

NAVSHIPS 92660

INSTRUCTION BOOK

for

FREQUENCY SHIFT CONVERTER

BOEHME TYPE 5-C, SERIES B



**MANUFACTURED BY
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SAFETY NOTICE

Severe shock may result from careless handling when servicing this unit. Be careful not to contact high voltage or 115 volt input connections. When working inside the equipment, after the power has been turned off, always short-circuit the high voltage capacitors.

I Section

FREQUENCY SHIFT CONVERTER

Description

Boehme Type 5-C, Series B

SECTION I

DESCRIPTION

1. GENERAL

The Boehme Frequency Shift Converter, Type 5-C, Series B, is designed to combine and convert the output of two diversity receivers into polar or neutral keyed D. C. The input may be either frequency shift or make - break signals. The output can be used either directly or through relays to drive teletype-writers, ink recorders, or transmitters.

2. SPECIFICATIONS

- Input Impedance - 500 or 5000 ohms
- Input Signal Level - -15 db to +20 db (zero db being 6 milliwatts).
- Input Frequencies - 500 to 5000 cycles on make-break keying
- 200 to 15,000 cycles spread on frequency shift keying
- Keying Speeds - 500 w.p.m. on make-break keying
- 250 w.p.m. on frequency shift keying
- Output Level - .065 amperes, neutral
- .045 amperes, polar. Remains constant at any pre-set level. Will not reflect input variations until minimum input requirement is exceeded.
- Output Ungrounded -
- Output Impedance - 100 to 100,000 ohms
- Power Source - 115 volts, plus/minus 20%
- 60 cycles, plus 20%, minus 10%
- 150 watts approximately
- Tube Complement -

<u>Number</u>	<u>Type</u>	<u>Reference Symbol</u>	<u>Number</u>	<u>Type</u>	<u>Reference Symbol</u>
4	6J6	V1 V2 V7 V8	4	6AL5	V3 V4 V5 V6

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<u>Number</u>	<u>Type</u>	<u>Reference Symbol</u>	<u>Number</u>	<u>Type</u>	<u>Reference Symbol</u>
4	6Y6	V9 V10 V11 V12	2	6AK6	V14
2	6AK6	V13	1	2AP1	V15
			2	5Y3	V16 V17

3. CONSTRUCTION

The Frequency Shift Converter is rugged and compact in design, with the front panel carrying all controls necessary for its operation. The unit is designed for standard 19" relay rack mounting and the panel is 10 1/2" high.

It is provided with a dust cover which is removed by pulling straight back. The terminal strip and polar-neutral switch are mounted on the subpanel and are accessible when the dust cover is removed.

4. DIMENSIONS AND WEIGHTS

- a. Maximum overall dimensions - 10 1/2" high, 19" wide, 15" deep
- b. Packing dimensions - 31 x 20 x 26
- c. Net weight - 67 lbs.
- d. Shipping weight - 157 lbs.

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SECTION II

INSTALLATION AND OPERATION

5. INSTALLATION

a. The Frequency Shift Converter is shipped from the factory with the input terminals connected to the 500 ohm windings of the input transformers T-1 and T-2. If 5000 ohm input is required, unsolder the lead connected to terminal #2 of the input transformers and connect to terminal #3. The tubes are packed separately and the tube sockets are plainly marked.

b. Fasten the unit to a standard 19" relay rack. A ten point terminal strip is mounted on the lower right hand side of the subpanel. To this terminal strip connect the incoming line from receiver #1, the incoming line from receiver #2, the power source and the line to the equipment being actuated and to a Boehme 6-E Tone Keyer if required. All connections are plainly marked.

c. The POLAR-NEUTRAL switch, Sw-7, located on the lower left hand side of the subpanel, should be switched to either polar or neutral, as required. For actuating a polarized relay, such as in a high speed ink recorder, polar output will give more positive operation. For actuating a non-polarized relay, such as in a teletypewriter, neutral output is required.

6. CONTROLS AND THEIR USES

Careless setting of the controls can cause damage to the equipment. For this reason, it is important to know the function of every control. The actual theory and operation is discussed in sections III and IV.

The controls on the front panel are shown in figure 1 and the functions are listed in the following table.

<u>SYMBOL</u>	<u>NAME</u>	<u>FUNCTION</u>
A	OUTPUT CURRENT	Milliammeter. Indicates both current amplitude and polarity of output signal.
F	FUSE	Line fuse. Protects the electrical system.
L-2 & L-4	TUNING	Variable inductance. Works in conjunction with SW-8 and tunes the selected range to match the frequency shift spread of the converter to the received signal.
R-18	SIGNAL BALANCE	Potentiometer. Corrects the unbalance between mark and space time relationship which may be present in the incoming signal.
R-34	INTENSITY	Potentiometer. Controls brilliance of the oscilloscope pattern.
R-35	FOCUS	Potentiometer. Adjusts sharpness of the oscilloscope pattern.

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<u>SYMBOL</u>	<u>NAME</u>	<u>FUNCTION</u>
R-50	NOISE REJECTOR	Potentiometer. Biases out the noise and permits signal which is greater than the noise to actuate the following circuits. It is used only with make-break signals.
SW-1	F.S.-A.M.	Two position switch. Selects either frequency shift operation or make-break operation.
SW-2	CHANNEL 2 OUT - IN	Toggle switch. Cuts channel 2 in or out of the circuit.
SW-3	OUTPUT LEVEL	Four position switch. Controls the amount of resistance and capacitance in the output circuit.
SW-4	OUTPUT REVERSE	Toggle switch. Reverses the flow of current through the output circuit in the event mark and space signals are inverted.
SW-5	CH.1 - CH.2	Toggle switch. Selects either channel 1 or 2 input for viewing on the oscilloscope.
SW-6	OFF - ON	Toggle switch. Removes or applies power to the unit.
SW-8	FREQUENCY SHIFT RANGE KC	Six position switch. Divides the total 200 -15,000 cycle frequency shift spread into six ranges.
V-15	TUNING INDICATOR	Oscilloscope. Indicates the tuning of frequency shift signals. It is not used on make-break signals.

7. OPERATION

a. Referring to the Front Panel View (Fig. 1), set the controls as follows:

Sw-5 - Oscilloscope switch to Channel 1.

Sw-1 - Input selector switch to FS.

R-18 - SIGNAL BALANCE control to middle of its arc.

SW-2 - CHANNEL SWITCH 2 to OUT.

Sw-6 - POWER SWITCH to ON position. (Allow approximately thirty seconds for the tubes to heat up.)

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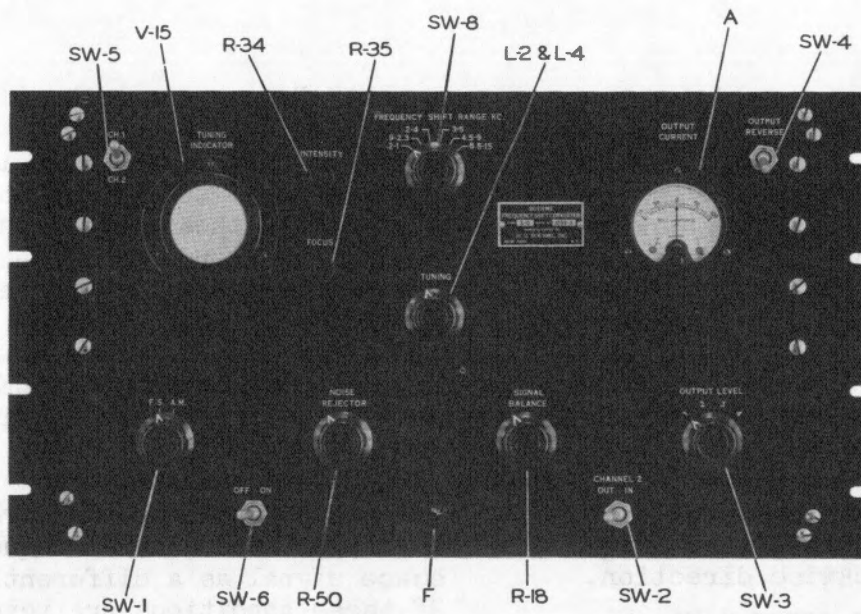


Figure 1. FRONT PANEL VIEW

- R-34 - INTENSITY control and
 R-35 - FOCUS control
- R-50 - NOISE REJECTOR control to its extreme counter-clockwise position. (NOTE: The noise rejection voltage is not utilized in frequency shift reception.)

b. Set Sw-8, the FREQUENCY SHIFT RANGE switch, to the range which includes the spread of the frequency shift signal. Tune the beat frequency oscillator of #1 receiver until the low frequency signal forms a horizontal pattern of maximum amplitude on the TUNING INDICATOR oscilloscope.

c. Rotate the TUNING control L-2 and L-4 until a vertical pattern of maximum amplitude is formed. When these two patterns (horizontal and vertical) are ninety degrees out of phase with each other and have their maximum amplitudes, it indicates that the frequency spread of the frequency shift signal is matched with the filters of the Frequency Shift Converter.

d. Set oscilloscope switch Sw-5 to Channel 2. Tune the beat frequency oscillator of receiver #2 until the oscilloscope TUNING INDICATOR shows two patterns (horizontal and vertical) ninety degrees out of phase with each other and having maximum amplitudes. The two receivers are now properly tuned and are diversity combined when channel switch Sw-2 is set to IN position.

e. By observing the terminating equipment for the best positive operation, the OUTPUT LEVEL switch Sw-3, the OUTPUT REVERSE switch Sw-4, the SIGNAL BALANCE control R-18 and the POLAR-NEUTRAL switch Sw-7 may be adjusted.

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f. In the event make-break operation is desired, set switch Sw-1 to AM and advance the NOISE REJECTOR control R-50 until clean keying is observed on the terminating equipment. With make-break operation the OSCILLOSCOPE, FREQUENCY SHIFT RANGE switch and the TUNING control are not in service.

8. ABNORMAL OPERATING CONDITIONS

a. In make-break operation, high noise pulses may key the amplifier. To suppress line noise, turn NOISE REJECTOR in a clockwise direction.

NOTE: If NOISE REJECTOR R-50 is turned too far in a clockwise direction the signals also will be rejected. Adjust this control only to the point where the best performance of the receiving equipment is obtained.

b. Proper operation of teletypewriter equipment requires that the duration of the mark signal be approximately equal to that of the space signal. If the mark-to-space time relationship is unequal, the driven equipment may fail to operate. To increase the time duration of the mark signal in relation to the space signal, turn SIGNAL BALANCE potentiometer R18 in a clockwise direction.

c. In usual teletypewriter and telegraph practice, the mark signal is transmitted as one frequency and the space signal as a different frequency. If these conditions are reversed, the unit will produce an inverted output causing the mark signal to be positive with respect to the space signal. To correct this inversion, throw OUTPUT REVERSE switch Sw-4 to the left-hand position.

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SECTION III

THEORY

9. BLOCK DIAGRAM (fig. 2)

The unit can be broken down into the following basic circuits.

<u>Stage</u>	<u>Symbol</u>	<u>Par.</u>
Input Amplifier - Limiter Channel 1	V-1	10
Input Amplifier - Channel 2	V-2	
Filter	L1 to L4 & SW-8	
Discriminator	V-3, V-4, V-5, V-6	11
Limiter - Amplifier	V-7	12
Low Pass Filter	CH-1 & C-6	
D.C. Amplifier & Phase Inverter	V-8	13
Signal Balance Control	R-18	
Output Section	V-9, V-10, V-11, V-12	14
Oscilloscope	V-13, V-14, V-15	15
Power Supplies	V-16, V-17	16

10. INPUT AMPLIFIER-LIMITER AND FILTER

The Input Amplifier-Limiter is composed of two identical circuits - one for each receiver output. Since input #1 is identical to input #2, only input #1 will be analyzed.

a. The tone is applied to the input transformer T-1 where it is

amplified and limited by tube V-1. The plate currents of tube V-1 flow through the filter circuits and the compensating resistors R-5 and R-6. The filter circuit composed of L-1 and C-2 is tuned to 1000 cycles and comprises the fixed frequency of the converter. The condensers C-3, 16, 18, 20, 22, 24, 26, 28, 30 and 32 are arranged in six groups to make six overlapping ranges. The variable inductance L-2 connected to any one of these groups will tune through one of the six ranges. L-2 connected successively to these six condenser groups can be tuned through a total range of 1,200 to 16,000 cycles and comprises the variable frequency of the converter. Assuming L-2 is tuned to 1850 cycles and the incoming tones of a frequency shift signal are 1000 and 1850 cycles respectively, the magnitude of the output signals applied to the primaries of transformers T-5 and T-6 will vary as the frequency of the signal shifts. The secondaries of T-5 and T-6 feed into the plates of two double diode rectifiers and since the two rectified signals are connected across resistors R-11 and R-12 in polarity opposition, discrimination of the two signals is accomplished.

b. Switch SW-1 marked F.S. - A.M. selects either frequency shift or make-break keying. For the latter type of operation, half of the input transformer secondaries T1 and T2 are tied directly to the primaries of T6 and T8. The entire input section used in F.S. operation is thus shorted out.

c. Switch SW-2, marked channel 2, is utilized to switch channel 2 in or out of the circuit.

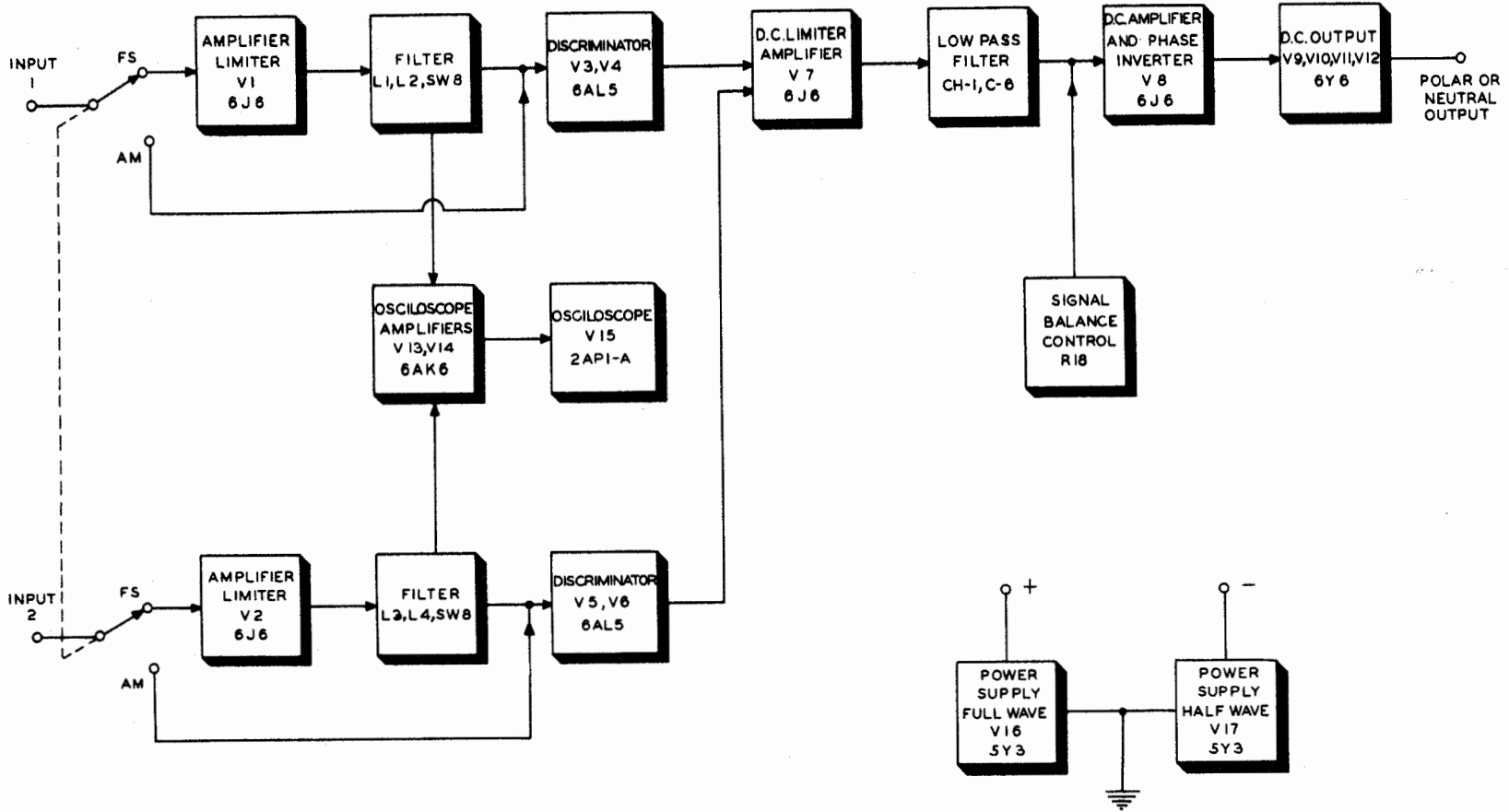


Figure 2. Block Diagram

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11. DISCRIMINATOR

a. The signal output from the amplifier-limiter is applied to the plates of the double diode rectifiers V-3, V-4 and the cathode load resistances R-11 and R-12. The extremes of R-11 and R-12 are connected across the grid and cathode of V-7. Since the rectified signals across R-11 and R-12 are in polarity opposition, the magnitude of the signal determines the conductivity of V-7.

b. NOISE REJECTOR control R-50 is in the cathode circuit of V-4 and V-6 and supplies positive bias to the discriminator. Signal or noise will not appear at the grid of V-7 until the value of this bias voltage is exceeded. The control is not utilized in frequency shift operation.

12. LIMITER-AMPLIFIER STAGE AND LOW-PASS FILTER

Limiter-amplifier V-7 consists of a twin triode hooked in parallel with a low-pass filter in the plate circuit. The function of this stage is to limit the peaks of, and remove the ripple from, the rectified output pulses of discriminator rectifiers V-3 and V-4. The stage also suppresses short-duration high-level noise pulses and converts the rectified d-c pulses into trapezoidal wave signals.

a. Resistor R-15 is part of a bleeder network composed of resistors R-16, R-17 and variable resistor R-18. This network is connected across the B₊ supply and returns to ground through resistor R-49. The grid of d-c amplifier V-8A is connected to the junction of resistors R-16 and R-17. The sliding arm of potentiometer R-18 is connected to a source that is negative with respect to ground. The voltage division across the bleeder network is such that the bias voltage applied to the grid is

always negative with respect to ground or its cathode. The magnitude of this negative potential depends on the setting of SIGNAL BALANCE control R-18.

b. The mark signal developed across resistor R-11 as a result of full-wave rectification is applied to the grid of limiter-amplifier V-7. Since the input audio tones are keyed alternately, the signals consist of rectified d-c pulses containing a ripple frequency twice the frequency of the input tone signal. If the peak amplitude of the ripple reaches a sufficiently high potential, it will drive limiter-amplifier V-7 to cutoff. When V-7 is driven to cutoff, the plate current falls to zero and the plate potential rises to full plate supply voltage. As the mark signal ceases, the space signal drives the grid of V-7 positive. Plate current begins to flow and plate potential decreases. This limiting action of tube V-7 clips part of the ripple voltage from the mark signal. The remaining ripple is removed by the low-pass filter as described in subparagraph c below. When V-7 is cutoff, the only current flowing through resistor R-15 is bleeder current. Under these conditions, the voltage at the junction of resistors R-16 and R-17 which is applied to the grid of d-c amplifier V-8A rises.

c. The low-pass filter in the plate circuit of limiter-amplifier V-7 consists of inductance CH1 and C-6. The filter removes the ripple from the output of limiter-amplifier tube V-7 (subparagraph (1) below), blocks short-duration high-level noise pulses (subparagraph (2) below), and changes the waveshape of the square-wave mark signals (subparagraph (3) below.)

(1) Inductance CH1 presents a high impedance and the associated capacitor has a comparatively low impedance at the ripple frequency.

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Therefore the greater part of the ripple voltage appears across inductance CH1 and a much smaller portion appears across the capacitor C-6. In actual operation, limiter-amplifier V-7 is driven with a relatively high-amplitude signal, which causes low-level clipping of the ripple frequency at the output of V-7 (subparagraph (2) below.) Only high-frequency components of the ripple frequency appear across the filter network. This permits still better ripple attenuation, since the impedance of the filter increases with increasing frequency. The desired signal, which at this point is a low-frequency keyed d-c voltage, is attenuated relatively little by the filter. This signal appears across resistor R-15, the load resistor of the filter section. The signal is applied to the grid of d-c amplifier V-8A through series resistors R-16 and R-17.

(2) High-amplitude, short-duration noise pulses will drive the grid of limiter-amplifier V-7 to cutoff for an instant, which ordinarily would cause a positive voltage to appear on the grid of d-c amplifier V-8A. However, inductance CH1 opposes the decrease of plate current in limiter-amplifier V-7 and the capacitor discharges through resistor R-15. If limiter-amplifier V-7 is cutoff only for an instant, the current through resistor R-15 is maintained almost constant. In this way, short-duration noise pulses do not effect the operation of the succeeding stages.

(3) The low-pass filter will completely block frequencies above a certain critical cutoff frequency. Frequencies below cutoff frequency will be passed. However, the filter offers some opposition to these frequencies also and tends to remove

them. Therefore, the squarewave keying signals, whose frequency must be below cutoff frequency, also are affected by the filter. The inductance CH1 opposes the sharp decrease in plate current caused by the sharp cutoff of limiter-amplifier V-7 at the beginning of a mark signal and also opposes the sharp increase in plate current at the beginning of the space signal. While the leading edge of the mark signal is rising the capacitor C-6 charges exponentially to a higher positive potential through resistor R-15. As the leading edge of the space signal increases the capacitor discharges through resistor R-15. The decay time of the capacitor is prolonged by inductance CH1. Thus both the leading and the trailing edge of the mark signal waveform are sloped.

13. DC AMPLIFIER STAGE, SIGNAL BALANCE CONTROL R-18 AND PHASE INVERTER STAGE.

D-C amplifier V-8A consists of one section of a twin triode. D-C phase inverter V-8B is the other section of the triode. The function of the d-c amplifier is to amplify the keyed signals from limiter-amplifier V-7. SIGNAL BALANCE control R-18 establishes the correct mark-to-space time ratio. D-C phase inverter V-8B inverts the output of d-c amplifier V-8A and provides keyed signals of the correct polarity to the output amplifiers.

a. D-C amplifier V-8A.

This circuit is similar to that of V-7.

V-8A is keyed by a voltage obtained from the junction of resistors R-16 and R-17. This junction is positive with respect to ground during mark conditions and negative during space conditions. The plate circuit of V-8A

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is a resistor network consisting of R-20, R-24 and R-25. Voltage distribution of the network is such that the junction of R-24 and R-25 is negative during mark and positive during space conditions. This junction feeds the grid of phase inverter V-8B as well as the grid of either V-9 or V-10 depending on the setting of the output reverse switch.

potential and the mark signal is not positive enough to overcome the bias until near the end of its leading edge. The same action occurs at the end of the mark signal. If the bias on the grid is small, the tube does not return to cutoff condition until near the end of the trailing edge of the mark signal waveshape. If the bias is great, cutoff occurs near the be-

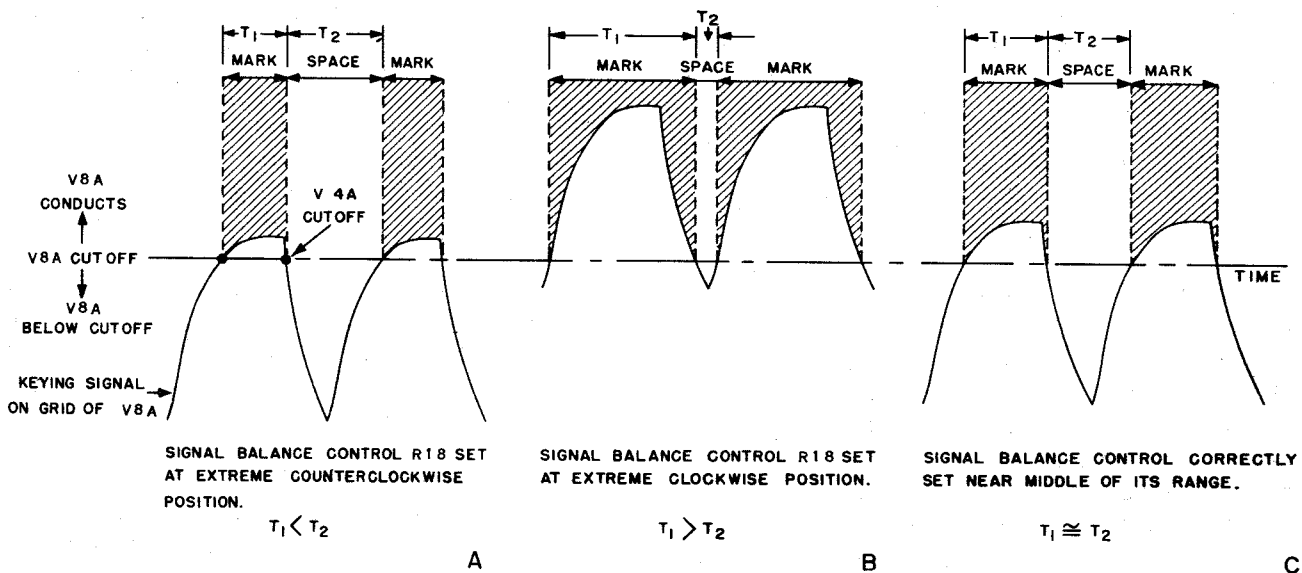


Figure 3. Function of SIGNAL BALANCE control R18.

b. SIGNAL BALANCE Control R-18. The purpose of SIGNAL BALANCE control R-18 is to adjust the mark-to-space time ratio of the keyed signal. Depending on the setting of the potentiometer, the static bias on the grid of d-c amplifier V-8A is negative. The positive mark signal from limiter-amplifier V-7 first must overcome this bias before d-c amplifier V-8A can conduct. If the control is set at or near its maximum counter-clockwise position, the bias on the grid is relatively small and d-c amplifier V-8A will conduct toward the beginning of the leading edge of the mark signal waveshape. If the control is set at or near its maximum clockwise position, the bias is far below cutoff

gining of the trailing edge. D-c amplifier V-8A therefore conducts for a greater or lesser portion of the mark signal from limiter-amplifier V-7 depending on the setting of SIGNAL BALANCE control R-18. Hence the width of the mark signal is directly proportional to the time interval between plate current on and plate current off of d-c amplifier V-8A and also is inversely proportional to the width of the space signal.

c. D-C Phase Inverter V-8B.

(1) Space signal. The grid of d-c phase inverter V-8B is directly connected to the junction of resistors R-24 and R-25. During a space signal,

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the voltage at the junction of these resistors is positive. With a positive voltage applied to its grid, the d-c phase inverter conducts. Plate current flows through resistor R-21, which is part of a bleeder network in the power supply. This bleeder network consists of resistors R-22, R-23 and R-21. When the d-c phase inverter conducts, both plate and bleeder current flow through resistor R-21. Under this condition, the voltage at the junction of resistors R-22 and R-23 is negative. Depending on the setting of output reverse switch SW-4, this voltage is applied to the grid of either V-9 or V-10.

(2) Mark signal. During a mark signal, the voltage at the junction of resistors R-24 and R-25, which is the voltage applied to the grid of the d-c phase inverter, is negative. This voltage is sufficient to cut off the phase inverter, and plate current ceases to flow. The only current that flows through resistor R-21 is bleeder current and the voltage at the junction of resistors R-22 and R-23 rises.

14. THE OUTPUT SECTION

The output section comprises tubes V-9, V-10, V-11, V-12, output level switch Sw-3, output reverse switch Sw-4, polar-neutral switch Sw-7 and associated components.

a. During space conditions, when the grid of V-10 is negative and the grid of V-9 is positive, current flows from B plus through tube V-12, resistor R-29 and tube V-9. In a parallel path current also flows from B plus through tube V-11, the output load circuit, resistor R-29 and tube V-9. Since the grid of V-11 is at the same potential as its cathode, the internal resistance of the tube will be low and losses incurred

will be minimized. At the same time the grid of V-12, by virtue of the load current flowing through R-29, is biased negatively, thus causing very little flow of current through tube V-12 and minimizing the loss in the parallel path. During marking conditions the grid of V-9 is negative and the grid of V-10 is positive. In this condition current flows through the load circuit in the opposite direction and the functions described above reverse.

b. The switch Sw-3 is the output level switch which limits the flow of current through the load circuit and injects suitable output shunt capacitance on each tap except #4. Tap #4 provides pulse sharpening which not only steepens the wave front, but increases the current to the output circuit for a very short pulse. The effect of this pulse is not shown on the output meter since the time duration is so short. It will, however, produce a marked effect on any terminating equipment since it will drive the mechanisms more abruptly. The peak value of this pulse is shown on the output load current curve (fig. 4). Pulse sharpening is not employed on neutral outputs and tap #4 of switch Sw-3 is readable on the output meter.

c. When switch Sw-7 is set for neutral operation, tube V-12 has no B plus and is out of the circuit. Current will flow through the output load only when the grid of V-10 is negative and that of V-9 positive. The path will be from B plus, through V-11, the output load, switch Sw-3, R-29 and V-9. When the grid of V-9 becomes negative and that of V-10 positive there will be no current flow through the load. However, there will be some flow through V-11, R-30 and V-10. This will be limited since sufficient negative voltage is developed across R-30 to bias the grid of V-11.

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d. The OUTPUT REVERSE switch Sw-4 reverses the operation of the output circuit so that mark and space signals may be inverted.

15. THE OSCILLOSCOPE SECTION

The Oscilloscope Section comprises tubes V-13, V-14, V-15, oscilloscope switch Sw-5, potentiometers R-34 and R-35 and associated components.

The oscilloscope is provided with vertical and horizontal amplifiers V-13 and V-14. The signal to the amplifiers is controlled by switch Sw-5. This switch selects either Channel 1 or Channel 2 for viewing on the oscilloscope.

Potentiometer R-35 controls the focus and R-34 controls the intensity of the oscilloscope tube.

Switch Sw-1 of the Audio Section removes the oscilloscope from the circuit when make-break keying is employed.

16. POWER SUPPLY

The Power Supply Section comprises transformers T-3 and T-4, tubes V-16 and V-17, chokes Ch-2 and Ch-3 and associated components.

The power supply consists of one full wave rectifier which supplies current to all of the plate circuits, and one half wave rectifier which supplies current to the D.C. amplifiers and to the oscilloscope tube. The same transformer winding is used for both power supplies.

The heater transformer T-4 supplies voltage to all the tubes in the unit.

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SECTION IV

MAINTENANCE

17. INSPECTION

a. Periodic inspection should be made of the Frequency Shift Converter by examining the cords and connections to the associated equipment. Be sure all connections are secure.

b. Before removing the dust cover, be sure the power is off. Remove any dust that may have collected, taking care not to damage the wiring.

18. LOCATING TROUBLE Refer to the schematic wiring diagram (fig. 8).

a. Check fuse.

b. Check vacuum tubes.

c. In the event the fuse and the vacuum tubes are in good condition, refer to the point to point voltage table and check in the following sequence:

1. Failure of the tubes to light indicates that the transformer T-4 or switch Sw-6 may be faulty. Determine the location of the fault by using an A.C. voltmeter and checking voltage points in that particular circuit.

2. Check the power supply output voltages by measuring from ground to R-48 and from ground to R-51. If these voltages correspond with those set forth in the voltage table, the power supply section is in working order.

3. The fault may be isolated more readily by checking the voltage

between the grid and cathode of V-7. This is the rectified signal voltage and should it not conform with the voltages set forth in the voltage table, the trouble will be found in the audio section. If the voltages appearing across the grid and cathode of V-7 are correct, connect the positive prod of the voltmeter to ground and the negative prod to the grid of V-9. Should the voltages indicated on the meter not correspond with the voltages set forth in the table, the fault will lie in the D.C. converter section. If the voltages appearing at the grid of V-9 are correct, the fault will lie in the output section. After the approximate location of the fault has been determined, check the voltages appearing in the various branches of that particular circuit. The oscilloscope is independent of the operation of the audio section, the D.C. converter section and the output section; hence, any failure of the oscilloscope tube to indicate correctly will be found in that circuit.

19. REPLACEMENT OF PARTS

a. The Frequency Shift Converter is so constructed that all parts are accessible either on the subpanel or behind the front panel. Electrical connections are all within easy access.

b. Care should be taken in soldering or unsoldering connections that solder does not drip and short out any part.

20. VOLTAGE TABLE

a. Voltages are measured plus/

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VOLTAGE TABLE

SEE PAR 20 FOR CONTROL SETTINGS AND INSTRUCTIONS

<u>D. C. VOLTS</u>		<u>M A R K</u>		<u>SYMBOL</u>	<u>POINT</u>	<u>SYMBOL</u>	<u>POINT</u>
<u>S</u>	<u>P A C E</u>	<u>M</u>	<u>A R K</u>				
	175	175	Measure across	R-49			
	210	210	" "	R-48			
	240	240	" "	R-51			
	75	75	" "	R-50			
	385	385	" between	Ground	BL	R-48	O
	315	315	" "	"	BL	R-51	GY
	200	200	" "	"	BL	V-1	Pin #1
	200	200	" "	"	BL	V-1	" #2
	200	200	" "	"	BL	V-2	" #1
	200	200	" "	"	BL	V-2	" #2
	35	180	" "	"	BL	V-7	" #1
Less than	0.5	13	" "	"	BL	V-7	" #6
	205	22	" "	"	BL	V-8	" #1
	40	210	" "	"	BL	V-8	" #2
Less than	1	75	" "	"	BL	V-8	" #5
	20	Less than 1	" "	"	BL	V-8	" #6
	285	285	" "	"	BL	V-15	" #2
	320	320	" "	"	BL	V-15	" #3
	110-220	110-220	" "	"	BL	V-15	" #4
	320	320	" "	"	BL	V-15	" #6
	320	320	" "	"	BL	V-15	" #7
	240-370	240-370	" "	"	BL	V-15	" #10
	130	130	" "	"	BL	V-13	" #5
	180	180	" "	"	BL	V-13	" #6
	11	11	" "	"	BL	V-13	" #7
	130	130	" "	"	BL	V-14	" #5
	180	180	" "	"	BL	V-14	" #6
	11	11	" "	"	BL	V-14	" #7

NOTE: Mark and space voltages may be inverted beyond this point but can be corrected with the output reversing switch.

	25	275	Measure between	Ground	BL	V-9	Pin #3
Less than	1	75	" "	"	BL	V-9	" #5
	270	25	" "	"	BL	V-10	" #3
	70	Less than 1	" "	"	BL	V-10	" #5
	15	225	" "	V-11	Pin #8	V-11	" #3
Less than	1	42	" "	V-11	" #8	V-11	" #5
	225	15	" "	V-12	" #8	V-12	" #3
	42	Less than 1	" "	V-12	" #8	V-12	" #5

Boehme Type 5-C, Series B

minus 20%. The D.C. voltages should be checked on a 20,000 ohm per volt meter.

b. All readings are to be taken with the Frequency Shift Converter set as follows:

Refer to the Front Panel View (fig. 1).

Set control switch Sw-5 to Channel 1.

Set switch Sw-1 to FS.

Set control R-50 to its extreme counter-clockwise position.

Set control R-18 to the middle of its arc.

Set control Sw-3 to #1 position.

Set switch Sw-6 to ON position.

Set switch Sw-2 to OUT position.

Set polar-neutral switch to POLAR.

Attach a 2000 ohm 5 watt load resistor to the output terminals.

Attach a tone source to the #1 input terminals.

When reading marking voltages, set the tone source to 1000 cycles and the output level to at least zero db. Adjust the oscilloscope controls R-34 and R-35 until a clear pattern is observed. The pattern on the oscilloscope screen should be on the horizontal plane and at maximum amplitude. In the event the pattern is not tuned to maximum, adjust the fixed tuned element to Channel 1 until maximum amplitude is observed with 1000 cycle input. When reading spacing voltages, adjust the input frequency to 1850 cycles and rotate the tuning control until maximum vertical pattern is obtained. When checking voltages of Channel 2 input, connect the tone source to the Channel 2 input terminals and measure voltages in that particular circuit.

Boehme Type 5-C, Series B

SECTION V
PARTS LIST

<u>S Y M B O L</u>	<u>DESCRIPTION</u>	<u>QUAN.</u>	<u>MIL TYPE</u>	<u>BOEHME PART NO.</u>
	Tuning Unit Assembly; Capacitor C-2 or C-4 and Inductance L-1 or L-3 are part of this assembly	2		5-C-C
	Tuning Unit Assembly; Capacitor C-3 or C-5 and Inductance L-2 or L-4 are part of this assembly	2		5-C-D
A	Milliammeter; WESTON 100-0-100 Bakelite case #506	1		5-C-40
C-1	Capacitor; 25-25 mfd., 150 V.	1	CE32A250J	5-C-265
C-2,4,7,15	Capacitor; 0.25 mfd., 600 V.	4	CP53BLEF254K	5-C-60
C-3,5,9,10	Capacitor; .1 mfd., 600V.	4	CP27A1EF104K	5-C-266
C-6	Capacitor; .1 mfd., 600V.	1	CP53BLEF104K	5-C-64
C-8	Capacitor; 2.0 mfd., 600V.	1	CP53BLEF205K	5-C-63
C-11,12,32,33	Capacitor; .002 mfd., 500 V.	4	CM30A202J	5-C-267
C-13,34,35	Capacitor; 25 mfd., 400 V.	3	CE31A250Q	5-C-264
C-14	Capacitor; 10-10-10-mfd., 400 V.	1	CE33A100Q	5-C-263
C-16,17,18,19	Capacitor; .05 mfd., 600 V.	4	CP27A1EF503K	5-C-268
C-20,21,22,23	Capacitor; .01 mfd., 600 V.	4	CP27A1EF103M	5-C-269
C-24,25	Capacitor; .02 mfd., 600 V.	2	CP27A1EF203K	5-C-270
C-26,27,28,29, 30,31	Capacitor; .006 mfd., 600 V.	6	CP27A1EF602M	5-C-271
Ch-1	Choke;	1		5-C-256
Ch-2	Choke 12 H, 125 ma.	1		5-C-250
Ch-3	Choke; 30 H, 40 ma.	1		5-C-251
F	Fuse; 5 amp., 3 AG.	1		5-C-248
L-1,2,3,4,	Coil	4		5-C-EA
R-1,2,3,4	Resistor; 1 meg., 1/2 W.	4	RC20BF105K	5-C-41
R-5,6,7,8,15, 20,21,41	Resistor; 47,000 ohm, 2 W.	8	RC41BF473K	5-C-42
R-9,10,11,12, 13,16,22,23, 24,25,38,39	Resistor; 100,000 ohm, 1 W.	12	RC30BF104K	5-C-43
R-14,43	Resistor; 470 ohm, 1 W.	2	RC30BF471K	5-C-44
R-17	Resistor; 150,000 ohm, 1 W.	1	RC30BF154K	5-C-244

Boehme Type 5-C, Series B

<u>S Y M B O L</u>	<u>DESCRIPTION</u>	<u>QUAN.</u>	<u>MIL TYPE</u>	<u>BOEHME PART NO.</u>
R-18,35	Potentiometer; Mallory QM-70-MP 70,000 ohm, 4 W.	2		5-C-56
R-29,30,31	Resistor; 2000 ohm, 12 W.	3	RW32G202	5-C-288
R-32	Resistor; 3100 ohm, 12 W.	1	RW32G312	5-C-289
R-33	Resistor; 15,000 ohm, 2 W.	1	RC41BF153K	5-C-48
R-34	Potentiometer; MALLORY QM-50-MP 50,000 ohm, 4 W.	1		5-C-57
R-36	Resistor; 33,000 ohm, 1 W.	1	RC30BF333K	5-C-49
R-37,53	Resistor; 220,000 ohm, 1 W.	2	RC30BF224K	5-C-50
R-40,42	Resistor; 22,000 ohm, 2 W.	2	RC41BF223K	5-C-51
R-44	Resistor; 15,000 ohm, $\frac{1}{2}$ W.	1	RC20BF153K	5-C-89
R-45,46	Resistor; 47,000 ohm, $\frac{1}{2}$ W.	2	RC20BF473K	5-C-53
R-47	Resistor; 4,700 ohm, $\frac{1}{2}$ W.	1	RC20BF472K	5-C-90
R-48,49	Resistor; 10,000 ohm, 60 W.	2	RW36G103	5-C-261
R-50	Potentiometer; 5,000 ohm, 25 W.	1	RP101FE502KK	5-C-58
R-51	Resistor; 16,000 ohm, 60 W.	1	RW36G163	5-C-262
R-52	Resistor; 800 ohm, 8 W.	1	RW31G801	5-C-245
Sw-1	4-circuit, 2-position switch; MALLORY 1312L	1		5-C-273
Sw-2,4,5,6,7	Toggle Switch; D.P.D.T., 5A, 125 V.	5	ST22N	5-C-272
Sw-3	2-circuit, 5-position switch MALLORY 1315L	1		5-C-274
Sw-8	2-circuit, 9-position switch MALLORY 3229J	1		5-C-275
T-1,2	Transformer; input	2		5-C-253
T-3	Transformer; power	1		5-C-252
T-4	Transformer; filament	1		5-C-255
T-5,6,7,8	Transformer; interstage	4		5-C-254
V-1,2,7,8	Tube, 6J6	4		5-C-80
V-3,4,5,6	Tube, 6AL5	4		5-C-81
V-9,10,11,12	Tube, 6Y6G	4		5-C-82
V-13,14	Tube, 6AK6	2		5-C-83
V-15	Cathode Ray Tube; 2 AP1-A	1		5-C-257
V-16,17	Tube, 5Y3GT	2		5-C-85

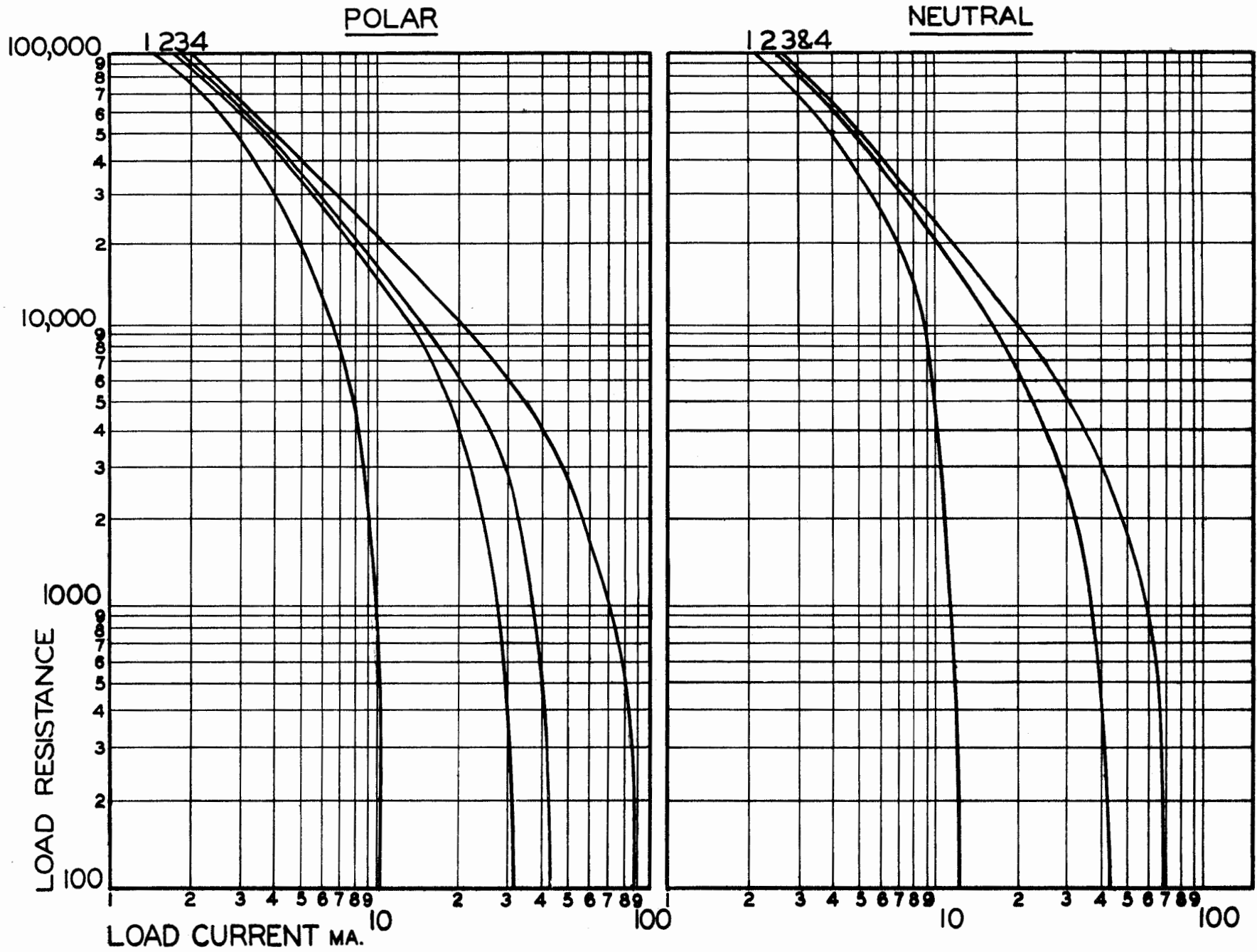


Figure 4. Output Level Curve

H. O. BOEHME, INC.

COMBINED PARTS AND SPARE PARTS LIST

CONTRACT NObsr-71064

(COMMON PARTS)

EQUIPMENT 5C SERIES B

SYMBOL DESIG.	NAME OF PART	LOCATING FUNCTION	REFERENCE NO.	BOEHME PART #	STANDARD NAVY STOCK NUMBER	TOTAL NO. PER EQUIP.	ALL SYMBOL DESIG. INVOLVED
C-1A	CAPACITOR; 25-25 mfd.	Cathode by-pass, V1 and V2	CE32A250J	5-C-265	*N5910-299-2621	1	C-1A C-1B
C-1B	P/O C-1-A	Cathode by-pass, V13 and V14	CE32A250J	5-C-265			
C-2	CAPACITOR; 0-25 mfd.	P/O fixed freq. filter, channel-1	CP53B1EF254K	5-C-260	N5910-112-7161	4	C-2 C-4 C-7 C-15
C-3	CAPACITOR; 0.1 mfd.	P/O vari. freq. filter, channel-1	CP27A1EF104K	5-C-266	N5910-192-9785	4	C-3 C-5 C-9 C-10
C-4	Same as C-2	P/O fixed freq. filter, channel-2					
C-5	Same as C-3	P/O vari. freq. filter, channel-2					
C-6	CAPACITOR; 0.1 mfd.	P/O ripple filter, plate ckt. V-7	CP53B1EF104K	5-C-64	N5910-112-7524	1	C-6
C-7	Same as C-2	Provides pulse sharpening in output ckt.					
C-8	CAPACITOR; 2 mfd.	Output shunt capacitance	CP53B1EF205K	5-C-63	N5910-112-7399	1	C-8
C-9	Same as C-3	Scope sweep coupling					
C-10	Same as C-3	Scope sweep coupling					
C-11	CAPACITOR; .002 mfd.	Blocking capacitor, V15	CM30A202J	5-C-267	*N5910-101-5781	4	C-11 C-12 C-32 C-33
C-12	Same as C-11	Blocking capacitor, V15					
C-13	CAPACITOR; 25 mfd.	P/O negative power supply filter	CE31A250Q	5-C-264	N5910-280-5396	3	C-13 C-34 C-35
C-14	CAPACITOR; 10-10-10 mfd.	P/O plus power supply filter	CE33A100Q	5-C-263	*N5910-227-0702	1	C-14
C-15	Same as C-2	Screen by-pass, V13 and V14					
C-16	CAPACITOR; .05 mfd.	P/O vari. freq. filter, channel-1	CP27A1EF503M	5-C-268	N5910-112-7137	4	C-16 C-17 C-18 C-19
C-17	Same as C-16	P/O vari. freq. filter, channel-2					
C-18	Same as C-16	P/O vari. freq. filter, channel-1					
C-19	Same as C-16	P/O vari. freq. filter, channel-2					
C-20	CAPACITOR; .01 mfd.	P/O vari. freq. filter, channel-1	CP27A1EF103M	5-C-269	*N5910-643-9005	4	C-20 C-21 C-22 C-23
C-21	Same as C-20	P/O vari. freq. filter, channel-2					
C-22	Same as C-20	P/O vari. freq. filter, channel-1					
C-23	Same as C-20	P/O vari. freq. filter, channel-2					
C-24	CAPACITOR; .02 mfd.	P/O vari. freq. filter, channel-1	CP27A1EF203K	5-C-270	N5910-196-2338	2	C-24 C-25
C-25	Same as C-24	P/O vari. freq. filter, channel-2					
C-26	CAPACITOR; .006 mfd.	P/O vari. freq. filter, channel-1	CP27A1EF602M	5-C-271	*N5910-642-6256	6	C-26 C-27 C-28 C-29 C-30 C-31
C-27	Same as C-26	P/O vari. freq. filter, channel-2					
C-28	Same as C-26	P/O vari. freq. filter, channel-1					
C-29	Same as C-26	P/O vari. freq. filter, channel-2					

* FOR REPLACEMENT USE

H. O. BOEHME, INC., NEW YORK 10, N.Y.

DWG. NO. 5-C-1000

SHEET 1 OF 5 SHEETS

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H. O. BOEHME, INC.

COMBINED PARTS AND SPARE PARTS LIST

CONTRACT NObSr-71064

(COMMON PARTS)

EQUIPMENT 5C SERIES B

SYMBOL DESIG.	NAME OF PART	LOCATING FUNCTION	REFERENCE NO.	BOEHME PART #	STANDARD NAVY STOCK NUMBER	TOTAL NO. PER EQUIP.	ALL SYMBOL DESIG. INVOLVED
C-30	Same as C-26	P/O vari. freq. filter, channel-1					
C-31	Same as C-26	P/O vari. freq. filter, channel-2					
C-32	Same as C-11	P/O vari. freq. filter, channel-1					
C-33	Same as C-11	P/O vari. freq. filter, channel-2					
C-34	Same as C-13	P/O negative power supply filter					
C-35	Same as C-13	P/O negative power supply filter					
F	FUSE; 5 amp., 3AG	Power fuse	3AG5	5-C-248	G5920-014-2630	1	F
R-1	RESISTOR; 1 meg., 1/2 W.	Grid series limiting, V-1	RC20BF105K	5-C-41	*N5905-192-0390	4	R-1 R-2 R-3 R-4
R-2	Same as R-1	Grid series limiting, V-1					
R-3	Same as R-1	Grid series limiting, V-2					
R-4	Same as R-1	Grid series limiting, V-2					
R-5	RESISTOR; 47K., 2 W.	Plate load, V-1	RC41BF473K	5-C-42	*N5905-195-6754	8	R-5 R-6 R-7 R-8 R-15 R-20 R-21 R-41
R-6	Same as R-5	Plate load, V-1					
R-7	Same as R-5	Plate load, V-2					
R-8	Same as R-5	Plate load, V-2					
R-9	RESISTOR; 100 K., 1 W.	Disc. diode load, channel-2	RC30BF104K	5-C-43	*N5905-299-2003	12	R-9 R-10 R-11 R-12 R-13 R-16 R-22 R-23 R-24 R-25 R-38 R-39
R-10	Same as R-9	Disc. diode load, channel-2					
R-11	Same as R-9	Disc. diode load, channel-1					
R-12	Same as R-9	Disc. diode load, channel-1					
R-13	Same as R-9	Grid series limiting, V-7					
R-14	RESISTOR; 470 ohms, 1 W.	Cathode bias, V-1 and V-2	RC30BF471K	5-C-44	*N5905-299-2051	2	R-14 R-43
R-15	Same as R-5	Plate load, V-7; P/O bleeder network					
R-16	Same as R-9	Bleeder grid limiting V8-A					
R-17	RESISTOR; 150 K., 1 W.	Bleeder grid limiting V8-A	RC30BF154K	5-C-244	*N5905-299-1999	1	R-17
R-18	POTENTIOMETER; 70 K., 4 W.	Signal balance control, V8-A	QM-70-MP	5-C-56	N5905-108-6506	2	R-18 R-35
R-20	Same as R-5	P/O bleeder network, plate V8-A					
R-21	Same as R-5	P/O bleeder network, plate V8-B					
R-22	Same as R-9	P/O bleeder network, plate V8-B					
R-23	Same as R-9	P/O bleeder network, plate V8-B					
R-24	Same as R-9	P/O bleeder network, plate V8-A					
R-25	Same as R-9	P/O bleeder network, plate V8-A					

* FOR REPLACEMENT USE

H. O. BOEHME, INC.

COMBINED PARTS AND SPARE PARTS LIST

CONTRACT Nobsr-71064

(COMMON PARTS)

EQUIPMENT 5C SERIES B

SYMBOL DESIG.	NAME OF PART	LOCATING FUNCTION	REFERENCE NO.	BOEHME PART #	STANDARD NAVY STOCK NUMBER	TOTAL NO. PER EQUIP.	ALL SYMBOL DESIG. INVOLVED
R-29	RESISTOR; 2000 ohms, 16 W.	Grid bias, V-12	RW32G202	5-C-288	*N5905-100-6786	3	R-29 R-30 R-31
R-30	Same as R-29	Grid bias, V-11					
R-31	Same as R-29	P/O output load shunt					
R-32	RESISTOR; 3100 ohms, 8 W.	P/O output load shunt	RW32G312	5-C-289	N5905-191-5075	1	R-32
R-33	RESISTOR; 15 K., 2 W.	P/O output load shunt	RC41BF153K	5-C-48	*N5905-279-2617	1	R-33
R-34	POTENTIOMETER; 50 K., 4 W.	Intensity control	QM-50-MP	5-C-57	N5905-549-2602	1	R-34
R-35	Same as R-18	Focus control					
R-36	RESISTOR; 33 K., 1 W.	P/O voltage divider network for V-15	RC30BF333K	5-C-49	*N5905-299-2018	1	R-36
R-37	RESISTOR; 220 K., 1 W.	P/O voltage divider network for V-15	RC30BF224K	5-C-50	*N5905-299-2000	2	R-37 R-53
R-38	Same as R-9	P/O voltage divider network for V-15					
R-39	Same as R-9	P/O voltage divider network for V-15					
R-40	RESISTOR; 22 K., 2 W.	Plate current limiting, V-14	RC41BF223K	5-C-51	*N5905-239-0568	2	R-40 R-42
R-41	Same as R-5	Suppressor, V-13 and V-14					
R-42	Same as R-40	Plate current limiting, V-13					
R-43	Same as R-14	Cathode bias, V-13					
R-44	RESISTOR; 15 K., 1/2 W.	Grid series limiting, V-13	RC20BF153K	5-C-89	*N5905-243-6821	1	R-44
R-45	RESISTOR; 47 K., 1/2 W.	Grid resistor, V-13	RC20BF473K	5-C-53	*N5905-254-9201	2	R-45 R-46
R-46	Same as R-45	Grid series limiting, V-14					
R-47	RESISTOR; 4700 ohms, 1/2 W.	Grid resistor, V-14	RC20BF472K	5-C-90	*N5905-279-3504	1	R-47
R-48	RESISTOR; 10 K., 60 W.	Bias network, power supply	RW36G103	5-C-261	N5905-283-4789	2	R-48 R-49
R-49	Same as R-48	Bias network, power supply					
R-50	POTENTIOMETER; 5 K., 25 W.	Noise rejector	RP101FE502KK	5-C-58	*N5905-195-2444	1	R-50
R-51	RESISTOR; 16 K., 60 W.	Voltage divider, power supply	RW36G163	5-C-262	*N5905-666-1116	1	R-51
R-52	RESISTOR; 800 ohms, 8 W.	Plate load, V-12	RW31G801	5-C-245	*N5905-100-6613	1	R-52
SW-1	SWITCH; 4 ckt., 2 pos.	Input selection; F.S.-A.M.	1312L	5-C-273	N5930-296-5170	1	SW-1
SW-2	SWITCH; toggle; DPDT	Channel 2 in or out	ST22N	5-C-272	N5930-050-2638	5	SW-2 SW-4 SW-5 SW-6 SW-7
SW-3	SWITCH; 2 ckt., 5 pos.	Output level	1315L	5-C-274	N5930-296-6377	1	SW-3
SW-4	Same as SW-2	Output reverse					
SW-5	Same as SW-2	Channel selector for scope viewing					
SW-6	Same as SW-2	Power ON - OFF					
SW-7	Same as SW-2	Polar-neutral output					
SW-8	SWITCH; 2 ckt., 9 pos.	Frequency shift range switch	3229J	5-C-275	N5930-412-1515	1	SW-8
V-1	TUBE; electron, 6J6	Amplifier limiter, channel-1	6J6	5-C-80	*N5960-262-0160	4	V-1 V-2 V-7 V-8
V-2	Same as V-1	Amplifier limiter, channel-2					

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H. O. BOEHME, INC., NEW YORK 10, N.Y.

DWG. NO. 5-C-1000

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H. O. BOEHME, INC.

COMBINED PARTS AND SPARE PARTS LIST

CONTRACT Nobsr-71064

(COMMON PARTS)

EQUIPMENT 5C SERIES B

SYMBOL DESIG.	NAME OF PART	LOCATING FUNCTION	REFERENCE NO.	BOEHME PART #	STANDARD NAVY STOCK NUMBER	TOTAL NO. PER EQUIP.	ALL SYMBOL DESIG. INVOLVED
V-3	TUBE; electron, 6AL5	P/O discriminator, channel-1	6AL5	5-C-81	N5960-262-0185	4	V-3 V-4 V-5 V-6
V-4	Same as V-3	P/O discriminator, channel-1					
V-5	Same as V-3	P/O discriminator, channel-2					
V-6	Same as V-3	P/O discriminator, channel-2					
V-7	Same as V-1	D.C. limiter amplifier					
V-8	Same as V-1	D.C. amplifier & phase inverter					
V-9	TUBE; electron, 6Y6G	D.C. output section	6Y6G	5-C-82	N5960-114-3808	4	V-9 V-10 V-11 V-12
V-10	Same as V-9	D.C. output section					
V-11	Same as V-9	D.C. output section					
V-12	Same as V-9	D.C. output section					
V-13	TUBE; electron, 6AK6	Vertical amplifier for V-15	6AK6	5-C-83	N-5960-262-0248	2	V-13 V-14
V-14	Same as V-13	Horizontal amplifier for V-15					
V-15	TUBE; electron, 2AP1-A	Tuning indicator	2AP1-A	5-C-257	N5960-170-4572	1	V-15
V-16	TUBE; electron, 5Y3GT	Power supply - B+	5Y3-GT	5-C-85	*N5960-272-9178	2	V-16 V-17
V-17	Same as V-16	Power supply; negative					

* FOR REPLACEMENT USE

H. O. BOEHME, INC. NEW YORK 10, N.Y.

DWG. NO. 5-C-1000

SHEET 4 OF 5 SHEETS

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H. O. BOEHME, INC.

COMBINED PARTS AND SPARE PARTS LIST

CONTRACT NObsr-71064

(PARTS PECULIAR)

EQUIPMENT 5C SERIES B

SYMBOL DESIG.	NAME OF PART	LOCATING FUNCTION	REFERENCE NO.	BOEHME PART #	STANDARD NAVY STOCK NUMBER	TOTAL NO. PER EQUIP.	ALL SYMBOL DESIG. INVOLVED
A	AMMETER; dc; 100-0-100 ma; Gov't. desig. MR25W1H1 DCMA; Weston #506	Indicates output load current & polarity		5-C-40	*N6625-648-8676	1	A
5-C-C	TUNING UNIT ASSEMBLY; Capacitor C-2 or C-4 and Inductance L-1 or L-3 are part of this assembly	Comprises fixed freq. of the converter		5-C-C	Assemble from component parts	2	5-C-C
5-C-D	TUNING UNIT ASSEMBLY; Capacitor C-3 or C-5 and Inductance L-2 or L-4 are part of this assembly	Tunes variable freq. of converter		5-C-D	Assemble from component parts	2	5-C-D
L-1	REACTOR; tuning unit; DC rating 350 V., 10 ma; inductance = 6.05 mh to 6.35 mh; Q = 2 to 2.5; DC resistance = 12.5 ohms; overall dimensions = 1-5/16 in. lg. x 1-7/32 in. w. x 29/32 in. H; BHO #5-C-EA	Forms part of tuning assemblies		5-C-EA	N5950-646-4673	4	L-1 L-2 L-3 L-4
L-2	Same as L-1						
L-3	Same as L-1						
L-4	Same as L-1						
Ch-1	CHOKE; 10H., 2.5 ma.; DCR 650 ohms max.; FTC #26080	Ripple filter in plate ckt. of V-7		5-C-256	N5950-504-7550	1	Ch-1
Ch-2	REACTOR; filter choke; 12H., 125 ma.; DC resis 150 ohms max.; FTC #26074	Full wave power supply filter choke		5-C-250	N5950-503-0046	1	Ch-2
Ch-3	REACTOR; filter choke; 30H., 40 ma.; DC resis 500 ohms max.; FTC #26075	Half wave power supply filter choke		5-C-251	N5950-504-7527	1	Ch-3
T-1	TRANSFORMER; input; pri impedance 500 ohms or 5000 ohms, tapped; sec. impedance 12,000 ohms, CT; input level -15 to +20 DB; freq response 800 to 16,000 cycles, level \pm 1.5 DB; FTC #26077	Input grid matching		5-C-253	N5950-503-1761	2	T-1 T-2
T-2	Same as T-1						
T-3	TRANSFORMER; power; pri. 117 V. 50-60 cycles; sec. 315-0-315 VCT; one full wave power supply .09 amps.; one half wave power supply .03 amps.; FTC #26076	Power supply		5-C-252	N5950-503-0025	1	T-3
T-4	TRANSFORMER; filament; pri. 117V. 50-60 cycles; sec. #1 6.3 V., .6a; sec. #2 5V., 2a.; sec. #3 5V., 2a.; sec. #4 6.3 V., 10a.; FTC #26079	Filament supply		5-C-255	N5950-504-7529	1	T-4
T-5	TRANSFORMER; plate coupling; freq. response 800 - 16,000 cycles, \pm 1.5 DB, level + 32 db; turns ratio 1:4; sec. center tapped; FTC #26078	Interstage coupling		5-C-254	N5950-507-0638	4	T-5 T-6 T-7 T-8
T-6	Same as T-5						
T-7	Same as T-5						
T-8	Same as T-5						

* FOR REPLACEMENT USE

H. O. BOEHME, INC., NEW YORK 10, N.Y.

DWG. NO. 5-C-1000

SHEET 5 OF 5 SHEETS

DWN. BY

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