

DESCRIPTION

VA-936E five-cavity klystron amplifiers for use in CW earth-to-satellite communication systems. The tube is mechanically tunable over the 5.925 to 6.425 gigahertz band and delivers a CW output of at least 3 kilowatts. The tube features an integral "channel tuner" which permits tuning to any of five selected preset frequencies within the 500-megahertz band in seconds. The channel settings may be reset and adjusted in the field. An optional accessory, the VA-1436 Remote Servo Tuner is available for remote channel selection. The VA-936E has a 1-dB bandwidth of about 58 megahertz at 6.4 gigahertz. Over the 500-megahertz range, the 1-dB bandwidth is at least 45 megahertz.

MAXIMUM RATINGS¹

Beam Voltage	10 kVdc
Beam Current	1.1 Adc
Body Current, with drive	50 mAdc
Heater Surge Current	14 A
Reflected Power ²	120 W
Coolant Outlet Temperature, tube	80 °C
Magnet Voltage	150 Vdc
Magnet Current	7 Adc
Hydrostatic Pressure	
Tube	125 lbf/in ² g
Magnet	125 lbf/in ² g
Magnet Coolant Inlet Temperature	65 °C

GENERAL CHARACTERISTICS³

ELECTRICAL

Frequency Range	5.925-6.425 GHz
Tuning Range	±250 MHz
Heater Voltage	6.0 V
Heater Current	6.5 ± 0.5 A
Heater Warm-up Time, minimum	5 min
Focusing Magnet	VA-1936B Electromagnet

PHYSICAL

Dimensions	See Outline Drawing
Weight, approximate	
VA-936E	24 lb
VA-1936B	70 lb
Mounting Position	Any
Tuning Method	Channel Selector
Cooling ⁴	Liquid and Forced Air
Connectors	See Outline Drawing



TYPICAL OPERATING CONDITIONS³

Frequency	6.395 GHz
Power Output	3.1 kW
Bandwidth, 1-dB	58 MHz
Drive Power	300 mW
Gain	40 dB
Efficiency	35 %
Beam Voltage	8.15 kVdc
Beam Current	1.07 Adc
Body Current with drive	10 mAdc
Magnet Current	6.5 Adc
Load VSWR	1.05:1

COOLING

Water Flow, minimum⁴

Body	1 gal/min
Magnet	1 gal/min

Air Flow, minimum⁵

Collector	900 lb/h
Cathode	85 lb/h

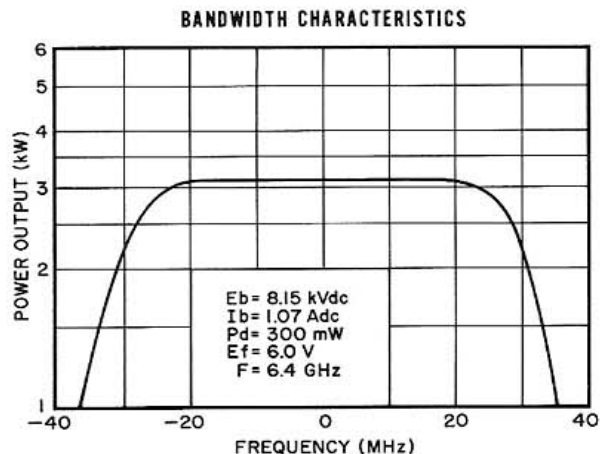
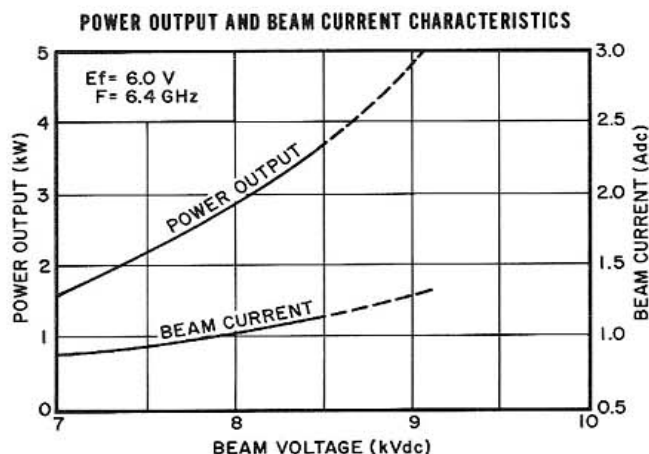
Pressure Drop, maximum at minimum flow

Body	5 lbf/in ²
Magnet	25 lbf/in ²

Back Pressure, at 900 lb/h 3 in-H₂O

CHARACTERISTIC CURVES

Typical performance values



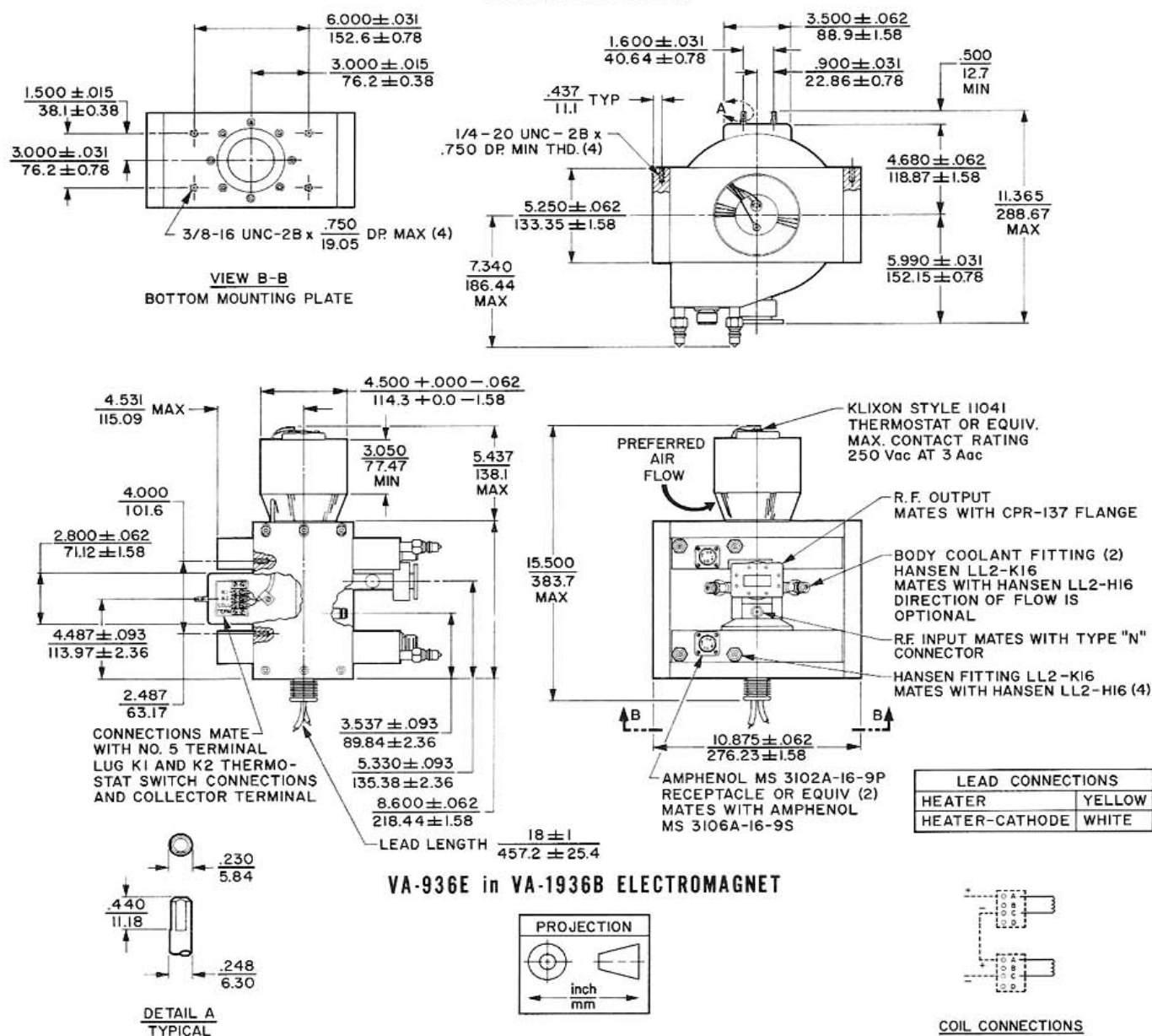
NOTES:

1. Ratings should not be exceeded under continuous or transient conditions. A single rating may be the limitation and simultaneous operation at more than one rating may not be possible. Equipment design should limit voltage and environmental variations so that ratings will never be exceeded.
2. Corresponds to a load VSWR of 1.5:1 at 3 kilowatts.
3. Characteristics and operating values are based on performance tests. These figures may change without notice as a result of additional information or product refinement. Varian Associates should be consulted before using this information for final equipment design.
4. Metals in the coolant system should be close to copper in

the galvanic series. Distilled water is the preferred coolant. In addition, approximately 85 lb/h (20 ft³/min) of air should be directed at the cathode end of the tube. Values specified are for systems operating at atmospheric pressure at sea level. For different coolants or operating conditions, consult Varian Associates for recommendations.

5. Minimum air flow rate required at maximum beam power input and 20 °C ambient temperature. At increased ambient temperatures, more air flow may be required to provide adequate cooling. The required increase in air flow can be determined from information published by blower manufacturers. For additional cooling information, contact the Varian Palo Alto Tube Division.

OUTLINE DRAWING



OPERATING HAZARDS

Read the following and take all necessary precautions to protect personnel. Safe operating conditions are the responsibility of the equipment designer and the user.

High Voltage. This tube operates at voltages which can be deadly. Equipment must be designed so personnel cannot come in contact with operating voltages. Enclose high-voltage circuits and terminals and provide fail-safe interlocking switch circuits to open the primary circuits of the power supply and to discharge high-voltage condensers whenever access is required.

Microwave Radiation. Exposure of the human body to microwave radiation in excess of 1 milliwatt per square centimeter is unsafe and can result in blindness or other injury. Personnel must be fully protected from the microwave energy which radiates from this device. All input and output r-f connections, waveguide flanges, and gaskets must be r-f leakproof and

properly engaged. Never operate this device without a microwave-energy-absorbing load attached. Personnel must be prevented from looking into open waveguides or antennas while such a device is energized. (Ref. Proc. IRE, Vol. 49, No. 2, pp. 427-447, Feb. 1961).

X Rays. This device may produce X-ray radiation when energized. Operating personnel must be protected by appropriate shielding. Provide adequate X-ray shielding on all sides of this device, as well as the modulator and pulse transformer tanks. X-ray caution signs or labels must be permanently attached to equipment directing operating personnel never to operate this device without X-ray shielding in place.

Equipment must be designed to fully safeguard all personnel from these hazards. Labels and caution notices must be provided on equipment and in manuals clearly warning of those hazards which cannot be avoided.