

**LORAIN**

**Power Equipment For Communications**

**INSTRUCTION MANUAL**

**LORAIN PRODUCTS CORPORATION**

LORAIN, OHIO

LORAIN PRODUCTS (CANADA) LTD., ST. THOMAS, ONTARIO

# LORAIN PRODUCTS CORPORATION WARRANTY

Lorain Products Corporation warrants that all equipment manufactured by it shall be free from defects in material and workmanship. The corporation will, at its option, replace or repair free of charge and pay surface carrier charges on any adequately packed equipment covered by its warranty which shall be returned to the factory within 90 days from date of turn-on and found to be defective. All circuit components are warranted for two years from the original shipping date from the factory and which upon examination prove to be defective in material or workmanship. The corporation recommends that all shipments of equipment be inspected by the customer for hidden damage upon receipt from the carrier to insure that a timely claim be filed, if necessary, by the customer. Lorain Products Corporation will not pay claims for shipping damages.

## Systems and Equipment Not Economically Returnable To The Factory

In the event that the product involved is a system or equipment which, in the judgment of Lorain Products Corporation, is not economically returnable to the factory or if Lorain Products Corporation has performed the installation, supervised the installation, or performed testing and turn-on, circuit components and Lorain repair labor are covered by this warranty for the first 90 days from date of turn-on and circuit components are warranted for two years from the date of shipment. Upon request, Lorain will send a service technician to the site to determine if the unit is defective in circuit components or workmanship, and will repair the equipment. If the failure is Lorain's fault, no invoice for circuit components or repair labor will be issued if the complaint has been issued within the first 90 days from date of turn-on. If the complaint is issued more than 90 days from the date of turn-on but within two years from the date of shipment, the customer will be billed at the prevailing Customer Service rates but will not be billed for circuit components. If the problem occurs after two years from the date of shipment, circuit components and repair labor are billable.

If the problem has been created by misuse or abuse of the equipment or by malfunction of associated equipment or by environmental conditions, at any time after shipment, the customer will be billed for circuit components and labor.

## General Provisions

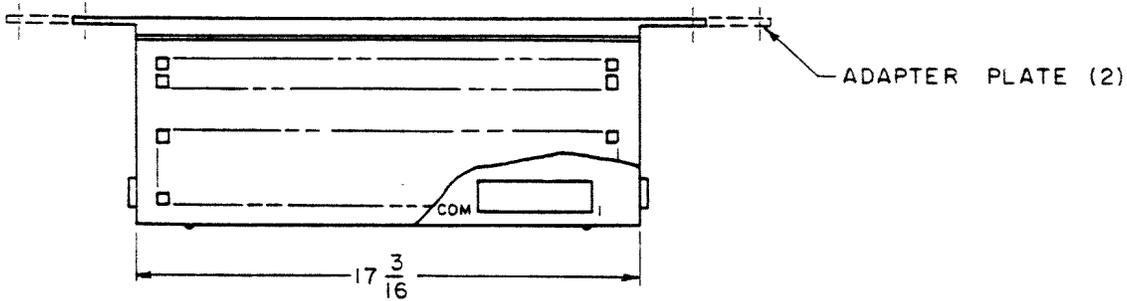
Lorain Products Corporation shall not be obligated to pay any costs or charges incurred by the customer or by any other party. In no event will Lorain Products Corporation be liable for consequential damages. No waiver, alteration or modification of any of the provisions herein shall be binding on Lorain Products Corporation unless in writing and signed by an authorized official of Lorain Products Corporation. If, during any warranty period, the subject equipment has, in the opinion of Lorain Products Corporation, been modified or misrepaired, the warranty will be void unless the modifications or repairs have been made after consultation with the corporation and upon the recommendation of the corporation.

# 1. SPECIFICATION

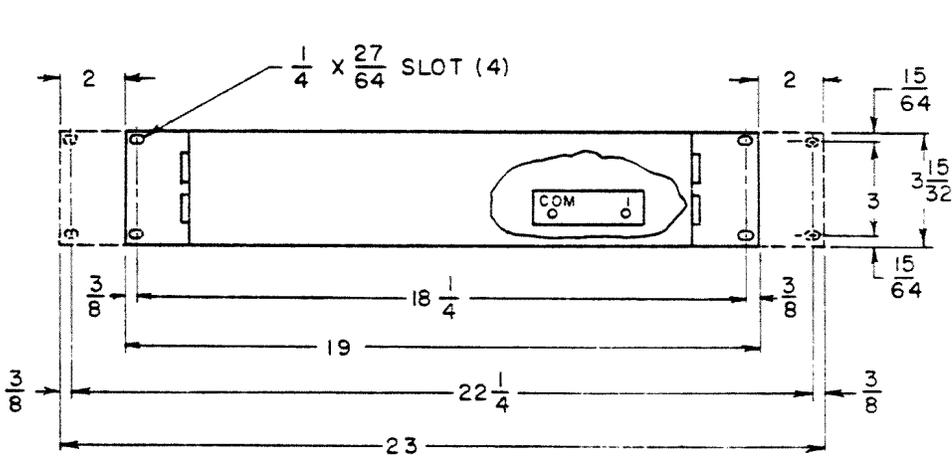
- 1.1 GENERAL: The LORAIN Model B5 Receiver-Off-Hook Tone Generator provides a tone signal for precise tone systems which is designed to arouse the attention of a subscriber whose telephone is in an "off-hook" condition.
- 1.2 OUTPUT RATINGS
- 1.2.1 Voltage: Adjustable over the range of 0 to 7 volts at no load, factory set at 3 volts no load.
  - 1.2.2 Voltage Regulation: Will not decrease more than 3 db from no load to full load, over the full input voltage range.
  - 1.2.3 Power: 75 milliwatts, maximum, available when no load voltage is adjusted to 7 volts.
  - 1.2.4 Frequency: Frequencies sequentially commutated in the following order, each frequency is on for 50 milliseconds: 2600 Hz, 2450 Hz, 2060 Hz and 1400 Hz.
  - 1.2.5 Frequency Stability: 2060 Hz, 2450 Hz and 2600 Hz frequencies controlled within  $\pm 2\%$  from no load to full load at any input voltage over the full input voltage range and with a temperature variation from  $0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . The 1400 Hz frequency is controlled within  $\pm 1/2\%$  over the same load, input voltage and temperature ranges.
  - 1.2.6 Harmonic Distortion: At least 26 db below the fundamental frequency for all loads.
- 1.3 INPUT RATINGS
- 1.3.1 Voltage: Negative 44-56 volts D-C
  - 1.3.2 Current: 190 milliamperes full load
  - 1.3.3 Filtering: Noise fed back to a 100 amp-hr battery is less than 20 dbrn, C-message weighting.
- 1.4 STANDARD FEATURES
- 1.4.1 Type Circuit: Transistor oscillator and amplifiers
  - 1.4.2 Input Protection: One 1/4 ampere Bussmann Type MDL fuse in negative lead
  - 1.4.3 Local-Remote Start: Unit may be started with push button on unit or by external start button.
  - 1.4.4 Automatic Shut-Off: Unit can be connected to shut-off automatically, "Y" Option, when the subscriber replaces his receiver or it can be connected for manual disconnect "X" Option.
  - 1.4.5 Manual Disconnect: X Option
  - 1.4.6 Manual Disconnect: Z Option furnishes d-c to reduce tone attenuation when diode bridges are used in telephone set.
  - 1.4.7 "In Use" Lamp: When unit is operating, a D-C ON lamp lights.
  - 1.4.8 Auxiliary Circuits: A set of contacts are provided to operate a remote D-C ON lamp or connect busy tone to a calling party.
- 1.5 ENVIRONMENTAL RATINGS
- 1.5.1 Operating Ambient Temperature Range:  $0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  ( $+32^{\circ}\text{F}$  to  $+122^{\circ}\text{F}$ )
  - 1.5.2 Storage Temperature Range:  $-40^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$  to  $+149^{\circ}\text{F}$ )
  - 1.5.3 Heat Dissipation: 25 BTU/HR
  - 1.5.4 Ventilation Requirements: In mounted position, unit should be located so that ventilating openings are not blocked and air entering the cabinet does not exceed  $+50^{\circ}\text{C}$  ( $+122^{\circ}\text{F}$ ).
- 1.6 ACCESSORIES AVAILABLE BUT NOT INCLUDED WITH THIS TONE GENERATOR
- 1.6.1 Adapter plate for 23 inch relay rack (requires 3-1/2 inch rack space - 1 inch multiple drilling): (2) Part No. 3471-102
  - 1.6.2 Adapter plate for 30 inch relay rack (requires 3-1/2 inch rack space - 1 inch multiple drilling): (2) Part No. 3471-702
- 1.7 MISCELLANEOUS
- 1.7.1 Schematic Diagram: SD5115-017
  - 1.7.2 Instructions: Form 2750
  - 1.7.3 Performance Curve  
(A) Output Volts/Output Amps: C1522
  - 1.7.4 Photographs: 10864 through 10869

LORAIN PRODUCTS CORPORATION LORAIN, OHIO LORAIN PRODUCTS (CANADA) LTD., ST. THOMAS, ONTARIO							
POWER DATA MODEL B5 RECEIVER-OFF-HOOK TONE GENERATOR SPEC NO. 5115-017							
DR. BY	<i>J. Vangh</i>	DATE	<i>6-30-71</i>	ENGR. BY	<i>B. Farrah</i>	DATE	<i>7-28-71</i>
CH. BY				APP. BY	<i>R. Van Buren</i>		<i>7-28-71</i>
				ECN APP	<i>By M. Schuster</i>	<i>11-19-73</i>	ISS 3
						ECN	1833055
						PAGE	1 OF 3

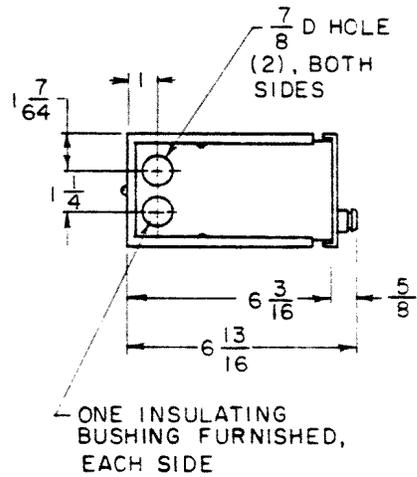
## 2. DIMENSIONS



TOP VIEW  
FIG. 2



REAR VIEW  
FIG. 1



ONE INSULATING  
BUSHING FURNISHED,  
EACH SIDE

SIDE VIEW  
FIG. 3

### NOTES

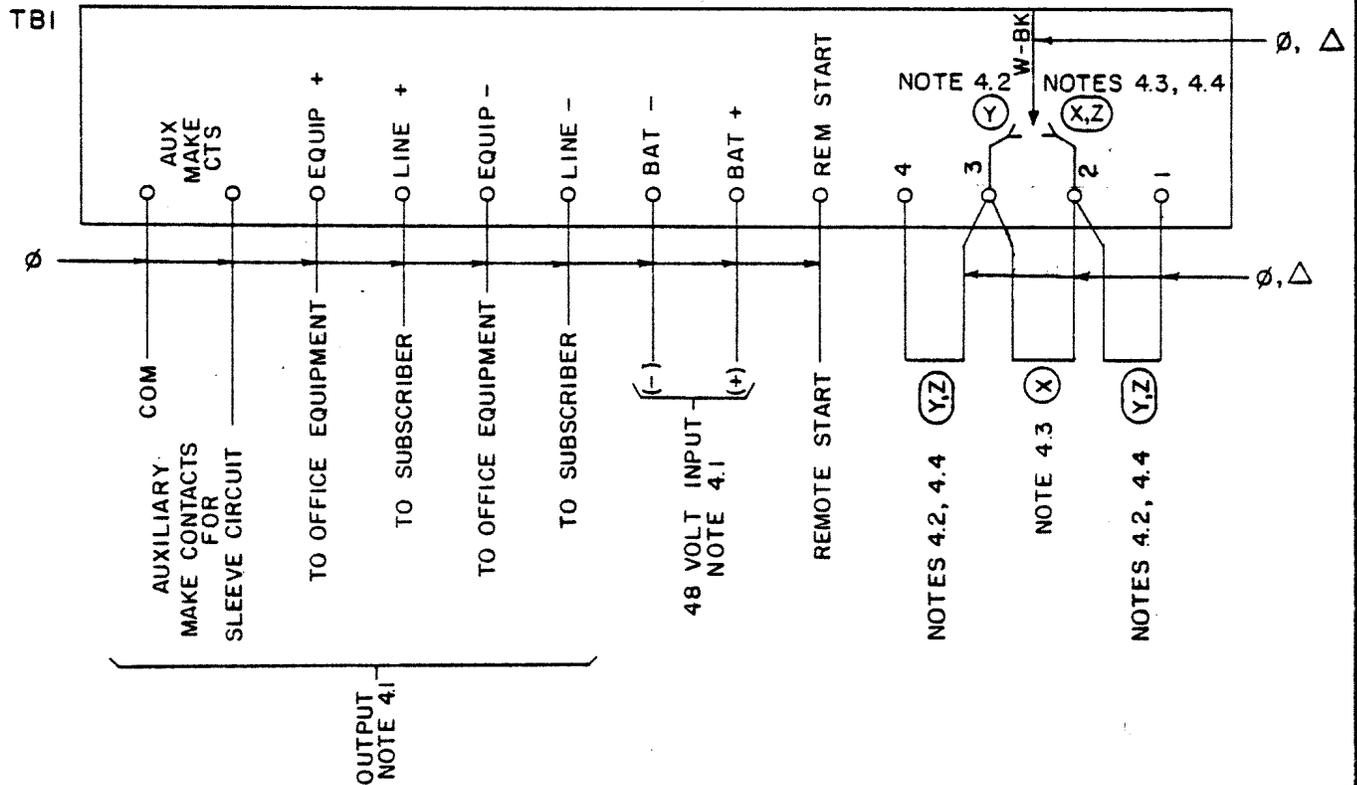
1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED
2. WEIGHT  
A. SHIPPING: 13 LBS  
B. NET: 12 LBS
3. FINISH: EQUIPMENT LIGHT GRAY

5.  INDICATES VENTILATING GRILLE

PD5115-017

PAGE	ECN	ISSUE
2 OF 3	1833055	3

### 3. INSTALLER'S CONNECTIONS -READ THE INSTRUCTION BOOK FOR INSTALLATION DETAILS



### 4. INSTALLER'S INFORMATION NOTES

4.1

Term. Cap.	D-C INPUT		OUTPUT	
	Recm Wire Size	Recm Fusing	Term. Cap.	Recm Wire Size
22 to 16 Ga.	22 Ga. Min.	1.6 Amp	22 to 16 Ga.	22 Ga. Min.

- 4.2 If "Y" Option is connected, this Tone Generator will automatically turn off and connect the line to the office equipment when the subscriber replaces his receiver.
- 4.3 If "X" Option is connected, this Tone Generator must be turned off manually after the subscriber replaces his receiver.
- 4.4 If "Z" Option is connected, this Tone Generator must be turned off manually after the subscriber replaces his receiver. In "Z" Option operation, a d-c subscriber loop current is provided.
- 4.5  $\phi$  indicates leads run by installer.
- 4.6  $\Delta$  indicates leads furnished with this Tone Generator.

PD5115-017

ISSUE 3	ECN 1833055	PAGE 3 OF 3
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**MODEL B5 TONE GENERATOR**

<b>CONTENTS</b>	PAGE
1. RATINGS .....	1
2. DESCRIPTION .....	1
Location .....	1
Mounting .....	1
Electrical Connections .....	1
4. ADJUSTMENT .....	3
5. OPERATION .....	3
Subscriber Line Connection .	3
Operation .....	3
Fuses .....	3
6. CIRCUIT DESCRIPTION .....	4
Input Circuit .....	4
Oscillator-Logic Assembly ..	4
Amplifier Assembly .....	4
Output Circuit .....	4

**1. RATINGS**

1.01 Refer to Power Data Sheet PD5115-017 for information concerning input and output ratings, operating limits, recommended input and output lead size and terminal block capacity, and detailed dimensions for this Tone Generator.

**2. DESCRIPTION**

2.01 This distinctive signal is intended to arouse the attention of a subscriber who has left his receiver off the hook. It will usually eliminate need for a service call. When connected with

the Y wiring option, the Tone Generator will automatically turn itself off and connect the subscriber line to office equipment when the subscriber returns his receiver to the hook.

**3. INSTALLATION**

Location

3.01 LORAIN Model B5 Tone Generator is designed to operate in an ambient temperature range of 0°C (+32°F) to +50°C (+122°F).

Mounting

3.02 The Model B5 Tone Generator is designed for 19 inch relay rack mounting; however, accessory mounting brackets are available to adapt the unit to 23 inch relay rack mounting. Refer to Power Data Sheet PD5115-017 for detailed dimensions.

Electrical Connections

3.03 A junction terminal strip is supplied with Y wiring option (refer to PD5115-017) unless otherwise specified. If the automatic shutoff and transfer feature is not desired, or if the test position is already equipped for automatic disconnect, use X or Z option. A locking REMOTE START key will also inhibit automatic shutoff and transfer.

3.04 Figure 1 shows connections for use with a test shoe; Figure 2 shows connections for use with a test cord and plug. These connections will vary, depending upon user requirements. Option V (Figure 3) applies ground and

CIRCUIT FOR USE WITH TEST SHOE

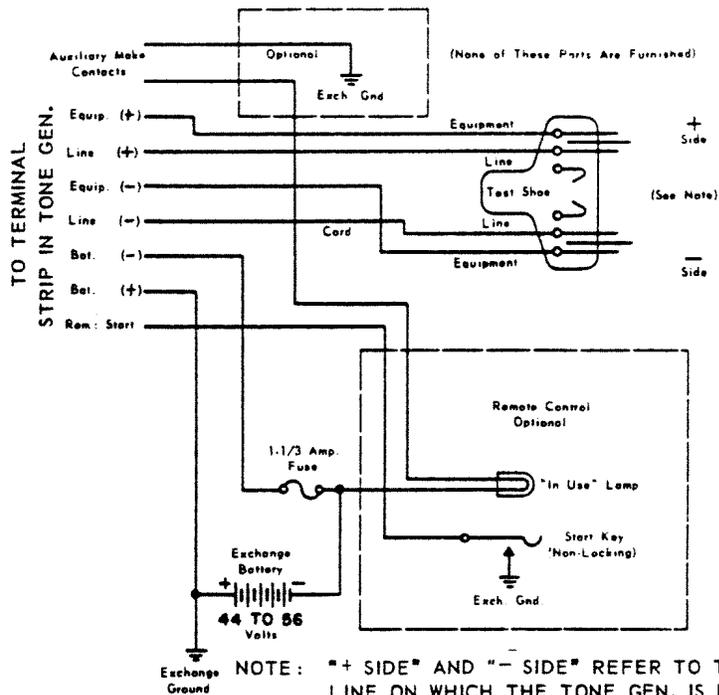


Fig. 1

CIRCUIT FOR USE WITH TEST CORD AND PLUG

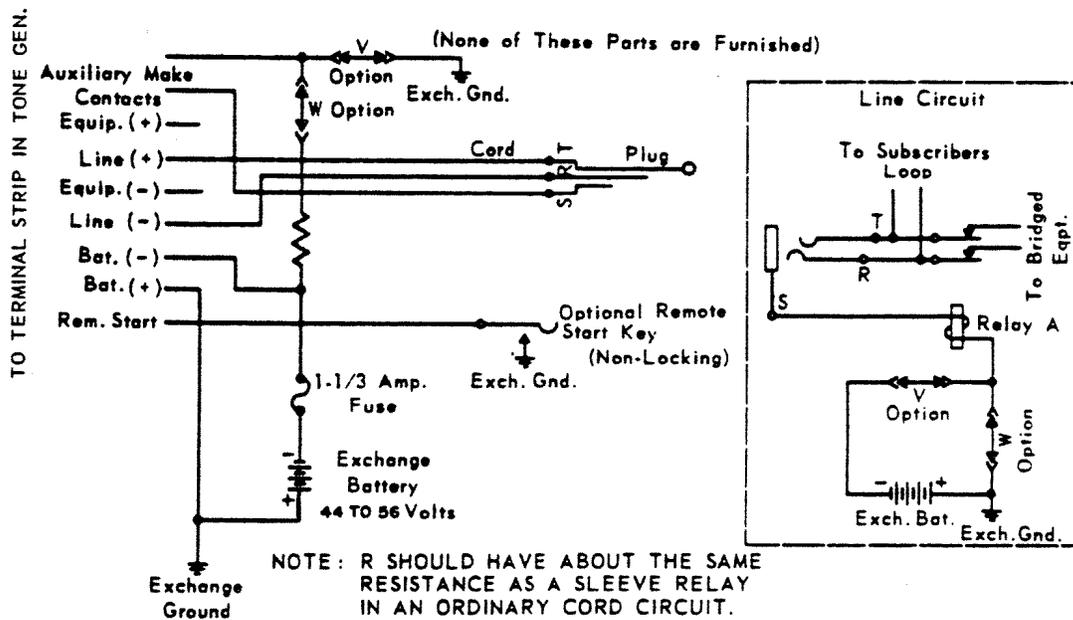


Fig. 2

Fig. 3

option W applies battery to the line jack sleeve. This makes the line test busy when the Tone Generator is in use.

## 4. ADJUSTMENT

### General

4.01 The only adjustment potentiometer associated with this Tone Generator is the output voltage level adjustment located behind the rear panel on the unit. This adjustment is factory set at 3 volts. If it is desired to change this factory setting, follow the procedure below.

### Output Voltage Adjustment

4.02 The output voltage can be adjusted over a range from 0 to 7 volts at no load. Make the adjustment as follows:

- a) Wire the Tone Generator for either X or Z option wiring. (Refer to Power Data Sheet PD5115-017.)
- b) With main battery applied and the load disconnected, connect an a-c voltmeter set for the 0 to 10 volt range, to output terminals LINE- and LINE+.
- c) Loosen the locknut on the output voltage level potentiometer R1 and adjust R1 clockwise or counterclockwise to increase or decrease the output voltage level, respectively.
- d) Observe the voltage on the externally connected voltmeter and adjust to the desired value. Carefully tighten the locknut on potentiometer R1, replace the rear cover and remove the voltmeter.

e) If Y option wiring is desired, make the necessary wiring changes. (Refer to Power Data Sheet PD5115-017.)

f) Reconnect the load and return the Tone Generator to service.

## 5. OPERATION

### Subscriber Line Connection

5.01 LORAIN B5 Tone Generator output can be connected to a subscriber line either by a test shoe at the office line protector (Figure 1), or by a test core plug inserted in a test position jack (Figure 2).

### Operation

5.02 Depress PUSH TO START button or operate REMOTE START key. DC ON lamp should light to indicate that Tone Generator is in operation.

5.03 Unless X or Z option (see PD5115-017) or a locking-type REMOTE START key is used, the Tone Generator will automatically cut off and transfer the subscriber line back to office equipment when the subscriber returns his receiver to its hook. This will enable the subscriber to originate and receive calls. Test shoe or test cord plug can be disconnected from the subscriber line when convenient.

### Fuses

5.04 The input is fused with a 1/4 amp MDL fuse.

## 6. CIRCUIT DESCRIPTION

### Input Circuit

6.01 The input circuit consists of fuse F1, diode CR5, capacitor C5 and inductor L1. Diode CR5 protects against incorrect input polarity, and inductor L1 and capacitor C5 form a filter circuit.

### Oscillator-Logic Assembly

6.02 This assembly consists of three basic circuits, an astable or free running multivibrator, a bistable multivibrator and an oscillator circuit. The astable multivibrator consisting of transistors Q1, Q2, Q3, and Q4 and associated components produces the basic timing pulses. The bistable multivibrator which includes transistors Q5 and Q6 is triggered by a portion of the astable multivibrator voltage. A certain combination of the four voltages produced by the multivibrators is used to switch the oscillator frequency control transistors so as to provide four distinct tone frequencies.

6.03 The oscillator circuit consists of oscillator transformer T1, capacitors C7, C8, C9, C10 and transistors Q7, Q8, Q9, Q10. Transformer T1 and capacitor C7 form a tank circuit which provides the first output frequency. At a time determined by the operation of the multivibrators, transistors Q8 through Q10 conduct in sequence to modify the total capacitance of the tank circuit and produce the other three frequencies. When transistor Q8 is turned on, capacitor C8 is added to C7 in the oscillator circuit producing a new frequency. Transistor Q8 remains in conduction until the on signal is removed, at which time, transistor Q8 cuts off

removing capacitor C8 from the tank circuit. The next pulse causes transistor Q9 to conduct adding capacitor C9 to C7 in the tank circuit and producing a third frequency. When the on signal is removed from transistor Q9, it cuts off removing capacitor C9 from the tank circuit. The next pulse causes transistor Q10 to conduct adding capacitor C10 to C7 in the tank circuit and producing the fourth frequency. This frequency sequence will keep repeating.

### Amplifier Assembly

6.04 The amplifier assembly consists of operational amplifier A1 and a pair of complementary transistors Q1 and Q2, and associated components. A portion of the oscillator voltage selected by potentiometer R1 fed into the amplifier stage through resistor R2 drives operational amplifier A1. The operational amplifier A1 output voltage drives the complementary emitter follower stage (transistors Q1 and Q2) to provide the required output of the amplifier. A feedback loop samples the output of the amplifier and feeds a negative current back to operational amplifier A1 input. This current is compared to the current at the input of operational amplifier A1 which controls the amplifier output voltage. The feedback to operational amplifier A1 insures low distortion and good regulation of the output. The amplifier assembly output is coupled through capacitor C3 to output transformer T1.

### Output Circuit

6.05 When the Y connection option is used at the Tone Generator junction strip, the Tone Generator will turn itself off and connect the subscriber

line to office equipment after the subscriber returns his receiver to the hook. This restores normal operation on the line. The transfer relay K1 is operated by battery applied at the Tone Generator battery terminals. Initially, the PUSH TO START button S1 connects battery to the coil of the transfer relay, which operates and holds itself operated through its own contacts, also lighting DC ON lamp DS1. This circuit is completed by the subscriber line under off-hook conditions. When the subscriber returns his receiver to the hook, the on-hook condition opens the battery circuit and releases the relay which connects the line to office equipment.

6.06 If the X connection option is used at the Tone Generator junction strip, the PUSH TO START button is shorted and battery is connected across transfer relay coil K1. This option is used when automatic disconnect is not required.

6.07 When the Z connection option is used at the Tone Generator junction strip, the PUSH TO START button is shunted and battery is connected through resistor R4 to transfer relay coil K1. The Z option wiring will provide a current through the subscriber loop, which will decrease attenuation of the receiver-off-hook tone by the diode bridge in the subscriber telephone.

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Lorain, Ohio, U. S. A.

LORAIN PRODUCTS (CANADA) LTD.  
St. Thomas, Ontario, Canada

February 16, 1973

**ELECTRICAL PARTS LIST**

LORAIN MODEL B5 RECEIVER-OFF-HOOK TONE GENERATOR  
 SPEC. NO. 5115-017

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN EQUIPMENT is installed at an accessible location so that parts can readily be obtained from Lorain Products stock. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate. The quantity of spare parts listed should be sufficient for ten or less assemblies or models for at least 18 months. If a single asterisk (\*) appears in the Quantity Recm. Spares column, it indicates the part, assembly, or model is listed more than once, in which case, use the quantity where the item first appears. If two asterisks (\*\*) appear, refer to the sub-list for that assembly or model. If a dash (-) appears, this indicates that spares are not recommended for this part or assembly.

<u>Ref.</u> <u>Desig.</u>	<u>LPC</u> <u>Part No.</u>	<u>Description</u>	<u>Quantity</u> <u>Recm. Spares</u>
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ASSEMBLIES

A1	4872-470	Osc/Logic PC	1
A2	4873-016	Amplifier PC	1

CAPACITORS

C1	2724-125	220PF 500 Volt, DC	1
C2	2724-125	220PF 500 Volt, DC	*
C3	2731-115	30UF 60 Volt, Electrolytic	-
C4	2713-198	2UF 100 Volt, DC	1
C5	2731-149	100UF 75 Volt, Electrolytic	-
C6	2713-115	0.0047UF 100 Volt, DC	1

DIODES

CR1	2812-310	1N4818, Silicon	2
CR2	2812-310	1N4818, Silicon	*
CR3	2812-310	1N4818, Silicon	*
CR4	2812-310	1N4818, Silicon	*
CR5	2812-310	1N4818, Silicon	*

FUSES

F1	2484-212	0.25 Amp, Cartridge	3
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INDICATOR LAMPS

DS1	2581-213	48 Volt, Filament	1
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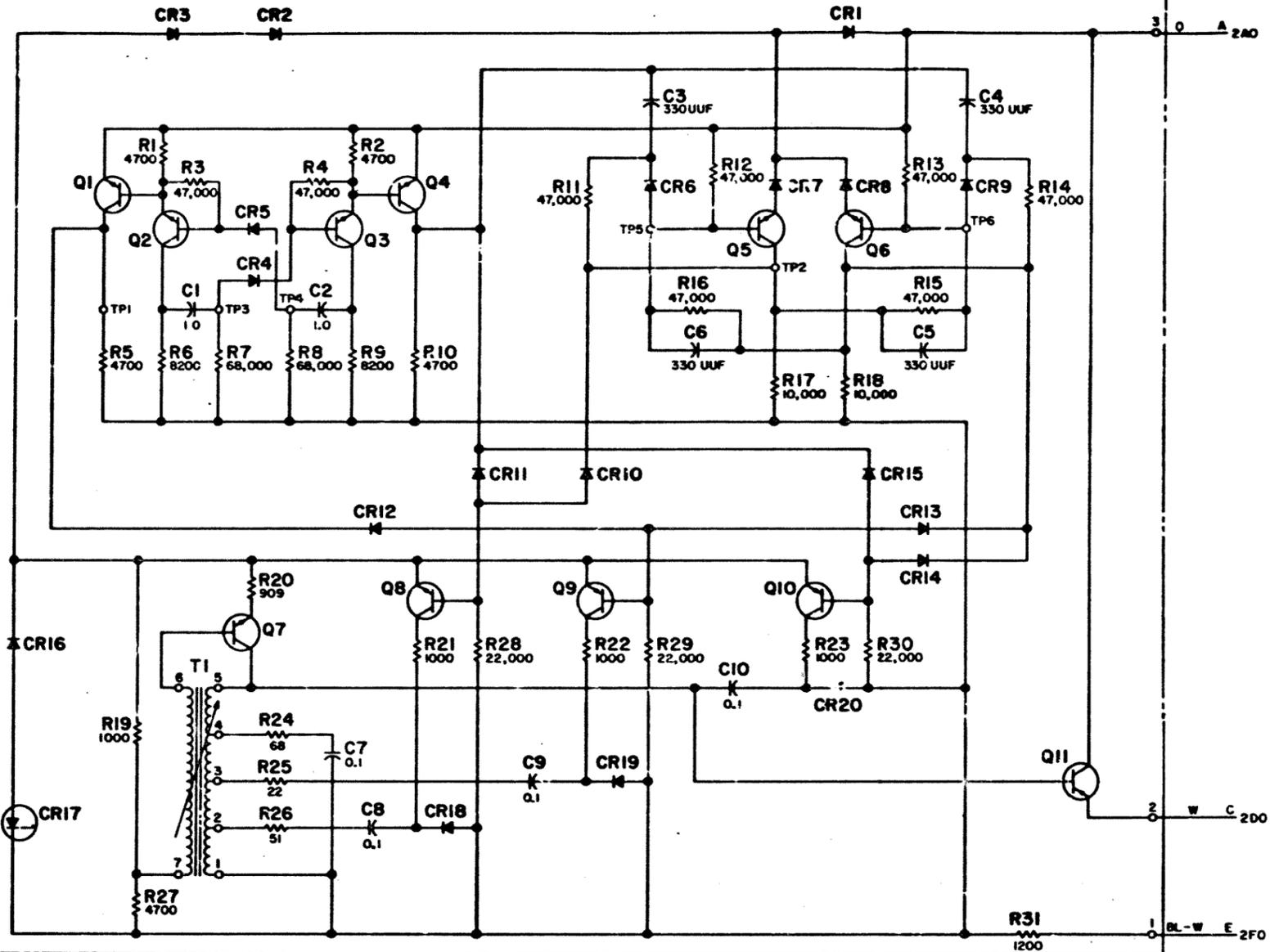
ELECTRICAL PARTS LIST  
 LORAIN MODEL B5 RECEIVER-OFF-HOOK TONE GENERATOR  
 SPEC. NO. 5115-017

<u>Ref.</u> <u>Desig.</u>	<u>LPC</u> <u>Part No.</u>	<u>Description</u>	<u>Quantity</u> <u>Recm. Spares</u>
<u>INDUCTORS</u>			
L1	4424-003	Input	-
<u>LIGHTNING ARRESTERS</u>			
CR6	2488-995		1
<u>RELAYS</u>			
K1	2542-733	48 Volt DC, Armature	1
<u>RESISTORS</u>			
R1	2683-278	10K Ohm 2 Watt, Potentiometer	1
R2	2615-293	18K Ohm 0.5 Watt, Fixed	1
R3	2615-239	100 Ohm 0.6 Watt, Fixed	1
R4	2651-198	2400 Ohm 3 Watt	1
<u>SWITCHES</u>			
S1	2526-443	0.25 Amp, Pushbutton	1
<u>TRANSFORMERS</u>			
T1	4451-016	Power Output	-
<u>TRANSISTORS</u>			
Q1	2844-041	2N3740, Silicon	1
Q2	2842-057	2N3767, Silicon	*
<u>MISCELLANEOUS</u>			
LDS1	2584-637	Cap, Lens, Green	1
XDS1	2584-113	Lampholder	1
XF1	2488-106	Fuseholder	1

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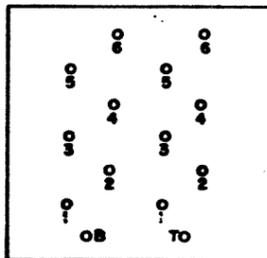
OLC-A1 (4872-470) OLC OSCILLATOR-LOGIC CIRCUIT



REVISIONS			
NO	CHK NO	DATE	DESCRIPTION
1			NEW
2	1531340	11 11 68	R2 WAS 22,000
3	14831732	8 11 68	"Z" OPTION ADDED, R4 AND R7 TRS ADDED
4	1834759	11 11 68	A1 ON AC-A2 M.K.D. 21 (4873-016) WAS 74 2871-102, R3, C4 AND C5 DELETED ON AC-A2 (4873-016).

MANUFACTURING NOTES:

- ALL WIRING SHALL BE 20 GA STRANDED UNLESS OTHERWISE SPECIFIED.
- PT- LEADS FURNISHED WITH COMPONENTS OR SUBASSEMBLIES.
- D INDICATES LEAD IS A JUMPER.
- K1 RELAY TERMINAL ARRANGEMENT



ENGINEERING NOTES:

- AS TERMINAL TO TERMINAL CONNECTIONS, WIRE SIZES AND COLORS, AND PART NUMBERS ARE SHOWN ON THIS SCHEMATIC, THERE IS NO SEPARATE WIRING DIAGRAM DRAWING.
- UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.
- CODES WITHIN PARENTHESES, AS (4872-470), REPRESENT LPC PART NUMBERS.
- HIGHEST REFERENCE DESIGNATION USED ON THIS DRAWING.

RES	CAP
R31	C10
NOT USED	

OPTION	REQ'D	PROVIDE WRG
AUTOMATIC DISCONNECT	REQ'D	Y
	NOT REQ'D	X, Z
MANUAL DISCONNECT WITHOUT D-C LOOP CURRENT	REQ'D	X
	NOT REQ'D	Y, Z
MANUAL DISCONNECT WITH D-C LOOP CURRENT	REQ'D	Z
	NOT REQ'D	X, Y

UNLESS OTHERWISE SPECIFIED, Y OPTION WIRING IS PROVIDED

LIST OF MATERIAL			
DESIG	QTY	PART NO.	DESCRIPTION
A1	1	4872-470	OSCILLATOR-LC C ASSY
A2	1	4873-016	AMPLIFIER ASSY
C1,2	2	2724-125	220 UUF 500VDC, CERAMIC
C3	1	2731-115	30 UUF 50VDC, ELECT
C4	1	2713-198	2 UUF 100VDC, MYLAR
C5	1	2731-149	100 UUF 75VDC, ELECT
C6	1	2713-115	0047 UUF 100VDC, MYLAR
CR1-5	5	2612-31C	DIODE, SILICON
CR6	1	2488-995	SURGE SUPPRESSOR
DS1	1	2581-213	LAMP, 0.035 AMP, TEL SLIDE
F1	1	2484-212	FUSE, MDL 1/4 AMP
K1	1	2542-733	RELAY, 48VDC, 1600 OHM, 4 C-CONTACTS
L1	1	4424-003	INDUCTOR, FILTER
Q1	1	2844-041	TRANSISTOR, PNP, SILICON
Q2	1	2842-057	TRANSISTOR, NPN, SILICON
R1	1	2683-278	10000 OHM 2 WATT POT, WIREWOUND
R2	1	2615-293	18,000 OHM 1/2 WATT
R3	1	2615-239	100 OHM 1/2 WATT
R4	1	2651-198	2400 OHM 3 WATT WIRE WOUND
S1	1	2526-443	SWITCH, PUSH BUTTON
T1	1	4451-016	TRANSFORMER, OUTPUT

SCHEMATIC DIAGRAM FOR MODEL 85

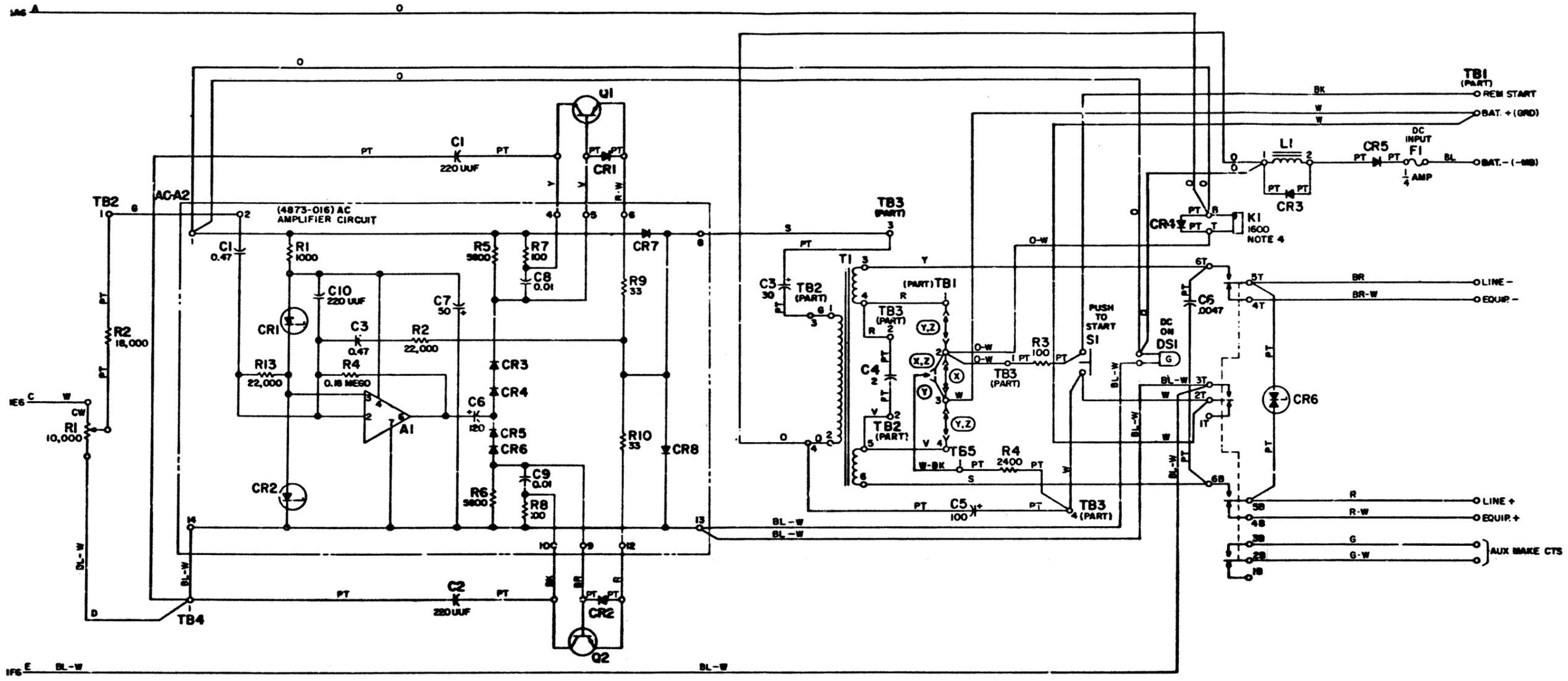
DESIGNED BY	DATE
B. BARNES	6-18-71
REPRC BY	DATE
P. Jones	6-28-71
CHECKED BY	DATE
S. Barnes	6-29-71
APPROVED BY	DATE
S. Barnes	7-29-71
APPROVED BY	DATE
S. Barnes	7-29-71

SD-5115-017

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LOREN, OHIO  
PRINTED IN U.S.A.

SHEET 1 OF 2

1	1-10
2	11-20
3	21-30
4	31-40



MODEL B5		SD-5115-017	
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