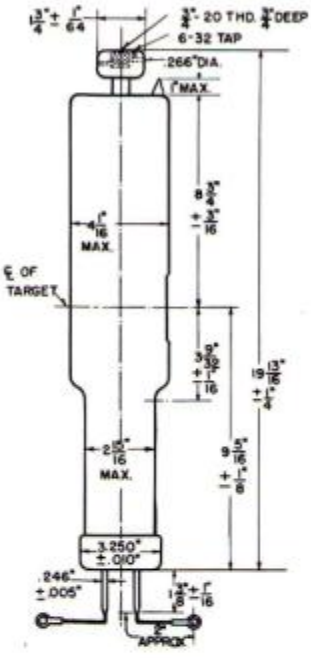
WESTINGHOUSE X-RAY TUBES



OIL INSULATED 220-250 KV DEEP THERAPY AND INDUSTRIAL RADIOGRAPHIC X-RAY TUBES TYPES WL340, 381, 390 AND 395

VOLTAGE RATINGS

TUBE TYPE	FULL WAVE RECTIFIED OR CONSTANT POTENTIAL
WL340 & 381	220 KVP
WL390 & 395	250 KVP

APPLICATION

This group of Westinghouse tubes is designed for operation in oil insulated, shockproof, cable connected heads with provision for forced oil cooling for deep therapy and industrial radiographic work at 220 and 250 kvp.

SPECIFICATIONS

FOCAL SPOTS:

The 20° line focus feature produces a projected focal spot 1/3 the actual area. The industrial radiographic types WL381 and 390 have focal spots 3.5 mm².

FILAMENT CHARACTERISTICS:

Filament currents range from 3.5 to 4.5 amperes and voltages from 4.0 to 7.0 volts.

Tube life is conserved by turning the filament off between exposures unless the next exposure is to follow immediately.

Operation at voltages below 100 kvp requires higher filament current, which should never be allowed to exceed 4.75 amperes. Do not operate filament over 4.5 amperes any longer than necessary.

RATING DATA:

KVP	Milliamperes—Continuous					
	Constant Potential				Pulsating	
	WL340	WL381	WL390 *	WL395 *	WL340	WL381
250			10	15		
225			11	16		
220	16	11			20	15
200	18	12.5	12.5	18	25	16.5
175	20	14	14	20	25	19
150	20	16.5	16.5	20	25	22
125	20	20	20	20	25	25
100	20	20	20	20	25	25

*Series resistances of 150,000 ohms at each terminal of the high voltage supply and 50,000 ohms within the tube head are required for these types.

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STARTING INSTRUCTIONS:

Initial application of high voltage should be performed with resistance in primary of x-ray transformer and should never exceed 150 kvp. It is recommended that tube voltage then be increased to the desired value by gradually removing the resistance in a period of from 8 to 15 seconds rather than by adjusting tap settings.

WARM-UP SCHEDULE:

When a tube has not been operated at the desired voltage, or higher, within two hours, the following warm-up schedule, starting at 150 kvp and increasing in 10 kv steps, shall be followed.

Idle Period	2 hours	8 hours	1 week	2 months
Time at Each Step	15 seconds	30 seconds	1 minute	5 minutes

GENERAL DESIGN INFORMATION

GETTER:

The most advanced techniques are used in pretreatment of parts and exhaust, but in addition, the use of an efficient getter within a specially shielded chamber in the tube insures maintenance of a high degree of vacuum during tube life. This reduces the possibility of gas flashes and insures maximum stability even with a hot anode. The latter effect is particularly noticeable in continuous operation where the usual drop in tube current is minimized.

BULB:

Bulbs are made of hard, high transmission glass and as a protection against punctures are of heavy cross section, being approximately one quarter of an inch thick. Uniformity of output of individual tubes is assured by controlled window thickness obtained by grinding.

ANODE:

Targets are made of Westinghouse tungsten and all surfaces of the anode except the target area are plated to inhibit bulb deposits throughout life.

KOVAR:

Anode seals are made of Westinghouse developed Kovar which has won wide acceptance in the electronics industry because of the high degree of quality control exercised in our plants during its manufacture. The use of Kovar provides a rugged construction so that the full thickness of metal is maintained at the edge of the glass seal insuring maximum strength and freedom from leaks through the metal, thus increasing the life expectancy of the tube.

ANODE COOLING

The design of the anode cooling device provides a means of transferring heat from the focal spot to the oil with a high degree of efficiency. Thus, under correct flow conditions, the oil is kept well below its carbonization temperature at maximum tube ratings. Highly polished plating of the cooling area of the anode and the cooling plug avoids any possibility of a chemical reaction occurring between the oil and hot copper. The maintenance of a low oil temperature and oil protection contribute to the life expectancy of the tube by preventing premature deterioration of the oil.

Lower than usual anode temperatures, with the accompanying beneficial results noted above, are obtained by providing for the delivery of a measured quantity of oil to the plated cooling surface behind the target at high velocity through a multiplicity of fine jets. With clean oil and a pressure drop of about 30 pounds per square inch across the tube, sufficient flow is assured by a calibrated annular space through which the oil returns to the tube head. This adjustment is made on each tube at the factory and locked in the position at which the correct flow is obtained under specified conditions of temperature and pressure. The setting of the cooling plug should never be altered in the field.

Proper cooling requires a cooler capable of delivering 4 gallons of oil per minute at a temperature not exceeding 125°F to the tube inlet at a pressure of 40 to 70 pounds per square inch depending on the diameter of the hose connections between the cooler and the tube head. Clean, low viscosity oil with a minimum dielectric breakdown of 40 kvp per .100" is required.

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