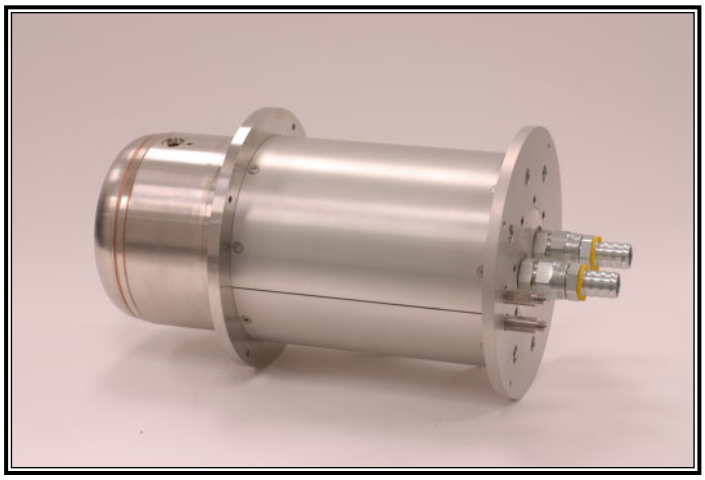
VARIAN medical systems

X-RAY PRODUCTS

CEG-200
Industrial X-Ray Tube



PRODUCT DESCRIPTION

Maximum X-ray intensity is achieved by use of a beryllium window which is the only element of inherent filtration.

The cathode operates at ground potential eliminating window heating caused by electron bombardment.

Cooling of the X-ray target ensures the insert's capability of continuous operation up to 16,000 watts. A cathode cooling system removes filament heating energy.

CONSTRUCTION

The design is based on the well proven OEG-76. The construction uses the most recent improvements in materials and fabrication technologies. The X-ray beam is projected along the longitudinal axis of the tube unit through the X-ray window which is located at the end of the tube. This design feature increases accessibility to the X-ray port.

The tungsten filament in the cathode has the shape of a toroid surrounding the anode. This design permits placement of the target in a plane perpendicular to the central axis of the X-ray beam which reduces target-to-sample distance to a minimum.

Insert Characteristics

Envelope: Grounded stainless steel vacuum section encloses anode and cathode assemblies. The cathode assembly incorporates a beryllium X-ray window and includes filament feed-thru insulators and cooling for removing filament heat. The anode-assembly incorporates a ceramic-to-metal anode support and insulation. The entire vacuum section is enclosed in the housing.

Anode: Copper with target imbedded. Contains cooling passage. Operates at positive high voltage with respect to grounded cathode jacket.

Target Material: Tungsten (W)

Target Angle: 90° to central X-ray beam and tube longitudinal axis. Target surface is parallel to beryllium window.

Focal Spot: Toroidal, approximately 80mm OD x 36mm ID

Filament (Cathode): Toroidal, tungsten filament. Filament leads are insulated from the grounded support and focusing structure.

Filament (Cathode) Characteristics:
Operating Voltage Range: 20.0 - 35.0 volts AC
Operating Current Range: 7.0 - 10.0 amperes
Filament Current (maximum): 11.0 amperes
Filament Insulation from Ground: 500 megohm minimum, 500V minimum breakdown. (see Operation Precautions)

Housing Characteristics

Electrical Rating:
Maximum Voltage: 200 kV
The high-voltage circuit should contain at least 20,000 ohms of added resistance.
(see Maximum Allowable Input Power Curves) - TBD

Radiation Characteristics:
Inherent Filtration - 2.5mm Beryllium

X-Ray Coverage: (See Figure) Full-umbra coverage of 40 cm diameter with specimen at 10 cm from end of tube.

Cooling Method: Anode - Forced flow of Syltherm HF.
Cathode Jacket - Circulated anode fluid or forced flow of tap water.

Terminal Connections: Anode - R28
Filament - Filament cable 20 foot. 2 conductor No.14 AWG

Ground/Earth: Terminal Available

Weight: Approximately 122 lbs. (50.8 kg)

WARNING

Beryllium windows transmit a very high level of long wavelength X-radiation, which can injure human tissue.

Injury may occur from even very short exposures to the primary X-ray beam.

Follow all precautions necessary to avoid radiation exposure to humans.

The radiation dose rate cannot be accurately measured with conventional radiation measurement instruments. Radiation intensity in each installation will vary, and calibration must include the effects of long wavelength X-radiation.

Fumes from beryllium metal (or its compounds) as well as dust can be hazardous if inhaled. During use, corrosion products may occur on the beryllium window, but these should not be scraped off, machined, or otherwise removed. Tube unit disposal should conform to federal, state, and local regulations governing beryllium.

WARRANTY NOTE

CEG-200 tube units which fail prematurely will not be covered by the Varian warranty when inspection at our factory indicates that a failure occurred due to cooling system.

INITIAL INSPECTION

When an CEG-200 is received, it should be unpacked and inspected as soon as possible.

Care must be used when handling the tube not to touch or apply any pressure to the exposed beryllium window. A careful inspection should be made for any visible damage, such as a broken beryllium window which may have occurred in transit.

An ohm meter may be used to determine if a filament (cathode)-to-vacuum section short has occurred. A filament-to-body short will prevent reading tube current when the tube current metering is in the filament (cathode) circuit.

EQUIPMENT DESIGN CONSIDERATIONS

(Mechanical Installation)

The tube unit may be mounted and operated with the window up, down, or at any angle. In the window up position, precautions must be taken to assure full flow to the anode cooling circuit for a minimum of 5 seconds after anode power is cut off. Anode cooling should be at full flow before turning on anode power in all positions.

A low resistance electrical connection should be made between the housing and ground.

OPERATION PRECAUTIONS

Since the cathode jacket of the tube is operated at ground potential, ordinary tap water can be used for cooling this part of the tube unit. However, the water should be reasonably free from corrosive or scale producing impurities. Whenever the filament is energized, the specified minimum water flow rate (TBD) should be maintained to prevent reaching excessive housing temperature due to filament heat. The cathode jacket may be connected in series with the anode cooling circuit, allowing the use of a single circulating pump without substantially incurring back pressure in the supply circuit.

The tube current metering circuit should be arranged so as not to read that portion of anode current due to leakage through the anode cooling. The filament leads of the tube unit are insulated from ground to facilitate the measurement of tube current.

The preferred tube current metering circuit is to place the meter in series with the filament (cathode) transformer winding center tap and tube unit ground. The filament must not be more than (TBD) volts dc, positive or negative, with respect to ground since biasing will distort the focal spot size and distribution. Operation with bias will nullify the warranty on this tube unit.

Under self bias conditions which can occur if the filament power transformer winding accidentally disconnects from ground (such as an open meter), the focal spot can shrink in size to a small diameter circular line which if under full power loading will melt the target material in a few seconds and ruin the tube unit.

NOTE

A protective device such as a zener diode should be employed between the filament circuit and ground to prevent the filament supply conductors from reaching a high potential in the event of interruption of the tube current metering circuit to ground.

Operation of the tube in high humidity conditions with the window temperature below ambient must be avoided. Condensation on the beryllium window will cause corrosion and subsequent window perforations.. Care should be taken to prevent water and other foreign materials from coming in contact with the beryllium surface.

CALIBRATION

Prior to the operation of the tube, both the high-voltage and filament energy sources should be calibrated. Kilovoltage calibration should be performed to ensure that the maximum voltage rating of the tube is not exceeded. Filament control circuit calibration is necessary to permit the filament current to be preset for any desired tube milli-amperage before each exposure.

SHIPPING AND TRANSPORT

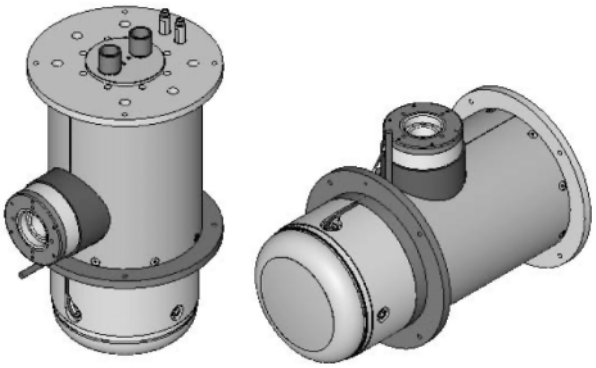
The original packing or its equivalent must be used when reshipping the tube unit. The tube unit should be wrapped in the plastic bag in which it was received and a bag of dry desiccant placed inside before sealing the bag. The desiccant originally used can be dried by baking in an oven at 212°F (100°C) for a few hours.

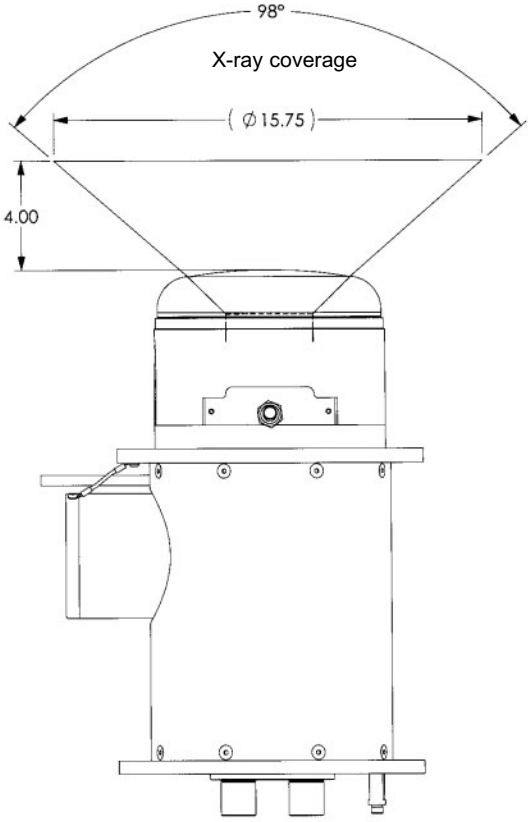
Minimum Temperature for Storage or Transportation:
15°F (-9.4°C)

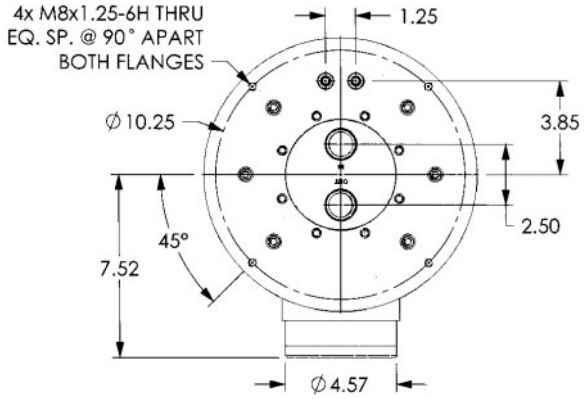
AGING PROCEDURE

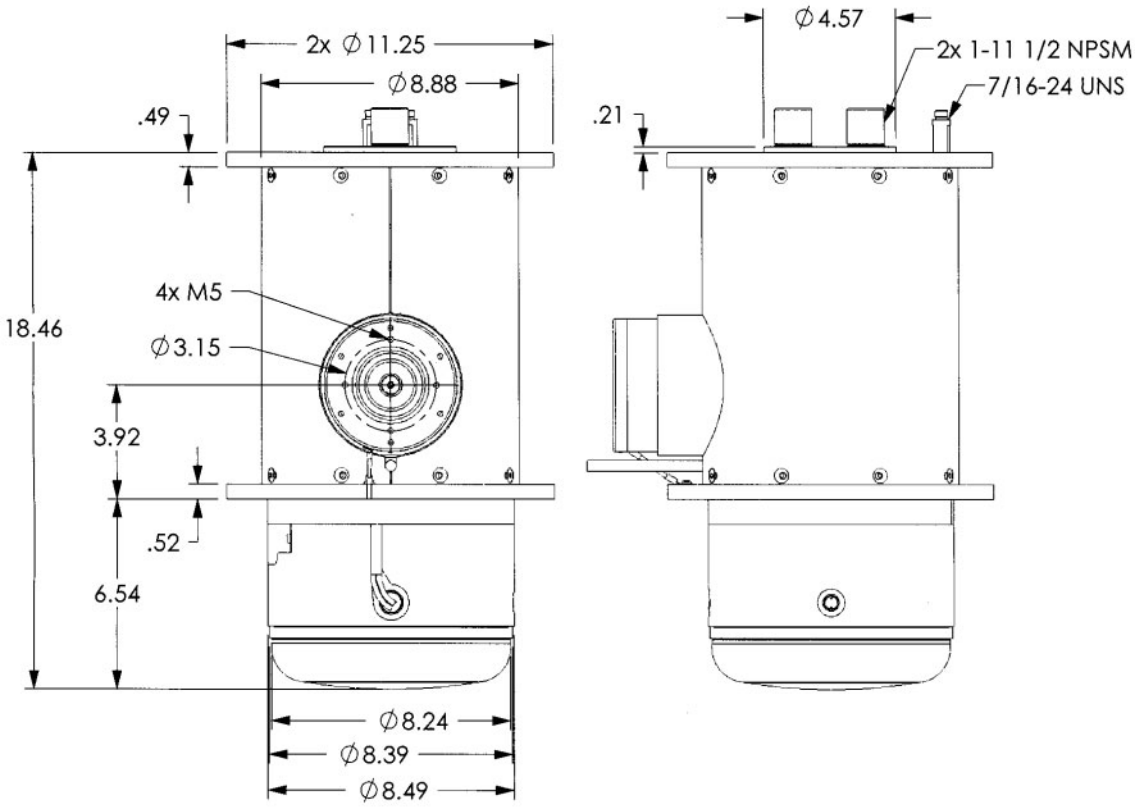
Full rated peak kilovoltage must not be applied immediately to these tubes after they have been idle for a period of time. Initial operation must begin at a reduced kVp, and the voltage must be gradually raised in small steps until the intended operating voltage is reached.. If instability is observed at any step, the time for that step must be increased until the tube has operated for at least 5 minutes with no further instability. If instability is violent, return to the previous step. Instability can be observed as fluctuations on the mA meter.

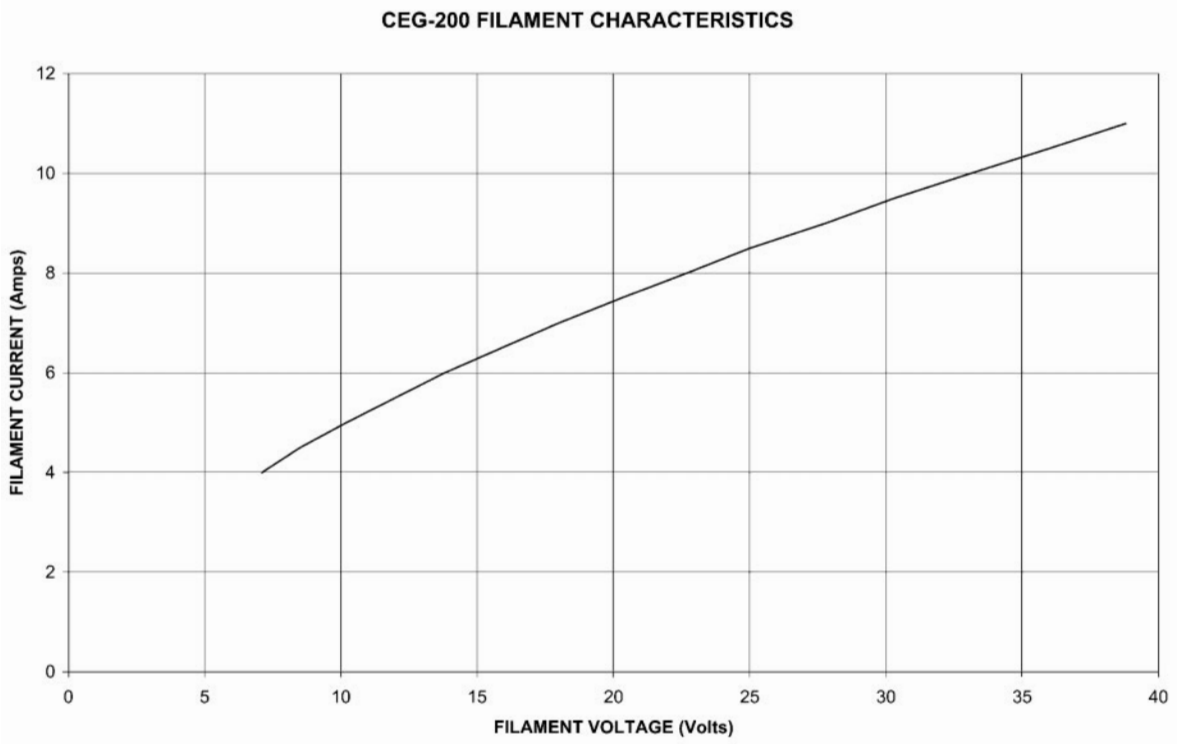
If instability is observed at progressively lower kVp levels, or if instability persists at a low kVp level, operation should be discontinued. Operation should be discontinued in any event if “crackling” or “spitting” sounds occur within the housing, indicating arcing or corona through the oil insulation. Continued operation under such conditions may result in serious damage to an otherwise repairable tube.

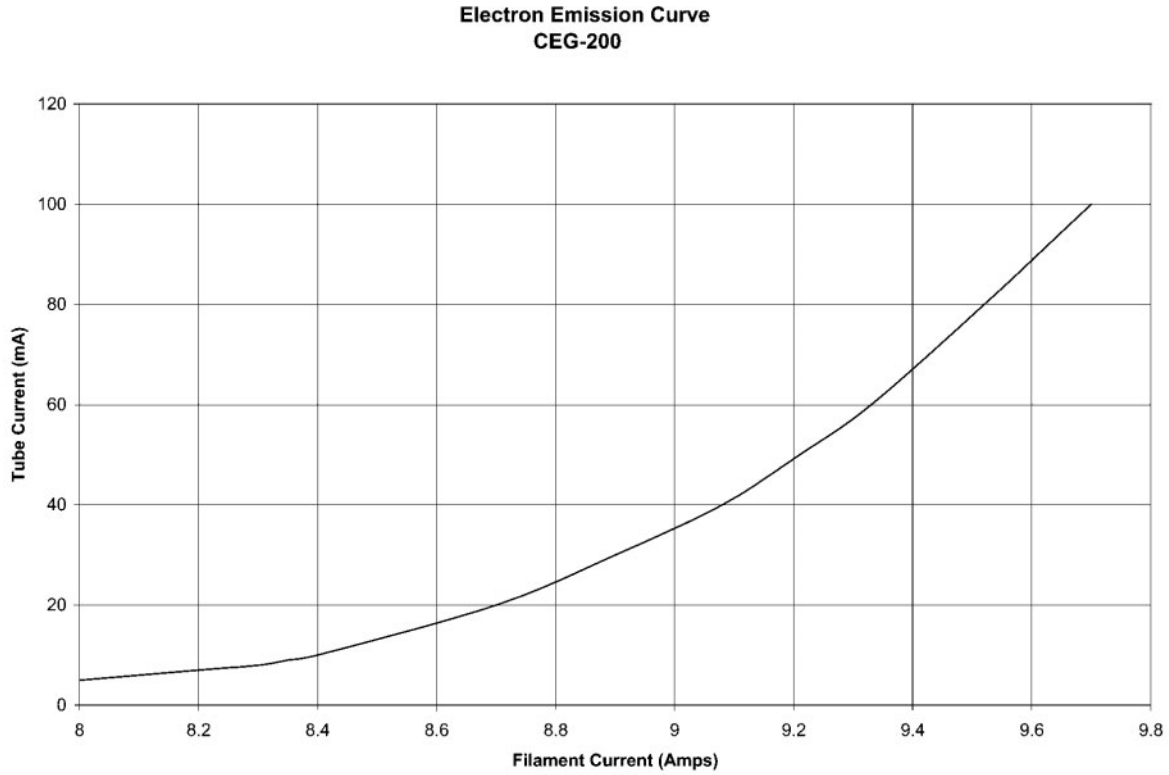












VARIAN medical systems
X-RAY PRODUCTS

Salt Lake City, UT 1-801-972-5000

www.varian.com