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BEAM POWER TUBE

COAXIAL-ELECTRODE STRUCTURE
CERAMIC-METAL SEALS
LOW DRIVE REQUIREMENTS
WATER-COOLED ELECTRODES
INTEGRAL WATER DUCTS
28-KW TV OUTPUT AT 550 Mc

For use at frequencies from 225 to 1000 Mc

GENERAL DATA

Electrical:

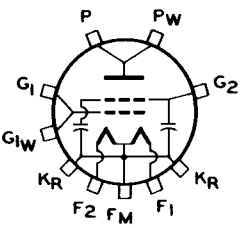
Filament, 2-Section Multistrand Thoriated Tungsten:		
Voltage* per section (AC or DC)	1.25 min.° / 1.35 typical / 1.50 max.	volts
Current per section at 1.35 volts	1000	amp
Starting current per section	Must never exceed 1200 amperes, even momentarily	
Cold resistance per section	0.00025	ohm
Minimum heating time	30	sec
Mu-Factor, Grid No.2 to Grid No.1 (Approx.) for plate volts = 9300, grid-No.2 volts = 950, and plate amperes = 4.3	8	
Direct Interelectrode Capacitances:		
Grid No.1 to plate	0.1 max.	μμf
Grid No.1 to filament and grid No.2	365	μμf
Plate to filament and grid No.2	30	μμf
Internal Bypass Capacitors between Grid No.2 and Cathode (Approx., total)	18000	μμf

Mechanical:

Operating Position	Tube axis vertical, with plate terminal either up or down
Overall Length	7.59" + 0.38" - 0.50"
Maximum Diameter	11.38"
Weight (Approx.)	28 lbs

Terminal Connections *(See Dimensional Outline)*:

F_1 – Fil. Sect. No.1 & Water Conn.
F_2 – Fil. Sect. No.2 & Water Conn.
G_1 – RF Grid-No.1 Term. Contact Surface
G_{1W} – DC Grid-No.1 & Water Conn.
G_2 – DC Grid-No.2 & Water Conn.
K_R – RF Cath. Term. Contact Surface For RF Circuit Returns



F_M – Common Point of Fil. Sections for DC Circuit Returns, Ground, & Water Conn.
P – RF Plate Term. Contact Surface
P_W – DC Plate & Water Conn.

°,*: See next page.

← Indicates a change.

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Air Cooling:

Forced-air cooling of the ceramic bushing at the grid-No.1 seal and at the plate seal may be required in order to limit the temperature of the ceramic bushing at either seal to the specified maximum value of 150° C. Under such conditions, provision should be made for blowing air at the ceramic bushings through suitable openings in the coaxial-cylinder cavity circuit.

Water Cooling:

Water cooling of the filament-section blocks, rf cathode terminals, grid-No.1 block, grid-No.2 block, and plate is required. The water flow must start before application of any voltages and preferably should continue for several seconds after removal of all voltages. Interlocking of the water flow through each of the cooled elements with all power supplies is recommended to prevent tube damage in case of failure of adequate water flow.

Water Flow:

	Absolute Min. Flow	*Typical Flow*	*Pressure* Differential for Typical Flow*
	gpm	*gpm*	*psi*
Through filament-section-No.1 block	0.5	1.2	17 max.
Through filament-section-No.2 block	0.5	1.2	17 max.
Through filament-common-point connection	0.5	1.2	11 max.
Through grid-No.1 block	0.5	1.2	9 max.
Through grid-No.2 block	0.5	1.2	17 max.
Through plate in direction shown on *Dimensional Outline:*			
For plate dissipation up to 16 kw	12	14	25 av. 31 max.
For plate dissipation of 20 kw.	14	16	32 av. 40 max.
For plate dissipation of 32 kw.	20	22	60 av. 75 max.

Gauge Pressure at Any Inlet Except Plate Inlet	70 max.	psi
Gauge Pressure at Plate Inlet	100 max.	psi
Ceramic-Bushing Temperature	150 max.	°C
Outlet-Water Temperature (Any outlet)	70 max.	°C
Min. Plate-Water-Column Resistance	4 megohms per kv of dc plate voltage at 25° C	

°,★,✠: See next page.

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LINEAR RF POWER AMPLIFIER
Class AB Single-Sideband Suppressed-Carrier Service

Crest of modulation conditions

Maximum CCS● Ratings, *Absolute Values:*§

	225 to 1000 Mc	
DC PLATE VOLTAGE	9000 max.	volts
DC PLATE-SUPPLY VOLTAGE	10000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1250 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	1350 max.	volts
MAX.-SIGNAL DC PLATE CURRENT	7 max.	amp
MAX.-SIGNAL PLATE INPUT	60000 max.	watts
MAX.-SIGNAL GRID-No.2 INPUT	750 max.	watts
PLATE DISSIPATION	35000 max.	watts

Typical CCS Operation:

	At 550 Mc⊕	
DC Plate Voltage	8000	volts
DC Grid-No.2 Voltage♦	1200	volts
DC Grid-No.1 (Control-grid) Voltage	-115	volts
Zero-Signal DC Plate Current	2.5	amp
Max.-Signal DC Plate Current	6	amp
Zero-Signal DC Grid-No.2 Current (Approx.)	0.15	amp
Max.-Signal DC Grid-No.2 Current (Approx.)	0.35	amp
Max.-Signal DC Grid-No.1 Current (Approx.)	0	amp
Max.-Signal Driver Power Output (Approx.)♣	90	watts
Output-Circuit Efficiency (Approx.)	90	%
Max.-Signal Useful Power Output (Approx.)	15000●●	watts

RF POWER AMPLIFIER — Class B Television Service

Synchronizing-level conditions per tube unless otherwise indicated

Maximum CCS● Ratings, *Absolute Values:*§

	225 to 1000 Mc	
DC PLATE VOLTAGE	9000 max.	volts
DC PLATE-SUPPLY VOLTAGE	10000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1100 max.	volts
DC GRID-No.2-SUPPLY VOLTAGE	1200 max.	volts
DC PLATE CURRENT	8.25 max.	amp
DC GRID-No.1 (CONTROL-GRID) CURRENT	0.5 max.	amp

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	225 to 1000 Mc	
PLATE INPUT	70000 max.	watts
GRID-No.2 INPUT (For black picture)*	750 max.	watts
PLATE DISSIPATION (For black picture)*	36000 max.	watts

→ **Typical CCS Operation:**	*At 550 Mc*●	*At 800 Mc*	
Bandwidth▲ of	7	7	*Mc*
DC Plate Voltage	8500	8000	volts
DC Grid-No.2 Voltage	1000	1000	volts
DC Grid-No.1 Voltage	-140	-140	volts
Peak RF Grid-No.1 Voltage:			
Synchronizing level	180	180	volts
Blanking level	140	140	volts
DC Plate Current:			
Synchronizing level	8	7.8	amp
Blanking level	5.8	5.6	amp
DC Grid-No.2 Current (Approx.):			
Synchronizing level	0.75	0.75	amp
Blanking level	0.55	0.55	amp
DC Grid-No.1 Current (Approx.):			
Synchronizing level	0.4	0.35	amp
Blanking level	0.15	0.13	amp
Driver Power Output (Approx.):♣			
Synchronizing level	800#	1000##	watts
Blanking level	450	550	watts
Output-Circuit Efficiency (Approx.)	90	85	%
Useful Power Output (Approx.):			
→ Synchronizing level	28000●●	19000●●	watts
→ Blanking level	17000●●	11500●●	watts

PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1 unless otherwise indicated

Maximum CCS● Ratings, *Absolute Values:*§

→	225 to 1000 Mc	
DC PLATE VOLTAGE	5500 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1000 max.	volts
PEAK GRID-No.2 VOLTAGE (DC + max. modulation swing)	1350 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts

o,★,⊕,●,§,⊕,♦,♣,●●,*,▲,#,##: See next page. → Indicates a change.

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	225 to 1000 Mc	
DC PLATE CURRENT	4.5 max.	amp
DC GRID-No.1 CURRENT	1 max.	amp
PLATE INPUT	25000 max.	watts
GRID-No.2 INPUT	500 max.	watts
PLATE DISSIPATION	17000 max.	watts

Typical CCS Operation:▲▲

	At 400 Mc	
DC Plate Voltage	5000	volts
DC Grid-No.2 Voltage●	800	volts
DC Grid-No.1 Voltage	-180	volts
Peak RF Grid-No.1 Voltage	210	volts
DC Plate Current	4.25	amp
DC Grid-No.2 Current (Approx.)	0.4	amp
DC Grid-No.1 Current (Approx.)	0.1	amp
Driver Power Output (Approx.)♣♣	300	watts
Output-Circuit Efficiency (Approx.)	90	%
Useful Power Output (Approx.)	10000●●	watts

RF POWER AMPLIFIER — Class C Telegraphy□
and
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS● Ratings, *Absolute Values:*§

	225 to 1000 Mc	
DC PLATE VOLTAGE	9000 max.	volts
DC PLATE-SUPPLY VOLTAGE	10000 max.	volts
DC GRID-No.2 (SCREEN-GRID) VOLTAGE	1100 max.	volts
DC GRID-No.2 SUPPLY VOLTAGE	1200 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-250 max.	volts
DC PLATE CURRENT	7 max.	amp
DC GRID-No.1 CURRENT	0.5 max.	amp
PLATE INPUT	60000 max.	watts
GRID-No.2 INPUT	750 max.	watts
PLATE DISSIPATION	35000 max.	watts

Typical CCS Operation:

	At 400 Mc	*At 900 Mc*	
DC Plate Voltage	8500	7500	volts
DC Grid-No.2 Voltage†	1000	1000	volts
DC Grid-No.1 Voltage††	-175	-175	volts
Peak RF Grid-No.1 Voltage	215	235	volts
DC Plate Current	6.75	6.8	amp
DC Grid-No.2 Current (Approx.)	0.5	0.55	amp

← Indicates a change.

o,★,♔,●,§,⊕,♦,♣,●●,*,▲,#,##,▲▲,♣♣,□,†,††: See next page.

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	At 400 Mc	At 900 Mc	
DC Grid-No.1 Current (Approx.)	0.2	0.25	amp
Driver Power Output (Approx.)♣♣	300	750	watts
Output-Circuit Efficiency (Approx.)	90	80	%
Useful Power Output (Approx.)	25000●●	13500●●	watts

★ To avoid undue thermal stresses in the filament, it is essential that the filament voltage be raised gradually to operating value in not less than 30 seconds. When the filament voltage is removed, it should be reduced gradually from the normal operating value to zero voltage in not less than 30 seconds.

○ Minimum operating value. The life of the tube can be conserved by operating the filament at the lowest power, within the operating filament-voltage range, which will enable the tube to provide the desired power output. Because the filament when operated near the maximum value provides emission in excess of any requirements within the tube ratings, the filament power must be reduced to a value that will give adequate but not excessive emission for any particular application. Good regulation of the filament power supply is in general economically advantageous from the viewpoint of tube life. During standbys, the filament may be operated at 1.08 volts.

⊕ Directly across cooled element at water connection for the indicated typical flow.

● Continuous Commercial Service.

§ Maximum voltage ratings apply for pressures down to 25 inches of mercury (altitudes up to 5000 feet) at 25° C.

⊕ In the vicinity of 550 Mc, it may be necessary to provide means for balancing out a circumferential $TE_{1,1}$ mode.

♦ Obtained preferably from a separate source.

♣ The driver stage is required to supply tube losses, rf-circuit losses, and rf "swamping-power" losses. "Swamping" may be required in practical circuit design to obtain the desired input-circuit bandwidth. The driver stage should be designed to provide an excess of power above the indicated values to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

●● This value of useful power is measured at load with output circuit having indicated efficiency.

* Continuous blanking level + sync pulses.

▲ Between the half-power points as measured in the output circuit.

This value includes 300 watts of rf "swamping power".

This value includes 100 watts of rf "swamping power".

▲▲ For 100% modulation of plate voltage, and 50% modulation of grid-No.2 voltage.

♣♣ The driver stage is required to supply tube losses and rf-circuit losses. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.

□ Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

† Obtained preferably from a separate source or from the plate-supply voltage with a voltage divider, or through a series resistor. A series grid-No.2 resistor should not be used if the 6806 or a preceding stage is keyed. In this case, the regulation of the source should be sufficient to prevent the grid-No.2 voltage from rising above 1200 volts under key-up conditions; and additional fixed grid-No.1 bias must be provided to limit the plate current.

†† Obtained from fixed supply, by grid-No.1 resistor, by cathode resistor, or by combination methods.

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Filament Current per Section. .	1	950	1050	amp
Filament Current per Section. .	2	985	1095	amp
Filament-Current Differential Between Sections.	1	–	30	amp
Filament-Voltage Differential Between Sections.	3	–	0.075	volt
Grid-No.1 Voltage	1,4	–	-180	volts
Useful Power Output:				
Class B Television Service— Synchronizing-level conditions.	1,5	27000	–	watts
Class C Telegraphy— Key-down conditions	1,6	22000	–	watts
Power Gain.	1,5,6,7	40	–	

Note 1: With 1.35 volts rms per filament section.

Note 2: With 1.5 volts rms per filament section.

Note 3: With 1000 amperes per filament section.

Note 4: With 2-phase excitation of the filament sections, dc plate volts = 8500, dc grid-No.2 volts = 1000, and dc grid-No.1 voltage adjusted to give a dc plate current of 0.25 ampere.

Note 5: With 2-phase excitation of the filament sections. In rf power amplifier circuit having a bandwidth of 7 Mc as defined by the half-power points and with dc plate volts = 8750, dc grid-No.2 volts = 1000, dc grid-No.1 voltage adjusted to give a zero-signal dc plate current of 0.25 ampere, drive adjusted to give synchronizing-level dc plate current of 8 amperes, and frequency (Mc) = 550.

Note 6: With 2-phase excitation of the filament sections. In rf power amplifier circuit, and with dc plate volts = 8500, dc grid-No.2 volts = 1000, dc grid-No.1 voltage adjusted to give a zero-signal dc plate current of 0.25 ampere, drive adjusted to give dc plate current of 7 amperes, and frequency (Mc) = 550.

Note 7: With driving power measured at input to input-cavity circuit fed by transmission line having voltage-standing-wave ratio not greater than 1.5. Power gain is ratio of useful power output to driving power.

← Indicates a change.

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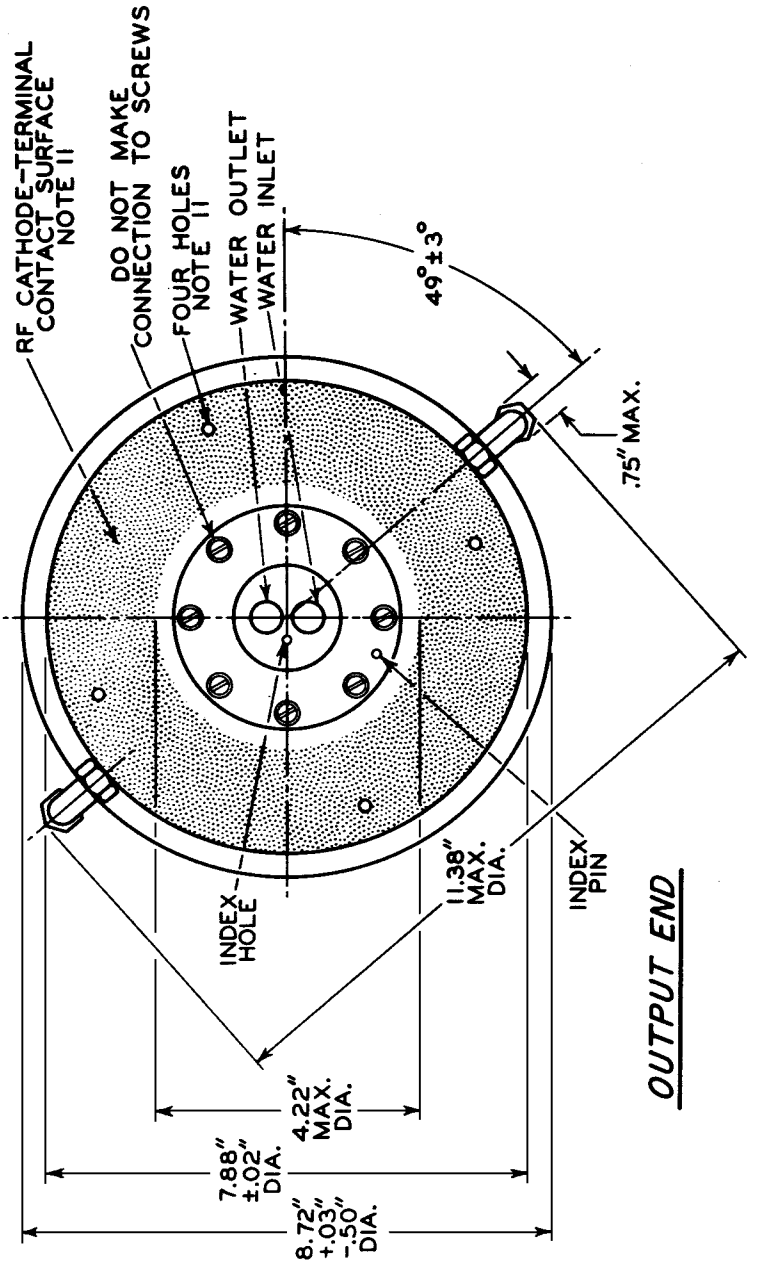

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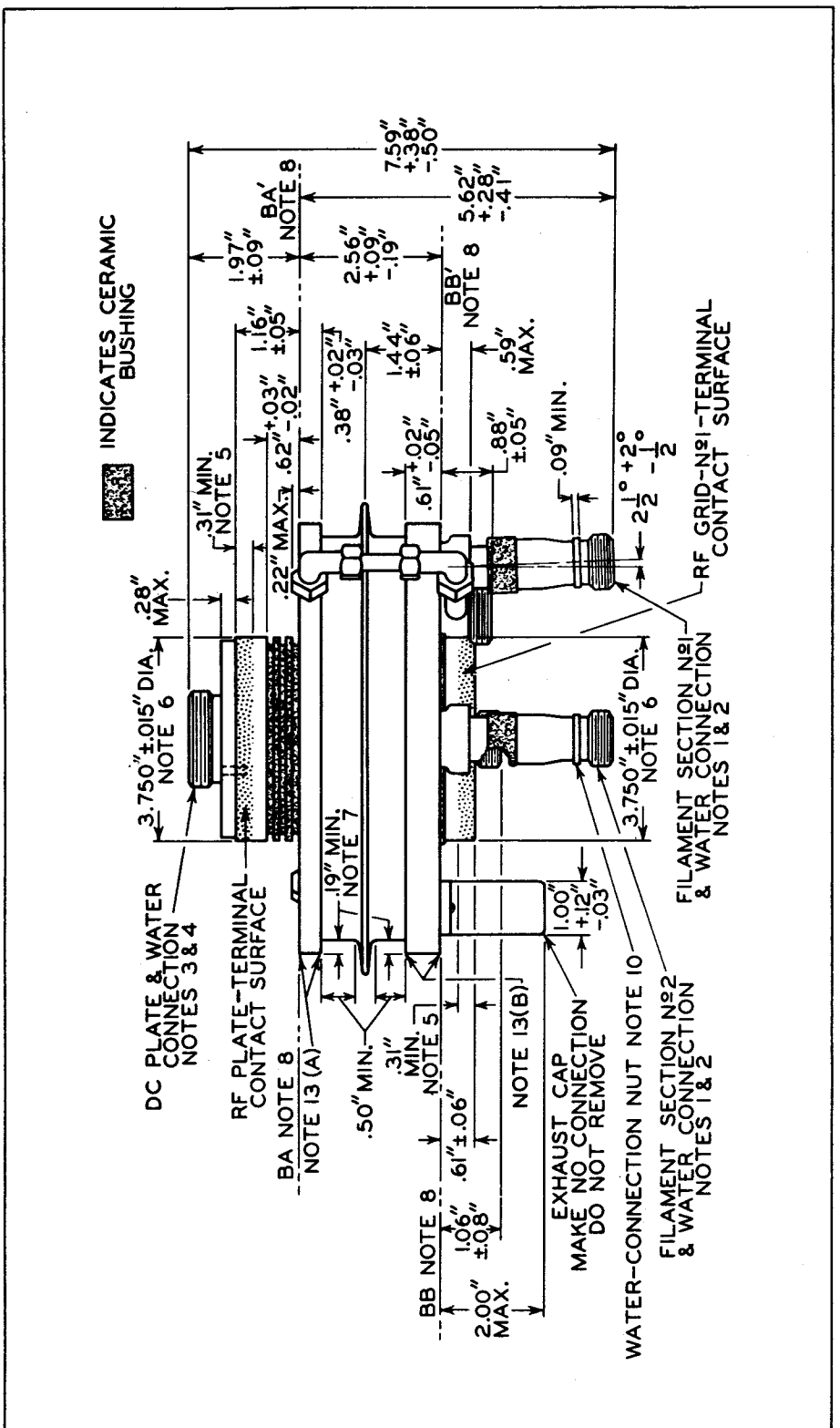

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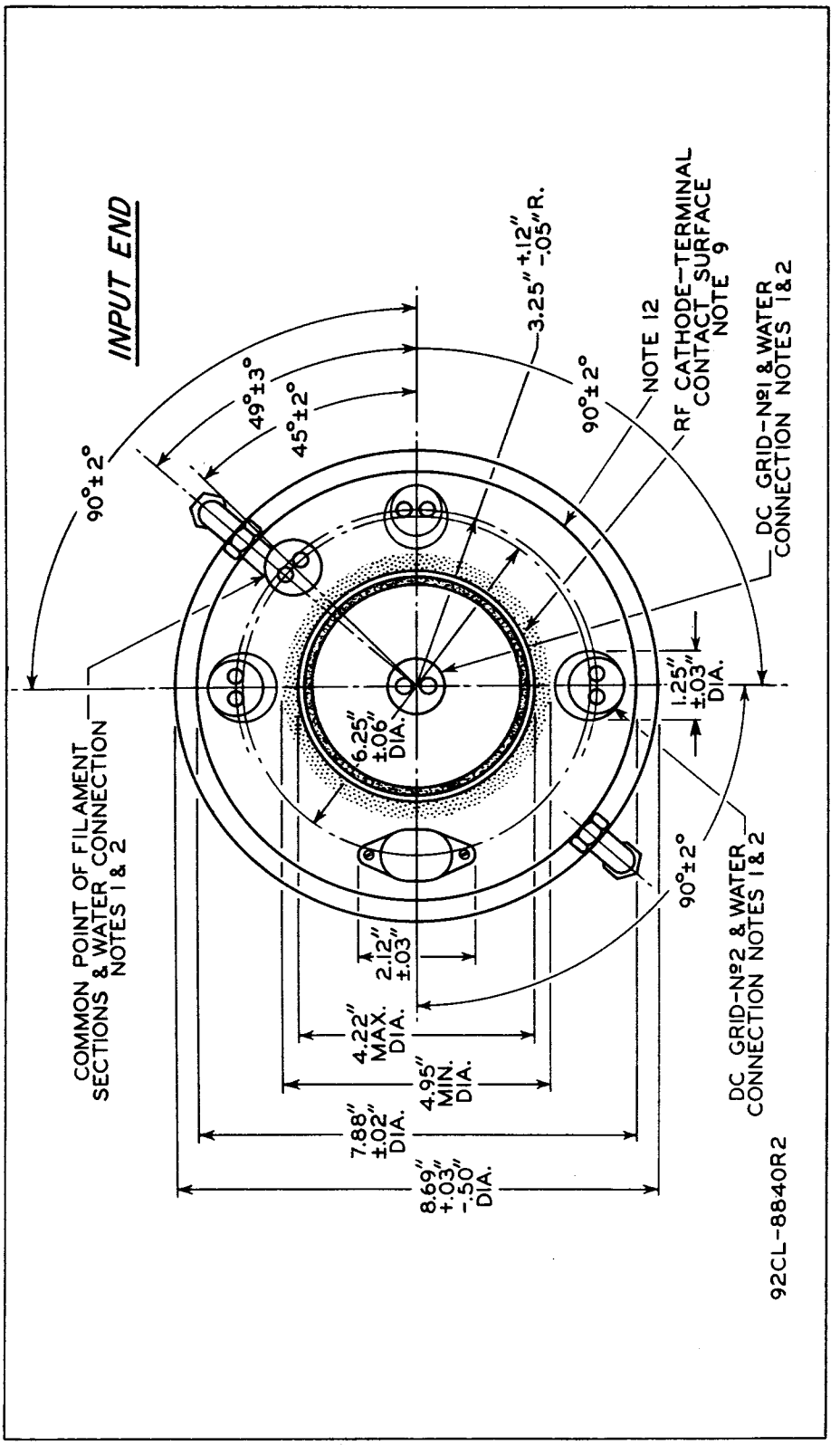

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NOTE 1: TERMINAL HAS 1" - 16 UNIFIED THREAD CLASS 2A FIT, 0.38" LONG AND 2 HOLES 0.258" - 0.270" DIAMETER SPACED 0.438" ON CENTERS.

NOTE 2: THE HOLES IN THE FILAMENT, GRID-No. 1, AND GRID-No. 2 WATER-TERMINAL CONNECTIONS WILL ACCEPT THE PINS OF THE PLUG-AND-CYLINDER COMBINATION GAUGE G_1.

NOTE 3: THE WATER CONNECTION FOR THE PLATE HAS 1-3/4" - 16 UNIFIED EXTRA FINE THREAD, CLASS 2A FIT, 0.38" LONG, 2 HOLES 0.508" - 0.522" DIAMETER SPACED 0.688" ON CENTERS AND AN INDEX HOLE 0.160" MAX. DIAMETER SPACED 0.344" FROM THE CENTER OF THE TERMINAL.

NOTE 4: THE HOLES IN THE PLATE WATER CONNECTION WILL ACCEPT THE PINS OF THE PLUG-AND-CYLINDER COMBINATION GAUGE G_2.

NOTE 5: PRESSURE FROM CIRCUIT CONTACTS SHOULD BE EXERTED ONLY OVER 0.31" MAX. LENGTH OF DESIGNATED CONTACT AREAS OF THE PLATE OR GRID-No. 1 TERMINALS.

NOTE 6: THE DIAMETER DIMENSION IS HELD ONLY OVER A LENGTH OF 0.31" MIN.

NOTE 7: THIS DIMENSION APPLIES OVER A LENGTH OF 0.50" MIN. AS INDICATED.

NOTE 8: THE CONTACT SURFACES, BA-BA' AND BB-BB', ARE PARALLEL WITHIN 0.06".

NOTE 9: CONTACT OF THE INPUT-END RF CATHODE TERMINAL SHOULD NOT BE MADE AT A DIAMETER SMALLER THAN 4.22".

NOTE 10: TO PREVENT EXCESSIVE STRESS ON THE CERAMIC SEAL, A 15/16" OPEN-END WRENCH MUST BE USED TO PERMIT GRIPPING THE TERMINAL WHEN REMOVING OR TIGHTENING THE WATER CONNECTORS.

NOTE 11: CONTACT OF THE OUTPUT-END RF CATHODE TERMINAL SHOULD NOT BE MADE AT A DIAMETER SMALLER THAN 4.22". THE PRESSURE EXERTED FOR THIS RF CONTACT SHOULD BE LIMITED TO THAT NECESSARY FOR GOOD ELECTRICAL CONTACT. THE MECHANICAL FORCE FOR THE CAVITY SUPPORT SHOULD BE MADE AT A DIAMETER NOT LESS THAN 4.22". ON THE OUTPUT-END RF CATHODE TERMINAL, THERE ARE FOUR EQUALLY SPACED 0.188"-DIAMETER HOLES ON A CIRCLE HAVING DIAMETER OF 6.75". THESE HOLES ARE FOR TUBE MANUFACTURING PURPOSES ONLY. ATTENTION IS CALLED TO THE EXISTENCE OF THESE HOLES SO THAT EQUIPMENT DESIGNERS CAN AVOID MAKING ELECTRICAL CONTACT AT POINTS WHICH ARE COINCIDENT WITH THESE HOLES. MECHANICAL CLAMPING DEVICES FOR THE OUTPUT CAVITY SHOULD BE DESIGNED SO AS TO EXERT THEIR CLAMPING FORCE ACROSS THE OUTER EDGE OF THE OUTPUT-HEADER FLANGE.

NOTE 12: SERIAL NUMBER IS LOCATED ON THIS SURFACE BETWEEN DC GRID-No. 2 AND FILAMENT-SECTION-No. 1 CONNECTIONS.

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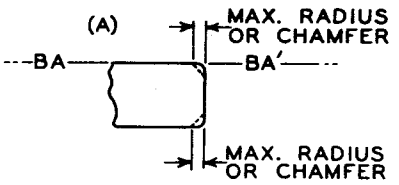
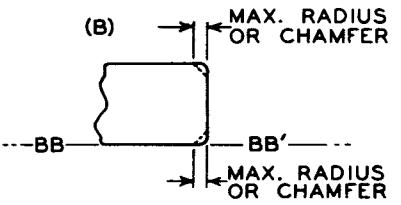
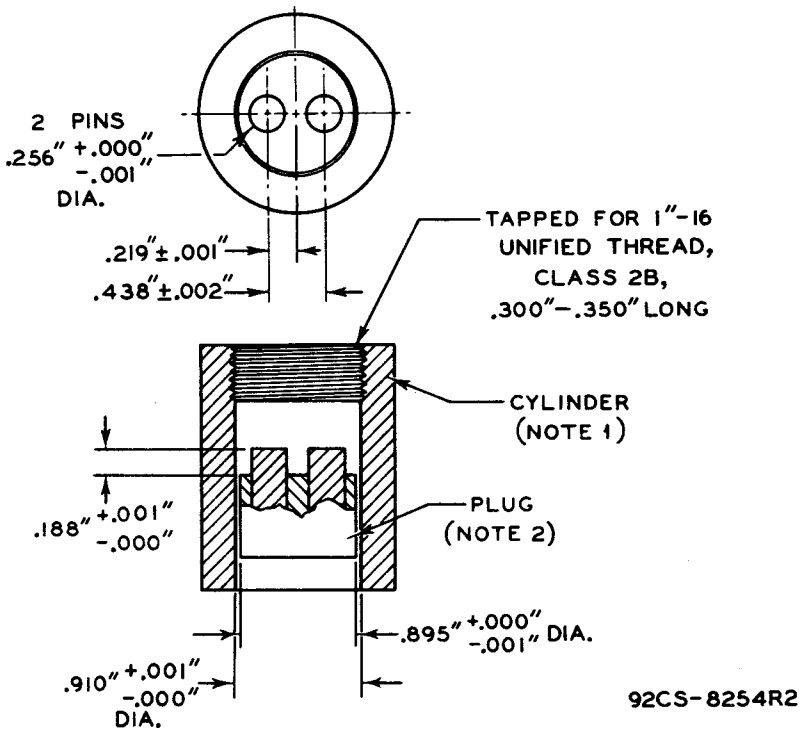
NOTE 13: CORNERS MAY BE ROUNDED OR CHAMFERED, AS INDICATED IN (A) AND (B), NOT TO EXCEED 0.05".





GAUGE G_1



NOTE 1: TAPPED SECTION OF CYLINDER MUST BE CONCENTRIC WITH UNTAPPED SECTION OF CYLINDER WITHIN .002".

NOTE 2: PLUG SIDES & PIN SIDES MUST BE PARALLEL WITHIN .001".

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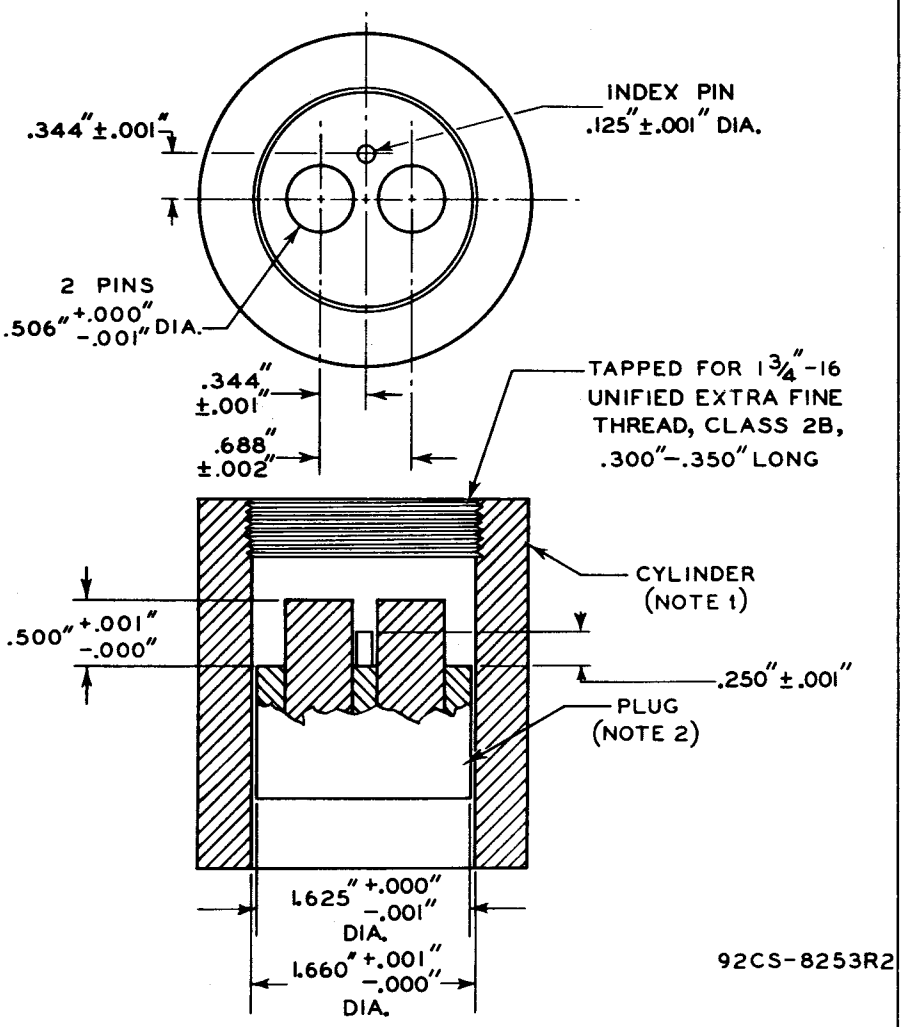
GAUGE G_2



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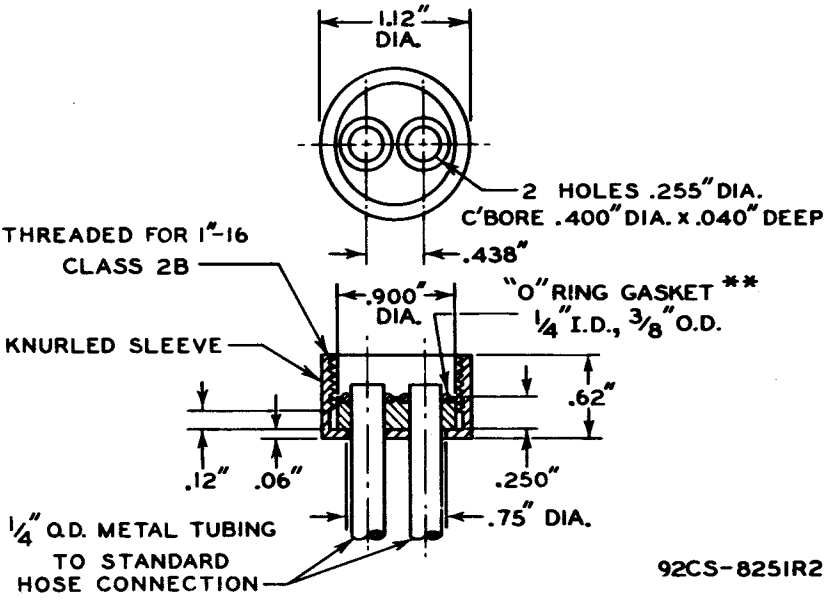
TYPICAL FITTING LAYOUT FOR ALL WATER CONNECTIONS OTHER THAN THAT FOR PLATE



** DWG. Nº 24849-5, GARLOCK PACKING CO., PALMYRA, N.Y.

For essential design tolerances, see Gauge G_1

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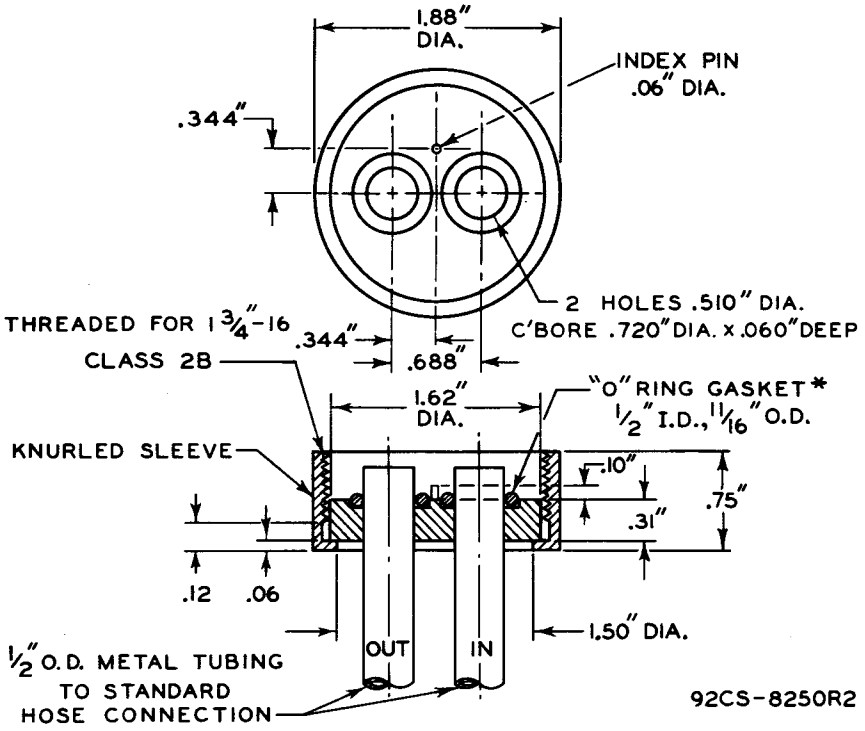
TYPICAL FITTING LAYOUT FOR PLATE WATER CONNECTION



*DWG. Nº 24849-10, GARLOCK PACKING CO., PALMYRA, N.Y.

For essential design tolerances, see Gauge G_2

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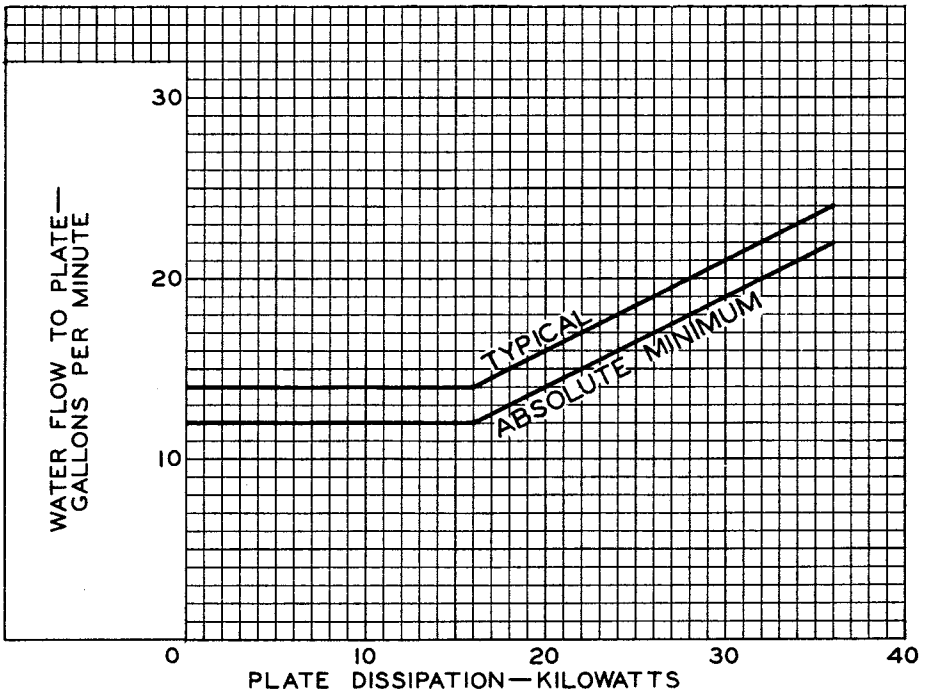
PLATE COOLING REQUIREMENTS



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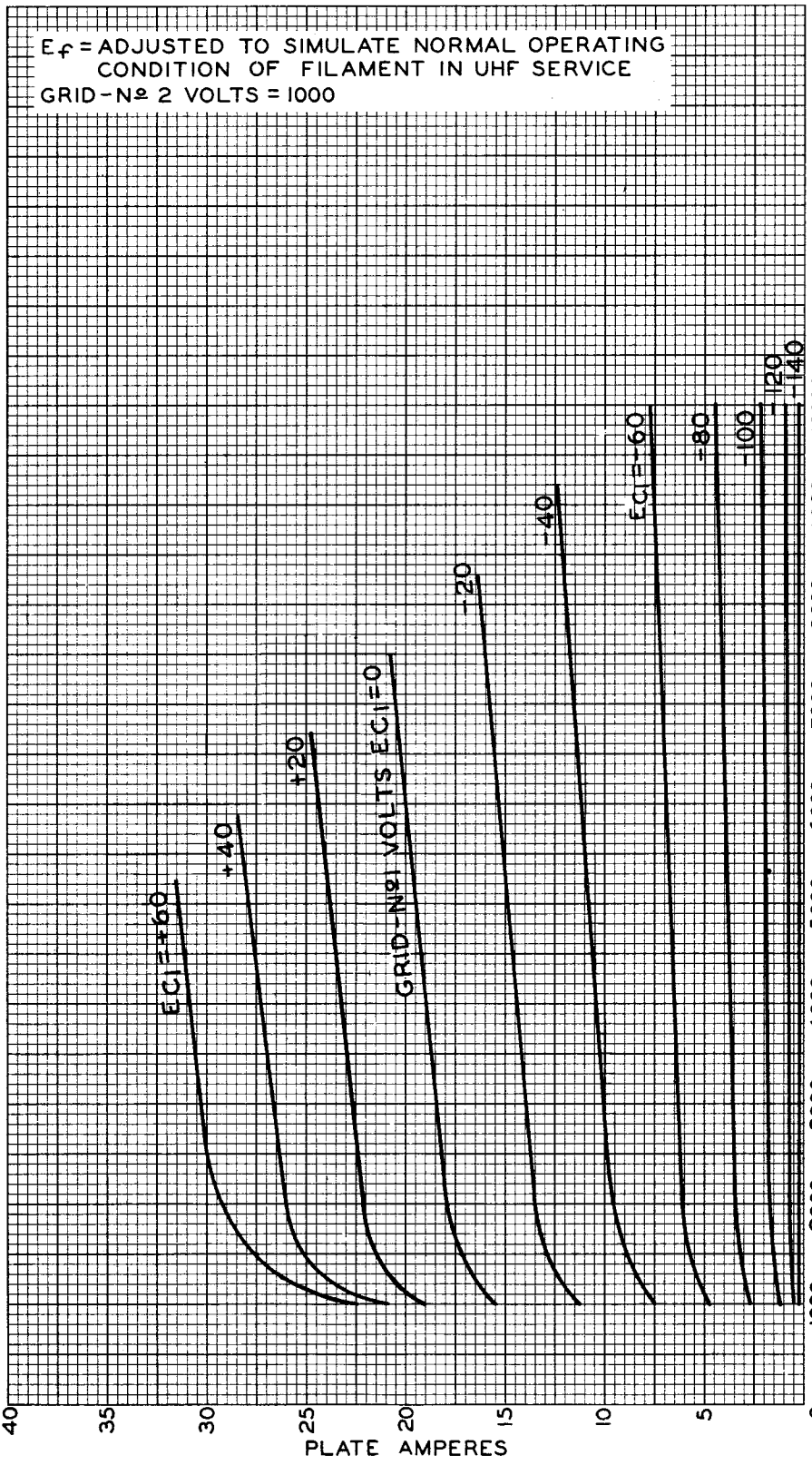
TYPICAL PLATE CHARACTERISTICS



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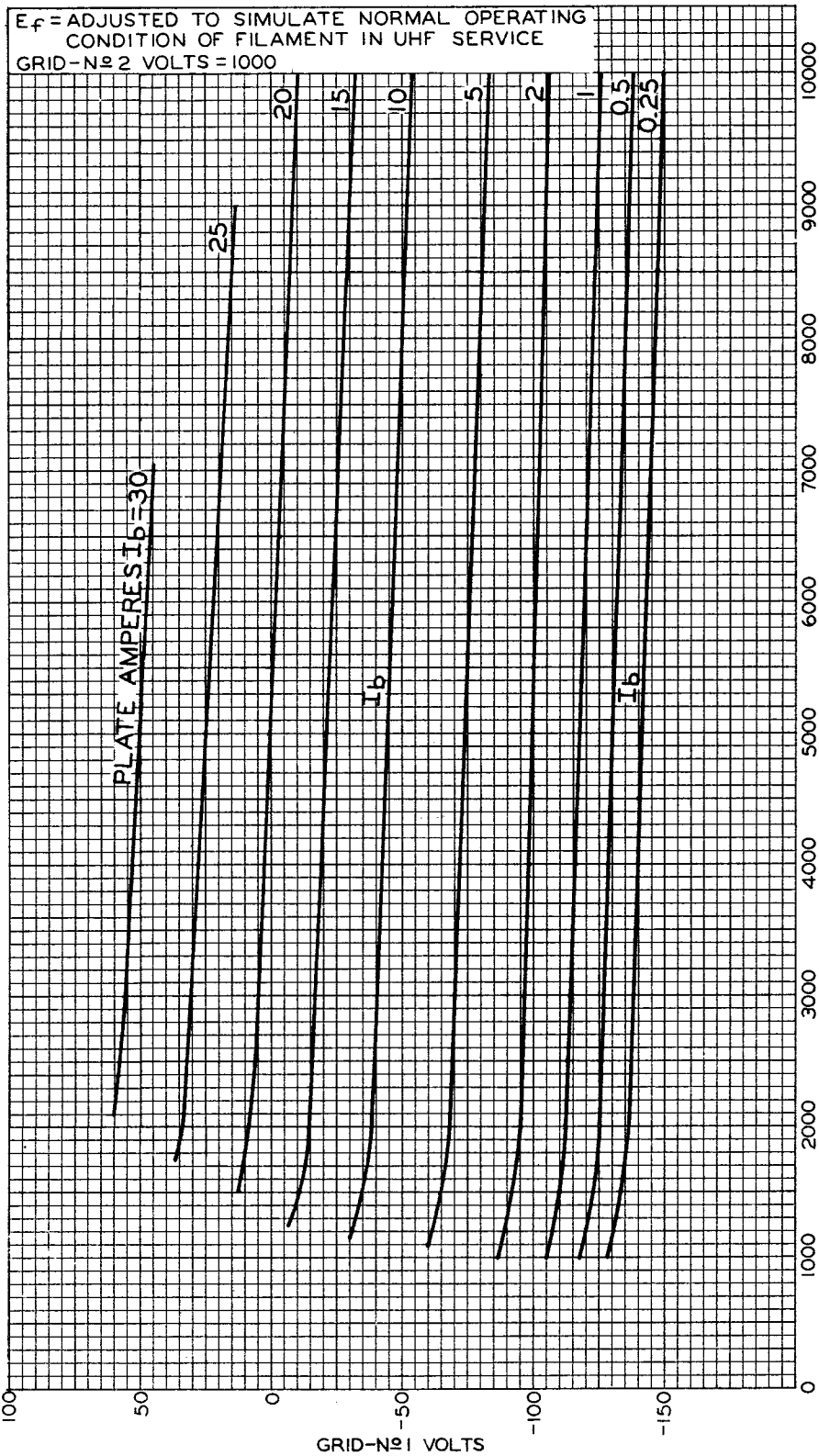
TYPICAL CONSTANT-CURRENT CHARACTERISTICS



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TYPICAL CHARACTERISTICS