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COMPANY
SCHENECTADY, N. Y., U. S. A.

DATA FOLDER No. 71177

Title Air-cooled Operation of Ignitron GL-415

By

Vac. Tube Engg. Dept. Div.

Information prepared for

Tests made by

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Countersigned by

Date 4-19-41

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Air-Cooled Operation of Ignitron GL-415

Vacuum Tube Engg. Dept.

April 19, 1941.

Purpose

This test checks the proposed rating of GL-415 with free air cooling and 80° C clamp temperature when passing an average current of 5.6 amperes, 155 amperes peak, and 3 amperes average with 345 peak amperes peak. This is at 60 and 30 cycle welds respectively.

In addition, the variation of clamp temperature with average current was wanted for the condition of compressed air through the clamp, 345 amperes peak, and 30 cycle welds.

Procedure

On the first run the anode seal was wrapped with asbestos to keep mercury from condensing on the seal. This was not enough for mercury did condense to cause arcbreak every few minutes.

A radiant heater was then placed about 3 inches from the seal thus eliminating trouble from this source. A negligible amount of water was in the clamp and the test was at 80° C without arcbreak and this also was the steady state clamp temperature without running a separate test.

For the variation of clamp temperature with average current the clamp was cooled with compressed air. At 22 amperes the ignitron began to hang on after the ignitor voltage was released. Naturally, this began to raise the apparent steady state temperature and became progressively more pronounced so that the test was discontinued there.

Results

	<u>I_{pk}</u>	<u>I_{avg}</u>	<u>Steady State</u> <u>Clamp °C</u>	
Part IA	155	6.85	87*)	Hour runs each
Part IB	345	3.9	79)	No cooling
Part II	345	2	41	1/2 hour
Compressed	"	4	44	1/2 hour
Air Cooling	"	6	48.5	1/2 hour
	"	9	53	20 Min
	"	13	61	25 "
	"	18	75	45 "
	"	22	88*	35 "

* Here the ignitron began to hang on and fire prematurely after holding these temperatures for ten minutes. Then the temperature went up until the tube arced back.

	<u>I_{avg}</u>	<u>Rise</u>	
Ignitron	.5	11)	No Ventilation.
In Welder Panel	1.0	17)	
By I.C. Dept.	2.1	29)	
	4.15	46)	
	2.1	20.5)	Ventilated
	4.15	34)	As Described.

Discussion

After the anode seal assembly was heated externally the ignitron performed nicely without an arcback for the first run made without forced cooling. Before this the tube arced back frequently even at light loads and with an asbestos jacket around the seal assembly. Investigation revealed that the seal was running too cold which caused the mercury vapor to condense on the seal in beads which fell to the anode.

The anode heater added heat near to the tube at the approximate rate of 600 watts. Some of this had to be handled by the ignitron because it was liberated in a restricting asbestos cylinder with a tin bottom and a ventilating cover. Knowing this and that the clamp temperature was limited to 80° C, it seems likely that the ignitron might do better if a more efficient, less heat-liberating anode heater were used.

There are three curves plotted on the sheets. Curve #3 is the one for the test made by the Vacuum Tube Engg. Dept. Number one curve is from data on a GL-415 in a CR-7503-AL00 thyratron welder with front and back doors closed. The #2 curve is the same except that the back door was replaced with corrugated board one-quarter inch thick and having four ventilating holes at top and bottom, each hole being 2 inches in diameter. In neither case was the clamp cooled forcefully.

Conclusion

The results show that the GL-415 will carry at 80° C clamp temperature the proposed 5.6 amperes average current for it carried nearly 7 amperes an hour and a half without failure while making 60 cycle welds at 155 amperes peak. Distress did not become evident until clamp temperature reached 87° C.

With compressed air cooling the same ignitron carried 18 amperes average without exceeding 80° C and at 20 amperes the indicated temperature is 83° C.

At the very beginning the tube arced back due to condensed mercury in the seal so that a small anode heater seems advisable. Comparison with the tank type rectifiers suggests about a 10 watt heater around the seal as an inexpensive precaution against condensed mercury.

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3-12-41

REF:HT

WC White)
OW Pike) 1 copy
RW Larson)

HL Palmer 1 copy
CW Garman 1 copy
AC Gable 1 copy
JH Hutchings 1 copy

