7 June 1938

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FR-1444

NAVY DEPARTMENT

BUREAU OF ENGINEERING

Report of Test

on

Horn, Navy Type H-1
Bendix Marine Products Company
Manufacturer and Exhibitor.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D.C.

Number of pages: Text - 6 Plates - 3

Authorization: Bueng. ltr. S65-4/L5(4-19-Ds) of 28 April 1938.

Date of Test: May and June 1938.

Tested by: _____
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Prepared by: _____
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Director.

Distribution: Bueng (5)

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Appendices

AUTHORIZATION FOR TEST

1. This problem was authorized by reference (a), and other additional references pertinent to this problem are listed as references (b) and (c).

Reference: (a) Bueng. ltr. S65-4/L5(4-19-Ds) of 28 April 1938.
(b) BuEng Specification 17S11(INT) of 15 Feb. 1938.
(c) Bendix Marine Drawing No. CAL 2667.

OBJECT OF TEST

2. The object of this test was to determine how closely the subject horn complied with the specification, reference (b), and its suitability for Naval use.

ABSTRACT OF TEST

3. The sample horn shown by photographs, Plates 1 and 2, was set up at this Laboratory and its performance carefully observed while under test for conformance with the specification, reference (b). An examination of the sample to ascertain whether the materials used were in strict accordance with the specifications concluded the test.

CONCLUSIONS

(a) The sample horn, manufactured by Bendix Marine Products Company, Brooklyn, New York, and submitted for type approval test under reference (b), fully complied except that double silk or double cotton enamel wire has not been used on the main and vibrator windings.

(b) The performance of the horn throughout the test was particularly good, and at no time was it necessary to make any adjustments. The incorporation of a separate vibrator for chopping up the direct current appears to be an advantage. As there is no mechanical coupling between the vibrator and the diaphragm, temperature changes, causing expansion and cupping of the diaphragm, or wear between armature and diaphragm, does not change the contact adjustment or frequency.

(c) It was noted that some of the sealing compound had leaked from the paper cartridge condenser. A can type, hermetically sealed, having a d.c. working voltage of not less than 400 volts, would be preferable.

RECOMMENDATIONS

(a) In view of the sample horn having complied with the specification, reference (b), except for the magnet wire requirement, it is recommended that it be approved for Naval use, subject to the use of approved wire on the electromagnets and a satisfactory inspection test.

(b) It is further recommended that the Bureau consider requiring the substitution of a can type hermetically sealed condenser for the paper cartridge one now used as a protective device for the contacts.

DESCRIPTION OF MATERIAL UNDER TEST

4. The sample horn is manufactured by Bendix Marine Products Company, 754 Lexington Avenue, Brooklyn, N. Y., and was submitted for type approval under reference (b), as a Navy type H-1.

5. It is of the vibratory type and is designed for direct current operation at a potential of 115 volts. Two sets of windings are employed, one located on a laminated core of "U" shape, the other being used to energize a small vibrator. Located on each pole piece of the "U" shape core is a form wound coil, the coils being connected in series.

6. The "U" shape electromagnet, vibrator, terminal block, fixed resistor, and condenser, are located on a cast aluminum alloy chassis which also supports the armature. The chassis serves as a clamping ring for the diaphragm and diaphragm gasket. Steel inserts are provided in the cover for the chassis securing screws.

7. The horn case is of cast aluminum alloy; of watertight construction; employing a 1/4 inch square rubber gasket, recessed into the rim of the case, and a "V" edge on the cover. The cover is so designed that the compression of the gasket is limited. Six (6) 1/4"-20 fillister headed machine screws, cadmium plated and equipped with nuts and washers, secure the cover to the case/ The case is provided with four (4) mounting lugs and two (2) bosses, one tapped for a standard 3/4 inch (IPS) terminal tube. The horn projector is cast integral with the case cover.

8. The diaphragm is of a nickel-chromium alloy, known commercially as "INCONEL". It is 5"0 in diameter and 0"020 thick.

9. The case and cover have a base coat of zinc chromate paint, followed with aluminum paint, and finished in gray. The chassis has a base coat of zinc chromate paint followed with aluminum paint.

DESCRIPTION OF OPERATION OF HORN

10. As shown by the schematic wiring diagram, Plate 3, the main winding of the horn is in series with one (1) pair of the vibrator contacts. These contacts are protected by a resistor condenser combination. The winding of the separate vibrator is connected across the line in series with a current limiting resistor. When voltage is applied to the line terminals, the vibrator winding is energized and the vibrator armature, which carries the movable contacts, shunts out the vibrator winding. This causes the release of the armature which rebounds and touches the contact connected to the main winding, allowing an impulse of current to flow through it. The vibrator circuit contacts have meanwhile opened and the vibrator winding is again energized. Thus the incorporation of a vibrator unit and its associated contacts chops up the 115 volt d.c. supply to the main winding. The frequency of the note produced is determined by the vibrator frequency.

METHOD OF TEST

11. The sample horn, following measurements for power consumption, pitch of note, and sound pressure output, was placed on a Navy standard shock machine, 12 inches below the anvil, and subjected to 2 shocks of 250 foot pounds each while deenergized and energized and mounted in each of the following positions.

(a) Normal vertical position.
(b) Parallel to anvil, inclined 45 degrees back from vertical.
(c) Parallel to anvil, inclined 45 degrees forward from vertical.
(d) Edgewise to anvil, inclined 45 degrees from vertical.
(e) Edgewise to anvil, inclined 45 degrees back from vertical.

12. Following the shock test, its vibration resistance was determined by placing it on a Navy standard 3 foot pound vibrating machine and subjecting it to six (6) tests of 30 minutes at 100, 150, 200, 250, 300, and 350 blows per minute. During this test, the horn was periodically tested for operation.

13. It was next tested for endurance by operating it one minute, every alternate minute, for an uninterrupted period of 1500 cycles. This test was conducted in two halves, the first half at an ambient temperature of 60°C. the second half at 0°C. The temperature rise of the windings was determined by the resistance method during the first half of the endurance test.

14. Upon completion of the endurance test, the acoustical output of the horn was again measured to determine the effect of the endurance tests.

15. Next followed tests for operation when inclined 45° to the vertical in all planes and energized at 10% over and 10% under rated voltage.

16. The unit was then given a test for dielectric strength by applying 1500 V. a.c., 60 cycles, between all current carrying parts and ground for a period of one minute. Immediately following, it was tested for insulation resistance, using a 1000 V megger.

17. Following an inspection of the horn to ascertain whether the materials used and the workmanship were in strict accordance with the specification, it was subjected under ultra-violet light to a 20 percent hot (55°C) salt spray for a period of three minutes, followed by a hot (55°C) air blast for a period of three minutes. This cycle was repeated for 100 continuous hours.

18. The horn was next immersed in sea water (sp.gr.1.025) to a depth of 3 feet for a period of 3 hours to determine its watertightness.

19. An examination of the unit, to determine any corrosion as a result of the salt spray test, concluded the test.

RESULTS OF TEST

20. The test results obtained were as follows.

Requirements	Test Values
Volts: 115	115
Current: Direct	Direct
Watts: Not over 25	16.56
Amperes: Not specified	0.144 amperes
Shock and inclination tests: Shall withstand a total of 20 shocks of 250 foot pounds each under the conditions specified in par. F-2g.	Satisfactory, there being no evidence of damage to any of the parts.
Vibration Tests: Shall withstand 3 foot pound shocks under the conditions specified in par. F-2h.	Satisfactory, there being no evidence of damage to any of the parts. The performance of the horn at conclusion of test was satisfactory.
Endurance: Shall operate satisfactorily one minute, every alternate minute, for an uninterrupted period of 750 cycles at ambient of 60°C. and 750 cycles at 0°C.	Satisfactory operation over the entire test, the horn requiring no adjustments.
Temperature rise: Shall not exceed 105°C during tests for endurance.	14.43°C rise above an ambient temperature of 60°C.
Pitch of Note: The fundamental shall be not less than 100 CPS or more than 600 CPS.	450 CPS determined by beat frequency oscillator.
Sound pressure output: Shall be not less than 75 decibels, measured as specified in par. D-13h.	At start of test: 78 db. At end of test: 76 db.
Inclination: Shall operate satisfactorily when inclined 45° to the vertical in all planes at 10% above and 20% below rated voltage.	Satisfactory operation under all conditions.
Dielectric: Shall withstand 1500 V. a.c., 60 cycles, applied for 1 min. between all current carrying parts and ground.	Satisfactory, no evidence of breakdowns.

Insulation resistance: Not less than 5 megohms between any electrical point and ground.	200 megohms by 1000V. megger.
Watertightness: Shall not leak when immersed in standard sea water (sp.gr. 1.025) to a depth of 3 feet for a period of 3 hours.	Satisfactory, no evidence of leaks.
Salt Spray Test: Shall be operative and show no corrosive or other damage to parts due to the salt spray test, conducted as specified in par. F-2p.	Satisfactory, there being no evidence of corrosion.
Total weight: Shall not exceed 5 lbs.	4 lbs. 2 ounces.
Diaphragm material: Shall be of nickel-chromium alloy.	Nicke-chromium alloy.
Terminal block: Molded phenolic material equipped with 9-S-1841-L terminals.	Complied.
Nameplate: Non-corrosive, specification 42N2.	Appears to be copper-nickel alloy. Unaffected by salt spray test.
Windings: Double silk or double cotton covered enamel copper wire.	*Silk enamel on main winding. Plain enamel on vibrator winding.
Contacts: Tungsten	Tungsten.
Case and cover material: Cast aluminum alloy or valve bronze.	Cast aluminum alloy.
Painting: One priming coat of zinc chromate paint followed with two coats of aluminum paint prior to finishing coat of gray paint.	Complied.
Dimensions: Not specified.	6"125 x 6"75 x 5"25

*Denotes failure to comply with specification.

CONCLUSIONS

21. The sample horn, manufactured by Bendix Marine Products Company, Brooklyn, New York, and submitted for type approval test under reference (b), fully complied, except that double silk or cotton enamel wire has not been used on the main and vibrator windings.

22. The performance of the horn throughout the test was particularly good, and at no time was it necessary to make any adjustments. The incorporation of a separate vibrator for chopping up the direct current appears to be an advantage. As there is no mechanical coupling between the vibrator and the diaphragm, temperature changes, causing expansion and cupping of the diaphragm, or wear between armature and diaphragm, does not change the contact adjustment or frequency.

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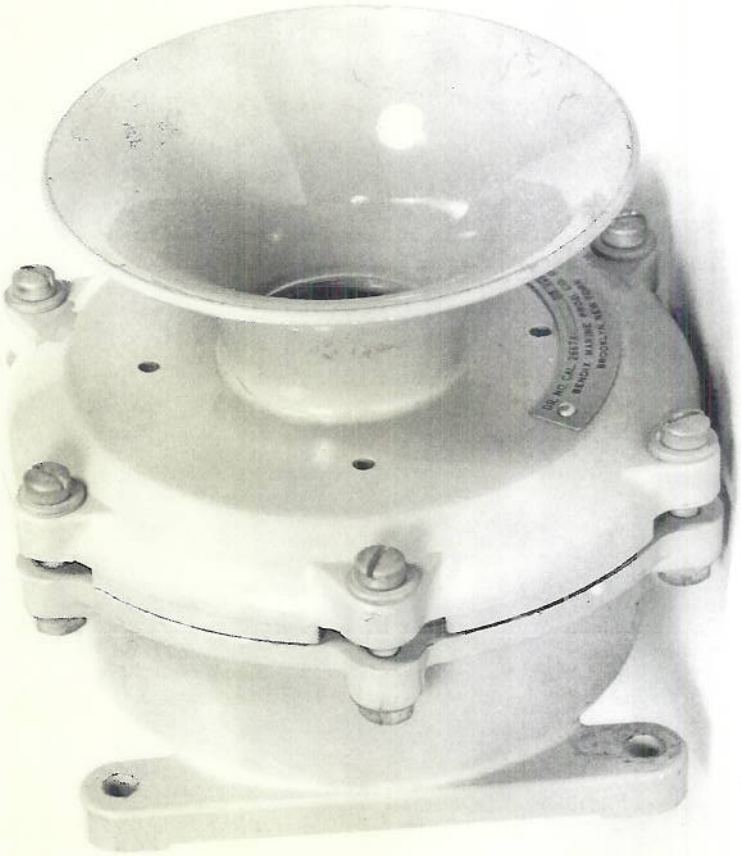


PLATE 1

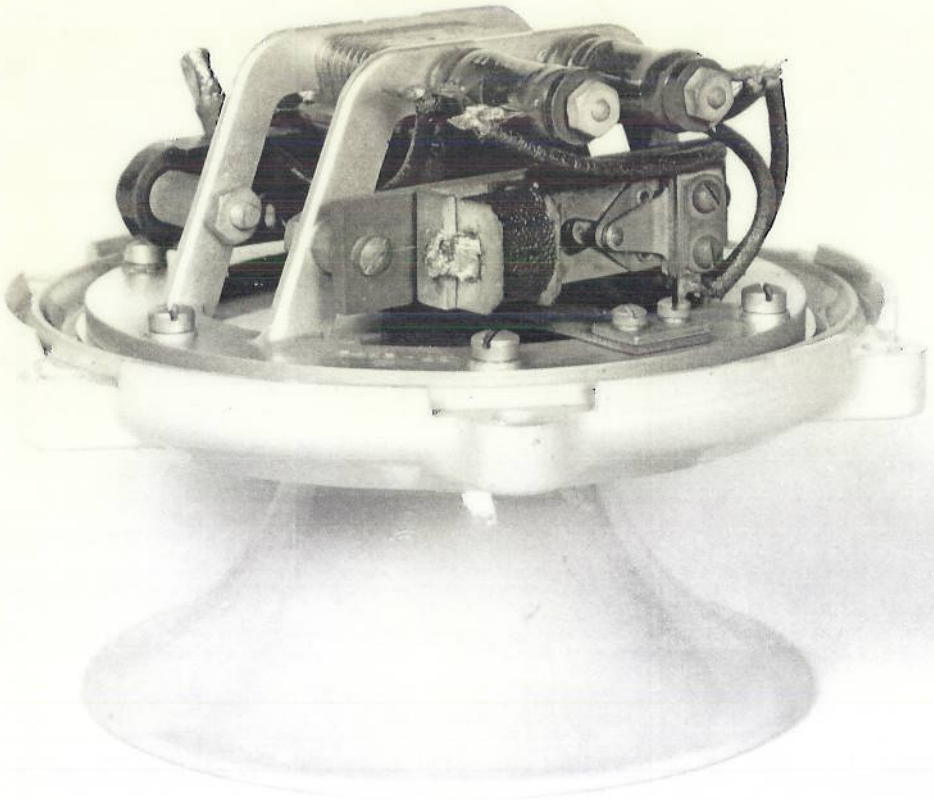
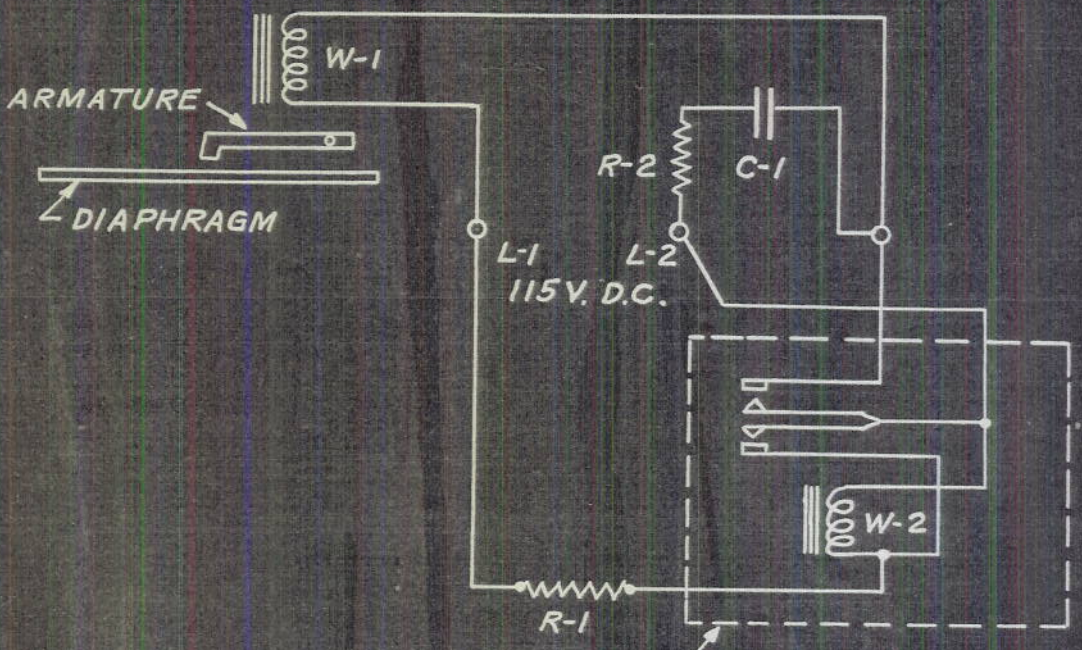


PLATE 2

WIRING DIAGRAM OF VIBRATOR TYPE H-1 HORN



R-1 = 2000 Ω
R-2 = 300 Ω
C-1 = 0.1 MFD.
W-1 = 199.6 Ω
W-2 = 760 Ω
(AT 26°C AMBIENT)

PLATE 3