

8-1572

1939

REPORT

REPORT OF TEST

General Alarm Contact Meter, Type A, Class 1,
110 volts d.c.,
Berkeley Aviation Corporation, Exhibitor

FR-1572

by

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NAVAL RESEARCH LABORATORY

Washington, D. C.

AUTHORIZATION FOR TEST

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

Reference: (a) Bueng.let. N102s-29092(10-5-Df) of 11 October 1939.
(b) Specification 17C16(INT) of 1 February 1939.
(c) Bendix Drawing CAL-5926-1, BuEng.file No.
SS201-S65-906-Alt. 1.

OBJECT OF TEST

2. The object of this test was to determine qualification of the sample contact maker under the specification, reference (b), and contract suitability under requisition 5-819(N102s-29092).

ABSTRACT OF TEST

3. The sample contact maker was set up at this Laboratory in suitable test circuits where its performance was carefully observed for compliance with the requirements. An inspection of the sample to determine compliance in the matter of materials, design, and workmanship concluded the test.

Conclusions

- (a) The winding of the relay should be so secured that there is no possibility of its rotating and grounding a lug to the chassis.
- (b) The flame-shield of the relay should be modified to prevent interference with the movable contact.
- (c) The contact maker checked with drawing, reference (c), except that resistor, pc. 55, is shown as a motor field resistor while it is connected as a series line resistor. The same error appears on the diagram in the cover. The panel is shown on the drawing as of one piece but is of two pieces.
- (d) Although the test results show slight discrepancies in temperature rises and timing intervals, this contactor is considered of good design and first class workmanship. Its operation throughout the test was entirely satisfactory and the contacts were in good condition at the end of the test.
- (e) No provision has been made to prevent radio interference.

Recommendations

- (a) It is recommended that the subject contact maker be given type approval for applications where the load will not exceed the equivalent of 20 amperes (non-inductive) at a potential of 115 volts, direct current, providing corrections as noted under Conclusions are effected.
- (b) It is further recommended that the sample submitted be accepted under requisition 5-819(N102s-29092) subject to correction of the defects noted under Conclusions.

DESCRIPTION OF MATERIAL

4. This contact maker is designed for 115 volts, direct current operation. Its mechanism is mounted on a two piece steel panel 5/16" x 11-1/4" x 15-1/4" and protected by a sheet steel cover supported by four (4) steel studs 5/16" x 6-1/2". The cover is secured by four (4) knurled brass nuts and is easily removed.

5. The principal parts of the mechanism are the electromagnet operated relay, a motor-driven contact interrupter, and a limit switch.

6. The motor is shunt wound and is manufactured by the Bodine Electric Company. It is designed to operate on 115 volts, direct current, and rated at 1/50 horsepower, 1725 r.p.m. A built-in worm reduction unit, of 60 to 1 ratio, reduces the work shaft speed to approximately 30 r.p.m.

7. Mounted on the motor work shaft is a plate cam which lifts a ball bearing follower three (3) times each revolution. The lever arm to which the follower is attached carries a spring mounted contact which, with its associated stationary contact, is in series with the operating coil of the contactor.

8. Another plate cam having two depressions is driven by the motor through an external worm and worm wheel at a speed of one r.p.m. and operates two spring mounted contacts by means of a ball bearing follower and lever. When the motor is started, the follower rises and closes these contacts and they remain closed until the cam has completed approximately one-half revolution.

9. Neither cam is secured to its driving shaft but receives its motion through a pin on an adjacent disc which engages a slot in the cam. The size and shape of the slot are such that, when the follower reaches a depression in the cam, the cam will advance faster than its driving shaft, due to the pressure of the follower spring, and allow a quick break at the contacts.

10. The operation of the unit is as follows: When a single pole external momentary contactor is closed, the motor circuit is completed and the motor begins to rotate. After three seconds, the follower of the one-half minute cam closes two sets of contacts which remain closed for approximately one-half minute. One set shunts the external momentary contactor so that the motor will continue to run after the contactor is released. The other set of contacts completes the circuit between the operating coil of the relay and the 90 impulse per minute interrupter.

11. When the motor starts to rotate, the 30 r.p.m. cam causes its contacts to close at the rate of 90 interruptions per minute, but the relay does not operate until the one-half r.p.m. cam, previously described, closes its contacts. The purpose of this feature is that the relay cannot remain closed at the end of the coded cycle even though the 90 per minute contacts remain in the closed position due to drifting of the motor after it is deenergized.

12. The relay employed is manufactured by Ward-Leonard Electric Company and the winding is designed to operate on 115 volts, direct current. It is of the single pole type, using copper contacts with a magnetic blowout, and is rated at 10 amperes. The armature is hinged and so balanced as to remain open when the winding is deenergized.

13. Further details are shown by photographs, Plates (1) and (2), and drawing, reference (c).

METHOD OF TEST

14. The voltage drop across the contacts, with a current of 20 amperes flowing, was first measured. Then the contact maker was tested for endurance by operating it one operating cycle per minute for 48 hours, the first 24 hours at 0°C ambient and the latter at 70°C. Each cycle consisted of operating the contact maker with coded operation for 30 seconds, with primary contacts closed for 15 seconds, and "off" for 15 seconds. During the final hour of the test the relay was operated at 90 contacts per minute. The temperature rises of the magnet winding and contacts were also measured at the end of a one hour period during which the winding was constantly energized and the contacts closed.

15. The temperature rise of the contacts was measured by a thermocouple and that of the motor and relay windings by the resistance method during the endurance tests.

16. The coded cycle of the contact maker was checked for accuracy.

17. The contact maker was then tested for shock and vibration integrity, as outlined under the specification, and checked for satisfactory operation when supplied with current at over and under voltage.

18. The insulation resistance and dielectric tests were then conducted and the contact maker was examined to determine the quality of workmanship and materials and conformance with the manufacturer's drawing, and the specifications.

RESULTS OF TEST

19. The results obtained when the contact maker was tested in the order required by the specification were as follows:

<u>Requirements</u>	<u>Test Values</u>
Voltage: 115 volts, d.c.	115 volts, d.c.
Current consumption of motor: Not specified.	0.12 ampere.
Current consumption of relay magnet winding: Not specified.	0.09 ampere.

Requirements

Contact rating of relay: Not specified - to vary with contract or requisition.

Voltage drop: Shall not exceed 10 millivolts at rated load.

Endurance: Shall operate for 24 hours at an ambient temperature of 0°C and 23 hours at 70°C while operating at one operating cycle per minute. Each cycle to consist of coded operation for 30 seconds, primary contacts closed for 15 seconds and "off" for 15 seconds.

Temperature rise: No part of contact maker shall have a rise exceeding 30°C above 70°C ambient during the last hour of the endurance test, while contacts were operated at a rate of 90 times per minute.

Temperature rise: No part of contact maker shall have a rise exceeding 15°C above 70°C ambient when contacts are held closed for one hour with rated load.

Accuracy Test: The coded cycle shall be 30 seconds of equal make and break periods.

Operation at voltage variation: Shall meet all requirements at $\pm 10\%$ rated voltage.

Inclination: Shall operate satisfactorily in all planes 45 degrees to the vertical.

Dielectric test: Shall withstand 1500 volts, 60 cycles, for a period of one minute.

Insulation resistance: Shall be not less than 10 megohms at 500 volts.

Test Values

Tested with a non-inductive load of 20 amperes at 115 volts to qualify contactor for future contracts.

10 millivolts before endurance test; 15 millivolts after endurance test, with 20 ampere load.

Complied. Maximum temperature rise during all but last hour of test; contacts 30°C by thermocouple; motor field 115°C by resistance method; relay winding 22.5°C by resistance method.

*Contacts 36.6°C by thermocouple; relay winding 16.4°C by resistance method; motor winding 14.6°C by resistance method. (Taken with 20 ampere load.)

Contacts 9.6°C by thermocouple; relay winding *36.6°C by resistance method. (Taken with 20 ampere load.)

*40 contacts, in 26.5 seconds, of .275 second on and .387 second off.

*40 contacts, in 28.0 seconds, of .285 second on and .415 second off at 103.5 volts. 40 contact, in 23.9 seconds, of .245 second on and .352 second off at 126.5 volts. Other requirements were satisfactory.

Complied.

Complied.

Greater than 100 megohms.

Requirements

Test Values

Shock and vibration integrity:
Shall operate satisfactorily
under conditions specified in
paragraph F-2e.

Complied.

Wiring: Shall be in accordance
with Specification 15C1.

Complied.

Terminal block: Shall be of
phenolic material equipped with
9-S-1841-L terminals.

Complied.

Case: Shall be of splash-proof
construction, formed of sheet
steel, and provided with metal
bracket at base of case for
terminal tubes.

Complied. Bracket tapped for
one terminal tube, one inch
(I.P.S.)

Additional control circuit
for gas alarm: Shall be
provided.

Complied.

Weight: Not specified.

39 pounds, 14 ounces.

Dimensions: Not specified.

15-1/4" x 11-1/4" x 6-1/2".

Provision to prevent radiation
of radio frequency energy: Shall
be incorporated if specifically
required by requisition or
contract.

*None incorporated.

*Denotes failure to comply with the specification.

CONCLUSIONS

20. The winding of the relay should be so secured that there is no possibility of its rotating and grounding a lug to the chassis.
21. The flame-shield of the relay should be modified to prevent interference with the movable contact.
22. The contact maker checked with drawing, reference (c), except that resistor, pc. 55, is shown as a motor field resistor while it is connected as a series line resistor. The same error appears on the diagram in the cover. The panel is shown on the drawing as of one piece but is of two pieces.
23. Although the test results show slight discrepancies in temperature rises and timing intervals, this contactor is considered of good design and first class workmanship. Its operation throughout the test was entirely satisfactory and the contacts were in good condition at the end of the test.
24. No provision has been made to prevent radio interference.

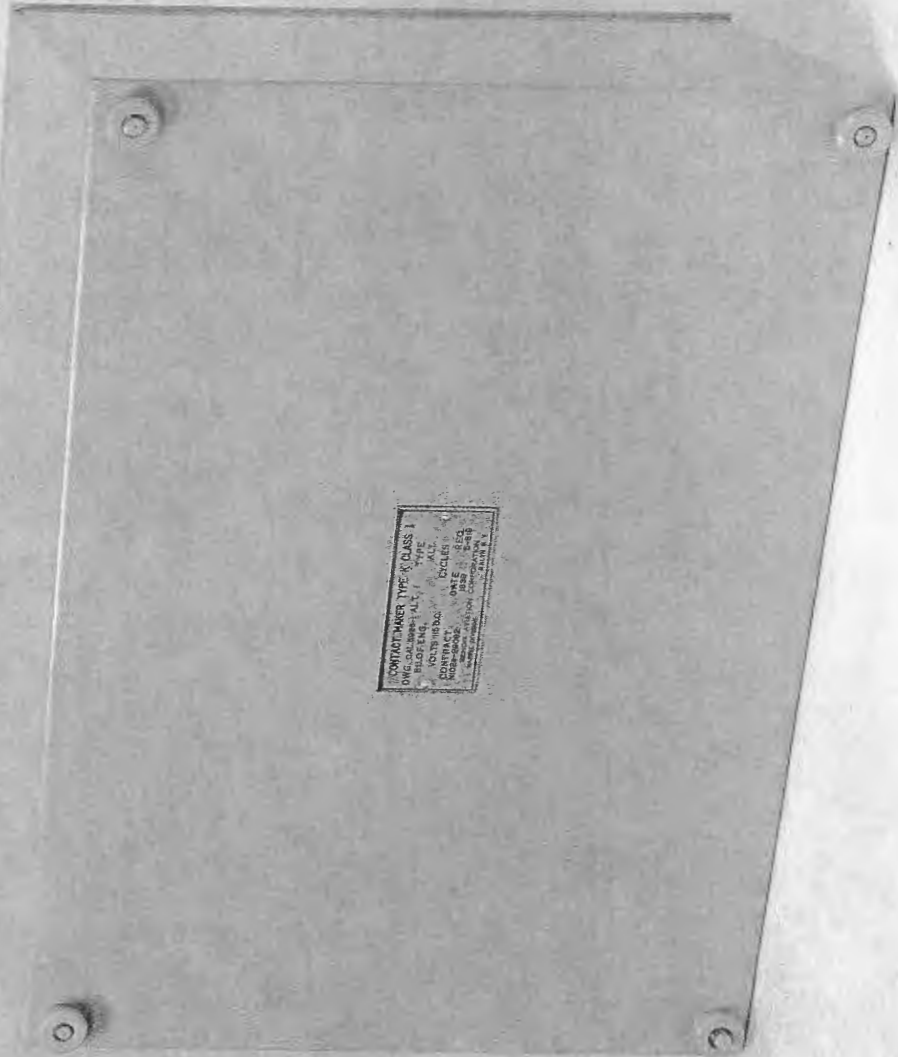


Plate 1

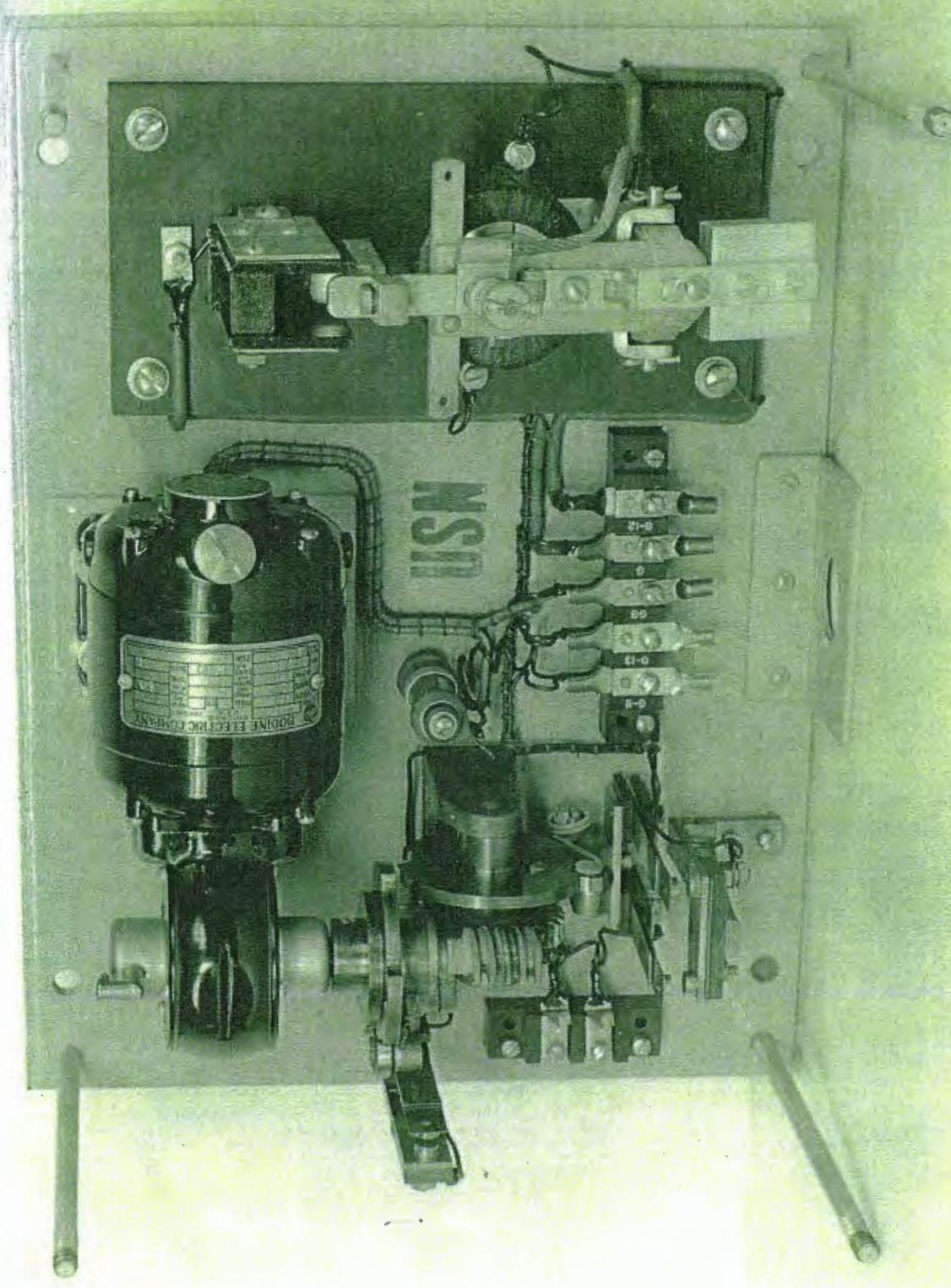


Plate 2