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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report of
Test on Navy Type "I" Horns
manufactured by

Delco-Remy Corporation

Contract N-140s-46624

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

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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) to (d) inclusive.

- Reference: (a) BuEng let.S65-4/L5(3-12-Ds) of 15 March 1935.
(b) BuEng let.NL4Os-46624(9-12-DF) of 9 Oct.1934
to INM, Cincinnati, Ohio.
(c) Delco-Remy Corp'n let. of 5 March 1935 to NRL.
(d) Navy Department Specifications for Horns,
Interior Communication, SGS(65)104 of 2 Jan.1935.

OBJECT OF TEST

2. The object of this test was to determine if the modified horns, as manufactured and submitted by the Delco-Remy Corporation, comply with the requirements of the Navy Department Specifications, reference (d).

ABSTRACT OF TEST

3. The horns were set up at this Laboratory in standard test circuits and closely observed for their operating characteristics while under test for conformance with specifications, reference (d). Particular attention was given to the diaphragms while under test for endurance, in order to note if any fractures had occurred.

Conclusions

These horns, as manufactured and submitted for test by the Delco-Remy Corporation, under Contract N-140s-46624, are of good workmanship and comply with most of the major requirements of the specifications. If modified, as outlined under COMMENTS, paragraphs 19, 21, and 22, they would be suitable for the Naval Service.

Recommendation

It is recommended that the horns be approved for use in the Naval Service, subject to correction of defects noted under COMMENTS, paragraphs 19, 21, and 22.

DESCRIPTION OF MATERIAL UNDER TEST

4. Two (2) horns were submitted for test; one (1) for direct current, 115 volt operation and one (1) for alternating current, 115 volt, 60 cycle operation.
5. The motors are series wound, each being enclosed in a splash-proof case made of steel, copper plated. The stationary part of the case, made of bronze material, is designed for bulkhead mounting and houses the steel motor case. Provisions are made for two (2) 3/4" standard Navy terminal tubes.
6. The sound is produced by a rotating steel cam striking against a steel button on the stainless steel diaphragm, at the rate of ten (10) times per revolution.
7. The adjustment of the sounding mechanism is accomplished by loosening a hexagon nut and turning the horn head in either direction. The direction in which the horn is turned governs the amplitude of the diaphragm movement when struck by the rotating cam.
8. The motor bearing at the armature end is packed with grease when assembled and requires no further attention under normal operating conditions. The outboard end bearing is lubricated from the outside by lifting a splash-proof cap located on top of the horn head.
9. All assembly screws, washers, and lock washers, are protected against corrosion by nickel or cadmium plating.
10. The diaphragms are made of stainless steel 5.50" in diameter and 0.015" in thickness.
11. The diaphragm buttons are made of steel, case hardened and secured by riveting.
12. The complete units are finished in black japan. For further description, see Plates 1 and 2.

METHOD OF TEST

13. The horns as received were first placed on a Bureau of Engineering shock stand and tested for shock integrity as given in ref.(d).
14. After having passed the shock test requirements, the horns were transferred to a compartment having an ambient temperature of 65°C and operated one minute, every alternate minute for 24 hours. The temperature was then lowered to 40°C and the horns again operated for one minute, every alternate minute for 24 hours. During the latter part of this test, the temperature rise of the motors was obtained by the thermometer method.

15. Next, the horns were tested for operation at over and under voltage when inclined 30° from the vertical plane in all directions.

16. They were then tested for current consumption, insulation resistance, dielectric strength, watertight integrity and audibility range.

17. The test was concluded with a general examination of the design, materials, and workmanship.

RESULTS OF TEST

18. No.1 - Alternating Current Horn.
No.2 - Direct Current Horn.

<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>
Voltage	115 Volts A.C. 115 Volts D.C.	No.1 - 115 Volts, A.C. No.2 - 115 Volts, D.C.
Frequency	60 cycles	No.1 - 60 cycles
Amperes	Not specified " "	No.1 - 1.23 amperes No.2 - 0.55 amperes
Watts	Not over 75 watts	*No.1 - 97.5 watts No.2 - 63.25 watts
Power Factor	Not less than 30%.	No.1 - 68.93%
Endurance	Shall operate one minute, every other minute for 24 hours at ambient temperature of 65°C and one minute, every other minute for 24 hours at ambient temperature of 30°C.	No.1 - 75 hours *No.2 - 44 hours
Pitch of Note	300 - 600 CPS	No.1 - 395 CPS No.2 - 400 CPS
Temperature Rise	Shall not exceed 30° at ambient of 40°C	*No.1 - 36.3°C rise No.2 - 25.3°C rise
Shock test	Shall be subjected to 5-250 foot pound blows when energized and when de-energized in normal position and when inclined 30° in all directions.	Satisfactory under all conditions. Total blows given (50).

<u>Specifications</u>	<u>Requirements</u>	<u>Test Values</u>
Inclination	Shall operate when inclined 30° from the vertical plane in all directions at 10% above line voltage and 20% below line voltage.	Satisfactory under all conditions.
Audibility range	Shall be heard in still air in the open 1000 yards.	Both horns could be heard at a distance of 1250 yards.
Insulation Resistance	Before splash test-5 megohms After " " -1 megohm	200 megohms 125 megohms
Dielectric	Before splash test, 1230 V. A.C., 60 cycle, for 1 minute. After splash test, 500 V. AC 60 cycle for 1 minute.	Satisfactory under both conditions.
Watertight Integrity	Shall not leak when subjected to a stream of water 1.0" in diameter under a pressure head of 35 ft. played from a hose at a distance of 20 ft. for a period of 5 minutes.	*Case leaked 20 cc.
Case Material	Bronze or heavily copper plated steel.	Bronze and heavily copper plated steel.
Diaphragm Material	Stainless steel, beryllium copper or bakelized cloth.	Stainless steel, 0.015" thick, 5.50" dia.
Weight	Not specified	13 lbs., 4 oz.
Dimensions	Not specified	Height - 11.75" Width - 5.625" Depth - 7.125"

* Failed to comply with specifications.

COMMENTS

19. The power required to operate No.1 horn (115 V. AC) was 97.5 watts. This exceeds the allowable wattage by 22.5 watts.

20. The diaphragm of No.2 horn (115 V. DC) failed after 44 hours of operation when operated at intervals of one minute every other minute. However, the diaphragm of No.1 horn (115 V. AC) was in good condition after 75 hours of operation.

21. The temperature rise of No.1 horn at ambient temperature of 40°C was 36.3°C. This exceeds the allowable temperature rise by 6.3°C .

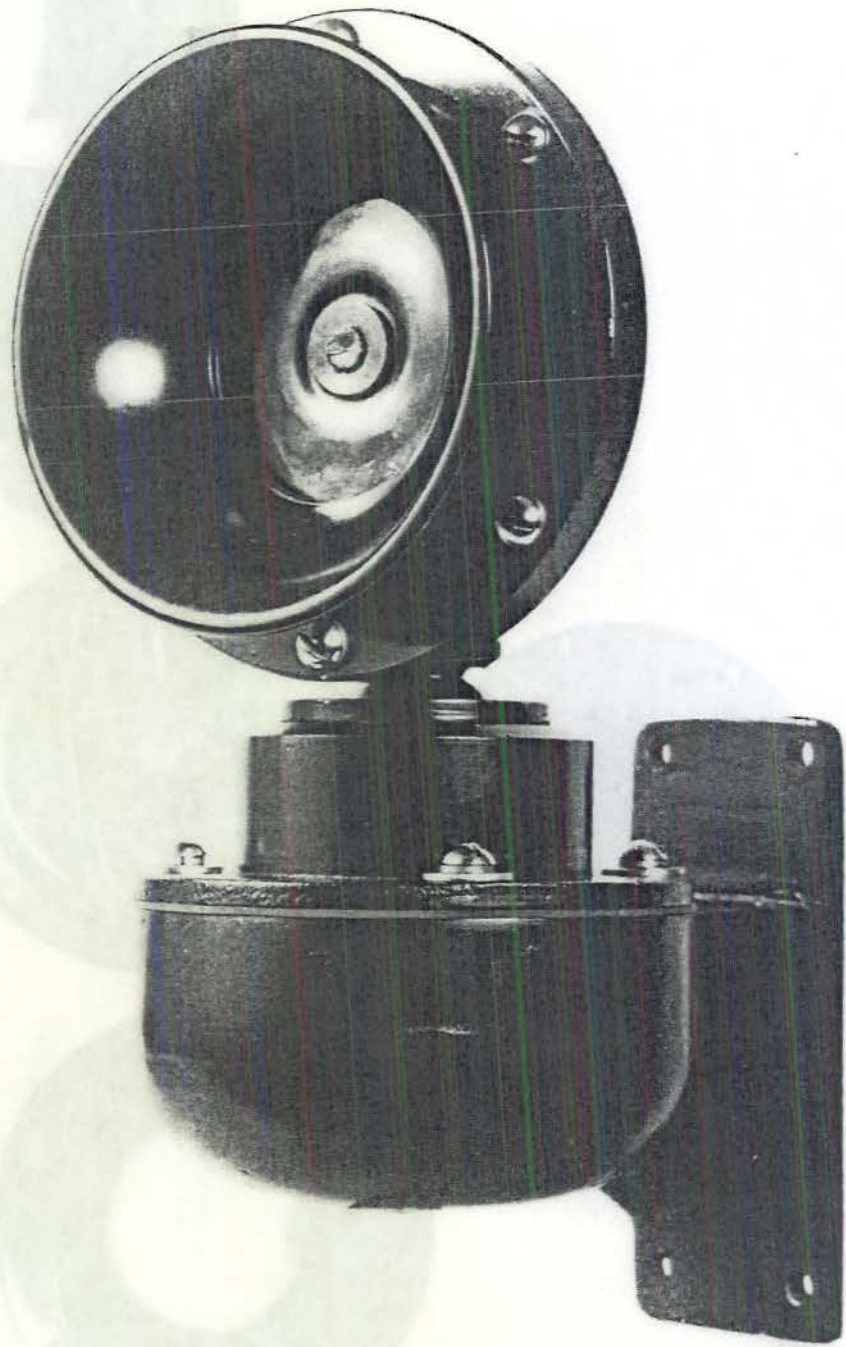
22. One of the horns, when tested for watertight integrity, leaked 20 cc. When examined, it was found that the leaks occurred around the screws that secure the motor unit to the case and through a drain hole located in the bottom of the case. This condition can be corrected by the use of a flat gasket, of material similar to "Velumoid", between each of the supporting screw washers and the case and by tapping the present drain hole for a steel machine screw, cadmium plated.

23. In order to simplify the testing of all horns covered by Specifications SGS(65)104, it is recommended that the second period of the endurance test, referred to in paragraph F-6a, be conducted at a temperature of 40°C. The temperature rise, referred to in paragraph D-8b, may then be determined during the test.

24. The Bureau is informed that the salt spray test was omitted because the equipment for conducting such a test is now under construction but not yet completed.

CONCLUSIONS

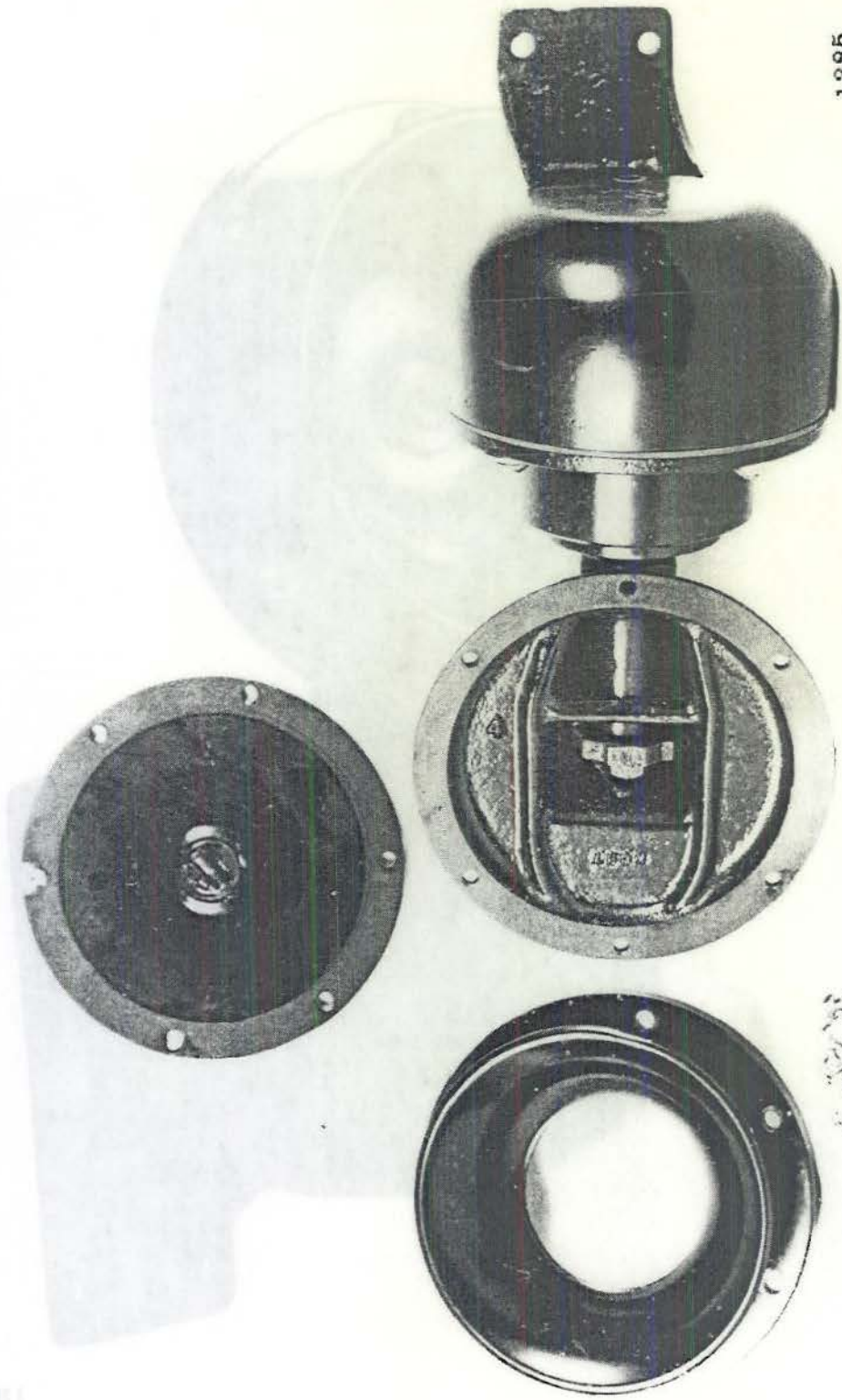
25. These horns, as manufactured and submitted for test by the Delco-Remy Corporation, under Contract N-140s-46624, are of good workmanship and comply with most of the major requirements of the specifications. If modified, as outlined under COMMENTS, paragraphs 19, 21, and 22, they would be suitable for the Naval Service.



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Plate 1

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