TECHNICAL DATA

HIGH-MU AIR-COOLED POWER TRIODE YC-243

The Eimac YC-243 is a power triode with an anode dissipation rating of 6000 Watts. The high-Mu grid provides high gain and operates with zero bias in class B or AB2 as a linear amplifier or with simple cathode bias it provides good efficiency in class C operation. This tube features large, threaded filament studs and it has an integral grid flange that allows mounting the tube directly to the chassis without the need for a socket.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten		
Voltage	7.0 ± 0.35	V
Current @ 7.0 volts	75	A
Direct Interelectrode Capacitances (grounded grid)[2]		
Cin	42	pF
Cout	24.5	pF
Cpk	0.28	pF
Amplification Factor (average)	165	
Frequency of Maximum Rating (CW)	108	MHz

MECHANICAL

Overall Dimensions:	
Length	9.78 in; 273.8 mm
Diameter	6.125in;156 mm
Weight (approx.)	9.5 lb; 4.3 kg
Operating Position	Vertical, base up or down
Maximum Operating Temperatures:	
Ceramic/Metal Seals & Envelope	250°C
Anode Core	250°C
Cooling	Forced Air
Base	Special, threaded terminals

[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 as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

RADIO FREQUENCY LINEAR AMPLIFIER
Class AB2, Cathode Driven, AM

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	6.0	Kilovolts dc
Anode Current	2.8	Amperes dc
Grid Voltage	-1.0	Kilovolt dc
Anode Dissipation	4	Kilowatts
Grid Dissipation	225	Watts

*Approximate Values [1] No Modulation

RADIO FREQUENCY LINEAR AMPLIFIER
Class AB2, Cathode Driven, SSB

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	7.0	Kilovolts dc
Anode Current	3.5	Amperes dc
Grid Voltage	-1.0	Kilovolt dc
Anode Dissipation	6.0	Kilowatts
Grid Dissipation	225	Watts

RADIO FREQUENCY POWER AMPLIFIER
Class C, Cathode Driven, CW

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	7.0	Kilovolts dc
Anode Current	3.5	Amperes dc
Grid Voltage	-1.0	Kilovolt dc
Anode Dissipation	6.0	Kilowatts
Grid Dissipation	225	Watts

TYPICAL OPERATION, below 30 MHz:
Carrier Conditions

Anode Voltage	4.0	kVdc
Anode Current	0.74	Adc
Cathode Bias Voltage	0	Vdc
Grid Current*[1]	0.13	Adc
Peak Cathode Voltage*[1]	85	V
Driving Power*[1]	90	W
Anode Dissipation*[1]	1.8	kW
Anode Output Power*[1]	1.13	kW
Input Impedance	50	Ohms
Load Impedance*	1750	Ohms

TYPICAL OPERATION, below 30 MHz:
Peak Envelope Conditions

Anode Voltage	4.8	kVdc
Zero-Signal Anode Current	0.35	Adc
Single-Tone Anode Current	2.0	Adc
Peak Driving Power	410	W
Cathode Bias Voltage	12	V
Anode Dissipation*	2.75	kW
Single-Tone Anode Output Power	7.3	kW
Single-Tone Grid Current*	0.6	Adc
Input Impedance	50	Ohms
Load Impedance*	1425	Ohms

*Approximate Values

TYPICAL OPERATION, below 30 MHz:

Anode Voltage	5.4	kVdc
Anode Current	2.3	Adc
Cathode Bias Voltage	60	Vdc
Grid Current	0.45	Adc
Peak Cathode Voltage	225	V
Driving Power	635	W
Anode Dissipation	4.4	kW
Anode Output Power	8	kW
Input Impedance	50	Ohms
Load Impedance	1050	Ohms

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 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.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament Current @ 7.0 Volts	65	78	A
Interelectrode Capacitances[1] (grounded grid)			
Cin	30.0	45.0	pF
Cout	20.0	28.0	pF
Cpk	---	1.0	pF
Zero Signal Anode Current (Ec = 0, Eb = 5.0 kV)	0.36	0.52	A
Cut-off Bias (Eb = 5 kV, Ib = 1.0 mA)	---	- 45.0	V

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

APPLICATION

HANDLING – This 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.

MOUNTING & SOCKETING – The tube must be operated with its axis vertical. The base of the tube may be up or down at the option of the equipment designer. This product contains a thoriated-tungsten filament and should be protected from shock and vibration. No socket is required with this tube. The grid terminates in a flange that is normally grounded directly to the chassis. Connection to the filament is made to threaded terminals on the base. The supplied nuts and washers are used to secure lugs for the filament contact. Filament connecting leads may be made from a stack of thin copper straps or flexible welding cable. Great care must be taken to avoid excessive torque when tightening nuts on the filament studs; 2 ft. lbs. is the maximum allowable torque and any lateral force applied to these terminals should be minimized to prevent undue strain on the ceramic/metal seals. Airflow should be directed against the filament studs on the base whenever filament voltage is applied. An air chimney is necessary in all applications to assure proper flow of air through the cooler fins..

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 that it has not been damaged and operates properly. If the tube is still in storage 6 months later it 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.

COOLING - The maximum temperature rating for the anode core and the ceramic/metal seals of this 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 the absolute minimum requirements is provided.

The table below shows minimum airflow rates for the worst-case anode dissipation (6000 W) with air-flow in two directions. The data reflects an inlet air temperature of 40°C at sea level and applies to operation below 30 MHz. If the tube is used above this frequency additional cooling may be required because of increased rf losses that occur at VHF.

Airflow Direction	Anode Dissipation Watts	Airflow CFM	Approximate Pressure Drop in H_2O
Anode to Base	4500	250	1.0
	5000	300	1.2
	6000	400	1.5
Base to Anode	5000	145	.22
	6000	205	.40

At higher altitudes increased airflow is required; in this case both the airflow and pressure drop values shown must be increased by the following factors: 5000 feet x 1.24; 10,000 feet x 1.46. Additional cooling of the tube base may be required especially if the anode cooling air is not directed past the base first; the preferred configuration is airflow is in the base-to-anode direction, although cooling air supplied in the alternate direction is permissible if of the proper flow rate. An air chimney is suggested to assure air flow is maintained through the anode cooler and its associated fins.

Cooling air should be filtered to remove particles of foreign matter that may become embedded in the anode cooling fins and impair cooling efficiency.

The main ceramic vacuum envelope in this tube is glazed to allow easy cleaning in the event any particulate matter collects on this surface; this procedure should be performed regularly in industrial applications where dust or particles are generated in the environment.

The designer is cautioned that the cooling recommendations shown are absolute values for inlet air and temperature rise conditions shown with no safety factor; it is considered good engineering practice to allow additional air flow for conservatism and to make allowance for variables such as dirty air filters, dirty plate cooling fins, pressure losses in air ducting, etc.

Temperature-sensitive paints are available which will allow a check of temperatures before any design is finalized. EIMAC Application Bulletin AB-20, TEMPERATURE MEASUREMENTS WITH EIMAC POWER TUBES, covers this subject in detail and is available on request.

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 serviceability of the tube may be impaired. In order not to exceed absolute ratings the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that 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. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

FILAMENT OPERATION - With a new tube, or one that has been in storage for some period of time, operation with filament voltage only 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 before commencing operation at full power.

Eimac Application Bulletin #18, EXTENDING TRANSMITTER TUBE LIFE, gives information on the effect of filament voltage on life expectancy.

Filament voltage should be measured at the tube base, using a known-accurate (preferably plus or minus one percent) rms-responding meter.
Variation in filament voltage should be limited to no more than +/- five percent for consistent tube performance.

Filament life may be compromised by excessive on-off cycling. This tube is designed for commercial service with no more than one normal on/off cycle per day. If additional filament cycling is anticipated it is recommended the user contact Application Engineering at CPI/Eimac for additional information.

When cold, the resistance of a thoriated tungsten filament is very low, therefore the initial starting (inrush) 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 inrush 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.

INPUT CIRCUIT – When operated as a cathode-driven amplifier, the use of a resonant circuit in the cathode is recommended. For best results with a linear amplifier, it is suggested the cathode matching network have a "Q" of 2 or more.

ZERO-BIAS OPERATION – At anode voltage less then 5000 Volts the YC-243 may be used with no external bias voltage. Additional bias may be employed to decrease the resting plate current

(with no drive power applied). Above 5000 Volts some cathode bias is necessary to reduce anode dissipation and increase operating efficiency. High power zener diodes or a series-connected string of forward-conducting rectifier diodes are generally suitable for obtaining bias voltage in linear amplifier applications using this tube. In class C service a resistor in the dc cathode return can be employed to establish the necessary cathode bias.

GRID OPERATION

The maximum allowable grid dissipation for the YC-243 is 225 Watts. This can be determined approximately by the product of the dc grid current and the peak positive grid voltage. This value should not be exceeded except during tuning for very short periods. A grid over-current protection circuit with interlock set to trip-off above approx. 0.75 ampere is highly recommended.

FAULT PROTECTION - In addition to normal cooling interlocks and an anode over-current interlock, it is good practice to protect the tube from internal damage which could result from occasional arcing at high plate voltage. In all cases, some protective resistance, at least 10 Ohms, should be used in series with the tube's anode supply to absorb power supply stored energy in case an arc should occur. An electronic crowbar, which will discharge power supply capacitors in a few microseconds after the start of an arc, may be required. The test for each electrode supply is to short each electrode to ground, one at a time, through a vacuum relay switch and a 6-inch length of #30 AGW copper wire. The wire will remain intact if protection is adequate. Eimac Application Bulletin #17, FAULT PROTECTION, contains considerable detail and is available upon request.

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 with tubes made by different manufacturers. 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.

HIGH VOLTAGE - The YC-243 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.

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 body with little attenuation or heating effect. Public health agencies are concerned with the hazard, and the published OSHA (Occupational Safety and Health Administration) or other local recommendations to limit prolonged exposure of rf radiation should be followed.

HOT SURFACES - Air-cooled surfaces and other parts of tubes can reach temperatures of several hundred degrees C and cause serious burns if touched for several minutes after all power is removed.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different

from those given here, contact the Application Engineering Dept., CPI Eimac Division, Palo Alto, CA 94304 U.S.A. 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 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 the 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.

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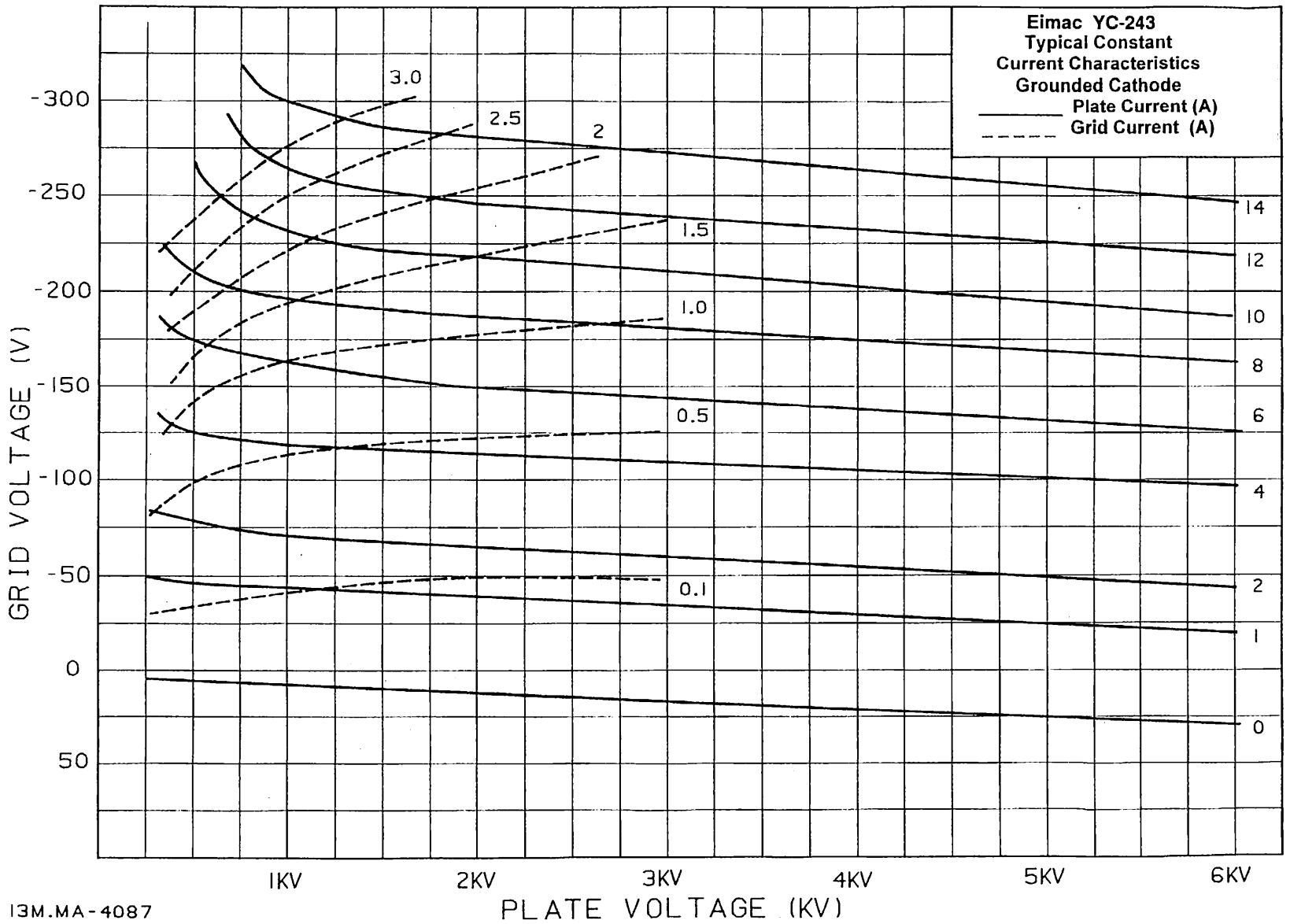
RF RADIATION – Exposure to strong rf fields should be avoided, even at relatively low frequencies. CARDIAC PACEMAKERS MAY BE AFFECTED.

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.

Please review the detailed Operating Hazards sheet enclosed with each tube, or request a copy from CPI, Eimac Division Application Engineering at 1-650-592-1221.


Eimac YC-243
Typical Constant
Current Characteristics
Grounded Cathode
Plate Current (A)
Grid Current (A)
3.0
2.5
2
1.5
1.0
0.5
0.1
14
12
10
8
6
4
2
1
0
-300
-250
-200
-150
-100
-50
0
50
GRID VOLTAGE (V)
1KV
2KV
3KV
4KV
5KV
6KV
PLATE VOLTAGE (KV)

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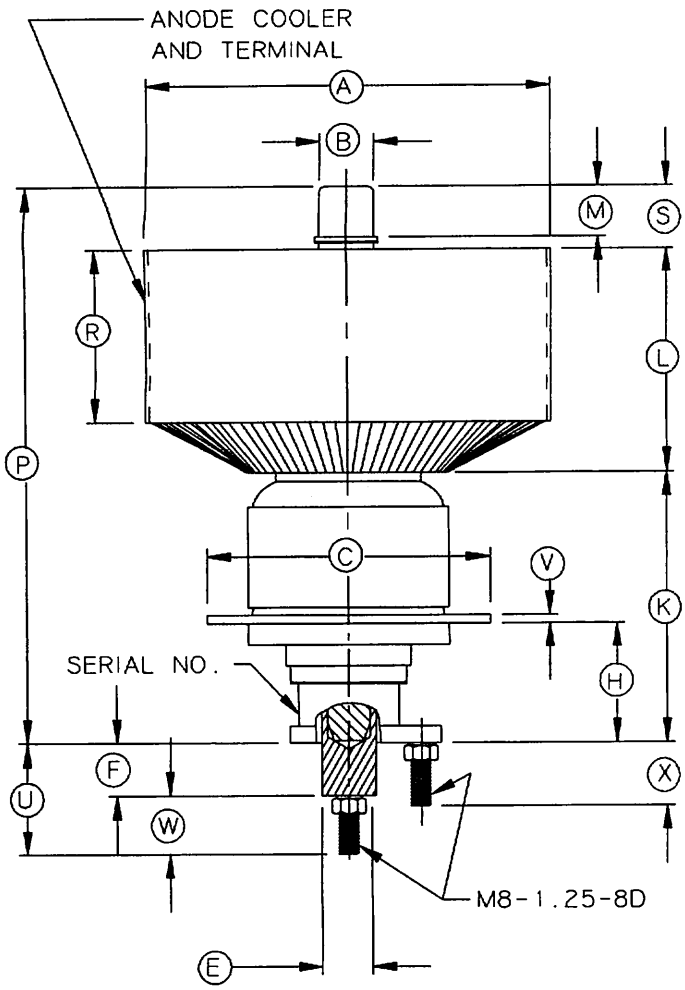
YC-243

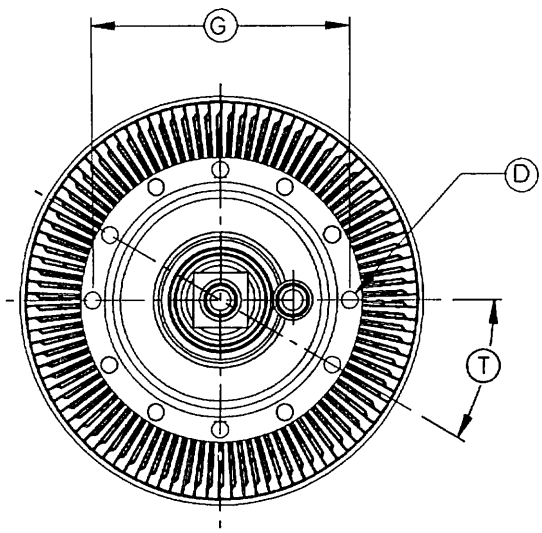


DIMENSIONAL DATA

	INCHES			MILLIMETERS		
DIM.	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	6.000	6.125		152.40	155.58	
B	.781	.843		19.80	21.40	
C	4.230	4.255		107.40	108.10	
D	.230	.265		5.84	6.73	
E			.812			20.60
F	.720	.900		18.29	22.86	
G	3.855	3.885		97.90	98.70	
H	1.703	1.953		43.30	49.60	
K	3.875	4.250		98.40	107.90	
L	3.290	3.350		83.60	85.10	
M	.687	.812		17.50	20.60	
P	8.000	9.000		203.2	228.60	
R			2.625			66.70
S			.900			22.90
T			30°			30°
U	1.600	1.780		40.64	45.21	
V			.125			3.17
W			.875			22.20
X			.938			23.80

NOTE:

1. REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY AND ARE NOT REQUIRED FOR INSPECTION PURPOSES.



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