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NAVY DEPARTMENT
BUREAU OF ENGINEERING

FR-1253

Report of
Test on Bells, Vibrating,
4", 8" and 12".
Manufactured and Submitted
by
Portsmouth Navy Yard.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D.C.

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AUTHORIZATION

1. This test was authorized by reference (a) and other additional references pertinent to this problem are given as references (b) to (g) inclusive.

- Reference:
- (a) BuEng.ltr. S65-4/L5(10-29-Ds) of 30 Oct.1935.
 - (b) Navy Dept. Specifications SGS(65)-102 of 2 Jan. 1935.
 - (c) Portsmouth Plan 29339, Bureau File No. 11-T-1136-L. Alt.O.
 - (d) Portsmouth Plan 29338, Bureau File No. 11-T-1135-L. Alt.O.
 - (e) Portsmouth Plans, 29336 and 29337, Bureau File Nos. 11-T-1133-L. Alt.O, and 11-T-1134-L, Alt.O.
 - (f) Portsmouth Plan 29335, Bureau File No. 11-T-1132-L, Alt.O.
 - (g) Bu.Eng.ltr.S65-4(10-11-Df) of 31 Dec.1935, to Comdt., Navy Yard, Portsmouth, N.H.

OBJECT OF TEST

2. The object of this test was to determine how closely the subject bells complied with the specifications, reference (b), and their suitability for the Naval Service.

ABSTRACT OF TEST

3. These bells, using first the A.C. and then the D.C. coils, were set up at this Laboratory in standard test circuits and closely observed while under test for endurance. During this test the current consumption and the temperature rises of the windings were obtained by the resistance method, at ambient temperatures of 40°C and 65°C respectively. All remaining tests were made, in order, as outlined by the specifications, reference (b). At the conclusion of the test, each unit was carefully examined to ascertain whether it was in accordance with the requirements in the matter of materials, design and workmanship.

CONCLUSIONS

(a) These bells, as manufactured by the Portsmouth Navy Yard, are of good workmanship and were, in general, satisfactory, under test for conformance with the specifications, ref. (b).

(b) The bells have a good sound output and were they modified in accordance with reference (g), and paragraph 22 of this report, they should prove satisfactory for use in the Naval Service, particularly so from a corrosion standpoint.

RECOMMENDATION

(a) It is recommended that final approval of these bells be held in abeyance pending an examination and tests deemed necessary by the Bureau on representative samples of modified bells. Modifications should be made in accordance with Bureau's letter, reference (g), and paragraph 22 of this report.

DESCRIPTION OF MATERIAL UNDER TEST

4. These bells were designed and manufactured by the Portsmouth Navy Yard for Naval use. The equipment submitted for test was as follows:

- Item 1. One 12 inch - single stroke - watertight bell - Type B12 - Designed for 115 volts, A.C. - 60 cycles. Portsmouth Plan 29339 - Bureau File No. 11-T-1136-L. Alt.O.
- Item 2. One 12 inch - Vibrating - Watertight Bell - Type A12 - Designed for 20 volts, D.C., and 115 volts D.C., - 20 volts A.C. and 115 volts A.C., 60 cycles. Portsmouth Plan 29338 - Bureau File Number 11-T-1135-L. Alt.O.
- Item 3. One 8 inch - Vibrating - Watertight Bell - Type A8 - Designed for 20 volts D.C. and 115 volts D.C., 20 volts A.C., 60 cycles and 115 volts A.C., 60 cycles. Portsmouth Plans 29336 and 29337 - Bureau File Nos. 11-T-1133-L, Alt. O, and 11-T-1134-L, Alt.O.
- Item 4. One 4 inch - Vibrating - Watertight Bell - Type A4 - Designed for 20 volts D.C. and 115 volts D.C. - 20 volts A.C., 60 cycles and 115 volts A.C., 60 cycles. Portsmouth Plan 29335 - Bureau File No. 11-T-1132-L, Alt.O.

5. Item 1, Type B12, is designed only for 115 volts, A.C., 60 cycle operation. It is of the single stroke, contactless type, and embodies a laminated core and armature. Located on the core are two windings, one having an approximate resistance of 45 ohms, the other, a resistance of approximately 185 ohms. No. 1 coil, (45 ohms) is connected across the line, while No. 2 coil, (185 ohms) is connected, in series with a 1.5 Mfd. condenser, to the line. The striker arm is a bent piece of brass rod threaded to fit a steel striker ball. It enters the case through a watertight packing gland and is supported by the gland and a bearing located in an internal boss. The striker shaft supports the laminated armature by means of two rectangular steel blocks. These blocks are drilled and slotted and contain a steel set screw for clamping them to the striker shaft. Attached to the laminated armature is a flat phosphorous bronze spring for returning it to its normal position when the circuit is opened. The air gap, between the armature and the pole pieces is adjusted by turning a steel machine screw in or out of a tapped boss, located internally. Steel inserts, threaded into the case, are provided for the screws securing the case cover, terminal block, laminated core and the condenser bracket. The gong is of cast bell material and is supported by a steel stud threaded into a steel insert

located in a boss on the case. Where the stud extends through the boss, a 1/2" steel locknut is provided to prevent it from backing out. The bell gong is secured with a hex head steel bolt threaded into the stud. A pin, located in the stud, extends partly into a hole in the gong and holds the gong in a definite position with relation to the ball striker. The watertight case is of cast aluminum alloy, having four mounting lugs and two bosses, one tapped for a 3/4 inch standard terminal tube. The back of the case is slightly recessed to allow for mounting on uneven surfaces. Further details, in the construction and design, are given by Plates 1 and 2 and Portsmouth Plan 29339.

6. Item 2, reference (d), is similar in construction to item 1, reference (c), except that it embodies a set of contacts for obtaining interruptions of current in the electromagnetic circuit. Operation of the bell on 20 volts D.C., 115 volts, D.C., 20 volts A.C., and 115 volts A.C. is accomplished with the use of interchangeable coil and core assemblies. The two coils on the core assembly are connected in parallel, one side of the line being broken by a contact making device. Further details, in the construction and design, are given by Plates 3 and 4 and Portsmouth Plan 29338.

7. Item 3, reference (e), is also similar in construction to item 2, reference (d), except that it embodies a 8-inch bell gong. Further details, in the construction and design, are given by Plates 5 and 6 and Portsmouth Plans 29336 and 29337.

8. Item 4, reference (f), is also similar in design to item 3, reference (e), except that it is proportionately smaller and embodies a four inch gong, single windings for the interchangeable units and a solid armature. Further details, in the construction and design, are given by Plates 7 and 8 and Portsmouth Plan 29335.

METHOD OF TEST

9. Prior to the start of the endurance test, each bell, using its respective interchangeable coils, was tested for sound output. These measurements were made in a sound-proof room with a General Radio Noise Meter, located at 18 feet from and on the axis of the bell under test. During this test the correct voltages were maintained.

10. Following, the bells were placed in a compartment having an ambient temperature of 65°C. and tested for endurance by operating each one minute every alternate minute for 24 hours, using the 115 volt A.C. coils. The ambient temperature was then lowered to 40°C and each unit again operated one minute every alternate minute for 24 hours. This test also applied to the single stroke bell except that it was operated at the rate of 90 times per minute, every alternate minute. During this test the temperature rises of the windings were obtained by the resistance method. The current consumption of each unit was also

measured at this time when energized at its respective voltage. The same test was conducted for periods of 16 hours each, using the interchangeable coils.

11. Next, each unit was tested for operation at over and under voltage when inclined 30° from the vertical plane in all directions. The a.c. units were also tested at frequencies above and below normal.

12. Each bell was then tested for its shock integrity by placing it on a Bureau of Engineering shock stand and subjecting it to the shocks and conditions specified under reference (b).

13. The units were next tested for their power consumption when energized at their rated voltages.

14. Then followed the insulation resistance and dielectric strength tests prior to and after the watertight test.

15. Finally, each bell was carefully inspected to ascertain whether the materials, design, and workmanship conformed with the specifications, reference (b).

RESULTS OF TEST

16. The data obtained during the test on the alternating current bells follow:

Requirements	Test Values							S.S.
	20 Volts A.C.			115 Volts A.C.				
	12"	8"	4"	12"	8"	4"	12"	
Voltage: 20 V. and 115 V.	20	20	20	115	115	115	115	
Frequency: 60 cycles	60	60	60	60	60	60	60	
Amperes: Not specified	1.65	1.30	1.10	0.475	0.475	0.270	0.360	
Watts: Not over								
25 watts, 12 inch	16.1			21.5				
20 watts, 8 inch		18.0			21.0			
15 watts, 4 inch			3.0			14.0		33.0
Power Factor: Not less than 30%	45.7	47.3	36.3	39.36	38.44	45.09	31.79	
Endurance: 1 minute, every alternate minute for 24 hours at ambient of 65°C and 24 hours at ambient of 40°C.	Satisfactory operation for periods of 16 hours each at 65°C. and 40°C. ambient.			Satisfactory operation as specified, using 115 V. coils.				

Requirements	Test Values						
	20 volts A.C.			115 volts A.C.			
	12"	8"	4"	12"	8"	4"	12" S.S.

Watertight integrity:
 Shall not leak when submerged in salt water to a depth of 3 ft. for a period of 12 hours.

Satisfactory, no leaks occurring.

Resistance of windings by bridge in ohms at ambient of 40°C.

1.15 1.19 3.49 25.7 23.6 100.8 40.0

Dielectric strength before immersion
 115 V. bells, 1220 V. a.c., 60 cycles.

Satisfactory, no breakdowns occurring.

20 v. bells, 500 V. a.c., 60 cycles.

Satisfactory
 no breakdowns occurring.

Dielectric strength after immersion:
 115 V. bells, 500 V. a.c. 60 cycles

Satisfactory, no breakdowns occurring.

20 V. bells, 500 V. a.c. 60 cycles Satisfactory, no breakdowns occurring.

17. The data obtained during the test on the direct current bells follow:

Requirements	Test Values					
	20 Volts, D.C.			115 Volts, D.C.		
	12"	8"	4"	12"	8"	4"
Voltage: 20 V. and 115 V.	20	20	20	115	115	115
Amperes: Not specified.	0.50	0.51	0.28	0.14	0.16	0.075
Watts: Not over -						
25 watts, 12 inch	10.0			16.1		
20 " 8 "		10.2			18.4	
15 " 4 "			5.6			8.6

Requirements	Test Values					
	20 volts D. C.			115 Volts D.C.		
	12"	8"	4"	12"	8"	4"

Endurance: One minute, every alternate minute, for 24 hours at ambient of 65°C. and 24 hours at ambient of 40°C.

Satisfactory operation as specified for periods of 16 hours each.	Satisfactory operation as specified for periods of 16 hours each.
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Observable temp:
Not to exceed 100°C. at an ambient of 65°C during first part of endurance test.

89.4	91.2	88.8	93.2	95.6	88.3
------	------	------	------	------	------

Temperature rise:
Not more than 30°C. rise at an ambient temperature of 40°C. during latter part of endurance test.

28.5	26.4	22.2	27.4	28.3	19.2
------	------	------	------	------	------

Inclination: Satisfactory operation when inclined 30° from the vertical in all directions at 10% over and under normal voltage.

Satisfactory operation as specified.	Satisfactory operation as specified.
--------------------------------------	--------------------------------------

Audibility range: Shall be heard in still air in the open not less than,

150 yards, 12 inch	418	454	418	382
100 " 8 inch	400			
50 " 4 "		328		

Note: These values computed from db. outputs given below.

Sound intensity:
Test made as described in par. 9. Results in decibels.

58	56	48	62	58	54
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Insulation resistance: (By 500 volt megger) (By 1000 volt megger)
Not less than 5 megohms. 100 100 100 200 200 200

Resistance of windings by bridge in ohms at ambient of 40°C.

6.24	6.13	17.50	174.7	196.6	404.4
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- (b) Omit internal steel parts and cadmium plating wherever practicable and substitute brass in order to minimize corrosion. If steel parts are retained, they should be protected by some method other than cadmium plating.
- (c) Substitute stamped stainless steel or stamped brass gongs for the present cast ones in order to reduce weight and increase ruggedness. Bells should be finished in gray, using "Glyptol" or similar lacquers.
- (d) A condenser, capable of withstanding a temperature of 65°C. should be substituted for the one now used in the 12 inch single stroke bell. During the first part of the endurance test at ambient temperature of 65°C., the greater part of the compound leaked out.

CONCLUSIONS

23. These bells, as manufactured by the Portsmouth Navy Yard, are of good workmanship and were, in general, satisfactory, under test for conformance with the specifications, ref. (b).

24. The bells have a good sound output and were they modified in accordance with reference (g), and paragraph 22 of this report, they should prove satisfactory for use in the Naval Service, particularly so from a corrosion standpoint.

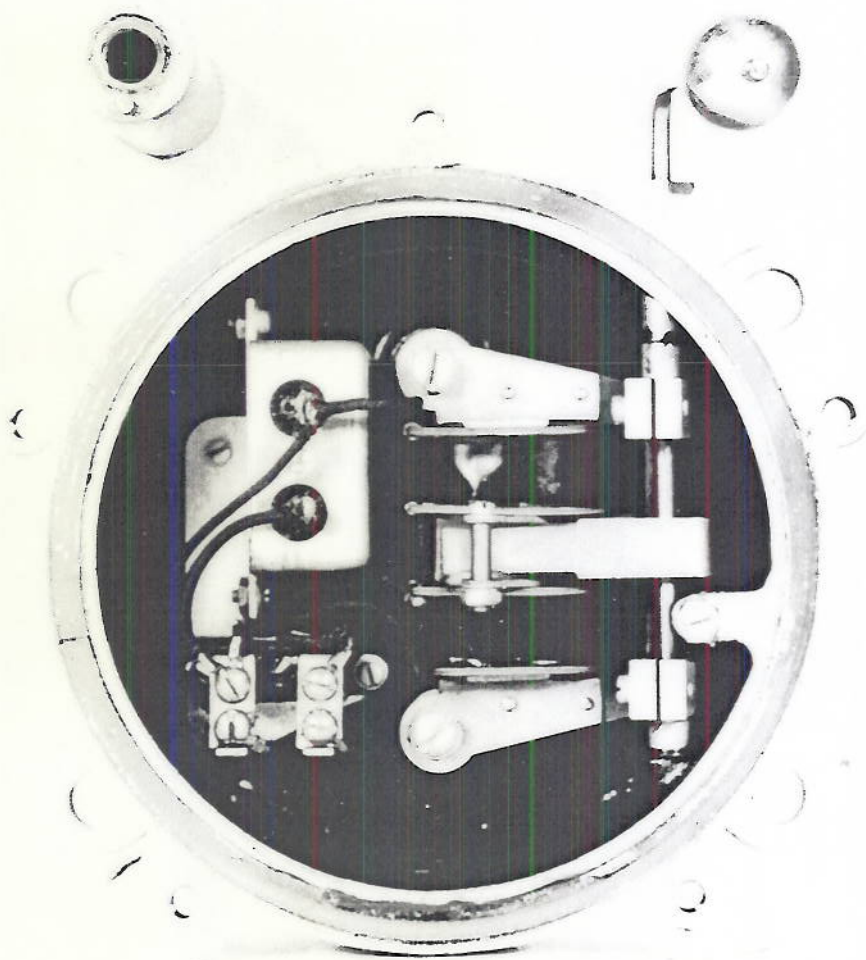


1542

*12" S.S. 115 V.A.C. 60 CYCLE
DRWG 11-T-1136*

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WASHINGTON, D. C.

PLATE I



1543

12" S.S. 115 V.A.C. 60 CYCLE
DRWG. 11-T-1136-L

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PLATE 2



1544

12" VIBRATING AC.-D.C.
DRWG. 11-T-1135-L

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PLATE 3

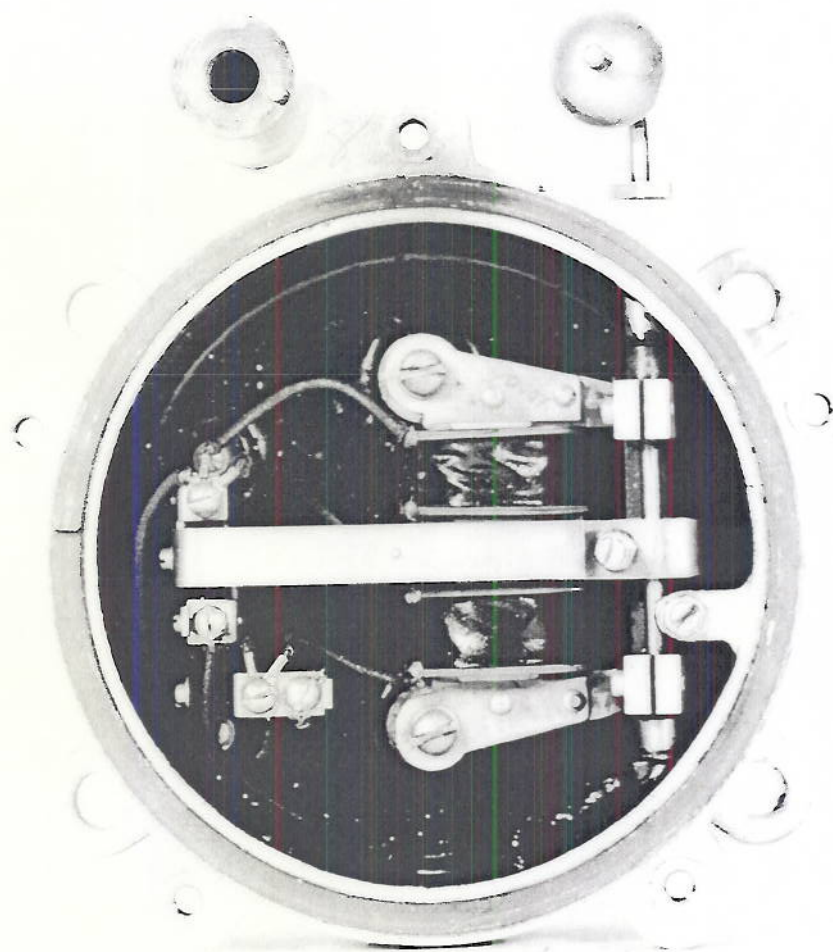


1548

8" VIBRATING A.C.-D.C.
DRWGS. 11-T-1133-L
11-T-1134-L

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PLATE 5

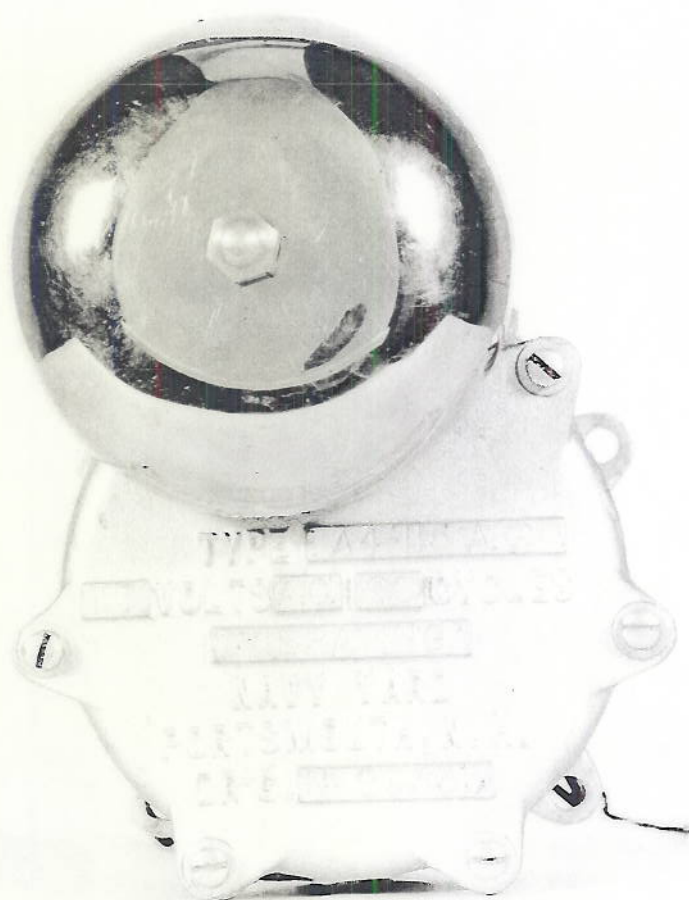


1547

8" VIBRATING A.C.-D.C.
DRWGS. 11-T-1133-L
11-T-1134-L

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PLATE 6

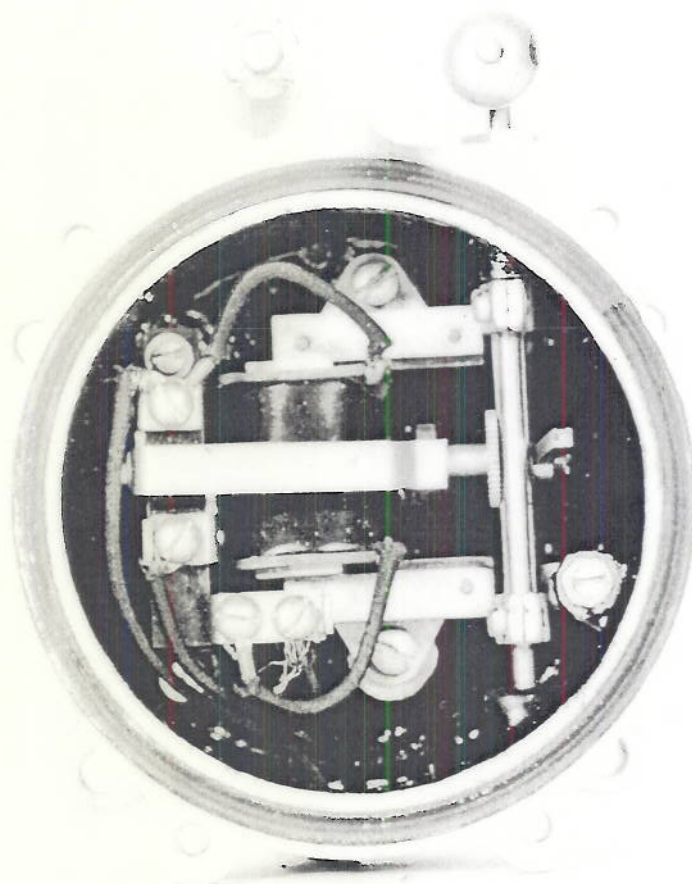


1548

4" VIBRATING A.C.-D.C.
DRWG. 11-T-1132-L

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PI ATF 7



1549

*4" VIBRATING A.C.-D.C.
DRWG. 11-T-1132-L*

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PI A T F R

Requirements	Test Values							
	20 volts A.C.				115 volts A.C.			
	12"	8"	4"	12"	8"	4"	12" S.S.	

Single stroke: 90 operations per minute, every alternate minute.

Satisfactory operation as specified.

Observable temperature: Not to exceed 100°C. at an ambient temp. of 65°C. during first part of endurance test.

88.3 90.8 84.3 92.9 92.3 87.6 86.9

Temperature rise: Not more than 30°C. rise at an ambient temp. of 40°C. during latter part of endurance test.

25.8 28.4 26.3 23.1 22.8 20.3 19.8

Inclination: Satisfactory operation when inclined 30° from vertical in all directions at 10% over and under normal voltage and 5 cycles above and below normal frequency.

Satisfactory operation as specified.

Satisfactory operation as specified.

Shock integrity: 250 ft. lb. shocks applied as specified by specifications, par. F-5c.

Representative bells of each type tested as specified and were unaffected by shock.

Audibility range: Shall be heard in still air in the open not less than

150 yards	12 inch	427		473		391
100 "	8 "		405		437	
50 "	4 "		337		373	

Note: These values were computed from the db outputs given below.

Sound intensity: Test made as described in par. 9. Results in decibels.

59 57 49 63 59 53 55

Insulation resistance before and after immersion.:

Before: Not less than 5 megohms.	(By 500 V. megger)	(By 1000 volt megger)
	100 100 100	200 200 200 200
After: Not less than 1 megohm.	100 100 100	100 100 100 100

Requirements	Test Values					
	20 volts D.C.			115 volts D.C.		
	12"	8"	4"	12"	8"	4"

Dielectric strength:
115 v. bells, 1230 v.
a.c., 60 cycles.

Satisfactory, no break-
downs occurring.

20 v. bells, 500 v.
a.c., 60 cycles

Satisfactory,
no breakdowns occurring.

WEIGHTS AND DIMENSIONS

Bell	Total Weight	Height	Width	Depth
12" single stroke	16 lbs.13 oz.	13"50	12"25	7"0
12" vibrating	16 lbs.11 oz.	13"50	12"25	7"0
8" "	9 lbs.10 oz.	11"50	9"50	6"75
4" "	2 lbs.12 oz.	7"00	5"25	4"375
Gong Weights:	12 inch	8 inch	4 inch	
	10 lbs.	3 lbs.4 oz.	10 oz.	

COMMENTS ON RESULTS OF TEST

18. The test results obtained show that the bells were, in general, satisfactory and complied with the specifications, reference (b).

19. The workmanship is good and the sound output of the bells is slightly better than that of those tested and reported in NRL Report No. B-1174 of 10 July 1935.

20. The present method of connecting the two windings in parallel is considered to be an advantage in view of the fact that it allows the bell to function even though one of the windings becomes open.

21. The magnet coils submitted do not conform with the specifications, par. D-6i. However, this is not considered objectionable in view of the fact they are made up on their respective cores and are easily installed.

22. Under inspection of the designs and materials, the following changes, in addition to those noted under reference (g), are considered desirable.

- (a) Omit "V" shaped circular ridge on the case cover which bears on rubber gasket of case and substitute grooves therefor.