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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report of Test
on
Contact Makers - Type L Class I
Clark Cooper Company, Exhibitor

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
Washington, D.C.

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AUTHORIZATION FOR TEST

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

Reference: (a) BuEng.ltr. CL49-50/S65(9-17-Ds) of 11 February 1938.
(b) Specifications SGS(65)-152, of 15 October 1936.
(c) Clark Cooper Company's Drawing EC3-1.

OBJECT OF TEST

2. The object of this test was to determine how closely the subject contact makers complied with the specifications, reference (b), and their suitability for installation in lubricating oil systems in the Naval Service.

ABSTRACT OF TEST

3. The sample contact makers, shown by photographs, Plates 2 and 3, were set up at this Laboratory and their performance was carefully observed while under test for conformance with the specifications, reference (b). The usual inspection of the samples for compliance with the requirements in the matter of materials, design and workmanship, concluded the test.

Conclusions

(a) The sample contact makers submitted, performed satisfactorily throughout all tests, and conform with the specifications, reference (b), except for the following:

1. The terminal tubes bosses are located on a removable part of the case.
2. The terminal block is located on the removable cover.
3. To gain access to the micro-switch, it is necessary to remove the part of the case which clamps the diaphragm, thereby opening the pressure line.
4. The required copper-nickel alloy nameplate has not been furnished. Raised lettering on the cast case cover has been substituted.
5. No condenser has been provided to enable the switch to break a load of 2 amperes at a potential of 115 volts, direct current, or to reduce radio interference.

(b) As a result of Mr. Clark Cooper's visit to this Laboratory during the latter part of the test, he prepared and forwarded a drawing showing proposed case modifications. This drawing is given as Plate 4.

Recommendations

(a) In view of this type of contact maker having complied with the major requirements of the specifications, it is recommended that it be approved for lubricating oil systems in the Naval service, subject to satisfactory changes in the case design and the inclusion of a suitable condenser.

(b) It is further recommended that a modified sample be submitted for a check test before final approval is given.

DESCRIPTION OF MATERIAL UNDER TEST

4. Each contact maker is built in a two piece case having a removable cover. The lower part is of BE composition and contains a shallow pressure chamber having a 3/8 inch (IPS) inlet and a 3/8 inch (IPS) plugged hole for draining purposes. A deck flange, cast integral, is provided for mounting.

5. The upper part of the chamber is sealed with a phosphorous bronze diaphragm and gaskets, clamped between the two flanged surfaces of the case. Ten (10) 1/4-20 fillister headed machine screws, provided with lockwashers and nuts, are used as through bolts to clamp these flanges.

6. The upper part of the case is of cast aluminum alloy and contains two (2) bosses, tapped for 3/4 inch (IPS) terminal tubes. This part also contains a support for a micro-switch and a yoke for the operating point adjustment device. The removable cover is secured to the top of the case with five (5) 8-32 fillister headed steel screws which thread into steel inserts. A 1/4 inch rubber gasket is partly recessed into the case and contacts the cover. A terminal block of phenolic material is secured to the underside of the cover.

7. Resting on the diaphragm is a plated cast iron disc, which contacts the operating button of the micro-switch when the pressure in the chamber is above the operating point. The disc is so fitted into a circular recess that its movement is limited. This feature is intended to protect the diaphragm and the switch when excessive pressures are applied to the chamber. When the pressure falls to the operating point, the disc recedes and allows the contacts of the switch to close.

8. Changes in the operating point may be obtained by turning an adjustment screw housed in the yoke, which varies the tension of a coil steel spring pressing on the center of the disc. Before changing the adjustment, a locking screw must be removed.

9. Further details of the design are shown by a portion of drawing, reference (c), given as Plate 1, and by Photograph, Plate 3.

METHOD OF TEST

10. The sample contact makers were first 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. The test was continuous for a period of 48 hours, each contactor being operated at the rate of 15 cycles per minute. The test set-up is shown by Plate 2.

11. Upon completion of the endurance and accuracy tests, they were placed on a standard Bureau of Engineering shock stand and subjected to 20 shocks of 250 foot pounds each, while operating as under the endurance test, to determine their shock integrity.

12. They were next placed on a vibrating machine and subjected to shocks of 3 foot pounds each, at frequencies of 100, 150, 200, 250, 300, and 350 vibrations per minute. While under this test, the contact makers were subjected to periods of 30 minutes at each frequency, while operating as under the endurance test.

13. Next followed the application of an air pressure of 200 pounds per square inch, for 15 periods of 10 seconds duration.

14. Tests were also made at ambient temperatures of 10° C. and 70° C., for periods of 2 hours each, to determine any change in their operating points. Checks of operating points were also made at the conclusion of each of the preceding tests.

15. The test was concluded with the usual tests for dielectric strength, insulation resistance, watertight integrity, and an inspection to determine their compliance with the specifications, in the matter of design, workmanship and materials.

RESULTS OF TEST

16. The test results which follow were obtained when the sample contact makers were tested in the order specified in the specifications, reference (b).

<u>Requirements</u>	<u>Test Values</u>	
	<u>No. 1 Sample</u>	<u>No. 2 Sample</u>
Operating range: Shall be adjustable over a range of from 2 to 10 pounds per sq.in.	1-1/2 to 15 pounds.	1-1/2 to 15 pounds.
Endurance: Shall be operated 15 cycles per minute for 48 hours.	Complied, breaking the required load of 2 amperes. (See note)	Complied, breaking the required load of 2 amperes (See note)
Accuracy: Operating point shall not vary more than $\pm 1/4$ lb.	See Table 1.	See Table 1.
Shock and vibration: Shall operate throughout the tests specified under paragraphs F-2e(3) and F-2e(4).	Complied	Complied
Over-pressure: Shall withstand 15 cycles of 10 seconds each at a pressure of 200 pounds per sq.in.	Complied	Complied
Inclination: Shall operate satisfactorily when inclined 45° from the vertical plane in all directions.	Complied	Complied

<u>Requirements</u>	<u>No. 1 Sample</u>	<u>Test Values</u>	
		<u>No. 2 Sample</u>	
Watertightness: Shall not leak when submerged in three feet of water for one hour.	Complied	Complied	
Dielectric strength: Shall withstand 1500 VAC 60 cycle for 1 minute, applied between all electrical parts and ground.	Complied	Complied	
Insulation resistance: Shall be not less than 10 megohms at 500 volts.	200 megohms by 1000 V. megger	200 megohms by 1000 V. megger	
Dimensions and weight: Not specified.	Weight - 6 pounds	6 pounds	
	Height - 5".5	5".5	
	Diameter - 5".25	5".25	

Note: For test purposes, a 1 mfd. condenser was placed across the contacts of each micro-switch in order to enable a non-inductive load of 2 amperes, at 115 V., D.C. to be broken.

CONCLUSIONS

17. The sample contact makers submitted, performed satisfactorily throughout all tests, and conform with the specifications, reference (b), except for the following:

- (a) The terminal tube bosses are located on a removable part of the case.
- (b) The terminal block is located on the removable cover.
- (c) To gain access to the micro-switch, it is necessary to remove the part of the case which clamps the diaphragm, thereby opening the pressure line.
- (d) The required copper-nickel alloy nameplate has not been furnished. Raised lettering on the cast case cover has been substituted.
- (e) No condenser has been provided to enable the switch to break a load of 2 amperes at a potential of 115 volts, direct current, or to reduce radio interference.

18. As a result of Mr. Clark Cooper's visit to this Laboratory during the latter part of the test, he prepared and forwarded a drawing showing proposed case modifications. This drawing is given as Plate 4.

TABLE 1

OPERATING POINTS DURING TESTS (POUNDS PER SQUARE INCH)

SAMPLE NO. 1			SAMPLE NO. 2	
Condition	Contacts Close	Contacts Open	Contacts Close	Contacts Open
Start of Test	3.7	3.75	3.4	3.6
After Endurance	3.65	3.7	3.6	3.9
After Shock	3.55	3.60	3.1	3.3
After Vibration	3.65	3.7	3.55	3.7
After 200 pounds Pressure	3.4	3.45	3.2	3.4
At 10° C. Ambient Temperature	3.35	3.4	3.3	3.5
At 70° C. Ambient Temperature	3.35	3.4	3.0	3.25

Note: Estimated Accuracy of Gauge is ± 0.1 pounds.

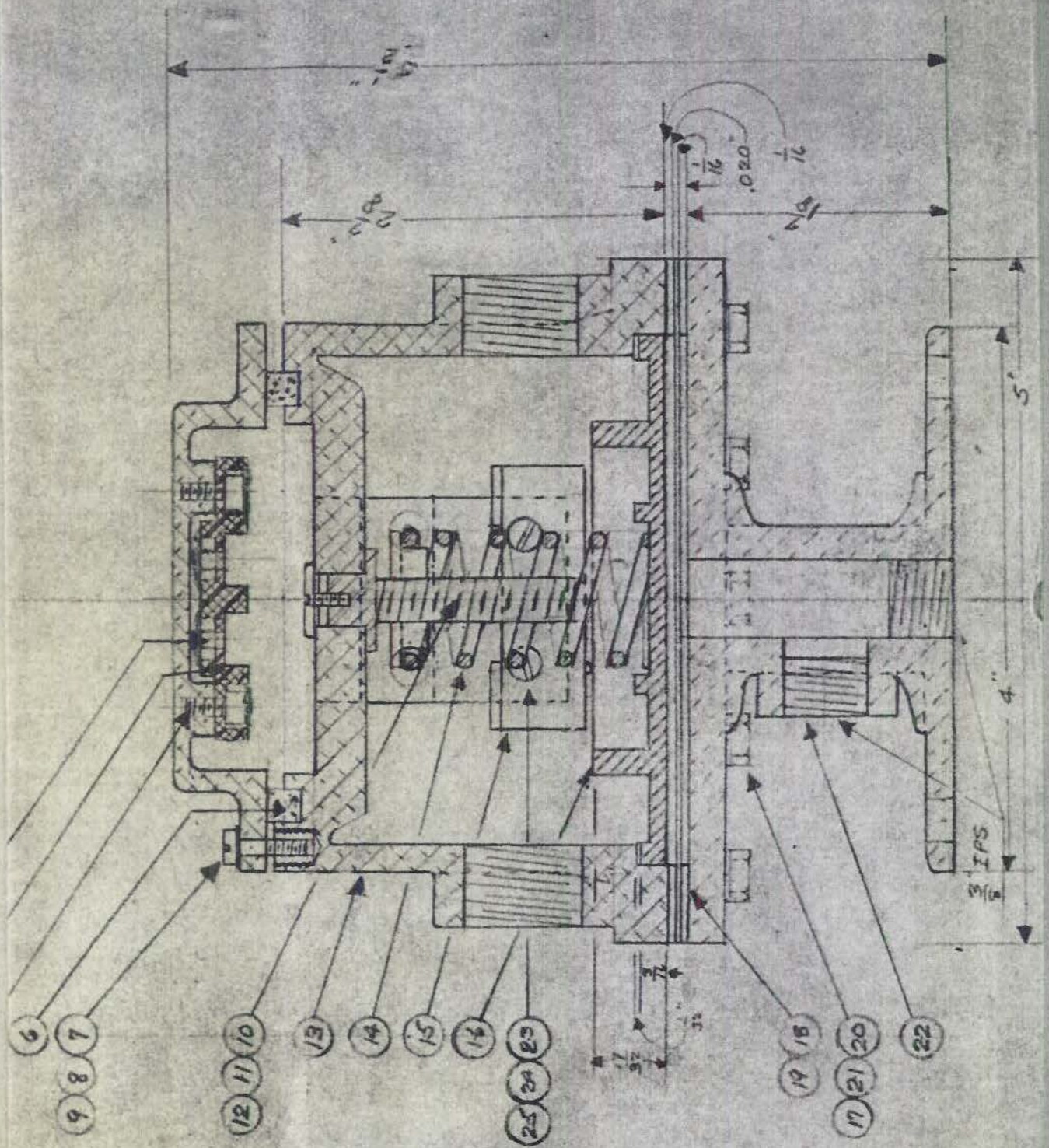


Plate 1

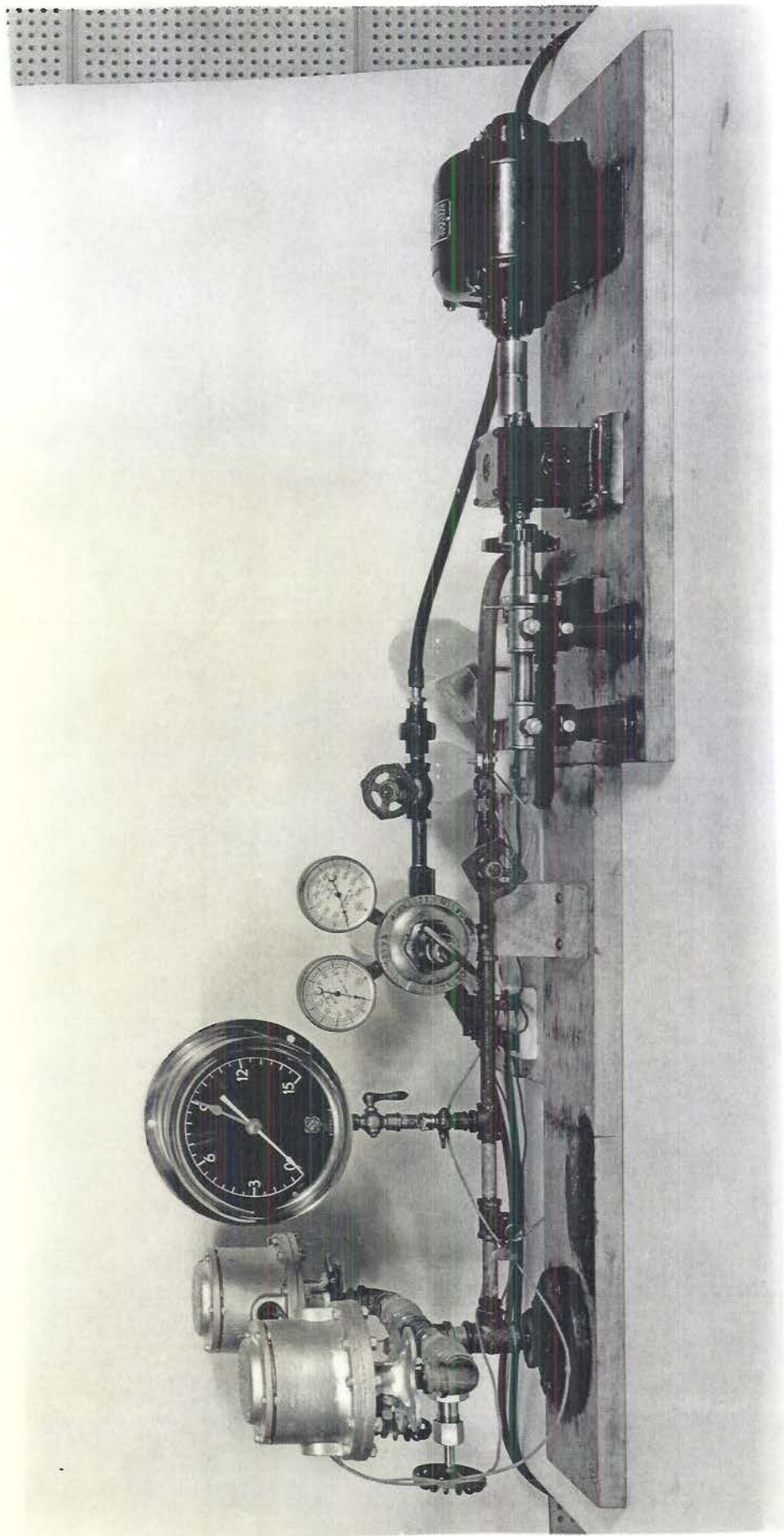


Plate 2

