MEDIUM-MU AIR-COOLED POWER TRIODE 3CX15,000H3

The EIMAC 3CX15,000H3 is an air cooled, ceramic-metal, medium-mu power triode designed primarily for use in broadcast and industrial radio-frequency heating services. Its air-cooled anode is rated at 15 kW of plate dissipation.

Full ratings apply up to 90 MHz. Plentiful reserve emission is available from its one kilowatt filament. The grid structure is rated at 500 watts making this tube an excellent choice for severe applications.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	6.3 ± 0.3	V
Current @ 6.3 Volts	156	A
Amplification Factor, Average	20	
Direct Interelectrode Capacitances (grounded cathode)[2]		
Cin	60	pF
Cout	2.5	pF
Cgp	39	pF
Frequency of Maximum Ratings (CW)	90	MHz

MECHANICAL

Maximum Overall Dimensions:	
Length (Excluding Leads)	8.75 in; 222.25 mm
Diameter	7.05 in; 179.07 mm
Net Weight	13 lbs.
Operating Position	Vertical, base up or down
Maximum Operating Temperature:	250°C
Cooling:	Forced Air
Base	See Outline

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. CPI Eimac Division should be consulted before using this information for final equipment design.

[2] Capacitance values are for a cold tube.

RADIO FREQUENCY INDUSTRIAL OSCILLATOR
Class C (Filtered DC Power Supply)

MAXIMUM RATINGS:

DC ANODE VOLTAGE	12	kV
DC GRID VOLTAGE	-1000	V
DC ANODE CURRENT	6.0	A
DC GRID CURRENT	1.0	A
ANODE INPUT POWER	60	kW
ANODE DISSIPATION	15	kW

TYPICAL OPERATION:*

DC Anode Voltage	7000	10,000	V
DC Anode Current	6.0	5.0	A
DC Grid Voltage	-600	-800	V
DC Grid Current	0.660	0.542	A
Peak Positive Grid Voltage	440	400	V
Driving Power	660	650	W
Anode Input Power	42	50	kW
Anode Dissipation	12	8.8	kW
Anode Output Power	30	41.2	kW
Approximate Load Impedance	600	1025	Ohms

* Loaded Conditions.

NOTE: TYPICAL OPERATION data are obtained from direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified anode current at the specified bias and anode 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 anode current is obtained is incidental and may vary from tube to tube. This current variation causes no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. In the case of Class C Service, 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 @ 6.3 Volts	148	164	A
Interelectrode Capacitances[1] (grounded cathode)			
Cin	55	65	pF
Cout	2.0	3.0	pF
Cgp	35	43	pF

[1] Capacitance values are for a cold tube in accordance with Electronic Industries Association Standard RS-191.

APPLICATION

MECHANICAL

HANDLING – These product contains a thoriated-tungsten filament and should be protected from shock and vibration. It is recommended that the tube be removed from equipment that is being shipped, to prevent damage that may occur in transit.

STORAGE – If a tube is to be stored as a spare it should be kept in its original shipping carton, with the original packing material, to minimize the possibility of handling damage. Before storage a new tube should be operated in the equipment for 100 to 200 hours to establish it has not been damaged and operates properly (see Filament Operation for recommendations on initial value of filament voltage during this operation period). If the tube is still in storage 6 months later, it again should be operated in the equipment for 100 to 200 hours to make sure there has been no degradation. If operation is satisfactory, the tube can again be stored with great assurance of being a known-good spare.

MOUNTING - The 3CX15,000H3 must be operated with its axis vertical. The base of the tube may be down or up at the convenience of the circuit designer. A grid contact flange is provided for bolting to a strap or a grid deck. Heavy flexible leads are provided for applying the filament voltage.

COOLING - The maximum temperature rating for the 3CX15,000H3 is 250ºC. Sufficient forced-air circulation

must be provided to keep the temperature of the anode at the base of the cooling fins and the temperature of the ceramic-metal seals below 250ºC. Air-flow requirements to maintain seal temperature at 225ºC in 50ºC ambient air are tabulated below (for operation below 30 MHz.

(Anode to Base Air Flow)

Anode* Dissipation (Watts)	SEA LEVEL		5,000 FEET	
	Air Flow (CFM)	Pressure Drop (In. of Water)	Air Flow (CFM)	Pressure Drop (In. of Water)
7500	361	1.63	433	1.96
10,000	606	3.26	728	3.92
15,000	1260	10.00	1510	12.00

*Since the power dissipated by the filament represents about 1100 watts and since grid dissipation can, under some conditions represent another 500 watts, allowance has been made in preparing this tabulation for an additional 1600 watts.

Additional stem cooling air must be provided. 16 CFM of air directed against the center filament contact ring ½" below the outer filament contact ring by a 1-1/2" I.D. air duct arranged at a 45º angle with the center line of the tube will provide adequate cooling for maximum frequency of 30 MHz, 50ºC ambient, and 5000 ft. altitude.

ELECTRICAL

FILAMENT OPERATION – For the 3CX15,000H3 the rated filament voltage is 6.3 volts. Filament voltage, as measured at the socket, should be maintained at 6.3 volts plus or minus five percent for long tube life and consistent performance. Maximum life will be obtained by operation at minus 5 percent.

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 CPI/Eimac for additional information.

With a new tube, or one which has been in storage for some period of time, operation with filament voltage only, at the nominal value of 6.3 volts, applied for a period of 30 to 60 minutes is recommended before full operation begins. This allows the active getter material mounted within the filament structure to absorb any residual gas molecules which have accumulated during storage. Once normal operation has been established a minimum filament warm-up time of five seconds is normally sufficient.

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). The voltage should then be increased a few tenths of a volt above the value where performance degradation was noted for operation. 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 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 valuable information and is available on request.

IN-RUSH – When cold, the resistance of a thoriated-tungsten filament is very low, therefore the initial starting (in-rush) current when filament voltage is applied can be many times the normal (hot) current; this can be detrimental to the longevity of a filament structure. Filament in-rush current should never exceed a value of twice the nominal rated current. The use of a special impedance-limited filament transformer or other "step-start" circuitry in the supply side (primary) of the filament transformer is recommended.

CONTROL GRID OPERATION – The grid current rating is one ampere dc. This value should not be exceeded for more than very short periods such as during tuning. Over-current protection in the grid circuit should be provided. Ordinarily it will not be necessary to operate with more than 0.4 to 0.7 amperes grid current to obtain reasonable efficiency. In industrial heating service with varying loads, grid current should be monitored continuously with a dc current meter. The maximum grid dissipation rating is 500 watts.

ANODE OPERATION – Maximum anode voltage rating of 12,000 volts and maximum anode current of 6.0 amps should not be applied simultaneously as rated anode dissipation may be exceeded.

Anode over-current protection should be provided to remove anode voltage quickly in the event of an over-load or an arc-over at the load. In addition current limiting power supply resistors should be used. These precautions are especially important in industrial service with its wide variations in loading.

Spark gaps from anode to ground should be used to prevent transient voltages from flashing across the tube envelope during any fault conditions.

HIGH VOLTAGE - The 3CX15,000H3 operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed 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 the primary circuits of the power supplies 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 connectors 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; however, in the case of the 3CX15,000H3, no special shielded fixture is used due to the length of the filament leads. 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 mounting which represents approximate final layout if capacitance values are highly significant in the design.

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.

SPECIAL APPLICATIONS - If it is desired to operate these tubes under conditions widely differ from those given here, contact the Application Engineering Dept., CPI Eimac Division, Palo Alto, CA for information and recommendations.

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 and are exposed to power tubes, or equipment that utilizes such tubes, must take precautions to protect 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.

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

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.

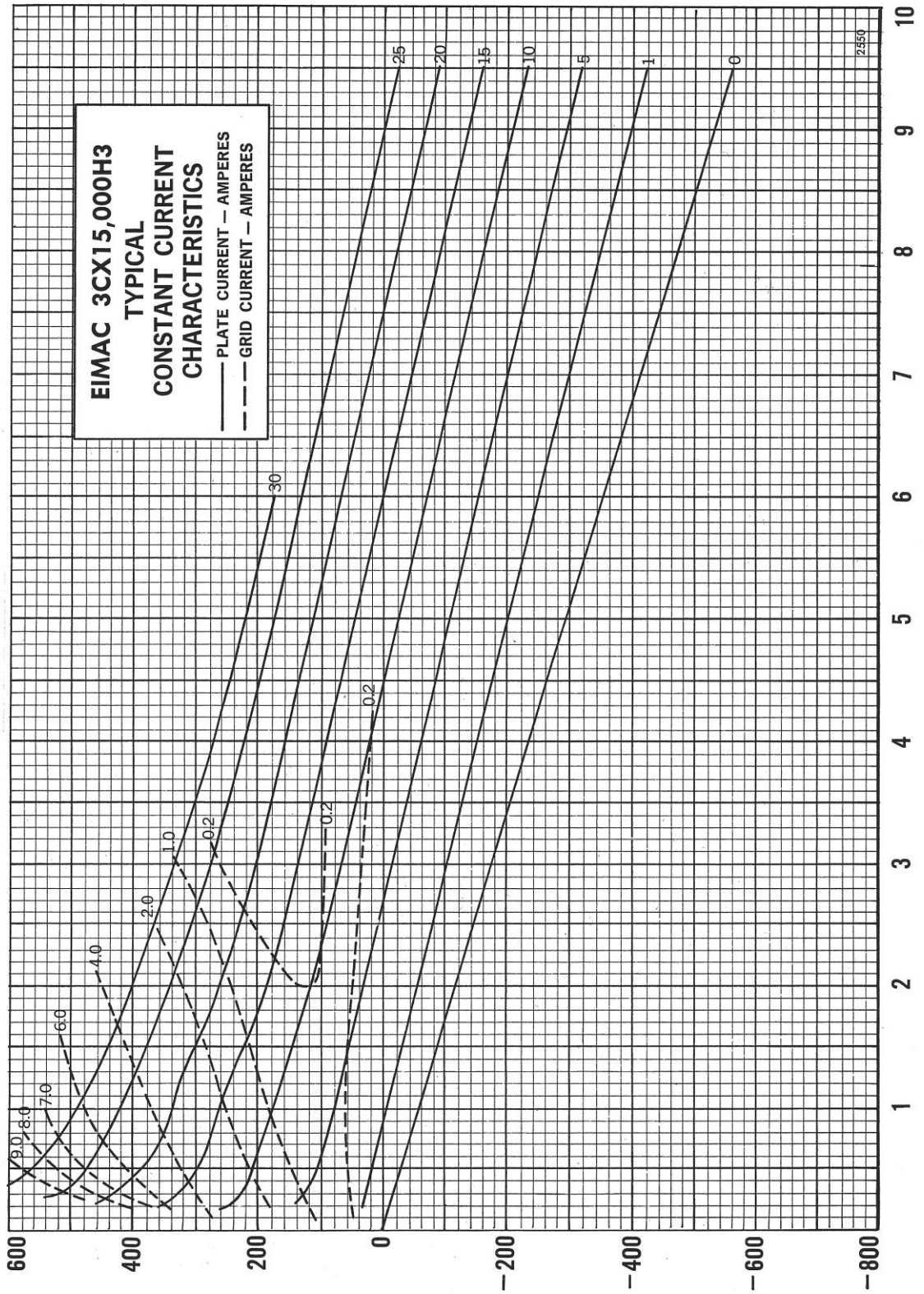
RF RADIATION – Exposure to strong rf fields should be avoided, even at relatively low frequencies. The dangers of rf radiation are more severe at UHF and microwave frequencies and can cause serious bodily and eye injuries. CARDIAC PACEMAKERS MAY BE EFFECTED.

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

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.

MATERIAL COMPLIANCE - This product and package conforms to the conditions and limitations specified in 49CFR 173.424 for radioactive material, excepted package-instruments or articles, UN2910. In addition, this product and package contains no beryllium oxide (BeO).

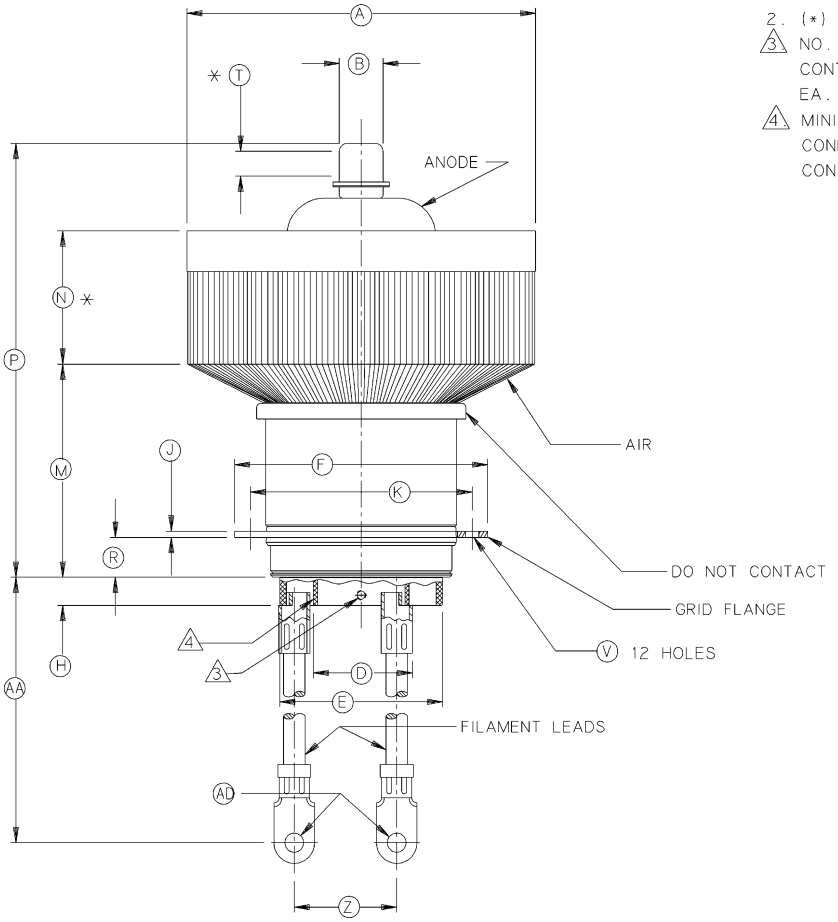
Please review the detailed Operating Hazards sheet enclosed with each tube, or request a copy from CPI, Eimac Division Application Engineering at 650/846-2800.


EIMAC 3CX15,000H3
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
25
20
15
10
5
1
0
2550
30
0.2
0.2
1.0
0.2
2.0
4.0
6.0
7.0
8.0
9.0
600
400
200
0
−200
−400
−600
−800
1
2
3
4
5
6
7
8
9
10
GRID VOLTAGE — VOLTS
PLATE VOLTAGE — KILOVOLTS

3CX15,000H3

DIMENSIONAL DATA						
	INCHES			MILLIMETERS		
DIM.	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	6.928	7.050		175.97	179.07	
B	.855	.895		21.72	22.73	
D			1.875			47.63
E	3.230	3.270		82.04	83.06	
F	5.030	5.090		127.76	129.29	
H	.530	.700		13.46	17.78	
J			.125			3.18
K	4.425	4.445		112.40	112.90	
M	3.950	4.300		100.33	109.22	
N	2.412	2.788		61.26	70.81	
P	8.250	8.750		209.55	222.25	
R	.700	.860		17.78	21.84	
T	.375			9.53		
V			.250			6.35
Z			2.000			50.80
AA	8.500	9.000		215.90	228.60	
AD			.390			9.91

NOTES:
1. REF. DIMS. ARE FOR INFO. ONLY. AND ARE NOT FOR INSPECTION PURPOSES.
2. (*) CONTACT SURFACES.
3. NO. 10-32 TAPPED HOLES IN CONTACT RINGS. (ONE HOLE EA. RING. IN LINE).
4. MINIMUM GAP BETWEEN CONNECTOR AND INNER CONTACT RING TO BE .05.



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