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NAVY DEPARTMENT  
BUREAU OF ENGINEERING

Report of Test

on

Motor Operated, Time Limit,  
Remote Controlled Contact Maker  
Chas. J. Henschel and Company, Inc.  
Manufacturer and Exhibitor

FR-1385

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON, D. C.

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Authorization: BuEng let.S65-4/L5(5-20-Ds) of 21 May 1937.

Date of Test: June and July 1937.

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AUTHORIZATION FOR TEST

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 let. S65-4/L5(5-20-Ds) of 21 May 1937.  
(b) Specifications SGS(65)-152, Contact Makers,  
Interior Communication and Fire Control.  
(c) Henschel Drawing No. 10-885 Bureau File No.  
CV7-S65-439 Alt.3.

OBJECT OF TEST

2. The object of this test was to determine the conformance of the motor-operated contact maker with the specifications, reference (b), and its suitability for Naval use as a type K motor-operated, time limit, remote controlled contactor.

ABSTRACT OF TEST

3 The subject contact maker was set up at this Laboratory in a circuit simulating service conditions where its performance was carefully checked for compliance with the specifications. An inspection of the sample equipment, relative to approved materials, design, and workmanship, concluded the test.

## Conclusions

(a) The contact maker shown by Plates 1 and 2 complies with the specifications in their entirety, but for the coded operating cycle which requires an equal duration of  $1/3$  second each for the "make" and "break" periods. The tests showed 0.47 second for the "make" and 0.18 second for the "break" periods. In addition, no provision has been made to prevent the radiation of radio frequency energy, except that the case will serve as a shield.

(b) The temperature rise of the Automatic switch magnet coil was  $30.6^{\circ}$  C at an ambient temperature of  $70^{\circ}$  C, when energized for one hour at 120 volts, a.c., 60 cycles. That allowable is  $30^{\circ}$  C.

(c) Under shocks of 250 foot pounds, a momentary closing of the automatic switch contactor occurred at the time of each impact.

(d) The current consumption of the automatic switch contactor magnet coil is 0.76 ampere at 120 volts, a.c., 60 cycles, while that consumed by the General Electric contactor was 0.27 ampere, or 64.5 percent less.

(e) The Automatic Switch Company's contactor alone weighs 12 lbs. 13 ozs., while the complete unit, using the General Electric contactor weighs only 20 lbs. 7 ozs. This contactor appears to be designed for a much heavier current than the General Electric contactor.

### Recommendations

(a) It is recommended that the motor-driven contact making device be approved for Naval use, subject to the correction of the timing of the "make" and "break" periods and the incorporation of a means to prevent the radiation of radio frequency energy.

(b) The use of the Automatic Switch Company's contactor is not recommended, as it closes the alarm circuit for an instant at the time of shock impact. In addition, it appears to be unnecessarily large for the estimated load of the system.

(c) In the body of this report the designation of contactors is as follows:

"A" - General Electric Company

"B" - Automatic Switch Company

## DESCRIPTION OF MATERIAL UNDER TEST

4. The sample contact maker is shown by Plates 1 and 2 and by drawing, reference (c). It is manufactured by the Chas. J. Henschel Company, Amesbury, Mass., and was submitted for type approval. This type of contact maker is intended for the (CV7(Wasp)) for operation of the "General Alarm" and "Chemical Attack" system.

5. The unit consists of a 3 pole, single throw, 110 volt, a.c., 60 cycle "A" contactor, solenoid operated, a Bodine 120 volt a.c., 60 cycle, 1/75 h.p. 1800 r.p.m., type NSY-12R motor, a contact mechanism, and a terminal block. All of these are mounted on a cast aluminum alloy base plate. A formed sheet aluminum cover, supported by 7/16 inch hexagon steel studs, threaded into the corners of the base plate, is provided. Four 1/2 inch holes are provided in the base for mounting.

6. The operation of the contact maker is as follows:

- (a) When the "General Alarm" secondary control circuit is closed from any remote station for approximately 2 seconds, the unit becomes operative and operates the alarm circuit at the rate of 90 times per minute. This automatically continues for a period of 30 seconds.
- (b) When the "Chemical Attack" secondary control circuit is closed, the alarm circuit is energized. This circuit remains energized as long as the secondary control circuit is closed.

7. The timing mechanism is driven by a Bodine synchronous motor having an internal reduction gear. The work shaft turns 15 r.p.m. and drives a six lift cam and a reduction gear. The six lift cam has a follower which operates two contacts connected in the circuit of the contactor solenoid at the rate of 90 times per minute. The reduction gear drives a cam which is slotted at two points, 180° apart, and rotates at 1 r.p.m. By means of a follower, the cam operates a pair of normally open contacts which are connected across the general alarm control circuit. When the control circuit is closed for approximately 2 seconds, the motor rotates a sufficient number of times to lift the cam follower and shunt the control circuit. Thus, the motor remains energized until the follower falls into the next slot. This occurs after 30 seconds of operation during which the alarm circuit has been operated 45 times.

8. The total weight of this unit is 20 lbs. 7 ozs. It is 16-5/8 inches in height, 10-1/2 inches in width, and 6-7/8 inches in depth.

9. The 3 pole, single throw, 110 volt, a.c., 60 cycle, magnetically operated "B" contactor, shown by Plate 3, is separate and was submitted to determine whether it could be satisfactorily used in connection with the contact maker unit. This contactor weighs 12 lbs., 13 ozs. It is 10 inches in height, 8 inches in width, and 5-7/8 inches in depth. It is mounted on an ebony asbestos base.

## METHOD OF TEST

10. The contact maker was first tested for endurance by operating it with coded operation for 30 seconds after which the primary circuit was closed for 15 seconds. This was repeated every minute for 48 hours, the first 24 hours at an ambient temperature of 10° C and the final 24 hours at 70° C. During the final hour of the test, the control circuit was continuously closed causing the contactor to "make" the alarm circuit 90 times per minute. The temperature rises of the motor and contactor windings were obtained by the resistance method during this period.

11. Next, followed tests for accuracy obtained by timing the "make" and "break" periods when operating the unit at  $\pm 10$  percent in voltage and  $\pm 5$  percent in frequency.

12. It was next placed on a Bureau of Engineering shock stand and subjected to 20 shocks of 250 foot pounds each, while the contact maker was electrically connected and under normal operation.

13. Upon completion of the shock test, the complete unit was placed on a vibrating machine and given six tests of 30 minutes each, consisting of 3 foot pound shocks at vibrations of 100, 150, 200, 250, 300, and 350 per minute.

14. Upon conclusion of the shock and vibration tests, the unit was again checked for accuracy as outlined in par.11.

15. During these tests, a 3-phase load of 25 amperes, 120 volts, a.c., 60 cycles, having a power factor of 62 percent, was connected to the contactor.

16. Then followed tests for insulation resistance, dielectric strength and voltage drop across the primary contacts at 25 amperes per contact.

17. In order to test the additional contactor, shown by Plate 3, it was necessary to repeat all of the required tests outlined in paragraphs 10 to 16 inclusive.

18. The usual inspection test to determine conformance with the specifications in the matter of design, workmanship, and materials concluded the test.

## RESULTS OF TEST

19. The test results obtained, using the General Electric and Automatic Switch contactors, were as follows:

### Requirements

Endurance, par.F-2c

### Test Values

| <u>"A" Contactor</u>                                   | <u>"B" Contactor</u>                               |
|--|--|
| Satisfactory operation under the specified conditions. | Satisfactory operation under specified conditions. |

Requirements

|  | <u>Test Values</u>   |   |
|--|--|---|
|  | <u>"A" Contactor</u>   | <u>"B" Contactor</u>  |
| Temperature rise of contacts during last hour of endurance, par.F-2c(3)  | 30.3° C  | 18.5° C   |
| Temperature rise: Sub.par.F-2c(3).<br>90 times per minute for 1 hour.  | Contactor coil<br>21.76° C   | Contactor coil<br>27.53° C  |
| Temperature rise of driving motor:<br>Not specified.   | 29.2° C  | 29.2° C   |
| Temperature rise of contacts following endurance: Sub.par.F-2c(6).<br>Contacts closed for 1 hour.                            | *23.3° C   | 14.46° C  |
| Accuracy test: Par.F-2d.<br>Coded operating cycle, sub.par.<br>E2a(1) and E-2a(2).   | *"Make" period. . . 0.47 second<br>"Break" period . . . 0.18 second<br>(at rated voltage and frequency)                      |   |
| Accuracy test: Sub.par.F-2d(5).<br>+ 10 percent in voltage and + 5<br>cycles in frequency when inclined<br>45° in any plane. | Satisfactory operation when<br>using either contactor, except<br>that frequency variations caused<br>a change in the timing. |   |
| Shock test: Par.F-2e, sub.pars.<br>F-2e(2) to F-2e(5) incl.  | Satisfactory operation under the<br>specified conditions.  | *Momentary<br>closing of<br>primary con-<br>tacts at time<br>of impact. |
| Accuracy test following shock<br>test: Par. F-2d.<br>(Shock and vibration)   | No apparent change in accuracy with<br>either of the contactors.   |   |
| Insulation resistance: Sub.par.<br>E-5f.   | 50 megohms by<br>500 volt megger.  | 50 megohms by<br>500 volt megger.                                       |
| Dielectric test: Sub.par.E-5f.   | Satisfactory under<br>the specified<br>conditions.   | Satisfactory<br>under the<br>specified con-<br>ditions.                 |
| Voltage drop across contacts<br>at 25 amperes per contact:<br>Sub.par. F-2f(4).  | 60 millivolts at<br>end of endurance<br>test.  | 25 millivolts at<br>end of endurance<br>test.                           |
| Current consumption of<br>contactor coils: Not specified.  | 0.27 amperes at<br>120 v a.c., 60 cy.  | 0.76 amperes at<br>120 v a.c., 60 cy.                                   |
| Nameplates: Specifications<br>17Ni(INT) 15 May 1936  | *Brass, relief<br>etched.  | None furnished.   |

\*Denotes failure to comply with the specifications.

## CONCLUSIONS

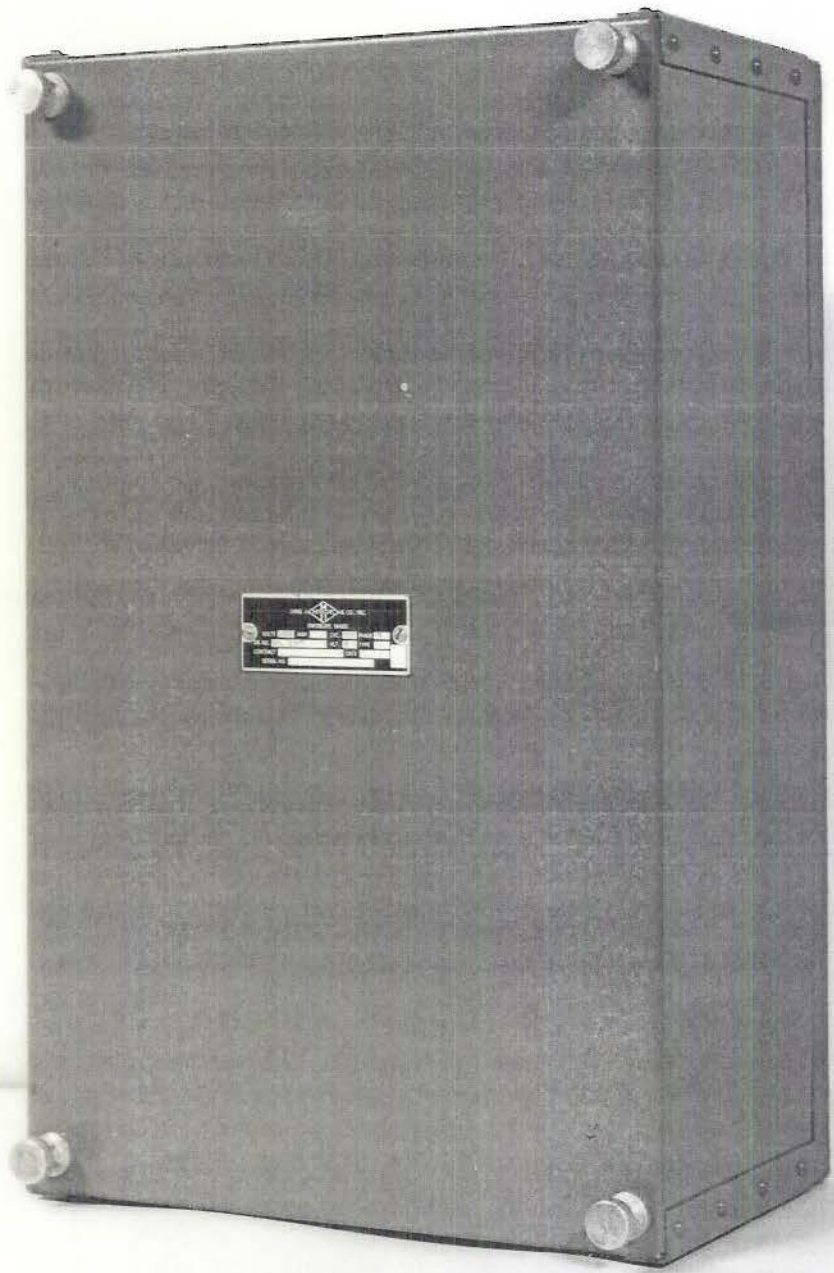
20. The contact maker, shown by Plates 1 and 2, complies with the specifications in their entirety, but for the coded operating cycle which requires an equal duration of  $1/3$  second each for the "make" and "break" periods. The tests showed 0.47 second for the "make" and 0.18 second for the "break" periods. In addition, no provision has been made to prevent the radiation of radio frequency energy, except that the case will serve as a shield.

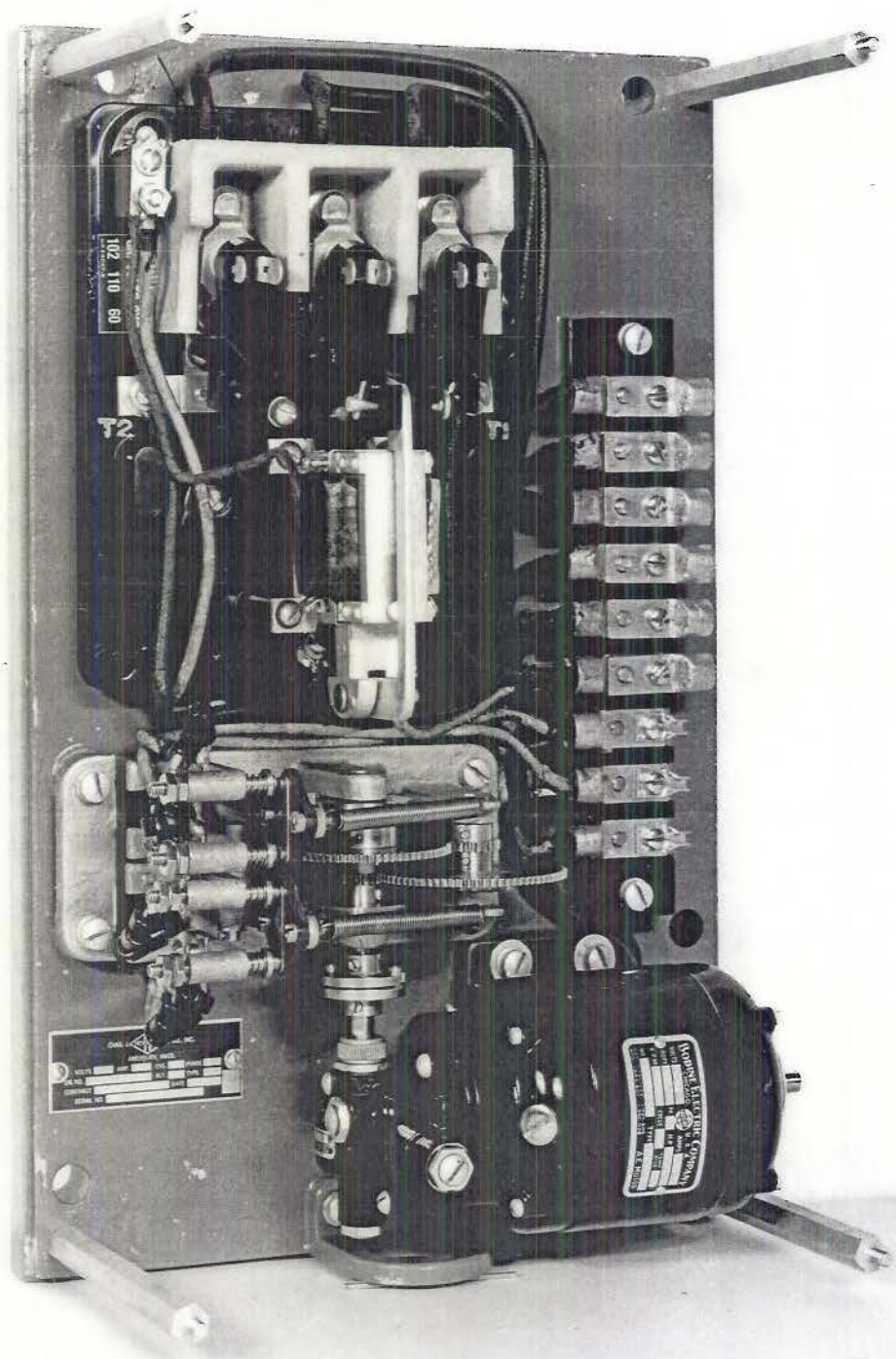
21. The temperature rise of the "B" contactor magnet coil was  $30.6^{\circ}$  C at an ambient temperature of  $70^{\circ}$  C when energized for one hour at 120 volts, a.c., 60 cycles. That allowable is  $30^{\circ}$  C.

22. Under shocks of 250 foot pounds, a momentary closing of the "B" contactor occurred at the time of each impact.

23. The current consumption of the "B" contactor magnet coil is 0.76 ampere at 120 volts a.c., 60 cycles, while that consumed by the "A" contactor was 0.27 ampere, or 64.5 percent less.

24. The "B" contactor alone weighs 12 lbs. 13 ozs., while the complete unit, using the "A" contactor, weighs only 20 lbs. 7 ozs. This contactor appears to be designed for a much heavier current than the "A" contactor.





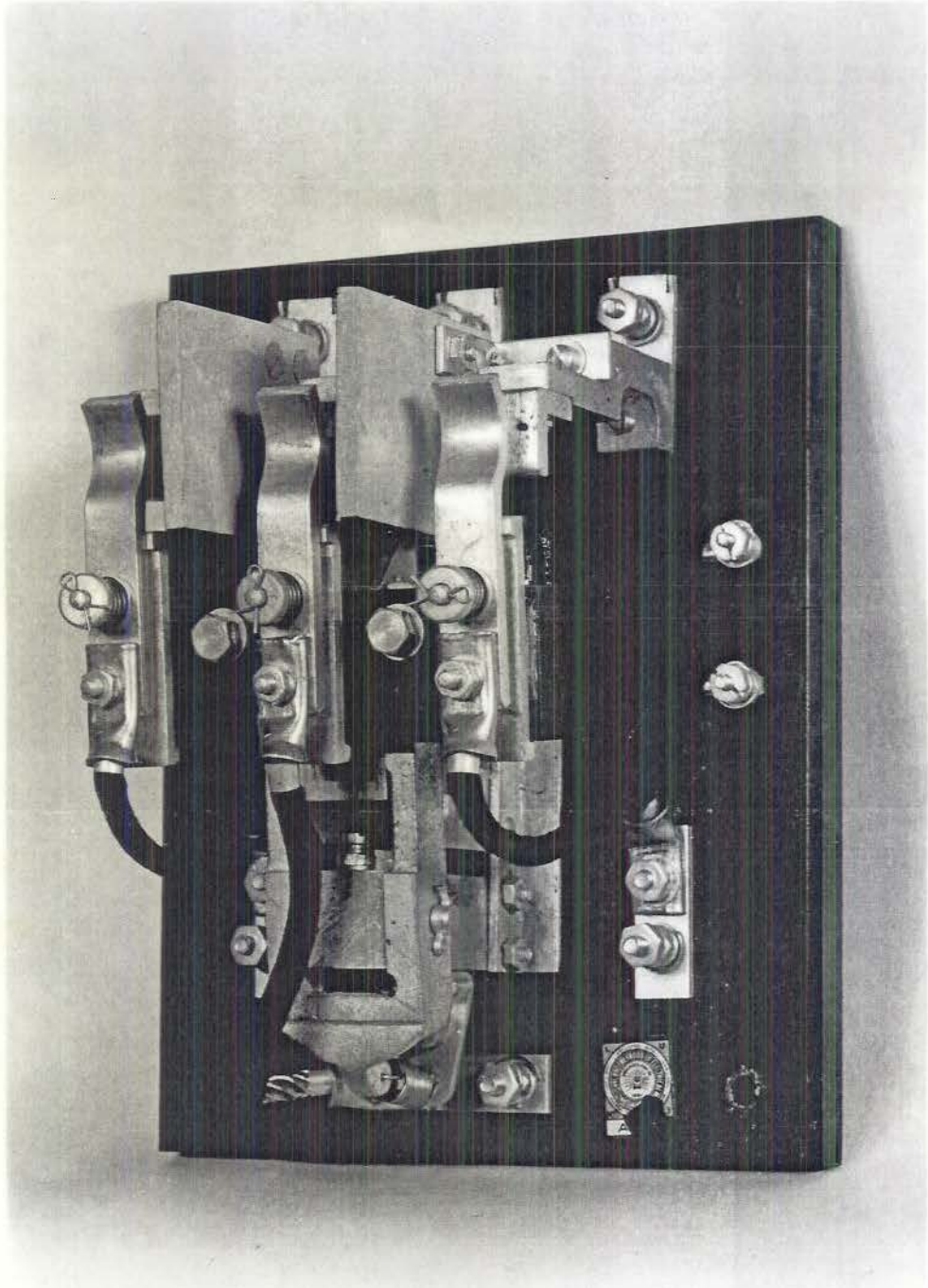


Plate 3