B-2066

FR-2066

5 June 1943 NRL Report No. B-2066

NAVY DEPARTMENT

Report of Test

on

Synchronous Motors, Non-Excited Type

Submitted by

Holtzer-Cabot Electric Company
Boston, Massachusetts

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

Number of Pages: Text - 4 Plates - 3

Authorization: BuShips Ltr. S63-1(355) of 15 October 1941.

Date of Test: November 1941 to May 1943.

Tested by:

J. S. Bryant, Principal Engineering Aide.

Reviewed by:

G. K. C. Hardesty, Associate Electrical Engineer, Asst. Supt., I. C. Division

W. B. Roberts, Electrical Engineer, Supt., I. C. Division

Approved by:

A. H. Van Keuran, Rear Admiral, USN
Director

Distribution:
BuShips (5)

TABLE OF CONTENTS

APPENDICES

AUTHORIZATION FOR TEST

1. This problem was authorized by reference (a), and another reference pertinent to this problem is listed as reference (b).

References: (a) BuShips Ltr. S63-1(350) of 15 October 1941.
(b) NRL Report No. B-1735 of 6 May 1941.

OBJECT OF TEST

2. The object of this test was to determine the suitability of the sample motors as constant speed motors for interior communication instruments.

ABSTRACT OF TEST

3. The sample motors were set up at this Laboratory in conjunction with suitable test circuits and loading equipment and their performances were carefully observed while under endurance at rated loads. The tests were concluded with an examination in regard to materials, design, and workmanship, and any defects resulting from the test.

CONCLUSIONS

(a) The results of the tests on the subject type RWC and RBC motors are not directly comparable as the test procedure used was not the same for both types in that one was mounted with shaft horizontal and the other with shaft vertical and the temperature was lowered 5° C. during the test. However, the results do show that the operating life of the type RBC motor is materially shortened by the 65° C. ambient temperature. At a temperature of 60° C., the operating life was at least twice as long with the motor in good condition at the time the test was terminated.

(b) The type RWC motor operated more than twice as long with its shaft horizontal as the type RBC did with its shaft vertical when tested at an ambient temperature of 65° C.

RECOMMENDATIONS

(a) That the results of this test be used for information only, its principal contribution being the approximate determination of operating life at high ambient temperatures under controlled conditions. It is not believed that the results of the tests on these two samples should be considered conclusive, particularly in view of the number of similar motors in use and on which service reports are available.

(b) That motor lead wires having insulation more resistant to oil and heat be provided.

DESCRIPTION OF MATERIAL

4. The subject motors, submitted by Holtzer-Cabot Electric Company, Boston, Massachusetts, are designed to operate at synchronous speed when energized from a supply of 115 volts, 60 cycles.

5. Two types were submitted. The type RBC -2505 has the rotor mounted in single race ball bearings lubricated with "Andock C" grease. It is rated at 9 watts input and 3 in.oz. torque output. The type RWC-2505 has the rotor mounted in sleeve bearings. It is rated at 8 watts input and 2 in. oz. torque output.

6. Both samples are of the reversible single value capicator type, employing synchronous type squirrel-cage rotors. The rotors rotate at 1800 rpm and the speed is reduced to a work shaft speed of 60 rpm by a reduction gear train in a separate compartment of the motor housing. The work shaft is provided with sleeve bearings.

7. The gears and bearings are lubricated by felt wicks saturated with SAE 10-W oil in the gear compartment. The ball bearings of the type RBC-2505 are packed with grease. Further details in the design and construction of the motors are shown by photographs, Plates 1, 2 and 3.

METHOD OF TEST

8. The sample motors were first tested to determine their electrical characteristics at rated voltage and frequency followed by measurements of the resistance of their windings at room temperature.

9. They were next subjected to an endurance test at 65° C. during which time the type RBC motor was mounted in the vertical position while loaded to 3 in. oz. torque and the type RWC was mounted in the horizontal position while loaded to 2 in. oz. torque. The temperature rises of the motors were determined by the resistance method during this test.

10. In accordance with a request of the manufacturer, the ambient temperature was reduced from 65° C. to 60° C. after failure of the type RBC motor due to freezing of the bearings. It was stated by the manufacturer that grease could not be obtained to operate at temperatures higher than 60° C. The samples were lubricated every 2500 hours.

11. After completion of the endurance tests, the samples were subjected to dielectric tests of 1500 volts for one minute, followed by tests for insulation resistance by a 1000 volt megger.

12. The tests were concluded with an examination of the samples to determine their condition and any defects resulting from the tests.

RESULTS OF TEST

13. The test results obtained were as follows:

Electrical Characteristics	Type RBC	Type RWC
Volts:	Tested at 115 volts, 60 cycles..	Tested at 115 volts, 60 cycles.
Amperes:	0.086 ampere.	0.086 ampere.

RESULTS OF TEST (Cont'd)

Electrical Characteristics	Type RBC	Type RWC
Watts:	9.78 watts.	9.78 watts.
Resistance of 1-2 windings at 28°C.	564 ohms.	580 ohms.
Resistance of 2-3 windings at 28°C.	1150 ohms.	1134 ohms.

Endurance

The type RBC motor failed after operating with shaft vertical for 3000 hours at 65° C.ambient temperature due to the freezing of the sleeve bearing on the work shaft and the ball bearings on the rotor. This motor was returned to the manufacturer for reconditioning and was resubmitted for test. Its operation was satisfactory at 60° C. for 6200 hours at which time the test was discontinued. The temperature rises of 1-2 and 2-3 windings were 30.2° C. and 26.0°C, respectively above 65° C. ambient temperature.

The type RWC motor operated satisfactorily for 7000 hours at 65° C. ambient temperature with shaft horizontal. Following 2800 additional hours of operation at 60° C., the motor failed due to the freezing of the work shaft bearing. The temperature rises of the 1-2 and 2-3 windings were 22.5° C. and 24° C. respectively above 65° C. ambient temperature.

Dielectric and Insulation Tests

The stator windings of the motors withstood dielectric tests of 1500 volts, a.c. for one minute and their insulation resistance was greater than 200 megohms by a 1000 volt Megger.

CONCLUSIONS

14. The results of the tests on the subject type RWC and RBC motors are not directly comparable as the test procedure used was not the same for both types in that one was mounted with shaft horizontal and the other with shaft vertical and the temperature was lowered 5° C. during the test. However, the results do show that the operating life of the type RBC motor is materially shortened by the 65° C. ambient temperature. At a temperature of 60° C., the operating life was at least twice as long with the motor in good condition at the time the test was terminated.

15. The type RWC motor operated more than twice as long with its shaft horizontal as the type RBC did with its shaft vertical when tested at an ambient temperature of 65° C.

PLATE I

PLATE 2

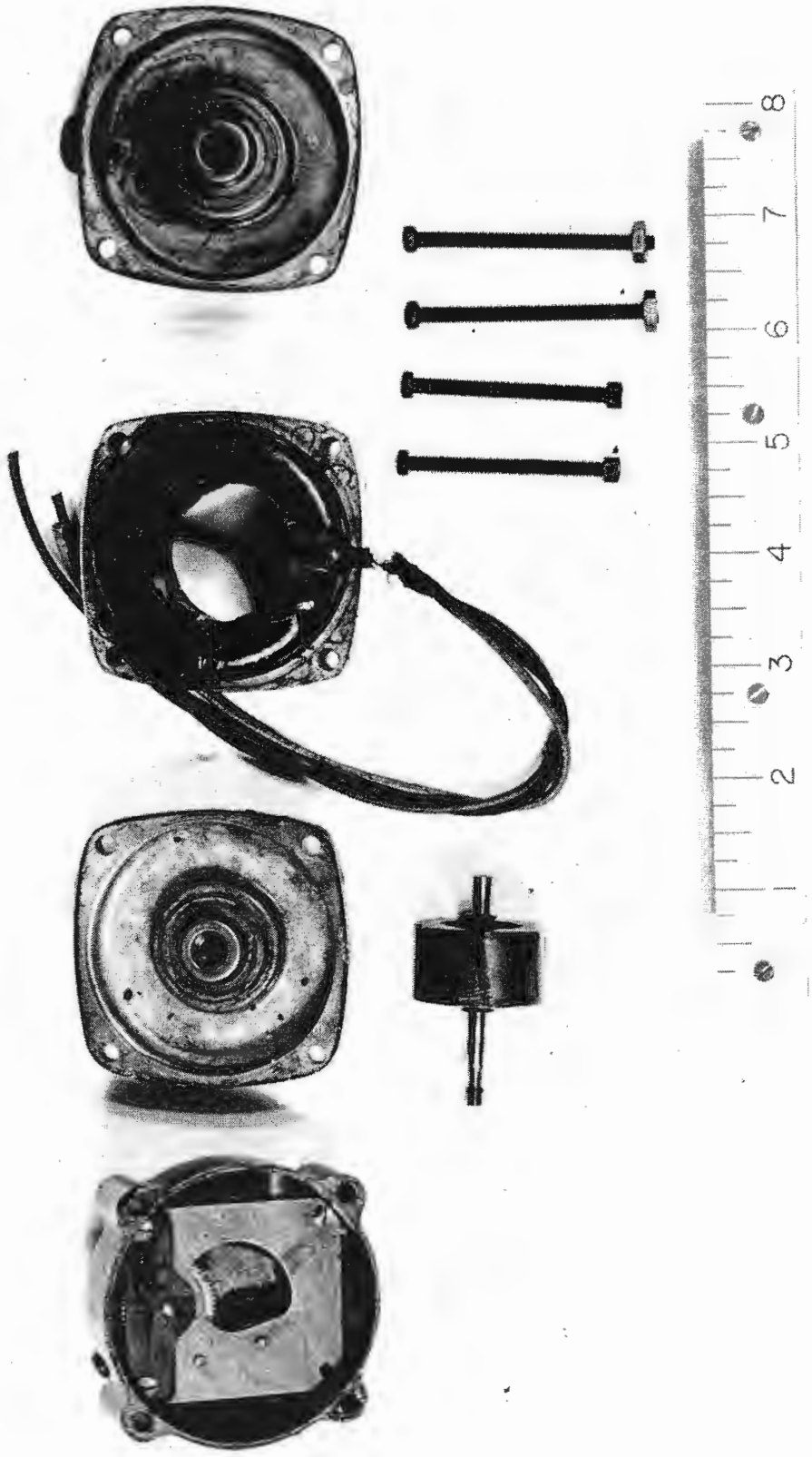

PLATE 3