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NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report of Test
on
Siren - Type A-1
submitted by
Portable Light Company
New York, N. Y.

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 references pertinent to this problem are listed as references (b) and (c).

- References: (a) BuEng let.S65-4/L5(9-9-Ds) of 11 Sept.1936.
(b) Specifications SGS (65)-105 Sirens,
Interior Communication, of 15 Feb.1936.
(c) NRL let.S65/A9,Ser.No.25 of 19 Oct.1936.

OBJECT OF TEST

2. The object of this test was to determine how closely the subject siren conforms with the specifications, reference (b), and its suitability for use in the Naval Service.

ABSTRACT OF TEST

3. The subject siren was set up at this Laboratory and tested in strict accordance with the specifications, reference (b), after which it was carefully inspected for quality of workmanship and materials, and suitability of design.

Conclusions

(a) The subject siren, as submitted by the Portable Light Company, New York, N. Y., in so far as the electrical characteristics and audibility range are concerned, complies with the specifications, reference (b). Under test for watertight integrity, however, 15 cc of water leaked into the case, the leak occurring around armature shaft, due to faulty packing. In addition, the note produced by the siren is 850 c.p.s., while that required by the specifications is 1500 to 2500 c.p.s.

(b) Under inspection of materials, it was noted that the priming coat of zinc chromate paint for the case has been omitted, and that no nameplate or terminal lugs, drawing 9-S-1841-L, were provided. In addition, the brass split sleeve riveted to the aluminum alloy rotor, should be substituted with one of steel, cadmium plated.

(c) It is also noted that the rotor housing is of zinc alloy, die-cast, instead of aluminum alloy as required and that oiled paper gaskets are used.

(d) The sound directional feature submitted with the siren was placed on the outboard end of the rotor housing cover and a test, conducted in open air under good weather conditions, using a General Radio Type 559-A noise meter, showed an average gain of 4 db, through 360° at a radius of 60 feet. The results of this test are given by Table 1.

Recommendations

(a) In view of the subject siren complying with the major requirements of the specifications, it is recommended that it be given type approval, subject to correction of defects, noted under "Conclusions" of this report.

(b) It is also recommended that the Bureau consider temporarily allowing the use of the zinc alloy material for the rotor housing, providing the increased weight of approximately 1-3/4 lbs. is not objectionable. This recommendation is based on the understanding that but few sirens of this type are required in the Service and the test results which show the material to be satisfactory under shock.

(c) Table 1, giving the results of tests with and without the use of the sound directional feature on the siren, is given for the Bureau's information. The directional feature submitted is of 1/32 inch copper and is not considered to be of sufficient ruggedness for the Service. A cast alloy directional feature would be far more practical and it is to be expected that its use would produce results, differing from those given by Table 1.

(d) A high power, type B1 siren, equipped with a cast aluminum alloy directional feature, surrounding the rotor housing, was tested by this Laboratory, and the results of tests pertaining to its directional features were included in a report, reference (c). It is believed that such a feature more nearly approaches what is desired and that this information will be useful to the Bureau in reaching a decision.

DESCRIPTION OF MATERIAL UNDER TEST

4. This siren was submitted by the Portable Light Company, as a Navy Type A1, for type approval test.

5. The motor is bipolar, series wound, and designed to operate on a potential of 115 volts, a.c. or d.c. The speed of the motor, when producing a note of 850 c.p.s., is 6,375 r.p.m. The motor is equipped with ball bearings, packed in grease.

6. The magnetic circuit is made up of thin laminated iron punchings, each pole piece supporting a form-wound coil, having a d.c. resistance of approximately 3.5 ohms, at a temperature of 26° C.

7. The motor is housed in a cast aluminum alloy case, having four (4) mounting lugs drilled for 1/4 inch bolts, and a terminal box, provided with two (2) bosses tapped for 3/4 inch (IPS) standard terminal tubes. A terminal block of phenolic material is located in the terminal box, cast integral with the case.

8. The rotor is of aluminum alloy, cast in one piece, and has eight (8) apertures in its periphery. It clamps the armature shaft when a hex brass nut is screwed downward on a brass split sleeve, secured to the rotor by a force fit and with four (4) steel drive pins.

9. The rotor housing, or cylinder, which also has eight (8) apertures in its periphery, is of zinc alloy, die-cast, and serves as a case cover. Three (3) #8-32 flat head steel screws, cadmium plated, extending through the rotor housing and into tapped holes in the brass end bell of the motor, secure the motor assembly. The housing is secured to the case with six (6) flat head #10-32 steel screws, cadmium plated, provided with steel lock washers and brass nuts and used as through bolts. Countersunk holes are provided in the housing for heads of screws in order to clear the rotor. A perforated cover of zinc alloy, die-cast, secured to the housing with eight (8) fillister head #4-36 steel screws, cadmium plated, prevents persons from coming in contact with the rotor. Oil paper gaskets are used where the case joins the rotor housing and on the terminal box cover.

10. Further details in the design and construction of the siren are given by Plates 1 and 2.

METHOD OF TEST

11. The siren as received was first tested for its shock integrity by placing it on a Bureau of Engineering shock stand and applying the required number of shocks, specified under par.F-2h(3), of reference (b).

12. It was next tested for endurance by placing it in a compartment, having an ambient temperature of 65° C, and operating it one minute, every alternate minute, for 24 hours. During this test, the temperature rise of the motor was obtained by the resistance method. The temperature was then lowered to 40° C and the siren again operated for 24 hours, at intervals of one minute, every alternate minute.

13. Next, it was tested for its operating characteristics when inclined 30° from the vertical in any plane and supplied with current at voltages between 20% under and 10% over normal operating voltage. It was also tested for operation over a frequency range of 55 to 65 cycles.

14. The pitch of note was obtained by beating it on a General Radio beat frequency oscillator, type 513-B. During this test, the voltage to the siren was maintained at 115 volts.

15. Prior to conducting the splash test, 1500 volts, a.c., 60 cycles, was applied between all current carrying parts and ground for a period of one (1) minute. Following the splash test, the dielectric test was repeated, using 500 volts, a.c., 60 cycles. Upon conclusion of each of these tests, its insulation resistance was measured.

16. The sound output of the siren was measured in a sound-proof room by a General Radio noise meter, type 559-A, located 18 feet from and on the axis of the siren. Its rated voltage (115 volts) was maintained during this test.

17. The watertight integrity of the siren was determined by spraying it with a stream of water of one inch diameter, under a pressure-head of approximately 30 feet, played from a hose at a distance of 20 feet, for a period of 5 minutes.

18. Then followed the usual power consumption measurement at rated voltage and frequency, and an inspection of the siren to note any defects resulting from tests, and its conformance with the specifications relative to materials, design and workmanship.

19. Sound intensity measurements in decibels were made in the open air, using a General Radio noise meter, type 559-A, on the siren with and without a directional feature, shown by Plate 1.

20. Operation of the siren at minus 30° C, concluded the test.

RESULTS OF TEST

21. The test results obtained were as follows:

<u>Requirements</u>	<u>Test Values</u>
Voltage: 115 volts	115 volts
Amperes: Not specified.	1.82 amperes
Frequency: 60 cycles	60 cycles
Watts: Not over 200 watts.	196 watts
Power Factor: Not less than 60%.	93.64%

Requirements

Endurance: Shall operate one minute, every alternate minute, for 24 hours at ambient temperature of 65° C and one minute every alternate minute, for 24 hours, at ambient temperature of 30° C.

Inclination: Shall operate satisfactorily when inclined 30° from the vertical in any plane and supplied with current at voltages between 20% under and 10% over normal operating voltage.

Frequency range: Shall operate satisfactorily over a frequency range of 55 to 65 cycles.

Dielectric strength: Shall withstand 1500 volts, a.c., 60 cycles, applied between all current carrying parts and ground for a period of one minute, prior to splash test, and 500 volts a.c., 60 cycles, following, for a period of one minute.

Insulation resistance: Shall be not less than 10 megohms by 500 volt megger prior to splash test and 1 megohm by 500 volt megger following the splash test.

Splash test: Shall not leak when sprayed with a stream of water of 1 inch diam., under a pressure-head of 30 feet, from a distance of 20 feet, for a period of 5 minutes.

Motor bearings: Ball bearings.

Temperature rise: Shall not exceed 35° C at ambient temperature of 65° C, during first part of endurance test.

Pitch of note: 1500 to 2500 c.p.s.

Audibility range: Minimum of 2000 yards in still air in the open.

Test Values

Satisfactory operation under conditions as specified. Operation also satisfactory at minus 30° C.

Satisfactory operation under conditions as specified.

Satisfactory operation under conditions as specified.

Satisfactory, no breakdowns occurring.

Before splash test - 200 megohms. After splash test - 100 megohms.

*Case leaked 15 cc of water, leak occurring at armature shaft packing gland.

Complied with.

30.4° C rise by resistance method.

*850 c.p.s.

2600 yards, computed from a db output of 101 decibels, measured in soundproof room, by General Radio noise meter, located 18 feet from and on the axis of siren.

Requirements

Case Material: Shall be made of aluminum alloy.

Rotor: Shall be made of aluminum alloy, cast in one piece.

Weight: Not specified.

Dimensions: Not specified.

Nameplates: Corrosion-resisting steel, etched or engraved lettering.

Terminal block: Phenolic material, equipped with wire terminal lugs, drwg. 9-S-1841-L.

Test Values

*Case, aluminum alloy. Rotor housing, zinc alloy.

Aluminum alloy, cast in one piece.

12 lbs. 4 oz.

Overall length 7"25
Max. dia. 7"00

*None furnished.

*Phenolic material, but terminal lugs omitted.

* Denotes failure to comply with the specifications.

CONCLUSIONS

22. The subject siren, as submitted by the Portable Light Company, New York, N.Y., in so far as the electrical characteristics and audibility range are concerned, complies with the specifications, reference (b). Under test for watertight integrity, however, 15 cc of water leaked into the case, the leak occurring around armature shaft, due to faulty packing. In addition, the note produced by the siren is 850 c.p.s. while that required by the specifications is 1500 to 2500 c.p.s.

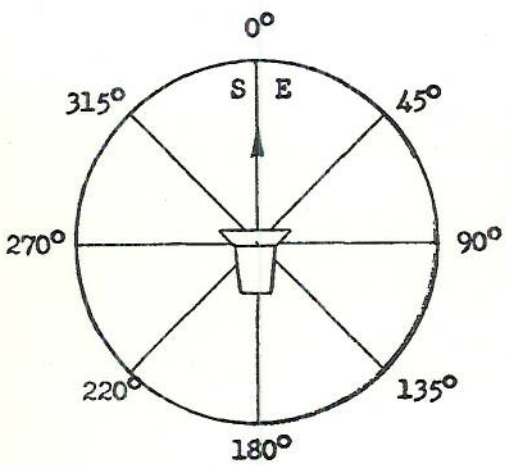
23. Under inspection of materials, it was noted that the priming coat of zinc chromate paint for the case has been omitted, and that no nameplate or terminal lugs, drawing 9-S-1841-L, were provided. In addition, the brass split sleeve riveted to the aluminum alloy rotor, should be substituted with one of steel, cadmium plated.

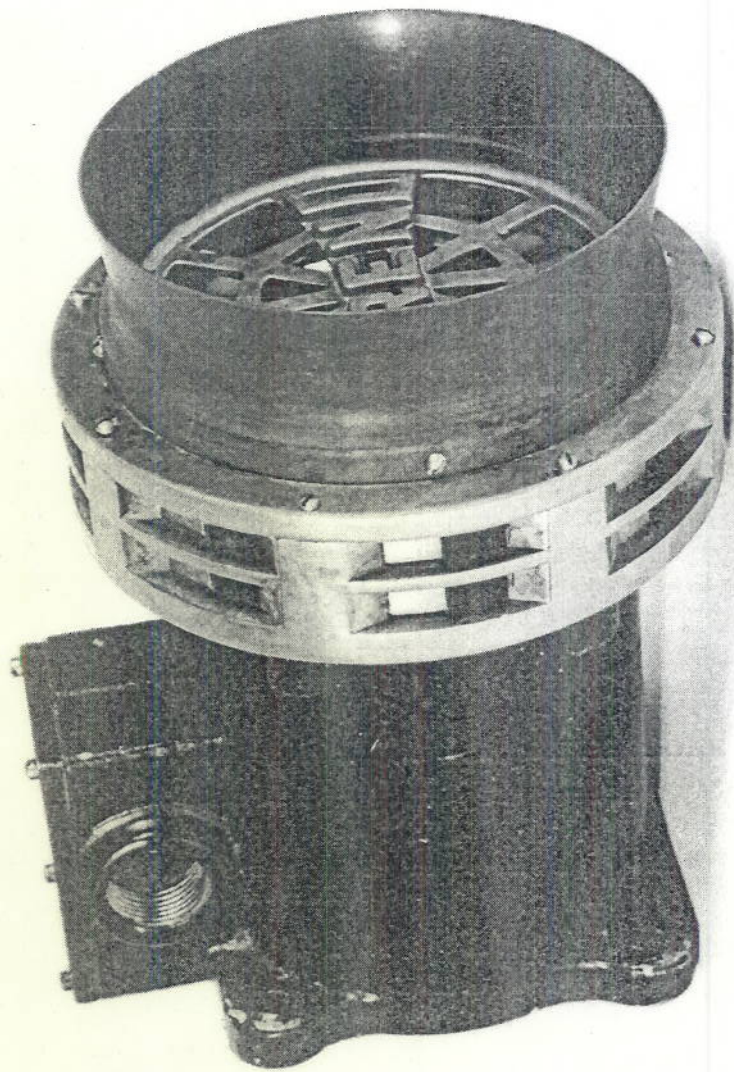
24. It is also noted that the rotor housing is of zinc alloy, die-cast, instead of aluminum alloy as required and that oiled paper gaskets are used.

25. The sound directional feature submitted with the siren was placed on the outboard end of the rotor housing cover and a test, conducted in open air under good weather conditions, using a General Radio Type 559-A noise meter, showed an average gain of 4 db, through 360° at a radius of 60 feet. The results of this test are given by Table 1.

Table 1

Decibel Output taken at 60 foot Radius
 using General Radio Noise Meter Type 599A
 115 volt 60 cycle A.C. Supply
 with and without Directional Feature

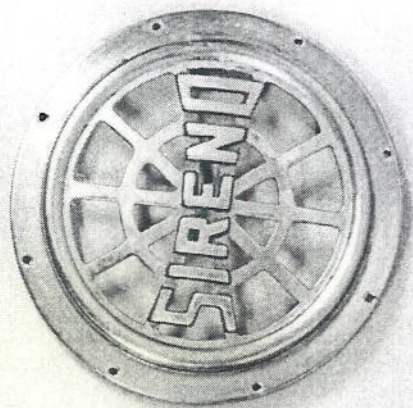
Location of Noise Meter	Without	With	Notes
0°	90	93	 <p>Weather Conditions 1 October 1936 Weather Clear Wind North Velocity 3 - 5 m.p.h. Temperature 74° F. Humidity 90%</p>
45°	86	90	
90°	86	89	
135°	84	88	
180°	82	92	
225°	82	87	
270°	88	89	
315°	85	85	
360°	90	93	



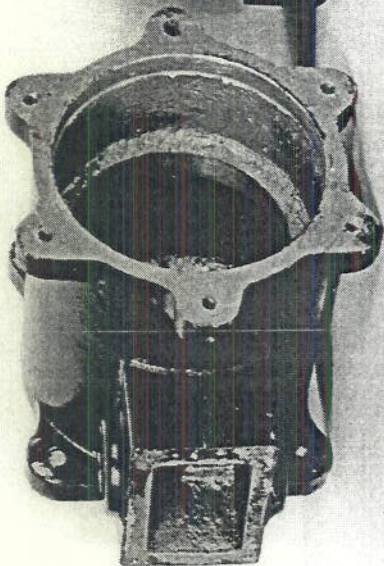
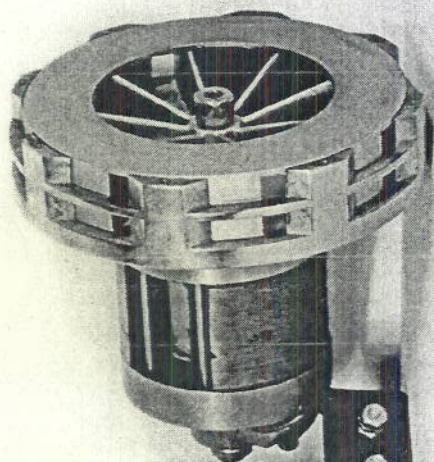
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PLATE I



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