# 7815
# 7815R

TECHNICAL DATA

PLANAR TRIODES

7815 7815R

The EIMAC 7815 and 7815R are rugged ceramic/metal planar triodes designed for use in CW, grid- or plate-pulsed oscillator, amplifier or frequency multiplier service up to 3 GHz. The tubes may also be used in pulse modulator or voltage regulator service. The 7815R is normally supplied with an air cooled radiator for forced air cooling, while the 7815 is supplied without radiator and is intended for conduction-convection cooling as found in many pulsed type applications. Except for the plate dissipation ratings and outline, the characteristics of both tube types are identical.

The 7815 and 7815R feature high mu, high transconductance, great mechanical strength and low interelectrode capacitances, as well as high current capability and increased grid-anode insulator length. Both tubes have an arc-resistant, extended interface cathode, well proven in airline applications, assuring reliable and long life operation under adverse conditions.

Note: This data sheet also covers the 3CPN10A5 (same as 7815) and 3CPX100A5 (same as 7815R).

## GENERAL CHARACTERISTICS[1]

### ELECTRICAL

| | | |
|---|---|---|
| Cathode: Oxide Coated, Unipotential | | |
| Heater: Voltage | 6.0 ± 0.3 | V |
| Current, at 6.0 volts | 1.00 | A |
| Transconductance (Average): | | |
| $I_b$ = 70 mAdc, ($E_b$ = 600 Vdc ) | 25 | mmhos |
| Amplification Factor (Average) | 100 | |
| Direct Interelectrode Capacitance (grounded cathode)[2], without heater voltage: | | |
| Cin | 6.3 | pF |
| Cgp | 1.98 | pF |
| Cout | 0.035 | pF |
| Cut-off Bias[3] (maximum) | -25 | V |

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. 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. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.
3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.



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## MECHANICAL

| | |
|---|---|
| Maximum Overall Dimensions: | |
| Length | 2.701 in; 68.60 mm |
| Diameter (7815) | 1.195 in; 30.35 mm |
| Diameter (7815R) | 1.264 in; 32.11 mm |
| Net Weight (7815) | 1.8 oz; 48 gm |
| Net Weight (7815R) | 2.2 oz; 63 gm |
| Operating Position | Any |
| Maximum Operating Temperature: | |
| Ceramic/Metal Seals | 250°C |
| Anode Core | 250°C |
| Cooling (7815) | Conduction and Convection |
| Cooling (7815R) | Forced Air |
| Terminals | Coaxial, special |

## ENVIRONMENTAL

| | |
|---|---|
| Shock, 11 ms, non-operating | 60 G |
| Vibration, operating, all axes 55 to 500 Hz | 10 G |
| Altitude, max (in a suitably designed circuit) | 70,000 ft. |

## CW RF POWER AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| DC PLATE VOLTAGE | 2500 VOLTS |
| DC GRID VOLTAGE | -150 VOLTS |
| INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE | |
| Grid negative to cathode | -400 VOLTS |
| Grid positive to cathode | 30 VOLTS |
| DC PLATE CURRENT | 100 MILLIAMPERES |
| DC GRID CURRENT | 50 MILLIAMPERES |
| AVERAGE PLATE DISSIPATION | |
| Conduction and Convection (7815) | 10 WATTS |
| Forced Air Cooling (7815R) | 100 WATTS |
| GRID DISSIPATION (Average) | 2 WATTS |
| FREQUENCY | 2.5 GHz |

OPERATING CONDITIONS FOR 7815 AND 7815R IN REPRESENTATIVE APPLICATION

| | |
|---|---|
| Grounded Grid CW Power Amplifier | |
| Frequency | 500 MHz |
| Heater Voltage | 6.0 V |
| DC Plate Voltage | 900 Vdc |
| DC Grid Voltage (approx) | -40 Vdc |
| DC Cathode Current | 90 mAdc |
| DC Grid Current | 25 mAdc |
| Drive Power (approx) | 6 W |
| Useful CW Power Output | 40 W |
| Grounded Grid CW Oscillator | |
| Frequency | 2.5 GHz |
| Heater Voltage | 5.0 V |
| DC Plate Voltage | 900 Vdc |
| DC Grid Voltage (approx) | -20 Vdc |
| DC Plate Current | 90 mAdc |
| DC Grid Current | 10 mAdc |
| Useful CW Power Output | 17 W |

## GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| DC PLATE VOLTAGE (GRID PULSED) | 2500 VOLTS |
| PEAK PULSE PLATE VOLTAGE (PLATE PULSED) | 3500 VOLTS |
| DC GRID VOLTAGE | -150 VOLTS |
| INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE | |
| Grid negative to cathode | -700 VOLTS |
| Grid positive to cathode | 250 VOLTS |
| PULSE PLATE CURRENT | 3.0 AMPERES |
| PULSE GRID CURRENT | 1.8 AMPERES |
| AVERAGE PLATE DISSIPATION | |
| Conduction and Convection (7815) | 10 WATTS |
| Forced Air Cooling (7815R) | 100 WATTS |
| GRID DISSIPATION (Average) | 2 WATTS |
| FREQUENCY | 3.0 GHz |
| PULSE DURATION[1] | 6 $\mu$s |
| DUTY FACTOR[1] | .0033 |

OPERATING CONDITIONS FOR 7815 AND 7815R IN REPRESENTATIVE APPLICATION

Grid Pulsed Amplifier

| | | |
|---|---|---|
| Frequency | 1.1 | GHz |
| Heater Voltage | 6.0 | V |
| DC Plate Voltage | 2200 | Vdc |
| DC Grid Voltage | -45 | Vdc |
| Peak Video Plate Current | 1.9 | a |
| Peak Video Grid Current | 1.1 | a |
| Pulse Drive Power (approx) | 400 | w |
| Useful Power Output (approx) | 2000 | w |
| Pulse Duration | 3 | μs |
| Duty Factor | .002 | |

Plate Pulsed Oscillator

| | | |
|---|---|---|
| Frequency | 3.0 | GHz |
| Heater Voltage | 5.8 | V |
| Peak Plate Voltage | 3500 | v |
| Peak Video Plate Current | 3.0 | a |
| Peak Video Grid Current | 1.8 | a |
| Useful Power Output (approx) | 1600 | w |
| Pulse Duration | 3 | μs |
| Duty Factor | .0025 | |

1. For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

## PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 2500 | VOLTS |
| PEAK PLATE VOLTAGE | 3500 | VOLTS |
| DC GRID VOLTAGE | -150 | VOLTS |
| INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE | | |
| Grid negative to cathode | -700 | VOLTS |
| Grid positive to cathode | 150 | VOLTS |
| PULSE CATHODE CURRENT | 4.8 | AMPERES |
| DC PLATE CURRENT | 100 | MILLIAMPERES |
| AVERAGE PLATE DISSIPATION | | |
| Conduction and Convection (7815) | 10 | WATTS |
| Forced Air Cooling (7815R) | 100 | WATTS |
| GRID DISSIPATION (Average) | 2 | WATTS |
| PULSE DURATION [1] | 6 | μs |
| DUTY FACTOR [1] | .0033 | |
| CUT-OFF MU | 70 | |

1. For application requiring long pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

## RANGE VALUES FOR EQUIPMENT DESIGN

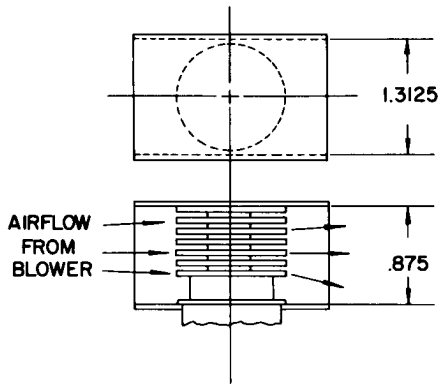
| | Min. | Max. | |
|---|---|---|---|
| Heater: Current at 6.0 volts | 0.90 | 1.05 | A |
| Cathode Heating Time | 60 | --- | sec. |
| Interelectrode Capacitances [1] (grounded cathode connection) | | | |
| Cin | 5.60 | 7.00 | pF |
| Cout | --- | 0.035 | pF |
| Cgp | 1.85 | 2.10 | pF |

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

## APPLICATION

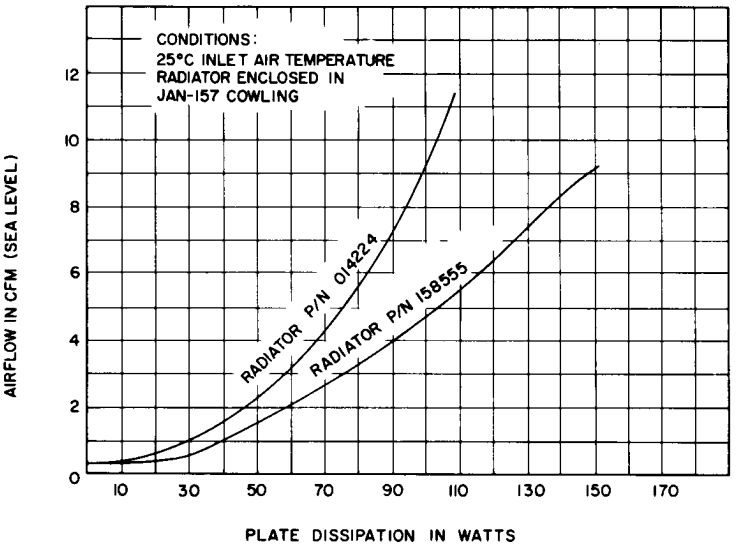
For general application information please refer to the Planar Triode Operating Instruction Sheet. The operating instructions should be consulted prior to the designing of new requirements around the above tube types. Plate dissipation of up to 150 watts is possible with the 7815/7815R tube type when using radiator P/N 158555. If this is required the tube order should include a reference the different radiator part number. For unusual and special application consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake, City, Utah.

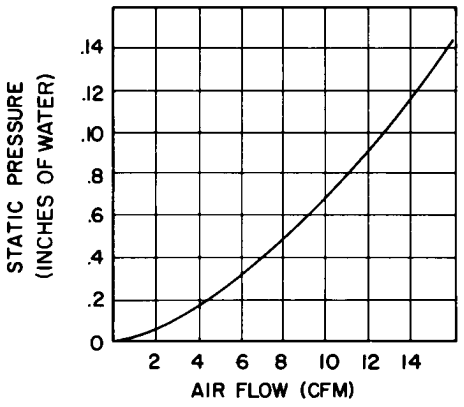
AIRFLOW vs STATIC PRESSURE WITH STANDARD COWLING JAN-157




-STANDARD COWLING-

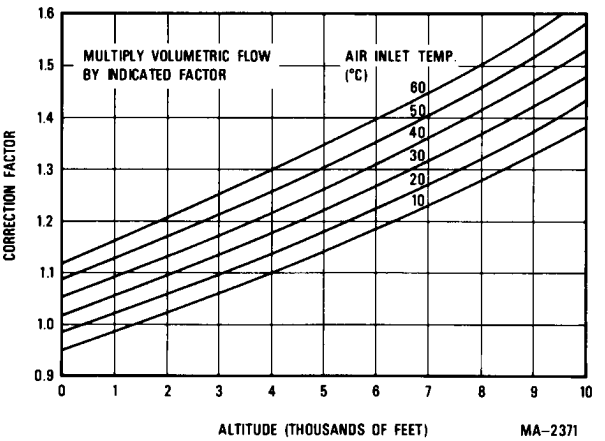
MAXIMUM PLATE DISSIPATION vs COOLING AIRFLOW

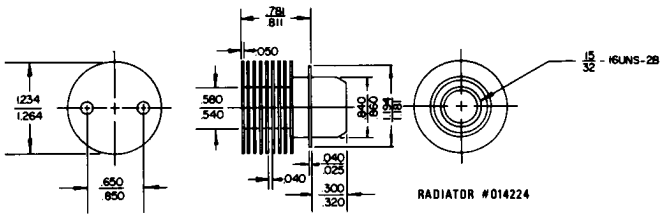


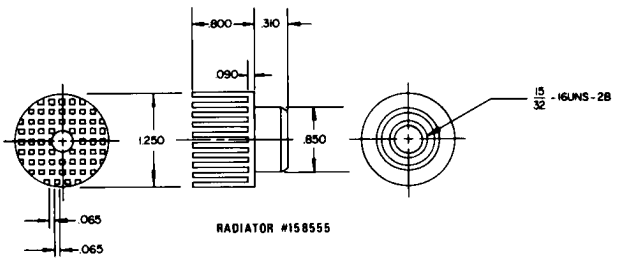



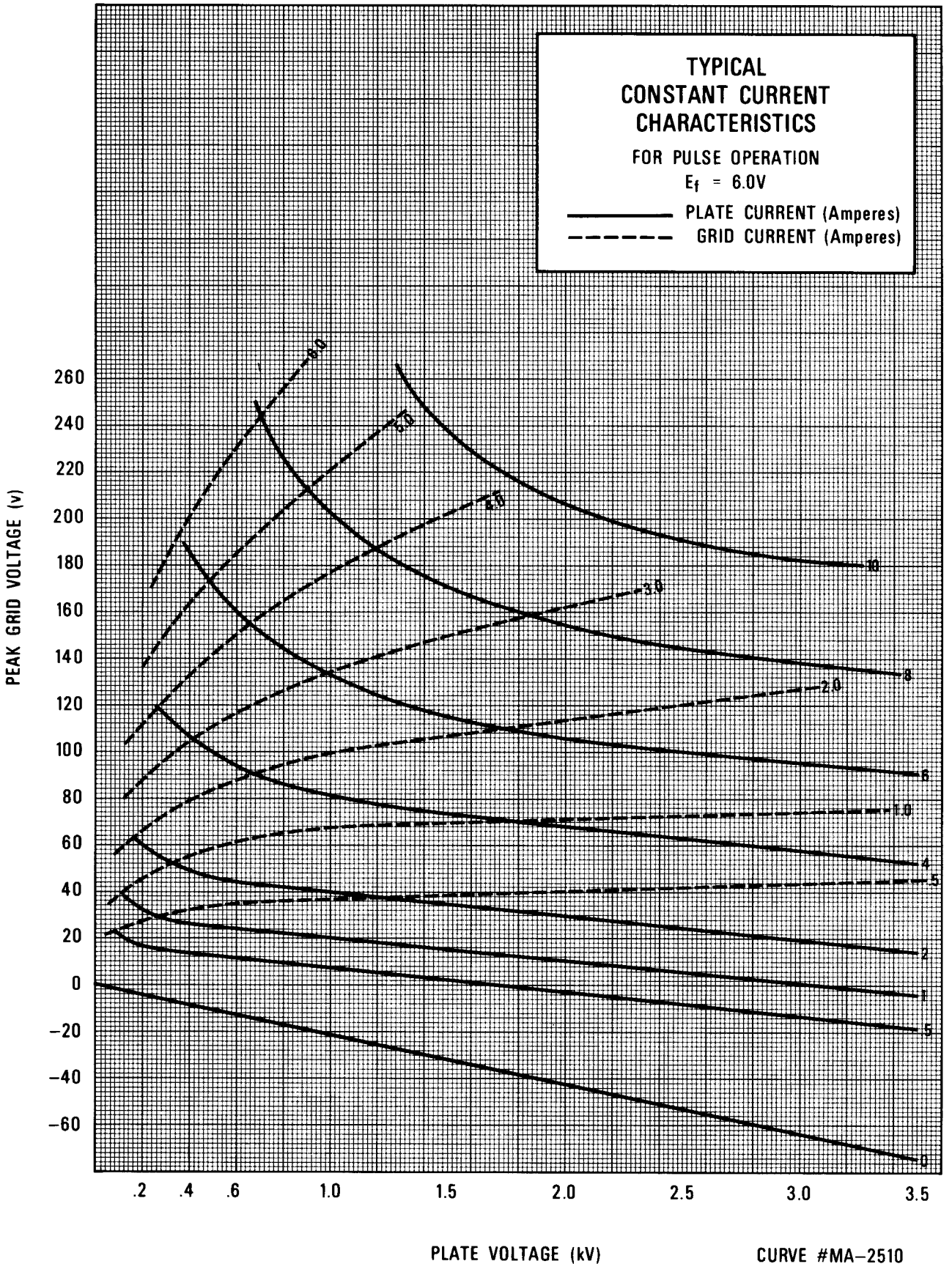

COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

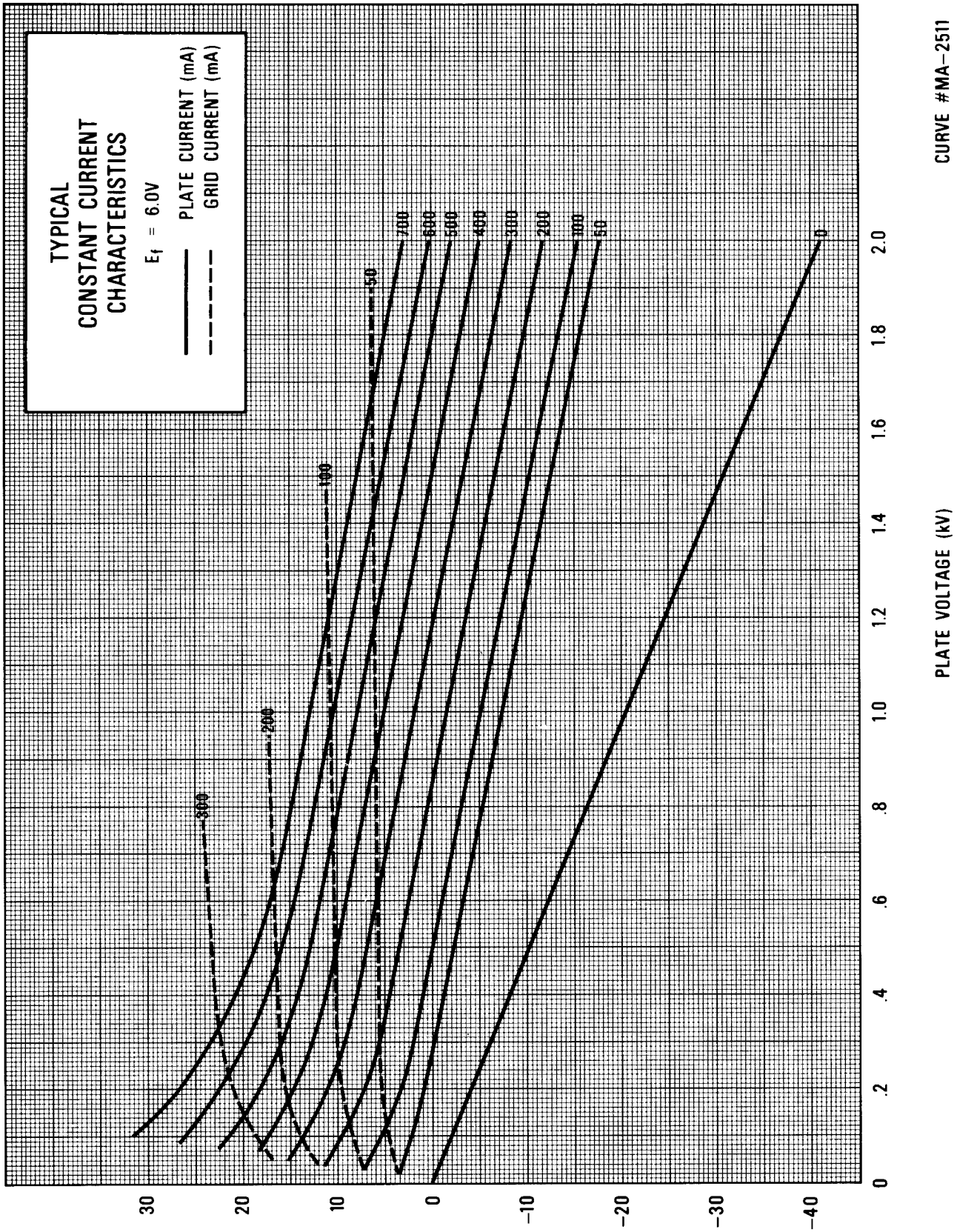
(RELATIVE TO 25°C AND SEA LEVEL)

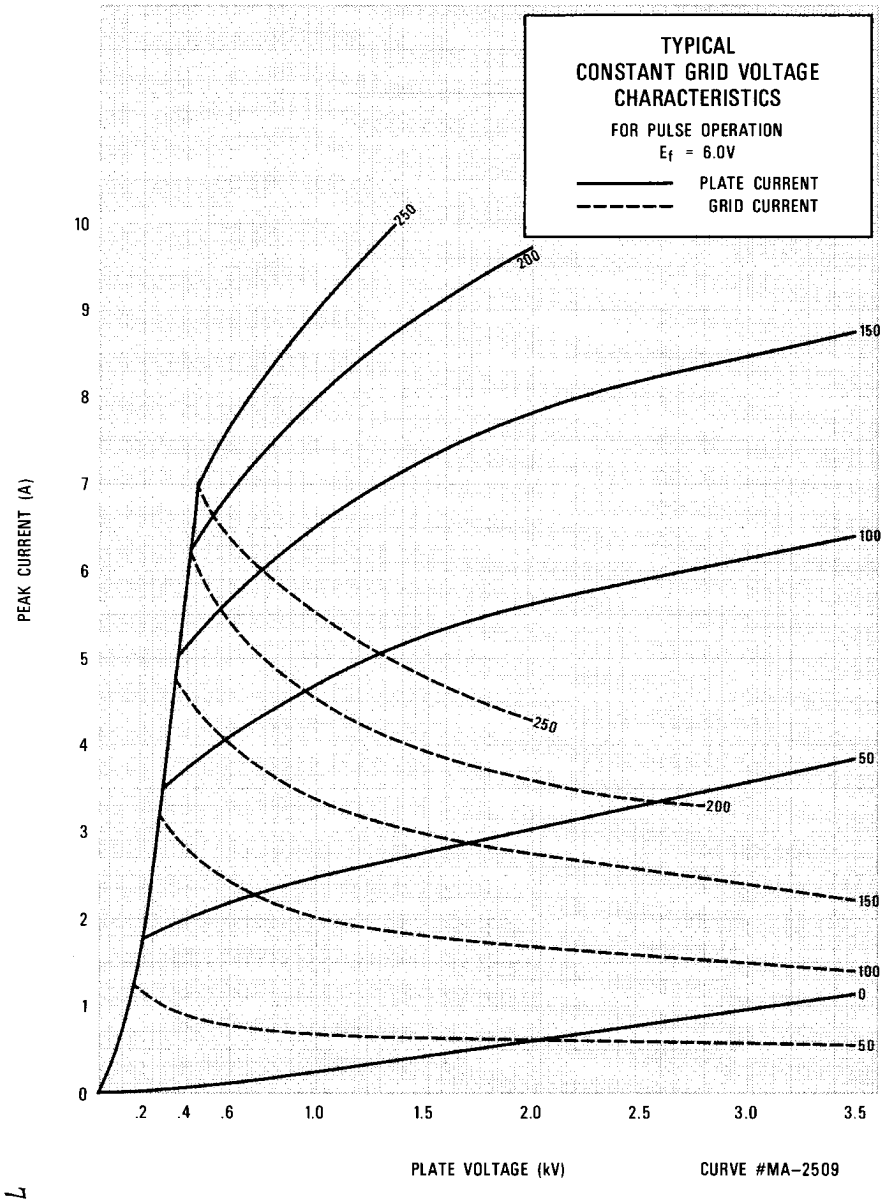


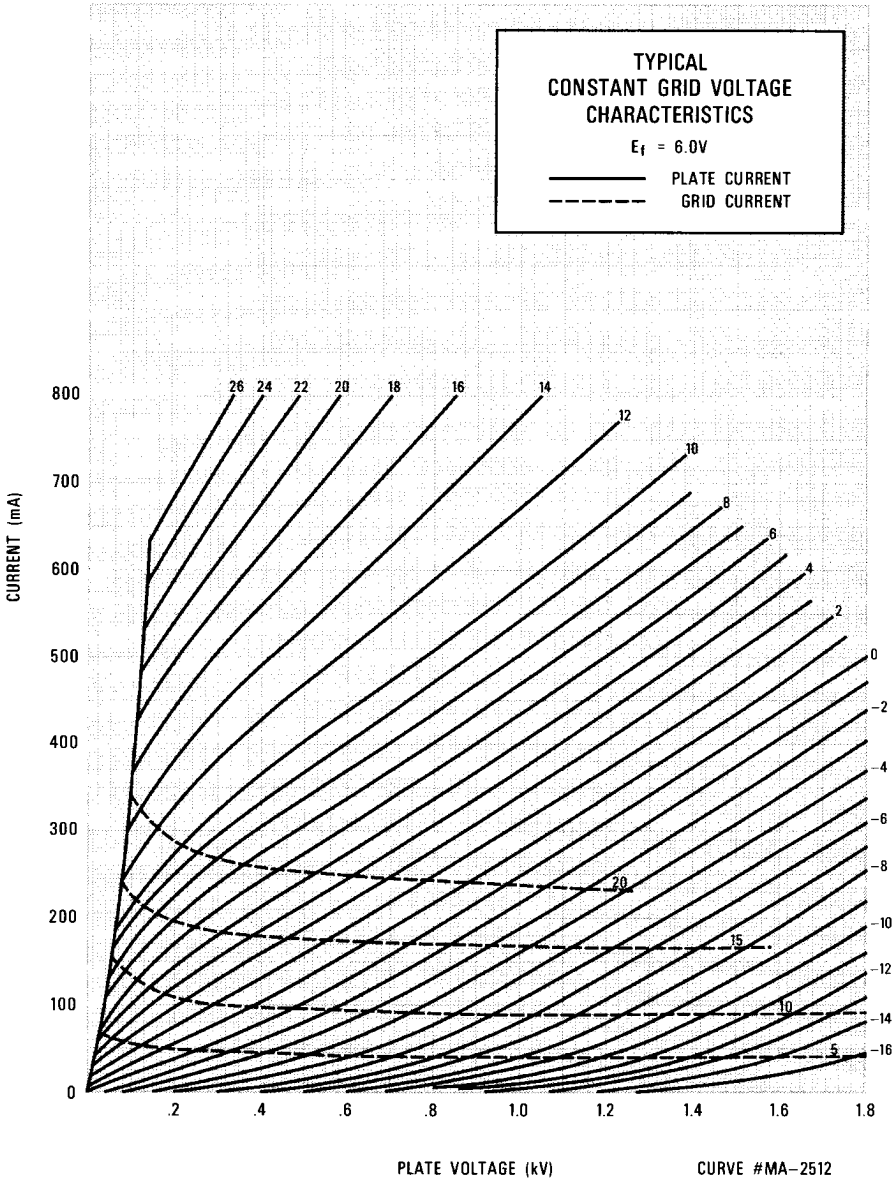



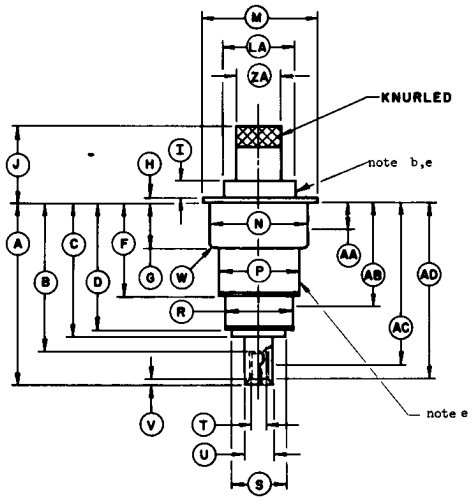




TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
FOR PULSE OPERATION
$E_f$ = 6.0V
PLATE CURRENT (Amperes)
GRID CURRENT (Amperes)
PEAK GRID VOLTAGE (v)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
.2
.4
.6
1.0
1.5
2.0
2.5
3.0
3.5
PLATE VOLTAGE (kV)
CURVE #MA−2510
6.0
5.0
4.0
3.0
2.0
1.0
.5
10
8
6
4
2
1
.5
0


TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
$E_f$ = 6.0V
PLATE CURRENT (mA)
GRID CURRENT (mA)
700
600
500
400
300
200
100
50
0
100
200
300
30
20
10
0
−10
−20
−30
−40
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
2.0
GRID VOLTAGE (V)
PLATE VOLTAGE (kV)
CURVE #MA-2511


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
$E_f$ = 6.0V
PLATE CURRENT
GRID CURRENT
PEAK CURRENT (A)
PLATE VOLTAGE (kV)
CURVE #MA-2509


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
$E_f$ = 6.0V
PLATE CURRENT
GRID CURRENT
CURRENT (mA)
PLATE VOLTAGE (kV)
CURVE #MA-2512




7815

| ELECTRODE CONTACT AREA (see note a,f) | | | | |
|---|---|---|---|---|
| DIM. | MIN. | MAX. | MIN. | MAX. |
| AA | .035 | .361 | .89 | 9.17 |
| AB | 1.185 | 1.265 | 30.10 | 32.14 |
| AC | 1.534 | 1.728 | 38.96 | 43.89 |
| AD | 1.475 | 1.815 | 37.47 | 46.10 |
| | DIM. IN INCHES | | DIM. IN MILLIMETERS | |

| DIMENSION DATA (Note a) | | | | | |
|---|---|---|---|---|---|
| DIM. IN INCHES | | DIM. | DIM. IN MILLIMETERS | | |
| MIN. | MAX. | | MIN. | MAX. | NOTES |
| 1.815 | 1.875 | A | 46.10 | 47.62 | |
| | 1.534 | B | | 38.96 | |
| | 1.475 | C | | 37.46 | |
| 1.289 | 1.329 | D | 32.74 | 33.76 | |
| .970 | 1.010 | F | 24.64 | 25.65 | |
| .462 | .477 | G | 11.73 | 12.12 | |
| | .040 | H | | 1.02 | |
| | .185 | I | | 4.70 | |
| .766 | .826 | J | 19.46 | 20.98 | |
| 1.180 | 1.195 | M | 29.97 | 30.35 | |
| 1.025 | 1.035 | N | 26.04 | 26.29 | d |
| .752 | .792 | P | 19.10 | 20.12 | |
| .655 | .665 | R | 16.64 | 16.89 | d |
| | .545 | S | | 13.84 | |
| .213 | .223 | T | 5.41 | 5.66 | d |
| .315 | .325 | U | 8.00 | 8.26 | d |
| | .086 | V | | 2.18 | |
| | .100 | W | | 2.54 | |
| .840 | .860 | LA | 21.34 | 21.84 | |
| .427 | .447 | ZA | 10.85 | 11.35 | |
| | | | | | |

NOTES:

a. Metric equivalents, to the nearest .01 mm, are given for general information only & are based on 1 inch = 25.4 mm.

b. This surface shall be used to measure Anode Shank temperature.

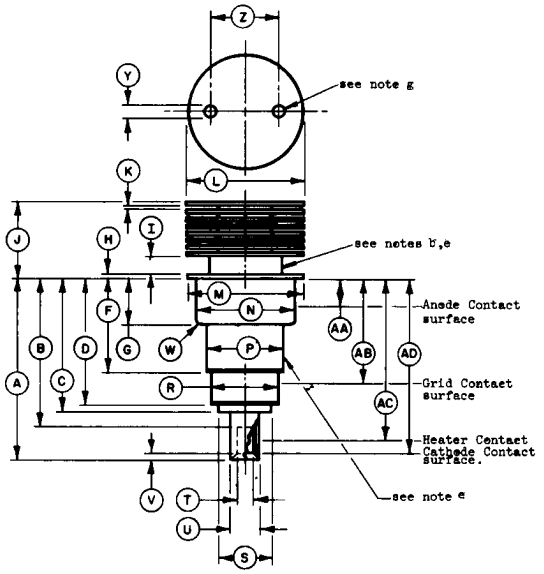
c. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows; note 2 shall apply:

| Contact Surface | TIR Max. | Reference |
|---|---|---|
| Anode | .020 | Cathode |
| Grid | .020 | Cathode |
| Heater | .012 | Cathode |

d. Dias. N,R,T,U shall apply throughout entire contact area as defined by dims. AA,AB, AC,AD respectively.

e. This surface shall not be used for clamping or locating.

f. Electrode Contact Dims. are given for socket design purposes & are not intended for inspection purposes.




7815R

| ELECTRODE CONTACT AREA (Note a,f) | | | | |
|---|---|---|---|---|
| Dim. in Inches | | | Dim. in Millimeter | |
| Dim. | Min. | Max. | Min. | Max. |
| AA | .035 | .361 | .89 | 9.17 |
| AB | 1.185 | 1.265 | 30.10 | 32.14 |
| AC | 1.534 | 1.728 | 38.96 | 43.89 |
| AD | 1.475 | 1.815 | 37.47 | 46.10 |

| DIMENSION DATA (Note a) | | | | | |
|---|---|---|---|---|---|
| Dim. in Inches | | Dim. | Dim. in Millimeters. | | |
| Min. | Max | | MIN. | MAX. | Notes |
| 1.815 | 1.875 | A | 46.10 | 47.62 | |
| | 1.534 | B | | 38.96 | |
| | 1.475 | C | | 37.46 | |
| 1.289 | 1.329 | D | 32.74 | 33.76 | |
| .970 | 1.010 | F | 24.64 | 25.65 | |
| .462 | .477 | G | 11.73 | 12.12 | |
| | .040 | H | | 1.02 | |
| .125 | .185 | I | 3.18 | 4.70 | |
| .766 | .826 | J | 19.46 | 20.98 | |
| .025 | .046 | K | .64 | 1.17 | |
| 1.234 | 1.264 | L | 31.34 | 32.11 | |
| 1.180 | 1.195 | M | 29.97 | 30.35 | |
| 1.025 | 1.035 | N | 26.04 | 26.29 | c,d |
| .752 | .792 | P | 19.20 | 20.12 | |
| .655 | .665 | R | 16.64 | 16.89 | c,d |
| | .545 | S | | 13.84 | |
| .213 | .223 | T | 5.41 | 5.66 | c,d |
| .315 | .325 | U | 8.00 | 8.26 | c,d |
| | .086 | V | | 2.18 | |
| | .100 | W | | 2.54 | |
| .105 | .145 | Y | 2.67 | 3.68 | |
| .650 | .850 | Z | 16.51 | 21.59 | |

Notes:

a. Metric equivalents to the nearest .01 mm, are given for general information only & are based on 1 inch= 25.4 mm.

b. This surface shall be used to measure anode shank temp.

c. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows:

| Contact Surface | TIR Max. | Reference |
|---|---|---|
| Anode | .020 | Cathode |
| Grid | .020 | Cathode |
| Heater | .012 | Cathode |

d. Dias. N,R,T & U shall apply throughout entire lenght as defined be dims. AA,AB,AC & AD respectively.

e. This surface shall not be used for clamping or locating.

f. Electrode Contact dims. are given for socket design purposes & are not intended for inspection purposes.

g. Holes for Tube Extractor thru top fin only.