

## IGNITRON TYPE WL-5555A

The WL-5555A is a sealed, stainless-steel jacketed, water-cooled, mercury-pool tube designed primarily for power rectification. In this service six tubes will rectify 600 kilowatts at 300 volts dc and 500 kilowatts at 600 and 900 volts dc. The WL-5555A is also used for alternating current control at 2400 volts, rms. The WL-5555A features an intergal thermostat bracket to permit installation of tube temperature-operated safety control circuitry.

### GENERAL DATA

#### Electrical

Type of Cathode Excitation . . . . .		Cyclic
Type of Cathode Spot Starting . . . . .		Ignitor
Number of Electrodes		
Main Anodes . . . . .	1	
Main Cathodes . . . . .	1	
Auxiliary Anodes . . . . .	1	
Ignitors . . . . .	2	
Arc Drop at 600 Peak Amperes (See Figure 13) . . . . .	16.2	volts
Ignitor Excitation Requirements (See page 2 for ignitor ratings)		
Separate-Excitation Source (See Figures 2 and 11)		
Open-Circuit Voltage Range . . . . .	450 - 750	volts
Short-Circuit Current Range . . . . .	45 - 75	amp
Anode Firing (2400 Volts, Welding Service),		
50 ohms in series with ignitor . . . . .	Anode	volts

#### Mechanical

Mounting Position . . . . .	Vertical, cathode down
Envelope Material . . . . .	Stainless steel
Length, maximum . . . . .	29-3/4 in
Width, not including water connections . . . . .	5-3/4 in
Type of Cooling . . . . .	water
Characteristics for Water Cooling, at continuous average	
current and rated minimum water flow of . . . . .	3 gpm
Water Temperature Rise, maximum . . . . .	5 °C
Maximum Pressure Drop, at 3 gallons per minute . . . . .	7 lbs/sq in
Net Weight . . . . .	25 lbs
Shipping Weight . . . . .	33 lbs

## MAXIMUM RATINGS

**AS A POWER RECTIFIER** (6-phase double-wye or 3-phase rectifier) See Note 1.

DC Output Voltage, maximum . . . . .	300	600	volts
Maximum Voltage Reduction by Phase Retard . . . . .	0	0	percent
Maximum Average Current Per Tube			
Continuous . . . . .	200	150	amp
Two-Hour Overload . . . . .	300	225	amp
One-Minute Overload . . . . .	400	300	amp
Outlet Water Temperature, maximum . . . . .	50	40	°C
Inlet Water Temperature, minimum . . . . .	3	3	°C
Minimum Water Flow Ratings			
For Recirculating Cooling . . . . .	3	3	gpm
For Direct Raw Water Cooling (See Note 2) . . . . .	1	1	gpm
Frequency Range . . . . .	25-60	25-60	cps

**AS AN AC CONTROL** (Two tubes in inverse parallel) See Note 3 and Figure 15.

Maximum Voltage, rms . . . . .	2400	volts
Maximum Demand (See Note 4) . . . . .	2400	kva
Average Current at Maximum Demand . . . . .	135	amp
Maximum Average Current . . . . .	207	amp
Demand at Maximum Average Current . . . . .	1105	kva
Maximum Averaging Time at 2400 Volts, rms . . . . .	1.66	sec
Maximum Surge Current, Peak . . . . .	6000	amp
Maximum Duration of Surge Current . . . . .	0.15	sec
Outlet Water Temperature, maximum . . . . .	30	°C
Inlet Water Temperature, minimum . . . . .	10	°C
Minimum Water Flow . . . . .	3	gpm

## IGNITOR RATINGS

For power rectifier or ac control service  
See page 1 for ignitor excitation requirements

Maximum Voltage		Maximum Current	
Positive . . . . .	Anode volts	Peak . . . . .	100 amp
Negative . . . . .	5 volts	Root Mean Square . . . . .	15 amp
		Average . . . . .	2 amp
		Maximum Averaging Time . . . . .	10 sec

Note 1.

These ratings are in accordance with American Standards Association Report C34.1-1949 "Pool Cathode Mercury Arc Power Converters for Railway Substations or Mining Service". For ratings apply to other voltages, voltage reduction by phase retard, or various outlet water temperatures See Figure 14.

Note 2.

For water flow controlled by a thermostatic valve. At highest ambient water temperature and minimum water pressure, water flow must be enough to insure outlet water below maximum rated temperature.

Note 3.

Rms demand voltage, current, and kva are all on the basis of full-cycle conduction (no phase delay) regardless of whether or not phase control is used.

Note 4.

With the use of log-log paper, straight-line interpolation between tabulated points may be used for other tabulated ratings of demand kva versus average anode current.

## MAXIMUM FAULT CURRENT RATINGS

The ratio of rated maximum fault current to rated zero-phase-retard continuous average tube current, occurring during the following intervals after fault initiation, shall not exceed the values tabulated below:

Interval	Peak Forward	Peak Reverse
0 to .016 second	80	185
.016 to .05 second	80	130
.05 to .15 second	80	92
.15 to .20 second	55	-

These fault-current ratios are based on field experience and measurements on commercial rectifiers and are to be construed as a basis for circuit design. The fault current has transient components which account for the higher values for the shorter times. The current corresponding to the last interval is the sustained dc short-circuit tube current. It may be used to calculate the minimum transformer commutating impedance ( $Z_c$ ), referred to the secondary, required to insure proper protection of the tubes.  $Z_c$  is determined by the following formula:

$$Z_c = \frac{\sqrt{2} E_s}{I_{ss}}$$

$E_s$  = line to neutral rms voltage of the dc winding in volts

$I_{ss}$  = sustained dc short-circuit current in amperes

$Z_c$  = commutating impedance in ohms

SELF OR ANODE IGNITOR EXCITATION

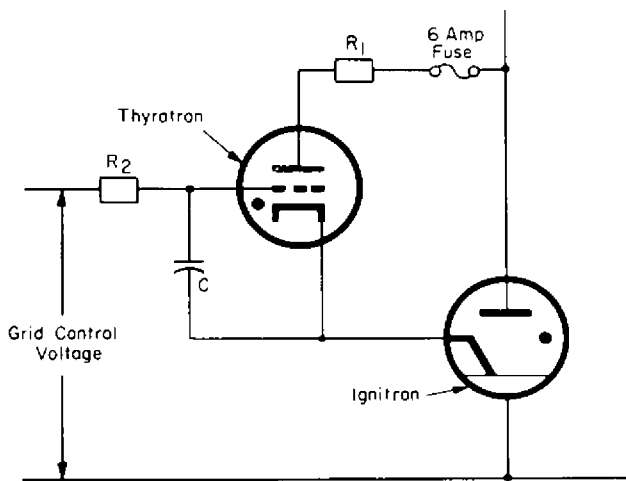


FIGURE 1

SATURATING REACTOR-CAPACITOR SEPARATE EXCITATION IGNITOR CIRCUIT

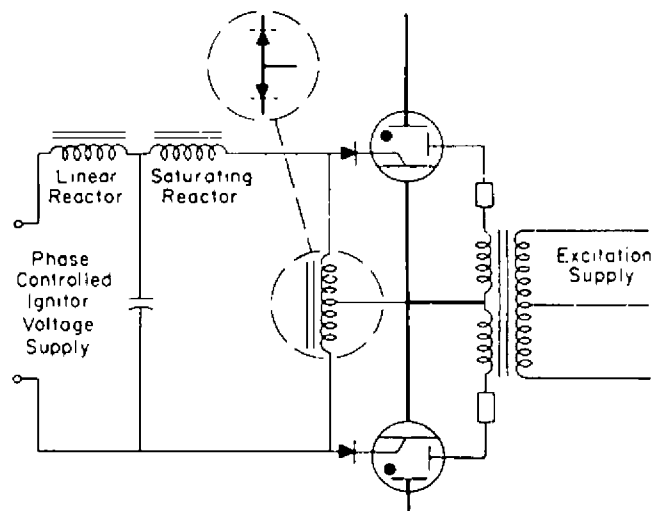


FIGURE 2

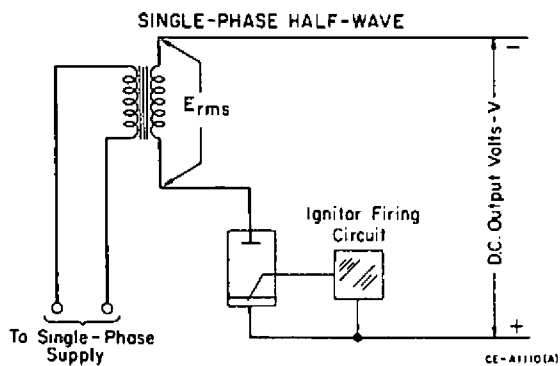


FIGURE 3

CE-A1110(A)

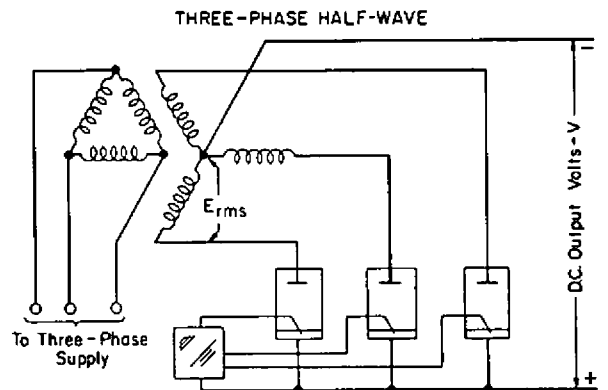


FIGURE 4

CE-A1110(B)

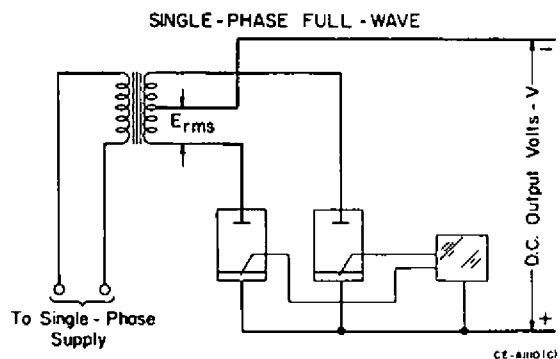


FIGURE 5

CE-A1110(C)

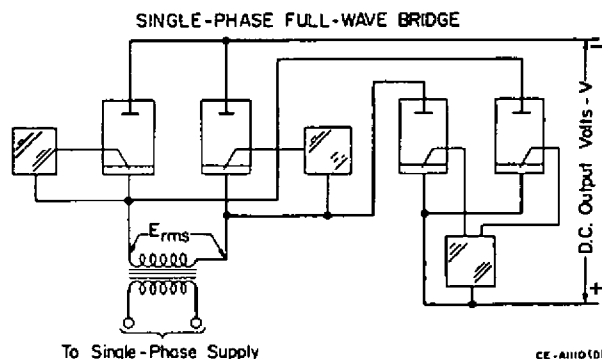


FIGURE 6

CE-A1110(D)

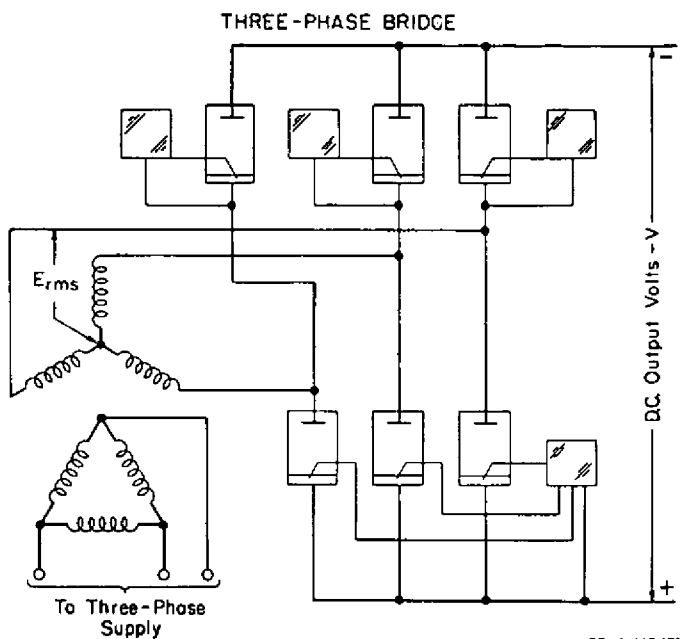


FIGURE 7

CE-A1110(E)

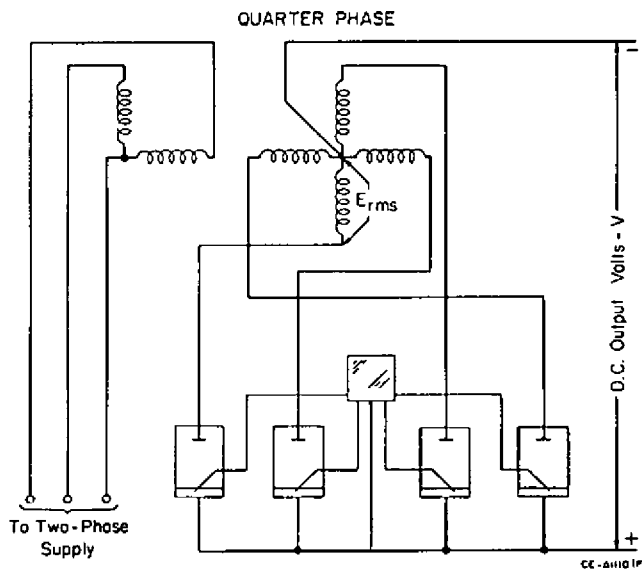


FIGURE 8

CE-A1110(F)

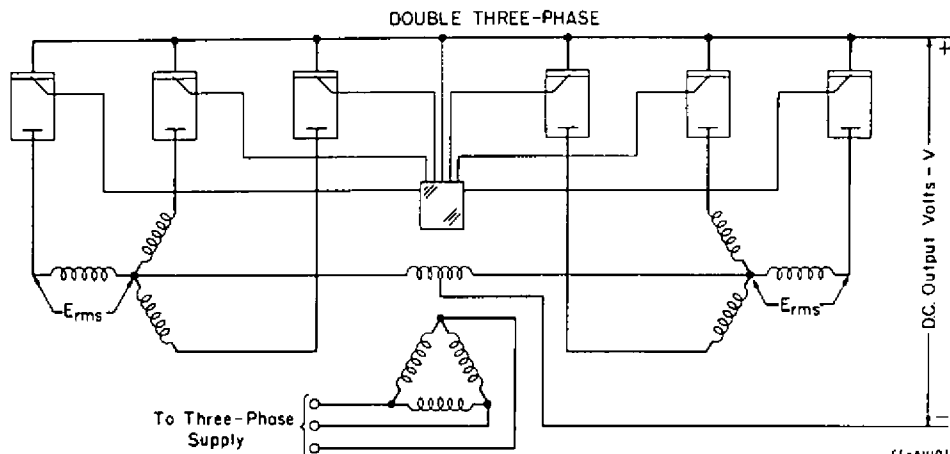


FIGURE 9

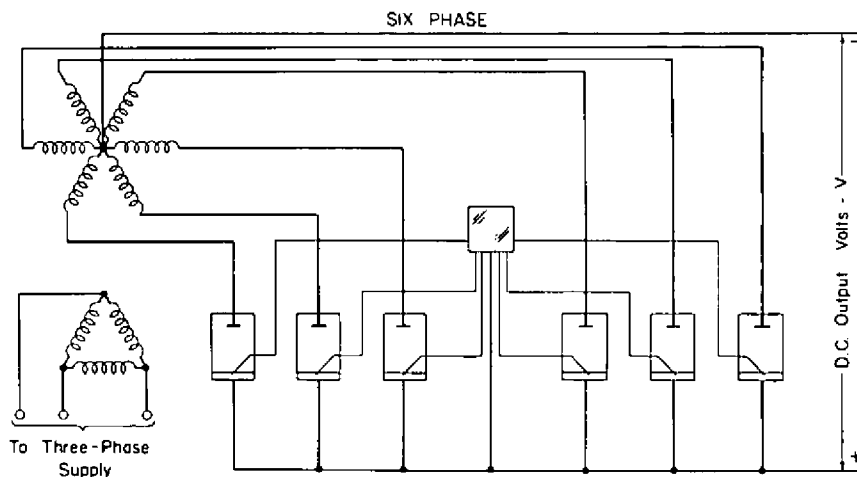


FIGURE 10

The information contained herein is furnished without assuming any obligations. The description and illustration of circuits herein does not convey to the purchaser of tubes any license for circuits under the patent claims of Westinghouse Electric Corporation or others.

	Symbol	Fig. 3	Fig. 4	Fig. 5	Fig. 6	Fig. 7	Fig. 8	Fig. 9	Fig. 10
Transformer Secondary Voltage, rms	E	2.22V	.854V	1.11V	1.11V	.427V	.785V	.854V	.740V
Peak Inverse Voltage	E <sub>1</sub>	1.41E	2.45E	2.83E	1.41E	2.45	2.83E	2.45E	2.83E
Peak Inverse Voltage	E <sub>1</sub>	3.14V	2.09V	3.14V	1.57V	1.05V	2.22V	2.09V	2.09V
Anode Current, rms	I	1.57A	0.578A	0.785A	0.785A	0.578A	0.500A	0.289A	0.408A
DC Output Voltage, average	V	—	—	—	—	—	—	—	—
DC Output Voltage, peak	V <sub>1</sub>	3.14V	1.21V	1.57V	1.57V	1.05V	1.11V	1.05V	1.05V
Major Ripple Voltage, rms	V <sub>2</sub>	1.11V	0.177V	0.472V	0.472V	0.04V	0.106V	0.04V	0.04V
Major Ripple Frequency	f	f	3f	2f	2f	6f	4f	6f	6f
DC Output Current, average	A	—	—	—	—	—	—	—	—
Anode Current, peak (resistive load)	A <sub>1</sub>	3.14A	1.21A	1.57A	1.57A	1.05A	1.11A	0.52A	1.05A
Anode Current, peak (resistive load)	A <sub>1</sub>	3.14A <sub>3</sub>	3.63A <sub>3</sub>	3.14A <sub>3</sub>	3.14A <sub>3</sub>	3.15A <sub>3</sub>	4.5A <sub>3</sub>	3.15A <sub>3</sub>	6.3A <sub>3</sub>
Anode Current, peak (inductive load)	A <sub>2</sub>	—	A	A	A	A	A	0.5A	A
Anode Current, average	A <sub>3</sub>	A	0.33A	0.5A	0.5A	0.33A	0.25A	0.167A	0.167A
Transformer Primary Volt-Amperes	—	3.49VA	1.21VA	1.11VA	1.11VA	1.05VA	1.11VA	1.05VA	1.29VA
Transformer Secondary Volt-Amperes	—	3.49VA	1.71VA	1.57VA	1.11VA	1.05VA	1.57VA	1.48VA	1.81VA
Line Volt-Amperes	—	3.49VA	1.21VA	1.11VA	1.11VA	1.05VA	1.11VA	1.05VA	1.05VA

NOTES

Symbols E and V are shown on circuit diagrams. Allowance must be made for voltage drop in tubes, transformer and circuit.

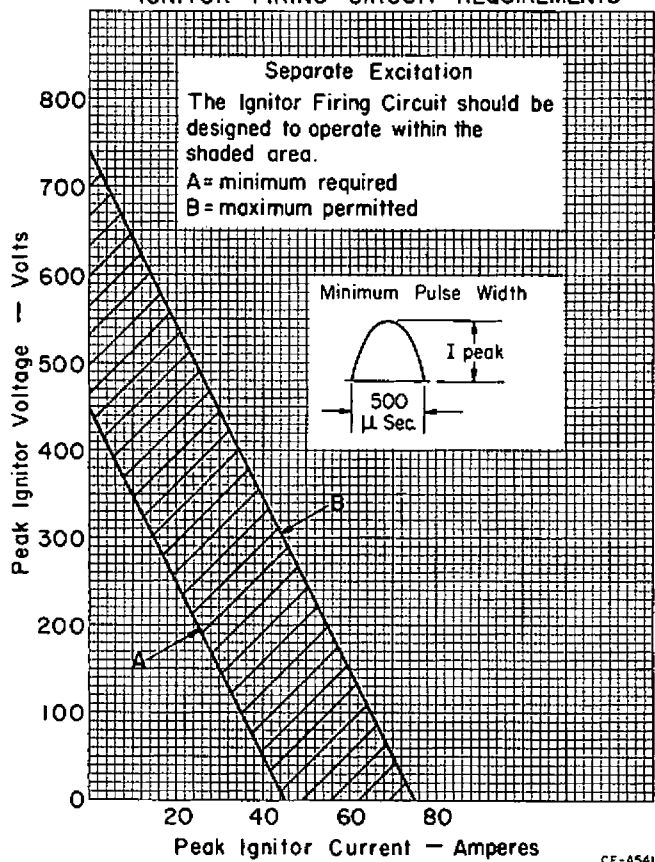
Circuit, Figure 3 results in considerable transformer unbalancing with consequent reduction of kva output.

Peak inverse voltage 2.45E, Figure 9, becomes 2.83E for light loading.

Ratios given are on the assumption that there is no back emf in the load circuit and no phase-back.

Primary volt-amperes required do not include transformer losses which must be considered.

### IGNITOR FIRING CIRCUIT REQUIREMENTS



### CIRCUIT DIAGRAM OF WELDER USING IGNITRONS AND THYRATRONS

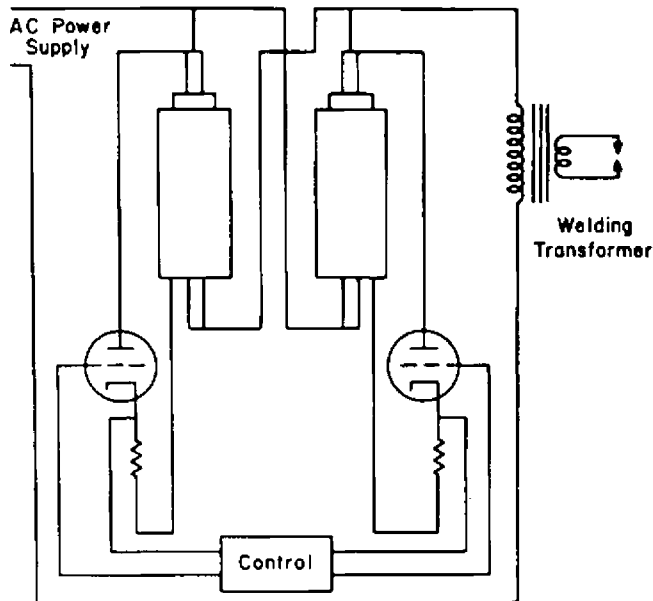


FIGURE 12

FIGURE 11

### ARC DROP CHARACTERISTICS

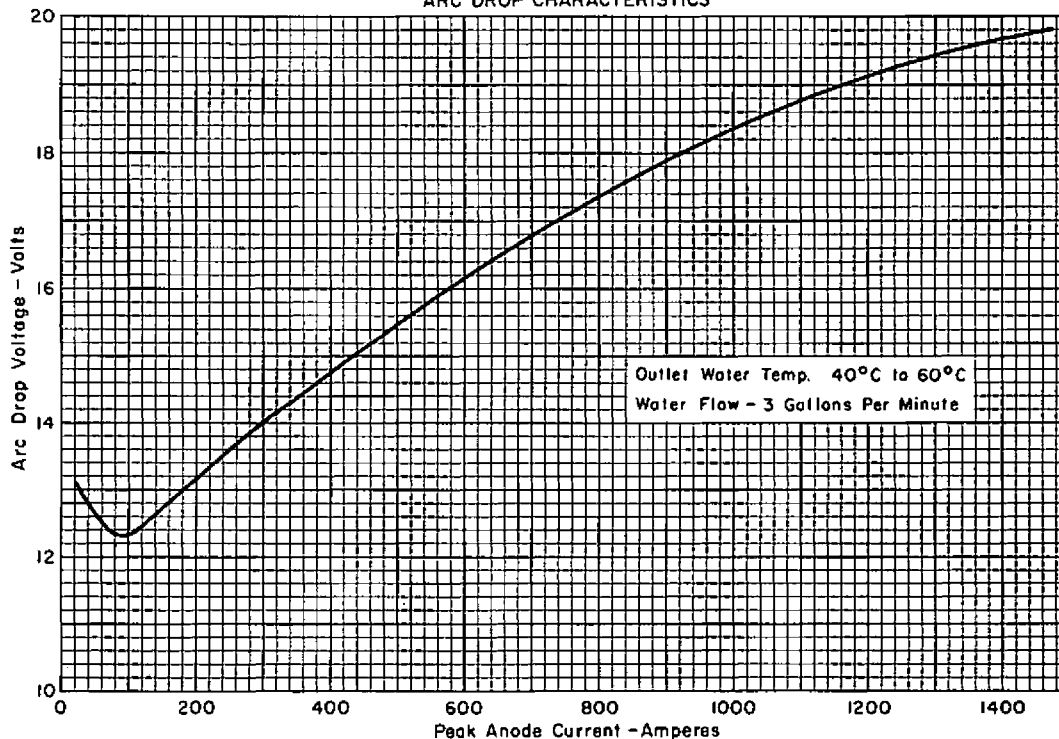


FIGURE 13

## RATING CHART FOR SIX-PHASE DOUBLE - WYE OR THREE - PHASE RECTIFICATION SERVICE

Showing  
D.C. Output Voltage and Current  
Percent Voltage Reduction by Phase Retard

For Maximum Outlet Water Temperature of 60°C

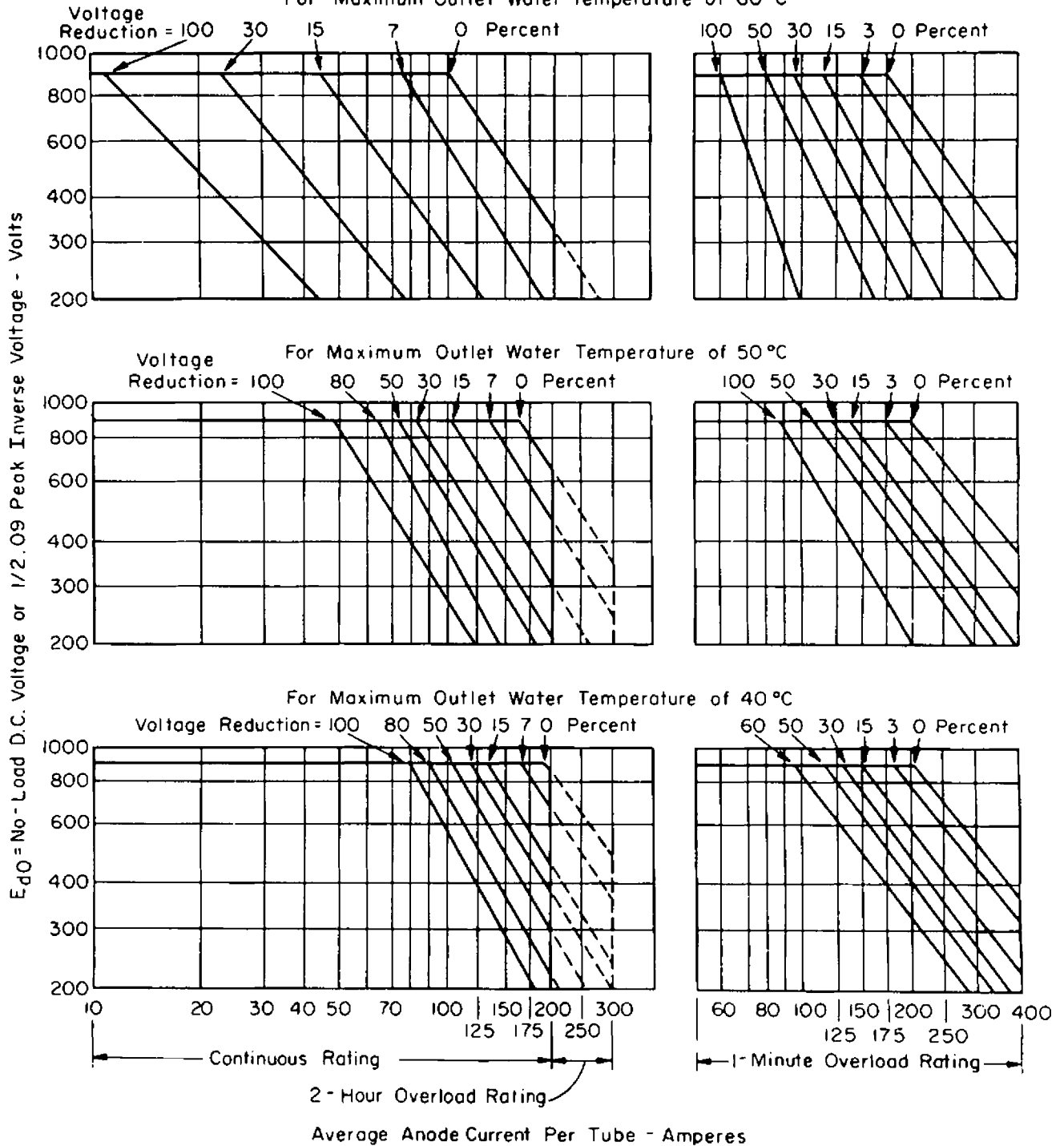


FIGURE 14

A.C. CONTROL TUBE RATINGS  
(Two Tubes in Inverse Parallel)

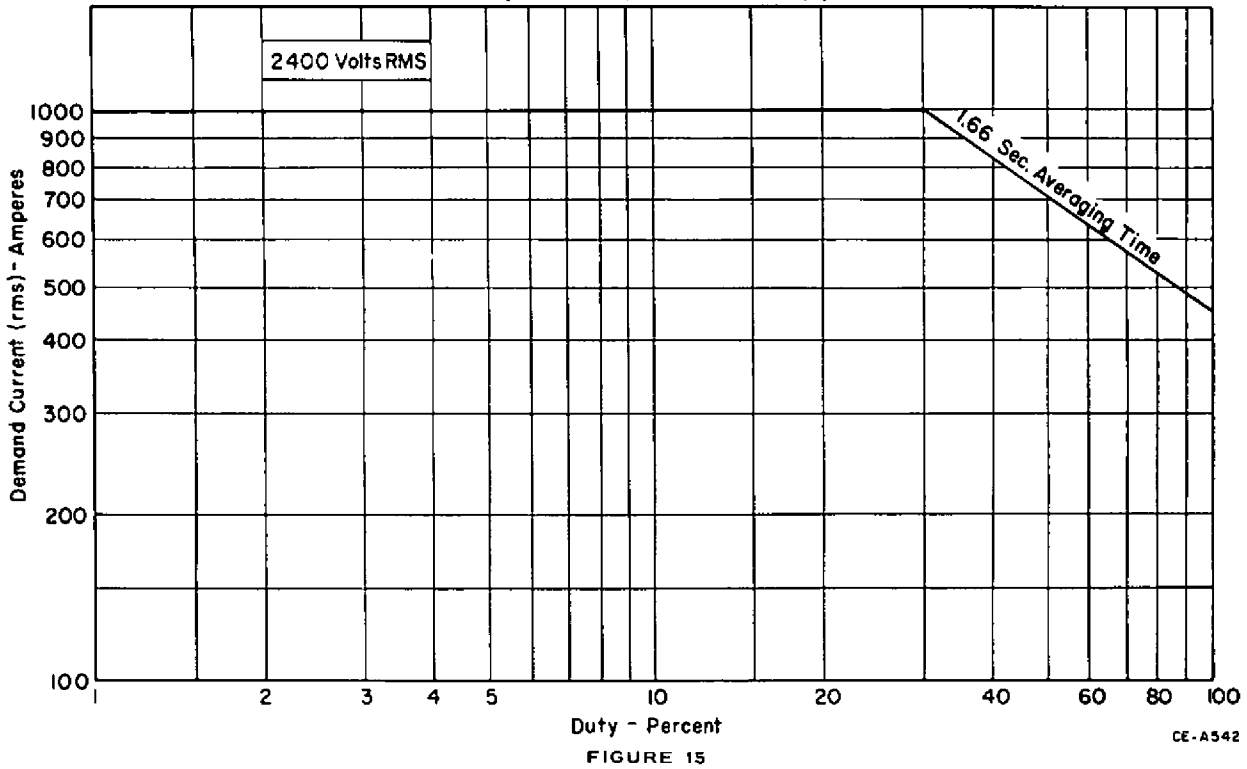


FIGURE 15

CE-A542

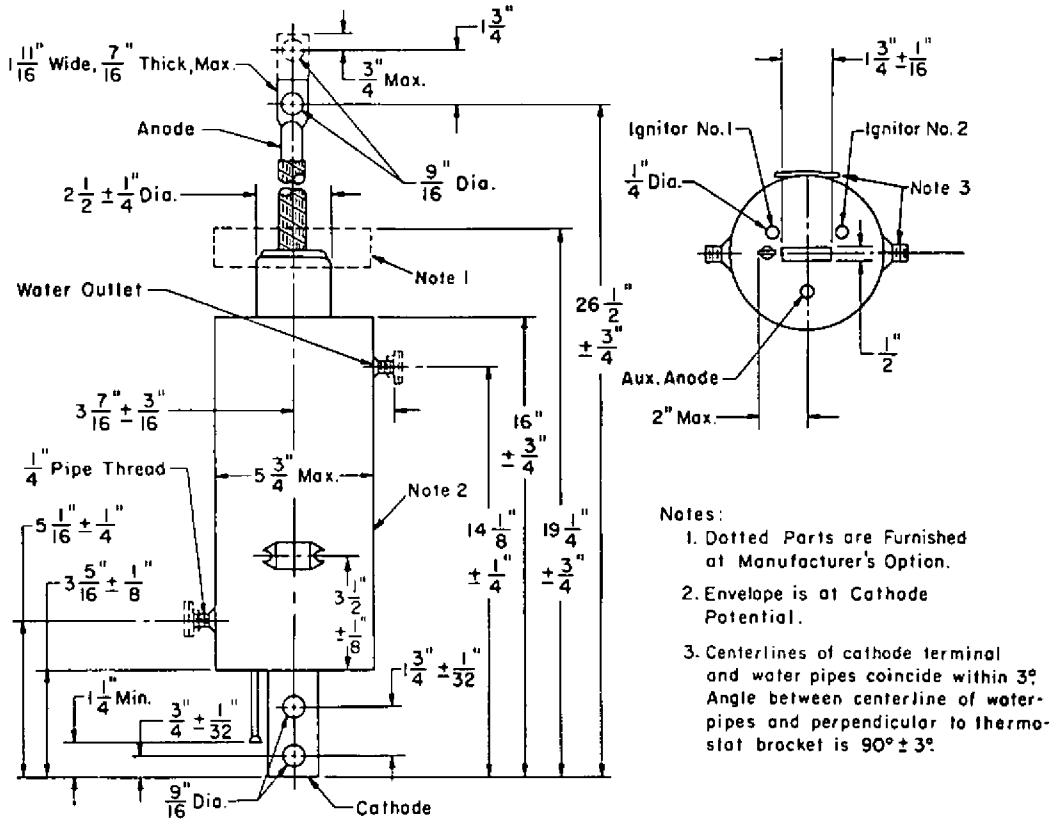


FIGURE 16

The information contained herein is supplied without assuming responsibility for infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Westinghouse Electric Corporation.  
 WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, NEW YORK