29 February 1944 NRL Report No. B-2222

NAVY DEPARTMENT

Report of Test

FR-2222

Salinity Indicating Equipment

Submitted by

McNab of Bridgeport, Inc.,
Bridgeport, Conn.

NAVAL RESEARCH LABORATORY
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WASHINGTON, D. C.

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Authorization: BuShips ltrs. S65-5(355) of 12 January 1942 and S65-5(335) of 2 November 1943 to NRL. BuShips Project Order 3/44

Date of Test: December 1943, and January 1944.

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Distribution: BuShips (5)

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AUTHORIZATION FOR TEST

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

Reference: (a) BuShips Ltr. S65-5(355) of 12 January 1942 to NRL.
(b) BuShips Ltr. S65-5(335) of 2 November 1943 to NRL.
(c) Specification 17-I-19b of 1 April 1943.
(d) Manufacturers Drwg. No. I-5022.
(e) Manufacturers Drwg. No. I-5023.

OBJECT OF TEST

2. The object of this test was to determine conformance of the sample salinity indicating equipment with specification, reference (c), and its suitability for Naval use.

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 specification. An inspection to determine compliance in the matter of materials, design, and workmanship, concluded the test on the indicator panel.

4. Tests on the conductivity cell submitted with this equipment involved a determination of the cell constant and a determination of the effect of a phenolic guard on the constant. This part of the cell testing is being done at the National Bureau of Standards where precision conductivity measuring equipment is available. The results will be forwarded in a supplementary report.

CONCLUSIONS

(a) The subject salinity indicator complied with specification, reference (c), except in the following respects:

(1) Indicating meter became filled with water when subjected to the splashproof test.

(2) Length of meter scale is less than 4-1/2 inches.

(3) Checking resistor control is incorporated in the cell selector switch instead of in an independent normally open pushbutton.

(4) Nameplate and directory plate are not separate.

(5) Pilot lights are equipped with green glass jewel lenses, and the 15 volt circuit pilot lamp is not a Navy standard type.

(6) Selector switch is not a Navy standard type rotary switch, but is functionally equivalent except that only one side of the cell circuit is interrupted when switching from one cell to another.

(7) The list of materials does not include a description of each part with respect to a referenced Navy Department or BuShips specification.

(8) The transformer, the cell, and the line terminal blocks are mounted on the back wall of the enclosure instead of on the rear of the hinged panel.

RECOMMENDATIONS

(a) That the subject salinity indicator be approved for Naval use subject to correction of deficiencies noted under "Conclusions" and a Laboratory check test.

(b) That action on approval of the salinity cell and valve assembly be deferred pending submission of a supplementary report covering this part of the equipment.

(c) That when next amended, specification reference (c) include:

(1) Specifically defined design and test requirements for degree of enclosure of indicator case.

(2) Reduced degree of enclosure for the indicating meter from the splashproof requirement as defined (which is considered too severe) to that defined in BuShips Specification 17E11(INT) of 15 May 1943 for Bulkhead mounted equipment.

(3) Clarification of requirement for method of presenting accuracy test data and, possibly, elimination of requirements resulting in presentation of same data in two different forms.

DESCRIPTION OF MATERIAL

5. The equipment submitted consists of one indicator unit, one conductivity cell and valve 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 and other water lines.

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

(a) A transformer, ratio 115/115-15.
(b) A power factor 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 grain	White
0.5 to 1.0 grain	Green
1.0 to 10 grain	Red

(c) A rotary type of selector switch for connecting any one of eight salinity cells or the checking resistor to the indicator circuit.
(d) A rotary temperature compensator switch, with a dial graduated from 60°F. to 200°F. in steps of 10°F., by which resistance in a circuit may be varied to compensate for temperature changes in the condensate.
(e) A checking resistor for testing operation of the meter when the temperature compensator is set at 110°F. and the cell selector switch turned to "check".
(f) Two pilot lights, with green glass jewel lenses, to indicate that the secondary circuits of the transformer are energized.
(g) A pair of fuses, each equipped with a neon blown-fuse indicator.
(h) A Hubbell two pole on-off line switch.
(i) A terminal block in two parts with connections for eight salinity cells.
(j) A line and fuse terminal block in two parts. The line and load sides of fuse block are separate.

7. All of the above parts, except the transformer, fuse block, and terminal block, which are mounted on the back wall of the case, are mounted on the hinged steel panel of the case. The steel case and panel are finished with gray paint.

8. Four Lord type rubber mountings, assembled into the rear of the case, are provided for mounting the indicator on a bulkhead.

9. A portable test resistor connected by a pair of 12-inch leads to female receptacles for inserting the cell electrodes is provided for checking the cell and indicator circuit at 1 gr/gal at 110°F.

DESCRIPTION OF MATERIAL (Contd)

10. Further details of design and construction are shown in photographs, Plates 1 and 2, and drawings, references (d) and (e).

OPERATION OF SYSTEM

11. The principal circuit elements of the Salinity Indicating Equipment are the conductivity cell, the temperature compensating resistors, the indicating meter (modified, power factor type), and 115 volt and 15 volt power supplies from the two secondary windings of the transformer.

12. The indicating meter has three coils. The stationary field coil is continuously energized from the 15 volt transformer secondary and is designed to produce an essentially uniform field. The two movable coils wound at right angles to each other are supported on a common shaft provided with a pointer, and are free to rotate in the field of the fixed coil. A fixed resistance, the temperature - compensating resistors, and these two coils are in series with respect to the 115 volt secondary winding. The conductivity cell is shunted across one coil and the temperature - compensating resistors.

13. When the system is energized, the deflection of the rotor (indicator pointer position) is determined by the reaction between the resultant of the magnetic fields of the two movable coils and the field of the stationary coil. Thus the deflection depends on the relative magnitudes of the currents in the two movable coils, and is independant of small supply voltage variations since both coils are in series across the power supply.

14. For a given temperature, the resistance across the cell varies inversely as the salinity of the solution, altering the relative magnitudes of the currents in the movable coils. The meter scale can be calibrated accordingly.

15. For a given salinity the resistance across the cell varies inversely as the temperature, altering the relative magnitudes of the currents in the movable coils. By proper choice of resistances in the temperature compensator, the ratio of currents in the movable coils may be held constant within required limits to correct for changes in the condensate temperature.

METHOD OF TEST

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

(a)[1] Preliminary accuracy - not specified.
(b) Endurance (50 hours)
(c) Shock
(d) Vibration
(e)[2] Accuracy
(f) Endurance (450 hours)

METHOD OF TEST (Contd)

(g) Inclination
(h)[3] Final accuracy - not specified
(i) Dielectric and Insulation
(j) Splashproof - (indicator meter only)
(k) Material, Design and Workmanship Inspection

NOTE: (a)[1], (e)[2], and (h)[3] - Accuracy of indication was checked at salinities of 0.1, 0.3, 0.5, 1.0, 2.0 and 5.0 gr/gal at the following supply voltages and frequencies:

108 volts	55 cycles
115 volts	60 cycles
122 volts	65 cycles

RESULTS OF TEST

17. The test results obtained were as follows:

Requirements	Test Values
Accuracy: Para. F-2k and E-6	Complied. (Variations ± 0.5% are considered within the limits of experimental error.)
Endurance: Para. F-2f	Complied.
Shock Integrity: Para. F-2h	Complied.
Vibration integrity: Para. F-2i	Complied.
Inclination: Para. F-2g	Complied.
Indicator pointer: Para. E-4c (11)	Complied. (Maximum displacement from zero at any time during test was ±2.5%)
Dielectric strength: Para. F-2n	Complied.
Insulation resistance: Para. F-2n	Complied.
Splashproof integrity: Para. F-2m	*When removed from the indicator and tested separately, the meter leaked approximately 1 liter of water. The red and green paints on the scale were almost entirely dissolved by water.
Scale length: Para. E-4c(9)	*Scale length is 4.1 inches.

RESULTS OF TESTS (Contd)

Requirements	Test Values
Selector Switch: Para. E-4c(13)	The 19-position cell selector switch is not a Navy Standard rotary type switch, but is equivalent except that only one side of each cell circuit is interrupted when switching from one cell to another.
Pilot light: Para. E-4c(15)	*Green glass jewel lenses are used. The 15V lamp is not Navy standard type.
Checking resistor: Para. E-4c (17)	*Checking resistor is connected into the circuit by means of the cell selector switch.
Lamp Socket: Type V-7	*Described as "Signico" and used for fuse indicator lamps and pilot lamps. The fuse indicator lamps are recessed so far as to make removal by hand difficult.
Nameplate: Para. E-4c(19)	*Nameplate and directory plate are combined. In addition a second plate is furnished with operating instructions.
Weight and Dimensions: Para. E-4c(26)	Complied. Height - 17 inches Width - 13 inches Depth - 7 inches Weight - 37 lbs., 15 ozs.

* - - Denotes failure to comply with specification.

CONCLUSIONS

(a) The subject salinity indicator complied with specification, reference (c), except in the following respects:

(1) Indicating meter became filled with water when subjected to the splashproof test.

(2) Length of meter scale is less than 4-1/2-inches.

(3) Checking resistor control is incorporated in the cell selector switch instead of in an independent normally open pushbutton.

(4) Nameplate and directory plate are not separate.

(5) Pilot lights are equipped with green glass jewel lenses, and the 15 volt circuit pilot lamp is not a Navy standard type.

(6) Selector switch is not a Navy standard type rotary switch, but is functionally equivalent except that only one side of the cell circuit is interrupted when switching from one cell to another.

(7) The list of materials does not include a description of each part with respect to a referenced Navy Department or BuShips specification.

(8) The transformer, the cell, and the line terminal blocks are mounted on the back wall of the enclosure instead of on the rear of the hinged panel.

TABLE 1

Initial 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	55	- 0.25	0	- 1.00	- 1.50	- 0.25	+ 0.50
60	60	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 0.75	+ 2.00
60	65	+ 1.50	+ 2.50	+ 2.50	+ 2.50	+ 2.00	+ 2.50
70	65	- 0.25	- 0.50	- 0.50	- 1.25	- 0.25	+ 0.50
70	70	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 1.50
70	75	+ 1.50	+ 2.50	+ 2.50	+ 2.50	+ 2.00	+ 2.50
80	75	0	- 0.50	- 0.50	- 0.50	- 0.25	+ 0.50
80	80	+ 0.50	+ 0.25	+ 0.50	+ 0.25	+ 1.00	+ 2.00
80	85	+ 1.50	+ 2.00	+ 2.00	+ 2.25	+ 2.00	+ 2.50
90	85	0	- 0.50	- 1.00	- 1.00	- 0.25	+ 0.50
90	90	+ 0.50	0	+ 0.25	+ 0.50	+ 0.50	+ 1.50
90	95	+ 1.25	+ 2.00	+ 2.00	+ 2.25	+ 1.50	+ 2.25
100	95	0	- 0.25	- 1.00	- 0.50	- 0.25	+ 1.00
100	100	+ 0.50	+ 0.25	+ 0.25	+ 0.25	+ 0.50	+ 1.50
100	105	+ 1.25	+ 1.50	+ 1.75	+ 2.00	+ 1.50	+ 2.25
110	105	- 0.50	- 0.50	- 0.50	- 0.50	- 0.25	+ 0.50
110	110	+ 0.25	+ 0.25	+ 0.25	+ 0.50	+ 0.50	+ 1.50
110	115	+ 1.00	+ 1.50	+ 2.00	+ 2.25	+ 1.50	+ 2.25
120	115	0	- 0.50	- 0.50	- 0.25	- 0.25	+ 0.50
120	120	+ 0.50	0	+ 0.50	+ 0.50	+ 0.25	+ 1.25
120	125	+ 1.00	+ 1.25	+ 1.75	+ 2.00	+ 1.25	+ 2.00
130	125	- 0.25	- 0.50	- 0.25	- 0.25	- 0.25	+ 0.50
130	130	0	0	+ 0.25	+ 0.50	+ 0.25	+ 1.50
130	135	+ 0.50	+ 1.25	+ 1.50	+ 2.00	+ 1.00	+ 2.00
140	135	- 0.25	- 0.50	- 0.25	- 0.25	- 0.25	+ 0.50
140	140	0	+ 0.25	+ 0.25	+ 0.50	0	+ 1.25
140	145	+ 0.50	+ 1.25	+ 1.50	+ 2.00	+ 1.00	+ 2.00
150	145	0	- 0.25	- 0.25	0	- 0.25	+ 0.50
150	150	0	+ 0.25	+ 0.25	+ 0.50	0	+ 1.00
150	155	+ 0.50	+ 1.25	+ 1.25	+ 2.00	+ 0.50	+ 2.00
160	155	0	0	0	+ 0.25	- 0.25	+ 0.50
160	160	+ 0.25	+ 0.50	+ 0.50	+ 1.25	+ 0.25	+ 1.00
160	165	+ 1.00	+ 2.00	+ 1.50	+ 2.25	+ 0.75	+ 2.00
170	165	0	0	0	+ 0.25	- 0.25	+ 0.50
170	170	+ 0.25	+ 1.25	+ 1.00	+ 1.25	+ 0.25	+ 1.25
170	175	+ 1.00	+ 2.00	+ 2.00	+ 2.25	+ 1.00	+ 2.00
180	175	0	+ 0.25	+ 0.25	+ 0.50	0	+ 1.00
180	180	+ 0.50	+ 1.25	+ 1.25	+ 1.25	+ 0.25	+ 1.50
180	185	+ 1.25	+ 2.25	+ 2.25	+ 2.50	+ 1.00	+ 2.00
190	185	0	+ 1.00	+ 0.50	+ 1.00	0	+ 1.25
190	190	+ 0.50	+ 2.00	+ 1.50	+ 2.00	+ 0.25	+ 1.50
190	195	+ 1.25	+ 2.50	+ 2.25	+ 2.50	+ 1.25	+ 2.25
200	195	0	+ 0.50	+ 0.25	+ 0.50	0	+ 1.00
200	200	+ 0.50	+ 1.50	+ 1.00	+ 1.50	+ 0.25	+ 1.25
200	205	+ 1.25	+ 2.25	+ 2.00	+ 2.50	+ 0.50	+ 2.25

TABLE 2

Initial 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	55	0	0	- 0.50	- 1.25	- 0.25	+ 0.25
60	60	+ 0.50	+ 1.50	+ 0.50	+ 1.00	+ 1.00	+ 1.50
60	65	+ 2.00	+ 2.75	+ 2.50	+ 2.50	+ 2.00	+ 2.25
70	65	0	- 0.25	- 0.25	- 1.25	- 0.25	+ 0.50
70	70	+ 0.50	+ 1.00	+ 0.50	+ 0.50	+ 0.50	+ 1.50
70	75	+ 2.00	+ 2.50	+ 2.50	+ 2.50	+ 2.25	+ 2.25
80	75	0	- 0.25	- 0.25	- 0.50	- 0.25	+ 1.00
80	80	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 1.50
80	85	+ 1.50	+ 2.25	+ 2.25	+ 2.50	+ 2.00	+ 2.50
90	85	0	- 0.50	- 0.50	- 0.50	- 0.25	+ 1.00
90	90	+ 0.25	+ 0.25	+ 0.50	+ 0.50	+ 0.50	+ 2.00
90	95	+ 1.25	+ 2.25	+ 2.25	+ 2.25	+ 1.50	+ 2.25
100	95	0	- 0.25	- 0.25	- 0.25	- 0.25	+ 1.00
100	100	+ 0.25	+ 0.25	+ 0.50	+ 0.25	+ 0.50	+ 1.50
100	105	+ 1.25	+ 2.00	+ 2.25	+ 2.00	+ 1.50	+ 2.25
110	105	0	- 0.25	- 0.25	- 0.50	- 0.25	+ 1.00
110	110	+ 0.25	+ 0.25	+ 0.50	+ 0.50	+ 0.50	+ 2.00
110	115	+ 1.25	+ 2.00	+ 2.25	+ 2.25	+ 1.50	+ 2.25
120	115	- 0.25	- 0.50	- 0.25	- 0.25	- 0.25	+ 0.50
120	120	+ 0.25	+ 0.25	+ 0.50	+ 0.50	+ 0.25	+ 1.50
120	125	+ 1.00	+ 1.25	+ 2.00	+ 2.00	+ 1.25	+ 2.25
130	125	- 0.25	- 0.50	- 0.25	- 0.25	- 0.25	+ 0.50
130	130	+ 0.25	+ 0.25	+ 0.25	+ 0.50	+ 0.25	+ 1.50
130	135	+ 0.50	+ 1.50	+ 1.50	+ 2.00	+ 1.00	+ 2.25
140	135	0	- 0.25	- 0.25	- 0.25	- 0.25	+ 0.50
140	140	+ 0.25	+ 0.50	+ 0.25	+ 0.50	0	+ 1.25
140	145	+ 0.50	+ 1.50	+ 1.50	+ 2.00	+ 1.00	+ 2.00
150	145	- 0.25	- 0.25	- 0.25	0	- 0.50	+ 0.50
150	150	+ 0.25	+ 0.25	+ 0.25	+ 0.50	0	+ 1.25
150	155	+ 0.50	+ 1.50	+ 1.25	+ 2.00	+ 1.00	+ 2.00
160	155	0	0	0	0	- 0.25	+ 0.50
160	160	+ 0.25	+ 0.50	+ 0.50	+ 1.00	0	+ 1.25
160	165	+ 0.50	+ 2.00	+ 1.50	+ 2.25	+ 0.50	+ 2.00
170	165	0	+ 0.25	0	+ 0.25	- 0.25	+ 1.00
170	170	+ 0.25	+ 1.25	+ 1.00	+ 1.00	+ 0.25	+ 1.50
170	175	+ 0.50	+ 2.25	+ 2.25	+ 2.25	+ 1.00	+ 2.00
180	175	0	+ 0.25	+ 0.25	+ 0.25	0	+ 1.00
180	180	+ 0.50	+ 1.25	+ 1.25	+ 1.25	+ 0.25	+ 1.50
180	185	+ 1.00	+ 2.50	+ 2.25	+ 2.25	+ 0.50	+ 2.00
190	185	+ 0.25	+ 1.00	+ 0.50	+ 1.25	0	+ 1.25
190	190	+ 0.50	+ 2.00	+ 1.50	+ 1.50	+ 0.25	+ 1.50
190	195	+ 1.25	+ 2.50	+ 2.25	+ 2.50	+ 1.00	+ 2.25
200	195	+ 0.25	+ 0.50	+ 0.25	+ 0.50	- 0.25	+ 1.25
200	200	+ 0.50	+ 1.50	+ 1.00	+ 1.50	0	+ 1.50
200	205	+ 1.25	+ 2.50	+ 2.00	+ 2.25	+ 0.50	+ 2.00

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	55	+ 0.10	- 0.50	- 0.50	- 1.25	- 0.25	+ 0.50
60	60	+ 1.00	+ 0.50	+ 1.00	+ 1.00	+ 0.50	+ 1.50
60	65	+ 2.00	+ 2.50	+ 2.50	+ 2.50	+ 2.00	+ 2.25
70	65	0	- 0.25	- 0.50	- 1.00	- 0.50	+ 1.00
70	70	+ 0.75	+ 0.50	+ 0.75	+ 0.75	+ 0.50	+ 1.75
70	75	+ 2.00	+ 2.25	+ 2.50	+ 2.50	+ 2.00	+ 2.50
80	75	0	- 0.50	- 0.50	- 0.50	- 0.25	+ 1.00
80	80	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 2.00
80	85	+ 1.50	+ 2.00	+ 2.25	+ 2.50	+ 2.00	+ 2.50
90	85	- 0.10	- 1.00	- 1.00	- 1.00	- 0.25	+ 0.75
90	90	+ 0.50	+ 0.25	+ 0.25	+ 0.50	+ 0.50	+ 2.00
90	95	+ 1.25	+ 2.00	+ 2.00	+ 2.25	+ 1.50	+ 2.25
100	95	- 0.20	- 0.50	- 0.50	- 0.25	- 0.25	+ 0.50
100	100	+ 0.25	+ 0.50	+ 0.50	+ 0.50	+ 0.50	+ 1.50
100	105	+ 1.25	+ 1.75	+ 2.00	+ 2.25	+ 1.25	+ 2.25
110	105	- 0.25	- 0.50	- 0.50	- 0.25	- 0.50	+ 0.75
110	110	+ 0.25	+ 0.25	+ 0.50	+ 1.00	+ 0.50	+ 2.00
110	115	+ 1.00	+ 1.75	+ 2.00	+ 2.25	+ 1.25	+ 2.25
120	115	- 0.25	- 0.50	- 0.50	- 0.25	- 0.25	+ 0.75
120	120	+ 0.25	+ 0.25	+ 0.50	+ 0.50	+ 0.25	+ 1.25
120	125	+ 0.75	+ 1.50	+ 2.00	+ 2.00	+ 1.25	+ 2.00
130	125	- 0.25	- 0.75	- 0.25	- 0.25	- 0.25	+ 0.50
130	130	+ 0.25	+ 0.25	+ 0.50	+ 1.00	+ 0.25	+ 1.50
130	135	+ 0.75	+ 1.50	+ 1.50	+ 2.25	+ 1.00	+ 2.00
140	135	- 0.25	- 0.50	- 0.25	0	- 0.50	+ 0.50
140	140	+ 0.25	+ 0.50	+ 0.25	+ 0.75	0	+ 1.25
140	145	+ 0.50	+ 1.50	+ 1.50	+ 2.25	+ 0.75	+ 2.00
150	145	- 0.25	- 0.25	- 0.25	0	- 0.50	+ 0.50
150	150	+ 0.25	+ 0.50	+ 0.50	+ 1.00	0	+ 1.25
150	155	+ 0.50	+ 2.00	+ 1.50	+ 2.25	+ 0.75	+ 1.75
160	155	0	0	0	+ 0.25	- 0.25	+ 0.75
160	160	+ 0.25	+ 1.00	+ 0.75	+ 1.25	+ 0.25	+ 1.25
160	165	+ 1.00	+ 2.00	+ 2.00	+ 2.25	+ 0.75	+ 2.00
170	165	0	+ 0.25	+ 0.25	+ 0.50	- 0.25	+ 1.00
170	170	+ 0.50	+ 1.25	+ 1.00	+ 1.25	+ 0.25	+ 1.50
170	175	+ 1.00	+ 2.25	+ 2.25	+ 2.25	+ 1.00	+ 2.00
180	175	+ 0.25	+ 0.50	+ 0.50	+ 0.50	.0	+ 1.00
180	180	+ 0.75	+ 1.50	+ 1.50	+ 1.50	+ 0.25	+ 1.50
180	185	+ 1.25	+ 2.50	+ 2.25	+ 2.50	+ 1.00	+ 2.00
190	185	+ 0.25	+ 1.00	+ 1.00	+ 1.25	0	+ 1.25
190	190	+ 0.75	+ 2.00	+ 2.00	+ 2.00	+ 0.50	+ 1.50
190	195	+ 1.25	+ 2.50	+ 2.50	+ 2.75	+ 1.25	+ 2.25
200	195	+ 0.25	+ 0.50	+ 0.50	+ 1.00	- 0.25	+ 1.25
200	200	+ 0.50	+ 1.75	+ 1.25	+ 1.50	+ 0.25	+ 1.50
200	205	+ 1.00	+ 2.25	+ 2.25	+ 2.50	+ 0.75	+ 2.00

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	55	+ 0.25	- 1.50	- 1.25	- 1.00	- 0.25	+ 0.25
60	60	+ 1.50	0	+ 0.50	+ 1.00	+ 0.75	+ 1.25
60	65	+ 2.25	+ 2.00	+ 2.50	+ 2.50	+ 2.00	+ 2.00
70	65	+ 0.25	- 1.25	- 1.00	- 0.50	- 0.25	+ 0.50
70	70	+ 1.25	0	+ 0.50	+ 0.75	+ 1.00	+ 1.50
70	75	+ 2.25	+ 2.00	+ 2.25	+ 2.50	+ 2.25	+ 2.25
80	75	+ 0.25	- 1.50	- 1.25	- 0.50	0	+ 0.50
80	80	+ 1.00	0	+ 0.25	+ 0.75	+ 1.00	+ 1.50
80	85	+ 1.75	+ 1.50	+ 2.00	+ 2.50	+ 2.00	+ 2.25
90	85	0	- 1.25	- 1.50	- 0.50	- 0.25	+ 0.50
90	90	+ 0.50	0	0	+ 0.75	+ 0.50	+ 1.25
90	95	+ 1.25	+ 1.25	+ 1.75	+ 2.50	+ 1.50	+ 2.25
100	95	0	- 1.25	- 1.25	- 0.25	- 0.50	+ 0.50
100	100	+ 0.50	0	+ 0.25	+ 0.75	+ 0.50	+ 1.25
100	105	+ 1.25	+ 1.25	+ 1.75	+ 2.25	+ 1.50	+ 2.00
110	105	0	- 1.00	- 1.00	- 0.25	- 0.50	+ 0.50
110	110	+ 0.50	0	+ 0.25	+ 0.75	+ 0.50	+ 1.25
110	115	+ 1.00	+ 1.25	+ 1.50	+ 2.25	+ 1.50	+ 2.00
120	115	0	- 1.25	- 1.00	- 0.25	- 0.25	+ 0.50
120	120	+ 0.25	- 0.25	+ 0.25	+ 0.50	+ 0.25	+ 1.25
120	125	+ 0.75	+ 0.75	+ 1.25	+ 2.25	+ 1.25	+ 2.00
130	125	0	- 1.25	- 1.00	- 0.25	- 0.25	+ 0.50
130	130	+ 0.25	- 0.20	0	+ 1.00	+ 0.25	+ 1.25
130	135	+ 0.75	+ 1.00	+ 1.25	+ 2.25	+ 1.25	+ 2.00
140	135	0	- 1.00	- 1.25	- 0.25	- 0.25	+ 0.50
140	140	+ 0.25	0	0	+ 0.75	+ 0.25	+ 1.00
140	145	+ 0.50	+ 0.75	+ 1.00	+ 2.00	+ 1.00	+ 1.50
150	145	0	- 1.00	- 0.75	0	- 0.25	+ 0.25
150	150	+ 0.25	0	0	+ 0.75	0	+ 0.75
150	155	+ 0.50	+ 0.75	+ 0.75	+ 2.25	+ 0.75	+ 1.50
160	155	0	- 0.50	- 0.50	+ 0.25	- 0.25	+ 0.50
160	160	+ 0.25	+ 0.25	+ 0.25	+ 1.25	+ 0.25	+ 1.25
160	165	+ 0.75	+ 1.25	+ 1.00	+ 2.25	+ 0.75	+ 1.75
170	165	+ 0.25	0	- 0.25	+ 0.50	- 0.25	+ 0.50
170	170	+ 0.50	+ 0.50	+ 0.50	+ 1.25	+ 0.25	+ 1.25
170	175	+ 1.00	+ 1.50	+ 1.75	+ 2.50	+ 1.00	+ 1.75
180	175	+ 0.25	0	0	+ 0.50	0	+ 0.50
180	180	+ 0.50	+ 0.75	+ 0.75	+ 1.50	+ 0.25	+ 1.25
180	185	+ 1.00	+ 2.00	+ 2.00	+ 2.50	+ 1.00	+ 1.75
190	185	+ 0.25	+ 0.50	+ 0.25	+ 1.25	0	+ 1.00
190	190	+ 0.75	+ 1.25	+ 1.50	+ 2.00	+ 0.50	+ 1.25
190	195	+ 1.25	+ 2.25	+ 2.00	+ 2.75	+ 1.25	+ 2.00
200	195	+ 0.25	+ 0.25	0	+ 0.75	0	+ 0.75
200	200	+ 0.50	+ 1.25	+ 0.75	+ 2.00	+ 0.25	+ 1.25
200	205	+ 1.25	+ 2.00	+ 1.75	+ 2.50	+ 0.75	+ 1.50

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	55	+ 0.25	- 1.50	- 1.75	- 1.00	+ 0.25	+ 0.20
60	60	+ 0.75	0	+ 0.25	+ 1.00	+ 1.50	+ 1.00
60	65	+ 2.00	+ 2.00	+ 2.25	+ 2.50	+ 2.50	+ 2.00
70	65	+ 0.25	- 1.25	- 1.25	- 0.50	0	+ 0.50
70	70	+ 0.50	0	+ 0.25	+ 1.00	+ 1.25	+ 1.25
70	75	+ 1.50	+ 1.50	+ 2.00	+ 2.50	+ 2.25	+ 2.25
80	75	+ 0.25	- 1.00	- 1.25	- 0.25	0	+ 0.50
80	80	+ 0.50	0	+ 0.25	+ 0.75	+ 1.00	+ 1.50
80	85	+ 1.50	+ 1.50	+ 2.00	+ 2.50	+ 2.00	+ 2.25
90	85	0	- 1.00	- 1.50	- 0.50	- 0.25	+ 0.50
90	90	+ 0.25	0	0	+ 1.00	+ 0.75	+ 1.50
90	95	+ 1.00	+ 1.25	+ 1.50	+ 2.50	+ 1.50	+ 2.00
100	95	0	- 1.25	- 1.25	- 0.25	- 0.25	+ 0.50
100	100	+ 0.25	- 0.25	+ 0.25	+ 0.75	+ 0.50	+ 1.50
100	105	+ 1.00	+ 1.00	+ 1.50	+ 2.50	+ 1.50	+ 2.00
110	105	0	- 1.00	- 1.25	- 0.25	- 0.25	+ 0.50
110	110	+ 0.25	- 0.25	+ 0.25	+ 1.00	+ 0.50	+ 1.25
110	115	+ 0.50	+ 1.00	+ 1.00	+ 2.50	+ 1.50	+ 2.00
120	115	0	- 1.00	- 1.00	- 0.25	- 0.20	+ 0.50
120	120	+ 0.25	- 0.25	+ 0.25	+ 0.75	+ 0.25	+ 1.00
120	125	+ 0.50	+ 0.50	+ 1.50	+ 2.25	+ 1.25	+ 1.75
130	125	0	- 1.00	- 0.50	- 0.25	- 0.25	+ 0.50
130	130	+ 0.25	- 0.25	+ 0.25	+ 1.00	+ 0.25	+ 1.00
130	135	+ 0.50	+ 0.75	+ 1.25	+ 2.25	+ 1.00	+ 1.75
140	135	0	- 0.75	- 1.00	- 0.20	- 0.25	+ 0.50
140	140	+ 0.25	0	0	+ 0.75	+ 0.25	+ 0.75
140	145	+ 0.50	+ 0.50	+ 1.00	+ 2.25	+ 1.00	+ 1.50
150	145	0	- 1.00	- 0.75	0	- 0.25	+ 0.25
150	150	+ 0.25	0	+ 0.20	+ 1.00	+ 0.20	+ 0.50
150	155	+ 0.50	+ 0.75	+ 1.00	+ 2.25	+ 0.75	+ 1.25
160	155	0	- 0.50	- 0.50	+ 0.25	- 0.25	+ 0.25
160	160	+ 0.25	+ 0.25	+ 0.25	+ 1.50	+ 0.25	+ 1.00
160	165	+ 0.75	+ 1.25	+ 1.25	+ 2.25	+ 0.75	+ 1.50
170	165	+ 0.25	- 0.25	- 0.25	+ 0.50	- 0.20	+ 0.50
170	170	+ 0.50	+ 0.50	+ 0.50	+ 1.50	+ 0.25	+ 1.00
170	175	+ 0.75	+ 1.50	+ 1.75	+ 2.50	+ 0.75	+ 1.50
180	175	+ 0.25	0	0	+ 0.75	0	+ 0.50
180	180	+ 0.50	+ 0.75	+ 0.75	+ 1.50	+ 0.25	+ 1.00
180	185	+ 1.00	+ 2.00	+ 2.00	+ 2.50	+ 0.50	+ 1.50
190	185	+ 0.25	+ 0.25	+ 0.25	+ 1.25	0	+ 0.50
190	190	+ 0.50	+ 1.25	+ 1.25	+ 2.00	+ 0.25	+ 1.25
190	195	+ 1.00	+ 2.25	+ 2.25	+ 2.50	+ 1.00	+ 1.75
200	195	+ 0.25	0	0	+ 0.75	0	+ 0.50
200	200	+ 0.50	+ 1.00	+ 0.50	+ 2.00	+ 0.25	+ 1.00
200	205	+ 1.00	+ 2.00	+ 1.75	+ 2.50	+ 0.75	+ 1.50

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	55	+ 0.25	- 1.25	- 1.50	- 0.50	0	+ 0.50
60	60	+ 1.00	0	+ 0.25	+ 1.25	+ 1.25	+ 1.50
60	65	+ 2.00	+ 2.00	+ 2.25	+ 2.50	+ 2.25	+ 2.25
70	65	0	- 1.25	- 1.25	- 0.50	- 0.25	+ 0.50
70	70	+ 0.50	0	+ 0.25	+ 1.00	+ 1.00	+ 1.50
70	75	+ 1.50	+ 1.50	+ 2.00	+ 2.50	+ 2.25	+ 2.25
80	75	+ 0.25	- 1.25	- 1.50	- 0.25	- 0.25	+ 0.50
80	80	+ 0.50	0	+ 0.25	+ 0.50	+ 1.00	+ 1.50
80	85	+ 1.25	+ 1.50	+ 2.00	+ 2.50	+ 2.00	+ 2.25
90	85	0	- 1.25	- 1.50	- 0.50	- 0.25	+ 0.50
90	90	+ 0.50	0	0	+ 1.00	+ 0.50	+ 1.25
90	95	+ 1.00	+ 1.50	+ 2.00	+ 2.50	+ 2.00	+ 2.00
100	95	0	- 1.25	- 1.25	- 0.25	- 0.20	+ 0.50
100	100	+ 0.25	0	+ 0.25	+ 0.75	+ 0.50	+ 1.25
100	105	+ 1.00	+ 1.25	+ 1.50	+ 2.25	+ 1.50	+ 2.00
110	105	0	- 1.25	- 1.25	- 0.25	- 0.25	+ 0.50
110	110	+ 0.25	0	+ 0.25	+ 1.00	+ 0.50	+ 1.25
110	115	+ 0.75	+ 1.25	+ 1.50	+ 2.50	+ 1.50	+ 2.00
120	115	0	- 1.00	- 1.25	- 0.25	- 0.25	+ 0.50
120	120	+ 0.25	- 0.20	+ 0.25	+ 0.75	+ 0.25	+ 1.00
120	125	+ 0.50	+ 0.75	+ 1.50	+ 2.25	+ 1.25	+ 1.75
130	125	0	- 1.00	- 1.00	- 0.25	- 0.25	+ 0.50
130	130	+ 0.25	0	+ 0.25	+ 1.00	+ 0.25	+ 1.00
130	135	+ 0.50	+ 1.00	+ 1.25	+ 2.25	+ 1.25	+ 1.75
140	135	0	- 1.00	- 1.00	- 0.25	- 0.25	+ 0.25
140	140	+ 0.25	0	0	+ 0.75	+ 0.25	+ 0.75
140	145	+ 0.50	+ 0.75	+ 1.00	+ 2.25	+ 1.00	+ 1.25
150	145	0	- 0.75	- 0.75	0	- 0.25	+ 0.25
150	150	+ 0.20	0	0	+ 1.00	+ 0.25	+ 0.75
150	155	+ 0.50	+ 1.00	+ 0.75	+ 2.25	+ 0.75	+ 1.25
160	155	0	- 0.25	- 0.50	+ 0.25	- 0.25	+ 0.50
160	160	+ 0.25	+ 0.25	+ 0.25	+ 1.25	+ 0.25	+ 1.00
160	165	+ 0.50	+ 1.50	+ 1.25	+ 2.25	+ 0.75	+ 1.50
170	165	+ 0.25	0	- 0.25	+ 0.50	- 0.20	+ 0.50
170	170	+ 0.50	+ 0.50	+ 0.50	+ 1.25	+ 0.25	+ 1.00
170	175	+ 0.75	+ 2.00	+ 1.75	+ 2.50	+ 1.00	+ 1.50
180	175	+ 0.25	+ 0.20	+ 0.25	+ 0.75	0	+ 0.50
180	180	+ 0.50	+ 1.00	+ 1.00	+ 1.50	+ 0.25	+ 1.00
180	185	+ 1.00	+ 2.25	+ 2.00	+ 2.50	+ 1.00	+ 1.50
190	185	+ 0.25	+ 0.50	+ 0.50	+ 1.25	0	+ 0.75
190	190	+ 0.75	+ 1.50	+ 1.50	+ 2.25	+ 0.50	+ 1.25
190	195	+ 1.25	+ 2.25	+ 2.25	+ 2.75	+ 1.25	+ 1.75
200	195	+ 0.25	+ 0.25	0	+ 1.00	0	+ 0.75
200	200	+ 0.75	+ 1.25	+ 0.75	+ 2.00	+ 0.25	+ 1.00
200	205	+ 1.00	+ 2.00	+ 1.75	+ 2.50	+ 0.75	+ 1.50

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	55	+ 0.20	- 1.25	- 1.50	- 0.75	0	0
60	60	+ 0.50	0	+ 0.50	+ 1.25	+ 1.00	+ 0.75
60	65	+ 1.50	+ 2.25	+ 2.50	+ 2.50	+ 2.00	+ 2.00
70	65	+ 0.25	- 1.25	- 1.25	- 0.75	- 0.25	+ 0.25
70	70	+ 0.50	0	+ 0.25	+ 0.75	+ 0.50	+ 1.25
70	75	+ 1.50	+ 2.00	+ 2.00	+ 2.50	+ 2.00	+ 2.00
80	75	+ 0.25	- 1.50	- 1.50	- 0.50	- 0.25	+ 0.25
80	80	+ 0.50	0	+ 0.25	+ 0.50	+ 0.50	+ 1.00
80	85	+ 1.25	+ 1.50	+ 2.00	+ 2.50	+ 1.75	+ 2.00
90	85	+ 0.20	- 1.50	- 1.75	- 0.50	- 0.25	+ 0.25
90	90	+ 0.50	- 0.25	0	+ 0.50	+ 0.50	+ 0.75
90	95	+ 1.00	+ 1.25	+ 1.75	+ 2.50	+ 1.25	+ 1.75
100	95	+ 0.20	- 1.25	- 1.25	- 0.25	- 0.25	+ 0.25
100	100	+ 0.50	- 0.25	+ 0.25	+ 0.50	+ 0.50	+ 0.75
100	105	+ 0.75	+ 1.00	+ 1.50	+ 2.25	+ 1.25	+ 1.75
110	105	0	- 1.25	- 1.25	- 0.50	- 0.25	+ 0.25
110	110	+ 0.25	- 0.25	+ 0.25	+ 0.75	+ 0.50	+ 0.75
110	115	+ 0.75	+ 1.00	+ 1.50	+ 2.25	+ 1.50	+ 1.75
120	115	0	- 1.25	- 1.25	- 0.25	- 0.25	+ 0.25
120	120	+ 0.25	- 0.25	+ 0.25	+ 0.50	+ 0.25	+ 0.50
120	125	+ 0.50	+ 0.50	+ 1.50	+ 2.00	+ 1.25	+ 1.50
130	125	- 0.25	- 1.50	- 1.00	- 0.25	- 0.25	+ 0.25
130	130	+ 0.25	- 0.25	0	+ 0.75	+ 0.25	+ 0.50
130	135	+ 0.50	+ 0.50	+ 1.25	+ 2.25	+ 0.75	+ 1.25
140	135	0	- 1.25	- 1.25	- 0.25	- 0.25	+ 0.25
140	140	+ 0.20	0	0	+ 0.50	0	+ 0.50
140	145	+ 0.50	+ 0.50	+ 1.00	+ 2.00	+ 0.50	+ 1.25
150	145	0	- 1.00	- 0.75	0	- 0.25	+ 0.25
150	150	+ 0.25	0	0	+ 0.75	0	+ 0.50
150	155	+ 0.50	+ 0.75	+ 0.75	+ 2.25	+ 0.50	+ 1.25
160	155	0	- 0.50	- 0.50	+ 0.25	- 0.25	+ 0.25
160	160	+ 0.25	+ 0.25	+ 0.25	+ 1.25	+ 0.25	+ 0.50
160	165	+ 0.75	+ 1.25	+ 1.25	+ 2.25	+ 0.50	+ 1.25
170	165	+ 0.25	- 0.25	- 0.25	+ 0.25	- 0.25	+ 0.25
170	170	+ 0.50	+ 0.50	+ 0.50	+ 1.25	+ 0.25	+ 0.50
170	175	+ 0.75	+ 1.75	+ 1.75	+ 2.50	+ 0.75	+ 1.25
180	175	+ 0.25	0	0	+ 0.50	0	+ 0.25
180	180	+ 0.75	+ 0.75	+ 0.75	+ 1.50	+ 0.25	+ 0.75
180	185	+ 1.00	+ 2.00	+ 2.00	+ 2.50	+ 0.50	+ 1.50
190	185	+ 0.25	+ 0.25	+ 0.25	+ 1.00	0	+ 0.50
190	190	+ 0.75	+ 1.25	+ 1.25	+ 2.00	+ 0.25	+ 1.00
190	195	+ 1.25	+ 2.25	+ 2.00	+ 2.75	+ 0.75	+ 1.75
200	195	+ 0.25	0	0	+ 0.75	- 0.25	+ 0.50
200	200	+ 0.50	+ 0.75	+ 0.75	+ 1.75	+ 0.25	+ 0.75
200	205	+ 1.00	+ 2.00	+ 1.75	+ 2.50	+ 0.50	+ 1.25

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	55	+ 0.25	- 1.75	- 2.00	- 1.25	0	0
60	60	+ 0.75	0	0	+ 0.75	+ 1.25	+ 0.75
60	65	+ 1.75	+ 1.75	+ 2.00	+ 2.50	+ 2.25	+ 1.75
70	65	+ 0.25	- 1.50	- 1.50	- 0.75	- 0.25	+ 0.25
70	70	+ 1.00	0	+ 0.25	+ 0.75	+ 0.75	+ 1.25
70	75	+ 2.00	+ 1.75	+ 2.00	+ 2.75	+ 2.00	+ 2.25
80	75	+ 0.25	- 1.50	- 1.50	- 0.50	0	+ 0.25
80	80	+ 0.75	0	+ 0.25	+ 0.50	+ 0.75	+ 1.00
80	85	+ 1.75	+ 1.50	+ 2.00	+ 2.50	+ 2.00	+ 2.00
90	85	+ 0.20	- 1.50	- 1.50	- 0.50	0	+ 0.25
90	90	+ 0.50	- 0.25	0	+ 0.75	+ 0.50	+ 1.00
90	95	+ 1.25	+ 1.25	+ 1.75	+ 2.50	+ 1.75	+ 2.00
100	95	+ 0.25	- 1.50	- 1.25	- 0.25	- 0.25	+ 0.25
100	100	+ 0.50	- 0.25	+ 0.25	+ 0.50	+ 0.50	+ 1.00
100	105	+ 1.00	+ 1.00	+ 1.75	+ 2.25	+ 1.25	+ 2.00
110	105	0	- 1.25	- 1.00	- 0.25	- 0.25	+ 0.25
110	110	+ 0.50	0	+ 0.25	+ 0.75	+ 0.50	+ 1.00
110	115	+ 1.00	+ 1.00	+ 1.50	+ 2.50	+ 1.50	+ 2.00
120	115	0	- 1.25	- 1.00	- 0.25	- 0.25	+ 0.25
120	120	+ 0.50	- 0.25	+ 0.25	+ 0.50	+ 0.25	+ 0.75
120	125	+ 0.75	+ 0.50	+ 1.25	+ 2.25	+ 1.25	+ 1.75
130	125	0	- 1.50	- 0.75	- 0.25	- 0.25	+ 0.25
130	130	+ 0.25	- 0.25	+ 0.25	+ 0.75	+ 0.25	+ 0.75
130	135	+ 0.75	+ 0.75	+ 1.25	+ 2.25	+ 1.00	+ 1.50
140	135	0	- 1.25	- 0.75	- 0.25	- 0.25	+ 0.25
140	140	+ 0.25	0	0	+ 0.50	+ 0.25	+ 0.50
140	145	+ 0.50	+ 0.75	+ 1.00	+ 2.25	+ 0.75	+ 1.00
150	145	0	- 1.00	- 0.75	0	- 0.50	+ 0.25
150	150	+ 0.25	0	0	+ 0.75	0	+ 0.50
150	155	+ 0.75	+ 0.75	+ 0.75	+ 2.25	+ 0.50	+ 1.00
160	155	0	- 0.50	- 0.50	+ 0.25	- 0.25	+ 0.25
160	160	+ 0.50	+ 0.25	+ 0.25	+ 1.25	+ 0.25	+ 0.50
160	165	+ 1.00	+ 1.25	+ 1.25	+ 2.25	+ 0.75	+ 1.25
170	165	+ 0.25	- 0.25	- 0.25	+ 0.25	- 0.25	+ 0.25
170	170	+ 0.50	+ 0.50	+ 0.50	+ 1.25	+ 0.25	+ 0.75
170	175	+ 1.00	+ 1.75	+ 1.75	+ 2.25	+ 0.75	+ 1.25
180	175	+ 0.25	0	0	+ 0.50	0	+ 0.25
180	180	+ 0.50	+ 0.75	+ 0.75	+ 1.50	+ 0.25	+ 0.75
180	185	+ 1.25	+ 2.00	+ 2.00	+ 2.50	+ 0.75	+ 1.50
190	185	+ 0.25	+ 0.25	+ 0.25	+ 1.00	0	+ 0.50
190	190	+ 0.50	+ 1.25	+ 1.25	+ 2.00	+ 0.50	+ 1.00
190	195	+ 1.25	+ 2.25	+ 2.00	+ 2.75	+ 1.00	+ 1.50
200	195	+ 0.25	0	0	+ 0.75	0	+ 0.25
200	200	+ 0.50	+ 0.75	+ 0.75	+ 1.75	+ 0.25	+ 0.75
200	205	+ 1.00	+ 2.00	+ 1.50	+ 2.50	+ 0.50	+ 1.25

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	55	0	- 1.50	- 1.75	- 1.25	0	+ 0.25
60	60	+ 0.50	0	+ 0.25	+ 0.75	+ 1.00	+ 1.00
60	65	+ 1.50	+ 2.00	+ 2.00	+ 2.50	+ 2.25	+ 2.00
70	65	0	- 1.50	- 1.50	- 0.75	- 0.25	+ 0.50
70	70	+ 0.75	0	+ 0.25	+ 0.75	+ 0.75	+ 1.25
70	75	+ 1.75	+ 1.75	+ 2.00	+ 2.50	+ 2.00	+ 2.00
80	75	+ 0.25	- 1.50	- 1.50	- 0.50	- 0.25	+ 0.50
80	80	+ 0.75	0	+ 0.25	+ 0.50	+ 0.75	+ 1.25
80	85	+ 1.50	+ 1.50	+ 1.75	+ 2.50	+ 1.75	+ 2.00
90	85	+ 0.25	- 1.50	- 1.50	- 0.50	- 0.25	+ 0.25
90	90	+ 0.50	0	0	+ 0.75	+ 0.50	+ 1.25
90	95	+ 1.25	+ 1.50	+ 1.75	+ 2.50	+ 1.50	+ 1.75
100	95	0	- 1.25	- 1.00	- 0.25	- 0.25	+ 0.25
100	100	+ 0.50	0	+ 0.25	+ 0.50	+ 0.50	+ 1.00
100	105	+ 1.25	+ 1.25	+ 1.75	+ 2.25	+ 1.50	+ 1.75
110	105	0	- 1.25	- 1.00	- 0.25	- 0.25	+ 0.25
110	110	+ 0.50	0	+ 0.25	+ 0.75	+ 0.50	+ 1.00
110	115	+ 1.25	+ 1.25	+ 1.75	+ 2.25	+ 1.50	+ 1.75
120	115	0	- 1.25	- 0.75	- 0.25	- 0.25	+ 0.25
120	120	+ 0.50	- 0.25	+ 0.25	+ 0.50	+ 0.25	+ 0.75
120	125	+ 0.75	+ 0.75	+ 1.50	+ 2.25	+ 1.25	+ 1.50
130	125	0	- 1.25	- 0.75	- 0.25	- 0.25	+ 0.25
130	130	+ 0.25	- 0.25	+ 0.25	+ 0.75	+ 0.25	+ 0.75
130	135	+ 0.75	+ 1.00	+ 1.25	+ 2.25	+ 1.00	+ 1.50
140	135	0	- 1.00	- 0.75	- 0.25	- 0.25	+ 0.25
140	140	+ 0.25	0	0	+ 0.75	+ 0.25	+ 0.50
140	145	+ 0.75	+ 0.75	+ 1.00	+ 2.25	+ 0.75	+ 1.25
150	145	0	- 1.00	- 0.50	0	- 0.25	+ 0.25
150	150	+ 0.25	0	+ 0.20	+ 0.75	0	+ 0.50
150	155	+ 0.75	+ 0.75	+ 1.00	+ 2.25	+ 0.75	+ 1.25
160	155	0	- 0.50	- 0.50	+ 0.25	- 0.25	+ 0.25
160	160	+ 0.50	+ 0.25	+ 0.50	+ 1.25	+ 0.25	+ 0.50
160	165	+ 1.00	+ 1.25	+ 1.25	+ 2.25	+ 0.75	+ 1.50
170	165	+ 0.25	0	- 0.25	+ 0.50	- 0.25	+ 0.50
170	170	+ 0.50	+ 0.50	+ 0.50	+ 1.25	+ 0.25	+ 0.75
170	175	+ 1.00	+ 1.75	+ 1.75	+ 2.50	+ 0.75	+ 1.50
180	175	+ 0.25	0	+ 0.25	+ 0.50	0	+ 0.50
180	180	+ 0.75	+ 0.75	+ 0.75	+ 1.50	+ 0.25	+ 1.00
180	185	+ 1.00	+ 2.00	+ 2.00	+ 2.50	+ 0.75	+ 1.50
190	185	+ 0.50	+ 0.50	+ 0.50	+ 1.00	0	+ 0.50
190	190	+ 0.75	+ 1.25	+ 1.50	+ 2.00	+ 0.25	+ 1.25
190	195	+ 1.50	+ 2.25	+ 2.25	+ 3.00	+ 1.00	+ 1.75
200	195	+ 0.25	+ 0.25	0	+ 0.75	0	+ 0.50
200	200	+ 0.50	+ 1.25	+ 1.00	+ 1.75	+ 0.25	+ 1.00
200	205	+ 1.25	+ 2.00	+ 1.75	+ 2.50	+ 0.75	+ 1.50

TABLE ~~XX~~

Table of Resistance of Solution in Ohms

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

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
55	22500	9550	6250	3350	1660	698
60	21000	9000	5850	3120	1560	653
65	19800	8450	5500	2950	1480	615
70	18500	8000	5200	2780	1390	578
75	17400	7550	4900	2600	1310	545
80	16500	7150	4620	2480	1230	515
85	15600	6750	4380	2330	1170	486
90	14800	6400	4150	2200	1110	460
95	14100	6050	3920	2090	1060	438
100	13400	5780	3720	2000	1000	418
105	12800	5500	3550	1900	960	398
110	12200	5250	3380	1800	910	380
115	11700	5000	3230	1720	870	364
120	11100	4800	3080	1650	840	350
125	10800	4600	2950	1580	800	335
130	10300	4400	2830	1500	770	320
135	9800	4200	2720	1440	740	308
140	9500	4000	2610	1390	715	298
145	9100	3880	2510	1330	685	288
150	8780	3720	2420	1280	665	278
155	8450	3580	2340	1230	640	268
160	8150	3450	2250	1190	620	260
165	7850	3320	2180	1150	600	250
170	7600	3200	2100	1120	580	242
175	7350	3100	2020	1080	562	235
180	7100	3000	1960	1050	550	228
185	6900	2900	1900	1010	533	221
190	6700	2820	1840	980	518	214
195	6500	2740	1800	950	500	208
200	6300	2650	1750	925	488	202
205	6150	2580	1700	900	475	196

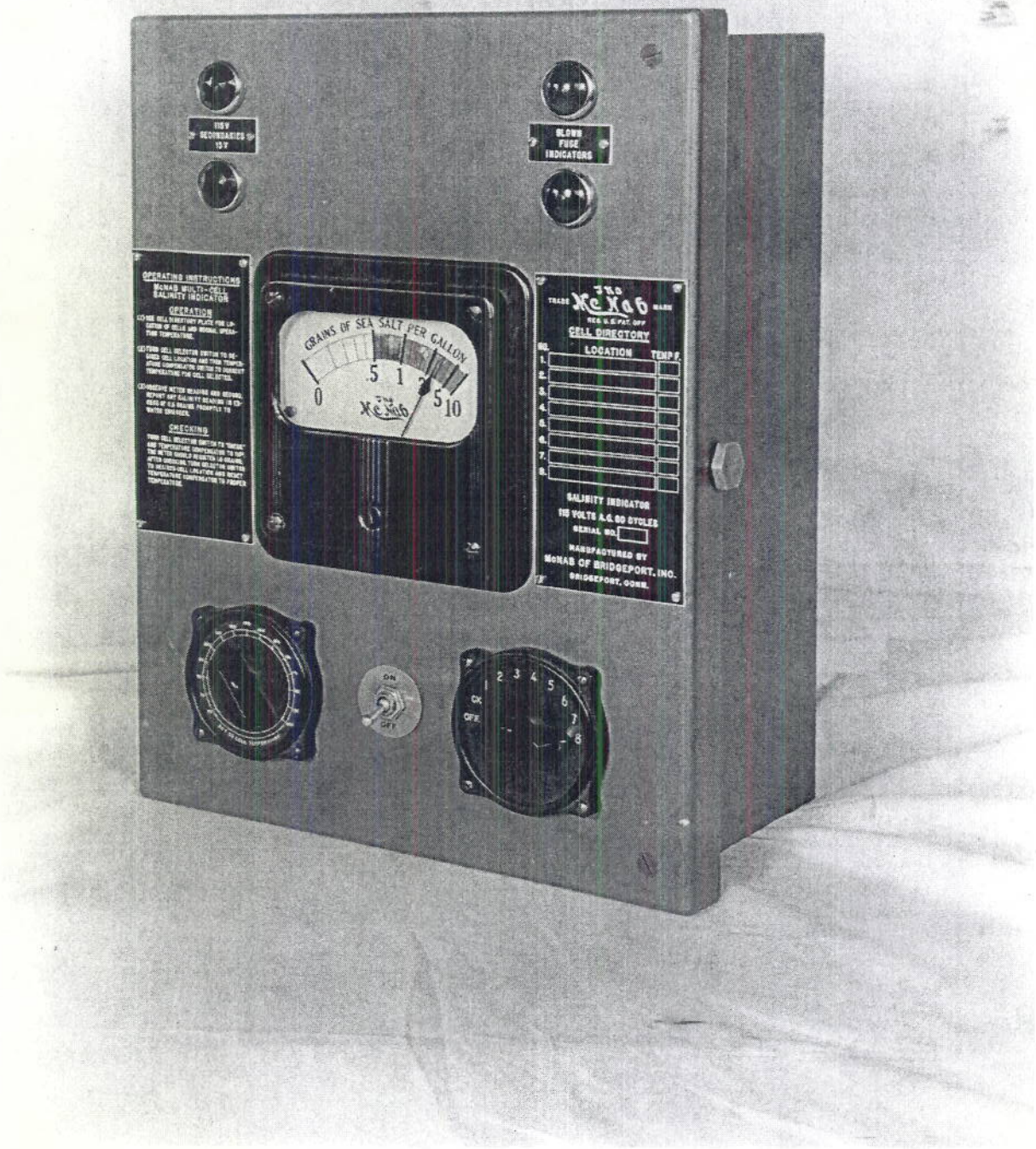

115V SECONDARIES 15 V
BLOWN FUSE INDICATORS
OPERATING INSTRUCTIONS
McNAB MULTI-CELL SALINITY INDICATOR
OPERATION
SALINITY INDICATOR
115 VOLTS A.C. 60 CYCLES
SERIAL NO.
MANUFACTURED BY
McNAB OF BRIDGEPORT, INC.
BRIDGEPORT, CONN.

PLATE 1

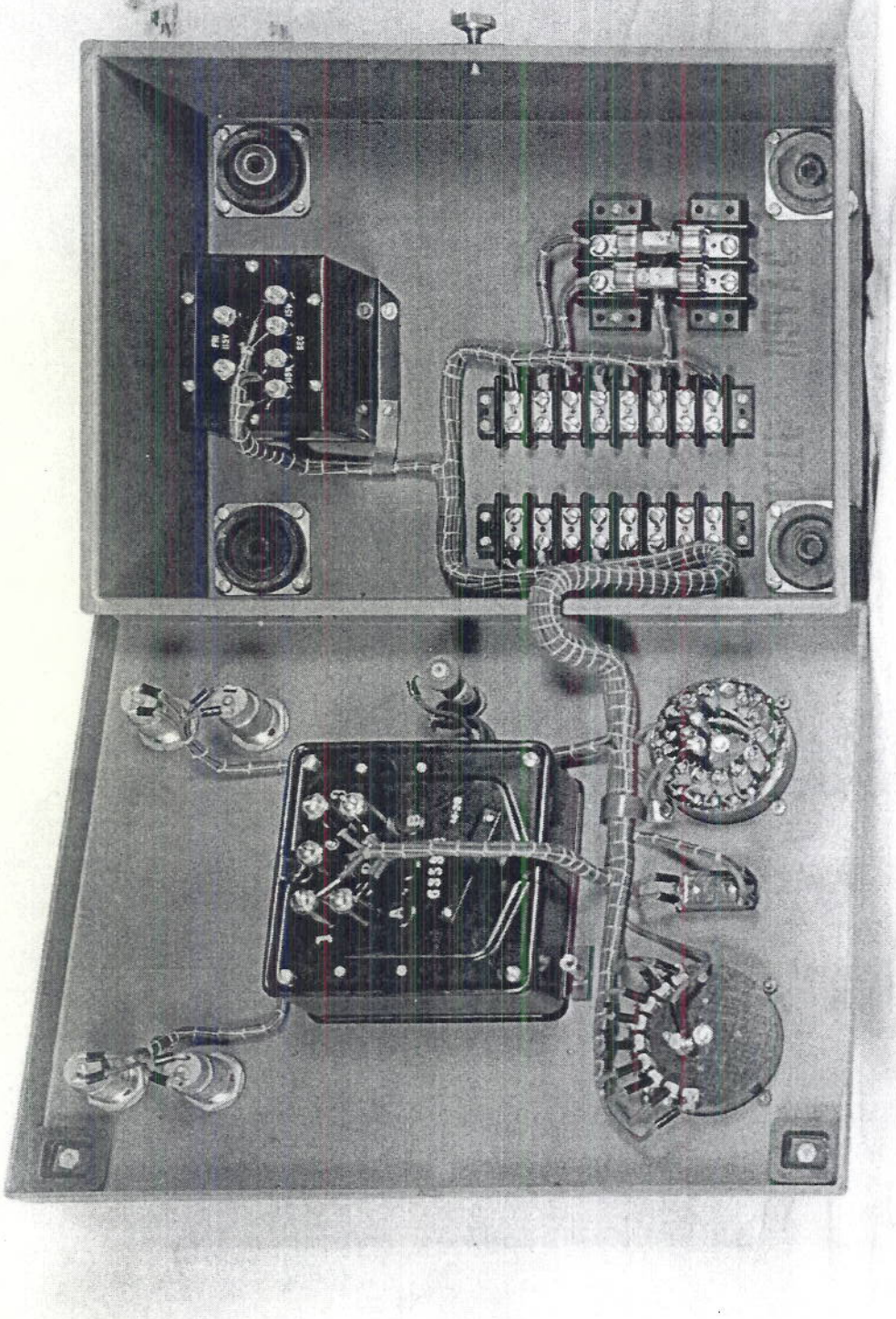
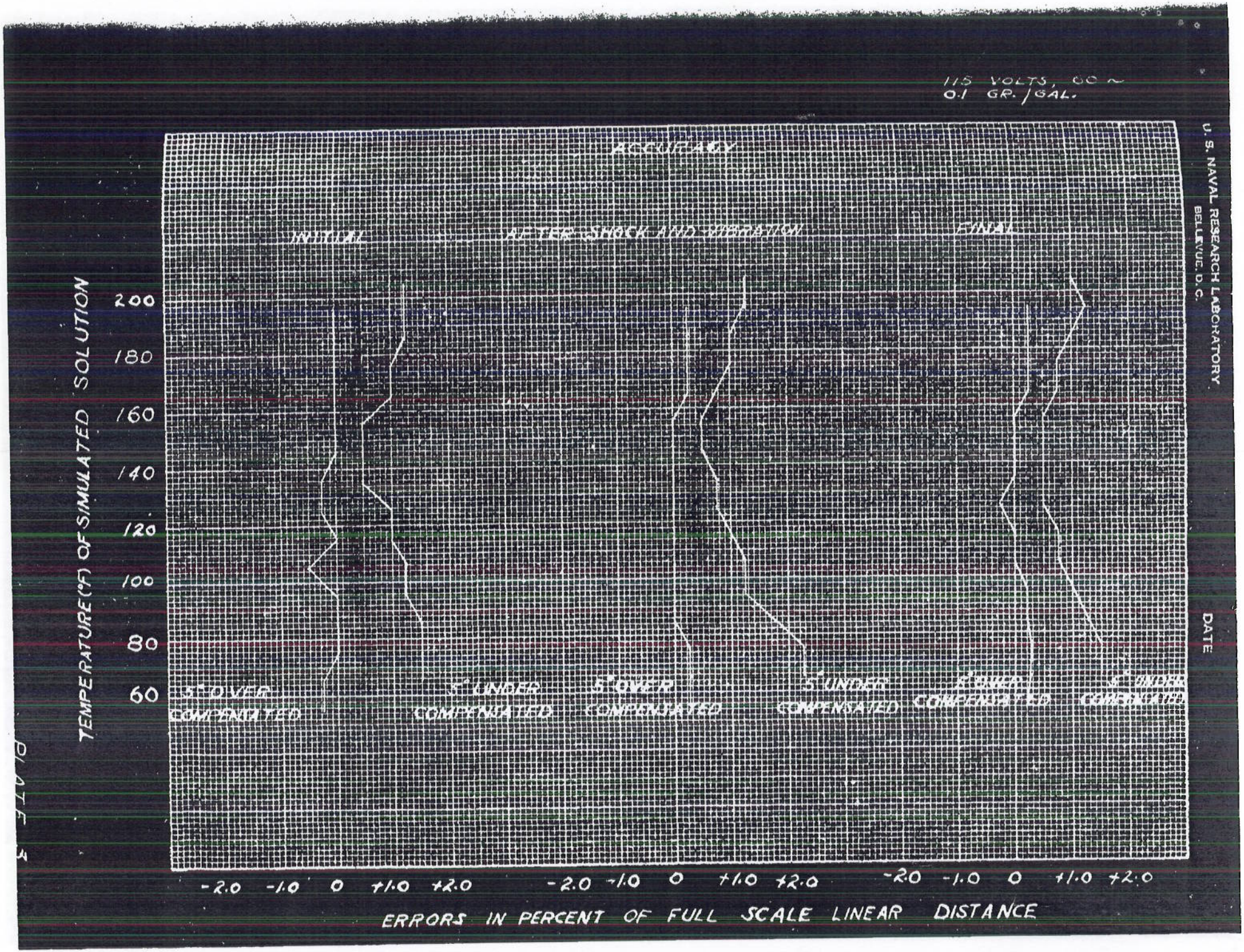
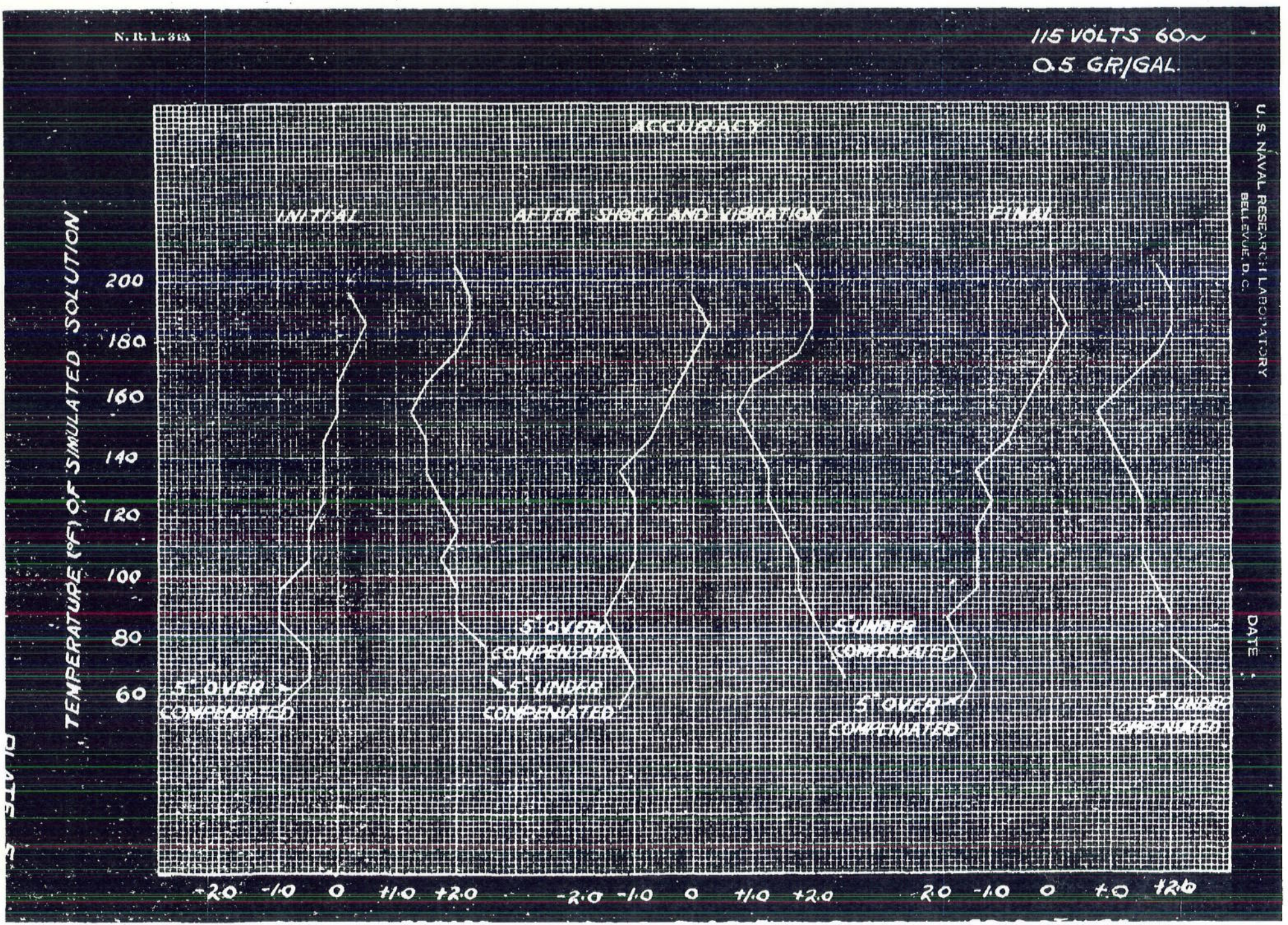


PLATE 2


115 VOLTS, 60 ~
0.1 GR./GAL.
ACCURACY
INITIAL
AFTER SHOCK AND VIBRATION
FINAL
U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.
DATE
TEMPERATURE (°F) OF SIMULATED SOLUTION
200
180
160
140
120
100
80
60
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER 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 PERCENT OF FULL SCALE LINEAR DISTANCE

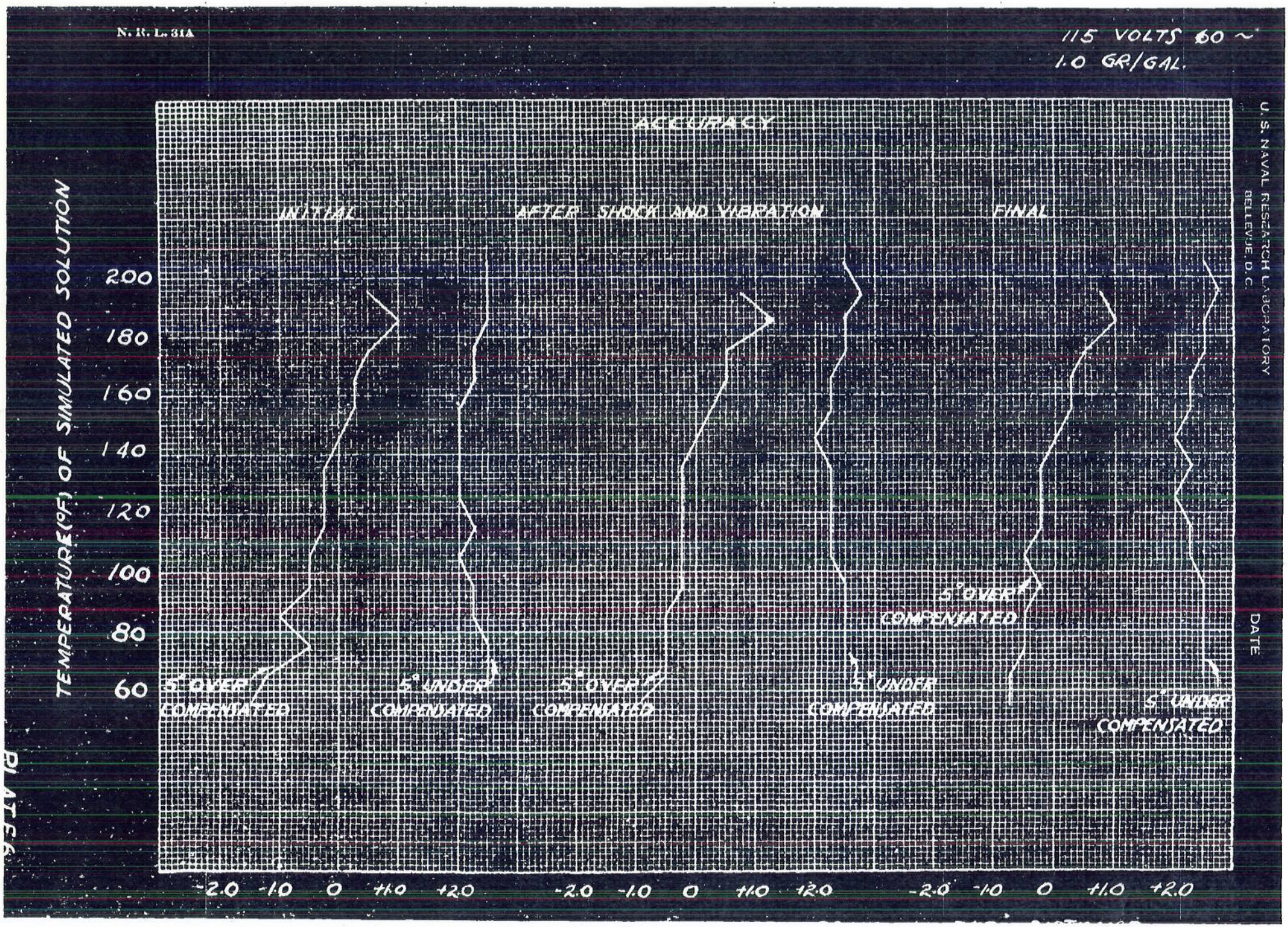
N. R. L. 31A

115 VOLTS 60~
0.5 GR./GAL.

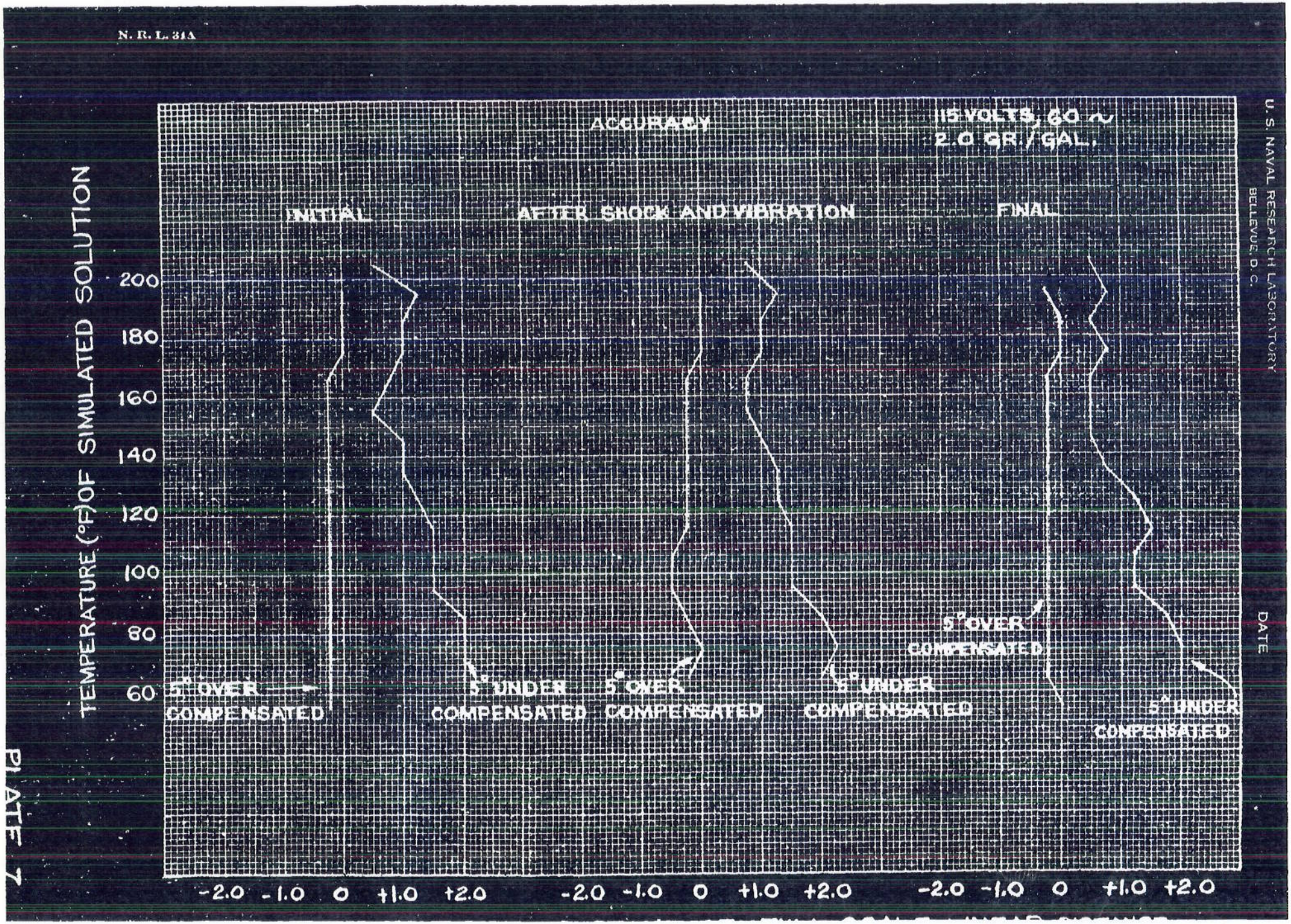


U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE :


N. R. L. 314
115 VOLTS 60 ~
1.0 GR/GAL.
ACCURACY
INITIAL
AFTER SHOCK AND VIBRATION
FINAL
TEMPERATURE (°F) OF SIMULATED SOLUTION
200
180
160
140
120
100
80
60
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER 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
U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D.C.
DATE
PLATE 6

N. R. L. 314

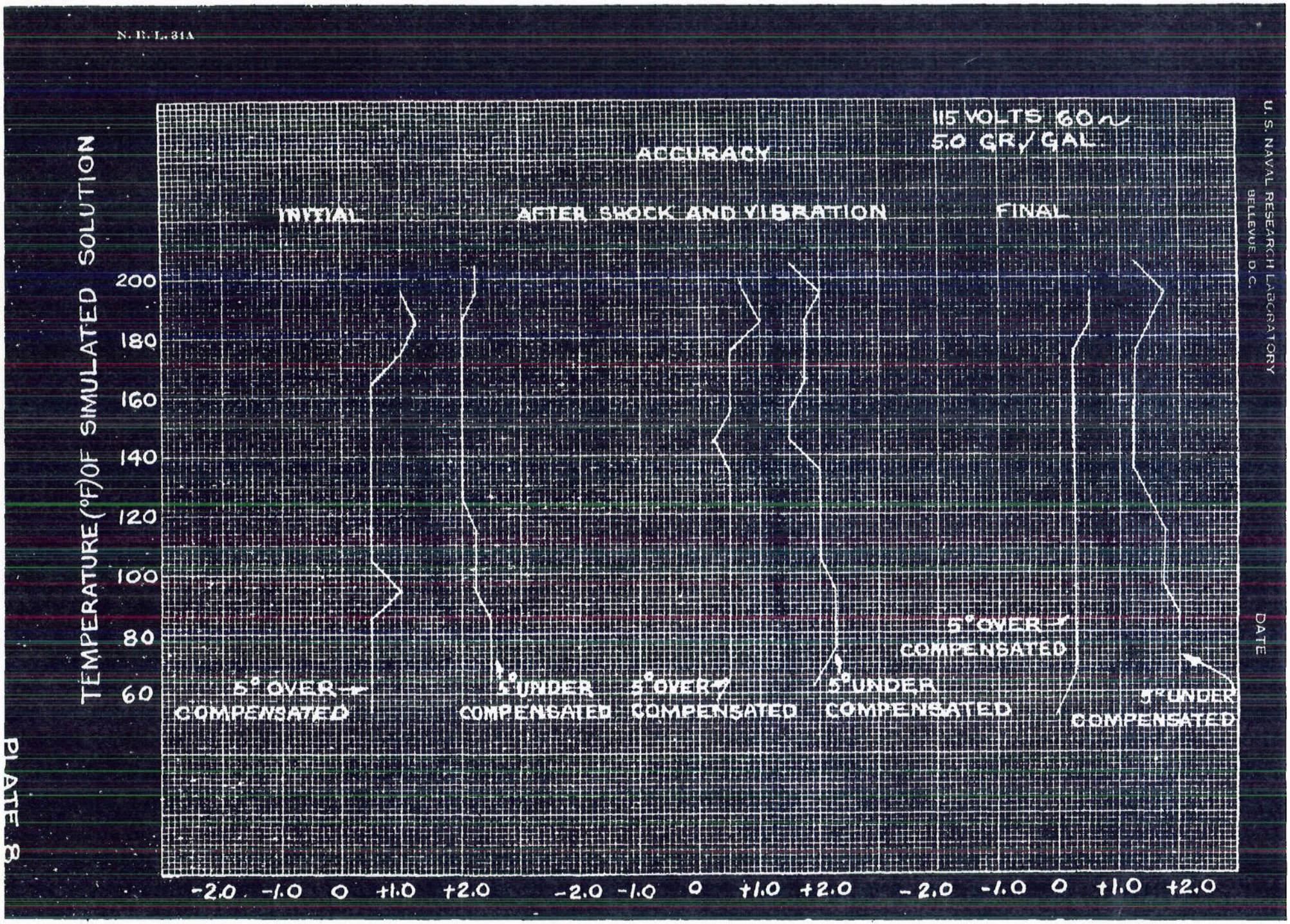


U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

PLATE 7

N. R. L. 31A

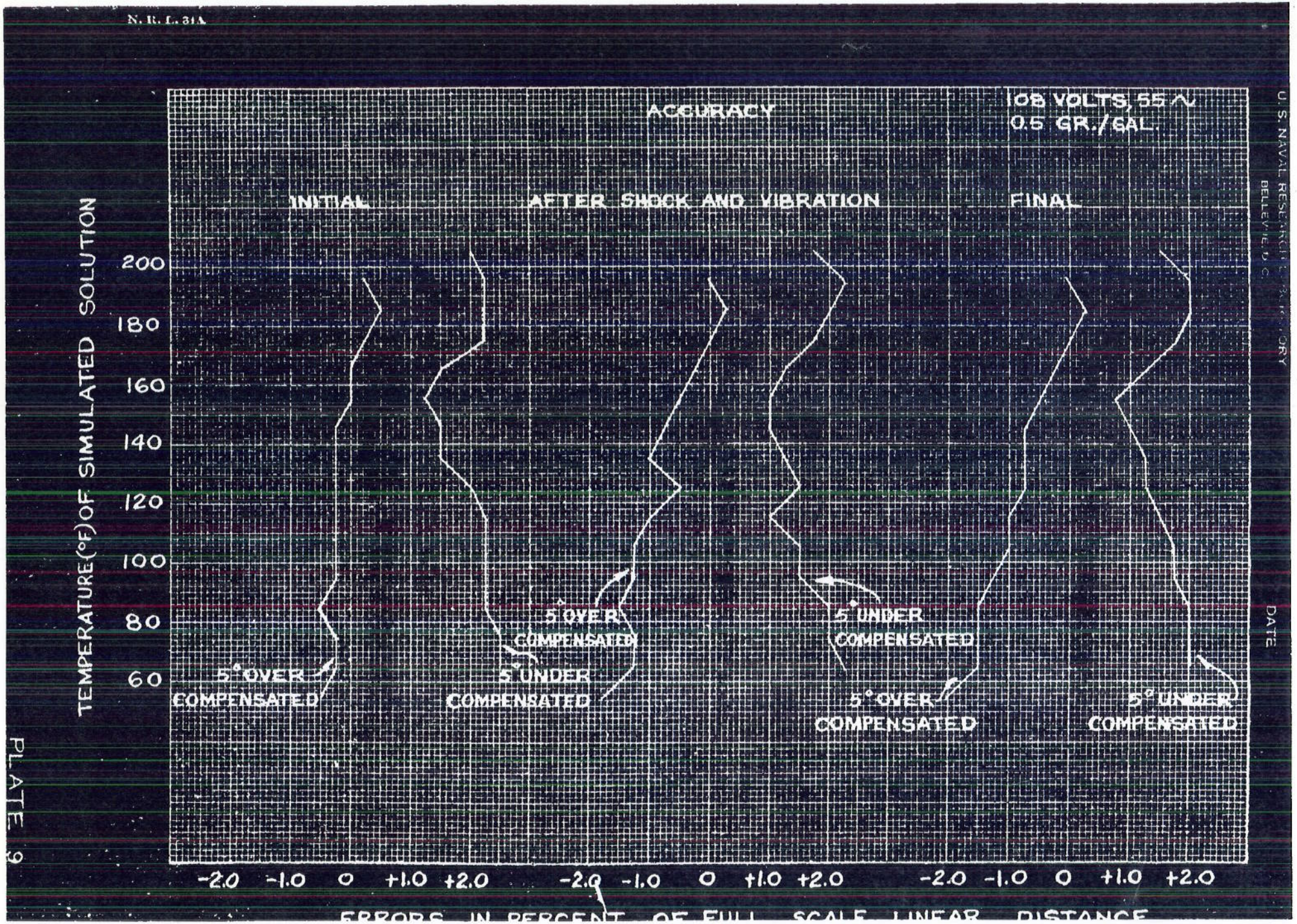


U. S. NAVAL RESEARCH LABORATORY
BELLEVUE D. C.

DATE

PLATE 8

N. R. L. 31A



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BELLEVUE, D. C.

DATE

PLATE 9

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

DATE

ACCURACY AFTER SHOCK AND VIBRATION

INITIAL

FINAL

28 VOLTS 55 ~
2.0 GR/GAL.

5° OVER-COMPENSATED

5° UNDER-COMPENSATED

5° OVER-COMPENSATED

5° UNDER-COMPENSATED

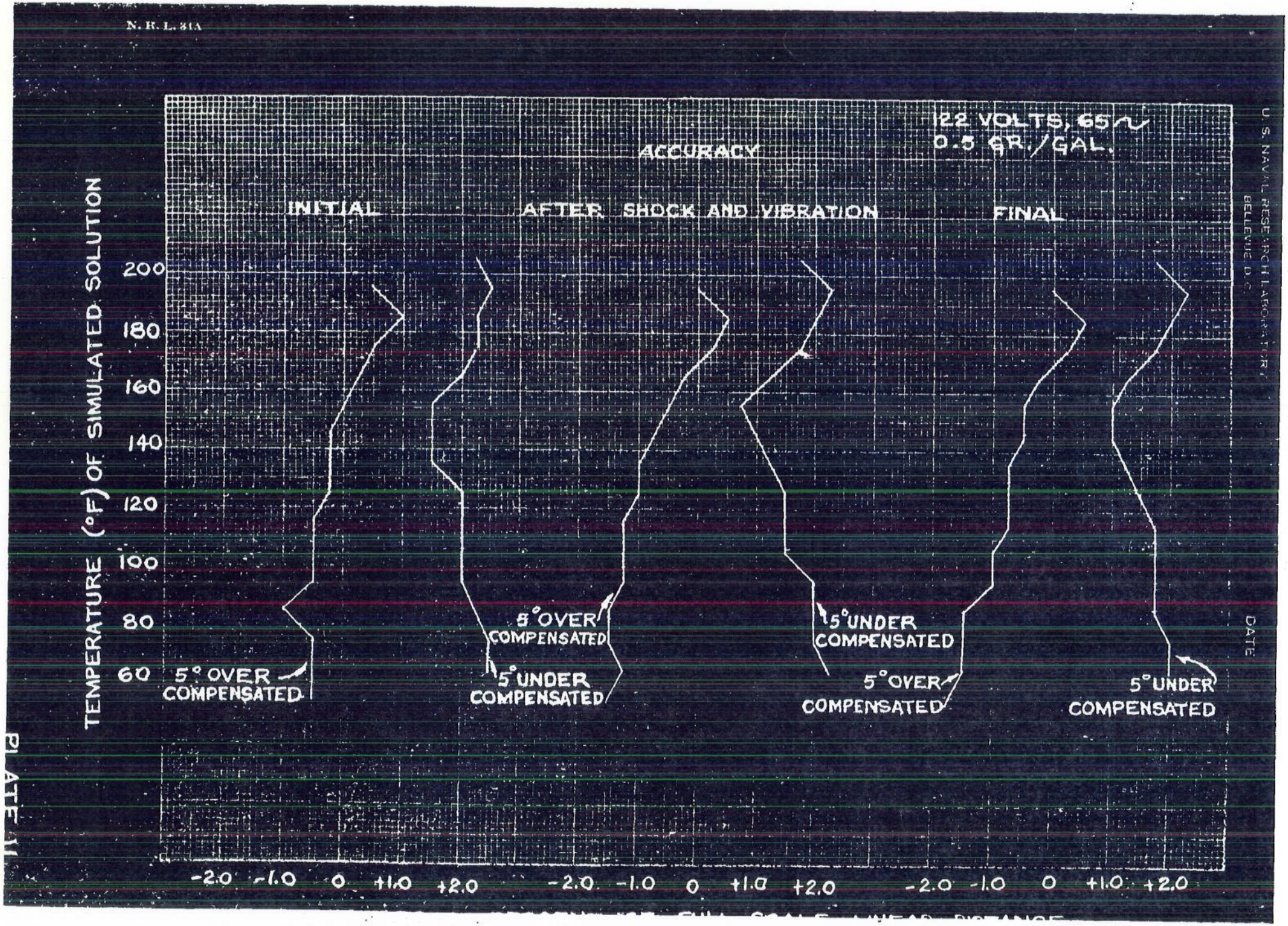
-2.0 -1.0 0 +1.0 +2.0 -2.0 -1.0 0 +1.0 +2.0 -2.0 -1.0 0 +1.0 +2.0

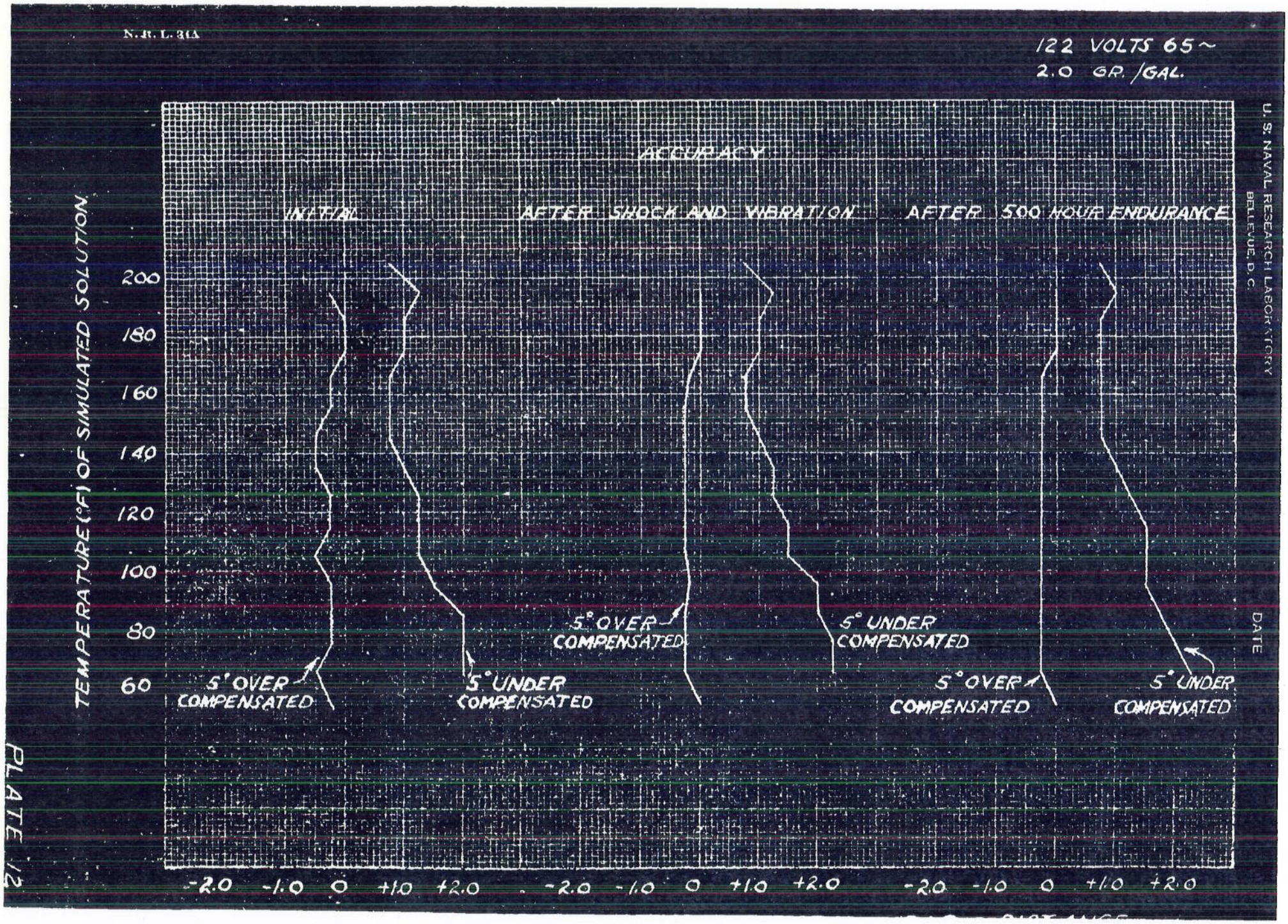
200 180 160 140 120 100 80 60

TEMPERATURE (°F) OF SIMULATED SOLUTION

N. R. L. 31A

PLATE 10


N. R. L. 31A
122 VOLTS, 65~
0.3 GR./GAL.
ACCURACY
INITIAL
AFTER SHOCK AND VIBRATION
FINAL
TEMPERATURE (°F) OF SIMULATED SOLUTION
200
180
160
140
120
100
80
60
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER 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
U. S. NAVAL RESEARCH LABORATORY, BELLEVUE, D.C.
DATE
PLATE II


N.R.L. 314
122 VOLTS 65~
2.0 GR. /GAL.
ACCURACY
INITIAL
AFTER SHOCK AND VIBRATION
AFTER 500 HOUR ENDURANCE
TEMPERATURE (°F) OF SIMULATED SOLUTION
200
180
160
140
120
100
80
60
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER COMPENSATED
5° OVER COMPENSATED
5° UNDER 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
U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.
DATE
PLATE 12

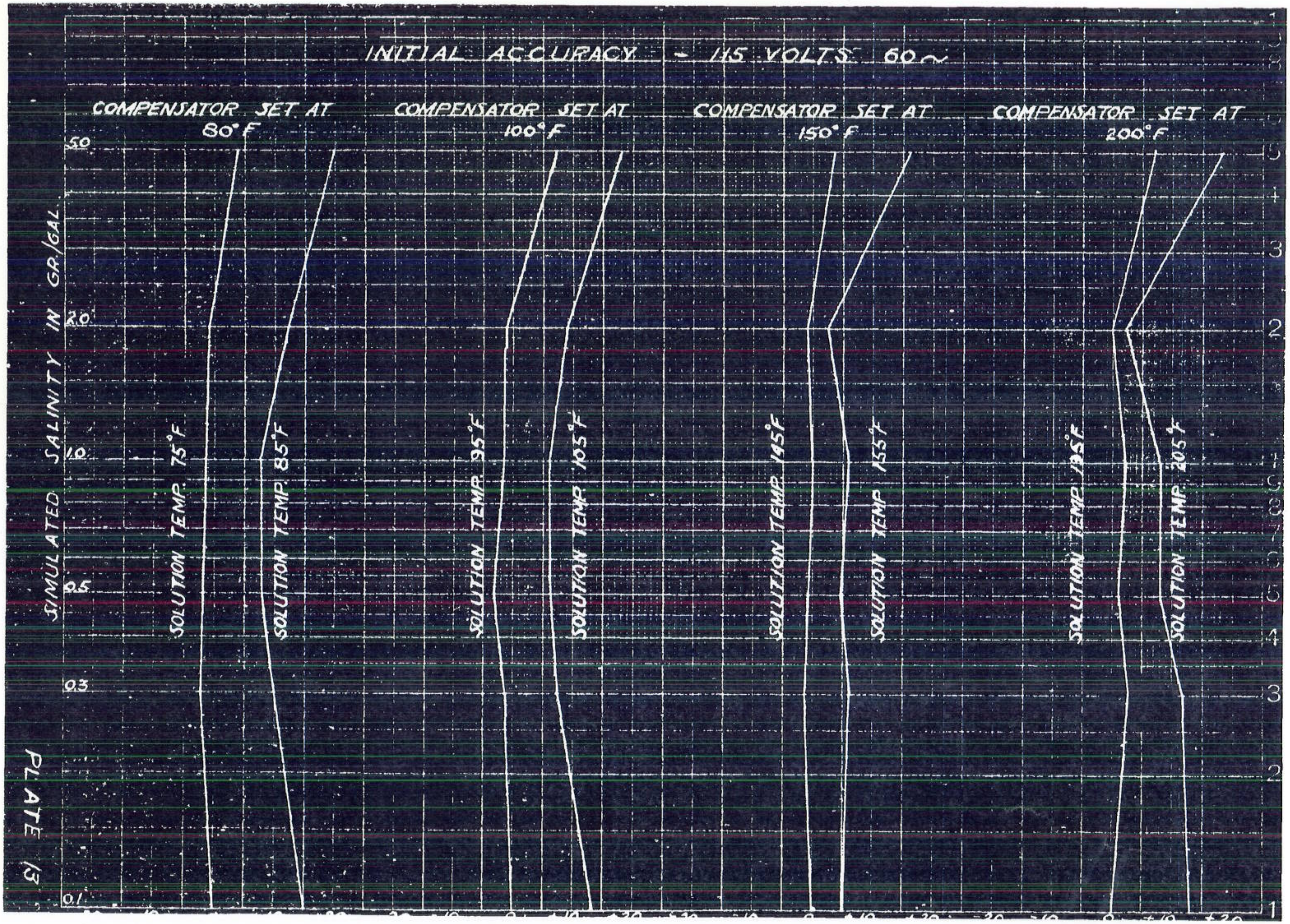

INITIAL ACCURACY - 115 VOLTS 60~
COMPENSATOR SET AT 80°F
COMPENSATOR SET AT 100°F
COMPENSATOR SET AT 150°F
COMPENSATOR SET AT 200°F
SOLUTION TEMP. 75°F
SOLUTION TEMP. 85°F
SOLUTION TEMP. 95°F
SOLUTION TEMP. 105°F
SOLUTION TEMP. 145°F
SOLUTION TEMP. 155°F
SOLUTION TEMP. 195°F
SOLUTION TEMP. 205°F
SIMULATED SALINITY IN GR./GAL.
5.0
2.0
1.0
0.5
0.3
0.1

PLATE 13

INITIAL ACCURACY - 108 VOLTS, 55~
COMPENSATOR SET AT 200°F
SOLUTION TEMP. 205°F
SOLUTION TEMP. 195°F
COMPENSATOR SET AT 150°F
SOLUTION TEMP. 155°F
SOLUTION TEMP. 145°F
COMPENSATOR SET AT 100°F
SOLUTION TEMP. 105°F
SOLUTION TEMP. 95°F
COMPENSATOR SET AT 80°F
SOLUTION TEMP. 85°F
SOLUTION TEMP. 75°F
SIMULATED SALINITY IN GR./GAL.
5.0
2.0
0.7
0.5
0.3
0.2
PLATE 14

INITIAL ACCURACY ±1/2 VOLTS, 65 ~
COMPENSATOR SET AT 80°F
COMPENSATOR SET AT 100°F
COMPENSATOR SET AT 150°F
COMPENSATOR SET AT 200°F
SOLUTION TEMP 75°F
SOLUTION TEMP 85°F
SOLUTION TEMP 95°F
SOLUTION TEMP 105°F
SOLUTION TEMP 145°F
SOLUTION TEMP 155°F
SOLUTION TEMP 195°F
SOLUTION TEMP 205°F
5.0
2.0
1.0
0.5
0.3
0.1
SIMULATED SALINITY IN GR./GAL.

PLATE 15

FINAL ACCURACY ± 1/5 VOLTS, 60 ~
COMPENSATOR SET AT 80°F
COMPENSATOR SET AT 100°F
COMPENSATOR SET AT 150°F
COMPENSATOR SET AT 200°F
SOLUTION TEMP 75°F
SOLUTION TEMP 85°F
SOLUTION TEMP 95°F
SOLUTION TEMP 105°F
SOLUTION TEMP 145°F
SOLUTION TEMP 155°F
SOLUTION TEMP 195°F
SOLUTION TEMP 205°F
5.0
2.0
1.0
0.5
0.3
SIMULATED SALINITY IN GR./GAL.
PLATE 16

FINAL ACCURACY: 108 VOLTS, 55 ~
COMPENSATOR SET AT 80°F
COMPENSATOR SET AT 105°F
COMPENSATOR SET AT 150°F
COMPENSATOR SET AT 200°F
SOLUTION TEMP 75°F
SOLUTION TEMP 85°F
SOLUTION TEMP 95°F
SOLUTION TEMP 105°F
SOLUTION TEMP 145°
SOLUTION TEMP 155°F
SOLUTION TEMP 195°F
SOLUTION TEMP 205°F
SIMULATED SALINITY IN GR./GAL.
5.0
2.0
1.0
0.5
0.3
0.1

PLATE 17

FINAL ACCURACY, 122 VOLTS, 65 ~
COMPENSATOR SET AT 80°F
COMPENSATOR SET AT 100°F
COMPENSATOR SET AT 150°F
COMPENSATOR SET AT 200°F
SOLUTION TEMP 75°F
SOLUTION TEMP 85°F
SOLUTION TEMP 95°F
SOLUTION TEMP 105°F
SOLUTION TEMP 145°F
SOLUTION TEMP 155°F
SOLUTION TEMP 195°F
SOLUTION TEMP 205°F
5.0
2.0
1.0
0.6
0.3
0.1
SIMULATED SALINITY IN GR/GAL.
+20
+10
0
-10
-20

PLATE 18

CONVERSION CURVES

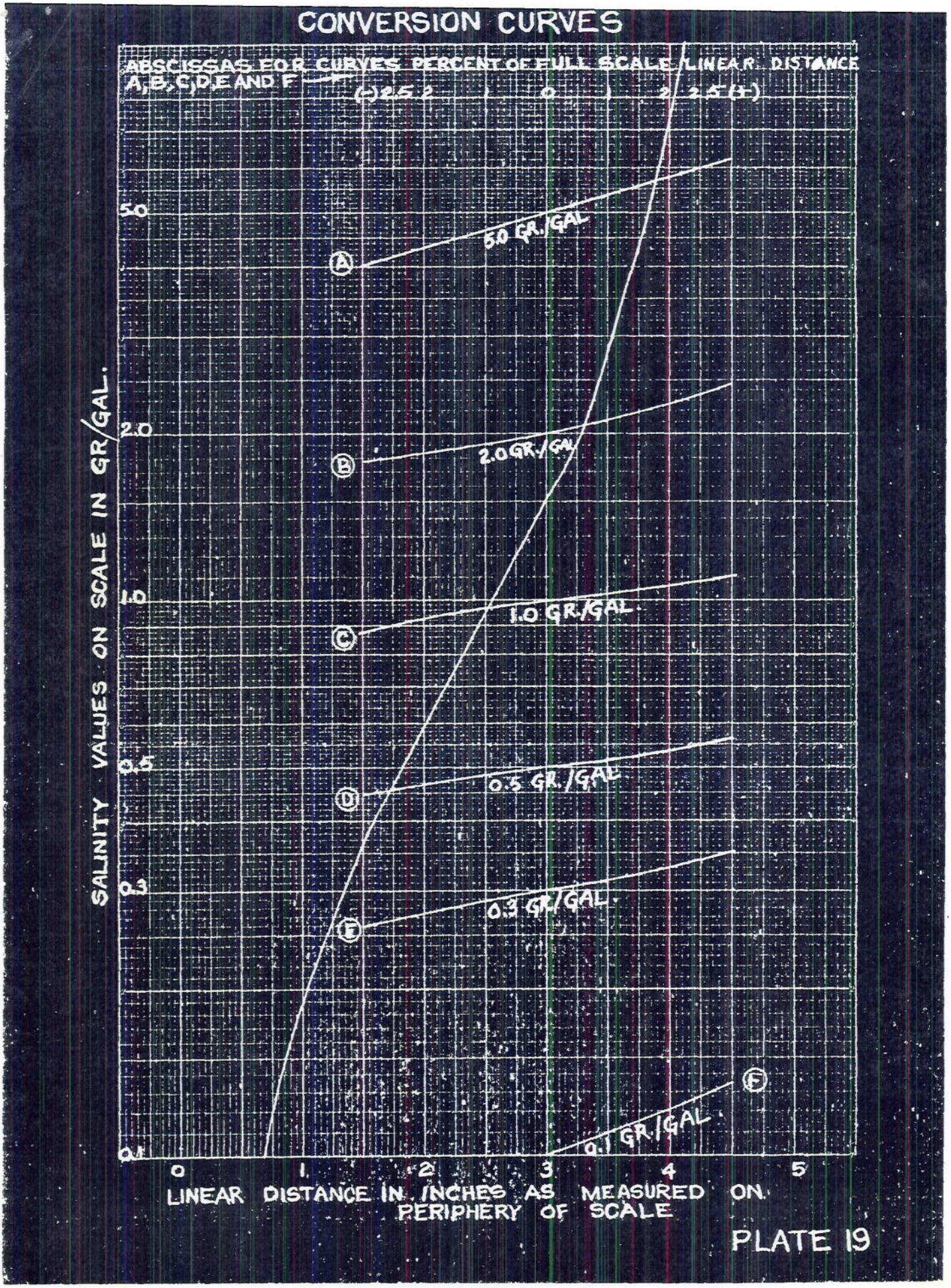


PLATE 19