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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report of Test

on

Lubricating Oil Low Pressure Alarm Contact
Maker.
Clark Cooper Company - Exhibitor.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D.C.

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Authorization: BuEng. ltr. NOs-39865 (7-16-Ds) of 19 July 1935.

Date of Test: July-August 1935.

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AUTHORIZATION FOR TEST

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

Reference: (a) BuEng. ltr. NOs-39865 (7-16-Ds) of 19 July 1935.
(b) INM ltr. L4-3/39865 of 6 July 1935 to NRL.
(c) NRL Report No. B-1086 of 19 Oct. 1934.
(d) Contract NOs-39865 - Contact Makers - For
Navy Yard, Norfolk - Clark Cooper Co., Contractor.

OBJECT OF TEST

2. The object of this test was to determine the suitability of the contact maker, submitted under reference (b), for the Naval Service, as a protective device for installation in lubricating oil system, to operate an alarm system when the pressure falls below a predetermined setting. The subject material was also examined to determine whether the manufacturer had complied with the recommendations, outlined under reference (c), and concurred in by the Bureau.

ABSTRACT OF TEST

3. The subject contact maker was set up at this Laboratory in an air system, simulating service conditions, and closely observed while under test for the required number of operations. Particular attention was given to the operating point of the contact maker, throughout the test, to determine its suitability in maintaining the original predetermined setting. The usual tests for shock integrity, insulation resistance, dielectric strength, watertight integrity and operation at over pressures were conducted.

DESCRIPTION OF MATERIAL UNDER TEST

4. The mechanism of this contact maker is housed in a cast brass case of watertight construction having three mounting lugs. It is of the bellows type and actuates the contact mechanism by means of a plunger. This plunger is soldered to the bellows diaphragm and operates an alarm circuit when the pressure falls below a predetermined setting.

5. In assembly, the bellows and its respective parts are first assembled, then placed in the pressure chamber and sealed by soldering the bellows ring to the pressure chamber.

6. The pressure chamber is drilled and tapped for one (1) 3/8" (IPS) pipe, for connecting in the lubricating oil system, and one (1) 1/2" (IPS) plug, for draining and cleaning. The chamber is secured to the case with four (4) fillister head steel screws, cadmium plated. To insure watertightness, a flat rubber gasket is provided between the bellows chamber and the case.

7. In operation the pressure does not enter, but surrounds the outside of the bellows.

8. The operating points are governed by turning the knurled nut in or out, varying the tension on a coil spring, thereby varying the pressure in opposition to that of the bellows.

9. The switch is single pole, embodying two tungsten contacts, one of which is movable. The stationary contact is mounted on a phosphorous bronze strip, secured to the movable insulated arm. The movable contact is connected to its terminal post by means of a flexible lead wire.

10. A set screw, provided with a locknut, is threaded into the main lever arm and is so adjusted that movement of both the lever arm and the bellows is limited to that necessary to operate the alarm circuit contacts. On pressures above the operating point, the set screw is in contact with the case, preventing further movement of the lever and damage of the bellows.

11. The total weight of the contact maker is 7 lbs., 12 ozs. The case is finished in light gray paint.

METHOD OF TEST

12. The contact maker, as received from the manufacturer, was first connected in an air pressure system and its operating point was obtained.

13. It was next tested for endurance and accuracy of operation, at rated pressure, by means of a mechanically driven cam which opened a release valve, thereby lowering the pressure to the operating point. This test was continued until the contact maker had operated the alarm circuit contacts 24,480 times, at the rate of ten (10) operations per minute.

14. Upon completion of the endurance and accuracy tests, the unit was tested to determine the effect of an air pressure of 250 lbs. per sq. in., applied for 15 periods of 10 seconds duration, on its operating point.

CONCLUSIONS

(a) This contact maker, as manufactured and submitted by the Clark Cooper Company, Philadelphia, Pa., has been modified in accordance with recommendations, contained in reference (c), except that steel fillister head screws, cadmium plated, have not been provided.

(b) Under test for contract suitability, the contact maker proved to be rugged, accurate and highly sensitive in operation, complying with all of the major requirements of the specifications.

(c) The principal defect discovered during the period of the test, was a bearing made with insufficient clearance between its shoulder and the lever arm which it secures. Tightening the screw, which passes through the bearing, causes the shoulder to grip the lever, thereby changing the operating point by introducing additional friction.

(d) The manufacturer's rating of the contact maker is 5 amperes, 115 volts, AC-DC. The contact maker appears to satisfactorily break a non-inductive load of 5 amperes at 115 volts, A.C., 60 cycles. However, the maximum current that can be safely broken at 115 volts, D.C., non-inductive load, is approximately 1 ampere, which is greater than that normally flowing in an alarm circuit. The rating on the cover should be changed accordingly.

(e) To prevent the backing out of the terminal screws, when making line connections, the counterbored holes in the insulating base should be filled with an approved insulating compound, having a high melting point.

(f) The manufacturer should provide terminal lugs, Bu.Eng. Drawing 9-3-1841-L-37, for both of the line terminal screws. Such a lug has been installed on one of the screws for the manufacturer's guidance.

RECOMMENDATION

(a) It is recommended that the subject contact maker be approved for the Naval Service, contract reference (d), subject to corrections in conformance with comments, outlined under "CONCLUSIONS" of this report.

15. It was then placed on a Bureau of Engineering shock stand and tested for ruggedness and ability to maintain its operating point, by subjecting it to 20-250 foot pound shocks. During the period of this test, the contact maker was connected in the air pressure system under the same conditions as when tested for endurance and accuracy. It was mounted on the bulkhead in the vertical plane, four inches below the point of impact of the shock. The shocks tended to move the unit away from the bulkhead.

16. The unit was then tested for its operating features when inclined 30° from the vertical plane in all directions.

17. Next, it was placed in a tank of salt water, to a depth of three feet for a period of 12 hours, to determine its watertightness.

18. The test was concluded with the usual insulation resistance and dielectric strength tests on all electrical parts.

19. The operating characteristics of the contact maker during the endurance, over pressure, and shock tests are given as Table 1.

RESULTS OF TEST

20. Prior to the start of the test, the air gauge used for checking the accuracy of the contact maker was compared with a mercury manometer.

<u>21. Specifications</u>	<u>Requirements</u>	<u>Test Values</u>
Voltage at contacts	115 volts	115 volts
Current	Direct	Direct
Contact load	One 6", 115 V. D.C. vibrating bell and one 75 watt, 115 V. lamp.	One 6", 115 V. D.C. vibrating bell and one 75 watt lamp. Total load 0.70 amps.
Endurance	20,000 operations, at the rate of 10 operations per minute.	24,480 operations at the rate of 10 operations per minute.
Operating point	Adjustable	Adjustable between 2 and 30 lbs.
Accuracy of Operation	Consistent operation within plus or minus 0.5 lb.	Consistent operation within plus or minus 0.3 lb.
Over pressure test.	250 lbs. per sq.in. pressure, applied for 15 periods of ten seconds duration without change, exceeding tolerance in operating point.	Change during this test did not exceed the allowable tolerance.

<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>
Sensitivity	Contact maker shall open the alarm circuit contacts when the applied pressure exceeds the operating point by 1 lb. or less.	Sensitivity, approximately 0.4 lb. throughout the entire test.
Shock test	Twenty blows, of 250 ft.lbs. each while mounted in the vertical plane, without change exceeding tolerance in the operating point.	Satisfactory operation following shock tests.
Inclination	Contact maker shall function satisfactorily when inclined 30° from the vertical plane in all directions.	Satisfactory operation under all tests.
Watertight integrity	Complete unit shall be watertight after having been immersed in salt water to a depth of 3 ft., for a period of 12 hours.	Satisfactory, no leaks occurring.
Insulation	Not less than 5 megohms by 1000 V. megger.	200 megohms between all current carrying parts and case.
Dielectric	1230 V. A.C., 60 cycle, applied for one minute between all current carrying parts and case without breakdown occurring.	Specified voltage applied and no breakdown occurred.

DIMENSIONS

22.	Overall length	--	8"75
	Overall depth	--	3"375
	Overall width	--	6"00

CONCLUSIONS

23. This contact maker, as manufactured and submitted by the Clark Cooper Company, Philadelphia, Pa., has been modified in accordance with recommendations, contained in reference (c), except that steel fillister head screws, cadmium plated, have not been provided.

24. Under test for contract suitability, the contact maker proved to be rugged, accurate and highly sensitive in operation, complying with all of the major requirements of the specifications.

25. The principal defect discovered during the period of the test, was a bearing made with insufficient clearance between its shoulder and

the lever arm which it secures. Tightening the screw, which passes through the bearing, causes the shoulder to grip the lever, thereby changing the operating point by introducing additional friction.

26. The manufacturer's rating of the contact maker is 5 amperes, 115 volts, AC-DC. The contact maker appears to satisfactorily break a non-inductive load of 5 amperes at 115 volts, A.C., 60 cycles. However, the maximum current that can be safely broken at 115 volts, D.C., non-inductive load, is approximately 1 ampere, which is greater than that normally flowing in an alarm circuit. The rating on the cover should be changed accordingly.

27. To prevent the backing out of the terminal screws, when making line connections, the counterbored holes in the insulating base should be filled with an approved insulating compound, having a high melting point.

28. The manufacturer should provide terminal lugs, Bu.Eng. Drawing 9-S-1841-L-37, for both of the line terminal screws. Such a lug has been installed on one of the screws for the manufacturer's guidance.

TABLE NO. 1

AIR PRESSURE IN POUNDS PER SQ. IN.		1st Day	2nd Day	3rd Day	4th Day	5th Day							
POP Point:	4.8	4.75	4.75	4.75	5.1	4.8	4.8	5.0	5.0	5.0	5.1	4.6	
POP Point	4.9	5.0	5.0	4.9	5.1	5.2	5.2	5.2	5.2	5.1	5.1	4.75	
	At start of test	After 4,080 operations	After 4,080 operations	After 9,180 operations	After 9,180 operations	After 9,180 operations	After 17,280 operations	After 17,280 operations	After 19,380 operations	After 19,380 operations	After 27,480 operations	After 10 periods of 15 seconds each at 250 lbs. per sq.in.	After 20 - 250 ft.lb. blows on shock machine

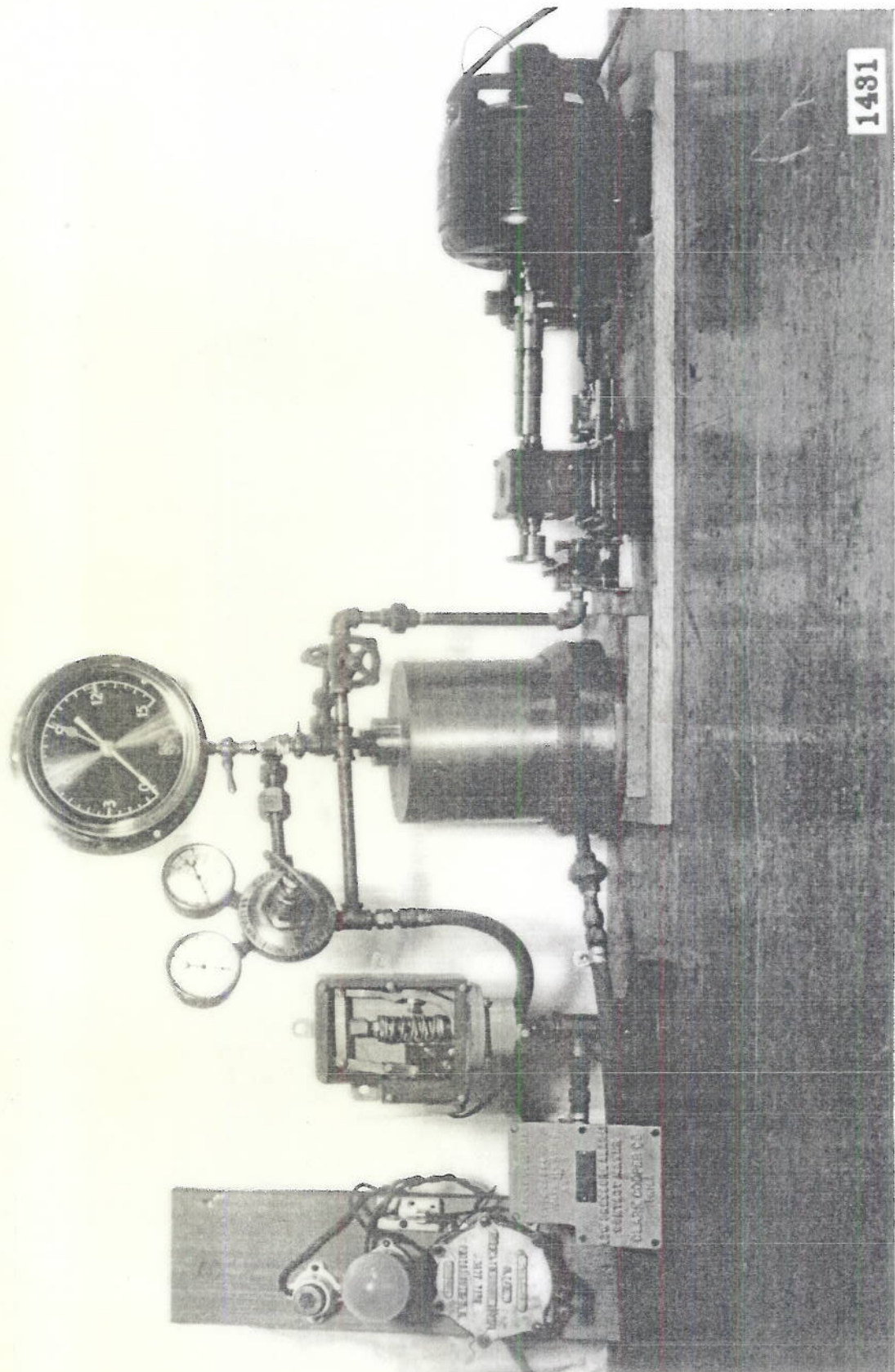
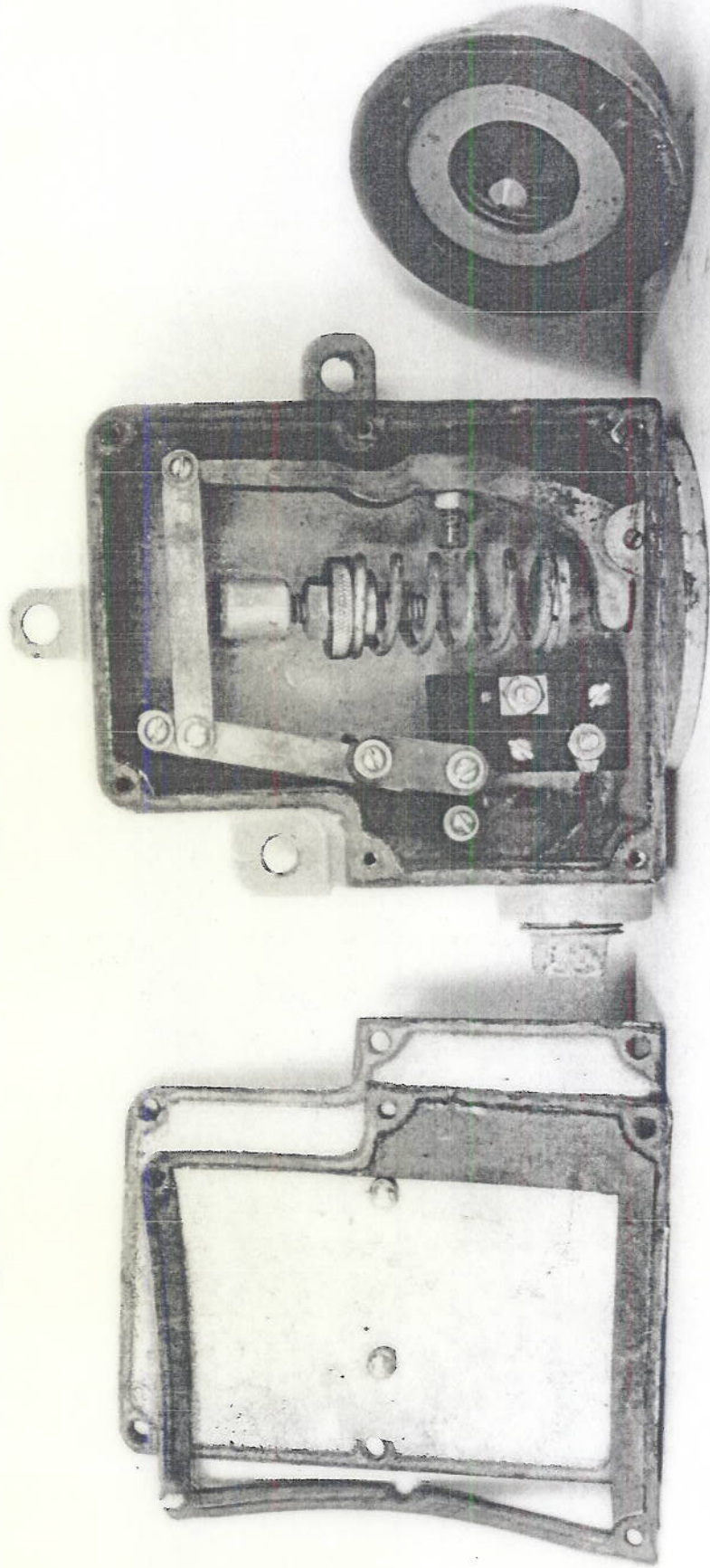


Plate 1



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