Collins Amateur Equipment Guarantee

The Collins Amateur Equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to workmanship or materials and which are returned to Collins at its factory or its designated Service Agency, transportation prepaid, provided:

(a) Buyer presents properly executed Warranty Verification Certificate.

(b) Notice of the claimed defect is given Collins or an authorized Service Agency, or an authorized Distributor, in writing, within 180 days from the date of purchase and goods are returned in accordance with Collins instructions.

(c) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins designs are subject to only such adjustments as Collins may obtain from the supplier thereof.

(d) Any failure due to use of equipment for purposes other than those contemplated in normal amateur operations or in violation of Collins applicable Instruction Book shall not be deemed a defect within the meaning of these provisions.

This Warranty is void with respect to equipment which is altered, modified or repaired by other than Collins or Collins Authorized Service Agencies. However, alteration or modification in accordance with Collins Service Bulletins shall not affect this Warranty.

Collins reserves the right to make any change in design or to make additions to, or improvements in, Collins products without imposing any obligations upon Collins to install them in previously manufactured Collins products.

No other warranties, expressed or implied, shall be applicable to said equipment, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements contained in these paragraphs. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

NOTICE: With each equipment or set of equipments purchased, the distributor should furnish a Warranty Verification Certificate. It is necessary that this certificate accompany the equipment when it is returned for warranty repairs. Be sure that you get it from your distributor.

Warranty Repairs

On the opposite page are listed the Service Agencies authorized to perform warranty repair on Collins Amateur Equipments.

If you should wish to return material or equipment direct to Collins under the guarantee, you should notify Collins, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

Out-of-warranty Repair, Modifications, Addition of Accessories, Alignment, etc.:

For information on service of this type write to the address shown below. If you wish to return your equipment for repairs, etc., without prior correspondence, be sure to include the following information attached to the equipment inside the packing carton:

(1) Complete instructions detailing work to be performed.
(2) Your return address.
(3) Method of shipment by which the equipment should be returned.
(4) Special instructions.

DIRECT YOUR CORRESPONDENCE TO:
Collins Radio Company
Service Repair Department
Third Street Building
Cedar Rapids, Iowa

HOW TO ORDER REPLACEMENT PARTS:

When ordering replacement parts, you should direct your order to one of the listed Collins distributors.

Please furnish the following information insofar as applicable:

INFORMATION NEEDED:
(A) Quantity required
(B) Collins part number (9 or 10 digit number) and description
(C) Item or symbol number obtained from parts list or schematic
(D) Collins type number, name and serial number of principal equipment
(E) Unit subassembly number (where applicable)

NOTE: See Distributor List.

1 August 1962
Collins Authorized Amateur Distributors and Service Agencies

ALABAMA
Ack Radio Supply Company
3201 40th Avenue South
Birmingham 5
Phone: 563-3588
Attn: E. C. Ackerman

*Badlow Engineering Services
3410 Tenth Avenue South
Birmingham
Phone: 213-1582
Attn: Dr. C. F. Badlow
SEE ALSO: Atlanta, Georgia (Ack)

ALASKA
Yukon Radio Supply, Inc.
(PO Box 400)
645 1st Street
Anchorage
Attn: A. E. Peterson

ARIZONA
Elliot Electronics, Inc.
418 N 4th Avenue
Tucson
Phone: 244-1173
Attn: Jerry Newell

**Southwest Electronic Devices
(PO Box 3647)
140 S 2nd Street
Phoenix
Attn: Herman A. Middleton

ARKANSAS
Lavender Supply Company
(PO Box 1148)
513-532 E 4th Street
Texarkana
Phone: 2-4195
Attn: Joe M. Lavender

Ed Mooy's Radio & Appliance
18th & Jefferson
DeWitt
Phone: 1-1280
Attn: Ed Mooy

CALIFORNIA
**Amrad Electronics
999 Howard Avenue
Berkeley
Phone: 5-5976
Attn: J. Stevenson

Amrad Supply, Inc.
3425 Balboa Street
San Francisco
Phone: 614-4661
Attn: David K. Bradley

**Calmar Electronic Co.
2145 A. Fulton Ave.
Sacramento
Phone: 447-0383
Attn: Alan M. Hertz

**Communication Receiver Service
5015 Maplewood
Los Angeles 4
Phone: 303-2429
Attn: Charles C. Messman

Elmar Electronics
140 11th Street at Madison
Oakland 7
Phone: 7X 4-3311
(TRAN-OATS)
Attn: Elvin Feige/M. L. Chunow

**Henry Radio Company, Inc.
(PO Box 45349)
11240 W. Olympic Blvd.
Los Angeles 44
Phone: OARATE 7-6701
Attn: Ted Henry

**Henry Radio, Inc.
931 N. Euclid
Anaheim
Phone: 395-8900
Attn: Mary Silva

8/1/62
*Authorized Service Agency only
**Authorized Distributor and Service Agency

Mission Ham Supplies
5474 Mission Blvd.
Riverside
Phone: OV-30583
Attn: Wm. P. Bullqust

Quasem Industrial Electronics
(P.O. Box 527
151 San Fernando
San Jose
Phone: 2P-4664
Attn: Frank Quasem

Radio Products Sales, Inc.
1501 S Hill Street
Los Angeles 15
Phone: 711-1271
Attn: Ken Rausin

Scott Radio Supply, Inc.
150 Alhambra
Lang Beach
Phone: 224-6360
Attn: Evelyn S. Scott

Western Radio & TV Supply Company
1150 N Western Avenue
Chicago 80
Phone: 1-7011
Attn: John Somvich/Jason Thomas

Klaus Radio & Electric Company
403 S Lake Street
Peoria
Phone: 3-5431
Attn: Clifford Morris

Swarak Electronics Corporation
22 S Madison Street
Chicago 6
Phone: 3-7944
Attn: N. J. Misko/A. L. Poncher

INDIANA
Brown Electronics, Inc.
1032 Broadway
Fort Wayne
Phone: Anthony 3362
Attn: A. A. Brown

Graham Electronics Supply, Inc.
122 S. Seneca 8
Indianapolis 4
Phone: ME7-7457
Attn: O. M. Graham/D. A. Bilts/J. F. Simp

Radio Distributing Co., Inc.
(PO Box 1499)
1212 High St.
South Bend 15
Phone: Atlantic 4-6665
Attn: William A. Davidson

IOWA
Radio Trade Supply Co.
1234 Grand Avenue
Des Moines 9
Phone: 288-7237
Attn: Leo Vinc Dennis/Larry Woolw

World Radio Laboratories, Inc.
(PO Box 919)
345 W Broadway
Council Bluffs
Phone: 32-8181
Attn: Allan McMillan/C. Ross

LOUISIANA
**Radio Parts Inc.
1112 Main Street
New Orleans 13
Phone: 522-017
Attn: Irish J. Levi

MARYLAND
Uncle George's Radio Shack Division
1719 Main Street
Hampton
Phone: 725-2262
Attn: George J. Paepa

MASSACHUSETTS
DeMambro Radio Supply, Inc.
1095 Commonwealth Avenue
Boston 15
Phone: Aglonj 4-9000
Attn: Frank DeMambro

Graham Radio, Inc.
505 Main Street
Reading
Phone: 44-4000
Attn: Robert F. Graham, Sr.

Radio Shack Corp.
1001 Commonwealth Avenue
Boston 17
Phone: 4-5100
Attn: Jack Schneider/Harry Waldman

*Two-Way Radio Engineers, Inc.
115 Ward Street
Boston
Phone: 345-3151
Attn: Sherman M. Wolf

MICHIGAN
*Communication Service Company
102 South Lincoln
Charlotte
Phone: 1-1207
Attn: Bob Rypstra

M. N. Duffy & Co.
204 Grand Avenue West
Detroit 28
Phone: Woodward 3-2270
Attn: M. N. Duffy/Bill Main

Purchase Radio Supply
327 E. Hooper Avenue
Ann Arbor
Phone: Normandy 4-8856/4-8862
Attn: Roy J. Purchese

Radio Supply & Engineering
90 Selden Avenue
Detroit 1
Phone: 7Mile 1-371
Attn: C. N. House

Warren Radio Company
1710 South Westnedge
Kalamazoo
Phone: 3-5870/3-5871
Attn: Frank Smith

MINNESOTA
Lew Bnn Company
1211 Lâskâpy Avenue
Minneapolis 3
Phone: 3-9351
Attn: Joe Holch

**Electronic Center, Inc.
107 3rd Avenue North
Minneapolis 1
Phone: 7-5878
Attn: Ward Jensen

MISSOURI
Walter Asby Radio Company
1125 Pine Street
St. Louis 3
Phone: Chestnut 1-1125
Attn: Joe Novak

Benson-Applebee Co.
1212-1214 McGee Street
Kansas City 6
Phone: 811-1115
Attn: R. E. Fritts/Clyde Fris

Henry Radio Company
211 North Main
Bellefonte
Phone: 2-9212
Attn: Bob Henry/HeLEN DeArmond

NEW HAMPSHIRE
Evan Radio
(PO Box 312)
Bow Junction, Route 3
Concord
Phone: Capital 5-3334
Attn: Eddie Andrew

NEW JERSEY
Federated Purchaser, Inc.
1021 S. H. S. 22
Mountainside
Phone: ADAMS 2-8000
Attn: N. A. Thorn

Hudson Radio & Television Corp.
35 Williams Street
Newark 2
Phone: MARKET 4-5154
Attn: Joseph Prestia
instruction book

30L-1
R-F Linear Amplifier

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SECTION I
Installation

NOTES:
1. HEADPHONES AND MICROPHONE CONNECT TO APPROPRIATE JACKS ON FRONT OF KWM-2.
2. POWER CONNECTORS ON KWM-2 AND PM-2 PUSH TOGETHER WHEN THE TWO UNITS ARE CLAMPED TOGETHER.
3. ALL LEADS CONNECTED TO PHONO JACKS AT REAR OF KWM-2 ARE BROUGHT DOWN THRU CHANNEL BETWEEN KWM-2 AND PM-2 AND OUT BENEATH PM-2.
4. AC CORD AND PLUG WITH 3RD WIRE GROUND. IF ADAPTER IS USED, CONNECT GREEN WIRE TO GROUND.
5. CONNECT TO EARTH GROUND.

Figure 1-1. Interconnections with KWM-2/2A Traveling Station
SECTION I
INSTALLATION

1.1 UNPACKING.

Carefully lift the amplifier out of the packing material. Examine for visible damage. If the amplifier has been damaged in shipment, save box and packing material and notify the transportation company. Fill out and mail the equipment registration card. Check tuning controls and switches for freedom of action. Check the equipment included with the amplifier against table 1-1.

Lift the amplifier cabinet lid. Loosen the ten screws in the r-f compartment cover, slide it forward, and lift off. Remove the packing material around the tubes. Replace the cover and tighten screws. Lower the lid.

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
<th>FUNCTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Shielded cables, 4 feet long, with phono plug on each end</td>
<td>Alc and antenna relay cables</td>
<td>426-2027-00</td>
</tr>
<tr>
<td>1</td>
<td>RG-58C/U cable, 20.5 feet long, with phono plug on each end</td>
<td>R-f input cable</td>
<td>426-5079-00</td>
</tr>
<tr>
<td>6</td>
<td>Fuses, 8-ampere</td>
<td>Spares</td>
<td>264-4110-00</td>
</tr>
<tr>
<td>1</td>
<td>A-c power plug adapter</td>
<td>A-c power</td>
<td>368-0138-00</td>
</tr>
<tr>
<td>1</td>
<td>UG-21D/U coaxial plug</td>
<td>R-f output connector</td>
<td>357-9261-00</td>
</tr>
<tr>
<td>1</td>
<td>Number 6 Bristo wrench</td>
<td>Knob removal</td>
<td>024-9730-00</td>
</tr>
<tr>
<td>1</td>
<td>Number 8 Bristo wrench</td>
<td>Knob removal</td>
<td>024-0019-00</td>
</tr>
<tr>
<td>1</td>
<td>Coaxial plug (Amphenol type 82-835)</td>
<td>Right-angle cable plug</td>
<td>357-9113-00</td>
</tr>
</tbody>
</table>

1.2 POWER TRANSFORMER CONNECTIONS.

The 30L-1 is shipped with the transformer primary connected for 115 volts a-c. If 230-volt a-c operation is planned, the primary connections must be changed on terminal board TB1. Refer to figure 7-2. This board is located at the bottom of the power supply compartment. The a-c power cord is connected to this board. To obtain access, refer to paragraph 4.2.

WARNING
DO NOT BLOCK INTERLOCK SWITCHES. Dangerous voltages are present in this equipment. The high voltage is interlocked with the amplifier covers. Make no attempt to put the amplifier into service until all compartment covers are in place.

1.3 CABLELING.

Interconnections with other station equipments are described in the following paragraphs. Assembly instructions for type N connectors, such as the UG-21D/U, are shown in figure 7-1.

1.3.1 TRAVELING STATION.

The 30L-1 is particularly applicable to traveling station use in conjunction with portable transceivers such as the KWM-2/2A. Refer to figure 1-1. IN THIS SERVICE, MAKE SURE THE TRANSFORMER PRIMARY IS CONNECTED FOR PROPER LINE VOLTAGE.

1.3.2 HOME STATION.

Connect to KWM-2/2A, KWM-1, or S-Line as shown in figures 1-2, 1-3, and 1-4.
CAUTION
BE SURE KWM-2 IS PLUGGED INTO 516F-2 BEFORE PLUGGING 516F-2 INTO AC LINE.

NOTES:
1. THIS CABLE IS FURNISHED WITH 30L-1 IN 20.5 FT LENGTH.
2. CONNECT HEADPHONES AND MICROPHONE TO APPROPRIATE JACKS ON FRONT OF KWM-2.
3. USE ONLY WITH 2 AND 6 METER CONVERTERS (CAUTION! +275 V DC PRESENT HERE).
4. DO NOT USE.
5. EXTERNAL RECEIVER MUTING.
6. CABLE TO ANTENNA-SWITCHING RELAYS (IF USED).
7. USE ONLY WITH 2 AND 6 METER CONVERTERS.
8. CONNECT TO EARTH GROUND.
9. EXTERNAL VFO POWER CABLE PLUGS INTO J17 ON KWM-2 CHASSIS.
10. AC CORD AND PLUG WITH 3RD WIRE GROUND. IF ADAPTER IS USED, CONNECT GREEN WIRE TO GROUND.

Figure 1-2. Interconnections with KWM-2/2A Home Station
Figure 1-3. Interconnections with KWM-1

NOTES:

1. THIS CABLE IS FURNISHED WITH 30L-1 IN 20.5 FT LENGTHS.
2. CONNECT HEADPHONES TO PHONES JACK, FRONT OF KWM-1. CONNECT MICROPHONE TO MIC JACK, FRONT OF KWM-1.
3. CABLE TO ANTENNA SWITCHING RELAYS (IF USED).
4. SEE DETAIL A FOR EXTERNAL RELAY CONNECTIONS FOR KWM-1 SWITCHING OF 30L-1 (KWM-1 SERIAL NUMBERS BELOW 861).
5. AC PLUG AND CORD WITH 3RD WIRE (ROUND PIN) GROUND. IF ADAPTER IS USED, CONNECT GREEN WIRE TO GROUND.
6. HIGH VOLTAGE PRESENT. EXTERNAL CIRCUITRY SHOULD BE ENCLOSED FOR PERSONNEL PROTECTION.
Figure 1-4. Interconnections with S-Line
1.3.3 KWM-1 SERIAL NUMBERS ABOVE 861.

If KWM-1 models above serial number 861 are used with the 30L-1, it will be necessary to bring out alc and ‘ground-on-transmit’ connections from the 516F-1 power cable plug, P-1, as shown in figure 1-3. Make the alc connection to terminal 19, and the ‘ground-on-transmit’ connection to terminal 20. Use a shielded wire, and connect to 30L-1 ALC and ANT. RELAY jacks with phono plugs.

1.3.4 KWM-1 SERIAL NUMBERS BELOW 861.

If models below serial number 861 are used with the 30L-1, it is necessary to make connections inside the KWM-1 for alc and antenna relay control.

a. Use an ohmmeter to locate the feedthrough capacitor, C169, which is connected to pin 19 of J5.

b. Connect a wire from this feedthrough capacitor to pin 7 of tube socket XV10.

c. Using an ohmmeter to trace the wiring, locate the feedthrough capacitor, C206, which is connected to terminal 20 of J5 in KWM-1.

d. Connect a wire from terminal 8 of TB1 in KWM-1 to C206.

e. Make corresponding breakout connection to P1 terminal 19 with shielded wire, and connect to the 30L-1 ALC jack with a phono plug.

f. Refer to figure 1-3, Detail A. External to the KWM-1, connect a 10,000-ohm, 5-watt resistor and a relay coil in series from J5 terminal 20 to a ground on the rear of the KWM-1 chassis. Use a relay, such as Collins part number 972-1346-00, with a 10,000-ohm, 10-ma coil, and a set of normally open contacts.

g. Connect the normally open contacts through a piece of shielded wire and a phono plug to the 30L-1 ANT. RELAY jack.

WARNING

BE CAREFUL to protect the operator from the 260-B+ present on the relay coil and resistor connections. It is recommended that this circuitry be enclosed in a suitable shield box.

NOTE

The r-f cable supplied for connecting the 32S-1, KWM-2/2A, or KWM-1 to the 30L-1 is 20.5 feet long. This length results in slightly lower system distortion than normally is obtained with other lengths of cable; however, a shorter length can be used for convenience.

1.4 INSTALLATION WITH OTHER MAKES OF EXCITERS.

Connect the r-f output of the exciter to the RF INPUT jack on the 30L-1. Existing antenna switching equipment between receiver and exciter may be left intact. To transmit, a ground must be supplied to the ANT. RELAY jack on the 30L-1. This removes blocking bias from the 811A tubes and energizes the internal antenna relay. Due to the variety of circuits involved, specific instructions for use of alc cannot be given. A detailed study of paragraph 3.7 will be helpful if it is desired to utilize the alc provisions in the 30L-1.
Figure 2-1. 30L-1 Operating Controls
SECTION II
OPERATION

2.1 OPERATION IN AMATEUR BANDS.

Table 2-1 shows normal and full-scale meter readings. If the exciter is a KWM-2/2A or S-line, set exciter BIAS ADJUST to produce an idling plate current of 50 ma. Tune and load according to exciter instruction book.

a. Connect the antenna for the band in use to the RF OUTPUT jack on the 30L-1. (When the ON-OFF switch is in the OFF position, the transfer relay in the 30L-1 connects the antenna to the exciter.)

b. Make sure the ON-OFF switch in the 30L-1 is in the OFF position as shown in figure 2-1.

c. Tune and load the exciter into the antenna. If the antenna does not present a nearly 50-ohm resistive load, the exciter can be tuned and loaded into a 50-ohm dummy load, such as the DL-1. When switched to the input of the 30L-1, the exciter will then remain in tune.

d. If using a Collins exciter, switch back to TUNE position, and set MIC GAIN to off position.

e. Set the 30L-1 METER switch to the TUNE position.

f. Set BAND switch to same band as that of the exciter, LOADING control to 1 on the dial, and TUNING control to white area for the band in use.

g. Press the 30L-1 ON-OFF switch to the ON position.

h. Set MIC GAIN to about 3/4 of full scale. (When using exciters other than KWM-2/2A or S-Line types, set microphone gain or carrier insertion control to provide approximately 20 watts drive to the 30L-1.)
i. Immediately adjust TUNING control for multimeter dip.
j. Alternately adjust TUNING and LOADING controls for zero multimeter reading. The meter will indicate zero at the dip when the amplifier is properly tuned and loaded. Always make the TUNING adjustment for meter dip as the last adjustment.
k. Switch the exciter to the desired sideband or to CW, and reduce exciter MIC GAIN control to normal operating level. The station is now ready to operate at rated power input.

1. Once the equipment has been tuned up on a given frequency, the 30L-1 may be switched in or out of the circuit at will by operating the ON-OFF switch. Output power from the amplifier is available instantly with no warm-up period required.

CAUTION

DO NOT operate the 30L-1 into a load presenting a VSWR greater than 2 to 1. The equipment may not function properly and damage may result. DO NOT operate the amplifier in continuous key-down condition at full input for more than 30 seconds. The power supply may be damaged. DO NOT use the 30L-1 in FSK, AM, or FM service. DO NOT use slow-blow fuses, or fuses larger than the 8-ampere type supplied.

2.2 OPERATION WITH OTHER MAKES OF EXCITERS.

Tune according to the procedure outlined in paragraph 2.1. If alc is not used, be careful not to overdrive either the exciter or the final amplifier. Normal plate current meter readings for the 30L-1 are from 300 to 350 ma on voice peaks. Actual plate current under these conditions will peak at approximately 600 to 700 ma. Be sure the exciter is capable of producing the required drive without excessive distortion. If not, the amplifier may be operated at reduced level.

2.3 OPERATION OUTSIDE AMATEUR BANDS.

Operation outside amateur band limits requires retuning of the 30L-1 input circuits. This is necessary to present the proper load impedance to the exciter. For procedure, refer to paragraph 4.4.

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</tr>
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<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Tune</td>
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<tr>
<td>D. C. VOLTS</td>
</tr>
<tr>
<td>D. C. AMPS</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
Figure 3-1. 3OL-1 Block Diagram
SECTION III
PRINCIPLES OF OPERATION

3.1 GENERAL.

The 30L-1 is a portable r-f linear power amplifier, including plate power and bias supplies. It is capable of 1000 watts PEP input power in SSB or 1000 watts d-c input in CW service with any exciter (such as the KWM-1, KWM-2/2A, or 325-1) capable of 70 watts PEP output. It covers the amateur bands between 3.5 and 29.7 mc. In addition, the amplifier may be operated outside the amateur bands over certain ranges of frequency. These ranges are specified in table 4-1. The power amplifier stage uses four 611A triodes connected in parallel with cathode drive.

3.2 INPUT CIRCUITS.

Refer to figures 3-1 and 7-2. Broadband pi-network circuits couple the exciting signal into the cathode circuits of the power amplifier tubes. The tuned input circuits provide increased efficiency, reduced distortion, and a better impedance match for the exciter than normally would be obtained with an untuned input. Tuning adjustments are not required except for operation outside the amateur bands.

3.3 OUTPUT CIRCUITS.

The plate circuit of the power amplifier is tuned by a pi network consisting of C32, L9, L10, and C33. Capacitor C32 resonates the tank circuit at the frequency in use. It is adjusted by the TUNING control on the front panel. The four-gang capacitor, C33, is adjusted by the LOADING control to match the pi-network circuit to the impedance presented by the antenna and feed system in use. Output from the plate tank circuit is connected through the contacts of antenna changeover relay, K1, to the antenna when the control circuits are energized.

3.4 POWER SUPPLY CIRCUITS.

Two d-c power supplies and one a-c filament supply are included in the 30L-1. The amplifier may be connected to a 115-volt single-phase or to a 230-volt, three-wire, single-phase source. Where practical, the 230-volt, three-wire connection is recommended. Power transformer T1 has two primary windings. These windings are connected in parallel for 115-volt operation, and in series for 230-volt operation. The 6.3-volt secondary winding provides filament power for the 811A tubes through r-f choke L8. It also powers the pilot lamp in the meter. Another secondary winding applies voltage through surge resistor R9 to semiconductor rectifier CR20. This is a half-wave circuit connected to furnish blocking bias to the amplifier tubes under receive conditions and operating bias when transmitting. It also furnishes power for changeover relay K1. Voltage from the third secondary winding is applied to two semiconductor rectifier strings connected in a full-wave voltage doubler configuration. These, strings consist of CR1-CR8, C44-C51 in one string, and CR9-CR16, C52-C59 in the other. The parallel capacitors equalize the reverse voltages impressed across the diode junctions and protect against damage by transients. The output of this supply provides approximately 1600 volts d-c under load for the amplifier tube plates.

3.5 SAFETY INTERLOCK CIRCUITS.

The r-f and power supply compartment covers operate safety interlock switches for operator protection. Switch S5 is located in the power supply compartment. Switches S6 and S7 are located in the r-f compartment. Cover removal closes these switches and shorts the high voltage to ground. This arrangement protects the operator from accidentally coming in contact with high-voltage d-c which is present in either compartment.

**WARNING**

DO NOT BLOCK INTERLOCK SWITCHES.
Contact with voltages in this equipment can be fatal. Be sure to disconnect the a-c power plug before removing any of the covers.

3.6 POWER CONTROL CIRCUITS.

Refer to figure 3-2. The front-panel ON-OFF switch breaks one side of the a-c line in the OFF position. When operated to the ON position, a-c power is applied to the power transformer primaries and the tube-cooling fan B1. Overload protection is provided by eight-ampere fuses F1 and F2. These are used for both 115-volt a-c and 230-volt a-c operation.

3.7 ALC CIRCUITS.

Automatic load control (alc) is a compressor circuit operating at radio frequencies. In the 30L-1, the grid-to-plate capacitances of the amplifier tubes in conjunction with capacitors C22, C23, C24, and C25 form capacitive voltage dividers. Under modulation, an r-f voltage is developed across these dividers and L3. It is coupled to the alc rectifier CR19 through capacitor C72. The r-f voltage is rectified and filtered to produce a negative d-c control voltage which is proportional to the modulation level. (The load resistor for CR19 must be provided by the exciter alc circuits.) This voltage is applied to the control grid of a low-level r-f amplifier tube or tubes in the exciter. The time constants of these circuits have a fast
SECTION III
Principles of Operation

![Control and Interlock Circuits Diagram]

Figure 3-2. Control and Interlock Circuits

attack, slow-release characteristic. The alc threshold is controlled by the amount of reverse bias on CR19. This voltage is developed across R7 in the plate supply bleeder network, and varied by potentiometer R16. It is adjusted at the factory for optimum operation in conjunction with the internal alc circuits of exciters such as the KWM-1, KWM-2/2A, or 32S-1. Normally it will not need readjustment.

This system allows a high average level of modulation and optimum power output from the amplifier, within the rated limits of distortion.

3.8 METERING CIRCUITS.

One section of the METER switch, S3, selects the output voltage from a tuning and loading bridge circuit. This circuit consists of the power amplifier tubes, CR17, CR18, and the associated load resistors and filter networks. The bridge is balanced when the plate circuit TUNING and LOADING controls are adjusted to present the proper load impedance to the power amplifier plates. The meter then will read zero.

The second section of the meter switch connects the meter to the plate supply through a four-megohm multiplier resistor to indicate the d-c voltage output. It is read on the D.C. KILOVOLT scale.

The third section of the meter switch connects the meter, through R10, across shunt, R8. This indicates power amplifier plate current. It is read on the D.C. AMPS scale.
SECTION IV
MAINTENANCE

4.1 GENERAL.

Adjustment of the r-f input circuits requires the following equipment:

a. R-f wattmeter and directional coupler, such as are included in the 312B-4 or 312B-5 Station Controls, or the 302C-3 Directional Wattmeter.

b. 50-ohm, 500-watt, nonreactive dummy load. (For short tests where key-down conditions do not exceed 30 seconds, the DL-1 Dummy Load can be used when applicable.)

The filament circuit in the 30L-1 is fused with a length of number 30 wire in the center-tap ground return of the filament winding on T1. The fuse is connected between the two outer lugs of a terminal strip located near R11 in the power supply compartment (refer to figure 6-1). Under some conditions, the amplifier may appear to function normally even though this fuse has blown; however, this causes hum to appear on the output signal. Check for shorts in the filament circuit.

4.2 REMOVAL OF CABINET AND COVERS.

a. Lift the cabinet lid, and remove the two Phillips-head screws located at the top-front edge of the cabinet. Remove the four feet and the Phillips-head screws located midway between the rear feet. Push the amplifier forward from the rear until the front panel projects from the cabinet about a half inch. Grasping the front panel at the edges, carefully slide the amplifier out of the cabinet, making sure the a-c power cord clears.

b. To remove the r-f compartment upper cover, loosen the ten screws about three turns, slide the cover toward the front panel, and lift off.

c. To remove the power supply compartment upper cover, remove screws located about the edges of the cover.

d. To remove the bottom cover, remove two round Phillips-head screws from each end of the cover and three flat-head screws near the middle of the cover, and lift off.

4.3 BLOWER LUBRICATION.

Every 1000 hours of operation (or 6 months, whichever comes first), lubricate the blower motor bearings with three or four drops of sewing machine oil. Do not over lubricate.

4.4 ALIGNMENT OF R-F INPUT CIRCUITS.

Remove the amplifier from its cabinet as outlined in paragraph 4.2. Do not remove any of the covers. To align for amateur band coverage, observe the following procedure:

a. Connect the directional wattmeter between the exciter output and the 30L-1 R-F INPUT jack. Connect the dummy load to the R-F OUTPUT jack on the 30L-1. Set up the equipment on 28.5 megacycles. Set the exciter EMISSION switch to LOCK KEY, and 30L-1 METER switch to TUNE.

b. With 30L-1 power off, tune and load the exciter to approximately 30 watts output as indicated on the wattmeter (forward power).

Figure 4-1. Location of Adjustments
c. Press the 30L-1 power switch to ON. Tune and load the 30L-1 into the dummy load. The exciter is now loaded into the 30L-1 input circuits. Retune and reload the exciter, if necessary, to 30 watts forward power output.

d. Watch the wattmeter in the exciter r-f output line, and with a nonmetallic tuning tool, tune L14 for minimum reflected power. Readjust the exciter as necessary to maintain 30 watts forward. Continue adjustment of L14 for minimum VSWR (not to exceed 2.0 to 1, or 11 percent reflected power).

e. Repeat the above procedures at 21.3, 14.3, 7.2, and 3.9 mc, adjusting L15, L16, L17, and L18 respectively. These adjustments are accessible through the holes in the rear cover of the r-f compartment. Do not remove the cover. Refer to figure 4-1.

For general coverage, use the same procedure as above, except set exciter to a frequency which is in the middle of the desired band. Useful bandwidth at the new alignment frequencies is approximately the same as that for the amateur bands. Do not attempt alignment to place the new operating bands outside the ranges listed in table 4-1 for the BAND switch positions indicated. Also do not attempt amateur-band operation on a BAND switch position for which the tuned circuits have been realigned for out-of-band operation.

<table>
<thead>
<tr>
<th>BAND SWITCH SETTINGS</th>
<th>LOWER LIMIT (mc)</th>
<th>UPPER LIMIT (mc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5</td>
<td>3.4</td>
<td>5.0</td>
</tr>
<tr>
<td>7.0</td>
<td>6.5</td>
<td>9.5</td>
</tr>
<tr>
<td>14</td>
<td>9.5</td>
<td>16.0</td>
</tr>
<tr>
<td>21</td>
<td>16.0</td>
<td>22.0</td>
</tr>
<tr>
<td>28</td>
<td>22.0</td>
<td>30.0</td>
</tr>
</tbody>
</table>

### 4.7 TUNE METER ADJUSTMENT.

a. Make normal connections between exciter and 30L-1.
b. Connect 50-ohm dummy load to 30L-1 output jack.
c. Connect vertical input of a wide-band oscilloscope across dummy load.
d. Connect a two-tone audio oscillator of about 15 mv rms output to exciter input.
e. Using normal procedure, tune and load exciter and amplifier into dummy load at 3.9 mc. Leave 30L-1 METER switch in TUNE position, and remove excitation.
f. Using USB or LSB emission, and monitoring output waveform on oscilloscope, increase drive until output ceases to increase or peaks begin to flatten.
g. Make fine adjustments to drive level and 30L-1 tuning and loading for maximum output without peak flattening. Output voltage across dummy load should be not less than 450 volts peak to peak or 160 volts rms, and CW (single tone) plate current should not exceed 700 ma.
h. Switch exciter to TUNE (approximately 20 watts drive) and adjust C18 with insulated tuning tool to produce reading of zero on 30L-1 multimeter.

### 4.8 ALC THRESHOLD ADJUSTMENT.

a. Perform steps a, b, d, and e of paragraph 4.7. Omit step c.
b. Disconnect alc cable between exciter and 30L-1.
c. Using USB or LSB emission, increase drive until indicated alc is about 4 db (S-4) on exciter meter.
d. Reconnect alc cable, and adjust R16 with insulated tuning tool for a 3-db (one S-unit) increase in alc.

Adjustments to tune meter and alc circuits should not be made unless the need has been clearly determined. If trouble is experienced, check PA tubes and exciter first. Improper adjustments can result in damage to amplifier and a distorted output signal. Do not attempt to make adjustments without proper test equipment.
SECTION V
SPECIFICATIONS

Size ................................................. 6-9/16 in. high, 14-3/4 in. wide, 13-3/4 in. deep (overall).

Weight ............................................. 38 pounds.

Frequency range ................................. 3.5-29.7 mc, covering all amateur bands. By retuning
input coils as necessary, the following general-
coverage bands may be covered:

<table>
<thead>
<tr>
<th>FREQUENCY BAND</th>
<th>TOTAL COVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 mc</td>
<td>3.4-5.0 mc</td>
</tr>
<tr>
<td>7.0 mc</td>
<td>6.5-9.5 mc</td>
</tr>
<tr>
<td>14 mc</td>
<td>9.5-16.0 mc</td>
</tr>
<tr>
<td>21 mc</td>
<td>16.0-22.0 mc</td>
</tr>
<tr>
<td>28 mc</td>
<td>22.0-30.0 mc</td>
</tr>
</tbody>
</table>

Mode ............................................. SSB or CW

Type of Service ................................. SSB - continuous voice modulation.
 .................................................. CW - 50-percent duty cycle (continuous key-down
 .................................................. conditions not to exceed 30 seconds duration).
 .................................................. CW - 1000 watts.
 .................................................. SSB - Nominal PEP input of 1000 watts with speech.
 .................................................. Third order distortion products at this level
 .................................................. are at least 30 db down from signal.

Plate power input ............................... 70 watts.

Drive power requirements ..................... 230 volts a-c ±10%, 3-wire, single phase, at 7.5
amperes max, or 115 volts a-c ±10% at 15 amperes
max, 50-400 cps. Operation from a line frequency
other than 50-60 cps requires an auxiliary 60-cps
supply for fan motor.

Primary power requirements ................... 70 watts.

Input impedance ................................. 52 ohms.

Output impedance ............................... 52 ohms unbalanced with vswr not to exceed 2 to 1
on the amateur bands.

Noise level ..................................... 40 db down from output signal with 1-kw single-tone
input.

Harmonic output ................................ All harmonics at least 40 db down from output signal.

Vacuum tubes ................................... Type 811A triodes (4).

Available accessories ......................... Model 351E-4 mounting plate (Collins part number
522-1482-003). This plate can be used when installing
the 30L-1 in an airplane, boat, or similar location
requiring a rigid mount. A luggage-type carrying case
is also available.
Figure 6-1. R-F and Power Supply Compartments, Parts Location
<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>COLLINS PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>FAN: 115 v ac, 60 cps, single phase</td>
<td>357-3702-00</td>
</tr>
<tr>
<td>C1</td>
<td>CAPACITOR, FIXED, CERAMIC: 10,000 uf -100% -20%, 500 v dc</td>
<td>913-3010-03</td>
</tr>
<tr>
<td>C2</td>
<td>CAPACITOR, FIXED, CERAMIC: same as C1</td>
<td>913-3013-03</td>
</tr>
<tr>
<td>C3</td>
<td>CAPACITOR, FIXED, ELECTROLYTIC: 100 uf -10% -100%, 450 v dc</td>
<td>183-1907-00</td>
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<td>C4</td>
<td>CAPACITOR, FIXED, CERAMIC: 10,000 uf ±20%, 1000 v dc</td>
<td>913-3922-00</td>
</tr>
<tr>
<td>C5</td>
<td>CAPACITOR, FIXED, ELECTROLYTIC: same as C3</td>
<td>183-1907-00</td>
</tr>
<tr>
<td>C6</td>
<td>CAPACITOR, FIXED, CERAMIC: same as C4</td>
<td>913-3923-00</td>
</tr>
<tr>
<td>C7</td>
<td>CAPACITOR, FIXED, ELECTROLYTIC: same as C3</td>
<td>183-1907-00</td>
</tr>
<tr>
<td>C8</td>
<td>CAPACITOR, FIXED, ELECTROLYTIC: same as C3</td>
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</tr>
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<td>C9</td>
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<tr>
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</tr>
<tr>
<td>C13</td>
<td>CAPACITOR, FIXED, MICA: 47 uf ±5%, 500 v dc</td>
<td>912-2792-00</td>
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<tr>
<td>C14</td>
<td>CAPACITOR, CERAMIC: 100 uf ±5%, 500 v dc</td>
<td>912-2016-00</td>
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<tr>
<td>C15</td>
<td>CAPACITOR, FIXED, CERAMIC: same as C1</td>
<td>913-3013-03</td>
</tr>
<tr>
<td>C16</td>
<td>CAPACITOR, FIXED, CERAMIC: 0.005 uf ±20%, 3000 v dc</td>
<td>913-4329-00</td>
</tr>
<tr>
<td>C17</td>
<td>CAPACITOR, FIXED, CERAMIC: same as C1</td>
<td>913-3013-03</td>
</tr>
<tr>
<td>C18</td>
<td>CAPACITOR, VARIABLE, CERAMIC: 8.0 uf ufd min 7.5, max 10.0, 500 v dc</td>
<td>917-1007-00</td>
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<tr>
<td>C19</td>
<td>CAPACITOR, FIXED, MICA: 270 uf ±5%, 500 v dc</td>
<td>912-2846-00</td>
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<td>C23</td>
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<tr>
<td>C26</td>
<td>CAPACITOR, FIXED, CERAMIC: same as C22</td>
<td>912-2840-00</td>
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<tr>
<td>C30</td>
<td>CAPACITOR, FIXED, CERAMIC: 1000 uf ±20%, 5000 v dc</td>
<td>913-0101-00</td>
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<td>C32</td>
<td>CAPACITOR, VARIABLE AIR: 15 uf min 350.0</td>
<td>920-0066-00</td>
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<td>C33</td>
<td>CAPACITOR, VARIABLE AIR: 14 uf min 432</td>
<td>921-0018-00</td>
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<tr>
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<td>CAPACITOR, FIXED, CERAMIC: 1000 uf -100% -20%, 5000 v dc</td>
<td>913-3909-00</td>
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<tr>
<td>C45</td>
<td>CAPACITOR, FIXED, CERAMIC: same as C44</td>
<td>913-3909-00</td>
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<tr>
<td>C50</td>
<td>CAPACITOR, FIXED, MICA: 82 uf ±5%, 500 v dc</td>
<td>912-2810-00</td>
</tr>
<tr>
<td>C51</td>
<td>CAPACITOR, FIXED, MICA: 510 uf ±5%, 300 v dc</td>
<td>912-2897-00</td>
</tr>
<tr>
<td>C52</td>
<td>CAPACITOR, FIXED, MICA: same as C22</td>
<td>912-2840-00</td>
</tr>
<tr>
<td>C55</td>
<td>CAPACITOR, FIXED, MICA: 180 uf ±5%, 500 v dc</td>
<td>912-2834-00</td>
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<tr>
<td>C56</td>
<td>CAPACITOR, FIXED, MICA: 330 uf ±5%, 500 v dc</td>
<td>912-2852-00</td>
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<tr>
<td>C60</td>
<td>CAPACITOR, FIXED, MICA: 150 uf ±5%, 500 v dc</td>
<td>912-2828-00</td>
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<tr>
<td>C70</td>
<td>CAPACITOR, FIXED, MICA: same as C60</td>
<td>912-2828-00</td>
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<tr>
<td>C71</td>
<td>CAPACITOR, FIXED, CERAMIC: same as C35</td>
<td>912-2902-00</td>
</tr>
<tr>
<td>C72</td>
<td>Same as C13</td>
<td>912-2902-00</td>
</tr>
<tr>
<td>C73</td>
<td>Same as C14</td>
<td>912-2916-00</td>
</tr>
<tr>
<td>C74</td>
<td>Same as C15</td>
<td>912-3013-03</td>
</tr>
<tr>
<td>C75</td>
<td>Same as C16</td>
<td>912-2816-00</td>
</tr>
<tr>
<td>C76</td>
<td>CAPACITOR, FIXED, MICA: same as C60</td>
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</tr>
<tr>
<td>C81</td>
<td>DIODE: silicon; type 1N1492</td>
<td>353-1600-00</td>
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<td>C82</td>
<td>DIODE: same as C81</td>
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<td>C83</td>
<td>DIODE: silicon; type 1N352</td>
<td>353-2900-00</td>
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<td>C84</td>
<td>DIODE: same as C83</td>
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<tr>
<td>C85</td>
<td>DIODE: silicon; type 1N540</td>
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<tr>
<td>C86</td>
<td>DIODE: same as C85</td>
<td>353-2900-00</td>
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SECTION VI
Parts List

20L-1 R-F Linear Amplifier

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<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>COLLINS PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>R20</td>
<td>RESISTOR, FIXED, COMPOSITION: same as R19</td>
<td>745-1419-00</td>
</tr>
<tr>
<td>R21</td>
<td>RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%, 1 w</td>
<td>745-3296-00</td>
</tr>
<tr>
<td>R22</td>
<td>RESISTOR, FIXED, COMPOSITION: same as R21</td>
<td>745-3296-00</td>
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<tr>
<td>R23</td>
<td>RESISTOR, FIXED, COMPOSITION: same as R21</td>
<td>745-3296-00</td>
</tr>
<tr>
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<td>RESISTOR, FIXED, COMPOSITION: same as R21</td>
<td>745-3296-00</td>
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<tr>
<td>R25</td>
<td>Part of Z1</td>
<td>745-5610-00</td>
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<td>R26</td>
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<tr>
<td>R27</td>
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<tr>
<td>R28</td>
<td>RESISTOR, FIXED, COMPOSITION: 39 ohms ±10%, 1/2 w</td>
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<tr>
<td>S1</td>
<td>SWITCH, ROTARY: 2 circuit (2 pole), 18 position, 1 section</td>
<td>259-1385-00</td>
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<tr>
<td>S2</td>
<td>SWITCH, ROCKER: dpst; 20 amps, 125 v ac. 10 amp, 250 v ac</td>
<td>266-6020-00</td>
</tr>
<tr>
<td>S3</td>
<td>SWITCH, ROTARY: 2 circuit (2 pole), 3 position, 1 section</td>
<td>259-1368-00</td>
</tr>
<tr>
<td>S4</td>
<td>SWITCH, ROTARY: 3 circuit (3 pole), 5 position, 1 section</td>
<td>259-1386-00</td>
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<table>
<thead>
<tr>
<th>ITEM</th>
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</tr>
</thead>
<tbody>
<tr>
<td>S5</td>
<td>INTERLOCK ASSEMBLY: copper, silver plated; 11/16 in. by 1/4 in. by 1.312 in.</td>
<td>547-3632-002</td>
</tr>
<tr>
<td>S6</td>
<td>Same as S5</td>
<td>547-3632-002</td>
</tr>
<tr>
<td>S7</td>
<td>Same as S5</td>
<td>547-3632-002</td>
</tr>
<tr>
<td>T1</td>
<td>POWER TRANSFORMER:</td>
<td>662-0010-00</td>
</tr>
<tr>
<td>V1</td>
<td>ELECTRON TUBE: triode; type 811A</td>
<td>256-0053-00</td>
</tr>
<tr>
<td>V3</td>
<td>ELECTRON TUBE: same as V1</td>
<td>256-0053-00</td>
</tr>
<tr>
<td>V4</td>
<td>ELECTRON TUBE: same as V1</td>
<td>256-0053-00</td>
</tr>
<tr>
<td>XF1</td>
<td>FUSE HOLDER: 15 amps-250 v</td>
<td>265-1019-00</td>
</tr>
<tr>
<td>XF2</td>
<td>FUSE HOLDER: same as XF1</td>
<td>265-1019-00</td>
</tr>
<tr>
<td>XV1</td>
<td>SOCKET, ELECTRON TUBE: 5 amps 2000 v rms</td>
<td>220-1451-00</td>
</tr>
<tr>
<td>XV2</td>
<td>SOCKET, ELECTRON TUBE: same as XV1</td>
<td>220-1451-00</td>
</tr>
<tr>
<td>Z1</td>
<td>SUPPRESSOR, PARASITIC: 4 turns no. 16 AWG wire, 100 ohms, 2 w resistor</td>
<td>547-3654-002</td>
</tr>
<tr>
<td>Z2</td>
<td>SUPPRESSOR, PARASITIC: same as Z1</td>
<td>547-3654-002</td>
</tr>
</tbody>
</table>

![Figure 6-2. Input Circuitry, Parts Location](image-url)
Connector Assembly Instructions

Place nut and gasket over cable and cut off jacket 3/16" from end.

Comb out braid and fold out. Cut off cable dielectric flush 1/8" from end of jacket.

Pull braid wires forward and taper toward center conductor. Place clamp over braid and push back against cable jacket.

Fold back braid wires as shown, trim to proper length and form over clamp as shown. Solder contact to center conductor.

Insert cable and parts into connector body. Make sure sharp edge of clamp seats properly in gasket. Tighten nut.

Figure 7-1. Connector Assembly Instructions
Figure 7-2. 30L-1 Schematic Diagram

7-3/7-4
ALL RESISTANCE VALUES ARE IN OHMS, ALL INDUCTANCE VALUES

1.2
2 WIRE SYSTEMS.
CR18 IS IN252.
NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UF, ALL INDUCTANCE VALUES ARE IN MH.
2. CR1 THRU CR16 ARE ALL IN/1492.
3. AMPLIFIER SHIPPED WITH PRIMARIES CONNECTED FOR 115VAC. TO CONNECT FOR 230 VAC, REMOVE JUMPERS ON TB1, TERMINALS 1 TO 2 AND 4 TO 5. MOVE WHITE WIRE OF POWER CORD AND UNGROUNDED LEAD OF C4 TO TERMINAL 2. ADD JUMPERS FROM TERMINALS 1 AND 4 TO 3.
4. BREAK AT POINT X FOR 230 VAC, 2 WIRE SYSTEMS.
5. ALTERNATE TYPE FOR CR17 AND CR18 IS IN252.
### Electrical Wire Code

**EXAMPLES:**

- **DA 92**
  - **UNSHIELDED WIRE, POLYVINYL, NO. 22 AWG, WHITE WITH A RED TRACER**
  - **D** Type of Wire
  - **A** Size of Wire
  - **9** Color of Body
  - **2** Color of Tracers

- **DAS 9123**
  - **SHIELDED WIRE (SINGLE) POLYVINYL, NO. 22 AWG, WHITE BODY WITH BROWN, RED AND ORANGE TRACERS**
  - **D** Type of Wire
  - **A** Size of Wire
  - **S** Shielded
  - **9** Color of Body
  - **123** Color of Tracers

- **DASJ (92)**
  - **SHIELDED AND JACKETED WIRE (MULTIPLE), POLYVINYL, NO. 22 AWG, WHITE AND WHITE WITH RED TRACER**
  - **D** Type of Wire
  - **A** Size of Wire
  - **SJ** Shielded and Jacketed
  - **9** First Conductor
  - **92** Second Conductor

- **A2A 91**
  - **UNSHIELDED WIRE, IRRADIATED POLYLEFIN, NO. 22 AWG, WHITE WITH BLACK TRACER**
  - **A2** Type of Wire
  - **A** Size of Wire
  - **9** Color of Body
  - **1** Color of Tracer

### TYPE OF WIRE CODE

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<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cotton Braid Over Plastic</td>
</tr>
<tr>
<td>A2</td>
<td>Irradiated Modified Polyolefin, (300 Volts)</td>
</tr>
<tr>
<td>A3</td>
<td>Irradiated Modified Polyolefin, (600 Volts)</td>
</tr>
<tr>
<td>A4</td>
<td>Irradiated Modified Polyolefin, (1000 Volts)</td>
</tr>
<tr>
<td>A5</td>
<td>Irradiated Modified Polyolefin, (3000 Volts)</td>
</tr>
<tr>
<td>B</td>
<td>Busswire, Round Timed</td>
</tr>
<tr>
<td>C</td>
<td>Polyvinyl Chloride, MIL-W-16878, Type B (600 Volts) No. 20-18-16</td>
</tr>
<tr>
<td>D</td>
<td>Polyvinyl Chloride, MIL-W-16878, Type B (600 Volts) No. 22-26-28</td>
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<tr>
<td>E</td>
<td>Vinyl, MIL-W-5086, Type I (600 Volts)</td>
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<tr>
<td>E2</td>
<td>Vinyl, MIL-W-5086, Type II (600 Volts) No. 22-12 Note 1</td>
</tr>
<tr>
<td>E3</td>
<td>Vinyl, MIL-W-5086, Type II (600 Volts) No. 0000-10 Note 2</td>
</tr>
<tr>
<td>E4</td>
<td>Vinyl, MIL-W-5086, Type III (600 Volts) No. 12-22 Note 3</td>
</tr>
<tr>
<td>E5</td>
<td>Vinyl, MIL-W-5086, Type III (600 Volts) No. 0000-10 Note 4</td>
</tr>
<tr>
<td>G</td>
<td>Kel-F (Monochlorotrifluoroethylene)</td>
</tr>
<tr>
<td>H</td>
<td>Not Available</td>
</tr>
<tr>
<td>I</td>
<td>Not Available</td>
</tr>
<tr>
<td>J</td>
<td>Neon Signs Cable (15,000 Volts)</td>
</tr>
<tr>
<td>L</td>
<td>Silicone, MIL-W-16878, Type FF (600 Volts)</td>
</tr>
<tr>
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<td>Silicone, MIL-W-16878, Type FTW (1000 Volts)</td>
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<td>L3</td>
<td>Silicone, Non-MIL (5000 Volts)</td>
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<td>L4</td>
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<td>L5</td>
<td>Silicone, Non-MIL (15,000 Volts)</td>
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<tr>
<td>M</td>
<td>Single Conductor Stranded (Non-Rubber)</td>
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<tr>
<td>N</td>
<td>Single Conductor Stranded (Rubber Covered)</td>
</tr>
<tr>
<td>Q</td>
<td>Polyvinyl Chloride, MIL-W-16878, Type C (1000 Volts)</td>
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<tr>
<td>S</td>
<td>Not Available</td>
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<tr>
<td>T</td>
<td>Teflon (TFE), MIL-W-16878, Type E (600 Volts) Stranded</td>
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<tr>
<td>U</td>
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<tr>
<td>V</td>
<td>Polyvinyl Chloride, MIL-W-16878, Type D (3000 Volts)</td>
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<td>W</td>
<td>Teflon (TFE), MIL-W-16878, Type EE (1000 Volts)</td>
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<tr>
<td>X</td>
<td>Teflon (TFE), MIL-W-16878, Type ET (250 Volts)</td>
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<tr>
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<td>Teflon (TFE), MIL-W-16878, Type KT (250 Volts)</td>
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<td>X4</td>
<td>Teflon (TFE), Non-MIL (3500 Volts)</td>
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<td>Y</td>
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<td>Y1</td>
<td>Teflon (TFE), Non-MIL; Solid Conductor</td>
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<tr>
<td>Z</td>
<td>Telephone Type, Braided Yarn</td>
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### SIZE OF WIRE

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<tr>
<td>C</td>
<td>No. 18</td>
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<tr>
<td>D</td>
<td>No. 16</td>
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<td>No. 14</td>
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<tr>
<td>F</td>
<td>No. 12</td>
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<tr>
<td>G</td>
<td>No. 10</td>
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<tr>
<td>H</td>
<td>No. 8</td>
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<tr>
<td>J</td>
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<tr>
<td>K</td>
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<td>T</td>
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### COVERING OF WIRE

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<tr>
<td>1</td>
<td>Brown</td>
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<tr>
<td>2</td>
<td>Red</td>
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<tr>
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<td>Orange</td>
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<tr>
<td>4</td>
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<tr>
<td>6</td>
<td>Blue</td>
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<td>7</td>
<td>Violet</td>
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<td>8</td>
<td>Gray (Slate)</td>
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<td>9</td>
<td>White</td>
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<td>a</td>
<td>Clear</td>
</tr>
<tr>
<td>b</td>
<td>Tan</td>
</tr>
<tr>
<td>c</td>
<td>Pink</td>
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<tr>
<td>d</td>
<td>Maroon</td>
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<tr>
<td>e</td>
<td>Light Green</td>
</tr>
<tr>
<td>f</td>
<td>Light Blue</td>
</tr>
</tbody>
</table>

**Note 1:** Extruded nylon over fiber glass braid.

**Note 2:** Braided, lacquered nylon over fiber glass braid.

**Note 3:** Extruded nylon over secondary vinyl over fiber glass over primary vinyl.

**Note 4:** Lacquered extruded nylon over secondary vinyl over fiber glass over primary vinyl.