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NAVY DEPARTMENT  
BUREAU OF ENGINEERING

FR-1297

Report of Test

on

Horn, Navy Type A1

submitted by

E. A. Laboratories,

Brooklyn, New York.

NAVAL RESEARCH LABORATORY  
ANACOSTIA STATION  
WASHINGTON, D.C.

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Authorization: BuEng. ltrs. S65-4/L5(1-21-Ds) of 22 January 1936  
and S65-4/L5(7-11-Ds) of 28 July 1936.

Date of Test: March, April and July 1936.

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Authorization For Test.

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

- Reference: (a) Bu.Eng. ltr. S65-4/L5(1-21-Ds) of 22 January 1936.  
(b) Bu.Eng. ltr. S65-4/L5(7-11-Ds) of 28 July 1936.  
(c) Specifications SGS(65)-104b of 1 April, 1936.

Object of Test.

2. The object of this test was to determine the conformity of this horn with specifications, reference (c), and its suitability for Naval use on motor boats.

Abstract of Test.

3. The subject horn was set up at this laboratory and tested in strict accordance with the specifications, after which it was carefully inspected for suitability in design and quality of workmanship and materials.

Conclusions.

(a) The subject horn, under test for conformance with specifications, reference (c), failed to meet the requirements as noted below.

- (1) Under test for endurance, a fracture occurred in the spring supporting the armature. The time at which the fracture occurred is not known in view of the fact there was no indication of trouble during the required 48 hour test. This fracture occurred just below the adjustment nut and is shown by Plate 2.
- (2) The temperature rise of the winding, obtained during the latter part of the endurance test, at an ambient temperature of 40° C. was 35.5° C. The allowable rise is 30° C. During the first part of the endurance test, the temperature rise was 45.7° C. at ambient of 65° C. The allowable rise at this ambient is 35° C.
- (3) Under test for watertightness, the case leaked 10 cc of water.
- (4) The insulation resistance following the immersion test was 50,000 ohms by 500 volt megger. It should have been not less than one megohm.
- (5) The nameplate, located on the outboard end of the horn projector, is of paper and is contrary to that required by the specifications, paragraph D-10.
- (6) Under inspection, it was noted that the flange of the case had become irregular in shape causing unsatisfactory compression of the gasket.
- (7) Cup grease is apparently used to obtain watertightness where the sleeve and armature bolt penetrate the diaphragm. At ambient temperature of 65° C., this grease softened and spread in the horn projector.
- (8) No drain holes have been provided in the chamber of the horn projector as required. Four 1/8 inch holes, equally spaced on the largest possible circumference, are usually provided.

### Recommendations.

- (a) It is recommended that this horn, as at present manufactured, be not approved for Naval use in view of its non-compliance with the specifications.
- (b) It is also recommended that the Bureau consider disregarding the excessive temperature rise, which exceeded the allowable rise by  $10.7^{\circ}$  C., as the winding was apparently in good condition at the end of the test.
- (c) In conclusion, it is recommended that the Bureau also consider advising the manufacturer to modify his horn in accordance with the following suggestions:
  - (1) Substitute a cast BE case, so designed that the chassis and diaphragm are secured by machine screws, threaded into, but not penetrating the case. The case should provide for the use of flat rubber gaskets. If a cast cover were used, some of the cover screws could be eliminated.
  - (2) Experiment with two (2) armature springs substituted for the present single one. Both springs should be of a shape similar to, but longer than that which would be obtained by cutting the present one in half on a line perpendicular to its length. Provision should be made to allow a sliding action where they are secured to the armature. This suggestion is based on the fact that the horn operated satisfactorily after one half of the spring had become ineffective due to fracture, indicating that not all of the spring tension was necessary.

### Description of Material Under Test.

4. The subject horn, shown by Plates 1 and 2, was manufactured by E. A. Laboratories, Brooklyn, New York. It is of the vibratory type and designed for six volts, direct current.

5. The mechanism is housed in a formed brass case, having a removable cover for permitting connection to the line and servicing and two (2) bosses tapped for 3/8 inch terminal tubes.

6. For installing the horn, two (2) types of brackets were furnished and are so designed as to permit free vibration of the horn.

7. The magnetic circuit consists of a three (3) pole laminated core and a laminated armature, which are plated. The armature is mounted on a supporting spring and linked to the diaphragm by means of a bolt. A single form wound coil is provided.

8. The contacts are actuated by a nut located on the armature bolt and are protected by a 0.12 microfarad condenser.

9. Brass screws, equipped with nuts and washers are used for securing the chassis and case cover. The horn is finished in black.

10. The coil can be replaced by disassembling the horn, removing the armature and bending up two clips riveted to the chassis. The chassis is of formed steel and plated for protection against corrosion.

11. Located in the throat of the projector is an aluminum disc, secured to the center of the diaphragm. It vibrates at the amplitude of the diaphragm center and serves as a piston for moving the air column.

### Method of Test.

12. The subject horn as received was first tested to determine its ability to withstand shock by placing it on a standard Bureau of Engineering shock stand and giving it fifty (50) shocks of 250 foot pounds each, under conditions specified in paragraph F-2h of the specifications.

13. It was next tested for endurance by operating it 24 hours of one minute on, every alternate minute, at ambient temperature of 65° C. and 24 hours at 40° C. During this test the temperature rises of the coil were obtained by the resistance method.

14. Then followed the usual tests of inclination, insulation resistance, dielectric strength, audibility range, operation at over and under normal voltage and watertight integrity of the horn.

15. The test was concluded with the usual inspection of the horn for conformance with the specifications pertaining to design and quality of workmanship and materials.

## Results of Test.

16. The test results obtained were as follows:

<u>Requirements</u>	<u>Test Values</u>
Voltage: 6 Volts	6 Volts
Current: Direct	Direct
Amperes: Not over 8.33 amps.	7.5 Amps.
Watts: Not over 50	45 Watts
Pitch of Note: 300 to 600 CPS.	380 CPS.
Audibility range: Shall be not less than 600 yards.	1950 yards, calculated from a sound output of 93 db, using General Radio noise meter, type 559. Measured 18 feet from the horn and on the axis thereof.
Shock integrity: Shall withstand 50 blows of 250 foot pounds each, under conditions specified in para. F-2h.	Horn proved satisfactory under the specified test.
Endurance: Shall operate 24 hours of one minute on, every alternate minute, at ambient temperature of 65° C. and 24 hours at 40° C.	*Horn operated for the required 48 hours. However, a fracture was discovered in the armature spring at the end of test.
Temperature rise: Winding shall not exceed 30° C. when the ambient temperature is 40° C.	*35.5° C. rise, obtained during the latter part of the endurance test by the resistance method.
Dielectric strength: Shall withstand 500 v.a.c., 60 cycles, applied between all current carrying parts and ground for a period of one minute, prior to and following the immersion test.	Satisfactory, no breakdowns occurring prior to immersion. *Test omitted after immersion due to leaks in the case.
Insulation resistance: Shall be not less than one megohm following the dielectric and immersion tests.	100 megohms following the dielectric test. *50,000 ohms following the immersion test.

\* Denotes non-compliance with the specifications.

Requirements

Test Values

Inclination: Shall operate in any plane 45° from vertical at 10% above and 20% below rated voltage.

Satisfactory operation under these conditions.

Watertight integrity: No leaks shall occur when placed in water to a depth of 3 feet for a period of one hour.

\*Case leaked 10 cc of water.

Case material: Bronze, pressed brass, stainless steel or steel, heavily copper plated.

Formed brass, finished in black.

Contacts: Not specified.

Tungsten, 5/32 inches in diameter.

Diaphragms: Shall be of stainless steel, beryllium copper, bakelized cloth or other equivalent material approved by the Bureau.

Stainless steel.  
Dia. 6#0  
Thickness - 0#025

Magnetic circuit: Shall be made of laminated punchings and provisions made for form-wound coil.

Laminated punchings and form-wound coil provided.

Supply leads: Shall enter through the casing and not through any removable part.

Two bosses tapped for 3/8 inch terminal tube and located on stationary part of case.

Condensers: Type not specified.

Paper type covered with varnish cambric.  
Capacity 0.12 MFDS.

Nameplate: Shall be in accordance with specifications, paragraph D-10.

\*Nameplate made of paper located on outboard end of projector.

Weight: Not specified.

6.5 lbs.

Dimensions: Not specified.

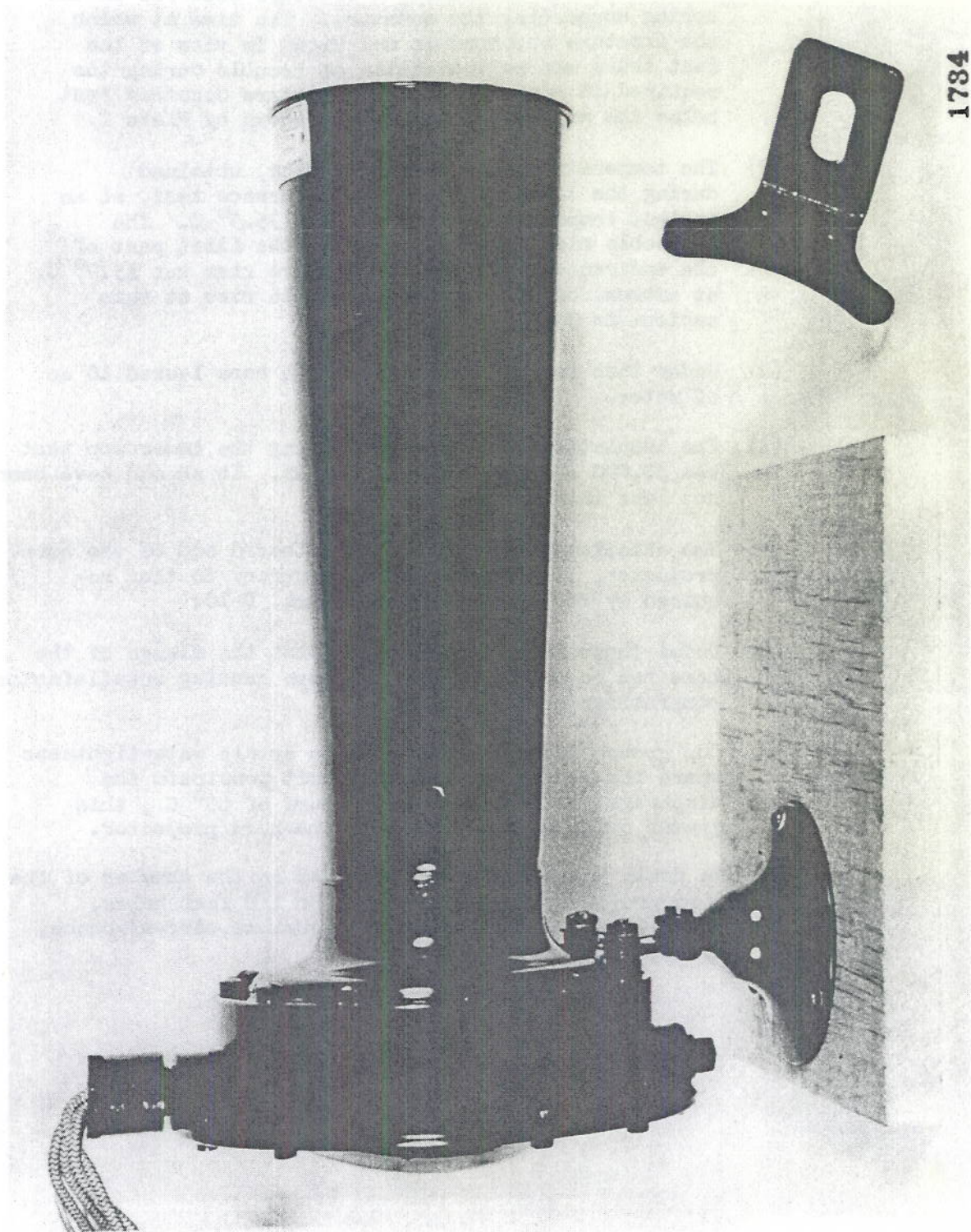
Overall length - 14#875  
Overall height - 8#75  
Overall width - 7#25

\* Denotes non-compliance with the specifications.

Conclusions.

17. The subject horn, under test for conformance with specifications, reference (c), failed to meet the requirements as noted below.

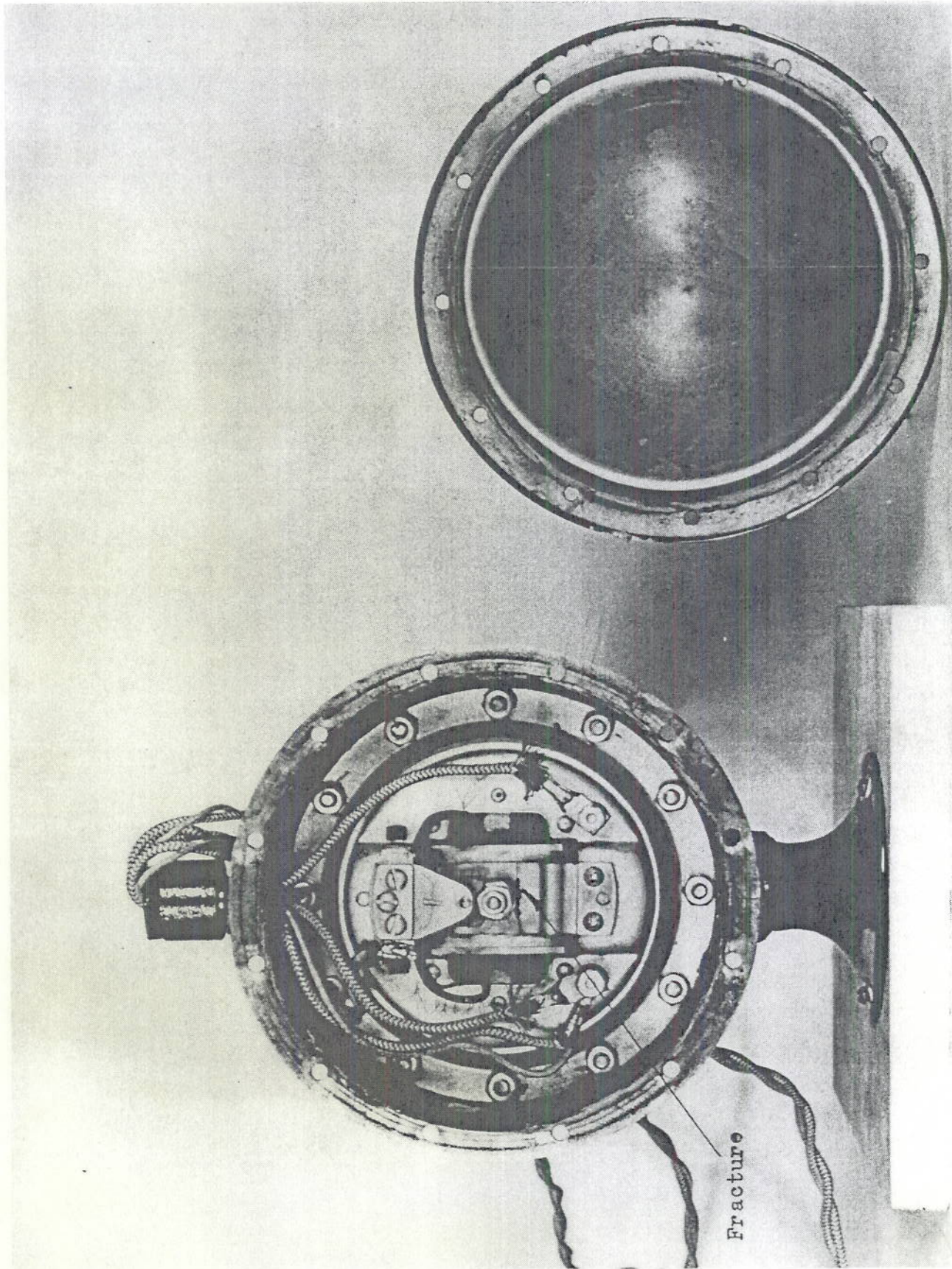
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Plate 1



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Fracture

Plate 2

