

# CW Klystron Amplifier

**High Power Output**  
**Very High Gain**  
**Long Life, High Reliability**  
**Integral Cavity Construction**  
**Water/Vapor Cooled**  
**Electromagnet Focusing**

**Easy to Install and Operate**  
**Modulating Anode — permits**  
 both visual and aural  
 application with  
 a single beam supply

## Electrical

Frequency Range . . . . . 470-566 MHz  
 Cathode Type . . . . . Indirectly heated, tungsten dispenser cathode  
 Heater (dc or 50-60 Hz):

Voltage<sup>a</sup> . . . . .  $6.0 \pm 0.5$  V  
 Current @ 6.0 V, typical . . . . . 16.4 A  
 Surge current, maximum . . . . . 30.0 A  
 Warm-up time, minimum . . . . . 180 sec

Focusing . . . . . RCA-AJ2166 Electromagnet

## Mechanical

Mounting Position . . . . . Vertical, cathode down  
 Dimensions, Maximum:

Height . . . . . (1485.9 mm) 58.5 in  
 Width . . . . . (381.0 mm) 15.0 in

Weight, Approximate:

Uncrated . . . . . (90.7 kg) 200 lbs  
 Crated . . . . . (213.1 kg) 470 lbs

Inlet Coolant Connector . . . . . Mates with Hansen B2-H16

Outlet Coolant Connector . . . . . Mates with Hansen LL3-H21

Steam Outlet . . . . . See Dimensional Outline

## Electrical Connections

RF Input . . . . . UG-22B/U jack mates with UG-21D/U plug

RF Output . . . . . See Dimensional Outline

Collector<sup>b</sup> . . . . . Pins F and G, Cannon Rec.<sup>c</sup>

Thermocouple:

Chromel . . . . . Pin H Cannon Rec.<sup>c</sup>

Alumel . . . . . Pin J Cannon Rec.<sup>c</sup>

Body . . . . . Pin E Cannon Rec.<sup>c</sup>

|                            |                                        |
|----------------------------|----------------------------------------|
| Modulating Anode . . . . . | See Dimensional Outline                |
| Heater-Cathode . . . . .   | See Dimensional Outline                |
| Heater . . . . .           | See Dimensional Outline                |
| Interlock #1 . . . . .     | Pins A and B, Cannon Rec. <sup>c</sup> |
| Interlock #2 . . . . .     | Pins C and D, Cannon Rec. <sup>c</sup> |

### Thermal

|                                              |     |      |    |
|----------------------------------------------|-----|------|----|
| Collector Temperature . . . . .              | 145 | max. | °C |
| Body Temperature . . . . .                   | 100 | max. | °C |
| Electron Gun Insulator Temperature . . . . . | 250 | max. | °C |
| Storage Temperature . . . . .                | -65 | min. | °C |

### Coolant Requirements

#### Collector and Body

|                                   |     |      |     |
|-----------------------------------|-----|------|-----|
| Water flow . . . . . (7.5 l/m)    | 2.0 | min. | gpm |
| Inlet water temperature . . . . . | 70  | max. | °C  |

#### Electron Gun

|                                    |    |      |     |
|------------------------------------|----|------|-----|
| Forced air flow . . . . . (24 l/s) | 50 | min. | cfm |
|------------------------------------|----|------|-----|

#### Water Pressure Differential for

|                                                               |    |      |     |
|---------------------------------------------------------------|----|------|-----|
| Typical Flow of 2.1 gpm . . . . (3.5 kg/cm <sup>2</sup> )     | 50 | max. | psi |
| Water Pressure at any Inlet . . . . (4.2 kg/cm <sup>2</sup> ) | 60 | max. | psi |

### Maximum Ratings, *Absolute-Maximum Values*

|                                        |         |      |    |
|----------------------------------------|---------|------|----|
| Beam Voltage, DC . . . . .             | 20      | max. | kV |
| Beam Current, DC . . . . .             | 5.5     | max. | A  |
| Body Current, DC . . . . .             | 250     | max. | mA |
| Modulating Anode Voltage, DC . . . . . | 20      | max. | kV |
| Load VSWR . . . . .                    | 1.5:1.0 |      |    |

### Typical Operation, UHF Television Service (Visual 471.25 MHz, Aural 475.75 MHz)

|                                              | Visual Aural |     |    |
|----------------------------------------------|--------------|-----|----|
| Collector Voltage, DC <sup>f</sup> . . . . . | 0            | 0   | V  |
| Body Voltage, DC . . . . .                   | 0            | 0   | V  |
| Beam Current, DC . . . . .                   | 4.7          | 2.4 | A  |
| Body Current, DC <sup>g</sup> . . . . .      | 70           | 15  | mA |

|                                                                           |       |       |    |
|---------------------------------------------------------------------------|-------|-------|----|
| Modulating Anode Voltage, DC . . . . .                                    | 0     | -6    | kV |
| Modulating Anode Current, DC . . . . .                                    | 1.5   | 1.0   | mA |
| Cathode Voltage, DC . . . . .                                             | -18   | -18   | kV |
| Focusing Current, DC (Typical<br>with RCA-AJ2166 Electromagnet) . . . . . | 28    | 28    | A  |
| Load VSWR . . . . .                                                       | 1.1:1 | 1.1:1 | —  |
| Drive Power, for Visual Peak-of-<br>Sync or Aural CW . . . . .            | 10    | 1.1   | W  |
| Output, for Visual Peak-of-Sync or<br>Aural CW . . . . .                  | 31    | 12    | kW |
| Gain . . . . .                                                            | 35    | 40    | dB |
| Efficiency . . . . .                                                      | 37    | 28    | %  |

- a Careful attention to maintaining the minimum value of filament voltage consistent with adequate emission will result in conserving the life of the tube.
- b Pins F and G must always be used in parallel.
- c Type CA22365-2729 Cannon Receptacle.
- d All water must be removed from the water course during storage.
- e Cooling air blower must be directed toward the electron gun and located within a distance of 24 inches.
- f A DC ammeter make the connection between the collector and ground.
- g The body is connected directly to ground. Body current is measured in the ground leg of the beam power supply.

## General Information

### Cooling

The electron gun is cooled by forced-air directed at the cathode-seal area. Air flow must be at least 50 cfm. (24.0 l/sec) The remainder of the tube is cooled by water/vapor system with water cooling the resonators and drift-tube sections and vapor cooling the collector.

The use of distilled water is essential. The liquid flow must start before application of any voltages and preferably should continue for five minutes after removal of voltages. Interlocking of the liquid flow through each of the cooled elements with the beam supply is recommended to prevent damage in case of cooling failure.

A steam exhaust sleeve must be provided for the top of the klystron boiler. A flexible, neoprene type is recommended. The sleeve is placed over the lip provided at the top of the boiler (see Dimensional Outline) and clamped securely in place for a water-tight connection.

## **Electrical Connections to Tube Terminals**

Connections to the Heater, Heater-Cathode and Modulating Anode Terminals (see Dimensional Outline) are made with preformed finger stock or knife blade type fuse clips. Care should be taken when making these connections not to place excessive stress on the ceramic-to-metal seals.

## **Protection Circuits**

Protection circuits serve a threefold purpose: safety of personnel, protection of the tube and protection of tube circuits. Consult Application Note AN4206 for complete information on protection circuits required.

## **RF Output Coaxial Adapter**

The RF output coaxial adapter shown in the klystron Outline Drawing is shipped as a separate item within the tube crate. It must be screwed on after the tube is installed within the electromagnet.

## **Installation and Operation**

RCA reference publications required for the installation and operation of this device include the following:

- Data Sheet — RCA-8824
- Application Note AN4206
- Application Guide 1CE-279A

These publications are available as a complete packet — request PWR-537, "Applications Information for the RCA-8824 Super-Power Klystron,"

## Personnel Safety

The high voltages and microwave radiations from this device can be dangerous to life. High voltage shielding and interlock precautions must be taken and all rf connections must be tightly closed and rf terminals adequately shielded.

This device, in operation, may produce X-radiation which can constitute a health hazard. Shielding or other precautions may be required.

## Packaging

The klystron is shipped in a specially designed shipping crate featuring steel tracks for receiving the rollers on the tube sides. Unpacking instructions are attached to the crate.

---

## RCA AJ2166 Electromagnet

The RCA 8824 klystron is designed to be mounted in and its beam focused by the water-cooled, single-coil electromagnet, RCA-AJ2166. The exposed surfaces of the electromagnet are treated by painting or plating to resist corrosion.

### General Data

|                  |                     |
|------------------|---------------------|
| Voltage, DC      | 125 max. V          |
| Current, DC      | 30 max. A           |
| Dimensions       | See Outline Drawing |
| Weight (approx.) | (158.7 kg) 350 lbs  |
| Cooling:         |                     |

|                     |                 |
|---------------------|-----------------|
| Water flow, minimum | (3.8 l/m) 1 gpm |
|---------------------|-----------------|

|                            |       |
|----------------------------|-------|
| Inlet temperature, maximum | 70° C |
|----------------------------|-------|

|                                                      |                                   |
|------------------------------------------------------|-----------------------------------|
| Maximum water pressure differential for typical flow | (3.5 kg/cm <sup>2</sup> ) 50 psig |
|------------------------------------------------------|-----------------------------------|

|                                     |                                   |
|-------------------------------------|-----------------------------------|
| Maximum water pressure at any inlet | (4.2 kg/cm <sup>2</sup> ) 60 psig |
|-------------------------------------|-----------------------------------|

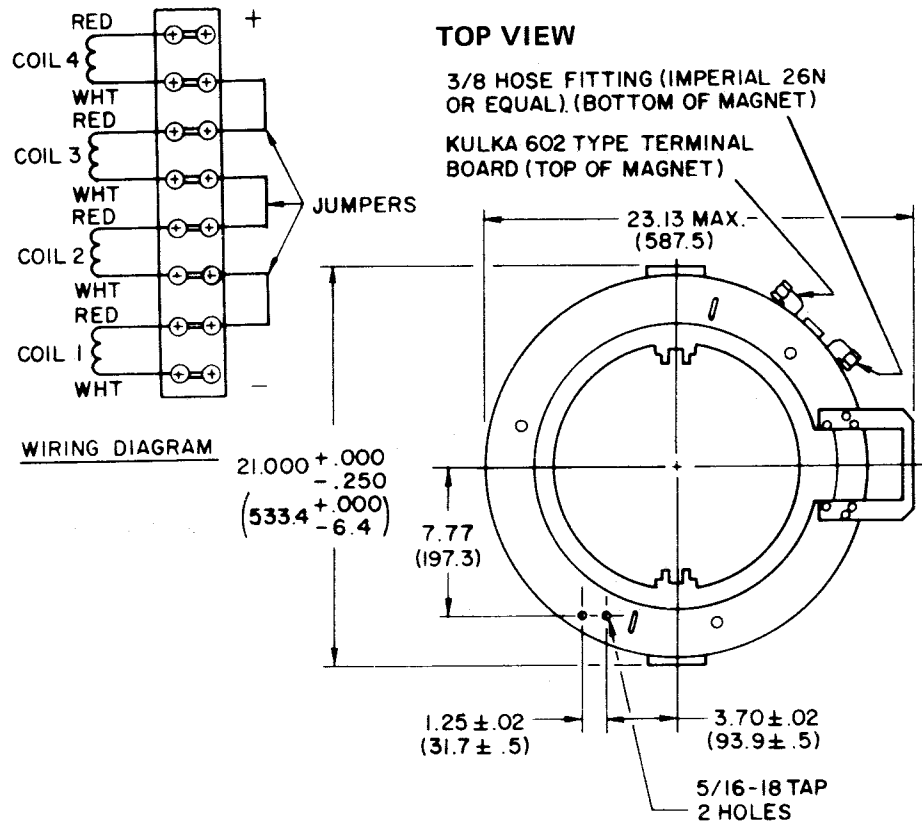
Operating Considerations

Typical operating coil currents are noted under "Typical Operation" data section.

It is recommended that the coil coolant flow start before the application of any coil voltage and preferably continue for five minutes after the removal of voltages. Interlocking of the coolant flow with the klystron beam and modulating-anode voltages and coil voltages is highly recommended to prevent tube and coil damage in the event of inadequate coolant flow.

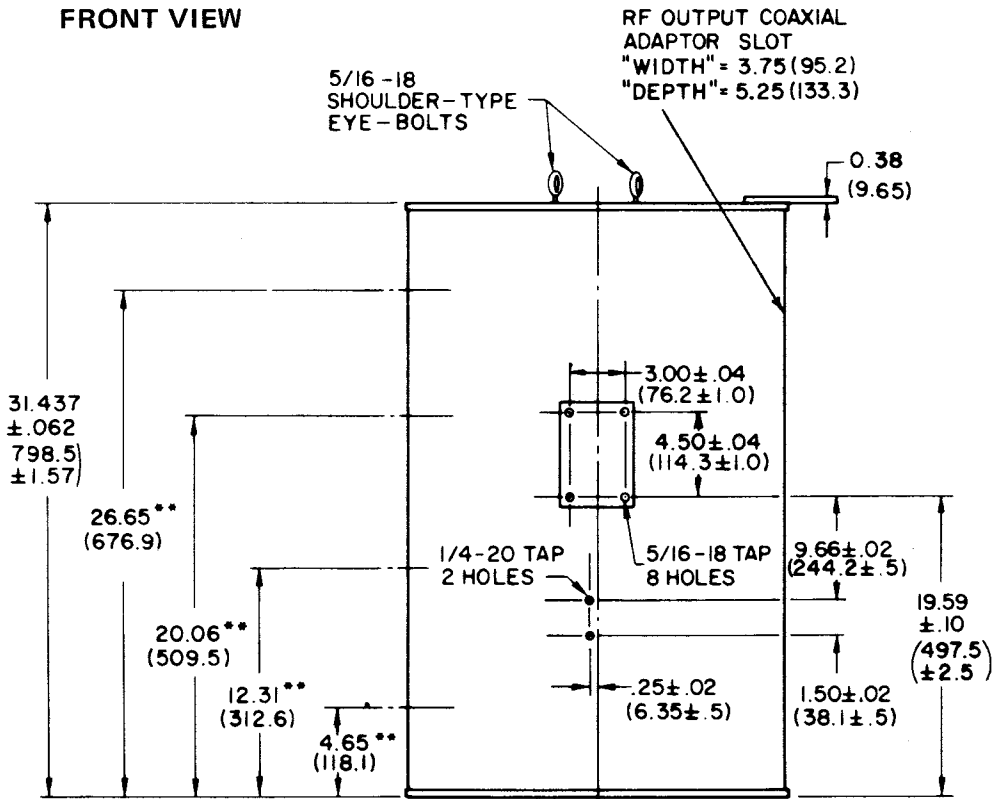
The use of a solid-state diode connected in parallel with the electromagnet is recommended to prevent excessive transient voltage build-up in the event of coil current interruptions. Connections should be made so the coil current will flow through the diode when the polarity of the normal coil voltage becomes reversed.

ELECTROMAGNET DIMENSIONAL OUTLINE



## ELECTROMAGNET DIMENSIONAL OUTLINE

## FRONT VIEW

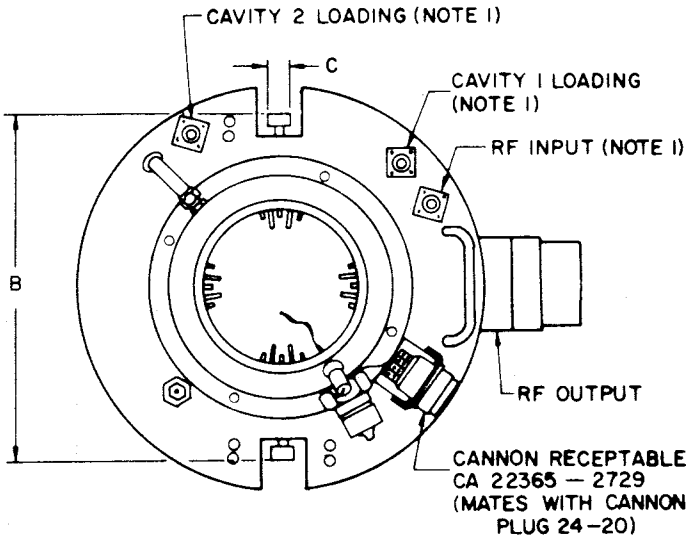


92 LM - 3369

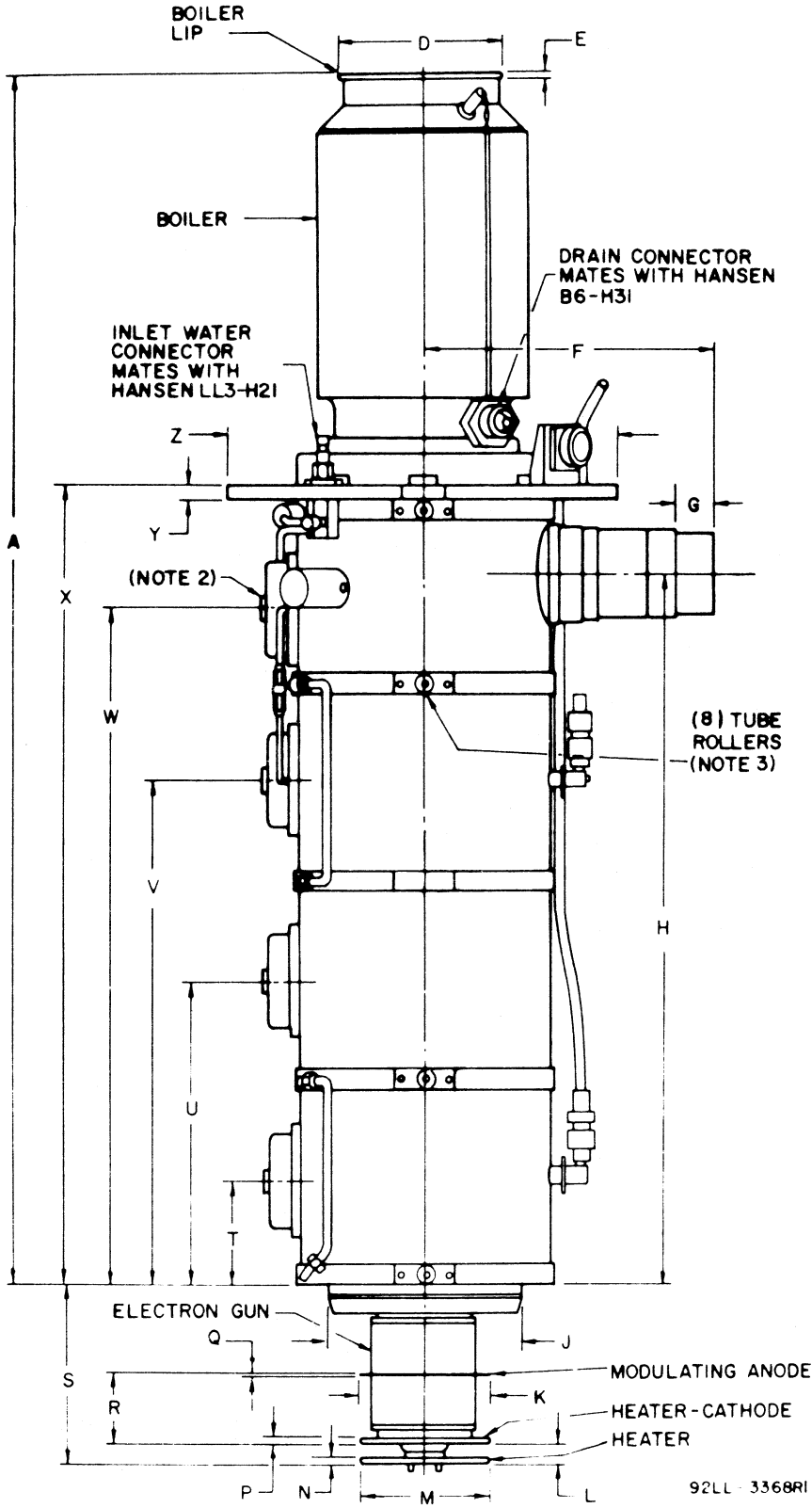
\*\*LOCATION OF 1" DIAMETER TUNING PORTS

## KLYSTRON DIMENSIONAL OUTLINE

## TOP VIEW



KLYSTRON DIMENSIONAL OUTLINE (Cont'd)



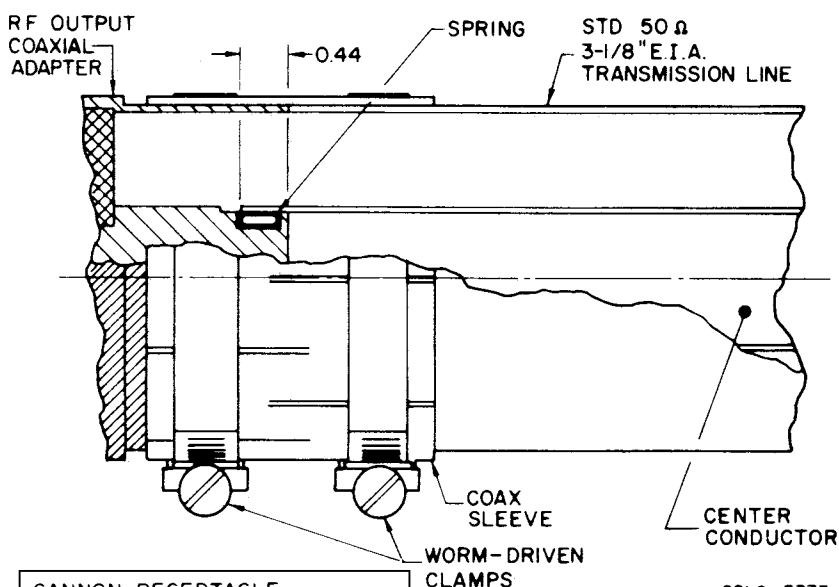
## KLYSTRON OUTLINE DIMENSIONS

| Ref.   | Inches           | Millimeters       |
|--------|------------------|-------------------|
| A      | $50.83 \pm 0.25$ | $1290.0 \pm 6.3$  |
| B      | 12.40 Max.       | 314.9 Max.        |
| C Dia. | 0.75 Ref.        | 19.05             |
| D Dia. | $6.40 \pm 0.04$  | $162.56 \pm 1.0$  |
| E      | $0.23 \pm 0.04$  | $5.84 \pm 1.0$    |
| F      | $11.00 \pm 0.12$ | $279.4 \pm 3.0$   |
| G      | $1.51 \pm 0.01$  | $38.35 \pm 0.25$  |
| H      | $27.52 \pm 0.06$ | $699.0 \pm 1.5$   |
| J Dia. | 7.50 Max.        | 190.5 Max.        |
| K Dia. | $5.00 \pm 0.01$  | $127.00 \pm 0.25$ |
| L      | $0.69 \pm 0.05$  | $17.53 \pm 1.2$   |
| M Dia. | $5.00 \pm 0.03$  | $127.00 \pm 0.76$ |
| N      | $0.19 \pm 0.01$  | $4.82 \pm 0.25$   |
| P      | $0.19 \pm 0.01$  | $4.82 \pm 0.25$   |
| Q      | 0.04             | 1.0               |
| R      | $2.79 \pm 0.05$  | $70.86 \pm 1.2$   |
| S      | $6.89 \pm 0.07$  | $175.0 \pm 1.7$   |
| T      | $4.16 \pm 0.03$  | $105.66 \pm 0.76$ |
| U      | $11.80 \pm 0.04$ | $299.72 \pm 1.0$  |
| V      | $19.60 \pm 0.05$ | $497.8 \pm 1.3$   |
| W      | $26.20 \pm 0.06$ | $665.5 \pm 1.5$   |
| X      | $30.82 \pm 0.09$ | $782.8 \pm 2.2$   |
| Y      | $0.50 \pm 0.02$  | $12.70 \pm 0.5$   |
| Z Dia. | 15.00 Max.       | 381.0 Max.        |

## Notes:

1. UG-22 B/U jack mates with UG-21 D/U
2. Channel tuning screws 5/16" hex socket head.
3. Tube rollers mate with RCA AJ2166 electromagnet.

## DETAIL RF OUTPUT CONNECTOR



CANNON RECEPTACLE  
CA 22365 - 2729

## PIN CONNECTIONS

|     |                        |
|-----|------------------------|
| A } | JUMPER, #16 AWG        |
| B } |                        |
| C } | JUMPER, #16 AWG        |
| D } |                        |
| E   | BODY (GROUND)          |
| F   | COLLECTOR *            |
| G   | COLLECTOR              |
| H   | CHROMEL } THERMOCOUPLE |
| J   | ALUMEL } CONNECTIONS   |

\*ALWAYS USE PINS F AND G IN PARALLEL

More complete information covering the handling, installation, safety and operation of this type may be obtained through an RCA Field Representative or by writing RCA Super Power Tube Marketing, Lancaster, PA. 17604.