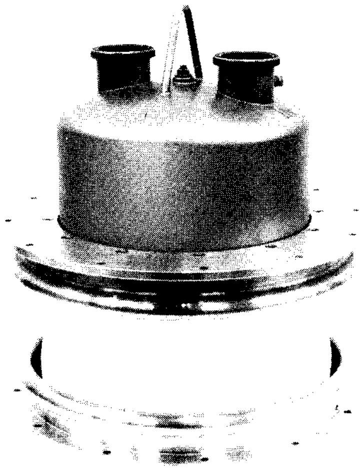
TECHNICAL DATA

8973 WATER COOLED POWER TETRODE



The EIMAC 8973 is a ceramic/metal, water-cooled power tetrode designed for very-high-powed broadcast service. It has demonstrated operation as a high-voltage switch and very high power pulsed rf amplifier in fusion applications.

The 8973 has a thoriated-tungsten mesh filament mounted on water-cooled supports. The maximum anode dissipation rating is 1000 kilowatts steady state.

Large-diameter coaxial terminals are used for the control grid and the rf filament terminals. Filament power and filament support cooling-water are applied through two special connectors. Anode cooling water connections are made with available knurled and threaded clamping rings.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated-tungsten Mesh		
Voltage	18.5 ± 0.9	V
Current @ 18.5 volts (nominal)	650	A
Frequency of Maximum Ratings (CW)	110	MHz
Amplification Factor, Average, Grid to Screen	4.5	
Direct Interelectrode Capacitances (grounded cathode)[2]		
Cin	1000	pF
Cout	165	pF
Cgp	5	pF
Direct Interelectrode Capacitances (grounded grid)[2]		
Cin	450	pF
Cout	165	pF
Cpk	0.7	pF

1. Characteristics and operating values are based on performance tests. These figures may change without notice as the result of additional data or product refinement. VARIAN EIMAC should be consulted before using this information for final equipment design.
2. Capacitance values shown are nominal, measured with no special shielding, in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Net Weight	153 lb; 69.5 kg
Operating Position	Vertical, Base Down
Cooling	Water and Forced Air
Maximum Overall Dimensions:	
Length	18.75 in; 47.62 cm
Diameter	17.03 in; 43.26 cm
Maximum Operating Temperature, Envelope and Ceramic/Metal Seals	200 °C
Available Filament Power Connector (not supplied with tube):	
Filament Power/Water Connector (2 required)	EIMAC SK-2310
Filament rf Connector (1 required)	EIMAC SK-2315
Available Anode Cooling Water Connectors (not supplied with tube):	
Note: 2 connectors are required per tube	EIMAC SK-2322 or SK-2323

396225(Effective April 1985 - Supersedes Sept 1983)
VA4747

Printed in U.S.A.

RADIO FREQUENCY LINEAR AMPLIFIER
GRID DRIVEN

Class AB

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE . . .	22.5	KILOVOLTS
DC SCREEN VOLTAGE . . .	2.5	KILOVOLTS
DC PLATE CURRENT . . .	65	AMPERES
PLATE DISSIPATION . . .	1000	KILOWATTTS
SCREEN DISSIPATION . .	7.5	KILOWATTS
GRID DISSIPATION . . .	2.0	KILOWATTS

TYPICAL OPERATION (Frequencies to 30 MHz)
CLASS AB1, Peak Envelope Conditions

Plate Voltage	20.0	kVdc
Screen Voltage	1500	Vdc
Grid Voltage **	-360	Vdc
Zero Signal Plate Current	10	Adc
Single Tone Plate Current	45	Adc
Single Tone Screen Current *	2.0	Adc
Peak rf Grid Voltage *	360	v
Plate Dissipation *	250	kW
Plate Load Resistance	264	Ohms
Plate Power Output *	610	kW

* Approximate value. ** Adjust for specified value of zero-signal plate current.

RADIO FREQUENCY POWER AMPLIFIER OR
OSCILLATOR Class C Telegraphy or FM
(Key-down Conditions)

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE . . .	22.5	KILOVOLTS
DC SCREEN VOLTAGE . . .	2.5	KILOVOLTS
DC PLATE CURRENT . . .	65	AMPERES
PLATE DISSIPATION . . .	1000	KILOWATTS
SCREEN DISSIPATION . .	7.5	KILOWATTS
GRID DISSIPATION . . .	2.0	KILOWATTS

TYPICAL OPERATION (Frequencies to 30 MHz)

Plate Voltage	21.0	kVdc
Screen Voltage	1500	Vdc
Grid Voltage	-1400	Vdc
Plate Current	59	Adc
Screen Current *	4.4	Adc
Grid Current *	1.7	Adc
Calculated Driving Power	2.7	kW
Plate Dissipation *	209	kW
Plate Load Resistance	173	Ohms
Plate Power Output *	1025	kW

* Approximate value.

RADIO FREQUENCY POWER AMPLIFIER - Long pulse for fusion applications
GROUNDED GRID - Drive Pulsed Intermittent duty (off-time > 10X on-time)

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE . . .	30	KILOVOLTS
DC SCREEN VOLTAGE . . .	2.5	KILOVOLTS
PLATE CURRENT #	110	AMPERES
PLATE DISSIPATION . . .	1000	KILOWATTS
SCREEN DISSIPATION . .	7.5	KILOWATTS
GRID DISSIPATION . . .	2.0	KILOWATTS

\# Average during the pulse
* Approximate value

TYPICAL OPERATION:

Plate-to-grid Voltage . . .	18.0	20.3	24.5	kVdc
Screen-to-grid Voltage . . .	1750	1100	1750	Vdc
Grid Voltage	-600	-300	-600	Vdc
Plate Current #	78	78	94.2	a
Screen Current #	1.1	5	3.3	a
Grid Current #	0.7	4.2	0.42	a
Drive Power * #	54.5	38	71.4	kW
Input Impedance	5.4	--	4.8	Ohms
Plate Load Impedance	94	--	128	Ohms
Power Output * #	900	--	1770	kW
Measured Power Output # . .	---	1050	--	kW
Pulse Length	10	100	20	Sec
Frequency	130	80	40	MHz

PLATE MODULATED RADIO FREQUENCY POWER
AMPLIFIER Class C Telephony
(Carrier Conditions)

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE . . .	17.5	KILOVOLTS
DC SCREEN VOLTAGE . . .	2.0	KILOVOLTS
DC PLATE CURRENT . . .	50	AMPERES
PLATE DISSIPATION # . .	650	KILOWATTS
SCREEN DISSIPATION . .	7.5	KILOWATTS
GRID DISSIPATION . . .	2.0	KILOWATTS

* Approximate value
\# 1000 kW at 100% sine-wave modulation

TYPICAL OPERATION (Frequencies to 30 MHz)

Plate Voltage	17.5	kVdc
Screen Voltage	800	Vdc
Grid Voltage	-800	Vdc
Plate Current	50	Adc
Screen Current *	4	Adc
Grid Current *	2.2	Adc
Peak Screen Voltage (100% modulation) . .	800	v
Peak rf Grid Driving Voltage *	1060	v
Calculated Driving Power	2400	W
Plate Dissipation *	175	kW
Plate Load Resistance	165	Ohms
Plate Power Output *	700	kW

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR Class AB

ABSOLUTE MAXIMUM RATINGS (per tube):

DC PLATE VOLTAGE	22.5	KILOVOLTS
DC SCREEN VOLTAGE	2.5	KILOVOLTS
DC PLATE CURRENT	65	AMPERES
PLATE DISSIPATION	1000	KILOWATTS
SCREEN DISSIPATION	7.5	KILOWATTS
GRID DISSIPATION	2.0	KILOWATTS

TYPICAL OPERATION (Two Tubes - Sinusoidal wave)

Plate Voltage	17.5	kVdc
Screen Voltage	1500	Vdc
Grid Voltage **	-400	Vdc
Zero-Signal Plate Current	5	Adc
Max.Signal Plate Current	78	Adc
Max.Signal Screen Current *	2.8	Adc
Peak Audio Freq.Grid Voltage * #	370	v
Max.Signal Plate Dissipation * #	208	kW
Plate/Plate Load Resistance	444	Ohms
Plate Power Output * ##	950	kW

\# Per tube.
* Approximate value.
** Adjust for stated zero-sig. plate current.
\## Will modulate a carrier power of 1.25 megawatts.

TYPICAL OPERATION values are obtained by measurement or by calculation from published characteristic curves. To obtain the specified plate current at the specified bias, screen, and plate voltages, adjustment of the rf grid voltage is assumed. Following this procedure, there will be little variation in ouput power when the tube is replaced, even though there may be some variation in grid and screen currents. The grid and screen currents which occur when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no performance degradation providing the circuit maintains the correct voltage in the presence of the current variations.

RANGE VALUES FOR EQUIPMENT DESIGN:	Min.	Max.	Unit
Filament Current, at 18.5 Volts ac	600	700	Aac
Interelectrode Capacitance (grounded cathode) - Measured with no special shielding			
Cin	800	1200	pF
Cout	135	195	pF
Cgp	---	10	pF
Interelectrode Capacitance (grounded grid) - Measured with no special shielding			
Cin	350	550	pF
Cout	135	195	pF
Cpk	---	1.0	pF

A P P L I C A T I O N

MECHANICAL

MOUNTING - The 8973 must be mounted vertically, base down. The full weight of the tube should rest on the screen-grid contact flange at the base of the tube, and all lifting of the tube should be done with the lifting eye which is attached to the top of the anode cooling jacket.

ANODE COOLING - The anode is cooled by circulating high velocity water through the structure. This provides efficient removal of heat from the anode and assures additional capacity for temporary overloads. The water cooling system prevents vaporlock and thermal runaway conditions which may occur in vapor or water-vapor systems. Since cooling does not depend on a change-of-state of water, vibration and mechanical shock to the tube is much lower than with vapor and water-vapor systems.

Tube life can be seriously compromised by water condition. With contaminated water deposits will form on the inside of the water jacket, causing localized anode heating and eventual tube failure. To minimize electrolysis and power loss, water resistance at 25°C should always be one megohm per cubic centimeter or higher. Relative water resistance can be continuously monitored in the reservoir by readily available instruments.

Minimum water flow requirements for the anode are shown in the table for an outlet water temperature not to exceed 70°C and inlet water temperature at 50°C. System pressure should not exceed 100 psi.

Anode Dissipation (kW)	Water Flow (gpm)	Approx.Jacket Press. Drop (psi)
Fil.Only	25	3
250	120	12
450	165	17
650	200	25
1000	300	55

High velocity water flow is required to maintain high thermal efficiency. Cooling water must be well filtered, with effectivness the equivalent of a 100-mesh screen, to eliminate any solid material and avoid the possibility of blockage of cooling passages, as this would immediately affect cooling efficiency and could produce localized anode overheating and failure of the tube.

EIMAC Application Bulletin #16, WATER PURITY REQUIREMENTS IN LIQUID COOLING SYSTEMS, is available on request, and contains considerable detail on purity requirements and maintenance systems.

BASE COOLING - The tube base requires air cooling with a minimum of 50 cfm of air at 50°C maximum at sea level, directed toward the base seal areas from a general purpose fan. It should be noted that temperatures of the ceramic/metal seals and the lower envelope areas are the controlling and final limiting factor and that the maximum allowable temperature is 200°C. Temperature-sensitive paints are available for use in checking temperatures in these areas before equipment design and air-cooling arrangements are finalized.

EIMAC Application Bulletin #20 titled TEMPERATURE MEASUREMENTS WITH EIMAC POWER TUBES contains considerable information and is available on request.

Water cooling of the filament and screen grid supports is also required, with inlet water temperature not to exceed 50°C. Each of the two filament connectors includes both an inlet and an outlet line, with the proper connector for the inlet water shown on the tube outline drawing. Minimum flow for the F1 connector is 2.0 gpm, at an approximate pressure drop of 12 psi. Minimum flow for the F2 connector is 4.0 gpm, at an approximate pressure drop of 50 psi. The screen grid cooling water is fed by means of 1/4-18 NPT tapped holes shown on the tube outline drawing, with a minimum flow of 2.0 gpm required, at an approximate pressure drop of 12 psi.

ALL COOLING MUST BE APPLIED BEFORE OR SIMULTANEOUSLY WITH THE APPLICATION OF ELECTRODE VOLTAGES, INCLUDING THE FILAMENT, AND SHOULD NORMALLY BE MAINTAINED FOR SEVERAL MINUTES AFTER ALL VOLTAGES ARE REMOVED TO ALLOW FOR TUBE COOLDOWN.

ELECTRICAL

FILAMENT OPERATION - Filament turn-on and turn-off should be programmed. Filament voltage should be smoothly increased from zero to the operating level over a period of two minutes. A motor-driven continuously variable autotransformer (such as a VARIAC® or a POWERSTAT®) is suggested. Inrush current must never be allowed to exceed twice normal operating current. Normal turnoff procedure should be a smooth decrease from the operating voltage to zero over a period of two minutes.

At rated (nominal) filament voltage the peak emission capability of the tube is many times that needed for communication service. A reduction in filament voltage will lower the filament temperature, which will substantially increase life expectancy. The correct value of filament voltage should be determined for the particular application. It is recommended the tube be operated at full nominal voltage for an initial stabilization period of 100 to 200 hours before any action is taken to operate at reduced voltage. The voltage should gradually be reduced until there is a slight degradation in performance (such as power output or distortion). For operation The voltage should then be increased several tenths of a volt above the value where performance degradation was noted. The operating point should be rechecked after 24 hours. Filament voltage should be closely regulated when voltage is to be reduced below nominal in this manner, to avoid any adverse influence caused by normal line voltage variations.

Filament voltage should be measured at the tube base or socket, using an accurate rms-responding meter. Periodically throughout the life of the tube the procedure outlined above for reduction of voltage should be repeated, with voltage reset as required, to assure best tube life. EIMAC Application Bulletin #18, titled "EXTENDING TRANSMITTER TUBE LIFE", contains detailed information and is available on request.

Where hum is an important system consideration it is permissible to operate the filaments with dc rather than ac power.

Care should be exercised to keep any rf power out of the filament of the tube, as this can cause excessive operating temperatures. Proper bypassing of the filament must be used to assure monopotential operation. It should be ascertained that no resonance exists in the filament circuit which could be excited during operation.

This tube is designed for commercial service, with no more than one normal off/on filament cycle per day. If additional cycling is anticipated it is recommended the user contact Application Engineering at Varian EIMAC for additional information.

ABSOLUTE MAXIMUM RATINGS - Values shown for each type of service are based on the "absolute system" and are not to be exceeded under any service conditions. These ratings are limiting values outside which the serviceability of the tube may be impaired. In order not to exceed these ratings the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of the rating by a safety factor so that the absolute values will never be exceeded under any usual conditions of supply-voltage variation, load variation, or manufacturing variation in the equipment itself. <u>It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously</u>.

VACION® PUMP OPERATION - The tube is supplied with an ion pump and magnet, mounted on the filament structure at the base (stem). A power supply and cable (Varian Part #921-0015 and #924-0020 or equivalents) are required for operation. The primary function of this device is to allow monitoring of the condition of the tube vacuum, as shown by an ion current meter.

With an operational tube it is recommended the VACION pump be operated full time so tube vacuum may be monitored on a continuous basis. A reading of less than 10 uAdc should be considered as normal, indicating excellent tube vacuum. In addition to other interlock circuitry it is recommended that full advantage be taken of the VACION pump readout by providing circuitry which will shut down all power to the tube in the event the readout current exceeds 50 uAdc. In the event of such a shutdown, the VACION pump should be operated alone until vacuum recovery is indicated by a reading of 10 uAdc or less, at which point the tube may again be made operational. If the vacuum current rises again it should be considered as indicating a circuit problem such that some tube element may be over-dissipating and outgassing.

In the case of a spare tube (non-operational) it is recommended the VACION pump be operated continuously if possible. Otherwise it should be operated periodically to check the condition of tube vacuum, and operated as long as necessary to achieve a reading of 10 uAdc or better.

Figure 1 shows the relationship between tube vacuum and the ion current reading. Electrode voltages, including filament voltage, should never be applied if a reading of 50 uAdc or higher is obtained. In the event that poor vacuum cannot be improved by operation of the VACION pump the user should contact EIMAC and review the case details with an Applications Engineering specialist.

PLATE OPERATION - The 1000 KW plate dissipation maximum rating may be exceeded for very brief periods during setup or tuning. When used as a plate-modulated rf amplifier, dissipation under carrier conditions is limited to 650 kilowatts.

GRID OPERATION - The maximum grid dissipation is 2000 watts and protective measures should be taken to insure that this rating is not exceeded. Grid dissipation is approximately equal to the product of dc grid current and peak positive grid voltage. A protective spark gap device should be connected between the control grid and the cathode to guard against excessive voltage.

SCREEN OPERATION - The maximum screen grid dissipation is 7500 watts. With no ac applied to the screen grid, dissipation is simply the product of dc screen voltage and the dc screen current. With screen modulation, dissipation is dependent on rms screen voltage and rms screen current. Plate voltage, plate loading, or bias voltage must never be removed while filament and screen voltages are present, since screen dissipation ratings will be exceeded. Suitable protective circuitry must be provided to remove screen power in case of a fault condition. A protective spark-gap device should be connected between the screen grid and the cathode to guard against excessive voltage.

Tetrode tubes may exhibit reversed screen current to a greater or lesser degree depending on individual tube design and operating conditions. The screen supply voltage must be maintained constant for any values of negative or positive screen currents which may be encountered. Dangerously high plate currents may flow if the screen power supply exhibits a rising voltage characteristic with negative screen current. Stabilization may be accomplished by use of a shunt regulator circuit in the screen voltage supply, bleeder resistors, or other suitable techniques.

PULSE OPERATION - The thermal time constants of the internal tube elements vary from a few milliseconds in the case of the grids to about 200 milliseconds for the anode. In many applications the meaning of duty as applied to a pulse chain is lost because the interpulse period is very long. For pulse lengths greater than 10 milliseconds, where the interpulse period is more than 10 times the pulse duration, the element dissipations and required cooling are governed by the watt-seconds during the pulse. Provided the watt-seconds are less than the listed maximum dissipation rating and sufficient cooling is supplied, tube life will be protected. To maintain high cooling efficiency the anode water flow must be sufficient to insure turbulent flow. EIMAC has determined that a minimum flow of 35 gpm (130 lpm) is required.

FAULT PROTECTION - In addition to the normal plate over-current interlock and coolant interlock, the tube must be protected from internal damage caused by any arc which may occur. A protective resistance should always be connected in series with the grid and anode to help absorb power supply stored energy if an arc should occur. An electronic crowbar, which will discharge power supply capacitors in a few microseconds after the start of an arc, is recommended. The protection criteria for each supply is to short each electrode to ground, one at a time, through a vacuum relay switch and a 6-inch length of #30 AWG copper wire. The wire will remain intact if criteria is met.

As noted under GRID OPERATION and SCREEN OPERATION a protective spark gap should be connected from the control grid to ground and from the screen grid to ground.

EIMAC Application Bulletin #17 titled FAULT PROTECTION contains considerable detail, and is available on request.

LOAD VSWR - The load VSWR should be monitored and the detected signal used to operate the interlock system to remove plate voltage within 20 milliseconds after a fault occurs. In the case of high stored energy in the load system, care must be taken to avoid excessive return energy from damaging the tube and associated circuit components.

X-RADIATION HAZARD - High-vacuum tubes operating at voltages higher than 15 kilovolts produce progressively more dangerous X-ray radiation as the voltage is increased. This tube, operating at its rated voltages and currents, is a potential X-ray source. Only limited shielding is afforded by the tube envelope. Moreover, the X-radiation level may increase significantly with tube aging and gradual deterioration, due to leakage paths or emission characteristics as they are effected by the high voltage. X-ray shielding may be required on all sides of tubes operating at these voltages to provide adequate protection throughout the life of the tube. Periodic checks on the X-ray level should be made, and the tube should never be operated without required shielding in place. If there is any question as to the need for or the adequacy of shielding, an expert in this field should be contacted to perform an equipment X-ray survey.

In cases where shielding has been found to be required operation of the equipment with interlock switches "cheated" and cabinet doors open in order to be better able to locate an equipment malfunction can result in serious X-ray exposure.

HIGH VOLTAGE - Normal operating voltages used with this tube are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage capacitors whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

RADIO-FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 300 MHz most of the energy will pass completely through the human body with little attenuation or heating affect. Public health agencies are concerned with the hazard even at these frequencies. OSHA (Occupational Safety and Health Administration) recommends that prolonged exposure to rf radiation should be limited to 10 milliwatts per square centimeter.

INTERELECTRODE RF TUNING CHARACTERISTICS - Typical interelectrode tuning characteristics may be obtained by contacting Varian EIMAC Power Grid Tube Application Engineering.

INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis from the tube terminals and associated wiring. To control actual capacitance values within the tube, as the key component involved, the industry and Military Services use a standard test procedure described in Electronic Industries Association Standard RS-191. The test is performed on a cold tube, and in the case of the 8973, with no special shielding. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time. The capacitance values shown in the technical data are taken in accordance with Standard RS-191 but with no special shielding.

The equipment designer is cautioned to make allowance for the capacitance values, including tube-to-tube variation and strays, which will exist in any normal application. Measurements should be taken with mounting which represent approximate final layout if capacitance values are highly significant in the design.

SPECIAL APPLICATIONS - When it is desired to operate this tube under conditions widely different from those listed here, write to Varian EIMAC; attn: Product Manager High Power Tubes, 301 Industrial Way; San Carlos, CA 94070 U.S.A.

OPERATING HAZARDS

PROPER USE AND SAFE OPERATING PRACTICES WITH RESPECT TO POWER TUBES ARE THE RESPONSIBILITY OF EQUIPMENT MANUFACTURERS AND USERS OF SUCH TUBES. ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES OR EQUIPMENT WHICH UTILIZES SUCH TUBES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. DO NOT BE CARELESS AROUND SUCH PRODUCTS.

The operation of this tube may involve the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel:

a. HIGH VOLTAGE - Normal operating voltages can be deadly. Remember that HIGH VOLTAGE CAN KILL.

b. LOW-VOLTAGE HIGH-CURRENT CIRCUITS - personal jewelry, such as rings, should not be worn when working with filament contacts or connectors as a short circuit can produce very high current and melting, resulting in severe burns.

c. RF RADIATION - Exposure to strong rf fields should be avoided, even at relatively low frequencies. The dangers of rf radiation are more severe at UHF and microwave frequencies and can cause serious bodily and eye injuries. CARDIAC PACEMAKERS MAY BE EFFECTED.

d. HOT WATER - Water used to cool tubes may reach scalding temperatures. Touching or rupture of the cooling system can cause serious burns.

e. HOT SURFACES - Surfaces of tubes can reach temperatures of several hundred °C and cause serious burns if touched for several minutes after all power is removed.

f. X-RAY RADIATION - High-voltage tubes can produce dangerous and possibly fatal X-rays and comprehensive shielding may be required. If shielding is provided, equipment should never be operated without all such shielding in place.

Please review the detailed operating hazards sheet enclosed with each tube, or request a copy from: Varian EIMAC, Power Grid Application Engineering, 301 Industrial Way, San Carlos CA 94070.

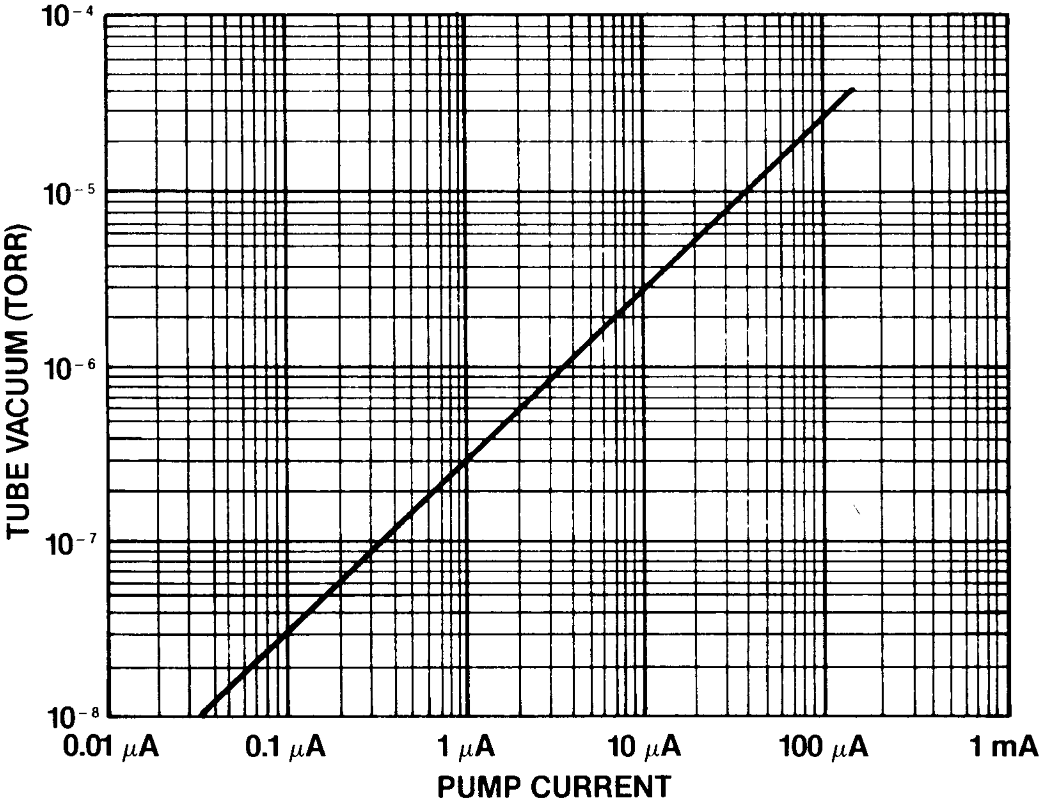
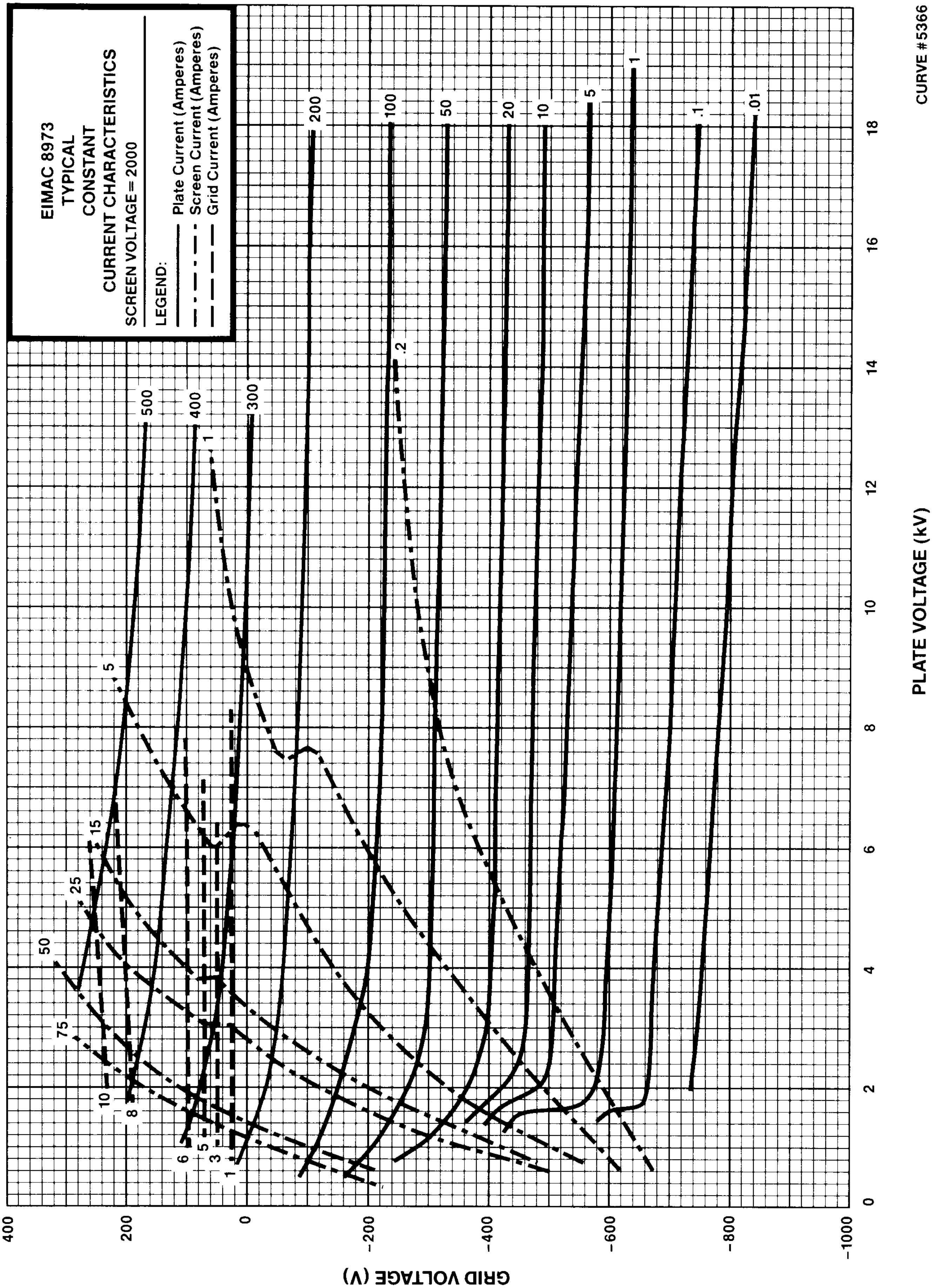
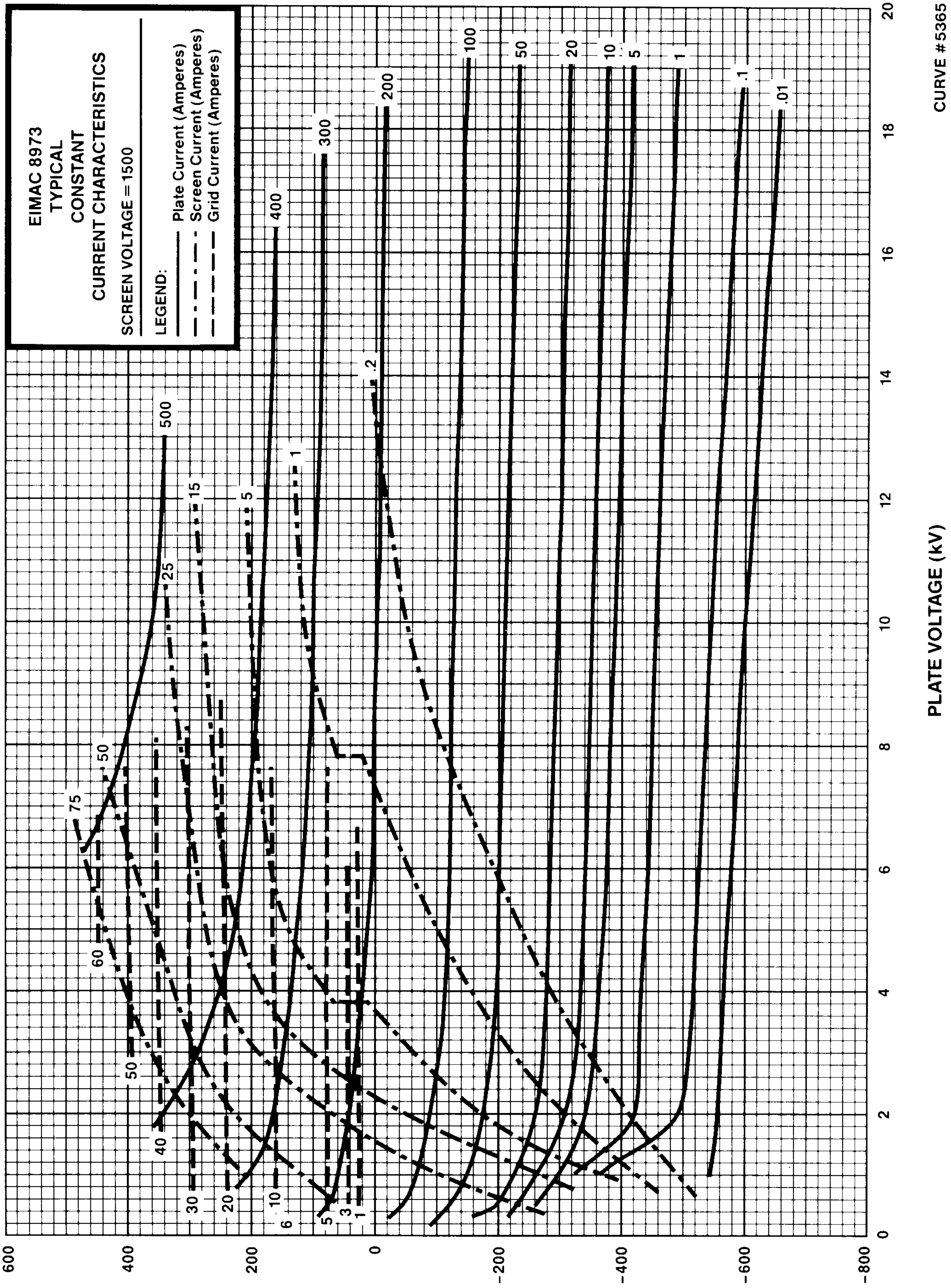


Figure 1 - Tube Vacuum VS Ion Current Reading


EIMAC 8973
TYPICAL
CONSTANT
CURRENT CHARACTERISTICS
SCREEN VOLTAGE = 2000
LEGEND:
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
PLATE VOLTAGE (kV)
GRID VOLTAGE (V)
CURVE #5366
0
2
4
6
8
10
12
14
16
18
400
200
0
-200
-400
-600
-800
-1000
500
400
300
200
100
50
20
10
5
1
.1
.01
.2
75
50
25
15
10
8
6
5
3


EIMAC 8973
TYPICAL
CONSTANT
CURRENT CHARACTERISTICS
SCREEN VOLTAGE = 1500
LEGEND:
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
PLATE VOLTAGE (kV)
GRID VOLTAGE (V)
CURVE #5365
0
2
4
6
8
10
12
14
16
18
20
600
400
200
0
-200
-400
-600
-800
500
400
300
200
100
50
20
10
5
1
.1
.01
75
60
50
40
30
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10
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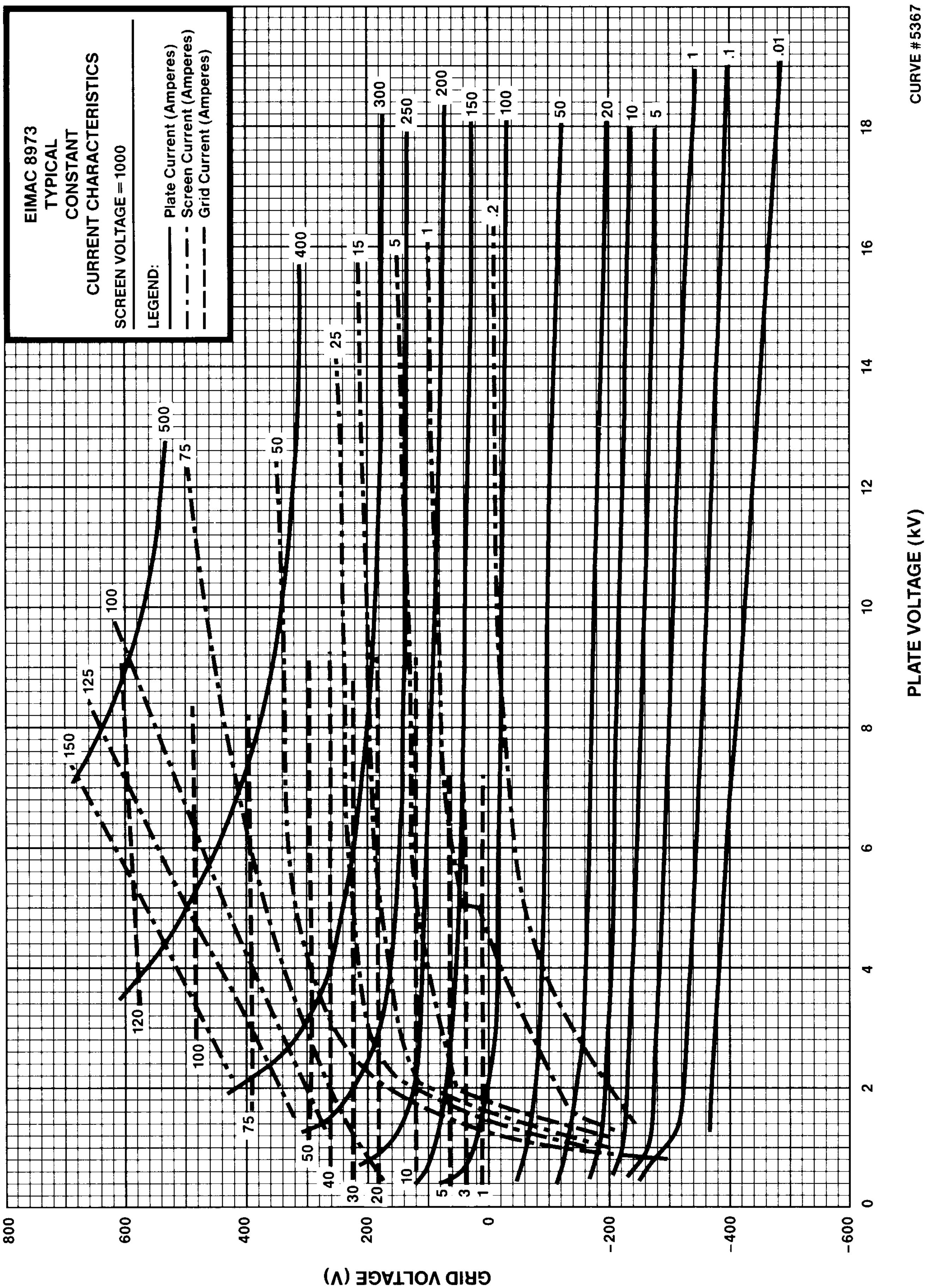
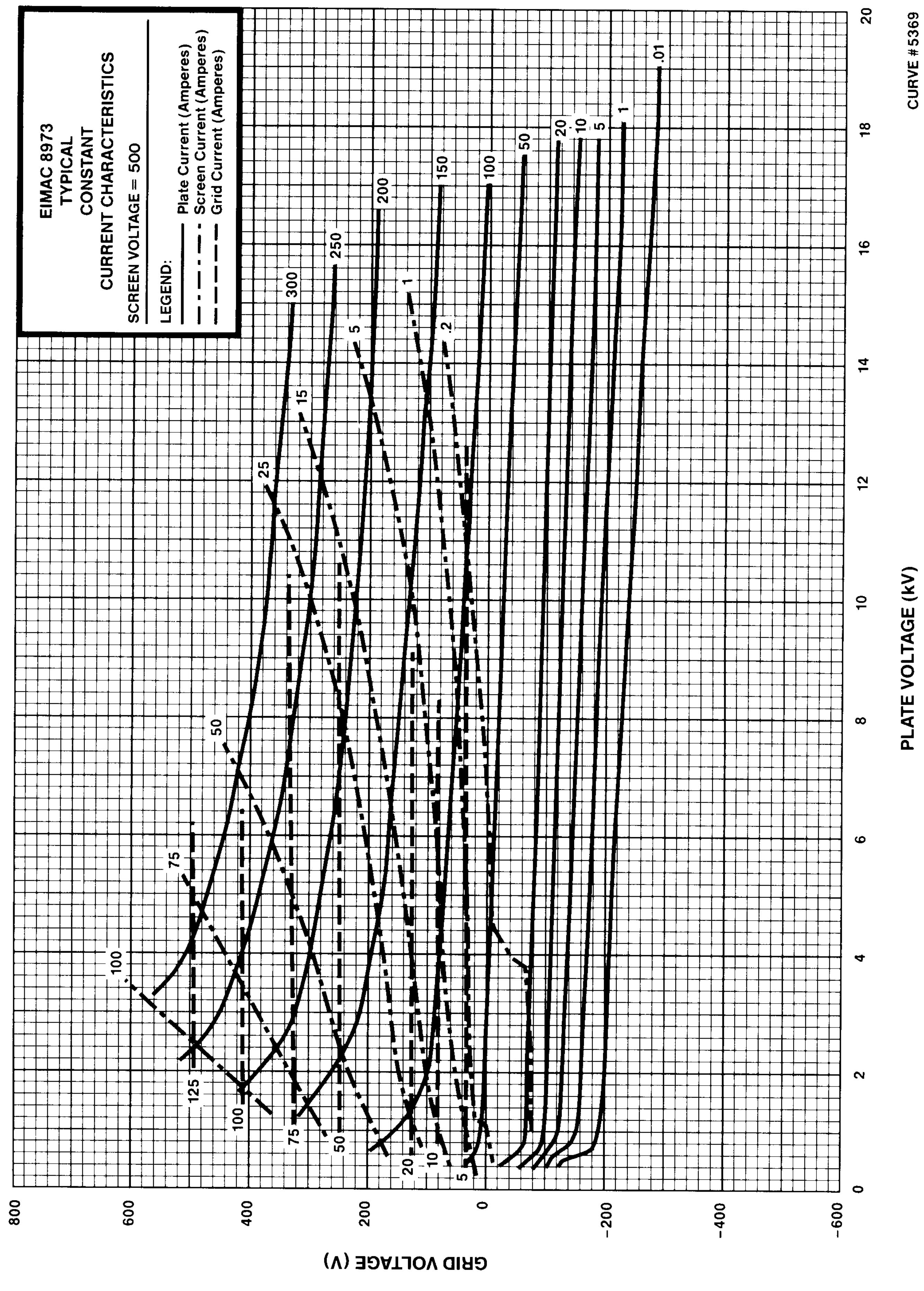
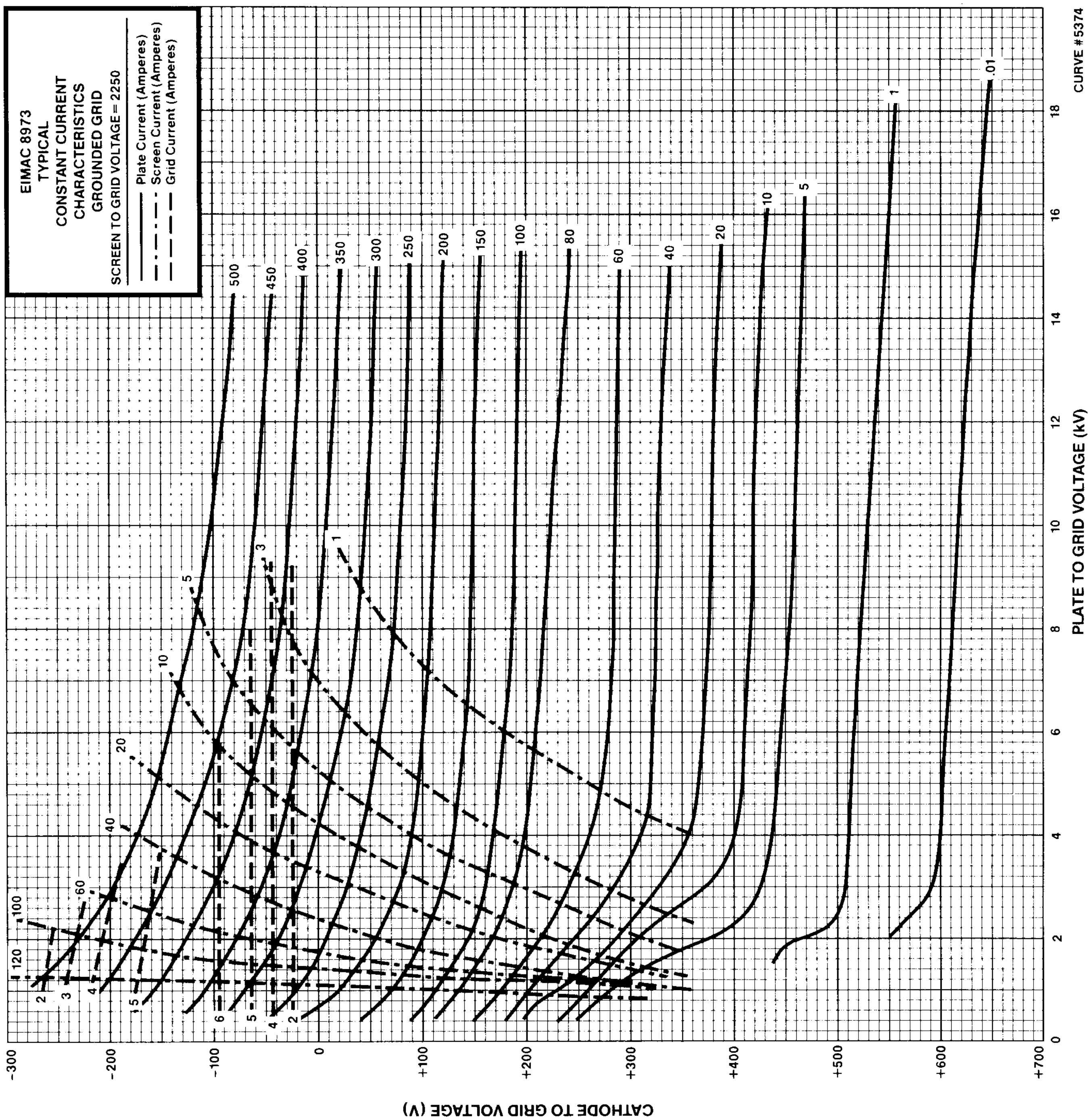
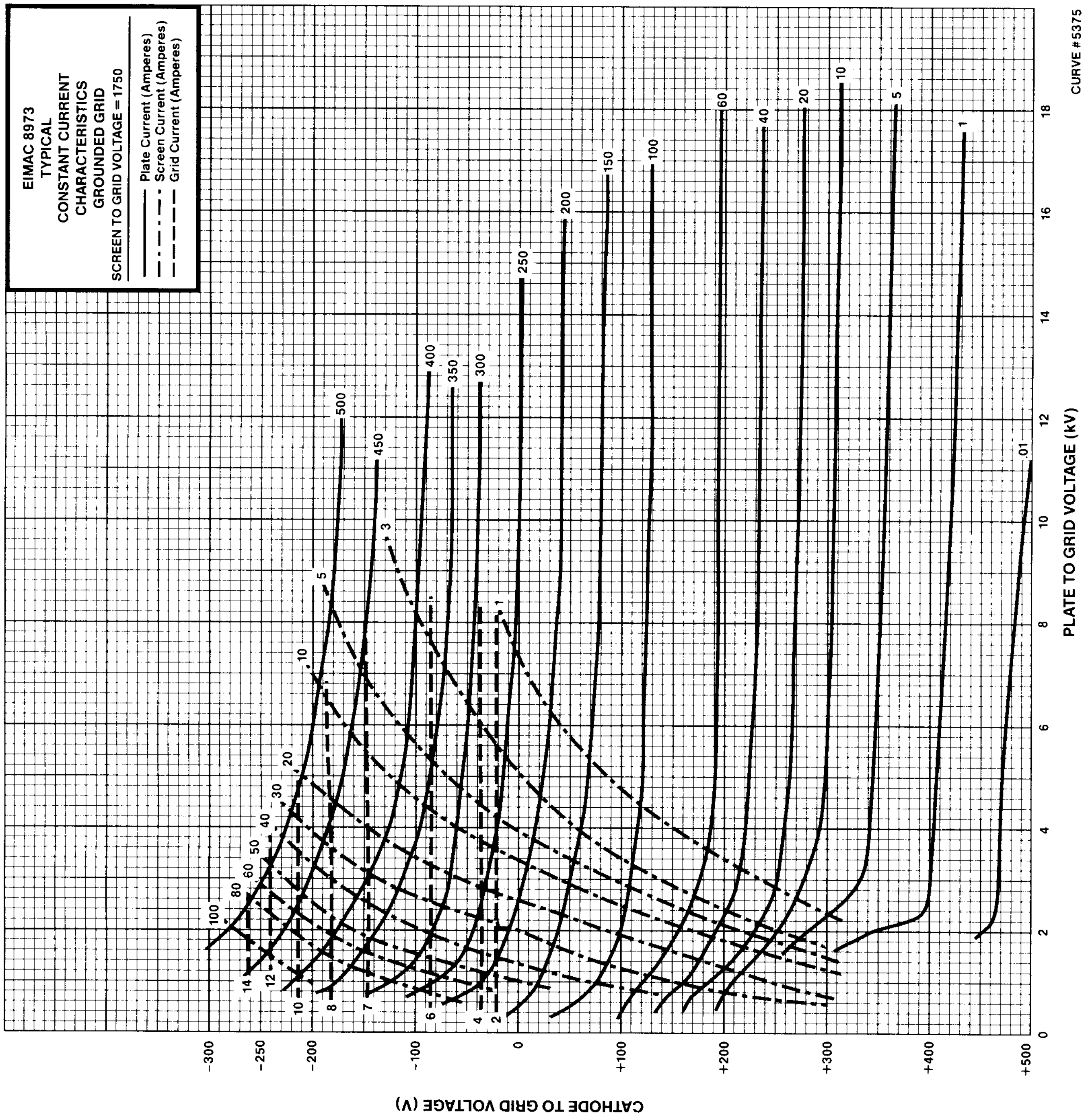
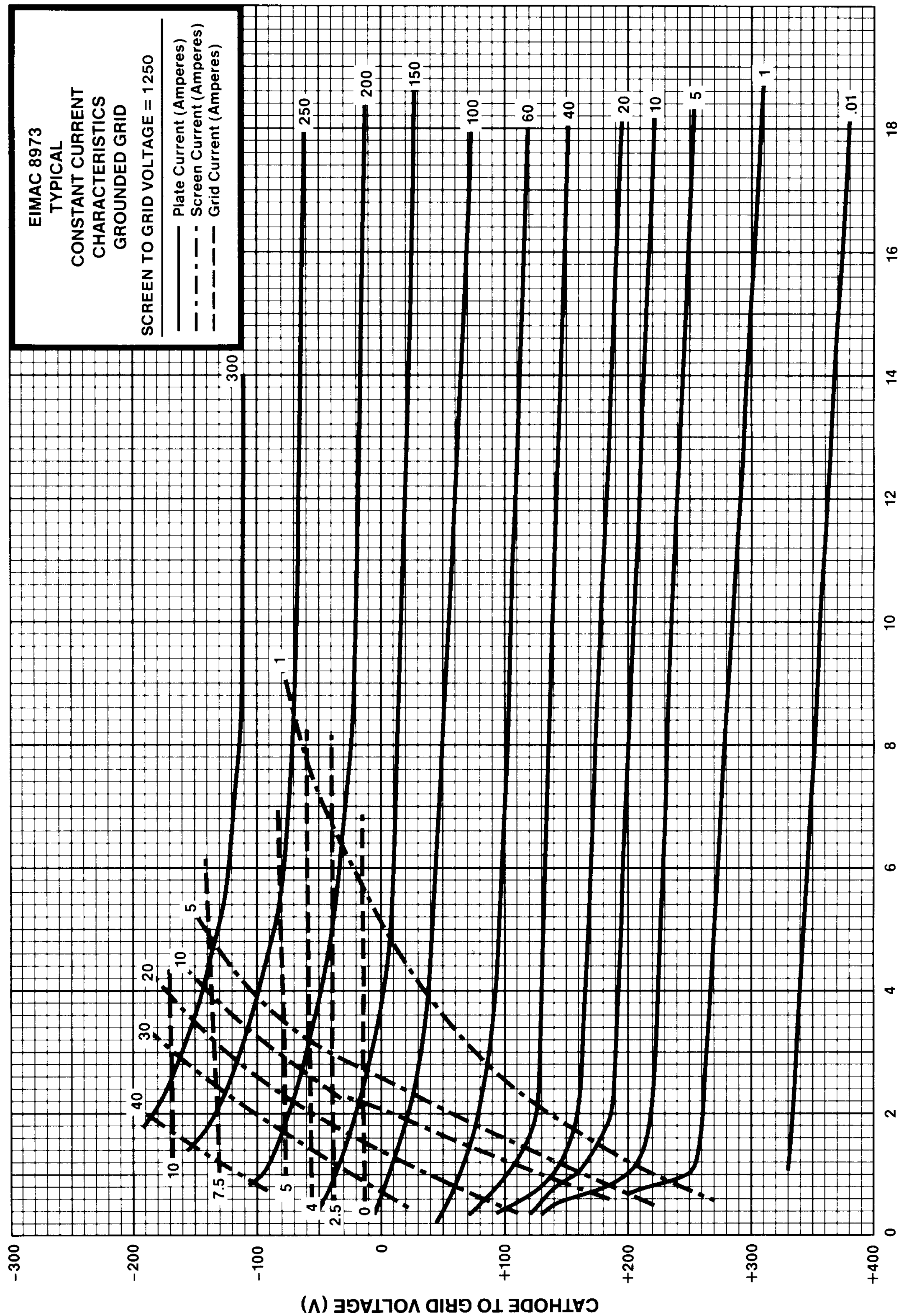
3
1
25
15
5
1
.2


EIMAC 8973
TYPICAL
CONSTANT
CURRENT CHARACTERISTICS
SCREEN VOLTAGE = 1000
LEGEND:
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
PLATE VOLTAGE (kV)
GRID VOLTAGE (V)
CURVE #5367

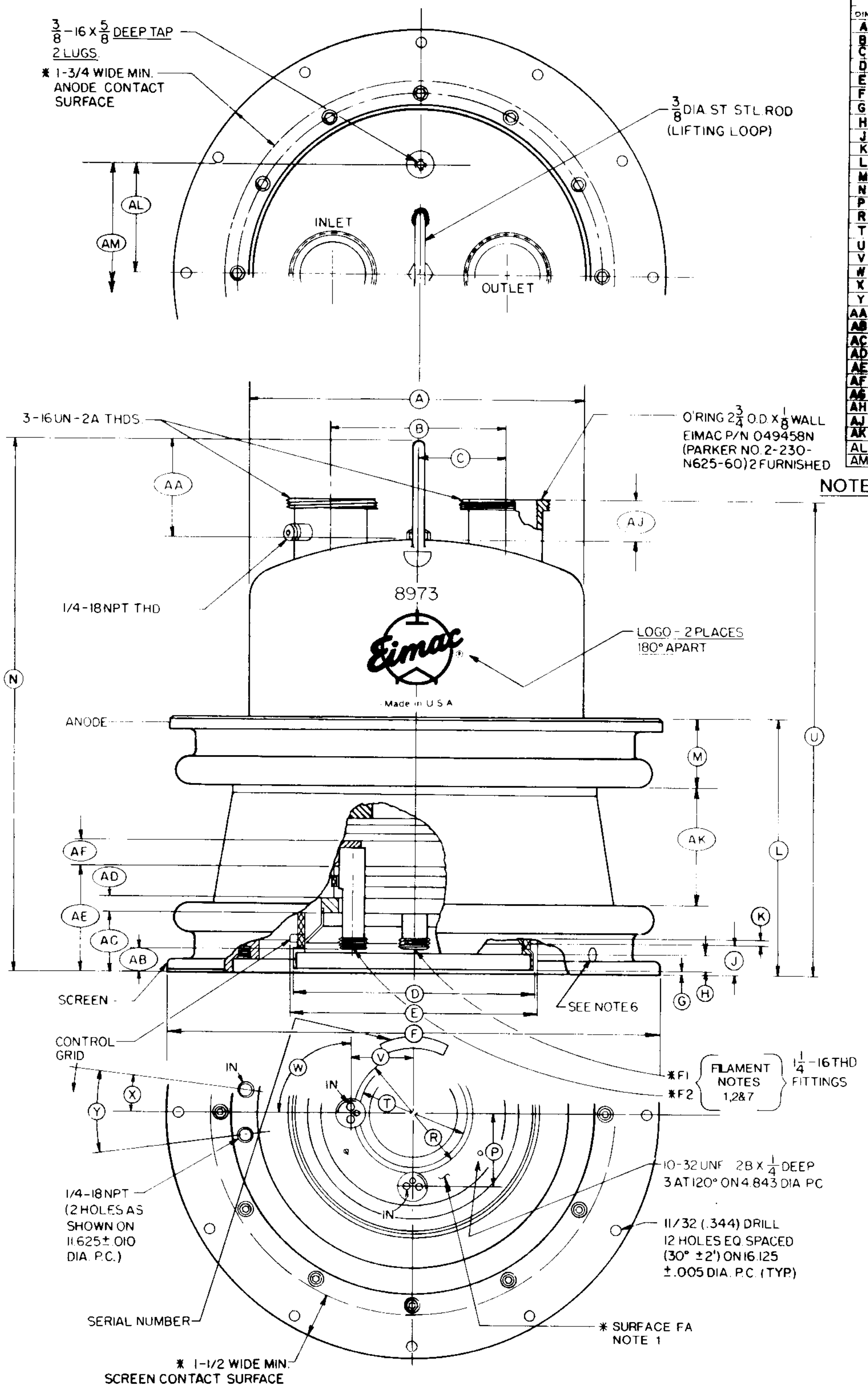

EIMAC 8973
TYPICAL
CONSTANT
CURRENT CHARACTERISTICS
SCREEN VOLTAGE = 500
LEGEND:
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
PLATE VOLTAGE (kV)
GRID VOLTAGE (V)
CURVE #5369


EIMAC 8973
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
SCREEN TO GRID VOLTAGE = 2250
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
PLATE TO GRID VOLTAGE (kV)
CATHODE TO GRID VOLTAGE (V)
CURVE #5374


EIMAC 8973
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
SCREEN TO GRID VOLTAGE = 1750
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
PLATE TO GRID VOLTAGE (kV)
CATHODE TO GRID VOLTAGE (V)
CURVE #5375


EIMAC 8973
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
SCREEN TO GRID VOLTAGE = 1250
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
PLATE TO GRID VOLTAGE (kV)
CATHODE TO GRID VOLTAGE (V)

CURVE #5371



DIMENSIONAL DATA

DIM	INCHES MIN	INCHES MAX	INCHES REF	MILLIMETERS MIN	MILLIMETERS MAX	MILLIMETERS REF
A	11.440	11.560		290.58	293.62	
B			6.000			152.40
C			3.000			76.20
D	8.255	8.265		209.17	209.93	
E	8.485	8.525		215.52	216.54	
F	16.970	17.030		431.04	432.56	
G			.025			.635
H	.310			7.87		
J	.900	1.000		22.86	25.40	
K	.180			4.57		
L	8.700	8.900		220.98	226.06	
M			2.375			60.32
N	18.500	18.750		469.90	476.25	
P			2.500			63.50
R	4.113	4.137		104.47	105.08	
T	3.675	3.699		93.34	93.95	
U	16.250	16.500		412.75	419.10	
V			2.156			54.76
W			90°			
X			7-1/2°			
Y			15°			
AA			3.575			90.80
AB			.720			18.29
AC	1.950	2.100		49.53	53.34	
AD	.450			11.43		
AE	3.560	3.680		90.42	93.47	
AF	.725			18.42		
AG						
AH						
AJ			1.375			34.92
AK			4.093			103.96
AL			4.000			101.60
AM			8.000			203.20

NOTES:
1. CIRCUIT RETURN MAY BE MADE TO FA BY SK-2315 CONNECTOR
2. MATE WITH EIMAC CONNECTOR SK-2310
3. DC RETURN SHOULD BE MADE TO F2
4. REF. DIMS. ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES
5. (✱) CONTACT SURFACES
6. 1/4 DIA. WATER DRAIN HOLE - 3 PLACES.
7. A TUBE OF ANTI-SEIZE THREAD LUBRICANT IS PROVIDED WITH TUBE TO PREVENT GALLING OF FILAMENT CONNECTOR THREADS, SEE INSTR. SHEET E14-1.2 ATTACHED TO TUBE