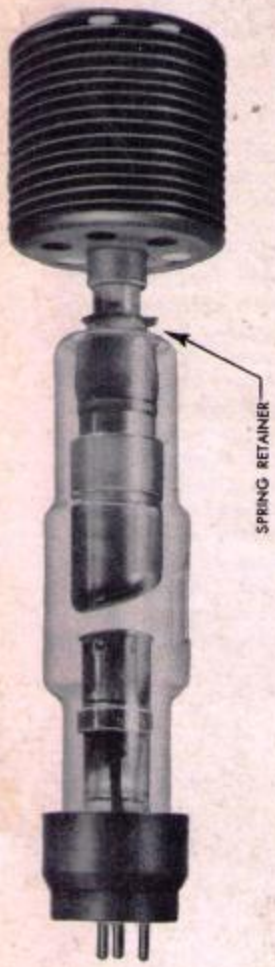
WESTINGHOUSE X-RAY TUBES



RAYPROOF 100 KV REMOVABLE INSERT RADIOGRAPHIC X-RAY TUBES

REGULAR DUTY	HEAVY DUTY
WL5532	WL5536
WL5533	WL5537
WL5534	WL5538
WL5535	WL5539
	WL5540

VOLTAGE RATINGS

FULL WAVE RECTIFIED.....100KVP
HALF WAVE RECTIFIED.....100KVP
SELF RECTIFIED.....90KVP USEFUL, 100KVP INVERSE

APPLICATION

Westinghouse Rayproof Tubes are designed for general radiographic work and are available in Regular and Heavy Duty designs depending upon the requirements of the user. The insulating housing incorporates x-ray protection for the operator and insert tubes may be readily changed and cleaned in the field.

SPECIFICATIONS

FOCAL SPOTS:

The 20° line focus feature produces a projected focal spot 1/3 the actual area. Single and double focal spot sizes are listed below.

TUBE TYPE		FOCAL SPOT
REGULAR DUTY	HEAVY DUTY	PROJECTED SIZE
WL5532	WL5536	2.1 mm²
WL5533	WL5537	3.0 mm²
WL5534	WL5538	4.2 mm²
WL5535	WL5539	2.1 & 4.2 mm²
	WL5540	1.5 & 3.0 mm²

FILAMENT CHARACTERISTICS:

Individual filament settings depend upon the exposure technique used. The range of currents is from 3.5 to 5.5 amperes and the voltage range from 3.5 to 10.0 volts. When taking a series of exposures, tube life is conserved by turning the filament off between exposures unless the next exposure is to follow immediately.

RATING DATA:

VOLTAGE: *See above.* CURRENT: *Maximum ratings given on pages 5, 6, 7 and 8.*

FLUOROSCOPY: *Regular Duty—85kvp, 5ma or 100kvp, 4.25ma, 10 min. Heavy Duty—85kvp, 5ma or 100 kvp, 4.25ma, 20 min.*

ANODE HEAT CAPACITY: *Regular Duty—150,000 H.U. Heavy Duty—270,000 H.U. See cooling charts on pages 2 and 3.*

TIME BETWEEN EXPOSURES AT MAXIMUM RATING: *Under 1/10 second—3 seconds, over 1/10 second—5 seconds. In Stereoradiography the total time of the two exposures is to be used as the basis for determining the ratings permitted by the chart. In general the ratings allowed will be 90% of that allowed for a single exposure.*

FRACTIONAL SECOND EXPOSURES:

The possibility of damaging the target during high milliamperage fractional second exposures on a cold tube is greatly minimized if a preliminary "warm up" exposure of about 20,000 H.U. is made at 10 to 15ma. When establishing settings to be used for high ma exposures, in order to avoid damaging the focal spot, care must be exercised not to exceed ratings.

GENERAL DESIGN INFORMATION

ANODE:

The design and processing of the anodes provides efficient conduction of heat from the target, made of Westinghouse tungsten, to the radiator.

KOVAR:

Anode seals are made of Westinghouse developed Kovar which has won wide acceptance for glass to metal seals 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. This sealing operation is performed by radio frequency.

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 during fluoroscopic operation where the usual drop in tube current is minimized.

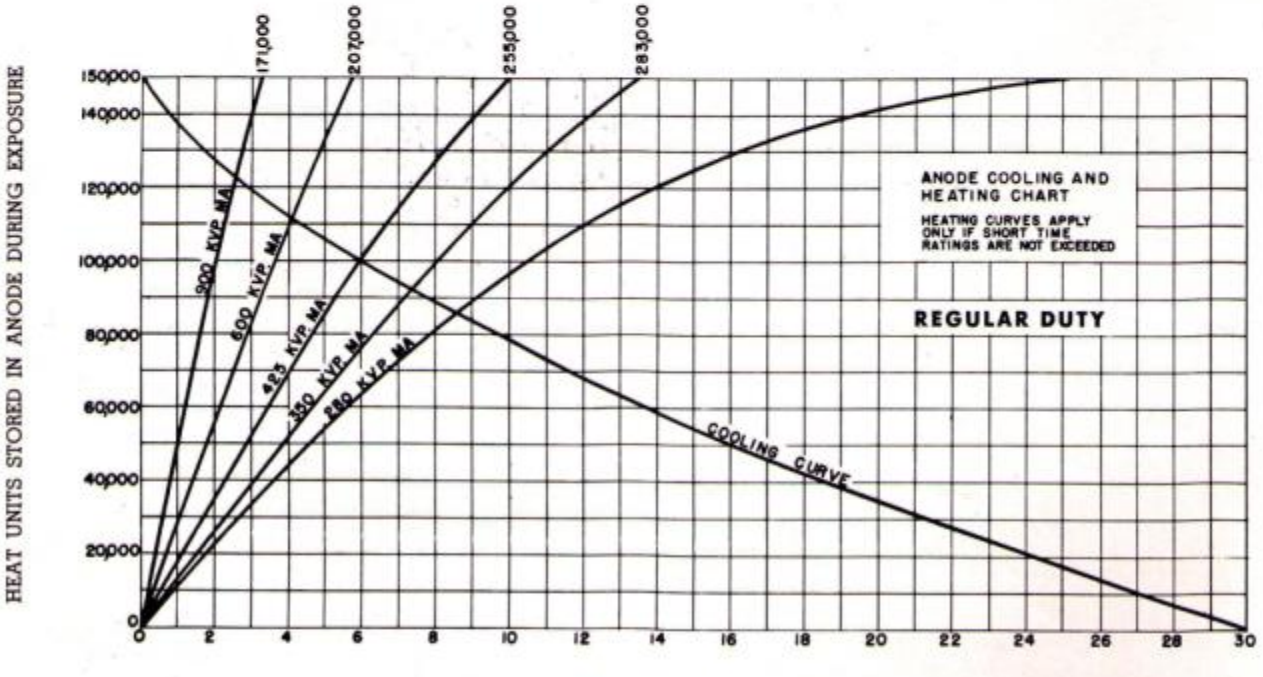
BULB:

Bulbs are made of hard high transmission glass with controlled window thickness contributing to low inherent filtration and maximum x-ray output.

INSERT REMOVAL:

Housings are constructed of rayproof insulating material providing x-ray protection for the operator. One housing design accommodates all tubes described in this bulletin. Inserts can be readily changed and cleaned in the field by removing the threaded clamping ring at the radiator end of the housing and carefully sliding out the insert while holding the split ceramic bushing to avoid breakage. Ceramic bushings need not be removed from the radiator rod when cleaning insert and housing but in installing new inserts the following instructions apply. With the spring retainer located on the shoulder as shown in the insert photograph and the clamping ring positioned adjacent to the radiator, the bushing halves are inserted between the retainer and the radiator rod shoulder nearest to the radiator. The assembly is then inserted in the housing with the target facing the x-ray portal. Positioning fins on the base fit into corresponding grooves in the housing to insure correct focal spot allignment. The clamping ring is then screwed into position by hand. No tools should be used for this operation since hand tightness is sufficient. Housings fit all standard bakelite cones having 1.750"—26 threads.

TOTAL HEAT UNITS APPLIED TO ANODE DURING EXPOSURE



COOLING AND HEATING CHARTS

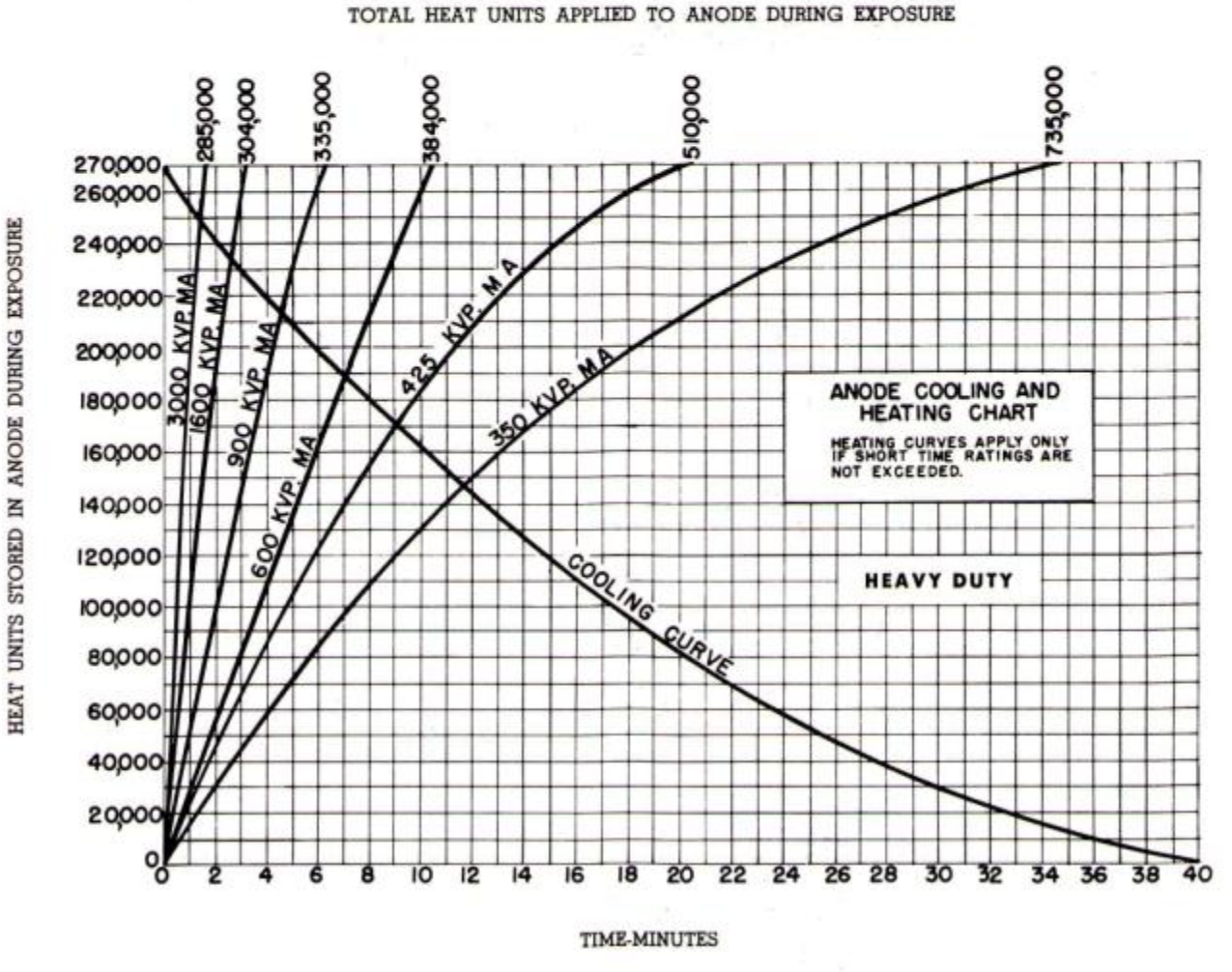
Proper use of the Anode Cooling and Heating Chart and Short Time Rating Charts permits maximum service to be obtained without exceeding tube ratings.

The "Regular Duty" cooling curve indicates the number of heat units (kvp x ma x sec) which are dissipated by the anode to the air as a function of cooling time. In order to insure continued stable operation it is necessary to limit the number of heat units (H.U.) in the anode to its capacity or 150,000 H.U. For this reason the number of H.U. applied to the tube must be totaled for successive exposures and after reaching the heat capacity of the tube, a definite interval of cooling time dependent upon the H.U. in the next exposure must be observed.

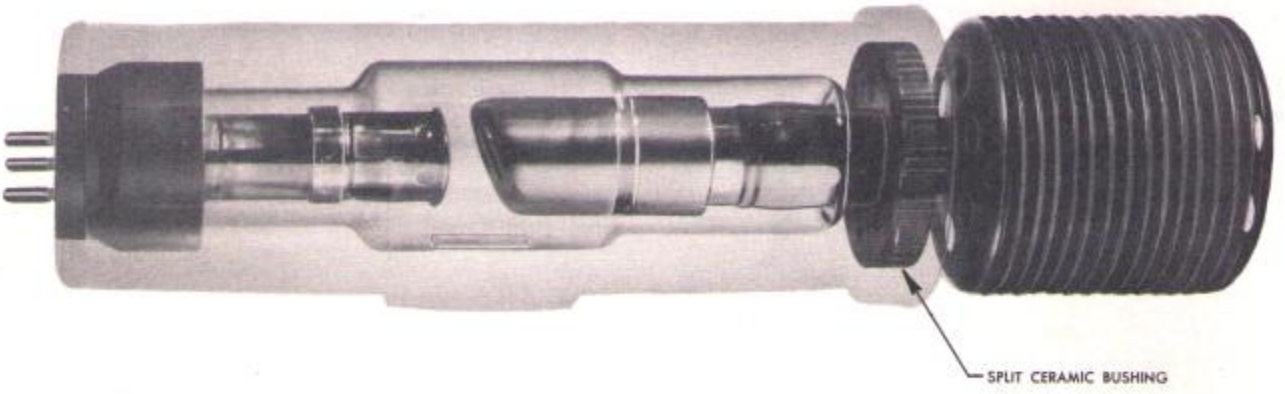
For instance, if in a series of exposures 150,000 H.U. have been applied and the next exposure totals 20,000 H.U. the required cooling interval would be 1.7 minutes to stay within the heat capacity of the tube. Similarly if 90,000 H.U. have been applied and the next exposure totals 90,000 H.U., the cooling interval of 6.0 minutes is the time required for the anode to cool from 90,000 H.U. to 60,000 H.U. in order to permit the additional 90,000 H.U. exposure to be made.

The group of heat curves labeled with heat input rates (kvp.ma) provide a means for taking into consideration the heat dissipation which occurs during exposures averaging 10 ma or less. Thus if a continuous load averaging 600 kvp.ma (which is equivalent to 36,000 H.U. /min) is applied, the heating curve indicates that this may be continued for a total of 5.7 minutes. The cooling curve will then determine the cooling interval required before further exposures can be made.

The procedure given above applies also to the "Heavy Duty" chart.

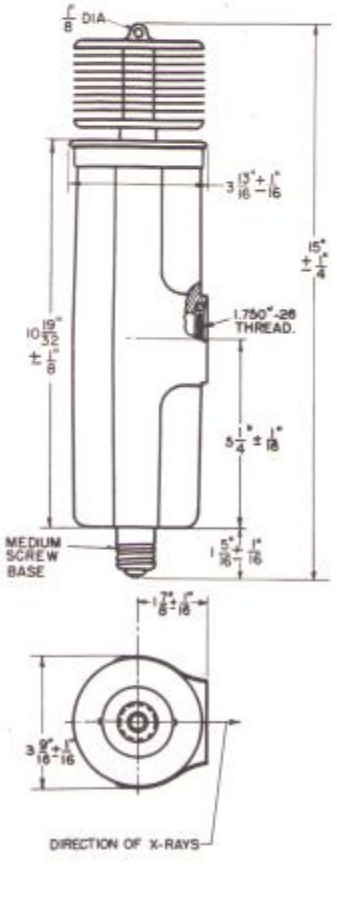


PHANTOM VIEW HEAVY DUTY RAYPROOF TUBE

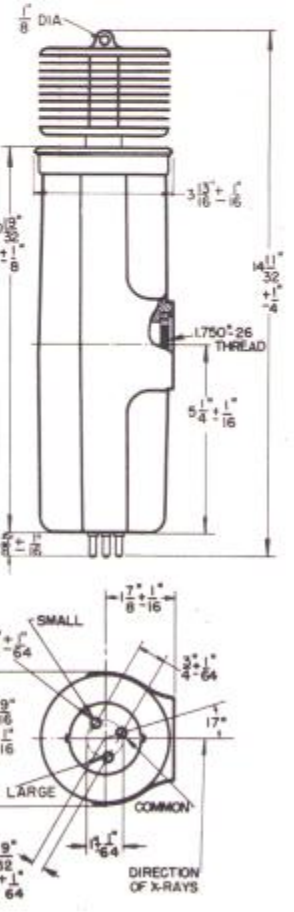


OUTLINE DRAWINGS

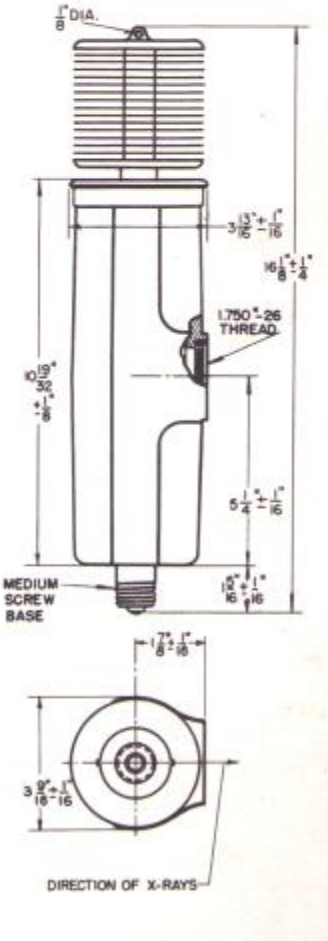
REGULAR DUTY SINGLE FOCUS



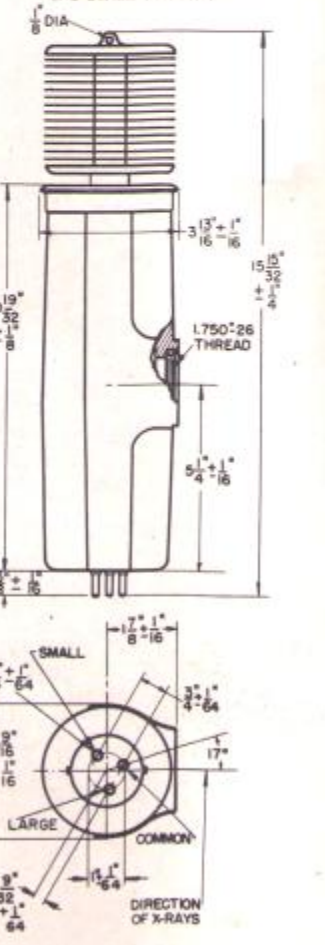
REGULAR DUTY DOUBLE FOCUS



HEAVY DUTY SINGLE FOCUS



HEAVY DUTY DOUBLE FOCUS



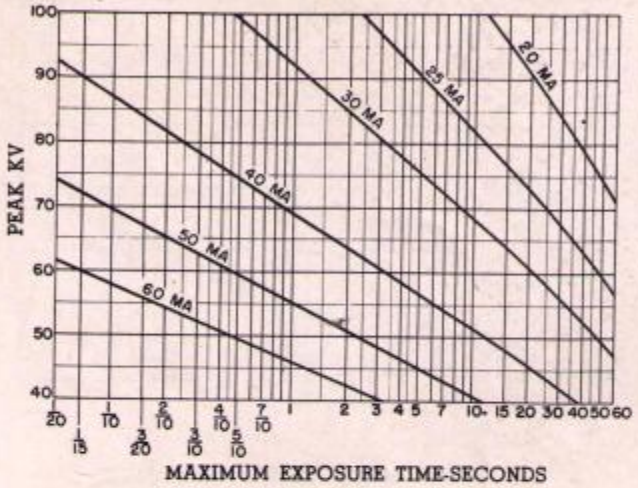
Note—Focus selection switch style 1980941 is available for use with double focus tubes.

WESTINGHOUSE X-RAY TUBES

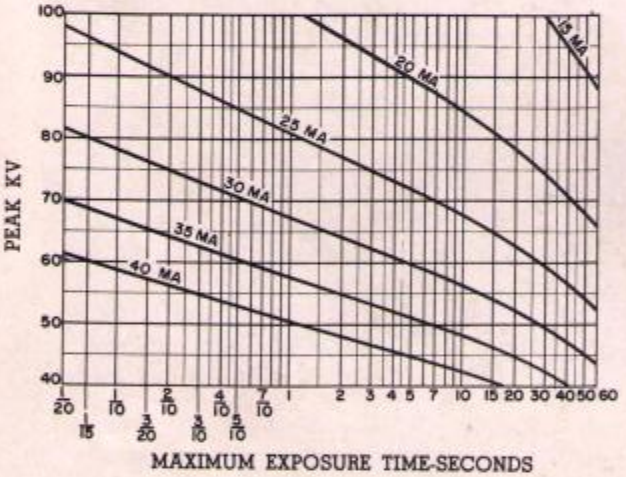
RAYPROOF 100 KV RADIOGRAPHIC X-RAY TUBES
REGULAR DUTY—SHORT TIME RATINGS

1.5 mm² PROJECTED FOCAL SPOT SIZE

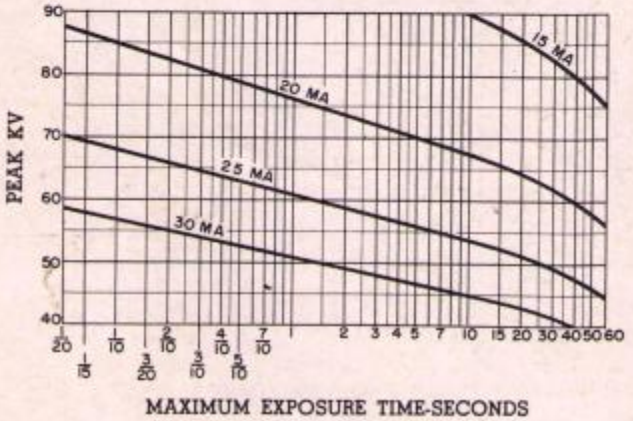
FULL WAVE



HALF WAVE

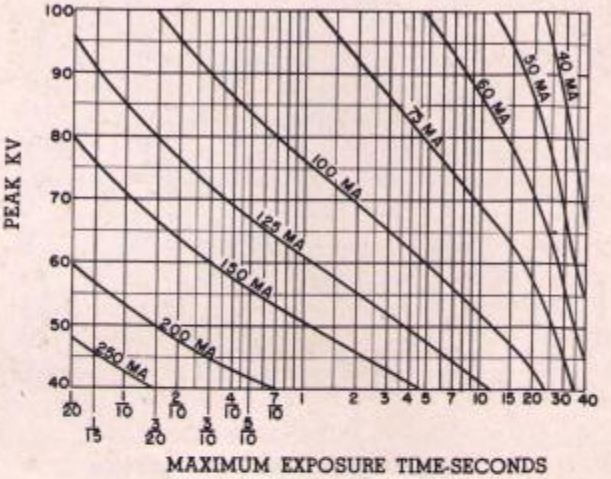


SELF-RECTIFIED

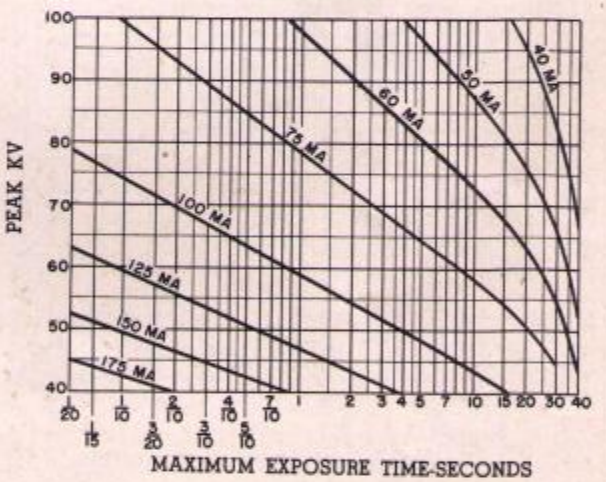


3.0 mm² PROJECTED FOCAL SPOT SIZE

FULL WAVE



HALF WAVE



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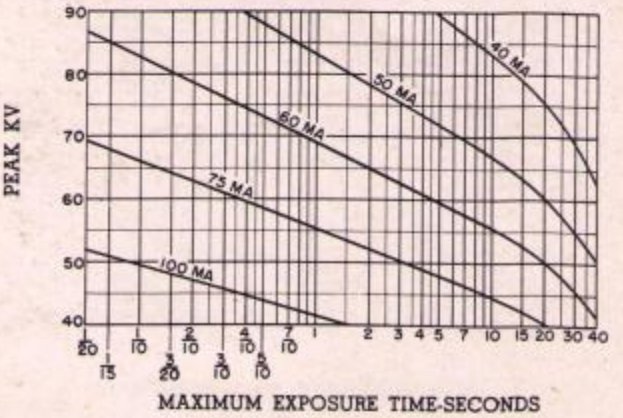

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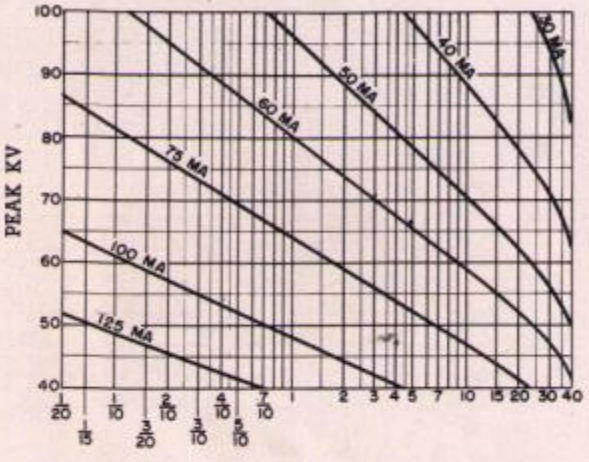
WESTINGHOUSE X-RAY TUBES

RAYPROOF 100 KV RADIOGRAPHIC X-RAY TUBES
REGULAR DUTY—SHORT TIME RATINGS

2.1 mm² PROJECTED FOCAL SPOT SIZE

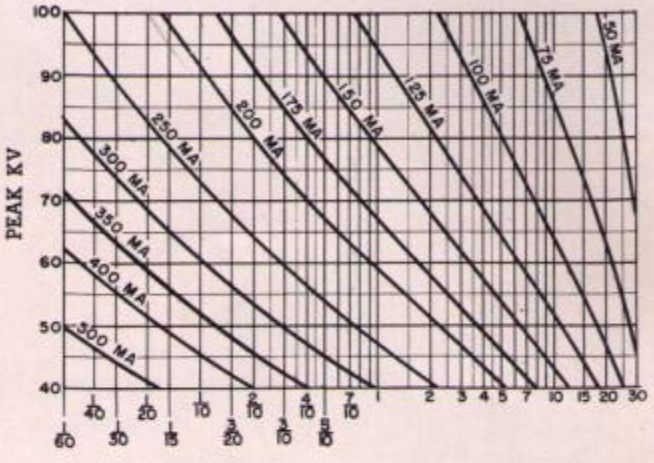
FULL WAVE



MAXIMUM EXPOSURE TIME-SECONDS

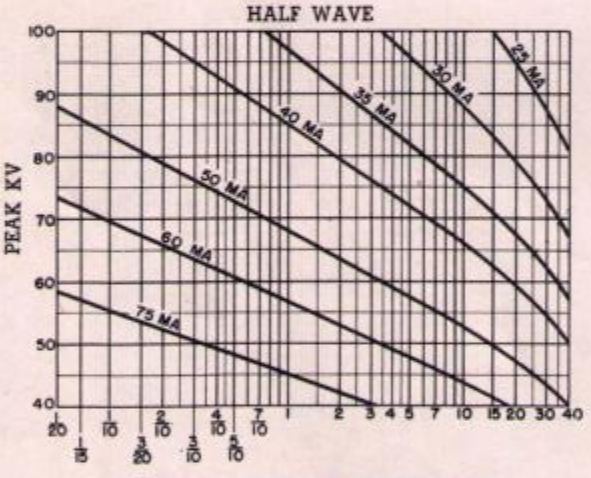
4.2 mm² PROJECTED FOCAL SPOT SIZE

FULL WAVE



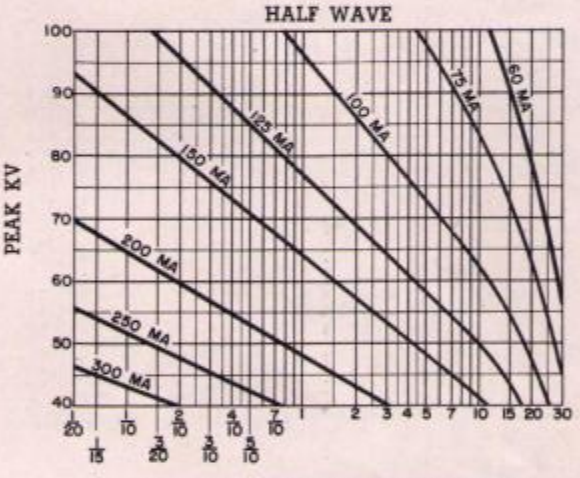
MAXIMUM EXPOSURE TIME-SECONDS

HALF WAVE



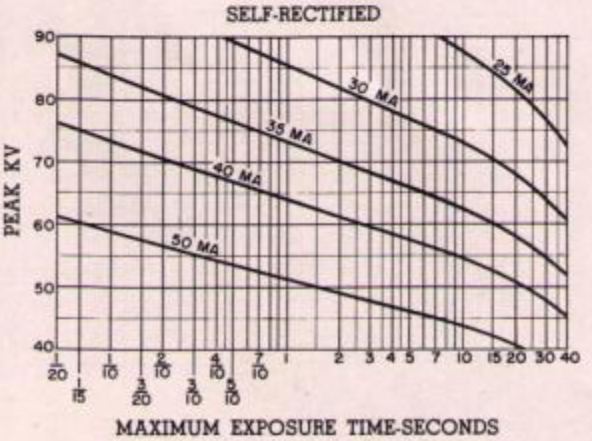
MAXIMUM EXPOSURE TIME-SECONDS

HALF WAVE



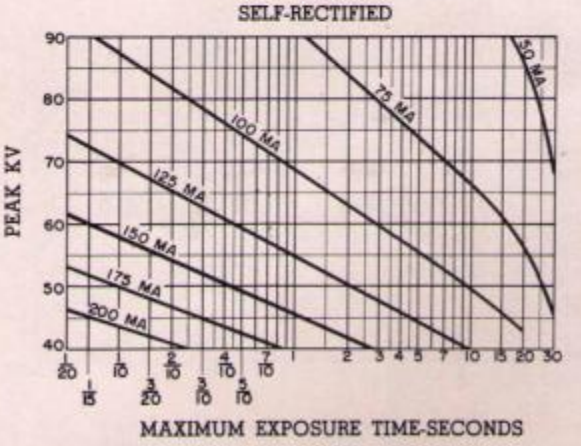
MAXIMUM EXPOSURE TIME-SECONDS

SELF-RECTIFIED



MAXIMUM EXPOSURE TIME-SECONDS

SELF-RECTIFIED



MAXIMUM EXPOSURE TIME-SECONDS

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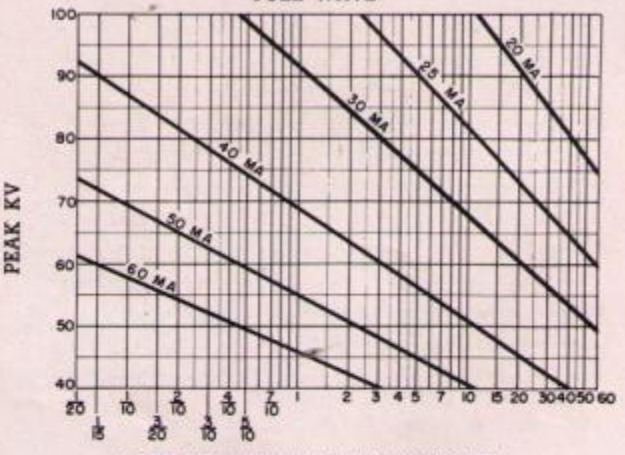
WESTINGHOUSE X-RAY TUBES

RAYPROOF 100 KV RADIOGRAPHIC X-RAY TUBES
HEAVY DUTY—SHORT TIME RATINGS

1.5 mm² PROJECTED FOCAL SPOT SIZE

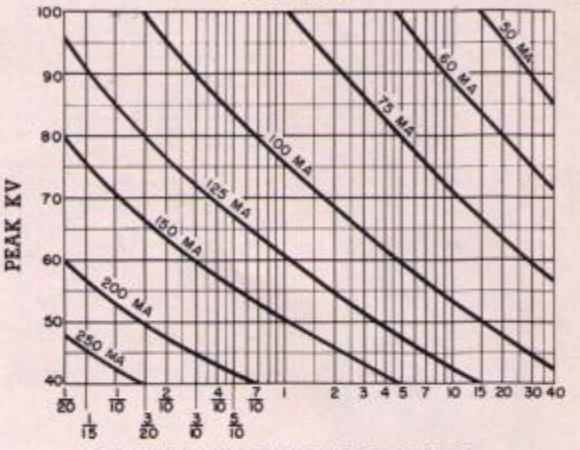
FULL WAVE



MAXIMUM EXPOSURE TIME-SECONDS

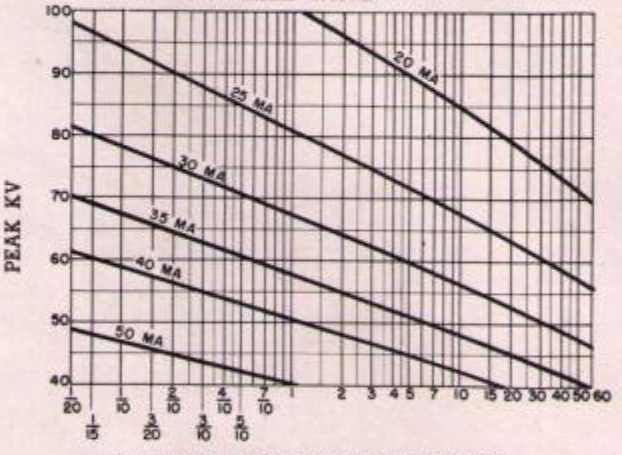
3.0 mm² PROJECTED FOCAL SPOT SIZE

FULL WAVE



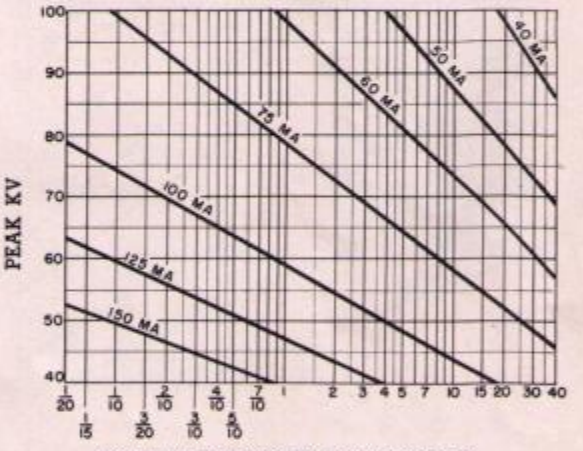
MAXIMUM EXPOSURE TIME-SECONDS

HALF WAVE



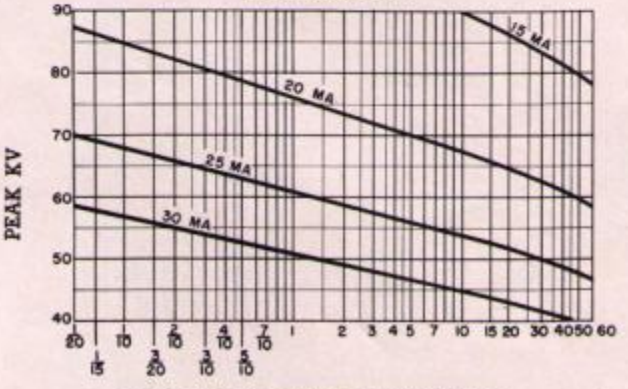
MAXIMUM EXPOSURE TIME-SECONDS

HALF WAVE



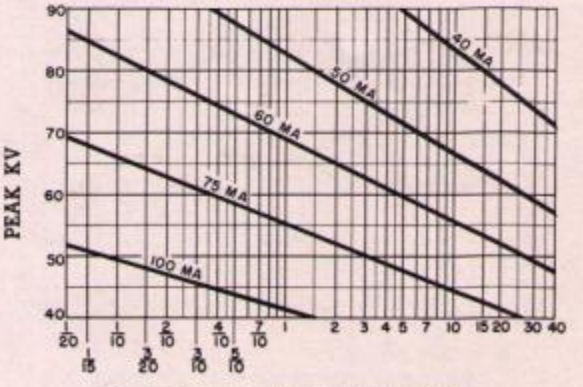
MAXIMUM EXPOSURE TIME-SECONDS

SELF-RECTIFIED



MAXIMUM EXPOSURE TIME-SECONDS

SELF-RECTIFIED



MAXIMUM EXPOSURE TIME-SECONDS

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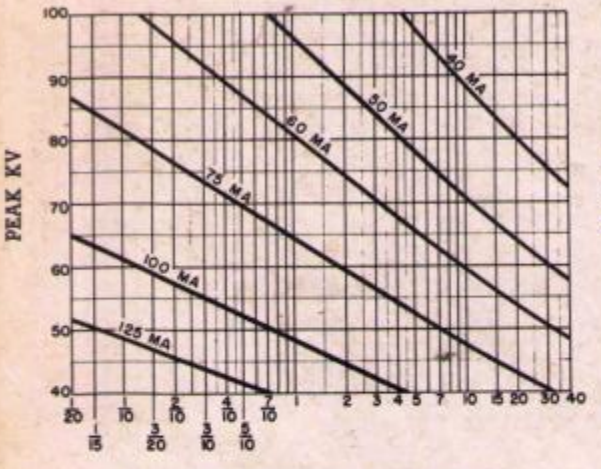
WESTINGHOUSE X-RAY TUBES

RAYPROOF 100 KV RADIOGRAPHIC X-RAY TUBES
HEAVY DUTY—SHORT TIME RATINGS

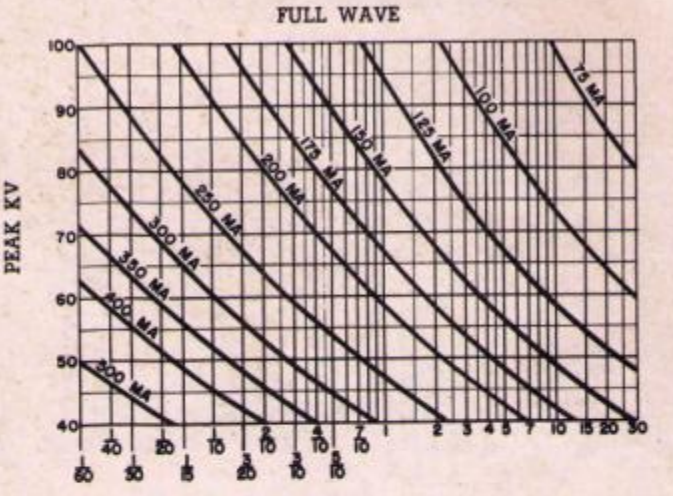
2.1 mm² PROJECTED FOCAL SPOT SIZE

FULL WAVE

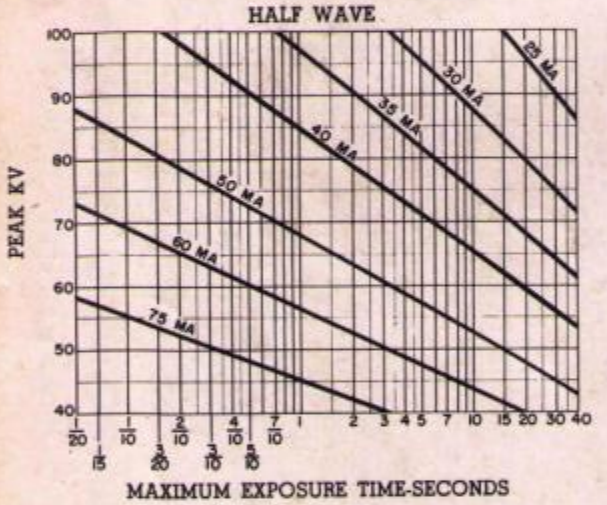


4.2 mm² PROJECTED FOCAL SPOT SIZE

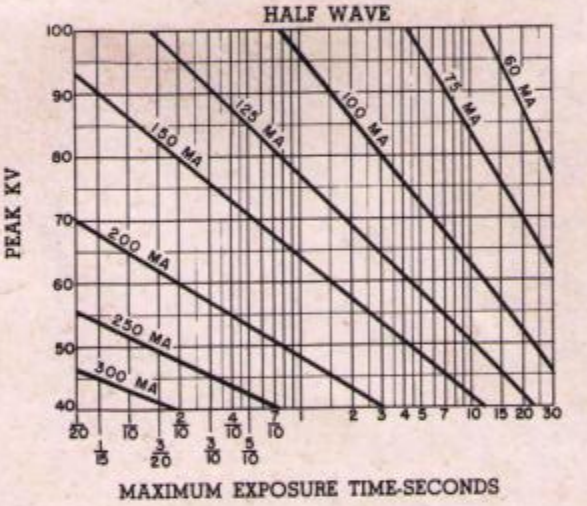
FULL WAVE



HALF WAVE



HALF WAVE



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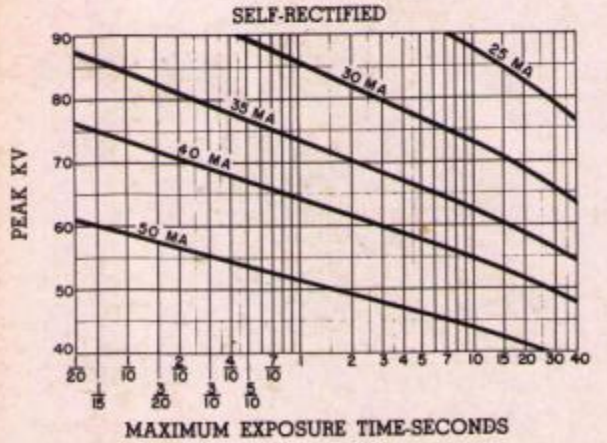

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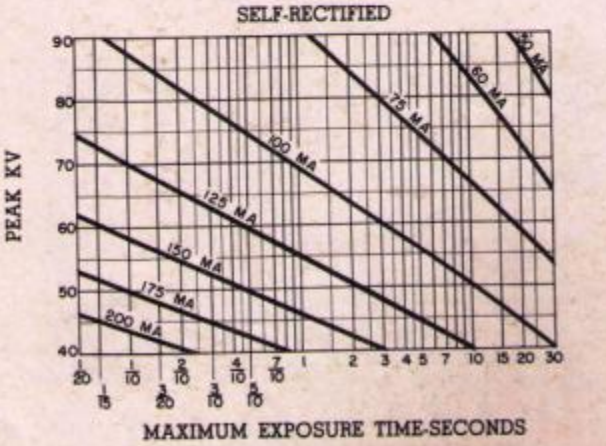

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