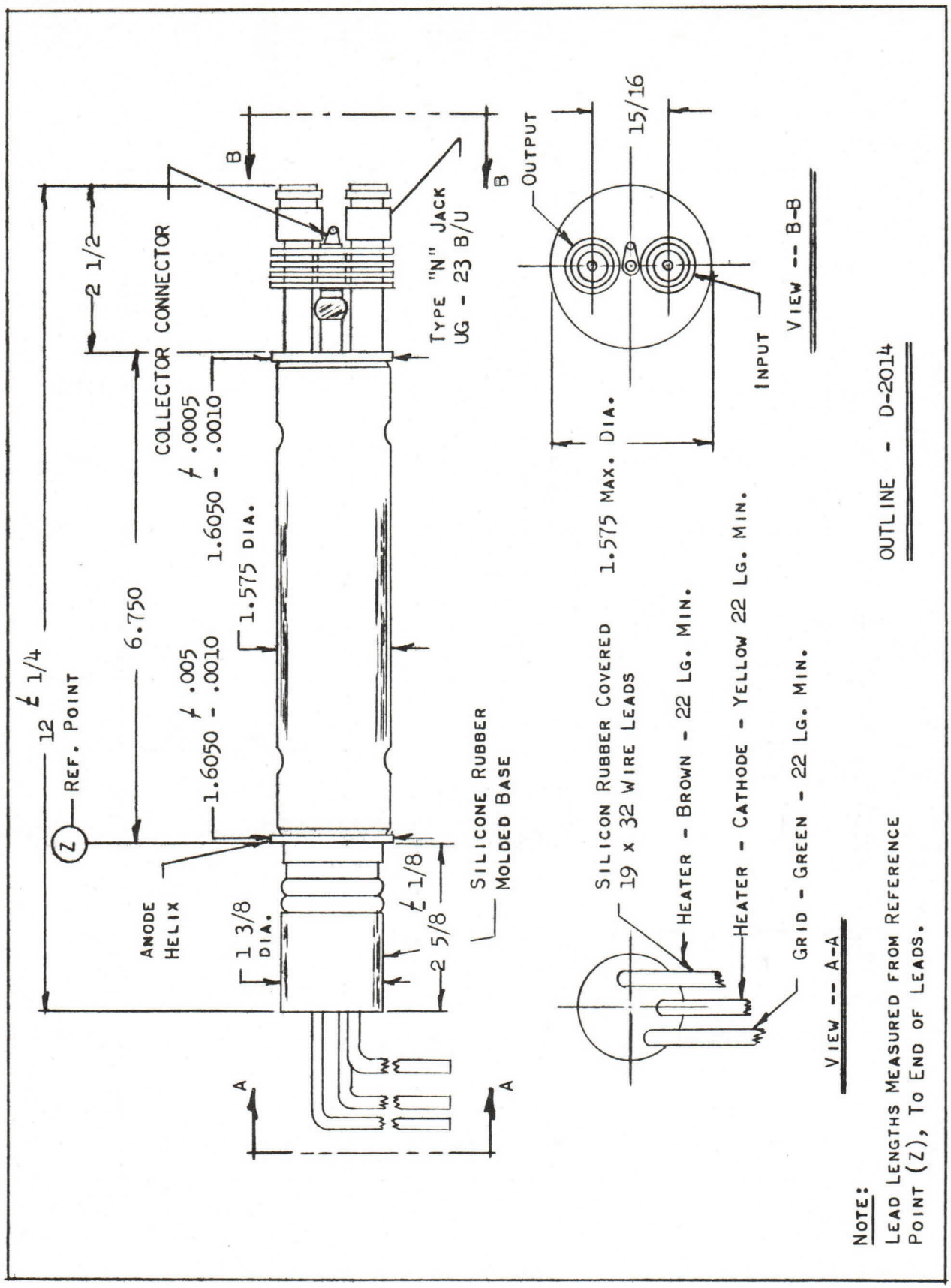
1. HEATER WARM UP OF 2 MINUTES BEFORE APPLYING HIGH VOLTAGE IS RECOMMENDED.
2. HIGH VOLTAGE MUST NOT BE APPLIED IN THE ABSENCE OF PROPER GRID BIAS AND MAGNETIC FIELD. POSITIVE GRID PULSE VOLTAGE MUST NOT BE APPLIED IN THE ABSENCE OF HIGH VOLTAGE.
3. INITIAL ADJUSTMENTS SHOULD BE DONE AT LOW DUTY CYCLE (LESS THAN .001) TO PREVENT TUBE DAMAGE DUE TO HIGH SHELL (INTERCEPTION) CURRENT.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE:

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 7065
ROANOKE, VIRGINIA


TYPICAL P_{OUT} VS. P_{IN} CHARACTERISTICS
Frequency 9000 mc
1000
100
1.0
10
100
1000
POWER INPUT - MILLIWATTS


TYPICAL POUT VS. FREQUENCY CHARACTERISTICS
SAT POUT
PIN 1 watt
RATED FREQUENCY RANGE
11000
10600
10200
9800
9400
9000
8600
8200
7800
7400
7000
Frequency - Megacycles
3000
2000
1000
500
400
300
200
100
Power Output - Watts


12 ± 1/4
REF. POINT
Z
6.750
2 1/2
COLLECTOR CONNECTOR
1.6050 - .0010 ± .005
1.6050 - .0010 ± .0005
1.575 DIA.
TYPE "N" JACK
UG - 23 B/U
B
B
ANODE HELIX
1 3/8 DIA.
2 5/8
1/8
SILICONE RUBBER MOLDED BASE
A
A
OUTPUT
15/16
1.575 MAX. DIA.
INPUT
VIEW -- B-B
SILICON RUBBER COVERED 19 x 32 WIRE LEADS
HEATER - BROWN - 22 LG. MIN.
HEATER - CATHODE - YELLOW 22 LG. MIN.
GRID - GREEN - 22 LG. MIN.
VIEW -- A-A
OUTLINE - D-2014
NOTE:
LEAD LENGTHS MEASURED FROM REFERENCE POINT (Z), TO END OF LEADS.

engineering TUBE DATA

D-2020
TRAVELING
WAVE TUBE

ITT Components Division

GENERAL DESCRIPTION:

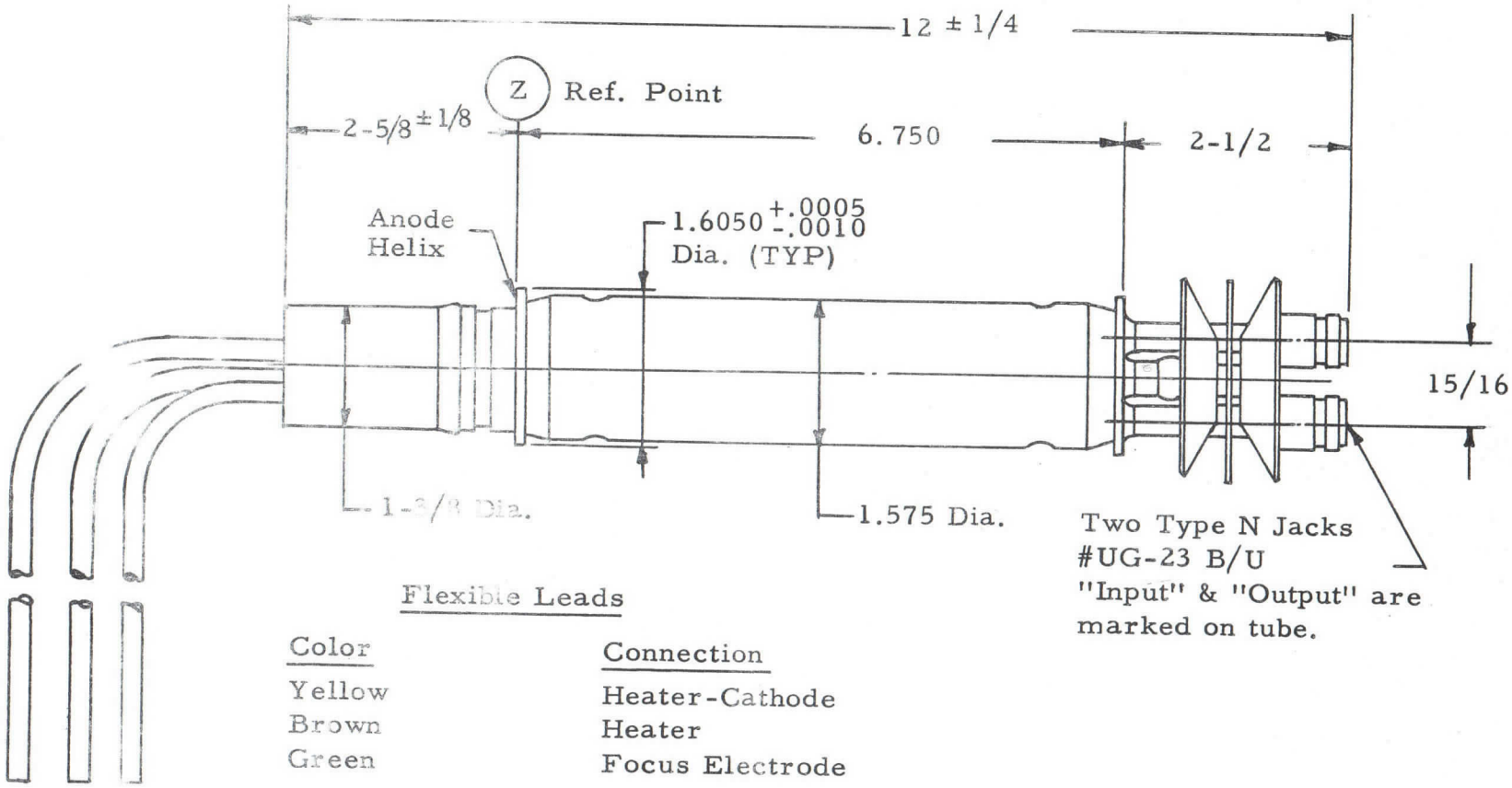
Type D-2020 is a mechanically modified version of type F-6996. Silicone rubber insulated flying leads attached to the tube with Silastic insulation are provided for altitude operation, in place of the Small Shell Duodecal 5 pin base. A modified radiator, which though requiring the same air flow, can be cooled with lower velocity air, is provided.

Capacitance of the control electrode to all other elements is increased to 16 μμfd by the base and lead configuration.

All other characteristics are the same as type F-6996 and additional information can be obtained by referring to the F-6996 data sheet.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P. O. Box 412
Clifton, New Jersey



Flexible Leads

Color	Connection
Yellow	Heater-Cathode
Brown	Heater
Green	Focus Electrode

Lead Length = 18 inches, min. measured from Ref. Point Z to end of lead.

TRAVELING WAVE TUBE TYPE D-2020

TENTATIVE

DESCRIPTION:

THE D-2023 IS A 1 KILOWATT PULSE TRAVELING WAVE TUBE HAVING 30 DB GAIN AND 4.0 TO 8.0 FREQUENCY RANGE. IT IS CONSTRUCTED IN A RUGGED METAL-CERAMIC ENVELOPE WITH A HELIX TYPE SLOW WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH FEMALE TYPE TNC CONNECTORS. THE TUBE IS SELF-ALIGNING IN AN EXTERNAL SOLENOID, WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE IMPREGNATED CATHODE ARE USED. DUTY CYCLES UP TO .01 CAN BE USED.

A CONTROL GRID FOR GRID PULSING IS PROVIDED.

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3 (±5%)	VOLTS
HEATER CURRENT	5.0	AMPS
MAXIMUM FREQUENCY	8.0	
MINIMUM FREQUENCY	4.0	
MINIMUM TRANSMISSION LOSS AT GRID BIAS = .60 VOLTS	40	DB
CAPACITANCE		
CONTROL GRID TO ALL OTHER ELEMENTS	22	UUFD

ELECTRICAL RATINGS, ABSOLUTE VALUES:

MAXIMUM ANODE VOLTAGE (NOTE 1)	10,000	VOLTS
MAXIMUM HELIX CURRENT	0.35	AMPS
MAXIMUM COLLECTOR DISSIPATION	240	WATTS
MAXIMUM R.F. INPUT POWER	5	WATTS
MAXIMUM DUTY CYCLE	.01	
MAXIMUM GRID VOLTAGE		
NEGATIVE	-200	VOLTS
POSITIVE	±400	VOLTS PEAK
MAXIMUM GRID CURRENT	0.3	AMPS PEAK

MECHANICAL INFORMATION:

Type of Cathode		Oxide Impregnated
Gun Connections		Flying Leads
R-F Connections		Female TNC
Magnetic Field Strength	2000	Gauss
Mounting Position		Any
Type of Cooling (Note 2)		

TYPICAL OPERATION: (Note 3)

Center Frequency	5.5	KMC
Anode Voltage	8800	Volts
Cathode Current	2.5	Amps peak
Power Output (at center frequency) (Note 4)	1.5	KW peak
Band Width (Note 4)	4 to 8	KMC
Gain (Note 4)	30	db
Duty	Variable to 0.01	max.
Pulse Width	2	usec.
Grid Bias (for cutoff)	-60	Volts
Grid Voltage during Pulse	200	Volts peak
Grid Current during Pulse	0.2	Amps peak

Note 1: All voltages shown are with respect to cathode. Anode, collector and outer coax conductor of the R-F terminals are connected internally to the shell. The helix is connected to the center conductor of the coax line and a DC connection from the helix to the shell must be provided externally in the R-F circuitry.

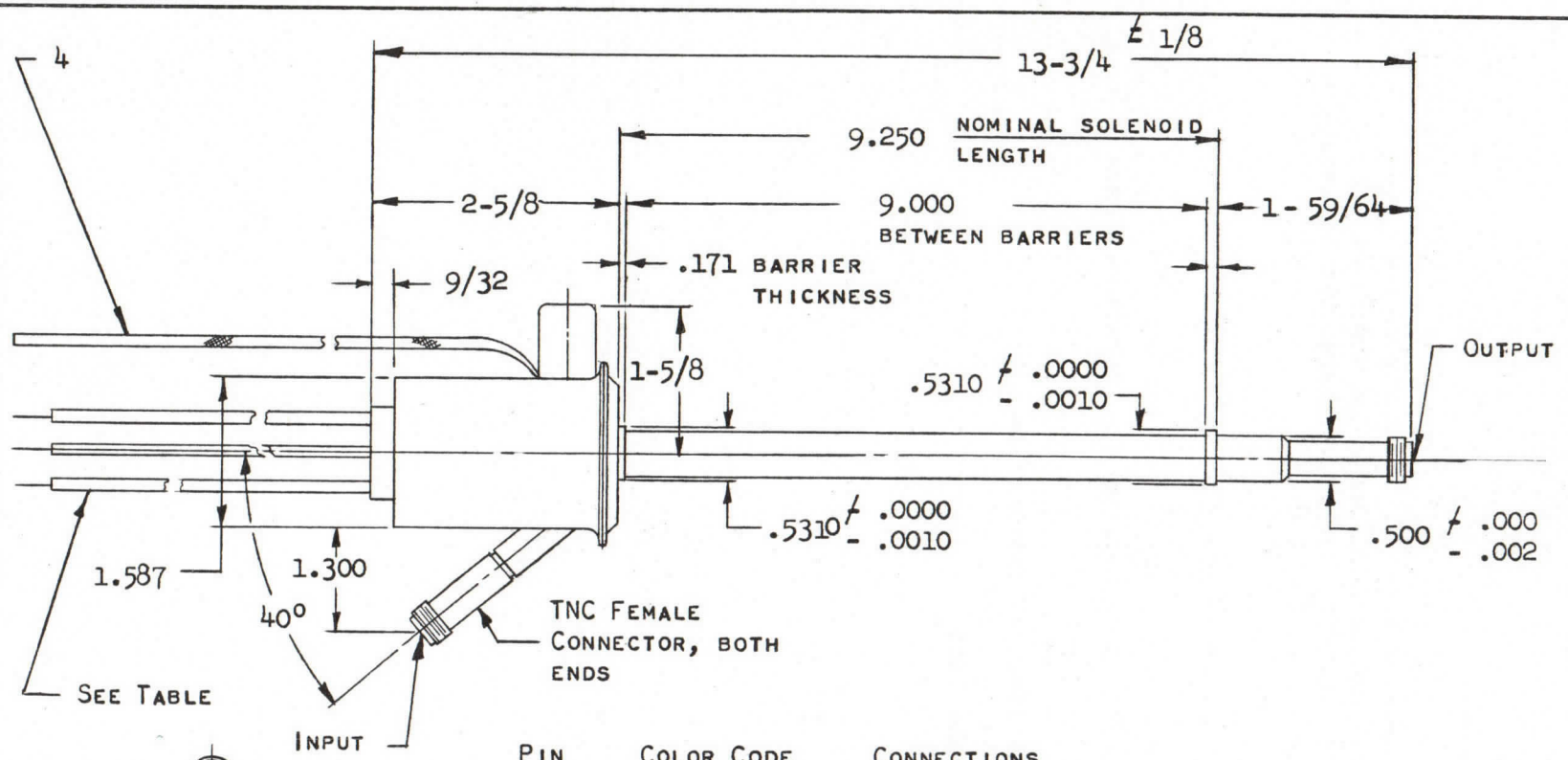
Note 2: A maximum of 240 watts is dissipated at the collector. A suitable heat sink must be provided to conduct heat from the collector and maintain its surface temperature below 180°C maximum. Cooling of the external solenoid must be provided such that the tube which is inserted into it will not exceed 180°C.

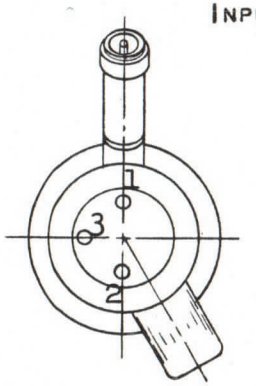
Note 3: The values of voltages to be used are provided in test data supplied with each tube. High voltage must not be applied in the absence of proper grid bias voltage. Positive grid pulse voltage must not be supplied in the absence of high voltage. Grid pulse voltage in excess of that indicated for each tube should not be used since beam defocussing will occur. Provisions must be made not to exceed maximum ratings, especially helix current and duty cycle. Initial adjustments are conveniently done at low duty cycle (less than .001) where misadjustment of parameters is much less likely to cause tube damage.

NOTE 4: POWER OUTPUT OF 1 KW PEAK OR MORE IS OBTAINED OVER THE FREQUENCY RANGE 4.0 TO 7.5 KMC, AND 800 WATTS OR MORE OVER THE FREQUENCY RANGE 7.5 TO 8.0 KMC. POWER INPUT REQUIRED TO OBTAIN THIS POWER OUTPUT DOES NOT EXCEED 1 WATT.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE:

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 7065
ROANOKE, VIRGINIA





PIN	COLOR CODE	CONNECTIONS
1	BROWN	HEATER
2	YELLOW	HEATER CATHODE
3	GREEN	GRID
4	BRAID	ANODE, COLLECTOR & CAPSULE

FLEXIBLE LEADS 24" MIN. LENGTH

NOTE: INPUT CONNECTOR ROTATED FOR CLARITY

OUTLINE - D-2023 TRAVELING WAVE TUBE

engineering TUBE DATA

D-2024
TRAVELING
WAVE TUBE

FORMERLY F-6996-A

ITT *Components Division*

GENERAL DESCRIPTION:

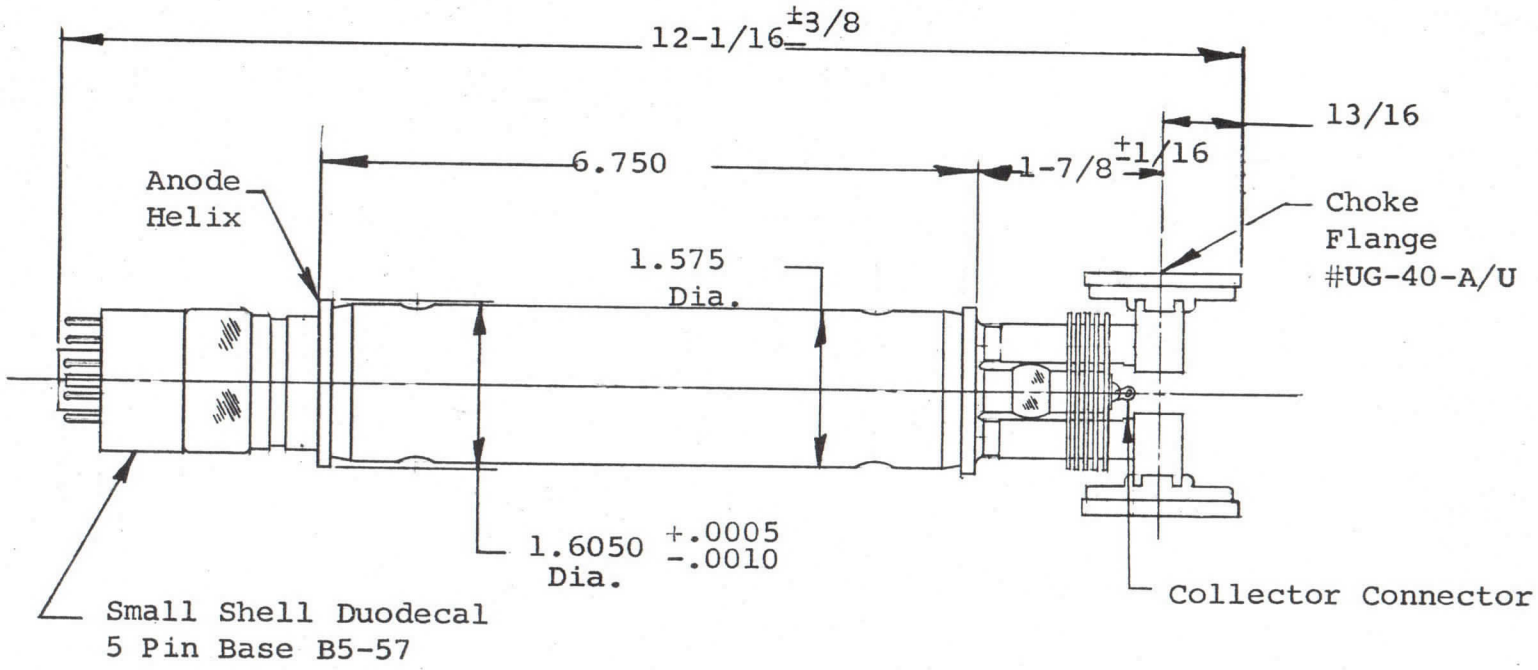
TYPE D-2024 IS A MECHANICALLY MODIFIED VERSION OF TYPE F-6996. AN INTEGRAL MATCHING CIRCUIT IS PROVIDED AND THE RF TERMINALS CONSIST OF UG-40-AU CHOKE FLANGE WAVE GUIDE CONNECTORS.

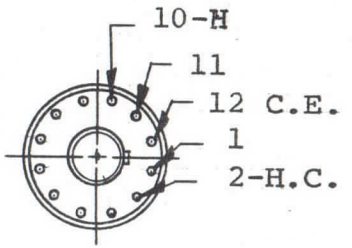
ALL OTHER CHARACTERISTICS ARE THE SAME AS TYPE F-6996 AND ADDITIONAL INFORMATION CAN BE OBTAINED BY REFERRING TO THE F-6996 DATA SHEET.

THE OUTLINE OF THE D-2024 IS ATTACHED.

ITT ELECTRON TUBE DEPARTMENT
COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

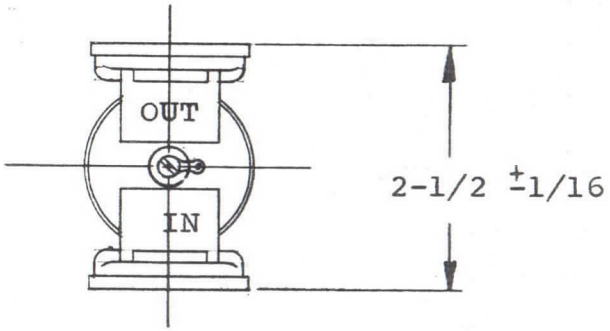
10-60





BASING

PIN	CONNECTION
1	No Conn.
2	Heater-Cathode
10	Heater
11	No Conn.
12	Control Electrode



TRAVELING WAVE TUBE TYPE D-2024

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2057 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION:

The F-2057 is a 1000 watt pulse traveling wave amplifier tube having 30db gain and designed primarily for use in the 2000 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with UG 19 B/U Type connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 100 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum R-F Input Power	2	watts average
Heater Current	3.0	amperes	Maximum R-F Output Power	30	watts average
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Duty Cycle	.01	
Maximum Shell Current	0.8	ampere peak	Maximum Pulse Width (beam)	100	microseconds
Maximum Collector Voltage	8000	volts	Maximum Cathode Current	2.0	ampere peak
Maximum Collector Dissipation	160	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	4000	mc	Minimum Cold Transmission Loss	50	db
Minimum Frequency (Note 2)	2000	mc			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight	10 pounds	maximum
Base	JETEC Designation B12-43	R-F Connections	UG-19 B/U	
Type of Envelope	Metal	Cooling Data	2 cfm of air	
Mounting Position	Any			

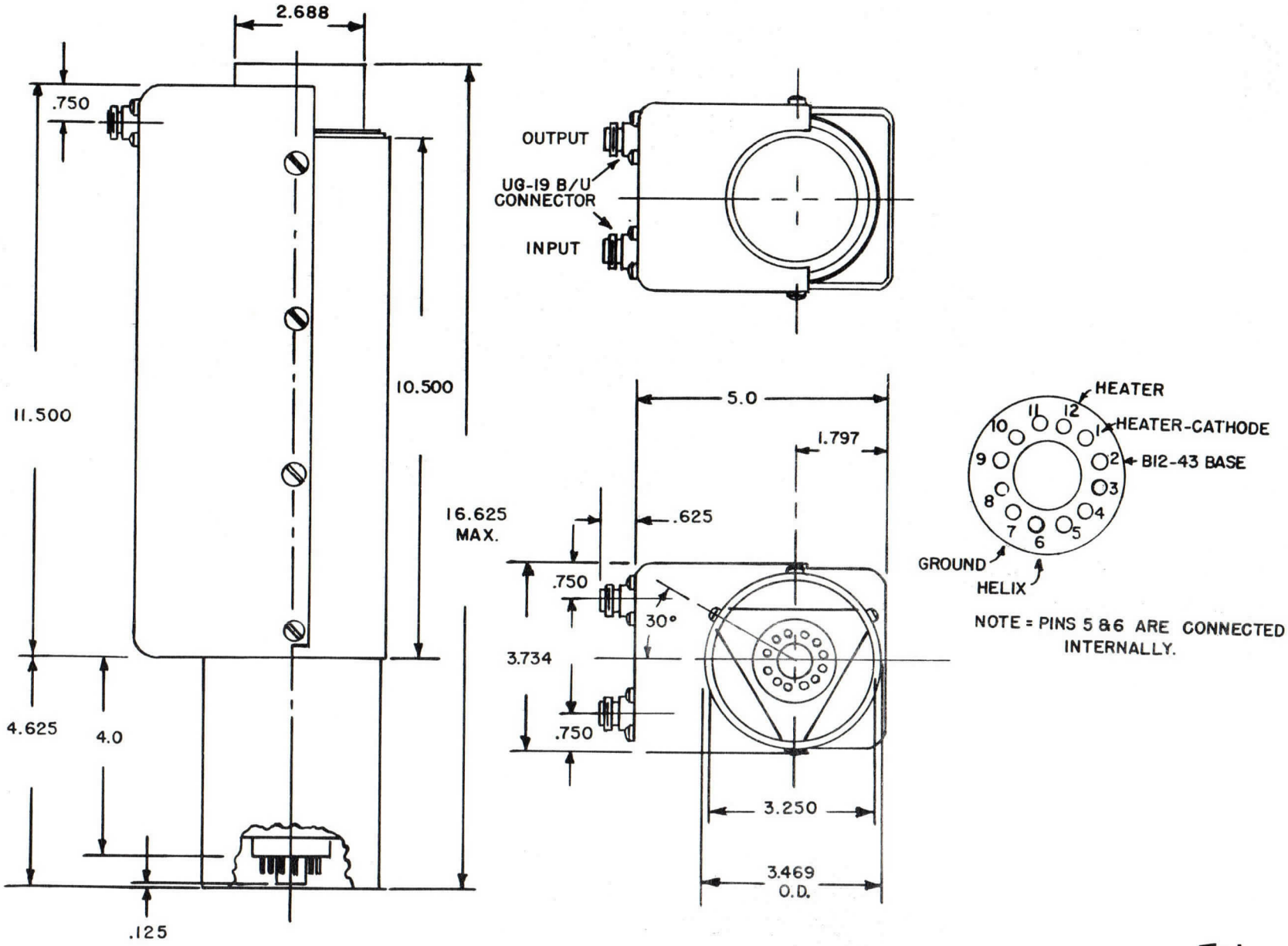
TYPICAL OPERATION AS POWER AMPLIFIER

Frequency	2000 to 4000	mc	Power Output (Minimum)	1000	watts peak
Anode Voltage (Note 1)	7300	volts	Gain	30	db
Cathode Current	1.4	amperes peak	Duty	.01	
Collector Voltage (tied to shell)	7300	volts	Pulse Width	5	microseconds
Collector Current	0.9	amperes peak			

NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

NOTE 3: Heater warmup of two minutes before applying high voltage is recommended.



F-2057
TRAVELING
WAVE TUBE

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2058 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION

The F-2058 is a 1000 watt pulse traveling wave amplifier tube having 30 db gain and designed primarily for use in the 2900 to 3100 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 100 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum R-F Input Power	2	watts average
Heater Current	3.0	amperes	Maximum R-F Output Power	30	watts average
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Duty Cycle	.01	
Maximum Shell Current	0.8	ampere peak	Maximum Pulse Width (beam)	100	microseconds
Maximum Collector Voltage	8000	volts	Maximum Cathode Current	2.0	ampere peak
Maximum Collector Dissipation	160	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	3100	mc	Minimum Cold Transmission Loss	50	db
Minimum Frequency (Note 2)	2900	mc			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight	10 Pounds	Maximum
Base	(See Outline)	R-F Connections	Type "TNC"	
Type of Envelope	Metal	Cooling Data	25 cfm of air	
Mounting Position	Any			

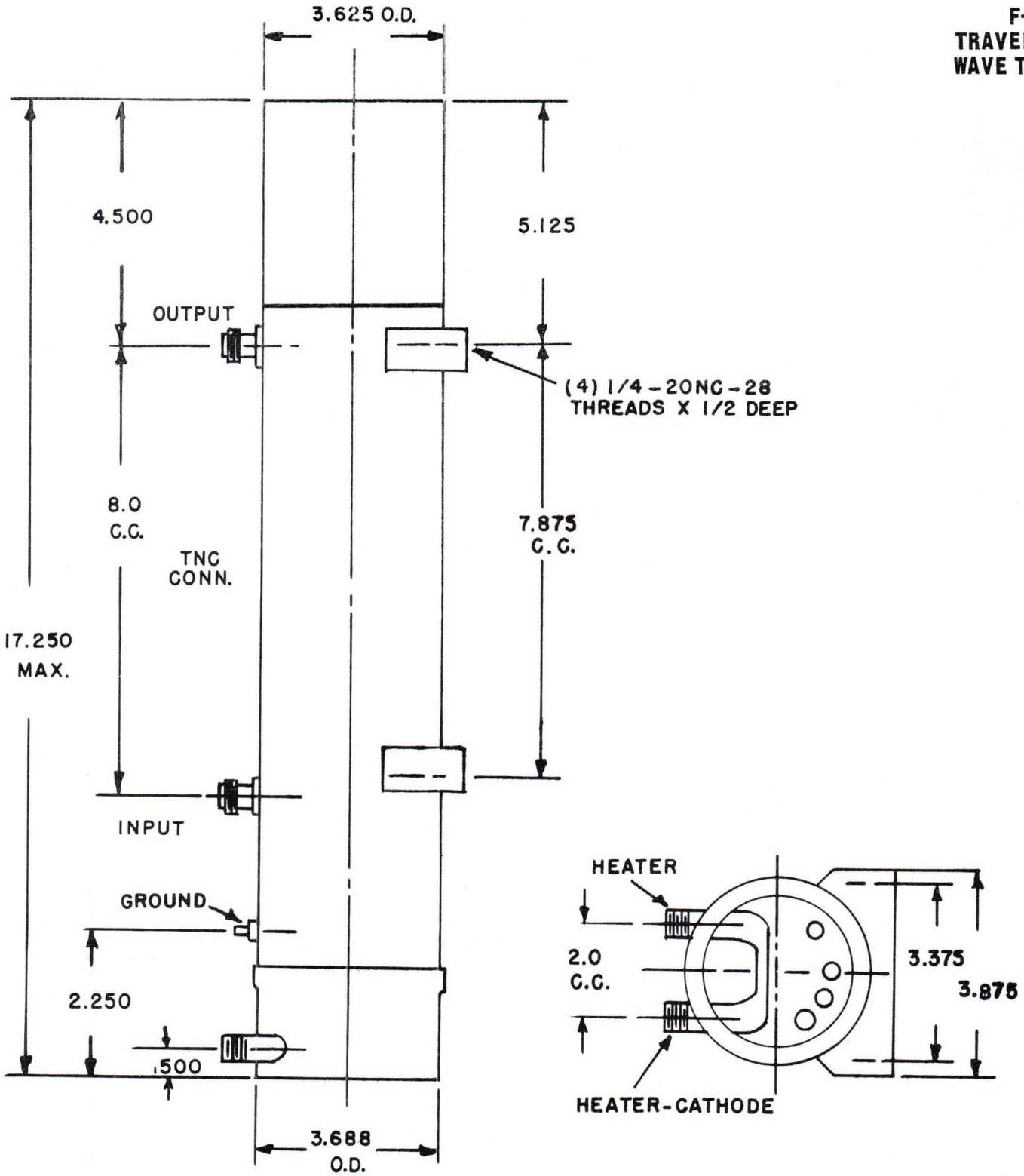
TYPICAL OPERATION AS POWER AMPLIFIER

Frequency	2900 to 3100	mc	Power Output (minimum)	1000	watts peak
Anode Voltage (Note 1)	7300	volts	Gain	30	db
Cathode Current	1.4	amperes peak	Duty	.01	
Collector Voltage (tied to shell)	7300	volts	Pulse Width	5	microseconds
Collector Current	0.9	amperes peak			

NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2900 mc and above 3100 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.


3.625 O.D.
4.500
5.125
OUTPUT
(4) 1/4-20NC-28
THREADS X 1/2 DEEP
8.0
C.C.
TNC
CONN.
7.875
C.C.
17.250
MAX.
INPUT
GROUND
2.250
.500
3.688
O.D.
HEATER
2.0
C.C.
3.375
3.875
HEATER-CATHODE

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2059 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION

The F-2059 is a 100 watt pulse traveling wave amplifier tube having 46 db gain and designed primarily for use in the 2700 to 2900 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 10 microseconds can be used. A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum Duty Cycle	.01	
Heater Current	3.0	amperes	Maximum Pulse Width (beam)	10	microseconds
Maximum Anode Voltage (Note 1)	5000	volts	Maximum Cathode Current	1.0	ampere peak
Maximum Shell Current	0.5	ampere peak	Maximum Grid Voltage		
Maximum Collector Voltage	5000	volts	Negative	−100	volts
Maximum Collector Dissipation	20	watts average	Positive (with respect to cathode)	200	volts
Maximum R-F Output Power	5	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	2900	mc	Capacitance		
Minimum Frequency (Note 2)	2700	mc	Control Grid to All Other Elements	20	uufd
Minimum Cold Transmission Loss	50	db			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight	10 Pounds Maximum
Base	(See Outline)	R-F Connections	Type "TNC"
Type of Envelope	Metal	Type of Cooling	Convection
Mounting Position	Any		

TYPICAL OPERATION AS POWER AMPLIFIER

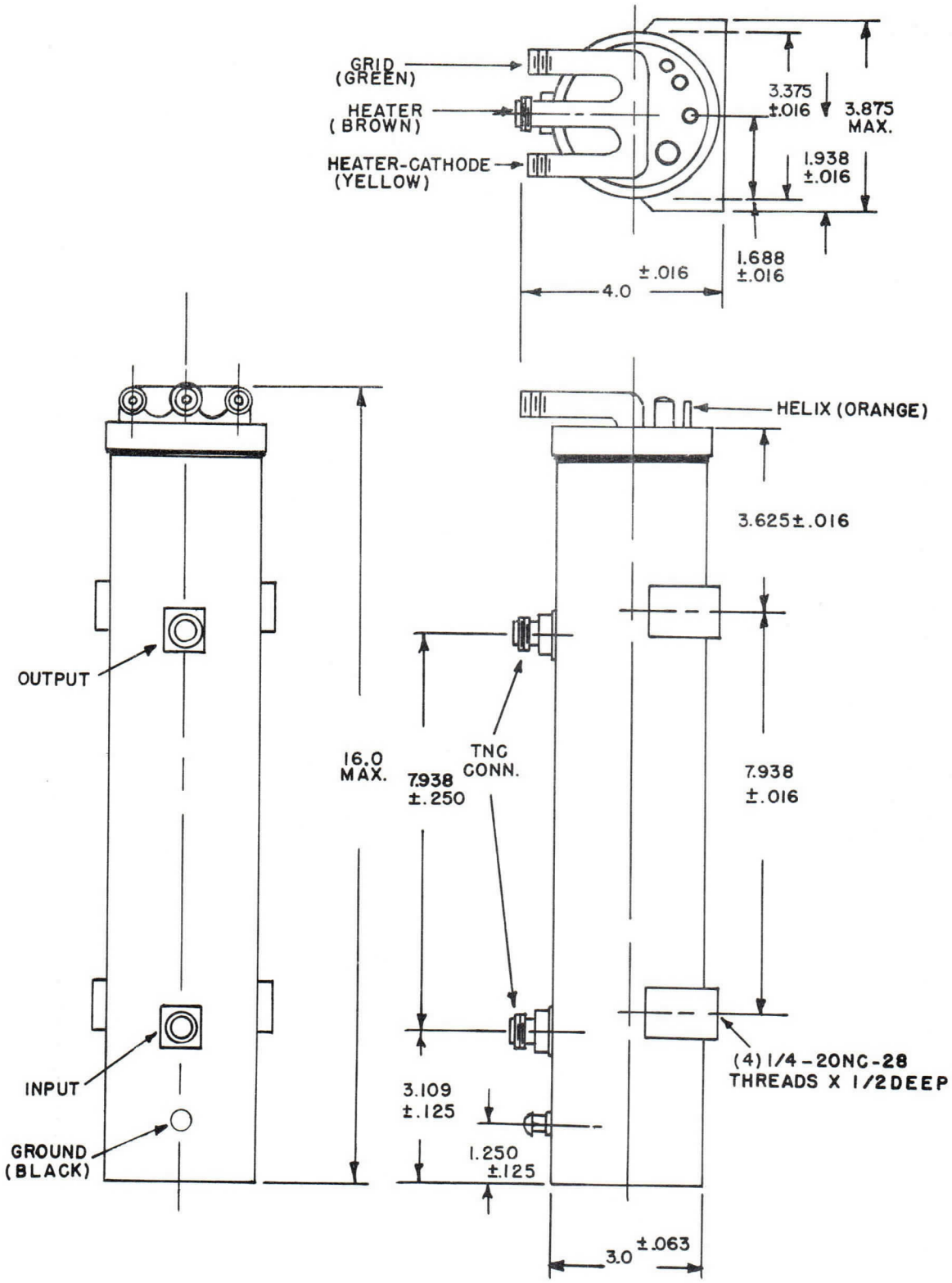
Frequency	2700 to 2900	mc	Gain	46	db
Anode Voltage (Note 1)	4400	volts	Duty	.01	
Cathode Current	0.5	amperes peak	Pulse Width	5	microseconds
Collector Voltage (tied to shell	4400	volts	Grid Bias (for cut-off)	−30	volts
Collector Current	0.3	amperes peak	Grid Voltage during Pulse	175	volts
Power Output (minimum)	100	watts peak			

NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2700 mc and above 2900 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.

NOTE 4: High voltage must be applied in the absence of proper grid bias.


GRID
(GREEN)
HEATER
(BROWN)
HEATER-CATHODE
(YELLOW)
3.375
±.016
3.875
MAX.
1.938
±.016
1.688
±.016
±.016
4.0
HELIX (ORANGE)
3.625±.016
OUTPUT
16.0
MAX.
7.938
±.250
TNC
CONN.
7.938
±.016
INPUT
GROUND
(BLACK)
3.109
±.125
1.250
±.125
(4) 1/4-20NC-28
THREADS X 1/2DEEP
3.0
±.063

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2060 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION:

The F-2060 is a 1500 watt pulse traveling wave amplifier tube having 32 db gain and designed primarily for use in the 3350 to 3650 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 100 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum R-F Input Power	2	watts average
Heater Current	3.0	amperes	Maximum R-F Output Power	30	watts average
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Duty Cycle	.01	
Maximum Helix Current	0.8	ampere peak	Maximum Pulse Width (beam)	100	microseconds
Maximum Collector Voltage	8000	volts	Maximum Cathode Current	2.0	ampere peak
Maximum Collector Dissipation	160	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	3650	mc	Minimum Cold Transmission Loss	50	db
Minimum Frequency (Note 2)	3350	mc			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight (not including magnet)	10 pounds Maximum
Base	(See Outline Drawing)	R-F Connections	"TNC"
Type of Envelope	Metal	Cooling Data	25 cfm of air
Mounting Position	Any		

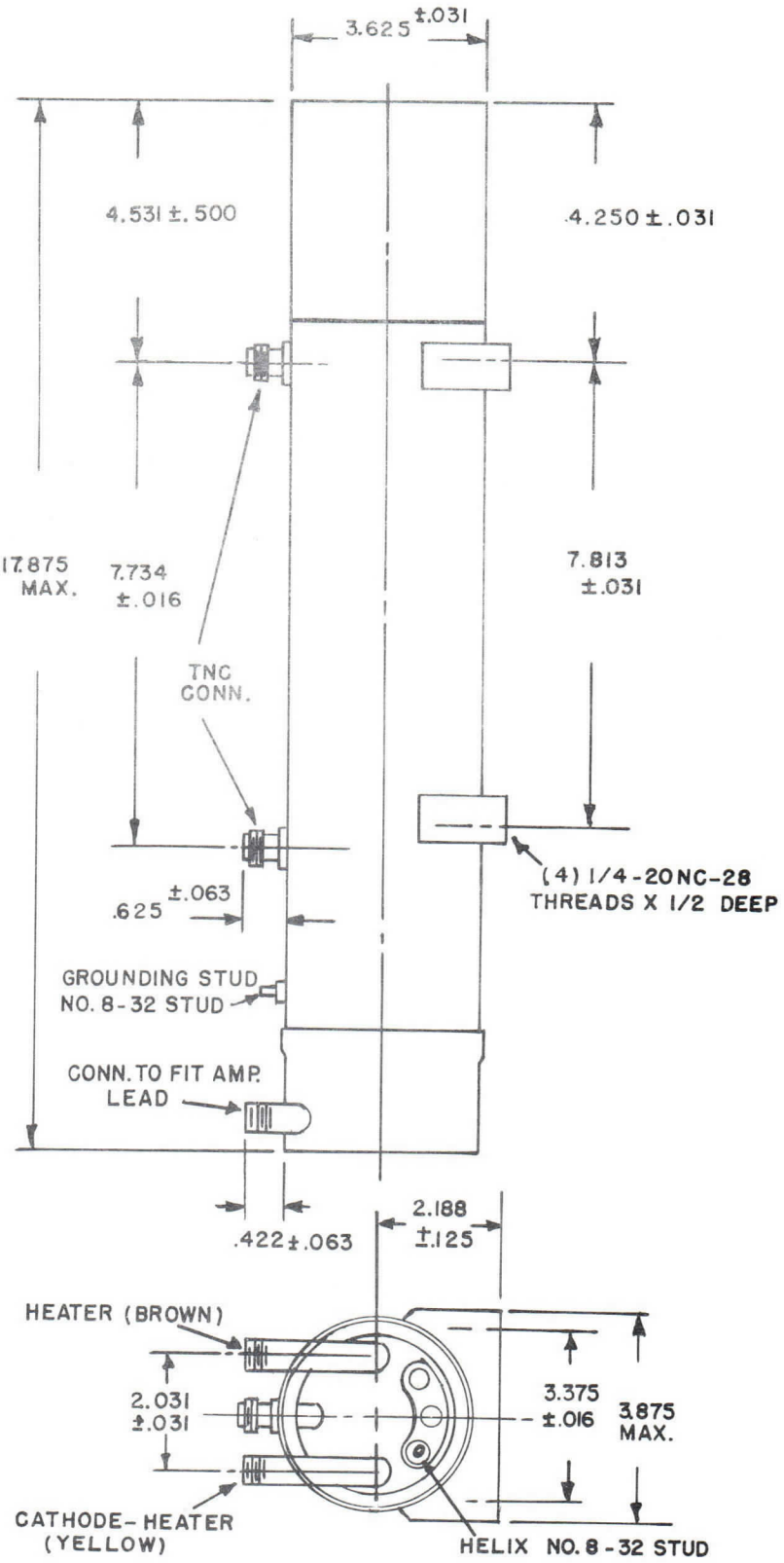
TYPICAL OPERATION AS POWER AMPLIFIER

Frequency	3350 to 3650	mc	Gain	32	db
Anode Voltage (Note 1)	7200	volts	Duty	.01	
Cathode Current	1.4	amperes peak	Pulse Width	5	microseconds
Collector Voltage (tied to shell)	7200	volts	Small Signal Gain Variation	3	db
Collector Current	0.9	amperes peak	Saturated Power Variation	3	db
Power Output (Minimum)	1500	watts peak			

NOTE 1: All Voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 3350 mc and above 3650 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth may be lower than rated values.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.


3.625 ±.031
4.531 ±.500
4.250 ±.031
17.875
MAX.
7.734
±.016
7.813
±.031
TNC
CONN.
(4) 1/4-20NC-28
THREADS X 1/2 DEEP
.625 ±.063
GROUNDING STUD
NO. 8-32 STUD
CONN. TO FIT AMP.
LEAD
.422±.063
2.188
±.125
HEATER (BROWN)
2.031
±.031
3.375
±.016
3.875
MAX.
CATHODE-HEATER
(YELLOW)
HELIX NO. 8-32 STUD

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2061 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION:

The F-2061 is a 1000 watt pulse traveling wave amplifier tube having 30 db gain and designed primarily for use in the 2900 to 3100 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .02 and pulse widths up to 50 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum R-F Input Power	2	watts average
Heater Current	3.0	amperes	Maximum R-F Output Power	40	watts average
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Duty Cycle	.02	
Maximum Shell Current	0.8	ampere peak	Maximum Pulse Width (beam)	50	microseconds
Maximum Collector Voltage	8000	volts	Maximum Cathode Current	2.0	ampere peak
Maximum Collector Dissipation	200	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	3100	mc	Minimum Cold Transmission Loss	50	db
Minimum Frequency (Note 2)	2900	mc			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential		Weight	10 pounds	Maximum
Base	(See Outline)		R-F Connections	Type "TNC"	
Type of Envelope		Metal	Cooling Data	25 cfm of air	
Mounting Position		Any			

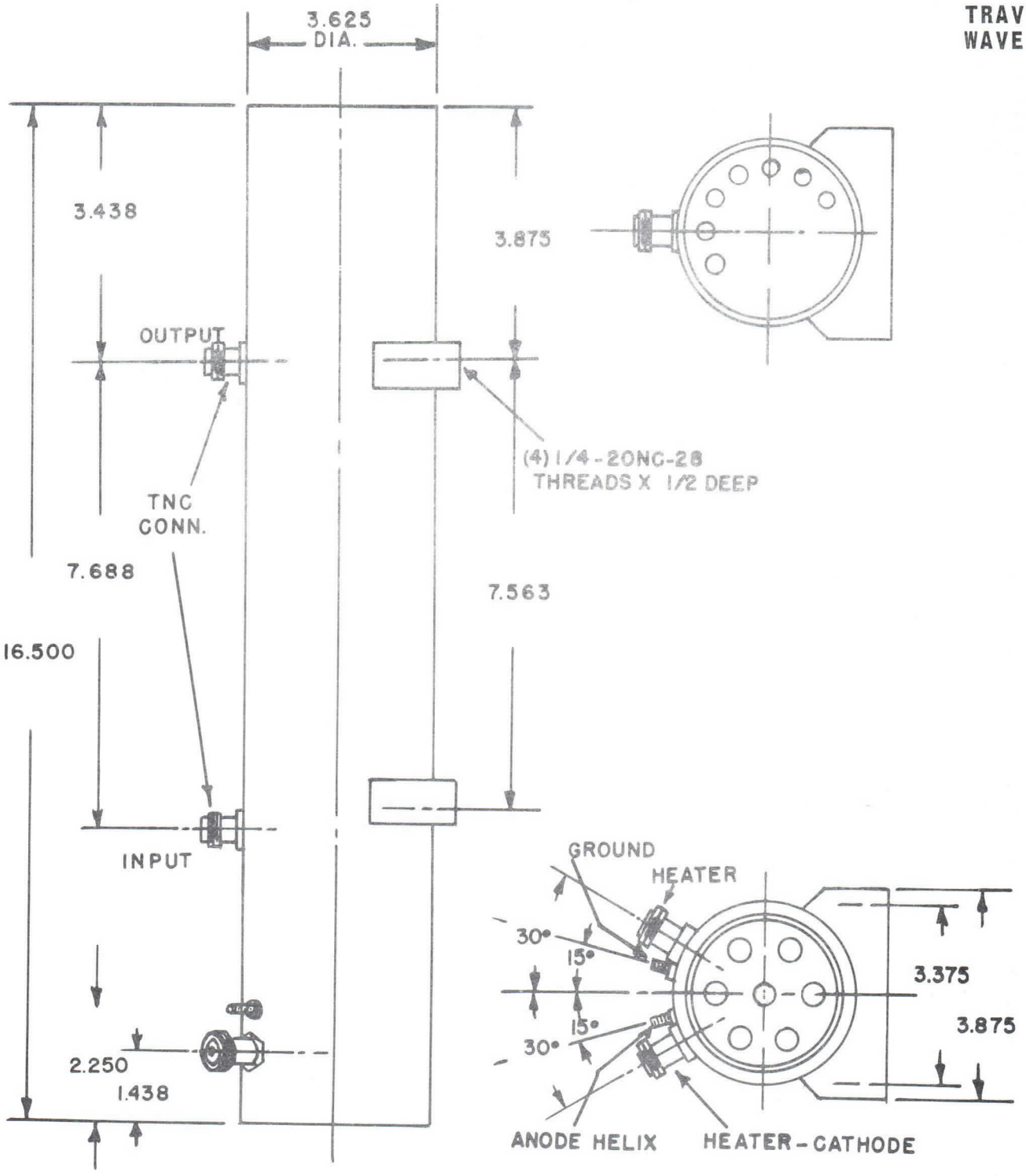
TYPICAL OPERATION AS POWER AMPLIFIER

Frequency	2900 to 3100	mc	Power Output (minimum)	1000	watts peak
Anode Voltage (Note 1)	7300	volts	Gain	30	db
Cathode Current	1.4	amperes peak	Duty	.02	
Collector Voltage (tied to shell)	7300	volts	Pulse Width	5	microseconds
Collector Current	0.9	amperes peak			

NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2900 mc and above 3100 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.


3.625
DIA.
3.438
3.875
OUTPUT
(4) 1/4-20NC-2B
THREADS X 1/2 DEEP
TNC
CONN.
7.688
7.563
16.500
INPUT
2.250
1.438
GROUND
HEATER
30°
15°
15°
30°
3.375
3.875
ANODE HELIX
HEATER-CATHODE

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2062 TRAVELING WAVE TUBE

T E N T A T I V E

GENERAL DESCRIPTION:

The F-2062 is a 1000 watt pulse traveling wave amplifier tube having 30 db gain and designed primarily for use in the 2000 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 10 microseconds can be used. A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum R-F Output Power	30	watts average
Heater Current	3.0	amperes	Maximum Duty Cycle	.01	
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Pulse Width (beam)	10	microseconds
Maximum Helix Current	0.8	ampere peak	Maximum Cathode Current	2.0	ampere peak
Maximum Collector Voltage	8000	volts	Maximum Grid Voltage		
Maximum Collector Dissipation	120	watts average	Negative	-100	volts
			Positive (with respect to cathode)	200	volts

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	4000	mc	Capacitance		
Minimum Frequency (Note 2)	2000	mc	Control Grid to All Other Elements	20	uufd
Minimum Cold Transmission Loss	50	db			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential		Weight	10 pounds	Maximum
Base	(See Outline)		R-F Connections	Type "TNC"	
Type of Envelope		Metal	Cooling Data	25 cfm of air	
Mounting Position		Any			

TYPICAL OPERATION AS POWER AMPLIFIER

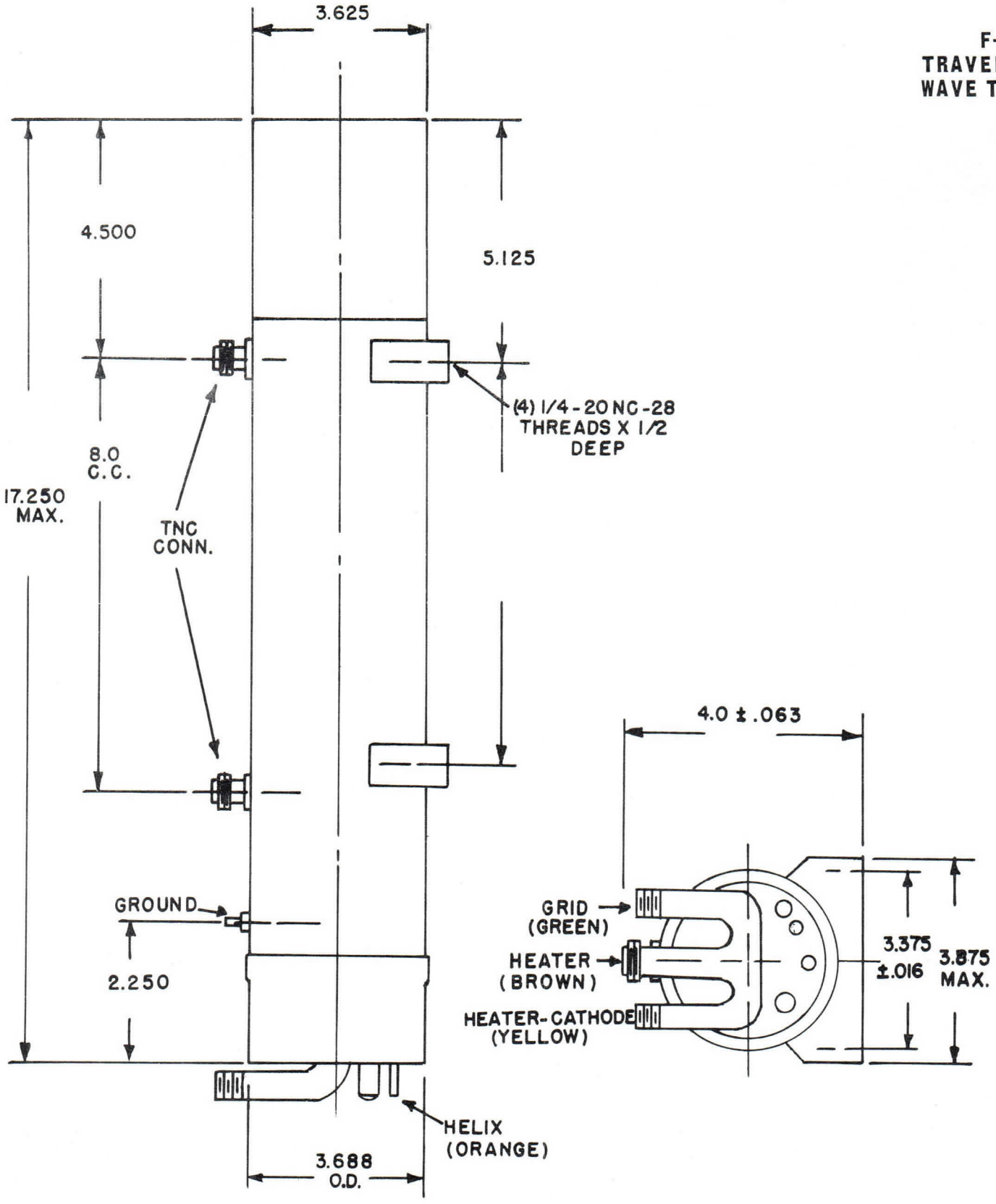
Frequency	2000 to 4000	mc	Power Output (minimum)	1000	watts peak
Anode Voltage (Note 1)	7500	volts	Gain	30	db
Cathode Current	1.5	amperes peak	Duty	.01	
Collector Voltage (tied to shell)	7500	volts	Pulse Width	5	microseconds
Collector Current	1.0	amperes peak	Grid Bias (for cut-off)	-30	volts
			Grid Voltage during Pulse	175	volts

NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.

NOTE 4: High voltage must not be applied in the absence of proper grid bias.


3.625
4.500
5.125
(4) 1/4-20 NC-28
THREADS X 1/2
DEEP
8.0
C.C.
17.250
MAX.
TNC
CONN.
GROUND
2.250
HELIX
(ORANGE)
3.688
O.D.
4.0 ± .063
GRID
(GREEN)
HEATER
(BROWN)
HEATER-CATHODE
(YELLOW)
3.375
±.016
3.875
MAX.

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CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2063 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION:

The F-2063 is a 1000 watt pulse traveling wave amplifier tube having 33 db gain and designed primarily for use in the 2500 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 10 microseconds can be used. A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum Duty Cycle	.01	
Heater Current	3.0	amperes	Maximum Pulse Width (beam)	10	microseconds
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Cathode Current	20	ampere peak
Maximum Helix Current	0.8	ampere peak	Maximum Grid Voltage		
Maximum Collector Voltage	8000	volts	Negative	-100	volts
Maximum Collector Dissipation	120	watts average	Positive (with respect to cathode)	200	volts
Maximum R-F Output Power	30	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	4000	mc	Capacitance		
Minimum Frequency (Note 2)	2500	mc	Control Grid to All Other Elements	20	uufd
Minimum Cold Transmission Loss	50	db			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight	10 pounds	Maximum
Base	(See Outline)	R-F Connections	Type "TNC"	
Type of Envelope	Metal	Cooling Data	25 cfm of air	
Mounting Position	Any			

TYPICAL OPERATION AS POWER AMPLIFIER

Frequency	2500 to 4000	mc	Power Output (minimum)	1000	watts peak
Anode Voltage (Note 1)	7500	volts	Gain	33	db
Cathode Current	1.5	amperes peak	Duty	.01	
Collector Voltage (tied to shell)	7500	volts	Pulse Width	5	microseconds
Collector Current	1.0	amperes peak	Grid Bias (for cut-off)	-30	volts
			Grid Voltage during Pulse	175	volts

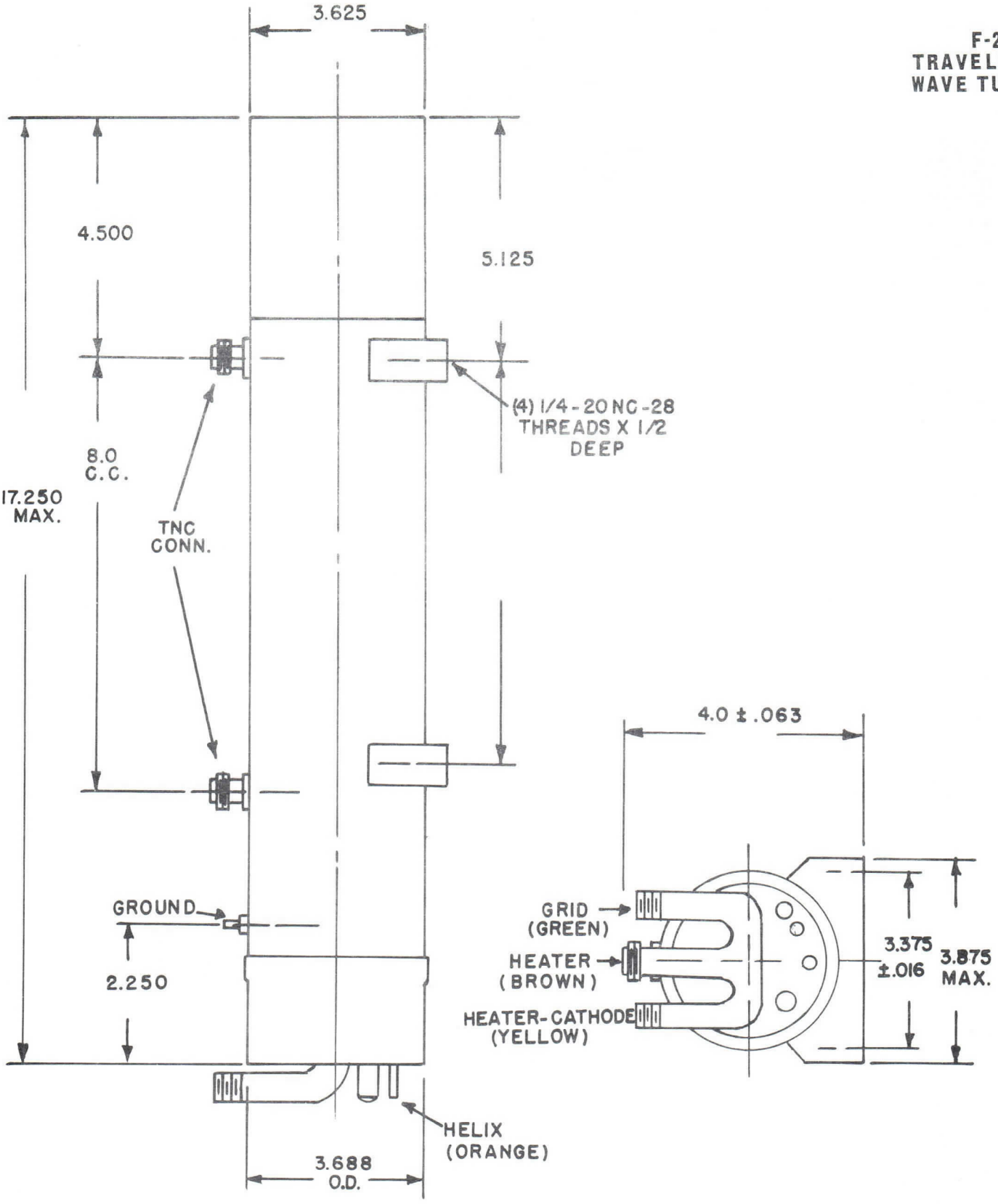
NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2500 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.

NOTE 4: High voltage must not be applied in the absence of proper grid bias.

F-2063
TRAVELING
WAVE TUBE



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F-2064 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION:

The F-2064 is a 2000 watt pulse traveling wave amplifier tube having 33 db gain and designed primarily for use in the 2800 to 3500 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 10 microseconds can be used. A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum Duty Cycle	.01	
Heater Current	3.0	amperes	Maximum Pulse Width (beam)	10	microseconds
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Cathode Current	2.0	ampere peak
Maximum Helix Current	0.8	ampere peak	Maximum Grid Voltage		
Maximum Collector Voltage	8000	volts	Negative	-100	volts
Maximum Collector Dissipation	120	watts average	Positive (with respect to cathode)	200	volts
Maximum R-F Output Power	30	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	3500	mc	Capacitance		
Minimum Frequency (Note 2)	2800	mc	Control Grid to All Other Elements	20	uufd
Minimum Cold Transmission Loss	50	db			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight	10 pounds	Maximum
Base	(See Outline)	R-F Connections	Type "TNC"	
Type of Envelope	Metal	Cooling Data	25 cfm of air	
Mounting Position	Any			

TYPICAL OPERATION AS POWER AMPLIFIER

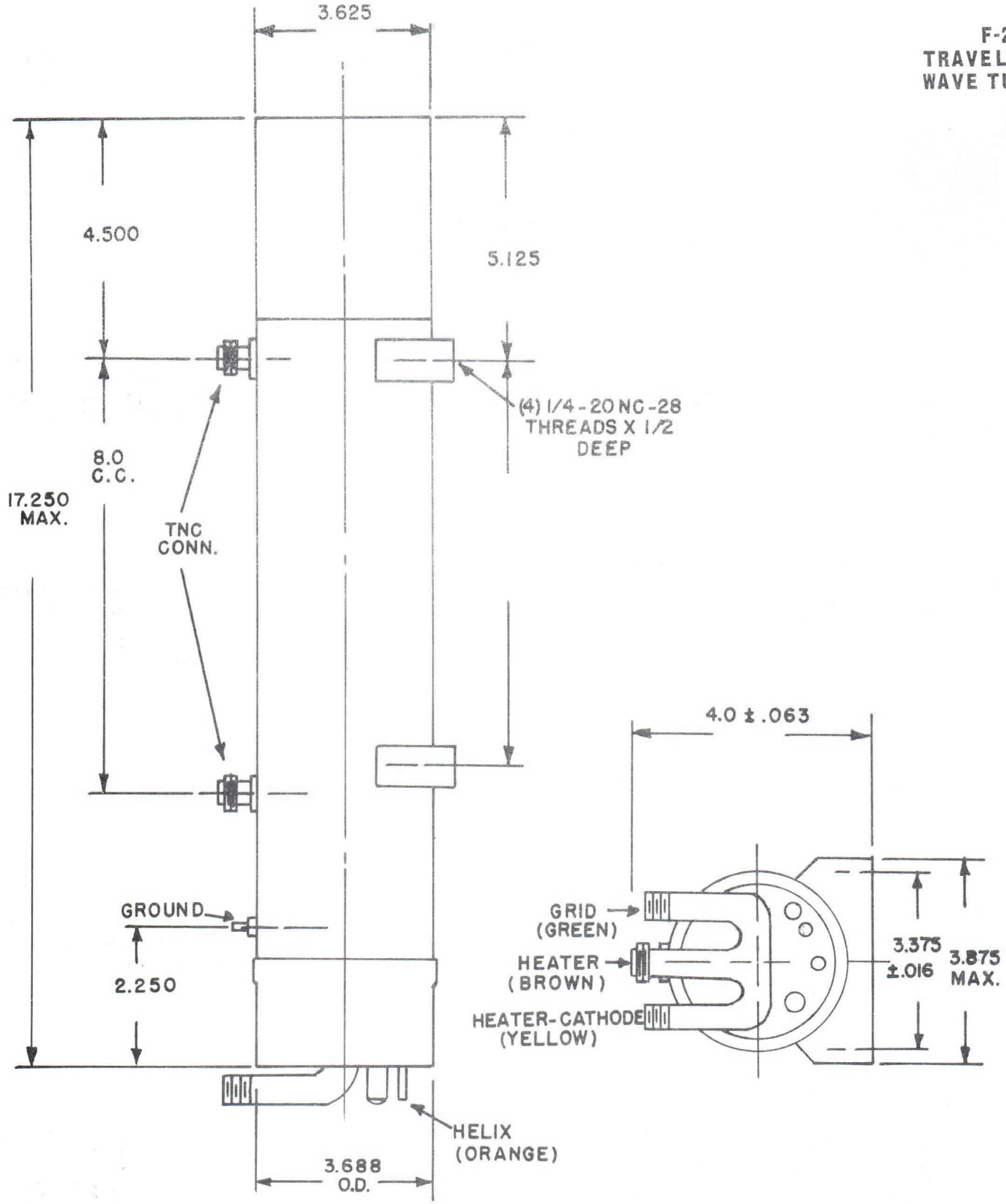
Frequency	2800 to 3500	mc	Power Output (minimum)	1000	watts peak
Anode Voltage (Note 1)	7500	volts	Gain	33	db
Cathode Current	1.5	amperes peak	Duty	.01	
Collector Voltage (tied to shell)	7500	volts	Pulse Width	5	microseconds
Collector Current	1.0	amperes peak	Grid Bias (for cut-off)	-30	volts
			Grid Voltage during Pulse	175	volts

NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2800 mc and above 3500 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.

NOTE 4: High voltage must not be applied in the absence of proper grid bias.


3.625
4.500
5.125
(4) 1/4-20 NC-28
THREADS X 1/2
DEEP
8.0
C.C.
17.250
MAX.
TNC
CONN.
GROUND
2.250
HELIX
(ORANGE)
3.688
O.D.
4.0 ± .063
GRID
(GREEN)
HEATER
(BROWN)
HEATER-CATHODE
(YELLOW)
3.375
±.016
3.875
MAX.

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F-2065 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION:

The F-2065 is a 1000 watt pulse traveling wave amplifier tube having 31 db gain and designed primarily for use in the 2000 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "TNC" connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 100 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum R-F Input Power	2	watts average
Heater Current	3.0	amperes	Maximum R-F Output Power	30	watts average
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Duty Cycle	.01	
Maximum Shell Current	0.8	ampere peak	Maximum Pulse Width (beam)	100	microseconds
Maximum Collector Voltage	8000	volts	Maximum Cathode Current	2.0	ampere peak
Maximum Collector Dissipation	160	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	4000	mc	Minimum Cold Transmission Loss	50	db
Minimum Frequency (Note 2)	2000	mc			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight	10 pounds	Maximum
Base	(See Outline)	R-F Connections	Type "TNC"	
Type of Envelope	Metal	Cooling Data	25 cfm of air	
Mounting Position	Any			

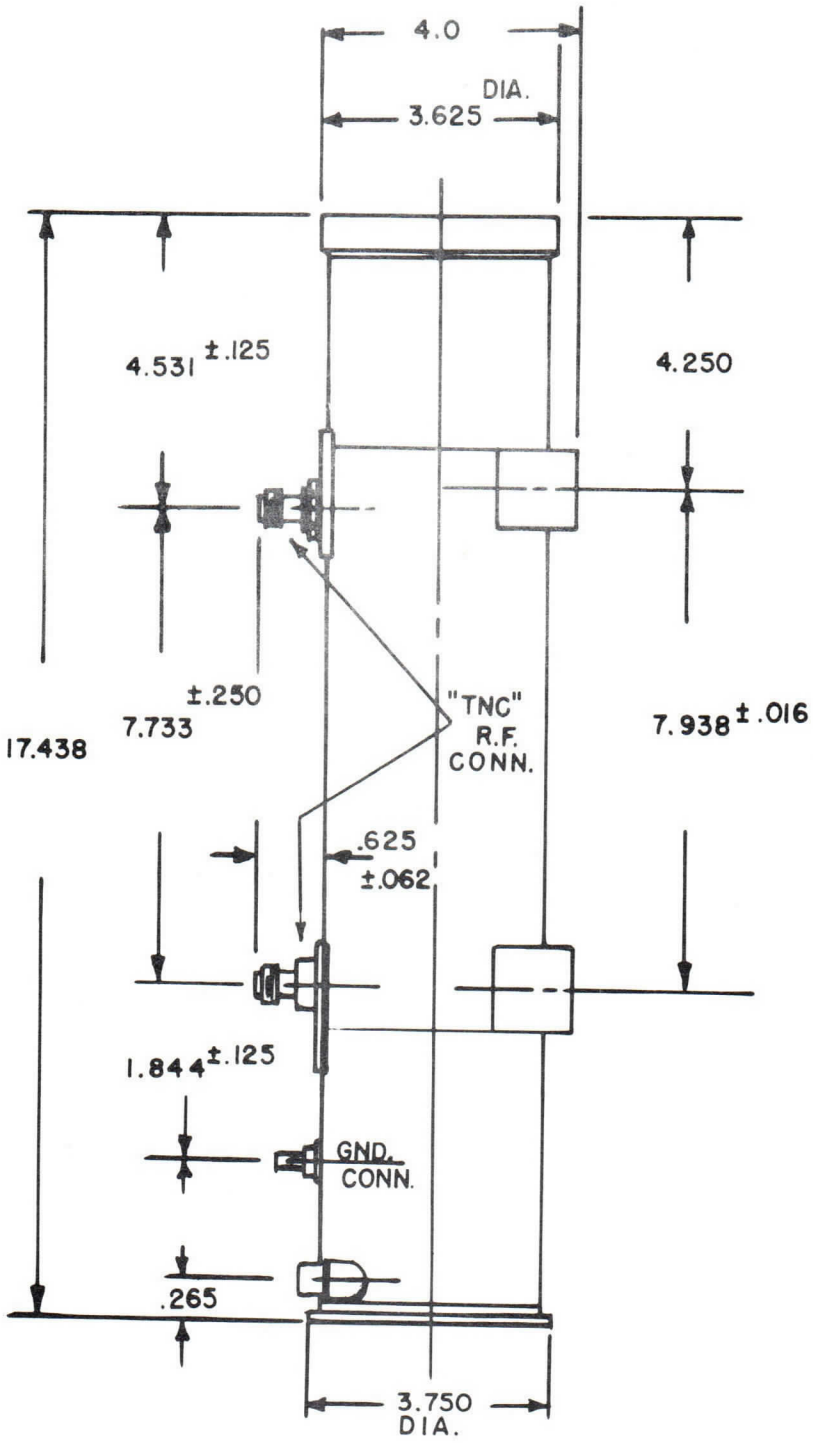
TYPICAL OPERATION AS POWER AMPLIFIER

Frequency	2000 to 4000	mc	Power Output (minimum)	1000	watts peak
Anode Voltage (Note 1)	7300	volts	Gain	31	db
Cathode Current	1.4	amperes peak	Duty	.01	
Collector Voltage (tied to shell)	7300	volts	Pulse Width	5	microseconds
Collector Current	0.9	amperes peak			

NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

NOTE 2: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated.

NOTE 3: Heater warm up of two minutes before applying high voltage is recommended.


4.0
DIA.
3.625
4.531 ±.125
4.250
±.250
7.733
17.438
"TNC"
R.F.
CONN.
7.938 ± .016
.625
±.062
1.844 ±.125
GND.
CONN.
.265
3.750
DIA.

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P.O. BOX 100
Easton, Pennsylvania 18042
Telephone 215 252-7331

F-2131

TRAVELING WAVE TUBE

DESCRIPTION

The tube type 2131 is a miniature, lightweight, 25 watt CW traveling wave tube amplifier covering the frequency range of 7.0 to 17 GHz with 50 dB small signal gain. The tube uses a helix type slow wave structure and is PPM focused with samarium cobalt magnets. It is of metal-ceramic construction for rugged environmental applications. The tube is conduction cooled and may be mounted in any position. The collector is isolated and may be depressed up to 50% of the cathode voltage. Type SMA coaxial fittings are provided for RF input and output. An anode electrode is provided that may be used for gain, current control and ion trapping.

RF PERFORMANCE

	Typical Values	Performance Limits
Frequency	7.0-17.0 GHz	7.0-17.0 GHz
Output Power	30 Watts	20 Watts Min.
Power Gain	57 dB	45 dB Min.
Noise Figure	30 dB	32 dB Max.
Duty Cycle	CW	CW

ELECTRICAL REQUIREMENTS

	Typical	Performance Limits		
	Values	Min.	Max.	Units
Cathode Voltage	—3900	—3600	—4000	Volts
Cathode Current	95	—	130	mA
Anode Voltage	180	—4000	500	Volts
Heater Voltage	6.3	6.0	6.6	Volts
Heater Current	.7	—	.8	Amp
Helix Current	5	—	12	mA
Collector Voltage	—1950	—	—2000	Volts

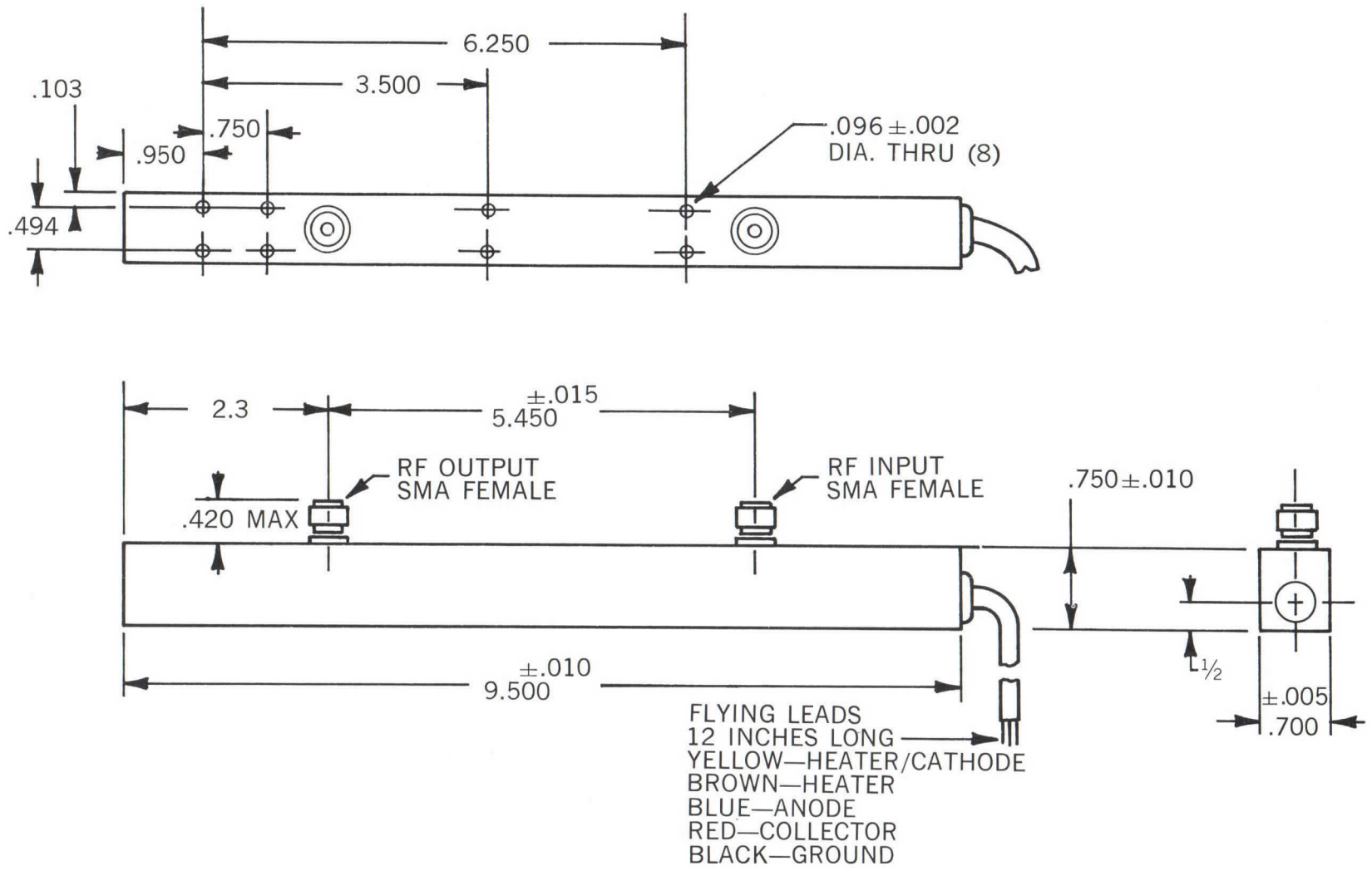
MECHANICAL

RF Connections	SMA Female
DC Connections	Flying Leads
Cooling (NOTE 1)	Conduction
Weight	.75 Pounds
Mounting Position	Any
Construction	Metal-Ceramic
Focusing	PPM

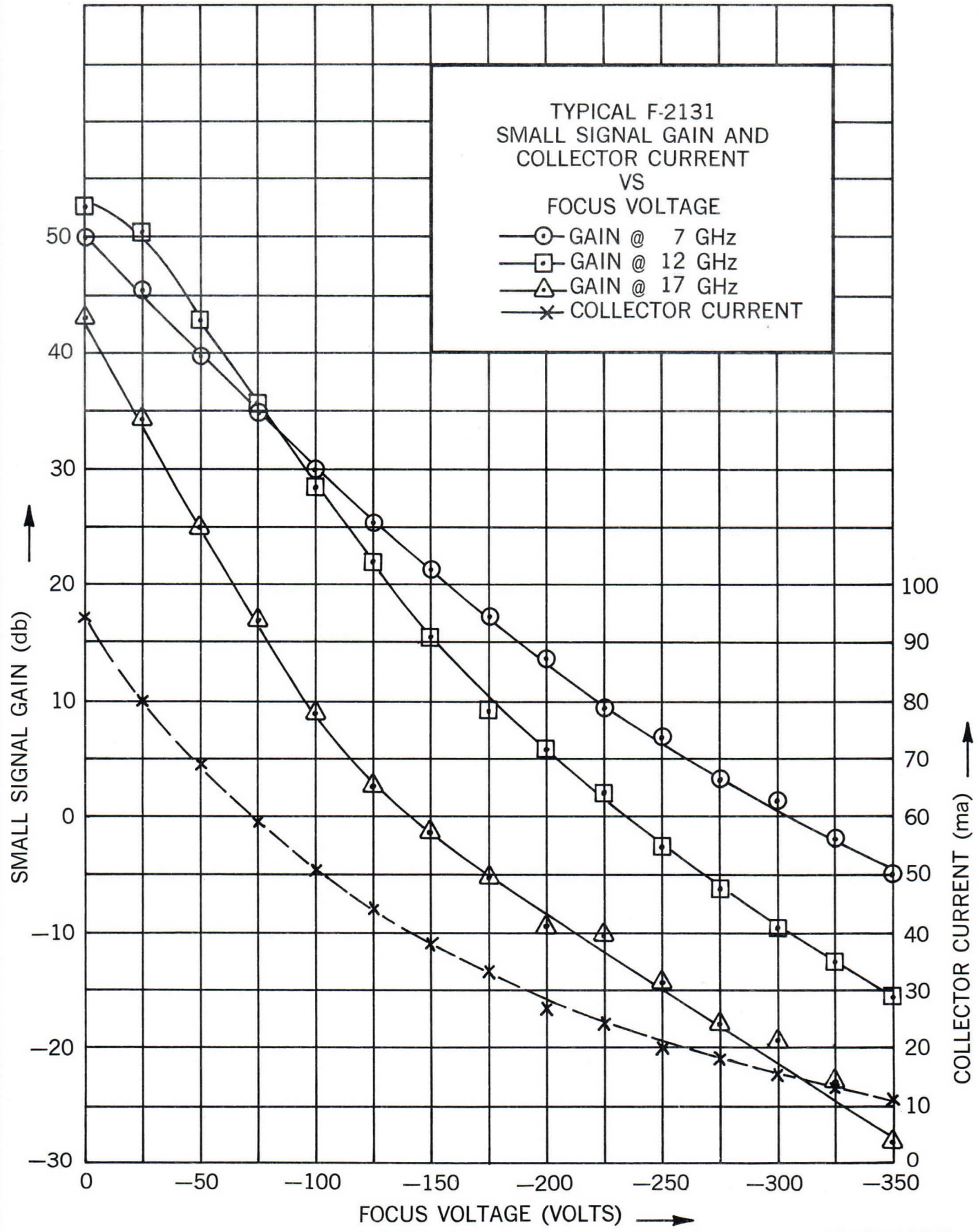
ENVIRONMENTAL

Shock	40G, 11 millisec
Vibration	30G, 5-2000 cycles
Temperature	—45 to +85° C

NOTE 1: For proper conduction cooling the tube must be securely fastened to a flat heat sink surface. The use of heat sink compound (astrodyne 829 or equivalent) is recommended.



F-2131 OUTLINE



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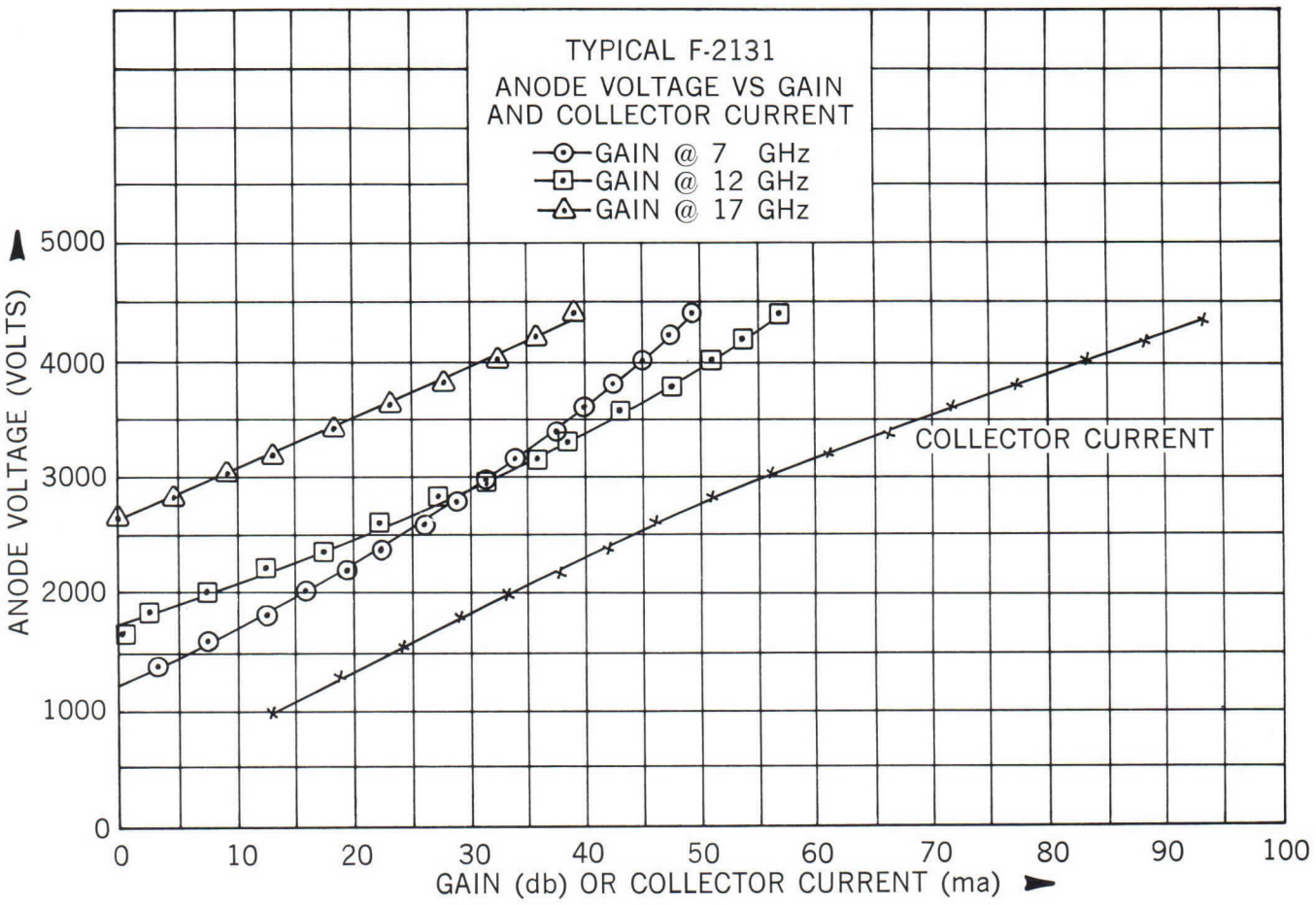
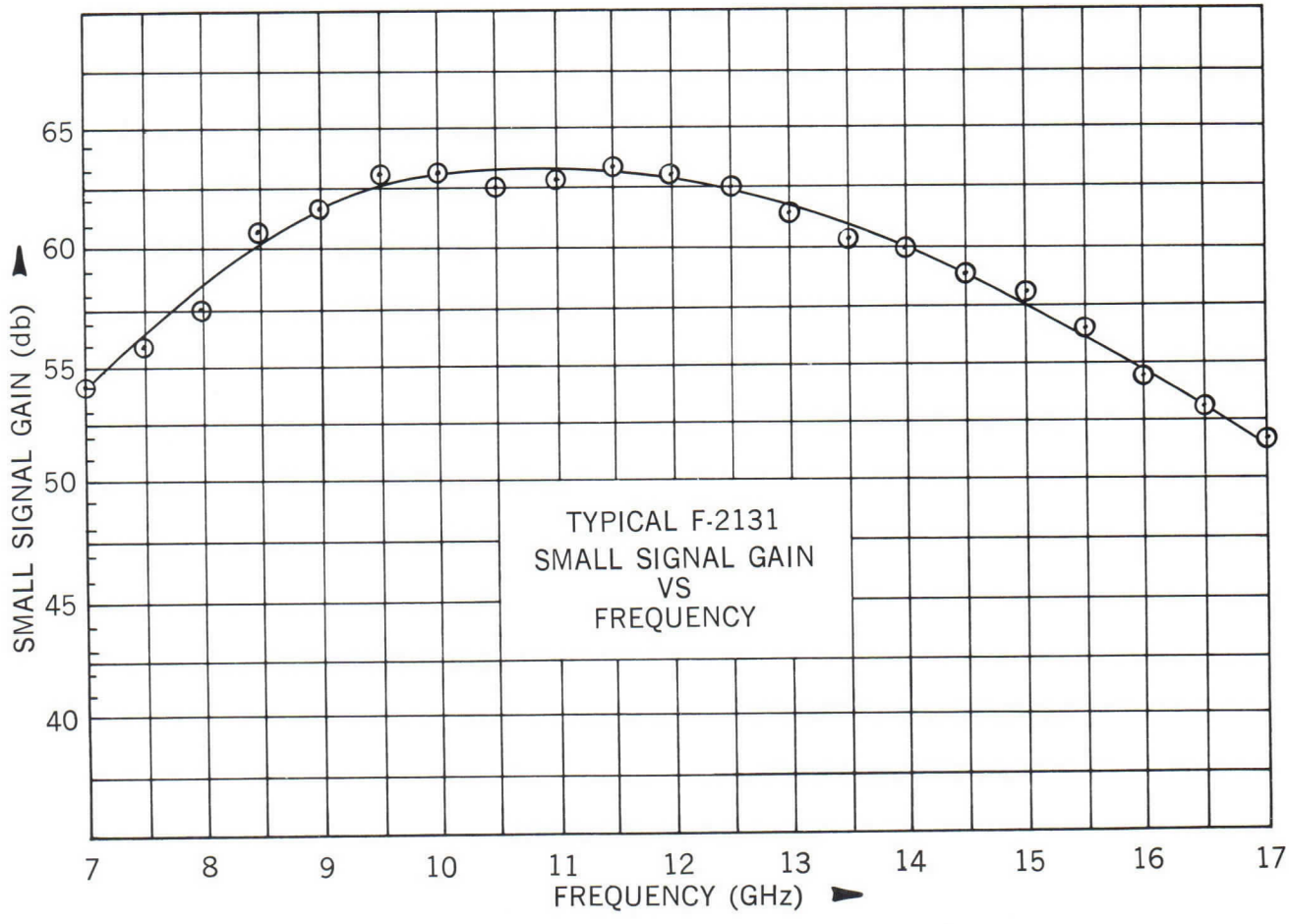
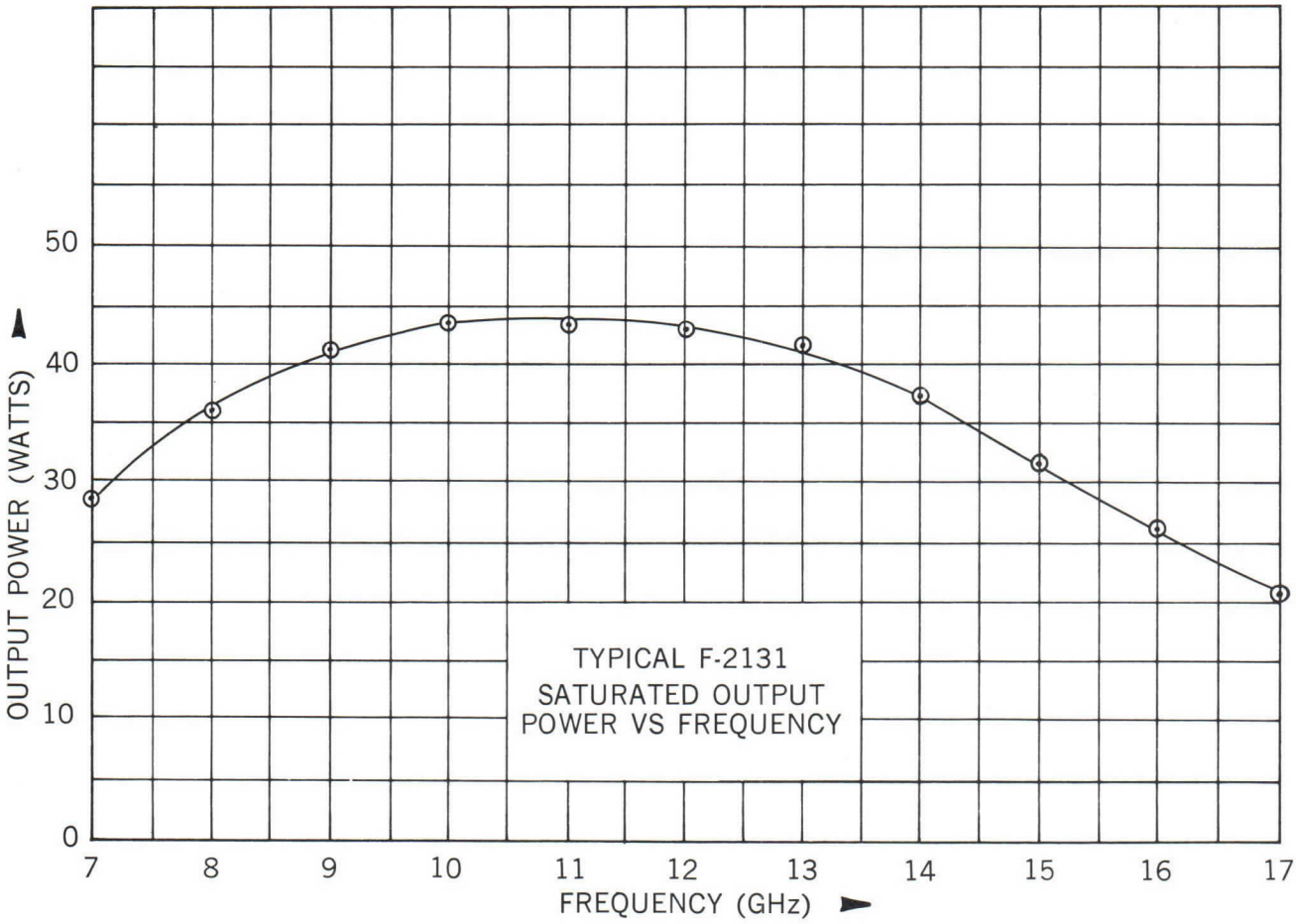
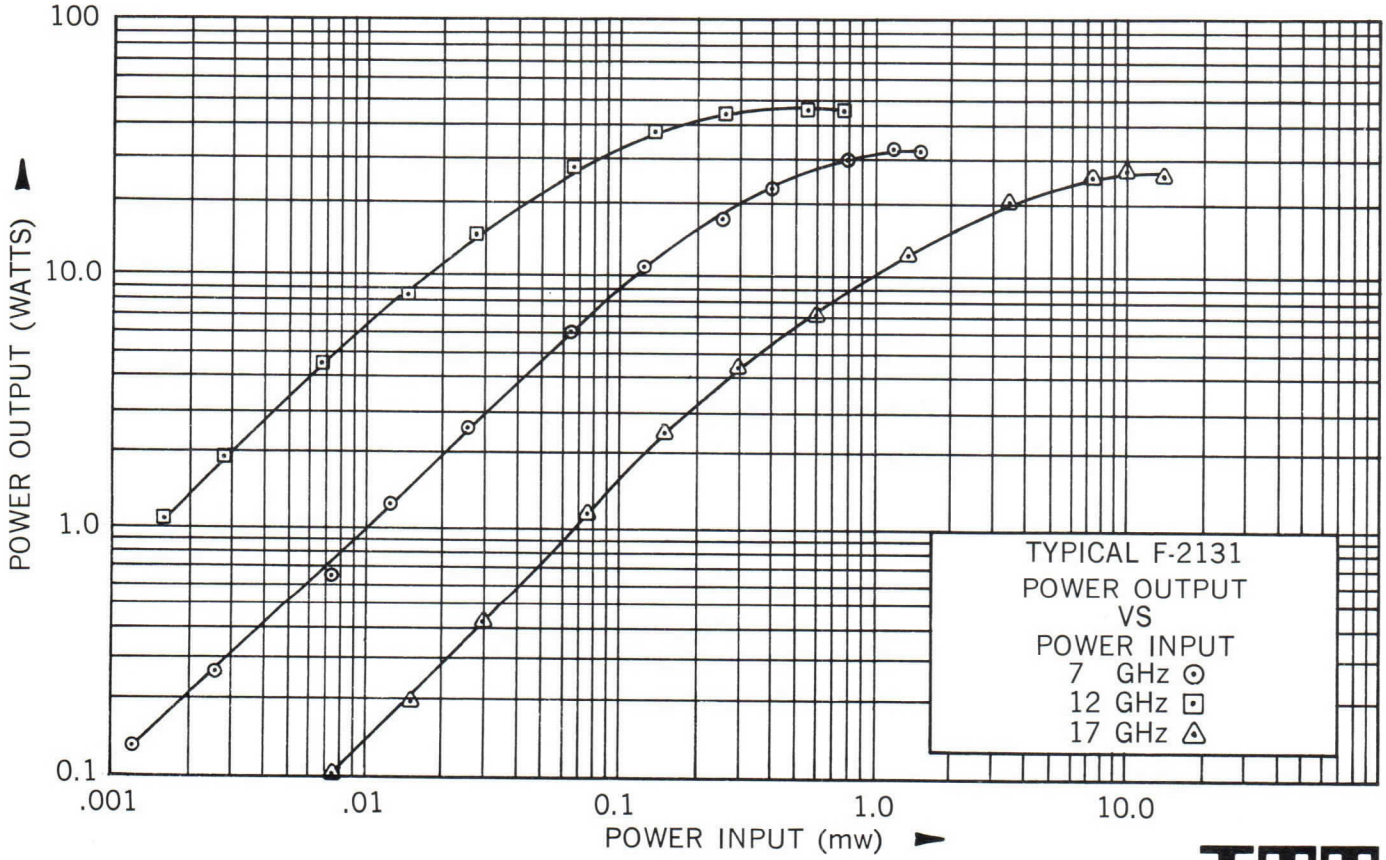
F-2131


TYPICAL F-2131
ANODE VOLTAGE VS GAIN
AND COLLECTOR CURRENT
GAIN @ 7 GHz
GAIN @ 12 GHz
GAIN @ 17 GHz
COLLECTOR CURRENT
ANODE VOLTAGE (VOLTS)
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
GAIN (db) OR COLLECTOR CURRENT (ma)


TYPICAL F-2131
SMALL SIGNAL GAIN
VS
FREQUENCY
SMALL SIGNAL GAIN (db)
65
60
55
50
45
40
7
8
9
10
11
12
13
14
15
16
17
FREQUENCY (GHz)

F-2131





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ELECTRON TUBE DIVISION
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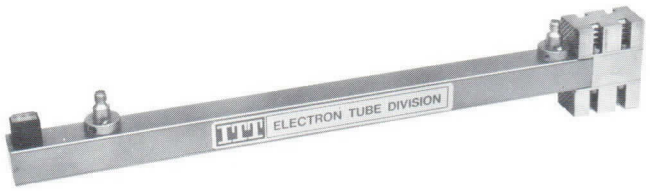
Easton, Pennsylvania 18042
Telephone 215 252-7331

F-2147



TRAVELING WAVE TUBE

DESCRIPTION

The tube type 2147 is a miniature, lightweight, very broad band 12 watt CW traveling wave tube amplifier covering the frequency range of 2.5 to 7.5 GHz with 50 dB small signal gain. The tube uses a helix type slow-wave structure and is PPM focused with samarium cobalt magnets. It is of metal-ceramic construction for rugged environmental applications. The tube can be either conduction or air cooled and may be mounted in any position. The collector is isolated and may be depressed up to 50% of the cathode voltage. Type SMA coaxial fittings are provided for RF input and output. The tube may also be equipped with QRM RF fittings which make the tube completely plug-in in a blind rack and panel mounting fashion. A very small AMP six-pin subminiature plug (#862584-1) is used for d.c. connection to the tube. An anode electrode is provided that may be used for gain, current control and ion trapping. A focus control is also provided which can also be used for gain control.

RF PERFORMANCE

	Typical Values	Performance Limits
Frequency	2.5-7.5 GHz	2.5-7.5 GHz
Output Power	15 Watts	12 Watts Min.
Power Gain	47 dB	45 dB Min.
Noise Figure	29 dB	32 dB Max.
Duty Cycle	CW	CW

ELECTRICAL REQUIREMENTS

	Typical	Performance Limits		
	Values	Min.	Max.	Units
Cathode Voltage	—2150	—2100	—2200	Volts
Cathode Current	80	—	95	mA
Anode Voltage	180	—2200	500	Volts
Heater Voltage	6.3	6.0	6.6	Volts
Heater Current	.8	—	1.0	Amp
Helix Current	5	—	16	mA
Collector Voltage	—950	—	—1075	Volts

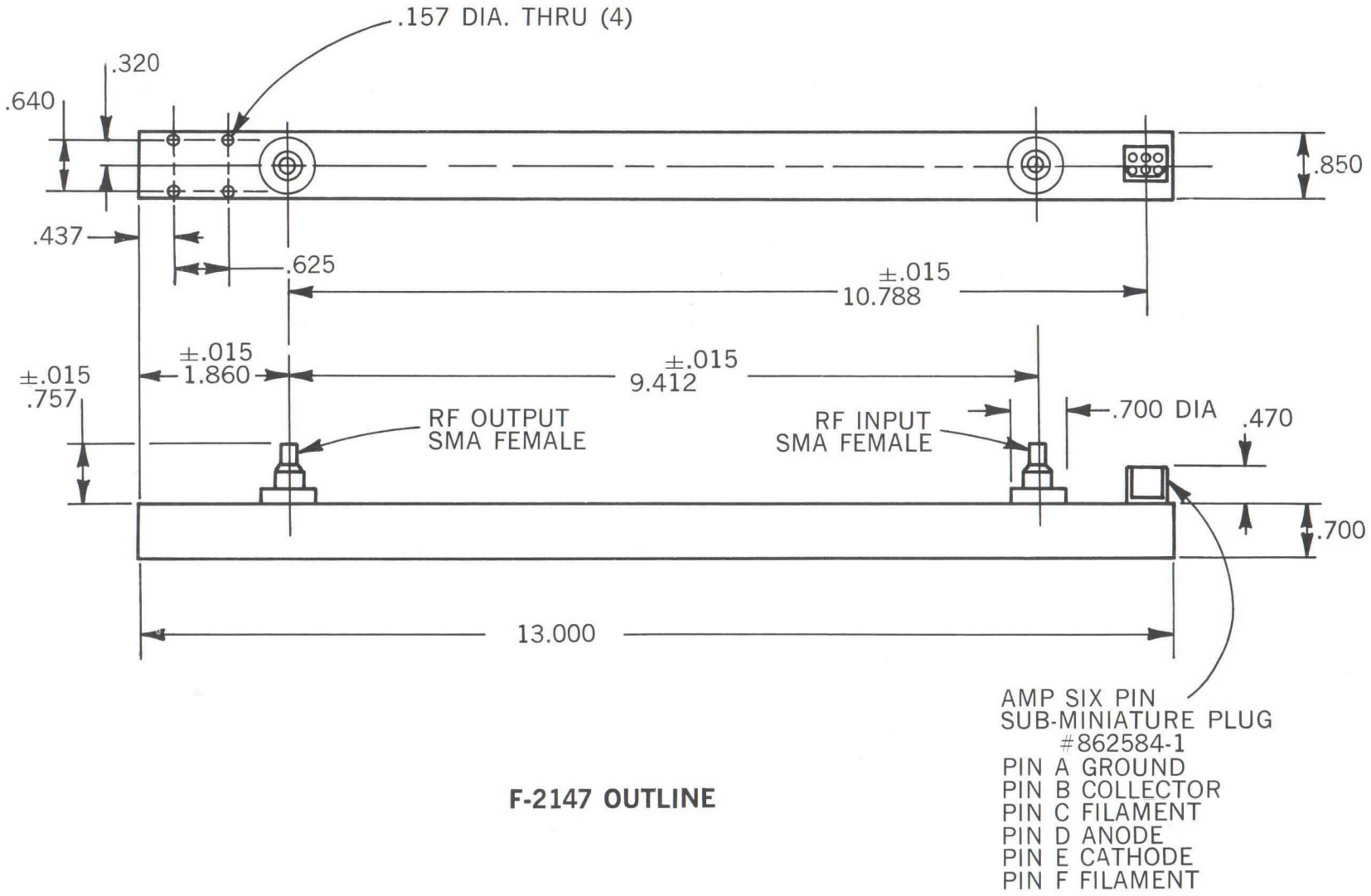
MECHANICAL

RF Connections	SMA Female
DC Connections	AMP Six-Pin Subminiature #862584-1
Cooling (NOTE 1)	Conduction or Air Cooling
Weight	1.0 Pounds
Mounting Position	Any
Construction	Metal-Ceramic
Focusing	PPM

ENVIRONMENTAL

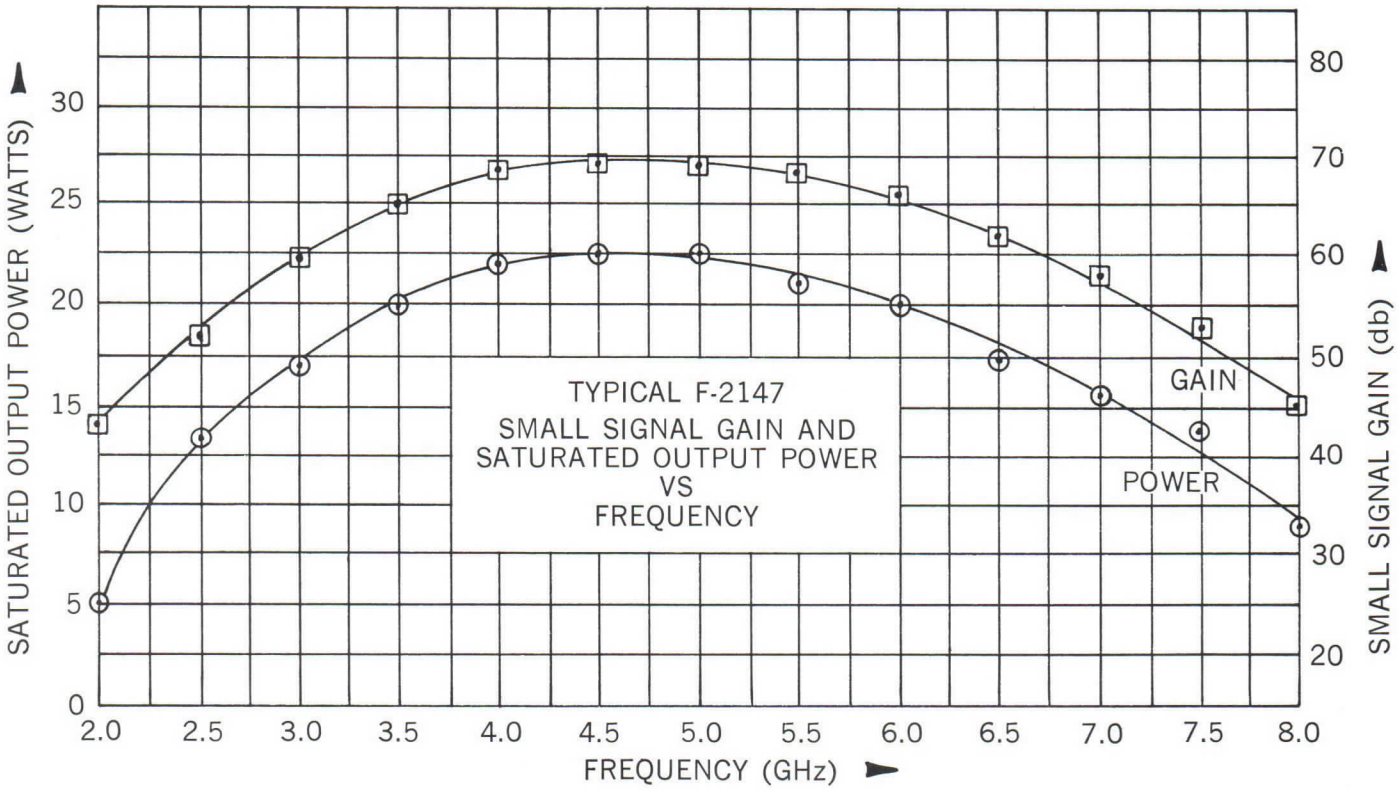
Shock	40G, 11 Millisec
Vibration	30G, 5-2000 Cycles
Temperature	—40 to +85° C

NOTE 1: For proper conduction cooling, the tube must be securely fastened to a flat heat sink surface. The use of heat sink compound (Astrodyne 829 or equivalent) is recommended. Air cooling fins can also be supplied to make the tube air cooled.



F-2147 OUTLINE

F-2147


SATURATED OUTPUT POWER (WATTS)
SMALL SIGNAL GAIN (db)
FREQUENCY (GHz)
TYPICAL F-2147
SMALL SIGNAL GAIN AND
SATURATED OUTPUT POWER
VS
FREQUENCY
GAIN
POWER
0
5
10
15
20
25
30
20
30
40
50
60
70
80
2.0
2.5
3.0
3.5
4.0
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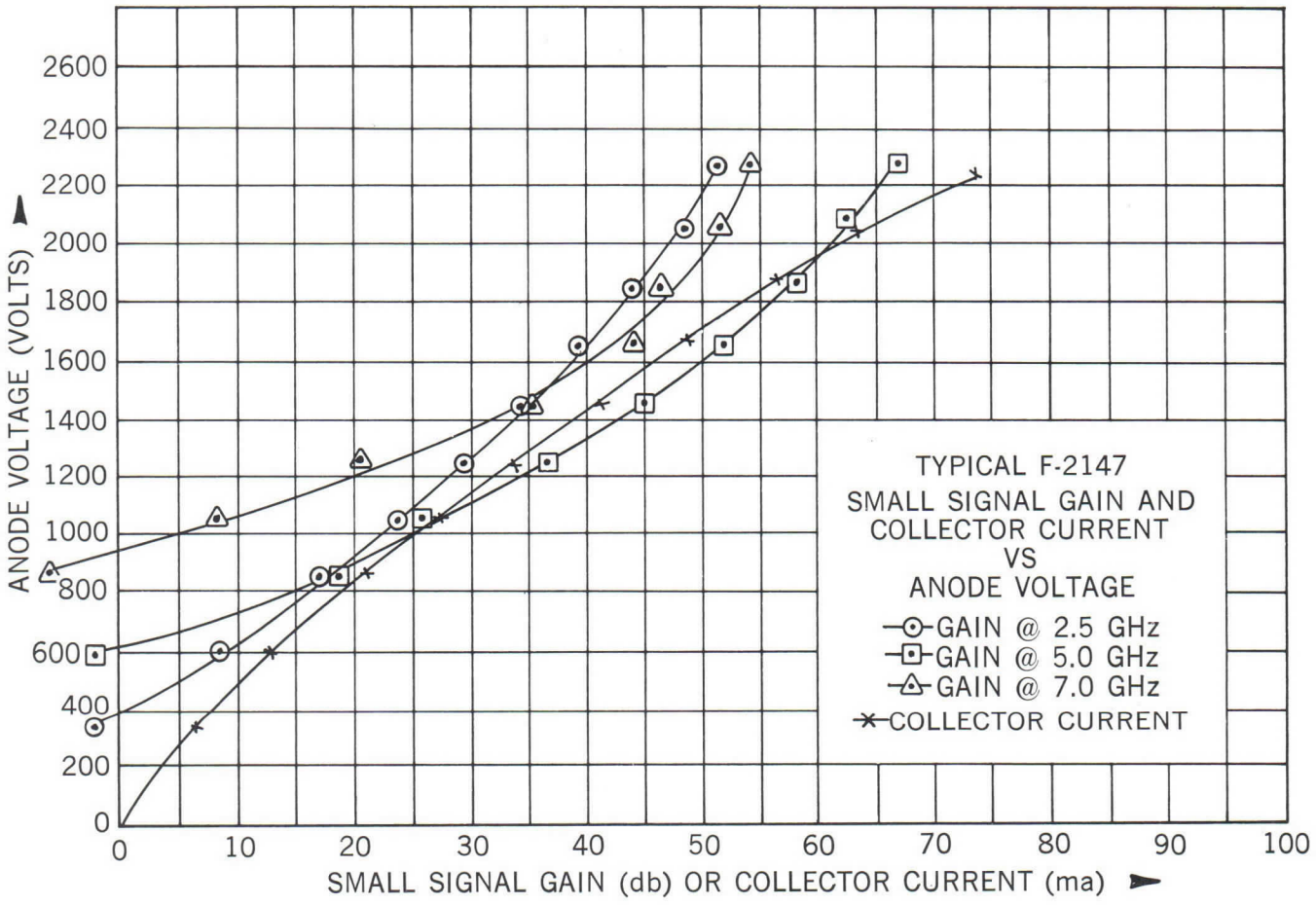
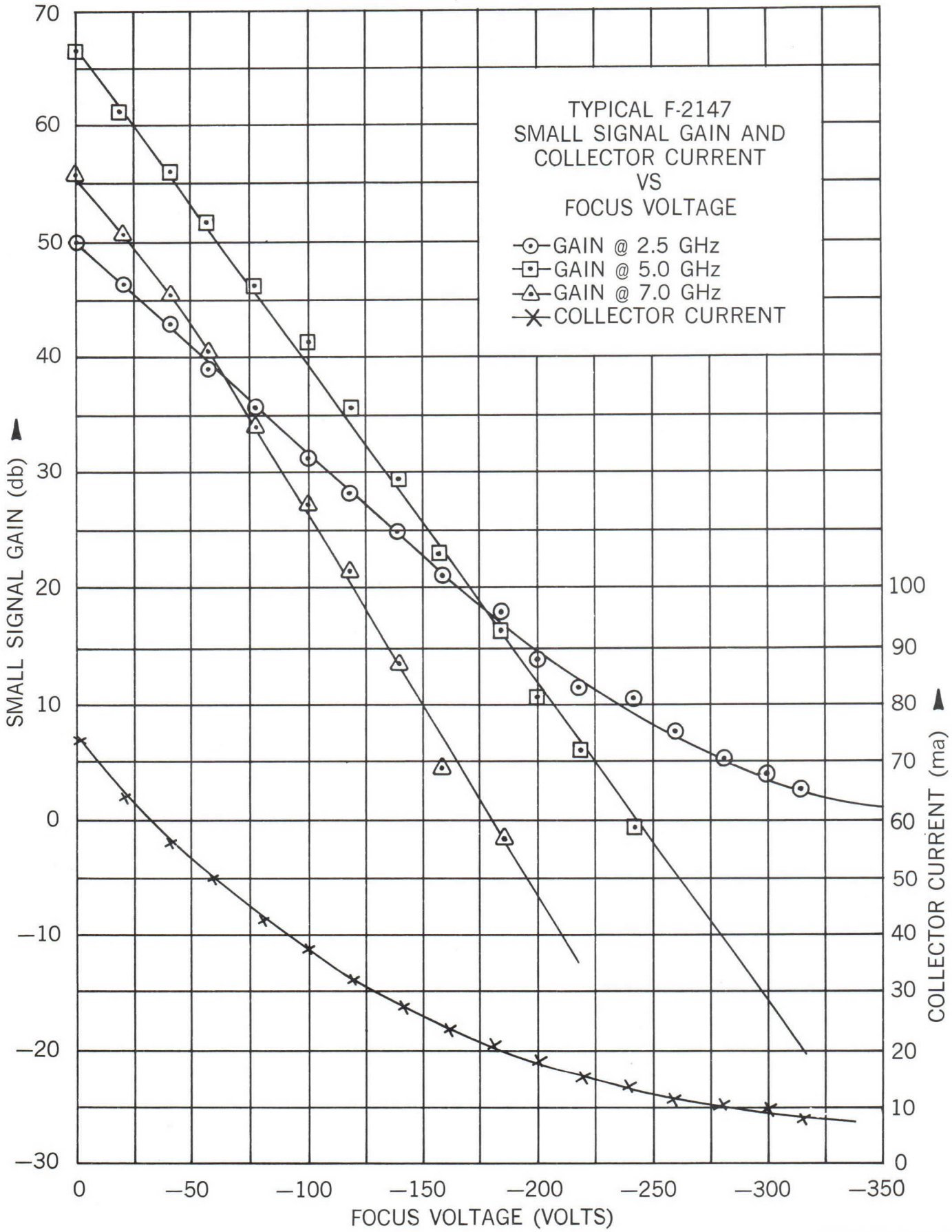
5.5
6.0
6.5
7.0
7.5
8.0


ANODE VOLTAGE (VOLTS)
SMALL SIGNAL GAIN (db) OR COLLECTOR CURRENT (ma)
TYPICAL F-2147
SMALL SIGNAL GAIN AND
COLLECTOR CURRENT
VS
ANODE VOLTAGE
GAIN @ 2.5 GHz
GAIN @ 5.0 GHz
GAIN @ 7.0 GHz
COLLECTOR CURRENT
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
0
10
20
30
40
50
60
70
80
90
100

F-2147



ELECTRON TUBE DIVISION ITT

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2/76

TENTATIVE

DESCRIPTION:

The F-2502 is a cathode-pulsed traveling wave amplifier capable of providing 1000 watts peak output in the frequency band of 4000 - 8000 mc. The tube is of all-metal/ceramic structure and is contained in a periodic permanent magnet focusing mount. The fundamental parameters of this tube are listed below:

Frequency	2000 - 4000	mc
Power Output	1	kw min.
Gain (Power)	30	db. min.
Beam Voltage	8000	Volts
Cathode Current	1.5	Amperes max.
Pulse Width	50	usec. max.
Duty	.02	(.05 objective)
Heater Voltage	6.3	V
Heater Current	3.0	max.
Focusing		PPM
Weight	7	lbs.
Cooling		Forced Air
Overall Length	17	Inches, approx.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2507 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2507 is a voltage-tunable, wide-band oscillator with a minimum output power of 100 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	1.8 - 2.8	Note 1	Gcs
Power Output	110 - 190	100 min.	mw
Power Output Variation	3	4 max.	db
Fine Grain Variation, Note 2	± .8	± 1 max.	db/100 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min/ 6.6 max.	Volts
Heater Current	0.96	1.2 max.	Amps
Anode Voltage (with respect to cathode)	95	250 max.	Volts
Anode Current	0.15	1.0 max.	Ma
Cathode Current	11.0	15.0 max.	Ma
Helix Voltage (with respect to cathode)	250 to 700	200 to 850	Volts
Helix Current	1.5	3.0 max.	Ma
Cathode Voltage	Zero (Ground)	Zero (Ground)	Volts

	TYPICAL	ABSOLUTE	UNITS
Grid Voltage for no Oscillation (RF Cutoff) (with respect to cathode)	-11	-30 max.	Volts
Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to All Electrodes	39	45 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	34	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	180	250 max.	$\mu\mu$fd.
Spurious Output Below Signal	50	40 min.	db.

NOTE 1 The F-2507 will operate over the frequency range of 1.782 to 2.828 Gcs. with a 3 db reduction in the rated minimum output power.

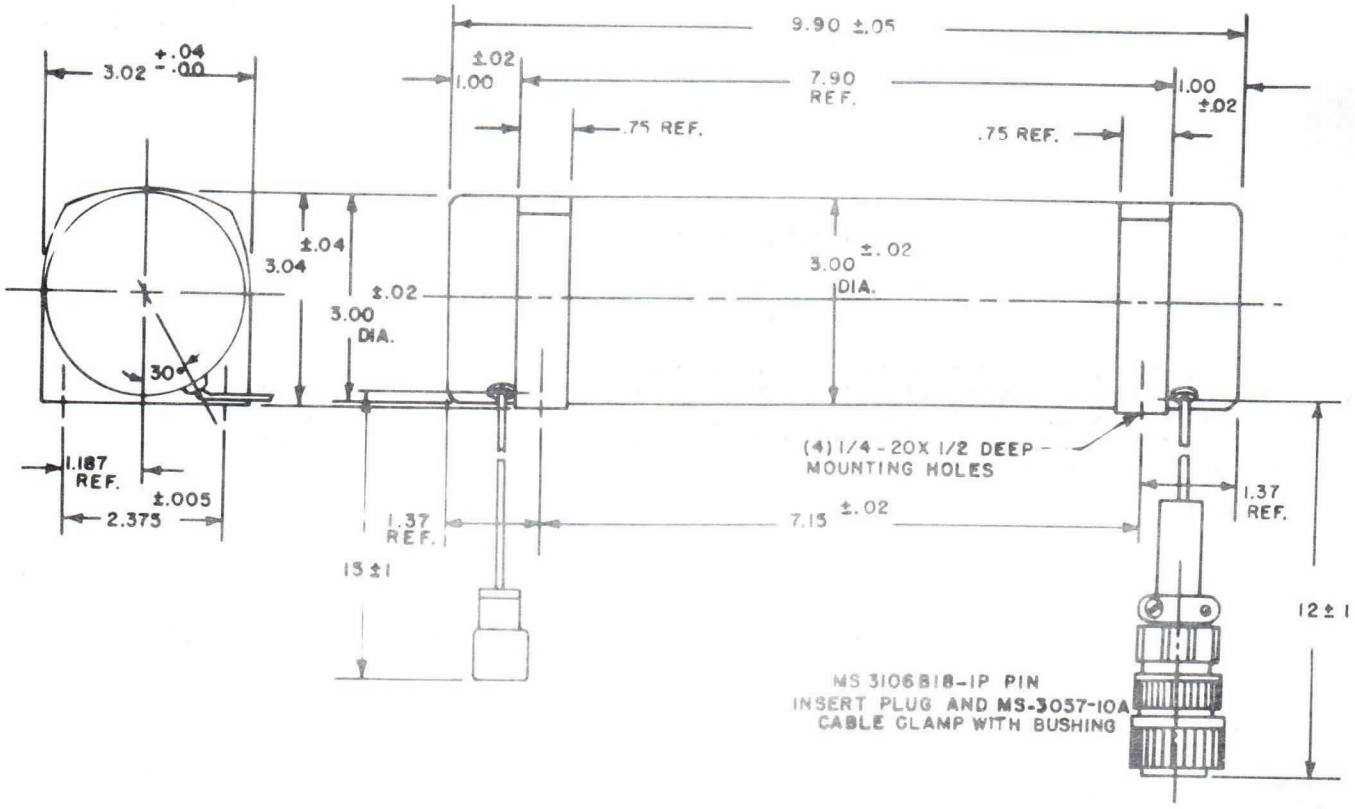
NOTE 2 This value is determined by selecting the 100 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

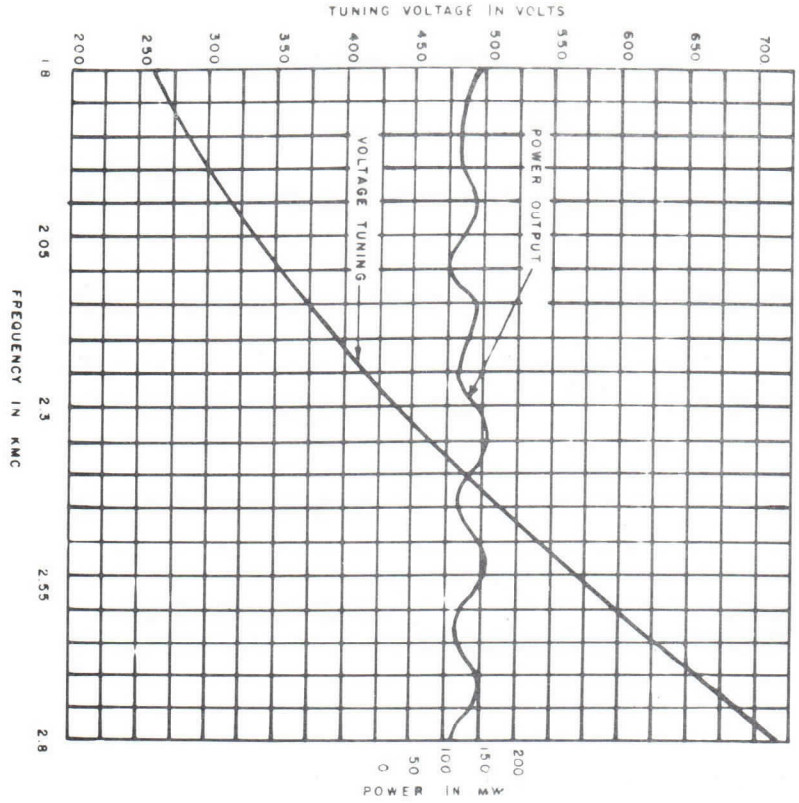
MECHANICAL

Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs. -14 oz.	10 max.	Pounds
Power Cable Length (to end of MS 3106B18-1P Plug)	12	11 min/13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min/16 max.	Inches

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey


9.90 ±.05
3.02 +.04 -.00
±.02
1.00
7.90
REF.
1.00
±.02
.75 REF.
.75 REF.
±.04
3.04
±.02
3.00
DIA.
3.00 ±.02
DIA.
30°
1.187
REF.
±.005
2.375
1.37
REF.
7.15 ±.02
15 ±1
(4) 1/4-20X 1/2 DEEP
MOUNTING HOLES
1.37
REF.
12 ±1
MS 3106B18-1P PIN
INSERT PLUG AND MS-3057-10A
CABLE CLAMP WITH BUSHING


TUNING VOLTAGE IN VOLTS
200
250
300
350
400
450
500
550
600
650
700
1.8
2.05
2.3
2.55
2.8
FREQUENCY IN KMC
VOLTAGE TUNING
POWER OUTPUT
0
50
100
150
200
POWER IN MW

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2508 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2508 is a voltage-tunable, wide-band oscillator with a minimum output power of 100 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	1.0 - 2.0	Note 1	Gcs
Power Output	100 - 800	100 min.	mw.
Power Output Variation	9	10 max.	db
Fine Grain Variation, Note 2	±1.5	±2.5 max.	db 100 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min/ 6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	+120	+250 max.	Volts
Anode Current	0.2	1.0 max.	Ma
Cathode Current	15	25 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	8.0	10.0 max.	Ma
*Cathode Voltage (with respect to Helix)	-250 to -1150	-200 to -1300	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-20	-30 max.	Volts
*Collector Voltage, with respect to Helix	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	42	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	30	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	210	300 max.	$\mu\mu$fd.
Spurious Output below Signal	50	40 min.	db

*The above data shows tube operation with the helix at ground potential (Zero volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2508 will operate over the frequency range of .99 to 2.02 Gcs. with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 100 mc region of the frequency range which has the greatest difference in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

MECHANICAL

Package Length	11.40	11.45 max.	Inches
Package Diameter	3.25	3.27 max.	Inches
Package Weight	14 lbs. -4 oz.	14.5 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min/13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min/16 max.	Inches

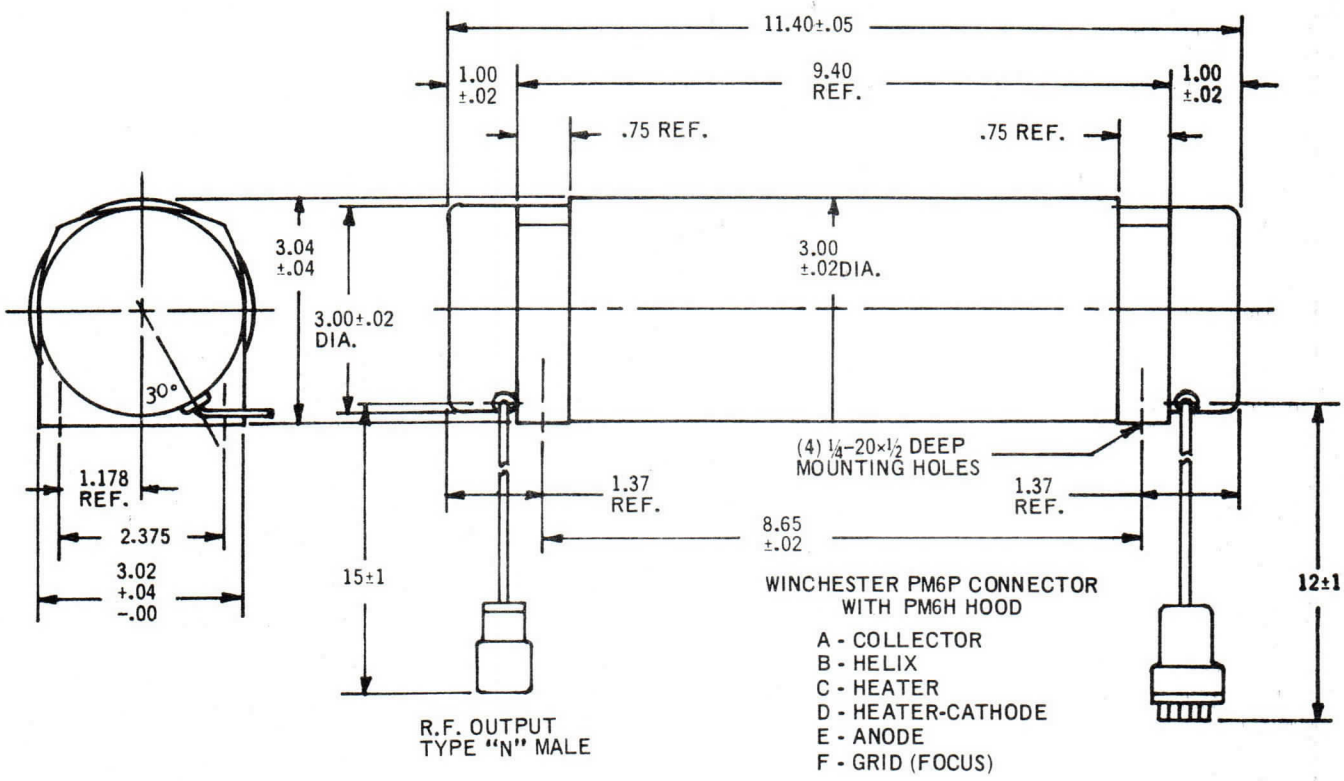
Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

TENTATIVE

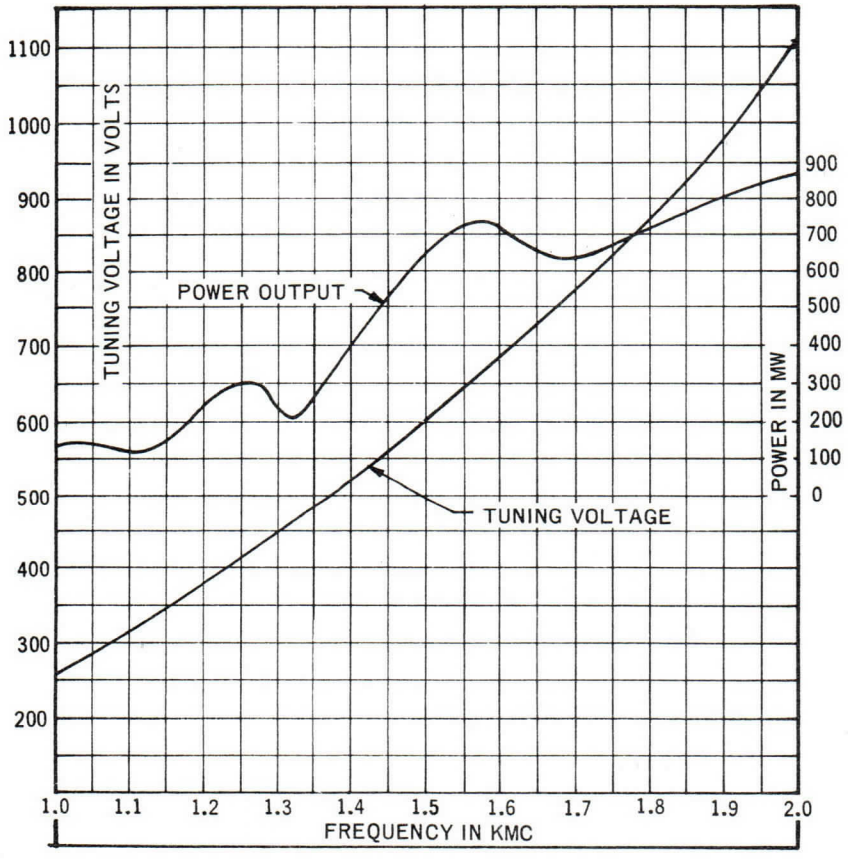
PERMANENT – MAGNET BACKWARD-WAVE OSCILLATOR

F-2508



TYPICAL TUNING CURVE AND POWER OUTPUT

BWO TYPE F-2508



ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2509 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2509 is a voltage-tunable, wide-band oscillator with a minimum output power of 100 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	2.0 - 4.0	Note 1	Gcs
Power Output	100 - 250	100 min.	mw
Power Output Variation	5	6 max.	db
Fine Grain Variation, Note 2	±1.0	±1.5 max.	db/200 mc
VSWR	2.0:1	2.5:1	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	106	250 max.	Volts
Anode Current	0.15	1.0 max.	Ma
Cathode Current	10.4	15 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	1.9	3.0 max.	Ma
*Cathode Voltage (with respect to Helix)	-300 to -1800	-200 to -2100	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-11	-30 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	42	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	30	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	210	300 max.	$\mu\mu$fd.
Spurious Output below Signal	50	40 min.	db

*The above data shows tube operation with the helix at ground potential (Zero volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2509 will operate over the frequency range of 1.98 to 4.04 Gcs. with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 200 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

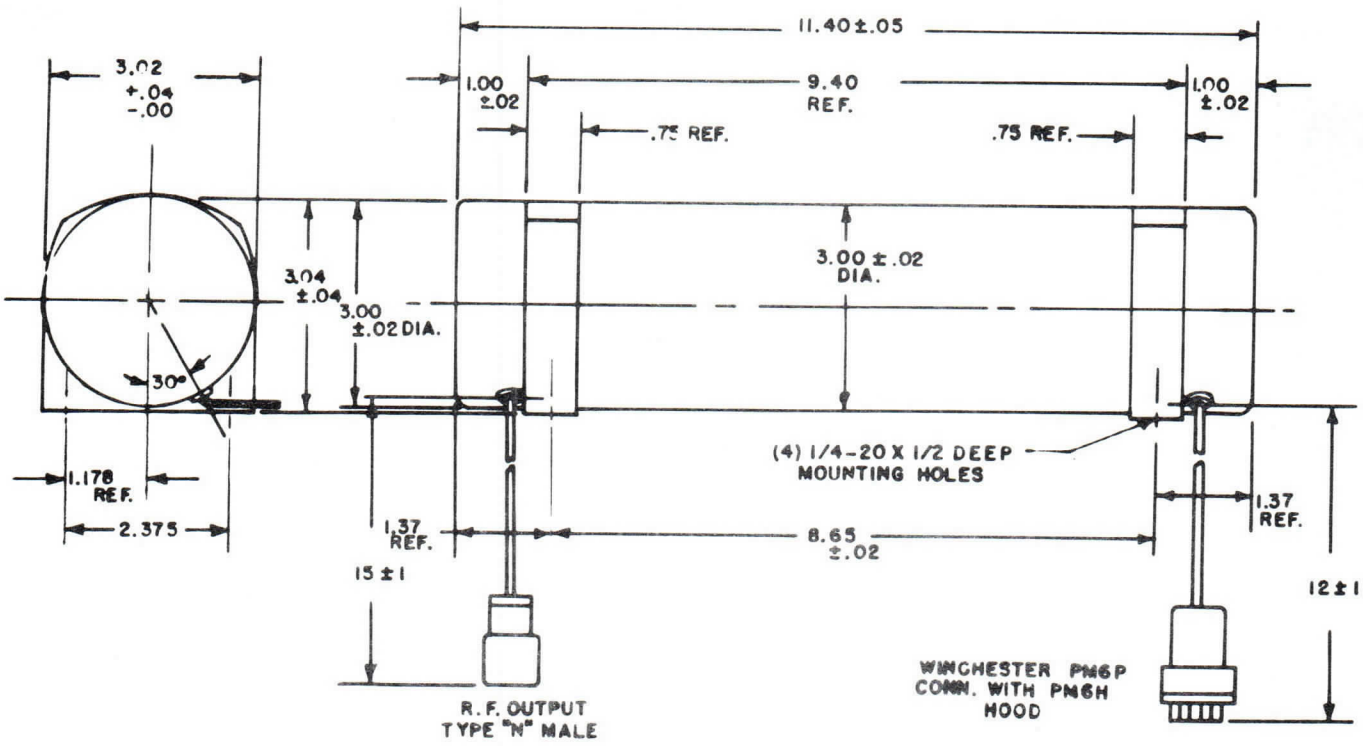
MECHANICAL

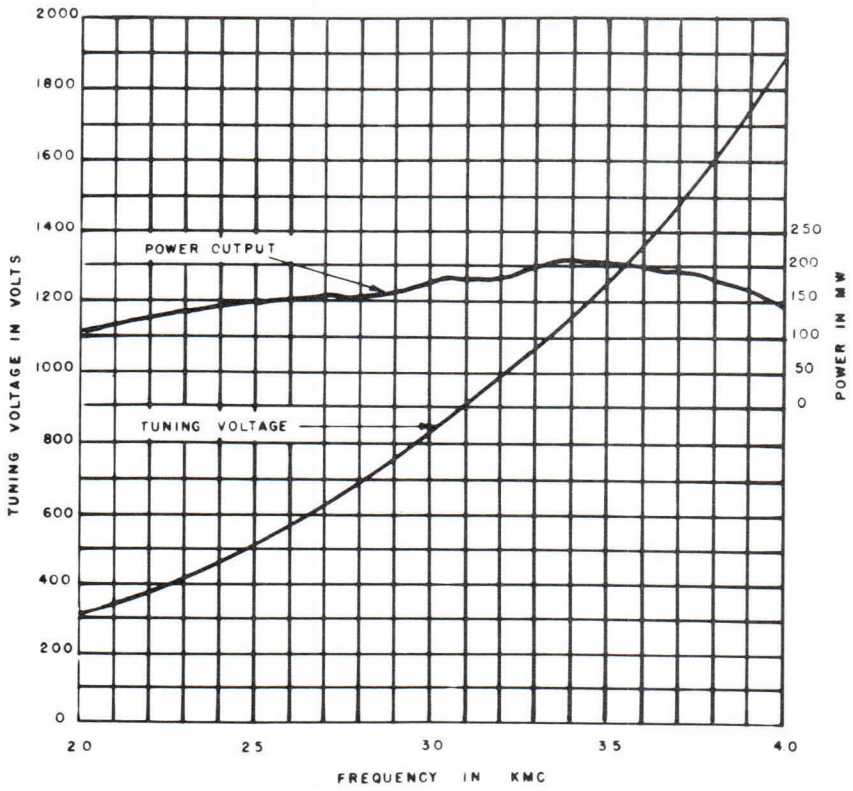
Package Length	11.40	11.45 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	14 lbs-4 oz.	14.5 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min/13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min/16 max.	Inches

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

F-2509


11.40±.05
3.02
+.04
-.00
1.00
±.02
9.40
REF.
1.00
±.02
.75 REF.
.75 REF.
3.04
±.04
3.00
±.02 DIA.
3.00 ± .02
DIA.
30°
(4) 1/4-20 X 1/2 DEEP
MOUNTING HOLES
1.178
REF.
2.375
1.37
REF.
8.65
±.02
1.37
REF.
15 ± 1
12 ± 1
R.F. OUTPUT
TYPE "N" MALE
WINCHESTER PM6P
CONN. WITH PM6H
HOOD


2000
1800
1600
1400
1200
1000
800
600
400
200
0
TUNING VOLTAGE IN VOLTS
POWER OUTPUT
TUNING VOLTAGE
250
200
150
100
50
0
POWER IN MW
20
25
30
35
40
FREQUENCY IN KMC

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2510 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2510 is a voltage-tunable, wide-band oscillator with a minimum output power of 25 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a unifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	4.0 - 8.2	Note 1	Gcs
Power Output	25 - 175	25 min.	mw
Power Output Variation	8	10 max.	db
Fine Grain Variation, Note 2	±1.5	±2 max.	db/420 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./ 6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	150	250 max.	Volts
Anode Current	0.3	1.0 max.	Ma
Cathode Current	12	15 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	3.5	6.0 max.	Ma
*Cathode Voltage (with respect to Helix)	-250 to -2400	-200 to -2500	Volts
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-13	-30 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	39	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	32	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	150	200 max.	$\mu\mu$fd.
Spurious Output below Signal	50	40 min.	db

*The above data shows tube operation with the helix at ground potential (Zero volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2510 will operate over the frequency range of 3.96 to 8.282 Gcs with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 420 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

MECHANICAL

Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs - 14 oz.	10 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min./13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min./16 max.	Inches

Additional information for specific applications can be obtained from the

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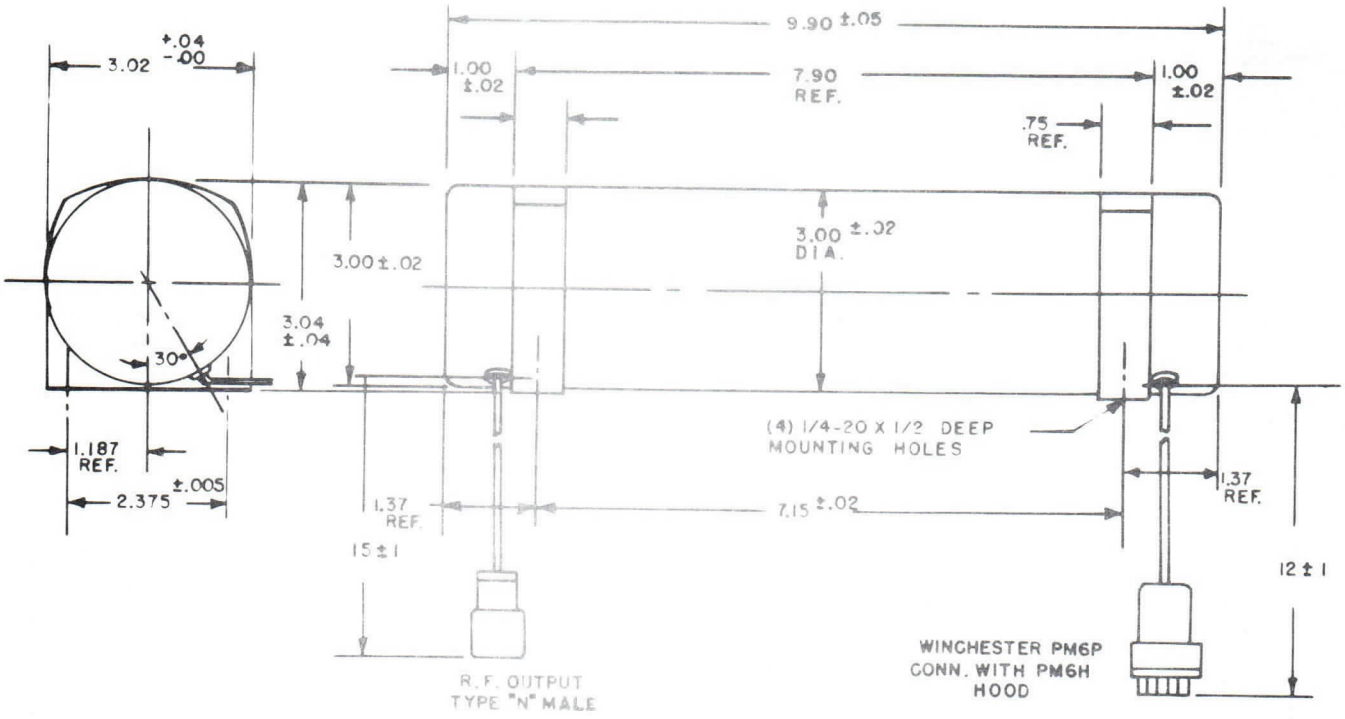
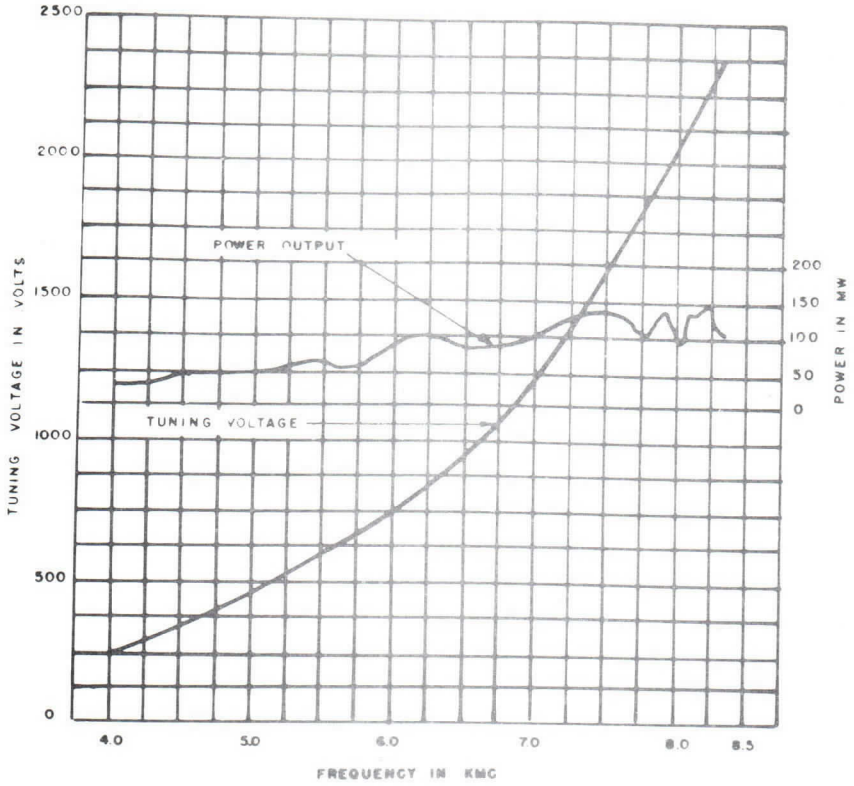
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

F-2510


9.90 ±.05
3.02 +.04 -.00
1.00 ±.02
7.90 REF.
1.00 ±.02
.75 REF.
3.00 ±.02 DIA.
3.00 ±.02
3.04 ±.04
30°
(4) 1/4-20 X 1/2 DEEP MOUNTING HOLES
1.187 REF.
2.375 ±.005
1.37 REF.
7.15 ±.02
1.37 REF.
15 ± 1
12 ± 1
R.F. OUTPUT TYPE "N" MALE
WINCHESTER PM6P CONN. WITH PM6H HOOD


2500
2000
1500
1000
500
0
TUNING VOLTAGE IN VOLTS
POWER OUTPUT
TUNING VOLTAGE
200
150
100
50
0
POWER IN MW
4.0
5.0
6.0
7.0
8.0
8.5
FREQUENCY IN KMC

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2511 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2511 is a voltage-tunable, wide-band oscillator with a minimum output power of 25 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a unifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	8.0 - 12.4	Note 1	Gcs
Power Output	25 - 130	25 min.	mw
Power Output Variation	8	9 max.	db
Fine Grain Variation, Note 2	±1.5	±2 max.	db/440 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./ 6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	150	250 max.	Volts
Anode Current	0.5	1.0 max.	Ma
Cathode Current	10.0	15 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	4.0	6.0 max.	Ma
*Cathode Voltage (with respect to Helix)	-550 to -2400	-450 to -2500	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-15	-30 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	40	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	29	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	80	150 max.	$\mu\mu$fd.
Spurious Output below Signal	50	40 min.	db

*The above data shows tube operation with helix at ground potential (Zero Volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential, provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2511 will operate over the frequency range of 7.92 to 12.524 Gcs. with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 440 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

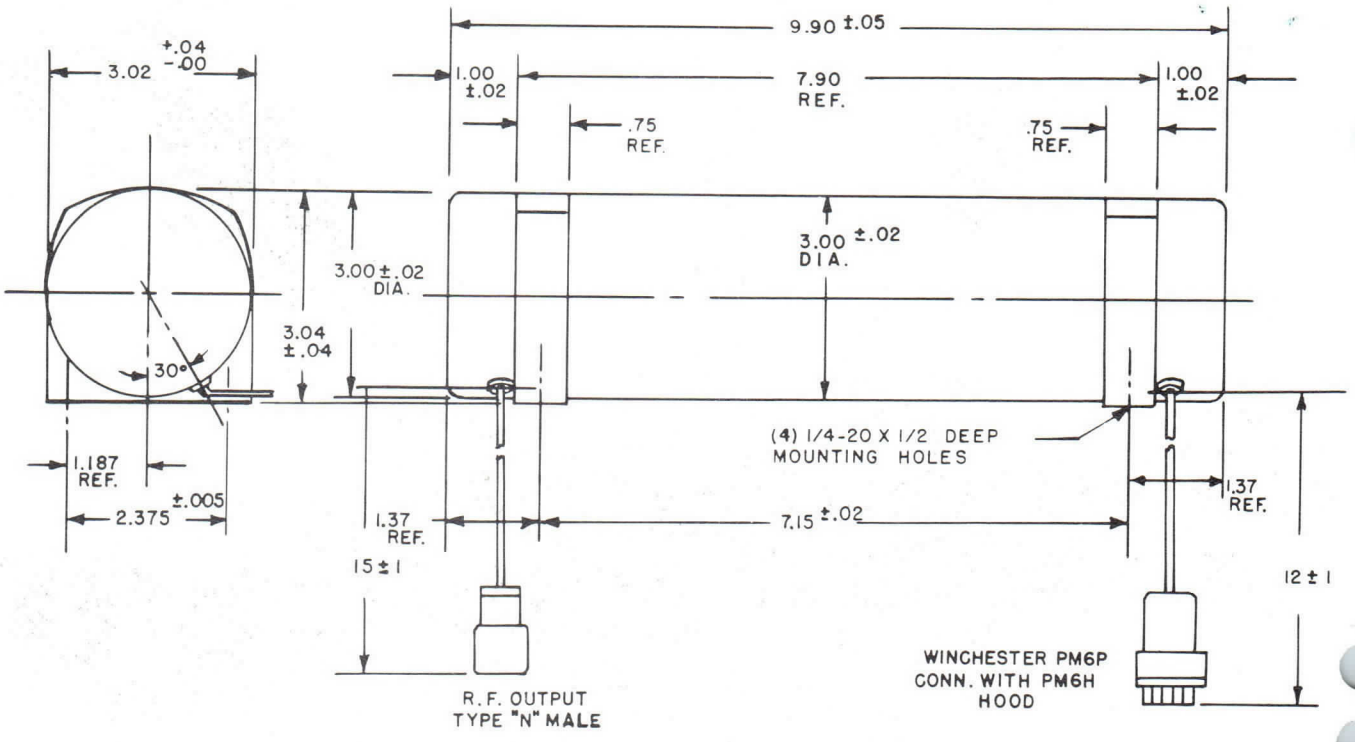
MECHANICAL

Package Length	9.9	9.95 max.	Inches
Package Diameter	3.0	3.02 max.	Inches
Package Weight	9 lbs. -14 oz.	10 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min./13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min./16 max.	Inches

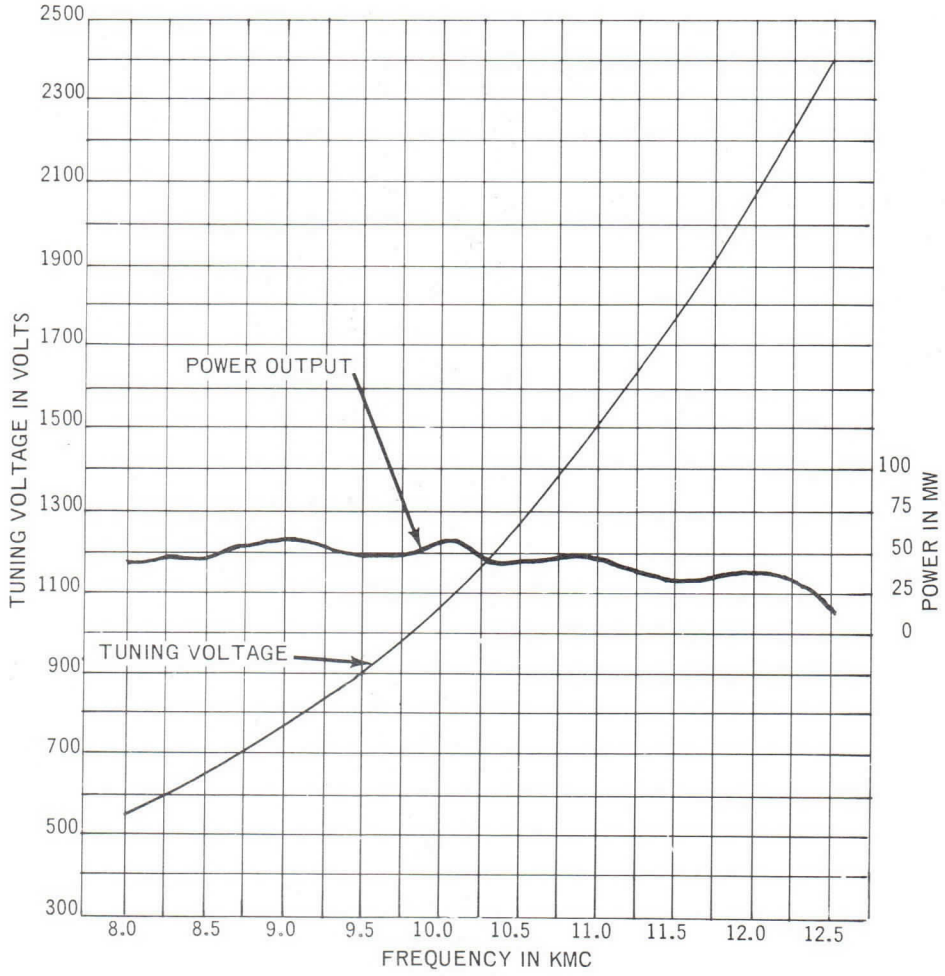
Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

F-2511



A-COLLECTOR
B-HELIX
C-HEATER
D-HEATER, CATHODE
E-ANODE
F-GRID (FOCUS)



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INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2513 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2513 is a voltage-tunable, wide-band oscillator with a minimum output power of 25 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	1.0 - 4.0	Note 1	Gcs
Power Output	25 - 150	25 min.	mw
Power Output Variation	11	15 max.	db
Fine Grain Variation, Note 2	±3	±3 max.	db/300 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./ 6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	95	250 max.	Volts
Anode Current	.15	1.0 max.	Ma
Cathode Current	12	20 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	5	8 max.	Ma
*Cathode Voltage (with respect to Helix)	-100 to -2400	-90 to -2500	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-11	-20 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	42	50 max.	μμfd.
Capacitance, Grid to all Electrodes	30	45 max.	μμfd.
Capacitance, Helix to all other Electrodes and Capsule	220	300 max.	μμfd.
Spurious Output below Signal	50	40 min.	db

*The above data shows tube operation with helix at ground potential (Zero Volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential, provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2513 will operate over the frequency range of .99 to 4.04 Gcs. with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 300 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

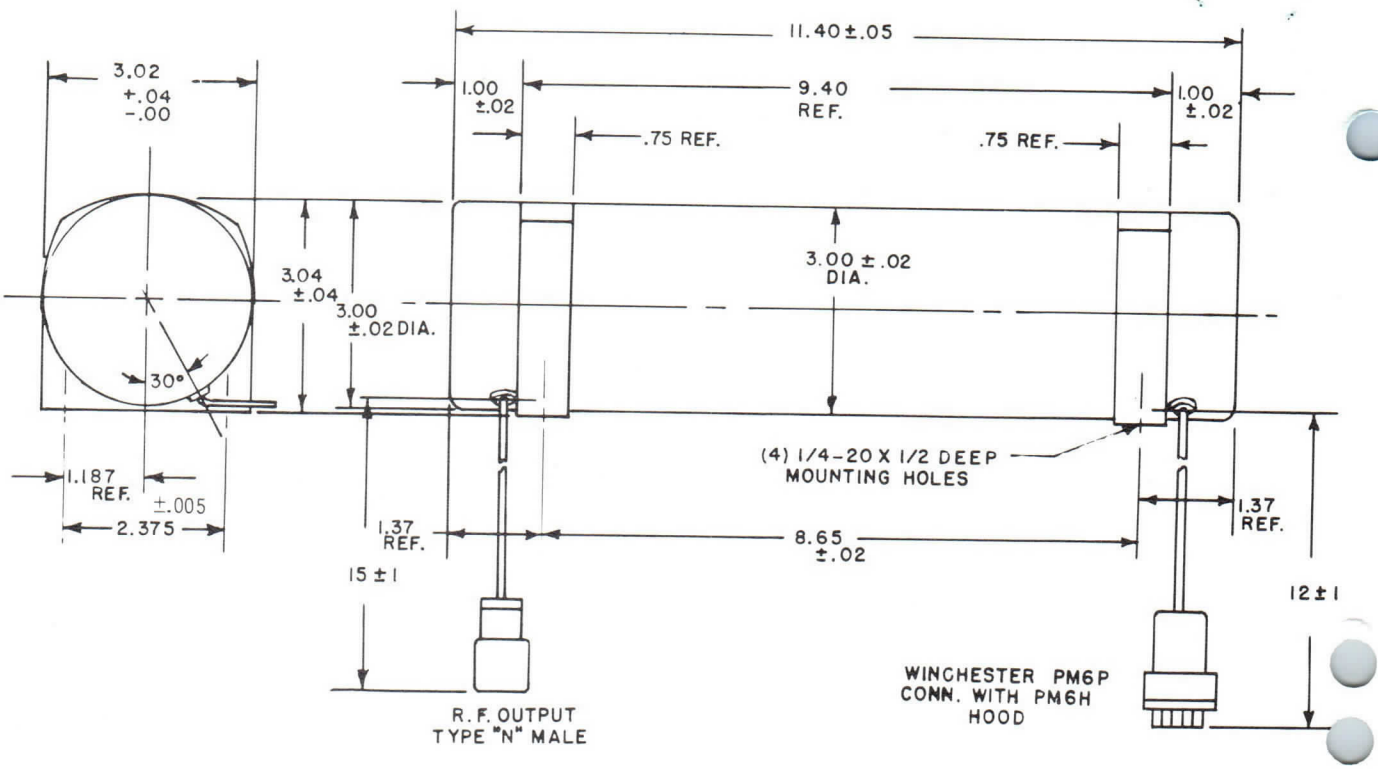
MECHANICAL

Package Length	11.40	11.45 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	14 lbs. -4 oz.	14.5 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min./13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min./16 max.	Inches

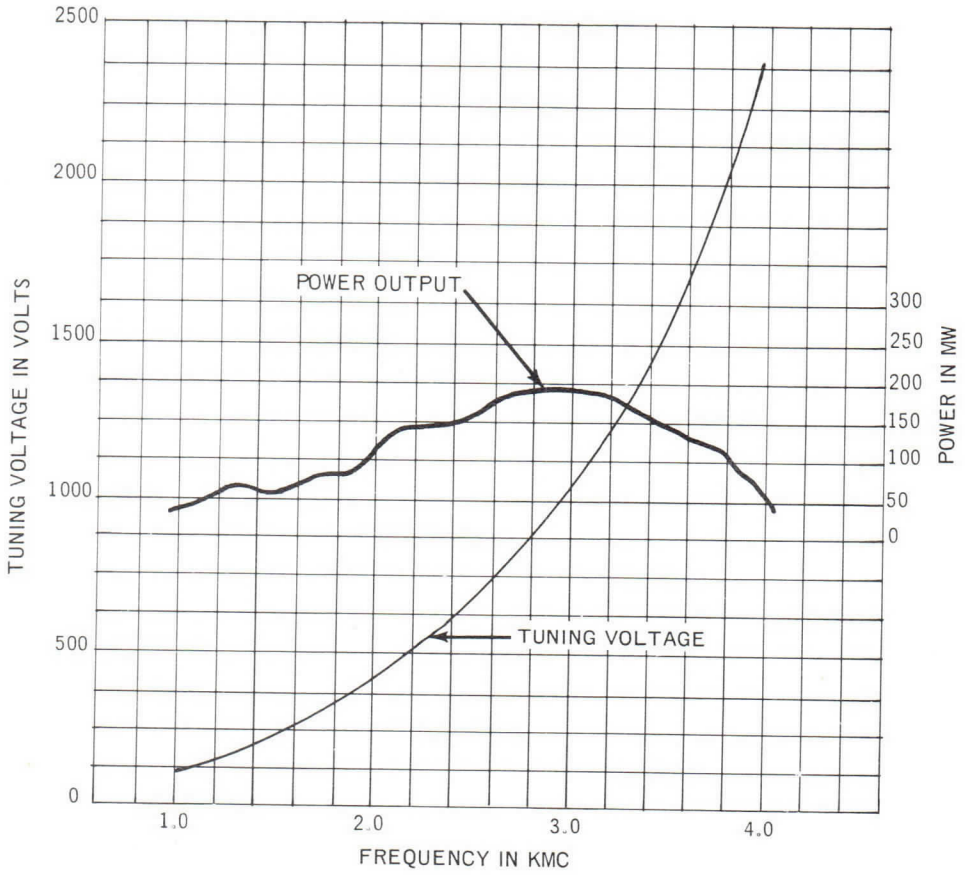
Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

F-2513



A-COLLECTOR
B-HELIX
C-HEATER
D-HEATER-CATHODE
E-ANODE
F-GRID (FOCUS)



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

F-2516 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2516 is a voltage-tunable, wide-band oscillator with a minimum output power of 20 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillators for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	5.3 - 10.3	Note 1	Gcs
Power Output	25 - 200	20 min.	mw
Power Output Variation	9	10 max.	db
Fine Grain Variation, Note 2	±2	±2.5	db/500 mc
VSWR	2.5:1	3.5:1	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./ 6.6 max.	Volts
Heater Current	0.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	200	250 max.	Volts
Anode Current	.25	1.0 max.	Ma
Cathode Current	10	15 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	4.0	6.0	Ma
*Cathode Voltage (with respect to Helix)	-245 to -2400	-200 to -2500	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to cathode)	-20	-30 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150 max.	Vdc
Capacitance, Cathode to all Electrodes	40	50 max.	μμfd.
Capacitance, Grid to all Electrodes	30	45 max.	μμfd.
Capacitance, Helex to all other Electrodes and Capsule	120	200 max.	μμfd.
Spurious Output below Signal	50	40 min.	db.

*The above data shows tube operation with helix at ground potential (Zero Volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential, provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2516 will operate over the frequency range of 5.247 to 10.4 Gcs. with a 3 db reduction in rated minimum output power.

NOTE 2 This value is determined by selecting the 500 mc region of the frequency range which has the greatest difference in power output. The difference between these power levels is divided by two and the plus or minus sign affixed to denote the difference from an average power level.

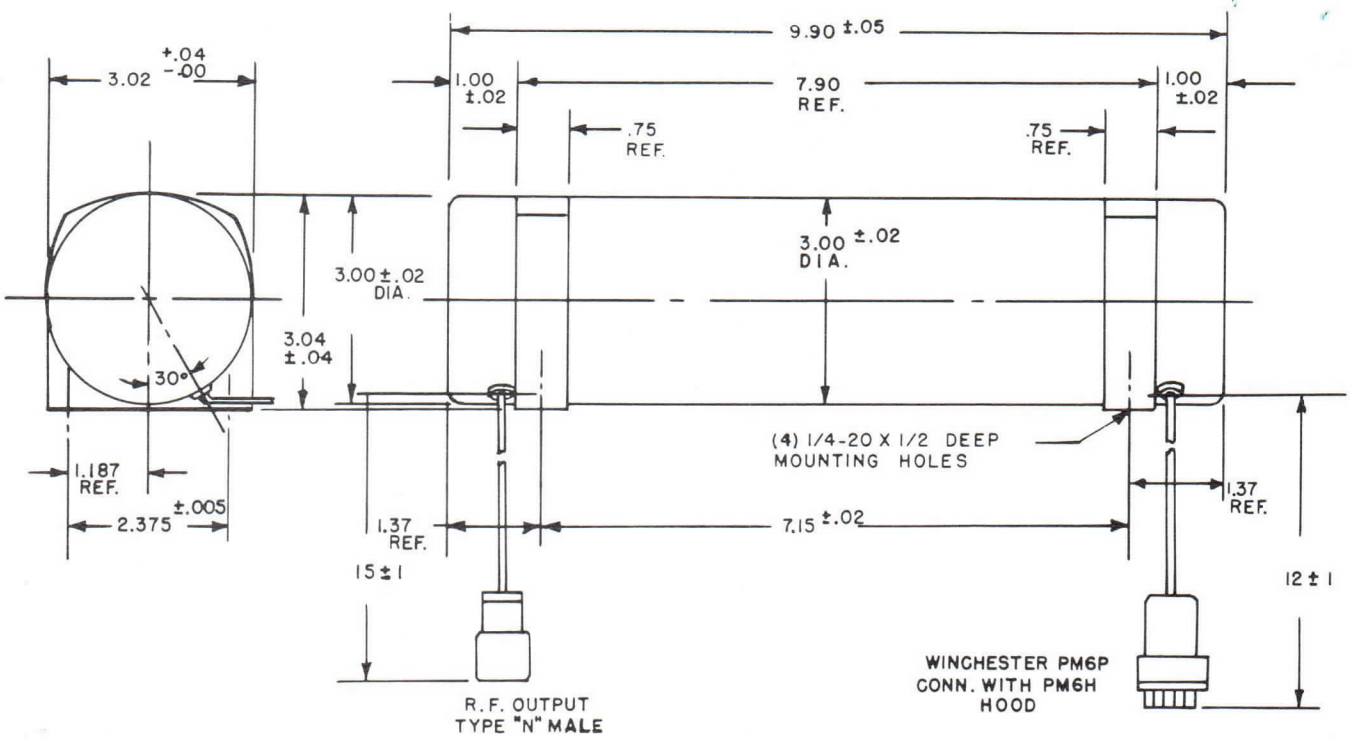
MECHANICAL

Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs. -14 oz.	10 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min./13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min./16 max.	Inches

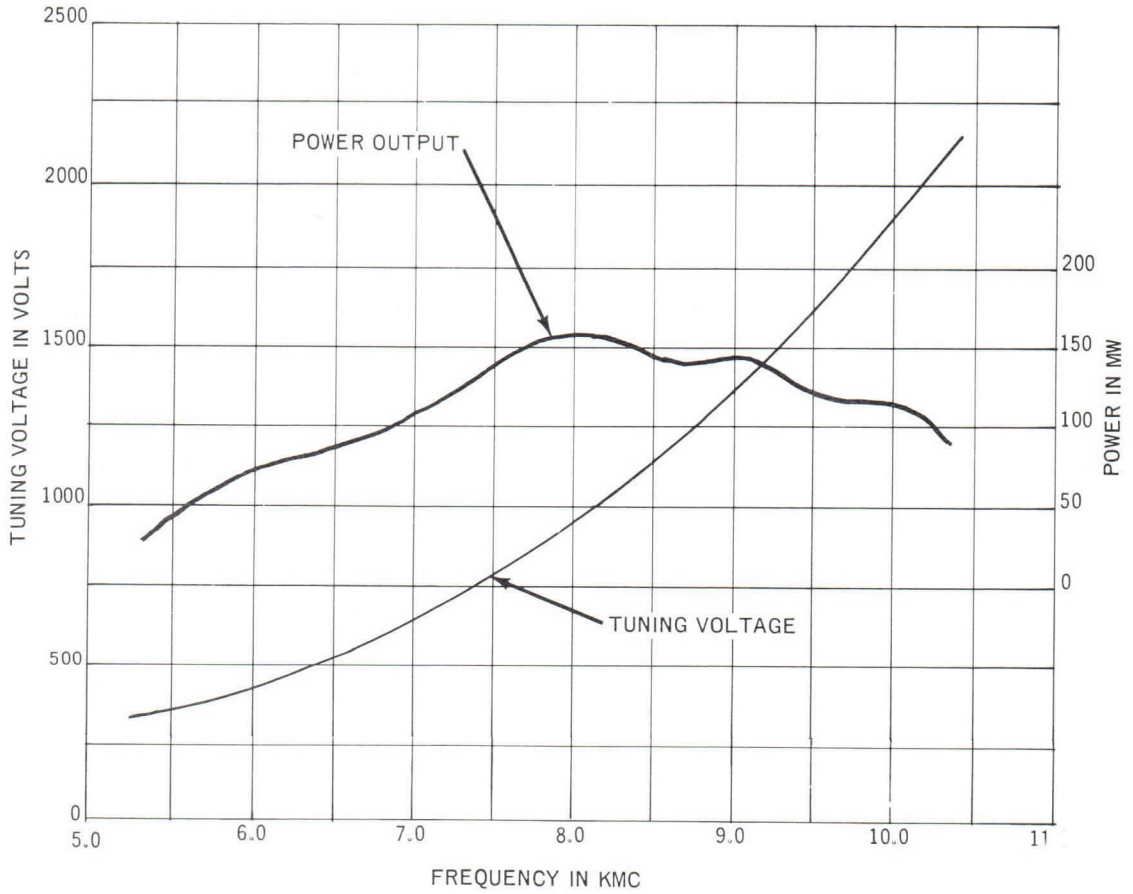
Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

F-2516



A-COLLECTOR
B-HELIX
C-HEATER
D-HEATER, CATHODE
E-ANODE
F-GRID (FOCUS)



ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2517 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2517 is a voltage-tunable, wide-band oscillator with a minimum output power of 50 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	3.7 - 5.5	Note 1	Gcs
Power Output	50 - 250	50 min.	mw
Power Output Variation	7	8 max.	db
Fine Grain Variation, Note 2	±1.5	±2 max.	db/180 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./ 6.6 max.	Volts
Heater Current	.98	1.20 max.	Amps
Anode Voltage	130	250 max.	Volts
Anode Current (with respect to Cathode)	.25	1.0 max.	Ma
Cathode Current	15.0	20 max.	Ma
Helix Voltage (with respect to Cathode	300 to 960	200 to 1100	Volts
Helix Current	1.5	3.0 max.	Ma
Cathode Voltage	Zero (ground)	Zero (ground)	Volts

	TYPICAL	ABSOLUTE	UNITS
Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-11	-30 max.	Volts
Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	42	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	30	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	210	300 max.	$\mu\mu$fd.
Spurious Output below Signal	30	40 min.	db

NOTE 1 The F-2517 will operate over the frequency range of 3.663 to 5.555 Gcs. with a 3 db reduction in the rated minimum output power.

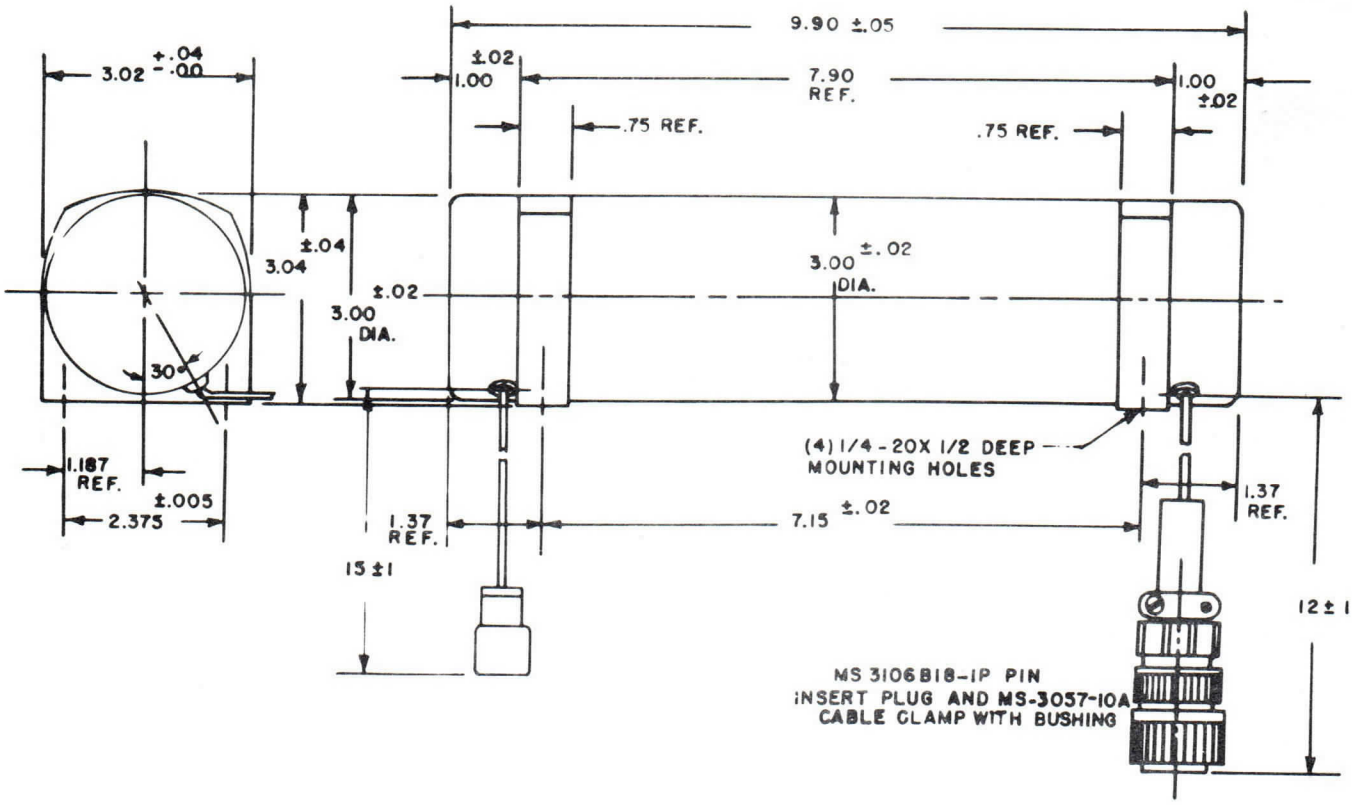
NOTE 2 This value is determined by selecting the 180 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

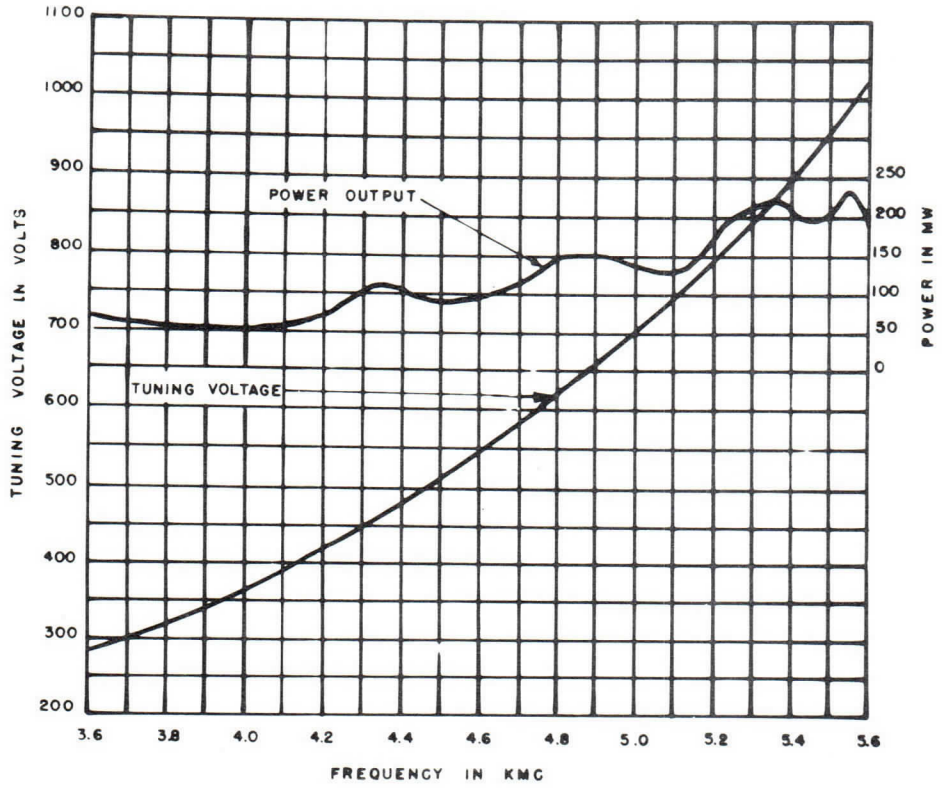
MECHANICAL

Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs. -14 oz.	10 max.	Pounds
Power Cable Length (to end of MS3106B18-IP Plug)	12	11 min./13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min./16 max.	Inches

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey


9.90 ±.05
3.02 +.04 -.00
±.02
1.00
7.90
REF.
1.00
±.02
.75 REF.
.75 REF.
±.04
3.04
3.00
DIA.
±.02
3.00 ±.02
DIA.
30°
(4) 1/4-20X 1/2 DEEP
MOUNTING HOLES
1.187
REF.
±.005
2.375
1.37
REF.
7.15 ±.02
1.37
REF.
15±1
12±1
MS 3106B18-1P PIN
INSERT PLUG AND MS-3057-10A
CABLE CLAMP WITH BUSHING


1100
1000
900
800
700
600
500
400
300
200
TUNING VOLTAGE IN VOLTS
POWER OUTPUT
TUNING VOLTAGE
250
200
150
100
50
0
POWER IN MW
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0
5.2
5.4
5.6
FREQUENCY IN KMC

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2518 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2518 is a voltage-tunable, wide-band oscillator with a minimum output power of 50 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60° C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	6.6 – 8.7	Note 1	Gcs
Power Output	50 – 150	50 min.	mw
Power Output Variation	5	6 max.	db
Fine Grain Variation, Note 2	±2.0	±2.5 max.	db/210 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min/6.6 max.	Volts
Heater Current	.97	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	225	250 max.	Volts
Anode Current	0.5	1.0 max.	Ma
Cathode Current	8.0	12 max.	Ma
Helix Voltage (with respect to Cathode)	460 to 1025	400 to 1200	Volts

	TYPICAL	ABSOLUTE	UNITS
Helix Current	3.0	5.0 max.	Ma
Cathode Voltage	Zero (Ground)	Zero (Ground)	Volts
Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	−15	−30 max.	Volts
Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	40	50 max.	μμfd.
Capacitance, Grid to all Electrodes	33	45 max.	μμfd.
Capacitance, Helix to all other Electrodes and Capsule	101	200 max.	μμfd.
Spurious Output below Signal	50	40 min.	db

NOTE 1 The F-2518 will operate over the frequency range of 6.534 to 8.787 Gcs. with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 210 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

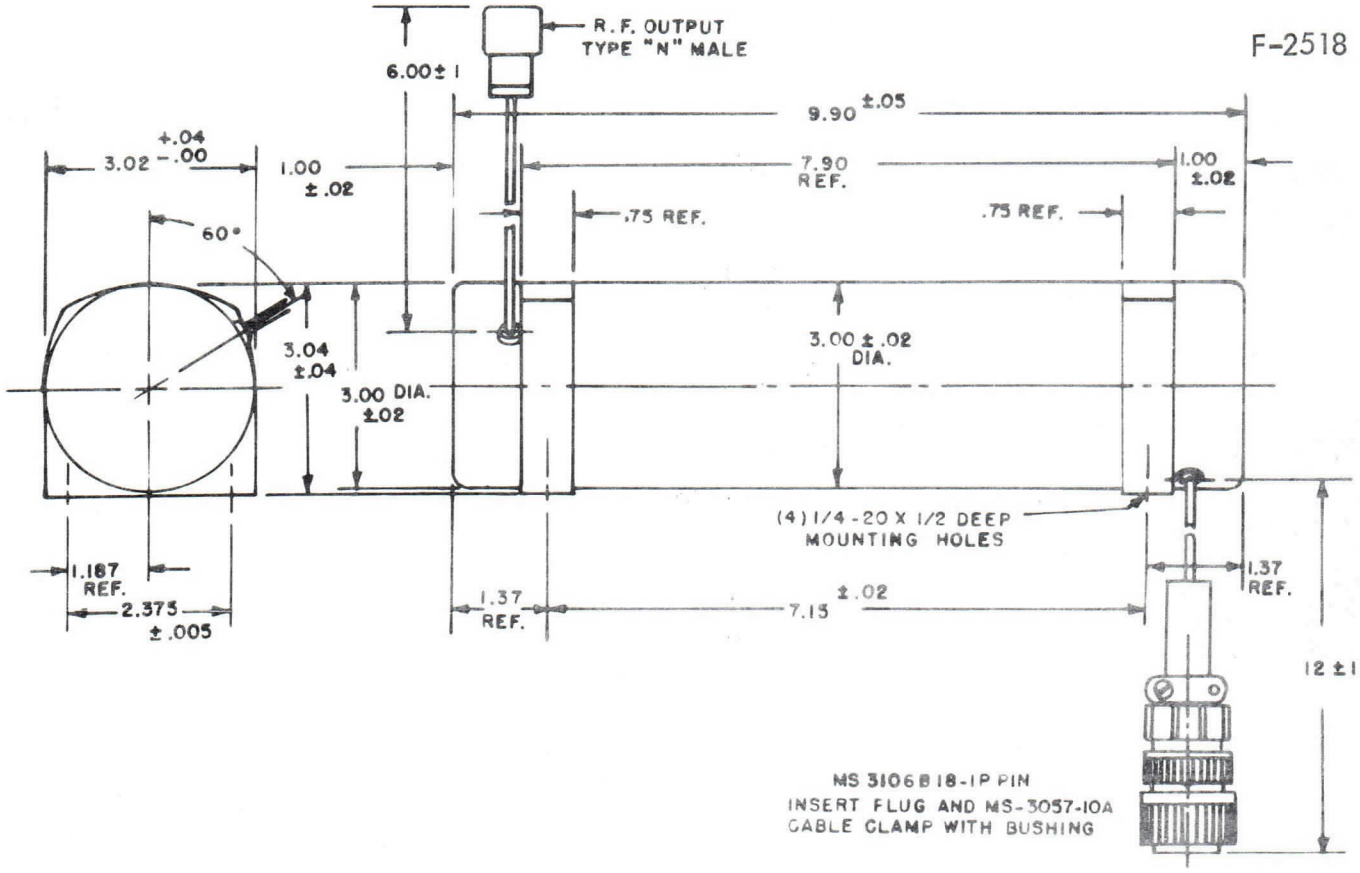
MECHANICAL

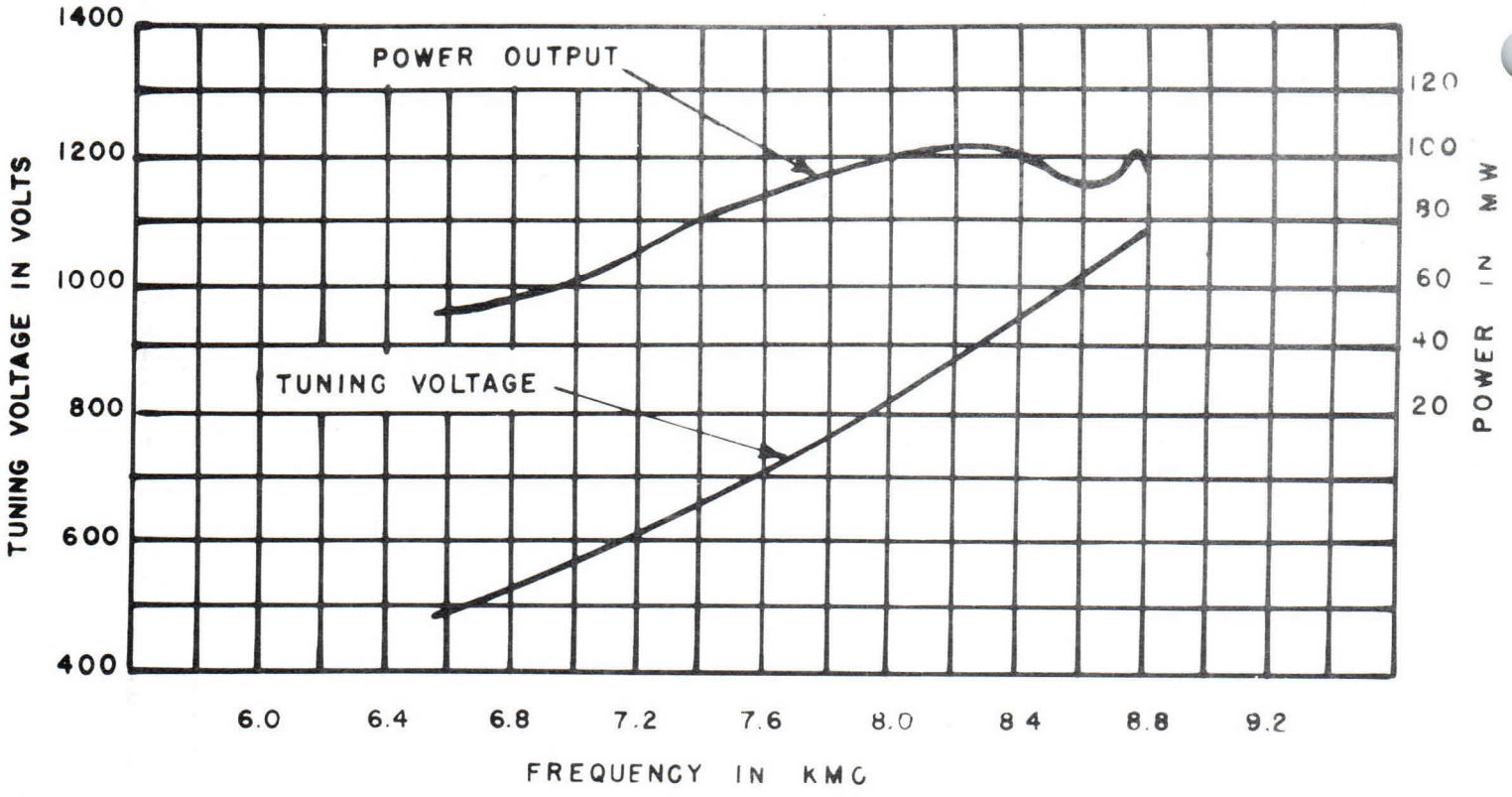
Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs.-14 oz.	10 max.	Pounds
Power Cable Length (to end of MS3106B18-IP Plug)	12	11 min/13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	6	5 min/7 max.	Inches

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

F-2518


R.F. OUTPUT
TYPE "N" MALE
6.00±1
9.90 ±.05
3.02 +.04 -.00
1.00 ±.02
7.90 REF.
1.00 ±.02
.75 REF.
.75 REF.
60°
3.04 ±.04
3.00 DIA. ±.02
3.00 ±.02 DIA.
(4) 1/4-20 X 1/2 DEEP MOUNTING HOLES
1.187 REF.
2.375 ±.005
1.37 REF.
7.15 ±.02
1.37 REF.
12 ±1
MS 3106B 18-1P PIN
INSERT PLUG AND MS-3057-10A
CABLE CLAMP WITH BUSHING


TUNING VOLTAGE IN VOLTS
1400
1200
1000
800
600
400
POWER OUTPUT
TUNING VOLTAGE
120
100
80
60
40
20
POWER IN MW
6.0
6.4
6.8
7.2
7.6
8.0
8.4
8.8
9.2
FREQUENCY IN KMC

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2519 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2519 is a voltage-tunable, wide-band oscillator with a minimum output power of 75 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60° C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	2.4 -5.3	Note 1	Gcs
Power Output	75 - 300	75 min.	mw
Power Output Variation	6	8 max.	db
Fine Grain Variation, Note 2	+1.0	+1.5 max.	db 290 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min. 6.6 max.	Volts
Heater Current	.98	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	120	250 max.	Volts
Anode Current	0.15	1.0 max.	Ma
Cathode Current	14.0	20 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	3.0	5.0 max.	Ma
*Cathode Voltage (with respect to Helix)	-220 to -1850	-150 to -2100	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-11	-30 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	42	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	30	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	220	300 max.	$\mu\mu$fd.
Spurious Output below Signal	50	40 min.	db.

*The above data shows tube operation with helix at ground potential (Zero Volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential, provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2519 will operate over the frequency range of 2.375 to 5.353 Gcs. with a 3 db reduction in the rated minimum output power.

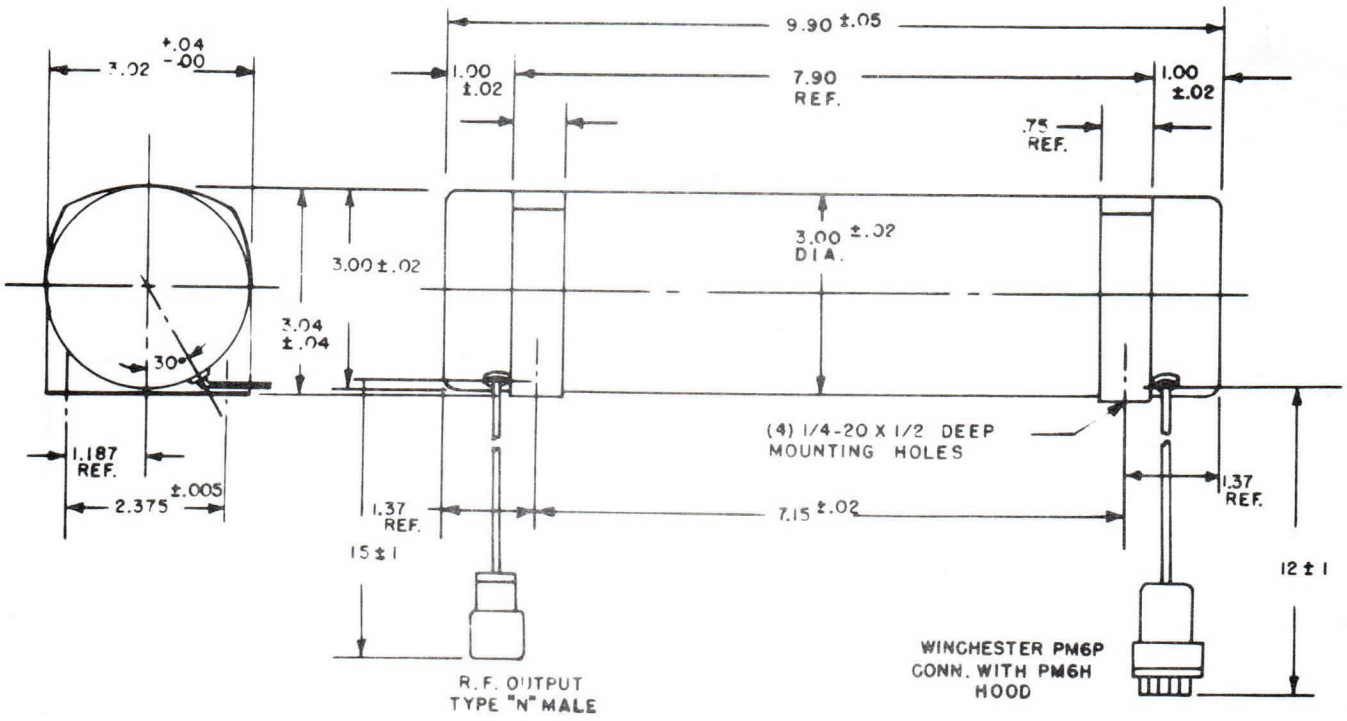
NOTE 2 This value is determined by selecting the 290 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

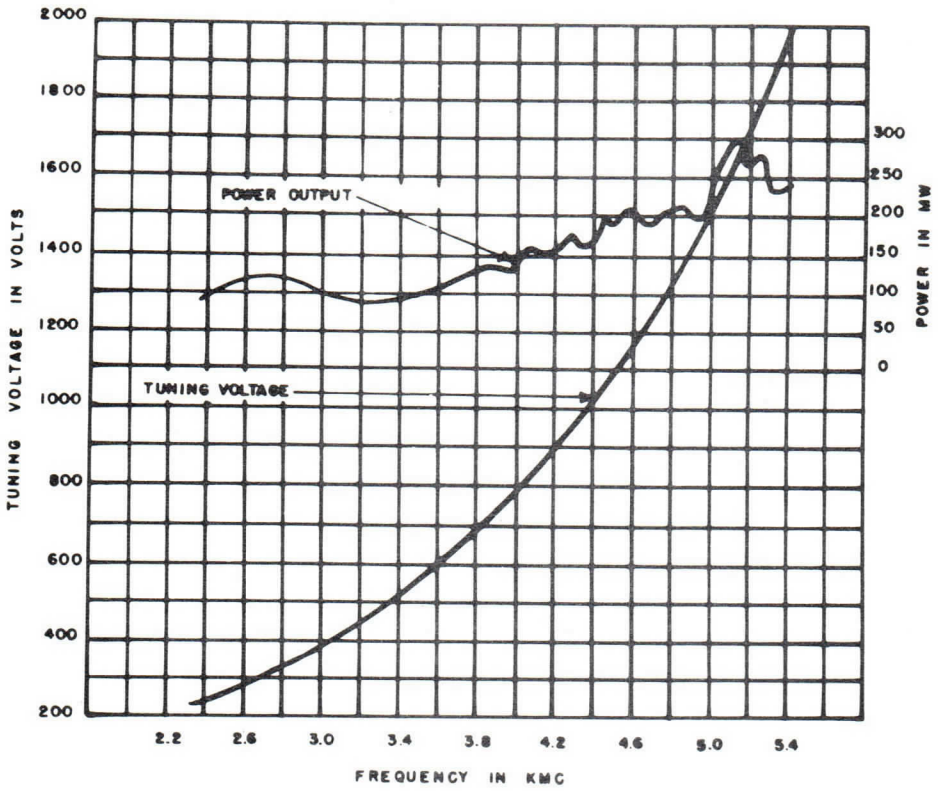
MECHANICAL

Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs. 14 oz.	10 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min./13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min./16 max.	Inches

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey


9.90 ±.05
3.02 +.04 -.00
1.00 ±.02
7.90 REF.
1.00 ±.02
.75 REF.
3.00 ±.02
3.00 ±.02 DIA.
3.04 ±.04
30°
(4) 1/4-20 X 1/2 DEEP MOUNTING HOLES
1.187 REF.
2.375 ±.005
1.37 REF.
7.15 ±.02
1.37 REF.
15 ± 1
12 ± 1
R.F. OUTPUT TYPE "N" MALE
WINCHESTER PM6P CONN. WITH PM6H HOOD


2000
1800
1600
1400
1200
1000
800
600
400
200
TUNING VOLTAGE IN VOLTS
300
250
200
150
100
50
0
POWER IN MW
POWER OUTPUT
TUNING VOLTAGE
2.2
2.6
3.0
3.4
3.8
4.2
4.6
5.0
5.4
FREQUENCY IN KMC

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2520 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2520 is a voltage-tunable, wide-band oscillator with a minimum output power of 20 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators: master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a unifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	7.0 - 12.4	Note 1	Gcs
Power Output	25 - 150	20 min.	mw
Power Output Variation	8	10 max.	db
Fine Grain Variation, Note 2	±1.5	±2 max.	db/540 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min/ 6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	200	250 max.	Volts
Anode Current	0.5	1.0 max.	Ma
Cathode Current	8.0	15 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	4.0	6.0 max.	Ma
*Cathode Voltage (with respect to Helix)	-390 to -2400	-300 to -2500	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to Cathode)	-15	-30 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150	Volts
Capacitance, Cathode to all Electrodes	40	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	30	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	80	150 max.	$\mu\mu$fd.
Spurious Output below Signal	50	40 min.	db.

*The above data shows tube operation with helix at ground potential (Zero volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential, provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2520 will operate over the frequency range of 6.93 to 12.524 Gcs. with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 540 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

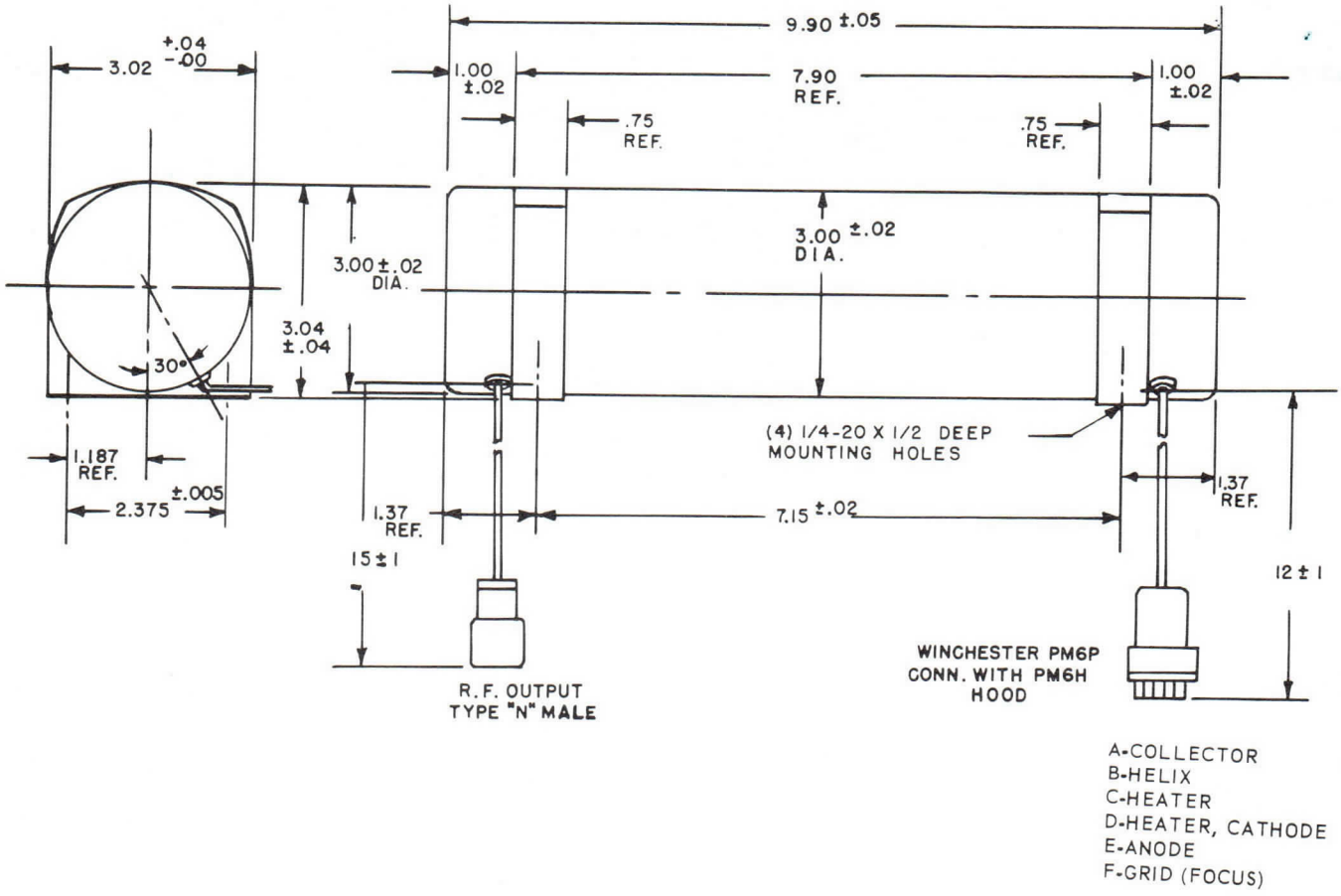
MECHANICAL

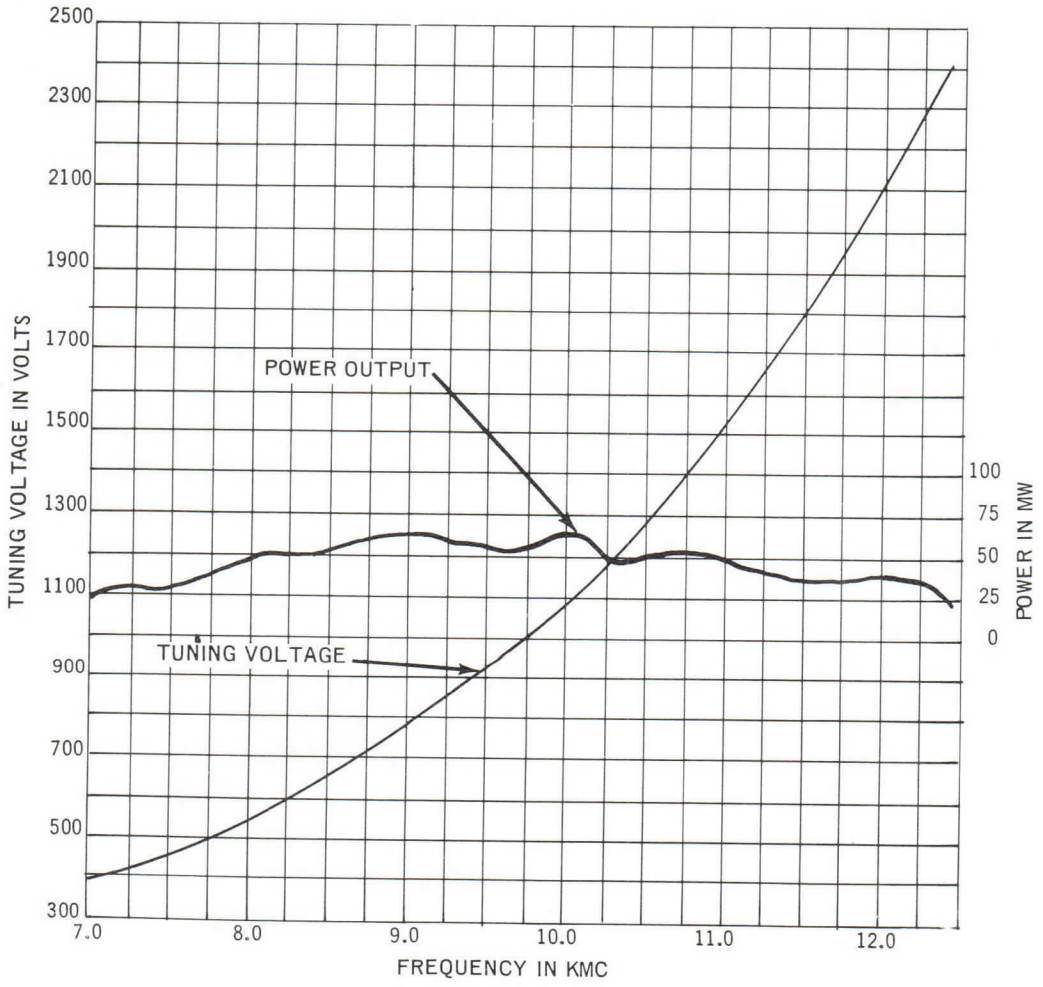
Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs. -14 oz.	10 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min/13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	15	14 min/16 max.	Inches

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

F-2520


9.90 ±.05
3.02 +.04 -.00
1.00 ±.02
7.90 REF.
1.00 ±.02
.75 REF.
.75 REF.
3.00 ±.02 DIA.
3.00 ±.02 DIA.
3.04 ±.04
30°
1.187 REF.
2.375 ±.005
1.37 REF.
7.15 ±.02
1.37 REF.
15 ± 1
12 ± 1
(4) 1/4-20 X 1/2 DEEP MOUNTING HOLES
R.F. OUTPUT TYPE "N" MALE
WINCHESTER PM6P CONN. WITH PM6H HOOD
A-COLLECTOR
B-HELIX
C-HEATER
D-HEATER, CATHODE
E-ANODE
F-GRID (FOCUS)


2500
2300
2100
1900
1700
1500
1300
1100
900
700
500
300
TUNING VOLTAGE IN VOLTS
POWER OUTPUT
TUNING VOLTAGE
100
75
50
25
0
POWER IN MW
7.0
8.0
9.0
10.0
11.0
12.0
FREQUENCY IN KMC

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

F-2521 BACKWARD WAVE OSCILLATOR

TENTATIVE

GENERAL

The F-2521 is a voltage-tunable, wide-band oscillator with a minimum output power of 250 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a bifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60° C ambient temperature.

ELECTRICAL

	TYPICAL	ABSOLUTE	UNITS
Frequency	5.4 - 5.9	Note 1, Note 3	Gcs
Power Output	250 - 480	250 min.	mw
Power Output Variation	3	4 max.	db.
Fine Grain Variation, Note 2	±.8	±1.0 max.	db/50 mc
VSWR	2.5:1	3:1 max.	—
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./ 6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to Cathode)	210	250 max.	Volts
Anode Current	.25	1.0 max.	Ma
Cathode Current	20	25 max.	Ma
*Helix Voltage	Zero	Zero	Volts
Helix Current	3.0	6.0 max.	Ma
*Cathode Voltage (with respect to Helix)	-937 to -1256	-800 to -1400	Volts

	TYPICAL	ABSOLUTE	UNITS
*Grid Voltage for no Oscillation (RF Cutoff) (with respect to cathode)	-25	-30 max.	Volts
*Collector Voltage (with respect to Helix)	+100	+150 max.	Volts
Capacitance, Cathode to all Electrodes	42	50 max.	$\mu\mu$fd.
Capacitance, Grid to all Electrodes	30	45 max.	$\mu\mu$fd.
Capacitance, Helix to all other Electrodes and Capsule	210	300 max.	$\mu\mu$fd.
Spurious Output below Signal	50	40 min.	db.

*The above data shows tube operation with helix at ground potential (Zero Volts). If desired as an alternate, any one of the asterisked elements may be operated at ground potential, provided the other electrode potentials are set at the appropriate relative levels.

NOTE 1 The F-2521 will operate over the frequency range of 5.346 to 5.959 Gcs. with a 3 db reduction in the rated minimum output power.

NOTE 2 This value is determined by selecting the 50 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

NOTE 3 The F-2521 will operate over the frequency range of 4 to 7 Gcs. at a reduced power output of not less than 20 milliwatts. Under this type of operation a typical cathode voltage range of -370 to -2390 volts will apply. However, caution must be observed that the cathode current does not exceed 14 ma and the cathode voltage does not exceed -2500 volts. A typical anode voltage of 125 volts will be required for this type of operation and the maximum anode voltage must be such that the cathode current does not exceed 14 ma.

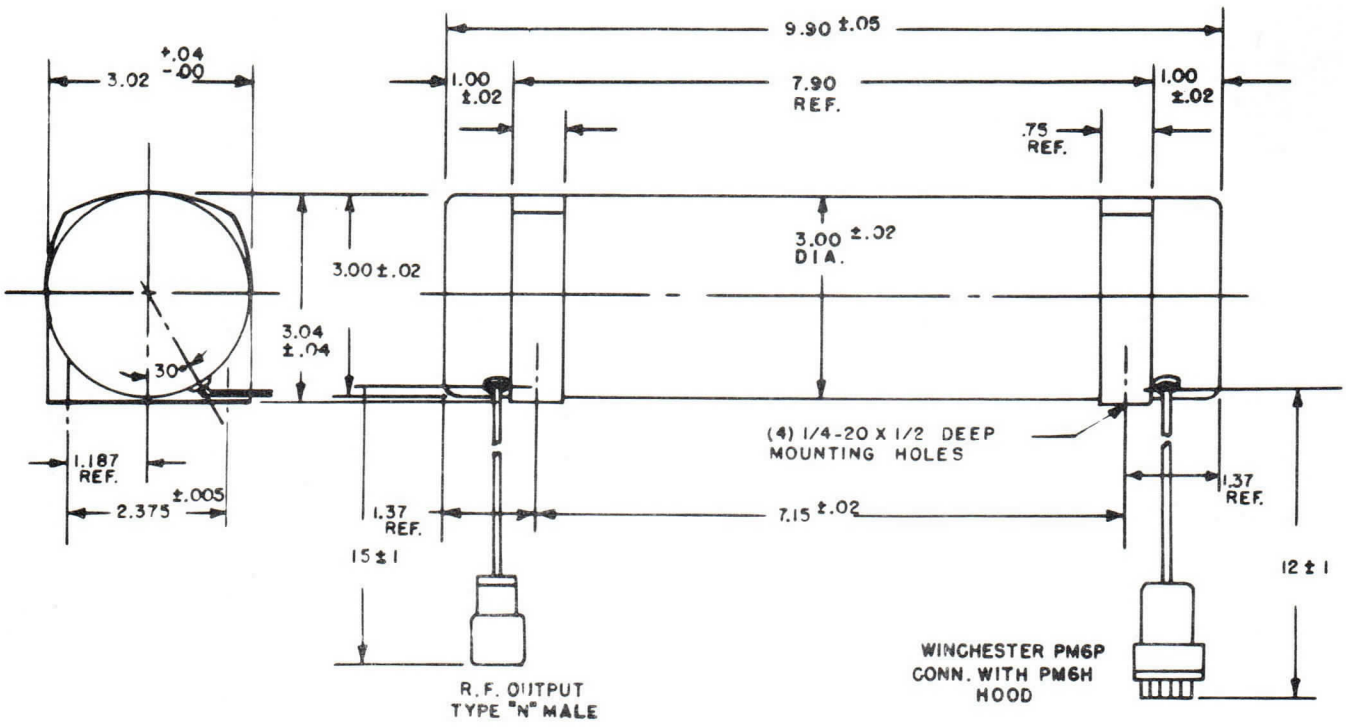
MECHANICAL

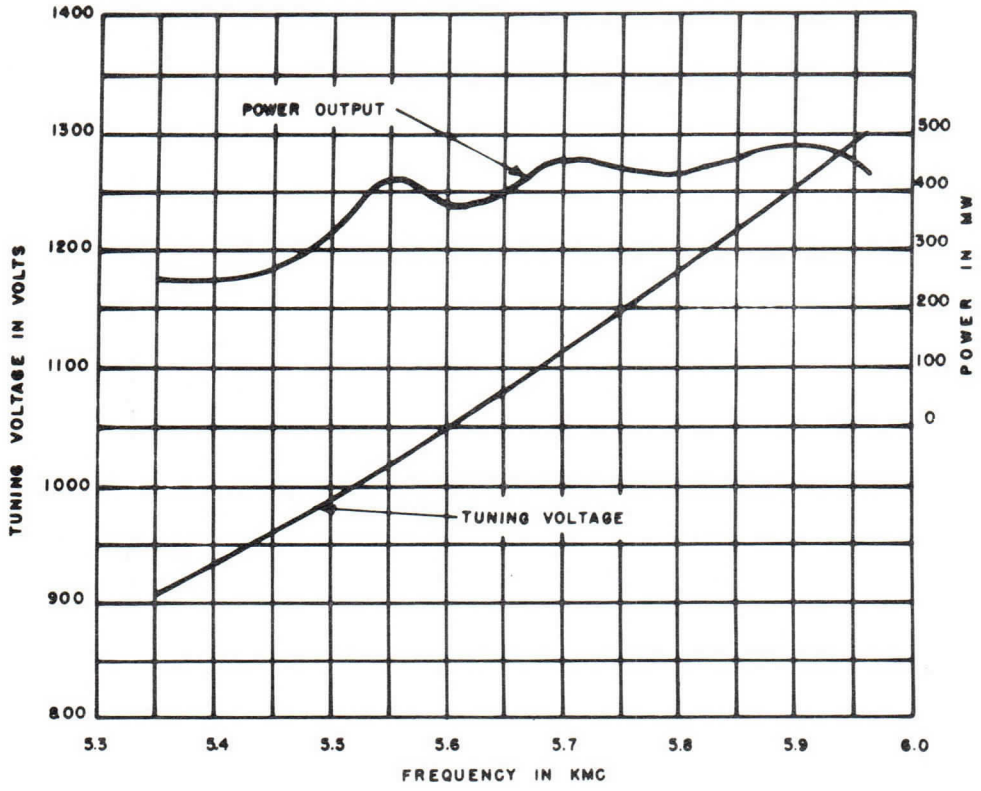
Package Length	9.90	9.95 max.	Inches
Package Diameter	3.00	3.02 max.	Inches
Package Weight	9 lbs.-14 oz.	10 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min/13 max.	Inches
Output Cable Length (to end of type "N" Connector)	15	14 min/16 max.	Inches

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Electron Tube Division
Post Office Box 104
Clifton, New Jersey

4/63


9.90 ±.05
3.02 +.04 -.00
1.00 ±.02
7.90 REF.
1.00 ±.02
.75 REF.
3.00 ±.02
3.00 ±.02 DIA.
3.04 ±.04
30°
(4) 1/4-20 X 1/2 DEEP MOUNTING HOLES
1.187 REF.
2.375 ±.005
1.37 REF.
7.15 ±.02
1.37 REF.
15 ± 1
12 ± 1
R.F. OUTPUT TYPE "N" MALE
WINCHESTER PM6P CONN. WITH PM6H HOOD


POWER OUTPUT
TUNING VOLTAGE
TUNING VOLTAGE IN VOLTS
1400
1300
1200
1100
1000
900
800
POWER IN MW
500
400
300
200
100
0
5.3
5.4
5.5
5.6
5.7
5.8
5.9
6.0
FREQUENCY IN KMC

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

F-2544
Backward Wave
Oscillator

TENTATIVE

GENERAL:

The F-2544 is a voltage-tunable, wide-band oscillator with a minimum output power of 10 milliwatts over its rated operating frequency range. This permanent magnet focused, highly stable device finds applications as a swept signal source in signal generators; master oscillator for frequency diversity transmitters; or typically as a local oscillator in radar or ECM receivers. The tube features a unifilar helix contained in a rugged envelope of simple mechanical design thus providing a highly reliable, compact unit. No cooling is required when the environment is below +60°C ambient temperature.

ELECTRICAL:	Typical	Absolute	Units
Frequency	4.0 - 8.0	-	Gcs
Power Output	15 - 200	10 min.	mw
Power Output Variation	10	12 max.	db
Fine Gain Variation, Note 1	±2.0	±2.5 max.	db/400 mc
VSWR	2.5:1	3:1 max.	-
Output Impedance	50	50	Ohms
Heater Voltage	6.3	6.0 min./6.6 max.	Volts
Heater Current	.96	1.2 max.	Amps
Anode Voltage (with respect to cathode)	150	250 max.	Volts
Anode Current	0.3	1.0 max.	Ma
Cathode Current	12	15 max.	Ma

	Typical	Absolute	Units
Helix Voltage	Zero	Zero	Volts
Helix Current	3.5	6.0 max.	Ma
Cathode Voltage (with respect to helix)	-215 to -1700	-180 to -2000	Volts
Grid Voltage for no Oscillation (RF Cutoff) (with respect to cathode)	-13	-30 max.	Volts
Collector Voltage	Zero	Zero	Volts
Capacitance, Cathode to all Electrodes	18	25 max.	μfd.
Capacitance, Cathode to all Electrodes	15	25 max.	μfd.
Capacitance, Helix to all other Electrodes & Capsule	170	200 max.	μfd.
Spurious Output below Signal	50	40 min.	db

Note 1. This value is determined by selecting the 400 mc region of the frequency range which has the greatest differences in power output. The difference between these power levels is divided by two and the plus or minus sign is affixed to denote the difference from an average power level.

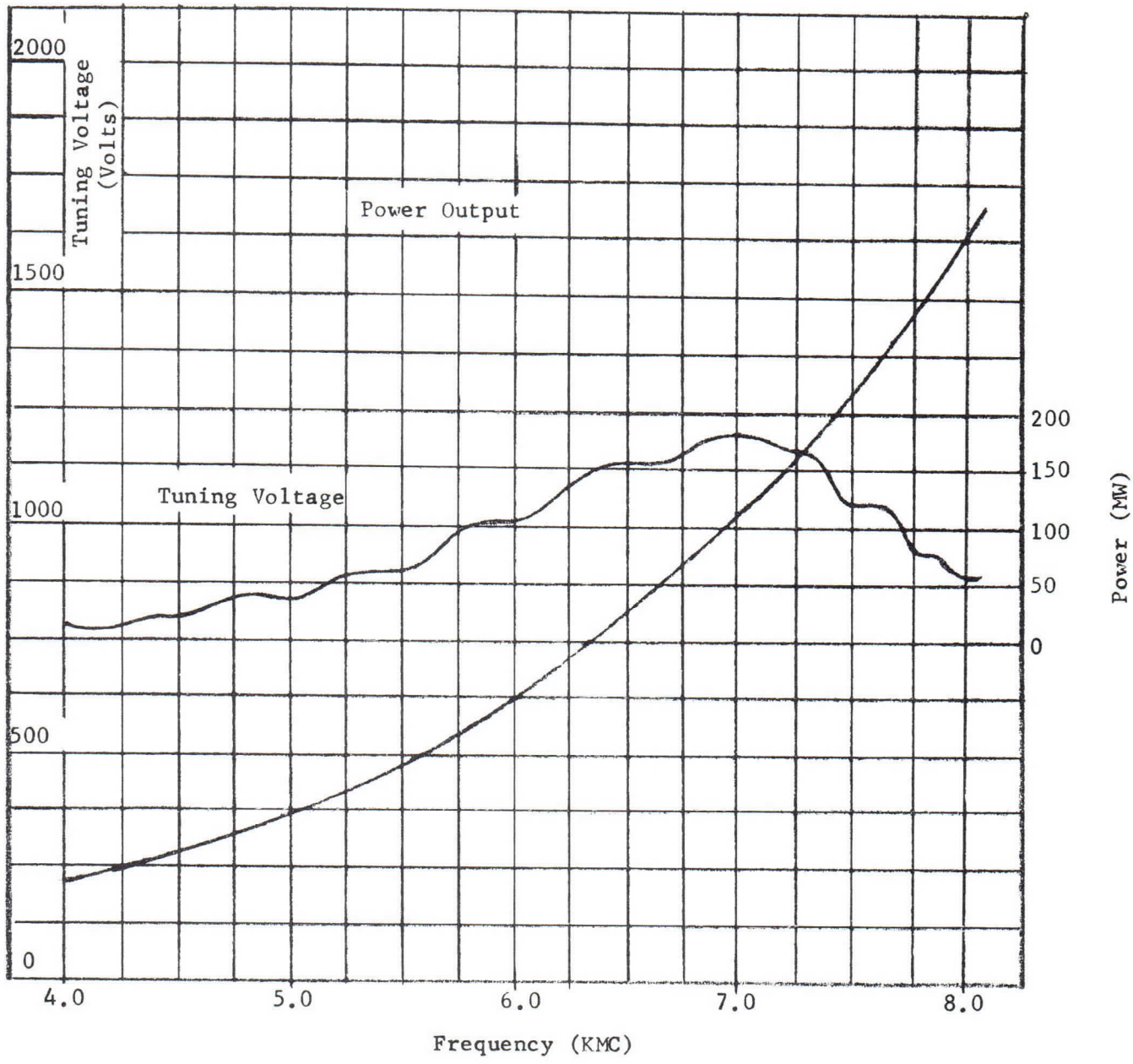
MECHANICAL:

Package Length	7.06	7.08 max.	Inches
Package Diameter	2.50	2.52 max.	Inches
Package Weight	3 lbs., 6 oz.	3.5 max.	Pounds
Power Cable Length (to end of Winchester PM6P Connector)	12	11 min./13 max.	Inches
Output Cable Length (to end of Type "N" Connector)	10 1/2	9 1/2 min./ 11 1/2 max.	Inches

Typical

Tuning Curve and Power Output

BWO Type F-2544



3/64

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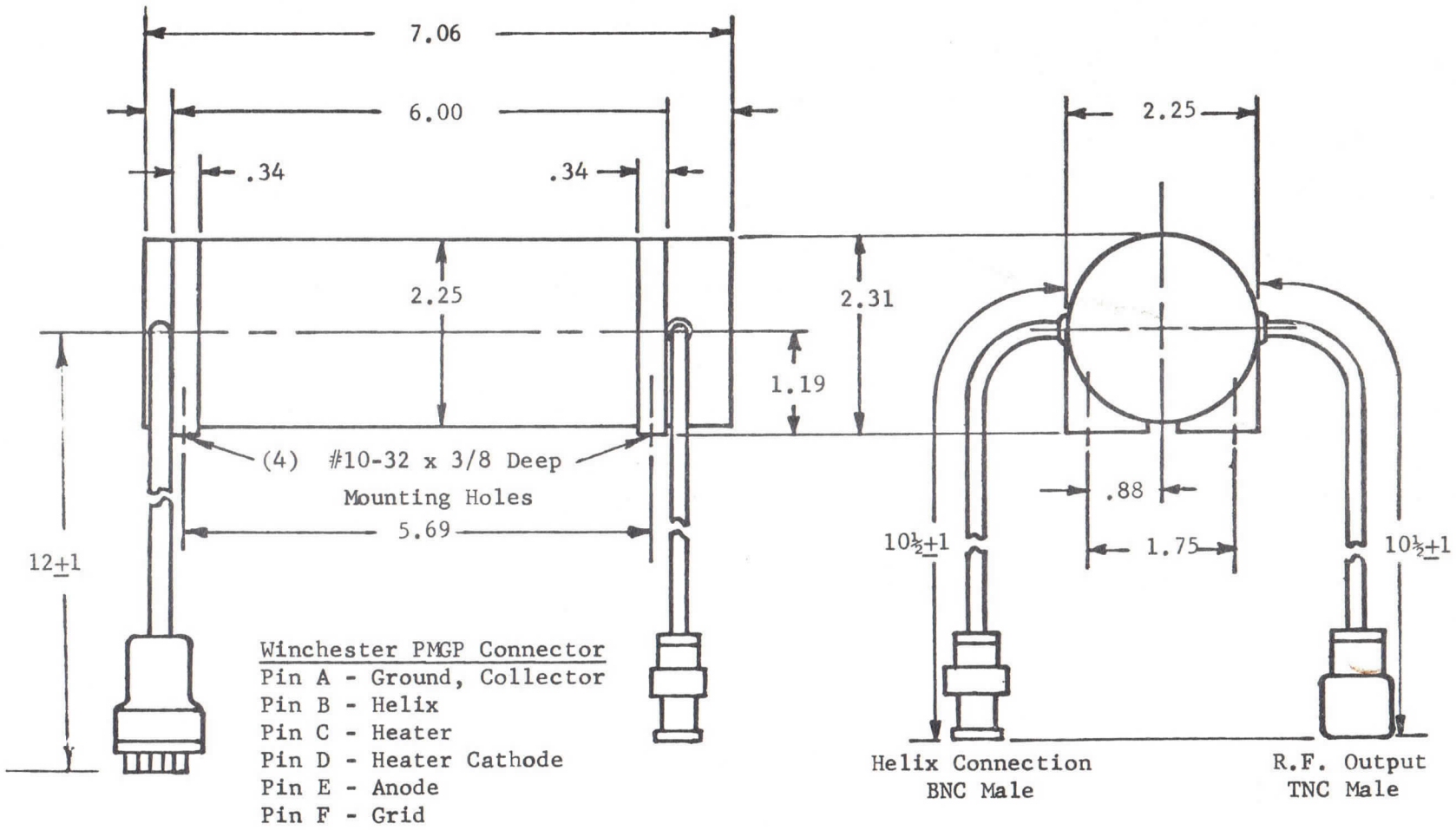
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION



TENTATIVE

Permanent-Magnet Backward-Wave Oscillator

F-2544

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

F-2900 REFLEX KLYSTRON

DESCRIPTION:

Type F-2900 Reflex Klystrons are millimeter wavelength tubes designed for operation in the 33 to 38 Gc frequency range. Each tube is fixed tuned and will deliver a minimum power output of one watt at its specific operating frequency in this range.*

The specific operating frequency may be shifted 2% while maintaining a minimum output of 1 watt, by using the MT-80 mechanical tuner which is available as an optional accessory.

The electronic tuning range as measured between the half power points is 0.1% of the specific operating frequency.

The small size and rugged construction of these tubes make them suitable as test equipment primary signal sources, receiver local oscillators, parametric amplifier pumps and low power transmitters.

TYPICAL OPERATION:

Operating Frequency	34.7	Gc	Grid Voltage (with respect to cathode)	−50	Volts
Beam Voltage	2000	Volts	Power Output	1.1	Watt
Beam Current	40	ma	Electronic Tuning (between 3 db points)	35	mc
Reflector Voltage (with respect to cathode)	−780	Volts	Heater Voltage	6.3	Volts
			Heater Current	1.2	Amperes

MAXIMUM RATINGS:

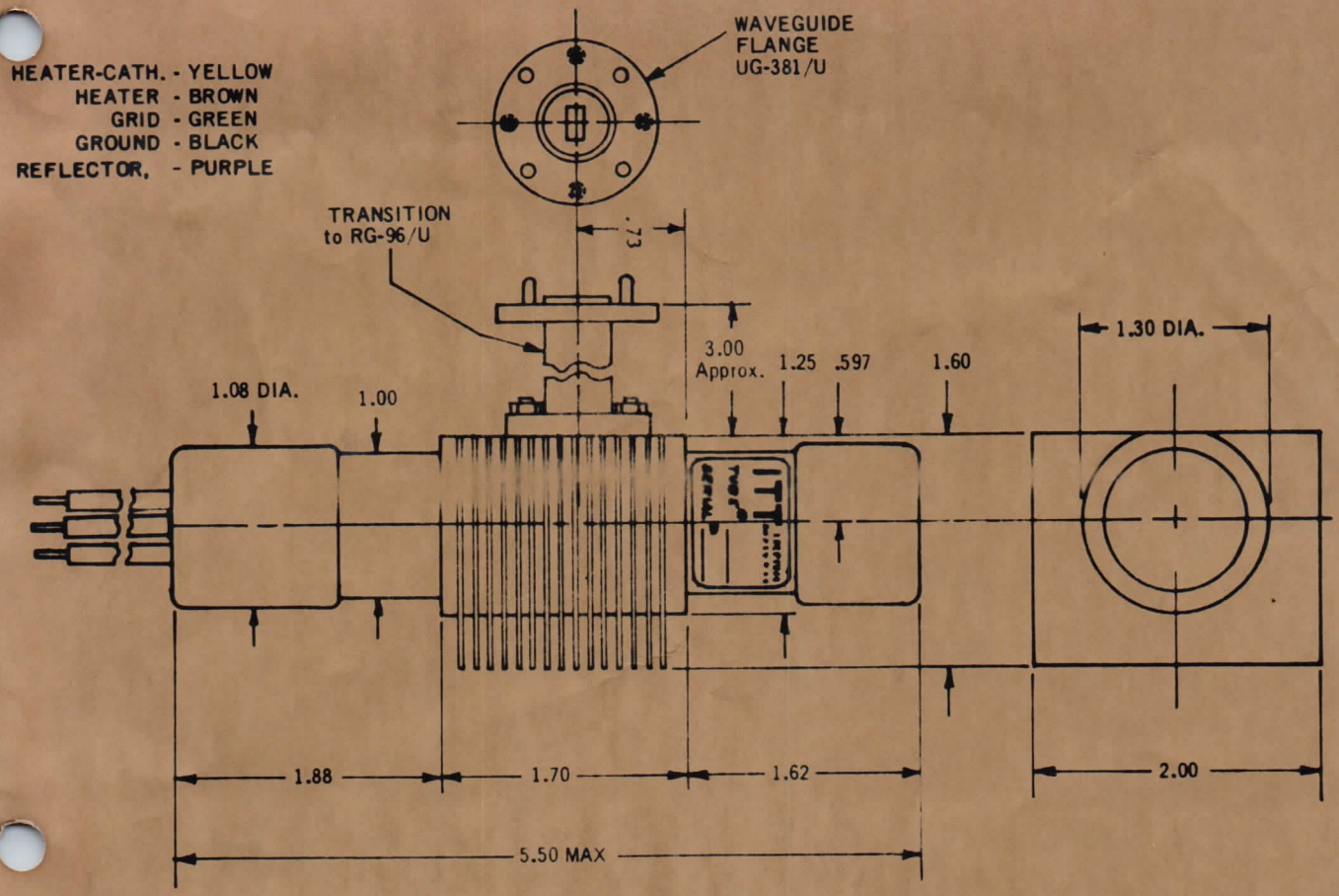
Beam Voltage	2500	Volts	Reflector Voltage	−25 to −1000	Volts
Beam Current	50	ma	Grid Voltage	0 to −100	Volts

MECHANICAL SPECIFICATIONS:

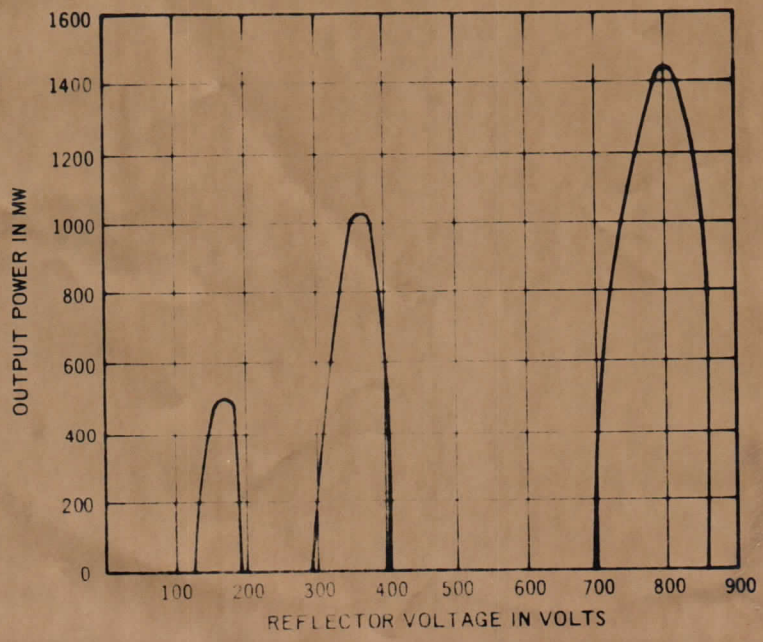
Cathode	Dispenser Type	Physical Dimensions		See Outline Drawing
Cooling	Forced Air	RF Connection	UG-381/U Flange RG-96/U Waveguide	
Weight	20 oz.			
Base Connection	Flying Leads	Mounting Position		Any

* Specify frequency required when ordering.

8mm REFLEX KLYSTRON OUTLINE



OUTPUT MODE PATTERN VERSUS REFLECTOR VOLTAGE FOR TUBE TYPE F-2900



TENTATIVE

DESCRIPTION:

The F-6658 is a 1 to 5 watt CW traveling wave amplifier tube having 30 db gain and 1700 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. A control grid suitable for use as a gain control is provided. The tube is suitable for either CW or pulse service, utilizing the full bandwidth or portions of it. It is also suitable for frequency shifting, such as serrodyne operation.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater Current	2.5	amperes
Maximum Anode Voltage (Note 1)	1250	volts
Maximum Shell Current (Note 2)	5	ma
Maximum Collector Voltage (Note 3)	1550	volts
Maximum Collector Dissipation (Note 4)	100	watts
Maximum Control Electrode Voltage (Note 5)	-250	volts

ELECTRICAL INFORMATION:

Maximum Frequency	4000	mc
Minimum Frequency	1700	mc
Minimum Cold Transmission Loss	50	db
Capacitance		
Control Electrode to all other Elements	12	μμfd
All Gun Elements to Shell	4.5	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential
Base, Small Shell Duodecal, 5 Pin	JEDEC Designation B-5-57
Type of Envelope	Metal
Magnetic Field Strength (Nominal)	750 gauss
Length of Magnetic Field	6.75 inches uniform
Mounting Position	Any
Weight (not including Magnet)	1 pound, 7 ounces
R-F Connections	50 ohm coax with Type N Jack UG-23B/U
Type of Cooling	Forced Air
Glass Temperature	160°C max.
Cooling Air Required (Note 4)	10 cfm

TYPICAL OPERATION AS POWER AMPLIFIER:

Anode Voltage	1000	volts
Shell Current	3	ma
Collector Voltage	1100	volts
Collector Current	47	ma
Control Electrode Voltage	0	volts
Power Output (see Curves)	1	watt
Gain (see Curves)	30	db nominal
Duty Cycle		
R-F	Variable to 1.0	
Beam	1.0	

TYPICAL OPERATION AS LINEAR AMPLIFIER:
(Input powers less than -10 dbm)

Anode Voltage	900	volts
Shell Current	2.0	ma
Collector Voltage	1000	volts
Collector Current	40	ma
Control Electrode Voltage	0	volts
Gain (see Curves)	35	db nominal
Noise Figure	30	db
Duty Cycle		
R-F	Variable to 1.0	
Beam	1.0	

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at approximate ground potential and the d-c connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between the cathode current and collector current. Since this current, in general, should be minimized, it is desirable to measure the current from shell to ground. It is recommended that overload protection be provided to remove high voltage if the shell current exceeds 5 milliamperes.

Note 3: It is generally desirable to operate the collector at 100 to 200 volts positive with respect to shell, and potential difference between collector and shell should be limited to 300 volts maximum.

Note 4: Forced air cooling of collector is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 100 watts, a minimum air flow of 10 cfm through the cooling fins is required.

Note 5: This electrode is a remote cutoff grid, suitable for use as a gain control providing approximately 30 db control range but is not suitable for low level pulsing of the beam. It is recommended that, where feasible, provision should be made to operate the tube with small voltage on this electrode (-5 to -10 volts) as this permits operation of the tube at approximately optimum conditions with very low interception (shell current). It may also be operated fixed at cathode potential, if desired.

OPERATING PROCEDURE:

(1) Insert tube in solenoid, secure in place with stops provided, make connections.

(2) Turn on cooling air, solenoid voltage (adjust to approximately 750 gauss), heater voltage, collector voltage (if used), control electrode voltage (if used).

(3) Raise high voltage to desired value, readjusting magnetic field if necessary to obtain minimum shell current. At no time should shell current exceed 5 ma.

(4) After initial set up as above, tube voltages may be applied simultaneously; however, it is recommended that heater voltage, solenoid voltage, and cooling air be supplied at least 2 minutes before applying high voltage. Observance of the 5 ma maximum limit for shell current is essential to prevent tube damage.

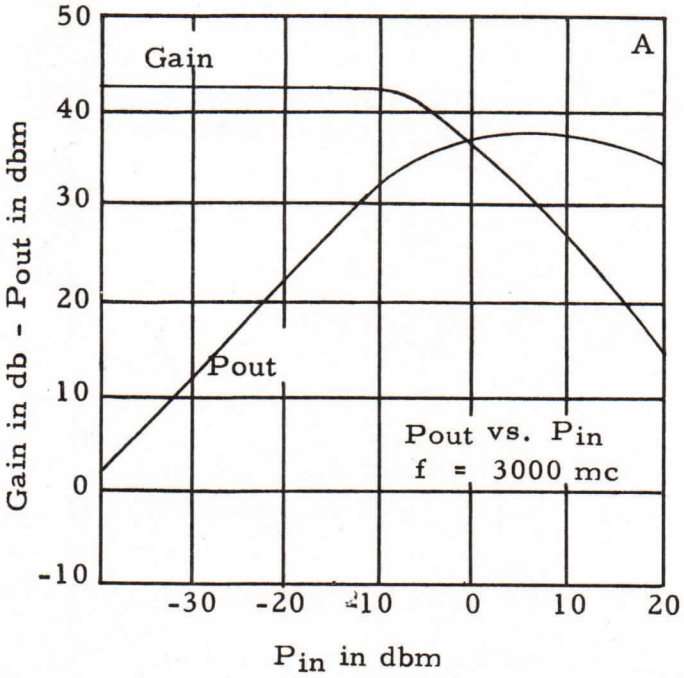
The data presented here is representative of operation of this type as an amplifier with maximum bandwidth and does not indicate the maximum performance obtainable under specific conditions, particularly narrower bandwidths.

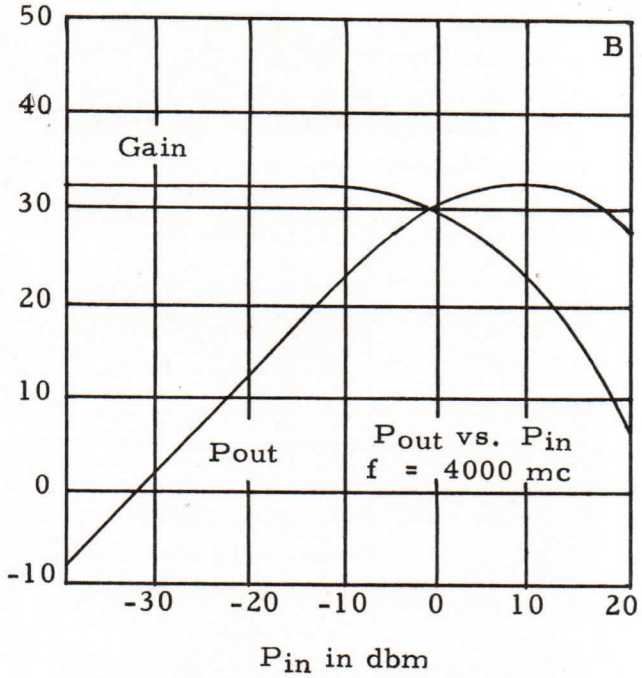
Standard solenoids to operate this tube are available, and solenoids designed for particular applications can be supplied.

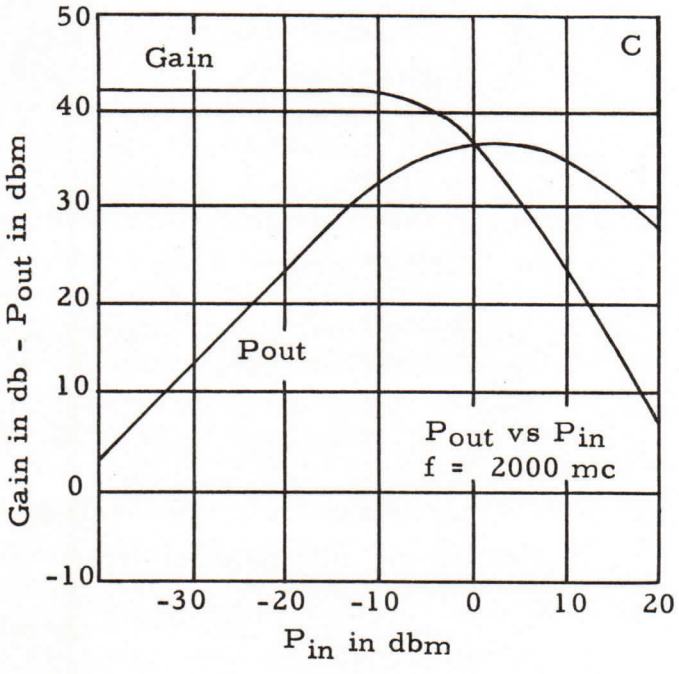
Additional information for specific applications can be obtained from the

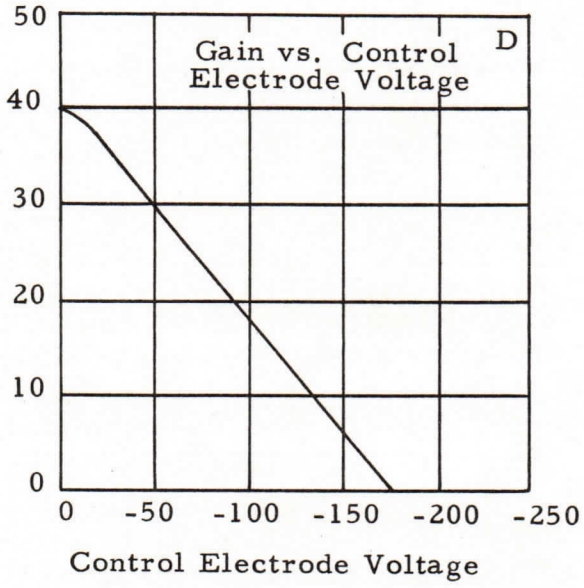
Electron Tube Applications Section
ITT Components Division
Box 7065
ROANOKE, VIRGINIA

TYPICAL CHARACTERISTICS

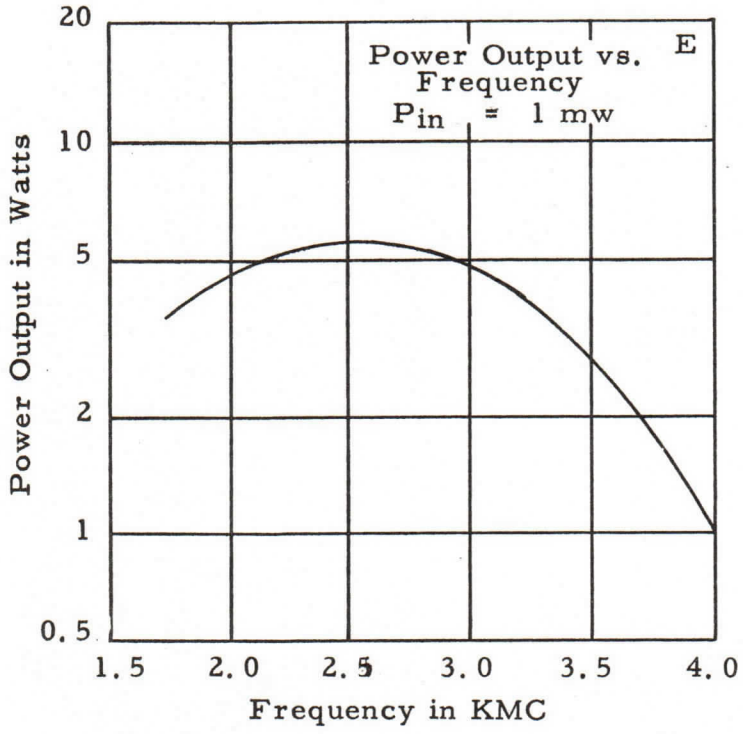








TYPICAL CHARACTERISTICS

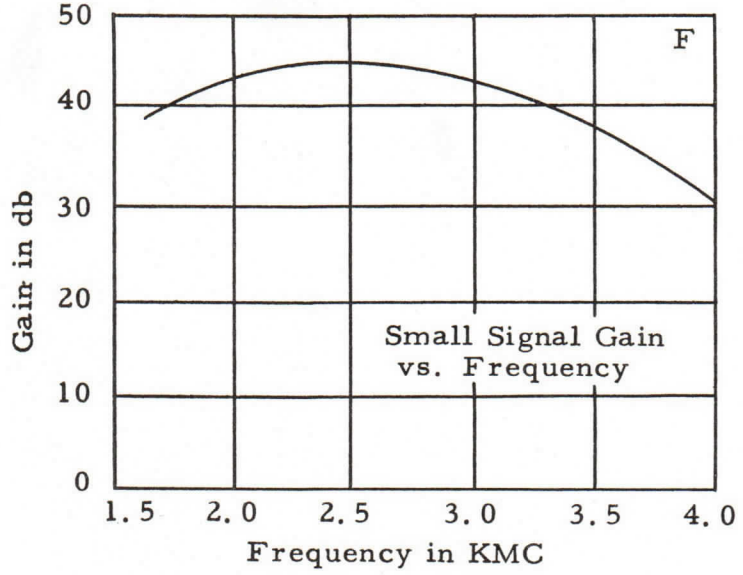


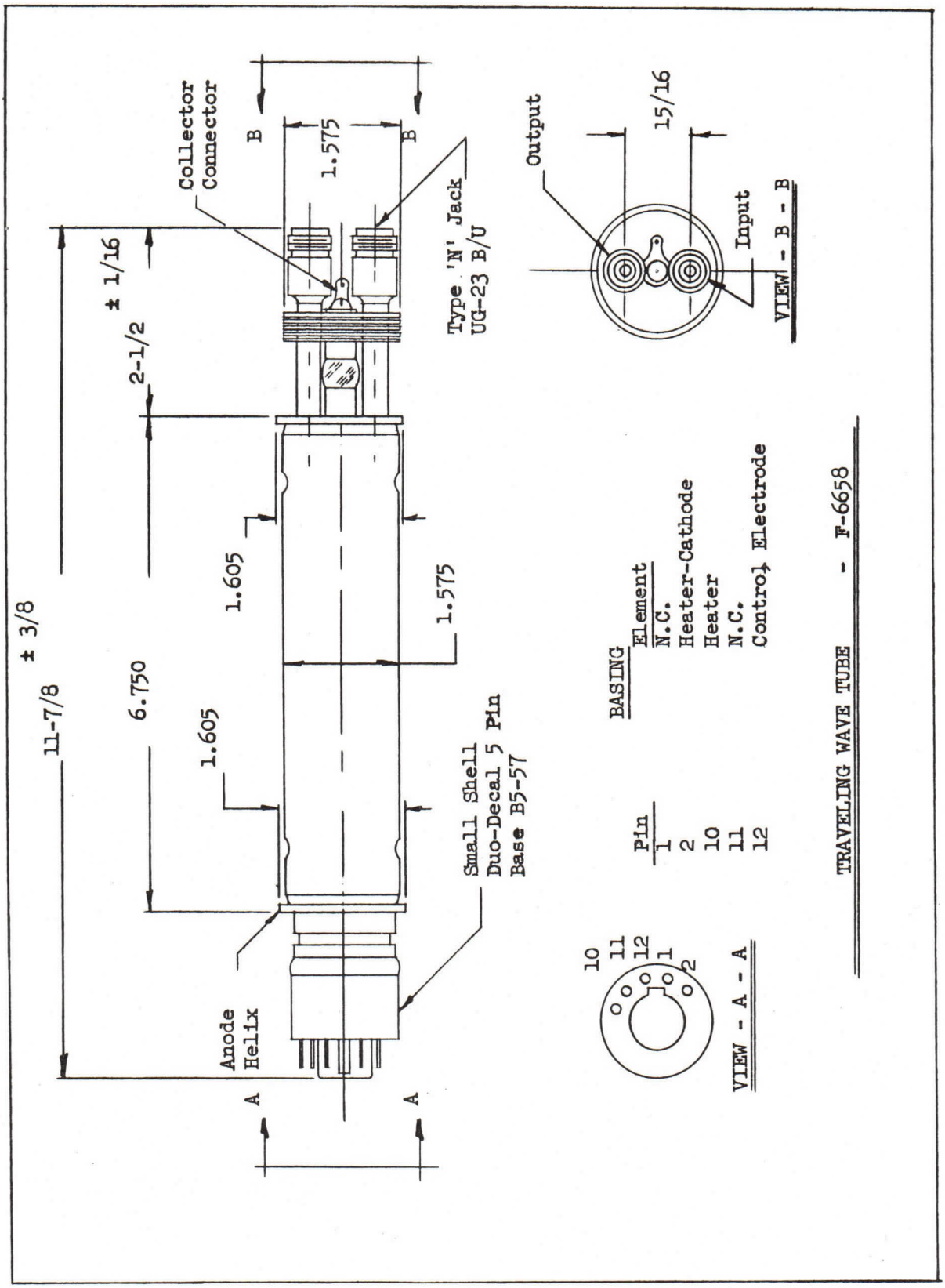
All curves shown with magnetic field set for minimum shell current in range of 600 to 750 gauss.

Curves A, B, C, and E voltage is set for maximum P_{out} at f = 4.0 KMC, P_{in} = mw (approx. 1000 volts).

Curve D shows typical shape and range of control electrode characteristic.

Curve F voltage is set for maximum gain at f = 4.0 KMC, P_{in} = -20 dbm (approx. 900 volts).





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

TENTATIVE

DESCRIPTION:

The F-6825 is a 1 kilowatt pulse traveling wave amplifier tube having 30 db gain and 2000 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix-type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .005 and pulse widths up to 15 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater Current	5.0	amperes
Maximum Anode Voltage (Note 1)	8500	volts peak
Maximum Shell Current (Note 2)	0.5	ampere peak
Maximum Collector Voltage (Note 3)	9000	volts peak
Maximum Collector Dissipation (Note 4)	150	watts average
Maximum R-F Input Power	10	watts average
Maximum R-F Output Power	20	watts average
Maximum Duty Cycle	.005	
Maximum Pulse Width (Beam)	15	microseconds
Maximum Cathode Current	2.5	amperes peak

ELECTRICAL INFORMATION:

Maximum Frequency (Note 5)	4000	mc
Minimum Frequency (Note 5)	2000	mc
Minimum Cold Transmission Loss	60	db
Capacitance		
All Gun Elements to Shell	4.2	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential
Base, Small Shell Duodecal, 5 Pin	JEDEC Designation B5-57
Type of Envelope	Metal
Magnetic Field Strength	1200 gauss
Length of Magnetic Field	9.625 inches uniform
Mounting Position	Any
Weight (not including Magnet)	1 pound, 14 ounces
R-F Connections	50 ohm coax with Type N Jack UG-23B/U
Type of Cooling	Forced Air
Air Flow on Collector Radiator (Note 4)	30 cfm
Glass Temperature	160° C max.

TYPICAL OPERATION AS POWER AMPLIFIER:

Center Frequency	3000 mc
Anode Voltage (Note 1)	8000 volts peak
Cathode Current	1.8 amperes peak
Collector Voltage (tied to Shell)	8000 volts peak
Collector Current	1.5 amperes peak
Power Output (at center frequency)	2 kw peak
Bandwidth to 3 db power points	2.0-4.0 kmc
Gain (Note 6)	30 db
Duty	.001
Pulse Width	2 μ seconds

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at ground potential and the anode connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between cathode current and collector current. Since this current in general should be minimized, it may be desirable to measure current from shell to ground. In making this measurement, care should be taken that both the tube and solenoid are completely insulated from ground. Once operating characteristics (voltage, current, and magnetic field) have been established, shell should be grounded.

Note 3: The tube may be operated with the collector tied to the shell (anode and helix) or may be operated at several hundred volts positive with respect to shell with slight improvement in beam transmission. The potential difference between collector and shell must be limited to 500 volts maximum.

Note 4: Forced air cooling is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 150 watts, a minimum air flow of 20 cfm through the cooling fins is required.

Note 5: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will usually be lower than rated values.

Note 6: This gain is obtained over the 2.0 to 4.0 kmc bandwidth at the power level indicated. Since this is in the power saturation region, small signal gain will be approximately 10 db higher.

OPERATING INSTRUCTIONS:

(1) Heater warm up of 2 minutes before applying high voltage is recommended.

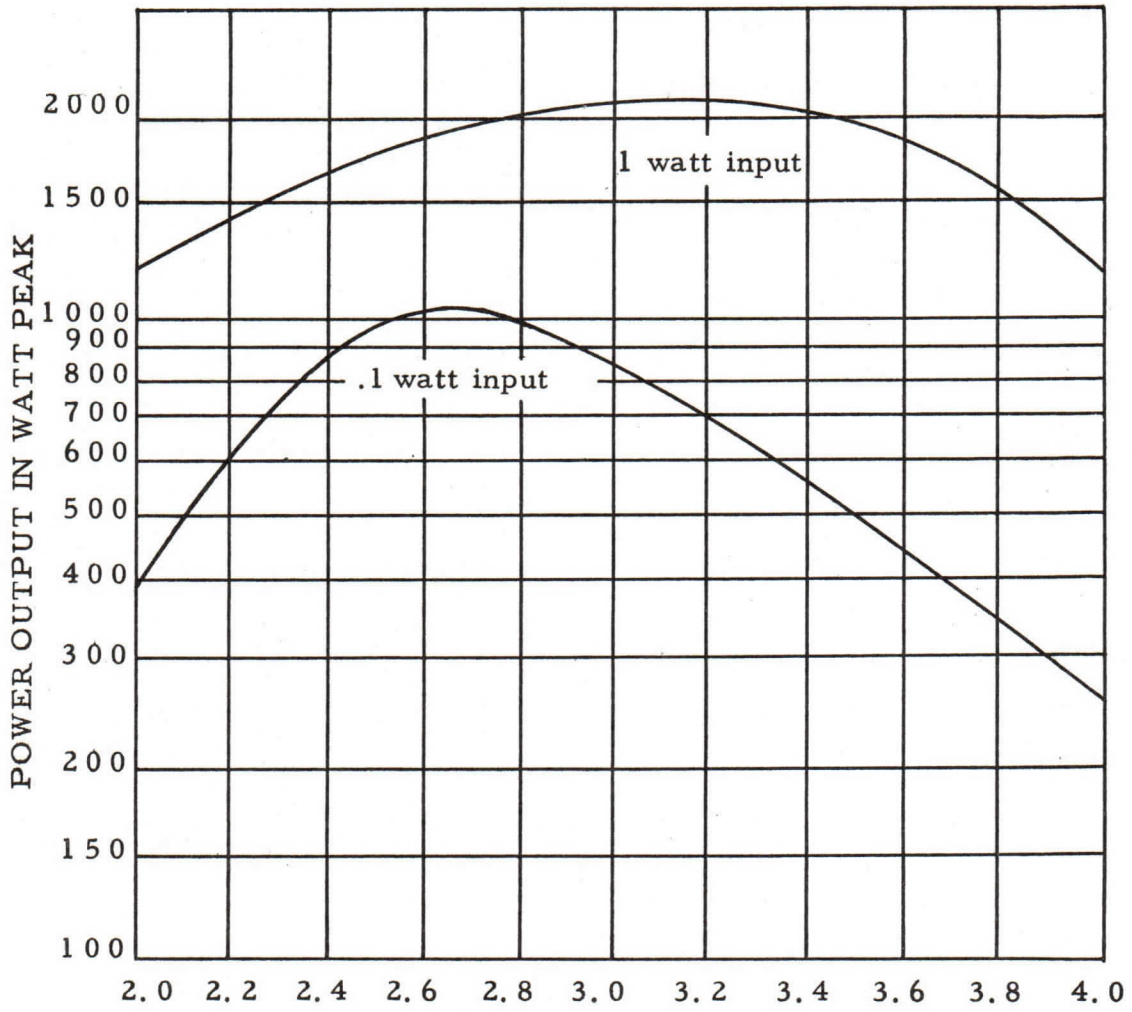
(2) Initial adjustments should be done at low duty cycle (less than .001) to prevent tube damage due to high shell (interception) current.

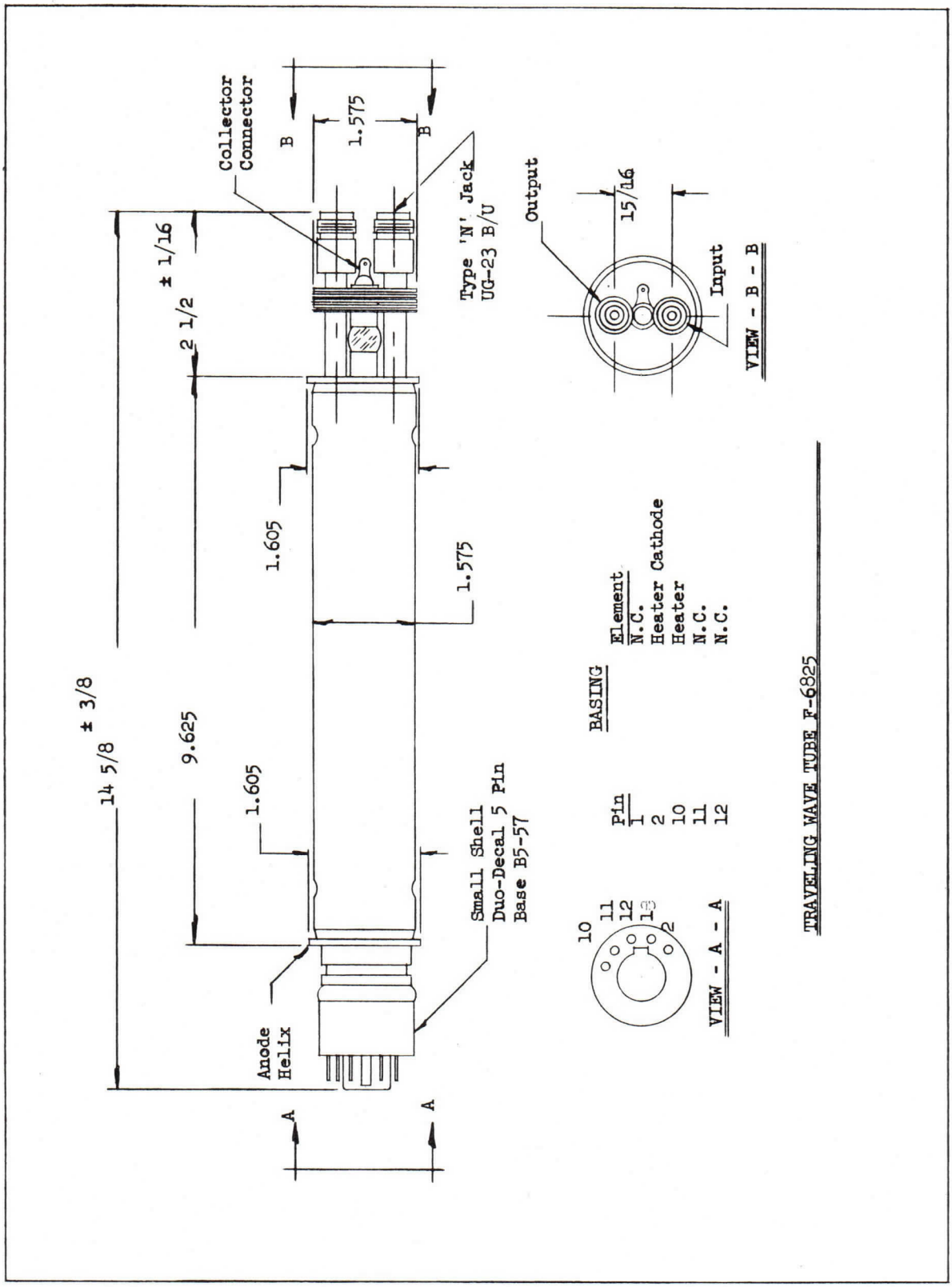
Standard solenoids to operate this tube are available, and solenoids designed for particular application can be supplied.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Box 7065
ROANOKE, VIRGINIA

TYPICAL P_{out} VS. FREQUENCY CHARACTERISTICS





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

TENTATIVE

DESCRIPTION:

The F-6826 is a 1 kilowatt pulse traveling wave amplifier tube having 30 db gain and 2000 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix-type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .005 and pulse lengths up to 10 microseconds can be used.

A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater Current	5.0	amperes
Maximum Anode Voltage (Note 1)	8500	volts
Maximum Shell Current (Note 2)	0.5	ampere peak
Maximum Collector Voltage (Note 3)	9000	volts
Maximum Collector Dissipation (Note 4)	100	watts avg.
Maximum R-F Input Power	10	watts avg.
Maximum R-F Output Power	10	watts avg.
Maximum Duty Cycle	.005	
Maximum Pulse Width (beam)	10	μ seconds
Maximum Cathode Current	2.5	amperes peak
Maximum Grid Voltage		
Negative	-300	volts
Positive (Note 7)	+6% of anode voltage	

ELECTRICAL INFORMATION:

Maximum Frequency (Note 5)	4000	mc
Minimum Frequency (Note 5)	2000	mc
Minimum Cold Transmission Loss	60	db
Capacitance		
Control Grid to all other Elements	9	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential
Base, Small Shell Duodecal, 6 Pin	JEDEC Designation B6-63
Type of Envelope	Metal
Magnetic Field Strength	1200 Gauss
Length of Magnetic Field	9.625 Inches Uniform
Mounting Position	Any
Weight (not including magnet)	1 lb. 14 ozs.
R-F Connections	50 ohm coax with Type "N" Jack UG-23B/U
Type of Cooling	Forced Air
Air Flow on Collector Radiator (Note 4)	20 cfm
Glass Temperature	160°C max.

TYPICAL OPERATION AS POWER AMPLIFIER:

Center Frequency	3000 mc
Anode Voltage (Note 1)	7500 volts
Cathode Current	1.8 amperes peak
Collector Voltage (tied to Shell)	7500 volts
Collector Current	1.4 amperes peak
Power Output (at center frequency)	1.5 kw peak
Bandwidth to 3 db power points	2.0-4.0 kmc
Gain (Note 6)	30 db
Duty	.001
Pulse Width	2 μ seconds
Grid Bias (for cut-off)	-100 volts
Grid Voltage during Pulse (Note 8)	+350 volts
Grid Current during Pulse	0.1 ampere peak

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at ground potential and the anode connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between cathode current and collector current. Since this current, in general, should be minimized, it may be desirable to measure current from shell to ground. In making this measurement, care should be taken that both the tube and solenoid are completely insulated from ground. Once operating characteristics (voltage, current, and magnetic field) have been established, shell should be grounded.

Note 3: The tube may be operated with the collector tied to the shell (anode and helix) or may be operated at several hundred volts positive with respect to shell with slight improvement in beam transmission. The potential difference between collector and shell must be limited to 500 volts maximum.

Note 4: Forced air cooling is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 100 watts, a minimum air flow of 20 cfm through the cooling fins is required.

Note 5: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

Note 6: This gain is obtained over the 2.0 to 4.0 kmc bandwidth at the power level indicated. Since this is in the power saturation region, small signal gain will be approximately 10 db higher.

Note 7: Positive voltage must not be applied to the grid in the absence of anode voltage.

Note 8: The positive grid voltage pulse should be the minimum consistent with normal power output.

GENERAL OPERATING INSTRUCTIONS:

(1) Heater warm up of 2 minutes before applying high voltage is recommended.

(2) High voltage must not be applied in the absence of proper grid bias and magnetic field. Positive grid pulse voltage must not be applied in the absence of high voltage.

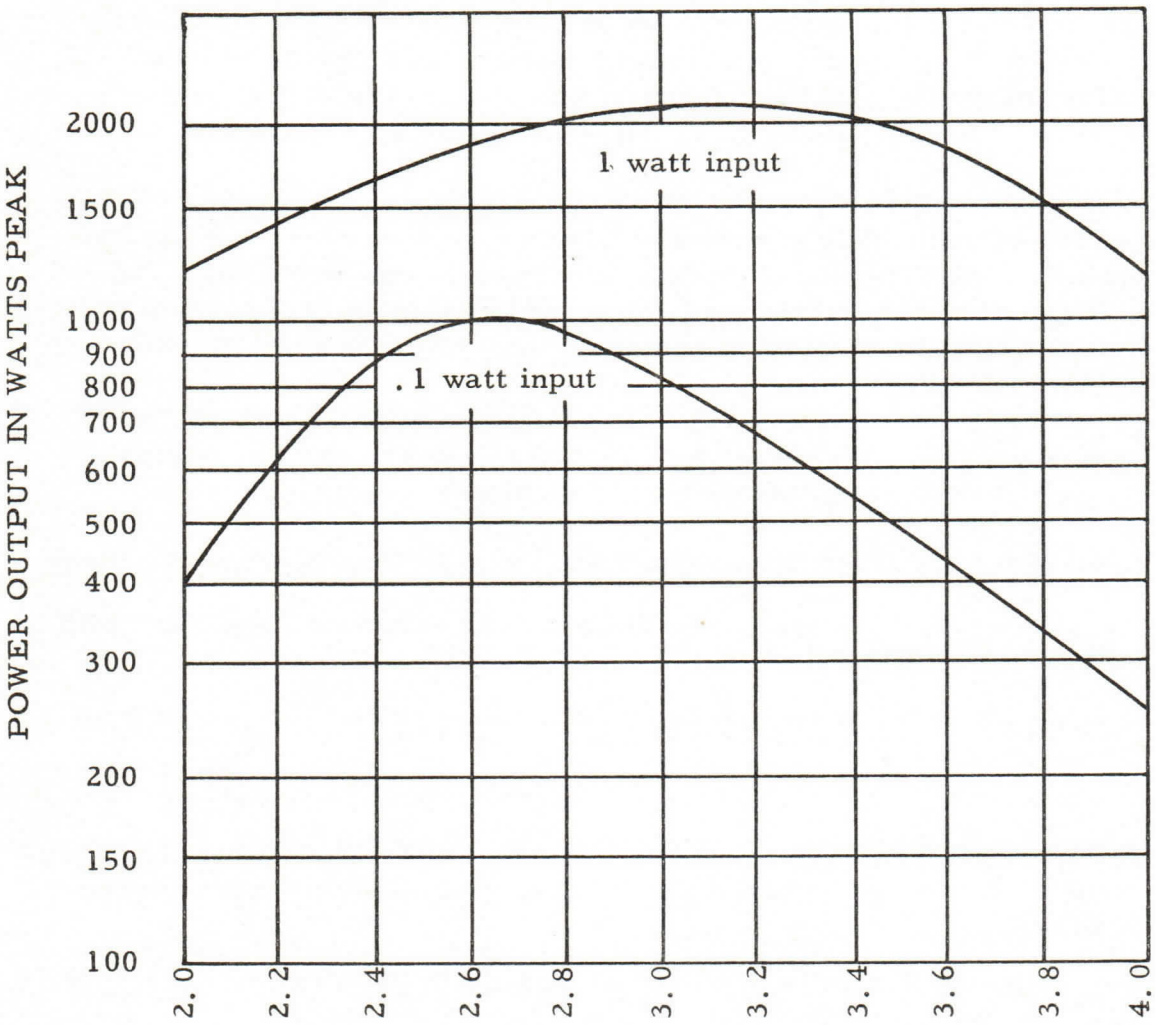
(3) Initial adjustments should be done at low duty cycle (less than .001) to prevent tube damage due to high shell (interception) current.

Standard solenoids to operate this tube are available, and solenoids designed for particular applications can be supplied.

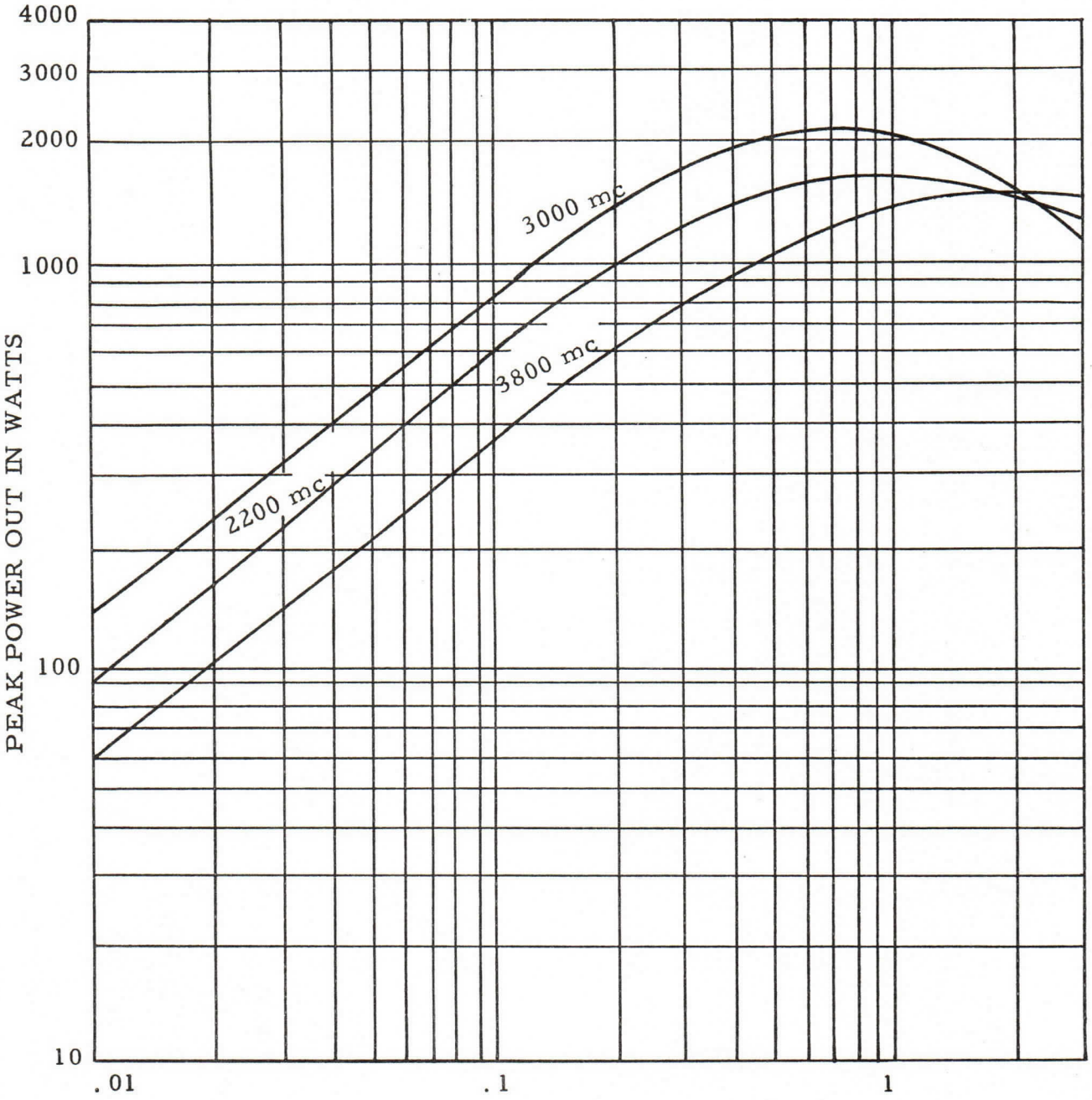
Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Box 412 - Clifton, New Jersey

TYPICAL P_{out} VS. FREQUENCY CHARACTERISTIC



TYPICAL POWER IN - POWER OUT CHARACTERISTIC



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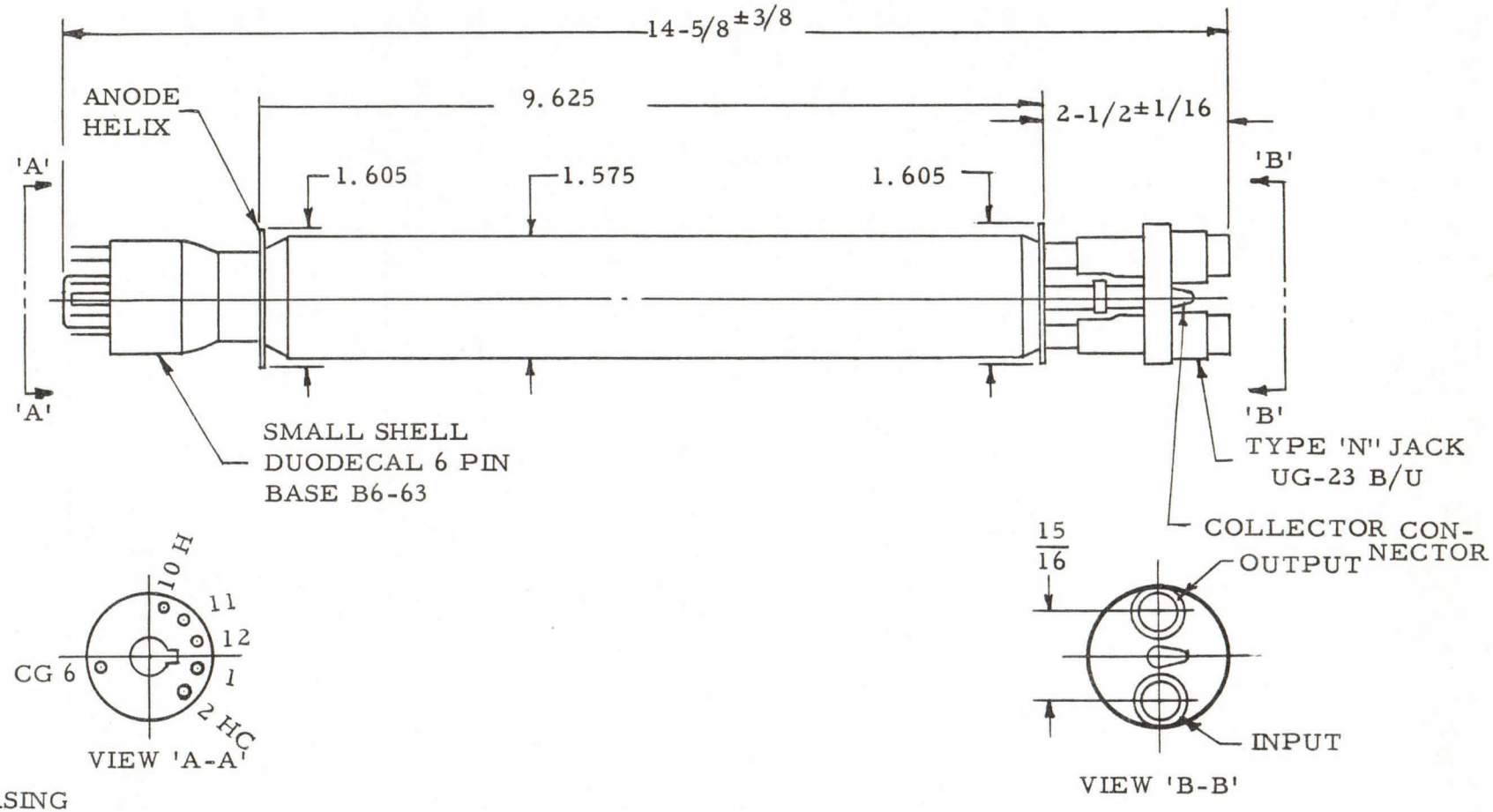
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



VIEW 'A-A'

VIEW 'B-B'

BASING

PIN	ELEMENT
1	NO CONN.
2	HEATER CATHODE
6	CONTROL GRID
10	HEATER
11	NO CONN.
12	NO CONN.

TRAVELING WAVE TUBE TYPE F-6826

TENTATIVE

DESCRIPTION:

The F-6867 is a 100 milliwatt CW traveling wave amplifier tube having 30 db gain and 8000 to 9600 mc frequency range. It is constructed in a rugged metal envelope with a helix-type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is normally provided with type "N" connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A control electrode suitable for use as a gain control is provided. The tube is suitable for either CW or pulse service.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater current	0.85	amperes
Maximum Anode Voltage (Note 1)	1500	volts
Maximum Shell Current (Note 2 and Note 6)	3	ma
Maximum Collector Voltage (Note 3)	1600	volts
Maximum Collector Dissipation (Note 4)	25	watts
Maximum Control Electrode Voltage (Note 5)	-250	volts

ELECTRICAL INFORMATION

Maximum Frequency	9600	mc
Minimum Frequency	8000	mc
Minimum Cold Transmission Loss	50	db
Capacitance		
Control Electrode to All Other Elements	7	μμfd
All Gun Elements to Shell	4.5	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Coated Unipotential	
Base, Small Shell Duodecal, 5 Pin	JEDEC Designation B5-57	
Type of Envelope	Metal	
Magnetic Field Strength	1300	Gauss
Length of Magnetic Field	5.25	inches uniform
Mounting Position	Any	
Weight (not including Magnet)	1 lb. 4 ozs.	
R-F Connections	50 ohm coax with Type "N" Jack UG-23B/U	
Type of Cooling	Forced Air	
Maximum Glass Temperature	160°C	
Cooling Air Required (See Note 4)	5	cfm

TYPICAL OPERATION AS INTERMEDIATE POWER AMPLIFIER:

Anode Voltage	1400	volts
Shell Current	2	ma
Collector Voltage	1500	volts
Collector Current	8	ma
Control Electrode Voltage (Note 5)	-15	volts
Power Output	100	milliwatts
Bandwidth	8.0 to 9.6	kmc
Gain over Bandwidth (Small Signal)	30	db min.
Gain over Bandwidth (Power)	25	db min.
Duty Cycle		
R-F	Variable to 1.0	
Beam	1.0	

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at ground potential and the d-c connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between the cathode current and collector current. Since this current in general should be minimized, it may be desirable to measure the current from shell to ground. It is desirable that overload protection be provided so that if shell current exceeds 3 ma, high voltage is removed.

Note 3: It is generally desirable to operate the collector at 100 volts positive with respect to shell, and potential difference between collector and shell should be limited to 300 volts maximum.

Note 4: Forced air cooling of collector is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 25 watts, a minimum air flow of 5 cfm through the cooling fins is required.

Note 5: The control electrode voltage is adjusted for maximum beam transmission (collector current/cathode current). It may further be used as a gain control or for introducing modulation, but cannot be operated less negative than the value required for proper transmission.

Note 6: In some cases, it may be necessary to rotate the tube in the solenoid to the point giving best transmission.

OPERATION PROCEDURE:

(1) Insert tube in solenoid, secure in place with stops provided, make connections.

(2) Turn on cooling air, solenoid voltage (adjust to approximately 1300 gauss), heater voltage, collector voltage (if used), control electrode voltage approximately -20 volts).

(3) Raise high voltage to desired value, adjusting solenoid voltage and control electrode voltage for maximum collector current, and observing care not to exceed 3 ma shell current. It may be necessary to rotate the tube in the solenoid to the point giving best transmission.

(4) The above procedure is not required after initial set up; however, heater voltage should be applied two minutes before applying high voltage, and proper magnetic field and control electrode voltage must be applied before applying high voltage. Observance of the 3 ma maximum limit on shell current is essential to prevent tube damage.

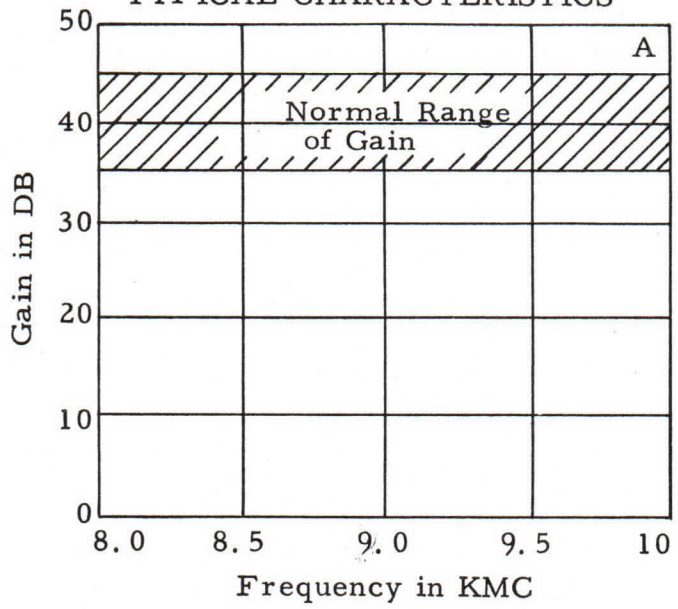
This tube has been designed primarily for operation in the 8000 to 9600 mc frequency range. Useful power and gain exist over a larger frequency range. Additional information for specific applications can be obtained from the Vacuum Tube Engineering Department.

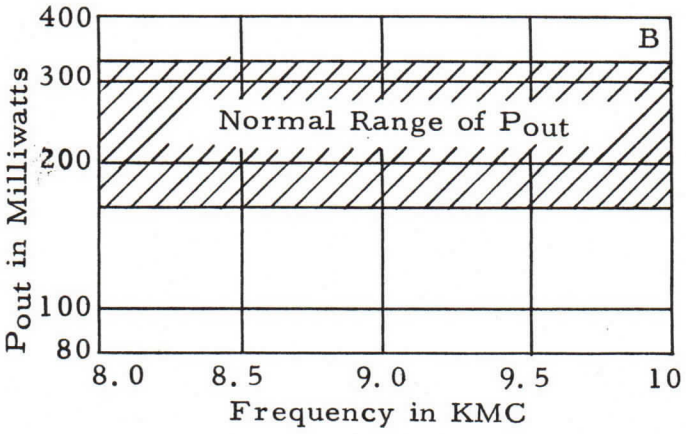
Standard solenoids for this tube type are available and solenoids designed for specific applications can be supplied.

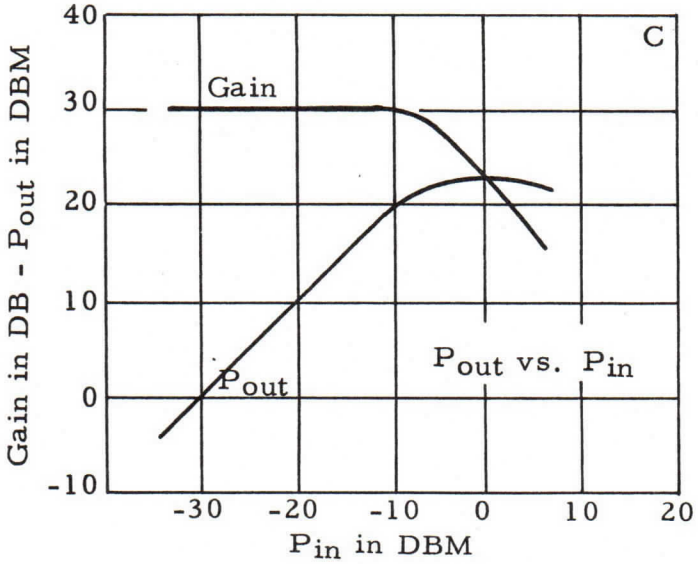
Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Box 7065
ROANOKE, VIRGINIA

TYPICAL CHARACTERISTICS



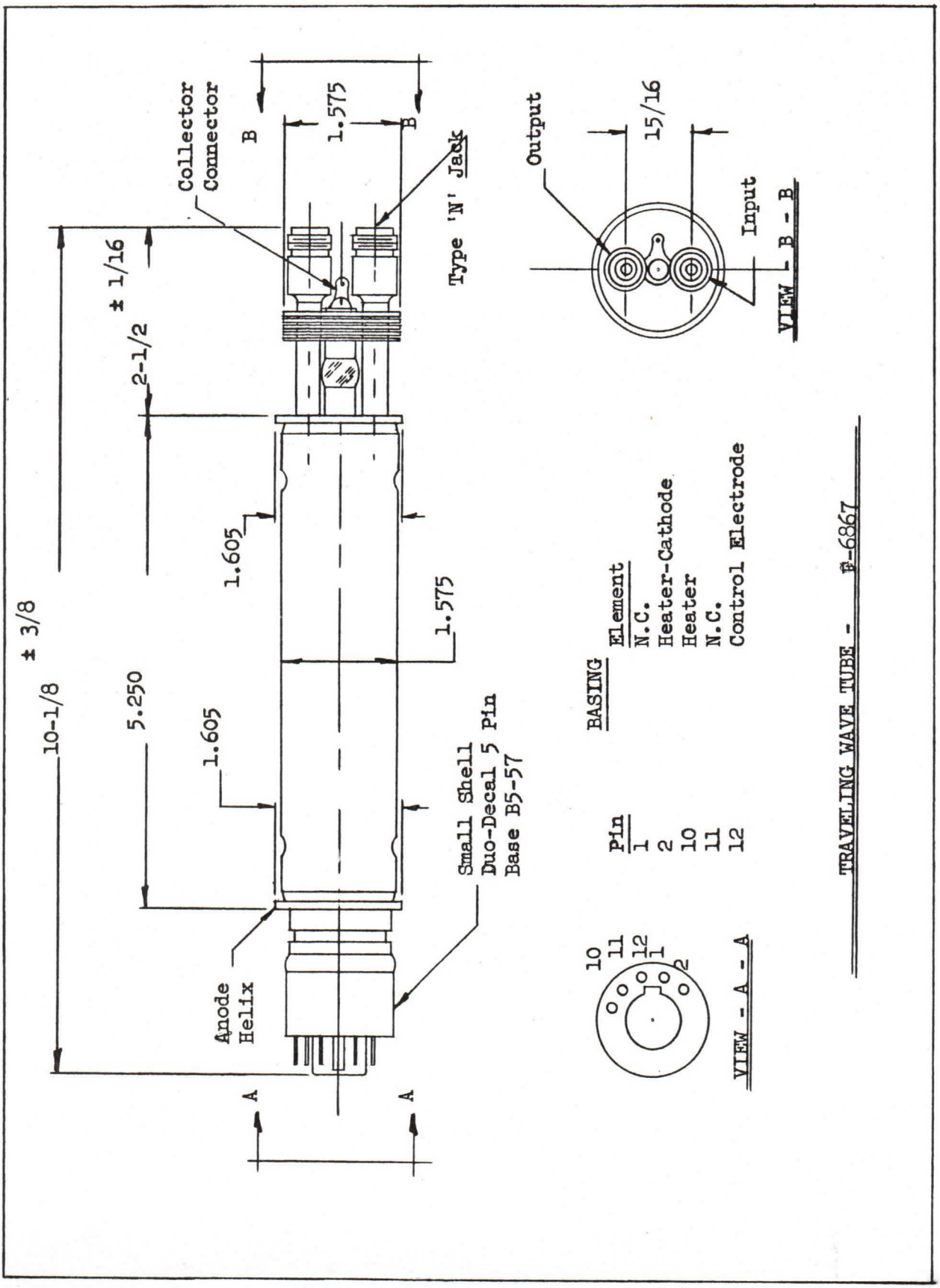




All data shown with magnetic field adjusted for best transmission in range of 900 to 1300 gauss and control electrode voltage adjusted for maximum collector current with shell current less than 3 ma.

For curve A, voltage is adjusted for maximum gain at f = 9.0 kmc and P_{in} <-10 dbm (approx. 1250 volts).

For curves B and C, voltage is adjusted for maximum P_{out} at f = 9.0 kmc and P_{in} = 0.5 mw (approx. 1400 volts).


Collector Connector
B
1.575
B
Type 'N' Jack
± 1/16
2-1/2
± 3/8
10-1/8
5.250
1.605
1.605
1.575
Small Shell
Duo-Decal 5 Pin
Base B5-57
Anode Helix
A
A
Output
15/16
Input
VIEW - B - B
BASING
Pin
Element
1
N.C.
2
Heater-Cathode
10
Heater
11
N.C.
12
Control Electrode
10
11
12
1
2
VIEW - A - A
TRAVELING WAVE TUBE - E-6867

TENTATIVE

DESCRIPTION:

The F-6868 is a 10 watt CW traveling wave amplifier tube having 30 db gain and 1700 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix-type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. A control electrode suitable for use as a gain control is provided. The tube is suitable for either CW or pulse service uitlizing the full bandwidth or portions of it. It is also suitable for frequency shifting, such as serrodyne operation.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater Current	2.5	amperes
Maximum Anode Voltage (Note 1)	1500	volts
Maximum Shell Current (Note 2)	5	ma
Maximum Collector Voltage (Note 3)	1750	volts
Maximum Collector Dissipation (Note 4)	150	watts
Maximum Control Electrode Voltage (Note 5)	-250	watts

ELECTRICAL INFORMATION:

Maximum Frequency	4000	mc
Minimum Frequency	1700	mc
Minimum Cold Transmission Loss	50	db
Capacitance		
Control Electrode to all other elements	12	μμfd
All Gun elements to Shell	4.5	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential
Base, Small Shell Duodecal, 5 Pin	JEDEC Designation B5-57
Type of Envelope	Metal
Magnetic Field Strength (nominal)	1000 gauss
Length of Magnetic Field	6.75 inches uniform
Mounting Position	Any
Weight (not including magnet)	1 lb. 7 ozs.
R-F Connections	50 ohm coax with Type "N" Jack UG-23B/U
Type of Cooling	Forced Air
Glass Temperature	160°C max.
Cooling Air Required (Note 4)	30 cfm

TYPICAL OPERATION AS POWER AMPLIFIER:

Anode Voltage	1200 volts
Shell Current	3 ma
Collector Voltage	1400 volts
Collector Current	70 ma
Control Electrode Voltage	0 volts
Power Output (see Curves)	10 watts nominal
Gain (see Curves)	30 db nominal
Duty Cycle	
R-F	Variable to 1.0
Beam	1.0

TYPICAL OPERATION AS LINEAR AMPLIFIER:
(Input powers less than -10 dbm)

Anode Voltage	1150 volts
Shell Current	2.5 ma
Collector Voltage	1400 volts
Collector Current	67 ma
Control Electrode Voltage	0 volts
Gain (see Curves)	35 db nominal
Noise Figure	30 db
Duty Cycle	
R-F	Variable to 1.0
Beam	1.0

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at approximate ground potential and the d-c connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between the cathode current and collector current. Since this current, in general, should be minimized, it is desirable to measure the current from shell to ground. It is recommended that overload protection be provided to remove high voltage if the shell current exceeds 5 ma.

Note 3: It is generally desirable to operate the collector at 100 to 200 volts positive with respect to shell, and potential difference between collector and shell should be limited to 300 volts maximum.

Note 4: Forced air cooling of collector is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 150 watts, a minimum air flow of 30 cfm through the cooling fins is required.

Note 5: This electrode is a remote cutoff grid, suitable for use as a gain control providing approximately 30 db control range but is not suitable for low level pulsing of the beam. It is recommended that, where feasible, provision should be made to operate the tube with small negative voltage on this electrode (-5 to -10 volts) as this permits operation of the tube at approximately optimum conditions with very low interception (shell current). It may also be operated fixed at cathode potential, if desired.

OPERATING PROCEDURE:

(1) Insert tube in solenoid, secure in place with stops provided, make connections.

(2) Turn on cooling air, solenoid voltage (adjust to approximately 1000 gauss), heater voltage, collector voltage (if used), control electrode voltage (if used).

(3) Raise high voltage to desired value, readjusting magnetic field if necessary to obtain minimum shell current. At no time should shell current exceed 5 ma.

(4) After initial set up as above, tube voltages may be applied simultaneously; however, it is recommended that heater voltage, solenoid voltage, and cooling air be applied at least two minutes before applying high voltage. Observance of the 5 ma maximum limit for shell current is essential to prevent tube damage.

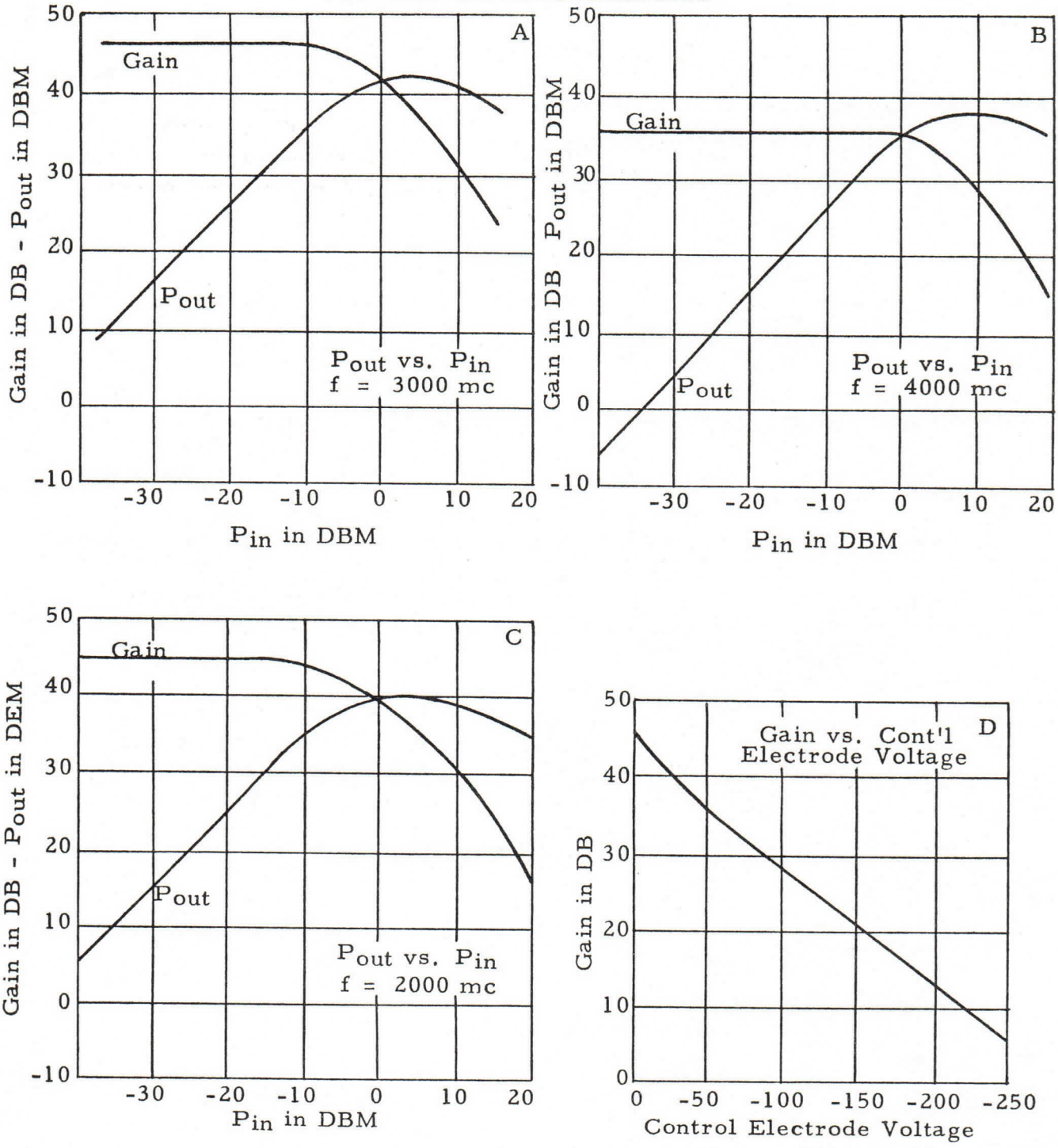
The data presented here is representative of operation of this type as an amplifier with maximum bandwidth and does not indicate the maximum performance obtainable under specific conditions, particularly narrower bandwidths.

Standard solenoids to operate this tube are available, and solenoids designed for particular applications can be supplied.

Additional information for specific applications can be obtained from the

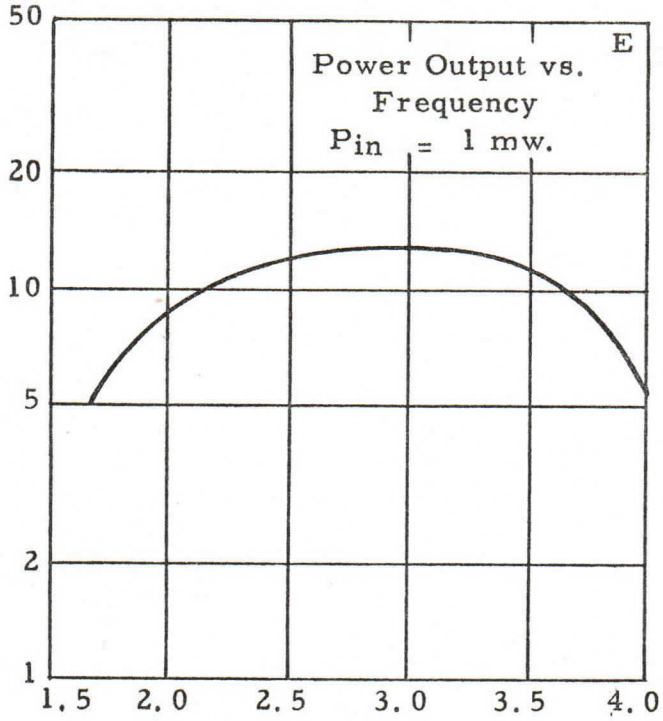
Electron Tube Applications Section
ITT Components Division
Box 412
Clifton, New Jersey

TYPICAL CHARACTERISTICS



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

TYPICAL CHARACTERISTICS

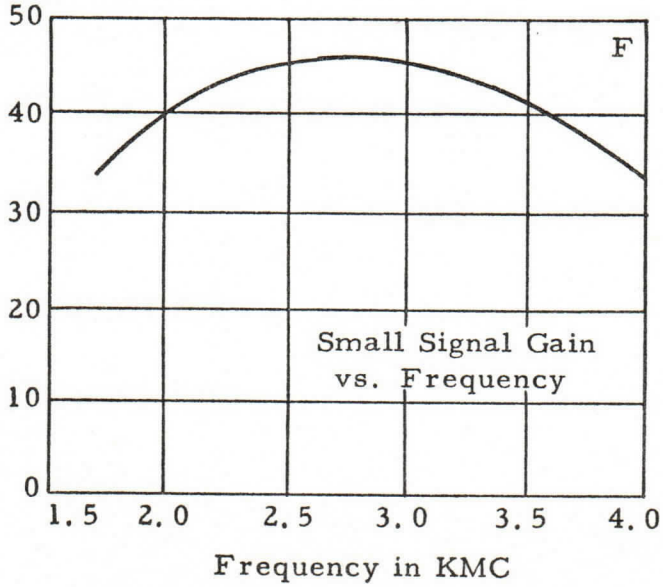


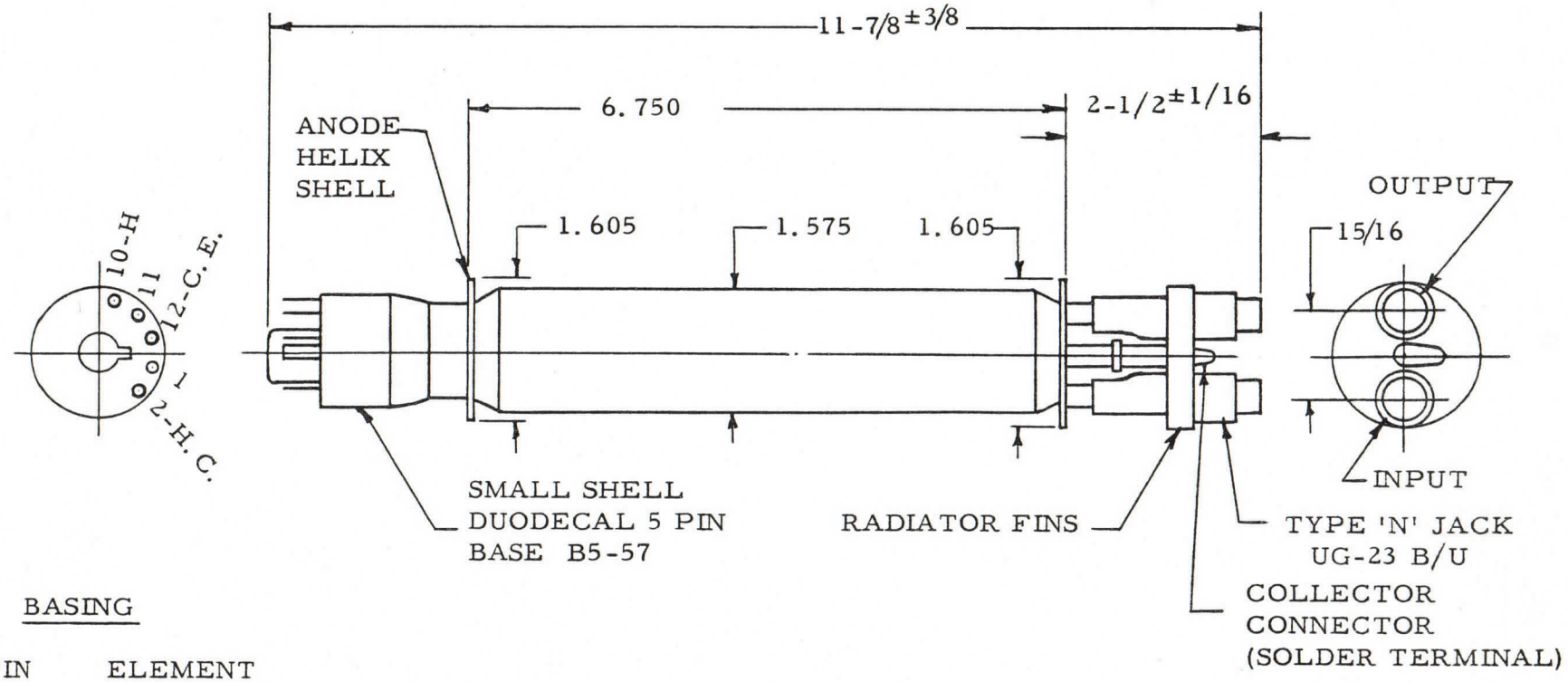
All curves shown with magnetic field set for minimum shell current in range of 750 to 1000 gauss.

For curves A, B, C, and E, voltage is set for maximum P_{out} at f = 4.0 kmc with P_{in} = 1 mw approx. 1200 v.).

For curve F, voltage is set for maximum gain at f = 4.0 kmc with P_{in} = -20 dbm. (approx. 1150 v.).

Curve D shows typical shape and range of control electrode characteristic.





BASING

PIN	ELEMENT
1	NO CONN.
2	HEATER-CATHODE
10	HEATER
11	NO CONN.
12	CONTROL ELECTRODE

TRAVELING WAVE TUBE TYPE F-6868

OPERATING INSTRUCTIONS FOR THE F-6868 TRAVELING WAVE TUBE

WHEN PLACING THE F-6868 TRAVELING WAVE TUBE IN OPERATION FOR THE FIRST TIME, THE FOLLOWING PROCEDURE SHOULD BE FOLLOWED:

1. MAKE A VISUAL INSPECTION OF THE TUBE TO CHECK FOR LOOSE CONNECTIONS OR GLASS CRACKS.

2. PLACE THE TUBE IN THE PROPER SOLENOID AND MAKE CONNECTIONS TO THE TUBE AND SOLENOID.

   A) HEATER, HEATER/CATHODE, AND CONTROL ELECTRODE CONNECTIONS ARE MADE TO THE BASE OF THE TUBE. THE COLLECTOR CONNECTION IS MADE TO A SOLDER LUG ON THE RADIATOR. THE SHELL/HELIX CONNECTION IS MADE TO THE SHELL OF THE TUBE AND/OR THE CASE OF THE SOLENOID WHICH IS GROUNDED.

3. APPLY COOLING TO THE SOLENOID AND TO THE RADIATOR OF THE TUBE.

4. VOLTAGES ARE APPLIED IN THE FOLLOWING ORDER:

   A) HEATER VOLTAGE (6.3 VOLTS).

   B) SOLENOID VOLTAGE (ADJUST SOLENOID CURRENT FOR PROPER MAGNETIC FIELD 1000 GAUSS).

   C) CONTROL ELECTRODE VOLTAGE. (USUALLY ZERO VOLTS WITH RESPECT TO CATHODE, BUT MAY BE USED TO CONTROL OUTPUT OF TUBE BY APPLYING NEGATIVE VOLTAGE WITH RESPECT TO CATHODE. THIS ELECTRODE SHOULD NEVER GO POSITIVE WITH RESPECT TO CATHODE.)

   D) COLLECTOR VOLTAGE (+150 VOLTS WITH RESPECT TO SHELL).

   E) CATHODE VOLTAGE. ADJUST SLOWLY TO THE VALUE INDICATED ON THE DATA SHEET; USUALLY ABOUT MINUS 1250 VOLTS WITH RESPECT TO THE SHELL. AT ALL TIMES OBSERVE HELIX CURRENT AND DO NOT PERMIT TO RISE ABOVE 3.0 MA. IT IS POSSIBLE FOR HELIX CURRENT TO READ NEGATIVE WITHOUT DAMAGE TO THE TUBE, BUT BEFORE OPERATION UNDER THIS CONDITION IS PERMITTED, POLARITY OF THE HELIX CURRENT METER SHOULD BE CHECKED TO BE SURE IT IS CORRECT.

OPERATING INSTRUCTIONS FOR THE F-6868 TRAVELING WAVE TUBE (CONTINUED)

5. R.F. INPUT TO THE TUBE SHOULD BE LIMITED TO 1.0 WATT AND R.F. OUTPUT SHOULD BE LIMITED TO 20 WATTS.

6. THE CATHODE VOLTAGE MAY BE ADJUSTED FOR OPTIMUM POWER OUTPUT AT THE DESIRED FREQUENCIES.

THE FOLLOWING PRECAUTIONS SHOULD BE TAKEN WHEN OPERATING THE TRAVELING WAVE TUBE:

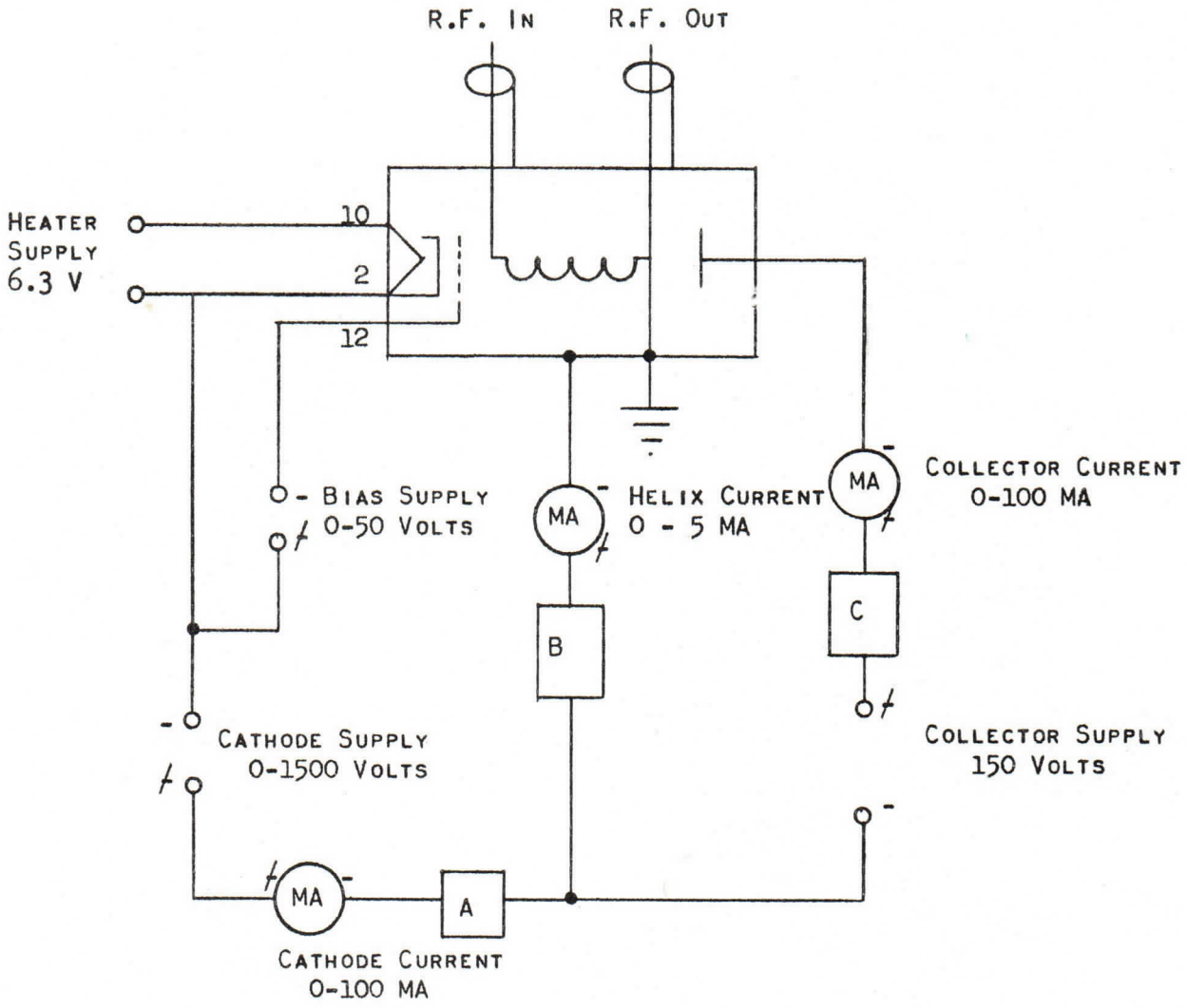
1. NEVER OPERATE THE F-6868 WITHOUT PROPER COOLING OF THE COLLECTOR. 50 CFM DIRECTED ACROSS THE RADIATOR FINS SHOULD BE SUFFICIENT. IN ANY CASE, THE TEMPERATURE OF THE GLASS TO METAL SEALS SHOULD NOT BE PERMITTED TO EXCEED 160°C.

2. NEVER OPERATE THE F-6868 WITHOUT THE PROPER MAGNETIC FIELD. BE SURE SUFFICIENT COOLING IS SUPPLIED TO TUBE AND SOLENOID.

3. NEVER OPERATE THE F-6868 WITH HELIX CURRENT IN EXCESS OF 3.0 MA. UNDER MOST CONDITIONS HELIX CURRENT WILL BE 1.0 MA OR LESS. IT IS IMPORTANT THAT HELIX OVERLOAD PROTECTION BE PROVIDED.

4. BE SURE COAXIAL CABLES TO BE CONNECTED TO THE TUBE INPUT AND OUTPUT CONNECTORS ARE ASSEMBLED CORRECTLY. IF THE INNER CONDUCTOR OF THE CABLE CONNECTION IS TOO LONG, PRESSURE WILL BE APPLIED TO A GLASS BEAD INSIDE THE TUBE, CAUSING PERMANENT DAMAGE TO THE TUBE. IF THE INNER CONDUCTOR OF THE CABLE CONNECTOR IS TOO SHORT, A POOR CONNECTION WILL RESULT IN POOR R.F. PERFORMANCE.

THE ATTACHED SCHEMATIC IS A SUGGESTED METHOD OF CONNECTING THE F-6868 SHOWING LOCATION OF PROTECTION CIRCUITS AND METER POLARITY.



BASE CONNECTIONS

PIN 2 - HEATER CATHODE
PIN 10 - HEATER
PIN 12 - CONTROL ELECTRODE

A. CATHODE CURRENT OVERLOAD PROTECTION SET AT 90 MA.

B. HELIX CURRENT OVERLOAD PROTECTION SET AT 3.0 MA.

C. COLLECTOR CURRENT OVERLOAD PROTECTION SET AT 90 MA.

NOTE: ALL OVERLOADS SHOULD OPERATE TO DISCONNECT HIGH VOLTAGE.

CONNECTION DIAGRAM FOR F-6868 TWT TUBE

F-6996
TRAVELING
WAVE TUBE

TENTATIVE

DESCRIPTION:

The F-6996 is a 10 watt CW traveling wave amplifier tube having 30 db gain and 8000 to 9600 mc frequency range. It is constructed in a rugged metal envelope with a helix-type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. The tube is suitable for either CW or pulse service.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater Current	2.3	amperes
Maximum Anode Voltage (Note 1)	3400	volts
Maximum Shell Current (Note 2)	3	ma
Maximum Collector Voltage (Note 3)	3500	volts
Maximum Collector Dissipation (Note 4)	200	watts
Maximum Control Electrode Voltage (Note 5)	-250	volts

ELECTRICAL INFORMATION:

Maximum Frequency	9600	mc
Minimum Frequency	8000	mc
Minimum Cold Transmission Loss	50	db
Capacitance		
Control Electrode to All Other Elements	10	μμfd
All Gun Elements to Shell	4.8	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential	
Base, Small Shell Duodecal, 5 Pin	JEDEC Designation B5-57	
Type of Envelope		Metal
Magnetic Field Strength (Nominal)	1300	Gauss
Length of Magnetic Field	6.75	inches uniform
Mounting Position		Any
Weight (not including Magnet)		1 lb. 7 ozs.
R-F Connections	50 ohm coax with type "N" Jack UG-23B/U	
Type of Cooling		Forced Air
Glass Temperature	160°C	max.
Cooling Air Required (Note 4)	70	cfm

TYPICAL OPERATION AS POWER AMPLIFIER:

Anode Voltage	3200	volts
Shell Current	1	ma
Collector Voltage	3300	volts
Collector Current	50	ma
Control Electrode Voltage	-15	volts
Power Output	10	watts nominal
Gain	30	db nominal
Duty Cycle		
R-F	Variable to 1.0	
Beam	1.0	

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at approximate ground potential and the d-c connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between the cathode current and collector current. Since this current, in general, should be minimized, it is desirable to measure the current from shell to ground. It is recommended that overload protection be provided to remove high voltage if the shell current exceeds 3 ma.

Note 3: It is generally desirable to operate the collector at 50 to 100 volts positive with respect to shell, and potential difference between collector and shell should be limited to 300 volts maximum.

Note 4: Forced air cooling of collector is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 200 watts, a minimum air flow of 70 cfm through the cooling fins is required.

Note 5: The control electrode voltage is adjusted for maximum beam transmission (collector current/cathode current).

OPERATING PROCEDURE:

(1) Insert tube in solenoid, secure in place with stops provided, make connections.

(2) Turn on cooling air, solenoid voltage (adjust to approximately 1300 gauss), heater voltage, collector voltage (if used), control electrode voltage (approximately -20 volts).

(3) Raise high voltage to desired value, adjusting solenoid voltage and control electrode voltage for maximum collector current, and observing care not to exceed 3 ma shell current. It may be necessary to rotate the tube in the solenoid to the point giving best transmission.

(4) The above procedure is not required after initial set up; however, heater voltage should be applied one minute before applying high voltage, and proper magnetic field and control electrode voltage must be applied before applying high voltage. Observance of the 3 ma maximum limit on shell current is essential to prevent tube damage.

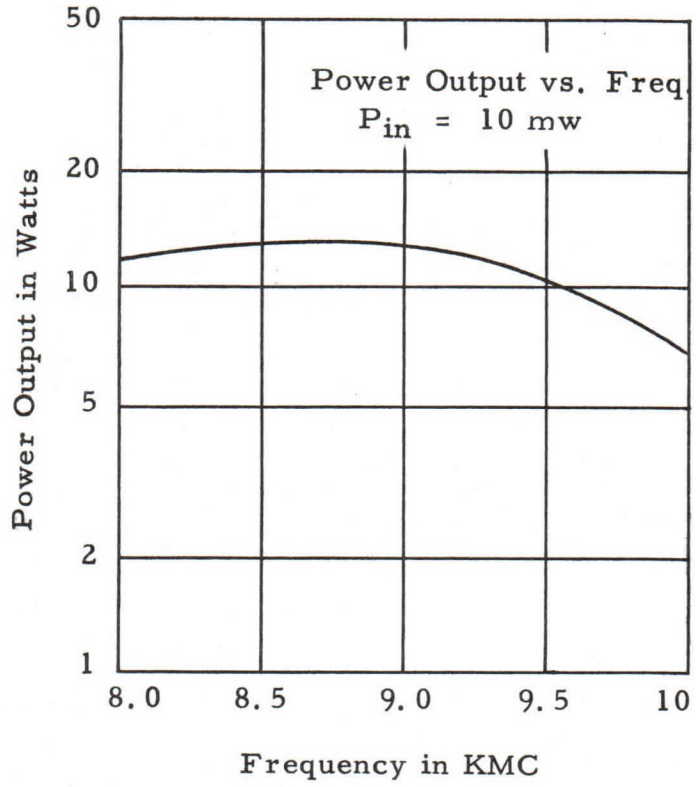
(5) Heater warm up of 2 minutes before applying high voltage is recommended.

Standard solenoids to operate this tube are available, and solenoids designed for particular applications can be supplied.

Additional information for specific applications can be obtained from the

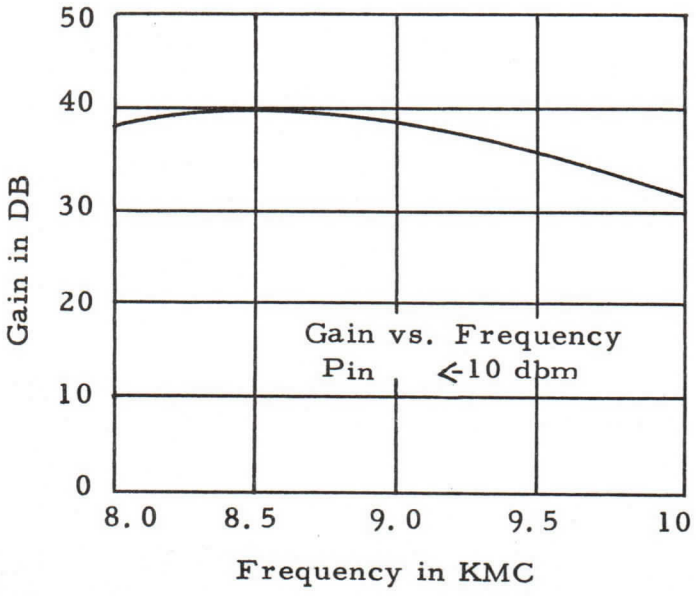
Electron Tube Applications Section
ITT Components Division
Box 7065
ROANOKE, VIRGINIA

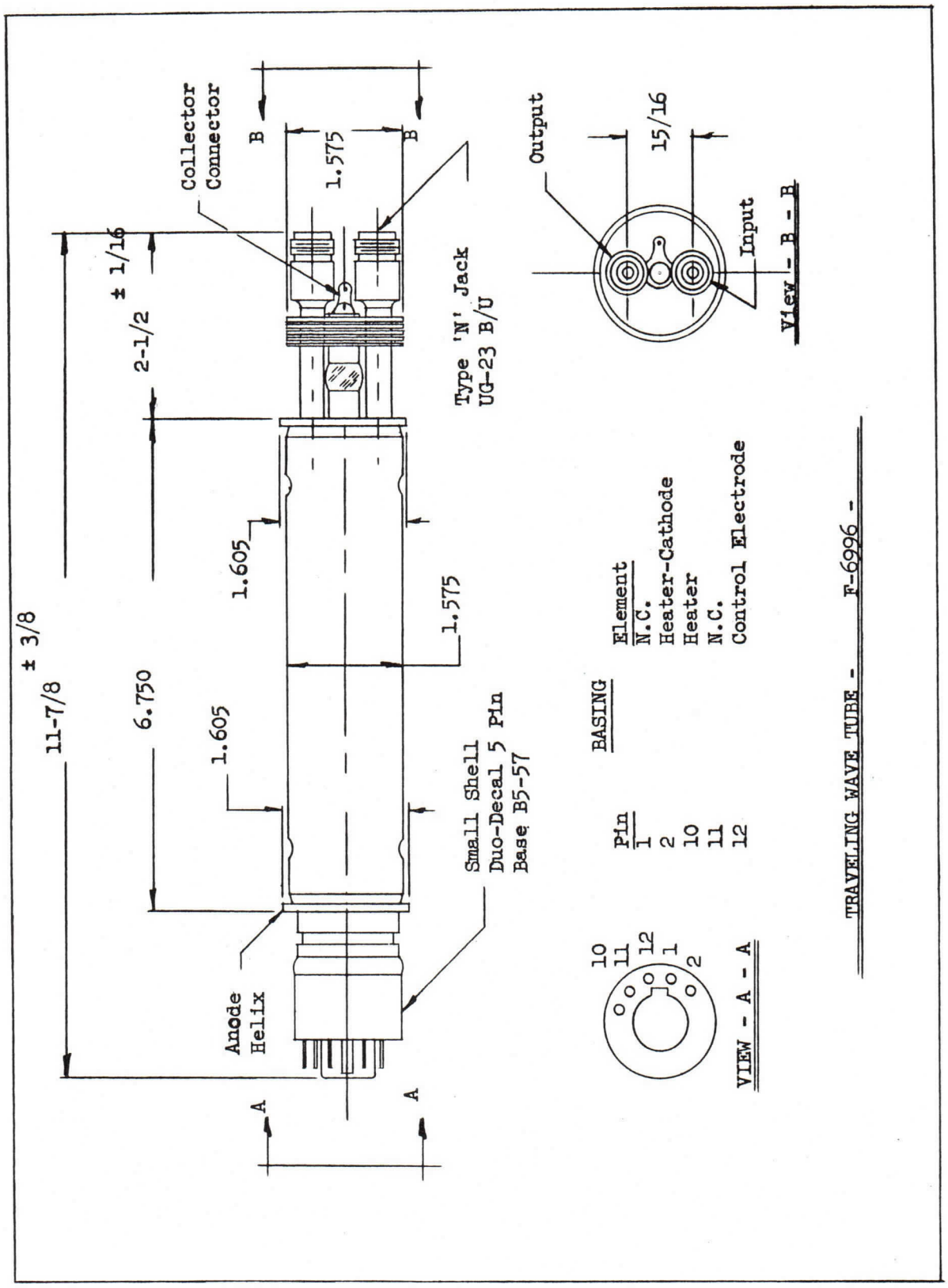
TYPICAL CHARACTERISTICS



Magnetic field and control electrode voltage set for best transmission.

Voltage set at approximately 3200 volts.





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

TENTATIVE

DESCRIPTION

The F-7066 is a 50 mw CW traveling wave amplifier tube having 30 db gain and 8.0 to 12.0 kmc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with female TNC connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide coated cathode are used. The tube is suitable for either CW or pulse service.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±5%)	volts
Heater Current	0.85	ampere
Maximum Anode Voltage (Note 1)	1600	volts
Maximum Helix Current (Note 2)	2	ma
Maximum Collector Dissipation (Beam Power)	15	watts
Maximum Control Electrode Voltage (Note 3)	-500	volts

ELECTRICAL INFORMATION:

Maximum Frequency	12.0	kmc
Minimum Frequency	8.0	kmc
Minimum Cold Transmission Loss	50	db
Capacitance		
Control Electrode to All Elements	10	μμf (max.)

MECHANICAL:

Type of Cathode	Oxide Coated	Unipotential
Gun Connections		Flying Leads
R-F Connections		Female TNC
Magnetic Field Strength (nominal)	900	gauss
Mounting Position		Any
Weight (tube only)	1	pound
Type of Cooling	Conduction to	Solenoid

TYPICAL OPERATION:

Anode Voltage	1500	volts
Anode Current	5	ma
Helix Current	0.5	ma
Control Electrode Voltage (Note 4)	-15	volts
Power Output	50	mw, nominal
Gain	30	db, nominal
Duty Cycle (Note 4)		
R-F	Variable to 1.0	
Beam	1.0	

Note 1: All voltages shown are with respect to cathode. Anode and collector are connected internally to the shell, and the outer coax conductor of the r-f connections is also at shell potential. The helix is connected to the center conductor of the coax line and a d-c connection to the helix must be provided externally in the r-f circuitry.

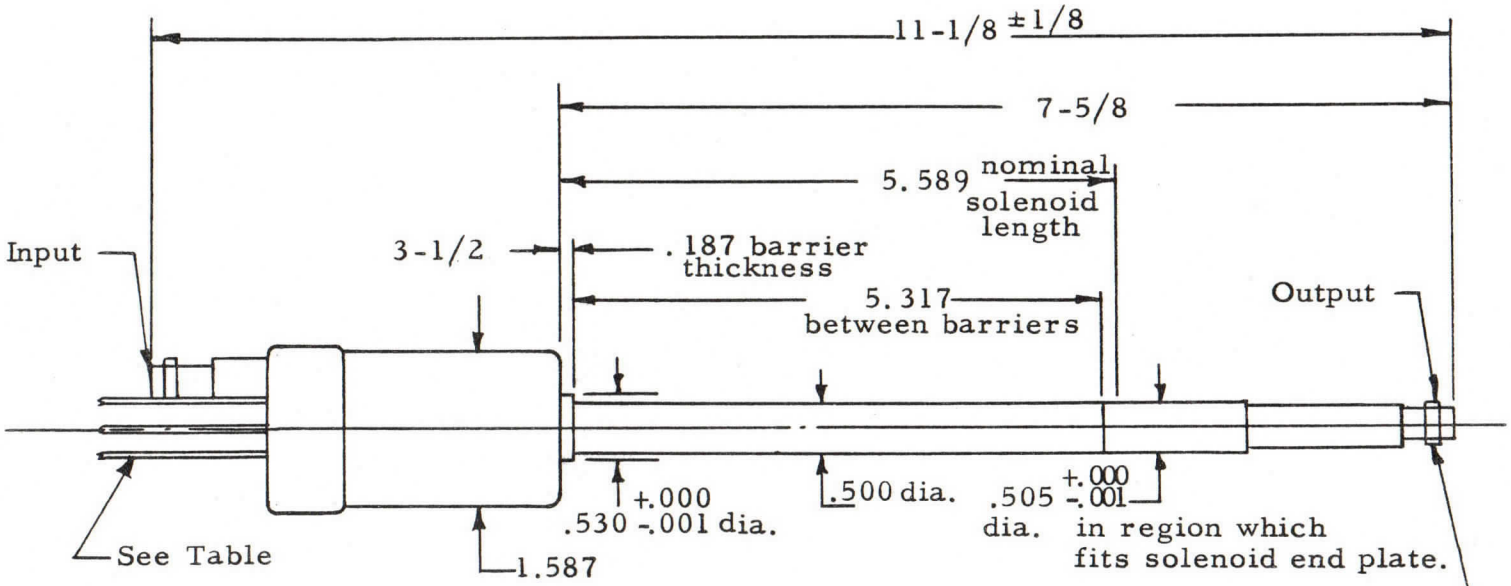
Note 2: The helix current should, in general, be minimized and must be less than the maximum rating. The control electrode voltage and magnetic field (solenoid current) can be properly adjusted before connection of r-f cables by monitoring current to the center coax conductor. It is desirable, when possible, to monitor this current during operation and to provide overload protection. In pulsed beam operation, the peak helix current may exceed 2 ma, but care should be taken to operate at reasonably low values and average current must not exceed 2 ma.

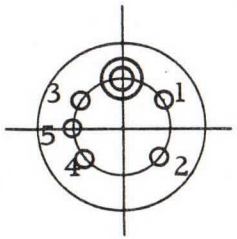
Note 3: The control electrode voltage is adjusted for best transmission for CW operation (normally about -15 volts). Beam gate off can be accomplished by applying voltage of -400 to -500 volts. Operation in the region of control electrode voltage between approximately -15 volts and -400 volts can be utilized with the control electrodes used as a gain control.

Note 4: Gated beam operation can also be utilized by applying -400 to -500 volts to the control electrode for gate off and approximately -15 volts (this value adjusted for best transmission) for gate on. In this type of operation, the values of power output, anode current and helix current become peak values.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Box 412 - Clifton, New Jersey





Pin	Color Code	Connections
1	Green	Focus
2	Brown	Heater
3	Yellow	Cathode
4	Black	Anode
5	Brown	Heater

Flexible Leads, 12" min. length

OUTLINE - F-7066 TRAVELING WAVE TUBE

OPERATING INSTRUCTIONS FOR THE F-7066 TRAVELING WAVE TUBE

The F-7066 is a 50 Milliwatt CW Traveling Wave Tube operating over the band of 8.0 to 12.0 KMC. It requires a magnetic field of 900 gauss for proper focusing. Basic power requirements are 10 MA at 1500 V and a 50 Volt bias supply, as well as 6.3 Volts at 1.0 Ampere for the heater.

When placing the F-7066 in operation for the first time, the following procedure should be followed:

1. Make a visual inspection of the tube to check for loose connections or other mechanical defects.

2. Place the tube in the proper solenoid and make connections to the tube and solenoid. Observe color-coding of the tube leads and polarity marking on the solenoid.

3. Apply cooling to the solenoid.

4. Apply the following voltages in the following order:

   4.1 Heater Voltage (6.3 Volts).

   4.2 Solenoid Voltage (adjust solenoid current to yield 900 Gauss).

   4.3 Control Electrode Voltage (apply bias voltage specified on data sheet supplied with tube.)

   4.4 Cathode Voltage (adjust slowly to the value indicated on the data sheet; usually about minus 1400 Volts with respect to the shell. At all times monitor helix current and observe the 2.0 Ma maximum limit.)

5. R.F. Input should be limited to 10 MW.

6. The cathode voltage may be optimized for optimum power output at the desired frequencies.

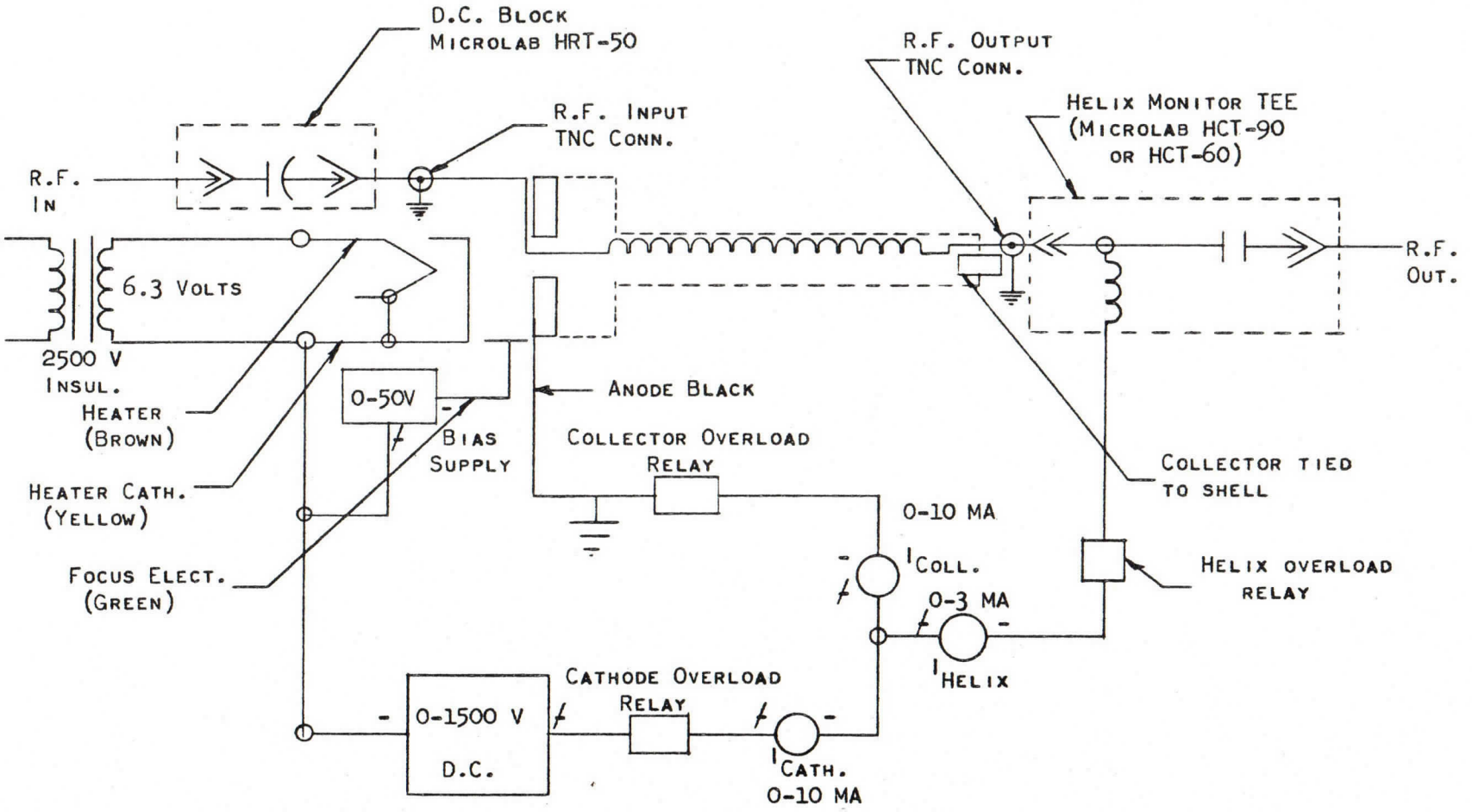
THE FOLLOWING PRECAUTIONS SHOULD BE TAKEN WHEN OPERATING THE TRAVELING WAVE TUBE:

1. NEVER OPERATE THE F-7066 WITHOUT PROPER MAGNETIC FIELD. BE SURE SUFFICIENT COOLING IS SUPPLIED TO TUBE AND SOLENOID.

2. NEVER OPERATE THE F-7066 WITH HELIX CURRENT IN EXCESS OF 2.0 MA. UNDER MOST CONDITIONS HELIX CURRENT WILL BE 1.0 MA OR LESS. IT IS IMPORTANT THAT HELIX OVERLOAD PROTECTION BE PROVIDED.

3. BE SURE COAXIAL CABLES TO BE CONNECTED TO THE TUBE INPUT AND OUTPUT CONNECTORS ARE ASSEMBLED CORRECTLY. IF THE INNER CONDUCTOR OF THE CABLE CONNECTOR IS TOO LONG, PRESSURE WILL BE APPLIED TO A CERAMIC BEAD, WHICH MAY CAUSE DAMAGE TO THE TUBE. IF IT IS TOO SHORT, A POOR CONNECTION WILL RESULT CAUSING POOR R.F. PERFORMANCE.

THE ATTACHED SCHEMATIC IS A SUGGESTED METHOD OF CONNECTING THE F-7066 AND SHOWS THE LOCATION OF PROTECTION CIRCUITS AND METER POLARITY.



NOTES:

1. ALL OVERLOADS OPERATE TO DISCONNECT HIGH VOLTAGE SUPPLY.
2. HELIX MONITOR AND D.C. BLOCK TO BE SUPPLIED BY USER.

BASIC SUPPLY AND METERING REQUIREMENTS FOR F-7066 TWT AMPLIFIER

TENTATIVE

DESCRIPTION:

The F-7067 is a 1 watt pulse traveling wave amplifier tube having 30 db gain and 8.0 to 12.0 kmc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with female TNC connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. The tube is for pulse service, at a maximum duty cycle of .04. A grid suitable for pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater Current	2.3	amperes
Maximum Anode Voltage (Note 1)	4500	volts
Maximum Helix Current (Note 2)	15	ma peak
Maximum Collector Dissipation (beam power)	10	watts
Maximum Grid Voltage (Note 3)		
Positive	+100	volts
Negative	-100	volts

ELECTRICAL INFORMATION:

Maximum Frequency	12.0	kmc
Minimum Frequency	8.0	kmc
Minimum Cold Transmission Loss	50	db
Capacitance		
Control Electrode to all elements	15	μμf max.

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential
Gun Connections	Flying Leads
R-F Connections	Female TNC Connectors
Magnetic Field Strength (nominal)	1200 gauss
Mounting Position	Any
Weight (tube only)	1 pound
Type of Cooling	Conduction to Solenoid

TYPICAL OPERATION:

Anode Voltage	3600 volts
Anode Current	50 ma peak
Helix Current	5 ma peak
Grid Voltage	
Bias	-10 volts
Applied Voltage Pulse	120 volts peak
Power Output (nominal) (Note 4)	1 watts peak
Gain (nominal)	30 db
Duty Cycle	.01

Note 1: All voltages shown are with respect to cathode. Anode and collector are connected internally to the shell, and the outer coaxial conductor of the r-f connections is also at shell potential. The helix is connected to the center conductor of the coaxial line and a d-c connection to the helix must be provided externally in the r-f circuitry.

Note 2: Initial adjustments of voltage and magnetic field may be made at low duty cycles. 5 ma helix current must not be exceeded at maximum duty cycle (.04).

Note 3: Positive voltage must not be applied to the grid in the absence of anode voltage.

Note 4: 2 watts power output at 30 db gain can be obtained from 8.0 to 11.0 kmc.

Additional information for specific applications can be obtained from the

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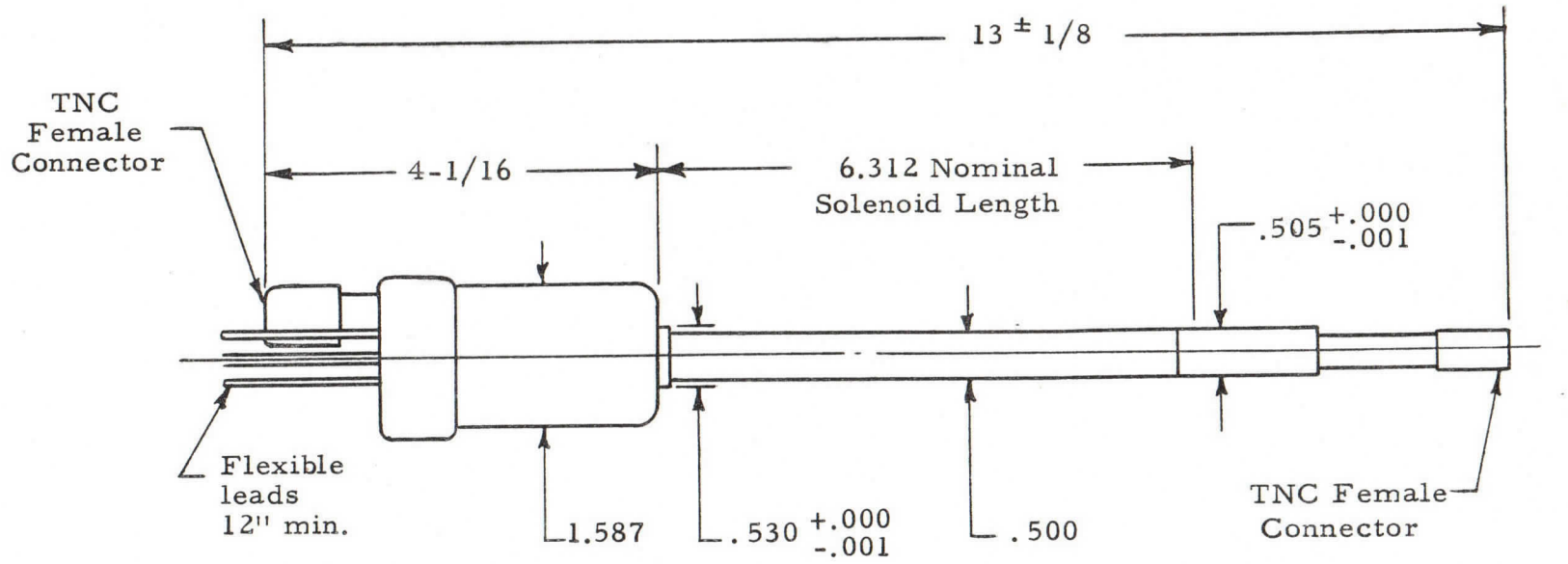

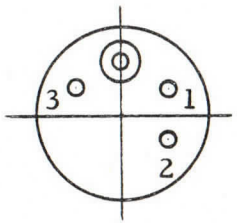

LEAD NO.	LEAD COLOR	CONNECTION
1	Green	Grid
2	Brown	Heater
3	Yellow	Heater-Cathode

OUTLINE - F-7067 TRAVELING WAVE TUBE

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INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

F-7338 TRAVELING WAVE TUBE

FORMERLY F-6826A

TENTATIVE

DESCRIPTION:

The F-7338 is a 1 kilowatt pulse traveling wave amplifier tube having 40 db gain and 2000 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix-type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .005 and pulse lengths up to 10 microseconds can be used.

A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%) volts
Heater Current	5.0 amperes
Maximum Anode Voltage (Note 1)	8500 volts
Maximum Shell Current (Note 2)	0.5 ampere peak
Maximum Collector Voltage (Note 3)	9000 volts
Maximum Collector Dissipation (Note 4)	100 watts avg.
Maximum R-F Input Power	10 watts avg.
Maximum R-F Output Power	10 watts avg.
Maximum Duty Cycle	.005
Maximum Pulse Width (Beam)	10 μ sec.
Maximum Cathode Current	2.5 amperes peak
Maximum Grid Voltage	
Negative	-300 volts
Positive (Note 7)	+6% of anode voltage

ELECTRICAL INFORMATION:

Maximum Frequency (Note 5)	2000 mc
Minimum Frequency (Note 5)	4000 mc
Minimum Cold Transmission Loss	60 db
Capacitance - control grid to all other elements	9 μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential
Base, Small Shell Duodecal, 6 Pin	JEDEC Designation B6-63
Type of Envelope	Metal
Magnetic Field Strength	1200 gauss
Length of Magnetic Field	9.625 inches uniform
Mounting Position	Any
Weight (not including magnet)	1 lb. 14 ozs.
R-F Connections	50 ohm coax with Type "N" Jack UG-23B/U
Type of Cooling	Forced Air
Air flow on Collector Radiator (Note 4)	20 cfm
Glass Temperature	160°C max.

TYPICAL OPERATION AS POWER AMPLIFIER:

Center Frequency	3000 mc
Anode Voltage (Note 1)	7800 volts
Cathode Current	1.8 amperes peak
Collector Voltage (tied to shell)	7500 volts
Collector Current	1.4 amperes peak
Power Output (at center frequency)	1.8 kw peak
Bandwidth (Note 6)	2.0 to 4.0 kmc
Gain (Note 6)	40 db
Duty	.001
Pulse Width	2 μ sec.
Grid Bias (for cut-off)	-100 volts
Grid Voltage during Pulse (Note 8)	+350 volts
Grid Current during Pulse	0.1 amperes peak

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at ground potential and the anode connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between cathode current and collector current. Since this current, in general, should be minimized, it may be desirable to measure current from shell to ground. In making this measurement, care should be taken that both the tube and solenoid are completely insulated from ground. Once operating characteristics (voltage, current, and magnetic field) have been established, shell should be grounded.

Note 3: The tube may be operated with the collector tied to the shell (anode and helix) or may be operated at several hundred volts positive with respect to shell with slight improvement in beam transmission. The potential difference between collector and shell must be limited to 500 volts minimum.

Note 4: Forced air cooling is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 100 watts, a minimum air flow of 20 cfm through the cooling fins is required.

Note 5: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

Note 6: The following gain, power, bandwidth relations apply: The minimum power and gain is 1 kw at 40 db from 2400 to 3600 mc, and 500 watts at 37 db from 2000 to 4000 mc. Small signal gain is less than 50 db over the operating bandwidth. Saturated power output of at least 1 kw can be obtained from 2200 to 4000 mc. Bandwidth between 6 db small signal points is greater than 500 mc and bandwidth between 10 db small signal points is greater than 1800 mc.

Note 7: Positive voltage must not be applied to the grid in the absence of anode voltage.

Note 8: The positive grid voltage pulse should be the minimum consistent with normal power output.

GENERAL OPERATING INSTRUCTIONS:

(1) Heater warm up of 2 minutes before applying high voltage is recommended.

(2) High voltage must not be applied in the absence of proper grid bias and magnetic field. Positive grid uplse voltage must not be applied in the absence of high voltage.

(3) Initial adjustments should be done at low duty cycle (less than .001) to prevent damage due to high shell (interception) current.

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Standard solenoids to operate this tube are available, and solenoids designed for particular applications can be supplied.

Additional information for specific applications can be obtained from the

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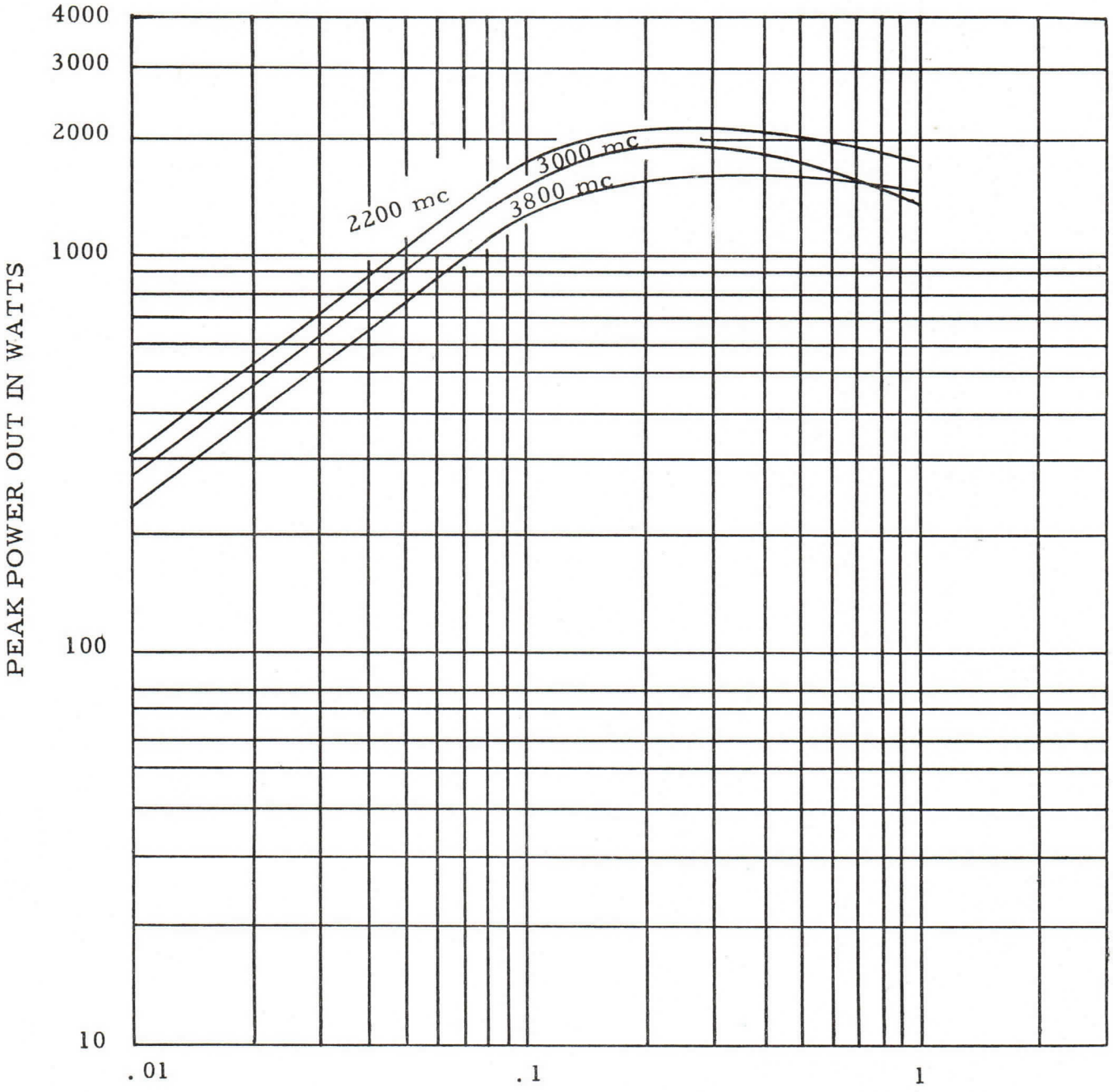
TYPICAL POWER IN - POWER OUT CHARACTERISTIC



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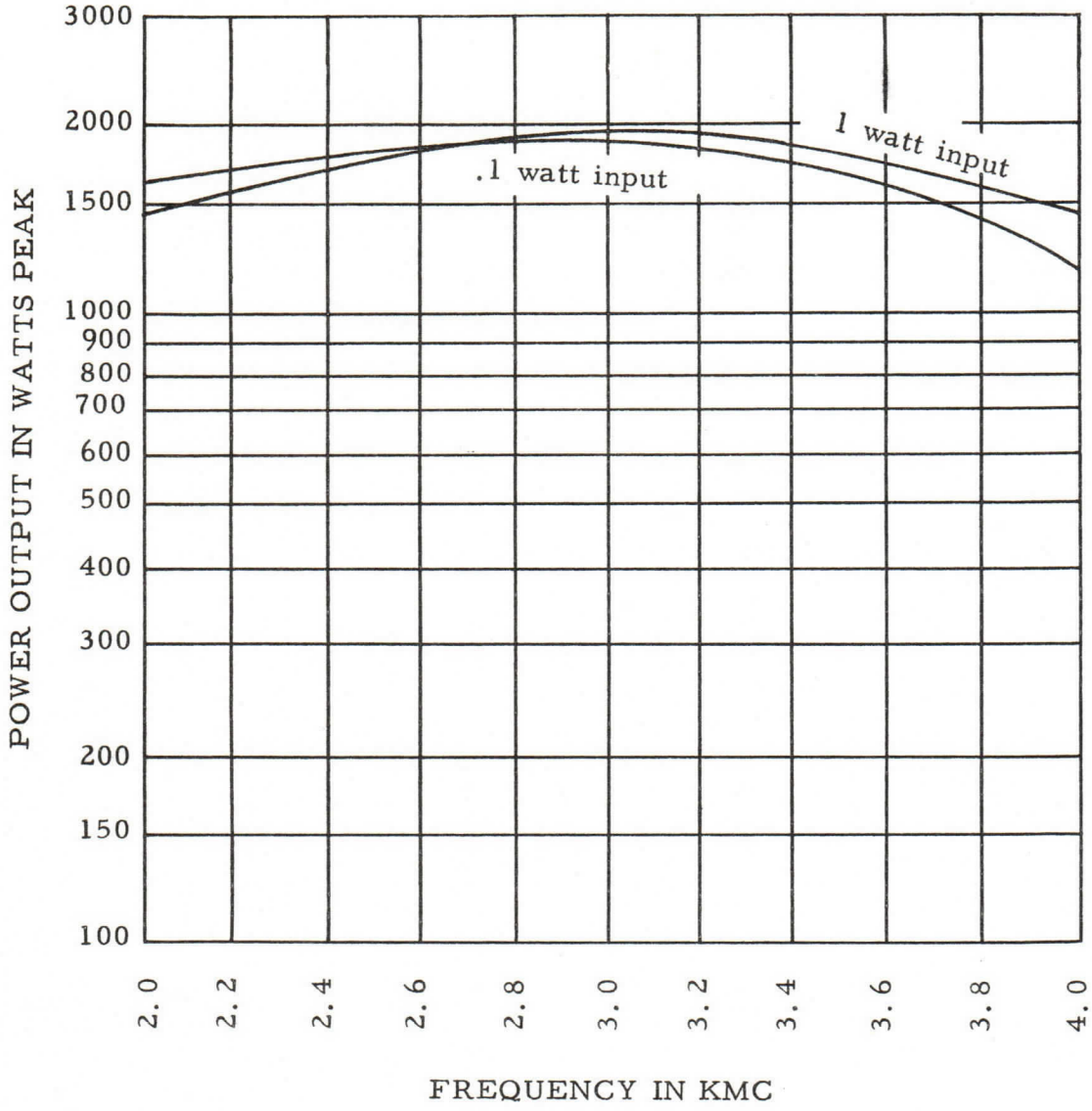
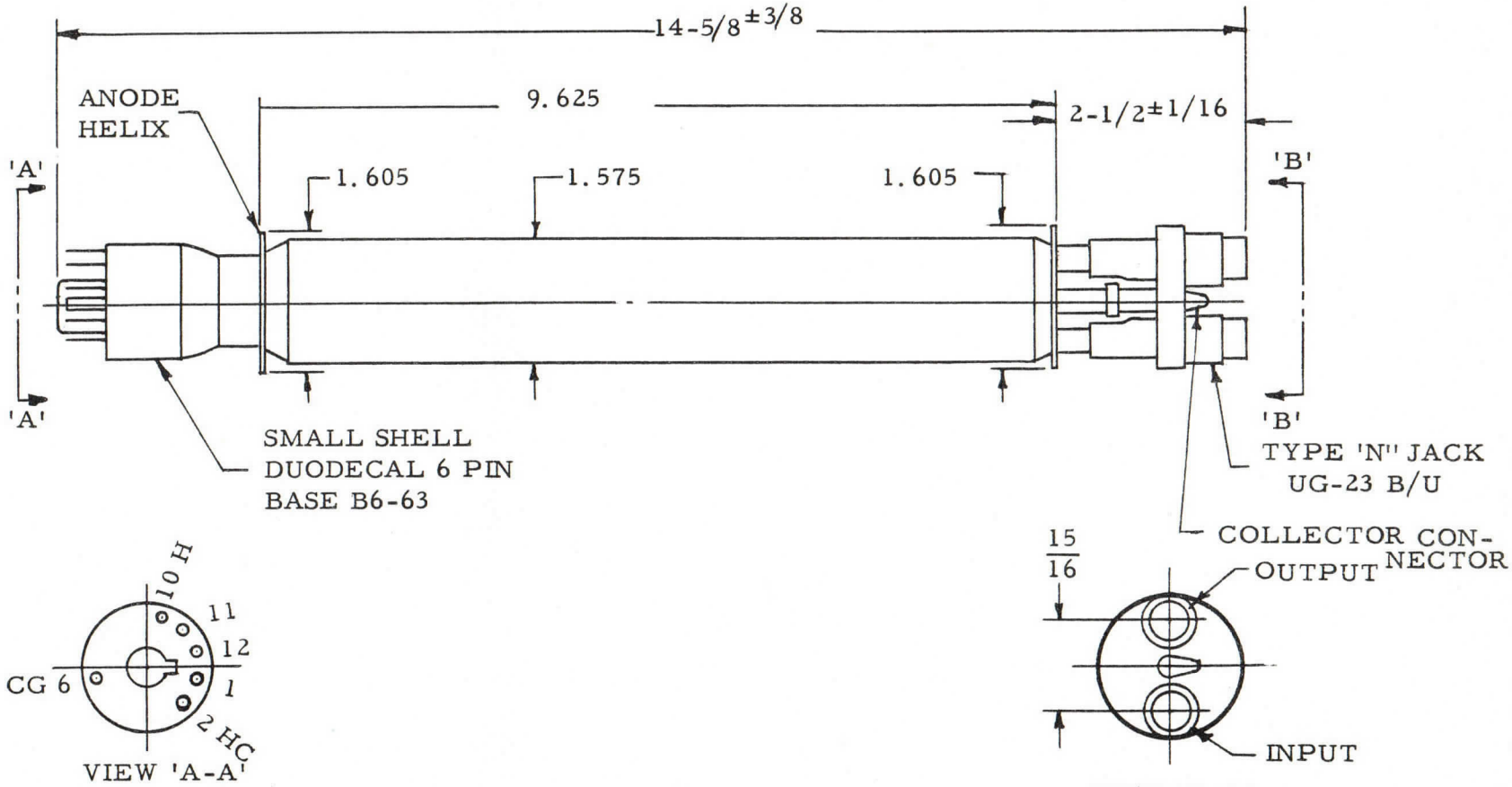
TYPICAL P_{OUT} VS. FREQUENCY CHARACTERISTIC





BASING

PIN	ELEMENT
1	NO CONN.
2	HEATER CATHODE
6	CONTROL GRID
10	HEATER
11	NO CONN.
12	NO CONN.

TRAVELING WAVE TUBE TYPE F-7338

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

F-7339
TRAVELING WAVE TUBE

FORMERLY
TYPE D-92

TENTATIVE

DESCRIPTION:

The F-7339 is a 1 kilowatt pulse traveling wave amplifier tube having 27 db gain and 8500 to 9600 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .005 and pulse widths up to 10 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±10%)	volts
Heater Current	2.5	amperes
Maximum Anode Voltage (Note 1)	12	kilovolts peak
Maximum Shell Current (Note 2)	0.5	ampere peak
Maximum Collector Voltage (Note 3)	12.5	kilovolts peak
Maximum Collector Dissipation (Note 4)	150	watts average
Maximum R-F Input Power	5	watts average
Maximum R-F Output Power	10	watts average
Maximum Duty Cycle	.005	
Maximum Pulse Width (Beam)	10	microseconds
Maximum Cathode Current	2.5	amperes peak

ELECTRICAL INFORMATION:

Maximum Frequency (Note 5)	9600	mc
Minimum Frequency (Note 5)	8500	mc
Minimum Cold Transmission Loss	60	db
Capacitance		
All Gun Elements to Shell	5	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential
Base, Small Shell Duodecal, 5 Pin	JEDEC Designation B5-57
Type of Envelope	Metal
Magnetic Field Strength	2000-2800 Gauss
Length of Magnetic Field	6.75 inches uniform
Mounting Position	Any
Weight (not including magnet)	1 lb. 7 ozs.
R-F Connections	50 ohm coax with Type "N" Jack UG-23B/U
Type of Cooling	Forced Air
Air Flow on Collector Radiator (Note 4)	30 cfm
Glass Temperature	160°C max.

TYPICAL OPERATION AS POWER AMPLIFIER:

Center Frequency	9000 mc
Anode Voltage (Note 1)	11 kilovolts peak
Cathode Current	1.8 amperes peak
Collector Voltage (tied to Shell)	11 kilovolts peak
Collector Current	1.5 amperes peak
Power Output (at center frequency)	1.5 kilowatts peak
Bandwidth for Po = 1 kilowatt	8.5 to 9.6 kmc
Gain (Note 6)	27 db
Duty	.001
Pulse Width	2 microseconds

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. The shell is normally operated at ground potential and the anode connection is made to the shell of the solenoid.

Note 2: The shell current is the difference between cathode current and collector current. Since this current, in general, should be minimized, it may be desirable to measure current from shell to ground. In making this measurement, care should be taken that both the tube and solenoid are completely insulated from ground. Once operating characteristics (voltage, current, and magnetic field) have been established, shell should be grounded.

Note 3: The tube may be operated with the collector tied to the shell (anode and helix) or may be operated at several hundred volts positive with respect to shell with slight improvement in beam transmission. The potential difference between collector and shell must be limited to 500 volts maximum.

Note 4: Forced air cooling is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 150 watts, a minimum air flow of 30 cfm through the cooling fins is required.

Note 5: Useful gain and power output exists below 8500 mc and above 9600 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will usually be lower than rated values.

Note 6: This gain is obtained over the 8.5 to 9.6 kmc bandwidth at the power level indicated. Since this is in the power saturation region, small signal gain will be approximately 10 db higher.

OPERATING INSTRUCTIONS:

(1) Heater warm up of 2 minutes before applying high voltage is recommended.

(2) Initial adjustments should be done at low duty cycle (less than .001 to prevent tube damage due to high shell (interception) current.

Standard solenoids to operate this tube are available, and solenoids designed for particular applications can be supplied.

Additional information for specific applications can be obtained from the

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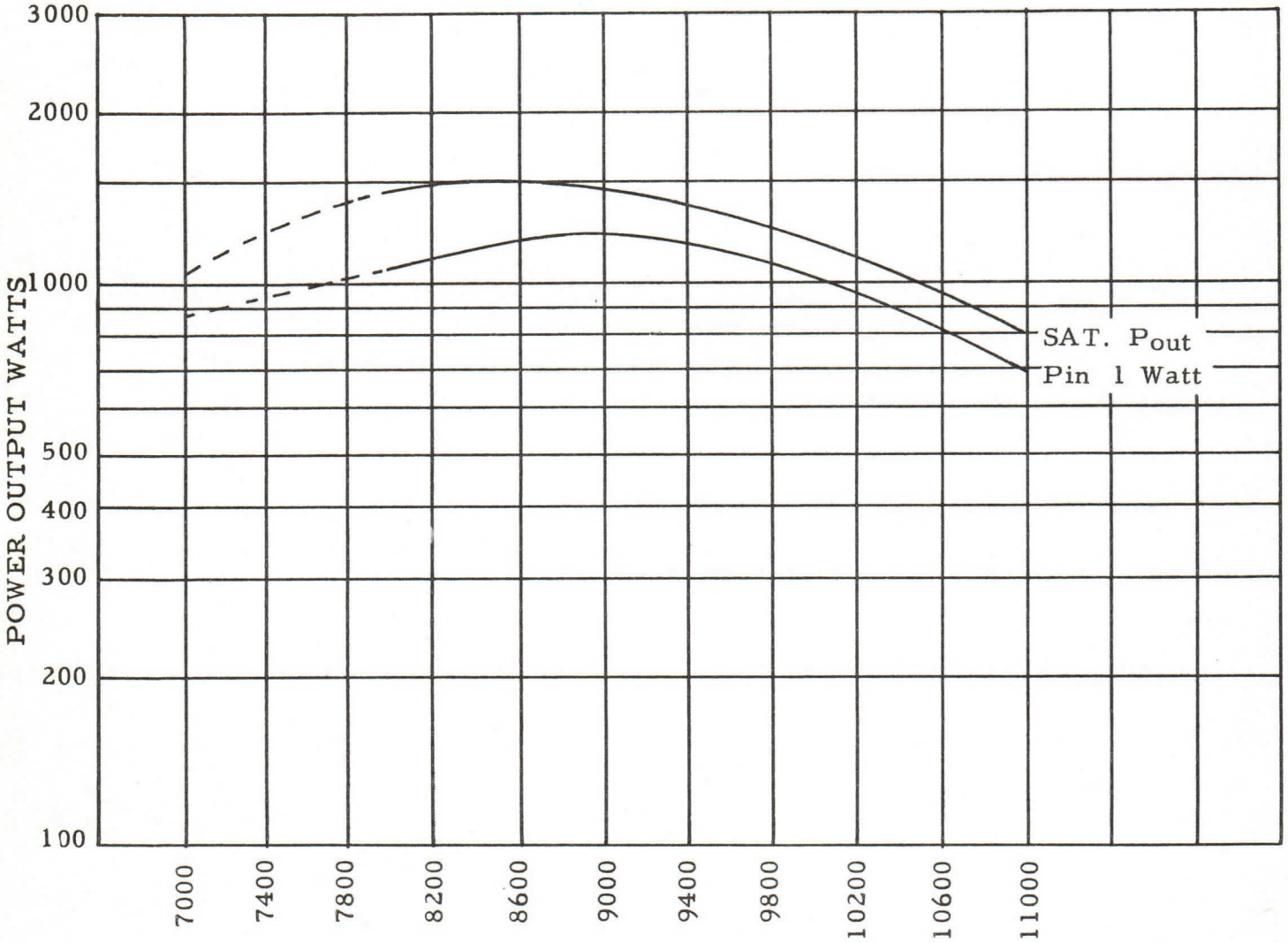
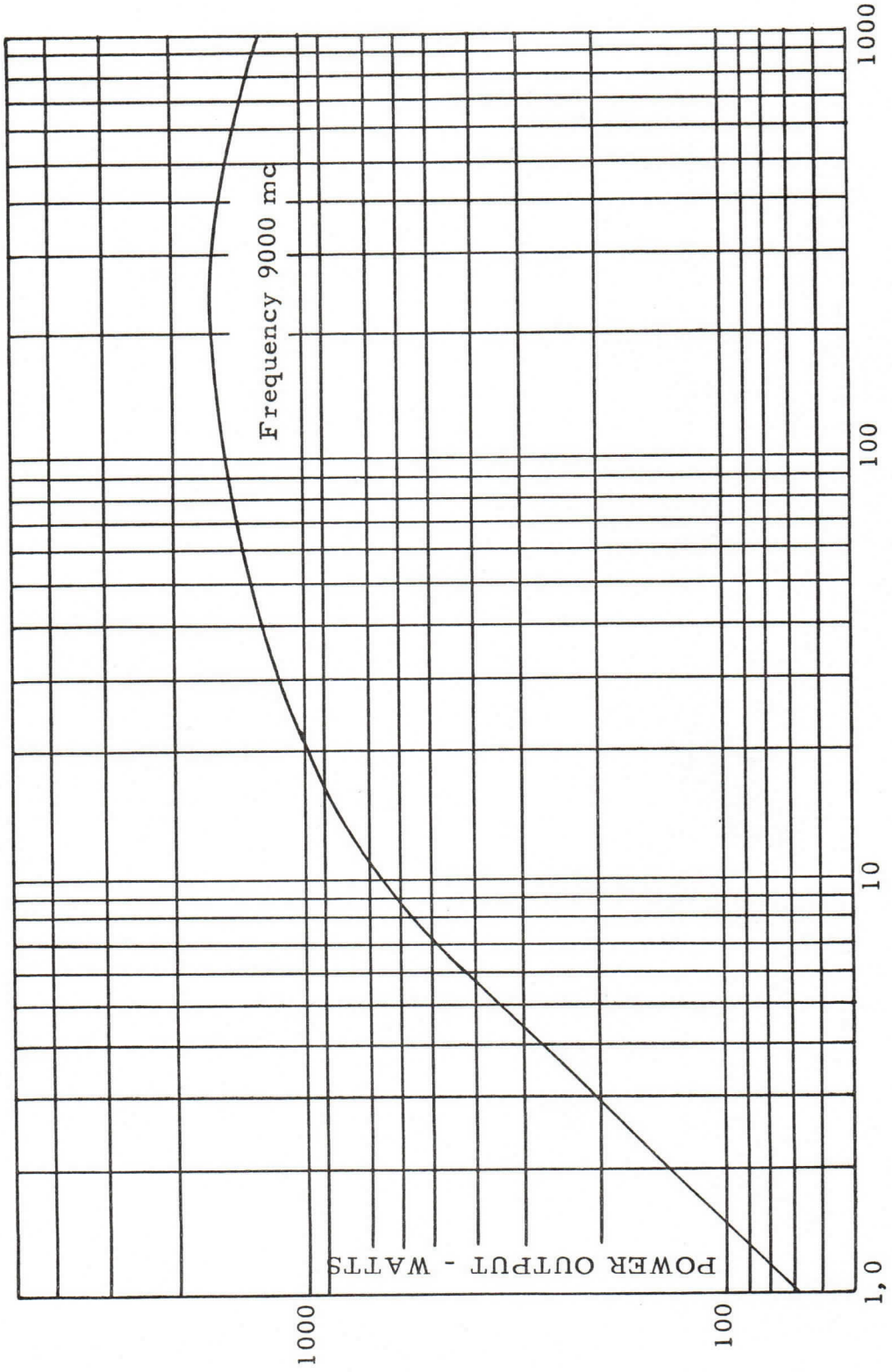
TYPICAL P_{out} VS. FREQUENCY CHARACTERISTICS



TYPICAL P_{out} VS. P_{in} CHARACTERISTIC



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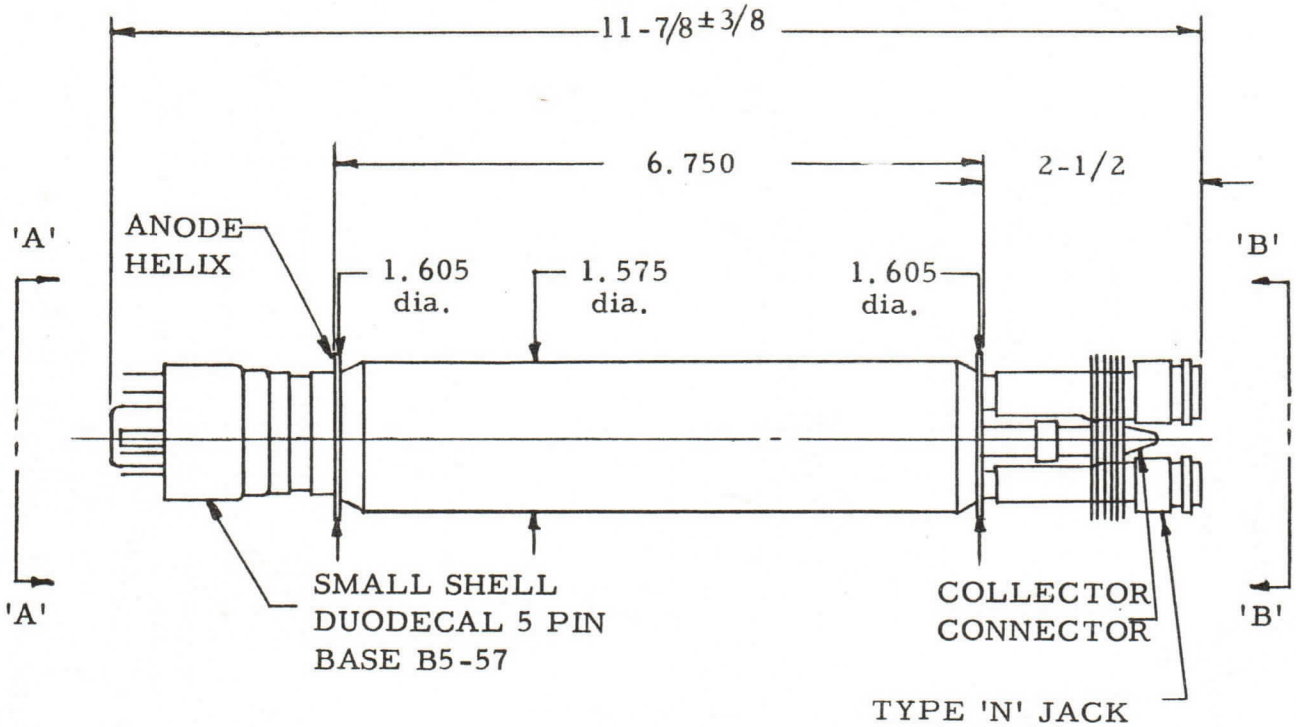
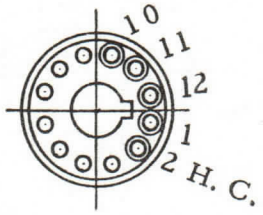
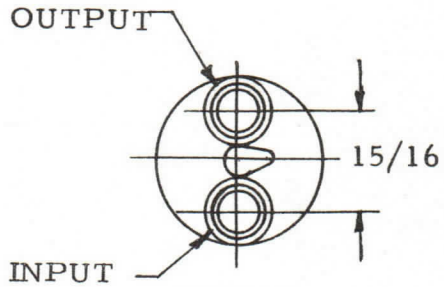




VIEW 'A-A'



VIEW 'B-B'

BASING

PIN	ELEMENT
1	No Conn.
2	Heater-Cathode
10	Heater
11	No conn.
12	No conn.

OUTLINE

TRAVELING WAVE TUBE F-7339

F-7340 TRAVELING WAVE TUBE

(FORMERLY D-95)

DESCRIPTION:

The F-7340 is a 1 kilowatt pulse traveling wave amplifier tube having 30 db gain and 8000 to 9600 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type 'N' connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .005 and pulse lengths up to 10 microseconds can be used.

A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±5%)	volts
Heater Current	5.2	amperes
Maximum Anode Voltage (Note 1)	12,000	volts
Maximum Shell Current	1.5	ampere peak
Maximum Collector Dissipation (Note 2)	180	watts average
Maximum R-F Input Power	10	watts average
Maximum R-F Output Power	10	watts average
Maximum Duty Cycle	.005	
Maximum Pulse Width	10	μ seconds
Maximum Cathode Current	3.0	amperes peak
Maximum Grid Voltage		
Negative	-300	volts
Positive (Note 5)	+450	volts
Maximum Grid Current	.27	ampere peak

ELECTRICAL INFORMATION:

Maximum Frequency (Note 3)	9600	mc
Minimum Frequency (Note 3)	8000	mc
Minimum Transmission Loss		
at Grid Bias = -200 volts	60	db

ELECTRICAL INFORMATION (Continued)

Capacitance		
Control Grid to All Other Elements	9	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential	
Base (Note 8)	JEDEC Designation B6-65	
Molded Silicone Rubber Base with Flying Leads or Small Shell Duodecal, 6 Pin		
Type of Envelope		Metal
Magnetic Field Strength	2400	gauss
Length of Magnetic Field	6.75	inches uniform
Mounting Position		Any
Weight of Tube	1 lb.	7 oz.
R-F Connections (Note 8)	Type N Jack UG-23 B/U	
Type of Cooling	Forced Air	
Air Flow on Collector Radiator (Note 2)	300	cfm
Maximum Glass Temperature	160	°C

TYPICAL OPERATION AS POWER AMPLIFIER:

Center Frequency	9000	mc
Anode Voltage (Note 1)	9600	volts
Cathode Current	1.8	amperes peak
Power Output (at center frequency)	1.8	kw peak
Bandwidth	8.0 to 9.6	kmc
Gain (Note 4)	30	db
Duty	.001	
Pulse Width	2.0	μ seconds
Grid Bias (for cut-off)	-100	volts
Grid Voltage during Pulse (Note 6)	+350	volts
Grid Current during Pulse	0.1	ampere peak

Note 1: All voltages shown are with respect to cathode. Anode and helix are connected internally to the shell. Helix connection is center conductor of coax. Shell is normally operated at ground potential and connection is made to the shell of the solenoid.

Note 2: Forced air cooling is required for average collector power in excess of 10 watts. As the collector power is increased, the air flow required increases. At the maximum collector power of 150 watts, a minimum air flow of 30 cfm through the cooling fins is required.

Note 3: Useful gain and power output exists below 8000 mc and above 9600 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

Note 4: This gain is obtained over the 8.0 to 9.6 kmc bandwidth at the power level indicated. Since this is in the power saturation region, small signal gain will be approximately 10 db higher. Fine grain structure of small signal gain is normally less than ± 3 db.

Note 5: Positive voltage must not be applied to the grid in the absence of anode voltage.

Note 6: The positive grid voltage pulse should be the minimum consistent with normal power output.

Note 7: Mismatch up to and including a short circuit in input or output lines will not cause oscillation.

Note 8: Unless otherwise specified on Purchase Order, tube will be provided with small shell duodecal base and type N jack. Waveguide flange, UG 40 A/U, r-f connections can also be provided.

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GENERAL OPERATING INSTRUCTIONS:

(1) Heater warm up of 2 minutes before applying high voltage is recommended.

(2) High voltage must not be applied in the absence of proper grid bias and magnetic field. Positive grid pulse voltage must not be applied in the absence of high voltage.

(3) Initial adjustments should be done at low duty cycle (less than .001) to prevent tube damage due to high shell (interception) current.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
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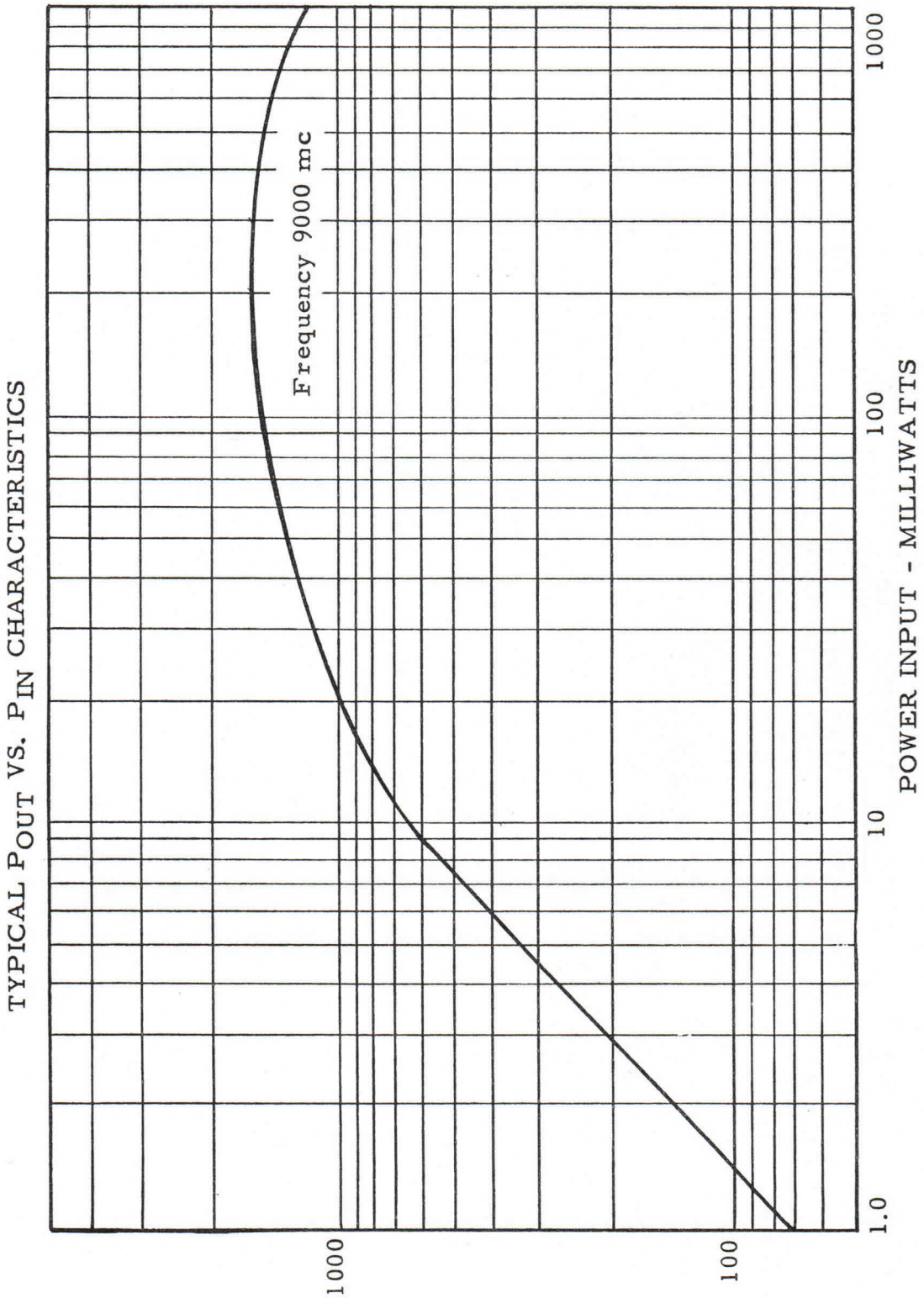
Clifton, New Jersey



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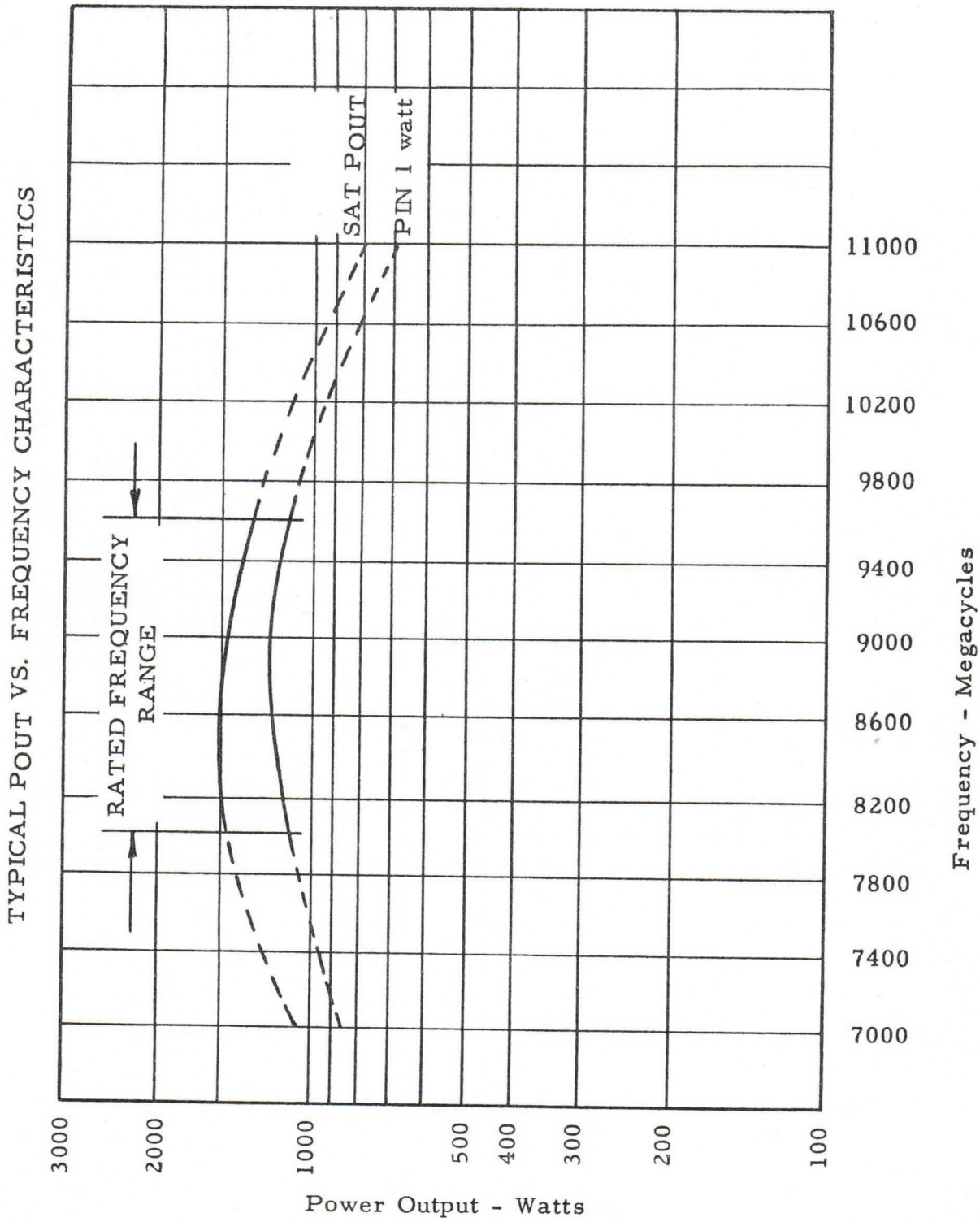
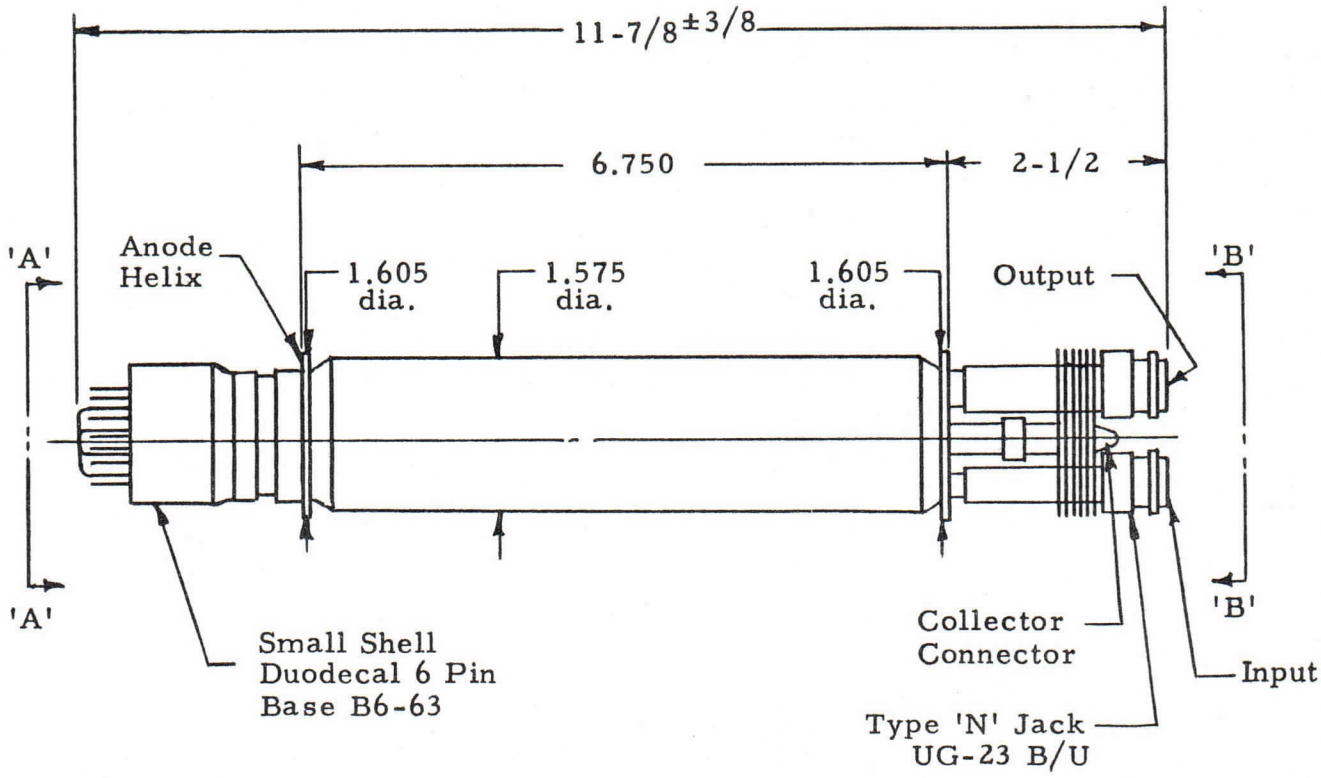
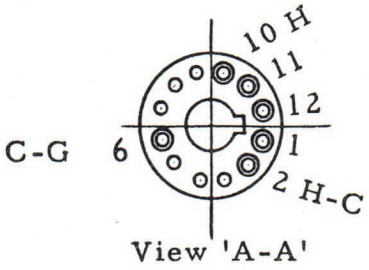

TYPICAL POUT VS. FREQUENCY CHARACTERISTICS
SAT POUT
PIN 1 watt
RATED FREQUENCY RANGE
3000
2000
1000
500
400
300
200
100
Power Output - Watts
11000
10600
10200
9800
9400
9000
8600
8200
7800
7400
7000
Frequency - Megacycles

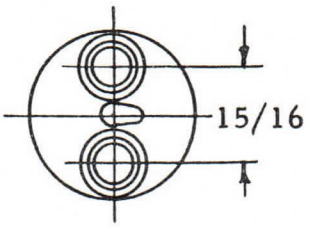




View 'A-A'

BASING

PIN	ELEMENT
1	No conn.
2	Heater-Cathode
6	Control Grid
10	Heater
11	No conn.
12	No conn.



View 'B-B'

OUTLINE

TRAVELING WAVE TUBE F-7340

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

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

* F-7341 TRAVELING WAVE TUBE

TENTATIVE

DESCRIPTION:

The F-7341 is a 5 watt pulse traveling wave amplifier tube having 25 db gain and 8000 to 9600 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with type "N" connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used.

The tube is mechanically and electrically similar to type F-6996 except that a mesh type grid, suitable for grid pulsing, is provided in place of the focus element used in F-6996. Operation is limited by this grid to pulse service, at a miximum duty cycle of .04.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts
Heater Current	2.3	amperes
Maximum Anode Voltage (Note 1)	3400	volts
Maximum Shell Current (Note 2)	20	ma peak
Maximum Collector Voltage (Note 3)	3500	volts
Maximum Collector Dissipation (Note 4)	10	watts
Maximum Duty Cycle	.04	
Maximum Grid Voltage (Note 5)		
Negative	-100	volts
Positive	+150	volts peak
Maximum Grid Current	6	ma peak

ELECTRICAL INFORMATION:

Minimum Frequency	8000	mc
Maximum Frequency	9600	mc
Minimum Cold Insertion Loss (Note 7)	50	db
Capacitance - Grid to all other elements	15	μμf max.

* Formerly Type D-2004

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential	
Base, Small Shell Duodecal, 6 Pin (Note 6)	JETEC B6-63	
Type of Envelope	Metal	
Magnetic Field Strength	1000	gauss
Length of Magnetic Field	6.75	inches uniform
Mounting Position	Any	
Weight (not including magnet)	1 lb. 7 oz.	
R-F Input and Output Impedance	50	ohm coax.
Type Connector	Type "N" Jack UG-23 B/U	
Type of Cooling	See Note 4	
Glass Temperature	160	°C max.

TYPICAL OPERATION AS POWER AMPLIFIER:

Anode Voltage	3200	volts
Shell Current	10	ma peak
Collector Voltage	3200	volts
Collector Current	50	ma peak
Grid Voltage		
Bias	0	volts
Applied Voltage Pulse	120	volts peak
Grid Current	3	ma peak
Power Output	5	watts nominal
Gain	25	db nominal
Duty Cycle	.03	

Note 1: All voltages shown are with respect to cathode. The shell is normally operated at approximately ground potential and the d-c connection is made to the shell of the solenoid. Anode and helix are connected internally to the shell.

Note 2: Initial adjustments of voltage and magnetic field may be made at low duty cycles. 20 ma shell current must not be exceeded at maximum duty cycle (.04).

Note 3: The collector is normally connected to the shell. A viewing resistor (recommended not to exceed 200 ohms) can be conveniently inserted in this connection.

Note 4: Convection cooling of the tube is adequate at sea level and ambients below 30°C when air circulation is not restricted. Under more severe environments, 10 cfm (or equivalent at altitudes) should be provided through the collector radiator. Cooling provisions for the solenoid are separate from the tube requirement.

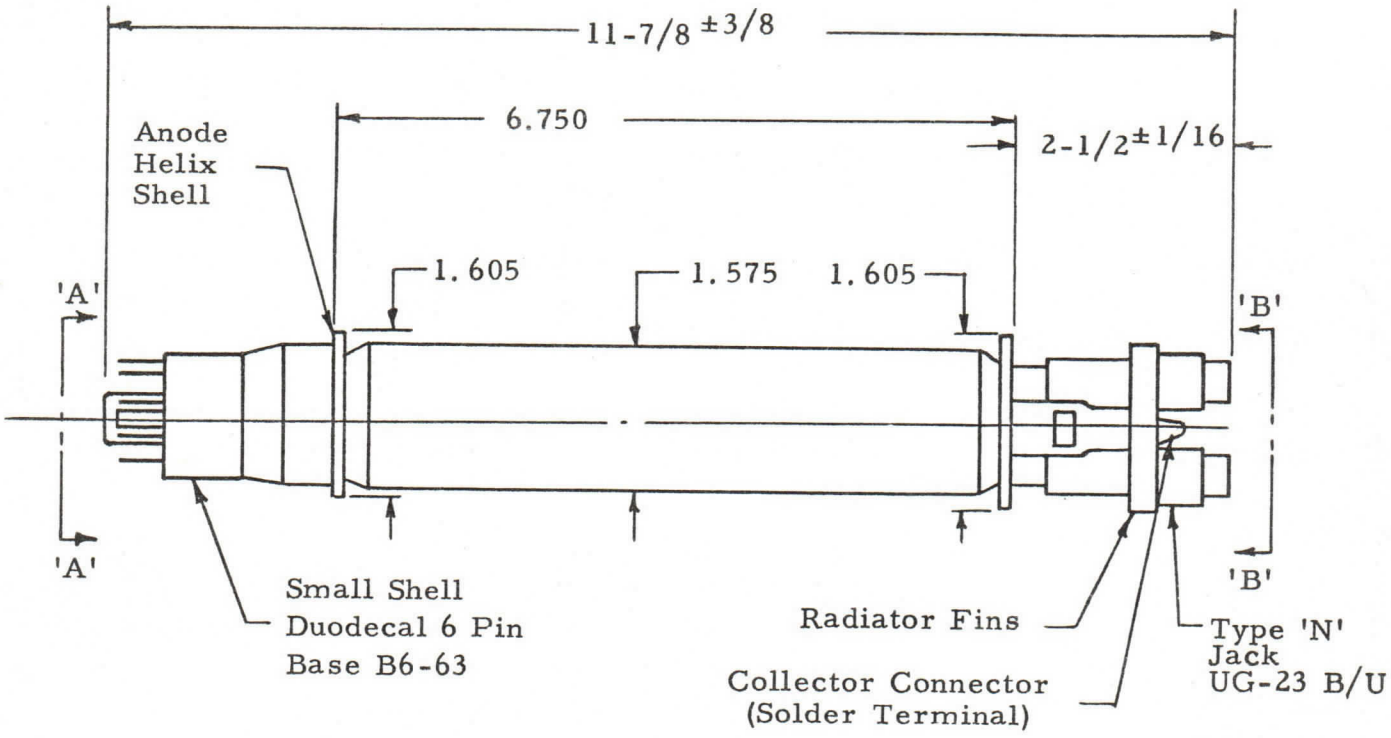
Note 5: Positive voltage must not be applied to the grid in the absence of anode voltage.

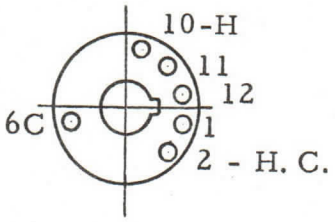
Note 6: A molded silicone rubber base, with flying leads, can be provided where altitude conditions must be met.

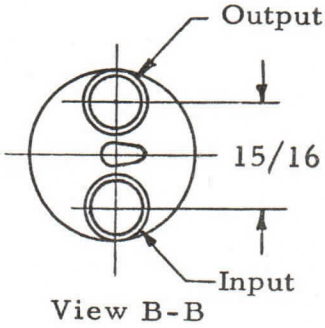
Note 7: The minimum cold insertion loss applies for grid voltage of -10 volts or more negative.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P. O. Box 412
Clifton, New Jersey







BASING

PIN	ELEMENT
1	No Conn.
2	Heater-Cathode
6	Grid
10	Heater
11	No conn.
12	No conn.

OUTLINE

F-7347 TRAVELING WAVE TUBE

Formerly D-2001

DESCRIPTION:

The F-7347 is a 1 kilowatt pulse traveling wave amplifier tube having 30 db gain and 2000 to 4000 mc frequency range. It is constructed in a rugged metal-ceramic envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with female type TNC connectors. The tube is self-aligning in an external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .005 and pulse lengths up to 10 microseconds can be used.

A control grid suitable for grid pulsing is provided.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±6%)	volts
Heater Current	5.2	amperes
Maximum Anode Voltage (Note 1)	8000	volts
Maximum Helix Current	0.5	ampere peak
Maximum Collector Dissipation (Note 2)	100	watts average
Maximum R-F Input Power	10	watts average
Maximum R-F Output Power	15	watts average
Maximum Duty Cycle	.005	
Maximum Cathode Current	2.5	amperes peak
Maximum Grid Voltage		
Negative	-300	volts
Positive (Note 5)	+400	volts
Maximum Grid Current	.5	ampere peak

ELECTRICAL INFORMATION:

Maximum Cold Input VSWR (Note 7)	4.0	
Maximum Frequency (Note 3)	4000	mc
Minimum Frequency (Note 3)	2000	mc

ELECTRICAL INFORMATION (Continued)

Minimum Transmission Loss at Grid Bias = -67 volts	10	db
Capacitance		
Control grid to all other elements	22	μμfd

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated Unipotential	
Base	Molded Silicone Rubber Base with Flying Leads	
Type of Envelope	Metal-Ceramic	
Magnetic Field Strength	1200	guass
Length of Magnetic Field	9.493	inches uniform
Mounting Position		Any
Weight of Tube	1.5	lbs., approx.
R-F Connections	Type N Jack	UG-23 B/U
Maximum Tube Temperature	177	°C

TYPICAL OPERATION AS POWER AMPLIFIER:

Center Frequency	3000	mc
Anode Voltage (Note 1)	7500	volts
Cathode Current	1.8	amperes peak
Power Output (at center frequency)	1.8	kw peak
Bandwidth	2.0 to 4.0	kmc
Gain (Note 4)	30	db
Duty	.002	
Pulse Width	10	μ seconds
Grid Bias (for cut-off)	-100	volts
Grid Voltage during Pulse (Note 6)	+300	volts
Grid Current during Pulse	0.2	ampere peak

Note 1: All voltages shown are with respect to cathode. Anode and collector are connected internally to the shell. Helix connection is center conductor of coax. External d-c connection is required between shell and helix. Shell is normally operated at ground potential and connection is made to the shell of the solenoid.

Note 2: Conduction cooling for the collector must be provided by a suitable device.

Note 3: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

Note 4: This gain is obtained over the 2.0 to 4.0 kmc bandwidth at the power level indicated. Since this is in the power saturation region, small signal gain will be approximately 10 db higher.

Note 5: Positive voltage must not be applied to the grid in the absence of anode voltage.

Note 6: The positive grid voltage pulse should be the minimum consistent with normal power output; otherwise shortened life or destruction of the tube may result.

Note 7: Mismatch up to and including a short circuit in input or output lines will not cause oscillation.

GENERAL OPERATING INSTRUCTIONS:

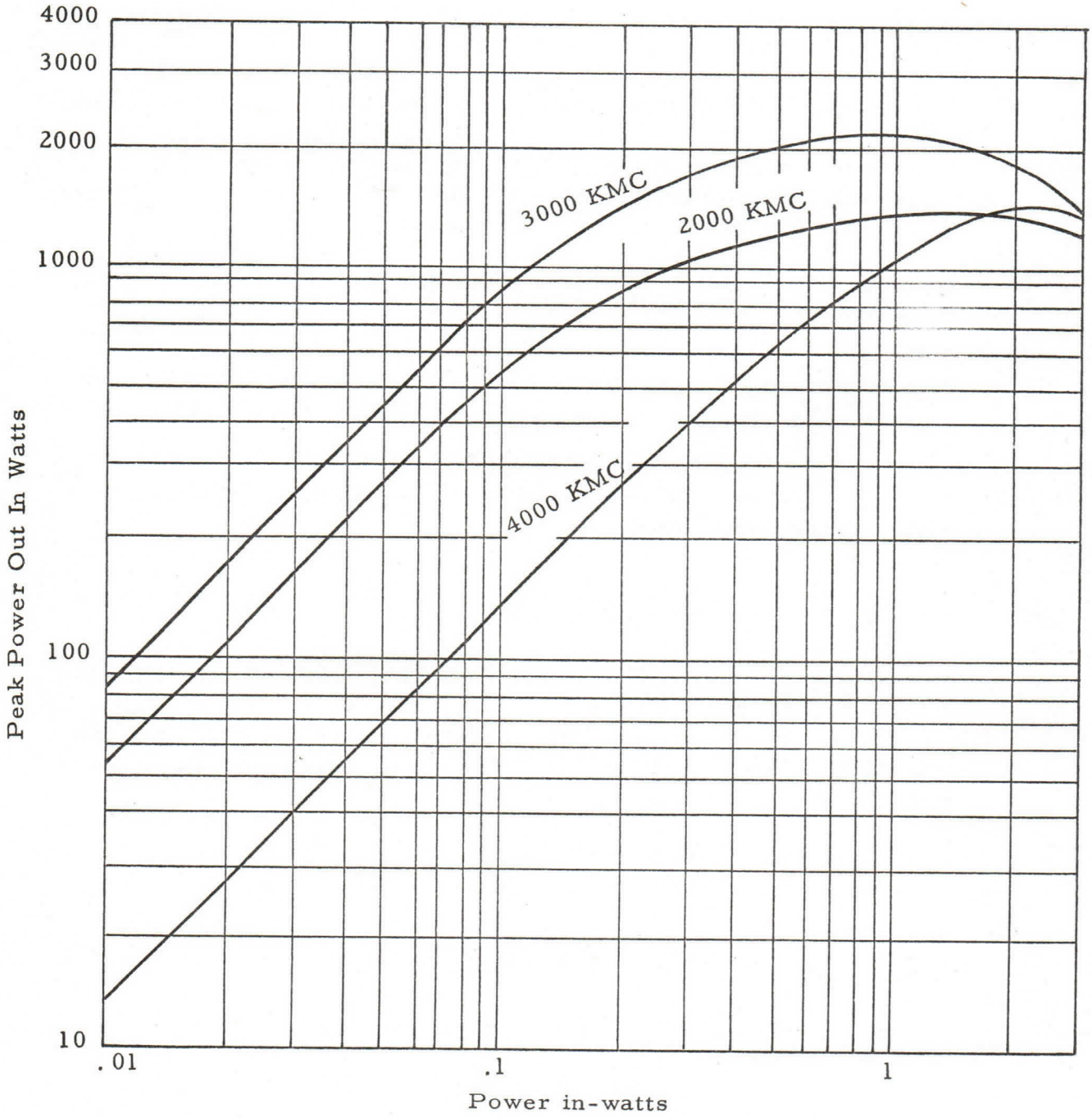
(1) Heater warm up of 2 minutes before applying high voltage is recommended.

(2) High voltage must not be applied in the absence of proper grid bias and magnetic field. Positive grid pulse voltage must not be applied in the absence of high voltage.

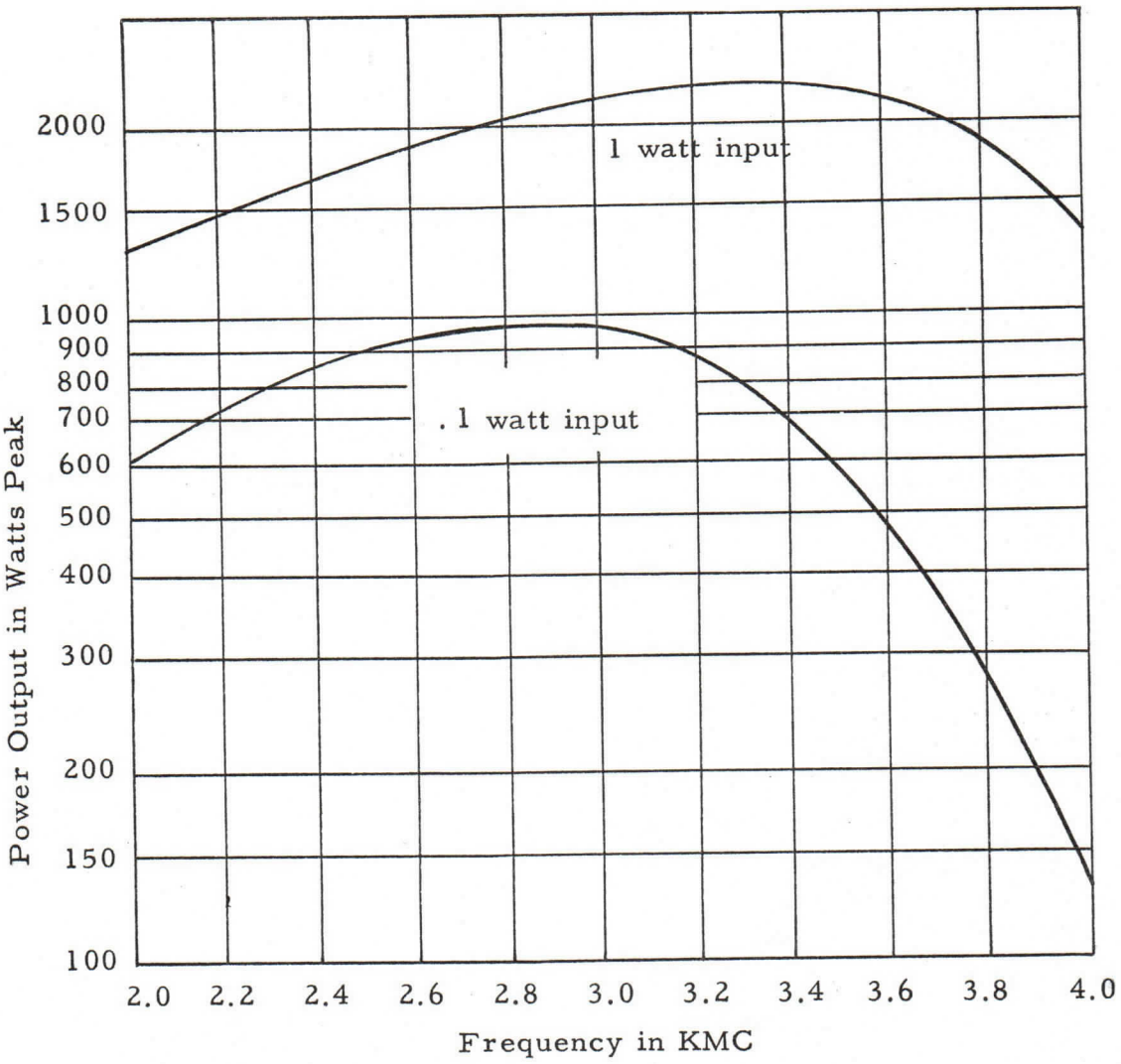
(3) Initial adjustments should be done at low duty cycle (less than .001) to prevent tube damage due to high shell (interception) current.

Additional information for specific applications can be obtained from the

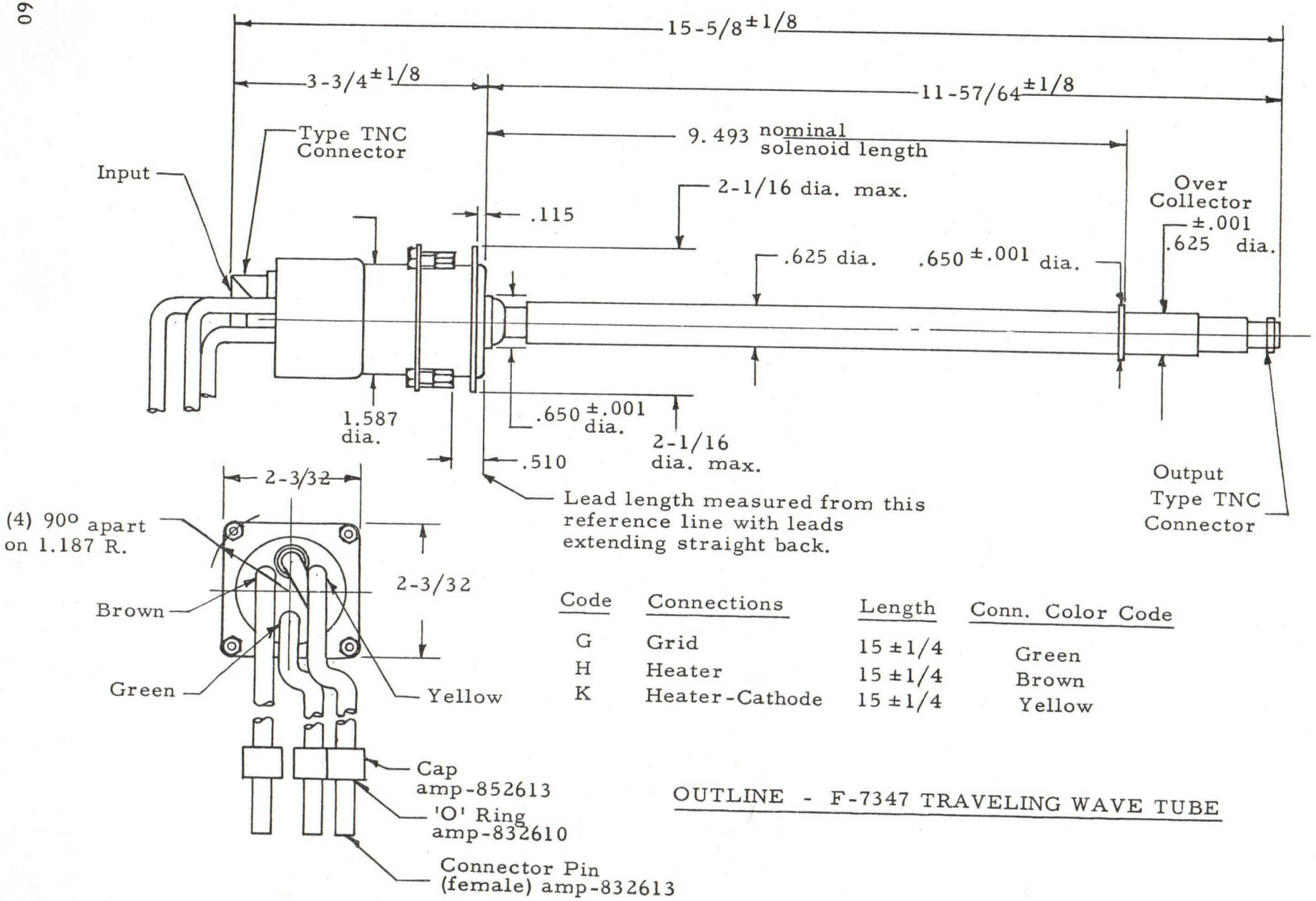
Electron Tube Applications Sections
ITT Components Division
P.O. Box 412
Clifton, New Jersey



TYPICAL POWER IN-POWER OUT CHARACTERISTIC



TYPICAL P_{out} VS FREQUENCY CHARACTERISTIC



Code	Connections	Length	Conn. Color Code
G	Grid	15 ±1/4	Green
H	Heater	15 ±1/4	Brown
K	Heater-Cathode	15 ±1/4	Yellow

OUTLINE - F-7347 TRAVELING WAVE TUBE

* F-7524 TRAVELING WAVE TUBE

TENTATIVE

DESCRIPTION:

The F-7524 is a 5 watt CW traveling wave amplifier tube having 20 db gain and 8.0 to 12.0 kmc frequency range. It is constructed in a rugged metal ceramic envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with female TNC connectors. The tube is self-aligning in the external solenoid which is required to provide a uniform magnetic field. A convergent beam gun and oxide impregnated cathode are used. The tube is suitable for either CW or pulse service.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

Heater Voltage	6.3 (±5%)	volts
Heater Current	1.7	amperes
Maximum Anode Voltage (Note 1)	4000	volts
Maximum Helix Current (Note 2)	2	ma
Maximum Collector Dissipation (beam power)	240	watts
Maximum Control Electrode Voltage (Note 3)	-500	volts

ELECTRICAL INFORMATION:

Maximum Frequency	12.0	kmc
Minimum Frequency	8.0	kmc
Minimum Cold Transmission Loss	50	db
Capacitance		
Control Electrode to All Elements	10	μμf, max.

MECHANICAL INFORMATION:

Type of Cathode	Oxide Coated Unipotential	
Gun Connections	Flying Leads	
R-F Connections	Female TNC Connectors	
Magnetic Field Strength (nominal)	1200	gauss
Mounting Position	Any	
Weight (Tube only)	1	pound
Type of Cooling	Dependent on package	

* FORMERLY D-2005

TYPICAL OPERATION:

Anode Voltage	3600	volts
Anode Current	50	ma
Helix Current	0.5	ma
Control Electrode Voltage (Note 4)	-30	volts
Power Output	5	watts nominal
Gain	20	db nominal
Duty Cycle (Note 4)		
R-F	Variable to 1.0	
Beam	1.0	

Note 1: All voltages shown are with respect to cathode. Anode and collector are connected internally to the shell, and the outer coax conductor of the r-f connections is also at shell potential. The helix is connected to the center conductor of the coax line and a d-c connection to the helix must be provided externally in the r-f circuitry.

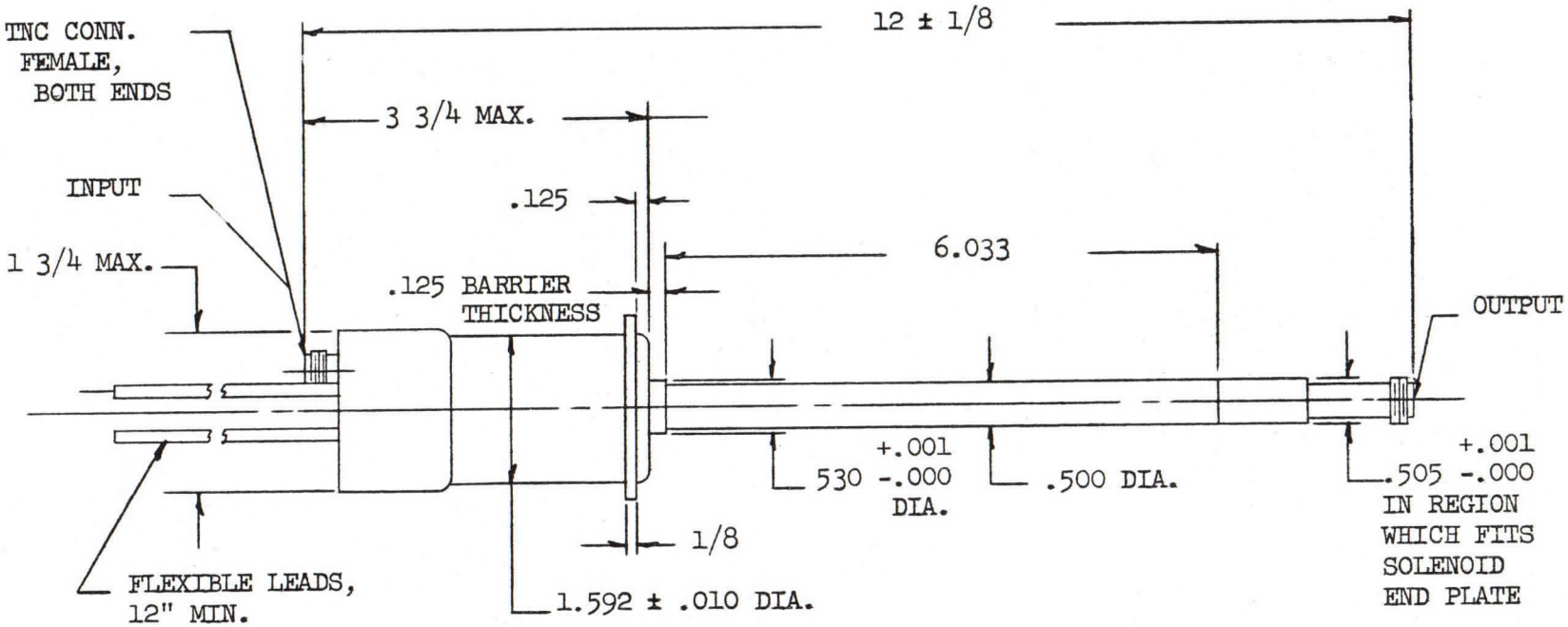
Note 2: The helix current should, in general, be minimized and must be less than the maximum rating. The control electrode voltage and magnetic field (solenoid current) can be properly adjusted before connection of r-f cables by monitoring current to the center coax conductor. It is desirable, when possible, to monitor this current during operation and to provide overload protection. In pulsed beam operation, the peak helix current may exceed 2 ma but care should be taken to operate at reasonably low values and average current must not exceed 2 ma.

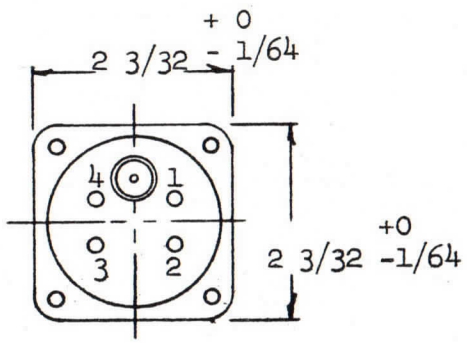
Note 3: The control electrode voltage is adjusted for best transmission for CW operation (normally about -30 volts). Beam gate off can be accomplished by applying voltage of -400 to -500 volts. Operation in the region of control electrode voltage between approximately -50 volts and -400 volts is not permitted.

Note 4: Gated beam operation can also be utilized by applying -400 to -500 volts to the control electrode for gate off and approximately -30 volts (this value adjusted for best transmission) for gate on. In this type of operation, the values of power output, anode current, and helix current become peak values.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Box 412 - Clifton, New Jersey





PIN	COLOR CODE	CONNECTIONS
2	GREEN	FOCUS
4	BROWN	HEATER
1	YELLOW	HEATER - CATHODE
3	BLACK	ANODE

OUTLINE F-7524 T.W.T.

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

*
F-7525
TRAVELING
WAVE TUBE

TENTATIVE

DESCRIPTION:

THE F-7525 IS A 5 WATT CW TRAVELING WAVE AMPLIFIER TUBE HAVING 20 DB GAIN AND 8.0 TO 12.0 KMC FREQUENCY RANGE. IT IS CONSTRUCTED IN A RUGGED METAL CERAMIC ENVELOPE WITH A HELIX TYPE SLOW WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH FEMALE TNC CONNECTORS. THE TUBE IS PACKAGED IN AN OIL COOLED SOLENOID WITH INTEGRAL COLLECTOR COOLER, WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE IMPREGNATED CATHODE ARE USED. THE TUBE IS SUITABLE FOR EITHER CW OR PULSE SERVICE.

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3 (±5%)	VOLTS
HEATER CURRENT	1.7	AMPERES
MAXIMUM FREQUENCY	12.0	KMC
MINIMUM FREQUENCY	8.0	KMC
MINIMUM COLD TRANSMISSION LOSS	50	DB
CAPACITANCE		
CONTROL ELECTRODE TO ALL ELEMENTS	10	UUF MAX.

ELECTRICAL RATINGS, ABSOLUTE VALUES:

MAXIMUM ANODE VOLTAGE (NOTE 1)	4000	VOLTS
MAXIMUM HELIX CURRENT (NOTE 2)	3	MA
MAXIMUM COLLECTOR DISSIPATION (BEAM POWER)	240	WATTS
MAXIMUM CONTROL ELECTRODE VOLTAGE (NOTE 3)	-500	VOLTS

SOLENOID DATA:

TYPE OF COOLANT	OS 45	OIL
PRESSURE MAXIMUM	100	PSI
FLOW	1	GALLON/MIN.
SOLENOID CURRENT	1 TO 2	AMPS.
SOLENOID VOLTAGE	140 TO 200	VOLTS D.C.

* FORMERLY D-2005-A

MECHANICAL INFORMATION:

Type of Cathode	Oxide Coated Unipotential
Gun Connections	Flying Leads
R-F Terminals	Female TNC Connectors
Mounting Position	Any

TYPICAL OPERATION:

Anode Voltage	3800	Volts
Anode Current	50	ma
Helix Current	1.0	ma
Control Electrode Voltage (Note 3)	-30	Volts
Power Output	5	Watts Nominal
Gain	20	db Nominal
Duty Cycle (Note 3)		
R-F	Variable to 1.0	
Beam	1.0	

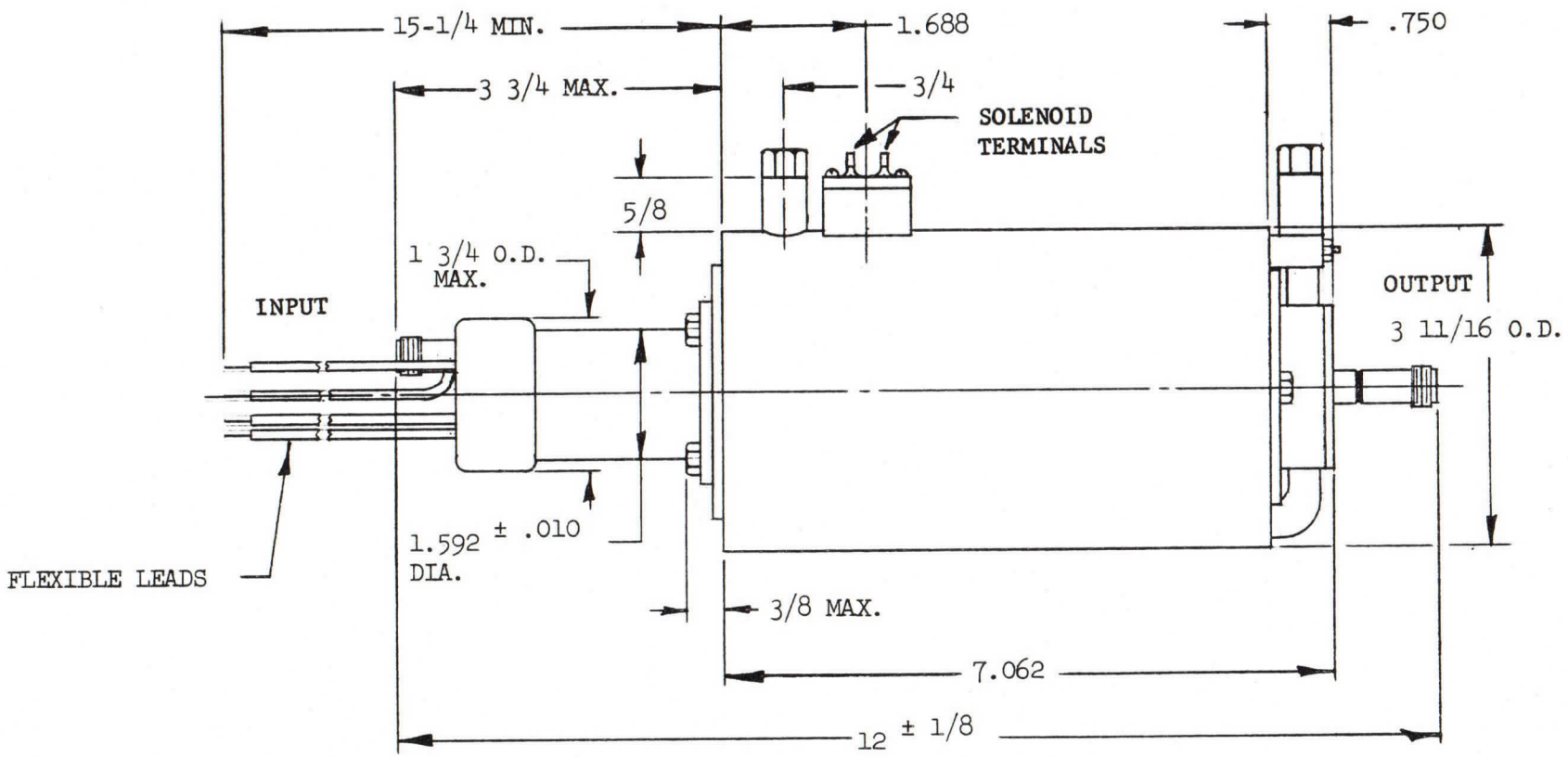
Note 1: All voltages shown are with respect to cathode. Anode, collector and outer coax conductor of the R-F terminals are connected internally to the shell and are operated at ground potential. The helix is connected to the center conductor of the coax line and a D.C. connection from the helix to the shell must be provided externally in the R-F circuitry.

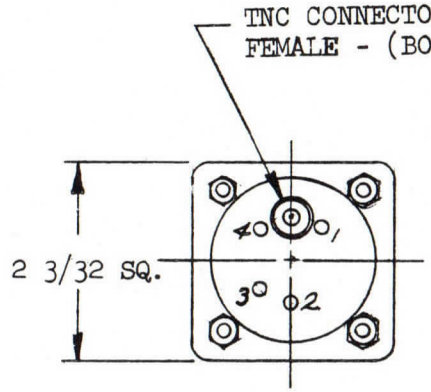
Note 2: The helix current should be minimized and must be less than the maximum rating. It is desirable to monitor this current during operation and to provide overload protection. In pulsed beam operation, the peak helix current may exceed 3 ma but care should be taken to operate at reasonably low values and average current must not exceed 3 ma.

Note 3: The control electrode voltage is adjusted for best transmission for CW operation (normally about -30 volts). Beam gate off can be accomplished by applying voltage of -400 to -500 volts. The tube should not be operated with control electrode voltage in the range of -50 to -400 volts. For gated beam (pulse) operation, the values of power output, anode current and helix current become peak values.

Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 7065
Roanoke, Virginia





LEAD CONNECTIONS

Lead	Color Code	Connections
1	Yellow	Heater-Cathode
2	Green	Control Electrode
3	Black	Anode
4	Brown	Heater

OUTLINE TUBE TYPE - 7525

DESCRIPTION:

THE F-7526 IS A 50 MW CW TRAVELING WAVE AMPLIFIER TUBE HAVING 30 DB GAIN AND 8.0 TO 12.0 KMC FREQUENCY RANGE. IT IS CONSTRUCTED IN A RUGGED METAL ENVELOPE WITH A HELIX TYPE SLOW WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH FEMALE TNC CONNECTORS. THE TUBE IS PACKAGED IN AN OIL COOLED SOLENOID WITH INTEGRAL COLLECTOR COOLER, WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE COATED CATHODE ARE USED. THE TUBE IS SUITABLE FOR EITHER CW OR PULSE SERVICE.

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3 (±5%)	VOLTS
HEATER CURRENT	0.85	AMPERE
MAXIMUM FREQUENCY	12.0	KMC
MINIMUM FREQUENCY	8.0	KMC
MINIMUM COLD TRANSMISSION LOSS	50	DB
CAPACITANCE		
CONTROL ELECTRODE TO ALL ELEMENTS	15	UUF (MAX.)

ELECTRICAL RATINGS, ABSOLUTE VALUES:

MAXIMUM ANODE VOLTAGE (NOTE 1)	1600	VOLTS
MAXIMUM HELIX CURRENT (NOTE 2)	2	MA
MAXIMUM COLLECTOR DISSIPATION (BEAM POWER)	15	WATTS
MAXIMUM CONTROL ELECTRODE VOLTAGE (NOTE 3)	-500	VOLTS

SOLENOID DATA:

SOLENOID CURRENT	.6 TO 1.13	AMPS
SOLENOID VOLTAGE	150 TO 200	VDC
TYPE OF COOLANT	OS 45	OIL
PRESSURE MAXIMUM	100	PSI
FLOW	1	GALLON/MIN.

MECHANICAL:

Type of Cathode	Oxide Coated Unipotential
Gun Connections	Flying Leads
R-F Connections	Female TNC
Mounting Position	Any

TYPICAL OPERATION:

Anode Voltage	1400	Volts
Anode Current	5	ma
Helix Current	0.5	ma
Control Electrode Voltage (Note 3)	-15	Volts
Solenoid Current	0.9	Amps
Solenoid Voltage	170	Volts
Power Output	50	mw nominal
Gain	30	db nominal
Duty Cycle (Note 3)		
R-F	Variable to 1.0	
Beam	1.0	

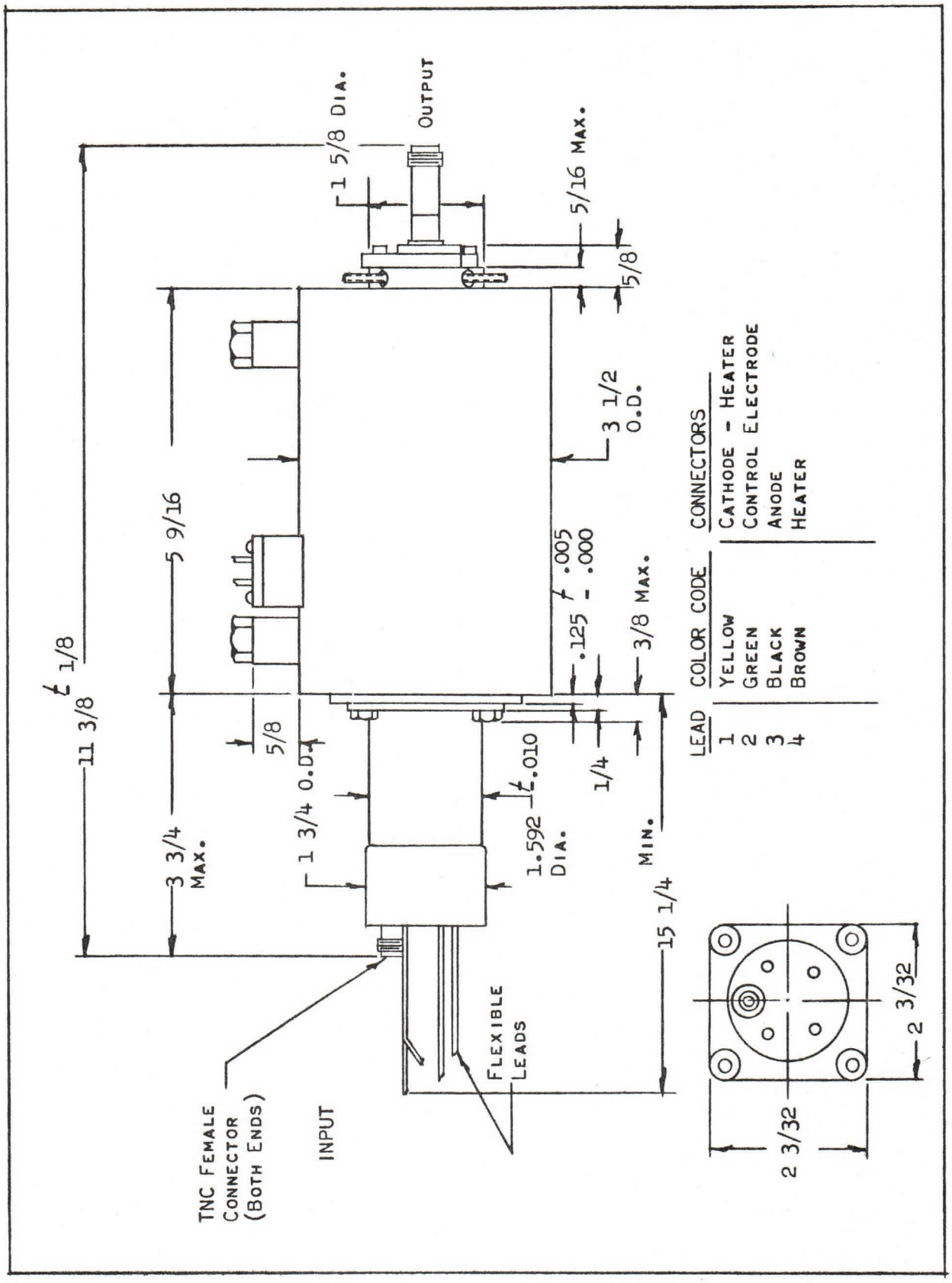
Note 1: All voltage shown are with respect to cathode. Anode, collector and outer coax conductor of the R-F terminals are connected internally to the shell and are operated at ground potential. The helix is connected to the center conductor of the coax line and a D.C. connection from the helix to the shell must be provided externally in the R-F circuitry.

Note 2: The helix current should be minimized and must be less than the maximum rating. It is desirable to monitor this current during operation and to provide overload protection. In pulsed beam operation, the peak helix current may exceed 2 ma, but care should be taken to operate at reasonably low values and average current must not exceed 2 ma.

Note 3: The control electrode voltage is adjusted for best transmission for CW operation (Normally about -5 volts). Beam gate off can be accomplished by applying voltage of -400 to -500 volts. The tube should not be operated with control electrode voltage in the range of approximately -5 to -400 volts. For gated beam (pulse) the values of power output, anode current and helix current become peak values.

Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 7065
Roanoke, Virginia



OUTLINE F-7526

10-60

ITT ELECTRON TUBE DIVISION
CLIFTON, NEW JERSEY
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

7640 TRAVELING WAVE TUBE

TENTATIVE

GENERAL DESCRIPTION:

The 7640 is a 1000 watt pulse traveling wave amplifier tube having 30db gain and designed primarily for use in the 2000 to 4000 mc frequency range. It is constructed in a rugged metal envelope with a helix type slow wave structure. The integral matching circuit is in 50 ohm coaxial line and is provided with UG 19 B/U Type connectors. The tube is focused by a periodic permanent magnet which is integral with the tube. A convergent beam gun and oxide impregnated cathode are used. Duty cycles up to .01 and pulse widths up to 100 microseconds can be used.

ELECTRICAL RATINGS, ABSOLUTE VALUES

Heater Voltage	6.3 (±10%)	volts	Maximum R-F Input Power	2	watts average
Heater Current	3.0	amperes	Maximum R-F Output Power	30	watts average
Maximum Anode Voltage (Note 1)	8000	volts	Maximum Duty Cycle	.01	
Maximum Shell Current	0.8	ampere peak	Maximum Pulse Width (beam)	100	microseconds
Maximum Collector Voltage	8000	volts	Maximum Cathode Current	2.0	ampere peak
Maximum Collector Dissipation	160	watts average			

ELECTRICAL INFORMATION

Maximum Frequency (Note 2)	4000	mc	Minimum Cold Transmission Loss	50	db
Minimum Frequency (Note 2)	2000	mc			

MECHANICAL INFORMATION

Type of Cathode	Oxide Impregnated Unipotential	Weight	10 pounds	maximum
Base	JETEC Designation B12-43	R-F Connections	UG-19 B/U	
Type of Envelope	Metal	Cooling Data	2 cfm of air	
Mounting Position	Any			

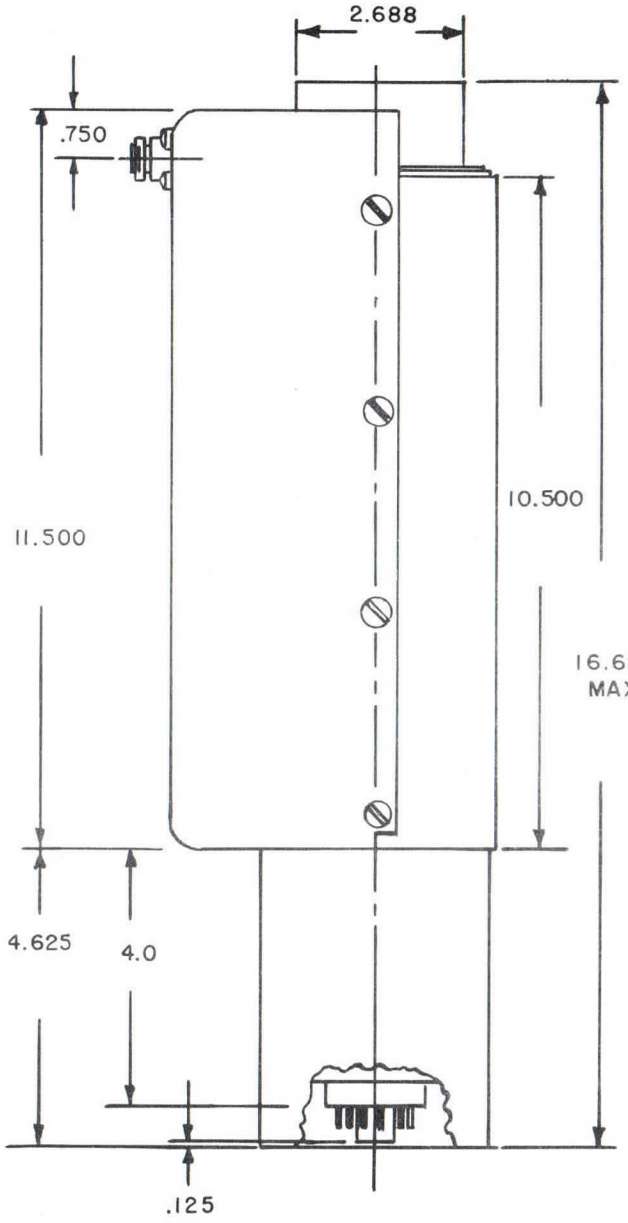
TYPICAL OPERATION AS POWER AMPLIFIER

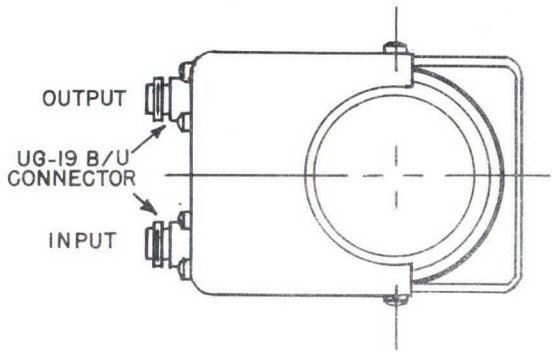
Frequency	2000 to 4000	mc	Power Output (Minimum)	1000	watts peak
Anode Voltage (Note 1)	7300	volts	Gain	30	db
Cathode Current	1.4	amperes peak	Duty	.01	
Collector Voltage (tied to shell)	7300	volts	Pulse Width	5	microseconds
Collector Current	0.9	amperes peak			

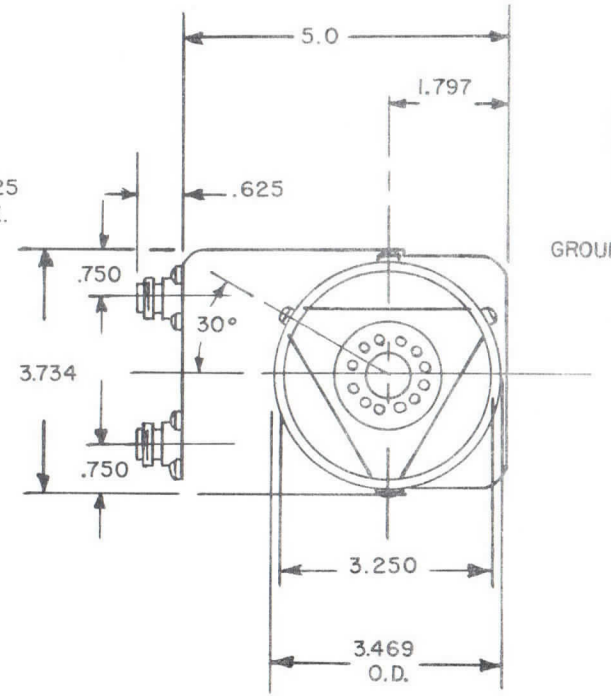
NOTE 1: All voltages shown are with respect to cathode. The shell is normally operated at ground potential and the anode connection is made to the shell of the package.

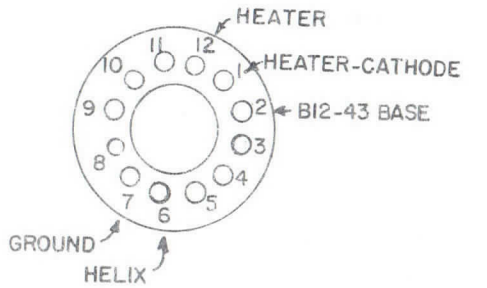
NOTE 2: Useful gain and power output exists below 2000 mc and above 4000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

NOTE 3: Heater warmup of two minutes before applying high voltage is recommended.









NOTE = PINS 5 & 6 ARE CONNECTED INTERNALLY.

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

F-7847
TRAVELING
WAVE TUBE

FORMERLY X-319

TENTATIVE

DESCRIPTION:

THE F-7847 IS A 10 WATT CW TRAVELING WAVE AMPLIFIER TUBE HAVING 27 DB GAIN AND 5.0 TO 6.0 FREQUENCY RANGE. IT IS CONSTRUCTED IN A RUGGED METAL ENVELOPE WITH A HELIX TYPE SLOW WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH FEMALE TNC CONNECTORS. THE TUBE IS SELF-ALIGNING IN THE EXTERNAL SOLENOID, WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE COATED CATHODE ARE USED. THE TUBE IS SUITABLE FOR EITHER CW OR PULSE SERVICE.

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3 (±5%)	VOLTS
HEATER CURRENT	2.2	AMPERES
MAXIMUM FREQUENCY	6.0	
MINIMUM FREQUENCY	5.0	
MINIMUM COLD TRANSMISSION LOSS	55	DB
CAPACITANCE		
CONTROL ELECTRODE TO ALL ELEMENTS	15	UUF

ELECTRICAL RATINGS, ABSOLUTE VALUES:

MAXIMUM ANODE VOLTAGE (NOTE 1)	3000	VOLTS
MAXIMUM HELIX CURRENT (NOTE 2)	2	MA
MAXIMUM COLLECTOR DISSIPATION (BEAM POWER) (NOTE 3)	196	WATTS
MAXIMUM CONTROL ELECTRODE VOLTAGE	0	VOLTS

MECHANICAL:

TYPE OF CATHODE	OXIDE COATED UNIPOTENTIAL	
GUN CONNECTIONS	FLYING LEADS	
R-F CONNECTIONS	FEMALE TNC	
MAGNETIC FIELD STRENGTH	1200	GAUSS
MOUNTING POSITION	ANY	
WEIGHT (TUBE ONLY)	14	OZ.
TYPE OF COOLING (NOTE 4)	WATER OR AIR	

TYPICAL OPERATION:

Anode Voltage	2800	Volts
Anode Current	67	ma
Helix Current	1.0	ma
Control Electrode Voltage	0	Volts
Power Output	10	Watts
Gain	27	db
Duty Cycle (Note 5)		
R-F	Variable to 1.0	
Beam	1.0	

Note 1: All voltages shown are with respect to cathode. Anode, collector and outer coax conductor of the R-F terminals are connected internally to the shell and are operated at ground potential. The helix is connected to the center conductor of the coax line and a D.C. connection to the helix must be provided externally in the R-F circuitry.

Note 2: The helix current should be minimized and must be less than the maximum rating. It is desirable to monitor this current during operation and to provide overload protection. In pulsed beam operation, the peak helix current may exceed 2 ma, but care should be taken to operate at reasonably low values and average current must not exceed 2 ma.

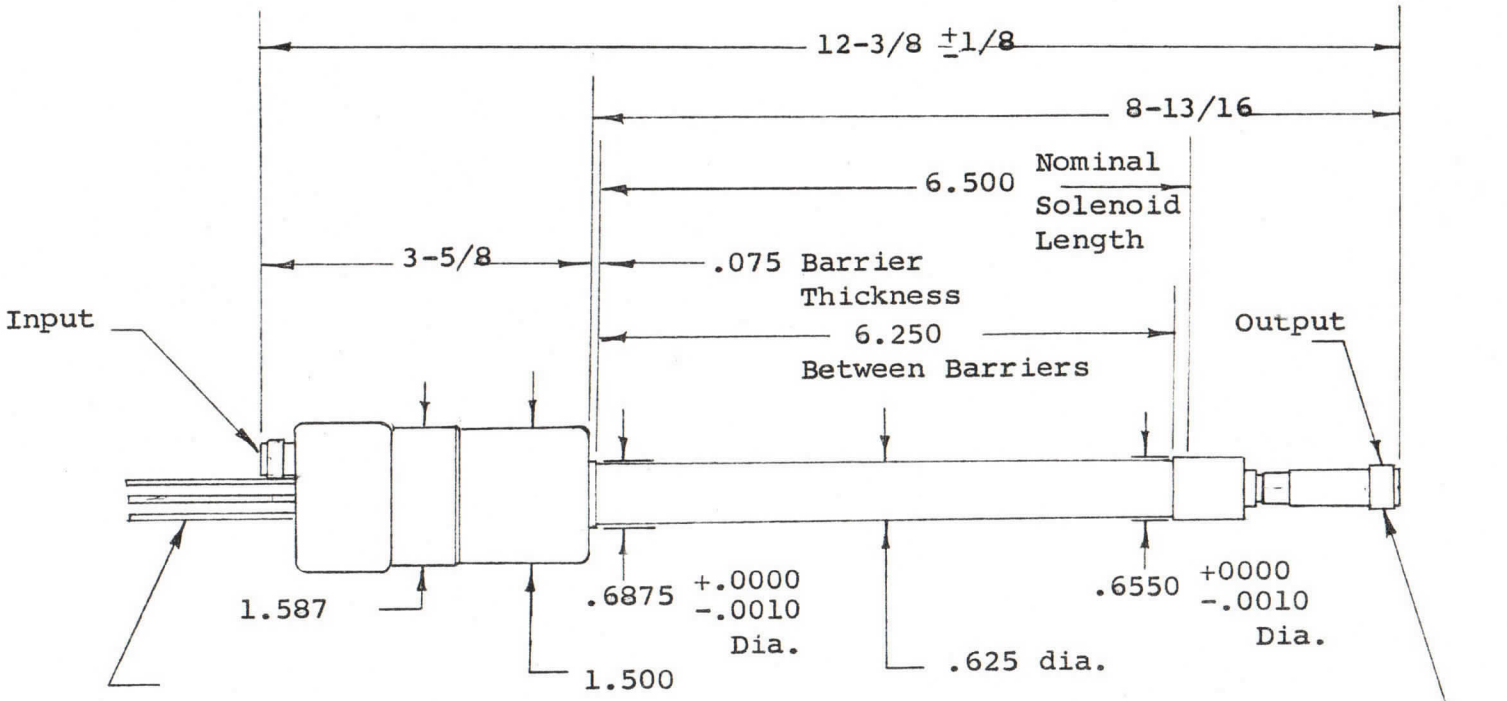
Note 3: The beam voltage should be applied to the tube only after the magnetic field is turned on and water or air is flowing through the collector cooling jacket.

Note 4: Cooling method depends on type of collector cooling jacket used.

Note 5: Gated beam operation can be utilized by pulsing anode voltage In this type of operation, the values of power output, anode current and helix current become peak values.

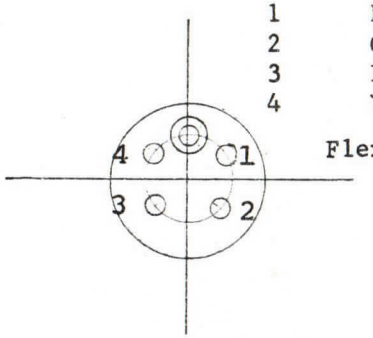
Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 7065
Roanoke, Virginia



Lead	Color Code	Connections
1	Brown	Heater
2	Green	Control Electrode
3	Black	Anode, Capsule and Collector
4	Yellow	Heater-Cathode

Flexible Leads 12" Min. Length



TNC Female Connector, Both Ends.

OUTLINE - F-7847

engineering TUBE DATA

F-7848
TRAVELING
WAVE TUBE

ITT Components Division

TENTATIVE

DESCRIPTION:

THE F-7848 IS A 2 KILOWATT PULSE TRAVELING WAVE AMPLIFIER TUBE HAVING 27 DB GAIN AND 5400 TO 5900 MC FREQUENCY RANGE. IT IS CONSTRUCTED IN A RUGGED METAL-CERAMIC ENVELOPE WITH A HELIX TYPE SLOW WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH FEMALE TNC CONNECTORS. THE TUBE IS SELF-ALIGNING IN AN EXTERNAL SOLENOID WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE IMPREGNATED CATHODE ARE USED. DUTY CYCLES UP TO .005 AND PULSE LENGTHS UP TO 6 MICROSECONDS CAN BE USED:

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	5.2	AMPERES
FREQUENCY RANGE (NOTE 1)	5400 MC TO 5900	MC
MINIMUM TRANSMISSION LOSS, NO VOLTAGES APPLIED	60	DB
CAPACITANCE		
CATHODE TO ALL OTHER ELEMENTS	25	UUFD

ELECTRICAL RATINGS, ABSOLUTE VALUES:

HEATER VOLTAGE	6.3 (±5%)	VOLTS
HEATER CURRENT	5.6	AMPERES
MAXIMUM ANODE VOLTAGE (NOTE 2)	17,000	VOLTS
MAXIMUM HELIX CURRENT	0.4	AMPERE PEAK
MAXIMUM COLLECTOR DISSIPATION (NOTE 3)	225	WATTS AVERAGE
MAXIMUM R-F INPUT POWER	10	WATTS AVERAGE
MAXIMUM R-F OUTPUT POWER	15	WATTS AVERAGE
MAXIMUM DUTY CYCLE	.005	
MAXIMUM CATHODE CURRENT	3.7	AMPERES PEAK
LOAD VSWR	3.5 : 1	MAX.

ITT ELECTRON TUBE DEPARTMENT
COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

MECHANICAL INFORMATION:

Type of Cathode	Oxide Impregnated	Unipotential
Base	Large Water	Octal Base
Type of Envelope	Metal	Ceramic
Magnetic Field Strength	2000	Gauss
Mounting Position		Any
Weight of Tube	1.5	lbs. approx.
R-F Connections	Female	Type TNC
Maximum Tube Temperature	177	°C

TYPICAL OPERATION AS POWER AMPLIFIER OVER FREQUENCY RANGE:

Anode Voltage (Note 1)	10,000	Volts
Cathode Current	2.5	Amperes Peak
Power Output	2.0	kw peak min.
Gain	27	db min.
Duty	.002	
Pulse Width	2	u seconds

Note 1: Useful gain and power output exists below 5000 mc and above 6000 mc and can be utilized by adjusting anode voltage to optimize the frequency range desired. However, bandwidth cannot be extended both upward and downward simultaneously and maximum gain and power output outside the normal bandwidth will be lower than rated values.

Note 2: All voltages shown are with respect to cathode. Anode, helix, collector, and outer coax conductor of the R-F connections are connected internally to the shell. An internal DC connection is provided between the center lead of the R-F coax terminals and the shell.

Note 3: Conduction cooling for the collector must be provided by a suitable device.

GENERAL OPERATING INSTRUCTIONS:

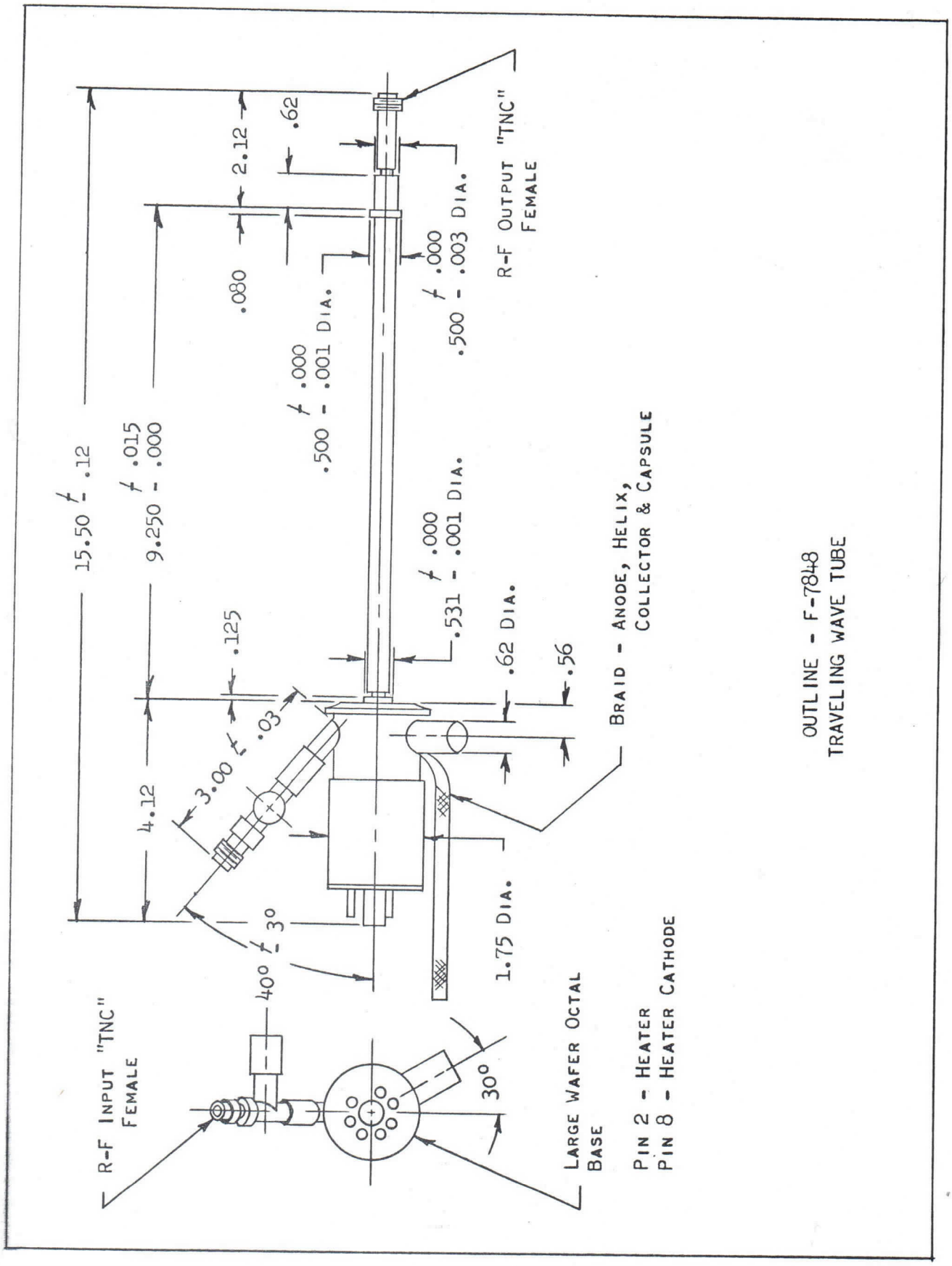
(1) Heater warm up of 2 minutes before applying high voltage is recommended.

(2) High voltage must not be applied in the absence of magnetic field.

(3) Initial adjustments should be done at low duty cycle (less than .001) to prevent tube damage due to high shell (interception) current.

Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 7065
Roanoke, Virginia



OUTLINE - F-7848
TRAVELING WAVE TUBE

ELECTRON TUBE DEPARTMENT
ITT COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

engineering TUBE DATA

X-282
TRAVELING
WAVE TUBE

ITT Components Division

TENTATIVE

DESCRIPTION:

THE X-282 IS A 10 WATT CW TRAVELING WAVE AMPLIFIER TUBE IN THE 4.0 TO 8.0 FREQUENCY RANGE AND HAVING 25 DB GAIN WHEN OPERATED AS A LOW-LEVEL AMPLIFIER. IT IS CONSTRUCTED IN A RUGGED METAL ENVELOPE WITH A HELIX-TYPE SLOW-WAVE STRUCTURE. THE INTEGRAL MATCHING CIRCUIT IS IN 50 OHM COAXIAL LINE AND IS PROVIDED WITH FEMALE TNC CONNECTORS. THE TUBE IS SELF-ALIGNING IN THE EXTERNAL SOLENOID, WHICH IS REQUIRED TO PROVIDE A UNIFORM MAGNETIC FIELD. A CONVERGENT BEAM GUN AND OXIDE COATED CATHODE ARE USED.

ELECTRICAL INFORMATION:

HEATER VOLTAGE	6.3 (±5%)	VOLTS
HEATER CURRENT	1.5	AMPERES
MAXIMUM FREQUENCY	8.0	
MINIMUM FREQUENCY	4.0	
MINIMUM COLD TRANSMISSION LOSS	55	DB
CAPACITANCE		
CONTROL ELECTRODE TO ALL ELEMENTS	15	UUF

ELECTRICAL RATINGS, ABSOLUTE VALUES

MAXIMUM ANODE VOLTAGE (NOTE 1)	3000	VOLTS
MAXIMUM HELIX CURRENT (NOTE 2)	2	MA
MAXIMUM COLLECTOR DISSIPATION (BEAM POWER)(NOTE 3)	196	WATTS
MAXIMUM POSITIVE CONTROL ELECTRODE VOLTAGE	0	VOLTS

MECHANICAL:

TYPE OF CATHODE	OXIDE COATED UNIPOTENTIAL	
GUN CONNECTIONS	FLYING LEADS	
R-F CONNECTIONS	FEMALE TNC	
MAGNETIC FIELD STRENGTH	1200	GAUSS
MOUNTING POSITION		ANY
WEIGHT (TUBE ONLY)	14	OUNCES
TYPE OF COOLING (NOTE 4)	WATER OR AIR	

ITT ELECTRON TUBE DEPARTMENT
COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
P. O. BOX 412, CLIFTON, NEW JERSEY

10-60

TYPICAL OPERATION:

As Power Amplifier		
Frequency	6	
Anode Voltage	2600	Volts
Anode Current	55	MA
Helix Current	1.0	MA
Control Electrode Voltage	0	volts
Power Output	10	watts
Gain	28	db
Duty	1.0	
As Low Level Amplifier		
Frequency	6	
Anode Voltage	2550	volts
Anode Current	53	MA
Helix Current	1.0	MA
Control Electrode Voltage	0	volts
Power Output	300	MW
Gain	33	db
Duty	1.0	

Note 1: All voltages shown are with respect to cathode. Anode and collector are connected internally to the shell, and the outer coax conductor of the R-F connections is also at shell potential. The helix is connected to the center conductor of the coax line and a D-C connection to the helix must be provided externally in the R-F circuitry.

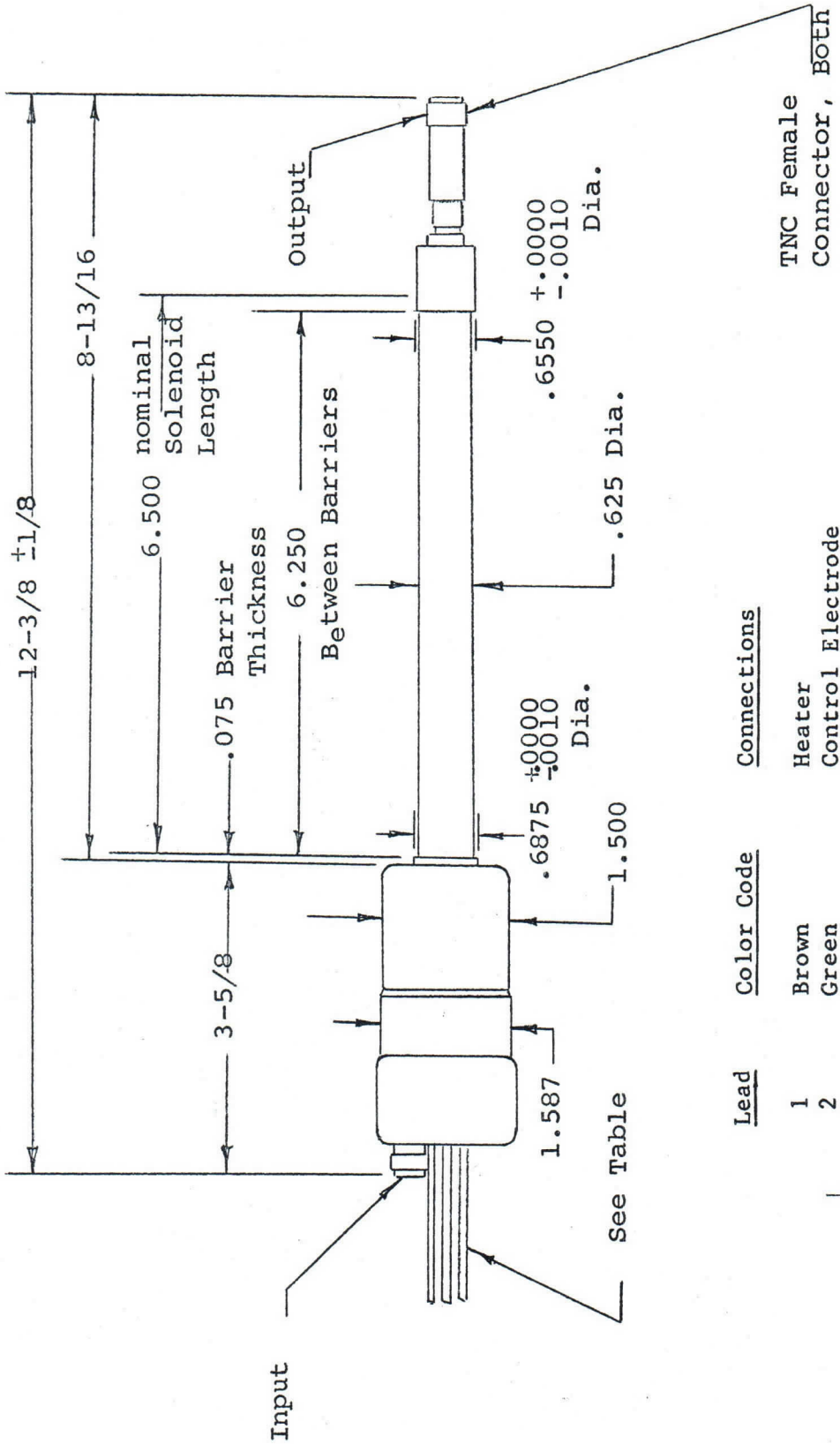
Note 2: The helix current should be minimized and must be less than the maximum rating. It is desirable to monitor this current during operation and to provide overload protection.

Note 3: The beam voltage should be applied to the tube only after the magnetic field is turned on and water or air is flowing through the collector cooling jacket.

Note 4: Cooling method depends on type of collector cooling jacket used.

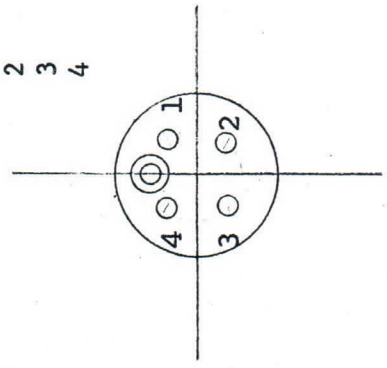
Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 7065
Roanoke, Virginia



Lead	Color Code	Connections
1	Brown	Heater
2	Green	Control Electrode
3	Black	Anode, Capsule and Collector
4	Yellow	Heater-Cathode

Flexible Leads 12" Min. Length



OUTLINE - X-282 TRAVELING WAVE TUBE

OPERATING INSTRUCTIONS FOR THE X-282 TRAVELING WAVE TUBE

THE X-282 IS A 10 WATT CW TRAVELING WAVE TUBE OPERATING OVER THE BAND OF 4 TO 8 KMC. IT REQUIRES A MAGNETIC FIELD OF 1200 GAUSS FOR PROPER FOCUSING. BASIC POWER REQUIREMENTS ARE 70 MA AT 2800 V AND A 50 VOLT BIAS SUPPLY, AS WELL AS 6.3 V AT 2.2 AMPS FOR THE HEATER.

WHEN PLACING THE X-282 IN OPERATION FOR THE FIRST TIME, THE FOLLOWING PROCEDURE SHOULD BE FOLLOWED:

1. MAKE A VISUAL INSPECTION OF THE TUBE TO CHECK FOR LOOSE CONNECTIONS OR OTHER MECHANICAL DEFECTS.

2. PLACE THE TUBE IN THE PROPER SOLENOID AND MAKE CONNECTIONS TO THE TUBE AND SOLENOID. OBSERVE COLOR-CODING OF THE TUBE LEADS AND POLARITY MARKING ON THE SOLENOID.

3. APPLY COOLING TO THE SOLENOID AND TO COLLECTOR.

4. APPLY THE FOLLOWING VOLTAGES IN THE FOLLOWING ORDER:

   4.1 HEATER VOLTAGE (6.3 VOLTS).

   4.2 SOLENOID VOLTAGE (ADJUST SOLENOID CURRENT TO YIELD 1200 GAUSS).

   4.3 CONTROL ELECTRODE VOLTAGE (APPLY BIAS VOLTAGE SPECIFIED ON DATA SHEET SUPPLIED WITH TUBE.)

   4.4 CATHODE VOLTAGE (ADJUST SLOWLY TO THE VALUE INDICATED ON THE DATA SHEET; USUALLY ABOUT MINUS 2700 VOLTS WITH RESPECT TO THE SHELL. AT ALL TIMES MONITOR HELIX CURRENT AND OBSERVE THE 2.0 MA MAXIMUM LIMIT.)

5. R.F. INPUT SHOULD BE LIMITED TO 200 MW.

6. THE CATHODE VOLTAGE MAY BE OPTIMIZED FOR OPTIMUM POWER OUTPUT AT THE DESIRED FREQUENCIES.

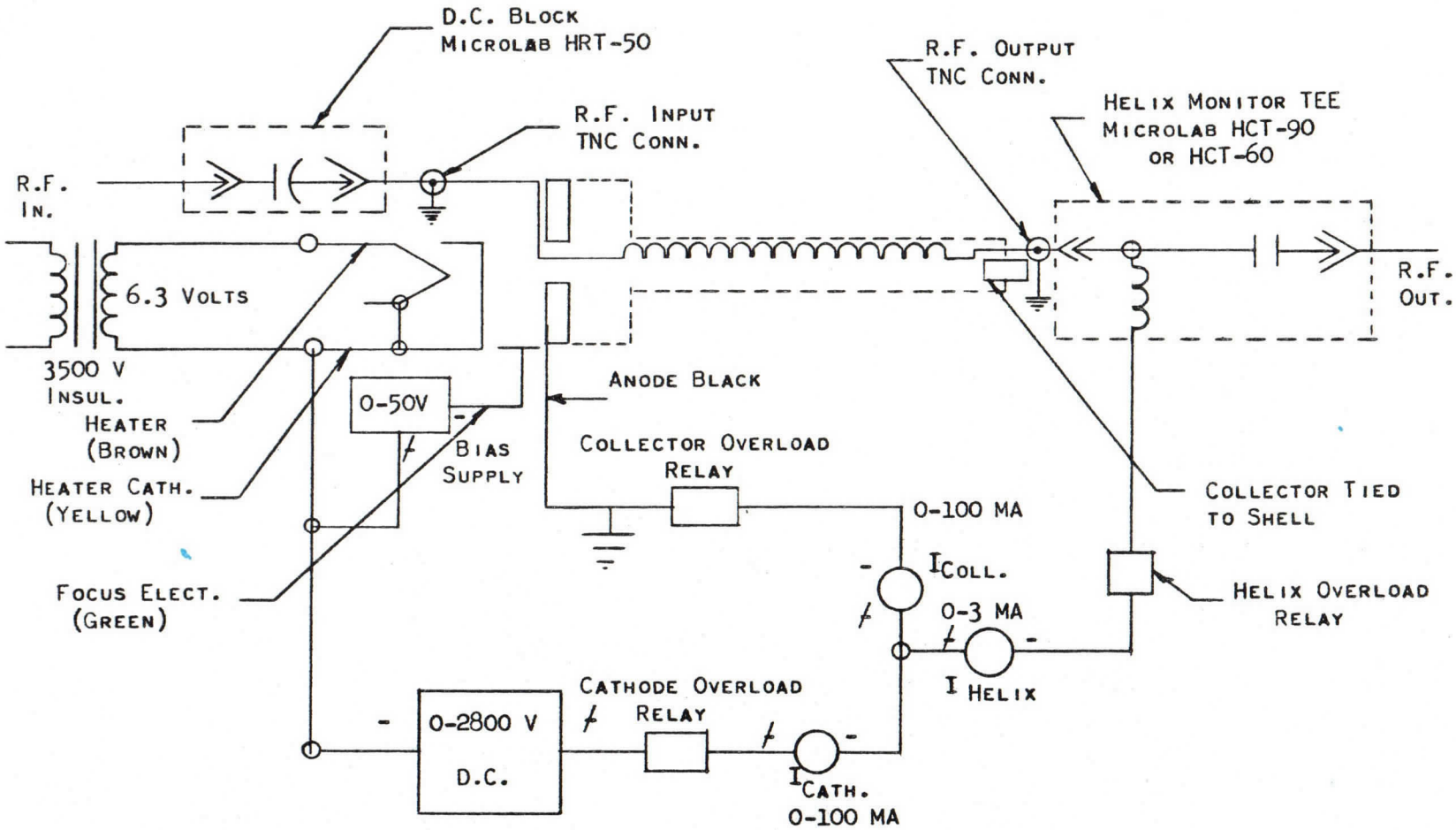
THE FOLLOWING PRECAUTIONS SHOULD BE TAKEN WHEN OPERATING THE TRAVELING WAVE TUBE:

1. NEVER OPERATE THE X-282 WITHOUT PROPER MAGNETIC FIELD. BE SURE SUFFICIENT COOLING IS SUPPLIED TO TUBE AND SOLENOID.

2. NEVER OPERATE THE X-282 WITH HELIX CURRENT IN EXCESS OF 2.0 MA. UNDER MOST CONDITIONS HELIX CURRENT WILL BE 1.0 MA OR LESS. IT IS IMPORTANT THAT HELIX OVERLOAD PROTECTION BE PROVIDED.

3. BE SURE COAXIAL CABLES TO BE CONNECTED TO THE TUBE INPUT AND OUTPUT CONNECTORS ARE ASSEMBLED CORRECTLY. IF THE INNER CONDUCTOR OF THE CABLE CONNECTOR IS TOO LONG, PRESSURE WILL BE APPLIED TO A CERAMIC BEAD, WHICH MAY CAUSE DAMAGE TO THE TUBE. IF IT IS TOO SHORT, A POOR CONNECTION WILL RESULT CAUSING POOR R.F. PERFORMANCE.

THE ATTACHED SCHEMATIC IS A SUGGESTED METHOD OF CONNECTING THE X-282 AND SHOWS THE LOCATION OF PROTECTION CIRCUITS AND METER POLARITY.



NOTES:

1. ALL OVERLOADS OPERATE TO DISCONNECT HIGH VOLTAGE SUPPLY.
2. HELIX MONITOR AND D.C. BLOCK TO BE SUPPLIED BY USER.

BASIC SUPPLY AND METERING REQUIREMENTS FOR X-282 TWT AMPLIFIER

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

TENTATIVE

DESCRIPTION:

THE X-354 IS A SUPER-HIGH-FREQUENCY, MEDIUM-POWER TRAVELING WAVE AMPLIFIER TUBE EMPLOYING A HELICAL WAVE PROPAGATING STRUCTURE. THE TUBE IS DESIGNED FOR USE AS A CONTINUOUS WAVE AMPLIFIER IN THE FREQUENCY RANGE OF 8 TO 12 KILOMEGACYCLES PER SECOND. IT IS OF ALL-METAL SHELL CONSTRUCTION, AND TYPE TNC FEMALE COAXIAL LINE R-F CONNECTORS ARE PROVIDED AS AN INTEGRAL PART OF THE STRUCTURE. THE TUBE IS SELF-ALIGNING IN THE PERMANENT MAGNET WHICH PROVIDES THE MAGNETIC FIELD REQUIRED TO DEFINE THE PATH OF THE ELECTRON BEAM.

ELECTRICAL DATA:

HEATER, FOR OXIDE-COATED, UNIPOTENTIAL CATHODE		
VOLTAGE	6.3	VOLTS
CURRENT	2.0	AMPERES
FREQUENCY	8 TO 12	KMC
GAIN (SMALL SIGNAL) (NOTE 1)	33	DB
GAIN (AT RATED POWER OUT) (NOTE 1)	25	DB
POWER OUTPUT (NOTE 1)	5	WATTS

MECHANICAL DATA:

MOUNT		SPECIAL
MOUNTING POSITION		ANY
BASE		MOULDED RUBBER FLEXIBLE LEADS
OVERALL TUBE LENGTH	12	INCHES
R-F CIRCUIT CONNECTORS		TNC FEMALE
TYPE OF COOLING		AIR OR WATER COOLED COLLECTOR

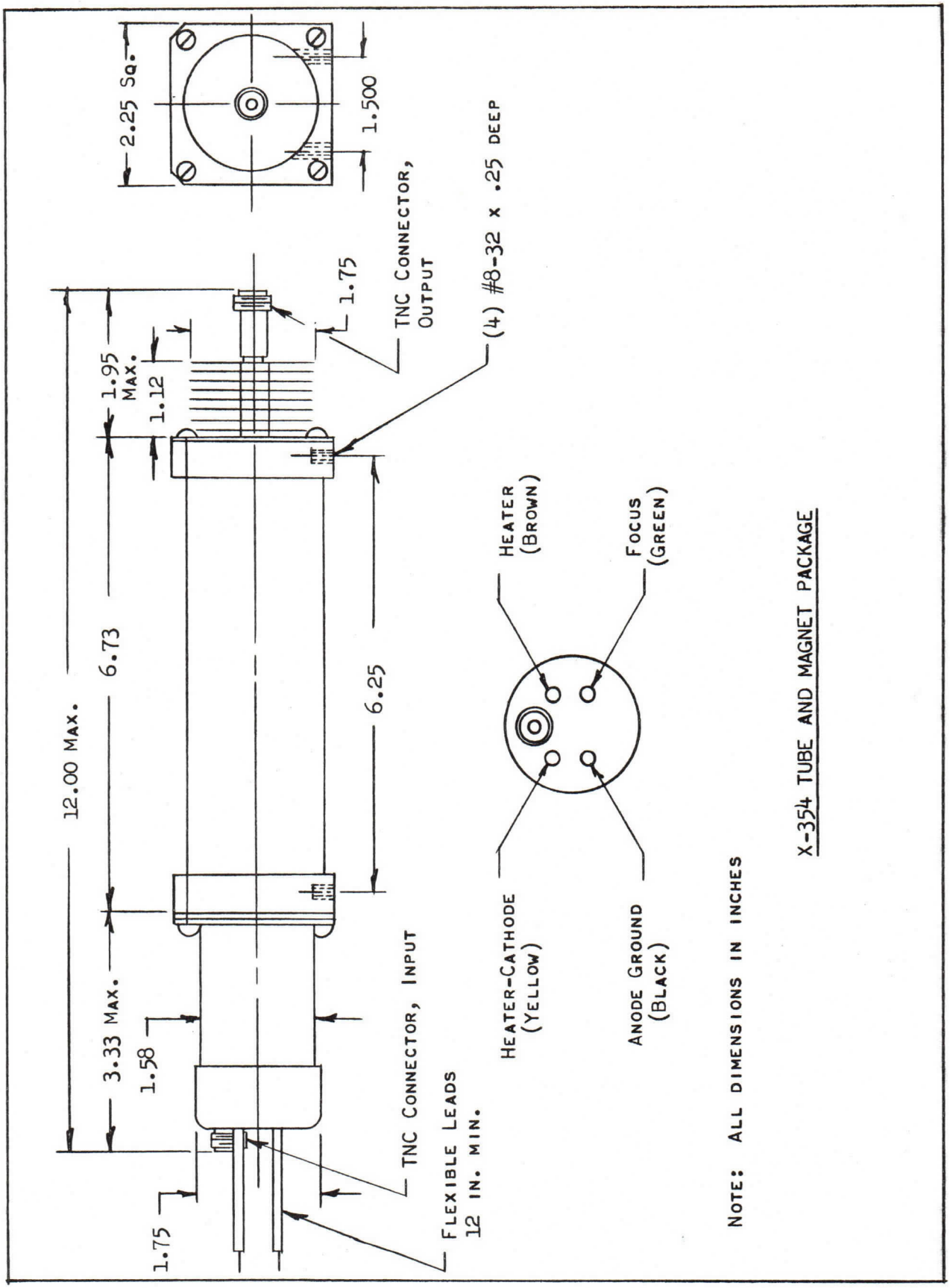
MAXIMUM RATINGS:

Helix Voltage with Respect to Ground (Externally)	0	Volts
Anode Voltage with Respect to Ground	0	Volts
Collector Voltage with Respect to Ground	0	Volts
Cathode Voltage with Respect to Ground	-4000	Volts
Cathode Current	60	MA
Collector Current	60	MA
Helix Current	5	MA
Focus Electrode Voltage with Respect to Cathode	-100	Volts
Beam Duty Cycle	100	Percent

Note 1: Minimum performance over the frequency band of 8 to 12 KMC with operating conditions optimized near the center of the band.

Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 7065
Roanoke, Virginia



X-354 TUBE AND MAGNET PACKAGE

NOTE: ALL DIMENSIONS IN INCHES

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

X-354C TRAVELING WAVE TUBE

TENTATIVE

DESCRIPTION:

THE X-354C IS A SUPER-HIGH-FREQUENCY, MEDIUM-POWER TRAVELING WAVE AMPLIFIER TUBE EMPLOYING A HELICAL-WAVE-PROPAGATING STRUCTURE. THE TUBE IS DESIGNED FOR USE AS A CONTINUOUS-WAVE AMPLIFIER IN THE FREQUENCY RANGE OF 8 TO 12 KILOMEGACYCLES PER SECOND.

THE X-354C IS OF ALL-METAL SHELL CONSTRUCTION, AND TYPE TNC GRFF-184 COAXIAL-LINE R-F CONNECTORS ARE PROVIDED AS AN INTEGRAL PART OF THE STRUCTURE.

THE TUBE IS SELF-ALIGNING IN THE PERMANENT MAGNET WHICH PROVIDES THE MAGNETIC FIELD REQUIRED TO DEFINE THE PATH OF THE ELECTRON BEAM.

ELECTRICAL DATA:

HEATER, FOR OXIDE-COATED, UNIPOTENTIAL CATHODE		
VOLTAGE	6.3	VOLTS
CURRENT	1.5	AMPERES
FREQUENCY	8 TO 12	KMC
GAIN - SMALL SIGNAL (NOTE 1)	36	DB
GAIN - AT RATED POWER OUT (NOTE 1)	33	DB
POWER OUTPUT (NOTE 1)	2	WATTS

MECHANICAL DATA:

MOUNT		SPECIAL
MOUNTING POSITION		ANY
BASE		MOULDED RUBBER FLEXIBLE LEADS
OVER-ALL TUBE LENGTH	12	INCHES
R-F CIRCUIT CONNECTORS		TNC FEMALE
TYPE OF COOLING		AIR OR WATER COOLED COLLECTOR

MAXIMUM RATINGS:

Helix Voltage with Respect to Ground (Externally)	0	Volts
Anode Voltage with Respect to Ground	0	Volts
Collector Voltage with Respect to Ground	0	Volts
Cathode Voltage with Respect to Ground	-3200	Volts
Cathode Current	38	ma
Collector Current	38	ma
Helix Current	3.5	ma
Grid Voltage with Respect to Cathode	-100	Volts
Beam Duty Cycle	100	Per Cent

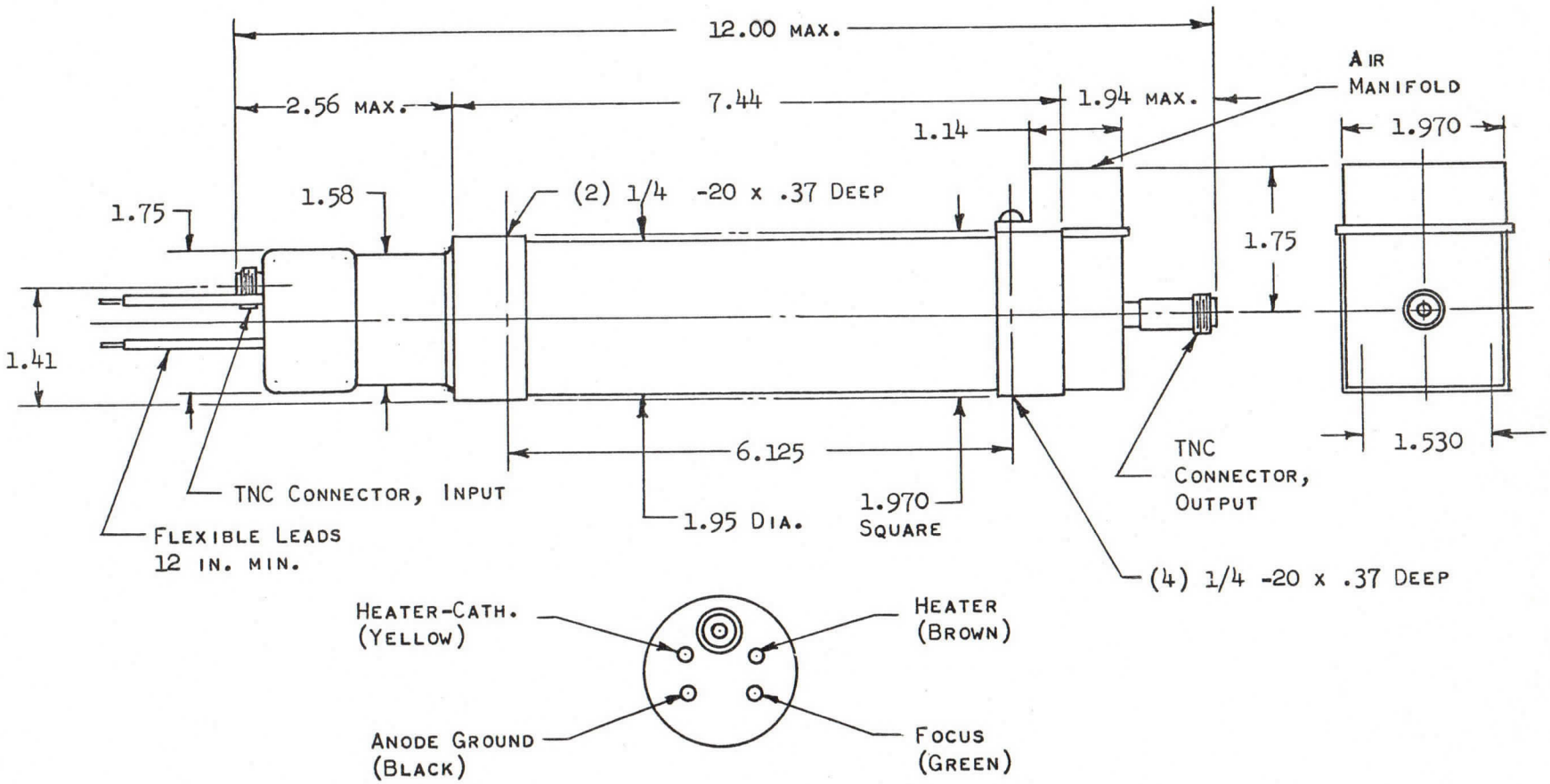
Note 1:

Minimum performance over the frequency band of 8 to 12 KMC with operating conditions optimized near the center of the band.

Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 412
Clifton, New Jersey

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



X-354C TUBE AND MAGNET PACKAGE

X-368 TRAVELING WAVE TUBE

TENTATIVE

DESCRIPTION:

THE X-368 IS A SUPER-HIGH-FREQUENCY, INTERMEDIATE-POWER, TRAVELING WAVE AMPLIFIER TUBE, EMPLOYING A HELICAL WAVE PROPAGATING STRUCTURE. THE TUBE IS DESIGNED FOR USE AS A CONTINUOUS WAVE AMPLIFIER IN THE FREQUENCY RANGE OF 8 TO 12 KILOMEGACYCLES PER SECOND. IT IS OF ALL-METAL SHELL CONSTRUCTION, AND TYPE TNC FEMALE COAXIAL LINE R-F CONNECTORS ARE PROVIDED AS AN INTEGRAL PART OF THE STRUCTURE. THE TUBE IS SELF-ALIGNING IN THE PERMANENT MAGNET WHICH PROVIDES THE MAGNETIC FIELD REQUIRED TO DEFINE THE PATH OF THE ELECTRON BEAM.

ELECTRICAL DATA:

HEATER, FOR OXIDE-COATED, UNIPOTENTIAL CATHODE		
VOLTAGE	6.3	VOLTS
CURRENT	0.85	AMPERE
FREQUENCY	8 TO 12	KMC
GAIN (SMALL SIGNAL)(NOTE 1)	35	DB
GAIN (AT RATED POWER OUT) (NOTE 1)	30	DB
POWER OUTPUT (NOTE 1)	50	MW
CAPACITANCE (CONTROL ELECTRODE TO ALL ELEMENTS)	20	UUFD

MECHANICAL DATA:

MOUNT		SPECIAL
MOUNTING POSITION		ANY
BASE		MOULDED RUBBER FLEXIBLE LEADS
SIZE	11 1/4 x 2 1/4 x 2 1/4	INCHES
R-F CIRCUIT CONNECTORS		TNC FEMALE
TYPE OF COOLING		CONDUCTION

MAXIMUM RATINGS:

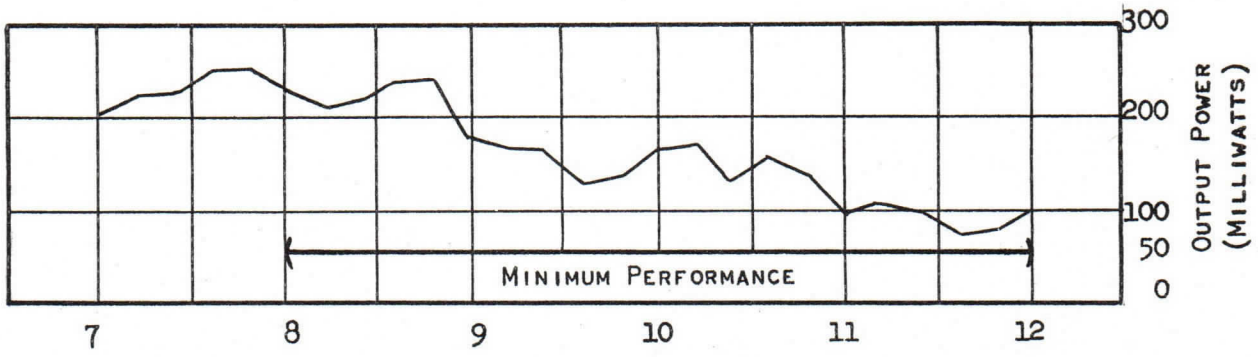
Helix Voltage with Respect to Ground (Externally)	0	Volts
Anode Voltage with Respect to Ground	0	Volts
Collector Voltage with Respect to Ground	0	Volts
Cathode Voltage with Respect to Ground	-1600	Volts
Cathode Current	8	ma
Collector Current	8	ma
Helix Current	2	ma
Focus Electrode Voltage with Respect to Cathode	-100	Volts
Beam Duty Cycle	100	Percent

Note 1: Minimum performance over the frequency band of 8 to 12 kmc with operating conditions optimized near the center of the band.

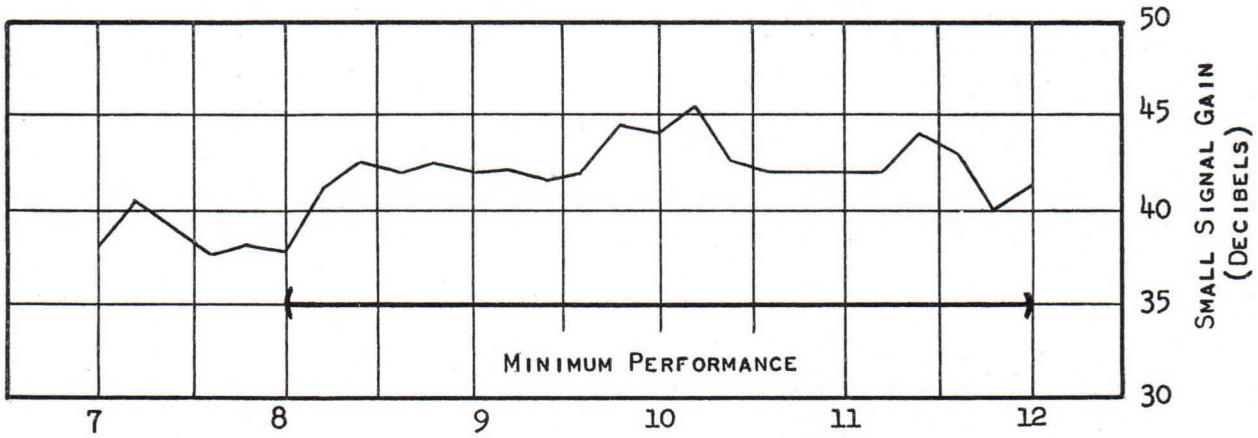
Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
Post Office Box 412
Clifton, New Jersey

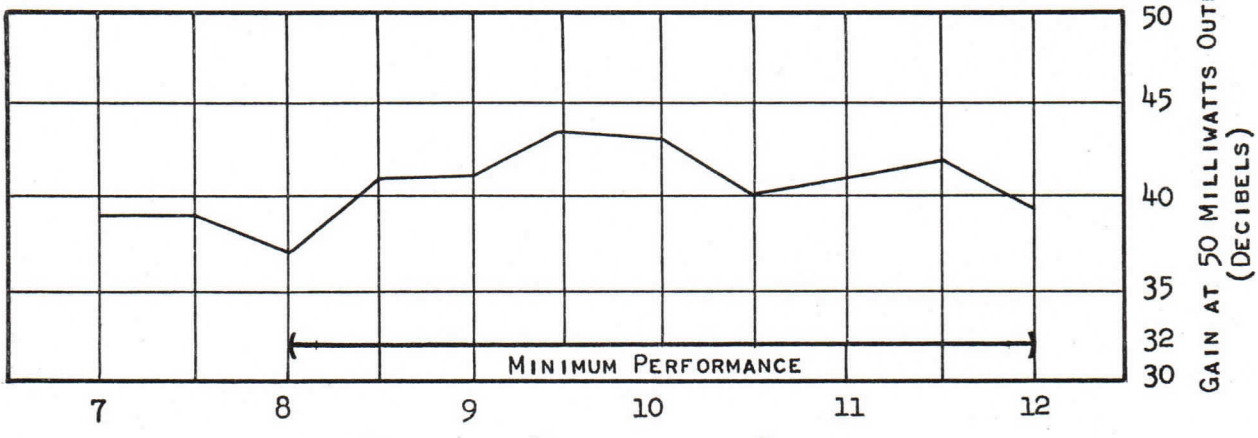
TYPICAL PERFORMANCE OF THE X-368 TRAVELING WAVE TUBE



SATURATED OUTPUT POWER VS. FREQUENCY



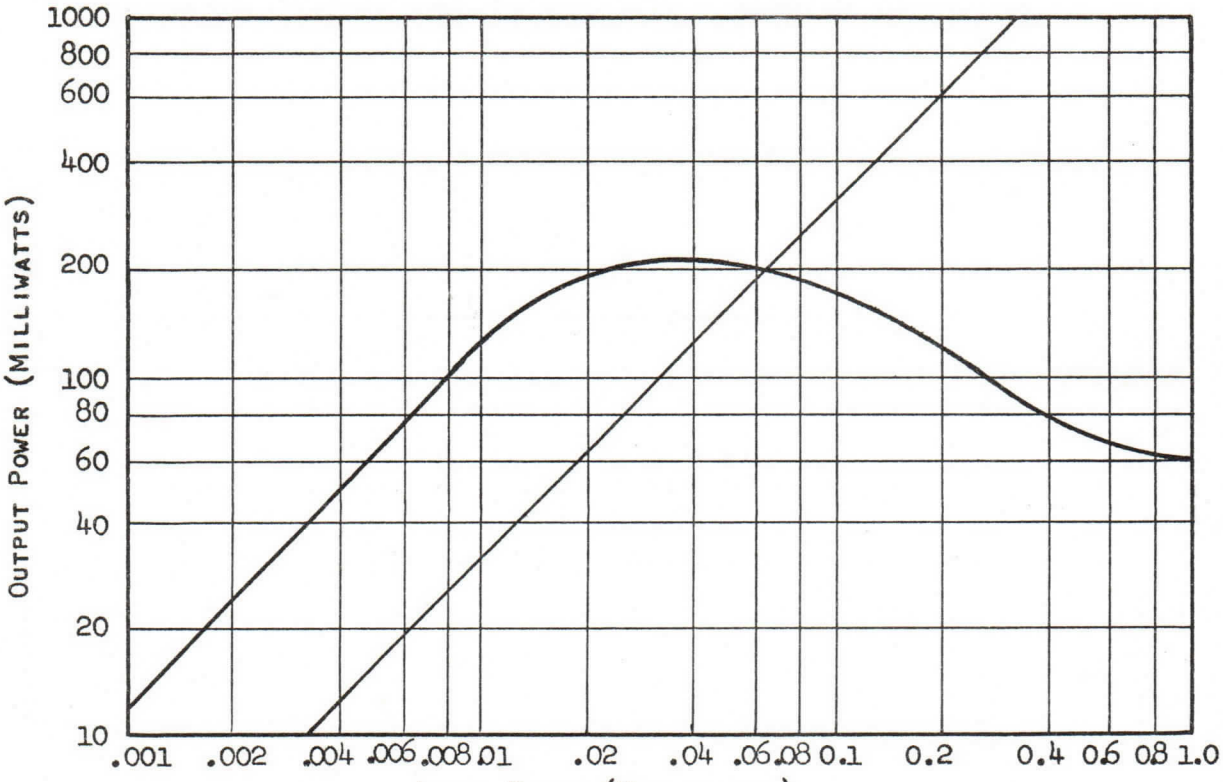
SMALL SIGNAL GAIN VS. FREQUENCY



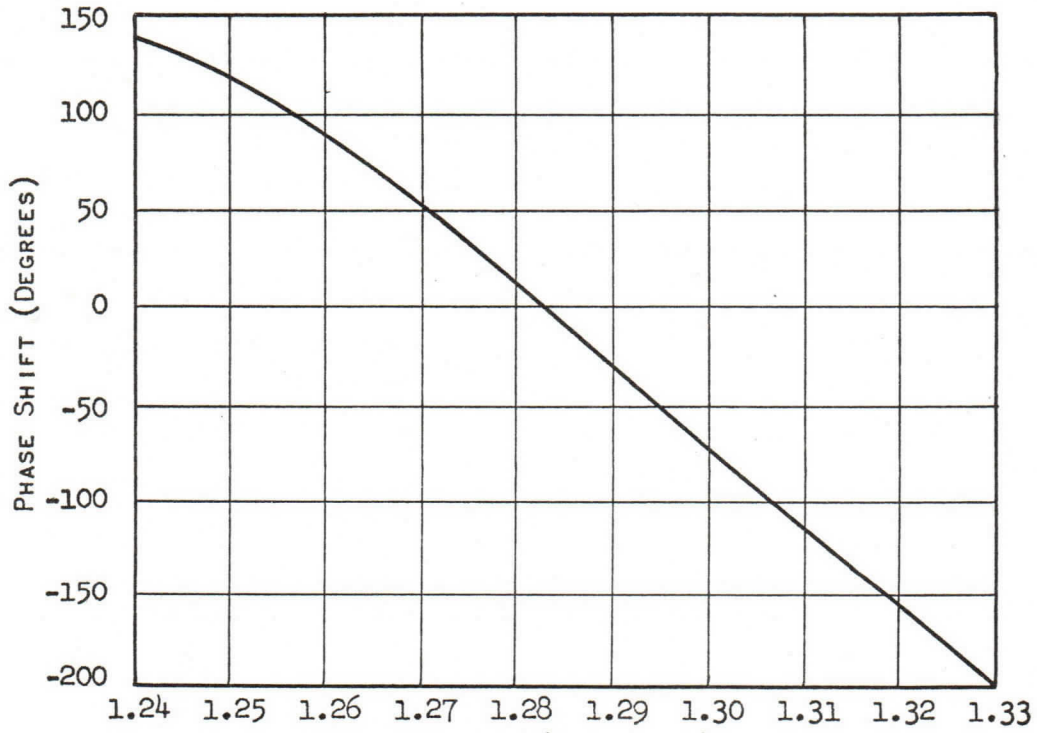
GAIN AT 50 MILLIWATTS OUTPUT POWER VS. FREQUENCY

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

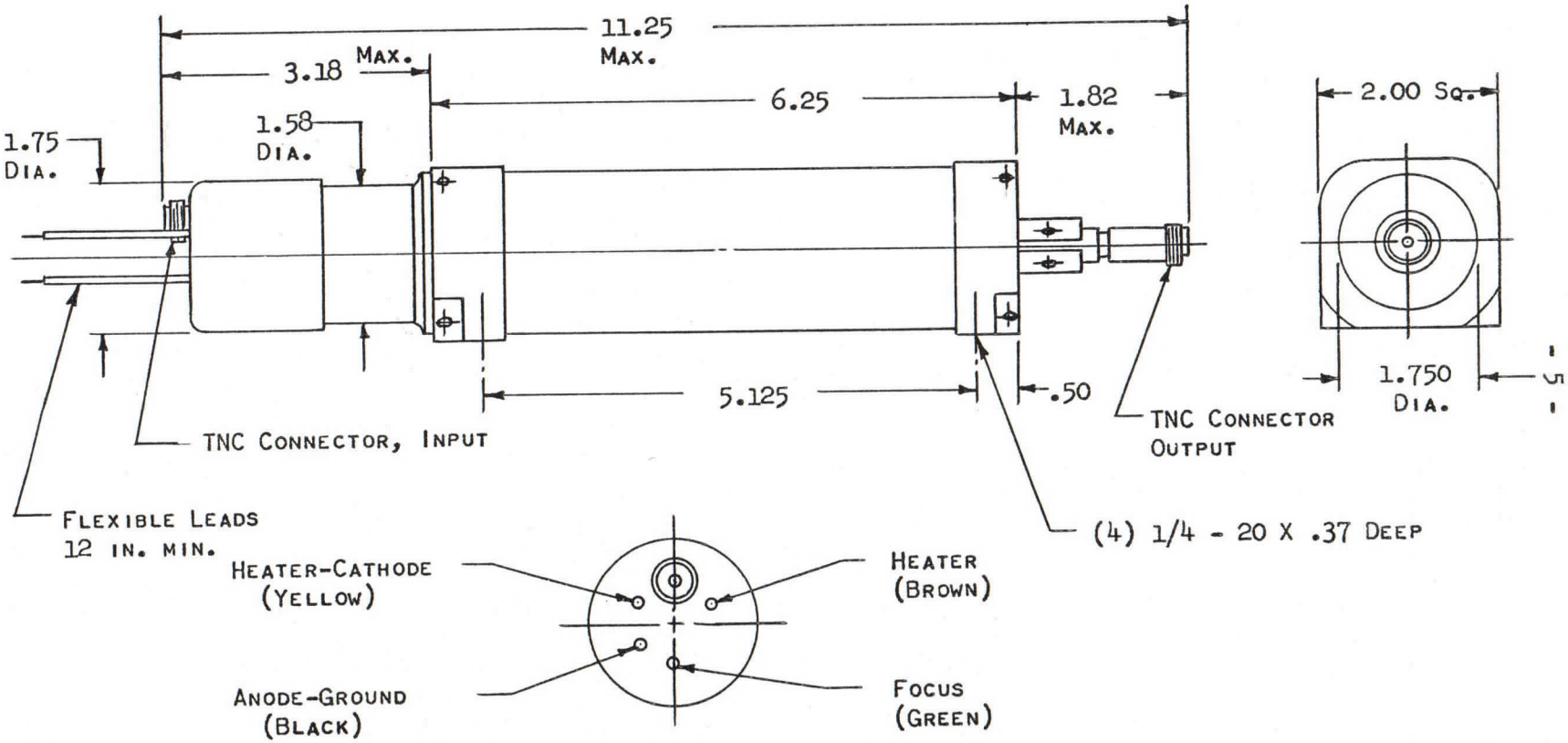
TYPICAL PERFORMANCE OF THE X-368 TRAVELING WAVE TUBE



OUTPUT POWER VS. INPUT POWER



PHASE SHIFT VS. HELIX VOLTAGE



X-368 TUBE AND MAGNET PACKAGE

(NOTE: SUPERSEDES OUTLINE DATED 10-60)

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

X-370 TRAVELING WAVE TUBE

TENTATIVE

DESCRIPTION:

THE X-370 IS A SUPER-HIGH-FREQUENCY TRAVELING WAVE AMPLIFIER TUBE, EMPLOYING A HELICAL WAVE PROPAGATING STRUCTURE. THE TUBE IS DESIGNED FOR USE AS AN R-F AMPLIFIER IN THE FREQUENCY RANGE OF 4000 TO 8000 MEGACYCLES PER SECOND. IT IS OF ALL-METAL SHELL CONSTRUCTION, AND TYPE TNC COAXIAL LINE R-F CONNECTORS ARE PROVIDED AS AN INTEGRAL PART OF THE STRUCTURE. THE TUBE IS SELF-ALIGNING IN A PERMANENT MAGNET WHICH PROVIDES THE MAGNETIC FIELD REQUIRED TO DEFINE THE PATH OF THE ELECTRON BEAM.

ELECTRICAL DATA:

HEATER, FOR OXIDE-COATED, UNIPOTENTIAL CATHODE		
VOLTAGE	6.3	VOLTS
CURRENT	2.0	AMPERES
FREQUENCY	4000-8000	MC
POWER OUTPUT (NOTE 1)	10	WATTS
GAIN, OPERATED AS		
POWER AMPLIFIER (NOTE 1)	30	DB
LOW-LEVEL AMPLIFIER (NOTE 1)	34	DB

MECHANICAL DATA:

MOUNT		SPECIAL
MOUNTING POSITION		ANY
BASE		MOULDED RUBBER WITH FLYING LEADS
SIZE	12 1/4 x 2 1/4 x 2 1/4	INCHES
NET WEIGHT	6.5	POUNDS
R-F CIRCUIT CONNECTORS		TYPE TNC
TYPE OF COOLING		AIR COOLED

NOTE 1: MINIMUM PERFORMANCE OVER THE FREQUENCY BAND OF 4000 TO 8000 MC.

MAXIMUM RATINGS:

Cathode Voltage with Respect to Ground	-3,000	Volts
Cathode Current	70	MA
Focus Electrode Voltage Range with Respect to Cathode	-15 to 0	Volts
Anode Voltage	Anode Connected Internally to Shell	
Shell Current	70	MA
Helix Voltage with respect to Shell	±500	Volts
Helix Current	3	MA
Collector Voltage	Anode Connected Internally to Shell	
Collector Current	Same as Shell	
Collector Dissipation	200	Watts
R-F Power Input	1	Watt Average
Load VSWR	3.0:1	

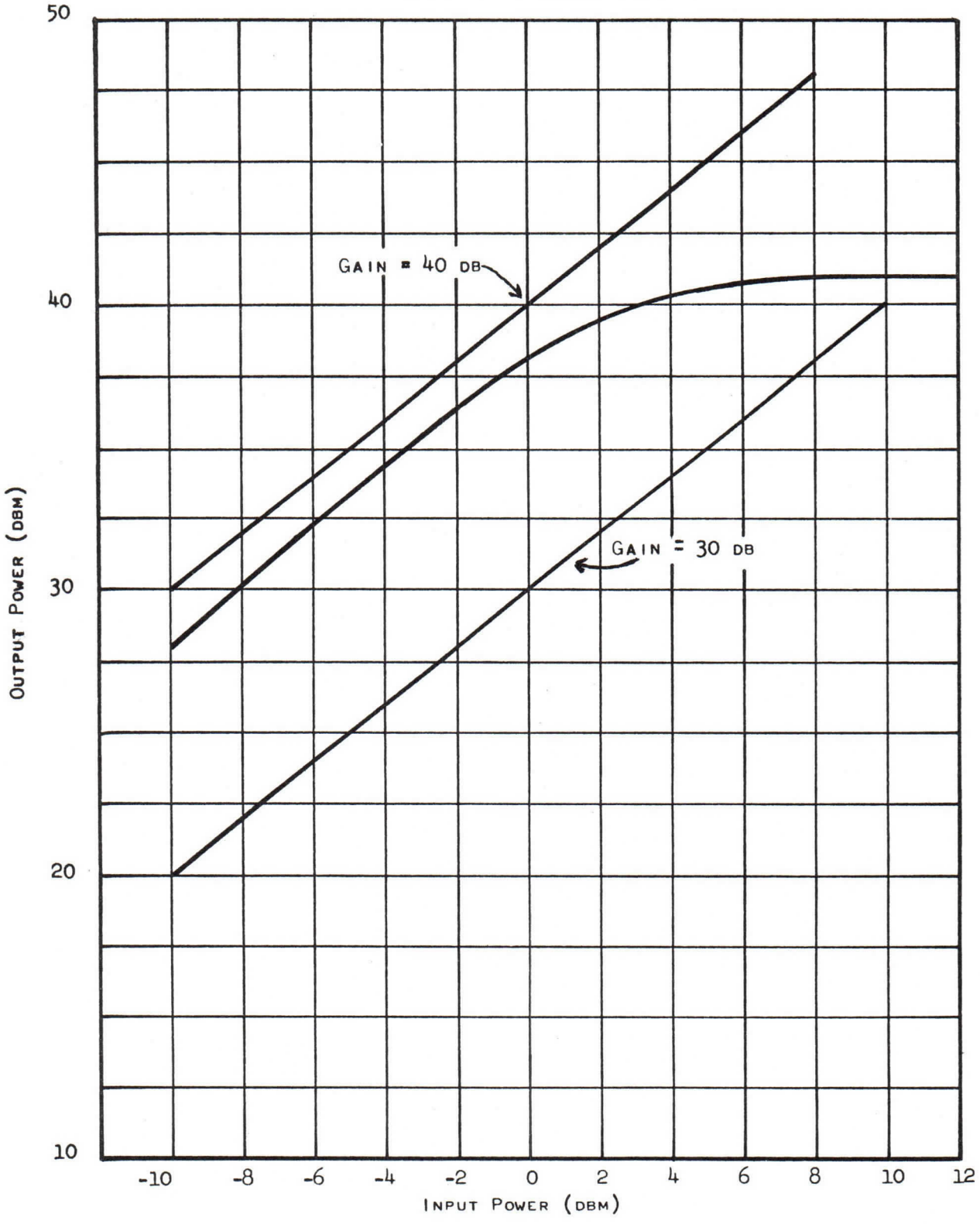
TYPICAL OPERATION:

As a Power Amplifier		
Frequency	6,000	MC
Cathode Voltage	2,800	Volts
Cathode Current	65	MA
Foucs Electrode Voltage with Respect to Cathode	-5	Volts
Shell Current	63	MA
Helix Current	2	MA
Power Output	10	Watts
Power Gain	30	DB
Duty	1.0	
As a Low-Level Amplifier		
Frequency	6,000	MC
Cathode Voltage	2,600	Volts
Cathode Current	55	MA
Focus Electrode Voltage with Respect to Cathode	-5	Volts
Shell Current	54	MA
Helix Current	1.5	MA
Power Output	300	MW
Power Gain	34	DB
Duty	1.0	

Additional information for specific applications can be obtained from the

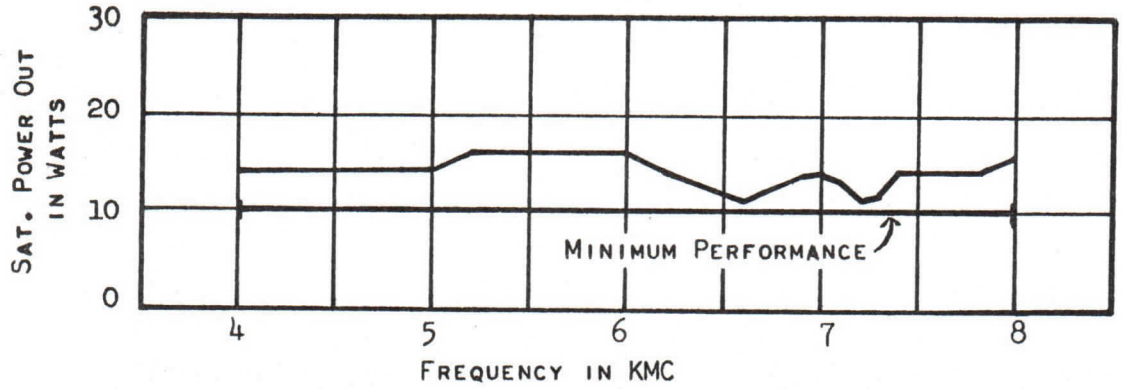
Electron Tube Applications Section
ITT Components Division
Post Office Box 412
Clifton, New Jersey

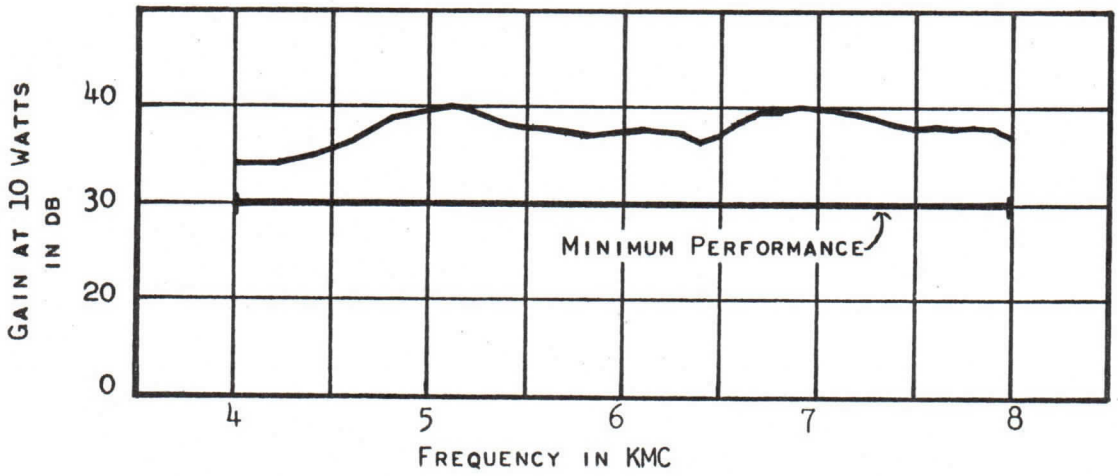
X-370 - POWER IN VS POWER OUT
TYPICAL PERFORMANCE

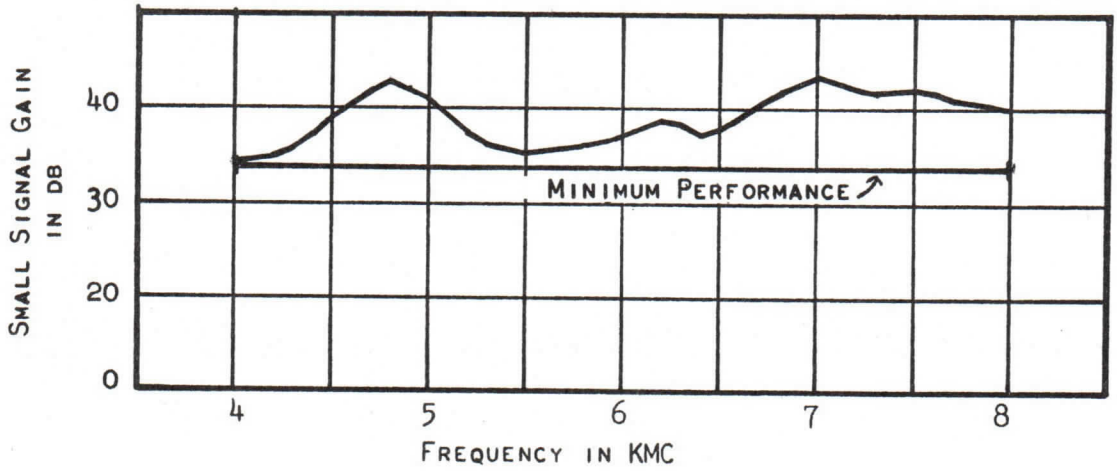


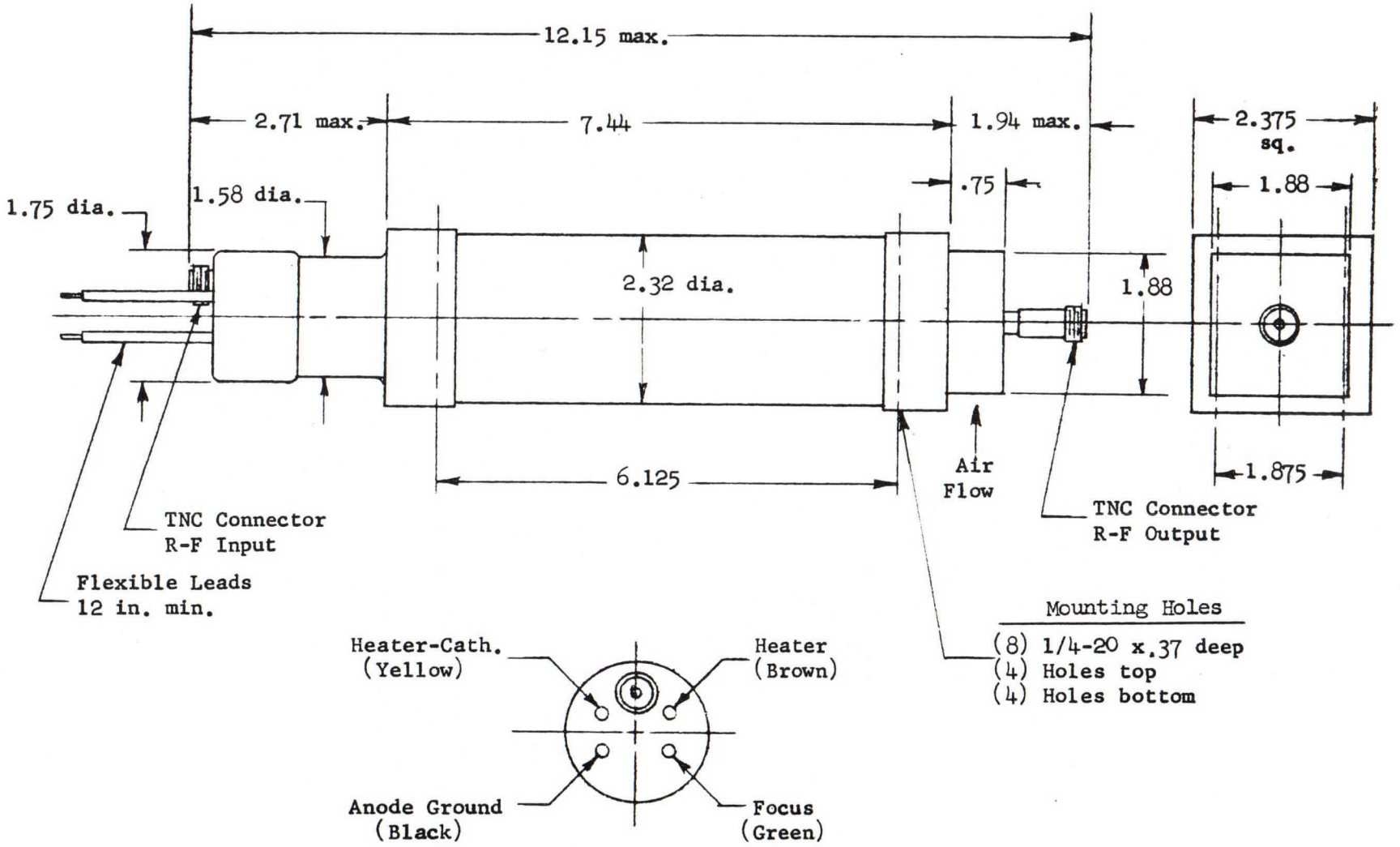
ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

TYPICAL PERFORMANCE
X-370 TRAVELING WAVE TUBE









NOTE: All dimensions in inches

X-370 TUBE AND MAGNET PACKAGE

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

X-388*
BACKWARD WAVE
CONVERTER
TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS:

The X-388 is a single tube designed to convert UHF signals in the band from 496-897 megacycles to a 50 megacycle intermediate frequency output signal.

The tube consists of a backward-wave amplifier and a backward wave oscillator in the same vacuum envelope. The r-f input signal is fed to the amplifier section where its level is increased. It is then mixed with the oscillator signal in the common electron beam that interacts with both r-f structures, to yield an i-f output signal which can be adjusted over a fairly large frequency range. This tube uses a 50 megacycle i-f.

The X-388 is a glass tube, mounted in an aluminum capsule. Solenoid focusing is required. A type "TNC" r-f input connector and a "TSM" i-f output connector are included as an integral part of the capsule. A type "TNC" l-o output connector can be supplied if required.

ELECTRICAL DATA:

Operating Frequency	496-897 megacycles
Bandwidth	10-25 megacycles
Noise Figure	20 db
I-F Output	50 megacycles
Conversion Gain	Unity
Image Rejection	40 db

Note: The image rejection is dependent upon the intermediate frequency selected. This tube utilizes a 50 megacycle i-f. An increase in the i-f would result in a higher level of image rejection.

* This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture, and should not be used for design purposes without prior arrangement.

MECHANICAL DATA:

Mounting Position	Horizontal (preferred)
Capsule Length	54 inches
Capsule Outside Diameter	3-1/4 inches
R-F Input Connector	Type "TNC" Coaxial, female
I-F Output Connector	Type "TSM" Coaxial, male
L-O Output Connector (if required)	Type "TNC" Coaxial, female
D-C Connections	Color coded flying leads

MAXIMUM RATINGS:

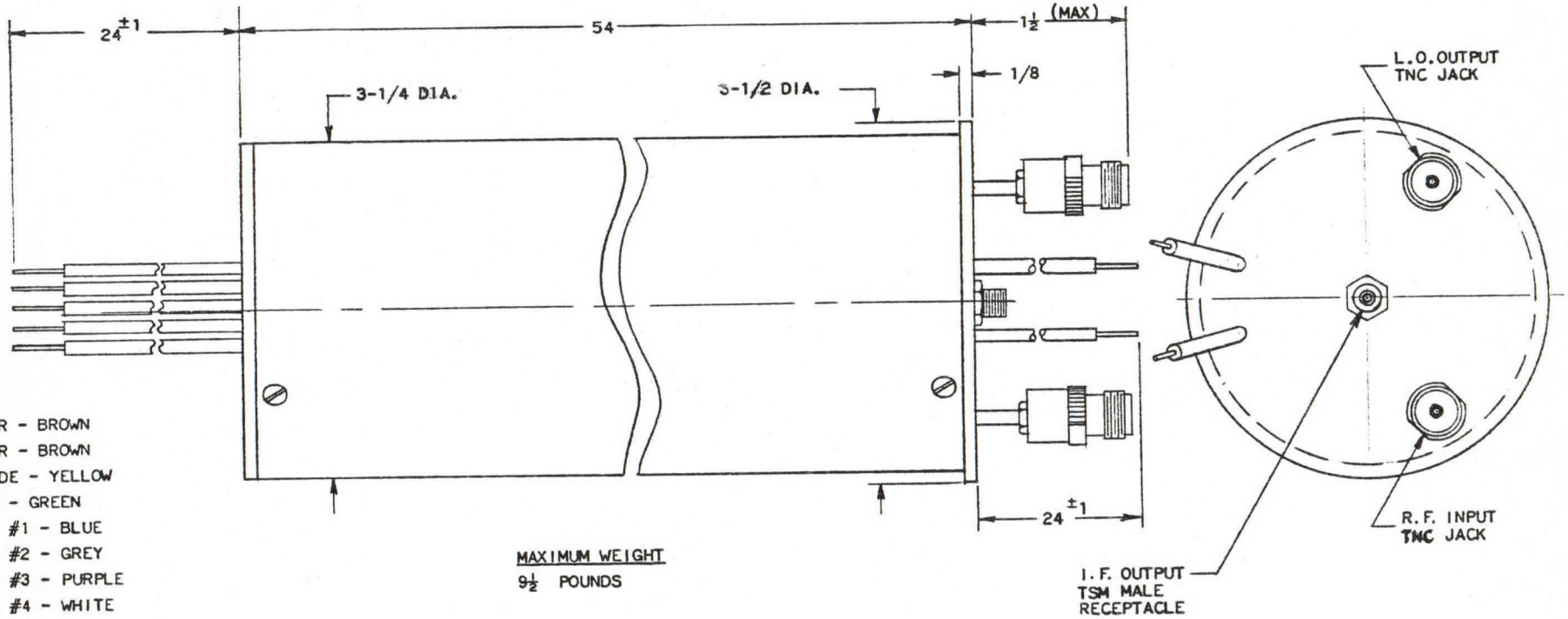
Heater Voltage	7.5 Volts maximum
Heater Current	4.5 Amperes maximum
Cathode Voltage	-100 to -1200 Volts maximum
Cathode Current	8 ma maximum
Focus Voltage	0 to -10 Volts maximum)
Anode No. 1 Voltage	15 to 80 Volts maximum)
Anode No. 2 Voltage	15 to 100 Volts maximum) With respect
Anode No. 3 Voltage	30 to 300 Volts maximum) to cathode
Anode No. 4 Voltage	100 to 500 Volts maximum)
Anode No. 5 Voltage)	
Amplifier Helix No. 1 Voltage)	
Amplifier Helix No. 2 Voltage)	Zero Volts (Ground)
Capsule Voltage)	
Oscillator Helix Voltage	-100 to +50 Volts maximum
Collector Voltage	250 Volts maximum
Focus Current	.3 ma maximum
Anode No. 1 Current	.3 ma maximum
Anode No. 2 Current	.3 ma maximum
Anode No. 3 Current	.3 ma maximum
Anode No. 4 Current	.3 ma maximum
Anode No. 5 Current	.3 ma maximum
Amplifier Helix No. 1 Current)	
Amplifier Helix No. 2 Current)	.5 ma maximum
Capsule Current)	
Oscillator Helix Current	.3 ma maximum
Collector Current	8 ma maximum
Solenoid Magnetic Field	500 Gauss maximum

TYPICAL OPERATION:

R-F Frequency	750 megacycles
L-O Frequency	700 megacycles
I-F Frequency	50 megacycles
Conversion Gain	0 db
Heater Voltage	7.0 Volts dc
Heater Current	3.9 Amperes
Cathode Voltage	-410 Volts with respect to ground
Cathode Current	3.0 ma
Focus Voltage	0 Volts)
Anode No. 1 Voltage	42 Volts)
Anode No. 2 Voltage	49 Volts) with respect to cathode
Anode No. 3 Voltage	56 Volts)
Anode No. 4 Voltage	164 Volts)
Anode No. 5 Voltage)	
Amplifier Helix No. 1 Voltage)	0 Volts (Ground)
Amplifier Helix No. 2 Voltage)	
Capsule Voltage)	
Oscillator Helix Voltage	-55 Volts)
Collector Voltage	200 Volts) with respect to ground
Focus Current	0 ma
Anode No. 1 Current	.06 ma
Anode No. 2 Current	.05 ma
Anode No. 3 Current	.05 ma
Anode No. 4 Current	.06 ma
Anode No. 5 Current	.04 ma
Amplifier Helix No. 1 Current)	
Amplifier Helix No. 2 Current)	.08 ma
Capsule Current)	
Oscillator Helix Current	.02 ma
Collector Current	2.6 ma
Solenoid Magnetic Field	450 Gauss

Additional information for specific application can be obtained from the

Electron Tube Application Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey



LEADS
HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED
OSCILLATOR HELIX - ORANGE

MAXIMUM WEIGHT
9½ POUNDS

BACKWARD WAVE CONVERTER

TYPE X-388

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

X-389*
BACKWARD WAVE
AMPLIFIER
TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS:

The X-389 is a backward wave amplifier tube with a helical wave propagation structure employing continuous beam operation. The tube is designed for use as a narrow band medium noise r-f amplifier with a pass band that can be electronically tuned over the frequency range of 496 to 897 megacycles.

The X-389 is a glass envelope tube mounted in an aluminum capsule and requires a solenoid to focus the electron beam. Type "TNC" female r-f connectors are included as an integral part of the capsule.

ELECTRICAL DATA:

Frequency Range	496 - 897 megacycles
Pass Band (3 db)	1 - 5 megacycles
Small Signal Gain	20 db minimum
Noise Figure	15 db maximum

MECHANICAL DATA:

Mounting Position	Horizontal (preferred)
Capsule Length	45 inches
Capsule Diameter	3-1/4 inches
Net Weight	8 pounds
R-F Connectors	Type "TNC" Female
D-C Connections	Color Coded Flying Leads
Cooling	Not Required

* This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS:

Heater Voltage	7.5 Volts maximum	
Heater Current	4.5 Amperes maximum	
Cathode Voltage	-100 to -1200 Volts maximum	
Cathode Current	5.0 ma maximum	
Focus Voltage	-10 to +10 Volts maximum)	
Anode No. 1 Voltage	+5 to 80 Volts maximum)	
Anode No. 2 Voltage	+5 to 100 Volts maximum)	With respect
Anode No. 3 Voltage	+20 to 200 Volts maximum)	to cathode
Anode No. 4 Voltage	+70 to 400 Volts maximum)	
Anode No. 5 Voltage)		
Helix No. 1 Voltage)		
Helix No. 2 Voltage)	Zero Volts (Ground)	
Capsule Voltage)		
Collector Voltage	250 Volts maximum	
Focus Current	.2 ma maximum	
Anode No. 1 Current	.2 ma maximum	
Anode No. 2 Current	.2 ma maximum	
Anode No. 3 Current	.2 ma maximum	
Anode No. 4 Current	.2 ma maximum	
Anode No. 5 Current	.2 ma maximum	
Helix No. 1 Current)		
Helix No. 2 Current)	.3 ma maximum	
Capsule Current)		
Collector Current	5 ma maximum	
Solenoid Magnetic Field	500 Gauss maximum	

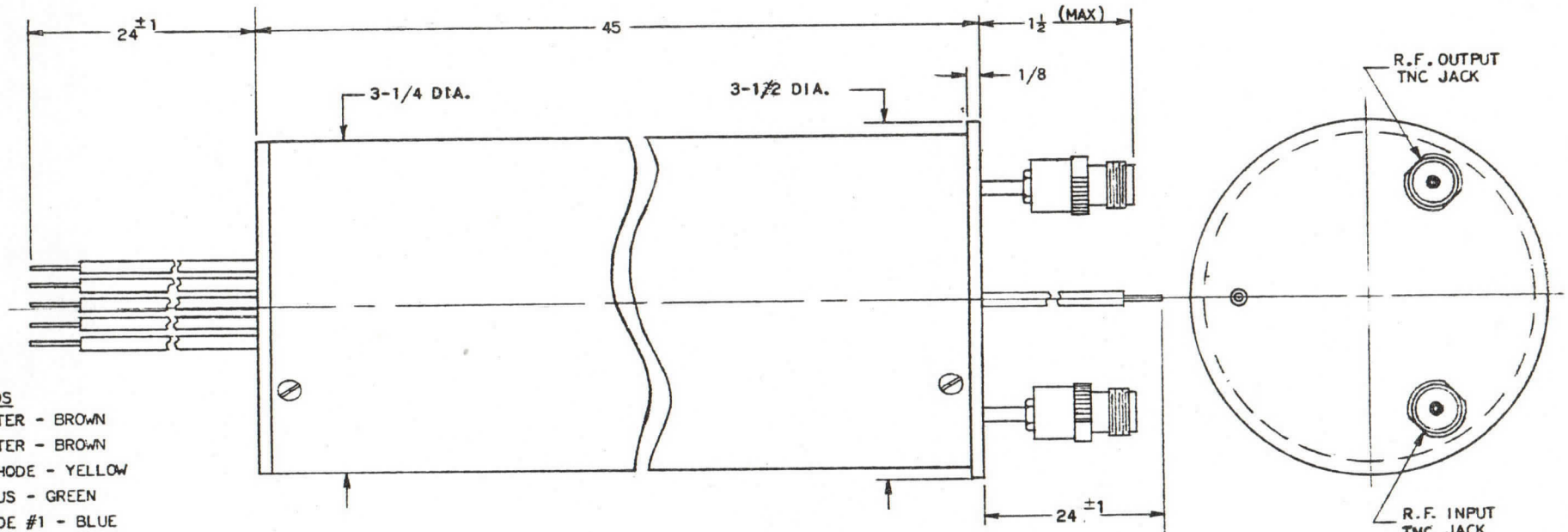
TYPICAL OPERATION:

Frequency (Center of Pass Band)	750 megacycles	
Pass Band (3 db)	3 megacycles	
Small Signal Gain	23 db	
Noise Figure	13 db	
Heater Voltage	7.0 Vdc	
Heater Current	3.9 Adc	
Cathode Voltage	-410 Vdc with respect to ground	
Cathode Current	1.2 ma)	
Focus Voltage	0 Vdc)	
Anode No. 1 Voltage	19 Vdc)	
Anode No. 2 Voltage	9 Vdc)	with respect to cathode
Anode No. 3 Voltage	65 Vdc)	
Anode No. 4 Voltage	180 Vdc)	
Anode No. 5 Voltage)		
Helix No. 1 Voltage)	Zero Volts (Ground)	
Helix No. 2 Voltage)		
Capsule Voltage)		

Collector Voltage	200 Volts with respect to ground
Focus Current	0 ma
Anode No. 1 Current	.03 ma
Anode No. 2 Current	.02 ma
Anode No. 3 Current	.01 ma
Anode No. 4 Current	.02 ma
Anode No. 5 Current	.01 ma
Helix No. 1 Current)	
Helix No. 2 Current)	.01 ma
Capsule Current)	
Collector Current	1.1 ma
Magnetic Field	450 gauss

Additional Information For Specific Applications Can Be Obtained from the:

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey



LEADS
HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED

MAXIMUM WEIGHT
8 POUNDS

BACKWARD WAVE AMPLIFIER

TYPE X-389

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

X-390* BACKWARD WAVE CONVERTER TUBE

TENTATIVE

GENERAL CHARACTERISTICS

The X-390 is a single tube designed to convert UHF signals in the band from 853-1543 megacycles to a 50 megacycle intermediate frequency output signal.

The tube consists of a backward-wave amplifier and a backward wave oscillator in the same vacuum envelope. The r-f input signal is fed to the amplifier section where its level is increased. It is then mixed with the oscillator signal in the common electron beam that interacts with both r-f structures, to yield an i-f output signal which can be adjusted over a fairly large frequency range. This tube uses a 50 megacycle i-f.

The X-390 is a glass tube, mounted in an aluminum capsule. Solenoid focusing is required. A type TNC r-f input connector a "TSM" i-f output connector are included as an integral part of the capsule. A type "TNC" l-o output connector can be supplied if required.

ELECTRICAL DATA

Operating Frequency	853-1543 megacycles
Bandwidth of Input Section	10-25 megacycles
Noise Figure	20 db
I-F Output	50 megacycles
Conversion Gain	Unity
Image Rejection	35 db

Note: The image rejection is dependent upon the intermediate frequency selected. This tube utilizes a 50 megacycle i-f, an increase in the i-f would result in a higher level of image rejection.

*This number identifies a particular experimental tube design, such number and identification data being subject tochange without notice. This tube is for experimental purposes only, carries no obligation for future manufacture, and should not be used for design purposes without prior arrangement.

MECHANICAL DATA

Mounting Position	Horizontal (preferred)
Capsule Length	47-1/2 inches
Capsule Outside Diameter	3-1/2 inches
R-F Input Connector	Type "TNC" coaxial, female
I-F Output Connector	Type "TSM" coaxial, male
L-O Output Connector (if required)	Type "TNC" coaxial, female
D. C. Connections	Color coded flying leads

MAXIMUM RATINGS

Heater Voltage	7.5 Volts maximum	
Heater Current	4.5 Amperes maximum	
Cathode Voltage	-200 to -1450 Volts maximum	
Cathode Current	8 ma maximum	
Focus Voltage	0 to -10 Volts maximum)	
Anode No. 1 Voltage	+10 to +75 Volts maximum)	With respect
Anode No. 2 Voltage	+10 to +100 Volts maximum)	to cathode
Anode No. 3 Voltage	+30 to +300 Volts maximum)	
Anode No. 4 Voltage	+80 to +900 Volts maximum)	
Anode No. 5 Voltage	)	
Amplifier Helix No. 1 Voltage	) Zero Volts (Ground)	
Amplifier Helix No. 2 Voltage	)	
Capsule Voltage	)	
Oscillator Helix Voltage	-50 to +55 Volts maximum	
Collector Voltage	250 Volts maximum	
Focus Current	.3 ma maximum	
Anode No. 1 Current	.3 ma maximum	
Anode No. 2 Current	.3 ma maximum	
Anode No. 3 Current	.3 ma maximum	
Anode No. 4 Current	.3 ma maximum	
Anode No. 5 Current	.3 ma maximum	
Amplifier Helix No. 1 Current)		
Amplifier Helix No. 2 Current)	.5 ma maximum	
Capsule Current)		
Oscillator Helix Current	.3 ma maximum	
Collector Current	8 ma maximum	
Solenoid Magnetic Field	600 Gauss maximum	

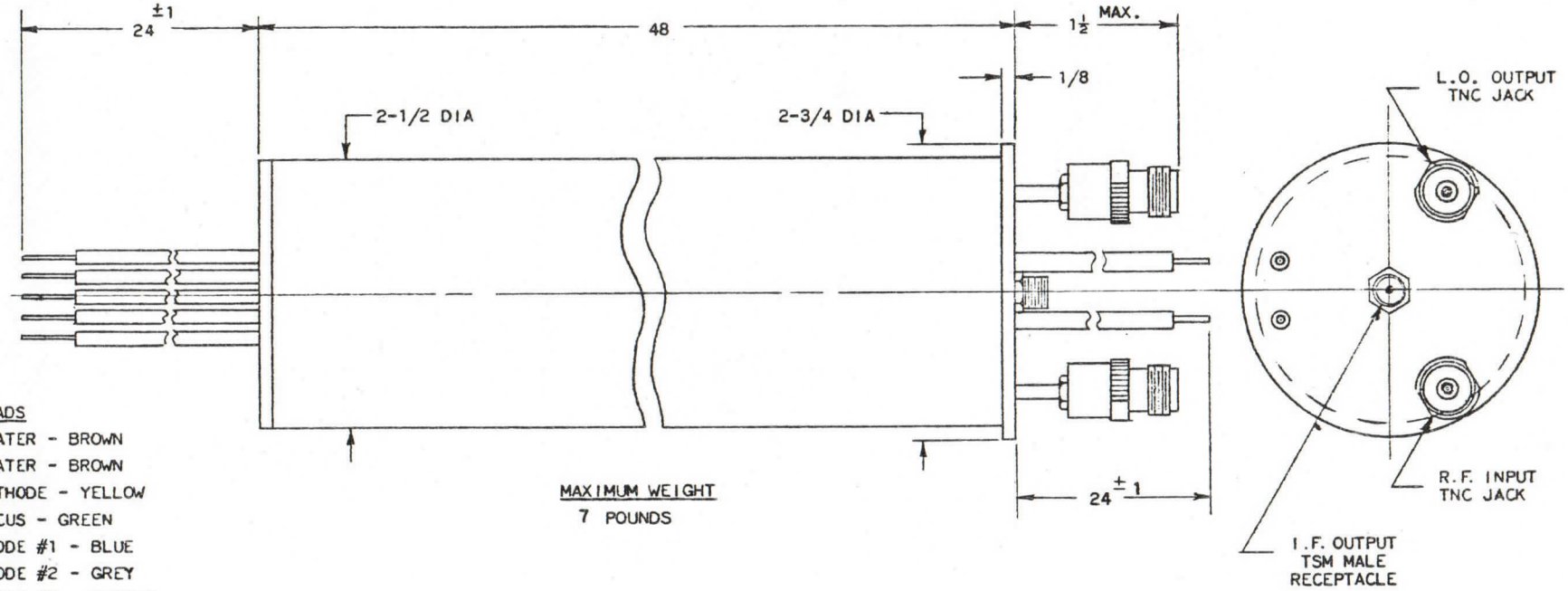
TYPICAL OPERATION

R-F Frequency	1200	megacycles	
L-O Frequency	1150	megacycles	
I-F Frequency	50	megacycles	
Conversion Gain	0	db	
Heater Voltage	7.0	Volts	
Heater Current	3.9	Amperes	
Cathode Voltage	-545	Volts with respect to ground	
Cathode Current	4.0	ma	
Focus Voltage	0	Volts)	
Anode No. 1 Voltage	39	Volts)	
Anode No. 2 Voltage	51	Volts)	With respect to cathode
Anode No. 3 Voltage	70	Volts)	
Anode No. 4 Voltage	230	Volts)	
Anode No. 5 Voltage)			
Amplifier Helix No. 1 Voltage)			
Amplifier Helix No. 2 Voltage)	0	Volts (Ground)	
Capsule Voltage)			
Oscillator Helix Voltage	-40	Volts)	
Collector Voltage	200	Volts)	with respect to ground
Focus Current	0	ma	
Anode No. 1 Current	.07	ma	
Anode No. 2 Current	.04	ma	
Anode No. 3 Current	.04	ma	
Anode No. 4 Current	.05	ma	
Anode No. 5 Current	.06	ma	
Amplifier Helix No. 1 Current)			
Amplifier Helix No. 2 Current)	.08	ma	
Capsule Current)			
Oscillator Helix Current	.02	ma	
Collector Current	3.6	ma	
Solenoid Magnetic Field	500	Gauss	

Additional information for specific application can be obtained from the:

Electron Tube Application Section
ITT Components Division
P. O. Box 412
Clifton, New Jersey

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



LEADS

HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED

OSCILLATOR HELIX-ORANGE

MAXIMUM WEIGHT
7 POUNDS

BACKWARD WAVE CONVERTER

TYPE X-390

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

X-391* BACKWARD WAVE AMPLIFIER TUBE

TENTATIVE

GENERAL CHARACTERISTICS

The X-391 is an L-band backward wave amplifier tube with a helical wave propagation structure employing continuous beam operation. The tube is designed for use as a narrow band medium noise r-f amplifier with a pass band that can be electronically tuned over the frequency range of 853 to 1543 megacycles.

The X-391 is a glass envelope tube mounted in an aluminum capsule and requires a solenoid to focus the electron beam. Type "TNC" female r-f connectors are included as an integral part of the capsule.'

ELECTRICAL DATA

Frequency Range	853 - 1543 mcs
Pass Band (3 db)	2 - 8 mcs
Small Signal Gain	20 db minimum
Noise Figure	15 db maximum

MECHANICAL DATA

Mounting Position	Horizontal (preferred)
Capsule Length	40 inches
Capsule Diameter	2-1/2 inches
Net Weight	6 pounds
R-F Connectors	Type "TNC" Female
D-C Connections	Color Coded Flying Leads
Cooling	Not Required

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	7.5 Volts dc maximum
Heater Current	4.5 Amperes maximum
Cathode Voltage	-175 to -1300 Volts maximum
Cathode Current	4 ma maximum
Focus Voltage	-10 to +10 Volts maximum)
Anode No. 1 Voltage	+5 to +70 Volts maximum)
Anode No. 2 Voltage	+5 to +100 Volts maximum) with respect
Anode No. 3 Voltage	+30 to +300 Volts maximum) to cathode
Anode No. 4 Voltage	+80 to +800 Volts maximum)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	Zero Volts (Ground)
Helix No. 2 Voltage)	
Capsule Voltage)	
Collector Voltage	250 Volts maximum
Focus Current	.2 ma maximum
Anode No. 1 Current	.2 ma maximum
Anode No. 2 Current	.2 ma maximum
Anode No. 3 Current	.2 ma maximum
Anode No. 4 Current	.2 ma maximum
Anode No. 5 Current	.2 ma maximum
Helix No. 1 Current)	
Helix No. 2 Current)	.3 ma maximum
Capsule Current)	
Collector Current	4 ma maximum
Solenoid Magnetic Field	600 Gauss maximum

TYPICAL OPERATION

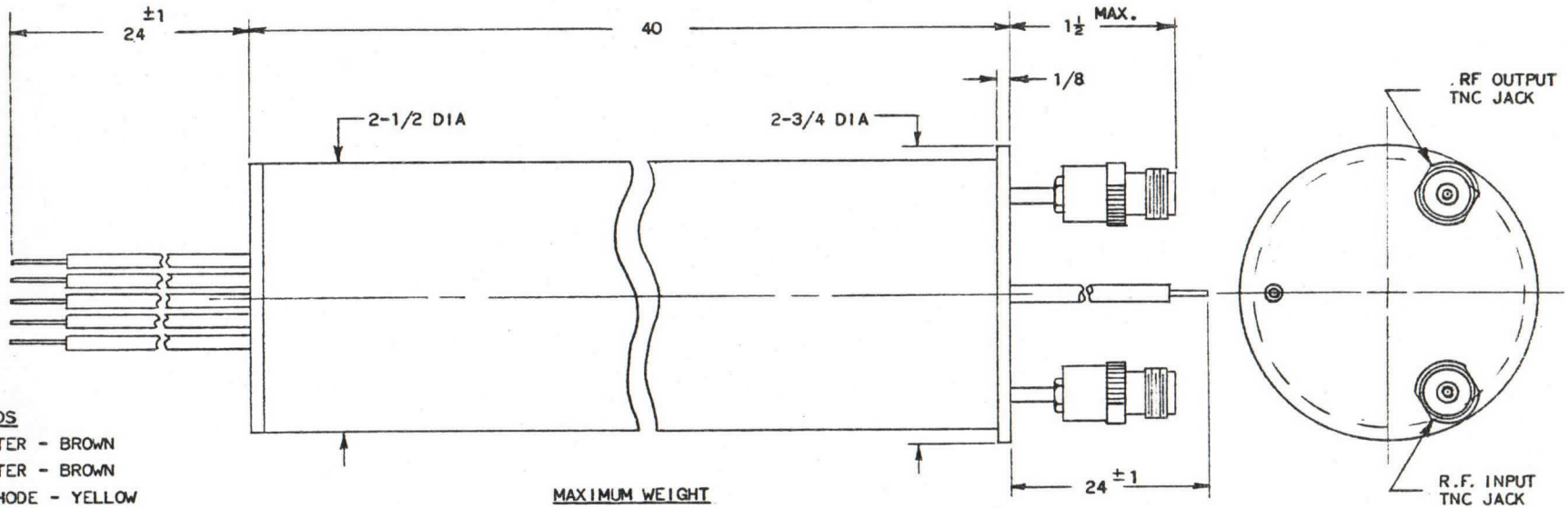
Frequency (Center of Pass Band)	1200 megacycles
Pass Band (3 db)	5 megacycles
Small Signal Gain	23 db
Noise Figure	12 db
Heater Voltage	7.0 Vdc
Heater Current	3.9 Adc
Cathode Voltage	-545 Vdc with respect to ground
Cathode Current	2.0 ma
Focus Voltage	-8 Vdc)
Anode No. 1 Voltage	+15 Vdc)
Anode No. 2 Voltage	+30 Vdc) with respect to cathode
Anode No. 3 Voltage	+150 Vdc)
Anode No. 4 Voltage	+300 Vdc)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	Zero Volts (Ground)
Helix No. 2 Voltage)	
Capsule Voltage)	
Collector Voltage	200 Volts with respect to ground
Focus Current	0 ma
Anode No. 1 Current	.02 ma
Anode No. 2 Current	.03 ma

Anode No. 3	.02 ma
Anode No. 4 Current	.01 ma
Anode No. 5 Current	.01 ma
Helix No. 1 Current)	
Helix No. 2 Current)	.01 ma
Capsule Current)	
Collector Current	1.9 ma
Magnetic Field	500 gauss

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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



LEADS

HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED

MAXIMUM WEIGHT
6 POUNDS

BACKWARD WAVE AMPLIFIER

TYPE X-391

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

X-392* BACKWARD WAVE CONVERTER TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-392 is a single tube designed to convert UHF signals in the band from 1470-2670 megacycles to a 130 megacycle intermediate frequency output signal.

The tube consists of a backward-wave amplifier and a backward wave oscillator in the same vacuum envelope. The r-f input signal is fed to the amplifier section where its level is increased. It is then mixed with the oscillator signal in the common electron beam that interacts with both r-f structures, to yield an i-f output signal which can be adjusted over a fairly large frequency range. This tube uses a 130 megacycle i-f.

The X-392 is a glass tube, mounted in an aluminum capsule. Solenoid focusing is required. A type "TNC" r-f input connector and a "TSM" i-f output connector are included as an integral part of the capsule. A type "TNC" l-o output connector can be supplied if required.

ELECTRICAL DATA

Operating Frequency	1470-2670 megacycles
Bandwidth of Input Section	10-30 megacycles
Noise Figure	20 db
I-F Output	130 megacycles
Conversion Gain	Unity
Image Rejection	35 db

NOTE: The image rejection is dependent upon the intermediate frequency selected. This tube utilizes a 130 megacycle i-f, an increase in the i-f would result in a higher level of image rejection.

MECHANICAL DATA

Mounting Position	Horizontal (preferred)
Capsule Length	39 inches
Capsule Outside Diameter	2 inches
R-F Input Connector	Type "TNC" coaxial, female
I-F Output Connector	Type "TSM" coaxial, male
L-O Output Connector (if required)	Type "TNC" coaxial, female
D.C. Connections	Color Coded Flying leads

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture, and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5 Volts dc maximum	
Heater Current	4 Amperes maximum	
Cathode Voltage	-200 to -1400 Volts maximum	
Cathode Current	8 ma maximum	
Focus Voltage	0 to -10 Volts maximum)	With respect to cathode
Anode No. 1 Voltage	+10 to +70 Volts maximum)	
Anode No. 2 Voltage	+10 to +150 Volts maximum)	
Anode No. 3 Voltage	+30 to +300 Volts maximum)	
Anode No. 4 Voltage	+70 to +900 Volts maximum)	
Anode No. 5 Voltage)		
Amplifier Helix No. 1 Voltage)		
Amplifier Helix No. 2 Voltage)		
Capsule Voltage)	Zero Volts (Ground)	
Oscillator Helix Voltage	-50 to +100 Volts maximum	
Collector Voltage	250 Volts maximum	
Focus Current	.3 ma maximum	
Anode No. 1 Current	.3 ma maximum	
Anode No. 2 Current	.3 ma maximum	
Anode No. 3 Current	.3 ma maximum	
Anode No. 4 Current	.3 ma maximum	
Anode No. 5 Current	.3 ma maximum	
Amplifier Helix No. 1 Current)		
Amplifier Helix No. 2 Current)	.5 ma maximum	
Capsule Current)		
Oscillator Helix Current	.3 ma maximum	
Collector Current	8 ma maximum	
Solenoid Magnetic Field	700 Gauss maximum	

TYPICAL OPERATION

R-F Frequency	2200 megacycles	
L-O Frequency	2070 megacycles	
I-F Frequency	130 megacycles	
Conversion Gain	+3 db	
Heater Voltage	6.3 Volts dc	
Heater Current	3.5 Amperes	
Cathode Voltage	-680 Volts with respect to ground	
Cathode Current	4.0 ma	
Focus Voltage	0 Volts)	With respect to cathode
Anode No. 1 Voltage	35 Volts)	
Anode No. 2 Voltage	47 Volts)	
Anode No. 3 Voltage	230 Volts)	
Anode No. 4 Voltage	550 Volts)	
Anode No. 5 Voltage)		
Amplifier Helix No. 1 Voltage)		
Amplifier Helix No. 2 Voltage)	0 Volts (Ground)	
Capsule Voltage)		
Oscillator Helix Voltage	-30 Volts)	With respect to ground
Collector Voltage	200 Volts)	

Focus Current	0 ma
Anode No. 1 Current	.06 ma
Anode No. 2 Current	.05 ma
Anode No. 3 Current	.05 ma
Anode No. 4 Current	.06 ma
Anode No. 5 Current	.04 ma
Amplifier Helix No. 1 Current) Amplifier Helix No. 2 Current) Capsule Current)	.08 ma
Oscillator Helix Current	.02 ma
Collector Current	3.6 ma
Solenoid Magnetic Field	650 Gauss

Additional information for specific application can be obtained from the

Electron Tube Application Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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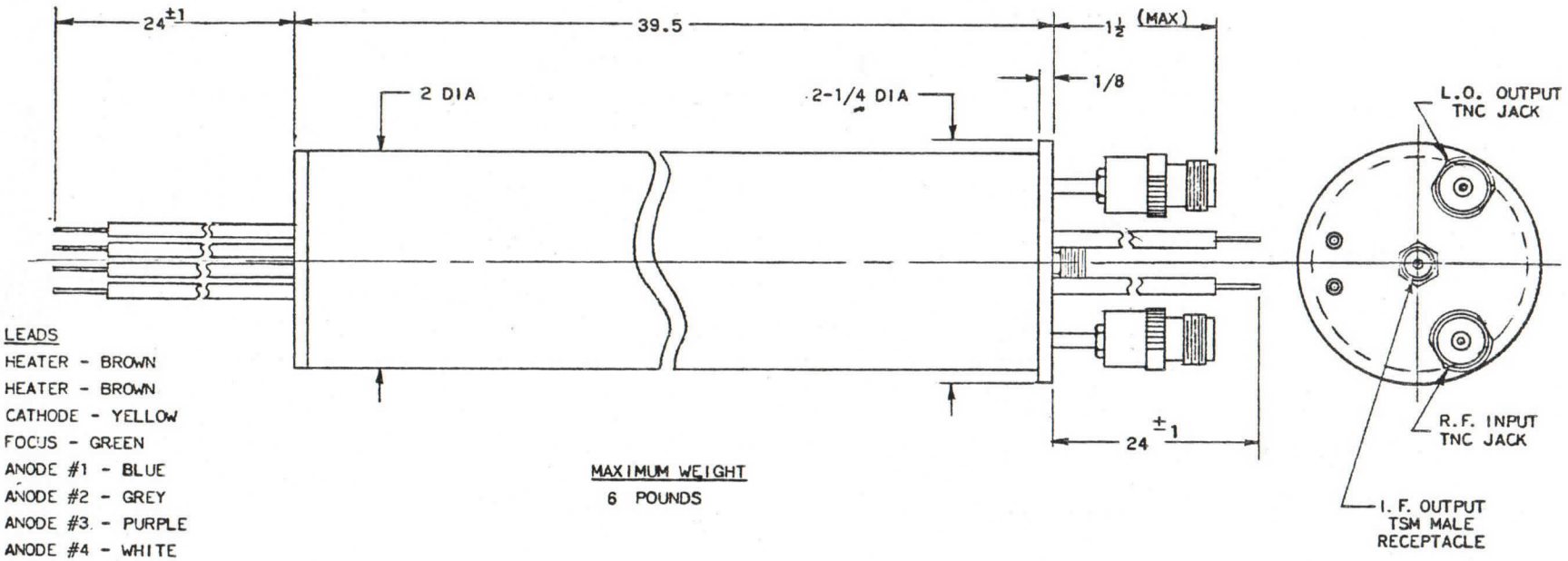
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



LEADS

HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED
OSCILLATOR HELIX - ORANGE

MAXIMUM WEIGHT
6 POUNDS

BACKWARD WAVE CONVERTER

TYPE X-392

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

X-393*
BACKWARD WAVE
AMPLIFIER
TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-393 is an S-band backward wave amplifier tube with a helical wave propagation structure employing continuous beam operation. The tube is designed for use as a narrow band medium noise r-f amplifier with a pass band that can be electronically tuned over the frequency range of 1470 to 2670 megacycles.

The X-393 is a glass envelope tube mounted in an aluminum capsule and requires a solenoid to focus the electron beam. Type "TNC" female r-f connectors are included as an integral part of the capsule.

ELECTRICAL DATA

Frequency Range	1470 - 2670 mcs
Pass Band (3 db)	3 - 15 mcs
Small Signal Gain	20 db minimum
Noise Figure	15 db maximum

MECHANICAL DATA

Mounting Position	Horizontal (preferred)
Capsule Length	32 inches
Capsule Diameter	2 inches
Net Weight	5 pounds
R-F Connectors	Type "TNC" Female
D-C Connections	Color Coded Flying Leads
Cooling	Not Required

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5 Volts dc maximum
Heater Current	4 Amperes maximum
Cathode Voltage	-200 to -1350 Volts maximum
Cathode Current	4 ma maximum
Focus Voltage	-10 to +10 Volts maximum)
Anode No. 1 Voltage	+5 to +70 Volts maximum)
Anode No. 2 Voltage	+10 to +150 Volts maximum) with respect
Anode No. 3 Voltage	+20 to +250 Volts maximum) to cathode
Anode No. 4 Voltage	+70 to +700 Volts maximum)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	
Helix No. 2 Voltage)	Zero Volts (Ground)
Capsule Voltage)	
Collector Voltage	250 Volts maximum
Focus Current	.2 ma maximum
Anode No. 1 Current	.2 ma maximum
Anode No. 2 Current	.2 ma maximum
Anode No. 3 Current	.2 ma maximum
Anode No. 4 Current	.2 ma maximum
Anode No. 5 Current	.2 ma maximum
Helix No. 1 Current)	
Helix No. 2 Current)	.3 ma maximum
Capsule Current)	
Collector Current	4 ma maximum
Solenoid Magnetic Field	700 Gauss maximum

TYPICAL OPERATION

Frequency (Center of Pass Band)	2200 megacycles
Pass Band (3 db)	9 megacycles
Small Signal Gain	23 db
Noise Figure	12 db
Heater Voltage	6.3 Vdc
Heater Current	3.5 ADC
Cathode Voltage	-680 Vdc with respect to ground
Cathode Current	2.0 ma
Focus Voltage	-7 Vdc)
Anode No. 1 Voltage	+18 Vdc)
Anode No. 2 Voltage	+15 Vdc) with respect to cathode
Anode No. 3 Voltage	+210 Vdc)
Anode No. 4 Voltage	+450 Vdc)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	
Helix No. 2 Voltage)	Zero Volts (Ground)
Capsule Voltage)	
Collector Voltage	200 Volts with respect to ground
Focus Current	0 ma
Anode No. 1 Current	.03 ma

Anode No. 2 Current	.01 ma
Anode No. 3 Current	.01 ma
Anode No. 4 Current	.01 ma
Anode No. 5 Current	.01 ma
Helix No. 1 Current)	
Helix No. 2 Current)	.03 ma
Capsule Current)	
Collector Current	1.9 ma
Magnetic Field	650 gauss

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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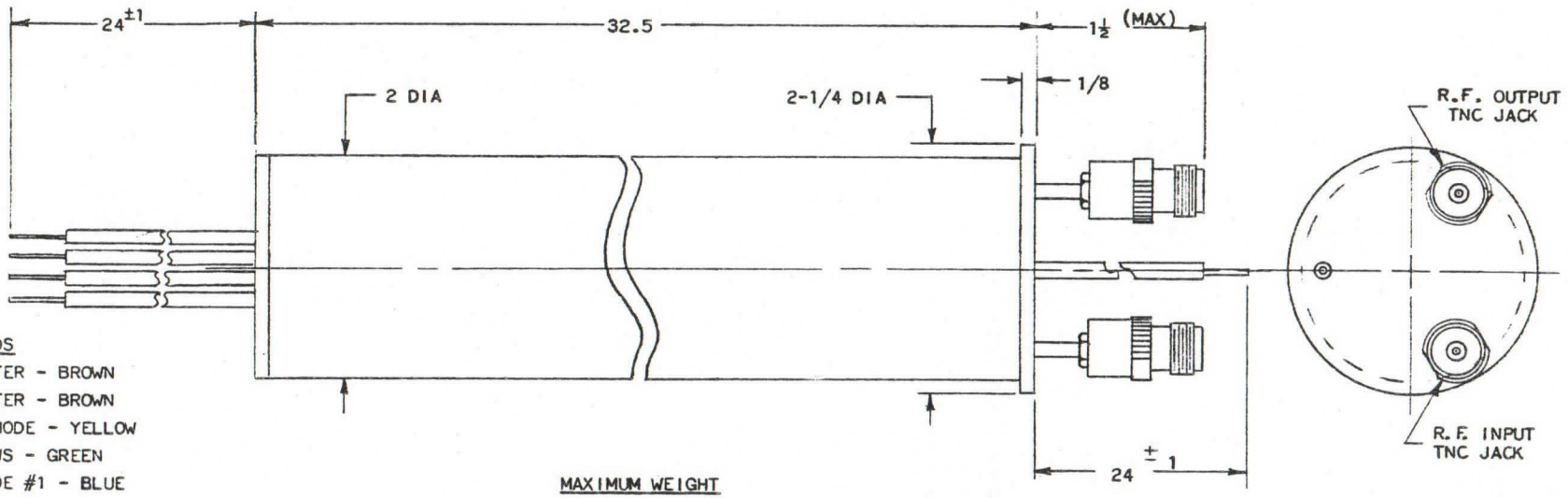
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



LEADS
HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED

MAXIMUM WEIGHT
5 POUNDS

BACKWARD WAVE AMPLIFIER

TYPE X-393

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

X-394* BACKWARD WAVE CONVERTER TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-394 is a single tube designed to convert SHF signals in the band from 2540-4050 megacycles to a 180 megacycle intermediate frequency output signal.

The tube consists of a backward-wave amplifier and a backward wave oscillator in the same vacuum envelope. The r-f input signal is fed to the amplifier section where its level is increased. It is then mixed with the oscillator signal in the common electron beam that interacts with both r-f structures, to yield an i-f output signal which can be adjusted over a fairly large frequency range. This tube uses a 180 megacycle i-f.

The X-394 is a glass tube, mounted in an aluminum capsule. Solenoid focusing is required. A type TNC r-f input connector and a "TSM" i-f output connector are included as an integral part of the capsule. A type "TNC" l-o output connector can be supplied if required.

ELECTRICAL DATA

Operating Frequency	2540-4050 megacycles
Bandwidth of Input Section	10-40 megacycles
Noise Figure	20 db
I-F Output	180 megacycles
Conversion Gain	Unity
Image Rejection	35 db

NOTE: The image rejection is dependent upon the intermediate frequency selected. This tube utilizes a 180 megacycle i-f, an increase in the i-f would result in a higher level of image rejection.

MECHANICAL DATA

Mounting Position	Any
Capsule Length	31 inches
Capsule Outside Diameter	1-3/8 inches
R-F Input Connector	Type "TNC" coaxial, female
I-F Output Connector	Type "TSM" coaxial, male
L-O Output connector (if required)	Type "TNC" coaxial, female
D.C. Connections	Color coded flying leads.

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture, and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5 Volts dc maximum
Heater Current	4.0 Amperes maximum
Cathode Voltage	-250 to -1500 Volts maximum
Cathode Current	8 ma maximum
Focus Voltage	0 to -10 Volts maximum)
Anode No. 1 Voltage	+15 to +75 Volts maximum)
Anode No. 2 Voltage	+15 to +150 Volts maximum) with respect
Anode No. 3 Voltage	+30 to +350 Volts maximum) to cathode
Anode No. 4 Voltage	+100 to +900 Volts maximum)
Anode No. 5 Voltage)	
Amplifier Helix No. 1 Voltage)	Zero Volts (Ground)
Amplifier Helix No. 2 Voltage)	
Capsule Voltage)	
Oscillator Helix Voltage	-50 to +100 Volts maximum
Collector Voltage	250 Volts maximum
Focus Current	.3 ma maximum'
Anode No. 1 Current	.3 ma maximum
Anode No. 2 Current	.3 ma maximum
Anode No. 3 Current	.3 ma maximum
Anode No. 4 Current	.3 ma maximum
Anode No. 5 Current	.3 ma maximum
Amplifier Helix No. 1 Current)	
Amplifier Helix No. 2 Current)	.5 ma maximum
Capsule Current)	
Oscillator Helix Current	.3 ma maximum
Collector Current	8 ma maximum
Solenoid Magnetic Field	750 Gauss maximum

TYPICAL OPERATION

R-F Frequency	3500 megacycles
L-O Frequency	3320 megacycles
I-F Frequency	180 megacycles
Conversion Gain	0 db
Heater Voltage	6.3 Volts dc
Heater Current	3.5 Amperes
Cathode Voltage	-820 Volts with respect to ground
Cathode Current	4.5 ma
Focus Voltage	0 Volts)
Anode No. 1 Voltage	54 Volts)
Anode No. 2 Voltage	60 Volts) With respect to cathode
Anode No. 3 Voltage	210 Volts)
Anode No. 4 Voltage	320 Volts)
Anode No. 5 Voltage)	
Amplifier Helix No. 1 Voltage)	0 Volts (Ground)
Amplifier Helix No. 2 Voltage)	
Capsule Voltage)	

Oscillator Helix Voltage	-20 Volts)
Collector Voltage	200 Volts) with respect to ground
Focus Current	0 ma
Anode No. 1 Current	.08 ma
Anode No. 2 Current	.06 ma
Anode No. 3 Current	.05 ma
Anode No. 4 Current	.05 ma
Anode No. 5 Current	.06 ma
Amplifier Helix No. 1 Current)	
Amplifier Helix No. 2 Current)	.08 ma
Capsule Current)	
Oscillator Helix Current	.02 ma
Collector Current	4.1 ma
Solenoid Magnetic Field	650 Gauss

Additional information for specific application can be obtained from the

Electron Tube Application Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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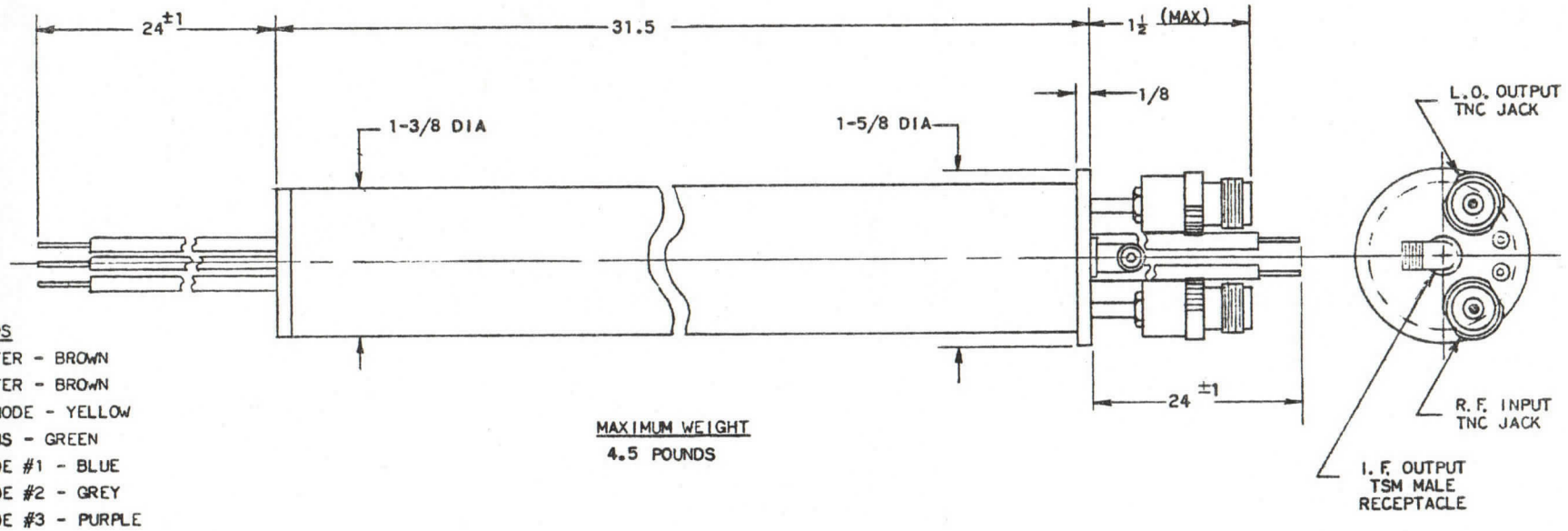
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



LEADS

HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED
OSCILLATOR HELIX - ORANGE

MAXIMUM WEIGHT
4.5 POUNDS

BACKWARD WAVE CONVERTER

TYPE X-394

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

X-395*
BACKWARD WAVE
AMPLIFIER
TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-395 is an S-band backward wave amplifier tube with a helical wave propagation structure employing continuous beam operation. The tube is designed for use as a narrow band medium noise r-f amplifier with a pass band that can be electronically tuned over the frequency range of 2540 to 4050 megacycles.

The X-395 is a glass envelope tube mounted in an aluminum capsule and requires a solenoid to focus the electron beam. Type "TNC" female r-f connectors are included as an integral part of the capsule.

ELECTRICAL DATA

Frequency Range	2540 - 4050 mcs
Pass Band (3 db)	6 - 22 mcs
Small Signal Gain	20 db minimum
Noise Figure	15 db maximum

MECHANICAL DATA

Mounting Position	Any
Capsule Length	24 inches
Capsule Diameter	1-3/8 inches
Net Weight	3-1/2 pounds
R-F Connectors	Type "TNC" Female
D-C Connections	Color Coded Flying Leads
Cooling	Not Required

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5 Volts dc maximum
Heater Current	4 Amperes maximum
Cathode Voltage	-250 to -1400 Volts maximum
Cathode Current	4 ma maximum
Focus Voltage	-10 to +10 Volts maximum)
Anode No. 1 Voltage	+5 to +80 Volts maximum)
Anode No. 2 Voltage	+5 to 200 Volts maximum) with respect
Anode No. 3 Voltage	+20 to 300 Volts maximum) to cathode
Anode No. 4 Voltage	+70 to 800 Volts maximum)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	
Helix No. 2 Voltage)	Zero Volts (Ground)
Capsule Voltage)	
Collector Voltage	250 Volts maximum
Focus Current	.2 ma maximum
Anode No. 1 Current	.2 ma maximum
Anode No. 2 Current	.2 ma maximum
Anode No. 3 Current	.2 ma maximum
Anode No. 4 Current	.2 ma maximum
Anode No. 5 Current	.2 ma maximum
Helix No. 1 Current)	
Helix No. 2 Current)	.3 ma maximum
Capsule Current)	
Collector Current	4 ma maximum
Solenoid Magnetic Field	750 Gauss maximum

TYPICAL OPERATION

Frequency (Center of Pass Band)	3500 megacycles
Pass Band (3 db)	14 megacycles
Small Signal Gain	24 db
Noise Figure	12 db
Heater Voltage	6.3 Vdc
Heater Current	3.5 Adc
Cathode Voltage	-820 Vdc with respect to ground
Cathode Current	2.0 ma
Focus Voltage	-7 Vdc)
Anode No. 1 Voltage	+18 Vdc)
Anode No. 2 Voltage	+15 Vdc) with respect to cathode
Anode No. 3 Voltage	+200 Vdc)
Anode No. 4 Voltage	+300 Vdc)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	
Helix No. 2 Voltage)	Zero Volts (Ground)
Capsule Voltage)	
Collector Voltage	200 Volts with respect to ground

Focus Current	0 ma
Anode No. 1 Current	.05 ma
Anode No. 2 Current	.02 ma
Anode No. 3 Current	.03 ma
Anode No. 4 Current	.05 ma
Anode No. 5 Current	.02 ma
Helix No. 1 Current)	
Helix No. 2 Current)	.03 ma
Capsule Current)	
Collector Current	1.8 ma
Magnetic Field	700 gauss

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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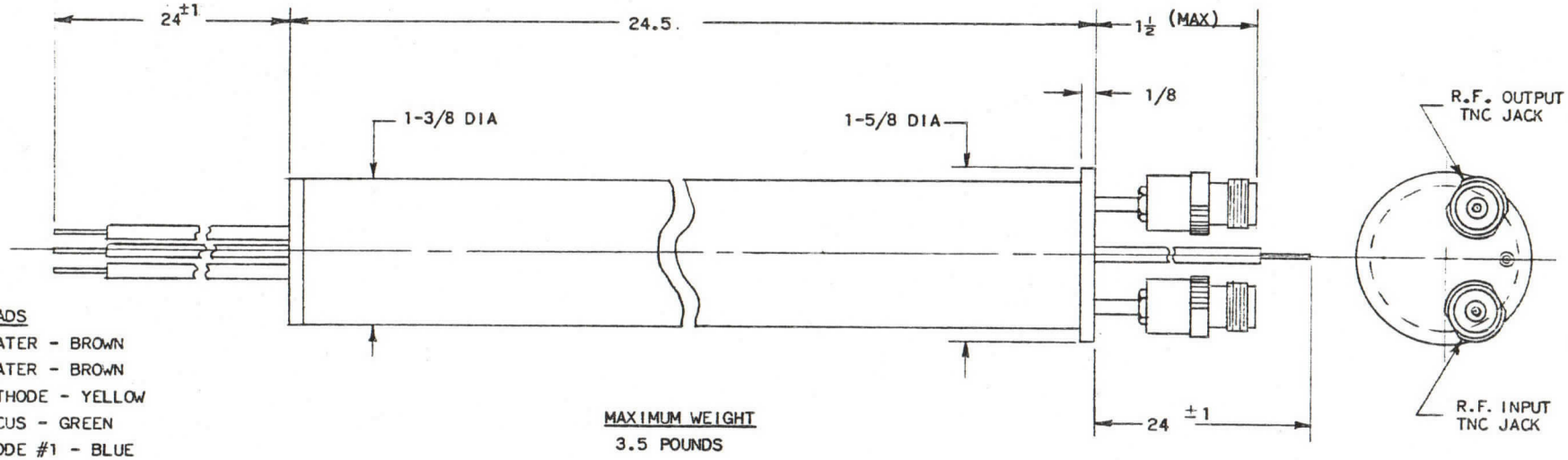
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



LEADS

HEATER - BROWN
HEATER - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE #1 - BLUE
ANODE #2 - GREY
ANODE #3 - PURPLE
ANODE #4 - WHITE
ANODE #5
AMPL. HELIX #1 — GROUND-BLACK
AMPL. HELIX #2
COLLECTOR - RED

MAXIMUM WEIGHT
3.5 POUNDS

BACKWARD WAVE AMPLIFIER

TYPE X-395

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

X-396* BACKWARD WAVE CONVERTER TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-396 is a single tube designed to convert SHF signals in the band from 3850-6000 megacycles toa 280 megacycle intermediate frequency output signal.

The tube consists of a backward-wave amplifier and a backward wave oscillator in the same vacuum envelope. The r-f input signal is fed to the amplifier section where its level is increased. It is then mixed with the oscillator signal in the common electron beam that interacts with both r-f structures, to yield an i-f output signal which can be adjusted over a fairly large frequency range. This tube uses a 280 megacycle i-f.

The X-396 is a glass tube, mounted in an aluminum capsule. Solenoid focusing is required. A type TNC r-f input connector and a "TSM" i-f output connector are included as an integral part of the capsule. A type "TNC" 1-o output connection can be supplied if required.

ELECTRICAL DATA

Operating Frequency	3850-6000 megacycles
Bandwidth of Input Section	12-60 megacycles
Noise Figure	20 db
I-F Output	280 megacycles
Conversion Gain	Unity
Image Rejection	35 db

Note: The image rejection is dependent upon the intermediate frequency selected. This tube utilizes a 280 megacycle i-f, an increase in the i-f would result in a higher level of image rejection.

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture, and should not be used for design purposes without prior arrangement.

MECHANICAL DATA

Mounting Position	Any
Capsule Length	24 inches
Capsule Outside Diameter	1-1/8 inches
R-F Input Connector	Type "TNC" coaxial, female
I-F Output Connector	Type "TSM" coaxial, male
L-O Output Connector	Type "TNC" coaxial female
D-C Connections	Color coded flying leads

MAXIMUM RATINGS

Heater Voltage	6.5	Volts dc maximum	
Heater Current	2	Amperes maximum	
Cathode Voltage	-300 to -1300	Volts maximum	
Cathode Current	8	ma maximum	
Focus Voltage	0 to -10	Volts maximum)	
Anode No. 1 Voltage	+15 to +75	Volts maximum)	
Anode No. 2 Voltage	+15 to +100	Volts maximum)	With respect to
Anode No. 3 Voltage	+30 to +300	Volts maximum)	cathode
Anode No. 4 Voltage	+100 to +800	Volts maximum)	
Anode No. 5 Voltage)			
Amplifier Helix No. 1 Voltage)			
Amplifier Helix No. 2 Voltage)	Zero Volts (Ground)		
Capsule Voltage)			
Oscillator Helix Voltage	-50 to +100	Volts maximum	
Collector Voltage	250	Volts maximum	
Focus Current	.3	ma maximum	
Anode No. 1 Current	.3	ma maximum	
Anode No. 2 Current	.3	ma maximum	
Anode No. 3 Current	.3	ma maximum	
Anode No. 4 Current	.3	ma maximum	
Anode No. 5 Current	.3	ma maximum	
Amplifier Helix No. 1 Current)			
Amplifier Helix No. 2 Current)	.5	ma maximum	
Capsule Current)			
Oscillator Helix Current	.3	ma maximum	
Collector Current	8	ma maximum	
Solenoid Magnetic Field	800	Gauss maximum	

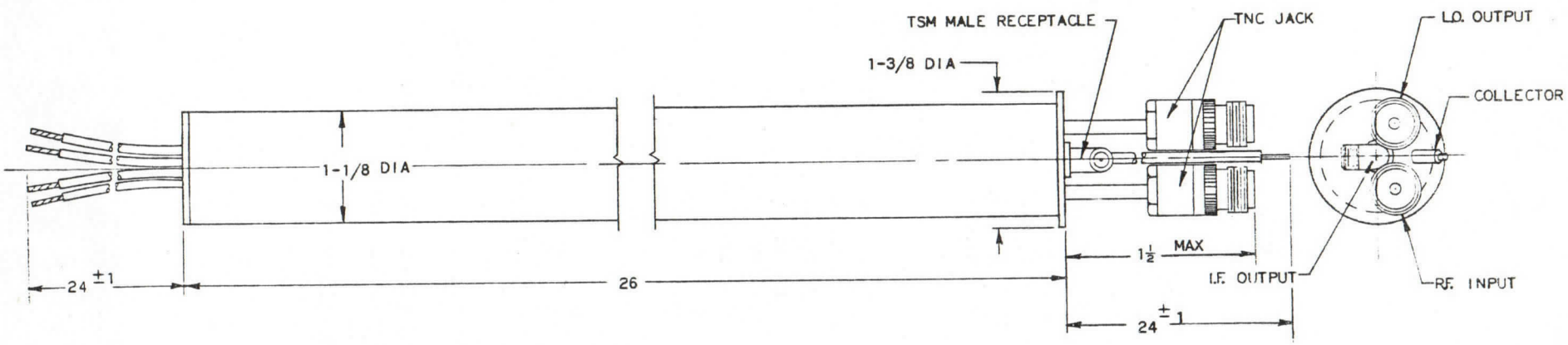
TYPICAL OPERATION

R-F Frequency	5000	megacycles
L-O Frequency	4720	megacycles
I-F Frequency	280	megacycles
Conversion Gain	+2	db
Heater Voltage	6.3	Volts dc
Heater Current	1.9	Amperes
Cathode Voltage	-610	Volts with respect to ground
Cathode Current	4.5	ma
Focus Voltage	0	Volts)
Anode No. 1 Voltage	40	Volts)
Anode No. 2 Voltage	50	Volts) With respect to cathode
Anode No. 3 Voltage	120	Volts)
Anode No. 4 Voltage	240	Volts)
Anode No. 5 Voltage)		
Amplifier Helix No.1 Voltage)	0	Volts (Ground)
Capsule Voltage)		
Oscillator Helix Voltage	-10	Volts)
Collector Voltage	200	Volts) with respect to ground
Focus Current	0	ma
Anode No. 1 Current	.1	ma
Anode No. 2 Current	.05	ma
Anode No. 3 Current	.05	ma
Anode No. 4 Current	.06	ma
Anode No. 5 Current	.04	ma
Amplifier Helix No. 1 Current)		
Amplifier Helix No. 2 Current)	.12	ma
Capsule Current)		
Oscillator Helix Current	.04	ma
Collector Current	4.0	ma
Solenoid Magnetic Field	700	Gauss

Additional information for specific application can be obtained from the:

Electron Tube Application Section
ITT Components Division
P. O. Box 412
Clifton, New Jersey

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



MAXIMUM WEIGHT

2 POUNDS

LEADS

HEATERS	- BROWN
CATHODE	- YELLOW
FOCUS	- GREEN
ANODE NO. 1	- BLUE
ANODE NO. 2	- GREY
ANODE NO. 3	- PURPLE
ANODE NO. 4	- WHITE
ANODE NO. 5	
AMPL. HELIX NO. 1	——GROUND-BLACK
AMPL. HELIX NO. 2	
COLLECTOR	- RED

OSCILLATOR HELIX - INNER CONDUCTOR OF L O OUTPUT JACK

BACKWARD WAVE CONVERTER

TYPE X-396

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

X-397* BACKWARD WAVE AMPLIFIER TUBE

TENTATIVE

GENERAL CHARACTERISTICS

The X-397 is a C-band backward wave amplifier tube with a helical wave propagation structure employing continuous beam operation. The tube is designed for use as a narrow band medium noise r-f amplifier with a pass band that can be electronically tuned over the frequency range of 3850 to 6000 megacycles.

The X-397 is a glass envelope tube mounted in an aluminum capsule and requires a solenoid to focus the electron beam. Type "TNC" female r-f connectors are included as an integral part of the capsule.

ELECTRICAL DATA

Frequency Range	3850-6000 megacycles
Pass Band (3 db)	8 to 33 megacycles
Small Signal Gain	20 db minimum
Noise Figure	15 db maximum

MECHANICAL DATA

Mounting Position	Any
Capsule Length	20 inches
Capsule Diameter	1-1/8 inches
Net Weight	2 pounds
R-F Connectors	Type "TNC", female
D. C. Connections	Color Coded Flying Leads
Cooling	Not Required

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5	Volts dc maximum
Heater Current	2	Amperes maximum
Cathode Voltage	-250 to -1200	Volts maximum
Cathode Current	4	ma maximum
Focus Voltage	-10 to +10	Volts maximum)
Anode No. 1 Voltage	+5 to +80	Volts maximum)
Anode No. 2 Voltage	+5 to +100	Volts maximum)
Anode No. 3 Voltage	+20 to +300	Volts maximum) with respect to
Anode No. 4 Voltage	+70 to +800	Volts maximum) cathode
Anode No. 5 Voltage)		
Helix No. 1 Voltage)		
Helix No. 2 Voltage)		Zero Volts (Ground)
Capsule Voltage)		
Collector Voltage	250	Volts maximum
Focus Current	.2	ma maximum
Anode No. 1 Current	.2	ma maximum
Anode No. 2 Current	.2	ma maximum
Anode No. 3 Current	.2	ma maximum
Anode No. 4 Current	.2	ma maximum
Anode No. 5 Current	.2	ma maximum
Helix No. 1 Current)		
Helix No. 2 Current)	.3	ma maximum
Capsule Current)		
Collector Current	4	ma maximum
Solenoid Magnetic Field	800	Gauss maximum

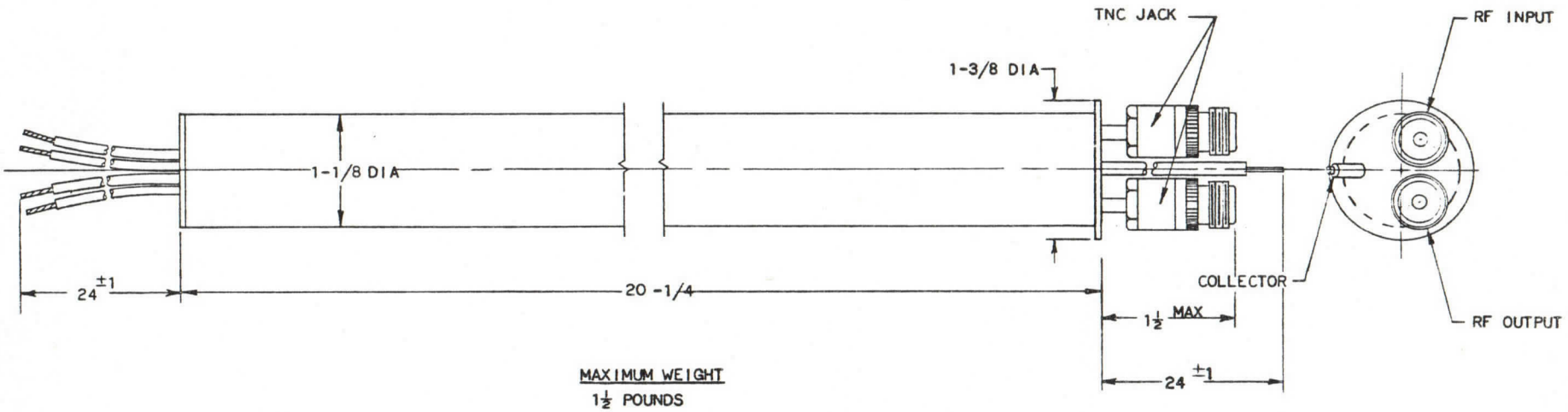
TYPICAL OPERATION

Frequency (Center of Pass Band)	5000	megacycles
Pass Band (3 db)	20	megacycles
Small Signal Gain	23	db
Noise Figure	12	db
Heater Voltage	6.3	Vdc
Heater Current	1.9	Adc
Cathode Voltage	-610	Vdc with respect to ground
Cathode Current	2.0	ma
Focus Voltage	-5	Vdc)
Anode No. 1 Voltage	+15	Vdc)
Anode No. 2 Voltage	+12	Vdc) with respect to cathode
Anode No. 3 Voltage	+80	Vdc)
Anode No. 4 Voltage	+200	Vdc)
Anode No. 5 Voltage)		
Helix No. 1 Voltage)		
Helix No. 2 Voltage)		Zero Volts (Ground)
Capsule Voltage)		
Collector Voltage	200	Volts with respect to ground
Focus Current	0	ma

Anode No. 1 Current	.10	ma
Anode No. 2 Current	.05	ma
Anode No. 3 Current	.03	ma
Anode No. 4 Current	.02	ma
Anode No. 5 Current	.03	ma
Helix No. 1 Current)		
Helix No. 2 Current)	.05	ma
Capsule Current)		
Collector Current	1.7	ma
Magnetic Field	700	gauss

Additional information for specific applications can be obtained from the:

Electron Tube Applications Section
ITT Components Division
P. O. Box 412
Clifton, New Jersey



MAXIMUM WEIGHT
1½ POUNDS

LEADS

HEATERS	- BROWN
CATHODE	- YELLOW
FOCUS	- GREEN
ANODE NO. 1	- BLUE
ANODE NO. 2	- GREY
ANODE NO. 3	- PURPLE
ANODE NO. 4	- WHITE
ANODE NO. 5, AMPL. HELIX NO. 1, AMPL. HELIX NO. 2	- GROUND-BLACK
COLLECTOR	- RED

BACKWARD WAVE AMPLIFIER

TYPE X-397

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

X-398*
BACKWARD WAVE
CONVERTER
TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-398 is a single tube designed to convert SHF signals in the band from 5700-8400 megacycles to a 320 megacycle intermediate frequency output signal.

The tube consists of a backward-wave amplifier and a backward wave oscillator in the same vacuum envelope. The r-f input signal is fed to the amplifier section where its level is increased and it mixes with the oscillator signal. Mixing is accomplished in the common electron beam that interacts with both r-f structures, to yield an i-f output signal which can be adjusted over a fairly large frequency range. This tube uses a 320 megacycle i-f.

The X-398 is a glass tube, mounted in an aluminum capsule. Solenoid focusing is required. A type "TNC" r-f input connector and a "TSM" i-f output connector are included as an integral part of the capsule. A type "TNC" l- output connector can be supplied if required.

ELECTRICAL DATA

Operating Frequency	5700-8400 megacycles
Bandwidth of Input Section	17-84 megacycles
Noise Figure	20 db
I-F Output	320 megacycles
Conversion Gain	Unity
Image Rejection	35 db

Note: The image rejection is dependent upon the intermediate frequency selected. This tube utilizes a 320 megacycle i-f, an increase in the i-f would result in a higher level of image rejection.

MECHANICAL DATA

Mounting Position	Any
Capsule Length	19 inches
Capsule Outside Diameter	7/8 inches
R-F Input Connector	Type "TNC" Coaxial, female
I-F Output Connector	Type "TSM" Coaxial, male
L-O Output Connector(if required)	Type "TNC" Coaxial female
D.C. Connections	Color coded flying leads.

*This number identifies a particular experimental tube design, such number and identification data being subject tochange without notice. This tube is for experimental purposes only, carries no obligation for future manufacture, and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5	Volts dc maximum	
Heater Current	2	Amperes maximum	
Cathode Voltage	-250 to -1300	Volts maximum	
Cathode Current	8	ma maximum	
Focus Voltage	0 to -10	Volts Maximum	with respect to cathode
Anode No. 1 Voltage	15 to 80	Volts Maximum	
Anode No. 2 Voltage	15 to 150	Volts Maximum	
Anode No. 3 Voltage	30 to 300	Volts Maximum	
Anode No. 4 Voltage	100 to 900	Volts Maximum	
Anode No. 5 Voltage Amplifier Helix No. 1 Voltage Amplifier Helix No. 2 Voltage Capsule Voltage	Zero Volts (Ground)		
Oscillator Helix Voltage	-50 to +100	Volts Maximum	
Collector Voltage	250	Volts maximum	
Focus Current	.3	ma maximum	
Anode No. 1 Current	.3	ma maximum	
Anode No. 2 Current	.3	ma maximum	
Anode No. 3 Current	.3	ma maximum	
Anode No. 4 Current	.3	ma maximum	
Anode No. 5 Current	.3	ma maximum	
Amplifier Helix No. 1 Current Amplifier Helix No. 2 Current Capsule Current	.5	ma maximum	
Oscillator Helix Current	.3	ma maximum	
Collector Current	8	ma maximum	
Solenoid Magnetic Field	900	ma maximum	

X-398
BACKWARD WAVE
CONVERTER TUBE

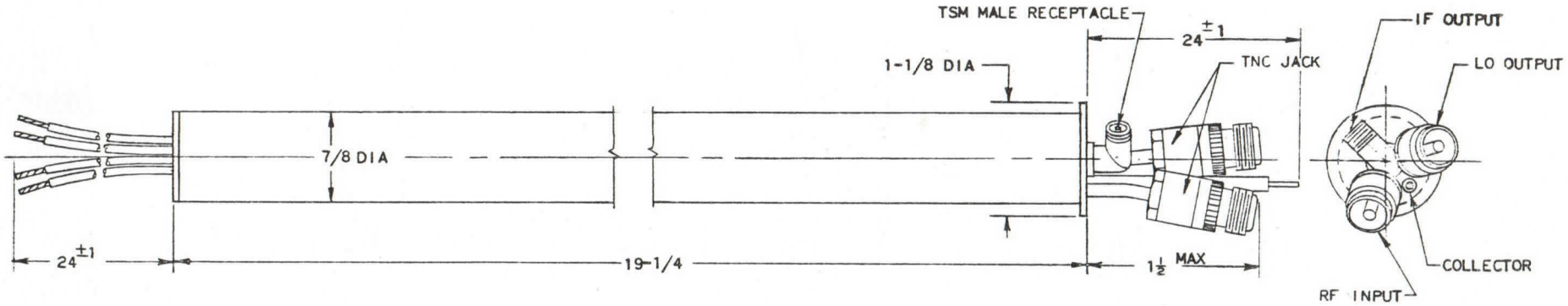
TYPICAL OPERATION

R-F Frequency	7000 megacycles
L-O Frequency	6680 megacycles
I-F Frequency	320 megacycles
Conversion Gain	+2 db
Heater Voltage	6.3 Volts dc
Heater Current	1.9 Amperes
Cathode Voltage	-640 Volts with respect to ground
Cathode Current	4.0 ma
Focus Voltage	0 Volts)
Anode No. 1 Voltage	49 Volts)
Anode No. 2 Voltage	62 Volts) with respect to cathode
Anode No. 3 Voltage	220 Volts)
Anode No. 4 Voltage	380 Volts)
Anode No. 5 Voltage)	
Amplifier Helix No. 1 Voltage)	0 Volts (Ground)
Amplifier Helix No. 2 Voltage)	
Capsule Voltage)	
Oscillator Helix Voltage	-25 Volts) with respect to ground
Collector Voltage	200 Volts)
Focus Current	0 ma
Anode No. 1 Current	.10 ma
Anode No. 2 Current	.08 ma
Anode No. 3 Current	.06 ma
Anode No. 4 Current	.06 ma
Anode No. 5 Current	.04 ma
Amplifier Helix No. 1 Current)	
Amplifier Helix No. 2 Current)	.08 ma
Capsule Current)	
Oscillator Helix Current	.02 ma
Collector Current	3.6 ma
Solenoid Magnetic Field	800 Gauss

Additional information for specific application can be obtained from the

Electron Tube Application Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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



MAXIMUM WEIGHT
1-1/4 POUNDS

LEADS

HEATERS ——— BROWN
CATHODE ——— YELLOW
FOCUS ——— GREEN
ANODE NO. 1 —— BLUE
ANODE NO. 2 —— GREY
ANODE NO. 3 —— PURPLE
ANODE NO. 4 —— WHITE
ANODE NO. 5
AMPL. HELIX NO. 1
AMPL. HELIX NO. 2 —— GROUND-BLACK
COLLECTOR ——— RED
OSCILLATOR HELIX - INNER CONDUCTOR OF L O OUTPUT JACK

BACKWARD WAVE CONVERTER

TYPE X-398

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

X-399* BACKWARD WAVE AMPLIFIER TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-399 is a C-band backward wave amplifier tube with a helical wave propagation structure employing continuous beam operation. The tube is designed for use as a narrow band medium noise r-f amplifier with a pass band that can be electronically tuned over the frequency range of 5700 to 8400 megacycles.

The X-399 is a glass envelope tube mounted in an aluminum capsule and requires a solenoid to focus the electron beam. Type "TNC" female r-f connectors are included as an integral part of the capsule.

ELECTRICAL DATA

Frequency Range	5700 - 8400 megacycles
Pass Band (3 db)	11 - 45 megacycles
Small Signal Gain	20 db minimum
Noise Figure	15 db maximum

MECHANICAL DATA

Mounting Position	Any
Capsule Length	16 inches
Capsule Diameter	7/8 inches
Net Weight	1 pound
R-F connectors	Type "TNC" female
D.C. Connections	Color Coded Flying Leads
Cooling	Not Required

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5 Volts dc maximum
Heater Current	2 Amperes maximum
Cathode Voltage	-250 to -1200 Volts maximum
Cathode Current	4 ma maximum
Focus Voltage	-10 to +10 Volts maximum)
Anode No. 1 Voltage	+5 to +80 Volts maximum)
Anode No. 2 Voltage	+5 to +150 Volts maximum) with respect
Anode No. 3 Voltage	+20 to +300 Volts maximum) to cathode
Anode No. 4 Voltage	+90 to +800 Volts maximum)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	Zero Volts (Ground)
Helix No. 2 Voltage)	
Capsule Voltage)	
Collector Voltage	250 Volts maximum
Focus Current	.2 ma maximum
Anode No. 1 Current	.2 ma maximum
Anode No. 2 Current	.2 ma maximum
Anode No. 3 Current	.2 ma maximum
Anode No. 4 Current	.2 ma maximum
Anode No. 5 Current	.2 ma maximum
Helix No. 1 Current)	.3 ma maximum
Helix No. 2 Current)	
Capsule Current)	
Collector Current	4 ma maximum
Solenoid Magnetic Field	900 Gauss maximum

TYPICAL OPERATION

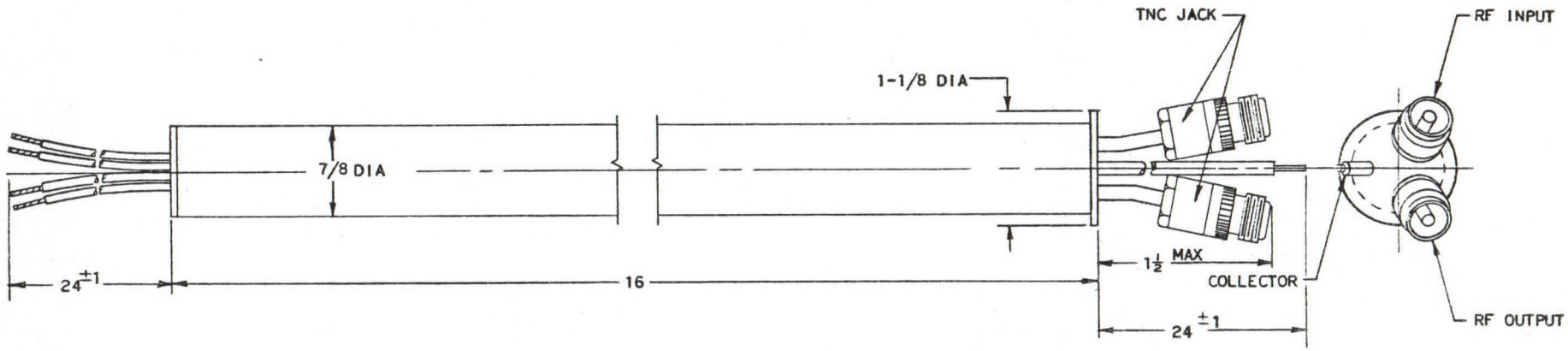
Frequency (Center of Pass Band)	7000 megacycles
Pass Band (3 db)	28 megacycles
Small Signal Gain	22 db
Noise Figure	14 db
Heater Voltage	6.3 Vdc
Heater Current	1.9 Adc
Cathode Voltage	-640 Vdc with respect to ground
Cathode Current	2.0 ma
Focus Voltage	-6 Vdc)
Anode No. 1 Voltage	+10 Vdc) with respect to cathode
Anode No. 2 Voltage	+8 Vdc)
Anode No. 3 Voltage	+260 Vdc)
Anode No. 4 Voltage	+350 Vdc)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	Zero Volts (Ground)
Helix No. 2 Voltage)	
Capsule Voltage)	
Collector Voltage	200 Volts with respect to ground.
Focus Current	0 ma

Anode No. 1 Current	.1 ma
Anode No. 2 Current	.08 ma
Anode No. 3 Current	.03 ma
Anode No. 4 Current	.02 ma
Anode No. 5 Current	.02 ma
Helix No. 1 Current)	
Helix No. 2 Current)	.03 ma
Capsule Current)	
Collector Current	1.7 ma
Magnetic Field	800 gauss

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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



MAXIMUM WEIGHT
1 POUND

LEADS

HEATERS	- BROWN
CATHODE	- YELLOW
FOCUS	- GREEN
ANODE NO. 1	- BLUE
ANODE NO. 2	- GREY
ANODE NO. 3	- PURPLE
ANODE NO. 4	- WHITE
ANODE NO. 5	GROUND-BLACK
AMPL. HELIX NO. 1	GROUND-BLACK
AMPL. HELIX NO. 2	GROUND-BLACK
COLLECTOR	- RED

BACKWARD WAVE AMPLIFIER

TYPE X-399

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

X-400* BACKWARD WAVE CONVERTER TUBE

TENTATIVE

GENERAL CHARACTERISTICS

The X-400 is a single tube designed to convert SHF signals in the band from 8000-12,700 megacycles to a 480 megacycle intermediate frequency output signal.

The tube consists of a backward-wave amplifier and a backward wave oscillator in the same vacuum envelope. The r-f input signal is fed to the amplifier section where its level is increased and it mixes with the oscillator signal. Mixing is accomplished in the common electron beam that interacts with both r-f structures, to yield an i-f output signal which can be adjusted over a fairly large frequency range. This tube uses a 480 megacycle i-f.

The X-400 is a glass tube, mounted in an aluminum capsule. Solenoid focusing is required. A type "TNC" r-f input connector and a "TSM" i-f output connector are included as an integral part of the capsule. A type "TNC" l-o output connector can be supplied if required.

ELECTRICAL DATA

Operating Frequency	8000-12,700 megacycles
Bandwidth of Input Section	25-127 megacycles
Noise Figure	20 db
I-F Output	480 megacycles
Conversion Gain	Unity
Image Rejection	35 db

Note: The image rejection is dependent upon the intermediate frequency selected. This tube utilizes a 480 megacycle i-f, an increase in the i-f would result in a higher level of image rejection.

MECHANICAL DATA

Mounting Position	Any
Capsule Length	17 inches
Capsule Outside Diameter	7/8 inches
R-F Input Connector	Type "TNC" Coaxial, female
I-F Output Connector	Type "TSM" Coaxial, male
L-O Output Connector (if required)	Type "TNC" Coaxial, female
D.C. Connections	Color coded flying leads

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture, and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5 Volts dc maximum
Heater Current	2 Amperes maximum
Cathode Voltage	-250 to -1500 Volts maximum
Cathode Current	8 ma maximum
Focus Voltage	0 to -10 Volts maximum)
Anode No. 1 Voltage	5 to 100 Volts maximum) With respect
Anode No. 2 Voltage	10 to 150 Volts maximum) to cathode
Anode No. 3 Voltage	30 to 300 Volts maximum)
Anode No. 4 Voltagd	70 to 900 Volts maximum)
Anode No. 5 Voltage)	
Amplifier Helix No. 1 Voltage)	Zero Volts (Ground)
Amplifier Helix No. 2 Voltage)	
Capsule Voltage)	
Oscillator Helix Voltage	-50 to +100 Volts maximum
Collector Voltage	250 Volts maximum
Focus Current	.3 ma maximum
Anode No. 1 Current	.3 ma maximum
Anode No. 2 Current	.3 ma maximum
Anode No. 3 Current	.3 ma maximum
Anode No. 4 Current	.3 ma maximum
Anode No. 5 Current	.3 ma maximum
Amplifier Helix No. 1 Current)	
Amplifier Helix No. 2 Current)	.5 ma maximum
Capsule Current)	
Oscillator Helix Current	.3 ma maximum
Collector Current	8 ma maximum
Solenoid Magnetic Field	1000 Gauss maximum

TYPICAL OPERATION

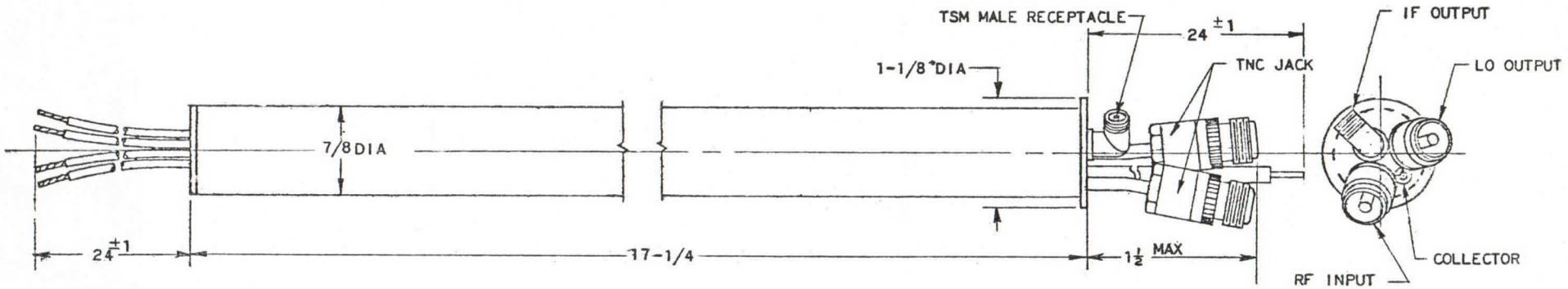
R-F Frequency	10,000 megacycles
L-O Frequency	9,520 megacycles
I-F Frequency	480 megacycles
Conversion Gain	0 db
Heater Voltage	6.3 Volts dc
Heater Current	1.9 Amperes
Cathode Voltage	-650 Volts with respect to ground
Cathode Current	4.0 ma
Focus Voltage	0 Volts)
Anode No. 1 Voltage	+40 Volts)
Anode No. 2 Voltage	+55 Volts) with respect to cathode
Anode No. 3 Voltage	+90 Volts)
Anode No. 4 Voltage	+250 Volts)
Anode No. 5 Voltage	0 Volts (Ground)

Amplifier Helix No. 1 Voltage)	0 Volts (Ground)
Amplifier Helix No. 2 Voltage)	
Capsule Voltage)	
Oscillator Helix Voltage	-40 Volts)
Collector Voltage	200 Volts) with respect to ground
Focus Current	0 ma
Anode No. 1 Current	.06 ma
Anode No. 2 Current	.05 ma
Anode No. 3 Current	.05 ma
Anode No. 4 Current	.06 ma
Anode No. 5 Current	.04 ma
Amplifier Helix No. 1 Current)	
Amplifier Helix No. 2 Current)	.08 ma
Capsule Current)	
Oscillator Helix Current	.02 ma
Collector Current	3.6 ma
Solenoid Magnetic Field	900 Gauss

Additional information for specific application can be obtained from the

Electron Tube Application Section
ITT Components Division
P.O. Box 412
Clifton, New Jersey

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



MAXIMUM WEIGHT

1 POUND

LEADS

HEATERS - BROWN
CATHODE - YELLOW
FOCUS - GREEN
ANODE NO. 1 - BLUE
ANODE NO. 2 - GREY
ANODE NO. 3 - PURPLE
ANODE NO. 4 - WHITE
ANODE NO. 5
AMPL. HELIX NO. 1 — GROUND-BLACK
AMPL. HELIX NO. 2
COLLECTOR - RED
OSCILLATOR HELIX - INNER CONDUCTOR OF L O OUTPUT JACK

BACKWARD WAVE AMPLIFIER

TYPE X-400

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

X-401* BACKWARD WAVE AMPLIFIER TUBE

T E N T A T I V E

GENERAL CHARACTERISTICS

The X-401 is an X-band backward wave amplifier tube with a helical wave propagation structure employing continuous beam operation. The tube is designed for use as a narrow band medium noise r-f amplifier with a pass band that can be electronically tuned over the frequency range of 8,000 to 12,700 megacycles.

The X-401 is a glass envelope tube mounted in an aluminum capsule and requires a solenoid to focus the electron beam. Type "TNC" female r-f connectors are included as an integral part of the capsule.

ELECTRICAL DATA

Frequency Range	8,000 to 12,700 megacycles
Pass Band (3 db)	16-65 megacycles
Small Signal Gain	20 db minimum
Noise Figure	15 db maximum

MECHANICAL DATA

Mounting Position	Any
Capsule Length	16 inches
Capsule Diameter	7/8 inches
Net Weight	1 pound
R-F Connectors	Type "TNC" Female
D.C. Connections	Color Coded Flying Leads
Cooling	Not Required

*This number identifies a particular experimental tube design, such number and identification data being subject to change without notice. This tube is for experimental purposes only, carries no obligation for future manufacture and should not be used for design purposes without prior arrangement.

MAXIMUM RATINGS

Heater Voltage	6.5	Volts dc maximum	
Heater Current	2	Amperes maximum	
Cathode Voltage	-250 to -1450	Volts maximum	
Cathode Current	4	ma maximum	
Focus Voltage	-10 to +10	Volts maximum)	
Anode No. 1 Voltage	5 to 100	Volts maximum)	with respect to cathode
Anode No. 2 Voltage	5 to 150	Volts maximum)	
Anode No. 3 Voltage	30 to 300	Volts maximum)	
Anode No. 4 Voltage	70 to 800	Volts maximum)	
Anode No. 5 Voltage)			
Helix No. 1 Voltage)		Zero Volts (Ground)	
Helix No. 2 Voltage)			
Capsule Voltage)			
Collector Voltage	250	Volts maximum	
Focus Current	.2	ma maximum	
Anode No. 1 Current	.2	ma maximum	
Anode No. 2 Current	.2	ma maximum	
Anode No. 3 Current	.2	ma maximum	
Anode No. 4 Current	.2	ma maximum	
Anode No. 5 Current	.2	ma maximum	
Helix No. 1 Current)			
Helix No. 2 Current)	.3	ma maximum	
Capsule Current)			
Collector Current	4	ma maximum	
Solenoid Magnetic Field	1000	Gauss maximum	

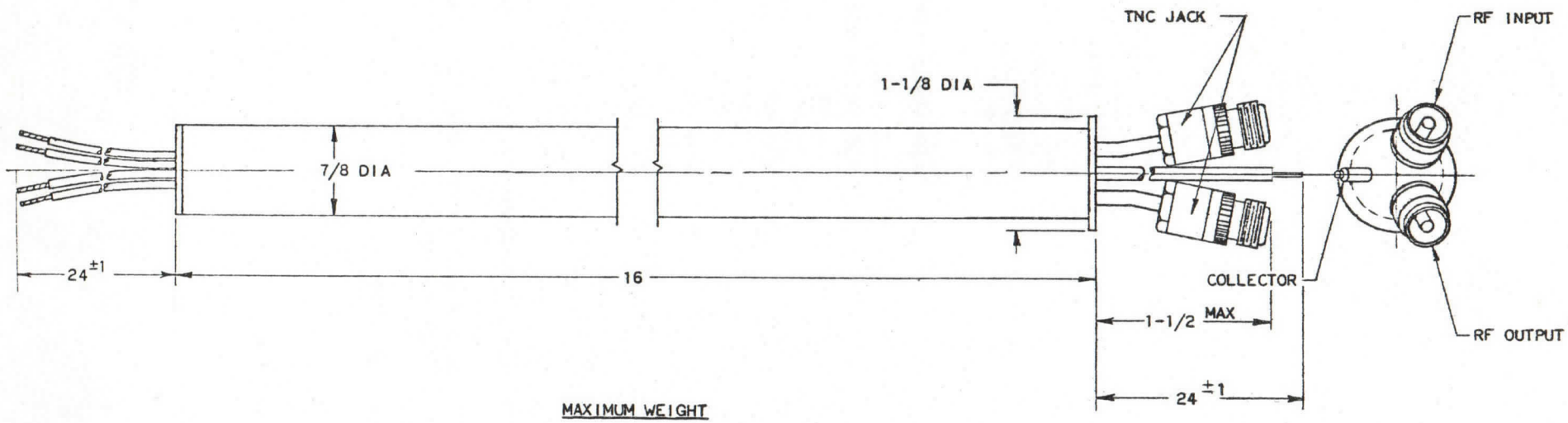
TYPICAL OPERATION

Frequency (Center of Pass Band)	10,000 megacycles
Pass Band (3 db)	40 megacycles
Small Signal Gain	25 db
Noise Figure	13 db
Heater Voltage	6.3 Vdc
Heater Current	1.9 Adc
Cathode Voltage	-650 Vdc with respect to ground
Cathode Current	2.0 ma
Focus Voltage	-8 Vdc)
Anode No. 1 Voltage	+20 Vdc)
Anode No. 2 Voltage	+18 Vdc)with respect to ground
Anode No. 3 Voltage	+80 Vdc)
Anode No. 4 Voltage	+230 Vdc)
Anode No. 5 Voltage)	
Helix No. 1 Voltage)	Zero Volts (Ground)
Helix No. 2 Voltage)	
Capsule Voltage)	
Collector Voltage	200 Volts with respect to ground
Focus Current	0 ma
Anode No. 1 Current	.10 ma
Anode No. 2 Current	.03 ma
Anode No. 3 Current	.02 ma
Anode No. 4 Current	.02 ma
Anode No. 5 Current	.01 ma
Helix No. 1 Current)	
Helix No. 2 Current)	.10 ma
Capsule Current)	
Collector Current	1.7 ma
Magnetic Field	900 Gauss

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
P. O. Box 412
Clifton, New Jersey

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



MAXIMUM WEIGHT
1 POUND

LEADS

HEATERS	- BROWN
CATHODE	- YELLOW
FOCUS	- GREEN
ANODE NO. 1	- BLUE
ANODE NO. 2	- GREY
ANODE NO. 3	- PURPLE
ANODE NO. 4	- WHITE
ANODE NO. 5	GROUND-BLACK
AMPL. HELIX NO. 1	GROUND-BLACK
AMPL. HELIX NO. 2	GROUND-BLACK
COLLECTOR	- RED

BACKWARD WAVE AMPLIFIER

TYPE X-401