NAVSHIPS 900,373 RESTRICTED

INSTRUCTION BOOK

FOR

RADIO TRANSMITTING EQUIPMENT

TBL SERIES

(MODELS TBL-4, TBL-8 and TBL-9)

MANUFACTURED

By

RCA VICTOR DIVISION, RADIO CORPORATION OF AMERICA

Camden, New Jersey, U. S. A.

U. S. NAVY DEPT. BUREAU OF SHIPS

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NAVY DEPT.

BUREAU OF SHIPS

CONTRACT NOs-60970
NOs-98591
NXss-33180

Approved 30 April, 1945

1. NAVSHIPS 900,373 is a restricted, non-registered instruction book covering the installation, operation, maintenance, and parts list for Radio Transmitting Equipment Models TBL-4, 8, and 9.

2. When superseded by a later edition, or when no longer required, this publication should be destroyed. No report of such destruction is required.

3. A copy of the spare parts catalog, NAVSHIPS 900,373-SP, should accompany each copy of NAVSHIPS 900,373.

4. Copies of the instruction book or of the spare parts catalog (for contract number see equipment nameplate) may be obtained from the nearest Radio Material Pool.

By direction
/s/ J. B. Dow

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RECORD OF CORRECTIONS MADE

Change No.	Date	Signature of Officer Making the Correction

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TBL Series

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CONTRACTUAL GUARANTEES

MODELS TBL-4, 8 AND 9 — **CONTRACT NOs-60970 NOs-98591**

The equipment, including all parts and spare parts, except vacuum tubes, shall be guaranteed for a service period of **two years** with the understanding that, as a condition of this contract, all items found to be defective as to design, material, workmanship or manufacture shall be replaced without delay and at no expense to the Government; provided that such guarantee and agreement shall not obligate the contractor to make replacement of defective material unless the failure, exclusive of normal shelf life deterioration, occurs within a period of five years from the date of delivery of the equipment to and acceptance by the Government, and provided further, that if any part or parts (except vacuum tubes) fail in service or are found defective in ten per cent (10%) or more of the total number of equipments furnished under the contract, such part or parts, whether supplied in the equipment or as spares, shall be conclusively presumed to be of defective design, and as a condition of contract subject to one hundred per cent (100%) replacement of all similar units supplied on subject contract by suitable redesigned replacements. Failure due to poor workmanship while not necessarily indicating poor design, will be considered in the same category as failure due to poor design. Redesigned replacements which will assure proper operation of the equipment shall be supplied promptly, transportation paid, to the Naval activities using such equipment, upon receipt of proper notice and without cost to the Government. All defective parts originally furnished under contract shall be held subject to rejection and return to the contractor.

This period of five years and the service period of two years shall not include any portion of the time that the equipment fails to give satisfactory performance due to defective items and the necessity for replacement thereof, and provided further, that any replacement part shall be guaranteed to give two years of satisfactory service.

MODEL TBL-8 — **CONTRACT NXss-33180**

The equipment including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced f.o.b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided that such guarantee will not obligate the contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the contractor's design or is of a design selected by the contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design and subject to one hundred per cent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any such defects, and any items repaired or replaced by the contractor will be guaranteed anew under this provision.

REPORT OF FAILURE

Report of failure of any part of this equipment during its service life, shall be made to the Bureau of Ships using form NBS-383 (Rev. 3-45). The report shall cover all details of the failure and give the date of the installation of the equipment. For procedure in reporting failures see Chapter 67 of the "Bureau of Ships Manual," or superseding instructions.

INSTALLATION RECORDS

Contract NOs-60970
NOs-98591
NOas-33180

Date of Contract: 2 June, 1938
26 March, 1942
29 June, 1943

Serial number of equipment .....

Date of acceptance by the Navy .....

Date of delivery to contract destination .....

Date of completion of installation .....

Date placed in service .....

Blank spaces in this book shall be filled in at the time of installation. Operating personnel shall also mark the "date placed in service" on the date of acceptance plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

REQUISITIONS FOR REPLACEMENT MATERIAL

All requests or requisitions for replacement material should include complete descriptive data covering the part desired, in the following form:

1. Name of part desired .....
2. Federal stock number (if assigned) .....
3. Navy Type number (if assigned) (including **prefix** and **suffix** as applicable) .....
4. Commercial designation .....
5. Model designation (including suffix) of equipment in which used .....
6. Navy type designation (including prefix and suffix where applicable) of major unit in which part is used .....
7. Contract, purchase order, requisition, etc., under which the equipment was procured .....
8. Circuit symbol designation of part .....
9. (a) Navy Drawing and/or Specification Number (include part or group number) .....
   (b) Manufacturer's Drawing or Specification Number (include part or group number) .....
10. Rating or other descriptive data .....

SAFETY

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES (2250 Volts) WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATOR OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES, ALWAYS REMOVE POWER, DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages (2250 volts) which are dangerous to human life is necessary to the successful operation of the radio transmitting equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, or commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS. Under no circumstances should any person other than authorized maintenance personnel be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits, within the equipment or to apply voltages to the equipment for testing purposes while any noninterlocked portion of the shielding or enclosure is removed or open. Wherever feasible in testing circuits, maintenance personnel should check for continuity and resistance rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE. Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS. Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO—SAFETY PRECAUTIONS TO BE OBSERVED."

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTER MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

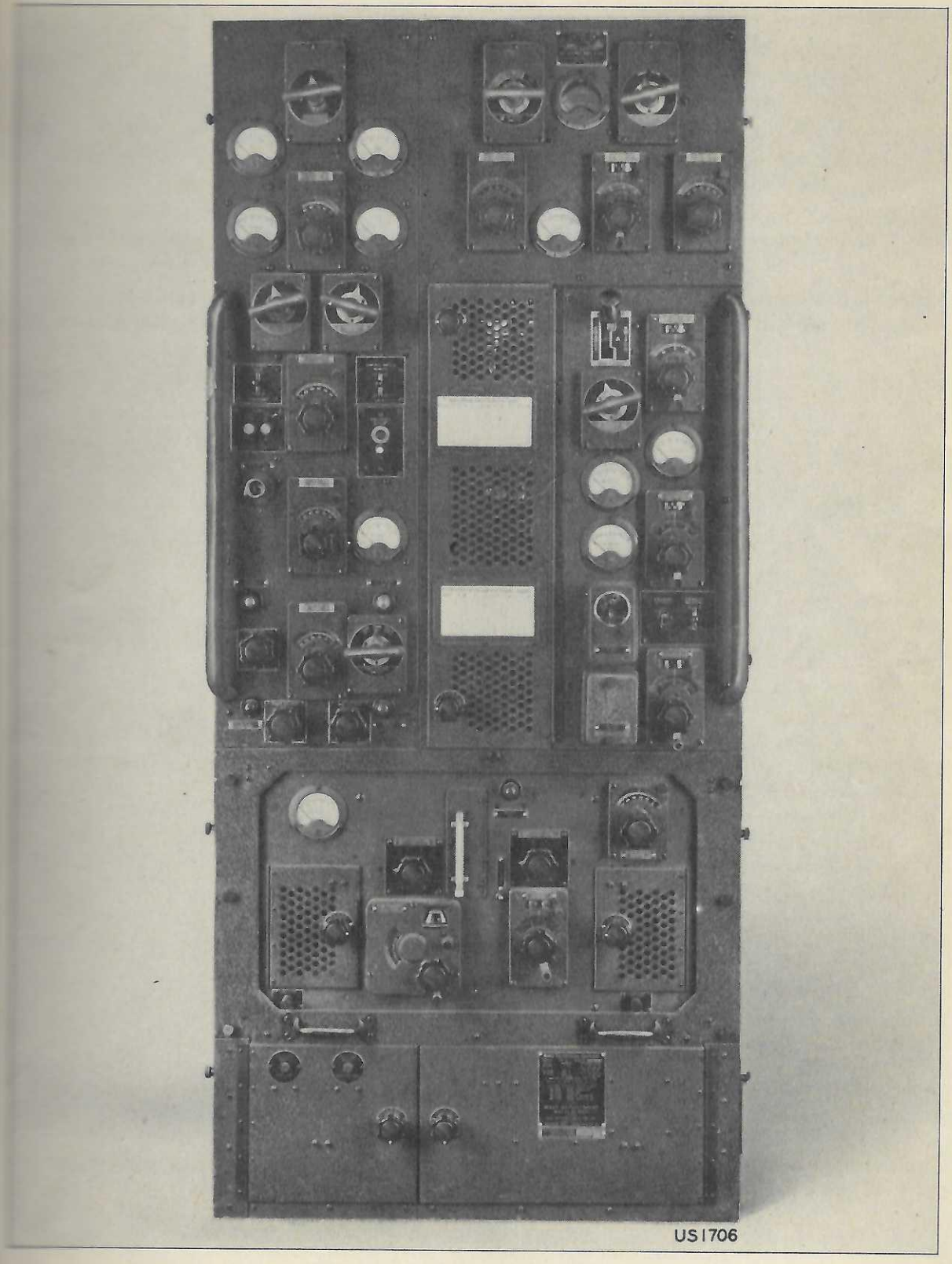

Figure 1—Transmitter, A-C Supply
(Front View, Access Doors Closed)

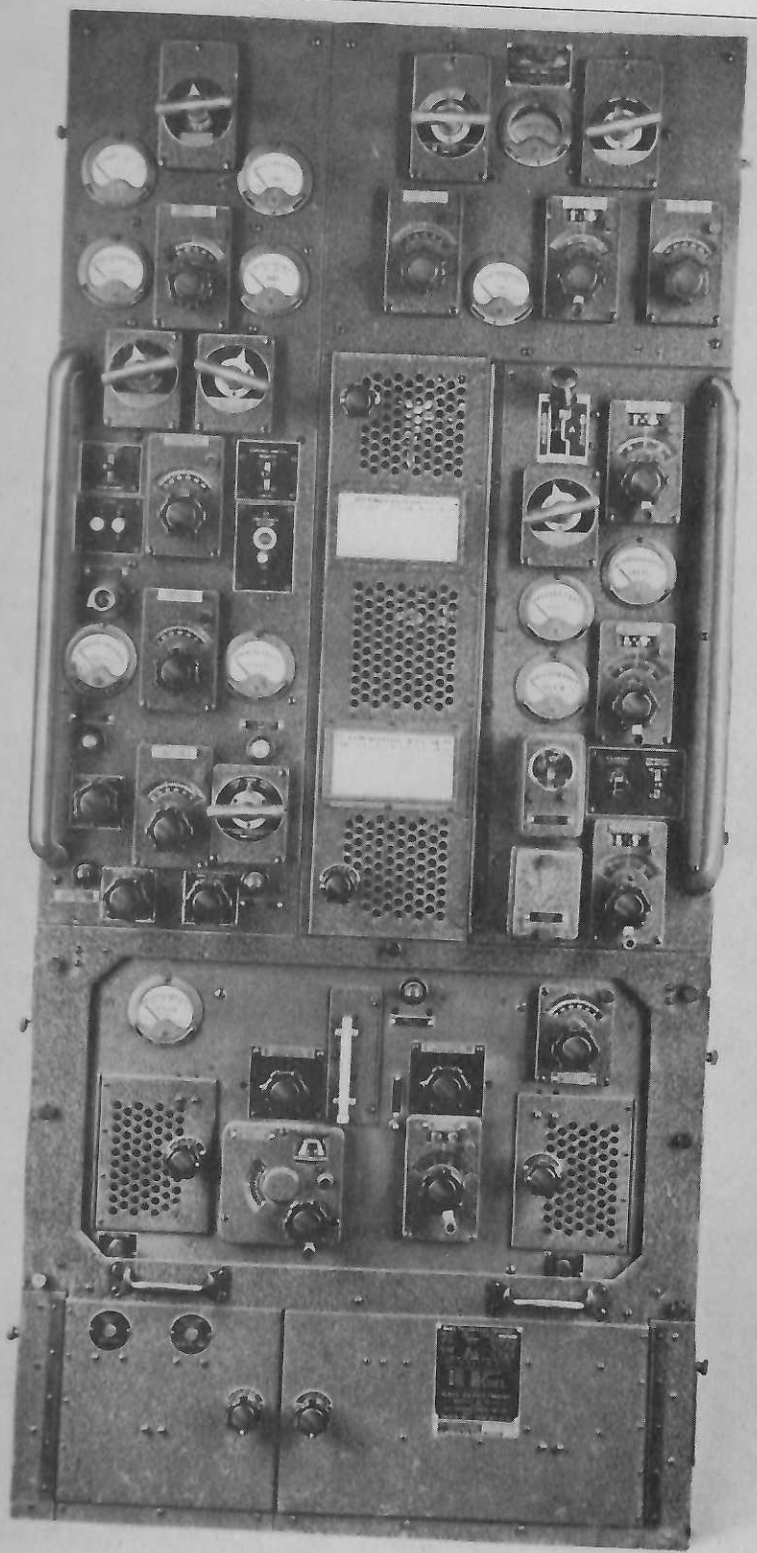

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Figure 2—Transmitter, D-C Supply
(Front View, Access Doors Closed)

SECTION I

INTRODUCTION

1.1 This Instruction Book covers the description, installation, operation and maintenance of the TBL Series Radio Transmitting Equipment (i.e., Models TBL-4, TBL-8 and TBL-9). These models are designed for use on submarines, destroyers, cruisers and other similar types of vessels. Each equipment consists essentially of a radio transmitter unit, a filter unit, a motor generator unit and magnetic controller unit. These major units differ slightly for the various power-supply voltages.

The output frequency of this equipment is continuously variable over two frequency bands; 175 to 600 kilocycles and 2,000 to 18,100 kilocycles. The transmitter is capable of delivering 200 watts of CW or MCW, or 50 watts of voice modulated power to the antenna.

All models of the equipment may be controlled from the transmitter or from a remote control station. Remote control units are not furnished on Contracts NOs-60970, NOs-98591 or NXss-33180.

SECTION II

EQUIPMENT

2.1 The chief difference between the three models of the TBL Series lies in the various supply voltages from which the equipment is designed to operate. Following is a tabulation of the models with respect to supply voltage:

TBL-4	TBL-8 (Contract NOs-98591)	TBL-9	TBL-8 (Contract NXss-33180)
220 v. a-c		220 v. a-c	
440 v. a-c	440 v. a-c		440 v. a-c
115 v. d-c	115 v. d-c		
230 v. d-c	230 v. d-c		230 v. d-c
250 v. d-c			

2.2 The TBL-4, the TBL-8 (Contract NOs-98591) and the TBL-9 are identical except for supply voltage. The TBL-8 (Contract NXss-33180) has a different type magnetic controller in both a-c and d-c equipment. See Tables I, II, III, and IV for details of the equipment differences.

2.3 The vacuum tubes used for all stages of the transmitter, except the oscillator, are common for the IF and the HF frequency band. The complete transmitter tube complement is as follows:

No.	Tube Type	IF Band	HF Band
1	Navy Type –860	Oscillator	
1	Navy Type –860		Oscillator
1	Navy Type –860	Int. Amplifier	First Amplifier
1	Navy Type –860	Audio Oscillator	Second Amplifier
2	Navy Type –803	Power Amplifier	Power Amplifier

2.4 These tubes are individually packed in separate containers which are packed for shipment in a wooden case having dimensions 26 x 21½ x 23½ inches. The gross weight of the case is 68 pounds.

TABLE I
TBL-4 RADIO TRANSMITTING EQUIPMENT
EQUIPMENT LIST

Spare Parts Box	Name of Unit	Navy Type Designation	Height (inches)		Width (inches)		Depth (inches)		Length (inches)		Weight (pounds)	
			†A	‡B	†A	‡B	†A	‡B	†A	‡B	†A	‡B
	POWER SUPPLY—440 volts, 3-phase, 60 cycles											
	Radio Transmitter	CRV-52181	72	78½	32¼	38	24½	29			841	1142
	Filter Unit	CRV-53074	18¾	28	17	20	7¾	18			80	111
	*Motor Generator Set	CBP-21340	°15½	22	18	23			60½	73	847	982
	**Motor Generator Set	CBP-21340	°20⅜	27	13	18			60½	73	847	982
	Magnetic Controller	CAE-21341	19⅝	24	17	19½	9	13½			45	65
§1	Transmitting Equipment Spare Parts		18	21	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CBP-21338 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CBP-21339 Generator		8	10	8	12			21	26	71	86
	POWER SUPPLY—220 volts, 3-phase, 60 cycles											
	Radio Transmitter	CRV-52181	72	78½	32¼	38	24½	29			841	1142
	Filter Unit	CRV-53074	18¼	28	17	20	7¾	18			80	111
	*Motor Generator Set	CBP-21340	°15½	22	18	23			60½	73	847	982
	**Motor Generator Set	CBP-21340	°20⅜	27	13	18			60½	73	847	982
	Magnetic Controller	CAE-21543	19⅝	24	17	19½	9	13½			45	65
§1	Transmitting Equipment Spare Parts		18	21	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CBP-21338 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CBP-21339 Generator		8	10	8	12			21	26	71	86

TABLE I—Continued
TBL-4 RADIO TRANSMITTING EQUIPMENT
EQUIPMENT LIST

RESTRICTED

	ator										34	96	118
4	Armature for Type CBP-21339 Generator		10	12	10	14			28	33	93	108
			8	10	8	12			21	26	71	86

TABLE I—Continued

TBL-4 RADIO TRANSMITTING EQUIPMENT

EQUIPMENT LIST

Spare Parts Box	Name of Unit	Navy Type Designation	Height (inches)		Width (inches)		Depth (inches)		Length (inches)		Weight (pounds)	
			†A	‡B	†A	‡B	†A	‡B	†A	‡B	†A	‡B
	POWER SUPPLY—115 volts D.C.											
	Radio Transmitter ..	CRV-52178	72	78½	32¼	38	24½	29			850	1151
	Filter Unit	CRV-53073	18¼	28	17	20	7¾	18			67	104
	*Motor Generator Set	CBP-21546	°15½	22	18	23			64	76½	970	1105
	**Motor Generator Set	CBP-21546	°20⅜	27	13	18			64	76½	970	1105
	Magnetic Controller	CAE-21541	21	24	17	19½	14	18			93	108
§1	Transmitter Equipment Spare Parts		18	21	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CBP-21338 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CBP-21339 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CBP-21544 Motor .		10	12	10	14			22½	27	90	110
	POWER SUPPLY—230 volts D.C.											
	Radio Transmitter ..	CRV-52179	72	78½	32¼	38	24½	29			850	1151
	Filter Unit	CRV-53073	18¼	28	17	20	7¾	18			67	104
	*Motor Generator Set	CBP-21547	°15½	22	18	23			64	76½	970	1105
	**Motor Generator Set	CBP-21547	°20⅜	27	13	18			64	76½	970	1105
	Magnetic Controller	CAE-21542	21	24	17	19½	14	18			93	108
§1	Transmitter Equipment Spare Parts		18	21	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CBP-21339 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CBP-21338 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CBP-21545 Motor .		10	12	10	14			22½	27	90	110

RESTRICTED

TABLE I—Continued
TBL-4 RADIO TRANSMITTING EQUIPMENT
EQUIPMENT LIST

Spare Parts Box	Name of Unit	Navy Type Designation	Height (inches)		Width (inches)		Depth (inches)		Length (inches)		Weight (pounds)	
			†A	‡B	†A	‡B	†A	‡B	†A	‡B	†A	‡B
	SUPPLY VOI[illegible]—250 volts D.C.											
	Radio Transmitter ..	CRV-52180	72	[illegible]	32¼	38	24½	29			850	1142
	Filter Unit	CRV-53073	18¼	28	17	20	7¾	18			80	111
	*Motor Generator Set	CBP-21547	°15½	22	18	23			64	73	97	1105
	**Motor Generator Set	CBP-21547	°20⅜	25	13	18			64	73	970	1105
	Magnetic Controller	CAE-21542	21	24	17	19½	14	18			93	108
§1	Transmitting Equipment Spare Parts .		18	21	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CBP-21338 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CBP-21339 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CBP-21545 Motor.		10	12	10	14			22½	27	90	110

* Terminal box on side.
** Terminal box on top.
† Equipment uncrated.
‡ Equipment crated.
° Does not include removable eyebolt.
§ Contains magnetic controller spares as well as transmitter spares. See Spare Parts List, Table III.

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§ Contains magnetic controller spares as well as transmitter spares. See Spare Parts List, Table III.

TABLE II
TBL-9 RADIO TRANSMITTING EQUIPMENT
EQUIPMENT LIST

Spare Parts Box	Name of Unit	Navy Type Designation	Height (inches)		Width (inches)		Depth (inches)		Length (inches)		Weight (pounds)	
			†A	‡B	†A	‡B	†A	‡B	†A	‡B	†A	‡B
POWER SUPPLY—220 volts, 3-phase, 60 cycles												
	Radio Transmitter	CRV-52181	72	78½	32¼	38	24½	29			841	1142
	Filter Unit	CRV-53074	18¼	28	17	20	7¾	18			80	111
	*Motor Generator Set	CGU-21950	°15½		18	23			60½	73	910	1045
	**Motor Generator Set	CGU-21950	°20⅜	25	13	18			60½	73	910	1045
	Magnetic Controller	CAE-21543	19⅝	24	17	19½	9	13½			45	65
§1	Transmitting Equipment Spare Parts		17	20	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CGU-21954 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CGU-21095 Generator		8	10	8	12			21	26	71	86

* Terminal box on side.
** Terminal box on top.
† Equipment uncrated.
‡ Equipment crated.
° Does not include removable eyebolt.
§ Contains magnetic controller spares as well as transmitter spares. See Spare Parts List, Table III.

TABLE III

TBL-8 (Contract NOs-98591)

RADIO TRANSMITTING EQUIPMENT

EQUIPMENT LIST

Spare Parts Box	Name of Unit	Navy Type Designation	Height (inches)		Width (inches)		Depth (inches)		Length (inches)		Weight (pounds)	
			†A	‡B	†A	‡B	†A	‡B	†A	‡B	†A	‡B
	POWER SUPPLY—440 volts, 3-phase, 60 cycles											
	Radio Transmitter	CRV-52181	72	78½	32¼	38	24½	29			841	1142
	Filter Unit	CRV-53074	18¼	28	17	20	7¾	18			80	111
	*Motor Generator Set	CGU-21950	°15½	22	18	23			60½	73	910	1045
	**Motor Generator Set	CGU-21950	°20⅜	25	13	18			60½	73	910	1045
	Magnetic Controller	CAE-21341	19⅝	24	17	19½	9	13½			45	65
§1	Transmitting Equipment Spare Parts		17	20	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CGU-21954 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CGU-21955 Generator		8	10	8	12			21	26	71	86
	POWER SUPPLY—115 volts D.C.											
	Radio Transmitter	CRV-52178	72	78½	32¼	38	24½	29			850	1151
	Filter Unit	CRV-53073	18¼	28	17	20	7¾	18			67	104
	*Motor Generator Set	CGU-21948	°15½	22	18	23			64	73	910	1045
	**Motor Generator Set	CGU-21948	°20⅜	25	13	18			64	73	910	1045
	Magnetic Controller	CAE-21541	21	24	17	19½	14	18			93	108
§1	Transmitting Equipment Spare Parts		17	20	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CGU-21954 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CGU-21955 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CGU-21951 Motor		10	12	10	14			22½	27	90	110

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Spare Parts Box	Name of Unit	Navy Type Designation	Height †A	Height ‡B	Width †A	Width ‡B	Depth †A	Depth ‡B	Length †A	Length ‡B	Weight †A	Weight ‡B
	… CGU-21954 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CGU-21955 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CGU-21951 Motor		10	12	10	14			22½	27	90	110

TABLE III—Continued

TBL-8 (Contract NOs-88891)

RADIO TRANSMITTING EQUIPMENT

EQUIPMENT LIST

Spare Parts Box	Name of Unit	Navy Type Designation	Height (inches)		Width (inches)		Depth (inches)		Length (inches)		Weight (pounds)	
			†A	‡B	†A	‡B	†A	‡B	†A	‡B	†A	‡B
	POWER SUPPLY—230 volts D.C.											
	Radio Transmitter	CRV-52179	72	78½	32¼	38	24½	29			850	1151
	Filter Unit	CRV-53073	18¼	28	17	20	7¾	18			67	104
	*Motor Generator Set	CGU-21949	°15½	22	18	23			64	73	910	1045
	**Motor Generator Set	CGU-21949	°20⅜	25	13	18			64	73	910	1045
	Magnetic Controller	CAE-21542	21	24	17	19½	14	18			93	108
§1	Transmitting Equipment Spare Parts		17	20	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CGU-21954 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CGU-21955 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CGU-21952 Motor		10	12	10	14			22½	27	90	110
	POWER SUPPLY—250 volts D.C.											
	Radio Transmitter	CRV-52180	72	78½	32¼	38	24½	29			850	1151
	Filter Unit	CRV-53073	18¼	28	17	20	7¾	18			67	104
	*Motor Generator Set	CGU-21949	°15½	22	18	23			64	73	910	1045
	**Motor Generator Set	CGU-21949	°20⅜	25	13	18			64	73	910	1045
	Magnetic Controller	CAE-21542	21	24	17	19½	14	18			93	108
§1	Transmitting Equipment Spare Parts		17	20	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CGU-21954 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CGU-21955 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CGU-21952 Motor		10	12	10	14			22½	27	90	110

* Terminal box on side.
** Terminal box on top.
† Equipment uncrated.
‡ Equipment crated.
° Does not include removable eyebolt.
§ Contains magnetic controller spares as well as transmitter spares. See Parts List, Table III.

TABLE IV

TBL-8 (Contract NXss-33180)

RADIO TRANSMITTING EQUIPMENT

EQUIPMENT LIST

Spare Parts Box	Name of Unit	Navy Type Designation	Height (inches)		Width (inches)		Depth (inches)		Length (inches)		Weight (pounds)	
			†A	‡B	†A	‡B	†A	‡B	†A	‡B	†A	‡B
	POWER SUPPLY—440 volts, 3-phase, 60 cycles											
	Radio Transmitter	CRV-52181	72	78½	32¼	38	24½	29			841	1142
	Filter Unit	CRV-53074	18¼	28	17	20	7¾	18			80	111
	Motor Generator Set	CGU-21950A	15½	22	18	23			60½	73	910	1045
	Magnetic Controller	CAE-211107	14	19½	9¾	14½	8¼	13			26	38
1	Transmitting Equipment Spare Parts		17	20	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	78	100
3	Armature for Type CGU-21954 Generator		10	12	10	14			28	33	103	118
4	Armature for Type CGU-21955 Generator		8	10	8	12			21	26	71	86
	POWER SUPPLY—230 volts D.C.											
	Radio Transmitter	CRV-52179	72	78½	32¼	38	24½	29			850	1151
	Filter Unit	CRV-53073	18¼	28	17	20	7¾	18			67	104
	Motor Generator Set	CGU-21949	15½	22	18	23			64	73	910	1045
	Magnetic Controller	CAE-211105	23	28	15½	18	10½	11			63	103
1	Transmitting Equipment Spare Parts		17	20	18	22			36	41	188	254
2	Miscellaneous Spare Parts for Motor Generator		8	10	12	16			29	34	96	118
3	Armature for Type CGU-21954 Generator		10	12	10	14			28	33	93	108
4	Armature for Type CGU-21955 Generator		8	10	8	12			21	26	71	86
5	Armature for Type CGU-21952 Motor		10	12	10	14			22½	27	90	110

† Equipment uncrated ‡ Equipment crated

SECTION III

DESCRIPTION

GENERAL DISCUSSION

The TBL Series Radio Transmitting Equipment described in this instruction book consists of four major units: (1) a transmitter unit; (2) a motor-generator unit; (3) a power supply filter; and (4) a magnetic type controller.

The design of the transmitter is based on the master-oscillator, intermediate-amplifier, power-amplifier principle. The transmitter unit, as controlled by the master oscillator, is continuously variable as to the emitted frequency throughout the frequency ranges specified. All necessary operating controls are located on the front panel and are electrically "dead." See Figure 2.

The antenna tuning systems are flexible and provide for operation into any of the various antennas specified for the previously mentioned types of vessels (see paragraph 1.1). A switch in the HF antenna circuit provides a choice of VOLTAGE or CURRENT feed to the antenna.

The keying system permits satisfactory service keying speeds up to 100 words per minute. The front panel mounting of the keying relay provides easy accessibility to this unit.

The power output may be varied from full power to a minimum of 25% by means of a single control on the transmitter unit. Modulated CW transmission is provided only on the intermediate frequency range. Telephone transmission on either the high frequency or intermediate frequency band may be obtained when the equipment is used in conjunction with suitable speech input equipment. The transmitter requires an audio input of 1.6 watts (i.e. 28 volts across 500 ohms) for 85% modulation. Telephone carrier will be approximately ¼ of the normal CW output value.

The transmitter receives its power through a suitable filter unit from a three unit motor-generator, the motor operating from the ship's supply lines.

The transmitting equipment can be controlled and keyed by using either the four-wire or the six-wire remote control system, or it may be controlled from a remote telephone station when associated with speech input equipment.

3.8 POWER OUTPUT—The transmitter has a nominal power output of 200 watts, CW telegraph. As shown in the tabulation which follows, the actual output will vary somewhat with frequency and type of emission employed.

Frequency Range	Emission	Output
175 to 600 kcs. and 2000 to 18,100 kcs. . .	CW	200 watts
175 to 600 kcs.	MCW	100 watts
175 to 600 kcs. and 2000 to 18,100 kcs. . .	PHONE	50 watts

3.9 The transmitter unit is suitable for use with any antenna having characteristics within the specified limits as follows:

(a) IF Band (175 to 600 KCS).

1. Equivalent Capacity—393 to 1750 mmfd.
2. Equivalent Resistance—1.12 to 15 ohms.

(b) HF Band (2000 to 18,100 KCS):

The equivalent constants of a high-frequency antenna vary greatly with any change in frequency. The resistance may be very high at one frequency and fairly low at another; the antenna may have an inductive reactance at one frequency and a capacitive reactance at another. These constants will vary with any particular installation due to numerous factors, such as length of the antenna, height above the deck, distance to surrounding objects, length of trunk, etc.; consequently, they cannot be accurately predicted.

3.10 As a result of the marked variation in antenna characteristics, the antenna tuning and coupling systems of the transmitter have been made highly flexible. Optimum performance is obtained in the HF band by the optional use of either current or voltage feed.

3.11 POWER SUPPLY REQUIREMENTS—The TBL Series Radio Transmitting Equipment will draw power from the supply lines as shown in the following table:

Condition	440 volts 3 Ph., 60 cy.	220 volts 3 Ph., 60 cy.	115 volts DC	230 volts DC	250 volts DC
Max. Power for Starting	22 kw	22 kw	8.3 kw	9.0 kw	9.2 kw
Power for "CW" Locked Key	3.4 kw	3.4 kw	3.3 kw	3.5 kw	3.6 kw
Supply Voltage Variation Permitted (per cent)	±10	±10	+45 −23	+45 −23	±30
Supply Frequency Variation (per cent)	±5	±5			

CIRCUIT DESIGN

3.12 TRANSMITTER UNIT—The transmitter unit consists of two frames of spot-welded aluminum alloy structure, bolted together to operate as a single mechanical assembly (see Figures 10 and 11). The left-hand assembly contains the intermediate frequency stages; the right-hand assembly contains the high frequency stages. The IF and HF master oscillator unit is contained in a removable assembly located in the lower portion of the transmitter frame. These three component units may be separated, if necessary, to facilitate installation.

3.13 Access to the tubes is provided by three doors in the front panels. See Figure 4. One door provides access to all of the amplifier tubes. Two similar small doors provide access to each of the oscillator tubes. In addition, there are two doors near the bottom of the panel which give access to the relays and the terminal boards. All these doors are electrically interlocked and all power, except line-voltage and MO heater power, is removed when the doors are opened. Access to the transmitter unit is provided by removable screens. Servicing is further facilitated by the ease with which the complete oscillator unit may be removed from the transmitter. By loosening eight thumb screws on the front panel the complete oscillator unit may be withdrawn from the transmitter on slides and rollers which are provided as a part of the main transmitter frame. A stop on each side prevents the oscillator from coming out completely. If removal is desired, reach through the square cut-outs about halfway out on the lower frame of the oscillator; press down (on the stops) and pull the oscillator forward slightly. The unit then is free to be removed from the transmitter. See Figure 10.

3.14 Eight lifting shackles are provided on the top of the transmitter frame, four being located at the corners of the intermediate frequency section and four being located at the corners of the high frequency section. These lifting shackles are to be used in hoisting or lowering the equipment. Each shackle has a locking screw and clamp; loosening these will permit the shackle to be raised to a position suitable for the insertion of a rope or chain.

3.15 The transmitter unit contains all necessary electrical circuits, tubes and control apparatus for taking power from a motor generator unit and delivering telegraphically keyed CW or MCW radio-frequency energy to an antenna. When used with suitable speech input equipment, it will deliver a speech-modulated wave to an antenna. Various views of the transmitter unit upon which are indicated the component parts are given in Figures 3 to 17.

3.16 The nominal power output for the various frequencies and conditions of operation is given in Paragraph 3.8. The carrier may be modulated up to 85%. The power output may be varied from full power, down to 25% power by manipulation of the generator field (plate voltage) rheostat which is located in the transmitter unit. This form of power reduction is not recommended for telephone operation as it will cause distortion. Telegraph keying speeds up to 100 words per minute may be employed.

3.17 The Radio Transmitter Unit consists of two entirely separate groups of radio frequency circuits (see Figure 11). One group known as the IF circuit covers the frequency range of 175 to 600 kc. The other group known as the HF circuit covers the frequency range of 2,000 to 18,100 kc.

3.18 Either one of the radio frequency bands may be selected by means of control "A", the "IF-HF CHANGE SWITCH" (S114), on the front panel. The switch sections of S114 connect the appropriate circuit elements to the tubes (V102, V103, V104, and V105) for the frequency range connected. Operating voltage applied to the tubes remains the same regardless of which band is in use. **In addition to the letters "IF" and "HF", the marker plates for the controls which apply to the IF circuits have a blue background, and those which apply to the HF circuits have a green background.**

3.19 For descriptive convenience the complete radio transmitter unit may be divided into the following sections:

Each of the above-mentioned transmitter sections is described in detail in the paragraphs which follow.

3.20 **OSCILLATOR UNIT**—The oscillator unit consists of a two-compartment casting, on each end of which are mounted additional compartments housing the two oscillator tubes. This casting and its associated tube compartments are assembled to the oscillator cradle or frame by means of shock absorbing mountings. The front panel of this unit extends the full width of the two transmitter frames. The unit houses the frequency-determining components and tuning circuits for the two oscillators. A motor and blower which are attached to the under side of the casting, together with heaters and thermostat controls mounted within the inner compartments, provide for maintenance of the circuits and components within at a temperature of 60 degrees C. The temperature controlled portions of the unit are covered with a thick layer of felt to retard heat radiation.

3.21 Temperature control of the oven compartments is accomplished by means of the heater resistor* (R138 or R137) located in the rear of the oven casting, the blower (B101 for 220/440 volts a-c or B102 for 115 volts d-c, B103 for 230/250 volts d-c) located beneath the oven and the thermostat relay (K100 or K103) located on the transmitter front panel. As the equipments may be required to operate at d-c voltages as much as 45% above normal, switch S113 is provided with "NORMAL" and "HIGH" positions to control the power to the oven heater. Switch S113 should be placed in the "HIGH" position when the line voltage is above the normal value of 115, 230 or 250 volts. In this position, resistors R149 and R150 are in series with the oven heater.

3.22 The heater consists of four grid type resistor units (R137A, B, C, D or R138A, B, C, D) each of equal resistance mounted on a Mycalex panel and provided with connecting terminals. A group of two units is used for normal (main) heat control and another group of two for (auxiliary) starting. It should be noted that in each group two units are connected in series for power supplies of 230 or 250 volts d-c, and in parallel for all other voltages. Details of connections at the heater terminals for either power supply are shown on the oscillator connection diagram, Figure 25. An amber colored light (I100) is mounted on the panel and indicates when lighted that the main heater is energized.

3.23 The blower (B101 for 220/440 volts a-c, B102 for 115 volts d-c, or B103 for 230/250 volts d-c) circulates the air constantly around a closed path through the oven compartments and thus tends to maintain a constant temperature of all internal components. This aids in maintaining constant transmitter frequency and minimizes the adverse effects of varying ambient temperature in which the equipment may be operated. Treated fabric hose are used to connect the blower inlet and outlet to the oven.

The blower motors for the equipments are conservatively rated for satisfactory operation within the limits specified for the respective supply line voltages. The normal speed for each type of motor is 2,850 r.p.m. For a-c equipments the blower motor operates from the secondary of the distribution transformer (T106) at 115 volts, plus or minus 10 per cent. For d-c equipments the blower motor operates from the supply line. D-C supply line voltages may vary from minus 23 per cent to plus 45 per cent of normal value for 115 or 230 volt supply, or minus 30 per cent to plus 30 per cent for 250 volt supply. Over these wide voltage limits, the motor speed will vary from approximately 2,300 r.p.m. to 3,900 r.p.m. This variation in blower speed will change the "ON" and "OFF" time of the heat cycle of the temperature oven to some extent but will not in any way be detrimental to the proper functioning of the equipment. When the line voltage is normal (115, 230 or 250 volts d-c) the temperature of the blower motor will not rise more than a few degrees above the ambient temperature. When operating at plus 45 per cent line voltage, the temperature rise will be relatively small, probably not exceeding 12 to 15 degrees Centigrade above its ambient temperature.

3.24 A protective oven-temperature thermostat (S101) operates to open the entire heater circuit in case the temperature should rise to 70° C. A

*NOTE: Whenever the items differ for a-c and d-c power supplies, both will be indicated, separated by the word "or." The item in a-c equipment will be mentioned first. However, this does not apply to those paragraphs devoted exclusively to the description of d-c equipment.

second thermostat (S128) opens the (auxiliary) starting section of the heater when the oven temperature reaches 50° C. or greater. By this method the power supplied to the heater is greatest when the oven is cold, thus reducing the time required for the oven to reach the operating temperature.

3.25 Three hours or less are required to bring the oven up to temperature, after which it is maintained at a constant temperature of 60° C. The operating temperature is accurately controlled by means of the mercury type thermostat (S102) set for 60° C. and its associated thermostat relay (K100 or K103). In normal operation the temperature will be held constant within 0.5° C.

3.26 The thermostat (heater) relay (K100 or K103) is actuated by the mercury thermostat and closes or opens the circuit through the main heater resistor units. It is mounted on the transmitter panel and is protected by a readily removable cover. The relay and heater circuits are alive at all times even when the transmitter is shut down. If the relay should require adjustment the "EMERGENCY" switch (S107) should be operated to its "OFF" position thus removing power. Associated with the heater relay and also mounted in the transmitter unit are the spark-absorbing capacitor (C175 or C176) and, for d-c equipment, the resistor (R139 or R190).

3.27 HF MASTER OSCILLATOR—The HF Master Oscillator tube, V100 (Navy Type –860) is housed in the tube compartment on the right-hand end of the oscillator oven casting. This compartment is not temperature controlled; however, a tube temperature compensator (C322) is mounted behind the tube. The tube is supported by the socket (X100), which is provided with a clamp operated by a thumb screw extending through the front panel. Behind the tube are located the filament choke coil (L136) and four cathode by-pass capacitors (C114, C115, C191 and C192). The screen by-pass capacitors (C116, C306 and C307) are mounted on the side of the tube compartment in front of the tube and are accessible through the tube door. A pick-up capacitor (C173), consisting of an adjustable disc in the field of (L108), is provided for monitoring.

3.28 Above the tube and shielded from it are located the plate tuning circuit and associated items. These consist of the tank coil (L108), tuning capacitor (C181), choke coil (L128) and capacitors (C155, C126 and C129). Behind the h-f oscillator tube compartment are located the oscillator unit terminal boards and the jack board which matches a complementary plug board mounted in the transmitter frame

3.29 Inside the oven are located the majority of the items which control the frequency of the oscillator. These include the tapped coil with the tuning plunger (L109); the tank capacitor (C316 to C320) inclusive and (C189, C190) the 2 section tap switch (S124); the calibration correction capacitor (C186); the grid capacitor (C187); the grid-leak resistors (R121, R128) and the keying compensator (C322) and (R172). Resistor (R172) is a heater winding within the keying compensator unit. Resistor (R167) is a rheostat in series with (R172) and is located outside the oven behind the front panel. The arm of this rheostat is geared for operation from the "HF OSC. RANGE SWITCH" (S124) and functions to vary the degree of compensation for various switch positions.

3.30 The oscillator circuit (within the oven) determines the transmitter frequency. The complete transmitter circuits are shown in the schematic diagrams (Figures 38 and 46 for a-c supply and Figures 39 and 47 for d-c supply). The frequency range of 1,000 to 2,262.5 kilocycles is covered in six bands selected by the "HF OSC. RANGE SWITCH" (S124), which selects the proper tap on the tuning coil and connects in the correct capacitors for the desired band. Vernier tuning in each band is accomplished by manipulating the "HF OSCILLATOR TUNING" dial (M), which causes a plunger to move in or out of the coil (L109), thus varying the coil inductance. In order to avoid reaction between the oscillator grid and plate circuits, the screen grid is tied to ground by the by-pass capacitors (C116, C306, C307), isolating the circuits from each other. The frequency-determining components of the oscillator circuit are connected to the screen-grid and control-grid elements of the tube; the plate of the tube is connected to a separate plate-tank circuit which is always tuned to a frequency twice that of the frequency-determining tank. Thus the plate (oscillator output) circuit is "Electron Coupled" within the tube. Since the filament is not at r-f ground potential, a filament choke coil (L136) is provided to prevent leakage of r-f potential from the filament to ground. The screen-grid of the tube, which is used as an anode in this oscillator arrangement, obtains its d-c potential from the MO plate generator through the dropping resistors (R118 and R119). The d-c potential on the screen-grid during operation is approximately 320 volts.

3.31 Plate potential is fed to the oscillator tube (V100) through the voltage-dropping resistor (R115) and choke coil (L128). The plate potential during operation is approximately 850 volts. Capacitor (C126) couples the plate to its tank circuit which has a tuning range from 2,000 to 4,525 kilocycles. The plate current is indicated by the oscillator plate current meter (M105) which is located on the front panel of the oscillator unit.

3.32 The MO calibration corrector (C186) has been provided to enable the operator to compensate for small changes in various tube or circuit capacitances. By its use a previously cali-

setting of the oscillator dial may be maintained. Adjustment may be accomplished with a screwdriver after first removing the plug in the oscillator front panel. Clockwise rotation of the control will lower the frequency.

Monitor coupling circuits have been provided. Coupling capacitor (C173) is adjacent to the oscillator plate tuning coil and provides for proper r-f pickup (between 15 and 500 millivolts) for monitoring the frequency. The r-f potentiometer, in the frequency band of 2,000 to 4,525 kilocycles, is wired to terminals 1 and 2 of the terminal board "F," in the terminal board and power section at the bottom of the transmitter cabinet, to provide a source of r-f voltage for an external frequency monitor. The audio output from the frequency monitor may be connected to terminals 7 and 8 of the "H" terminal board which in turn are wired to the audio output jack (J111) where headphones may be plugged in. In the use of a monitor an operator can tune the oscillator to the exact frequency desired, while listening to the beat frequency in headphones. Previous to tuning to the exact frequency, the oscillator frequency controls (L and M) may be set accurately set to any frequency within their tuning limits by using settings shown by the calibration curves, Figure 56.

Keying of the transmitter affects the oscillator circuits as follows: When the key is up, the keying relay contacts K101 (A) are open. Thus the positive voltage across R157 is applied through the winding of relay K105 to the mid-point on the secondary winding of the filament transformer (T101). This biases the oscillator tube to cut off. When the key is closed, the winding of keying relay (K101) is energized which causes the contacts (A) to close. This removes the blocking potential on the cathode of the oscillator tube to the point where the tube is permitted to oscillate.

HF FIRST INTERMEDIATE AMPLIFIER The first intermediate amplifier tube (V102) is located centrally in the main transmitter frame in the first compartment above the oscillator unit. The tank circuit and tuning controls are in the same compartment and mounted on the right side of the tube. Also in this compartment, and extending upward through the succeeding amplifier compartments, is located the "IF-HF CHANGE SWITCH" and its component sections (S114A to S114F inclusive) and (S114GX, S114GY, S142, S143, S144), all operated from the single control "A."

The tube of the first intermediate stage obtains its excitation from the oscillator plate tank circuit through the coupling capacitor (C129). Grid bias is fed to the tube grid through grid resistor (R107) and choke coil (L126). The low potential end of the choke is by-passed to ground by capacitor (C145). The tube filament and screen grid are by-passed to ground by capacitors (C111, C112 and C113).

3.37 D-C plate potential is fed to the tube plate through the voltage-dropping resistor (R114) and the plate tank coil (L105). The plate potential of this stage during operation is 1,500 to 1,800 volts depending on the mode of operation. The plate tank circuit of the intermediate amplifier consists of variable coil (L105) and variable air capacitor (C148) which are mechanically geared together and driven from the "HF-1ST I.A. TUNING" dial (control "O"). The plate tank circuit is by-passed to ground by capacitor (C122). The tuning range is from 2,000 to 9,050 kilocycles. For transmitter output frequencies from 2,000 to 4,525 kc, the tube operates as a fundamental or straight-through amplifier. For the transmitter output range of 4,525 to 9,050 kc, the amplifier is operated as a frequency multiplier or doubler, to double the output frequency of the master oscillator plate tank circuit. (The tank circuit frequency, when doubling, is four times the frequency of the frequency-determining oscillator circuit. See Paragraph 3.30.) The plate current is indicated by the "1ST I.A. PLATE CURRENT" meter (M104).

3.38 The screen grid potential for this stage is obtained from the 500-volt output of the motor generator through the screen resistor (R117). Keying of this tube (V102) is accomplished by the blocking action of the potential drop across keying-resistor (R157) when the key is open. This potential is fed through the overload relay (K105) to the mid-tap of the "1ST IPA" winding of the filament transformer (T103). This in effect increases the bias potential between the tube filament and its control grid. Closing the key operates keying relay (K101), one contact "A" of which shorts out resistor (R157), thus removing the blocking bias potential from the tube.

3.39 HF SECOND INTERMEDIATE AMPLIFIER—The second intermediate amplifier is located immediately above the first intermediate amplifier. It employs a –860 type tube (V103). R-F excitation for the 2nd intermediate amplifier stage is obtained from the first intermediate amplifier tank circuit through the coupling capacitor (C128). Fixed bias potential is fed to the control grid through grid resistor (R106) and choke coil (L127). The low potential end of the choke coil is by-passed to ground by capacitor (C144). The tube filament and screen grid are by-passed to ground by capacitors (C108, C109 and C110). Plate potential is fed through the voltage-dropping resistors (R113 and R174) in parallel and the plate tank coil (L104). The plate tank circuit is by-passed to ground by capacitor (C121). The plate potential of this stage during operation is 1,200 to 1,500 volts, depending on the mode of operation.

3.40 The plate tank circuit of the 2nd intermediate amplifier consists of variable coil (L104) and variable air capacitor (C147) which are mechanically geared together and driven from

the "2ND I.A. TUNING" (control "P"). The tuning range is 2,000 to 18,100 kilocycles. For transmitter output frequencies from 2,000 to 9,050 kc, the tube operates as a fundamental amplifier. For the transmitter output range of 9,050 to 18,100 kc, the stage operates as frequency doubler. (The tank circuit frequency, when doubling, is eight times the frequency of the frequency-determining oscillator circuit.) The plate current is indicated by the "2ND I.A. PLATE CURRENT" meter (M103).

3.41 Screen-grid potential is obtained from the 500 volt output of the motor generator through the resistor (R116). Keying of this stage is accomplished by introducing the bias potential-drop across keying resistor (R157) into the mid-tap of the "2ND IPA" winding of transformer (T103), in the same manner as already described for the first intermediate amplifier stage. (See paragraph 3.38.)

3.42 HF POWER AMPLIFIER—The power amplifiers use two Navy Type –803 tubes (V104, V105) in parallel. These are located centrally in the transmitter unit at the top of the amplifier-tube access door. The power amplifier control grids obtain their excitation from the 2nd IA tank circuit through the coupling capacitor (C127). Fixed bias potential is fed to the grids through the grid resistor (R105) and choke coil (L134). The low potential end of the choke coil is by-passed to ground by capacitor (C143). Resistors (R122, R123) and their associated coils (L117, L118) are provided at the grid terminals of the tube sockets to reduce any tendency toward spurious oscillation.

3.43 The "HF PA FREQ. RANGE SW." (S131) (Q) connects the tank coil and capacitor in parallel from the tube plate to (r-f) ground in the conventional manner when in position 1 for the lower frequency band. In this position the antenna is fed through coupling capacitors (C170 and C171) from the plate end of the tank circuit. When the "HF P.A. FREQ. RANGE SW." (Q) is in position 2, the tuning coil (L102) is connected to form a pi-network with the power amplifier plate capacitance at the input end and capacitor (C146) at the antenna end of the coil. In this position the antenna is fed from the point of the tank circuit common to the high potential side of C146 and the coil L102.

3.44 The h-f plate tank circuit components are located immediately above those of the 2nd intermediate amplifier stage. The circuit tuning elements consist of the variable coil (L102), variable capacitor (C146) and the tank band switch (S131). The coil and capacitor are mechanically geared together and driven from the "HF PA TUNING" dial control "R." The tuning range of 2,000 to 18,100 kilocycles is divided into two bands by the "HF P.A. FREQUENCY RANGE SW" (S131), control "Q." Wide overlap between the two bands is possible; however, it is recommended that the low frequency po tion 1 of the switch be used for the freque band of 2,000 to approximately 11,000 k cycles and the high frequency position 2 of switch be used for the frequency band of appr imately 11,000 to 18,000 kilocycles. The po amplifier grid current is indicated by the "P GRID CURRENT" meter (M106) which is cated immediately above the "2ND I.A. PLA CURRENT" meter. Plate current for the po amplifier stage is indicated by the "P.A. PLA CURRENT" meter (M102) which is located the extreme right side of the transmitter unit a just below the "HF P.A. TUNING" control "R

3.45 Filament, screen-grid and suppressor-g leads are by-passed to ground by capacito (C100 to C107). Plate potential is series f to the tube through the choke coil (L125) a the plate tank coil (L102). Capacitor (C12 is provided to by-pass the tank circuit to grou This stage operates at a plate voltage of 2,0 volts obtained directly from the 2,000-volt ou put of the motor generator. The suppress grids may be connected to the audio transform (T105) and bias potentiometer (R131) f phone operation or to voltage divider resis (R173) for CW operation by a section "EMISSION SELECTOR" switch (S126). T "MCW" position of the switch should not be us for the HF range of the transmitter.

3.46 HF ANTENNA COUPLING AND TU ING—The antenna coupling and tuning comp nents are located in the top compartment of t right-hand section of the transmitter unit. T "HF ANT. FEED SWITCH" (S119), contr "U," provides for either "Current" or "Voltage feed to the antenna. The output feeds throu the "HF ANTENNA CURRENT" meter (M10 mounted on insulating spacers behind a fa meter front in the front panel, to the "ANTENN SWITCH" (S120), control "W", the comm point of which is connected to the antenna te minal in the top of the transmitter unit. Variab coil (L100), control "T" and variable capacito (C172) control "S" are connected in series fro antenna to ground for "Current" feed and parallel from antenna to ground for "Voltage feed. Variable coupling over wide limits is pr vided by the variable "HF COUPLING CAPAC TOR" (C171), control "V." Blocking capacito (C170) is provided in series with the couplin capacitor to prevent d-c potentials from reachin the antenna system under any condition. T antenna terminal is provided with a protectiv spark gap. This gap is properly adjusted for pr tection of the equipment against high voltage which may be developed under certain condition of operation in the IF band and is further de scribed in paragraph 3.62.

3.47 IF MASTER OSCILLATOR—The IF o cillator tube (Navy Type –860) (V101) i housed in the tube compartment which is mount ed on the left-hand end of the oscillator ove

compartment is not temperature controlled. The tube is supported by the socket (XV102), which is provided with a clamp operated by a thumb screw which extends through the front panel. Behind and above the tube are mounted the filament transformer (T102), the cathode by-pass capacitors (C117, C118, C156, C157, C161, C162, C185) and the r-f choke coil (L135). The three sections of the choke coil are connected in the primary leads and the center cathode lead from the transformer. The complete transformer unit is thus operated at the same r-f potential as the tube filament. As this potential is above that of ground, the transformer is insulated from the compartment case and mounted on insulators. The screen by-pass capacitors (C307, C308 and C309) are mounted on the side of the tube compartment and in front of the tube.

Inside the oven are located the majority of the items which control the frequency of the oscillator. These include the combination, section wound coil and variometer (L110), the tank capacitors (C196 to C199 inclusive and C200) and (C194, C195), the "IF OSCILLATOR RANGE SWITCH" (S123), control "B," the grid capacitor (C188), and the grid leak resistors (R125 and R129).

The oscillator circuit (within the oven) determines the transmitter frequency. The complete transmitter circuits are shown in the schematic diagrams, Figures 38 and 46 for a-c supply and Figures 39 and 47 for d-c supply. The frequency range, from 87.5 to 300 kilocycles, is covered in six bands selected by the "IF OSCILLATOR RANGE SWITCH" (S123), control "B," which selects the proper tuning-coil tap and inserts the correct capacitors for the desired band. Tuning in each band is provided by the "OSCILLATOR TUNING" dial (control "C") which in turn controls the angular position of the tuning coil built into the end section of the oscillator coil (L110). The components of the frequency-determining circuit within the oven are connected to the elements of the oscillator tube in conventional manner for electron coupling. The screen-grid is employed as an anode and operates at r-f ground potential. The d-c screen potential is obtained from the 1600-volt output of the power generator through the screen voltage-dropping resistors (R118 and R119). The screen-grid potential during operation is approximately 220 volts.

The IF oscillator plate tank circuit, consisting of the variometer (L111) and capacitors (C160 and C164), is located in the compartment immediately above the oscillator in the left-hand corner of the transmitter. Plate potential is fed to the plate through the voltage dropping resistor (R135), "OSC. PLATE CURRENT" meter (M103) and choke coil (L131). Capacitor (C162) blocks d-c plate potential from the tank circuit. The oscillator plate tank circuit is resonated at the output frequency of the transmitter, which is twice the frequency of the oscillator. The plate potential during operation is approximately 850 volts. Capacitor (C158) blocks the d-c grid bias potential of the following intermediate stage from ground. Resistors (R102, R103, and R104), in parallel across the tank circuit, limit the variation of oscillator frequency due to tuning of the plate tank circuit by variometer (L111).

3.51 The plate tank circuits of the IF oscillator, the IF intermediate amplifier and the IF power amplifier are arranged so that the frequency range of 175 to 600 kilocycles is divided into two bands as shown by the calibration curves. The band switches (S115, S116A, and S116B) are employed and operated from "IF FREQUENCY RANGE" switch (control "G").

3.52 Frequency-monitor coupling is provided by an open loop of wire at the top end of (L111) shown as (C174). This coupling provides the proper r-f voltage (between 15 and 500 millivolts) for exciting an external monitor, and is wired to terminals 1 and 2 of the terminal board "Y" at the base of the transmitter unit. The audio output from the frequency monitor may be connected to terminals 7 and 8 of the "H" terminal board which in turn are wired to the frequency meter audio output jack (J101) where headphones may be plugged in. The oscillator may be adjusted to the exact frequency desired by use of a monitor and by listening to the beat frequency in the headphones. The oscillator may be quite accurately set to any frequency within its limits by using the setting shown by the calibration curves for controls "B" and "C." See Figure 52.

3.53 Keying of the IF oscillator tube is accomplished by applying the positive potential-drop across resistor (R157) to the secondary mid-tap of the filament transformer (T102). This potential is controlled by the keying relay as explained in Paragraph 3.34.

3.54 IF INTERMEDIATE AMPLIFIER—R-F excitation to the intermediate amplifier control grid of tube (V102) is obtained directly from the high potential end of the preceding oscillator plate tank circuit. Fixed bias potential is fed to the grid through the grid resistor (R107) and the variometer (L111) of the oscillator plate tank circuit. Plate potential is fed to the tube plate through "1ST I.A. PLATE CURRENT" meter (M104), resistor (R112) and choke coil (L130). C124 by-passes the low potential end of the choke coil to ground and C131 isolates the tank circuit from the d-c plate potential.

3.55 The plate tank circuit of the i-f intermediate amplifier is located immediately above the oscillator plate tank compartment. The circuit consists of the variometer (L112), capacitors (C159, C163, C325) and the band switch (S116A). The tuning range is from 175 to 320

kilocycles on band 1 and 320 to 600 kilocycles on band 2. The variometer is driven from "IF I.A. TUNING" control, dial "E," and this intermediate stage is always operated as a fundamental or straight-through amplifier.

3.56 Keying is accomplished by the keyed potential-drop across keying resistor (R157) introduced into the filament-to-ground circuit of the tube as explained in Paragraph 3.34 for the HF transmitter.

3.57 IF AUDIO OSCILLATOR—For intermediate frequency operation the Navy Type –860 tube (V103), which operates as the HF 2nd intermediate amplifier at high frequencies, is switched into the IF audio oscillator circuit by switches (S114C, S114D and S142). The audio (Howler) transformer (T104) and its associated capacitors (C178 and C179) are mounted behind the tube. D-C potential is fed to the plate of the tube through voltage-dropping resistor (R111) which is by-passed by capacitor (C180) and the primary of the transformer (T104). The secondary of the transformer is tuned by capacitor (C179) to resonate at an audio frequency of 800 cycles. The control grid of the audio oscillator tube is connected to ground through the resistor (R110) and coupled to the high potential end of the transformer secondary by coupling capacitor (C178). MCW emission (on the IF frequencies only) is provided by feeding audio frequency potential from the audio oscillator transformer through coupling capacitor (C326) to the suppressor-grid elements of the following power amplifier tubes. For "MCW" operation, the filament of the audio oscillator tube is energized through contacts of the "EMISSION SELECTOR" switch (S126). When this switch is used in "CW", "PHONE" or "MCW" positions, the filament compensating resistor (R130) is switched into the circuit and the tube filament voltage is cut off. This substitution of a resistor in place of the tube filament maintains a constant potential on the other tube filaments of the transmitter, regardless of the position of the "EMISSION SELECTOR" switch (S126). The tube screen-grid is electrostatically grounded through capacitor (C110) and is fed d-c potential through the screen resistor (R116).

3.58 IF POWER AMPLIFIER—The IF power amplifier plate tank circuit is tuned by "IF P.A. TUNING" variometer (L113), control "F," located immediately above the IF intermediate amplifier variometer. The circuit may be tuned for two bands by means of switch S115 and the tank capacitors (C165, C167, C168 and C169). Band 1 covers the frequencies from 175 to 320 kilocycles; band 2 covers the frequencies from 320 to 600 kc. The capacitors are connected from each end of the variometer to ground in a manner to form a pi-section, low-pass filter circuit which attenuates the harmonic frequencies.

3.59 Fixed bias is fed to the control grids of the two Navy Type –803 tubes (V104, V105) through "P.A. GRID CURRENT" mete (M106), grid resistor (R109), choke co (L132) and parasitic suppressor units (R12 R123, L117, and L118). Capacitor (C177) connected from the low potential end of th choke coil to ground. The plates are parallel fe through "P.A. PLATE CURRENT" mete (M102) and the plate choke coil (L129). Ca pacitor (C123) by-passes the low-potential en of the plate choke coil to ground and (C166 provides coupling from the plate to the tank ci cuit. The screen-grid is connected to the 500-vo source through resistor (R108) and effectivel by-passed to ground by capacitor (C106).

3.60 The tube suppressors are connected to on of three circuits by a section of "EMISSIO SELECTOR" switch (S126), and therefore th condition of their operation is dependent upo the type of emission selected. For phone emis sion, the secondary of the audio line transforme (T105) is connected to the suppressor grid Fixed negative bias potential is obtained fro the potentiometer (R131). For "MCW" emis sion, 800 cycles audio potential from the audi oscillator circuit is supplied to the suppresso through the coupling capacitor (C326), and th circuit is completed to ground through the self biasing resistor (R124). When "CW" is em ployed, positive d-c bias is applied to the suppres sor-grids from the 2,000-volt motor generato via voltage divider composed of (R170) (R171) and (R173), the potential-drop acros (R173) supplying the necessary voltage of abou 40 volts.

3.61 IF ANTENNA COUPLING AND TUNING SYSTEM—The IF antenna coupling and tuning system is mounted in the upper portion o the left-hand frame. Variable coupling to the antenna is provided by the "IF ANTENNA COUPLING" switch (S121) (H) and its associated capacitors (C133 to C142) inclusive. These coupling capacitors are arranged for connection across the output section of the plate tank circuit consisting of capacitors (C168) and (C169). R-F output energy is fed to the antenna through the "IF ANTENNA CURRENT" mete (M101), antenna variometer (L114), antenna load coil (L115) and antenna switch (S120). The "IF ANTENNA LOADING" switch (S117) (J) varies the inductance of the load coil by shorting out the unused turns.

3.62 When the transmitter is operated into certain antennas having constants such that a large portion of the loading coil is required for tuning, the antenna circuit components may be subjected to voltages which are of sufficient magnitude to form corona or cause injurious sparking. Protection against injury of parts from flash-overs has been provided by a protective SPARK GAP at the antenna terminal. This gap has been set at a spacing (approximately ¼ inch) such that it will flash-over before the voltages reach a value which might cause injury to the equipment.

CAUTION: Do not change the spark-gap setting. Flash-over of the gap under normal operating conditions indicates that the antenna connected to the equipment has characteristics unsuitable for full power operation and the transmitter should be operated on such antennas at reduced power by reducing the plate voltage.

VOICE MODULATION—The output of either the HF transmitter or the IF transmitter may be voice modulated. This is accomplished by suppressor grid modulation of the power amplifier tubes. One section of the "EMISSION SELECTOR" switch (S126) transfers the suppressor grids of the Type –803 tubes from a (approximately plus 40 volt) CW operating point on voltage divider resistors (R173, R170, R171) to a negative potential point on the bias potentiometer (R131) for "PHONE" operation. The value of negative potential is chosen to give an unmodulated carrier output of one-fourth of the output on "CW" telegraph. For "MCW" the suppressor grids are self-biased by the voltage-drop through resistor (R124).

For telephone transmission, speech input equipment must be associated with the transmitting equipment. The audio output from the speech equipment is connected to the primary of the audio line transformer (T105) through terminals 9H and 10H and the resistor-capacitor attenuator units (R120 and C330). The secondary of the transformer is connected in series with the suppressor grid lead. The audio voltage from the transformer effectively modulates the power amplifier stage. When in "PHONE" position, a section of the "EMISSION SELECTOR" switch (S126) transfers control of the keying relay to a "press-to-talk" button in the combination handset or to an equivalent lever switch in the front panel of the amplifier unit of the speech input equipment. These control buttons in the speech input equipment serve the same function as a manual telegraph key.

3.65 TERMINAL BOARD AND RELAY SECTION—The terminal boards are located across the bottoms of the two frame sections of the transmitter and are accessible through the two doors located at the bottom of the front panels. All external control and power wiring (except for the antenna lead) is connected to these terminals. Details of connections are shown by the external connection diagrams, Figures 40 and 48 (a-c) and 41 and 49 (d-c). The relays are mounted on the inside surfaces of the two lower access doors and are accessible for inspection or adjustment when the doors are opened. The relays located in this section are as follows:

K105 MO-IPA (Auxiliary) Overload Relay.

K106 Plate Voltage Overload Relay.

K110 (0.1 second) Auxiliary Keying Relay.

K102 or K111 Master Start Relay.

K104 or K112 Generator Field Relay.

K108 Bias Relay.

3.66 Fuses (F104, F105, F108 and F109) are located on the left side of the relay section in front of the terminal boards. Behind the terminal boards on the base plates are mounted the items of equipment as indicated in Figure 13.

3.67 Filament adjusting rheostats (R152 and R153) are located at the right side of the section behind the terminal boards. These units in the base section are accessible from the sides by removing the oscillator unit. Door interlock switches are mounted just behind the doors on the base frame and push buttons for resetting the overload relays are provided in the door on which they are mounted.

3.68 PANEL EQUIPMENT AND CONTROLS—All the tuning controls are marked with letters and with functional designations. They are as follows:

Panel Letter	Panel Description	Schematic Symbol
A	IF-HF CHANGE SWITCH	(S114)
B	IF-OSCILLATOR RANGE SWITCH	(S123)
C	IF-OSCILLATOR TUNING	(L110)
D	IF-OSCILLATOR PLATE TUNING	(L111)
E	IF-I.A. TUNING	(L112)
F	IF-P.A. TUNING	(L113)
G	IF-FREQUENCY RANGE	(S115) (S116)
H	IF-ANTENNA COUPLING	(S121)
I	IF-ANTENNA TUNING	(L114)
J	IF-ANTENNA LOADING	(L117)
L	HF-OSCILLATOR RANGE SWITCH	(S124)

Panel Letter	Panel Description	Schematic Symbols
M	HF-OSCILLATOR TUNING	(L109)
N	HF-OSC. PLATE TUNING	(C181)
O	HF-1ST I.A. TUNING	(L105) (C148)
P	HF-2ND I.A. TUNING	(L104) (C147)
Q	HF-P.A. FREQ. RANGE SW	(S131)
R	HF-P.A. TUNING	(L102) (C146)
S	HF-ANTENNA CAPACITOR	(C172)
T	HF-ANTENNA INDUCTOR	(L100)
U	HF-ANT. FEED SWITCH	(S119)
V	HF-COUPLING CAPACITOR	(C171)
W	ANTENNA SWITCH	(S120)

3.69 In addition to tuning controls the front panels are provided with the following miscellaneous control equipment:

	Schematic Symbols
(a) Left-hand section, mid-panel	
TEST KEY	(S111)
CONTROL (LOCAL-REMOTE) SWITCH	(S110)
"START" switch (4-wire control)	(S108)
"START" switch (6-wire control)	(S140 and S141)
"EMERGENCY STOP" switch	(S107)
"FREQUENCY METER AUDIO OUTPUT" jack	(J101)
"FILAMENT VOLTAGE" rheostat	(R134)
"PLATE VOLTAGE" rheostat	(R143)
"BIAS VOLTAGE" rheostat	(R144)
TUNE-OPERATE SWITCH	(S125)
(b) Right-hand section; mid-panel	
KEYING RELAY	(K101)
"FILAMENT STANDBY" switch (a-c sets only)	(S106)
(HEATER) line voltage switch (d-c sets only)	(S113)
"EMISSION SELECTOR" (PHONE-CW-MCW) switch	(S126)
(Thermostat) "HEATER RELAY" (a-c sets)	(K100)
(Thermostat) "HEATER RELAY" (d-c sets)	(K103)
(c) Oscillator Panel	
Thermometer	(M112)
(HF Osc.) calibrate	(C186)
(d) Bottom section, left-hand door	
"AUXILIARY OVERLOAD" relay "RESET"	(K105)
"HIGH VOLTAGE OVERLOAD" relay "RESET"	(K106)

3.70 Meters are provided on the front panels as follows:

(a) Top sections	
I.F. ANTENNA CURRENT	(M101)
FILAMENT VOLTAGE	(M107)

	Schematic Symbols
[illegible] CURRENT	(M100)
[illegible] PLATE VOLTAGE	(M111)
[illegible] PLATE VOLTAGE	(M110)
[illegible] VOLTAGE	(M109)
[illegible] section, mid-panel	
[illegible] VOLTAGE (d-c sets only)	(M108)
[illegible] PLATE CURRENT	(M104)
[illegible] section, mid-panel	
[illegible] PLATE CURRENT	(M102)
[illegible] GRID CURRENT	(M106)
[illegible] PLATE CURRENT	(M103)
[illegible] section	
[illegible] PLATE CURRENT	(M105)
[illegible] lights are provided as follows:	
[illegible] section, mid-panel	
[illegible] VOLTAGE (Red)	(I102)
[illegible] FILAMENT (Clear)	(I104)
[illegible] VOLTAGE (Green)	(I101)
[illegible] START (Red), a-c sets	(I103)
[illegible] START (Red), d-c sets	(I105)
[illegible] "ON" (Amber)	(I100)

[illegible] "HF-IF CHANGE SWITCH" designated "A" on the front panel actuates switches [illegible] to S114F, inclusive) (S114GX), [illegible] (S142), (S143) and (S144). [illegible] S114A and S114B) transfer the plate and grid connections of the power amplifier [illegible] V104, V105) to the r-f circuits of either the HF or IF components of the transmitter. [illegible] S114C and S114D) transfer the plate and grid connections of the 2nd IA tube (V103) for either the HF radio frequency circuit components of the 2nd IA or to the audio oscillator components for IF operation. Switches (S114E and S114F) transfer the plate and grid connections of the 1st IA tube (V102) to the r-f circuits of either the HF or IF components of the transmitter. Switches (S114GX and S114GY) transfer the plate and screen grid voltage supply from the oscillator tubes (V100 or V101) to the plate and screen circuits of either the HF or IF oscillator tubes. Switch (S142) connects one side of the filament supply for the 2nd IA amplifier tube (V103) to the tube filament for HF operation. For IF operation, this tube becomes the "MCW" oscillator; switch (S142) then connects one side of its filament supply to either the tube filament or an equivalent resistor, through a section of switch (S126). Switch (S144) transfers the control voltage for operation of the relays in the receiver attenuator units to either the IF attenuator unit (through terminal 10Y) or the HF attenuator (through terminal 9Y). Switch (S144) transfers one side of the 115-volt, a-c supply voltage to either the filament transformer primary circuit of the HF oscillator tube or the filament transformer primary circuit of the IF oscillator tube.

3.73 The "ANTENNA SWITCH (S120), designated as control "W" on the top front panel, transfers the antenna to the HF circuits of the transmitter, the IF circuits of the transmitter, or to a receiver position.

3.74 All other control and power circuits function the same, regardless of which frequency range (HF or IF) is in use.

3.75 The "TEST KEY" (S111) is of the toggle type and accomplishes the same function as the telegraph key, but has control regardless of the position of the "LOCAL-REMOTE" switch. The test key locks in its "UP" position, but when thrown to the "DOWN" position it will return to the "OFF" position (center) when released. The same function, which is that of energizing the keying relay, is performed in either the "UP" or "DOWN" position.

3.76 The "LOCAL-REMOTE" switch (S110) is also of the toggle type and is a five-pole, double-throw switch which transfers the transmit-

ter control to "LOCAL" operation when pushed down or to "REMOTE" operation when in the center position. This switch has no "UP" position.

3.77 The "START" switch may be a single-toggle switch (S108) for four-wire control or two momentary-contact push-buttons (S140), (S141), for a six-wire control. Both types are provided with the equipment, each type having a suitable mounting nameplate. One type is mounted in the equipment while the other type will be provided with the transmitter accessories.

3.78 The "EMERGENCY STOP" switch (S107) is a push-button type switch that permits cutting off the heater circuit, the filament circuit and the transmitter control circuits in case of emergency. This switch should be operated to the "OFF" position when changing fuses or when servicing the equipment (other than replacing tubes).

3.79 The three rheostat controls located on the front panel provide for manual adjustment of "FILAMENT R134," "BIAS R144," and "PLATE R143" potentials. As indicated by an arrow at each control, clockwise rotation will produce an increase in voltage. The "FILAMENT" rheostat is arranged in series with the primary windings of all filament transformers. The "BIAS" and "PLATE" rheostats are arranged in the field circuits of their respective generators.

3.80 The "TUNE-OPERATE SWITCH" (S125) protects the tubes from overheating during tuning such as may occur due to improper adjustments when changing frequency. Three switch positions are provided. In position "TUNING STEP-1", plate voltage is removed from the power amplifier stage and reduced to a safe value on the intermediate amplifier stages. In position "TUNING STEP-2", reduced plate voltage is supplied to all amplifier stages, including the power amplifier. In position "OPERATE STEP-3", normal operating voltages are supplied to all stages. The oscillator plate and screen voltages remain constant for all positions.

3.81 The "KEYING RELAY" (K101) performs the functions of keying either the HF or IF transmitting circuits. It is mounted on the front panel behind an easily removable cover and is readily accessible for cleaning or adjustment. One set of contacts (A) controls the (tube bias) keying potential by shorting resistor (R157) which, in series with (R151, R158, and R159) is a part of a voltage divider across the 1,600-volt (auxiliary) generator supply. A second set of contacts (B) is wired in series with the heater (R172) of the HF oscillator tube compensator (C322). Contacts (B) energize the compensator when the keying relay is closed. The heater resistor causes the capacitance of C322 to change in such a manner as to compensate for changes in the oscillator tube capacitance, which occurs while keying. Thus, a constant frequency of oscillation is maintained. The relay auxiliary contacts (C and D) are connected to operate the receiver attenuator unit relays when attenuator units are associated with the equipment.

3.82 A "FILAMENT-STANDBY" switch (S106), on a-c sets only, makes it possible to keep the oscillator filament energized when the equipment is not operating. The emergency switch must be "ON" in order to energize the oscillator filament for the standby condition.

3.83 A "LINE VOLTAGE" switch (S113), on d-c sets only, is provided to avoid excess power in the oven heater when the d-c line voltage exceeds normal values. It functions to insert or short-out resistance units connected in series with the heater unit. In NORMAL position the resistors are shorted.

3.84 The "EMISSION SELECTOR" switch (S126) is of the toggle type. It has three positions and performs three functions. One section of the switch connects the suppressors of the power amplifier tubes to the proper circuit for "PHONE," "CW," or "MCW" operation. One section transfers the control of the keying relay to the PUSH-TO-TALK buttons of the speech equipment for "PHONE" operation and one section lights the filament of the audio oscillator tube for "MCW" operation. The "MCW" position of this switch is for use at IF frequencies only. If the "EMISSION SELECTOR" switch is placed in the "MCW" position when operating on HF, power is reduced to 65% of the normal value.

3.85 The "HEATER RELAY" (K100 or K103) is mounted on the front panel and provided with a protective cover. Energy to the coil of this relay is controlled by the mercury thermostat (S102) which is in the heat oven of the oscillator unit. The relay contacts are wired to apply or remove power in the oven heater units.

3.86 The thermometer on the front panel of the oscillator units is provided to indicate the temperature within the heat oven.

3.87 "OVERLOAD" relay reset buttons in the door of the bottom compartment provide for manually resetting the relays after they have been operated by an overload.

3.88 START-STOP CONTROL FOR A-C POWER SUPPLY—The simplified control diagram, Figure 23 shows the circuits for both six-wire control and four-wire control. In each case, the connection link (4- or 6-wire) settings are fully shown.

3.89 SIX-WIRE SYSTEM—In the six-wire-control system, the transmitter may be started locally by pressing the "ON" push-button (S140) of the "START" switch which energizes the starting relay (K102) and applies power to the indicating

ter control to "LOCAL" operation when pushed down or to "REMOTE" operation when in the center position. This switch has no "UP" position.

3.77 The "START" switch may be a single-toggle switch (S108) for four-wire control or two momentary-contact push-buttons (S140), (S141), for a six-wire control. Both types are provided with the equipment, each type having a suitable mounting nameplate. One type is mounted in the equipment while the other type will be provided with the transmitter accessories.

3.78 The "EMERGENCY STOP" switch (S107) is a push-button type switch that permits cutting off the heater circuit, the filament circuit and the transmitter control circuits in case of emergency. This switch should be operated to the "OFF" position when changing fuses or when servicing the equipment (other than replacing tubes).

3.79 The three rheostat controls located on the front panel provide for manual adjustment of "FILAMENT R134," "BIAS R144," and "PLATE R143" potentials. As indicated by an arrow at each control, clockwise rotation will produce an increase in voltage. The "FILAMENT" rheostat is arranged in series with the primary windings of all filament transformers. The "BIAS" and "PLATE" rheostats are arranged in the field circuits of their respective generators.

3.80 The "TUNE-OPERATE SWITCH" (S125) protects the tubes from overheating during tuning such as may occur due to improper adjustments when changing frequency. Three switch positions are provided. In position "TUNING STEP-1", plate voltage is removed from the power amplifier stage and reduced to a safe value on the intermediate amplifier stages. In position "TUNING STEP-2", reduced plate voltage is supplied to all amplifier stages, including the power amplifier. In position "OPERATE STEP-3", normal operating voltages are supplied to all stages. The oscillator plate and screen voltages remain constant for all positions.

3.81 The "KEYING RELAY" (K101) performs the functions of keying either the HF or IF transmitting circuits. It is mounted on the front panel behind an easily removable cover and is readily accessible for cleaning or adjustment. One set of contacts (A) controls the (tube bias) keying potential by shorting resistor (R157) which, in series with (R151, R158, and R159) is a part of a voltage divider across the 1,600-volt (auxiliary) generator supply. A second set of contacts (B) is wired in series with the heater (R172) of the HF oscillator tube compensator (C322). Contacts (B) energize the compensator when the keying relay is closed. The heater resistor causes the capacitance of C322 to change in such a manner as to compensate for changes in the oscillator tube capacitance, which occurs while keying. Thus, a constant frequency of oscillation is maintained. The relay auxiliary contacts (C and D) are connected to operate the receiver attenuator unit relays when attenuator units are associated with the equipment.

3.82 A "FILAMENT-STANDBY" switch (S106), on a-c sets only, makes it possible to keep the oscillator filament energized when the equipment is not operating. The emergency switch must be "ON" in order to energize the oscillator filament for the standby condition.

3.83 A "LINE VOLTAGE" switch (S113), on d-c sets only, is provided to avoid excess power in the oven heater when the d-c line voltage exceeds normal values. It functions to insert or short-out resistance units connected in series with the heater unit. In NORMAL position the resistors are shorted.

3.84 The "EMISSION SELECTOR" switch (S126) is of the toggle type. It has three positions and performs three functions. One section of the switch connects the suppressors of the power amplifier tubes to the proper circuit for "PHONE," "CW," or "MCW" operation. One section transfers the control of the keying relay to the PUSH-TO-TALK buttons of the speech equipment for "PHONE" operation and one section lights the filament of the audio oscillator tube for "MCW" operation. The "MCW" position of this switch is for use at IF frequencies only. If the "EMISSION SELECTOR" switch is placed in the "MCW" position when operating on HF, power is reduced to 65% of the normal value.

3.85 The "HEATER RELAY" (K100 or K103) is mounted on the front panel and provided with a protective cover. Energy to the coil of this relay is controlled by the mercury thermostat (S102) which is in the heat oven of the oscillator unit. The relay contacts are wired to apply or remove power in the oven heater units.

3.86 The thermometer on the front panel of the oscillator units is provided to indicate the temperature within the heat oven.

3.87 "OVERLOAD" relay reset buttons in the door of the bottom compartment provide for manually resetting the relays after they have been operated by an overload.

3.88 START-STOP CONTROL FOR A-C POWER SUPPLY—The simplified control diagram, Figure 23 shows the circuits for both six-wire control and four-wire control. In each case, the connection link (4- or 6-wire) settings are fully shown.

3.89 SIX-WIRE SYSTEM—In the six-wire-control system, the transmitter may be started locally by pressing the "ON" push-button (S140) of the "START" switch which energizes the starting relay (K102) and applies power to the indicating

lamp (I103). The relay (K102) is equipped with four sets of contacts. The function of each of these contacts is as follows: Contacts (K102A) short circuit the MO "FILAMENT STANDBY" switch (S106) and resistor (R152), thus applying full voltage to the filament of the MO tube in use. Contacts (K102B) latch the relay in; the "ON" push-button switch (S140) may then be released. Contacts (K102C) apply power to the remote indicator light. Contacts (K102D) energize the magnetic controller, the filament transformer (T103) and the generator field relay (K104).

3.90 When the contacts of relay (K104) close, the bias generator voltage increases as the machine comes up to speed; thus the bias relay (K108) is energized and lamp I101 (green) is lighted. Contacts "A" of relay (K108) complete the field circuit of the high-voltage generator and light the (red) indicator lamp (I102); the other contacts (K108B) permit operation of the keying relay (K101) and the 0.1 second time-delay relay (K110) if the "TEST KEY" (S111) is closed or if the remote key is pressed. Relays (K101 and K110) operate from the 250-volt bias generator.

3.91 If the "OFF" push-button (S141) of the "START" switch is momentarily closed, the coil of relay (K102) will be short-circuited, the current being limited by resistor (R166). The contacts of relay (K102) then open, thus stopping the motor generator, opening all relays and removing all power from the filaments.

3.92 It should be noted that:

(a) The door interlocks must be closed to operate relay (K102).

(b) The overload relays must be closed to operate relay (K104).

(c) The switch interlocks (S132, S134, S135, S136, S137, S138, S139) must be closed to operate the keying relay (K101).

3.93 When **four-wire control** is used, the "START" switch (S108) replaces switches (S140 and S141). Switch (S108) is of the maintaining toggle type so that the circuit is simply closed for starting and opened for stopping the equipment.

3.94 One set of contacts of relay (K102) "B" is not used for four-wire control since the starting and stopping methods are not the same as for six-wire control.

3.95 For remote operation (S110 in "REMOTE" position), switch (S108) must be closed to complete the circuit. In other respects, the operation of the four-wire control circuits is identical with that for six-wire control.

3.96 START-STOP CONTROL FOR D-C POWER SUPPLY—The simplified control diagram, Figure 24, shows the circuits for both six-wire control and four-wire control. In each case, the connection link (four-wire or six-wire) settings are described fully.

3.97 In the six-wire control system, the transmitter may be started locally by means of the "START" switch (S140) which in the "ON" position causes operation of the "MASTER" relay (K111) and lights indicator lamp (I103). Relay (K111) has four sets of contacts. The function of each of these sets of contacts is as follows:

"A" contacts are not used.

"B" contacts latch the relay in; the "ON" push-button switch (S140) may then be released.

"C" contacts apply power to the remote indicator light.

"D" contacts cause the magnetic controller and the generator field relay (K112) to be energized.

3.98 When the contacts of the generator field relay (K112) close, the bias generator voltage increases as the machine comes up to speed; thus the bias relay (K108) is energized and indicator lamp (I101) is lighted. Closing of contacts "A" of relay (K108) causes the field of the high-voltage and auxiliary generators to be energized and lamp (I102) to be lighted; closing of contact (K108B) permits operation of the keying relay (K101) and the 0.1 second time-delay relay (K110) if the "TEST KEY" switch (S111) is closed or if the remote key is pressed. The keying relay (K101) and time-delay relay (K110) operate from the 250-volt bias generator. If the "START" switch is momentarily placed in the "OFF" position, the coil of the starting relay (K111) will be short circuited, the current being limited by resistor (R187 or R188). The contacts of relay (K111) then open, thus stopping the motor generator, opening all relays and turning off the filaments. It should be noted that:

(a) The door interlocks must be closed to operate relay (K111).

(b) The overload relays must be closed to operate relay (K112).

(c) The switch interlocks (S132, S134, S135, S136, S137, S138 and S139) must be closed to operate the keying relay (K101).

3.99 In the **four-wire control** system, contacts "B" of relay (K111) are not used since the starting and stopping methods are not the same as for six-wire control.

3.100 It should also be noted that the keying relay (K101) and the 0.1 second time-delay relay (K110) operate from the power supply when four-wire control is used, and not from the 250-volt bias generator as in the case of six-wire control. Thus, the keying circuit voltage is similar in value for four- and six-wire control when the power supply is 230 or 250 volts d-c, but is not the same when the power supply is 115 volts d-c.

In the latter case, when four-wire control is used, resistor (R140, 600 ohms) is replaced by resistor (R181, 300 ohms), resistor (R141, 600 ohms), is replaced by resistor (R182, 300 ohms), and resistor (R163, 1,000 ohms) is omitted from its clips. Thus the proper voltage (approximately 48 volts) is maintained across the coils of the relays (K101 and K110).

3.101 Wherever more than one item number is given for one position in the equipment the particular item to be used depends upon the voltage of the power supply and upon the type of control (4-wire or 6-wire) that is employed. (See Figures 61 and 62.) The correct item for each multiple marked position is indicated in the following tabulation:

Specific Items To Be Used in Positions Indicated by Multiple Item Numbers

Item Number Combinations	6-Wire Control			4-Wire Control		
	Power Supply			Power Supply		
	115 V D-C	230 V D-C	250 V D-C	115 V D-C	230 V D-C	250 V D-C
R140 R181	R140	R140	R140	R181	R140	R140
R141 R182	R141	R141	R141	R182	R141	R141
R162 R186	R162	R162	R162	Link	R186	R162
R163 R164	R163	R163	R163	omit	R164	R163
†R178 R179 R180	R178	R179	R180	R178	R179	R180
†R139 R190	R139	R190	R190	R139	R190	R190
†R187 R188	R187	R188	R188	R187	R188	R188
†I103 I105	I103	I105	I105	I103	I105	I105

† Note that there is no change of item when merely changing from 6-wire to 4-wire control. These items change only when changing power supply.

3.102 POWER SUPPLY CIRCUITS—1600-VOLT SUPPLY—The BIAS AND AUXILIARY GENERATOR (G402) supplies a positive potential of 1,600 volts. The a-c component of this voltage is filtered out of the circuit by means of capacitor (C303) which is located in the filter unit box. An r-f filter capacitor (C184) is located in the relay and resistor section of the transmitter assembly. The voltage is indicated by meter (M111) which operates in conjunction with the multiplier composed of resistor (R176) with capacitor (C328). The meter is shunted by capacitor (C311).

3.103 At this point the circuit is divided into three branches.

1. Voltage is applied through the dropping resistors (R118 and R119) to the screen grids of the MO tubes (V100 and V101).

2. Voltage is applied through resistor (R115) and the oscillator plate current meter (M105) to the plates of the MO tubes (V100 and V101).

3. A voltage divider is provided by the resistors (R157), (R158), (R159), and (R151) in series between the generator and ground. The drop across (R157) is used to bias the cathodes of the power amplifier tubes (V104 and V105) for keying. This voltage across (R157) is also applied through the overload relay winding of (K105) for keying bias to the cathodes of tubes (V100), (V101), (V102) and (V103). The contacts "A" of the keying relay (K101) are shunted across the resistor (R157) so that when the contacts are closed the resistor (R157) is shorted out and thus removes positive potential from the cathodes of all the tubes. Contacts (K101A) are shunted by resistor (R165) and capacitor (C314) in series. The winding of overload relay (K105) is shunted by capacitor (C323) and resistor (R148) in parallel.

3.104 250 VOLT BIAS SUPPLY—The bias and auxiliary generator (G402) generates a negative potential of 250 volts. The a-c component of this voltage is filtered out of the circuit by means of capacitors (C304) and (C305) in the a-c supplied equipment, and by means of (C304), (C305), (C329), and choke coil (L116) in the d-c supplied equipment. This voltage has three functions to perform: to supply control grid bias for the various tubes; to supply power to the keying relay (K101), and the slow acting relay (K110), and the associated attenuator unit relay; and to energize the fields of all three generators.

3.105 The grid bias circuit consists of the following:

1. Dropping resistors (R126), (R127), (R132) and (R133) form a voltage divider from various points of which voltages are taken off to supply bias to the tubes (V102), (V103), (V104), (V105).

2. "BIAS VOLTAGE," meter (M109) with by-pass capacitor (C312).

3. Indicator lamp (green) (I101).

4. Bias Relay winding (K108) in series with resistor (R168). The energizing of this relay applies the bias generator voltage to the keying relay circuits and to the field coils of the auxiliary and main plate generators. The keying and attenuator relay circuits are energized by the bias generator voltage when contacts "B" of relay (K108) are closed.

3.106 The bias generator field coil is energized as soon as the contacts of relay (K104 or K112) close. The bias generator thus becomes self-excited. The voltage generated is controlled by the field rheostat (R144) in series with the field coil.

3.107 When contacts "A" of the bias relay (K108) close, bias generator voltage is applied to the field coils of both the 1600 volt generator and the main plate generator. The full 250 volts is applied to the 1600 volt generator field. The 250 volts is also applied to the main plate generator field through resistors (R142), (R143) and (R146). The high voltage generator field current is controlled by the field rheostat resistor (R143).

3.108 When contacts "A" of relay (K108) close, voltage is also applied across lamp (I102) (red) which indicates that high voltage is being supplied to the equipment.

3.109 500 VOLT SUPPLY—One winding of generator (G401) generates a positive potential of 500 volts. The a-c component of this voltage is removed by capacitor (C301) located in the filter box and the generator is protected from r-f potentials by capacitor (C193) which is located in the relay and resistor compartment of the transmitter assembly.

The voltage generator supplies the screen grid bias for tubes (V102), (V103), (V104), and (V105).

3.110 2000 VOLT SUPPLY—The plate generator develops a positive potential of 2000 volts. The a-c component of this voltage is removed by capacitor (C302) located in the filter box. The r-f by-pass capacitor (C183) is located in the relay and resistor compartment of the transmitter assembly. It protects the high-voltage supply from r-f potentials.

3.111 This voltage is supplied through switch (S125) to the plates of tubes (V102), (V103), (V104) and (V105). A meter (M110) in series with multiplier (R175) indicates plate voltage. The suppressor grids of the power amplifier are biased by the drop across (R173) of the voltage divider resistors (R170), (R171) and (R173).

3.112 FILAMENT SUPPLY—In the a-c equipments the filaments are supplied from transformer (T106) which is connected to the supply line and mounted in the filter box.

3.113 In the d-c equipments the filaments are supplied by slip rings on the bias generator. In each case the filament voltage is controlled by the series rheostat (R134).

MOTOR GENERATORS

3.114 The motor generators supplied with this equipment are of ample capacity for operation with the transmitter. The motor generators (see Figures 30 and 31) are of the three-unit, six-bearing type with all units mounted on a common bedplate. They are employed to operate respectively from the following power supplies: (a) 440 volts, or 220 volts, 3-phase, 60 cycles; (b) 115 volts d-c and (c) 230 volts, or 250 volts, d-c. A complete set consists of a driving motor for one of the above voltages, a main plate generator supplying voltages of 2000 and 500 volts d-c, and a bias and auxiliary generator supplying voltages of 250 and 1600 volts d-c and 110 volts a-c. Except for driving motors, all types of motor-generator equipment are electrically identical. The bias and auxiliary generator is equipped with slip rings from which the 110 volt, a-c energy is supplied. This 110 volt, a-c supply furnishes filament voltage for d-c equipments and is likewise available (but not used) on a-c equipment. The motors are mechanically interchangeable with one another, thus providing flexibility in case of power supply changes. The bias and auxiliary generator is self-excited from the 250-volt commutator; this commutator also furnishes field excitation for the main plate generator.

3.115 All of the motors and generators are of the semi-enclosed, drip-proof, ball bearing type.

The motor is direct coupled to the generators by means of flexible couplings. Terminal boxes, which are suitably arranged for mounting on either the top or side of the motors and generators, provide for wiring and contain protective fuses. Any motor or generator may be removed from the bedplate without disturbing the adjacent unit. The normal speed of rotation is 1750 r.p.m.

3.116 Type numbers are assigned to each motor and generator, and to each combination of the three units and bedplate as shown below.

1. 440/220 volts, 3 phase, 60 cycle supply	
Motor Generator	Navy Type CBP-21340 CGU-21950A
Motor, 440/220 volts a-c	Navy Type CBP-21337 CGU-21953 CAOG-21953A
Generator, 2000/500 volts d-c	Navy Type CBP-21339 CGU-21955
Generator, 250/1600 volts d-c, 110 volts a-c	Navy Type CBP-21338 CGU-21954
2. 115 volts d-c supply	
Motor Generator	Navy Type CBP-21546 CGU-21948
Motor, 115 volts d-c	Navy Type CBP-21544 CGU-21951
Generator, 2000/500 volts d-c	Navy Type CBP-21339 CGU-21955
Generator, 250/1600 volts d-c, 110 volts a-c	Navy Type CBP-21338 CGU-21954
3. 230 volts d-c supply and 250 volts d-c supply	
Motor Generator	Navy Type CBP-21547 CGU-21949
Motor, 230/250 volts d-c	Navy Type CBP-21545 CGU-21952
Generator, 2000/500 volts d-c	Navy Type CBP-21339 CGU-21955
Generator, 250/1600 volts d-c, 110 volts a-c	Navy Type CBP-21338 CGU-21954

3.117 MAIN PLATE GENERATOR, TYPE CBP-21339 or CGU-21955—This is a double commutator generator which is compound wound and separately excited from the bias generator. It is rated at 0.6 ampere, 1200 watts at 2000 volts d-c and 0.35 ampere, 175 watts at 500 volts d-c. There are 31 slots in the armature. The 2000-volt commutator has 124 bars and the 500-volt commutator has 93 bars. The field consists of two main poles and two interpoles. The main field poles have two windings; the shunt winding is separately excited from the 250-volt generator, while the compound winding (and the interpoles) are connected in series with the armature winding. The voltage is controlled by means of a rheostat located on the transmitter panel. The terminals and the high voltage fuses are mounted on a mycalex board within the terminal box. These are rated 1 ampere, 2500 volts and 3/8 ampere, 2500 volts.

3.118 BIAS AND AUXILIARY GENERATOR, TYPE CBP-21338 or CGU-21954—This generator is provided with two commutators and a pair of slip-rings, and is compound wound. It is rated at 0.1 ampere, 160 watts at 1600 volts d-c, 1.0 ampere, 250 watts at 250 volts d-c and 3.55 amperes at 110 volts, 60 cycles, 1 phase. The 1600-volt armature has 31 slots and 124 commutator bars. The field consists of two poles, each of which has two windings; the shunt winding is excited from the 250-volt commutator, while the compound winding is connected in series with the armature winding. The 250-volt commutator has 95 bars. The field consists of four poles which have two windings; the shunt winding is self-excited from the 250-volt d-c commutator, while the compound winding is connected in series with the (250 volts) armature winding. The 250-volt field circuit is wired to a

rheostat control on the transmitter panel. The terminals and fuses are mounted within the terminal box. The fuses are rated at 3/8 ampere, 2500 volts, 6 amperes, 250 volts.

3.119 MOTORS—The following motors are used with this equipment:

(a) Type CBP-21337, CGU-21953 or CAOG-21953A—This motor is rated 440 or 220 volts (is interconnectable for these voltages), 3 phase, 60 cycles, 1750 rpm, 3.5 hp. It is rated for continuous duty. The line current rating is 5.5 amperes for 440 volts, 11 amperes for 220 volts operation. The stator has 36 slots. The 3-phase winding is a four pole series-multiple Y.

(b) Type CBP-21544 or CGU-21951—This motor, for operation from 115 volts d-c, is a compound-wound, direct-current motor with interpoles and is rated 4.5 hp, 37.5 amperes, 1750 rpm, continuous duty. The machine has 29 armature slots and 87 commutator bars.

(c) Type CBP-21545 or CGU-21952—This motor, for operation from 230 or 250 volts d-c, is a compound-wound, direct-current motor with interpoles and is rated 4.5 hp, 1750 rpm, 18.8 amperes at 230 volts and 17.2 amperes at 250 volts, continuous duty. The machine has 29 armature slots and 87 commutator bars.

3.120 SPEED REGULATOR—Each d-c type motor generator set furnished on this contract is equipped with a speed regulator. This regulator functions to produce automatically and essentially constant motor speed when the supply line voltage is varied over wide limits. The regulating device consists of a three ring collector at one end of which is mounted a double contact vibrating regulator. Each pair of contacts is connected across one-half of a resistor unit which is connected in series with the shunt field of the motor. Connections between the motor and the collector rings are made through brushes mounted in the stationary housing. Small capacitors are connected across the contactors to reduce sparking and radio interference. Figure 32 shows the construction of the speed regulator and the manner in which it is connected.

3.121 Speed regulation is accomplished by designing the motor for 1750 rpm with full field current at 167 volts for the 115 volt motor, or at 325 volts for 230/250 volt motors. With any lower voltage or rpm, the regulator automatically cuts-in resistance in the shunt field and thus restores the speed. The motor starts with all the resistance in the field. As the speed increases above the rated speed, the contacts close and short the resistance in the field and the speed decreases. At a little below rated speed the contacts open again, the motor speeds up and the cycle above is repeated. With a properly adjusted regulator, the changes in motor speed are small. The regulator has been adjusted for the proper speed during test at the factory and should not be changed until wear necessitates adjustment. However, if adjustment of the speed regulator should become necessary, the following procedure should be adhered to (refer to Figure 32):

a. Clean the contacts with #00 sandpaper or finer.

b. Short circuit center brush-box "C" and inside brush-box "B."

c. Adjust contact "X" until motor runs at desired speed without load.

d. Change short circuit to brush-boxes "C" and "A" and adjust contact "Y" until motor runs about 15 rpm faster than above, no load.

e. Remove short circuit and make sure that contact clamp screws "P" and "Q" are tight.

MAGNETIC CONTROLLERS

3.122 Navy Type CAE-21341 or CAE-21543—This magnetic controller is an across-the-line type for a three-phase, 60 cycle supply. The voltage will be 440 on the Type CAE-21341 magnetic controllers and 220 on the Type CAE-21543 magnetic controllers. In both cases, the contactor coil always operates on 110 volts, 60 cycles, this voltage being obtained from the transmitter unit. A three-phase disconnect switch and two line fuses are provided. Power for operating the transmitter is fed through these fuses and the disconnect switch. Two of the motor lines are also protected by means of a thermal type overload relay, the contacts of which are connected in series with the contactor coil. The thermal overload is of the manual reset type, a reset button being provided on the door of the controller cabinet. The thermal overload device protects against overloads while the fuses protect against short circuits. (See Figure 42.)

3.123 Type CAE-211107—This magnetic controller, which is used with the TBL-8 on Contract NXss-33180, is similar to Type CAE-21341 except for minor differences. Type CAE-211107 has no disconnect switch and the fuses are placed beyond the point where the magnetic controller circuits are connected to the line. Fuse F503 is eliminated. Two separate overload relays are used instead of a single relay with two energizing circuits. (See Figure 50.)

3.124 Type CAE-21541 or CAE-21542—The wiring and outline drawings of the d-c magnetic controller are given in Figure 43. When the "START" switch of the transmitter is in the "ON" position, power is applied to the terminals LL2 and LL1 of the motor controller. Current then flows through the main coil of relay (OL) and resistor (X-Y) in series. This causes the contacts of relay (OL) to close, thus applying power across the coil of the master relay (M). The main contacts of relay (M) now close and apply power directly from the lines to the motor generator. Here power is applied through a shunt field winding and rheostat, and across the series circuit consisting of the series windings of

Fuses (a) and (b) are in the Bias and MO plate generator terminal box.

Fuses (c) and (d) are in the h-v generator terminal box.

3.135 In the motor generators for d-c power supply, fuses in the Bias and MO plate generator terminal box protect the filament slip ring circuit. These are (F405) and (F406), and are of the terminal box protect the filament slip-ring circuit. rating is 6 amperes.

3.136 MAGNETIC CONTROLLER (Type CAE-21341 or CAE-21543)—This a-c controller is equipped with one fuse F503 rated at 10 amperes, 250 volts, in the control circuit, and two fuses (F501 and F502) in the main line. The latter are rated at 60 amperes for 220 volts a-c and 35 amperes for 440 volts a-c. The main line is additionally protected by a thermal overload relay. A manual reset button for this relay is provided on the door of the magnetic controller box.

3.137 The thermal overload relay is adjustable over the range of 12.5 to 15 amperes for the 220-volt a-c starter, and over the range of 5.9 to 7.2 amperes for the 440-volt a-c starter. Normal settings for these two are 13 and 6.5 amperes respectively. The tripping time of this relay as shown on the curve, Figure 42 is inversely proportional to the value of the overload current. The relay will trip if the current is 20 per cent or more above the normal setting. Since thermal metal is melted during this overload, a time interval of 10 to 20 seconds is required to allow the metal to solidify before resetting the overload button.

3.138 Type CAE-211107—This a-c controller is equipped with two fuses, rated at 10 amperes, 250 volts, in the transformer circuit. The main line is protected by two thermal overload relays. Manual reset buttons for these relays are provided in the door of the housing.

3.139 Overload relays are equipped with a heater which is adjustable from 90% to 110% of its normal value. Normal value is 4.5 amperes for the 440-volt a-c starter. The relays will trip if the current is 20% or more above the normal setting. Since thermal metal is melted during this overload, a time interval of 10 to 20 seconds is required to allow the metal to solidify. After this interval, the relays may be reset by depressing the reset buttons.

3.140 Type CAE-21541 or CAE-21542—This d-c controller is equipped with two fuses (F504 and F505), rated at 10 amperes 250 volts, in the control circuit. The main line is protected by an overload relay of the magnetic type equipped with an oil dash-pot. This overload relay is calibrated from 48 to 72 amperes for the 115-volt d-c controller, from 24 to 36 amperes for the 230-volt d-c controller and from 23 to 33 amperes for the 250-volt d-c controller. Normal ratings are 36, 18 and 16.6 amperes respectively. The d-c resistance of the overload relay latchout coil is 155 ohms. This relay is connected across the line in series with resistor X-Y. The latter has a resistance of 750 ohms for 115-volt supply, and 1500 ohms for 230-volt and 250-volt supply.

3.141 Type CAE-211105—No fuses are provided with the d-c controller. The main line is protected by an overload relay of the magnetic type, while the motor is protected by an overload heater. Normal rating for the overload heater is 15.3 amperes for the 230-volt d-c controller. The magnetic overload relay is, in each case, of the compensated type, adjustable from 110% to 200% of the motor amperes. They are of the instantaneous, automatic overload reset type; motor overload current flowing in the relay coil causes the plunger to trip the relay contacts open. Coil resistance for 230-volt d-c model is 195 ohms with a protective resistor (X-Y) of 2000 ohms.

SECTION IV

INSTALLATION

4.1 It is recommended that the installation force become familiar with this entire section before attempting to install the equipment. A knowledge of the design and operation, as covered in other sections of this book, is also desirable. This will materially aid in reducing the installation time and assure proper subsequent operation.

UNPACKING

4.2 In unpacking and handling the units, care should be exercised to prevent damage to the equipment. The following precautions should be observed:

(a) All boxes and crates containing equipment should be kept in an upright position at all times. Since some of the crated units may weigh from 500 to 1500 pounds, adequate transporting and lifting gear and sufficient personnel should be available to prevent any of the equipment from being subjected to unwarranted shock.

(b) Uncrate the various units and unwrap them carefully to avoid unnecessary damage to the finishes. In opening boxes or crates, remove at least three sides, extracting all nails with a nail puller; DO NOT USE A HAMMER OR PINCH BAR FOR THIS PURPOSE.

4.3 Upon uncrating the transmitter unit, remove the rear and side shields and inspect the interior for possible damage in shipment. Any parts or wiring which may have been displaced during shipment should be replaced in their proper locations and the shock absorbers for supporting the heat oven compartment of the master oscillator unit should be inspected to ascertain that they are free to move. All temporary blocks (RED) used for supports during shipping should be removed and replaced where required by insulators or spacers. The "Type Test" data sheet secured inside the front cover of the radio transmitter unit box, after acceptance by the local inspector, should be removed and placed in the copy of the instruction book to be used during installation.

The thermometer M112 and the thermostats S101, S102 and S128 are separately packed and should be installed in their respective positions in the oscillator unit, as indicated by marker labels within the unit.

LOCATION OF UNITS

4.4 Careful attention must be given to the location of the various units of this equipment. The location selected should afford adequate ventilation, illumination and accessibility for operating and servicing. It is also important to place the units so as to obtain the greatest convenience of inter-connection and external wiring.

4.5 TRANSMITTER UNIT—The transmitter unit is constructed in two separate (major unit) frames which are bolted together. In addition, the master oscillator unit is built into a separate frame which is arranged by means of tracks to slide into and become a part of the transmitter unit when the two major frames are bolted together.

4.6 For conditions where the transmitter unit is to be moved or transported with the oscillator unit removed, there are provided two (RED) temporary angle members which are to be bolted in place to stiffen the two frames at the center of the oscillator unit aperture. For installations where it is necessary to separate the two major frames to allow passage through hatches or doors, care should be taken NOT to remove the temporary (RED) angles until the two frames have been reassembled and bolted together.

4.7 In moving the transmitter to the intended location, the overall dimensions may be reduced temporarily to clear doors and hatches, by removing the rear and side shields. Should the shields be removed for this purpose, particular care must be employed in handling to prevent damage to the interior of the unit.

4.8 The oscillator unit, when completely removed from the transmitter, should be handled with care. It should be laid on the deck in such a way as to prevent damage to the motor and blower unit which projects on the under side. To clear doors and hatches, the blower and motor unit may be temporarily removed by removal of the mounting screws and loosening of the blower hose connections.

4.9 The transmitter unit may be installed with the back against a bulkhead, if necessary, although it is desirable to have a clear space of 18 inches around the entire transmitter to permit accessibility. The clearance in front of the transmitter must be approximately 21 inches to permit withdrawing the oscillator unit for servicing. This allows sufficient clearance for opening the doors. For complete removal of the oscillator, approximately 23 inches must be allowed.

4.10 The transmitter is designed to be secured to the deck by means of six bolts. As shown by the outline drawing, Figure 35, these bolts go through the four-inch base channels. The bolts must therefore be long enough to pass through the channels and through the deck.

4.11 The installation will be facilitated if the transmitter frame is bolted to the deck and the interconnections completed with the oscillator unit completely removed. Complete removal is accomplished by releasing the two spring-operated catches in the supporting slides. Holes in the sides of the slides provide accessibility to the release catches.

4.12 When separating or reassembling the two major transmitter frames, care should be taken to disconnect and reconnect all interconnecting wires between the two frames (see Figures 40, 41, 48 and 49). These interconnecting leads are divided into three general groups as follows:

(a) Leads between terminal boards "H" and "Y" in the bottom, front transmitter compartment. These leads are cabled and their ends marked showing the terminals to which they connect.

(b) Leads between terminal boards "J" and "T." These boards are located adjacent to one another in the rear of the oscillator unit and centrally in the transmitter frame. Each lead connects between like terminals of the two boards.

(c) There are ten r-f and high voltage interconnecting leads in the various compartments of the two frames. One lead (¼-inch copper tubing) connects from the antenna loading switch S117 (control "J") to antenna switch (S120) (control "W"). Also in the top compartment, a few inches behind the front panel, are two "stand-off" insulator terminals (101H) and (102H) from which the lead-covered leads (to R175 and R176) should be disconnected if separating the two transmitter frames. Insulating bushing terminals (103H) to (109H) inclusive are provided in the shield plate between the two frames. This shield plate is a part of the HF (large) frame, therefore the connecting leads should be disconnected from the LF (small frame) side of the bushings. Also three high volt-

4.24 Normally, the equipment is shipped with all link connections, switches and resistors in place for six-wire control operation. Changes are therefore necessary only if four-wire control is employed.

PRELIMINARY ADJUSTMENTS

4.25 WARNING—OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. SEE THE SECTION HEADED "SAFETY" WHICH IS LOCATED IN THE FRONT PART OF THIS INSTRUCTION BOOK. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH THE HIGH-VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION, BUT ALWAYS SHUT DOWN THE MOTOR GENERATOR OR OTHER POWER EQUIPMENT AND OPEN THE MAIN SWITCH IN THE SUPPLY LINE TO THE EQUIPMENT.

4.26 The schematic diagrams (Figures 38, 39, 46 and 47) and simplified control circuits (Figures 23 and 24) should be referred to in checking or studying the following instructions.

4.27 Before power is applied to the equipment and without tubes in the sockets:

(a) Remove power from the transmitter supply line by opening the disconnect switch on the distribution board, or in the Radio Room if one is provided there.

(b) For d-c equipments, the magnetic controller overload relay dash-pot should be filled with the oil that is provided for this purpose. The dash-pot may be filled by first unscrewing it from the relay frame and then removing the plunger. About ¾-inch of oil should be placed in the dash-pot. When filling, particular care should be taken to prevent any foreign substance from entering the dash-pot. After filling, the plunger should be replaced and the dash-pot returned to its position on the overload relay.

(c) Place the proper oil in the dash-pot cups of the overload relays (K105) and (K106). The oil to be used is attached to the transmitter frame at the time of shipment and nameplates on the relays indicate the requirement for oil and the amount. The oil that is supplied is Navy Type 9045 oil.

(d) Turn the "FILAMENT VOLTAGE" rheostat (R134) to the maximum counterclockwise position (all resistance in).

(e) Set the "CONTROL SWITCH" (S110) to the "LOCAL" position.

(f) Set the local "START" switch to the "OFF" position. For four-wire control the lever of the "START" toggle switch (S108) is operated to the "OFF" position. For six-wire control, a momentary push of the "OFF" button (switch S141) will provide a check that the transmitter is "OFF."

(g) Set the "EMERGENCY" switch (S107) to the "STOP" position.

(h) Set the "BIAS VOLTAGE" rheostat (R144) to the maximum counterclockwise position (all resistance in).

(i) Set the "PLATE VOLTAGE" rheostat (R143) to the maximum counterclockwise position (all resistance in).

(j) Set the "TUNE-OPERATE" switch (S125) to position "1".

(k) Set the "FILAMENT-STANDBY" switch (S106) to the "ON" position. (NOTE: This switch is on a-c sets only.)

(l) Set the "HEATER-AUXILIARY-CONTROL" switch (S113) to the "NORMAL" position. (NOTE: This switch is on d-c sets only.)

(m) Set the "EMISSION SELECTOR" switch (S126) to the "CW" position.

(n) Push the "OVERLOAD-RESET" buttons on the auxiliary and high voltage relays (K105 and K106).

(o) Close all doors of the transmitter and be sure that all shields are in place.

(p) Close the door of the filter unit.

4.28 The circuit through the magnetic controller should now be completed in the following manner: (1) On a-c equipments, close the door of the magnetic controller and then after pressing the overload reset buttons, close the controller disconnect switch; (2) On d-c equipments, close the double-pole, single-throw disconnect switch in the magnetic controller and then close the controller door.

NOTE: There are no disconnect switches on magnetic controllers, Types CAE-211107 and CAE-211105.

When the preceding instructions (1 or 2) have been complied with, close the "EMERGENCY" switch (S107) thus applying operating voltage to the MO heater and causing the following operations to occur:

(a) The blower (B101 for 220/440 volts a-c), (B102 for 115 volts d-c or B103 for 230/250 volts d-c) should start.

(b) The heater indicator **amber** lamp (I100) should light.

(c) On a-c sets, the oscillator filament indicator **clear** lamp (I104) should light. Upon opening the "FILAMENT STANDBY" switch (S106) this light will be extinguished.

(d) On d-c sets, the oscillator filament and the associated indicator lamp (I104) will not light until the motor generator starts.

(e) The heater indicator lamp (I100) should remain lighted until the oven temperature is near 60° C., when it "cycles" with the demand of the oven for heat. The final temperature (60° C.) is normally reached within an hour or two. When the oven temperature exceeds 50° C., the auxiliary heater winding thermostat (S128) will be actuated, thus disconnecting the auxiliary heater winding.

4.29 Close the "START" switch (S108) for four-wire control, or push the "ON" button (S140) for six-wire control (1,000 volts). The following operations should occur:

(a) The "START" contactors (K102 or K111) should close.

(b) The "MASTER START" **red** indicator lamp (I103 or I105) should light.

(c) The motor generator should start and should reach normal speed within five or ten seconds, thus applying approximately 1,000 volts to the transmitter. WARNING—HIGH VOLTAGE WILL BE APPLIED TO THE TRANSMITTER AT ALL TIMES WHEN THE MOTOR-GENERATOR IS RUNNING.

(d) The "BIAS" indicator **green** lamp (I1001) should light.

(e) The field contactor (K104 or K112) should close.

(f) The bias interlock relay (K108) should operate.

(g) The plate indicator **red** lamp (I102) should light.

(h) There should be voltage readings (lower than normal) on the "FILAMENT VOLTAGE" meter (M107), the "BIAS VOLTAGE" meter (M109), the "OSC. PLATE VOLTAGE" meter (M111), and the "MAIN PLATE VOLTAGE" meter (M110).

4.30 Adjust the "BIAS VOLTAGE" generator field rheostat (R144) until the "OSC. PLATE VOLTAGE" meter (M111) indicates 1600 volts. The "BIAS VOLTAGE" meter (M109) should then indicate approximately 250 volts d-c.

4.31 Adjust the plate voltage generator field rheostat (R143) until the "MAIN PLATE VOLTAGE" meter (M110) indicates approximately 1200 volts.

4.32 Check the operation of the door interlocks by opening one door at a time. The motor-generator should stop and all of the transmitter controls (except those for the heater, blower motor, etc., described in paragraph 4.28) should open. Restart the equipment.

4.33 Operate the "TEST KEY" switch (S111). If relay (K108) and the switch interlocks (S132, S134 to S139 inclusive) are closed, the keying relay (K101) will operate. This operation may be observed through the window in the relay housing.

4.34 Check the operation of the switch interlocks (S132, S134 to S139 inclusive) by locking the "TEST KEY" switch and turning the "TUNE-OPERATE", "HF-IF" and "ANTENNA FEED" switches. The keying relay should open momentarily each time either of these latter switches is operated.

4.35 To stop the equipment, open the "START" switch (S108) for four-wire control, or push the "OFF" button (S141) for six-wire control.

4.36 Place the "CONTROL SWITCH" (S110) in the "REMOTE" position and start, stop, and key the equipment from the remote station. For four-wire control, switch (S108) (2000 volts) must be closed to make remote operation effective. Thus the local operator is still able to stop the equipment.

4.37 For six-wire control, a number of remote stations may be used and the equipment may be started, stopped, and keyed from any station or from the transmitter. It should be noted that the "OFF" button (S141) and the equivalent switches in the remote stations are intended only for **momentary** operation and should not be held down for long periods of time.

4.38 During the above tests, power is applied to the heater and blower motor circuits when the "EMERGENCY" switch (S107) is closed. Normally the oven will approach the final temperature of 60° C. within 1½ hours and "cycle" at this temperature, the heater light going on and off as the heater resistors (R137) or (R138) are energized by the action of the heater relay (K100) or (K103). The latter is operated by the mercury thermostat (S102) which thus controls the oven temperature.

TUNING

4.39 It is desirable to consult the "Routine" or "Type Test" data (data bearing the same serial number and shipped with the equipment) during the following preliminary tests. This data contains exact dial settings for various frequencies within the specified bands as taken on this particular unit during Navy acceptance tests at the manufacturer's plant. The frequencies desired in service will not be the same as these readings but interpolation will indicate the approximate dial settings. By following this data, the error of tuning a stage to an incorrect harmonic will be avoided. Figures 52 to 60 show approximate calibration curves for each oscillator and amplifier tuning control. With reference to Figure 56, the actual oscillator frequencies are one-half of those shown. Since the basic HF frequency range is 2000 to 4525 kc, the curve is plotted in terms of the latter range for simplicity.

4.40 Shut down the transmitter by means of the "EMERGENCY" switch (S107) and set the following controls as indicated:

(a) "CONTROL SWITCH" (S110) at "LOCAL" position.

(b) "TUNE-OPERATE SWITCH" (S125) at "TUNING STEP-1" position.

(c) "TEST KEY" switch (S111) at "OFF" position.

(d) "FILAMENT" rheostat (R134) at maximum counterclockwise position.

(e) "BIAS VOLTAGE" rheostat (R144) at maximum counterclockwise position.

(f) "PLATE VOLTAGE" rheostat (R143) at maximum counterclockwise position.

(g) "START" switch (S108) at "OFF" position for four-wire control. For six-wire control, momentarily depress the "OFF" button switch (S141).

4.41 Place all tubes in their proper sockets and connect all grid and plate leads to the terminal posts. The oscillator tubes must be firmly seated in the sockets and then clamped by means of the locking screw.

4.42 Place the "IF-HF CHANGE SWITCH, A" and the "ANTENNA SWITCH, W" in the HF position.

4.43 Press the "ON" push-button of the "EMERGENCY" switch (S107). On a-c sets, the MO tube filament selected by the "IF-HF CHANGE SWITCH" will be lighted when the "FILAMENT-STANDBY" switch (S106) is in the "ON" position. Open this switch, thus removing all power from both the filament and the indicating lamp.

4.44 Close the "START" switch (S108 or S140) **(2000 volts)**, OBSERVE HIGH-VOLTAGE PRECAUTIONS and, when the motor generator comes up to speed, adjust the filament, bias and power amplifier plate voltages (in sequence) to the proper value by means of their respective rheostats. These voltages should be:

Filament	10 volts
Bias	250 volts
Power Amplifier Plate (tune-operate SW on position 1) (approx.).	1200 volts

When the bias voltage is adjusted to the correct value (250 volts), the "OSC. PLATE VOLTAGE" meter should indicate approximately 1600 volts.

4.45 HIGH FREQUENCY—Select the settings for the desired frequency by consulting the curves shown in Figures 56 to 60 and set Dials "L" to "R" inclusive accordingly.

Also:

(a) Set Control "V" at zero.

(b) Set Control "U" at "CURRENT" position.

(c) Set Control "S" at zero.

(d) Set Control "T" at zero.

4.46 Close the "TEST KEY" switch (S111). Oscillator plate current should be approximately 30-40 ma. Open the "TEST KEY" switch and set the "TUNE-OPERATE SWITCH" (S125) at position "2."

4.47 Close the "TEST KEY" switch (S111) and tune control "N" until the first intermediate amplifier plate current is at **maximum.** The oscillator plate current should now be approximately 35 milliamperes.

4.48 Adjust control "O" to obtain **minimum** first intermediate amplifier plate current (approximately 40 to 60 ma depending upon the frequency) or to **maximum** second intermediate amplifier plate current.

4.49 Adjust control "P" to obtain **minimum** second intermediate amplifier plate current (approximately 50 to 90 ma, depending upon the frequency) or to maximum power amplifier grid current approximately 23 to 55 ma, depending upon the frequency).

4.50 Adjust control "R" to obtain **minimum** power amplifier plate current.

4.51 Turn control "T" slowly, watching the "PA PLATE CURRENT" meter for a sudden increase. If no such point is found, set control "V" to approximately 20 divisions and again turn control "T." If the tuning point is still not located, set control "S" to approximately 30 divisions (and, if necessary, to a still higher reading) again turning control "T" to find resonance as indicated by an **increase** in power amplifier plate current. When resonance is found, there will also be some indication of current on the "HF ANTENNA CURRENT" meter (M100). Tune Control "T" to obtain **maximum** antenna current.

4.52 Retune control "R" to obtain minimum power amplifier plate current, which should be approximately 150 ma. Adjust control "V" until this current is attained and retune control "R" to obtain **minimum** power amplifier plate current.

4.53 Operate the "TEST KEY" switch (S111) a few times and note that each time the key is operated the plate currents of all stages drop to zero.

4.54 Open the "TEST KEY" switch, set the "TUNE-OPERATE SWITCH" at position "3," and close the "TEST KEY" switch momentarily. Normal loading of the power amplifier (power amplifier plate current) is 320 ma. Adjust to

this value by means of the control "V," and if necessary retune control "R" to obtain minimum power amplifier plate current. Check for correct filament and bias voltages as listed in paragraph 4.44 and adjust the plate voltage to 2,000 volts.

4.55 At certain frequencies, dependent upon the antenna characteristics, proper antenna coupling and tuning cannot be achieved with control "U" at the "CURRENT" position; therefore, set this control at "VOLTAGE" and repeat the tuning procedure given in paragraphs 4.46 to 4.52 inclusive. Stop the transmitter by throwing the "START" switch to "OFF."

4.56 Place the "CONTROL SWITCH" (S110) in the "REMOTE" position. For four-wire control, close the "START" switch (S108). Close the remote "START" **(2000 volts)** switch; the motor generator should come up to speed, and the indicator lamp on the remote unit should light. The remote station telegraph key may then be operated and the transmitter keyed in the normal manner. (It may also be keyed locally.) Stop the equipment by opening the remote "START" switch, for four-wire control, or by pressing the remote "STOP" switch for six-wire control.

4.57 Return the "CONTROL SWITCH" (S110) to the "LOCAL" position. The equipment is now ready for final calibration and tuning on the other service frequencies which are to be used.

4.58 FINAL ADJUSTMENT—To tune the transmitter to any frequency within the range, perform the following operations:

(a) Open the "TEST KEY" switch (S111).

(b) Set the "CONTROL SWITCH" (S110) at the "LOCAL" position.

(c) Close the "EMERGENCY" switch (S107).

(d) Set the "TUNE-OPERATE SWITCH" (S125) at position "1."

(e) Close the "START" switch (S108 or S140), thus starting the motor generator which will, when it comes up to speed, apply approximately 1,200 volts to the transmitter.

(f) Adjust the "FILAMENT" control to provide an indication of 10 volts on the "FILAMENT VOLTAGE" meter.

(g) Adjust the "BIAS VOLTAGE" control to provide an indication of 250 volts on the "BIAS VOLTAGE" meter. (The "OSC. PLATE VOLTAGE" meter should indicate approximately 1,600 volts.)

(h) Adjust the "PLATE VOLTAGE" control to provide an indication of approximately 1,200 volts on the "PA PLATE VOLTAGE" meter.

4.59 Set the lettered controls to the values indicated in the following tabulation of Typical Control Settings (HF).

TYPICAL CONTROL SETTINGS (HF)

Freq. KC	A	L	M	N	O	P	Q	R	S	T	U	V	W
2000	HF	1	1449	22	495	585	1	385	35	632	CUR.	53	HF
3000	HF	3	4530	63	1461	1488	1	1310	47	1584	CUR.	50	HF
4000	HF	5	4407	78	1790	1918	1	1815	30	2363	CUR.	58	HF
4540	HF	6	4682	83	1920	2048	1	1910	65	2176	CUR.	40	HF
5000	HF	2	3363	49	2015	2152	1	2014	66	2199	CUR.	40	HF
6000	HF	3	4530	63	2179	2314	1	2212	55	2710	CUR.	47	HF
7000	HF	5	1375	72	2293	2428	1	2308	70	2623	CUR.	38	HF
8050	HF	5	4407	78	2416	2551	1	2424	83	2589	CUR.	32	HF
9080	HF	6	4682	83	2492	2626	1	2487	86	2603	CUR.	33	HF
10000	HF	2	3363	49	2014	2687	1	2551	71	1808	VOL.	38	HF
12000	HF	3	4530	63	2179	2885	2	2307	50	2679	VOL.	50	HF
14000	HF	5	1375	72	2291	2854	2	2417	85	2318	VOL.	59	HF
16000	HF	5	4407	78	2416	2925	2	2535	90	2628	VOL.	25	HF
18160	HF	6	4682	63	2489	2974	2	2597	90	2682	VOL.	28	HF

4.60 If desired, the settings for controls "L" to "R" may be selected from the tuning curves indicated as follows:

(a) Controls "L" and "M" Figure 56.

(b) Control "N" Figure 57.

(c) Control "O" Figure 58.

(d) Control "P" Figure 59.

(e) Control "R" Figure 60.

4.61 Close the "TEST KEY" switch (S111). The oscillator plate current should be about 30 ma.

4.62 Set the "TUNE-OPERATE" switch to position "2." Close the "TEST KEY" switch and tune each stage to exact resonance as follows:

(a) Tune control "N" to **maximum** first amplifier plate current.

(b) Tune control "O" to **maximum** second amplifier plate current.

(c) Tune control "P" to **maximum** power amplifier grid current.

(d) Tune control "R" to **minimum** power amplifier plate current.

(e) Set control "U" at "CURRENT" or "VOLTAGE" depending upon the transmission frequency and the antenna dimensions (see paragraphs 4.64 and 3.46).

(f) Tune controls "S" and "T" to obtain **maximum** antenna current, adjusting control "V", if necessary, until the power amplifier plate current is approximately 150 ma. Retune control "R" to obtain **minimum** power amplifier plate current.

4.63 Set the "TUNE-OPERATE" switch on position "3" and readjust the power amplifier plate voltage to 2,000 volts. Adjust controls "S" and "T" to obtain maximum antenna current and adjust control "V" for a power amplifier plate current of 320 ma.

4.64 With a given antenna, current feed is best at certain frequencies and voltage feed is best at others. If proper antenna tuning and loading with current feed cannot be found, set control "U" to "VOLTAGE" and retune controls "R," "V," "S" and "T." If at some frequencies, both current and voltage feed give good output, use the method which gives the greater output with a plate current of 320 ma. **The power amplifier plate current must never exceed 350 ma.** If lower output is desired, turn the "PLATE VOLTAGE" control (R143) in a counterclockwise direction.

4.65 Each front panel dial (except the switch dials) is equipped with a thumbscrew for securely locking the control in position. The operating personnel should develop the habit of locking each control after tuning to guard against accidental detuning by careless contact or by vibration. The thumbscrew should be turned clockwise to lock and counterclockwise to unlock.

4.66 The following is a tabulation of the meter indications that may be expected when the transmitter is operating at various frequencies in the HF range. All operating voltages should be adjusted to the values given in paragraph 4.44.

TYPICAL METER READINGS (HF)

Freq. KC	Osc. Plate (Ma)	1st IA Plate (Ma)	2nd IA Plate (Ma)	PA Grid (Ma)	PA Plate (Ma)	Plate Volts	Osc. Plate Volts	Bias Volts	Ant. Amps.	Power Watts
2000	36	45	102	88	320	2000	1620	250	4.2	507
3000	35	48	77	86	320	2000	1620	250	4.2	425
4000	36	50	72	80	320	2000	1620	250	4.2	485
4540	38	49	73	78	320	2000	1630	250	4.2	485
5000	39	38	68	72	320	2000	1620	250	4.2	485
6000	38	52	71	70	320	2000	1620	250	4.1	480
7000	37	65	74	68	320	2000	1620	250	4.1	472
8000	38	70	72	67	320	2000	1620	250	4.0	455
9080	38	55	72	62	320	2000	1630	250	3.9	425
10000	39	42	90	47	320	2000	1620	250	3.7	400
12000	39	55	96	46	320	2000	1620	250	3.5	380
14000	39	65	100	42	320	2000	1620	250	3.3	350
16000	39	70	101	40	320	2000	1620	250	3.1	340
18160	40	62	101	35	320	2000	1620	250	2.5	285

4.67 TUNING ABOVE 16 MC—These paragraphs furnish instructions needed for tuning, due to tube variations and other contributing causes, in addition to the standard tuning procedure which may be required when tuning the transmitters at the upper end of the high frequency band. The tuning procedure for both low and high frequencies is similar except that for frequencies above 16 mc, the power amplifier plate tuning is finally adjusted for MAXIMUM ANTENNA CURRENT. This maximum may be found at a point slightly different from the resonant point indicated by the minimum dip of the power amplifier plate current meter. Also, antenna current maximum may be obtained by adjusting the coupling to the antenna for an optimum value, rather than for a power amplifier plate current value of 320 ma.

4.68 When tuning to frequencies above 16 mc, the standard tuning procedure described in paragraphs 4.39 to 4.66 should be followed, and controls "R", "S", "T" and "V" adjusted until further increase in coupling fails to result in an increase in antenna current. The PA plate tuning control "R" will be at "resonance" as indicated by the minimum "dip" of power amplifier plate current. Then an additional adjustment of the PA tuning control "R" should be made (to a point somewhat removed from the plate current dip) to a point where "MAXIMUM ANTENNA CURRENT" is obtained. Observe the power amplifier plate current. If it exceeds the normal operating value of 320 ma, coupling should be decreased by readjustment of control "V" and the entire previous tuning adjustments again repeated. If the power amplifier plate current is somewhat less than 320 ma when the peak antenna current has been attained, and no further increase is obtained by increasing coupling, no further attempt should be made to obtain a higher plate current value.

4.69 Summary:

1. Tune PA as described in Paragraphs 4.39 to 4.66.
2. Turn control "R" slightly away from plate current minimum until maximum antenna current is reached.
3. If PA plate current exceeds 320 ma, decrease coupling control "V" and start over with step 1 above. If PA plate current is less than 320 ma for maximum antenna current, and increasing coupling gives no further antenna current increase, the transmitter should be operated at the lower PA plate current value where the maximum antenna current is obtained.

4.70 INTERMEDIATE FREQUENCY — Shut down the transmitter by means of the "OFF" switch (S108 or S141) and set the following controls as indicated:

(a) "TEST KEY" switch at "OFF" position.

(b) "TUNE-OPERATE SWITCH" at "Tuning Step 1."

(c) "HF-IF CHANGE SWITCH A" at "IF."

(d) "ANTENNA SWITCH W" at "IF."

4.71 Select the settings for the desired frequency by consulting the curves shown in Figures 52, 53, 54 and 55, and set controls "B" to "G" inclusive accordingly.

Also:

(a) Set the "IF ANTENNA COUPLING" control "H" at point "1."

(b) Set the "IF ANTENNA LOADING" control "J" at point "1."

(c) Start the transmitter as described in Paragraph 4.44.

4.72 Close the "TEST KEY" switch (S111). The oscillator plate current should be approximately 30 ma. Open the "TEST KEY" switch and set the "TUNE-OPERATE" switch (S125) at "TUNE STEP 2."

4.73 Adjust control "E" to obtain a **minimum** on the "1st I.A. PLATE CURRENT" meter (approximately 50 ma) or to a **maximum** on the "PA GRID CURRENT" meter. (Approximately 75 ma.)

4.74 Adjust control "F" to obtain a **minimum** on the "PA PLATE CURRENT" meter.

4.75 Rotate control "I" slowly, watching the "PA PLATE CURRENT" meter for a sudden increase. If no such point is found, set "IF ANTENNA COUPLING" (control "H") to point 2 or 3 and again rotate control "I" slowly. If the tuning point is still not located, set the "IF ANTENNA LOAD" control "J" to point 2 and again rotate control "I." (It may be necessary to search successively each setting of control "J," tuning control "I" slowly over its range for each setting of control "J.") When resonance is found, there will be also indication of current on the "IF ANTENNA CURRENT" meter (M101). Tune control "I" to obtain maximum indication on the "IF ANTENNA CURRENT" meter.

4.76 Retune control "F" to obtain minimum "PA PLATE CURRENT," which should be approximately 150 ma. Adjust the "IF ANTENNA COUPLING" control "H" until this value is obtained, retuning control "F" to obtain minimum "PA PLATE CURRENT" and control "I" to obtain maximum "IF ANTENNA CURRENT."

4.77 Open the "TEST KEY" switch. The currents in all stages should drop to zero.

4.78 Set the "TUNE-OPERATE" switch at position "3" and momentarily close the "TEST KEY" switch. Normal "PA PLATE CURRENT" is 230 ma. Adjust to this value by adjusting con-

trol "H," readjusting controls "H" and "I" if necessary. Check the correctness of filament bias and plate voltages as listed in paragraph 4.44. Stop the transmitter by operating the "START" switch to "OFF."

4.79 Place the "CONTROL SWITCH" (S110) in the "REMOTE" position. If 4-wire control is being used, close the "START" switch (S108). Close the remote "START" switch (2000 volts). The generator should come up to speed and the indicator lamp on the remote unit should light. The transmitter may then be operated from the remote station in the usual manner, or may be keyed locally. To stop the equipment, open either the local or remote "START" switches, if 4-wire control is being used, or press either the local or remote "STOP" button if 6-wire control is employed.

4.80 Return the "CONTROL SWITCH" to "LOCAL." Record the control settings used. The equipment is now ready for final calibration and tuning up on the other service frequencies.

4.81 Following is a tabulated list of correct control settings for various frequencies, and a list giving meter readings which may be expected at the operating frequencies shown. All operating voltages should be adjusted to the values given in paragraph 4.44.

TYPICAL CONTROL SETTINGS (IF)

Freq. Kc	A	B	C	D	E	F	G	H	I	J	W
175	IF	1	1560	27	33	32	1	3	26	6	IF
175	IF	1	1560	27	33	24	1	5	41	4	IF
175	IF	1	1560	27	33	26	1	7	23	9	IF
175	IF	1	1560	27	33	24	1	6	38	7	IF
200	IF	2	1360	41	47	46	1	3	40	8	IF
200	IF	2	1360	41	47	42	1	5	21	7	IF
200	IF	2	1360	41	47	42	1	7	55	10	IF
200	IF	2	1360	41	47	42	1	6	35	9	IF
245	IF	3	1330	60	65	64	1	3	40	11	IF
245	IF	3	1330	60	65	66	1	3	41	10	IF
245	IF	3	1330	60	65	64	1	6	64	12	IF
245	IF	3	1330	60	65	65	1	4	30	12	IF
300	IF	4	912	72	77	78	1	2	70	12	IF
300	IF	4	912	72	77	78	1	3	27	12	IF
300	IF	4.	912	72	77	78	1	3	79	13	IF
300	IF	4	912	72	77	78	1	4	77	13	IF
375	IF	5	725	32	31	35	2	8	26	14	IF
375	IF	5	725	32	31	37	2	8	67	13	IF
375	IF	5	725	32	31	35	2	9	59	14	IF
375	IF	5	725	32	31	38	2	8	76	14	IF
400	IF	5	1180	43	42	41	2	9	47	14	IF
400	IF	5	1180	43	42	45	2	9	30	14	IF
400	IF	5	1180	43	42	44	2	10	19	15	IF
400	IF	5	1180	43	42	45	2	9	33	15	IF
500	IF	6	720	61	61	66	2	8	36	15	IF
500	IF	6	720	61	62	67	2	8	28	15	IF
500	IF	6	720	61	61	64	2	9	51	15	IF
500	IF	6	720	61	61	64	2	8	65	15	IF
600	IF	6	1840	79	80	85	2	7	68	15	IF
600	IF	6	1840	79	80	85	2	8	65	15	IF
600	IF	6	1840	79	80	87	2	7	41	16	IF
600	IF	6	1840	79	80	87	2	5	54	16	IF

TYPICAL METER READINGS (IF)

Freq. Kc	Ant. Res. (ohms)	Ant. Cap. (mmf.)	Plate Volts	PA Plate (ma)	PA Grid (ma)	IA Plate (ma)	Osc. Plate (ma)	Ant. Amps. (Int.)	*(Ext.) Ant. Amps.	Watts (Ext.)
175 . . .	2.0	525	2000	320	64	47	35	7.9	7.0	98
175 . . .	2.5	440	2000	320	64	47	35	7.0	6.4	102
175 . . .	12.0	770	2000	320	65	47	35	5.8	5.4	350
175 . . .	6.0	600	2000	320	65	47	34	7.0	6.3	240
200 . . .	1.6	530	2000	320	66	49	37	8.2	7.6	93
200 . . .	2.5	440	2000	320	65	49	36	7.4	6.7	112
200 . . .	12.0	775	2000	320	66	49	36	5.5	5.3	337
200 . . .	6.0	600	2000	320	65	48	36	6.6	6.2	231
300 . . .	1.7	550	2000	320	63	52	37	9.3	8.4	120
300 . . .	2.5	450	2000	320	63	53	36	8.4	7.5	142
300 . . .	8.0	800	2000	320	63	53	36	7.0	6.7	360
355 . . .	4.3	915	2000	320	73	49	35	9.3	8.4	303
400 . . .	2.3	580	2000	320	73	50	36	9.7	8.8	178
400 . . .	2.8	480	2000	320	73	50	37	9.1	8.1	183
400 . . .	5.8	825	2000	320	73	50	36	8.5	7.8	353
500 . . .	2.3	615	2000	320	73	53	36	11.2	9.7	216
500 . . .	3.2	549	2000	320	73	53	37	10.2	9.0	259
500 . . .	4.5	870	2000	320	73	51	36	9.3	8.6	332
500 . . .	2.6	1200	2000	320	73	51	36	11.7	11.0	315
600 . . .	2.5	660	2000	320	68	50	37	11.0	9.5	225
600 . . .	4.8	630	2000	320	68	49	37	8.6	7.6	278
600 . . .	3.8	930	2000	320	67	50	37	10.0	8.8	293
600 . . .	1.5	1400	2000	320	67	49	37	13.2	12.5	235

* Readings under the column headed "(EXT.) ANT. AMPS." are readings taken on a separate meter connected externally to the Transmitter Unit.

4.82 Power Supply Requirements are given in Paragraph 3.11.

SECTION V

OPERATION

5.1 WARNING — OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. SEE THE SECTION HEADED "SAFETY" WHICH IS LOCATED IN THE FRONT PART OF THIS INSTRUCTION BOOK. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH THE HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION, BUT ALWAYS SHUT DOWN THE MOTOR GENERATOR OR OTHER POWER EQUIPMENT AND OPEN THE MAIN SWITCH IN THE SUPPLY LINE TO THE EQUIPMENT.

5.2 It is assumed that the transmitter has been tuned as described in Section IV ("INSTALLATION") of this book to the desired carrier frequency.

WARNING: THE POWER AMPLIFIER PLATE VOLTAGE IS NORMALLY 2,000 VOLTS.

LOCAL CONTROL OPERATION

5.3 Preliminary—Set the transmitter controls as follows:

1. "EMERGENCY SWITCH" to "ON" position.
2. "LOCAL-REMOTE CONTROL SWITCH" to "LOCAL" position.
3. "TUNE-OPERATE SWITCH" to "OPERATE-STEP 3" position.

5.4 To Start the Transmitter—

1. Four-Wire Control: Set the "START" switch to "ON" position.
2. Six-Wire Control: Push the "ON" button of "START" switch.

5.5 To Stop the Transmitter—

1. Four-Wire Control: Set the "START" switch to "OFF" position.
2. Six-Wire Control: Push the "OFF" button of the "START" switch.

REMOTE CONTROL OPERATION

5.6 Preliminary—Set the transmitter controls as follows:

1. "EMERGENCY" switch to "ON" position.
2. "LOCAL-REMOTE CONTROL SWITCH" to "REMOTE" position.
3. "TUNE-OPERATE SWITCH" to "OPERATE STEP-3" position.

5.7 To **Start** the Transmitter—(Four-Wire Control):

1. Set the local "START" switch to "ON" position.
2. Operate remote start switch to "START" position.

5.8 To **Start** the Transmitter—(Six-Wire Control)—Press the "START" button of the remote control unit.

5.9 To **Start** the Transmitter Locally while in "REMOTE" Position—

1. Four-Wire Control: Remote "START" switch must be on. Then set local "START" switch to "ON" position.
2. Six-Wire Control: Press the "ON" button of the "START" switch.

5.10 As soon as the motor generator has come up to normal speed (about 10 seconds) the transmitter may be keyed by manipulation of the remote telegraph key.

5.11 CAUTION—HIGH VOLTAGE WILL BE APPLIED TO THE TRANSMITTER AT ALL TIMES WHEN THE MOTOR GENERATOR IS RUNNING.

5.12 To **Stop** the Transmitter—(Four-Wire Control)—Operate the remote "START" switch to the "STOP" position.

5.13 To **Stop** the Transmitter—(Six-Wire Control)—Press the "STOP" button of the remote control unit.

5.14 To **Stop** the Transmitter Locally While in "REMOTE" position—

1. Four-Wire Control: Operate the local "START" switch to "OFF" position.
2. Six-Wire Control: Press the "OFF" button momentarily.
3. EMERGENCY: Push the "STOP" push button of the "EMERGENCY" switch.

5.15 The "FILAMENT-STANDBY" switch should be left at the "ON" position at all times if filament warm-up delays are to be avoided.

START-STOP CONTROL FOR A-C POWER SUPPLY

5.16 See Paragraphs 3.88 to 3.95.

START-STOP CONTROL FOR D-C POWER SUPPLY

5.17 See Paragraphs 3.96 to 3.101.

TO CHANGE FREQUENCY

5.18 Place the "TUNE-OPERATE SWITCH" in the "TUNING STEP-1" position and the "CONTROL SWITCH" in the "LOCAL" position. Adjust the lettered controls to the position indicated by the "CALIBRATION CHART" tabulation and proceed as described in Paragraphs 4.49 to 4.82 inclusive.

TO CHANGE POWER

5.19 To increase power, rotate the "PLATE VOLTAGE" control in a clockwise direction. Do not allow the PA plate current to exceed 320 milliamperes. Do not operate at a plate voltage in excess of 2,000 volts.

5.20 To decrease power, rotate the "PLATE VOLTAGE" control in a counterclockwise direction.

TO VOICE MODULATE THE CARRIER

5.21 To prepare the transmitter for voice modulation proceed as follows:

1. Start the transmitter for remote control operation as explained in Paragraphs 5.6 to 5.8.
2. Place the "EMISSION SELECTOR" switch in the "PHONE" position.
3. Press the "press-to-talk" button of the associated hand telephone set of the speech input equipment, and speak into the microphone.

TO SELECT ANY AVAILABLE TYPE OF EMISSION

5.22 Set the "EMISSION SELECTOR" switch to the indicated type of emission desired—"CW," "MCW," or "PHONE." NOTE: "MCW" operation can be obtained in the "IF" frequency range (175 to 600 kc) only.

SUBMARINE LOOP OPERATION

5.23 The transmitter is not intended for direct operation into a submarine loop. It will, however, operate directly into such loop antennas over certain I.F. band frequency ranges depending on the loop characteristics. Loop operation over the entire I.F. band may be obtained if a proper capacitor unit is provided external to the transmitter and connected in series with the loop antenna. Use of the external series capacitor is necessary when the reactance of the loop antenna falls between the limits of approximately one hundred ohms negative and several hundred ohms positive reactance. For loops having about 100 ohms negative to several hundred ohms negative reactance at the operating frequencies, the use of the external capacitor will not be required. Average loop antenna characteristics for the I.F. band have been indicated to be between the reactance limits of approximately 250 ohms negative at 175 kc and approximately 110 ohms positive at 600 kc. For operation on such loop antennas the transmitter will require the use of a separate series capacitor of about 0.001 microfarads over the frequency range from 350 kc to 600 kc. This capacitor is not furnished as a part of the equipment. It should be capable of carrying 10 amperes current at these frequencies without excessive heating.

SECTION VI
MAINTENANCE

TEST SCHEDULE

6.1 **GENERAL**—A maintenance schedule strictly adhered to will be very helpful in keeping the equipment in good condition. The recommended inspection periods and points to be observed are given in the following table:

NOTE: THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENT OF CHAPTER 67 OR 68 OF THE "BUREAU OF SHIPS MANUAL," OF THE LATEST ISSUE.

Interval	CHECK POINT
Daily	Check all control circuits for proper operation.
	Check and record all meter and thermometer readings.
	Check the tuning of the equipment on two frequencies.
	Dust off all exterior surfaces of equipment.
Weekly	Dust the entire equipment, inside and outside.
	Check all electrical connections for tightness.
	Inspect and clean all relay and contactor contacts.
	Inspect and clean all switch blade contacts.
	Check the speed of the motor generator.
	Inspect all commutators and clean them when necessary.
	Inspect all brushes and replace them when necessary.
Monthly	Check all bearings for lubrication.
	Check all tubes. This can be done by comparing the daily meter readings taken over a considerable time. The end of useful life of a tube is usually gradual and is evidenced by reduced plate current for that stage with other conditions normal. Thus by checking plate current readings against previous readings, failure may be anticipated and the tube replaced before an outright failure occurs.
Semi-Annually	Grease the bearings of the motor generator.
	Lubricate the oscillator lead screw sparingly with graphite.
Annually	Clean and repack the bearings of the blower motor with Navy Spec. Number 14L3 grease.
Biennially	Clean and repack the bearings of the motor generator with Navy Spec. Number 14L3 grease.

TROUBLE SHOOTING

6.2 Typical meter readings are tabulated on pages 34 and 37. The following notes are included to aid the radioman in promptly determining the cause of abnormal condition and in effecting a cure in the shortest possible time. The following table classifies the general troubles which may occur in the system, and indicates the probable causes.

Symptom	Cause
Starting relay (K102 or K111) does not operate.	"EMERGENCY" switch (S107) in "STOP" (off) position.
	Line voltage too low.
	Magnetic controller disconnect switch open.
	"CONTROL SWITCH" (S110) in wrong position.
	Transmitter door open.
	Blown fuse in magnetic controller (a-c only).
	Blown fuse (F104, F105) in transmitter.
Starting relay (K102 or K111) operates but motor generator does not start.	Magnetic controller overload device not reset.
	Blown fuse in magnetic controller (a-c only).
	No oil in magnetic controller dashpot (d-c only).
Motor generator runs but no voltages indicated on meters M109, M110 or M111.	Motor-generator fuses (F401, F402, F403 or F404) blown.
	Overload relays (K105, K106) tripped.
	Relay (K108) not operated.
	Generator field rheostats (R143 or R144) open.
	Bias generator field reversed. To correct, connect the positive (+) terminal of a 12- to 45-volt battery to ground and make a momentary connection to terminal 12H with the negative (–) terminal.
Tube filaments do not light—no indication on filament voltmeter (M107).	Filament rheostat (R134) open.
	Loose or broken filament transformer connection.
	Slip-ring fuse (F405, F406) blown (d-c only).
	Slip-ring brushes not making contact (d-c only).
No indication on "OSC. PLATE CURRENT" meter (M105) when "TEST KEY" switch (S111) is operated.	Switch interlocks (S132, S134, S135, S136, S137, S138, S139) open.
	Relay (K108B) not making contact.
	Resistors (R140, R141, R181 or R182) open.
	Keying relay (K101) inoperative.
	MO grid leak (R121, R128, or R125, R129) defective.
	"TEST KEY" switch (S111) contacts dirty.
	Plate resistor (R115) open.
"OSC. PLATE CURRENT" meter (M105) indicates but others do not.	MO plate tank (Control "D" or "N") tuned to wrong frequency.
	"TUNE-OPERATE SWITCH" in position "1."
	Open IPA or PA grid or plate circuit.

Symptom	Cause
Low power output.	Tuning incorrect.
	"TUNE-OPERATE SWITCH" in wrong position.
	Defective tube.
	Low live voltage.
	Antenna lead-in connection loose.
	"EMISSION SELECTOR" (Phone CW-MCW) switch in wrong position.
No antenna current (M100 or M101).	Antenna short-circuited or open.
	Antenna ammeter defective.
	"ANTENNA SWITCH" (S120) defective, or in wrong position.
	Capacitor (C146) short-circuited.
Tubes do not block when "TEST KEY" switch (S111) is **off.**	"TEST KEY" switch contacts not opening.
	Keying relay (K101) stuck closed.
	Transmitting key closed.
	Keying relay contact grounded.
	No bias voltage.
	Amplifier tube (or tubes) defective.
Power Amplifier tubes heat excessively.	PA incorrectly tuned (Control "F" or "R").
	Antenna circuit incorrectly tuned (Controls "H," "I," "J" or "S," "T," "U").
	Antenna too tightly coupled (Controls "H," "V").
	Second amplifier tuned to incorrect frequency—PA is frequency doubling.
	Plate voltage high.
	PA screen or bleeder resistor short-circuited.
	PA tube defective.
Abnormal frequency drift.	MO tube defective.
	Heater cycling relay out of adjustment.
	Thermostats S101, S102 or S128 not functioning.
	Oven-cover screws not tight.
	Oven-cover gasket defective.

GENERAL CARE

6.3 TRANSMITTER UNIT—Proper appearance of the radio transmitter unit may be maintained by carefully dusting the entire exterior surface daily with a soft dry cloth. Interior surfaces should also be cleaned carefully with a soft dry cloth. When cleaning, be sure that no lint remains on the surfaces; also make certain that no parts are scratched and that no capacitor plates are deformed. If DRY compressed air is available, it may be used to blow dust out of the set. A bellows may also be used. When cleaning, do not pull or strain the wiring.

6.4 When painting in the vicinity of the transmitter, cover it to prevent the settling of paint globules. Do not paint over or attempt to refinish the exterior surfaces of the transmitter. With proper care, these finishes will last for years.

6.5 The operator should note that numerous items may be removed from the front panel without reaching around behind the panel. This is advantageous should access to the sides of the transmitter be limited.

6.6 Master Oscillator—The master oscillator unit should be kept in excellent condition if the frequency stability of which the unit is capable

is to be obtained. Inspect it regularly to see that the compartment holds its proper temperature and that the heater relay operates properly. Inspect the latter also to be sure that the contacts are not pitted or corroded. If pitting or corrosion has occurred, clean the contacts with crocus cloth or a fine file, or if necessary, replace them with spare contacts. Unstable frequency may often be traced to loose or dirty connections in the oscillator circuit; therefore, all connections in the oscillator unit should be kept tight and free of dirt or corrosion. If possible, keep the oscillator compartment up to temperature continuously as this will provide the best frequency stability.

6.7 Removal—

(a) Loosen the seven knurled thumbscrews around the edges of the oscillator panel.

(b) Open the door to the relay section below the oscillator panel.

(c) Pull the complete unit out through the front of the transmitter. Handles are provided on the front panel; slides with rollers support the unit until it reaches stops that limit its complete withdrawal. Electrical circuits are automatically broken by jacks and plugs provided at the rear.

(d) Release the limiting stops located in the supporting slides, and remove the oscillator from the transmitter.

6.8 Installation—

(a) Slide the oscillator unit in on the guide rails and push it home with enough force to seat completely the jacks and plugs.

(b) Tighten the thumbscrews and close the door to the relay section below the oscillator panel.

6.9 NOTE—In removing or replacing the cover of the oscillator compartment, the screws should be tightened firmly, but obviously not with the operator's full strength, since it might deform or strip the threads in the aluminum housing. In removing the cover, do not strain or deform the connection leads terminating on the cover.

6.10 Substitution—If it ever becomes necessary to substitute another oscillator unit, repositioning of the terminal board (B) at the rear of the transmitter may be required.

(a) Remove the original oscillator unit from the transmitter.

(b) Disconnect the leads from back of the terminal board (B) located in the right rear of the oscillator compartment. Loosen the terminal board to permit alignment of the plugs when the oscillator is installed.

(c) Loosen the screws securing the locating pin to the frame (left rear of the oscillator compartment).

(d) Insert the new oscillator unit in guide rails until locks catch. Withdraw oscillator unit to full extent of travel to properly located rollers.

(e) Push the oscillator unit into the compartment until the locating pin and jacks are engaged. Carefully check for strain (caused by misalignment) on the terminal board, and on the locating pin. If necessary, elongate the screw holes in the brackets on which the male jack board and locating pin are mounted.

If the oscillator will not push all the way into the compartment, due to interference of the panels, trim the edges of the oscillator panel to obtain clearance and touch up with black finish.

(f) With the oscillator in correct position, tighten the seven thumbscrews locking the oscillator into the transmitter. Tighten the nuts securing the jacks in the jack board, and connect the leads to their respective jack terminals. Tighten the screws securing the locating pin.

6.11 Shock Mounts—The shock mounts, used on the oscillator compartment, should be replaced after three or four years (or sooner if they become cracked). In replacing them, change only one mount at a time to avoid the possibility of misalignment.

6.12 VACUUM TUBES — NOTE — ALL TUBES SUPPLIED WITH THE EQUIPMENT, OR AS SPARES ON THE EQUIPMENT CONTRACT, SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

6.13 Tubes should be handled with care as they may be permanently injured if subjected to sudden shocks. When inserting tubes in the sockets do not allow them to snap into position. Do not chill the tubes by allowing the hot glass to come in contact with cold or wet surfaces, as breakage may result. Tubes should never be operated above their ratings. Store them in an upright position in their original containers. In all cases careful handling and conservative operation will be amply repaid by long and uniform tube life.

6.14 An accurate record should be kept of all vacuum tubes, including the date of receipt, use intended, date placed in service, date of failure, number of hours operated and other pertinent information.

6.15 NOTE—THE NAVY TYPE -860 TUBE USED IN THE MASTER OSCILLATOR CIRCUITS SHOULD BE OF THE ANCHORED FILAMENT TYPE, WITH FILAMENT SUPPORTED TOP AND BOTTOM SO AS TO PREVENT CONTACT VARIATION AND RESULTANT VARIATION IN EMITTED FREQUENCY. USE OF AN UNANCHORED FILAMENT TYPE TUBE MAY CAUSE AN UNSTABLE FREQUENCY. ANCHORED TYPE TUBES MAY BE RECOGNIZED BY THE COLOR OF THE FILAMENT AT THE CENTER (TOP) SUPPORT. WITH NORMAL FILAMENT VOLTAGE, THIS POINT WILL BE COLD ON THE ANCHORED TYPE AND WILL GLOW ON THE UNANCHORED TYPE.

6.16 CAUTION—THE NAVY TYPES –860 AND –803 TUBES MUST BE OPERATED AT THEIR RATED FILAMENT VOLTAGE (10 VOLTS); ANY VARIATION FROM THIS VOLTAGE SHOULD BE LESS THAN FIVE PER CENT.

6.17 Filament Emission Test—Filament emission of any tube may be checked by momentarily raising or lowering the filament voltage approximately one-quarter of a volt (by means of the filament rheostat), at the same time watching the plate-current meter for that particular tube. If the plate current for the tube in question increases and decreases respectively as the filament voltage is raised and lowered, the tube should be replaced.

NOTE: NORMAL PLATE VOLTAGES FOR THE TYPES –860 AND –803 TUBES ARE 1500 AND 2000 VOLTS D-C RESPECTIVELY. EXCEPT WHERE INDICATING INSTRUMENTS ARE ALREADY INCORPORATED IN THE EQUIPMENT, OPERATING PERSONNEL SHOULD PROCEED WITH CAUTION WHEN MEASURING POTENTIALS IN EXCESS OF 500 VOLTS WITHIN THE EQUIPMENT DUE TO HAZARD TO LIFE.

6.18 When it is necessary to use an external meter to measure voltages within the transmitter ALWAYS proceed as follows:

(a) Make certain that the motor generator is not running.

(b) Attach grounding sticks to terminals 14V and 15U.

(c) Connect external meter leads to required positions in the transmitter. Make certain that the meter range is sufficient for the highest voltage possible between the points of connection.

(d) Remove grounding sticks.

(e) Start the transmitter and note the voltage indicated on the external meter. DO NOT TOUCH THE METER NOR THE LEADS WHICH ARE CONNECTED TO IT.

(f) Stop the transmitter and attach grounding sticks before removing the external meter.

6.19 Meters—Each of the meters, except the antenna ammeter (M100), can be removed from the front of the panel by withdrawing the three mounting screws, after removing connections at back. To remove meter M100, proceed as follows: Remove the right-hand top cover from the transmitter frame. Reach inside the transmitter and disconnect the leads to the meter. From the front of the transmitter panel, remove the three screws holding the glass and bezel, being careful not to drop the nameplate, bezel and window assembly, or the meter. Withdraw the meter through the top of the transmitter. The mounting posts may be removed by unscrewing the three screws holding them to the meter case.

WARNING—DO NOT ADJUST THE ZERO INDICATION OF THE METERS WITH POWER **ON.** WHEN SERVICING THE RADIO TRANSMITTER UNIT, **ALWAYS DISCHARGE THE FILTER CAPACITORS** SINCE THEY MAY BE HOLDING DANGEROUS CHARGES EVEN THOUGH POWER MAY NOT BE ON IN THE SET. FOR THIS PURPOSE, USE A

CONTROL SWITCHES AND INTERLOCKS

Control	Switch	Interlock	Remarks
J	S117	S137	
G	S115 & S116	S138	
Tune-Operate	S125	S139	
W	S120	S134	
U	S119	S135	
Q	S131	S136	
Emission Selector and Filament Standby	S126 & S106	—	A-C sets only. Common panel.
Emission Selector and Line Voltage Switch	S126 & S113	—	D-C sets only. Common panel.
Test Key	S111	—	
Start	S108		4-wire control only.
Start-Stop	S140 & S141	—	6-wire control only.
Emergency	S107	—	
Control (local-remote) Switch	S110	—	

GROUND STICK (AN INSULATED ROD WITH A FLEXIBLE, INSULATED WIRE FASTENED BETWEEN ONE END OF THE ROD AND GROUND) SO THAT HIGH-VOLTAGE PARTS CAN BE GROUNDED BEFORE HANDLING. THIS ASSURES THAT ALL PARTS ARE "DEAD" ALTHOUGH RESISTORS NORMALLY DISCHARGE THE CAPACITORS.

6.20 Switches—Most of the switch controls in the equipment may be serviced by removing the panel screws and withdrawing the control; a separate coupling or clutch is provided to permit this withdrawal. This is particularly valuable in the case of those switches having interlocks, but the opening may also be used for servicing or circuit-checking adjacent items. Removable control switches and their attendant interlocks are listed in the table "CONTROL SWITCHES AND INTERLOCKS."

6.21 The contacts of switches (S114), (S115), (S116), (S119), (S120), (S121), (S125) and (S131) should be kept clean and in good contact. The bearings of these switches and those of (S123) may be given an occasional drop of light oil such as Navy Type 2075.

6.22 Relays—Inspect the relays regularly for rust, noise, and condition of contacts. If the contacts are rough, smooth them carefully with a jeweler's file or crocus cloth, rounding the surfaces so as to leave no sharp contact points. If the contacts are badly burned, replace them with spare contacts.

6.23 Keep relay armature and pole piece free from rust; otherwise the relay may become noisy. If necessary, a very light coating of petrolatum may be applied to the pole faces.

6.24 Keying Relay—Check the keying relay occasionally to see that the contacts are clean and the keying action satisfactory.

CAUTION—DO NOT ADJUST THESE CONTACTS UNLESS ABSOLUTELY NECESSARY. THE CONTACTS OF THE KEYING RELAY ARE SET AT THE FACTORY WITH AN OSCILLOSCOPE TO ASSURE HIGH-SPEED KEYING, AND SHOULD NOT BE CHANGED UNLESS NECESSARY TO ELIMINATE ARCING OR OTHER FAULTY KEYING.

6.25 The keying relay may be serviced easily by removing the housing. If necessary, the entire relay and mounting brackets may be removed by withdrawing the two screws which fasten the mounting brackets to the front panel. The leads to the coil (in front of panel) should be disconnected. The leads to the rear terminals are long enough to permit removal of the relay; if they are disconnected, they should be tagged to insure proper connections when the relay is replaced.

6.26 When adjustment of the keying relay is required, the following procedure should be observed: The designations "A" to "M" inclusive refer to the corresponding designations on the photograph, Figure 21.

a. First determine that the plunger does not strike the core piece when at the **down** end of the stroke. To check this condition, lower the adjustable contacts (A) until the plunger can be pushed down firmly against the bottom core piece. Then adjust the "A" contacts until they just touch the "B" contacts, carefully holding the plunger against the bottom core piece.

b. Now release the plunger and adjust the backstop nuts (C) until a distance of $\frac{5}{16}$ inch is obtained between the relay base and both sides of the bottom edge of strap "D."

c. Next adjust the "A" contacts with the plunger **up,** so that the gap between contacts "A" and "B" is 0.025 inch.

d. Now with the plunger in the **down** position, adjust the clearance between the push rod (E) and the eyelet (F) to 0.017 inch.

e. Now adjust contacts "G" and "H" by means of the adjusting screw (L) to provide a clearance of 0.015 inch when the plunger is in the **up** position.

f. Then adjust contacts "I" and "K" by means of the adjusting screw "M" to provide a clearance of 0.015 inch when the plunger is in the **down** position.

CAUTION—After the completion of the above adjustments and before operating the relay, make certain that all locknuts are tight.

6.27 Thermostats and Thermometers — The mercury thermostats and thermometers are delicate devices and they should be handled with care. Even with the best of care, the mercury column sometimes separates. Should the column separate, it may be reunited by placing the bulb in water, at a temperature of about 40° C., and gradually adding warmer water until the column reunites. The instrument should then be cooled gradually.

6.28 The thermometer may be removed by removing the guard screws on the front panel. The thermostat may be removed by withdrawing four screws (two at each end of the molded phenolic strip near the bottom of the oven) located directly above the blower which is on the left-hand side of the oscillator unit. Thus the strip which holds the thermostat mounting clips, and the thermostat may be removed without removing the main oven cover plate.

6.29 SPARK GAP—The protective spark-gap consists of two pieces of $\frac{1}{4}$ inch rod properly shaped to form a horn gap. One rod is permanently fastened to the transmitter antenna terminal. The other rod mounts on a grounded frame member of the transmitter and its position is adjustable. The spacing of the gap is set at the time of manufacture and the adjustable rod is locked in position by a setscrew and locknut. The spacing of this gap has been determined by

the conditions described in Paragraph 3.62 and unless this spacing should become accidentally changed, the gap setting should not be altered.

6.30 MOTOR GENERATOR UNIT—Inspect the motor generator occasionally to ascertain that the brushes are not sparking excessively and that the commutators are not burned or grooved. Commutators and collector rings must be kept clean and the brushes must fit these surfaces properly. The carbon dust which settles on the surfaces adjacent to the brushes should be removed periodically by means of a bellows or a clean cloth. If the commutator and slip rings acquire a polish, no other attention is required. It is not harmful if the commutators and slip-rings darken eventually from brush friction. Speed regulator adjustments are shown in Figure 32.

6.31 If the motor generator has not been used for a long period, the brushes and commutators should be examined before starting the equipment, since, in a salt atmosphere, it is possible for the brushes to be stuck in the holders, or for the commutators to be corroded and covered with green spots.

6.32 Inspect the motor-generator bearings occasionally to be sure that they are free and that the armature turns easily. These bearings are of the ball-bearing type and should require little attention. If, for any reason, the housing covers over the bearings are removed, be very careful to keep all dirt out of the bearings. **Dirt can ruin ball bearings.** For lubrication, see Paragraph 6.40.

6.33 If at any time it should be necessary to replace a bearing, proceed as follows:

(a) Remove the rotor or armature as described in paragraph 6.34.

(b) Measure the distance from the end of the shaft to the face of the bearing and then, using a bearing puller, remove the bearing from the shaft. The bearing puller should be such that pressure will be evenly applied to that portion of the bearing which is nearest the shaft (the inner bearing race).

(c) The new bearing assembly must be installed on the shaft at the same distance from the end of the shaft as that of the original bearing and in such a manner as to keep it exactly square with the shaft. Before installing the new bearing make certain that there are no burrs on the shaft. The new bearing may be driven into position by placing a piece of tubing over the shaft and against the inner ring of the bearing and then tapping against the outer end of the tube with a hammer. Only light tapping should be required. Heavy pounding must be avoided.

6.34 Most repairs on the motor generator set can be made without removing any unit from the bedplate. If repairs are of such a nature as to necessitate the dismantling of a motor or generator, proceed as follows:

(a) Remove the interunit covers.

(b) Remove brushes (d.c. motor or generator only).

(c) Loosen interunit coupling and slide both sections to shaft of adjacent machine.

(d) Remove end bell.

(e) Withdraw armature or rotor.

To reassemble, repeat steps (a) to (e) in reverse sequence. When reassembling, parts should not be forced. Start with parts which are clean and keep them so during assembly operations. Make sure that lubrication has been provided (see paragraph 6.43) then replace the interunit covers.

6.35 Reconnect and check connections against those shown in the interconnection diagram (see Figures 40, 41, 48, or 49). Rotate armature or rotor by hand, noting and making the necessary corrections for binding or uneven torque. Apply voltage and operate with no load noting ventilation, lubrication, speed, and noise.

6.36 A special inspection of repaired equipment should be made a few days after it is placed in service.

6.37 If it is necessary to remove a motor or generator from the bedplate, this may be done by removing the bolts and dowel pins or taper pins which fasten the unit to the bedplate (or to the elevating blocks when used). It is also necessary to unbolt the couplings; then the unit may be removed without disturbing the position of adjacent units.

6.38 Commutators and Slip Rings—The commutators and slip rings may be cleaned occasionally with fine (4/0) sandpaper.

CAUTION—NEVER USE EMERY CLOTH OR EMERY PAPER ON THE COMMUTATOR. NEVER MAKE REPAIRS TO COMMUTATOR WHILE THE MACHINE IS RUNNING AS THE GENERATOR VOLTAGE IS DANGEROUS TO LIFE. ROTATE THE GENERATOR ARMATURE BY HAND.

6.39 If the commutators or slip rings become excessively grooved or roughened, they should be turned down accurately in a lathe.

CAUTION—After turning the commutator down, the mica should be undercut cleanly to a slight depth ONLY ON THE D-C MOTOR OR ON THE 250-VOLT GENERATOR. THE H.V. GENERATOR COMMUTATORS SHOULD NEVER BE UNDERCUT.

6.40 Brushes and Brushholders—The position of the brushholders is set at the factory to provide best commutation. **Do not alter this position.**

6.41 If the brushes become stuck in the brushholders, remove them and clean the brushholders with fine 4/0 sandpaper. Do not replace the brushes until all grit has been removed.

6.42 When the brushes have worn down to the point where the spring is nearing the end of its travel, they should be replaced. New brushes should be of the same make and grade as those shipped with the machines. The brushes should have only enough clearance in the brushholder to slide easily. If they are tight, sandpaper the sides until they slide easily. When fitting new brushes to the commutator or slip-ring surface, grind them in by wrapping a strip of fine sandpaper (approximately the width of the commutator) around the commutator with the rough side turned out. Apply normal spring pressure to the brushes and rotate the armature by hand until a radius forms on the brush. About 70 per cent of the brush surface should be so formed for good commutation; the grinding-in process need not be so carefully done on slip-ring brushes. **Make certain that all carbon dust and grit is removed before operating the machine.**

CAUTION—NEVER USE EMERY CLOTH OR EMERY PAPER ON THE BRUSHES OR BRUSHHOLDERS. NEVER MAKE REPAIRS TO THE BRUSHES WHILE THE MACHINE IS RUNNING AS THE GENERATOR VOLTAGE IS DANGEROUS TO LIFE. ROTATE THE GENERATOR ARMATURE BY HAND.

6.43 LUBRICATION

MOTOR GENERATOR UNIT—This unit is shipped with sufficient lubrication in the bearings to last for several months. At intervals of about six months in normal operation, the bearings should be greased. Use a high-grade, sodium-base, clean ball-bearing grease similar to that supplied in the bearings, or use Navy "Grade A Soft," Spec. Number 14L3. When lubricating, remove the bearing drain plugs and with the motor generator running, force in clean grease, by means of the grease cup at the top, until clean grease appears at the outlets. Then allow the unit to run an additional fifteen minutes before replacing the drain plugs. DO NOT FORGET TO REPLACE THE PLUGS. This procedure will prevent an excessive amount of grease accumulating in, and overheating the bearings. At intervals of two years, remove the bearing cover plates, wash the bearings out and repack with clean grease. KEEP GREASE AND BEARINGS CLEAN. DIRT DESTROYS BALL BEARINGS.

6.44 Magnetic Controller Unit—The sealing surfaces of the magnet core and armature may be given a very light coating of Navy lubricant 14P1C if they show any tendency to rust. The switch blades of the d-c magnetic controller may have a light coating of Navy lubricant 14P1C added to the surfaces if they show any signs of cutting or binding. The switch contacts in the a-c controller should not be greased. Relay or contactor bearings in the controller should not be oiled since this may cause the controller to be noisy in operation. The a-c magnetic controller is illustrated in Figure 36. Maintenance instructions for this controller are included in Manufacturer Bulletins Nos. B 70-194 and 1759 which are located at the rear of this book. The d-c magnetic controller is illustrated in Figure 37. Maintenance instructions for this controller are included in Manufacturer Bulletins Nos. 111, 4519, 1055 and 5221 which are located at the rear of this book.

6.45 BLOWER MOTOR—The ball bearings of this machine are packed in grease which should be replaced at intervals of about one year. Use a high-grade, sodium-base, clean, ball-bearing grease similar to that supplied in the bearings, or use Navy "Grade A Soft," Spec. Number 14L3.

6.46 OVERLOAD RELAYS—The oil in the dashpot of the d-c magnetic controller overload relay should be maintained at a level of about ¾ inch from the bottom. Relays K105 and K106 in the transmitter also require oil. The proper type and amount is specified on the relay nameplate.

POINT-TO-POINT RESISTANCE

FROM	TO	OHMS	REMARKS
6W	Ground	15,000	
18W	F403	85,000	S114 in H.F.
		Infinite	S114 in I.F.
V100, Grid	Ground	40,000	
V100, Plate	F403	25,000	S114 in H.F.
		Infinite	S114 in I.F.
V101, Term 1 or 4	Ground	15,000	
V101, Grid	Ground	40,000	
V101, Term 3	F403	Infinite	S114 in H.F.
		85,000	S114 in I.F.
V101, Plate	F403	Infinite	S114 in H.F.
		25,000	S114 in I.F.
V102, Term 1 or 4	Ground	15,000	
V102, Grid	F401	10,800	
V102, Term 3	Ground	32,000	
	F402	12,000	
V102, Plate	F404	5,000	S114 in H.F.
		10,000	S114 in I.F.
V103, Term 1 or 4	Ground	15,000	S142 in H.F.
V103, Grid	F401	25,000	S114 in H.F.
	Ground	16,000	S114 in I.F.
V103, Term 3	Ground	32,000	
	F402	12,000	
V103, Plate	F404	7,500	S114 in H.F.
	F404	15,000	S114 in I.F.
V104, V105 —Term 1 or 5	Ground	15,000	
V104, V105 —Term 2	Ground	21,000	
	F402	1,000	
V104, V105 —Term 3	F401	5,800	S114 in H.F.
	F401	4,300	S114 in I.F.
	Ground	4,000	S126 in M.C.W.
V104, V105 —Term 4	F401	3,300	S126 in Phone
	F404	50,000	S126 in C.W.
	Ground	1,500	S126 in C.W.
V104, V105 —Plate	F404	0	S125 in OPERATE
C314	Ground	400	220/440V AC only
E4	Ground	40,000	
E5	Ground	40,000	
E12	X1	15,000	S114 in I.F.
E12	X1	7,500	S114 in H.F.
E13	Ground	16,000	S114 in H.F.
H12	Y32	500	
H15	Ground	3,300	S125 in OPERATE

POINT-TO-POINT RESISTANCE—Continued

FROM	TO	OHMS	REMARKS
H15	Ground	5,300	S125 — Tune Step 1—Remove T102
H19	H30	5	
H24	H25	23	
H107	H108	15,000	S114 in H.F.
J11	H104	3,500	
J14	H13	15	
L126/C145	Ground	850	Remove R127
L127/C144	11T	25,400	Remove R127
L127/C144	5Y	25,400	Remove R168
L134/C143	11T	5,000	
M106+	Ground	2,500	Remove R126, R127
P3	Y7	16,500	
P10	Ground	4,000	
S1	S5	1,700	115V DC only
S1	S5	3,200	230V DC only
S1	S5	3,700	250V DC only
S8	Y24	35	S144 in I.F.
S15	U14	35,000	S114 in I.F.
S16	U14	25,000	
T11	Ground	850	Remove R127
T14	T15	80	S106 Closed
T105	H10	180	
W9	W14	100	
X1	H101	2.5 megohms	
X1	P3	50,000	
X2	H102	2.5 megohms	
X2	Y7	49,000	
X3	Ground	20,000	
X102-3	X103-3	24,000	
X105-4	X103-3	13,000	
Y4	Y6	100	220/440V AC only Remove I103
Y4	Y6	1,000	115V DC only Remove I103
Y4	Y6	4.000	230V DC only Remove I185
Y7	Ground	15,000	
Y8	Y15	3,500	Open shorting link
Y8	Y15	3,000	115V DC only Remove I103 Open shorting link
Y10	Y18	1,000	
Y10	Y18	1,200	230V DC only
Y18	Y31	1,200	
Y18	Y31	600	
Y25	Y30	4,500	Open shorting link
Y33	Y35	3.500	Remove R127

TYPICAL VOLTAGE AND CURRENT MEASUREMENTS

			OSC		1ST I.P.A.		2ND I.P.A.		P.A.	
			VOLTS	MA	VOLTS	MA	VOLTS	MA	VOLTS	MA
GRID		H.F.	–150	13	125-140	3.6	180-400	19	–95	*
		I.F.	–150	13	125-140	3.6	0-260	19	–95	*
SCREEN		H.F.	500	13.0	480	10	410-480	10	400	125
		I.F.	500	13.6	480	10	410-480	10	400	125
PLATE	H.F.	PHONE	*	*	1750	*	1450	*	*	*
		C.W.	*	*	1750	*	1450	*	*	*
		M.C.W.	*	*	1750	*	1450	*	*	*
	I.F.	PHONE	*	*	1450	*	1550	*	*	*
		C.W.	*	*	1450	*	1550	*	*	*
		M.C.W.	*	*	1450	*	1550	*	*	*

* Denotes panel mounted meter.

TABLE I
LIST OF MAJOR UNITS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

CONTRACT NOs-60970
CONTRACT NOs-98591
CONTRACT NXss-33180

QUANTITY								
TBL-4,8	TBL-4,9	TBL-4,‡8	TBL-4,8	TBL-4	SYMBOL GROUP	NAVY TYPE DESIGNATION	NAME OF MAJOR UNIT	ASSEMBLY DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.				
1					100 - 399	CRV-52181	Transmitter Unit	K-856170-501
	1					CRV-52181	Transmitter Unit	K-856170-502
		1				CRV-52178	Transmitter Unit	K-856170-503
			1			CRV-52179	Transmitter Unit	K-856170-504
				1		CRV-52180	Transmitter Unit	K-856170-505
1	1					CRV-53074	Filter Unit	P-720509-501
		1	1	1		CRV-53073	Filter Unit	P-720509-502
1	1				400 - 499	CBP-21340,21950	Motor Generator Unit	K-860402-1
		1				CBP-21546,21948	Motor Generator Unit	K-860403-1
			1	1		CBP-21547,21949	Motor Generator Unit	K-860404-1
1					500 - 599	CAE-21341	Magnetic Controller Unit	K-860428-1
	1					CAE-21543	Magnetic Controller Unit	K-860429-1
		1				CAE-21541	Magnetic Controller Unit	K-860430-1
			1	1		CAE-21542	Magnetic Controller Unit	K-860431-1
ó1						CAE-211107	Magnetic Controller Unit	K-885330-1
			ó1			CAE-211105	Magnetic Controller Unit	K-885329-1

ó TBL-8 Contract NXss-33180 only.
‡ TBL-8 Contract NOs-98591 only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,7,8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							STRUCTURAL PARTS						
x	x	x	x	x	δA-101	Shock Mount for Oscillator Unit	2-1/4" square, 25 lbs. load rating at 1/16" deflection			27	Cat.#200P25		K-856017-14
x	x	x	x	x	δA-102	Shock Mount for V-105	Rubber, 13/16" long, 3/4" O.D. one end, 1/2" O.D. the other end, 5/16" I.D.			462			K-818505-1
x	x	x	x	x	δA-103	Shock Mount, Tube Socket Base	3/8" long, 3/4" O.D., 1/2" I.D.			462			K-818505-4
x	x	x	x	x	δA-104	Shock Mount, Tube Socket Base	Rubber, 1/8" thick, 1" dia. hole			528	Cat.#280		K-855934-1
x	x	x	x	x	δA-105	Shock Mount, Tube Socket Base	Buna rubber, 1/8" thick, 3-1/2" square			528	Cat.#1275		K-855633-1
							MOTORS						
x	x				B-101	Air Blower (TBL-4,8&9)	Blower and B-101A, motor assembly			22			P-720534-501
x					B-101	Air Blower (TBL-8)	Blower and B-101A, motor assembly			258			P-720519-501
x	x				*B-101A	Blower Motor (TBL-4,8&9)	110 v, 60 cycles a.c., single phase, 2850 r.p.m., 1/70 h.p., counter-clockwise rotation			22 δ258	Cat.#B2264XZ Type NCI-12		P-720519-4
x					*B-101A	Blower Motor (TBL-8)	110 v, 60 cycles a.c., single phase, 2850 r.p.m., 1/70 h.p., counter-clockwise rotation			258			P-720519-11
x	x				*B-101B	Bearing for Motor (TBL-4,8&9)	Set of bearings (2)			22	5387		K-856514-3
x					*B-101B	Bearing for Motor (TBL-8)	Bearing			258			K-885655-2

TBL-4 CONTRACT NOs-98591 Only.
δ TBL-8 Spare Only Contract NXss-33180 Only.
** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
δ May be substituted for American Blower Co.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,†8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							MOTORS (Continued)						
		x			B-102	Air Blower (TBL-4,8)	Blower & B-102A			22			P-720534-502
		x			*B-102A	Blower Motor (TBL-4,8)	115 v d.c., 2850 r.p.m., 1/70 h.p., counter-clockwise rotation			22 δ258	Cat.#B2156XZ Type NSH-12		P-720519-2
		x			*B-102B	Bearings for Motor (TBL-4,8)	Set of bearings (2)			22	5387		K-856514-8
		x			*B-102C	Brushes for Motor (TBL-4,8)	Set of brushes (2)			22	Pt.#2077-10		K-856514-9
		x			*B-102D	Brushes for Electrolux Motor (TBL-8)	Set of brushes & springs			258	22934		K-885367-1
			x	x	B-103	Air Blower (TBL-4)	Blower & B-103A, motor assembly			22			P-720534-503
			x		B-103	Air Blower (TBL-8 Contract NOs-98591)	Blower & B-103A, motor assembly			258			P-720534-503
			x		B-103	Air Blower (TBL-8 Contract NXss-33180)	Blower & B-103A, motor assembly			258			P-720519-503
			x	x	*B-103A	Blower Motor (TBL-4)	230 v d.c., 2850 r.p.m., 1/70 h.p., counter-clockwise rotation			22	Cat.#5647XZ Type NCO-12		P-720519-3
			x		*B-103A	Blower Motor (TBL-8 Contract NOs-98591)	230 v d.c., 2850 r.p.m., 1/70 h.p., counter-clockwise rotation			22 δ258	Cat.#5647XZ Type NCO-12		P-720519-3
			x		*B-103A	Blower Motor (TBL-8 Contract NXss-33180)	230 v d.c., 2850 r.p.m., 1/70 h.p., counter-clockwise rotation			258			P-720519-10
			x	x	*B-103B	Bearings for Motor (TBL-4)	Set of bearings (2)			22	5387		K-856514-16

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
δ *May be substituted for American Blower Co.*
TBL-† CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,18 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							MOTORS (Continued)						
			x		*B-103B	Bearings for Motor (TBL-8 Contract NOs-98591)	Set of bearings (2)			22	5387		K-856514-16
			x		*B-103B	Bearings for Motor (TBL-8 Contract NXss-33180)	Same as B-101B			258			K-855655-2
			x	x	*B-103C	Brushes for Motor (TBL-4)	Set of brushes			22	Pt.#2077-10		K-856514-17
			x		*B-103C	Brushes for Motor (TBL-8 Contract NOs-98591)	Set of brushes (2)			22	Pt.#2077-10		K-856514-17
			x		*B-103D	Brushes for Electrolux Motor (TBL-8)	Same as B-102D			258	22934		K-885367-1
			x		*B-103E	Brush Holder (TBL-8 Contract NXss-33180)	Brush holder			258			K-885366-1
			x		*B-103F	Bearing for Motor (TBL-8 Contract NXss-33180)	Bearing			258			K-885655-1

TBL-4,8 CONTRACT NOs-98591 Only.
** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,28	TBL-4,8	TBL-4										
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS						
x	x	x	x	x	*C-100	Power Amplifier Filament By-pass Capacitor	Fixed, mica, 0.01 mfd ±10%, 1200 v d.c. working, 2500 v d.c. test	CM55-103K (-48035-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-49
x	x	x	x	x	*C-101	Power Amplifier Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-102	Power Amplifier Screen Grid By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-103	Power Amplifier Suppressor By-pass Capacitor	Fixed, mica, 0.005 mfd ±10%, 1200 v d.c. working, 2500 v d.c. test	CM55-502K (-48409-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-46
x	x	x	x	x	*C-104	Power Amplifier Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-105	Power Amplifier Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-106	Power Amplifier Screen Grid By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-107	Power Amplifier Suppressor By-pass Capacitor	Same as C-103	CM55-502K (-48409-B10)					

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-4B CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4, 9	TBL-4, †8	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.									
							CAPACITORS (Continued)						
x	x	x	x	x	*C-108	2nd Intermediate Power Amplifier Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-109	2nd Intermediate Power Amplifier Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-110	2nd Intermediate Power Amplifier Screen By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-111	1st Intermediate Power Amplifier Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-112	1st Intermediate Power Amplifier Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-113	1st Intermediate Power Amplifier Screen By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-114	H-F Oscillator Filament Choke By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-115	H-F Oscillator Filament Choke By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-116	H-F Oscillator Screen By-pass Capacitor	Fixed, mica, 0.05 mfd ±5%, 1500 v d.c. working	CM70-503J (-48003-B5)	RE 13A 389M RE 48A 131D	1	UC-2990A		K-860215-23
x	x	x	x	x	*C-117	I-F Oscillator Filament Choke By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-118	I-F Oscillator Filament Choke By-pass Capacitor	Same as C-116	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-119	I-F Oscillator Screen By-pass Capacitor	Same as C-116	CM70-503J (-48003-B5)					

TBL-†8 CONTRACT NOs-98591 Only.
** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 v A.C.	TBL-4,9 220 v A.C.	TBL-4,28 115 v D.C.	TBL-4,8 230 v D.C.	TBL-4 250 v D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
CAPACITORS (Continued)													
x	x	x	x	x	*C-120	H-F Power Amplifier Plate By-pass Capacitor	Fixed, mica, 0.002 mfd ±5%, 5000 v d.c. working	CM70-202J (-48347-B5)	RE 48A 131D RE 13A 389M	1	UC-3054		K-860215-17
x	x	x	x	x	*C-121	H-F 2nd Intermediate Power Amplifier Plate By-pass Capacitor	Same as C-120	CM70-202J (-48347-B5)					
x	x	x	x	x	*C-122	H-F 1st Intermediate Power Amplifier Plate By-pass Capacitor	Same as C-120	CM70-202J (-48347-B5)					
x	x	x	x	x	*C-123	I-F Power Amplifier Plate By-pass Capacitor	Fixed, mica, 0.006 mfd ±5%, 3000 v d.c working	-48349-B5	RE 13A 389M RE 48A 131D	1	UC-3021	Replacement use -48740	K-860215-20
x	x	x	x	x	*C-124	I-F Intermediate Power Amplifier Plate By-pass Capacitor	Same as C-123	-48349-B5					
x	x	x	x	x	*C-125	Oscillator Plate By-pass Capacitor	Same as C-123	-48349-B5					
x	x	x	x	x	*C-126	H-F Oscillator Plate Coupling Capacitor	Fixed, mica, 30 mmfd ±10%. 2000 v d.c. working	-48963-B10	RE 48A 222D RE 13A 389M	1	UC-2944		K-860215-1
x	x	x	x	x	*C-127	H-F Power Amplifier Grid Coupling Capacitor	Fixed, mica, 100 mmfd ±5%, 5000 v d.c. working	CM70-101J (-48592-B5)	RE 48A 131D RE 13A 389M	1	UC3127A	Replacement use -48752	K-860215-24
x	x	x	x	x	*C-128	H-F 2nd Intermediate Power Amplifier Coupling Capacitor	Same as C-120	CM70-202J (-48347-B5)					
x	x	x	x	x	*C-129	H-F 1st Intermediate Power Amplifier Grid Coupling Capacitor	Fixed, mica, 60 mmfd ±5%, 3000 v d.c. working	-48964-B5	RE 48A 222B RE 13A 389M	1	UC-3150		K-860215-2
x	x	x	x	x	*C-130	I-F Power Amplifier Grid Coupling Capacitor	Same as C-120	CM70-202J (-48347-B5)					

TBL-28 CONTRACT NOs-98591 Only.
* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,28 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-131	Intermediate Power Amplifier Plate Coupling Capacitor	Same as C-120	CM70-202J (-48347-B5)					
					C-132	Not Used							
x	x	x	x	x	*C-133	Antenna Coupling Capacitor	Fixed, mica, 0.001 mfd ±2%, 2500 v d.c. working, 5000 v d.c. test	CM55-102G (-48036-B2)	RE 48A 112R RE 13A 389M	1	Model F		K-35484-40
x	x	x	x	x	*C-134	Antenna Coupling Capacitor	Same as C-133	CM55-102G (-48036-B2)					
x	x	x	x	x	*C-135	Antenna Coupling Capacitor	Fixed, mica, 0.0015 mfd ±2%, 2500 v d.c. working, 5000 v d.c. test	CM55-152G (-48398-B2)	RE 48A 112R RE 13A 389M	1	Model F		K-35484-41
x	x	x	x	x	*C-136	Antenna Coupling Capacitor	Same as C-135	CM55-152G (-48398-B2)					
x	x	x	x	x	*C-137	Antenna Coupling Capacitor	Fixed, mica, 0.002 mfd ±2%, 2500 v d.c. working, 5000 v d.c. test	CM55-202G (-48037-B2)	RE 48A 112R RE 13A 389M	1	Model F		K-35484-43
x	x	x	x	x	*C-138	Antenna Coupling Capacitor	Same as C-137	CM55-202G (-48037-B2)					
x	x	x	x	x	*C-139	Antenna Coupling Capacitor	Fixed, mica, 0.003 mfd ±10%, 2500 v d.c. working, 5000 v d.c. test	CM55-302K (-48399-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-44
x	x	x	x	x	*C-140	Antenna Coupling Capacitor	Fixed, mica, 0.004 mfd ±10%, 1200 v d.c. working, 2500 v d.c. test	CM55-402K (-48033-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-45
x	x	x	x	x	*C-141	Antenna Coupling Capacitor	Fixed, mica, 0.006 mfd ±10%, 1200 v d.c. working, 2500 v d.c. test	CM55-602K (-48980-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-47
x	x	x	x	x	*C-142	Antenna Coupling Capacitor	Fixed, mica, 0.008 mfd ±10%, 1200 v d.c. working, 2500 v d.c. test	CM55-802K (-48034-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-48
x	x	x	x	x	*C-143	H-F Power Amplifier Grid By-pass Capacitor	Same as C-137	CM55-202G (-48037-B2)					

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-4,8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,δ8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-144	H-F 2nd Intermediate Power Amplifier Grid By-pass Capacitor	Same as C-137	CM55-202G (-48037-B2)					
x	x	x	x	x	*C-145	H-F 1st Intermediate Power Amplifier Grid By-pass Capacitor	Same as C-137	CM55-202G (-48037-B2)					
x	x	x	x	x	C-146	H-F Power Amplifier Tuning Capacitor	Variable, air, max. 175 mmfd, min. 35 mmfd, steatite insulation, air gap 0.175"			2	Type D		M-420844-6
x	x	x	x	x	δC-146A	Insulator for C-146	Alsimag #196, 4-1/4" long			2			K-881638-1
x	x	x	x	x	C-147	H-F 2nd Intermediate Power Amplifier Tuning Capacitor	Variable, air, max. 320 mmfd, min. 40 mmfd, steatite insulation, air gap 0.125"			2	Type D		M-420844-7
x	x	x	x	x	δC-147A	Insulator for C-147	Same as C-146A						
x	x	x	x	x	C-148	H-F 1st Intermediate Power Amplifier Tuning Capacitor	Variable, air, max. 320 mmfd, min. 40 mmfd, steatite insulation, air gap 0.125"			2	Type D		M-420844-3
x	x	x	x	x	δC-148A	Insulator for C-148	Same as C-146A						
x	x	x	x	x	*C-149	Power Amplifier Plate Ammeter By-pass Capacitor	Fixed, mica, 0.02 mfd ±10%, 600 v d.c. working, 1000 v d.c. test	CM55-203K (-48029-B10)	RE 48A 112R RE 13A 389M	1	Type BF	With terminal link	K-36172-505
x	x	x	x	x	*C-150	2nd Intermediate Power Amplifier Plate Ammeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-151	1st Intermediate Power Amplifier Plate Ammeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-152	Oscillator Plate Ammeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
δ *TBL-8 Spare Only Contract NXss-99180.*
TBL-δ8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4, 8 440 V A.C.	TBL-4, 9 220 V A.C.	TBL-4, 28 115 V D.C.	TBL-4, 8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-153	Filament Voltmeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-154	Power Amplifier Grid Ammeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-155	H-F Oscillator Plate By-pass Capacitor	Fixed, mica, 0.01 mfd ±5%, 2000 v d.c. working	CM70-103J (-48352-B5)	RE 48A 131D RE 13A 389M	1	UC-3004		K-860215-21
x	x	x	x	x	*C-156	I-F Oscillator Filament Transmitter By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-157	I-F Oscillator Filament Transmitter By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-158	I-F Oscillator Plate Tank Capacitor	Same as C-116	CM70-503J (-48003-B5)					
x	x	x	x	x	*C-159	I-F Intermediate Power Amplifier Plate Tank Capacitor	Fixed, mica, 0.0012 mfd ±2%, 5000 v d.c. working	-48511-B2	RE 48A 131D RE 13A 389M	1	UC-3313		K-860215-27
x	x	x	x	x	*C-160	I-F Oscillator Plate Tank Capacitor	Fixed, mica, 0.0011 mfd ±2%, 5000 v d.c. working	-48706-B2	RE 48A 131D RE 13A 389M	1	UC-3299		K-860215-14
x	x	x	x	x	*C-161	I-F Oscillator Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-162	I-F Oscillator Filament By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-163	1st Intermediate Power Amplifier Plate Tank Capacitor	Fixed, mica, 0.00036 mfd ±5%, 5000 v d.c. working	-481172-B5	RE 48A 131D RE 13A 389M	1	UC-3301		K-860215-4
x	x	x	x	x	*C-164	I-F Oscillator Plate Tank Capacitor	Fixed, mica, 0.00025 mfd ±5%, 5000 v d.c. working	CM70-251J (-48749-B5)	RE 13A 389M RE 48A 131D	1	UC-3367		K-856829-3
x	x	x	x	x	*C-165	I-F Power Amplifier Plate Tank Capacitor	Fixed, mica, 320 mmfd ±2%, 5000 v d.c. working	-48966-B2	RE 13A 389M RE 48A 131D	1	UC-3298		K-860215-3

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* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-28 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,δ8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-166	I-F Power Amplifier Plate Coupling Capacitor	Same as C-120	CM70-202J (-48347-B5)					
x	x	x	x	x	*C-167	I-F Power Amplifier Plate Tank Capacitor	Same as C-159	-48511-B2					
x	x	x	x	x	*C-168	I-F Power Amplifier Plate Tank Capacitor	Same as C-155	CM70-103J (-48352-B5)					
x	x	x	x	x	*C-169	I-F Power Amplifier Plate Tank Capacitor	Fixed, mica, 0.005 mfd ±5%, 3000 v d.c. working	CM70-502J (-48406-B5)	RE 13A 389M RE 48A 131D	1	UC-3030		K-856829-1
x	x	x	x	x	*C-170	H-F Antenna Coupling Capacitor	Same as C-120	CM70-202J (-48347-B5)					
x	x	x	x	x	C-171	H-F Antenna Coupling Capacitor	Variable, air, max. 50 mmfd, air gap 0.375"			1			K-856514-158
x	x	x	x	x	C-172	H-F Antenna Capacitor	Variable, air, max. 350 mmfd, min. 45 mmfd, air gap 0.125"			2	Type D		M-420844-4
x	x	x	x	x	δC-172A	Insulator for C-172	Same as C-146A						
x	x	x	x	x	C-173	R-F Coupling Capacitor for Frequency Meter	Variable, air, capacity formed between circular electrode and coil C-108			1			K-856514-164
x	x	x	x	x	C-174	R-F Coupling Capacity for Frequency Meter	Fixed, air, capacitor, formed between wire loop 4-5/8" I.D. and variometer L-111			1			K-856514-165
x	x				*C-175	Spark Absorbing Capacitor	Fixed, oil filled, 0.1 mfd +10% -3%, 1250 v d.c. working	-48596A	RE 13A 488E RE 48A 110Q	1	72053-504		P-720555-6
		x	x	x	*C-176	Spark Absorbing Capacitor	Fixed, oil filled, 0.5 mfd +10% -3%, 600 v d.c. working	-481160	RE 13A 488E RE 48A 110Q	1	72053-507		P-720555-8
x	x	x	x	x	*C-177	I-F Power Amplifier Grid By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					

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* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
δ *TBL-8 Spare Only Contract NXss-33180.*
TBL-18 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,78	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-178	Audio Oscillator Grid Coupling Capacitor	Fixed, oil filled, 0.5 mfd +10% -3%, 1000 v d.c. working	-481177	RE 13A 488E RE 48A 159C	3	25F296		K-860217-11
x	x	x	x	x	*C-179	Modulated CW Tuning Capacitor	Same as C-178	-481177					
x	x	x	x	x	*C-180	Modulated CW Plate By-pass Capacitor	Fixed, oil filled, 1 mfd +10% -3%, 1500 v d.c. working	-48978	RE 13A 488E RE 48A 159C	3	25F68		K-860217-3
x	x	x	x	x	*C-181	H-F Oscillator Plate Tuning Capacitor	Variable, air, max. 495 mmfd, min. 18 mmfd, air gap 0.045", ceramic insulation			2	Type E		K-860285-2
x	x	x	x	x	δC-181A	Insulator for C-181	Isolantite, 2-5/8" long			23	Cat.#500E20		K-870691-1
x	x	x	x	x	*C-182	I-F Oscillator Plate Coupling Capacitor	Fixed, mica, 0.0005 mfd ±5%, 3000 v d.c. working	-48583-B5	RE 48A 222B RE 13A 389M	1	UC-3094		K-860215-6
x	x	x	x	x	*C-183	High Voltage R-F By-pass Capacitor	Same as C-123	-48349-B5					
x	x	x	x	x	*C-184	High Voltage R-F By-pass Capacitor	Same as C-123	-48349-B5					
x	x	x	x	x	*C-185	I-F Oscillator Filament Mid Tap Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-186	H-F Oscillator Frequency Adjusting Capacitor	Variable, air, capacity between one stationary and one movable plate			1			K-856514-183
x	x	x	x	x	*C-187	H-F Oscillator Grid Capacitor	Fixed, mica, 0.0005 mfd ±2%, 2500 v d.c. working, 5000 v d.c. test	CM55-501G (-48401-B2)	RE 48A 112R RE 13A 389M	1	Model F		K-35484-38
x	x	x	x	x	*C-188	I-F Oscillator Grid Capacitor	Same as C-103	CM55-502K (-48409-B10)					
x	x	x	x	x	*C-189	H-F Oscillator Tuning Capacitor	Fixed, mica, 0.0004 mfd ±5%, 5000 v d.c. working	CM70-401J (-48002-B5)	RE 48A 131D RE 13A 389M	1	UC-3103		K-860215-5

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
δ TBL-8 Spare Only Contract NXss-33180.
TBL-78 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,/8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-190	H-F Oscillator Tuning Capacitor	Fixed, mica, 800 mmfd ±5%, 5000 v d.c. working	CM70-801J (-48967-B5)	RE 48A 131D RE 13A 389M	1	UC-3079		K-860215-9
x	x	x	x	x	*C-191	H-F Oscillator Filament Capacitor	Same as C-100	CM55-103K (-48035-B10					
x	x	x	x	x	*C-192	H-F Oscillator Filament Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-193	High Voltage R-F By-pass Capacitor	Same as C-100	CM55-103K (-48035-B10)					
x	x	x	x	x	*C-194	I-F Oscillator Tank Capacitor	Same as C-159	-48511-B2					
x	x	x	x	x	*C-195	I-F Oscillator Tank Capacitor	Fixed, mica, 0.0035 mfd ±5%, 3000 v d.c. working	-48989-B5	RE 48A 131D RE 13A 389M	1	UC-3187		K-860215-19
x	x	x	x	x	*C-196	I-F Oscillator Tank Capacitor	Same as C-169	CM70-502J (-48406-B5)					
x	x	x	x	x	*C-197	I-F Oscillator Tank Capacitor	Same as C-195	-48989-B5					
x	x	x	x	x	*C-198	I-F Oscillator Tank Capacitor	Fixed, mica, 0.004 mfd ±5%, 3000 v d.c. working	-48218-B5	RE 48A 131D	1	UC-3038	Replacement use -481289	K-856829-2
x	x	x	x	x	*C-199	I-F Oscillator Tank Capacitor	Same as C-120	CM70-202J (-48347-B5)					
x	x	x	x	x	*C-300	I-F Oscillator Tank Capacitor	Same as C-190	CM70-801J (-48967-B5)					
x	x	x	x	x	*C-301	500 V Supply Filter Capacitor	Fixed, oil filled, 10 mfd +10% -3%, 600 v d.c. working	-48721	RE 48A 159C	3	9CE5A87		K-860217-2
x	x	x	x	x	*C-302	2000 V Supply Filter Capacitor	Fixed, oil filled, 4 mfd +10% -3%, 2500 v d.c. working	-48947	RE 48A 159C	3	25F56		K-860217-6

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-/8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,*8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-303	1500 V Supply Filter Capacitor	Fixed, oil filled, 4 mfd +10% -3%, 2000 v d.c. working	-48979	RE 48A 159C	3	25P70		K-860217-5
x	x	x	x	x	*C-304	Bias Filter Capacitor	Same as C-301	-48721					
x	x	x	x	x	*C-305	Bias Filter Capacitor	Same as C-301	-48721					
x	x	x	x	x	*C-306	H-F Oscillator Screen By-pass Capacitor	Same as C-116	CM70-503J (-48003-B5)					
x	x	x	x	x	*C-307	H-F Oscillator Screen By-pass Capacitor	Same as C-116	CM70-503J (-48003-B5)					
x	x	x	x	x	*C-308	I-F Oscillator Screen By-pass Capacitor	Same as C-116	CM70-503J (-48003-B5)					
x	x	x	x	x	*C-309	I-F Oscillator Screen By-pass Capacitor	Same as C-116	CM70-503J (-48003-B5)					
x	x	x	x	x	*C-310	Line Voltmeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-311	Oscillator Plate Voltmeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-312	Bias Voltmeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-313	High Voltage Voltmeter By-pass Capacitor	Same as C-149	CM55-203K (-48029-B10)					
x	x	x	x	x	*C-314	Keying Relay Filter Capacitor	Fixed, oil filled, 1 mfd +10% -3%, 600 v d.c. working	-48719	RE 48A 159C	3	9CE5A90		K-860217-1
x	x	x	x	x	*C-315	Bias Voltage Divider By-pass Capacitor	Same as C-301	-48721					

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** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
*TBL-*8 CONTRACT NOs-98591 Only.*

* SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.
TBL-4B CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-316	H-F Oscillator Tuning Capacitor	Same as C-160	-48706-B2					
x	x	x	x	x	*C-317	H-F Oscillator Tuning Capacitor	Same as C-190	CM70-801J (-48967-B5)					
x	x	x	x	x	*C-318	H-F Oscillator Tuning Capacitor	Fixed, mica, 0.0005 mfd ±5%, 5000 v d.c. working	CM70-501J (-48332-B5)	RE 48A 131D RE 13A 389M	1	UC-3095B	Replacement Use -48754	K-860215-7
x	x	x	x	x	*C-319	H-F Oscillator Tuning Capacitor	Same as C-165	-48966-B2					
x	x	x	x	x	*C-320	H-F Oscillator Tuning Capacitor	Fixed, mica, 0.0002 mfd ±5%, 5000 v d.c. working	CM70-201J (-481105-B5)	RE 48A 131D RE 13A 389M	1	UC-3115	Replacement use -48750	K-860215-30
x	x	x	x	x	C-321	Temperature Compensating Capacitor	Variable, bimetallic plate			1			K-854652-502
x	x	x	x	x	C-322	Temperature Compensating Capacitor	Variable, bimetallic plate			1			M-418245-501
x	x	x	x	x	*C-323	Overload By-pass Capacitor	Fixed, oil filled, 1 mfd +10% -3%, 250 v d.c. working	-48553		1			P-72024-502
					C-324	Not Used							
x	x	x	x	x	*C-325	I-F Intermediate Power Amplifier Tank Capacitor	Fixed, mica, 0.0006 mfd ±5%, 5000 v d.c. working	CM70-601J (-48825-B5)	RE 48A 131D RE 13A 389M	1	UC-3087	Replacement use -48425	K-860215-8
x	x	x	x	x	*C-326	Audio Feed MCW Coupling Capacitor	Fixed, mica, 0.02 mfd ±10%, 600 v d.c. working, 1000 v d.c. test	CM55-203K (-48029-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-52
x	x	x	x	x	*C-327	High Voltage Voltmeter By-pass Capacitor	Same as C-123	-48349-B5					
x	x	x	x	x	*C-328	1500 V Voltmeter By-pass Capacitor	Same as C-123	-48349-B5					
		x	x	x	*C-329	Bias Supply Filter Capacitor	Fixed, oil filled, 4 mfd +10% -3%, 600 v d.c. working	-48884	RE 48A 159C	3	26F111		K-860217-9
x	x	x	x	x	*C-330	Audio Line Capacitor	Fixed, oil filled, 0.25 mfd +10% -3%, 400 v d.c. working	-481176	RE 48A 110Q	1	72053-511		P-720555-1

* SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,δ8	TBL-4,8	TBL-4										
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
MISCELLANEOUS ELECTRICAL PARTS													
x	x	x	x	x	δE-101	Insulator for S-119	Stand-off steatite ceramic, 4" long, 1" O.D., each end tapped 1/4"-20 threads for 1/2"	-61011	RE 13A 317	1			K-802918-27
x	x	x	x	x	δE-102	Insulators for Supporting Resistors	Pillar, steatite ceramic, 23/32" x 23/32" x 1-1/4" long, each end tapped #10-24 threads for 3/8"	-61158	RE 13A 317F Grade G	22			K-823038-3
x	x	x	x	x	δE-103	Insulator for M-100	Stand-off steatite ceramic, 1-1/2" long 1/2" O.D., each end tapped #6-32 threads	-61348	RE 13A 317	22			K-823568-22
x	x	x	x	x	δE-104	Insulator for C-171	Stand-off, steatite ceramic, 4" long, 1-1/4" O.D., each end tapped 1/4"- 20 threads for 1/2"	-61283	RE 13A 317	1			K-802918-15
x	x	x	x	x	δE-105	Insulator for C-171	Stand-off, steatite ceramic, 2" long, 1" O.D., each end tapped #10-24 threads for 1/2"	-61281	RE 13A 317	1			K-802918-16
x	x	x	x	x	δE-106	Insulator for L-100	Stand-off, steatite ceramic, 1-3/4" long, 1" O.D., each end tapped #10-24 threads for 1/2"	-61349	RE 13A 317	1			K-802918-29
x	x	x	x	x	δE-107	Insulator for C-171	Conical, steatite ceramic, 2" long, one end 1-1/8" O.D. tapered to 5/8" O.D. the other end, each end tapped #10-24 threads for 1/2"	-61157	RE 13A 317	1			K-802919-4
x	x	x	x	x	δE-108	Insulator for C-326	Stand-off, steatite ceramic, 1" long, 1/2" O.D., each end tapped #6-32 threads	-61170	RE 13A 317	22			K-823568-5
x	x	x	x	x	δE-109	Insulator for C-147	Conical, steatite ceramic, 1-11/16" long, one end 1" O.D. tapered to 1/2" O.D. the other end, each end tapped #8-32 threads for 3/8"	-61299	RE 13A 317	1			K-802919-5

δ TBL-8 Spare Only Contract NXss-33180
TBL-8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,8&9	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							CAPACITORS (Continued)						
x	x	x	x	x	*C-316	H-F Oscillator Tuning Capacitor	Same as C-160	-48706-B2					
x	x	x	x	x	*C-317	H-F Oscillator Tuning Capacitor	Same as C-190	CM70-801J (-48967-B5)					
x	x	x	x	x	*C-318	H-F Oscillator Tuning Capacitor	Fixed, mica, 0.0005 mfd ±5%, 5000 v d.c. working	CM70-501J (-48332-B5)	RE 48A 131D RE 13A 389M	1	UC-3095B	Replacement Use -48754	K-860215-7
x	x	x	x	x	*C-319	H-F Oscillator Tuning Capacitor	Same as C-165	-48966-B2					
x	x	x	x	x	*C-320	H-F Oscillator Tuning Capacitor	Fixed, mica, 0.0002 mfd ±5%, 5000 v d.c. working	CM70-201J (-481105-B5)	RE 48A 131D RE 13A 389M	1	UC-3115	Replacement use -48750	K-860215-30
x	x	x	x	x	C-321	Temperature Compensating Capacitor	Variable, bimetallic plate			1			K-854652-502
x	x	x	x	x	C-322	Temperature Compensating Capacitor	Variable, bimetallic plate			1			M-418245-501
x	x	x	x	x	*C-323	Overload By-pass Capacitor	Fixed, oil filled, 1 mfd +10% -3%, 250 v d.c. working	-48553		1			P-72024-502
					C-324	Not Used							
x	x	x	x	x	*C-325	I-F Intermediate Power Amplifier Tank Capacitor	Fixed, mica, 0.0006 mfd ±5%, 5000 v d.c. working	CM70-601J (-48825-B5)	RE 48A 131D RE 13A 389M	1	UC-3087	Replacement use -48425	K-860215-8
x	x	x	x	x	*C-326	Audio Feed MCW Coupling Capacitor	Fixed, mica, 0.02 mfd ±10%, 600 v d.c. working, 1000 v d.c. test	CM55-203K (-48029-B10)	RE 48A 112R RE 13A 389M	1	Model F		K-35482-52
x	x	x	x	x	*C-327	High Voltage Voltmeter By-pass Capacitor	Same as C-123	-48349-B5					
x	x	x	x	x	*C-328	1500 V Voltmeter By-pass Capacitor	Same as C-123	-48349-B5					
		x	x	x	*C-329	Bias Supply Filter Capacitor	Fixed, oil filled, 4 mfd +10% -3%, 600 v d.c. working	-48884	RE 48A 159C	3	26F111		K-860217-9
x	x	x	x	x	*C-330	Audio Line Capacitor	Fixed, oil filled, 0.25 mfd +10% -3%, 400 v d.c. working	-481176	RE 48A 110Q	1	72053-511		P-720555-1

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,δ8	TBL-4,8	TBL-4									
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
MISCELLANEOUS ELECTRICAL PARTS													
x	x	x	x	x	δE-101	Insulator for S-119	Stand-off steatite ceramic, 4" long, 1" O.D., each end tapped 1/4"-20 threads for 1/2"	-61011	RE 13A 317	1			K-802918-27
x	x	x	x	x	δE-102	Insulators for Supporting Resistors	Pillar, steatite ceramic, 23/32" x 23/32" x 1-1/4" long, each end tapped #10-24 threads for 3/8"	-61158	RE 13A 317F Grade G	22			K-823038-3
x	x	x	x	x	δE-103	Insulator for M-100	Stand-off steatite ceramic, 1-1/2" long 1/2" O.D., each end tapped #6-32 threads	-61348	RE 13A 317	22			K-823568-22
x	x	x	x	x	δE-104	Insulator for C-171	Stand-off, steatite ceramic, 4" long, 1-1/4" O.D., each end tapped 1/4"- 20 threads for 1/2"	-61283	RE 13A 317	1			K-802918-15
x	x	x	x	x	δE-105	Insulator for C-171	Stand-off, steatite ceramic, 2" long, 1" O.D., each end tapped #10-24 threads for 1/2"	-61281	RE 13A 317	1			K-802918-16
x	x	x	x	x	δE-106	Insulator for L-100	Stand-off, steatite ceramic, 1-3/4" long, 1" O.D., each end tapped #10-24 threads for 1/2"	-61349	RE 13A 317	1			K-802918-29
x	x	x	x	x	δE-107	Insulator for C-171	Conical, steatite ceramic, 2" long, one end 1-1/8" O.D. tapered to 5/8" O.D. the other end, each end tapped #10-24 threads for 1/2"	-61157	RE 13A 317	1			K-802919-4
x	x	x	x	x	δE-108	Insulator for C-326	Stand-off, steatite ceramic, 1" long, 1/2" O.D., each end tapped #6-32 threads	-61170	RE 13A 317	22			K-823568-5
x	x	x	x	x	δE-109	Insulator for C-147	Conical, steatite ceramic, 1-11/16" long, one end 1" O.D. tapered to 1/2" O.D. the other end, each end tapped #8-32 threads for 3/8"	-61299	RE 13A 317	1			K-802919-5

δ TBL-8 Spare Only Contract NXss-33180
TBL-δ8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,78 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							MISCELLANEOUS ELECTRICAL PARTS (Continued)						
x	x	x	x	x	δE-110	Insulator	Bushing, steatite ceramic, female type, 3/4" long, one end 1-1/8" O.D., 3/4" I.D., the other end 1" O.D., 0.200" I.D.	-61290	RE 13A 317	1			K-860348-6
x	x	x	x	x	δE-111	Insulator	Bushing, steatite ceramic, male type, 1-5/16" long, one end 1" O.D., the other end 47/64" O.D., 9/16" long shank, 0.200" square hole	-61330	RE 13A 317	1			K-860348-7
x	x	x	x	x	E-112	Insulator for C-180	Mycalex, 3" long, 1" wide, 1" high, 4 counterbored holes			1			K-893151-1
x	x	x	x	x	δE-113		Same as E-110	-61290					
x	x	x	x	x	δE-114		Same as E-111	-61330					
x	x	x	x	x	E-115	Knob for S-124	Assembly including molded knob, 6 notches, 1" long shank, 0.375" I.D., 2 holes tapped #4-40 threads, 2 holes tapped #8-32 threads, complete with two #4-40 x 1/4" long brass machine screws, two #8-32 x 1/4" long steel setscrews and pointer			1			K-860010-503
x	x	x	x	x	E-116	Knob for S-123	Same as E-115						
x	x	x	x	x	E-117	Knob for Right-Hand Oscillator Door	Black molded insulation, 6 notches, 1" long shank, 0.375" I.D., 2 holes tapped #8-32 threads, 2 holes tapped #4-40 threads, white dot on face, overall length 1-7/16"			1			K-860197-5
x	x	x	x	x	E-118	Knob for Left-Hand Oscillator Door	Same as E-117						

δ TBL-8 Spare Only Contract NXss-39180.
TBL-78 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,7δ 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
MISCELLANEOUS ELECTRICAL PARTS (Continued)													
x	x	x	x	x	E-119	Knob for Right-Hand Bottom Door Assembly	Black molded insulation, 6 notches, 1" long shank, 0.251" I.D., 2 holes tapped #8-32 threads, 2 holes tapped #4-40 threads, white dot on face, overall length 1-7/16"			1			K-860197-3
x	x	x	x	x	E-120	Knob for Left-Hand Bottom Door Assembly	Same as E-119						
x	x	x	x	x	E-121	Knob for Top Door Assembly	Same as E-119						
x	x	x	x	x	E-122	Knob for Top Door Assembly	Same as E-119						
x	x	x	x	x	E-123	Knob for R-143	Black molded insulation, 6 notches 1" long shank, 0.375" I.D., 2 holes tapped #4-40 threads, 2 holes tapped #8-32 threads, overall length 1-7/16"			1			K-856602-2
x	x	x	x	x	E-124	Knob for R-144	Same as E-123						
x	x	x	x	x	E-125	Knob for R-134	Similar to E-123 except 0.251" shank I.D.			1			K-856602-1
x	x	x	x	x	δE-126	Insulator located near L-114	Stand-off, steatite ceramic, 1" long, 1-3/4" O.D., each end tapped #10-24 threads for 3/8"	-61154	RE 13A 317	1			K-802918-12
x	x	x	x	x	δE-127	Insulator for L-114	Stand-off, steatite ceramic, 1-1/2" long, 1-1/4" O.D., each end tapped 1/4"-20 threads for 1/2"	-61156	RE 13A 317	1			K-802918-14
x	x	x	x	x	δE-128	Insulator for L-115	Stand-off, steatite ceramic, 3" long, 1" O.D., each end tapped 1/4"-20 threads for 3/8"	-61296	RE 13A 317	1			K-802918-25
x	x	x	x	x	δE-129	Insulators, Supporting	Same as E-102	-61158					

δ TBL-8 Spare Only Contract NXss-33180.
TBL-7δ CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,7B	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
MISCELLANEOUS ELECTRICAL PARTS (Continued)													
x	x	x	x	x	6E-130	Insulator Located near L-113	Stand-off, steatite ceramic, 2" long, 1" O.D., each end tapped, 1/4"-20 threads for 1/2"	-61295	RE 13A 317	1			K-802918-24
x	x	x	x	x	6E-131	Insulator Located near R-114	Same as E-111	-61330					
x	x	x	x	x	6E-132	Insulators for V-100 Grid Lead and C-173	Bushing, steatite ceramic, male type, 7/8" long, one end 3/4" O.D., the other end 31/64" O.D., 3/8" long shank, 0.200" I.D.	-61287		1			K-860348-3
x	x	x	x	x	6E-133	Insulator, Mate with E-132	Bushing, steatite ceramic, female type, 1/2" long, one end 7/8" O.D., 1/2" I.D., the other end 3/4" O.D., 0.200" I.D.	-61288		1			K-860348-4
x	x	x	x	x	6E-134	Insulator for T-102	Stand-off, steatite ceramic, 1" long, 1/2" O.D., each end tapped #8-32 threads for 1/4"	-61292		1			K-802918-26
x	x	x	x	x	6E-135	Insulator Located Near J-100	Stand-off, steatite ceramic, 13/16" long, 1/2" O.D., each end tapped #8-32 threads for 9/32"	-61185	RE 13A 317	22			K-823568-8
x	x	x	x	x	6E-136	Insulator for V-100 Plate Lead	Steatite ceramic, one end 2-1/8" O.D., 27/32" I.D., the other end 25/32" O.D., 13/64" I.D., 4 convolutions	-61045		1			K-855670-1
x	x	x	x	x	6E-137	Insulators Located to the Right of L-108	Same as E-111	-61330					
x	x	x	x	x	6E-138	Insulators for L-135	Stand-off, steatite ceramic, 1-1/2" long, 1" O.D., each end tapped #10-24 threads for 1/2"	-61294		1			K-802918-23

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,7δ 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							MISCELLANEOUS ELECTRICAL PARTS (Continued)						
x	x	x	x	x	E-139	Insulator Located to the Right of R-172, C-322	Laminated insulation 0.031" thick, 1-5/8" x 1-3/4", two 0.147 holes			1			K-864842-1
x	x	x	x	x	δE-140	Insulator, Mates with E-137	Same as E-110	-61290					
x	x	x	x	x	δE-141	Insulator Mates with E-131	Same as E-110	-61290					
x	x	x	x	x	δE-142	Insulator, Stand-off	Steatite ceramic 1/2" x 1/2" x 1" long, each end tapped #8-32 threads for 3/8"	-61102	RE 13A 317	1			K-843759-1
x	x	x	x	x	δE-143	Insulator, Stand-off	Steatite ceramic, 1/2" O.D., 1/2" long, each end tapped #6-32 threads for 3/16"	-61166	RE 13A 317	22			K-823568-1
x	x	x	x	x	E-144	Not Used							
x	x	x	x	x	δE-145	Insulator, Bushing, Part of K-101	Male steatite ceramic, 1/2" O.D., 3/64" long shank, 5/16" square; 13/64" square hole, overall length 27/64"		RE 13A 317	1			K-843619-2
x	x	x	x	x	δE-146	Insulator, Bushing, Part of K-101	Steatite ceramic, male, 1/2" O.D., 3/64" long shank, 5/16" square; 13/64" square hole, overall length 1/4"		RE 13A 317	1			K-843619-1
x	x	x	x	x	δE-147	Tube Cap Connector (for 0.550" Cap) (Part of W-101)	Assembly consisting of contact, terminal and 12" of wire			1			K-860858-501
x	x	x	x	x	δE-148	Bridging Link for Use With Terminal Board K-418080	Brass, 1" x 31/32" x 0.04" thick			1			K-862325-1
x	x	x	x	x	δE-149	Connector (Part of W-101)	Assembly consisting of 2 terminals and a length of wire; approx. 3-1/4" overall length			1			K-856418-501

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δ TBL-8 Spare Only Contract NXss-33180.
TBL-48 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,8	TBL-4,8	TBL-4									
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
MISCELLANEOUS ELECTRICAL PARTS (Continued)													
x	x	x	x	x	6E-150	Terminal (Part of W-101)	Terminal #10			1			K-818337-9
x	x	x	x	x	6E-151	Terminal (Part of W-101)	Terminal 1/4"			1			K-818337-2
x	x	x	x	x	6E-152	Terminal (Part of W-101)	Terminal #10			1			K-845462-2
x	x	x	x	x	6E-153	Terminal (Part of W-101)	Terminal, left-hand, 1/4"			1			K-843002-1
x	x	x	x	x	6E-154	Terminal (Part of W-101)	Terminal, right-hand, 1/4"			1			K-843002-2
x	x	x	x	x	6E-155	Contact for S-114A,B,C,D,E & F	Contact, brass, 0.062" x 1/2" x 1-25/32" long			1		Fin. #100	K-818870-1
x	x	x	x	x	6E-156	Contact for S-114A,B,C,D,E & F	Contact, nickel silver, 0.032" x 1/2" x 1-3/16" long			1			K-818870-2
x	x	x	x	x	6E-157	Switch Blade for S-114A,B,C,D, E & F	Switch blade, nickel silver, 1/16" x 9/16" x 3-3/32" long			1			K-818877-502
x	x	x	x	x	6E-158	Contact for S-114GX,GY	Contact, nickel silver, 0.064" x 1/2" x 1-1/32" long			1			K-843739-1
x	x	x	x	x	6E-159	Contact Blade for S-114GX,GY	Contact blade, nickel silver, 0.020" x 7/8" x 1-3/8" long			1			K-843744-1
x	x	x	x	x	6E-160	Contact Blade for S-115,119, 125,131	Contact blade, nickel silver, 0.032" x 3/8" x 1-45/64"			1			K-843697-1
x	x	x	x	x	6E-161	Contact Blade for S-115,119, 125,131	Contact blade, same as E-160 except of opposite hand			1			K-843697-2
x	x	x	x	x	6E-162	Contact Assembly for S-115,116A and B,125	Contact assembly, brass 1/2" hex stock, 1-1/4" long			1			K-855499-501

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4 TBL-8 Spare Only Contract NXss-33180.
TBL-8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,δ8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
MISCELLANEOUS ELECTRICAL PARTS (Continued)													
x	x	x	x	x	δE-163	Contact Blade for S-116A,B	Contact blade, nickel silver, 0.032" x 3/8" x 1-9/16"			1			K-843778-1
x	x	x	x	x	δE-164	Contact Blade for S-117	Contact blade, nickel silver, 0.032" x 17/32" x 1-15/16" long			1			K-818450-1
x	x	x	x	x	δE-165	Contact Assembly for S-117	Contact assembly, brass, 1/2" hex. stock, 1-21/32" long			1			K-843782-504
x	x	x	x	x	δE-166	Contact Assembly for S-117	Contact assembly, brass 1/2" hex. stock, 1-3/4" long			1			K-843860-502
x	x	x	x	x	δE-167	Hub & Disc Assembly for S-117	Hub & disc assembly including two 2-7/8" long nickel silver contact blades & 2-7/8" O.D. copper contact disc staked to hub			1			M-422851-501
x	x	x	x	x	δE-168	Contact Assembly for S-119,131	Contact assembly including brass contact 1-5/8" long 1/2" hex. stock & 5/16" long brass pin			1			K-843860-503
x	x	x	x	x	δE-169	Contact Assembly for S-120	Contact assembly including brass contact 1-3/4" long, 1/2" hex. stock & 1/2" long brass pin			1			K-843860-504
x	x	x	x	x	δE-170	Contact Blade for S-120	Contact blade, nickel silver, 0.0403" x 3/8" x 2-1/4" long			1			K-843861-1
x	x	x	x	x	δE-171	Contact for S-121	Contactor, phosphor bronze, formed, 0.032" x 1/4" x 1-5/8" long			1		Fin. #100	K-838853-1
x	x	x	x	x	δE-172	Contact Plate Assembly for S-121	Contact plate assembly consisting of 3-7/8" long brass shaft & 3/16" thick plate, semicircular, 2" radius from center of center hole			1			K-838857-502

δ TBL-8 Spare Only Contract NXss-33180.
TBL-48 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,δ8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							MISCELLANEOUS ELECTRICAL PARTS (Continued)						
x	x	x	x	x	δE-173	Contact for S-123,124	Contact, hard brass, nickel plated, 5/16" dia., 29/32" long			304	Cat.#J-138-C		K-843817-1
x	x	x	x	x	δE-174	Contact Brush for S-123	Contact brush assembly consisting of four 0.010" thick blades stacked one on top of the other; overall length 1-41/64"			1			K-875752-501
x	x	x	x	x	δE-175	Contact for S-123	Contact brass, 7/16" dia. head, 7/8" long			1		Fin. #100	K-856332-1
x	x	x	x	x	δE-176	Contact Brush for S-123	Contact brush consisting of four nickel silver leaves welded together, 1-15/16" long			1			M-421167-501
x	x	x	x	x	δE-177	Contact, interlock for S-115, 117,119,120,125,131	Contact, interlock, nickel silver, 1/4" dia. head, 7/8" long			1			K-854515-3
x	x	x	x	x	δE-178	Contact, interlock, for S-115, 117,119,120,125,131	Contact, interlock, nickel silver, 1/4" dia. head, 1-3/16" long			1			K-854515-1
							FUSES						
x	x	x	x	x	*F-104	Control Voltage Supply Fuse	250 v, 10 amperes, renewable ferrule type		17-F-2	3	Cat.#1022		K-860218-2
x	x	x	x	x	*F-104A	Fuse Link For F-104	250 v, 10 amps.			3	Cat.#1099		K-860218-32
x	x	x	x	x	*F-105	Control Voltage Supply Fuse	Same as F-104		17-F-2				
x	x	x	x	x	*F-105A	Fuse Link For F-105	Same as F-104A						
					F-106	Not Used							
					F-107	Not Used							

δ TBL-8 Spare Only Contract NXss-33180.
* SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.
TBL-28 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,δ8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							FUSES (Continued)						
x	x	x	x	x	*F-108	Oscillator Heater Fuse	250 v, 15 amps., renewable ferrule type		17-F-2	3	Cat.#1024		K-860218-3
x	x	x	x	x	*F-108A	Fuse Link for F-108	250 v, 15 amps.			3	Cat.#1101		K-860218-33
x	x	x	x	x	*F-109	Oscillator Heater Fuse	Same as F-108						
x	x	x	x	x	*F-109A	Fuse Link for F-109	Same as F-108A						
x	x				*F-401	Fuse (Motor Generator)	Renewable ferrule type, 250 v, 6 amps.			23	5871-115		K-865765-33
x	x				*F-401A	Fuse Link	250 v, 6 amps.			23	5871-116		K-865765-34
x	x	x	x	x	*F-402	Fuse (Motor Generator)	Small ferrule type, non-renewable, 2500 v, 3/8 amp.			23	5871-118		K-865765-35
x	x	x	x	x	*F-403	Fuse (Motor Generator)	Same as F-402						
x	x	x	x	x	*F-404	Fuse (Motor Generator)	Small ferrule type, non-renewable, 2500 v, 1 amp.			23	7235-94		K-865765-36
		x	x	x	*F-405	Fuse (Motor Generator)	Same as F-401						
		x	x	x	*F-405A	Fuse Link	Same as F-401A						
		x	x	x	*F-406	Fuse (Motor Generator)	Same as F-401						
		x	x	x	*F-406A	Fuse Link	Same as F-401A						
							INDICATING DEVICES						
x	x	x	x	x	δI-100	Heater Indicating Light	125 v indicator lamp receptacle assembly, includes 1200 ohm resistor			9	Cat.#549462		K-860290-2
x	x	x	x	x	*I-100A	Lens Cap for I-100	Amber colored		17-L-5	9			K-860290-7
x	x	x	x	x	*I-100B	Lamp	18 v, 0.11 amp., candelabra screw base	TS51	RE 38F 149B	9	Cat.#549474		K-860290-9
x	x	x	x	x	δI-101	Bias Indicating Light	250 v indicator lamp receptacle assembly, includes 2600 ohm resistor			9	Cat.#549463		K-860290-1

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TBL-8 CONTRACT NOs-98591 Only.
δ TBL-8 Spare Only Contract NXss-33180.
** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,δ8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							INDICATING DEVICES (Continued)						
x	x	x	x	x	*I-101A	Lens Cap for I-101	Green colored		17-L-5	9			K-860290-4
x	x	x	x	x	*I-101B	Lamp	Same as I-100B	TS51					
x	x	x	x	x	δI-102	Plate Indicating Light	Same as I-100						
x	x	x	x	x	*I-102A	Lens Cap for I-102	Red colored		17-L-5	9			K-860290-5
x	x	x	x	x	*I-102B	Lamp	Same as I-100B	TS51					
x	x	x			δI-103	Master Start Indicating Light	Same as I-100						
x	x	x			*I-103A	Lens Cap for I-103	Same as I-102A						
x	x	x			*I-103B	Lamp	Same as I-100B	TS51					
x	x	x	x	x	δI-104	Oscillator Filament Indicating Light	Same as I-100						
x	x	x	x	x	*I-104A	Lens Cap for I-104	Clear		17-L-5	9			K-860290-8
x	x	x	x	x	*I-104B	Lamp	Same as I-100B	TS51					
			x	x	δI-105	Master Start Indicating Lamp	Same as I-101						
			x	x	*I-105A	Lens Cap for I-105	Same as I-102A						
			x	x	*I-105B	Lamp	Same as I-100B	TS51					
							JACKS						
x	x	x	x	x	δJ-101	A-F Output Jack	Double pole, closed circuit	-49021A	RE 13A 481E	10			K-833932-1
x	x	x	x	x		Jacks on Terminal Board at Rear of Oscillator	For banana plug, 1-9/32" long, threaded 3/8"-24 threads, tapped 1/4"-20 threads			23	Cat.#76		K-99015-4
							RELAYS						
x	x				K-100	Thermostat Relay	Relay, S.P.D.T., SB, coil rated 55 v, 60 cycles at approx. 12 ma, contacts rated 2.5 amps. at 115 v a.c., 1.2 amps. at 230 v a.c., non-inductive load	-29047		11	Type 34C		K-843820-1

TBL-8 CONTRACT NOs-98591 Only.
δ TBL-8 Spare Only Contract NXss-33180.
** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,78 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RELAYS (Continued)						
x	x				*K-100A	Coil for K-100	43 v, 60 cycles at 8 ma +0% -10%, d-c resistance approx. 765 ohms			11			K-881735-1
x	x				*K-100B	Contact for K-100	Stationary			11			K-881735-2
x	x				*K-100C	Contact and Armature Assembly for K-100	Contact and armature assembly			11			K-881735-3
x	x	x	x	x	K-101	Keying Relay	Two-pole, single throw (each pole has two breaks per circuit normally open) with an auxiliary single pole, double-throw contact having one break per circuit, normal coil requirements: 87 ma at 48 v d.c.	-29034		1			P-720375-501
x	x	x	x	x	*K-101A	Coil for K-101	7220 turns of AWG #36 E wire, d-c resistance 550 ohms			25a			K-881558-1
x	x	x	x	x	*K-101B	Contact for K-101	Single, stationary			752	Cat.#4817FS Fig. #4		K-855412-1
x	x	x	x	x	*K-101C	Contact for K-101	Movable			1			K-855193-501
x	x	x	x	x	*K-101D	Contact Assembly for K-101	Contact assembly			14			M-420616-2
x	x				K-102	Master Start Relay	4 P.S.T., normally open, to operate (with 100 ohms resistance in series) at 110 v, 60 cycle a.c. ±10%, max. 85 ma at 122 v a.c., close 70 ma at 100 v a.c., coil resistance 174 ohms, contact rating 3 amperes at 110 v d.c.	-29048		12	Class 8511K		M-420465-1
x	x				*K-102A	Coil for K-102	175 ohms d-c resistance			12	1267-S1-W-33		K-881732-1
x	x				*K-102B	Contact for K-102	Stationary assembly			12			K-881731-1
x	x				*K-102C	Contact Arm Assembly for K-102	Contact arm assembly			12			K-881731-2

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** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-7S CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,*8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RELAYS (Continued)						
		x	x	x	K-103	Thermostat Relay	Single Contact, S.P.D.T., normally closed, 11 v d.c. (-23% +45%) at 12 ma, contact rating 5 amps. at 230 v d.c., min. current for normal operation is 0.007 amp.	-29046		13	CX1968		K-855602-1
		x	x	x	*K-103A	Coil for K-103	9000 turns AWG #36 E wire, 11 v d.c., 0.017/0.009 amps., d.c. resistance 930 ohms			13	#53861		K-881736-1
		x	x	x	*K-103B	Contact for K-103	Stationary			13			K-881736-2
		x	x	x	*K-103C	Contact & Armature Assembly for K-103	Contact & armature assembly			13			K-881736-3
x	x				K-104	Generator Field Relay	D.P.S.T., normally open, coil rated 110 v a.c. +10% -15%, .174 ohms d-c resistance, contact ratings 6 amps. at 110 v d.c., 3 amps. at 220 v d.c., 15 amps. at 220 v 60 cycle, max. coil rating 85 ma at 121 v a.c., close 67 ma at 93 v a.c.	-29037		12	Class 8511		K-860238-2
x	x				*K-104A	Coil for K-104	Same as K-102A						
x	x				*K-104B	Contact for K-104	Stationary assembly			12			K-881731-3
x	x				*K-104C	Contact for K-104	Arm assembly			12			K-881731-4
x	x	x	x	x	K-105	Overload Relay	S.P.S.T., single break contacts normally closed, time delay, manual reset, 0.31 to 0.62 amp. d.c., coil rated 22 ohms d.c., type 739-S26-W24, contacts rated 0.4 amp. at 230 v d.c., 1 amp. at 115 v d.c., 5 amps. at 115 v a.c., oil dash-pot, max. adj. 0.67 amp. pull in, 0.07amp. drop out, min. adj. 0.29 amp. pull in, 0.03 amp. drop out	-29044		12	Type EQ779		M-420648-3

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
*TBL-*8 CONTRACT NOs-98591 Only.*

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,~~8~~	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RELAYS (Continued)						
x	x	x	x	x	*K-105A	Coil for K-105	1860 turns AWG #24 E wire, 0.31-0.62 amp., d-c resistance 22 ohms			12	739-S26-W-24		K-881732-6
x	x	x	x	x	*K-105B	Contact for K-105	Block assembly			12			K-881731-5
x	x	x	x	x	K-106	Overload Relay	S.P.S.T., single break, contacts normally closed, time delay, manual reset, 0.62 to 1.25 amps. d.c., coil rated 5.38 ohms d.c., type 739-S26-W21, contacts rated 0.4 amp. at 230 v.d.c., 1 amp. at 115 v d.c., 5 amps. at 110 v a.c., oil dash-pot, max. adj. 1.35 amps. pull in, 0.15 amp. drop out, min. adj. 0.57 amp. pull in, 0.06 amp. drop out	-29043		12	Type EQ779		M-420648-4
x	x	x	x	x	*K-106A	Coil for K-106	930 turns AWG #21 E wire, 0.62-1.25 amps., d-c resistance 5.38 ohms			12	739-S26-W21		K-881732-7
x	x	x	x	x	*K-106B	Contact for K-106	Same as K-105B						
					K-107	Not Used							
x	x	x	x	x	K-108	Bias Interlock Relay	D.P.S.T., normally open, coil rated 115 v d.c. ±10%, 2620 ohms d-c resistance, contact ratings 6 amps. at 110 v d.c., 3 amps. at 220 v d.c. 15 amps. at 220 v, 60 cycle, max. coil rating 48.3 ma at 126.5 v d.c., close 39.6 ma at 103.5 v d.c.	-29045		12	Class 7811		K-860238-1
x	x	x	x	x	*K-108A	Coil for K-108	17,700 turns AWG #37 E wire, 115 v d.c. 0.0438 amp., d-c resistance 2600 ohms			12	1305-S1-W37		K-881732-3
x	x	x	x	x	*K-108B	Contact for K-108	Same as K-104B						
x	x	x	x	x	*K-108C	Contact for K-108	Same as K-104C						

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-~~8~~ CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,*8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RELAYS (Continued)						
		x	x	x	K-103	Thermostat Relay	Single Contact, S.P.D.T., normally closed, 11 v d.c. (-23% +45%) at 12 ma, contact rating 5 amps. at 230 v d.c., min. current for normal operation is 0.007 amp.	-29046		13	CX1968		K-855602-1
		x	x	x	*K-103A	Coil for K-103	9000 turns AWG #36 E wire, 11 v d.c., 0.017/0.009 amps., d.c. resistance 930 ohms			13	#53861		K-881736-1
		x	x	x	*K-103B	Contact for K-103	Stationary			13			K-881736-2
		x	x	x	*K-103C	Contact & Armature Assembly for K-103	Contact & armature assembly			13			K-881736-3
x	x				K-104	Generator Field Relay	D.P.S.T., normally open, coil rated 110 v a.c. +10% -15%, .174 ohms d-c resistance, contact ratings 6 amps. at 110 v d.c., 3 amps. at 220 v d.c., 15 amps. at 220 v 60 cycle, max. coil rating 85 ma at 121 v a.c., close 67 ma at 93 v a.c.	-29037		12	Class 8511		K-860238-2
x	x				*K-104A	Coil for K-104	Same as K-102A						
x	x				*K-104B	Contact for K-104	Stationary assembly			12			K-881731-3
x	x				*K-104C	Contact for K-104	Arm assembly			12			K-881731-4
x	x	x	x	x	K-105	Overload Relay	S.P.S.T., single break contacts normally closed, time delay, manual reset, 0.31 to 0.62 amp. d.c., coil rated 22 ohms d.c., type 739-S26-W24, contacts rated 0.4 amp. at 230 v d.c., 1 amp. at 115 v d.c., 5 amps. at 115 v a.c., oil dash-pot, max. adj. 0.67 amp. pull in, 0.07amp. drop out, min. adj. 0.29 amp. pull in, 0.03 amp. drop out	-29044		12	Type EQ779		M-420648-3

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
*TBL-*8 CONTRACT NOs-98591 Only.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,8a	TBL-4,8	TBL-4									
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RELAYS (Continued)						
x	x	x	x	x	*K-105A	Coil for K-105	1860 turns AWG #24 E wire, 0.31-0.62 amp., d-c resistance 22 ohms			12	739-S26-W-24		K-881732-6
x	x	x	x	x	*K-105B	Contact for K-105	Block assembly			12			K-881731-5
x	x	x	x	x	K-106	Overload Relay	S.P.S.T., single break, contacts normally closed, time delay, manual reset, 0.62 to 1.25 amps. d.c., coil rated 5.38 ohms d.c., type 739-S26-W21, contacts rated 0.4 amp. at 230 v.d.c., 1 amp. at 115 v d.c., 5 amps. at 110 v a.c., oil dash-pot, max. adj. 1.35 amps. pull in, 0.15 amp. drop out, min. adj. 0.57 amp. pull in, 0.06 amp. drop out	-29043		12	Type EQ779		M-420648-4
x	x	x	x	x	*K-106A	Coil for K-106	930 turns AWG #21 E wire, 0.62-1.25 amps., d-c resistance 5.38 ohms			12	739-S26-W21		K-881732-7
x	x	x	x	x	*K-106B	Contact for K-106	Same as K-105B						
					K-107	Not Used							
x	x	x	x	x	K-108	Bias Interlock Relay	D.P.S.T., normally open, coil rated 115 v d.c. ±10%, 2620 ohms d-c resistance, contact ratings 6 amps. at 110 v d.c., 3 amps. at 220 v d.c. 15 amps. at 220 v, 60 cycle, max. coil rating 48.3 ma at 126.5 v d.c., close 39.6 ma at 103.5 v d.c.	-29045		12	Class 7811		K-860238-1
x	x	x	x	x	*K-108A	Coil for K-108	17,700 turns AWG #37 E wire, 115 v d.c. 0.0438 amp., d-c resistance 2600 ohms			12	1305-S1-W37		K-881732-3
x	x	x	x	x	*K-108B	Contact for K-108	Same as K-104B						
x	x	x	x	x	*K-108C	Contact for K-108	Same as K-104C						

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* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-~~4~~8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,#8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RELAYS (Continued)						
					K-109	Not Used							
x	x	x	x	x	K-110	Keying Auxiliary Relay	S.P.S.T., time delay 0.1 second, nominal operating voltage 50 v d.c., 2400 ohms, contact rating 150 watts, 3 amps. max., normal operation 0.009 amp.	-29041		14	Type E		K-856448-1
x	x	x	x	x	*K-110A	Coil for K-110	21,700 turns AWG #38 EC wire, 50 v d.c d-c resistance 2400 ohms, 1" heel end slug			14			K-856448-2
x	x	x	x	x	*K-110B	Contacts for K-110	A.C. or d.c., 150 watts, 3 amps. max.			14			K-856448-3
		x	x	x	K-111	Master Start Relay	4 P.S.T., normally open, coil rated 90 v d.c. +45%-23%, 1650 ohms d.c. resistance, contact ratings 3 amperes at 110 v d.c., 1.5 amps. at 220 v d.c., 6 amps. at 220 v 60 cycle, max. coil rating 66 ma at 104 v d.c., close 33 ma at 52 v d.c.	-29136		12	Class 7811-K		M-420465-3
		x	x	x	*K-111A	Coil for K-111	14,000 turns AWG #36 E wire, 90 v d.c. 0.0545 amp., d-c resistance 1650 ohms						
		x	x	x	*K-111B	Contact for K-111	Same as K-102B						
		x	x	x	*K-111C	Contact Arm for K-111	Same as K-102C						
		x	x	x	K-112	Generator Field Relay	D.P.S.T., normally open, coil rated 115 v d.c. +45%-23%, 4250 ohms d-c resistance, contact ratings 6 amps at 110 v d.c., 3 amps. at 220 v d.c., 15 amps. at 220 v 60 cycle, max. coil rating 39.4 ma at 167 v d.c., close 19.3 at 82 v d.c.	-29135		12	Class 7811		K-860238-4
		x	x	x	*K-112A	Coil for K-112	22,200 turns AWG #38 E wire, 145 v d.c 0.0341 amp., d-c resistance 4250 ohms			12	1305-S1-W-38		K-881732-4
		x	x	x	*K-112B	Contact for K-112	Same as K-104B						
		x	x	x	*K-112C	Contact for K-112	Same as K-104C						

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-#8 CONTRACT NOs-98591 Only.

TABLE II (Continued)

PARTS LIST BY SYMBOL DESIGNATION

FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,8 220 V A.C.	TBL-4,8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							INDUCTANCES						
x	x	x	x	x	δL-100	H-F Antenna Tuning Coil	Special variable rotary coil assembly			1			P-713901-502
x	x	x	x	x	δL-100A	Arm, Part of L-100	Arm, brass sand casting, 1-15/64" long			1		Fin. #100	K-843176-1
x	x	x	x	x	δL-100B	Wheel, Part of L-100	Wheel, phosphor bronze, 3/4" O.D., 0.128" I.D.			1			K-883856-1
x	x	x	x	x	δL-100C	Rivet, Part of L-100	Rivet, brass, 17/32" long			1		Fin. #100	K-57494-65
x	x	x	x	x	δL-100D	Spring, Part of L-100	Spring, copper inner, 2-1/64" long, 1/2" wide, 0.01" thick			1			K-883855-1
x	x	x	x	x	δL-100E	Lockwasher, Part of L-100	Lockwasher #6, bronze			1		Fin. #100	K-59048-59
x	x	x	x	x	δL-100F	Spacer, Part of L-100	Spacer, brass, 1/2" long, 1/2" O.D., 0.370" I.D.			1		Fin. #100	K-59067-14
x	x	x	x	x	δL-100G	Screw, Part of L-100	Screw, fillister head, brass, 3/16" long, threaded full length			1		Fin. #100	K-57476-53
x	x	x	x	x	δL-100H	Spring, Part of L-100	Spring, copper, outer 2-1/64" long, 1/2" wide, 0.01" thick			1			K-883855-2
					L-101	Not Used							
x	x	x	x	x	δL-102	H-F Power Amplifier Plate Tank Coil	Same as L-100						
x	x	x	x	x	δL-102A	Arm, Part of L-102	Same as L-100A						
x	x	x	x	x	δL-102B	Wheel, Part of L-102	Same as L-100B						
x	x	x	x	x	δL-102C	Rivet, Part of L-102	Same as L-100C						
x	x	x	x	x	δL-102D	Spring, Part of L-102	Same as L-100D						
x	x	x	x	x	δL-102E	Lockwasher, Part of L-102	Same as L-100E						
x	x	x	x	x	δL-102F	Spacer, Part of L-102	Same as L-100F						
x	x	x	x	x	δL-102G	Screw, Part of L-102	Same as L-100G						
x	x	x	x	x	δL-102H	Spring, Part of L-102	Same as L-100H						
					L-103	Not Used							

δ TBL-8 Spare Only Contract NXss-33180.
TBL-48 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,δ8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							INDUCTANCES (Continued)						
x	x	x	x	x	δL-104	H-F 2nd Intermediate Power Amplifier Plate Tank Coil	Special variable rotary coil assembly			1			P-717191-502
x	x	x	x	x	δL-104A	Contact, Part of L-104	Contact, brass, 3-7/16" long			1		Fin. #100	K-843554-1
x	x	x	x	x	δL-104B	Slide, Part of L-104	Slide, brass, 33/64" long, 5/8" O.D., 0.2525" I.D.			1			K-843351-2
x	x	x	x	x	δL-104C	Spring, Part of L-104	Spring, phosphor bronze, 1-5/8" long, 3/8" wide, 0.016" thick			1		Fin. #100	K-843349-1
x	x	x	x	x	δL-105	H-F 1st Intermediate Power Amplifier Plate Tank Coil	Same as L-104						
x	x	x	x	x	δL-105A	Contact, Part of L-105	Same as L-104A						
x	x	x	x	x	δL-105B	Slide, Part of L-105	Same as L-104B						
x	x	x	x	x	δL-105C	Spring, Part of L-105	Same as L-104C						
					L-106	Not Used							
					L-107	Not Used							
x	x	x	x	x	δL-108	H-F Oscillator Plate Tank Coil	20 turns #16 AWG, DC copper wire, single layer right-hand, close wound over steatite ceramic form 1-3/4" dia., 3-3/4" long, approx. inductance 15.3 mh			1			M-418180-505
x	x	x	x	x	L-109	H-F Oscillator Grid Tuning Coil	26 turns 1/16" x 1/4" rectangular copper wire, 0.228" pitch left-hand edgewise wound, outside dia. 3-1/2" supported from outside by four slotted ceramic bars, winding tapped at 1st and 7th turns			1			T-611603-501
x	x	x	x	x	δL-109A	Insulator	Steatite ceramic, 9" long		RE 13A 317	1			M-418220-1
x	x	x	x	x	δL-109B	Insulator	Steatite ceramic, 9" long		RE 13A 317	1			M-418220-2
x	x	x	x	x	δL-109C	Insulator	Steatite ceramic, 9" long		RE 13A 317	1			M-418220-3
x	x	x	x	x	δL-109D	Insulator	Steatite ceramic, 9" long		RE 13A 317	1			M-418220-4

δ TBL-8 Spare Only Contract NXss-33180.
TBL-48 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,8&9 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							INDUCTANCES (Continued)						
x	x	x	x	x	L-110	I-F Oscillator Grid Tuning Coil	Variometer assembly			1			T-620257-501
x	x	x	x	x	L-111	I-F Oscillator Plate Tuning Coil	Variometer assembly			1			P-720381-502
x	x	x	x	x	L-112	I-F 1st Intermediate Power Amplifier Plate Tuning Coil	Variometer assembly			1			P-720381-501
x	x	x	x	x	L-113	I-F 2nd Intermediate Power Amplifier Plate Tuning Coil	Variometer assembly			1			P-708342-503
x	x	x	x	x	L-114	I-F Antenna Tuning Coil	Variometer assembly			1			T-606243-505
x	x	x	x	x	L-115	I-F Antenna Loading Coil	160 turns 10 x 3 x 10 #38 litz wire, wound in 23 slotted sections 3/8" apart, each section contains 7 turns, 1 layer per turn, inside dia. 5-1/2", tapped at 3rd, 11th, 20th, 30th, 40th, 50th, 60th, 70th, 81st, 92nd, 104th, 116th, 132nd & 160th turns, supported by 8 slotted steatite ceramic spacers, approx. inductance 2050 mh			1			T-620263-501
		x	x	x	δL-116	Bias Supply Filter Reactor	1430 turns #19 AWG enameled, copper wire, wound 55 turns per layer over 2-3/4" x 1-11/16" kraft spool wire traverse 2.25", coil build 1-3/8", d-c resistance 13.2 ohms at 25° C., laminations stacked 2-1/2", hi-pot 3000 v, inductance 1.75 henries at 30 v 60 cycles a.c. and 0.35 amps. d.c.	-30582		1	XT-3485		K-900996-501
x	x	x	x	x	L-117	Power Amplifier Grid Suppressor	Included in R-122						
x	x	x	x	x	L-118	Power Amplifier Grid Suppressor	Included in R-123						

δ TBL-8 Spare Only Contract NIss-33180.
TBL-48 CONTRACT NOs-98591 Only.

TABLE II (Continued)

PARTS LIST BY SYMBOL DESIGNATION

FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4, 8 440 V A.C.	TBL-4, 9 220 V A.C.	TBL-4, 8 115 V D.C.	TBL-4, 8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							INDUCTANCES (Continued)						
					L-119 to L-124	Not Used							
x	x	x	x	x	*L-125	H-F Power Amplifier Plate Choke Coil	52 turns #24 AWG DC copper wire, single layer right-hand close wound over steatite ceramic form 1-3/4" dia., 3-3/4" long, approx. inductance 91 mh			1			M-418180-503
x	x	x	x	x	*L-126	H-F 1st Intermediate Power Amplifier Grid Choke Coil	135 turns #28 AWG DS copper wire, single layer right-hand close wound over steatite ceramic form 1-3/4" dia., 3-3/4" long, approx. inductance 460 mh			1	#28DS		M-418180-507
x	x	x	x	x	*L-127	H-F 2nd Intermediate Power Amplifier Grid Choke Coil	81 turns #28 AWG DC copper wire, single layer right-hand close wound over steatite ceramic form 1-3/4" dia., 3-3/4" long, approx. inductance 200 mh			1			M-418180-502
x	x	x	x	x	*L-128	H-F Oscillator Plate Choke Coil	160 turns #30 AWG DS copper wire, single layer right-hand close wound over steatite ceramic form 1-3/4" dia., 3 -3/4" long, approx. inductance 640 mh			1			M-418180-501
x	x	x	x	x	*L-129	I-F Power Amplifier Plate Choke Coil	Consists of four universal wound sections 3/8" apart, connected in series, wound over phenolic form 2" dia., 5-1/8" long, each section 175 turns #24 AWG DC copper wire, universal wound with two crosses per turn, 14 turns per layer, wire traverse 1/2", coil build 3/8", approx. inductance 13.6 millihenries			1			M-402482-503
x	x	x	x	x	*L-130	I-F 1st Intermediate Power Amplifier Plate Choke Coil	Same as L-129						

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-4,8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,7,8	TBL-4,8	TBL-4									
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							INDUCTANCES (Continued)						
x	x	x	x	x	*L-131	I-F Oscillator Plate Choke Coil	Same as L-129						
x	x	x	x	x	*L-132	I-F Power Amplifier Grid Choke Coil	Same as L-129						
					L-133	Not Used							
x	x	x	x	x	*L-134	H-F Power Amplifier Grid Choke Coil	Same as L-125						
x	x	x	x	x	*L-135	I-F Filament Choke Coil	Consists of three separate universal wound sections, wound over steatite ceramic form 1" dia., 4" long, each section 450 turns #24 AWG DC copper wire, universal wound with 2 crosses per turn, 14 turns per layer, wire traverse 1/2", coil build 1", approx. inductance 8 millihenries			1			M-418201-501
x	x	x	x	x	*L-136	H-F Filament Choke Coil	Double winding (2 conductors), each conductor #16 AWG SC enameled copper wire right-hand close wound in 6 sections, 16 layers per section, over two steatite ceramic slotted insulators 3-3/8" x 4-5/8" x 1/2", arranged in form of a cross, 96 turns (total) per conductor, inside dia. of winding 1-1/4"			1			M-418195-501
							METERS						
x	x	x	x	x	*M-100	H-F Antenna Ammeter	Scale 0-8 amperes r.f., 3-1/2" dia., round flush mounting, anti-glare glass	-22030	17-I-12	9	Type NT-35		M-418316-1
x	x	x	x	x	M-100A	Window for Reading M-100	Meter case, 3-1/2" dia. round flush mounting, clear glass			9	Type Nos. NA NC, NT & NX		K-860308-1

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-4B CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							METERS (Continued)						
x	x	x	x	x	*M-101	I-F Antenna Ammeter	Scale 0-15 amperes r.f., 3-1/2" dia. round flush mounting, anti-glare glass	-22035	17-I-12	9	Type NT-35		M-418316-2
x	x	x	x	x	*M-102	Power Amplifier Plate Milliammeter	Scale 0-500 milliamperes, d.c., 3-1/2" dia., round flush mounting, anti-glare glass	-22067	17-I-12	9	Type NX-35		M-418316-3
x	x	x	x	x	*M-103	2nd Intermediate Power Amplifier Plate Milliammeter	Scale 0-200 milliamperes, d.c., 3-1/2" dia., round flush mounting, anti-glare glass	-22063	17-I-12	9	Type NX-35		M-418316-4
x	x	x	x	x	*M-104	1st Intermediate Power Amplifier Plate Milliammeter	Same as M-103	-22063					
x	x	x	x	x	*M-105	Oscillator Plate Milliammeter	Scale 0-100 milliamperes, d.c., 3-1/2" dia., round flush mounting, anti-glare glass	-22059	17-I-12	9	Type NX-35		M-418316-5
x	x	x	x	x	*M-106	Power Amplifier Grid Milliammeter	Same as M-105	-22059					
x	x	x	x	x	*M-107	Filament Voltmeter	Scale 0-15 v a.c., 3-1/2" dia., round flush mounting, anti-glare glass	-22080	17-I-12	9	Type NA-35		M-418316-6
		x	x	x	*M-108	Line Voltmeter	Scale 0-350 v d.c., 1000 ohms per v, 3-1/2" dia., round flush mounting, anti-glare glass	-22143	17-I-12	9	Type NX-35		M-418316-7
x	x	x	x	x	*M-109	Bias Voltmeter	Same as M108	-22143					
x	x	x	x	x	*M-110	High Voltage Supply Voltmeter	Scale 0-2.5 kv d.c., 1000 ohms per v, for use with external multiplier (R-175), 3-1/2" dia., round flush mounting, anti-glare glass	-22310	17-I-12	9	Type NX-35		M-418316-15
x	x	x	x	x	*M-111	Oscillator Plate Voltmeter	Same as M-110 (external multiplier R-176)	-22310					
x	x	x	x	x	*M-112	Oscillator Temperature Thermometer	Scale 58°-62° C., bent at right angles, 7" x 4-1/2" x 1/4" magnifying glass construction	-40014	RE 13A 486C	16	#CSD-6		K-818975-4

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-4B CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,78 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							DIALS						
x	x	x	x	x	N-101	Index Dial for S-120	Assembly including aluminum alloy knob and 3-1/4" dia. dial, 3 position 45°, "H.F., I.F., REC. W ANTENNA SWITCH" engraved on face			1			P-720589-504
x	x	x	x	x	N-102	Index Dial for S-119	Assembly including aluminum alloy knob and 3-1/4" dia. dial, 2 position 30°, "CURRENT VOLTAGE, U ANT. FEED SWITCH HF" engraved on face			1			P-720589-505
x	x	x	x	x	N-103	Index Dial for S-131	Assembly including aluminum alloy knob and 3-1/4" dia. dial, 2 position 30°, "1,2,Q.P.A. FREQ. RANGE SWITCH HF" engraved on face			1			P-720589-503
x	x	x	x	x	N-104	Dial for L-111	(4:1) assembly including black molded knob and 3" C D. dial, one half the scale graduated from 0 to 90, 2" I.D.			1			P-720312-507
x	x	x	x	x	N-105	Dial for L-112	Same as N-104						
x	x	x	x	x	N-106	Dial for L-100	(36 to 1) assembly including knob and crank and two dials, one a bakelite dial, 2" O.D., 0.375" I.D., 0 to 35 engraved on outer periphery, the other 3" O.D., 2" I.D., graduated from 0 to 100			1			P-720313-501
x	x	x	x	x	N-107	Dial for L-102	(36 to 1) assembly including knob and crank and two dials, one a bakelite dial, 2" O.D., 0.375" I.D., 0 to 35 engraved on outer periphery, the other 3" O.D., 2" I.D., graduated from 0 to 100			1			P-720383-503
x	x	x	x	x	N-108	Dial for L-104	Same as N-107						
x	x	x	x	x	N-109	Dial for L-105	Same as N-107						

TBL-78 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,78 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							DIALS (Continued)						
x	x	x	x	x	N-110	Index Dial for S-117	(16 position, 19° 20') assembly including knob and pointer and 3-1/4" O.D. dial, graduated from 1 to 16 over 290° "J ANTENNA LOADING IF" engraved on face			1			P-720317-501
x	x	x	x	x	N-111	Dial for L-113	Same as N-104						
x	x	x	x	x	N-112	Dial for L-114	Same as N-104						
x	x	x	x	x	N-113	Dial for C-171	Same as N-104						
x	x	x	x	x	N-114	Dial for C-172	Same as N-104						
x	x	x	x	x	N-115	Index Dial for S-121	(11 position, 18°) assembly including knob and pointer and 3-1/4" O.D. dial, graduated from 1 to 11 over 180° "H ANTENNA COUPLING IF" engraved on face			1			P-720317-502
x	x	x	x	x	N-116	Index Dial for S-115	(2 position 30°) assembly including knob and pointer and 3-1/4" O.D. dial, graduated from 1 to 2 over 30°, "G FREQUENCY RANGE IF" graduated on face			1			P-720589-502
x	x	x	x	x	N-117	Index Dial for S-125	(3 position 30°) assembly including knob and pointer and 3-1/4" O.D. dial, "TUNING STEP-1 TUNING STEP-2 TUNING STEP-3" engraved on upper portion, "TUNE-OPERATE SWITCH" engraved on lower portion			1			P-720589-501
x	x	x	x	x	N-118	Dial for L-109	(72:1) assembly including knob and crank and two dials, one a bakelite dial, 2" O.D., 0.375" I.D., 0 to 70 engraved on outer periphery, the other 3" O.D., 2" I.D., graduated from 0 to 100			1			P-720383-501

TBL-78 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,7&8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							DIALS (Continued)						
x	x	x	x	x	N-119	Dial for L-110	Precision type (50:1) assembly including knob and crank; aluminum dial, 2-3/8" O.D., 0.1875" I.D., 25/32" long, graduated from 0 to 100 on outer periphery and 3" dial, graduated from 0 to 25 over 180°; both dials set at right angles to each other			1			P-717339-501
x	x	x	x	x	N-120	Dial for C-181	(4:1) assembly including black molded knob and 3" O.D. dial, one half the scale graduated from 0 to 90, 2" I.D.			1			P-720312-501
							MISCELLANEOUS MECHANICAL PARTS						
x	x	x	x	x	60-101	Spring (Part of Flexible Lead W-101)	Phosphor bronze strip, 0.005" thick, 7/16" wide, 6' long			1		Fin. #100	K-865148-11
x	x	x	x	x	60-102	Gasket for Mounting Plate Located Near V-100 & 101	Vellutex, 2-7/16" long, 1-11/16" wide			1			K-856193-2
x	x	x	x	x	60-103	Gasket	Vellumoid, 14-3/8" long, 1/2" wide, 1/16" thick			1			K-843917-2
x	x	x	x	x	60-104	Spring for Dials on N-101, 102, 103, 110, 116, & 117	Music wire, 0.016" dia., 7 turns, 5/32" I.D., 7/16" free length			1		Fin. #014	K-854519-1
x	x	x	x	x	60-105	Spring for Dials on N-104, 105, 111, 112, 113, 114 & 120	Music wire, 0.020" dia., 6 turns, 3/16" O.D., 3/8" free length			1		Fin. #009	K-854282-1
x	x	x	x	x	60-106	Spring for Dials on N-106, 107 108, 109 & 118	Same as 0-105 except fin. #014						
x	x	x	x	x	60-107	Spring for Dials on N-101, 102, 103 & 116	Music wire, 0.040" dia., 25 turns, 1-1/2" free length			1		Fin. #014	K-854521-1
x	x	x	x	x	60-108	Spring for Dials on N-110 & 115	Music wire, 0.035" dia., 33 turns, 1.725" free length			1		Fin. #014	K-854521-2

6 *TBL-8 Spare Only Contract NXss-33180.*
TBL-7&8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,d8	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C									
DIALS (Continued)													
x	x	x	x	x	N-119	Dial for L-110	Precision type (50:1) assembly including knob and crank; aluminum dial, 2-3/8" O.D., 0.1875" I.D., 25/32" long, graduated from 0 to 100 on outer periphery and 3" dial, graduated from 0 to 25 over 180°; both dials set at right angles to each other			1			P-717339-501
x	x	x	x	x	N-120	Dial for C-181	(4:1) assembly including black molded knob and 3" O.D. dial, one half the scale graduated from 0 to 90, 2" I.D.			1			P-720312-501
MISCELLANEOUS MECHANICAL PARTS													
x	x	x	x	x	60-101	Spring (Part of Flexible Lead W-101)	Phosphor bronze strip, 0.005" thick, 7/16" wide, 6' long			1		Fin. #100	K-865148-11
x	x	x	x	x	60-102	Gasket for Mounting Plate Located Near V-100 & 101	Vellutex, 2-7/16" long, 1-11/16" wide			1			K-856193-2
x	x	x	x	x	60-103	Gasket	Vellumoid, 14-3/8" long, 1/2" wide, 1/16" thick			1			K-843917-2
x	x	x	x	x	60-104	Spring for Dials on N-101,102, 103,110,116,& 117	Music wire, 0.016" dia.,7turns, 5/32" I.D., 7/16" free length			1		Fin. #014	K-854519-1
x	x	x	x	x	60-105	Spring for Dials on N-104,105, 111,112,113,114 & 120	Music wire, 0.020" dia., 6 turns, 3/16" O.D., 3/8" free length			1		Fin. #009	K-854282-1
x	x	x	x	x	60-106	Spring for Dials on N-106,107 108,109 & 118	Same as 0-105 except fin. #014						
x	x	x	x	x	60-107	Spring for Dials on N-101,102, 103 & 116	Music wire, 0.040" dia., 25 turns, 1-1/2" free length			1		Fin. #014	K-854521-1
x	x	x	x	x	60-108	Spring for Dials on N-110 & 115	Music wire, 0.035" dia., 33 turns, 1.725" free length			1		Fin. #014	K-854521-2

d TBL-8 Spare Only Contract NXss-33180.
TBL-48 CONTRACT NOs-98591 Only.

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TABLE II (Continued)

PARTS LIST BY SYMBOL DESIGNATION

FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,†8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							MISCELLANEOUS MECHANICAL PARTS (Continued)						
x	x	x	x	x	60-109	Spring for Dials on S-123 & 124	Music wire, 0.063" dia., 16 turns, 3/8" O.D.			1		Fin. #100	K-864856-1
x	x	x	x	x	60-110	Spring for Dial on N-119	Phosphor bronze, 1" long, 0.204" wide, 0.010" thick			1		Fin. #100	K-856076-1
x	x	x	x	x	60-111	Spring for Dial on N-119	Music wire, 47 turns, left hand, 1/8" O.D., approximately 11/16" long			1		Fin. #014	K-856272-1
x	x	x	x	x	60-112	Spring for J-101	Phosphor bronze, 1" long, 15/64" wide, 0.032" thick			1		Fin. #070	K-854551-1
x	x	x	x	x	60-113	Worm Gear for N-106,107,108, 109 & 118	Assembly including bushing, spring and 2 gears, 1.25" pitch dia., 32 dia. pitch, 36 teeth, one with hole 0.314" across flats, other with 0.375" dia. hole			1			K-864053-501
x	x	x	x	x	60-114	Worm for Dials N-106,107,108, 109 & 118	Bronze, 0.500" pitch dia., 0.100" linear pitch, single lead, 3°39' helix angle			1			K-854290-1
x	x	x	x	x	60-115	Gears for N-106,107,108 & 109	Assembly including 2 brass gears., 0.875" pitch dia., 32 dia. pitch, 28 teeth, 0.064" thick			1			K-855652-504
x	x	x	x	x	60-116	Gear for N-106,107,108 & 109	Brass, 0.875" pitch dia., 32 dia. pitch, 28 teeth			1			K-854291-1
x	x	x	x	x	60-117	Gear for N-106	Brass, 0.625" pitch dia., 32 dia. pitch, 20 teeth			1			K-854679-502
x	x	x	x	x	60-118	Gear for N-106	Brass 1.166" pitch dia., 24 dia. pitch, 28 teeth, 0.040" thick			1			K-864114-503
x	x	x	x	x	60-119	Gear for Dials on N-104,105, 111,112,113,114 & 120	2" pitch dia., 32 dia. pitch, 64 teeth			1			K-854274-1
x	x	x	x	x	60-120	Worm Gear for Dial on N-119	2-1/2" pitch dia., 24 dia. pitch, 50 teeth			106	Cat. #G-1037		K-818811-3
x	x	x	x	x	60-121	Worm for Dial on N-119	0.500" pitch dia., 24 dia. pitch, single thread, right hand			1			K-818810-501

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6 *TBL-8 Spare Only Contract NXss-33180.*
TBL-†8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,68 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
MISCELLANEOUS MECHANICAL PARTS (Continued)													
X	X	X	X	X	60-122	Gear for Dial on N-119	0.500" pitch dia., 32 dia. pitch, 16 teeth			106	Cat. #G-462 Modified		K-818821-1
X	X	X	X	X	60-123	Gear to Operate S-125	1-1/2" pitch dia., 24 dia. pitch, 36 teeth			106			K-843898-1
X	X	X	X	X	60-124	Worm wheel for C-146,147 & 148	Bronze, 1-7/8" pitch dia., 32 dia. pitch, 60 teeth, single thread			106	Cat. #G-1032		K-843868-1
X	X	X	X	X	60-125	Worm for C-146	Steel, 7/16" pitch dia., 32 dia. pitch			1			K-843836-504
X	X	X	X	X	60-126	Worm for C-147	Steel, 7/16" pitch dia., 32 dia. pitch			1			K-843836-501
X	X	X	X	X	60-127	Worm for C-148	Steel, 7/16" pitch dia., 32 dia. pitch			1			K-843836-502
X	X	X	X	X	60-128	Coupling for N-101,102 & 103	Assembly consisting of brass coupling and 2 pins			1			M-420687-501
X	X	X	X	X	60-129	Coupling (Part of O-128)	Brass, 1-9/16" long, 5/8" wide			1			M-420687-3
X	X	X	X	X	60-130	Coupling for N-110	Assembly including brass coupling, 1-1/32" long, 5/8" O.D., 0.375" I.D. both ends			1			K-856278-501
X	X	X	X	X	60-131	Coupling for N-110	Assembly consisting of: coupling plate; 4 brass spacers and coupling bar			1			M-418230-502
X	X	X	X	X	60-132	Coupling for N-101	Assembly consisting of: insulator sleeve, groove pin and brass coupling, 1-9/16" long, 1" wide, 3/8" thick			1			K-855965-501
X	X	X	X	X	60-133	Flexible Coupling for N-106, 107 & 113	Insulated, 1-7/16" overall length, complete with 2 holes, 0.3775" I.D., and 2 steel setscrews, #8-32 threads x 3/8" long			1			M-402566-501

6 TBL-8 Spare Only Contract NXss-33180.
TBL-48 CONTRACT NOs-98591 Only.

* TBL-8 Spare Only Contract NXss-33180.
TBL-8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,*8	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.									
MISCELLANEOUS MECHANICAL PARTS (Continued)													
x	x	x	x	x	60-134	Flexible Coupling for N-108, 109	Insulated, 1-15/32" overall length, complete with 6 plates, 2 hubs and 2 yokes; 1/4" to 3/8"			1			M-402566-508
x	x	x	x	x	60-135	Flexible Coupling Between L-102 & C-146	Insulated, 2-1/8" x 2-1/8" x 1-1/2", each end 0.3775" I.D.			1			K-843322-2
x	x	x	x	x	60-136	Flexible Coupling Between L-104 & C-147, L-105 & C-148	Insulated, 2-1/8" x 2-1/8" x 1-1/2", one end 0.2525" I.D., the other end 0.3775" I.D.			1			K-843322-3
x	x	x	x	x	60-137	Flexible Coupling for L-110 Shaft	Assembly overall dimensions, 53/64" long, 1-3/4" O.D.			1			K-856293-502
x	x	x	x	x	60-138	Flexible Coupling for L-110 Shaft	Assembly overall dimensions, 61/64" long, 1-3/4" O.D.			1			K-856293-505
x	x	x	x	x	60-139	Coupling for S-115 & 121	Assembly including laminated coupling 1-7/8" long, 1" O.D., 0.375" I.D.			1			K-855947-501
x	x	x	x	x	60-140	Coupling Between N-104 & C-172	Brass, 2" long, 5/8" O.D., 0.375" I.D., one end 0.2525" I.D., the other end 0.375" I.D., 2 holes tapped #8-32 threads			1			K-860027-2
x	x	x	x	x	60-141	Binding Post for V-101 Lead	Brass bright nickel finish, 1/2" dia. knurled head, 11/16" closed length, tapped #8-32 threads			230	Cat.#13 Sergeant		K-860002-1
PLUGS													
x	x	x	x	x		Plugs on Terminal Board at Rear of Oscillator	Banana type, 1/4"-28 threads, shank			23	Cat.#77		K-99035-8

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,28	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.									
							RESISTORS						
x	x	x	x	x	*R-101	Not Used							
x	x	x	x	x	*R-102	I-F Outer Anode Tank Resistor	56,000 ohms ±5%, 2 watts, composition	-63426	RE 13A 340C	4	Type F-2		K-838589-8
x	x	x	x	x	*R-103	I-F Outer Anode Tank Resistor	Same as R-102	-63426					
x	x	x	x	x	*R-104	I-F Outer Anode Tank Resistor	Same as R-102	-63426					
x	x	x	x	x	*R-105	H-F Power Amplifier Grid Resistor	5000 ohms ±5%, wire wound, ferrule type, style B	-63149F	RE 13A 372J	5			T-620340-258
x	x	x	x	x	*R-106	H-F 2nd Intermediate Power Amplifier Grid Resistor	25,000 ohms ±5%, wire wound, ferrule type, style B	-63267E	RE 13A 372J	5			M-418350-33
x	x	x	x	x	*R-107	H-F 1st Intermediate Power Amplifier Grid Resistor	10,000 ohms ±5%, wire wound, ferrule type, style C	-63029E	RE 13A 372J	5			M-418350-43
x	x	x	x	x	*R-108	Power Amplifier Screen Resistor	1000 ohms ±5%, wire wound, ferrule type, style B	-63141F	RE 13A 372J	5			T-620340-231
x	x	x	x	x	*R-109	I-F Power Amplifier Grid Resistor	3500 ohms ±5%, wire wound, ferrule type, style B	-63146F	RE 13A 372J	5			T-620340-252
x	x	x	x	x	*R-110	Audio Oscillator Grid Resistor	16,000 ohms ±5%, wire wound, ferrule type, style C	-63030E	RE 13A 372J	5			M-418350-46
x	x	x	x	x	*R-111	Audio Oscillator Plate Resistor	15,000 ohms ±5%, wire wound, ferrule type, style B	-63512F	RE 13A 372J	5			T-620340-270
x	x	x	x	x	*R-112	I-F 1st Intermediate Power Amplifier Plate Resistor	10,000 ohms ±5%, wire wound, ferrule type, style A	-63217F	RE 13A 372J	5			T-620340-117
x	x	x	x	x	*R-113	H-F 2nd Intermediate Power Amplifier Plate Resistor	15,000 ohms ±5%, wire wound, ferrule type, style A	-63218F	RE 13A 372J	5			T-620340-120
x	x	x	x	x	*R-114	H-F 1st Intermediate Power Amplifier Plate Resistor	5000 ohms ±5%, wire wound, ferrule type, style A	-63212F	RE 13A 372J	5			T-620340-108
x	x	x	x	x	*R-115	I-F Oscillator Plate Resistor	25,000 ohms ±5%, wire wound, ferrule type, style A	-63220F	RE 13A 372J	5			T-620340-124

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

TBL-28 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,78 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RESISTORS						
x	x	x	x	x	*R-101	Not Used							
x	x	x	x	x	*R-102	I-F Outer Anode Tank Resistor	56,000 ohms ±5%, 2 watts, composition	-63426	RE 13A 340C	4	Type F-2		K-838589-8
x	x	x	x	x	*R-103	I-F Outer Anode Tank Resistor	Same as R-102	-63426					
x	x	x	x	x	*R-104	I-F Outer Anode Tank Resistor	Same as R-102	-63426					
x	x	x	x	x	*R-105	H-F Power Amplifier Grid Resistor	5000 ohms ±5%, wire wound, ferrule type, style B	-63149F	RE 13A 372J	5			T-620340-258
x	x	x	x	x	*R-106	H-F 2nd Intermediate Power Amplifier Grid Resistor	25,000 ohms ±5%, wire wound, ferrule type, style B	-63267E	RE 13A 372J	5			M-418350-33
x	x	x	x	x	*R-107	H-F 1st Intermediate Power Amplifier Grid Resistor	10,000 ohms ±5%, wire wound, ferrule type, style C	-63029E	RE 13A 372J	5			M-418350-43
x	x	x	x	x	*R-108	Power Amplifier Screen Resistor	1000 ohms ±5%, wire wound, ferrule type, style B	-63141F	RE 13A 372J	5			T-620340-231
x	x	x	x	x	*R-109	I-F Power Amplifier Grid Resistor	3500 ohms ±5%, wire wound, ferrule type, style B	-63146F	RE 13A 372J	5			T-620340-252
x	x	x	x	x	*R-110	Audio Oscillator Grid Resistor	16,000 ohms ±5%, wire wound, ferrule type, style C	-63030E	RE 13A 372J	5			M-418350-46
x	x	x	x	x	*R-111	Audio Oscillator Plate Resistor	15,000 ohms ±5%, wire wound, ferrule type, style B	-63512F	RE 13A 372J	5			T-620340-270
x	x	x	x	x	*R-112	I-F 1st Intermediate Power Amplifier Plate Resistor	10,000 ohms ±5%, wire wound, ferrule type, style A	-63217F	RE 13A 372J	5			T-620340-117
x	x	x	x	x	*R-113	H-F 2nd Intermediate Power Amplifier Plate Resistor	15,000 ohms ±5%, wire wound, ferrule type, style A	-63218F	RE 13A 372J	5			T-620340-120
x	x	x	x	x	*R-114	H-F 1st Intermediate Power Amplifier Plate Resistor	5000 ohms ±5%, wire wound, ferrule type, style A	-63212F	RE 13A 372J	5			T-620340-108
x	x	x	x	x	*R-115	I-F Oscillator Plate Resistor	25,000 ohms ±5%, wire wound, ferrule type, style A	-63220F	RE 13A 372J	5			T-620340-124

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

TBL-4,8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4.8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,7,8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RESISTORS (Continued)						
x	x	x	x	x	*R-116	2nd Intermediate Power Amplifier Screen Resistor	12,000 ohms ±5%, wire wound, ferrule type, style C	-63799E	RE 13A 372J	5			M-418350-44
x	x	x	x	x	*R-117	1st Intermediate Power Amplifier Screen Resistor	Same as R-116	-63799E					
x	x	x	x	x	*R-118	Oscillator Screen Resistor	50,000 ohms ±5%, wire wound, ferrule type, style A	-63222E	RE 13A 372J	5			M-418350-29
x	x	x	x	x	*R-119	Oscillator Screen Resistor	35,000 ohms ±5%, wire wound, ferrule type, style A	-63221E	RE 13A 372J	5			M-418350-6
x	x	x	x	x	*R-120	Audio Dropping Resistor	180 ohms ±5%, 2 watts, composition	-63426		4	Type F-2		K-838589-9
x	x	x	x	x	*R-121	H-F Oscillator Grid Leak Resistor	20,000 ohms ±5%, wire wound, ferrule type, style C	-63485E	RE 13A 372J	5			M-418350-50
x	x	x	x	x	*R-122	Power Amplifier Grid Suppressor Resistor	56 ohms, 2 watts, composition, in parallel with 5 turns #20 DC copper wire (L-117) wound over it	-63474	RE 13A 340C	1			K-843198-501
x	x	x	x	x	*R-123	Power Amplifier Grid Suppressor	Same as R-122	-63474					
x	x	x	x	x	*R-124	Modulated CW Load Resistor	4000 ohms ±5%, wire wound, ferrule type, style C	-63760F	RE 13A 372J	5			T-620340-404
x	x	x	x	x	*R-125	I-F Oscillator Grid Leak Resistor	Same as R-121	-63485E					
x	x	x	x	x	*R-126	Bias Voltage Divider Resistor	650 ohms ±5%, wire wound, ferrule type, style C	-63711F	RE 13A 372J	5			T-620340-373
x	x	x	x	x	*R-127	Bias Voltage Diyider Resistor	400 ohms ±5%, wire wound, ferrule type, style C	-63019F	RE 13A 372J	5			T-620340-362
x	x	x	x	x	*R-128	H-F Oscillator Grid Leak Resistor	Same as R-121	-63485E					

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
TBL-4,8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,7,8	TBL-4,8	TBL-4									
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
RESISTORS (Continued)													
x	x	x	x	x	*R-129	I-F Oscillator Grid Leak Resistor	Same as R-121	-63485E					
x	x	x	x	x	*R-130	CW Oscillator Filament Resistor	3.2 ohms ±5%, wire wound, ferrule type, style C	-63790F	RE 13A 372J	5			T-620340-318
x	x	x	x	x	R-131	Power Amplifier Suppressor Adjustment Rheostat	2500 ohms, wire wound, 100 watts			6	Cat. #0460		K-860347-1
x	x	x	x	x	*R-132	Bias Voltage Divider Resistor	Same as R-126	-63711F					
x	x	x	x	x	*R-133	Bias Voltage Divider Resistor	Same as R-127	-63019F					
x	x	x	x	x	R-134	Filament Rheostat	15 ohms, wire wound, 150 watts			6	Cat. #0531		M-418349-6
x	x				*R-135	Thermostat Voltage Divider Resistor	800 ohms ±5%, wire wound, ferrule type, style C	-63793F	RE 13A 372J	5			T-620340-378
x	x				*R-136	Thermostat Voltage Divider Resistor	Same as R-135	-63793F					
		x	x	x	*R-137 A,B,C&D	Oven Heater Resistor	Heater resistor assembly, 70 ohms			26	Type A		K-838135-8
x	x				*R-138 A,B,C&D	Oven Heater Resistor	Heater resistor assembly, 80 ohms			26	Type A		K-838135-7
		x			*R-139	Spark Absorbing Resistor	0.75 ohm ±5%, wire wound, ferrule type, style E	-63009F	RE 13A 372J	5			T-620340-609
x	x	x	x	x	*R-140	Keying Bleeder Resistor	600 ohms ±5%, wire wound, ferrule type, style C	-63021F	RE 13A 372J	5			T-620340-369
x	x	x	x	x	*R-141	Keying Bleeder Resistor	Same as R-140	-63021F					
x	x	x	x	x	*R-142	Field Resistor	2000 ohms ±5%, wire wound, ferrule type, style A	-63205F	RE 13A 372J	5			T-620340-94
x	x	x	x	x	R-143	High Voltage Generator Field Potentiometer	2500 ohms, 0.5 to 0.15 ampere			7	#M-420835		M-420835-2

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
TBL-4B CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,*8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RESISTORS (Continued)						
x	x	x	x	x	R-144	Bias Generator Field Rheostat	500 ohms, 1.5 to 0.43 amperes			7	#64-301		M-420835-1
					R-145	Not Used							
x	x	x	x	x	*R-146	High Voltage Generator Field Shunt Resistor	Same as R-135	-63793F					
x	x	x	x	x	*R-147	Overload Relay Shunt Resistor	500 ohms ±5%, wire wound, ferrule type, style E	-63278F	RE 13A 372J	5			T-620340-666
x	x	x	x	x	*R-148	Overload Relay Shunt Resistor	Same as R-147	-63278F					
		x	x	x	*R-149	Heater Series Resistor	25 ohms ±5%, wire wound, ferrule type, style A	-63178F	RE 13A 372J	5			T-620340-30
		x	x	x	*R-150	Heater Series Resistor	Same as R-149	-63178F					
x	x	x	x	x	*R-151	Keying Resistor	14,000 ohms ±5%, wire wound, ferrule type, style B	-63156F	RE 13A 372J	5			T-620340-269
x	x				R-152	Filament Stand-by Rheostat	80 ohms, wire wound, 50 watts			6	Cat. #0319		K-860328-5
x	x	x	x	x	R-153	I-F Filament Rheostat	35 ohms, wire wound, 50 watts			6	Cat. #0317		K-860328-3
					R-154	Not Used							
					R-155	Not Used							
x	x	x	x	x	*R-156	Screen Bleeder Resistor	Same as R-121	-63485E					
x	x	x	x	x	*R-157	Keying Resistor	15,000 ohms ±5%, wire wound, ferrule type, style C	-63708E	RE 13A 372J	5			M-418350-45
x	x	x	x	x	*R-158	Keying Resistor	Same as R-107	-63029E					
x	x	x	x	x	*R-159	Keying Resistor	Same as R-115	-63220F					
					R-160	Not Used							
					R-161	Not Used							

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

*TBL-*8 CONTRACT NOs-98591 Only.*

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,6	220 V A.C. TBL-4,9	115 V D.C. TBL-4,7&8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
x	x	x	x	x	*R-162	Attenuator Series Resistor	3500 ohms ±5%, wire wound, ferrule type, style C	-63796F	RE 13A 372J	5			T-620340-402
x	x	x	x	x	*R-163	Keying Bleeder Resistor	1000 ohms ±5%, wire wound, ferrule type, style C	-63777F	RE 13A 372J	5			T-620340-381
			x		*R-164	Keying Bleeder Resistor	1200 ohms ±5%, wire wound, ferrule type, style C	-63794F	RE 13A 372J	5			T-620340-385
x	x	x	x	x	*R-165	Keying Spark Absorbing Resistor	Same as R-127	-63019F					
x	x				*R-166	K-102 Series Resistor	100 ohms ±5%, wire wound, ferrule type style B	-63124F	RE 13A 372J	5			T-620340-192
x	x	x	x	x	R-167	Compensator Heater Rheostat	50 ohms, 1 amp, 50 watts			5	Type B-50		K-854749-1
x	x	x	x	x	*R-168	Bias Relay Series Resistor	Same as R-162	-63796F					
x	x	x	x	x	*R-169	Audio Transformer Output Resistor	8700 ohms ±10%, 5 watts, composition	-63368	RE 13A 340C	25			K-860419-3
x	x	x	x	x	*R-170	High Voltage Bleeder Resistor	Same as R-115	-63220F					
x	x	x	x	x	*R-171	High Voltage Bleeder Resistor	Same as R-115	-63220F					
x	x	x	x	x	R-172	H-F Oscillator Compensator Heater Resistor	50" nichrome wire wound over mica strip			1			K-843877-501
x	x	x	x	x	*R-173	High Voltage Bleeder Resistor	1500 ohms ±5%, wire wound, ferrule type, style E	-63545F	RE 13A 372J	5			T-620340-689
x	x	x	x	x	*R-174	2nd Intermediate Power Amplifier Plate Resistor	Same as R-113	-63218F					
x	x	x	x	x	*R-175	Meter Multiplier Resistor (M-110)	2.5 megohms, wire wound, ferrule type, 1 ma, 2.5 kv d.c., style MFB	-63774	RE 13A 590A	4			K-855640-2
x	x	x	x	x	*R-176	Meter Multiplier Resistor (M-111)	Same as R-175	-63774					

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

TBL-4B CONTRACT NOs-98391 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

440 V A.C. TBL-4,8	220 V A.C. TBL-4,9	115 V D.C. TBL-4,7&8	230 V D.C. TBL-4,8	250 V D.C. TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							RESISTORS (Continued)						
		x	x	x	*R-177	Thermostat Voltage Divider Resistor	200 ohms ±5%, wire wound, ferrule type, style C	-63319F	RE 13A 372J	5			T-620340-352
		x			*R-178	Thermostat Voltage Divider Resistor	1500 ohms ±5%, wire wound, ferrule type, style C	-63022F	RE 13A 372J	5			T-620340-389
			x		*R-179	Thermostat Voltage Divider Resistor	3000 ohms ±5%, wire wound, ferrule type, style C	-63024F	RE 13A 372J	5			T-620340-400
				x	*R-180	Thermostat Voltage Divider Resistor	Same as R-162	-63796F					
		x			*R-181	Keying Bleeder Resistor	300 ohms ±5%, wire wound, ferrule type, style C	-63017F	RE 13A 372J	5			T-620340-358
		x			*R-182	Keying Bleeder Resistor	Same as R-181	-63017F					
			x	x	*R-183	K-112 Series Resistor	4500 ohms ±5%, wire wound, ferrule type, style C	-63025F	RE 13A 372J	5			T-620340-406
					R-184	Not Used							
					R-185	Not Used							
			x		*R-186	Attenuator Series Resistor	Same as R-179	-63024F					
		x			*R-187	K-111 Series Resistor	Same as R-108	-63141F					
			x	x	*R-188	K-111 Series Resistor	4000 ohms ±5%, wire wound, ferrule type, style B	-63147F	RE 13A 372J	5			T-620340-254
					R-189	Not Used							
			x	x	*R-190	Spark Absorbing Resistor	2 ohms ±5%, wire wound, ferrule type, style E	-63243F	RE 13A 372J	5			T-620340-615

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
TBL-4,8 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,δ8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							SWITCHES						
x	x	x	x	x	*S-101	Heater Thermostat	Cartridge type, normally closed circuit opens at 70°C. ±30 & over, operating voltage 115 v, 2-1/2 amperes			17	Type M8-D82B		K-818383-5
x	x	x	x	x	*S-102	Heater Thermostat	Mercury type, circuit is made at 60° C. and over, platinum contacts set within 0.05°, straight type, 70 volts, 20 ma (RMS) 60 cycles, 12 v ma d.c.	-40004	RE 13A 486D	16			K-818977-2
x	x	x	x	x	*S-103	Door Interlock Switch	Plunger type, in porcelain-lined steel box, circuit closes when plunger is pressed, S.P.S.T. normally open, contacts rated 3 amps. at 250 v, plunger depressed 1/4" to operate, plunger returns 3/8" to open	-24076		18	#2023E	Vertical plunger roller	K-818833-3
x	x	x	x	x	*S-104	Door Interlock Switch	Same as S-103	-24076					
x	x	x	x	x	*S-105	Door Interlock Switch	Plunger type, in porcelain-lined steel box, circuit closes when plunger is pressed, S.P.S.T. normally open, contacts rated 3 amps. at 250 v, plunger depressed 1/4" to operate, plunger returns 3/8" to open	-24110		18	#2023E	Horizontal plunger roller	K-818833-1
x	x				δS-106	Filament Stand-by Switch	Lever type, D.P.S.T., 250 v, 30 amps.			19	Cat. #7475C		K-818231-2
x	x	x	x	x	δS-107	Emergency Stop Switch	Push button type, D.P.S.T.			18	Type 3946		K-860379-1
x	x	x	x	x	δS-108	Start Switch, Four Wire Control	Same as S-106						
x	x	x	x	x	*S-109	Interlock Switch	Same as S-105	-24110					
x	x	x	x	x	δS-110	Local Remote Switch	Cam lever type, D.P.D.T.			20			M-415987-10

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
δ TBL-8 SPARES ONLY Contract NXss-33180.
TBL-4,8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,78	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.									
							SWITCHES (Continued)						
x	x	x	x	x	ó S-111	Test Key Switch	Cam lever type, two S.P.D.T. open neutral sections, one locking, one non-locking, contacts 10 amperes 110 v a.c.			20			M-415987-3
x	x	x	x	x	*S-112	Interlock Switch	Same as S-105	-24110					
		x	x	x	ó S-113	Heater Control Switch	Same as S-106						
x	x	x	x	x	S-114A	Power IF-HF Transfer Switch							
					B	Power IF-HF Transfer Switch							
					C	2nd Intermediate Power Amplifier IF-HF Transfer Switch							
					D	2nd Intermediate Power Amplifier IF-HF Transfer Switch							
					E	1st Intermediate Power Amplifier IF-HF Transfer Switch	Special switch assembly comprised of S.P.D.T. switch sections			1			T-620280-501
					F	1st Intermediate Power Amplifier IF-HF Transfer Switch							
					GX	IF-HF Oscillator Plate Transfer Switch							
					GY	IF-HF Oscillator Screen Transfer Switch							
x	x	x	x	x	S-115	I-F Power Amplifier Band Switch	Special switch assembly, two S.P.D.T. sections			1			M-420634-501
x	x	x	x	x	S-116A	I-F Band Change Switch	Special switch assembly, S.P.D.T.			1			M-420633-501
x	x	x	x	x	S-116B	I-F Band Change Switch	Same as S-116A						
x	x	x	x	x	S-117	I-F Antenna Loading Switch	Rotary switch assembly, single pole, 16 throws			1			P-717231-501
					S-118	Not Used							

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
ó TBL-8 SPARES ONLY Contract NXss-33180.
TBL-78 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,ƒ8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							SWITCHES (Continued)						
x	x	x	x	x	S-119	H-F Antenna Feed Switch	Two S.P.S.T. assemblies			1			M-420655-502
x	x	x	x	x	S-120	Antenna Send-Receive Switch	Special S.P. three T assembly			1			P-717253-501
x	x	x	x	x	S-121	I-F Antenna Coupling Switch	Rotary switch assembly, single pole, 10 throws			1			P-720390-501
					S-122	Not Used							
x	x	x	x	x	S-123	I-F Oscillator Switch	Special rotary tap switch built in conjunction with L-110, S.P. eleven T			1			K-856514-814
x	x	x	x	x	S-124	H-F Oscillator Switch	Special rotary tap switch in two sections, each section S.P. six T, a part of L-109 assembly			1			K-856514-815
x	x	x	x	x	S-125	"ADJUST-TUNE-OPERATE" Switch	Special switch assembly, two S.P.D.T. sections			1			M-420634-502
x	x	x	x	x	ó S-126	"PHONE-CW-MCW" Switch	Cam lever type, one D.P.D.T. locking section, one S.P.D.T. and single pole break locking section, two S.P.D.T. locking sections			20			M-415987-5
					S-127	Not Used							
x	x	x	x	x	*S-128	Heater Thermostat	Cartridge type, normally closed, circuit opens at 50°C. ±3° and over, operating voltage 115 v, 2-1/2 amperes			17	Type M8-D82B		K-818383-7
					S-129	and S-130 Not Used							
x	x	x	x	x	S-131	H-F Power Amplifier Band Switch	Two S.P.D.T. assemblies			1			M-420636-501
x	x	x	x	x	* S-132	Interlock Switch for S-114	Plunger type, in porcelain-lined steel box; circuit opens when plunger is pressed			18	Cat. #2022	Vertical plunger roller	K-818833-4

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
ó TBL-8 SPARES ONLY Contract NXss-33180.
TBL-ƒ8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,78 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							SWITCHES (Continued)						
					S-133	Not Used							
x	x	x	x	x	S-134	Interlock Switch for S-120	S.P.S.T., a part of the index dial assembly			1			K-856514-828
x	x	x	x	x	S-135	Interlock Switch for S-119	S.P.S.T., a part of the index dial assembly			1			K-856514-829
x	x	x	x	x	S-136	Interlock Switch for S-131	S.P.S.T., a part of the index dial assembly			1			K-856514-830
x	x	x	x	x	S-137	Interlock Switch for S-117	S.P.S.T., a part of the index dial assembly			1			K-856514-831
x	x	x	x	x	S-138	Interlock Switch for S-115	S.P.S.T., a part of the index dial assembly			1			K-856514-832
x	x	x	x	x	S-139	Interlock Switch for S-125	S.P.S.T., a part of the index dial assembly			1			K-856514-833
x	x	x	x	x	6S-140	6-wire Control "ON" Switch	Single circuit, momentary contact, normally open, green button			12	KB1-G201		K-842822-2
x	x	x	x	x	6S-141	6-wire Control "OFF" Switch	Single circuit, momentary contact, normally open, red button			12	Type KB1		K-842822-6
x	x	x	x	x	6S-142	2nd Intermediate Power Amplifier Filament Switch	S.P.D.T., toggle type	-24095		18	Cat. #8929	With #20978 lever	K-860407-1
x	x	x	x	x	6S-143	Receiver Attenuator Relay Transformer Switch	Same as S-142						
x	x	x	x	x	6S-144	Oscillator Filament Transformer Switch	Same as S-142						
x	x					Switch on Power Supply Panel	Toggle, two circuit, 10 amps., 125 v	-24095A or -24095		18	DL-7502323-C2		K-882824-1

6 TBL-8 SPARES ONLY Contract NXss-33180.
TBL-78 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,7§ 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							TRANSFORMERS						
x	x	x	x	x	6T-101	H-F Oscillator Filament Transformer	Consists of two primaries and one secondary, primary 200/140/100/70 v 60 cycles a.c., secondary no load voltage 12.6 ±3%, full load 11.6/5.8 v, rated secondary current 3.25 amperes, hi-pot primary 2500 v, secondary 4000 v, laminations stacked 1-1/16", transformer impregnated and sealed in can, max. core loss 5 watts Primary #1: 413 turns #25 AWG enameled copper wire wound 75 turns per layer over kraft spool 1-9/32" x 1-1/8", tapped at 289th turn wire traverse 1.562", coil build 0.193", d-c resistance 6.53 Primary #2: 413 turns #25 AWG enameled copper wire wound 75 turns per layer over primary #1, tapped at 289th turn, wire traverse 1.562", coil build 0.173", d-c resistance 7.95 ohms at 25°C. Secondary: 52 turns #16 AWG enameled copper wire wound 26 turns per layer over primary #2, tapped at 26th turn, wire traverse 1.465", coil build 0.166", d-c resistance 0.15 ohms at 25°C.	-30459		1	XT-3000		K-900562-501
x	x	x	x	x	6T-102	I-F Oscillator Filament Transformer	Same as T-101	-30459					
x	x	x	x	x	6T-103	Amplifier Filament Transformer	Consists of two primaries and three secondaries, max. core loss 13 watts, laminations stacked 2-3/8", transformer impregnated and sealed in can	-30469		1	XT-3009		K-900564-501

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6 TBL-8 SPARE ONLY Contract NXss-33180.
TBL-7§ CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4, 8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,18 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
TRANSFORMERS (Continued)													
					T-103	(Continued)							

Winding	No Load Voltage	Full Load Voltage	Rated Cur. Amps.	Hi-pot Volts
Pri. #1&#2	200/140/ 100/70			2500
Sec#1	10.58 ±3%	10/5	10	4000
Sec#2	10.58 ±3%	10/5	3.25	4000
Sec#3	10.58 ±3%	10/5	3.25	4000

Primary #1: 170 turns #18 AWG enameled copper wire wound 43 turns per layer over kraft spool 2-1/2" x 1-13/32", tapped at 119th turn, wire traverse 1.9375" coil build 0.234", d-c resistance 0.935 ohms at 25°C.

Primary #2: 170 turns #18 AWG enameled copper wire wound 43 turns per layer over primary #1, tapped at 119th turn, wire traverse 1.9375", coil build 0.224", d-c resistance 0.935 ohms at 25°C.

Secondary #1: 18 turns 0.085" x 0.085" DC copper wire single layer wound over primary #2, tapped at 9th turn, wire traverse 1.9", coil build 0.13", d-c resistance 0.026 ohms at 25°C.

Secondary #2: 18 turns #16 enameled copper wire single layer wound over secondary #1 tapped at 9th turn, wire traverse 1.01", coil

TBL-18 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,6	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.									
TRANSFORMERS (Continued)													
					T-103	(Continued)	build 0.086", d-c resistance 0.073 ohms at 25°C. Secondary #3: 18 turns #16 enameled copper wire single layer wound over secondary #2, tapped at 9th turn, wire traverse 1.01", coil build 0.086", d-c resistance 0.077 ohm at 25°C.						
x	x	x	x	x	6T-104	Audio Oscillator Transformer	Primary 1650 v, 800 cycles; secondary 640 v, 1.0 kva, laminations stacked 2" with 0.125" air gap Secondary: 435 turns #19 AWG enameled copper wire wound 40 turns per layer over spool 2-1/8" x 1-1/16", wire traverse 1.625", coil build 0.645", d-c resistance 2.55 ohms at 25°C. Primary: 1140 turns #28 AWG wound 115 turns per layer over secondary, wire traverse 1.6875", coil build 0.206", d-c resistance 73.8 ohms at 25°C.	-30583		1	900982		K-900982-501
x	x	x	x	x	6T-105	Audio Input Transformer	Ratio primary to secondary 1 to 5 ±5%, secondary impedance at 3 v 60 cycles and no d.c. 7500 ohms minimum, hi-pot 1500 v, laminations stacked 11/16", transformer impregnated and sealed in can Primary: 395 turns #29 AWG enameled copper wire wound 76 turns per layer over spool 3/4" x 23/32", wire traverse 1", coil build 0.144", d-c resistance 9.8 ohms at 25°C.	-30470		1	XT-3010		K-900565-501

6 *TBL-8 SPARE ONLY Contract NXss-33180.*
TBL-4,8 CONTRACT NOs-98591 Only.

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,*8	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.									
							TRANSFORMERS (Continued)						
					T-105	(Continued)	Secondary: 1974 turns #29 AWG enameled copper wire wound 76 turns per layer over primary, tapped at 987th turn, wire traverse 1", coil build 0.44", d-c resistance 71.6 ohms at 25°C.						
x	x		x		T-106	Control, Heater & Filament Power Transformer	Primary 440/220 v 60 cycles, secondary 230/115 v, 0.6 kva, primary and secondary each consists of two separate windings, max. core loss 30 watts and max. exciting current 0.75 ampere at 440 v 60 cycles; hi-pot primary 3000 v, secondary 4000 v, laminations stacked 4-1/4" Primary #1: 154 turns #17 AWG enameled copper wire, wound 39 turns per layer over kraft spool 5" x 2-9/32", wire traverse 2", coil build 0.292", d-c resistance 1 ohm at 25°C. Primary #2: 154 turns #17 AWG enameled copper wire, wound 39 turns per layer over primary #1, wire traverse 2", coil build 0.262", d-c resistance 1.14 ohms at 25°C. Secondary #1: 83 turns #14 AWG enameled copper wire, wound 28 turns per layer over primary #2, wire traverse 2", coil build 0.240", d-c resistance 0.35 ohm at 25°C. Secondary #2: 83 turns #14 AWG enameled copper wire, wound 28 turns per layer over secondary #1, wire traverse 2", coil build 0.26", d-c resistance 0.38 ohm at 25°C.	-30468		1	XT-3008		K-900563-501

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*TBL-*8 CONTRACT NOs-98591 Only.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,*6	TBL-4,8	TBL-4	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.									
							VACUUM TUBES						
x	x	x	x	x	δV-100	H-F Oscillator Tube	Screen grid r-f power amplifier oscillator	-860	JAN 1A	1a	RCA-860		
x	x	x	x	x	δV-101	I-F Oscillator	Same as V-100	-860					
x	x	x	x	x	δV-102	1st Intermediate Power Amplifier Tube	Same as V-100	-860					
x	x	x	x	x	δV-103	2nd Intermediate Power Amplifier Tube	Same as V-100	-860					
x	x	x	x	x	δV-104	Power Amplifier Tube	R-F power amplifier pentode	-803	JAN 1A	1a	RCA-803		
x	x	x	x	x	δV-105	Power Amplifier Tube	Same as V-104	-803					
							WIRES & CONDUCTORS						
x	x	x	x	x	*W-101		Set of spare lead material			1			K-865148-501
							SOCKETS						
x	x	x	x	x	δX-100	Socket for V-100	Standard 4-contact, one base pin has no connection, mycalex base	-49344		21			M-418196-1
x	x	x	x	x	δX-100A	Tube Clamp for V-100	Assembly includes one brass screw, one #8 bronze lockwasher, brass hex. nut tapped #8-32 threads, and one brass clamp, 1.375" I.D.			1			K-864790-501
x	x	x	x	x	δX-101	Socket for V-101	Same as X-100	-49344					
x	x	x	x	x	δX-101A	Tube Clamp for V-101	Same as X-100A						

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δ *TBL-8 SPARE ONLY Contract NXss-33180.*
* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-48 CONTRACT NOs-98591 Only.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8	TBL-4,9	TBL-4,ϯ8	TBL-4,8	TBL-4									
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							SOCKETS (Continued)						
x	x	x	x	x	ϭX-102	Socket for V-102	4-contact, bayonet type, steatite ceramic base	-49345		2			K-860350-1
x	x	x	x	x	ϭX-103	Socket for V-103	Same as X-102	-49345					
x	x	x	x	x	ϭX-104	Socket for V-104	Special 5-contact socket, steatite ceramic base, bayonet type	-49352		2	MI-7458C		M-418370-1
x	x	x	x	x	ϭX-105	Socket for V-105	Same as X-104	-49352					
							ΨMOTOR GENERATORS						
							TBL-4						
x	x				MG-401	Motor Generator	Motor Generator 440/220 v a.c.	-21340		23			K-860402-1
		x			MG-402		Motor Generator 115 v d.c.	-21546		23			K-860403-1
			x	x	MG-403		Motor Generator 230/250 v d.c.	-21547		23			K-860404-1
							TBL-8 or 9 Contract NOs-98591						
x	x				MG-401		Motor Generator 440/220 v a.c.	-21950		103			K-860402-11
		x			MG-402		Motor Generator 115 v d.c.	-21948		103			K-860403-11
			x		MG-403		Motor Generator 230/250 v d.c.	-21949		103			K-860404-11
							TBL-8 Contract NXss-33180						
x					MG-401		Motor Generator 440 v a.c.	-21950		103			K-860402-11
			x		MG-402		Motor Generator 230 v d.c.	-21949		103			K-860404-11
							ΨMOTOR CONTROLLERS						
							TBL-4						
x					K-501		Magnetic Controller, 440 v a.c.	-21341	-2654	24			K-860428-1
	x				K-502		Magnetic Controller, 220 v a.c.	-21543	-17-C-10	24			K-860429-1
			x		K-503		Magnetic Controller, 115 v d.c.	-21541	-17-M-9C	24			K-860430-1
			x	x	K-504		Magnetic Controller, 230/250 v d.c.	-21542	-17-M-9C	24			K-860431-1

ϭ *TBL-8 SPARE ONLY Contract NXss-33180.*
Ψ *SPARE COMPONENT PARTS FURNISHED, refer to TABLE IV, for quantities.*
Ж *SPARE COMPONENT PARTS FURNISHED, refer to TABLE IV, for quantities. TBL-8 CONTRACT NOs-98591 Only.*

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TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

TBL-4,8 440 V A.C.	TBL-4,9 220 V A.C.	TBL-4,8 115 V D.C.	TBL-4,8 230 V D.C.	TBL-4 250 V D.C.	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
							‡MOTOR CONTROLLERS (Continued)						
							TBL-8 or 9 Contract NOs-98591						
x					K-501		Magnetic Controller, 440 v a.c.	-21341	2654	24			K-860428-1
	x				K-502		Magnetic Controller, 220 v a.c.	-21543	17-C-10	24			K-860429-1
		x			K-503		Magnetic Controller, 115 v d.c.	-21541	17-M-9C	24			K-860430-1
			x		K-504		Magnetic Controller, 230 v d.c.	-21542	17-M-9C	24			K-860431-1
							TBL-8 Contract NXss-33180						
x					K-501		Magnetic Controller, 440 v a.c.	-211107		24			K-885330-1
			x		K-502		Magnetic Controller, 230 v d.c.	-211105		24			K-885329-1
							MISCELLANEOUS						
x	x	x	x			Switch on Power Supply Panel	Toggle, two circuit, 10 amps., 125 v	-24095A or -24095		18	DL-7502323-C2		K-882824-Y
x	x	x	x	x		Jack on Terminal Board at Rear of Oscillator	For banana plug, 1-9/32" long, threaded 3/8"-24 threads, tapped 1/4"-20 threads			23	Cat. #76		K-99015-4
x	x	x	x	x		Plug on Terminal Board at Rear of Oscillator	Banana type, 1/4"-28 threads, shank			23	Cat. #77 Special		K-99025-8

‡ *SPARE COMPONENT PARTS FURNISHED, refer to TABLE IV, for quantities.*
TBL-8 CONTRACT NOs-98591 Only.

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CONTRACT NOs-60970
CONTRACT NOs-98591
CONTRACT NXss-33180

TABLE III
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	DESCRIPTION	† QUANTITY					SYMBOL DESIG.	FUNCTION	MFR.	MFR. DESIG.	SPECIAL TOLERANCE, RATING OR MODIFICATION	RCA DRAWING NUMBER
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.			440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.						
					-21341	Magnetic Controller, 440 v a.c.	x					K-501		24			K-860428-1
					-21542	Magnetic Controller, 230 v d.c.				x		K-504		24			K-860431-1
					-21543	Magnetic Controller, 220 v a.c.		x				K-502		24			K-860429-1
					-21541	Magnetic Controller, 115 v d.c.			x			K-503		24			K-860430-1
					-24095	Toggle, two circuit, 10 amps., 125 v	x	x	x	x			Switch on Power Supply Panel	18	DL-7502323-C2		K-882824-Y
					-24095A	Toggle, two circuit, 10 amps., 125 v	x	x	x	x			Switch on Power Supply Panel	18	DL-7502323-C2		K-882824-Y
					-211105	Magnetic Controller, 230 v d.c.				x		K-502		24			K-885329-1
					-211107	Magnetic Controller, 440 v a.c.	x					K-501		24			K-885330-1
x	x	x	x	x		Jack on Terminal Board at Rear of Oscillator	x	x	x	x	x		Jack on Terminal Board at Rear of Oscillator	23	Cat. #76	For banana plug, 1-9/32" long, threaded 3/8"-24 threads, tapped 1/4"-20 threads	K-99015-4
x	x	x	x	x		Plug on Terminal Board at Rear of Oscillator	x	x	x	x	x		Plug on Terminal Board at Rear of Oscillator	23	Cat. #77 Special	Banana type, 1/4"-28 threads, shank	K-99025-8

CONTRACT NOs-60970
CONTRACT NOs-98591
CONTRACT NXss-33180

TABLE III
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
MISCELLANEOUS (CLASS 10)						
5	5	5			-TS51	I-100B,101B,102B,103B,104B
			5	5	-TS51	I-100B,101B,102B,104B,105B
4	4	4	4	4		A-101
6	6	6	6	6		A-102
6	6	6	6	6		A-103
1	1	1	1	1		A-104
1	1	1	1	1		A-105
4	4	4				I-100,102,103,104
			3	3		I-100,102,104
1	1	1	1	1		I-100A
1	1	1				I-101
			2	2		I-101,105
1	1	1	1	1		I-101A
2	2	2				I-102A,103A
			2	2		I-102A,105A
1	1	1	1	1		I-104A
1	1	1	1	1		N-101
1	1	1	1	1		N-102
1	1	1	1	1		N-103
6	6	6	6	6		N-104,105,111,112,113,114
1	1	1	1	1		N-106
3	3	3	3	3		N-107,108,109

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
MISCELLANEOUS (CLASS 10) (Continued)						
1	1	1	1	1		N-110
1	1	1	1	1		N-115
1	1	1	1	1		N-116
1	1	1	1	1		N-117
1	1	1	1	1		N-118
1	1	1	1	1		N-119
1	1	1	1	1		N-120
1	1	1	1	1		O-101
2	2	2	2	2		O-102
4	4	4	4	4		O-103
6	6	6	6	6		O-104
7	7	7	7	7		O-105
5	5	5	5	5		O-106
7	7	7	7	7		O-107
2	2	2	2	2		O-108
2	2	2	2	2		O-109
1	1	1	1	1		O-110
1	1	1	1	1		O-111
1	1	1	1	1		O-112
5	5	5	5	5		O-113

† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 18
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-18 CONTRACT NOs-98591 only.

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY 440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MISCELLANEOUS (CLASS 10) (Continued)						
5	5	5	5	5		O-114
4	4	4	4	4		O-115
4	4	4	4	4		O-116
1	1	1	1	1		O-117
1	1	1	1	1		O-118
7	7	7	7	7		O-119
1	1	1	1	1		O-120
1	1	1	1	1		O-121
2	2	2	2	2		O-122
2	2	2	2	2		O-123
3	3	3	3	3		O-124
1	1	1	1	1		O-125
1	1	1	1	1		O-126
1	1	1	1	1		O-127
7	7	7	7	7		O-128
5	5	5	5	5		O-129
1	1	1	1	1		O-130
1	1	1	1	1		O-131
1	1	1	1	1		O-132
4	4	4	4	4		O-133
4	4	4	4	4		O-134
1	1	1	1	1		O-135
6	6	6	6	6		O-136
1	1	1	1	1		O-137
1	1	1	1	1		O-138
2	2	2	2	2		O-139
1	1	1	1	1		O-140
MOTORS (CLASS 21)						
1	1				-21340, 21950	MG-401
1					-21950	δMG-401
1	1				-21341	K-501 (440 v a.c. only)
		1			-21541	K-503
			1	1	-21542	K-504
1	1				-21543	K-502 (220 v a.c. only)
		1			-21546,21948	MG-402
			1		-21949	δMG-402
			1	1	-21547	MG-403
			1		-21949	δMG-403
			1		-211105	δK-502
1					-211107	δK-501
1	1					B-101
1	1					B-101A

δ TBL-8 only Contract NXss-93180

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† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, ‡8
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-‡8 CONTRACT NOs-98591 only

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY   † QUANTITY

230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-f8 CONTRACT NOs-98591 only

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY						
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MOTORS (CLASS 21) (Continued)						
1	1					B-101B
		1				B-102
		1				B-102A
		1				B-102B
		1				B-102C
		2	2			⁄B-102D,↘103D
			1	1		B-103
			1	1		B-103A
			1	1		B-103B
			1	1		B-103C
			1			ó B-103E
			1			ó B-103F
ELECTRICAL MEASURING INSTRUMENTS (CLASS 22)						
1	1	1	1	1	-22030	M-100
1	1	1	1	1	-22035	M-101
2	2	2	2	2	-22059	M-105,106
2	2	2	2	2	-22063	M-103,104
1	1	1	1	1	-22067	M-102
1	1	1	1	1	-22080	M-107
		2	2	2	-22143	M-108,109
1	1				-22143	M-109
2	2	2	2	2	-22310	M-110,111
1	1	1	1	1		M-100A
SWITCHES (CLASS 24)						
2	2	2	2	2	-24076	S-103,104
3	3	3	3	3	-24110	S-105,109,112
6	6	6	6	6		E-155
6	6	6	6	6		E-156
6	6	6	6	6		E-157
6	6	6	6	6		E-158
4	4	4	4	4		E-159
16	16	16	16	16		E-160
16	16	16	16	16		E-161
13	13	13	13	13		E-162
2	2	2	2	2		E-163
2	2	2	2	2		E-164
15	15	15	15	15		F-165
1	1	1	1	1		E-166
1	1	1	1	1		E-167

↘ TBL-8 only. ó TBL-8 only Contract NXss-33180.

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† NOTE:

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, f8
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-f8 CONTRACT NOs-98591 only

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
SWITCHES (CLASS 24) (Continued)						
12	12	12	12	12		E-168
3	3	3	3	3		E-169
2	2	2	2	2		E-170
1	1	1	1	1		E-171
1	1	1	1	1		E-172
33	33	33	33	33		E-173
2	2	2	2	2		E-174
11	11	11	11	11		E-175
1	1	1	1	1		E-176
6	6	6	6	6		E-177
6	6	6	6	6		E-178
2	2					S-106,108
		2	2	2		S-108,113
1	1	1	1	1		S-107
1	1	1	1	1		S-110
1	1	1	1	1		S-111
1	1	1	1	1		S-114A,B,C,D,E,F,GX,GY
1	1	1	1	1		S-115
2	2	2	2	2		S-116A,B
1	1	1	1	1		S-117
1	1	1	1	1		S-119
1	1	1	1	1		S-120
1	1	1	1	1		S-121
1	1	1	1	1		S-123
1	1	1	1	1		S-124
1	1	1	1	1		S-125
1	1	1	1	1		S-126
1	1'	1	1	1		S-131
1	1	1	1	1		S-132
1	1	1	1	1		S-134
1	1	1	1	1		S-135
1	1	1	1	1		S-136
1	1	1	1	1		S-137
1	1	1	1	1		S-138
1	1	1	1	1		S-139
1	1	1	1	1		S-140
1	1	1	1	1		S-141
3	3	3	3	3		S-142,143,144

† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 8

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
SWITCHES (CLASS 24) (Continued)						
12	12	12	12	12		E-168
3	3	3	3	3		E-169
2	2	2	2	2		E-170
1	1	1	1	1		E-171
1	1	1	1	1		E-172
33	33	33	33	33		E-173
2	2	2	2	2		E-174
11	11	11	11	11		E-175
1	1	1	1	1		E-176
6	6	6	6	6		E-177
6	6	6	6	6		E-178
2	2					S-106,108
		2	2	2		S-108,113
1	1	1	1	1		S-107
1	1	1	1	1		S-110
1	1	1	1	1		S-111
1	1	1	1	1		S-114A,B,C,D,E,F,GX,GY
1	1	1	1	1		S-115
2	2	2	2	2		S-116A,B
1	1	1	1	1		S-117
1	1	1	1	1		S-119
1	1	1	1	1		S-120
1	1	1	1	1		S-121
1	1	1	1	1		S-123
1	1	1	1	1		S-124
1	1	1	1	1		S-125
1	1	1	1	1		S-126
1	1'	1	1	1		S-131
1	1	1	1	1		S-132
1	1	1	1	1		S-134
1	1	1	1	1		S-135
1	1	1	1	1		S-136
1	1	1	1	1		S-137
1	1	1	1	1		S-138
1	1	1	1	1		S-139
1	1	1	1	1		S-140
1	1	1	1	1		S-141
3	3	3	3	3		S-142,143,144

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† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 18
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-18 CONTRACT NOs-98591 only

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY 440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
PROTECTIVE DEVICES (CLASS 28)						
2	2	2	2	2		F-104,105
2	2	2	2	2		F-108,109
1	1					F-401
		3	3	3		F-401,405,406
2	2	2	2	2		F-402,403
1	1	1	1	1		F-404
RELAYS (CLASS 29)						
1	1	1	1	1	-29034	K-101
1	1				-29037	K-104
1	1	1	1	1	-29041	K-110
1	1	1	1	1	-29043	K-106
1	1	1	1	1	-29044	K-105
1	1	1	1	1	-29045	K-108
		1	1	1	-29046	K-103
1	1				-29047	K-100
1	1				-29048	K-102
		1	1	1	-29135	K-112
		1	1	1	-29136	K-111

† QUANTITY 440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
TRANSFORMERS (CLASS 30)						
2	2	2	2	2	-30459	T-101,102
1	1				-30468	T-106
1	1	1	1	1	-30469	T-103
1	1	1	1	1	-30470	T-105
		1	1	1	-30582	L-116
1	1	1	1	1	-30583	T-104
VACUUM TUBES (CLASS 38)						
2	2	2	2	2	-803	V-104,105
4	4	4	4	4	-860	V-100,101,102,103
TEMPERATURE APPARATUS (CLASS 40)						
1	1	1	1	1	-40004	S-102
1	1	1	1	1	-40014	M-112
1	1	1	1	1		S-101
1	1	1	1	1		S-128
INDUCTANCES (CLASS 47)						
2	2	2	2	2		L-100,102
2	2	2	2	2		L-100A,102A

† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 18
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-18 CONTRACT NOs-98591 only

TABLE III (Continued)

PARTS LIST BY NAVY TYPE NUMBERS

FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
INDUCTANCES (CLASS 47) (Continued)						
2	2	2	2	2		L-100B,102B
2	2	2	2	2		L-100C,102C
2	2	2	2	2		L-100D,102D
2	2	2	2	2		L-100E,102E
2	2	2	2	2		L-100F,102F
2	2	2	2	2		L-100G,102G
2	2	2	2	2		L-100H,102H
2	2	2	2	2		L-104,105
2	2	2	2	2		L-104A,105A
2	2	2	2	2		L-104B,105B
2	2	2	2	2		L-104C,105C
1	1	1	1	1		L-108
1	1	1	1	1		L-109
1	1	1	1	1		L-110
1	1	1	1	1		L-111
1	1	1	1	1		L-112
1	1	1	1	1		L-113
1	1	1	1	1		L-114
1	1	1	1	1		L-115
1	1	1	1	1		L-117
1	1	1	1	1		L-118
2	2	2	2	2		L-125,134
1	1	1	1	1		L-126
1	1	1	1	1		L-127
1	1	1	1	1		L-128
4	4	4	4	4		L-129,130,131,132
1	1	1	1	1		L-135
1	1	1	1	1		L-136
CAPACITORS (CLASS 48)						
1	1	1	1	1	-48002-B5	C-189
7	7	7	7	7	-48003-B5	C-116,119,158,306,307,308,309
9	9				-48029-B10	C-149,150,151,152,153,154,311,312,313
		10	10	10	-48029-B10	C-149,150,151,152,153,154,310,311,312,313
1	1	1	1	1	-48029-B10	C-326
1	1	1	1	1	-48033-B10	C-140
1	1	1	1	1	-48034-B10	C-142
25	25	25	25	25	-48035-B10	C-100,101,102,104,105,106,108,109,110,111,112,113,114,115,117,118,156,157,161,162,177,185,191,192,193
2	2	2	2	2	-48036-B2	C-133,134

† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, ‡8
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-‡8 CONTRACT NOs-98591 only

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED	† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.			440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
CAPACITORS (CLASS 48) (Continued)							CAPACITORS (CLASS 48) (Continued)						
5	5	5	5	5	-48037-B2	C-137,138.143,144,145	1	1	1	1	1	-48825-B5	C-325
1	1	1	1	1	-48218-B5	C-198			1	1	1	-48884	C-329
1	1	1	1	1	-48332-B5	C-318	1	1	1	1	1	-48947	C-302
9	9	9	9	9	-48347-B5	C-120,121,122,128,130,131,166,170,199	1	1	1	1	1	-48963-B10	C-126
7	7	7	7	7	-48349-B5	C-123,124,125,183,184,327,328	1	1	1	1	1	-48964-B5	C-129
2	2	2	2	2	-48352-B5	C-155,168	2	2	2	2	2	-48966-B2	C-165,319
2	2	2	2	2	-48398-B2	C-135,136	3	3	3	3	3	-48967-B5	C-100.300,317
1	1	1	1	1	-48399-B10	C-139	1	1	1	1	1	-48978	C-180
1	1	1	1	1	-48401-B2	C-187	1	1	1	1	1	-48979	C-303
2	2	2	2	2	-48406-B5	C-159,196	1	1	1	1	1	-48980-B10	C-141
3	3	3	3	3	-48409-B10	C-103.107,188	2	2	2	2	2	-48989-B5	C-195,197
3	3	3	3	3	-48511-B2	C-159,167.194	1	1	1	1	1	-481105-B5	C-320
1	1	1	1	1	-48553	C-323			1	1	1	-481160	C-176
1	1	1	1	1	-48583-B5	C-182	1	1	1	1	1	-481172-B5	C-163
1	1	1	1	1	-48592-B5	C-127	1	1	1	1	1	-481176	C-330
1	1				-48595A	C-175	2	2	2	2	2	-481177	C-178,179
2	2	2	2	2	-48706-B2	C-160,315	1	1	1	1	1		C-146
1	1	1	1	1	-48719	C-314	1	1	1	1	1		C-147
4	4	4	4	4	-48721	C-301,304,305,315	1	1	1	1	1		C-148
1	1	1	1	1	-48749-B5	C-164	1	1	1	1	1		C-171

† NOTE:

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 8
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

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TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
CAPACITORS (CLASS 48) (Continued)						
1	1	1	1	1		C-172
1	1	1	1	1		C-173
1	1	1	1	1		C-174
1	1	1	1	1		C-181
1	1	1	1	1		C-186
1	1	1	1	1		C-321
1	1	1	1	1		C-322
JACKS, SOCKETS (CLASS 49)						
1	1	1	1	1	-49021A	J-101
2	2	2	2	2	-49344	X-100,101
2	2	2	2	2	-49345	X-102,103
2	2	2	2	2	-49352	X-104,105
2	2	2	2	2		X-100A,101A
INSULATORS (CLASS 61)						
3	3	3	3	3	-61011	E-101
4	4	4	4	4	-61045	E-136
6	6	6	6	6	-61102	E-142
2	2	2	2	2	-61154	E-126

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
INSULATORS (CLASS 61) (Continued)						
4	4	4	4	4	-61156	E-127
1	1	1	1	1	-61157	E-107
97	97	103	103	103	-61158	E-102,129
5	5	5	5	5	-61166	E-143
5	5	5	5	5	-61170	E-108
6	6	6	6	6	-61185	E-135
4	4	4	4	4	-61281	E-105
2	2	2	2	2	-61283	E-104
5	5	5	5	5	-61287	E-132
1	1	1	1	1	-61288	E-133
16	16	16	16	16	-61290	E-110,113,140,141
4	4	4	4	4	-61292	E-134
2	2	2	2	2	-61294	E-138
4	4	4	4	4	-61295	E-130
4	4	4	4	4	-61296	E-128
6	6	6	6	6	-61299	E-109
16	16	16	16	16	-61330	E-111,114,131,137
3	3	3	3	3	-61348	E-103
3	3	3	3	3	-61349	E-106
1	1	1	1	1		E-112

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† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 18
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-18 CONTRACT NOs-08501 only

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY						
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	NAVY TYPE NUMBER	ALL SYMPOL DESIGNATIONS INVOLVED
INSULATORS (CLASS 61) (Continued)						
2	2	2	2	2		E-115,116
2	2	2	2	2		E-117,118
4	4	4	4	4		E-119,120,121,122
2	2	2	2	2		E-123,124
1	1	1	1	1		E-125
14	14	14	14	14		E-145
4	4	4	4	4		E-146
2	2	2	2	2		E-147
4	4	4	4	4		E-148
2	2	2	2	2		E-149
14	14	14	14	14		E-150
16	16	16	16	16		E-151
5	5	5	5	5		E-152
2	2	2	2	2		E-153
3	3	3	3	3		E-154
WIRES & CABLES (CLASS 62)						
1	1	1	1	1		W-101

† QUANTITY						
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
RESISTORS (CLASS 63)						
		1			-63009F	R-139
		2			-63017F	R-181,182
3	3	3	3	3	-63019F	R-127,133,165
2	2	2	2	2	-63021F	R-140,141
		1			-63022F	R-178
			2		-63024F	R-179,186
			1	1	-63025F	R-183
2	2	2	2	2	-63029E	R-107,158
1	1	1	1	1	-63030E	R-110
1	1				-63124F	R-166
1	1		1	1	-63141F	R-108
		2			-63141F	R-108,187
1	1	1	1	1	-63146F	R-109
			1	1	-63147F	R-188
1	1	1	1	1	-63149F	R-105
1	1	1	1	1	-63156F	R-151
		2	2	2	-63178F	R-149,150
1	1	1	1	1	-63205F	R-142
1	1	1	1	1	-63212F	R-114
1	1	1	1	1	-63217F	R-112

† NOTE:

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 18
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

TBL-18 CONTRACT NOs-98591 only

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TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODELS TBL-4,8&9 RADIO TRANSMITTING EQUIPMENT

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
RESISTORS (CLASS 63) (Continued)						
2	2	2	2	2	-63218F	R-113,174
4	4	4	4	4	-63220F	R-115,159,170,171
1	1	1	1	1	-63221E	R-119
1	1	1	1	1	-63222F	R-118
			1	1	-63243F	R-190
1	1	1	1	1	-63267E	R-106
2	2	2	2	2	-63278F	R-147,148
		1	1	1	-63319F	R-177
1	1	1	1	1	-63368	R-169
1	1	1	1	1	-63426	R-120
3	3	3	3	3	-63426	R-102,103,104
2	2	2	2	2	-63474	R-122,123
5	5	5	5	5	-63485E	R-121,125,128,129,156
1	1	1	1	1	-63512F	R-111
1	1	1	1	1	-63545F	R-173
1	1	1	1	1	-63708E	R-157
2	2	2	2	2	-63711F	R-120,132
1	1	1	1	1	-63760F	R-124
2	2	2	2	2	-63774	R-175,176
1	1	1	1	1	-63777F	R-163

† QUANTITY					NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS
440 V A.C.	220 V A.C.	115 V D.C.	230 V D.C.	250 V D.C.		
RESISTORS (CLASS 63) (Continued)						
1	1	1	1	1	-63790F	R-130
3	3				-63793F	R-135,136,146
		1	1	1	-63793F	R-146
			1		-63794F	R-164
2	2	2	2		-63796F	R-162,168
				3	-63796F	R-152,168,180
2	2	2	2	2	-63799E	R-116,117
		1	1	1		R-137A,B,C,D
1	1					R-138A,B,C,D
1	1	1	1	1		R-131
1	1	1	1	1		R-143
1	1	1	1	1		R-144
1	1					R-152
1	1	1	1	1		R-153
1	1	1	1			R-167
1	1	1	1	1		R-172

† *NOTE:*

440 V A.C. Equipment supplied with Models TBL-4,8
220 V A.C. Equipment supplied with Models TBL-4,9
115 V D.C. Equipment supplied with Models TBL-4, 18
230 V D.C. Equipment supplied with Models TBL-4,8
250 V D.C. Equipment supplied with Models TBL-4

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TABLE V APPLICABLE COLOR CODE

RESISTOR AND CAPACITOR CODES

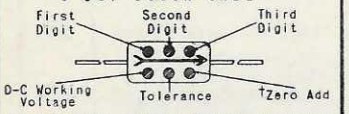
MICA CAPACITOR CODING

Values of capacitance and tolerance are coded identically on both R.M.A. 6 dot and A.W.S. coded capacitors. Only the coding of the sixth (lower left) dot differs between the two.

R. M. A. CODE

R.M.A. coded capacitors have 3 or 6 dots located as shown below.

6 DOT COLOR CODE

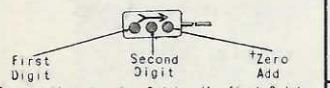


On capacitors bearing 6 dots, the upper 3 dots become the first 3 figures. When the number of zeros determined by the "Zero Add" (lower right) dot is added, the capacitance in micromicrofarads (mmfd) is obtained. The other two dots show the percentage tolerance and the voltage rating.

EXAMPLE:

Brown, Red, Green	125 + 0 = 1250 mmfd capacitance
Green, Silver, Brown	10% tolerance
	500 v d-c working voltage

3 DOT COLOR CODE



On capacitors bearing 3 dots, the first 2 dots become the first two figures. When the number of zeros determined by the "Zero Add" (third) dot is added, the capacitance in micromicrofarads (mmfd) is obtained. All 3 dot capacitors are rated at 500 v d-c working voltage.

EXAMPLE:

Red, Green, Brown	25 + 0 = 250 mmfd capacitance
	(inferred tolerance) 500 v d-c working voltage

A. W. S. CODE

A.W.S. coded capacitors may have a coded "Type Designation" or 6 colored dots as shown below.

TYPE DESIGNATION

CM 20 A 050 M

Component Case Characteristic Capacitance Tolerance

COMPONENT: All mica capacitors are identified by "CM".

*CASE: Identifies external shape and dimensions.

*CHARACTERISTIC: Identifies temperature coefficient and "0".

CAPACITANCE: The first 2 digits are the first 2 figures of the capacitance, in mmfd. The third determines the number of zeros to add. If more than 3 digits are used, all except the last are figures of capacitance. The last determines the number of zeros to add.

TOLERANCE:

Designation	Tolerance
G	±2%
J	±5%
K	±10%
M	±20%

EXAMPLE: The above type designation identifies the capacitance as 5 mmfd and the tolerance as 20 per cent.

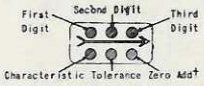
*For specific information see publication C75.3 - 1942 of the American Standards Association.

6 DOT COLOR CODE

EXAMPLE:

Black	Orange	Orange
Black	Silver	Red

033 + 00 = 3300 mmfd capacitance
10% tolerance
"A" characteristic

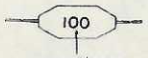


R. C. A. CODE

for mica capacitors of the shape shown below

The capacitance in micromicrofarads (mmfd) is stamped on the case. The color of the numbers shows the tolerance, as follows:

Green . . .	2.5%	Blue	10%
Black . . .	5%	Yellow . . .	20%
		Red . . .	30%



capacitance in micromicrofarads

† *When the "ZERO ADD" color is GOLD, multiply the preceeding digits by 0.1 for capacitance in mmfd; when the "ZERO ADD" color is SILVER, multiply by 0.01*

COLOR IDENTIFICATION FOR MICA CAPACITORS

COLOR	DIGITS and ZERO ADD	TOLERANCE R.M.A.	TOLERANCE A.W.S.	TOLERANCE R.C.A. mica	D-C VOLTAGE (R.M.A.)	CHARACTERISTIC (A.W.S.)
BLACK	0			5%		A
BROWN	1	1%			100	B
RED	2	2%	2% (G)		200	C
ORANGE	3	3%			300	D
YELLOW	4	4%		20%	400	E
GREEN	5	5%		2½%	500	F
BLUE	6	6%		10%	600	G
VIOLET	7	7%			700	
GRAY	8	8%			800	
WHITE	9	9%			900	
GOLD	†	5%	5% (J)		1000	
SILVER	†	10%	10% (K)		2000	
NO COLOR		20%	20% (M)		500	

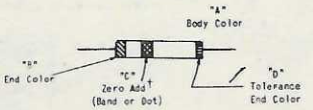
†When the "ZERO ADD" color is GOLD, multiply the number obtained from "A" and "B" by 0.1 to get capacitance in mmfd; when it is SILVER; multiply the number by 0.01.

RESISTOR CODING

(Composition and Low Power Wire Wound Resistors)

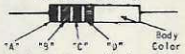
THE R.M.A. CODING AND A.W.S. CODING FOR THESE RESISTORS ARE IDENTICAL

FIRST SYSTEM



Tolerance may not be given; in which case there will be no "D" band.

SECOND SYSTEM



The body color indicates the type of resistor, and is coded as follows:

BODY COLOR	TYPE
Black	Composition, non-insulated
Any Color but Black Chocolate Brown	Composition, insulated
	Wire wound, insulated

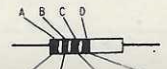
TO FIND RESISTANCE IN OHMS FROM COLOR CODING:

Obtain the digits identified by the colors of "A", "B", and "C" from the following table:

COLOR	Digit or Zero Add	COLOR	Digit or Zero Add	Tolerance
	COLOR IDENTIFICATION			
Black	0	Violet	7	
Brown	1	Gray	8	
Red	2	White	9	
Orange	3	Gold	†	5%
Yellow	4	Silver	†	10%
Green	5	No Color		20%
Blue	6			

† When the "ZERO ADD" color is GOLD, multiply the number obtained from "A" and "B" by 0.1 to get resistance in ohms; when it is SILVER; multiply the number by 0.01.

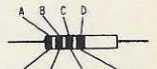
EXAMPLE



A B x C = 25 x 0.1 = 2.5
Resistance is 2.5 ohms
Tolerance: 10 per cent

EXAMPLE

The first two digits "A" and "B" become the first two numbers of the resistance. The ZERO ADD digit, "C", gives the number of zeros to add after the first two numbers. If the ZERO ADD color is GOLD or SILVER, it becomes a multiplier. See note †)



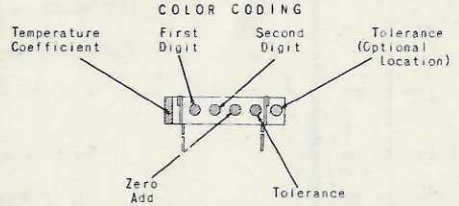
A B + C zeros =
25 + 3 zeros = 25,000
Resistance is 25,000 ohms
Tolerance: 10 per cent

RCA CERAMIC CAPACITOR CODING

COLOR IDENTIFICATION

COLOR	DIGIT	ZERO ADD	TOLERANCE Note 1	TOLERANCE Note 2	TEMP. COEFFICIENT [MMFD/MMFD/°C.]
BLACK	0	0			0
BROWN	1	1	5%	0.5 mmfd	-0.30 x 10⁻⁶
RED	2	2			-0.60 x 10⁻⁶
ORANGE	3	3	2½%		-1.5 x 10⁻⁶
YELLOW	4	4			-2.2 x 10⁻⁶
GREEN	5	5	5%	0.5 mmfd	-3.3 x 10⁻⁶
BLUE	6	6			-4.7 x 10⁻⁶
VIOLET	7	7			-7.5 x 10⁻⁶
GRAY	8		2½%	0.25 mmfd	
WHITE	9		10%	1.0 mmfd	

COLOR CODING



The d-c working voltage of this type is 500 volts.

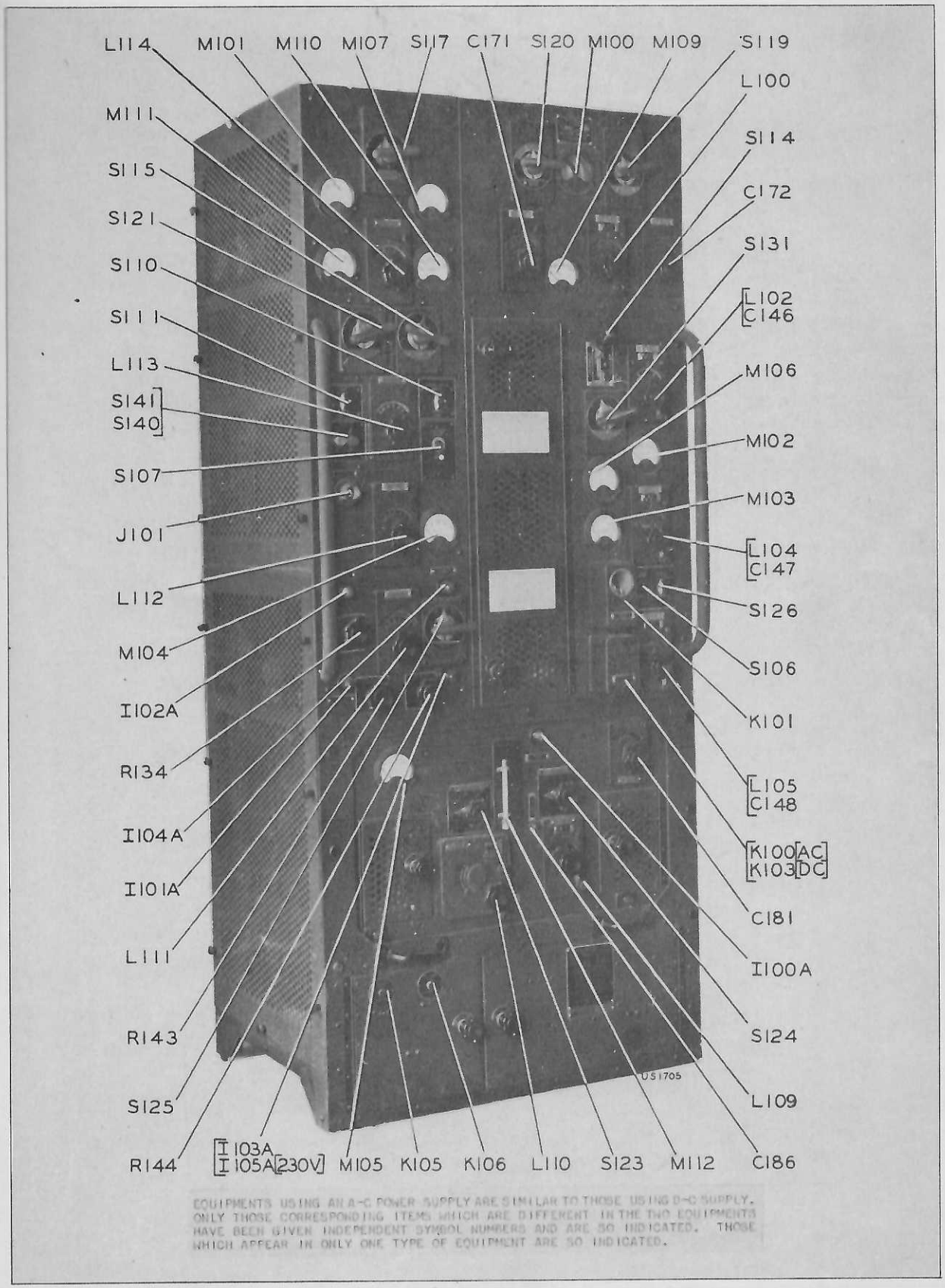
EXAMPLE:

11 + 0 = 110 mmfd capacitance
5% tolerance

LIST OF MANUFACTURERS

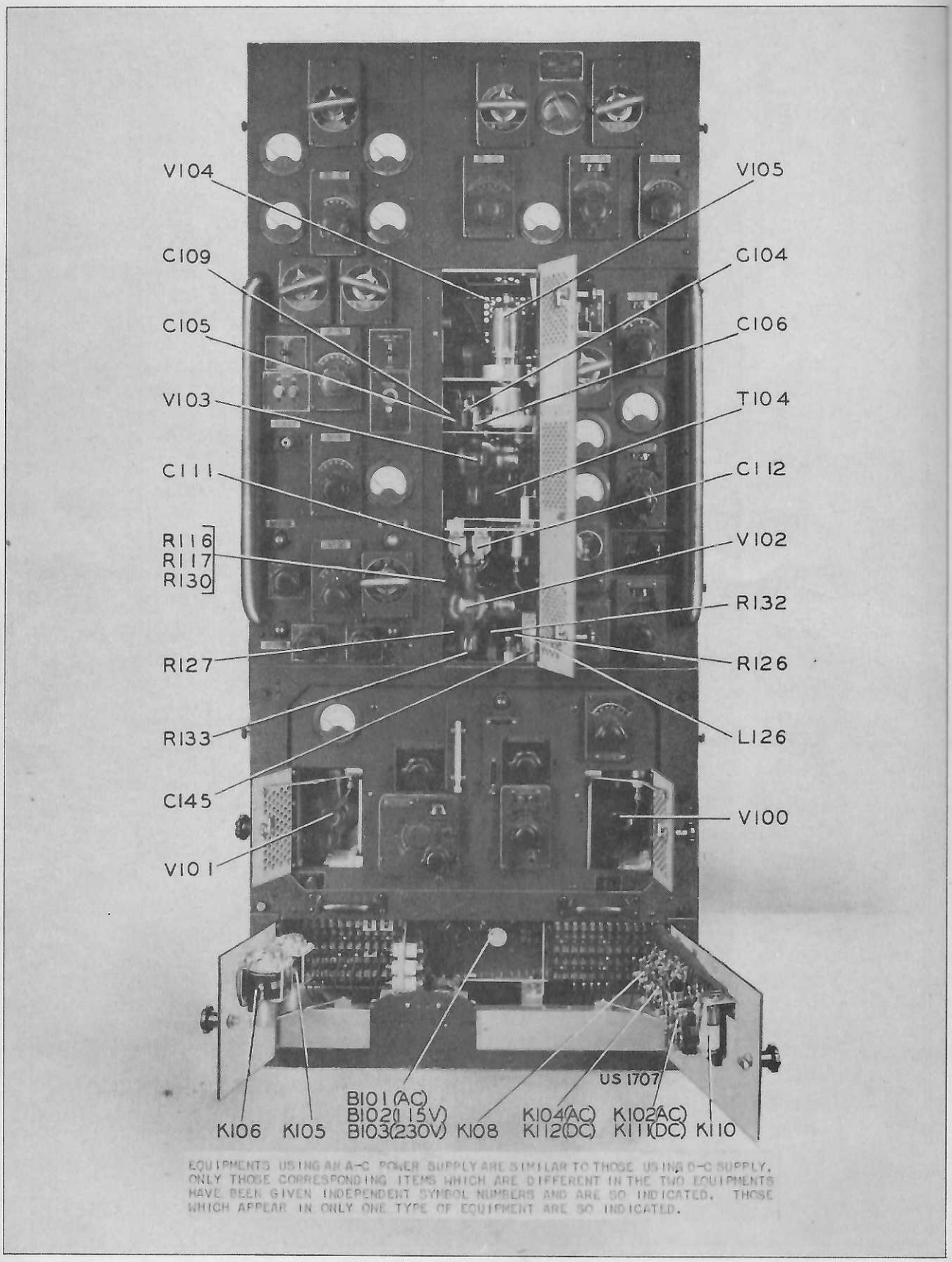
FOR MODELS TBL-4, 849 RADIO TRANSMITTING EQUIPMENT

CODE NUMBER	MFR. PREFIX	NAME	ADDRESS
1	CRV	RCA Manufacturing Company, Inc.	Camden, N.J.
1a	CRC	RCA Manufacturing Company, Inc. (Harrison Division)	Harrison, N.J.
2	CEJ	E.F. Johnson Co.	Waseca, Minn.
3	CG	General Electric Co.	Bridgeport, Conn.
4	CIR	International Resistance Co.	401 N. Broad St. Phila., Pa.
5	CHD	Hardwick Hindle, Inc.	40 Herman St. Newark, N.J.
6	COM	Ohmite Mfg. Co.	4835 Flournoy St. Chicago, Ill.
7	CAO	Ward Leonard Electric Co.	Mt. Vernon, N.Y.
9	CAY	Westinghouse Elec. & Mfg. Co.	3001 Walnut St. Phila., Pa.
10	CMA	P.R. Mallory & Co., Inc. (Yaxley Division)	3029 E. Washington St. Indianapolis, Ind.
11	CKU	Kurman Electrical Co., Inc.	241 Lafayette St. New York, N.Y.
12	CSZ	Square D Company	Milwaukee, Wis.
13	CSD	Struthers Dunn, Inc.	1315 Cherry St. Phila., Pa.
14	CRY	C.P. Clare & Co.	Lawrence & Lamon Aves. Chicago, Ill.
15	CV	Weston Electrical Instrument Co.	Newark, N.J.
16	CHB	H.B. Instrument Co.	2518 N. Broad St. Phila., Pa.
17	CEE	Edison Electric Controls, Inc.	West Orange, N.J.
18	CHH	Arrow-Hart & Hegeman Co.	Hartford, Conn.
19	CGT	Trumbull Elec. Mfg. Co.	Plainville, Conn.
20	CGC	General Control Co.	Cambridge, Mass.
21	CEZ	Electronic Mechanics, Inc.	85 Hazel St. Paterson, N.J.
22	CCF	American Blower Co.	6000 Russell St. Detroit, Mich.
23	CBP	Electric Specialty Co.	Stamford, Conn.
24	CAE	Cutler-Hammer, Inc.	Milwaukee, Wis.
25	CCC	Continental Carbon Co.	13900 Lorain Ave. Cleveland, Ohio
25a	CLR	Leach Relay Co.	5912 Avalon Blvd., Los Angeles, Calif.
26	CSO	States Co.	Hartford, Conn.
27		Lord Mfg. Co.	Erie, Pa.
103	CGU	Bogue Electric Co.	60 Glover Avenue W. Paterson, N.J.
106	CBH	Boston Gear Works, Inc.	Terminal Commerce Bldg. Phila., Pa.
230	CEB	H.H. Eby Co.	4700 Stenton Ave., Phila., Pa.
258		Electrolux Corp	Old Greenwich, Conn.
304	CAB	General Radio Co.	30 State St., Cambridge, Mass.
462	CMO	Miller Rubber Co, Inc.	1234 Stanton Ave., Akron, Ohio
528		Pierce Roberts Rubber Co.	Trenton, N.J.
752		H.A. Wilson Co.	Newark, N.J.



EQUIPMENTS USING AN A-C POWER SUPPLY ARE SIMILAR TO THOSE USING D-C SUPPLY. ONLY THOSE CORRESPONDING ITEMS WHICH ARE DIFFERENT IN THE TWO EQUIPMENTS HAVE BEEN GIVEN INDEPENDENT SYMBOL NUMBERS AND ARE SO INDICATED. THOSE WHICH APPEAR IN ONLY ONE TYPE OF EQUIPMENT ARE SO INDICATED.

Figure 3—Transmitter, A-C Supply (Front Oblique View, Access Doors Closed)



EQUIPMENTS USING AN A-C POWER SUPPLY ARE SIMILAR TO THOSE USING D-C SUPPLY. ONLY THOSE CORRESPONDING ITEMS WHICH ARE DIFFERENT IN THE TWO EQUIPMENTS HAVE BEEN GIVEN INDEPENDENT SYMBOL NUMBERS AND ARE SO INDICATED. THOSE WHICH APPEAR IN ONLY ONE TYPE OF EQUIPMENT ARE SO INDICATED.

Figure 4—Transmitter, A-C Supply (Front View, Access Doors Open)

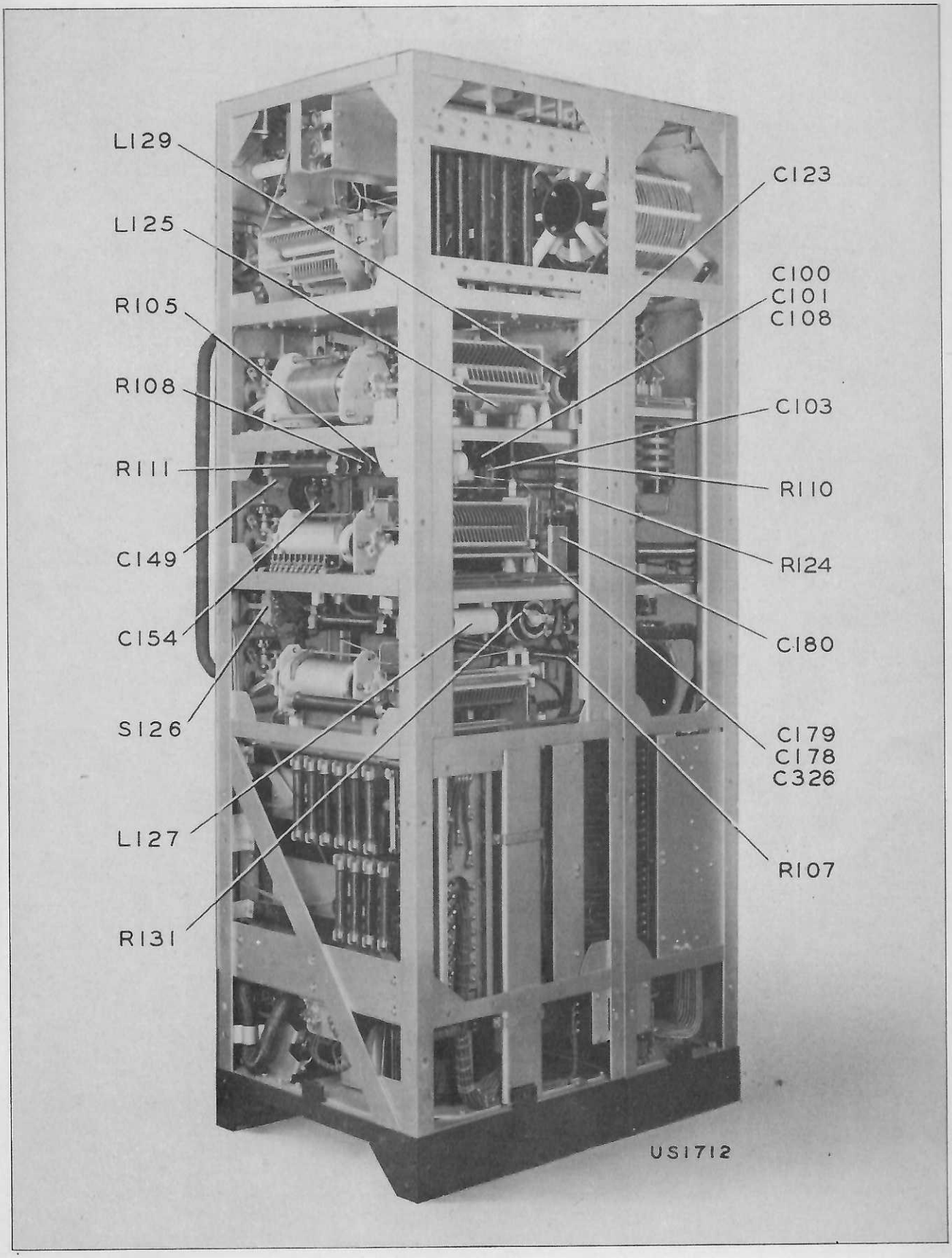


Figure 5—Transmitter, A-C Supply (R.H. Rear Oblique View, Shields Removed)

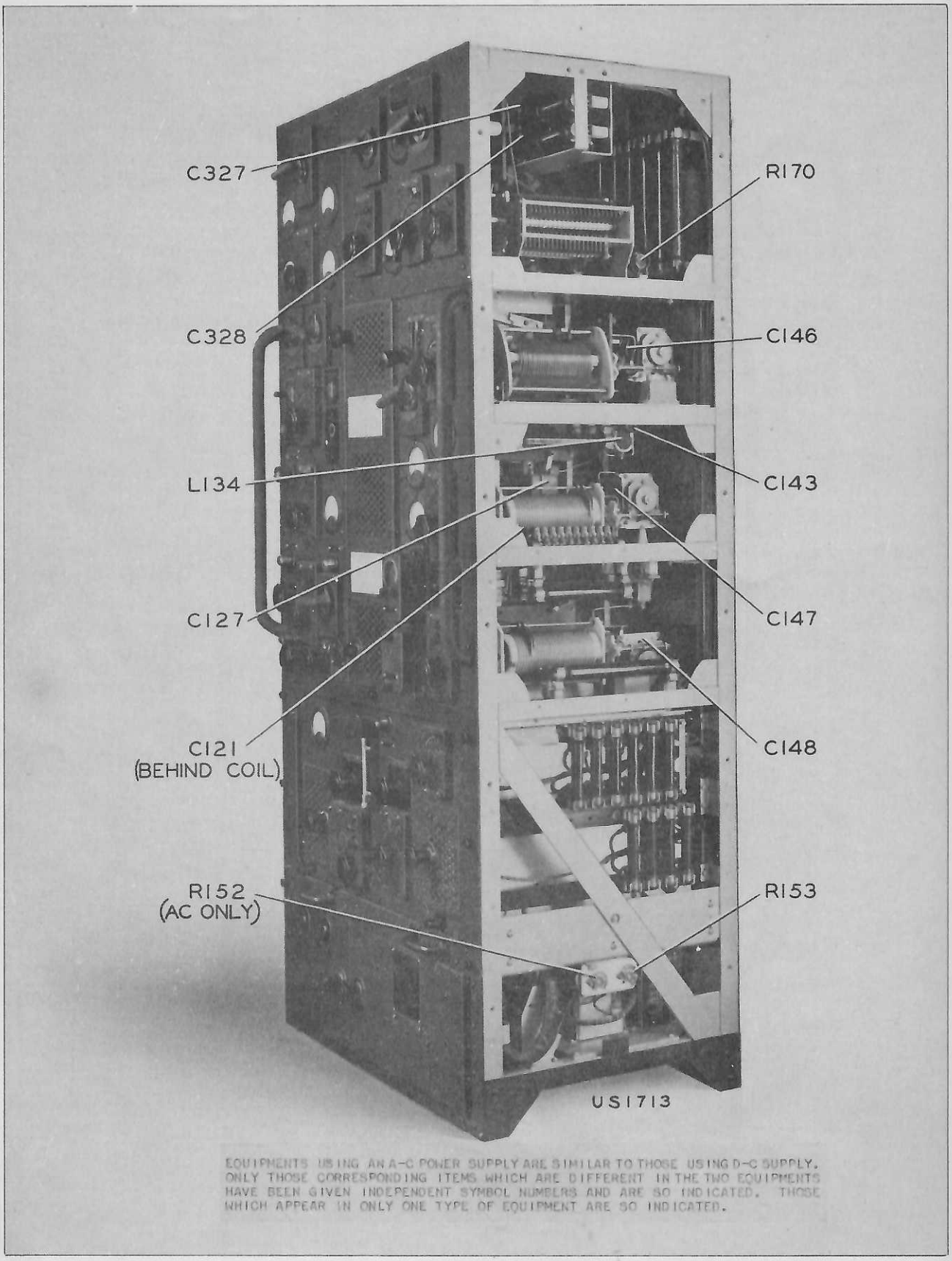


Figure 6—Transmitter, A-C Supply (R.H. Front View, Shields Removed)

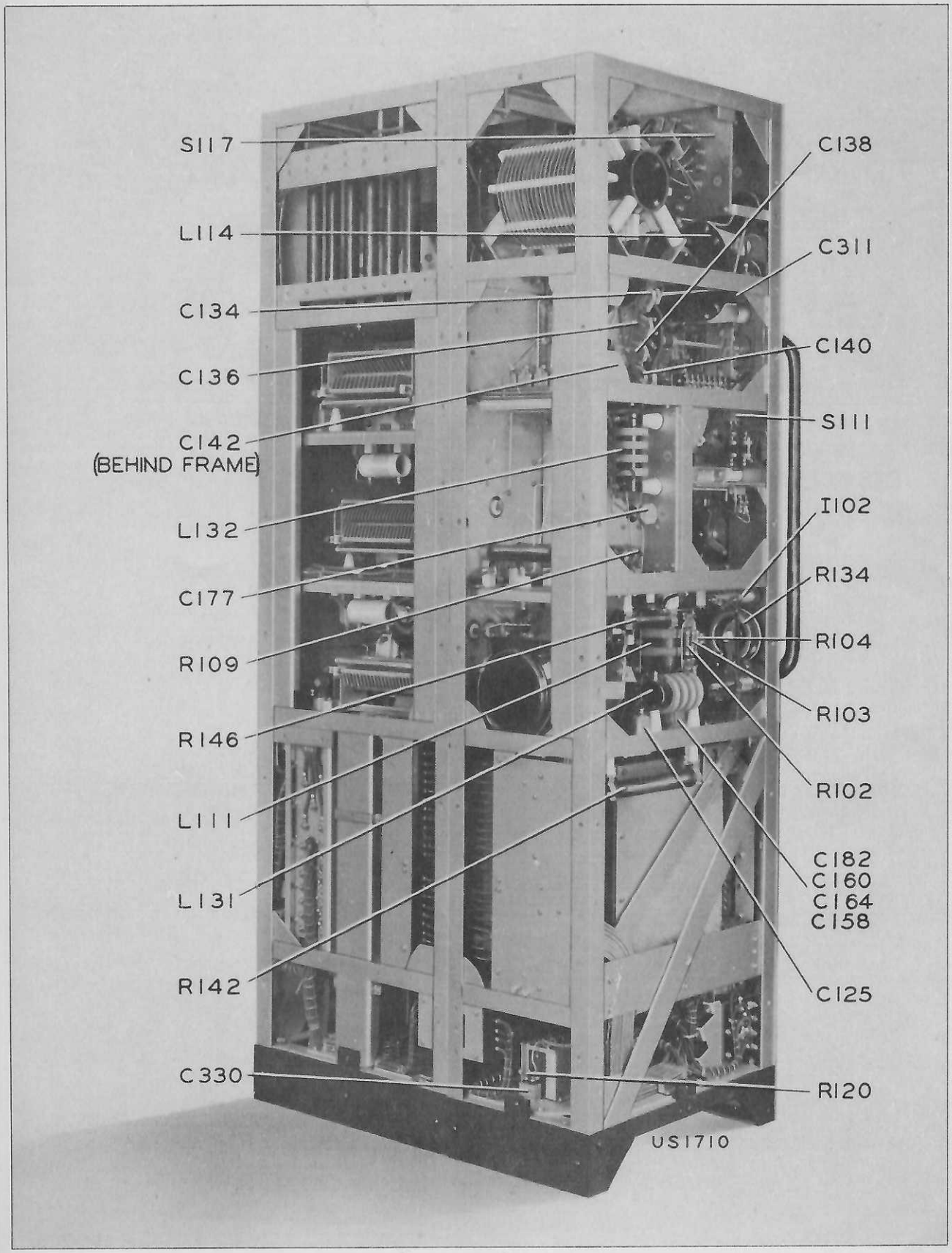


Figure 7—Transmitter, A-C Supply (L.H. Rear Oblique View, Shields Removed)

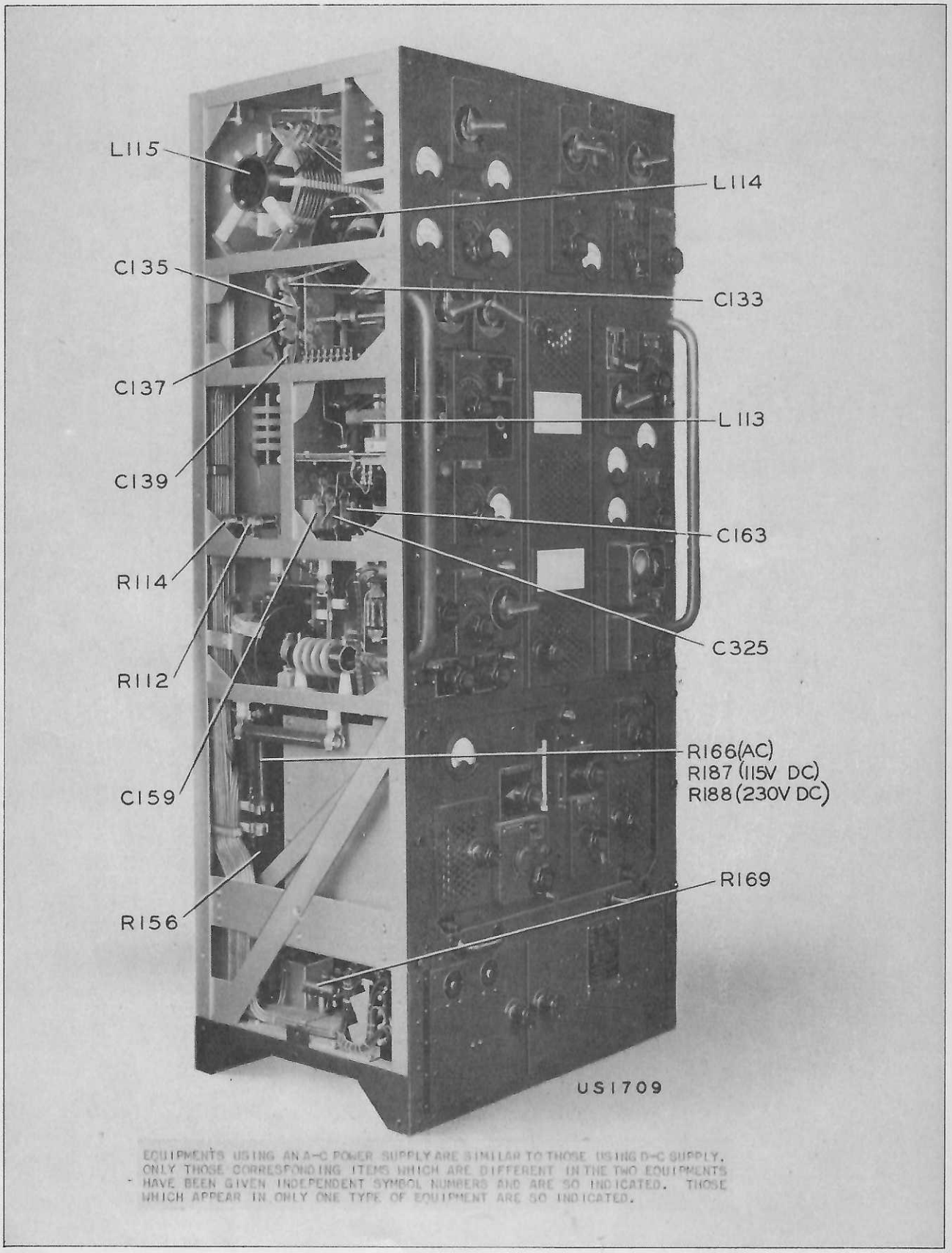


Figure 8—Transmitter, A-C Supply (L.H. Front Oblique View, Shields Removed)

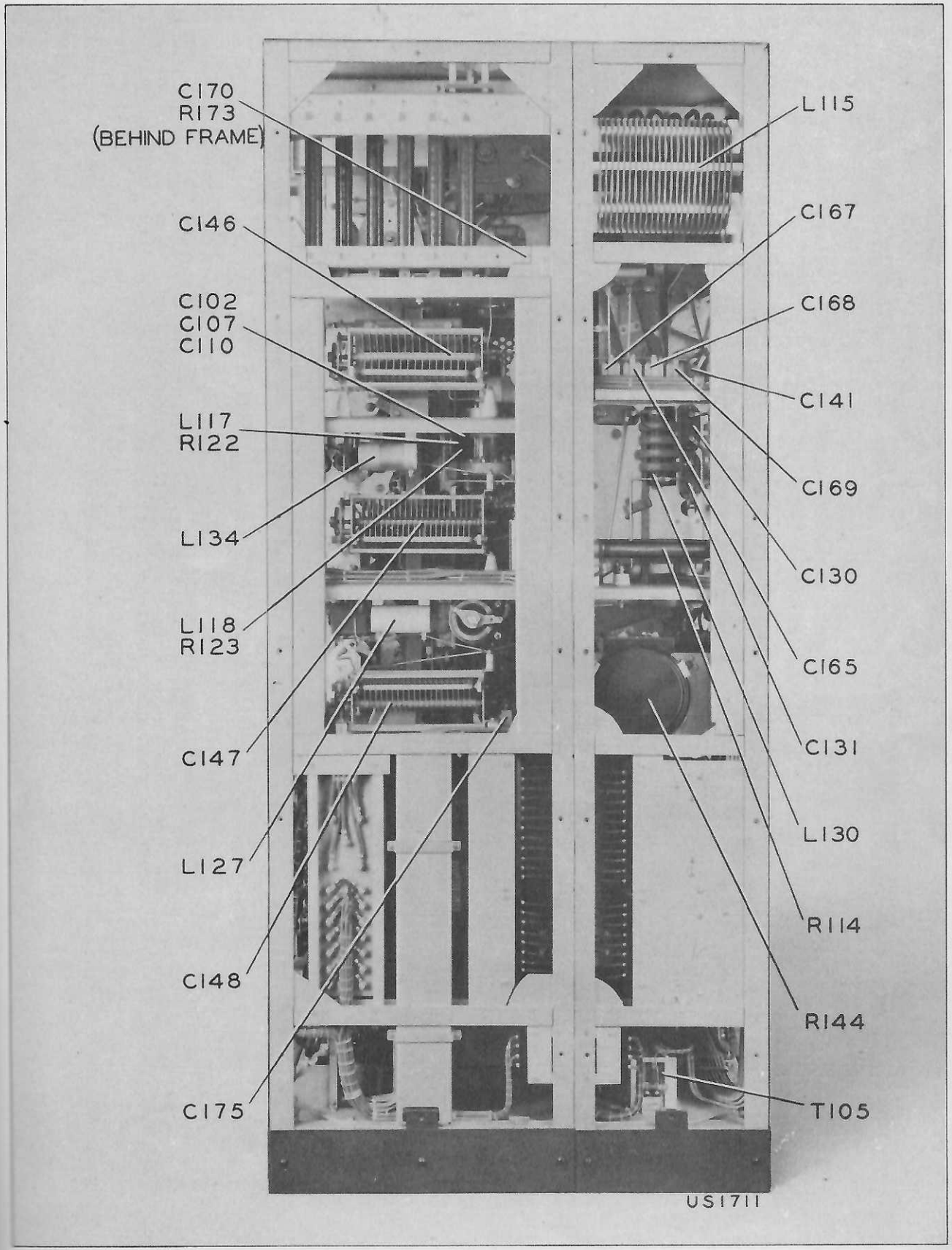


Figure 9—Transmitter, A-C Supply (Rear View, Shields Removed)

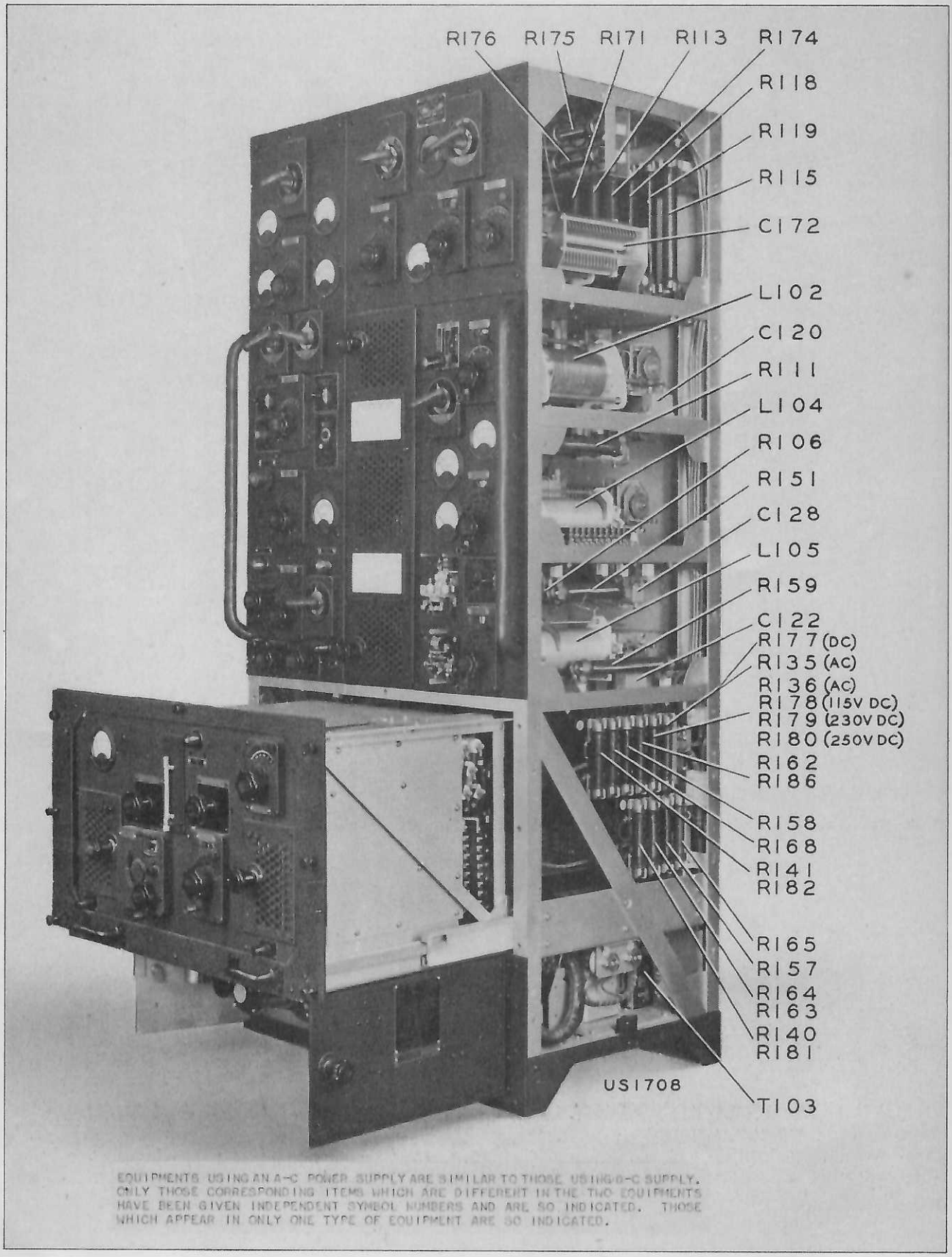


Figure 10—Transmitter, A-C Supply (Front View, Relay Covers Removed, Oscillator Unit Partially Removed)

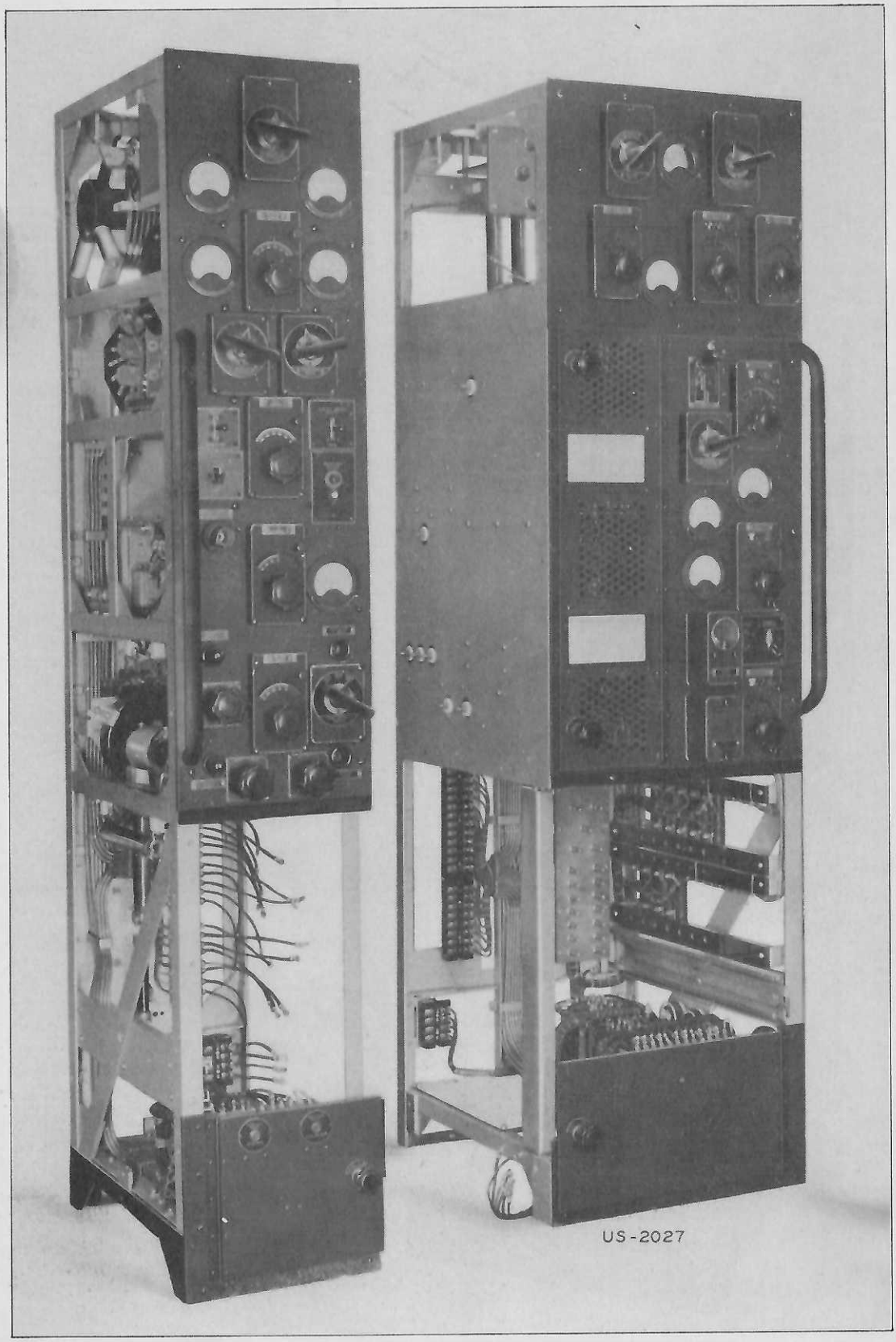


Figure 11—Transmitter, A-C Supply (Front Oblique View, H-F and I-F Units Separated)

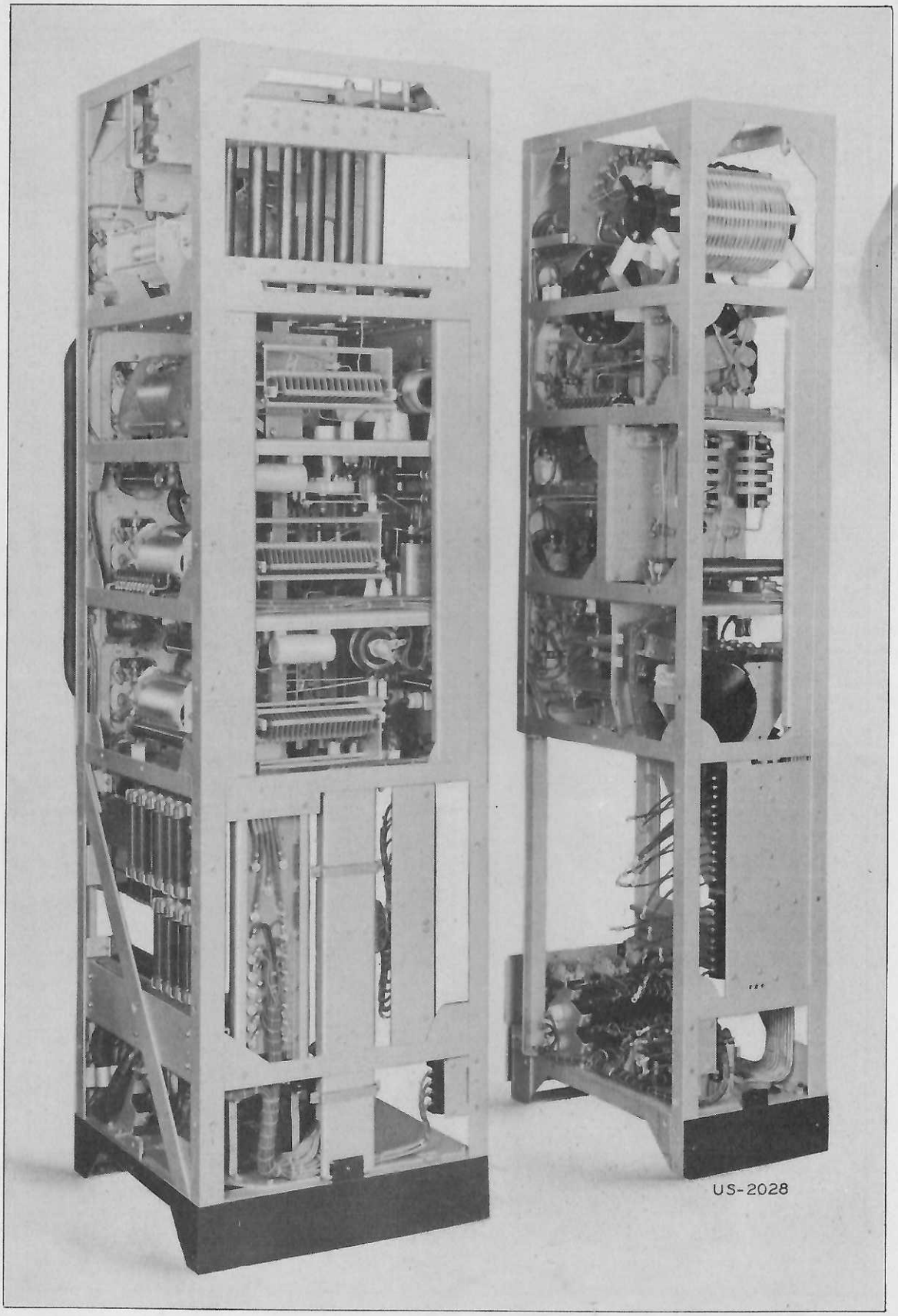


Figure 12—Transmitter, A-C Supply (Rear Oblique View, H-F and I-F Units Separated)

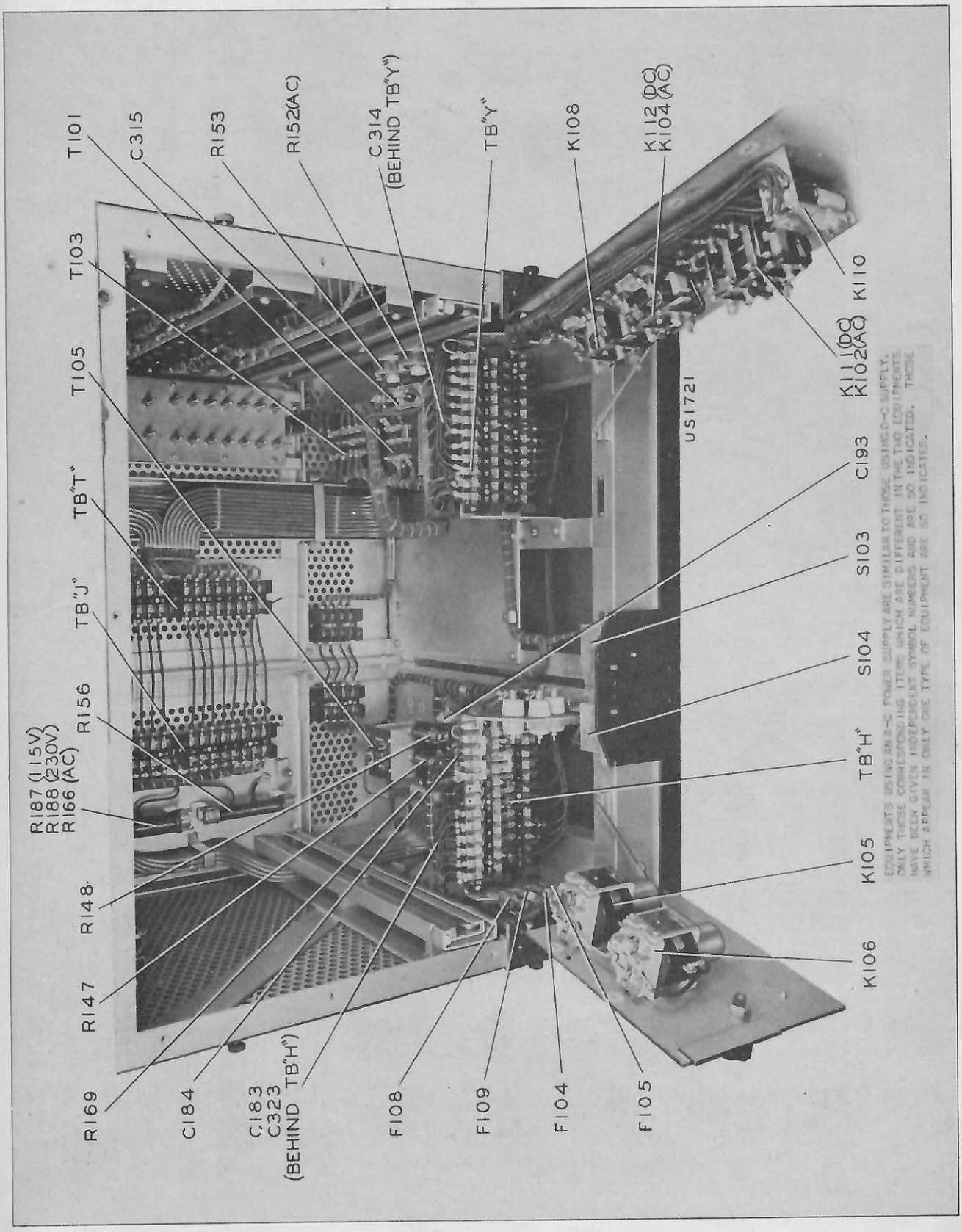


Figure 13—Transmitter, A-C Supply (Relay and Resistor Compartment, Front View)

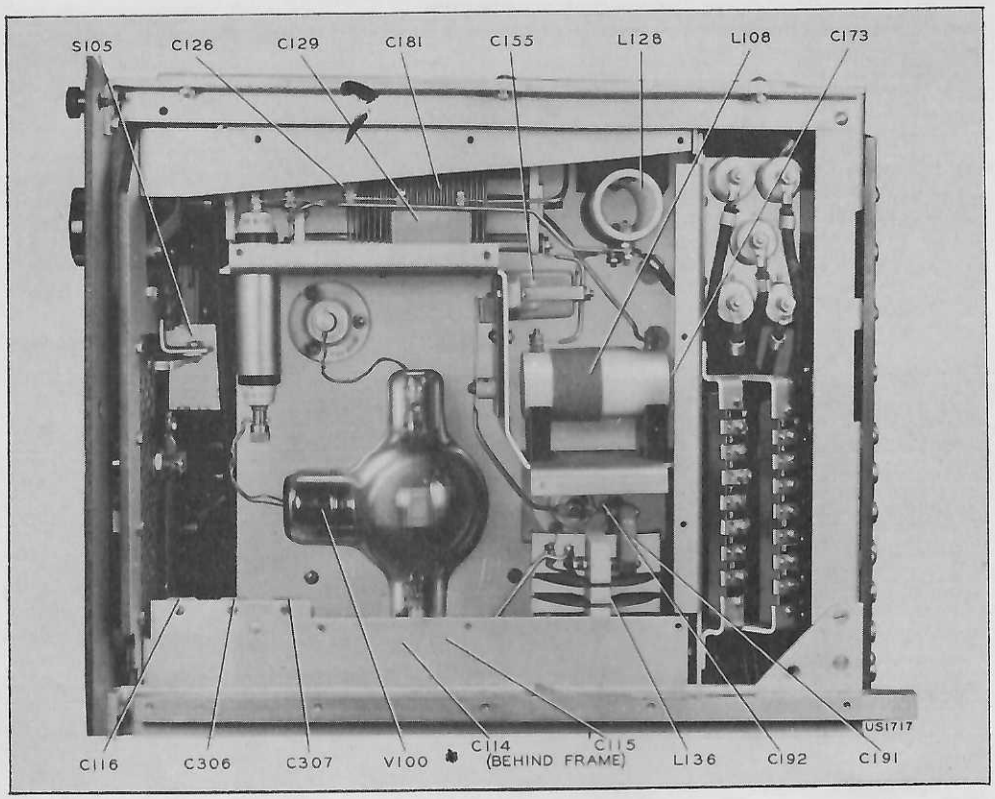


Figure 14—*Oscillator (Right Side View, Shields Removed)*

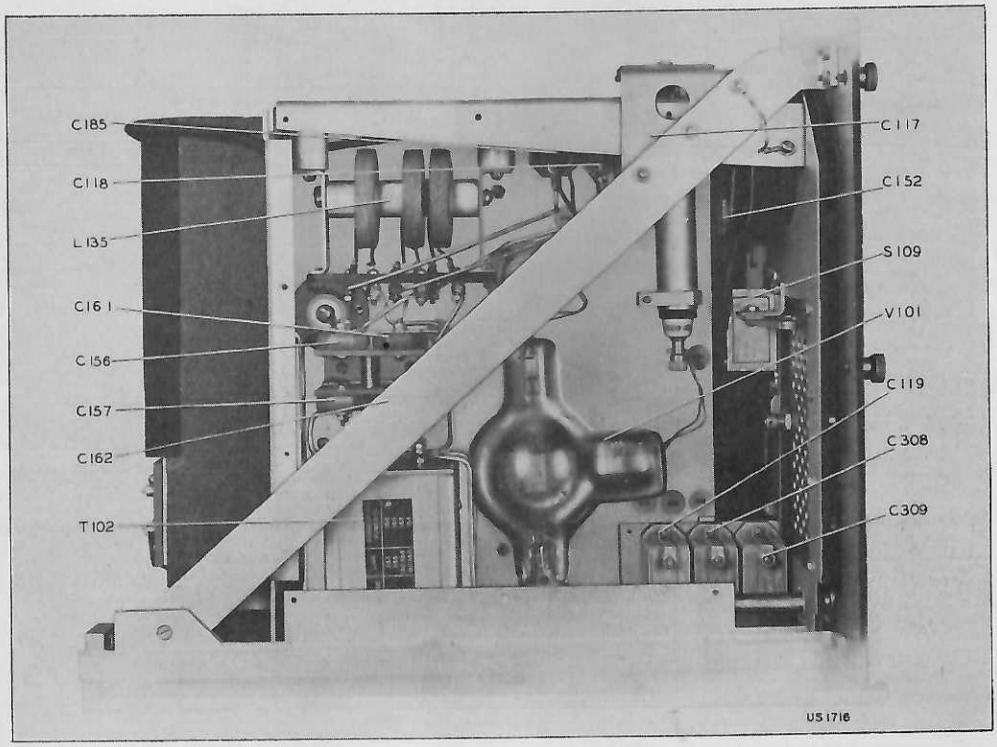


Figure 15—*Oscillator (Left Side View, Shields Removed)*

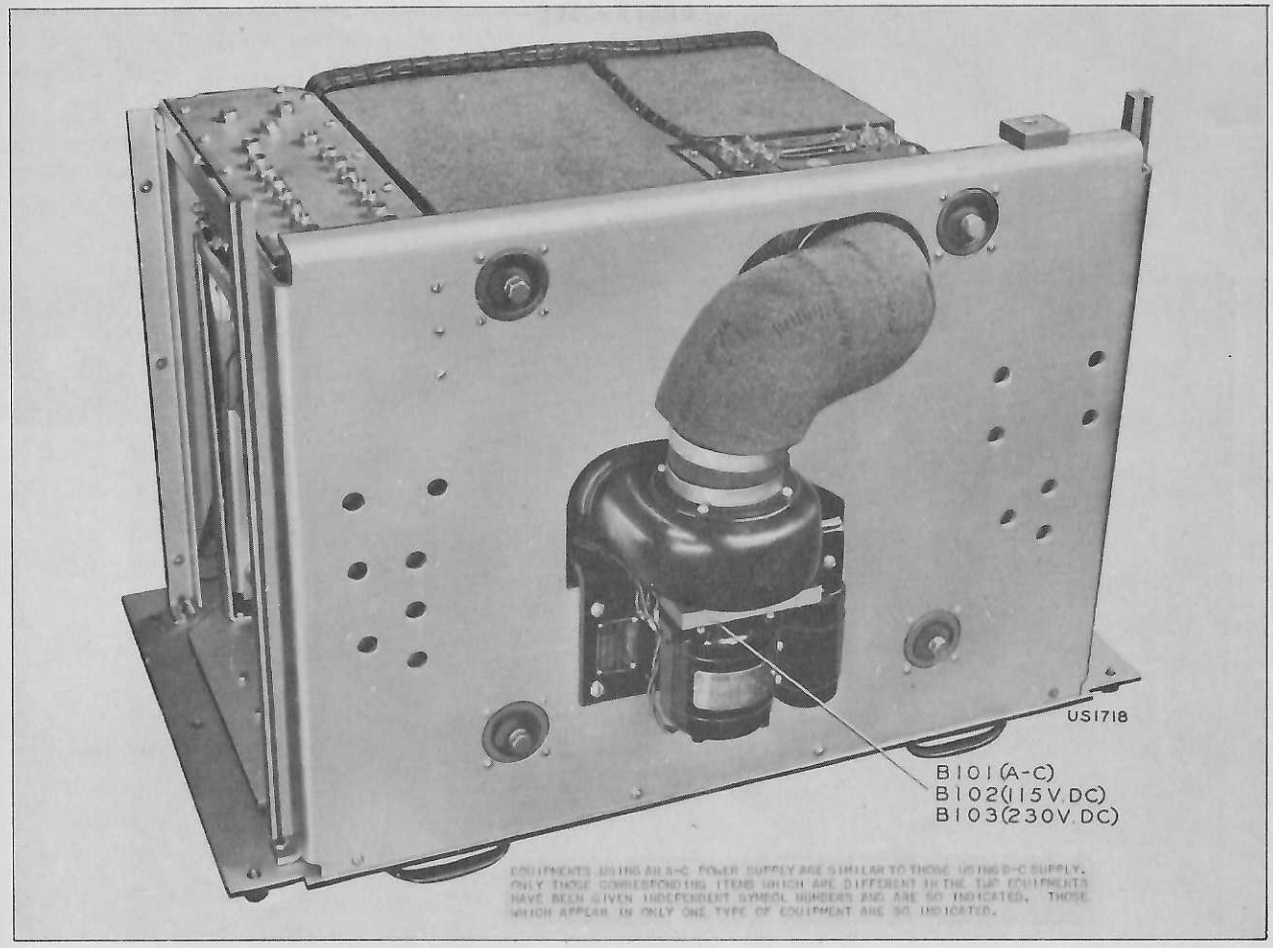


Figure 16—Oscillator (Bottom Oblique View, Shields Removed)

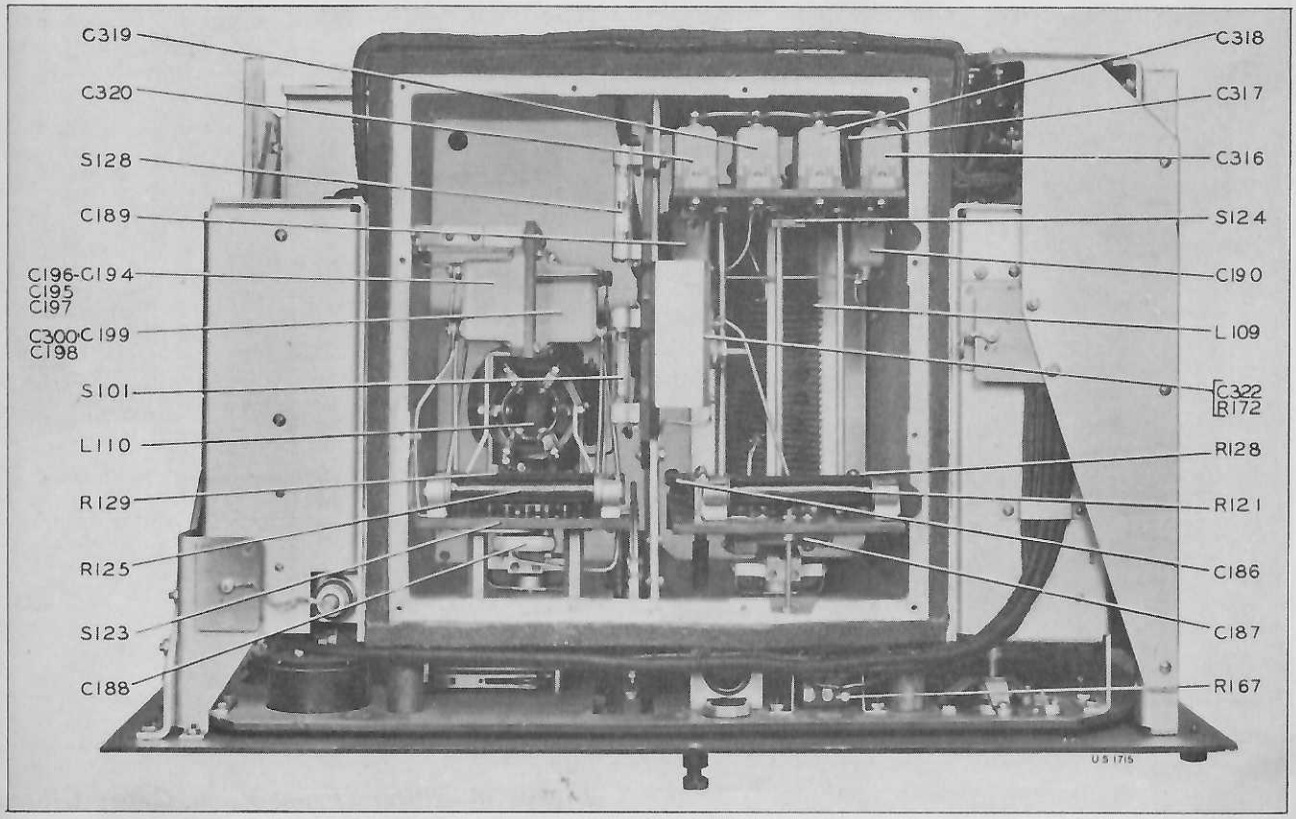


Figure 17—Oscillator (Top View, Shields Removed)

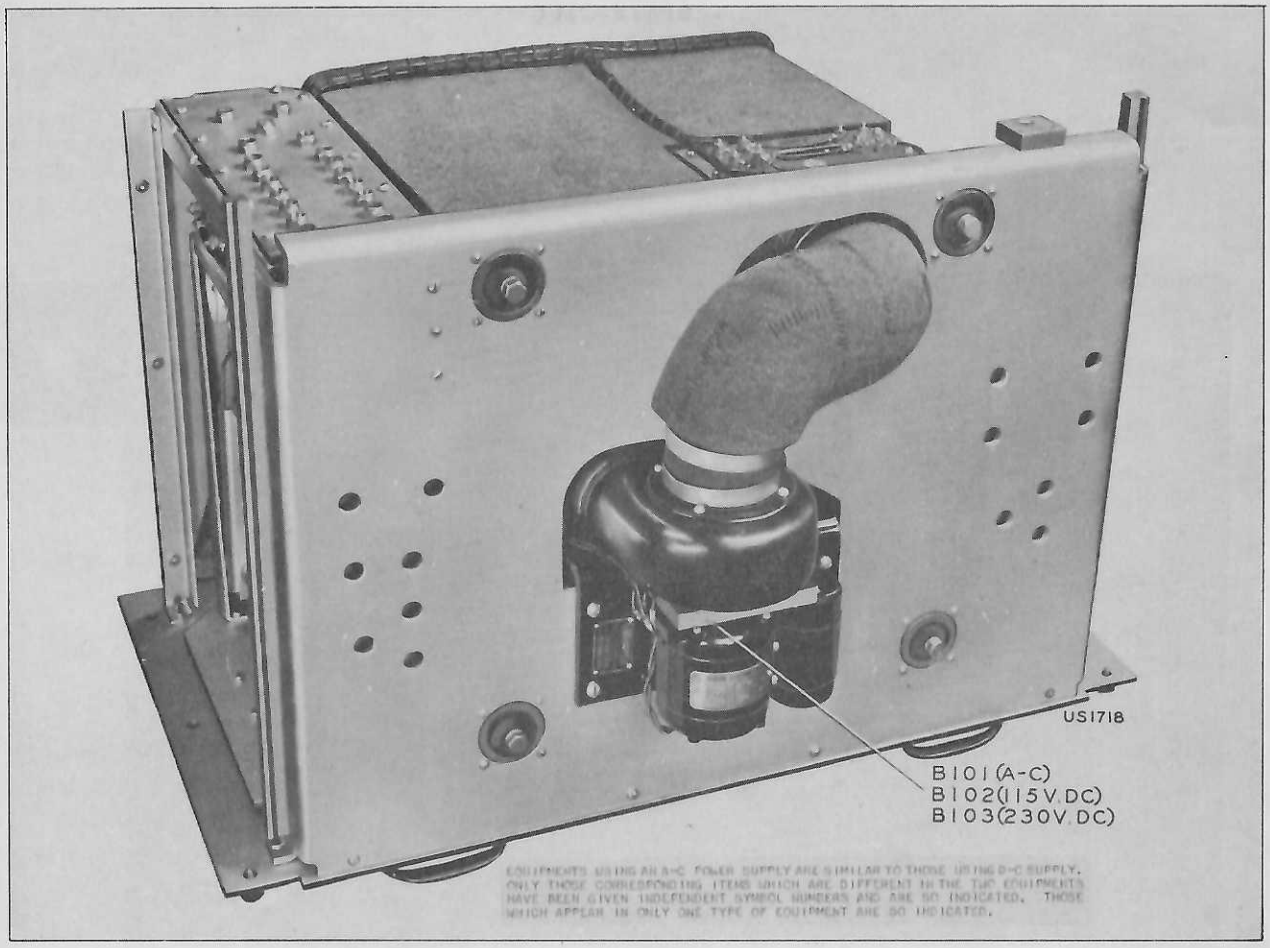


Figure 16—Oscillator (Bottom Oblique View, Shields Removed)

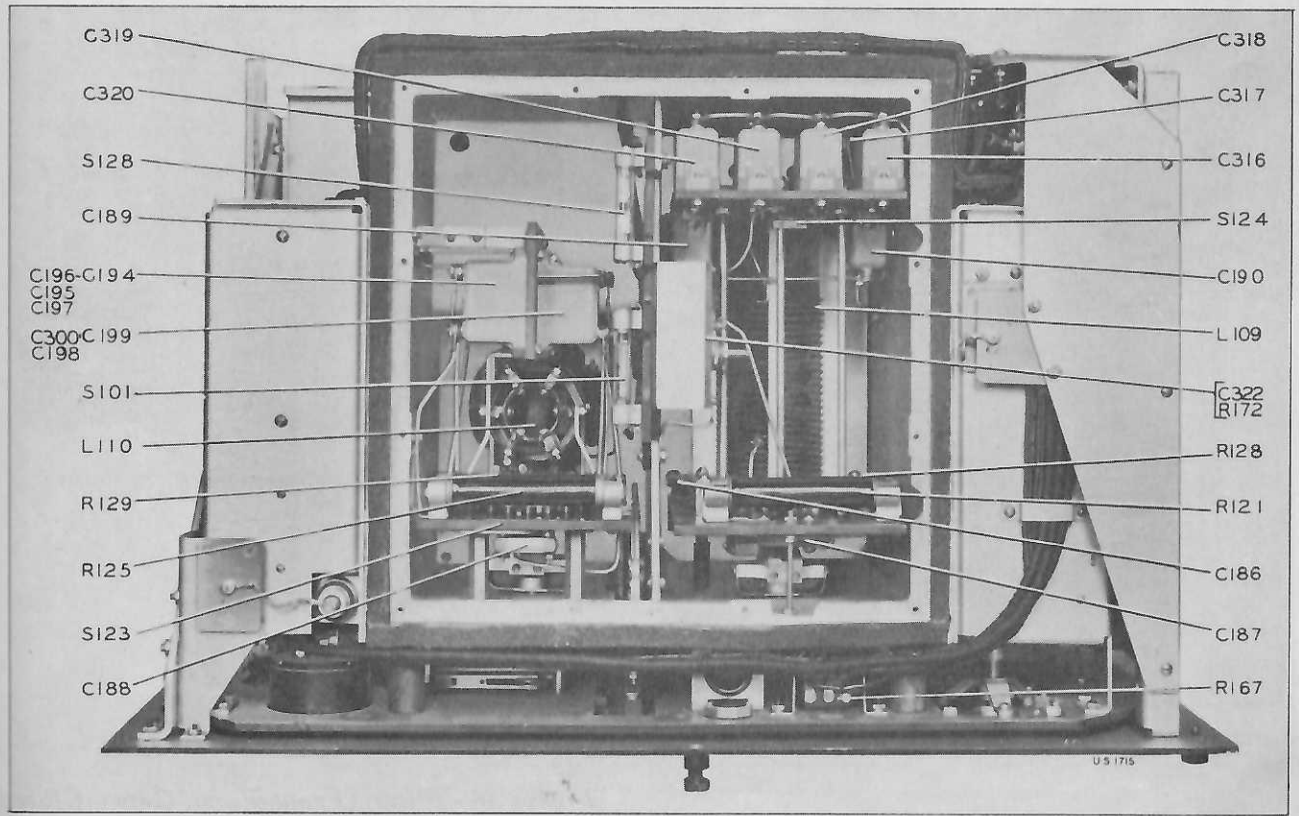


Figure 17—Oscillator (Top View, Shields Removed)

Figure 18—Filter (Front View, Cover Closed)

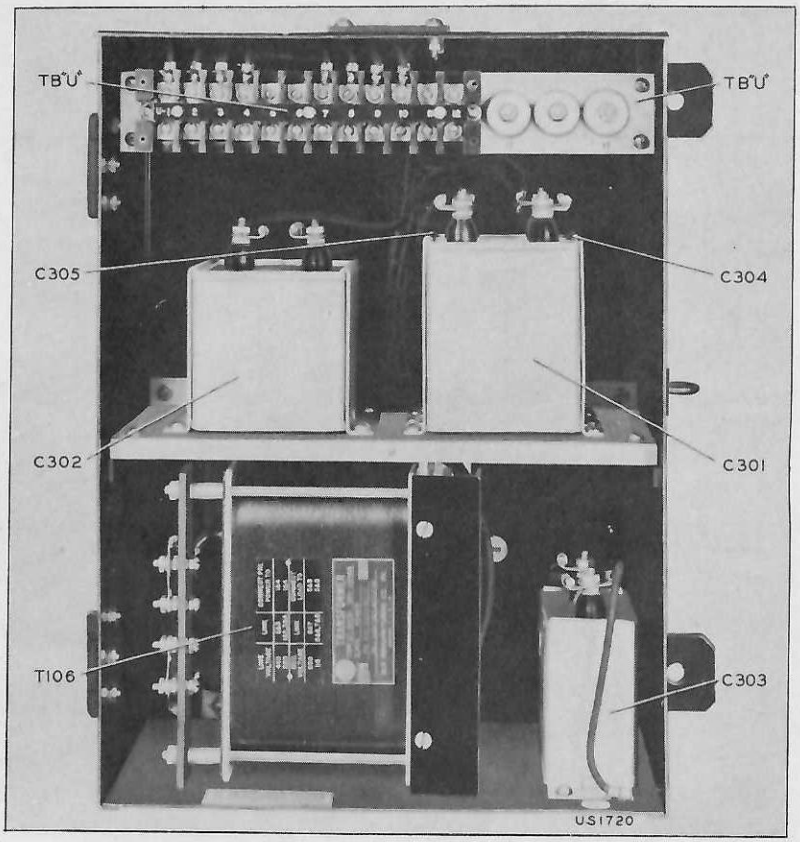


Figure 19—Filter, A-C Supply (Front View, Cover Open)

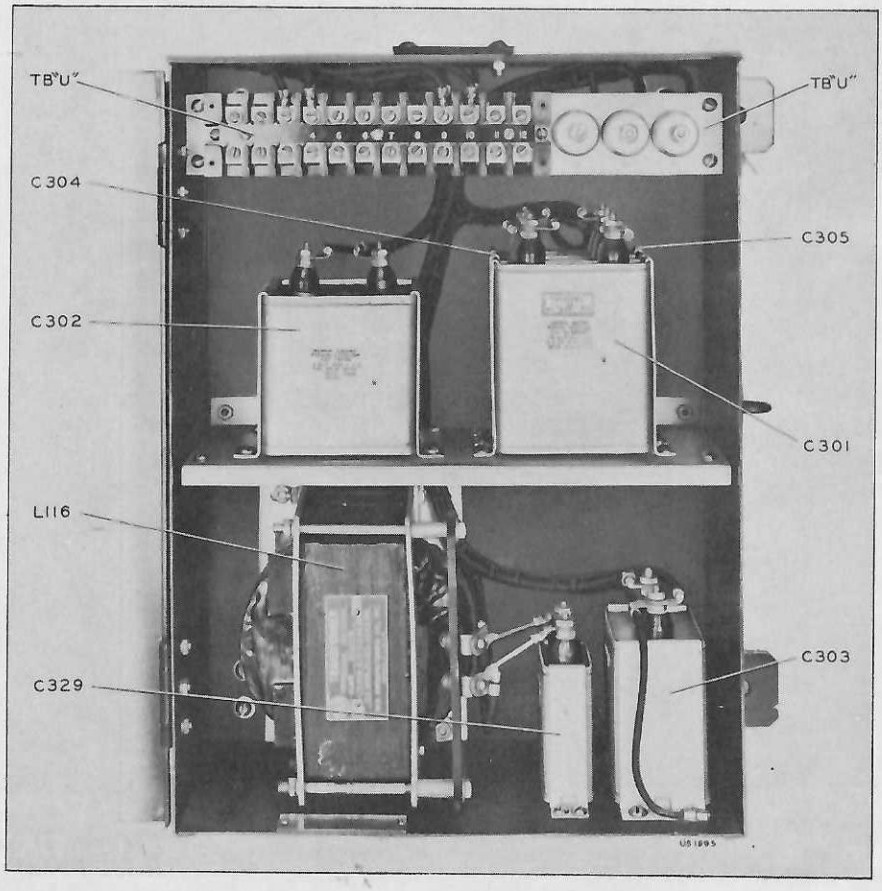


Figure 20—Filter, D-C Supply (Front View, Cover Open)

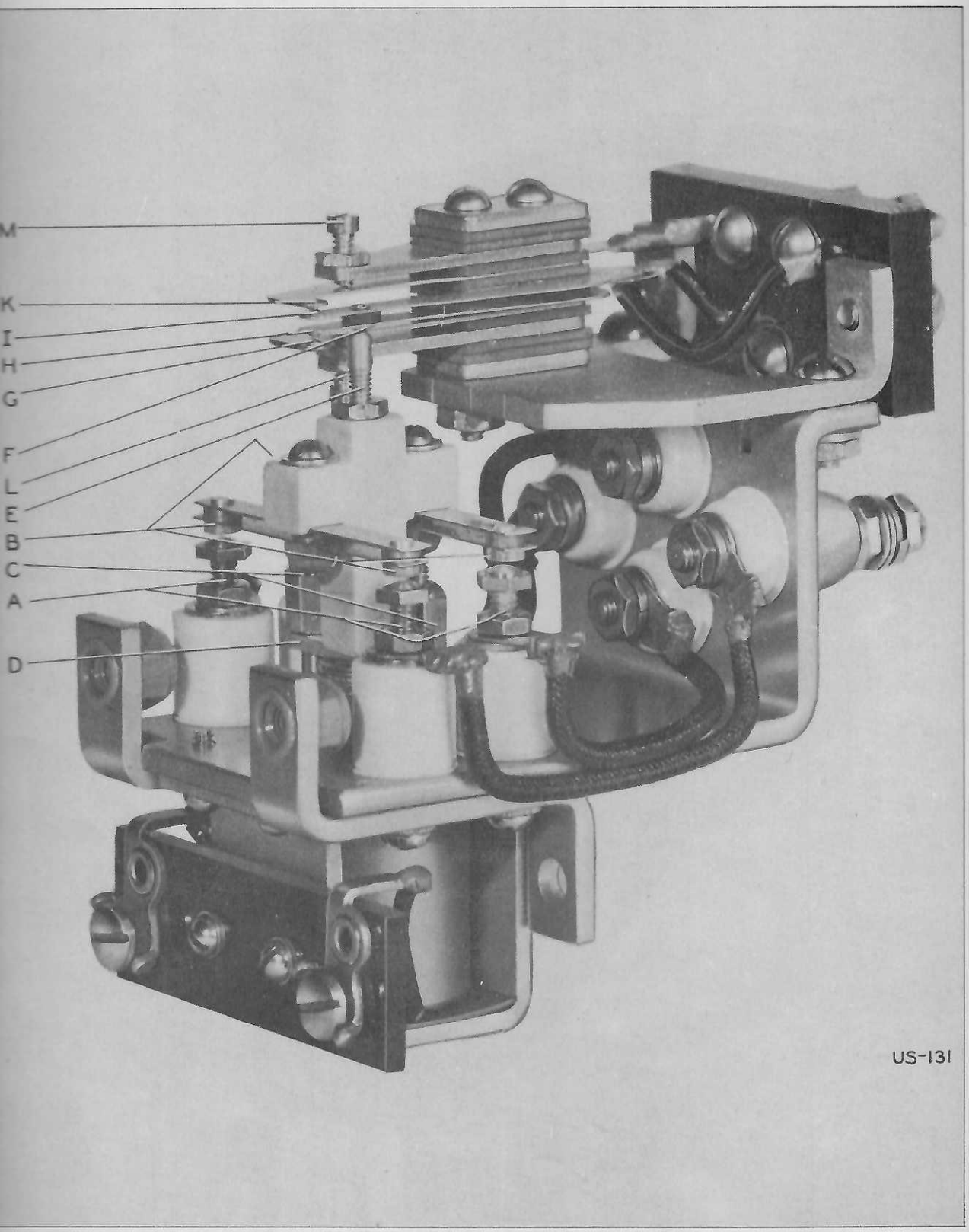


Figure 21—Keying Relay
(R.H. Front Oblique View)

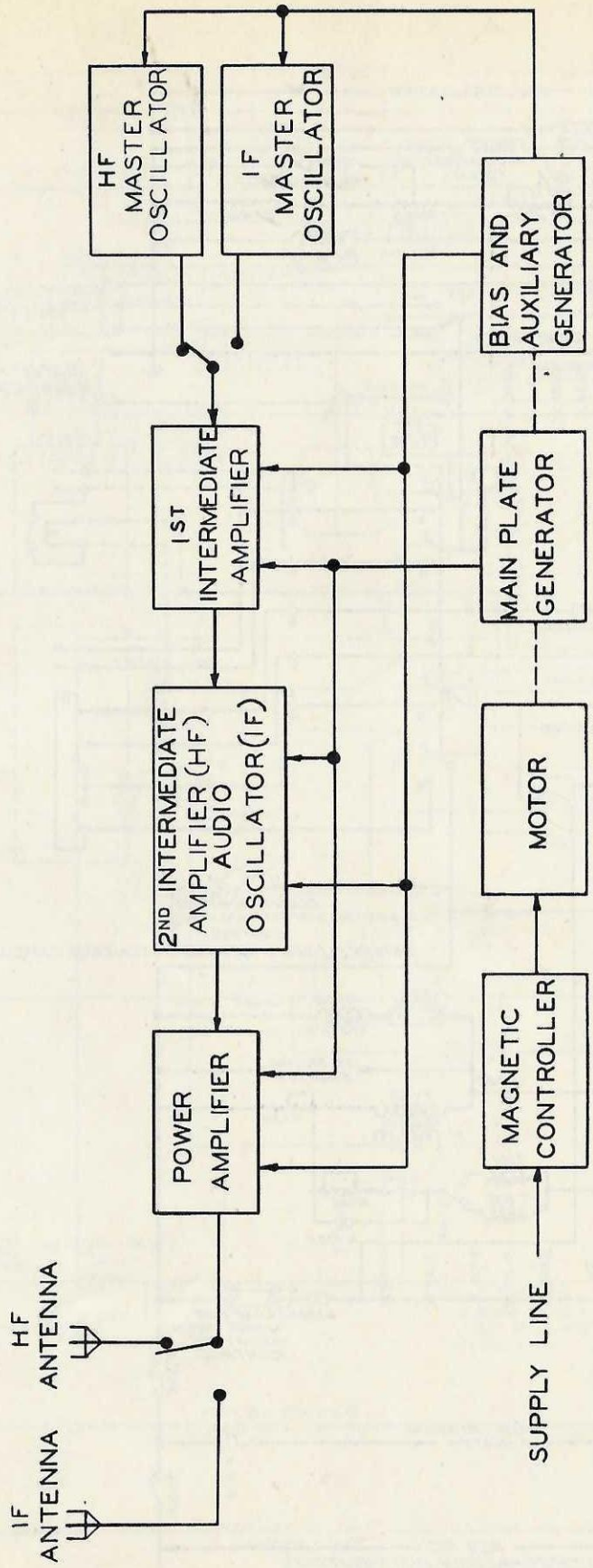


Figure 22—Block Diagram (M-439751)

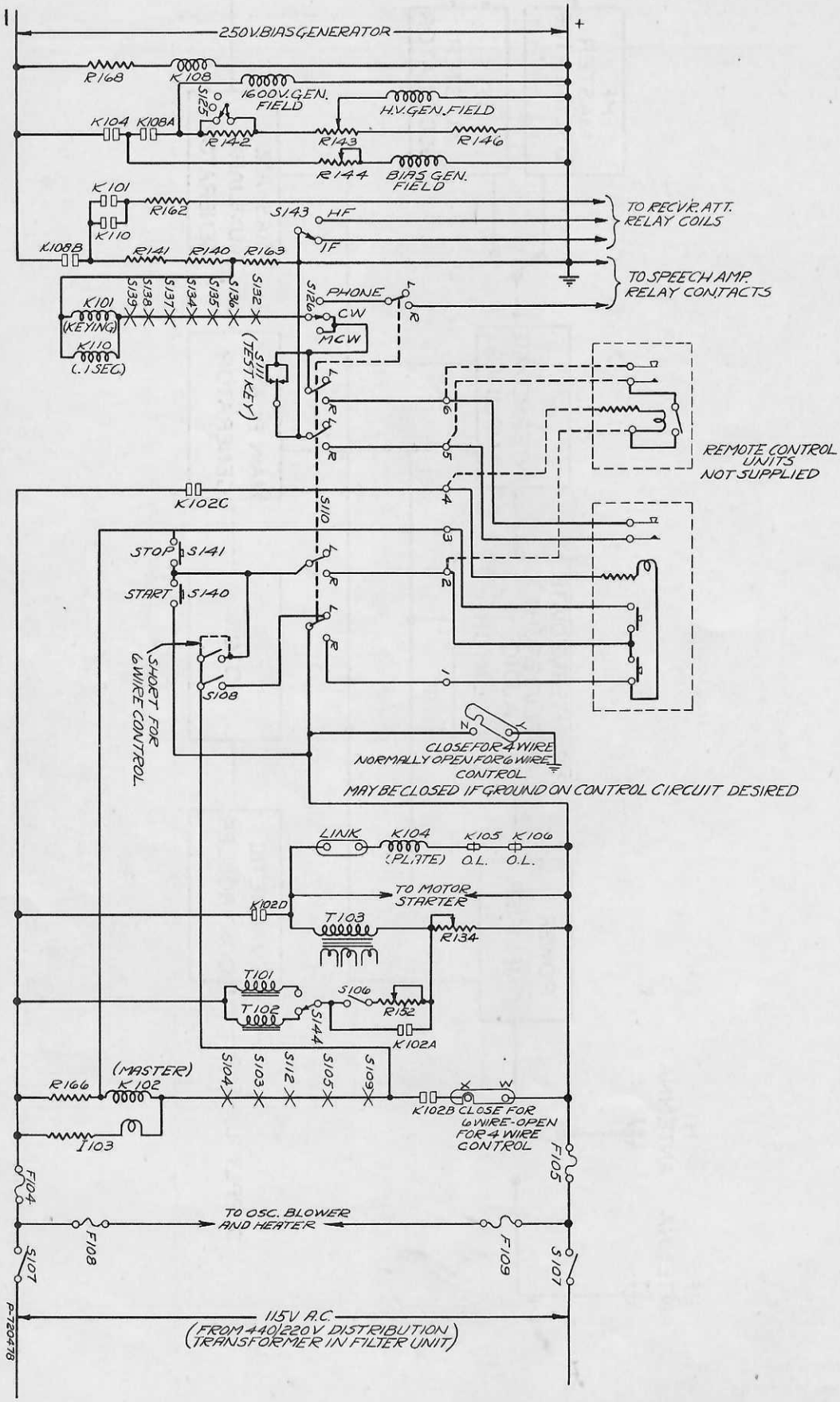


Figure 23—Transmitting Equipment, 220/440 volts a-c (Simplified Control Circuits P-720478)

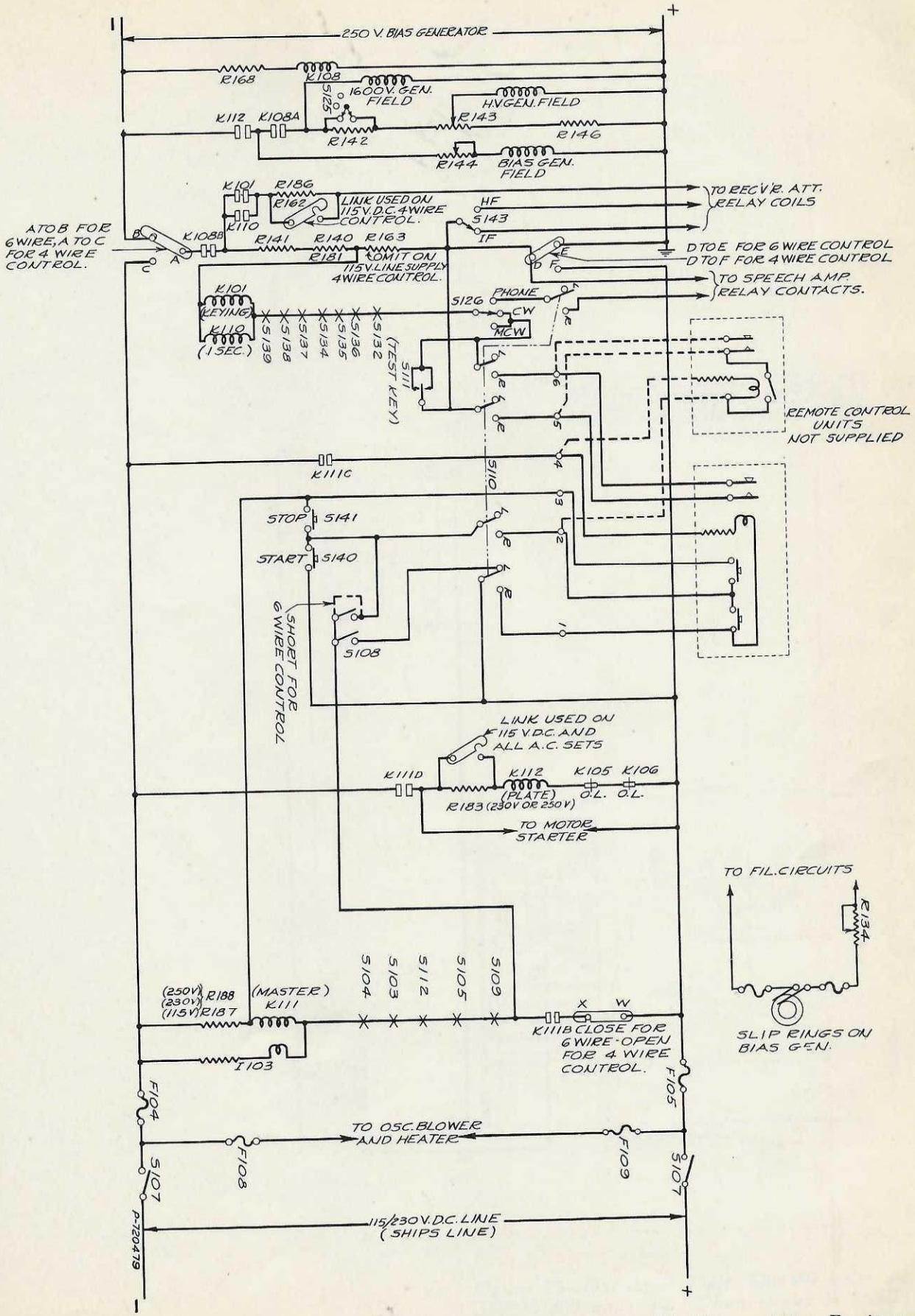
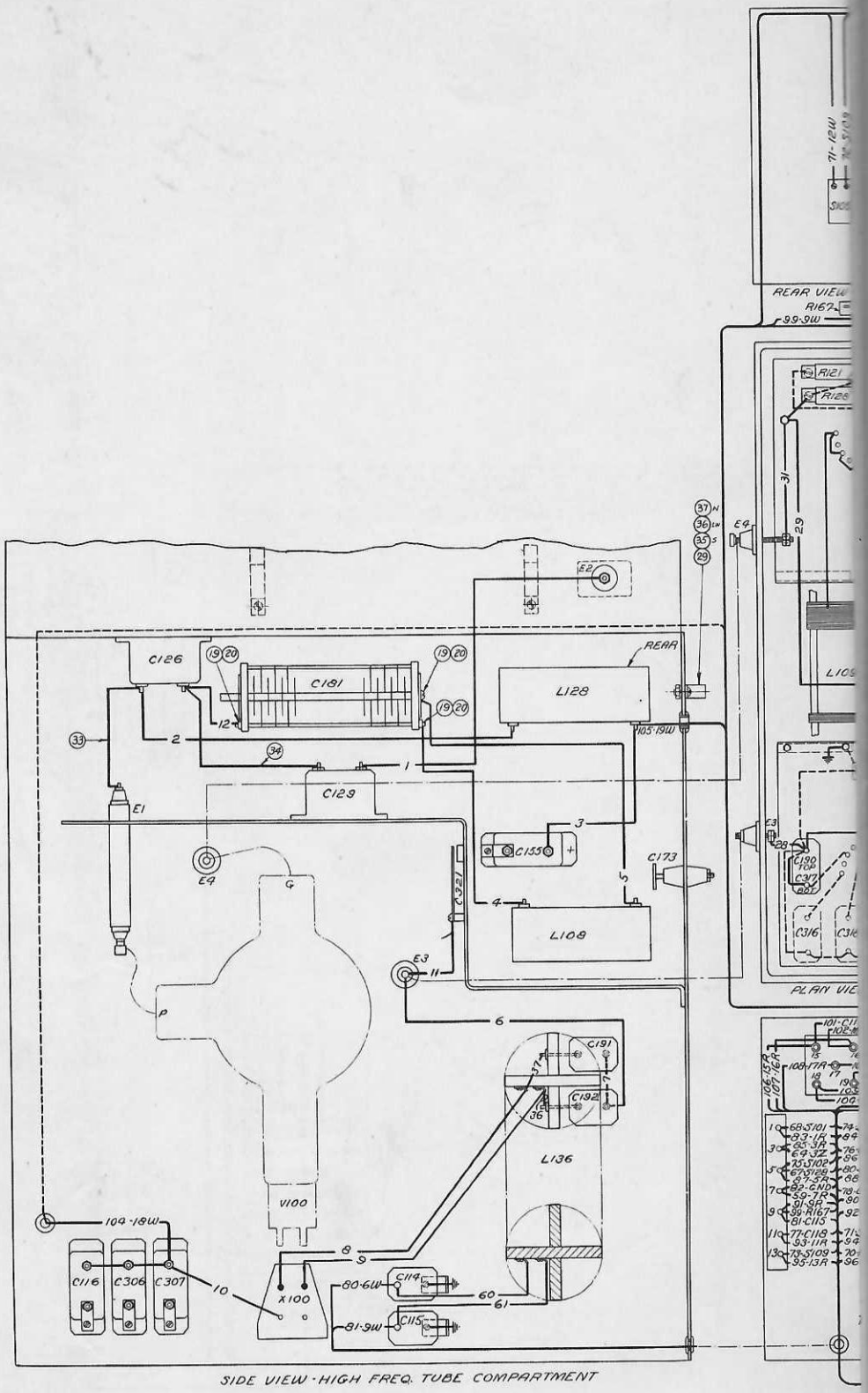
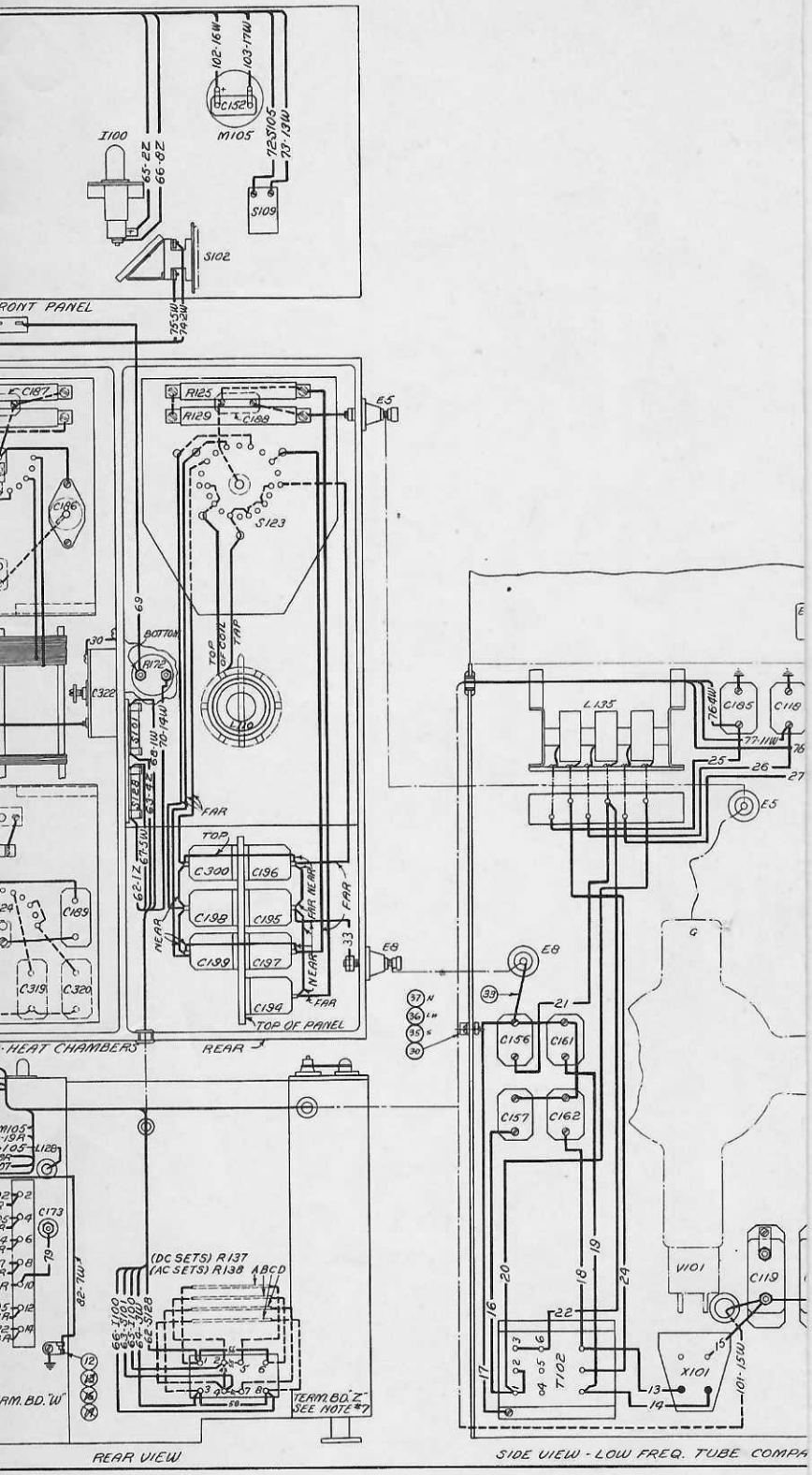
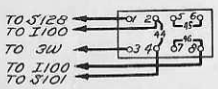


Figure 24—Transmitting Equipment, 115/230/250 volts d-c (Simplified Control Circuits P-720479)

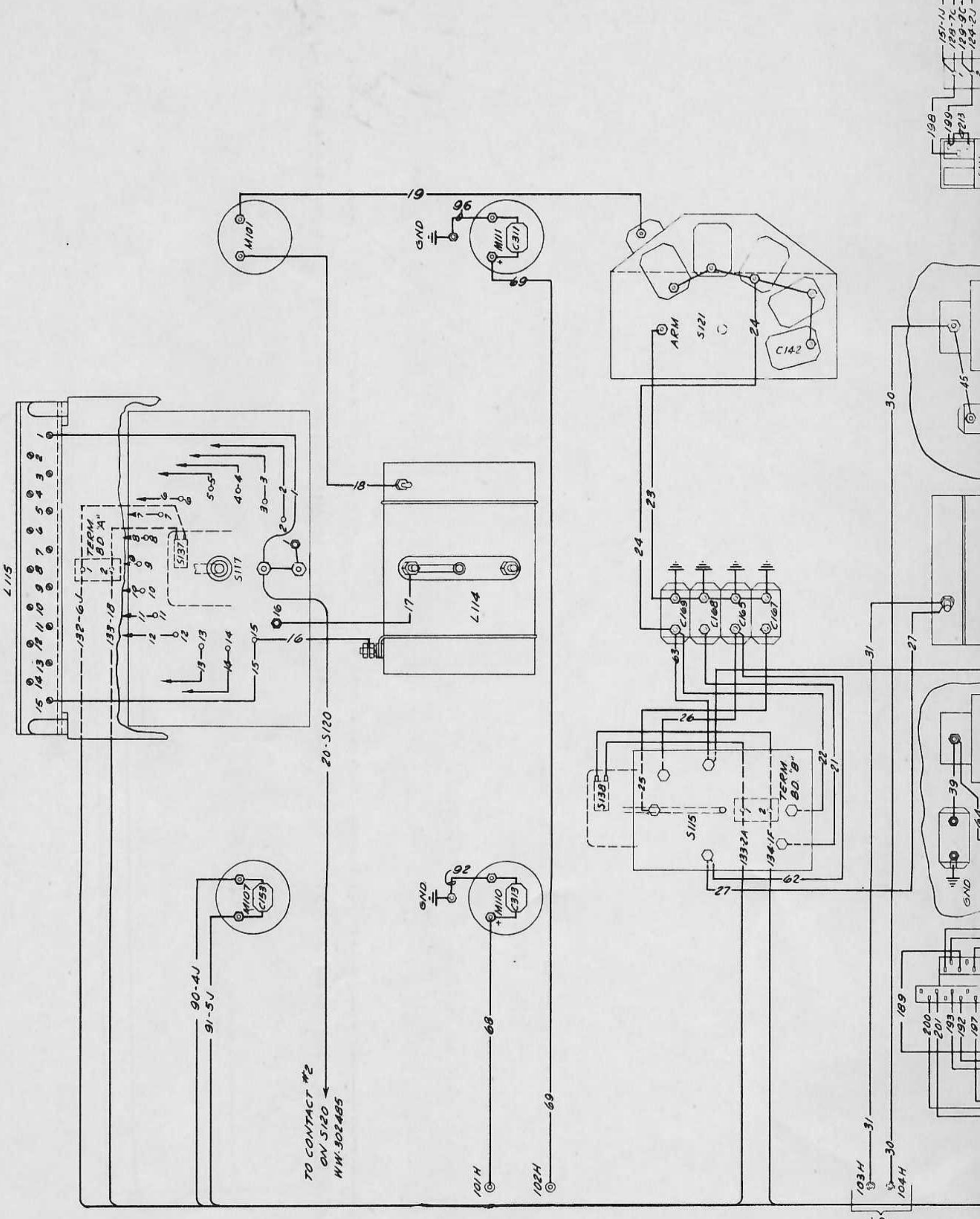


SIDE VIEW - HIGH FREQ. TUBE COMPARTMENT

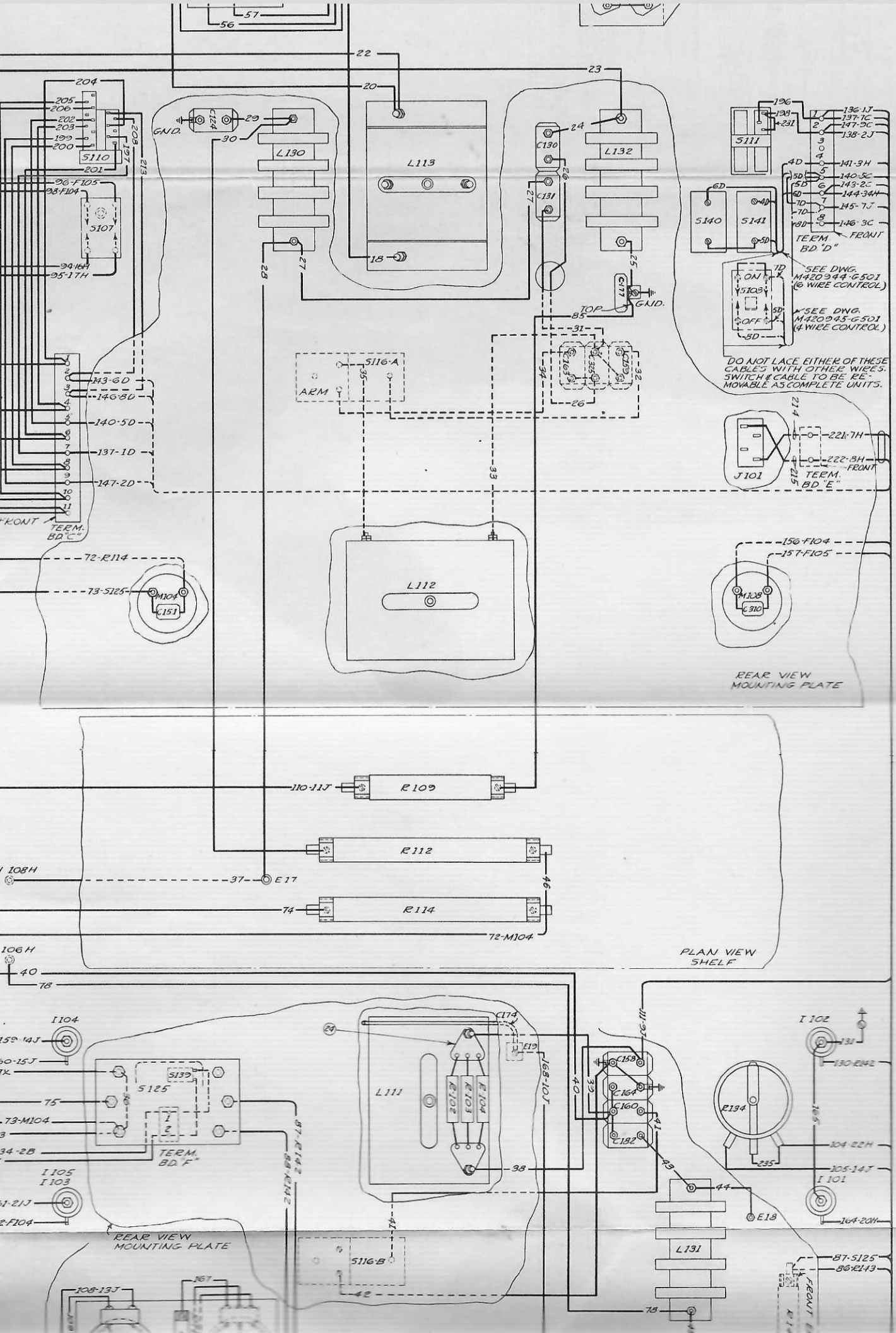




HEATER TERMINAL BOARD ("Z")
WIRING FOR EQUIPMENTS WHICH
OPERATE FROM 230 V. D.C. OR
250 V. D.C. LINE SUPPLY.


L115
TERM BD "A"
S117
S137
L114
M101
M111
C311
GND
S121
ARM
C142
C169
C168
C165
C167
S138
S115
TERM BD "B"
M107
C153
M110
C313
TO CONTACT #2 ON S120 WW-302485
20-S120
90-4J
91-5J
101H
102H
103H
104H
THESE BUSHINGS LOCATED IN H.F. UNIT

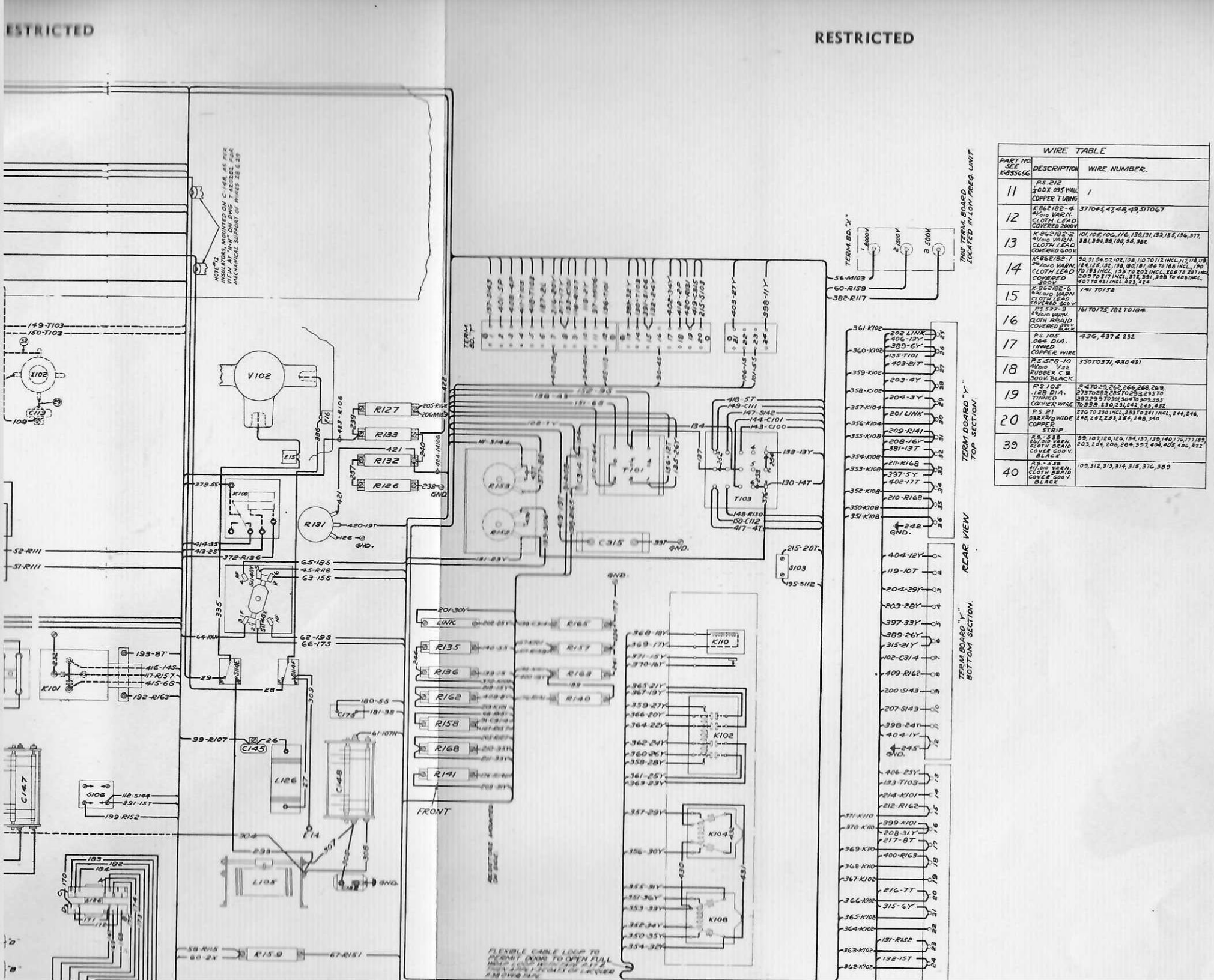
RESTRICTED


RESTRICTED
RESTRICTED
L130
L113
L132
L112
L111
L131
S110
S107
S111
S140
S141
S116-A
S116-B
S125
S139
C130
C131
C171
C174
C158
C164
C160
C182
C161
C235
C159
C310
R109
R112
R114
R102
R103
R104
E17
E18
E19
E134
I102
I101
I104
I105
I103
J101
M104
M108
ARM
GND.
TOP
FRONT
TERM. BD "C"
TERM. BD "D"
TERM. BD "E"
TERM. BD "F"
REAR VIEW MOUNTING PLATE
PLAN VIEW SHELF
SEE DWG. M420944-G501 (6 WIRE CONTROL)
SEE DWG. M420945-G501 (4 WIRE CONTROL)
DO NOT LACE EITHER OF THESE CABLES WITH OTHER WIRES. SWITCH & CABLE TO BE REMOVABLE AS COMPLETE UNITS.

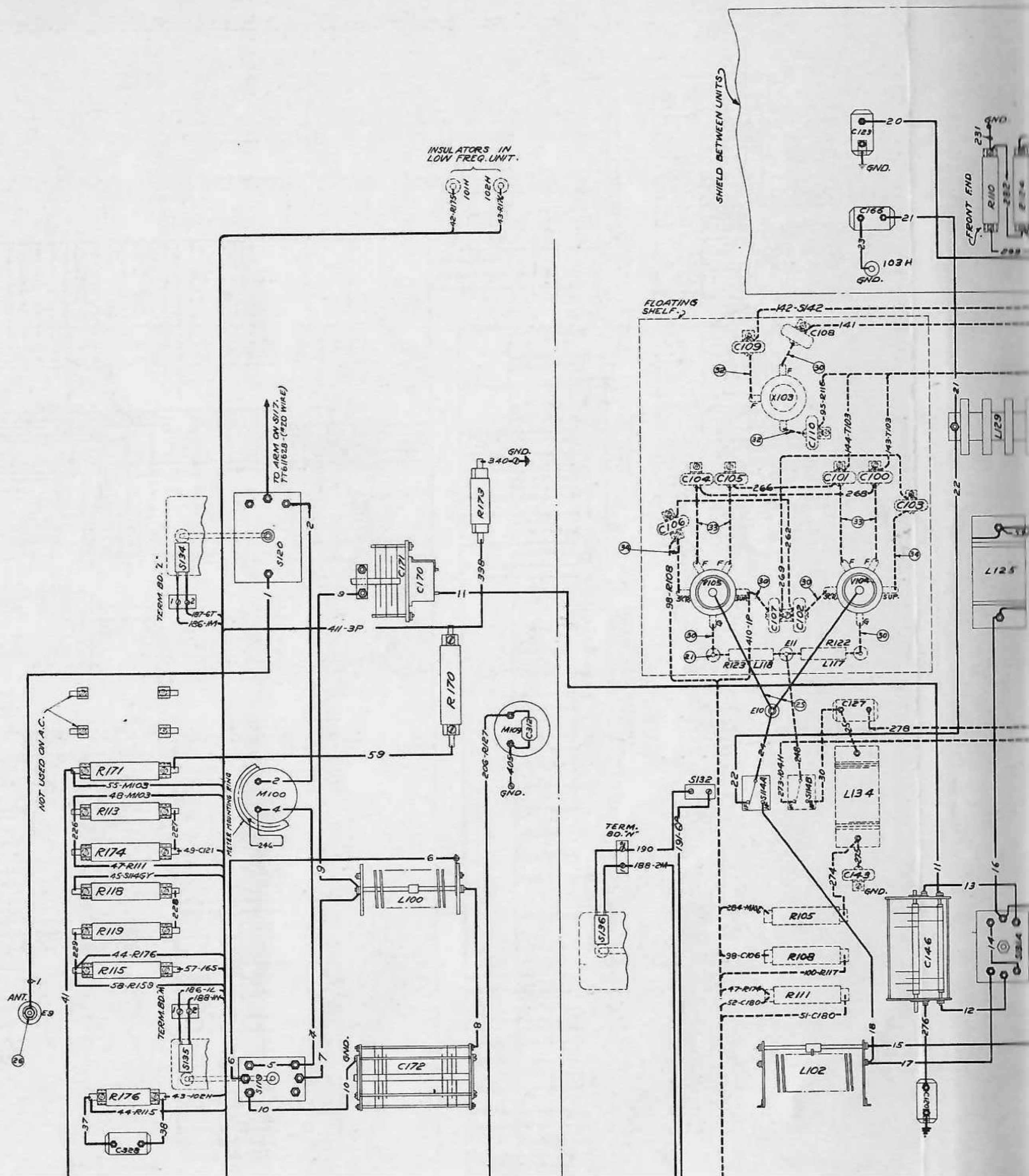
RESTRICTED

RESTRICTED

RESTRICTED

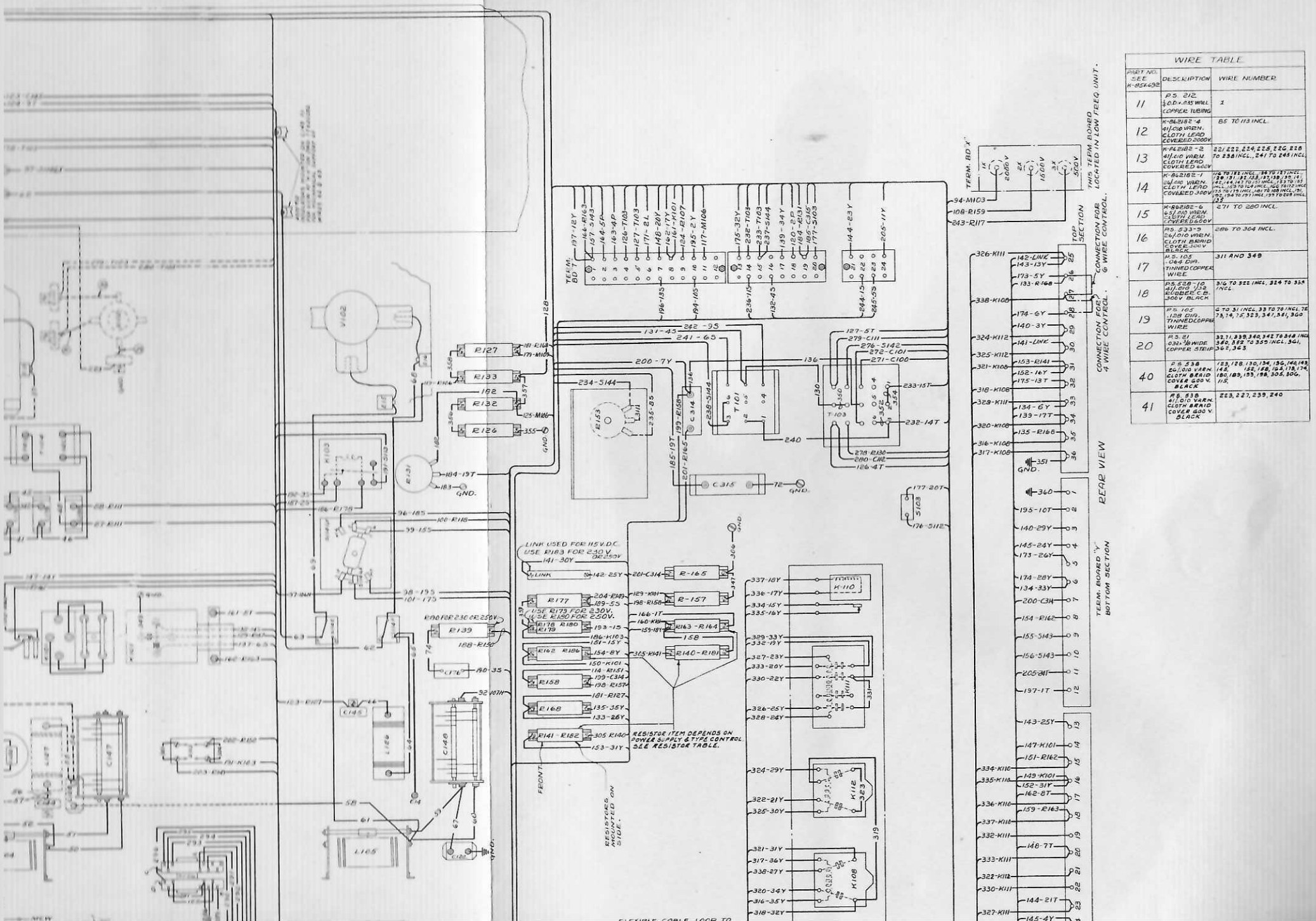


WIRE TABLE		
PART NO. SEE K-855656	DESCRIPTION	WIRE NUMBER.
11	P.S. 212 $\frac{1}{4}$ O.D. X .035 WALL COPPER TUBING	1
12	K-862182-4 $4\frac{1}{2}$/1000 VARN. CLOTH LEAD COVERED 2000V	37, 7045, 47, 48, 49, 51, 1067
13	K-862182-2 $4\frac{1}{2}$/1000 VARN. CLOTH LEAD COVERED 600V.	101, 105, 106, 116, 130, 131, 133, 135, 136, 377, 381, 390, 98, 100, 96, 382
14	K-862182-1 $2\frac{6}{10}$/1000 VARN. CLOTH LEAD COVERED 600V.	93, 91, 84, 87, 102, 108, 110 TO 112 INCL., 113, 118, 119, 124, 125, 132, 138, 180, 181, 186 TO 188 INCL., 190 TO 193 INCL., 196 TO 202 INCL., 208 TO 281 INCL., 283 TO 287 INCL., 378, 381, 388 TO 405 INCL., 407 TO 421 INCL. 423, 424
15	K-862182-6 $6\frac{6}{10}$/1000 VARN. CLOTH LEAD COVERED 600V.	141 TO 152
16	P.S. 533-9 $2\frac{6}{10}$/1000 VARN. CLOTH BRAID COVERED 300V. BLACK	161 TO 175, 182 TO 184
17	P.S. 105 .064 DIA. TINNED COPPER WIRE	436, 437 & 232
18	P.S. 588-10 $\frac{14}{1000}$ $\frac{1}{32}$ RUBBER C.B. 300V. BLACK	350 TO 371, 430 451
19	P.S. 105 .128 DIA. TINNED COPPER WIRE	24 TO 29, 242, 266, 268, 269, 273 TO 278, 285 TO 293, 295 TO 297, 299 TO 301, 304 TO 309, 335 TO 338, 230, 231, 242, 245, 432
20	P.S. 21 .032 X $\frac{1}{8}$ WIDE COPPER STRIP	226 TO 230 INCL., 233 TO 241 INCL., 244, 246, 248, 262, 263, 264, 298, 340
39	P.S. 538 $2\frac{6}{10}$/1000 VARN. CLOTH BRAID COVER 600V. BLACK	99, 107, 120, 126, 134, 137, 139, 140, 176, 177, 189, 203, 204, 208, 284, 357, 404, 405, 406, 422
40	P.S. - 538 $4\frac{1}{2}$/1000 VARN. CLOTH BRAID COVER 600V. BLACK	109, 312, 313, 314, 315, 376, 389

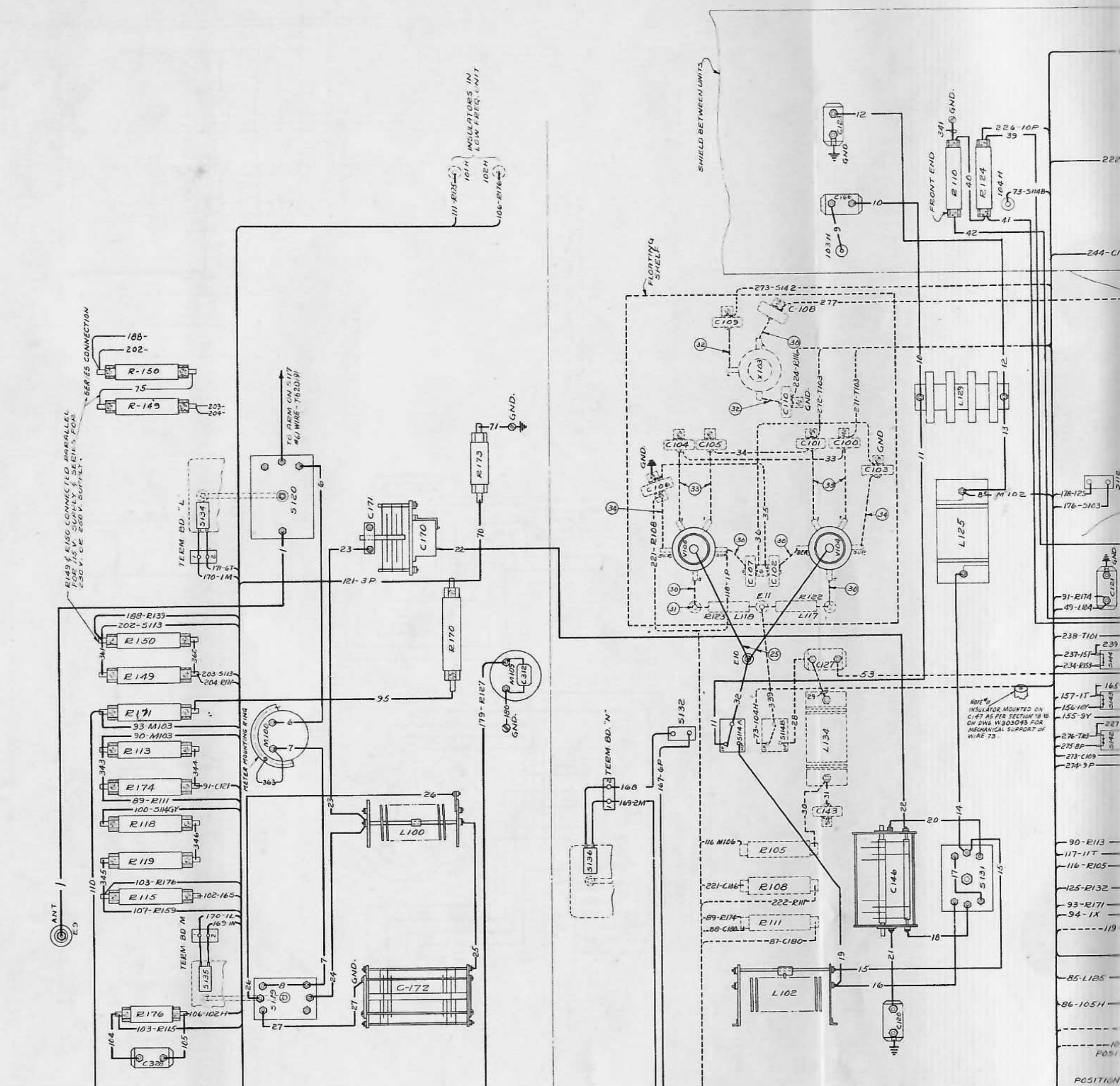

INSULATORS IN LOW FREQ. UNIT.
SHIELD BETWEEN UNITS
FLOATING SHELF
FRONT END
TO ARM ON S117. TT611628-(#20 WIRE)
TERM. BD. "Z"
TERM. BD. "N"
TERM. BD. "M"
NOT USED ON A.C.
METER MOUNTING RING
ANT.
GND.
R171
R113
R174
R118
R119
R115
R176
R170
R173
S120
S134
S135
S136
S132
M100
L100
L102
L117
L118
L125
L129
L134
C146
C170
C171
C172
X103
R105
R108
R111
R122
R123
C100
C101
C102
C103
C104
C105
C106
C107
C108
C109
C110
C123
C127
C166

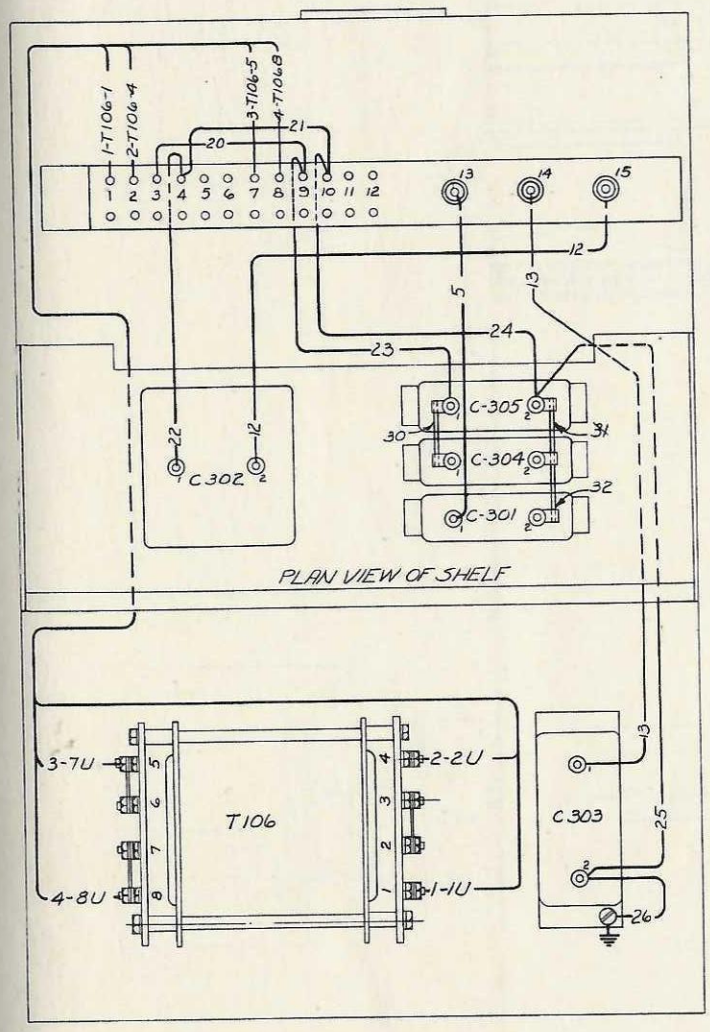
RESTRICTED

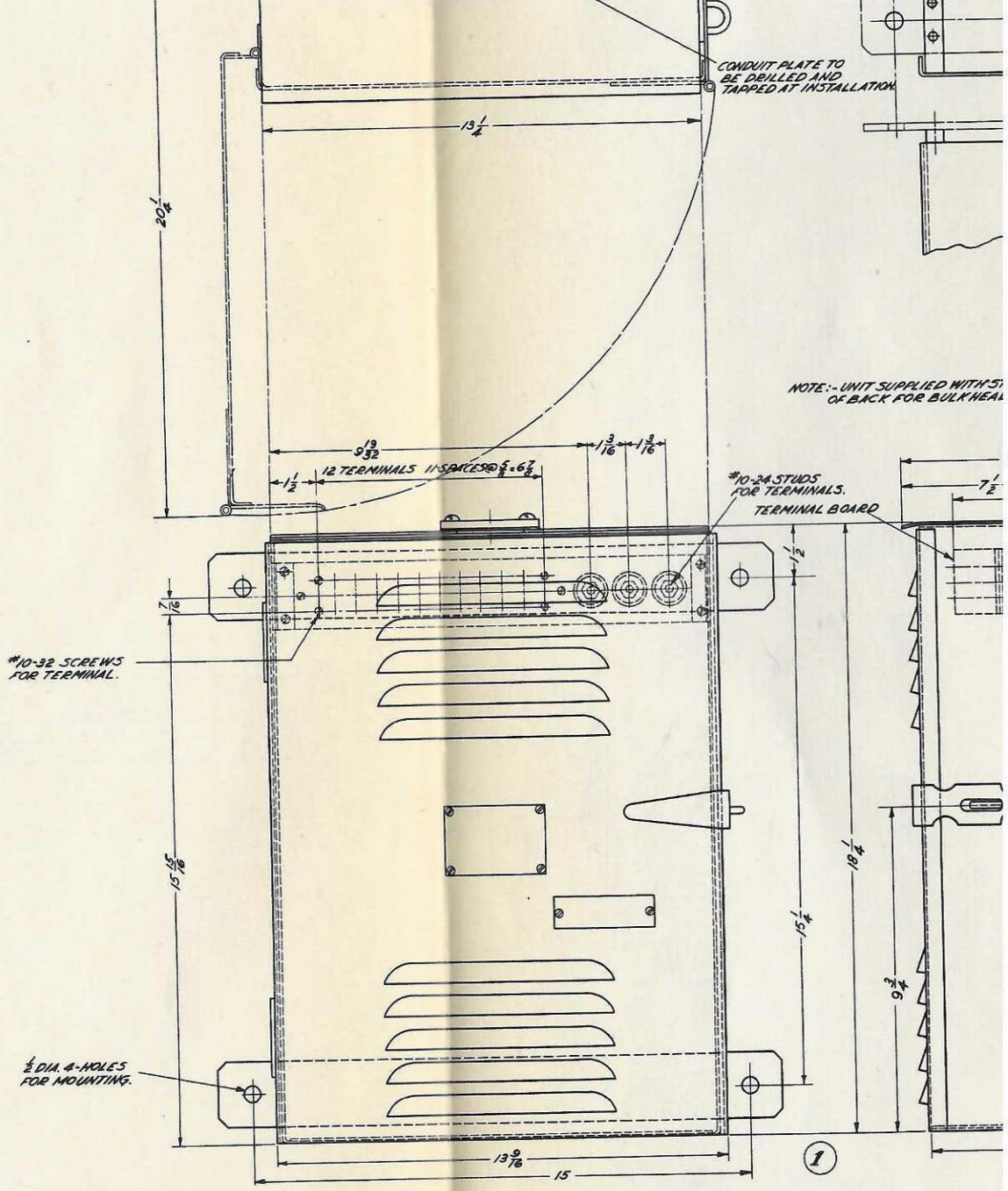
RESTRICTED

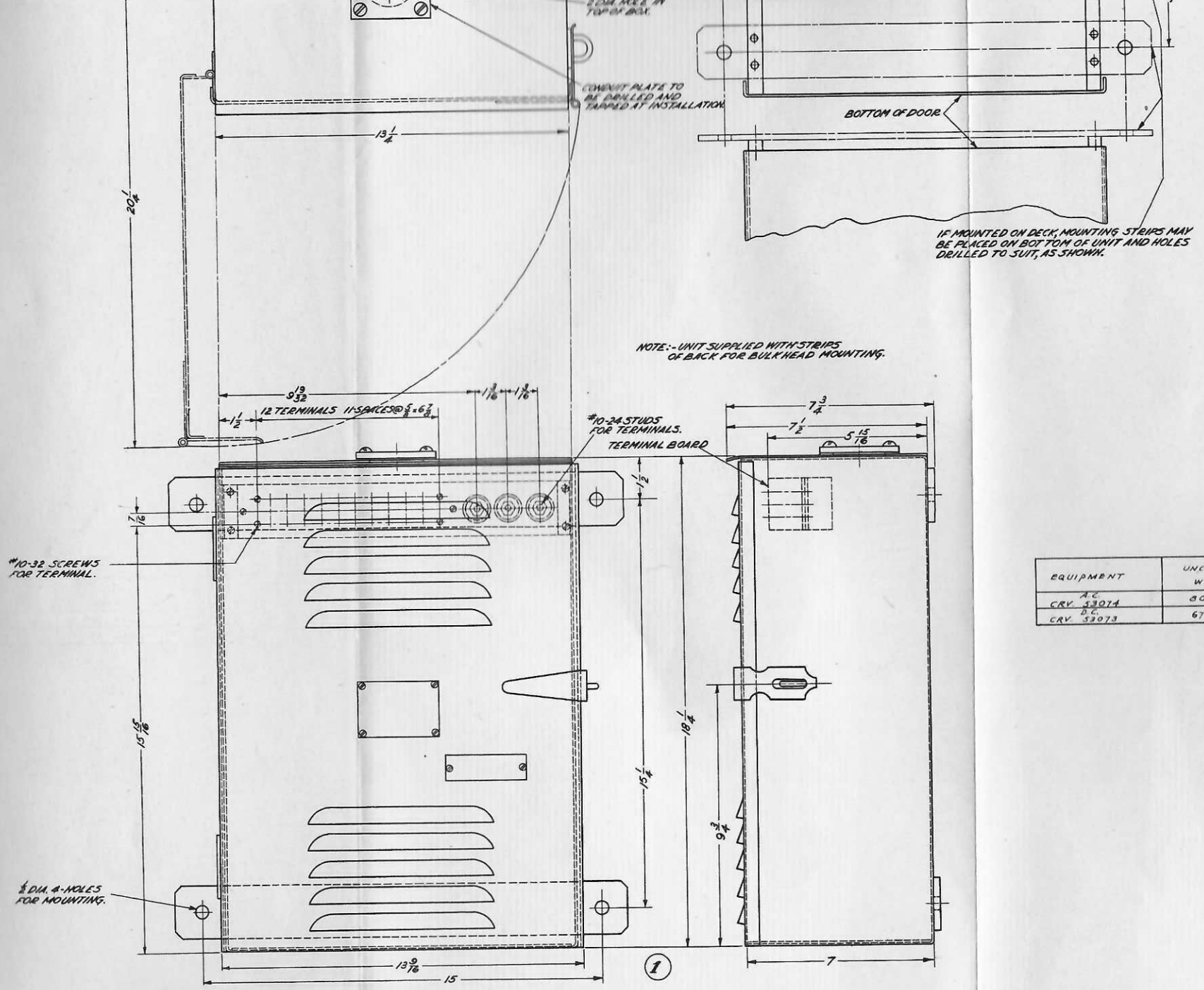


WIRE TABLE		
PART NO. SEE K-954692	DESCRIPTION	WIRE NUMBER
11	P.S. 212 $\frac{1}{4}$ O.D. x .035 WALL COPPER TUBING	1
12	K-862182-4 41/.010 VARN. CLOTH LEAD COVERED 2000V	85 TO 113 INCL.
13	K-862182-2 41/.010 VARN CLOTH LEAD COVERED 600V	221, 222, 224, 225, 226, 228 TO 238 INCL., 241 TO 245 INCL.
14	K-862182-1 26/.010 VARN. CLOTH LEAD COVERED 300V	116 TO 118 INCL., 86 TO 87 INCL., 128, 131, 132, 133, 137, 138, 139, 141, 142, 144, 145 TO 151 INCL., 153 TO 155 INCL., 159 TO 164 INCL., 166 TO 172 INCL., 175 TO 179 INCL., 181 TO 188 INCL., 191, 192 TO 197 INCL., 199 TO 208 INCL., 212
15	K-862182-6 41/.010 VARN. CLOTH LEAD COVERED 600V	271 TO 280 INCL.
16	P.S. 533-9 26/.010 VARN. CLOTH BRAID COVER 300 V BLACK	286 TO 304 INCL.
17	P.S. 105 .064 DIA. TINNED COPPER WIRE	311 AND 349
18	P.S. 528-10 41/.010 $\frac{1}{32}$ ELECTRO E.B. 300V BLACK	314 TO 322 INCL., 324 TO 328 INCL.
19	P.S. 105 .128 DIA. TINNED COPPER WIRE	6 TO 31 INCL., 33 TO 70 INCL., 72, 73, 74, 75, 323, 341, 341, 360
20	P.S. 21 .032 x $\frac{1}{8}$ WIDE COPPER STRIP	32, 71, 339, 340, 342, TO 348 INCL., 350, 352 TO 355 INCL., 361, 362, 363
40	P.S. 538 26/.010 VARN. CLOTH BRAID COVER 600 V BLACK	123, 128, 130, 134, 136, 140, 149, 148, 152, 156, 166, 170, 174, 180, 189, 193, 198, 305, 306, 115.
41	P.S. 538 41/.010 VARN. CLOTH BRAID COVER 600 V BLACK	223, 227, 239, 240


SHIELD BETWEEN UNITS
FLOATING SHELF
FRONT END
INSULATORS IN LOW FREQ. UNIT
SERIES CONNECTION
R149 & R150 CONNECTED PARALLEL FOR 115 V. SUPPLY & SERIES FOR 230 V. OR 250 V. SUPPLY.
TO ARM ON S117 #6 WIRE - T62019
TERM BD "L"
TERM BD M
TERM BD. "N"
METER MOUNTING RING
NOTE: INSULATOR MOUNTED ON C147 AS PER SECTION 18 ON DWG W303093 FOR MECHANICAL SUPPORT OF WIRE 73.
ANT
E9
R-150
R-149
R150
R149
R171
R113
R174
R118
R119
R115
R176
C328
R170
R173
C170
C171
S120
S119
S134
S135
S136
S132
M100
M103
C312
L100
C-172
L102
C146
C120
S131
L125
M102
L129
L134
C143
C127
R105
R108
R111
S114A
S114B
V104
V106
X103
C-108
C109
C110
C104
C105
C106
C101
C100
C103
C107
C102
R123
L118
E11
R122
L117
E10
R110
R124
GND.
POSITION


1-T106-1
2-T106-4
3-T106-5
4-T106-8
20
21
12
5
13
24
23
C-305
C-304
C-301
C 302
22
12
30
31
32
PLAN VIEW OF SHELF
3-7U
2-2U
T106
4-8U
1-1U
C 303
25
26
FRONT VIEW

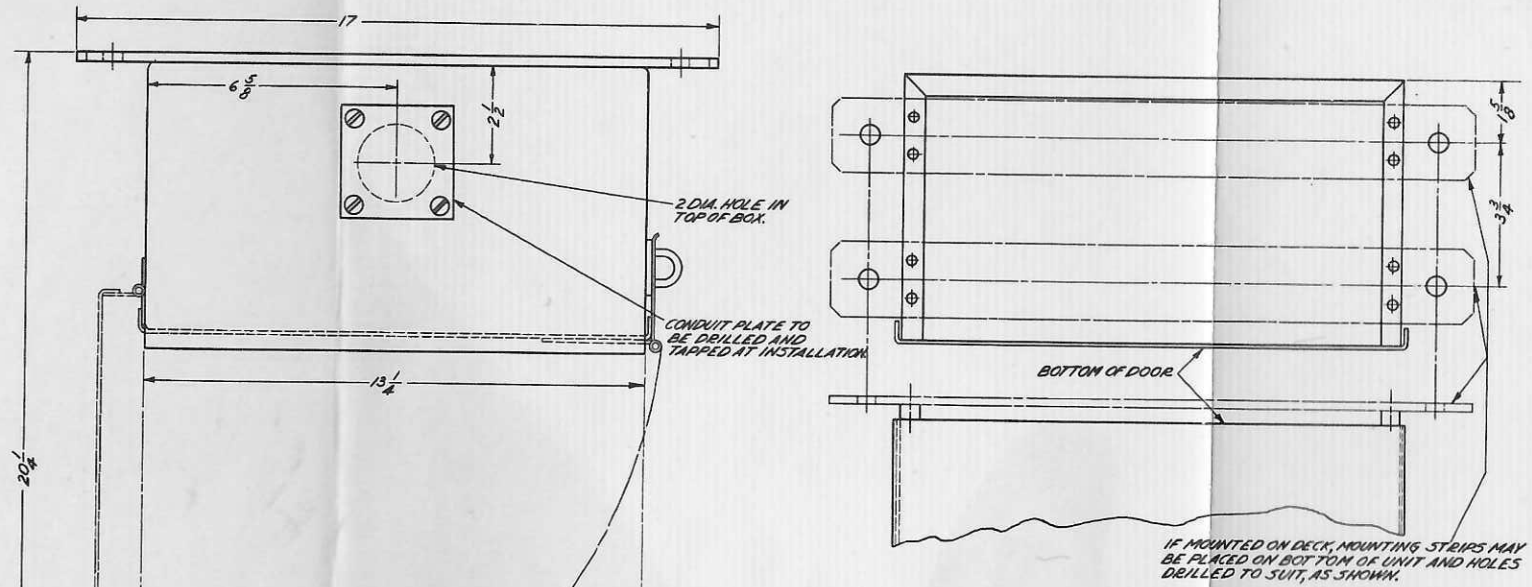

CONDUIT PLATE TO BE DRILLED AND TAPPED AT INSTALLATION.
13 1/4
20 1/4
NOTE:- UNIT SUPPLIED WITH ST
OF BACK FOR BULKHEAD
9 19/32
1 3/16
1 3/16
1/2
12 TERMINALS 11 SPACES @ 5/8 = 6 7/8
#10-24 STUDS FOR TERMINALS.
TERMINAL BOARD
7 1/2
1 1/2
7/16
#10-32 SCREWS FOR TERMINAL.
15 15/16
15 1/4
18 1/4
9 3/4
1/2 DIA. 4-HOLES FOR MOUNTING.
13 9/16
15
1



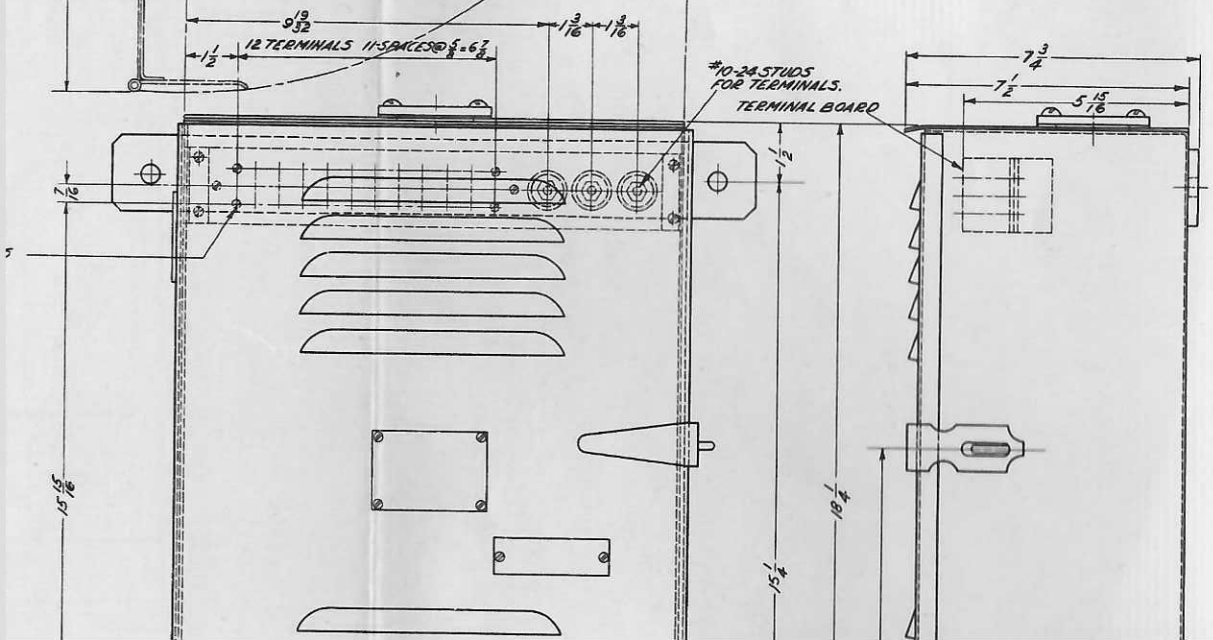
EQUIPMENT	UNCRATED WEIGHT	CRATED WEIGHT	CU
A.C. CRV 33074	80 LBS.	110 LBS.	4
D.C. CRV 33073	67 LBS.	100 LBS.	4

Figure 33—Filter Unit, 220/440 vol
(Connections P-720642) (Outline T-6

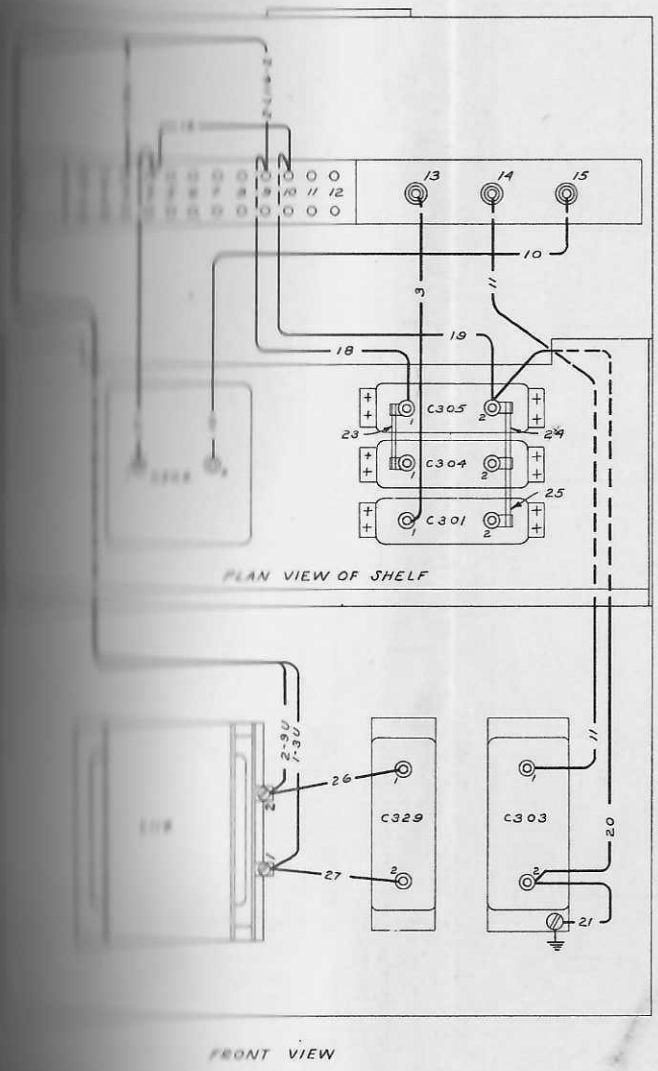
RESTRICTED

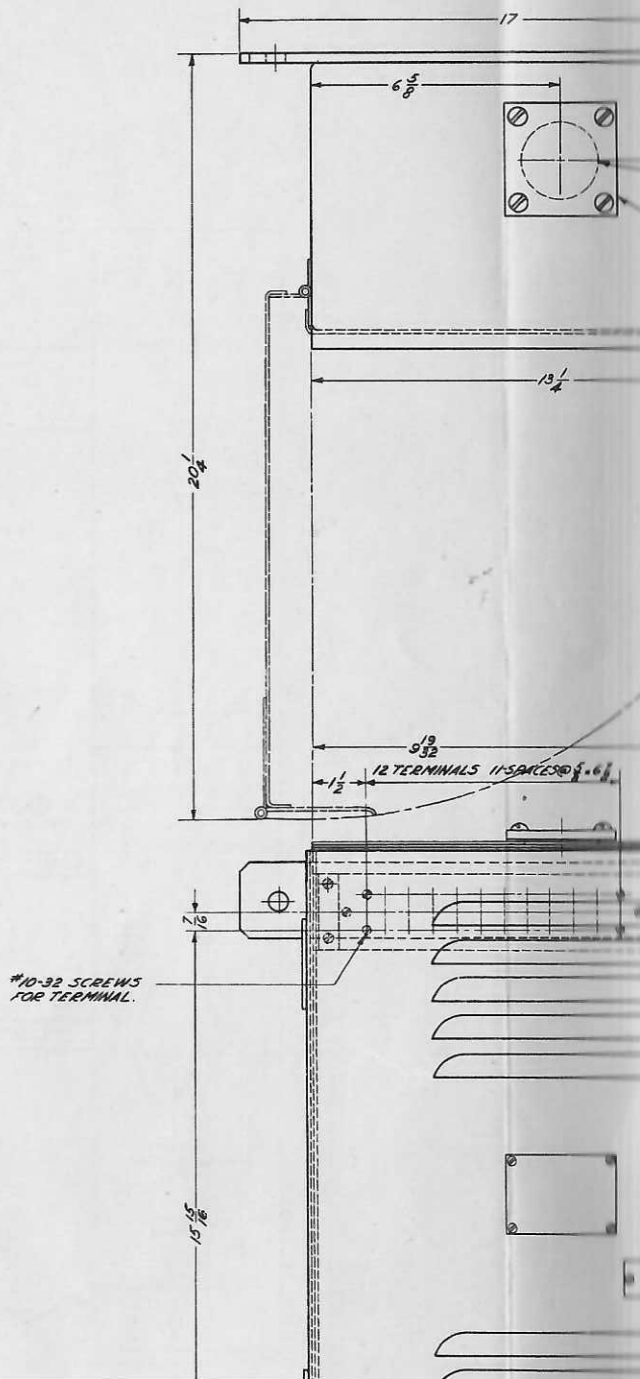


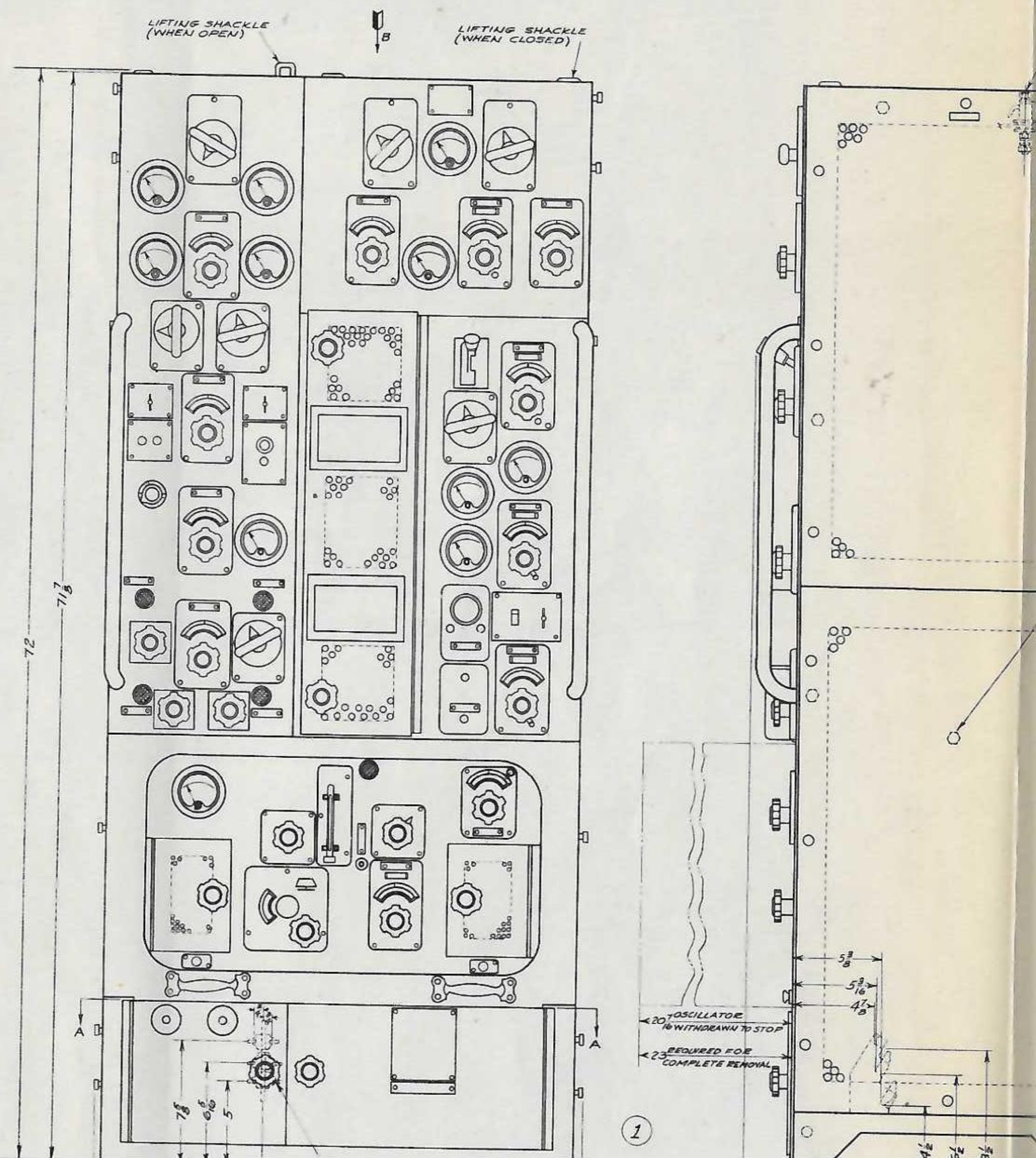
NOTE:- UNIT SUPPLIED WITH STRIPS OF BACK FOR BULKHEAD MOUNTING.



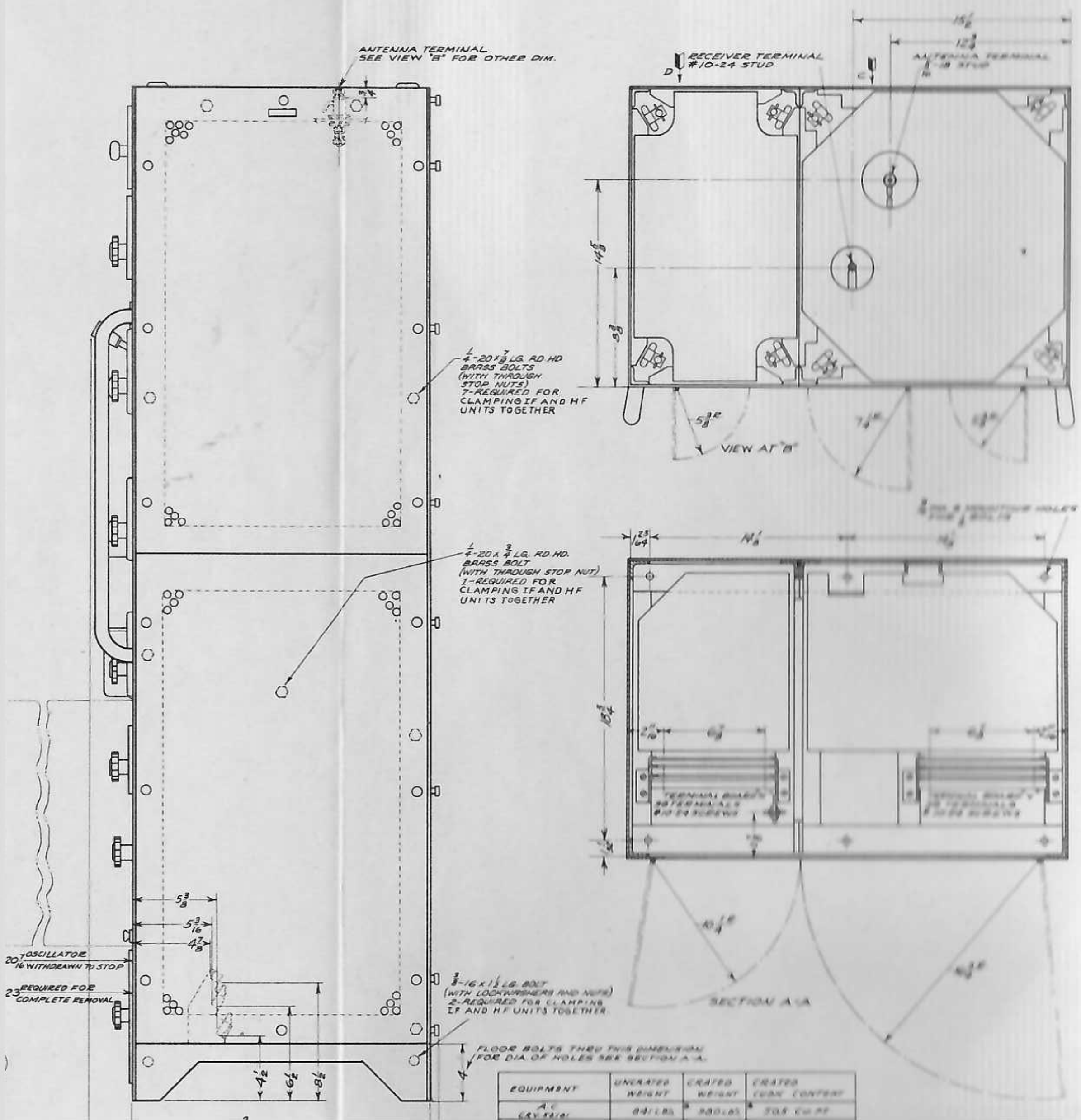
EQUIPMENT	UNCRATED WEIGHT	CRATED WEIGHT	CUBIC CONTENT CRATED
A.C. CRV. 53074	80 LBS.	110 LBS.	4 CUBIC FT.
D.C. CRV. 53073	67 LBS.	100 LBS.	4 CUBIC FT.

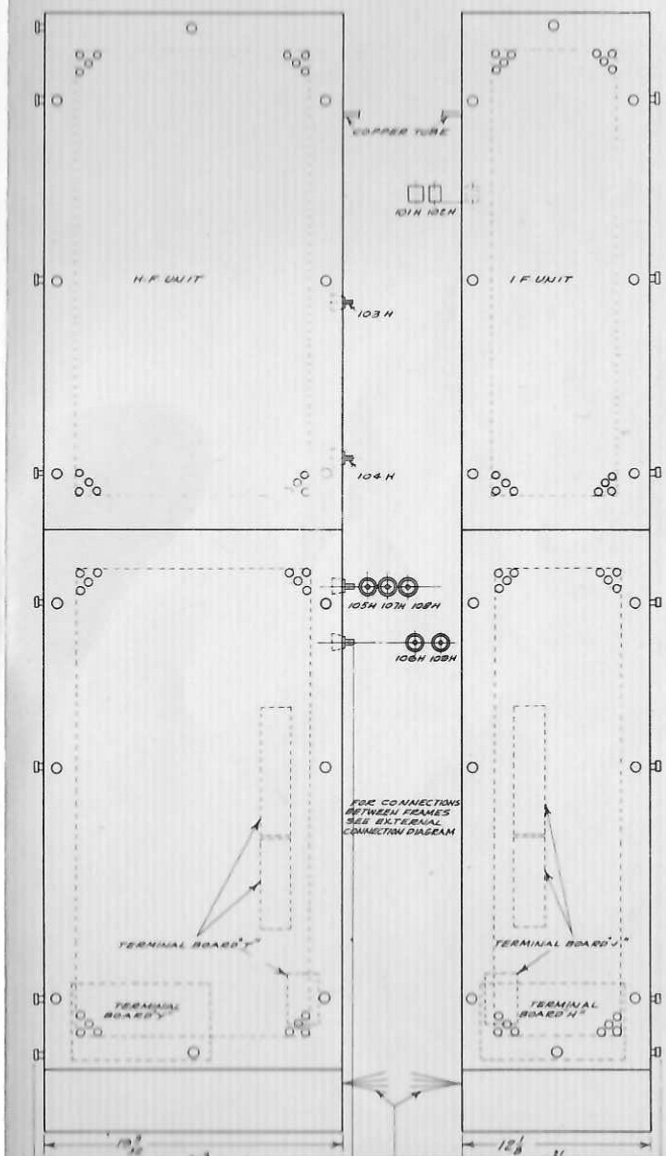

13
14
15
10
3
11
19
18
C305
C304
C301
23
24
25
PLAN VIEW OF SHELF
2-3U
1-3U
26
27
C329
C303
20
21
FRONT VIEW


17
6 5/8
13 1/4
20 1/4
9 19/32
12 TERMINALS 11-SPACES @ .6
1 1/2
7/16
#10-32 SCREWS FOR TERMINAL.
15 55/64


LIFTING SHACKLE (WHEN OPEN)
B
LIFTING SHACKLE (WHEN CLOSED)
72
71 7/8
A
A
7 5/8
6 5/16
5
1
20 7/16 OSCILLATOR WITHDRAWN TO STOP
23 REQUIRED FOR COMPLETE REMOVAL
5 3/8
5 3/16
4 7/8

RESTRICTED


ANTENNA TERMINAL SEE VIEW "B" FOR OTHER DIM.
RECEIVER TERMINAL #10-24 STUD
ANTENNA TERMINAL
VIEW AT "B"
1/4-20 x 7/8 LG. RD. HD. BRASS BOLTS (WITH THROUGH STOP NUTS) 7-REQUIRED FOR CLAMPING I.F. AND H.F. UNITS TOGETHER
1/4-20 x 3/4 LG. RD. HD. BRASS BOLT (WITH THROUGH STOP NUT) 1-REQUIRED FOR CLAMPING I.F. AND H.F. UNITS TOGETHER
3/8-16 x 1 1/2 LG. BOLT (WITH LOCKWASHERS AND NUTS) 2-REQUIRED FOR CLAMPING I.F. AND H.F. UNITS TOGETHER
SECTION A-A
FLOOR BOLTS THRU THIS DIMENSION FOR DIA. OF HOLES SEE SECTION A-A.
OSCILLATOR WITHDRAWN TO STOP
REQUIRED FOR COMPLETE REMOVAL
EQUIPMENT
UNCRATED WEIGHT
CRATED WEIGHT
CRATED CUBIC CONTENT
841 LBS.
980 LBS.
30.5 CU. FT.


COPPER TUBE
101H 102H
H.F. UNIT
I.F. UNIT
103 H
104 H
105H 107H 108H
106H 109H
FOR CONNECTIONS BETWEEN FRAMES SEE EXTERNAL CONNECTION DIAGRAM
TERMINAL BOARD "I"
TERMINAL BOARD "J"
TERMINAL BOARD "H"
CRV-52178
CRV-52179
CRV-52180
CRV-52181

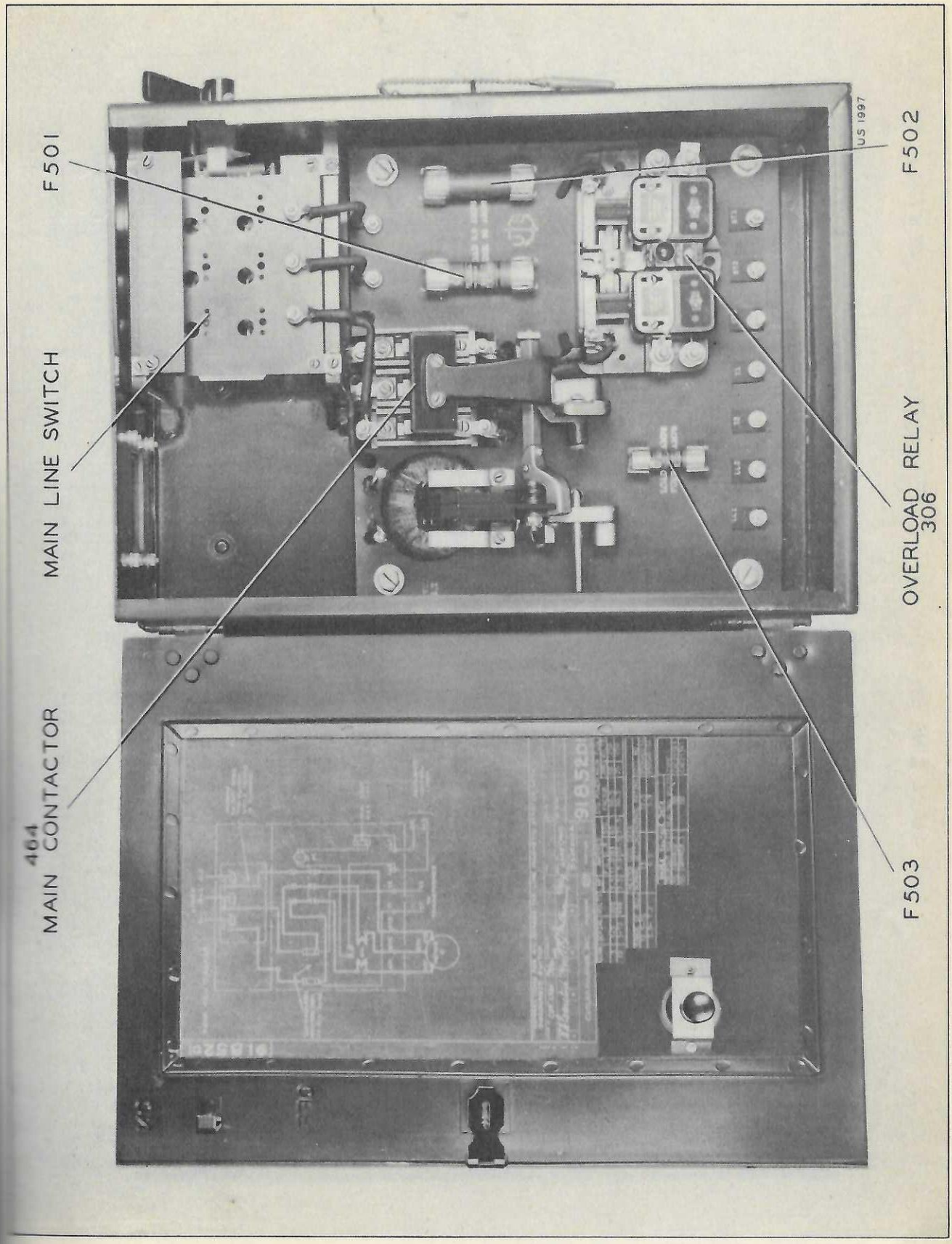


Figure 36—Magnetic Controller, A-C Supply (Front View, Cover Open)

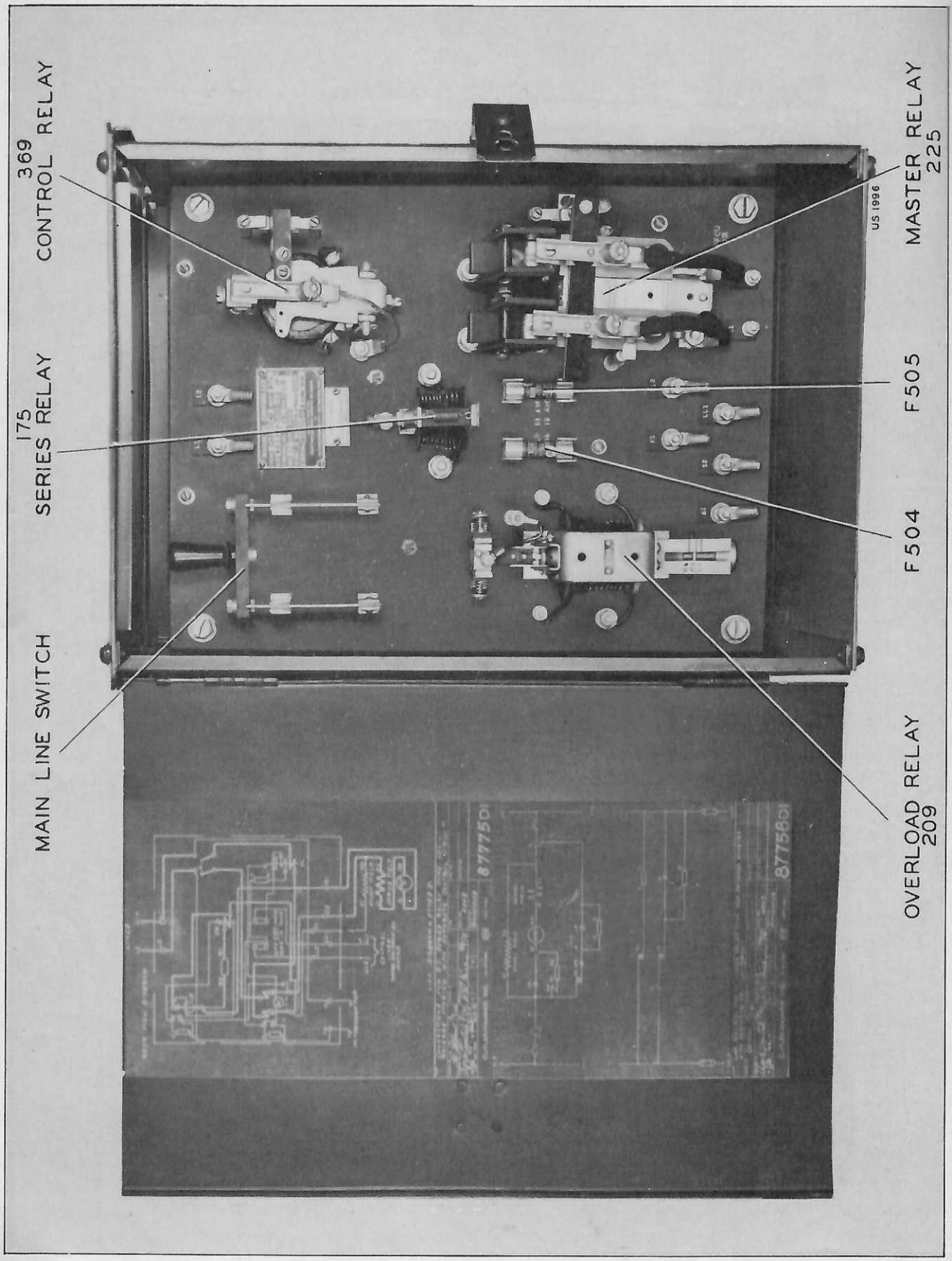


Figure 37—Magnetic Controller, D-C Supply (Front View, Cover Open)

RESTRICTED

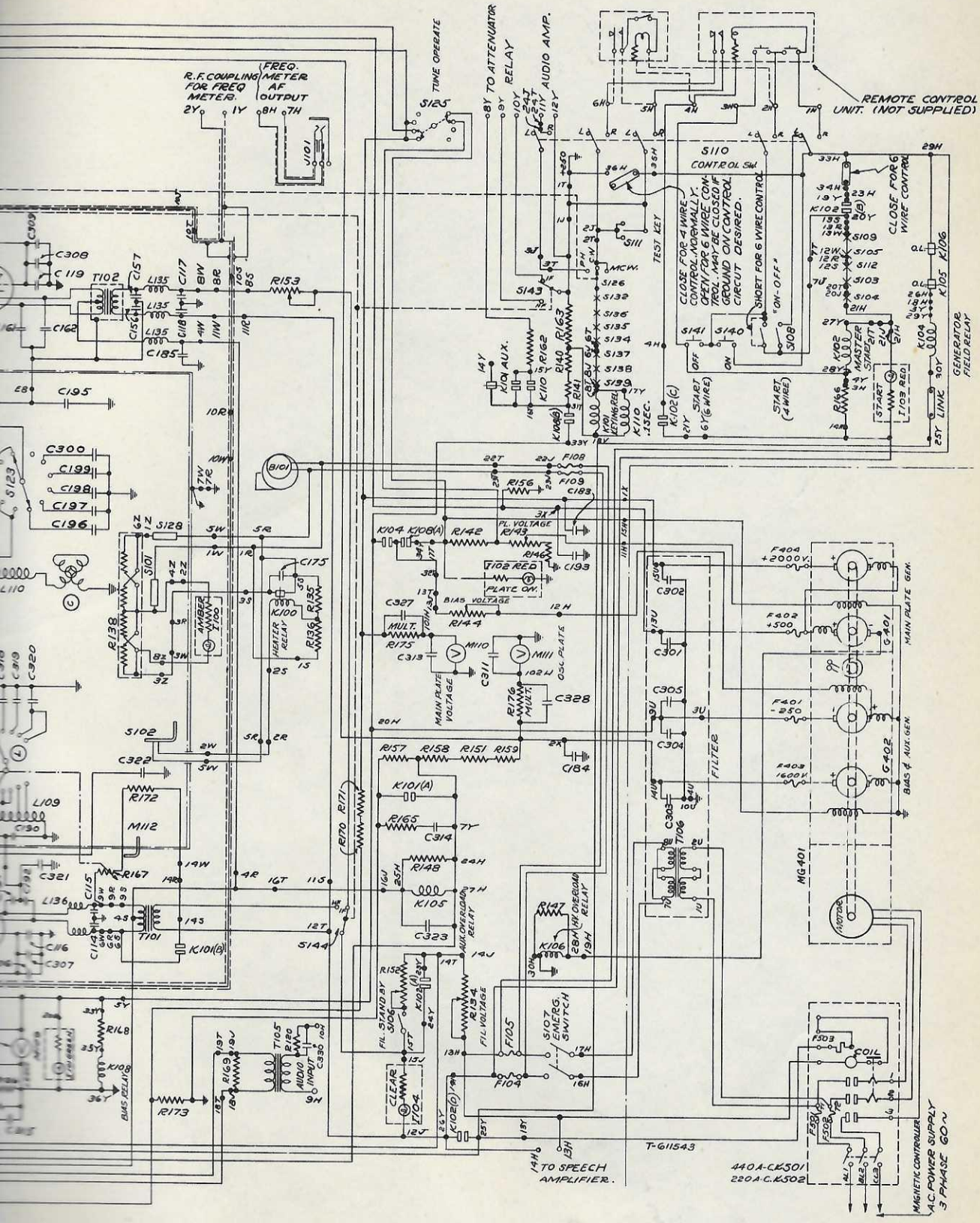
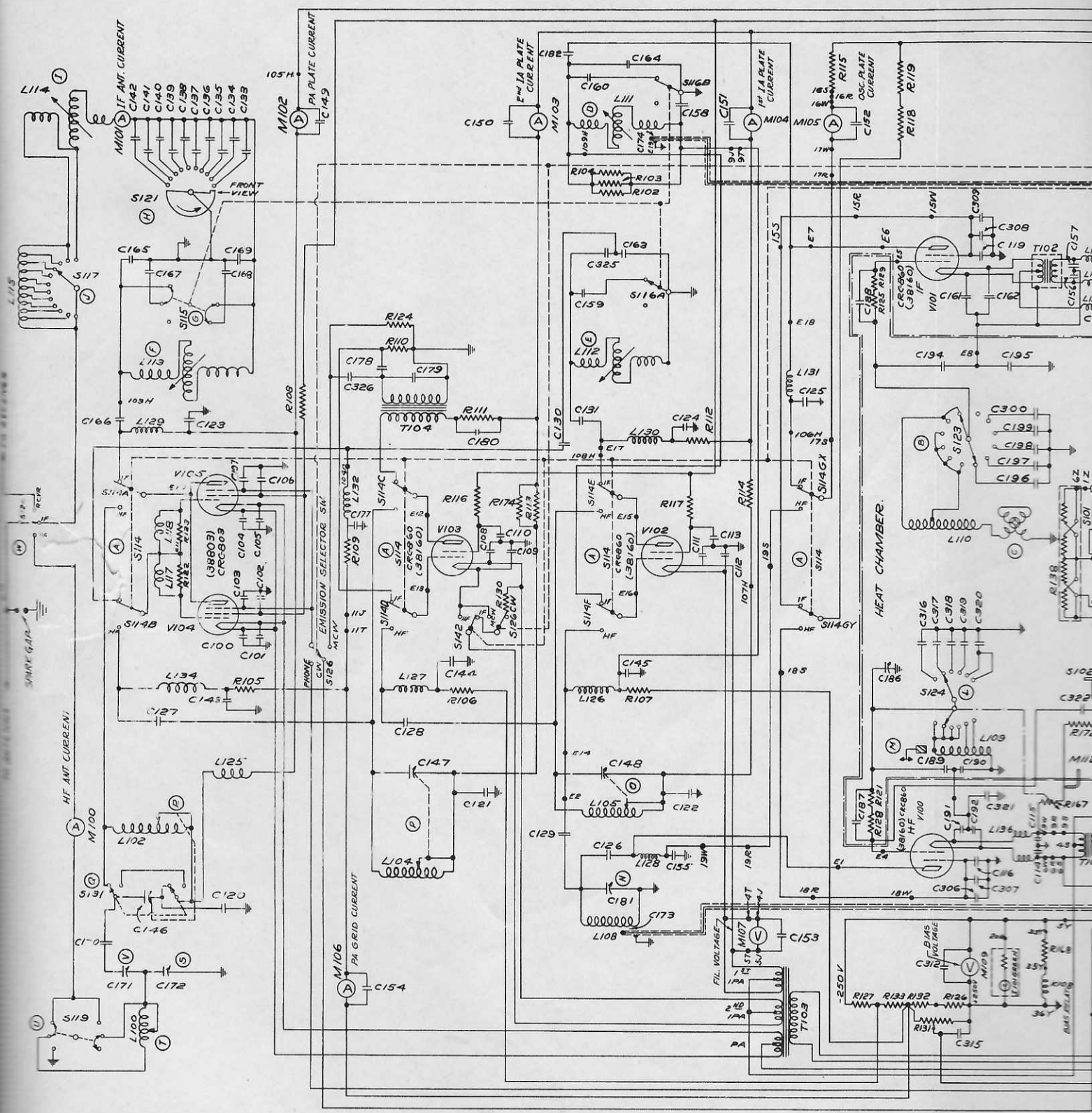


Figure 38—Transmitting Equipment, 220/440 volts a-c (Schematic T-611543)

RESTRICTED

RESTRICTED



RESTRICTED

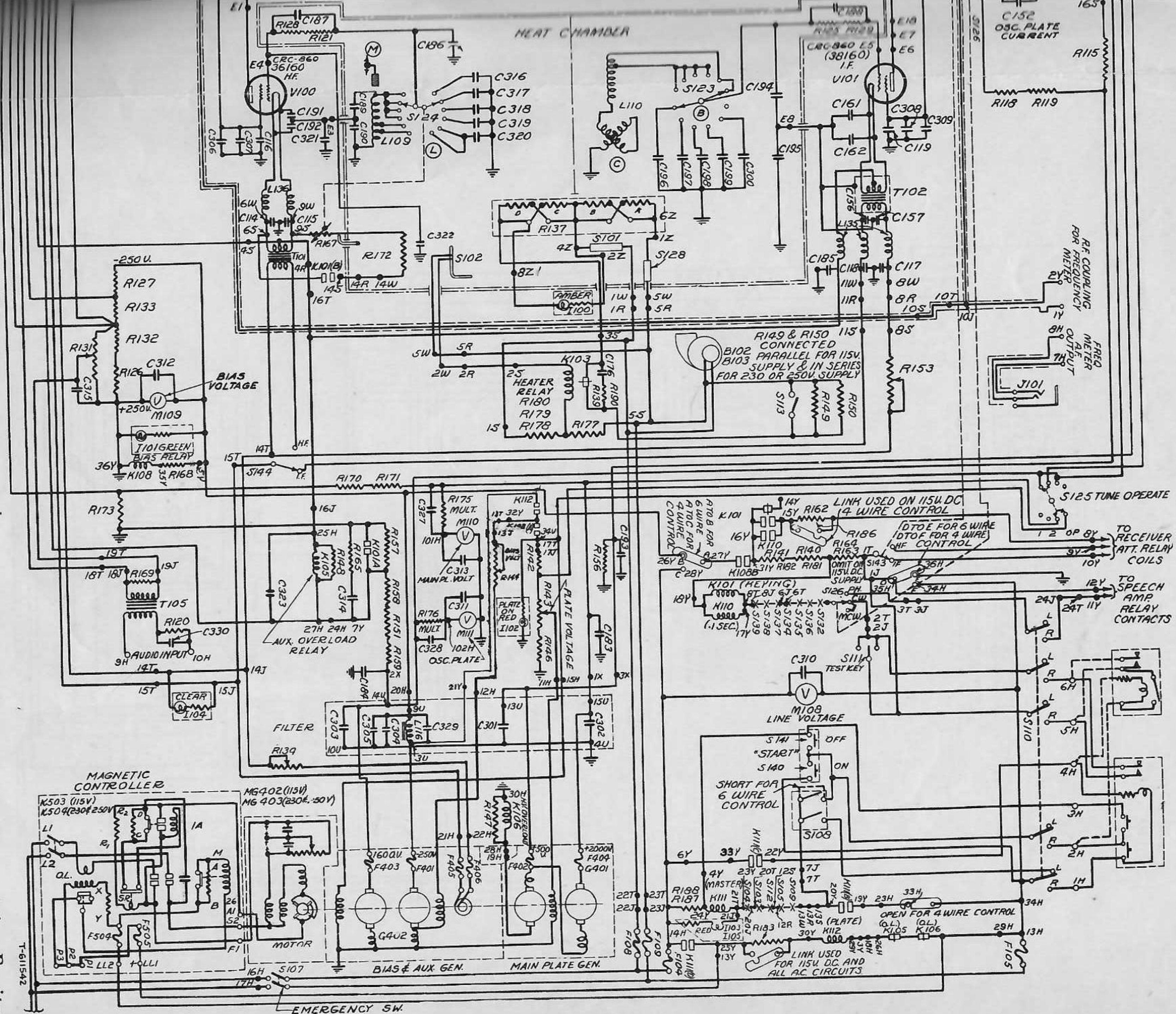
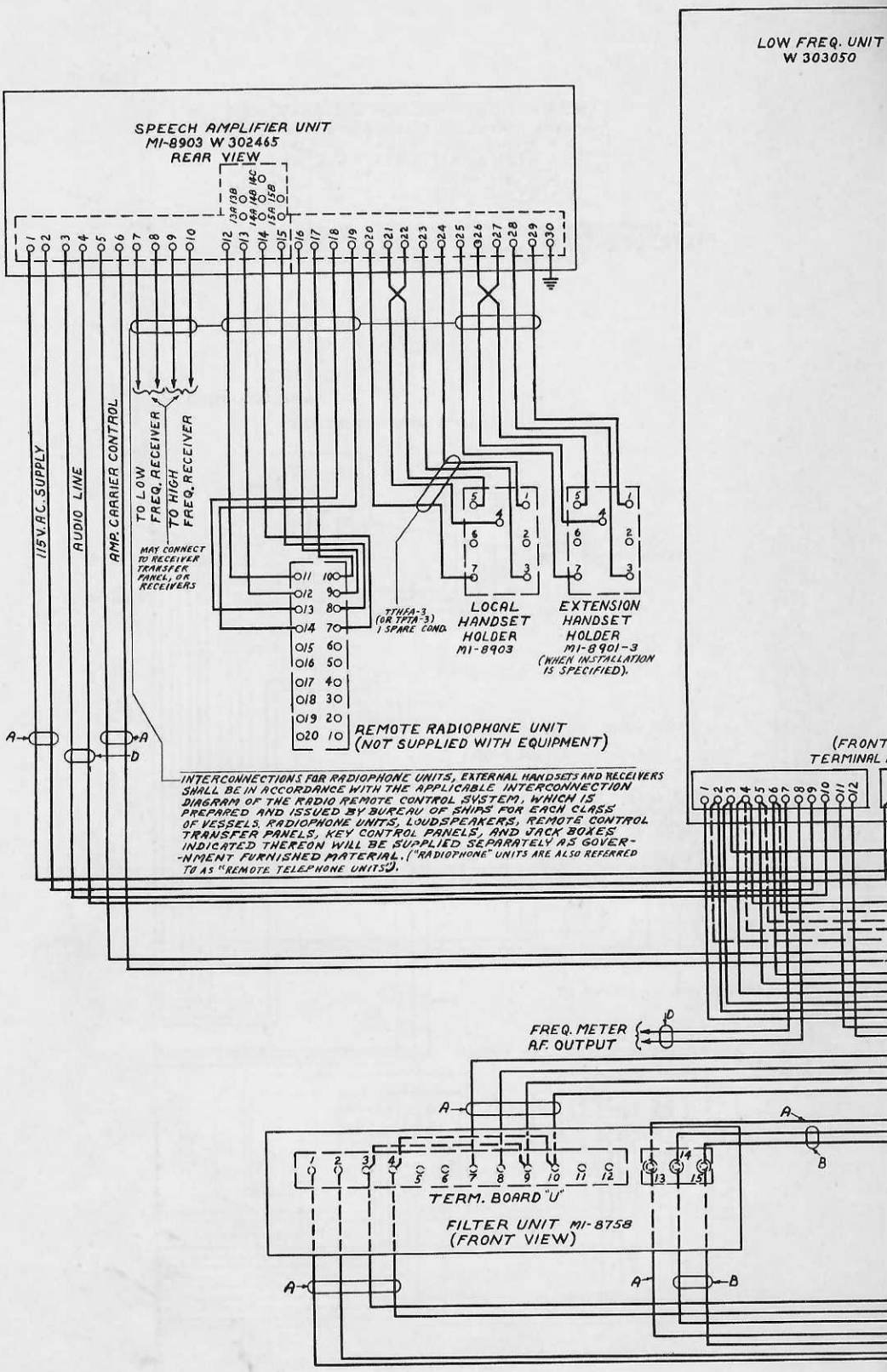


Figure 39—Transmitting Equipment, 115/230/250 volts d-c (Schematic T-611542)

RESTRICTED

RESTRICTED


LOW FREQ. UNIT
W 303050
SPEECH AMPLIFIER UNIT
MI-8903 W 302465
REAR VIEW
115 V. A.C. SUPPLY
AUDIO LINE
AMP. CARRIER CONTROL
TO LOW FREQ. RECEIVER
TO HIGH FREQ. RECEIVER
MAY CONNECT TO RECEIVER TRANSFER PANEL, OR RECEIVERS
T7HFA-3 (OR TPTA-3) 1 SPARE COND.
LOCAL HANDSET HOLDER MI-8903
EXTENSION HANDSET HOLDER MI-8901-3 (WHEN INSTALLATION IS SPECIFIED).
REMOTE RADIOPHONE UNIT (NOT SUPPLIED WITH EQUIPMENT)
INTERCONNECTIONS FOR RADIOPHONE UNITS, EXTERNAL HANDSETS AND RECEIVERS SHALL BE IN ACCORDANCE WITH THE APPLICABLE INTERCONNECTION DIAGRAM OF THE RADIO REMOTE CONTROL SYSTEM, WHICH IS PREPARED AND ISSUED BY BUREAU OF SHIPS FOR EACH CLASS OF VESSELS. RADIOPHONE UNITS, LOUDSPEAKERS, REMOTE CONTROL TRANSFER PANELS, KEY CONTROL PANELS, AND JACK BOXES INDICATED THEREON WILL BE SUPPLIED SEPARATELY AS GOVERNMENT FURNISHED MATERIAL. ("RADIOPHONE" UNITS ARE ALSO REFERRED TO AS "REMOTE TELEPHONE UNITS").
FREQ. METER A.F. OUTPUT
TERM. BOARD "U"
FILTER UNIT MI-8758 (FRONT VIEW)

RESTRICTED

WIRE DESIGNATION PER NAVY SPEC. 15CI(INT) SUB. I.			
WIRE	NAVY TYPE	CIR. MILS.	DIELECTRIC STRENGTH
A	SRLL-4	4494	2500 VOLTS A.C.
B	SRHLA-4 *	4494	25,000 VOLTS A.C.
C	SRLL-14	14350	2500 VOLTS A.C.
D	DRLL-4	4494	2500 VOLTS A.C.

* WHEN AVAILABLE, NEW NAVY TYPE SHFR CABLE SHALL BE USED. PENDING THE AVAILABILITY OF THE NEW CABLE (SHFR), TYPE SLPA-4 CABLE MAY BE SUBSTITUTED. (SLPA-4 IS PERMISSIBLE FOR LEADS UP TO 3500 V. D.C.)

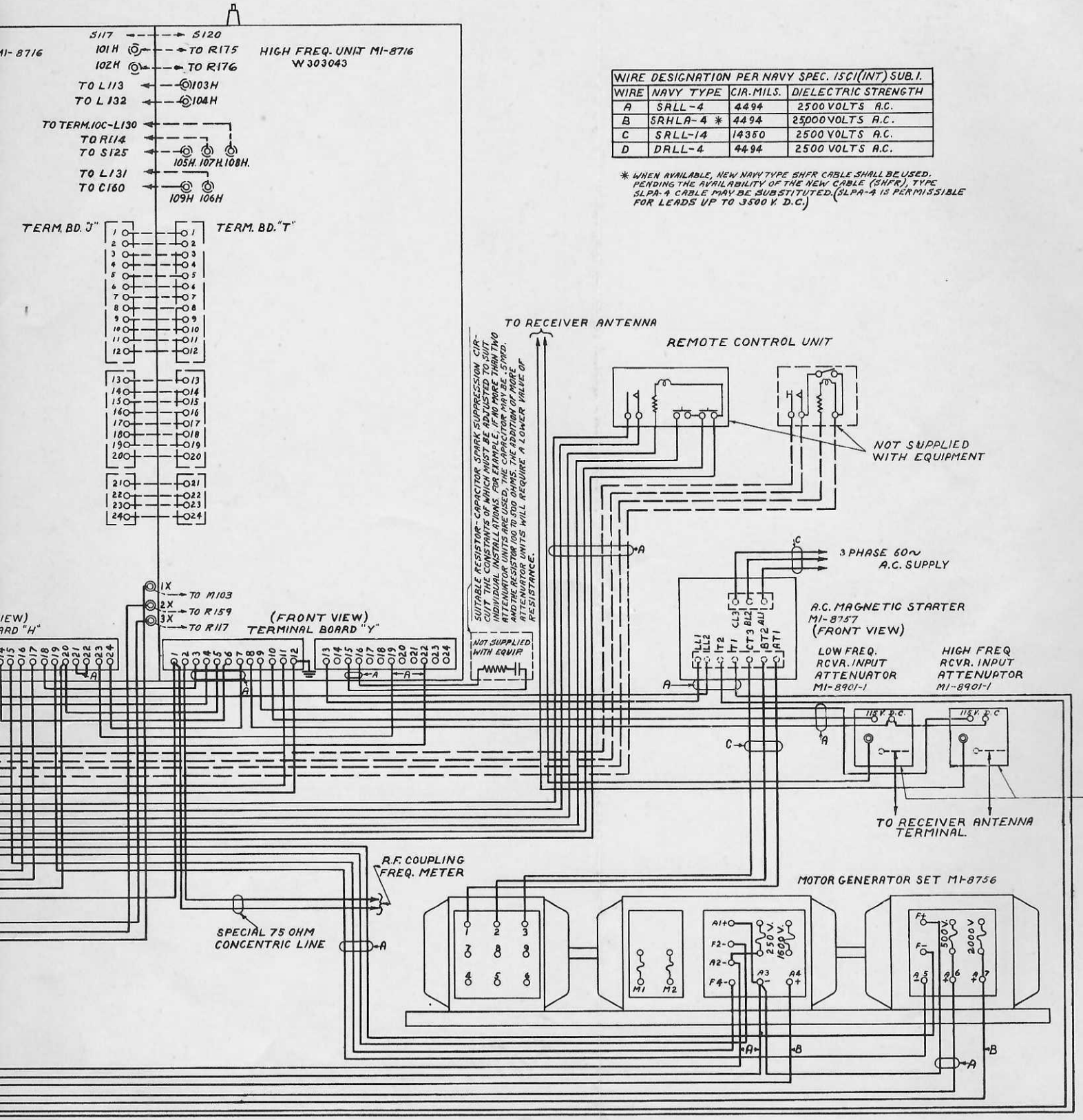
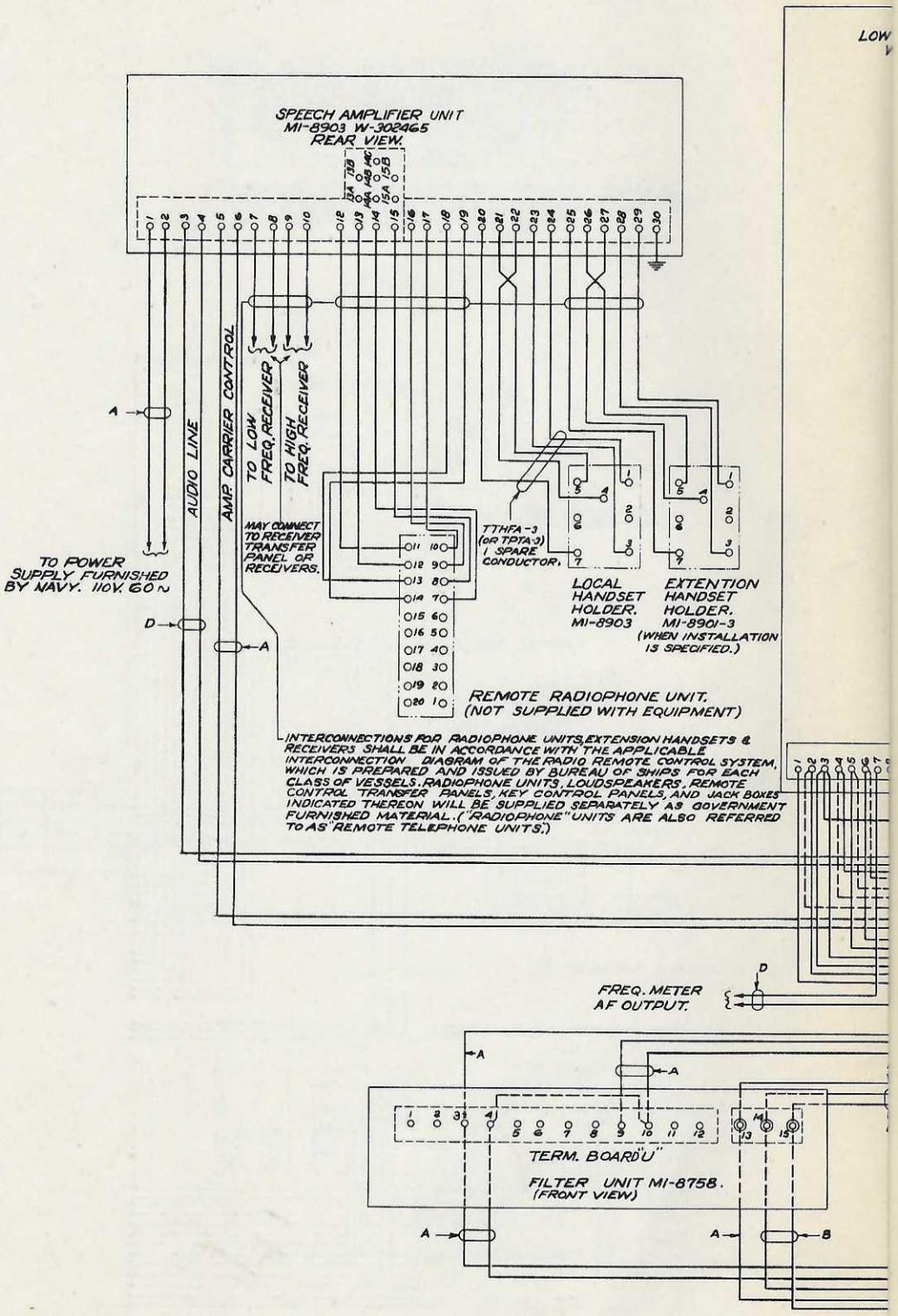
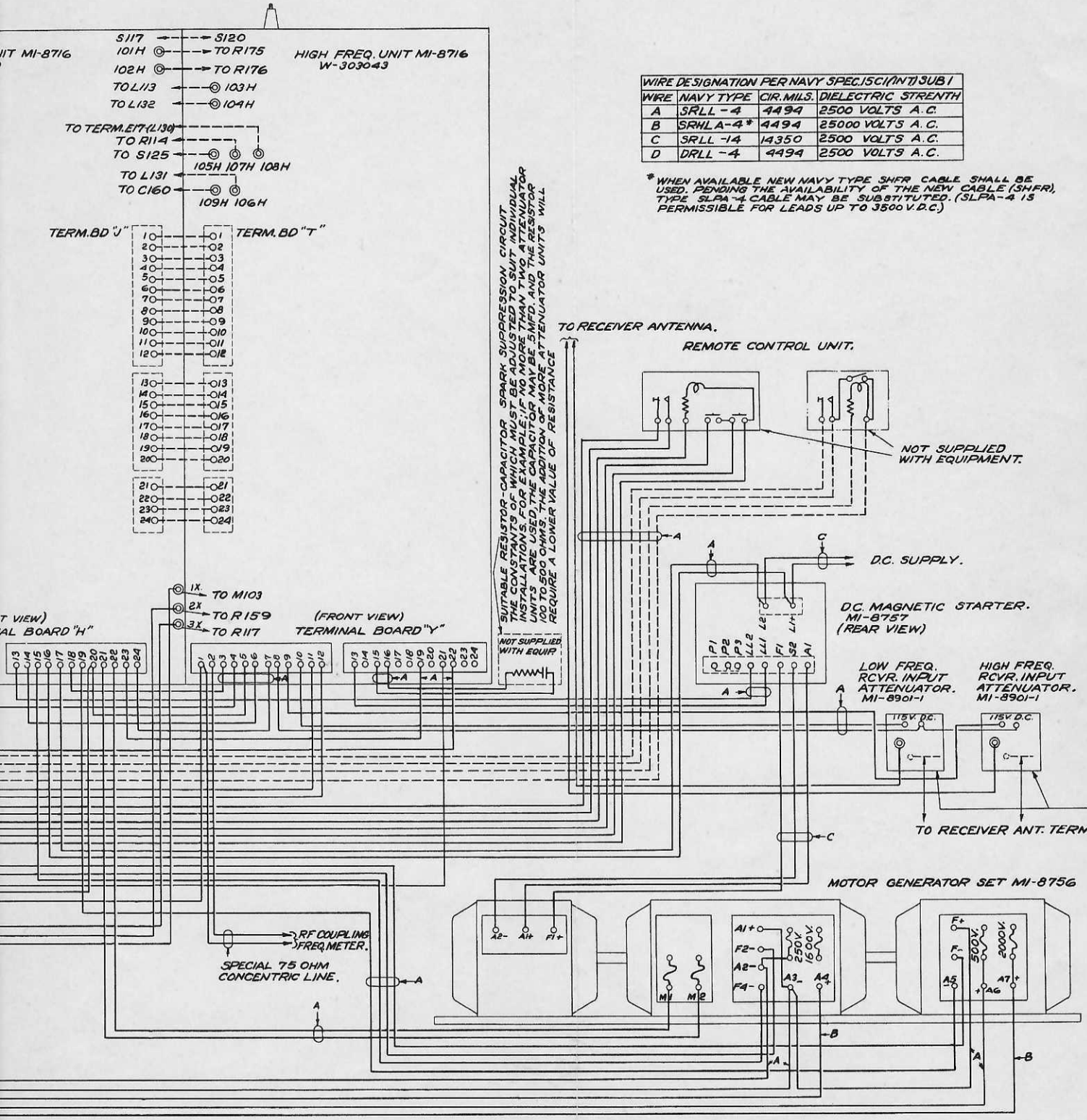


Figure 40—Transmitting Equipment, 220/440 volts a-c (External Connections T-611633)

RESTRICTED


SPEECH AMPLIFIER UNIT
MI-8903 W-302465
REAR VIEW.
AUDIO LINE
AMP. CARRIER CONTROL
TO LOW FREQ. RECEIVER
TO HIGH FREQ. RECEIVER
MAY CONNECT TO RECEIVER TRANSFER PANEL OR RECEIVERS.
TTHFA-3 (OR TPTA-3) 1 SPARE CONDUCTOR.
TO POWER SUPPLY FURNISHED BY NAVY. 110V. 60~
LOCAL HANDSET HOLDER. MI-8903
EXTENTION HANDSET HOLDER. MI-8901-3 (WHEN INSTALLATION IS SPECIFIED.)
REMOTE RADIOPHONE UNIT. (NOT SUPPLIED WITH EQUIPMENT)
INTERCONNECTIONS FOR RADIOPHONE UNITS, EXTENSION HANDSETS & RECEIVERS SHALL BE IN ACCORDANCE WITH THE APPLICABLE INTERCONNECTION DIAGRAM OF THE RADIO REMOTE CONTROL SYSTEM, WHICH IS PREPARED AND ISSUED BY BUREAU OF SHIPS FOR EACH CLASS OF VESSELS. RADIOPHONE UNITS, LOUDSPEAKERS, REMOTE CONTROL TRANSFER PANELS, KEY CONTROL PANELS, AND JACK BOXES INDICATED THEREON WILL BE SUPPLIED SEPARATELY AS GOVERNMENT FURNISHED MATERIAL. ("RADIOPHONE" UNITS ARE ALSO REFERRED TO AS "REMOTE TELEPHONE UNITS.")
FREQ. METER AF OUTPUT.
TERM. BOARD "U"
FILTER UNIT MI-8758. (FRONT VIEW)

RESTRICTED



WIRE DESIGNATION PER NAVY SPEC. 15C (INT) SUB 1			
WIRE	NAVY TYPE	CIR. MILS.	DIELECTRIC STRENTH
A	SRLL-4	4494	2500 VOLTS A.C.
B	SRHLA-4*	4494	25000 VOLTS A.C.
C	SRLL-14	14350	2500 VOLTS A.C.
D	DRLL-4	4494	2500 VOLTS A.C.

* WHEN AVAILABLE NEW NAVY TYPE SHFR CABLE SHALL BE USED. PENDING THE AVAILABILITY OF THE NEW CABLE (SHFR), TYPE SLPA-4 CABLE MAY BE SUBSTITUTED. (SLPA-4 IS PERMISSIBLE FOR LEADS UP TO 3500 V.D.C.)

Figure 41—Transmitting Equipment, 115/230/250 volts d-c (External Connections T-611845)

RESTRICTED

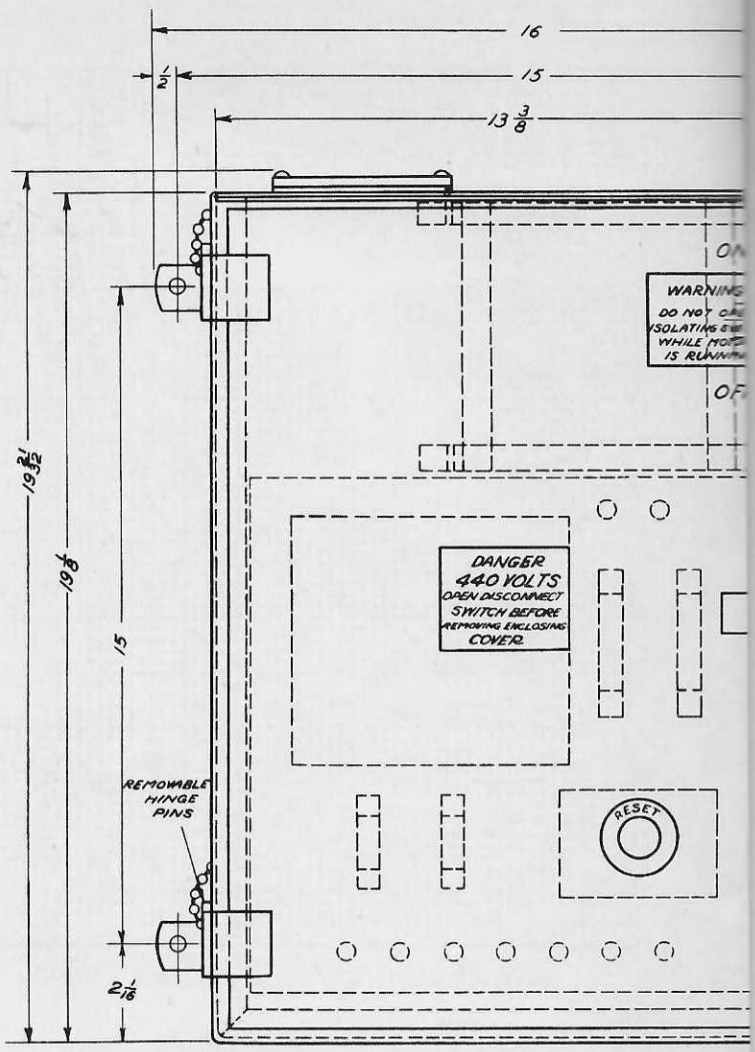
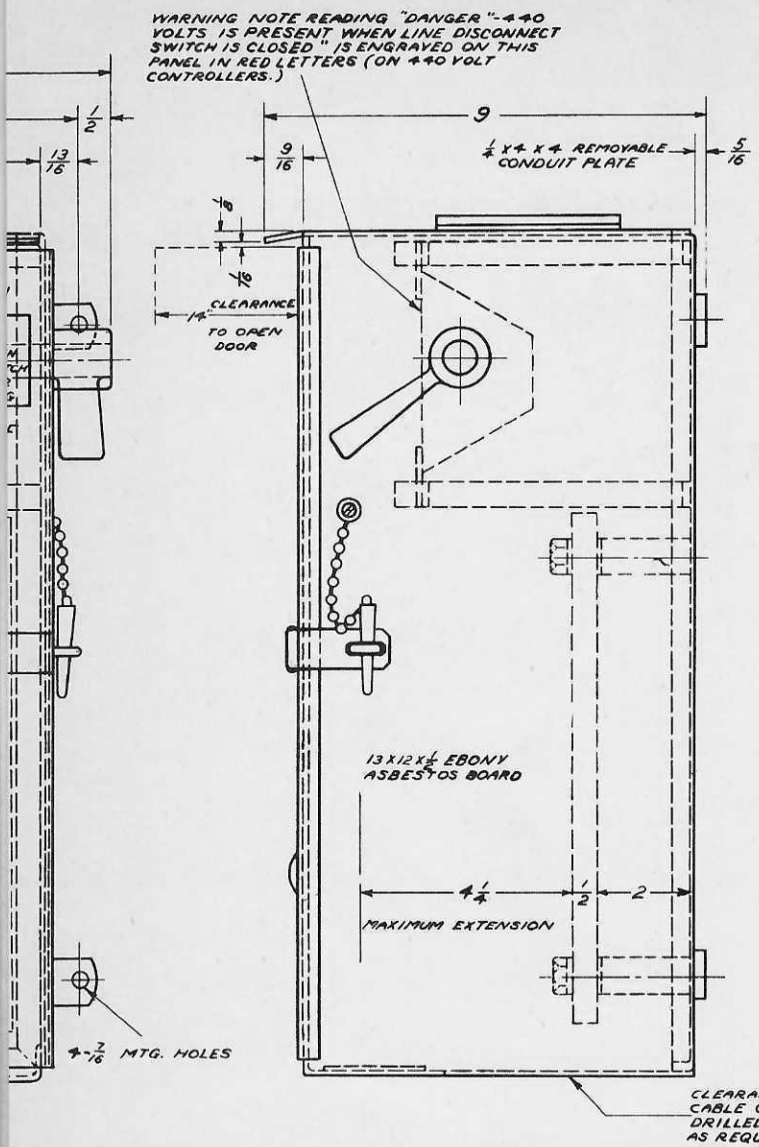


TABLE A.

QUAN.	SERIAL	VOLTS	H.P.	AMPERES			STG. POWER FACTOR	MAIN FUSE		HEATER COIL DATA				UNC
				F.L.	L.R.	STG.		AMP.	VOLTS	RANGE OF ADJ.	NORMAL SETTING	NORMAL RATING	COIL NO.	DROPO
3	1-3	220	3.5	11.8	63	63	66.5	60	250	12.5 - 15	13	12.5	9586H221A	55(AF
12	1-12	440	3.5	5.9	31.5	31.5	66.5	35	250	5.9 - 7.2	6.5	5.9	9586H216A	55(AF



ER VOLTAGE DATA		TYPE
UT VOLTS	SEALING VOLTS	
PROX.)	88	CAE 21543
PROX.)	88	CAE 21341

.062 THICK SHEET STEEL CASE & COVER - WELDED CONS

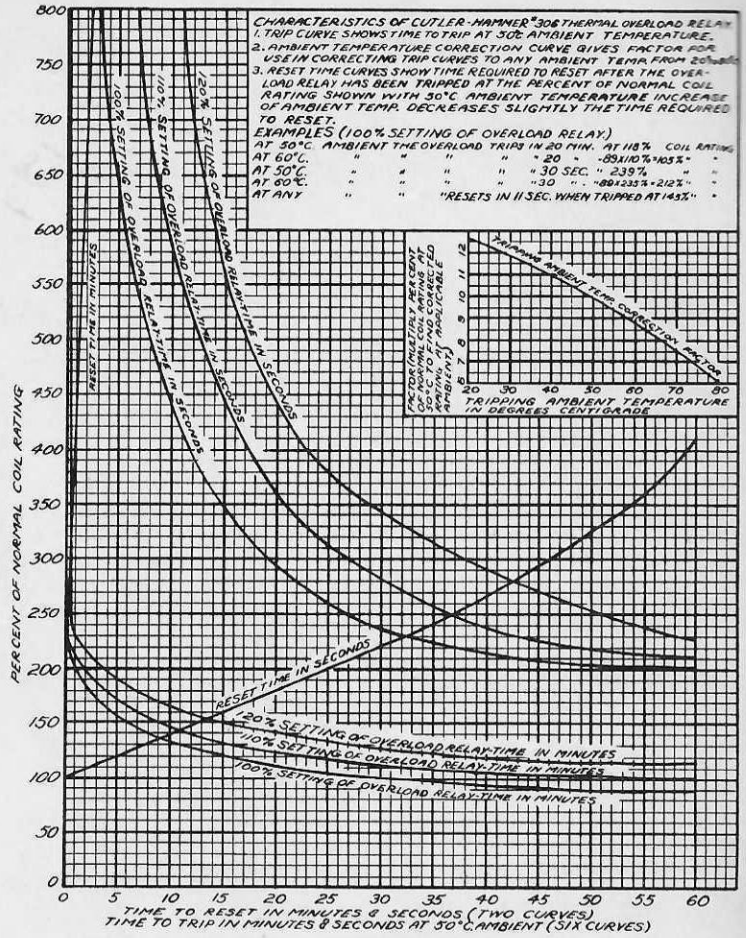
DOOR REINFORCED BY ANGLE IRON PICTURE FRAME AROUND

OUTLINE DIMENSIONS OF CON

WEIGHT
COMPLETE UNIT_____45 LBS
SPEC. PARTS___CONTROL PANEL (ESTIMATED)_43 LBS
SPARE PARTS_____2 LBS

REAR V

220 V, 60A, 250
440 V, 35A, 250



OR

TRUCTION.

QUAN.	SERIAL	VOLTS	INSIDE OF COVER
3	1-3	220	3
12	1-12	440	3

TROLLER.

IEW DIAGRAM.

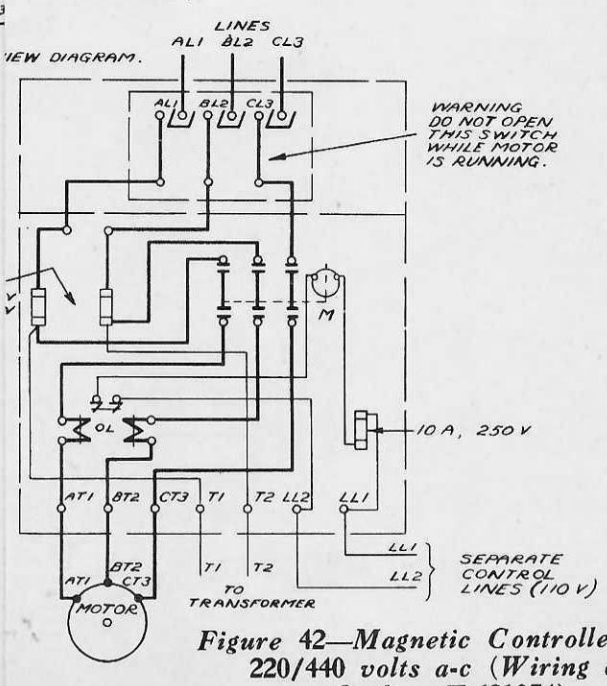
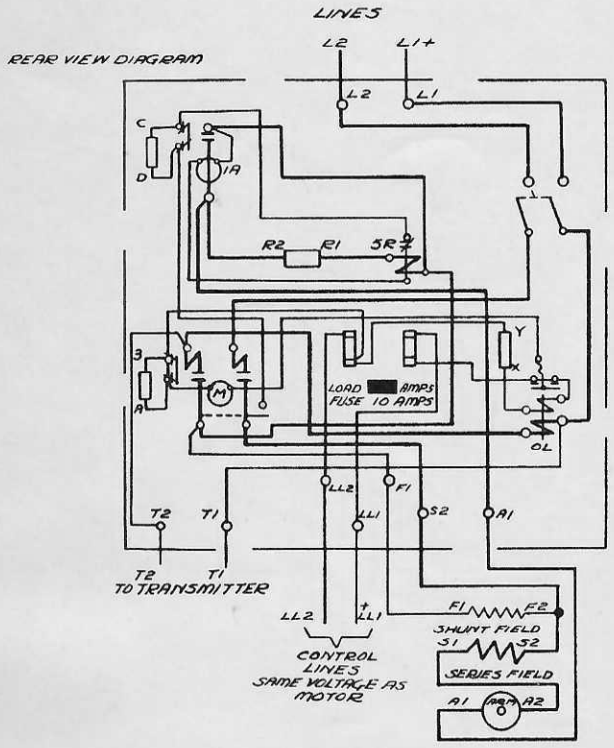
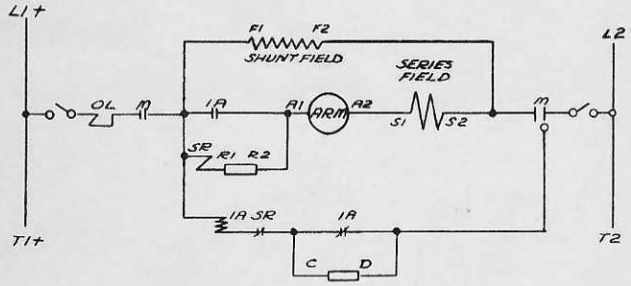


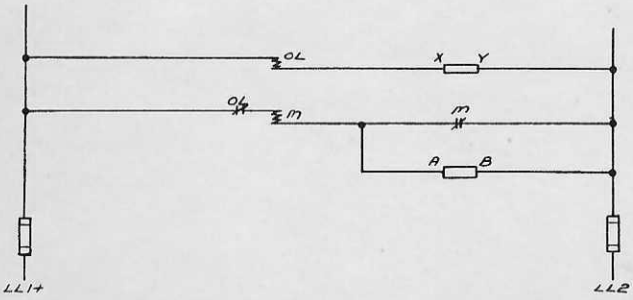
Figure 42—Magnetic Controller Unit, 220/440 volts a-c (Wiring and Outline T-621074)

RESTRICTED



CONNECTION DIAGRAM

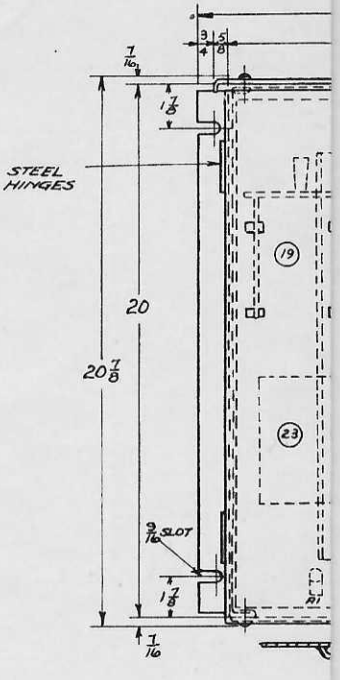




SCHEMATIC DIAGRAM

SHEET STEEL DOOR [illegible] 14 U.S.S. G
SHEET STEEL TOP & BOTTOM
SHEET STEEL SIDES & BACK [illegible]

CASE ASSEMBLED WITH



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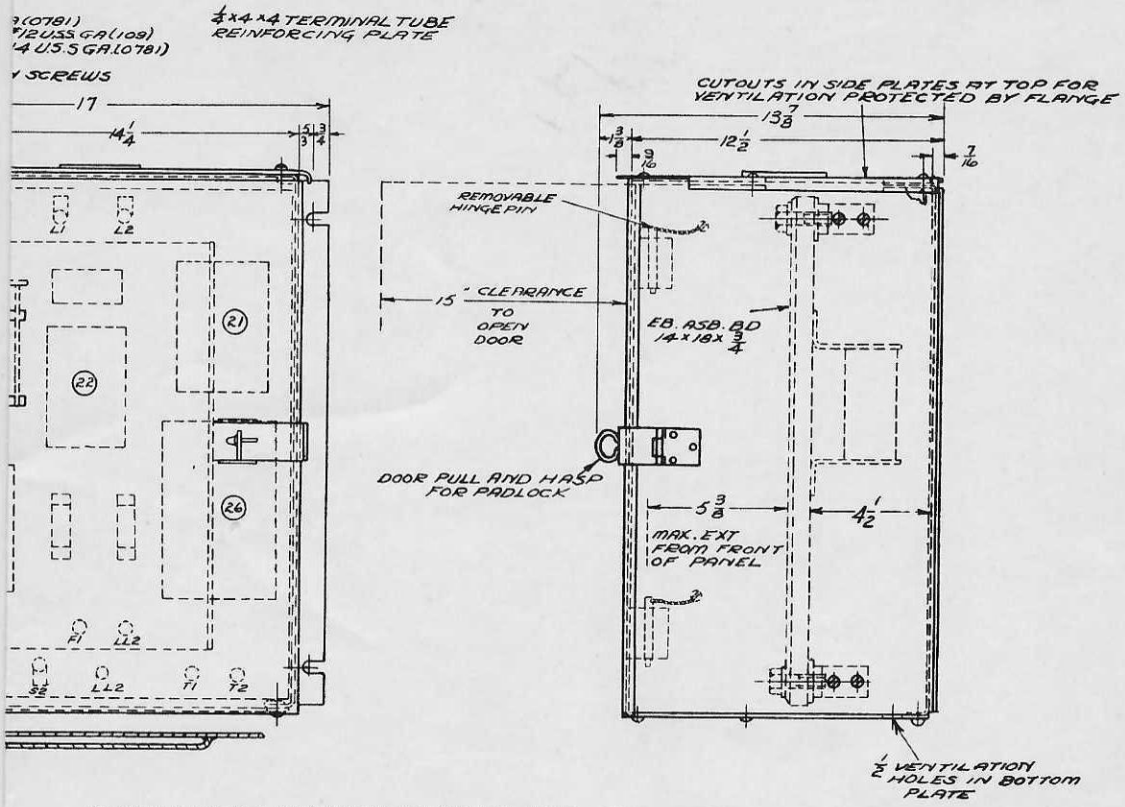


OUT LINE DIMENSION OF CONTROLLER

TABLE A

VOLTS	H.P.	AMPS	COIL DROPOUT VOLTAGE	OVERLOAD DATA RATING	OVERLOAD DATA CALIBRATION	QUANTITY	SERIAL	TYPE
115	4.5	36	12	60	40-30-72	11	1-11	CAE 21541
230	4.5	18	23	33	24-30-36	11	1-11	CAE 21542
250	4.5	16.6	25	33	23-28-33	6	1-6	CAE 21542

WEIGHT

COMPLETE UNIT (ESTIMATED)	93 LBS
SPEC. PARTS CONTROLLER ESTIMATED)	90 LBS
SPARE PARTS (ESTIMATED	10 LBS

Figure 43—Magnetic Controller Unit, 115/230/250 volt d-c (Wiring and Outline T-621075)

RESTRICTED

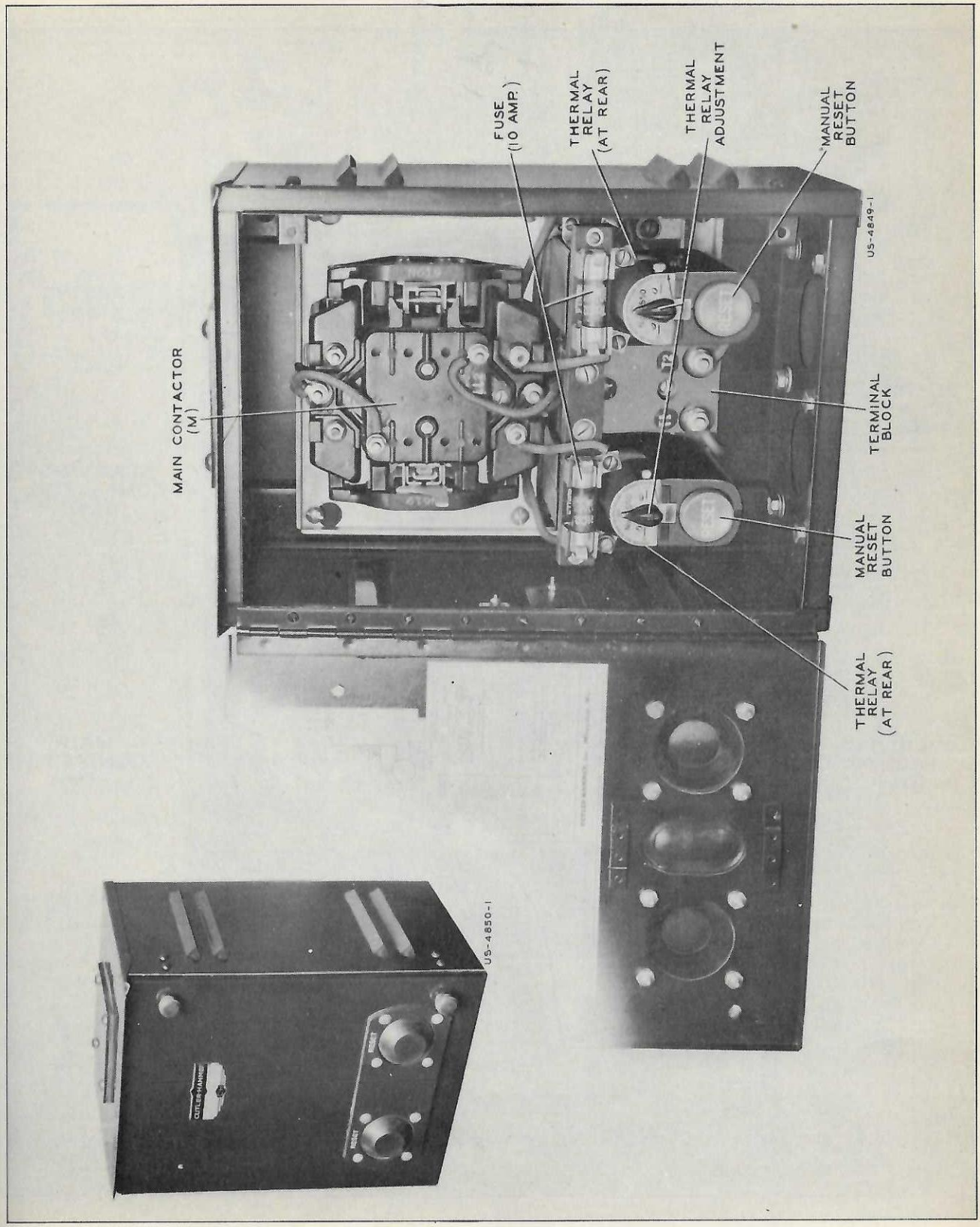


Figure 44—Magnetic Controller, A-C Supply (Front View, Cover Open)

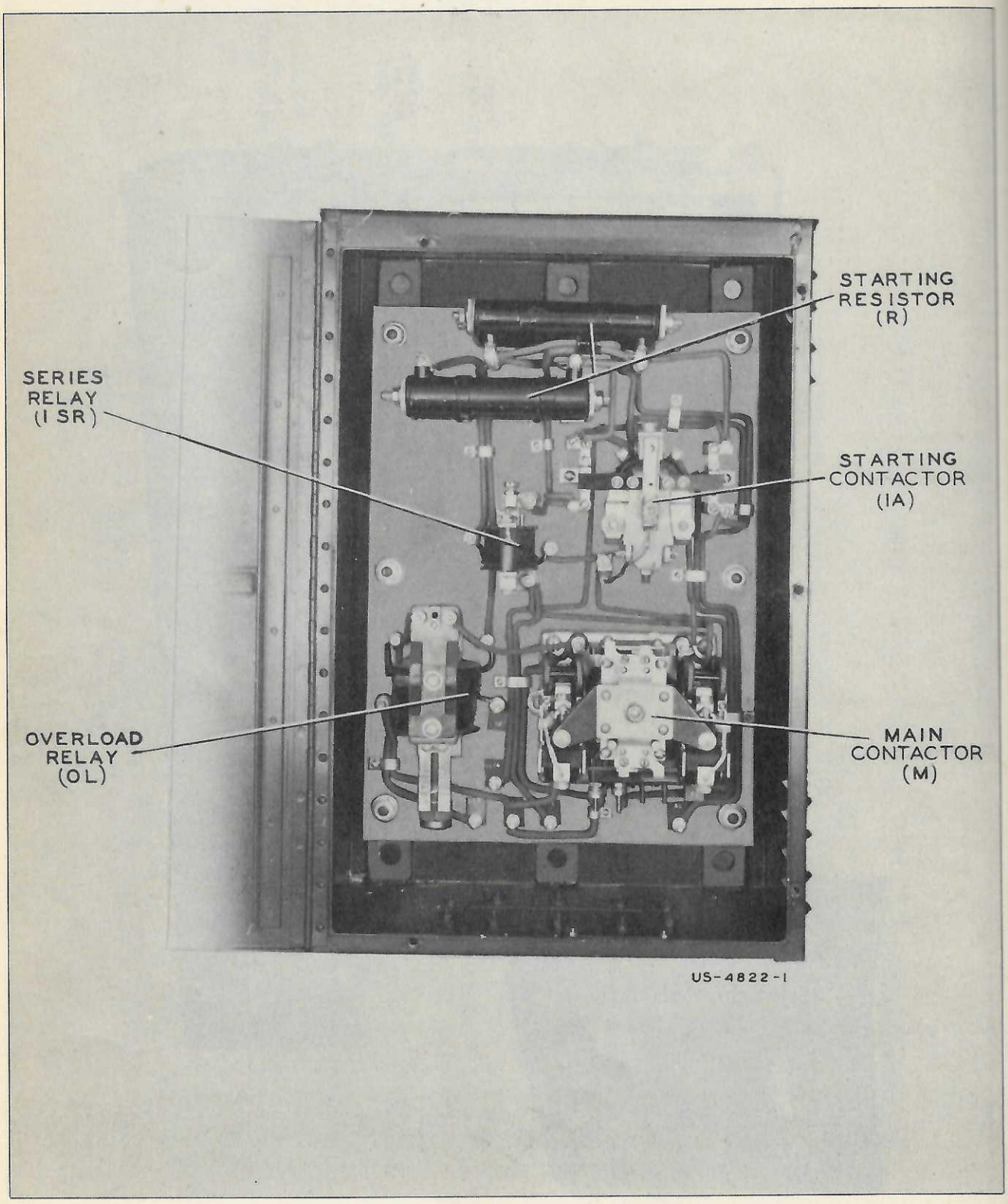
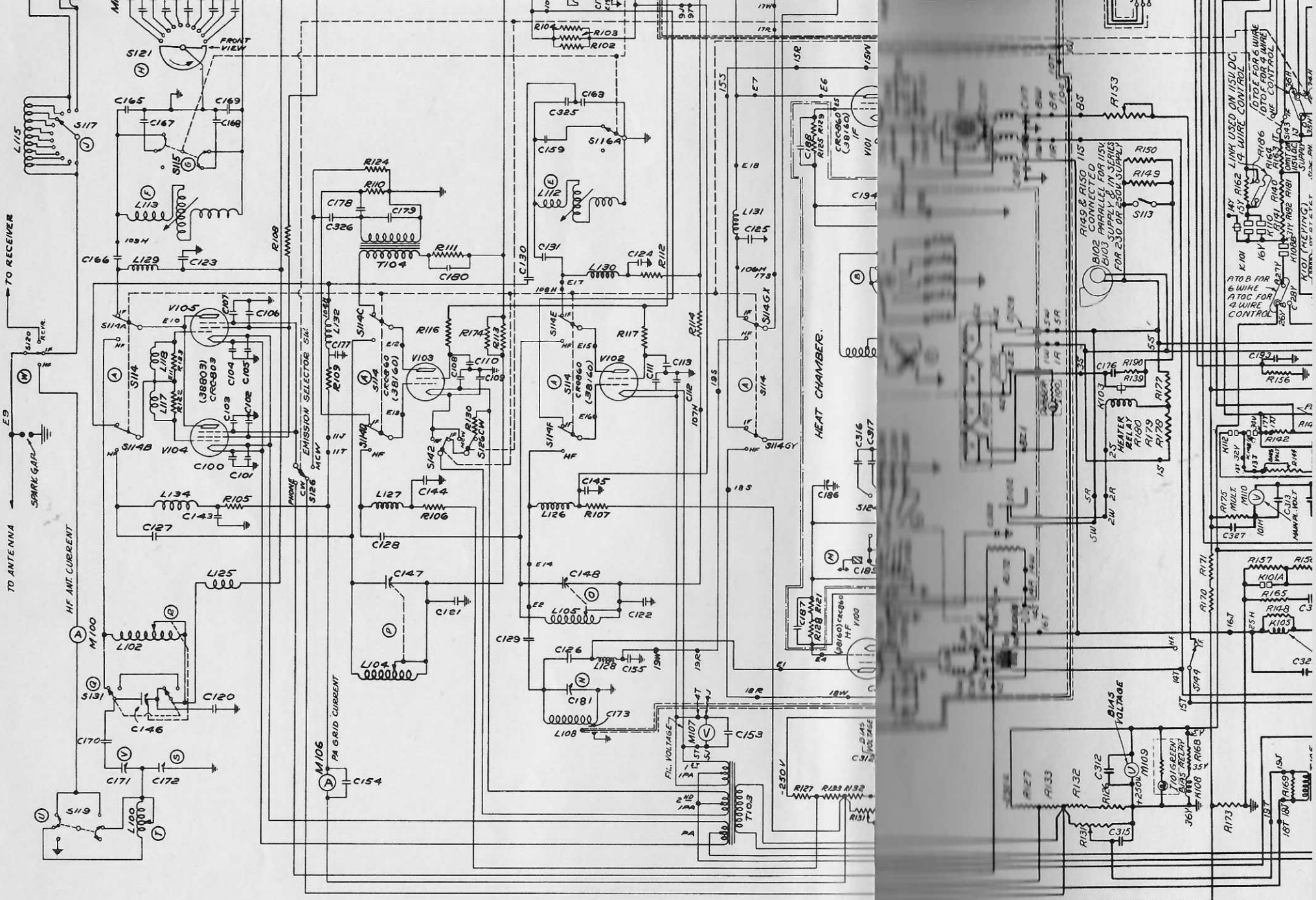


Figure 45—Magnetic Controller, D-C Supply (Front View, Cover Open)



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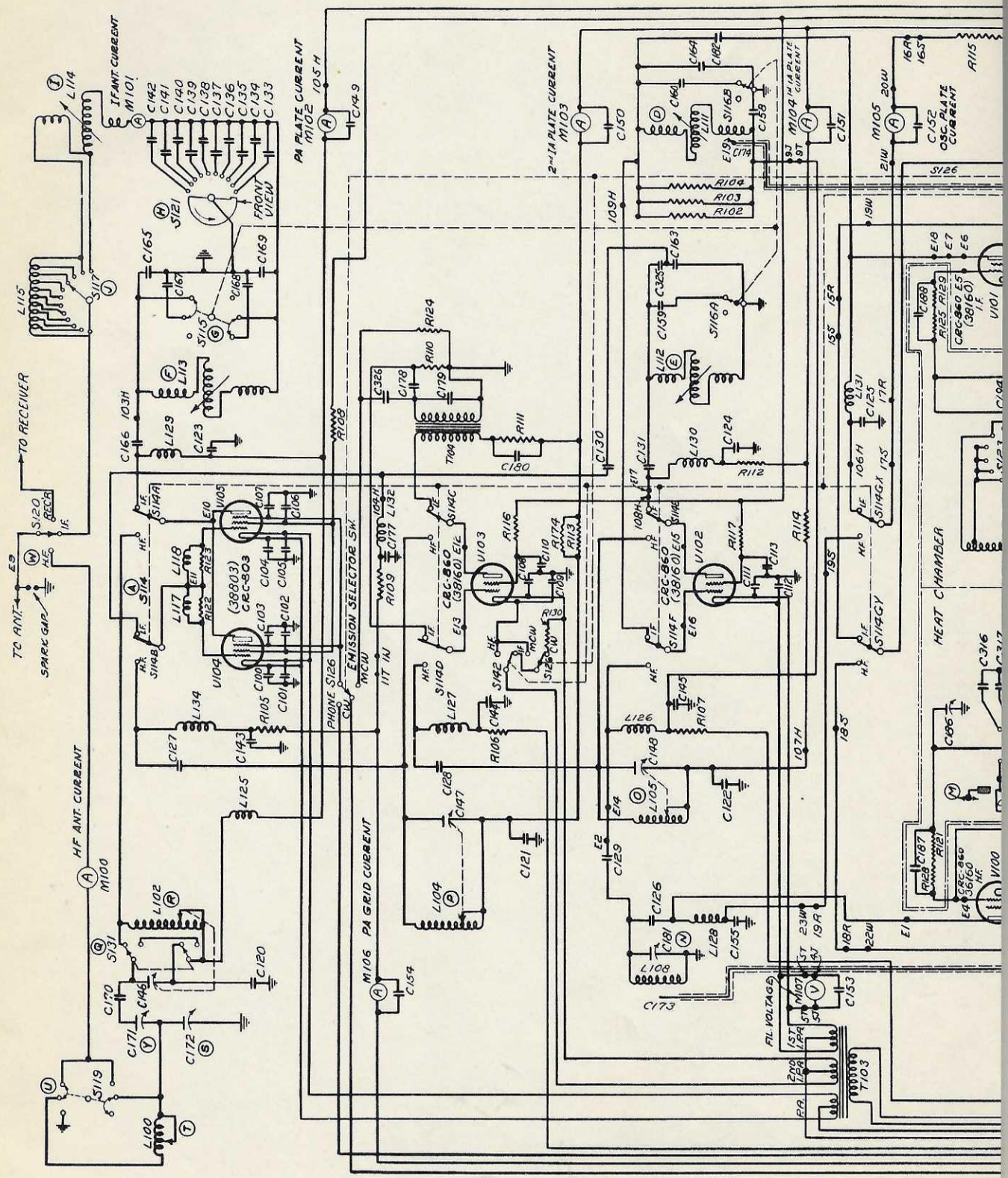

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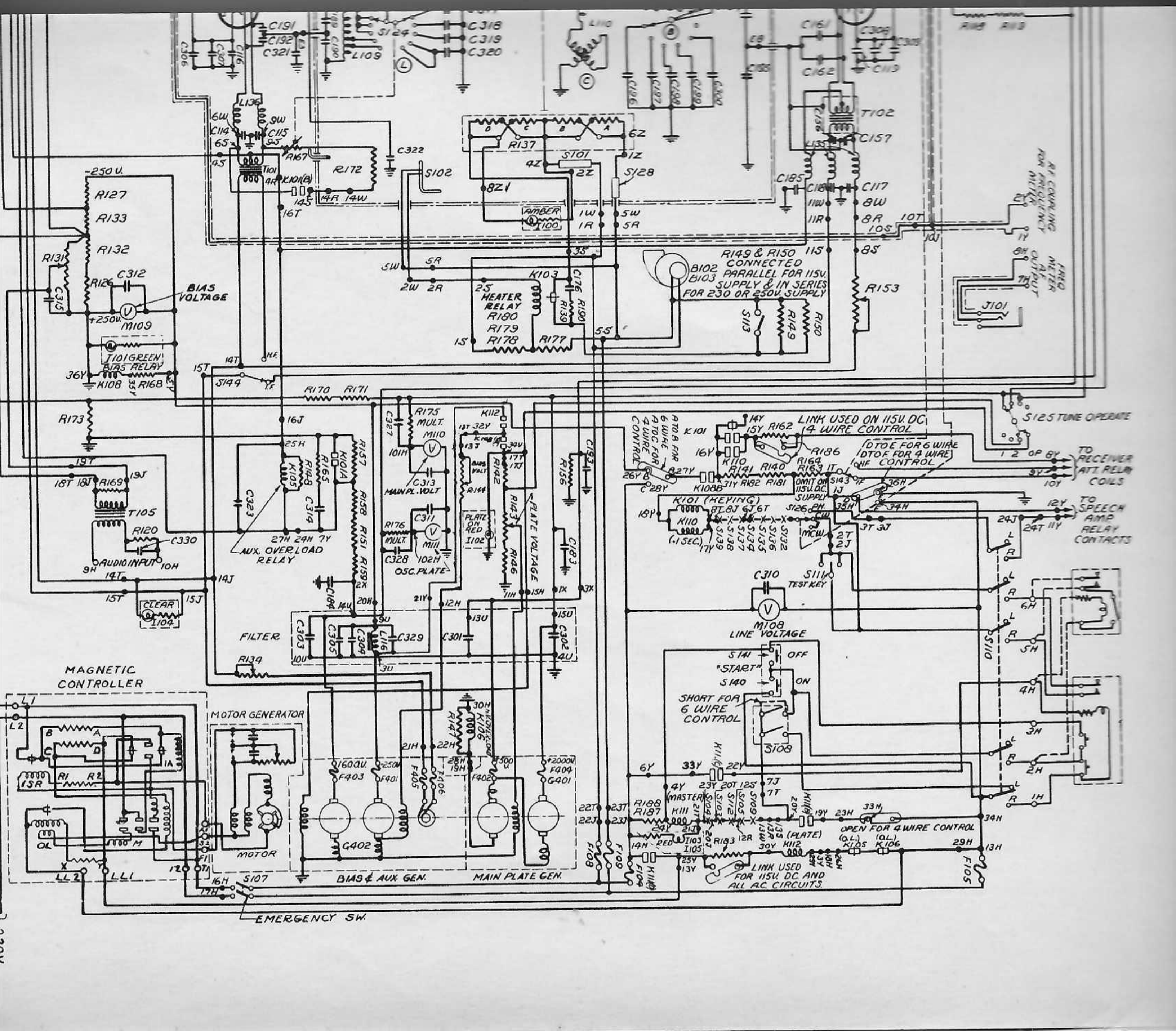
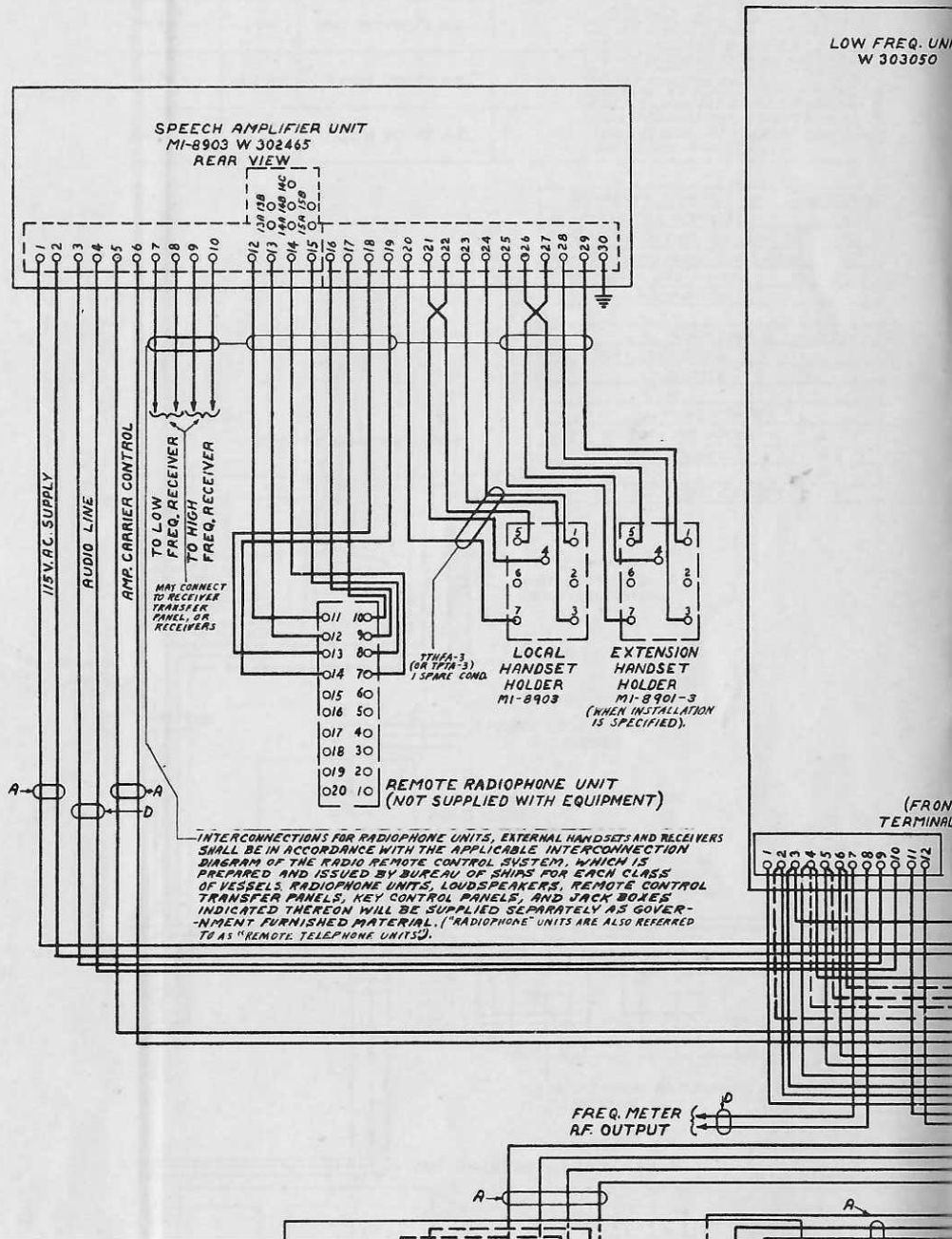


BIAS VOLTAGE
T101 GREEN BIAS RELAY
HEATER RELAY
R149 & R150 CONNECTED PARALLEL FOR 115V. SUPPLY & IN SERIES FOR 230 OR 250V. SUPPLY
R.F. COUPLING FOR FREQUENCY METER
FREQ METER AF OUTPUT
S125 TUNE OPERATE
LINK USED ON 115V. DC 4 WIRE CONTROL
A TO B FOR 6 WIRE A TO C FOR 4 WIRE CONTROL
D TO E FOR 6 WIRE D TO F FOR 4 WIRE HF CONTROL
OMIT ON 115V. D.C. SUPPLY
TO RECEIVER ATT. RELAY COILS
TO SPEECH AMP RELAY CONTACTS
K101 (KEYING)
AUX. OVERLOAD RELAY
AUDIO INPUT
MAIN PL. VOLT
OSC. PLATE
PLATE VOLTAGE
CLEAR
FILTER
TEST KEY
LINE VOLTAGE
"START"
OFF
ON
SHORT FOR 6 WIRE CONTROL
MAGNETIC CONTROLLER
MOTOR GENERATOR
MOTOR
BIAS & AUX. GEN.
MAIN PLATE GEN.
OPEN FOR 4 WIRE CONTROL
LINK USED FOR 115V. DC. AND ALL A.C. CIRCUITS
EMERGENCY SW.


SPEECH AMPLIFIER UNIT
MI-8903 W 302465
REAR VIEW
115 V. A.C. SUPPLY
AUDIO LINE
AMP. CARRIER CONTROL
TO LOW FREQ. RECEIVER
TO HIGH FREQ. RECEIVER
MAY CONNECT TO RECEIVER TRANSFER PANEL, OR RECEIVERS
TTHFA-3 (OR TFIA-3) 1 SPARE COND.
LOCAL HANDSET HOLDER MI-8903
EXTENSION HANDSET HOLDER MI-8901-3 (WHEN INSTALLATION IS SPECIFIED).
REMOTE RADIOPHONE UNIT (NOT SUPPLIED WITH EQUIPMENT)
INTERCONNECTIONS FOR RADIOPHONE UNITS, EXTERNAL HANDSETS AND RECEIVERS SHALL BE IN ACCORDANCE WITH THE APPLICABLE INTERCONNECTION DIAGRAM OF THE RADIO REMOTE CONTROL SYSTEM, WHICH IS PREPARED AND ISSUED BY BUREAU OF SHIPS FOR EACH CLASS OF VESSELS. RADIOPHONE UNITS, LOUDSPEAKERS, REMOTE CONTROL TRANSFER PANELS, KEY CONTROL PANELS, AND JACK BOXES INDICATED THEREON WILL BE SUPPLIED SEPARATELY AS GOVERNMENT FURNISHED MATERIAL. ("RADIOPHONE" UNITS ARE ALSO REFERRED TO AS "REMOTE TELEPHONE UNITS").
LOW FREQ. UNI
W 303050
(FRON
TERMINAL
FREQ. METER
A.F. OUTPUT

RESTRICTED

WIRE DESIGNATION PER NAVY SPEC 15C1 (INT) SUB1					
WIRE	NAVY TYPE	CIR. MILS	DIELECTRIC STRENGTH	CURRENT RATING	TYPE OF INSULATION
A	SRLL-4	4494	2500 VOLTS AC.		COTTON THREAD, 40% RUBBER, COTTON BRAID AND SOFT LEAD SHEATH.
B	SHFR-4	4494	8000 VOLTS AC.		SEPARATOR, VARNISHED CAMBRIC, SEPARATOR, FELTED ASBESTOS OR GLASS FIBERS, IMPERVIOUS SHEATH, BRAIDED METAL ARMORING, PAINTING.
C	THFA-14	14350	2000 VOLTS AC.		EACH CONDUCTOR-FELTED ASBESTOS OR GLASS FIBERS, VARNISHED CAMBRIC, FELTED ASBESTOS OVERALL, FELTED ASBESTOS OR GLASS FIBERS, IMPERVIOUS SHEATH, BRAIDED METAL ARMORING
D	DRLL-14	4494	2500 VOLTS AC.		EACH CONDUCTOR-COTTON THREAD, 40% RUBBER, COTTON BRAID; OVERALL, SOFT LEAD SHEATH.

NOMINAL SUPPLY	440/3/60
RATED MOTOR OUTPUT	3.5 H.P.
ALLOWABLE SUPPLY VOLTAGE VARIATION	± 10%
ALLOWABLE SUPPLY FREQUENCY VARIATION	± 5%
STARTING: LINE AMPS.	33
KILOWATTS	22
KVA	25
% POWER FACTOR	87
STANDBY: LINE AMPS.	
KILOWATTS	
KVA	
% POWER FACTOR	
KEY LOCKED: LINE AMPS	5.4
KILOWATTS	3.2
KVA	4.1
% POWER FACTOR	78

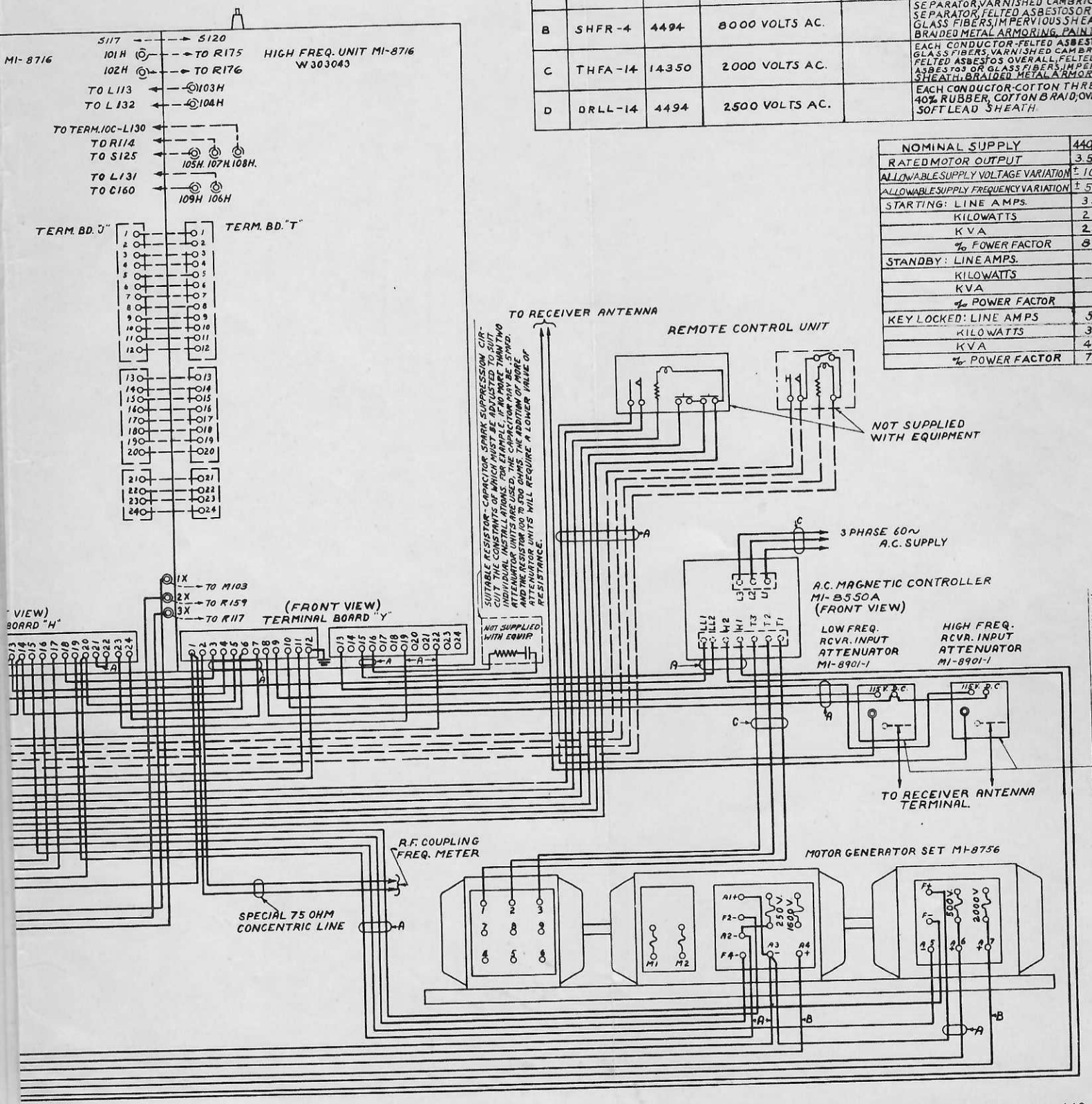
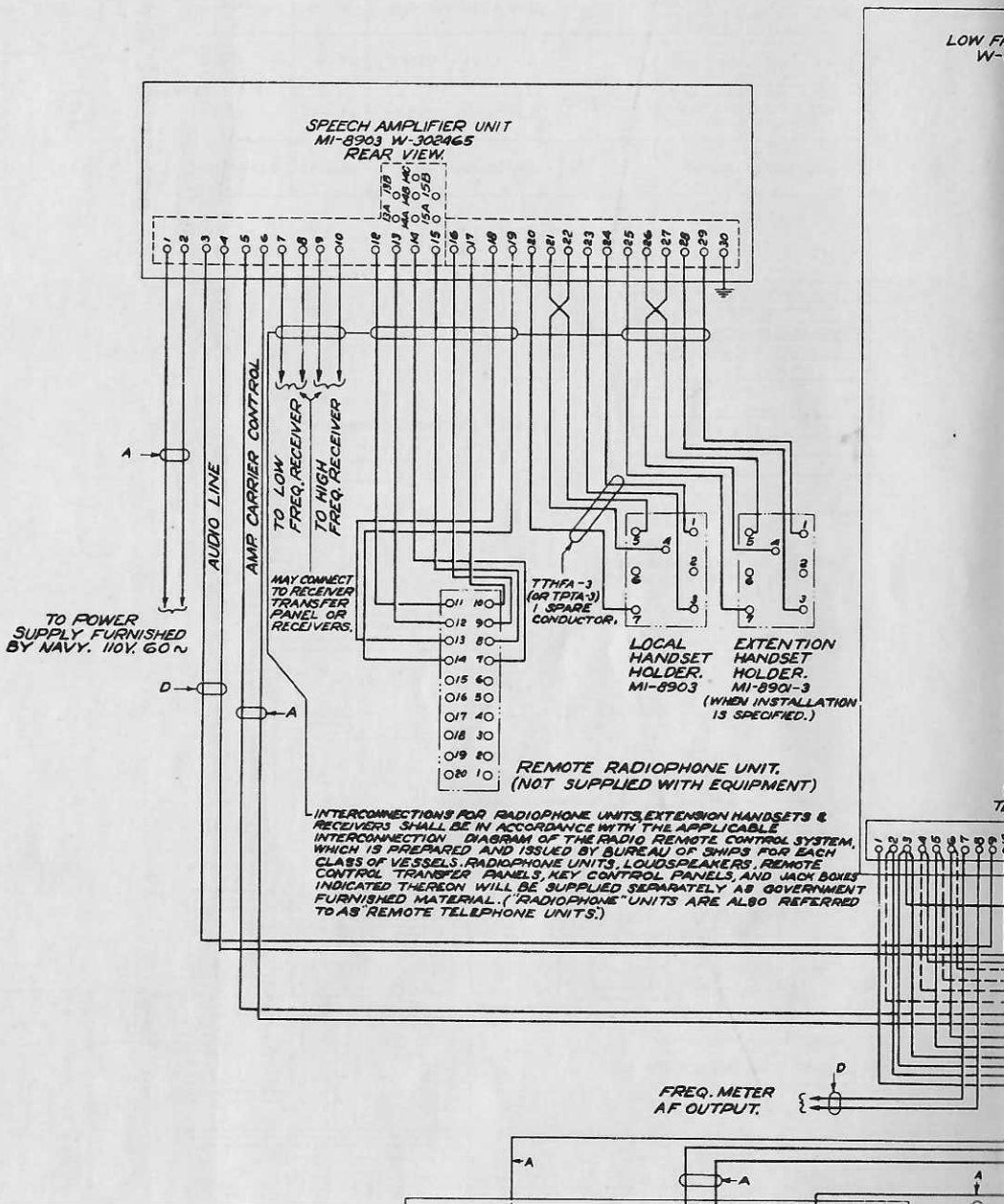


Figure 48—Transmitting Equipment, 440 volt a-c (External Connections T-611960)

RESTRICTED


SPEECH AMPLIFIER UNIT
MI-8903 W-302465
REAR VIEW.
AUDIO LINE
AMP CARRIER CONTROL
TO LOW FREQ. RECEIVER
TO HIGH FREQ. RECEIVER
MAY CONNECT TO RECEIVER TRANSFER PANEL OR RECEIVERS.
TTHFA-3 (OR TPTA-3) 1 SPARE CONDUCTOR.
TO POWER SUPPLY FURNISHED BY NAVY. 110V. 60~
LOCAL HANDSET HOLDER. MI-8903
EXTENTION HANDSET HOLDER. MI-8901-3 (WHEN INSTALLATION IS SPECIFIED.)
REMOTE RADIOPHONE UNIT. (NOT SUPPLIED WITH EQUIPMENT)
INTERCONNECTIONS FOR RADIOPHONE UNITS, EXTENSION HANDSETS & RECEIVERS SHALL BE IN ACCORDANCE WITH THE APPLICABLE INTERCONNECTION DIAGRAM OF THE RADIO REMOTE CONTROL SYSTEM, WHICH IS PREPARED AND ISSUED BY BUREAU OF SHIPS FOR EACH CLASS OF VESSELS. RADIOPHONE UNITS, LOUDSPEAKERS, REMOTE CONTROL TRANSFER PANELS, KEY CONTROL PANELS, AND JACK BOXES INDICATED THEREON WILL BE SUPPLIED SEPARATELY AS GOVERNMENT FURNISHED MATERIAL. ("RADIOPHONE" UNITS ARE ALSO REFERRED TO AS "REMOTE TELEPHONE UNITS.")
FREQ. METER AF OUTPUT.

RESTRICTED

WIRE DESIGNATION PER NAVY SPEC. 15CI(INT)SUB1					
WIRE	NAVY TYPE	C.M.MILS	DIELECTRIC STRENGTH	CURRENT RATING	TYPE OF IN
A	SRLL-4	4494	2500 VOLTS A.C.		COTTON THREAD & C BRAID AND SOF
B	SHFR-4	4494	8000 VOLTS A.C.		SEPARATOR VARNISH FELTED ASBESTOS C IMPERVIOUS SHEA ARMORING, PAI
C	THFA-14	14,350	2000 VOLTS A.C.		EACH CONDUCTOR FE FIBERS, VARNISHED C OVERALL FELTED ASB IMPERVIOUS SHEATH,
D	DRLL-4	4494	2500 VOLTS A.C.		EACH CONDUCTOR RUBBER, COTTON SOFT LEAD SHE
E	DHFA-14	14350	2000 VOLTS A.C.		SAME AS FOR

NOMINAL SUPPL	
RATED MOTOR OU	
ALLOWABLE SUPPLY VOLTA	
STARTING: LINE A	
KILOWA	
STAND BY: LINE AM	
KILOWAT	
KEY LOCKED LINE	
KILOWAT	

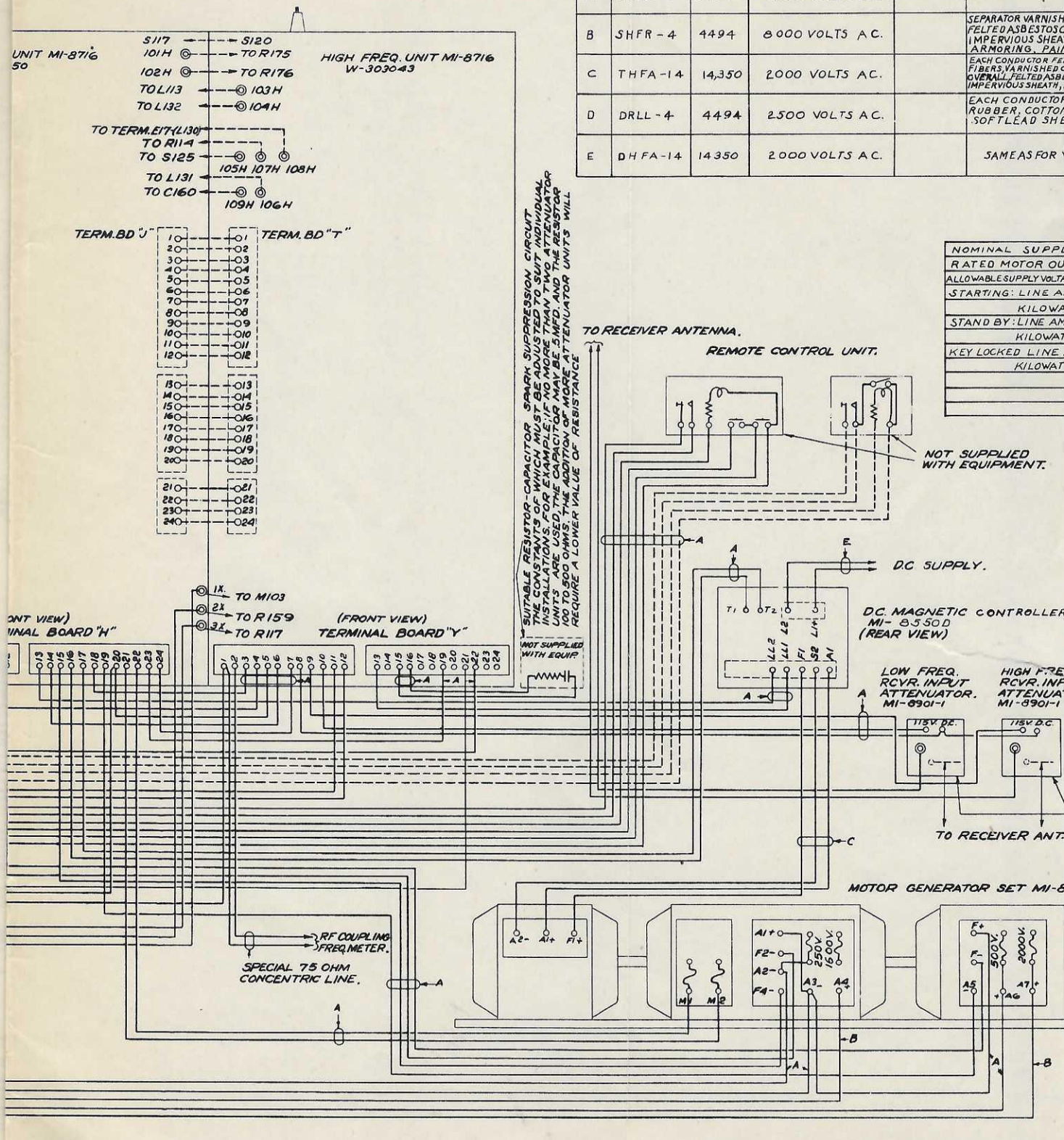
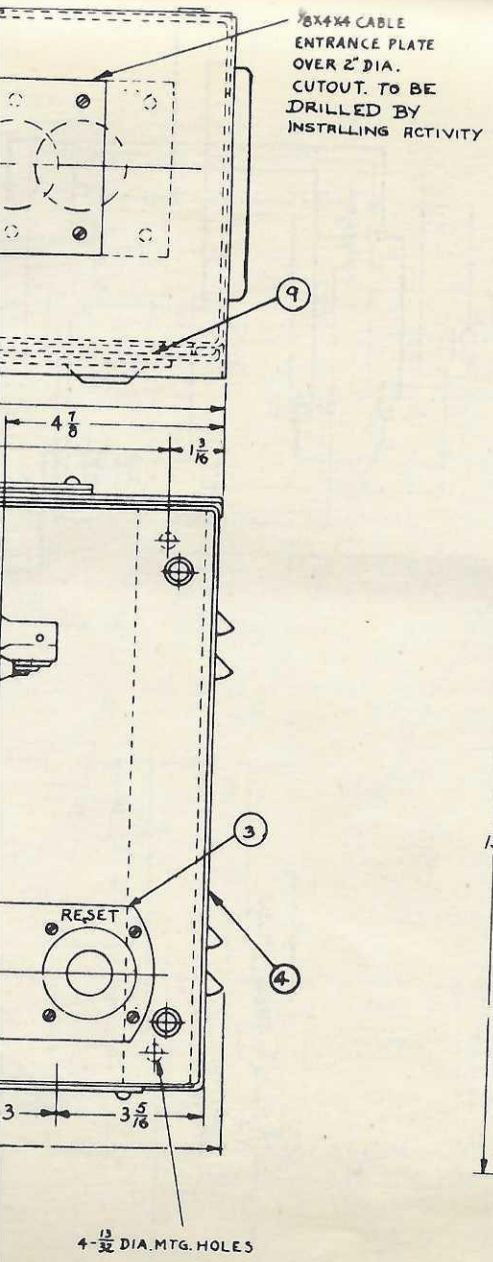


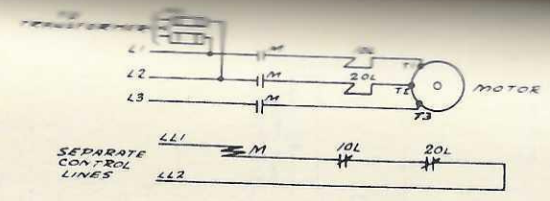
Figure 49—Transmitting Equipmer
d-c (External Connections T-

RESTRICTED

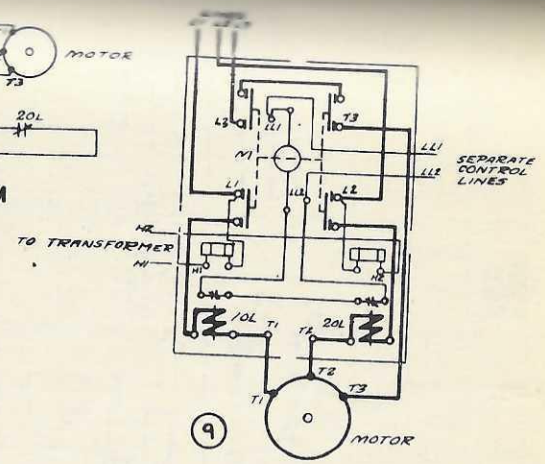
RESTRICTED



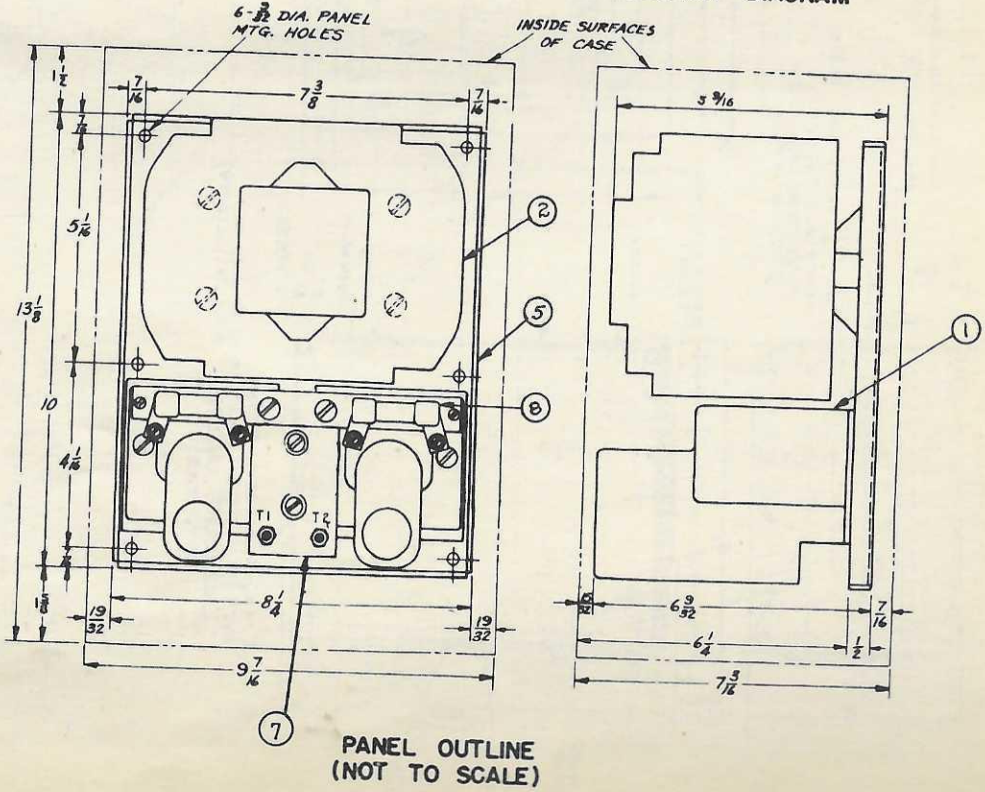
UTLINE
ALE)



SCHEMATIC DIAGRAM

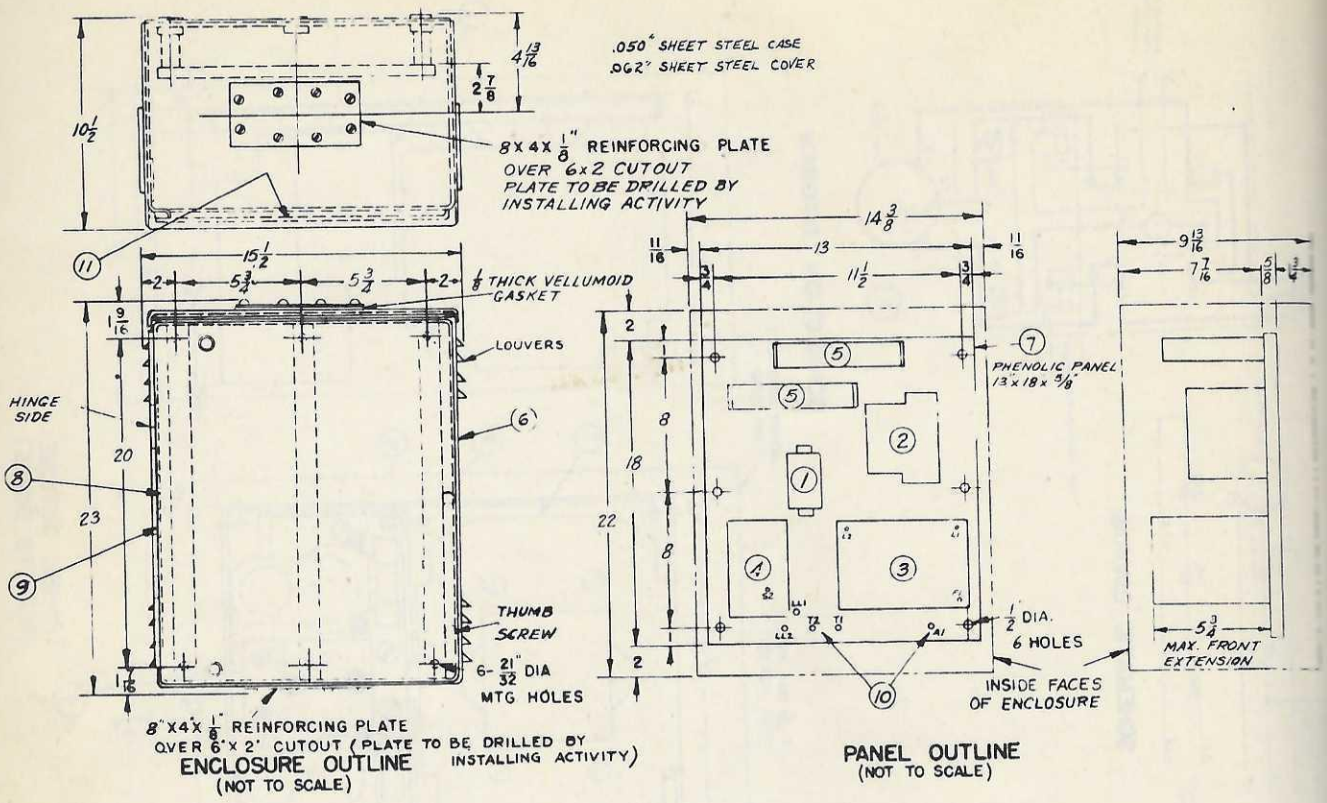


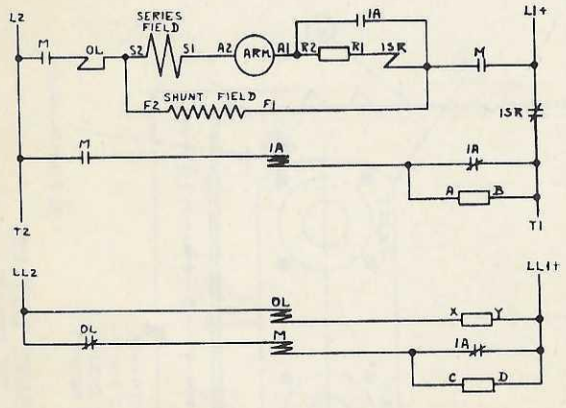
CONNECTION DIAGRAM



PANEL OUTLINE
(NOT TO SCALE)

RESTRICTED





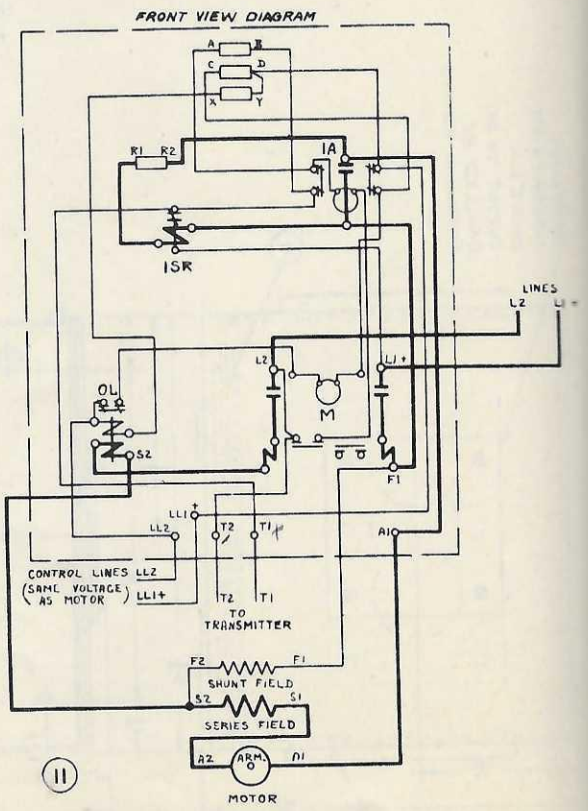


Figure 51—*Magnetic Controller Unit,* 230 *volts d-c* (*Wiring and Outline* K-942-1-11M1)

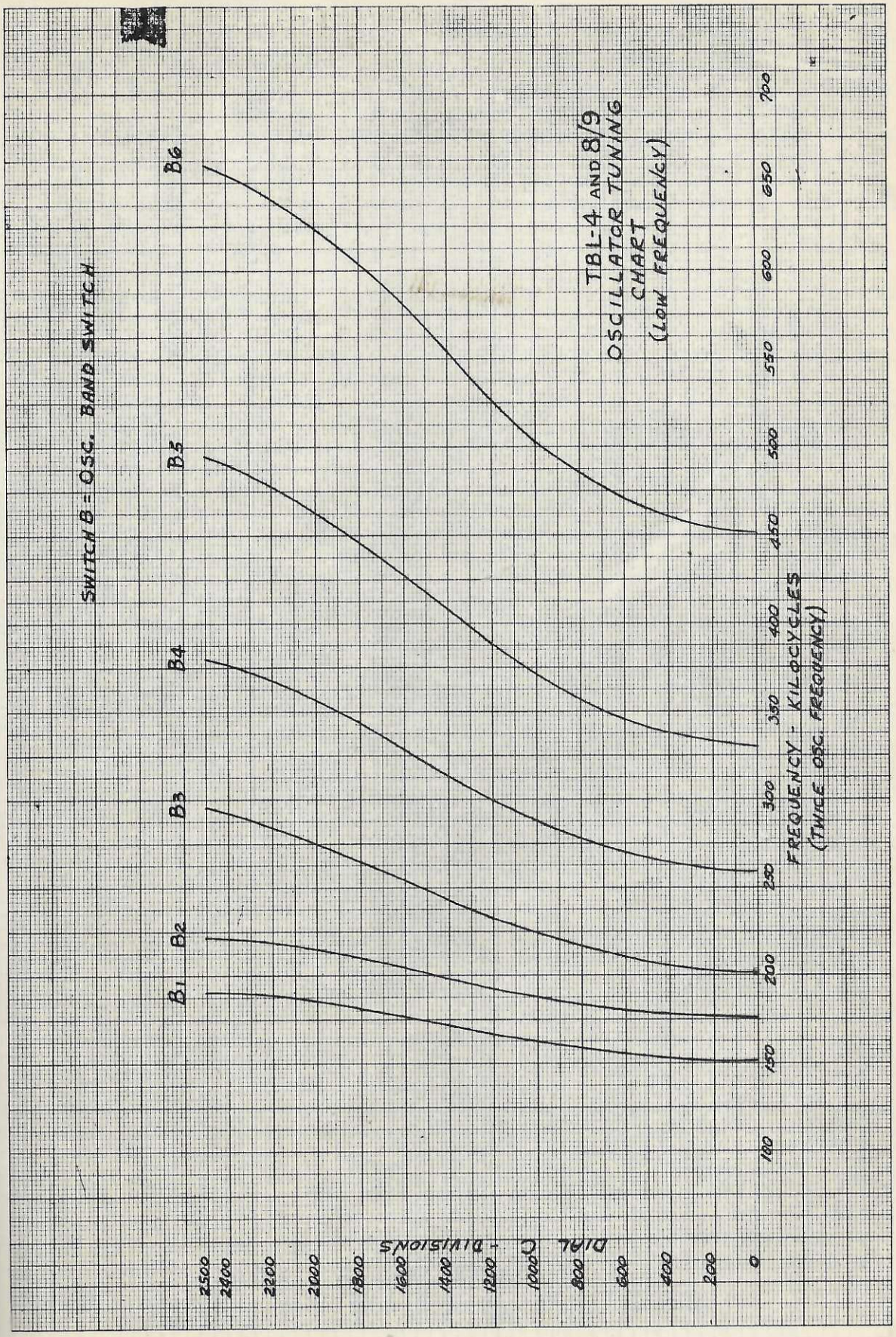


Figure 52—Tuning Dial C (Controls B and C)
(Typical Calibration S-851914)

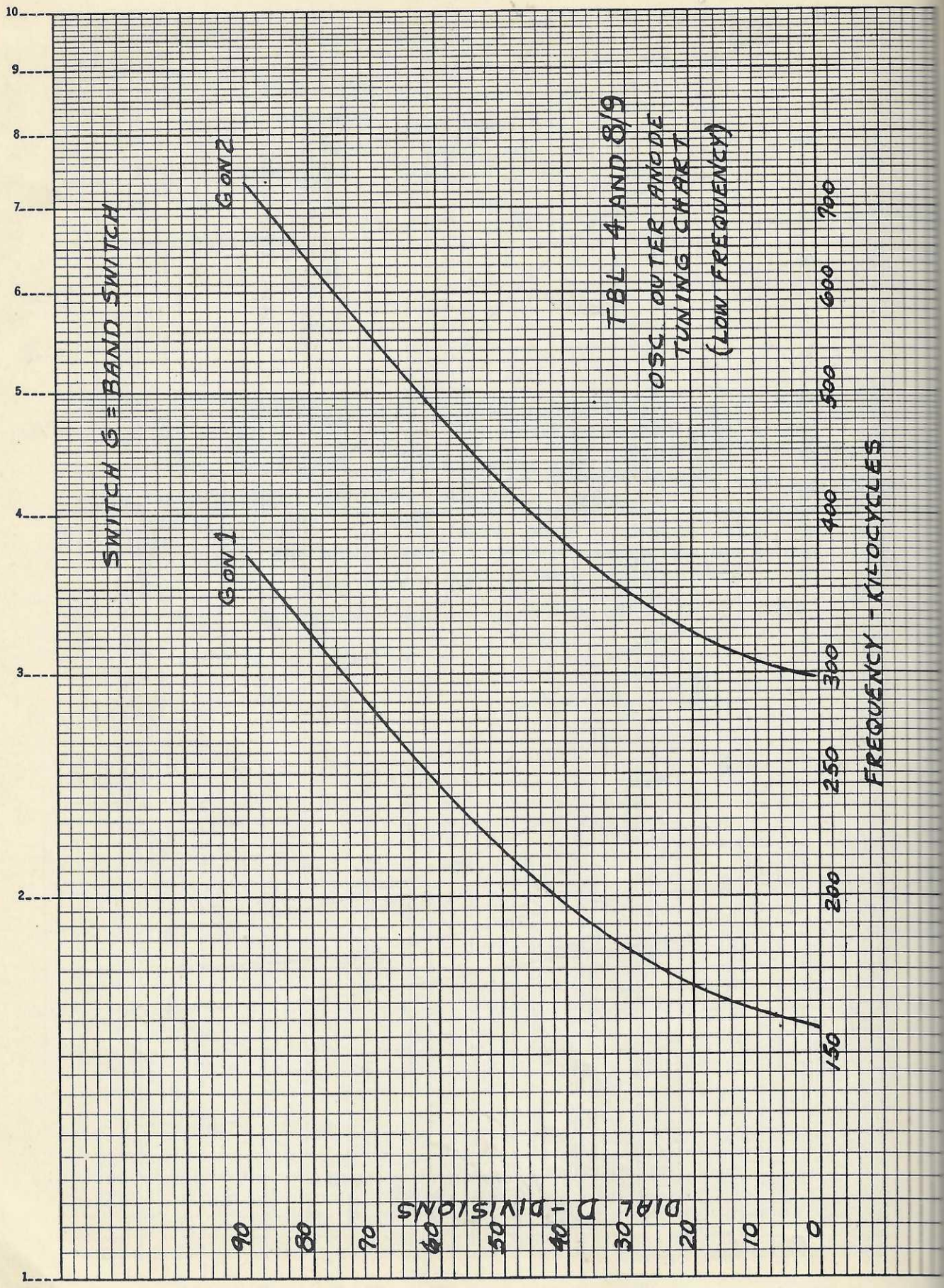


Figure 53—Tuning Dial D (Typical Calibration S-851906)

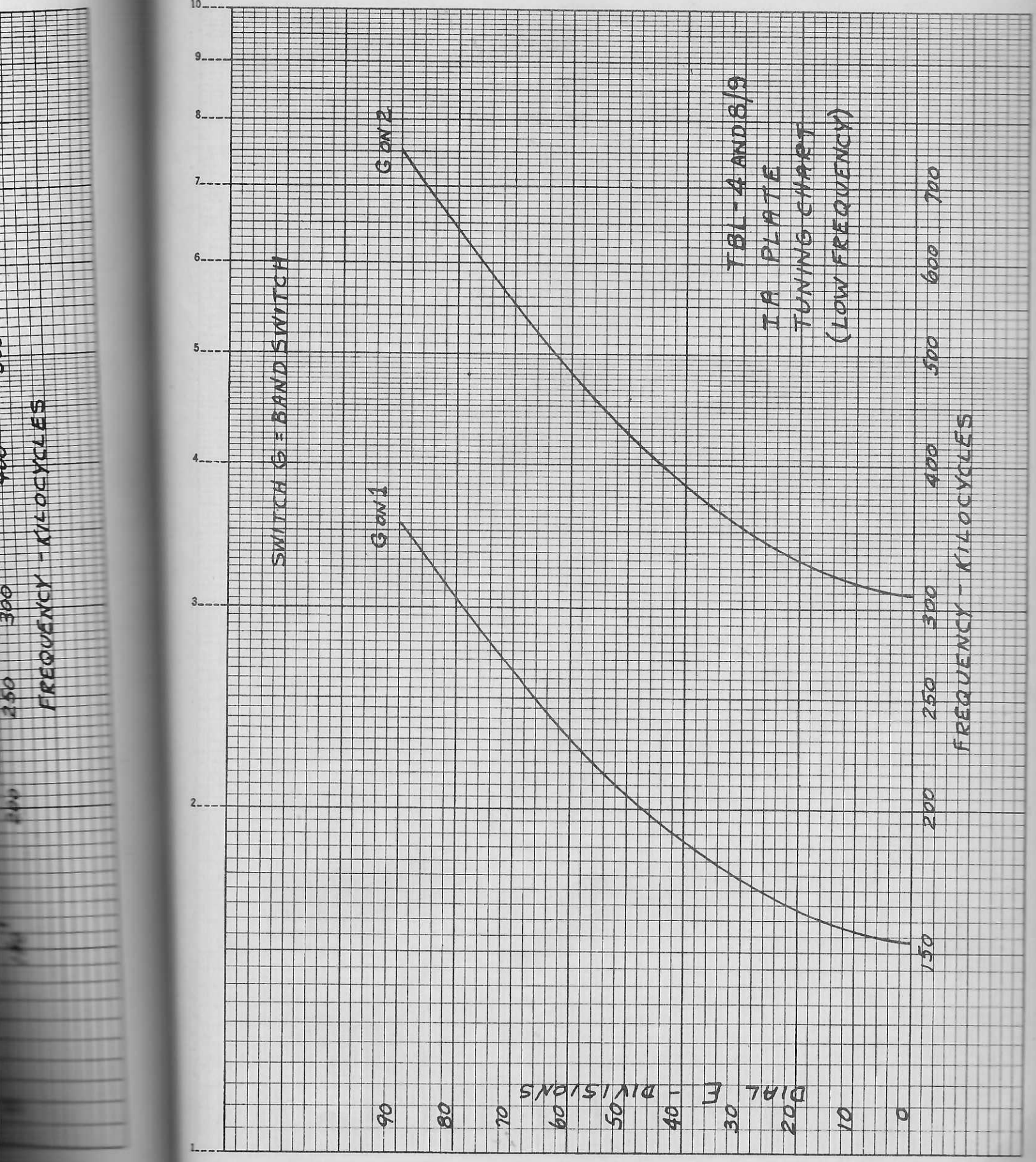


Figure 54—Tuning Dial E (Typical Calibration S-851909)

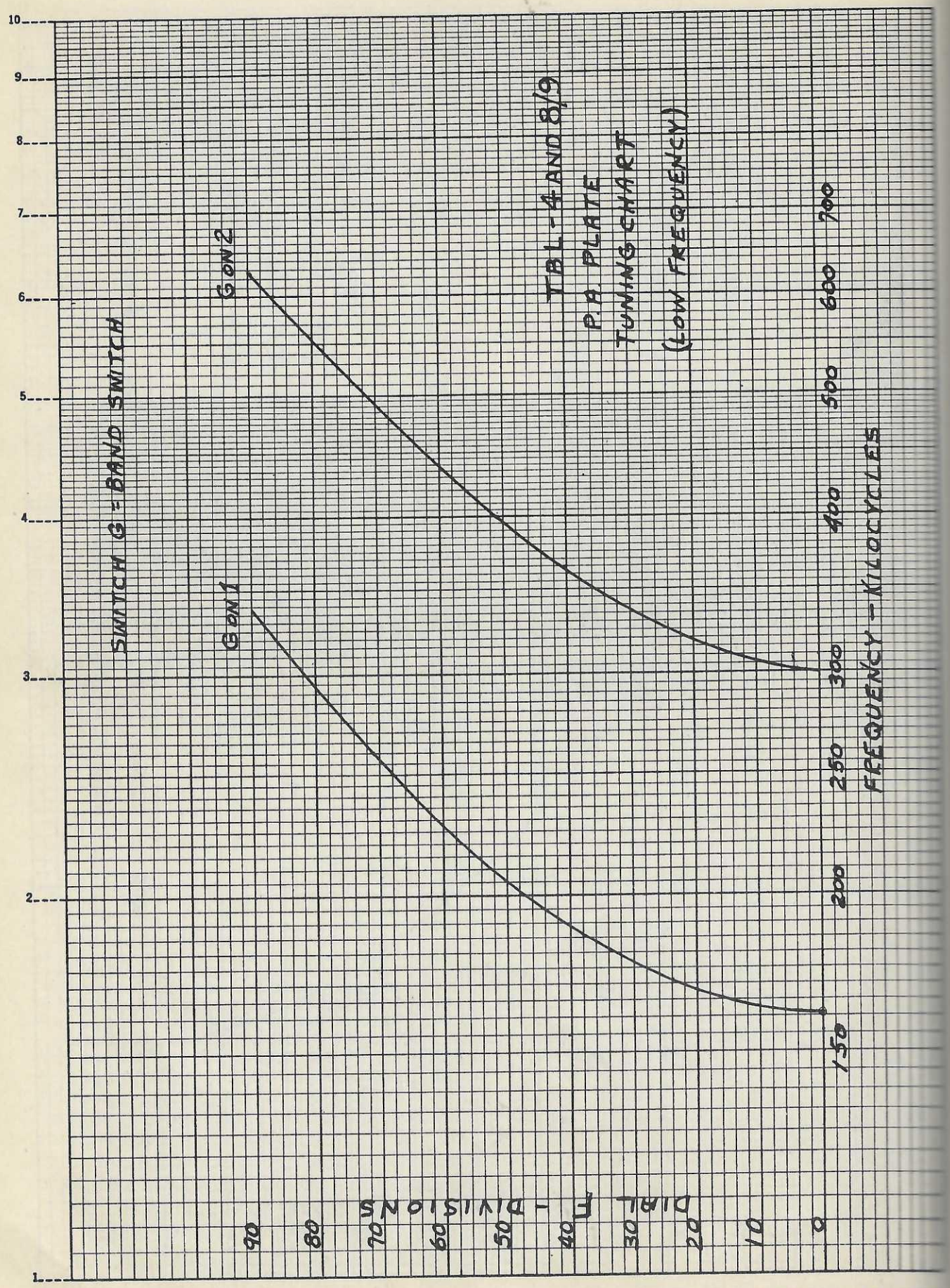


Figure 55—Tuning Dial F (Controls F and G
(Typical Calibration S-851907)

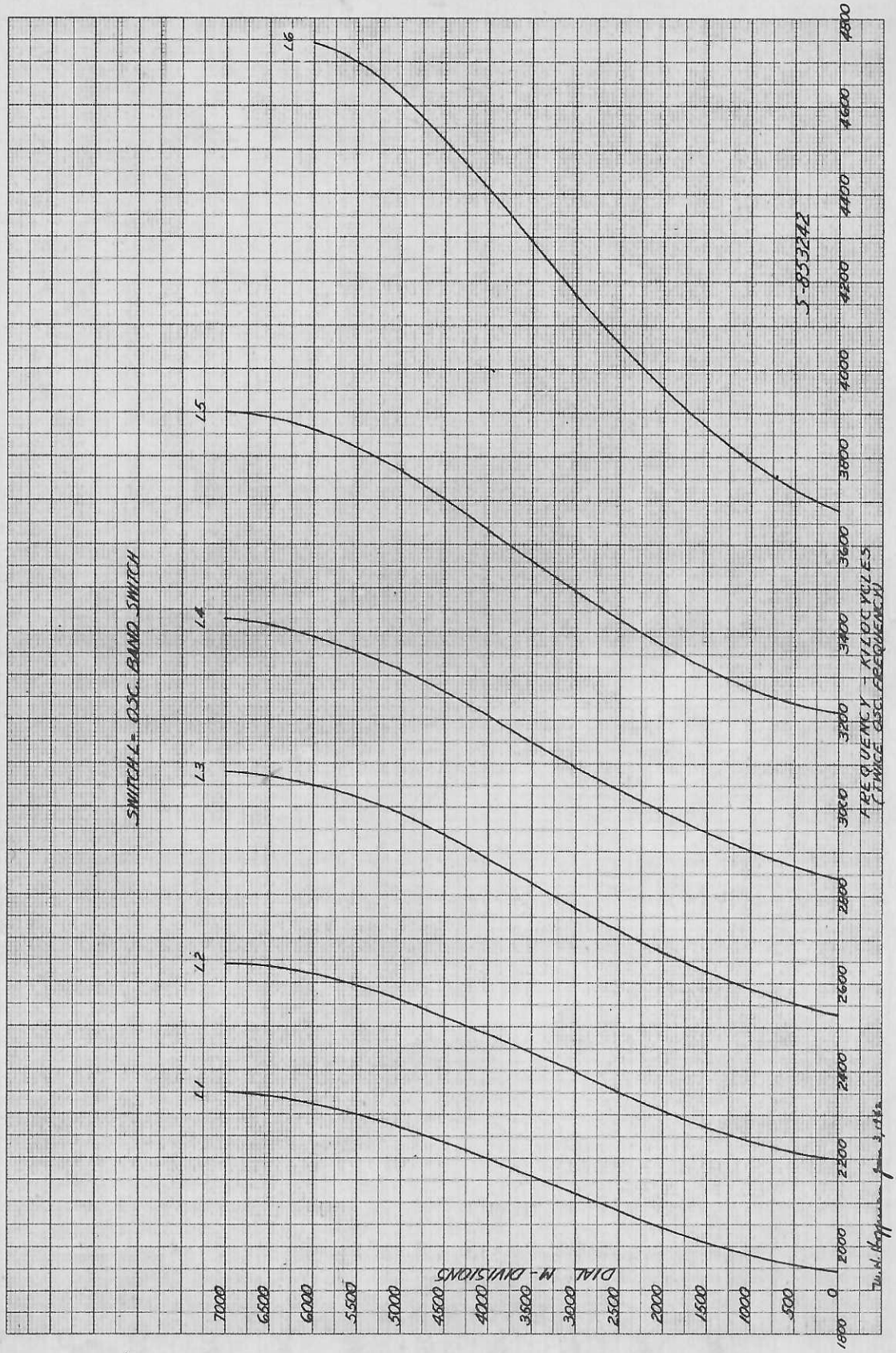


Figure 56—Tuning Dial M (Controls L and M)
(Typical Calibration S-853242)

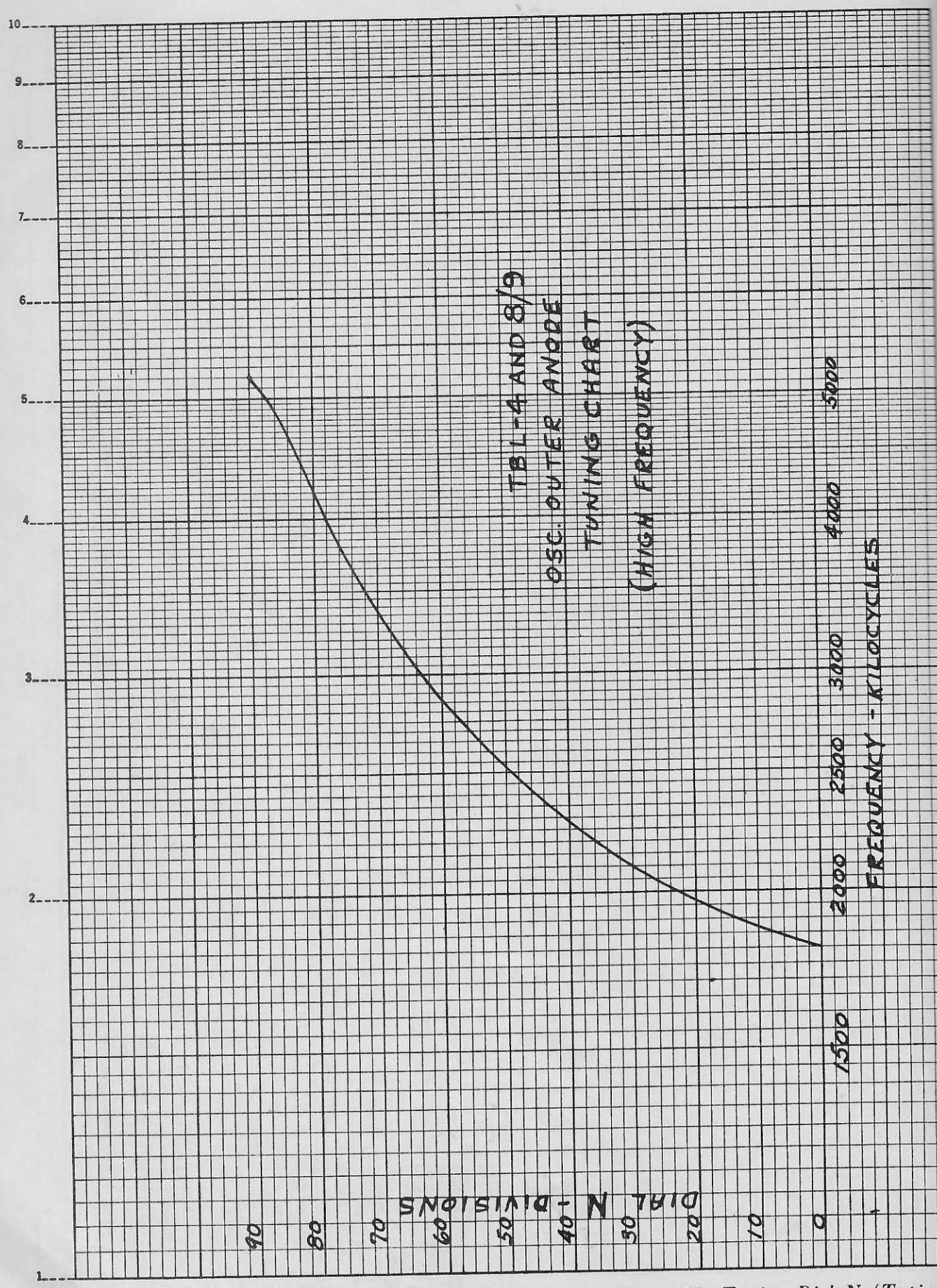


Figure 57—Tuning Dial N (Typical Calibration S-851910)

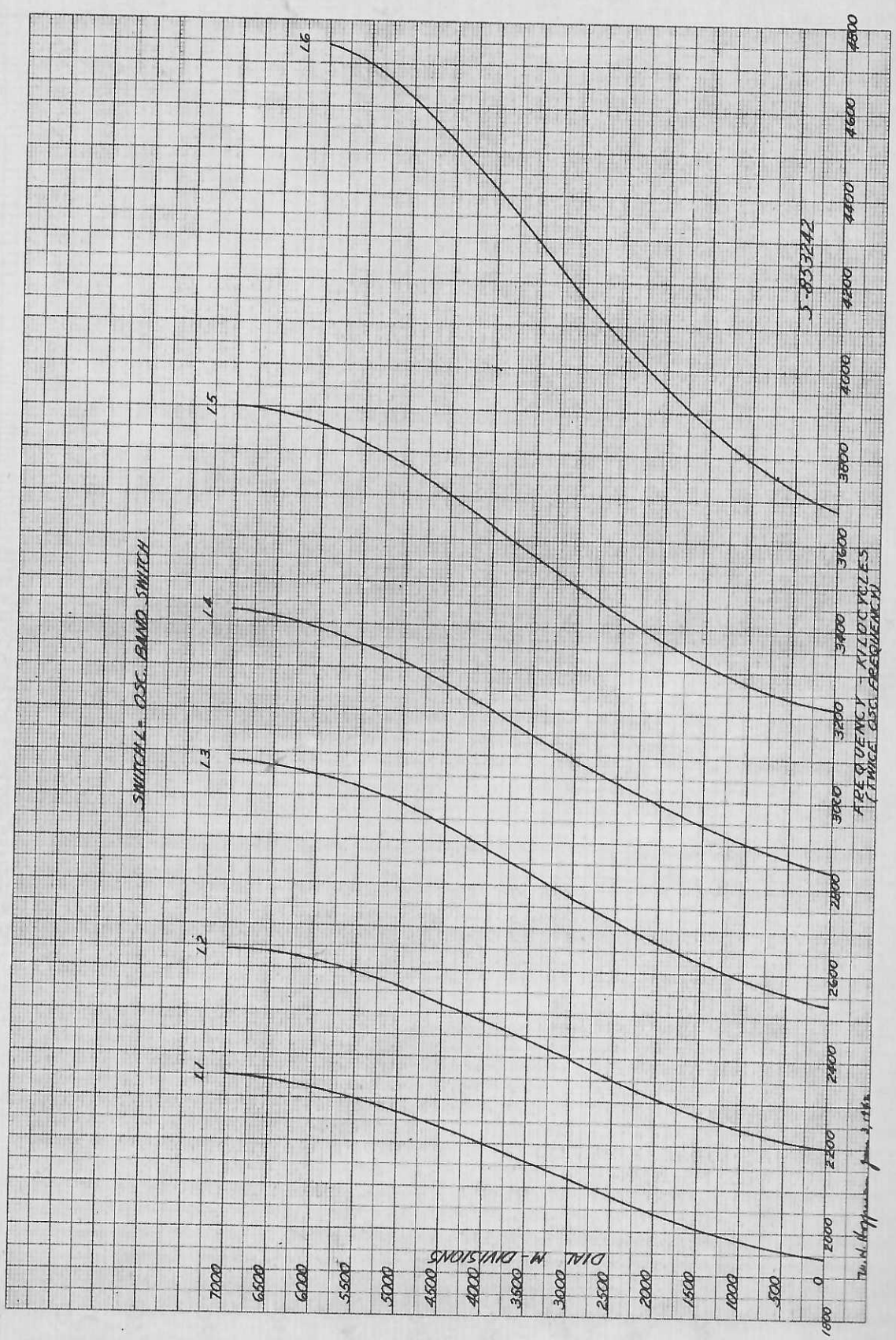


Figure 56—Tuning Dial M (Controls L and M) (Typical Calibration S-853242)

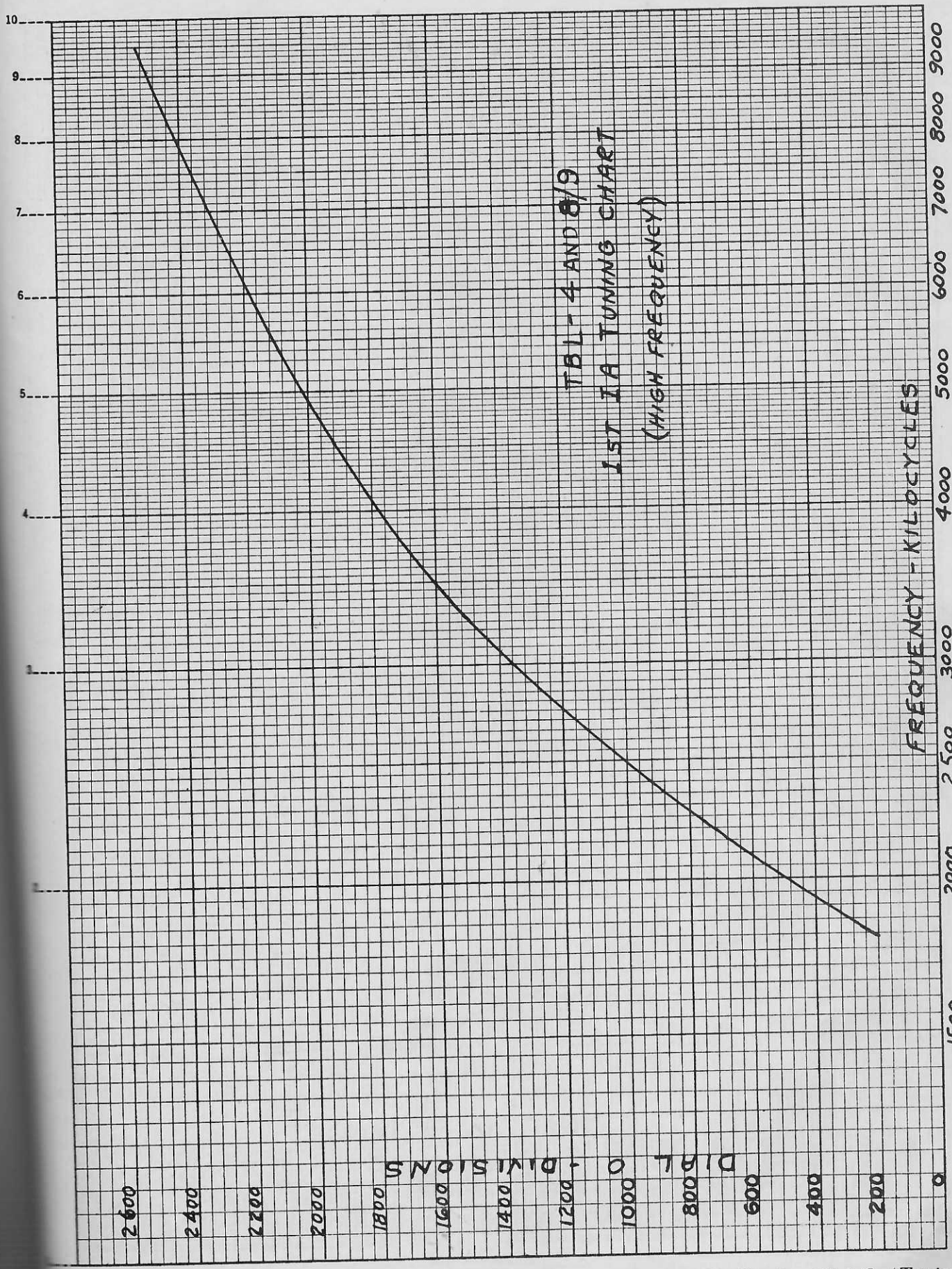


Figure 58—Tuning Dial O (Typical Calibration S-851912)

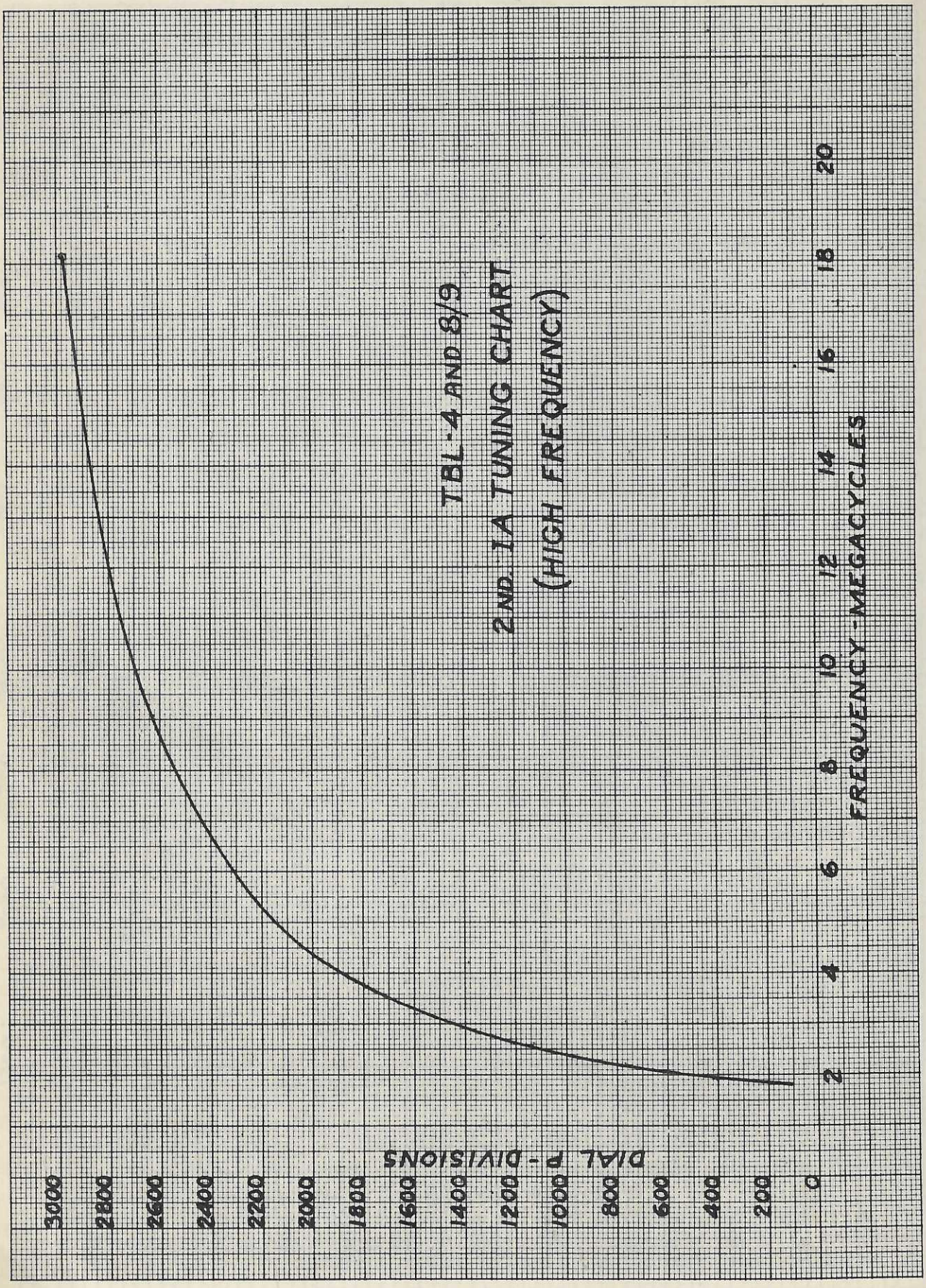


Figure 59—Tuning Dial P (Typical Calibration S-851908)

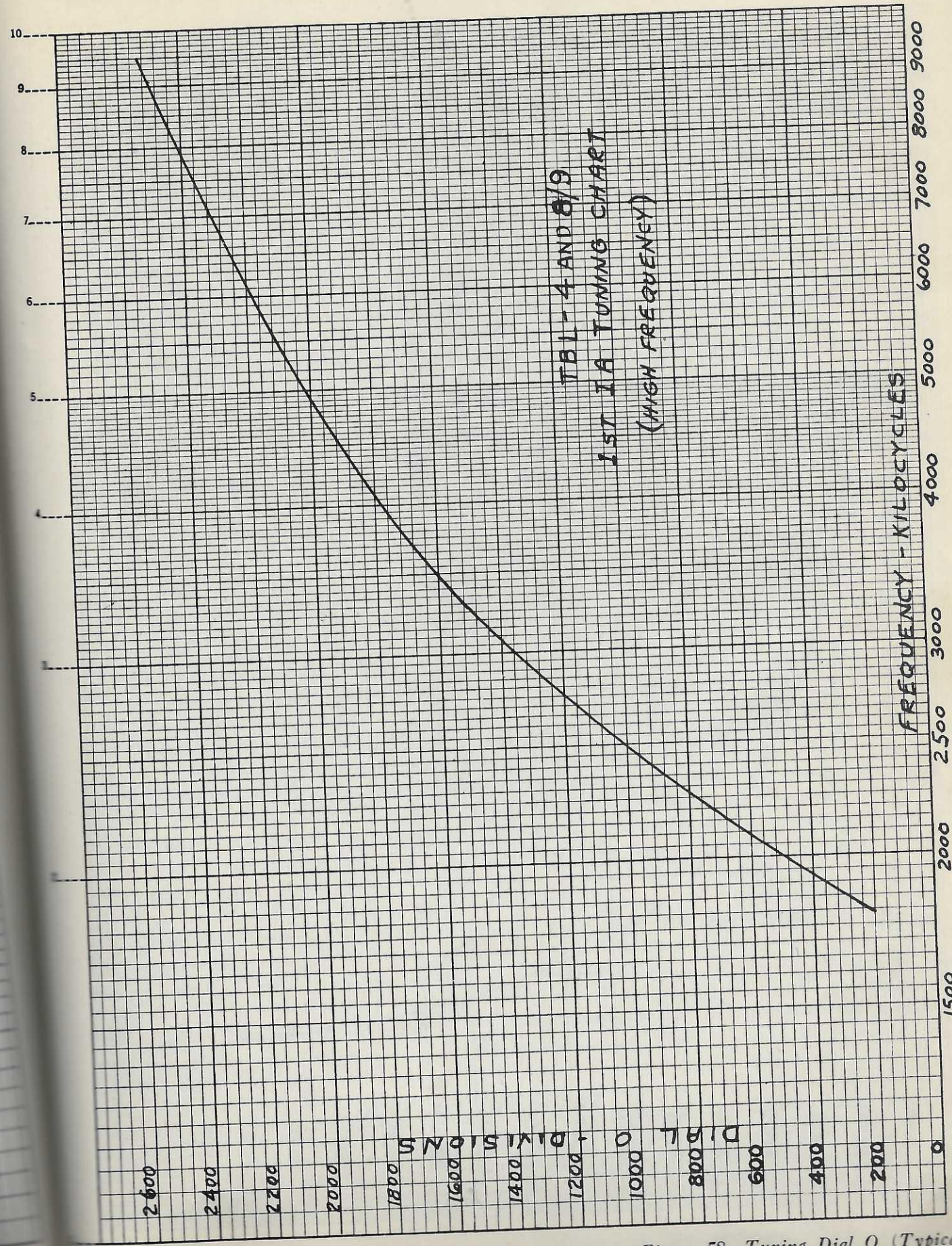


Figure 58—Tuning Dial O (Typical Calibration S-851912)

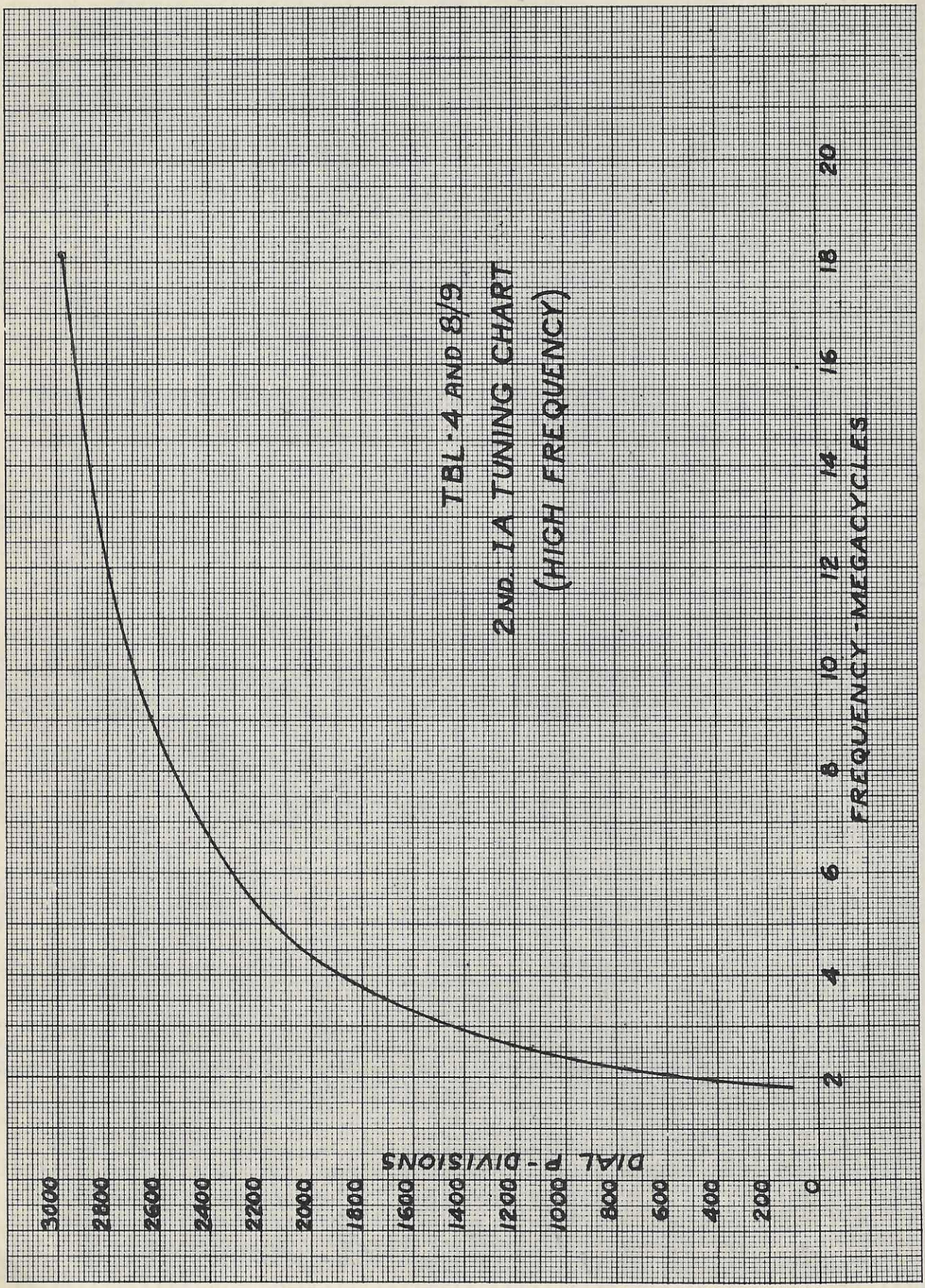


Figure 59—Tuning Dial P (Typical Calibration S-851908)

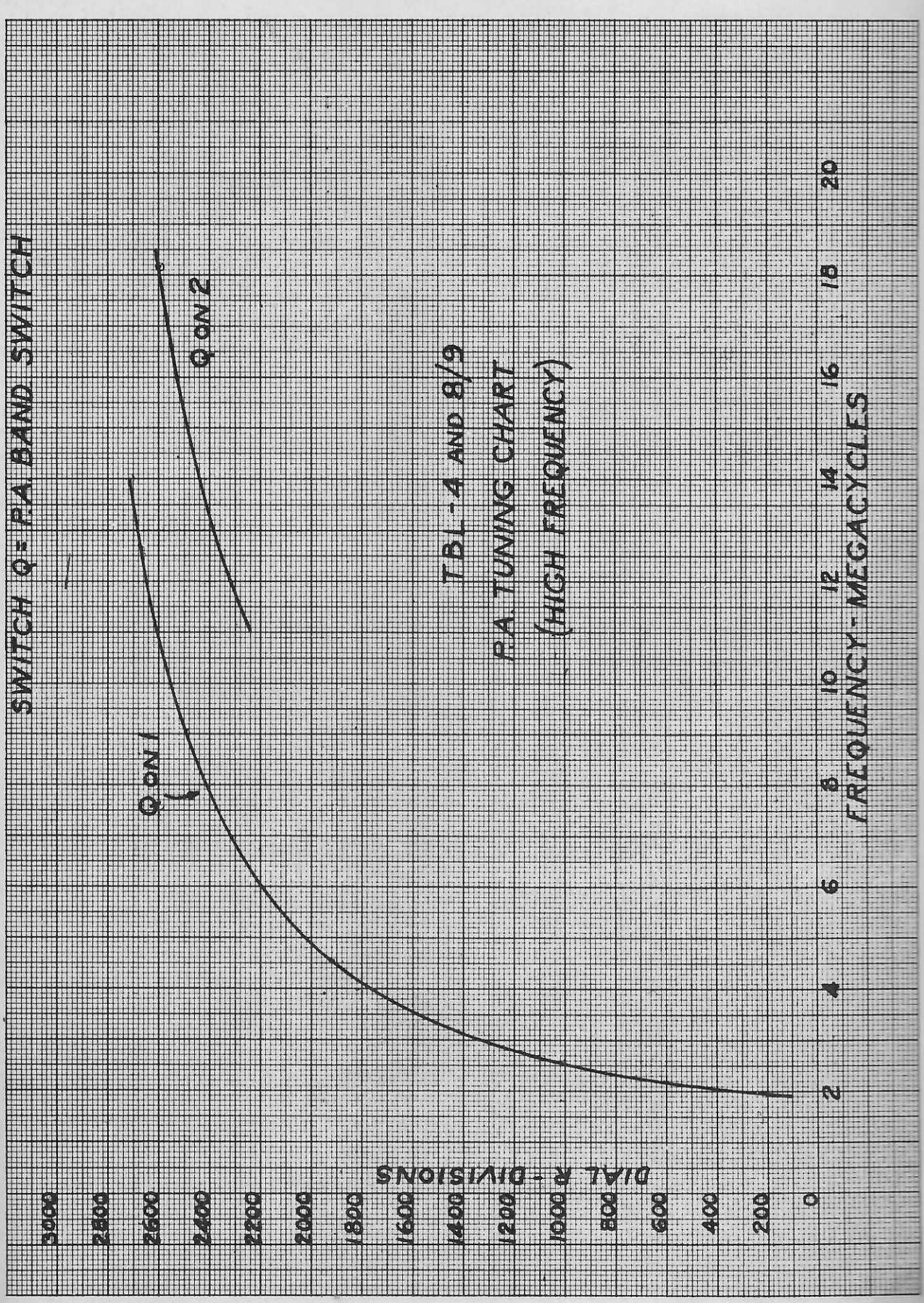


Figure 60—Tuning Dial R (Controls Q and R) (Typical Calibration S-851911)

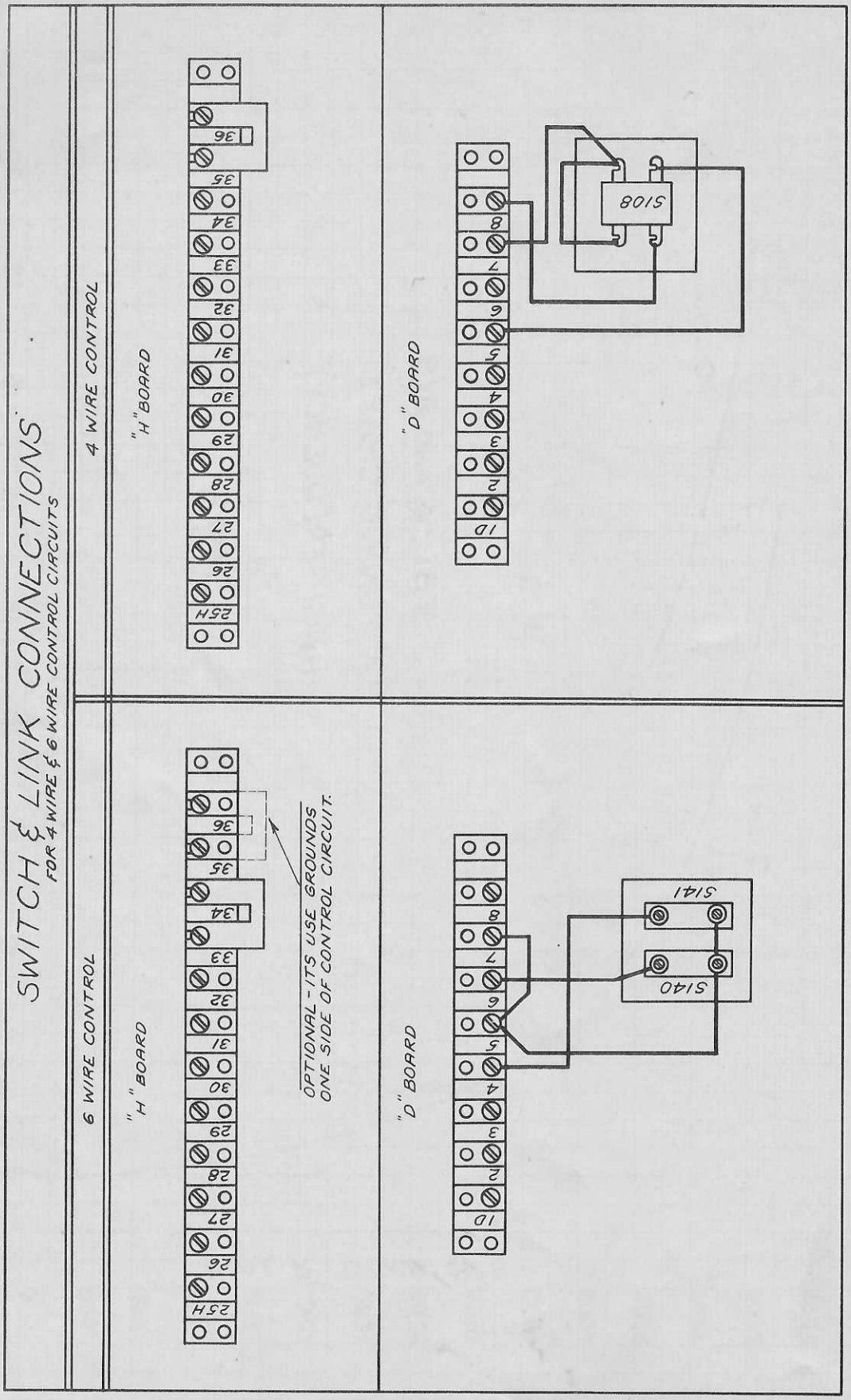
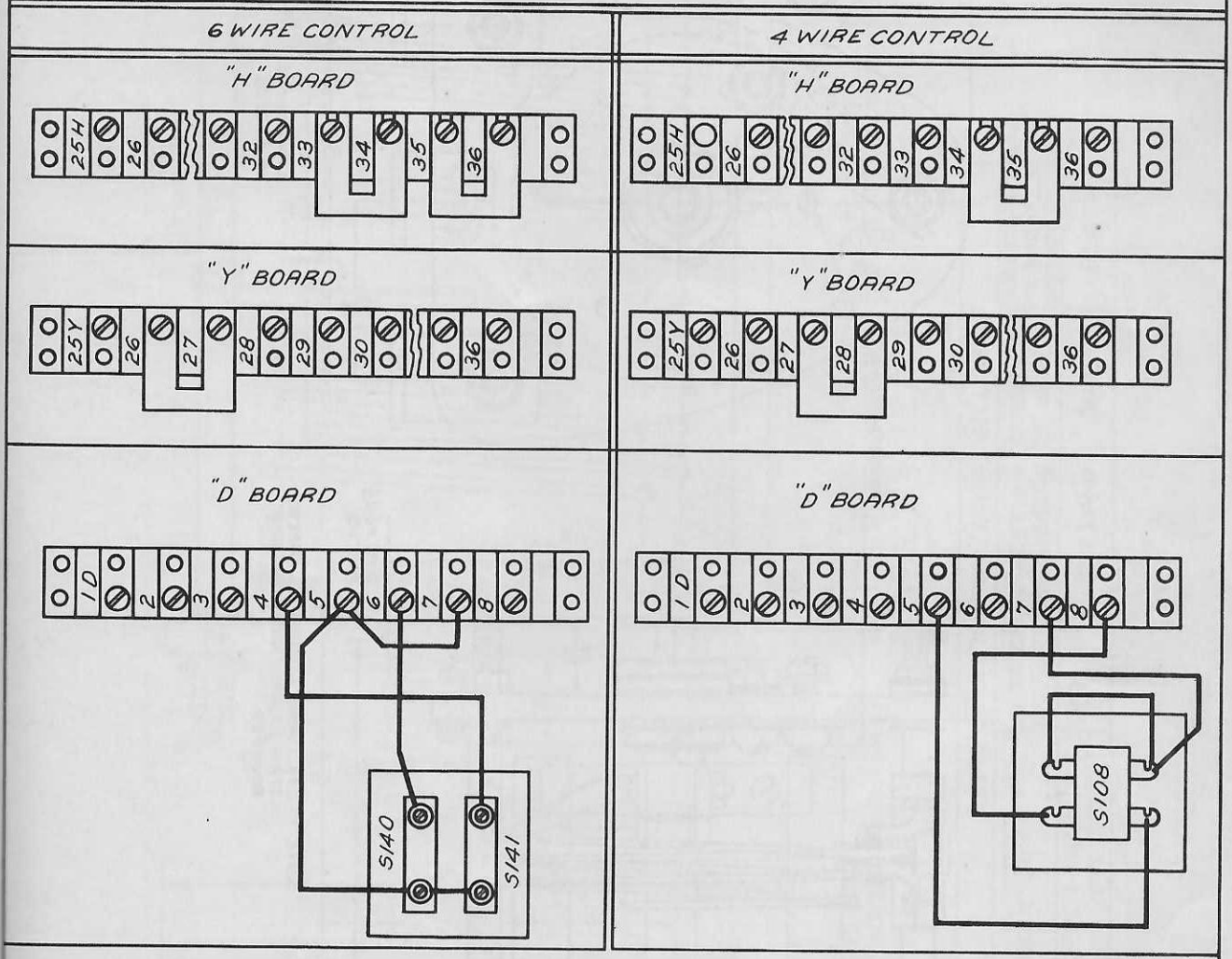


Figure 61—Control Circuit Adjustments, 220/440 volts a-c (M-421362)

SWITCH & LINK CONNECTIONS
FOR 4 WIRE & 6 WIRE CONTROL CIRCUITS



CONTROL CIRCUIT RESISTOR VALUES TO BE INSTALLED AT POSITIONS HAVING MULTIPLE LABELS FOR 6 WIRE AND 4 WIRE CONTROL, AND FOR DESIGNATED POWER SUPPLIES.

6 WIRE CONTROL				4 WIRE CONTROL			
POSITION MARKED: FOR ITEMS	SUPPLY			POSITION MARKED: FOR ITEMS	SUPPLY		
	115 V. D.C.	230 V. D.C.	250 V. D.C.		115 V. D.C.	230 V. D.C.	250 V. D.C.
R140, R181	600 Ω	600 Ω	600 Ω	R140, R181	300 Ω	600 Ω	600 Ω
R141, R182	600 Ω	600 Ω	600 Ω	R141, R182	300 Ω	600 Ω	600 Ω
R162, R186	3500 Ω	3500 Ω	3500 Ω	R162, R186	STRAP	3000 Ω	3500 Ω
R163, R164	1000 Ω	1000 Ω	1000 Ω	R163, R164	OMIT	1200 Ω	1000 Ω

NOTE - Refer to Paragraph 3.101, "Table of Specifications to be used in Positions Indicated by Multiple Item Numbers".

Figure 62—Control Circuit Adjustments, 115/230/250 volts d-c (M-421363)

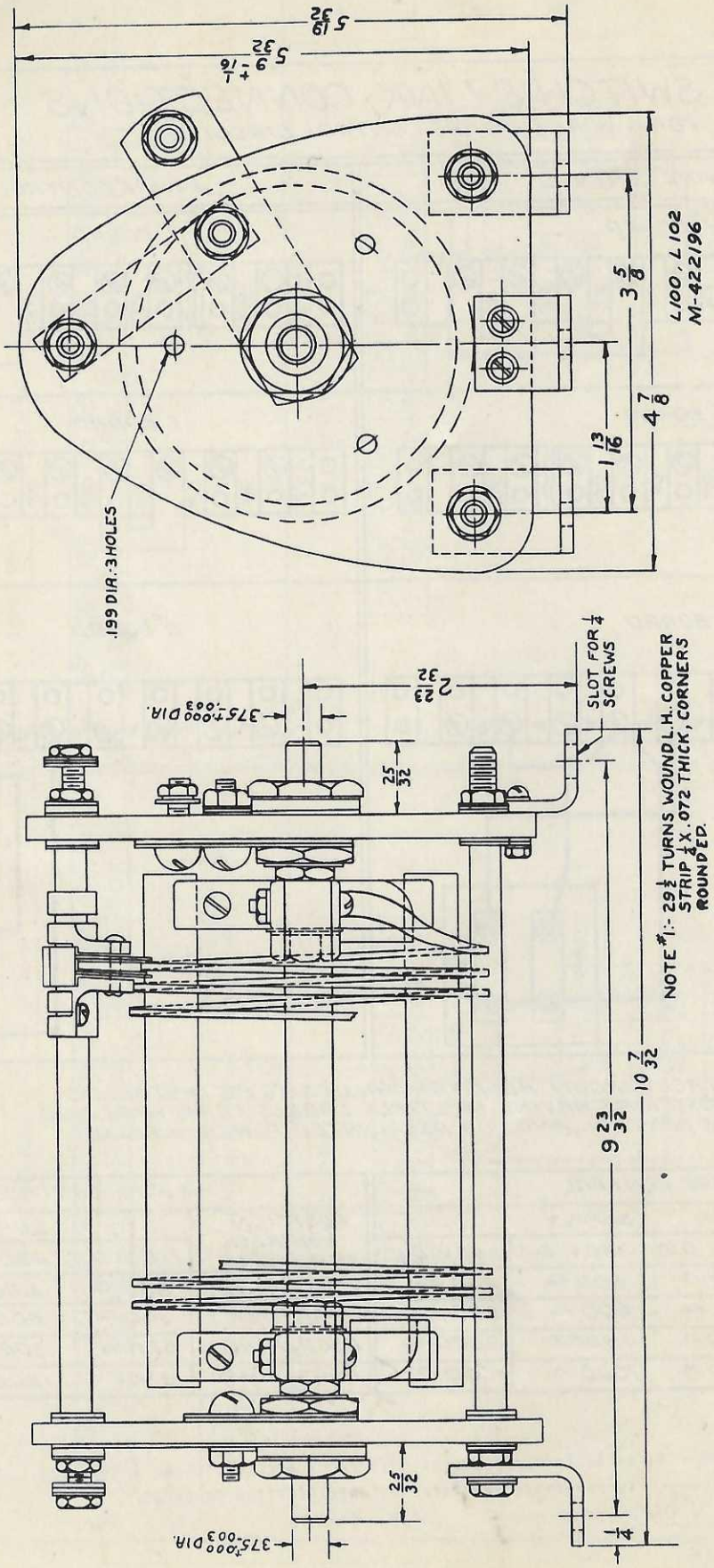
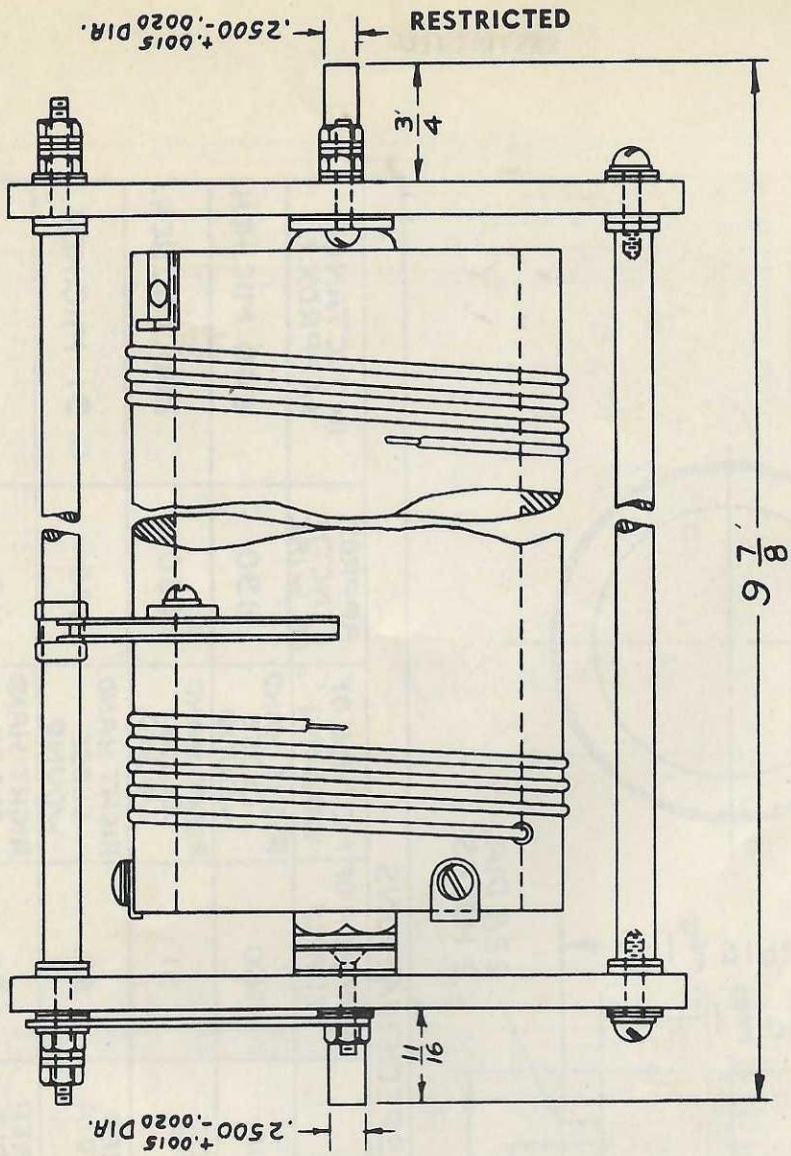


Figure 63—Coils L100 and L102 (Winding Data M-422196)



COIL SPECIFICATION (L104) & (L105)				
CONDUCTOR	NUMBER OF TURNS	DIRECTION OF WINDING	APRON L'GTH OF WIRE	INDUCTANCE MICROHENRIES @ 1000 CYC.
WIRE-COPPER TINNED .081 DIA.	30 5/6	LEFT HAND	300	27.0

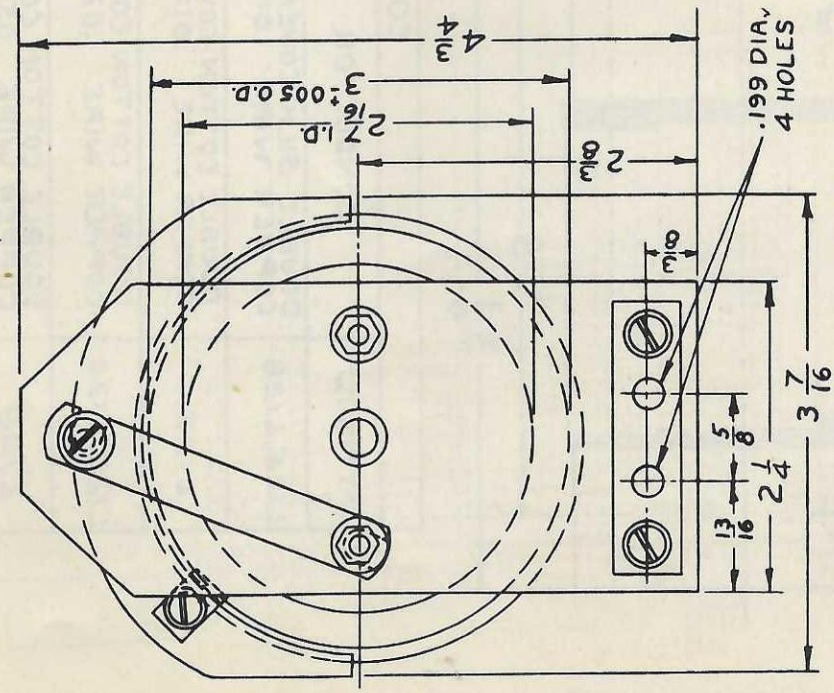


Figure 64—Coils L104 and L105 (Winding Data M-422198)

COIL SPECIFICATIONS					
SYMBOL	CONDUCTOR	NUMBER OF TURNS	METHOD OF WINDING	APPROX. LENGTH OF WIRE	INDUCTANCE (APPROX.)
L126, L128	DOUBLE SILK COVERED COPPER WIRE .010 DIA.	160	RIGHT HAND CLOSE WOUND	890	640 MIC. HEN.
L127	DOUBLE COTTON COVERED COPPER WIRE .0126 DIA.	81	RIGHT HAND CLOSE WOUND	460	200 MIC. HEN.
L125, L134	DOUBLE COTTON COVERED COPPER WIRE .0201 DIA.	52	RIGHT HAND CLOSE WOUND	300	91 MIC. HEN.
L108	DOUBLE COTTON COVERED COPPER WIRE .0508 DIA.	20	RIGHT HAND CLOSE WOUND	110	

Figure 65—Coils L108, L125, L126, L127, L128, L134 (Winding Data K-871621)

RESTRICTED

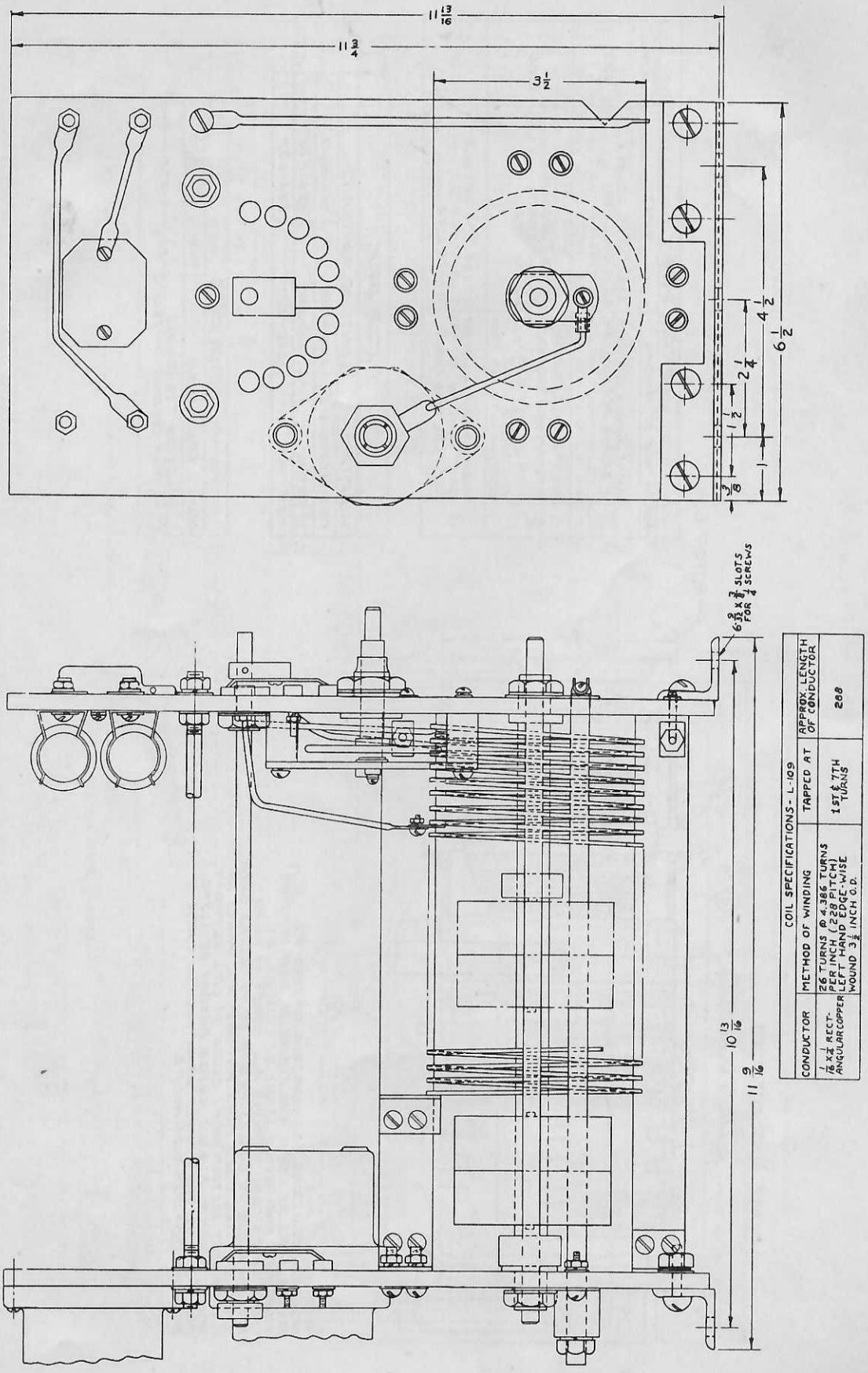


Figure 66—Coil L109 (Winding Data P-721657)

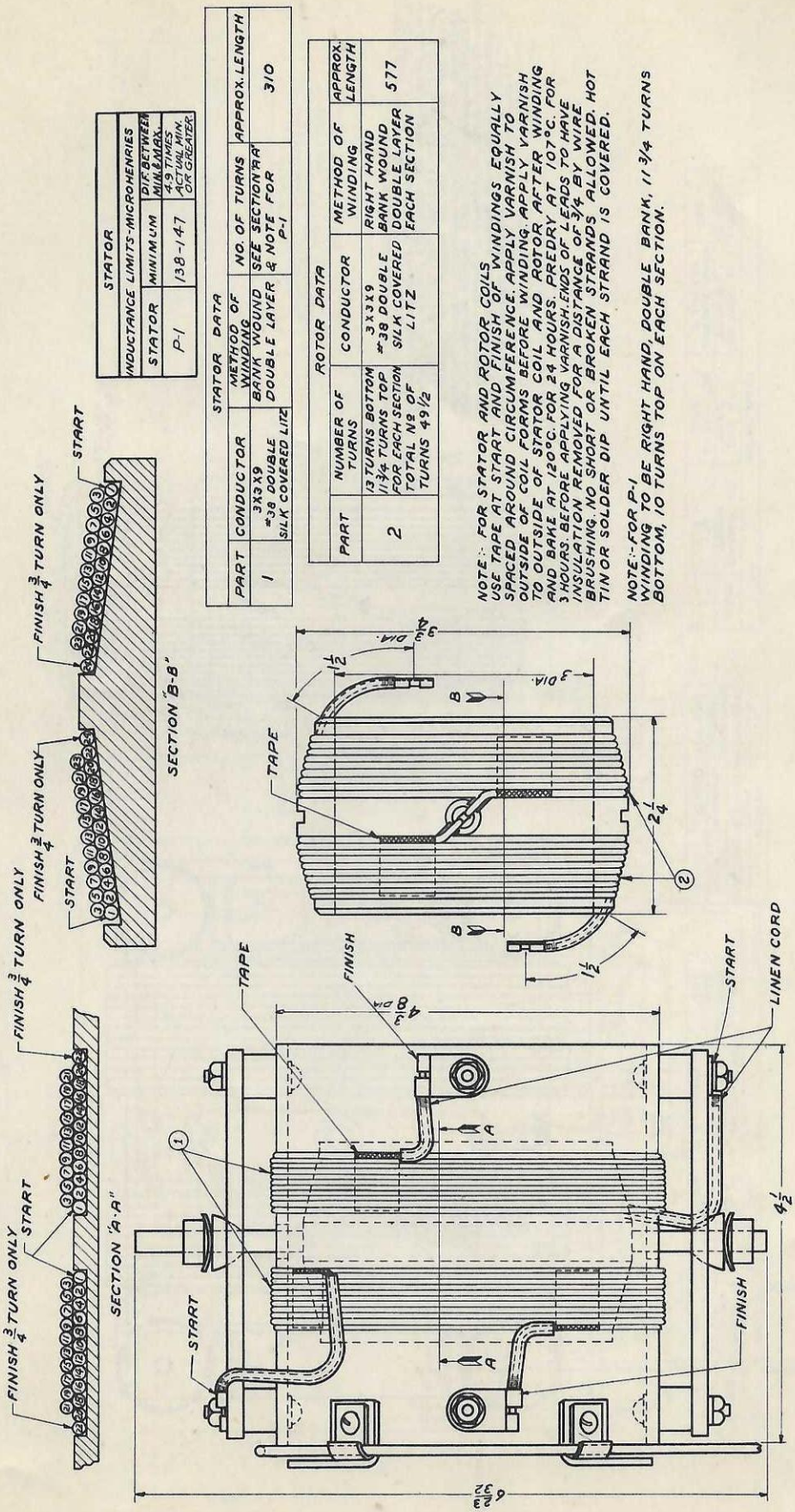
NOTE:- FOR P1,2 & 3
SECURE ENDS OF COIL P 3 USING TAPE ON COIL P2, SECURE WIRE AT START AND FINISH OF BANK WINDING USING TAPE AND SECURE START OF COIL P 2 BY TYING LINEN CORD AROUND ALL WIRES IN THIRD SECTION CLOSE TO COIL SUPPORT. ON P1 SECURE BOTH ENDS BY TYING LINEN CORD AROUND ALL WIRES IN FIRST & LAST SECTION OF P1, CLOSE TO COIL SUPPOPT. AFTER WINDING P1 2 3 & ROTOR, PREDRY AT 115°C. FOR 3 HOURS. THEN APPLY IMPR. VARNISH. THEN BAKE AT 120° C FOR 24 HOURS.

STATOR DATA			
PART	METHOD OF WINDING	WIRE	LENGTH OF WIRE
1	RIGHT HAND, 5 SECTIONS 11 TURNS PER SECTION.	3X3X9 #38 DOUBLE SILK COVERED WHITELITZ.	455
2	RIGHT HAND, 3 SECTIONS. 11 TURNS PER SECTION, THEN 2 LAYER BANK WINDING, 16 TURNS BOTTOM, 14 TURNS TOP.	3X3X9 #38 DOUBLE SILK COVERED WHITE LITZ	560
3	RIGHT HAND, 2 LAYER BANK WINDING, 16 TURNS BOTTOM, 14 1/2 TURNS TOP.	3X3X9 #38 DOUBLE SILK COVERED WHITE LITZ	280

STATOR DATA		
INDUCTANCE	LIMITS-MICROHENRIES	
COIL SECTIONS	MINIMUM	MAXIMUM
TOTAL	488-512	825-865
1ST TAP	245-257	564-592

ROTOR DATA			
PART	CONDUCTOR	TURNS	APPROX LENGTH
4&5	3X3X9 #38 DOUBLE SILK COVERED WHITELITZ	24 1/4	175

Figure 67—Coil L110 (Winding Data M-422128)



STATOR

INDUCTANCE LIMITS-MICROHENRIES		
STATOR	MINIMUM	DIF. BETWEEN MIN & MAX.
P-1	138-147	4.9 TIMES ACTUAL MIN. OR GREATER

STATOR DATA

PART	CONDUCTOR	METHOD OF WINDING	NO. OF TURNS	APPROX. LENGTH
1	3X3X9 #38 DOUBLE SILK COVERED LITZ	BANK WOUND DOUBLE LAYER	SEE SECTION "A" & NOTE FOR P-1	310

ROTOR DATA

PART	NUMBER OF TURNS	CONDUCTOR	METHOD OF WINDING	APPROX. LENGTH
2	13 TURNS BOTTOM 11¾ TURNS TOP FOR EACH SECTION TOTAL Nº OF TURNS 49½	3X3X9 #38 DOUBLE SILK COVERED LITZ	RIGHT HAND BANK WOUND DOUBLE LAYER EACH SECTION	577

Figure 68—Coils L111 and L112 (Winding Data M-422137)

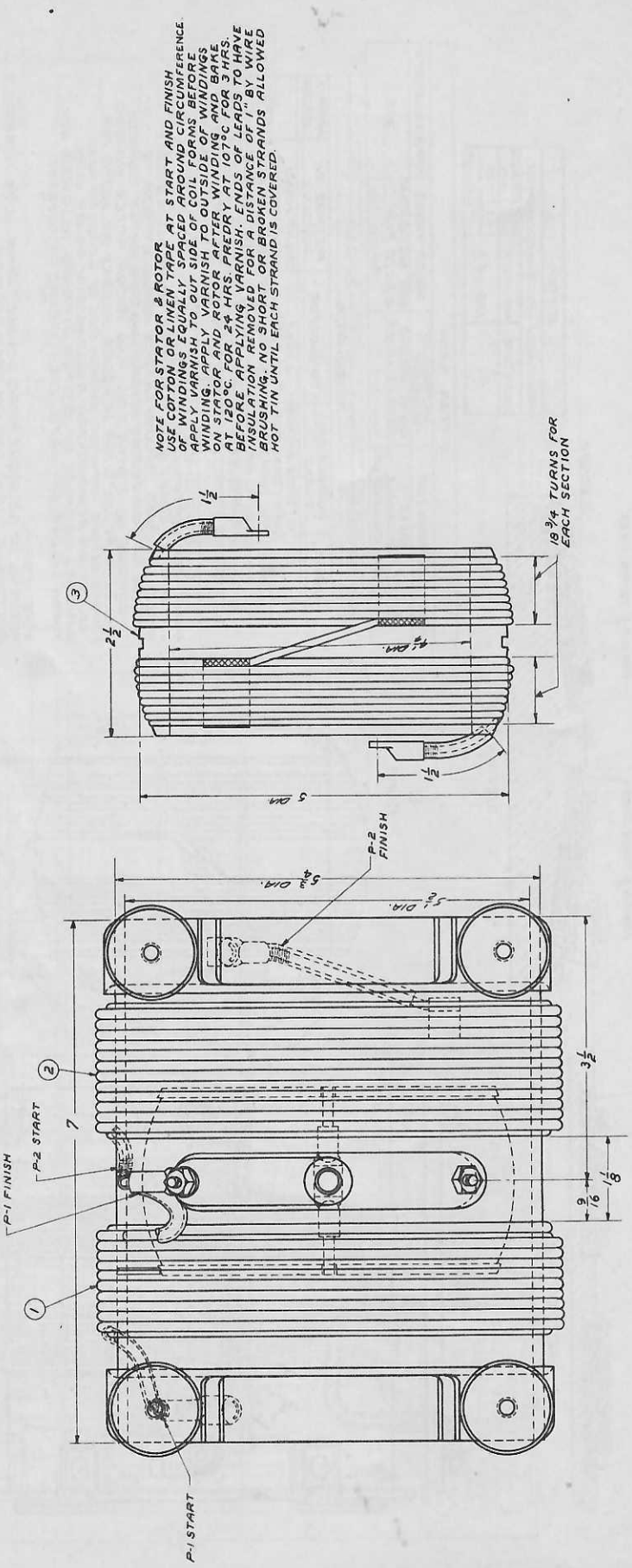


Figure 69—Coil L113 (Winding Data P-721131)

COIL DATA	SIZE OF WIRE	LENGTH OF WIRE
STATOR	10 X 3 X 10 #38 DOUBLE SILK COVERED LITZ	600
ROTOR	10 X 3 X 10 #38 DOUBLE SILK COVERED LITZ	288

STATOR DATA	
INDUCTANCE LIMITS-MICROHENRIES BETWEEN LEADS	
MINIMUM	MAX.
66 - 70	180 - 172

NOTE FOR STATOR & ROTOR COILS.
APPLY VARNISH TO OUTSIDE COIL FORMS BEFORE WINDING. AFTER WINDING PREDRY AT 107°C. FOR 3 HRS. APPLY VARNISH TO STATOR & ROTOR WINDINGS AFTER WINDING & AND BAKE FOR 24 HRS. AT 120°C. BEFORE ASSEMBLING TO CASTINGS, SHAFTS, ETC ENDS OF LEADS TO HAVE INSULATION REMOVED FOR A DISTANCE OF 3/4" & WIRE BRUSHING, NO SHORT OF BROKEN STRANDS SHALL EXIST. ENDS TOGETHER AND HOT DIP IN SOLDER UNTIL EACH STRAND IS COVERED. AFTER SOLDERING ON TERMINAL LUGS BIND INSULATION FOR 1/2" AS SHOWN USING LINEN CORD. USE 3 OF COTTON TAPE FOR EACH SECTION OF WINDING, SPACED EQUALLY AROUND CIRCUMFERENCE.

P-721132

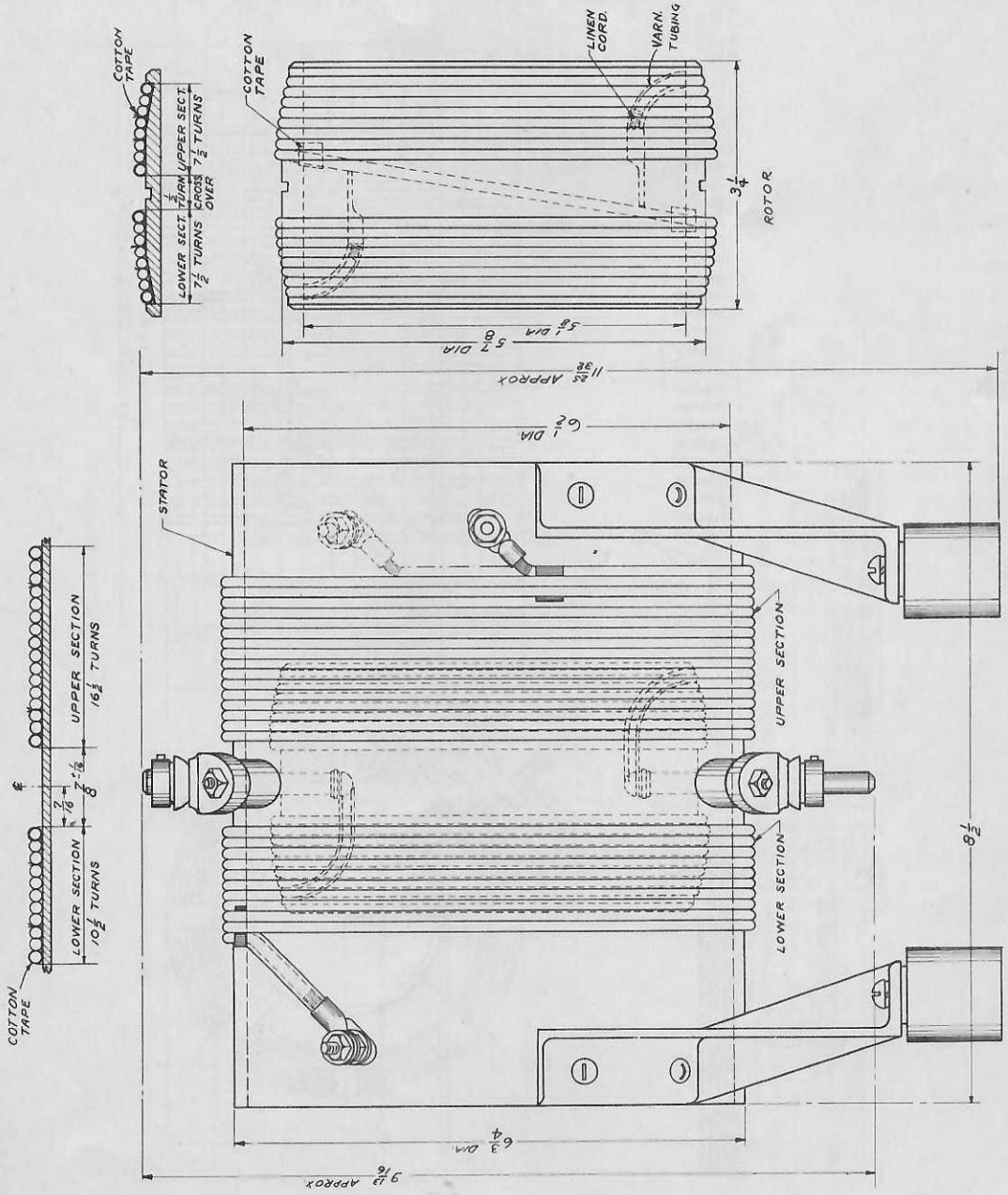
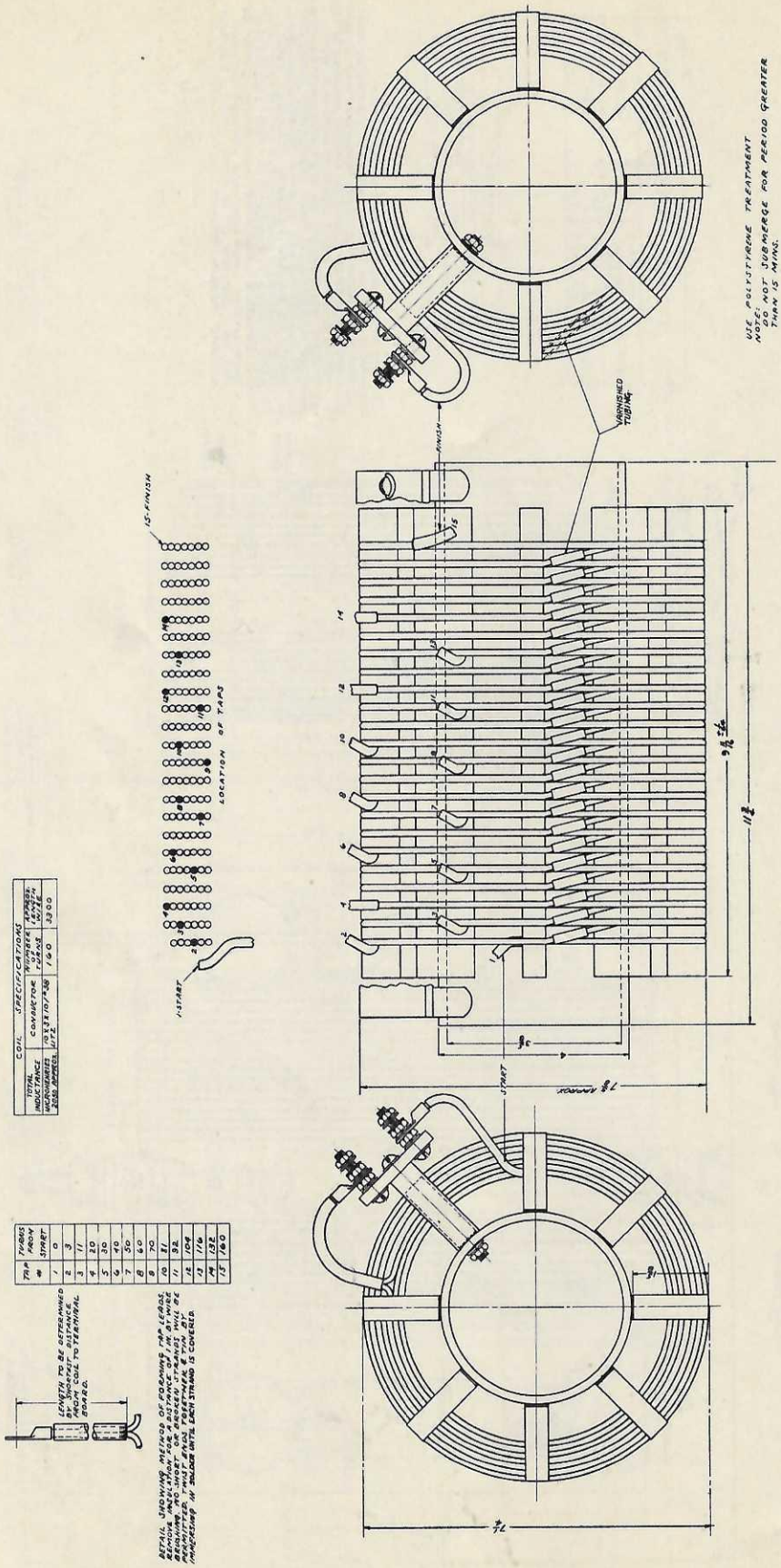
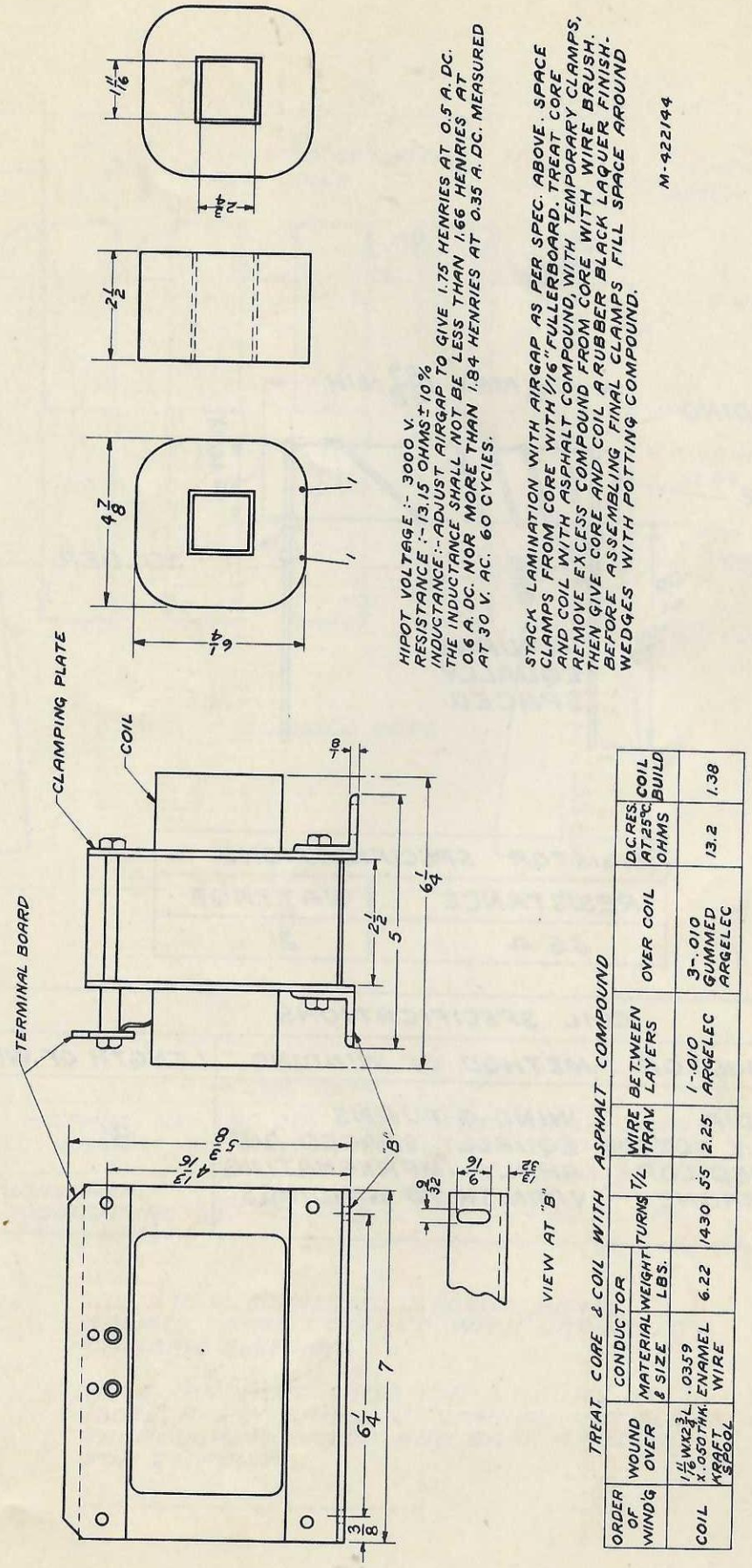


Figure 70—Coil L114 (Winding Data P-721132)



TAP #	TURNS ABOVE START
1	0
2	3
3	11
4	20
5	30
6	40
7	50
8	60
9	70
10	81
11	92
12	104
13	116
14	132
15	160

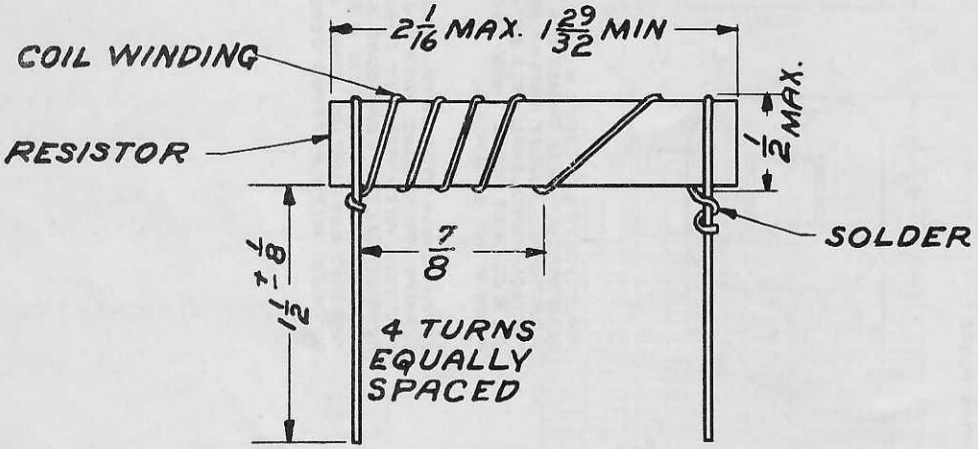
Figure 71—Coil L115 (Winding Data T-620721)



TREAT CORE & COIL WITH ASPHALT COMPOUND

ORDER OF WINDG	WOUND OVER	CONDUCTOR MATERIAL & SIZE	CONDUCTOR WEIGHT LBS.	TURNS	T/L	WIRE TRAY	BETWEEN LAYERS	OVER COIL	D.C. RES. AT 25°C OHMS	COIL BUILD
COIL	1 1/16 WX2 3/4 L X .030 THK. KRAFT SPOOL	.0359 ENAMEL WIRE	6.22	1430	55	2.25	1-.010 ARGELEC	3-.010 GUMMED ARGELEC	13.2	1.38

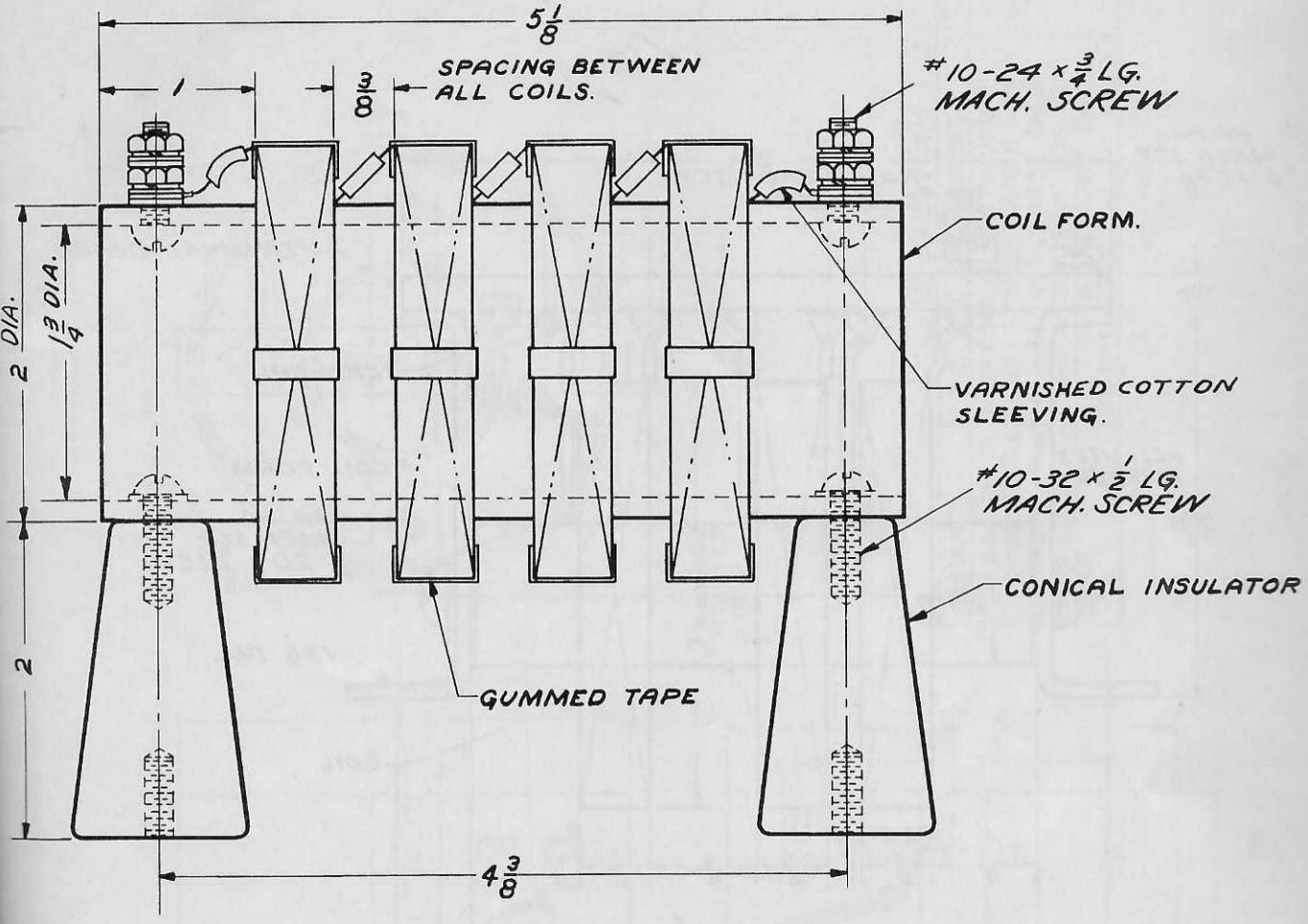
Figure 72—Coil L116 (Winding Data M-422144)



RESISTOR SPECIFICATIONS	
RESISTANCE	WATTAGE
56 Ω	2

COIL SPECIFICATIONS		
CONDUCTOR	METHOD OF WINDING	LENGTH OF WIRE
.032 DIA. DOUBLE COTTON COVERED COPPER MAGNET WIRE.	WIND 4 TURNS EQUALLY SPACED AND APPLY IMPREGNATING VARNISH TO WINDINGS.	9

Figure 73—Coils L117 and L118, part of R122 and R123 (Winding Data K-871399)



COIL DATA							
WIRE	METHOD OF WINDING	NO. OF TURNS	O.D. APPROX	WIDTH OF COIL	TOTAL LENGTH	TURNS PER LAYER	INDUCTANCE AT 1000 CYCLES
#24 DOUBLE COTTON COVERED	UNIVERSAL WOUND 2 CROSSES PER TURN	175	2 3/4	1/2	1300	14	13.6 M.H.

COILS TO BE CONNECTED IN SERIES, AIDING. SPLICES TO BE COVERED WITH VARNISHED CAMBRIC SLEEVING.

NOTE:-PREHEAT COILS FOR 3 HOURS AT 120°C. APPLY BAKELITE VARNISH UNTIL THOROUGHLY COATED AND BAKE AT 120°C. FOR 24 HOURS.

Figure 74—Coils L129, L130, L131, L132 (Winding Data M-422154)

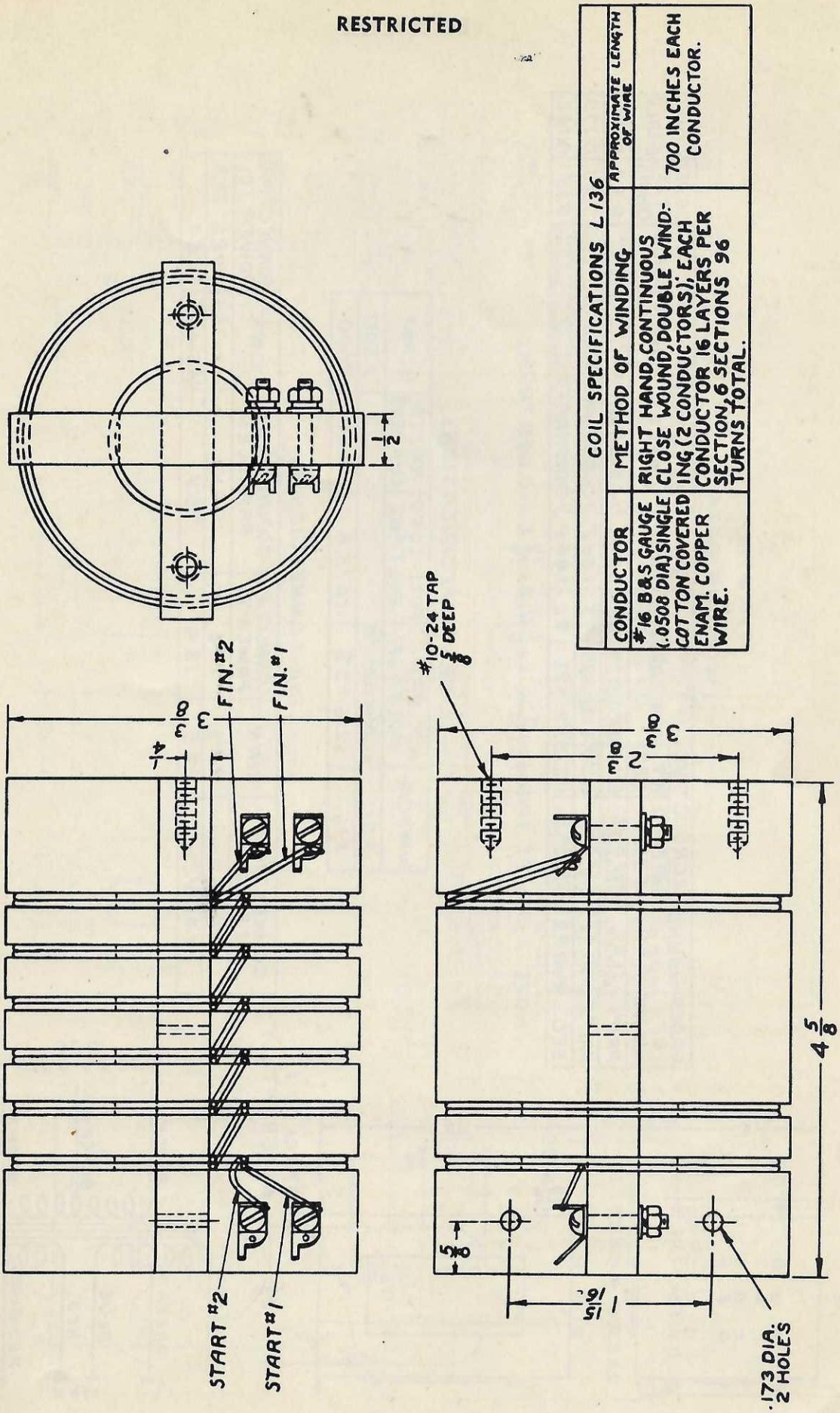


Figure 76—Coil L136 (Winding Data M-422197)

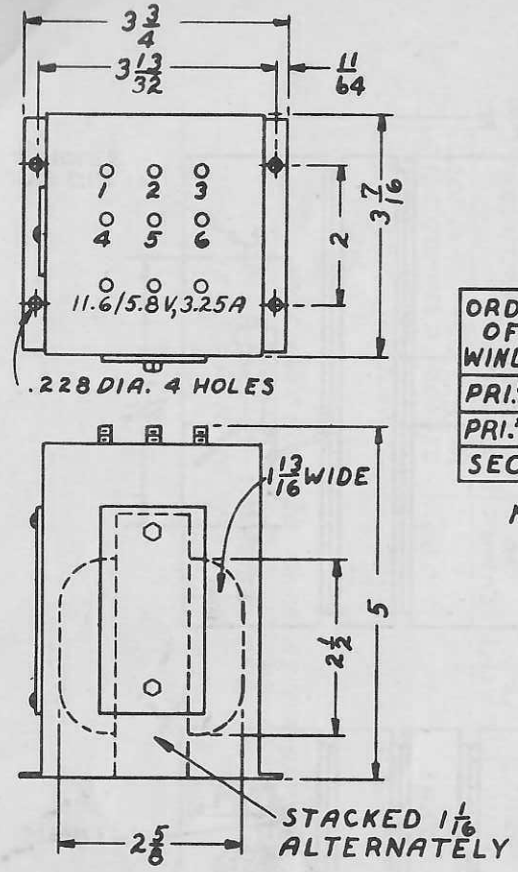


Figure 77—Transformers T101 and T102 (Winding Data M-422195)

T101 & T102

WINDING DATA

ORDER OF WINDING	WOUND OVER	CONDUCTORS MATERIAL & SIZE	CONDUCTORS WT. LBS.	TURNS	TAPS	T/L	WIRE TRAV.	BETWEEN LAYERS	OVER COIL	DC. RES. AT 25°C OHMS	COIL BUILD
PRI. #1	SEE NOTE #1	#25 AWG ENAMEL	0.191	413½	289	75	1.562	1-0.003 KRAFT	2 LAYERS OF .010 KRAFT 2 LAYERS OF .001 ACETATE	6.53	0.193
PRI. #2	PRI. #1	#25 AWG ENAMEL	0.227	413½	289	75	1.562	1-0.003 KRAFT	3 LAYERS OF .010 KRAFT 3 LAYERS OF .001 ACETATE	7.95	0.173
SEC.	PRI. #2	#16 AWG ENAMEL	0.272	52	26	26	1.465	1-0.010 KRAFT	3 LAYERS OF .010 KRAFT 3 LAYERS OF .001 ACETATE	0.15	0.166

NOTE: 1 - KRAFT SPOOL $1\frac{2}{32}$ W. X $1\frac{1}{8}$ H. X $1\frac{13}{16}$ L X 0.050 THICK.

TEST SPECIFICATIONS

WINDING	NO LOAD VOLTAGE	FULL LOAD VOLTAGE	RATED CURRENT	HI POT
PRI.	200/140/100/70			2500
FIL.	12.6 ± 3%	11.6/5.8	3.25	4000

LINK CONNECTIONS

CONNECTION SERIES	LINK	CONNECT PRI. POWER TO	CONNECTION PARALLEL	LINK	CONNECT PRI. POWER TO
200V.	2&3	1&6	100V.	1&2-3&6	1&6
140V.	2&5	1&4	70V.	1&2-4&5	1&4

TAG #	
TAG #1	PRI. #1 START
TAG #2	PRI. #1 TAP
TAG #3	PRI #1 FINISH
TAG #4	PRI. #2 START
TAG #5	PRI. #2 TAP
TAG #6	PRI. #2 FINISH
TAG #7	F-1 START & FIN.
TAG #8	F-1 TAP
TAG #9	F-2 ST. & FIN.
TAG #10	F-2 TAP
TAG #11	F-3 ST. & FIN.
TAG #12	F-3 TAP

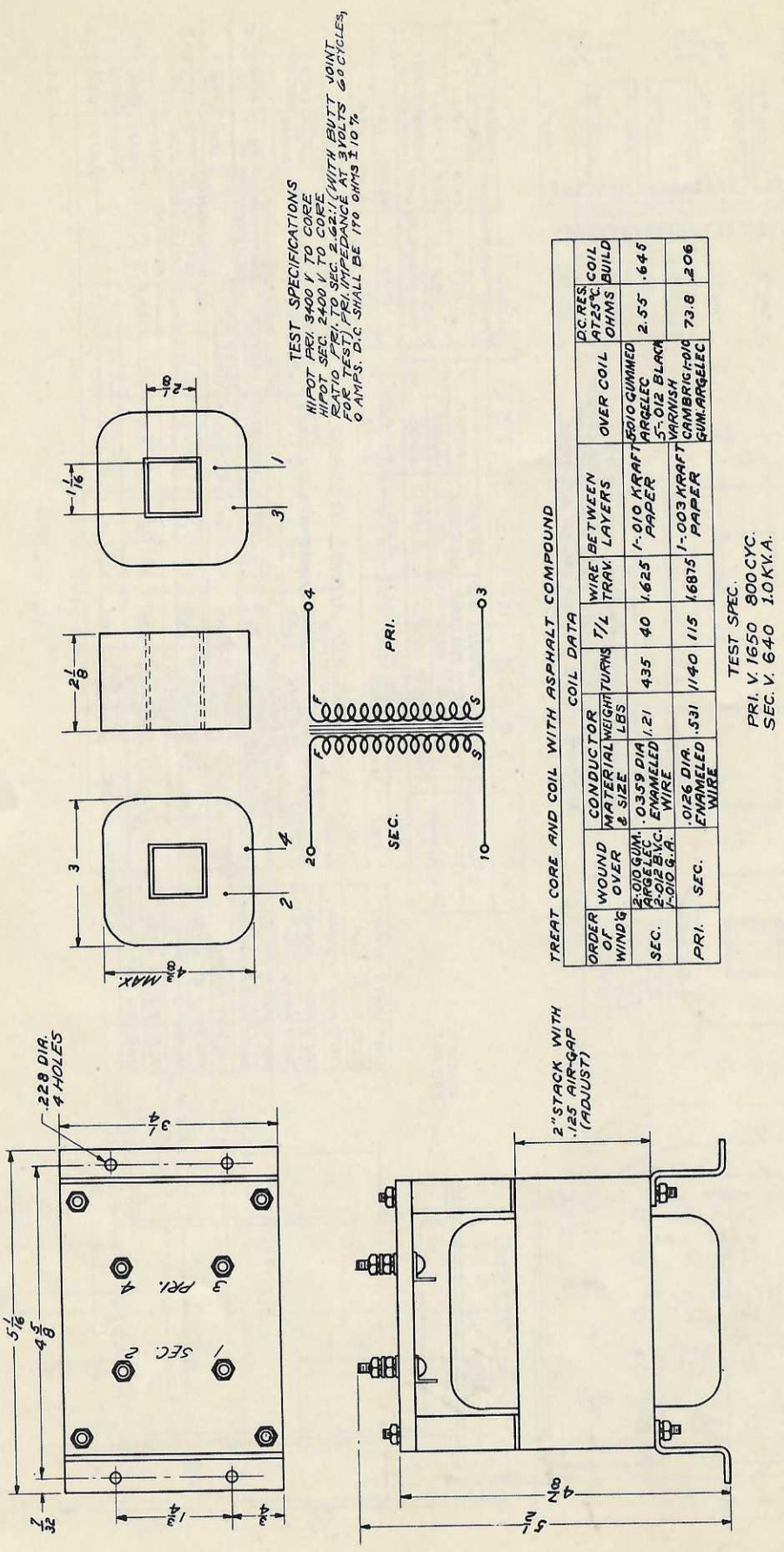
WINDING	NO LOAD VOLTAGE	FULL LOAD VOLTAGE	RATED CURRENT	HIPOT
F1	10.58 ± 3%	10/5	10	4000
F2	10.58 ± 3%	10/5	3.25	4000
F3	10.58 ± 3%	10/5	3.25	4000
PRI.	200/140/100/70			2500

CONNECTION (SERIES)	LINK	CONNECT PRI. POWER TO
200 V.	2 & 3	1 & 6
140 V.	2 & 5	1 & 4
CONN. (PARALLEL)	LINK	CONNECT PRI. POWER TO
100 V.	182,386	1 & 6
70 V.	182,485	1 & 4

TREAT CORE & COIL WITH ASPHALT COMPOUND

ORDER OF WIND'G	WOUND OVER	CONDUCTOR MATERIAL & SIZE	WEIGHT LBS.	TURNS	TAPS	T/L	WIRE TRAV.	BETWEEN LAYERS	OVER COIL	D.C. RES AT 25°C OHMS	COIL BUILD
PRI. #1	KRAFT SPOOL .030 THK. X 2 1/2 H X 1 3/32 W.	.0403 DIA. ENAMELED WIRE	.616	170	119	4-3	1.9375	1-.005 KRAFT PAPER	2-7 GUMMED KRAFT, 1 MIL. OF CELLULOSE ACITATE	.81	.234
PRI. #2	PRI. #1	.0403 DIA. ENAMELED WIRE	.70	170	119	43	1.9375	1-.005 KRAFT PAPER	4-7 GUMMED KRAFT, 1 MIL. OF CELLULOSE-ACITATE	.935	.224
F-1	PRI. #2	.085 X .085 DOUBLE COTTON COV.	.446	18	9	18	1.9	———		.026	.130
F-2	F-1	.0508 DIA. ENAMELED WIRE	.138	18	9	18	1.01	———		.073	.086
F-3	F-2	.0508 DIA. ENAMELED WIRE	.145	18	9	18	1.01	———		.077	.086

Figure 78—Transformer T103 (Winding data M-422173)



ORDER OF WIND'G	WOUND OVER	CONDUCTOR MATERIAL & SIZE	WEIGHT LBS	TURNS	T/L	WIRE TRAV.	BETWEEN LAYERS	OVER COIL	D.C. RES. AT 25°C. OHMS	COIL BUILD
SEC.	2-.010 GUM. ARGELEC 2-.012 B.V.C. 1-.010 G.A.	.0359 DIA. ENAMELLED WIRE	1.21	435	40	1.625	1-.010 KRAFT PAPER	5-.010 GUMMED ARGELEC 5-.012 BLACK VARNISH	2.55	.645
PRI.	SEC.	.0126 DIA. ENAMELLED WIRE	.531	1140	115	1.6875	1-.003 KRAFT PAPER	CAMBRIC 1-.010 GUM. ARGELEC	73.8	.206

Figure 79—Transformer T104 (Winding Data M-422162)

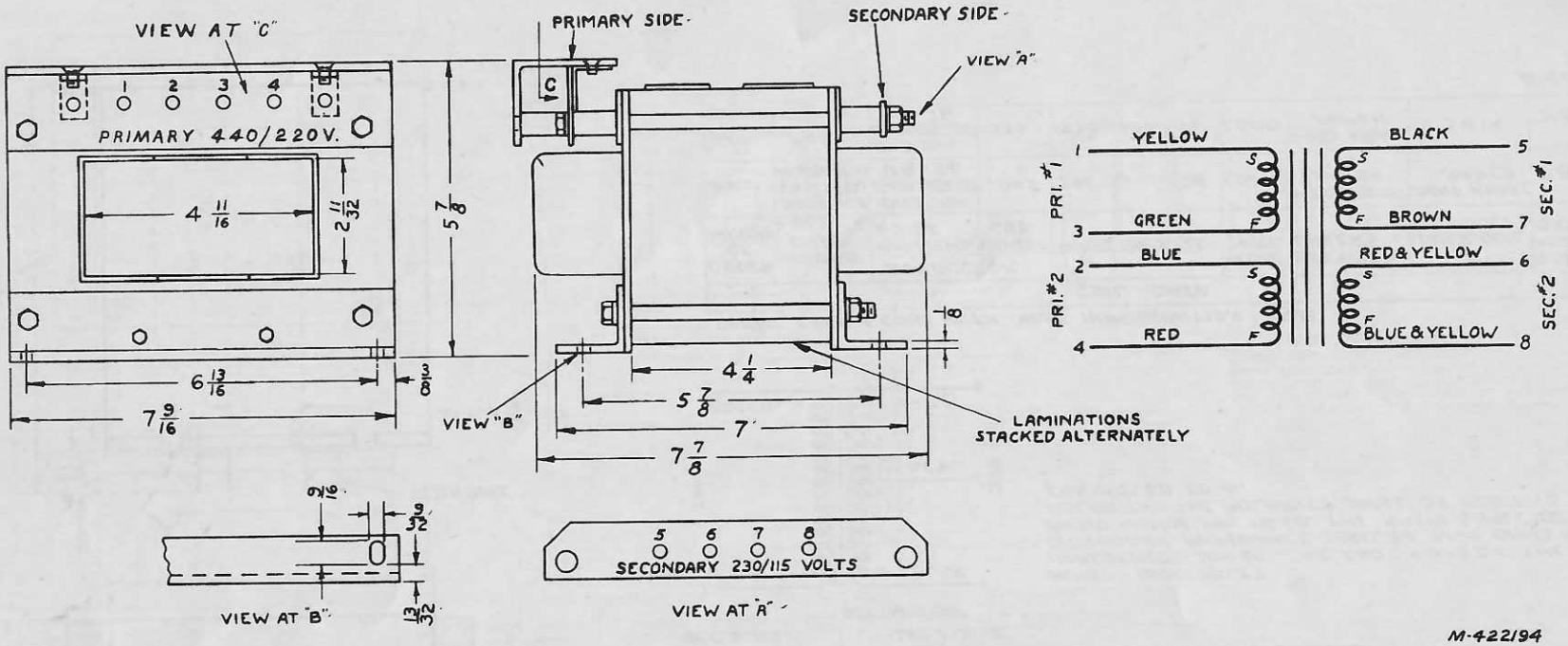
HIPOT :- 1500 VOLTS
IMPEDANCE :- 30V, 60 ~ A.C. AND 0 AMPS D.C.. THE SECONDARY IMPEDANCE SHALL BE 7500 OHMS MIN.
RATIO :- FROM PRI. TO SEC. THE RATIO SHALL BE 1-5 ± 5%
POLARITY :- THE POLARITY SHALL BE ADDITIVE WITH 3 CONNECTED TO 4.

TREAT CORE & COIL WITH WAX INPREGNATION (MS41)

COIL DATA											
ORDER OF WINDG	WOUND OVER +.002 C.A.	CONDUCTOR MATERIAL & SIZE	CONDUCTOR WEIGHT LBS.	TURNS	TAPS	T/L	WIRE TRAV.	BETWEEN LAYERS	OVER COIL	D.C. RES. AT 25°C OHMS	COIL BUILD
PRI.	.035 THK. X 3/4 H. X 2 3/32 W. KRAFT P.	.0113 DIA. ENAMELED PS-36	.045	395	—	76	1.000	1-.003 KRAFT PAPER	2-.010 KRAFT PAPER	9.8	.144
SEC.	PRI.	.0113 DIA. ENAMELED PS-36	.334	1974	987	76	1.000	1-.003 KRAFT PAPER	3-5KIA	71.6	.440

M-422166

Figure 80—Transformer T105 (Winding Data M-422166)



M-422194

TESTING SPECIFICATION
WITH 440 V, 60~ ON TERMINALS 1&4 (LINK 2&3) THE SEC.
NO LOAD VOLTAGE SHALL BE 237 VOLTS ±3%
MAX. CORE LOSS 30 WATTS AT 440 V., 60~
MAX. EXCITING CURRENT .75 AMPS AT 440V, 60~
INDUCE PRIMARY (440 V. CONNECTION) AT 1760 V., 500~
HIPOT:- PRIMARY 3000 V, SECONDARY 4000 V.

CONNECTIONS

PRIMARY CONNECTIONS	LINK	CONNECT PRI. POWER TO
440	2&3	1&4
220	1&2, 3&4	1&4

SECONDARY CONNECTIONS	LINK	CONNECT LOAD TO
230 V.	6&7	5&8
115 V.	5&6, 7&8	5&8

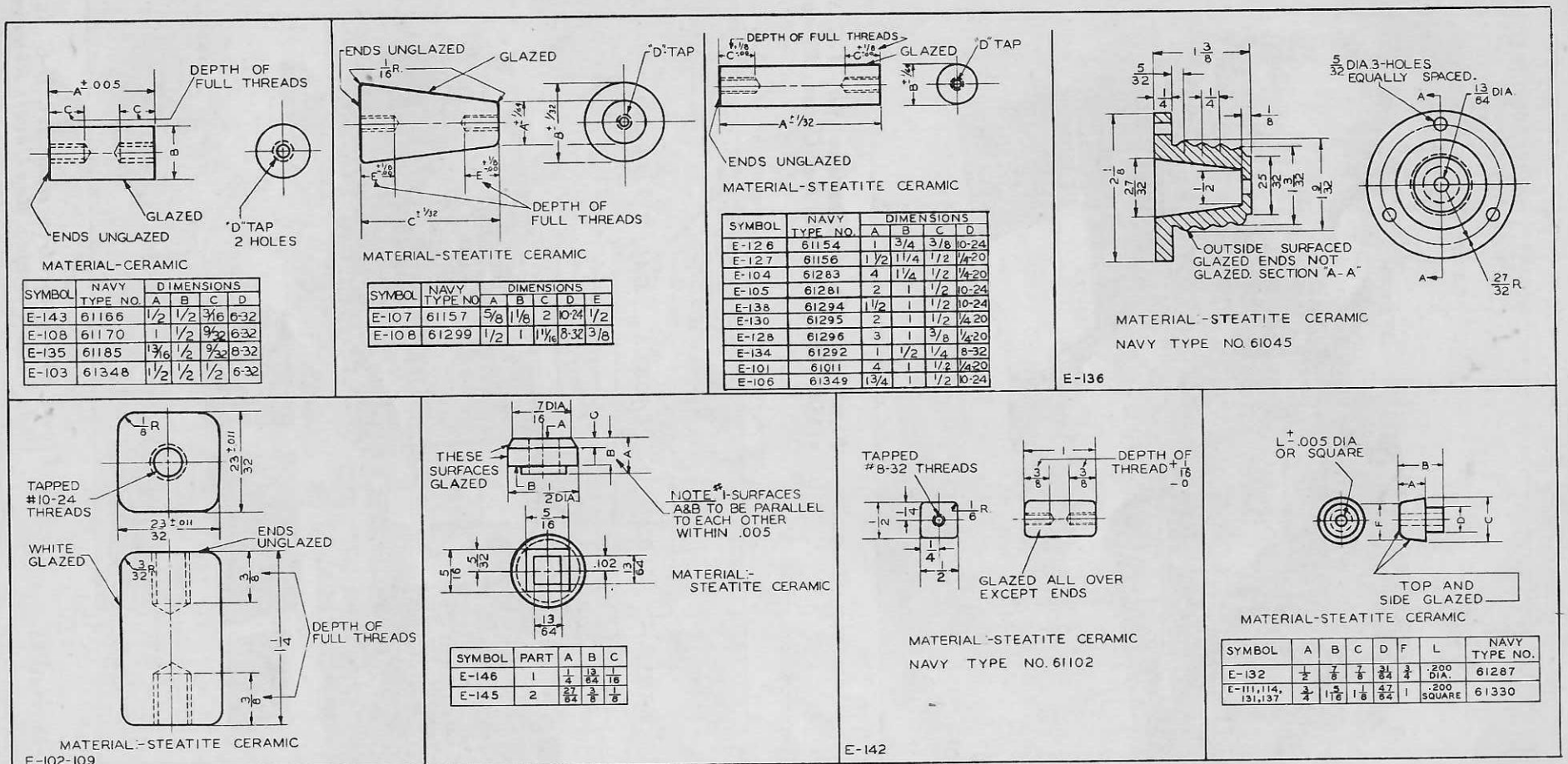
T106
WINDING DATA

ORDER OF WINDING	WOUND OVER	CONDUCTORS MATERIAL & SIZE	CONDUCTORS WT. LBS.	TURNS	TAPS	T/L	WIRE TRAV.	BETWEEN LAYERS	OVER COILS	DC RES. AT 25°C OHMS	COIL BUILD
PRI#1	SEE NOTE1	#17 AWG ENAMEL	1.21	154		39	2.00	1-.010 KRAFT	2-LAYERS OF .005 KRAFT 1-LAYER OF .001 ACETATE	1.0	0.292
PRI#2	PRI#1	#17 AWG ENAMEL	1.36	154		39	2.00	1-.010 KRAFT	3-LAYERS OF .005 KRAFT 1-LAYER OF .001 ACETATE	1.14	0.262
SEC#1	PRI#2	#14 AWG ENAMEL	1.67	83		28	2.00	1-.010 KRAFT	2-LAYERS OF .005 KRAFT 1-LAYER OF .001 ACETATE	.35	0.240
SEC#2	SEC#1	#14 AWG ENAMEL	1.78	83		28	2.00	1-.010 KRAFT	3-LAYERS OF .005 KRAFT 1-LAYER OF .001 ACETATE	.38	0.260

NOTE #1:- KRAFT SPOOL $2\frac{9}{32}$ W. X 5 H. X $2\frac{11}{32}$ L. X 0.050 THK. - $\frac{1}{4}$ INSIDE RADIUS.

Figure 81—Transformer T106 (Winding Data M-422194)

RESTRICTED



SYMBOL	NAVY TYPE NO.	DIMENSIONS A	B	C	D
E-143	61166	1/2	1/2	3/16	6-32
E-108	61170	1	1/2	9/32	6-32
E-135	61185	13/16	1/2	9/32	8-32
E-103	61348	1 1/2	1/2	1/2	6-32

SYMBOL	NAVY TYPE NO.	DIMENSIONS A	B	C	D	E
E-107	61157	5/8	1 1/8	2	10-24	1/2
E-108	61299	1/2	1	1 11/16	8-32	3/8

SYMBOL	NAVY TYPE NO.	DIMENSIONS A	B	C	D
E-126	61154	1	3/4	3/8	10-24
E-127	61156	1 1/2	1 1/4	1/2	1/4-20
E-104	61283	4	1 1/4	1/2	1/4-20
E-105	61281	2	1	1/2	10-24
E-138	61294	1 1/2	1	1/2	10-24
E-130	61295	2	1	1/2	1/4-20
E-128	61296	3	1	3/8	1/4-20
E-134	61292	1	1/2	1/4	8-32
E-101	61011	4	1	1/2	1/4-20
E-106	61349	1 3/4	1	1/2	10-24

SYMBOL	PART	A	B	C
E-146	1	1/4	13/64	1/16
E-145	2	27/64	3/8	1/8

SYMBOL	A	B	C	D	F	L	NAVY TYPE NO.
E-132	1/2	7/8	7/8	31/64	3/4	.200 DIA.	61287
E-111,114, 131,137	3/4	1 5/16	1 1/8	47/64	1	.200 SQUARE	61330

SYMBOL	A	B	C	D	F	L	NAVY TYPE NO.
E-133	1/2	3/8	7/8	1/2	3/4	.200	61288
E-110,113, 140,141	3/4	9/16	1 1/8	3/4	1	.200	61290

Figure 82—Insulators (P-722667)

RESTRICTED

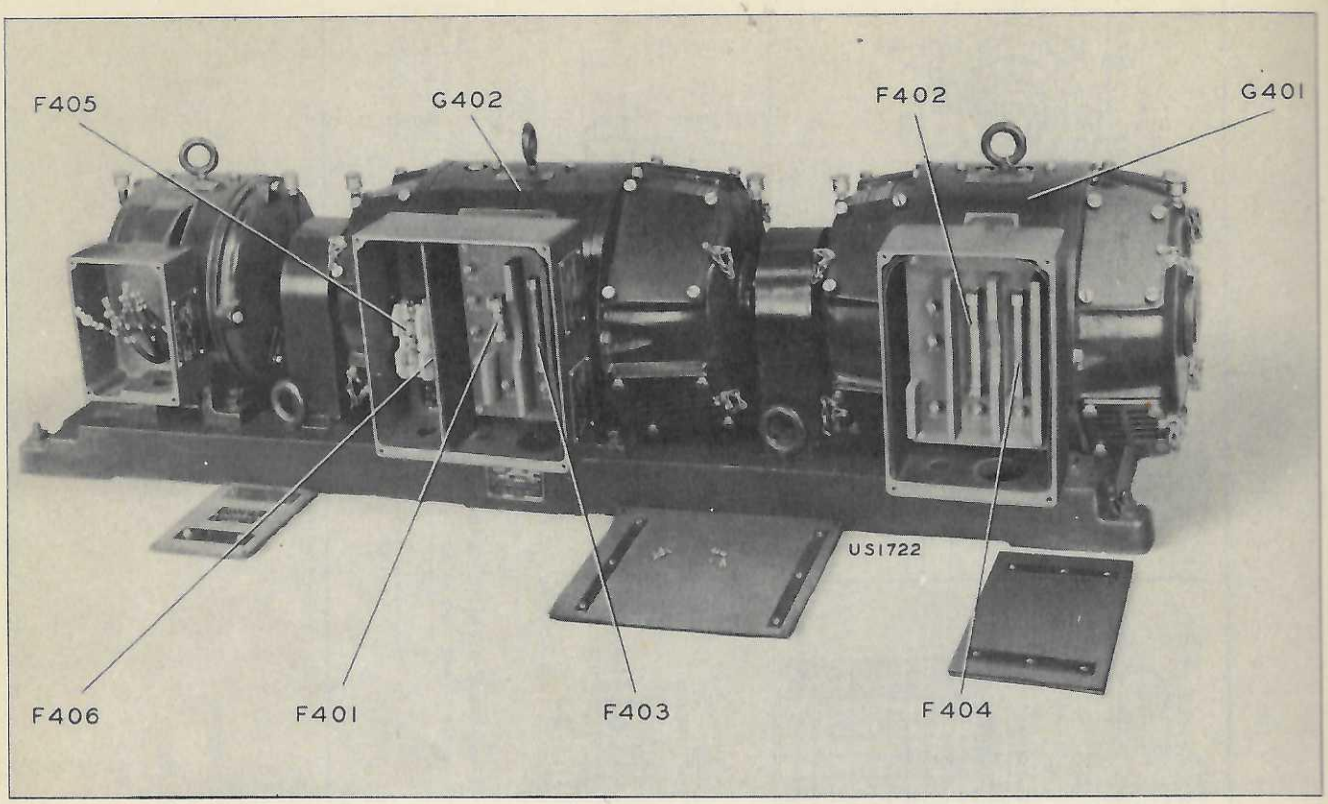


Figure 83—Motor Generator Set, A-C Supply (Side View, Terminal Box Covers Removed)

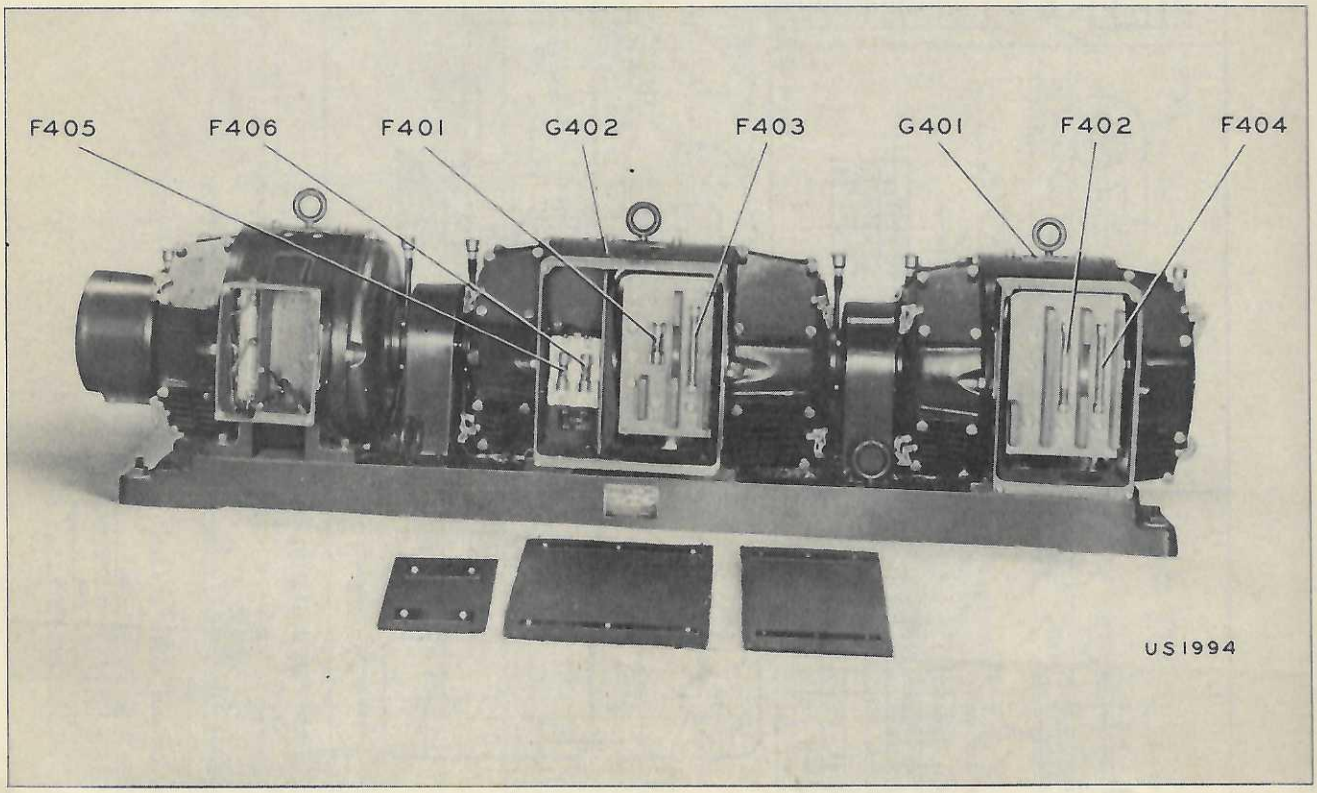


Figure 84—Motor Generator Set, D-C Supply (Side View, Terminal Box Covers Removed)

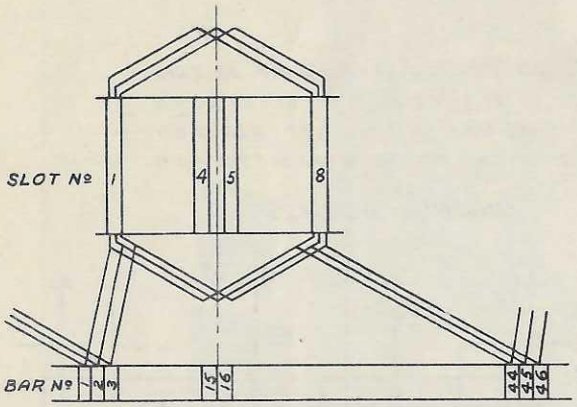
STATOR WINDING

3 PHASE, 4 POLE, SERIES - MULT. Y.
Nº SLOTS - 36 TURNS PER COIL - 40
Nº COILS - 18 SPAN - 1:10
SIZE OF WIRE - Nº16 DOUBLE COTTON ENAMEL

Figure 85—Motor, 220/440 volts a-c (Winding Data M-422175)

STATOR SLOT SECTION

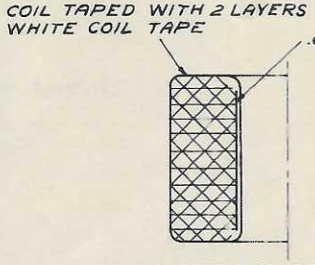
COILS TAPED ON ENDS WITH 1" COTTON TAPE
WINDING VACUUM IMPREGNATED WITH
INSULATING VARNISH (NAVY SPEC. 52V13)
AND BAKED, WINDING THEN DIPPED AND BAKED AGAIN.



ARMATURE WINDING

ALL MOTORS (250, 230 & 115 VOLT) HAVE 29 ARMATURE SLOTS, 87 COMMUTATOR BARS; SPAN, SLOTS-1:8, COMM. BARS 1:44.
COILS WOUND & PLACED IN SLOTS IN GROUPS OF 3.
250 & 230 V MOTORS - 87 COILS, 5 TURNS Nº15 DOUBLE COTTON-SINGLE ENAMEL WIRE
115 VOLT MOTORS :- 87 COILS, 2½ TURNS .055 X .100 DOUBLE COTTON COVERED WIRE. (ALTERNATE COIL GROUPS ARE WOUND WITH 2 TURNS PER COIL, THEN 3 TURNS, ETC.)
ALL COILS TAPED WITH WHITE COTTON COILTAPE WOUND HALF LAP.

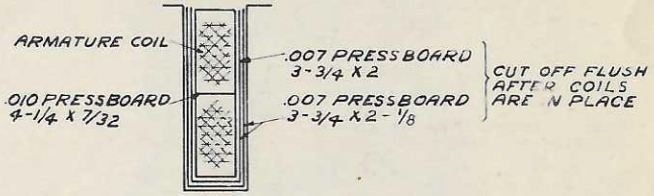
ALL WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC 52V13) AND BAKED. WINDINGS THEN DIPPED & BAKED AGAIN.



INTERPOLE COIL

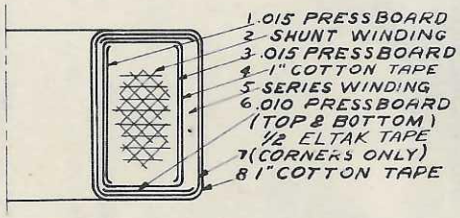
250 & 230 VOLT MOTORS
63 TURNS Nº10 SQUARE
DOUBLE COTTON COVERED.

115 VOLTS MOTORS
31 TURNS Nº8 SQUARE
DOUBLE COTTON COVERED.



ARMATURE SLOT INSULATION

ARMATURE BANDING
ON ENDS: APPROX. 18 TURNS Nº18 STEEL BANDING WIRE WOUND ON 1¼ X .020 PRESSBOARD.
IN GROOVE: 14 TURNS Nº18 STEEL BANDING WIRE WOUND ON ⅝ STRIP OF .010 PRESSBOARD. 7/8 X 1/4 X 1/32 FIBER IN EACH SLOT NEXT TO WIRE.



MAIN FIELD COILS

SHUNT: 250 & 230 VOLT MOTORS - 1200 TURNS Nº 24 SINGLE COTTON, PLUS.
1200 TURNS Nº 25 SINGLE COTTON COVERED.
115 VOLT MOTORS - 600 TURNS Nº 21 SINGLE COTTON, PLUS.
600 TURNS Nº 22 SINGLE COTTON COVERED
SERIES: 250 & 230 VOLT MOTORS - 4 TURNS Nº 10 SQ. DOUBLE COTTON COVERED
115 VOLT MOTORS - 2 TURNS Nº 8 SQ. DOUBLE COTTON COVERED.

Figure 86—Motor, 115/230/250 volts d-c (Winding Data M-422179)

RESTRICTED

WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC. 52 V 13) AND BAKED. WINDINGS THEN DIPPED AND BAKED AGAIN.

ARMATURE WINDING

NUMBER OF SLOTS - 31 SPAN: SLOTS 1:15, BARS 1:2 (BOTH WINDINGS)
500 VOLT WINDING - 93 COILS (31 GROUPS OF 3) 14 TURNS №27 DOUBLE ENAMEL, DOUBLE SILK WIRE.
93 COMM. BARS (SHAFT PROJECTION END)
2000 VOLT WINDING - 124 COILS (31 GROUPS OF 4) 32 TURNS №29 DOUBLE ENAMEL, DOUBLE SILK WIRE.
124 COMM. BARS - OUTBOARD END.

ARMATURE CORE HAS 5 END FIBERS EACH END, 8 - .010 PRESSBOARD WASHERS AND 6 OIL MUSLIN WASHERS. SHAFT IS WRAPPED WITH 7 LAYERS OIL SILK, 3 LAYERS PRESSBOARD, 10 ADDITIONAL LAYERS OIL SILK AND 10 LAYERS WHITE BIAS TAPE. ON ENDS BETWEEN WINDINGS ARE 4 OIL SILK WASHERS, 1 UNBLEACHED MUSLIN WASHER AND AT EVERY 5TH COIL A QUARTER WASHER OF UNBLEACHED MUSLIN AND ONE OF OIL SILK IS ADDED. BEHIND COMMUTATORS ARE PRESSBOARD & CANVAS WASHERS. FAN SPOKES WRAPPED WITH APPROX. 10 LAYERS OIL SILK. COMMUTATOR LEADS IN SPAGHETTI TUBING THROUGH FAN.

ARMATURE SLOT INSULATION

WIND & INSULATE IN ORDER AS NUMBERED ABOVE

INTERPOLE COIL №YPC301

WOUND TOGETHER { (500 V.) 400 TURNS №22 SILK ENAMEL
(2000 V.) 1200 TURNS №24 SILK ENAMEL

WIND & INSULATE IN ORDER AS NUMBERED ABOVE.

FIELD COIL DATA

№YP301

SERIES WOUND TOGETHER SHUNT { (500V) 82 TURNS №21 COTTON ENAMEL
(2000V) 275 TURNS №23 SILK ENAMEL
(250 V.) 4000 TURNS №26 COTTON COVERED

Figure 87—Generator, 2000/500 volts d-c (Winding Data M-422183)

RESTRICTED

1600 VOLT ARMATURE WINDING
31 SLOTS 124 COMMUTATOR BARS
SPAN-SLOTS 1:15, COMM. BARS 1:2
124 COILS-110 TURNS OF Nº 33 DOUBLE ENAMEL, DOUBLE SILK, COILS WOUND IN SLOTS IN GROUPS OF 4

250 VOLT ARMATURE WINDING
32 SLOTS, 95 COMMUTATOR BARS
SPAN SLOTS 1:9, COMM. BARS 1:48
95 COILS*-7 TURNS OF Nº 20 SINGLE COTTON ENAMEL. COILS WOUND AND PLACED IN SLOTS IN GROUPS OF 3. WDG. IN BOTTOM OF SLOT.
(*PLUS ONE DUMMY COIL)

AC. ARMATURE WINDING
32 SLOTS - SPAN 1:9 - 24 COILS EACH OF 7 TURNS Nº 16 SINGLE COTTON ENAMEL WINDING IN TOP OF SLOT.

1600 VOLT ARMATURE SLOT INSULATION

AC-DC ARMATURE SLOT INSULATION

Nº YP101 FIELD COIL DATA
1600 V. SERIES: 5000 TURNS Nº 28 SINGLE SILK ENAMEL.
250 V. SHUNT: 4000 TURNS Nº 30 SINGLE SILK ENAMEL

Nº Y115 FIELD COIL DATA
SHUNT: 2000 TURNS Nº 24 SINGLE COTTON COV.
SERIES: 100 TURNS Nº 17 SINGLE COTTON ENAMEL

SHAFT INSULATED WITH 7 LAYERS OIL SILK, 2 OF BIAS COTTON TAPE & 1 OF WHITE FRICTION TAPE. CORE HAS 3 END FIBERS, 6 OIL SILK WASHER, & 6 MUSLIN WASHERS EACH END. BETWEEN WINDINGS AT ENDS ARE 1 EACH OF SIMILAR WASHERS. BETWEEN COMPLETED WINDING & COMM. ARE 2 LARGE OIL SILK & 2 MUSLIN WASHERS WITH SILK TAPE WOUND ON AND LAPPED OVER BACK END OF COMM. MICA COLLAR.

ALL WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC. 52Y13) AND BAKED. WINDINGS THEN DIPPED & BAKED AGAIN.

Figure 88—Generator, 1600/250 volts d-c, 110 volts, 60 cycles a-c (Winding Data P-721139)

RESTRICTED

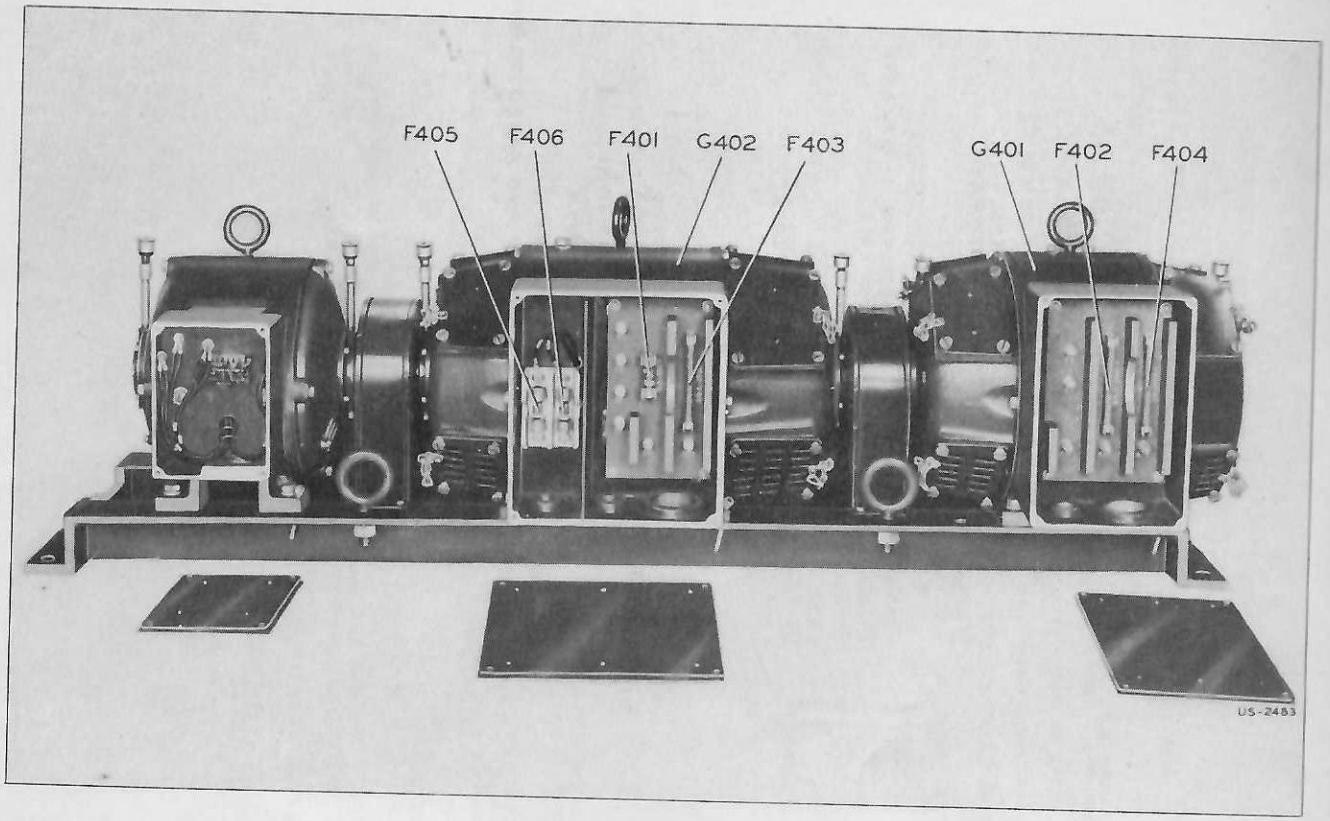


Figure 89—Motor Generator Set, A-C Supply (Side View, Terminal Box Covers Removed)

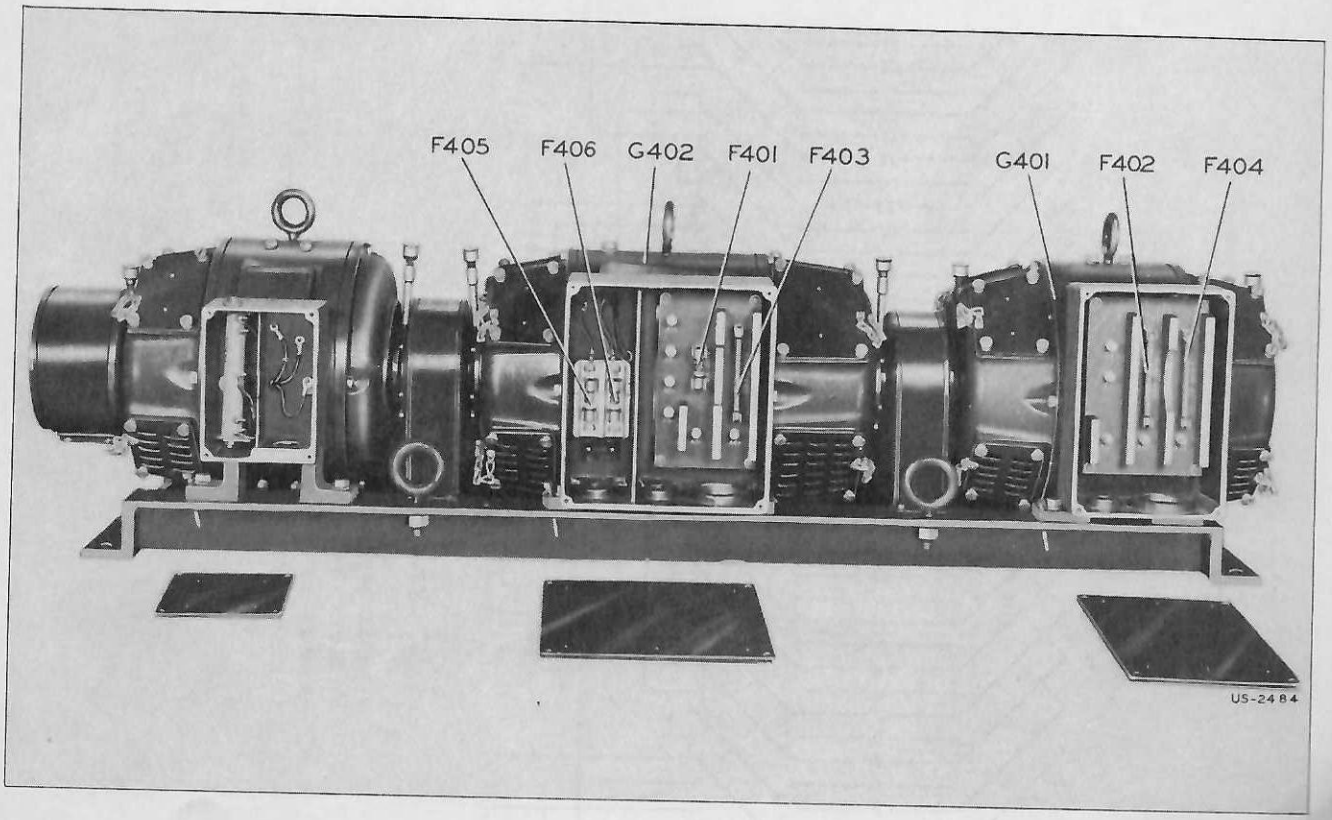
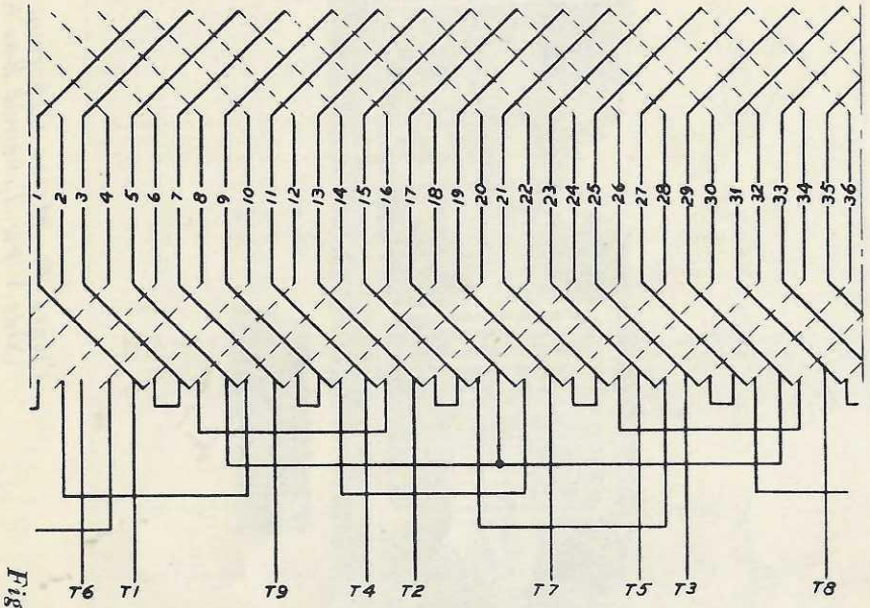


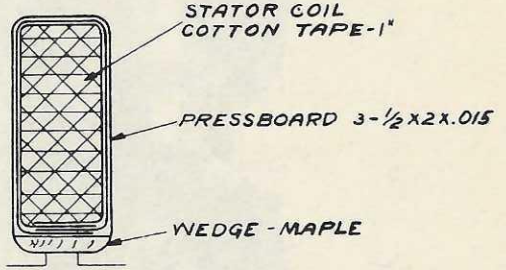
Figure 90—Motor Generator Set, D-C Supply (Side View, Terminal Box Covers Removed)



STATOR WINDING

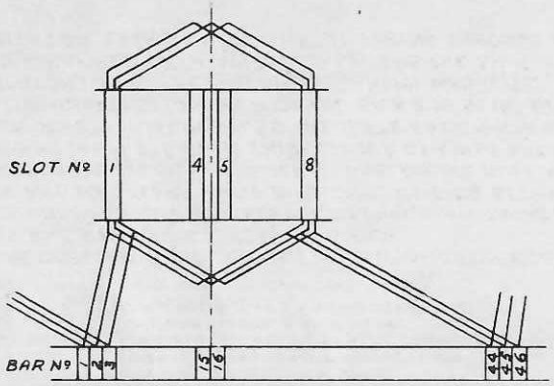
3 PHASE, 4 POLE, SERIES - MULT. Y.
Nº SLOTS - 36 TURNS PER COIL - 40
Nº COILS - 18 SPAN - 1-10
SIZE OF WIRE - Nº 15 DOUBLE COTTON ENAMEL

Figure 91—Motor, 220/440 volts a-c (Winding Data M-439758)



STATOR SLOT SECTION

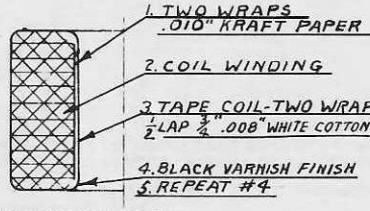
COILS TAPED ON ENDS WITH 1" COTTON TAPE
WINDING VACUUM IMPREGNATED WITH
INSULATING VARNISH (NAVY SPEC. 52V13)
AND BAKED, WINDING THEN DIPPED AND BAKED AGAIN.



ARMATURE WINDING

ALL MOTORS (250, 230 & 115 VOLT) HAVE 29 ARMATURE SLOTS, 87 COMMUTATOR BARS; SPAN, SLOTS-1:8, COMM. BARS 1:44. COILS WOUND & PLACED IN SLOTS IN GROUPS OF 3.
250 & 230 V MOTORS - 87 COILS, 5 TURNS Nº15 DOUBLE COTTON-SINGLE ENAMEL WIRE
115-VOLT MOTORS:- 87 COILS, 2½ TURNS 2 NO. 15 SINGLE COTTON COVERED WIRE (ALTERNATE COIL GROUPS ARE WOUND WITH 2 TURNS PER COIL, THEN 3 TURNS, ETC.)
ALL COILS TAPED WITH WHITE COTTON COILTAPE WOUND HALF LAP.

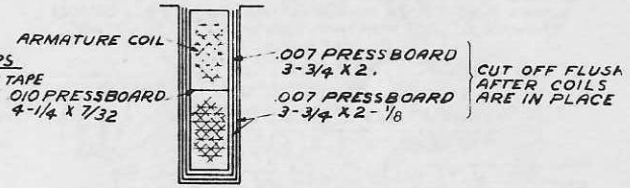
ARMATURE WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC 52V13) AND BAKED. WINDINGS THEN DIPPED & BAKED AGAIN.



INTERPOLE COIL

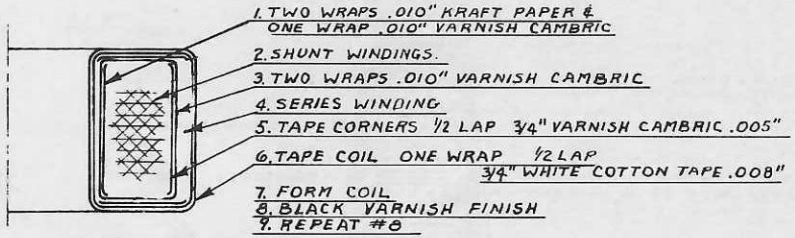
250 & 230 VOLT MOTORS
63 TURNS Nº10 SQUARE
DOUBLE COTTON COVERED.

115 VOLTS MOTORS
31 TURNS Nº8 SQUARE
DOUBLE COTTON COVERED.



ARMATURE SLOT INSULATION

ARMATURE BANDING
ON ENDS: APPROX. 18 TURNS CORD BANDING WOUND ON 1¼ X .020 PRESSBOARD
IN GROOVE: 12 TURNS NO.22 STEEL BANDING WIRE WOUND ON 5/8 STRIP OF .010 PRESSBOARD

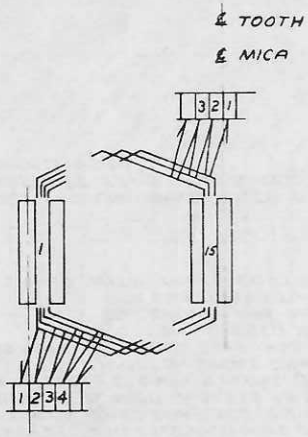


MAIN FIELD COILS

SHUNT: 250 & 230 VOLT MOTORS - 2400 TURNS NO. 24½ SINGLE COTTON COVERED COPPER WIRE
115 VOLT MOTORS - 1200 TURNS NO. 21½ SINGLE COTTON COVERED COPPER WIRE
SERIES: 250 & 230 VOLT MOTORS - 4 TURNS Nº 10SQ DOUBLE COTTON COVERED
115 VOLT MOTORS - 2 TURNS Nº 8SQ DOUBLE COTTON COVERED.

Figure 92—Motor 115/230/250 volts d-c (Winding Data M-439756)

RESTRICTED

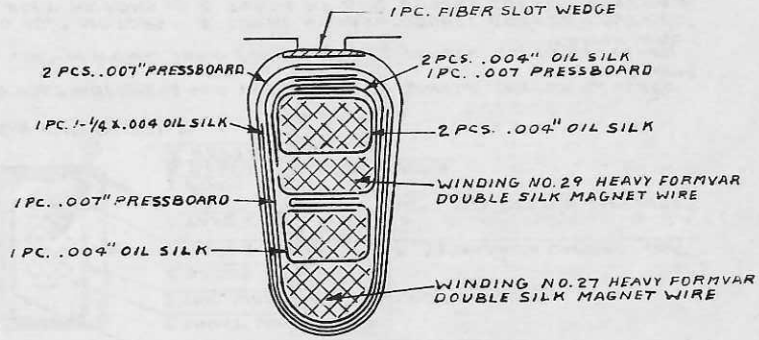


ARMATURE WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC. 52V13) AND BAKED. WINDINGS THEN DIPPED AND BAKED AGAIN.

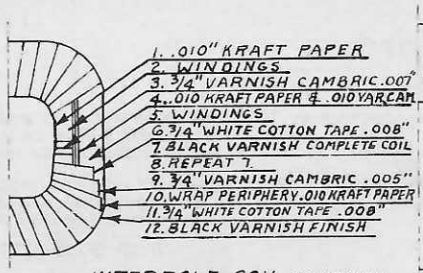
ARMATURE WINDING

NUMBER OF SLOTS - 31 SPAN: SLOTS 1:15. BARS 1:2 (BOTH WINDINGS)
500 VOLT WINDING - 93 COILS (31 GROUPS OF 3) 14 TURNS №27 HEAVY FORMVAR, DOUBLE SILK WIRE.
93 COMM. BARS (SHAFT PROJECTION END)
2000 VOLT WINDING - 124 COILS (31 GROUPS OF 4) 32 TURNS №29 HEAVY FORMVAR, DOUBLE SILK WIRE.
124 COMM. BARS - OUTBOARD END

ARMATURE CORE HAS 3 END FIBERS EACH END, 4 - .007 PRESSBOARD WASHERS AND 3 MUSLIN WASHERS EACH END.
SHAFT IS WRAPPED WITH 3 LAYERS PRESSBOARD, 10 ADDITIONAL LAYERS OIL SILK AND 10 LAYERS WHITE BIAS TAPE. ON ENDS BETWEEN WINDINGS ARE 4 OIL SILK WASHERS, 1 UNBLEACHED MUSLIN WASHER AND INSULATE EACH THIRD GROUP OF COILS WITH 1-.004 OIL SILK AND 1 MUSLIN, ALSO INSULATE EACH NINTH GROUP WITH A ONE-QUARTER WASHER OF OIL SILK & MUSLIN. BEHIND COMMUTATORS ARE PRESSBOARD & CANVAS WASHERS. FAN SPOKES WRAPPED WITH APPROX. 6 LAYERS OIL SILK. COMMUTATOR LEADS IN SPAGHETTI TUBING THROUGH FAN.

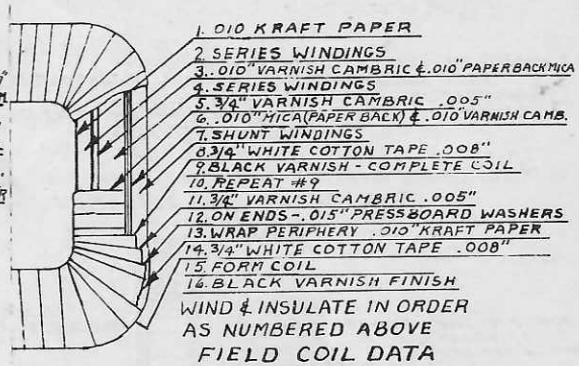


ARMATURE SLOT INSULATION



INTERPOLE COIL №YPC301

WOUND TOGETHER { (500V) 400 TURNS №22 SILK ENAMEL
(2000V) 1200 TURNS №24 SILK ENAMEL



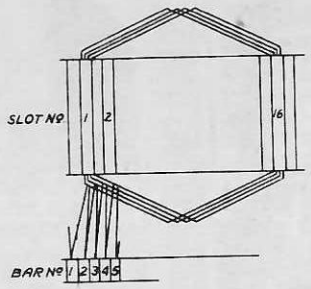
WIND & INSULATE IN ORDER AS NUMBERED ABOVE

FIELD COIL DATA
№YP301

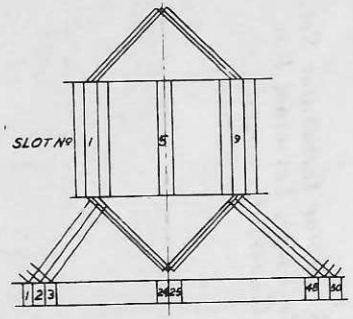
SERIES WOUND TOGETHER SHUNT { (500V) 100 TURNS №21 COTTON ENAMEL
(2000V.) 330 TURNS №23 SILK ENAMEL
(250V.) 3500 TURNS №26 HEAVY FORMVAR

Figure 93—Generator, 2000/500 volts d-c (Winding Data M439757)

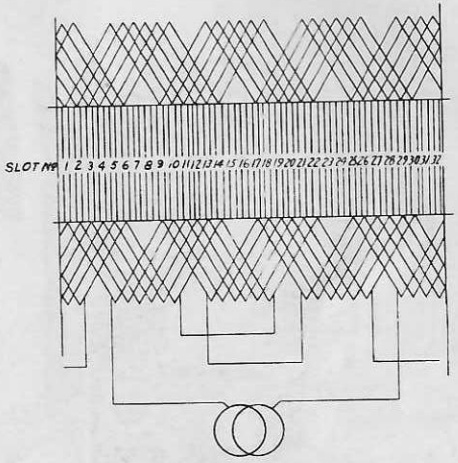
RESTRICTED



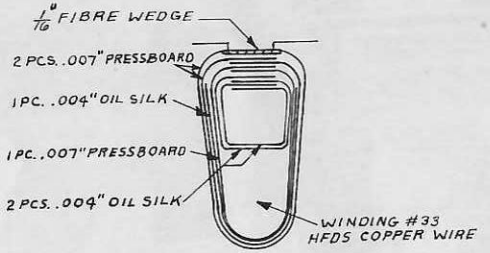
1600 VOLT ARMATURE WINDING
31 SLOTS 124 COMMUTATOR BARS
SPAN-SLOTS 1:15, COMM. BARS 1:2
124 COILS · 7.5 TURNS OF Nº 31 HEAVY FORMVAR, DOUBLE SILK. COILS WOUND IN SLOTS IN GROUPS OF 4



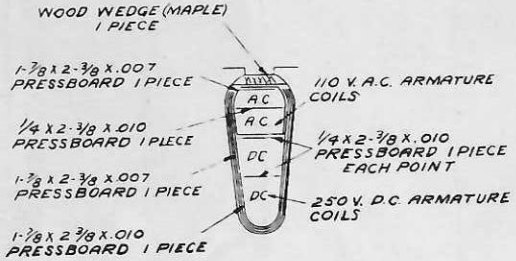
250 VOLT ARMATURE WINDING
32 SLOTS, 95 COMMUTATOR BARS
SPAN SLOTS 1:9, COMM. BARS 1:48
95 COILS* - 7 TURNS OF Nº 21 SINGLE COTTON ENAMEL. COILS WOUND AND PLACED IN SLOTS IN GROUPS OF 3. WDG. IN BOTTOM OF SLOT.
(*PLUS ONE DUMMY COIL)



AC. ARMATURE WINDING
32 SLOTS - SPAN 1:9 - 24 COILS EACH OF 7 TURNS Nº 17 SINGLE COTTON ENAMEL WINDING IN TOP OF SLOT.



1600 VOLT ARMATURE
SLOT INSULATION

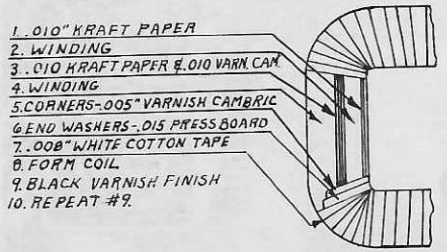


AC-DC ARMATURE
SLOT INSULATION

ARMATURE CORE HAS 3 END FIBRES, 4-.007 PRESSBOARD WASHERS AND 3 MUSLIN WASHERS EACH END. SHAFT IS WRAPPED WITH 3 LAYERS .007 PRESSBOARD, 6 LAYERS .004 OIL SILK, AND 6 LAYERS BIAS TAPE. ON ENDS INSULATE EACH THIRD GROUP OF COILS WITH 1-.004 OIL SILK AND 1 MUSLIN, ALSO INSULATE EACH NINTH GROUP WITH A ONE-QUARTER WASHER OF OIL SILK & MUSLIN.

ARMATURE WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC. 52Y(3)) AND BAKED. WINDINGS THEN DIPPED & BAKED AGAIN.

NO. Y P101 FIELD COIL DATA
1600 V. SERIES: 3500 TURNS NO. 28 SINGLE SILK ENAMEL
250 V. SHUNT: 4500 TURNS NO. 30 HEAVY FORMVAR



NO. Y 115 FIELD COIL DATA
SHUNT: 2000 TURNS NO 24 SINGLE COTTON COVERED
SERIES: 100 TURNS NO 17 SINGLE COTTON ENAMEL

Figure 94—Generator, 1600/250 volts d-c, 110 volts, 60 cycles a-c (Winding Data P-7229)

RESTRICTED

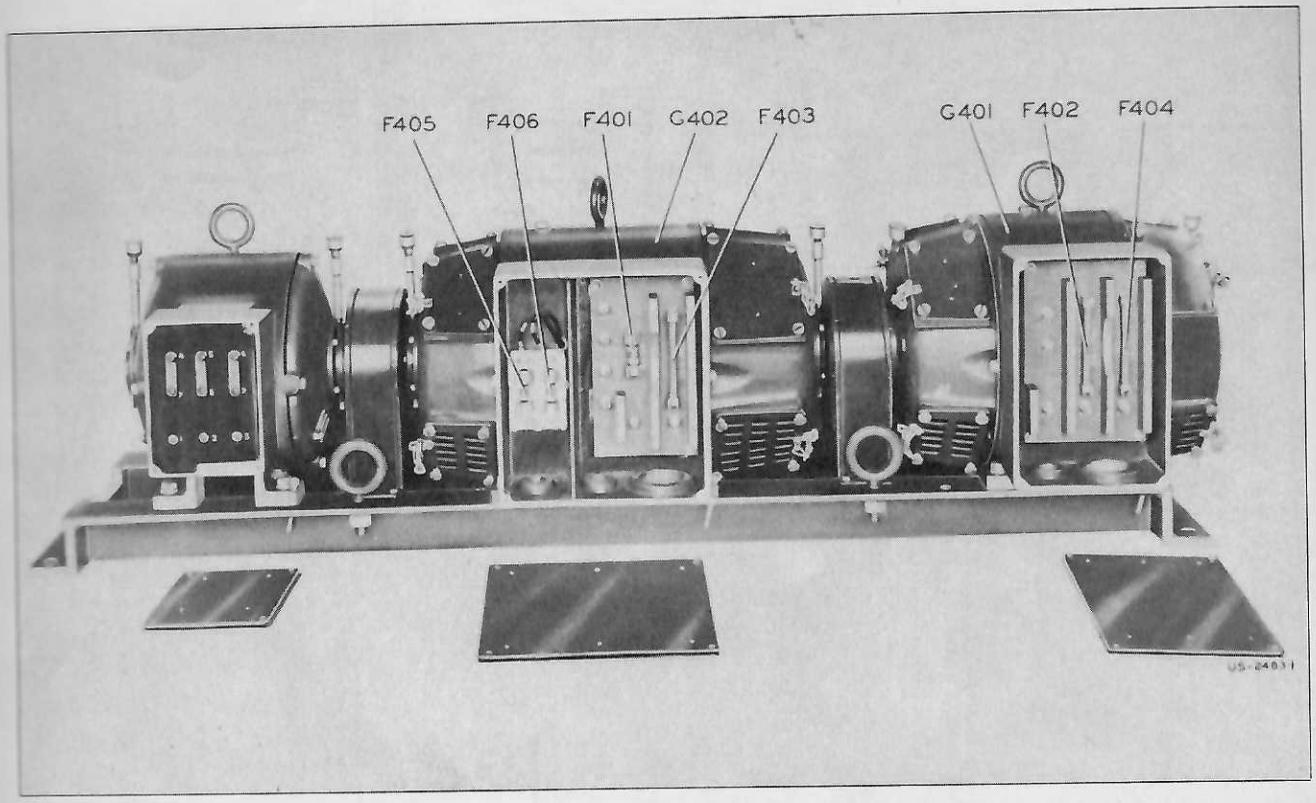


Figure 95—Motor Generator Set, a-c (Side View, Terminal Box Covers Removed)

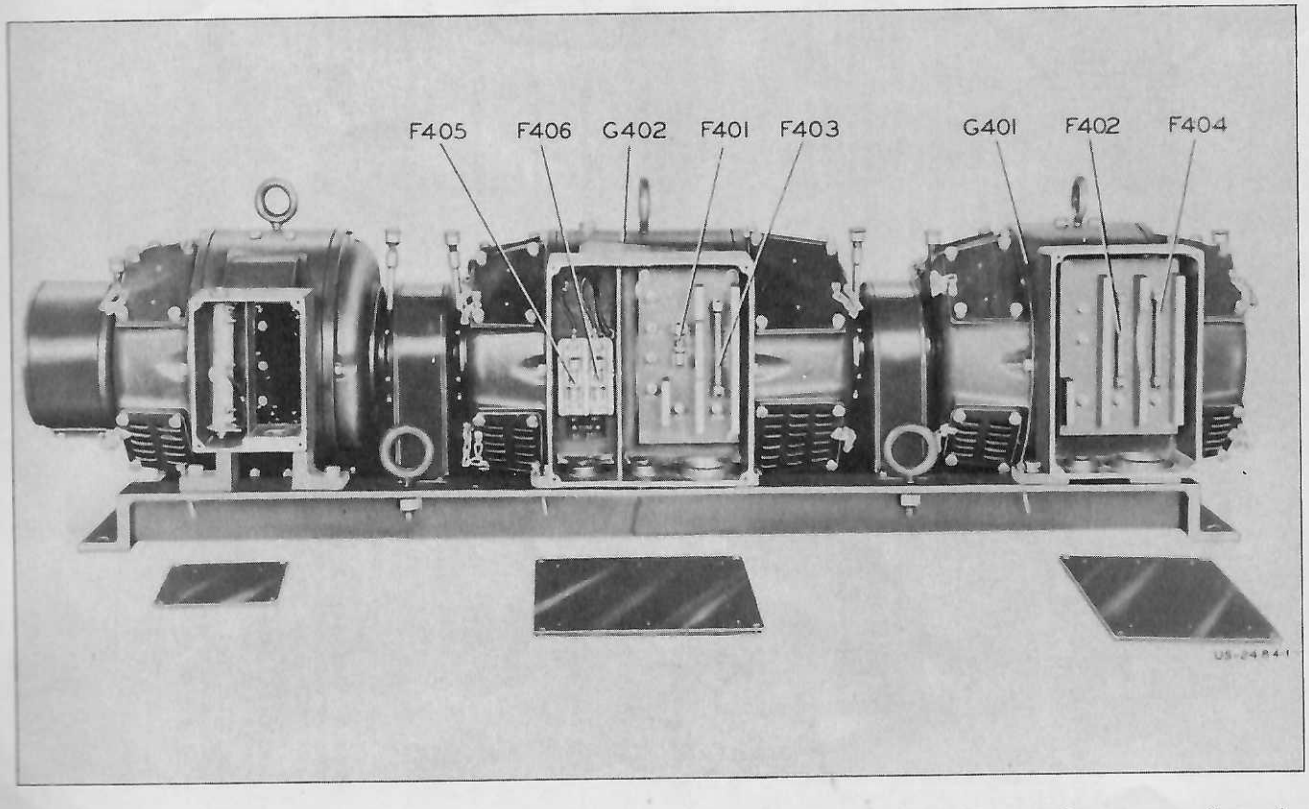
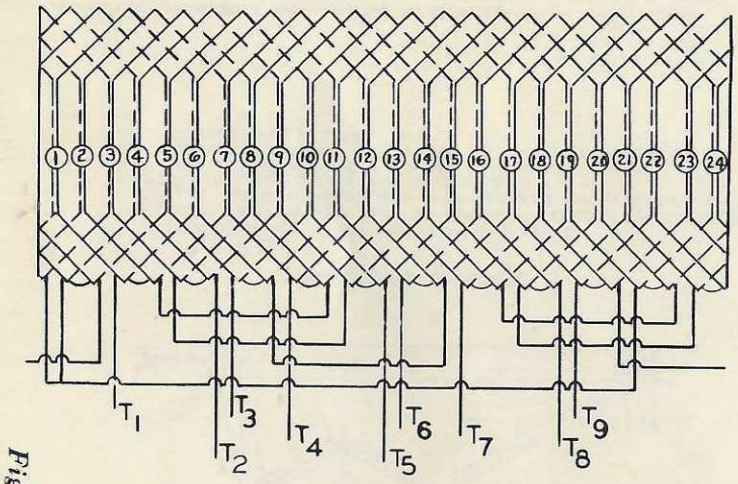


Figure 96—Motor Generator Set, d-c (Side View, Terminal Box Covers Removed)

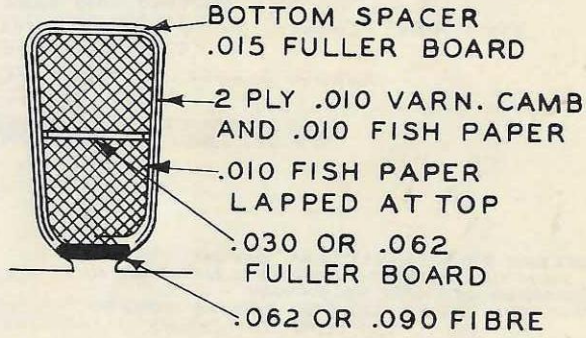
STATOR WINDING



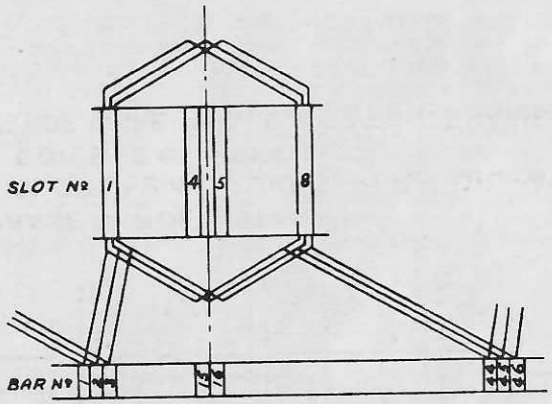
3-PHASE 4 POLE STAR
NO. SLOTS-24 TURNS PER COIL-40
NO. COILS-24 SPAN-1:6
SIZE OF WIRE-NO.16 COTTON ENAMEL

Figure 97—Motor, 220/440 volts a-c (Winding Data M-439752)

STATOR SLOT SECTION



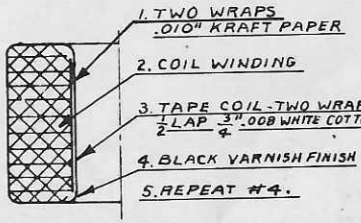
WINDINGS IMPREGNATED IN INSULATING VARNISH (NAVY SPEC. 52V13), BAKED, REIMPREGNATED AND REBAKED.



ARMATURE WINDING

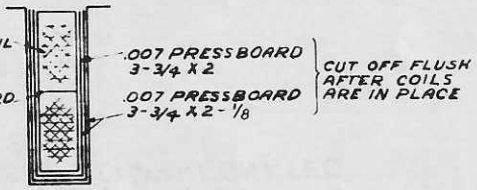
MOTORS HAVE 29 ARMATURE SLOTS
87 COMMUTATOR BARS; SPAN, SLOTS-1:8, COMM. BARS 1:44.
COILS WOUND & PLACED IN SLOTS IN GROUPS OF 3.
87 COILS, 5 TURNS NO. 15 DOUBLE
COTTON-SINGLE ENAMEL WIRE.
ALL COILS TAPED WITH WHITE COTTON COILTAPE
WOUND HALF LAP

ARMATURE WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC 52V13) AND BAKED. WINDINGS THEN DIPPED & BAKED AGAIN.



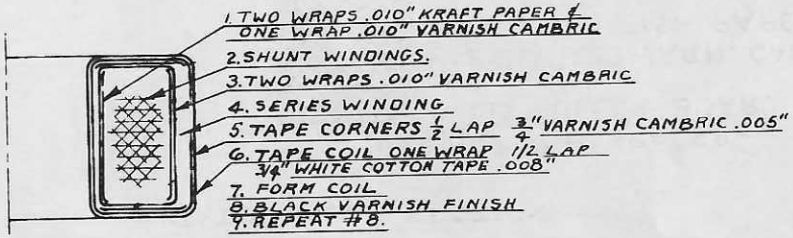
INTERPOLE COIL

63 TURNS NO. 10 SQUARE
DOUBLE COTTON COVERED.



ARMATURE SLOT INSULATION

ARMATURE BANDING
ON ENDS: APPROX. 18 TURNS CORD BANDING WOUND ON 1 1/4 X .020 PRESSBOARD.
IN GROOVE: 12 TURNS NO. 22 STEEL BANDING WIRE WOUND ON 5/8 STRIP OF .010 PRESSBOARD.



MAIN FIELD COILS

SHUNT: 2400 TURNS NO. 24 1/2 SINGLE COTTON COVERED COPPER WIRE

SERIES: 4 TURNS NO. 10 SQ. DOUBLE COTTON COVERED.

RESTRICTED

Figure 98—Motor, 115/230/250 volts d-c (Winding Data M 439755)

ARMATURE WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC. 52V13) AND BAKED. WINDINGS THEN DIPPED AND BAKED AGAIN.

ARMATURE SLOT INSULATION

ARMATURE WINDING

NUMBER OF SLOTS - 31 SPAN: SLOTS 1:15, BARS 1:2 (BOTH WINDINGS)
500 VOLT WINDING - 93 COILS (31 GROUPS OF 3) 14 TURNS №27 HEAVY FORMVAR, DOUBLE SILK WIRE.
93 COMM. BARS (SHAFT PROJECTION END)
2000 VOLT WINDING - 124 COILS (31 GROUPS OF 4) 32 TURNS №29 HEAVY FORMVAR, DOUBLE SILK WIRE.
124 COMM. BARS - OUTBOARD END.

ARMATURE CORE HAS 3 END FIBERS EACH END, 4 - .007 PRESSBOARD WASHERS AND 3 MUSLIN WASHERS EACH END. SHAFT IS WRAPPED WITH 3 LAYERS PRESSBOARD, 10 ADDITIONAL LAYERS OIL SILK AND 10 LAYERS WHITE BIAS TAPE. ON ENDS BETWEEN WINDINGS ARE 4 OIL SILK WASHERS, 1 UNBLEACHED MUSLIN WASHER AND INSULATE EACH THIRD GROUP OF COILS WITH 1-.004 OIL SILK AND 1 MUSLIN, ALSO INSULATE EACH NINTH GROUP WITH A ONE-QUARTER WASHER OF OIL SILK & MUSLIN. BEHIND COMMUTATORS ARE PRESSBOARD & CANVAS WASHERS. FAN SPOKES WRAPPED WITH APPROX. 6 LAYERS OIL SILK. COMMUTATOR LEADS IN SPAGHETTI TUBING THROUGH FAN.

INTERPOLE COIL №YPC301

WOUND TOGETHER { (500 V) 400 TURNS №9.22 SILK ENAMEL
(2000 V) 1200 TURNS №24 SILK ENAMEL

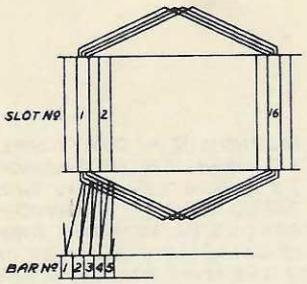
WIND & INSULATE IN ORDER AS NUMBERED ABOVE

FIELD COIL DATA
№YP301

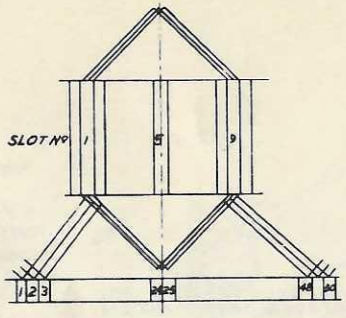
SERIES WOUND TOGETHER SHUNT { (500V) 100 TURNS №21 COTTON ENAMEL
(2000V) 330 TURNS №23 SILK ENAMEL
(250 V.) 3500 TURNS №26 HEAVY FORMVAR

Figure 99—Generator, 2000/500 volts d-c (Winding Data M-439757)

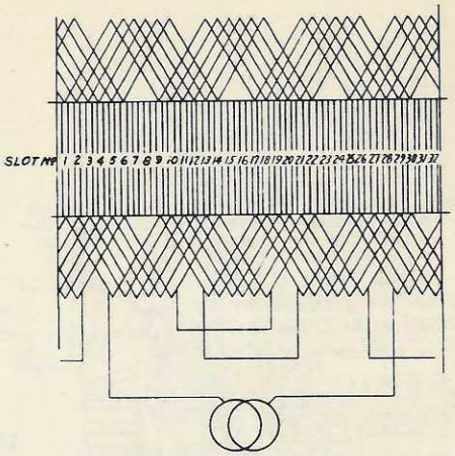
RESTRICTED



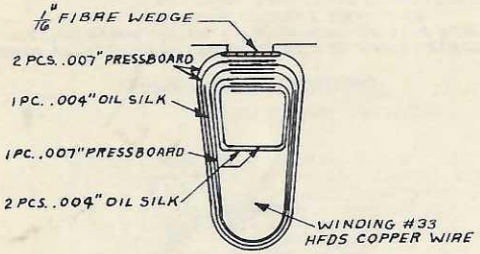
1600 VOLT ARMATURE *WINDING
31 SLOTS 124 COMMUTATOR BARS
SPAN-SLOTS 1:15, COMM. BARS 1:2
124 COILS - 75 TURNS OF Nº 30 HEAVY FORMVAR, DOUBLE SILK. COILS WOUND IN SLOTS IN GROUPS OF 4



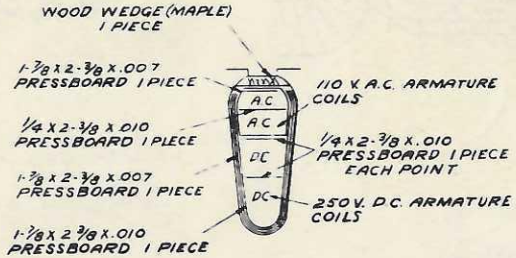
250 VOLT ARMATURE WINDING
32 SLOTS, 95 COMMUTATOR BARS
SPAN SLOTS 1:9, COMM. BARS 1:48
95 COILS* - 7 TURNS OF Nº 21 SINGLE COTTON ENAMEL. COILS WOUND AND PLACED IN SLOTS IN GROUPS OF 3. WDG. IN BOTTOM OF SLOT.
(*PLUS ONE DUMMY COIL)



AC ARMATURE WINDING
32 SLOTS - SPAN 1:9 - 24 COILS EACH OF 7 TURNS Nº 17 SINGLE COTTON ENAMEL WINDING IN TOP OF SLOT.



1600 VOLT ARMATURE
SLOT INSULATION



AC-DC ARMATURE
SLOT INSULATION

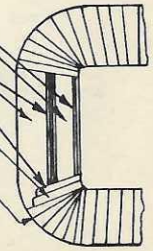
ARMATURE CORE HAS 3 END FIBRES, 4-.007 PRESSBOARD WASHERS AND 3 MUSLIN WASHERS EACH END. SHAFT IS WRAPPED WITH 3 LAYERS .007 PRESSBOARD, 6 LAYERS .004 OIL SILK, AND 6 LAYERS BIAS TAPE. ON ENDS INSULATE EACH THIRD GROUP OF COILS WITH 1-.004 OIL SILK AND 1 MUSLIN, ALSO INSULATE EACH NINTH GROUP WITH A ONE-QUARTER WASHER OF OIL SILK & MUSLIN.

ARMATURE WINDINGS VACUUM IMPREGNATED WITH INSULATING VARNISH (NAVY SPEC. 52V13) AND BAKED. WINDINGS THEN DIPPED & BAKED AGAIN

1. .010" KRAFT PAPER
2. SERIES WINDING
3. .005" VARNISH CAMBRIC
4. .010" PAPER BACK MICA & .010 VARN. CAM.
5. SHUNT WINDING
6. .008" WHITE COTTON TAPE
7. BLACK VARNISH OVER #6
8. REPEAT #7
9. .005" VARNISH CAMBRIC
10. END WASHER .015" PRESSBOARD
11. WRAP PERIPHERY .010" KRAFT PAPER
12. .008" WHITE COTTON TAPE
13. FORM COIL
14. BLACK VARNISH FINISH

NO. Y P101 FIELD COIL DATA
1600 V. SERIES: 3500 TURNS NO. 28 SINGLE SILK ENAMEL
250 V. SHUNT: 4500 TURNS NO. 30 HEAVY FORMVAR

1. .010" KRAFT PAPER
2. WINDING
3. .010 KRAFT PAPER & .010 VARN. CAM
4. WINDING
5. CORNERS - .005" VARNISH CAMBRIC
6. END WASHERS - .015 PRESS BOARD
7. .008" WHITE COTTON TAPE
8. FORM COIL
9. BLACK VARNISH FINISH
10. REPEAT #9.



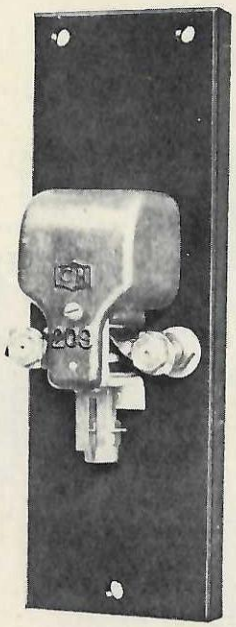
NO. Y 115 FIELD COIL DATA
SHUNT: 2000 TURNS NO. 24 SINGLE COTTON COVERED
SERIES: 100 TURNS NO. 17 SINGLE COTTON ENAMEL

RESTRICTED

Figure 100—Generator, 1600/250 volts d-c, 110 volts, 60 cycles a-c
Winding Data P-722917)

INSTRUCTION SHEET
NO. 209 D. C. OVERLOAD RELAY
With Time Limit Protection

Additional Copies of this Instruction Sheet can be obtained by requesting Publication No. 1055.



DESCRIPTION

The No. 209 direct current overload relay is used where overload protection with time lag, or delayed action is desired. This allows a momentary overload, but if the overload is sustained for an appreciable period, the control circuit will be opened and injury to the motor will be prevented.

The time lag is produced by an oil dash-pot. When the current taken by the motor being protected rises to 175 percent of full load current, the plunger is drawn forcibly upward against the action of the dash-pot, and will reach its upward limit and open the contacts in approximately one and one-half to two seconds.

The relay is extremely simple and consists of few moving parts, It was designed particularly rugged so as to withstand severe service and remain reliable under all conditions. The contacts are large and heavy for a relay and are not affected by vibration or violent motion of any kind. The contact mechanism is protected by a cast iron cover which also serves to keep it clean and free from dirt.

This device is built in two types, namely, single coil or double coil. The single coil relay should be used only with three wire control or its equivalent. When the control circuits are opened they will remain so until some master device is operated. The relay coil in this case is connected in series with the motor armature.

The double coil relay is used with two wire control. In this case one coil is connected in series with the motor armature, and a second small coil is in shunt with the line, so that the relay will be held open when the series coil causes the plunger to move upward. The shunt coil does not have sufficient power to operate the relay, but will hold the plunger up when it has once been placed in this position. To reset the relay it is necessary to open the circuit to the shunt coil.

INSTALLATION

Fill the dash-pot with oil before attempting to operate the controller. The oil for this purpose is supplied with the relay and no other oil should be used if correct operation is expected. This oil has properties which insure satisfactory results under practically any temperature conditions. When more oil is needed, it can be obtained from Cutler-Hammer, Inc., Milwaukee.

The dash-pot can be filled by unscrewing it from the relay frame and removing the plunger. About 3/4 inch of oil should be placed in the dash-pot. When filling take particular care not to allow any foreign substance to enter the dash-pot.

Always keep sufficient oil in the dash-pot to cover the piston to a depth of 3/4 inch. Before placing new oil in the dash-pot it is well to thoroughly clean it.

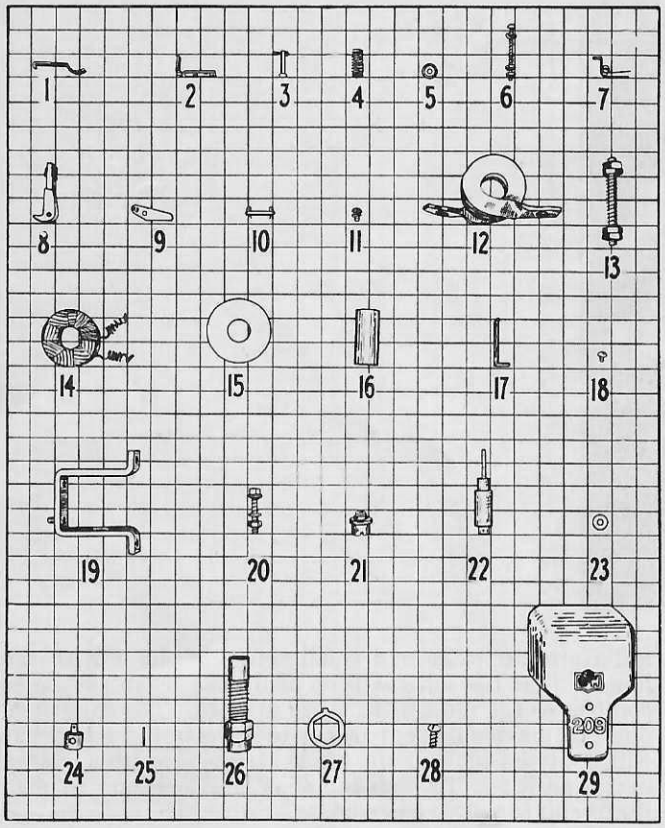
CARE

Lubricate the bearing points of the contact mechanism occasionally with a light engine or machine oil.

Keep the contacts clean and lubricate them with a small amount of vaseline.

INSTRUCTION SHEET
NO. 209 D. C. OVERLOAD RELAY
With Time Limit Protection

REPAIR PART LIST

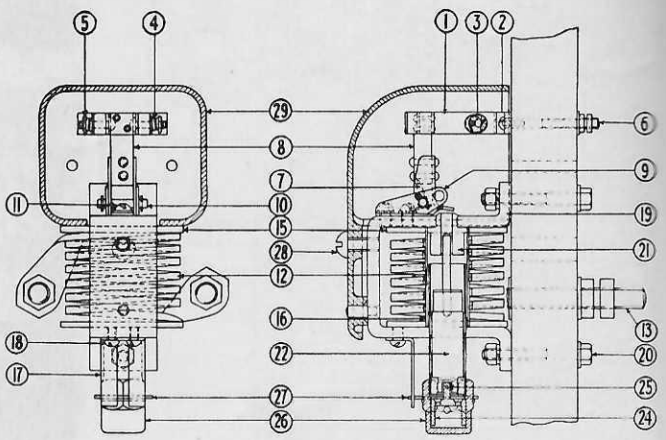


Scale: One Division = One Inch

INFORMATION REQUIRED

Your parts CANNOT be sent promptly unless you include the FOLLOWING with your order: PUBLICATION No. 1055, ITEM NUMBER, PART NUMBER and DESCRIPTION.

Item No.	No. Req'd	Part No.	Description
1	2	740-8F1	Contact finger
2	2	979-15Z	Support for contact finger
3	2	913-1195Z	Pin for finger spring
	2	913-21Z	Cotter pin
4	2	969-19J	Tension spring for finger
5	4	916-561Z	Cup washer
6	2	911-672Z	10/24x2-1/4" R. H. screw
	4	915-283Z	10/24 nut
	2	916-523Z	3/16" washer
7	1	969-16	Spring for contact lever
8	1	624-266	Contact lever
9	1	979-14	Support for contact lever
10	1	956-16	Shaft for contact lever
	2	913-21Z	Cotter pin



Drawing No. 18036-1

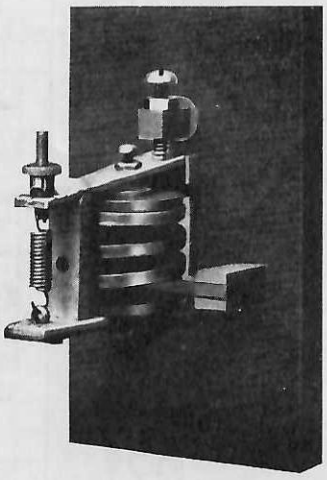
Item No.	No. Req'd	Part No.	Description
11	2	911-846Z	1/4"x3/8" R. H. screw
	2	916-644Z	1/4 lock washer
12	1	18036-1	Bar wound coil—Give No. stamped on coil
13	2	1314-723	3/8"x3-1/2" copper stud
	8	815-883	3/8" brass nut
	4	916-2Z	3/8" washer
	2	915-1005	3/8" steel nut
14	1	Wire wound coil—Give No. stamped on coil tag	
15	2	1016-1165	Insulation washer
16	1	4429-98	Insulation tube
17	1	827-327	Indicator plate
18	2	911-608Z	10/24x1/4" R. H. screw
19	1	949-54	Magnet frame
20	2	911-5458Z	1/4"x2-1/4" cap screw
	2	916-641Z	1/4" washer
	2	915-605Z	1/4" nut
	2	916-644Z	1/4" lock washer
21	1	939-62	Plug
22	1	651-35	Plunger
23	1	816-2	Washer for piston
24	1	759-1	Piston for dash-pot
25	1	912-41	Pin for piston
26	1	699-326	Dash-pot
27	1	816-5	Lock washer for dash-pot
28	1	911-1172Z	5/16"x3/4" R. H. screw
29	1	3244-410J1	Cover for relay

Your parts **CANNOT** be sent promptly unless you supply the **INFORMATION REQUIRED.**

Supersedes Issue Dated BB-UL

INSTRUCTION SHEET
No. 175 DIRECT CURRENT SERIES RELAY
For Use With Magnetic Contactors

Additional copies of this Instruction Sheet can be obtained by requesting Publication No. 111.



ADJUSTMENT

These relays are for use with direct current contactors of various capacities, to govern the acceleration of the motor.

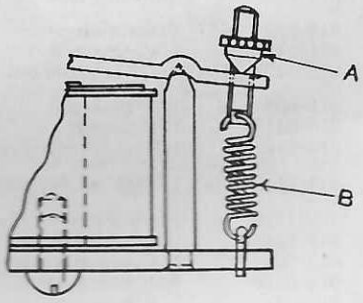
They are sent out properly adjusted for average load conditions of the motors with which they are to be used. If it is necessary to alter the rate of acceleration of the motor, it may readily be done by means of the adjusting screw A, shown in sketch opposite.

Turning the nut A to the right, increases the tension of the spring B on the armature lever and causes an increase in the rate of acceleration of the motor. Turning the nut A to the left, decreases the tension of the spring on the armature lever, and causes a decrease in the rate of acceleration of the motor.

To speed up acceleration—turn nut A to the right.
To slow down acceleration—turn nut A to the left.

CARE

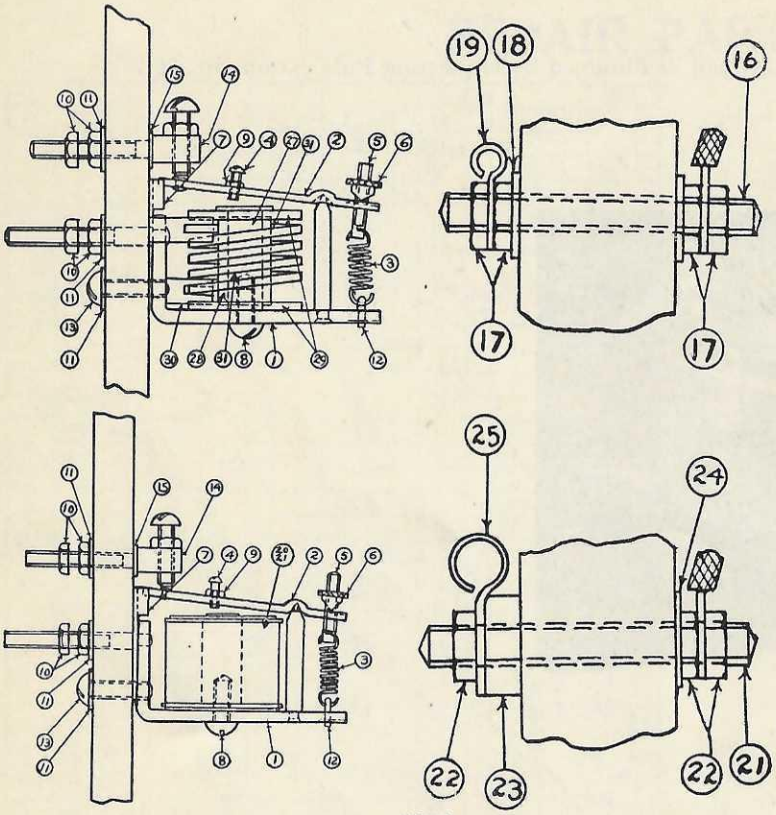
Keep contacts clean, and free from oil and grease. Lubrication of any part of the relay will serve only to retain dust and make the relay liable to stick.



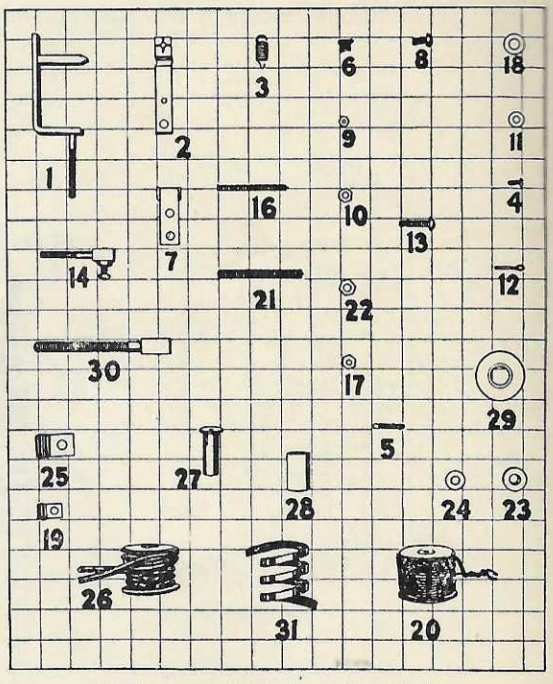
Your parts **CANNOT** be sent promptly unless you supply the **INFORMATION REQUIRED.**

Supersedes Issue Dated BM-UE

INSTRUCTION SHEET
No. 175 DIRECT CURRENT SERIES RELAY
For Use With Magnetic Contactors



1901-7



Scale: One Division=One Inch

INFORMATION REQUIRED

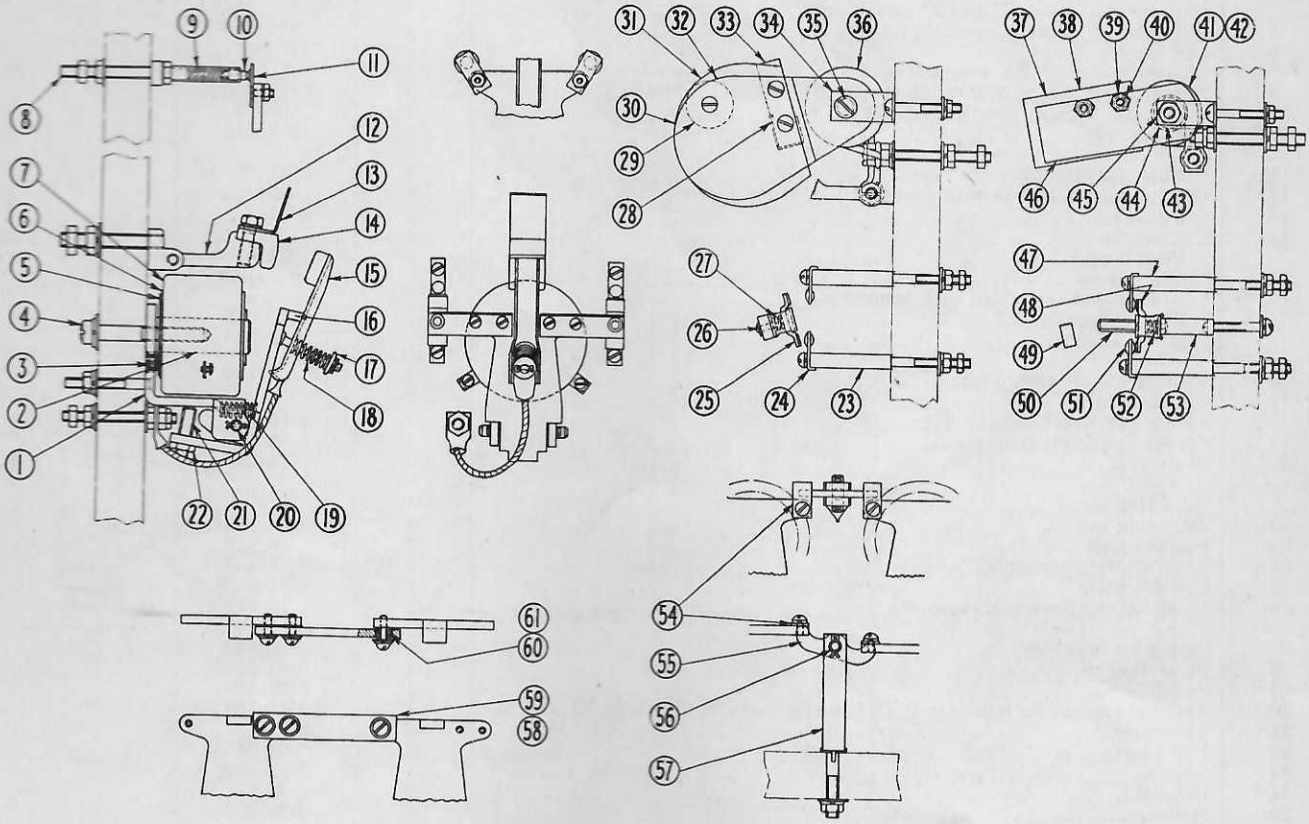
Your parts CANNOT be sent promptly unless you include the FOLLOWING with your order: PUBLICATION No. 111, ITEM NUMBER, STOCK NUMBER and DESCRIPTION.

Item No.	No. Req'd	Stock No.	Description
			Parts Common to All Relays
1	1	979-806AZ	Bracket
2	1	624-263	Contact lever
3	1	69-512	Spring
4	1	811-412	8/32"x3/8" brass screw
5	1	914-422	Adjusting stud
6	1	915-62	Adjusting nut
7	1	819-962	Brass quide
8	1	911-848Z	1/4"-20 screw
9	1	915-242Z	8/32" hexagon nut
10	4	815-601	1/4" brass nut
11	2	916-641Z	1/4" washer
12	1	913-81Z	1/8"x5/8" cotter pin
13	1	911-856Z	1/4"x1" rd. head screw
14	1	918-492Z	Binding post
	1	811-854A	Contact screw
	2	815-601	1/4" hexagon brass nut
	1	916-682Z	1/4" lock washer
	1	915-24Z	1/4" hexagon nut
15	1	916-601Z	1/4" washer
16	1	814-489	1/4"x2-1/4" brass stud
17	4	815-601	1/4" hexagon brass nut
18	2	916-641Z	1/4" washer
19	1	1380-1041	Copper lug
20	1	Series Coil	(Give number stamped on coil)
			75 Ampere Wire Wound
21	1	814-566	5/16"x2-3/4" brass stud.
22	2	815-721	5/16" hexagon brass nut
23	1	815-726	5/16" brass jam nut
24	2	916-762Z	5/16" washer
25	1	1380-1201	Copper lug
26		Series Coil	(Give number stamped on coil)
			Bar Wound
27	1	985-1121Z	Core
28	1	1029-88	Insulating tube
29	2	1016-884F	Insulating washer
30	2	1318-1001	Copper binding post
	4	815-883	3/8" mtg. nut
	2	916-882Z	3/8" washer
31	1	Bar Wound coil	(Give number stamped on coil)

Your parts **CANNOT** be sent promptly unless you supply the **INFORMATION REQUIRED.**

Supersedes Issue Dated BM-UE

INSTRUCTION SHEET FOR NO. 369 CONTACTOR RATING—50 AMPERES D. C.



C10-45

CARE

Do not lubricate the main contacts, items 14 and 15. If these contacts become badly pitted or burned, smooth them with a fine file, taking care to remove as little copper as possible.

These contacts should be renewed when the distance "A" indicated on figure 1 becomes not less than 1/32". This distance should be measured with the panel disconnected from the line and the armature lever moved by hand to close the contacts as indicated in Figure 1.

The contact surfaces of the electrical interlock contacts, items 25, 48 and 51, should be kept clean, and these contacts should be replaced if they become badly pitted or worn.

All bearing points on the contactor should be lubricated occasionally with a good grade of light machine oil.

ADJUSTMENT

These contactors are adjusted at the factory for normal conditions. If it is desired to change the voltage value at which the contactor closes it can readily be done.

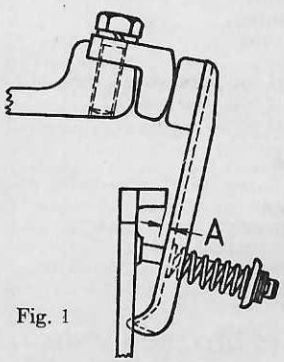


Fig. 1

Turning slotted screw, item 21, clockwise will decrease this voltage value, while turning it counter-clockwise will increase it. After making any adjustment be sure to lock the screw in position with the lock-nut, item 22.

See Page 2 for Repair Part List

RENEWAL PARTS—Information Required

Your parts **CANNOT** be sent promptly unless you include the **FOLLOWING** with your order: **PUBLICATION NO. 4519, PART NUMBER, DESCRIPTION, and NO. STAMPED ON CONTROLLER NAME PLATE.**

Item No.	Description of Part	No. Req'd	Part No.	Remarks
1	Magnet frame assembled with stud	1	649–375	
2	Core	1	51–64	
3	Spring (for magnet frame)	1	969–566	
4	Core screw (for 3/4″ and 1″ panel)	1	811–3534	
	Core screw (for 1-1/2″ and 2″ panel)	1	811–3542	
5	Coil washer	1	916–1561Z	
6	Coil washer	2	4416–134	
7	Magnet coil (give No. stamped on coil)	1	.....	
8	Contact post complete (for non-insulated electrical interlock)	1	618–335	
9	Spring (for contact post)	1	869–22	
10	Contact only	1	1321–516	
11	Contact plate	1	21–80	
12	Contact post complete with contact tip, and arc guard	1	10–44–8	
13	Arc guard	1	4221–7	
14	Contact tip	1		
	Plain copper		1321–61	
	Silver faced		23–1258	
15	Contact finger assembled with connector	1		
	Plain copper tip		640–246	
	Silver faced tip		640–315	
16	Armature lever assembled	1	24–315–2	
17	Cup washer	1	916–2641Z	
18	Spring (for finger assembly)	1	69–95	
19	Spring (for armature lever)	1	69–179	
20	Shaft	1	956–343	
21	Adjusting screw	1	711–6	
22	Adjusting nut	1	915–193	
23	Contact post	2	18–116	
24	Contact plate assembled	2	21–144	
25	Contact plate	1	4221–4	
26	Insulated interlock bar assembled	1	10–87	Used on contactor without tie bar
27	Spring for interlock	1	969–633	
28	Protecting clip	1	933–203Z	
29	Spacer	1	2222–483	
30	Arc shield assem. for mill duty B. O. Includes items 28, 29, 31, 32, 33, and 35	1	662–159	
31	Arc shield	2	4973–5	
32	Pole piece	2	962–54	
33	Spacer	1	2222–402	
34	Bracket	2	79–373	
35	Spacer	2	929–992	
36	Blowout coil (give No. stamped on coil)	1	.....	
37	Arc shield assembled for 230 V. blowout. Includes items 38, 39, 40, and 46	1	62–21	
38	Arc Shield	2	73–108	
39	Outer tube	2	1329–681	
40	Inside tube	2	1029–50	
41	Blowout coil wire wound (give No. stamped on coil)	1	.....	
42	Blowout coil (bar wound)	1	460–51	
43	Blowout core	1	985–526Z	
44	Tube	1	1029–274	
45	Bracket	1	79–217	
46	Pole piece	2	962–923Z	
47	Contact post	2	18–116	
48	Contact plate	1	23–820	
49	Contact Bar	1	61–76	
50	Post	1	18–115	
51	Contact plate	2	21–144	
52	Spring for interlock	1	969–633	
53	Contact support assembled	1	23–821	
54	Stop	2	18–59	
55	Lever (Steel)	1	924–172	
	(Bakelite)	1	24–1223	
56	Hinge Pin	1	956–325	
57	Walking beam interlock assembled with post, pin, cotter pin and lever	1	10–80–2	
	Same as above but with insulated lever	1	10–80–6	
58	Tie bar (used with normally closed interlock and plain tie bar)	1	61–75	
59	Normally open interlock bar (for use with tie bar arrangement)	1	10–87–2	
60	Spacer (used with normally closed and plain interlock)	1	929–1035	
61	Spacer (used with normally open interlock)	1	29–273	

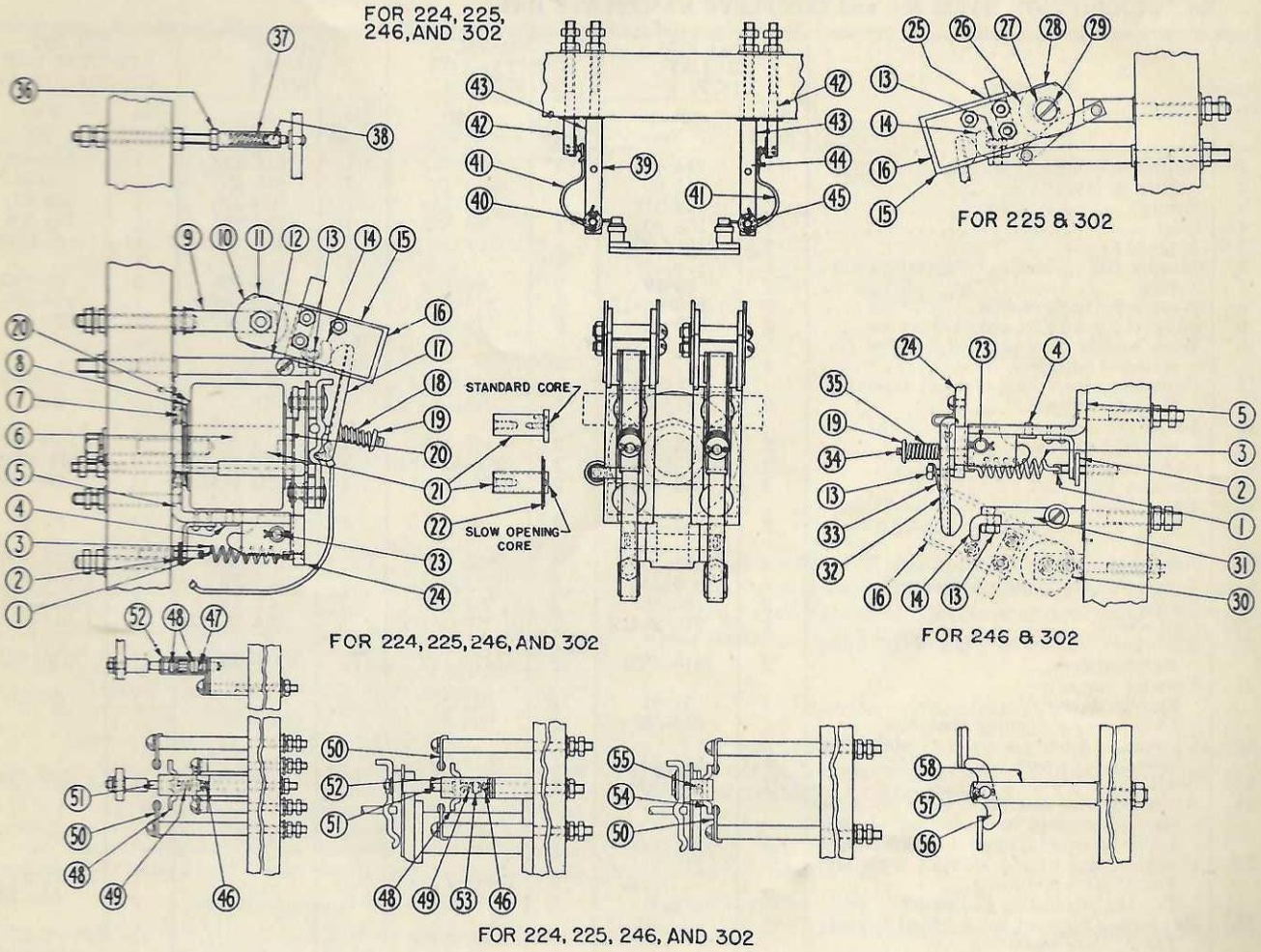
FEBRUARY, 1937

CUTLER-HAMMER INC.
PIONEER MANUFACTURERS OF ELECTRIC CONTROL APPARATUS
Milwaukee Wisconsin

PUBLICATION NO. 5221

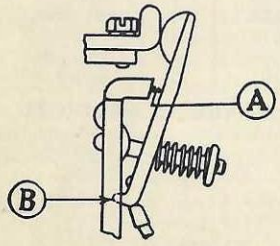
INSTRUCTION SHEET

NO. 224 AND NO. 246 DIRECT CURRENT RELAYS
NO. 225 AND NO. 302 DIRECT CURRENT CONTACTORS



CARE

An inspection of this contact at regular intervals is recommended, as proper operation will then be assured. Kindly note the following points:



Lubricate the armature lever shaft occasionally, with a light engine or machine oil.

Apply a drop or two of oil at the point B where the contact finger hinges on the armature lever.

Do not lubricate the contact tips. In case they become badly roughened or burned, smooth off with a fine file, taking care to remove as little copper as necessary.

The main contact tips should be renewed when the distance at point A becomes $\frac{1}{32}$". Neglect of this might damage the contactor, as sufficient pressure cannot be exerted on the contact tip by the pressure spring when the distance has been reduced beyond this point.

Keep the surface of the magnet core (item 21) and the armature lever (item 24) that come together when the contactor closes, clean and free from dust or oil. If any foreign matter gets between these parts, it will prevent them from sealing properly and will cause the contacts to heat.

The arc shields (item 16) **should be renewed** before the material is burned away enough to allow the arc to touch the blowout pole pieces. The arc shields can be easily raised for inspection or renewal of contact parts. However, they should be lowered to their normal position, as shown in the illustration above, before the contactor is again operated. If this is not done the contacts will wear rapidly.

ADJUSTMENT OF DOWN CONTACT FINGER FOR THE NO. 246 AND NO. 302

This contact is adjusted at the factory to have the proper contact pressure. When necessary to readjust this finger because of wear, proceed as follows: Have the contactor in its normally open position. The down contact finger will then be making contact with the lower contact tip. Turn the adjusting screw (item 13) to the right until the contact tip of the finger just begins to leave the contact (item 14). Now turn the adjusting screw one full revolution to the left. The clamping spring (item 33) will retain the screw in this position.

RENEWAL PARTS

INFORMATION REQUIRED

Parts **CANNOT** be sent promptly unless you include the **FOLLOWING** with your order; **PUBLICATION NO. 5221, PART No., DESCRIPTION, ITEM No. and COMPLETE NAMEPLATE DATA.**

Item No.	Description of Part	NO. 224 RELAY 18774-2		NO. 225 CONTACTOR 18774-1		NO. 246 RELAY 18773-1		NO. 302 CONTACTOR C10-311, C10-312	
		No. Reqd	Part No.	No. Reqd	Part No.	No. Reqd	Part No.	No. Reqd	Part No.
1	Adjusting Stud	1	914-423	1	914-423	1	914-423	1	914-423
2	Adjusting Nut	1	915-63	1	915-63	1	915-63	1	915-63
3	Spring	1	969-279	1	969-279	1	969-279	1	969-279
4	Stop	1	768-801	1	768-801	1	768-801	1	768-801
5	Magnet Frame	1	949-1482AZ	1	949-1482AZ	1	949-1482AZ	1	949-1482AZ
6	Magnet coil. Give No. stamped on coil	1	.....	1	.....	1	.....	1	.....
7	Spring	2	69-195	2	69-195	2	69-195	2	69-195
8	Washer for back of coil	1	916-2881Z	1	916-2881Z	1	916-2881Z	1	916-2881Z
9	Support for wire wound blowout	2	879-32	2	879-32	2	879-32	2	879-32
10	Wire wound blowout coil. Give No. stamped on coil	2	.....	2	.....	As Reqd.	.....	As Reqd.	.....
11	Complete wire wound blowout assembly. Give No. on coil	2	57530-3 Fig. 3	2	57530-3 Fig. 3	2	57530-3 Fig. 3	2	57530-3 Fig. 3
12	Upper contact post complete. For wire wound blowout	2	618-198	2	618-198	2	618-198	2	618-198
13	Cap screw	2	911-5248FZ	2	911-5248FZ	3	911-5248FZ	3	911-5248FZ
14	Contact Tip	2	1323-1484	2	1323-1484	3	1323-1484	3	1323-1484
15	Upper blowout chute. Without blowout coil	2	62-13	2	62-13	2	62-13	2	62-13
16	Arc shield	4	2673-100F	4	2673-100F	As Reqd.	2673-100F	As Reqd.	2673-100F
17	Upper contact finger with connector	2	940-963AZ7	2	940-963AZ7	2	940-963AZ7	2	940-963AZ7
18	Spring	2	69-467	2	969-548	2	69-467	2	969-548
19	Cup washer	2	916-2641Z	2	916-2641Z	3	916-2641Z	3	916-2641Z
20	2¼" diam. washer for front of coil using standard core	2	4416-1321	2	4416-1321	2	4416-1321	2	4416-1321
21	Core for magnet— Standard core	1	51-51	1	51-51	1	51-51	1	51-51
	Core for slow opening contactor	1	685-56	1	685-56	1	685-56	..	.....
22	2" diam. washer for front of coil using slow opening core	1	816-1441	1	816-1441	1	816-1441	..	.....
23	Shaft	1	956-500	1	956-500	1	956-500	1	956-500
24	Armature lever assembly. Give complete nameplate data and position of contactor on panel if more than one is used.	1	.....	1	.....	1	.....	1	.....
25	Complete bar wound blowout assembly. For 2" slate mounting	..	.....	2	57603-2 Fig. 3	..	.....	2	57603-2 Fig. 3
	For 1½" mounting and under	..	.....	2	662-79	..	.....	2	662-79
26	Bar wound blowout coil sweated to posts For 2" slate mounting	..	.....	2	57603-2 Fig. 5	..	.....	2	57603-2 Fig. 5
	For 1½" mounting and under	..	.....	2	57603-2 Fig. 4	..	.....	2	57603-2 Fig. 4
27	Fibre spacer for core	..	.....	2	1029-274	..	.....	2	1029-274
28	Washers on coil ends	..	.....	4	4416-6044	..	.....	4	4416-6044
29	Core for bar wound coil	..	.....	2	985-526Z	..	.....	2	985-526Z
30	Lower blowout chute complete	..	.....	..	.....	1	48920-1 Fig. 1	1	48920-1 Fig. 1
31	Lower contact post complete	..	.....	..	.....	1	618-163	1	618-163
32	Lower contact finger with connector	..	.....	..	.....	1	940-963AZ	1	940-963AZ
33	Spring	..	.....	..	.....	1	970-645Z	..	970-645Z
34	Lower contact finger pin	..	.....	..	.....	1	913-563	1	913-563
35	Spring	..	.....	..	.....	1	69-467	1	969-4

REPAIR PARTS LIST FOR ELECTRICAL AND MECHANICAL INTERLOCK PARTS. QUANTITIES ARE AS REQUIRED.

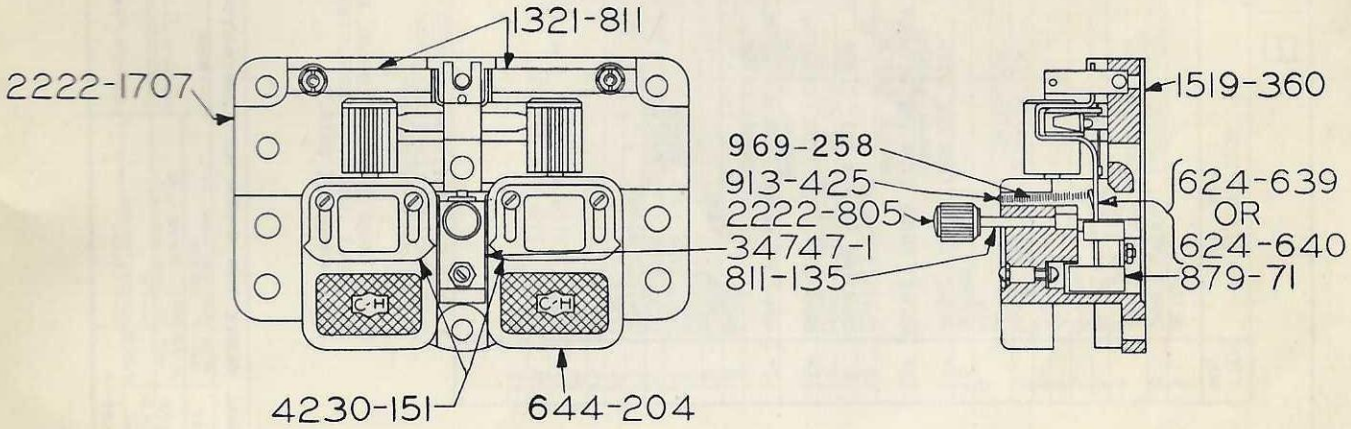
Item No.	Description of Part	Part No.
36	Plug switch complete	618-118
37	Spring	869-22
38	Contact	1321-516
39	Right hand normally open or normally closed lamp switch complete	618-214
40	Spring	769-363
41	Contact lever	969-764AZ1
42	Contact Post	918-294AZ
43	Post	918-445AZ
44	Left hand normally open or normally closed lamp switch complete	618-213
45	Spring	769-363F
46	Spring	69-525
47	Spacer	29-363
48	Contact	23-887
49	Spring	69-524
50	Contact plate	21-174-2
51	Post	18-284
52	Contact guide	54-295
53	Spacer { (Interlocks using this spacer have been redesigned to use spacer, item 47, and an additional contact, item 48, in place of this spacer, item 53. These parts should be ordered instead of item 53 and assembled as shown in the picture calling for item 47, 48 and 52.)	4221-4
54	Contact	969-633
55	Spring	924-172
56	Lever	956-325
57	Pin	918-723Z
58	Post	

Supersedes Pubs. 1077, 1157 and 1475

INSTRUCTION SHEET

No. 306 ADJUSTABLE—DUPLEX—THERMAL OVERLOAD RELAY

Additional Copies of this Instruction Sheet can be obtained by requesting Publication No. 1759 from Milwaukee.



DESCRIPTION

The thermal overload relays, as the name indicates, are of the thermal type and provide inverse time limit overload protection. A heater coil in each relay is connected in series with the circuit to be protected. When a certain overload condition occurs, the heat produced by this heater is sufficient to melt the special alloy. When the alloy in either or both of the tubes melts due to an overload, one or both of the ratchet rods rotates and a spring causes the control circuit to open. This will bring about the opening of the main line contactor by disconnecting the contactor coil from its source of supply.

HOW TO SET THE OVERLOAD RELAY

The calibration plate shows the currents which the relay will carry without tripping, with a surrounding temperature less than 40° C. (104°F.). The two pointers should be set opposite each other; at the calibration current at which it is desired to have the overload relay trip. The proper heater coils for use with a certain motor can be determined by refering to the table according to the motor current rating.

HOW TO RESET

To reset, it is only necessary to wait until the overload heater has cooled slightly, then push the "Reset" button.

If the relay is of the type with stop feature, stopping can be obtained by momentarily pressing the "Reset" button beyond its normal latched-in position.

HOW TO INSTALL THE HEATER COIL

1. Remove the screws holding the index plate to the overload relay and take off this plate.
2. Remove the cover of the overload relay by sliding it to the extreme upper position and pulling outward.
3. Remove the terminal nuts at the side of the relay.
4. Insert the heater coil in the overload relay base, with the asbestos tube surrounding the coil. Be sure that the heater coil eyes fit over the terminal studs.
5. Fasten the celluloid calibration plate, which forms a part of the heater coil package, to the front of the overload relay base, using the screw provided for this purpose. Note that the celluloid plate bears a symbol marking which should agree with that on the heater coils.
6. Replace the relay cover which should fit over the heater coil. inclosing all of the coiled portion of the heater.
7. Replace the terminal nuts.

REPAIR PARTS

CUTLER-HAMMER repair parts are made with the same manufacturing precision and quality of materials as the parts originally furnished. Proper installation and care of these parts will result in better performance and lowest possible maintenance costs.

INFORMATION REQUIRED

Your parts CANNOT be sent promptly unless you include the FOLLOWING with your order: PUBLICATION No. 1759, PART NUMBER and DESCRIPTION.

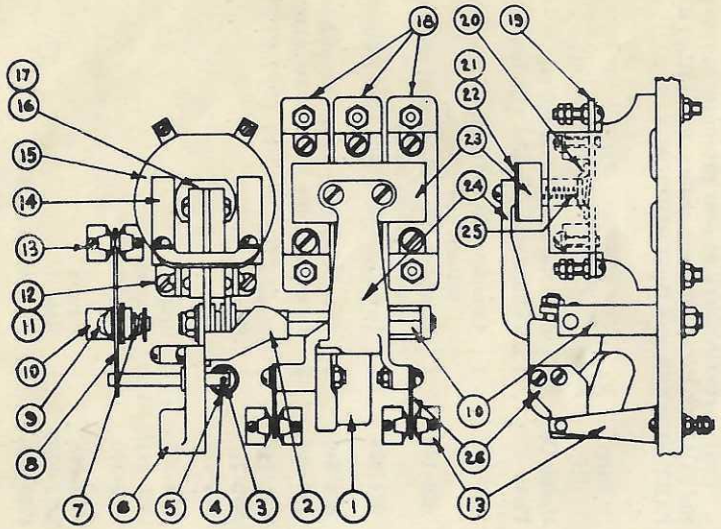
Part No.	No. Req.	Description
Heater Coils	2	Give No. stamped on coil tag.
Plate	1	Calibration—supplied with heater coils.
620–144	1	Complete No. 306 overload relay with hand reset without lost motion.
620–145	1	Complete No. 306 overload relay with hand reset with lost motion.
624–639	1	Lever assembly–hand reset without lost motion
624–640	1	Lever assembly—hand reset with lost motion.
644–204	2	Cover assembly with ratchet wheel
811–135	1	Screw stem
879–71	1	Support
913–425	1	Pin
969–258	1	Spring
1321–811	2	Contact
1519–360	1	Insulator
2222–805	1	Button
2222–1707	1	Base
4230–151	2	Instruction plate

Your parts **CANNOT** be supplied promptly unless you supply the **INFORMATION REQUIRED.**

Supersedes publication dated BF-UD

Printed in U. S. A.

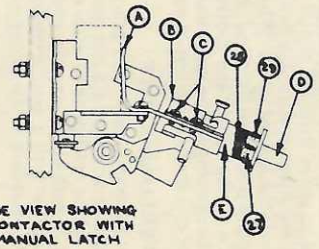
B 70-194



ITEM NO.	DESCRIPTION OF PART -	NO. REQ.	PART NO.
1	WEIGHT	1	54-775
2	SHAFT OVERALL LENGTH 5 1/2" OR	1	13-1289
	SHAFT OVERALL LENGTH 7 1/8"	1	656-67
3	BINDING STUD	1	814-339
4	ADJUSTING SPRING STUD	1	14-291
5	SPRING	1	69-560
6	WEIGHT	1	54-774
7	SPRING	AS REQ.	969-569
8	LEVER FOR N. O. INTERLOCK	AS REQ.	24-1655
	LEVER FOR N. C. INTERLOCK	AS REQ.	24-1069
9	PIN	AS REQ.	913-994
10	SUPPORT	AS REQ.	979-961
11*	MAGNET FRAME (FOR USE WITH MANUAL LATCH)	1	17-1738
12*	MAGNET FRAME (FOR USE WITHOUT MANUAL LATCH	1	17-1738
13	CONTACT FINGER	AS REQ.	40-221
14	ARMATURE STOP & COIL CLAMP	1	18-559
15	COIL (GIVE NO. ON COIL)	1	
16*	ARMATURE LEVER (FOR USE WITH MANUAL LATCH)	1	24-1714-2
17*	ARMATURE LEVER (FOR USE WITHOUT MANUAL LATCH	1	624-543
18	BASE	3	2222-1824 F1
19	CONTACT PLATE	6	21-510
20	CONTACT	3	23-1517
21	INSULATOR 1/64 THICK	AS REQ.	56-560
22	INSULATOR 1/32 THICK	AS REQ.	56-560-2
23	CONTACT BOARD	1	81-1818-3
24	LEVER	1	24-1751
25	SPRING	3	969-577
26	LEVER	AS REQ.	24-1420
27	MANUAL LATCH ASSEMBLY, COMPLETE	1	61-467-3
28	SPRING (INCLUDES IT. 29)	1	69-927
29	TUBULAR RIVET	1	12-298

* TO INSURE SATISFACTORY OPERATION, IT IS IMPORTANT THAT ARMATURE LEVER AND MAGNET FRAME BE REPLACED TOGETHER AND KEPT "MATED".

NOTE: WHEN ORDERING RENEWAL PARTS GIVE THIS DWG. NO. (B70-194) ITEM NO., DESCRIPTION, PART NO., AND COMPLETE NAMEPLATE DATA.



SIDE VIEW SHOWING CONTACTOR WITH MANUAL LATCH

RENEWAL OF CONTACTS

WHEN ANY OF THE CONTACTS HAVE BECOME WORN OR BURNED BELOW THE SILVER FACE OF THE CONTACT, THE COMPLETE SET OF CONTACTS SHOULD BE RENEWED. THE MOVABLE CONTACTS CAN BE READILY REMOVED BY UNSCREWING THE CONTACT BOARD FROM THE ARMATURE LEVER. THE CONTACTS CAN THEN BE TURNED AND REMOVED FROM THE CONTACT SUPPORT. THE STATIONARY CONTACTS ARE REMOVED BY LOOSENING THE SCREWS IN THE MOLDED BASES.

CARE

LUBRICATE THE HINGE PINS OF THE CONTACTOR OCCASIONALLY WITH A FEW DROPS OF LIGHT MACHINE OIL. THE SILVER CONTACTS REQUIRE NO CARE DURING THEIR NORMAL LIFE.

BE SURE THAT GOOD CONTACT IS MADE BETWEEN STATIONARY AND MOVABLE CONTACTS AND THAT THE SCREWS, ETC., ARE TIGHT.

FOR REPLACEMENT OF SPRING IN MANUAL LATCH

REMOVE THE (4) SCREWS (C). LIFT OFF MECHANISM FROM BRACKET (A). LIFT UP AT ARROW AND REMOVE BRACKET (B). REMOVE RIVET, ITEM 29. KNOB (D) AND SPRING, ITEM 28, CAN BE DISASSEMBLED.

FOR REASSEMBLY OF SPRING

ASSEMBLE ITEM 28 IN "E" AND PLACE PIN OF "B" INTO ROUND LOOP OF SPRING, ITEM 28, THEN ASSEMBLE "B" TO MOUNTING BRACKET "A" WITH SCREWS "C". PLACE SLOT OF KNOB "D" OVER FREE END OF ITEM 28, COMPRESS SPRING, ITEM 28, AND TURN KNOB "D" WITH SPRING ITEM 28, ONE FULL TURN LEFT AND SECURE IN THIS POSITION WITH RIVET, ITEM 29.

A				BULLETIN	RENEWAL PARTS FOR N 464 A.C. CONTACTOR (GROUP 60N)
B				DR R.G.FRANCEY	10-13-1941 FIRST ASSEM WHERE LISTED D10-565
C				CH G.E.MUELLER	11-24-41 SUPS B070-176 NON-INTERCHANGEABLE
D				APPD E.C. Peterson R.R.S.	11-25-41 AUP'D BY NON-INTERCHANGEABLE
				ORDER NO DEV.4495-10	SURFACE COATING

SCALE NONE — DO NOT SCALE DRAWING WORK ACCORDING TO DIMENSIONS.

STANDARD TOLERANCES ±0.2% APPLY TO DIMENSIONS FOR WHICH TOLERANCES ARE NOT SHOWN.

CUTLER-HAMMER INC. MILWAUKEE