



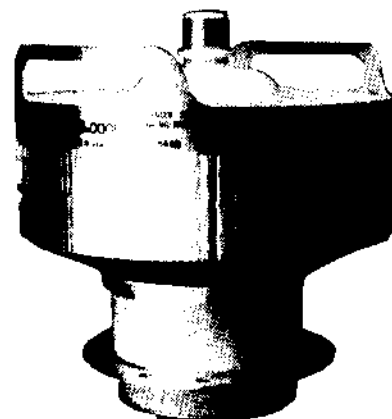
TECHNICAL DATA

3CX15,000B7 HIGH-MU POWER TRIODE

The EIMAC 3CX15,000B7 is a ceramic/metal high-mu power triode designed especially for use as a cathode-driven Class AB rf power amplifier. It is forced-air cooled, with an anode dissipation rating of 15 kilowatts.

The 3CX15,000B7 uses a beam-forming cathode and control grid geometry to produce high gain and outstanding intermodulation performance in linear amplifier service. These attributes make the tube well suited for SSB communications equipment.

The tube does not require a socket. It is designed to be bolted directly to the chassis by the grid flange. Cathode and heater connections are also made by bolting directly to the amplifier circuitry. This reduces equipment cost and complexity.



GENERAL CHARACTERISTICS ¹

ELECTRICAL

Cathode: Oxide-coated Unipotential

| | | |
|---|-------------|-----|
| Heater Voltage | 15.0 ± 0.75 | V |
| Heater Current (approx.), at 15.0 Volts | 15.0 | A |
| Minimum Cathode Warmup Time, at 15.0 Volts ² | 6 | Min |
| Amplification Factor (average) | 200 | |
| Maximum Frequency For Full Ratings | 110 | MHz |
| Direct Interelectrode Capacitance (grounded grid connection) ³ | | |
| C _{in} | 93 | pF |
| C _{out} | 28 | pF |
| C _{pk} | 0.33 | pF |

1. Characteristics and operating values are estimated. 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. In minutes, before high voltage and rf drive voltage are applied.
3. Capacitance values are for a cold tube as measured in accordance with EIA Standard RS-191 except no special shielding is used.

MECHANICAL

Overall Dimensions:

| | |
|---|--------------------------------------|
| Length | 8.6 in; 218.5 mm |
| Diameter | 7.5 in; 90.5 mm |
| Cooling | Forced Air |
| Net Weight (approximate) | 13 lb; 5.9 kg |
| Operating Position | Vertical, Base Up or Down |
| Recommended Air-System Chimney | EIMAC SK-316 |
| Base | Designed for Direct Chassis Mounting |
| Maximum Operating Temperature, Ceramic/Metal Seals & Anode Core | 250°C |
| Available Anode Connector Clip | EIMAC ACC-3 |

RADIO FREQUENCY POWER AMPLIFIER
CATHODE DRIVEN - Class AB Service

ABSOLUTE MAXIMUM RATINGS:

| | | |
|---------------------------------------|------|-----------|
| DC PLATE VOLTAGE | 6500 | VOLTS |
| DC PLATE CURRENT | 3.75 | AMPERES |
| PLATE DISSIPATION | 15.0 | KILOWATTS |
| GRID DISSIPATION | 25 | WATTS |
| DC GRID CURRENT | +0.1 | AMPERES |
| INSTANTANEOUS GRID-TO-CATHODE VOLTAGE | ±560 | VOLTS |

TYPICAL PERFORMANCE, to 30 MHz (measured data)

| | | |
|-------------------------|------|------|
| Plate Voltage | 6.0 | kVdc |
| Zero Sig. Plate Current | 0.6 | Adc |
| Max. Sig. Plate Current | 2.6 | Adc |
| Cathode Bias * | +35 | Vdc |
| Grid Current * | 30 | mAdc |
| Driving Power * | 300 | W |
| Useful Power Output # | 10.2 | kW |
| Power Gain * | 15.3 | dB |
| Cathode Input Impedance | 24 | Ohms |
| Resonant Load Impedance | 1000 | Ohms |

* Will vary from tube to tube
Delivered to the load

VA5110(March 1989, supersedes October 1988)

Printed in U.S.A.



A P P L I C A T I O N

MECHANICAL

SHIPPING & STORAGE - It is recommended the tube always be shipped or reshipped in its original EIMAC carton and packing material, and never shipped installed in the end-use equipment. This also gives the end user the approved carton & packing material to store in case later reshipment of the tube is ever required.

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.

MOUNTING - The 3CX15,000B7 should be mounted vertically, base up or down, and should be protected from shock and vibration. The tube is designed to be bolted directly to the chassis in equipment designed for dc and rf grounded-grid circuits. The mounting may be insulated for other circuitry. A flange with threaded holes is provided for a low-inductance cathode connection. Similar provisions are made for the heater connections.

COOLING - The maximum temperature rating for the external surfaces of the tube is 250°C, and sufficient forced-air cooling must be used in all applications to keep the temperature of the anode (at the base of the cooling fins) and the temperature of the ceramic/metal seals comfortably below this rated maximum.

Cooling data shown is for sea level with cooling air at 35°C with air flowing in a base-to-anode direction, and represents minimum anode cooling requirements for an anode outside surface temperature of 250°C.

| Plate Diss. kW | Flow Rate CFM | Press. Drop In. Water |
|-------------------|------------------|--------------------------|
| 10 | 370 | 1.5 |
| 12.5 | 560 | 3.4 |
| 15 | 820 | 7.2 |

At an altitude of 5000 feet both air flow and pressure drop must be increased by a factor of 1.2 and at 10,000 feet 1.46 is the factor.

It is considered good engineering practice to design for a maximum anode core temperature somewhat lower than the maximum rating of 250°C and temperature-sensitive paints are available for checking base and seal temperatures before any design is finalized. EIMAC Application Bulletin #20 titled TEMPERATURE MEASUREMENTS WITH EIMAC POWER TUBES is available on request.

It is also considered good practice to allow for variables such as dirty air filters, rf seal heating, and the fact that the anode cooling fins may not be clean if the tube has been in service for some length of time.

Forced air cooling of the base is also required, with air directed past the seal areas. An air interlock system should be included in the design to automatically remove all voltages from the tube in case of even partial failure of the cooling air.

Air flow must be applied before or simultaneously with the application of power, including the tube heater, and should normally be maintained for a short period of time after all power is removed.

ELECTRICAL

HEATER-CATHODE OPERATION - Rated heater voltage for the 3CX15,000B7 is 15.0 volts and should be maintained within plus/minus 0.75 volt when good life and consistent performance are factors. Voltage should be measured with an accurate (preferably plus or minus 1%) rms-responding voltmeter. Heater voltage should be applied for six minutes (minimum) before high voltage is applied to the tube and any operation is attempted, to allow for cathode warmup to full temperature.

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 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 or load variation, or manufacturing variation in the equipment itself. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

INPUT CIRCUIT - When this tube is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of five or more.

GRID OPERATION - The maximum rated dc grid bias voltage for the tube is -250 volts and the maximum grid dissipation is 25 watts. The maximum instantaneous positive grid voltage must not exceed 560 volts, and average grid current should never exceed 100 mAdc.

In normal applications the grid dissipation will not approach the maximum rating. Oxide cathode tubes may exhibit reverse grid current. Protective circuitry for detection of overload and fault conditions must be capable of accepting current flow in either direction. This type of circuitry is necessary to prevent excessive grid dissipation and resulting tube degradation which can occur if proper output (plate) tuning or loading is lost due to failure in the tuned circuit or failure in the load.

CW OPERATION - Class C operation is not permitted. Operation should be restricted to Class A and AB service.

MICROWAVE OSCILLATION - All high gain, high trans-conductance tubes are capable of supporting internal oscillation at frequencies in the microwave region. Oscillation under these circumstances, if not damped by external means, can lead to premature loss of power or arcing. The tube and its external circuitry comprise a system which can be designed to effectively prevent the occurrence of unwanted oscillation. The EIMAC product manager should be contacted before committing to a new design.



FAULT PROTECTION - All power tubes operate at voltages which can cause severe damage in the event of an internal arc, especially in those cases where large amounts of stored energy or follow-on current are involved. Some means of protection is advised in all cases, and it is imperative that a series resistor be used in the anode circuit to limit peak current and help dissipate the energy in the event of a tube or circuit arc. A resistance of 10 ohms in the positive plate power supply lead, together with a protective spark gap such as the Siemens #81-C145 connected between the cathode and grid will help protect the tube in the event of an internal arc. A maximum of 4 joules total energy may be permitted to dissipate into a grid-to-cathode arc. Amounts in excess of this will permanently damage the cathode or grid structure.

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

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. 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 depend-

ent 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. **CARDIAC PACEMAKERS MAY BE AFFECTED.**

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, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube [as the key component involved] industry and the Military Services use a standard test procedure described in Electronic Industries Association Standard RS-191. With the 3CX15,000B7 no special shielded fixture is used. The test is performed on a cold tube. Other factors being equal, controlling internal capacitance in this way normally assures good interchangeability of tubes over a period of time. Capacitance values shown 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 the application. Measurements should be taken with the mounting which represents 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; 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:

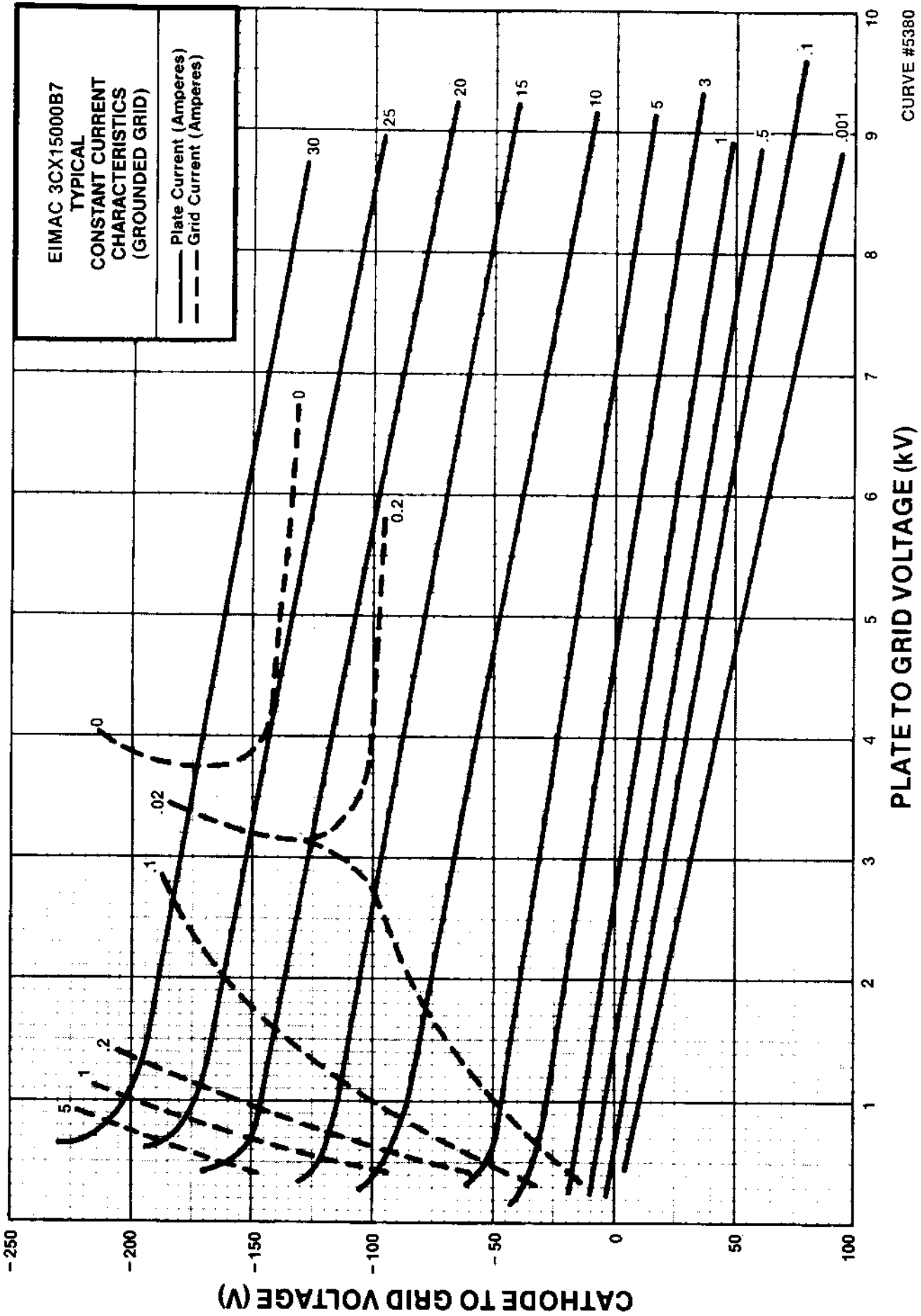
- a. **HIGH VOLTAGE** - Normal operating voltages can be deadly. Remember that **HIGH VOLTAGE CAN KILL**.
- b. **LOW-VOLTAGE HIGH-CURRENT CIRCUITS** - Personal jewelry, such as rings, should not be worn when working with filament contacts or connectors as a short circuit can produce very high current and melting, resulting in severe burns.
- c. **RF RADIATION** - Avoid exposure to strong rf fields even at relatively low frequencies. The danger is more severe at UHF and microwave frequencies and can cause serious bodily and eye injuries. **CARDIAC PACEMAKERS MAY BE EFFECTED.**
- d. **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: Varian EIMAC, Power Grid Application Engineering, 301 Industrial Way, San Carlos CA 94070.



3CX15,000B7

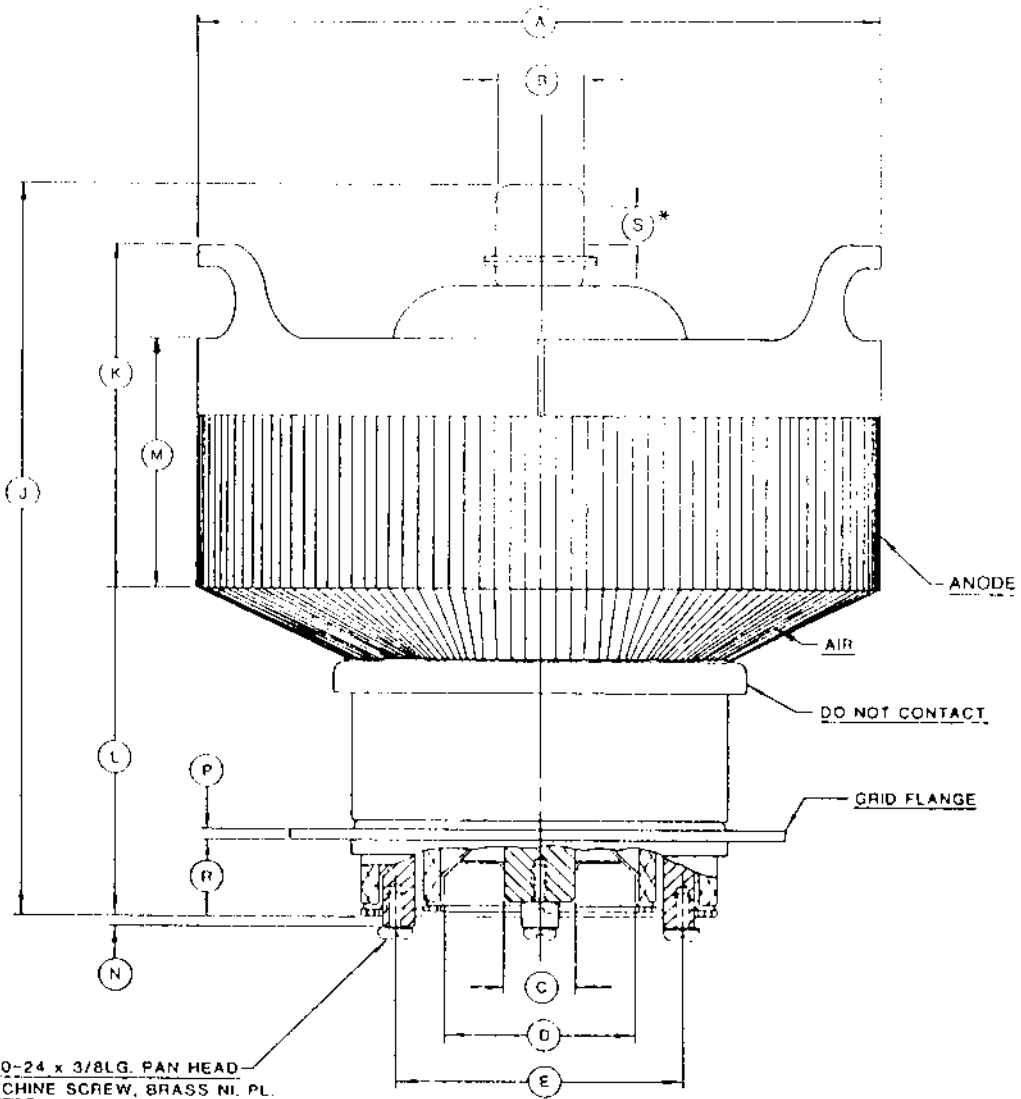
GROUNDING GRID CONSTANT CURRENT CHARACTERISTICS



CURVE #5380



| DIM | INCHES | | | MILLIMETERS | | |
|-----|--------|-------|------|-------------|--------|------|
| | MIN | MAX | REF | MIN | MAX | REF |
| A | 7.437 | 7.561 | | 188.90 | 192.05 | |
| B | .855 | .895 | | 21.72 | 22.73 | |
| C | .800 | .760 | | 15.24 | 19.30 | |
| D | 1.896 | 1.936 | | 48.18 | 49.17 | |
| E | 2.895 | 2.935 | | 73.53 | 74.55 | |
| F | 4.425 | 4.445 | | 112.40 | 122.90 | |
| G | 5.030 | 5.090 | | 127.78 | 129.29 | |
| H | | | 265 | | | 6.73 |
| J | 7.625 | 7.975 | | 193.68 | 200.00 | |
| K | 3.412 | 3.788 | | 86.88 | 96.21 | |
| L | 3.216 | 3.604 | | 81.68 | 91.54 | |
| M | 2.412 | 2.788 | | 61.28 | 70.81 | |
| N | .093 | .158 | | 2.36 | 3.96 | |
| P | | | .125 | | | 3.18 |
| R | .721 | .845 | | 18.31 | 21.46 | |
| S | .375 | | | 9.53 | | |
| T | | | | | | |
| U | | | | | | |
| V | | | | | | |
| W | | | | | | |
| X | | | | | | |
| Y | | | | | | |
| Z | | | | | | |



NOTES
 1 REF DIMENSIONS ARE FOR INFO ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES
 2 (*) CONTACT SURFACE

#10-24 x 3/8 LG. PAN HEAD MACHINE SCREW, BRASS NI. PL. & #10 LOCKWASHER INTERNAL TOOTH BR. NI. PL. (5 EACH SUPPLIED)

