



TECHNICAL DATA

3CX3000A7
8162

3CX3000F7
HIGH-MU
AIR COOLED
POWER TRIODES

The EIMAC 3CX3000A7 high-mu forced-air cooled power triode provides relatively high power output as an amplifier, oscillator, or modulator at low plate voltages. The tube has a low inductance cylindrical filament-stem structure which readily becomes part of a linear filament tank circuit for VHF operation. The grid provides good shielding between the input and output circuits for grounded-grid applications and conveniently terminates in a ring between the plate and filament terminals.

Operation with zero grid bias in many applications offers circuit simplicity by eliminating the bias supply. Grounded-grid operation is attractive, since a power gain of over 20 times can be obtained.

The 8162/3CX3000F7 tube is identical except for the addition of flexible leads on the base for grid and filament connections which can simplify socketing in low-frequency applications.

3CX3000A7



3CX3000F7



GENERAL CHARACTERISTICS¹

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	7.5 ± 0.37	V
Current @ 7.5 V	51.5	A

Amplification Factor (average)	160
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Direct Interelectrode Capacitances (grounded filament)²

Cin	38.0	pF
Cout	0.6	pF
Cgp	24.0	pF

Direct Interelectrode Capacitances (grounded grid)²

Cin	38.0	pF
Cout	24.0	pF
Cpk	0.6	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. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture, in accordance with Electronic Industries Association Standard RS-191.



3CX3000A7/F7

Frequency of Maximum Rating: 3CX3000A7 110 MHz
3CX3000F7 75 MHz

MECHANICAL

Maximum Overall Dimensions:

Length (3CX3000A7) 9.000 In; 227.60 mm
(3CX3000F7, incl. fil. leads) 18.437 In; 468.30 mm
Diameter (both types) 4.156 In; 105.56 mm
Operating Position Vertical, base up or down
Net Weight: (3CX3000A7) (Approx.) 6.2 Lb; 2.8 kg
(3CX3000F7) (Approx.) 7.0 Lb; 3.2 kg
Cooling Forced Air
Base (3CX3000A7) Special Coaxial
(3CX3000F7) Special with Flying Leads

Maximum Operating Temperature:

Anode Core and Ceramic/Metal Seals 250°C
3CX3000F7 Filament Lead/Tube Base Junctions 150°C

RADIO FREQUENCY LINEAR AMPLIFIER
CATHODE DRIVEN
Class AB2

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB2, Peak Envelope or Modulation
Crest Conditions

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE 5000 VOLTS
DC PLATE CURRENT 2.5 AMPERES
PLATE DISSIPATION 4000 WATTS
GRID DISSIPATION 225 WATTS

Plate Voltage 4000 4800 4800 Vdc
Zero-Signal Plate Current1 0.25 0.35 0.35 Adc
Single-Tone Plate Current 2.00 1.68 2.00 Adc
Single-Tone Grid Current1 0.61 0.46 0.60 Adc
Peak Driving Power 420 293 410 w
Plate Dissipation 2285 2275 2775 W
Single-Tone Plate
Output Power 6030 6000 7266 W
Resonant Load Impedance 1210 1720 1425 Ω
Driving Impedance 47.5 50.0 46.3 Ω

1. Approximate value.

RADIO FREQUENCY LINEAR AMPLIFIER
GRID DRIVEN
Class AB2

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB2, Grid Driven, Carrier Conditions

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE 5000 VOLTS
DC PLATE CURRENT 2.5 AMPERES
PLATE DISSIPATION 4000 WATTS
GRID DISSIPATION 225 WATTS

Plate Voltage 4000 Vdc
Zero-Signal Plate Current1 0.25 Adc
DC Plate Current 0.74 Adc
DC Grid Current1 0.13 Adc
Peak rf Grid Voltage1 85.0 v
Peak Driving Power1 11.5 w
Plate Dissipation 1830 W
Single-Tone Plate Output Power 1130 W
Resonant Load Impedance 1750 Ω
Peak rf Plate Voltage 2000 v

1. Approximate value.

RADIO FREQUENCY POWER AMPLIFIER
Class C Telegraphy or FM, Cathode Driven
(Key-down Conditions)

TYPICAL OPERATION (Frequencies to 110 MHz for
3CX3000A7, to 30 MHz for 3CX3000F7)

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE 5000 VOLTS
DC PLATE CURRENT 2.5 AMPERES
PLATE DISSIPATION 4000 WATTS
GRID DISSIPATION 225 WATTS

Plate Voltage 3500 4800 Vdc
Grid Voltage -50 -60 Vdc
Plate Current 1.30 1.54 Adc
Grid Current1 0.42 0.48 Adc
Peak rf Cathode Voltage1 220 267 v
Calculated Driving Power1 310 435 W
Plate Dissipation 985 1480 W
Useful Output Power2 3300 5500 W

1. Approximate value.

2. Output circuit and filter loss of 10% assumed.



HIGH-LEVEL MODULATED RADIO-FREQUENCY AMPLIFIER PULSE-WIDTH MODULATION - Grid Driven

ABSOLUTE MAXIMUM RATINGS:

	RF Amplifier	Switching Modulator	
DC PLATE VOLTAGE	5.5	15.0	KILOVOLTS
DC PLATE CURRENT	2.5	2.5	AMPERES
DC GRID VOLTAGE	-500	-500	VOLTS
PLATE DISSIPATION	4000	4000	WATTS
GRID DISSIPATION	225	225	WATTS

TYPICAL OPERATION (Carrier Conditions)¹

	RF Amplifier	Switching Modulator
Plate Voltage	5.0	13.7 kVdc
Plate Current	1.25	0.53 Adc
Grid Voltage	-240	-125 Vdc
Grid Current ²	0.8	0.6 Adc
Useful Power Output ²	5.5	6.25 kW

1. These conditions assume rectangular drive waveform and a third harmonic, high-efficiency "Tyler" circuit.
2. Approximate value.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class AB 2, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS: (Per Tube)

DC PLATE VOLTAGE	5000 VOLTS
DC PLATE CURRENT	2.5 AMPERES
PLATE DISSIPATION	4000 WATTS
GRID DISSIPATION	225 WATTS

1. Approximate value.
2. Per tube.

TYPICAL OPERATION (Two Tubes)

Plate Voltage	4000 Vdc
Zero-Signal Plate Current ¹	0.50 Adc
Max. Signal Plate Current	3.58 Adc
Max. Signal Grid Current ¹	0.58 Adc
Peak af Grid Voltage ²	190 v
Peak Driving Power ³	115 w
Max. Signal Plate Dissipation	1850 W
Plate Output Power	10,500 W
Load Resistance (plate to plate)	2720 Ω

3. Nominal drive power is one-half peak power.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.
Filament: Current @ 7.5 volts	48.0	54.0 A
Interelectrode Capacitances¹ (grounded filament connection)		
Cin	30.0	45.0 pF
Cout	---	1.0 pF
Cgp	20.0	28.0 pF
Interelectrode Capacitances¹ (grounded grid connection)		
Cin	30.0	45.0 pF
Cout	20.0	28.0 pF
Cpk	---	1.0 pF
Zero Bias Plate Current (E b = 5000 volts)	0.36	0.52 A
Cut-off Bias (E b = 5000 volts, I b = 1.0 mA dc)	---	-45.0 V

1. Capacitance values are for a cold tube as measured in a shielded fixture.

APPLICATION

MECHANICAL

MOUNTING - The 3CX3000A7 and 3CX3000F7 must be mounted vertically, base down or up at the convenience of the circuit designer. The filament connections

to the 3CX3000A7 should be made through spring collets. These are available from EIMAC with the following part numbers:

- 149575 Inner line collet
- 149576 Outer line collet



Reasonable care should be taken that these collets do not impart undue strain to the terminals or the base of the tube.

COOLING - The maximum temperature rating for the anode core and the ceramic/metal seal areas of either tube is 250°C, and sufficient forced-air cooling must be provided to assure operation at safe tube temperatures. Tube life is usually prolonged if cooling in excess of absolute minimum requirements is provided for cooler tube temperatures.

The filament leads of the 3CX3000F7 are attached to the tube with soft solder, and care must therefore be taken to supply sufficient cooling to this area of the tube to maintain temperatures below 150°C to avoid melting or loosening of these leads.

Minimum air flow requirements to maintain anode core and ceramic/metal seal areas below 225°C at sea level with an inlet-air temperature of 40°C are tabulated for air-flow in the base-to-anode and anode-to-base directions. At higher ambient temperatures, frequencies above 30 MHz, or at higher altitudes, a greater quantity of air will be required.

With air flowing in a base-to-anode direction, and with the specified air also flowing past the base section of the tube, no additional base cooling of either type is normally required. With air flowing in an anode-to-base direction, both types require additional cooling air directed into the filament stem structure, between the inner and outer filament terminals, in the amount of 5 cfm minimum, directed by an appropriate air nozzle or pipe.

It is suggested that temperatures, especially in the base area of the tube, be monitored in any new installation to insure proper cooling. Temperatures may be measured with any of the available temperature-sensing paint or crayon materials.

Base-to-Anode Air Flow				
Sea Level			5,000 Feet	
Anode Dissipation watts	Air Flow CFM	Pressure Drop Inches water	Air Flow CFM	Pressure Drop Inches water
2500	36	0.60	43	0.72
4000	67	1.20	80	1.45
Anode-to-Base Air Flow				
2500	42	0.70	50	0.84
4000	84	1.70	101	2.00

ELECTRICAL

FILAMENT OPERATION - The filament voltage, as measured at the filament terminals, should be 7.5 volts, with maximum allowable variation due to line fluctuations of from 7.12 to 7.87 volts.

INTERLOCKS - An interlock device should be provided to insure that cooling air flow is established before application of electrical power, including the heater. The circuit should be so arranged that rf drive cannot be applied in the absence of normal plate voltage.

INPUT CIRCUIT - When operated as a grounded-grid rf amplifier, the use of a matching network in the cathode circuit is recommended. For best results with a single-ended amplifier, and depending on the application, it is suggested the network have a "Q" of at least 5, and higher if possible.

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 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

Many EIMAC power tubes, such as these, are specifically designed to generate or amplify radio frequency power. There may be a relatively strong rf field in the general proximity of the power tube and its associated circuitry--the more power involved, the stronger the rf field. Proper enclosure design and efficient coupling of rf energy to the load will minimize the rf field in the vicinity of the power amplifier unit itself.

FAULT PROTECTION - In addition to normal cooling airflow interlock and plate over-current interlock it is good practice to protect the tube from internal damage which could result from occasional plate arcing at high plate voltage.

In all cases some protective resistance



should be used in series with the tube anode to absorb power supply stored energy in case a plate arc should occur. EIMAC Application Bulletin #17, titled "FAULT PROTECTION" is available on request.

HIGH VOLTAGE - Normal operating voltages used with these tubes 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.

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, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure

as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers.

The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

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

SPECIAL APPLICATION - If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California, 94070, for information and recommendations.

DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	4.094	4.156	--	103.99	105.56	--
B	0.781	0.844	--	19.83	21.44	--
C	2.990	3.010	--	75.95	76.45	--
D	0.615	0.635	--	15.62	16.13	--
E	1.490	1.510	--	37.85	38.35	--
F	--	3.625	--	--	92.08	--
G	0.813	0.937	--	20.65	23.80	--
H	1.375	1.625	--	34.92	41.28	--
J	0.391	0.422	--	9.93	10.72	--
K	3.875	4.250	--	98.43	107.95	--
L	2.937	3.063	--	74.60	77.80	--
N	1.187	1.687	--	30.15	42.85	--
P	8.000	9.000	--	203.20	228.60	--
Q	0.687	0.813	--	17.45	20.65	--

NOTES:
1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.



OPERATING HAZARDS

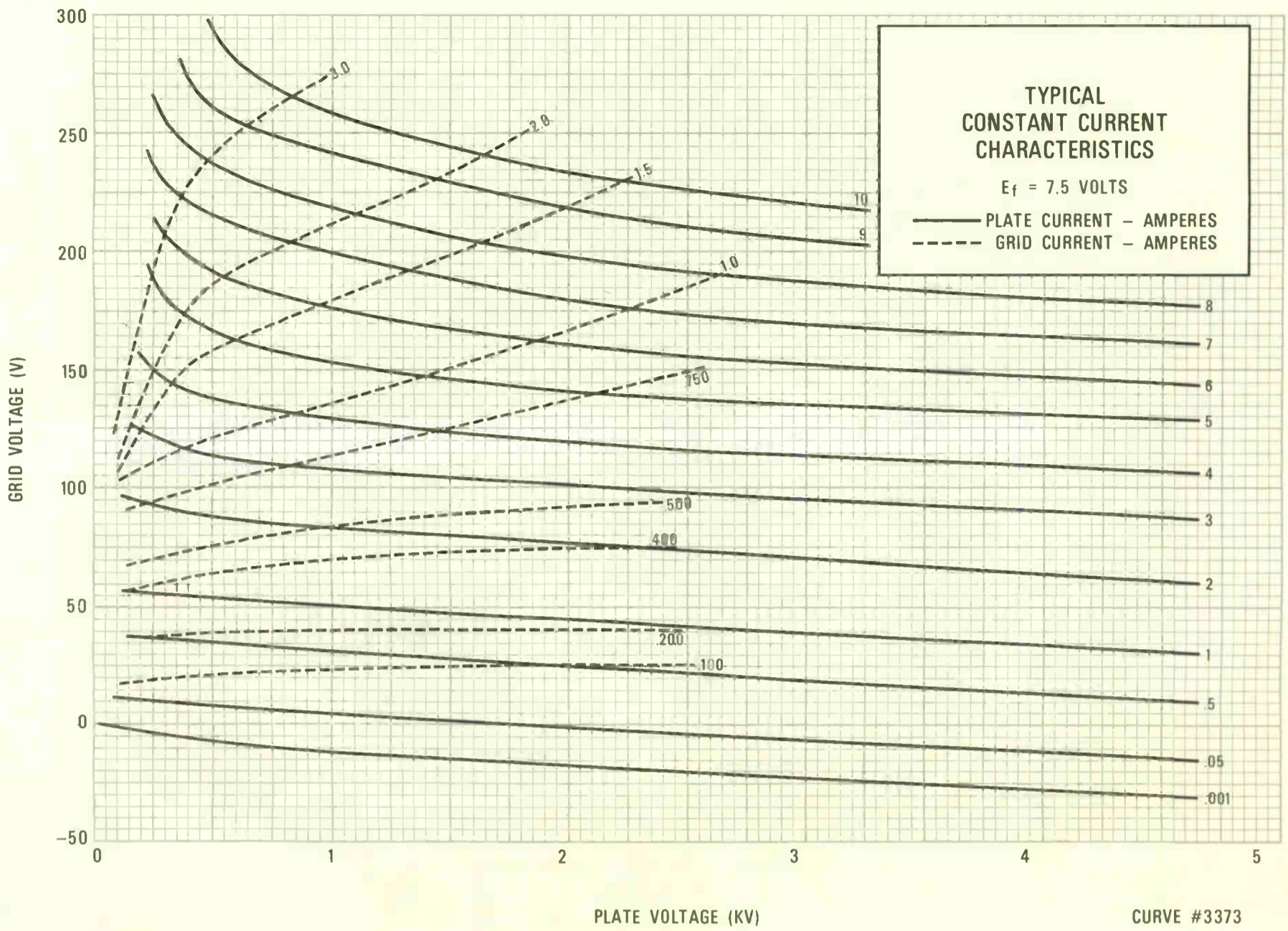
PROPER USE AND SAFE OPERATING PRACTICES WITH RESPECT TO POWER TUBES ARE THE RESPONSIBILITY OF EQUIPMENT MANUFACTURERS AND USERS OF SUCH TUBES. ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES OR EQUIPMENT WHICH UTILIZES SUCH TUBES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS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

The operation of power tubes involves one or more of 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.
- b. *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 AFFECTED.*
- c. *X-RAY RADIATION* - High voltage tubes can produce dangerous and possibly fatal x-rays.
- d. *BERYLLIUM OXIDE POISONING* - Dust or fumes from BeO ceramics used as thermal links with some conduction-cooled power tubes are highly toxic and can cause serious injury or death.
- e. *GLASS EXPLOSION* - Many electron tubes have glass envelopes. Breaking the glass can cause an implosion, which will result in an explosive scattering of glass particles. Handle glass tubes carefully.
- f. *HOT WATER* - Water used to cool tubes may reach scalding temperatures. Touching or rupture of the cooling system can cause serious burns.
- g. *HOT SURFACES* - Surfaces of air-cooled radiators and other parts of tubes can reach temperatures of several hundred degrees centigrade and cause serious burns if touched.

Please review the detailed operating hazards sheet enclosed with each tube or request a copy from the address shown below: Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070.

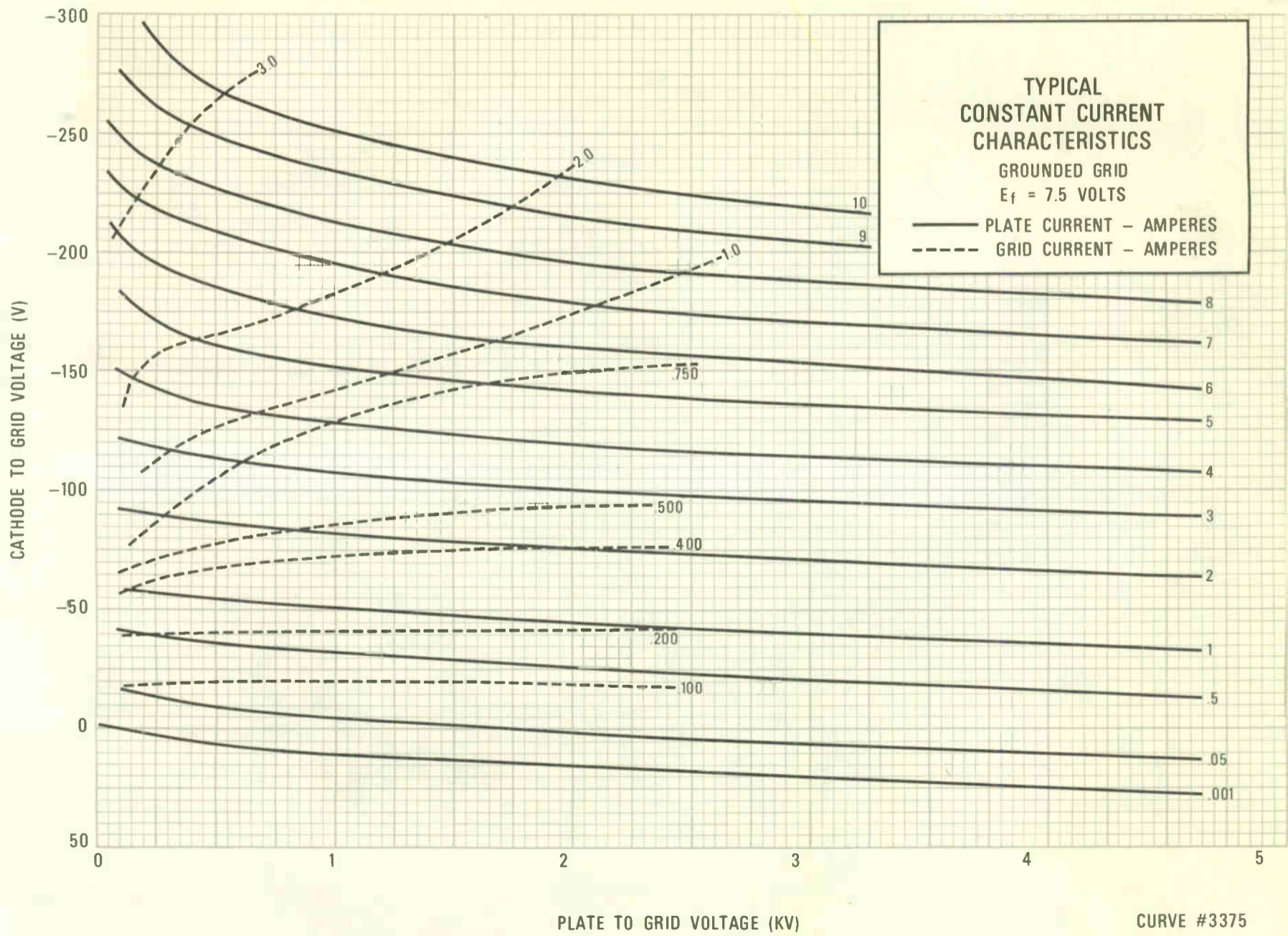
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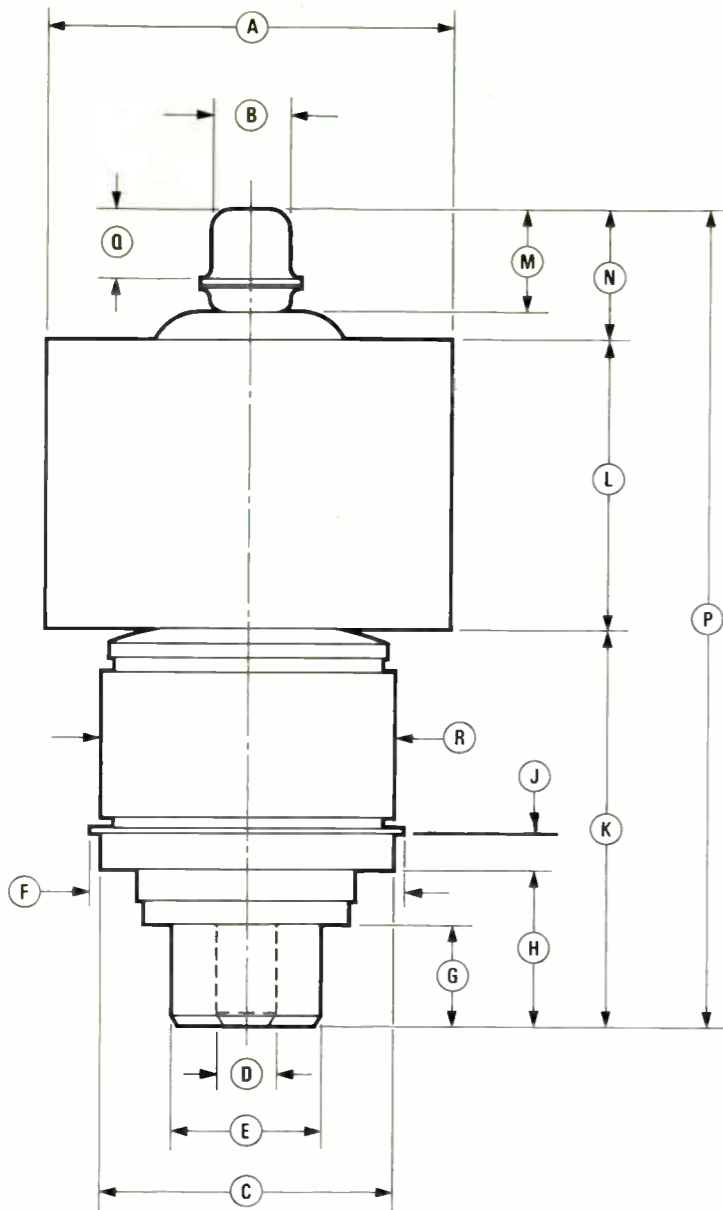
3CX3000A7/F7



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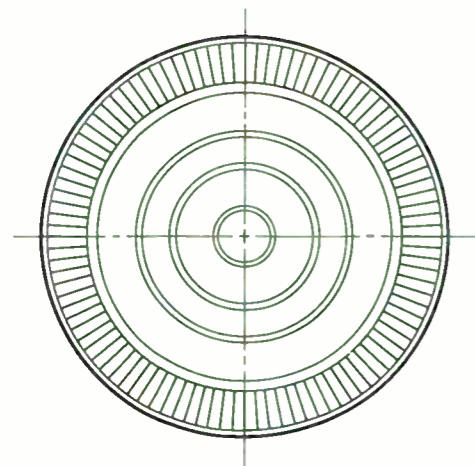
3CX3000A7/F7



DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	4.094	4.156	--	103.99	105.56	--
B	0.781	0.844	--	19.83	21.44	--
C	2.990	3.010	--	75.95	76.45	--
D	0.615	0.635	--	15.62	16.13	--
E	1.490	1.510	--	37.85	38.35	--
F	--	3.625	--	--	92.08	--
G	0.813	0.937	--	20.65	23.80	--
H	1.375	1.625	--	34.92	41.28	--
J	0.391	0.422	--	9.93	10.72	--
K	3.875	4.250	--	98.43	107.95	--
L	2.937	3.063	--	74.60	77.80	--
N	1.187	1.687	--	30.15	42.85	--
P	8.000	9.000	--	203.20	228.60	--
Q	0.687	0.813	--	17.45	20.65	--

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3CX3000A7



DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	4.094	4.156	--	103.99	105.56	--
B	0.781	0.844	--	19.84	21.44	--
C	--	3.625	--	--	92.08	--
D	6.375	6.625	--	161.93	168.28	--
E	0.859	0.890	--	21.82	22.61	--
F	0.812	0.937	--	20.62	23.80	--
G	0.687	0.813	--	17.45	20.65	--
H	7.000	7.500	--	177.80	190.50	--
K	0.375	0.437	--	9.53	11.00	--
M	7.000	7.500	--	177.80	190.50	--
N	1.375	1.625	--	34.93	41.28	--
P	7.937	8.437	--	201.60	214.30	--
Q	3.875	4.250	--	98.43	107.95	--
R	2.937	3.063	--	74.60	77.80	--
S	1.187	1.687	--	30.15	42.85	--
T	8.000	9.000	--	203.20	228.60	--
U	8.937	9.437	--	227.00	239.70	--
V	0.194	0.200	--	4.93	5.08	--
W	0.385	0.395	--	9.78	10.03	--

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3CX3000F7

