

FR-1101

NRL Report No. B-1101
Metal Vacuum Type Relay submitted by General Electric Company

REPORT NO. B-1101

DATE 11 December 1934

SUBJECT

Metal Vacuum Type Relay

submitted by

General Electric Company



BY

NAVAL RESEARCH LABORATORY

BELLEVUE, D. C.

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11 December 1934

NRL Report No.B-1101

NAVY DEPARTMENT
BUREAU OF ENGINEERING
Report on
Metal Vacuum Type Relay
submitted by
General Electric Company
Contracts NOs-33955 and NOs-34530

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

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Authorization: BuEng let.S62-2(S)/L5(10-30-Ds) of 6 November 1934.

Date of Test: November 1934.

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AUTHORIZATION FOR TEST

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

- Reference:(a) BuEng let.S62-2(S)/L5(10-30-Ds) of
6 November 1934.
(b) INM Schenectady, N.Y. let. S69/L2(83)
of 30 October 1934 to BuEng.
(c) General Electric Company's let. T/GE(22)
of 26 October 1934 to INM, Schenectady.
(d) Navy Dept.Specifications for Interior
Communication Apparatus, BuEng let.
S67/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, complied with Navy Department Specifications, ref.(d), and its suitability for installation in "Thyratron Remote Control Racks" to transfer the circuit from low speed to high speed receiver regulators.

ABSTRACT OF TEST

3. The relay was set up in this Laboratory in a circuit simulating the conditions to which the relay would be subjected aboard ship and closely observed while under test for endurance. The usual test for operation of the relay at over and under voltage and when subjected to shock was made. The insulation resistance, dielectric strength, temperature rise of the solenoid were then determined.

Conclusions

This relay, as submitted, complied with all of the requirements of the specifications with the exception of the shock test requirement. However, this fault can be easily corrected by a change in the mounting of the metal vacuum breaker. A sketch of this modification is shown on Plate 2.

Recommendations

(a) It is recommended that this relay be approved for use on Contracts NOs-33955 and NOs-34550, providing the manufacturer changes the mounting of the metal vacuum breaker. A sketch of a proposed mounting is shown on Plate 2.

(b) It is recommended that the manufacturer specify the contact rating of the metal vacuum breaker on the relay name plate.

DESCRIPTION OF MATERIAL UNDER TEST

4. This relay, manufactured by the General Electric Company, is known as a type 12 HBC 13A1 relay, and includes a type FA-6 metal vacuum breaker. The rating of the vacuum breaker is 10 amperes at 230 volts a.c. The operating coil of the relay is for intermittent duty on a 125 volt d.c. circuit.

5. The metal vacuum breaker consists of a steel tube, containing two fixed insulated contacts and one movable contact which is in common with the metal case. The movement of the common contact is made possible by means of a rod extending through the thin flexible diaphragm which forms one end of the tube.

6. The normal position of the breaker, when mounted on the relay, allows one circuit to be closed and the other opened. The solenoid, when energized, transfers these connections, as the vacuum breaker is the equivalent of a single pole, double throw switch. The breaker case, being in common with one side of the line, is insulated from the relay chassis.

7. A photograph of the relay is shown on Plate 1.

METHOD OF TEST

8. First, the relay was tested for endurance by connecting the solenoid in a 115 volt direct current circuit and interrupting its current at the rate of ten cycles per minute by means of a contactor mechanically driven. This test was continued until the relay had operated 20,000 times. Each cycle of operation opened and closed a load of 10 amperes at 220 volts a.c., 60 cycle, 50% P.F.

9. Next the relay was tested for operation when inclined 30° from the vertical plane in all directions at voltages of 10% above and 20% below normal line voltage.

10. The relay was then placed on a Navy standard shock machine and tested for operation while under shock. The test was concluded with the usual insulation and dielectric tests.

RESULTS OF TEST

11. <u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>
Voltage of solenoid	115 volts	115 volts
Solenoid Current	Direct	Direct
Amperes (solenoid)	Not specified	0.0093 amps
Contact Load	10 amps at 220 volts a.c., 60 cycle 50% P.F.	10 amps. at 220 volts, a.c., 60 cycle 50% P.F.
Endurance	20,000 operations at the rate of 10 cycles per minute. Each cycle opening and closing the rated load.	20,000 operations at the rate of 10 cycles per minute. Each cycle opening and closing the rated load.
Inclination	Relay shall operate satisfactorily when inclined 30° from the vertical plane in all directions at 10% above and 20% below normal line voltage.	Relay operated satisfactorily.
Insulation resistance.	Not less than 5 megohms when measured by 1000 volt megger.	200 megohms by 1000 volt megger.
Dielectric strength.	1240 volts a.c., 60 cycle applied for one minute between all current carrying parts and chassis.	1240 volts a.c., 60 cycle applied for one minute between all current carrying parts and chassis.
Temperature rise of solenoid.	Not more than 30°C. rise at ambient temp. of 40°C. at conclusion of endurance test.	11.53°C rise at conclusion of endurance test.
Shock test.	Relay shall operate satisfactorily after application of 20 blows of 150 foot lbs. when mounted on a Navy std. shock machine.	Unsatisfactory. (See comment, Par. 13.)

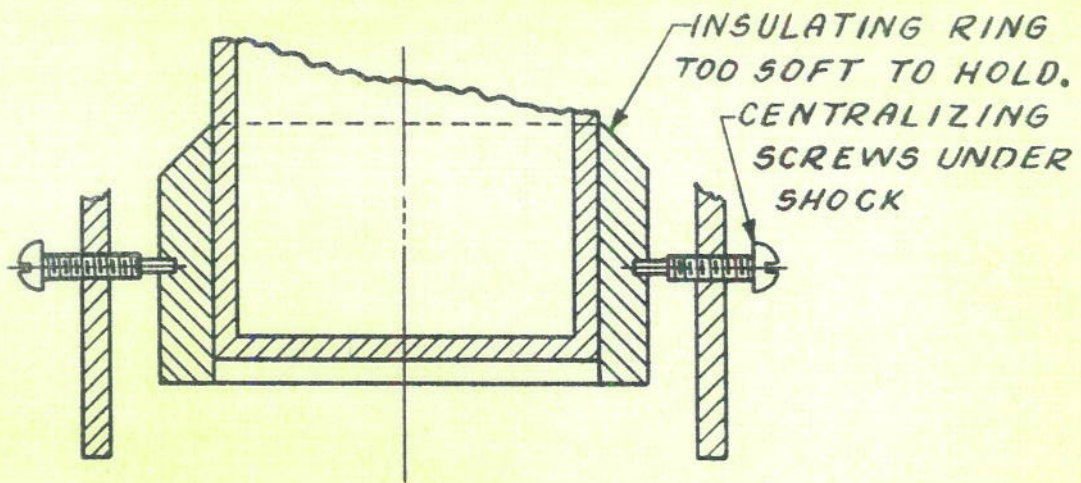
12. The operation of the relay and metal vacuum breaker during the endurance test was entirely satisfactory.

13. The relay complied with all of the requirements of the specifications with the exception of the shock test requirement. When given 13 blows of 150 foot pounds on a Navy standard shock machine, the relay failed to operate satisfactorily. An examination disclosed that the screws securing the breaker were loose in the insulating ring.

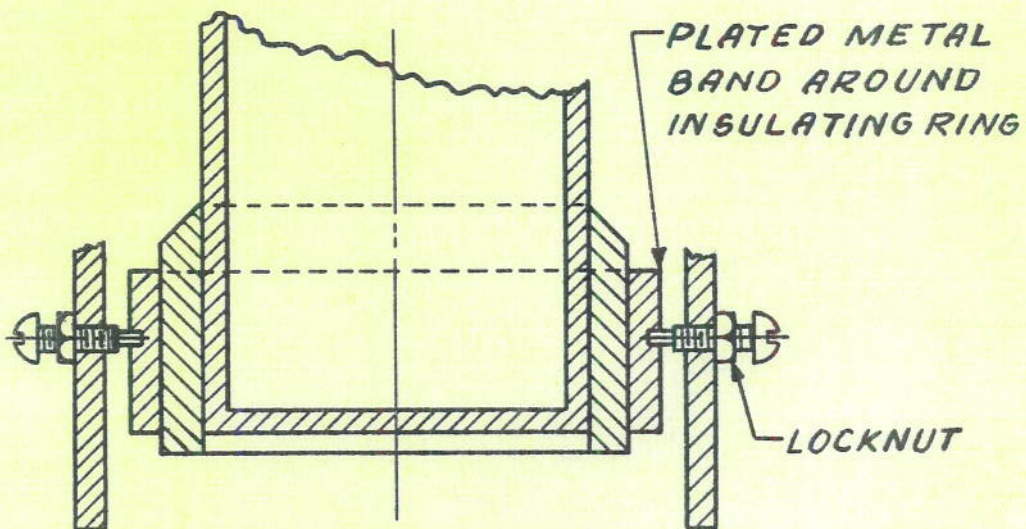
14. For proper operation the metal vacuum breaker should be rigidly mounted. A sketch of a proposed mounting is shown on Plate 2.

CONCLUSIONS

15. This relay, as submitted, complied with all the requirements of the specifications with the exception of the shock test requirement. However, this fault can be easily corrected by a change in the mounting of the metal vacuum breaker. A sketch of this modification is shown on Plate 2.



PRESENT MOUNTING



PROPOSED MODIFICATION OF
BREAKER MOUNTING