



varian
palo alto tube division

TECHNICAL DATA

4KM50SK

CW KLYSTRON AMPLIFIER

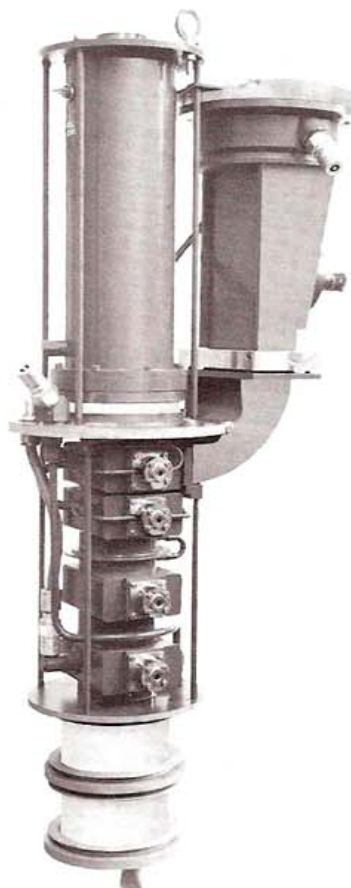
2.55-2.70 GHz
10 kW

DESCRIPTION

The 4KM50SK is a four-cavity klystron amplifier for use in tropospheric scatter communication systems. It delivers a CW output of at least 10 kilowatts over its tunable frequency range of 2.55 to 2.70 gigahertz. An integral modulating anode provides protection against internal arcs and a photocell detector in the output waveguide protects the tube against external arcs. The extra-large cathode assures long tube life. The 4KM50SK uses the H-161 Electromagnet for beam focusing. Both the klystron and electromagnet are liquid cooled. In addition, the klystron cathode requires auxiliary forced-air cooling.

MAXIMUM RATINGS¹

Beam Voltage	20 kVdc
Beam Current	3 Adc
Collector Dissipation	50 kW
Body Current	100 mAdc
Heater Surge Current	12 A
Load VSWR ²	1.5:1
Outlet Water Temperature	80 °C
Hydrostatic Pressure	100 lbf/in ² g



GENERAL CHARACTERISTICS³

ELECTRICAL⁴

Frequency Range	2.55 to 2.70 GHz
Power Output, min	10 kW
Heater Voltage	7.5 V
Heater Current, typ	12 A
Heater Warm-up Time, min	5 min
Getter Voltage ⁵	4 Vac
Getter Current	20 Aac
Phase Pushing Factor, Typ	0.062 °/V
Electromagnet Voltage, max	150 Vdc
Electromagnet Current, max	15 Adc

PHYSICAL

Dimensions	See Outline Drawings
Weight, approx	
Tube	90 lb
H-161 Electromagnet	170 lb
Mounting Position	Vertical, cathode down
Cooling	Liquid and Forced Air
Connectors	See Outline Drawings

TYPICAL OPERATING CONDITIONS ³

	HIGH EFFICIENCY TUNED		BROADBAND TUNED	
	2.55	2.70	2.55	2.70 GHz
Frequency	2.55	2.70	2.55	2.70 GHz
Power Output	13.2	12.1	10.2	10.1 kW
Drive Power	1	1	1	1 W
Gain	41.2	40.7	40.1	40.0 dB
Bandwidth, 3-dB	9	10	14	14 MHz
Beam Voltage	18	18	18	18 kVdc
Beam Current	1.8	1.8	1.8	1.8 Adc
Modulating Anode Voltage	10.4	10.4	10.4	10.4 kVdc
Body Current	45	45	55	55 mAdc
Electromagnet Current	12.5	12.5	12.5	12.5 Adc

COOLING

The tube and electromagnet require a cooling system capable of dissipating about 50 kilowatts. Distilled water is the preferred coolant. Metals in the circulating system should be close to copper in the galvanic series. Maximum inlet water temperature is 60°C for cooling systems operating at atmospheric pressure at sea

level. In addition, a forced-air flow of 20 ft³/min should be directed at the cathode ceramic-to-metal seals. For different coolants or operating conditions, contact the nearest Varian Sales Office or the Palo Alto Tube Division for recommendations.

Water Flow, min

Collector	18.0 gal/min
Body	1.2 gal/min
H-161 Electromagnet	2.0 gal/min

Pressure Drop, at min flow

Collector	30 lbf/in ²
Body	40 lbf/in ²
H-161 Electromagnet	25 lbf/in ²

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 ener-

gized. (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.

Beryllium-Oxide Ceramics. This tube contains Beryllium-Oxide Ceramics. BERYLLIUM-OXIDE DUST AND FUMES ARE HIGHLY TOXIC AND BREATHING THEM CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH. Never perform any operation on the ceramic parts of this tube which might produce dust or fumes, such as grinding, grit blasting and acid cleaning.

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.

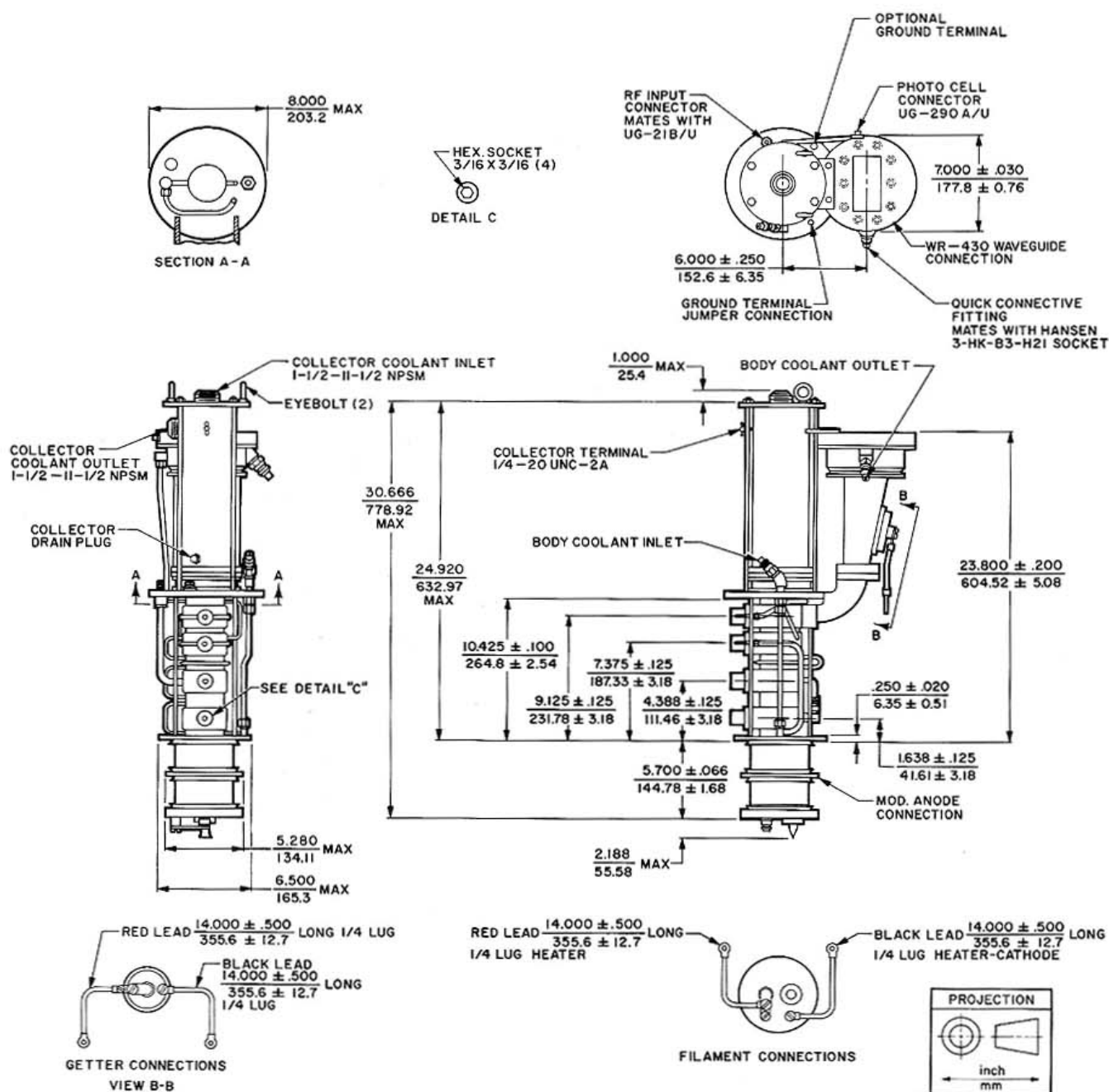
NOTES:

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 the absolute ratings will never be exceeded.
2. Although the tube will withstand a load VSWR of 1.5:1, the load VSWR must be 1.3:1 or less to produce an output of 20 kW or more.
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 considered before using this information for final equipment design.

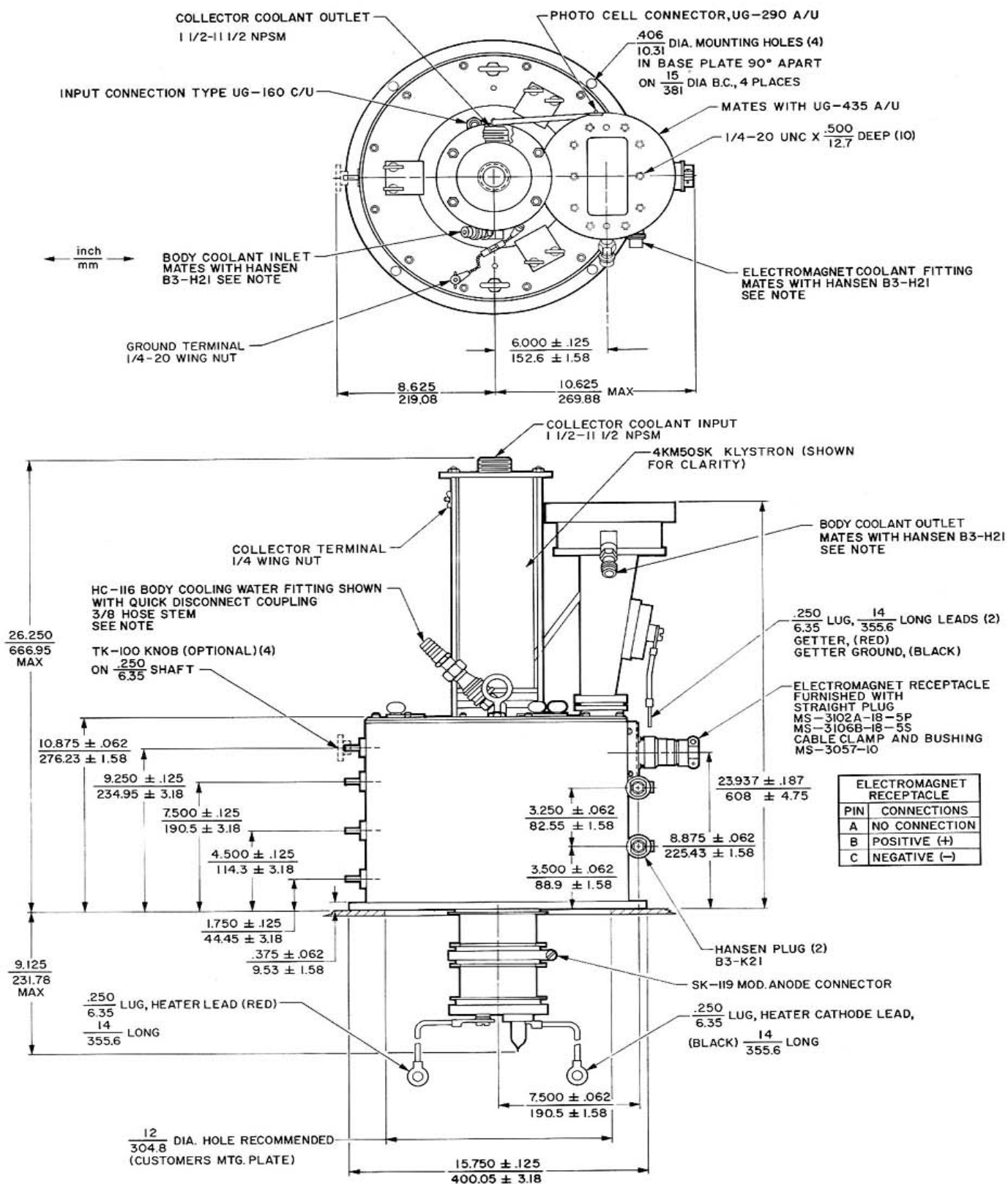
4. To protect against internal arcs, a 10,000-ohm, 100-watt resistor should be connected between the modulating anode and the beam supply.
5. Getter voltage must be applied whenever heater voltage is applied.

OUTLINE DRAWING



4KM50SK

OUTLINE DRAWING



NOTE:

ALL TUBE BODY AND ELECTROMAGNET COOLANT FITTINGS
CAN BE FITTED WITH OPTIONAL QUICK DISCONNECT VALVED COUPLING,
HC-116, .375 HOSE STEM.
9.53