REPORT NO. R-1567

DATE 25 October 1939

SUBJECT

Report on

Test of Resubmitted Model XTBK-8 Radio

Radio Transmitting Equipment

FR-1567

by

J. D. Wallace
O. C. Dresser
R. B. Meyer

NAVAL RESEARCH LABORATORY

BELLEVUE, D. C.

25 October 1939

NRL Report No. R-1567
BuEng.Problem T5-28C

UNCLASSIFIED
NAVY DEPARTMENT

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Contractor:

R.C.A. Manufacturing Co.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
Washington, D.C.

Number of Pages: Text - 58 Tables - 47 Plates - 41

Authorization: BuEng.let. C-NOs-61006(10-19-R8) of 29 October 1938.

Date of Test: July 25, 1939 to October 3, 1939.

Tests conducted by: _____
J.D. Wallace, Associate Radio Engineer.

_____
O.C. Dresser, Associate Radio Engineer.

Report prepared by: _____
R.B. Meyer, Radio Engineer,
Chief of Section.

Reviewed by: _____
A.Hoyt Taylor, Head Physicist,
Superintendent, Radio Division.

Approved by: _____
H.G. Bowen, Rear Admiral, U.S. Navy
Director.

Distribution:
BuEng. (10)

Fund'l by NRL Ltr C-567/52

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APPENDICES

AUTHORIZATION OF TEST

1. The tests herein reported were originally authorized by reference (a), supplemented by references (b) and (c). Other pertinent data are listed as references (d) to (l).

Reference: (a) BuEng.let. C-NOs-61006(10-19-R8) of 29 Oct. 1938.
(b) BuEng.let. C-NOs-61006(10-19-R5) of 11 Feb. 1939 to BuS&A (copy to NRL).
(c) BuS&A.let. NOs-61006(SPM) of 15 Feb. 1939 to RCA Mfg.Co. (copy to NRL).
(d) BuEng.let. C-NOs-61006(10-19-R6) of 10 Feb. 1939 to INM, Phila. (copy to NRL).
(e) BuEng.let. C-NOs-61006(10-19-R6) of 22 May 1939 to INM, Phila. (copy to NRL).
(f) BuEng.let. C-NOs-61006(10-19-R6) of 18 Aug.1939.
(g) NRL Report No. R-1507 of 16 Jan. 1939.
(h) BuEng.Specifications RE 13A 442G.
(i) Navy Contract NOs-61006.
(j) RCA Mfg. Co. Descriptive Specs. AS-5326A-G.
(k) RCA Mfg. Co. Type Test Report of 7/20/39 on re-submitted Model XTBK-8 Equipment.
(l) RCA Preliminary Instructions covering re-submitted Model XTBK-8 Equipment.

OBJECT OF TESTS

2. The object of the tests was:

(a) To determine the extent to which the equipment complies with contractural requirements and basic specifications.

(b) To determine the efficacy of the changes incorporated in the re-submitted Model XTBK-8 equipment by the contractor in order to overcome the defects noted in the original model, as detailed in reference (g).

(c) To obtain data to permit submission of recommendations regarding any changes necessary to make the equipment more suitable for Naval use.

(d) To obtain performance data and recommendations for use in revision of basic specifications required in the purchase of additional equipments of similar nature.

ABSTRACT OF TESTS

3. The tests herein reported were conducted to determine the degree of compliance of the re-submitted Model XTBK-8 transmitting equipment with the mechanical and electrical requirements set forth in the governing contract.

4. Specifically, tests were conducted to determine the following:

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OBJECT OF TESTS

2. The object of the tests was:

(a) To determine the extent to which the equipment complies with contractural requirements and basic specifications.

(b) To determine the efficacy of the changes incorporated in the re-submitted Model XTBK-8 equipment by the contractor in order to overcome the defects noted in the original model, as detailed in reference (g).

(c) To obtain data to permit submission of recommendations regarding any changes necessary to make the equipment more suitable for Naval use.

(d) To obtain performance data and recommendations for use in revision of basic specifications required in the purchase of additional equipments of similar nature.

ABSTRACT OF TESTS

3. The tests herein reported were conducted to determine the degree of compliance of the re-submitted Model XTBK-8 transmitting equipment with the mechanical and electrical requirements set forth in the governing contract.

4. Specifically, tests were conducted to determine the following:

[redacted]

(a) Ability of the equipment to withstand shipment and movement from one location to another.

(b) Check of mechanical and physical construction and assembly; general workmanship; materials employed; corrosion resisting measures used and the adequacy of electrical circuits to withstand operation under Naval Service conditions.

(c) Power output; power input; overall efficiency and flexibility of antenna coupling circuits.

(d) Quality of emitted signals; lilt; undesirable modulation and keying characteristics at various speeds of signalling.

(e) Check of dimensions and weights of the various component units.

(f) Determination of frequency overlap; limiting frequencies of various circuits and cycles per division of the Master Oscillator controls.

(g) Check of the adequacy of the temperature control circuits employed in the equipment.

(h) Check of the protective circuits employed in the equipments.

(i) Frequency stability and accuracy under the following conditions:

(1) Accuracy of re-set.
(2) Lost motion and backlash.
(3) Operation of Adjust-Tune-Operate control.
(4) Detuning of circuits.
(5) Operation of power output control.
(6) Change of tubes.
(7) Variation of supply line voltage.
(8) Variation of ambient temperature.
(9) Variation of humidity.
(10) Locked key operation for two hours.
(11) Key locked to intermittently keyed condition.
(12) Continuously keyed to intermittently keyed condition.
(13) Inclination due to roll and pitch.
(14) Vibration.
(15) Shock.

In general, the above tests were conducted at two frequencies within the range of the transmitter. However, where conditions warranted, a greater number of frequencies were investigated.

5. Particular attention was paid to the facilities provided in the re-submitted model to provide accessibility and ease of servicing.

6. The power equipment supplied was tested to determine voltage regulation, percentage of voltage ripple and general performance under a variety of conditions.

[redacted]

Conclusions

(a) Detailed tests and examination of the re-submitted Model XTBK-8 equipment reveal that all former objectionable characteristics have been remedied or eliminated and that the present equipment is far superior in design, construction, appearance and operating characteristics.

(b) Power output and frequency stability characteristics comply with the terms of the governing specifications with the single exception of operation under conditions of high humidity. The departure from specification requirements in this instance is not of serious magnitude.

(c) The general appearance of the equipment, external and internal, is good and the treatment of wires and cables is excellent. Good accessibility to all parts has been provided and the removable unit construction of the master oscillator compartment reflects excellent design and workmanship.

(d) In general, the equipment operated in a safe and satisfactory manner after certain adjustments had been made during the course of the tests to which it was subjected. These tests demonstrated, however, that certain specific items require some further consideration in order to attain maximum reliability and improved operation.

(e) With proper corrective action applied to the deficiencies listed, the re-submitted Model XTBK-8 equipment should be capable of meeting the rigorous requirements of the Naval Service.

Recommendations

It is recommended:

(a) That the switch detents on the "Adjust-Tune-Operate" and "Antenna Feed" switches be modified to provide a greater degree of positioning accuracy. (See paragraph 31).

(b) That the necessary remedial action be applied to the items discussed in paragraph 33.

(c) That fuse mountings be marked to indicate the characteristics of the fuses in order to insure proper replacements. (Paragraphs 40 and 187).

(d) That the nameplates located near the overload relay re-sets be expanded to include the designation of the circuit in which each relay operates. (Paragraph 42).

(e) That the flexible tube socket mountings for the 1st and 2nd intermediate amplifier tubes be modified to possess the proper degree of flexibility. (Paragraph 53).

(f) That the nameplate letters which designate the tuning controls be of a continuous series and that care be exercised to insure that the calibration cards agree with the revised lettering. (Paragraphs 56 and 119).

(g) That the pivot construction of the meters be adjusted to prevent sticking of the indicating pointer; that antenna ammeters capable of satisfactory operation be supplied and that all meters be secured so that they may be removed through the front panel. (Paragraph 58).

(h) That precautionary measures be assured to provide the necessary set screws for securing control knobs. (Paragraph 65).

(i) That knurled head securing screws used for securing the master oscillator compartment and the removable shields be furnished in accordance with the improved sample submitted by the contractor. (Paragraphs 67(a) and 135).

(j) That the proper steps be taken to insure that all symbol tags will adhere to the equipment permanently. (Paragraphs 72 and 73).

(k) That the necessary precautions be taken to insure adequate filament potentials when the line supply voltage is varied over the limits of plus and minus 10%. (Paragraph 75).

(l) That the blue globe covering the "start" indicator light be replaced by a red globe. (Paragraphs 83 and 129).

(m) That the necessary steps be taken to provide a master oscillator tuning control of suitable operational characteristics free from excessive tension and stiffness. (Paragraph 85).

[redacted]

(n) That the necessary precautions be exercised to prevent excessive backlash in the master oscillator tuning control. (Paragraph 96).

(o) That the equipment be designed to function satisfactorily over the required range of ambient temperatures. (Paragraphs 102 and 111).

(p) That the Bureau of Engineering consider the advisability of accepting the operation now afforded by the equipment when subjected to humidity variation tests in accordance with paragraph 3-7-9 of the governing specifications. (Paragraph 103).

(q) That the master oscillator filament rheostat be removed from the front panel to a location within the interior of the transmitter; that the filament voltmeter be connected to indicate the potential applied to the power amplifier filaments and that the necessary modifications be made to insure that the master oscillator tube seats home properly. (Paragraph 113)

(r) That the switch interlocks on the "Adjust-Tune-Operate" and Antenna Feed switches be removed from the generator field circuit and connected into the keying circuit. (Paragraph 116(a)).

(s) That the necessary precautions be taken to insure that the clamps provided for securing the fabric blower couplings be of adequate design. (Paragraph 127).

(t) That a distribution transformer of adequate design, properly marked, be provided. (Paragraphs 138 and 155).

(u) That compensating capacitor C-172 be eliminated from the equipment. (Paragraph 150(b)).

(v) That the monitor coupling circuit be modified to couple to the plate circuit of the master oscillator tube in order that monitoring voltages at twice the frequency of the master oscillator frequency establishing circuit are available and that output levels of the order of 15 to 25 millivolts be retained. (Paragraphs 151(b) and 151(c)).

(w) That the Bureau of Engineering give detailed consideration to the operation of the 4-wire and 6-wire control circuits as outlined in paragraphs 157 to 166 in order to insure that the most desirable and satisfactory operation is obtained.

(x) That the manufacturer of the motor generator equipment give assurance that the proper grade of lubricant has been provided for the safe operation of the power equipment. (Paragraph 185).

(y) That the Bureau of Engineering consider the advisability of accepting generators where the ripple voltage produced is of the order listed in Table No. 47, since this slight excess does not appear to affect the purity of the emitted carrier. (Paragraph 190).

(z) That the necessary steps be taken to insure that the construction of the motor starter is modified in accordance with paragraph 192.

[redacted]

(aa) That adequate assurance be obtained that the filter capacitors provided will insure continued and safe operation under Service conditions. (Paragraph 193).

(bb) That the motor generator equipment and accessories be finished in the standard blue-gray color designated by the Bureau of Engineering. (Paragraph 195).

(cc) That the instruction books as finally compiled contain information in accordance with the suggestions outlined in paragraphs 196 to 200.

(dd) That, after the items referred to above have been corrected or complied with in a manner meeting the approval of the Bureau of Engineering, the Model TBK-8 transmitting equipment be considered suitable and satisfactory for the needs of the Naval Service.

[redacted]

MATERIAL UNDER TEST

7. The material under test consisted of one re-submitted preliminary Model XTBK-8 radio transmitting equipment complete with motor generator equipment designed to operate from 440 volts 3 phase 60 cycle supply. This equipment was manufactured under contract NOs-61006 by the RCA Manufacturing Company, Inc., Camden, N.J. The motor generator equipment was manufactured by the Electric Specialty Company, Stamford, Conn. As originally received on July 25, 1939, the equipment was accompanied by a Cutler-Hammer Company motor starter provided with a magnetic door lock. On August 3, 1939, a second Cutler-Hammer Company motor starter was received at the Naval Research Laboratory. This starter was not equipped with a magnetic door lock but was provided with a main line disconnect switch. The radio transmitter is rated at a nominal output of 500 watts and is capable of covering the frequency range of 2,000 to 18,100 kilocycles. The equipment is designed for CW emission only.

8. The re-submitted Model XTBK-8 equipment was received at the Naval Research Laboratory on July 25, 1939. Transportation was accomplished by means of the Contractor's truck from the Camden, N.J., plant of the RCA Manufacturing Company.

METHOD OF TEST

9. The equipment, when received, was carefully examined to determine whether adequate precautions had been observed in preparing the material for shipment and whether any damage had been incurred during the process of transportation.

10. After the preliminary inspection the equipment was wired up and placed into commission.

11. Power output measurements were made by means of a 500 watt, 115 volt lamp and a photronic cell. The base of the lamp was removed to minimize capacity losses. In order to insure maximum accuracy the lamp load and the photronic cell were rigidly anchored with a definite spacing between them. The transmitter was adjusted for optimum output and the reading of the microammeter noted after all parts of the antenna circuit and photronic cell circuits had reached equilibrium. Then the load lamp was disconnected from the transmitter and connected to a calibrating source of 60 cycles as rapidly as possible. The 60 cycle supply was then adjusted to give exactly the same microammeter reading and the power determined by means of an accurate wattmeter (Weston Model 310, Serial No. 3958).

12. Frequency changes and drifts were checked by means of Model LK frequency indicators, Serials No. 1 and 4. During certain tests both indicators were operated simultaneously to definitely insure that any frequency changes encountered were due to transmitter conditions rather than any instability in the measuring apparatus. The transmitter was operated at full power output whenever the governing specifications required this method of operation.

13. The transmitting equipment, including motor generator and starter, was placed within the Naval Research Laboratory test chamber and subjected to variations in ambient temperature between the limits of zero and plus fifty degrees Centigrade and variations in relative humidity, at 40 degrees Centigrade, between the limits of approximately 30% and 95%. Output frequency and output power were kept under constant observation during these tests. Certain additional data and information were recorded during the course of these tests, such as line and generator potentials, M.O. cabinet temperatures, M.O. cabinet heat cycles, etc.

14. Frequency range, overlap, and tolerances, kilocycles per division of dial marking and the adequacy of the calibrating circuits incorporated in the equipment were determined by means of Model LD-2 equipment.

15. The R.F. potentials available for calibrating purposes were determined at the far end of a concentric transmission line, 2 feet long and of approximately 50 ohms impedance. A Model "OF" Ferris Interference Locator and a Model LN Signal Generator (in substitution method) were employed to determine the voltages available.

16. Measurements of the ripple voltage present in the outputs of the various generators were determined by means of high impedance voltmeters of Weston and Ballantine manufacture.

17. Model RAB receivers were employed for determining the quality of the emitted signals.

18. The ability of the equipment to withstand vibration and the roll and pitch of a vessel in a heavy sea was determined by mounting the entire equipment on the laboratory test stand which is capable of producing the necessary conditions.

19. Shock tests were conducted by subjecting the equipment to blows from a 20 pound weight suspended in the manner outlined by the governing specifications.

20. The degree of amplitude modulation present in the CW output was determined through the medium of a suitable rectifier, blocking condenser and voltmeter.

DATA RECORDED

21. Complete data were recorded during all tests conducted and this information is appended hereto as Tables 1 to 47 and Plates 1 to 41 inclusive.

PROBABLE ERRORS IN RESULTS

22. Precautions were taken to minimize errors in the results obtained during the tests; where necessary and desirable, duplicate tests were conducted to insure accuracy. At times duplicate measuring equipment was used to obtain simultaneous measurements to obviate errors or failures in the measurements.

23. Meters of the precision type, of verified accuracy, were employed under conditions to insure maximum accuracy.

24. As stated in paragraph 11 above, power output tests were so conducted that the elements of time and temperature were prevented from influencing the results to as great an extent as was practicable.

RESULTS OF TESTS

25. The re-submitted Model XTBK-8 equipment was received on July 25, 1939, in undamaged condition. When received, the tubes were found to be in place in the Master Oscillator stage and in the first intermediate amplifier stage. Both tubes were undamaged, however. The master oscillator compartment had been removed from the transmitter and packed separately. One Type 38860 tube, which was packed in a carton, was found to have an open filament when received. This tube bore serial No. 19998.

26. In the following paragraphs of this report, reference is made to the governing specifications, RE 13A 442G, under which the equipment was constructed.

27. Section I. The general construction and design of the Model XTBK-8 equipment conforms with this introductory section of the governing specifications. The transmitter covers the range of 2000 to 18,100 kilocycles and is designed for CW operation. The succeeding paragraphs of this report discuss in detail the construction and operating characteristics of the equipment.

28. Paragraph 2-2. The component parts which go to make up the complete assembly were examined to the extent possible without resorting to complete disassembly or destruction of the various parts.

(a) The vacuum tubes used in the equipment have received Navy type approval. Types 38160 and 38161 tubes were used.

(b) Numerous units of standard design are used in the equipment. Special design of parts is resorted to where necessary to provide satisfactory performance and to meet the requirements of the governing specifications.

(c) All meters provided had received Navy inspection and type approval. However, checks of certain meters were made, particularly those which would be likely to influence the results of power output tests. The meters checked were found to comply with the specification requirements with respect to accuracy. Certain other characteristics of the meters supplied were made the subject of special investigation and details of this investigation will be discussed under paragraph 2-25 of the governing specifications. (See paragraph 58 of this report.)

(d) Table No. 1, appended hereto, lists the resistors used in the Model XTBK-8 equipment, together with the measured values at which the various units operate. Specifications RE 13A 372J list the power dissipation and the maximum voltages which may be employed in connection with each type of resistor, together with the maximum resistance permitted. It will be noted that the resistors furnished comply with the requirements of the governing specifications. It will be noted that Resistor R-146, which forms a part of the 6-wire control circuit, is required to dissipate 120 watts momentarily. This momentary load is of such short duration that no overheating or damage is expected to result therefrom. Attention is invited to the fact that Resistors R-101, R-102, R-114 and R-140, which are of the Ohmspun type, are those which were supplied originally with the equipment. As the tests progressed, it was found necessary to change the value of these resistors, as reported in connection with paragraph 3-7-8 of the governing specifications. (See paragraph 102 of this report.)

29. Paragraph 2-3. In general, aluminum or aluminum alloys have been used in the construction of the equipment for the purpose of minimizing weight. In certain specific applications, steel or brass has been employed where increased strength or resistance to wear is desired. High grade radio frequency insulation is employed; ceramic insulation such as Isolantite or Steatite together with Micalex is used and the use of bakelite is held to a practical minimum.

30. Paragraph 2-3-1. At the conclusion of the extensive tests to which the XTBK-8 equipment was submitted, inspection revealed no pitting of contacts and during the tests no difficulties were experienced which could be attributed to faulty contacts.

(Note: The defects reported in paragraph 31 of NRL Report R-1507 covering the original XTBK-8 equipment have been remedied in the re-submitted model.)

31. Paragraph 2-3-2. The "push-to-turn" switches supplied with the original XTBK-8 equipment have been eliminated in the re-submitted model, thus eliminating the difficulties experienced with that type of switch. The present switches are equipped with "T-Handles" which provide greater ease of operation. In connection with the "Adjust-tune-operate" and "Antenna Feed" switches, some further improvement in the positioning device is desirable. The "detent" or "clicker" arrangement is too broad, so that the switch contacts and switch arms do not make full contact. A slight re-design of this feature should provide improved and satisfactory performance.

32. Paragraph 2-3-3. All variable resistors furnished are of the wire wound type, and performed satisfactorily during the course of the tests. These resistors are described in Table 1. It will be noted that in all cases the actual current flowing in the resistors is less than that permitted by the manufacturer's rating.

33. Paragraph 2-4. This paragraph of the specifications states that "All workmanship on this equipment must be of the best." The large number of items of defective workmanship listed in paragraph 34 of NRL Report R-1507 have been eliminated in the re-submitted model. However, a few items were noted in the re-submitted model which require corrective action. These items are as follows:

(a) The hold-down strap by means of which filter condenser C-154 is secured was broken off and missing. An inspection of the condenser securing straps or mountings reveals that the method of manufacture weakens the mounting and subjects the metal to excessive strains. In order to avoid breakages in service, it is recommended that mountings of more suitable characteristics be provided.

(b) The high voltage connections to the main terminal board are made by means of studs bushed with Isolantite. These studs, Nos. 21, 22 and 23, can be turned from the front, thus permitting the lugs and leads on the rear of the studs to be turned. An improved method of anchoring these studs should be provided.

(c) An extra panel thumb screw was found lodged behind the terminal panel, which apparently caused an intermittent short circuit on bias terminal No. 8. Under the influence of temperature and roll and pitch, this screw caused fuses to blow.

(d) The right hand edge of the access door to the main terminal panel does not present a finished appearance. It is recommended that a full length filler piece be used in this location to correspond to the filler piece on the left hand edge of the door. A slight modification of the door interlock mounting will be necessary to permit this change.

(e) The M.O. dial control is too tight and stiff to be operated with ease. This makes it difficult to arrive at precise frequency settings. This control should be eased off to provide greater ease of adjustment. It is noted that the M.O. dial is provided with better zero coincidence at the low end of the frequency range than is provided at the high frequency end. Attempts should be made to improve zero coincidence at the high frequency end.

(f) The contact wheels on the edgewise wound inductors give somewhat erratic operation. This is particularly noticeable at the higher frequencies. It is understood that these contact wheels are supposed

to be equipped with tapered grooves so that additional contact surface will be afforded. The wheels supplied have straight sided grooves. This defect should be remedied.

(g) The plate of the master oscillator circuit connects to a special type terminal in the form of a dural tube equipped with a combination bakelite and Isolantite insert. The construction of this terminal assembly is such that it tends to loosen. It is recommended that the design of this assembly be modified to provide a more permanent and lasting contact.

34. Paragraph 2-5. The equipment was subjected to temperatures ranging from zero to 50 degrees Centigrade and to 95% relative humidity at 40 degrees Centigrade. No operational failures or signs of overheating were observed during these tests which could be attributed to the atmospheric conditions. The effect upon frequency of varying temperatures and humidity will be discussed later in this report.

35. Paragraph 2-6. The corrosion resisting measures employed in the equipment proved to be adequate during the course of these tests. The universal joints in the shaft of control "H", Antenna Coupling, and the spur gears on controls D, E, G, and K are of ferrous material, apparently of the stainless steel type. The cases of the door interlock switches and hoisting eyes are also constructed of ferrous material. The universal joints and spur gears are plated, apparently cadmium being used for this purpose, while the switch cases are made corrosion-proof by the use of metallic paint. As far as could be observed, all brass, bronze and copper parts are plated, with the exception of the edge-wound inductors on controls D, E, G and K.

36. Paragraph 2-7. The use of iron and steel has been kept to a practical minimum. Where steel is employed, corrosion resisting measures have been employed.

37. Paragraph 2-8. High quality insulation of the Isolantite or Micalex type has been used throughout the equipment. The use of phenolic insulation has been restricted to such employment as does not violate the governing specifications.

38. Paragraph 2-9. Wood has not been used as an electrical insulator in the construction of this equipment.

39. Paragraph 2-10 (general). The design of the electrical circuits is such that during the course of these tests no failures of any parts were noted. Through the use of interlocks, overload relays and fuses, protection has been afforded for safe and satisfactory operation.

40. Paragraph 2-10-1. The following fuses are supplied in the equipment, exclusive of the motor generator circuits.

(a) Motor leads. 2 fuses used rated at 250 volts. Paragraph

H-2 of Specifications 17F2g permits the use of 250 volt fuses in 440 volt AC circuits. These fuses are rated at 35 amperes and operate in the 440 volt supply line circuit. The current through the fuses under starting conditions is 34 amperes, while under normal full load running conditions the current is approximately 5 amperes.

(b) Filament and Control Supply. Two fuses marked F-102 and F-103 are used, rated at 250 volts 6 amperes. This circuit operates at 110 volts and the fuses carry 3.1 amperes.

(c) Heater Circuits. Two fuses labelled F-107 and F-108 are used in these circuits, rated at 250 volts, 10 amperes. This circuit operates at 110 volts and the maximum current flowing is approximately 5 amperes.

(d) Magnetic Controller. As finally revised by the substitution of a 110 volt relay coil, this circuit draws a current of approximately 0.5 ampere at 110 volts. The fuse provided is rated at 250 volts, 10 amperes. Paragraph E-10h of Specifications 17C10a requires the use of a ten ampere fuse in this location.

At present, only the controller circuit fuse mounting is marked to indicate the fuse rating for convenience in replacement or servicing operations. It is suggested that all fuse mountings be marked in this manner.

41. Paragraph 2-10-2. A complete discussion of the fuses provided in the generator circuits will be found under paragraph 187 of this report.

42. Paragraph 2-10-3. The overload relays provided were adjusted to approximately 125% of normal operating load and functioned satisfactorily. At this setting 125% of normal current causes the relays to open in approximately 5 or 6 seconds. The equipment was subjected to vibration and inclination and the overloads performed satisfactorily. These relays require the use of a small quantity of oil and an adjacent nameplate indicates the type of oil and gives the necessary direction with respect to refilling, etc. Both relays are manufactured by the Square D Company and bear the following nameplate data:

Relay	Class	Type	Full Load Current
P.A. Overload	9050	--	395 MA
MO/IPA	9050	F-2	170-185 MA

The relays are of the manual re-set type and may be reset by means of bakelite plungers which extend through openings in the door leading to the main terminal panel. Each re-set plunger is marked with a nameplate bearing the legend "Overload Reset". It is recommended that this

information be expanded to include the particular function of the relay, i.e., "Overload Reset, MO/IPA" and "Overload Reset, P.A.". This type of marking would aid in locating trouble when the relays operate.

43. Paragraph 2-11. The vacuum tube protective relays (overload) have been discussed in paragraph 42 above. The power amplifier circuit is protected by its individual overload relay, while the oscillator and intermediate amplifiers, employing 38860 tubes, are provided protection by a common overload relay. The five second relay which was included in the original Model XTBK-8 has been eliminated from the re-submitted model in accordance with the instructions of the Bureau of Engineering.

44. Paragraph 2-12. The design of the equipment is such that all outside cases and frame numbers are at ground potential. The access doors in the transmitter are fitted with interlocks which operate at 110 volts AC. Opening of any door causes the motor generator equipment to shut down. All interlocks operated positively and satisfactorily when subjected to shock, vibration and the simulated roll and pitch of a vessel. An insulating coverplate has been secured over the 440 volt terminals on the terminal board to prevent accidental contact. The cover is clearly marked to indicate the presence of line voltage underneath. (Note: This feature eliminates the objection raised in paragraph 45(a) of NRL Report R-1507.)

(a) In the case of the original Model XTBK-8, the motor generator coasted for a period of two minutes after the starting and field circuits had been opened. In the re-submitted model, this time has been reduced to one minute and 18 seconds. Immediately after the relays open, the following voltages are present:

Main plate - 425 volts.
Auxiliary plate - 200 volts.
Bias - 38 volts.

These voltages gradually diminish as the motor generator slows down.

45. Paragraph 2-13. Ventilation of the transmitter is provided by means of perforated side, rear and top shields. In addition, the access doors to the tube compartments are perforated, thus providing additional ventilation. These factors are illustrated in Plates 1 and 3 appended hereto. In the original model the master oscillator tube was subjected to forced ventilation by means of a motor-driven blower. This blower has been eliminated in the re-submitted model. No signs of overheating were noted during the tests conducted and the elimination of the MO blower is considered a desirable step towards simplification and increased reliability.

46. Paragraph 2-14. During the course of the tests, which covered temperature ranges from zero to 50 degrees Centigrade, no leakage of compound from any component parts was noted.

47. Paragraph 2-15. The equipment was subjected to numerous key locked periods of operation of two to eight hours duration under varying conditions of temperature and humidity. These tests were conducted at full power and no signs of brush discharge, arcing or corona were observed. Additionally, the equipment was keyed at 100 words per minute with satisfactory results.

48. Paragraph 2-16. The equipment was operated at full power output at several frequencies. The antenna was short-circuited and open-circuited with the results indicated in Table No. 2 attached hereto.

49. Paragraph 2-17. All vacuum tubes in the equipment operate within the current and potential limitations required by Navy tube specifications. No vacuum tubes failed during the test and no signs of overheating were observed during protracted periods of locked key operation.

50. Paragraph 2-18. This paragraph of the specifications requires that "The equipment must be designed so that safe operation and satisfactory performance are assured." A few items which failed to produce entirely satisfactory operation are noted under appropriate paragraphs of this report, but in general, it may be stated that the design, construction and operational characteristics of the re-submitted Model XTBK-8 equipment are such that the intent of this paragraph of the governing specifications has been complied with and the objectionable factors found in the original model have been eliminated.

51. Paragraph 2-19. The design of the re-submitted model is such that it fulfills the demands that the equipment, when secured at the base only as under Service installation conditions, operate successfully and without damage on a moving platform inclining up to 45 degrees from the vertical in any direction. The equipment was bolted to the inclination and vibration table by means of the regular base fittings. Numerous inclination and vibration tests were conducted and the transmitter showed no signs of failure or weakness. For a detailed discussion of the effect of inclination upon the frequency stability of the transmitter, see paragraph 107 of this report.

52. Paragraph 2-20. The equipment was subjected to vibration and shock, as outlined in the governing specifications, and withstood such tests without damage or faulty operation. Nuts and machine screws are secured by means of split type lock washers, suitably plated to resist corrosion. All wires connected to terminals are secured in such a manner that the conductor is soldered to the terminal and the insulation is firmly crimped in the terminal. Water-proof fibre washers are used to absorb stress which might damage ceramic insulators. In general, the construction and wiring are such that the deficiencies reported in paragraph 53 of NRL Report R-1507 have been eradicated and the workmanship in the re-submitted model presents a pleasing and clean-cut appearance. This is illustrated in Plates 1 to 17 inclusive, which form a part of this report. The type of wiring employed is shown most clearly in Plates 5, 6, 9, 10, 11 and 12, which also illustrate the use of metallic clamps and felt buffers for securing and protecting the wiring.

[redacted]

53. Paragraph 2-21. Provision has been made to protect tubes and the master oscillator compartment from the effects of shock and vibration by means of flexible mountings. The master oscillator tube is rigidly mounted in the compartment, but the entire compartment is flexibly mounted to guard against shock. The Power Amplifier tube is now provided with an individual mounting which operated successfully during vibration, inclination and shock tests, thus demonstrating that the difficulties in this connection which were reported in paragraph 54 of NRL Report R-1507 have been eliminated. The 1st and 2nd intermediate amplifier tubes were individually mounted on 1/8" thick sheet rubber, which in turn was mounted on four spacers. This mounting is extremely flexible and allows the tube to swing about two inches to either side of center. While these mountings gave no definite trouble during the course of the tests, it is believed that when actual gun fire is encountered on board ship, there is a possibility that the tubes may be damaged. The contractor submitted alternative mountings for these tubes similar to those used in the original model. The tests indicated that these alternative mountings are too rigid. It is recommended, therefore, that efforts be made to provide a mounting for the 1st and 2nd Intermediate Amplifier tubes which is not as flexible as the rubber sheet mountings but possessesa greater degree of flexibility than the original mountings. When this is accomplished in a satisfactory manner, all delicate parts in the equipment should be capable of withstanding service requirements with respect to shock and vibration.

54. Paragraph 2-22. The design and control of the circuits in the re-submitted Model XTBK-8 equipment are considered as simple as possible within the requirements of the governing specifications. In accordance with the request of the Bureau of Engineering, the five-second relay and the High-Low-Power Switch have been eliminated. These changes have the effect of simplifying the circuits, provide greater accessibility and do not detract in any measureable degree from the general overall functioning of the equipment.

55. Paragraph 2-23-1. All indicating instruments and controls for the operation and monitoring of the equipment are located on the front panel. A list of all controls and meters appears in Table No. 3 attached hereto. As illustrated in Plate No. 1, the meters and controls have been arranged in as symmetrical a manner as space limitations permit.

56. Paragraph 2-23-2. A nameplate of suitable characteristics has been affixed adjacent to each control to designate its purpose. The markings provided are listed in Table No. 3, while Plate No. 1 shows their location with respect to the controls. From Table No. 3 it will be noted that no "F" designation has been provided on the re-submitted model. This is apparently due to the elimination of the "High-Low" power switch. It is recommended that the designations be modified to provide a continuous series from "A" to "J" instead of designating the controls "A" to "K" with "F" omitted. Paragraph 57 of NRL Report R-1507 listed a number of objections to the controls supplied on the original Model XTBK-8. These controls have been redesigned, providing a noteworthy improvement in the case of manipulation, readability and appearance in the re-submitted model. "T"-handles have been provided on certain

switches, the control knobs do not interfere with visibility of the dials and the so-called Veeder counters have been abandoned in favor of more suitable verniers. A particularly desirable feature has been provided in connection with the interlocked controls. This is illustrated in Plate No. 21 appended hereto. By the removal of three screws the entire switch control may be separated from the panel. A sufficient length of semi-flexible wire permits the switch to be withdrawn sufficiently so that the interlocks may be serviced with ease. A separate clutch arrangement is provided by means of which power is transmitted from the handle to the switch proper and the design is such that no tools are required for disassembly and re-assembly. No danger exists on the score of assembling the unit in a manner which will destroy the original calibration. In general, the revised system of controls furnished with the re-submitted Model XTBK-8 is considered suitable and satisfactory, aside from the system of lettering mentioned above.

57. Paragraph 2-24. All control shafts and bushings have been grounded in the interest of safety and all handles and knobs have been insulated in an approved manner.

58. Paragraph 2-25. All electrical indicating instruments furnished are of the 3.5 inch diameter flush type with bakelite cases. The meters are equipped with anti-glare glass and all meters are of Westinghouse manufacture. The meters provided are listed in Table No. 3. During the course of the tests it was noted that practically all of the meters showed signs of sticking. After the index pointer had reached a steady state, the reading of the meter could be changed by tapping the meter glass. This subject was discussed with the manufacturer who indicated that this factor could be governed by the pivot adjustment in the meter. If this adjustment is made to permit more easy movement and less binding, it affects the damping of the meter to some extent. It is believed, however, that the pivot adjustment should be modified sufficiently to prevent severe sticking.

(1) The antenna ammeter is connected in the high side of the circuit and is located behind the front panel. During the early portions of the test work, while conducting power output measurements in the region of 18,000 kilocycles, this meter burned out while the meter indicated a current of 3.15 amperes. The meter is rated at 8 amperes full scale. The magnet in the meter was extremely hot and an arc occurred between the pointer and the face of the meter. A similar occurrence apparently had taken place when the XTBK-8 equipment was originally submitted for test, although the meter did not happen to be under observation at the time of failure. NRL letter S67/23(4593) of 18 January, 1932, to the Bureau of Engineering reported similar failures in connection with meters of Westinghouse manufacture. Examination indicated that the compensating resistor, which sometimes takes the form of a small coil ranging up to 10 or 12 turns, may have contributed to the failure. In an effort to substantiate this belief, sample meters were supplied by the manufacturer, one of which contained a 10 turn and the other a 13 turn compensating resistor. These meters were subjected

to locked key operation for a period of approximately two days (16 hours). The frequency was varied from time to time and the meters observed for heating. No failures occurred during these additional tests and the investigation had to be abandoned due to lack of further time. Hence the Laboratory is unable to state the exact reason for the failure of this meter.

(2) Six of the meters provided on the transmitter were secured by means of screws tapped into the adjacent panel and the leads connecting these meters were provided with sufficient extra length to permit the meters to be withdrawn through the mounting holes. The six meters located along the top of the set were not mounted in this manner, but had through screws with nuts behind the panel. The contractor explained that the top panel had been salvaged from the original XTBK-8 equipment and hence these meter mountings were not fitted with tapped holes. In production all meters will be secured by means of tapped holes and all leads will be of sufficient length to permit removal through the mounting hole.

(3) All meters and multipliers in the equipment are equipped with by-pass units with the exception of the antenna ammeter. The meter units themselves are fitted with capacitors of 0.02 mfd. rated at 700 volts, while the voltmeter multipliers are protected by capacitors of 0.002 mfd. rated at 5000 volts.

59. Paragraph 2-26. Nameplates have been affixed to all major units. Nameplate data are quoted below:

Radio Transmitter Unit
Type CRV-52105
Frequency Range 2000 to 18100 kcs.
Weight ----- Serial (Model)
Unit of Model TBK-8 Equipment
manufactured for
Navy Department, Bu.of Engineering
by
RCA Manufacturing Co., Inc.
Camden, N.J. U.S.A.
Contract NOs-61006 Contract Date 15 June 1938

Radio Transmitter Equipment
Model TBK-8 Serial (Model)
Frequency Range 2000 to 18100 kcs.
Supply: 440 volts, 60 cycles
Equipment consists of the following units:
CRV-52105 Transmitter
CBP-21332 Motor Generator
CAE-21332 Motor Starter
See license notice inside

Navy Department
Bureau of Engineering
Contractor:
RCA Manufacturing Co., Inc.
Camden, N.J., U.S.A.
Contract NOs-61006 Contract Date: 15 June 1938

Motor

Electric Specialty Co.,
Stamford, Conn., U.S.A.
A.C. Motor Serial No. 89161
Type BY 54 Volts 220-440 P.F. -------
Phase 3 Cyc. 60 H.P. 4.5 Amps. 12.0 - 6.0
R.P.M. 1750 Wind'g: ------- Duty: Cont.
Contract NOs-61006 Date: 1938
Accepted by:

Plate Generator

Electric Specialty Co.,
Stamford, Conn. U.S.A.
D.C. Generator Serial No. 301587
Type P53 Volts 3000-1500 P.F. -------
Phase ---- Cyc. ----- H.P. -- Amps. .5 - .4
R.P.M. 1750 Wind'g: Comp. Duty: Cont.
Cont. NOs-61006 Date: 1939
Accepted by:

Auxiliary Generator

Electric Specialty Co.,
Stamford, Conn. U.S.A.
D.C. Generator Serial No. 89162
Type F 51 Volts 250-1500 P.F. ----
Phase --- Cyc --- H.P. --- Amps. .4 - .13
R.P.M. 1750 Wind'g: Comp. Duty: Cont.
Contract NOs-61006 Date: 1938
Accepted by:

Motor Starter

(Original)

No. B209503A 440 volts
Duty: Stg. 6 Amp.
Type Mag. Cont. 3 Ph. 4.5 HP
Cont. Order NOs-61006
Spec. 17C10 BuEng 60 Cy.
U.S.S.
Aux. Motor Generator
Cutler-Hammer
New York Inc. Milwaukee

Motor Starter

(Replacement)

No. B319181A 220/440 V 4.5 HP
Duty: Starting
Type: Magnetic
Cycles: 60
Amps. ---
Cont. NOs-61006
Year: 1939
Spec. 17C10A
Bueng
USS -
3 Phase
Aux. - Motor Generator
Cutler-Hammer
New York Inc Milwaukee

60. Paragraph 2-27. Assembled separate items have been provided with descriptive nameplates marked in the manner listed in paragraph 59 above.

61. Paragraph 2-28. The requirements of this paragraph regarding marking do not apply to preliminary models as initially submitted for Navy type tests.

62. Paragraph 2-29. It was unfeasible to determine whether the screws and bolts used in the assembly of the equipment are in strict compliance with the provisions of this paragraph without resorting to complete disassembly. This was not done. Where screws or bolts used did not conform or were unsuitable for the purpose intended, notations were made which will be found elsewhere in this report.

63. Paragraph 2-30-1. All scales and dials are so arranged that the settings increase numerically or alphabetically in a clockwise direction to increase the final controlled effect.

64. Paragraph 2-30-2. Where verniers are employed, continuity throughout the dial range has been provided. The dials and verniers are marked in evenly spaced divisions. The width of any single dial division is approximately 0.05 inch, or greater. At least, three significant figures are visible on the dials at all times; in some instances more figures are visible.

[redacted]

65. Paragraph 2-30-3. Rotatable devices have been secured to their shafts as indicated below:

Control	Method of Securing
A	1 pin and 2 set screws
B	1 pin and 2 set screws
C	1 pin and 1 set screw (1 screw missing)
D	1 pin and 2 set screws
E	1 pin and 2 set screws
G	1 pin and 2 set screws
H	1 pin and 1 set screw (1 screw missing)
I	1 pin
J	1 pin and 1 set screw (1 screw missing)
K	1 pin and 2 set screws
Main Gen Field	1 pin and 2 set screws
Bias Gen Field	1 pin and 1 set screw
Main Fil Rheo	1 pin and 2 set screws
Osc Fil Rheo	1 pin and 2 set screws
Adj-Tune Switch	1 pin
Door Knobs	1 pin

It will be noted that several set screws are missing. These details were checked after the equipment had been subjected to complete tests and it cannot be stated whether the full complement of set screws was furnished originally or whether the missing screws were lost during the course of the tests.

66. Paragraph 2-31-1. The construction of the equipment is such that suitable tolerances have been provided for the accommodation of various component parts, such as tubes and resistors.

67. Paragraph 2-31-2. Paragraph 70 of NRL Report No. R-1507 discussed in some detail the type of construction and the degree of accessibility provided in the original XTBK-8 equipment. In the original model an attempt had been made to provide a form of unit construction which permitted the transmitter to be disassembled by the removal of four sub-assemblies. The difficulties encountered in connection with this design were of such magnitude that the original model was deemed unsuitable for Naval Service needs.

(a) The re-submitted Model XTBK-8 is practically a complete redesign. The so-called unit construction has been eliminated except in the case of the master oscillator circuit. The master oscillator compartment can be withdrawn from the main transmitter unit by withdrawing seven knurled head securing screws and disconnecting the grid lead to the first intermediate amplifier tube. The necessary power is fed to the master compartment through the medium of fifteen plugs and jacks of the General Radio Mogul type. These plugs and jacks are of rugged construction and no trouble was experienced from this source during the course of the tests. The seven securing screws referred to above are not

deemed rugged enough for continuous service. This fact was brought to the attention of the contractor's representative who submitted a new sample design. This new design is illustrated in Plate No. 22 and is considered satisfactory for this purpose. The arrangement of the mogul plugs and jacks may be seen in Plates 2, 7, 10 and 17. The plugs and jacks are mounted in micalex, the plugs remaining in the transmitter unit proper and the jacks being secured to the removable master oscillator unit. Substantial guides and positioning devices are provided and the guide rails are equipped with stops to assist in withdrawing the unit. The removable unit weighs 136 pounds and can readily be handled by two men.

(b) Plates 13, 14, 15, 16 and 17 are views of the master oscillator unit removed from the transmitter. By removing the sides of this unit, all interior parts become easily accessible. In addition, provision is made for removing the blower unit with a minimum of difficulty.

(c) Plate 2 is a front view of the transmitter showing the access doors in the open position and the master oscillator unit removed. This plate, together with the views shown in Plates 4, 5, 6, 7 and 8, illustrate the degree of accessibility provided. In general, it may be stated that the access to all parts in the re-submitted Model XTBK-8 has been greatly improved over that offered by the original model and in many specific instances the re-submitted Model XTBK-8 is superior to former equipments of this type. The elimination of the Low-High power switch has also increased accessibility.

(d) The transmitter, in general, reflects good design and construction. The corners are built up of "Z" and angle sections, leaving a channel for wiring in each corner. This type of construction makes a neat and strong assembly and provides adequate room for wiring, while at the same time offering additional protection to the wiring against mechanical injury. The wiring is practically concealed from casual observation, which contributes to neatness and accessibility. The corners are rounded and the shields are set in flush with the outside vertical corner members. The intermediate shelves are fastened to the upright members by means of 3/16" dowels and friction clamps. The dowels are of the non-removable type and the reason for this type of construction is understood to be for the purpose of permitting accurate alignment of front panel controls.

68. Paragraph 2-31-3. All toggle and push button switches are mounted on individual plates which may be readily removed from

the front of the panel. Sufficient lengths of flexible wire are used for connections so that the switches may be withdrawn from the panel without the necessity for disconnecting any leads.

69. Paragraph 2-32. The weight of the equipment falls within the specified limit as illustrated in Table No. 4 attached hereto.

70. Paragraph 2-33. Any single unit of this equipment, when uncrated for installation and without further disassembly, is capable of passing through a door 25 inches wide by 54 inches high or through a hatch 36 inches long by 30 inches wide.

71. Paragraph 2-34. The equipment was subjected to sudden and gradual variations of supply line voltage between the limits of plus and minus 5% of normal and additionally between the limits of plus and minus 10% of normal. The results of these tests are illustrated in Table No. 18 appended hereto. No damage occurred during the tests and the equipment functioned normally and satisfactorily during and after the tests. No provisions were available for varying the supply line frequency over the limits of plus and minus 5%.

72. Paragraph 2-35-1. Symbol markings as used in the instruction book and wiring diagram have been placed adjacent to the various component parts. These markings are in the form of circular tags cemented in place. Several of these symbol tags came loose during the period of the tests, indicating that the particular adhesive used is not satisfactory over a period of time. Similar tags have been used in other equipments and have remained fast over a period of years. The use of a proper cement or glue should be investigated in order to provide a satisfactory adhesive.

73. Paragraph 2-35-2. Resistor mountings are marked to indicate the Navy type number and the value of resistance employed. Tube mountings are marked to indicate the Navy type number of the tube used for each socket. This information appears on the symbol number tag and the same objections apply to the adhering qualities of these tags as to the symbol number tags as outlined in paragraph 72 above.

74. Paragraph 2-36. The design of the flexible mountings is such that with the proper materials available, replacements can be accomplished with a minimum amount of disassembly.

75. Paragraph 2-37. Satisfactory operation of the equipment was obtained when the line voltage was varied, both gradually and rapidly, over the limits of minus to plus 10% of normal line voltage. However, reference to Table No. 43 reveals that insufficient leeway is provided to maintain filament potentials exactly at normal when the line voltage is decreased to a minus 10 percent. Provision should be made to avoid this difficulty.

76. Paragraph 2-38. Lifting shackles of rugged construction are located at each top corner of the transmitter unit. The shackles are made of 3/8" cadmium plated steel and are provided with openings 1-3/8" x 1-1/4". When not in use, the shackles are held in place by means of clamps operated by T-handle screws. The clamps and screws

are of the non-losable type. Suitable nameplates are affixed to the sides of the transmitter along the top edge to indicate the location of the shackles.

77. Paragraph 2-39-1. The front panels, access doors and all external shields are of black wrinkle finish similar to samples held by Inspectors of Naval Material.

78. Paragraph 2-39-2. All exterior surfaces have been treated, as outlined in paragraph 77 above, to resist the effects of corrosion.

79. Paragraph 2-39-3. The shield securing screws are provided with a black nickel finish of corrosion resisting qualities.

80. Paragraph 2-39-4. All interior surfaces of aluminum or aluminum alloy have been protected against corrosion by a process which provides a bright finish. No indications of poor contact between various surfaces were noted during the course of the tests.

81. Paragraph 2-40-1. Type TS-51 lamps are used for indicator, rated at 18 volts, 0.11 ampere, fitted with candelabra screw bases.

82. Paragraph 2-40-2. Each indicator lamp is mounted as a part of a combined receptacle, resistor lamp assembly. The housing of the lamp and socket is of aluminum, the visible portions of which are finished in dull black. The portion of the housing which protrudes through the panel has been provided with a rolled edge which forms a bezel around the lamp. The dimensions of the indicator assembly are:

Outside diameter of bezel - 1-3/8".
Projection of globe beyond bezel - 7/8".
Overall length of unit from front
of globe to rear of stud - 6".

The resistor units used with the various indicators are listed in Table No. 1, together with the currents drawn by each.

83. Paragraph 2-40-3. The indicator lights conform with the color markings required by the specifications as listed in Table No. 3, except that a blue light is used for motor generator start indication. Since voltages in excess of 500 volts are immediately available when the motor generator is up to speed, this lamp should be red.

84. Paragraph 2-41. Capacitors of the electrolytic type have not been used in the construction of the XTBK-8 equipment.

85. Paragraphs 2-42 to 2-49. These paragraphs of the specifications cover type tests of component parts. No separate component parts were provided with the preliminary model and it is assumed that such tests have been and will be made at the point of manufacture.

86. Paragraph 2-50. The control and starting circuits are so designed that filament potentials are applied to the tubes in

advance of plate potentials and bias voltage must be available before plate voltage can be supplied to the tubes.

87. Paragraph 3-1. The design of the Model XTBK-8 transmitter is based on the master oscillator, power amplifier principle and does not require the use of quartz crystals as a means of frequency control. The equipment is designed to function as a nominal 500 watt transmitter over the frequency range of 2000 to 18,100 kilocycles. In accordance with paragraph 9(c) of reference (d), the requirement that the transmitter operate as a 75 watt transmitter over the range 2000 to 9050 kilocycles was eliminated. The following circuits are incorporated in the transmitter:

(1) A master oscillator circuit of the electron coupled type, using one type 38160 vacuum tube. This circuit operates over the frequency range of 1000 to 2262.5 kilocycles and the frequency establishing elements are maintained at a constant temperature of approximately 60 degrees Centigrade.

(2) A master oscillator output doubler circuit for exciting the following stage at twice the frequency of the frequency determining circuit, i.e., 2000 to 4525 kilocycles.

(3) A first intermediate amplifier circuit using one type 38160 vacuum tube. This stage functions as a fundamental amplifier for transmitter output frequencies in the range of 2000 to 4525 kilocycles and as a frequency doubler when the output frequency is in excess of 4525 kilocycles.

(4) A second intermediate amplifier circuit using one type 38160 vacuum tube. This stage functions as a fundamental amplifier for output frequencies in the range 2000 to 9050 kilocycles and as a frequency doubler over the range 9050 to 18,100 kilocycles. In the re-submitted Model XTBK-8, this stage no longer operates as a 75 watt output stage over the range 2000 to 9050 kilocycles.

(5) A power amplifier circuit using one 38161 vacuum tube, operating over the frequency range of 2000 to 18,100 kilocycles.

(6) An antenna circuit for coupling the output of the power amplifier stage to antennas of varying characteristics.

(7) As staged above, the equipment is provided with front panel controls which permit its use as a nominal 500 watt transmitter obtaining output power from the final power amplifier stage only. By means of the plate generator field rheostat, output power may be reduced to approximately 6% of full power.

[redacted]

88. Paragraph 3-2. It was found impracticable to test the transmitter in connection with the various trunk and antenna combinations specified in this paragraph of the specifications. However, the antenna coupling system is designed for flexible operation and was operated into a number of antennas of varying characteristics without trouble.

89. Paragraph 3-3-1. As stated in paragraph 87 above, the re-submitted Model XTBK-8 equipment is not required or designed to operate as a 75 watt output transmitter.

90. Paragraph 3-3-2. Tables 5, 6, 7 and 8 list the results of tests conducted to determine the power output over the frequency range of the transmitter. The power measurements were made in the manner described in paragraph 11 of this report. It will be noted that in all cases the power output is equal to or in excess of the specification requirements.

91. Paragraph 3-4. Provision has been made for current or voltage feeding the antenna. In the re-submitted model, this switch is marked "Antenna Feed Switch" and the two positions are designated "Current" and "Voltage", thus eliminating the objection to the marking as discussed in paragraph 93 of NRL Report No. R-1507.

92. Paragraph 3-5-1. Determination of the harmonic content in the transmitter output was not undertaken. Paragraph 10-31 of the governing specifications indicates that such measurements will be undertaken, if required, after the equipments have been installed in service afloat. The character of the emitted signal was observed locally by means of RAB receivers and no traces of lilt were observed. The master oscillator tube is completely blocked when the key is open and no radiation is encountered from this source. The average frequency variation due to the heat cycle of the temperature control circuits is approximately 3 to 5 cycles at 2000 kilocycles and 13 to 15 cycles at 4500 kilocycles. When frequency multiplication is resorted to to increase the frequency, the heat cycle increases in the same ratio. The heat cycle of the re-submitted model is somewhat less than that observed in connection with the original model as reported in paragraph 94 of NRL Report No. R-1507.

93. Paragraph 3-5-2. Tests were conducted to determine the amount of amplitude modulation present in the CW output of the transmitter. The results of these tests are indicated in Table No. 9. It will be noted that in all cases the degree of ripple observed is less than the 2% permitted by the governing specifications.

94. Paragraph 3-6. The transmitting equipment is so constructed that by means of the front panel controls any frequency within the specified range may be obtained. The number of controls has been kept to a minimum compatible with the specification requirements.

95. Paragraph 3-7-1. Accuracy of Reset to Previously Calibrated Frequencies. Table No. 10 shows the results of reset tests conducted at 2000 and 4500 kilocycles. In all cases the

requirements of the governing specifications have been complied with, but in this connection it was found that the continuously variable master oscillator control was too "stiff" for easy operation. This condition persisted throughout the course of the tests and steps should be taken to correct this condition before this control can be considered as being suitable and satisfactory.

96. Paragraph 3-7-2. Test for Lost Motion, Back Lash and Torque Lash. On August 9th, tests were conducted to determine the degree of back lash existing in the master oscillator control. The results of these tests are shown in Table No. 11. In all cases the results exceeded the specification requirements. This condition was referred to the attention of the contractor's representative who arranged to have the master oscillator compartment returned to the factory for adjustment. After these adjustments had been completed and the M.O. unit was reinstalled in the transmitter, the back lash tests were repeated with the results indicated in Table No. 12. It will be observed that in all instances the back lash has been reduced to values well within the specification requirements. In the construction and assembly of production equipment, care should be exercised to insure satisfactory backlash conditions.

97. Paragraph 3-7-3. Operation of Adjust-Tune-Operate Control. Table No. 13 lists the results of tests conducted at six different output frequencies to determine the influence of the Adjust-Tune-Operate control. In all instances the maximum frequency shift resulting from the adjustment of this control is well within the specification limitations.

98. Paragraph 3-7-4. Detuning of Circuits. Table No. 14 covers tests conducted in conformity with this paragraph of the governing specifications. The maximum frequency shift encountered was 0.00115% at 2000 kilocycles, which is well within the specification requirement of 0.003%. The effect of detuning circuits subsequent to the oscillator plate circuit is in all cases practically negligible.

99. Paragraph 3-7-5. Operation of Power Output Control. The effect upon frequency caused by variation of the plate motor generator field rheostat by means of which the power output may be varied is shown in Table No. 15. This control has a practically negligible effect upon the output frequency, the greatest variation noted being 0.0005% at 2000 kilocycles as compared with the specification limit of 0.001%. With the minimum voltage obtainable, the power output is reduced to approximately 6% of the full power figure.

100. Paragraph 3-7-6. Change of Tubes. Tables 16 and 17 list the results of tests conducted in accordance with this paragraph of the governing specifications. Tests were conducted at 2000 and 4500 kilocycles. The mean frequency change caused by the change of tubes in the master oscillator circuit at 2000 kilocycles was found to be 0.0079%, while at 4500 kilocycles the value of 0.0067% was obtained. Specifications permit a frequency change of 0.01%. Change of tubes in the subsequent circuits, i.e., first intermediate, second intermediate and final power amplifier, caused negligible frequency changes.

101. Paragraph 3-7-7. Variation of Supply Line Voltage. The Model XTBK-8 transmitting equipment operates from a supply of 440 volts, 3 phase, 60 cycles. Hence, by the terms of this paragraph, the equipment should be subjected to a line voltage variation of plus and minus 5%. The results of such tests are outlined in Table No. 18. The line voltage was varied in a period of one minute and additionally in a time of five minutes. Under both conditions and at two frequencies, 2000 and 4500 kilocycles, the frequency variations noted are well within the limits imposed by the governing specifications. Paragraph 6-3 requires that the equipment withstand 10% line voltage variations without damage to tubes or equipment. While conducting this test, the effect upon frequency was recorded as shown in Table No. 18.

102. Paragraph 3-7-8. Variations in Ambient Temperature. The re-submitted Model XTBK-8 equipment, including transmitter unit, motor generator and starter, were installed in the temperature test chamber. Dummy antennas consisting of low inductive plaque resistors were used as a load, approximately 25 ohms (RF) resistance being used at 200 kilocycles and 48.5 ohms (RF) at 4500 kilocycles.

(a) The first temperature test was conducted at 4500 kilocycles and the results are shown in Table No. 19 and Plate 25. It will be noted that the frequency changes occurring between the temperature limits of 50 and 100 degrees Centigrade fall within the specification requirements, but in the range of 10 degrees and zero, excessive frequency changes were encountered. Reference to the table shows that in the region of zero degrees the temperature of the master oscillator cabinet fell below normal due to a lack of sufficient heating capacity. Also, during this test the auxiliary plate generator fuse was blown. Later it was discovered that a screw had accidentally become lodged behind the terminal board and apparently caused the fuse to blow.

(b) In this connection it may be stated that the NRL temperature test room is provided with two sets of blowers capable of moving approximately 50,000 cubic feet of air per minute. The blowers are arranged in two units so that they work in opposition, i.e., one set directs the air from the right side of the chamber while the other directs the air from the left side. This results in the rapid movement of air and causes a great deal of turbulence with the result that temperature gradients within the chamber are small. Thus, when a piece of equipment like a radio transmitter is placed within the chamber, a rapid movement of air takes place within the transmitter itself, particularly if the transmitter is designed for maximum ventilation. This causes the temperature within the transmitter to attempt to seek the level of the rapidly circulating circumambient. This phenomenon has an effect upon the

equipment under test which would not be encountered in a chamber where the air circulation is less rapid and violent. These factors had to be taken into account in making adjustments and changes in the transmitting equipment during the course of the temperature and humidity tests.

(c) Since the test described in sub-paragraph (a) above failed to meet specification requirements at low ambients due to a lack of heat in the M.O. compartment, a second test was conducted. In this test a potential of 132 volts was applied to the heater circuits, instead of the original 110 volts, in order to increase the heat dissipation. The results of this test are listed in Table No. 20 and Plate No. 26. The summary of this test shows that the equipment failed to meet specification requirements in the region of 50 degrees and zero degrees Centigrade. The small abrupt frequency changes noted during this test were later found to be caused by the tube compartment compensating condenser. These were later eliminated by an adjustment of this condenser.

(d) After the foregoing test which was conducted on August 30th, the tube compartment compensating condenser C-173 was removed from the circuit. New heaters of 46 ohms resistance designed to give increased heat dissipation were installed in place of the original heaters in the MO compartment. In addition about 3 square inches of felt insulation was removed from one corner of the MO heater compartment. Check tests indicated that improved operation resulted from these changes except that the specification requirements were still exceeded in the region of 10 to zero degrees Centigrade. The results of these checks indicated the need for some degree of compensation and hence the compensating capacitor C-173 was reinstalled after removing two 1/32" thick shims. The removal of these shims decreased the value of capacity by increasing the distance between the condenser plates. An additional check test was then made. The results of this test, which were not in strict conformity with specification procedure due to lack of time, indicated that the equipment would meet specification requirements over the entire range of ambients.

(e) After the foregoing data had been collected, it was deemed desirable to incorporate the changes found necessary in a permanent and workmanlike manner. In order to accomplish this, the MO unit was taken back to the factory by representatives of the contractor. The necessary adjustments were made and the unit returned to the Laboratory and reinstalled in the transmitter. The next test conducted is shown in

Table No. 21 and Plate 27. The summary of this test, which was conducted at 4500 kilocycles, shows that the maximum change in frequency per one degree change in temperature was 0.00015 in the region of 50 to 40 degrees Centigrade. In the temperature range from 40 to zero the frequency change was of still smaller magnitude and the specification requirements were complied with in all instances.

(f) A test was then conducted at 2000 kilocycles, the results of which are listed in Table No. 22 and Plate No. 28. The equipment functioned satisfactorily and the frequency changes were well within specification limits, the greatest change being of the order of 0.0001% per degree.

(g) As a result of the foregoing tests and adjustments, the re-submitted model XTBK-8 equipment functioned satisfactorily and gave exceedingly stable performance. If due precautions are taken to insure that production equipments are designed and adjusted in accordance with this information, satisfactory performance should be assured.

103. Paragraph 3-7-9. Variation in Humidity (Ambient Temperature Constant.) The entire equipment, including transmitter, motor generator, starter and dummy antenna, was installed in the temperature-humidity test chamber. Since it was necessary to conduct a large number of tests before the final results were arrived at, reference is made to paragraph 102(b) above as the conditions prevailing within the test chamber had a decided influence upon steps taken to improve operation of the transmitting equipment.

(a) The first humidity test was conducted at 4500 kilocycles with the results illustrated in Table No. 23 and Plate No. 29. It will be observed that the frequency changes encountered were approximately double those permitted by the governing specifications, while the power decrease was slightly in excess of that permitted.

(b) The next humidity test was conducted after the MO cabinet had been returned to the factory for adjustment. This second test, which was in the nature of a re-check, was run at 4500 kilocycles also. The results of this test are illustrated in Table No. 24 and Plate No. 30. It will be observed that the frequency changes encountered are almost identical with those observed during the first test illustrated in Table No. 23. It will be noted, however, that the falling off in power was less, being of the order of 2.7%.

(c) As a result of the foregoing humidity tests, a careful survey of the situation indicated that due

to the rapid circulation of air within the test chamber and the well ventilated condition of the master oscillator tube compartment, the large frequency variations encountered might be due to a combination of these conditions. Hence, it was decided to shield this compartment by placing a solid aluminum sheet at the right side of the compartment in place of the perforated shield originally used. In addition, the perforations at the back of the compartment were blocked off. The results of a test conducted under these conditions is shown in Table No. 25 and Plate 31. It will be noted that the frequency change was reduced to a value of 0.0044%.

(d) In an effort to still further reduce the frequency variation encountered, the original filament choke assembly which was mounted on specially treated bakelite was replaced by a filament choke wound on an Isolantite form. This change, however, did not improve the results obtained as may be seen by referring to Table No. 26 and Plate 32.

(e) The original filament choke assembly was then re-installed in the transmitter, and in addition to the side and rear shielding mentioned above, the bottom of the tube compartment was blocked off. The test conducted under these conditions is illustrated in Table No. 27 and Plate 33. No definite change over the two previous tests could be noted, the frequency change remaining of the order of 0.0046%.

(f) A test was then conducted at 2000 kilocycles under the same conditions listed in sub-paragraph (e) above. The results of this test are shown in Table No. 28 and Plate No. 34. The equipment complies with the specification requirements both with respect to frequency variation and power output reduction.

(g) Since it appears that all practical steps have been taken to protect the equipment against the effects of humidity and since the frequency variation at 2000 kilocycles is of the order of 0.0023%, while that at 4500 kilocycles is only about 0.0015% in excess of specification requirements (67 cycles), it is recommended that the Bureau of Engineering consider the advisability of waiving this particular item of non-compliance.

104. Paragraph 3-7-10. Locked Key Operation for Two Hours. Originally, the Model XTBK-8 transmitter was provided with a compensating capacitor which was energized in parallel with the master oscillator filament as described in paragraph 106(d) of NRL Report R-1507. The operation of this device was not considered satisfactory. In the re-submitted Model XTBK-8 this form of compensation

has been eliminated. The results of a two hour locked key test at 2000 kilocycles are shown in Table No. 29. The results of this test indicate agreement with the specification requirements within the limits of observational error. Table No. 30 covers a test conducted at 4500 kilocycles and the results obtained are well within the specification limits.

105. Paragraph 3-7-11. Change from Key Locked to Intermittently Keyed Condition. The re-submitted Model XTBK-8 complies with the requirements of this specification test as illustrated in Table No. 31.

106. Paragraph 3-7-12. Change from Continuously Keyed Condition to Intermittently Keyed Condition. Table No. 32 covers tests conducted at 2000 kilocycles and 4500 kilocycles in conformity with this paragraph of the governing specifications. The results obtained are well within the specification limits.

107. Paragraph 3-7-13. Inclination Due to Roll and Pitch of Ship. The complete Model XTBK-8 equipment, including transmitter, motor generator and starter, was secured to the inclination test table by means of the regular hold down fittings provided. The equipment was then inclined to forty-five degrees from the vertical in fore and aft and side to side directions at a rate of five cycles per minute. Table 33 lists the results of tests conducted at 2000 kilocycles and 4500 kilocycles when the equipment was inclined from front to back, while Plates 35 and 36 show these data in graphic form. In all instances the frequency changes noted fall well within the specification limits. Table No. 34 and Plates 37 and 38 cover similar data, except in these tests the equipment was inclined from side to side. Again the specification requirements have been complied with at both test frequencies, 2000 kilocycles and 4500 kilocycles.

108. Paragraph 3-7-14. Vibration. With the complete equipment secured to the vibration test table, it was subjected to vibration of varying degrees of amplitude and frequency. The vibration had practically no effect upon the emitted frequency as may be seen by referring to Plates Nos. 39 and 40 and Table No. 35. During the course of these tests no damage was incurred nor was any faulty operation observed.

109. Paragraph 3-7-15. Shock. With the transmitter secured to the deck by means of the regular base fittings, shocks were applied to the equipment in the manner designated by the governing specifications. Table No. 36 shows the results of this test. It will be observed that the shocks had negligible effect upon the emitted frequency of the transmitter and the shocks themselves caused no disarrangement of parts or faulty operation.

110. Paragraph 3-7 (General). For purposes of information and comparison, a summary of all frequency stability tests, as outlined in paragraph 3-7 of the governing specifications, is presented in Table No. 37. The values listed for each specific test are the maximum values obtained during those tests. In the case of tests 3-7-2 and 3-7-9, the results listed are those obtained after the equipment had been readjusted to improve operation. The totals listed

in columns 2 and 3 are the arithmetical sums of the various tests, no account being taken of whether the variations were plus or minus. Columns 4 and 5 under the heading "Percent frequency variation of specification allowance" give the percentage values of the actual test results as compared with the values permitted by the specifications. Thus a percentage value of 100% indicates that the test value and specification value are in exact agreement. A test value of 10% indicates that the frequency variation observed during the test was only 10% of the value permitted by the specifications. A test value in excess of 100% indicates that the specification value was exceeded.

111. Paragraph 3-8. As originally submitted, the re-submitted Model XTBK-8 transmitter failed to maintain a constant temperature within the master oscillator compartment when the ambient temperature approached zero, as reported in paragraph 102 above. During the course of the tests, the heater resistors were changed in order to provide greater heat capacity. The heater units now installed are considered temporary in nature and it is understood that the contractor intends to provide suitable units, four in number, in production equipments. A running record of the action of the temperature controlled cabinet was kept over the period of time that the equipment was being subjected to temperature and humidity tests. This record is tabulated in Table No. 38. It will be observed that the maximum spread in temperature, after sufficient heat capacity was supplied, ranged from 60.08 to 60.78, with an average value of approximately 60.30. Thus, the maximum variation from this average value is approximately plus or minus 0.35 degree, which complies with the specification requirement of plus or minus 0.5 degree. The design of the temperature controlled equipment is such that frequency stabilization and temperature stabilization are obtained in approximately one hour after heating power is applied when the ambient temperature is 28 degrees Centigrade. The results of a test of this nature are illustrated in Plate 41. It will be observed that the auxiliary heater ceases operation at 50 degrees Centigrade and that the total frequency variation during the warm-up period is 0.018% at 2000 kilocycles.

112. Paragraph 3-9. A thermostatically controlled cut-out is incorporated in the master oscillator cabinet which automatically opens the heater circuit when the temperature within reaches approximately 67 degrees Centigrade. The heater circuits are restored to normal operating condition when the temperature recedes towards normal. The operation of this cut-out also extinguishes the heater indicator light.

113. Paragraph 3-10. Provision is made for energizing the filament of the master oscillator tube during the periods in which the transmitter is idle, i.e., when the motor generator equipment is shut down. Power for this purpose is obtained from the 440 volt supply line through distribution transformer T-103 and M.O. filament transformer T-102. A suitable switch is provided on the transmitter panel to permit selection of stand-by operation or to permit the oscillator filament to be extinguished during idle periods. A separate filament rheostat is provided on the front panel for adjustment of the master oscillator filament when in the stand-by condition.

It is believed, however, that this control should be removed from the front panel since there is great likelihood that an operator may confuse this control with the main filament control and thus misadjust the amplifier filaments. It is recommended, therefore, that the standby rheostat control on the panel be eliminated and the proper adjustment, once arrived at, remain fixed. At the present time the filament voltmeter is connected to the master oscillator filament on the low side of the filament R.F. chokes. This requires the voltmeter to be adjusted to a value of 11.7 volts in order to compensate for the drop in the filament chokes. A more suitable condition would exist if the filament voltmeter were connected to the 11 volt secondary of the main filament transformer where it could then be adjusted to read a standard voltage of 11 volts. Several times during the course of the tests, while changing tubes in the master oscillator tube socket, the filaments failed to light. It was found that the socket construction is such that unless the tube is seated home with considerable force, the filament prongs fail to make contact. A slight modification of the existing design will overcome this difficulty and the contractor has stated this will be accomplished in production equipments.

114. Paragraph 3-11. All neutralization necessary for satisfactory operation is accomplished through the use of screen grid vacuum tubes.

115. Paragraph 3-12. The design of the keying circuit is such that all tubes cease to oscillate when the key is open. The keying action of the transmitter was observed at speeds of 20, 40, 60, 80 and 100 words per minute. Observations were made by means of a cathode ray oscillograph and satisfactory operation was obtained. Keying was clean-cut, well spaced and no traces of "key bounce" or other erratic operation were noted. The equipment was keyed at the rate of 100 words per minute for one hour with satisfactory results.

116. Paragraph 3-13. The frequency range of the master oscillator circuit is divided into six bands, any of which may be selected by means of a six point band switch. The remaining circuits of the transmitter may be varied over the specified frequency range by means of variable controls, no range switches being provided. The M.O. range switch is not fitted with interlock protection and the need for such protection is unnecessary since no serious arcing exists.

(a) Two switches in the equipment are fitted with interlocks, namely the "Adjust-Tune-Operate" and the "Antenna Feed" switches. These switch interlocks remove power from the transmitter by opening the coil circuit of relay K-104, which in turn removes field excitation from the motor generators. While this type of operation performed satisfactorily during the course of the tests, it is believed more satisfactory operation would be obtained if the interlocks were placed in the keying circuit. Relay contacts which operate in highly inductive field circuits are subject to considerable

arcing and it is believed advisable to limit the operation of these contacts if it is practical to do so. Protection against excessive arcing is provided by means of Thyrite resistor units, but the residual arcing is still noticeable and hence it is recommended that the interlocks be transferred to the keying circuit.

(b) Table No. 39 shows the overlap and end point tolerances existing in the master oscillator circuit. In all cases the overlap is in excess of the 3% required by specifications calculated in accordance with the formula outlined in paragraph 3-13-2.

(c) Paragraph 117(b) of NRL Report R-1507 pointed out that the master oscillator control was provided with a calibrated dial marked from 0000 to 9550, while only the portion between zero and 7000 was useful. In the re-submitted model XTBK-8, the dial markings run from zero to 7000 and hence only the useful portion of the scale is used.

(d) Table No. 40 shows that the remainder of the circuits in the transmitter cover the range specified and that the required 3% overlap has been provided. The limiting circuit on the low frequency end of the range is the master oscillator while the antenna circuit limits the high frequency end. However, this is true only with antenna loads of certain characteristics, such as the lamp load used during these measurements.

117. Paragraph 3-14. Table No. 3 lists the controls provided on the front panel for the operation of the transmitter. The "high-low" power switch has been removed from the equipment, thus reducing the number of controls, and as discussed in paragraph 113 above, it is recommended that the master oscillator filament rheostat be eliminated from the front panel. The remainder of the controls is necessary for satisfactory operation in accordance with specification requirements.

118. Paragraph 3-15. Each control is fitted with a suitable nameplate to indicate its function and in addition the tuning controls have been labelled from "A" to "K". As pointed out in paragraph 56 above, the letter "F" has been omitted from the series and this discrepancy should be remedied.

119. Paragraph 3-16. A calibration card holder is mounted on the front panel of the equipment. The calibration cards are 6-1/4" x 4-5/8" in size and contain provision for logging thirteen frequencies. Four extra cards are provided in addition to the front or active card. In this connection it is pointed out that the cards still carry the "F" designation, which is no longer used. In production equipments care should be exercised to insure cards with proper markings.

120. Paragraph 3-17. Continuously variable controls are actuated by means of positive gearing. As shown in Table No. 41, the variation of resonant frequency of the master oscillator control per division of dial marking falls between the limits of 0.01 and 0.001 percent. The remaining circuits have been provided with controls which provide for the non-critical adjustment of these circuits.

121. Paragraph 3-18. All rotating or continuously variable tuning controls are provided with dial locking mechanisms to prevent accidental movement of such controls. The locking knobs are so located and designed that they do not interfere with the operation of the controls or present sharp corners or surfaces which might injure an operator's hand. Tests showed that the operation of the dial locks has no appreciable effect upon the frequency of the transmitter.

122. Paragraph 3-19. A calibration correction condenser has been provided whereby the calibration of the master oscillator circuit may be kept substantially constant when changing tubes or other circuit elements. This condenser is of the screw driver adjustable type and the adjust is accomplished through a covered aperture in the front panel. The purpose and location of this device are indicated by a nameplate bearing the legend " M O Calibration Corrector". The range of the capacitor is such that it is possible to vary the frequency in excess of plus and minus 0.03%. The calibration corrector has been equipped with a stop to prevent short circuiting the condenser.

123. Paragraph 3-20. The design of the equipment is such that it is possible to shift from one frequency to any other frequency and obtain normal voltage in all cases without readjusting filament, bias or plate voltage controls.

124. Paragraph 3-21. A three position, interlocked switch has been incorporated in the equipment to facilitate frequency shifting with safety and minimum production of interference. The operation provided is as follows:

Step 1: Plate potential is removed from all amplifier stages and only the master oscillator circuit is energized.

Step 2: The power amplifier potential is derived from the midtap of the main plate generator and the intermediate amplifiers are operated at reduced potential by the insertion of a series resistor.

Step 3: All potentials on the transmitter are restored to full power operating values.

Table No. 42 lists the voltages which are applied to the transmitter with the Tune-Adjust-Operate switch set on positions 1, 2 and 3 respectively.

125. Paragraph 3-22. A substantially constructed test key of Gamewell Company manufacture is provided. The test key is mounted

for vertical operation and provides key locked condition in the "up" position, key open in the horizontal position and momentary contact in the down position. The five-second relay has been eliminated from the re-submitted Model XTBK-8 in accordance with the provisions of reference (d).

126. Paragraph 3-23. The design of the equipment is such that no signal is radiated when the key is open; hence, in the un-keyed condition the transmitter does not interfere with incoming signals.

127. Paragraph 3-24. The re-submitted Model XTBK-8 equipment is equipped with one blower motor which is used for circulating the air within the master oscillator compartment. The blower for cooling the master oscillator tube, which was furnished with the original model, has been eliminated. No interference was experienced from the blower motor in nearby receiving equipment. The re-submitted Model XTBK-8 was equipped with the original rubber couplings for the blower motor. However, replacement couplings of fabric were sub-mitted separately. One of these fabric couplings was installed in the equipment. The clamps as furnished with the rubber couplings are slightly large for the fabric type unless used at the extreme edges where the hem increases the thickness of the material. Properly designed and fitted clamps should be furnished for use with the fabric couplings which operated satisfactorily during the tests and which are believed to be superior to the rubber couplings for service use.

128. Paragraph 3-25. It is possible to vary the power output of the transmitter by means of the plate generator field control from full power condition to a value of approximately 6%. The results of this test are covered in Table No. 15.

129. Paragraph 3-26. Suitable indicator lamps have been provided on the front panel to indicate the following functions:

(1) When bias voltage is supplied to the transmitter: Green light.
(2) When Plate Voltage is supplied to the transmitter: Red light.
(3) When starting contactor is energized: Blue light. (As pointed out in paragraph 83 above, the specifications require a red light for this purpose.)
(4) When temperature compartment heater circuit is energized: Amber light.
(5) When master oscillator tube filament is energized: Clear light.

130. Paragraph 3-27. Indicating instruments (meters) have been provided in conformity with the requirements of this paragraph of the governing specifications, as listed in Table No. 3. Since the second intermediate amplifier is no longer required to operate as a final power amplifier, the grid current meter for this tube has been eliminated. The antenna ammeter is located in the high potential side of the circuit adjacent to the antenna terminal and

is mounted behind the front panel and suitably insulated therefrom. A glass window permits the meter to be viewed from the front panel. A complete discussion of the meters provided will be found in paragraph 58 above.

131. Paragraph 3-28. A tube life meter of Westinghouse manufacture has been provided to register the number of hours of operation of the power amplifier tube.

132. Paragraph 3-29. The transmitter dimensions are listed in Table No. 4. The hand rails of the re-submitted model have been repositioned so as to decrease the width of the transmitter to conform with specification limitations. It will be noted, however, that the depth of the transmitter exceeds the specification limit by 9/16". This was brought about by making the rear shields removable. In the original model the rear shield was solid and non-removable. The securing studs are 9/16" in length and protrude from the transmitter. It is understood that this condition is acceptable to the Bureau of Engineering in view of the increased accessibility afforded. Where the transmitter must pass through restricted passages, the rear shields may be removed to decrease the depth dimension. The transmitter is essentially of one unit construction, although it is possible to remove the master oscillator compartment.

133. Paragraph 3-30. The dimensions of the various units of the equipments are such that they comply with the requirements of paragraph 2-33.

134. Paragraph 3-31. The transmitter unit includes all component parts as required by this paragraph. Filter capacitors for the motor generator supplies are contained within the transmitter housing.

135. Paragraph 3-32. The transmitter is completely shielded on all six sides and is equipped with the necessary internal shielding to provide satisfactory operation. All connecting leads are enclosed in grounded lead sheaths which are securely anchored and protected by felt buffers. The wiring has been greatly improved over that which existed in the original Model XTBK-8 and gave satisfactory results throughout these tests. The shields are secured to the frame by the same type of securing screws described in paragraph 67(a) above. An improved design, submitted by the contractor, is illustrated in Plate 22 and it is the understanding of the Laboratory that the improved type of securing screw will be employed on production equipment. When this is accomplished the means for securing the external shielding will be satisfactory.

136. Paragraph 3-33. All electrical indicating instruments, except R.F. instruments, together with associated multipliers, are by-passed as described in paragraph 58 above.

137. Paragraph 3-34. Vacuum tube filaments are lighted from alternating current by means of two filament transformers. Transformer T-102 supplies energy for the master oscillator tube while transformer T-101 serves the same purpose for the intermediate and power amplifier stages. Paragraph 113 above discusses the master

oscillator filament circuits in some detail and suggests certain recommended changes. The filament transformers have tapped secondaries (mid-point) and the primaries are provided with taps and adjustable links permitting primary operation at approximately 70, 100, 140 and 200 volts. A suitable filament rheostat provides adjustment for normal variation of these primary voltages. The transformers are equipped with bakelite plates on which the necessary information is engraved to enable an operator to adjust the links for the desired primary operation.

138. Paragraph 3-35. The transformers provided are of the aircooled type, and the construction has been improved over the original assemblies previously submitted. While no trouble was experienced during the course of the tests, it is recommended that the Contractor give special consideration to the distribution transformer T-103. Measurements show that the magnetizing power required for this transformer is 45 watts, which is considered high for this size and rating. Additionally, as pointed out in paragraph 102(d) above, it was found necessary to increase the M.O. heater load which in turn will place an additional load on transformer T-103. Then, as illustrated in Table No. 43, it was found impossible to obtain adequate filament potential at minus 10% line voltage. If the output voltage of transformer T-103 were increased by the necessary amount, this difficulty would be overcome. A more efficient transformer of adequate power and voltage rating is indicated.

139. Paragraph 3-36. Table No. 43 illustrated the regulation of the various transformers provided. Between the keyed and unkeyed condition it will be noted that the regulation of all circuits is less than 5%, 1.7% being the maximum observed.

140. Paragraph 3-37-1. The transmitter is so constructed that it can be installed with its back flush against a bulkhead. However, if installation conditions are such as to permit access to the rear of the transmitter, the rear shields may be removed.

141. Paragraph 3-37-2. The foundation pedestal is constructed of two longitudinal dural channels, 1-1/2" x 3". Provision is made for bolting to the deck by means of four 1/2" bolts. Heavy spacers are secured at each bolt location to prevent deformation of the channels. Heavy dural shields have been secured over the wiring in the vicinity of the holding down bolts to prevent accidental injury to the wiring during the process of bolting or unbolting the transmitter. The foundation pedestal was found to be adequate during the vibration and inclination tests. As will be noted by referring to Plates 3, 4, 5 and 6, the external connection cables may be brought in on either side of the base or may be introduced through the openings in the rear channel. The front foundation channel has been covered by a black crystalline finish kick plate to give the front panel a smooth and unbroken appearance as illustrated in Plate No. 1.

142. Paragraph 3-37-3. All external cable connections can be effected at a terminal board located at the bottom of the transmitter as illustrated in Plate No. 2. The lower edge of the terminal board is 4-1/2" from the deck. As stated in paragraph 141 above, cables may be brought in from either side or from the rear of the

in the first model. This change in mounting overcomes the objections originally raised in paragraph 149 of NRL Report R-1507.

150. Paragraph 3-42. The antenna tuning and coupling system is so designed that capacitor C-147, of 0.002 capacity rated at 5000 volts, prevents dc voltages from reaching the antenna circuit.

(a) Antenna coupling capacitor C-148 has been relocated in the re-submitted Model XTBK-8 in such a manner that the half cylindrical fixed plates are in no danger of being short circuited by foreign materials. The position of this condenser can be seen in Plate No. 9. The burrs and rough spots have been removed from the plates and in general a more satisfactory installation has resulted.

(b) The P.A. tank circuit is equipped with an equalizing or balancing capacitor of 0.00003 rating. The purpose of this element was to provide more uniform coupling conditions over the frequency range. Tests indicate, however, that better coupling conditions and somewhat more efficient output is obtained at the high frequency end of the range when this condenser is eliminated. It is recommended, therefore, that capacitor C-172 be removed from the circuit.

151. Paragraph 3-43. Calibration facilities.

(a) In order to expedite adjustment of the equipment to frequencies for which the equipment has not been previously calibrated, coupling and terminating facilities have been incorporated in the Model XTBK-8 equipment to facilitate the use of standard frequency measuring equipment such as Model LDs.

(b) R.F. pick-up is provided by means of a small single plate air capacitor located near the master tank circuit within the temperature controlled compartment. Thus the energy provided for monitoring purposes is at the fundamental frequency of the master oscillator and not at the output frequency, or double frequency. Thus it would be necessary to adjust the frequency meter to one-half the desired output frequency. It is believed that a more desirable arrangement would be provided by coupling to the plate circuit of the master oscillator tube which operates always at double the frequency of the M.O. tank. This arrangement will require that the doubler plate circuit be resonated and hence a greater degree of frequency accuracy should be obtained since it would be free from the reactions caused by plate circuit tuning. The R.F. pick-up is connected through suitably shielded leads to the terminal board of the transmitter, one side of the circuit being at ground potential. A measuring

equipment output jack is located on the front panel of the transmitter and connected to the terminal panel of the equipment.

(c) The R.F. voltages available from the coupling circuit provided are listed in Table 44. It will be noted that in all instances the R.F. potentials exceed 60 millivolts. The governing contract calls for a potential of approximately 1 millivolt, although subsequent revisions may have increased this value. In order to provide efficient operation in locations of high noise level, it is recommended that coupling potentials of at least 15 millivolts be available.

(d) The output phone jack is located at midpanel height on the left side of the front panel. The location is illustrated in Plate No. 1 just to the left of the access door to the power amplifier tube. The jack is provided with a shield to permit the use of shielded phone plugs. Tests with a type 49034 indicated that the assembly was satisfactory for this purpose.

(e) The coupling circuit terminals have been labelled "R.F. Coupling for frequency meter" and the output phone jack is identified by a nameplate bearing the legend "Frequency Meter Audio Output".

152. Section V, Transmitter Control. The requirements of this section of the specifications have been modified in accordance with paragraph 9(d) of reference (d). In general, the 4-wire control circuits have been eliminated in favor of an arrangement which permits the use of either 6-wire or 4-wire controls. Further correspondence on this subject is contained in reference (e). In the following paragraphs such items of the original specifications as still apply will first be discussed, after which the modified circuits will be considered.

153. Paragraph 5-6. The keying relay, which is described in detail in paragraph 144 above, forms an integral part of the transmitter unit and provision has been made on the terminal board for the connection of all monitor and remote control lines. This relay controls the emission of the transmitter for telegraphic signalling and in addition provides a set of single pole double throw contacts for the control of auxiliary equipment.

154. Paragraph 5-8. The keying relay operates satisfactorily at speeds up to 100 words per minute. The coil circuit of the relay is energized from the 230 volt bias generator through a suitable series resistor. The following currents flow through the key relay and coil and through the control key:

	Control System	Actual M.A.	M.A. permitted by specs.
Key Relay Current:	6-wire	90	110
Control Key Current:	6-wire	90	140
Key Relay Current:	4-wire	90	110
Control Key Current:	4-wire	90	140

155. Paragraph 5-24. The following relays are used in the Model XTBK-8 transmitter:

D.C. Operated Relays

Part No.	Function	Relay Coil Voltage
K-102	Keying	48 - key closed 115 - key open
K-105	Bias relay	230
K-106	Overload, main plate	-
K-107	Overload, Aux.plate	-

A.C. Operated Relays

K-101	Master starting	110
K-104	Generator Field	110
-	*Motor starting	*220/440

Note: The motor starter is equipped with a relay which permits operation on either 220/or 440 volts. This feature will be discussed in detail under the heading of motor controller.

The d.c. operated relays obtain operating voltage from the bias generator, while the 110 volt AC relays obtain energy from distribution transformer T-103. This transformer has primary windings for 440/220 volt operation and secondary windings for 220/110 volts. The transformer is rated at 850 VA. As previously indicated in paragraph 138 above, a demand for more heater energy requires further consideration be given this rating to insure adequate output. It is further recommended that this transformer be equipped with a plate similar to those provided on the filament transformers, containing instructions for shifting transformer potentials.

156. Paragraph 5-25. The relays and contactors incorporated in the XTBK-8 equipment operate in a quiet and efficient manner without undue noise or hum.

157. In the following paragraphs reference is made to the diagrams and memorandum covering 4-wire and 6-wire control circuits which form enclosure (g) of Bureau of Engineering letter C-NOs-61006(10-19-R6) of 22 May 1939. The numerals listed correspond to the paragraph numbers appearing in the above mentioned memorandum.

158. Requirements for Transmitter Control Circuits, AC and DC Supply; General. The resubmitted Model XTBK-8 equipment is designed for use with either 4-wire or 6-wire control circuits. The equipment is provided with the necessary switches and facilities to provide this type of operation.

(1) A local-remote switch has been provided on the front panel of the transmitter which may be used in connection with both 4-wire and 6-wire circuits. When in the local position, this switch causes the remote circuits to be inoperative, and when in the remote position, this switch permits control from the remote control unit and from the local front panel controls of the transmitter unit.

(2) An emergency switch, of the push button type, is provided on the front panel of the transmitter. The "stop" or shut down position of the switch is indicated by large lettered engraving and additionally by a red bullseye surrounding the stop button. When this switch is thrown to the "stop" position, all power is removed from the equipment, including M.O. heaters and the only live circuits remaining are those connecting to and contained in the distribution transformer T-103. The equipment cannot be restarted, either locally or remotely, until this switch is thrown to the "on" position. The switch functions in the same manner when either the 4-wire or 6-wire circuits are used.

(3) A set of six terminals has been provided on the terminal board of the transmitter to provide facilities for connecting to external control units. Links are provided on sub-terminal panels within the transmitter to adapt the equipment to either 4-wire or 6-wire control.

(4) The transmitter is so designed and equipped that either 4-wire or 6-wire control circuits may be selected. Interchangeable switch plates equipped with two button momentary contact switch or a maintaining toggle switch are provided, so that either type of control may be utilized.

(5) The transmitting equipment under test is designed for operation from a primary source of 440 volts, 3 phase, 60 cycles. Hence keying potential is derived from the bias-exciter generator, which has a nominal output of 230 volts. This voltage is reduced to the required value by means of a suitable potentiometer.

(6) A standard potential of 110/115 volts A.C. is used for starting and indicator circuits, this potential being derived from the secondary of a suitable distribution transformer whose primary operates from a single phase of the 440 volt supply circuit.

[redacted]

(7) Keying potential is not available until the motor generator equipment has been started and reaches full operating speed. This type of operation is accomplished by a circuit employing protective relays of an interlocking nature.

159. Requirements for 6-wire remote control circuits - A.C. and D.C. Equipments.

(1) The equipment may be started or stopped locally by means of a two-button momentary contact normally open switch. This may be accomplished when the "Local-Remote" switch is in either the "local" or "remote" position.

(2) The equipment may be started, stopped and keyed from any connected remote unit after the "Local-Remote" switch is placed in the "remote" position.

(3) A local indicator light is provided on the front panel of the transmitter which is connected in parallel with the coil circuit of the Master Start Relay.

(4) A remote indicator light, forming a part of the remote 6-wire control station, is connected in parallel with the local indicator lamp when the "Local-Remote" switch is in the "remote" position and the equipment has been started.

160. Two 6-wire remote control stations were connected in parallel in order to study operation under these conditions. The required operation, as listed in paragraph 159 above, is obtained when two stations are operated in parallel. Both remote indicator lights are illuminated whether the transmitter is started either locally or from either of the two remote control stations.

161. Comments on 6-wire Control System. Below are listed certain conditions under which an operator at a remote station would believe that the transmitter was capable of delivering keyed power, judging by the remote indicator light, but would find that the transmitter was actually inoperative.

(1) If either vacuum tube overload relay is open.
(2) If motor thermal overload is open.
(3) If motor controller contactor coil circuit fuse should blow.
(4) If either motor fuse should blow.
(5) If any of the four generator fuses should blow.
(6) If motor controller disconnect switch should be left open.
(7) If adjust-tune-operate switch were left in improper position, i.e., step 1.

162. Additional Comments on 6-wire Control System.

(1) If primary power should fail or if the line voltage should drop below 50% of normal value, the equipment would shut down and the remote indicator would be extinguished. When the primary power was restored to normal, it would be necessary to manually re-start the equipment.

(2) If one of the interlocked doors on the transmitter is opened, the equipment shuts down which is accompanied by the extinguishment of the remote indicator light if the "Remote-Local" switch is in the "remote" position. Manual re-starting is necessary.

(3) In the re-submitted Model XTBK-8 equipment a ground is included on both AC and DC control circuits for 6-wire control. A study of the circuit diagrams indicates that it would be possible to remove the ground from AC and still obtain operation. This could not be done at present since several circuits are completed through the frame members and additional wires will be necessary to provide complete non-grounded circuits. It is understood that the Bureau of Engineering desires to have the AC 6-wire control circuits definitely divorced from ground. In this connection it is pointed out that a definitely grounded AC circuit provides certain safety features which are possibly worthy of consideration. For example, accidental short circuits between the control wiring and the 440 volt supply or any of the high voltage DC potentials will prove to be less dangerous if a permanent ground exists on the control wiring.

(4) If AC power for the control circuits was taken from the motor side instead of the line side of the motor line fuses, the remote indicator light, as well as the local indicator light, would extinguish when the motor fuses were disrupted. Additionally, the indicators would go out when the controller disconnect switch is opened. (See sub-paragraphs (4) and (6) of paragraph 161 above.)

(5) In order to overcome all the so-called "difficulties" listed in paragraph 161 above a rather complex circuit of additional relays, relay contacts and connections would results. These devices in themselves would be subject to faulty operation and in the final analysis the improvements wrought by their incorporation would be outweighed by the attendant difficulties and additional gear required.

163. Requirements for 4-wire Remote Control Circuits - A.C. and D.C. Equipments.

[redacted]

(1) The re-submitted Model XTBK-8 equipment may be started or stopped locally by means of a maintaining contact toggle switch. The governing memorandum states "This feature to be operative when the "Local-Remote" switch is in the "Local" or "Remote" position." It is pointed out that with the "Local-Remote" switch in the "Remote" position, it is impossible to start the equipment locally unless the remote control station start switch is closed. It is believed that this is the intent of the revised specifications since it would evidently be undesirable to have the equipment start when thrown to "Remote" if the remote start switch was open.

(2) The equipment may be started, stopped and keyed from a remote unit after the local start switch is placed in the "on" position, and the "Local-Remote" switch is placed in the "Remote" position.

(3) The local indicator lamp is connected in parallel with the Master Start Relay coil.

(4) The remote indicator lamp is connected in parallel with the local indicator light after the "Local-Remote" switch is placed in the "Remote" position and the equipment has been started.

164. Two 4-wire remote control stations were connected in parallel in order to study operation under these conditions. The required operation, as listed in paragraph 163 above, is obtained when two stations are operated in parallel.

165. Comments on 4-wire Control System.

(1) Items (1) to (7) listed under paragraph 161 above apply to the 4-wire control system as well as the 6-wire system.

(2) In case of failure of the main line power, the equipment ceases operation, but upon re-application of the power the equipment starts immediately.

(3) If transmitter door is opened, the equipment is shut down and remote indicator is extinguished. When the door is re-closed, the equipment is immediately restored to service.

(4) AC and DC potentials use common circuits and hence where a ground is required on the DC circuit, the AC circuits must necessarily become grounded.

(5) When the transmitter is operating and in remote control, shifting the "Local-Remote" switch to local causes a momentary shut-down. The equipment immediately is re-started when the switch gets to the "Local" position. This is normal operation for this type of circuit.

166. From experience obtained with the 4-wire and 6-wire control circuits supplied in the re-submitted Model XTBK-8 equipment and from a study of the diagrams submitted in connection therewith, the following suggestions are made:

(1) In substituting the maintaining contact toggle switch for the momentary contact push button switch, or vice-versa, difficulty is experienced in selecting the proper leads or wires. The momentary contact switch requires 3 leads while the toggle switch requires only two, and one lead must be taped up and stowed behind the switch. It is recommended that these leads be clearly marked near the terminals and that the diagrams in the instruction books be similarly marked and in addition the switches themselves bear the same identifying marks.

(2) Furnish sketches or diagrams of terminal strips for both 4-wire and 6-wire systems, indicating which links are used and location of same for each system.

(3) Drawings P720354 and T-611536 show terminal K-4 grounded. This terminal is not grounded in the transmitter so it was necessary to use a shorting link between K-4 and K-3 in order to get M.O. filament power through the contacts of K-101(A). The drawings should be corrected and indicate clearly the operations to be performed.

(4) The simplified control circuit, Drawing P720354, is very useful and should be included in the final instruction data after the necessary corrections have been made.

167. Paragraph 6-1. The following paragraphs of this report comment in detail upon the operation and performance of the power equipment supplied with the Model XTBK-8 equipment as re-submitted.

168. Paragraph 6-2. The power equipment supplied is designed for operation from 440 volts, 60 cycle, 3 phase power. The motor is capable of operation from either 220 or 440 volts. The magnetic controllers furnished are designed for 440 volt operation, and all tests were conducted at this potential.

169. Paragraph 6-3. The equipment, including motor generator and magnetic controller, was subjected to plus and minus 10% variations in line voltage and the power equipment functioned satisfactorily. No means were available for changing the frequency of the supply voltage.

170. Paragraph 6-4. The power equipment was subjected to numerous full power key locked tests for varying periods of time ranging up to 8 hours. During these tests the ambient temperature was varied between the limits of zero and 50 degrees Centigrade and the relative humidity was varied from a low value to 95% at 45 degrees Centigrade. No overheating, breakdowns, or unsatisfactory performance were noted during the course of the tests.

171. Paragraph 6-5. The total power required for operation of the Model XTBK-8 equipment and the power required for various conditions of operation are listed in Table No. 45. This table indicates the power required for plus 10% of normal line voltage. In no case is the specification requirement of 4.5 KW exceeded.

172. Paragraph 6-6. Power for the filament lighting transformers is obtained from the 440 volt 60 cycle line through the medium of a step-down distribution transformer which permits the filament transformers to operate at a primary voltage of 110/115 volts.

173. Paragraph 6-7. The power required for the vacuum tube plate, screen grid and control grid bias circuits is obtained from motor driven generators.

174. Paragraph 6-8. DC power required for the excitation of the generators involved and for auxiliary use is obtained from the bias generator which has a nominal rating of 250 volts. The total load on the bias generator is 0.92 ampere, which is distributed as follows:

Main generator excitation: 0.41 amp.
Bias/MO Plate generator excitation: 0.22 amp.
Potentiometers, indicators, key relay,
etc. in transmitter unit: 0.29 amp.

This generator is so designed that in addition to the current required for field excitation, 0.4 ampere is available for auxiliary use. The manufacturer of the motor generator indicated that the bias-exciter generator is capable of delivering 1.25 ampere as a normal load.

175. Paragraph 6-9. The power equipment as supplied consists of a 4.5 H.P., 220/440 volt, 3 phase, 60 cycle motor driving a double commutator main plate generator, 1500/3000 volts and a double commutator auxiliary generator which furnishes power at 1500 and 250 volts. The three units are assembled on a common bed plate.

176. Paragraph 6-10. The motor generator unit furnished is of the three unit six bearing type.

177. Paragraph 6-11. The length of the largest armature assembly furnished with the equipment is 21 inches which is well within the specification limit of 36".

178. Paragraph 6-14. The design of the power equipment is such that two generators are not connected in series in order to obtain the necessary potentials.

179. Paragraph 6-15. The flexible couplings between the various units of the motor generator assembly are of good design, substantially constructed to withstand intermittent stresses due to keying. In the re-submitted model, the coupling guards have been redesigned to provide a rigid cover which is proof against vibration and accidental deformation.

180. Paragraph 6-16. The motor and generators are mounted on a suitably cast bedplate of rigid design and construction. The construction and method of securing the units are such as to permit the removal of any one unit of the assembly without disturbing the position of the other units. Securing bolts and studs are of such design that they do not fall out of reach when a unit is removed from the bedplate. The dowels employed for alignment of units are of standard taper and are provided with square heads of satisfactory dimensions. The dowels in the motor and main plate generator are provided with square heads 3/8" x 3/8", while the auxiliary generator dowels are 5/16" x 5/16".

181. Paragraph 6-17. All motor and generator frames are grounded to the main bedplate which in turn may be secured to the station ground upon installation. All metal cover plates on the terminal boxes are securely mounted and grounded to the frame. The terminal boxes are of rugged construction and will withstand a weight of 250 pounds without bending or deformation.

182. Paragraph 6-18. Each individual unit of the motor generator assembly is fitted with an eyebolt of substantial construction for hoisting the individual unit, while the bedplate is fitted with lifting holes for hoisting the motor generator as a unit. The individual eyebolts have warning plates affixed adjacent to them directing that the eyebolt be used only for lifting the individual units and not the entire motor generator.

183. Paragraph 6-19. The dimensions of the motor generator equipment comply with the requirements of the governing specifications as illustrated in Table No. 4.

184. Paragraph 6-20. The motor generator equipment is fitted with ball bearings. The entire equipment was not disassembled to permit inspection of all bearings. The outboard bearings of the bias generator and motor could be checked without disassembly. These bearings bore the following marks:

Bias Generator: SKF DH N-05
Motor: SKF EH N-07

Provision has been made to take up end thrust.

185. Paragraph 6-21. All units of the motor generator are equipped with nameplate designating the proper grade of Navy type lubricant to be employed. The nameplates call for Grade "A" grease and direct that the bearings be flushed and refilled every six months. In this connection it is pointed out that while the bearings contained a sufficient quantity of lubricant, the balls in the motor end were practically dry. Thus it appears that the grease used in the bearings may be too heavy. While no apparent injury resulted during the course of these tests, it is deemed advisable that a further check of the lubricant designated be made to insure that it is of the proper quality and consistency.

186. Paragraph 6-22. The outboard shaft end of the bias

generator is marked "Radio 891622". No other markings could be observed without disassembling the equipment.

187. Paragraph 6-23. The output terminals of the motor generators are provided with protective fuses. These fuses are housed in the generator terminal boxes. The fuses are mounted on micalex base plates and heavy bakelite baffles are placed between the separate fuses. The metal cover plates are lined with bakelite. These precautions are taken to prevent arc-over between terminals or to the terminal housing. The following fuses are provided:

Generator	Circuit	Mfgr.	Voltage Rating	Current Rating	Actual Current thru fuse	Gen. Rating
Main Plate	3000 V	Littelfuse	5000	1 amp	380 MA	0.5
Main Plate	1500 V	"	2500	.75 amp	189	0.4
Bias/MO	1350	"	2500	.13 amp	92	0.13
Bias/MO	230	--	250	3 amp	920	0.4

The bias generator 250 volt fuse is of the renewable type. The high voltage fuses are not renewable without theaid of special equipment. During the course of the earlier tests conducted, trouble was experienced from blown fuses in the 1350 volt output circuit of the MO generator. After the stray screw mentioned in paragraph 33(c) had been removed from behind the terminal board, no further fuse trouble was encountered. The fuse holders are not equipped with nameplates or other markings to indicate the value of fuse to employ in any particular circuit. Markings of this nature would be helpful in making service replacements.

188. Paragraph 6-24. In accordance with past procedure, the generators were not subjected to short circuit tests.

189. Paragraph 6-30. The direct current generators supplied have been designed in accordance with the requirements set forth in this paragraph of the specifications as far as could be determined without disassembly or detailed tests of component parts.

190. Paragraph 6-31. The voltage regulation of the various generators supplied is illustrated in Table No. 46. In all instances the percent regulation was well within the specified limit of 5%, the maximum noted being 2.8%. This paragraph of the specifications states further that the total ripple voltage as measured on the load side of the filter shall not exceed one-quarter of one per cent. As revealed by reference to Table No. 47, this value is exceeded in the equipment furnished, the key closed ripple value of the main plate generator being 0.53%. In this connection attention is invited to Table No. 9. It will be noted that the carrier ripple measured at various frequencies is less than the 2% permitted by specification requirements and hence it appears that the degree of generator ripple present has not real deleterious effects upon the output of the transmitter.

191. Paragraph 6-33. The alternating current motor supplied with this equipment has been designed in accordance with the

requirements of this paragraph of the governing specifications as far as could be determined without disassembly or detailed tests of the component parts. The motor performed satisfactorily during the course of these tests.

192. Paragraph 6-34. As originally received on July 25, 1939, the re-submitted Model XTBK-8 equipment was accompanied by a magnetic controller for motor starting purposes which was not equipped with a disconnect switch. On August 3rd, a replacement starter was received. The nameplate data covering these two starters will be found in paragraph 59 above.

(a) The replacement starter provided has the following characteristics:

(1) Ambient temperature of reference: 50 degrees C.
(2) Class of insulation: Class A.
(3) Degree of Enclosure: Protected drip-proof.
(4) Degree of Shock-Proofness: Class A.
(5) Control functions: Motor Starting.
(6) Type of Construction: Magnetic Controller.
(7) Operation of Control Circuit: Semi-automatic.
(8) Type of Master Switch: Push Button.
(9) Proximity of Master Switch: Distant Master Control.
(10) Duty Period: Heavy Starting.
(11) Kinds of Protection: Overload protection of thermal type and low voltage release. Low voltage release becomes effective when line voltage drops to 20% of normal; however, 60% normal voltage is required to make contactor seat properly.
(12) Size: As shown in Table No. 4.

(b) The starter is equipped with a three pole disconnect switch designed to isolate the starter circuits from the supply line but is not intended to break the circuit under load. The handle of this switch is located on the right hand side of the enclosing cover and is interlocked with the door so that the door cannot be opened while the switch is closed. The construction is such, however, that the switch may be closed while the door is open. This type of switch was tested at the New York Navy Yard as per their Report No. 3431 of March 26, 1936, and received approval per BuEng letter S62-2(S)/L5(6-5-Ds).

(c) On the wiring diagram inside the door is the warning "Do not open this switch while the motor is running". This warning should be placed on the outside of the door in order to make it effective. This warning should be of such a nature that is readily visible and of permanent characteristics. In addition, it is recommended that a warning plate indicating the presence of 440 volts be attached to the outside of the door.

(d) The door of the starter is provided with one stiffening member. This single member leaves the door quite flexible and it is recommended that two stiffening members be provided. The original starter door was provided with two such members and the assembly was much more rigid.

(e) The door is equipped with a hasp and staple to secure the door against accidental opening. The arrangement is such that the staple is secured to the door and the hasp to the side of the enclosing box. It is recommended that this arrangement be reversed so that the hasp appears on the door where it may be used as a handle for opening the door.

(f) A check of the thermal overload characteristics was made to determine the time required to open the circuit with various values of current flowing. With the overload adjusted to the 8 ampere setting, the following results were obtained:

Current	Time required to open
7.5 amps.	1 hour, 6 minutes, 20 sec.
8.0 amps.	39 minutes, 15 sec.
9.0 amps.	8 minutes, 25 sec.
10.0 amps.	5 minutes, 45 sec.

The above data were taken at an ambient temperature of 24 degrees C.

(g) As originally submitted on August 3rd, the replacement starter was equipped with a relay coil designed for operation at either 220 or 440 volts A.C. Since all controls in the equipment operate at 110 volts, it was necessary to provide a step-up transformer to operate the starter. On October 2nd, the contractor provided a replacement coil which is designed for 110 volt operation. This was installed in the starter and functioned in a satisfactory manner. All starters should be equipped with relay coils designed to operate at 110 volts A.C.

(h) The starter is equipped with a door of the non-removable type. Paragraph 6-36 of the governing specifications requires that the doors of the starter shall be mounted on hinges with removable pins to facilitate installation and maintenance. The pins shall be secured to the cabinet by short chains to protect against accidental loss. It is recommended that the starters supplied on this contract be modified to agree with this requirement.

193. Paragraph 6-35. The high voltage filter capacitors for the motor generators are located within the transmitter proper. Capacitors C-152, C-154 and C-155 are used as filters, while C-153 is placed across the generator field discharge resistor R-152.

C-154 is rated at 1500 volts and is used across the generator mid-tap. C-155 is rated at 3000 volts and is placed across the entire output of the main plate generator. C-152 is rated at 1500 volts and is connected across the auxiliary plate generator terminals. It is possible to raise the output voltage of the main plate generator to 3500 volts. Thus it appears that capacitors C-154 and C-155 may be subjected to overloads. While no apparent difficulty was experienced from this source during the course of the tests, assurances should be obtained that the capacitors provided will function satisfactorily if subjected to overloads of this nature. The cases of the capacitors appear to have swelled somewhat. However, it is not known whether this is normal or not. It may be the result of the manufacturing process employed.

194. Paragraph 6-36. As pointed out in paragraph 192(h) above, the hinges of the starter cabinet are not in conformity with this requirement of the specifications. Hinges with removable pins should be provided.

195. General Comments on Generator Equipment. The general assembly appears rugged and substantial and presents a neat appearance. The motor generator and starter are finished in black enamel. It is understood that the Bureau of Engineering is standardizing on a blue gray finish for power equipment and accessories. It is recommended, therefore, that the power equipment of the Model XTBK-8 equipment be finished in accordance with this standard.

(a) No difficulties were encountered in connection with the power equipment during the course of the tests. At the conclusion of the tests, inspection revealed that the commutators were in excellent condition.

(b) The main plate generator is equipped with ceramic brush gear mountings. The commutators are not undercut and it is understood that the manufacturer considers this type of construction preferable to undercutting, particularly in machines of high voltage characteristics. The commutators are 1-1/8" wide and each commutator is fitted with two 1/4" x 3/4" brushes. The generator is equipped with salient pole field windings.

(c) The bias generator is equipped with an undercut commutator 1-3/16" wide and is fitted with canvas-bakelite brush gear mountings. Two brushes 5/16" x 3/4" are employed. The generator is equipped with salient pole field windings.

(d) The auxiliary plate generator is fitted with ceramic brush gear mountings and the commutator is not undercut. The commutator is 1-1/8" wide and equipped with two brushes 1/4" x 3/4". Salient pole field windings are employed.

(e) From the foregoing it will be noted that none of the generators are equipped with the distributed type of field windings. It is understood that the salient pole fields are desirable from the standpoint of Navy servicing operations.

SECTION IX (DRAWINGS AND INSTRUCTION BOOKS)

196. The changing requirements of the specifications under which transmitting equipments are constructed and the new forms of construction which are employed necessitate, it is believed, that certain concise and definite statements appear in the instruction books. With constantly shifting personnel of varying degrees of experience and ability, situations may arise in the Service where full advantage of improvements incorporated in the equipment may not be realized. Explanations and instructions covering items of the following nature should be included in the instructions to insure proper servicing, efficient handling, and maximum utilization of all special features contained in the equipment.

(a) Instructions for the removal of the Master Oscillator compartment, leads to be disconnected, precautions to be observed; which items should be examined at frequent intervals to insure successful and continuous operation.

(b) Attention to be directed to and instruction given in detail regarding the use and operation of the calibration facilities supplied.

(c) Attention directed to the fact that meters can be removed from the equipment through the front panel.

(d) Attention directed to the fact that switches are so mounted that they can be removed from the front panel.

(e) Attention directed to the fact that the interlock mechanisms of the "Adjust-Tune-Operate" switch and the "Antenna Feed" switch may be serviced from the front of the panel by the removal of three securing screws.

(f) Call attention to the fact that the locking devices supplied should be used regularly after each change in transmitter settings to prevent accidental movement of controls.

(g) Describe the purpose and use of the Master Oscillator Filament Standby switch and the reasons why it is incorporated in the equipment.

197. Since the Model TBK-8 equipment is one of the first to utilize the 4-wire and 6-wire control circuits, a complete and comprehensive explanation covering the working of these circuits should be presented. In this connection attention is invited to paragraph

166 above which contains recommendations relative to the marking and drawings covering the control circuits.

198. The section devoted to adjustment and calibration should be as complete as possible with respect to the best procedure to be followed in obtaining optimum antenna adjustments. It is realized that definite data cannot be presented due to the large variety of antenna constants that the equipment must operate into, but every detail of adjustment which may prove helpful to an operator should be listed.

199. During the course of the tests, the following items in connection with the instruction book and diagrams which were submitted in preliminary form were noted.

(a) Schematic Diagram T-611536. Heater Circuit. Connection missing between top of R-141 and top of F-103.

(b) Instruction Book, page 12, line 4. The statement "Toggle switch S-120 serves to disconnect the heater and heat control system without stopping the blower" is incorrect. S-120 is 6-wire start switch.

(c) Instruction Book, page 12, paragraph 7.2, line 5. The text indicates that capacitor C-106 forms a part of the M.O. circuit. There is no capacitor C-106 in the equipment.

(d) Instruction Book, page 14, line 8 from bottom of page. Capacitor C-174 is not shown on Schematic Diagram.

200. The explanation and understanding of the operation of multi-contact relays or contactors would be simplified if each contact were given a designating letter. For example, relay K-101 is equipped with four contacts. These should be indicated as contacts K-101-A, K-101-B, K-101-C and K-101-D. This would eliminate confusion between the various contacts.

201. At the conclusion of the tests of the original Model XTBK-8, certain recommendations were submitted with a view of correcting defects and improving the operation of the equipment. These recommendations were listed on pages 2b, 2c, 2d, 2e and 2f of NRL Report No. R-1507. In the following pages of this report comment is made, item by item, indicating the action which has been taken to overcome the defects in the re-submitted Model XTBK-8 equipment.

(a) The resistors supplied in the re-submitted model are in accordance with specification requirements.

(b) The heater control relay gave uninterrupted satisfactory service during the course of the tests.

(c) The "Push" type switches have been eliminated and an improved and satisfactory substitute has been provided.

(d) All of the items of faulty workmanship referred to have been eliminated in a satisfactory manner.

(e) The re-submitted model showed no signs of corrosion during the course of the tests.

(f) The use of steel has been held to a practical minimum and corrosion-resisting measures have been provided.

(g) Satisfactory tube mountings have been provided for the Power Amplifier tube.

(h) A condition still exists in the re-submitted Model XTBK-8 which is detrimental to the antenna ammeter. Tests failed to reveal the exact causes which contribute to the failure of this meter.

(i) The plate overloads functioned satisfactorily in the re-submitted model.

(j) The defects in the protective system have been eliminated.

(k) In general, all items referred to in Report R-1507 have been corrected in a satisfactory manner. As reported elsewhere in this report, certain additional items require further consideration to provide improved conditions of operation.

(l) The foundation pedestal of the re-submitted model is substantial and satisfactory.

(m) The re-submitted model performed very satisfactorily in the presence of severe vibration.

(n) An improved power amplifier tube mounting has been provided which is proof against vibration.

(o) The nameplates designating control functions have been positioned for good visibility and the tuning controls have been modified to provide ease and accuracy of operation.

(p) All meters in the equipment have been provided with anti-glare glass.

(q) Voltmeter multipliers have been provided with adequate by-pass units; the method of securing and wiring meters has been modified to permit replacement with a minimum of trouble.

(r) All parts have been assembled in a manner compatible with good engineering practice; excessive play does not exist in controls and satisfactory "stops" have been provided.

(s) The so-called "sub-chassis" form of construction has been eliminated and the re-submitted model is well constructed with a view of providing greater accessibility. The type of removable construction used in connection with the master oscillator compartment is particularly desirable.

(t) Toggle switch mountings have been modified to provide maximum ease in servicing and replacement.

(u) Complete symbol markings have been provided but the method of securing the markings is unsatisfactory and requires improvement.

(v) Resistor mountings have been marked to indicate the type number and rating of the resistor and tube sockets have been marked to indicate the type of tube to be used.

(w) An improved method of securing the lifting eyes has been provided.

(x) The conditions which interfered with proper output at the high frequency range of the transmitter have been eliminated. Slight modifications to further improve operation in this region have been indicated. (See paragraph 150(b).)

(y) The antenna control switch has been labelled in accordance with previous recommendations.

(z) Satisfactory operation was obtained with the re-submitted model when changing tubes at 2000 kilocycles.

(aa) Erratic frequency variations have been eliminated and improved frequency stability has been provided when the equipment is operating under conditions of varying ambient temperature.

(bb) Some improvement in the frequency stability of the equipment under high humidity conditions has been obtained, but the specification requirements are not complied with at 4500 kilocycles.

(cc) The compensating circuits in the transmitter have been modified and produce satisfactory results.

(dd) The equipment functions satisfactorily when inclined to 45 degrees from the vertical in any direction.

(ee) Vibration has negligible effect upon the emitted frequency of the equipment.

(ff) The heater indicator is so connected that it is extinguished when the heaters are de-energized.

(gg) Overlap and end point tolerances in excess of 3% have been provided.

(hh) The calibration correction capacitor has been fitted with a stop to prevent short circuiting.

(ii) Fabric couplings have been provided in the blower ducts.

(jj) Satisfactory measures have been incorporated to prevent overloading of indicator lamps due to inductive discharges.

(kk) The dimensions of the equipment are in accordance with Bureau requirements and the hand rails have been secured in a satisfactory manner.

(ll) The wiring of the re-submitted model has been improved to the point where it presents an excellent appearance and provides safe and satisfactory operation.

(mm) The primaries of the filament transformers have been marked to provide self-explanatory connection means; the distribution transformer has not been marked in this manner.

(nn) The workmanship of the filament transformer has been improved.

(oo) Satisfactory means have been provided for cable ingress and for the connection of external leads.

(pp) A completely re-designed key relay of rugged construction and satisfactory operating characteristics has been provided.

(qq) The rear shield of the re-submitted model is of perforated construction and may be removed in two sections.

(rr) The finish of the antenna coupling condenser has been improved and the condenser is so mounted as to prohibit the lodging of foreign material between the plates.

(ss) The monitoring leads and connections have been plainly marked and a shielded output jack has been provided.

(tt) 4-wire and 6-wire control circuits have been substituted for the original control circuits. The "Remote-Local" switch has been provided with only two positions.

(uu) Substantial toggle switches with adequate handles have been provided.

(vv) Rigid and substantial guards have been provided over the flexible couplings on the motor generator.

(ww) The necessary modifications have been made to insure satisfactory mounting of the individual units on the motor generator bed plate; spacers have been secured to the units where necessary; adequate square headed dowels have been provided and the dowels have been located at diagonal corners where they do not interfere with the removal of the units.

(xx) Suitable warning plates have been affixed adjacent to the individual eye bolts intended for lifting one unit only.

(yy) The ripple voltage of the various generators is still in excess of the 0.25% called for by the governing specifications.

(zz) A new type of starter, equipped with disconnect switch, has been furnished. This results in increased size which has been approved by the Bureau of Engineering.

(aaa) The starter is now equipped with a disconnect switch.

(bbb) The present starter is not equipped with removable hinge pins; this should be corrected.

(ccc) The brushes on the bias generator have been staggered 1/8".

(ddd) All field windings of the various generators are of the salient pole type.

202. A summary of the defects noted in the re-submitted Model XTBK-8 equipment and such items as do not comply with the requirements of the governing specifications are listed below. The numerals enclosed in parentheses refer to the paragraph of this report under which these items are discussed in detail.

(a) (31) Switch detents on "Tune-Operate" and "Antenna Feed" switches are too broad.

(b) (33) Seven items classed as "poor workmanship" require remedial measures.

(c) (40 & 187) Fuse mountings are not marked to indicate characteristics of replacements.

(d) (42) Overload relay resets should be marked to indicate the circuits affected.

(e) (53) Flexible mountings for 1st and 2nd IPA tubes require modification in interests of safety under conditions of gun fire.

(f) (56 & 119) Letters designating tuning controls should be in continuous series; calibration charts should be corrected to agree with tuning control designations.

(g) (58) Indicating pointers of meters stick; antenna ammeter failed during tests; six meters not secured by means of tapped holes in front panel.

(h) (65) Set screws missing from several controls.

(i) (67(a) & 135) Knurled head securing screws in M.O. unit and in removable shielding should be changed to conform with subsequently submitted sample.

(j) (72 & 73) Symbol tags do not adhere properly.

(k) (75) Normal filament potential cannot be maintained at minus 10% line potential.

(l) (83 & 129) Blue indicator light should be red to comply with specifications.

(m) (95) The master oscillator tuning control is too tight and stiff for satisfactory manipulation.

(n) (96) Excessive backlash existed when equipment was originally received.

(o) (102 & 111) Equipment did not function satisfactorily as originally received when subjected to variations in ambient temperature.

(p) (103) Equipment fails to comply with specification humidity requirements at 4500 kilocycles.

(q) (113) Suggest changes in location of M.O. filament rheostat and filament voltmeter connections; M.O. tube failed to seat properly in socket.

(r) (116(a) Suggest transfer of switch interlocks to keying circuit.

(s) (127) Clamps for fabric blower couplings require further consideration to insure successful operation.

(t) (138 & 155) Design of distribution transformer should be modified and nameplate should be provided to indicate methods of connection.

[redacted]

(u) (150(b) The elimination of capacitor C-172 should be considered.

(v) (151(b)(c) Recommend that monitor coupling be provided at double frequency of M.O. and that high level output be retained.

(w) (157 to 166) Cover comments for consideration in connection with 4-wire and 6-wire control circuits.

(x) (185) Consideration should be given to insure that motor generator bearings are provided with proper grade of lubricant.

(y) (190) Generator ripple exceeds 0.25%.

(z) (192) Construction of motor starter requires certain improvements.

(aa) (193) Filter capacitor likely to operate somewhat in excess of rated voltage.

(bb) (195) Suggest motor generator and accessories be finished in standard blue-gray finish.

(cc) (196 to 200) Contain suggestions relative to instruction book material.

CONCLUSIONS

203. Detailed tests and examination of the re-submitted Model XTBK-8 equipment reveal that all former objectionable characteristics have been remedied or eliminated and that the present equipment is far superior in design, construction, appearance and operating characteristics.

204. Power output and frequency stability characteristics comply with the terms of the governing specifications with the single exception of operation under conditions of high humidity. The departure from specification requirements in this instance is not of serious magnitude.

205. The general appearance of the equipment, external and internal, is good and the treatment of wires and cables is excellent. Good accessibility to all parts has been provided and the removable unit construction of the master oscillator compartment reflects excellent design and workmanship.

206. In general, the equipment operated in a safe and satisfactory manner after certain adjustments had been made during the course of the tests to which it was subjected. These tests demonstrated, however, that certain specific items require some further consideration in order to attain maximum reliability and improved operation.

207. With proper corrective action applied to the deficiencies listed, the re-submitted Model XTBK-8 equipment should be capable of meeting the rigorous requirements of the Naval Service.

Table 1

Model XTBK-8 Radio Transmitting Equipment
CHECK OF RESISTORS USED IN EQUIPMENT
Test as per paragraph 2-2 of Specifications RE 13A 442G

Res. No.	Rated Ohms	Style	Type No.	Permitted by Specs. Watts	Volts	Max. R	Measured Watts	Volts	Res.
R103	20000	C	63095E	28	1650	75000	Neg.	0.22	19890
R104	35000	A	63221E	80	1650	75000	6.2	463	34740
R105	20000	B	63159E	60	1200	50000	32	795	19870 110°
R106	6000	C	63086E	28	1650	75000	0.1	24	5899
R107	7000	C	63087E	28	1650	75000	1.9	115	6942
R108	16000	C	63093E	28	1650	75000	3.8	238	15490
R109	1000	C	63076E	28	1650	75000	Neg.	7.5	993
R112	2000	C	63079E	28	775	25000	6.1	112	2042
R113	60	F	63309E	15	225	4000	key contacts		58
R115	2000	A	63205E	80	1650	75000	53	325	1994 155°
R116	1500	A	63204E	80	1650	75000	27.3	200	1461
R120	5000	C	63085E	28	1650	75000	3.5	132	4965
R121	20000	C	63095E	28	1650	75000	Neg.	0.22	19750
R123	1500	C	63078E	28	1650	75000	13.6	188	1494 150°
R125	15000	A	63218E	80	1650	75000	30.8	680	15000
R126	8000	C	63088E	28	1650	75000	11	298	8043
R127	2000	B	63143E	60	1200	50000	7.5	124	2035
R128	2000	A	63205E	80	1650	75000	38.8	280	2023 100°
R130	4000	C	63083E	28	1650	75000	3.1	109	3865
R132	8000	B	63152E	60	1200	50000	10.8	294	7977
R133	35000	A	63221E	80	1650	75000	5.7	448	34940
R134	2000	A	63205E	80	1650	75000	51.4	320	1992 152°
R135	2000	A	63205E	80	1650	75000	48.9	312	1990 153°
R136	15000	A	63218E	80	1650	75000	30.6	678	14980
R138	15000	A	63218E	80	1650	75000	36.6	734	14720
R139	15000	A	63218E	80	1650	75000	38.5	758	14940 130°
R141	800	C	63074E	28	1650	75000	3.8	55	806
R142	800	C	63074E	28	1650	75000	3.8	55	808
R146*	100	C	63058D	70	775	700	120*	110	101
R151	1500	A	63204E	80	1650	75000	29.1	209	1502
R153	200	B	63128E	60	1200	50000	11.3	48	203
R154	1500	C	63078E	28	1650	75000	9.2	118	1507

* Note: R-146 dissipates 120 watts only momentarily while set is being shut down by means of 6-wire control circuits.

Table 1 Continued

Res. No.	Function	Mfgr.	Type	Mfgr's Rating	Measured Res.	Measured Curr.	See Note
R101	Heater, aux.,	Ohmspun	Fixed	130 ohms, 1 A.	130	0.85	
R102	Heater, main	Ohmspun	Fixed	130 ohms, 1 A.	130	0.85	
R114	Heater, main	Ohmspun	Fixed	130 ohms, 1 A.	130	0.85	
R117	Main Fil Rheo	Ohmite	Var.	10 ohms, 3.88A.	10.1	2.67	(1)
R118	Bias Fld Rheo	Ohmite	Var.	750 ohm, 0.44A.	755	0.2	(2)
R119	Ep fld Rheo	Ward-L'd.	Var.	- -	2530	0.42	(3)
R129	Ep multiplier	Westghse.	Fixed	3.5 meg. 1 MA	3.5M	0.86 MA	(3)
R137	Osc.Fil.Rheo	Ohmite	Var.	50 ohm, 1 Amp.	50.3	0.47	(4)
R140	Heater, aux.	Ohmspun	Fixed	130 ohm, 1 A	130	0.85	
R143	Aux multiplier	Westghse.	Fixed	3.5 Meg. 1 MA	3.5M	0.39 MA	(5)
R145	Key Compensator		Fixed		18.2	0.64	(6)
I101	Bias Ind Lamp Res.		Fixed		2650	87 MA	(7)
I102	Plate Ind Lamp Res.		Fixed		2650	87 MA	(7)
I103	Start Ind Lamp Res.		Fixed		1240	89 MA	(7)
I104	MO Heater Lamp Res.		Fixed		1210	91 MA	(7)

Note: (1): Measured with filaments at normal potential.
(2): Measured with bias voltage at 230 volts.
(3): Measured with plate potential at 3000 volts.
(4): Measured with MO filament potential at normal.
(5): Measured with Aux Plate potential at 1350 volts.
(6): Special make for this purpose.
(7): A part of indicator lamp assembly.

Resistors R-117, R-118 and R-137 are of the open type construction.

Resistor R-119 is an enclosed type approximately 6-1/2" outside diameter and 1-3/4" deep.

[redacted]

Table 2

Model XTBK-8 Radio Transmitting Equipment
ANTENNA SHORT CIRCUITED AND OPEN CIRCUITED
Test as per paragraph 2-16 of Specifications RE 13A 442C

Frequency kc	Antenna Condition	Antenna Current	Plate Current	Plate Voltage	Output Watts
2000	Normal	4.55	300	3000	590
2000	Open	-	150	3000	-
2000	Shorted	off scale	280	3020	-
3000	Normal	4.5	300	3000	590
3000	Open	-	130	3000	-
3000	Shorted	5.9	220	3020	-
4500	Normal	4.35	300	3000	570
4500	Open	-	440	3025	-
4500	Shorted	3.8	480	2950	-
18100	Normal	1.7	300	3000	280
18100	Open	-	370	3000	-
18100	Shorted	1.0	380	2980	-

For comparison see Table No. 3 of NRL Report No. R-1507.

[redacted]

Table 3

Model XTBK-8 Radio Transmitting Equipment
LIST OF CONTROLS AND METERS
Data as per paragraph 2-23 of Specifications RE 13A 442G

Control Designation	Purpose
A	Oscillator Range switch, 6 point (knob control).
B	Oscillator Tuning (knob with crank)
C	Oscillator plate tuning (knob)
D	1st Amplifier plate tuning (knob with crank)
E	2nd Amplifier plate tuning (knob with crank)
	(No "F" designation used)
G	Power amplifier tuning (knob with crank)
H	Antenna coupling (knob)
I	Antenna Feed switch, interlocked, 2 position, (T-handle)
J	Antenna capacitor (knob)
K	Antenna inductor (knob with crank)

Meters

Bias voltage, 0-350 V, Westinghouse Mfgr.
Aux. plate voltage, 0-3500 V " "
Tube hour meter " "
PA Plate voltage, 0-3500 V " "
Antenna current, 0-8 Amps RF " "
Filament voltage, 0-15 AC " "
PA Plate current, 0-500 MA " "
PA Grid current, 0-150 MA " "
1st Amp. Plate current, 0-150 MA " "
2nd Amp. Plate current, 0-150 MA " "
Osc. Plate current, 0-150 MA " "
Osc. Screen current, 0-50 MA " "

Thermometer, 58-62 Deg. C.
Adjust-Tune-Operate Switch, interlocked, 3-pos. (T-handle)
Emergency Switch, "Stop-On"
Start Switch, "Off-On"
Test Key, "Key locked, off, momentary"
Control Switch, "Remote-local"
Oscillator fil stand-by switch, "Off-on"

Rheostats

Bias voltage
Plate voltage
Oscillator filament
Filament (main)

Indicator Lights
Start - Blue
Bias - Green
MO Heater - Amber
MO Filament - Clear
Plate Voltage - Red

Doors
MO Compartment, interlocked
Relay Compartment, interlocked
1st and 2nd Amplifier compartment, interlocked
P.A. Tube compartment, interlocked

Main plate overload reset
Aux. plate overload reset
Calibration chart
Frequency meter audio output jack
MO Calibration corrector

Nameplates
Equipment nameplate
Transmitter unit nameplate
Date of acceptance nameplate

[redacted]

Table 4

Model XTBK-8 Radio Transmitting Equipment
DIMENSIONS AND WEIGHTS
Test as per par. 2-32, 3-29, 6-19 and 6-34 of Specs. RE 13A 442G.

	Overall Dimensions	Specification Requirements
Transmitter:		
Height:	72"	72"
Width:	31-11/16"	32"
Depth:	24-9/16"	24"
Weight: 682 pounds.		
Motor Generator:		
Length:	70-1/8"	75"
Height:	22-9/16"	23"
Width:	18-7/8"	19"
Weight: 1115 pounds		
Automatic Starter:		
Height:	20"	20"
Width:	16"	11"
Depth:	9-1/8"	12"
Weight: 46 pounds.		

Total weight of combined equipment: 1843 pounds.
Permitted by Specifications: 2100 pounds.

Additional starter dimensions
(Box only)

Height: 19-1/4" Top cover plate projects 1/2".
Bottom cover plate screws project 1/4".

Width: 13-1/4" Mounting straps project 1-3/8".
Switch handle projects 1-3/16".
Hinges project 1/4".

Depth: 8-5/16" Front top edge projects 3/8".
Staple projects 1/2".
Hinges project 1/4".
Mounting straps project 5/16".

Table 5

Model XTBK-8 Radio Transmitting Equipment
DETERMINATION OF POWER OUTPUT
Antenna Load: 115 Volt, 500 Watt Lamp
Test as per paragraph 3-3-2 of Specifications RE 13A 442G

Control or Meter	2000 kc	3000 kc	4000 kc	5000 kc
A	1	4	6	2
B	1600	1200	2250	3500
C	13	59.5	12	44
D	416.5	1275	1693	1938
E	383.5	1314	1720	1957
G	279	1188	1590	1893
H	51.5	60	66	67
I	Curr.	Curr.	Curr.	Curr.
J	58	51.5	70	63
K	188	1733	2084	2568
MO Isg	13	15	13	12
MO Ip	33	37	34	40
1st IA Ip	44	30	50	38
2nd IA Ip	90	59	50	49
PA Ig	54	45	37	33
PA Ip	300	300	300	300
Ant I	4.6	4.55	4.4	4.38
Aux. Ep	1350	1350	1300	1340
PA Ep	3000	3000	3000	3000
Fil. E	11.7	11.7	11.7	11.7
Bias E	230	230	230	230
Line E	437	432	433	434
Watts Out.	606	600	560	558
Spec. Require.	500	500	475	450
RCA Test Data	575	573	545	548

For comparison see Table No. 9 of NRL Report No. R-1507.

[redacted]

Table 6

Model XTBK-8 Radio Transmitting Equipment
DETERMINATION OF POWER OUTPUT
Antenna Load: 115 Volt, 500 Watt Lamp
Test as per paragraph 3-3-2 of Specifications RE 13A 442G

Control or Meter	6000 kc	7000 kc	8000 kc	9000 kc
A	4	5	6	6
B	1200	1500	2250	4310
C	60	70	76	81
D	2105	2238	2330	2409
E	2119	2244	2332	2402
G	2057	2183	2273	2348
H	43	66	46	46
I	Curr.	Volt	Volt	Volt
J	88	56	41	43
K	2484	400	2343	2590
MO Isg	12	13	12	12
MO Ip	38	38	38	39
1st IA Ip	54	60	57	47
2nd IA Ip	49	51	52	50
PA Ig	34	32	31	28
PA Ip	300	300	300	300
Ant I	4.25	4.2	4.1	4.0
Aux Ep	1350	1350	1350	1350
PA Ep	3000	3000	3000	3000
Fil E	11.7	11.7	11.7	11.7
Bias E	230	230	230	230
Line E	437	435	435	437
Watts Out	540	516	500	480
Spec. Require.	450	400	375	375
RCA Test Data	537	530	513	490

For comparison see Table No. 10 of NRL Report R-1507.

[redacted]

Table 7

Model XTBK-8 Radio Transmitting Equipment
DETERMINATION OF POWER OUTPUT
Antenna Load: 115 Volt, 500 Watt Lamp
Test as per paragraph 3-3-2 of Specifications RE 13A 442G

Control or Meter	10,000 kc	12,000 kc	14,000 kc	16,000 kc
A	2	4	5	6
B	3500	1200	1500	2250
C	44	60	70	76
D	1936	2102	2238	2329
E	2462	2556	2633	2686
G	2408	2502	2585	2641
H	33	27	14	12
I	Volt	Volt	Volt	Volt
J	44	90	84	85
K	2610	2321	2616	2718
MO Isg	11	12	12	12
MO Ip	40	37	38	38
1st IA Ip	40	58	63	58
2nd IA Ip	72	78	84	83
PA Ig	24	27	24	22
PA Ip	300	300	300	300
Ant I	3.82	3.75	3.6	3.39
Aux Ep	1350	1350	1350	1350
PA Ep	3000	3000	3000	3000
Fil E	11.7	11.7	11.7	11.7
Bias E	230	230	230	230
Line E	439	432	435	440
Watts Out	450	446	400	350
Spec. Require.	360	360	325	325
RCA Test Data	475	474	420	387

For comparison see Table No. 11 of NRL Report R-1507.

Table 8

Model XTBK-8 Radio Transmitting Equipment
DETERMINATION OF POWER OUTPUT
Test as per paragraph 3-3-2 of Specifications RE 13A 442G

Control or Meter	18100 kc	18100 kc
A	6	6
B	4600	4600
C	82	82
D	2417	2417
E	2743	2739
G	2689	2693
H	4	23
I	Volt	Volt
J	88	82
K	2722	2841
MO Isg	14	14
MO Ip	40	38
1st IA Ip	52	54
2nd IA Ip	78	83
PA Ig	18	18
PA Ip	292	300
Ant I	3.15	1.2
Aux Ep	1350	1350
PA Ep	3000	3000
Fil E	11.7	11.7
Bias E	230	230
Line E	430	431
Watts Out	300	320
Spec. Require.	300	300
RCA Test Data	324	-

Note: Column 1 data obtained with 115 volt, 500 watt lamp load.
Column 2 data obtained with 230 volt, 500 watt lamp load.

For comparison see Table No. 12 of NRL Report No. R-1507

Table 9

Model XTBK-8 Radio Transmitting Equipment
MEASUREMENT OF CARRIER RIPPLE
Test as per paragraph 3-5-2 of Specifications RE 13A 442G

Output Frequency	Carrier Voltage	Ripple Voltage	Per Cent Ripple
2000 kc	125	0.25	0.2
4500 kc	110	0.6	0.54
18100 kc	95	0.85	0.9

Specification Requirements: 2% or less

Table 10

Model XTBK-8 Radio Transmitting Equipment
ACCURACY OF RESET TO PREVIOUSLY CALIBRATED FREQUENCIES
Test as per paragraph 3-7-1 of Specifications RE 13A 442G

Trial No.	Frequency kc	Time Seconds	Deviation in Frequency Cycles	Per Cent
Original	2000.189			
1	187	62	2	0.0001
2	187	45	2	0.0001
3	200	57	11	0.00055
4	197	58	8	0.0004
5	185	54	4	0.0002
			Average:	0.00027
Original	4500.324			
1	316	56	8	0.0002
2	338	62	14	0.0003
3	305	55	19	0.0004
4	333	58	9	0.0002
5	344	65	20	0.0004
			Average:	0.0003

Specification Requirements:

Average of five trials: 0.003%
No one trial to exceed: 0.005%

For comparison see Table No. 14 of NRL Report No. R-1507.

[redacted]

Table 11

Model XTBK-8 Radio Transmitting Equipment
TEST FOR LOST MOTION, BACK LASH AND TORQUE LASH
Test as per paragraph 3-7-2 of Specifications RE 13A 442G

Trial No.	Frequency when approached from Clockwise Direction	Counter Clockwise Direction	Backlash Cycles	Per Cent
1	2000.258	2000.608	350	0.0175
2	253	610	357	0.0178
3	251	608	357	0.0178
4	254	604	350	0.0175
5	252	616	364	0.0182
		Average:		0.0177

Initial Frequency: 2000.258
Frequency of maximum departure: 2000.616
Difference: 358 cycles 0.0178%
Permitted by specifications: 0.008%
Average permitted by specifications: 0.005%

In retuning counter-clockwise to same frequency obtained by clockwise rotation, M.O. dial shows 5.7 divisions difference in setting.

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1	4502.580	4504.150	1570	0.0349
2	605	155	1555	0.0346
3	590	150	1560	0.0347
4	590	150	1560	0.0347
5	605	150	1545	0.0343
		Average:		0.0346

Initial Frequency: 4502.580
Frequency of maximum departure: 4504.155
Difference: 1575 cycles; 0.035%
Permitted by specifications: 0.008%
Average permitted by specifications: 0.005%

In retuning counter-clockwise to same frequency obtained by clockwise rotation, M.O. dial shows 6 divisions difference in setting.

For comparison see Table No. 15 of NRL Report No. R-1507.

[redacted]

Table 12

Model XTBK-8 Radio Transmitting Equipment

TEST FOR LOST MOTION, BACK LASH AND TORQUE LASH

Test as per paragraph 3-7-2 of Specifications RE 13A 442G.

NOTE: Prior to this test the M.O. compartment had been returned to the factory for re-adjustment of tuning mechanism. For backlash data as originally obtained see Table No. 11.

Trial No.	Frequency when approached from Clockwise Direction	Counter Clockwise Direction	Backlash Cycles	Backlash Per cent
1	2000.295	2000.308	13	0.00065
2	294	305	11	0.00055
3	297	304	7	0.00035
4	296	306	10	0.0005
5	297	307	10	0.0005
			Average:	0.00049

Initial Frequency: 2000.295
Frequency of maximum departure: 2000.308
Difference: 13 cycles: 0.00065%
Permitted by specifications: 0.008%
Average permitted by specifications: 0.005%

1	4500.464	4500.561	97	0.00216
2	457	531	74	0.00164
3	454	541	87	0.00193
4	471	539	68	0.00151
5	458	547	89	0.00198
			Average:	0.00184

Initial Frequency: 4500.464
Frequency of maximum departure: 4500.561
Difference: 97 cycles: 0.00215%
Permitted by specifications: 0.008%
Average permitted by specifications: 0.005%

Table 13

Model XTBK-8 Radio Transmitting Equipment
OPERATION OF ADJUST-TUNE-OPERATE CONTROL
Test as per paragraph 3-7-3 of Specifications RE 13A 442G

Step 1 "Adjust"	Step 2 "Tune"	Step 3 "Operate"	Maximum Frequency Change Cycles	Per Cent
4500.305	4500.300	4500.290	15	0.00033
4000.275	4000.265	4000.264	11	0.00027
3500.382	3500.380	3500.377	5	0.00014
3000.821	3000.816	3000.805	16	0.00053
2500.270	2500.260	2500.259	11	0.00044
2000.490	2000.480	2000.480	10	0.0005

Specification Requirements: 0.001%

For comparison see Table No. 16 of NRL Report No. R-1507.

Table 14

Model XTBK-8 Radio Transmitting Equipment
DETUNING OF CIRCUITS
Test as per paragraph 3-7-4 of Specifications RE 13A 442G

Circuit Detuned	Frequency kc	Change in Frequency Cycles	Per Cent
Normal	2000.326		
C cc	349	23	0.00115
C c	345	19	0.00095
D cc	331	5	0.00025
D c	328	2	
E cc	325	1	
E c	326	0	
G cc	326	0	
G c	326	0	
H cc	327	1	
H c	326	0	
J cc	326	0	
J c	326	0	
K cc	327	1	
K c	326	0	
Normal	4500.265		
C cc	295	30	0.00067
C c	286	21	0.00046
D cc	261	4	0.00009
D c	268	3	
E cc	268	3	
E c	264	1	
G cc	265	0	
G c	265	0	
H cc	266	1	
H c	265	0	
J cc	266	1	
J c	266	1	
K cc	265	0	
K c	265	0	

Specification Requirements: 0.003%

For comparison see Table No. 17 of NRL Report R-1507.

[redacted]

Table 15

Model XTBK-8 Radio Transmitting Equipment
OPERATION OF POWER OUTPUT CONTROL
Test as per paragraphs 3-7-5 and 3-25 of Specifications
RE 13A 442G

Frequency kc	Frequency Change Cycles	Frequency Change Per Cent	Plate Volts	Power Output	Per Cent Power	Per Cent Voltage
2000.255			3000	550	100	100
260	5	0.0002	2700	432	78.6	90
263	8	0.0004	2390	324	58.8	79.7
264	9	0.0004	1920	176	32	64
265	10	0.0005	1700	116	21.1	57.6
4500.362			3000	540	100	100
359	3	0.000066	2700	394	73	90
358	4	0.000089	2400	272	50.4	80
357	5	0.00011	2190	200	37	73
357	5	0.00011	1960	124	24.8	65
355	7	0.00015	1780	80	14.8	59.6
353	9	0.0002	1500	34	6.3	50

Specification Requirements: 0.001%

For comparison see Table No. 18 of NRL Report No. R-1507.

Table 16

Model XTBK-8 Radio Transmitting Equipment
CHANGE OF TUBES
Test as per paragraph 3-7-6 of Specifications RE 13A 442G

Manufacturer and serial No. of Tube	Frequency	Deviation from Mean Frequency Cycles	Per Cent
RCA 11219	2001.160	186	0.0093
RCA 58158	2001.305	41	0.002
GE.1313	2001.175	171	0.0085
GE 1314	2001.190	156	0.0078
GE 1319	2001.205	141	0.007
WL 27849	2001.590	254	0.0127
WL 42786	2001.710	364	0.0182
WL 30116	2001.400	54	0.0027
WL 40921	2001.475	129	0.0064
RCA 20017	2001.255	91	0.0045
Mean:	2001.346	158.7	0.0079

Specification Requirements: 0.01%

Change of tubes in 1st Intermediate Amplifier caused an average variation from mean frequency of 0.0002%

Change of tubes in 2nd Intermediate Amplifier caused an average variation from mean frequency of 0.00015%

Change of tubes in Power Amplifier caused an average variation from mean frequency of 0.00005%

For comparison see Table No. 19 of NRL Report No. R-1507.

Table 17

Model XTBK-8 Radio Transmitting Equipment
CHANGE OF TUBES
Test as per paragraph 3-7-6 of Specifications RE 13A 442G

Manufacturer and serial No. of Tube	Frequency	Deviation from Mean Frequency Cycles	Per Cent
RCA 11219	4500.743	255	0.0056
GE 58149	4501.140	142	0.0031
GE 1313	4501.200	202	0.0045
GE 1314	4501.060	62	0.0014
GE 1319	4500.730	268	0.0059
WL 27849	4501.400	402	0.0089
WL 42786	4501.780	782	0.0174
WL 30116	4500.625	173	0.0038
WL 40921	4500.850	148	0.0033
RCA 20017	4500.453	545	0.0121
Mean:	4500.660	298	0.0067

Specification Requirements: 0.01%

Change of tubes in 1st Intermediate Amplifier caused an average variation from mean frequency of 0.00012%

Change of tubes in 2nd Intermediate Amplifier caused an average variation from mean frequency of 0.00004%

Change of tubes in Power Amplifier caused an average variation from mean frequency of 0.00004%

Specification Requirements: 0.0005%

For comparison see Table No. 20 of NRL Report No. R-1507.

Table 18

Model XTBK-8 Radio Transmitting Equipment
VARIATION OF SUPPLY LINE VOLTAGE
Test as per paragraph 3-7-7 of Specifications RE 13A 442G

Line Volts	Fil. Volts	Bias Volts	M.O. Ep	P.A. Ep	Output Watts	Frequency kc	Frequency Change Cycles	Frequency Change Per Cent
			Minus to plus 5% in one minute					
418	11.0	230	1350	3000	574	2000.295		
440	11.7	230	1350	3000	574	2000.300		
462	12.1	230	1350	3000	574	2000.305	10	0.0005
418	11.0	230	1350	3000	530	4500.320		
440	11.7	230	1350	3000	534	4500.315		
462	12.1	230	1350	3000	540	4500.301	19	0.00042
			Minus to plus 5% in five minutes					
418	11.0	230	1350	3000	574	2000.295		
440	11.6	230	1350	3000	574	2000.296		
462	12.2	230	1350	3000	574	2000.305	10	0.0005
418	11.0	230	1350	3000	530	4500.310		
440	11.7	230	1350	3000	534	4500.303		
462	12.1	230	1350	3000	540	4500.298	12	0.00027

Specification Requirements: 0.0015%

Line Volts	Fil. Volts	Bias Volts	M.O. Ep	P.A. Ep	Output Watts	Frequency kc	Frequency Change Cycles	Frequency Change Per Cent
			Minus to plus 10% in one minute					
396	10.5	230	1340	2990	570	2000.308		
440	11.7	230	1350	3000	574	2000.317		
484	12.75	230	1350	3000	574	2000.323	15	0.00075
396	10.5	230	1340	2980	520	4500.313		
440	11.6	230	1350	3000	520	4500.295		
484	12.8	231	1350	3000	520	4500.285	28	0.00062
			Minus to plus 10% in five minutes					
396	10.5	230	1340	2980	570	2000.295		
440	11.6	230	1350	3000	572	2000.304		
484	12.75	231	1350	3000	574	2000.312	17	0.00085
396	10.5	230	1340	2990	520	4500.315		
440	11.6	230	1350	3000	530	4500.289		
484	12.75	231	1350	3000	540	4500.290	25	0.00056

All relays in the equipment functioned satisfactorily during the period of these tests.

For comparison see Table No. 21 of NRL Report No. R-1507.

[redacted]

Table 19

Model XTBK-8 Radio Transmitting Equipment
VARIATION IN AMBIENT TEMPERATURE
Test as per paragraph 3-7-8 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Hum.	Frequency kc	Cab. Temp.	Watts Output	P.A. Ep	P.A. Ip	Line Volts
0800	49.5	37	4500.605	60.25	525	3000	300	435
15	50.0	25	672	25	510	3000	299	438
30	50.5	26	692	24	491	3000	298	440
45	50.5	27	688	22	474	3000	295	438
0900	51.0	25	679	22	466	3000	292	438
0915	40.0	24	705	34	466	3000	293	437
30	41.0	24	735	37	475	3000	294	440
45	40.5	30	748	35	487	2990	294	440
1000	40.0	22	760	37	493	2990	295	438
15	41.0	24	764	37	493	2990	295	439
30	30.5	21	772	47	493	2990	295	436
45	31.0	23	782	54	497	2990	297	435
1100	30.0	21	798	53	521	3000	299	437
15	30.5	26	802	54	521	3000	299	438
30	30.5	26	804	54	525	3000	300	440
45	22.0	22	800	63	530	3000	300	440
1200	19.5	21	796	69	532	3000	302	440
15	20.0	22	803	70	534	3000	304	442
30	20.5	23	815	70	546	3020	308	440
45	20.0	21	814	70	546	3020	308	436
1300	10.5	27	650	67	534	3010	300	437
15	9.5	28	640	71	559	3010	300	438
30	10.5	31	640	74	563	3020	305	438
45	9.5	28	600	74	569	3030	306	438
1400	8.0	31	583	79	563	3030	306	437
15	1.0	20	520	60.00	582	3050	310	440
30	1.0	20	715	58.90	591	3060	311	437
45	0.5	39	920	Off Scale	596	3070	313	435
1500	1.0	59	4501.150	down	599	3080	316	438
15	1.0		250	"	601	3100	317	438
	(Voltages readjusted to normal at conclusion of test.)							
17	1.0		275	"	569	3000	308	438

[redacted]

Table 19 continued

SUMMARY

Temperature Change Degrees C	Cycles Change per 10 Degrees C	Per Cent Change per one Deg. C.
50 to 40	+85	0.00019
40 to 30	+40	0.000085
30 to 20	+10	0.000021
20 to 10	-107*	0.0002*
10 to 0	+667	0.0021

Specification Requirements: 0.00025%

Notes: At 1250 the Aux. plate generator fuse blew. The original 0.25 amp. fuse was replaced by a 0.75 amp. fuse. When power was reapplied, the frequency was the same as before the interruption, but rapidly drifted downwards to value shown at 1300.

(*) The frequency change which occurred when the Aux. plate fuse was disrupted was eliminated in calculating these values.

Table 20

Model XTBK-8 Radio Transmitting Equipment
VARIATIONS IN AMBIENT TEMPERATURE
Test as per paragraph 3-7-8 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Hum.	Frequency kc	Cab. Temp.	Watts Output	P.A. Ep	P.A. Ip	Line Volts
0800	50.0	26	4500.583	60.27	564	3040	300	444
15	51.0	29	617	13	529	3040	299	444
30	50.5	26	588	13	520	3020	295	441
45	50.5	23	602	10	500	3000	292	445
0900	50.0	19	621	10	497	3000	292	445
15	41.0	18	630	23	507	3000	293	446
30	40.0	15	660	25	511	3000	293	445
45	40.0	15	688	26	524	3000	293	444
1000	40.0	21	740	26	520	3010	293	444
15	40.0	20	768	27	511	3000	293	444
30	30.5	16	740	34	524	3000	294	445
45	30.0	16	709	36	532	3000	296	445
1100	30.0	16	735	38	548	3010	298	444
15	30.0	18	750	38	543	3000	299	443
30	30.0	22	752	39	553	3000	299	444
45	21.0	22	708	42	553	3000	300	445
1200	19.5	27	690	46	561	3000	300	444
15	20.0	29	695	46	561	3010	301	447
30	20.0	27	723	47	568	3020	302	445
45	20.0	25	658	50	570	3025	303	445
1300	10.0	29	550	55	588	3060	306	446
15	10.0	29	550	58	590	3060	309	443
30	10.0	29	541	61	593	3070	310	443
45	10.0	27	538	62	593	3070	310	436
1400	10.0	29	546	63	593	3070	310	440
15	1.0	37	380	67	601	3090	312	435
30	1.0	32	363	70	612	3090	315	434
45	1.0	47	358	72	621	3110	317	434
1500	0.5	37	357	72	625	3110	317	435
15	0.5	47	360	73	621	3110	318	435
	(Voltages readjusted to normal at conclusion of test.)							
1518	0.5	47	345	73	588	3000	310	436

[redacted]

Table 20 continued

SUMMARY

Temperature Change Degrees C.	Cycles Change per 10 Degrees C.	Per Cent Change per One Degree C.
50 to 40	+147	0.00033
40 to 30	-16	0.000036
30 to 20	-94	0.00021
20 to 10	-112	0.00025
10 to 0	-186	0.00043

Specification Requirements: 0.00025%

Notes: A potential of 132 volts was applied to the heater circuits during this test.

During the course of the test a number of abrupt frequency changes were noted, ranging from 20 to 60 cycles.

[redacted]

Table 21

Model XTBK-8 Radio Transmitting Equipment
VARIATIONS IN AMBIENT TEMPERATURE
Test as per paragraph 3-7-8 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Hum.	Frequency kc	Cab. Temp.	Watts Output	P.A. Ep	P.A. Ip	Line Volts
0830	51.0	27	4500.440	60.20	516	3010	299	449
45	51.0	23	447	18	500	3000	298	450
0900	51.0	24	448	16	494	3000	296	448
15	51.0	23	450	15	494	2990	295	449
30	51.0	26	450	16	491	2980	294	445
0945	40.5	14	468	23	497	2980	292	444
1000	41.0	18	490	28	508	2980	296	445
15	41.0	21	510	28	512	2990	297	445
30	41.0	23	514	28	512	2990	297	445
45	41.0	22	518	28	516	2990	297	442
1100	30.0	20	522	35	522	3000	298	444
15	30.0	21	535	40	532	3000	299	444
30	30.0	23	545	40	536	3000	300	444
45	30.5	23	547	40	541	3000	301	447
1200	30.5	23	550	40	539	3000	301	441
15	19.5	25	541	46	544	3000	302	445
30	19.5	34	546	49	556	3000	305	442
45	20.5	23	545	49	559	3000	306	444
1300	20.0	29	549	52	559	3000	307	442
15	20.0	27	554	53	561	3010	308	444
30	11.0	26	528	58	570	3030	310	441
45	10.5	31	526	63	584	3050	312	443
1400	10.5	35	531	63	589	3060	314	444
15	10.0	35	533	64	589	3060	315	444
30	10.0	31	531	64	591	3060	315	441
45	1.5	32	495	68	595	3060	317	441
1500	1.0	32	520	70	598	3080	319	438
15	1.0	32	500	71	598	3080	320	438
30	0.5	-	500	72	605	3080	320	440
45	0.5	-	501	70	603	3090	321	438

Table 21 continued

SUMMARY

Temperature Change Degrees C.	Cycles Change per 10 Degrees C.	Per Cent Change per One Degree C.
50 to 40	+68	0.00015
40 to 30	+32	0.000068
30 to 20	+ 4	0.0000085
20 to 10	-23	0.000051
10 to 0	-30	0.00007

Specification Requirements: 0.00025%

Note: Compensator capacitor C-173 reduced in value from the original value supplied.

[redacted]

Table 22

Model XTBK-8 Radio Transmitting Equipment
VARIATIONS IN AMBIENT TEMPERATURE
Test as per paragraph 3-7-8 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Hum.	Frequency kc	Cab. Temp.	Watts Output	P.A. Ep	P.A. Ip	Line Volts
0745	50.5	23	2000.445	60.38	610	3000	300	453
0800	51.0	22	414	25	571	2960	290	448
15	50.5	26	404	22	558	2950	288	444
30	51.0	22	410	22	550	2940	285	441
45	50.5	19	407	21	549	2930	284	442
0900	40.5	16	420	27	552	2940	285	444
15	41.0	20	425	28	560	2940	285	445
30	41.0	24	424	29	560	2930	285	443
45	40.0	22	427	30	560	2930	285	443
1000	40.0	22	429	30	561	2930	286	442
15	30.0	21	435	35	569	2930	287	440
30	30.5	18	440	40	574	2930	289	440
45	30.0	21	447	42	572	2930	289	443
1100	31.0	18	446	41	574	2940	290	439
15	30.5	21	447	42	574	2940	290	439
30	20.0	25	452	44	582	2940	291	438
45	19.5	27	460	48	599	2950	294	442
1200	20.0	25	462	51	591	2960	292	443
15	20.5	23	463	53	599	2960	294	444
30	20.0	28	461	52	599	2960	295	439
45	10.5	35	468	57	603	2970	297	439
1300	10.0	27	470	61	610	2970	298	436
15	9.5	34	478	60	619	2990	300	440
30	10.0	31	477	62	619	3000	300	436
45	10.0	29	476	62	619	3000	300	438
1400	1.0	-	478	65	625	3000	300	440
15	1.0	-	479	66	625	3000	300	436
30	0.5	-	485	67	639	3020	304	438
45	0.5	-	483	66	639	3020	305	437
1500	1.0	-	485	67	639	3020	305	439

[redacted]

Table 22 continued

SUMMARY

Temperature Change Degrees C.	Cycles Change per 10 Degrees C.	Per Cent Change per One Degree C.
50 to 40	+22	0.000105
40 to 30	+18	0.000095
30 to 20	+14	0.000067
20 to 10	+17	0.000085
10 to 0	+ 7	0.000039

Specification Requirements: 0.00025%

Compensator capacitor C-173 reduced in value from the original value supplied.

[redacted]

Table 23

Model XTBK-8 Radio Transmitting Equipment
VARIATIONS IN HUMIDITY
Test as per paragraph 3-7-9 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Humid.	Frequency kc	P. A. Ep	P.A. Ip	Watts Output	Line Volts.
1215	40.0	30	4500.650	3000	300	535	438
1230	40.0	28	695	3000	300	522	436
1245	40.0	30	682	3000	300	500	437
1300	40.5	71	642	2980	297	490	432
1315	41.0	90	568	2980	296	474	435
1330	42.5	97	478	2980	294	470	436
1345	41.5	93	422	2970	295	470	437
1400	40.5	90	420	2960	293	470	434
1415	41.0	93	400	2960	292	470	437
1430	40.0	38	472	2950	293	470	437
1445	41.0	29	551	2950	296	473	437
1500	41.5	28	601	2950	296	473	436
1515	39.5	29	632	2950	296	473	434
1530	40.5	30	652	2950	296	476	436
1545	41.0	32	663	2950	297	476	442
	(Voltages readjusted to normal at conclusion of test).						
1547	41.0	32	4500.670	3000	309	511	439

Greatest frequency variation noted during second and third portion of test from that prevailing at end of first test:
282 cycles - 0.0063%
Maximum permitted by specifications: 0.003%.

Decrease in power output during test:
Greatest variation from beginning of test - 535 to 470 watts of 12.1%.
Greatest variation from power at end of first test period - 500 to 470 watts or 6%.

Maximum decrease in power permitted by specifications: 5%.

Antenna Load: Plaque Resistors; Estimated R.F. resistance 48.5 ohms; DC resistance 20 ohms.

For comparison, see Table No. 25 of NRL Report No. R-1507.

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Table 24

Model XTBK-8 Radio Transmitting Equipment
VARIATIONS IN HUMIDITY
Test as per paragraph 3-7-9 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Hum.	Frequency kc	P.A. Ep	P.A. Ip	Watts Output	Line Volts
1145	41.0	17	4500.775	3000	300	536	426
1200	40.0	19	794	3000	298	521	431
1215	40.5	16	787	3000	298	511	430
1230	40.0	71	757	3000	297	511	433
1245	41.0	83	700	3000	296	509	432
1300	41.5	97	624	3000	292	500	430
1315	42.0	93	570	3000	292	497	432
1330	42.0	93	543	3000	292	497	426
1345	42.0	93	512	3000	292	497	425
1400	42.0	93	498	2992	291	497	428
1415	40.5	35	560	2990	294	508	426
1430	40.0	30	627	2990	296	511	431
1445	40.0	30	672	2990	297	515	429
1500	40.0	30	700	2990	296	519	432
1515	40.5	29	712	2990	297	519	432

Greatest frequency variation noted during second and third portion of test from that prevailing at end of first test period: 289 cycles; 0.0064%
Maximum permitted by specifications: 0.003%

Decrease in power output during test:
Greatest variation from beginning of test - 536 to 497 watts or 7.8%
Greatest variation from power at end of first test period - 511 to 497 watts or 2.7%
Maximum decrease in power permitted by specifications: 5%

Note: This test conducted after master oscillator compartment had been taken back to factory for modification of insulating cover to increase heat loss.

Table 26

Model XTBK-8 Radio Transmitting Equipment
VARIATIONS IN HUMIDITY
Test as per paragraph 3-7-9 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Hum.	Frequency kc	P.A. Ep	P.A. Ip	Watts Output	Line Volts
0815	40.0	30	4500.472	3000	300	531	444
0830	40.0	32	503	3000	298	526	445
0845	41.0	31	502	3000	298	526	446
0900	40.5	80	455	3000	296	522	446
0915	41.5	97	395	2990	292	503	447
0930	41.5	97	342	2970	291	497	443
0945	41.5	97	315	2970	290	497	443
1000	41.5	97	299	2970	290	497	442
1015	41.5	97	285	2960	290	497	438
1030	40.0	34	354	2960	290	503	442
1045	40.5	29	415	2960	290	507	439
1100	41.0	29	446	2960	290	507	443
1115	40.0	29	464	2960	290	512	444
1130	40.5	30	477	2950	290	512	439
	(Voltages readjusted to normal at conclusion of test)						
	40.5	30	477	3000	292	526	441

Greatest frequency variation noted during second and third portion of test from that prevailing at end of first test period: 217 cycles; 0.0048%
Maximum permitted by specifications: 0.003%

Decrease in power output during test:
Greatest variation from beginning of test: 531 to 417 watts or 6.4%
Greatest variation from power at end of first test period: 526 to 497 or 5.5%
Maximum decrease in power permitted by specifications: 5%

Note: During this test the perforated shield at right side of MO tube case was replaced by a solid aluminum sheet and a solid piece of aluminum was secured over the perforations at the back of the tube compartment; in addition the original filament choke assembly was replaced with one wound on an Isolantite form.

Table 28

Model XTBK-8 Radio Transmitting Equipment
VARIATIONS IN HUMIDITY
Test as per paragraph 3-7-9 of Specifications RE 13A 442G

Time	Amb. Temp.	Rel. Hum.	Frequency kc	P.A. Ep	P.A. Ip	Watts Output	Line Volts
0815	41.0	26	2000.363	2990	297	599	448
0830	41.0	29	355	2980	296	599	446
0845	41.0	31	352	2960	292	590	446
0900	41.0	90	336	2970	291	581	445
0915	41.5	90	319	2960	290	577	447
0930	41.5	97	312	2960	290	577	446
0945	41.5	97	307	2950	290	572	440
1000	41.5	97	307	2950	290	577	445
1015	41.5	97	306	2950	290	577	446
1030	40.0	41	315	2950	291	577	440
1045	40.0	32	334	2960	291	579	445
1100	40.5	27	340	2960	292	584	445
1115	40.0	31	344	2960	292	584	444
1130	40.5	30	347	2960	292	584	443
1145	40.0	29	349	2950	292	579	448
	(Voltages readjusted to normal at conclusion of test.)						
1147	40.0	29	351	3000	299	615	448

Greatest frequency variation noted during second and third portion of test from that prevailing at end of first test period: 46 cycles - 0.0023%.

Maximum permitted by specifications: 0.003%

Decrease in power output during test:

Greatest variation from beginning of test - 599 to 572 watts - 4.5%
Greatest variation from power at end of first test period - 590 to 572 watts - 3.05%

Maximum decrease in power permitted by specifications: 5%

Antenna Load: Plaque resistors; estimated R. F. resistance 25 ohms; D.C. resistance 20 ohms.

For comparison see Table No. 24 of NRL Report No. R-1507

[redacted]

Table 29

Model XTBK-8 Radio Transmitting Equipment
LOCKED KEY OPERATION FOR TWO HOURS
Test as per paragraph 3-7-10 of Specifications RE 13A 442G

Time	Amb.Temp. Deg. C.	Frequency kc	Power Watts	P.A. Ip	P.A. Ep	Line Volts	Cabinet Temp. ° C.
0810	Filaments lighted						
15	27.3	2000.362	570	300	3000	440	60.30
20	27.2 (high)	337	-	300	3000	440	60.30
25	27.4	325	-	300	3000	440	60.34
30	27.3	320	-	300	3000	442	60.35
35	27.3	315	-	299	3000	442	60.35
40	27.0	312	-	299	2995	444	60.38
45	27.0	310	-	299	2990	432	60.37
50	26.9	310	-	299	2990	422	60.34
55	26.9	310	570	298	2990	441	60.38
0900	27.3	306	566	295	2990	440	60.38
05	27.1	305	560	290	2990	440	60.35
10	27.2	305	554	295	2990	441	60.30
15	27.0	305	552	295	2990	438	60.35
20	27.1	305	554	295	2990	440	60.35
25	27.1 (low)	305	561	293	2995	440	60.38
30	27.4	306	566	292	2995	438	60.38
35	26.8	306	564	293	2995	438	60.39
40	26.0	306	570	295	2990	440	60.30
45	26.8	310	570	295	2990	435	60.35
50	26.8	311	570	295	2995	433	60.38
55	27.0	310	570	295	2997	440	60.35
1000	27.0	309	566	295	2995	440	60.35
05	27.1	307	580	298	2995	437	60.35
10	27.3	307	554	295	2995	435	60.32
15	26.8	311	560	295	2995	440	60.32
20	26.9	308	554	295	2995	435	60.38

(At the completion of test all voltages were readjusted to normal, with the following results:)

311 570 300 3000

Frequency Change during first five minutes: 25 cycles; 0.00125%
Frequency Change during remainder of test: 32 cycles; 0.0016%

Specification Requirements:
1st five minutes: 0.001%
Remainder of test: 0.0025%

This test was conducted from a cold start, i.e., transmitter had been idle overnight with only the temperature control circuits in operation; M.O. filament was not lighted previous to start of test.

For comparison see Table No. 26 of NRL Report No. R-1507.

Table 30

Model XTBK-8 Radio Transmitting Equipment
LOCKED KEY OPERATION FOR TWO HOURS
Test as per paragraph 3-7-10 of Specifications RE 13A 442G.

Time	Amb. Temp. °C.	Frequency kc	Power Watts	P.A. I_p	P.A. E_p	Line Volts	Cabinet Temp. °C.
0805	Filaments lighted						
10	27.4	4500.285	-	300	3000	447	60.39
15	27.3	(low) 306	-	298	3000	445	60.36
20	27.3	325	-	296	3000	442	60.29
25	27.6	(high) 337	-	296	3000	444	60.29
30	27.6	330	-	295	3000	441	60.32
35	27.6	326	570	294	3000	440	60.33
40	27.5	330	554	292	3000	439	60.29
45	27.7	322	540	291	3000	437	60.29
50	27.8	325	536	291	3000	440	60.32
55	27.8	321	530	291	3000	440	60.33
0900	27.9	325	520	291	2990	438	60.29
05	27.9	328	514	291	2970	441	60.33
10	28.0	326	510	291	2950	440	60.28
15	28.0	325	510	292	2970	439	60.32
20	28.0	324	506	292	2960	440	60.34
25	28.1	326	500	291	2950	436	60.30
30	28.2	326	500	291	2950	435	60.33
35	28.2	325	500	290	2950	436	60.32
40	28.4	335	496	290	2950	434	60.33
45	28.5	330	496	290	2950	435	60.32
50	28.5	332	496	290	2950	437	60.29
55	28.7	326	500	290	2950	436	60.32
1000	28.9	335	500	291	2950	437	60.29
05	28.9	327	496	291	2950	439	60.31
10	28.9	330	494	291	2950	437	60.30
15	29.0	332	494	291	2960	439	60.32

At the completion of test all voltages were readjusted to normal, with the following results:

320 510 298 3000 438

Frequency change during first five minutes: 21 cycles; 0.00047%.
Frequency change during remainder of test : 31 cycles; 0.00069%.

Specification requirements:
1st five minutes : 0.001%.
Remainder of test: 0.0025%.

This test was conducted from a cold start; i.e., transmitter had been idle overnight with only the temperature control circuits in operation; M.O. filament not lighted previous to start of test.

For comparison see Tables 27 and 28 of NRL Report No. R-1507.

Table 31

Model XTBK-8 Radio Transmitting Equipment
CHANGE FROM KEY LOCKED TO INTERMITTENTLY KEYED CONDITION
Test as per paragraph 3-7-11 of Specifications RE 13A 442G.

Test Condition	Frequency at end of 10 min. key locked period.	Frequency at end of 10 sec. dash 20 min. later.	Change in Frequency Cycles	Per Cent
All fil. lighted	2000.326	2000.346	20	0.001
MO fil. lighted	2000.325	2000.349	24	0.0012
Fil. not lighted	2000.332	2000.372	40	0.002
All fil. lighted	4500.302	4500.235	67	0.0015
MO fil. lighted	4500.330	4500.265	65	0.00145
Fil. not lighted	4500.335	4500.395	60	0.0013

Specification requirements:
MO filament lighted: 0.0025%.
MO filament not lighted: 0.005%.

Table 32

Model XTBK-8 Radio Transmitting Equipment
CHANGE FROM CONTINUOUSLY KEYED CONDITION
TO INTERMITTENTLY KEYED CONDITION.
Test as per paragraph 3-7-12 of Specifications RE 13A 442G.

Frequency at end of 30 minutes of continuous keying	Frequency at end of 10 sec. dash after 20 min. pause	Change in Frequency Cycles	Per Cent
2000.336	2000.346	10	0.0005
4500.315	4500.275	40	0.00089

Specification requirements: 0.001%.

All filaments remained lighted during the 20-minute stand-by period preceding the 10 second dash.

For comparison see Table 30 of NRL Report No. R-1507.

Table 33

Model XTBK-8 Radio Transmitting Equipment
INCLINATION TEST
Test as per paragraph 3-7-13 of Specifications RE 13A 442G

Inclination: Front to Back

Time	Minimum Frequency	Difference (cycles)	Maximum Frequency	Test Condition
1344	2000.289			Stationary
1345	292	3	2000.295	inclination
1350	293	4	297	"
1355	292	4	296	"
1400	292	4	296	"
1405	292	4	296	"
1410	293	4	297	"
1415	295	3	298	"
1416	295			Stationary

Maximum frequency change from stationary condition at start of test: 9 cycles, 0.00045%.
Maximum frequency change from stationary condition at end of test: 3 cycles, 0.00015%.
Maximum frequency change noted during test, minimum to maximum: 4 cycles, 0.0002%.

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1459	4500.223			Stationary
1500	230	15	4500.245	Inclination
1505	230	20	250	"
1510	230	30	260	"
1515	229	30	259	"
1520	230	30	260	"
1525	231	31	262	"
1530	231	31	262	"
1531	233			Stationary

Maximum frequency change from stationary condition at start of test: 39 cycles, 0.00087%.
Maximum frequency change from stationary condition at end of test: 29 cycles, 0.00065%.
Maximum frequency change noted during test, minimum to maximum: 31 cycles, 0.00069%.

Specification requirements: 0.001%.
Inclination at rate of 5 complete cycles per minute.

For comparison see Tables 31 and 32 of NRL Report No. R-1507.

Table 34

Model XTBK-8 Radio Transmitting Equipment
INCLINATION TEST
Test as per paragraph 3-7-13 of Specifications RE 13A 442G.

Inclination: Side to Side

Time	Minimum Frequency	Difference (cycles)	Maximum Frequency	Test Condition
1049	2000.241			Stationary
1050	245	5	2000.250	Inclination
1055	245	5	250	"
1100	248	4	252	"
1105	245	7	252	"
1110	245	6	251	"
1115	247	7	254	"
1120	249	6	255	"
1121	250			Stationary

Maximum frequency change from stationary condition at start of test: 14 cycles, 0.0007%.
Maximum frequency change from stationary condition at end of test: 5 cycles, 0.00025%.
Maximum frequency change noted during test, minimum to maximum: 7 cycles, 0.00035%.

0909	4511.311			Stationary
0910	306	36	4500.342	Inclination
0915	310	40	350	"
0920	315	29	344	"
0925	317	43	350	"
0930	310	44	354	"
0935	312	39	351	"
0940	315	41	356	"
0941	328			Stationary

Maximum frequency change from stationary condition at start of test: 45 cycles, 0.001%.
Maximum frequency change from stationary condition at end of test: 28 cycles, 0.00062%.
Maximum frequency change noted during test, minimum to maximum: 44 cycles, 0.00098%.

Specification requirements: 0.001%.
Inclination at rate of 5 complete cycles per minute.

For comparison see Tables 31 and 32 of NRL Report No. R-1507.

[redacted]

Table 35

Model XTBK-8 Radio Transmitting Equipment
VIBRATION
Test as per paragraph 3-7-14 of Specifications RE 13A 442G.

Time	Frequency kc	Antenna Current	P.A. Ip	P.A. Ep	Filament Volts	Test Conditions
1230	2000.287	2.1	267	3020	11.6	Stationary
1231	287	2.1	268	3040	11.6	Vibrating
1235	286	2.1	268	3020	11.5	"
1240	286	2.1	269	3030	11.5	"
1245	287	2.1	269	3020	11.55	"
1250	286	2.1	269	3020	11.5	"
1255	286	2.1	269	3020	11.55	"
1300	287	2.1	269	3020	11.5	"
1301	287	2.1	268	3020	11.55	Stationary

Maximum set in frequency: 0 cycles.
Maximum variation in frequency during test: 1 cycle.

1000	4500.238	2.03	294	2980	11.7	Stationary
1001	238	2.03	294	2980	11.7	Vibrating
1005	235	2.03	293	2970	11.8	"
1010	234	2.03	294	2990	11.75	"
1015	233	2.03	294	2990	11.8	"
1020	234	2.03	294	2990	11.8	"
1025	234	2.03	294	2990	11.8	"
1030	235	2.03	294	2970	11.7	"
1031	235	2.03	294	2980	11.8	Stationary

Maximum set in frequency: 5 cycles, 0.000067%.
Maximum variation in frequency during test: 4 cycles, 0.000089%.

Specification requirements: Maximum set in frequency not to exceed 0.0005%.

For comparison see Table No. 33 of NRL Report No. R-1507.

Table 36

Model XTBK-8 Radio Transmitting Equipment
SHOCK TEST
Test as per paragraph 3-7-15 of Specifications RE 13A 442G.

Shock Applied to:	Frequency before shock	Frequency after shock	Frequency Difference Cycles	Per cent
Front	2000.260	2000.260	0	0
Left side	258	258	0	0
Back	267	266	1	0.00005
Right side	262	262	0	0
Front	4500.217	4500.219	2	Neg.
Left side	218	212	6	0.00013
Back	217	221	4	0.00009
Right side	217	217	0	0

Dial locks secured during test.
Specification requirements: 0.001%.

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In order to determine the effect of subsequent shocks the following data were obtained. In each case readings were taken immediately after the first corresponding test.

Front	2000.260	2000.260	0	0
Left side	258	258	0	0
Back	266	266	0	0
Right side	262	262	0	0
Front	4500.219	4500.220	1	Neg.
Left side	212	213	1	Neg.
Back	218	220	2	Neg.
Right side	217	217	0	0

For comparison see Table No. 34 of NRL Report No. R-1507.

[redacted]

Table 37

Model XTBK-8 Radio Transmitting Equipment
SUMMARY OF FREQUENCY STABILITY TESTS
Tests as per paragraph 3-7 of Specifications RE 13A 442G.

Test No.	Maximum Frequency Variation (%) 2000 KC	4500 KC	Percent Frequency Variation of Specification allowance 2000 KC	4500 KC	Specification Limits
3-7-1 (a)	0.00027	0.0003	9%	10%	0.003
(b)	0.00055	0.0004	11	8	0.005
3-7-2 (a)	0.00049	0.00184	10	37	0.005
(b)	0.00065	0.00216	8	26	0.008
3-7-3	0.0005	0.00033	50	33	0.001
3-7-4	0.00115	0.00067	38	22	0.003
3-7-5	0.0005	0.0002	50	20	0.001
3-7-6 (a)	0.0079	0.0067	79	67	0.01
(b)	0.0002	0.00012	40	24	0.0005
3-7-7	0.0005	0.00042	33	28	0.0015
3-7-8	0.0001	0.00015	40	60	0.00025
3-7-9	0.0023	0.0046	77	153	0.003
3-7-10 (a)	0.00125	0.00047	125	47	0.001
(b)	0.0016	0.00069	64	27	0.0025
3-7-11 (a)	0.0012	0.00145	48	58	0.0025
(b)	0.002	0.0013	40	26	0.005
3-7-12	0.0005	0.00089	50	89	0.001
3-7-13	0.0007	0.001	70	100	0.001
3-7-14	0.0	0.00006	0	12	0.0005
3-7-15	0.00005	0.00013	5	13	0.001
Total:	0.02241	0.02388	Avg: 42	Avg: 43	Total: 0.05575

[redacted]

Table 38

Model XTBK-8 Radio Transmitting Equipment
OPERATIONAL CHARACTERISTICS OF MASTER OSCILLATOR TEMPERATURE CONTROLLED CABINET.
Test as per paragraph 3-8 of Specifications RE 13A 442G.

Ambient Temp. Deg. C.	Rel. Hum. %	Frequency High	Frequency Low	M.O. Temp. High	Cabinet Deg. C. Low	% time Heater "on"	Length Heat Cycle (sec)	Date
40	30	4500.694	684	60.40	60.34	28.4	17.8	8/24
41	93	423	415	60.39	60.32	21.0	19.6	8/24
40.5	30	654	646	60.41	60.36	27.8	17.0	8/24
50.5	27	684	674	60.26	60.18	4.8	63.0	8/25
41	24	766	766	60.40	60.34	28.1	17.8	8/25
30.5	26	799	807	60.58	60.50	52.0	15.6	8/25
20	23	818	810	60.73	60.67	75.0	20.0	8/25
9	28	570	-	60.80	-	100.0	indef.	8/25
(data below with 130 volts applied to heater circuits; previously 110 volts had been used)								
1.5	-	226	217	60.78	60.70	73.8	17.5	8/29
50.5	16	620	610	60.25	60.10	2.4	85.0	8/29
50.5	23	Thermostat does not work				0	indef.	8/30
40.0	20	760	750	60.31	60.22	13.2	22.7	8/30
30.0	18	747	738	60.42	60.35	33.0	15	8/30
20.0	29	657	646	60.50	60.44	46.1	13.7	8/30
10.0	28	544	536	60.57	60.58	66.8	15.5	8/30
0.5	37	362	350	60.76	60.69	73.7	17.5	8/30
(one 46 ohm main and one 46 ohm auxiliary heaters installed in place of original heater units; 110 volts applied to heaters. In addition about 2-1/2 square inches of insulation removed from one corner of heater cabinet).								
50.0	20	442	424	60.25	60.10	4.23	74.0	8/31
40.0	15	571	556	60.31	60.20	16.3	24.5	8/31
0.5	40	840	830	60.70	60.60	81.1	23.8	8/31
11.0	27	674	664	60.58	60.50	67.3	18.3	8/31
50.0	19	585	569	60.22	60.08	2.96	84.5	9/1
40.0	20	656	643	60.30	60.18	15.5	24.6	9/1
30.0	16	730	720	60.39	60.30	33.8	17.8	9/1
10.0	15	712	698	60.54	60.46	54	18.3	9/1
(data below obtained after MO cabinet had been returned to factory; thermal insulation removed from screw heads).								
40.5	19	794	780	60.35	60.25	16.8	23.8	9/5
42.0	93	509	495	60.32	60.20	14.3	28.0	9/5
41.0	30	718	704	60.34	60.24	17.4	23.0	9/5
(data below with an additional 2 square inches of thermal insulation removed from one corner of MO cabinet).								
51.0	23	440	460	60.24	60.10	1.3	194	9/6
41	22	524	511	60.34	60.22	15.0	25.3	9/6
30.5	23	557	544	60.45	60.35	33.3	18	9/6
20	27	560	547	60.58	60.48	48.4	16.8	9/6

Table 38 (continued)

10	35	4500.540	526	60.68	60.59	62.5	18.1	9/6
0.5	-	508	494	60.73	60.67	78.6	23.4	9/6
50.5	19	2000.412	406	60.28	60.14	2.2	97	9/7
40.5	22	431	427	60.36	60.26	16	25	9/7
30.5	21	450	447	60.46	60.36	33.7	17.8	9/7
20.0	28	463	460	60.57	60.47	48.4	16.9	9/7
10.0	31	479	476	60.66	60.58	64.3	18.4	9/7
1.0	-	489	486	60.72	60.63	77.8	22.6	9/7
41.0	94	4500.470	454	60.30	60.20	13.4	26.9	9/8
41.5	97	296	280	60.30	60.20	13.9	24.4	9/11
40.0	29	481	468	60.34	60.24	17.4	23.0	9/11
41.5	97	302	290	60.31	60.20	15.1	26.5	9/11
41.5	97	2000.308	304	60.30	60.20	14.8	27.0	9/12

Table 39

Model KTBK-8 Radio Transmitting Equipment
DETERMINATION OF LIMITING FREQUENCIES AND OVERLAP OF M.O. CIRCUIT
Test as per paragraph 3-13 of Specifications RE 13A 442G.

Control A	Control B	Frequency kc	Kilocycles Overlap	Mean Frequency	Per Cent Overlap
Specification limit:		1000.0			
1	0000	969.07	31	984.5	3.2
1	7000	1180.0	61.5	1149.2	5.3
2	0000	1118.5			
2	7000	1388.6	110.3	1333.4	8.2
3	0000	1278.3			
3	7000	1586.9	123.6	1525.1	8.1
4	0000	1463.3			
4	7000	1816.2	114.8	1759.8	6.5
5	0000	1701.4			
5	7000	2154.1	302.7	2002.7	15.1
6	0000	1851.4			
6	7000	2410.4	147.9	2336.4	6.3
Specification limit:		2262.5			

Specification requirements:
Not less than 3% overlap and end tolerance.

[redacted]

Table 40

Model XTBK-8 Radio Transmitting Equipment
DETERMINATION OF LIMITING FREQUENCIES AND OVERLAP
OF TRANSMITTER.
Test as per paragraph 3-13 of Specifications RE 13A 442G.

	Low	High
Output frequency	1938.2	18654.1
Specified frequency	2000	18100
Overlap, kilocycles	61.8	554.1
Mean frequency	1969.1	18377
Per cent overlap	3.2	3.02
Limiting circuit	MO	Antenna (lamp)
Control A	1	6
B	0000	4925
C	7	82
D	322	2428
E	230	2750
G	204	2691
H	53	2
I	Current	Volt
J	57	89
K	150	2856

Antenna: 115 volt, 500 watt lamp.

All controls except master oscillator are continuously variable over the entire frequency range.

Specification requirements: 3% overlap.

For comparison see Table 36 of NRL Report No. R-1507.

Table 41

Model XTBK-8 Radio Transmitting Equipment
VARIATION OF RESONANT FREQUENCY OF MASTER OSCILLATOR
PER DIVISION OF DIAL MARKING.
Test as per paragraph 3-17 of Specifications RE 13A 442G.

Control A	Control B	Frequency kc	Kc per Division	Per Cent per Division
1	0000	969.07		
1	421	975	0.0141	0.0014
1	1435	1000	0.0246	0.0024
1	2198	1025	0.0328	0.0032
1	2873	1050	0.0370	0.0035
1	3494	1075	0.0402	0.0037
1	4083	1100	0.0425	0.0038
1	4690	1125	0.0412	0.0036
1	5422	1150	0.0341	0.0029
1	6583	1175	0.0215	0.0018
1	7000	1180	0.0120	0.0010
2	0000	1118.5		
2	384	1125	0.0169	0.0015
2	1231	1150	0.0295	0.0025
2	1862	1175	0.0396	0.0033
2	2421	1200	0.0448	0.0037
2	2932	1225	0.0490	0.0040
2	3410	1250	0.0521	0.0041
2	3868	1275	0.0546	0.0042
2	4320	1300	0.0551	0.0042
2	4895	1325	0.0435	0.0032
2	5368	1350	0.0528	0.0039
2	6270	1375	0.0277	0.0020
2	7000	1388.6	0.0186	0.0013
3	0000	1278.3		
3	843	1300	0.0257	0.0019
3	1468	1325	0.0400	0.0030
3	1995	1350	0.0474	0.0035
3	2475	1375	0.0520	0.0037
3	2929	1400	0.0560	0.0040
3	3340	1425	0.0595	0.0041
3	3746	1450	0.0615	0.0042
3	4135	1475	0.0642	0.0043
3	4540	1500	0.0617	0.0041
3	4986	1525	0.0560	0.0036
3	5520	1550	0.0468	0.0030
3	6300	1575	0.0320	0.0020
3	7000	1586.9	0.0170	0.0010

(Continued)

Table 41 (Continued)

Control A	Control B	Frequency kc	Kc per Division	Per Cent per Division
4	0000	1463.3		
4	480	1475	0.0243	0.0016
4	1122	1500	0.0390	0.0026
4	2073	1550	0.0520	0.0032
4	2880	1600	0.0620	0.0038
4	3600	1650	0.0690	0.0041
4	4300	1700	0.0710	0.0041
4	5060	1750	0.0650	0.0037
4	5535	1775	0.0525	0.0029
4	6194	1800	0.0380	0.0021
4	7000	1816.2	0.0200	0.0011
5	0000	1701.4		
5	686	1725	0.0340	0.0019
5	1143	1750	0.054	0.0030
5	1893	1800	0.066	0.0036
5	2540	1850	0.077	0.0041
5	3120	1900	0.086	0.0045
5	3656	1950	0.093	0.0047
5	4180	2000	0.095	0.0047
5	4722	2050	0.092	0.0044
5	5384	2100	0.075	0.0035
5	6600	2150	0.041	0.0019
5	7000	2154.1	0.012	0.0005
6	0000	1851.4		
6	572	1875	0.041	0.0021
6	965	1900	0.064	0.0033
6	1585	1950	0.081	0.0041
6	2116	2000	0.094	0.0047
6	2591	2050	0.105	0.0051
6	3033	2100	0.113	0.0053
6	3444	2150	0.121	0.0056
6	3840	2200	0.126	0.0057
6	4230	2250	0.128	0.0056
6	4636	2300	0.123	0.0053
6	5111	2350	0.105	0.0044
6	5815	2400	0.071	0.0029
6	7000	2410.4	0.0088	0.0003

Specification requirements:
To fall within the limits of 0.01 and 0.001%.

[redacted]

Table 42

Model XTBK-8 Radio Transmitting Equipment
TEST OF ADJUST-TUNE-OPERATE CONTROL
Test as per paragraph 3-21 of Specifications RE 13A 442G.

	Voltages present with key closed		
	Tuning Step 1	Tuning Step 2	Operate Step 3
Master oscillator plate volts	1360	1360	1360
First amplifier plate volts	0	1325	1510
Second amplifier plate volts	0	1325	1510
Power amplifier plate volts	0	1405	3000
Bias	230	230	230

[redacted]

Table 43

Model XTBK-8 Radio Transmitting Equipment
VOLTAGE REGULATION OF FILAMENT CIRCUITS
Test as per paragraph 3-36 of Specifications RE 13A 442G.

Circuit	Voltage Key Open	Voltage Key Closed	Per Cent Regulation
Line voltage	438	438	0
Secondary of distribution transformer, T-103	109.3	109.1	0.18
Primary of M.O. filament transformer, T-102	100.3	99.9	0.39
Secondary of M.O. filament transformer, T-102	11.7*	11.5	1.7
Voltage at M.O. filament socket connections	10.0*	9.8	2.0
Primary of IPA-PA filament transformer, T-101	100.3	99.9	0.39
1st IPA filament, socket voltage	10.0	9.9	1.0
2nd IPA filament, socket voltage	10.0	9.9	1.0
P.A. filament, socket voltage	11.05	11.0	0.45

* Voltage drop in filament chokes accounts for difference in values.

Note: Heater circuits and blower disconnected during above measurements.

The range of the filament rheostat was checked under conditions where the line voltage was varied between the limits of plus and minus 10 per cent, with the following results:

Line Volts	Key Position	Max. Fil. Volts	Min. Fil. Volts
484	Open		11.1
396	Closed	11.0*	

* 11.7 volts are actually required at all times; therefore insufficient voltage is available at minus 10 per cent of normal line voltage.

Table 44

Model XTBK-8 Radio Transmitting Equipment
R.F. VOLTAGE OUTPUT OF FREQUENCY METER COUPLING CIRCUIT
Test as per paragraph 3-43-3 of Specifications RE 13A 442G.

Oscillator Fundamental Frequency (kc)	Oscillator Output Frequency (kc)	Radio Frequency output - Millivolts
1000	2000	100 plus
1100	2200	96
1175	2350	72.5
1250	2500	63.5
1500	3000	73
1750	3500	67.5
2000	4000	70
2250	4500	61

Notes: Voltage measurements made at Oscillator fundamental frequency.

At 1000 KC the voltage available was in excess of 100 millivolts. The exact voltage could not be determined as it was in excess of the range of the measuring equipment available.

The setting of any transmitter control, or of the "Adjust-Tune-Operate" switch did not alter the above values by more than 2%.

Voltages measured at the end of a two foot section of lead covered, rubber insulated wire whose characteristic impedance was approximately 50 ohms.

Voltages measured with Ferris Model OF field strength equipment, serial No. 40, which was previously standardized by General Radio Type 605-B Signal Generator, Serial No. 955.

[redacted]

Table 45

Model XTBK-8 Radio Transmitting Equipment
POWER REQUIRED FROM SUPPLY LINES
Test as per paragraph 6-5 of Specifications RE 13A 442G.

	Starting	Running-Key Open
Power input (kw)	-	1.4
Line current "A" (amps.)	33	3.15
Line current "B" (amps.)	35	3.72
Line current "C" (amps.)	34	2.7
Line voltage	434	440

Operation at 2000 kc

	Keyed 20 wpm	Key Locked
Power input (kw)	2.1	2.9
Line current "A" (amps.)	3.6	5.0
Line current "B" (amps.)	4.5	5.4
Line current "C" (amps.)	3.6	4.4
Line voltage	437	437
RF power output (watts)	-	574

Operation at 4500 kc

	Keyed 20 wpm	Key Locked
Power input (kw)	2.0	2.9
Line current "A" (amps.)	3.6	5.0
Line current "B" (amps.)	4.5	5.43
Line current "C" (amps.)	3.5	4.45
Line voltage	436	436
RF power output (watts)	-	534

Note: Heater and fan not included in above measurements.

Heater power and fan (auxiliary heater and main heater on), T-103 and indicator light - 445 watts.
Heater power and fan (auxiliary heater off, main heater on), T-103 and indicator light - 274 watts.
MO filament stand-by power, T-103, T-102 and indicator light - 95 watts.
Magnetizing power required for T-103 - 45 watts.
Magnetizing power required for T-102 - 5 watts.

Power required at plus and minus 10 per cent of normal line voltage:

Key Locked - 2000 kc

Line Volts	Power - KW
396	2.98
440	3.12
484	3.29

Above data include main heater power.

[redacted]

Table 46

Model XTBK-8 Radio Transmitting Equipment
REGULATION OF GENERATORS
Test as per paragraph 6-31 of Specifications RE 13A 442G.

Generator	Full Load Voltage	No Load Voltage	Per cent Regulation
Main Plate	3020	3055	1.15
Main Plate Mid-Tap	1510	1525	0.98
Auxiliary Plate	1380	1420	2.8
Bias	227	227	0

Specification Requirements - not to exceed 5%.

Table 47

Model XTBK-8 Radio Transmitting Equipment
MEASUREMENT OF GENERATOR RIPPLE
Test as per paragraph 6-31 of Specifications RE 13A 442G.

Generator	Output Voltage	Ripple Volts		Percent Ripple	
		Key Open	Key Closed	Key Open	Key Closed
Bias	230	1.0	1.1	0.44	0.48
Aux. Plate	1360	2.2	4.1	0.16	0.3
Mid Tap	1500	9.5	7.2	0.63	0.48
Main Plate	3000	20.0	16.0	0.67	0.53

These data were checked several times, using different types of meters and close agreement was obtained on all measurements.

During the tests brushes were examined and adjusted to give best operating conditions.

Specification Requirements: 0.25%.

[redacted]

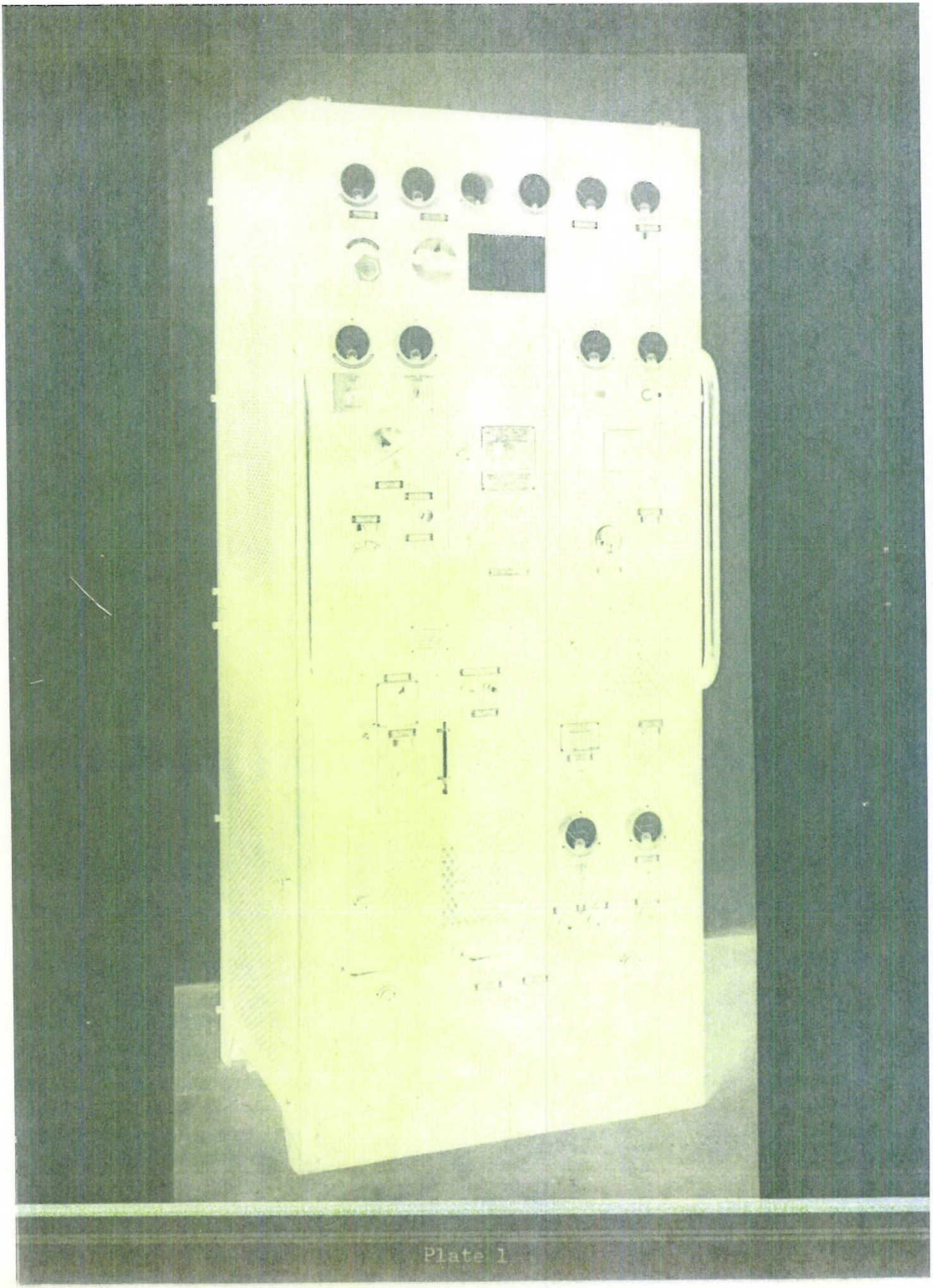


Plate 1

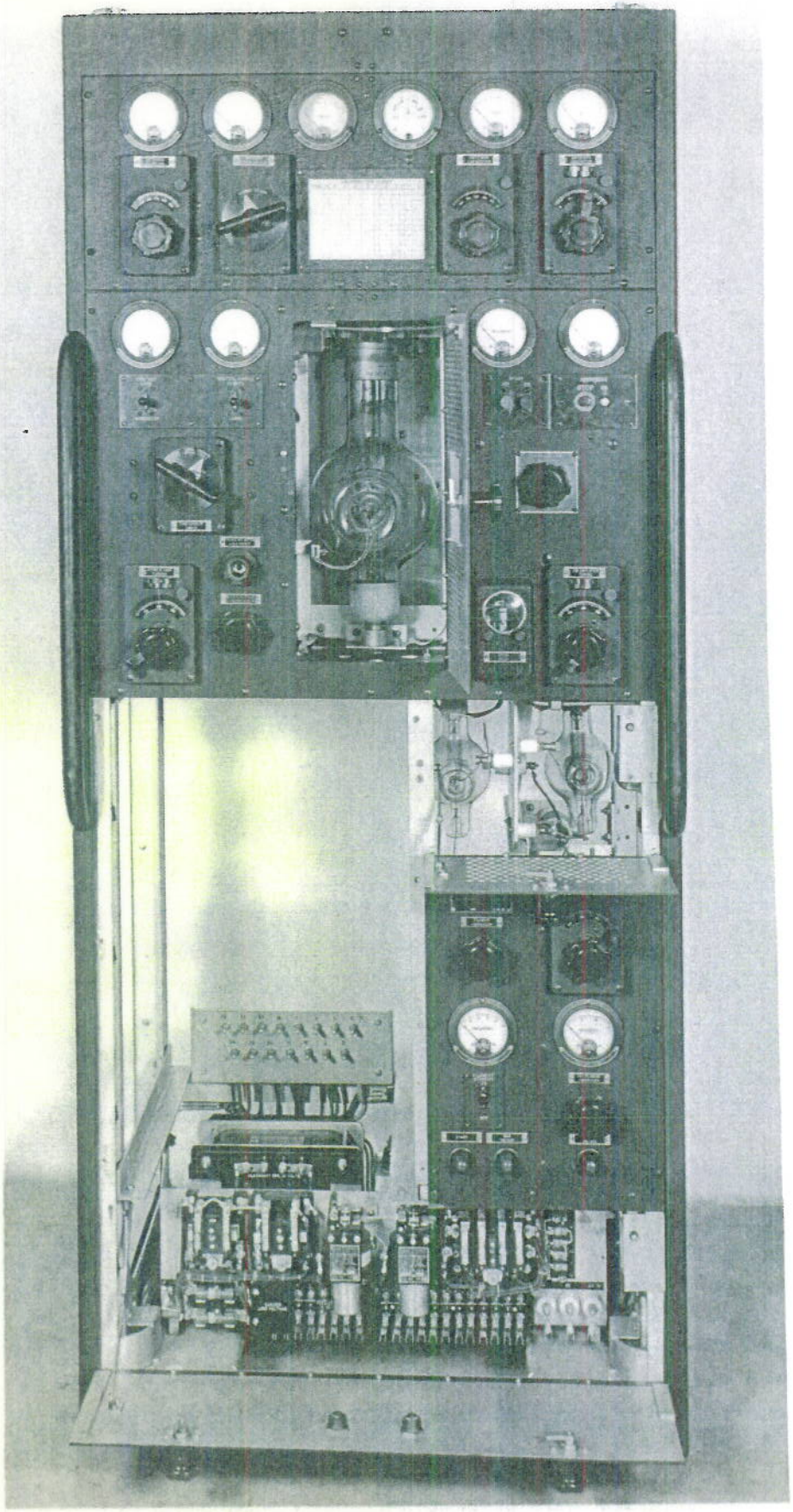


Plate 2

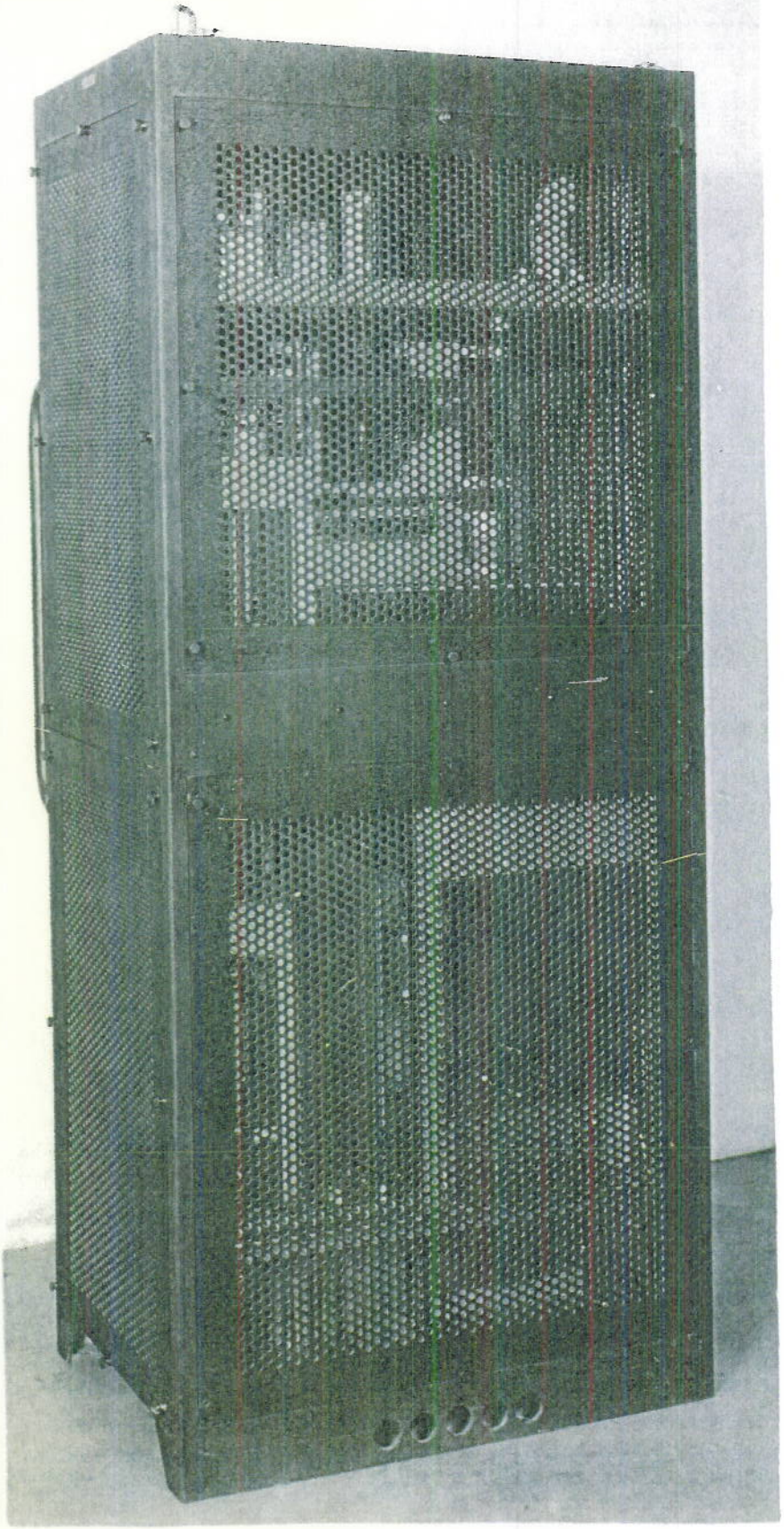
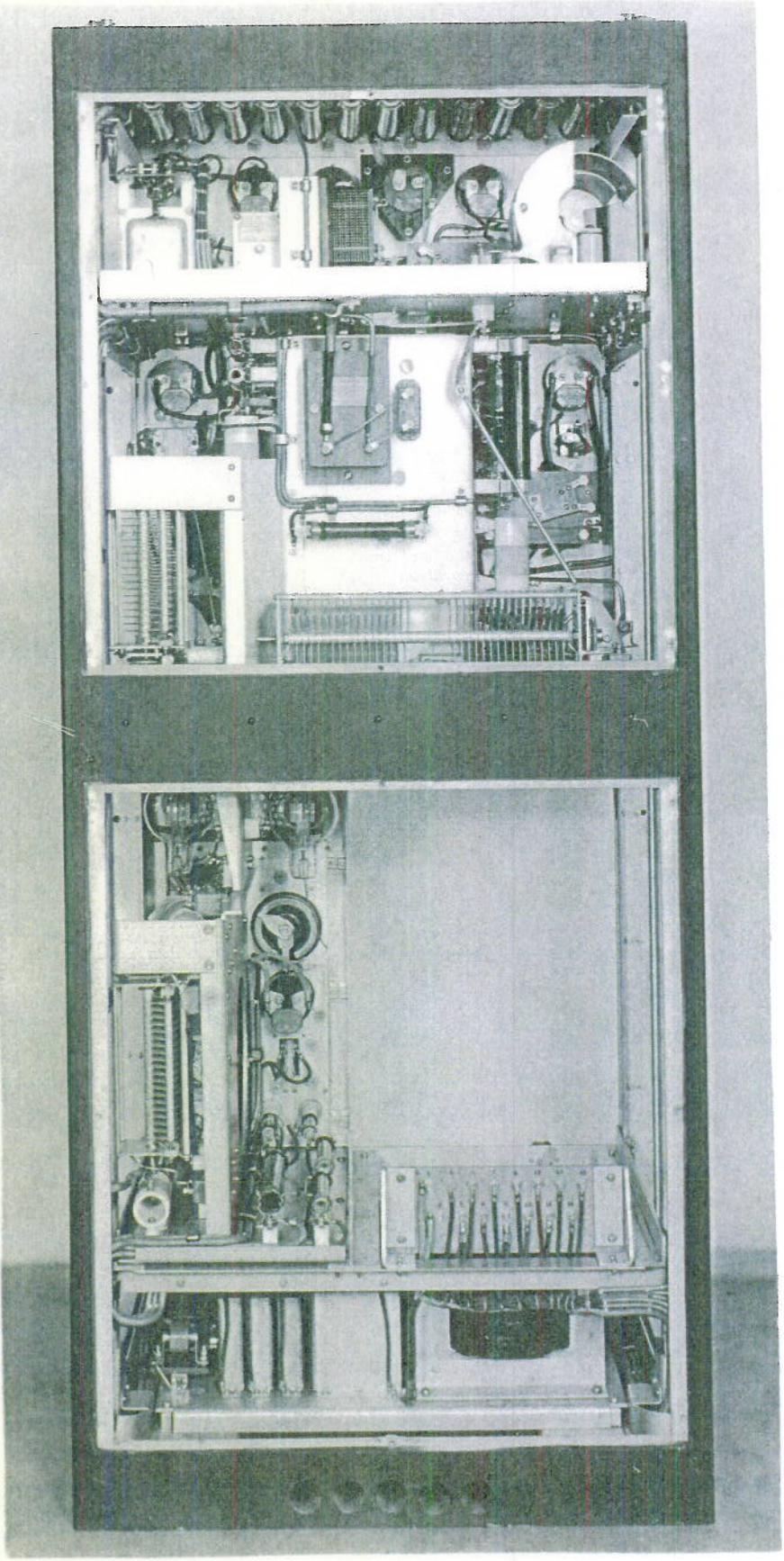
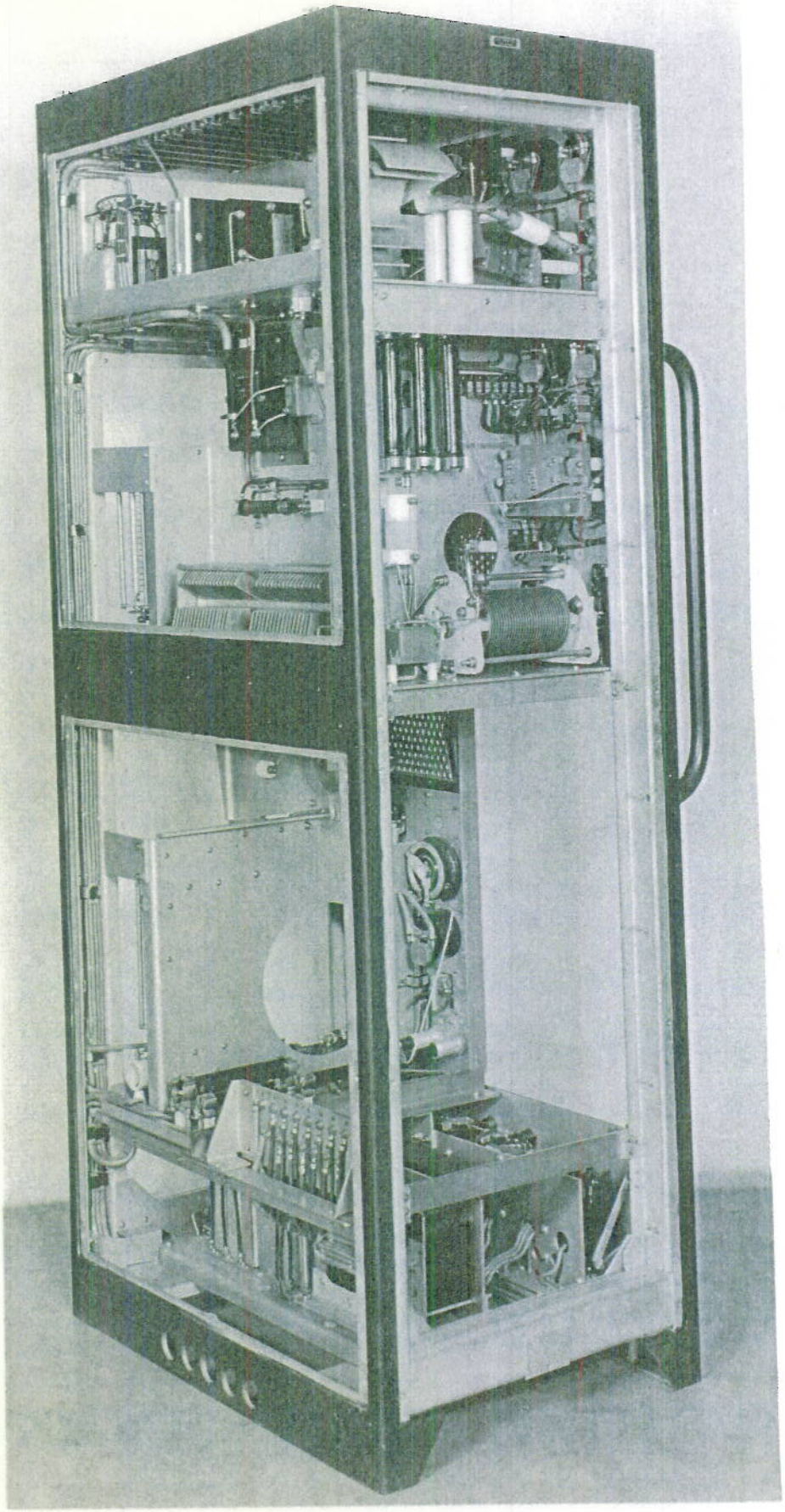


Plate 8





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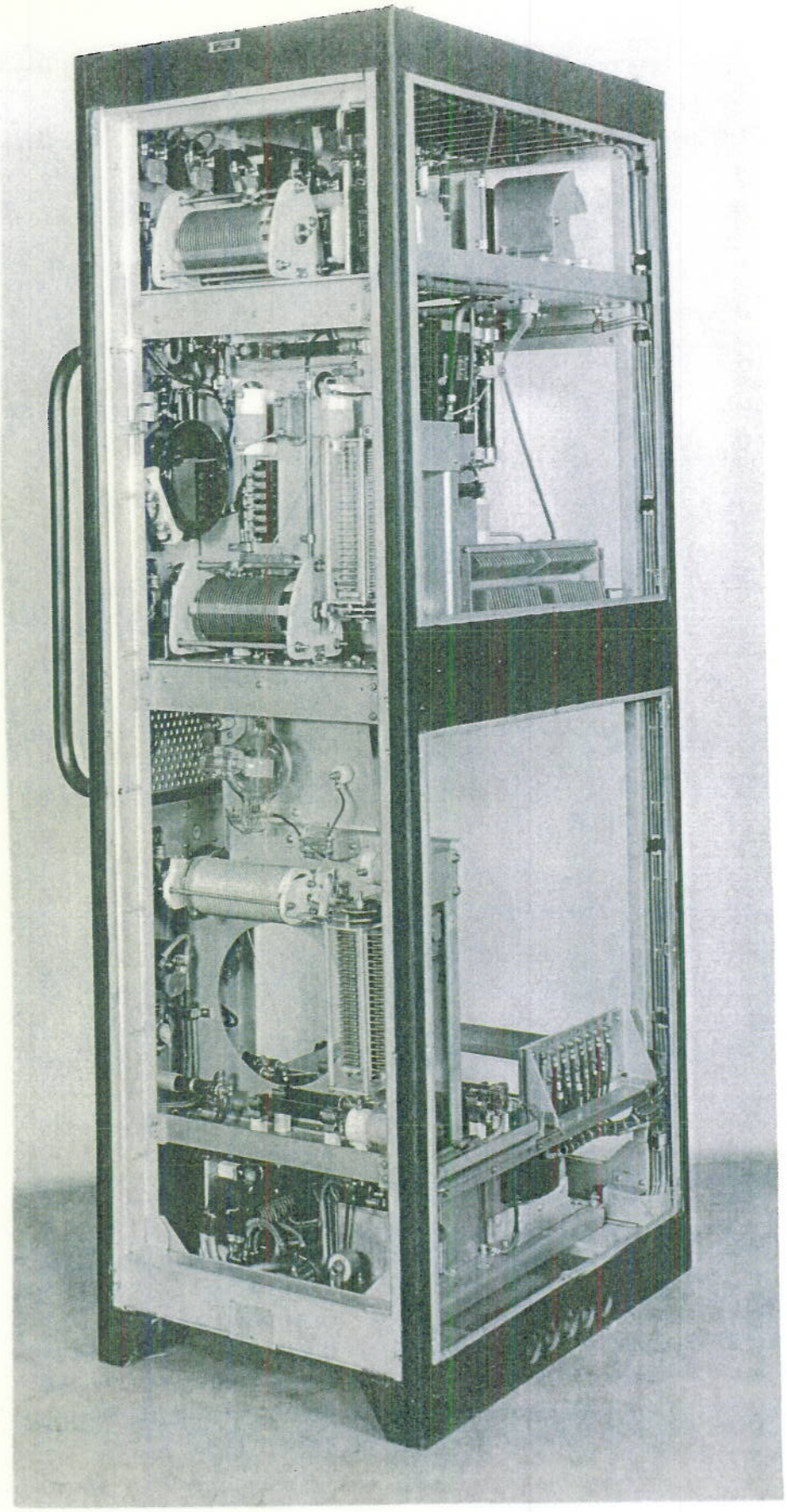
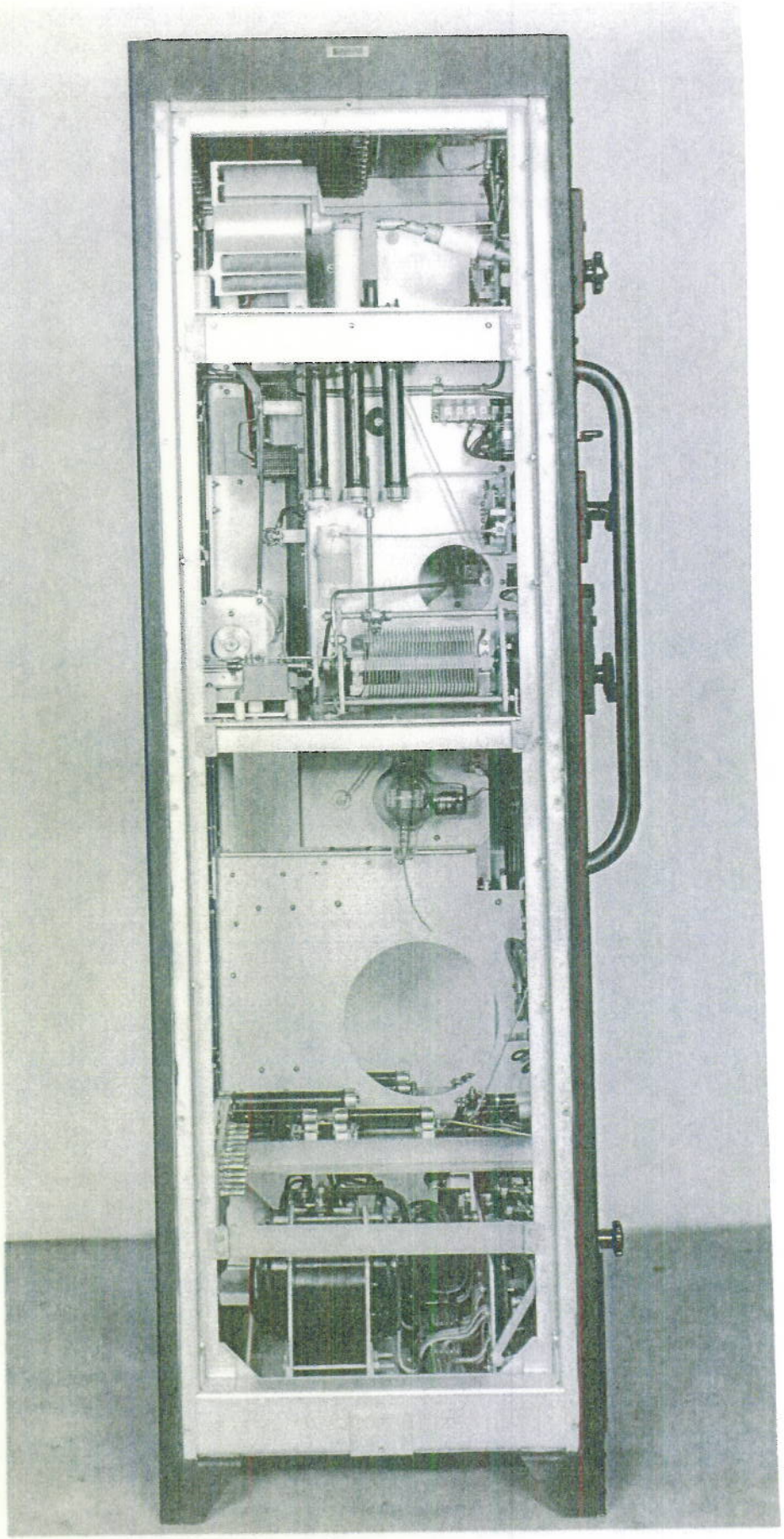


Plate 6



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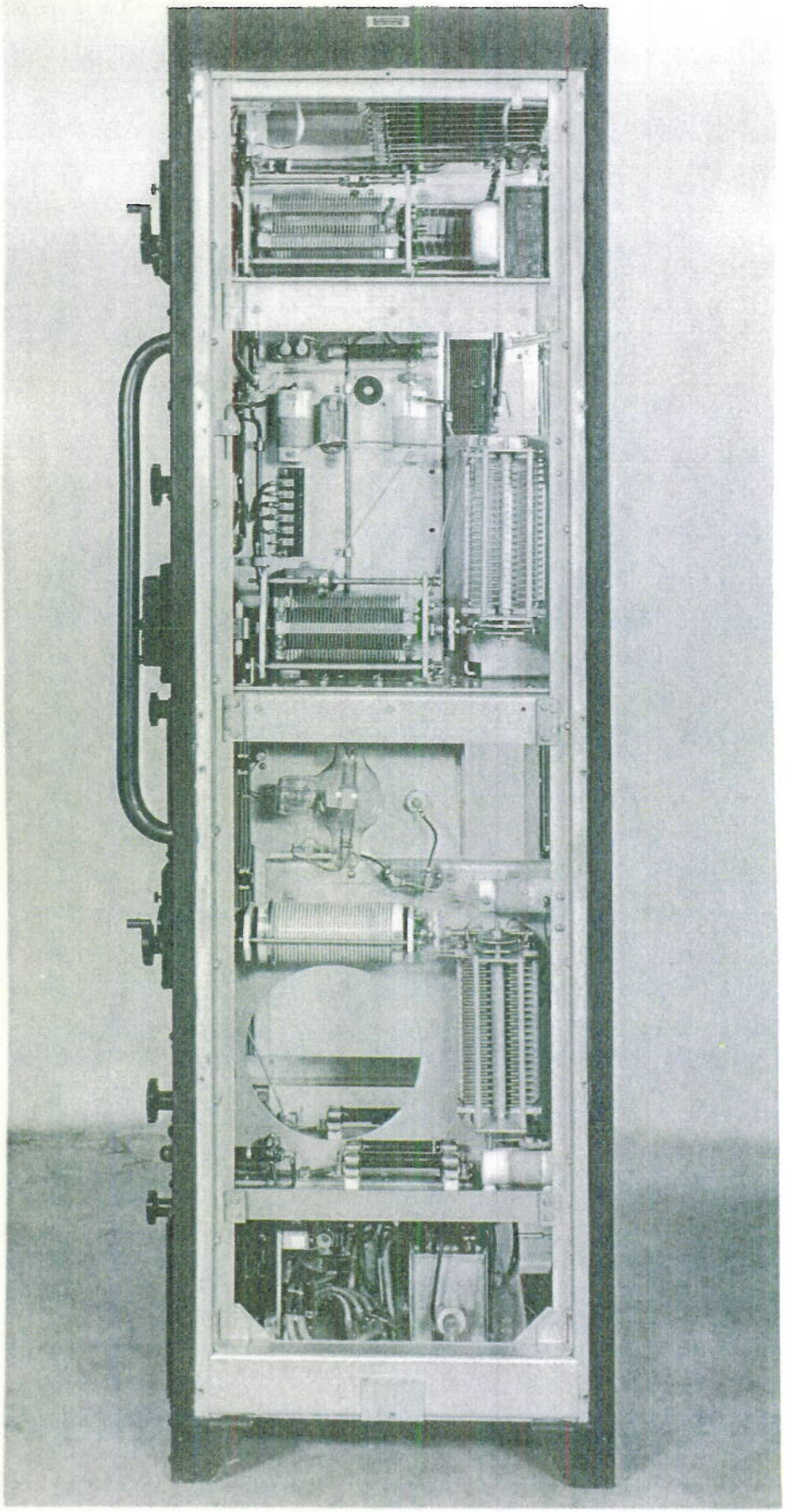
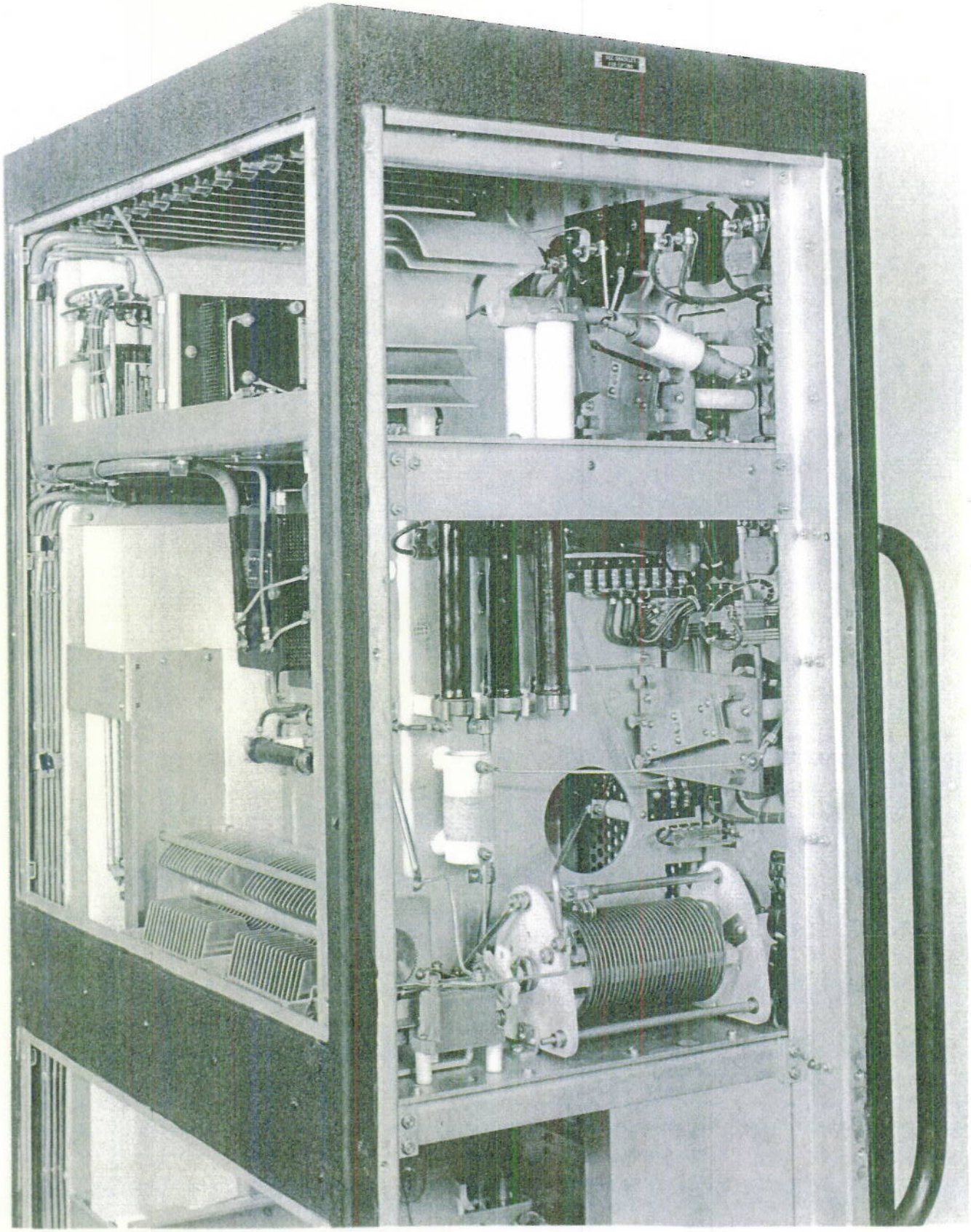


Plate 8



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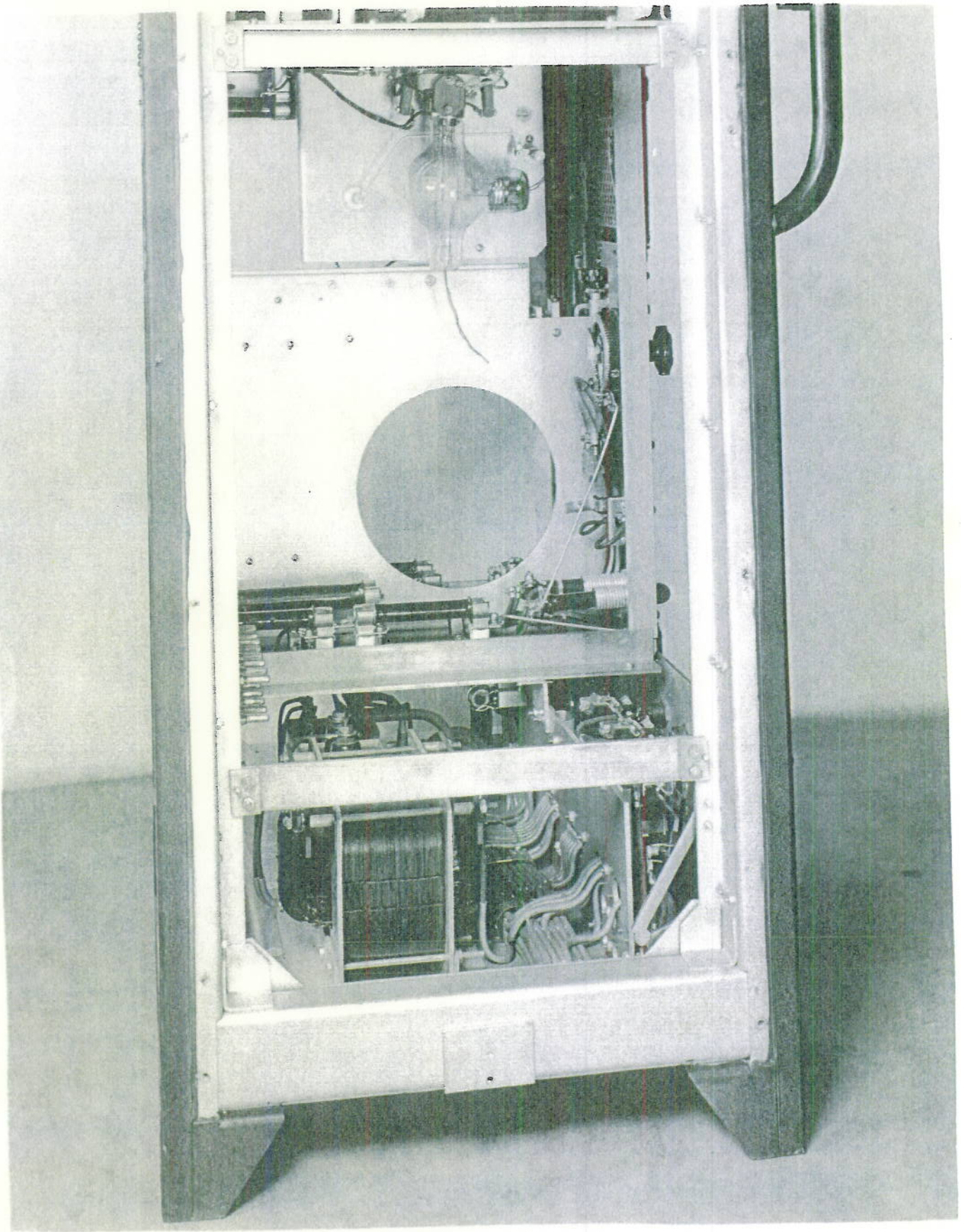

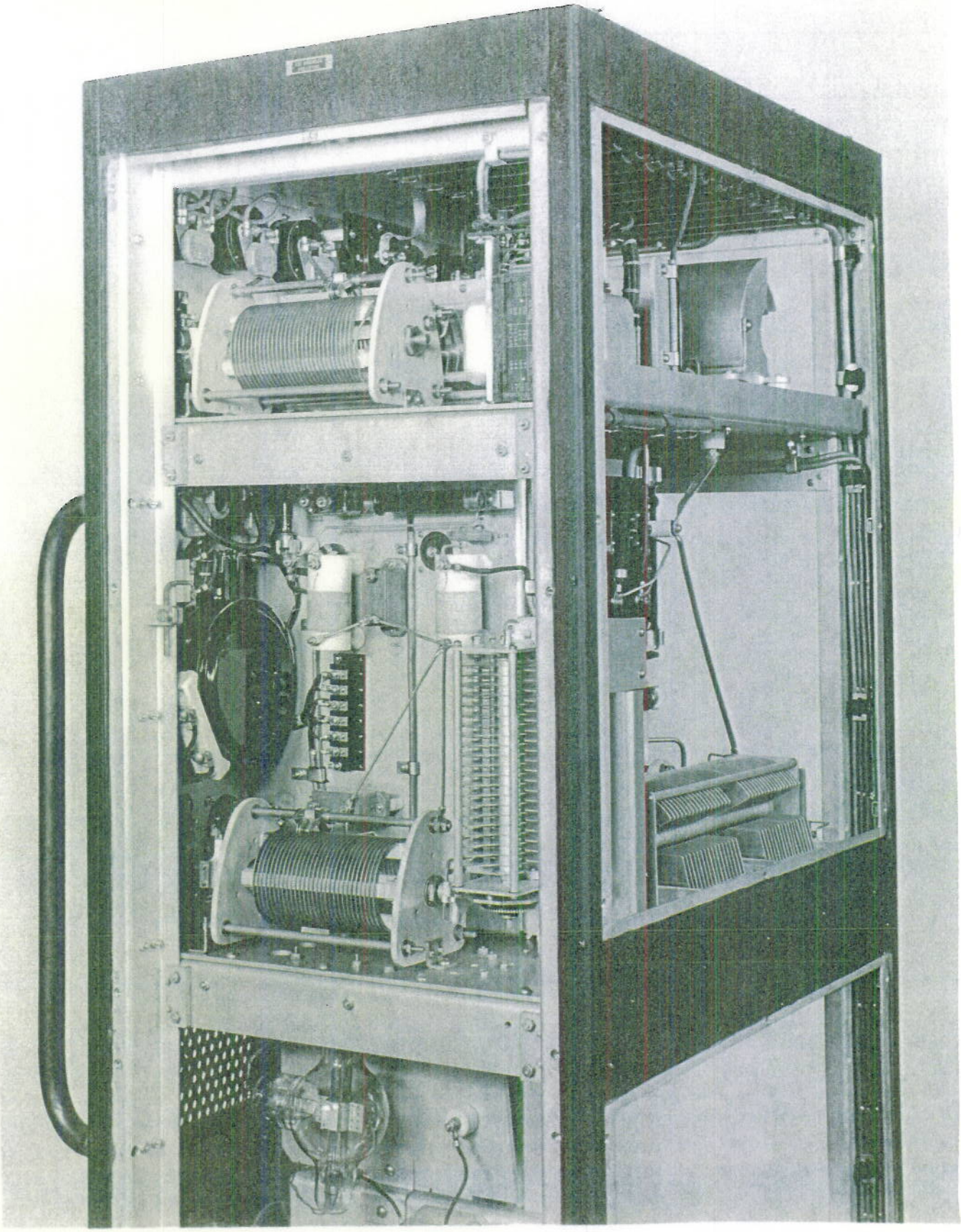

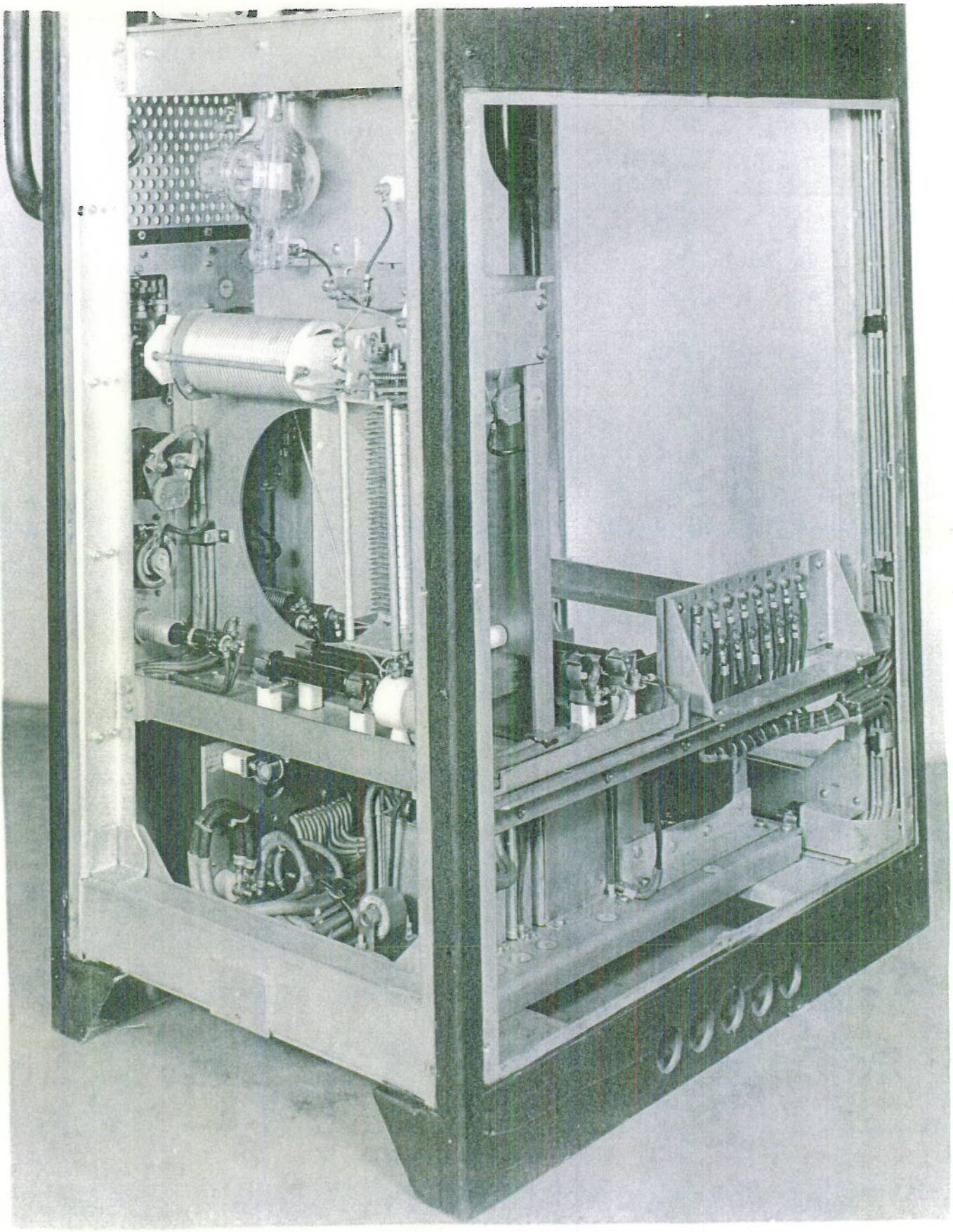

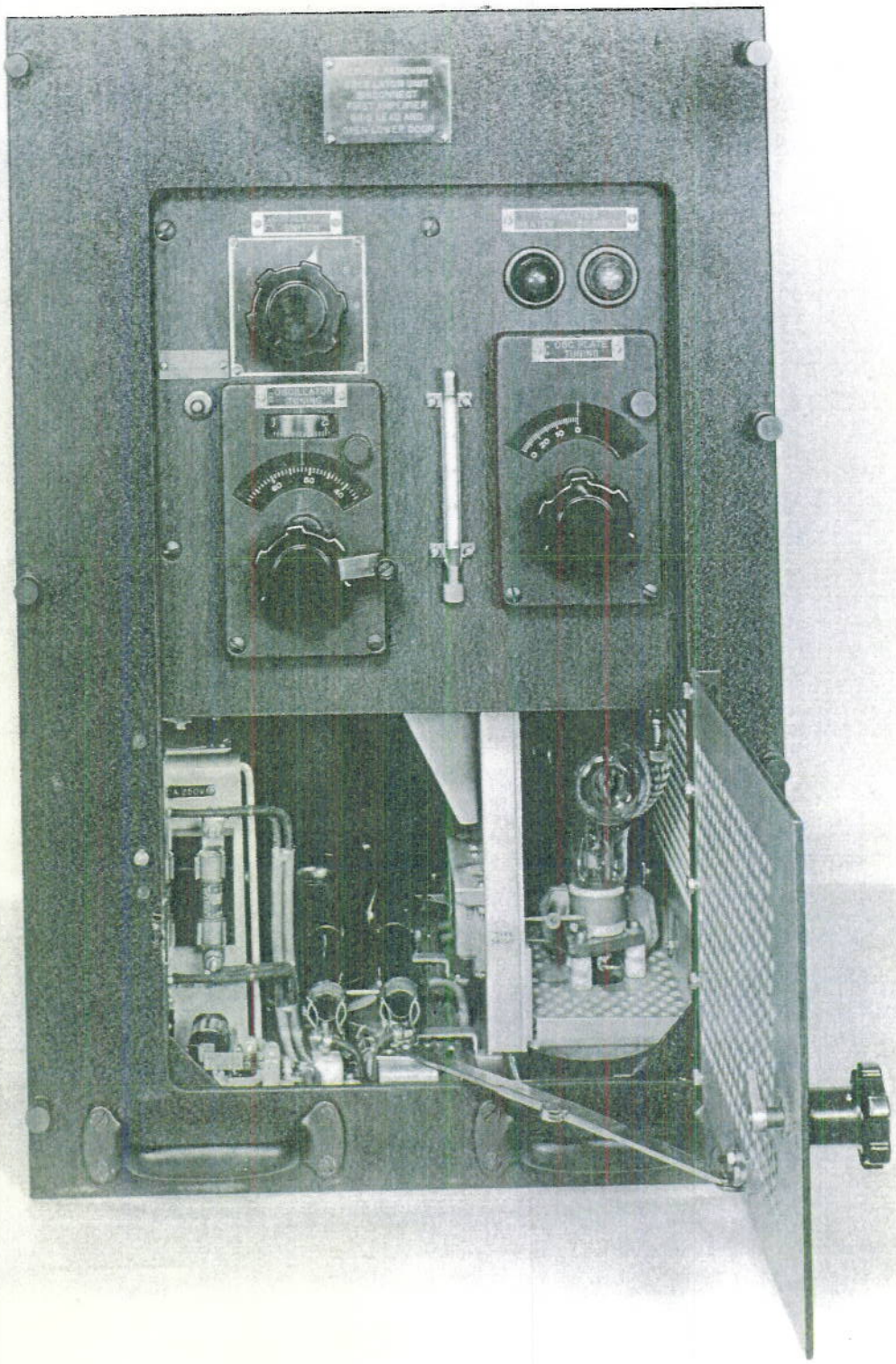

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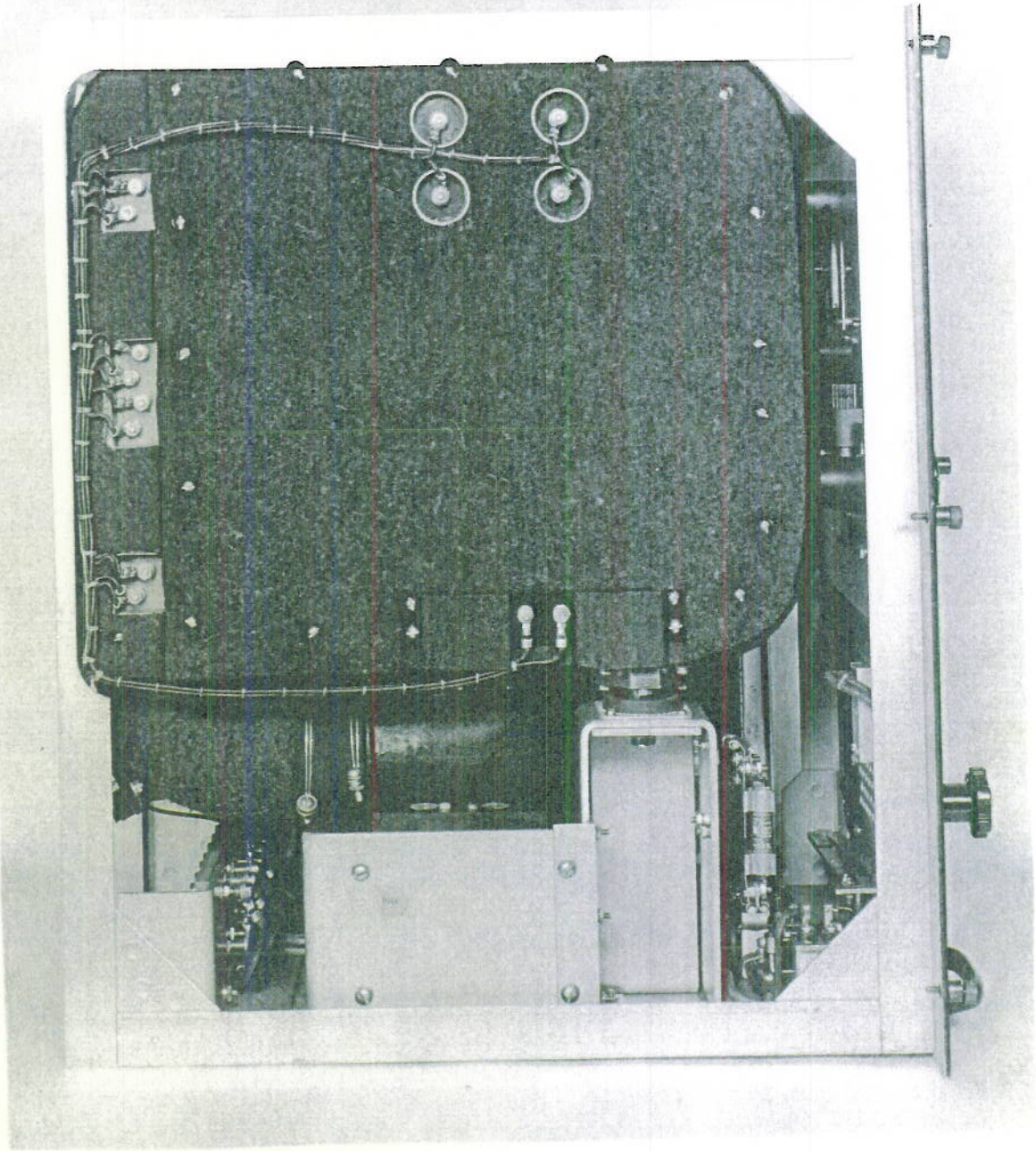


Plate 14

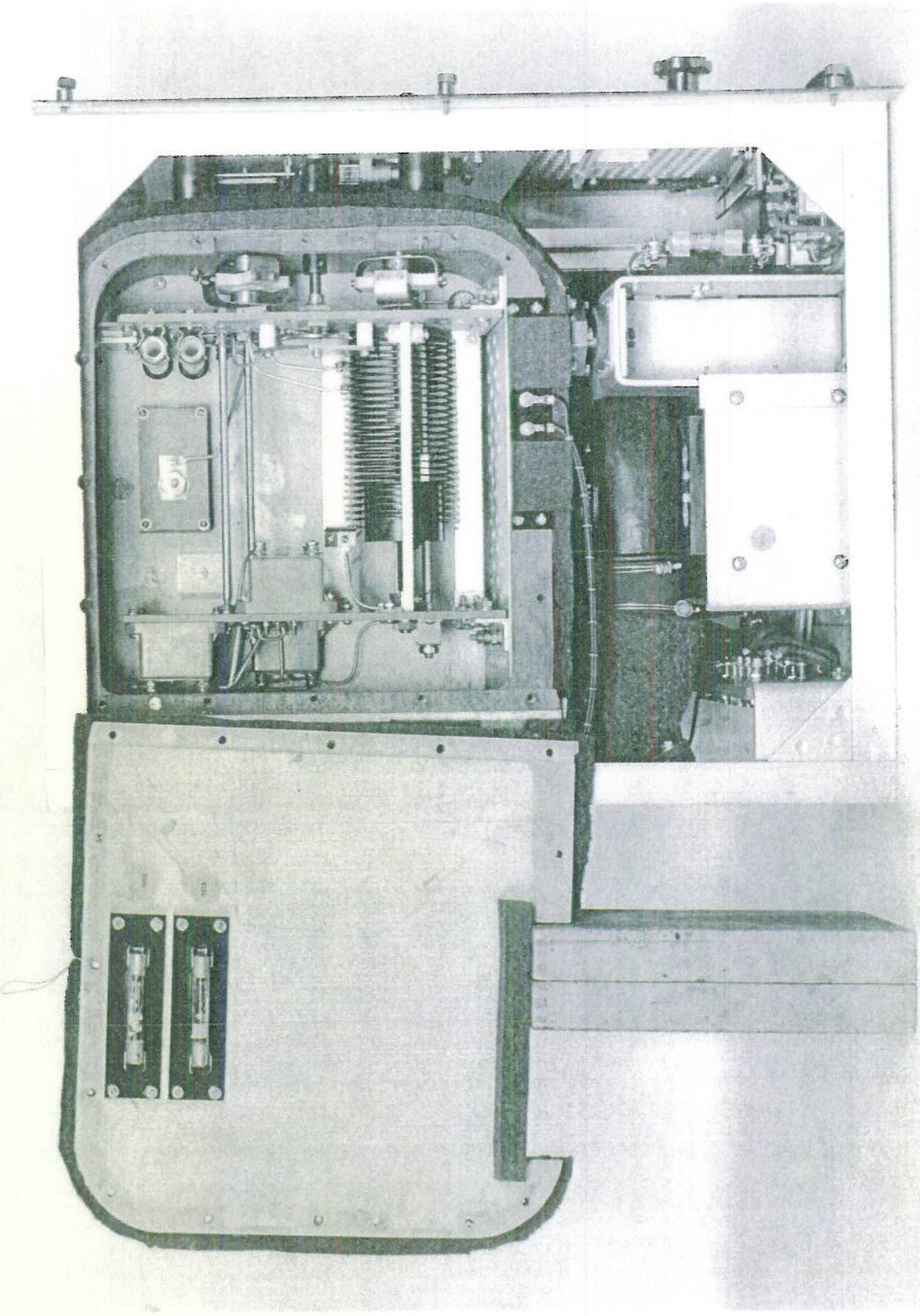


Plate 15

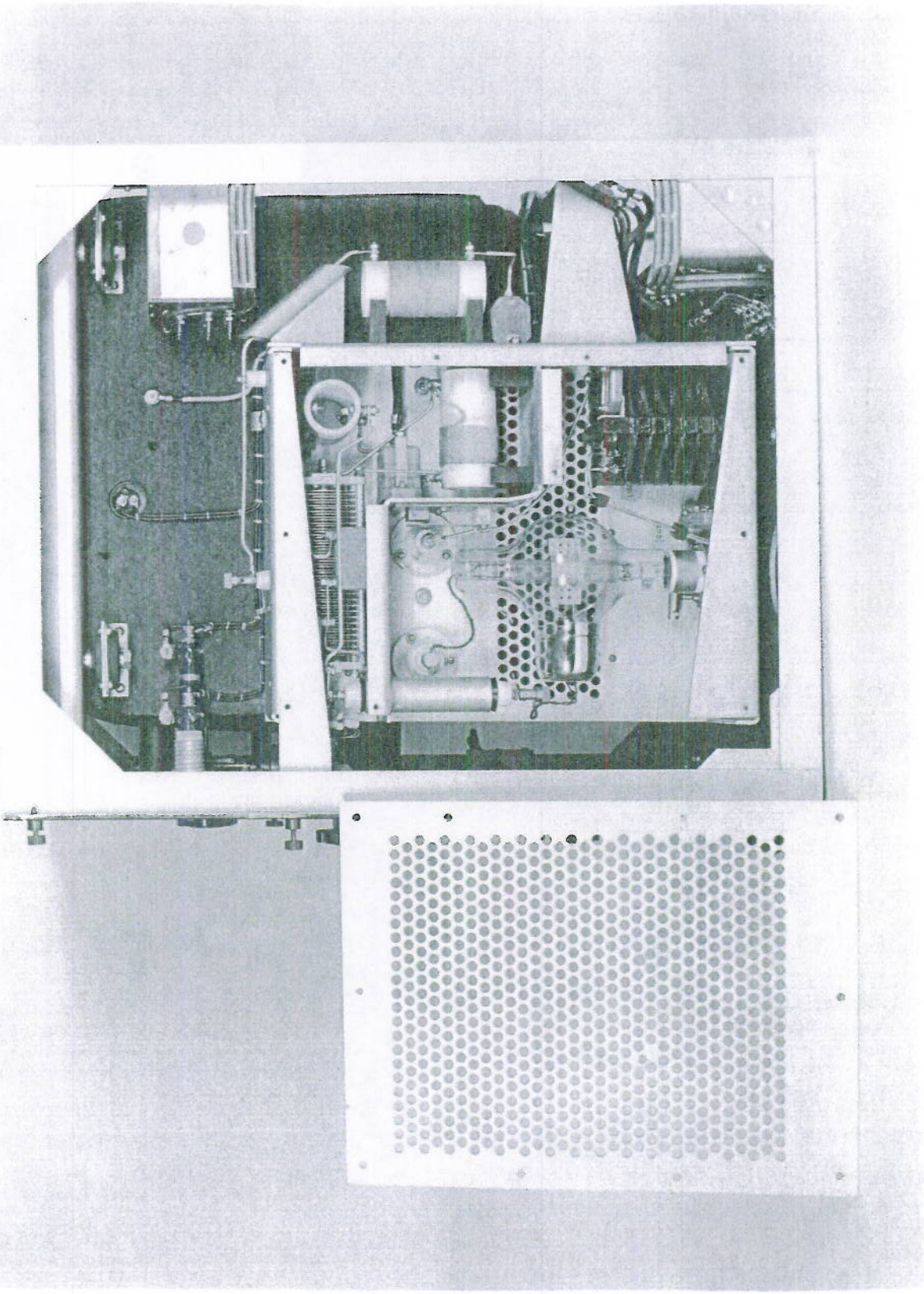


Plate 16

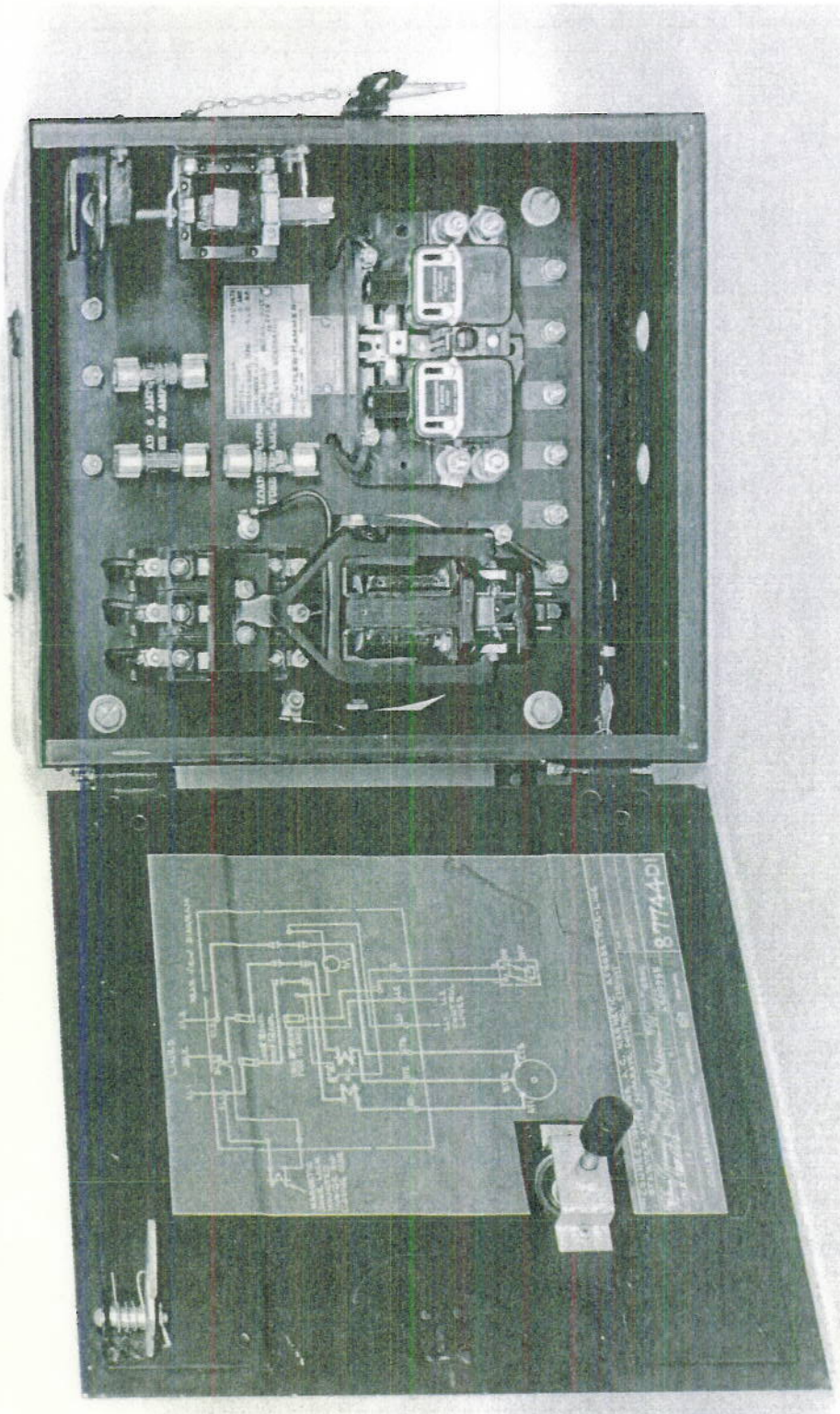
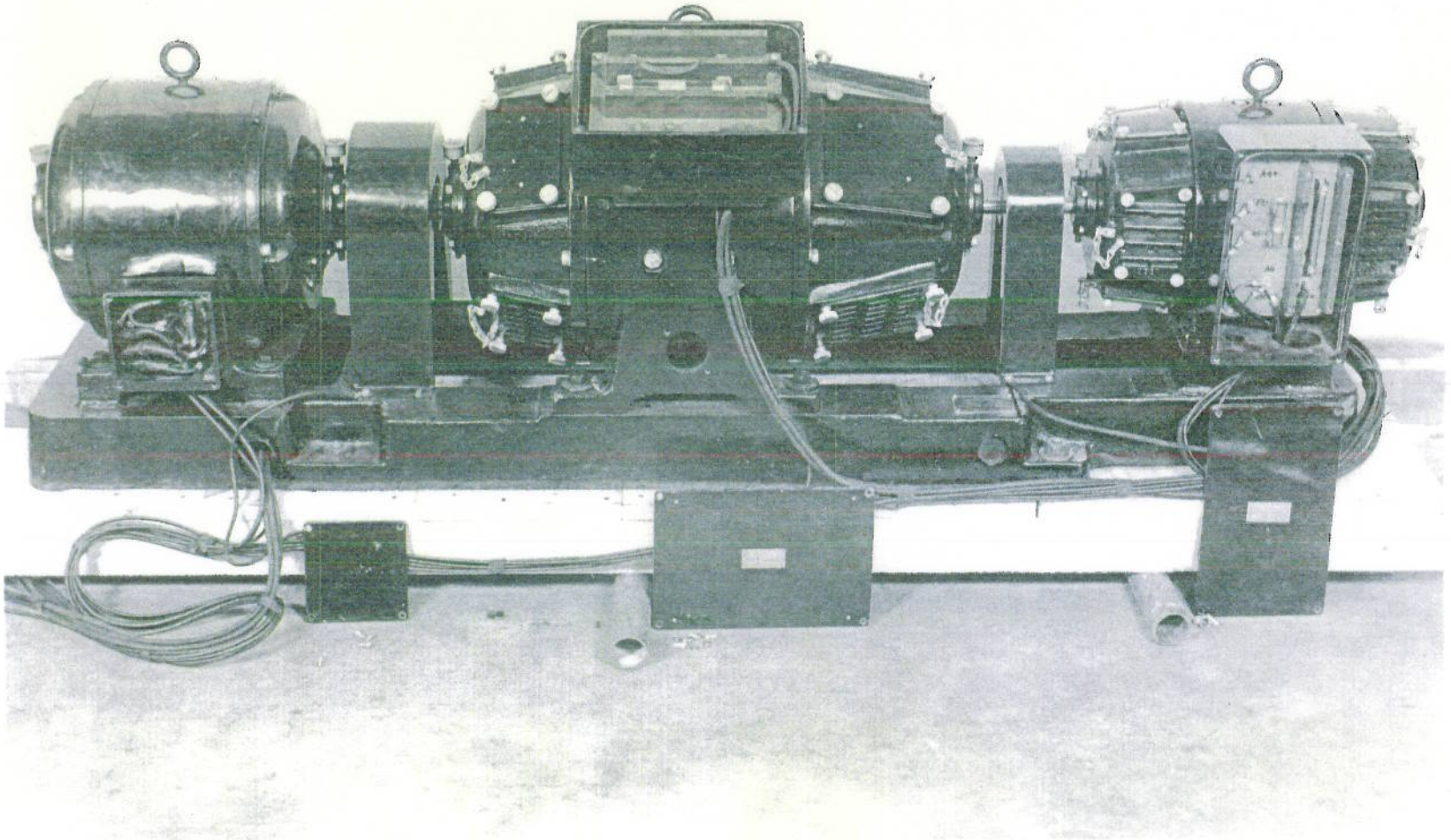


Plate 18

Plate 19



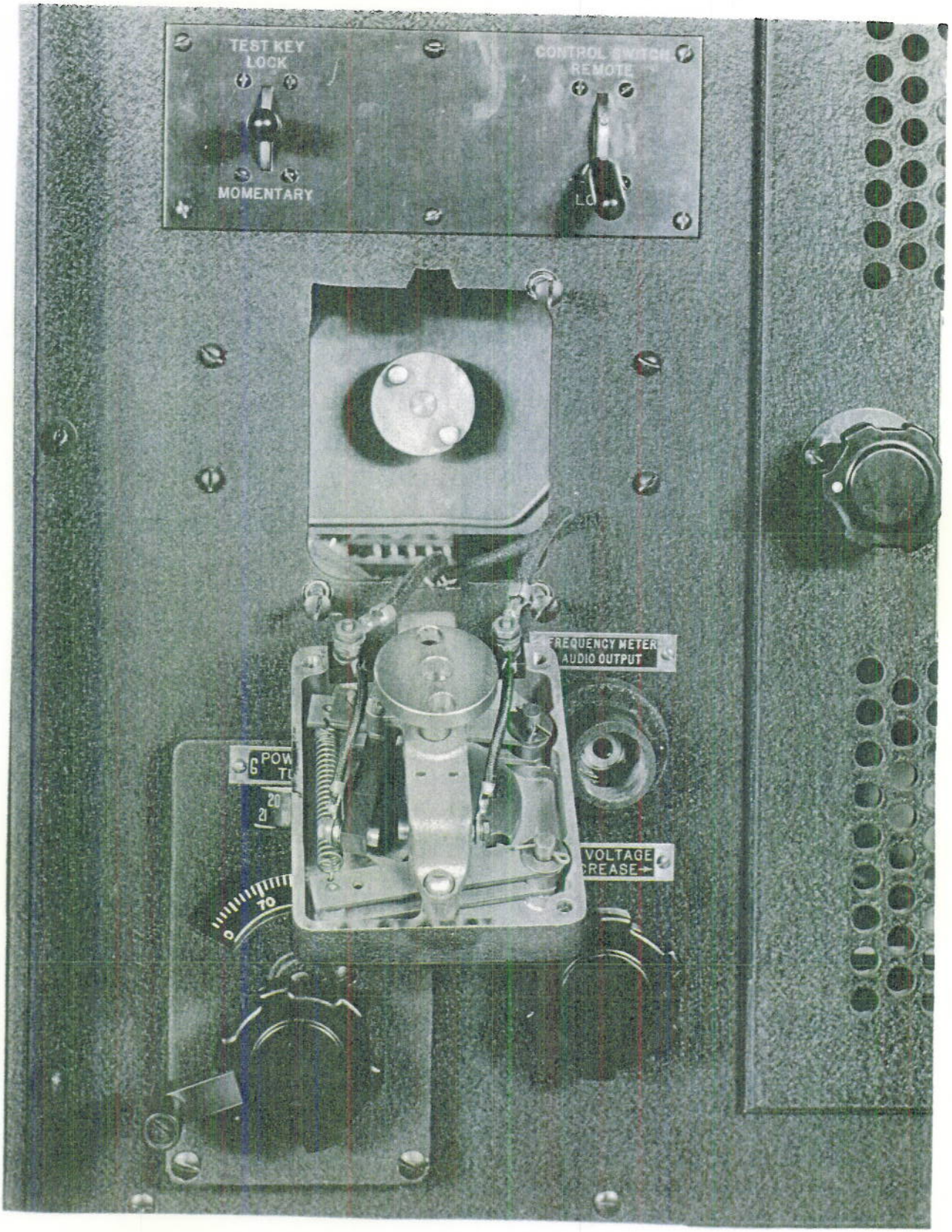

TEST KEY
LOCK
MOMENTARY
CONTROL SWITCH
REMOTE
FREQUENCY METER
AUDIO OUTPUT
VOLTAGE

Plate 21

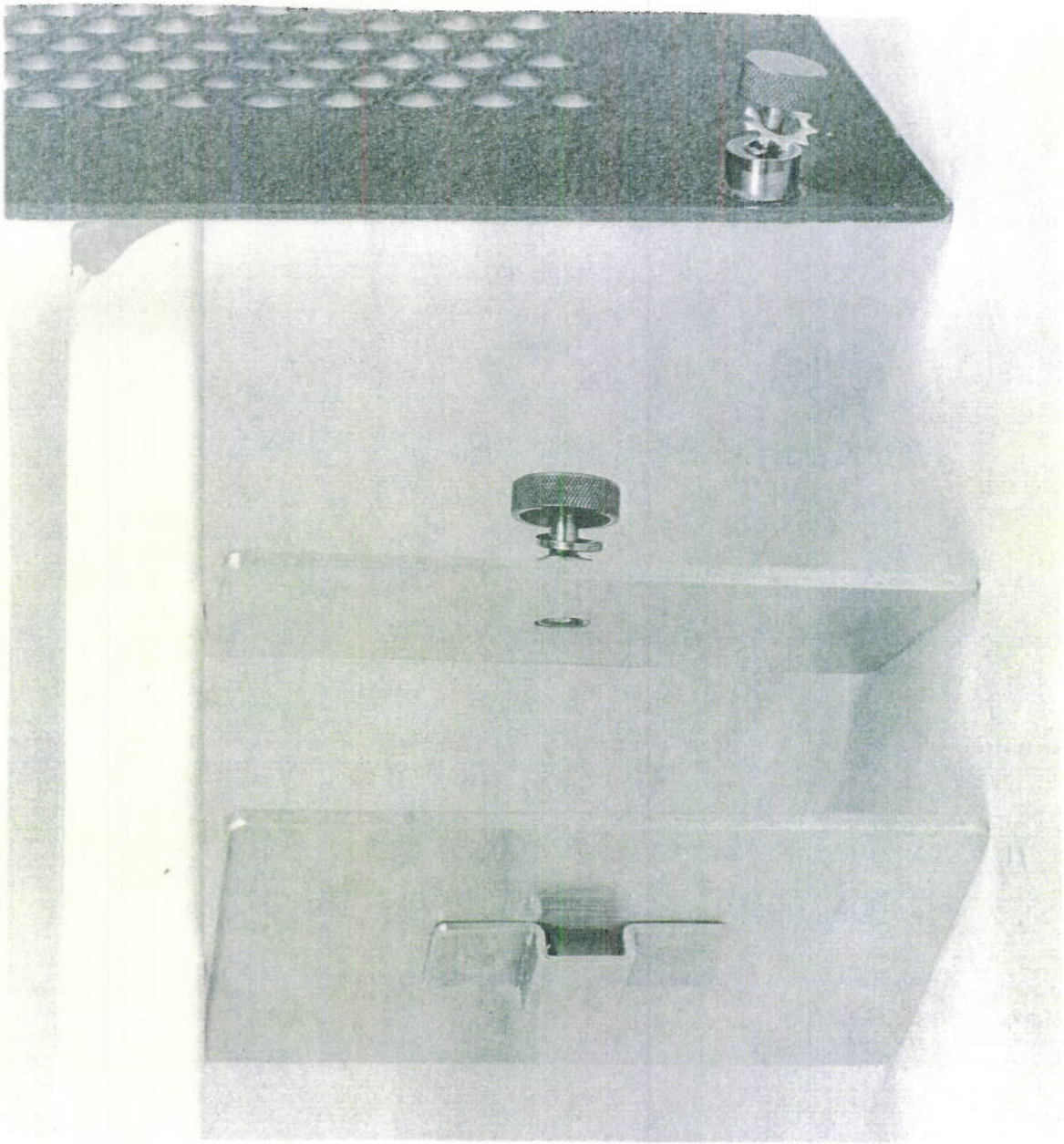


Plate 22

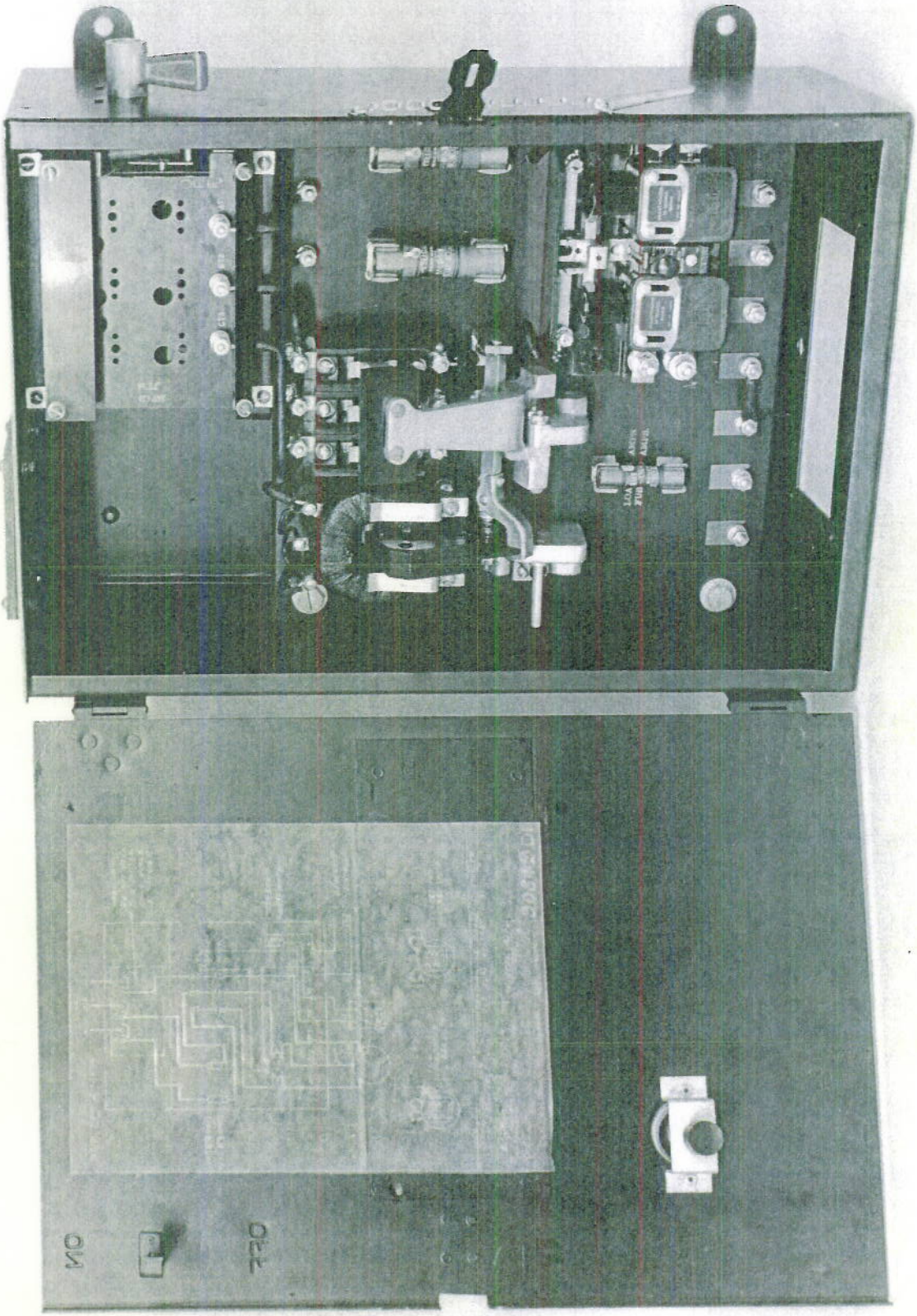


Plate 23

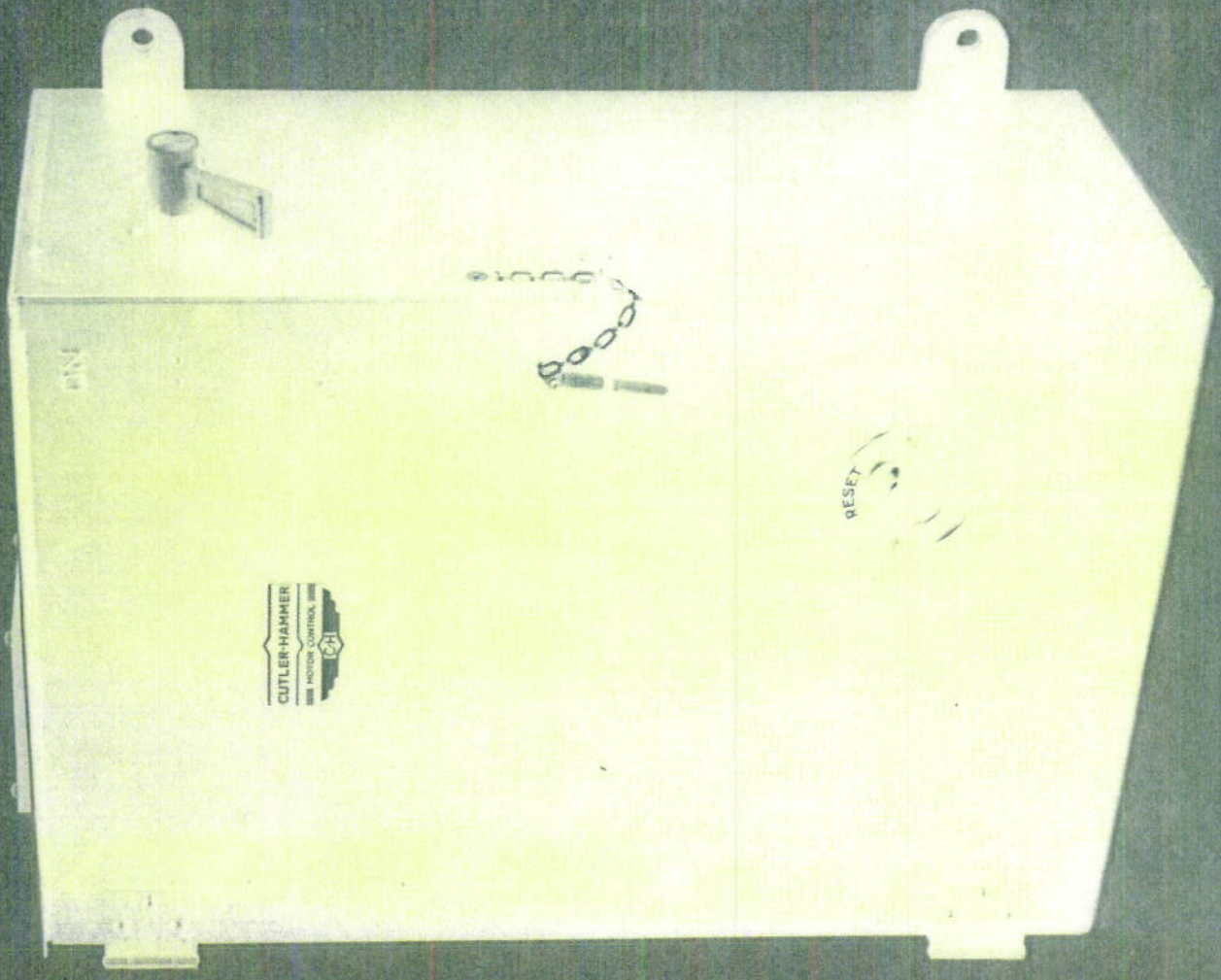


Plate 24

BELLEVUE, D. C.

DATE

PLATE 25

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

DATE

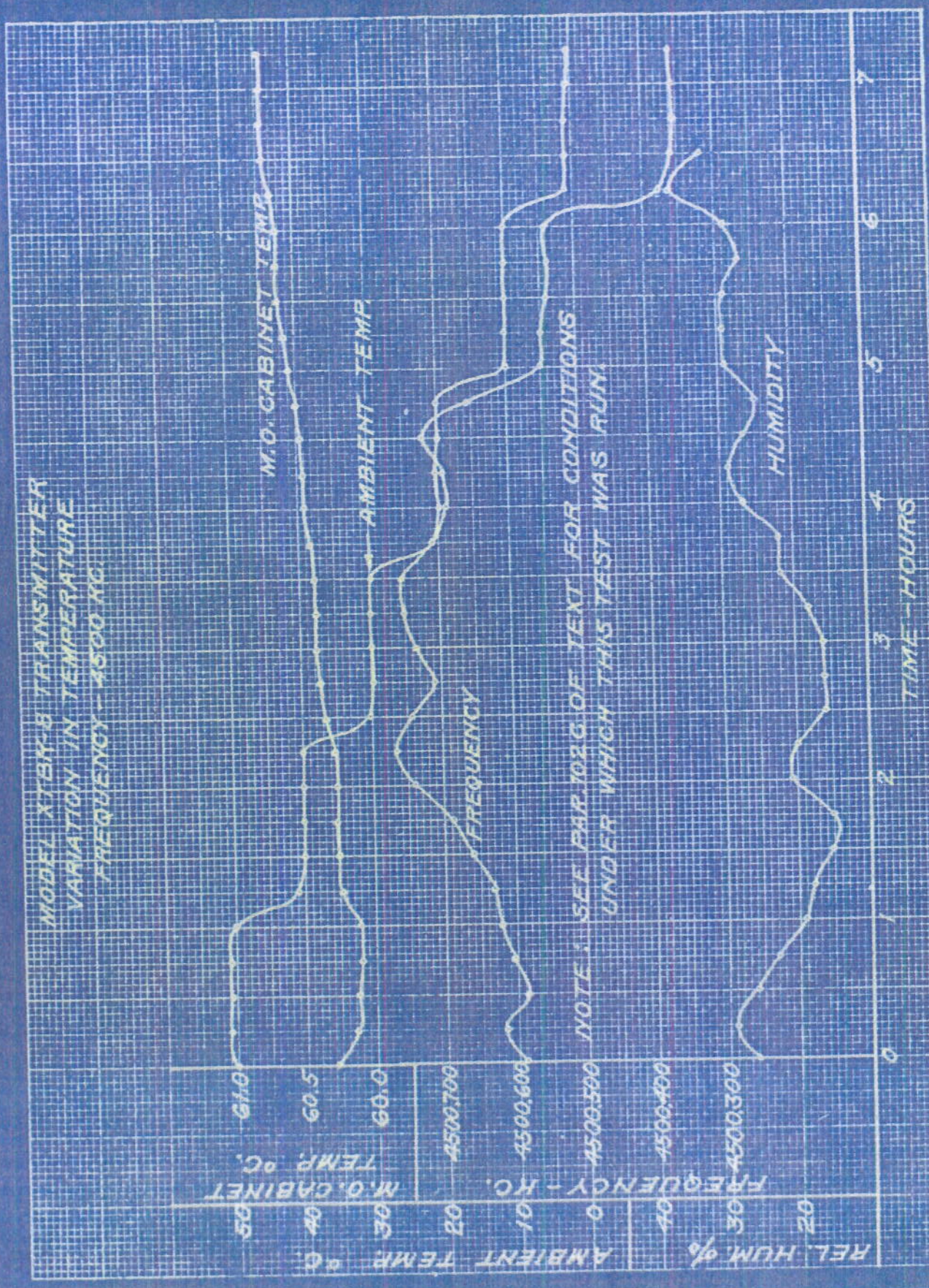


PLATE 26

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

DATE

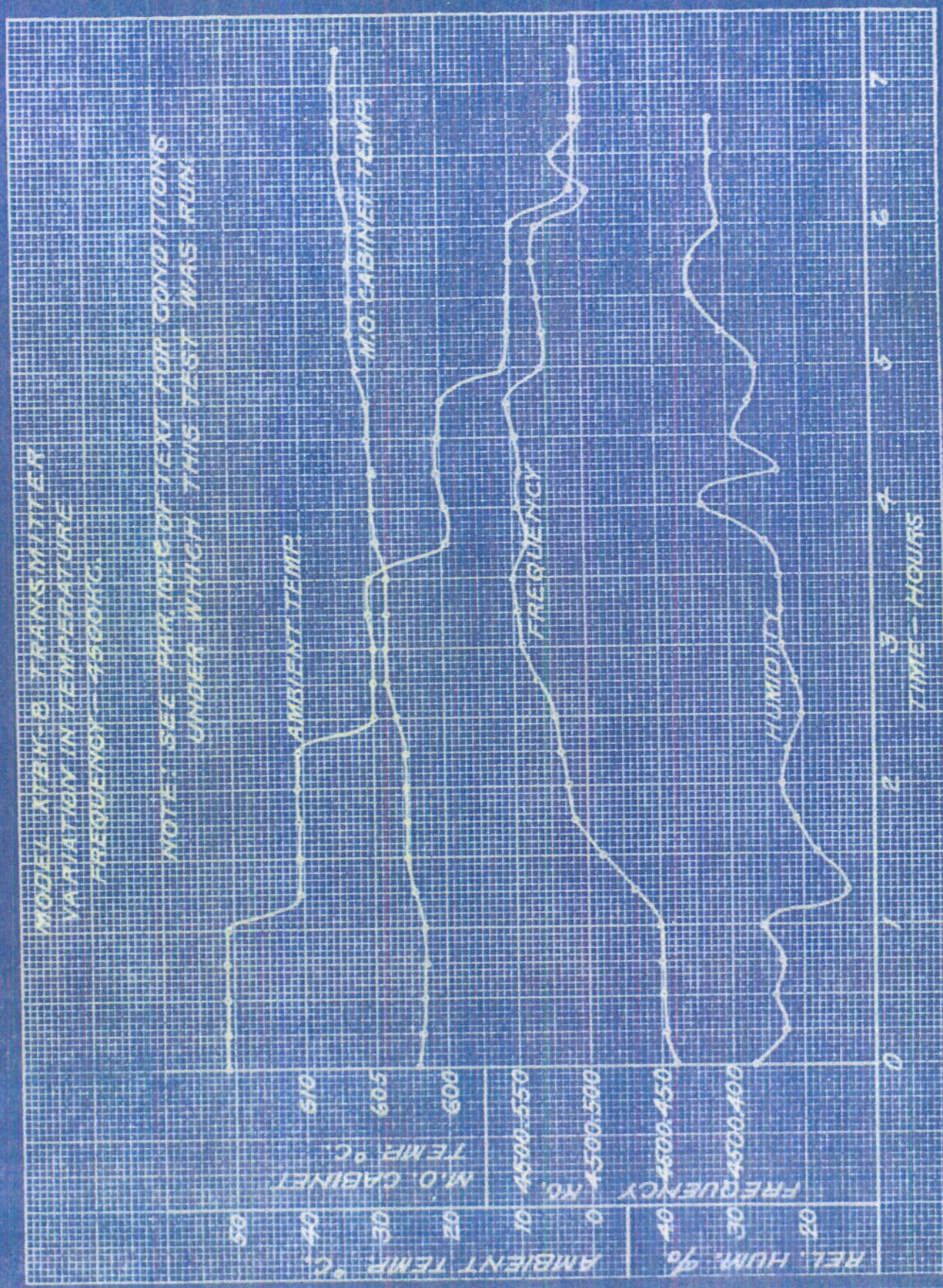


PLATE 27

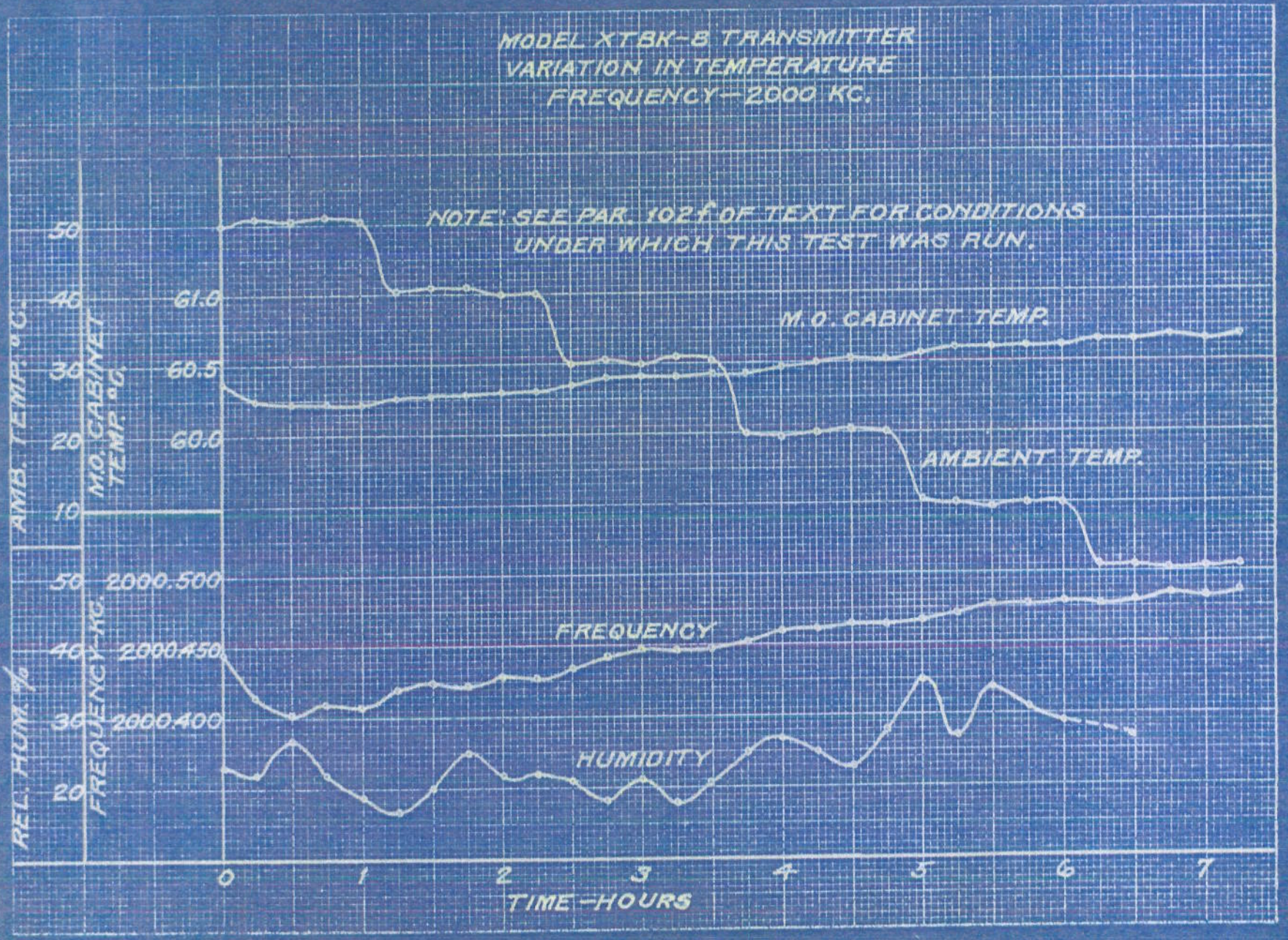

MODEL XTBK-8 TRANSMITTER
VARIATION IN TEMPERATURE
FREQUENCY—2000 KC.
NOTE: SEE PAR. 102 f OF TEXT FOR CONDITIONS UNDER WHICH THIS TEST WAS RUN.
M.O. CABINET TEMP.
AMBIENT TEMP.
FREQUENCY
HUMIDITY
REL. HUM. %
AMB. TEMP. °C.
M.O. CABINET TEMP. °C.
FREQUENCY—KC.
50
40
30
20
10
61.0
60.5
60.0
2000.500
2000.450
2000.400
0
1
2
3
4
5
6
7
TIME—HOURS

PLATE 28

BELLEVUE, D. C.

DATE

PLATE 29

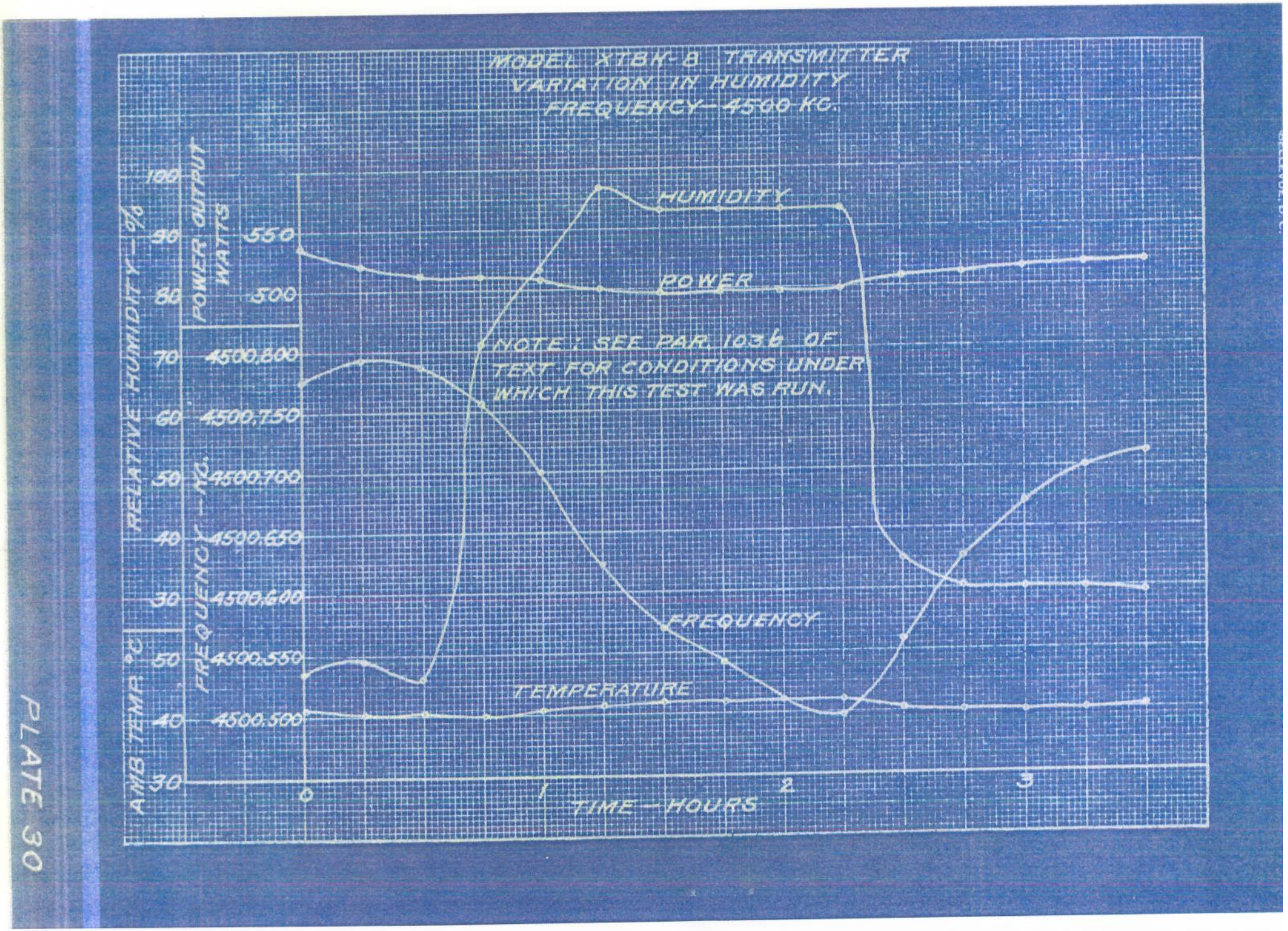

MODEL XTBK-8 TRANSMITTER
VARIATION IN HUMIDITY
FREQUENCY-4500 KC.
HUMIDITY
POWER
FREQUENCY
TEMPERATURE
NOTE: SEE PAR. 1036 OF TEXT FOR CONDITIONS UNDER WHICH THIS TEST WAS RUN.
RELATIVE HUMIDITY-%
POWER OUTPUT WATTS
FREQUENCY-KC.
AMB. TEMP. °C
100
90
80
70
60
50
40
30
550
500
4500.800
4500.750
4500.700
4500.650
4500.600
4500.550
4500.500
50
40
0
1
2
3
TIME-HOURS

PLATE 30

MODEL NUMBER-8 TRANSMITTER
VARIATION IN HUMIDITY
FREQUENCY 4500 KC.
NOTE: SEE PAR 103c OF
TEXT FOR CONDITIONS
UNDER WHICH THIS TEST
WAS RUN
HUMIDITY
POWER
FREQUENCY
TEMPERATURE
TIME-HOURS
0
1
2
3
AMB. TEMP °C.
RELATIVE HUMIDITY %
FREQUENCY - KC
POWER OUTPUT
WATTS

PLATE 31

MODEL XCER-8 TRANSMITTER
VARIATION IN HUMIDITY
FREQUENCY—4500 KC.
POWER
HUMIDITY
NOTE: SEE PAR 13d OF
TEST FOR CONDITIONS
UNDER WHICH THIS TEST
WAS RUN.
FREQUENCY
TEMPERATURE
TIME—HOURS
2
1
0
AMB. TEMP. °C.
RELATIVE HUMIDITY %
FREQUENCY—KC.
POWER OUTPUT
WATTS

PLATE 32

BELLEVUE, D. C.

PLATE 33

BELLEVUE, D. C.

DATE

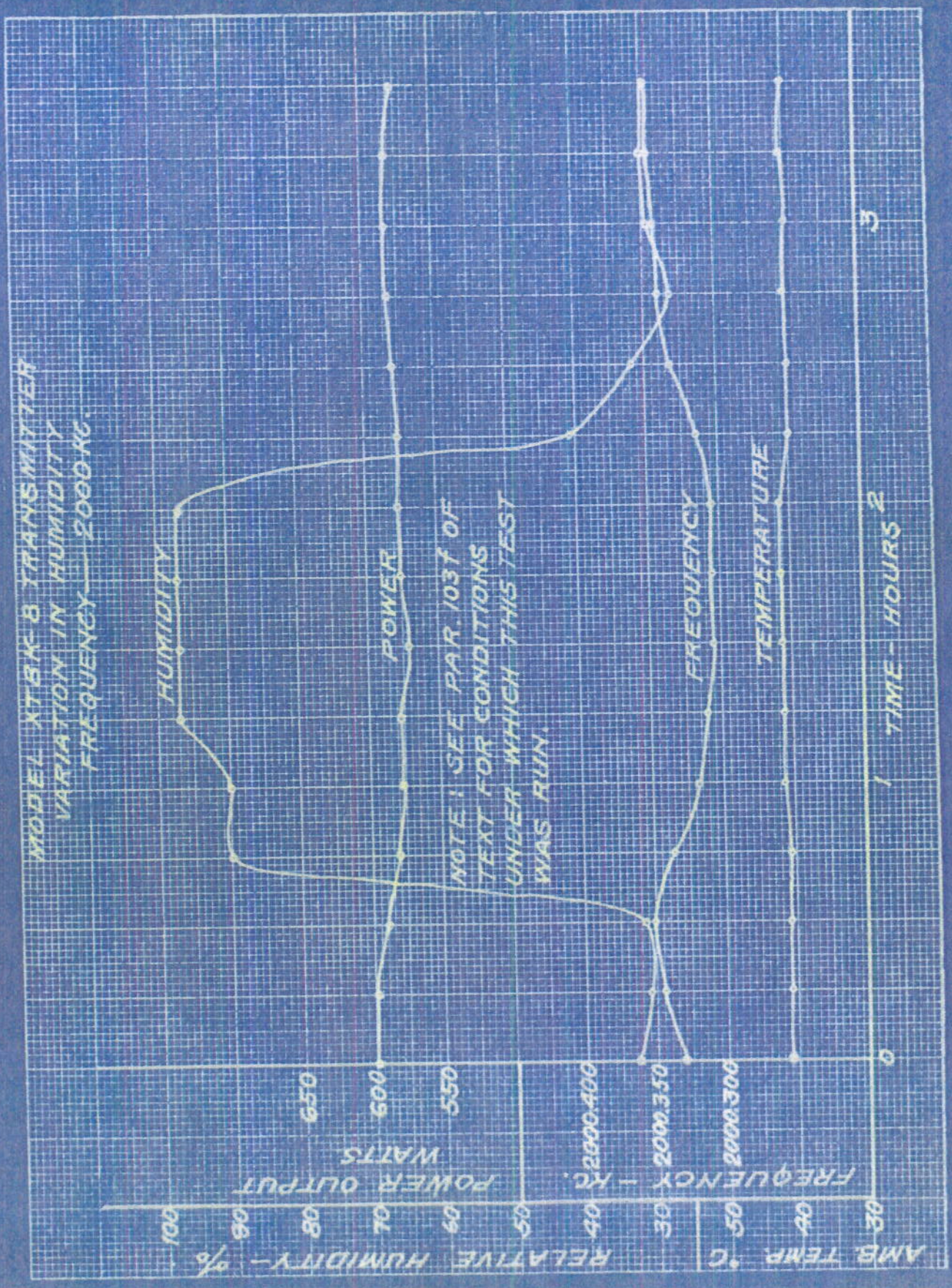


PLATE 34

MODEL XTBK-8 TRANSMITTING EQUIPMENT
INCLINATION TEST AT 2000 KC
EQUIPMENT INCLINED FROM FRONT TO BACK

500 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 10 CYCLES PER DIVISION

End Inclination

10

Frequency variation
due to heat cycle -
3 cycles.

Start Inclination

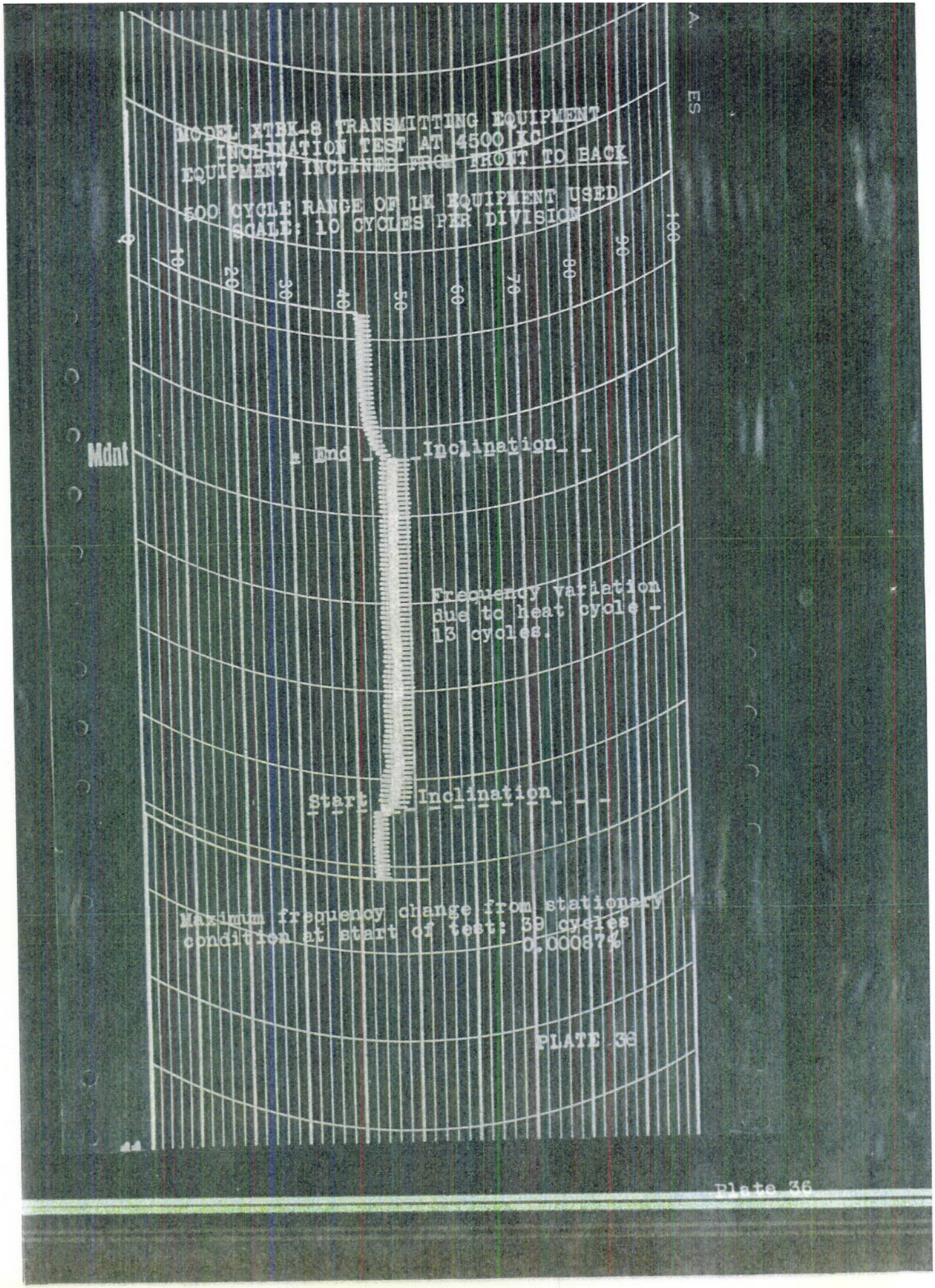
Maximum frequency change from stationary
condition at start of test: 9 cycles,
0.00045%

0 10 20 30 40 50 60 70 80 90 100

8

PLATE 35

THE ESTERLINE-ANGUS CO., INDIANAPOLIS, IND., U.S.A. CHART No. 4313-D


MODEL XTBL-8 TRANSMITTING EQUIPMENT
INCLINATION TEST AT 4500 KC
EQUIPMENT INCLINED FROM FRONT TO BACK
500 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 10 CYCLES PER DIVISION
Mdnt
End Inclination
Frequency variation due to heat cycle - 13 cycles.
Start Inclination
Maximum frequency change from stationary condition at start of test: 39 cycles 0.00087%
PLATE 36

7

MODEL NTHK-8 TRANSMITTING EQUIPMENT
INCLINATION TEST AT 2000 KC
EQUIPMENT INCLINED FROM SIDE TO SIDE

500 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 10 CYCLES PER DIVISION

End Inclination

0 10 20 30 40 50 60 70 80 90 100

Start Inclination

6

Maximum frequency change from stationary condition at start of test: 4 cycles
0.0007%

PLATE 37

JS CO., INDIANAPOLIS, IND., U.S.A. ES

4

MODEL XTBL-8 TRANSMITTING EQUIPMENT
INCLINATION TEST AT 4500 KC
EQUIPMENT INCLINED FROM SIDE TO SIDE

500 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 10 CYCLES PER DIVISION

Stop Inclination

Frequency variation due
to heat cycle - 13 cycles

0 10 20 30 40 50 60 70 80 90 100

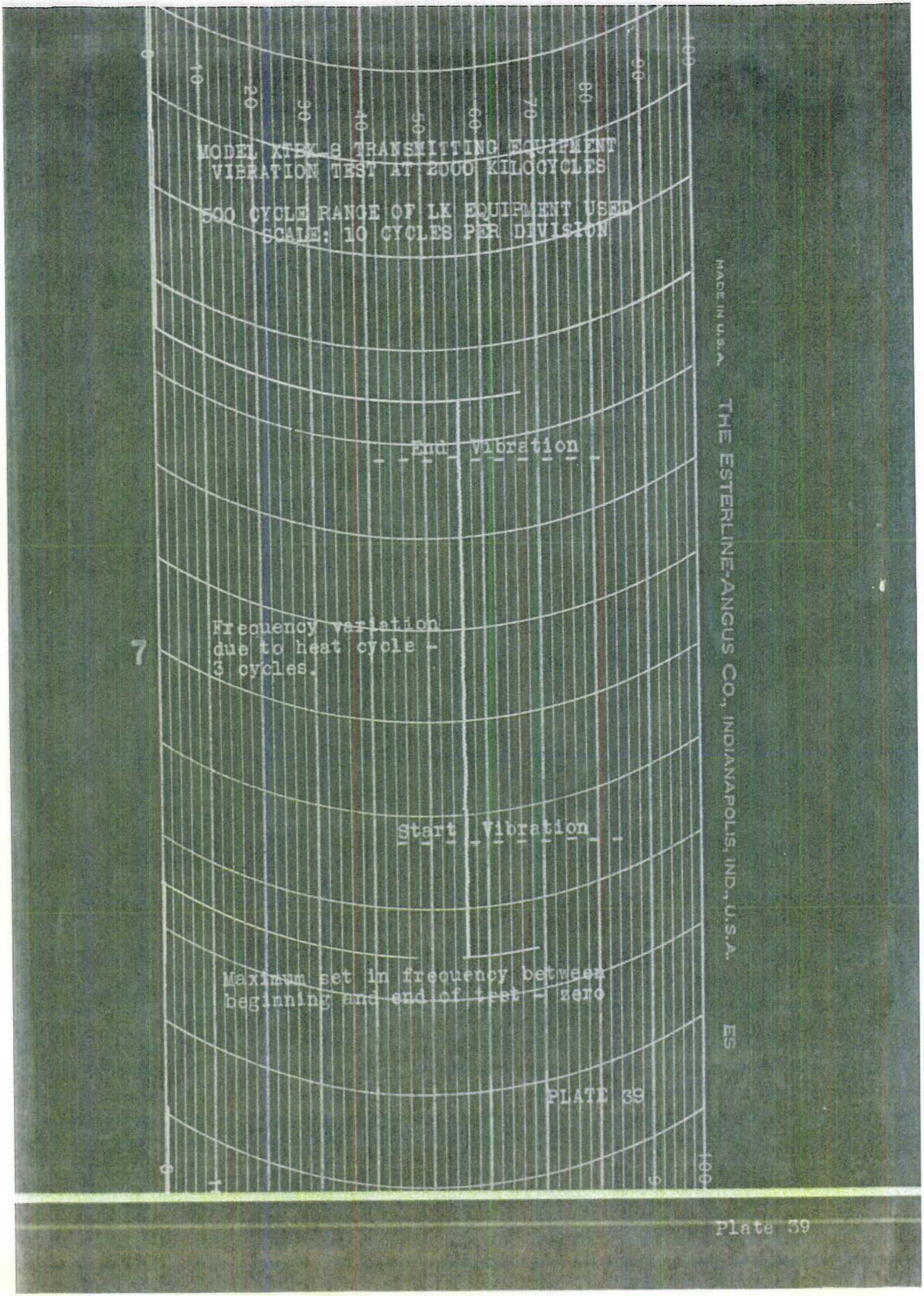
Start Inclination

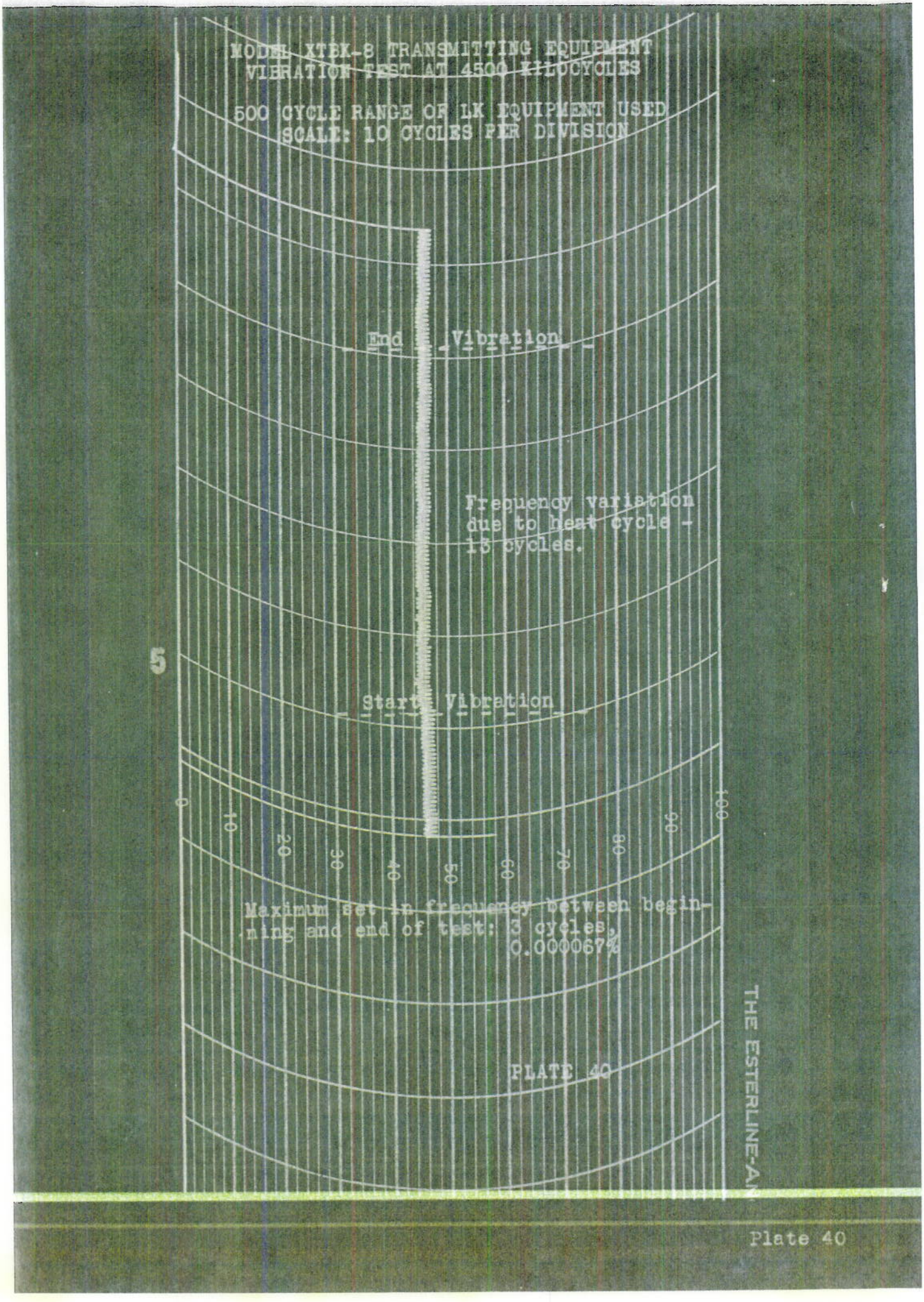
3

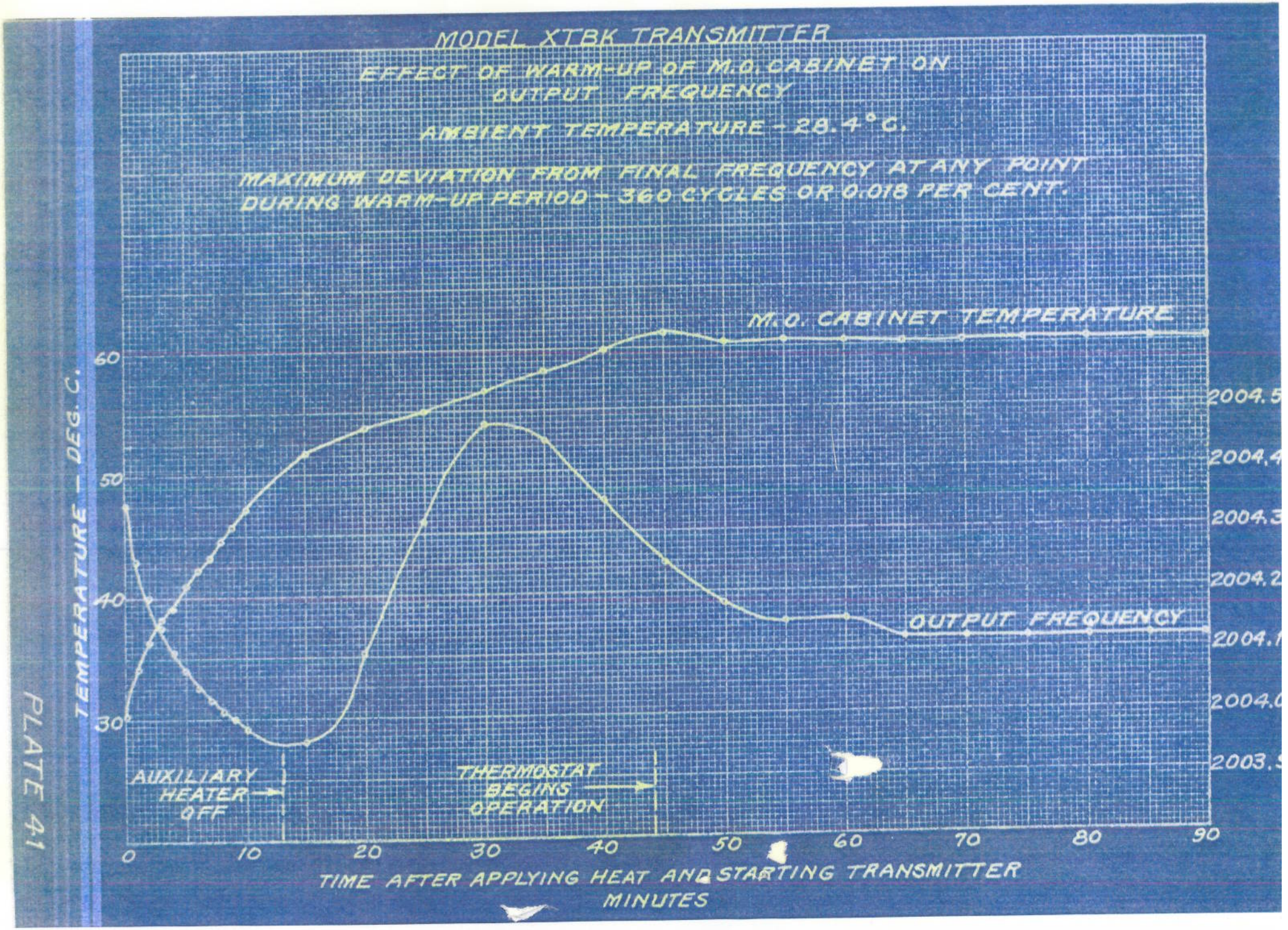
Maximum frequency change from stationary
condition at start of test: 45 cycles
0.001%

PLATE 38

NAPOLIS, IND., U.S.A. CHART No. 4313-D


MODEL XTBX-8 TRANSMITTING EQUIPMENT
VIBRATION TEST AT 2000 KILOCYCLES
500 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 10 CYCLES PER DIVISION
End Vibration
Frequency variation
due to heat cycle -
3 cycles.
7
Start Vibration
Maximum set in frequency between
beginning and end of test - zero
PLATE 39
MADE IN U.S.A. THE ESTERLINE-ANGUS CO., INDIANAPOLIS, IND., U.S.A.
ES


MODEL XTBX-8 TRANSMITTING EQUIPMENT
VIBRATION TEST AT 4500 KILOCYCLES
500 CYCLE RANGE OF LK EQUIPMENT USED
SCALE: 10 CYCLES PER DIVISION
End Vibration
Frequency variation due to heat cycle - 13 cycles.
Start Vibration
0
10
20
30
40
50
60
70
80
90
100
Maximum set in frequency between beginning and end of test: 3 cycles, 0.000067%
PLATE 40
THE ESTERLINE-A


MODEL XTBK TRANSMITTER
EFFECT OF WARM-UP OF M.O. CABINET ON OUTPUT FREQUENCY
AMBIENT TEMPERATURE - 28.4° C.
MAXIMUM DEVIATION FROM FINAL FREQUENCY AT ANY POINT DURING WARM-UP PERIOD - 360 CYCLES OR 0.018 PER CENT.
M.O. CABINET TEMPERATURE
OUTPUT FREQUENCY
AUXILIARY HEATER OFF
THERMOSTAT BEGINS OPERATION
TEMPERATURE - DEG. C.
60
50
40
30
2004.5
2004.4
2004.3
2004.2
2004.1
2004.0
2003.9
0
10
20
30
40
50
60
70
80
90
TIME AFTER APPLYING HEAT AND STARTING TRANSMITTER
MINUTES
PLATE 41