18 September 1944. NRL Report No. B-2355

FR-2355

NAVY DEPARTMENT

Report of Test

on

Salinity Indicating Equipment

Submitted by

The Instrument Laboratory, Inc.,
Seattle, Washington.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

Number of Pages: Text - 6 Tables - 10 Plates - 13

Authorization: BuShips ltr. JJ17-I-19(335a) of 20 April 1944 to NRL.

Date of Test: June, July, August 1944.

Tested and Prepared by: _____
C. C. Tinstman, Jr., Ensign, USNR.

Reviewed by: _____
G.K.C. Hardesty, Asst. Supt., I.C. Division.

_____
W. B. Roberts, Supt., I. C. Division.

Approved by: _____
A. H. Van Keuren, Rear Admiral, USN, Director.

Distribution:
BuShips (5)

TABLE OF CONTENTS

SUBJECT	PAGE
Authorization for Test	1
Object of Test	1
Abstract of Test	1
(a) Conclusions	1a
(b) Recommendations	1b
Description of Material	2
Operation of the System	3
Method of Test	4
Results of Test	4
Conclusions	6

APPENDICES

	TABLES
Initial Accuracy Test at 115 volts, 60 cycles	1
Initial Accuracy Test at 108 volts, 55 cycles	2
Initial Accuracy Test at 122 volts, 65 cycles	3
Accuracy Test after Shock and Vibration at 115 volts, 60 cycles	4
Accuracy Test after Shock and Vibration at 108 volts, 55 cycles	5
Accuracy Test after Shock and Vibration at 122 volts, 65 cycles	6
Final Accuracy Test at 115 volts, 60 cycles	7
Final Accuracy Test at 108 volts, 55 cycles	8
Final Accuracy Test at 122 volts, 65 cycles	9
Equivalent Resistance values of Simulated Solutions in Ohms	10

	PLATES
Photograph of Salinity Indicator	1
Photograph of Salinity Indicator, Interior View	2
Curves of Error vs Temperature at 0.1 gr/gal - 115 v, 60 cycles	3
Curves of Error vs Temperature at 0.3 gr/gal - 115 v, 60 cycles	4
Curves of Error vs Temperature at 0.5 gr/gal - 115 v, 60 cycles	5
Curves of Error vs Temperature at 1.0 gr/gal - 115 v, 60 cycles	6
Curves of Error vs Temperature at 2.0 gr/gal - 115 v, 60 cycles	7
Curves of Error vs Temperature at 5.0 gr/gal - 115 v, 60 cycles	8
Curves of Error vs Temperature at 0.5 gr/gal - 108 v, 55 cycles	9
Curves of Error vs Temperature at 2.0 gr/gal - 108 v, 55 cycles	10
Curves of Error vs Temperature at 0.5 gr/gal - 122 v, 65 cycles	11
Curves of Error vs Temperature at 2.0 gr/gal - 122 v, 65 cycles	12
Conversion Curves	13

AUTHORIZATION FOR TEST

1. This problem was authorized by reference (a). Other references pertinent to this problem are listed as references (b) to (h) inclusive.

Reference: (a) BuShips ltr. JJ17-I-19(335a) of 20 April 1944 to NRL.
(b) Specification 17-I-19b of 1 April 1943.
(c) Specification 17E11(INT) of 15 May 1943.
(d) Manufacturer's Drwg. 6000-7724-Alt. 1; BuShips Plan No. S6505-551861.
(e) Manufacturer's Drwg. 6001-7724-Alt. 1; BuShips Plan No. S6505-551862.
(f) Manufacturer's Drwg. 6002-7724-Alt. 1; BuShips Plan No. S6505-551863.
(g) Manufacturer's Drwg. 6003-7724-Alt. 0.
(h) Manufacturer's Drwg. 6004-7724-Alt. 0.

OBJECT OF TEST

2. The object of this test was to determine conformance of the sample salinity indicating equipment with specification, reference (b), and a modified splashproof requirement as set forth in paragraph F-1b(2), subparagraph (b), of specification, reference (c).

ABSTRACT OF TEST

3. The sample salinity indicating equipment was set up at this Laboratory in suitable test circuits where its performance was carefully observed for compliance with the pertinent specifications. An inspection to determine conformance in the matter of materials, design, and workmanship, concluded the test on the indicator panel assembly.

4. Tests on the cell and valve assembly submitted with this equipment have not yet been conducted. The results of tests on this assembly will be forwarded as a supplementary report at the earliest possible date.

CONCLUSIONS

(a) The subject salinity indicator complied with specification, reference (b), but did not conform with the splashproof requirement described in paragraph F-1b(2), subparagraph (b), of specification, reference (c), as noted in Results of Test. Examination and an approximate dimensional check of the meter enclosure and the cover plate brought out the fact that the cover plate was bottoming on the enclosure mounting flange before its gasket had been compressed sufficiently to effect a splashproof seal. A change in gasket material, from the processed cord now used to something more suitable, such as rubber, along with an increase in the thickness of the gasket and the addition of a soft brass washer under the head of each of the four screws securing the cover plate, are considered desirable modifications.

(b) The hinging of the front panel at the right of the indicator case instead of at the bottom is also considered a desirable modification.

(c) The use of a wire wound potentiometer as a means of temperature compensation is a new feature of electrical design insofar as comparison with salinity equipment now in the service is concerned. It is not considered that its service life would equal that of the tapped switch type now used in approved equipment, nor would it be suitable for repair in service.

RECOMMENDATIONS

(a) That the subject salinity indicator be approved for Naval use subject to the Bureau's decision on the desirability of the use of a wire wound potentiometer and to the following modifications:

(1) The material of the gasket in the cover plate of the meter enclosure is to be changed from the processed cord now used to something more suitable such as rubber.

(2) The thickness of the gasket in the cover plate of the meter enclosure is to be approximately doubled to insure that it is sufficiently compressed when the cover plate is tightened down.

(3) A soft brass washer is to be provided for each of the four screws securing the cover plate of the meter enclosure, to eliminate the possibility of leakage at these points.

(4) The front panel of the indicator case is to be hinged to the right side of the case instead of at the bottom.

DESCRIPTION OF MATERIAL

5. The equipment submitted for test consists of one indicator unit, one conductivity cell and valve assembly, two spanner wrenches for the cell assembly, and one test resistor. It is designed to operate from a supply of 115 volts, 60 cycles, and its purpose is to indicate the saline content in the boiler feed, condenser, and other water lines.

6. The indicator unit consists of the following major parts:

(a) A transformer, ratio 115/115 - 15.

(b) A power factor type meter with a dial graduated in grains of sea salt per gallon, from 0 to 10 grains, with zones of the scale colored as follows:

Scale Reading	Indication
0 to 0.5 gr/gal	White
0.5 to 1.0 gr/gal	Green
1.0 to 10 gr/gal	Red

(c) A Navy type JR rotary transfer switch for connecting any one of seven salinity cells to the indicator circuit.

(d) A wire-wound 5,000 ohm potentiometer with a dial graduated from 55°F. to 240°F. in steps of 5°, by which the resistance in the measuring circuit may be varied to compensate for changes in the resistance of condensate due to temperature.

(e) A fixed resistance unit for checking the indicating meter accuracy at 1.0 gr/gal with the temperature compensator set at 110°F.

(f) A single pole double throw push button switch for checking the meter accuracy, the fixed resistance unit being substituted for a cell when the button is depressed.

(g) A pilot light, with a blue glass jewel lens, to indicate that the secondary circuits of the transformer are energized.

(h) A pair of G.E. type EL-1 fuse holders provided with neon blown fuse indicators and 3 amp, 250 volt cartridge type non-renewable fuses.

(i) A terminal block in two parts with connections for seven salinity cells and the power supply.

DESCRIPTION OF MATERIAL (Contd.)

7. All the above parts except the terminal block, which is mounted on the back wall of the case, are mounted on the front panel. This front panel is hinged at the bottom and is secured in the closed position by two cadmium plated steel "Shakeproof" panel fasteners, one in each upper corner. Both the panel and the case are of steel and are finished with gray paint.

8. Four Lord type rubber mountings, assembled into the four rear corner, are provided for mounting the indicator on a bulkhead. Further details of design and construction are shown in photographs, plates 1 and 2, and drawings, references (d), (e), (f), (g), and (h).

9. The portable test resistor is contained in a 2-1/2" diameter cylinder, 1 inch high. Female receptacles, for accomodating the cell electrodes are provided in one end. On the other end is a nameplate furnishing the correct information regarding temperature compensation setting for obtaining a check on the indicator and cell circuit at 1.0 gr/gal and 110°F.

OPERATION OF THE SYSTEM

10. The principal circuit elements of the salinity indicating equipment are the conductivity cell, a fixed resistance unit, the temperature compensating potentiometer (used as a rheostat), the indicating meter, and the 115 volt and 15 volt power supplies from the secondary windings of the transformer.

11. The elements of the indicating meter are two fixed resistance units, three movable coils, and two stationary coils. An essentially uniform field is set up between the two stationary coils which are connected in series and continuously energized from the 15 volt secondary of the transformer. In this field, supported on a common shaft which is free to rotate, are the three movable coils, two of which are wound at right angles to the third. Of these two, one is connected in series with temperature compensating potentiometer and the external fixed resistance unit, and the conductivity cell is shunted across this part of the circuit. This series-parallel combination, the other two movable coils, and the two internal resistance units are connected in series with respect to the 115 volt secondary of the transformer.

12. When the system is energized, the deflection of the pointer is determined by the reaction between the resultant field of the movable coils and the field of the stationary coils. Thus the deflection depends upon the relative magnitudes of the currents in the movable coils; i.e., it is a function of the resistance of the solution in which the cell is immersed and also of the resistance value selected on the temperature compensating potentiometer.

OPERATION OF THE SYSTEM (Contd.)

13. For a given temperature, the resistance across the cell varies inversely as the salinity of the solution, producing a corresponding variation in the relative magnitudes of the currents in the movable coils. For a given salinity the resistance across the cell varies inversely with the temperature, and the compensating potentiometer can be adjusted to establish the proper relation of current values in the movable coils for a correct meter reading.

METHOD OF TEST

14. The following tests were conducted in the order given:

(a)[1] Preliminary Accuracy - not specified.
(b) Endurance (50 hr.)
(c) Shock
(d) Vibration
(e)[2] Accuracy
(f) Endurance (450 hr.)
(g) Inclination
(h)[3] Final Accuracy - not specified.
(i) Dielectric and Insulation
(j) Splashproof - (indicator meter only)
(k) Material, Design, and Workmanship Inspection

Note: 1,2, and 3 - Accuracy of indication was checked at salinities of 0.1 gr/gal, 0.3 gr/gal, 0.5 gr/gal, 1.0 gr/gal, 2.0 gr/gal, and 5.0 gr/gal for each 10° from 50°F. to 200°F. on the temperature compensator at 115 volts, 60 cycles. The resistance values chosen were of simulated solutions at ±2.5° of the compensator settings (the dial being calibrated at 5° intervals), so that the instrument was alternately 2.5° over compensated, correctly compensated, and 2.5° under compensated. This procedure was repeated at 108 volts, 55 cycles, and 122 volts, 65 cycles.

RESULTS OF TEST

15. The test results were as follows:

Requirements	Test Values
Accuracy: Para. F-2k and E-6 of spec., ref. (b).	Complied. Variations ± 0.5% are considered within the limits of experimental error).
Endurance: Para. F-2f of spec., ref. (b).	Complied.

RESULTS OF TEST (Contd.)

Requirements (Contd.)	Test Values (Contd.)
Shock Integrity: Para. F-2h of spec., ref. (b).	Complied.
Vibration Integrity: Para. F-2i of spec., ref. (b).	Complied.
Inclination Integrity: Para. F-2g of spec., ref. (b).	Complied.
Indicator Pointer: Para. E-4c(11) of spec., ref. (b).	Complied.
Dielectric Strength: Para. F-2n of spec., ref. (b).	Complied.
Insulation Resistance: Para. F-2n of spec., ref. (b).	Complied.
Splashproof Integrity: Para. F-1b (2), subpara. (b) of spec., ref. (c).	Meter enclosure leaked approximately 2cc.
Scale Length: Para. E-4c(9) of spec., ref. (b).	Complied.
Selector Switch: Para. E-4c(13) of spec., ref. (b).	Complied.
Temperature Compensator: Para. E-4c(14) of spec., ref. (b).	Complied.
Pilot Light: Para. E-4c(15) of spec., ref. (b).	Complied.
Checking Resistor: Para. E-4c(17) of spec., ref. (b).	Complied.
Nameplate: Para. E-4c(19)a of spec., ref. (b).	Complied.
Cell Director Plate: Para. E-4c(19)b of spec., ref.(b).	Complied.
Weight and Dimensions: Para. E-4c(26) of spec., ref. (b).	Complied. Height - 20-1/4" Width - 13-1/8" Depth - 7-3/4" Weight - 36 lbs.

CONCLUSIONS

(a) The subject salinity indicator complied with specification, reference (b), but did not conform with the splashproof requirement described in paragraph F-1b(2), subparagraph (b), of specification, reference (c), as noted in Results of Test. Examination and an approximate dimensional check of the meter enclosure and the cover plate brought out the fact that the cover plate was bottoming on the enclosure mounting flange before its gasket had been sufficiently compressed to effect a splashproof seal. A change in the gasket material, from the processed cord now used to something more suitable, such as rubber, along with an increase in the thickness of the gasket and the addition of a soft brass washer under the head of each of the four screws securing the cover plate, are considered desirable modifications.

(b) The hinging of the front panel at the right of the indicator case instead of at the bottom is also considered a desirable modification.

(c) The use of a wire wound potentiometer as a means of temperature compensation is a new feature of electrical design insofar as comparison with salinity equipment now in the service is concerned. It is not considered that its service life would equal that of the tapped switch now used in approved equipment, nor would it be suitable for repair in service.

TABLE 1

INITIAL ACCURACY TEST
(115 volts, 60 cycles)

Compensation Setting °F.	Temp.(°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal.	0.3 Gr/ Gal.	0.5 Gr/ Gal.	1.0 Gr/ Gal.	2.0 Gr/ Gal.	5.0 Gr/ Gal.
60	57.5	- 1.0	- 1.5	- 2.5	- 2.5	- 1.0	- 0.5
60	60	- 0.5	- 0.5	- 2.0	- 1.5	0	0
60	62.5	0	0	- 1.0	- 0.5	0	0
70	67.5	- 1.0	- 2.0	- 2.0	- 2.5	- 0.5	- 0.5
70	70	- 0.5	- 0.5	- 1.5	- 1.5	0	0
70	72.5	0	0	- 1.0	- 0.5	+ 0.5	0
80	77.5	- 1.5	- 2.0	- 2.0	- 2.0	- 0.5	- 0.5
80	80	- 0.5	- 1.0	- 1.5	- 1.5	0	0
80	82.5	- 0.5	0	- 0.5	- 0.5	0	0
90	87.5	- 1.5	- 2.0	- 2.0	- 2.0	- 1.0	- 0.5
90	90	- 1.0	- 0.5	- 1.0	- 1.0	0	0
90	92.5	- 0.5	0	0	0	+ 0.5	0
100	97.5	- 1.5	- 1.5	- 2.0	- 2.0	- 0.5	0
100	100	- 1.0	- 1.0	- 1.0	- 1.0	0	0
100	102.5	- 0.5	0	0	- 0.5	+ 0.5	0
110	107.5	- 1.0	- 1.0	- 0.5	- 0.5	0	0
110	110	- 0.5	0	0	0	+ 0.5	0
110	112.5	0	+ 0.5	+ 0.5	+ 0.5	+ 0.5	0
120	117.5	- 1.5	- 1.0	- 1.0	- 1.0	0	0
120	120	- 1.0	- 0.5	- 0.5	- 0.5	0	0
120	122.5	- 0.5	0	0	0	+ 0.5	0
130	127.5	- 1.0	- 1.0	- 1.0	- 0.5	0	0
130	130	- 1.0	0	0	0	+ 0.5	0
130	132.5	- 0.5	+ 0.5	+ 0.5	+ 0.5	+ 0.5	0
140	137.5	- 1.0	- 0.5	- 0.5	0	0	0
140	140	- 0.5	0	0	0	+ 0.5	0
140	142.5	0	+ 0.5	+ 0.5	+ 0.5	+ 0.5	0
150	147.5	- 1.0	- 0.5	- 0.5	0	0	0
150	150	- 0.5	0	0	0	0	0
150	152.5	- 0.5	+ 0.5	+ 0.5	+ 0.5	+ 0.5	0
160	157.5	- 1.0	0	- 0.5	0	0	0
160	160	- 0.5	0	0	+ 0.5	+ 0.5	0
160	162.5	- 0.5	+ 0.5	+ 0.5	+ 1.0	+ 0.5	0
170	167.5	- 1.0	0	0	0	0	0
170	170	- 0.5	+ 0.5	+ 0.5	+ 0.5	+ 0.5	0
170	172.5	0	+ 1.0	+ 1.0	+ 1.0	+ 1.0	0
180	177.5	- 0.5	+ 0.5	+ 0.5	+ 0.5	0	0
180	180	- 0.5	+ 1.0	+ 0.5	+ 1.0	+ 0.5	0
180	182.5	0	+ 1.0	+ 1.0	+ 1.0	+ 1.0	0
190	187.5	- 1.0	+ 0.5	+ 0.5	+ 0.5	+ 0.5	0
190	190	- 0.5	+ 1.0	+ 1.0	+ 1.0	+ 0.5	0
190	192.5	0	+ 1.5	+ 1.0	+ 1.5	+ 0.5	0
200	197.5	- 1.0	+ 0.5	+ 0.5	+ 0.5	0	0
200	200	- 0.5	+ 1.0	+ 0.5	+ 1.0	+ 0.5	0
200	202.5	- 0.5	+ 1.5	+ 2.5	+ 1.5	+ 0.5	0

TABLE 2

INITIAL ACCURACY TEST
(108 volts, 55 cycles)

Compensation Setting °F.	Temp. (°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
60	57.5	- 0.5	- 0.5	- 2.0	- 2.5	- 1.0	- 1.0
60	60	0	0	- 1.5	- 2.0	- 0.5	- 0.5
60	62.5	+ 0.5	+ 0.5	- 0.5	- 1.0	0	0
70	67.5	- 0.5	- 1.0	- 2.0	- 2.5	- 1.0	- 1.0
70	70	0	0	- 1.5	- 2.0	- 0.5	- 0.5
70	72.5	0	0	- 0.5	- 1.0	0	0
80	77.5	- 1.0	- 1.5	- 2.0	- 2.5	- 0.5	- 0.5
80	80	- 0.5	- 0.5	- 1.5	- 2.0	0	- 0.5
80	82.5	0	+ 0.5	- 0.5	- 1.0	0	0
90	87.5	- 1.0	- 1.0	- 2.0	- 2.0	- 1.5	- 0.5
90	90	- 0.5	0	- 1.0	- 1.0	0	0
90	92.5	0	+ 0.5	- 0.5	- 0.5	+ 0.5	0
100	97.5	- 1.0	- 1.0	- 2.0	- 2.0	- 0.5	- 0.5
100	100	- 0.5	- 0.5	- 1.0	- 1.5	0	0
100	102.5	0	+ 0.5	- 0.5	- 0.5	0	0
110	107.5	- 0.5	- 0.5	- 0.5	- 1.0	0	0
110	110	- 0.5	0	0	- 0.5	0	0
110	112.5	0	+ 0.5	0	0	+ 0.5	0
120	117.5	- 1.0	- 1.0	- 1.5	- 1.0	- 0.5	- 0.5
120	120	- 0.5	0	- 0.5	- 0.5	0	0
120	122.5	0	0	0	0	+ 0.5	0
130	127.5	- 1.0	- 0.5	- 1.0	- 1.0	0	0
130	130	- 0.5	0	0	0	0	0
130	132.5	0	+ 0.5	0	+ 0.5	+ 0.5	0
140	137.5	- 0.5	0	- 0.5	- 0.5	0	0
140	140	0	+ 0.5	0	0	0	0
140	142.5	0	+ 0.5	0	+ 0.5	+ 0.5	0
150	147.5	- 0.5	0	- 0.5	- 0.5	0	0
150	150	- 0.5	+ 0.5	0	0	0	0
150	152.5	0	+ 1.0	+ 0.5	+ 0.5	+ 0.5	0
160	157.5	- 0.5	0	- 0.5	- 0.5	0	- 0.5
160	160	- 0.5	+ 0.5	0	0	0	0
160	162.5	0	+ 0.5	+ 0.5	+ 0.5	+ 0.5	0
170	167.5	- 0.5	+ 0.5	0	0	0	0
170	170	0	+ 1.0	0	+ 0.5	0	0
170	172.5	0	+ 1.0	+ 1.0	+ 1.0	+ 0.5	0
180	177.5	0	+ 0.5	0	0	0	0
180	180	0	+ 1.0	+ 0.5	+ 0.5	0	0
180	182.5	0	+ 1.0	+ 1.0	+ 1.0	+ 0.5	0
190	187.5	- 0.5	+ 0.5	+ 0.5	0	0	0
190	190	0	+ 1.0	+ 1.0	+ 1.0	0	0
190	192.5	0	+ 1.5	+ 1.0	+ 1.5	+ 0.5	0
200	197.5	- 0.5	+ 0.5	0	+ 0.5	0	0
200	200	0	+ 1.0	0	+ 0.5	0	0
200	202.5	0	+ 1.5	+ 2.5	+ 1.0	+ 0.5	0

TABLE 3

INITIAL ACCURACY TEST
(122 volts, 65 cycles)

Compensator Setting °F.	Temp.(°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
60	57.5	- 1.0	- 2.0	- 2.5	- 2.5	- 0.5	- 0.5
60	60	- 0.5	- 1.0	- 1.5	- 1.5	0	0
60	62.5	0	0	- 0.5	- 0.5	+ 0.5	0
70	67.5	- 1.0	- 2.5	- 2.0	- 2.5	- 0.5	- 0.5
70	70	- 0.5	- 1.5	- 1.5	- 1.5	0	0
70	72.5	- 0.5	- 0.5	- 0.5	- 0.5	+ 0.5	0
80	77.5	- 1.5	- 2.5	- 2.0	- 2.0	- 0.5	- 0.5
80	80	- 1.0	- 1.5	- 1.5	- 1.5	0	0
80	82.5	- 0.5	0	- 0.5	- 0.5	+ 0.5	0
90	87.5	- 1.5	- 2.0	- 2.0	- 2.0	- 1.0	- 0.5
90	90	- 1.0	- 1.0	- 1.0	- 1.0	0	0
90	92.5	- 0.5	0	- 0.5	0	+ 0.5	0
100	97.5	- 1.5	- 2.0	- 2.0	- 2.0	- 0.5	- 0.5
100	100	- 1.0	- 1.0	- 1.0	- 1.0	0	0
100	102.5	- 0.5	- 0.5	- 0.5	- 0.5	+ 0.5	0
110	107.5	- 1.0	- 1.5	- 0.5	- 1.0	0	0
110	110	- 0.5	- 0.5	- 0.5	0	+ 0.5	0
110	112.5	0	+ 0.5	0	+ 0.5	+ 1.0	0
120	117.5	- 1.5	- 2.0	- 1.5	- 1.0	0	0
120	120	- 1.0	- 1.0	- 0.5	- 0.5	0	0
120	122.5	- 0.5	- 0.5	0	0	+ 0.5	0
130	127.5	- 1.0	- 1.5	- 1.0	- 0.5	0	0
130	130	- 1.0	- 0.5	- 0.5	0	+ 0.5	0
130	132.5	- 0.5	0	0	+ 0.5	+ 0.5	0
140	137.5	- 1.0	- 0.5	- 1.0	0	0	0
140	140	- 0.5	0	0	0	+ 0.5	0
140	142.5	0	0	0	+ 0.5	+ 0.5	+ 0.5
150	147.5	- 1.0	- 0.5	- 1.0	0	0	0
150	150	- 0.5	0	0	+ 0.5	+ 0.5	0
150	152.5	- 0.5	0	0	+ 1.0	+ 0.5	0
160	157.5	- 0.5	- 0.5	- 0.5	0	0	0
160	160	- 0.5	0	0	+ 0.5	+ 0.5	0
160	162.5	0	+ 0.5	+ 0.5	+ 1.0	+ 0.5	0
170	167.5	- 0.5	0	0	0	0	0
170	170	- 0.5	+ 0.5	0	+ 0.5	+ 0.5	0
170	172.5	0	+ 1.0	+ 0.5	+ 1.0	+ 0.5	+ 0.5
180	177.5	- 0.5	+ 0.5	0	+ 0.5	+ 0.5	0
180	180	0	+ 1.0	+ 0.5	+ 1.0	+ 0.5	0
180	182.5	0	+ 1.0	+ 1.0	+ 1.0	+ 0.5	+ 0.5
190	187.5	- 0.5	0	+ 0.5	+ 0.5	0	0
190	190	- 0.5	+ 0.5	+ 0.5	+ 1.0	+ 0.5	0
190	192.5	0	+ 1.0	+ 1.0	+ 1.5	+ 0.5	+ 0.5
200	197.5	- 0.5	0	0	+ 0.5	0	0
200	200	- 0.5	+ 0.5	+ 0.5	+ 1.0	+ 0.5	0
200	202.5	0	+ 1.0	+ 2.5	+ 1.0	+ 0.5	0

TABLE 4

ACCURACY TEST AFTER SHOCK AND VIBRATION
(115 volts, 60 cycles)

Compensator Setting °F.	Temp.(°F) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
60	57.5	- 1.0	- 1.5	- 2.5	- 2.0	- 0.5	- 1.0
60	60	- 0.5	- 0.5	- 1.5	- 1.0	0	- 0.5
60	62.5	- 0.5	+ 0.5	- 1.0	0	+ 0.5	- 0.5
70	67.5	- 1.0	- 1.5	- 2.0	- 1.5	- 0.5	- 0.5
70	70	- 0.5	- 0.5	- 1.5	- 1.0	0	0
70	72.5	- 0.5	+ 0.5	- 1.0	0	+ 0.5	0
80	77.5	- 1.0	- 1.5	- 2.0	- 1.0	0	- 0.5
80	80	- 0.5	- 0.5	- 1.5	- 0.5	0	- 0.5
80	82.5	- 0.5	+ 0.5	- 1.0	0	+ 0.5	0
90	87.5	- 1.0	- 1.5	- 1.5	- 1.5	- 0.5	0
90	90	- 0.5	- 0.5	- 1.5	- 0.5	0	0
90	92.5	- 0.5	+ 0.5	- 0.5	0	+ 1.0	0
100	97.5	- 1.0	- 1.0	- 0.5	- 1.0	0	0
100	100	- 1.0	- 0.5	0	0	0	0
100	102.5	- 0.5	+ 0.5	+ 0.5	+ 0.5	+ 1.0	+ 0.5
110	107.5	- 1.0	- 0.5	+ 0.5	0	+ 0.5	0
110	110	- 0.5	0	+ 0.5	+ 0.5	+ 1.0	+ 0.5
110	112.5	0	+ 0.5	+ 1.0	+ 1.0	+ 1.0	+ 0.5
120	117.5	- 1.0	- 0.5	0	0	+ 0.5	0
120	120	- 0.5	- 0.5	+ 0.5	+ 0.5	+ 1.0	0
120	122.5	0	0	+ 0.5	+ 1.0	+ 1.0	+ 0.5
130	127.5	- 1.0	- 0.5	0	0	+ 0.5	0
130	130	- 1.0	0	+ 0.5	+ 1.0	+ 1.0	0
130	132.5	- 0.5	+ 0.5	+ 1.0	+ 1.5	+ 1.0	+ 0.5
140	137.5	+ 1.5	0	0	+ 0.5	+ 0.5	0
140	140	+ 2.0	+ 0.5	+ 0.5	+ 1.0	+ 1.0	0
140	142.5	+ 2.0	+ 1.0	+ 1.0	+ 1.5	+ 1.0	+ 0.5
150	147.5	+ 1.5	0	0	+ 0.5	+ 0.5	0
150	150	+ 2.0	+ 0.5	+ 0.5	+ 1.0	+ 1.0	+ 0.5
150	152.5	+ 2.0	+ 1.0	+ 1.5	+ 1.5	+ 1.0	+ 0.5
160	157.5	+ 1.5	0	+ 0.5	+ 0.5	+ 0.5	0
160	160	+ 2.0	+ 0.5	+ 1.0	+ 1.5	+ 1.0	0
160	162.5	+ 2.0	+ 1.0	+ 1.5	+ 1.5	+ 1.0	+ 0.5
170	167.5	+ 1.0	+ 0.5	+ 1.0	+ 1.0	+ 1.0	0
170	170	+ 1.5	+ 1.0	+ 1.0	+ 1.5	+ 1.0	0
170	172.5	+ 2.0	+ 1.5	+ 2.0	+ 2.0	+ 1.0	+ 0.5
180	177.5	+ 1.0	+ 1.0	+ 1.5	+ 1.0	+ 1.0	0
180	180	+ 1.5	+ 1.0	+ 1.5	+ 1.5	+ 1.0	+ 0.5
180	182.5	+ 1.5	+ 1.5	+ 2.0	+ 2.0	+ 1.0	+ 0.5
190	187.5	+ 1.0	+ 1.0	+ 1.0	+ 1.0	+ 0.5	0
190	190	+ 1.5	+ 1.0	+ 1.5	+ 1.5	+ 1.0	+ 0.5
190	192.5	+ 1.5	+ 1.5	+ 2.0	+ 2.0	+ 1.0	+ 0.5
200	197.5	+ 1.0	+ 0.5	+ 1.0	+ 0.5	+ 0.5	0
200	200	+ 1.5	+ 1.5	+ 1.0	+ 1.0	+ 1.0	+ 0.5
200	202.5	+ 1.5	+ 1.5	+ 2.0	+ 1.5	+ 1.0	+ 0.5

TABLE 5

ACCURACY TEST AFTER SHOCK AND VIBRATION
(108 volts, 55 cycles)

Compensator Setting °F.	Temp. (°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/Gal	0.3 Gr/Gal	0.5 Gr/Gal	1.0 Gr/Gal	2.0 Gr/Gal	5.0 Gr/Gal
60	57.5	+ 0.5	+ 0.5	- 1.0	- 1.5	- 0.5	- 0.5
60	60	+ 1.0	+ 1.0	+ 0.5	- 1.0	0	- 0.5
60	62.5	+ 1.5	+ 1.5	+ 1.0	0	+ 0.5	0
70	67.5	+ 0.5	- 1.5	- 1.0	- 1.0	0	- 0.5
70	70	+ 1.0	- 0.5	- 0.5	- 0.5	+ 0.5	0
70	72.5	+ 1.0	+ 0.5	+ 0.5	0	+ 1.0	0
80	77.5	+ 0.5	- 1.5	- 1.0	- 1.0	0	- 0.5
80	80	+ 0.5	- 0.5	0	- 0.5	+ 0.5	0
80	82.5	+ 0.5	+ 0.5	+ 0.5	0	+ 1.0	0
90	87.5	+ 0.5	- 1.0	- 1.0	- 1.0	- 0.5	- 0.5
90	90	+ 1.0	0	0	0	+ 0.5	0
90	92.5	+ 1.0	+ 0.5	+ 1.0	+ 0.5	+ 1.0	0
100	97.5	+ 0.5	- 1.0	- 0.5	- 1.0	0	- 0.5
100	100	+ 0.5	0	0	0	+ 0.5	0
100	102.5	+ 1.0	+ 0.5	+ 1.0	+ 0.5	+ 1.0	0
110	107.5	+ 0.5	- 0.5	+ 1.0	- 0	+ 0.5	0
110	110	+ 0.5	0	+ 1.0	+ 0.5	+ 1.0	+ 0.5
110	112.5	+ 1.0	+ 1.0	+ 1.5	+ 1.0	+ 1.5	+ 0.5
120	117.5	+ 0.5	- 0.5	0	0	+ 0.5	0
120	120	+ 0.5	0	+ 0.5	+ 0.5	+ 1.0	0
120	122.5	+ 1.0	+ 0.5	+ 1.0	+ 1.0	+ 1.0	+ 0.5
130	127.5	0	- 0.5	0	+ 0.5	+ 0.5	0
130	130	+ 0.5	0	+ 1.0	+ 1.0	+ 1.0	+ 0.5
130	132.5	+ 0.5	+ 1.0	+ 1.0	+ 1.5	+ 1.5	+ 0.5
140	137.5	+ 2.0	0	0	+ 1.0	+ 0.5	0
140	140	+ 2.0	+ 0.5	+ 1.0	+ 1.0	+ 1.0	+ 0.5
140	142.5	+ 2.5	+ 1.0	+ 1.5	+ 2.0	+ 1.0	+ 0.5
150	147.5	+ 2.0	0	0	+ 0.5	+ 0.5	0
150	150	+ 2.0	+ 0.5	+ 1.0	+ 1.5	+ 1.0	0
150	152.5	+ 2.0	+ 1.0	+ 1.5	+ 1.5	+ 1.0	+ 0.5
160	157.5	+ 1.5	0	+ 0.5	+ 1.0	+ 0.5	0
160	160	+ 2.0	+ 1.0	+ 1.0	+ 1.5	+ 1.0	0
160	162.5	+ 2.0	+ 1.0	+ 1.5	+ 2.0	+ 1.0	+ 0.5
170	167.5	+ 1.5	+ 0.5	+ 1.0	+ 1.0	+ 0.5	0
170	170	+ 1.5	+ 1.0	+ 1.0	+ 1.5	+ 1.0	0
170	172.5	+ 2.0	+ 1.5	+ 2.0	+ 2.0	+ 1.0	0
180	177.5	+ 1.5	+ 0.5	+ 1.0	+ 1.5	+ 1.0	0
180	180	+ 1.5	+ 1.0	+ 1.5	+ 1.5	+ 1.0	+ 0.5
180	182.5	+ 2.0	+ 1.5	+ 2.0	+ 2.0	+ 1.0	+ 0.5
190	187.5	+ 1.5	+ 0.5	+ 1.0	+ 1.0	+ 1.0	0
190	190	+ 1.5	+ 1.0	+ 1.5	+ 2.5	+ 1.0	+ 0.5
190	192.5	+ 2.0	+ 2.0	+ 2.0	+ 3.0	+ 1.0	+ 0.5
200	197.5	+ 1.0	+ 0.5	+ 1.0	+ 2.0	+ 0.5	0
200	200	+ 1.5	+ 1.0	+ 1.0	+ 2.5	+ 1.0	+ 0.5
200	202.5	+ 1.5	+ 1.5	+ 2.0	+ 2.5	+ 1.0	+ 0.5

TABLE 6

ACCURACY TEST AFTER SHOCK AND VIBRATION
(122 volts, 65 cycles)

Compensator Setting °F.	Temp.(°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
60	57.5	- 2.0	- 2.5	- 2.0	- 1.0	- 0.5	- 1.0
60	60	- 1.0	- 1.5	- 1.0	0	+ 0.5	- 0.5
60	62.5	- 0.5	- 0.5	0	+ 1.0	+ 1.0	- 0.5
70	67.5	- 1.5	- 2.5	- 2.0	- 0.5	- 0.5	- 1.0
70	70	- 1.0	- 2.0	- 1.0	0	+ 0.5	- 0.5
70	72.5	- 0.5	- 0.5	0	+ 1.0	+ 1.0	0
80	67.5	- 1.5	- 2.5	- 1.5	0	0	- 0.5
80	80	- 1.0	- 1.0	- 1.0	0	+ 0.5	- 0.5
80	82.5	- 0.5	0	0	+ 1.0	+ 1.0	0
90	87.5	- 1.5	- 2.0	- 1.5	- 0.5	- 0.5	- 0.5
90	90	- 1.0	- 1.0	- 1.0	+ 0.5	+ 0.5	- 0.5
90	92.5	- 0.5	0	0	+ 1.0	+ 1.0	0
100	97.5	- 1.5	- 1.5	- 1.5	- 0.5	0	- 0.5
100	100	- 1.0	- 1.0	- 0.5	0	+ 0.5	0
100	102.5	- 0.5	0	0	+ 1.0	+ 1.0	0
110	107.5	- 1.0	- 1.0	0	+ 0.5	+ 0.5	- 0.5
110	110	- 0.5	- 0.5	0	+ 1.0	+ 1.0	0
110	112.5	0	+ 0.5	+ 0.5	+ 1.5	+ 1.5	0
120	117.5	- 1.5	- 1.0	- 1.0	+ 0.5	+ 0.5	- 0.5
120	120	- 1.0	- 0.5	0	+ 1.0	+ 1.0	0
120	122.5	- 0.5	0	+ 0.5	+ 1.5	+ 1.0	0
130	127.5	- 1.0	- 0.5	- 0.5	+ 0.5	+ 1.0	0
130	130	- 0.5	0	0	+ 1.0	+ 1.0	0
130	132.5	0	+ 0.5	+ 0.5	+ 1.5	+ 1.5	0
140	137.5	- 1.0	0	- 0.5	+ 1.0	+ 1.0	0
140	140	- 0.5	+ 0.5	+ 0.5	+ 1.5	+ 1.0	0
140	142.5	+ 0.5	+ 0.5	+ 1.0	+ 2.0	+ 1.5	0
150	147.5	- 0.5	0	- 0.5	+ 1.0	+ 0.5	0
150	150	- 0.5	+ 0.5	+ 0.5	+ 1.5	+ 1.0	0
150	152.5	0	+ 1.0	+ 1.0	+ 1.5	+ 1.5	0
160	157.5	- 0.5	0	0	+ 1.0	+ 1.0	0
160	160	- 0.5	+ 0.5	+ 0.5	+ 1.5	+ 1.0	0
160	162.5	+ 0.5	+ 1.0	+ 1.0	+ 2.0	+ 1.0	0
170	167.5	- 0.5	+ 0.5	+ 0.5	+ 1.0	+ 1.0	0
170	170	0	+ 1.0	+ 1.0	+ 1.5	+ 1.0	0
170	172.5	+ 0.5	+ 1.0	+ 1.5	+ 2.0	+ 1.5	+ 0.5
180	177.5	- 0.5	+ 0.5	+ 1.5	+ 1.5	+ 1.0	0
180	180	0	+ 1.0	+ 2.0	+ 1.5	+ 1.0	0
180	182.5	+ 0.5	+ 1.5	+ 2.5	+ 2.0	+ 1.5	+ 0.5
190	187.5	- 0.5	+ 0.5	+ 1.0	+ 1.5	+ 1.0	0
190	190	- 0.5	+ 1.0	+ 1.5	+ 2.0	+ 1.0	0
190	192.5	0	+ 1.5	+ 2.0	+ 2.5	+ 1.5	0
200	197.5	- 1.0	+ 0.5	+ 1.0	+ 1.5	+ 1.0	0
200	200	- 0.5	+ 1.0	+ 1.0	+ 2.0	+ 1.0	0
200	202.5	0	+ 1.5	+ 2.0	+ 2.5	+ 1.5	+ 0.5

TABLE 7

FINAL ACCURACY TEST
(115 volts, 60 cycles)

Compensator Setting °F.	Temp.(°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
60	57.5	+ 1.5	- 2.5	- 2.0	- 2.0	- 1.5	- 1.0
60	60	+ 2.0	- 2.0	- 0.5	- 0.5	- 0.5	- 0.5
60	62.5	+ 2.5	- 1.0	0	0	+ 0.5	0
70	67.5	+ 1.0	- 2.5	- 1.5	- 0.5	- 1.0	- 1.0
70	70	+ 1.5	- 2.0	- 1.0	0	0	0
70	72.5	+ 2.0	- 1.0	0	+ 1.0	+ 0.5	0
80	77.5	+ 1.0	- 2.0	- 1.5	0	- 0.5	- 0.5
80	80	+ 1.5	- 1.5	- 0.5	+ 0.5	0	0
80	82.5	+ 1.5	- 1.0	0	+ 1.0	+ 0.5	0
90	87.5	+ 0.5	- 2.0	- 1.0	- 0.5	- 1.0	- 0.5
90	90	+ 1.0	- 1.5	- 0.5	+ 0.5	0	0
90	92.5	+ 1.5	- 1.0	0	+ 1.0	+ 0.5	0
100	97.5	+ 0.5	- 1.5	- 1.0	0	- 0.5	- 0.5
100	100	+ 1.0	- 1.0	- 0.5	+ 0.5	0	0
100	102.5	+ 1.0	- 0.5	0	+ 1.0	+ 0.5	0
110	107.5	+ 1.0	- 1.0	0	+ 0.5	0	0
110	110	+ 1.0	- 0.5	+ 0.5	+ 1.0	+ 0.5	0
110	112.5	+ 1.5	0	+ 1.0	+ 1.5	+ 1.0	0
120	117.5	+ 0.5	- 1.0	- 0.5	+ 0.5	0	0
120	120	+ 0.5	- 0.5	0	+ 1.0	0	0
120	122.5	+ 1.0	0	+ 0.5	+ 1.0	+ 0.5	0
130	127.5	+ 0.5	- 1.0	- 0.5	+ 0.5	+ 0.5	0
130	130	+ 0.5	- 0.5	+ 0.5	+ 1.0	+ 1.0	0
130	132.5	+ 1.0	0	+ 1.0	+ 1.5	+ 1.0	0
140	137.5	+ 0.5	- 0.5	0	+ 1.0	+ 0.5	0
140	140	+ 0.5	0	+ 0.5	+ 1.0	+ 1.0	0
140	142.5	+ 1.0	+ 0.5	+ 1.0	+ 1.5	+ 1.0	0
150	147.5	+ 0.5	0	0	+ 1.0	+ 0.5	0
150	150	+ 0.5	+ 0.5	+ 0.5	+ 1.5	+ 0.5	0
150	152.5	+ 1.0	+ 1.0	+ 1.0	+ 1.5	+ 1.0	0
160	157.5	0	0	0	+ 1.5	+ 0.5	0
160	160	+ 0.5	+ 0.5	+ 0.5	+ 1.5	+ 0.5	0
160	162.5	+ 1.0	+ 1.0	+ 1.0	+ 2.0	+ 1.0	0
170	167.5	+ 0.5	+ 0.5	+ 0.5	+ 1.0	+ 0.5	0
170	170	+ 1.0	+ 1.0	+ 1.0	+ 1.5	+ 1.0	0
170	172.5	+ 1.0	+ 1.0	+ 1.5	+ 2.0	+ 1.0	0
180	177.5	+ 0.5	+ 0.5	+ 0.5	+ 1.5	+ 0.5	0
180	180	+ 1.0	+ 1.0	+ 1.0	+ 1.5	+ 0.5	0
180	182.5	+ 1.0	+ 1.5	+ 1.5	+ 2.0	+ 1.0	+ 0.5
190	187.5	+ 0.5	+ 0.5	+ 0.5	+ 1.5	+ 0.5	0
190	190	+ 0.5	+ 1.0	+ 1.0	+ 1.5	+ 0.5	0
190	192.5	+ 1.0	+ 1.5	+ 1.5	+ 2.0	+ 1.0	0
200	197.5	+ 0.5	+ 0.5	+ 0.5	+ 1.0	+ 0.5	0
200	200	+ 0.5	+ 1.0	+ 1.0	+ 1.5	+ 0.5	0
200	202.5	+ 1.0	+ 1.5	+ 1.5	+ 2.0	+ 1.0	0

TABLE 8

FINAL ACCURACY TEST
(108 volts, 55 cycles)

Compensator Setting °F.	Temp.(°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
60	57.5	0	- 1.5	- 2.0	- 2.0	- 1.0	- 1.5
60	60	+ 0.5	- 0.5	- 1.0	- 1.0	- 0.5	- 1.0
60	62.5	+ 1.0	0	- 0.5	0	0	- 1.0
70	67.5	0	- 1.5	- 2.0	- 1.5	- 1.0	- 1.5
70	70	+ 0.5	- 0.5	- 1.0	- 0.5	- 0.5	- 1.0
70	72.5	+ 1.0	0	0	0	0	- 1.0
80	77.5	0	- 1.5	- 1.0	- 1.0	- 0.5	- 1.0
80	80	+ 0.5	- 0.5	- 0.5	- 0.5	0	- 0.5
80	82.5	+ 1.0	0	0	0	0	- 0.5
90	87.5	0	- 1.5	- 1.0	- 1.5	- 1.0	- 1.0
90	90	+ 0.5	- 0.5	- 0.5	0	0	- 0.5
90	92.5	+ 0.5	0	+ 0.5	+ 0.5	+ 0.5	- 0.5
100	97.5	0	- 1.0	- 1.0	- 1.5	- 0.5	- 1.0
100	100	0	- 0.5	0	- 1.0	0	- 0.5
100	102.5	+ 0.5	0	+ 0.5	+ 0.5	+ 0.5	- 0.5
110	107.5	0	- 0.5	+ 0.5	0	0	- 1.0
110	110	+ 0.5	0	+ 0.5	+ 0.5	+ 0.5	- 0.5
110	112.5	+ 1.0	+ 1.0	+ 1.0	+ 1.5	+ 1.0	0
120	117.5	0	- 1.0	- 0.5	0	0	- 0.5
120	120	0	- 0.5	0	0	0	- 0.5
120	122.5	+ 1.0	0	+ 1.0	+ 1.0	+ 0.5	0
130	127.5	0	- 0.5	0	+ 0.5	0	0
130	130	0	0	+ 0.5	+ 1.0	0	0
130	132.5	+ 0.5	+ 0.5	+ 1.0	+ 2.0	+ 0.5	0
140	137.5	0	0	0	+ 0.5	0	0
140	140	0	+ 0.5	+ 0.5	+ 1.5	0	0
140	142.5	+ 0.5	+ 1.0	+ 1.5	+ 2.0	+ 0.5	0
150	147.5	0	0	0	+ 1.0	0	0
150	150	0	+ 0.5	+ 1.0	+ 1.5	0	0
150	152.5	0	+ 1.0	+ 1.5	+ 1.5	+ 0.5	0
160	157.5	0	0	0	+ 1.0	0	0
160	160	0	+ 0.5	+ 1.0	+ 1.5	0	0
160	162.5	0	+ 1.0	+ 1.5	+ 2.0	+ 0.5	0
170	167.5	0	+ 0.5	+ 1.0	+ 1.0	0	0
170	170	0	+ 1.0	+ 1.0	+ 1.5	0	0
170	172.5	+ 0.5	+ 1.5	+ 2.0	+ 2.0	+ 0.5	0
180	177.5	0	+ 1.0	+ 1.0	+ 1.5	0	0
180	180	+ 0.5	+ 1.0	+ 1.5	+ 1.5	0	0
180	182.5	+ 0.5	+ 1.5	+ 2.0	+ 2.0	+ 0.5	0
190	187.5	0	+ 0.5	+ 1.0	+ 1.5	0	0
190	190	+ 0.5	+ 1.0	+ 1.5	+ 1.5	0	0
190	192.5	+ 0.5	+ 1.5	+ 2.0	+ 2.0	+ 0.5	0
200	197.5	0	+ 1.0	+ 1.0	+ 1.0	0	0
200	200	0	+ 1.5	+ 1.0	+ 1.5	0	0
200	202.5	+ 0.5	+ 2.0	+ 2.0	+ 2.0	+ 0.5	+ 0.5

TABLE 9

FINAL ACCURACY TEST
(122 volts, 65 cycles)

Compensator Setting °F.	Temp.(°F.) for values of resistances taken from curves	Errors in percent of full scale linear distance 0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
60	57.5	- 0.5	- 2.0	- 1.5	- 1.5	0	0
60	60	0	- 1.0	- 0.5	- 0.5	+ 0.5	0
60	62.5	+ 0.5	0	0	0	+ 1.0	+ 0.5
70	67.5	- 0.5	- 2.0	- 1.5	- 1.0	0	0
70	70	0	- 1.0	- 0.5	0	+ 0.5	0
70	72.5	+ 0.5	- 0.5	0	+ 1.0	+ 1.0	+ 0.5
80	77.5	- 0.5	- 2.0	- 1.0	- 0.5	0	0
80	80	0	- 1.0	- 0.5	0	+ 0.5	0
80	82.5	0	- 0.5	0	+ 0.5	+ 1.0	+ 0.5
90	87.5	- 0.5	- 2.0	- 1.0	- 0.5	0	0
90	90	0	- 1.0	- 0.5	0	+ 0.5	+ 0.5
90	92.5	0	0	+ 0.5	+ 1.0	+ 1.0	+ 0.5
100	97.5	- 0.5	- 1.5	- 1.0	- 0.5	0	0
100	100	0	- 0.5	0	0	+ 0.5	0
100	102.5	0	0	+ 0.5	+ 1.0	+ 1.0	+ 0.5
110	107.5	0	- 1.0	0	+ 0.5	+ 0.5	0
110	110	0	- 0.5	+ 0.5	+ 1.0	+ 1.0	+ 0.5
110	112.5	+ 0.5	+ 0.5	+ 1.0	+ 2.0	+ 1.5	+ 0.5
120	117.5	- 0.5	- 1.0	- 0.5	0	+ 0.5	0
120	120	0	- 0.5	0	+ 0.5	+ 0.5	+ 0.5
120	122.5	+ 0.5	0	+ 1.0	+ 1.0	+ 1.0	+ 0.5
130	127.5	- 0.5	- 1.0	0	+ 0.5	+ 0.5	+ 0.5
130	130	- 0.5	- 0.5	+ 0.5	+ 1.0	+ 1.0	+ 0.5
130	132.5	0	+ 0.5	+ 1.0	+ 2.0	+ 1.0	+ 0.5
140	137.5	- 0.5	- 0.5	0	+ 1.0	+ 0.5	+ 0.5
140	140	- 0.5	+ 0.5	+ 0.5	+ 1.5	+ 1.0	+ 0.5
140	142.5	0	+ 1.0	+ 1.0	+ 2.0	+ 1.0	+ 1.0
150	147.5	- 0.5	0	0	+ 1.0	+ 0.5	+ 0.5
150	150	0	+ 0.5	+ 0.5	+ 1.5	+ 1.0	+ 0.5
150	152.5	0	+ 1.0	+ 1.5	+ 2.0	+ 1.0	+ 0.5
160	157.5	- 0.5	0	0	+ 1.0	+ 0.5	+ 0.5
160	160	- 0.5	+ 0.5	+ 0.5	+ 1.5	+ 1.0	+ 0.5
160	162.5	0	+ 1.0	+ 1.5	+ 2.0	+ 1.0	+ 1.0
170	167.5	- 0.5	0	+ 0.5	+ 1.0	+ 1.0	+ 0.5
170	170	0	+ 1.0	+ 1.5	+ 1.5	+ 1.0	+ 0.5
170	172.5	0	+ 1.0	+ 2.0	+ 2.5	+ 1.0	+ 1.0
180	177.5	0	+ 0.5	+ 1.5	+ 1.5	+ 1.0	+ 0.5
180	180	0	+ 1.0	+ 2.0	+ 2.0	+ 1.0	+ 0.5
180	182.5	0	+ 1.5	+ 2.5	+ 2.0	+ 1.0	+ 1.0
190	187.5	- 0.5	+ 0.5	+ 1.0	+ 1.5	+ 1.0	+ 0.5
190	190	0	+ 1.0	+ 1.5	+ 2.0	+ 1.0	+ 1.0
190	192.5	0	+ 1.5	+ 2.0	+ 2.0	+ 1.0	+ 1.0
200	197.5	- 0.5	+ 0.5	+ 1.0	+ 1.5	+ 0.5	+ 0.5
200	200	0	+ 1.0	+ 1.0	+ 1.5	+ 1.0	+ 0.5
200	202.5	0	+ 1.5	+ 2.0	+ 2.0	+ 1.0	+ 1.0

TABLE 10

TABLE OF RESISTANCE OF SOLUTION IN OHMS

Taken from Resistance - Temperature Curves, Figure 1 of Reference (b).

Solution Temp. (°F.)	0.1 Gr/ Gal	0.3 Gr/ Gal	0.5 Gr/ Gal	1.0 Gr/ Gal	2.0 Gr/ Gal	5.0 Gr/ Gal
57.5	21800	9300	6050	3230	1620	680
60	21000	9000	5850	3120	1560	653
62.5	20300	8700	5700	3030	1510	635
67.5	19010	8250	5350	2850	1430	600
70	18500	8000	5200	2780	1390	578
72.5	18000	7800	5050	2680	1340	560
77.5	17000	7350	4750	2510	1260	530
80	16500	7150	4620	2480	1230	515
82.5	16000	6900	4500	2400	1200	500
87.5	15200	6600	4250	2280	1180	475
90	14800	6400	4150	2200	1110	460
92.5	14400	6200	4020	2130	1080	450
97.5	13600	5900	3830	2050	1030	430
100	13400	5780	3720	2000	1000	418
102.5	13000	5600	3630	1950	980	408
107.5	12400	5380	3400	1850	935	390
110	12200	5250	3380	1800	910	380
112.5	11800	5100	3300	1750	895	372
117.5	11300	4900	3150	1680	855	355
120	11100	4800	3080	1650	840	350
122.5	10800	4700	3020	1620	820	340
127.5	10400	4500	2900	1540	785	328
130	10300	4400	2830	1500	770	320
132.5	10000	4300	2780	1470	755	315
137.5	9700	4100	2680	1410	730	302
140	9500	4000	2610	1390	715	298
142.5	9350	3950	2570	1360	700	290
147.5	8850	3780	2480	1310	675	282
150	8780	3720	2420	1280	665	278
152.5	8700	3650	2380	1260	650	272
157.5	8300	3520	2300	1220	630	263
160	8150	3450	2250	1190	620	260
162.5	8000	3400	2200	1170	610	253
167.5	7700	3280	2120	1140	590	247
170	7600	3200	2100	1120	580	242
172	7450	3150	2050	1090	570	238
177.5	7200	3050	1990	1060	555	232
180	7100	3000	1960	1050	550	228
182.5	7000	2970	1930	1030	540	224
187.5	6800	2880	1870	1000	522	218
190	6700	2820	1840	980	518	214
192.5	6600	2780	1820	965	510	211
197.5	6400	2700	1760	940	495	205
200	6300	2650	1750	925	488	202
202.5	6200	2600	1710	910	480	198

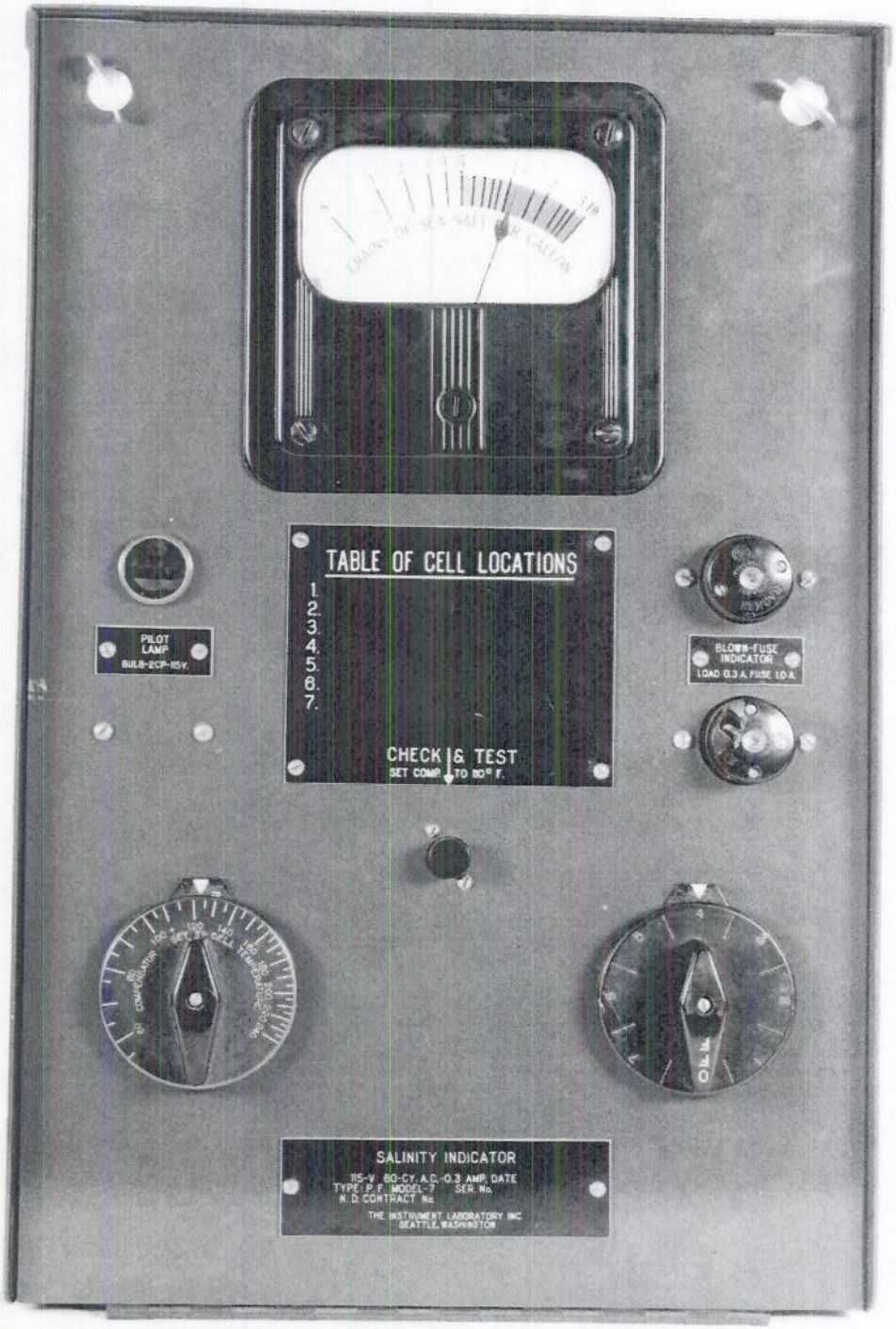


TABLE OF CELL LOCATIONS
1.
2.
3.
4.
5.
6.
7.
CHECK & TEST
SET COMP. TO 80° F.
PILOT LAMP
BULB-2CP-115V.
BLOWN-FUSE INDICATOR
LOAD 0.3 A. FUSE 1.0 A.
SALINITY INDICATOR
115-V. 60-CY. A.C.-0.3 AMP. DATE
TYPE P. F. MODEL-7 SER. No.
N. D. CONTRACT No.
THE INSTRUMENT LABORATORY INC.
SEATTLE, WASHINGTON

PLATE 1

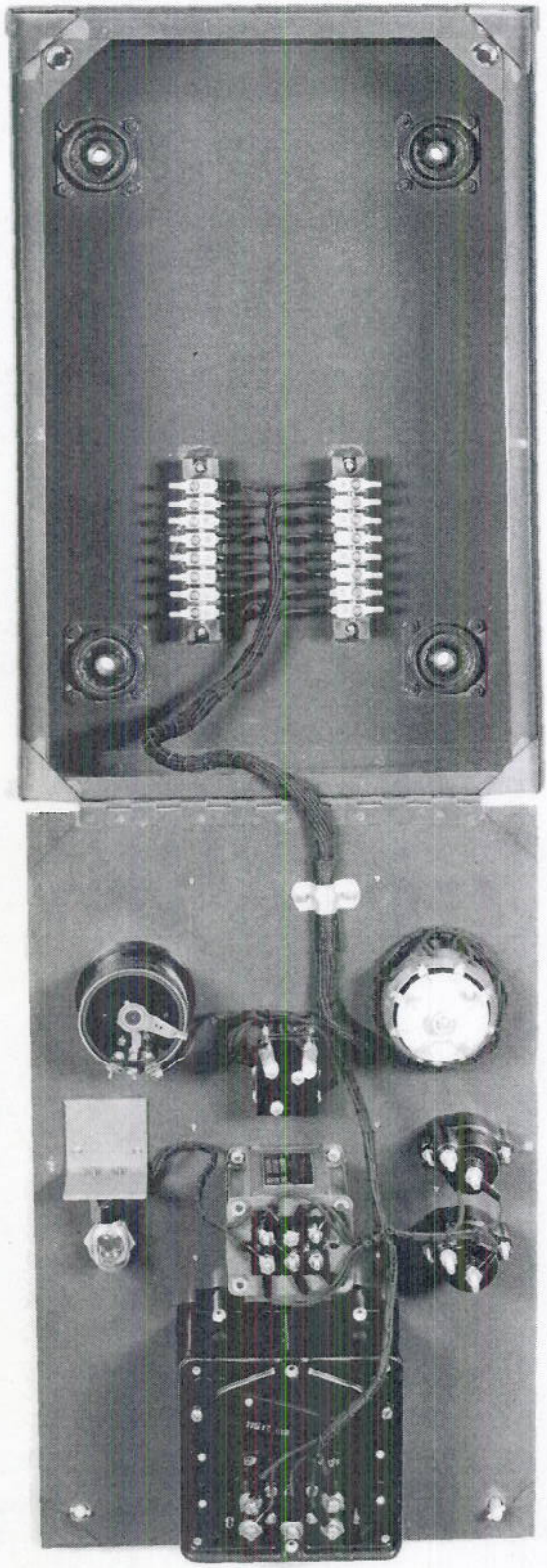


PLATE 2

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

ACCURACY
0.1% FSL - MOD 151

AFTER SHOCK AND VIBRATION

INITIAL

2.5° OVER COMPENSATED

2.5° UNDER COMPENSATED

FINAL

2.5° OVER COMPENSATED

2.5° UNDER COMPENSATED

ERRORS IN PER CENT OF FULL SCALE LINEAR DISTANCE

-2.0 -1.0 0 +1.0 +2.0

TEMPERATURE (°F) OF SIMULATED SOLUTION

200 180 160 140 120 100 80 60

PLATE 3

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

ERRORS IN PER CENT OF FULL SCALE LINEAR DISTANCE

-2.0 -1.0 0 +1.0 +2.0

FINAL

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

ACCURACY
0.3 sec. TRAVEL - 15g SHOCK AND VIBRATION
AFTER SHOCK AND VIBRATION

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

INITIAL

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

200 180 160 140 120 100 80 60

TEMPERATURE (°F) OF SIMULATED SOLUTION

PLATE 4

U. S. NAVAL RESEARCH LABORATORY
• BELLEVUE, D.C.

DATE

ACCURACY, MOD 0, 15-JET, 60M

AFTER SHOCK AND VIBRATION

FINAL

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

INITIAL

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

-2.0 -1.0 0 +1.0 +2.0

ERRORS IN PER CENT OF FULL SCALE LINEAR DISTANCE

200 180 160 140 120 100 80 60

TEMPERATURE (°F) OF SIMULATED SOLUTION

PLATE 5

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

PLATE 6

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

ACCURACY
AFTER SHOCK AND VIBRATION
MOG TYPE 1151 GOM

FINAL

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

INITIAL

2.5° UNDER COMPENSATED

2.5° OVER COMPENSATED

-2.0 -1.0 0 +1.0 +2.0

-2.0 -1.0 0 +1.0 +2.0

-2.0 -1.0 0 +1.0 +2.0

ERRORS IN PER CENT OF FULL SCALE LINEAR DISTANCE

200 180 160 140 120 100 80 60

TEMPERATURE (°F) OF SIMULATED SOLUTION

PLATE 7

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

PLATE 8

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

PLATE 9

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

ACCURACY AFTER SHOCK AND VIBRATION
20 g's at 10 to 1,000 c.p.s.

INITIAL

2.5° OVER COMPENSATED

2.5° UNDER COMPENSATED

FINAL

2.5° OVER COMPENSATED

2.5° UNDER COMPENSATED

-2.0 -1.0 0 +1.0 +2.0

ERRORS IN PER CENT OF FULL SCALE LINEAR DISTANCE

TEMPERATURE (°F) OF SIMULATED SOLUTION

60 80 100 120 140 160 180 200

PLATE 10

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

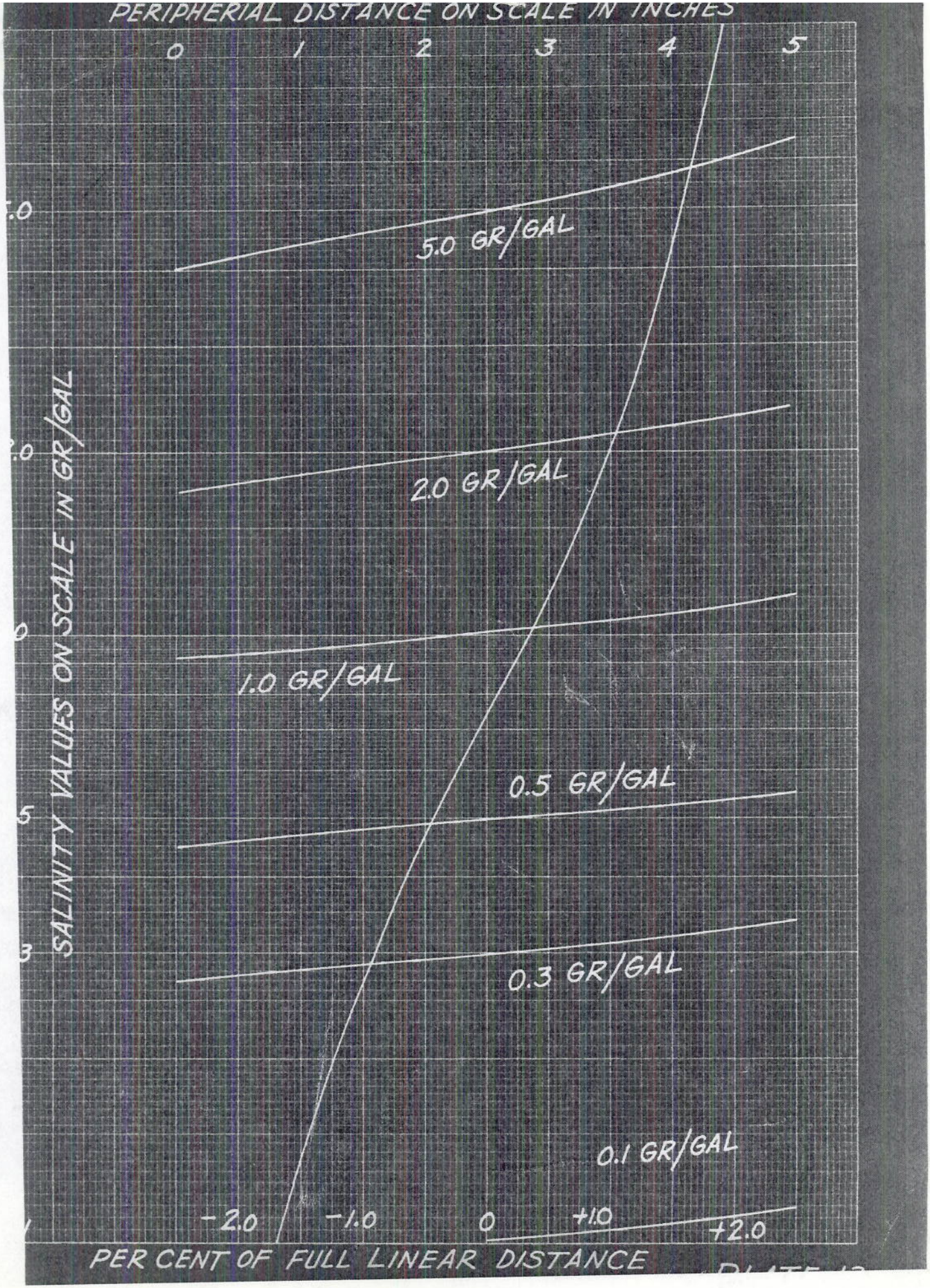
DATE

PLATE 11

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D.C.

DATE

PLATE 12


PERIPHERIAL DISTANCE ON SCALE IN INCHES
0
1
2
3
4
5
5.0 GR/GAL
2.0 GR/GAL
1.0 GR/GAL
0.5 GR/GAL
0.3 GR/GAL
0.1 GR/GAL
SALINITY VALUES ON SCALE IN GR/GAL
-2.0
-1.0
0
+1.0
+2.0
PER CENT OF FULL LINEAR DISTANCE