

21 July 1937

NRL Report No. B-1384

NAVY DEPARTMENT  
BUREAU OF ENGINEERING

Report of Test  
on

Duplex Horn

Submitted by

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New York, New York

FR-1384

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WASHINGTON, D.C.

Number of Pages: Text - 6 Plates - 2  
Authorization: BuEng. ltr. S62-2/L5(11-4-Ds) of 27 May 1937.  
Date of Test: June and July 1937.  
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Distribution:  
BuEng. (5)

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#### AUTHORIZATION FOR TEST

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

Reference: (a) Bu.Eng. ltr. S62-2/L5-(11-4-De) of 27 May 1937.  
(b) Specifications SGS(65) 103a, Buzzers, Interior Communication, of 1 June 1936.

#### OBJECT OF TEST

2. The object of this test was to determine how closely the sample horn complied with the specifications, reference (b), and its suitability for Naval use as a type B-2 buzzer.

#### ABSTRACT OF TEST

3. The subject horn was set up at this Laboratory in standard test circuits where its performance was carefully checked for compliance with the specifications. An inspection of the sample horn, relative to approved materials, design and workmanship, concluded the test.

## CONCLUSIONS

(a) The subject horn, under test for conformance with the specifications, reference (b), insofar as they were applicable, failed to comply with the following requirements:

- (1) The maximum power consumption allowed for type B-2 buzzers is 15 watts. The sample consumes 18.7 watts.
  - (2) The minimum allowable sound pressure output, measured 18 feet from the horn and on the axis thereof in a soundproof room, is 75 decibels. The sound output of the sample is 67 decibels with either of the horn projectors in line with the noise meter.
  - (3) Under test for watertight integrity, the case leaked badly around the diaphragms. Following this test, the insulation resistance by 500 volt megger, was zero. The minimum allowable is 1 megohm.
  - (4) The maximum allowable weight for type B-2 buzzers is 5 pounds. The sample weighs 13.75 pounds.
  - (5) Plain enameled copper wire for magnets is used. That required is double silk or cotton covered enameled copper wire, protected by covering of non-hygroscopic material.
  - (6) The terminal block, although of insulating material, is not equipped with 9-S-1841-L terminal lugs.
  - (7) The case is of cast iron and projectors are of steel, while that required under paragraph D-3 is cast aluminum alloy.
- (b) The average dimensions of type B-2 buzzers now used in the service, are approximately 4"25 x 6"50. The sample dimensions are 10"75 x 18"50.

(c) This horn is of commercial design and does not meet the specifications in its present form. However, it incorporates a feature whereby a double action is obtained and sound is projected in two opposite directions although a single electromagnetic device is employed.

RECOMMENDATIONS

(a) It is recommended that the subject horn be not approved for Naval use in its present form.

(b) It is further recommended that this horn be considered worthy of further development if there is a service application for a signal of its characteristics.

#### DESCRIPTION OF MATERIAL UNDER TEST

4. The sample horn is of the contactless vibrating type, designed for 110 volts, a.c., 60 cycles. Although designated as type ACW-1 Duplex Horn, its characteristics identify it as a type B-2 buzzer as defined by the specifications, reference (b).

5. The magnetic circuit consists of two (2) spool magnets, each having a 3/8 inch iron stud riveted to a cross bar cast integral with the case, thus forming a "U" shaped magnet. An iron disc, 3 inches in diameter and 1/16 inch thick, complete the magnetic circuit.

6. The disc, forming the armature, is riveted at its center to a 1/4 inch iron rod, reduced to 1/8 inch diameter at one end to provide a shoulder. The reduced diameter projects 3/16 inches from the opposite side of the armature.

7. A hollow boss, also cast integral with the case and cross bar, is located between the spool magnets. It is lined with a brass sleeve, having clearance for the armature rod, and serves as a guide. A coil spring, located on this rod, holds the disc away from the magnet poles until the circuit is energized.

8. Two (2) flexible rubber covered wires extend from the spool magnets to a terminal block of insulating material, located in the line connection box. The box is drilled to accommodate two (2) 1/2 inch (IPS) terminal tubes and is provided with a hand hole cover and two (2) mounting lugs. A fabric inserted rubber gasket is provided between the two sections of the connection box.

9. The horn projectors are of steel, each secured to the cast iron case with six (6) round head brass nickel-plated machine screws.

10. A plated steel diaphragm is provided for each horn projector and each has a small hole and a slot located near its edge. The slot prevents the diaphragm from turning. A rubber fabric inserted gasket is located between each projector flange and case flange. However, the diaphragm is not clamped between these gaskets but rests in a recess.

11. The duplex action of the horn is obtained by the armature rod alternately striking each diaphragm once each half cycle.

12. An adjustment screw is located on the flange of each projector and is used to vary the tension on the diaphragm.

13. The entire unit is finished in black, weighs 13-1/2 pounds, measures 18-1/2 inches from end to end of each projector, and is 10-3/4 inches in height.

#### METHOD OF TEST

14. The sample horn, as received, was first tested for power

consumption, pitch of note, and d.b. output while energized at a potential of 115 volts, a.c., 60 cycles.

15. Next followed tests for shock integrity by placing the horn on a standard Bureau of Engineering shock stand, under the various conditions specified in paragraph F-2g. Shocks of 250 foot pounds were applied while energized and deenergized.

16. Then followed tests for endurance, consisting of an operation cycle of "one minute on" and "one minute off" for a period of 1400 cycles conducted in two periods, the first 700 cycles with an ambient temperature of 70° C. and the second 700 cycles at 0° C. During the first part of this test, the temperature rises of the windings were obtained, using the resistance method. This test was repeated for periods of one hour each with the voltage reduced to 103.5 volts at 65 cycles and increased to 126.5 volts at 55 cycles, with the horn inclined 45° from the vertical in all planes.

17. It was then subjected to a dielectric test of 1500 volts, a.c., 60 cycles, applied for a period of one minute, followed by tests for insulation resistance. After immersing in water to a depth of 3 feet for a period of one hour, a dielectric test of 500 volts, a.c., 60 cycles was applied for one minute and the insulation resistance was measured, using a 500 volt megger.

18. The test was concluded with an inspection of the horn for conformance with the specifications in the matter of materials, design and workmanship.

#### RESULTS OF TEST

19. The test results obtained were as follows:

<u>Requirements</u>	<u>Test Values</u>
Voltage: 115	115 volts
Current: Alternating	Alternating
Frequency: 60 cycles	60 cycles
Watts: Not over 15.	* 18.7 watts
Power Factor: Not less than 30%.	51.4%
Amperes: Not specified	0.316 amperes
Temperature rise: Not more than 30° C. at ambient temperature of 70° C.	24.84° C. rise by resistance method.

Requirements

Sound output: Shall be not less than 75 d.b. under conditions specified in paragraph E-5.

Pitch of note: 60 to 500 CPS.

Inclination: Shall operate in any plane 45° from vertical at 10% over and 10% under normal voltage.

Voltage and frequency variation: Shall operate satisfactorily at 103.5 volts at 65 cycles and 126.5 volts at 55 cycles.

Endurance: Shall operate 700 cycles of one minute, every alternate minute, at ambient temperature of 70° C. and 700 cycles at 0° C.

Shock integrity: Shall withstand 20 shocks of 250 foot pounds each under the conditions specified in paragraph F-2g(3).

Dielectric: Shall withstand 1500 V.A.C., 60 cycles, applied between all current-carrying parts and ground for one minute and 500 V.A.C., 60 cycles following immersion test.

Insulation resistance: Not less than 10 megohms following dielectric test and 1 megohm following the immersion test.

Watertight integrity: No leaks shall occur when placed in water to a depth of 3 feet for a period of 12 hours.

Total weight: Shall not exceed 5 pounds.

Test Values

\* 67 d.b., measured 18 feet from the unit and on the axis thereof in a sound-proof room, using General Radio noise meter, type 559.

120 CPS at 60 cycle input.

Satisfactory operation under conditions specified.

Satisfactory operation under conditions specified.

Satisfactory operation under conditions specified.

Satisfactory.

Before immersion - Complied.  
After immersion - (See comments under "Conclusions.")

Following dielectric -- 200 megohms by 1000 volt megger.

\* Following immersion - Zero by 500 volt megger.

\* Water leaked into case around diaphragms.

\* 13.75 pounds.

Requirements

Windings: Shall be of double silk or cotton covered enameled copper wire, protected by covering of non-hygroscopic material.

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

Test Values

\* Enameled copper wire uncovered.

\* Insulating material but not equipped with 9-S-1841-L terminal lugs.

\* Denotes failure to comply with the specifications.

## CONCLUSIONS

20. The subject horn, under test for conformance with the specifications, reference (b), insofar as they were applicable, failed to comply with the following requirements:

- (a) The maximum power consumption allowed for type B-2 buzzers is 15 watts. The sample consumes 18.7 watts.
- (b) The minimum allowable sound pressure output, measured 18 feet from the horn and on the axis thereof in a soundproof room, is 75 decibels. The sound output of the sample is 67 decibels with either of the horn projectors in line with the noise meter.
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- (d) The maximum allowable weight for type B-2 buzzers is 5 pounds. The sample weighs 13.75 pounds.
- (e) Plain enameled copper wire for magnets is used. That required is double silk or cotton covered enameled copper wire, protected by covering of non-hygroscopic material.
- (f) The terminal block, although of insulating material, is not equipped with 9-S-1841-L terminal lugs.
- (g) The case is of cast iron and projectors are of steel, while that required under paragraph D-3 is cast aluminum alloy.

21. The average dimensions of type B-2 buzzers now used in the service, are approximately 4"25 x 6"50. The sample dimensions are 10"75 x 18"50.

22. This horn is of commercial design and does not meet the specifications in its present form. However, it incorporates a feature whereby a double action is obtained and sound is projected in two opposite directions although a single electromagnetic device is employed.

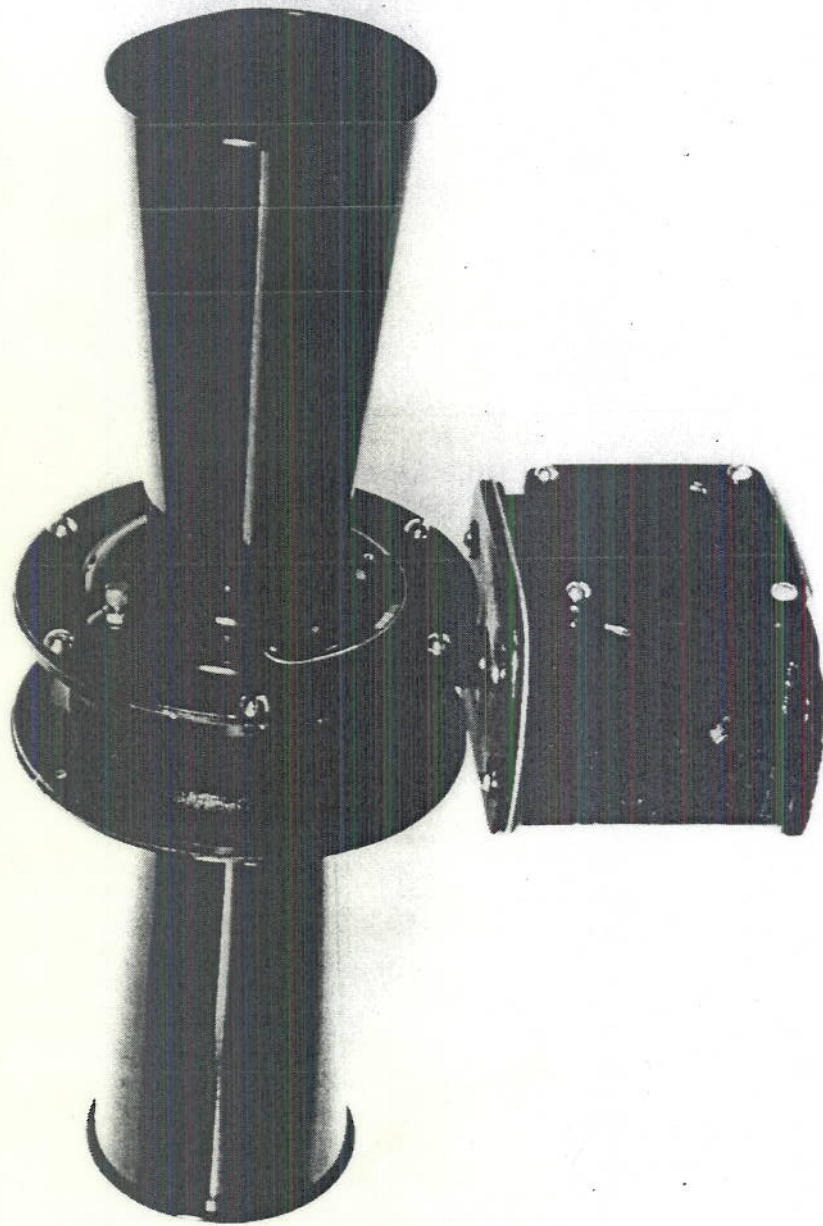


plate 1

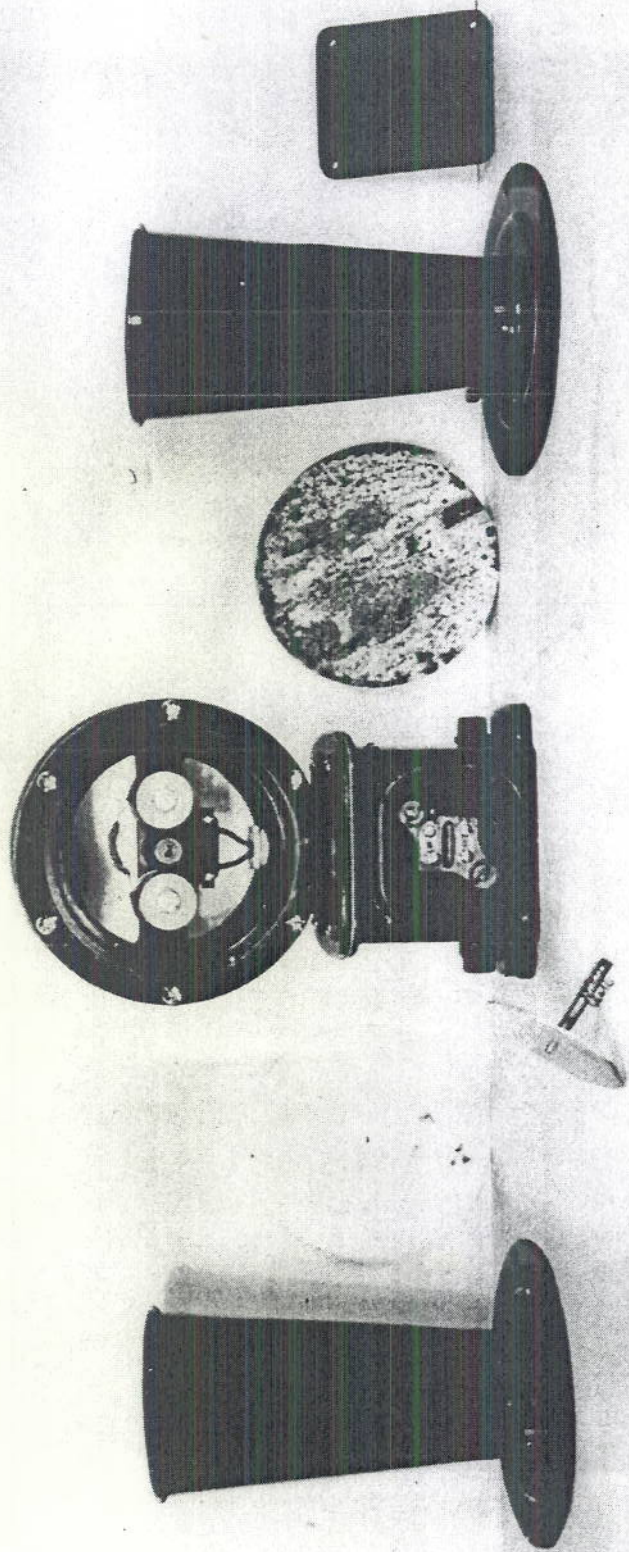


Plate 2