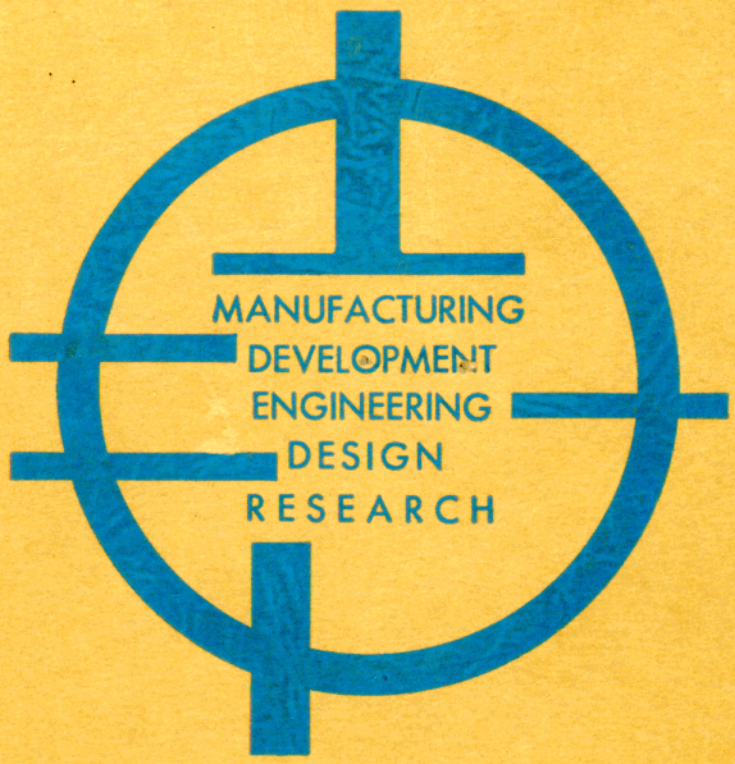
HUGGINS LABORATORIES

INCORPORATED

Vol. 2

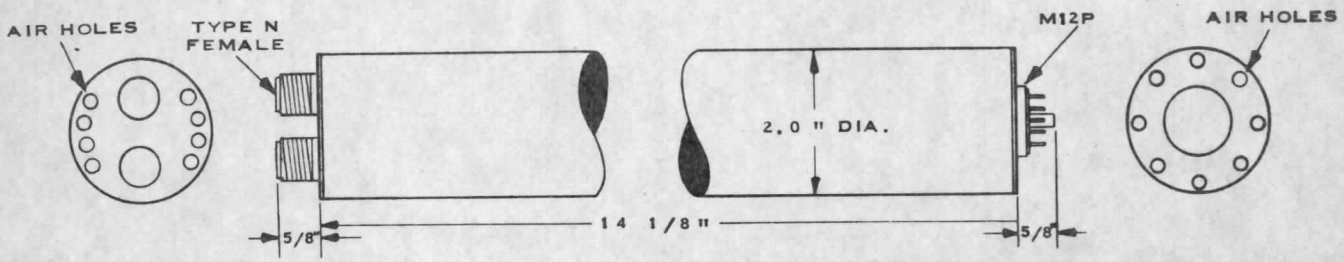


HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California

TENTATIVE DATA

PERMANENT MAGNET FOCUSED MEDIUM POWER TRAVELING WAVE TUBE AMPLIFIER

OPENINGS ARE PROVIDED IN BOTH ENDS OF THE CAPSULE TO ALLOW FOR A SMALL AMOUNT OF AIR FLOW NECESSARY FOR COOLING. THE RF END OF THE CAPSULE OPERATES AT THE HIGHEST TEMPERATURE AND SHOULD BE COOLED FIRST.



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.0 TO 11.0 KMC
SATURATION POWER OUTPUT	27 DBM (MIN.)
SATURATION GAIN	27 DB (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX VOLTAGE[1]	2000 TO 2400 VOLTS
COLLECTOR VOLTAGE[1]	2000 TO 2600 VOLTS
CATHODE CURRENT	20 MA (MAX.)
HELIX CURRENT	1.0 TO 2.0 MA
ANODE VOLTAGE[2]	1100 TO 2200 VOLTS
ANODE CURRENT	50 μA (MAX.)
GRID VOLTAGE	0 TO −100 VOLTS[3]
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	1.2 AMPS (MAX.)

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P
CAPSULE LENGTH	14 1/8 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	4.3 POUNDS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

2 THIS GIVES THE RANGE OF ANODE VOLTAGES WHICH IS NECESSARY FOR 20 MA CATHODE CURRENT AND TAKES INTO ACCOUNT TUBE TO TUBE VARIATIONS. THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0 TO 2200 VOLTS TO PREVENT POSSIBLE TUBE DAMAGE WHEN INITIALLY APPLYING VOLTAGES.

3 THIS RANGE OF GRID VOLTAGE WILL CUT THE TUBE OFF BY THE ORDER OF 30 DB OVER A MAJOR PORTION OF THE SPECIFIED BAND.

CUSTOMERS CONFIRMATION SHEET

SOLENOID	CUSTOMER	TUBE TYPE
PPM	DATE 3-27-62	HA-21AF
SOLENOID MANUFACTURE	P.O. NUMBER	TUBE QUANTITY

GENERAL DESCRIPTION

8.5 TO 10.0 KMC - PPM FOCUSED - 1 WATT TWT AMPLIFIER - SPECIAL ENVIRONMENTAL REQUIREMENTS

R.F. SPECIFICATIONS

FREQUENCY RANGE	8.5 to 10.0 KMC	GRID ATTENUATION AT V	-
SMALL SIGNAL GAIN	> 50 DB	SPURIOUS MODULATION	-
SATURATED POWER OUTPUT	> 30 DBM	NOISE FIGURE	-
SATURATED GAIN	> 37 DB	V.S.W.R	< 2:1
PULSE FALL OFF	-	BACK ATTENUATION	-
G2T	-		
MAX. SMALL SIGNAL GAIN VAR	-		
OSCILLATION CHECK			

D.C. SPECIFICATIONS

$V_{COLLECTOR}$	2100 TO 2300	$I_{COLLECTOR}$	< 20.0 MA	$V_{ANODE\ 1}$		$I_{ANODE\ 1}$	
V_{HELIX}	2100 TO 2300	I_{HELIX}	< 2.0 MA	$V_{ANODE\ 2}$		$I_{ANODE\ 2}$	
V_{SNOUT}	-	I_{SNOUT}	-	$V_{ANODE\ 3}$		$I_{ANODE\ 3}$	
V_{ANODE}	1000 TO 1500	I_{ANODE}	< 0.1 MA	$V_{ANODE\ 4}$		$I_{ANODE\ 4}$	
V_{GRID}	0	I_{GRID}	< 0.1 MA				
$V_{CATHODE}$	0	$I_{CATHODE}$	< 20.0 MA				
V_{HEATER}	7.0	I_{HEATER}	< 1.2 A				

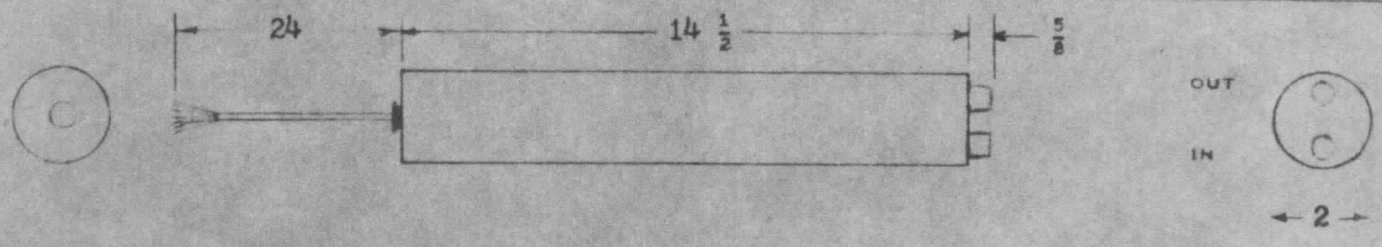
VOLTAGE BREAKDOWN OF COLLECTOR GROUNDED

REMARKS:

OPERATION: BEAM CW, RF INPUT PULSED.

ENVIRONMENTAL: PER MIL-E-5400 CLASS 2, VIBRATION PER CURVE IV EXTENDED TO 2000 CPS @ ±10 G.

CAPSULE – COUPLER SPECIFICATIONS



	POWER	R F IN	R.F OUT	COLLECTOR			
CABLE	MULTI CONDUCTOR	-	-	-			
CONNECTOR	NONE	N FEMALE		GROUNDED			

REMARKS: CATHODE - ORANGE HELIX - BLUE GRID - YELLOW
HEATER - BLACK ANODE - BROWN
HEATER - WHITE COLLECTOR-CAPSULE GROUND - GREEN

SHIPPING INFORMATION

F 208L

CUSTOMERS CONFIRMATION SHEET

SOLENOID	CUSTOMER	TUBE TYPE
PPM	DATE 3-30-62	HA-35U
SOLENOID MANUFACTURE	P.O NUMBER	TUBE QUANTITY

GENERAL DESCRIPTION: 4.0 TO 8.0 KMC - PPM FOCUSED - TWT AMPLIFIER - GROUNDED COLLECTOR

- SPECIAL ENVIRONMENTAL REQUIREMENTS -

R.F. SPECIFICATIONS

FREQUENCY RANGE	4.0 TO 8.0 KMC	GRID ATTENUATION AT V	-
SMALL SIGNAL GAIN	> 30 DB	SPURIOUS MODULATION	-
SATURATED POWER OUTPUT	> 27 DBM	NOISE FIGURE	-
SATURATED GAIN	> 27 DB	V.S.W.R	< 2:1
PULSE FALL OFF	-	BACK ATTENUATION	-
G2Y	-		
MAX SMALL SIGNAL GAIN VAR	-		
OSCILLATION CHECK			

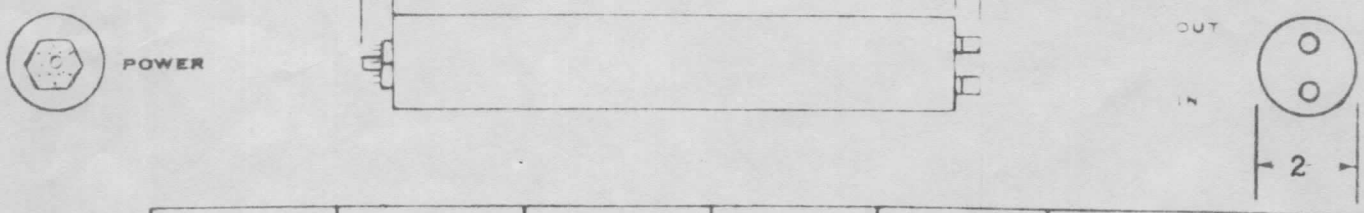
D.C. SPECIFICATIONS

$V_{COLLECTOR}$	1300 TO 1600	$I_{COLLECTOR}$	< 20.0 MA	$V_{ANODE\ 1}$	$I_{ANODE\ 1}$
V_{HELIX}	1300 TO 1600	I_{HELIX}	< 2.0 MA	$V_{ANODE\ 2}$	$I_{ANODE\ 2}$
V_{SNOUT}	-	I_{SNOUT}	-	$V_{ANODE\ 3}$	$I_{ANODE\ 3}$
V_{ANODE}	0 TO 700	I_{ANODE}	< 0.1 MA	$V_{ANODE\ 4}$	$I_{ANODE\ 4}$
V_{GRID}	0	I_{GRID}	< 0.1 MA		
$V_{CATHODE}$	0	$I_{CATHODE}$	< 20.0 MA		
V_{HEATER}	7.0	I_{HEATER}	< 1.3 A		
VOLTAGE BREAKDOWN OF COLLECTOR		GROUNDED			

REMARKS:

ENVIRONMENTAL: PER MIL-E-5400 CLASS 3, VIBRATION PER CURVE IV EXTENDED TO 2000 CPS @ ±10 G.

CAPSULE - COUPLER SPECIFICATIONS



	POWER	R.F. IN	R.F. OUT	COLLECTOR			
CABLE	-	-	-	-			
CONNECTOR	M12P-LR	N FEMALE		GROUNDED			

REMARKS:

B - GRID
D - CAPSULE-COLLECTOR-GROUND
F - HEATER
H - HEATER
J - CATHODE
L - HELIX
N - ANODE

SHIPPING INFORMATION

F 2081

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California.

TENTATIVE DATA
WIDEBAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	1.6 TO 2.6 KMC
SMALL SIGNAL GAIN	30 DB (MIN.)
POWER OUTPUT	10 DBM (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	400 TO 500 VOLTS
CATHODE CURRENT	3.5 MA
HELIX CURRENT	~~50 μA~~ 200 μA max
ANODE VOLTAGE[2]	0 TO 400 VOLTS
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	0.7 AMPS
MAGNETIC FIELD	300 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTORS	TYPE N MALE
DC CONNECTOR	WINCHESTER PLUG M7P*
CAPSULE LENGTH	16 ~~3/4~~ 5/8 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

* SUPPLIED WITH MATING RECEPTACLE.

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE MAY BE OPERATED AT GROUND POTENTIAL.

2 ALL ANODE VOLTAGES SHOULD BE ADJUSTABLE FROM ZERO FOR INITIAL FOCUSING PURPOSES.

HUGGINS LABORATORIES, INC.
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TENTATIVE DATA

LOW NOISE X—BAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.2 – 11.0 KMC
SMALL SIGNAL GAIN	25 DB (MIN.)
NOISE FIGURE	10 DB (MAX.)

POWER SUPPLY REQUIREMENTS

HELIX VOLTAGE[1]	1000 – 1300 VOLTS
COLLECTOR VOLTAGE	1000 – 1800 VOLTS
CATHODE CURRENT	0.7 – 0.8 MA 1.5 MA max.
HELIX CURRENT	< 10 UA
ANODE NO. 1 VOLTAGE[2]	0 – 150 VOLTS
ANODE NO. 2 VOLTAGE[2]	0 – 150 VOLTS
ANODE NO. 3 VOLTAGE[2]	0 – 450 VOLTS
ANODE NO. 4 VOLTAGE[2]	0 TO MINUS 15 VOLTS
HEATER VOLTAGE	6.3 VOLTS 6.5 to
HEATER CURRENT	.85 AMPS
MAGNETIC FIELD	900 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER M9P
CAPSULE LENGTH	16 INCHES 15 7/8
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

PRICE $1500.00

DELIVERY 6 TO 8 WEEKS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE CAN BE OPERATED AT GROUND POTENTIAL.

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California.

TENTATIVE DATA

STANDARD K—BAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	12.4 TO 14.0 KMC	12.4 TO 15.0 KMC
SMALL SIGNAL GAIN	30 DB (MIN.)	20 DB (MIN.)
POWER OUTPUT	7 DBM (MIN.)	7 DBM (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	1150 TO 1250 VOLTS
CATHODE CURRENT	2.5 MA (MAX.)
HELIX CURRENT	150 μA (MAX.)
ANODE VOLTAGE[2]	0 TO 400 VOLTS
HEATER CURRENT	0.9 TO 1.2 AMPS
HEATER VOLTAGE[3]	6.3 OR 7.0 VOLTS
MAGNETIC FIELD	400 GAUSS (MIN.)

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER M7P
CAPSULE LENGTH	~~14 3/4~~ INCHES 14.8
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE MAY BE OPERATED AT GROUND POTENTIAL.

2 THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0 TO 400 VOLTS FOR INITIAL FOCUSING PURPOSES.

3 PROVISIONS SHOULD BE MADE TO ALLOW FOR EITHER 6.3 OR 7.0 VOLT OPERATION TO OBTAIN OPTIMUM LIFE PERFORMANCE FROM THE TUBE.

TENTATIVE CHARACTERIS

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, HIGH – GAIN K_U – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS ($V_G = 0$)

FREQUENCY RANGE	12.0 TO 18.0 KMC
SMALL–SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	7 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	3:1 MAX

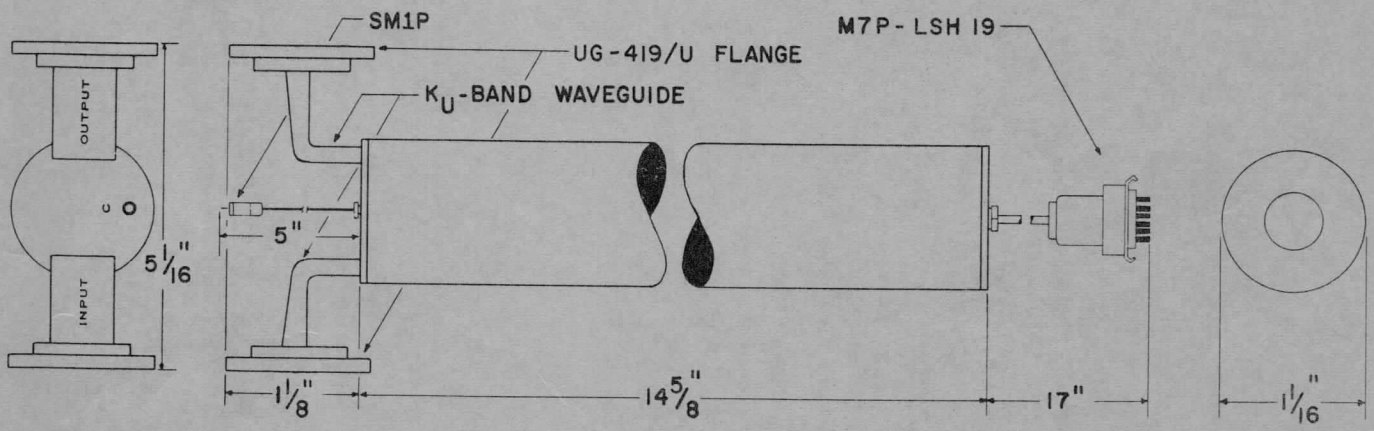
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	1000 TO 1300 V	--	0.1 MA MAX
COLLECTOR	1000 TO 1300 V	--	0.8 MA MAX
ANODE	0 TO 500 V	--	0.05 MA MAX
CATHODE	0 V	--	0.8 MA MAX
GRID	0* V	--	0.05 MA MAX
HEATER	6.3 OR 7.0 V	--	1.4 AMP MAX

* A NEGATIVE VOLTAGE CAN BE APPLIED FOR R–F ATTENUATION.

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	▲1 3/4 LBS

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, 10 MW C — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 TO 8.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

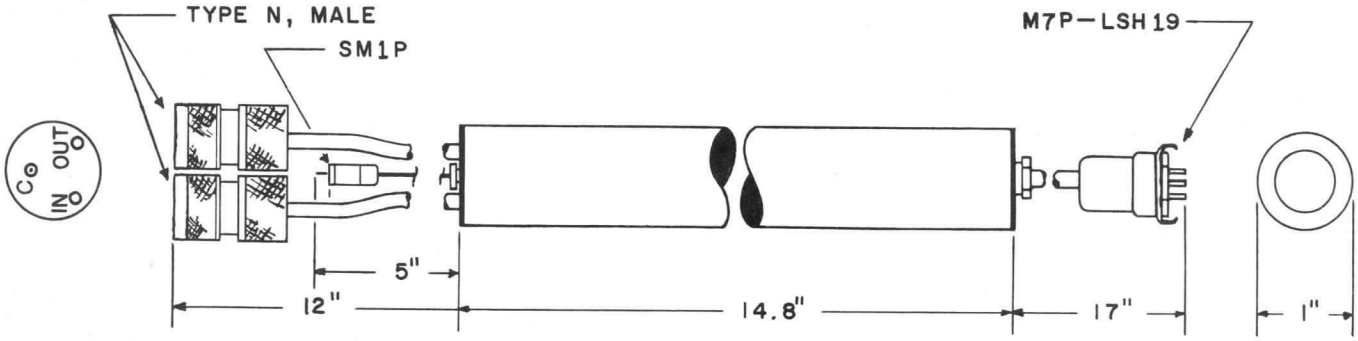
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	650 TO 800 V	--	0.2 MA MAX
COLLECTOR	650 TO 800 V	--	2.5 MA MAX
ANODE	0 TO 450 V	--	0.1 MA MAX
CATHODE	0 V	--	2.5 MA MAX
GRID	0* V	--	0.1 MA MAX
HEATER	6.3 V	--	1.0 AMP MAX

* A NEGATIVE VOLTAGE CAN BE APPLIED FOR R-F ATTENUATION.

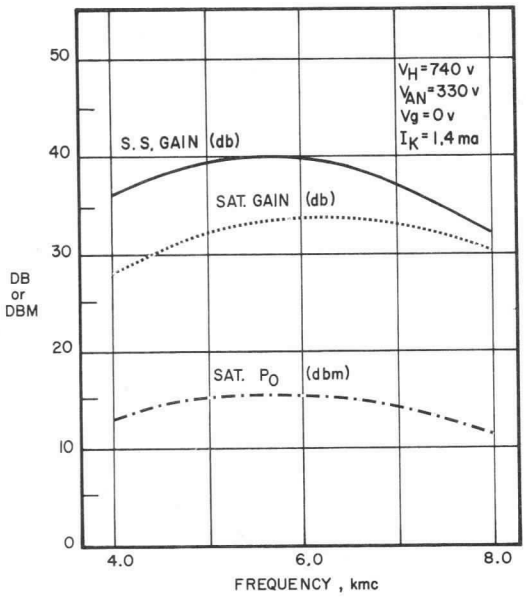
FOCUSING . . . . . SOLENOID, 400 GAUSS

MECHANICAL CHARACTERISTICS

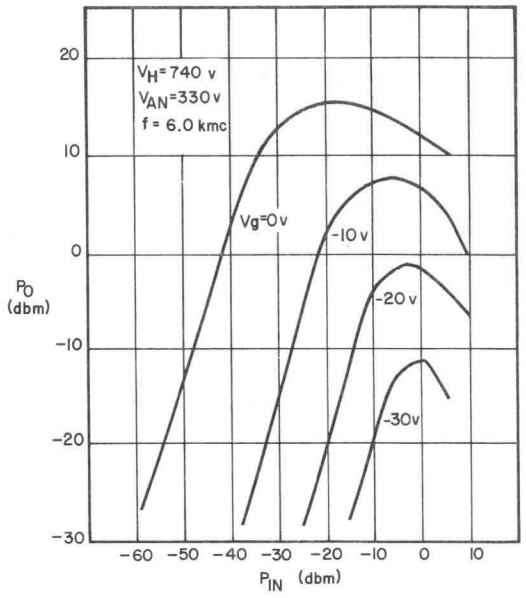


CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1.0 LB

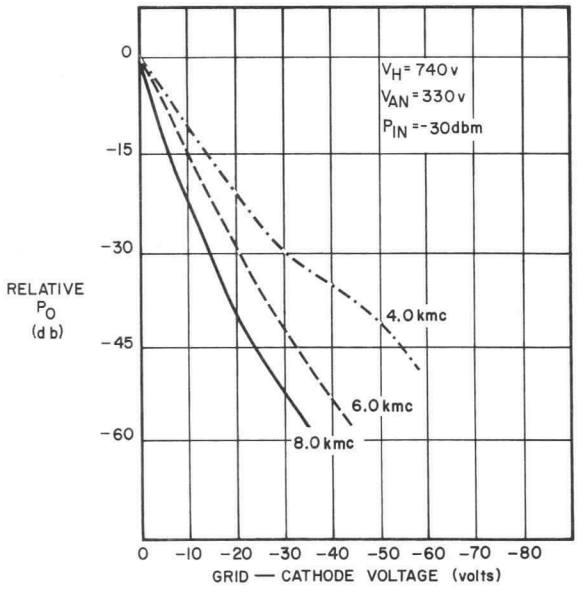
TYPICAL OPERATING CHARACTERISTICS



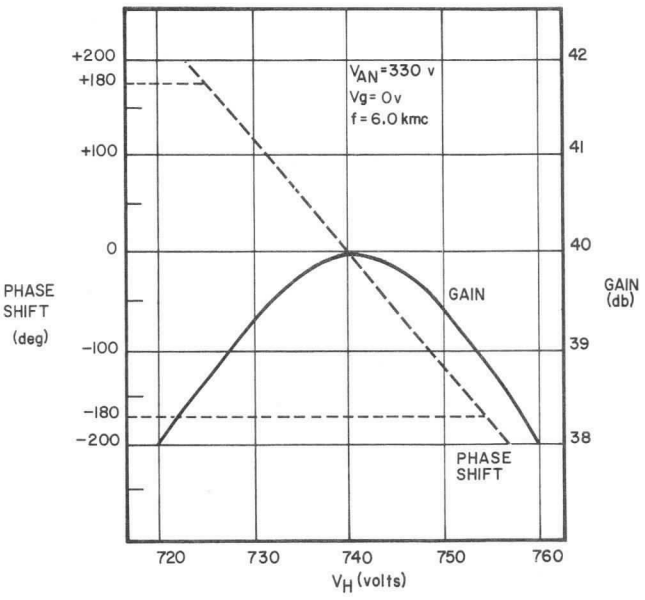
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

TENTATIVE DATA
ELECTROSTATICALLY FOCUSED L—BAND TRAVELING WAVE TUBE AMPLIFIER
HA—27

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	1—2 KMC
SMALL-SIGNAL GAIN	30 DB (MINIMUM)
NOISE FIGURE	25—30 DB (MAXIMUM)
SATURATED POWER OUTPUT	5 DBM (MINIMUM)

POWER SUPPLY REQUIREMENTS

HELIX NO.1 VOLTAGE[1]	0—500 VOLTS
HELIX NO.2 VOLTAGE	0—200 VOLTS
POTENTIAL DIFFERENCE BETWEEN HELICES	50—500 VOLTS
COLLECTOR VOLTAGE	0—500 VOLTS
GRID VOLTAGE[2]	—50 TO 50 VOLTS
ANODE NO. 1 VOLTAGE[3]	0—500 VOLTS
ANODE NO. 2 VOLTAGE	0—500 VOLTS
HEATER VOLTAGE	5.5—7.5 VOLTS
HEATER CURRENT	0.7 TO 1.0 AMP
HELIX NO. 1 CURRENT	0—1.5 MA
HELIX NO. 2 CURRENT	0—1.5 MA
CATHODE CURRENT	0—3.0 MA
COLLECTOR CURRENT	0—3.0 MA
BEAM TRANSMISSION**	APPROX. 40%—100%

MECHANICAL CHARACTERISTICS

R.F. CONNECTORS*	AMPHENOL 27—36
D—C CONNECTOR[4]*	VIKING VR12/2AG15
CAPSULE LENGTH	15 3/4 INCHES
CAPSULE DIAMETER	1 INCH
NET WEIGHT	1 POUND
AUXILIARY COOLING	NONE REQUIRED

1. ALL D—C VOLTAGES MEASURED WITH RESPECT TO CATHODE.
2. NORMALLY RUN AT ZERO POTENTIAL
3. ANODE SUPPLY MUST BE ADJUSTABLE FROM ZERO VOLTS IN ORDER TO OBTAIN PROPER CATHODE CURRENT AND FOCUS.
4. SUPPLIED WITH MATING PLUG. HERMETIC SEAL.

* SUBJECT TO CHANGE.

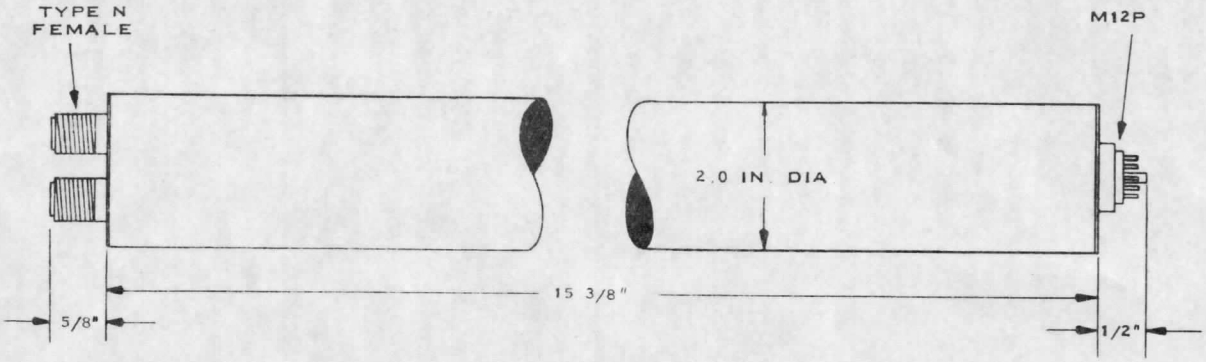
** $\left(\frac{I_K \times 100\%}{I\ \text{COLLECTOR}}\right)$

AUGUST 15, 1959

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California

TENTATIVE DATA

PERMANENT MAGNET FOCUSED HIGH GAIN TRAVELING WAVE TUBE AMPLIFIER



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 – 8.0 KMC
SMALL SIGNAL GAIN	30 DB (MIN.)
POWER OUTPUT	10 DBM (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	650 – 800 VOLTS
CATHODE CURRENT	2.5 MA
HELIX CURRENT	0.5 MA (MAX.)
ANODE VOLTAGE[2]	0– 450 VOLTS
ANODE CURRENT	50 μ (MAX.)
HEATER VOLTAGE[3]	6.3 OR 7.0 VOLTS
HEATER CURRENT	0.75 AMPS
GRID VOLTAGE	0 VOLTS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P ON CAPSULE
CAPSULE LENGTH	15 3/8 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	4 1/2 POUNDS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

2 THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0–450 VOLTS TO PREVENT POSSIBLE TUBE DAMAGE WHEN INITIALLY APPLYING VOLTAGES.

3 PROVISION SHOULD BE MADE TO ALLOW FOR EITHER 6.3 OR 7.0 VOLTS OPERATION TO OBTAIN OPTIMUM LIFE PERFORMANCE FROM THE TUBE.

HUGGINS LABORATORIES
MENLO PARK CALIFORNIA

HA-29

PERMANENT MAGNET FOCUSED FORWARD WAVE S-BAND AMPLIFIER

▲GENERAL DESCRIPTION

THE HA-29 IS A LOW POWER TRAVELING-WAVE TUBE AMPLIFIER POSSESSING HIGH GAIN AND BROADBAND AMPLIFICATION CHARACTERISTICS.

THE TUBE IS ENCLOSED IN A METAL CAPSULE WITH RADIO FREQUENCY AND POWER SUPPLY CONNECTIONS EXTENDING FROM THE ENDS FOR EXTERNAL CONNECTION.

THE HA-29 HAS A BROADBAND SMALL SIGNAL GAIN IN EXCESS OF 30 DB, SATURATION POWER OUTPUT IN EXCESS OF 10MW, AND A NOISE FIGURE OF 25DB OR LESS. IT FINDS USE AS A GENERAL PURPOSE WIDE BAND AMPLIFIER AND MODULATOR.

FOR AMPLITUDE MODULATION SERVICE, THE HA-29 IS PROVIDED WITH A GRID WHICH IS CAPABLE OF CONTROLLING THE GAIN AND POWER OUTPUT OF THE TUBE OVER EXTREMELY WIDE RANGES. THE CAPACITANCE OF THE GRID IS HELD LOW SO THAT A PULSE RISETIME OF LESS THAN 10 MILLI-MICROSECONDS CAN BE ACHIEVED.

THE HA-29 CAN PROVIDE WIDE DEVIATION PHASE MODULATION SINCE RELATIVE OUTPUT PHASE IS ESSENTIALLY A LINEAR FUNCTION OF HELIX VOLTAGE[1]. AN IMPORTANT USE OF THIS ELECTRONIC PHASE SHIFTING PROPERTY HAS BEEN TO SIMULATE SIGNALS WHICH HAVE HAD THEIR FREQUENCY SHIFTED BY THE DOPPLER EFFECT. THIS IS ACCOMPLISHED BY APPLYING LINEAR SAWTOOTH VOLTAGE WAVEFORMS TO THE HELIX. THIS TECHNIQUE IS ALSO USEFUL IN THE MICROWAVE MEASUREMENT FIELD FOR WIDE DYNAMIC RANGE HOMODYNE DETECTION[2].

▲METERING

IT IS USUALLY NECESSARY TO METER ONLY HELIX VOLTAGE, BEAM CURRENT AND HELIX CURRENT. BEAM CURRENT CAN BE CONVENIENTLY METERED BY MONITORING CATHODE CURRENT OR BY COMBINING COLLECTOR AND HELIX CURRENT IN A COMMON METER.

POWER SUPPLY REQUIREMENTS

TO OBTAIN LESS THAN 1 DEGREE TOTAL PHASE EXCURSION AT THE OUTPUT, THE HELIX SUPPLY MUST HAVE LESS THAN 0.01% PEAK TO PEAK RIPPLE.

TO OBTAIN LESS THAN 0.1 DB AMPLITUDE MODULATION, THE HELIX SUPPLY MUST HAVE LESS THAN 0.1% RIPPLE AND ANODE SUPPLY LESS THAN 1.0% RIPPLE.

▲GENERAL CHARACTERISTICS

ELECTRICAL

HEATER VOLTAGE	6.3 VOLTS	RMS
HEATER CURRENT	0.8 AMP	MAX
CATHODE CURRENT	3.5 MA	MAX
HELIX VOLTAGE RANGE	400 TO 525	VOLTS
HELIX CURRENT	0.5 MA	MAX
ANODE VOLTAGE RANGE[3]	150 TO 350	VOLTS
ANODE CURRENT	.05 MA	MAX
COLLECTOR VOLTAGE	400 TO 525	VOLTS
COLLECTOR CURRENT	3.5 MA	MAX
GRID VOLTAGE[4]	0 TO -200	VOLTS
GRID CURRENT	.02 MA	MAX
FREQUENCY RANGE	2 TO 4	KMC/S
SMALL SIGNAL GAIN	30 DB	MIN
SATURATION POWER OUTPUT	10 DBM	MIN
GAIN AT SATURATION	20 DB	MIN
NOISE FIGURE	25 DB	MAX
VSWR, INPUT AND OUTPUT	1.0	MAX

MECHANICAL

CAPSULE LENGTH	~~16.7~~ 17	INCHES
CAPSULE DIAMETER	2.0	INCH
R.F. CONNECTORS	TYPE N FEMALE	
COLLECTOR CONNECTOR[5]	WINCHESTER TYPE SM1P	
POWER CONNECTOR[5]	WINCHESTER TYPE M12P	
NET WEIGHT	~~4.0~~ 3.6	POUNDS
SHIPPING WEIGHT	15	POUNDS

▲TYPICAL OPERATION

D.C. DATA[6]

CATHODE CURRENT	2.80	MA
COLLECTOR CURRENT	2.64	MA
HELIX CURRENT	0.14	MA
ANODE VOLTAGE	230	VOLTS
HELIX VOLTAGE	420	VOLTS
GRID VOLTAGE	0	VOLTS
COLLECTOR VOLTAGE	470	VOLTS

R.F. PERFORMANCE[7]

SMALL SIGNAL GAIN	31 TO 34	DB
SATURATION POWER OUTPUT	12 TO 18	DBM
GAIN AT SATURATION OUTPUT	23 TO 30	DB
NOISE FIGURE	25	DB OR LESS

NOTES:

1–HUGGINS LABORATORIES ENGINEERING NOTES, PP 53 TO 63.
2–HUGGINS LABORATORIES ENGINEERING NOTES, P 20.
3–THIS GIVES THE RANGE OF ANODE VOLTAGE WHICH IS NECESSARY FOR 3.5 MA CATHODE CURRENT AND TAKES INTO ACCOUNT TUBE TO TUBE VARIATION. THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0–350 VOLTS TO PROTECT THE TUBE WHEN INITIALLY APPLYING VOLTAGES.
4–REFER TO GRID CHARACTERISTICS DATA.
5–FURNISHED WITH MATING CONNECTOR.
6–ALL VOLTAGES MEASURED WITH RESPECT TO CATHODE.
7–DATA TAKEN BY OPERATING INTO MATCHED LOAD. TUBE IS STABLE AT OPERATING CURRENT UNDER SHORT CIRCUIT CONDITIONS AT EITHER R.F. CONNECTOR.

▲R.F. CONNECTORS

TYPE N FEMALE CONNECTORS ARE FURNISHED WITH STANDARD TUBES.

WINCHESTER TYPE M12P POWER CONNECTOR IS FILLED WITH A SILICONE RUBBER COMPOUND TO PROVIDE EXCELLENT VOLTAGE BREAKDOWN CHARACTERISTICS.

▲PLUG: WINCHESTER M12P OR EQUIVALENT

B - GRID
C - GROUND
F - HEATER-CATHODE
H - HEATER
J - CATHODE
L - HELIX
N - ANODE

STANDARD TUBES ARE CONSTRUCTED WITH THE COLLECTOR INSULATED AND THEREFORE ANY ELEMENT MAY BE OPERATED AT GROUND POTENTIAL. THE COLLECTOR LEAD WILL APPEAR AS AN EXTERNAL CONNECTION AT THE R.F. END OF THE CAPSULE, WINCHESTER TYPE SM1P.

▲SPECIAL MODIFICATIONS

1. FOR FAST RISETIME PULSE APPLICATIONS IT IS RECOMMENDED THAT THE GRID CONNECTION BE BROUGHT OUT ON A SEPARATE CONNECTOR ON THE END OF THE CAPSULE.

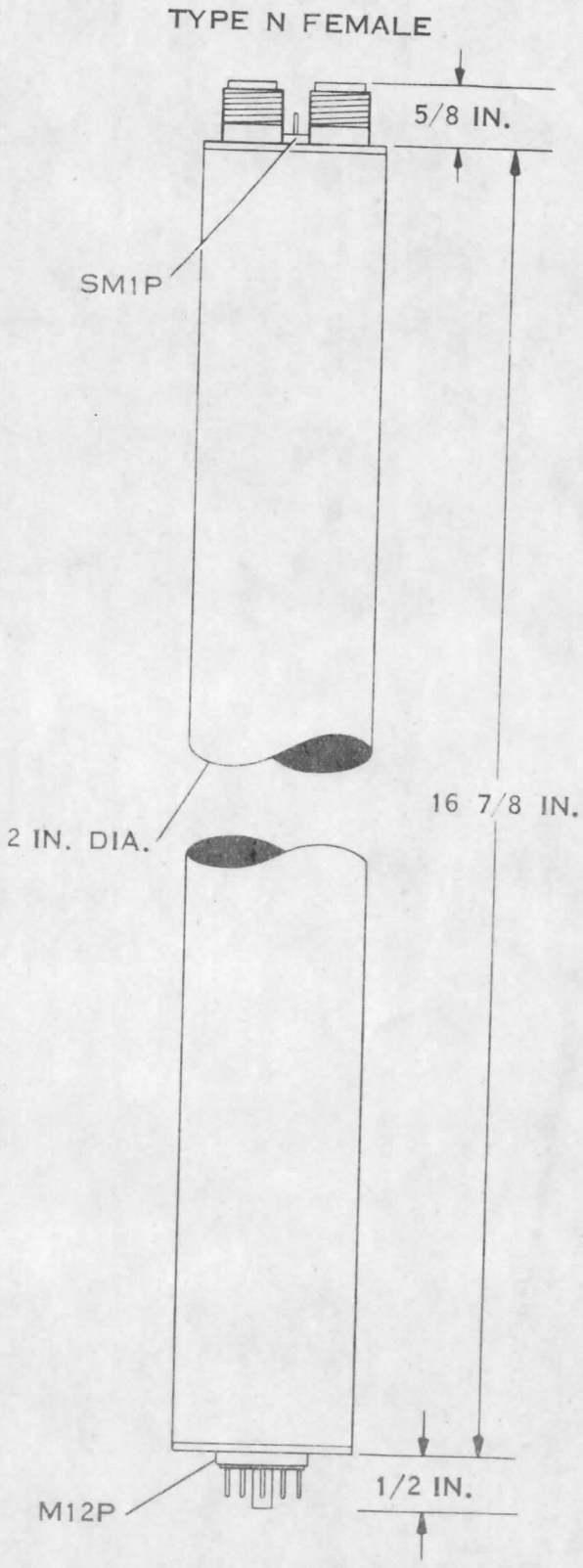
2. FOR APPLICATIONS REQUIRING VERY FLAT OR SPECIALLY SHAPED GAIN RESPONSE AS A FUNCTION OF FREQUENCY, TUBES CAN BE PROVIDED THAT MEET SUCH REQUIREMENTS OVER RESTRICTED FREQUENCY RANGES WITHIN THE BAND.

3. A SPECIAL PHASE MODULATOR VERSION OF THIS TUBE CAN BE SUPPLIED WHICH HAS LOW GAIN AND LOW INCIDENTAL AMPLITUDE MODULATION.

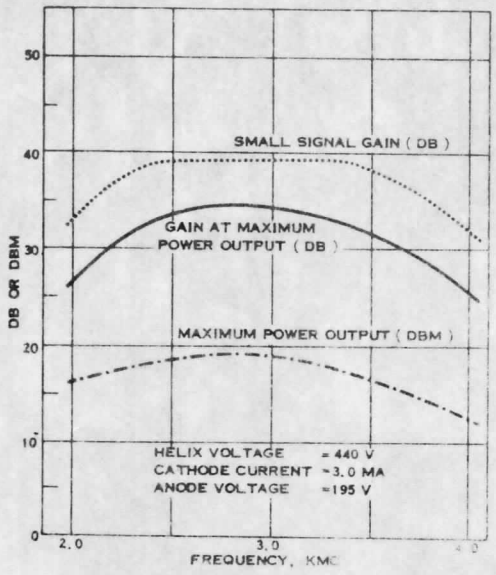
▲CAPSULE FINISH

BRUSHED CHROME WITH ANODIZED ALUMINUM END CAPS DYED BLACK.

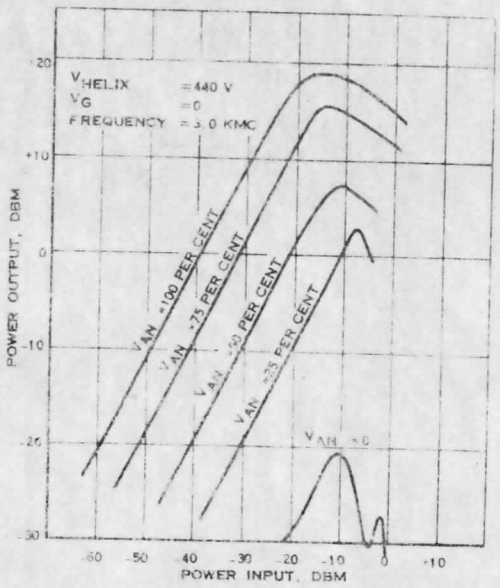
▲MECHANICAL OUTLINE



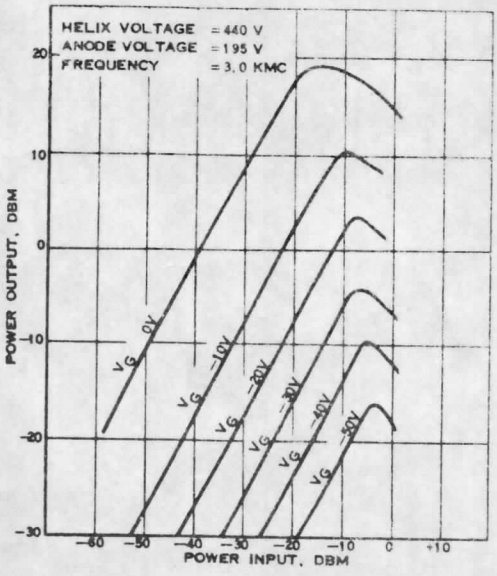
TYPICAL OPERATING CHARACTERISTICS



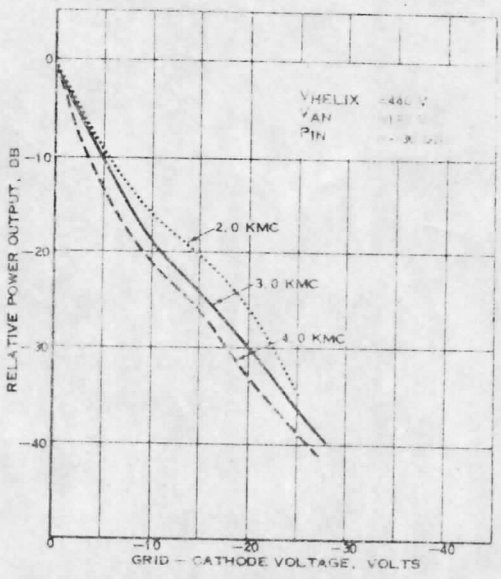
GAIN AND POWER OUTPUT



ANODE CHARACTERISTICS

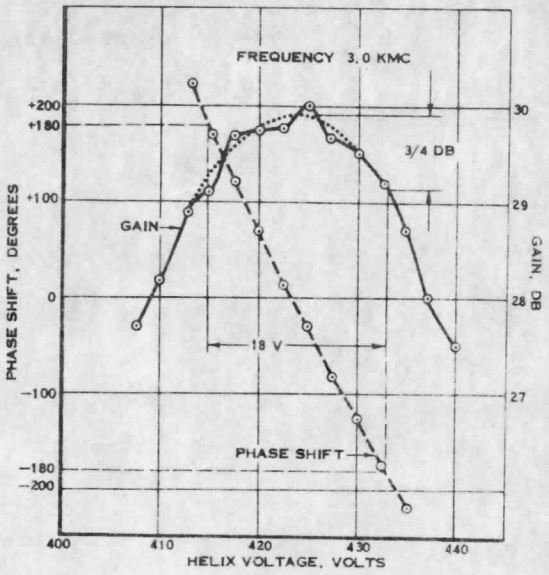


GRID CHARACTERISTICS

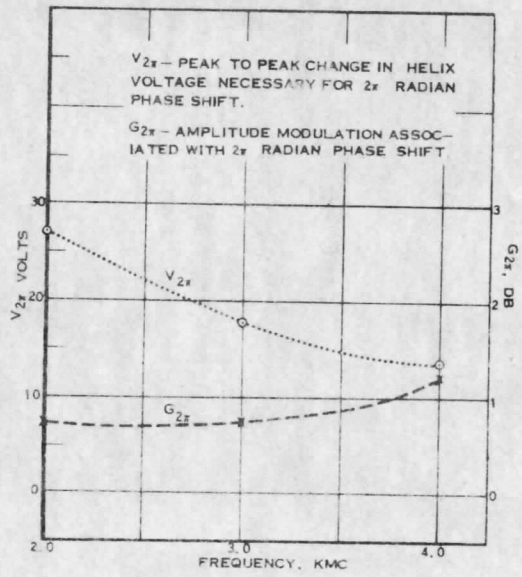


GRID CONTROL

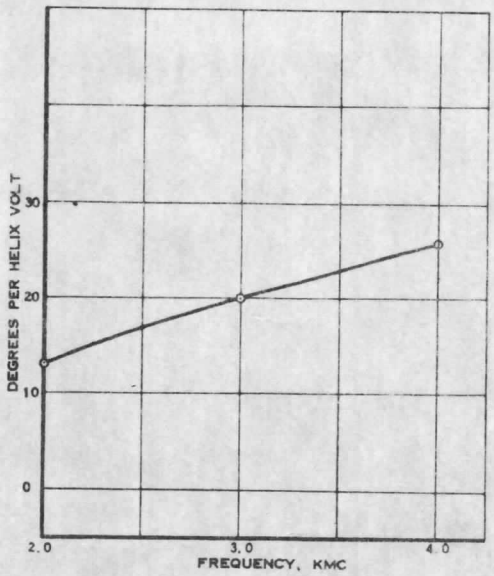
TYPICAL PHASE SHIFT CHARACTERISTICS



PHASE SHIFT AND GAIN VS HELIX VOLTAGE (SMALL SIGNAL)



HELIX PHASE MODULATION CHARACTERISTICS



SLOPE OF HELIX PHASE CHARACTERISTIC VS FREQUENCY

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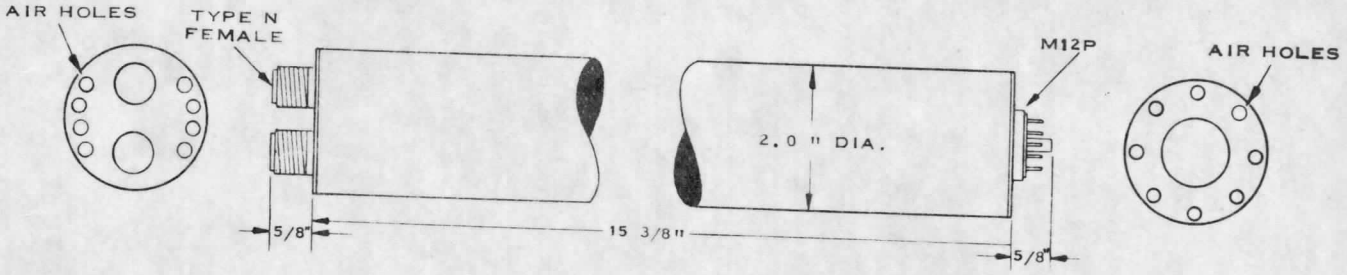
TENTATIVE DATA

PERMANENT MAGNET FOCUSED MEDIUM POWER TRAVELING WAVE TUBE AMPLIFIER

OPENINGS ARE PROVIDED IN BOTH ENDS OF THE CAPSULE TO ALLOW FOR A SMALL AMOUNT OF AIR FLOW NECESSARY FOR COOLING. THE RF END OF THE CAPSULE OPERATES AT THE HIGHEST TEMPERATURE AND SHOULD BE COOLED FIRST.



ELECTRICAL CHARACTERISTICS[1]

FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL SIGNAL GAIN	30 DB (MIN.)
POWER OUTPUT	30 DBM (MIN.)

POWER SUPPLY REQUIREMENTS[2]

HELIX AND COLLECTOR VOLTAGE	800 TO 1100 VOLTS
CATHODE CURRENT	20 MA
HELIX CURRENT	3 MA (MAX.)
ANODE VOLTAGE	250 TO 450 VOLTS
ANODE CURRENT	50 μA (MAX.)
HEATER VOLTAGE	7.0 VOLTS
HEATER CURRENT	0.9 AMPS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P ON CAPSULE*
CAPSULE LENGTH	15 3/8 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	5 POUNDS

* SUPPLIED WITH MATING CONNECTOR.

1. DATA TAKEN OVER THE ENTIRE 2.0 TO 4.0 KMC BAND BY OPERATING INTO MATCHED LOAD, WITH THE INDICATED POTENTIALS FIXED. TUBE IS STABLE AT 15.0 MA BEAM CURRENT WITH INPUT CONNECTOR SHORT CIRCUITED, AND A LOAD WHOSE VSWR IS LESS THAN 2.0 TERMINATING THE OUTPUT CONNECTOR. TUBE IS STABLE AT 22.0 MA BEAM CURRENT WITH INPUT CONNECTOR TERMINATED IN A MATCHED LOAD, AND A LOAD WHOSE VSWR IS LESS THAN 2.0 TERMINATING THE OUTPUT CONNECTOR.

2. ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

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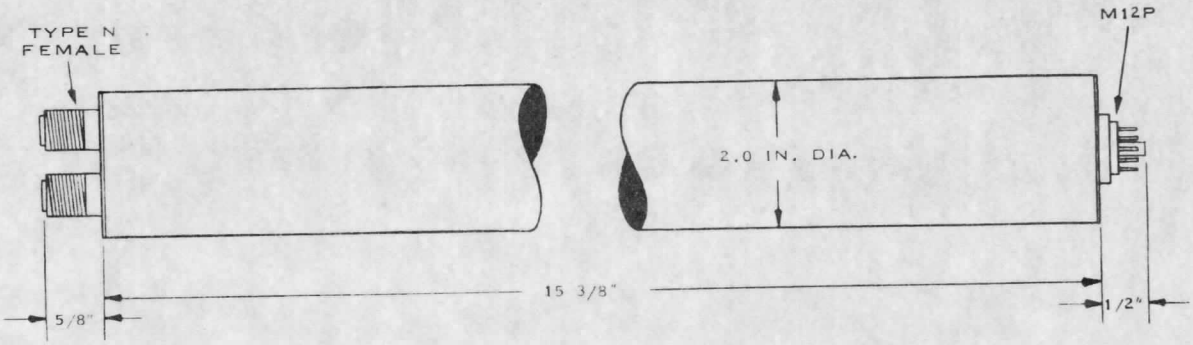
TENTATIVE DATA

PERMANENT MAGNET FOCUSED HIGH GAIN TRAVELING WAVE TUBE AMPLIFIER



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	1.0 – 2.0 KMC
SMALL SIGNAL GAIN	30 DB (MIN.)
POWER OUTPUT	10 DBM (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	180 – 220 VOLTS
CATHODE CURRENT	4.0 MA
HELIX CURRENT	2.0 MA
ANODE VOLTAGE[2]	0–175 VOLTS
ANODE CURRENT	50 μA (MAX.)
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	0.5 AMPS 1.2
GRID VOLTAGE	0 VOLTS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P ON CAPSULE
CAPSULE LENGTH	15 3/8 1/2 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	4 1/2 POUNDS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

2 THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0 – 175 VOLTS TO PREVENT POSSIBLE TUBE DAMAGE WHEN INITIALLY APPLYING VOLTAGES.

TENTATIVE CHARACTE

HA–32

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SOLENOID – FOCUSED, MEDIUM – NOISE C – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 TO 8.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	.0 DBM MIN
NOISE FIGURE[1]	.15 DB MAX
VSWR, INPUT AND OUTPUT	3:1 MAX

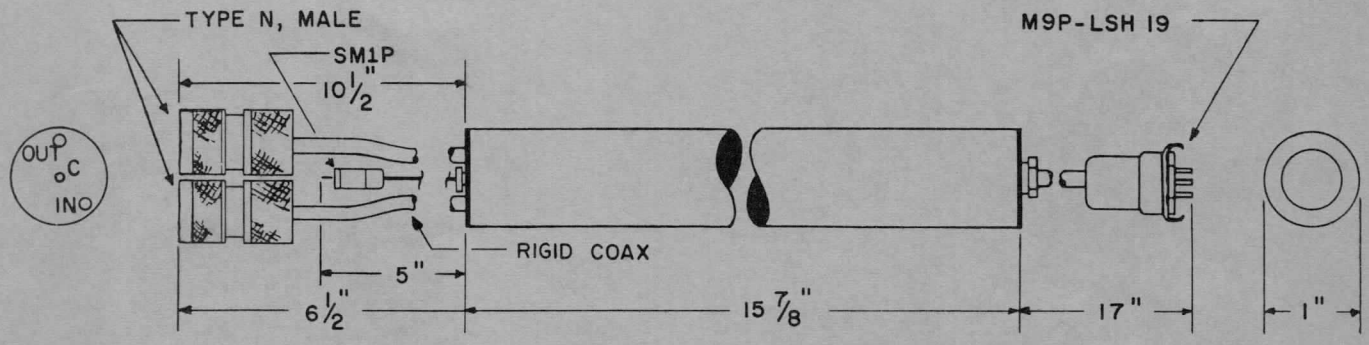
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	500 TO 700 V	--	0.1 MA MAX
COLLECTOR	FIXED * V	--	2.0 MA MAX
ANODE 1	0 TO 100 V	--	0.01 MA MAX
ANODE 2	0 TO 150 V	--	0.01 MA MAX
ANODE 3	0 TO 500 V	--	0.01 MA MAX
ANODE 4	0 TO -150 V	--	0.01 MA MAX
CATHODE	0 V	--	2.0 MA MAX
HEATER	5.0 TO 7.5 V	--	1.1 AMP MAX

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 700 TO 800 VOLTS.

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . BLACK ANODIZED
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1 1/2 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

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TENTATIVE DATA

MEDIUM NOISE WIDEBAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.0 TO 14.0 KMC
SMALL SIGNAL GAIN	25 DB (MIN.)
NOISE FIGURE	15 DB (MAX.)

POWER SUPPLY REQUIREMENTS

HELIX VOLTAGE[1]	1000 TO 1300 VOLTS
COLLECTOR VOLTAGE	1000 TO 1800 VOLTS
CATHODE CURRENT	0.7 TO 1.2 MA
HELIX CURRENT	< 10 μA
ANODE NO.1 VOLTAGE[2]	0 TO 150 VOLTS
ANODE NO.2 VOLTAGE[2]	0 TO 150 VOLTS
ANODE NO.3 VOLTAGE[2]	0 TO 450 VOLTS
ANODE NO.4 VOLTAGE[2]	0 TO MINUS 20 VOLTS
HEATER VOLTAGE[3]	5.0 TO 7.0 VOLTS
HEATER CURRENT	0.9 TO 1.2 AMPS
MAGNETIC FIELD	900 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER M9P*
CAPSULE LENGTH	17 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

* SUPPLIED WITH MATING CONNECTOR.

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE CAN BE OPERATED AT GROUND POTENTIAL.

2 ALL ANODE VOLTAGE SUPPLIES MUST START FROM ZERO VOLTS FOR INITIAL FOCUSING PURPOSES.

3 HEATER VOLTAGE SUPPLY SHOULD BE CONTINUOUSLY VARIABLE OVER THE RANGE 5.0 TO 7.0 VOLTS TO ALLOW FOR OPTIMUM NOISE FIGURE PERFORMANCE

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TENTATIVE DATA

SPECIAL PURPOSE TRAVELING WAVE TUBE AMPLIFIER UHF BAND TO S–BAND FREQUENCY MULTIPLIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	400 – 1000 KMC IN 2000–4000 KMC OUT
CONVERSION GAIN	MINUS 10 DB TO 0 DB
S–BAND POWER OUTPUT	3 TO 10 DBM

POWER SUPPLY REQUIREMENTS

COLLECTOR VOLTAGE[1]	450–550 VOLTS
HELIX NO. 1 VOLTAGE	200–250 VOLTS
HELIX NO. 2 VOLTAGE	450–550 VOLTS
CATHODE CURRENT	6 MA
HELIX CURRENT	200 μA
ANODE VOLTAGE	0–200 VOLTS
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	0.75 AMP
MAGNETIC FIELD	550 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER M9P
CAPSULE LENGTH	16 1/2 INCHES 15 5/8
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

PRICE $850.00

DELIVERY 6 TO 8 WEEKS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

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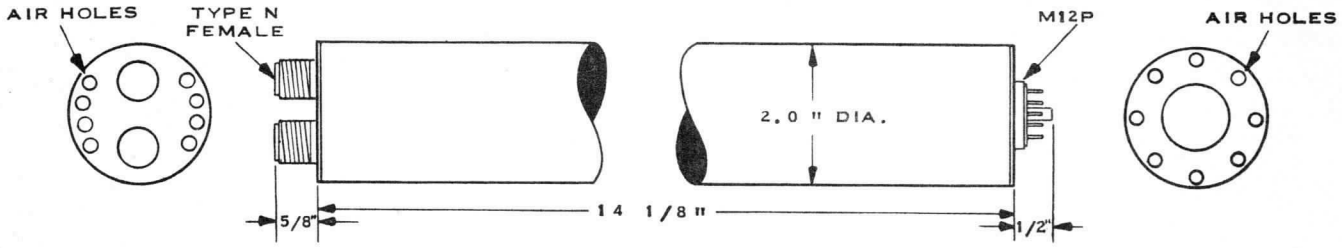
TENTATIVE DATA

PERMANENT MAGNET FOCUSED MEDIUM POWER TRAVELING WAVE TUBE AMPLIFIER

OPENINGS ARE PROVIDED IN BOTH ENDS OF THE CAPSULE TO ALLOW FOR A SMALL AMOUNT OF AIR FLOW NECESSARY FOR COOLING. THE RF END OF THE CAPSULE OPERATES AT THE HIGHEST TEMPERATURE AND SHOULD BE COOLED LAST.



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 TO 8.0 KMC
SATURATION POWER OUTPUT	27 DBM (MIN.)
SATURATION GAIN	27 DB (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX VOLTAGE[1]	1200 TO 1500 VOLTS
COLLECTOR VOLTAGE[1]	1200 TO 1500 VOLTS
CATHODE CURRENT	20 MA (MAX.)
HELIX CURRENT	1.5 MA (MAX.)
ANODE VOLTAGE[2]	300 TO 700 VOLTS
ANODE CURRENT	50 μA (MAX.)
HEATER VOLTAGE	7.0 VOLTS
HEATER CURRENT	1.2 AMPS (MAX.)

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P
CAPSULE LENGTH	14 1/8 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	6 POUNDS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

2 THIS GIVES THE RANGE OF ANODE VOLTAGES WHICH IS NECESSARY FOR 20 MA CATHODE CURRENT AND TAKES INTO ACCOUNT TUBE TO TUBE VARIATIONS. THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0 TO 700 VOLTS TO PREVENT POSSIBLE TUBE DAMAGE WHEN INITIALLY APPLYING VOLTAGES.

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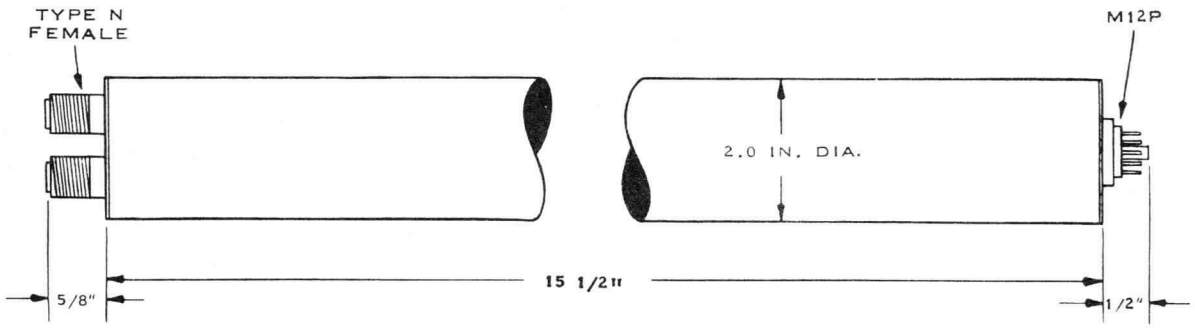
TENTATIVE DATA

PERMANENT MAGNET FOCUSED HIGH GAIN TRAVELING WAVE TUBE AMPLIFIER



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL SIGNAL GAIN	~~30~~ DB (MIN.) 20
POWER OUTPUT	10 DBM (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	~~180 TO 220~~ VOLTS 200 to 400
CATHODE CURRENT	~~6.0~~ MA 10.0
HELIX CURRENT	~~2.0~~ MA 4.0
ANODE VOLTAGE[2]	~~0 TO 175~~ VOLTS 0 to 300
ANODE CURRENT	~~50 μA~~ (MAX.) 1.0 ma
HEATER VOLTAGE	~~6.3~~ VOLTS 7.0
HEATER CURRENT	~~1.2~~ AMPS 1.4
GRID VOLTAGE	~~-20~~ VOLTS 0 to -20

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P ON CAPSULE
CAPSULE LENGTH	15 1/2 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	4 1/2 POUNDS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

2 THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0 – 175 VOLTS TO PREVENT POSSIBLE TUBE DAMAGE WHEN INITIALLY APPLYING VOLTAGES.

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TENTATIVE DATA

LOW NOISE S–BAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	2.0 TO 4.0 KMC...2.5 TO 3.5 KMC
SMALL SIGNAL GAIN	25 DB (MIN.).....25 DB (MIN.)
NOISE FIGURE	11 DB (MAX.) ....10 DB (MAX.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	400 TO 500 VOLTS
CATHODE CURRENT	1.0 MA (MAX.)
HELIX CURRENT	$<20\ \mu A$
ANODE NO.1 VOLTAGE[2]	0 TO 20 VOLTS
ANODE NO.2 VOLTAGE	0 TO 50 VOLTS
ANODE NO.3 VOLTAGE	0 TO 50 VOLTS
ANODE NO.4 VOLTAGE	0 TO –30 VOLTS
HEATER VOLTAGE	4.5 TO 6.3 VOLTS
HEATER CURRENT	0.9 AMPS (MAX.)
MAGNETIC FIELD	750 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE*
DC CONNECTOR	WINCHESTER M9P**
CAPSULE LENGTH	21 1/2 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

* SUPPLIED WITH MATING CONNECTOR.

** OUTPUT AND INPUT R.F. CABLES ARE RIGID COAX.

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE MAY BE OPERATED AT GROUND POTENTIAL.

2 ALL ANODE VOLTAGES SHOULD BE ADJUSTABLE FROM ZERO FOR INITIAL FOCUSING PURPOSES.

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SOLENOID — FOCUSED, 1 — WATT 1.6 TO 2.6 KMC AMPLIFIER

ELECTRICAL CHARACTERISTICS

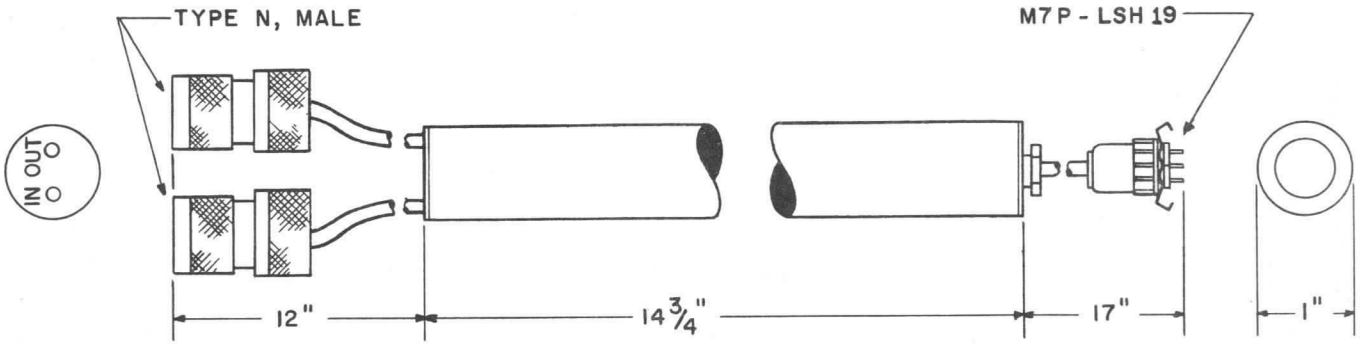
FREQUENCY RANGE	1.6 TO 2.6 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	30 DBM MIN
GAIN AT 30 DBM POWER OUTPUT	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	850 TO 1250 V	— —	0.3 MA MAX
COLLECTOR	850 TO 1250 V	— —	25.0 MA MAX
ANODE	0 TO 450 V	— —	0.1 MA MAX
CATHODE	0 V	— —	25.0 MA MAX
GRID	0* V	— —	0.1 MA MAX
HEATER	7.0 V	— —	1.2 AMP MAX
*A NEGATIVE VOLTAGE CAN BE APPLIED FOR R-F ATTENUATION.			

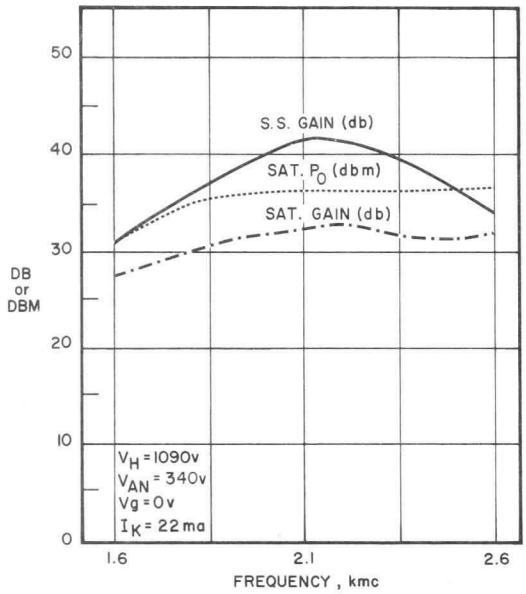
FOCUSING . . . . . SOLENOID, 600 GAUSS

MECHANICAL CHARACTERISTICS

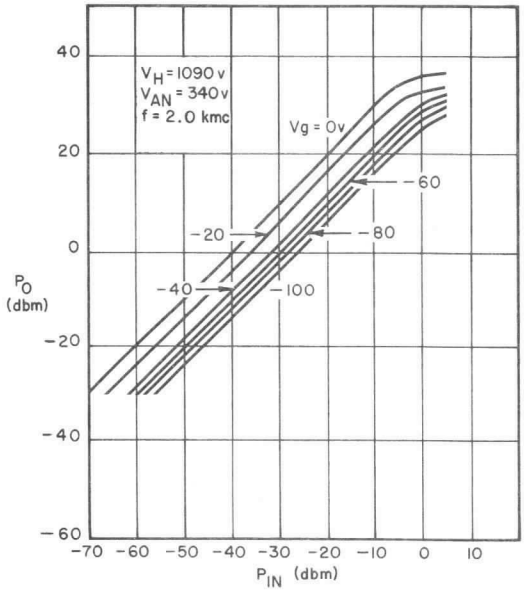


CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

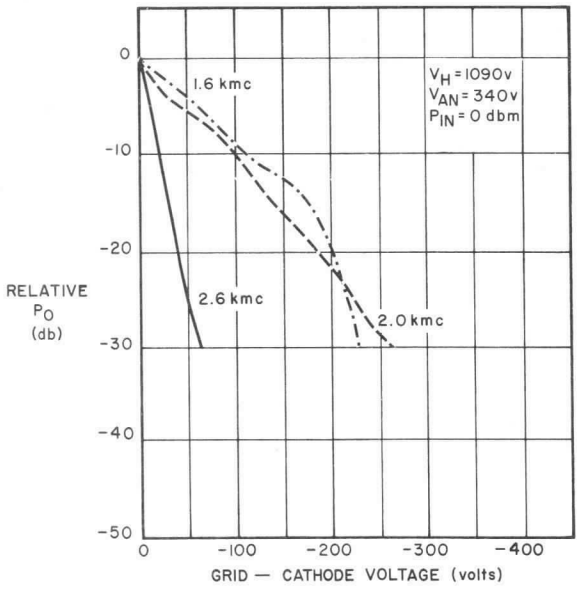
TYPICAL OPERATING CHARACTERISTICS



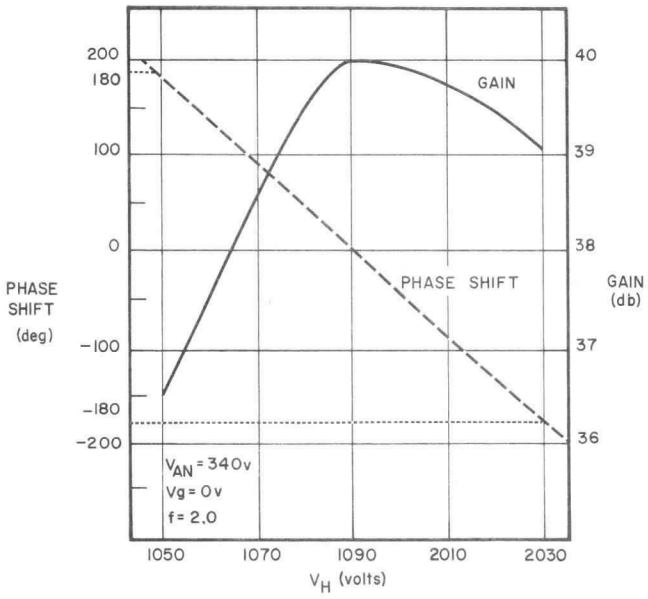
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

TENTATIVE CHARACTERISTICS

HA–47

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, LOW NOISE C – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 TO 8.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	10 DB MAX
VSWR, INPUT AND OUTPUT	3:1 MAX

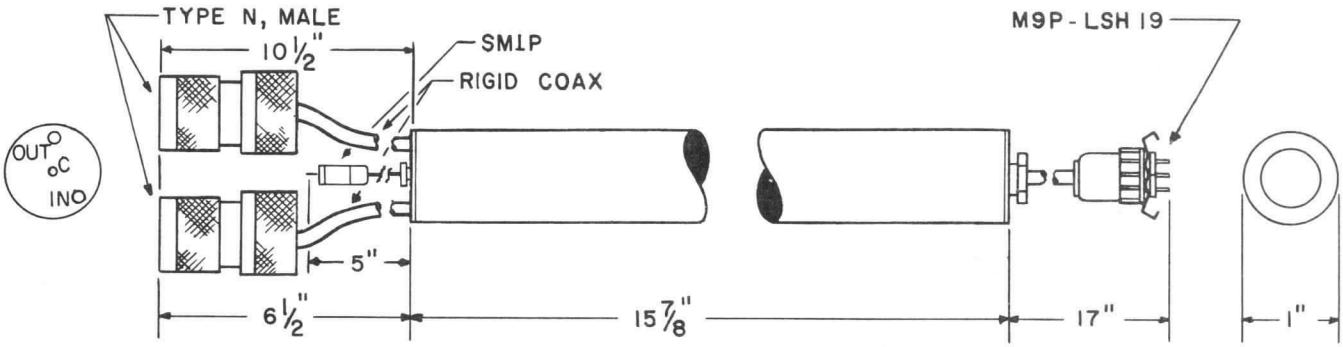
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	500 TO 700 V	--	0.1 MA MAX
COLLECTOR	FIXED *	--	2.0 MA MAX
ANODE 1	0 TO 100 V	--	0.01 MA MAX
ANODE 2	0 TO 150 V	--	0.01 MA MAX
ANODE 3	0 TO 500 V	--	0.01 MA MAX
ANODE 4	0 TO –150 V	--	0.01 MA MAX
CATHODE	0 V	--	2.0 MA MAX
HEATER	5.0 TO 7.5 V	--	1.1 AMP MAX

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 700 TO 800 VOLTS.

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . BLACK ANODIZED

END CAP FINISH . . . . . BLACK ANODIZED

AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER

NET WEIGHT . . . . . 1 1/2 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California.

TENTATIVE DATA

MEDIUM NOISE UHF—BAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL SIGNAL GAIN	25 DB (MIN.)
NOISE FIGURE	15 DB (MAX.)

POWER SUPPLY REQUIREMENTS

HELIX VOLTAGE[1]	90 TO 130 VOLTS
COLLECTOR VOLTAGE	300 to 450 ~~90 TO 130~~ VOLTS
CATHODE CURRENT	2.0 MA (MAX.)
HELIX CURRENT	<20 μA
ANODE NO. 1 VOLTAGE[2]	0 TO 5 10 VOLTS
ANODE NO. 2 VOLTAGE	0 TO 20 VOLTS
ANODE NO. 3 VOLTAGE	0 VOLTS
ANODE NO. 4 VOLTAGE	0 TO −10 VOLTS
HEATER VOLTAGE	5.0 to 6.3 VOLTS
HEATER CURRENT	0.85 AMPS
MAGNETIC FIELD	800 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER M9P*
CAPSULE LENGTH	~~1 7/16~~ 1 1/2 INCHES
CAPSULE DIAMETER	1 5/16 INCHES
NET WEIGHT	1.5 POUNDS

* SUPPLIED WITH MATING CONNECTOR

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE MAY BE OPERATED AT GROUND POTENTIAL.

2 ALL ANODE VOLTAGE SUPPLIES MUST BE ADJUSTABLE FROM ZERO VOLTS FOR INITIAL FOCUSING PURPOSES.

TENTATIVE CHARACTERISTI

HA–43

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, MEDIUM NOISE K_U – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

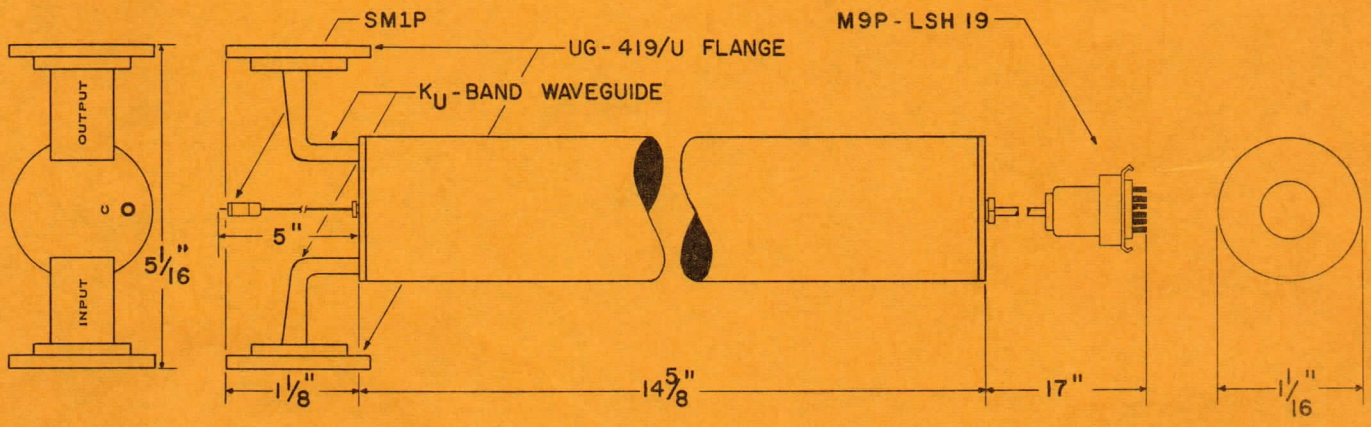
FREQUENCY RANGE	12.0 TO 18.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE [1]	17 DB MAX
VSWR, INPUT AND OUTPUT	3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	1000 TO 1300 V	--	0.1 MA MAX
COLLECTOR	1000 TO 1300 V	--	0.8 MA MAX
ANODE 1	0 TO 100 V	--	0.01 MA MAX
ANODE 2	0 TO 100 V	--	0.01 MA MAX
ANODE 3	0 TO 750 V	--	0.01 MA MAX
ANODE 4	0 TO –50 V	--	0.01 MA MAX
CATHODE	0 V	--	0.8 MA MAX
HEATER	5.0 TO 7.5 V	--	1.4 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1 3/4 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

Tech. Bull. ~~duplicate~~ copy

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California

TENTATIVE DATA

MEDIUM NOISE X–BAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.2 TO 12.4 KMC
SMALL SIGNAL GAIN	25 DB (MIN.)
POWER OUTPUT	5 MW (MIN.)
NOISE FIGURE	15 DB (MAX.)

POWER SUPPLY REQUIREMENTS[1]

COLLECTOR VOLTAGE	1100 TO 1600 VOLTS
HELIX VOLTAGE	1100 TO 1300 VOLTS
CATHODE CURRENT	1.7 MA (MAX.)
ANODE NO. 1 VOLTAGE[2]	0 TO 100 VOLTS
ANODE NO. 2 VOLTAGE	0 TO 150 VOLTS
ANODE NO. 3 VOLTAGE	0 TO 450 VOLTS
ANODE NO. 4 VOLTAGE	0 TO –10 VOLTS
ANODE CURRENT	LESS THAN 5 μA
HEATER VOLTAGE	5.0 TO 7.0 VOLTS[3]
HEATER CURRENT	0.9 TO 1.2 AMPS
MAGNETIC FIELD	1000 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER M9P*
CAPSULE LENGTH	1~~4~~ 3/4 ~~to~~ INCHES 1 5/8"
CAPSULE DIAMETER	1.0 INCH
RF CABLE LENGTH (CAPSULE TO END OF CONNECTOR)	11 3/4 INCHES
DC CABLE LENGTH (CAPSULE TO END OF PLUG)	17 INCHES
NET WEIGHT	1.0 POUND
SHIPPING WEIGHT	11 POUNDS

* SUPPLIED WITH MATING CONNECTOR.

1. ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE MAY BE OPERATED AT GROUND POTENTIAL. IMPROVED TUBE PERFORMANCE CAN USUALLY BE OBTAINED BY OPERATING THE COLLECTOR UP TO 300 V. POSITIVE WITH RESPECT TO THE HELIX.

2. ALL ANODE VOLTAGES SHOULD BE ADJUSTABLE FROM ZERO FOR INITIAL FOCUSING PURPOSES.

3. PROVISION SHOULD BE MADE TO ALLOW FOR CONTINUOUS HEATER VOLTAGE VARIATION OVER THE INDICATED RANGE TO OBTAIN OPTIMUM NOISE FIGURE AND LIFE PERFORMANCE.

TENTATIVE CHARACTERIS

HA–45

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SOLENOID FOCUSED, LOW NOISE UHF – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE [1]	10 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

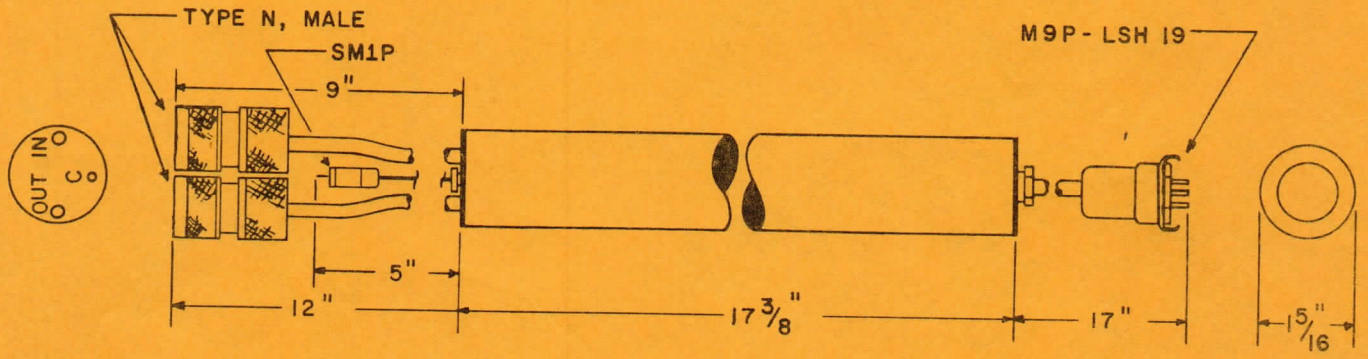
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	80 TO 120 V	--	0.02 MA MAX
COLLECTOR	* FIXED	--	2.0 MA MAX
ANODE 1	0 TO 30 V	--	0.010 MA MAX
ANODE 2	0 TO 30 V	--	0.010 MA MAX
ANODE 3	0 TO 50 V	--	0.010 MA MAX
ANODE 4	-50 TO 50 V	--	0.010 MA MAX
CATHODE	0 V	--	2.0 MA MAX
HEATER	5.0 TO 7.5 V	--	1.0 AMP MAX

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 270 TO 400 VOLTS.

FOCUSING . . . . . SOLENOID, 820 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1 1/2 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

TENTATIVE CHARACTERI

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SOLENOID – FOCUSED, LOW NOISE K_U – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

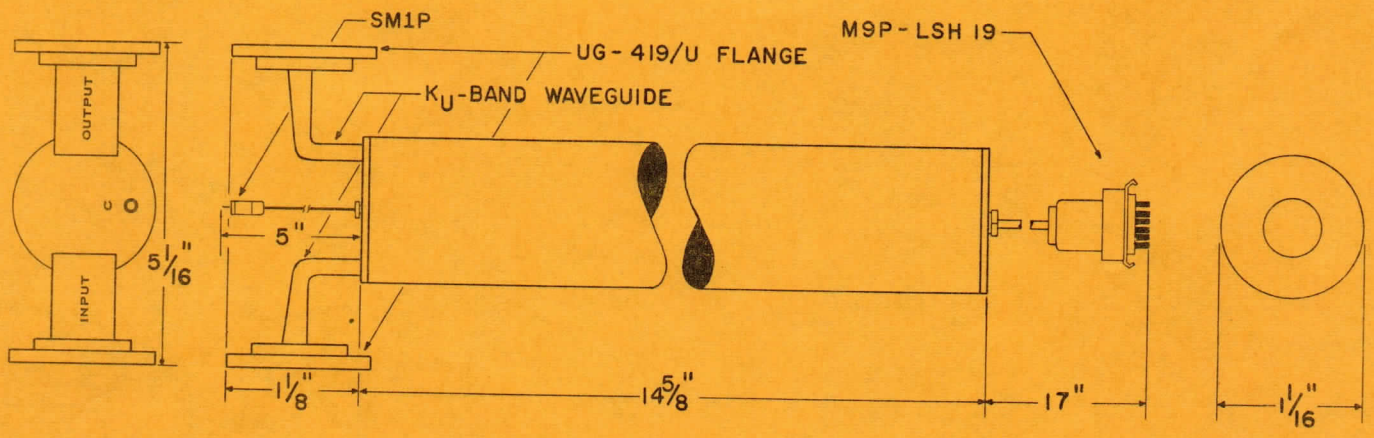
FREQUENCY RANGE	12.0 TO 18.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE [1]	12 DB MAX
VSWR, INPUT AND OUTPUT	3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	1000 TO 1300 V	--	0.1 MA MAX
COLLECTOR	1000 TO 1300 V	--	0.8 MA MAX
ANODE 1	0 TO 100 V	--	0.01 MA MAX
ANODE 2	0 TO 100 V	--	0.01 MA MAX
ANODE 3	0 TO 750 V	--	0.01 MA MAX
ANODE 4	0 TO -50 V	--	0.01 MA MAX
CATHODE	0 V	--	0.8 MA MAX
HEATER	5.0 TO 7.5 V	--	1.4 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1 3/4 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

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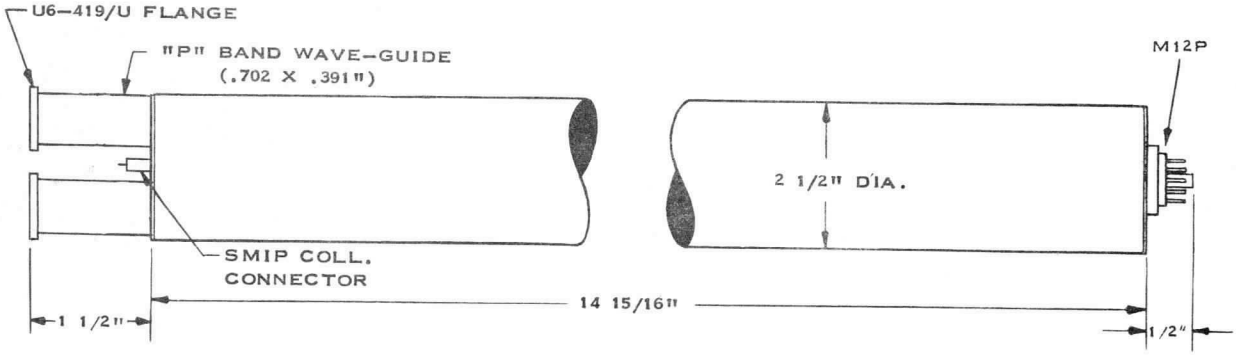
TENTATIVE DATA

PERMANENT MAGNET FOCUSED HIGH GAIN TRAVELING WAVE TUBE AMPLIFIER



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	12.0 TO 18.0 KMC. . . 10.5 TO 16.0 KMC
SMALL SIGNAL GAIN	20 DB (MIN.) . . . . . 30 DB (MIN.)
POWER OUTPUT	~~10~~ 0 DBM (MIN.) . . . . . ~~10~~ 5 DBM (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	1100 TO 1300 VOLTS
CATHODE CURRENT	3.0 MA (MAX.)
HELIX CURRENT	0.5 (MAX.)
ANODE VOLTAGE[2]	0 TO 400 VOLTS
ANODE CURRENT	50 μA (MAX.)
HEATER VOLTAGE	6.3 OR 7.0 VOLTS
HEATER CURRENT	1.5 AMPS (MAX.)
GRID VOLTAGE	0 TO –20 VOLTS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	P–BAND WAVE GUIDE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P ON CAPSULE
CAPSULE LENGTH	14 15/16 INCHES
CAPSULE DIAMETER	2 1/2 INCHES
NET WEIGHT	5 POUNDS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED FROM TUBE CAPSULE SO THAT ANY ELECTRODE MAY BE OPERATEE AT GROUND POTENTIAL.

2 THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0 TO 400 VOLTS TO PREVENT POSSIBLE TUBE DAMAGE WHEN INITIALLY APPLYING VOLTAGES.

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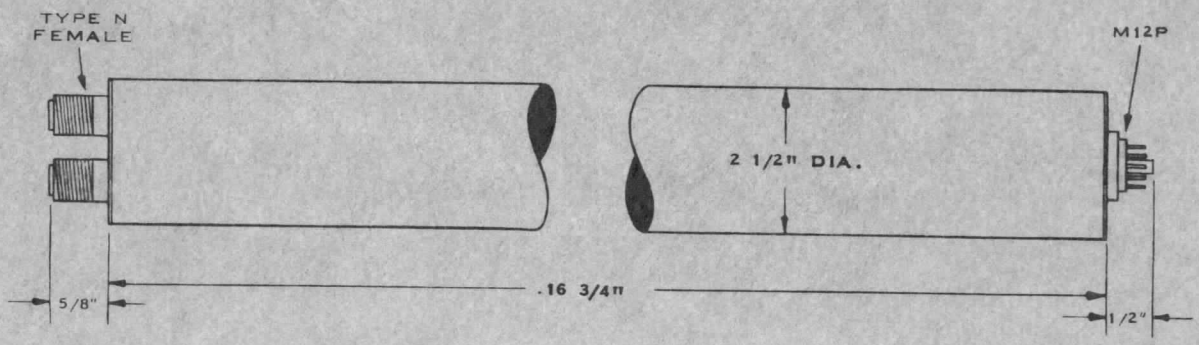
TENTATIVE DATA

PERMANENT MAGNET FOCUSED HIGH GAIN TRAVELING WAVE TUBE AMPLIFIER



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	250 TO 500 MC
SMALL SIGNAL GAIN	20 DB (MIN.)
POWER OUTPUT	10 DBM (MIN.)

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	180 TO 220 VOLTS
CATHODE CURRENT	10 MA
HELIX CURRENT	2.0 MA
ANODE VOLTAGE[2]	0 TO 200 VOLTS
ANODE CURRENT	50 μA (MAX.)
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	1.5 AMPS
GRID VOLTAGE	0 TO –20 VOLTS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P ON CAPSULE
CAPSULE LENGTH	16 3/4 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	6 POUNDS

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

2 THE ANODE VOLTAGE SUPPLY MUST COVER THE RANGE 0 TO 200 VOLTS TO PREVENT POSSIBLE TUBE DAMAGE WHEN INITIALLY APPLING VOLTAGES.

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TENTATIVE DATA

ELECTROSTATICALLY–FOCUSED, 3 MW UHF–BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 0.5 TO 1.0 KMC

SMALL–SIGNAL GAIN . . . . . 20 DB MIN

SATURATION POWER OUTPUT. . . . . .5 DBM MIN

VSWR, INPUT AND OUTPUT. . . . . 2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE *	CURRENT
HELIX 1	0 TO 50 VDC	5 MA MAX
HELIX 2	0 TO 200 VDC	5 MA MAX
COLLECTOR	200 TO 350 VDC	3 MA MAX
ANODE 1	0 TO 100 VDC	3 MA MAX
ANODE 2	0 TO 100 VDC	3 MA MAX
ANODE 3	0 TO 300 VDC	3 MA MAX
ANODE 4	–25 TO 25 VDC	5 MA MAX
CATHODE	0 VDC	3 MA MAX
HEATER	6.0 TO 8.0 VDC	1.0 AMP MAX

FOCUSING . . . . . ELECTROSTATIC

MECHANICAL CHARACTERISTICS

CAPSULE FINISH . . . . . .CHROME

END CAP FINISH. . . . . .BLACK ANODIZED

AUXILIARY COOLING REQUIRED . . . . . NONE

R–F CONNECTORS . . . . . .FEMALE, GREMAR TNC 6132

D–C CONNECTOR. . . . . .WINCHESTER M12P–LSH19

COLLECTOR CONNECTOR . . . . . .WINCHESTER SM1P

NET WEIGHT . . . . . 1 1/2 LBS

* ALL VOLTAGES MEASURED WITH RESPECT TO CATHODE.

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PPM — FOCUSED, 2 — WATT L — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	1.0 TO 2.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	33 DBM MIN
GAIN AT 33 DBM POWER OUTPUT	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

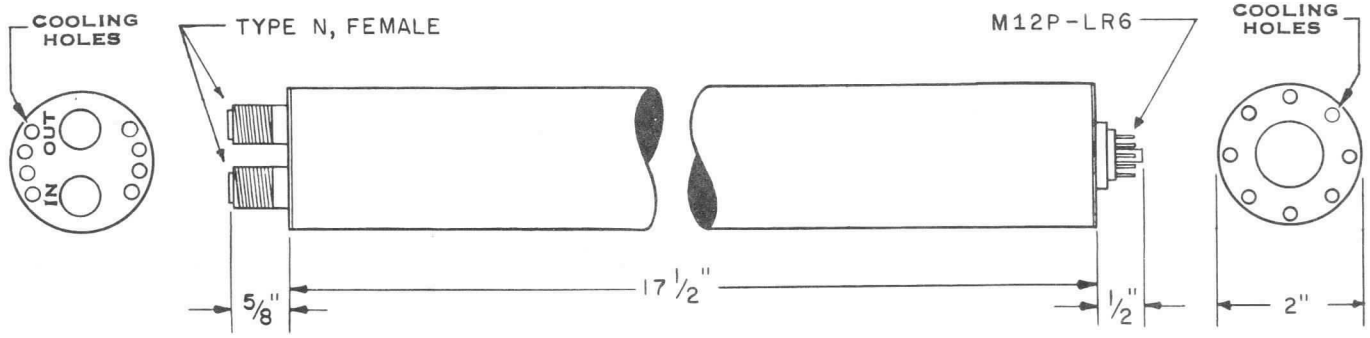
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	700 TO 1000 V	— —	5.0 MA MAX
COLLECTOR*	1300 V	— —	50.0 MA MAX
ANODE	300 TO 600 V	— —	1.0 MA MAX
CATHODE	0 V	— —	75.0 MA MAX
GRID	0 TO 100 V	— —	20.0 MA MAX
HEATER	7.0 V	— —	1.4 AMP MAX

* COLLECTOR IS AT OUTER SHELL GROUND POTENTIAL.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	AIR: 5 CFM @ 1" H_2O
NET WEIGHT	4 1/4 LBS

HUGGINS LABORATORIES, INC.

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PPM — FOCUSED, LOW NOISE S — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

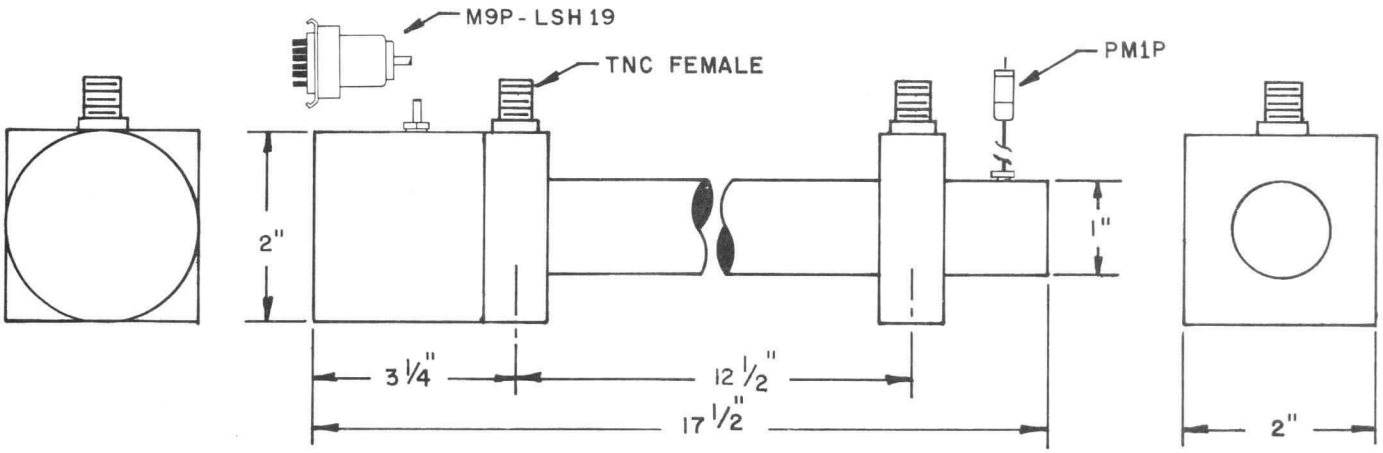
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	5 DBM MIN
NOISE FIGURE [1]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	400 TO 500 V	— —	0.05 MA MAX
COLLECTOR	600 TO 800 V	— —	2.0 MA MAX
ANODE 1	0 TO 75 V	— —	0.01 MA MAX
ANODE 2	0 TO 50 V	— —	0.01 MA MAX
ANODE 3	0 TO 200 V	— —	0.01 MA MAX
ANODE 4	0 TO −200 V	— —	0.01 MA MAX
CATHODE	0 V	— —	2.0 MA MAX
HEATER	5.0 TO 7.0 V	— —	1.0 AMP MAX

FOCUSING . . . . . PERIODIC PERMANENT, MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	5 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

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REgent 6-9330 TWX Sunnyvale, Calif. 116

TENTATIVE DATA

ELECTROSTATICALLY–FOCUSED, 1 WATT UHF–BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 0.5 TO 0.9 KMC

SMALL–SIGNAL GAIN . . . . . 30 DB MIN

SATURATION POWER OUTPUT . . . . . 1 WATT MIN[1]

VSWR, INPUT AND OUTPUT. . . . . 2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE [2]	CURRENT
HELIX 1	0 TO 100 VDC	5 MA MAX
HELIX 2	550 TO 850 VDC	20 MA MAX
COLLECTOR	550 TO 950 VDC	30 MA MAX
ANODE 1	0 TO 25 VDC	5 MA MAX
ANODE 2	0 TO 25 VDC	5 MA MAX
ANODE 3	0 TO 200 VDC	5 MA MAX
ANODE 4	0 TO 200 VDC	5 MA MAX
ANODE 5	0 TO 600 VDC	5 MA MAX
ANODE 6	0 TO 600 VDC	5 MA MAX
CATHODE	0 VDC	30 MA MAX
HEATER	6 TO 12 VDC	3 AMP MAX

FOCUSING . . . . . ELECTROSTATIC

MECHANICAL CHARACTERISTICS

CAPSULE FINISH . . . . . CHROME

END CAP FINISH . . . . . BLACK ANODIZED

AUXILIARY COOLING REQUIRED . . . . . NONE

R–F CONNECTORS. . . . . FEMALE, GREMAR TNC 6132

D–C CONNECTOR . . . . . WINCHESTER M12P–LSH19

COLLECTOR CONNECTOR . . . . . WINCHESTER SM1P

NET WEIGHT. . . . . 2.0 LBS

1 0.63 WATTS OVER RANGE 0.5 TO 1.0 KMC

2 ALL VOLTAGES MEASURED WITH RESPECT TO CATHODE

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

PPM — FOCUSED, X — BAND LOW — NOISE AMPLIFIER

ELECTRICAL CHARACTERISTICS

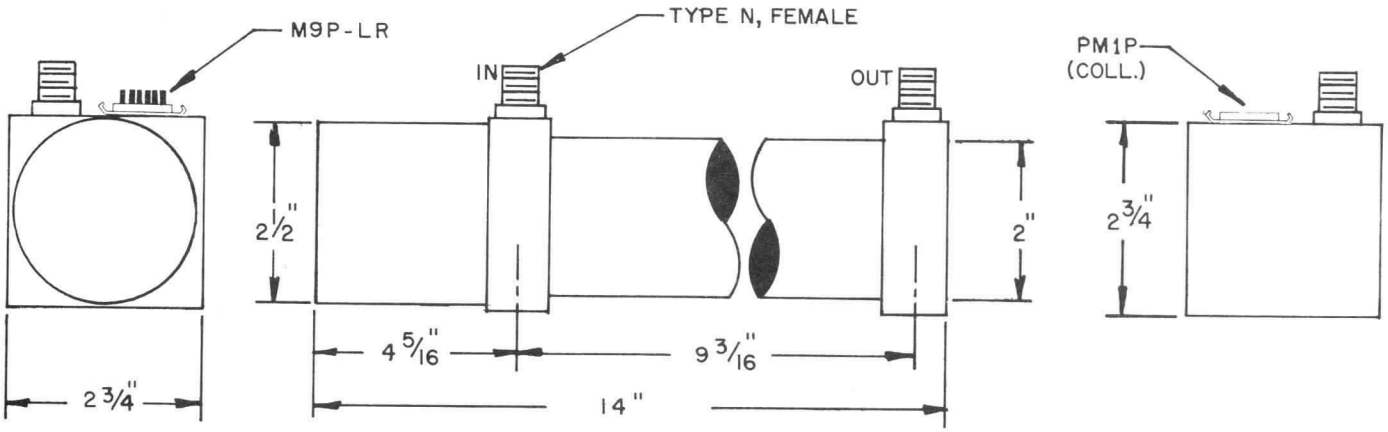
FREQUENCY RANGE	8.0 TO 11.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
NOISE FIGURE [1]	17 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	1050 TO 1250 V	– –	0.5 MA MAX
COLLECTOR	1300 V	– –	1.5 MA MAX
ANODE 1	0 TO 150 V	– –	0.01 MA MAX
ANODE 2	50 TO 200 V	– –	0.01 MA MAX
ANODE 3	250 TO 600 V	– –	0.01 MA MAX
ANODE 4	0 TO –100 V	– –	0.01 MA MAX
CATHODE	0 V	– –	1.5 MA MAX
HEATER	6.3 V	– –	1.2 AMP MAX

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . CHROME

END CAP FINISH . . . . . BLACK ANODIZED

AUXILIARY COOLING REQUIRED . . . . . NONE

NET WEIGHT . . . . . 4.5 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, MEDIUM – NOISE 7.0 TO 14.0 KMC AMPLIFIER

ELECTRICAL CHARACTERISTICS

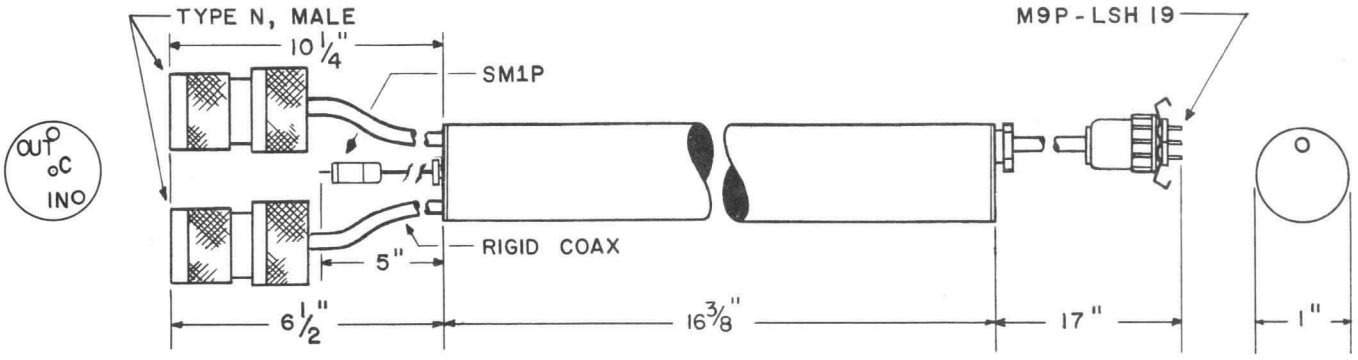
FREQUENCY RANGE	7.0 TO 14.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1, 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	1000 TO 1300 V	– –	0.025 MA MAX
COLLECTOR *	1000 TO 1500 V	– –	2.0 MA MAX
ANODE 1	0 TO 150 V	– –	0.01 MA MAX
ANODE 2	0 TO 150 V	– –	0.01 MA MAX
ANODE 3	0 TO 500 V	– –	0.01 MA MAX
ANODE 4	0 TO –50 V	– –	0.01 MA MAX
CATHODE	0 V	– –	2.0 MA MAX
HEATER	5.0 TO 7.5 V	– –	1.1 AMP MAX
*COLLECTOR VOLTAGE MUST BE ADJUSTABLE.			

FOCUSING . . . . . SOLENOID, MPE TYPE BS – 27C

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . BLACK ANODIZED
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, LOW – NOISE S – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

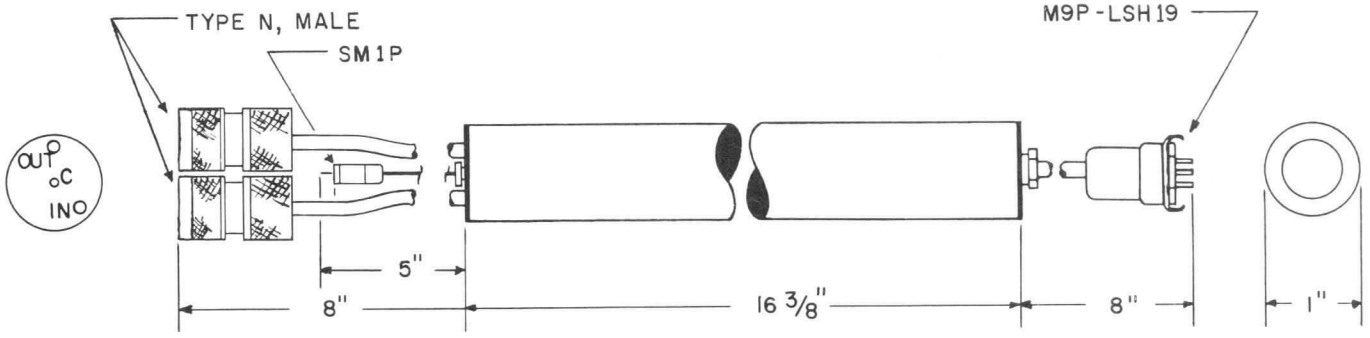
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	7 DBM MIN
NOISE FIGURE [1]	10 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	385 TO 500 V	– –	0.02 MA MAX
COLLECTOR [2]	385 TO 700 V	– –	2.0 MA MAX
ANODE 1	0 TO 75 V	– –	0.01 MA MAX
ANODE 2	0 TO 150 V	– –	0.01 MA MAX
ANODE 3	0 TO 150 V	– –	0.01 MA MAX
ANODE 4	0 TO – 75 V	– –	0.01 MA MAX
CATHODE	0 V	– –	2.0 MA MAX
HEATER	5.0 TO 6.3 V	– –	1.0 AMP MAX

FOCUSING . . . . . SOLENOID, MPE TYPE BS – 53C[2,3]

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

[2] COLLECTOR AND SOLENOID VOLTAGES MUST BE ADJUSTABLE.

[3] LIGHTWEIGHT, LOW – POWER SOLENOID.

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

PPM — FOCUSED, 100 MW X — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8. TO 12.4 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	20 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

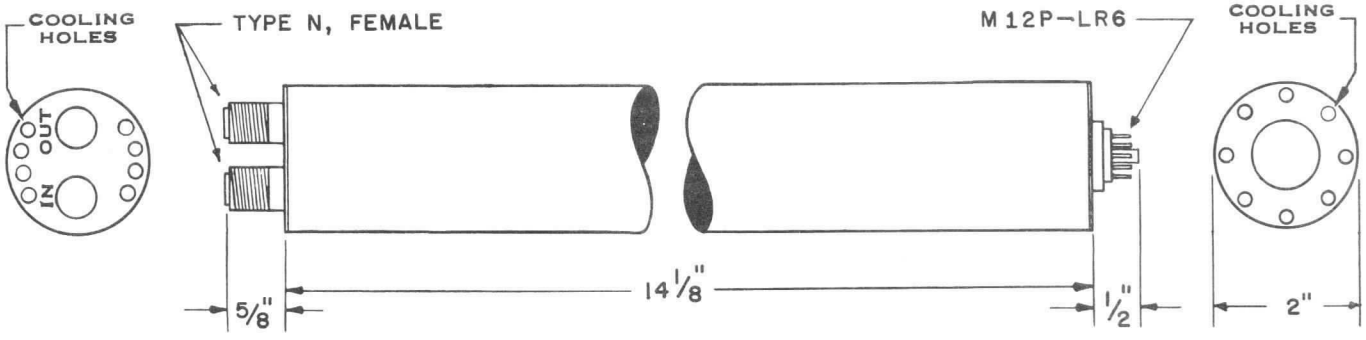
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	2000 TO 2300 V	— —	1.0 MA MAX
COLLECTOR	2000 TO 2300 V	— —	8.0 MA MAX
ANODE	0 TO 800 V	— —	0.1 MA MAX
CATHODE	0 V	— —	8.0 MA MAX
GRID	0* V	— —	0.25 MA MAX
HEATER	7.0 V	— —	1.2 AMP MAX

*A NEGATIVE VOLTAGE CAN BE APPLIED FOR R-F ATTENUATION.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	5 CFM @ 1" OF H_2O
NET WEIGHT	3 1/4 LBS

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, LOW — NOISE UHF — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

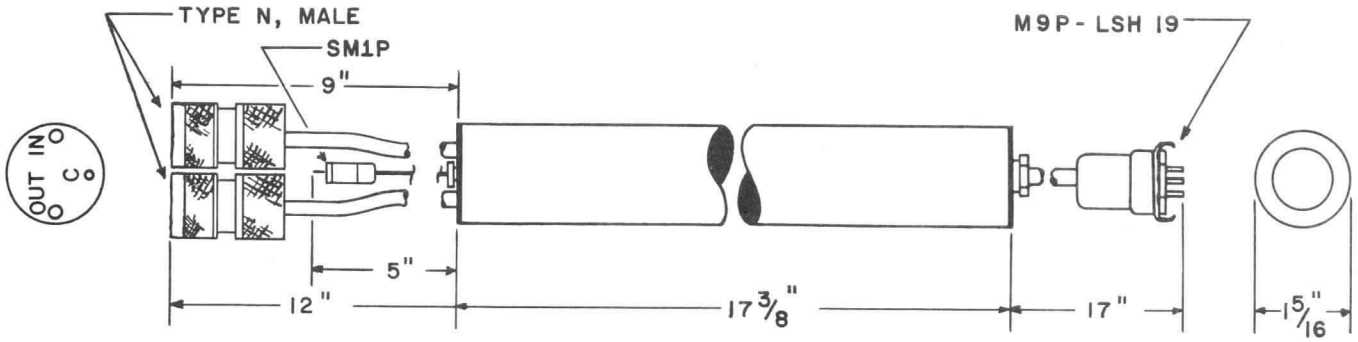
FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE [1]	8 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	70 TO 120 V	— —	0.02 MA MAX
COLLECTOR	* FIXED	— —	2.0 MA MAX
ANODE 1	0 TO 30 V	— —	0.01 MA MAX
ANODE 2	0 TO 30 V	— —	0.01 MA MAX
ANODE 3	0 TO 30 V	— —	0.01 MA MAX
ANODE 4	0 TO 30 V	— —	0.01 MA MAX
CATHODE	0 V	— —	2.0 MA MAX
HEATER	5.0 TO 7.5 V	— —	1.2 AMP MAX
* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 270 TO 400 VOLTS.			

FOCUSING . . . . . SOLENOID, 820 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1 1/2 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, LOW — NOISE L — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

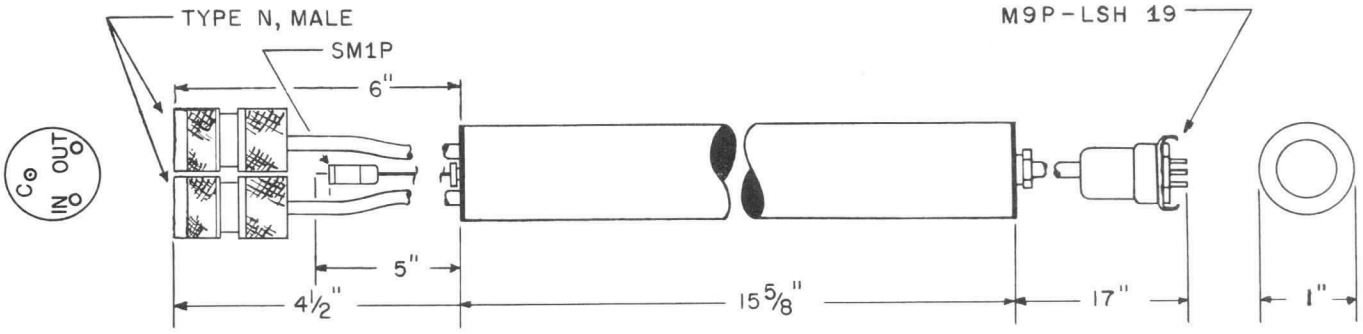
FREQUENCY RANGE	1.0 TO 2.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE [1]	8 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	165 TO 200 V	--	0.01 MA MAX
COLLECTOR	165 TO 500 V	--	2.0 MA MAX
ANODE 1	0 TO 20 V	--	0.01 MA MAX
ANODE 2	0 TO 20 V	--	0.01 MA MAX
ANODE 3	0 TO 150 V	--	0.01 MA MAX
ANODE 4	-25 TO 25 V	--	0.01 MA MAX
CATHODE	0 V	--	2.0 MA MAX
HEATER	5.0 TO 7.5 V	--	0.8 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS *

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.
* SOLENOID VOLTAGE MUST BE ADJUSTABLE OVER A MINIMUM RANGE OF 90 — 115 VOLTS.

CUSTOMERS CONFIRMATION SHEET

SOLENOID	CUSTOMER	TUBE TYPE
BS-27C		HA-80
	DATE 11-22-60	
SOLENOID MANUFACTURE	P.O. NUMBER	TUBE QUANTITY

GENERAL DESCRIPTION: 1.0 TO 2.0 KMC - 7 DB NOISE FIGURE - TWT AMPLIFIER - INSULATED COLLECTOR

R.F. SPECIFICATIONS

FREQUENCY RANGE	1.0 TO 2.0 KMC	GRID ATTENUATION AT V.	-
SMALL SIGNAL GAIN	> 25 DB	SPURIOUS MODULATION	-
SATURATED POWER OUTPUT	> 0 DBM	NOISE FIGURE	≤ 7 DB
SATURATED GAIN	-	V.S.W.R.	< 2:1
PULSE FALL OFF	-	BACK ATTENUATION	-
G2I	-		
MAX. SMALL SIGNAL GAIN VAR.	-		
OSCILLATION CHECK			

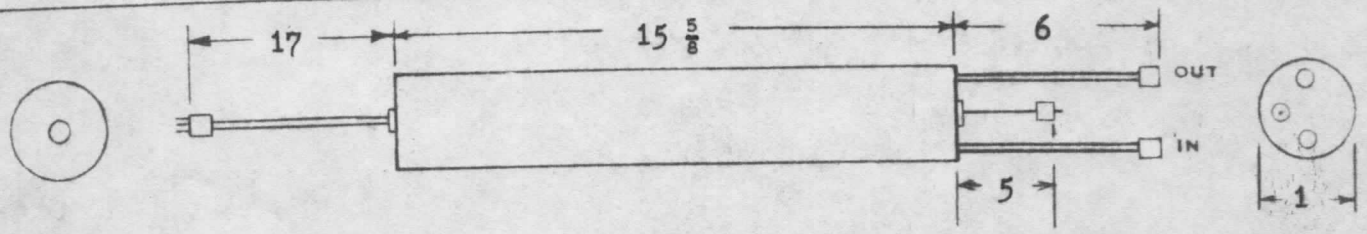
D.C. SPECIFICATIONS

$V_{COLLECTOR}$	300 TO 550	$I_{COLLECTOR}$	< 2.0 MA	$V_{ANODE\ 1}$	0 TO 20	$I_{ANODE\ 1}$	< 10 μA
V_{HELIX}	165 TO 200	I_{HELIX}	< 10 μA	$V_{ANODE\ 2}$	0 TO 20	$I_{ANODE\ 2}$	< 10 μA
V_{SNOUT}	--	I_{SNOUT}	--	$V_{ANODE\ 3}$	0 TO 150	$I_{ANODE\ 3}$	< 10 μA
V_{ANODES}	NOTED *	I_{ANODES}	NOTED	$V_{ANODE\ 4}$	-25 TO 25	$I_{ANODE\ 4}$	< 10 μA
V_{GRID}	--	I_{GRID}	--				
$V_{CATHODE}$	0	$I_{CATHODE}$	< 2.0 MA				
V_{HEATER}	5.0 TO 7.5	I_{HEATER}	< 0.8 A				

VOLTAGE BREAKDOWN OF COLLECTOR

REMARKS:

CAPSULE – COUPLER SPECIFICATIONS



	POWER	R.F. IN	R.F. OUT	COLLECTOR			
CABLE	MULTI CONDUCTOR	RG-142/U		TEFLON INS. WIRE			
CONNECTOR	M9P	N MALE		SM1P			

REMARKS:

A-ANODE 2 D-HELIX H-ANODE 1
B-ANODE 3 E-HEATER J-ANODE 4
C-CAPSULE F-HEATER K-CATHODE

SHIPPING INFORMATION

F 208

CUSTOMERS CONFIRMATION SHEET

SOLENOID	CUSTOMER	TUBE TYPE
PPM		HA - 85
	DATE 2-20-62	
SOLENOID MANUFACTURE	P.O. NUMBER	TUBE QUANTITY

GENERAL DESCRIPTION

1.0 TO 2.0 KMC - PPM FOCUSED TWT AMPLIFIER
INSULATED COLLECTOR

R.F. SPECIFICATIONS

FREQUENCY RANGE	1.0 - 2.0 KMC	GRID ATTENUATION AT V	---
SMALL SIGNAL GAIN	> 25 DB	SPURIOUS MODULATION	---
SATURATED POWER OUTPUT	> 5 DBM	NOISE FIGURE	< 15 DB
SATURATED GAIN	---	V.S.W.R	< 2:1
PULSE FALL OFF	---	BACK ATTENUATION	---
Q.T	---		
MAX. SMALL SIGNAL GAIN VAR	---		
OSCILLATION CHECK			

D.C. SPECIFICATIONS

$V_{COLLECTOR}$	V_H + 400	$I_{COLLECTOR}$	< 3.0 MA	$V_{ANODE\ 1}$	0 - 100	$I_{ANODE\ 1}$	< 20 μA
V_{HELIX}	150 - 250	I_{HELIX}	< 0.25 MA	$V_{ANODE\ 2}$	0 - 100	$I_{ANODE\ 2}$	< 20 μA
V_{SNOUT}	---	I_{SNOUT}	---	$V_{ANODE\ 3}$	0 - 150	$I_{ANODE\ 3}$	< 20 μA
V_{ANODE}	NOTED	I_{ANODE}	NOTED	$V_{ANODE\ 4}$	-100-+10	$I_{ANODE\ 4}$	< 20 μA
V_{GRID}	---	I_{GRID}	---				
$V_{CATHODE}$	0	$I_{CATHODE}$	< 3.0 MA				
V_{HEATER}	5.0 - 7.5	I_{HEATER}	< 1.0 A				

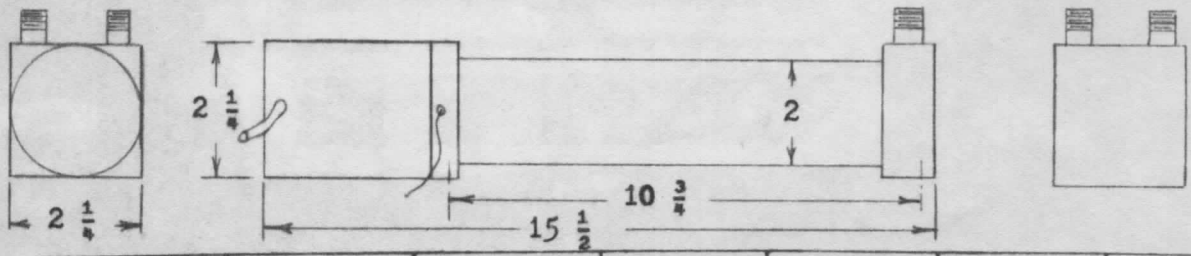
VOLTAGE BREAKDOWN OF COLLECTOR

REMARKS:

POWER CABLE LENGTH INCLUDING CONNECTOR 12 INCHES

COLLECTOR LEAD LENGTH INCLUDING CONNECTOR 12 INCHES

CAPSULE – COUPLER SPECIFICATIONS



	POWER	R F IN	R.F OUT	COLLECTOR			
CABLE	MULTI CONDUCTOR	-	-	TEFLON INS. WIRE			
CONNECTOR	M9P LSH19	N FEMALE		PM1P LSH10			

REMARKS:

A - ANODE 2
B - ANODE 3
C - CAPSULE
D - HELIX
E - HEATER
F - HEATER
H - ANODE 1
J - ANODE 4
K - CATHODE

DATA SHEET - 50-163C
OPR. INST. - 50-19

SHIPPING INFORMATION

F 208J

CUSTOMERS CONFIRMATION SHEET

SOLENOID: BS-26C	CUSTOMER:	TUBE TYPE: HA-86
	DATE: 1-9-61	
SOLENOID MANUFACTURE:	P.O. NUMBER:	TUBE QUANTITY:

GENERAL DESCRIPTION: 0.5 TO 1.0 KMC - 7 DB NOISE FIGURE - TWT AMPLIFIER - INSULATED COLLECTOR

R.F. SPECIFICATIONS

FREQUENCY RANGE	0.5 TO 1.0 KMC	GRID ATTENUATION AT V	-
SMALL SIGNAL GAIN	> 25 DB	SPURIOUS MODULATION	-
SATURATED POWER OUTPUT	> 0 DBM	NOISE FIGURE	< 7 DB
SATURATED GAIN	-	V.S.W.R.	< 2:1
PULSE FALL OFF	-	BACK ATTENUATION	-
GIT	-		
MAX. SMALL SIGNAL GAIN VAR	-		
OSCILLATION CHECK			

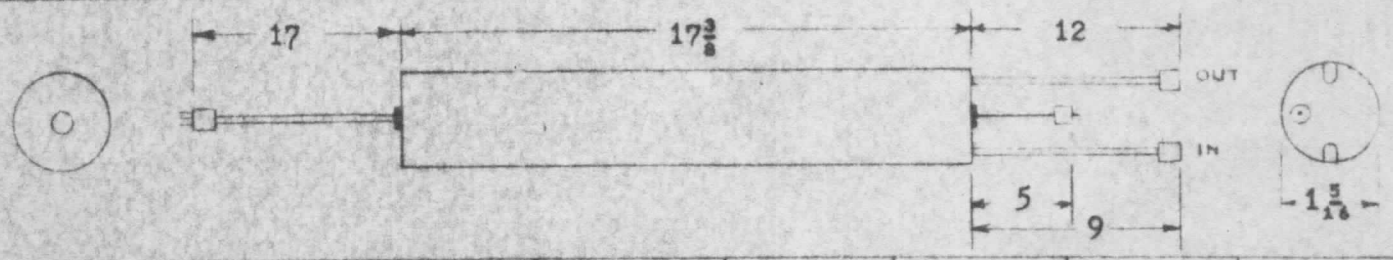
D.C. SPECIFICATIONS

$V_{COLLECTOR}$	350 TO 430	$I_{COLLECTOR}$	< 2.0 MA	$V_{ANODE\ 1}$	0 TO 30	$I_{ANODE\ 1}$	< 10 μA
V_{HELIX}	75 TO 120	I_{HELIX}	< 20 μA	$V_{ANODE\ 2}$	0 TO 30	$I_{ANODE\ 2}$	< 10 μA
V_{SNOUT}	--	I_{SNOUT}	--	$V_{ANODE\ 3}$	0 TO 30	$I_{ANODE\ 3}$	< 10 μA
V_{ANODE}	NOTED	I_{ANODE}	NOTED	$V_{ANODE\ 4}$	0 TO 30	$I_{ANODE\ 4}$	< 10 μA
V_{GRID}	--	I_{GRID}	--				
$V_{CATHODE}$	0	$I_{CATHODE}$	< 2.0 MA				
V_{HEATER}	5.0 TO 7.5	I_{HEATER}	< 1.0 A				

VOLTAGE BREAKDOWN OF COLLECTOR

REMARKS:

CAPSULE – COUPLER SPECIFICATIONS



	POWER	R.F. IN	R.F. OUT	COLLECTOR			
CABLE	MULTI CONDUCTOR	RG-142/U		TEFLON INS. WIRE			
CONNECTOR	M9P	N MALE		SM1P			

REMARKS:

A-ANODE 2	D-HELIX	H-ANODE 1
B-ANODE 3	E-HEATER	J-ANODE 4
C-CAPSULE	F-HEATER	K-CATHODE

SHIPPING INFORMATION

F 208A4

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, LOW — NOISE S — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

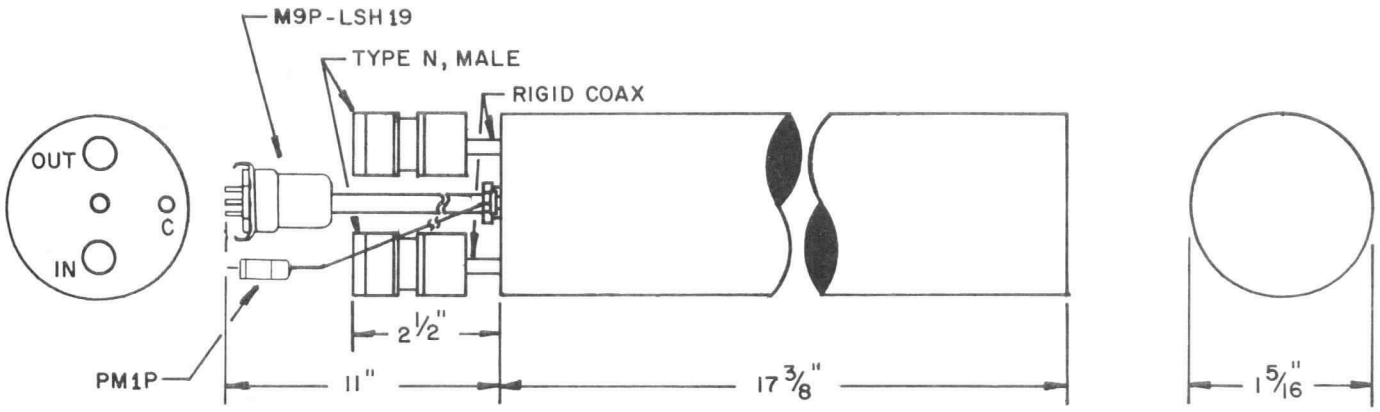
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL-SIGNAL GAIN	20 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
NOISE FIGURE [1]	8 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	375 TO 450 V	— —	0.02 MA MAX
COLLECTOR *	V_H + 400 V	— —	2.0 MA MAX
ANODE 1	0 TO 75 V	— —	0.01 MA MAX
ANODE 2	0 TO 100 V	— —	0.01 MA MAX
ANODE 3	0 TO 150 V	— —	0.01 MA MAX
ANODE 4	0 TO − 75 V	— —	0.01 MA MAX
CATHODE	0 V	— —	2.0 MA MAX
HEATER	5.0 TO 6.5 V	— —	1.1 AMP MAX

FOCUSING . . . . . SOLENOID, BS — 67C*

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	2 1/2 LBS

[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.
*COLLECTOR AND SOLENOID VOLTAGES MUST BE ADJUSTABLE.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, LOW — NOISE S — BAND AMPLIFIER

THE HA - 89 CAN BE SUPPLIED TO PROVIDE VERY LOW NOISE PERFORMANCE OVER SELECTED PORTIONS OF THE S - BAND.

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	MAXIMUM NOISE FIGURE	MINIMUM SMALL - SIGNAL GAIN	MINIMUM SATURATION POWER OUTPUT	MAXIMUM INPUT AND OUTPUT VSWR
2.2 TO 2.3 KMC	4.5 DB	25 DB	10 MW	2:1
2.3 TO 2.7 KMC	4.5 DB	25 DB	10 MW	2:1
2.9 TO 3.1 KMC	5.5 DB	25 DB	10 MW	2:1
3.4 TO 3.6 KMC	5.5 DB	25 DB	10 MW	2:1

OPERATING CHARACTERISTICS

SAME AS SPECIFIED FOR STANDARD HA - 89

FOCUSING: BS - 67C, LIGHTWEIGHT (APPROXIMATELY 22 LBS) AND LOW POWER (150 WATTS MAX)

MECHANICAL CHARACTERISTICS

SAME AS SPECIFIED FOR STANDARD HA - 89.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

TENTATIVE DATA
PULSED X–BAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.0 TO 11.0 KMC
PEAK POWER OUTPUT	1 WATT (MIN.)
SATURATION GAIN	28 DB (MIN.)
DUTY RATIO	0.03 (MAX.)

POWER SUPPLY REQUIREMENTS[1]

PEAK CATHODE CURRENT	50 MA (MAX.)
PEAK HELIX CURRENT	15 MA (MAX.)
PEAK PULSED GRID VOLTAGE (FORWARD)	100 VOLTS (MAX.)
PEAK GRID CURRENT	5 MA (MAX.)
AVERAGE CATHODE CURRENT WITH ZERO BIAS	5 MA (MAX.)
ANODE VOLTAGE (NOT PULSED)	1900 TO 2300 VOLTS
HELIX AND COLLECTOR VOLTAGE	2100 TO 2600 VOLTS
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	1.5 AMPS (MAX.)
MAGNETIC FIELD	1000 GAUSS
ANODE VOLTAGE (NOT PULSED)	1900 TO 2600 VOLTS
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	1.5 AMPS (MAX.)
MAGNETIC FIELD	1000 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTORS	TYPE N MALE
DC CONNECTOR	WINCHESTER PM6P*
CAPSULE LENGTH	14 3/4 INCHES
CABLE LENGTHS (CAPSULE TO END OF CONNECTOR)	
RF CABLES INPUT	12.0 INCHES
RF CABLES OUTPUT	12.0 INCHES
POWER CABLE	17.0 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

* SUPPLIED WITH MATING CONNECTOR.

1ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. STANDARD TUBE IS SUPPLIED WITH COLLECTOR GROUNDED TO THE CAPSULE.

2PULSED GRID VOLTAGE MUST BE ADJUSTABLE FROM ZERO VOLTS FOR INITIAL FOCUSING PURPOSES.

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California

TENTATIVE DATA[1]

PULSED S—BAND TRAVELING WAVE TUBE AMPLIFIER
(ANODE PULSED)

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	2.0 – 4.0 KMC	
	PULSED OPERATION	CW OPERATION
POWER OUTPUT	10 WATT (MIN.)	1 WATT (MIN.)
SATURATION GAIN	27 DB (MIN.)	27 DB (MIN.)
SMALL SIGNAL GAIN	30 DB (MIN.)	30 DB (MIN.)
DUTY RATIO	0.1 (MAX.)	

OPERATING CHARACTERISTICS

	PULSED OPERATION	CW OPERATION
CATHODE CURRENT	60 MA (MAX.)	25.0 MA (MAX.)
HELIX CURRENT	1.0 MA (MAX.)	0.1 MA (MAX.)
ANODE VOLTAGE[3]	450–600 VOLTS	200–300 VOLTS
HELIX AND COLLECTOR VOLTAGE[2]	900–1100 VOLTS	850–950 VOLTS
HEATER VOLTAGE	7.0 VOLTS	
HEATER CURRENT	1.0 AMPS	
MAGNETIC FIELD	1000 GAUSS	

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER M7MP
CAPSULE LENGTH	13 1/2 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

PRICE $1000.00

DELIVERY 6 TO 8 WEEKS

1 THIS SUPERCEDS DATA SHEET PA–3 /1/ 6–1–57.

2 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR MAY BE INSULATED AND THUS ANY ELECTRODE OPERATED AT GROUND POTENTIAL.

3 ANODE SUPPLY MUST BE ADJUSTABLE FROM ZERO VOLTS FOR INITIAL FOCUSING PURPOSES.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, 1 — WATT S — BAND PULSE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 2.0 TO 4.0 KMC
MAXIMUM DUTY CYCLE 0.10
VSWR, INPUT AND OUTPUT . . . . . 2:1 MAX

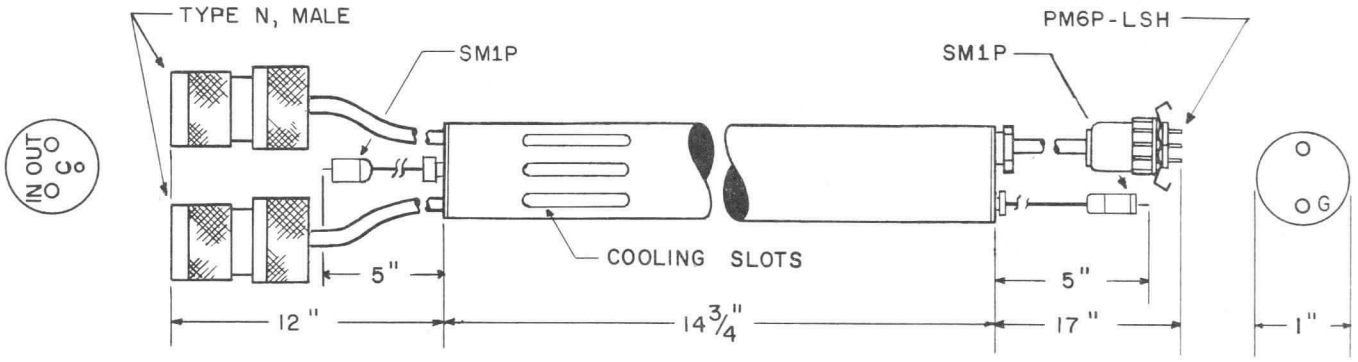
CHARACTERISTIC	PULSED OPERATION			CW OPERATION		
SMALL SIGNAL GAIN	33	DB	MIN	25	DB	MIN
SATURATION GAIN	30	DB	MIN	20	DB	MIN
POWER OUTPUT	30	DBM	MIN	20	DBM	MIN

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *				CW OPERATION			
HELIX AND COLLECTOR VOLTAGE	800	TO	950	V	800	TO	950	V
ANODE VOLTAGE	200	TO	700	V	200	TO	700	V
GRID VOLTAGE	0	TO	150	V	0	TO	100	V
HEATER VOLTAGE			7.0	V			7.0	V
HELIX CURRENT	5.0	MA	MAX		0.3	MA	MAX	
COLLECTOR CURRENT	50.0	MA	MAX		20.0	MA	MAX	
ANODE CURRENT	0.10	MA	MAX		0.10	MA	MAX	
GRID CURRENT	15.0	MA	MAX		5.0	MA	MAX	
CATHODE CURRENT	50.0	MA	MAX		20.0	MA	MAX	
HEATER CURRENT	1.2	AMP	MAX		1.2	AMP	MAX	

FOCUSING. . . . . SOLENOID, 600 GAUSS

MECHANICAL CHARACTERISTICS

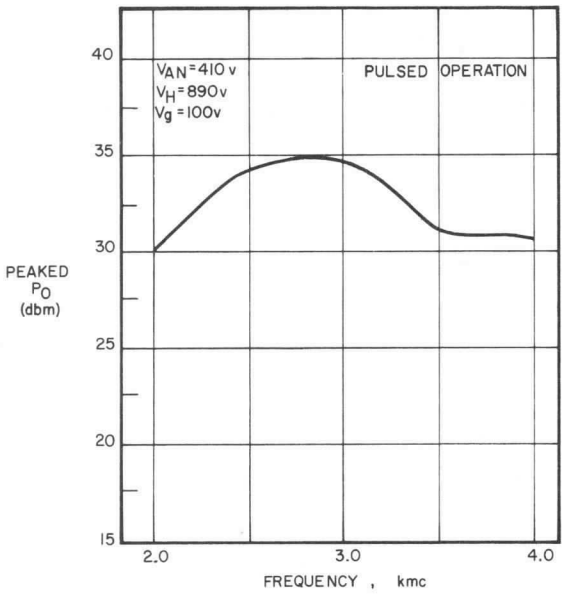


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . CHROME
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

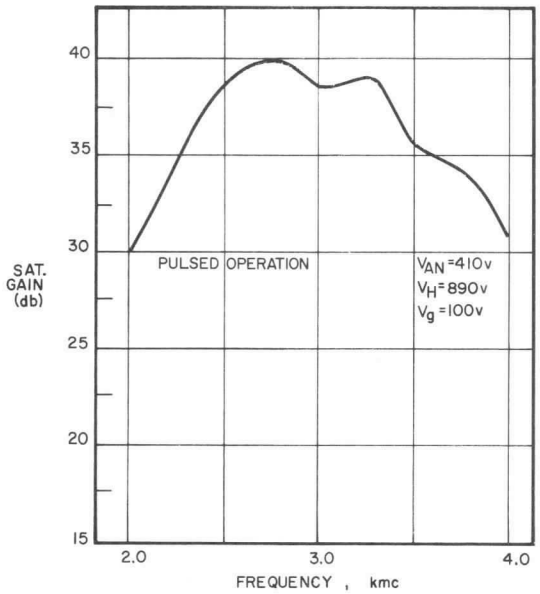
* PEAK VALUES

HUGGINS LABORATORIES, INC.

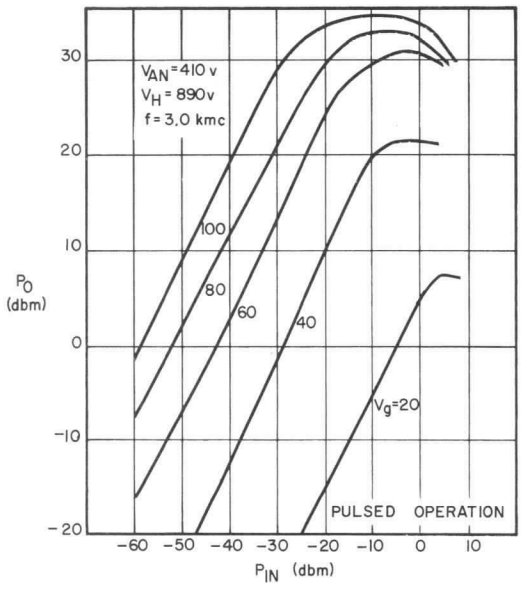
TYPICAL OPERATING CHARACTERISTICS



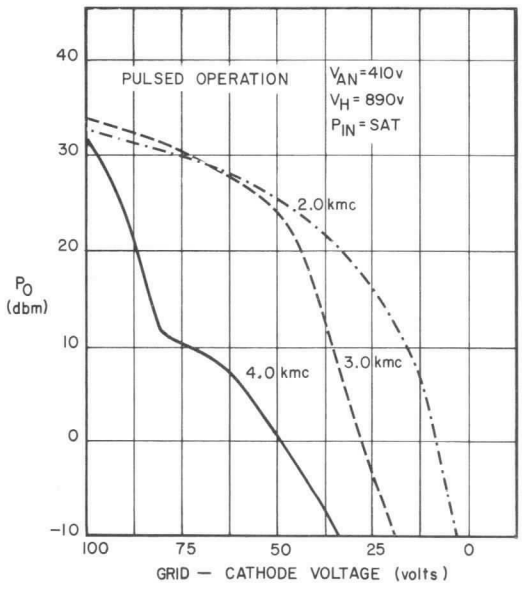
POWER OUTPUT



SATURATION GAIN



TRANSFER CHARACTERISTICS



GRID CONTROL

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, 300 — MW X — BAND PULSE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 8.0 TO 12.4 KMC
MAXIMUM DUTY CYCLE 0.1
VSWR, INPUT AND OUTPUT . . . . . 2:1 MAX

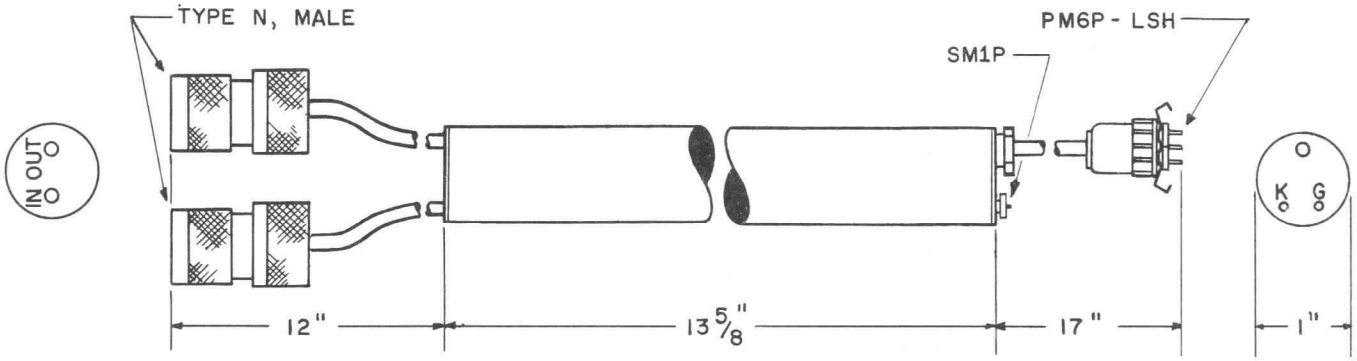
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	23 DB MIN
SATURATION GAIN	23 DB MIN	15 DB MIN
POWER OUTPUT	25 DBM MIN	17 DBM MIN

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *	CW OPERATION
HELIX AND COLLECTOR VOLTAGE	1800 TO 2300 V	1800 TO 2300 V
ANODE VOLTAGE	0 TO 750 V	0 TO 750 V
GRID VOLTAGE	0 TO 250 V	0 TO 50 V
HEATER VOLTAGE	7.0 V	7.0 V
HELIX CURRENT	10.0 MA MAX	0.5 MA MAX
COLLECTOR CURRENT	50.0 MA MAX	10.0 MA MAX
ANODE CURRENT	0.10 MA MAX	0.10 MA MAX
GRID CURRENT	15.0 MA MAX	3.0 MA MAX
CATHODE CURRENT	50.0 MA MAX	10.0 MA MAX
HEATER CURRENT	1.2 AMP MAX	1.2 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

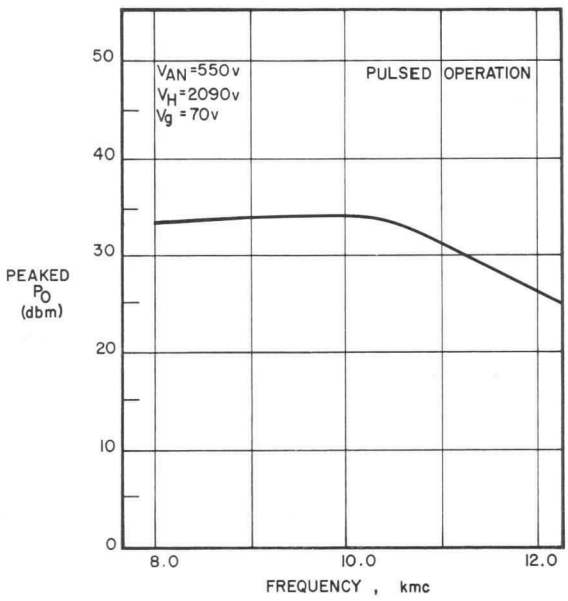
MECHANICAL CHARACTERISTICS



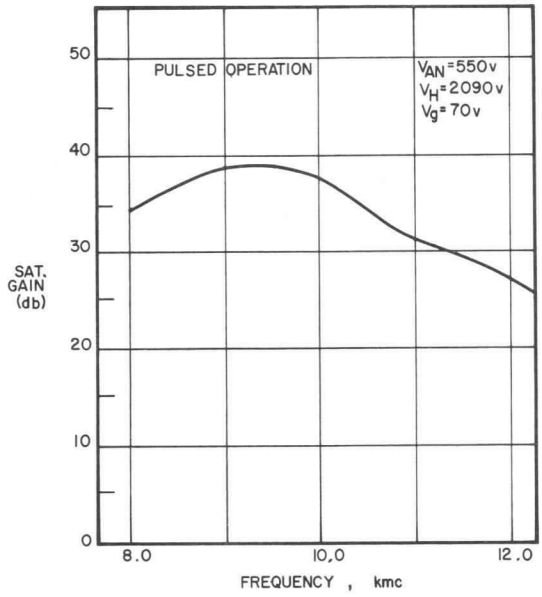
CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . CHROME
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

* PEAK VALUE

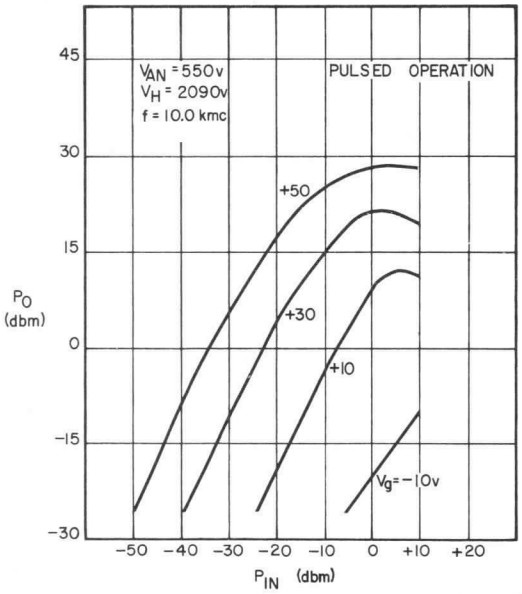
TYPICAL OPERATING CHARACTERISTICS



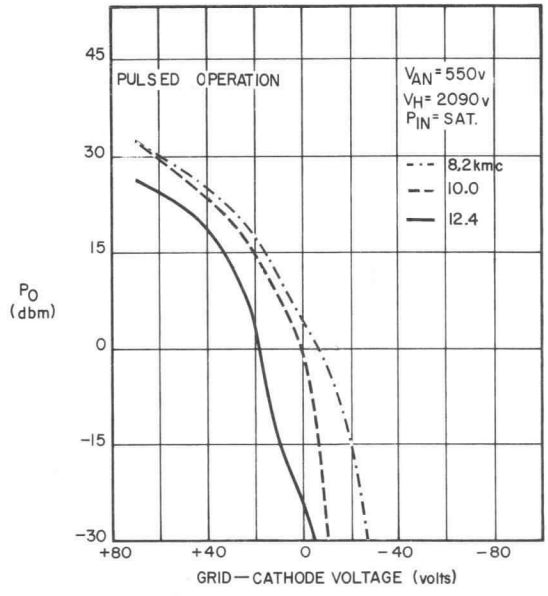
POWER OUTPUT



SATURATION GAIN



TRANSFER CHARACTERISTICS

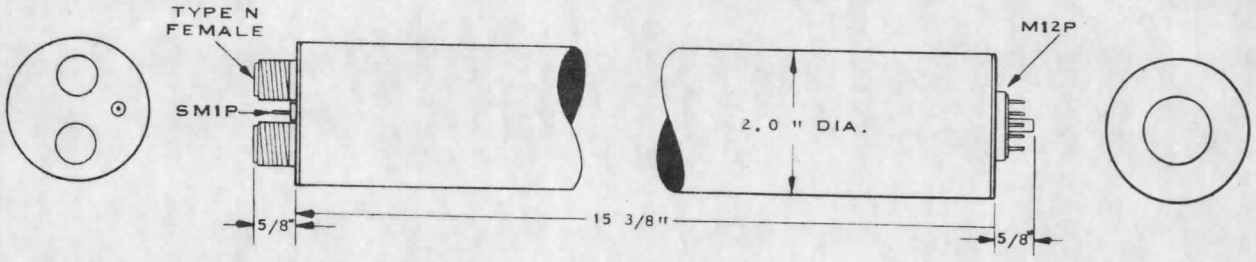


GRID CONTROL

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California

TENTATIVE DATA

PERMANENT MAGNET FOCUSED PULSED S–BAND TRAVELING WAVE TUBE AMPLIFIER



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	2.0 TO 4.0 KMC	
	PULSED OPERATION	CW OPERATION
POWER OUTPUT	1 WATT (MIN.)	100 MW (MIN.)
SATURATION GAIN	30 DB (MIN.)	20 DB (MIN.)
SMALL SIGNAL GAIN	33 DB (MIN.)	25 DB (MIN.)
DUTY RATIO	0.1 (MAX.)	

POWER SUPPLY REQUIREMENTS[1]

	PULSED OPERATION PEAK VALUES	CW OPERATION
CATHODE CURRENT	60.0 MA (MAX.)	15.0 MA (MAX.)
HELIX CURRENT	10.0 MA (MAX.)	0.2 MA (MAX.)
GRID VOLTAGE	150 VOLTS (MAX.)	60 VOLTS (MAX.)
GRID CURRENT	15 MA (MAX.)	3 MA (MAX.)
ANODE VOLTAGE (NOT PULSED)	200 TO 600 VOLTS	200 TO 600 VOLTS
HELIX AND COLLECTOR VOLTAGE	800 TO 950 VOLTS	
HEATER VOLTAGE	7.0 VOLTS	
HEATER CURRENT	1.0 AMPS	
MAGNETIC FIELD	600 GAUSS	

MECHANICAL CHARACTERISTICS

RF CONNECTORS	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER M12P ON CAPSULE*
CAPSULE LENGTH	15 3/8 INCHES
CAPSULE DIAMETER	2.0 INCHES
NET WEIGHT	5.0 POUNDS

* SUPPLIED WITH MATING CONNECTOR.

1. ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS INSULATED AND THUS ANY ELECTRODE OPERATED AT GROUND POTENTIAL.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

TENTATIVE DATA

PULSED C–BAND TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 TO 8.0 KMC	
	PULSED OPERATION	CW OPERATION
POWER POUTPUT	1 WATT (MIN.)	100 MW (MIN.)
SATURATION GAIN	30 DB (MIN.)	20 DB (MIN.)
SMALL SIGNAL GAIN	33 DB (MIN.)	25 DB (MIN.)
DUTY RATIO	0.1 (MAX.)	

POWER SUPPLY REQUIREMENTS[1]

	PULSED OPERATION PEAK VALUES	CW OPERATION
CATHODE CURRENT	60.0 MA (MAX.)	15.0 MA (MAX.)
HELIX CURRENT	10.0 MA (MAX.)	0.2 MA (MAX.)
GRID VOLTAGE	150 VOLTS (MAX.)	60 VOLTS (MAX.)
GRID CURRENT	15 MA (MAX.)	3 MA (MAX.)
ANODE VOLTAGE[2] (NOT PULSED)	100 TO 600 VOLTS	100 TO 600 VOLTS
HELIX AND COLLECTOR VOLTAGE	1200 TO 1600 VOLTS	
HEATER VOLTAGE	7.0 VOLTS	
HEATER CURRENT	1.2 AMPS	
MAGNETIC FIELD	1100 GAUSS	

MECHANICAL CHARACTERISTICS

RF CONNECTORS	TYPE N MALE
DC CONNECTOR	WINCHESTER PM6P*
GRID CONNECTOR	WINCHESTER SM1P*
CAPSULE LENGTH	13 5/8 INCHES
CABLE LENGTHS (CAPSULE TO END OF CONNECTOR)	
RF CABLES INPUT	12.0 INCHES
RF CABLES OUTPUT	12.0 INCHES
POWER CABLE	17.0 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

* SUPPLIED WITH MATING CONNECTOR.

1 ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR MAY BE INSULATED AND THUS ANY ELECTRODE OPERATED AT GROUND POTENTIAL

2 ANODE SUPPLY MUST BE ADJUSTABLE FROM ZERO VOLTS FOR INITIAL FOCUSING PURPOSES.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

PPM – FOCUSED, 1 WATT C – BAND AMPLIFIER
(HIGH Mu GRID)

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 4.0 TO 8.0 KMC

MAXIMUM DUTY CYCLE 0.1

VSWR, INPUT AND OUTPUT . . . . . 2:1 MAX

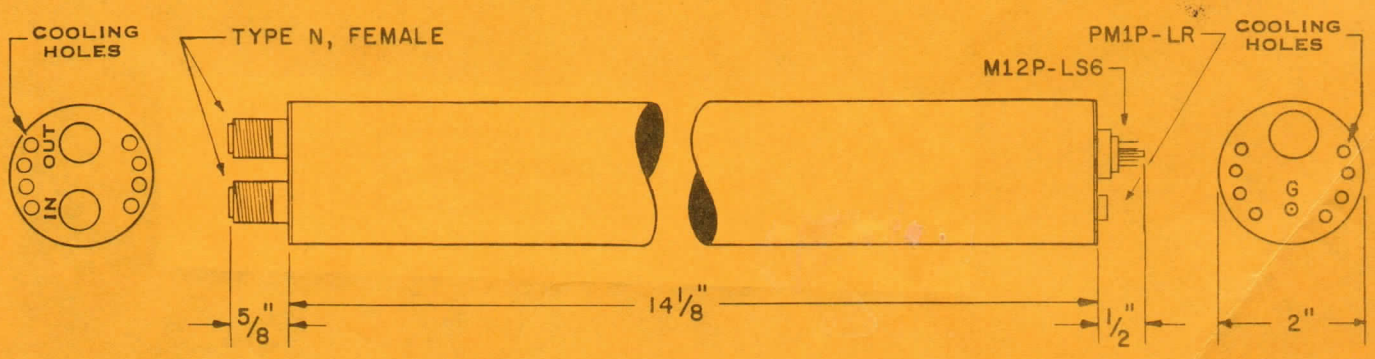
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	27 DB MIN
SATURATION GAIN	30 DB MIN	20 DB MIN
POWER OUTPUT	30 DBM MIN	27 DBM MIN

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *	CW OPERATION
HELIX AND COLLECTOR VOLTAGE	1200 TO 1600 V	1200 TO 1500 V
ANODE VOLTAGE	0 TO 600 V	0 TO 700 V
GRID VOLTAGE	0 TO 150 V	0 TO 150 V
HEATER VOLTAGE	7.0 V	7.0 V
HELIX CURRENT	10.0 MA MAX	2.0 MA MAX
COLLECTOR CURRENT	35.0 MA MAX	25.0 MA MAX
ANODE CURRENT	0.1 MA MAX	0.150 MA MAX
CATHODE CURRENT	35.0 MA MAX	30.0 MA MAX
GRID CURRENT	15.0 MA MAX	10.0 MA MAX
HEATER CURRENT	1.2 AMP MAX	1.2 AMP MAX

FOCUSING. . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . CHROME

END CAP FINISH . . . . . BLACK ANODIZED

AUXILIARY COOLING REQUIRED . . . . . AIR: 5 CFM @ 1" WATER

NET WEIGHT . . . . . 5 1/2 LBS

* PEAK VALUES

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

PPM – FOCUSED, 1 – WATT 8.0 TO 11.0 KMC PULSED AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 8.0 TO 11.0 KMC
MAXIMUM DUTY CYCLE 0.03
VSWR, INPUT AND OUTPUT . . . . . 2:1 MAX

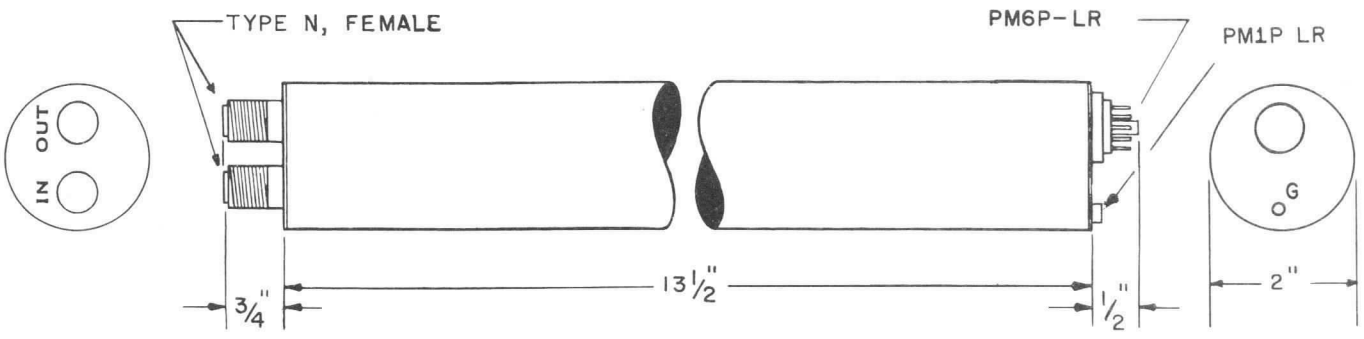
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	NOT APPLICABLE
SATURATION GAIN	27 DB MIN	NOT APPLICABLE
POWER OUTPUT	30 DBM MIN	NOT APPLICABLE

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *	CW OPERATION
HELIX AND COLLECTOR VOLTAGE	2000 TO 2600 V	NOT APPLICABLE
ANODE VOLTAGE	1500 TO 3000 V	NOT APPLICABLE
GRID VOLTAGE	0 TO 100 V	NOT APPLICABLE
HEATER VOLTAGE	7.0 V	NOT APPLICABLE
HELIX CURRENT	15 MA MAX	NOT APPLICABLE
COLLECTOR CURRENT	35 MA MAX	NOT APPLICABLE
ANODE CURRENT	3 MA MAX	NOT APPLICABLE
CATHODE CURRENT	50 MA MAX	NOT APPLICABLE
GRID CURRENT	5 MA MAX	NOT APPLICABLE
HEATER CURRENT	1.4 AMP MAX	NOT APPLICABLE

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . NONE
NET WEIGHT . . . . . 5 1/4 LBS

* PEAK VALUES

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

PPM – FOCUSED, 10 – WATT S – BAND PULSE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 2.0 TO 4.0 KMC
MAXIMUM DUTY CYCLE 0.1
VSWR, INPUT AND OUTPUT . . . . . 2:1 MAX

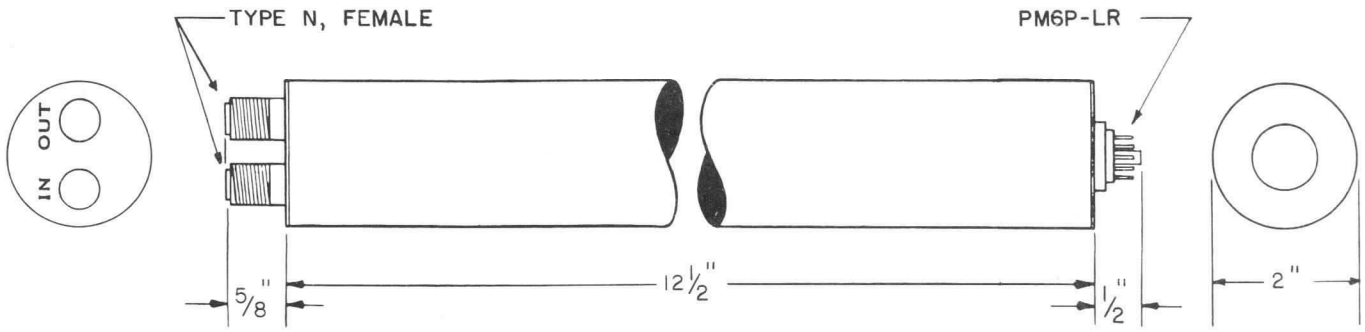
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MAX	NOT APPLICABLE
SATURATION GAIN	27 DB MAX	NOT APPLICABLE
POWER OUTPUT	40 DBM MAX	NOT APPLICABLE

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *	CW OPERATION
HELIX AND COLLECTOR VOLTAGE	900 TO 1100 V	NOT APPLICABLE
ANODE VOLTAGE	450 TO 700 V	NOT APPLICABLE
GRID VOLTAGE	NOT APPLICABLE	NOT APPLICABLE
HEATER VOLTAGE	7.0 V	NOT APPLICABLE
HELIX CURRENT	1.0 MA MAX	NOT APPLICABLE
COLLECTOR CURRENT	60.0 MA MAX	NOT APPLICABLE
ANODE CURRENT	0.1 MA MAX	NOT APPLICABLE
GRID CURRENT	NOT APPLICABLE	NOT APPLICABLE
CATHODE CURRENT	60.0 MA MAX	NOT APPLICABLE
HEATER CURRENT	1.2 AMP MAX	NOT APPLICABLE

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . NONE
NET WEIGHT . . . . . 5 1/4 LBS

* PEAK VALUES

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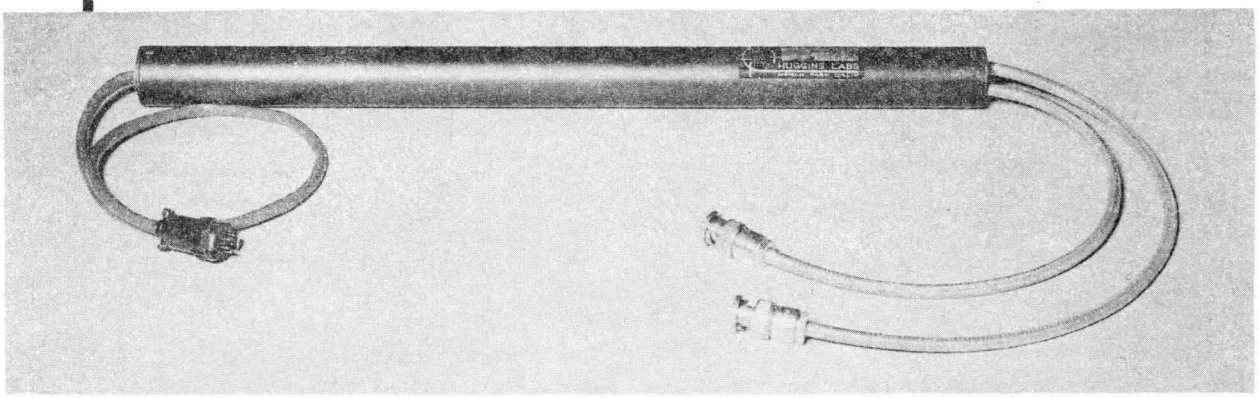


NARROW BAND - VOLTAGE TUNED AMPLIFIER

GENERAL CHARACTERISTICS

ELECTRICAL

FREQUENCY RANGE		2.0 - 4.0 KMc
SMALL SIGNAL GAIN	Swept Anode[1]	Fixed Anode
	2.0 KMc 22 db	10 db
	4.0 KMc 28 db	28 db
BANDWIDTH (5 db down)		15% to 20% of center frequency

OPERATING

HELIX VOLTAGE	2.0 KMc 2280 ±100 volts 4.0 KMc 1160 ± 50 volts
COLLECTOR VOLTAGE	Helix Voltage
CATHODE CURRENT	0.75 ma (Fixed Anode)
ANODE VOLTAGE	450 - 600 volts (Fixed Anode)
ANODE CURRENT	50 ua (Max.)
HEATER VOLTAGE.	6.3 volts
HEATER CURRENT.	0.75 amperes
MAGNETIC FIELD.	100 gauss

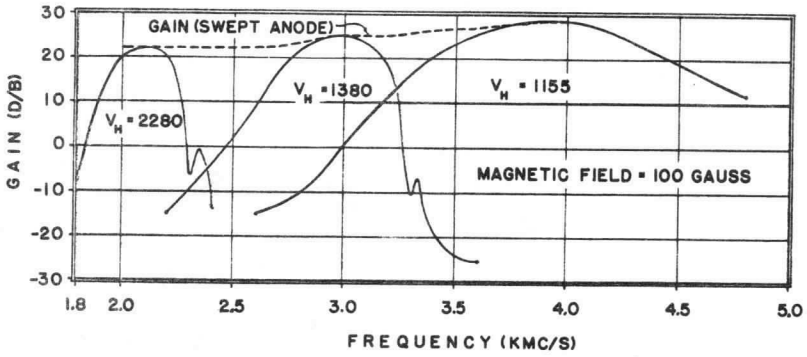
MECHANICAL

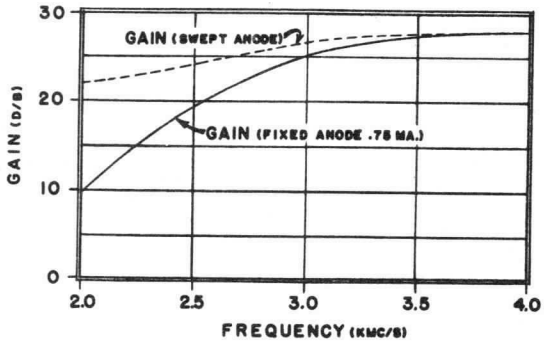
R.F. CONNECTORS	BNC Male UG-88C/U
D.C. CONNECTORS	Octal or Winchester (M7P)[2]
CAPSULE LENGTH[3]	17½ inches
CAPSULE DIAMETER.	1 inch
NET WEIGHT.	1 pound
SHIPPING WEIGHT	11 pounds

1 A portion of the helix voltage is applied to the anode and the instantaneous beam current is higher during the low frequency portion of the sweep cycle. This operation can be obtained only if helix voltage is swept as a function of time.
2 Supplied with mating receptacle.
3 Length may vary as a function of tube specifications.

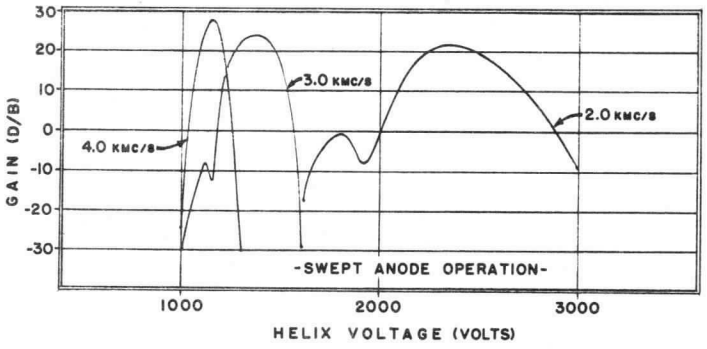
DHA-1

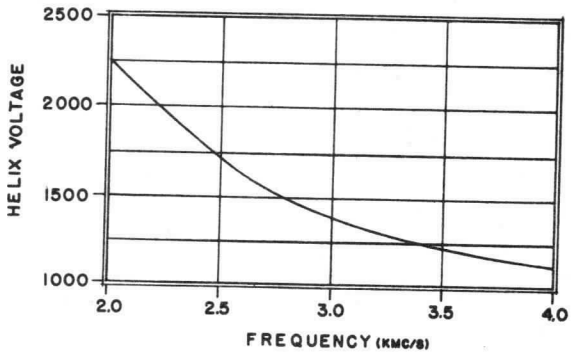
PERFORMANCE





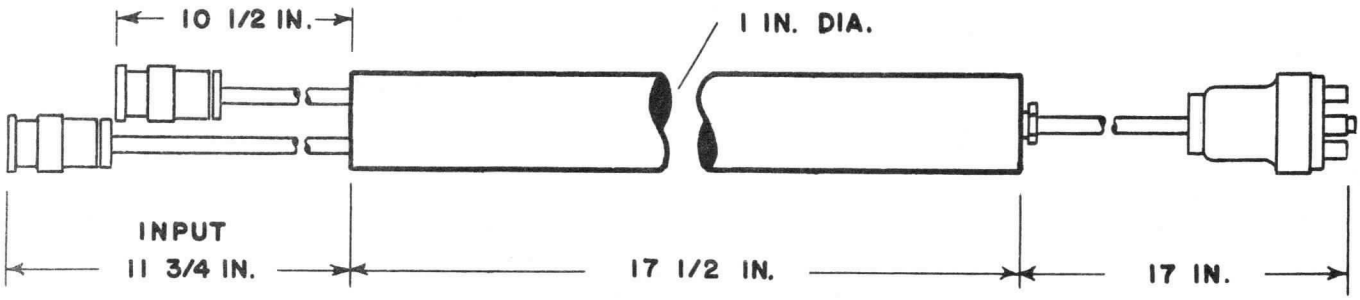
GAIN CHARACTERISTICS





VOLTAGE CHARACTERISTICS

DIMENSIONS



Note: Other lead lengths or connectors may be specified.

SOLENOID

AS-9B

HUGGINS LABORATORIES, INC.
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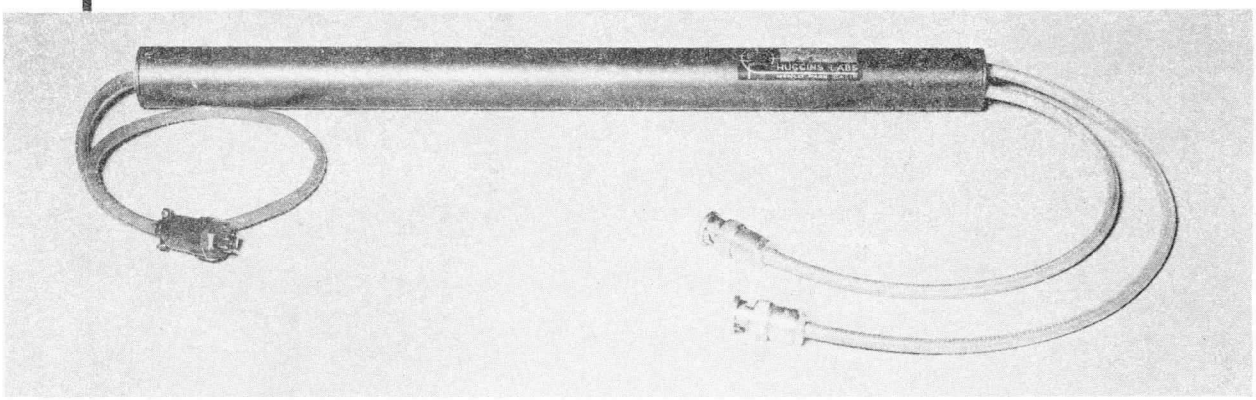


NARROW BAND - VOLTAGE TUNED AMPLIFIER

GENERAL CHARACTERISTICS

ELECTRICAL

FREQUENCY RANGE		1.0 - 2.0 KMc	
SMALL SIGNAL GAIN		Swept Anode[1]	Fixed Anode
	1.0 KMc	15 db	3 db
	2.0 KMc	33 db	33 db
BANDWIDTH (5 db down)		15% to 20% of center frequency	

OPERATING

HELIX VOLTAGE	1.0 KMc 920 ±100 volts 2.0 KMc 380 ± 50 volts
COLLECTOR VOLTAGE	Helix Voltage
CATHODE CURRENT	0.2 ma (Fixed Anode)
ANODE VOLTAGE	200 - 350 volts (Fixed Anode)
ANODE CURRENT	50 ua (Max.)
HEATER VOLTAGE	6.3 volts
HEATER CURRENT	0.75 amperes
MAGNETIC FIELD	100 gauss

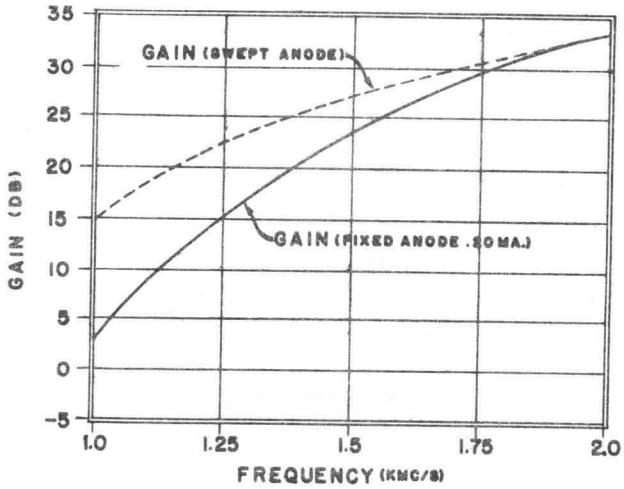
MECHANICAL

R.F. CONNECTORS	BNC Male UG-88C/U
D.C. CONNECTORS	Octal or Winchester (M7P)[2]
CAPSULE LENGTH[3]	17½ inches
CAPSULE DIAMETER	1 inch
NET WEIGHT	1 pound
SHIPPING WEIGHT	11 pounds

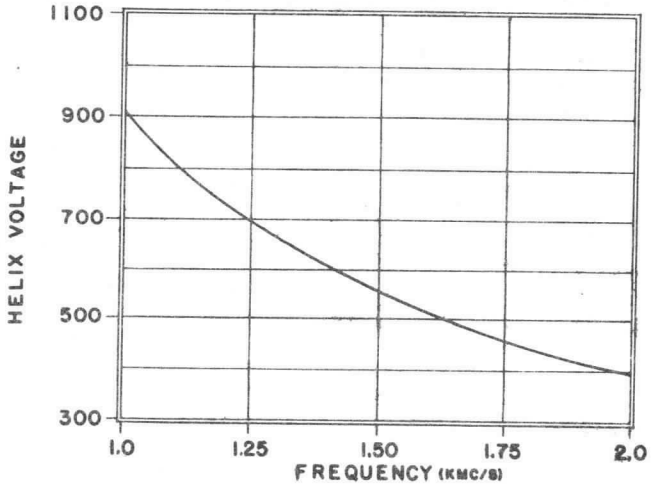
1 A portion of the helix voltage is applied to the anode so that the beam current is higher when tuned to the lower frequencies.
2 Supplied with mating receptacle.
3 Length may vary as a function of tube specifications.

DHA-2

PERFORMANCE

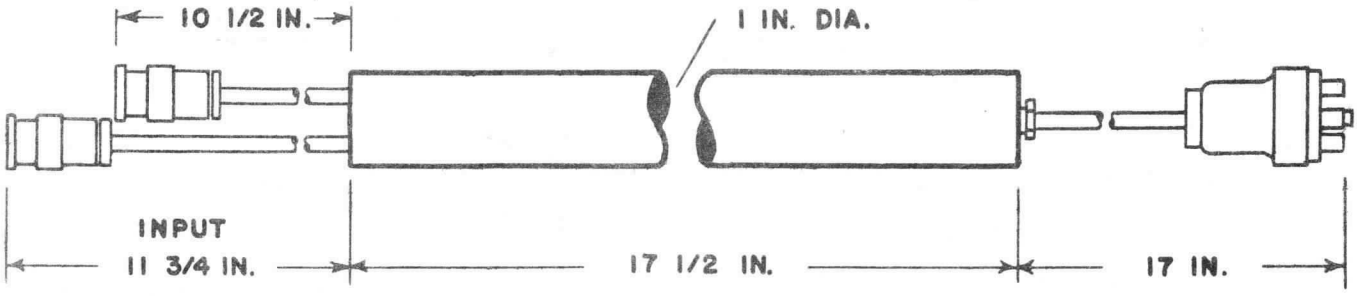


GAIN CHARACTERISTICS



VOLTAGE CHARACTERISTICS

DIMENSIONS

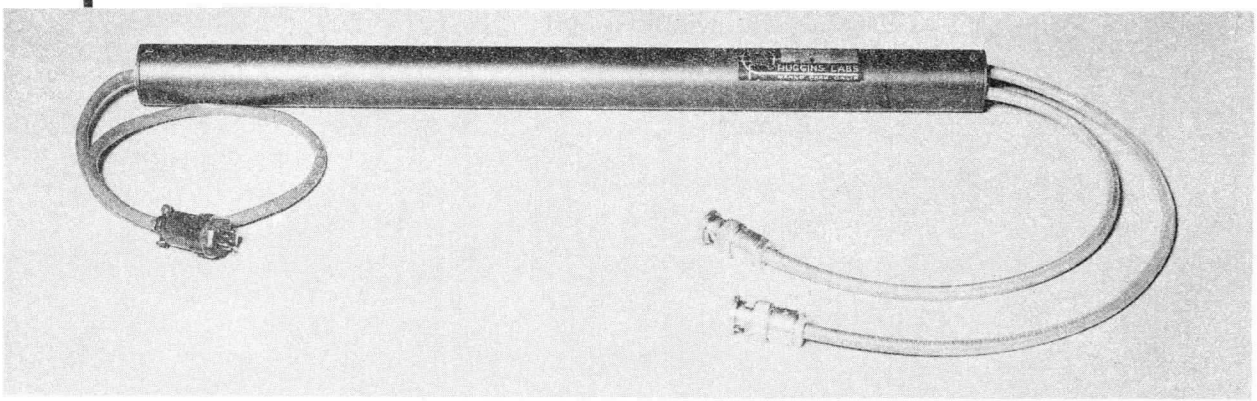


Note: Other lead lengths or connectors may be specified.

SOLENOID

AS-9B

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California



NARROW BAND - VOLTAGE TUNED AMPLIFIER

GENERAL CHARACTERISTICS

ELECTRICAL

FREQUENCY RANGE	0.5 - 1.0 KMc	
SMALL SIGNAL GAIN	Swept Anode[1]	Fixed Anode
	0.5 KMc 13 db	2 db
	1.0 KMc 33 db	33 db
BANDWIDTH (5 db down)	15% to 20% of center frequency	

OPERATING

HELIX VOLTAGE	0.5 KMc 1015 ±50 volts 1.0 KMc 505 ±50 volts
COLLECTOR VOLTAGE	Helix Voltage
CATHODE CURRENT	1.35 ma (Fixed Anode)
ANODE VOLTAGE	300 - 450 volts (Fixed Anode)
ANODE CURRENT	50 ua (Max.)
HEATER VOLTAGE.	6.3 volts
HEATER CURRENT.	0.75 amperes
MAGNETIC FIELD.	100 gauss

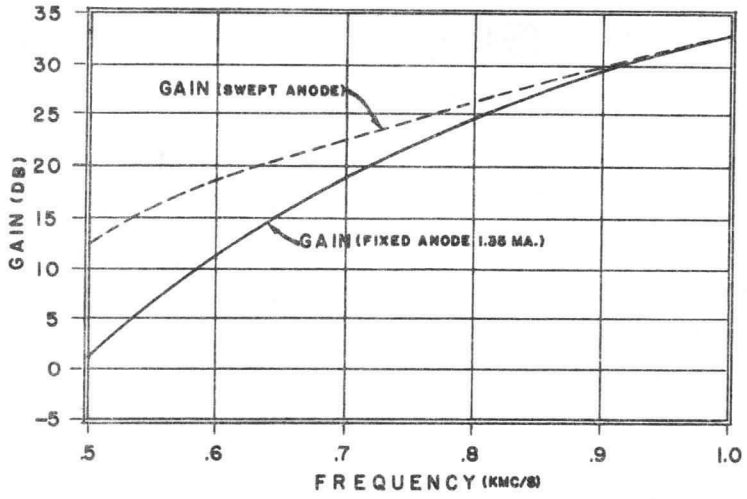
MECHANICAL

R.F. CONNECTORS	BNC Male UG-88C/U
D.C. CONNECTORS	Octal or Winchester (M7P)[2]
CAPSULE LENGTH[3]	17½ inches
CAPSULE DIAMETER.	1 inch
NET WEIGHT.	1 pound
SHIPPING WEIGHT	11 pounds

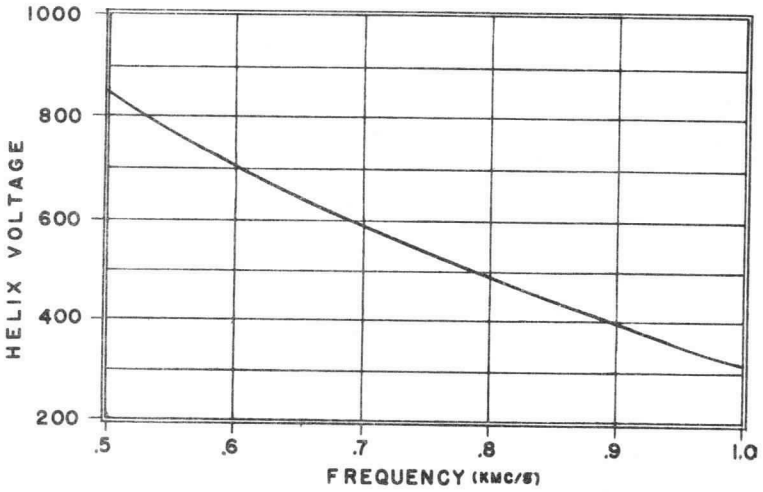
1 A portion of the helix voltage is applied to the anode so that the beam current is higher when tuned to the lower frequencies.
2 Supplied with mating receptacle.
3 Length may vary as a function of tube specifications.

DHA-3

PERFORMANCE

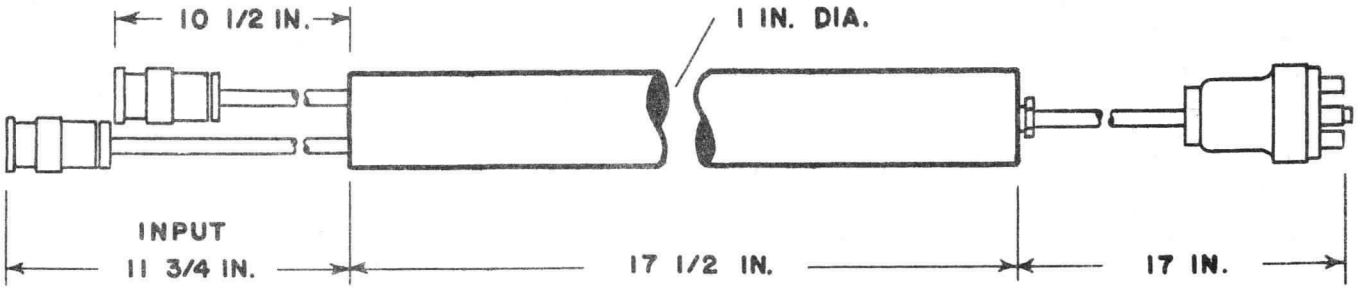


GAIN CHARACTERISTICS



VOLTAGE CHARACTERISTICS

DIMENSIONS



Note: Other lead lengths or connectors may be specified.

SOLENOID

AS-9B

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, S — BAND VOLTAGE TUNED DISPERSIVE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 2.0 TO 4.0 KMC

	FREQUENCY	SWEPT ANODE	FIXED ANODE
SMALL-SIGNAL GAIN	2 KMC	20 DB MIN.	10 DB MIN.
	4 KMC	28 DB MIN.	28 DB MIN.

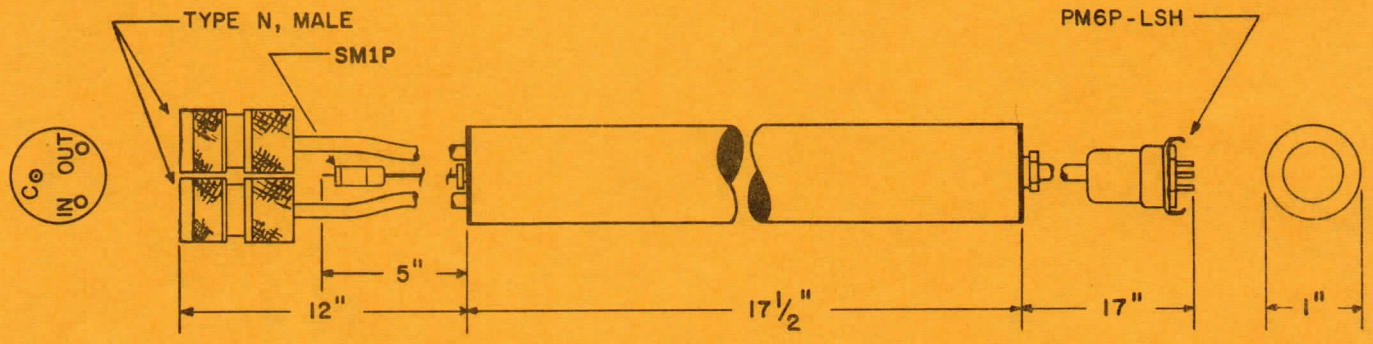
BANDWIDTH (3 DB DOWN) . . . . . 15 TO 20% OF CENTER FREQUENCY

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	CURRENT
HELIX	1110 TO 2380 V	0.20 MA MAX.
COLLECTOR	1110 TO 2380 V	1.50 MA MAX.
ANODE (FIXED)	0 TO 650 V	.10 MA MAX.
CATHODE	0 V	1.50 MA MAX.
HEATER	6.3 OR 7.0 V	0.85 AMP MAX.

FOCUSING . . . . . SOLENOID, 250 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . BLACK ANODIZED
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED. . . . . NONE
NET WEIGHT . . . . . 1.0 LB

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, L – BAND VOLTAGE TUNED DISPERSIVE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 1.0 TO 2.0 KMC

	FREQUENCY	SWEPT ANODE	FIXED ANODE
SMALL-SIGNAL GAIN	1 KMC	15 DB MIN	3 DB MIN
	2 KMC	33 DB MIN	30 DB MIN

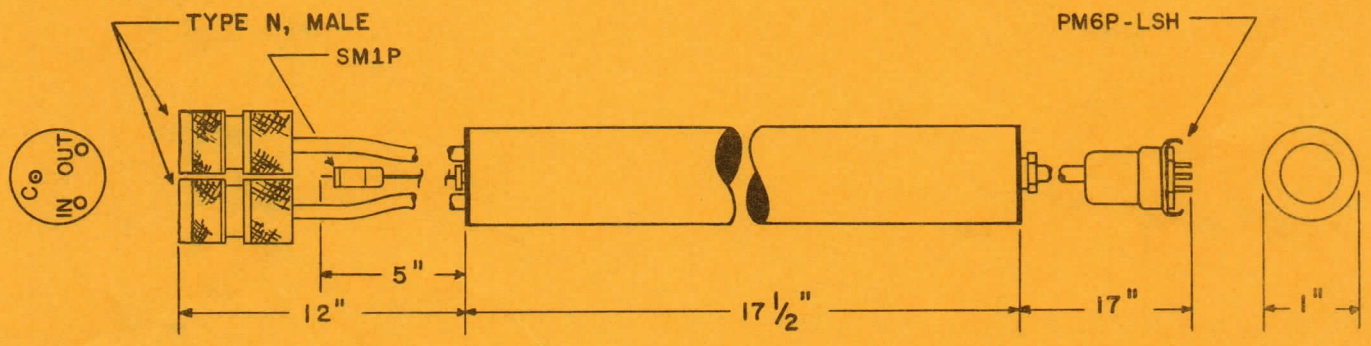
BANDWIDTH (5 DB DOWN). . . . . 15 TO 20% OF CENTER FREQUENCY

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	CURRENT
HELIX	330 TO 1020 V	0.2 MA MAX.
COLLECTOR	330 TO 1020 V	0.75 MA MAX.
ANODE (FIXED)	0 TO 330 V	.10 MA MAX.
CATHODE	0 V	0.75 MA MAX.
HEATER	6.3 OR 7.0 V	1.2 AMP MAX

FOCUSING . . . . . SOLENOID, 250 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . BLACK ANODIZED
END CAPSULE FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED. . . . . NONE
NET WEIGHT . . . . . 1.0 LB

HUGGINS LABORATORIES, INC.
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SOLENOID – FOCUSED, UHF – BAND VOLTAGE TUNED DISPERSIVE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 0.5 TO 1.0 KMC

	FREQUENCY	SWEPT ANODE	FIXED ANODE
SMALL-SIGNAL GAIN	0.5 KMC	15 DB MIN.	2 DB MIN.
	1.0 KMC	30 DB MIN.	30 DB MIN.

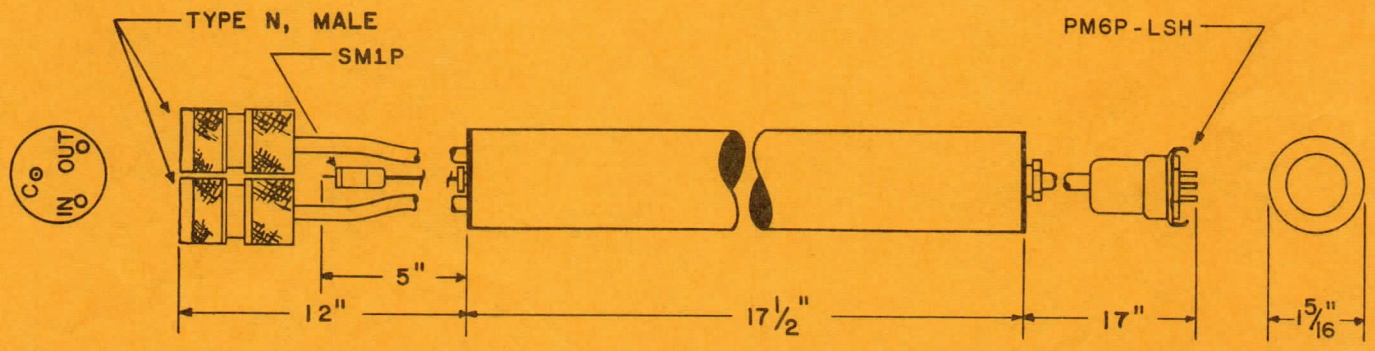
BANDWIDTH (5 DB DOWN) . . . . . 15 TO 20% OF CENTER FREQUENCY

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	CURRENT
HELIX	1250 TO 2500 V	0.2 MA MAX.
COLLECTOR	1250 TO 2500 V	1.0 MA MAX.
ANODE (FIXED)	0 TO 300 V	0.1 MA MAX.
CATHODE	0 V	1.0 MA MAX.
HEATER	6.3 OR 7.0 V	1.1 AMP MAX.

FOCUSING . . . . . SOLENOID, 400 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . BLACK ANODIZED
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . NONE
NET WEIGHT . . . . . 1.0 LB

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California

TENTATIVE DATA

DISPERSIVE C—BAND TRAVELING WAVE TUBE AMPLIFER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE		4.0 – 8.0 KMC
SMALL SIGNAL GAIN	SWEPT ANODE	FIXED ANODE
4.0 KMC	15 DB	10 DB
8.0 KMC	25 DB	20 DB
BANDWIDTH (5 DB DOWN)		15 PER CENT TO 20 PER CENT OF CENTER FREQUENCY

OPERATING CHARACTERISTICS

HELIX VOLTAGE	4.0 KMC	2400 ± 100
	8.0 KMC	1300 ± 50
COLLECTOR VOLTAGE		HELIX VOLTAGE
CATHODE CURRENT		0.5 MA
ANODE VOLTAGE		300 VOLTS
HEATER VOLTAGE		7.0 VOLTS
HEATER CURRENT		0.7 AMPS
MAGNETIC FIELD		400 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N MALE
DC CONNECTOR	WINCHESTER PM6P
CAPSULE LENGTH	13 11/16 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

PRICE $750.00

DELIVERY 4 TO 6 WEEKS

[1] ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR MAY BE INSULATED AND THUS ANY ELECTRODE OPERATED AT GROUND POTENTIAL.

HUGGINS LABORATORIES, INC.
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TENTATIVE DATA

S—BAND BACKWARD WAVE TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	2.4 – 3.6 KMC
BANDWIDTH	0.1 – 1.0 PER CENT
SMALL SIGNAL GAIN	10 – 25 DB

OPERATING CHARACTERISTICS

HELIX AND COLLECTOR VOLTAGE[1]	300 – 1500 VOLTS
CATHODE CURRENT	4 – 10 MA
ANODE VOLTAGE	200 – 500 VOLTS
ANODE CURRENT	0.3 MA
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	1.45 AMP
MAGNETIC FIELD	600 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE
DC CONNECTOR	WINCHESTER PM6P
CAPSULE LENGTH	15 INCHES
CAPSULE DIAMETER	1 1/2 INCHES
NET WEIGHT	2 1/2 POUNDS

PRICE $1500.00

DELIVERY 2 TO 3 MONTHS

[1] ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

HUGGINS LABORATORIES, INC.
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TENTATIVE DATA

X—BAND BACKWARD WAVE TRAVELING WAVE TUBE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.2 – 12.4 KMC
BANDWIDTH	.1 – 1.0 PER CENT
SMALL SIGNAL GAIN	10 – 25 DB

OPERATING CHARACTERISTICS

HELIX AND COLLECTOR VOLTAGE[1]	450 – 2400 VOLTS
CATHODE CURRENT	4 – 10 MA
ANODE VOLTAGE	150 – 400 VOLTS
ANODE CURRENT	0.3 MA
HEATER VOLTAGE	7.0 VOLTS
HEATER CURRENT	0.7 AMP
MAGNETIC FIELD	850 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE
DC CONNECTOR	WINCHESTER PM6P
CAPSULE LENGTH	15 1/2 INCHES
CAPSULE DIAMETER	1.0 INCHES
NET WEIGHT	1.0 POUND

PRICE $1500.00

DELIVERY 2 TO 3 MONTHS

[1]ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

TENTATIVE CHARACTERIS

SALES & SERVICE IN THE UNITED KINGDOM:-
B. & K. LABORATORIES LTD.
4 TILNEY ST., PARK LANE, LONDON, W.1., ENGLAND.
TELEPHONE: GROSVENOR 4567

BA–4

HUGGINS manufacture development engineering design research LABORATORIES

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SOLENOID – FOCUSED, Ku – BAND BACKWARD WAVE AMPLIFIER

ELECTRICAL CHARACTERISTICS

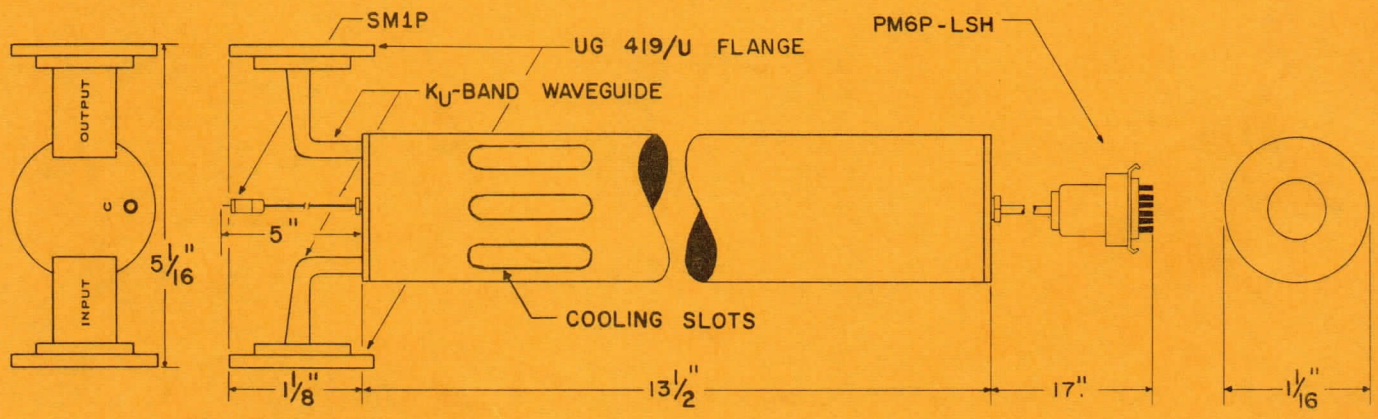
FREQUENCY RANGE . . . . . 12.0 TO 18.0 KMC
SMALL-SIGNAL GAIN. . . . . 30 DB MIN
SYNCHRONOUS BANDWIDTH [1] @ 20 DB S – S GAIN. . . . . 20 MC MIN
VSWR, INPUT AND OUTPUT . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	400 TO 2000 V	--	1.0 MA MAX
COLLECTOR	400 TO 2000 V	--	10.0 MA MAX
ANODE	0 TO 250 V	--	0.5 MA MAX
CATHODE	0 V	--	10.0 MA MAX
HEATER	6.3 OR 7.0 V	--	1.2 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . CHROME
AUXILIARY COOLING REQUIRED. . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1 3/4 LBS

1. STAGGER TUNED (HELICES TUNED TO SLIGHTLY DIFFERENT FREQUENCIES) BANDWIDTH IS APPROXIMATELY TWICE THE SYNCHRONOUS (HELICES TUNED TO SAME FREQUENCY) BANDWIDTH.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, S — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

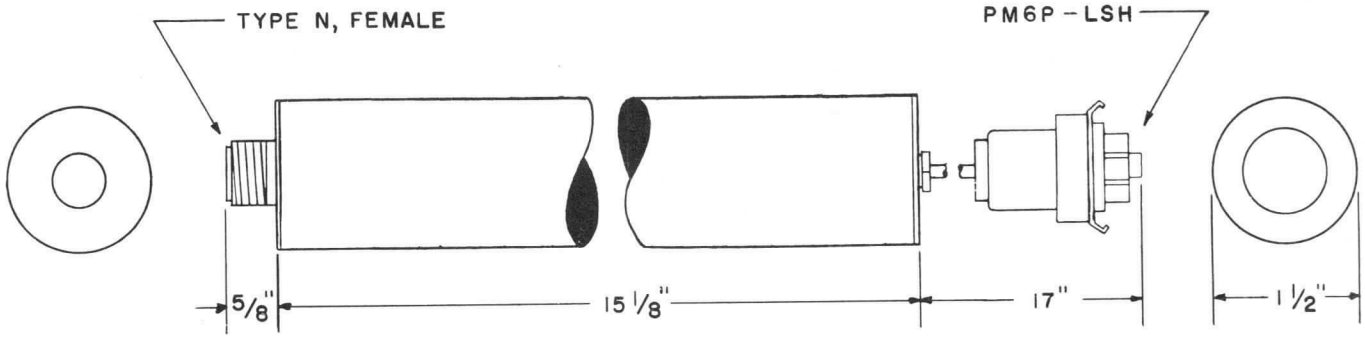
FREQUENCY RANGE . . . . . 2.0 TO 4.0 KMC
POWER OUTPUT . . . . . 10 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	200 TO 3400 V	4 MCS / VOLT MAX	3.0 MA MAX
COLLECTOR	200 TO 3400 V	— —	15.0 MA MAX
ANODE	0 TO 300 V	0.6 MCS / VOLT MAX	0.4 MA MAX
CATHODE	0 V	— —	15.0 MA MAX
HEATER	6.3 OR 7.0 V	0.4 MCS / 0.1 VOLT MAX	2.0 AMP MAX

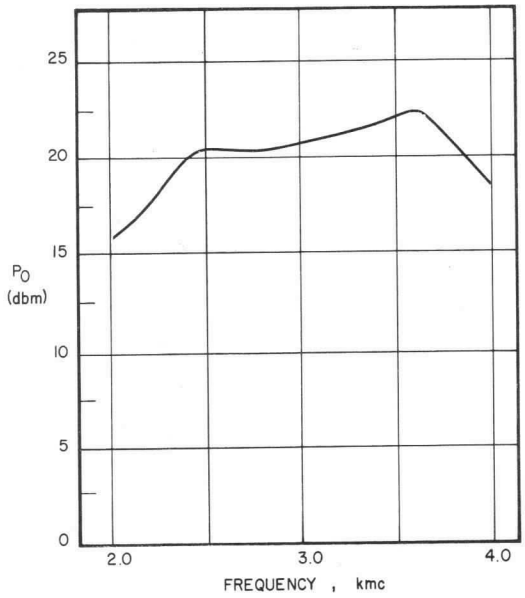
FOCUSING . . . . . SOLENOID, 760 GAUSS

MECHANICAL CHARACTERISTICS

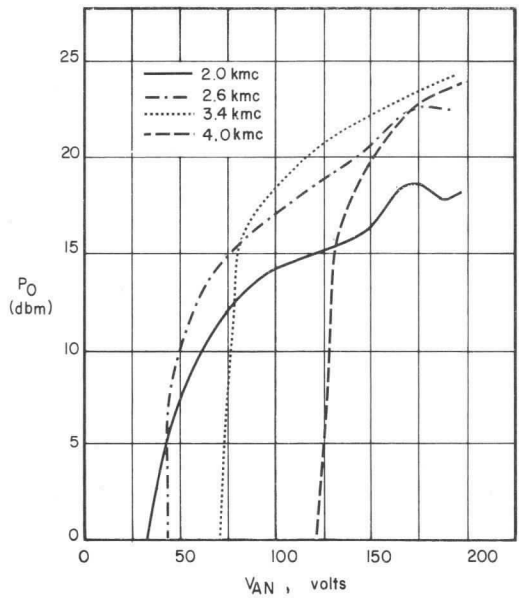


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 2 1/2 LBS

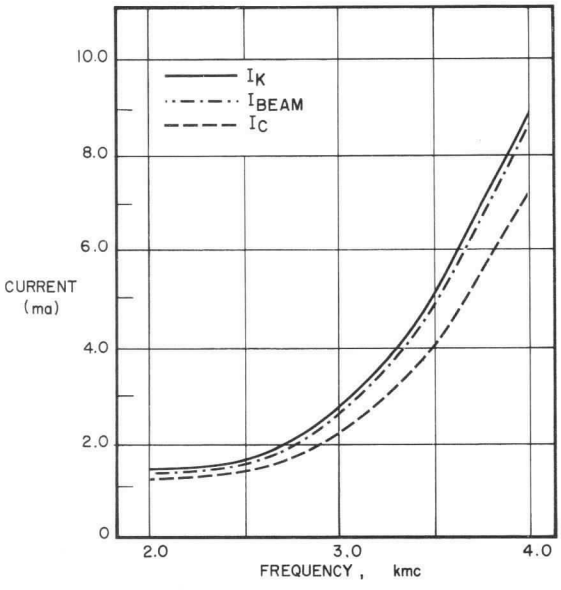
TYPICAL OPERATING CHARACTERISTICS



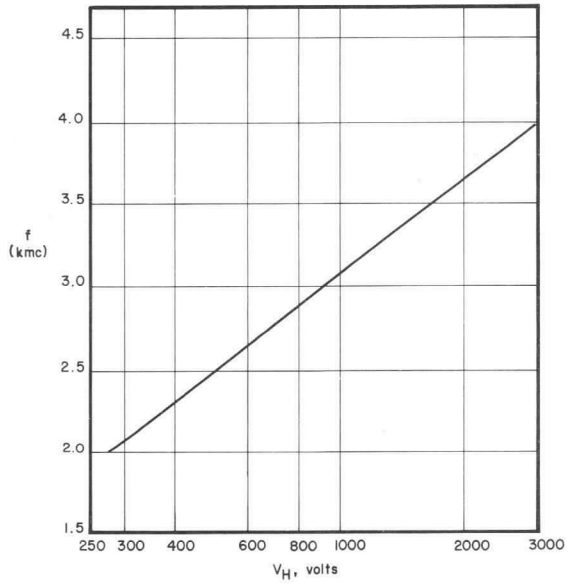
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

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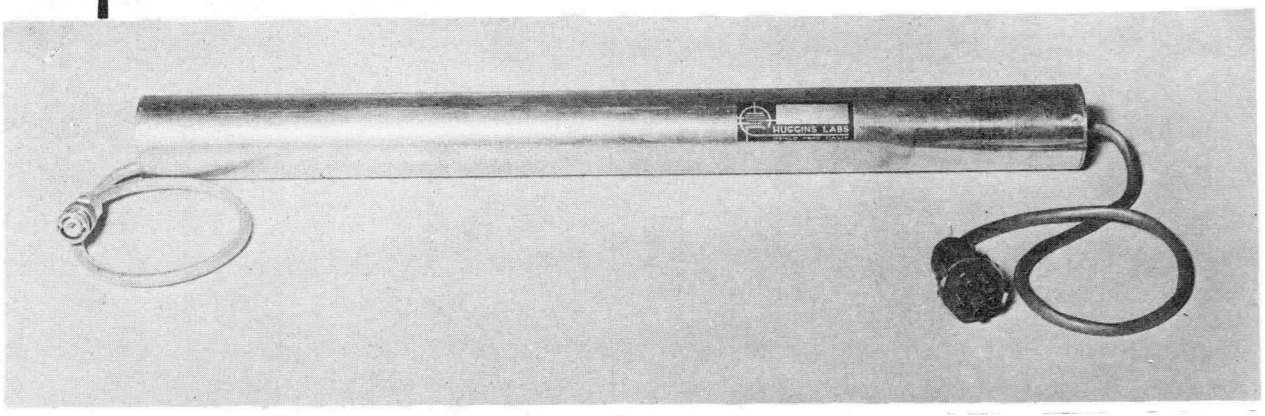


LOW POWER - BACKWARD-WAVE OSCILLATOR

GENERAL CHARACTERISTICS

ELECTRICAL

FREQUENCY RANGE	2 to 4 KMc
POWER OUTPUT	20 dbm (Min.) 2.5 to 4 KMc 10 dbm (Min.) 2 to 4 KMc

OPERATING

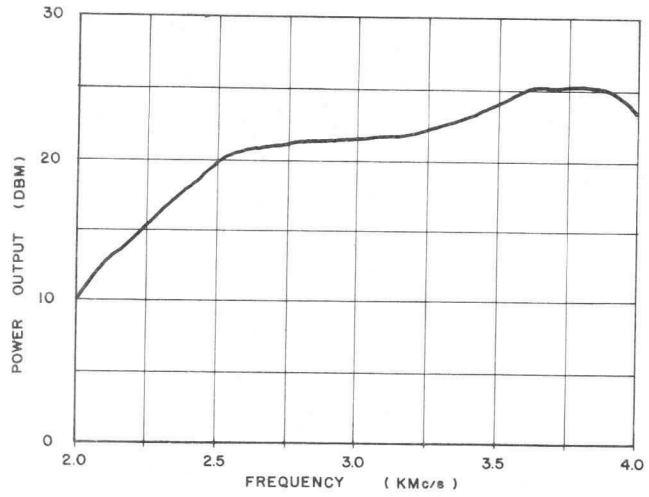
HELIX AND COLLECTOR VOLTAGE[1]	300 to 3400 Volts D.C.
CATHODE CURRENT	20 Ma.
ANODE VOLTAGE	300 to 500 Volts D.C.
ANODE CURRENT	0.4 Ma.
HEATER VOLTAGE	6.3 Volts
HEATER CURRENT	1.2 Amps
MAGNETIC FIELD	800 Gauss

MECHANICAL

RF CONNECTOR	Type BNC Male
DC CONNECTOR	Winchester Plug[2] PM6P
CAPSULE LENGTH	14 7/8 Inches
CAPSULE DIAMETER	1⅛ Inches
NET WEIGHT	2⅛ Pounds
SHIPPING WEIGHT	13 Pounds

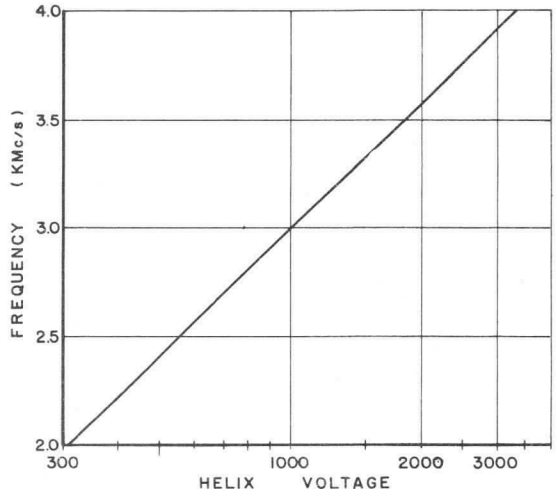
1 See tuning curve.
2 Supplied with mating receptacle.

HO-1A PERFORMANCE

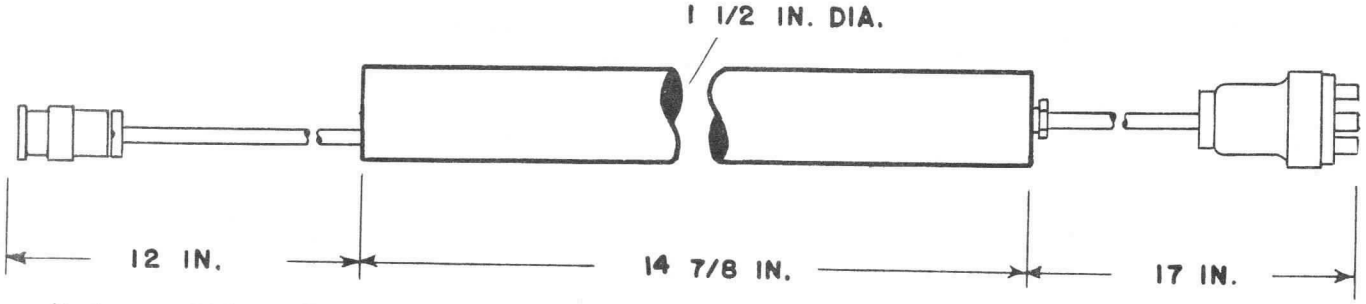


POWER OUTPUT
VS
FREQUENCY

TUNING CHARACTERISTIC



DIMENSIONS



Note: Other lead lengths or connectors may be specified.

SOLENOID

See Solenoid Section for appropriate unit and specifications.

HUGGINS LABORATORIES, INC.
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SOLENOID — FOCUSED, X — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

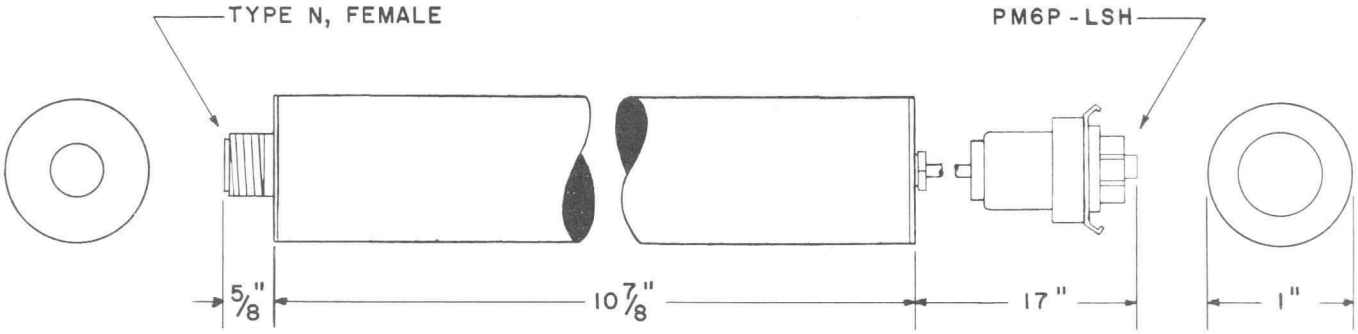
FREQUENCY RANGE . . . . . 8.2 TO 12.4 KMC
POWER OUTPUT . . . . . 10 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	350 TO 2000 V	6.5 MC / VOLT MAX	3.0 MA MAX
COLLECTOR	350 TO 2000 V	— —	12.0 MA MAX
ANODE	0 TO 350 V	1.5 MC / VOLT MAX	1.0 MA MAX
CATHODE	0 V	— —	12.0 MA MAX
HEATER	6.3 OR 7.0 V	2.0 MC / 0.1 VOLT MAX	1.2 AMP MAX

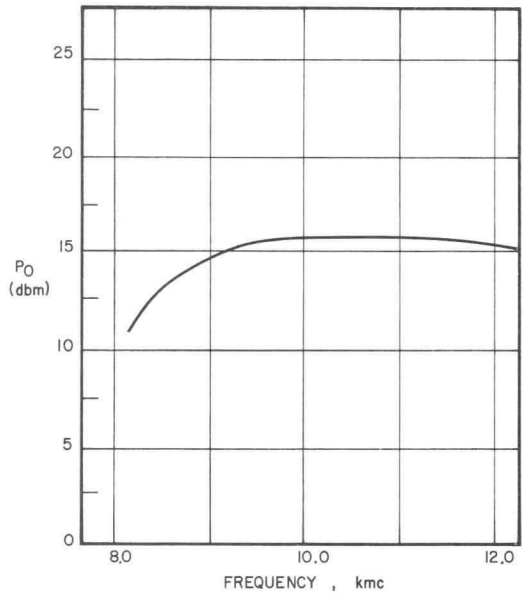
FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS

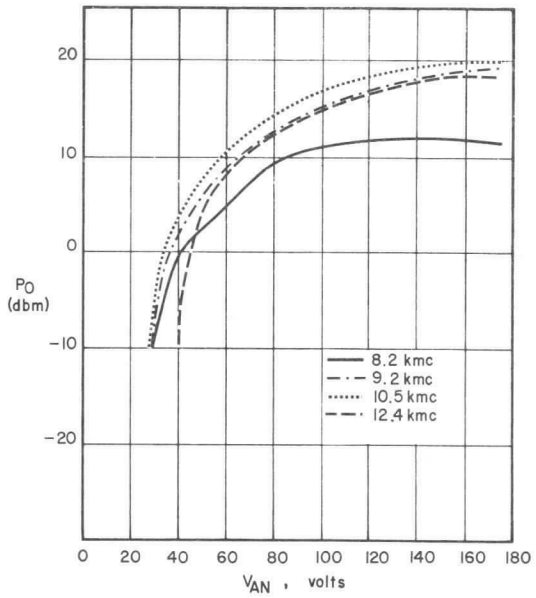


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

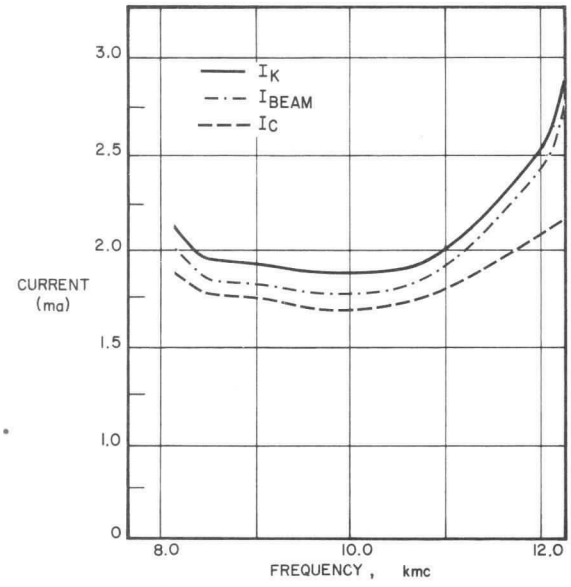
TYPICAL OPERATING CHARACTERISTICS



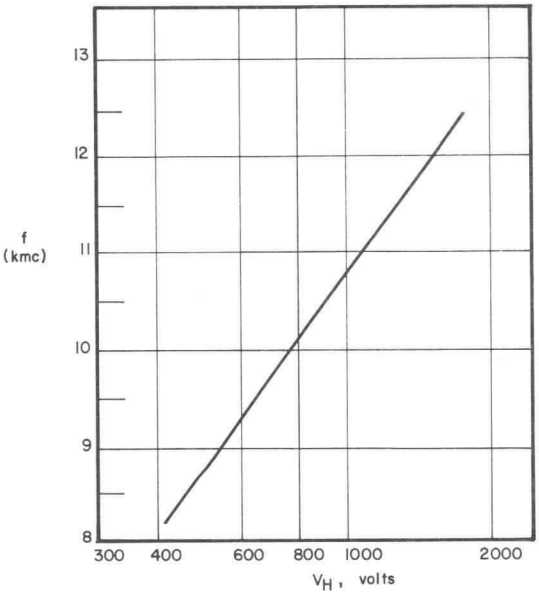
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

HUGGINS LABORATORIES, INC.
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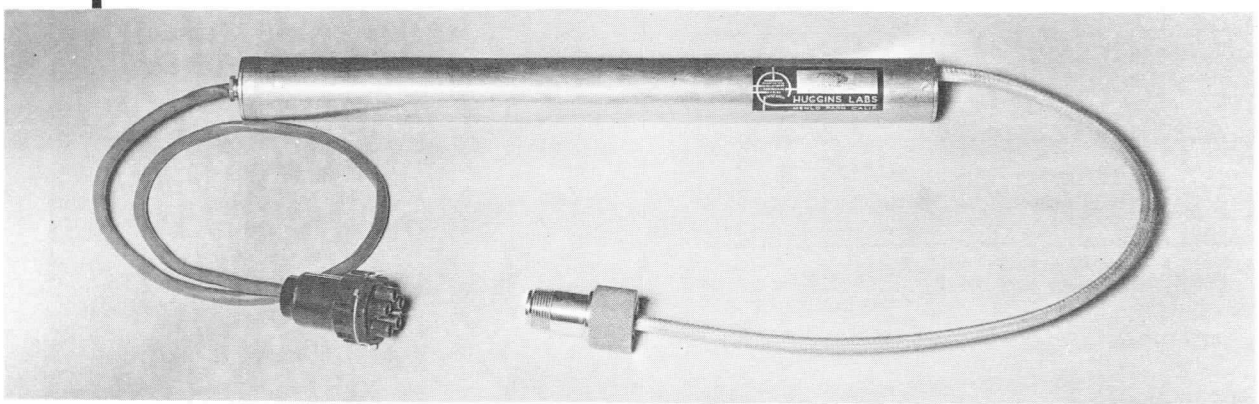


LOW POWER - BACKWARD-WAVE OSCILLATOR

GENERAL CHARACTERISTICS

ELECTRICAL

FREQUENCY RANGE	7 to 14 KMc/s
POWER OUTPUT	10 dbm (Min.) 7.6 to 13.7 KMc/s 4 dbm (Min.) 7.0 to 14.0 KMc/s

OPERATING

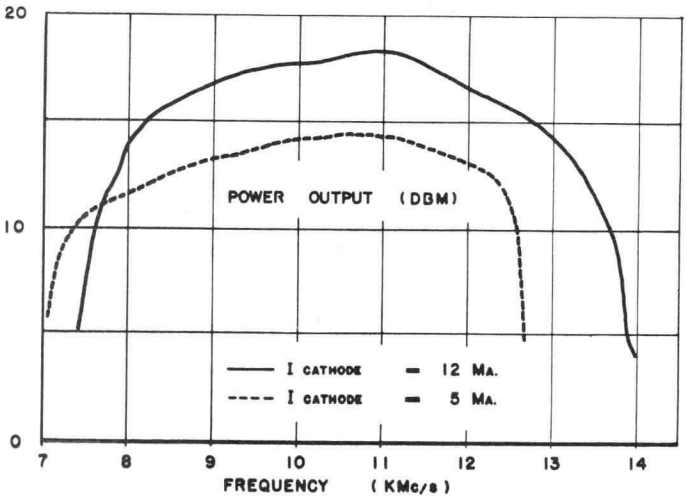
HELIX AND COLLECTOR VOLTAGE[1]	300 to 3400 Volts D.C.
CATHODE CURRENT	12 Ma.
ANODE VOLTAGE	300 to 500 Volts D.C.
ANODE CURRENT	0.3 Ma.
HEATER VOLTAGE	7.0 Volts
HEATER CURRENT	0.8 Amps.
MAGNETIC FIELD	1000 Gauss

MECHANICAL

RF CONNECTOR	Type N Female, or "X" Band 1" x 1½" Waveguide Adapter
DC CONNECTOR	Winchester Plug[2] PM6P
CAPSULE LENGTH	10 7/8 Inches
CAPSULE DIAMETER	1 Inch
NET WEIGHT	1 Pound
SHIPPING WEIGHT	11 Pounds

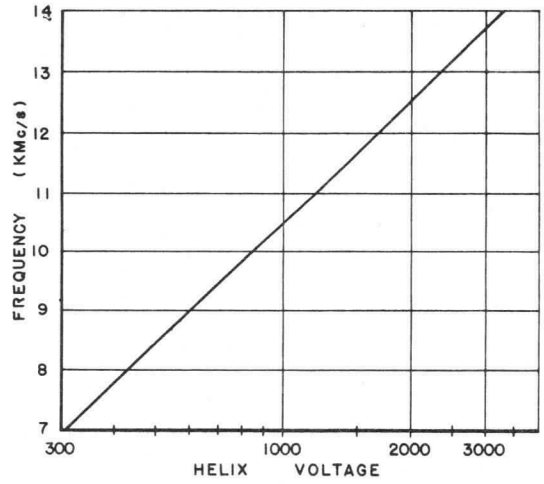
1 See tuning curve.
2 Supplied with mating receptacle.

HO-2B PERFORMANCE

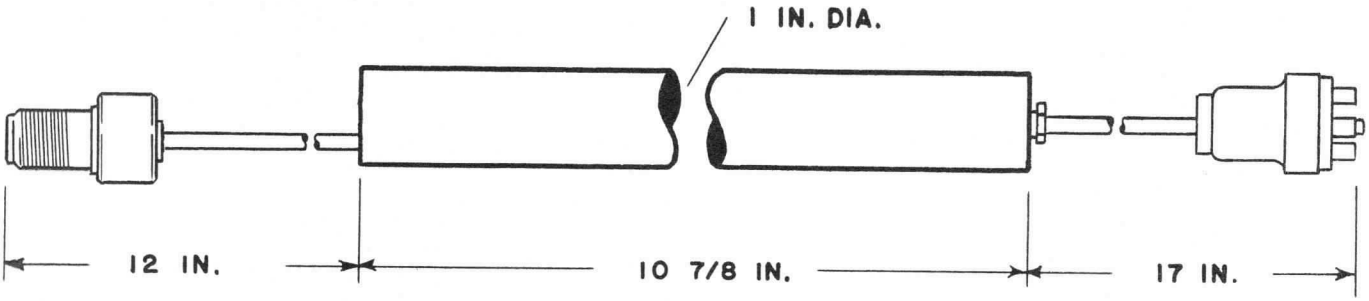


POWER OUTPUT VS FREQUENCY

TUNING CHARACTERISTIC



DIMENSIONS



Note: Other lead lengths or connectors may be specified.

SOLENOID

See Solenoid Section for appropriate unit and specifications.

HUGGINS LABORATORIES
manufacture
development
engineering
design
research

"X" BAND OPERATION

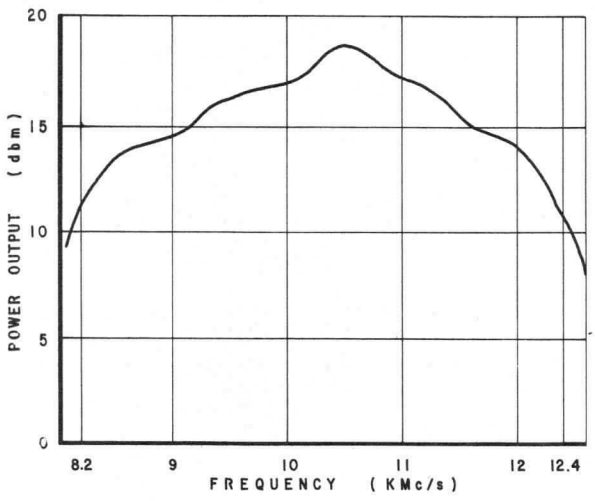
The HO-2B was designed to cover the 7 to 14 Kmc band. However, many applications call for a band covering only the so-called X-band (8.2 to 12.4 Kmc). For operation over this limited frequency range a reduced magnetic field with a high saving in solenoid power requirements is possible. The following data applies to HO-2B operation between 8.2 and 12.4 Kmc with reduced magnetic field.

ELECTRICAL

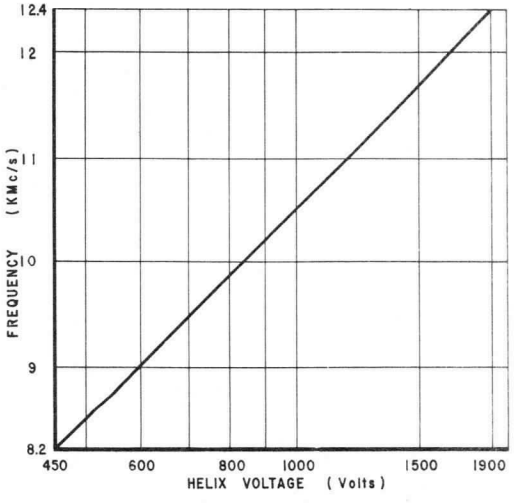
FREQUENCY RANGE	8.2 - 12.4 Kmc
POWER OUTPUT	10.0 dbm (Min.)

OPERATING

HELIX AND COLLECTOR VOLTAGE	450 - 1900 Volts
CATHODE CURRENT	12 Ma
ANODE VOLTAGE	300 - 500 Volts
ANODE CURRENT	0.3 Ma
HEATER VOLTAGE	7.0 Volts
HEATER CURRENT	0.8 Amps
MAGNETIC FIELD	750 Gauss



POWER OUTPUT vs FREQUENCY



TUNING CHARACTERISTIC

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, 3.75 TO 7.0 KMC BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

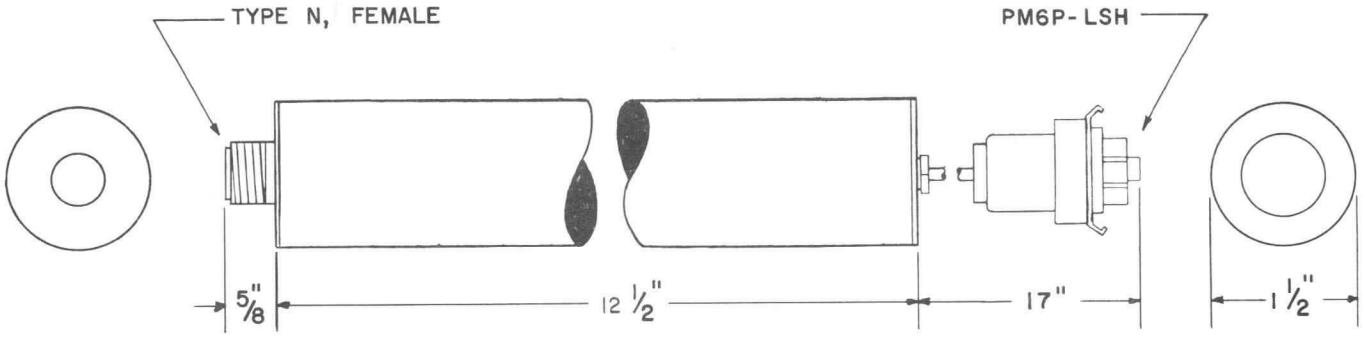
FREQUENCY RANGE . . . . . 3.75 TO 7.0 KMC
POWER OUTPUT . . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	350 TO 2600 V	— —	3.5 MA MAX
COLLECTOR	350 TO 2600 V	— —	12.0 MA MAX
ANODE	0 TO 300 V	— —	1.0 MA MAX
CATHODE	0 V	— —	12.0 MA MAX
HEATER	6.3 OR 7.0 V	— —	1.4 AMP MAX

FOCUSING . . . . . SOLENOID, 675 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 2 1/2 LBS

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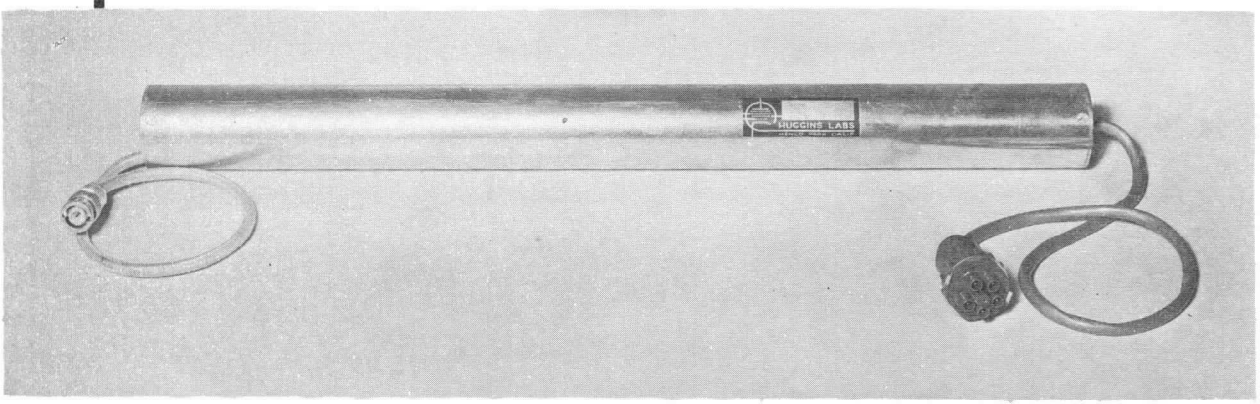


LOW POWER - BACKWARD-WAVE OSCILLATOR

GENERAL CHARACTERISTICS

ELECTRICAL

FREQUENCY RANGE	3.75 to 7.0 kmc
POWER OUTPUT	20 dbm (Min.) 4.3 to 7.0 kmc 10 dbm (Min.) 3.75 to 4.3 kmc

OPERATING

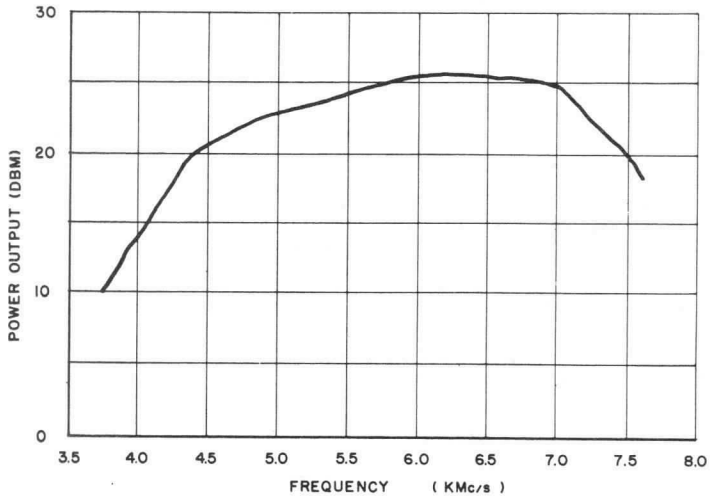
HELIX AND COLLECTOR VOLTAGE[1]	300 to 3400 Volts D.C.
CATHODE CURRENT	13 Ma.
ANODE VOLTAGE	300 to 500 Volts D.C.
ANODE CURRENT	0.7 Ma.
HEATER VOLTAGE	7.0 Volts
HEATER CURRENT	0.8 Amps
MAGNETIC FIELD	800 Gauss

MECHANICAL

RF CONNECTOR	Type BNC Male
DC CONNECTOR	Winchester Plug[2] PM6P
CAPSULE LENGTH	11 7/8 Inches
CAPSULE DIAMETER	1½ Inches
NET WEIGHT	2½ Pounds
SHIPPING WEIGHT	13 Pounds

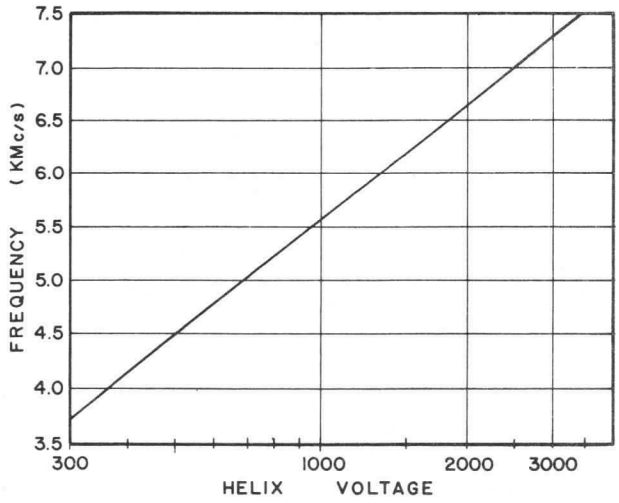
1 See tuning curve.
2 Supplied with mating receptacle.

HO-3A PERFORMANCE

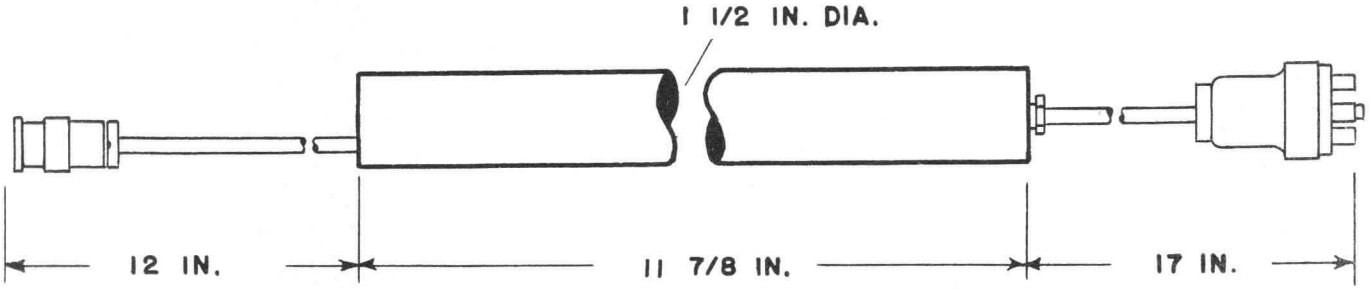


POWER OUTPUT vs FREQUENCY

TUNING CHARACTERISTIC



DIMENSIONS



Note: Other lead lengths or connectors may be specified.

SOLENOID

See Solenoid Section for appropriate unit and specifications.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, Ku — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

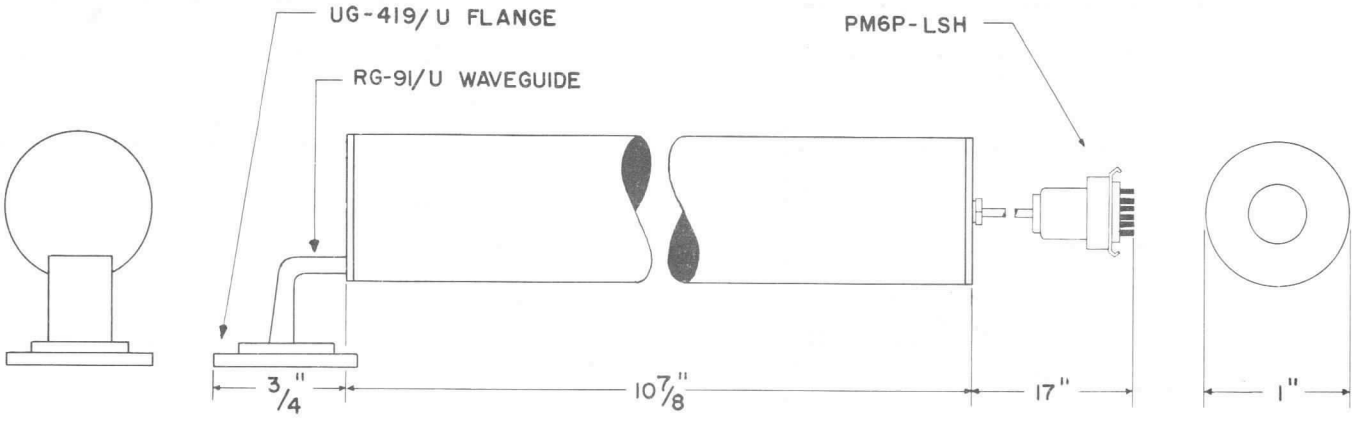
FREQUENCY RANGE	12.4 TO 18.0 KMC
POWER OUTPUT	10 DBM MIN
VSWR	3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	450 TO 2200 V	8 MC / VOLT MAX	3.0 MA MAX
COLLECTOR	450 TO 2200 V	— —	10.0 MA MAX
ANODE	0 TO 350 V	2.2 MC / VOLT MAX	1.0 MA MAX
CATHODE	0 V	— —	10.0 MA MAX
HEATER	6.3 OR 7.0 V	3 MC / 0.1 VOLT MAX	1.2 AMP MAX

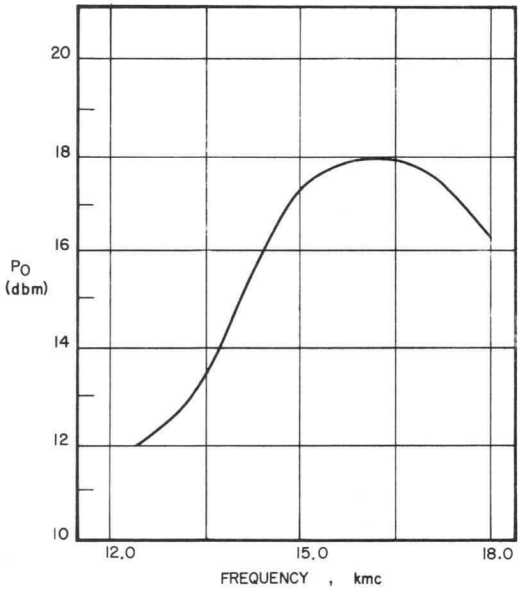
FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS

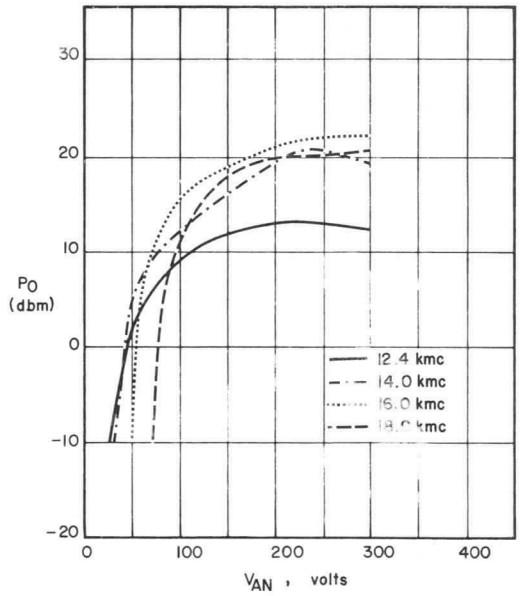


CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

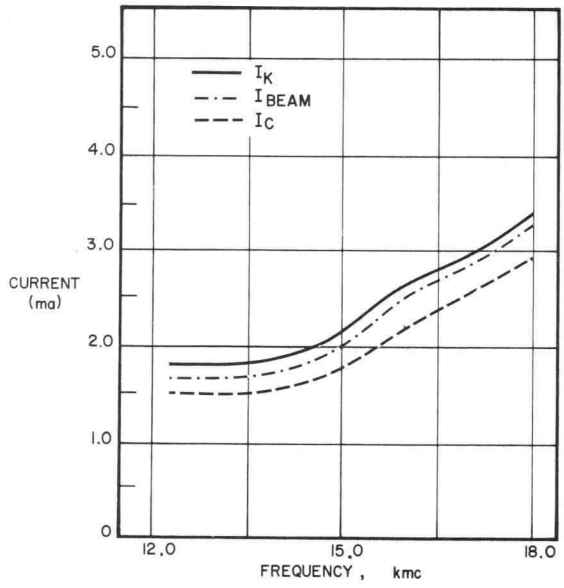
TYPICAL OPERATING CHARACTERISTICS



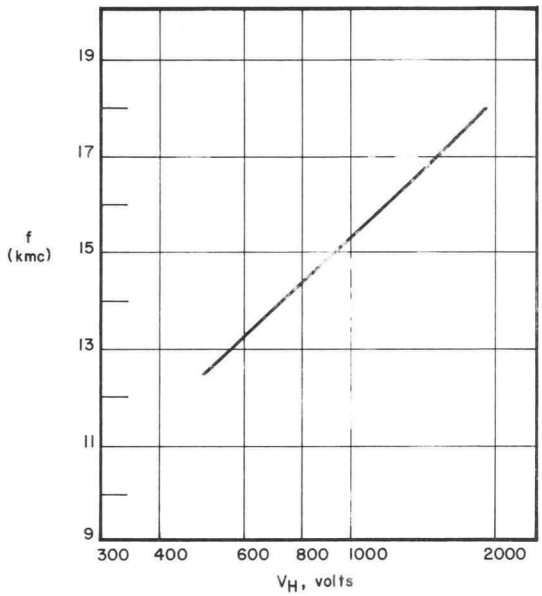
POWER OUTPUT



POWER OUTPUT

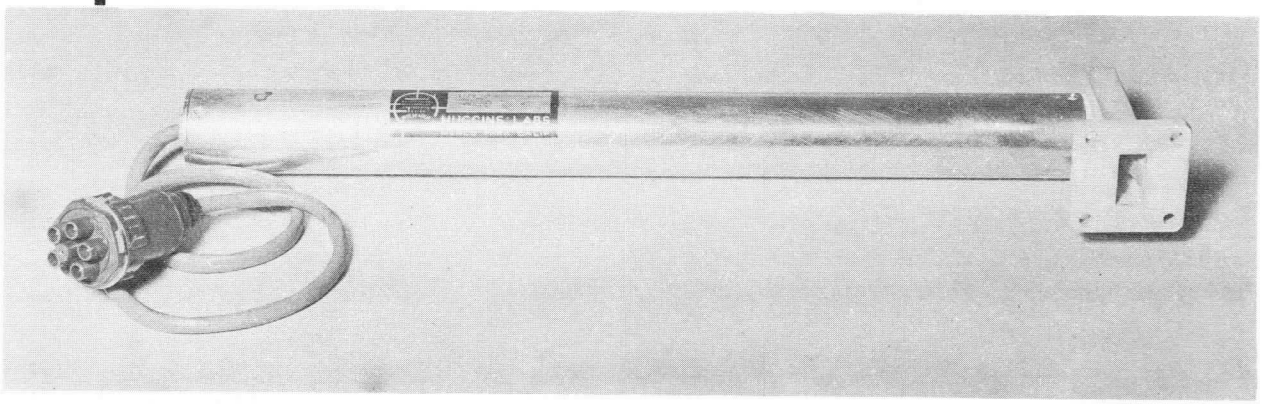


STARTING CURRENT



TUNING CURVE

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue · Menlo Park, California



LOW POWER - BACKWARD-WAVE OSCILLATOR

GENERAL CHARACTERISTICS

ELECTRICAL

FREQUENCY RANGE	12.4 to 18.0 Kmc
POWER OUTPUT	10 dbm (Min.)

OPERATING

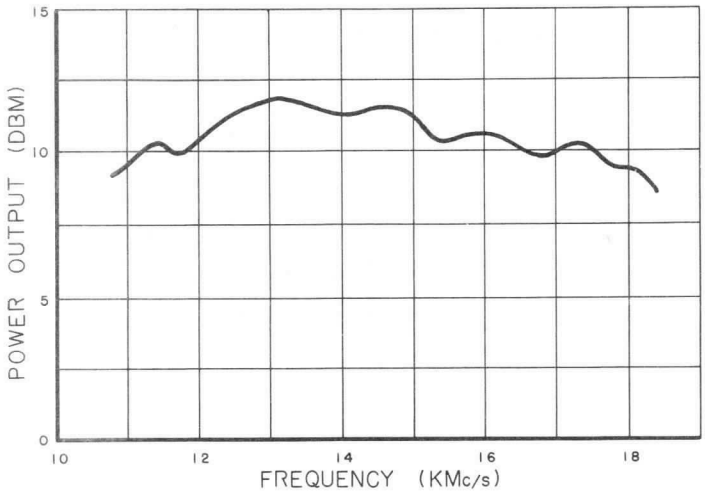
HELIX AND COLLECTOR VOLTAGE[1]	450 to 2000 Volts D.C.
CATHODE CURRENT	10 Ma.
ANODE VOLTAGE	200 to 600 Volts D.C.
ANODE CURRENT	0.5 Ma.
HEATER VOLTAGE	7.0 Volts
HEATER CURRENT	0.8 Amps.
MAGNETIC FIELD	1000 Gauss

MECHANICAL

RF CONNECTOR	"P"-Band Waveguide (.702" x .391") with Cover Flange
DC CONNECTOR	Winchester Plug[2] PM6P
CAPSULE LENGTH	See Outline on Reverse Side.
CAPSULE DIAMETER	1 Inch
NET WEIGHT	1 Pound
SHIPPING WEIGHT	11 Pounds

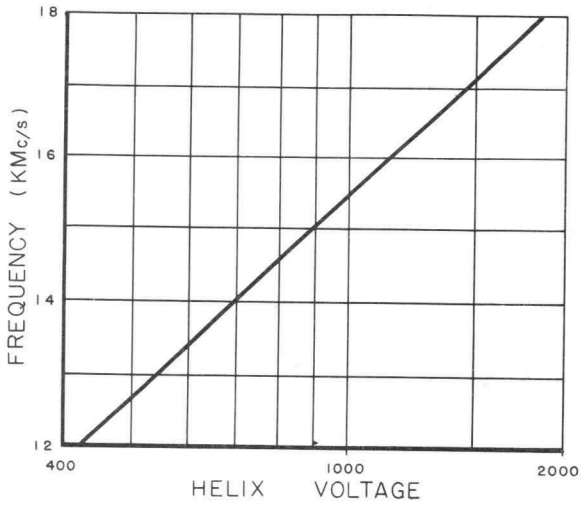
1 See tuning curve.
2 Supplied with mating receptacle.

HO-4B PERFORMANCE

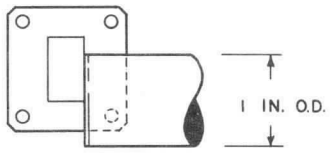


POWER OUTPUT
vs
FREQUENCY

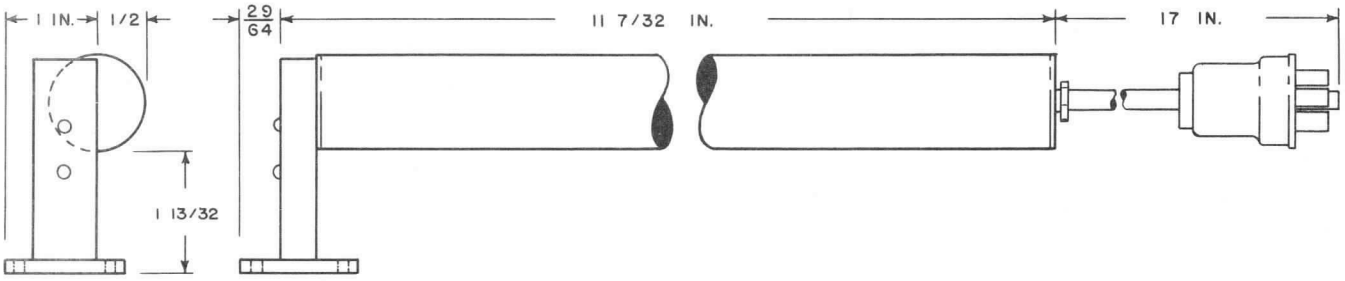
TUNING CHARACTERISTIC



DIMENSIONS



"P-BAND WAVEGUIDE (.702" x .391")
WITH COVER FLANGE



Note: Other lead lengths may be specified.

SOLENOID

See Solenoid Section for appropriate unit and specifications.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, L – BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

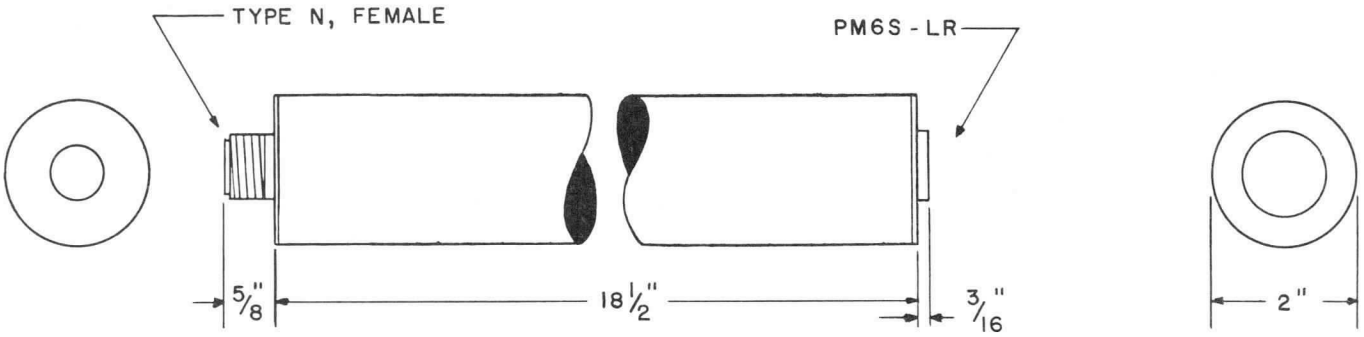
FREQUENCY RANGE . . . . . 1.0 TO 2.0 KMC
POWER OUTPUT . . . . . 10 DBM MIN

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	200 TO 2800 V	2 MCS / VOLT MAX	3.5 MA MAX
COLLECTOR	200 TO 2800 V	--	25.0 MA MAX
ANODE	0 TO 200 V	0.5 MCS / VOLT MAX	0.5 MA MAX
CATHODE	0 V	--	25.0 MA MAX
HEATER	6.3 OR 7.0 V	5 MCS / VOLT MAX	2.5 AMP MAX

FOCUSING . . . . . SOLENOID, 800 GAUSS

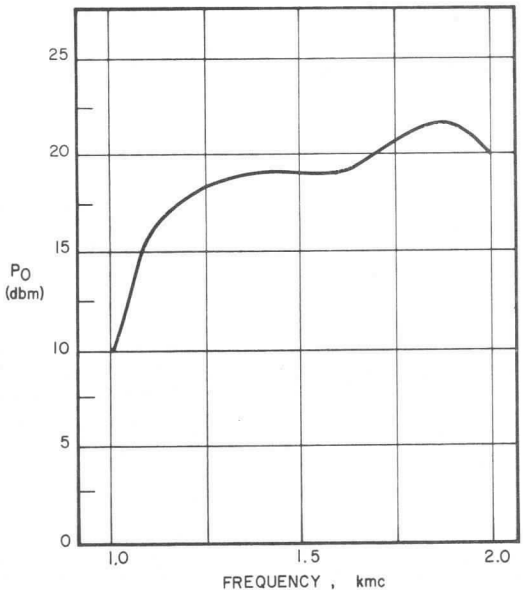
MECHANICAL CHARACTERISTICS



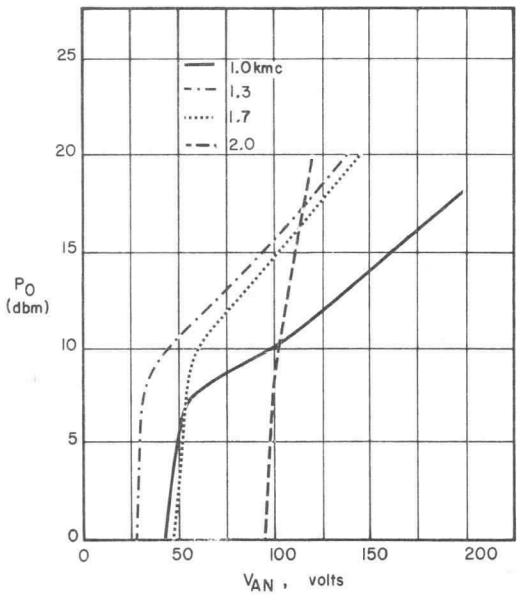
CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 5.0 LBS

SALES & SERVICE IN THE UNITED KINGDOM:-
B. & K. LABORATORIES LTD.
4 TILNEY ST., PARK LANE, LONDON, W.1., ENGLAND.
TELEPHONE: GROSVENOR 4567

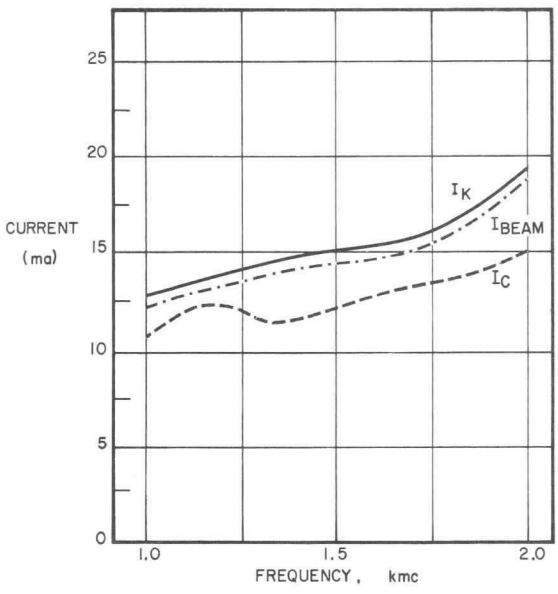
TYPICAL OPERATING CHARACTERISTICS



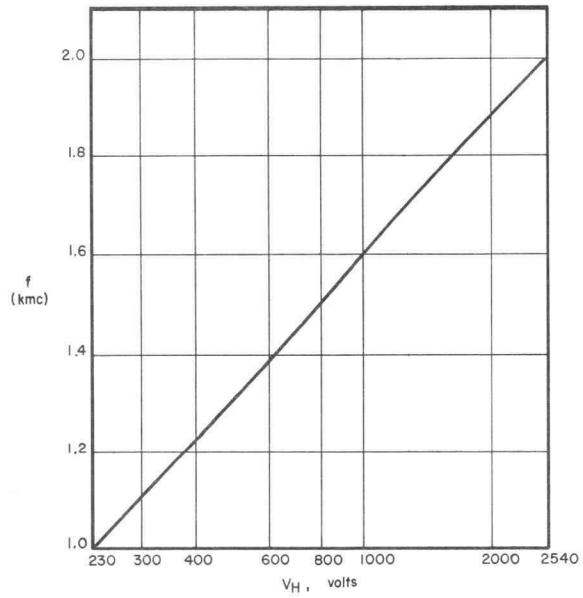
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT

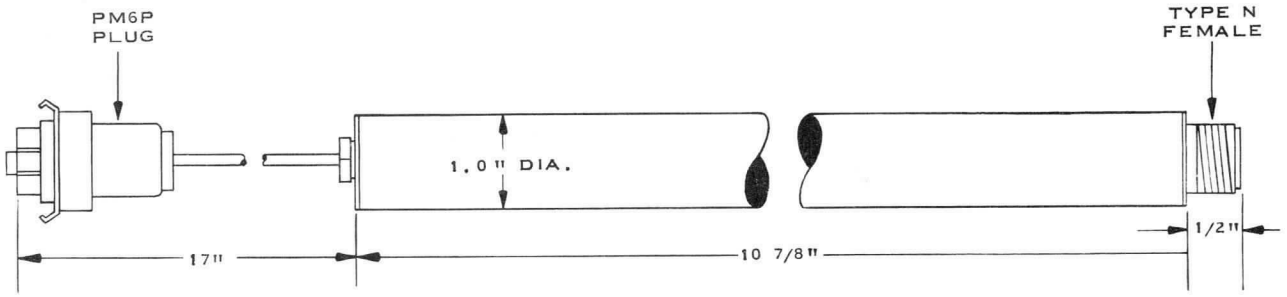


TUNING CURVE

HUGGINS LABORATORIES, INC.
711 Hamilton Avenue • Menlo Park, California.

TENTATIVE DATA

3.7 — 5.9 KMC BACKWARD OSCILLATOR



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	3.7 – 5.9 KMC
POWER OUTPUT (MIN.)	1 MW

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	400–2000 VOLTS
CATHODE CURRENT	9 MA
ANODE VOLTAGE	150–300 VOLTS
ANODE CURRENT	0.2 MA
HEATER VOLTAGE	7.0 VOLTS
HEATER CURRENT	1.30 AMPS
MAGNETIC FIELD	1000 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER PLUG PM6P
CAPSULE LENGTH	10 7/8 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

1ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

HUGGINS LABORATORIES, INC.
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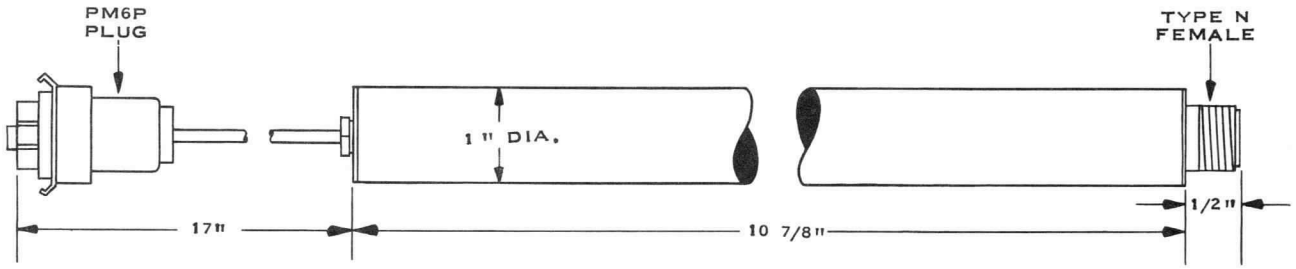
TENTATIVE DATA

5.2 —8.3 KMC BACKWARD WAVE OSCILLATOR



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	5.2 – 8.3 KMC
POWER OUTPUT(MIN.)	1 MW

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	400–2000 VOLTS
CATHODE CURRENT	8 MA
ANODE VOLTAGE	200–500 VOLTS
ANODE CURRENT	0.3 MA
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	1.4 AMPS
MAGNETIC FIELD	1000 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER PLUG PM6P
CAPSULE LENGTH	10 7/8 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 POUND

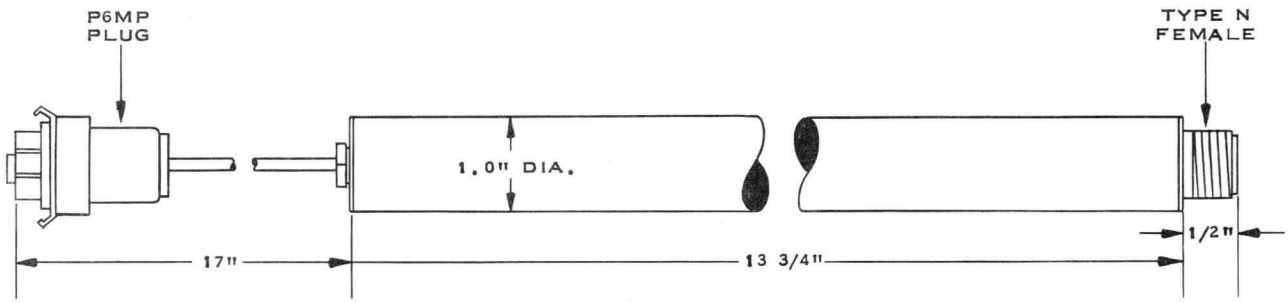
[1]ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

HUGGINS LABORATORIES, INC.

711 Hamilton Avenue · Menlo Park, California

TENTATIVE DATA

C—BAND BACKWARD WAVE OSCILLATOR



ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 – 8.0 KMC
POWER OUTPUT (MIN.)	1 MW

POWER SUPPLY REQUIREMENTS

HELIX AND COLLECTOR VOLTAGE[1]	400–3000 VOLTS
CATHODE CURRENT	10 MA
ANODE VOLTAGE	200–500 VOLTS
ANODE CURRENT	0.3 MA
HEATER VOLTAGE	6.3 VOLTS
HEATER CURRENT	1.4 AMPS
MAGNETIC FIELD	1000 GAUSS

MECHANICAL CHARACTERISTICS

RF CONNECTOR	TYPE N FEMALE ON CAPSULE
DC CONNECTOR	WINCHESTER PLUG PM6P
CAPSULE LENGTH	13 3/4 INCHES
CAPSULE DIAMETER	1.0 INCH
NET WEIGHT	1.0 INCH

[1]ALL DC VOLTAGES MEASURED WITH RESPECT TO CATHODE. COLLECTOR IS GROUNDED TO CAPSULE AND MUST OPERATE AT GROUND POTENTIAL.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, X — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

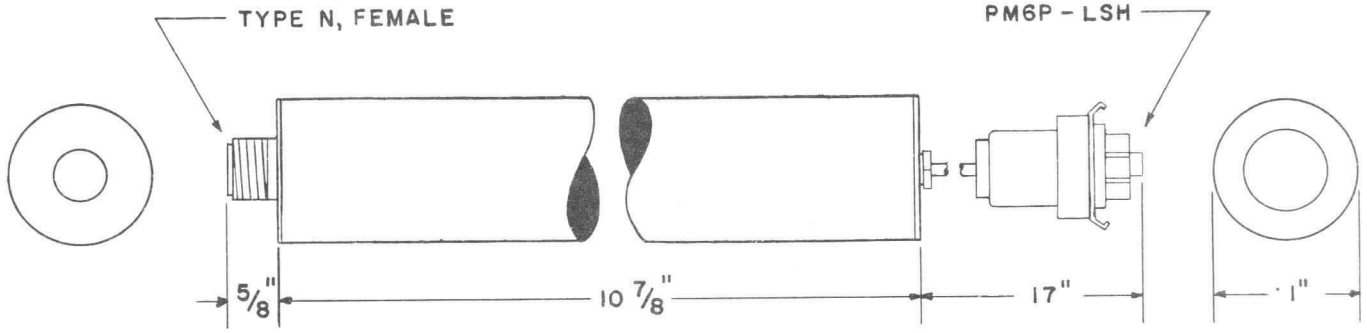
FREQUENCY RANGE . . . . . 8.2 TO 12.4 KMC
POWER OUTPUT . . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	350 TO 2000 V	6.5 MC / VOLT MAX	3.0 MA MAX
COLLECTOR	350 TO 2000 V	— —	12.0 MA MAX
ANODE	0 TO 350 V	1.5 MC / VOLT MAX	1.0 MA MAX
CATHODE	0 V	— —	12.0 MA MAX
HEATER	6.3 OR 7.0 V	2.0 MC / 0.1 VOLT MAX	1.2 AMP MAX

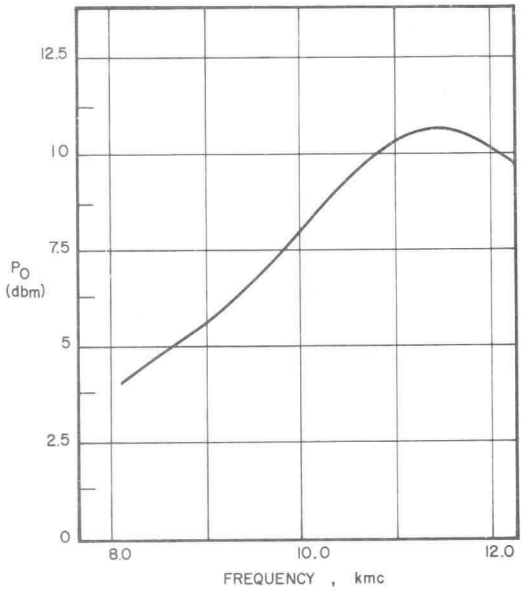
FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS

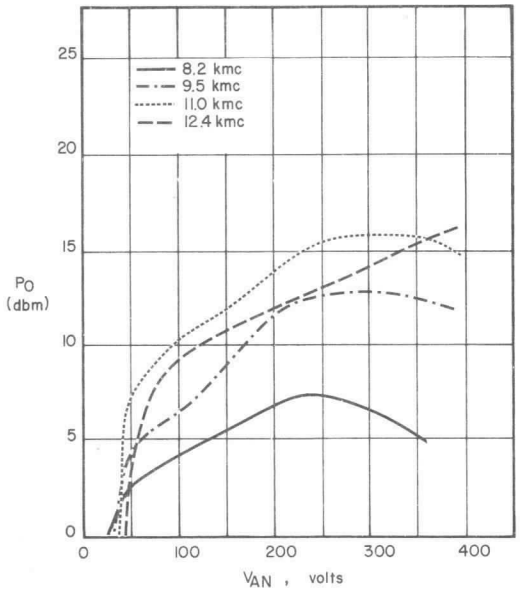


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

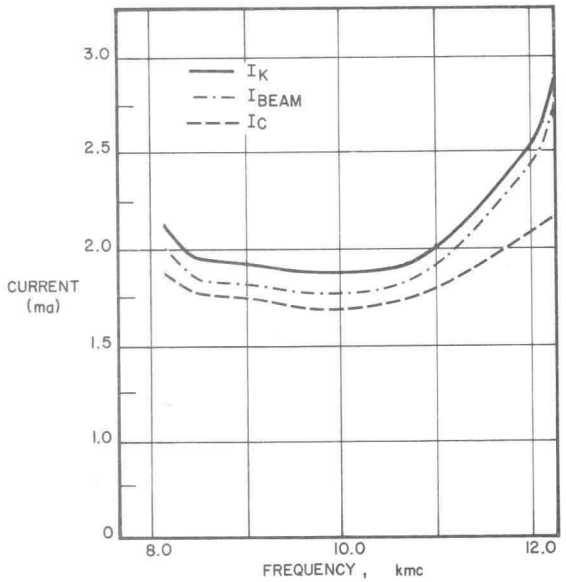
TYPICAL OPERATING CHARACTERISTICS



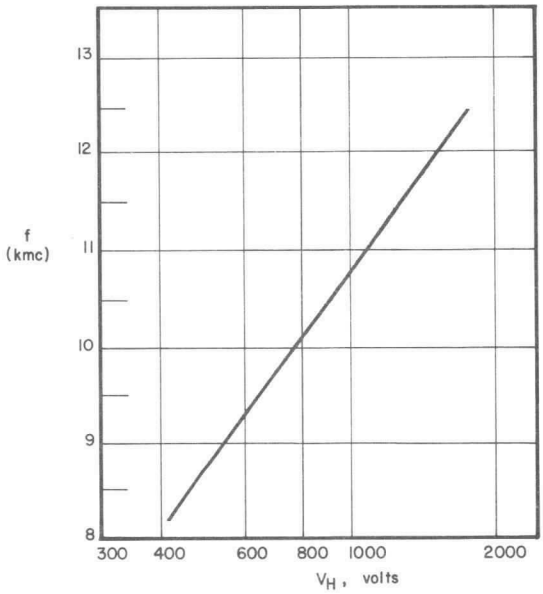
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, 7.0 TO 11.0 KMC BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

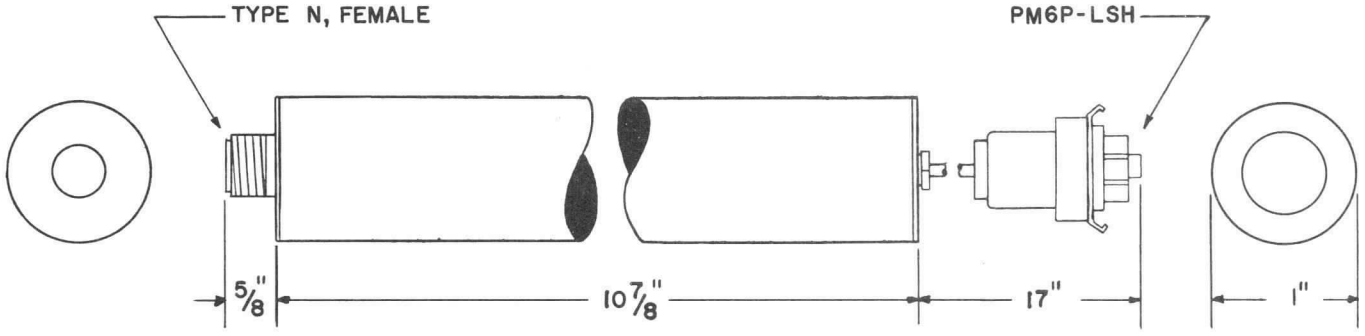
FREQUENCY RANGE . . . . . 7.0 TO 11.0 KMC
POWER OUTPUT . . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	350 TO 2000 V	— —	3.0 MA MAX
COLLECTOR	350 TO 2000 V	— —	10.0 MA MAX
ANODE	0 TO 300 V	— —	1.0 MA MAX
CATHODE	0 V	— —	10.0 MA MAX
HEATER	6.3 OR 7.0 V	— —	1.2 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, S — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

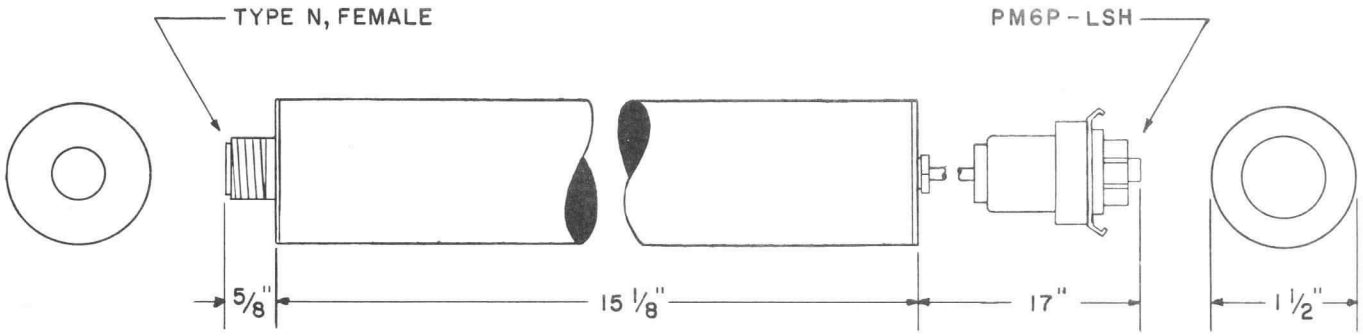
FREQUENCY RANGE . . . . . 2.0 TO 4.0 KMC
POWER OUTPUT . . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	200 TO 3400 V	4 MCS / VOLT MAX	2.0 MA MAX
COLLECTOR	200 TO 3400 V	— —	15.0 MA MAX
ANODE	0 TO 300 V	0.6 MCS / VOLT MAX	0.4 MA MAX
CATHODE	0 V	— —	15.0 MA MAX
HEATER	6.3 OR 7.0 V	0.4 MCS / 0.1 VOLT MAX	2.0 AMP MAX

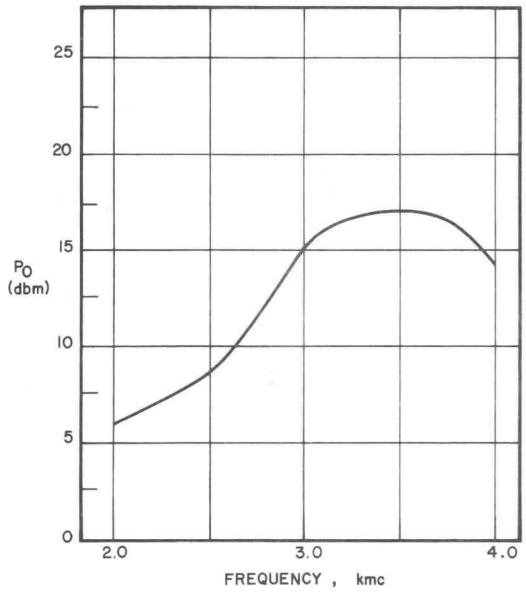
FOCUSING . . . . . SOLENOID, 760 GAUSS

MECHANICAL CHARACTERISTICS

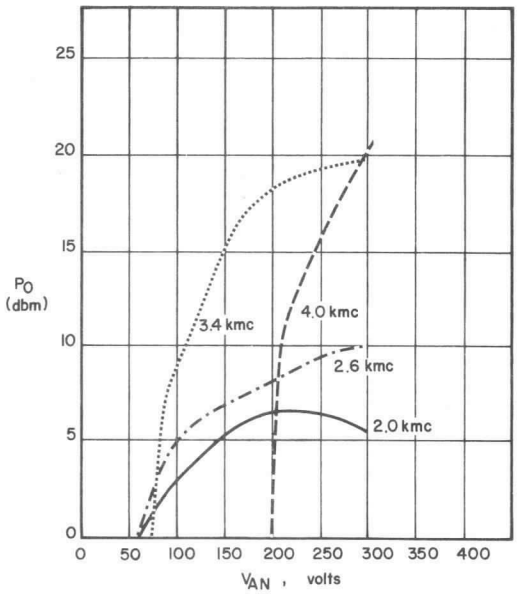


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 2 1/2 LBS

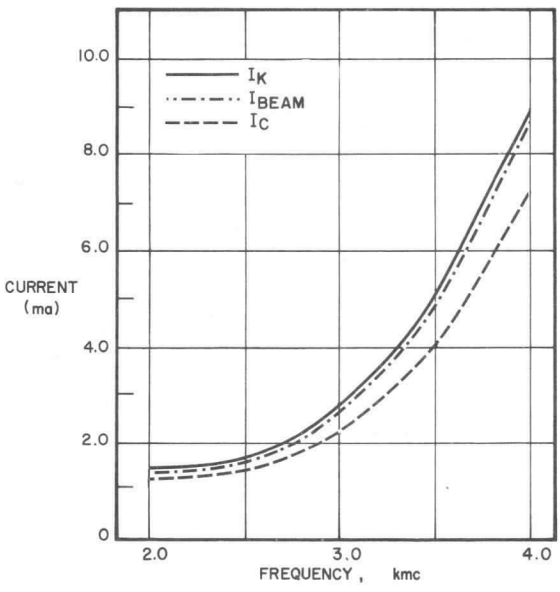
TYPICAL OPERATING CHARACTERISTICS



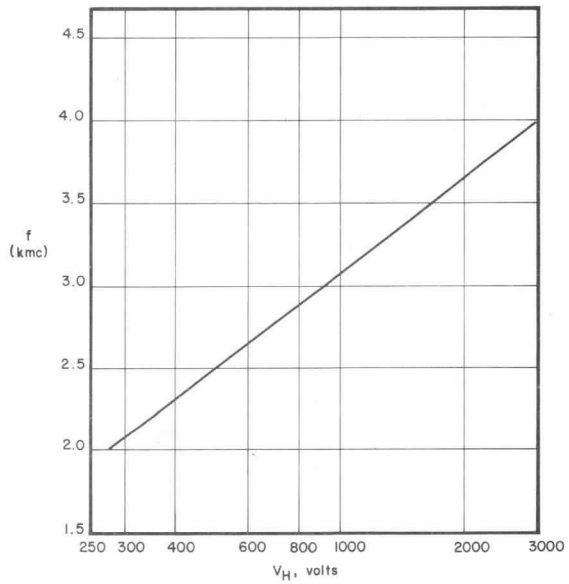
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID FOCUSED, Ku — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

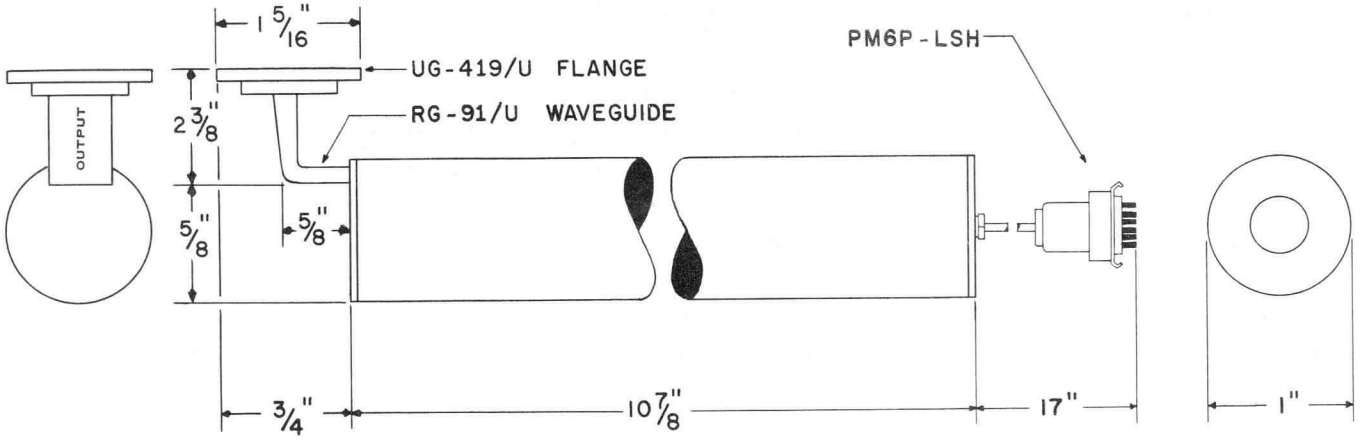
FREQUENCY RANGE . . . . . 12.0 TO 18.0 KMC
POWER OUTPUT. . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	400 TO 2200 V	10 MCS / VOLT MAX	3.0 MA MAX
COLLECTOR	400 TO 2200 V	--	10.0 MA MAX
ANODE	0 TO 350 V	0.4 MCS / VOLT MAX	1.0 MA MAX
CATHODE	0 V	--	10.0 MA MAX
HEATER	6.3 OR 7.0 V	30 MCS / VOLT MAX	1.2 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

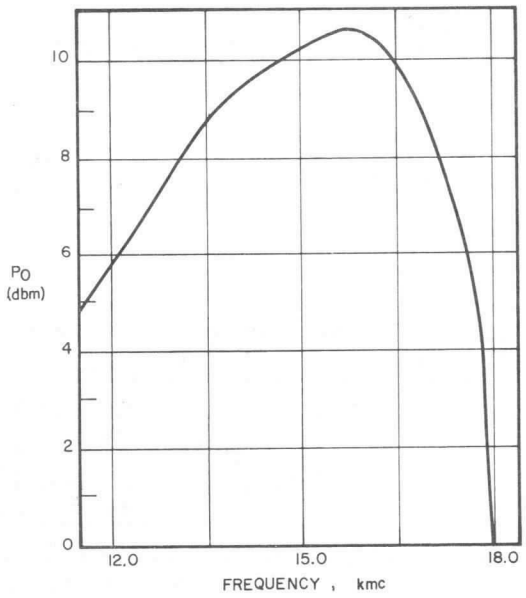
MECHANICAL CHARACTERISTICS



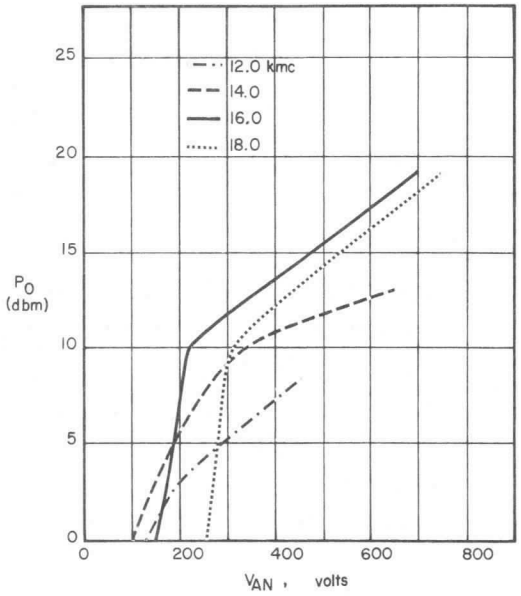
CAPSULE FINISH. . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED. . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

SALES & SERVICE IN THE UNITED KINGDOM:-
B. & K. LABORATORIES LTD.
4 TILNEY ST., PARK LANE, LONDON, W.1., ENGLAND.
TELEPHONE: GROSVENOR 4567

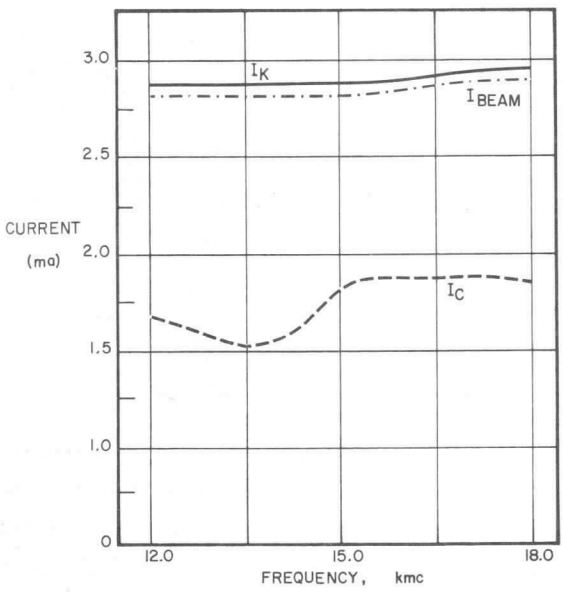
TYPICAL OPERATING CHARACTERISTICS



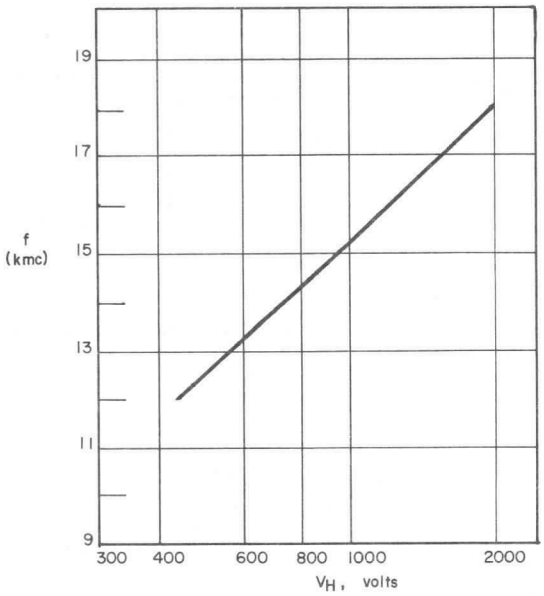
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

TENTATIVE CHARACTER

HO–20

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, 3.75 TO 7.0 KMC BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

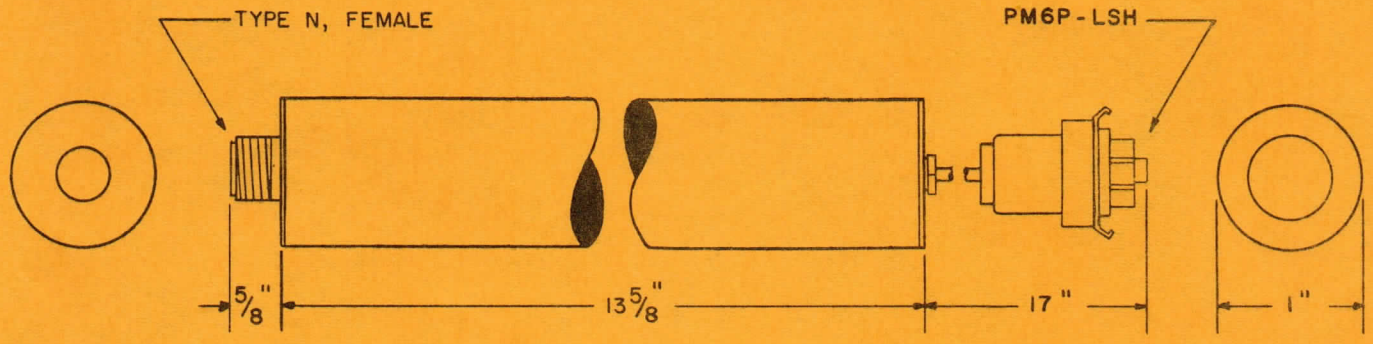
FREQUENCY RANGE	3.75 TO 7.0 KMC
POWER OUTPUT	10 DBM MIN
VSWR	3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	350 TO 2600 V	--	3.5 MA MAX
COLLECTOR	350 TO 2600 V	--	12.0 MA MAX
ANODE	40 TO 300 V	--	1.0 MA MAX
CATHODE	0	--	12.0 MA MAX
HEATER	6.3 OR 7.0 V	--	1.4 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

TENTATIVE CHARAC

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, C – BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

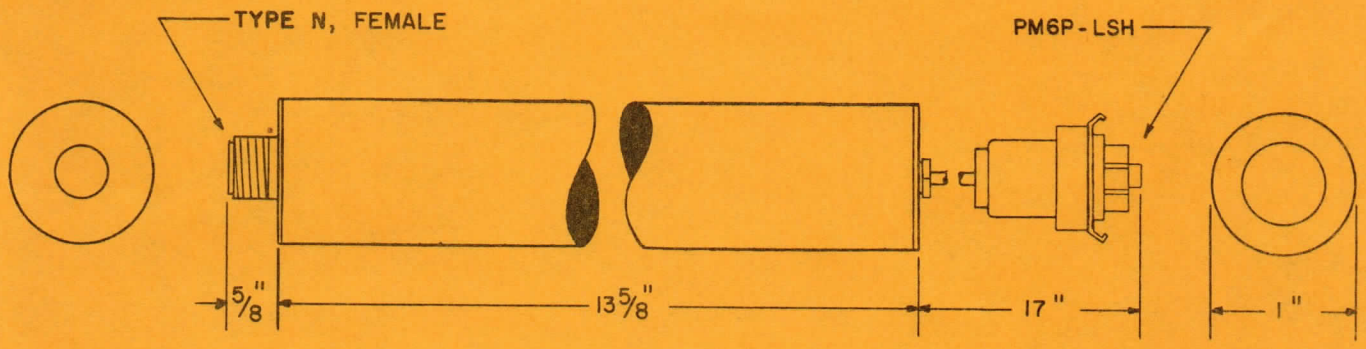
FREQUENCY RANGE . . . . . 4.0 TO 8.0 KMC
POWER OUTPUT. . . . . 10 DBM MIN
VSWR . . . . . 3: 1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	240 TO 2400 V	--	3.5 MA MAX
COLLECTOR	240 TO 2400 V	--	12.0 MA MAX
ANODE	40 TO 300 V	--	1.0 MA MAX
CATHODE	0 V	--	12.0 MA MAX
HEATER	6.3 OR 7.0 V	--	1.4 AMP MAX

FOCUSING. . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH. . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED. . . . . SOLENOID BLOWER
NET WEIGHT. . . . . 1.0 LB

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California

PPM – FOCUSED, X – BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

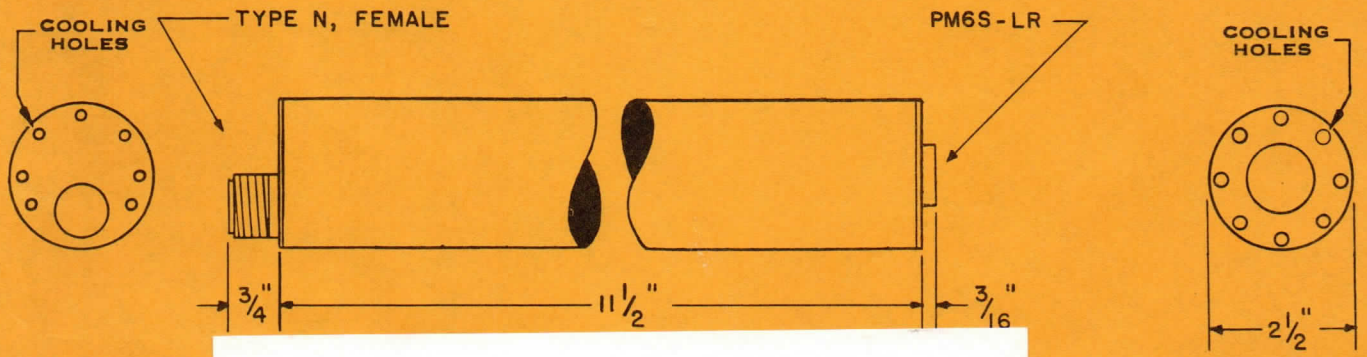
FREQUENCY RANGE . . . . . 8.2 TO 12.4 KMC
POWER OUTPUT . . . . . .5 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	400 TO 2000 V	--	4.0 MA MAX
COLLECTOR	400 TO 2000 V	--	12.0 MA MAX
ANODE	0 TO 300 V	--	1.0 MA MAX
CATHODE	0 V	--	12.0 MA MAX
HEATER	6.3 OR 7.0 V	--	1.2 AMP MAX

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



SALES & SERVICE IN THE UNITED KINGDOM:-
B. & K. LABORATORIES LTD.
4 TILNEY ST., PARK LANE, LONDON, W.1., ENGLAND.
TELEPHONE: GROSVENOR 4567

CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . AIR: 5 CFM @ 1" WATER
NET WEIGHT . . . . . 3 1/2 LBS

ASSOCIATED SOLENOID LIST

HUGGINS MENLO PARK ENGINEERING

TUBE TYPE	SOLENOID TYPE	RATED FIELD, GAUSS	SOLENOID VOLTAGE
HA-1	AS-3	300	90-100
	AS-4	300	24-28
	AS-5	300	225-250
HA-2	BS-9C	600	90-100
	* AS-17	600	90-100
HA-3	AS-7	400	90-100
	AS-12	400	24-28
HA-4	AS-7	400	90-100
	AS-12	400	24-28
HA-5	AS-22	400	90-100
HA-6	BS-4B, BS-4C	1100	110-120
HA-7	AS-25	300	90-100
HA-9	BS-11C	1000	90-100
	BS-16C	1000	45-55
HA-10	BS-4B, BS-4C	1000	90-100
	BS-8B	1000	24-28
HA-11	AS-10	500	90-100
	AS-15	500	24-28
HA-14	BS-13C	1000	90-100
HA-15	BS-4B, BS-4C	1000	90-100
HA-16	BS-9C	600	90-100
HA-17	BS-13C	1000	90-100
HA-18	BS-26B, BS-26C	870	100-120
HA-19	BS-13C	1000	90-100
HA-22	AS-3	300	90-100
	AS-4	300	24-28
	AS-5	300	225-250
HA-23	BS-27B, BS-27C	1000	90-100
HA-24	AS-6	400	90-100
HA-26	AS-6	400	90-100
HA-33	BS-27B, BS-27C	1000	90-100
HA-34	AS-21	500	90-100
HA-37	BS-25C	750	90-100
HA-39	BS-9C	600	90-100
HA-40	BS-26C	820	90-100
HA-44	BS-13B, BS-13C	1000	90-100
PA-1	BS-11C	1000	90-100
PA-3	BS-4B,BS-4C	1000	90-100
PA-4 (HA-12)	BS-9C	600	90-100
	* AS-17	600	90-100
PA-5 (HA-13)	BS-8B	1000	24-28
	BS-4C	1000	90-100
PA-7	BS-4C	1000	90-100

* REQUIRES EXTERNAL FAN FOR PURPOSES OF COOLING TUBE. BS-9C IS RECOMMENDED FOR USE WITH THIS TUBE.

ASSOCIATED SOLENOID LIST (CON.)

HUGGINS — MENLO PARK ENGINEERING

TUBE TYPE	SOLENOID TYPE	RATED FIELD GAUSS	SOLENOID VOLTAGE
DA-1	AS-19	250	90-100
DA-2	AS-19	250	90-100
DA-3	AS-20	250	90-100
DA-4	AS-12	400	24-28
	AS-7	400	90-100
BA-1	BS-5C	820	90-100
BA-2	BS-4C	1 000	90-100
HO-1	BS-5C, BS-5A	820	90-100
HO-2	BS-3B, BS-3C	1 000	90-100
HO-3	BS-6A, BS-6C	675	90-100
HO-4	BS-3B, BS-3C	1 000	90-100
HO-10	BS-3B, BS-3C	1 000	90-100
HO-11	BS-3B, BS-3C	1 000	90-100
HO-13	BS-4B, BS-4C	1 000	90-100
HO-14	BS-3B, BS-3C	1 000	90-100

NOTE: FOR PRICES AND DELIVERY INFORMATION, CONTACT:

MENLO PARK ENGINEERING
721 HAMILTON AVENUE, MENLO PARK, CALIFORNIA

not white to date

PRICE LIST

BROADBAND AMPLIFIERS	PRICE
HA-1	$ 650.00
HA-2	650.00
* HA-3	750.00
HA-4	750.00
HA-5 ✓	750.00
HA-6 ✓	850.00
HA-7 ✓	750.00
HA-9	1,500.00
HA-10 ✓	850.00
HA-11 ✓	1,000.00
HA-14	1,500.00
* HA-15 ✓	1,000.00
HA-16	850.00
HA-17	1,000.00
HA-18 sheets missing	850.00

BROADBAND AMPLIFIERS	PRICE
HA-19	$ 1,000.00
HA-20 ✓	1,125.00
HA-21	3,000.00
HA-22	750.00
HA-23	1,500.00
HA-24	750.00
HA-26	750.00
HA-28	1,500.00
HA-29	975.00
HA-30 ✓	1,300.00
HA-31	1,500.00
HA-33 ✓	1,500.00
HA-34	850.00
HA-37 ✓ HA-39 sheets missing	1,500.00 750.00
HA-40	1,000.00
HA-44 ✓	1,000.00

PULSED AMPLIFIERS	PRICE
PA-1	$ 1,750.00
PA-3	1,000.00
PA-4 ✓(HA-12)	850.00
PA-5 ✓(HA-13)	950.00
PA-6 ✓	1,500.00
PA-7	950.00

DISPERSIVE AMPLIFIERS	PRICE
DA-1	$ 650.00
DA-2	750.00
DA-3	850.00
DA-4	750.00

BACKWARD WAVE AMPLIFIERS	PRICE
BA-1	$ 1,500.00
BA-2	1,500.00

BACKWARD WAVE OSCILLATORS	PRICE
HO-1	$ 750.00
* HO-2	1,000.00
HO-3	750.00
HO-4	1,250.00
HO-10	750.00
HO-11	750.00
HO-13	750.00
HO-14	750.00

* FOR REPLACEMENT PURPOSES ONLY.

NOTE:

PRICES — ABOVE PRICES APPLY TO SMALL QUANTITIES ONLY. SUBJECT TO CHANGE WITHOUT NOTICE. A 15% CREDIT WILL BE ALLOWED UPON RETURN OF THE USED ENCAPSULATED TUBE WHEN REORDERING.

SHIPMENT — F. O. B. MENLO PARK, CALIFORNIA, VIA AIR FREIGHT.

DELIVERY — SEE SHORT FORM CATALOG.

TERMS — NET, 30 DAYS.

HUGGINS LABORATORIES, INC.

711 HAMILTON AVENUE, MENLO PARK, CALIFORNIA

missing 9-1-58