MACHLETT

HIGH-VOLTAGE INDUSTRIAL RECTIFIER TUBES

ML-103, ML-108, ML-115, ML-120
ML-121, ML-170, ML-180

DESCRIPTION & RATINGS

DESCRIPTION

High-Voltage Industrial Rectifier Tubes, ML-103, ML-108, ML-115, ML-120, ML-121, ML-170, and ML-180, are high-vacuum diodes designed to be used in various power-supply circuits for the rectification, at high peak inverse voltages, of relatively small values of alternating current to unidirectional or direct current. Industrial applications for such tubes include high-voltage cable testing; purifying of process and exhaust atmospheres; smoke, dust, and other small-particle electrostatic precipitation; and many others which require high-voltage, low-current power.

The electron tubes listed in this data sheet are capable of withstanding peak inverse voltages of 125 to 200 kilovolts and delivering 78 to 200 milliamperes of peak anode current, depending upon the tube type. Design and process features are incorporated which insure stable and reliable operation even under wide variations in ambient temperature and the inherently severe conditions of many industrial applications. Cathodes are especially sturdy, loop-type, pure tungsten filaments permitting tubes to be mounted in any position. Anodes are of highest purity tantalum, processed to withstand the high temperatures resulting from variable loads or transient conditions.

The several types of high-voltage industrial rectifier tubes included in this series, providing a range of inverse voltage and load current ratings suitable for a variety of applications, are listed below with their characteristics and ratings.

TYPE	GENERAL CHARACTERISTICS			MAXIMUM RATINGS	
ML-	Insulating Medium*	Filament Voltage, Volts	Filament Current (Approx.), Amperes	Peak Inverse Anode Voltage, Kilovolts	Peak Anode Current, Milliamperes
103	Oil†	10	11.5	125	78
108	Oil†	13	12.5	140	200
115	Air	10	11.5	125	100
120	Air	13	12.5	140	200
121	Oil†	10	11.5	140	100
170	Air	13	12.5	200	200
180	Oil†	13	12.5	200	200

* Cooling is by oil or air convection, depending upon the tube type, and requires adequate free circulation of the medium to prevent localized overheating.

† The dielectric value of the insulating oil should not fall below 25,000 volts peak per 0.1 inch.

LOAD CURRENT RATINGS
(Average Direct Current Delivered To Load)

Type of Tube	Circuit	Filament Voltage Volts	Peak Anode Current Milliamperes	Load Current Rating Unfiltered* Milliamperes	Load Current Rating Filtered** Milliamperes
ML-103	Single-Phase, Two-Tube, Half-Wave	10.0	78	25	.....
		9.5	72	23	.....
		9.0	63	20	.....
	Single-Phase, Four-Tube, Full-Wave	10.0	78	50	50
		9.5	72	46	50
		9.0	63	40	50
	Three-Phase, Double-Y Parallel	10.0	78	150	156
		9.5	72	138	144
		9.0	63	121	126
	Three-Phase, Full-Wave	10.0	78	74	78
		9.5	72	68	72
		9.0	63	60	63
ML-108 ML-120	Single-Phase, Two-Tube, Half-Wave	13.0	200	64	.....
		12.0	157	50	.....
		11.0	100	32	.....
	Single-Phase, Four-Tube, Full-Wave	13.0	200	128	128
		12.0	157	100	128
		11.0	100	64	100
	Three-Phase, Double-Y Parallel	13.0	200	385	400
		12.0	157	302	314
		11.0	100	192	200
	Three-Phase, Full-Wave	13.0	200	191	200
		12.0	157	150	157
		11.0	100	95	100
ML-115 ML-121	Single-Phase, Two-Tube, Half-Wave	10.0	100	32	.....
		9.5	90	28	.....
		9.0	78	25	.....
	Single-Phase, Four-Tube, Full-Wave	10.0	100	64	64
		9.5	90	57	64
		9.0	78	50	64
	Three-Phase, Double-Y Parallel	10.0	100	192	200
		9.5	90	173	180
		9.0	78	150	156
	Three-Phase, Full-Wave	10.0	100	95	100
		9.5	90	86	90
		9.0	78	74	78
ML-170 ML-180	Single-Phase, Two-Tube, Half-Wave	13.0	200	64	.....
		12.0	157	50	.....
		11.0	100	32	.....
	Single-Phase, Four-Tube, Full-Wave	13.0	200	128	200
		12.0	157	100	157
		11.0	100	64	100
	Three-Phase, Double-Y Parallel	13.0	200	385	400
		12.0	157	302	314
		11.0	100	192	200
	Three-Phase, Full-Wave	13.0	200	191	200
		12.0	157	150	157
		11.0	100	95	100

* Unfiltered—Load Current Ratings are based on sine-wave voltage input and resistance load without inductive or capacitive effects.

** Filtered—Load Current Ratings are based on sine-wave voltage input and infinite inductance choke input filter.

APPLICATION NOTES

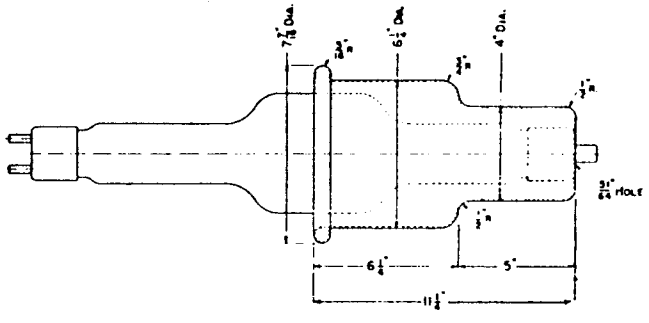
The life of tubes should be conserved as much as possible by turning on their filaments only just before the rectified power is to be used and turning them off immediately afterward. Also, when lower than rated load current values are employed, the filament voltage may be reduced somewhat, as indicated under "Load Current Ratings", to obtain extended filament life.

It is important that the circuit in which a rectifier tube is used does not subject it to inverse voltages which exceed the maximum voltage rating of the tube, as operation at higher voltages may result in tube instability, flash-over, or puncture. Types designated for oil-immersed operation cannot be used in air satisfactorily except at voltages sufficiently reduced to avoid flash-over.

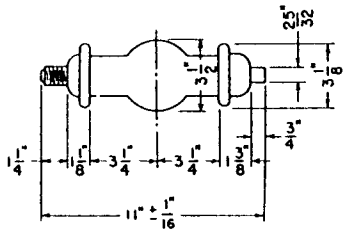
The load impedance of the rectifier circuit must be such as to limit the peak plate current to the maximum value specified. The actual value of average plate current obtainable within the peak tube current rating depends upon the current wave-form, which in turn is determined by the type of load impedance, i.e., whether it is resistive, inductive, or capacitive, and by the type of circuit employed. The foregoing tabulation of load current ratings for the various types of tubes in the various types of circuits listed represents the maximum permissible loading of the rectifier tubes, expressed in terms of average current *delivered to the load.* These load current ratings take into account the anode wattage dissipation capacity of the rectifier tube as well as the wave-form of the current through the tube under the specific circuit conditions indicated. The filtered condition assumes square current wave-form in the tubes; the unfiltered condition assumes a sine-wave or section thereof. In the case of capacitive loading or other conditions in which a more highly-peaked wave-form is obtained, the maximum peak current rating will constitute the only limitation on average load current.

The peak inverse voltage and peak plate current requirements of a tube in a particular circuit and with a particular type of filter or load must be determined and compared with the respective tube ratings before tubes of a type are installed and operated under the desired conditions. Factors such as line surges and circuit capacitance may result in inverse voltage and peak current requirements greater than calculated values so that it may be advisable in certain cases to make determinations by means of a sphere gap or oscilloscope when a tube is operated at or near maximum ratings.

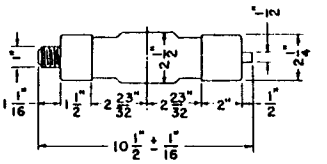
When the ML-180 is installed in an oil-filled container of minimum size and is to be subjected to inverse voltage in the order of 200 PKV, the anode end should be fitted with an external metallic shield, electrically connected to the anode terminal, to avoid the possibility of damage due to cold emission or field currents originating at the anode. A shield of the dimensions indicated in the sketch below has been found to give proper results for operation under such conditions.



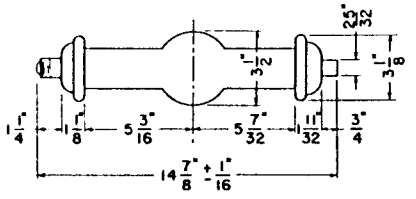
DIMENSIONS—EXTERNAL SHIELD FOR ML-180



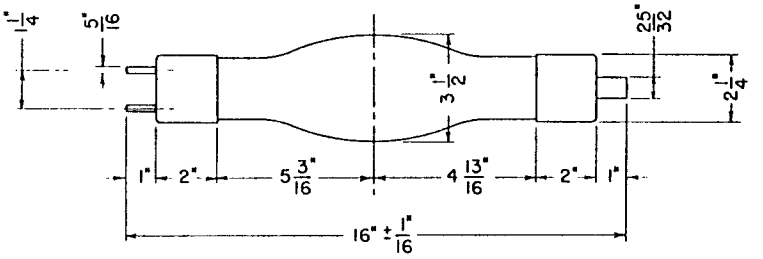
ML-121



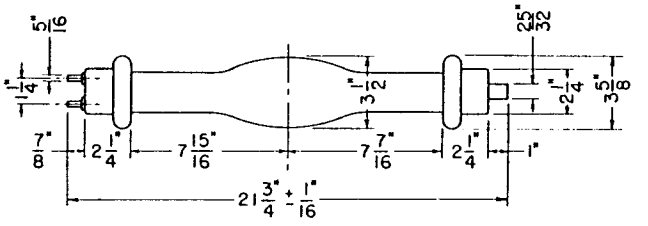
ML-103



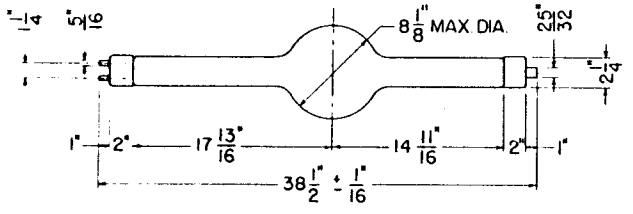
ML-108



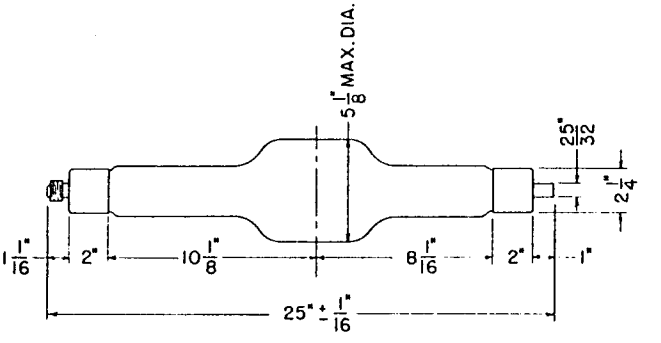
ML-115



ML-120



ML-170



ML-180

DIMENSIONS—HIGH-VOLTAGE INDUSTRIAL RECTIFIER TUBES

MACHLETT LABORATORIES, INC.

SPRINGDALE MACHLETT CONNECTICUT

U. S. A.