TWT's

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Here are your copies of Huggins TWT Catalog and Volumes I and II of Huggins Engineering Handbook.

Your name has been placed in our files so that you will receive additions and revisions to both publications as they are published.

Huggins Engineering Handbook is a collection of Engineering Notes which discuss various aspects of TWT theory and application. The Handbook consists of two volumes: Volume I is completed, and Volume II is a growing publication to which Engineering Notes will be added from time to time.

The catalog presents detailed information on Huggins TWTs--solenoid requirements, electrical and mechanical characteristics, prices, and warranty facts.

For your convenience the catalog is divided into ten sections: GENERAL, D-C CONNECTORS (both arranged by page number), BACKWARD WAVE AMPLIFIERS, BACKWARD WAVE OSCILLATORS, FORWARD WAVE AMPLIFIERS, LOW NOISE TUBES, PULSED AMPLIFIERS, SPECIAL PURPOSE TUBES (all arranged numerically by tube number), ASSOCIATED SOLENOID LIST, and PRICE LIST (both arranged by page number).

Besides additions and revisions, you will periodically receive a "Check List" to check your catalog for completeness. Because an up-to-date catalog works better for you, these tips on keeping your catalog current are offered:

1. Insert revisions and additions as you receive them.
2. Insert each page sectionally and numerically according to the designator that appears in the lower right or left corner; e. g., GI/PAGE 6/APRIL, 1961 and FWA/HA-1/MARCH, 1961.

   Section codes are: General (GI), D-C Connectors (DC), Backward Wave Amplifiers (BWA), Backward Wave Oscillators (BWO), Forward Wave Amplifiers (FWA), Low Noise Tubes (LNT), Pulsed Amplifiers (PA), Special Purpose Tubes (SPT), Associated Solenoid List (ASL), and Price List (PL).
3. Remove outdated pages.
4. When you receive a "Check List," use it to make certain that your catalog is up to date. Order missing pages directly from Huggins Laboratories, Inc.

As an added convenience, postage-paid return post cards are supplied with your catalog. These cards make it very easy for you to have your name removed from our files or have your mailing address changed on our records.

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[1] Periodic permanent magnet focused

[2] Permanent magnet focused

[4] Characteristics yet to be published

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[1] Periodic permanent magnet focused

[4] Characteristics yet to be published

[5] Tube furnished for replacement only

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[1] Periodic permanent magnet focused

[4] Characteristics yet to be published

[5] Tube furnished for replacement only

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[1] Periodic permanent magnet focused

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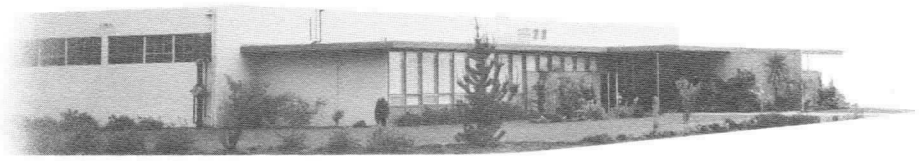
HUGGINS LABORATORIES, INCORPORATED...
producing the TWT industry's broadest line



From this modern 40,000-square-foot facility comes the world's most complete line of quality TWTs.

Since 1952, when Richard A. Huggins placed the first commercially available traveling-wave tube on the market, Huggins Laboratories has made many notable commercial firsts. Besides the first wave tube, these include the...

first backward wave oscillator,

first low-noise amplifier,

first PPM-focused wave tube,

first electrostatically focused TWT.

As a pioneer in TWT manufacture, the Laboratories has advanced the traveling-wave tube industry years ahead of its state by making the broadest line of quality TWTs available in quantity. Huggins tubes are standard setters; thus they are accepted and widely used in microwave systems the world over.

—— HUGGINS LABORATORIES, INC. ——

In pioneering the art of TWT manufacture, Huggins Laboratories developed the ability to combine either company or externally-sponsored research with excellent engineering and technical know-how to convert ideas into field-operable tubes. During this development, Huggins has acquired a great store of information and unequalled experience related to TWT design and manufacture.

To meet wave tube design and fabrication problems, Huggins has brought together an outstanding team of engineers and technicians whose skills and knowledge range from microwave circuits to electron ballistics. The efforts of this team are devoted entirely to the traveling-wave tube and have made Huggins Laboratories the acknowledged leader in producing quality TWTs in production quantities.

An intensive research and development program continues to add new tubes to the Huggins' line, to increase our knowledge of wave tubes, to improve the performance of existing tubes, and to advance the state-of-the-art.

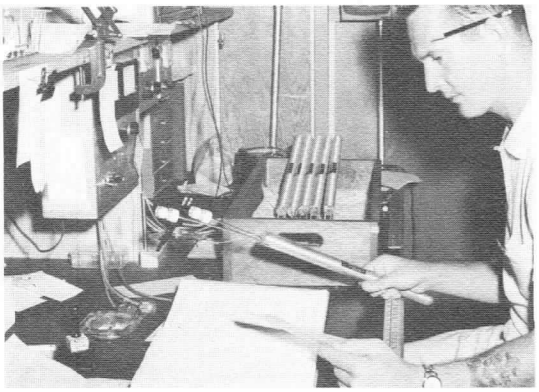
Our Research and Development and Product Development Departments are staffed with engineers and technicians who are well versed in TWT design and practice. Many have worked with the wave tube since its infancy. This knowledge and experience is augmented by the most modern and advanced equipment obtainable.

Experience.....knowledge.....and modern equipment are combined to bring you the best in wave tubes.

The Production Department at Huggins Laboratories is staffed, equipped, and geared to deliver production quantities on short delivery schedules. It is this department which has consistently produced 35 % to 40 % of all forward wave amplifiers, with an output power less than 100 watts, sold each year. Quality and quantity are the doctrines by which the Production Department operates.

—— HUGGINS LABORATORIES, INC. ——

Simplified handling and production techniques unique to Huggins TWTs permit large-scale manufacturing of our tubes. Careful production design and strict quality control throughout all stages of manufacture guarantees a dependable, long-lived product. As an example, an average of 25 % of the production time for each low-noise amplifier is spent in quality control.



Strict quality control throughout all stages of manufacture guarantees a dependable, long-lived product.

To fill the needs of modern microwave applications, Huggins Laboratories produces over 450 traveling-wave tubes which cover the microwave frequencies from 250 to 15,000 megacycles.

Tubes whose characteristics fall outside those of our standard catalog tubes are manufactured to individual customer specifications. If a tube for your requirements is not included in this catalog, you are invited to contact our Sales Department and join the more than 75 satisfied microwave systems manufacturers who currently turn to Huggins Laboratories for their TWT needs.

Huggins Laboratories, through its Instruments/Subsystems Division, is also engaged in the research, development, and manufacture of TWT and BWO solenoids and power supplies, microwave sweep oscillators, all types of TWT packages, and microwave subsystem modules.

This division has gained the experience and technical knowledge which are so valuable to the economical handling of all engineering problems commonly encountered in TWT packaging and power supply design. Close liaison between TWT and systems engineers results in creative engineering with a sound approach to solving instrumentation and subsystems problems.

Whether your application dictates currently available microwave instruments or custom-designed units, we will welcome the opportunity to supply microwave equipment to meet your specific requirements.

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

All Huggins traveling-wave tubes are thoroughly tested and inspected prior to shipment and are warranted as shown below:

HUGGINS LABORATORIES, INC.
999 EAST ARQUES AVENUE
SUNNYVALE, CALIFORNIA

TRAVELING WAVE TUBE WARRANTY AND SERVICE REPORT

PARTS OF TUBE SERVICE REPORT (SEE OTHER SIDE) ARE TO BE FILLED OUT WHEN TUBE IS PLACED IN SERVICE.

Breakage due to shipping is the **carrier's** responsibility, and claims must be filed within 15 days of receipt of the tube. **Immediately** upon receipt, examine the tube for physical damage and check electrical performance against the accompanying data sheet. Internal damage is indicated by an open filament, high filament current at rated filament voltage, or zero cathode current.

WARRANTY

This traveling wave tube is warranted by Huggins Laboratories, Inc. to be free of manufacturing defects for 12 months from the date of shipment by the manufacturer. In terms of this warranty, credit will be offered on returned tubes **only** if the tube is handled according to the following "return procedure" and is operated as directed in the accompanying operating instructions. In cases of solenoid focused tubes, solenoid or solenoid blower failure can cause **severe** tube damage. This warranty applies **only** if Huggins-approved solenoids are used with such tubes. **Written approval** must be obtained from Huggins Laboratories, Inc. if other than a Huggins-approved solenoid is used.

Should the traveling wave tube fail within the warranty period because of manufacturing defects, return the tube in accordance with the "return procedure" so that Huggins Laboratories, Inc. may act promptly. If the manufacturer is judged at fault, the tube will be either replaced or repaired at his discretion. Should a replacement tube be required, credit for the inoperable tube will be prorated as follows:

1. Within 12 months of the beginning of the warranty period, credit will be prorated on the basis of heater operating time (1-10 MW amplifiers, 2000 hours; low-noise amplifiers, 1500 hours; 100 MW and above amplifiers, 1000 hours; backward wave amplifiers and oscillators, 500 hours). Throughout this 12-month period a full guarantee will exist during the first 500 hours of heater operating time on 1-10 MW and low-noise amplifiers, during the first 250 hours of heater operating time on 100 MW and above amplifiers, and during the first 100 hours of heater operating time on backward wave amplifiers and oscillators.

No credit will be awarded for tubes received by Huggins Laboratories, Inc. after the 12-month warranty period has expired.

Any applicable credit awarded under the terms of this warranty applies only toward the future purchase of a replacement tube from Huggins Laboratories, Inc. Cash settlements will not be made. In terms of this warranty, a replacement tube must be the same type as that upon which credit is awarded. Credit for only one tube may be applied toward the purchase of a single replacement tube. Credit will remain open for a maximum of 6 months after Huggins Laboratories, Inc. notifies the customer of the amount awarded. All credits will be based on the purchase price of the tube which prevails at the time the order for a replacement tube is received by the manufacturer.

RETURN PROCEDURE

Do not return tubes to Huggins Laboratories, Inc. without first obtaining permission.
Be certain that the traveling wave tube is inoperable before returning it. If possible, check by tube substitution.

1. Complete the tube service report on the reverse side of this sheet. Answer **all** questions fully, particularly the number of heater operating hours, all voltages and currents at time of failure, and a description of what occured at the time of failure.
2. If possible, repack the tube using the same materials as used in original shipment. Include the completed tube service report and one copy of the performance data sheet for the tube.
3. Ship the tube **prepaid** via surface transportation. Insure for **minimum** amount.
4. If Huggins Laboratories, Inc. finds the returned tube meets specifications, the customer will be notified, and the tube will be returned at the **customer's** expense.
5. If Huggins Laboratories, Inc. finds that tube failure was not the manufacturer's fault, the customer will be notified and the tube will either be returned at the **customer's** expense, or, if possible repaired for a service charge upon the customer's **written** authorization. If it is necessary to dismantle the tube, Huggins Laboratories, Inc. **will not** be held responsible for any subsequent breakage of the glass envelope.
6. If a replacement tube is required, the customer will be notified of any applicable replacement charge. If a replacement charge is involved, the customer **must** give **written** authorization before Huggins Laboratores, Inc. can proceed. If there is no replacement charge, the tube will be replaced with a new tube and returned to the customer.
7. Should the returned tube be found irreparable, the customer will be notified. The customer **must** inform the manufacturer within 30 days of what action to take (viz., issue a credit allowance or return the tube at the **customer's** expense). If not otherwise advised, the manufacturer will act according to the terms of the above warranty.

November 1, 1962

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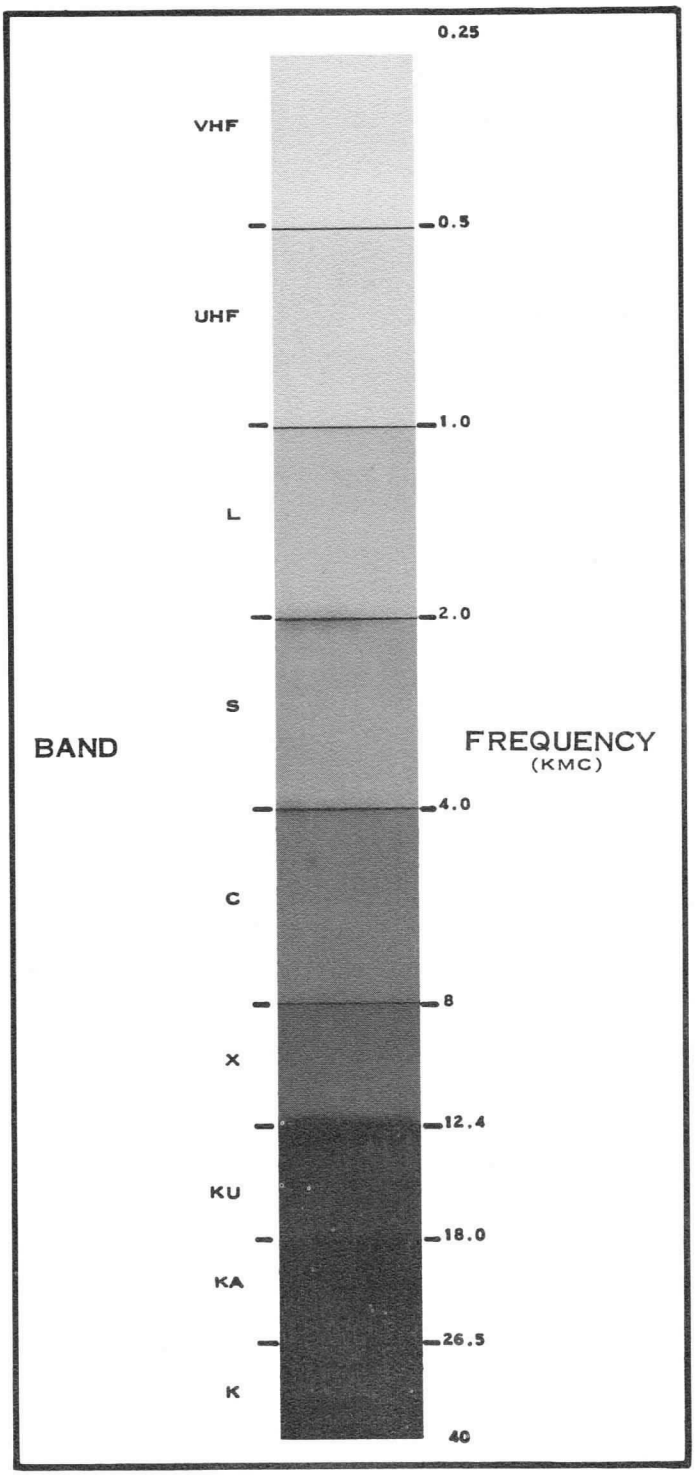

CONVERSION TABLE : DBM TO MILLIWATTS	
DBM	MW
−6	0.25
−3	0.5
0	1
1	1.25
3	2
4	2.5
6	4
7	5
9	8
10	10
13	20
16	40
17	50
20	100
27	500
30	1000
33	2000
36	4000
39	8000
40	10000
DBM = 10 $\log_{10}$ P/1 MW	

SEE NEXT PAGE FOR A POWER UNITS CONVERSION NOMOGRAPH.

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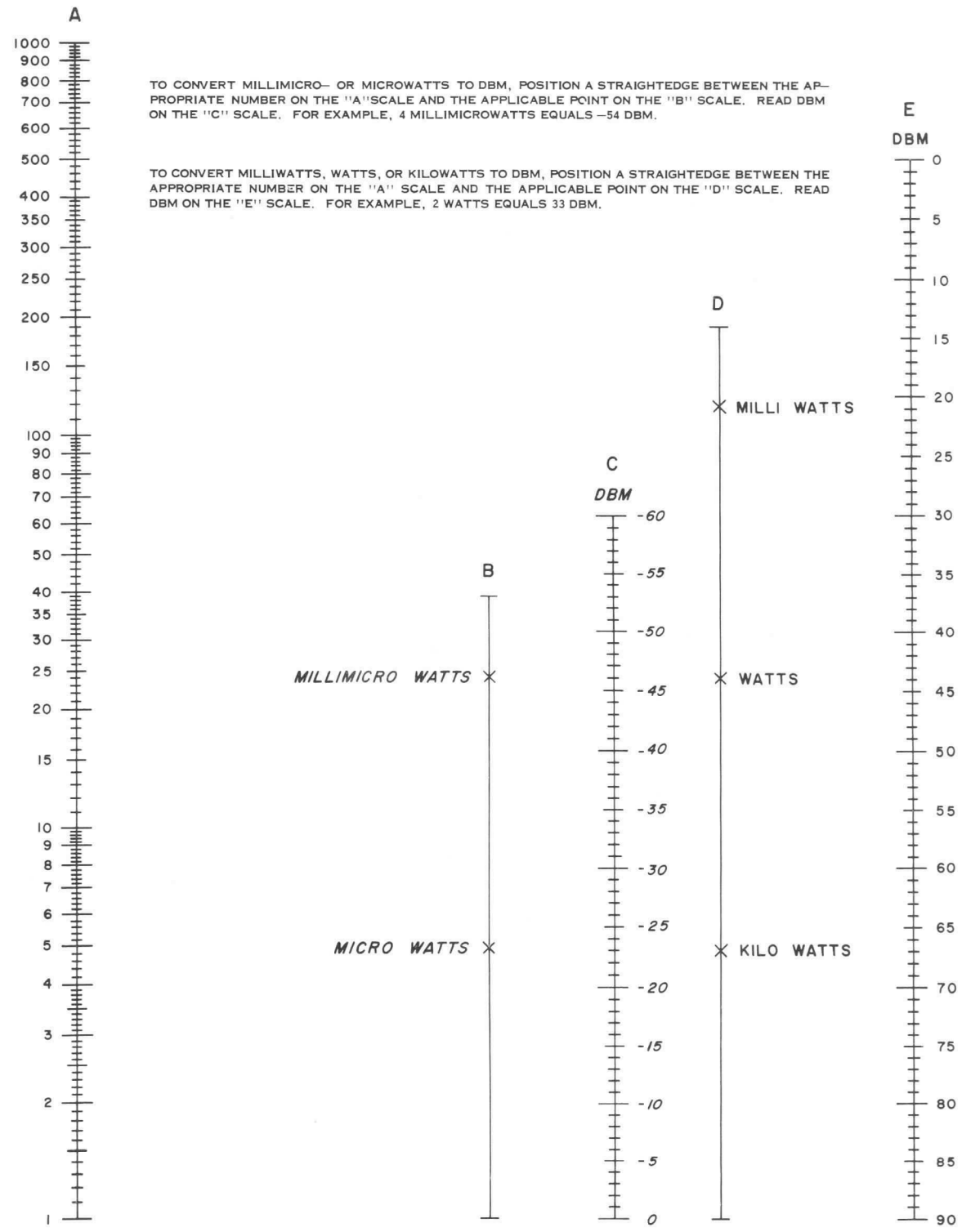
POWER UNITS CONVERSION NOMOGRAPH

TO CONVERT MILLIMICRO– OR MICROWATTS TO DBM, POSITION A STRAIGHTEDGE BETWEEN THE APPROPRIATE NUMBER ON THE "A"SCALE AND THE APPLICABLE POINT ON THE "B" SCALE. READ DBM ON THE "C" SCALE. FOR EXAMPLE, 4 MILLIMICROWATTS EQUALS –54 DBM.

TO CONVERT MILLIWATTS, WATTS, OR KILOWATTS TO DBM, POSITION A STRAIGHTEDGE BETWEEN THE APPROPRIATE NUMBER ON THE "A" SCALE AND THE APPLICABLE POINT ON THE "D" SCALE. READ DBM ON THE "E" SCALE. FOR EXAMPLE, 2 WATTS EQUALS 33 DBM.



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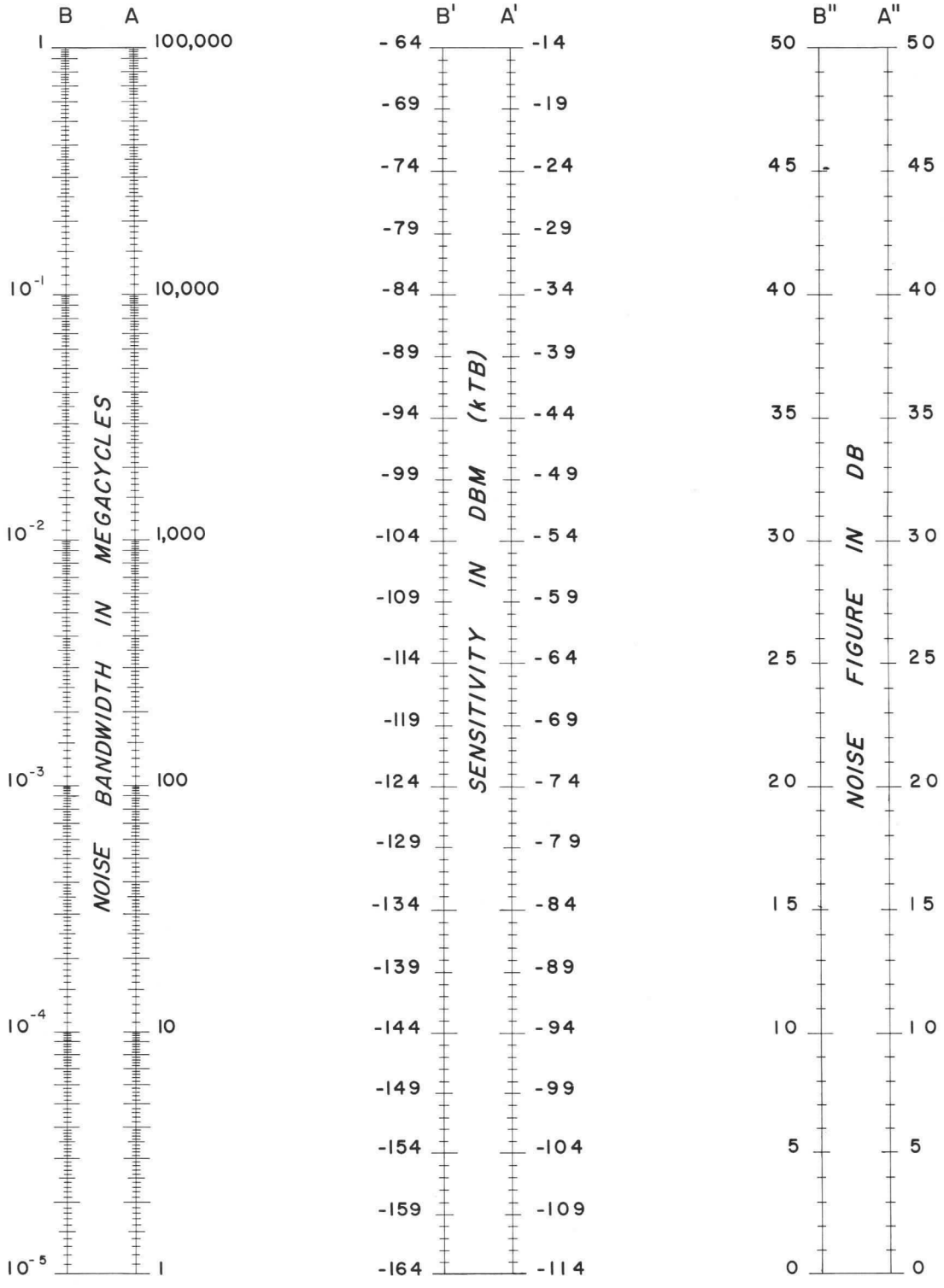
RECEIVER SENSITIVITY NOMOGRAPH



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EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED IN THIS CATALOG

(Symbols and abbreviations may appear in either upper or lower case)

@	:	at
a. c. or a-c	:	alternating current
amp	:	amperes
C	:	collector
db	:	10 $\log_{10} P_2/P_1$
dbm	:	10 $\log_{10}$ P/1 mw
d. c. or d-c	:	direct current
deg or ^{0}	:	degrees
f	:	frequency
G	:	grid
I_c	:	collector current
I_K	:	cathode current
IN	:	input
K	:	cathode
kmc	:	kilo megacycles
ma	:	milliamperes
max	:	maximum
mc	:	megacycles
min	:	minimum
mw	:	milliwatts
nf	:	noise figure
OUT	:	output
P_{in}	:	input power
P_{out}	:	output power
PPM	:	periodic permanent magnet
r. f. or r-f	:	radio frequency
s. s. or s-s	:	small signal
v	:	volts d. c.
vac	:	volts a. c.
V_{AN}	:	anode voltage (may carry number)
V_c	:	collector voltage
V_f	:	heater voltage
V_g	:	grid voltage
V_H	:	helix voltage (may carry number)
VSWR	:	voltage standing wave ratio

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ABOUT HUGGINS TWTs

PERFORMANCE CHARACTERISTICS

I. High Gain

A. Broadband small-signal gain is a minimum of 25 to 40 db depending upon the frequency band and specified RF performance required. Fifty to 60 db small-signal gain has been achieved in narrowband applications.

B. Gain at rated power output for the medium power tubes is a minimum of 27 db. These tubes can be driven to rated output power with a milliwatt power input.

II. Broadband Operation

Most tubes provide rated gain and power output over a 2:1 frequency range without readjustment of the electrode voltages, and they have useful gain and power output over a much wider range.

III. Stability (freedom from oscillation)

The tubes are stable under RF short circuit conditions through all phases of a mismatch. Except for some power amplifiers that require a 2:1 load at the output, total reflections of arbitrary phase can be simultaneously connected to the input and output RF cables without causing oscillation.

IV. Gain Variations (fine grain structure)

Fluctuations in the gain vs. frequency curve (viz., fine grain structure) caused by regenerative feedback are minimized by applying loss within the tubes. Fine grain of less than ±1 db can be expected into a matched load.

V. Low VSWR

The VSWR measured with the tube not operating is less than 1.7:1 for most tubes. Both the input and output VSWR measured with the tube operating do not differ appreciably from the cold VSWR except at one or two isolated frequencies within the band. The better VSWR normally exists on the input connector.

VI. Holes

Holes in the gain and power output as a function of frequency are virtually eliminated.

VII. Grid Control

All forward wave amplifiers are supplied with a grid electrode which enables a variation of gain and power output over wide ranges with relatively small changes in grid voltage. In low-power tubes, a minimum of 30 db reduction in gain is provided anywhere within the operating band when approximately -50 v are applied to the grid (medium-power tubes need approximately -150 v). Under grid cutoff conditions the total reduction in output can be as great as 90 to 100 db.

VIII. Vibration Effects

See Huggins Laboratories, Inc. "Engineering News," ENL Vol. I, No. 1 or inquire directly to the manufacturer for vibration performance.

IX. Temperature Effects

Solenoid focused tubes generally present no difficulty with respect to temperature conditions. Inquire directly to the manufacturer for temperature information on any specific tube.

X. Warranted Life

See page 4 of this section.

OPERATING CHARACTERISTICS

I. A minimum number of voltages are required for operation.

A. Heater supply[1,2,3]

B. Helix and collector supply

C. Anode supply[4] (anode draws negligible current)

D. Solenoid supply if applicable

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[1] Heater supplies for low-power tubes should provide 6.3 to 7.0 v or vac.

[2] Heater supplies for low-noise tubes should provide 5.0 to 7.5 v or vac.

[3] Medium-power tubes require 7.0 v or vac.

[4] Low-noise tubes have more than one anode

E. Grid supply[5]

II. Simple adjustments to set tube into operation without RF measurements.

A. Using a meter that is accurate to 1 %, adjust the helix voltage to the value given on the tube data sheet.

B. Adjust tube position in the magnetic field for minimum helix current on solenoid focused tubes.

C. Apply anode voltage for cathode current specified on tube data sheet.

III. Optimum Broadband Gain

A. Apply an RF signal of highest frequency of desired bandwidth.

B. Set for small-signal operation.

C. Adjust helix voltage for maximum gain.

IV. Optimum Broadband Power Output

A. Apply an RF signal of highest frequency of desired bandwidth.

B. Saturate the tube.

C. Adjust helix voltage for maximum power output.

PHYSICAL CHARACTERISTICS

I. Rugged Capsulation

A. Tubes are permanently locked in place inside all-metal capsules.

B. Tubes will easily withstand the shock of normal handling by unskilled or untrained personnel.

C. All mechanical adjustments on the tubes are made at the factory.

II. RF Input And Output Cables

Tubes are provided with input and output leads consisting of flexible or rigid high-temperature 50-ohm coax or standard waveguide. Type N connectors are usually provided in most frequency ranges for tubes with coax leads. Connectors are attached directly to the capsule end cap on periodic permanent magnet focused tubes.

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[5] Applicable to low and medium-power and pulsed tubes only. For all gridded tubes in which the grid is at cathode potential for full gain, a grid supply is optional. The grid is provided for attenuation and pulse applications.

III. DC Connectors

Winchester connectors or equivalent are standard on most Huggins traveling-wave tubes. See the "D-C Connector" and the various "Characteristics" sections of this catalog for specific information. Other types of DC connectors can be supplied. Consult the manufacturer concerning your requirements.

SPECIAL MODIFICATIONS OF TUBES

I. Power Lead Filters

A. Power lead filters can be provided for use in high-signal-strength areas to keep unwanted signals out of the amplifying channel. Filters are also necessary to prevent oscillations caused by feedback when high gain tubes are operated in tandem.

B. Filters can be provided within the tube capsule to prevent RF feed-through into the tube on the DC voltage leads. In some cases, installation of these filters may lengthen the capsule up to 2 inches.

C. These filters provide at least 35 db dissipative loss in series with each lead entering the capsule.

II. High Altitude Insulation

By using a PM6P or another high-altitude connector, Huggins traveling-wave tubes can be specially encapsulated to operate at altitudes of 70,000 feet without corona or arc-over problems.

III. Special Gain Characteristics

A. Tubes with special gain vs. frequency characteristics (e. g., flat, sloped, and narrowband-high gain) can be provided.

B. Special tubes with very low regeneration characteristics can also be supplied.

IV. Mechanical Modifications

Radial and miniature RF connectors, a variety of DC connectors, flying leads, special lead lengths, hermetic sealing, and other mechanical modifications can be provided upon request.

V. Modifications In General

Many modifications other than those outlined can be made to a customer's specifications. A technical staff is available for your problems as well as for special research and development. You are invited to address us with your inquiry.

SOLENOIDS

I. Compatible solenoids can be supplied for those tubes that use solenoid focusing. These solenoids are designed for minimum weight and size consistent with good engineering practice and operating temperature conditions.

II. Solenoids are available for:

A. Aircraft voltage ranges (24-28 v)

B. Rectification from 110 vac (90-100 v)

C. Special voltage requirements

III. High gauss, air or oil cooled solenoids are available for tubes that require high magnetic fields and which have high collector power to dissipate. Air cooled solenoids provide air cooling for the tube as well as for the solenoid windings. This is accomplished by one solenoid-mounted blower which can be supplied to operate on 24-28 v or 110 vac.

IV. The tube warranty applies only if Huggins-approved solenoids are used.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue · Sunnyvale, California
REgent 6-9330

FACTS TO REMEMBER

(WHEN YOU USE THIS CATALOG)

1. ALL D – C POTENTIALS ARE MEASURED WITH RESPECT TO THE CATHODE.
2. WHERE INDICATED, ANODE OR GRID SUPPLIES MUST BE ADJUSTABLE FROM ZERO VOLTS FOR INITIAL FOCUSING PURPOSES.
3. ALL 10 MW AMPLIFIERS ARE SUPPLIED WITH AN INSULATED COLLECTOR UNLESS REQUESTED OTHERWISE.
4. UNLESS SPECIFIED DIFFERENTLY ON THE CATALOG SHEET, ALL TUBES WITH AN OUTPUT POWER OF 100 MW OR GREATER ARE SUPPLIED WITH THE COLLECTOR INTERNALLY GROUNDED TO THE OUTER SHELL.
5. ALL D – C CONNECTORS ARE SUPPLIED WITH MATING CONNECTORS.
6. UNLESS SPECIFIED TO THE CONTRARY ON THE TUBE OUTLINE DRAWING, RG – 142 / U COAX CABLE IS USED FOR R – F LEADS. TEFLON – COVERED WIRE IS USED FOR COLLECTOR LEADS, AND MULTICONDUCTOR CABLING IS USED FOR POWER LEADS.
7. ORIENTATION OF R – F END CAPS WITH RESPECT TO D – C END CAPS AS SHOWN IN TUBE OUTLINE DRAWINGS DOES NOT REPRESENT AN ACTUAL PHYSICAL RELATIONSHIP.
8. ALL PERIODIC PERMANENT MAGNET (PPM) FOCUSED TUBES WITH AN OUTPUT POWER OF 1 / 2 WATT AND ABOVE HAVE OPENINGS IN BOTH ENDS OF THE CAPSULE TO ALLOW COOL – ING. THE COOLANT MUST FLOW FROM THE D – C END TO THE R – F END BECAUSE THE R – F END OPERATES AT A HIGHER TEMPERATURE.
9. COOLING REQUIREMENTS ARE SPECIFIED FOR STANDARD ATMOSPHERIC CONDITIONS.
10. ALL PPM – FOCUSED TUBES HAVE NEGLIGIBLE EXTERNAL FIELDS.
11. THE OPERATING CHARACTERISTICS OF AN INDIVIDUAL TUBE MAY VARY SLIGHTLY FROM THOSE INDICATED BY THE CHARACTERISTIC CURVES SHOWN FOR THAT PARTICULAR TUBE.
12. MANY MODIFICATIONS OF OUR CATALOG TUBES HAVE BEEN MADE TO CUSTOMERS' SPECIFICA– TIONS. YOU ARE INVITED TO ADDRESS US WITH YOUR INQUIRY.

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

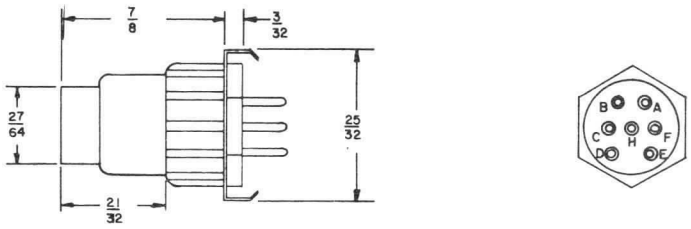
D. C. CONNECTOR INFORMATION

The information on the following two pages gives the electrode which is associated with the corresponding pin on the various connectors which are supplied with our standard (catalog) traveling wave tubes. Other types of d-c connectors can be supplied at additional cost to meet customer specifications. Feel free to address us with your inquiry. The color coding indicated for the leads used with our standard connectors, however, cannot be changed. In all cases, mating d-c connectors are supplied with our traveling wave tubes.

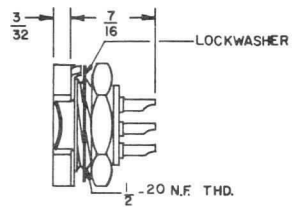
HUGGINS LABORATORIES, INC.

D. C. CONNECTOR INFORMATION

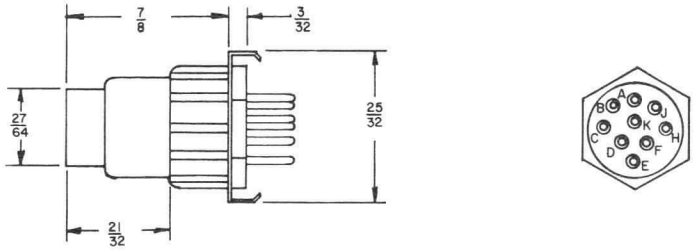
(ALL D-C CONNECTORS ARE WINCHESTER OR EQUIVALENT)



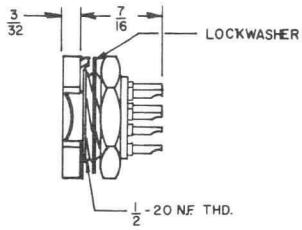
M7P-LSH 19



M7S-LRN



M9P-LSH 19



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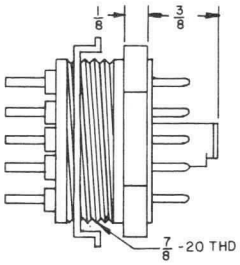
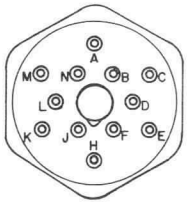
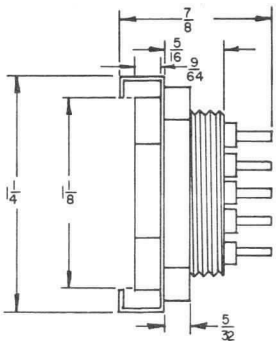
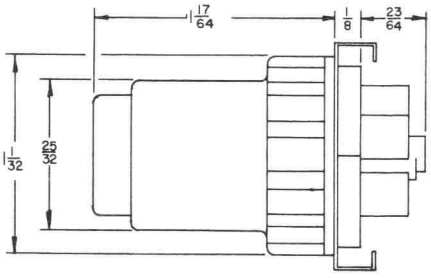


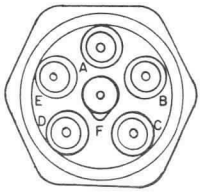


M12P-LR6

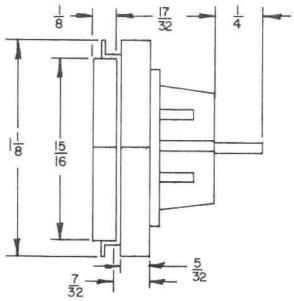


M12S-LS6N

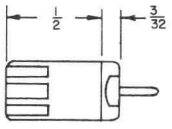


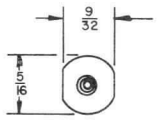


PM6P-LS

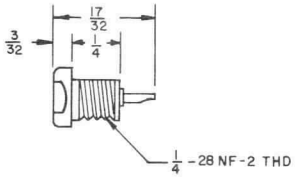


PM6S-LRN





SM1P



SM1S

D. C. CONNECTOR INFORMATION

CONNECTOR TERMINAL	CONNECTOR M7P-LSH 19 [1]	COLOR OF LEAD	CONNECTOR M9P-LSH 19 [2]	COLOR OF LEAD	CONNECTOR M12P-LR [3]	COLOR OF LEAD	CONNECTOR PM6P-LSH [4]	COLOR OF LEAD
A	GRID [5]	YELLOW	ANODE NO. 2	YELLOW			CATHODE	ORANGE
B	ANODE	BROWN	ANODE NO. 3	BROWN	GRID	YELLOW	ANODE	BROWN
C	CAPSULE GROUND [6] (COLLECTOR)	GREEN	CAPSULE GROUND [6] (COLLECTOR)	GREEN			HELIX	RED
D	HELIX	RED	HELIX	RED	CAPSULE GROUND [6] (COLLECTOR)	GREEN	HEATER	BLACK
E	HEATER	BLUE OR BLACK	HEATER	BLUE			HEATER	WHITE
F	HEATER	WHITE	HEATER	WHITE	HEATER	BLUE	CAPSULE GROUND [6] (COLLECTOR)	GREEN
H	CATHODE	ORANGE	ANODE NO. 1	ORANGE	HEATER	WHITE		
J			ANODE NO. 4	BLACK	CATHODE	ORANGE		
K			CATHODE	PURPLE				
L					HELIX	RED		
N					ANODE	BROWN		

1. SUPPLIED AS STANDARD CONNECTOR ON MOST SOLENOID FOCUSED 10 MW AMPLIFIERS.
2. SUPPLIED AS STANDARD CONNECTOR ON MEDIUM AND LOW NOISE TUBES.
3. SUPPLIED AS STANDARD CONNECTOR ON MOST PPM FOCUSED AMPLIFIERS.
4. SUPPLIED AS STANDARD CONNECTOR ON MOST 1 WATT FORWARD WAVE AMPLIFIER, BWA, DA, BWO TUBES AND MOST 1 WATT PULSED AMPLIFIERS. WHERE APPLICABLE THE GRID IS BROUGHT OUT ON THE D-C END CAP WITH A SM1P FLYING LEAD.
5. THE GRID CAN BE SUPPLIED ON A FEMALE BNC CONNECTOR ATTACHED TO THE D-C END CAP ON TUBES INTENDED FOR PULSE USE WITH GROUNDED CATHODE.
6. IN 10 MW AMPLIFIERS AND ALL OTHER TUBES WITH AN INSULATED COLLECTOR, THE COLLECTOR IS BROUGHT OUT ON A SM1P CONNECTOR.

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

SOLENOID – FOCUSED, S – BAND BACKWARD WAVE AMPLIFIER

ELECTRICAL CHARACTERISTICS

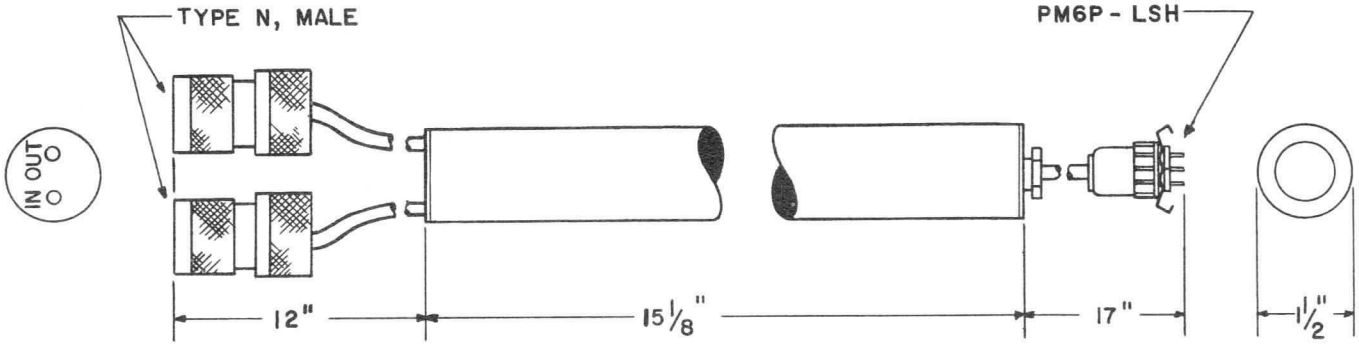
FREQUENCY RANGE	2.4 TO 3.6 KMC
SMALL – SIGNAL GAIN @ SYNCHRONISM	10 DB MIN
SYNCHRONOUS BANDWIDTH[1]	0.1 TO 1.0 %
VSWR, INPUT AND OUTPUT	3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	CURRENT
HELIX 1	V_{H2} ± (0 TO 300) V	2.0 MA MAX.
HELIX 2 AND COLLECTOR	300 TO 1500 V	15.0 MA MAX.
ANODE	0 TO 500 V	0.5 MA MAX.
CATHODE	0 V	15.0 MA MAX.
HEATER	6.3 OR 7.0 V	2.3 AMP MAX.

FOCUSING . . . . . SOLENOID, 820 GAUSS

MECHANICAL CHARACTERISTICS



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

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

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

SOLENOID — FOCUSED, S — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

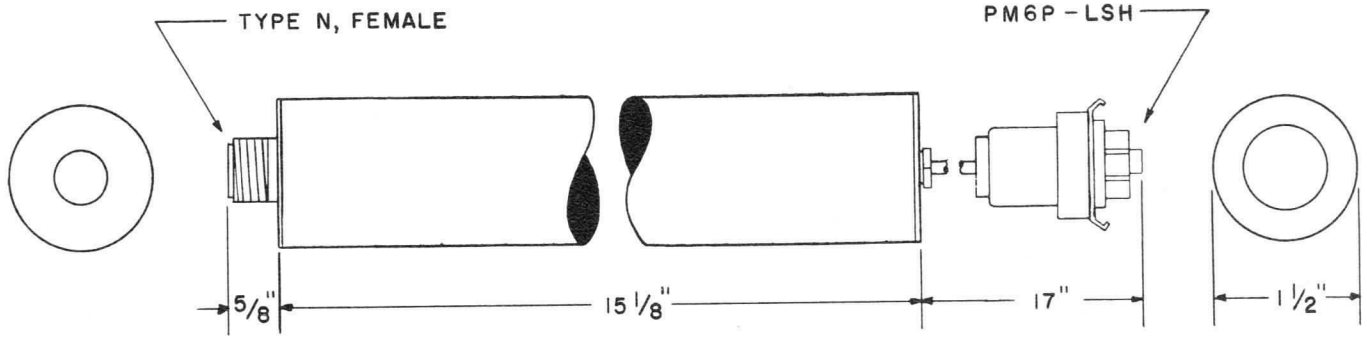
FREQUENCY RANGE . . . . . 2.0 TO 4.0 KMC
POWER OUTPUT . . . . . 10 DBM MIN
VSWR . . . . . 3:1 MAX

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

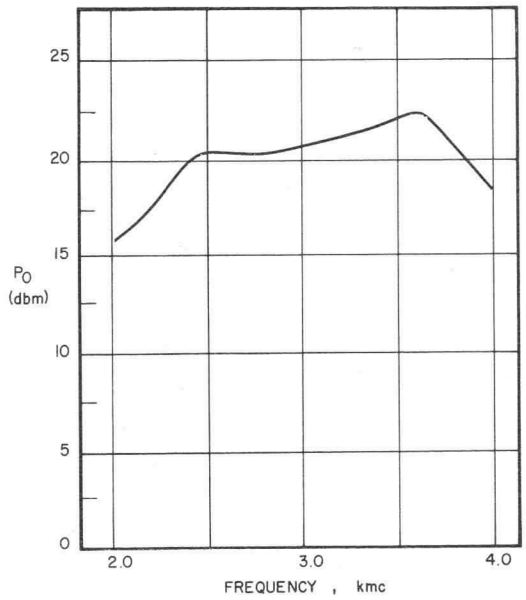
MECHANICAL CHARACTERISTICS



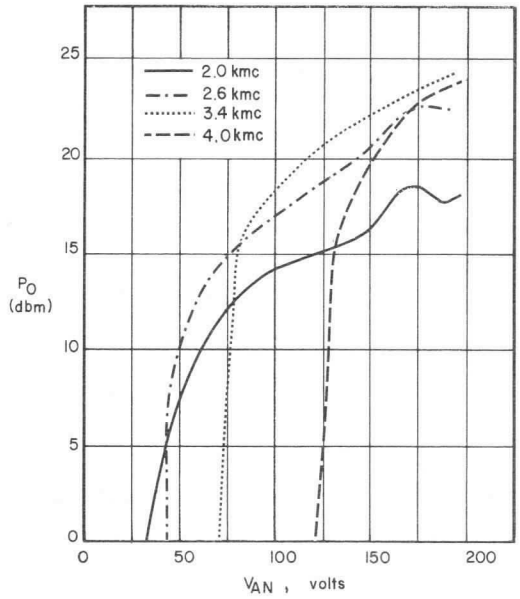
CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 2 1/2 LBS

HUGGINS LABORATORIES, INC.

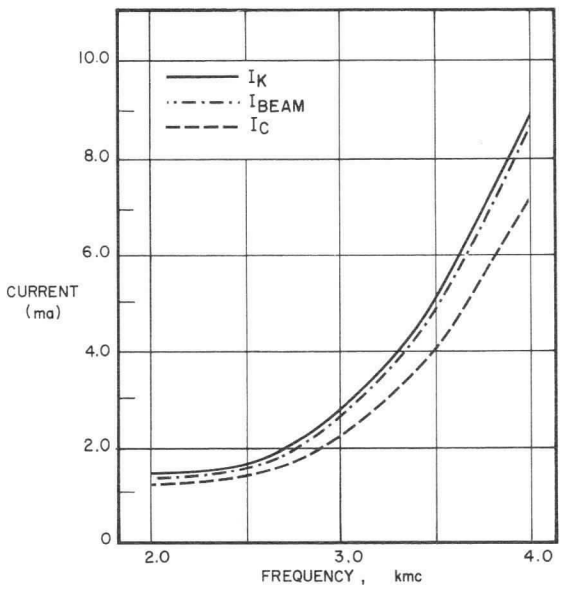
TYPICAL OPERATING CHARACTERISTICS



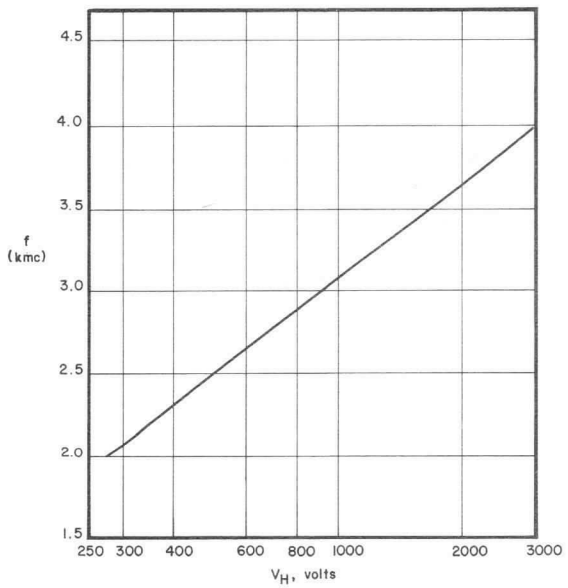
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

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

SOLENOID — FOCUSED, X — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

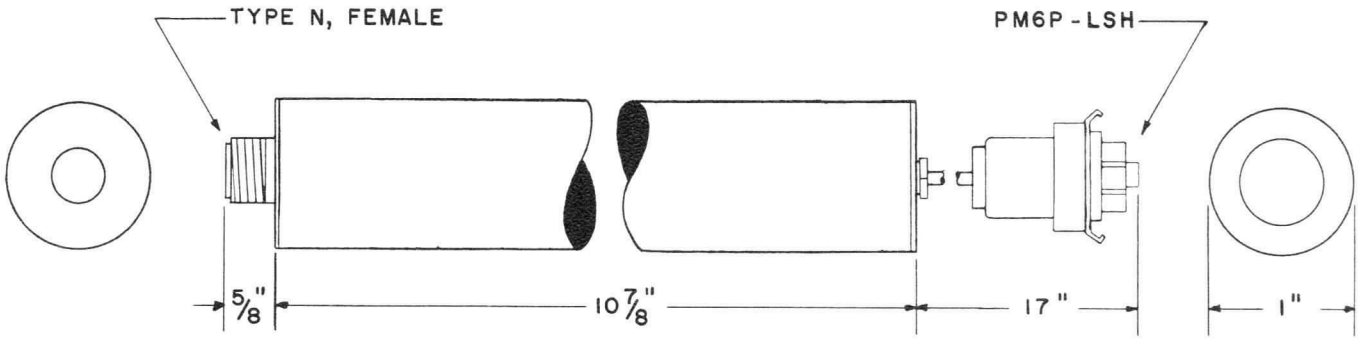
FREQUENCY RANGE	8.2 TO 12.4 KMC
POWER OUTPUT	10 DBM MIN
VSWR	3:1 MAX

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

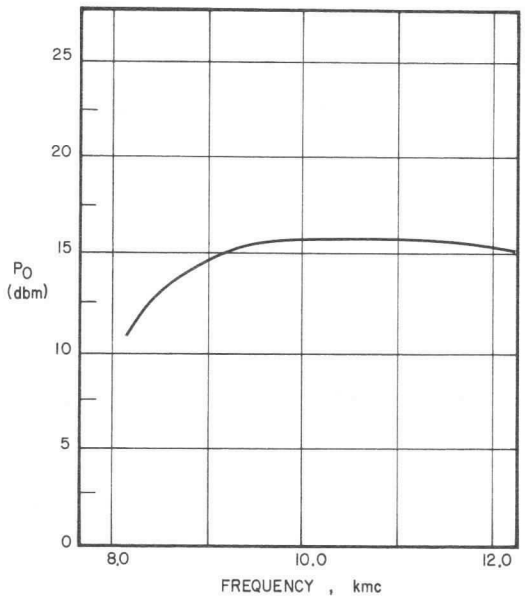
MECHANICAL CHARACTERISTICS



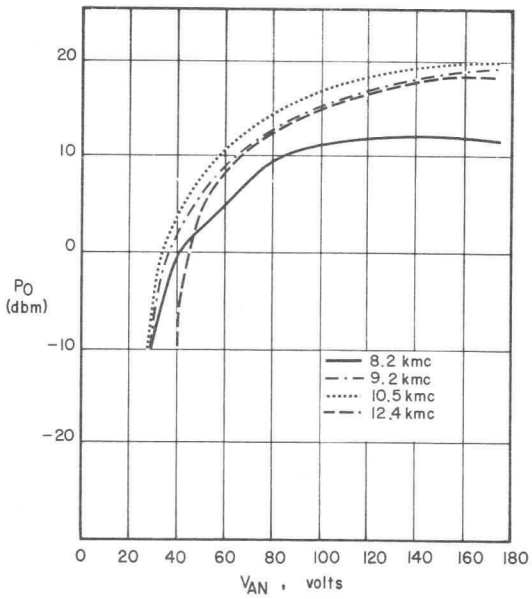
CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

HUGGINS LABORATORIES, INC.

TYPICAL OPERATING CHARACTERISTICS



POWER OUTPUT



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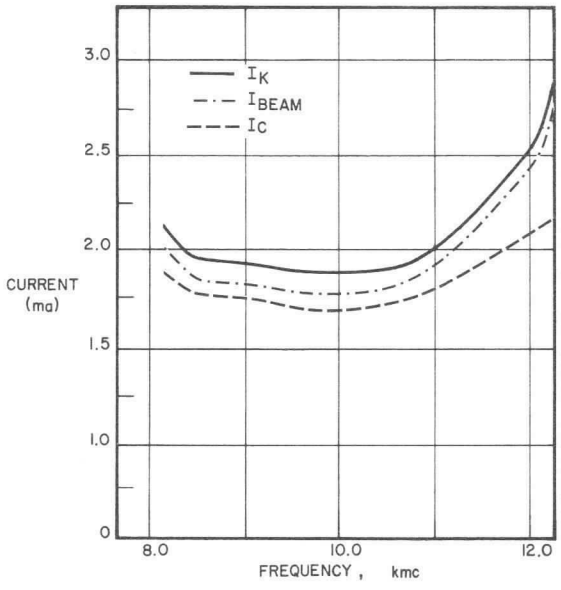
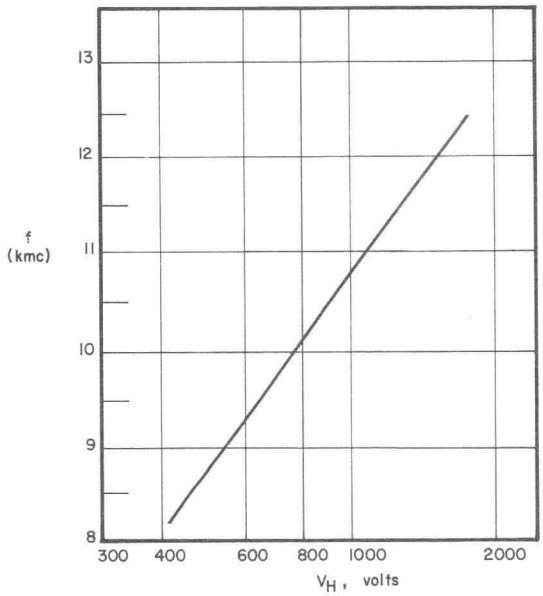


STARTING CURRENT



TUNING CURVE

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

SOLENOID — FOCUSED, 3.75 TO 7.0 KMC BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

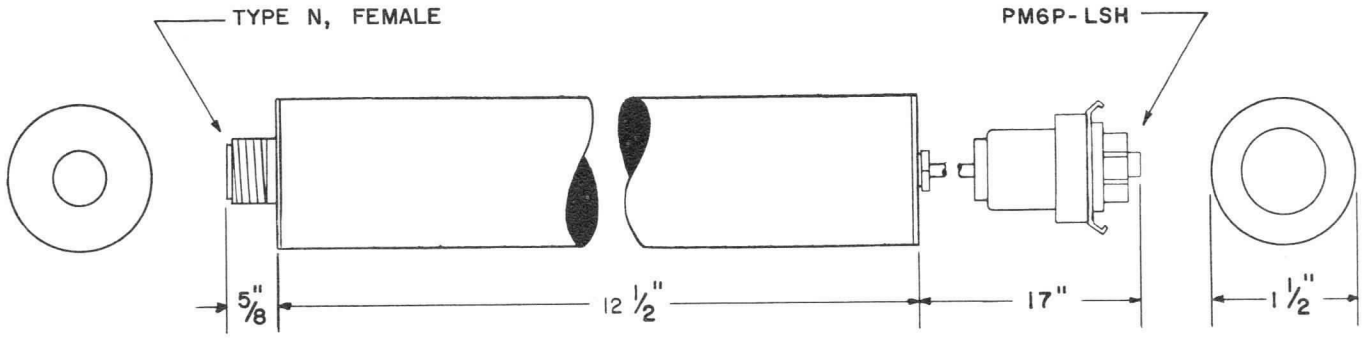
FREQUENCY RANGE . . . . . 3.75 TO 7.0 KMC
POWER OUTPUT . . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

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

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, Ku — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

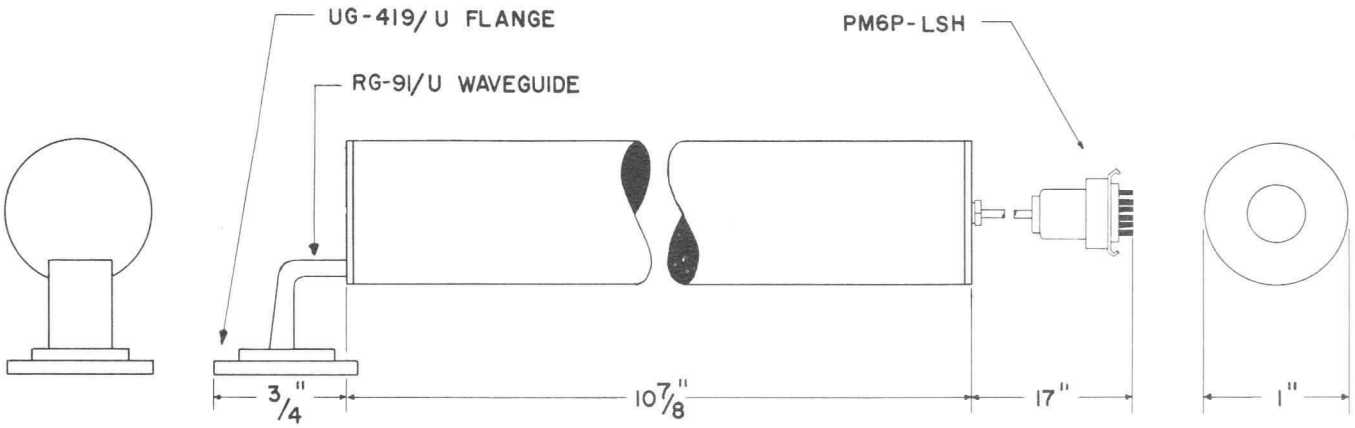
FREQUENCY RANGE	12.4 TO 18.0 KMC
POWER OUTPUT	10 DBM MIN
VSWR	3:1 MAX

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

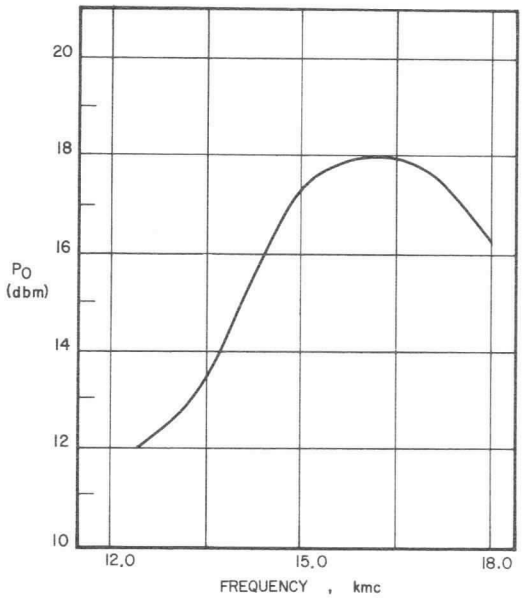
MECHANICAL CHARACTERISTICS



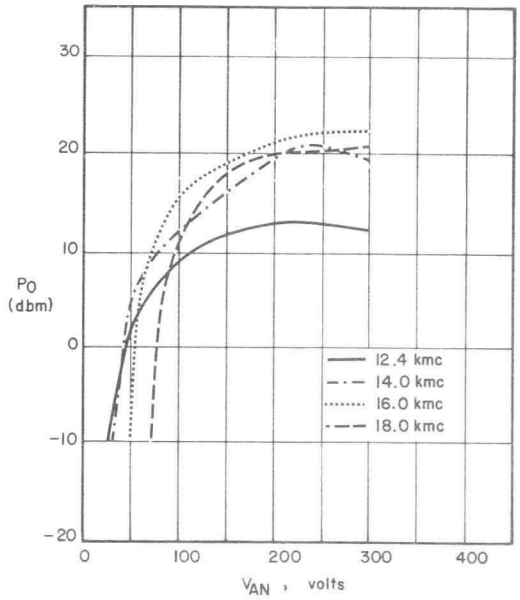
CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

HUGGINS LABORATORIES, INC.

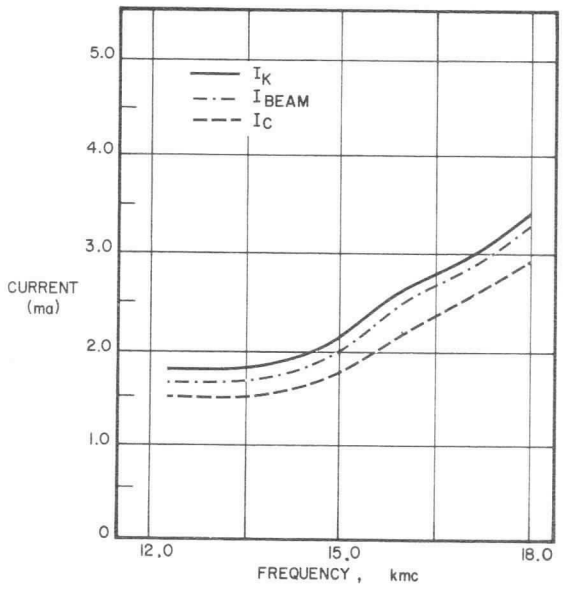
TYPICAL OPERATING CHARACTERISTICS



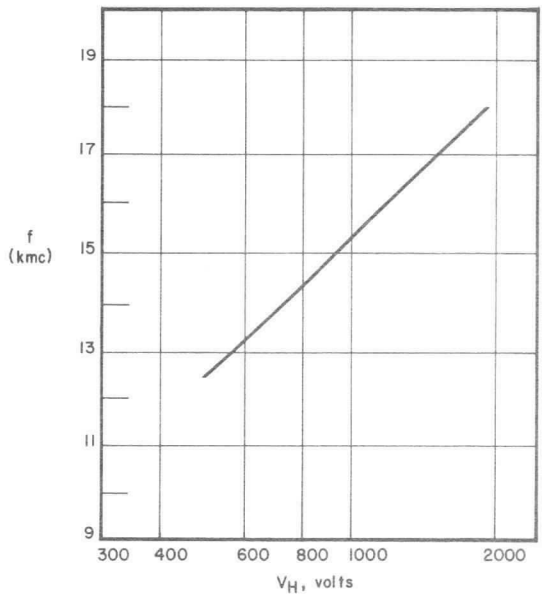
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

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

SOLENOID – FOCUSED, L – BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

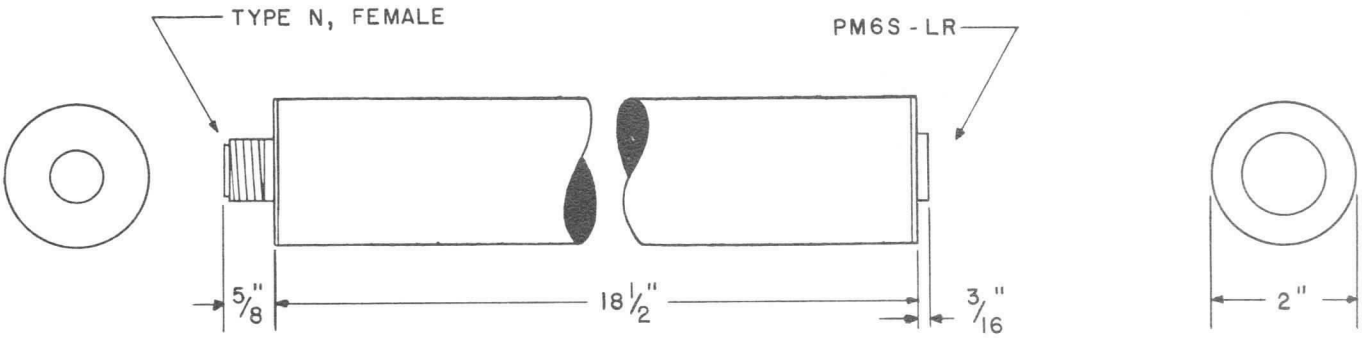
FREQUENCY RANGE . . . . . 1.0 TO 2.0 KMC
POWER OUTPUT . . . . . 10 DBM MIN

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

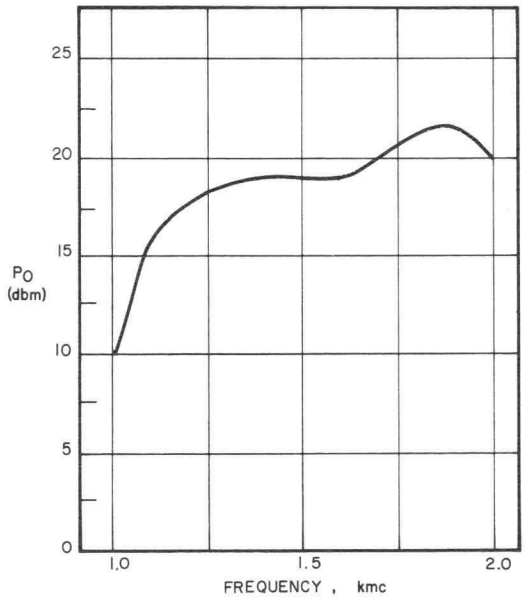
MECHANICAL CHARACTERISTICS



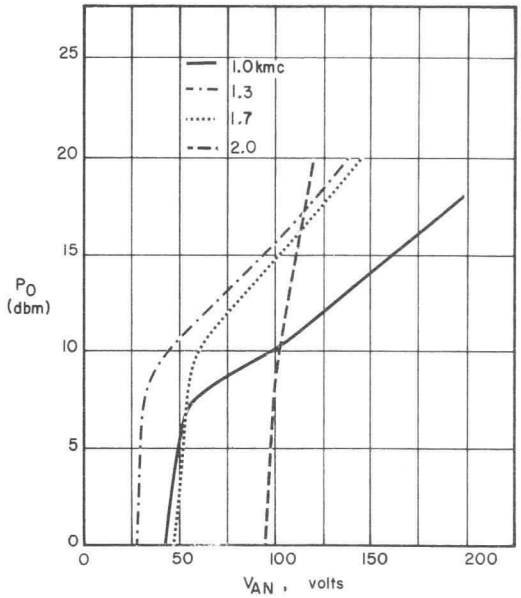
CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 5.0 LBS

HUGGINS LABORATORIES, INC.

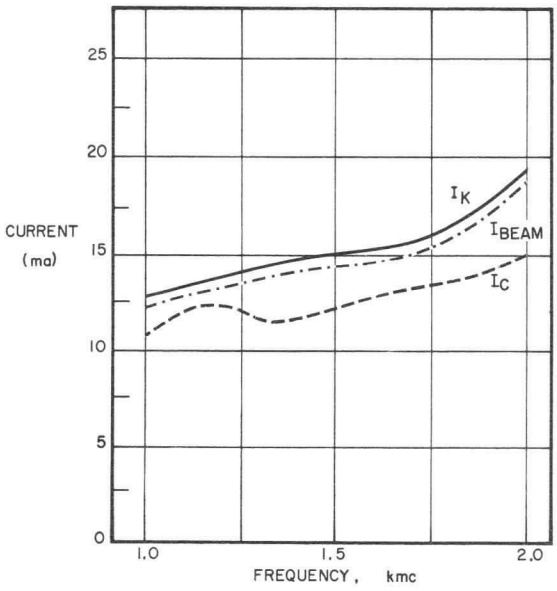
TYPICAL OPERATING CHARACTERISTICS



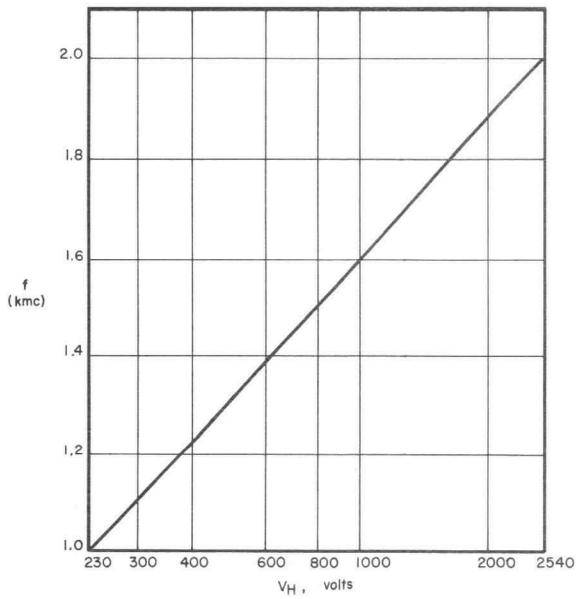
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID FOCUSED, 3.7 TO 5.9 KMC BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 3.7 TO 5.9 KMC

POWER OUTPUT . . . . . 10 DBM MIN

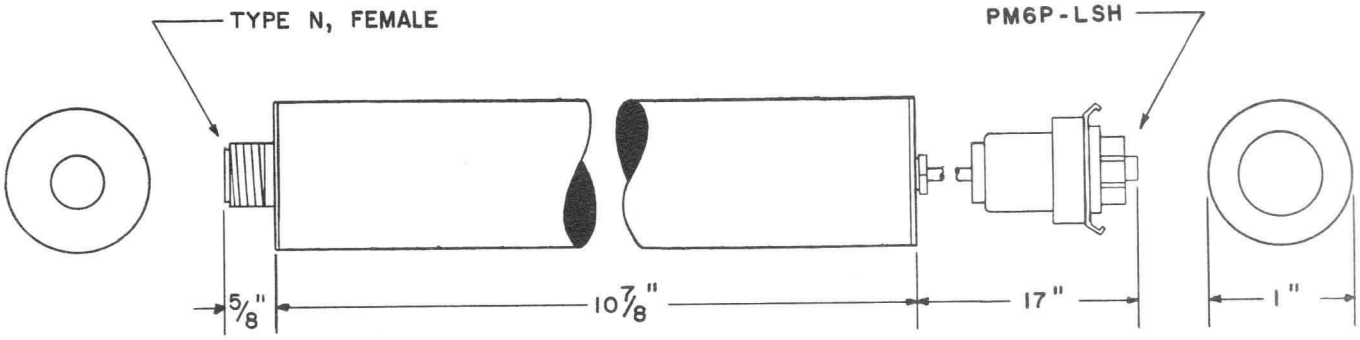
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	400 TO 2000 V	--	3.0 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	--	2.0 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, 5.2 TO 8.3 KMC BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

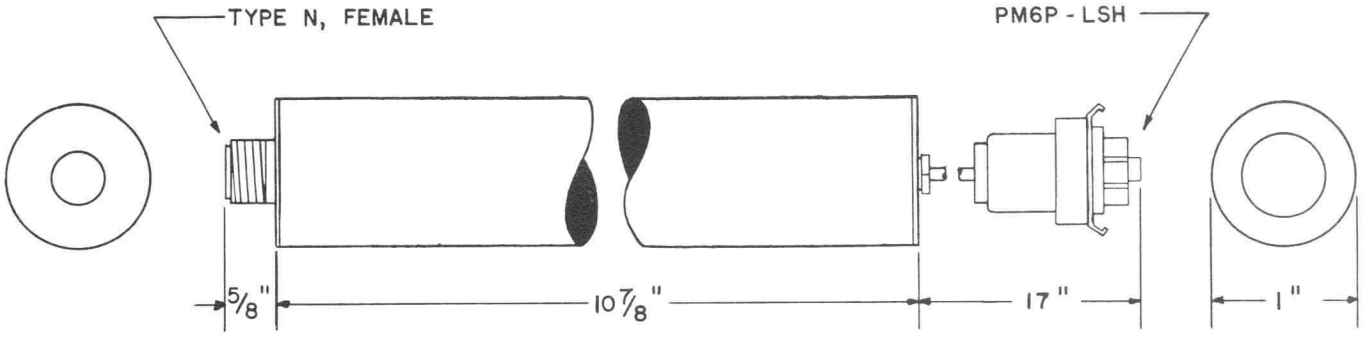
FREQUENCY RANGE . . . . . 5.2 TO 8.3 KMC
POWER OUTPUT . . . . . 10 DBM MIN
VSWR . . . . . 3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	FREQUENCY SENSITIVITY	CURRENT
HELIX	400 TO 2000 V	--	3.0 MA MAX
COLLECTOR	400 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	--	1.4 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

SOLENOID – FOCUSED, C – BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

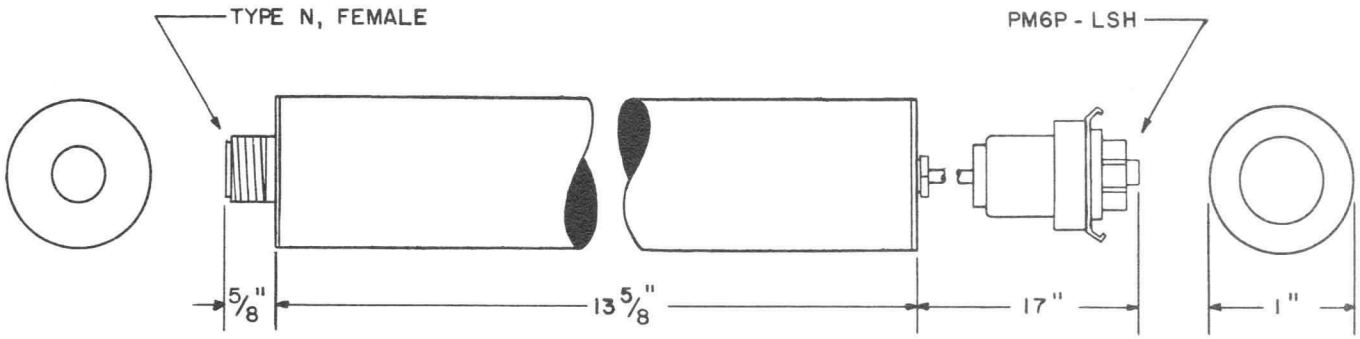
FREQUENCY RANGE . . . . . 4.0 TO 8.0 KMC
POWER OUTPUT. . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

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

SOLENOID — FOCUSED, X — BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

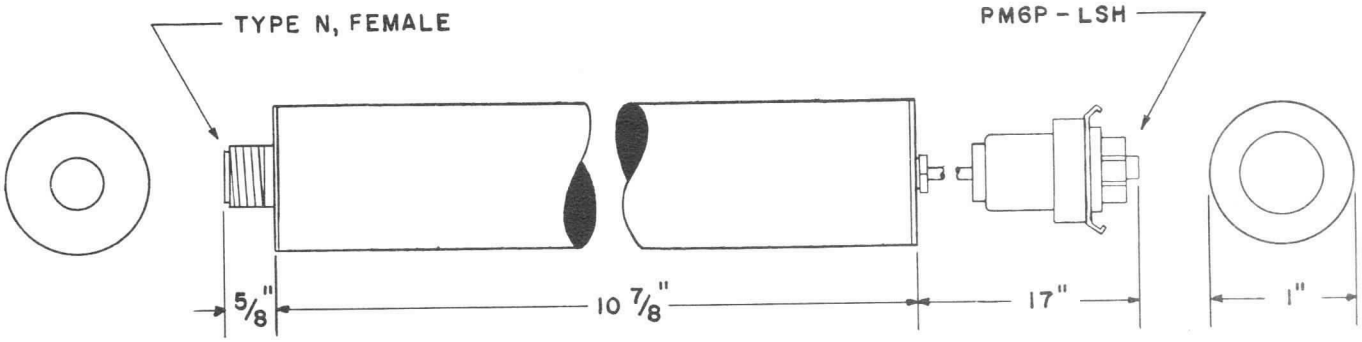
FREQUENCY RANGE	8.2 TO 12.4 KMC
POWER OUTPUT	0 DBM MIN
VSWR	3:1 MAX

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

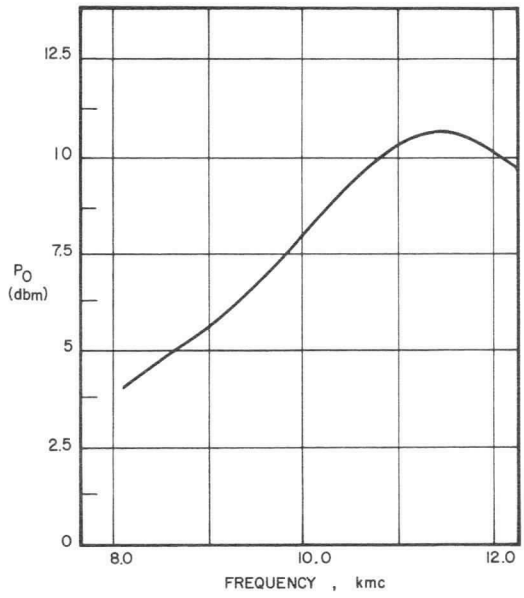
MECHANICAL CHARACTERISTICS



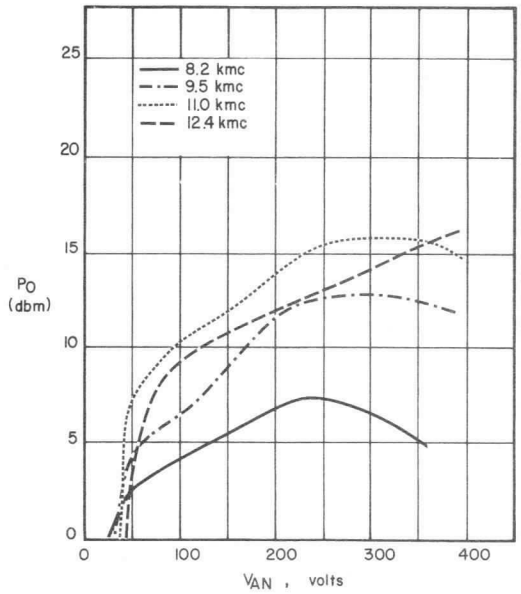
CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

HUGGINS LABORATORIES, INC.

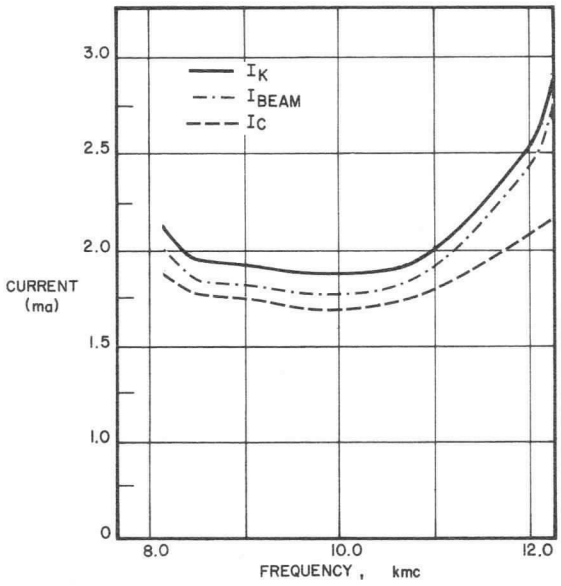
TYPICAL OPERATING CHARACTERISTICS



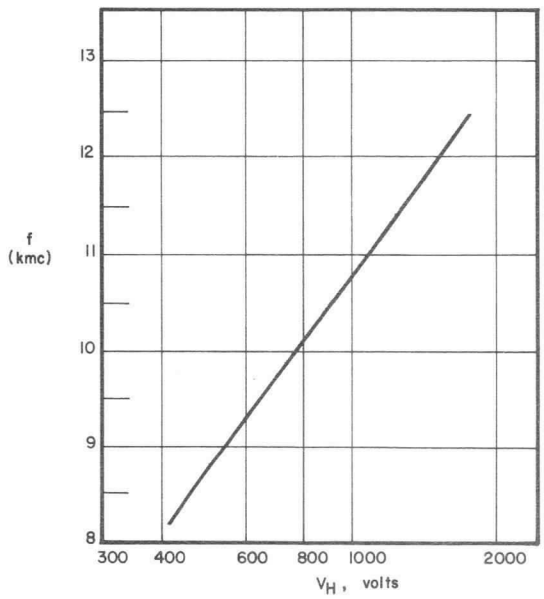
POWER OUTPUT



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

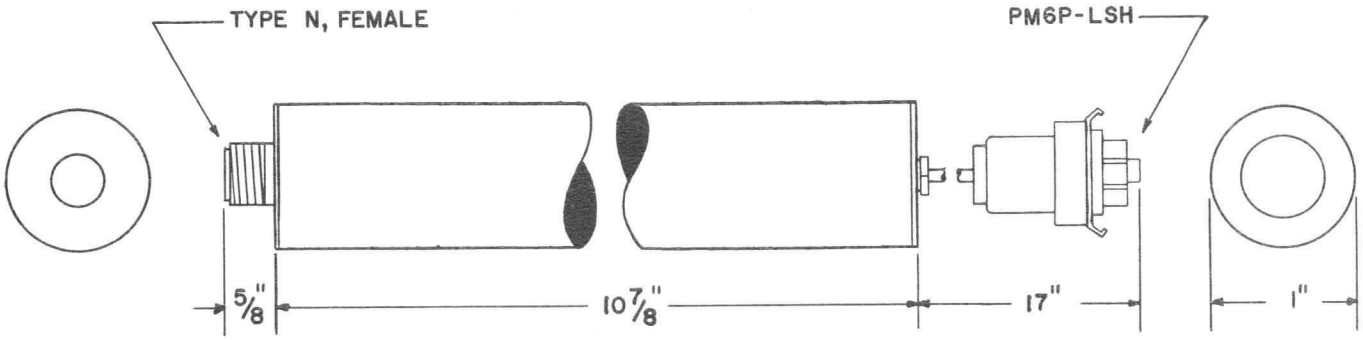
VSWR . . . . . 3:1 MAX

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

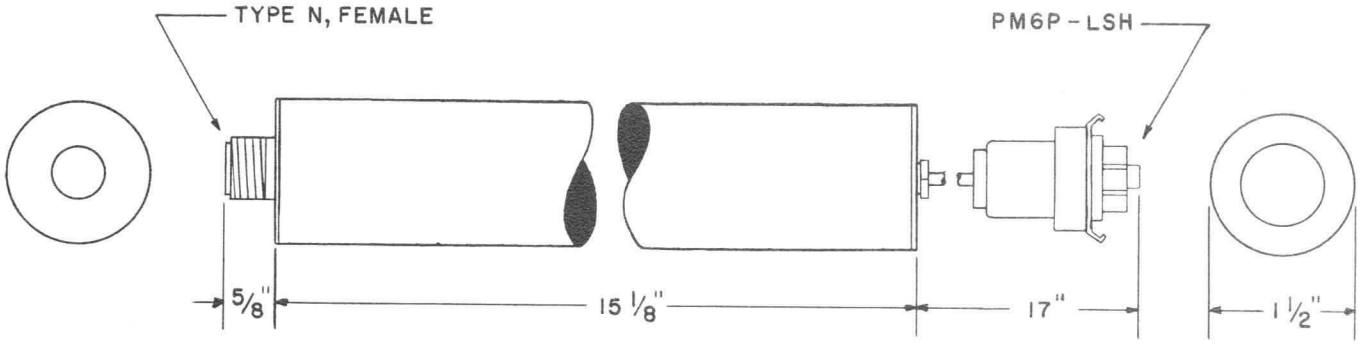
FREQUENCY RANGE . . . . . 2.0 TO 4.0 KMC
POWER OUTPUT . . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

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

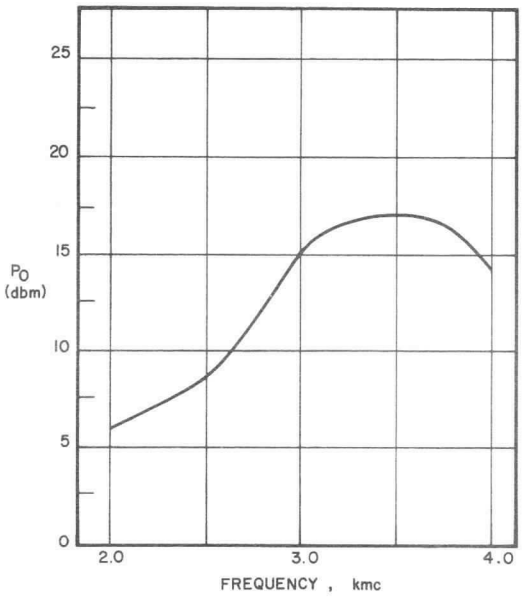
MECHANICAL CHARACTERISTICS



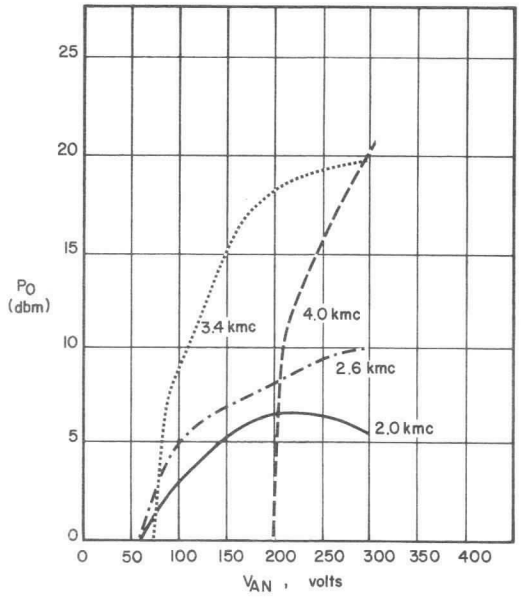
CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 2 1/2 LBS

HUGGINS LABORATORIES, INC.

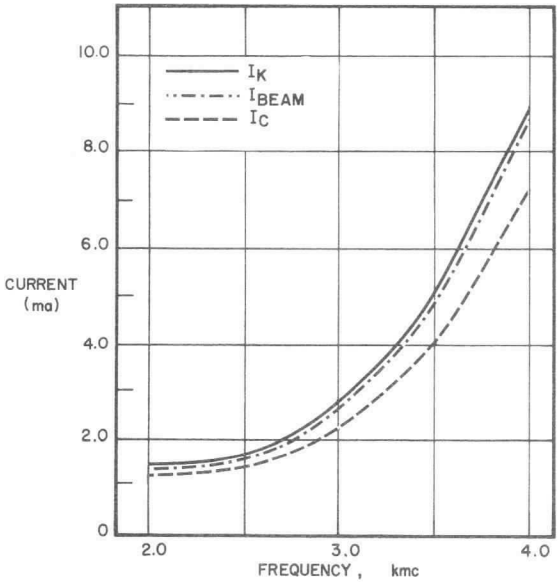
TYPICAL OPERATING CHARACTERISTICS



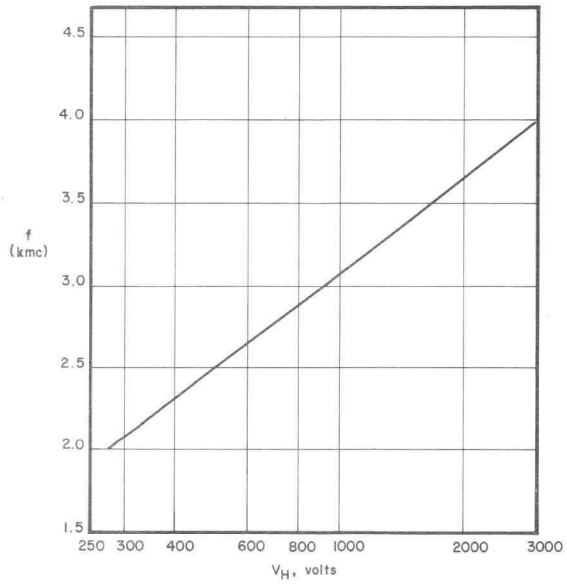
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

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

SOLENOID FOCUSED, Ku – BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

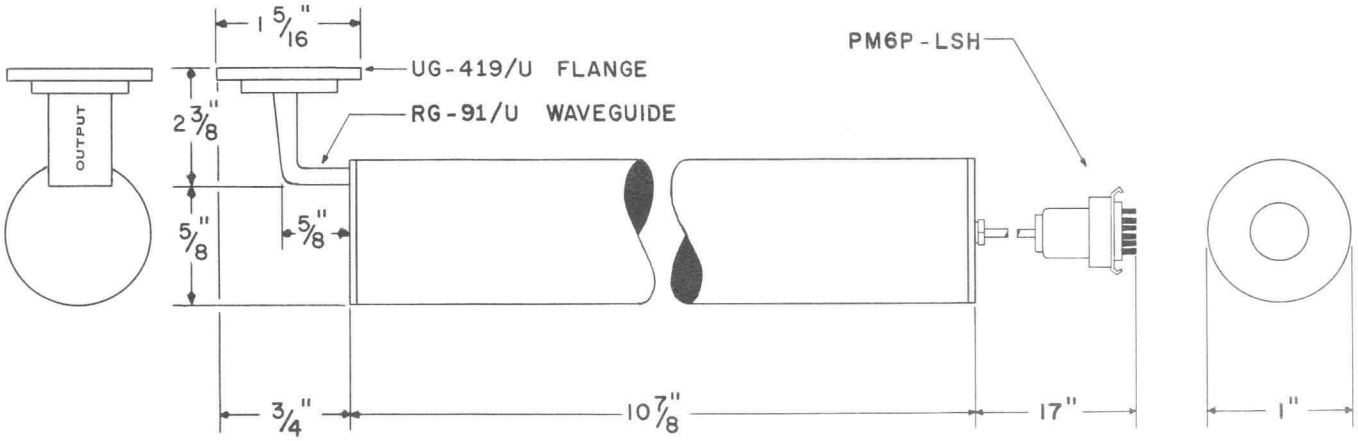
FREQUENCY RANGE . . . . . 12.0 TO 18.0 KMC
POWER OUTPUT . . . . . 0 DBM MIN
VSWR . . . . . 3:1 MAX

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

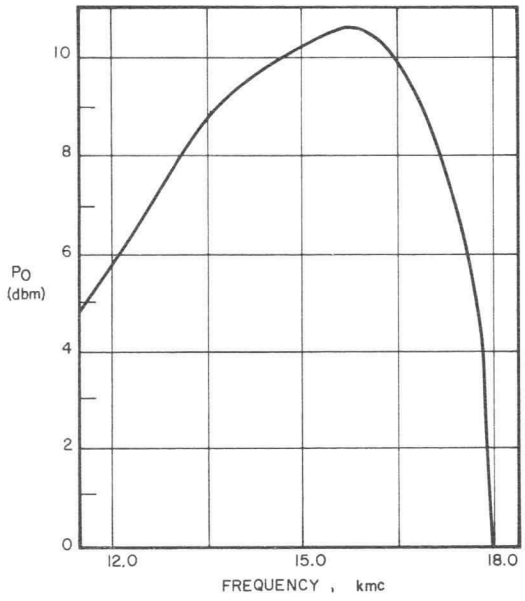
FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS

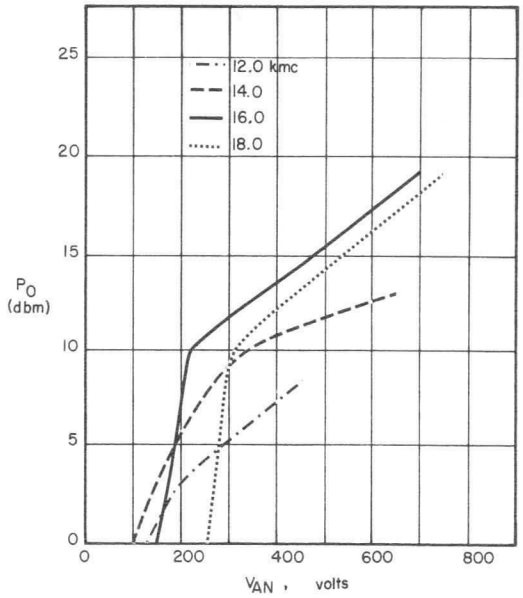


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

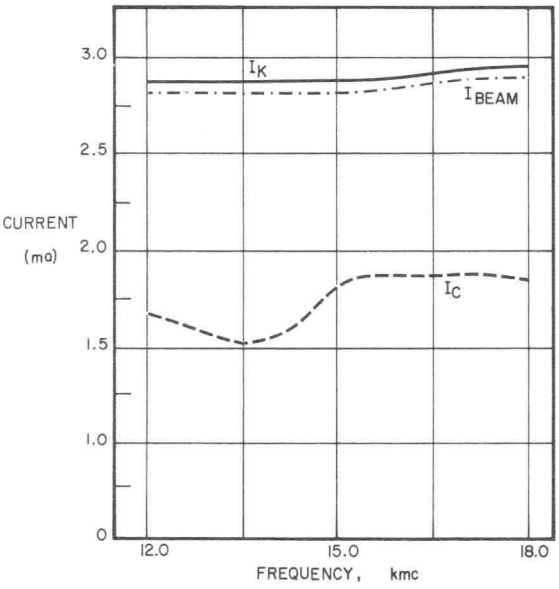
TYPICAL OPERATING CHARACTERISTICS



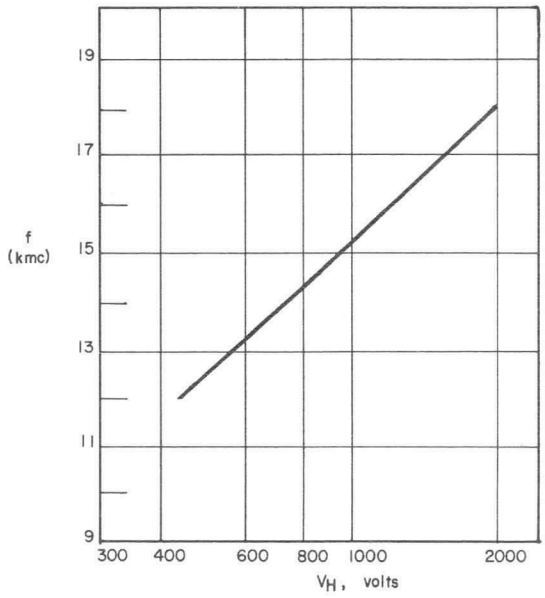
POWER OUTPUT



POWER OUTPUT



STARTING CURRENT



TUNING CURVE

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

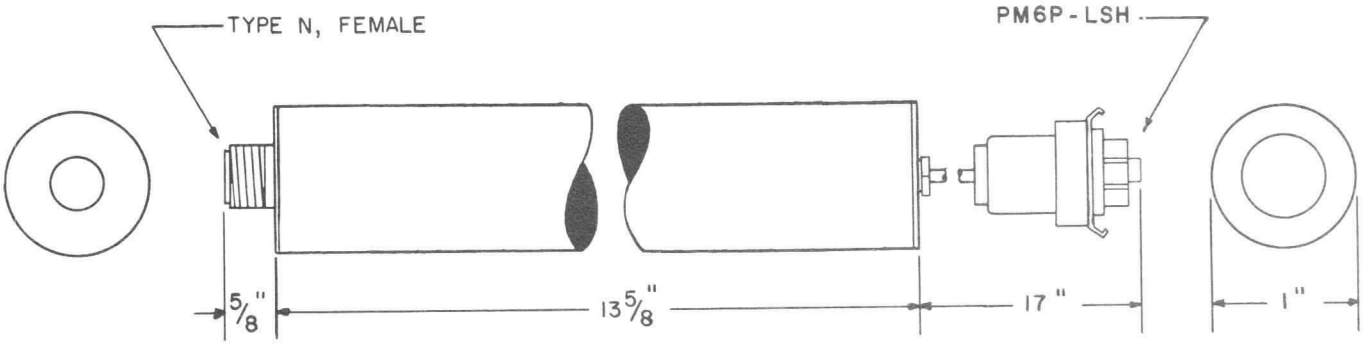
VSWR . . . . . 3:1 MAX

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

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

SOLENOID – FOCUSED, C – BAND BACKWARD WAVE OSCILLATOR

ELECTRICAL CHARACTERISTICS

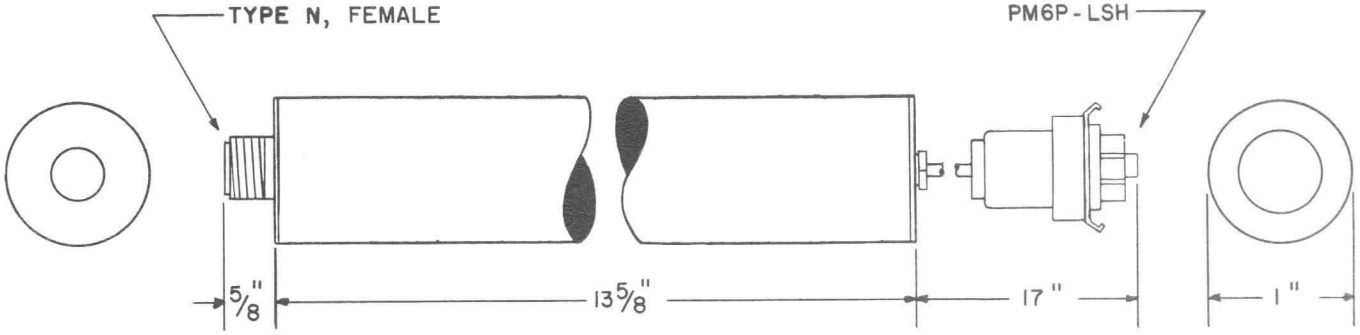
FREQUENCY RANGE . . . . . 4.0 TO 8.0 KMC
POWER OUTPUT. . . . . 10 DBM MIN
VSWR . . . . . 3: 1 MAX

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

SOLENOID – FOCUSED, 10 MW S – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

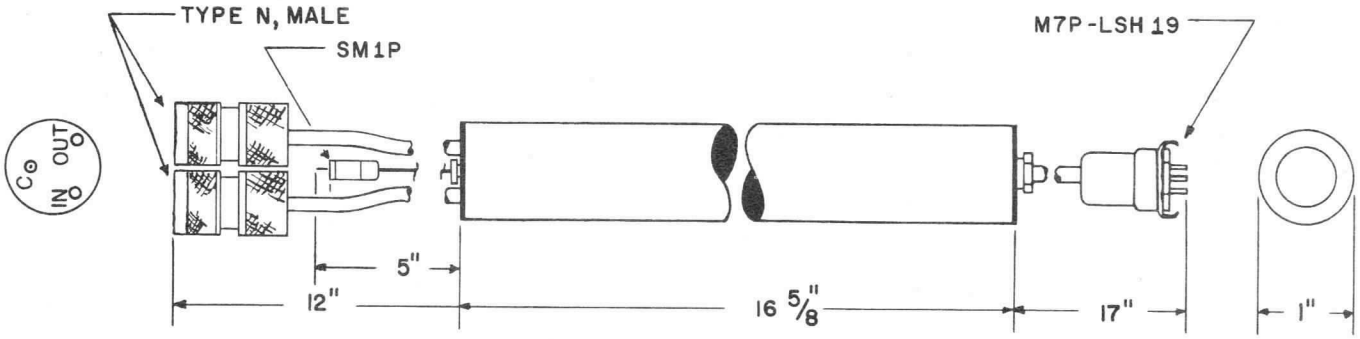
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	400 TO 525 V	--	0.2 MA MAX
COLLECTOR	400 TO 525 V	--	3.5 MA MAX
ANODE	0 TO 350 V	--	0.1 MA MAX
CATHODE	0 V	--	3.5 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, 300 GAUSS

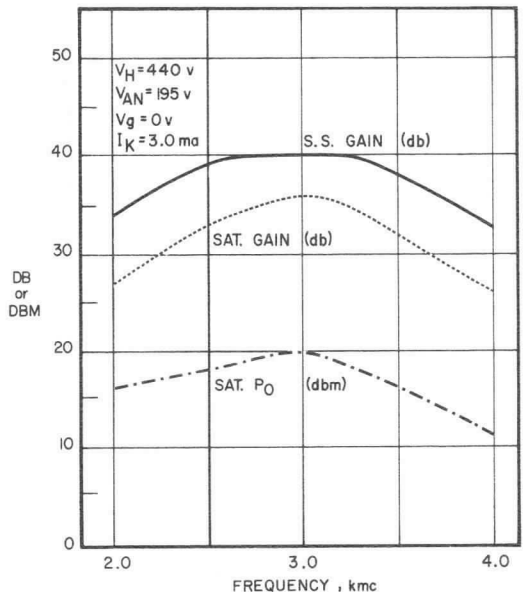
MECHANICAL CHARACTERISTICS



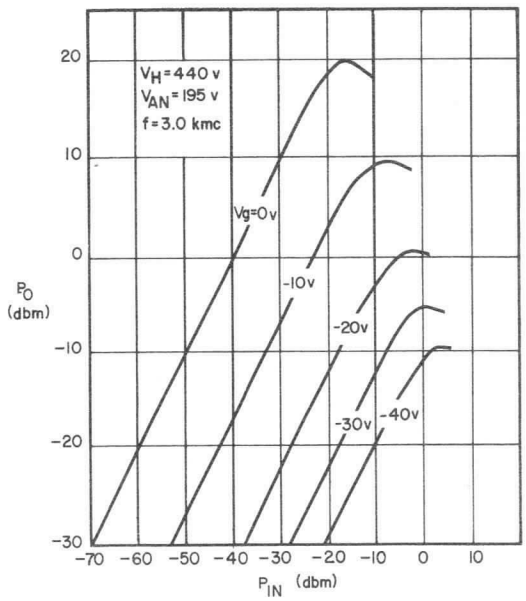
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1.0 LB

HUGGINS LABORATORIES, INC.

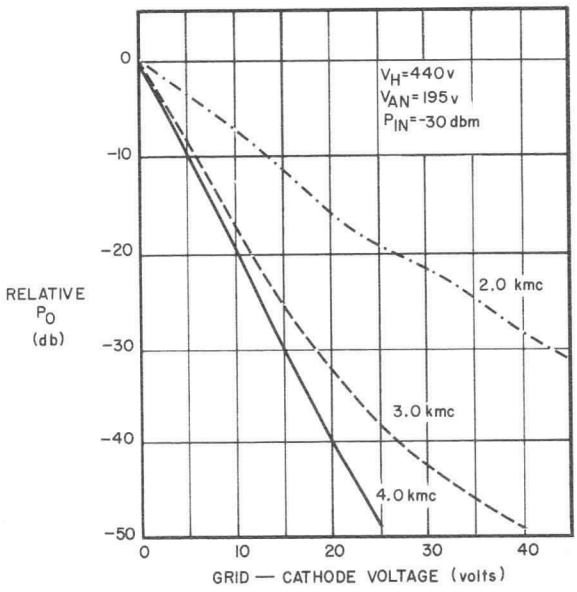
TYPICAL OPERATING CHARACTERISTICS



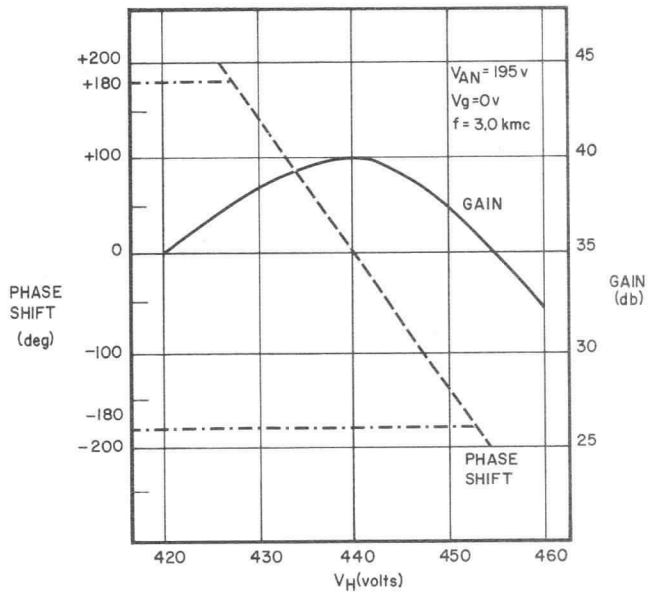
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

SOLENOID — FOCUSED, 1 WATT S — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	2.0 TO 4.0 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

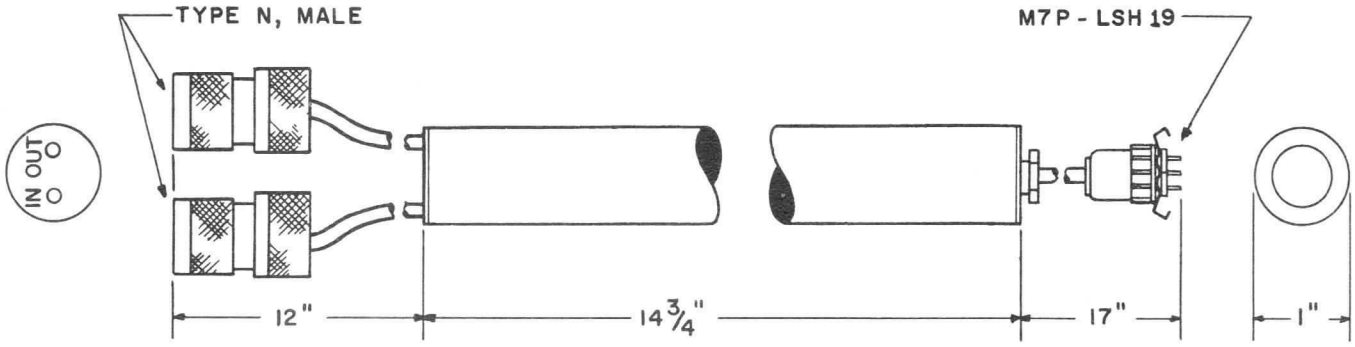
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	800 TO 1100 V	--	0.3 MA MAX
COLLECTOR	800 TO 1100 V	--	25.0 MA MAX
ANODE	0 TO 450 V	--	0.1 MA MAX
CATHODE	0 V	--	25.0 MA MAX
GRID [1]	0 *	--	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

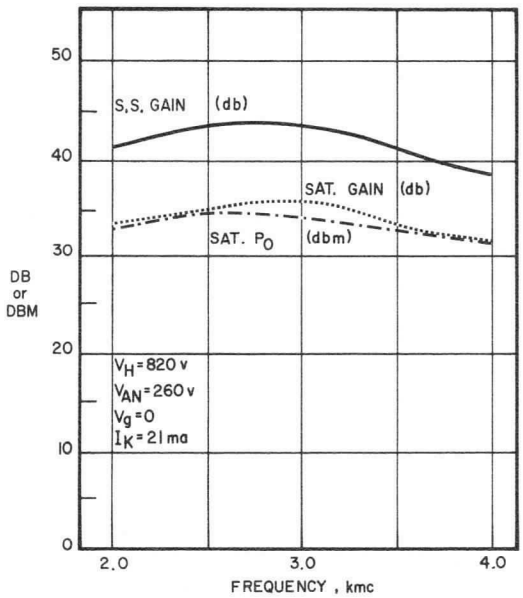
MECHANICAL CHARACTERISTICS



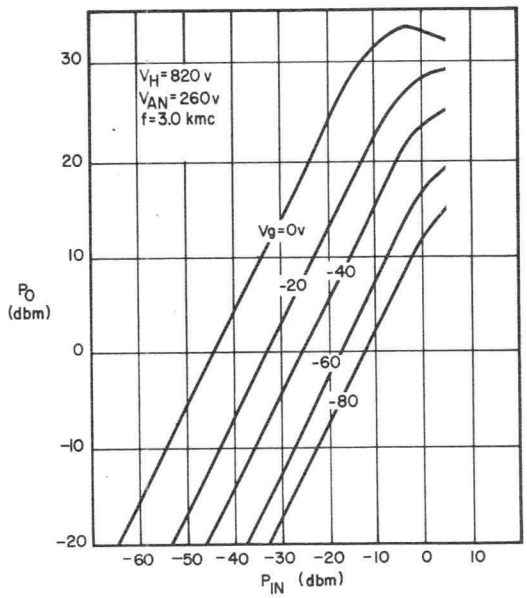
CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

[1] FOR TUBE WITH GRID CONNECTED INTERNALLY TO CATHODE, ORDER HA-2J.

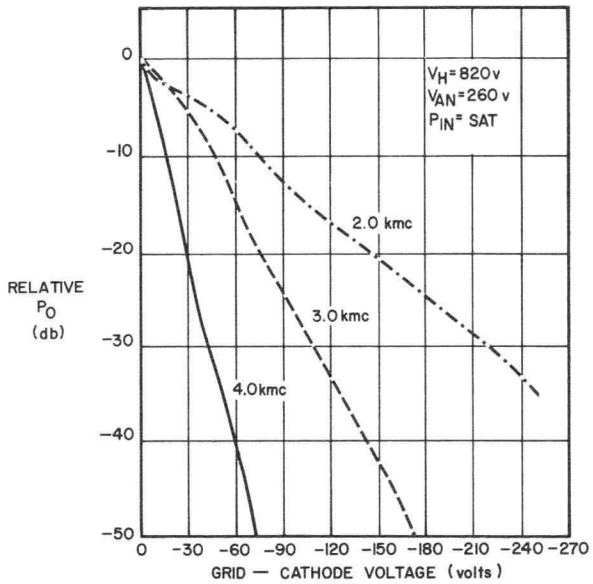
TYPICAL OPERATING CHARACTERISTICS



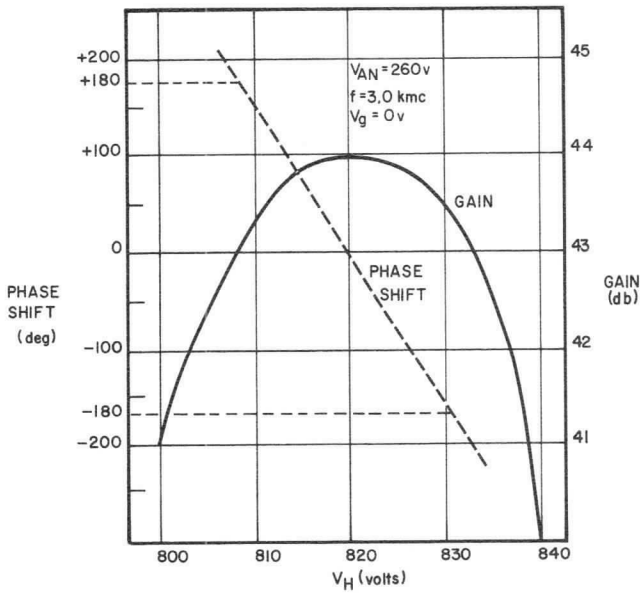
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

SOLD FOR REPLACEMENT ONLY

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

SOLENOID—FOCUSED, 10 MW C—BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

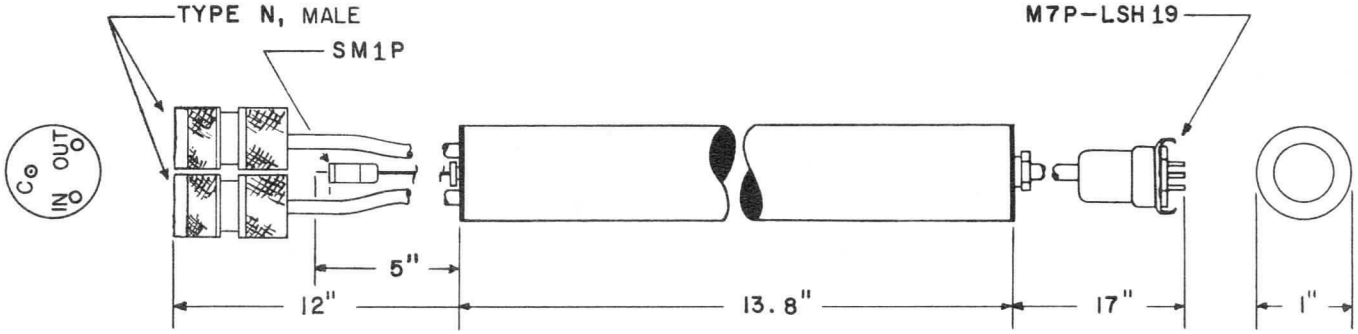
FREQUENCY RANGE	4.0 TO 8.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

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			

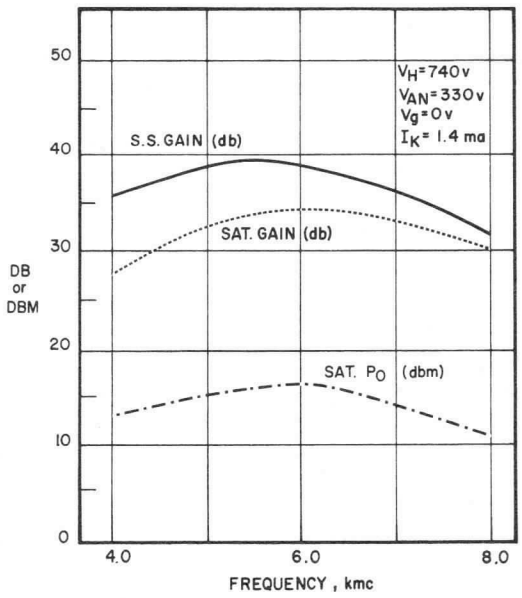
FOCUSING . . . . . SOLENOID, MPE TYPE AS-7

MECHANICAL CHARACTERISTICS

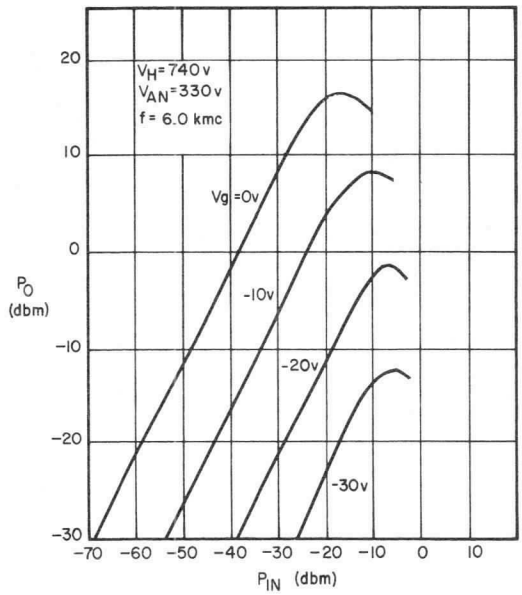


CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1.0 LB

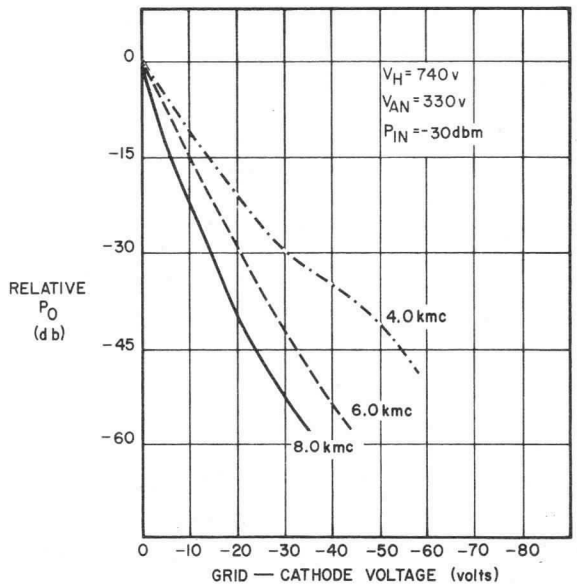
TYPICAL OPERATING CHARACTERISTICS



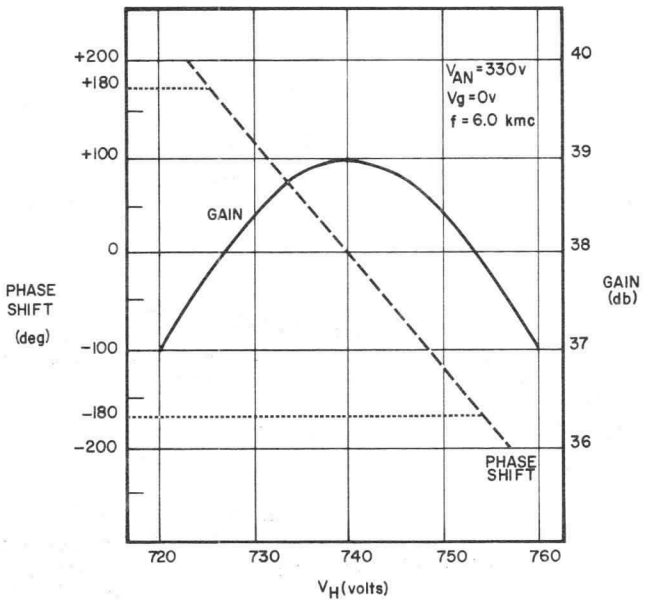
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

SOLENOID — FOCUSED, 10 MW X — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.0 TO 12.4 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

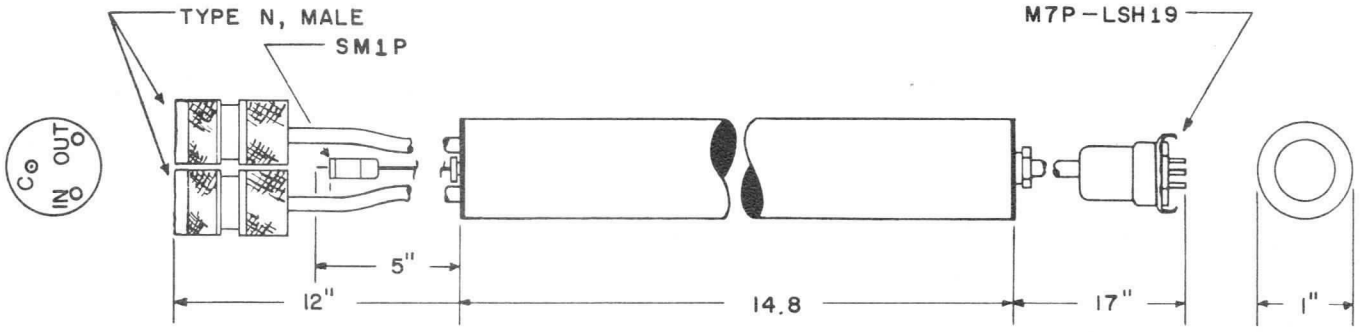
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	1100 TO 1300 V	--	0.2 MA MAX
COLLECTOR	1100 TO 1300 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 OR 7.0 V	--	1.2 AMP MAX

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

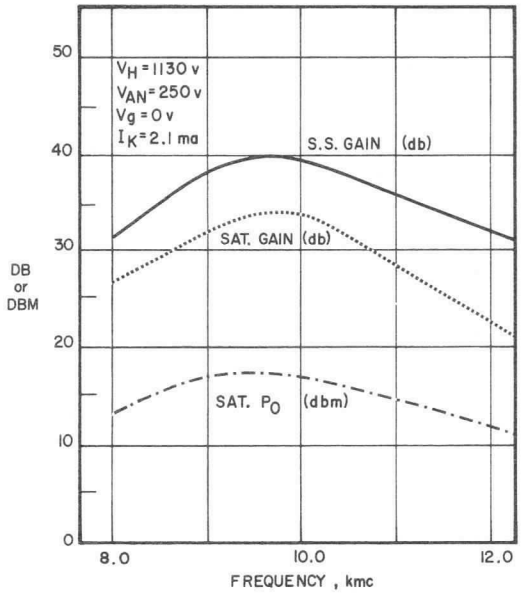
FOCUSING . . . . . SOLENOID, 400 GAUSS

MECHANICAL CHARACTERISTICS

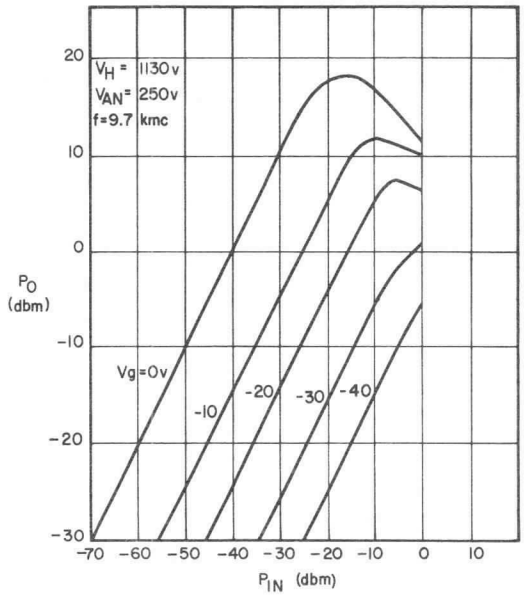


CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1.0 LB

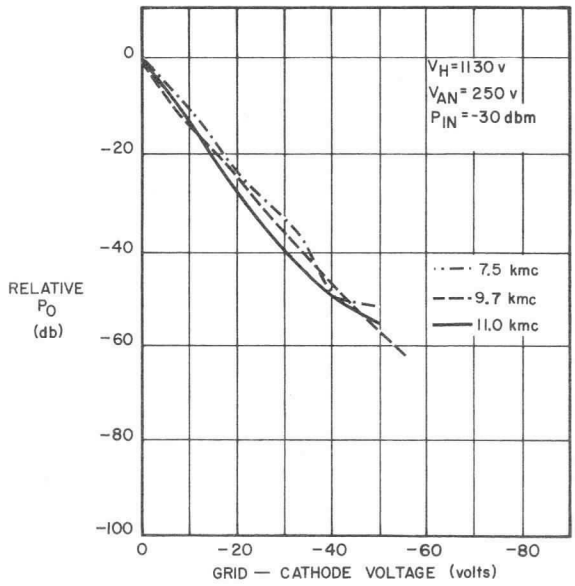
TYPICAL OPERATING CHARACTERISTICS



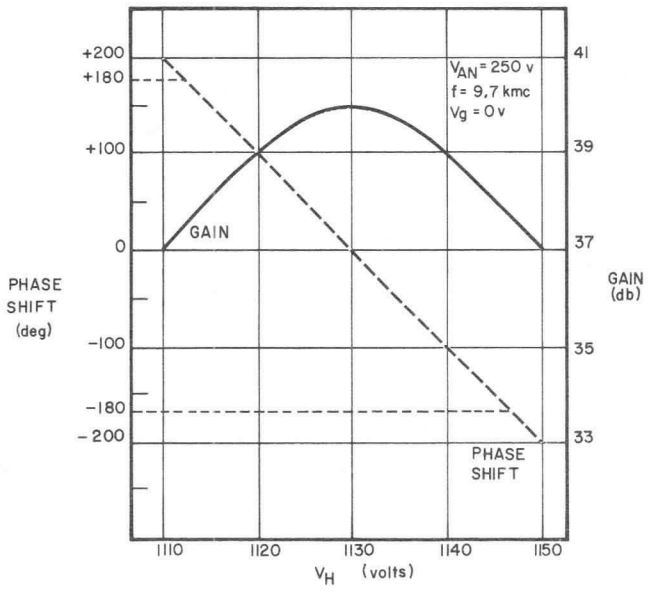
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, 10 MW L – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	1.0 TO 2.0 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

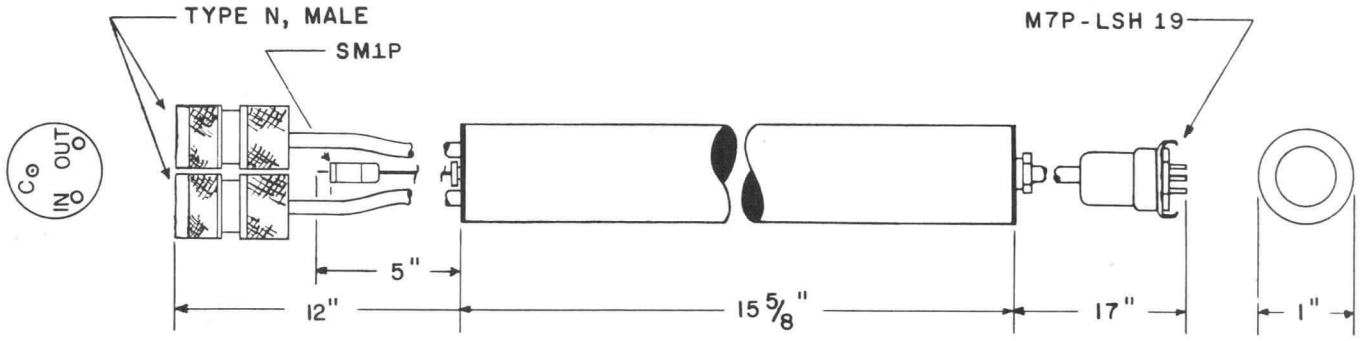
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	180 TO 220 V	--	0.2 MA MAX
COLLECTOR	FIXED *	--	3.5 MA MAX
ANODE	0 TO 150 V	--	0.1 MA MAX
CATHODE	0 V	--	3.5 MA MAX
GRID	0 **	--	0.1 MA MAX
HEATER	6.3 V	--	1.4 AMP MAX

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 270 TO 350 VOLTS.

FOCUSING . . . . . SOLENOID, 400 GAUSS

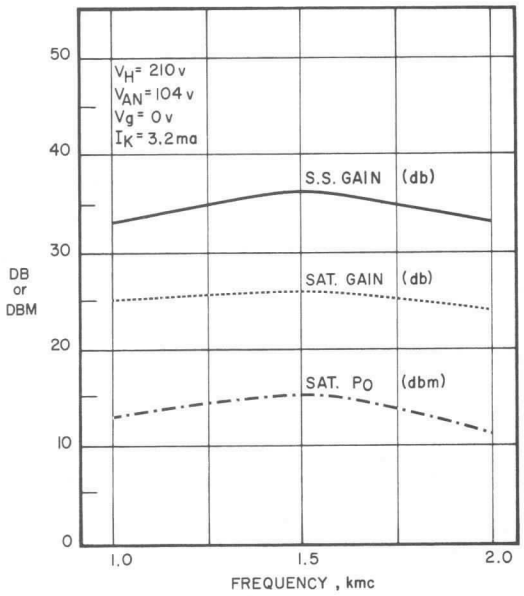
MECHANICAL CHARACTERISTICS



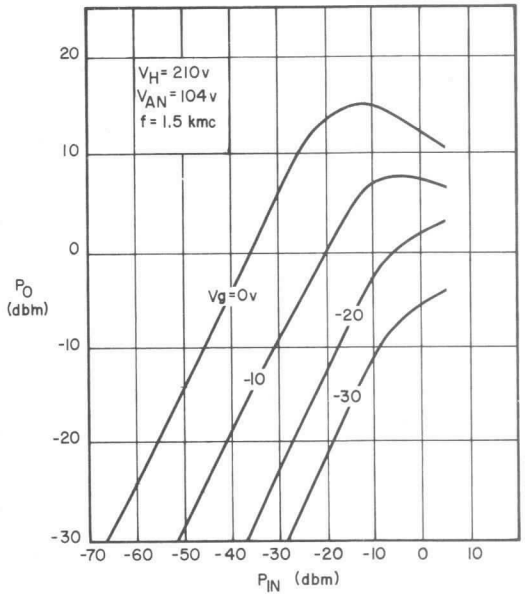
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1.0 LBS

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

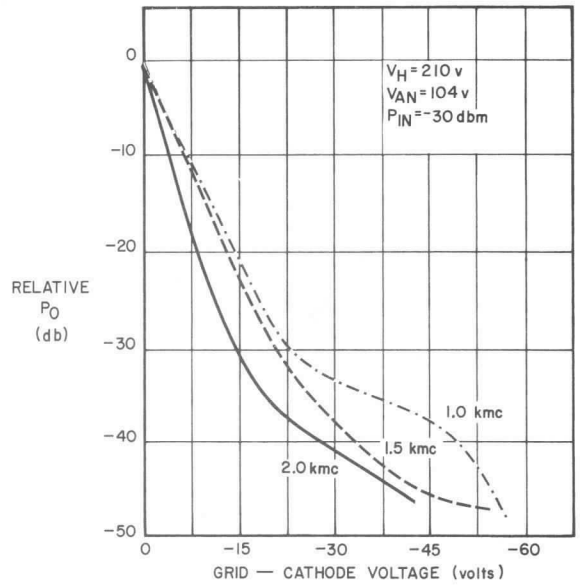
TYPICAL OPERATING CHARACTERISTICS



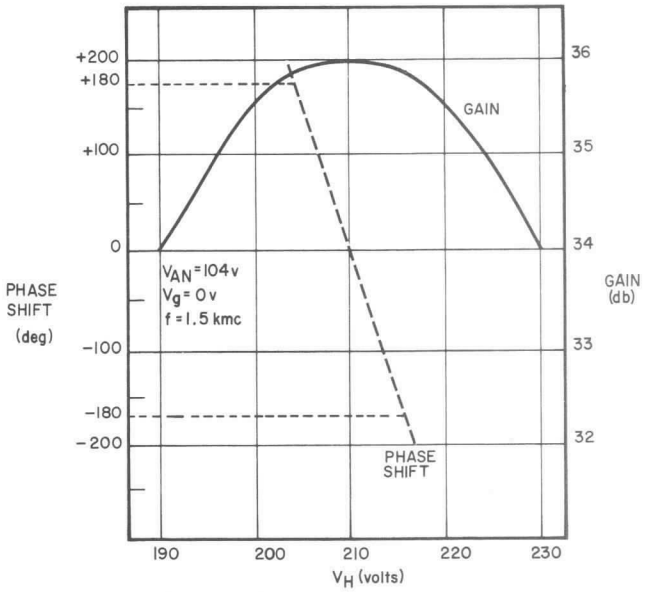
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

SOLENOID – FOCUSED, 0.5 WATT C – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 TO 8.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	27 DBM MIN
GAIN AT 27 DBM POWER OUTPUT	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

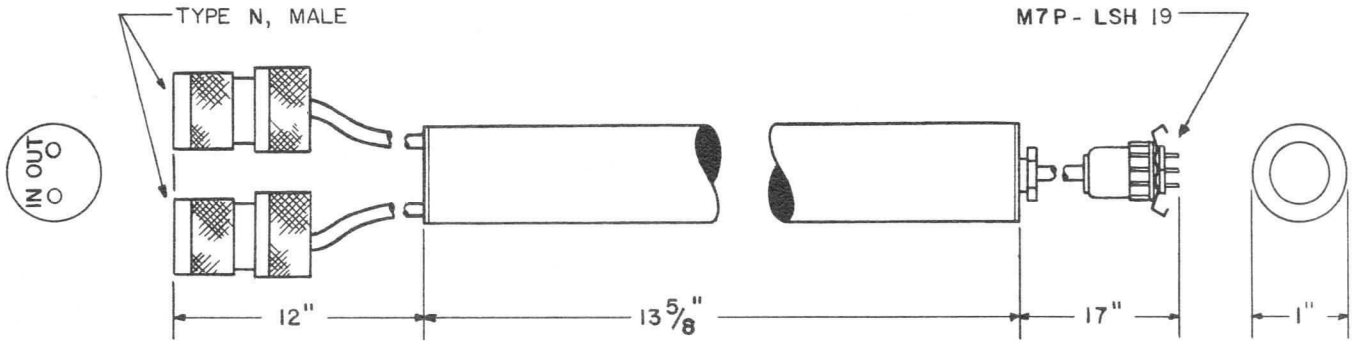
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	1200 TO 1500 V	--	0.5 MA MAX
COLLECTOR	1200 TO 1500 V	--	20.0 MA MAX
ANODE	0 TO 700 V	--	0.1 MA MAX
CATHODE	0 V	--	20.0 MA MAX
GRID [1]	0 * V	--	0.1 MA MAX
HEATER	7.0 V	--	1.3 AMP MAX

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

FOCUSING . . . . . SOLENOID, MPE TYPE BS-49C

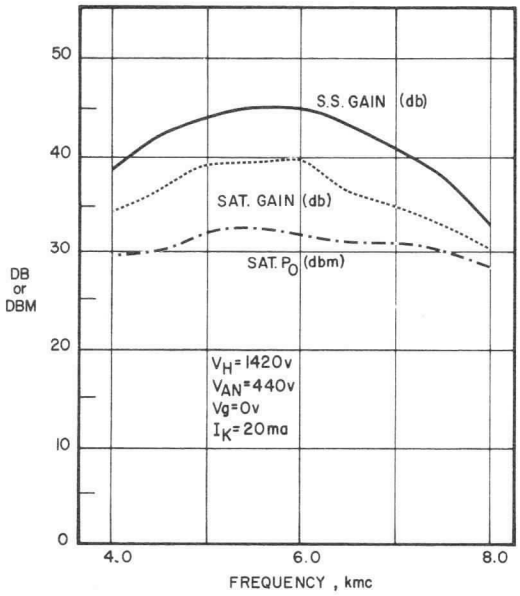
MECHANICAL CHARACTERISTICS



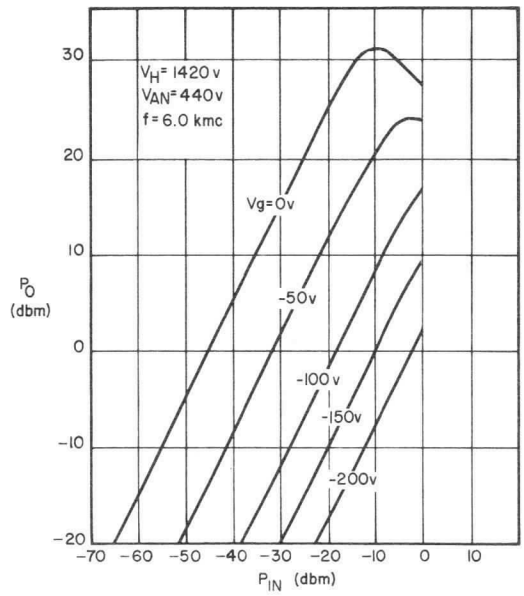
CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

[1] FOR TUBE WITH GRID CONNECTED INTERNALLY TO CATHODE, ORDER HA – 6S

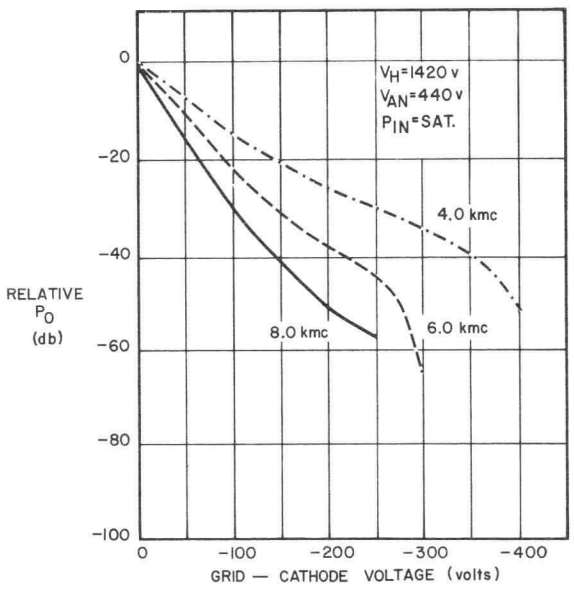
TYPICAL OPERATING CHARACTERISTICS



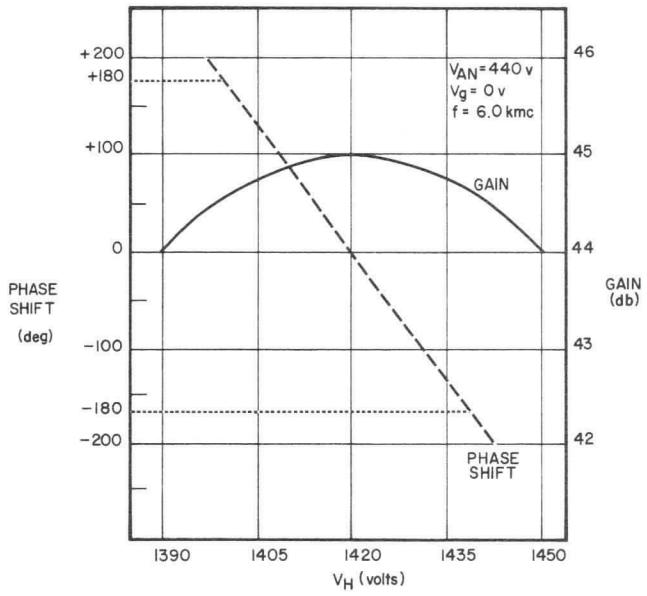
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

SOLENOID — FOCUSED, 10 MW UHF — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	0.5 TO 1.0 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

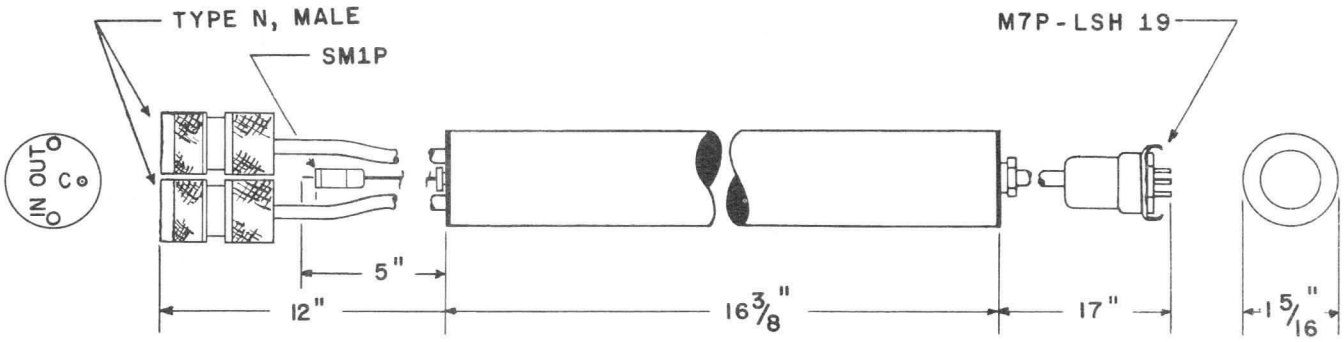
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	90 TO 120 V	--	0.3 MA MAX
COLLECTOR	FIXED *	--	3.5 MA MAX
ANODE	0 TO 100 V	--	0.1 MA MAX
CATHODE	0 V	--	3.5 MA MAX
GRID	0 TO 5.0 ** V	--	0.1 MA MAX
HEATER	6.3 V	--	1.5 AMP MAX

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 240 TO 300 VOLTS.

FOCUSING . . . . . SOLENOID, MPE TYPE AS-25

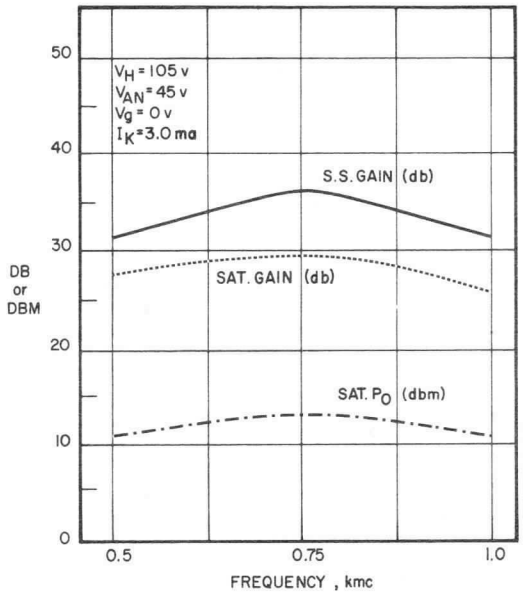
MECHANICAL CHARACTERISTICS



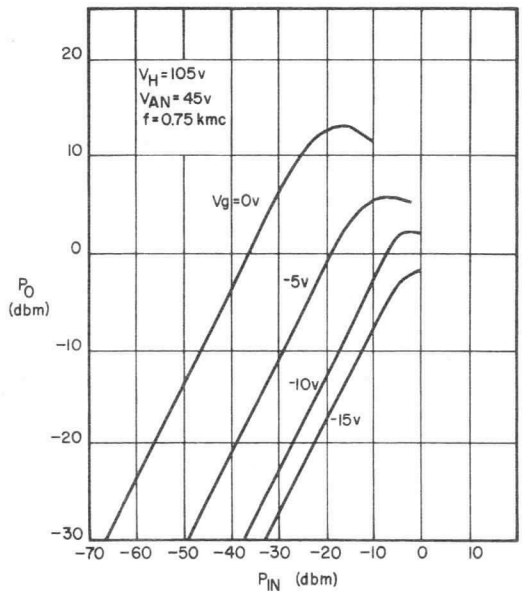
CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	2.0 LBS

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

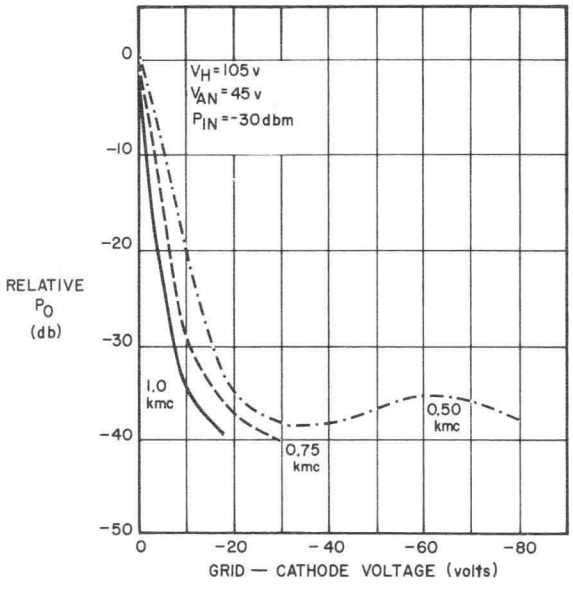
TYPICAL OPERATING CHARACTERISTICS



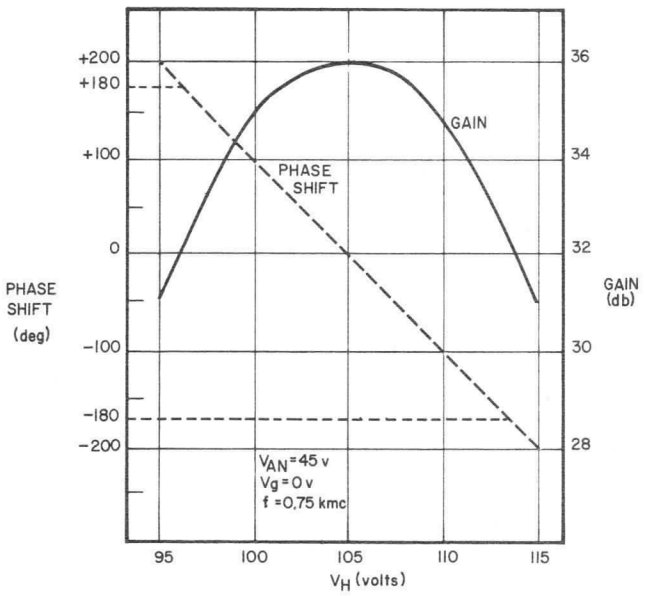
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, 1 — WATT UHF — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

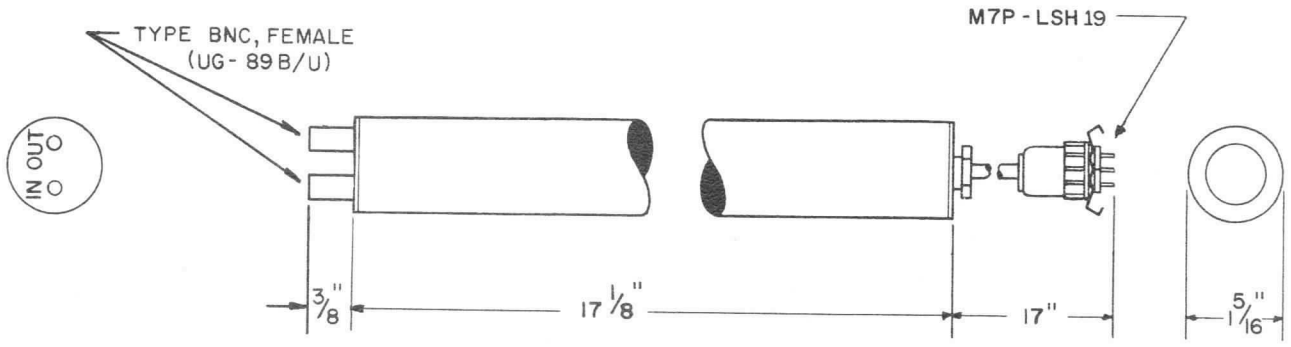
FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	30 DBM MIN
GAIN AT 30 DBM POWER OUTPUT	30 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	400 TO 500 V	– –	1.0 MA MAX
COLLECTOR	400 TO 500 V	– –	50.0 MA MAX
ANODE	0 TO 500 V	– –	1.0 MA MAX
CATHODE	0 V	– –	60.0 MA MAX
GRID	0 TO 200 V	– –	5.0 MA MAX
HEATER	7.0 V	– –	2.2 AMP MAX

FOCUSING . . . . . SOLENOID, 560 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	2.0 LBS

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, 0.5 WATT X — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

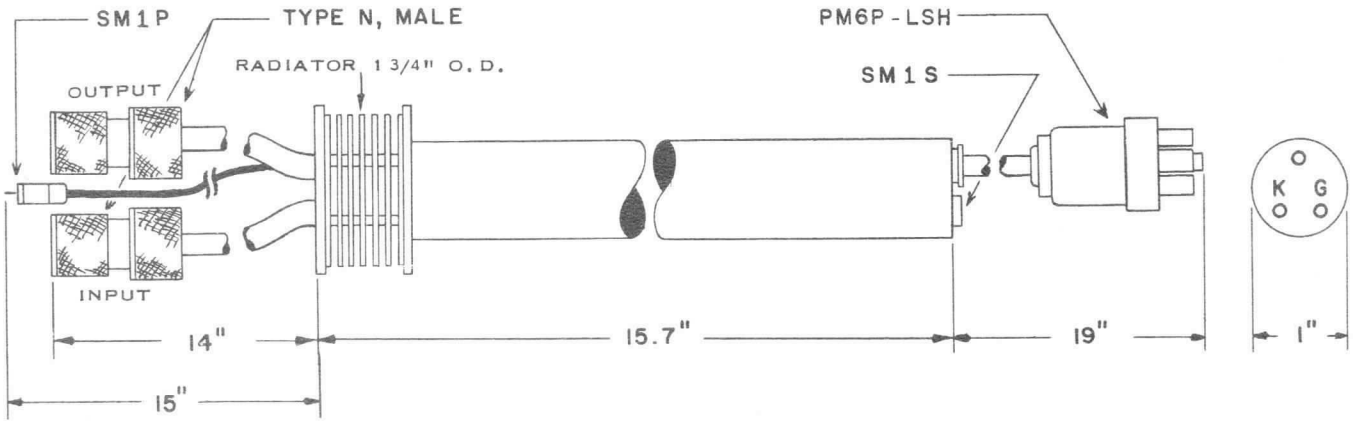
FREQUENCY RANGE	8.0 TO 11.0 KMC
SMALL-SIGNAL GAIN	33 DB MIN
SATURATION POWER OUTPUT	27 DBM MIN
GAIN AT 27 DBM POWER OUTPUT	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	2000 TO 2400 V	--	1.0 MA MAX
COLLECTOR	2000 TO 2400 V	--	20.0 MA MAX
ANODE	1000 TO 1800 V	--	0.1 MA MAX
CATHODE	0 V	--	20.0 MA MAX
GRID	0* V	--	0.1 MA MAX
HEATER	6.3 V	--	1.2 AMP MAX
* A NEGATIVE VOLTAGE CAN BE APPLIED FOR R-F ATTENUATION			

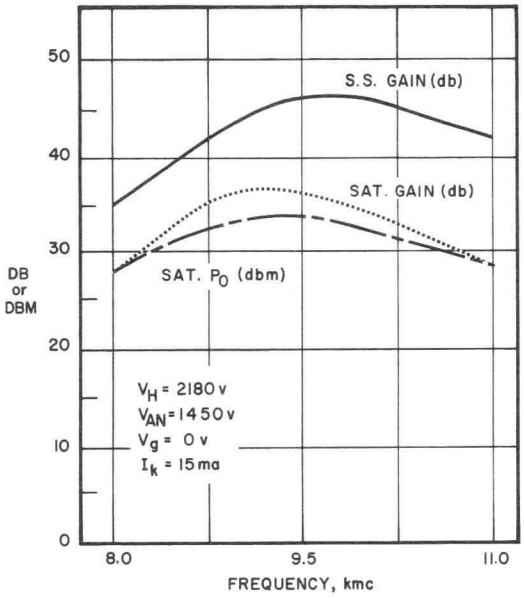
FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS

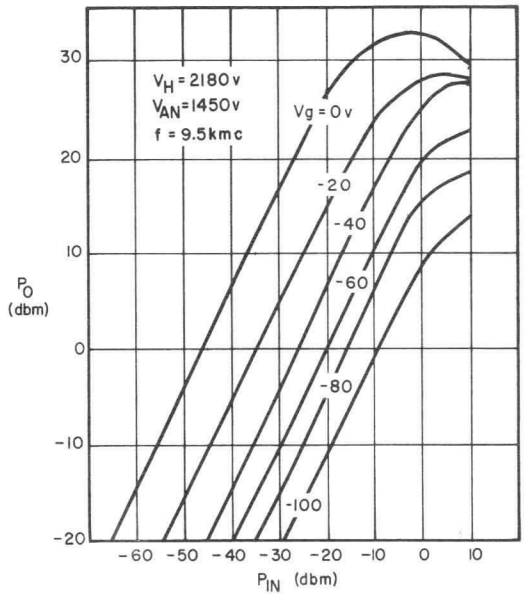


CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	2.0 LBS

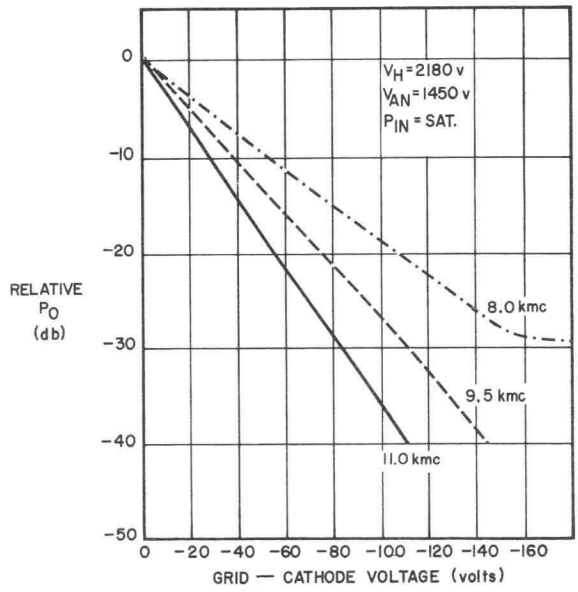
TYPICAL OPERATING CHARACTERISTICS



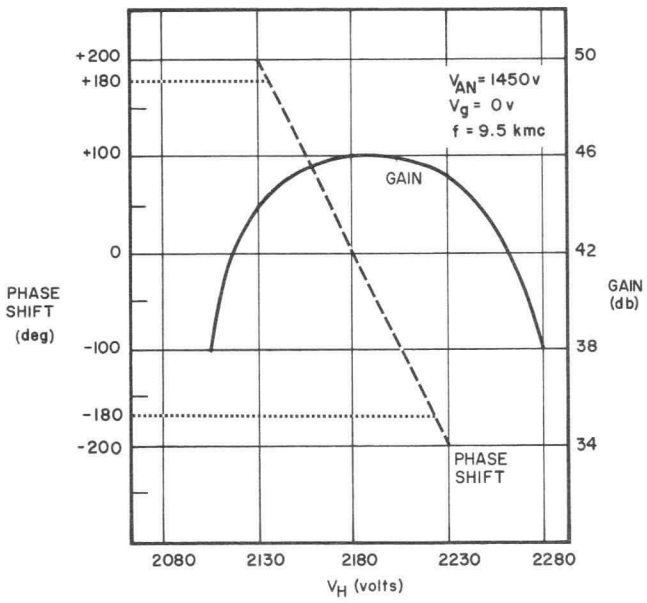
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID–FOCUSED, 100 MW X–BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

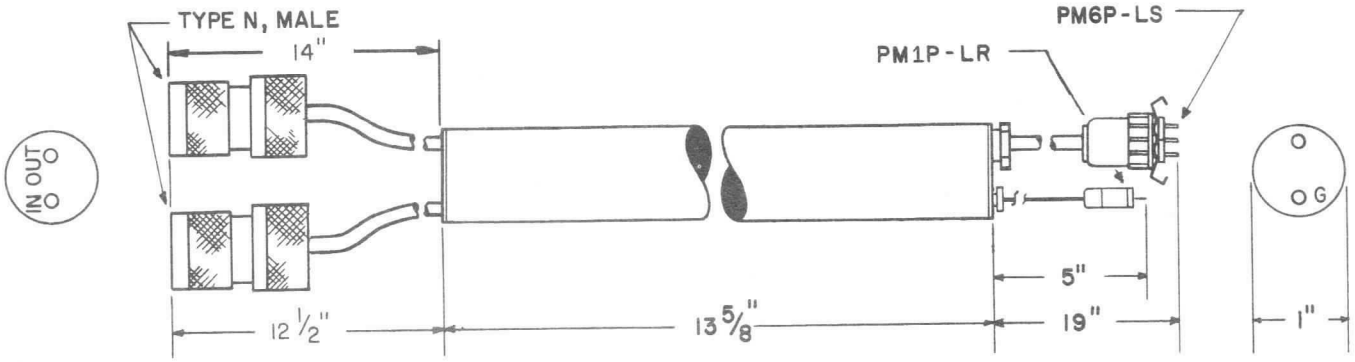
FREQUENCY RANGE	8.0 TO 12.4 KMC
SMALL–SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	20 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	2000 TO 2300 V	– –	0.5 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[1]	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, MPE TYPE BS–4C

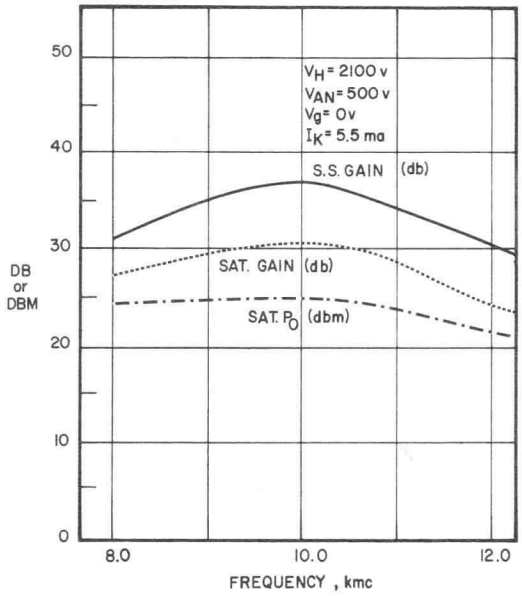
MECHANICAL CHARACTERISTICS



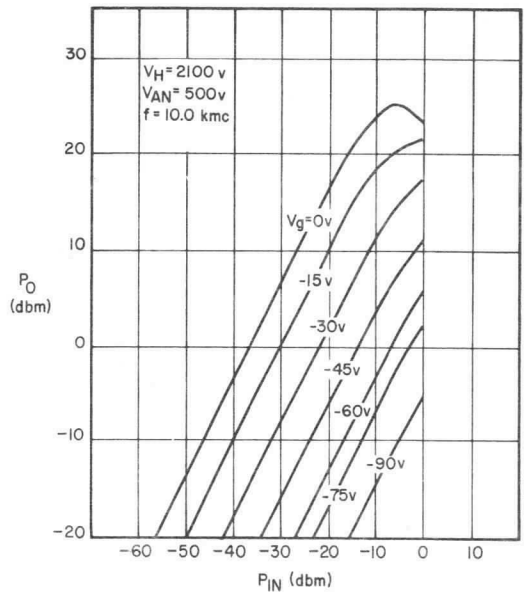
CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

[1]FOR TUBE WITH GRID CONNECTED INTERNALLY TO CATHODE, ORDER HA – 10 B.

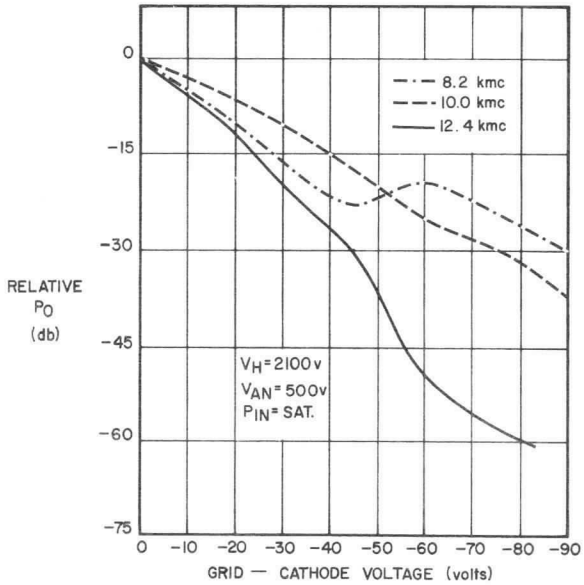
TYPICAL OPERATING CHARACTERISTICS



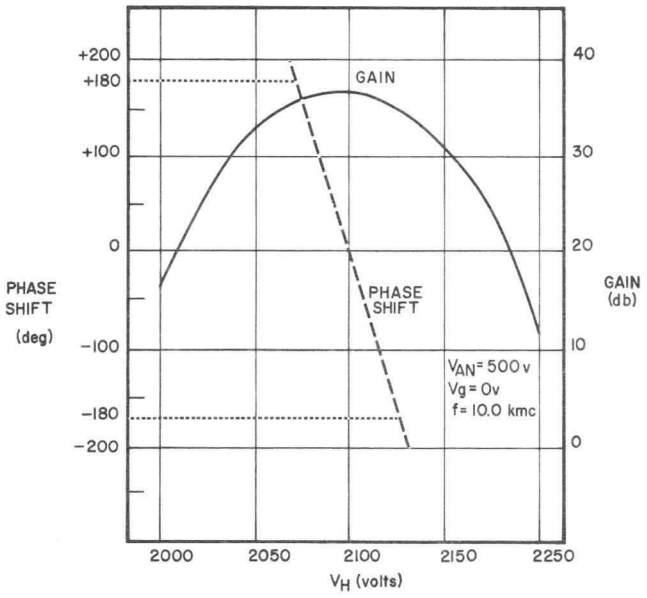
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

SOLENOID — FOCUSED, TWO WATT L — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

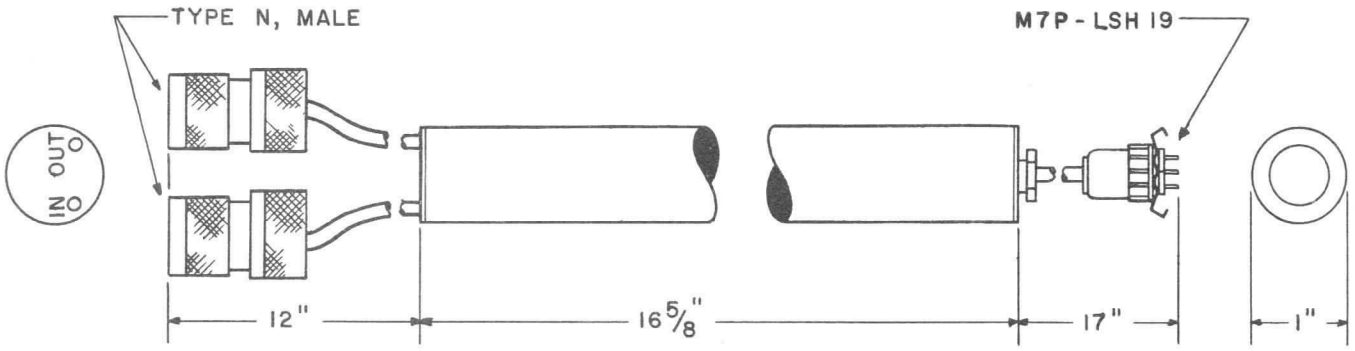
FREQUENCY RANGE	1.0 TO 2.0 KMC
SMALL-SIGNAL GAIN	33 DB MIN
SATURATION POWER OUTPUT	33 DBM MIN
GAIN AT 33 DBM POWER OUTPUT	30 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	650 TO 850 V	— —	2.0 MA MAX
COLLECTOR	650 TO 850 V	— —	50.0 MA MAX
ANODE	300 TO 550 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

FOCUSING . . . . . SOLENOID, 750 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

PPM — FOCUSED, 10 MW X — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

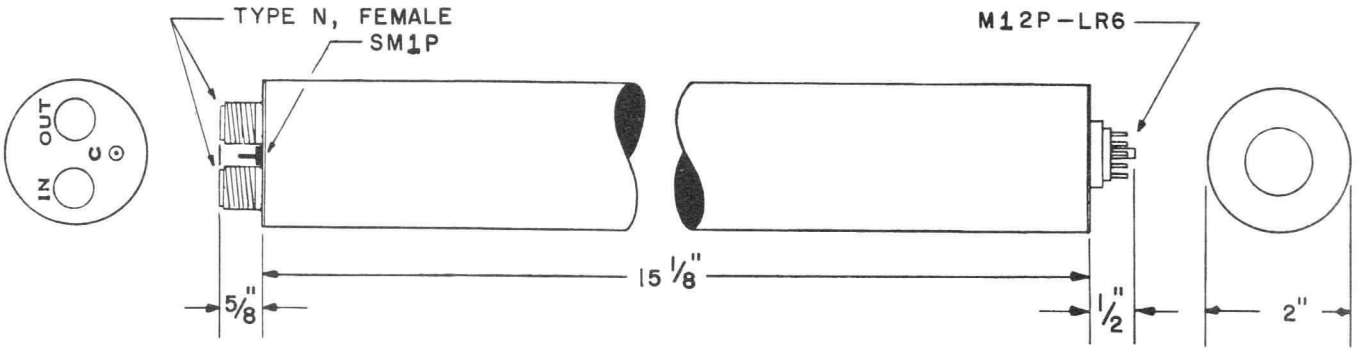
FREQUENCY RANGE	8.0 TO 11.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	1100 TO 1300 V	--	0.5 MA MAX
COLLECTOR	1100 TO 1300 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 OR 7.0 V	--	1.2 AMP MAX
* A NEGATIVE VOLTAGE CAN BE APPLIED FOR R - F ATTENUATION			

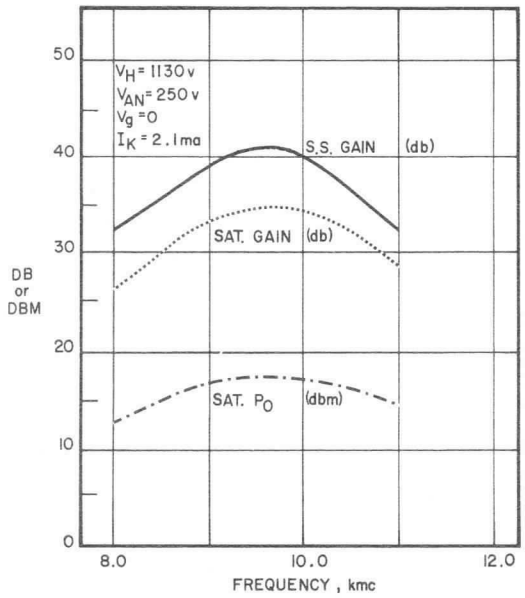
FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS

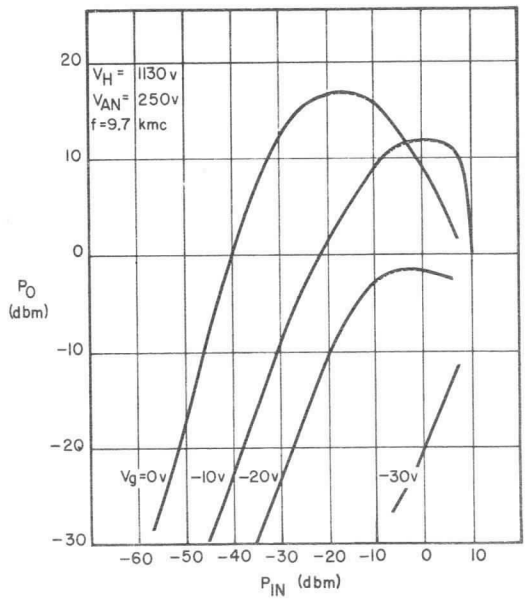


CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	3.6 LBS

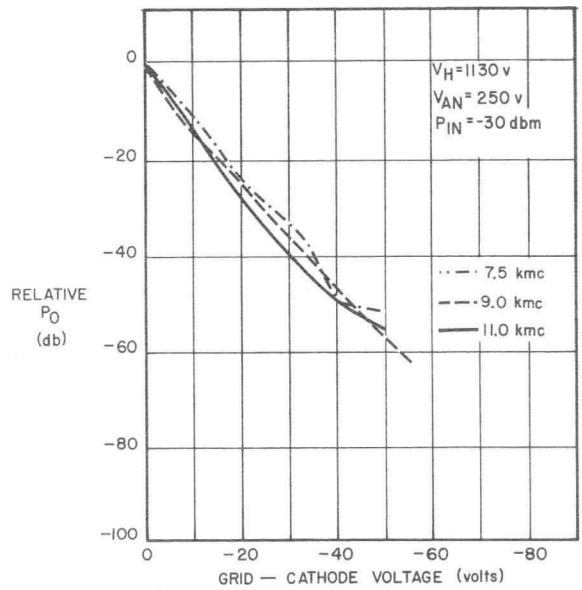
TYPICAL OPERATING CHARACTERISTICS



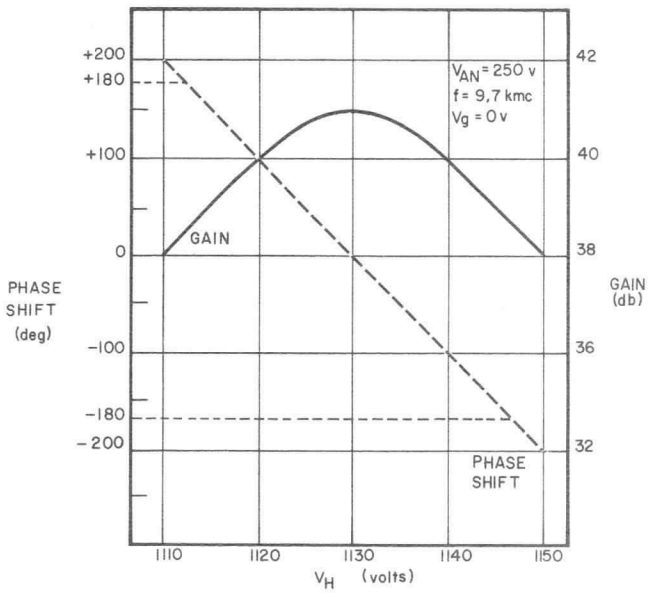
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM — FOCUSED, 0.5 WATT X — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	8.0 TO 11.0 KMC
SMALL-SIGNAL GAIN	33 DB MIN
SATURATION POWER OUTPUT	27 DBM MIN
GAIN AT 27 DBM POWER OUTPUT	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

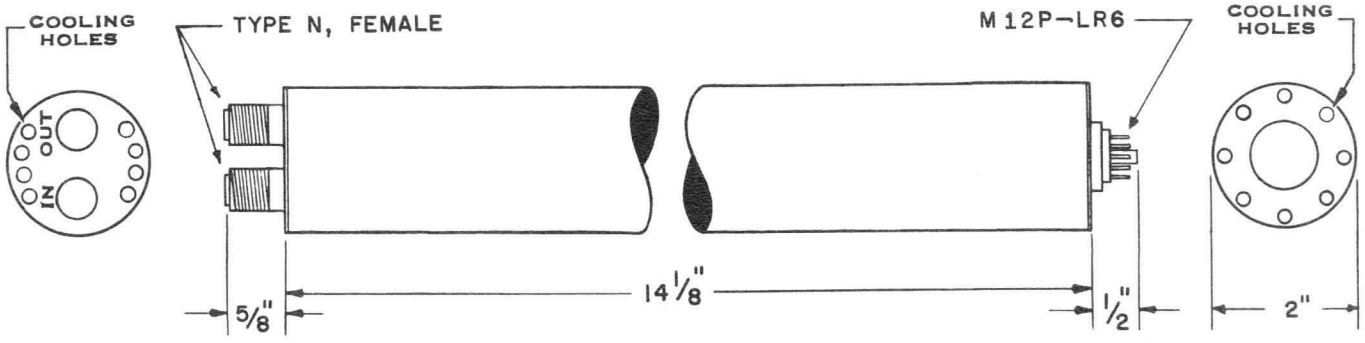
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	2000 TO 2400 V	--	2.0 MA MAX
COLLECTOR	2000 TO 2400 V	--	20.0 MA MAX
ANODE	1000 TO 2200 V	--	0.1 MA MAX
CATHODE	0 V	--	20.0 MA MAX
GRID [1]	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 . . . . . PERIODIC PERMANENT MAGNET

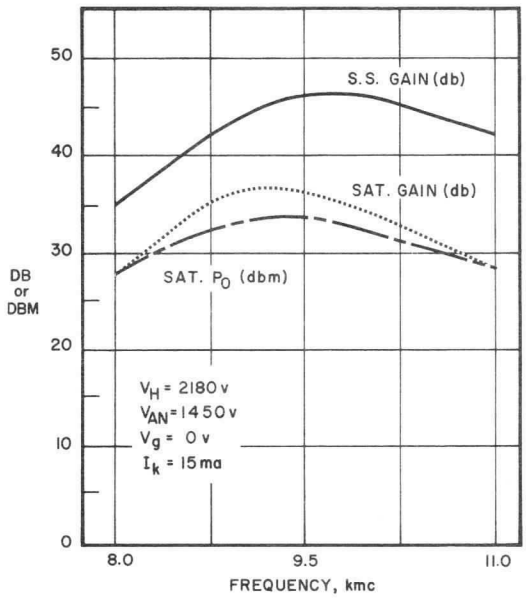
MECHANICAL CHARACTERISTICS



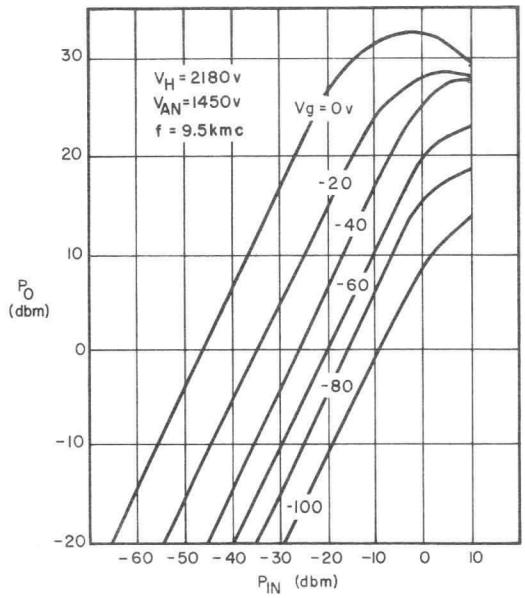
CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	AIR: 5 CFM @ 1" WATER
NET WEIGHT	4.3 LBS

[1] FOR TUBE WITH GRID CONNECTED INTERNALLY TO CATHODE, ORDER HA-21P.

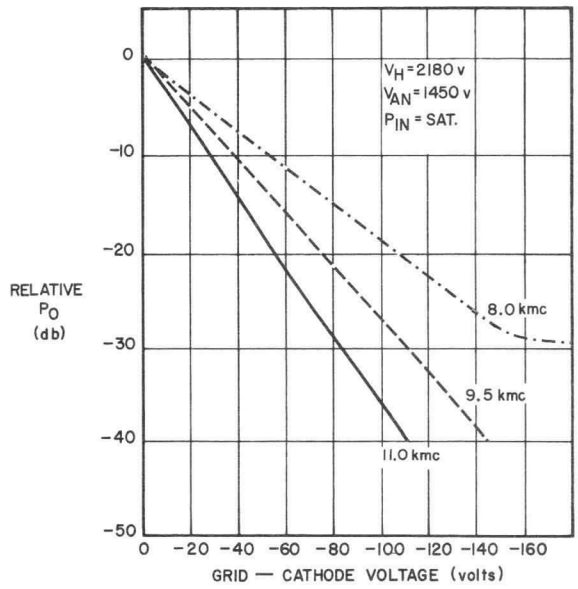
TYPICAL OPERATING CHARACTERISTICS



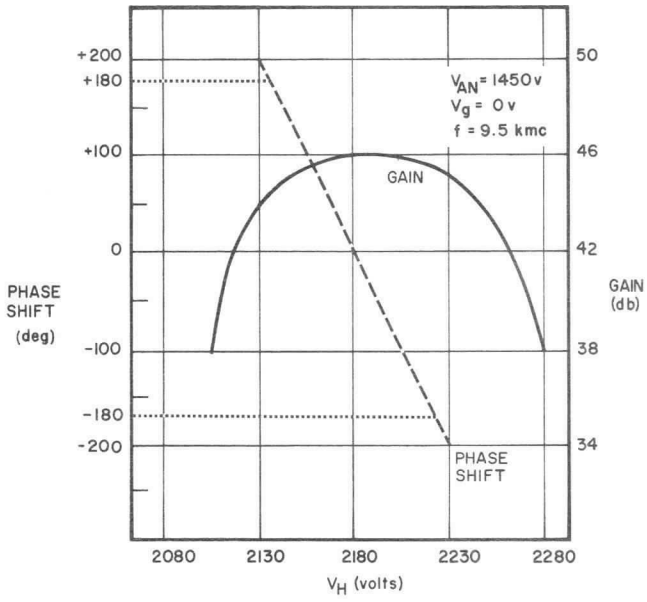
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

SOLENOID FOCUSED, 10 MW 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	10 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

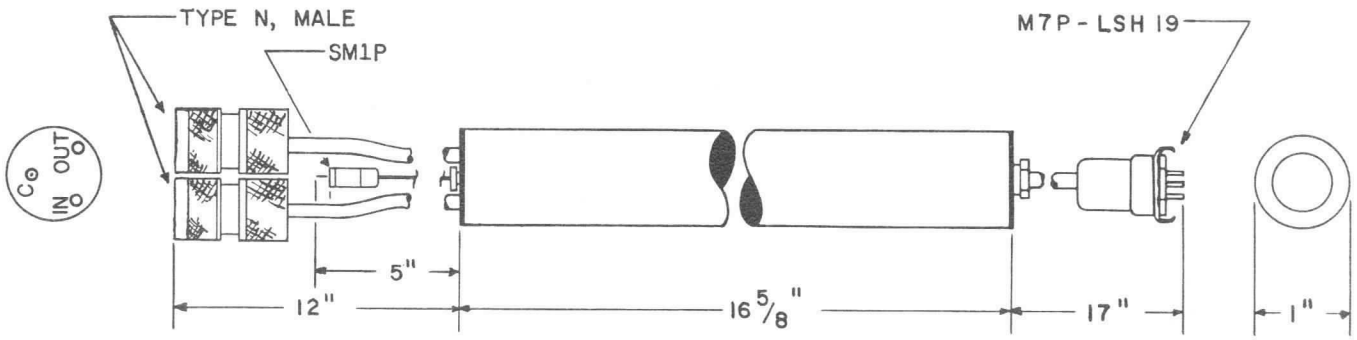
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	400 TO 500 V	--	0.2 MA MAX
COLLECTOR	400 TO 500 V	--	3.5 MA MAX
ANODE	0 TO 400 V	--	0.1 MA MAX
CATHODE	0 V	--	3.5 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, 300 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, 5 MW KU — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	12.4 TO 15.0 KMC
SMALL-SIGNAL GAIN	20 DB MIN
SATURATION POWER OUTPUT	7 DBM MIN
GAIN AT 7 DBM POWER OUTPUT	15 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

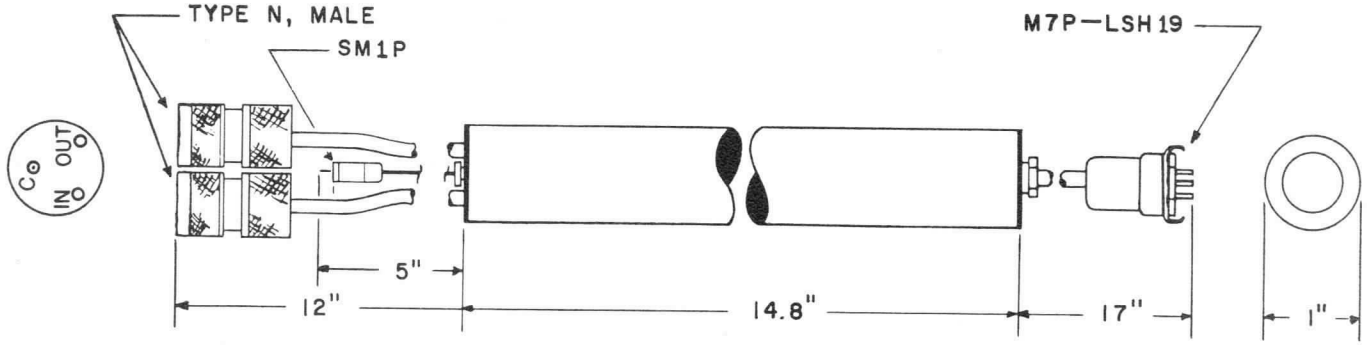
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	1100 TO 1300 V	--	0.25 MA MAX
COLLECTOR	1100 TO 1300 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 OR 7.0 V	--	1.2 AMP MAX

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

FOCUSING. . . . . SOLENOID, 400 GAUSS

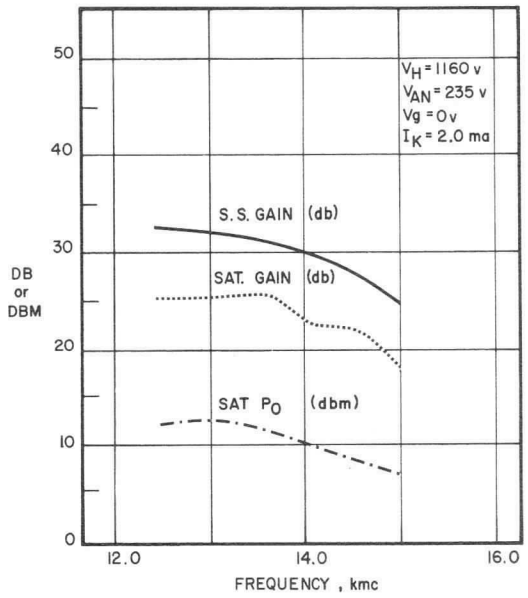
MECHANICAL CHARACTERISTICS



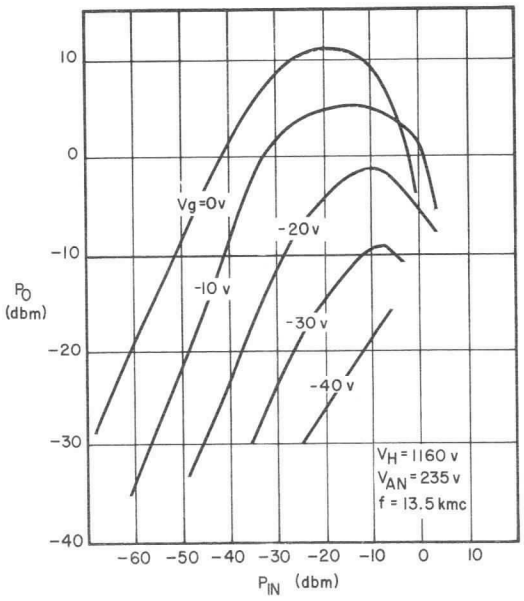
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1.0 LB

HA-24 HUGGINS LABORATORIES, INC.

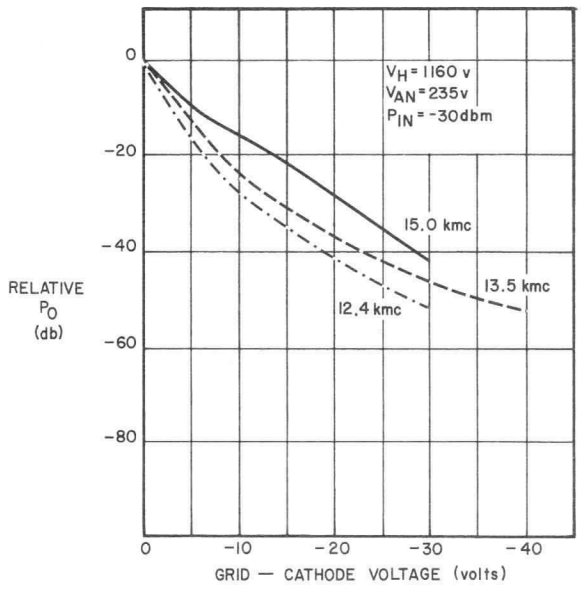
TYPICAL OPERATING CHARACTERISTICS



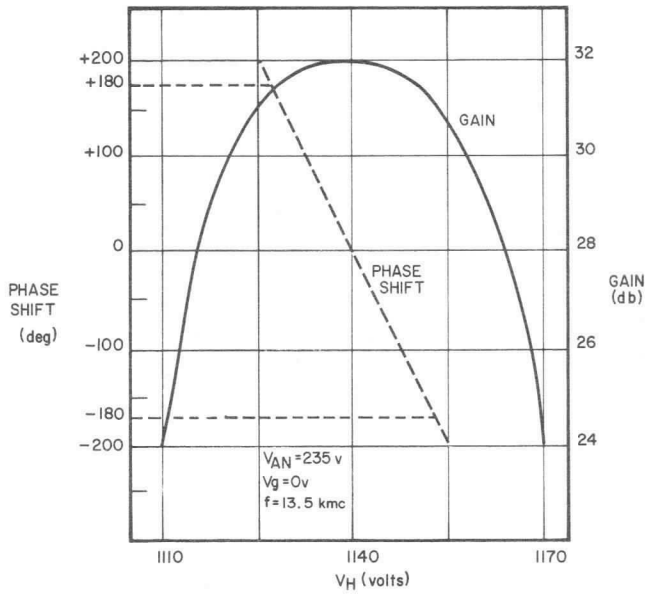
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

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

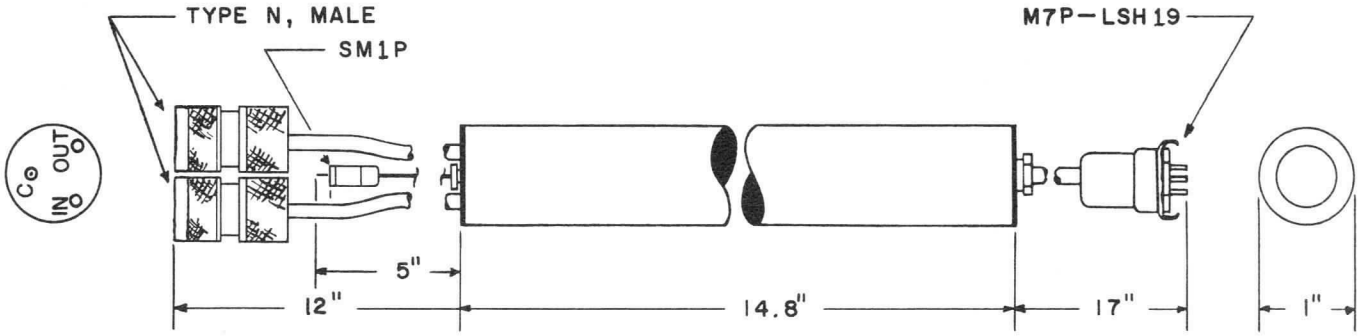
OPERATING CHARACTERISTICS

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

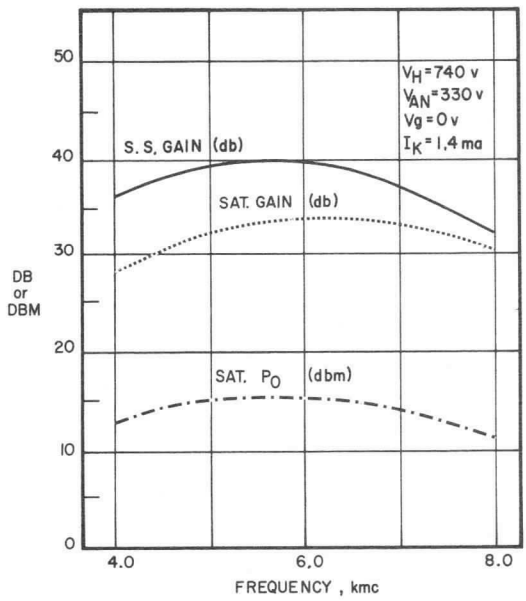
MECHANICAL CHARACTERISTICS



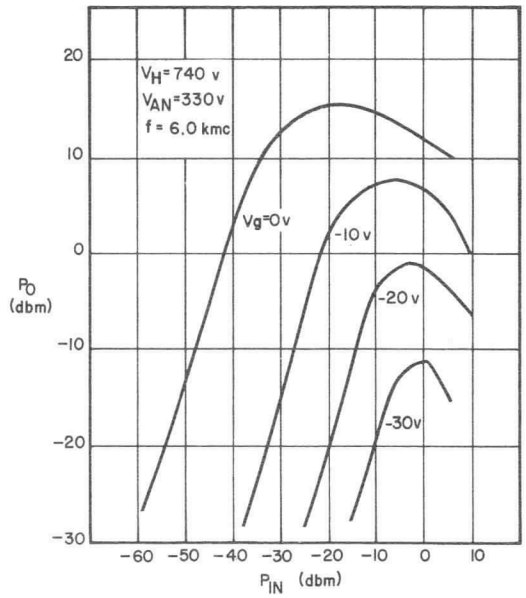
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	1.0 LB

HA-26 HUGGINS LABORATORIES, INC.

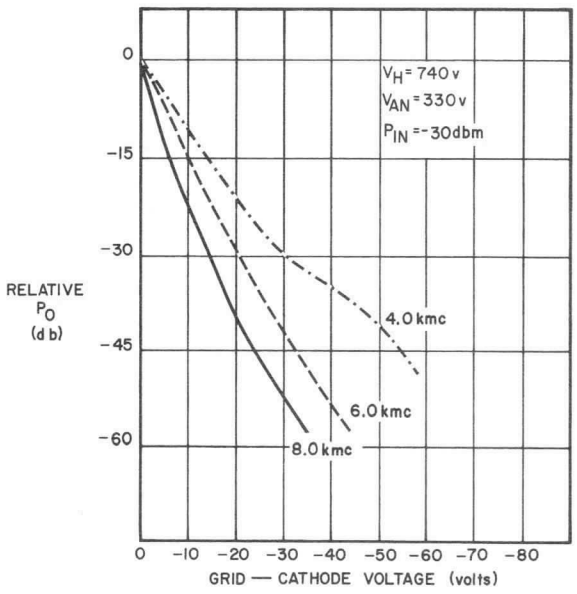
TYPICAL OPERATING CHARACTERISTICS



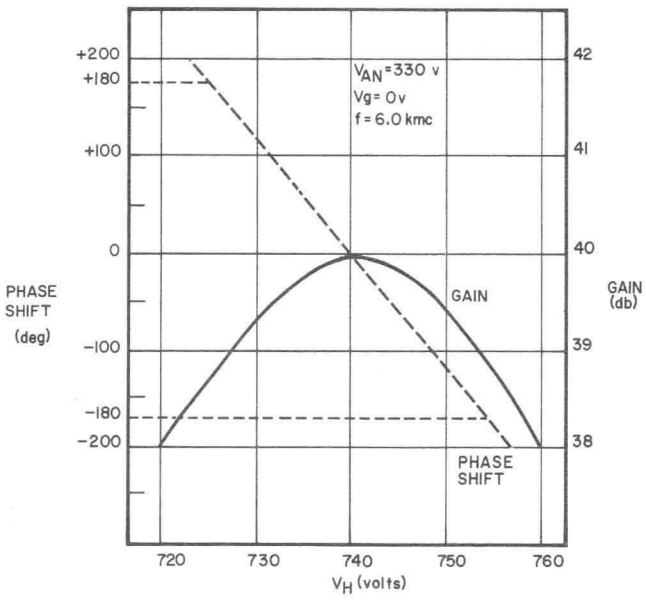
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM — 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

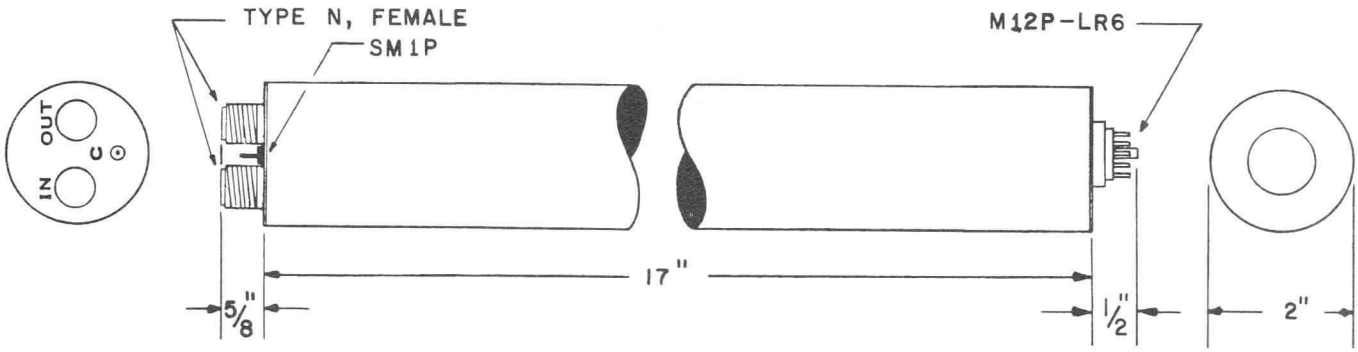
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	650 TO 800 V	--	0.5 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 OR 7.0	--	1.0 AMP MAX

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

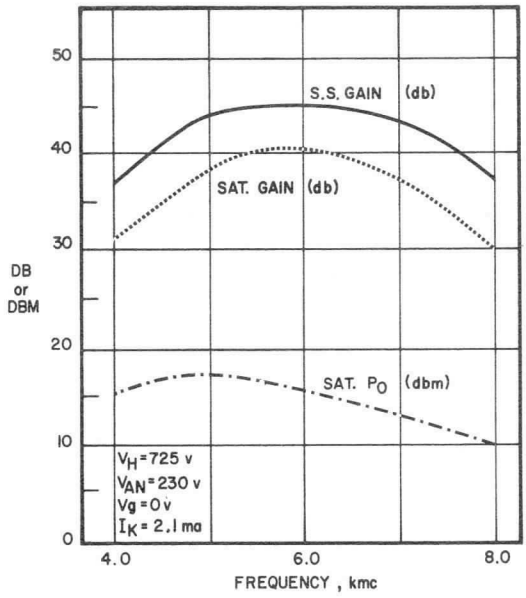
FOCUSING. . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS

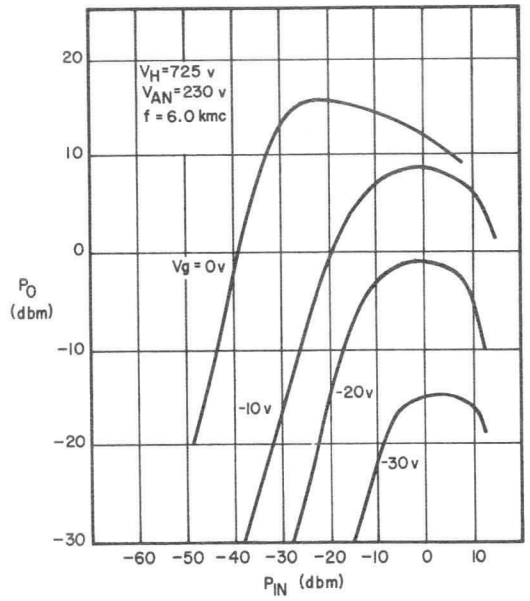


CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	4.5 LBS

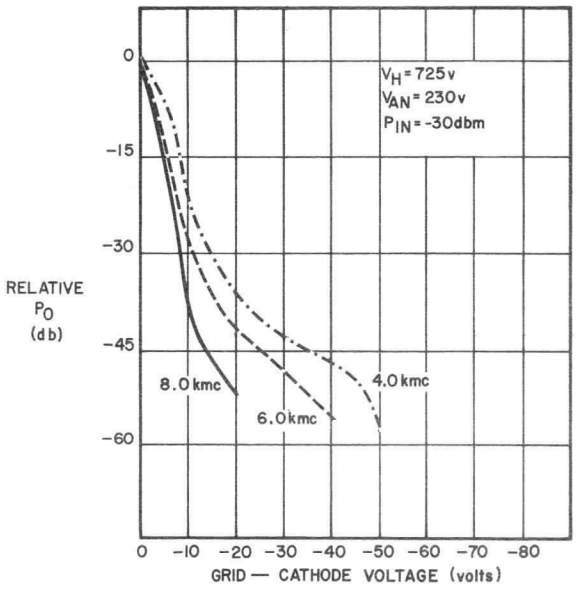
TYPICAL OPERATING CHARACTERISTICS



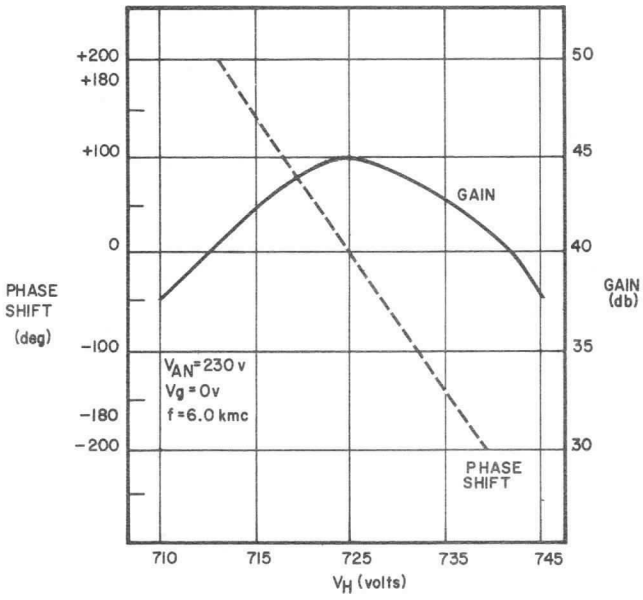
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM — FOCUSED, 10 MW S — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	2.0 TO 4.0 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

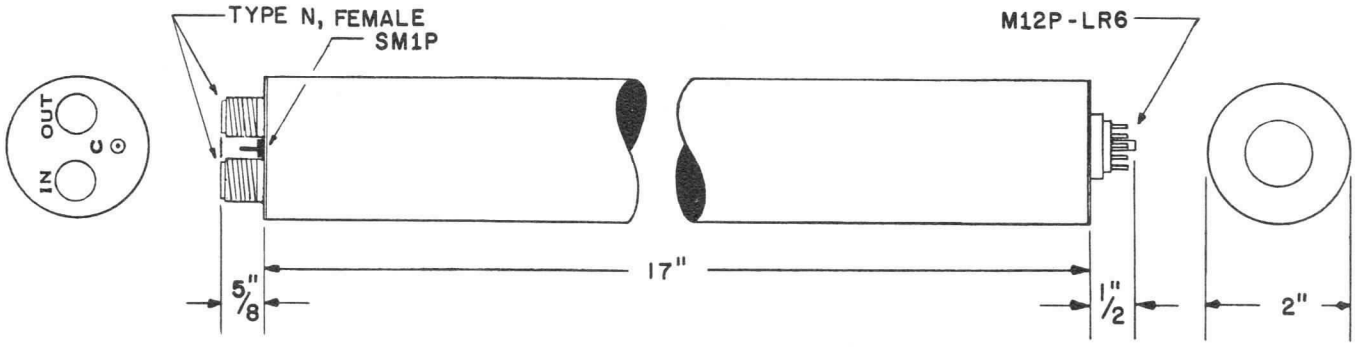
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	400 TO 525 V	— —	0.5 MA MAX
COLLECTOR	400 TO 525 V	— —	4.0 MA MAX
ANODE	0 TO 350 V	— —	0.1 MA MAX
CATHODE	0 V	— —	4.0 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

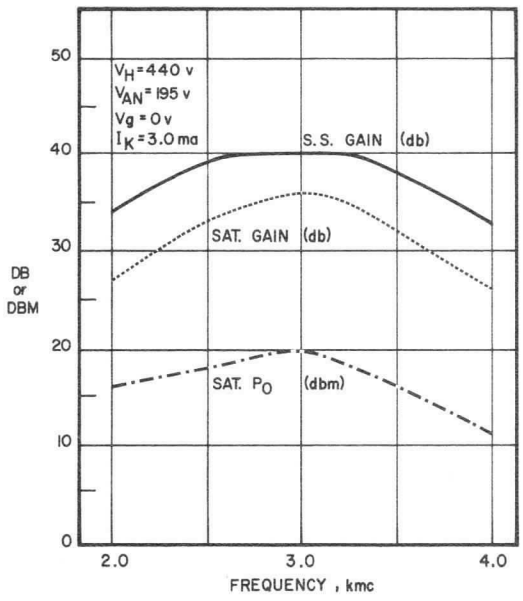
FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS

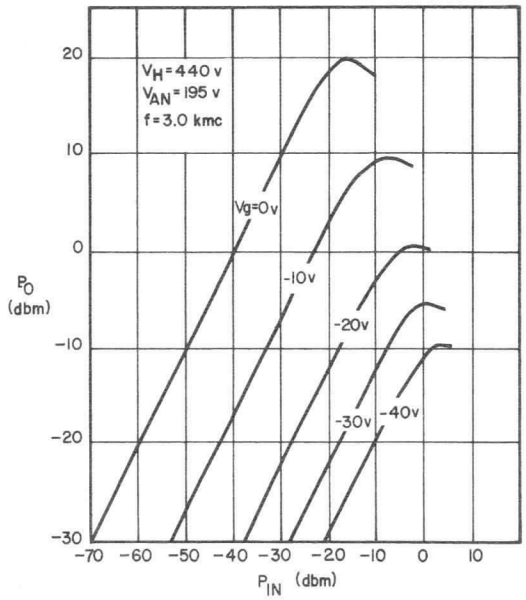


CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	3 1/2 LBS

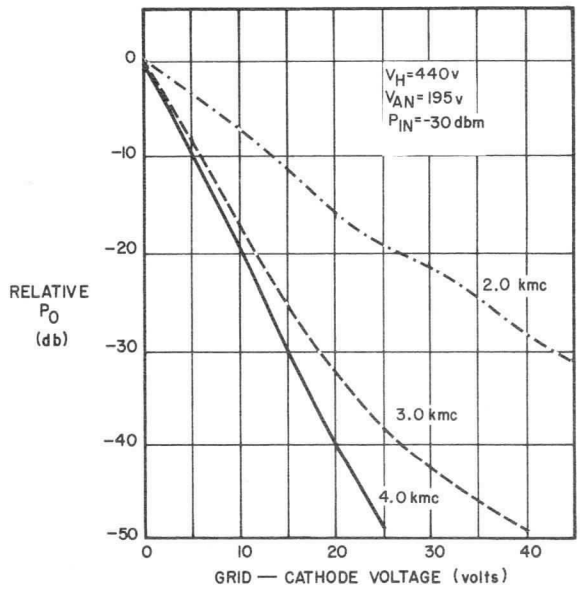
TYPICAL OPERATING CHARACTERISTICS



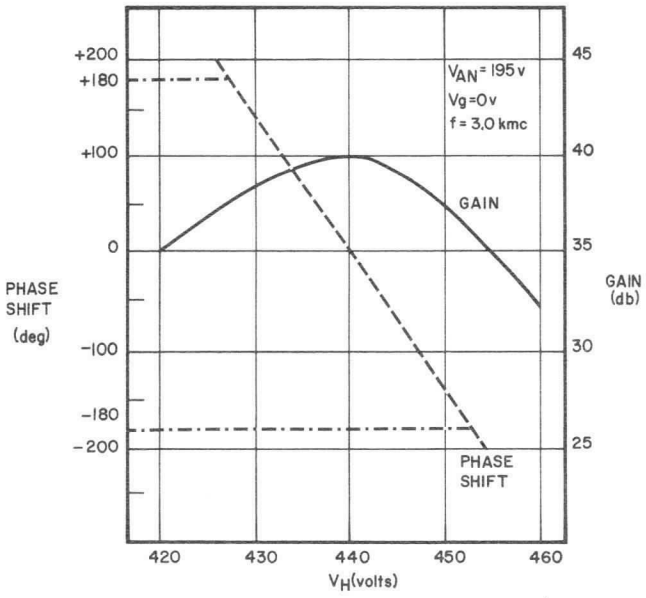
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM — FOCUSED, 1 WATT S — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	2.0 TO 4.0 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

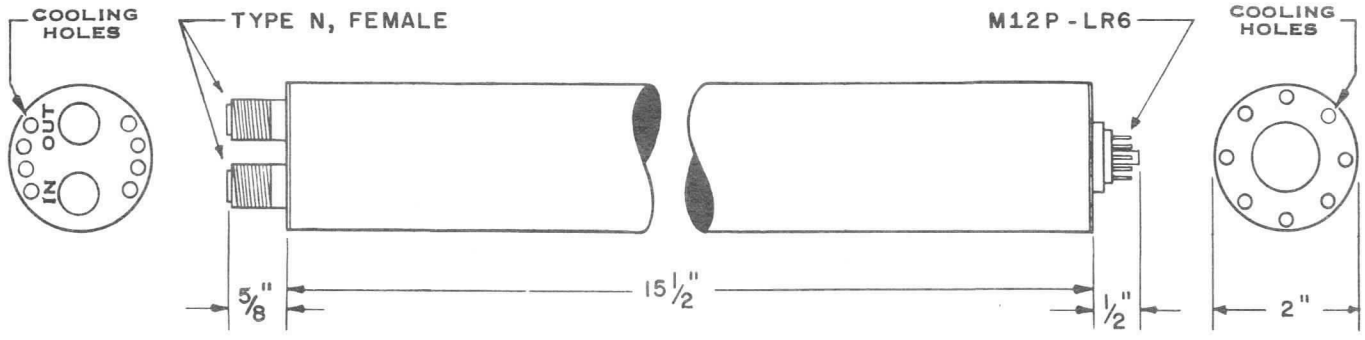
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	800 TO 1100 V	--	3.0 MA MAX
COLLECTOR	800 TO 1100 V	--	25.0 MA MAX
ANODE	0 TO 450 V	--	0.1 MA MAX
CATHODE	0 V	--	25.0 MA MAX
GRID [1]	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 . . . . . PERIODIC PERMANENT MAGNET

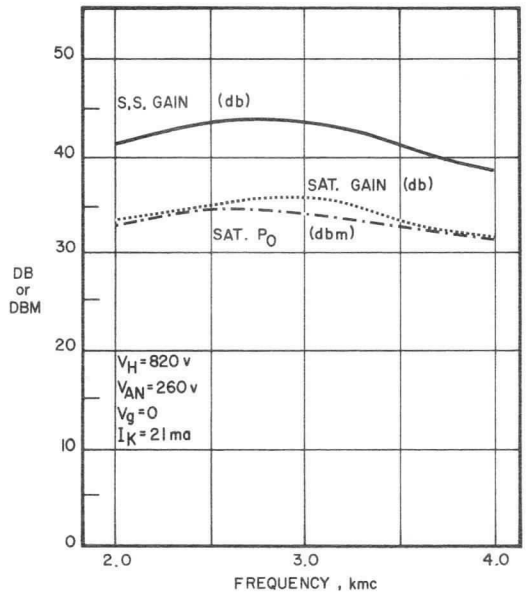
MECHANICAL CHARACTERISTICS



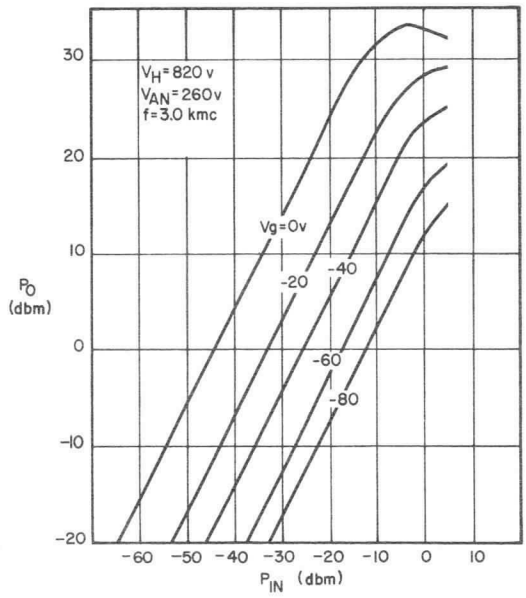
CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	.5 CFM @ 1" OF H_2O
NET WEIGHT	5 3/4 LBS

1 FOR TUBE WITH GRID INTERNALLY CONNECTED TO CATHODE, ORDER HA-30J.

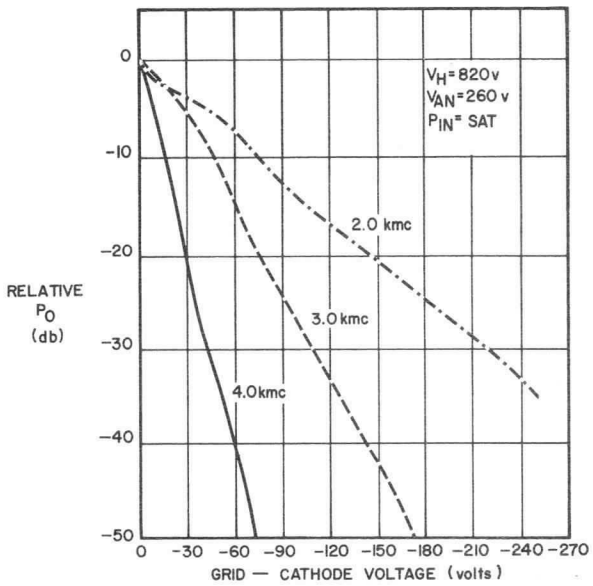
TYPICAL OPERATING CHARACTERISTICS



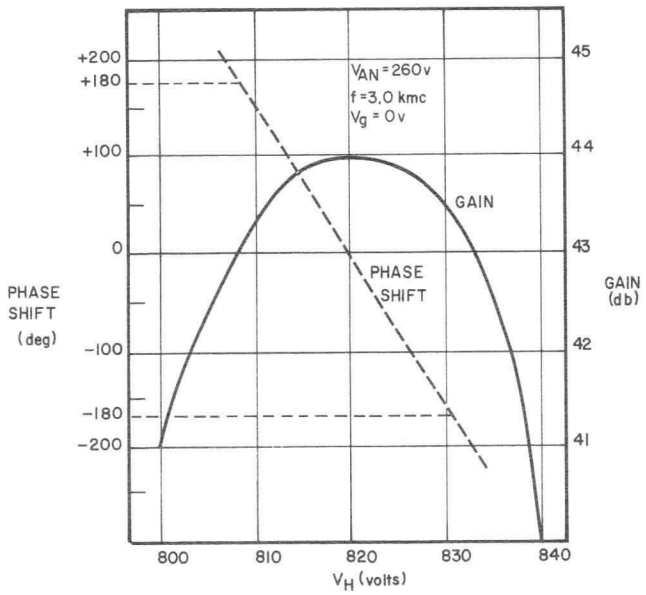
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM – FOCUSED, 10 MW L – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	1.0 TO 2.0 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

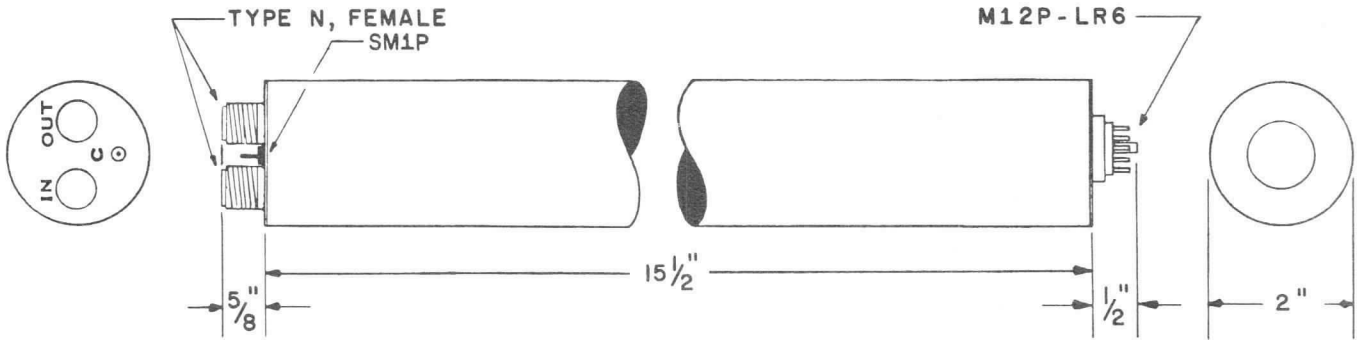
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	180 TO 220 V	--	2.0 MA MAX
COLLECTOR	180 TO 220 V	--	6.0 MA MAX
ANODE	0 TO 180 V	--	0.1 MA MAX
CATHODE	0 V	--	6.0 MA MAX
GRID	0 * V	--	0.1 MA MAX
HEATER	6.3 V	--	1.4 AMP MAX

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

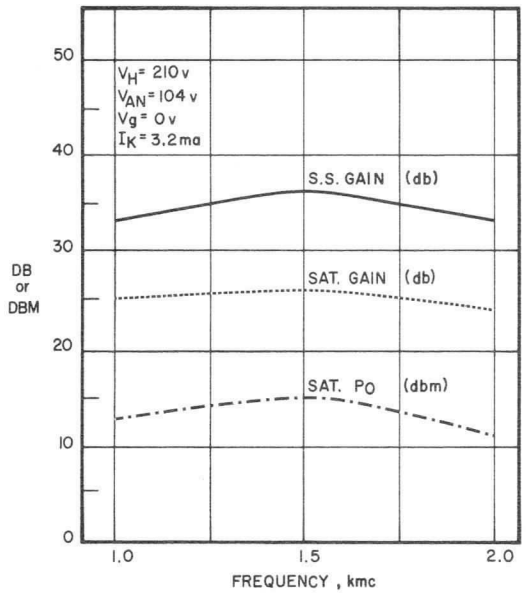
FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS

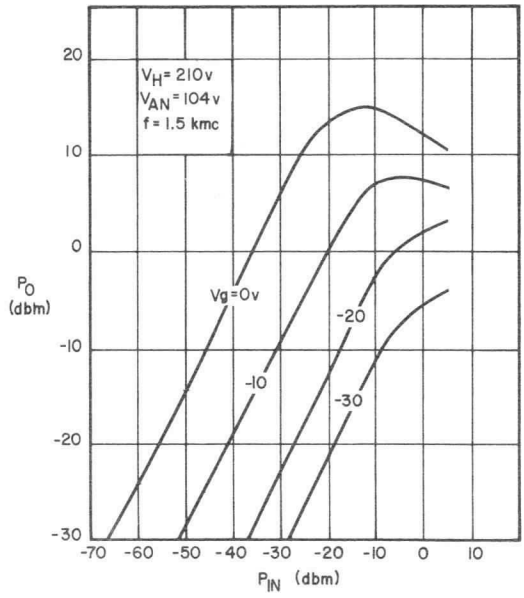


CAPSULE FINISH	CHROME
END CAP FINISH	ANODIZED BLACK
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	4.5 LBS

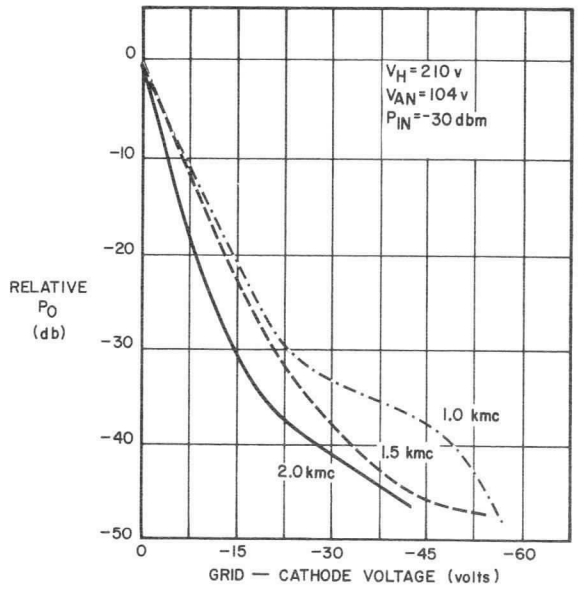
TYPICAL OPERATING CHARACTERISTICS



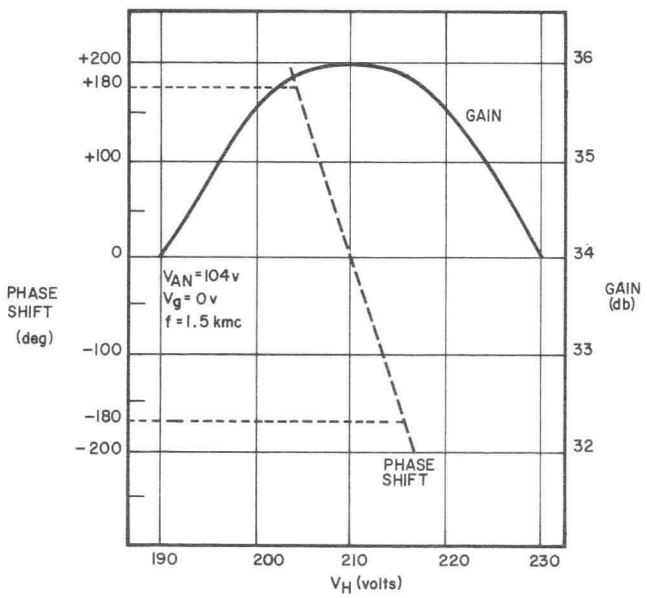
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM — FOCUSED, 0.5 WATT C — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	4.0 TO 8.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	27 DBM MIN
GAIN AT 27 DBM POWER OUTPUT	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

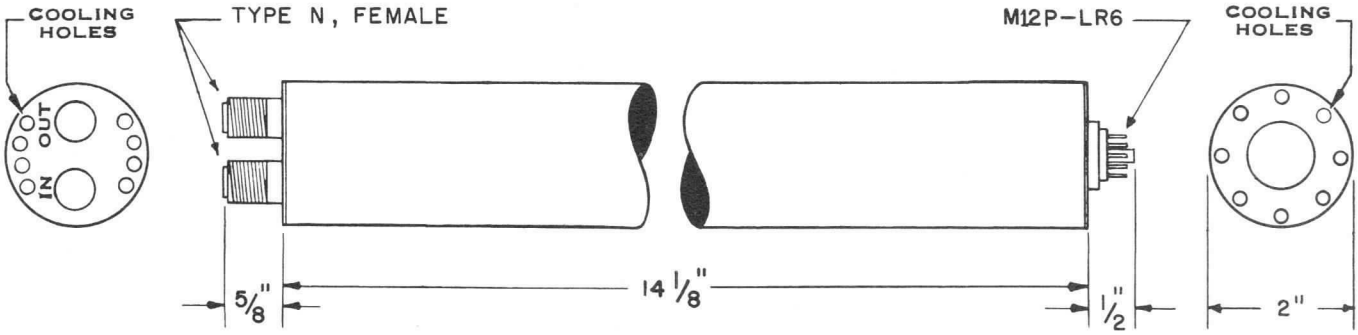
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	1300 TO 1600 V	--	2.0 MA MAX
COLLECTOR	1300 TO 1600 V	--	20.0 MA MAX
ANODE	0 TO 700 V	--	0.1 MA MAX
CATHODE	0 V	--	20.0 MA MAX
GRID [1]	0* V	--	0.1 MA MAX
HEATER	7.0 V	--	1.3 AMP MAX

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

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

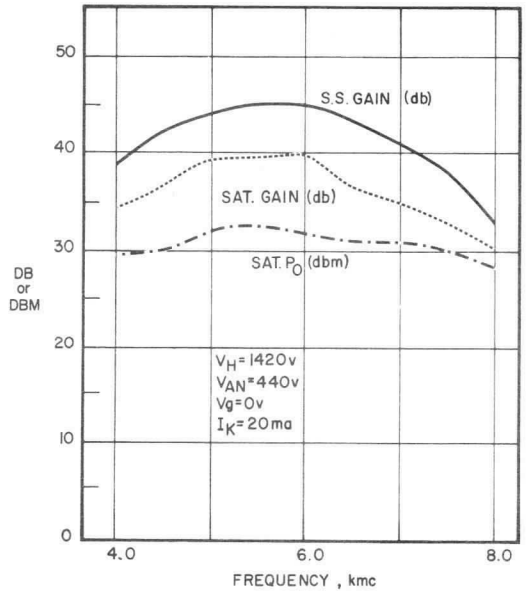
MECHANICAL CHARACTERISTICS



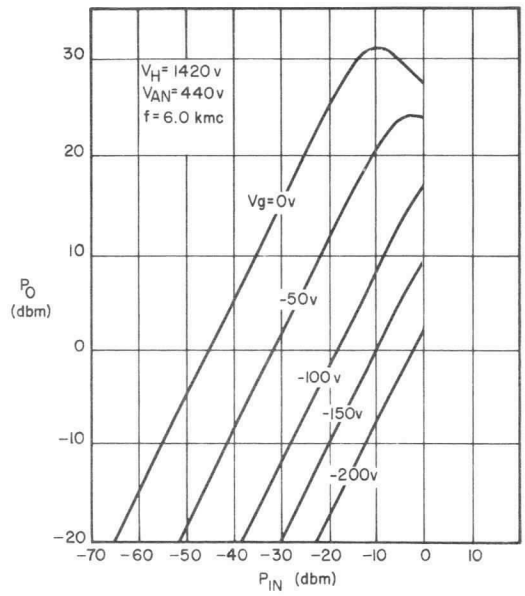
CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . AIR: 5 CFM @ 1'' WATER
NET WEIGHT . . . . . 5 1/2 LBS

[1] FOR TUBE WITH GRID CONNECTED INTERNALLY TO CATHODE, ORDER HA-35J.

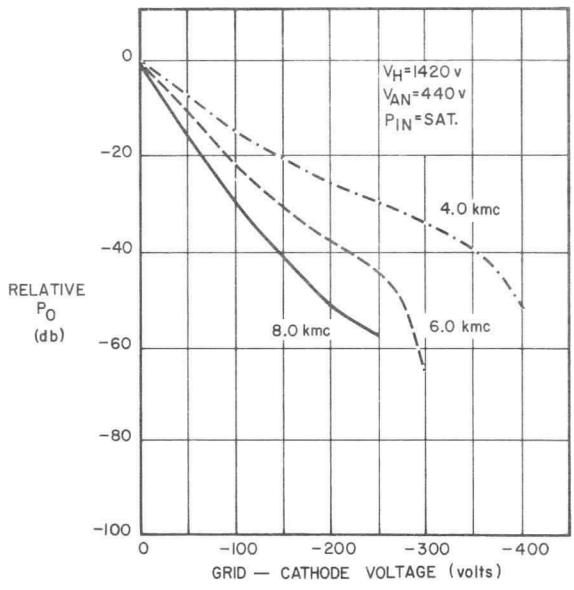
TYPICAL OPERATING CHARACTERISTICS



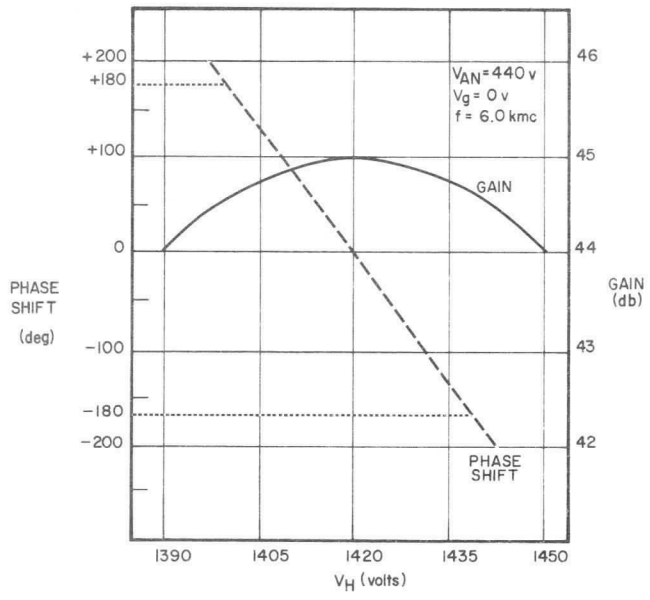
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM — FOCUSED, 10 MW UHF — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

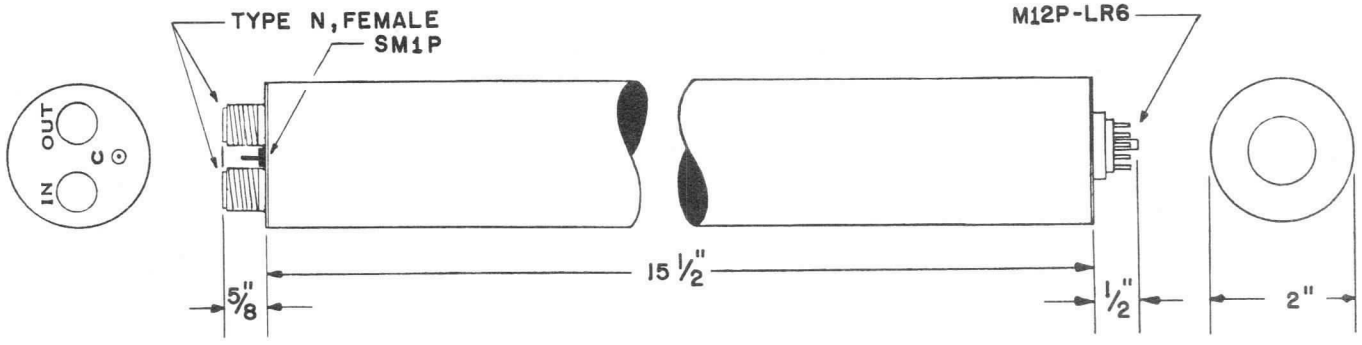
FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL-SIGNAL GAIN	20 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
GAIN AT SATURATION	10 DB MIN

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	180 TO 300 V	--	8.0 MA MAX
COLLECTOR	180 TO 300 V	--	8.0 MA MAX
ANODE	0 TO 175 V	--	0.1 MA MAX
CATHODE	0 V	--	8.0 MA MAX
GRID	0 * V	--	0.1 MA MAX
HEATER	6.3 V	--	1.4 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	NONE
NET WEIGHT	4 1/2 LBS

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

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

ELECTRICAL CHARACTERISTICS

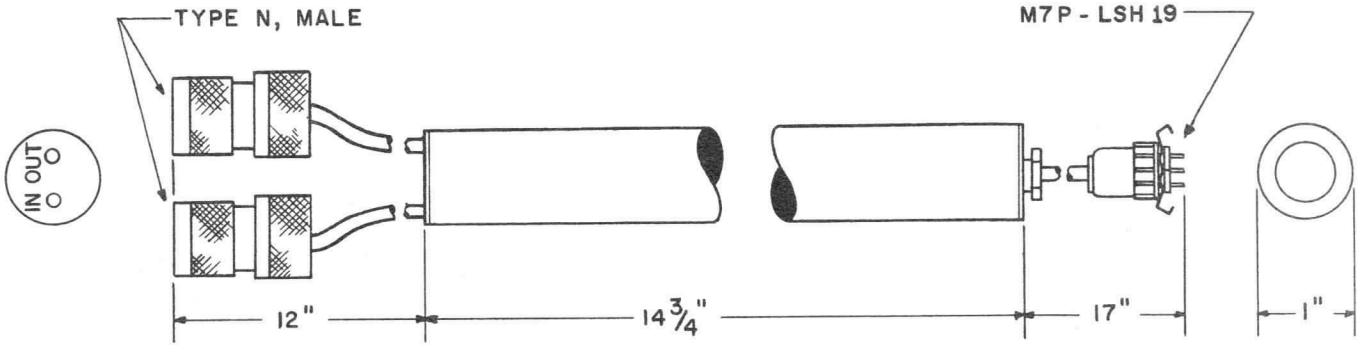
FREQUENCY RANGE	1.6 TO 2.6 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	30 DBM MIN
GAIN AT 30 DBM POWER OUTPUT	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

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

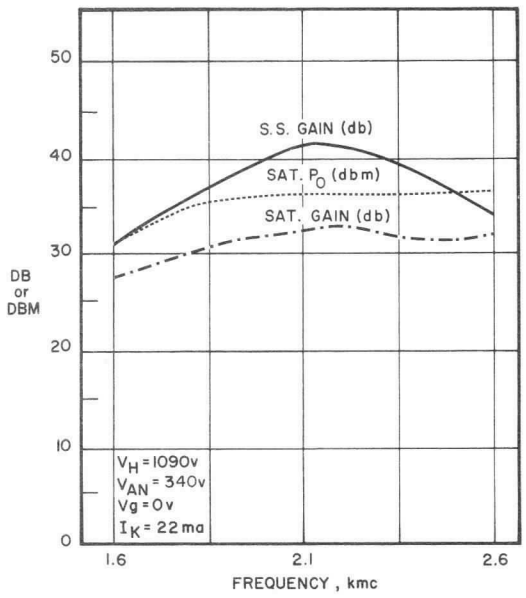
MECHANICAL CHARACTERISTICS



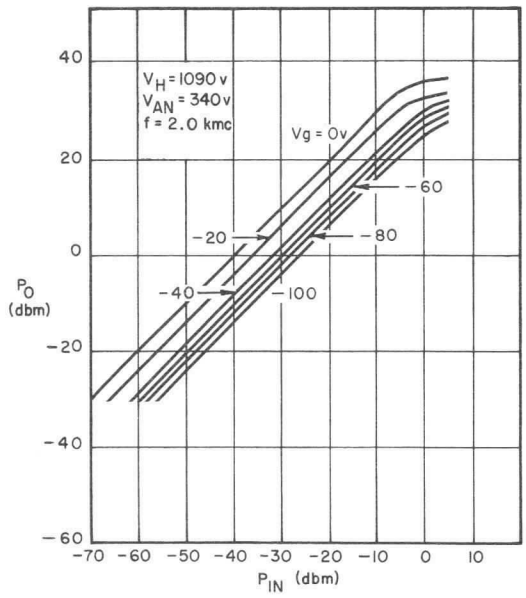
CAPSULE FINISH	CHROME
END CAP FINISH	CHROME
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

HUGGINS LABORATORIES, INC.

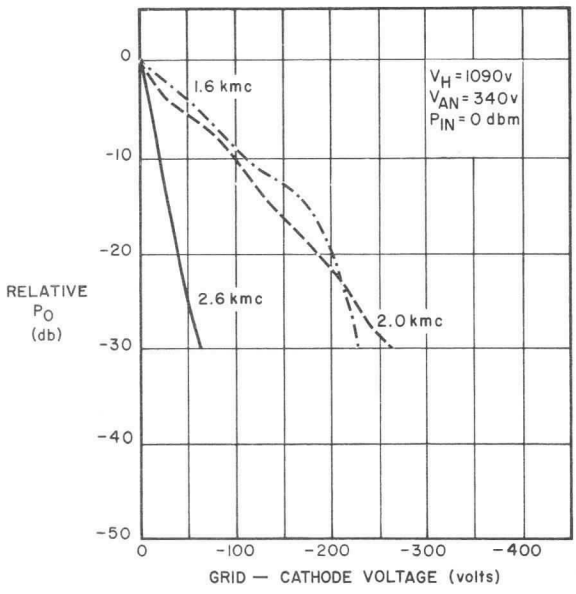
TYPICAL OPERATING CHARACTERISTICS



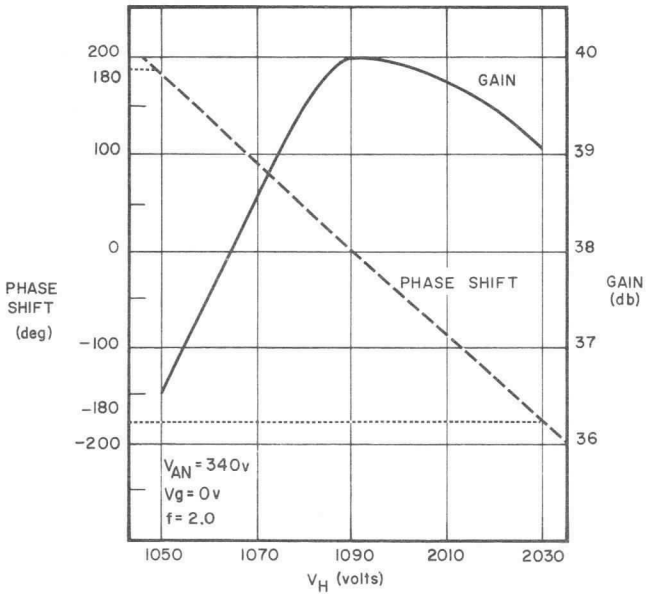
GAIN AND POWER OUTPUT



TRANSFER CHARACTERISTICS



GRID CONTROL



PHASE SHIFT AND GAIN vs HELIX VOLTAGE (small signal)

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

PPM — FOCUSED, 3 MW 10.5 TO 16.0 KMC AMPLIFIER

ELECTRICAL CHARACTERISTICS

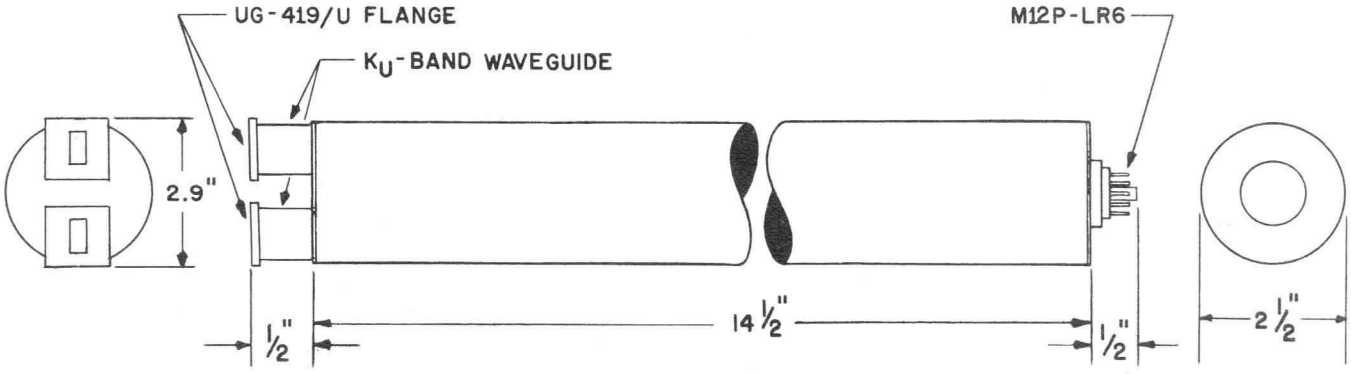
FREQUENCY RANGE	10.5 TO 16.0 KMC
SMALL-SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	5 DBM MIN
GAIN AT SATURATION	15 DB MIN
VSWR, INPUT AND OUTPUT	3:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	1100 TO 1300 V	— —	0.4 MA MAX
COLLECTOR	1100 TO 1300 V	— —	3.0 MA MAX
ANODE	0 TO 450 V	— —	0.1 MA MAX
CATHODE	0 V	— —	3.0 MA MAX
GRID	0 TO −20 V	— —	0.1 MA MAX
HEATER	6.3 OR 7.0 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 . . . . . 5 LBS

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

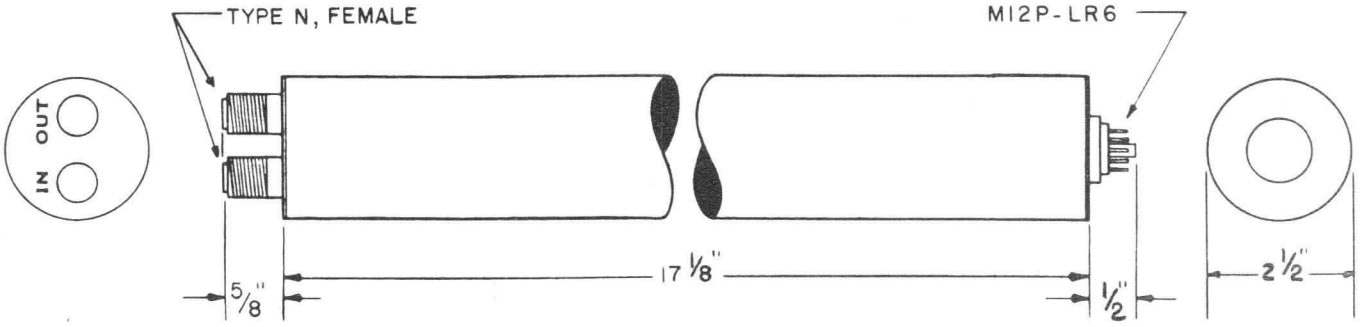
PPM–FOCUSED, 10 MW VHF–BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	250 TO 500 MC
SMALL–SIGNAL GAIN	20 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
GAIN AT SATURATION	15 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	150 TO 250 V	--	4.0 MA MAX
COLLECTOR	350 V	--	10.0 MA MAX
ANODE	0 TO 300 V	--	0.5 MA MAX
CATHODE	0 V	--	10.0 MA MAX
GRID	0 TO –50 V	--	0.1 MA MAX
HEATER	6.3 V	--	1.5 AMP MAX



CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	5 1/2 LBS.

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

PPM–FOCUSED, 2–WATT L–BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

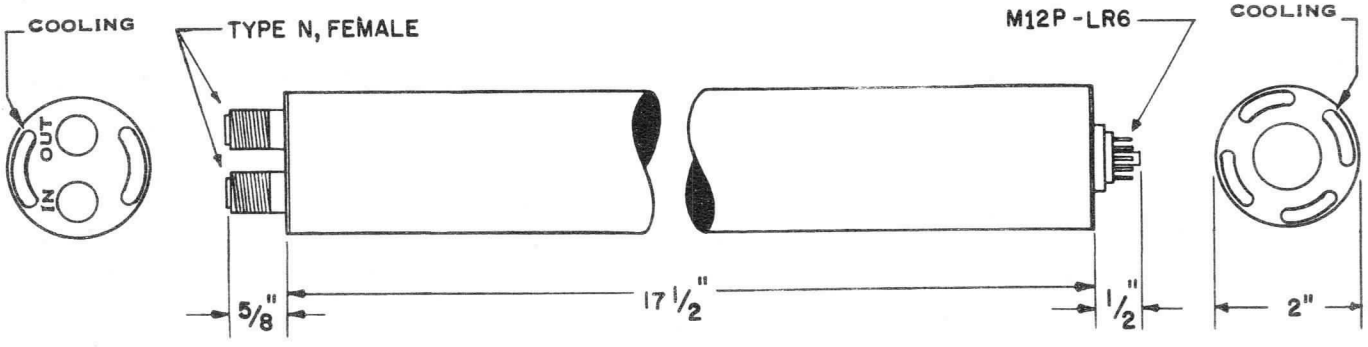
FREQUENCY RANGE	1.0 TO 2.0 GC
SMALL–SIGNAL GAIN	30 DB MIN
SATURATION POWER OUTPUT	33 DBM MIN
GAIN AT SATURATION	27 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	% REGULATION	CURRENT
HELIX	700 TO 1000 V	– –	8.0 MA MAX
COLLECTOR	1200 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	– –	1.7 AMP MAX

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.

999 East Arques Avenue · Sunnyvale, California

PPM — FOCUSED, 100 MW X — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

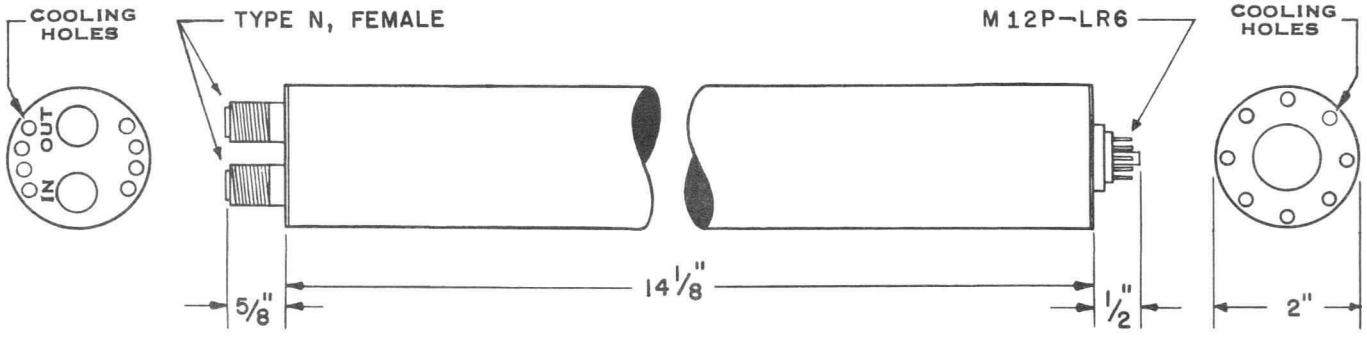
FREQUENCY RANGE	8. TO 12.4 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	20 DBM MIN
GAIN AT SATURATION	20 DB MIN
VSWR, INPUT AND OUTPUT	2:1 MAX

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	5 1/4 LBS

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

SOLENOID – FOCUSED, MEDIUM – NOISE S – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

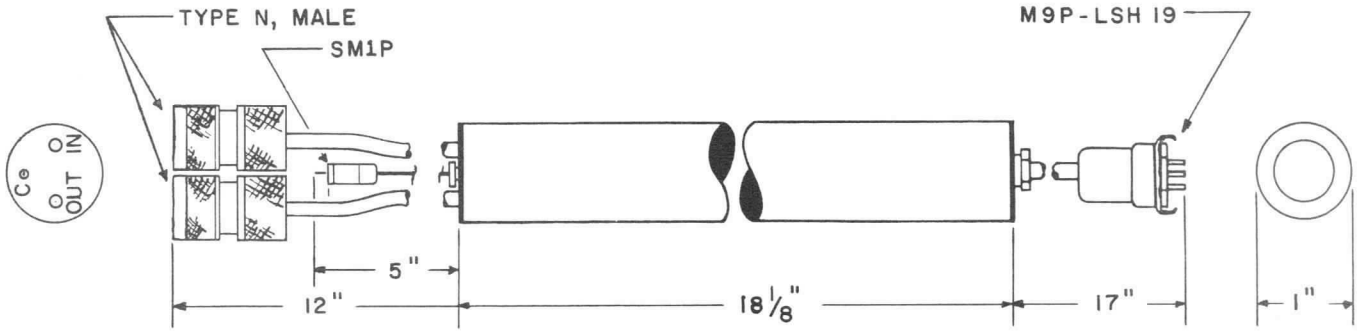
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL–SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	375 TO 475 V	--	0.03 MA MAX
COLLECTOR	375 TO 475 V	--	2.0 MA MAX
ANODE 1	0 TO 50 V	--	0.01 MA MAX
ANODE 2	0 TO 80 V	--	0.01 MA MAX
ANODE 3	0 TO 150 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

FOCUSING . . . . . SOLENOID, MPE TYPE AS – 10

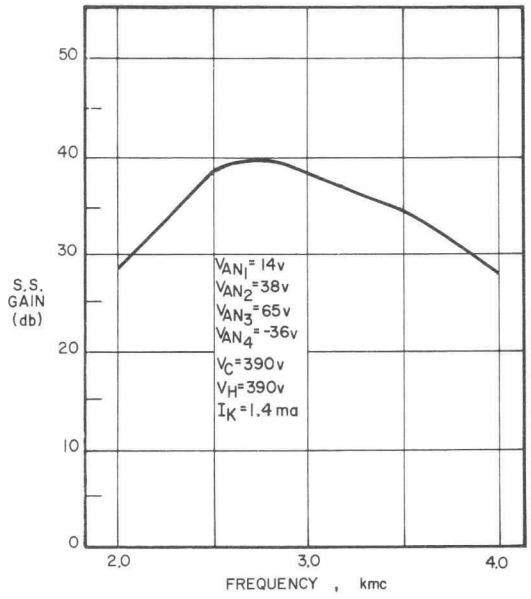
MECHANICAL CHARACTERISTICS



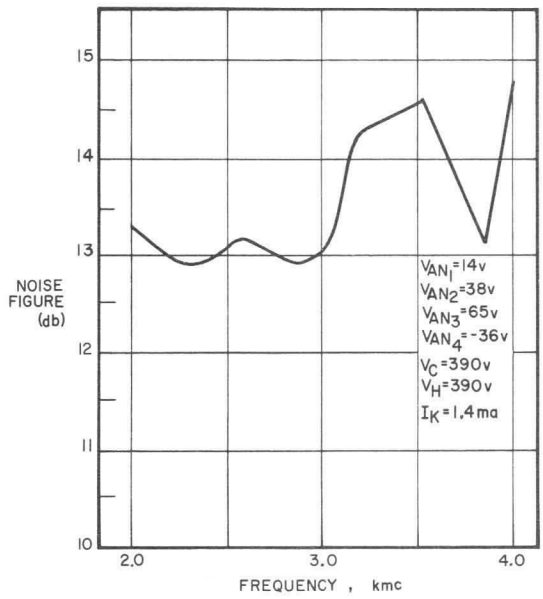
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

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

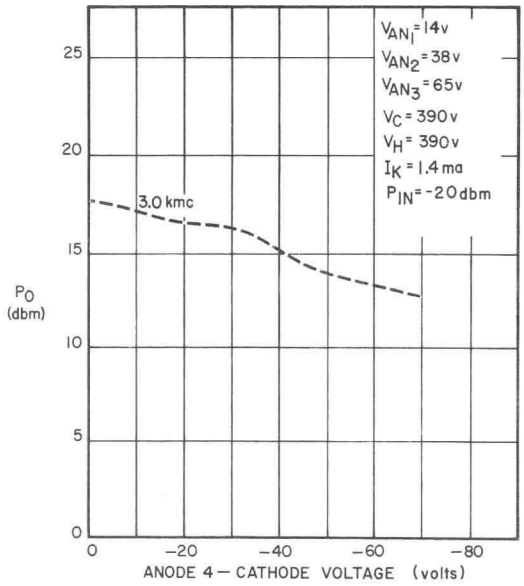
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 4 CONTROL

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]	10 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

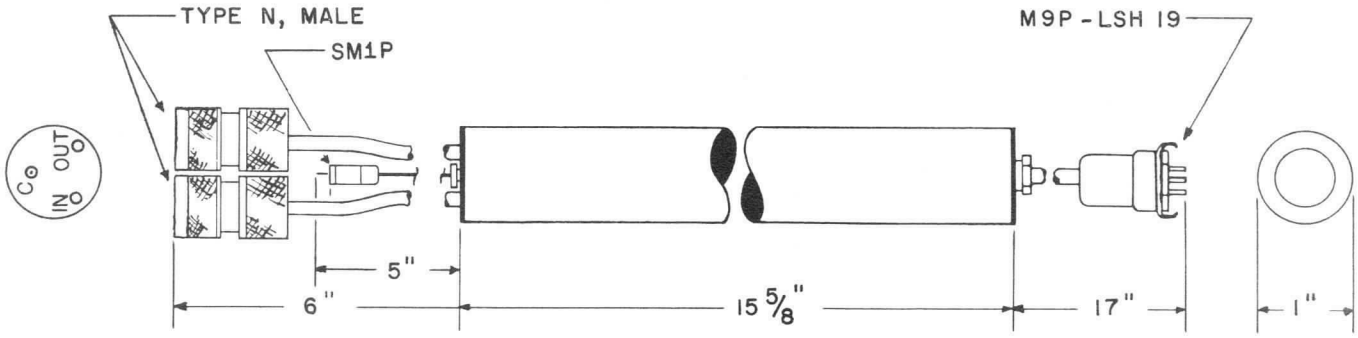
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	165 TO 200 V	--	0.01 MA MAX
COLLECTOR	FIXED *	--	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 120 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

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 350 TO 500 VOLTS.

FOCUSING . . . . . SOLENOID, 1000 GAUSS

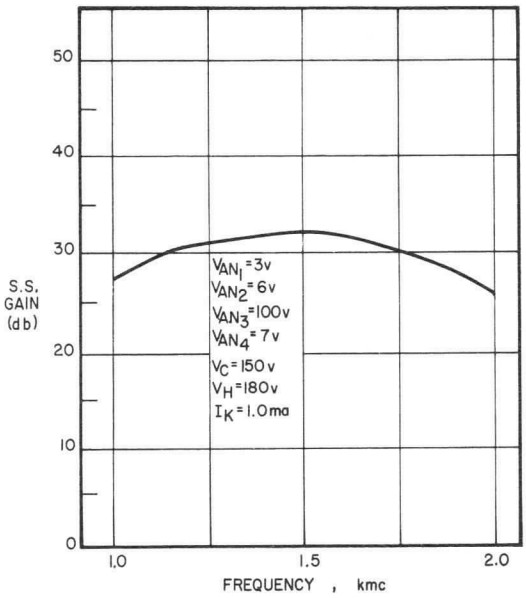
MECHANICAL CHARACTERISTICS



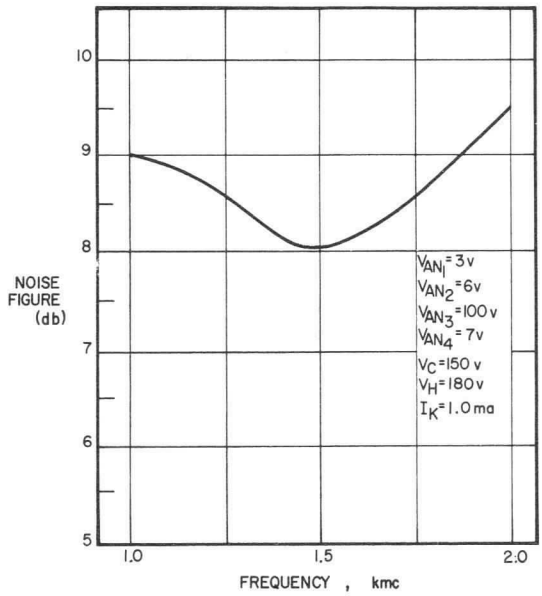
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

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

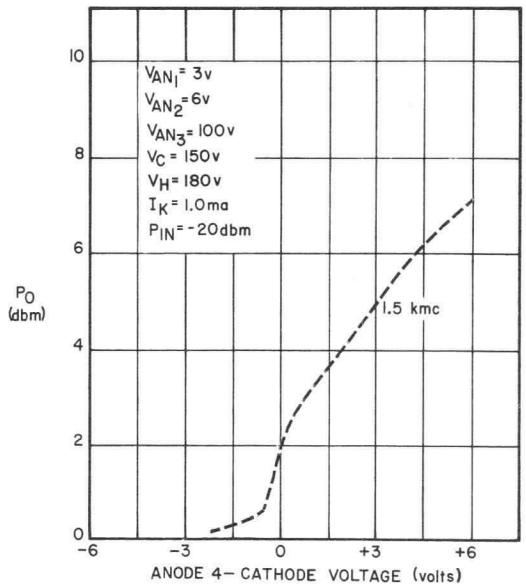
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 4 CONTROL

SOLD FOR REPLACEMENT ONLY

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

SOLENOID – FOCUSED, MEDIUM – NOISE X – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

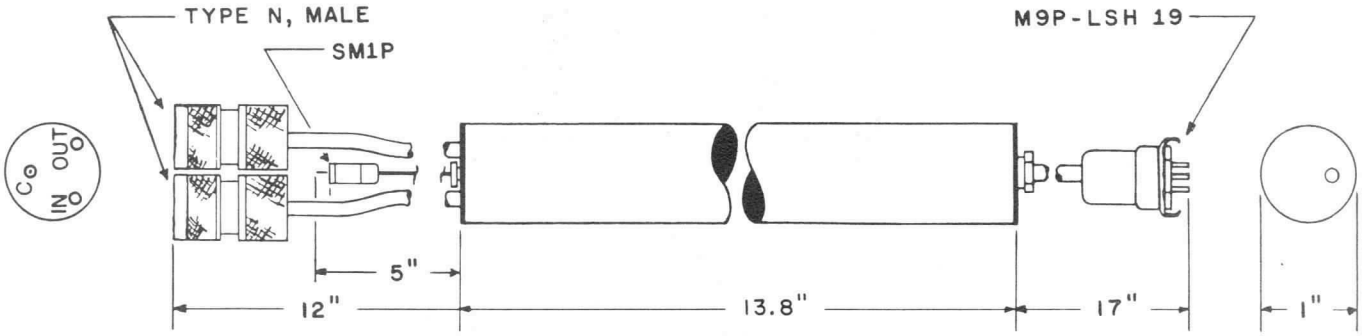
FREQUENCY RANGE	8.2 TO 12.4 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	7 DBM MIN
NOISE FIGURE[1]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	1050 TO 1250 V	--	0.01 MA MAX
COLLECTOR	1050 TO 1250 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 −50 V	--	0.01 MA MAX
CATHODE	0 V	--	2.0 MA MAX
HEATER	5.0 TO 7.5 V	--	1.1 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

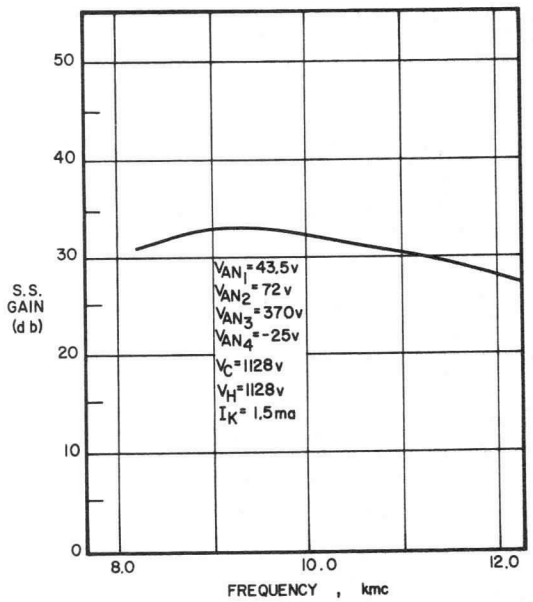
MECHANICAL CHARACTERISTICS



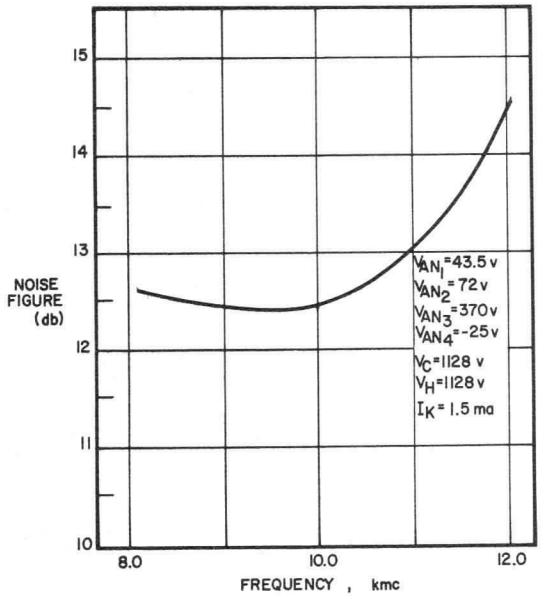
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

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

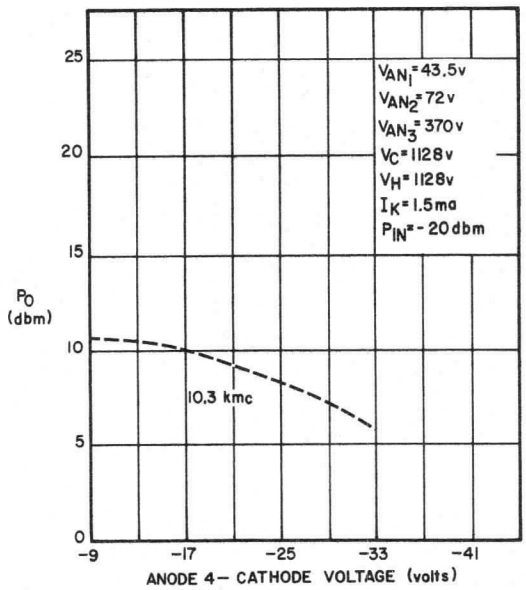
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 4 CONTROL

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

SOLENOID – FOCUSED, MEDIUM – 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]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

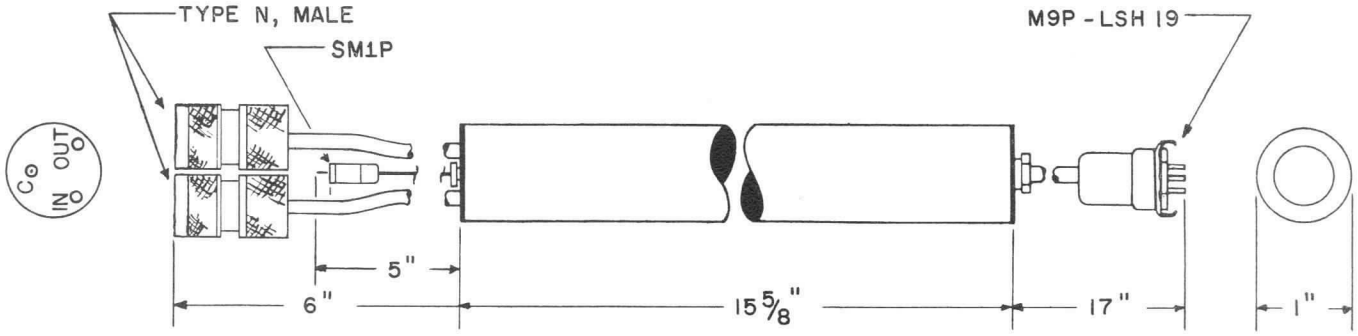
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	165 TO 200 V	--	0.01 MA MAX
COLLECTOR	FIXED *	--	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 120 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

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 350 TO 500 VOLTS.

FOCUSING . . . . . SOLENOID, 1000 GAUSS

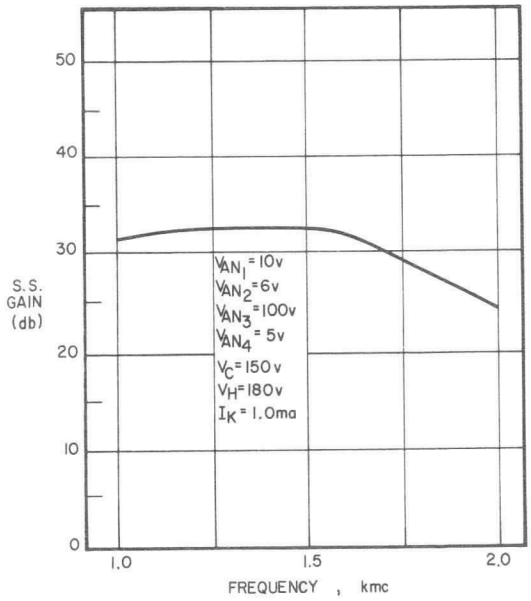
MECHANICAL CHARACTERISTICS



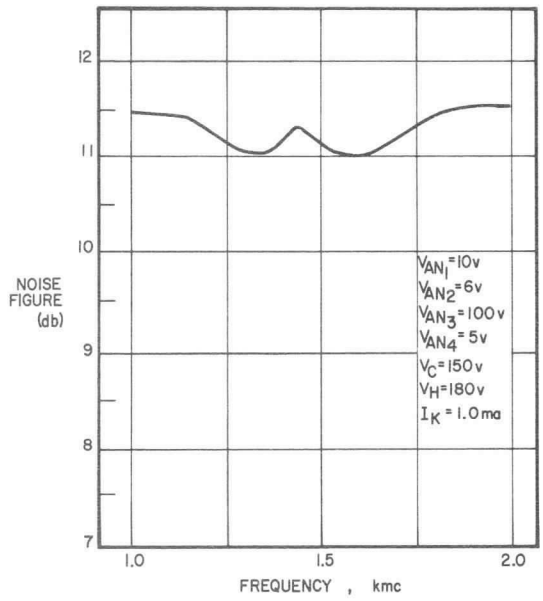
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1.0 LB

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

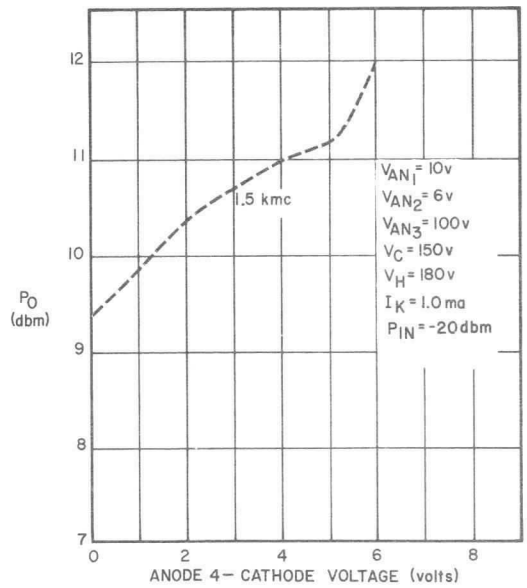
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 4 CONTROL

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

SOLENOID – FOCUSED, MEDIUM NOISE 1.6 TO 2.6 KMC AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE	1.6 TO 2.6 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 MAX

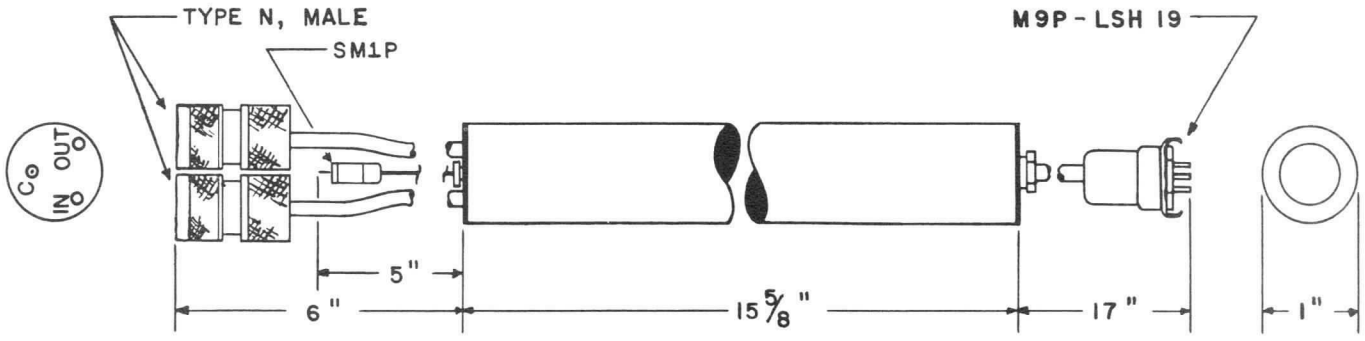
OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	165 TO 200 V	--	0.010 MA MAX
COLLECTOR	FIXED *	--	2.0 MA MAX
ANODE 1	0 TO 20 V	--	0.010 MA MAX
ANODE 2	0 TO 20 V	--	0.010 MA MAX
ANODE 3	0 TO 120 V	--	0.010 MA MAX
ANODE 4	–25 TO 25 V	--	0.010 MA MAX
CATHODE	0 V	--	2.0 MA MAX
HEATER	5.0 TO 7.5 V	--	0.8 AMP MAX

* THIS TUBE WILL OPERATE WITH ANY FIXED COLLECTOR VOLTAGE IN THE RANGE OF 350 TO 500 VOLTS.

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.

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

SOLENOID – FOCUSED, LOW – NOISE X – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

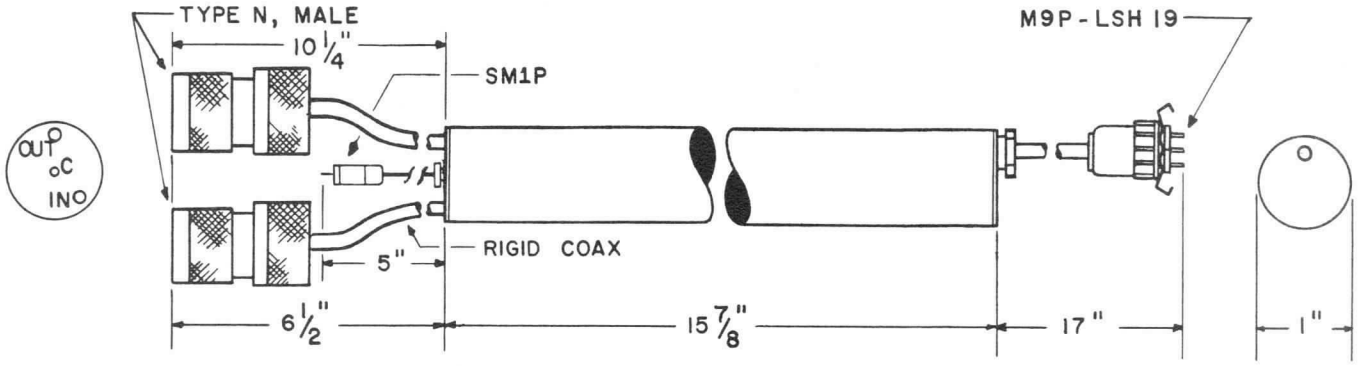
FREQUENCY RANGE	8.2 TO 11.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	10 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	1050 TO 1250 V	--	0.01 MA MAX
COLLECTOR	1050 TO 1250 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 −50 V	--	0.01 MA MAX
CATHODE	0 V	--	2.0 MA MAX
HEATER	5.0 TO 7.5 V	--	1.1 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

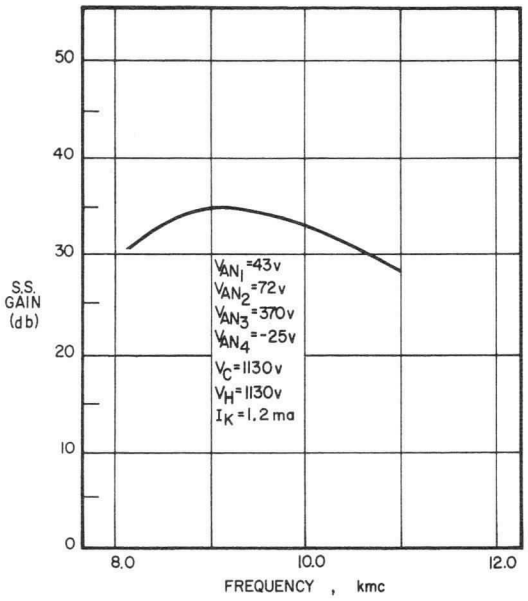
MECHANICAL CHARACTERISTICS



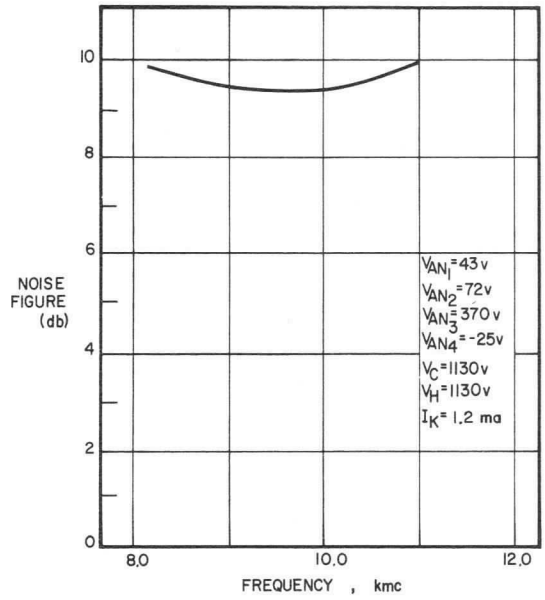
CAPSULE FINISH . . . . . BLACK ANODIZED
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

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

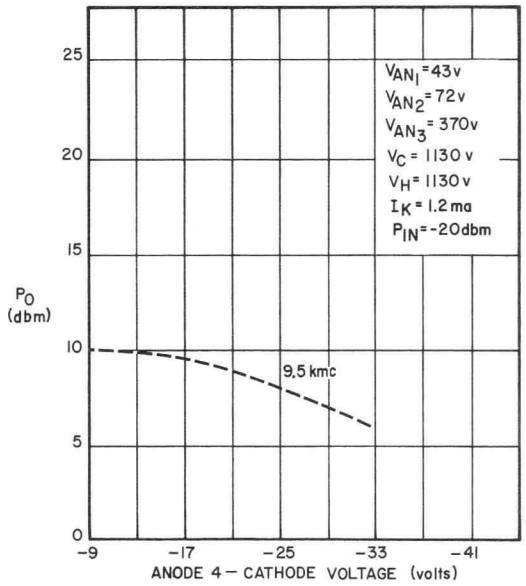
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 4 CONTROL

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

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

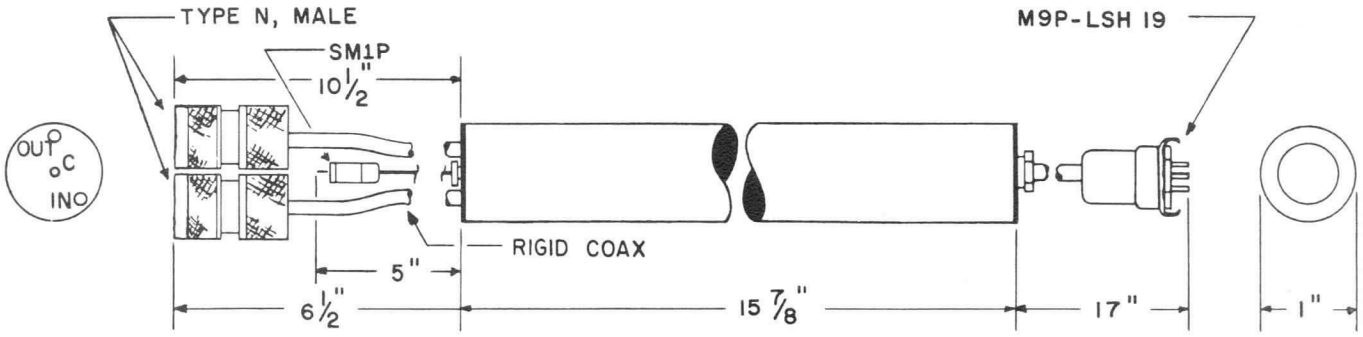
OPERATING CHARACTERISTICS

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.

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID – FOCUSED, LOW – NOISE S – BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

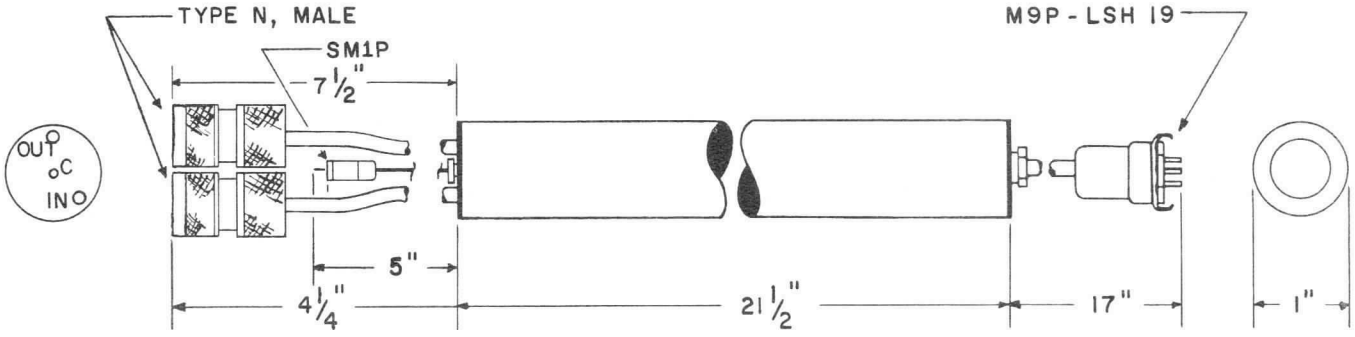
FREQUENCY RANGE	2.3 TO 4.4 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE [1]	10 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	375 TO 475 V	--	0.03 MA MAX
COLLECTOR [2]	375 TO 700 V	--	1.5 MA MAX
ANODE 1	0 TO 50 V	--	0.01 MA MAX
ANODE 2	0 TO 80 V	--	0.01 MA MAX
ANODE 3	0 TO 150 V	--	0.01 MA MAX
ANODE 4	0 TO -50 V	--	0.01 MA MAX
CATHODE	0 V	--	1.5 MA MAX
HEATER	4.5 TO 6.3 V	--	1.0 AMP MAX

FOCUSING . . . . . SOLENOID, MPE TYPE BS – 44C[2,3]

MECHANICAL CHARACTERISTICS



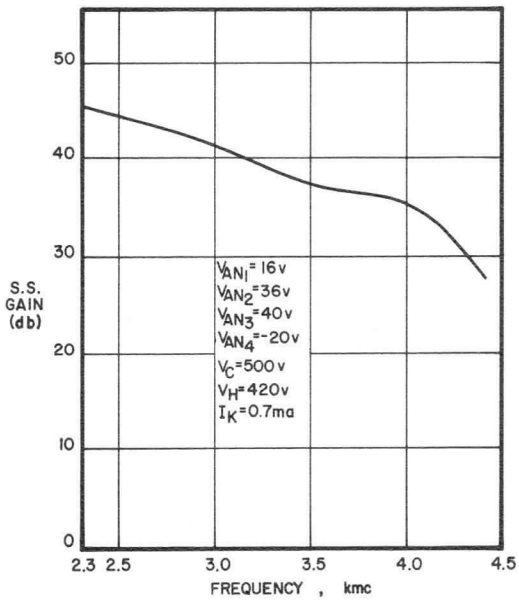
CAPSULE FINISH	BLACK ANODIZED
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	SOLENOID BLOWER
NET WEIGHT	1 1/2 LBS

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

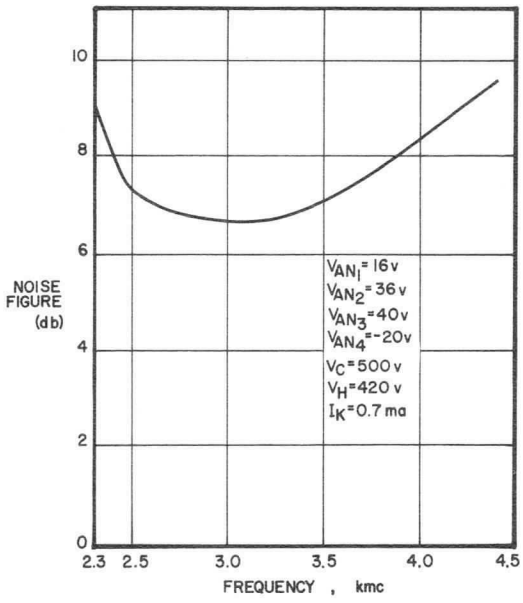
[2] COLLECTOR AND SOLENOID VOLTAGES MUST BE ADJUSTABLE.

[3] LIGHTWEIGHT, LOW – POWER SOLENOID.

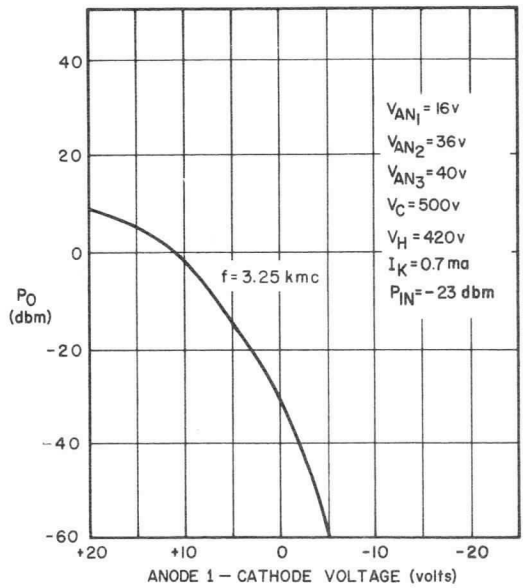
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 1 CONTROL

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

SOLENOID — FOCUSED, MEDIUM — 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]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

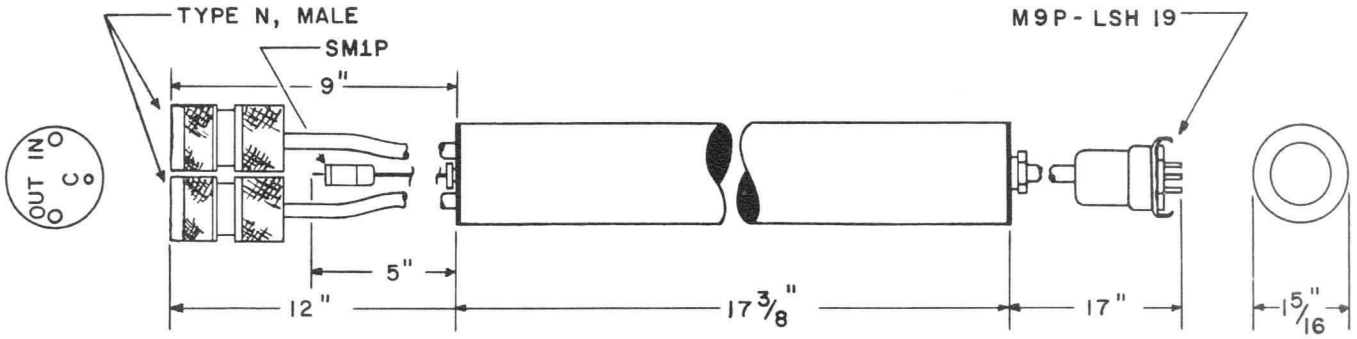
OPERATING CHARACTERISTICS

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	--	0.025 MA MAX
ANODE 2	0 TO 30 V	--	0.025 MA MAX
ANODE 3	0 TO 50 V	--	0.025 MA MAX
ANODE 4	-50 TO 50 V	--	0.025 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

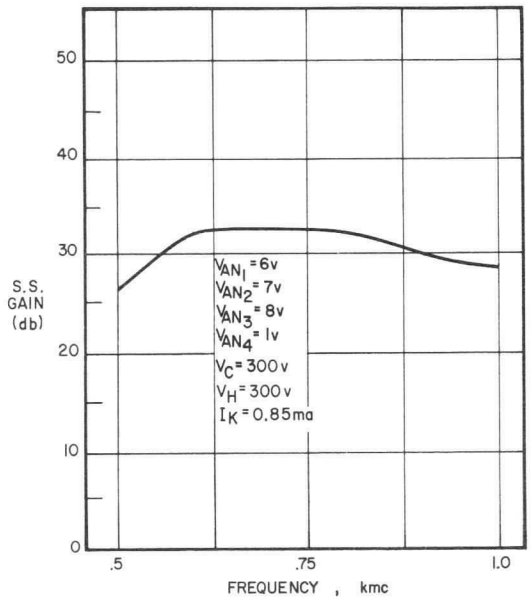
MECHANICAL CHARACTERISTICS



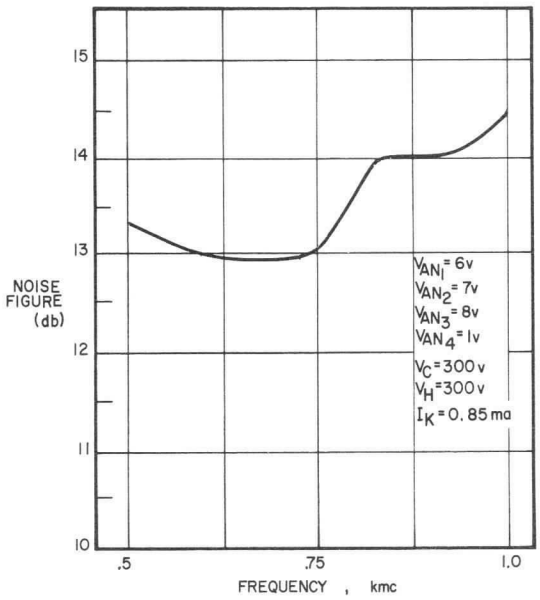
CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . CHROME
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1 1/2 LBS

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

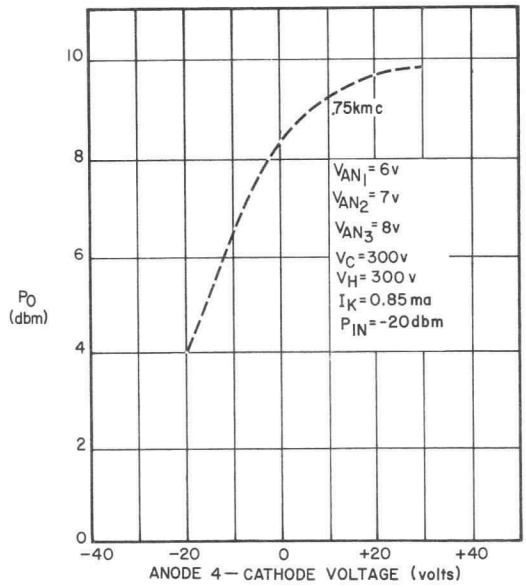
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 4 CONTROL

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

SOLENOID — FOCUSED, MEDIUM — NOISE X — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

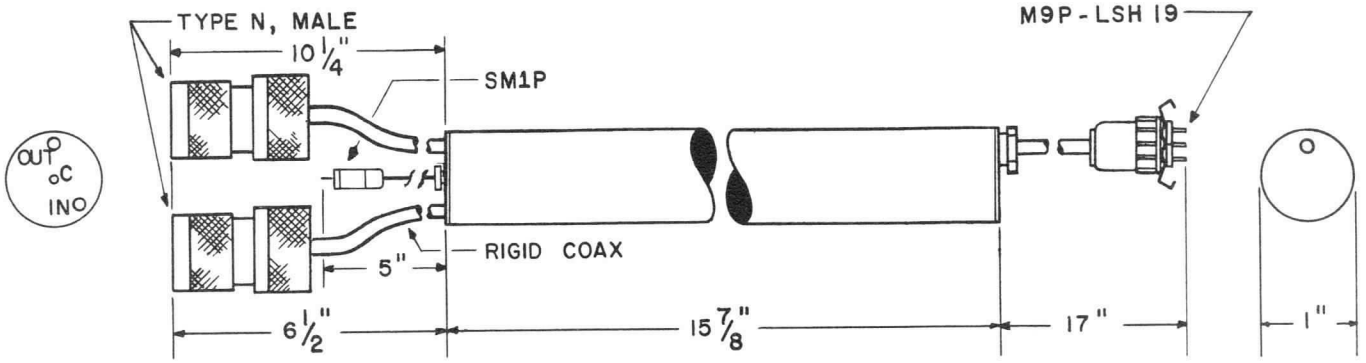
FREQUENCY RANGE	8.2 TO 12.4 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	1050 TO 1250 V		0.10 MA MAX
COLLECTOR	1050 TO 1250 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 −50 V		0.01 MA MAX
CATHODE	0 V		2.0 MA MAX
HEATER	5.0 TO 7.5 V		1.1 AMP MAX

FOCUSING . . . . . SOLENOID, 1000 GAUSS

MECHANICAL CHARACTERISTICS



CAPSULE FINISH . . . . . BLACK ANODIZED

END CAP FINISH . . . . . BLACK ANODIZED

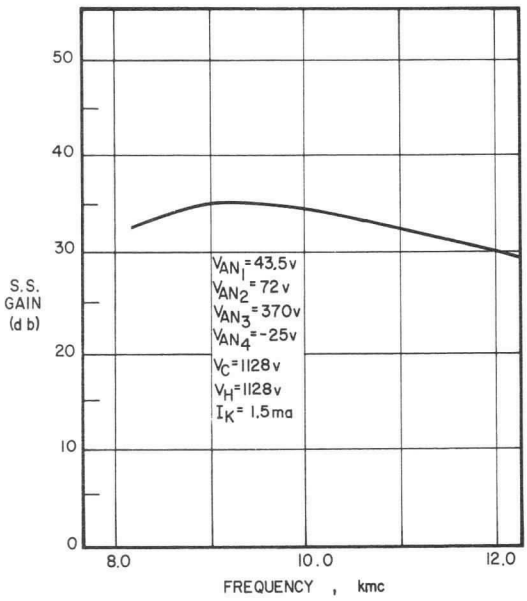
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER

NET WEIGHT . . . . . 1.0 LB

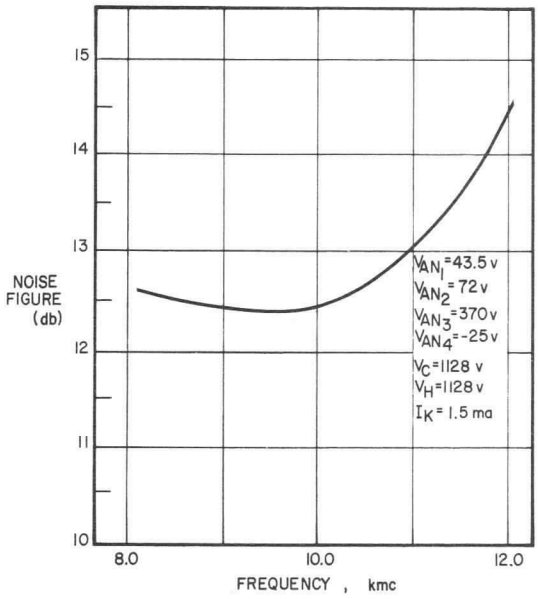
[1] A LOWER NOISE FIGURE CAN BE ACHIEVED BY OPTIMIZING THE TUBE FOR NARROWBAND OPERATION.

HUGGINS LABORATORIES, INC.

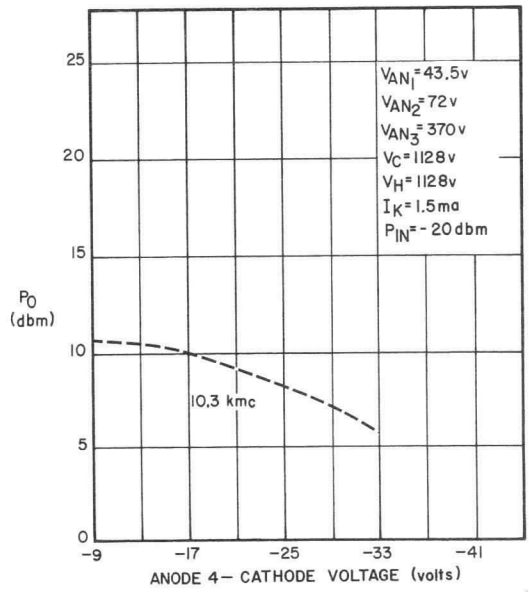
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



NOISE FIGURE



ANODE 4 CONTROL

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]	10 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

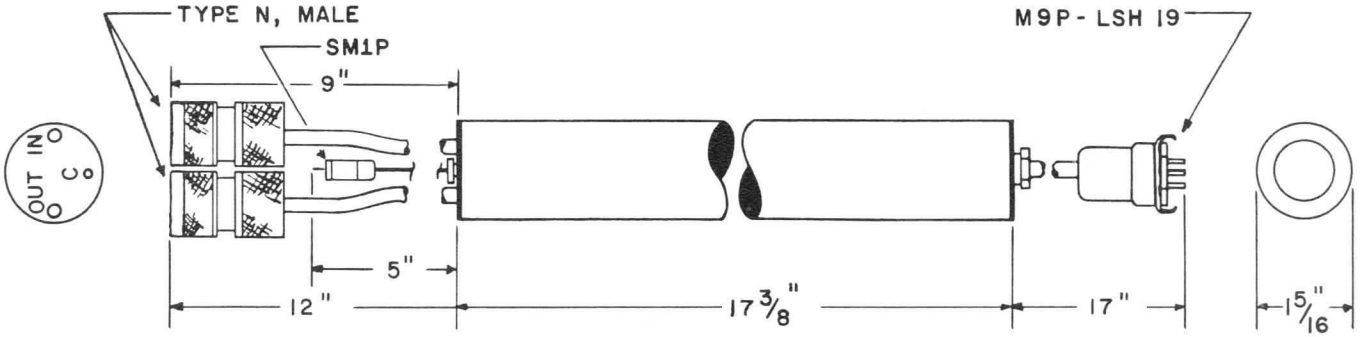
OPERATING CHARACTERISTICS

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.

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

SOLENOID—FOCUSED, LOW NOISE C—BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

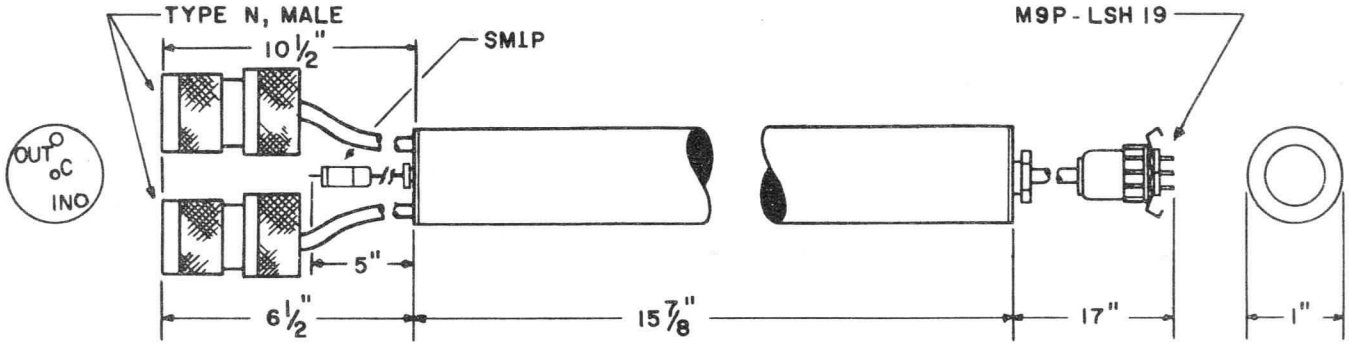
FREQUENCY RANGE	4.0 TO 8.0 GC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	10 DB MAX
VSWR, INPUT AND OUTPUT	2.5:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	500 TO 700 V	— —	0.1 MA MAX
COLLECTOR	700 TO 850 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

FOCUSING . . . . . SOLENOID, HUGGINS TYPE BS-27C

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.
999 East Arques Avenue · Sunnyvale, California

PPM — FOCUSED, LOW NOISE S — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

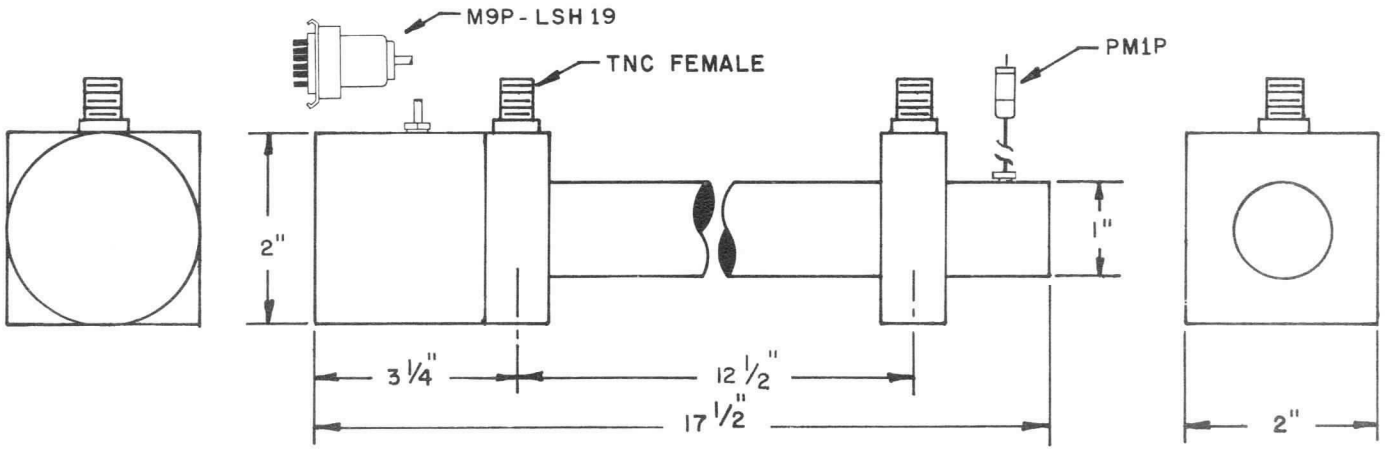
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	5 DBM MIN
NOISE FIGURE [1]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

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.

HUGGINS LABORATORIES, INC.

999 East Arques Avenue · Sunnyvale, California

PPM — FOCUSED, X — BAND LOW — NOISE AMPLIFIER

ELECTRICAL CHARACTERISTICS

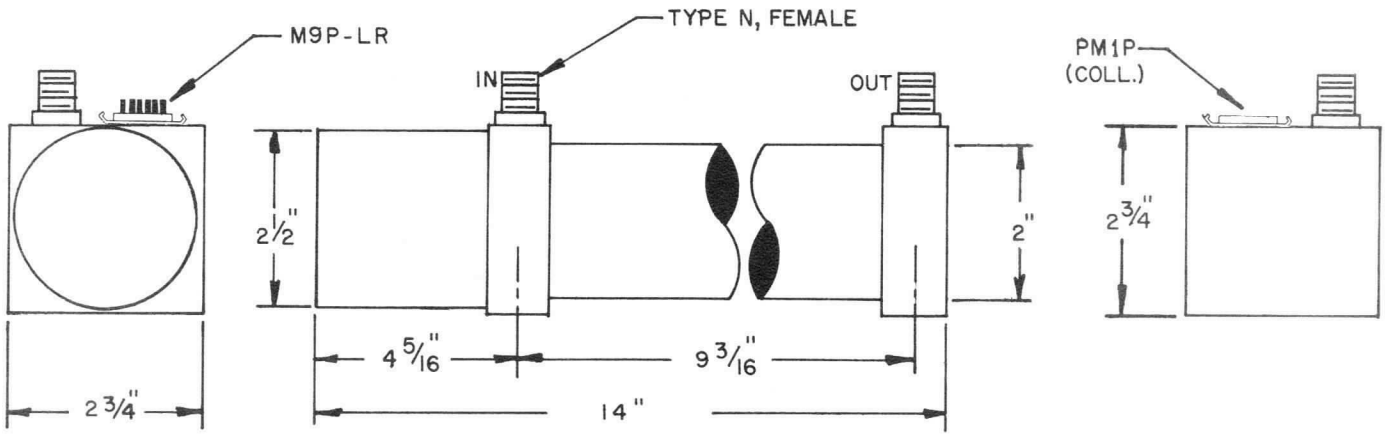
FREQUENCY RANGE	7.0 TO 11.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
NOISE FIGURE [1]	15 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

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 250 V	— —	0.01 MA MAX
ANODE 3	150 TO 500 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	— —	1.5 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

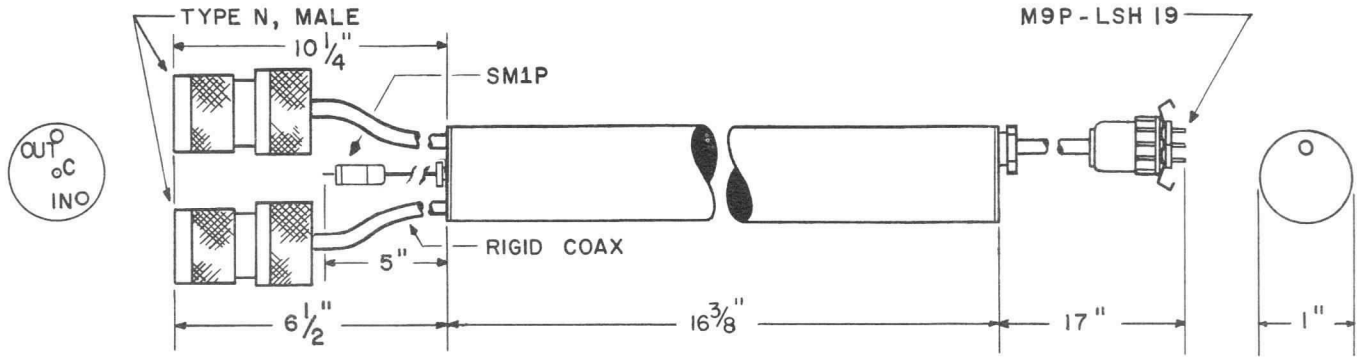
FREQUENCY RANGE . . . . . 7.0 TO 14.0 KMC
SMALL-SIGNAL GAIN . . . . . 25 DB MIN
SATURATION POWER OUTPUT . . . . . 0 DBM MIN
NOISE FIGURE[1] . . . . . 15 DB MAX
VSWR, INPUT AND OUTPUT . . . . . 2:1, 3:1 MAX

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

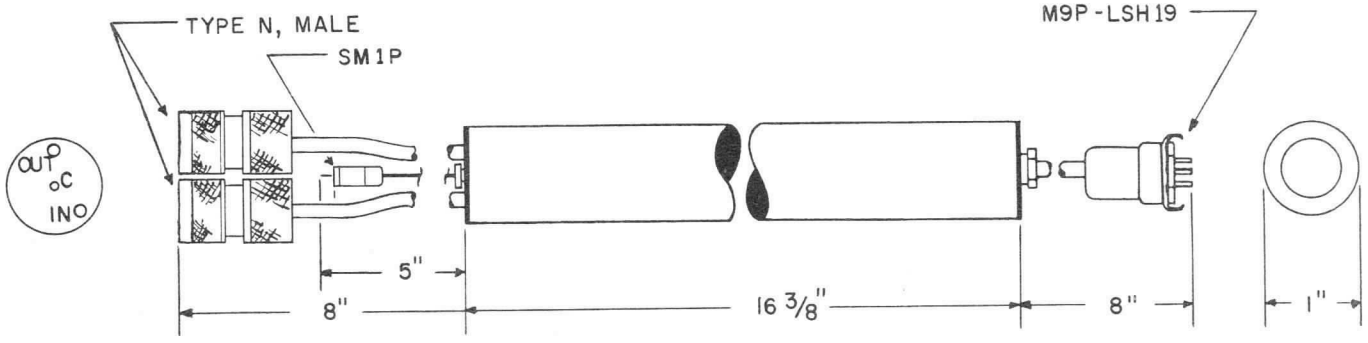
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	7 DBM MIN
NOISE FIGURE[1]	10 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

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, LOW NOISE UHF—BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

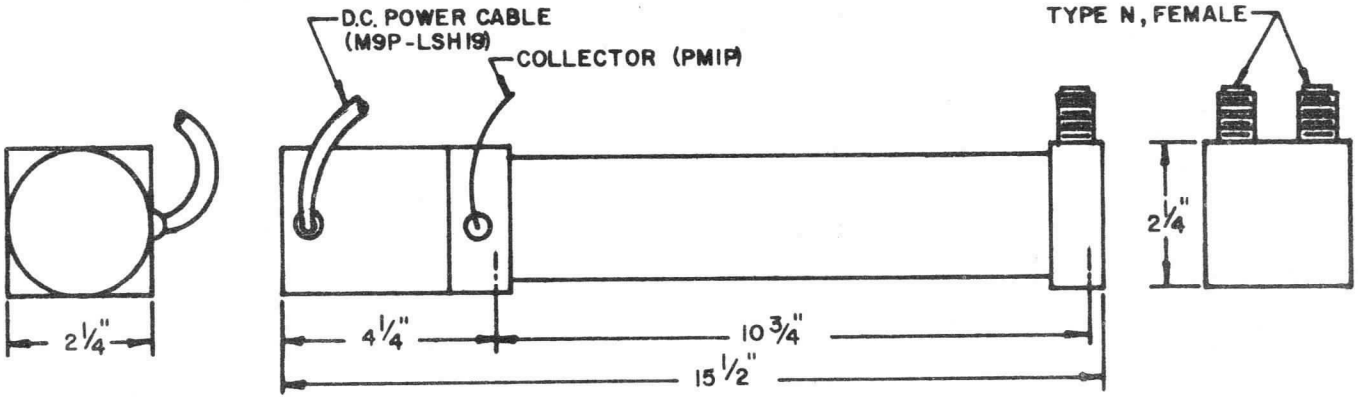
FREQUENCY RANGE	0.5 TO 1.0 GC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
NOISE FIGURE[1]	14 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	200 TO 300 V	– –	0.5 MA MAX
COLLECTOR	250 TO 500 V	– –	4.5 MA MAX
ANODE 1	150 TO 350 V	– –	0.01 MA MAX
ANODE 2	0 TO 50 V	– –	0.01 MA MAX
ANODE 3	0 TO 50 V	– –	0.01 MA MAX
ANODE 4	–50 TO 0 V	– –	0.01 MA MAX
CATHODE	0 V	– –	4.5 MA MAX
HEATER	5.5 TO 7.0 V	– –	0.8 AMP MAX

FOCUSING ..... PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	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, LOW NOISE UHF—BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

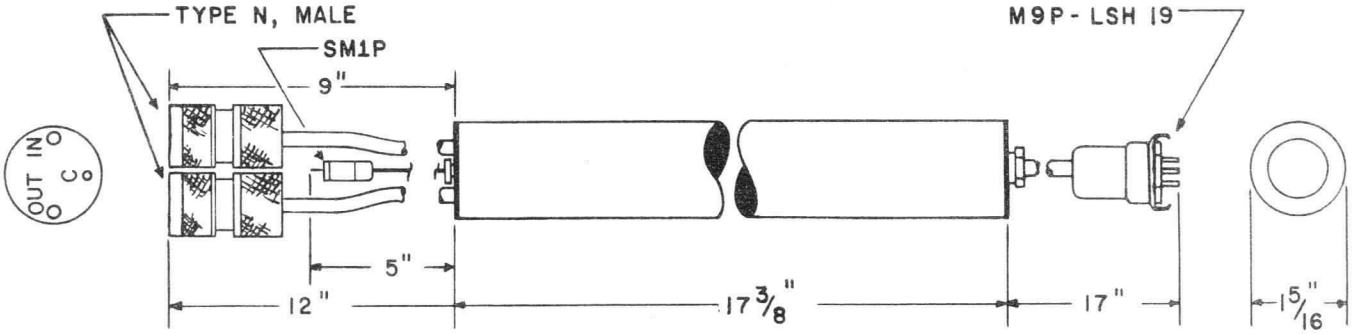
FREQUENCY RANGE	0.5 TO 1.0 GC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE [1]	6 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	75 TO 120 V	— —	0.02 MA MAX
COLLECTOR	300 TO 500 V	— —	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	— —	1.0 AMP MAX

FOCUSING ..... SOLENOID, HUGGINS TYPE BS-26C

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 UHF — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

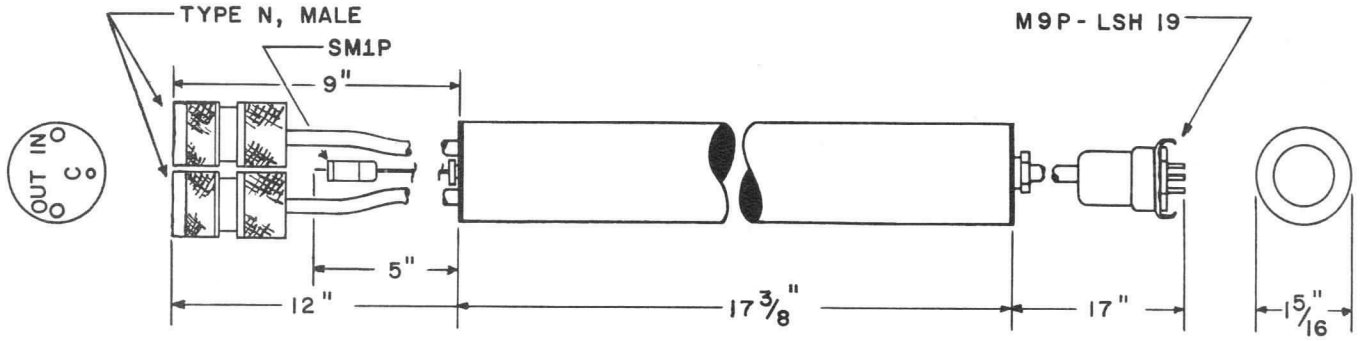
FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	8 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

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

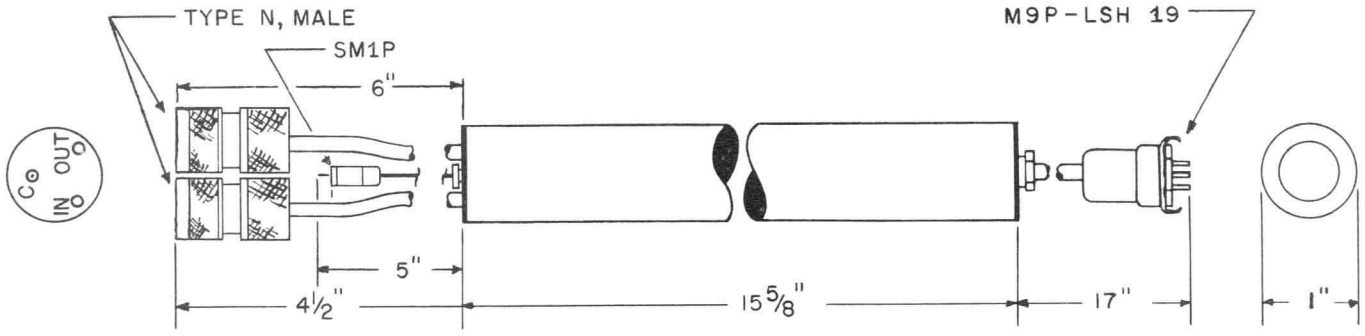
FREQUENCY RANGE	1.0 TO 2.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	8 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

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.

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

SOLENOID—FOCUSED, LOW—NOISE L—BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

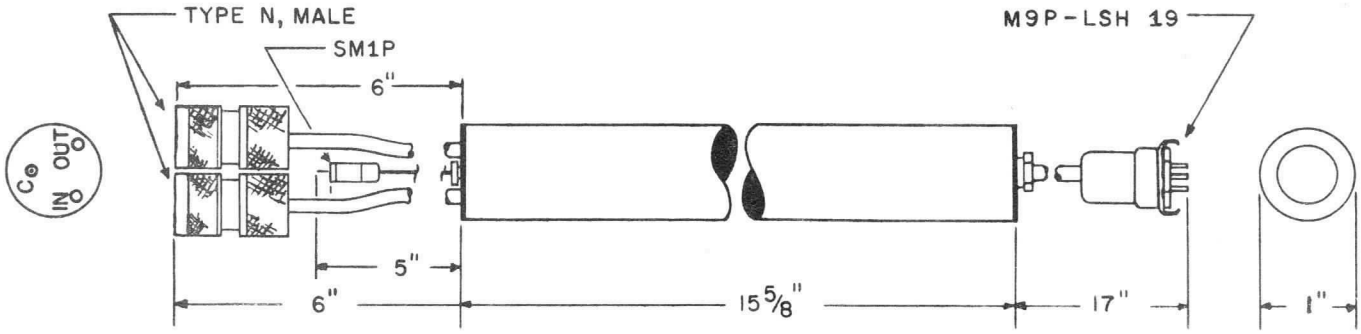
FREQUENCY RANGE	1.0 TO 2.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	5 DBM MIN
NOISE FIGURE [1]	7 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	165 TO 200 V	--	0.01 MA MAX
COLLECTOR [2]	350 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, 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

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

[2] COLLECTOR VOLTAGE MUST BE ADJUSTABLE.

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

PPM–FOCUSED, L–BAND LOW–NOISE AMPLIFIER

ELECTRICAL CHARACTERISTICS

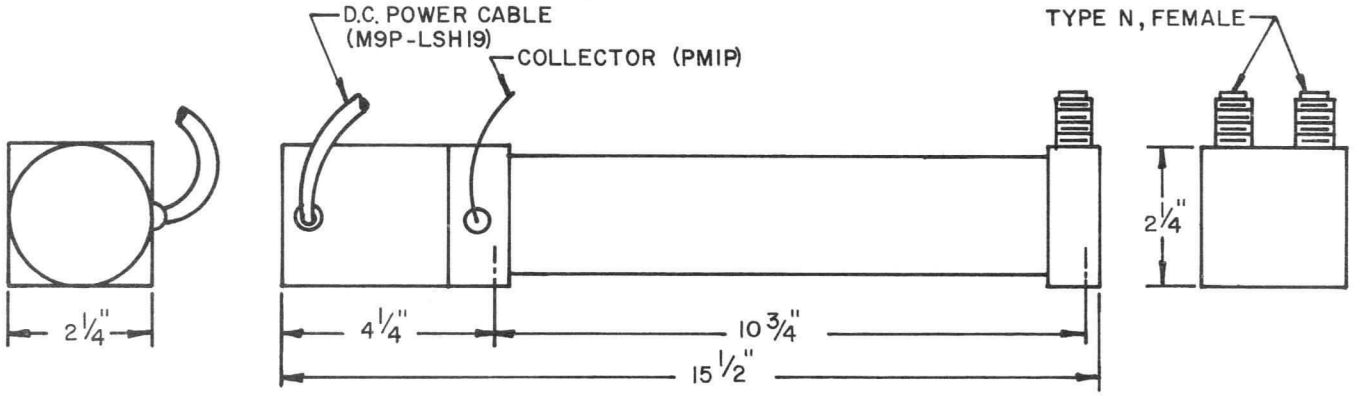
FREQUENCY RANGE	1.0 TO 2.0 KMC
SMALL–SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	7 DBM MIN
NOISE FIGURE [1]	14 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	150 TO 250 V	--	0.25 MA MAX
COLLECTOR	V_H + 400 V	--	3.0 MA MAX
ANODE 1	0 TO 100 V	--	0.02 MA MAX
ANODE 2	0 TO 100 V	--	0.02 MA MAX
ANODE 3	0 TO 150 V	--	0.02 MA MAX
ANODE 4	−100 TO 0 V	--	0.02 MA MAX
CATHODE	0 V	--	3.0 MA MAX
HEATER	6.3 V	--	1.0 AMP MAX

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



CAPSULE FINISH	CHROME
END CAP FINISH	BLACK ANODIZED
AUXILIARY COOLING REQUIRED	NONE
NET WEIGHT	5.0 LBS. MAX

[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 UHF–BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

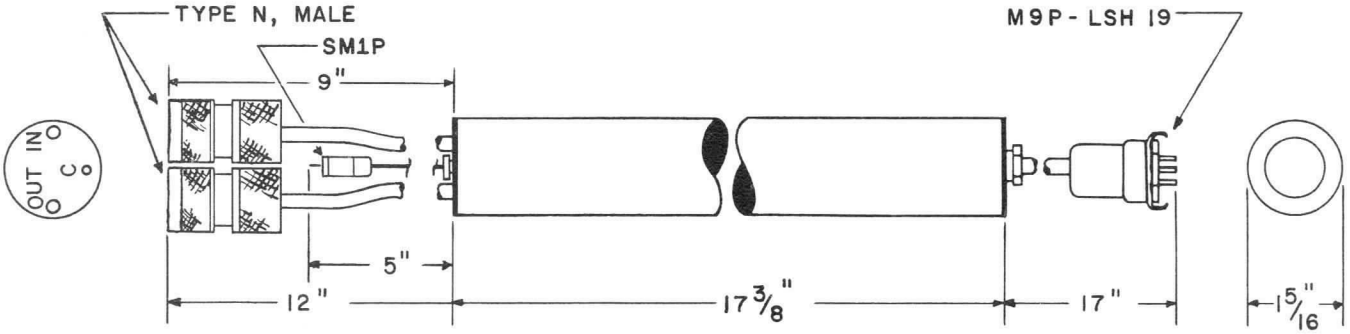
FREQUENCY RANGE	0.5 TO 1.0 KMC
SMALL–SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	0 DBM MIN
NOISE FIGURE[1]	7 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	%REGULATION	CURRENT
HELIX	75 TO 120 V	--	0.02 MA MAX
COLLECTOR	300 TO 430 V	--	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	--	1.0 AMP MAX

FOCUSING . . . . . SOLENOID, MPE TYPE BS–26C

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 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

SOLENOID — FOCUSED, LOW — NOISE S — BAND AMPLIFIER

ELECTRICAL CHARACTERISTICS

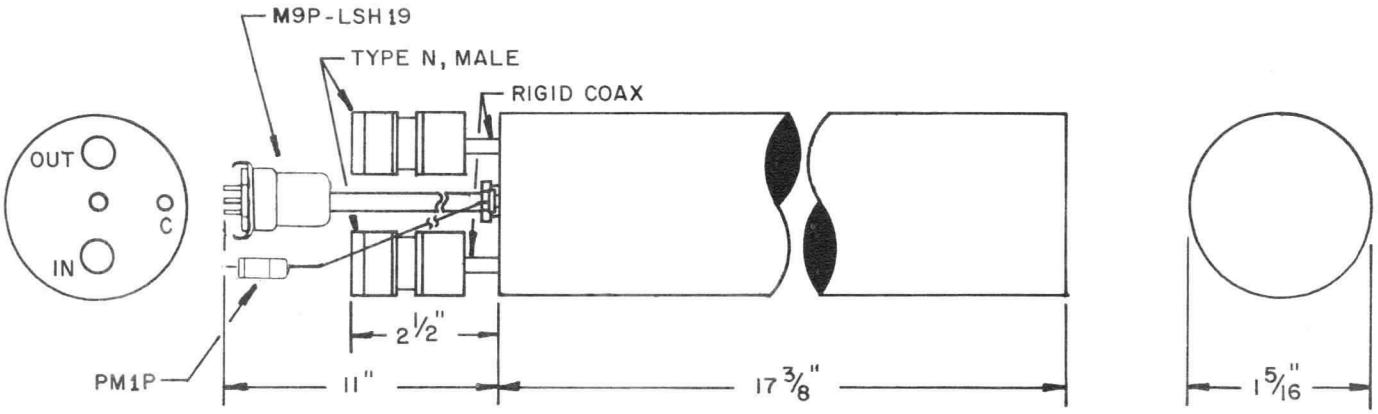
FREQUENCY RANGE	2.0 TO 4.0 KMC
SMALL-SIGNAL GAIN	25 DB MIN
SATURATION POWER OUTPUT	10 DBM MIN
NOISE FIGURE [1]	8 DB MAX
VSWR, INPUT AND OUTPUT	2:1 MAX

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
Telephone: 408-736-9330 TWX: 408-737-9992

TYPE
HA – 100
LNT
S-BAND 15 DB NF

PPM–FOCUSED 1–WATT, LOW–NOISE S–BAND AMPLIFIER

PERFORMANCE CHARACTERISTICS

FREQUENCY	2.0 TO 4.0 GC
MINIMUM SMALL –SIGNAL GAIN	35 DB
MINIMUM SATURATION POWER OUTPUT	30 DBM
MAXIMUM NOISE FIGURE*	15 DB
MINIMUM COLD ATTENUATION (INPUT TO OUTPUT)	70 DB
MAXIMUM VSWR: INPUT, OUTPUT (BEAM OFF)	2 : 1

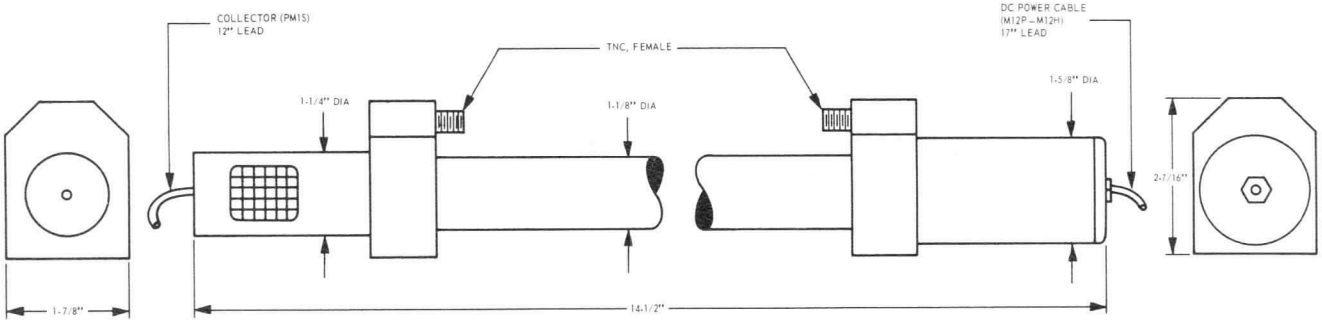
POWER SUPPLY REQUIREMENTS

ELEMENT	REQUIRED RANGES	
	VOLTAGE	CURRENT
COLLECTOR[1]	800 TO 1000 V	0 TO 25.0 MA
HELIX	800 TO 1000 V	0 TO 3.0 MA
ANODE	100 TO 500 V	0 TO 0.1 MA
GRID[2]	–100 TO 0 V	0 TO 0.2 MA
CATHODE[3]	0 V	0 TO 25.0 MA
HEATER	7.0 V	0 TO 1.2 AMP

[1] Insulated. [2] Can be used for gating, noise figure may increase. [3] Voltage reference.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



AUXILIARY COOLING REQUIRED . . . . . 5 CFM @ .35" H_2O
MOUNTING POSITION . . . . . ANY
ENVIRONMENT . . . . . CAN BE MANUFACTURED TO MIL SPECS
WEIGHT . . . . . 5–1/4 LBS

* A lower noise figure can be achieved by optimizing the tube for narrowband operation.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue Sunnyvale, California
Telephone: 408-736-9330 TWX: 408-737-9992

TYPE

HA – 100B

LNT

S-BAND 13 DB NF

PPM-FOCUSED 1-WATT, LOW-NOISE S-BAND AMPLIFIER

PERFORMANCE CHARACTERISTICS

FREQUENCY	2.0 TO 4.0 GC
MINIMUM SMALL –SIGNAL GAIN	35 DB
MINIMUM SATURATION POWER OUTPUT	30 DBM
MAXIMUM NOISE FIGURE*	13 DB
MINIMUM COLD ATTENUATION (INPUT TO OUTPUT)	70 DB
MAXIMUM VSWR: INPUT, OUTPUT (BEAM OFF)	2 : 1

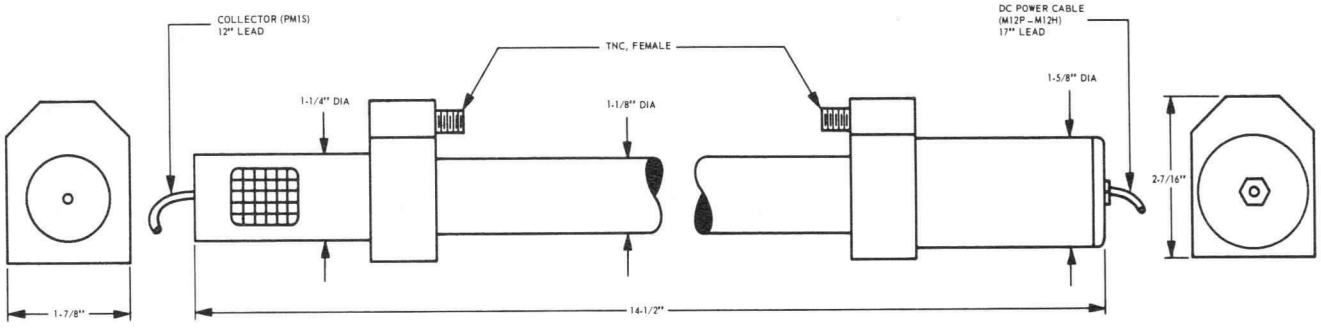
POWER SUPPLY REQUIREMENTS

ELEMENT	REQUIRED RANGES	
	VOLTAGE	CURRENT
COLLECTOR[1]	800 TO 1100 V	0 TO 25.0 MA
HELIX	800 TO 1100 V	0 TO 3.0 MA
ANODE 1[2]	0 TO 300 V	0 TO 0.2 MA
ANODE 2	200 TO 600 V	0 TO 0.1 MA
ANODE 3	50 TO 400 V	0 TO 0.1 MA
ANODE 4	–600 TO –200 V	0 TO 0.2 MA
CATHODE[3]	0 V	0 TO 25.0 MA
HEATER	7.0 V	0 TO 1.2 AMP

[1] Insulated. [2] Can be used for gating, noise figure may increase. [3] Voltage reference.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



AUXILIARY COOLING REQUIRED	5 CFM @ 35" H_2O
MOUNTING POSITION	ANY
ENVIRONMENT	CAN BE MANUFACTURED TO MIL SPECS
WEIGHT	5–1/4 LBS

* A lower noise figure can be achieved by optimizing the tube for narrowband operation.

TYPE

HA — 100B

LNT

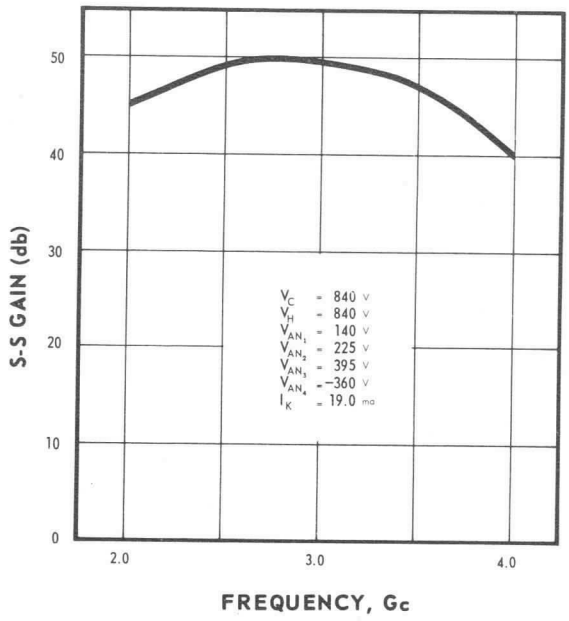
S-BAND 13 DB NF

HUGGINS LABORATORIES, INC.

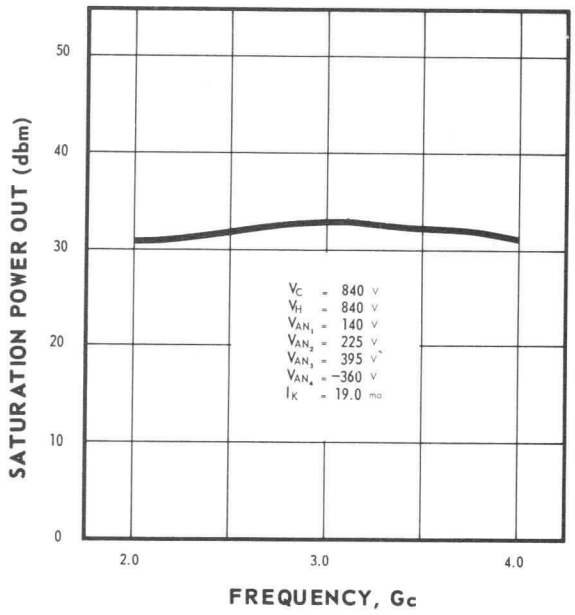
999 East Arques Avenue Sunnyvale, California

Telephone: 408-736-9330 TWX: 408-737-9992

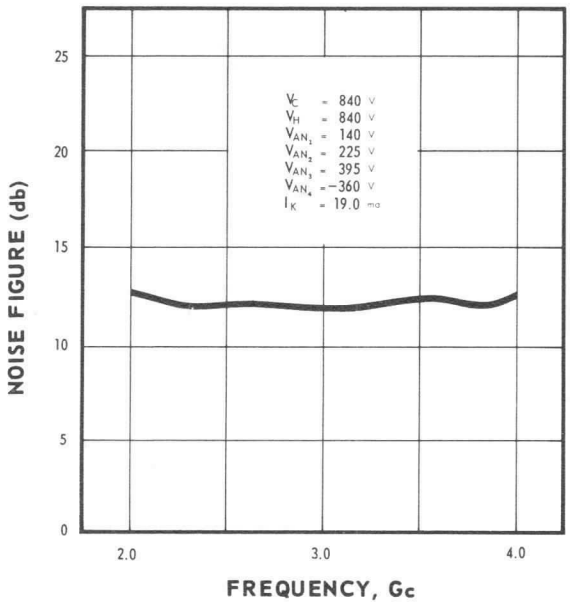
TYPICAL OPERATING CHARACTERISTICS



SMALL-SIGNAL GAIN



POWER OUTPUT



NOISE FIGURE

HUGGINS LABORATORIES, INC.
999 East Arques Avenue Sunnyvale, California
Telephone: 408-736-9330 TWX: 408-737-9992

TYPE

HA – 104

LNT

L-BAND 15 DB NF

PPM-FOCUSED 2-WATT, LOW-NOISE L-BAND AMPLIFIER

PERFORMANCE CHARACTERISTICS

FREQUENCY	1.0 TO 2.0 GC
MINIMUM SMALL -SIGNAL GAIN	30 DB
MINIMUM SATURATION POWER OUTPUT	33 DBM
MAXIMUM NOISE FIGURE*	15 DB
MINIMUM COLD ATTENUATION (INPUT TO OUTPUT)	70 DB
MAXIMUM VSWR: INPUT, OUTPUT (BEAM OFF)	2 : 1

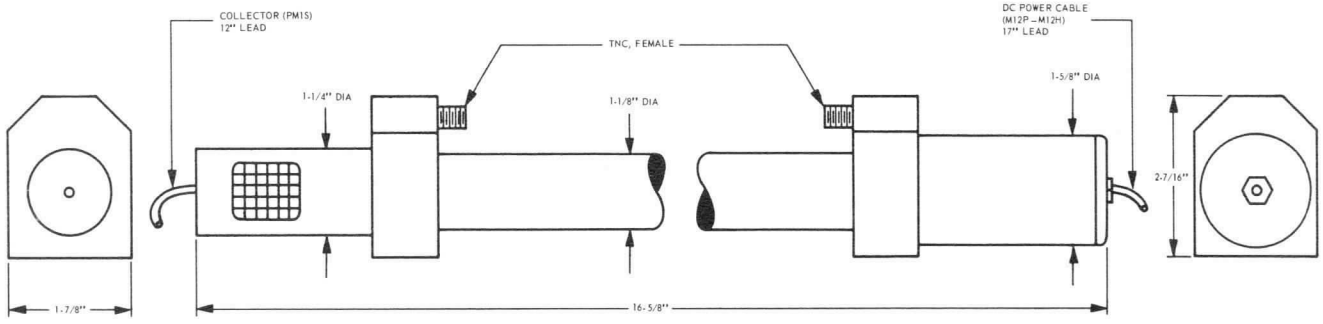
POWER SUPPLY REQUIREMENTS

ELEMENT	REQUIRED RANGES	
	VOLTAGE	CURRENT
COLLECTOR[1]	V_H + 200 V	0 TO 60.0 MA
HELIX	800 TO 1100 V	0 TO 10.0 MA
ANODE 1[2]	0 TO 300 V	0 TO 0.2 MA
ANODE 2	0 TO 400 V	0 TO 0.2 MA
ANODE 3	200 TO 800 V	0 TO 0.2 MA
ANODE 4	-500 TO 0 V	0 TO 0.2 MA
CATHODE[3]	0 V	0 TO 60.0 MA
HEATER	7.0 V	0 TO 1.7 AMP

[1] Insulated. [2] Can be used for gating, noise figure may increase. [3] Voltage reference.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



AUXILIARY COOLING REQUIRED	5 CFM @ 1/2" H_2O
MOUNTING POSITION	ANY
ENVIRONMENT	CAN BE MANUFACTURED TO MIL SPECS
WEIGHT	5-1/4 LBS

* A lower noise figure can be achieved by optimizing the tube for narrowband operation.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue Sunnyvale, California
Telephone: 408-736-9330 TWX: 408-737-9992

TYPE
HA – 105
LNT
C-BAND 20 DB NF

PPM–FOCUSED 1–WATT, LOW–NOISE C–BAND AMPLIFIER

PERFORMANCE CHARACTERISTICS

FREQUENCY	4.0 TO 8.0 GC
MINIMUM SMALL –SIGNAL GAIN	30 DB
MINIMUM SATURATION POWER OUTPUT	30 DBM
MAXIMUM NOISE FIGURE*	20 DB
MINIMUM COLD ATTENUATION (INPUT TO OUTPUT)	70 DB
MAXIMUM VSWR: INPUT, OUTPUT (BEAM OFF)	2 : 1

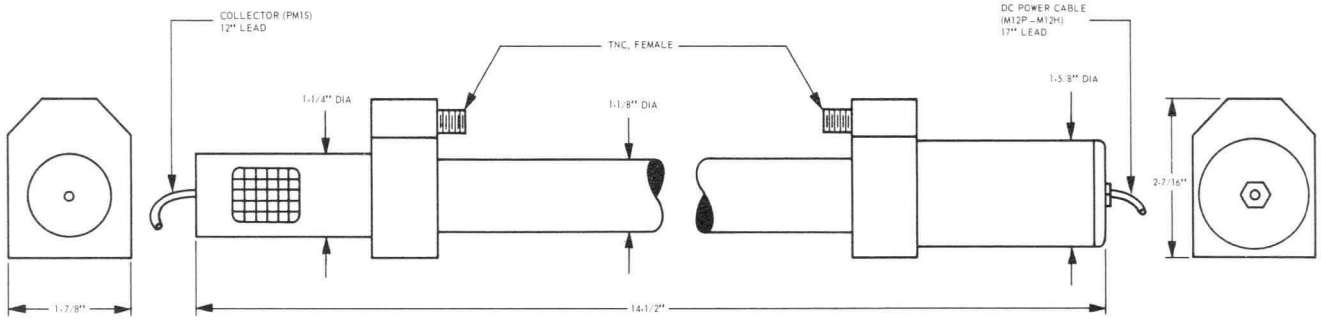
POWER SUPPLY REQUIREMENTS

ELEMENT	REQUIRED RANGES	
	VOLTAGE	CURRENT
COLLECTOR[1]	1600 TO 2100 V	0 TO 30.0 MA
HELIX	1600 TO 2100 V	0 TO 3.0 MA
ANODE 1[2]	0 TO 300 V	0 TO 0.2 MA
ANODE 2	0 TO 400 V	0 TO 0.1 MA
ANODE 3	0 TO 600 V	0 TO 0.1 MA
ANODE 4	–500 TO 0 V	0 TO 0.2 MA
CATHODE[3]	0 V	0 TO 30.0 MA
HEATER	7.0 V	0 TO 1.2 AMP

[1] Insulated. [2] Can be used for gating, noise figure may increase. [3] Voltage reference.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



AUXILIARY COOLING REQUIRED	5 CFM @ .35" H_2O
MOUNTING POSITION	ANY
ENVIRONMENT	CAN BE MANUFACTURED TO MIL SPECS
WEIGHT	5–1/4 LBS

* A lower noise figure can be achieved by optimizing the tube for narrowband operation.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue Sunnyvale, California
Telephone: 408-736-9330 TWX: 408-737-9992

TYPE
HA – 106
LNT
UHF – BAND 15 DB NF

PPM–FOCUSED 1–WATT, LOW–NOISE UHF–BAND AMPLIFIER

PERFORMANCE CHARACTERISTICS

FREQUENCY	0.5 TO 1.0 GC
MINIMUM SMALL –SIGNAL GAIN	30 DB
MINIMUM SATURATION POWER OUTPUT	30 DBM
MAXIMUM NOISE FIGURE*	15 DB
MINIMUM COLD ATTENUATION (INPUT TO OUTPUT)	70 DB
MAXIMUM VSWR: INPUT, OUTPUT (BEAM OFF)	2 : 1

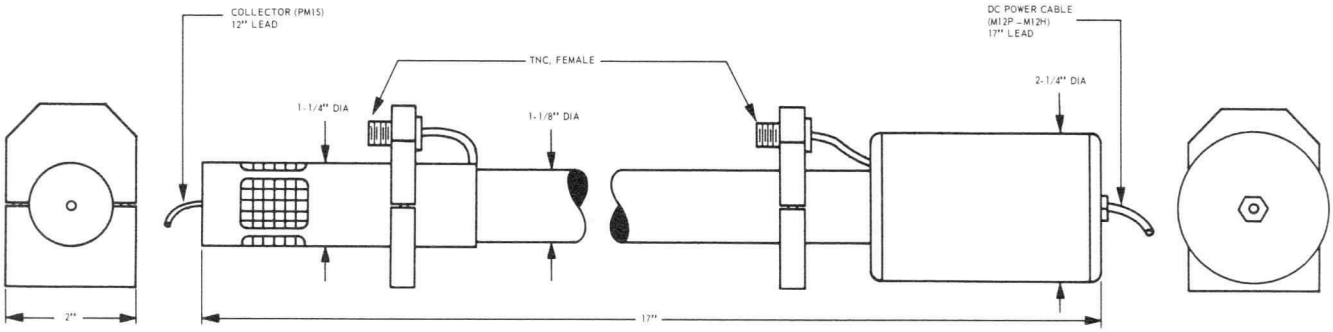
POWER SUPPLY REQUIREMENTS

ELEMENT	REQUIRED RANGES	
	VOLTAGE	CURRENT
COLLECTOR [1]	V_H + 200 V	0 TO 60.0 MA
HELIX	400 TO 600 V	0 TO 30.0 MA
ANODE 1 [2]	0 TO 300 V	0 TO 0.2 MA
ANODE 2	0 TO 400 V	0 TO 0.2 MA
ANODE 3	0 TO 600 V	0 TO 0.2 MA
ANODE 4	–500 TO 0 V	0 TO 0.2 MA
CATHODE [3]	0 V	0 TO 60.0 MA
HEATER	7.0 V	0 TO 2.2 AMP

[1] Insulated. [2] Can be used for gating, noise figure may increase. [3] Voltage reference.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



AUXILIARY COOLING REQUIRED	5 CFM @ 1/2" H_2O
MOUNTING POSITION	ANY
ENVIRONMENT	CAN BE MANUFACTURED TO MIL SPECS
WEIGHT	5–1/4 LBS

* A lower noise figure can be achieved by optimizing the tube for narrowband operation.

HUGGINS LABORATORIES, INC.
999 East Arques Avenue Sunnyvale, California
Telephone: 408-736-9330 TWX: 408-737-9992

TYPE
HA – 107
LNT
L-BAND 20 DB NF

PPM-FOCUSED 5-WATT, LOW-NOISE L-BAND AMPLIFIER

PERFORMANCE CHARACTERISTICS

FREQUENCY	1.0 TO 2.0 GC
MINIMUM SMALL –SIGNAL GAIN	30 DB
MINIMUM SATURATION POWER OUTPUT	37 DBM
MAXIMUM NOISE FIGURE*	20 DB
MINIMUM COLD ATTENUATION (INPUT TO OUTPUT)	70 DB
MAXIMUM VSWR: INPUT, OUTPUT (BEAM OFF)	2 : 1

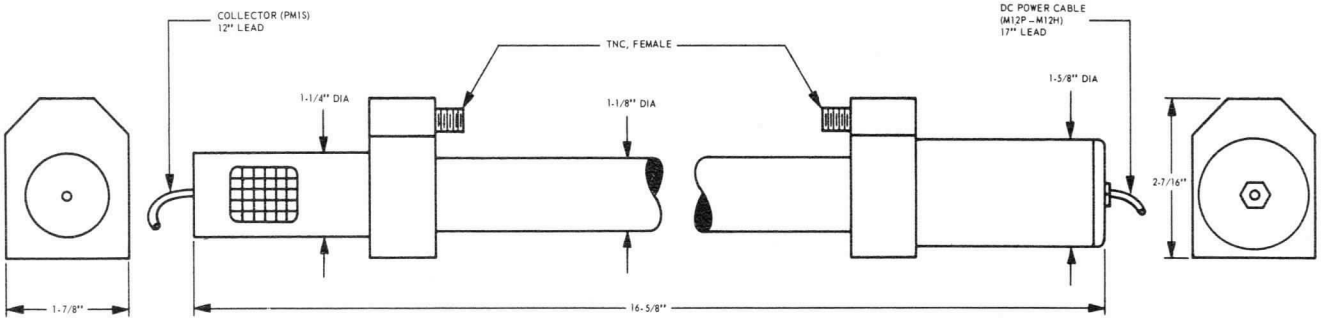
POWER SUPPLY REQUIREMENTS

ELEMENT	REQUIRED RANGES	
	VOLTAGE	CURRENT
COLLECTOR[1]	V_H + 200 V	0 TO 70.0 MA
HELIX	800 TO 1100 V	0 TO 15.0 MA
ANODE 1[2]	0 TO 300 V	0 TO 0.2 MA
ANODE 2	0 TO 400 V	0 TO 0.2 MA
ANODE 3	200 TO 800 V	0 TO 0.2 MA
ANODE 4	–500 TO 0 V	0 TO 0.2 MA
CATHODE[3]	0 V	0 TO 70.0 MA
HEATER	7.0 V	0 TO 1.7 AMP

[1] Insulated. [2] Can be used for gating, noise figure may increase. [3] Voltage reference.

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS



AUXILIARY COOLING REQUIRED . . . . . 5 CFM @ 1/2" H_2O
MOUNTING POSITION . . . . . ANY
ENVIRONMENT . . . . . CAN BE MANUFACTURED TO MIL SPECS
WEIGHT . . . . . 5–1/4 LBS

* 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, 1 — WATT X — BAND PULSE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 8.0 TO 11.0 KMC

MAXIMUM DUTY CYCLE 0.03

VSWR, INPUT AND OUTPUT . . . . . 2.5:1 MAX

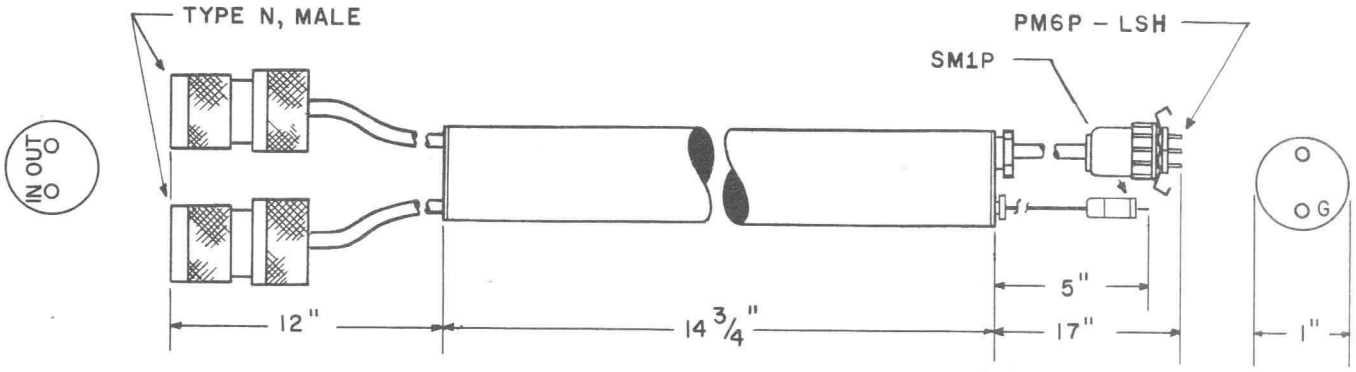
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	NOT APPLICABLE
SATURATION GAIN	27 DB MIN	NOT APPLICABLE
POWER OUTPUT	30 DBM MIN	NOT APPLICABLE

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *	CW OPERATION
HELIX AND COLLECTOR VOLTAGE	2000 TO 2600 V	NOT APPLICABLE
ANODE VOLTAGE	1900 TO 2600 V	NOT APPLICABLE
GRID VOLTAGE	0 TO 100 V	NOT APPLICABLE
HEATER VOLTAGE	7.0 V	NOT APPLICABLE
HELIX CURRENT	15.0 MA MAX	NOT APPLICABLE
COLLECTOR CURRENT	35.0 MA MAX	NOT APPLICABLE
ANODE CURRENT	3.0 MA MAX	NOT APPLICABLE
GRID CURRENT	5.0 MA MAX	NOT APPLICABLE
CATHODE CURRENT	50.0 MA MAX	NOT APPLICABLE
HEATER CURRENT	1.4 AMP MAX	NOT APPLICABLE

FOCUSING . . . . . SOLENOID, 1000 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.
999 East Arques Avenue · Sunnyvale, California

SOLENOID — 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

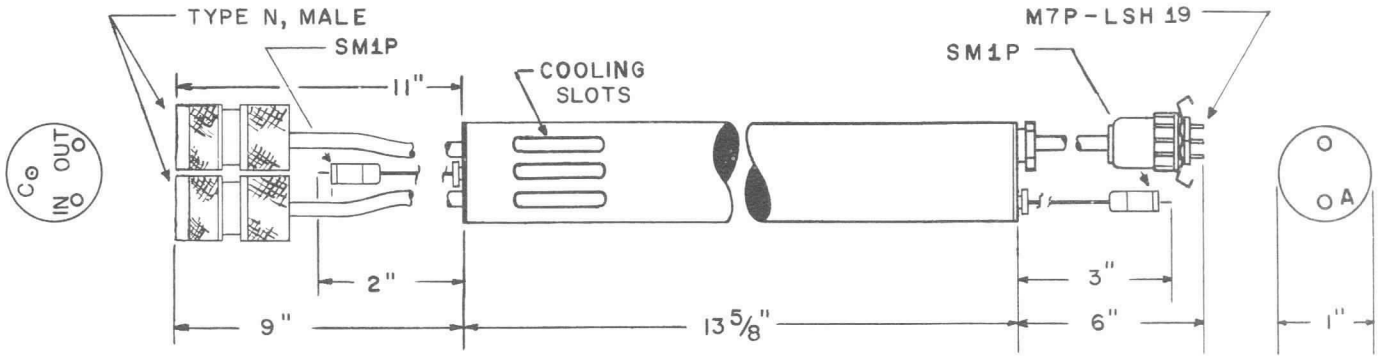
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	30 DB MIN
SATURATION GAIN	27 DB MIN	27 DB MIN
POWER OUTPUT	40 DBM MIN	30 DBM MIN

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *	CW OPERATION
HELIX AND COLLECTOR VOLTAGE	900 TO 1100 V	850 TO 900 V
ANODE VOLTAGE	0 TO 600 V	0 TO 300 V
GRID VOLTAGE	NOT APPLICABLE	NOT APPLICABLE
HEATER VOLTAGE	7.0 V	7.0 V
HELIX CURRENT	1.0 MA MAX	0.1 MA MAX
COLLECTOR CURRENT	60.0 MA MAX	25.0 MA MAX
ANODE CURRENT	0.1 MA MAX	0.1 MA MAX
GRID CURRENT	NOT APPLICABLE	NOT APPLICABLE
CATHODE CURRENT	60.0 MA MAX	25.0 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 VALUES

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

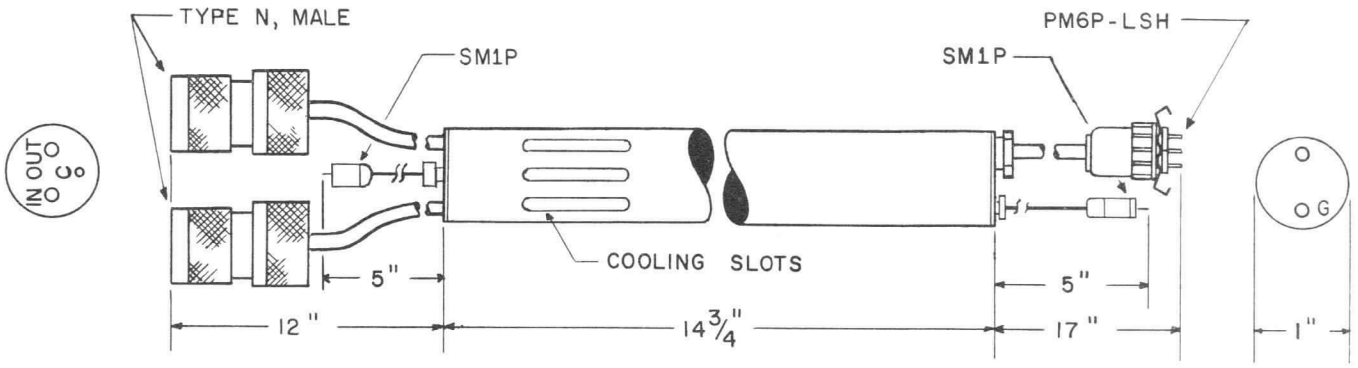
CHARACTERISTIC	PULSED OPERATION			CW OPERATION		
SMALL SIGNAL GAIN	33	DB	MIN	25	DB	MIN
SATURATION GAIN	30	DB	MIN	20	DB	MIN
POWER OUTPUT	30	DBM	MIN	20	DBM	MIN

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

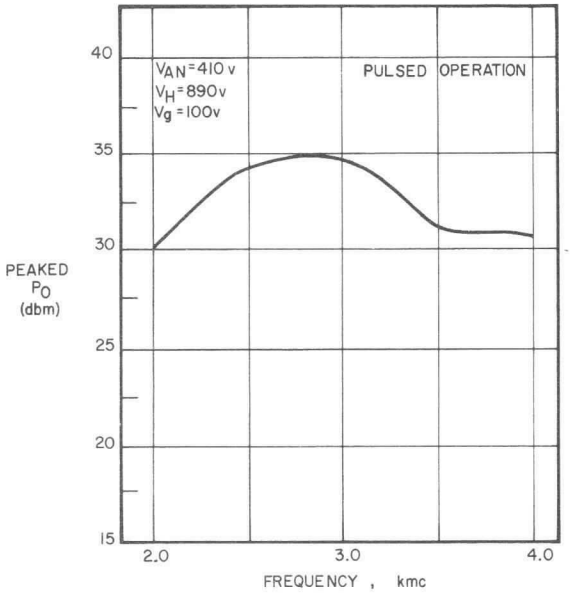


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . CHROME
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

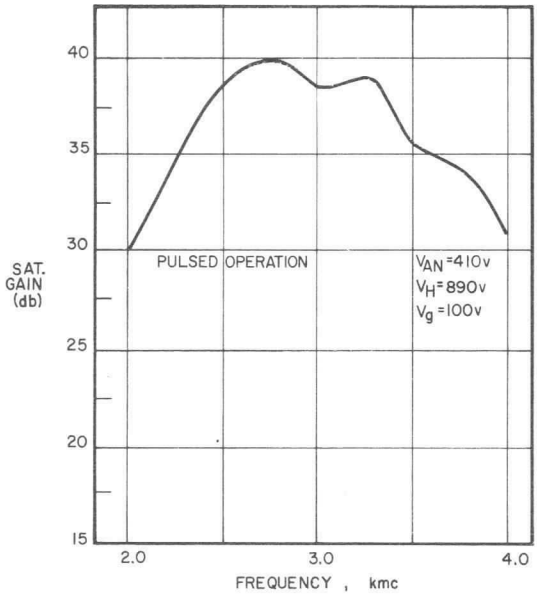
* PEAK VALUES

HUGGINS LABORATORIES, INC.

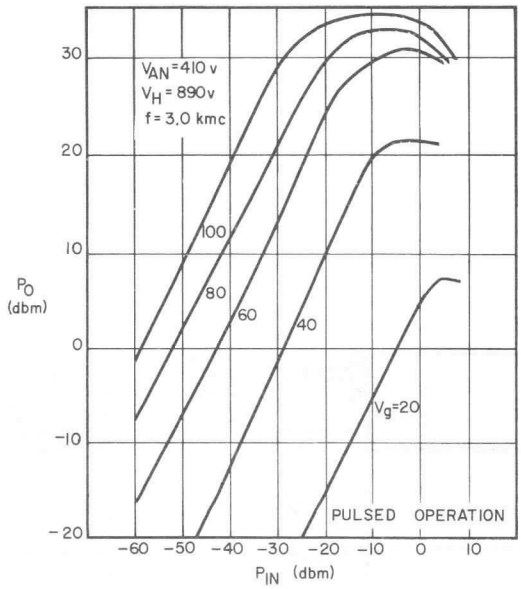
TYPICAL OPERATING CHARACTERISTICS



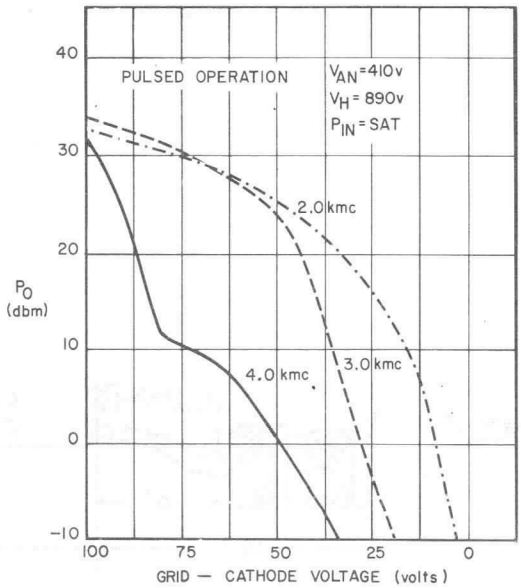
POWER OUTPUT



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

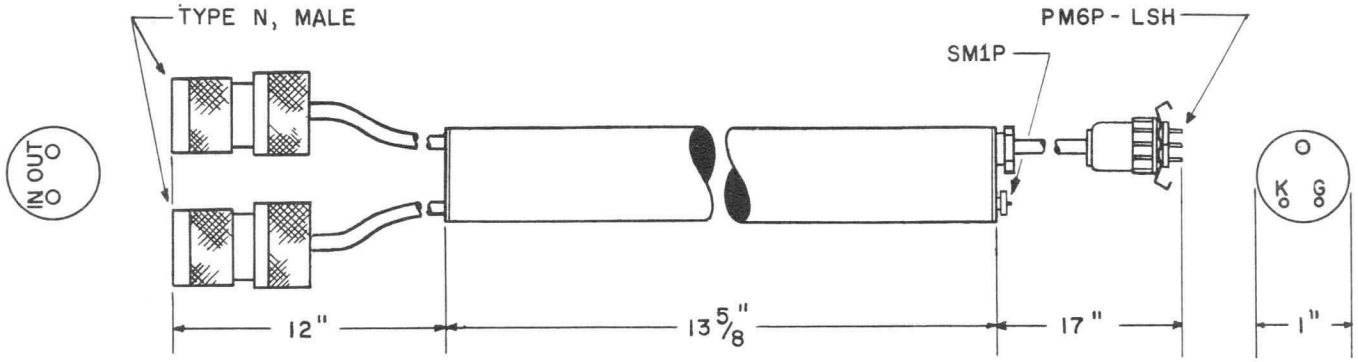
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	23 DB MIN
SATURATION GAIN	23 DB MIN	15 DB MIN
POWER OUTPUT	25 DBM MIN	17 DBM MIN

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

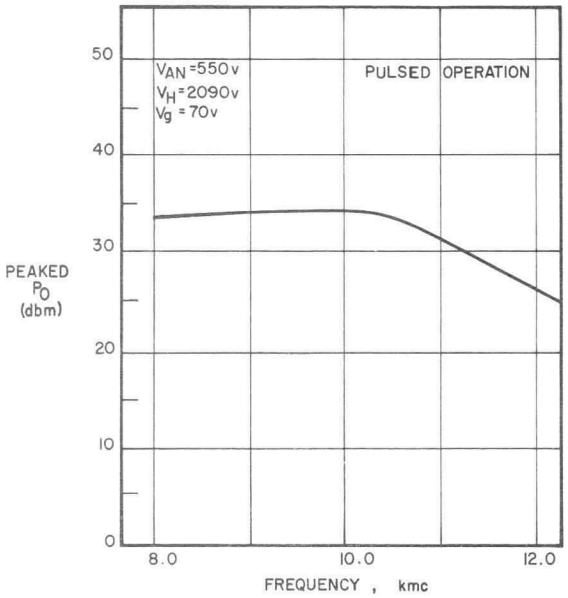


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . CHROME
AUXILIARY COOLING REQUIRED . . . . . SOLENOID BLOWER
NET WEIGHT . . . . . 1.0 LB

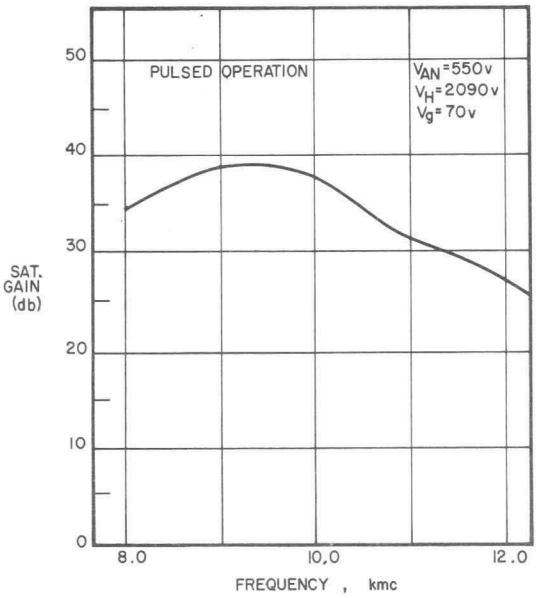
* PEAK VALUE

HUGGINS LABORATORIES, INC.

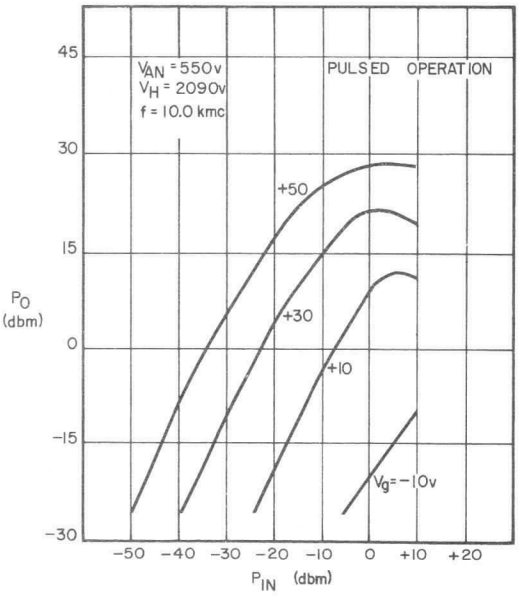
TYPICAL OPERATING CHARACTERISTICS



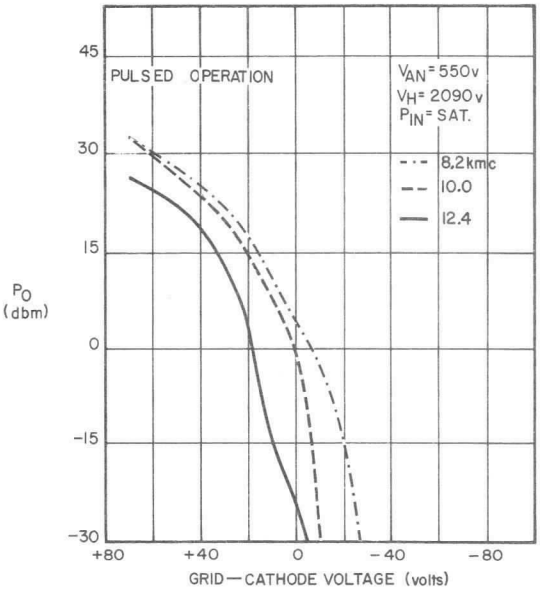
POWER OUTPUT



SATURATION GAIN



TRANSFER CHARACTERISTICS



GRID CONTROL

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

PPM — 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

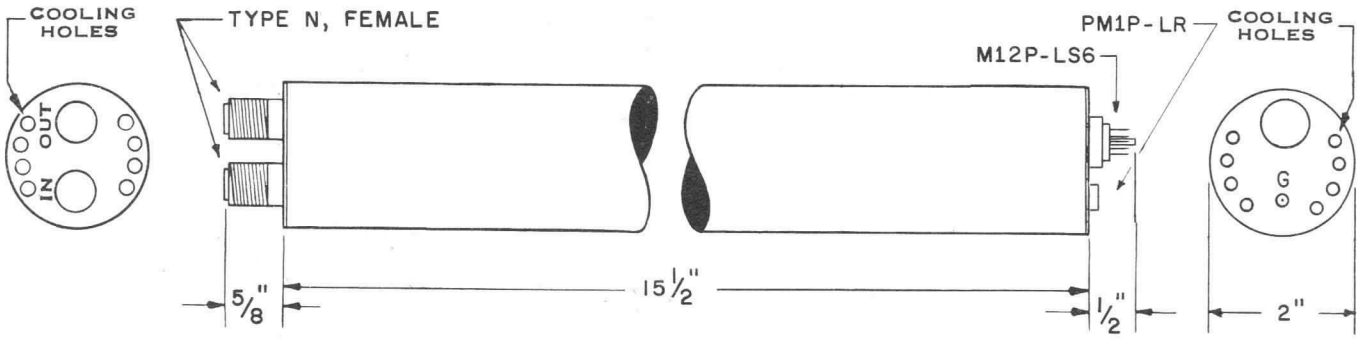
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	25 DB MIN
SATURATION GAIN	30 DB MIN	20 DB MIN
POWER OUTPUT	30 DBM MIN	20 DBM MIN

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *	CW OPERATION
HELIX AND COLLECTOR VOLTAGE	800 TO 1000 V	800 TO 1000 V
ANODE VOLTAGE	0 TO 600 V	0 TO 600 V
GRID VOLTAGE	0 TO 150 V	0 TO 100 V
HEATER VOLTAGE	7.0 V	7.0 V
HELIX CURRENT	10.0 MA MAX	2.0 MA MAX
COLLECTOR CURRENT	50.0 MA MAX	20.0 MA MAX
ANODE CURRENT	0.15 MA MAX	0.15 MA MAX
GRID CURRENT	15.0 MA MAX	6.0 MA MAX
CATHODE CURRENT	50.0 MA MAX	20.0 MA MAX
HEATER CURRENT	1.2 AMP MAX	1.2 AMP MAX

FOCUSING . . . . . PERIODIC PERMANENT MAGNET

MECHANICAL CHARACTERISTICS

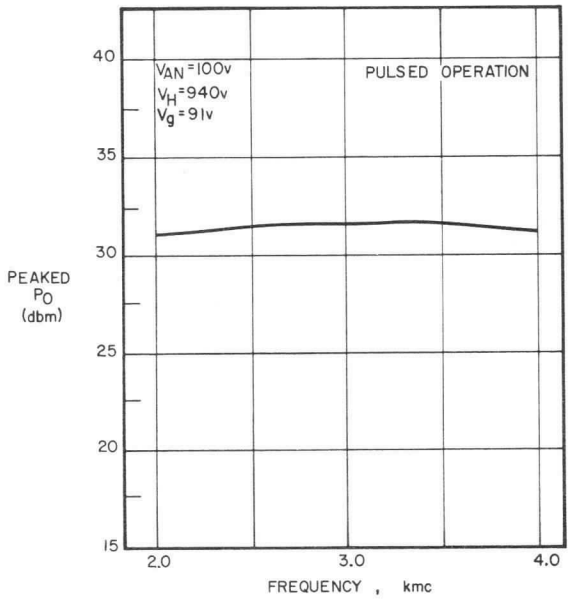


CAPSULE FINISH . . . . . CHROME
END CAP FINISH . . . . . BLACK ANODIZED
AUXILIARY COOLING REQUIRED . . . . . AIR: 5 CFM @ 1" WATER
NET WEIGHT . . . . . 6.0 LBS

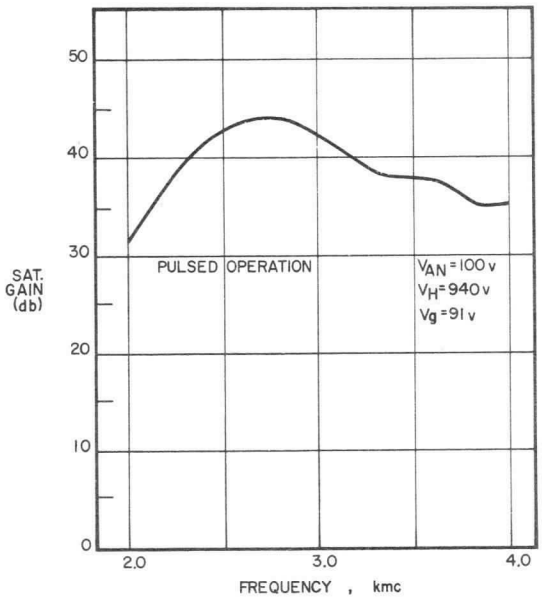
* PEAK VALUES

HUGGINS LABORATORIES, INC.

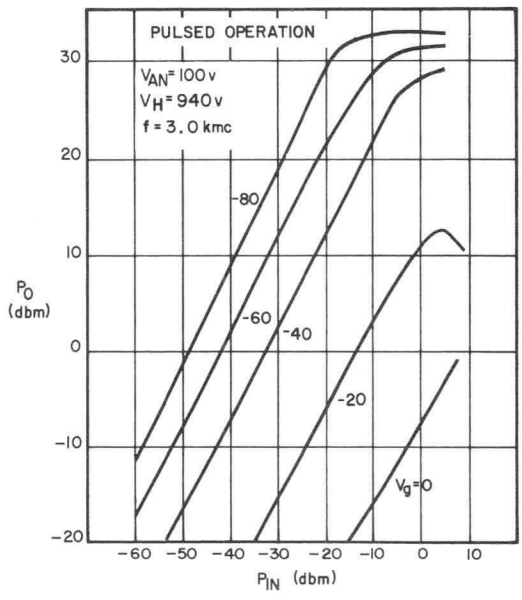
TYPICAL OPERATING CHARACTERISTICS



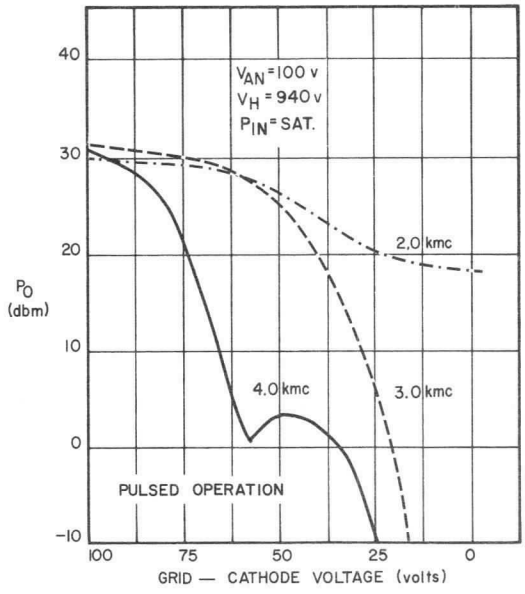
POWER OUTPUT



SATURATION GAIN



TRANSFER CHARACTERISTICS



GRID CONTROL

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

SOLENOID – FOCUSED, 1 – WATT C – BAND PULSE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 4.0 TO 8.0 KMC

MAXIMUM DUTY CYCLE 0.1

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

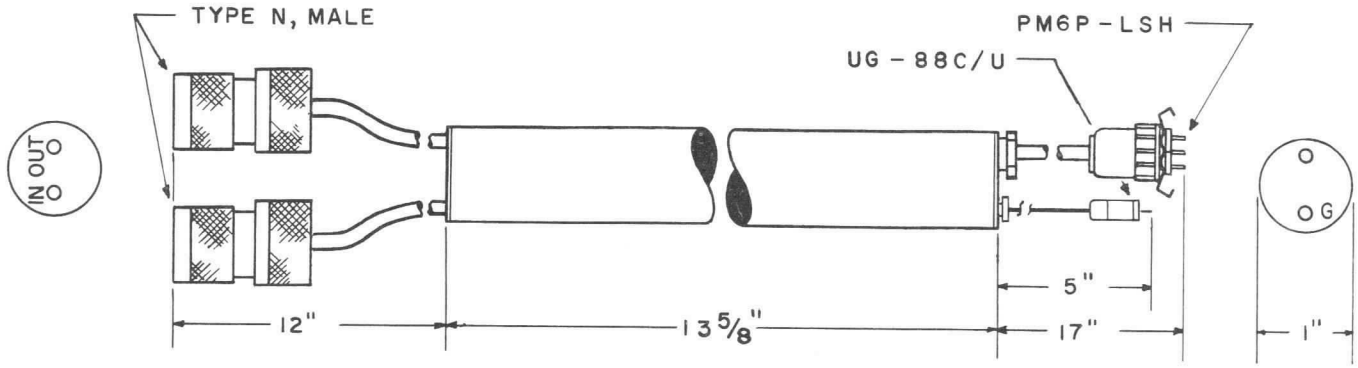
CHARACTERISTIC	PULSED OPERATION			CW OPERATION		
SMALL SIGNAL GAIN	30	DB	MIN	25	DB	MIN
SATURATION GAIN	30	DB	MIN	20	DB	MIN
POWER OUTPUT	30	DBM	MIN	20	DBM	MIN

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION*				CW OPERATION			
HELIX AND COLLECTOR VOLTAGE	1200	TO	1600	V	1200	TO	1600	V
ANODE VOLTAGE	0	TO	600	V	0	TO	600	V
GRID VOLTAGE	0	TO	150	V	0	TO	100	V
HEATER VOLTAGE			7.0	V			7.0	V
HELIX CURRENT	10.0	MA	MAX		0.5	MA	MAX	
COLLECTOR CURRENT	60.0	MA	MAX		20.0	MA	MAX	
ANODE CURRENT	0.1	MA	MAX		0.1	MA	MAX	
GRID CURRENT	15.0	MA	MAX		6.0	MA	MAX	
CATHODE CURRENT	60.0	MA	MAX		20.0	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 VALUES

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

PPM — FOCUSED, 1 — WATT C — BAND PULSE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 4.0 TO 8.0 KMC
MAXIMUM DUTY CYCLE 0.1
VSWR, INPUT AND OUTPUT . . . . . 2:1 MAX

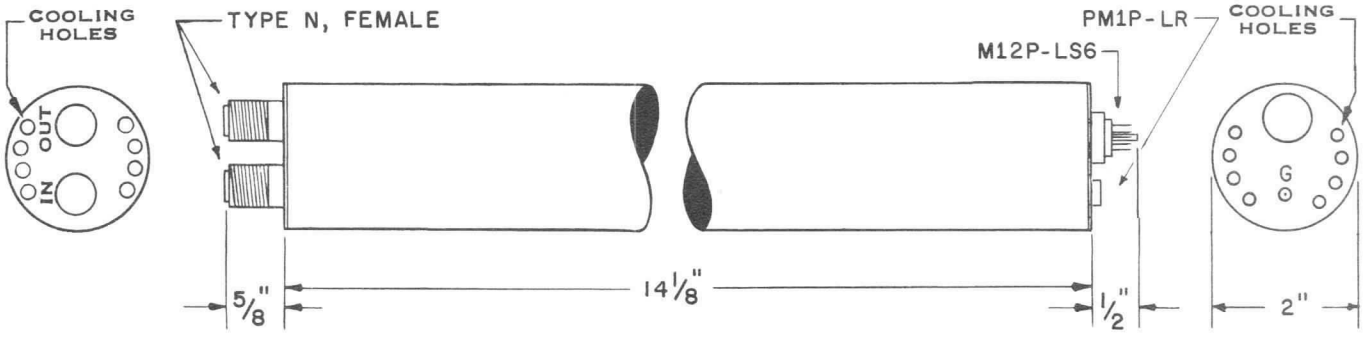
CHARACTERISTIC	PULSED OPERATION			CW OPERATION		
SMALL SIGNAL GAIN	30	DB	MIN	25	DB	MIN
SATURATION GAIN	30	DB	MIN	20	DB	MIN
POWER OUTPUT	30	DBM	MIN	20	DBM	MIN

OPERATING CHARACTERISTICS

CHARACTERISTIC	PULSED OPERATION *				CW OPERATION			
HELIX AND COLLECTOR VOLTAGE	1200	TO	1600	V	1200	TO	1600	V
ANODE VOLTAGE	0	TO	600	V	0	TO	600	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	60.0	MA	MAX		20.0	MA	MAX	
ANODE CURRENT	0.1	MA	MAX		0.1	MA	MAX	
GRID CURRENT	15.0	MA	MAX		6.0	MA	MAX	
CATHODE CURRENT	60.0	MA	MAX		20.0	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

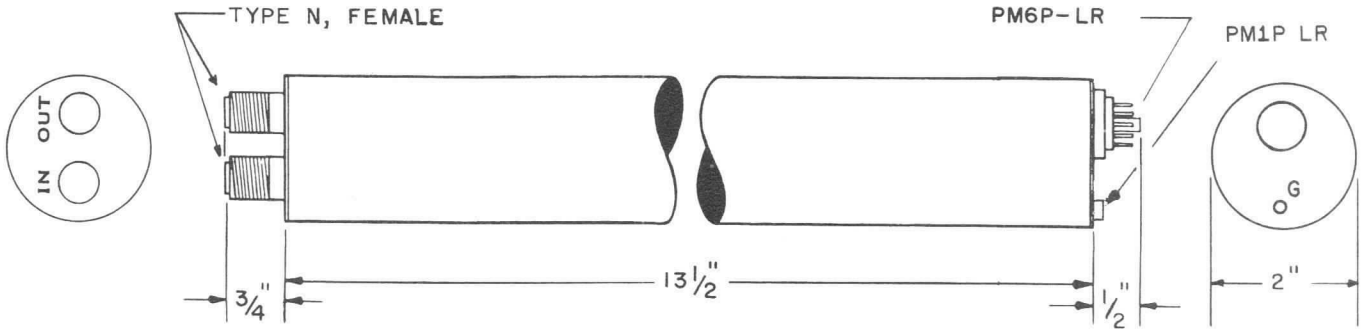
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MIN	NOT APPLICABLE
SATURATION GAIN	27 DB MIN	NOT APPLICABLE
POWER OUTPUT	30 DBM MIN	NOT APPLICABLE

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

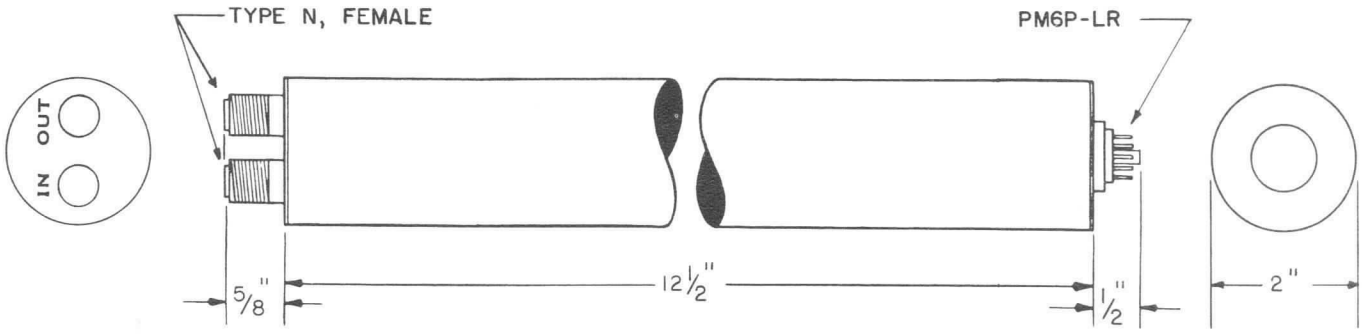
CHARACTERISTIC	PULSED OPERATION	CW OPERATION
SMALL SIGNAL GAIN	30 DB MAX	NOT APPLICABLE
SATURATION GAIN	27 DB MAX	NOT APPLICABLE
POWER OUTPUT	40 DBM MAX	NOT APPLICABLE

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

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.

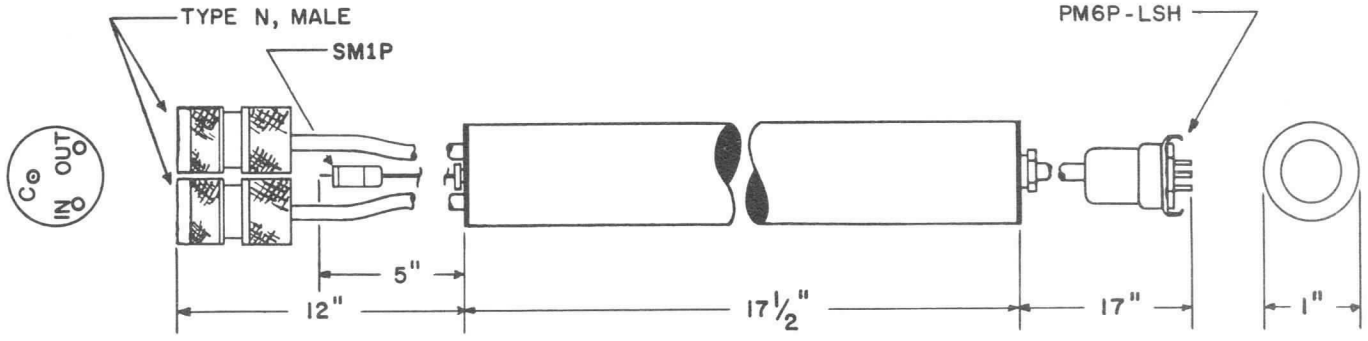
BANDWIDTH (3 DB DOWN) . . . . . 15 TO 20% OF CENTER FREQUENCY

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

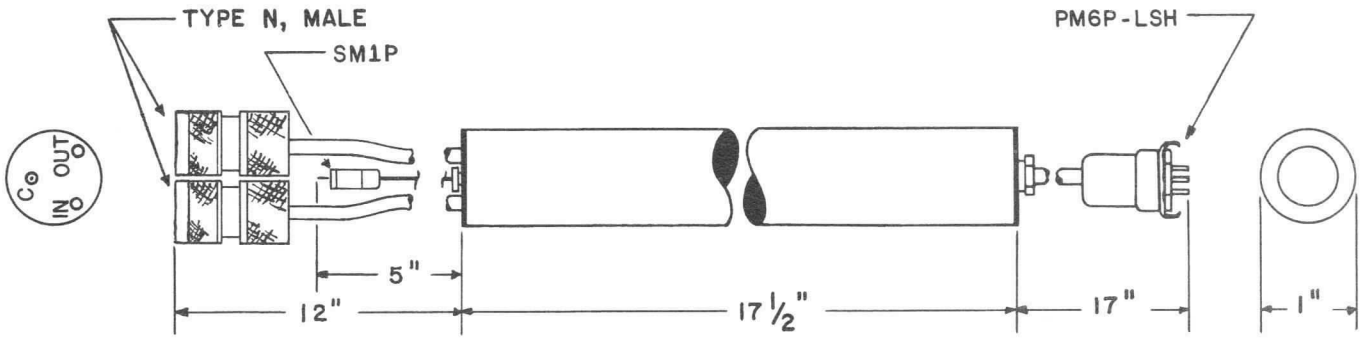
BANDWIDTH (5 DB DOWN). . . . . 15 TO 20% OF CENTER FREQUENCY

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.
999 East Arques Avenue · Sunnyvale, California

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.

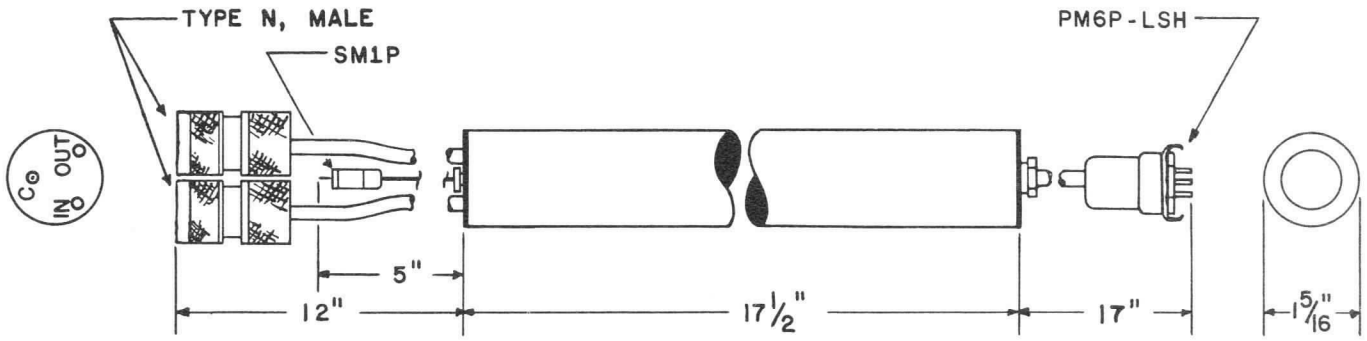
BANDWIDTH (5 DB DOWN) . . . . . 15 TO 20% OF CENTER FREQUENCY

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	CURRENT
HELIX	450 TO 1065 V	0.3 MA MAX.
COLLECTOR	450 TO 1065 V	1.5 MA MAX.
ANODE (FIXED)	0 TO 450 V	0.1 MA MAX.
CATHODE	0 V	1.5 MA MAX.
HEATER	6.3 OR 7.0 V	1.1 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, C – BAND VOLTAGE TUNED DISPERSIVE AMPLIFIER

ELECTRICAL CHARACTERISTICS

FREQUENCY RANGE . . . . . 4.0 TO 8.0 KMC

	FREQUENCY	SWEPT ANODE	FIXED ANODE
SMALL-SIGNAL GAIN	4.0 KMC	25 DB MIN.	25 DB MIN.
	8.0 KMC	15 DB MIN.	10 DB MIN.

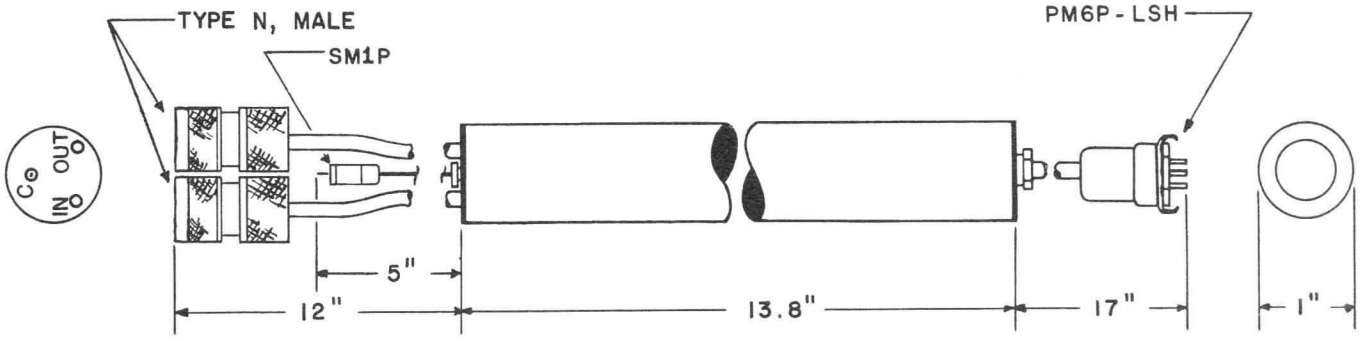
BANDWIDTH (5 DB DOWN) . . . . . 15 TO 20% OF CENTER FREQUENCY

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 . . . . . CHROME
END CAP FINISH . . . . . CHROME
AUXILIARY COOLING REQUIRED. . . . . NONE
NET WEIGHT . . . . . 2.0 LB

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

SOLENOID – FOCUSED, S – BAND TO X – BAND FREQUENCY MULTIPLIER

ELECTRICAL CHARACTERISTICS

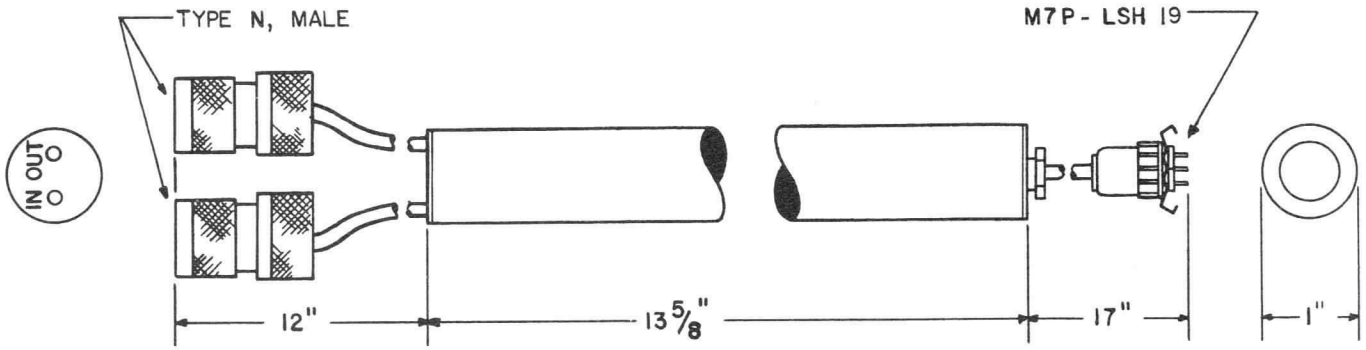
FREQUENCY RANGE . . . . . 1.76 KMC ±10 % INPUT; 8.8 KMC ±10 % OUTPUT
CONVERSION GAIN . . . . . –10 DB MIN
SATURATION POWER OUTPUT . . . . . 3 DBM MIN
VSWR, INPUT AND OUTPUT . . . . . 2.5:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	CURRENT
HELIX	850 TO 1200 V	0.3 MA MAX
COLLECTOR	850 TO 1200 V	25.0 MA MAX
ANODE	0 TO 550 V	0.10 MA MAX
CATHODE	0 V	25.0 MA MAX
HEATER	7.0 V	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

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

SOLENOID — FOCUSED UHF — BAND TO S — BAND FREQUENCY MULTIPLIER

ELECTRICAL CHARACTERISTICS

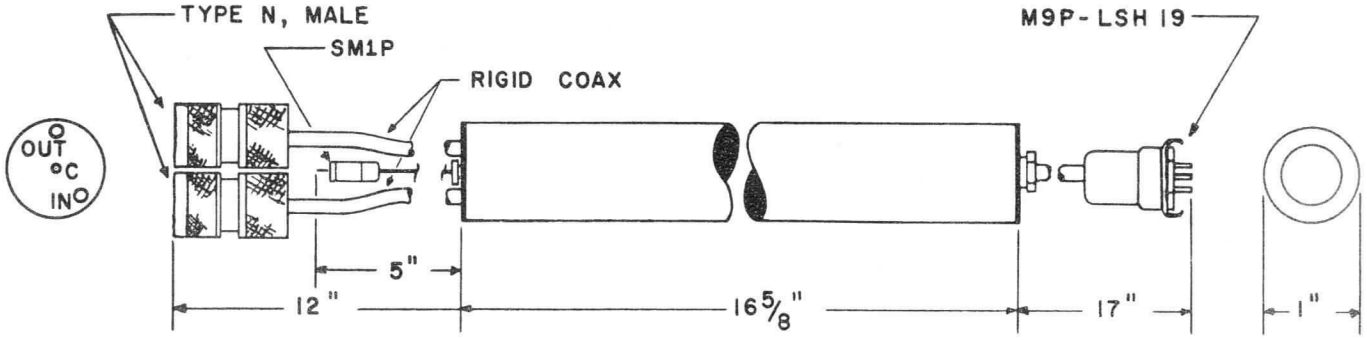
FREQUENCY RANGE . . . . . 400 – 1000 MC INPUT; 2000 – 4000 MC OUTPUT
CONVERSION GAIN. . . . . –10 DB MIN
SATURATION POWER OUTPUT . . . . . 3 DBM MIN
VSWR, INPUT AND OUTPUT. . . . . 2:1 MAX

OPERATING CHARACTERISTICS

ELEMENT	VOLTAGE	CURRENT
HELIX 1	170 TO 250 V	0.2 MA MAX
HELIX 2	400 TO 550 V	0.2 MA MAX
COLLECTOR	400 TO 550 V	6.0 MA MAX
ANODE	0 TO 200 V	.10 MA MAX
CATHODE	0 V	6.0 MA MAX
HEATER	6.3 OR 7.0 V	1.0 AMP MAX

FOCUSING . . . . . SOLENOID, 550 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
Telephone: 408-736-9330 TWX: 408-737-9992

HIGH VACUUM DIODE

THE HR-5973 MAY BE USED IN BOTH DIODE-LIMITER AND RECTIFIER SERVICE. HIGH AVERAGE CURRENTS CAN BE DELIVERED WITH A RELATIVELY LOW VOLTAGE DROP.

AS A DIODE-LIMITER THE HR-5973 WILL PASS UP TO 20 AMPERES AT 75 KV. IN RECTIFIER SERVICE THE TUBE OPERATES AT 1.25 AMPERES WITH 40 KV APPLIED AND 1 AMPERE WITH HIGHER VOLTAGES APPLIED.

ELECTRICAL CHARACTERISTICS

FILAMENT VOLTAGE, VAC ..... 16.8 MAX, 15.2 MIN
FILAMENT CURRENT @ E_f = 16V, AMPS ..... 20.2 MAX, 18.0 MIN
FILAMENT RESISTANCE (COLD), OHMS ..... 0.1 MAX
TUBE VOLTAGE DROP (I_B = 5 AMPS PK), VOLTS ..... 1050 MAX, 850 MIN

OPERATING CHARACTERISTICS (MAXIMUM RATINGS)

LIMITER SERVICE	
PEAK INVERSE VOLTAGE (E_B)	75 KV
PEAK PLATE CURRENT (I_B)	20 AMPS
AVERAGE PLATE DISSIPATION	800 WATTS
RECTIFIER SERVICE	
PEAK INVERSE VOLTAGE (E_B)	75 KV
PEAK PLATE CURRENT (I_B)	5 AMPS
AVERAGE PLATE CURRENT, $E_B \leq 40$ KV	1.25 AMPS
AVERAGE PLATE CURRENT, $E_B > 40$ KV	1.00 AMPS
AVERAGE PLATE DISSIPATION, $E_B \leq 40$ KV	850 WATTS
AVERAGE PLATE DISSIPATION, $E_B > 40$ KV	800 WATTS

PERFORMANCE GUARANTEE TESTS

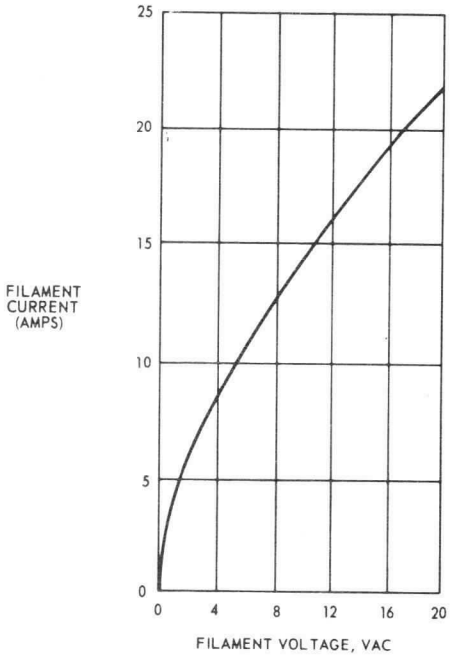
PARAMETER	TEST 1	TEST 2*	TEST 3
FILAMENT VOLTAGE, VAC	16.0	16.0	16.0
PEAK INVERSE VOLTAGE, KV	--	75	40
PEAK ANODE VOLTAGE, VOLTS	850 TO 1050	--	--
PEAK PLATE CURRENT, AMPS	5.0	3.16	3.94
AVERAGE DC PLATE CURRENT, AMPS	--	1.0	1.25
TEST DURATION, MINUTES	--	10	10

*A 10 MINUTE AGING PROCESS PRECEDES THIS TEST. NO INTERNAL ARCING OCCURS DURING TEST 2.

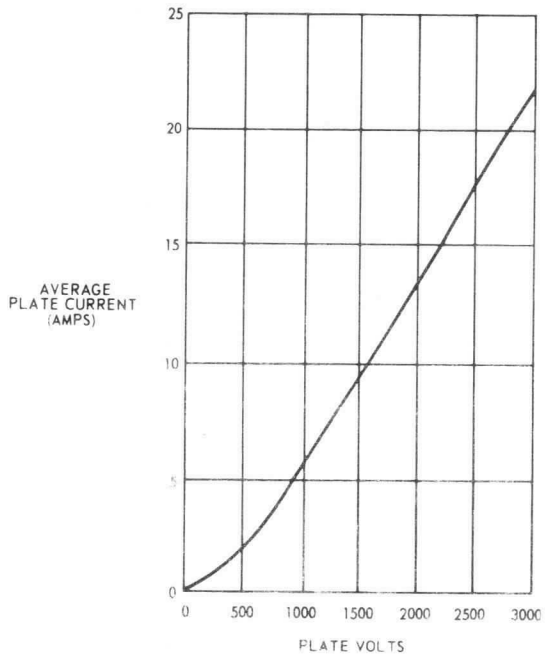
MECHANICAL CHARACTERISTICS

MOUNTING ..... VERTICAL, BASE DOWN
COOLING ..... AIR
WEIGHT ..... 3 LBS

TYPICAL CHARACTERISTICS

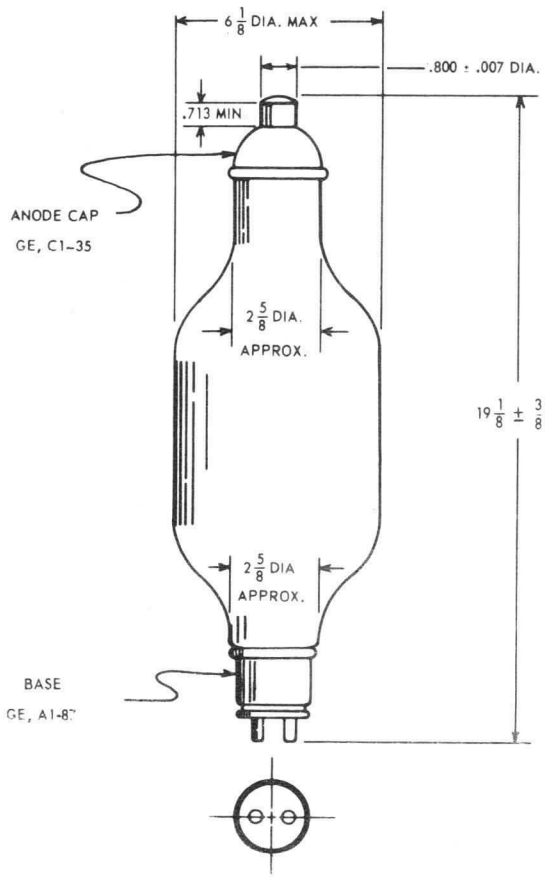


FILAMENT CHARACTERISTIC



AVERAGE PLATE CHARACTERISTIC

HR-5973 OUTLINE



ASSOCIATED SOLENOID LIST

SUPERSEDES ALL SOLENOID REQUIREMENTS PUBLISHED PRIOR TO AUGUST, 1961

HUGGINS TUBE TYPE	MPE SOLENOID TYPE	RATED FIELD (GAUSS)	VOLTAGE (VOLTS)	CURRENT (AMPERES)
HA – 1	AS – 3	300	90 – 100	0.64
HA – 2	BS – 9C	600	90 – 100	2.60
HA – 3	AS – 7	400	90 – 100	0.66
HA – 4	AS – 6	400	90 – 100	0.75
HA – 5	AS – 22	400	90 – 100	0.77
HA – 6	BS – 49C	1100	90 – 100	5.20
HA – 7	AS – 25	300	90 – 100	0.66
HA – 8	BS – 46C	560	90 – 100	2.20
HA – 9	BS – 11C	1000	90 – 100	4.90
HA – 10	BS – 4C	1000	90 – 100	4.90
HA – 11	AS – 10	500	90 – 100	1.35
HA – 14	BS – 27C	1000	90 – 100	6.50
HA – 15	3 – 64C	1000	90 – 100	4.90
HA – 16	BS – 4C	1000	90 – 100	4.90
HA – 17	BS – 27C	1000	90 – 100	6.50
HA – 18	BS – 41C	750	90 – 100	3.60
HA – 19	BS – 27C	1000	90 – 100	6.50
HA – 22	AS – 3	300	90 – 100	0.64
HA – 23	BS – 27C	1000	90 – 100	6.50
HA – 24	AS – 6	400	90 – 100	0.75
HA – 25	BS – 4C	1000	90 – 100	4.90
HA – 26	AS – 6	400	90 – 100	0.75
HA – 32	BS – 27C	1000	90 – 100	6.50
HA – 33	BS – 27C	1000	90 – 100	6.50
HA – 34	AS – 21	500	90 – 100	1.10
HA – 37	BS – 44C	SHAPED	115 – 130	1.00*
HA – 39	BS – 9C	600	90 – 100	2.60
HA – 40	BS – 26C	800	95 – 105	4.80
HA – 43	BS – 64C	1000	90 – 100	4.90
HA – 44	BS – 27C	1000	90 – 100	6.50
HA – 45	BS – 26C	800	95 – 105	4.80
HA – 46	BS – 64C	1000	90 – 100	4.90
HA – 47	BS – 27C	1000	90 – 100	6.50
HA – 48	BS – 64C	1000	90 – 100	4.90
HA – 61	BS – 27C	1000	90 – 100	6.50
HA – 62	BS – 53C	SHAPED	80 – 90	0.80*
HA – 72	BS – 26C	800	95 – 105	4.80
HA – 73	BS – 27C	1000	90 – 100	6.50
HA – 80	BS – 27C	1000	90 – 100	6.50
HA – 86	BS – 26C	800	95 – 105	4.80
HA – 89	BS – 67C	SHAPED	90 – 100	1.50*

*TYPICAL VALUE. OPTIMUM VALUE SPECIFIED ON TUBE DATA SHEET.

ASSOCIATED SOLENOID LIST

SUPERSEDES ALL SOLENOID REQUIREMENTS PUBLISHED PRIOR TO AUGUST, 1961

HUGGINS TUBE TYPE	MPE SOLENOID TYPE	RATED FIELD (GAUSS)	VOLTAGE (VOLTS)	CURRENT (AMPERES)
PA – 1	BS – 11C	1000	90 – 100	4.90
PA – 3	BS – 4C	1000	90 – 100	4.90
PA – 4	BS – 9C	600	90 – 100	2.60
PA – 5	BS – 4C	1000	90 – 100	4.90
PA – 7	BS – 49C	1100	90 – 100	5.20
DA – 1	AS – 19	250	90 – 100	0.48
DA – 2	AS – 19	250	90 – 100	0.48
DA – 3	AS – 20	250	90 – 100	0.50
DA – 4	AS – 7	400	90 – 100	0.66
BA – 1	BS – 5C	760	90 – 100	4.30
BA – 2	BS – 4C	1000	90 – 100	4.90
BA – 4	BS – 4C	1000	90 – 100	4.90
HO – 1	BS – 5C	760	90 – 100	4.30
HO – 2	BS – 3C	1000	90 – 100	4.10
HO – 3	BS – 6C	675	90 – 100	3.30
HO – 4	BS – 3C	1000	90 – 100	4.10
HO – 9	BS – 23C	800	115 – 135	4.10
HO – 10	BS – 3C	1000	90 – 100	4.10
HO – 11	BS – 3C	1000	90 – 100	4.10
HO – 13	BS – 4C	1000	90 – 100	4.90
HO – 14	BS – 3C	1000	90 – 100	4.10
HO – 17	BS – 3C	1000	90 – 100	4.10
HO – 18	BS – 5C	760	90 – 100	4.30
HO – 19	BS – 3C	1000	90 – 100	4.10
HO – 20	BS – 4C	1000	90 – 100	4.90
HO – 21	BS – 4C	1000	90 – 100	4.90