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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report on

Telephone Extension Relay

submitted by

Automatic Electric Company
Chicago, Illinois.

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WASHINGTON, D.C.

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AUTHORIZATION FOR TEST

1. This problem was authorized by the Bureau of Engineering letter, reference (a), and other additional correspondence pertinent to this problem is listed as reference (b).

Reference: (a) BuEng. ltr. S65-4/L5 (8-31-Ds) of 5
September 1934.
(b) Navy Department Specifications for
Interior Communication Apparatus
Bueng ltr. S65/L5 (2-7-Df) of 11 Feb. 1928.

OBJECT OF TEST

2. The object of this test was to determine if the relay as submitted for test was suitable for installation in a ships service telephone system to replace a ringer and operate an auxiliary signal.

ABSTRACT OF TEST

3. The relay as submitted was first tested for shock integrity. This test proved that the vacuum glass type contactor was unsuitable and in view of this it was removed and a "Burgess Micro Switch" substituted.

4. The modified relay was closely observed while under operation for endurance and further shock integrity tests.

5. The test was concluded with the usual over and under voltage and frequency, insulation resistance, dielectric strength, and water-tight integrity tests.

CONCLUSIONS

(a) This relay as submitted by the Automatic Electric Company is not satisfactory for installation in ships service telephone systems because of its failure to comply with the requirements of the specifications with respect to shock integrity.

(b) This relay, if modified to incorporate a "Burgess Micro Switch" in place of the "Burgess Vacuum Contactor", would be satisfactory for the Naval Service. Such a modification as made by this Laboratory is shown on Plate 2.

RECOMMENDATIONS

(a) That the relay, as submitted, be not approved for the Naval service because of its failure under shock.

(b) That the relay, if modified by the manufacturer to incorporate a "Burgess Micro Switch" with a 1 mfd. condenser in series with a 0.5 ohm resistor shunted across the switch contacts, be approved for installation in ships service telephone systems.

(c) It is recommended that all modified parts be nickel plated for protection against corrosion.

DESCRIPTION OF MATERIAL

6. This relay is designed for use on a ships service telephone system, for operation on the ringer circuit output of 80 volts, 16-2/3 cycles. It replaces a standard ringer in locations having high noise levels, operating instead, a Navy type I motor driven horn.

7. As received for test it consisted of a laminated core chassis on which was mounted a "Burgess Vacuum Contactor" with a 0.006 mfd. condenser shunted across its contacts.

8. The relay coil is wound on a molded form of approved insulating material and is connected in series with a 2 mfd. condenser. Terminals are provided for both line and load connections.

9. The entire unit is mounted on a base of approved insulating material and enclosed in a watertight cast aluminum alloy case provided with 3 bosses drilled and tapped for 3/4" Navy terminal tubes. Four lugs are provided on the case for mounting. The relay as received is shown on Plate I.

DESCRIPTION OF MODIFIED RELAY

10. This relay was modified by removing the vacuum type contact, together with its protective condenser and adjusting screw, and substituting a "Burgess Micro Switch" having a 1 mfd. condenser, in series with a 0.5 ohm resistor, connected across its contacts. This substitution made it necessary to provide a new mounting having an adjustable feature. This modification is shown on plate 2.

METHOD OF TEST

11. The relay as submitted was first tested for shock integrity by subjecting it to 20 - 150 foot pound blows on a Navy standard shock machine. At conclusion of this test, the relay was modified and again tested for shock integrity. It was then connected in an automatic telephone ringer circuit, having an output of 80 volts, 16-2/3 cycles, and operated for endurance with a load consisting of 1 - 100 Watt, 115 volt lamp, and 1 Navy type I 115 volt D.C. motor driven horn. The test was concluded with the usual over and under voltage and frequency, insulation resistance, dielectric strength, and watertight integrity tests.

RESULTS OF TEST ON MODIFIED RELAY

12.	<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>
	Voltage	80 volts	80 volts
	Current	Alternating	Alternating
	Frequency	16-2/3	16-2/3
	Amperes	Not specified	0.038
	Endurance	20,000 operations at the rate of 15 cycles, one sec. on, and 3 sec. off, per minute.	33,000 operations at the specified rate.

<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>
Load across switch contacts during endurance test.	One Navy type I motor driven horn, approximately 0.89 amperes.	One Navy type I, 115 volt DC motor driven horn and one 100 watt 115 V. lamp. Total - 1.75 amps.
Capacity in series with relay coil.	2 mfd.	2.21 mfd.
Shock test.	Twenty 150 foot pound blows.	Relay withstood test.
Inclination	Relay shall operate satisfactorily in all planes, 30° from the vertical.	Relay operated satisfactorily in all planes.
Watertightness	Unit shall be submerged in 3 ft. salt water for 12 hours without leakage.	Test complied with.
Weight		6 lbs. 8 oz.
Case Dimensions.		Height - 7"0625 Width - 8"0625 Depth - 4"3125
Temperature rise of relay coil.	Not to exceed 30° C. at ambient temperature of 40° C.	8.78° C. at ambient temperature of 40° C.
Over and under voltage and frequency.	10% above 10% below	88 volts at 17.5 cycles 72 volts at 15.25 "
Insulation resistance	Not less than 1 megohm when measured by 1000 volt megger.	200 megohms by 1000 V. megger.
Dielectric Strength	Relay shall withstand 1000 volts A.C. 60 cycle, applied for one minute between all current carrying parts and ground.	Relay withstood test.
Impedance		2105.2 ohms at 16-2/3 cycles.

DIRECTIONS FOR ADJUSTING RELAY

13. First, the armature should be adjusted as follows:

Residual gap - - - - - 0"002

Air line gap - - - - - 0"002

Armature stroke - - - - 0"030

Next, the lever arm should be adjusted until positive operation of the micro switch is obtained.

14. The glass enclosed contacts on the relay as submitted were injured under shocks of 150 foot pounds causing the alarm circuit to remain closed. In view of this a "Burgess Micro Switch" was substituted and found capable of withstanding shocks of 150 foot pounds.

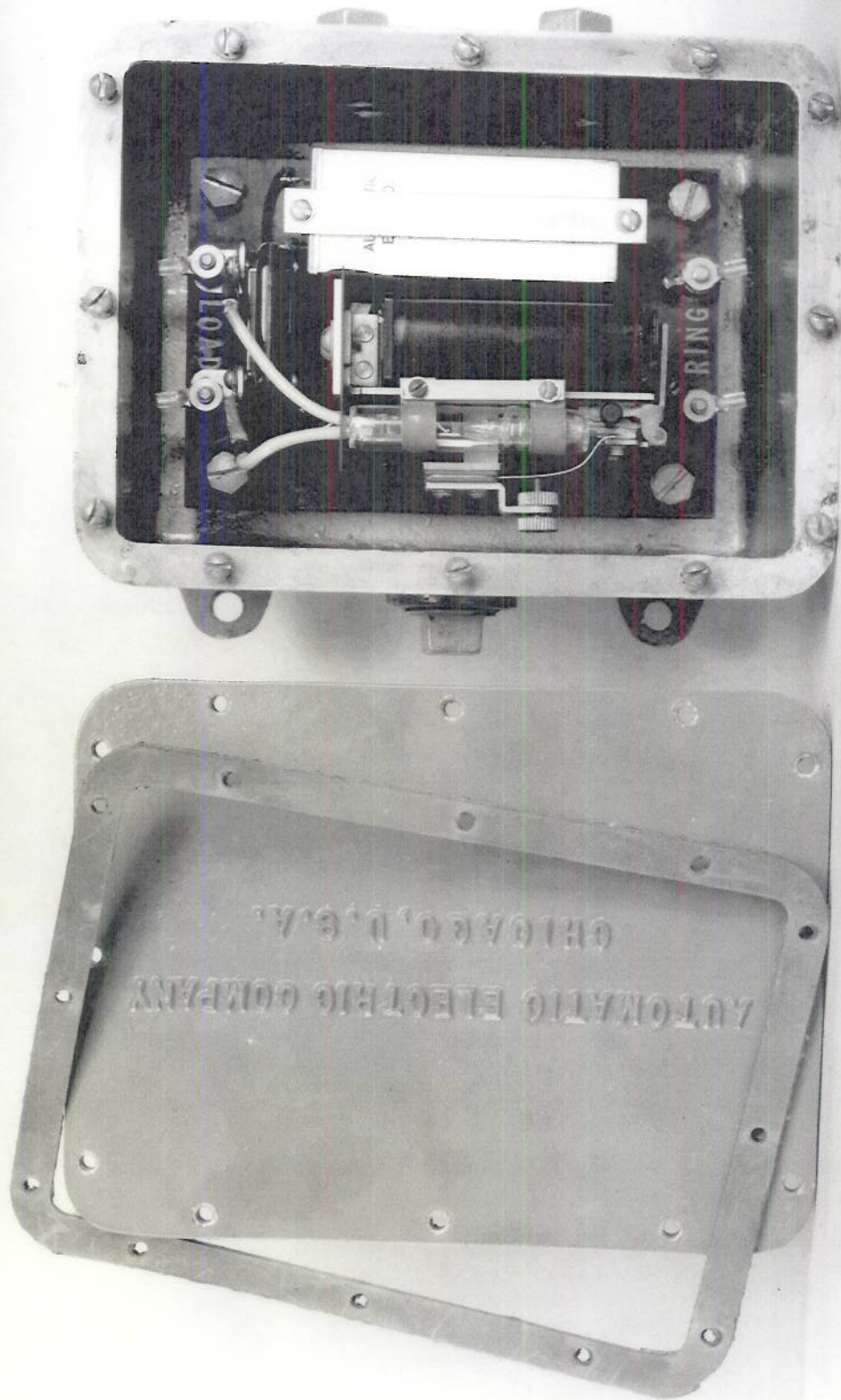
15. For the protection of the micro switch contacts, when breaking a direct current load of 1.75 amperes a 1 mfd. condenser, in series with a 0.5 ohm resistor, was connected across the switch contacts. For loads greater than 0.5 amperes at 115 volts direct current, this shunt must be used. For all alternating current loads, it must be removed. Plate 3, oscillograms 1 and 2, show the necessity of this shunt for direct current loads.

16. The modified relay under test was entirely satisfactory and complied with the specifications.

CONCLUSIONS

17. This relay as submitted by the Automatic Electric Company is not satisfactory for installation in ships service telephone systems because of its failure to comply with the requirements of the specifications with respect to shock integrity.

18. This relay, if modified to incorporate a "Burgess Micro Switch" in place of the "Burgess Vacuum Contactor", would be satisfactory for the Naval service. Such a modification as made by this Laboratory is shown on Plate 2.



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PLATE 1

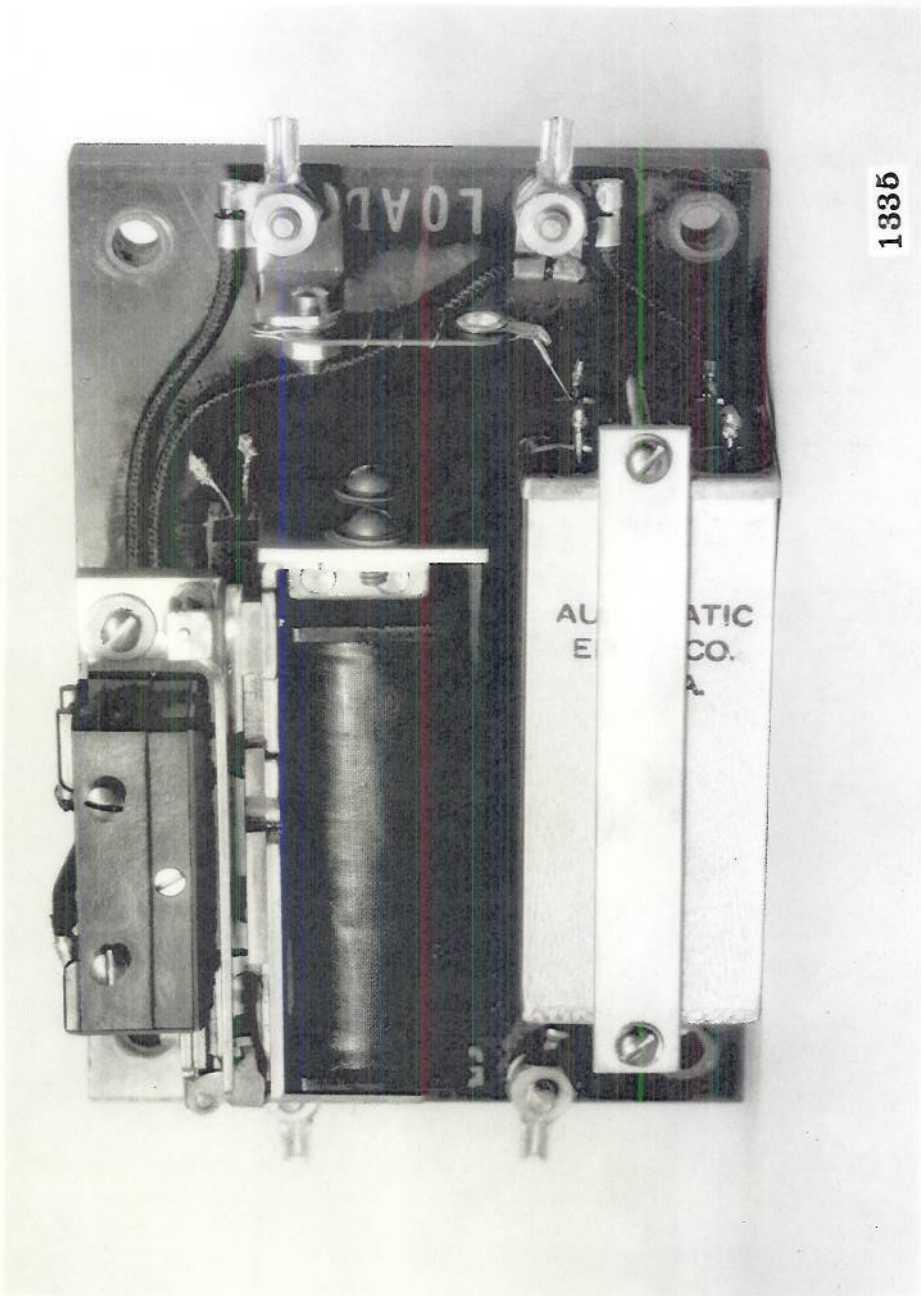


PLATE 2



D.C. WITH CONDENSER AND RESISTOR



D.C. WITHOUT CONDENSER AND RESISTOR



60 ν A.C. WITHOUT CONDENSER