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NAVY DEPARTMENT
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Report
of
Test on Fire Alarm Equipment

FR-1313

Submitted by
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Authorization: BuEng. ltr. S65-4/L5 (8-6-Ds) of 11 August 1936.
Date of Test: August and September 1936.
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Table of Contents

<u>Subject</u>	<u>Page</u>
Authorization	1
Object of Test	1
Abstract of Test	1
Conclusions	1-a
Recommendations	1-b
Description of Material under Test	2
Method of Test	2
Results of Test	3
Conclusions	5

Appendix

Four Line Unit submitted for Test, Front Angle View Plate 1	
Same Unit, Rear Angle View	2

AUTHORIZATION

1. This test was authorized by reference (a), and other references pertinent to this problem are listed as references (b) and (c).

Reference: (a) BuEng. ltr. S65-4/L5 (8-6-Ds) of 11 August 1936.
(b) Specifications SGS(65)-25b, Fire Alarm Equipment,
of 15 December 1935.
(c) Drawing 9-S-4663-L, Alt. 6.

OBJECT OF TEST

2. The object in conducting this test was to determine whether the subject material complied with the specifications, reference (b), drawing, reference (c), and its suitability for the Naval service when used in connection with fire alarm systems.

ABSTRACT OF TEST

3. The four line unit was set up at this Laboratory and tested in strict accordance with the specifications, reference (b), after which it was carefully checked against drawing, reference (c), and inspected for quality of workmanship and materials, and suitability of design.

Conclusions

(a) The maximum allowable current through the thermostat when indicating a fire is 0.070 amperes. The average current of the four line unit when the external resistor was shorted, simulating a fire, was 0.090 amperes, an excess of approximately 28%.

(b) All of the units failed to withstand the required ruggedness test, failing before ten shocks had been applied. This was due to open circuits caused by wires breaking at the soldered connections on the relays and switches. Although the entire assembly was securely fastened to the shock stand to prevent distortion, the chassis of the relays and targets were badly bent at the conclusion of this test. A more rugged chassis should be provided for each of these parts.

(c) Nameplates have not been provided for the individual units as required by the specifications, paragraph E-4e.

(d) The sample units failed to withstand the dielectric test, failures probably occurring in the windings.

(e) The following undesirable features were noted:

- (1) An adhesive tape is used to protect the windings instead of the usual non-hydroscopic material lapped and cemented in the lap.
- (2) The neon lamps are replaceable from the back of the unit only.
- (3) The dust cover is neither separately removable or complete. The two-line units should be secured at the top to an independent member supported by brackets. The bus and line terminal assembly should also be supported independently from the dust cover.
- (4) Line terminals, drawing 9-S-1841-L, are not provided on the back of the terminal strip.
- (5) The cloth inserted bakelite insulators on switches and relays should be coated with an approved varnish on all edges.

(f) As received, the units were not wired in accordance with the latest alteration of drawing, reference (c), and in order to conduct the test the necessary changes were made.

(g) As no ground detector was furnished, a temporary one was provided and was found to operate satisfactorily in connection with this equipment.

(h) No extension alarm relay was furnished.

Recommendations

(a) In view of the subject material having failed to comply with the specifications, as noted under "Conclusions" of this report, it is recommended that its approval be withheld pending the correction of deficiencies and the submission of a modified sample for test.

DESCRIPTION OF MATERIAL UNDER TEST

4. This four line fire alarm panel was manufactured by Chas. J. Henschel and Co., Inc., Amesbury, Mass.
5. Each line unit consists of one trouble relay, one telephone type transfer switch, one neon lamp (Navy Type VG-2), a socket (Drawing 9-S-4625-L) and one combined fire alarm target and relay. No extension relay accompanied the equipment.
6. The line units are mounted in pairs on metal plates which are hinged to allow free access to the mechanism by removing two machine screws at the top of each plate.
7. Located at the rear of the panel are four bus bars, secured to bakelite for the line, trouble, and fire alarm circuits. Terminals are provided for the lines which connect to the thermostats.
8. Four "3000 ohm" resistors were furnished, one connected across each of the thermostat circuits to simulate normal working conditions.
9. Each line unit is designed to operate from a supply of 120 volts, direct current. The circuit is composed of three series elements, namely, a trouble relay, a combined fire alarm target and relay, and a resistor. The trouble relay is of the normally closed double contact type and closes an alarm circuit when deenergized. A current of approximately 0.03 amperes flows constantly through the circuit and is sufficient to operate the trouble relay and hold open the alarm contacts. The neon lamps glow when the alarm contacts close and indicates which circuit has operated the trouble alarm.
10. The combined fire alarm target and relay is of the marginal type and does not operate at the normal supervisory current. However, it does function, closing the fire alarm circuit and causing the target to indicate, when the current is increased to approximately 0.08 amperes. This normally occurs only when the "3000 ohm" resistor is shorted by the fire alarm thermostat, but shorting the line from any other cause will produce the same effect.
11. The three position cut-out switch is provided so that a unit may be cut-out and disconnected from the fire and trouble alarm circuits, common to all units. This switch also provides a fire test when thrown down and a trouble test at a point between the normal center position and the cut-out position, when thrown upward. It will remain in either the normal center or upward cut-out position.

METHOD OF TEST

12. The subject material was tested in strict accordance with and in the order outlined under the specifications for switchboard equipment, reference (b). A mechanical device was used to operate the

cut-out switches for the required endurance test and the resulting values are given under "Results of Test," paragraph 13. An inspection, as to the quality of workmanship, design and materials, concluded the test.

RESULTS OF TEST

13. The test results obtained were as follows:

<u>Requirements</u>	<u>Test Values</u>
Endurance: Par. F-2c(3). Current shall be applied to the four circuits with resistors in circuit for 48 continuous hours.	Complied with, energizing the units from a supply of 120 volts, d.c.
Endurance: Par. F-2c(3)b. Each individual fire target, relay and lamp shall be operated by movement of the related test and cut-out switch at the rate of 30 times per minute for 15 minutes, every alternate 15 minutes, until each unit has operated 3000 cycles.	Satisfactory under conditions specified.
Endurance: Par. F-2c(3)c. No damage shall occur to the equipment resulting from 3000 cycles of operation.	Satisfactory, no damage or derangement of any parts of the equipment occurring.
Temperature rise: Par. F-2c(3)c. Coils of relays and targets shall not exceed 30°F. above an ambient of 130°F. during endurance test.	The average temperature rise of target coils was 26.4°F. and 21.7°F. for the trouble relay coils.
Dielectric test: Par. F-2c(4)b. Each electrical device shall withstand 1500 volts, a.c., 60 cycles, applied for a period of one second without breakdown.	*Unsatisfactory, breakdown occurring after 1 second test at 1500 volts, a.c. 60 cycles.
Insulation test: Par. F-2c(4)c. Shall be not less than 1 megohm by 500 volt megger.	*50 megohms before dielectric test and zero following dielectric test.
Operating current: Par. F-2c(6). Shall not exceed 0.07 amperes through the thermostat when indicating a fire, or 0.03 amperes under supervisory condition.	*Average current when indicating a fire 0.090 amperes. Average supervisory current 0.028 amperes.

Requirements

Ruggedness test: Par. F-2c(2).
Complete panel shall withstand
20 shocks of 250-foot pounds each
under conditions specified.

Test Values

*All units had failed after
10 shocks due to wires break-
ing from connections when
panel was distorted by shock
impact. When placed in the
cut-out position, the switches
remained stationary.

* Denotes failure to comply with the specifications.

14. Weights and Dimensions

Total weight	8 lbs. 4 oz.
Height	7"0
Width	5"5
Depth	10"0

CONCLUSIONS

15. The maximum allowable current through the thermostat when indicating a fire, is 0.070 amperes. The average current of the four line units when the external resistor was shorted, simulating a fire, was 0.090 amperes, an excess of approximately 28%.

16. All of the units failed to withstand the required ruggedness test, failing before ten shocks had been applied. This was due to open circuits caused by wires breaking at the soldered connections on the relays and switches. Although the entire assembly was securely fastened to the shock stand to prevent distortion, the chassis of the relays and targets were badly bent at the conclusion of this test. A more rugged chassis should be provided for each of these parts.

17. Nameplates have not been provided for the individual units as required by the specifications, paragraph E-4e.

18. The sample units failed to withstand the dielectric test, failures probably occurring in the windings.

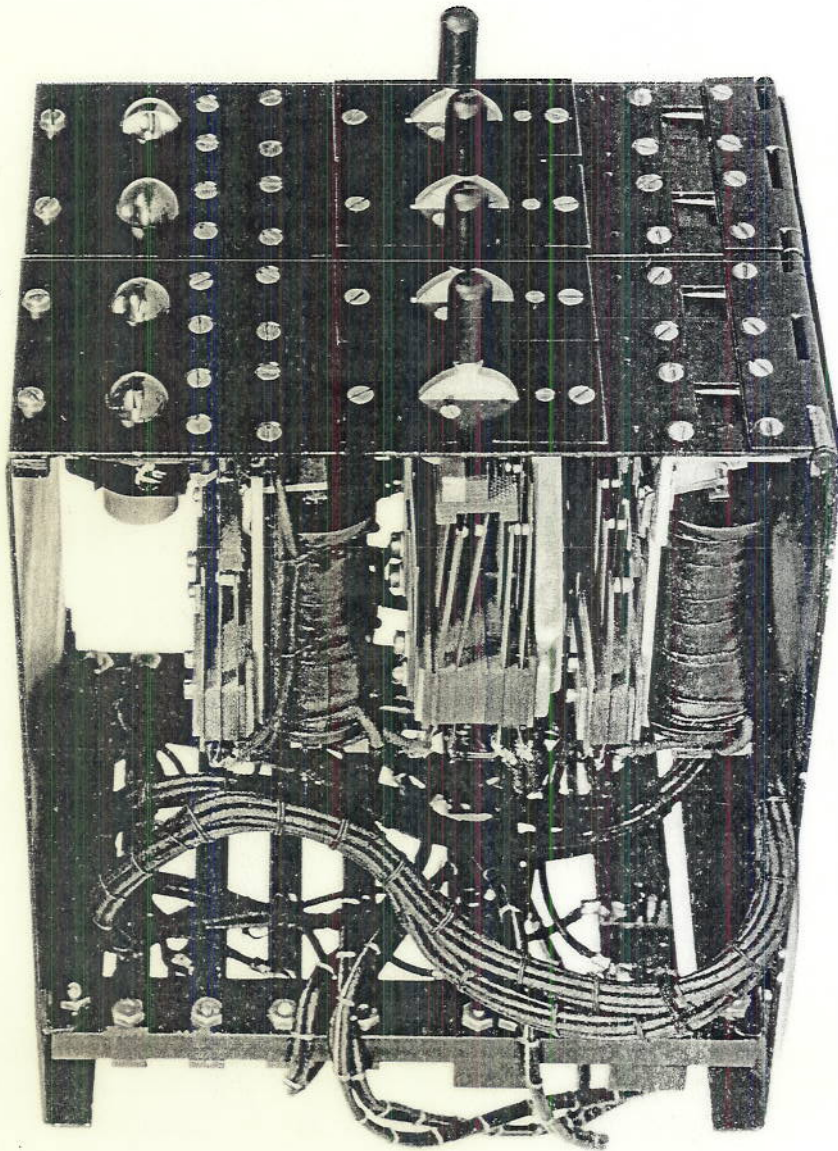
19. The following undesirable features were noted:

- (1) An adhesive tape is used to protect the windings instead of the usual non-hygroscopic material lapped and cemented in the lap.
- (2) The neon lamps are replaceable from the back of the unit only.
- (3) The dust cover is neither separately removable or complete. The two line units should be secured at the top to an independent member supported by brackets. The bus and line terminal assembly should also be supported independently from the dust cover.
- (4) Line terminals, drawing 9-S-1841-L, are not provided on the back of the terminal strip.
- (5) The cloth inserted bakelite insulators on switches and relays should be coated with an approved varnish on all exposed edges.

20. As received, the units were not wired in accordance with the latest alteration of drawing, reference (c), and in order to conduct the test the necessary changes were made.

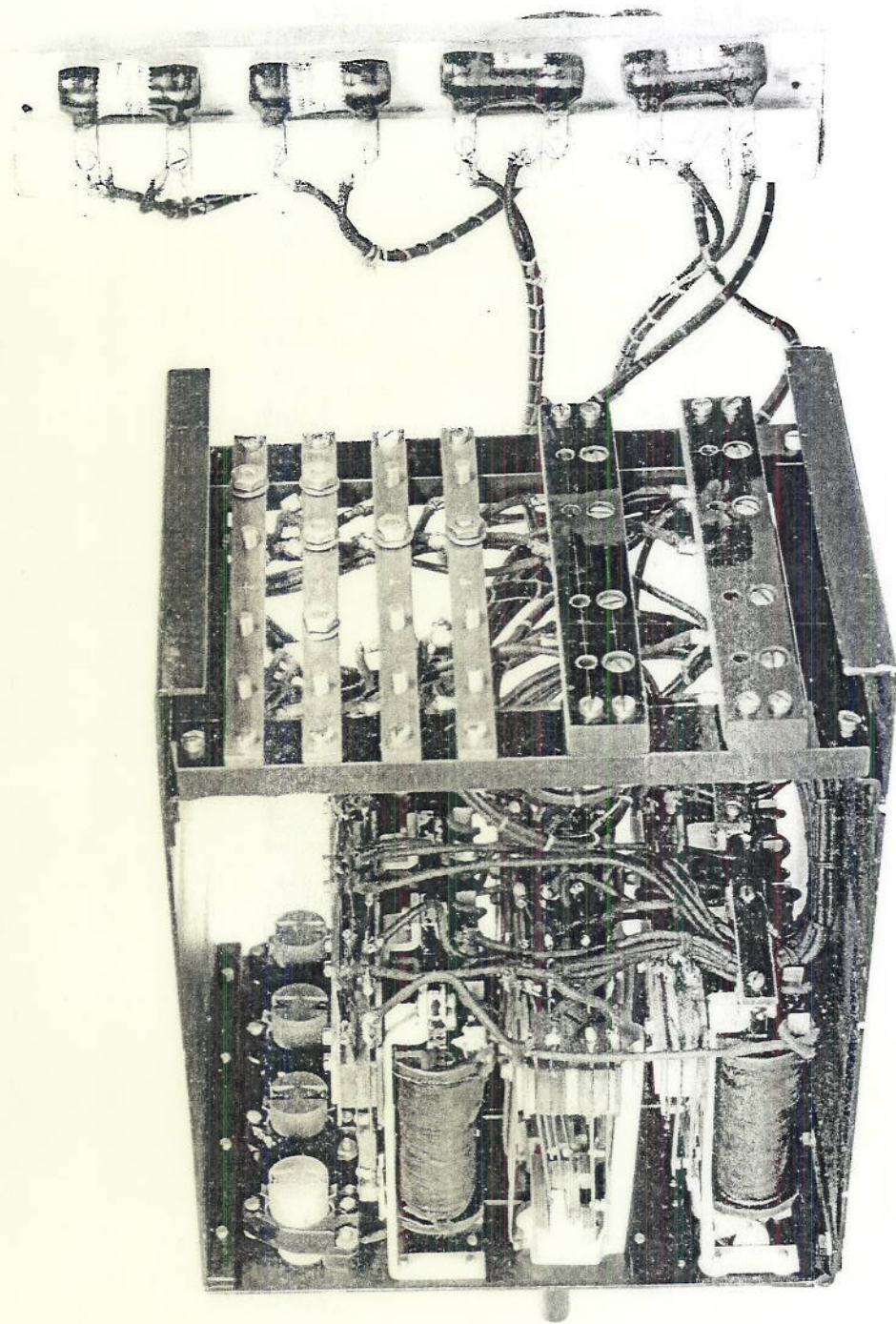
21. As no ground detector was furnished, a temporary one was provided and was found to operate satisfactorily in connection with this equipment.

22. No extension alarm relay was furnished.



1756

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1757

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