JERROLD

INSTRUCTION SHEET

#I-503HU-754

JERROLD UHF CONVERTER, MODEL 503 HU

The Jerrold UHF Converter consists of two units, an antenna mounted UHF head (Model 453-H), and a separately mounted local-oscillator and power supply (Model 450-H). The circuits employed are a double-cavity-tuned UHF input, a crystal mixer stage, and a crystal controlled UHF oscillator for stability. The converter is designed to produce a specified VHF channel from any specified UHF channel.

The design features of this converter were determined by the particular requirements of TV distribution systems, namely: Oscillator stability; full TV channel bandwidth; best possible noise figure; minimum maintenance; selectivity; rugged construction. Model 503 HU has been proven in the field to excell in all these features.

The cavity construction of the head, using microwave techniques provides a very high Q and excellent noise figure. Teflon insulated trimmers used in the head and oscillator reduce dielectric losses, and are a special Jerrold design for mechanical stability. The head is weather proof constructed and mounts on the antenna mast near the UHF antenna terminals, eliminating UHF transmission line losses. Successful tests of the head followed by a preamplifier have been made with a 20 microvolt UHF signal input, where other commercial converters produced no useable output, indicating an excellent noise figure. Fully shielded construction further increases stability and reduces extraneous noises. The Jerrold VHF preamplifier is used with the converter in fringe areas to provide an overall circuit gain (20 db). Use of a separate preamplifier was preferred to incorporating tubes in the head itself which would create maintenance problems.

Both the head and oscillator have been subjected to heat runs to test their temperature stability. Ambient temperature changes of 100° F. produced no change of any kind in the frequency response curve.

Technical Data

UHF Head

UHF Input: Double cavity tuned (any Channel 14-83); 10 MC bandwidth, 72 ohms.

Conversion Loss: 8 to 12 db, depending on frequency.

VHF Output: Broadband, 20-220 MC, 72 ohms.

Mixer Crystal: Raytheon CK710.

Technical Data (Continued)

UHF Head

Coaxial Connectors: Jerrold C-61, female, for JRP-59, RG-59/U RG-6/U.

Dimensions: 4 1/4" x 4 9/16" x 2 9/16".

Weight: 1 pound, 13 ounces

Oscillator

Tube Complement: 5654 X'tal Oscillator Tripler
5654 Buffer
6AF4 Doubler or Tripler
6AF4 Doubler

X'tal: Part No. H173 (Jerrold) - Specify channel conversion when ordering.

Power Supply: 115 volts, 60 cps, a-c, 45 watts

Dimensions: (Mesh Cover), 6 1/2" x 5 9/16" x 10 1/4"

Weight: 9 pounds, 3/4 ounces.

NOTE: Oscillator coils are custom designed for specified channel conversions.

Theory of Operation

UHF Head

The three tunable cavities are similar in size and shape, being cut from rectangular brass and spot welded together. A tubular brass shaft is mounted through the center of each cavity. A conductive tuning slug inside each shaft is insulated from the conductive shaft by a thin wall of Teflon dielectric. Cavity tuning is by means of a screwdriver adjustment at the top of each cavity.

UHF signals introduced into the coaxial type cavities cause current flow along the inner conductive surfaces, resulting in the setting up of magnetic fields. This field effect can be compared to the action of an inductor. An electrostatic field is set up between the shafts in the cavities and their Teflon insulated conductive slugs creating an adjustable capacity. Thus each cavity can be considered an ordinary LC tank circuit.

(For the following analysis refer to Figure 1.)

A selective UHF antenna is connected through the proper balun and transmission line to the ANTENNA terminal of the head.

Theory of Operation (Continued)

The UHF signals are fed to the cavity by the coupling helix, L1, which also matches the low impedance transmission line to the high impedance cavity. The coupling helix therefore prevents excessive loading down of the cavity, which has an unloaded Q of about 800. Helix L1 has a self resonant point below the UHF band which gives it the characteristics of a parallel LC circuit operating above resonance. Thus the UHF coupling property of L1 is capacitive, providing excellent response, with little choking effect on the input signal.

The first tuned cavity resonates sharply over the desired channel. Resonating RF energy is induced into the coupling loop, mutually coupling the signal into the second RF cavity, which is also tuned to resonate over the desired channel. Together, the cavities are a double-tuned circuit that produces a 10 MC bandwidth enclosing the selected channel.

Coupling helix L2 feeds the UHF channel to the crystal mixer (CK-710). Also, at this point in the circuit, the local oscillator frequency is injected from the oscillator cavity into the crystal mixer, through helix L3. The output of the mixer is the difference frequencies between the local oscillator frequency and the inclusive frequencies of the UHF channel. (The local oscillator frequency being lower than the lowest frequency of the UHF channel, to maintain picture and sound carriers in their proper relationship at the mixer output.) The resulting frequencies at the mixer output are I.F. to the UHF band, but appear as normal VHF to any VHF preamplifier or amplifier.

The mixer output is applied to a VHF band pass network via feed through jack J1, whose capacity is an integral part of the network. This output network acts as a UHF filter, rejecting any UHF or oscillator signals that pass through the crystal. The VHF output is obtained at the I.F. terminal of the head. Note the TEST POINT provided for metering x'tal current (C-61 connector). Normally a short circuit cap is present over the C-61, and removed when measuring x'tal current. Network C2 and RFC filters R.F. from the test point.

As illustrated in Figure 1, all UHF circuit elements are physically placed inside cavities. The resultant shielding effectively confines the field around each element, greatly reducing oscillator and spurious signal radiation.

UHF Oscillator (Figure 2)

Oscillator, V1, is controlled by an overtone x'tal. The output of this stage is tuned to the third harmonic of the x'tal overtone.

The second stage, V2, amplifies the low level third harmonic signal, and serves as a buffer to increase oscillator stability.

The third stage, V3, multiplies the signal frequency two or three times depending on the desired oscillator output frequency. The grounded grid 6AF4 reduces feedback and Miller effect.

The output stage, V4, is tuned to the second harmonic of the driving signal and produces the desired oscillator output frequency, which is either 12 (3X1X2X2) or 18 (3X1X3X2) times the crystal overtone.

The oscillator output is delivered to the OSC connection on the head through a length of coaxial transmission line. The oscillator cavity in the head is single tuned to the OSC frequency. No coupling helix or critical matching is necessary in feeding the oscillator cavity because of the isolation afforded by the transmission line. The oscillator has sufficient output to drive through 50 feet of RG-59/U cable.

Installation (Figure 3)

1. Use a selective UHF antenna. In UHF fringe areas a high gain array such as the corner reflector, Yagi, or colinear should be used.

2. Use a 0.5 wavelength balun to match the 300 ohm antenna output to the 72 ohm converter input. (See Figure 4).

3. Mount the converter head as close to the antenna feed terminals as practical.

4. Use a Jerrold VHF preamplifier (Model 403A or 401A) in a fringe area. The location of the preamplifier will depend on the signal strength of the UHF signal and the transmission line loss involved. For 117 V a-c operation use Model 403A. In very weak signal areas, an antenna top preamplifier, Model 401A may be mounted close to the converter head to avoid transmission line loss. A coaxial connection on the Local Oscillator Power Supply provides 24 V a-c power to the antenna top preamp. The VHF signal is carried on the same cable and taken off the Local Oscillator Power supply connection, marked "VHF output". To energize the 24 volt terminal an internal connection must be made in the oscillator, see schematic, Figure 2.

5. Connections:
(All connections should be made with 72 ohm coax.)

   a. Connect antenna through balun to converter head input (marked ANT)

   b. Connect "OSC" connector on converter head to Local Oscillator output. The length of this lead should not exceed 50 feet of RG-59/U (JEL-102), 100 feet of RG-11/U (JEL-101) or equivalent.

   c. Connect "IF" output to TV receiver or Master Antenna System equipment.

6. When system is completely wired, turn preamplifier and crystal oscillator unit on, and allow approximately five (5) minutes warm-up time.

Field Alignment and Adjustment

The converter cavities are accurately pretuned in conjunction with the local oscillator for the specified channel conversion.

The factory adjustments are extremely stable and should not be tampered with until a picture of some kind has been obtained at the I.F. output.

Test Equipment

1. TV Receiver

2. 20,000 ohm/volt Volt-Ohm-Mil Meter.

3. A few feet of RG-59/U, fitted with a C-52 connector on one end with braid and center conductor exposed at the other end (for connecting V.O.M. Meter to x'tal test point).

4. VTVM and RF probe for checking voltages in oscillator only (in absence of VTVM a x'tal detector and microammeter previously calibrated at UHF may be used - see Trouble Shooting).

Procedure

1. Connect a TV receiver to the output of the preamplifier and obtain a picture on the converted channel. Critical antenna location and orientation for best picture is common at UHF. Check all connections if a signal of some kind is not received.

2. Proceed with the following adjustments in the order indicated, only after picture is obtained.

NOTE 1: During alignment restrict crystal current to less than 2 MA by using OSC. amplitude control R10. X'tal mixer has longest life when operating with low current drain in the order of 2 MA or less.

CONTROL	LOCATION	INDICATION	COMMENTS
OSC Amplitude Control R10	Local Oscillator	Best Picture (on weak signal least snow)	Accessible through hole in top of mesh cover with 6" screw-driver.
OSC Tuning Slug (screw-driver	Converter Head OSC. Cavity	Max X'tal Current	See Note 2
Slight Adjust-ment of both RF Tuning Slugs	Converter Head RF Cavities	Best Pictures	
Output Trimmer C5 (screwdriver)	Local Oscillator	Max X'tal Current	Remove Mesh Cover See Note 2.

Procedure (Continued)

NOTE 2: X'tal current may be measured at base or top of tower, whichever is most convenient. Connect V.O.M. Meter to x'tal test point through necessary length of cable.

3. In the event of tube replacement in the oscillator, adjust the input and output trimmer of the particular stage for Max x'tal current.

4. In the event of a change in cable length or type used, readjust C5 for Max x'tal current.

Trouble Shooting

SYMPTOM	POSSIBLE CAUSE	CHECK	CORRECT READING
Loss of Pic	Local Oscillator defective	OSC Output with VTVM and RF probe	1½ to 2 volts
or			
Snowy Pic	Mixer x'tal defective	x'tal current	Approx. 2 MA or previous setting.
Snowy Pic	Poor Alignment	Alignment	

Maintenance and Repair

This equipment is guaranteed against defective workmanship and materials for a period of 90 days from date of sale. Any defect arising from these causes will be promptly corrected upon return of the complete unit.

Alignment: No adjustments of the oscillator or head, other than the specified field alignment, should be attempted.

Tube Replacement: Tubes may be replaced without affecting alignment, other than repeaking of the local oscillator output trimmer, C5. The 6AF4 is characterized by a slump in output during the first 500 hours of approximately 6 db. This slump can be taken up with the oscillator gain control under normal operating conditions.

CONSTRUCTION OF UHF "BALUN"

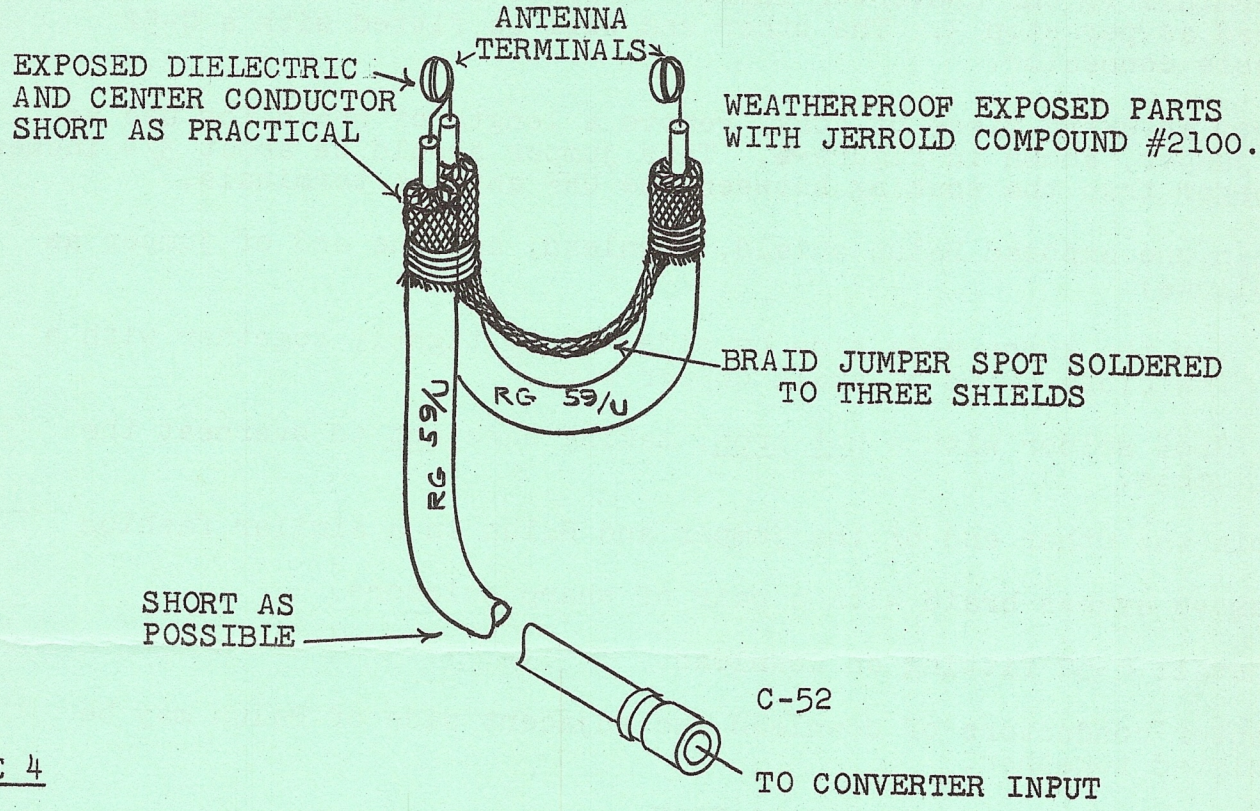
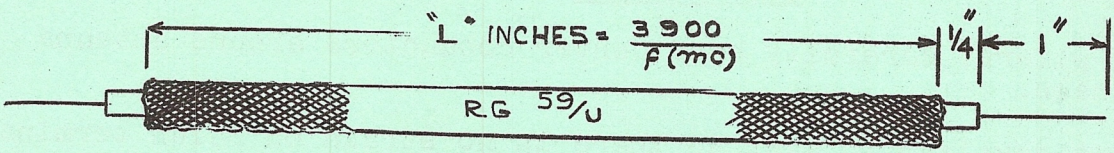


FIGURE 4



ASSEMBLY

Balun should be assembled in the shop, following these instructions:

1. Calculate Balun length "L" from the formula given in Figure 4. Some representative Balun lengths are given below

CHANNEL	27	28	46	55	61
L	7 1/8	7	5 7/8	5 3/8	5 1/8

2. Cut a piece of RG-59/U 2 1/2 inches longer than length "L" for the particular UHF channel.

3. Prepare each end of Balun as shown in Figure 4. Expose 1 1/4 inches of shield and fold back over vinyl jacket. Remove 1 inch of dielectric from center conductor.

4. Cut a second length of RG-59/U for use as downlead from antenna terminal to UHF converter input. Prepare one end of this downlead as per step 3. The other end will be fitted with a C-52 cable connector.

5. From an extra piece of coax, remove a length of braid for use as a jumper, shown in figure 4. This jumper should be about 3/4 inches longer than the spacing between the UHF antenna terminals.

6. Join one exposed Balun shield, downlead, and one end of jumper as follows:

   a. Lay the three ends side by side. Wrap tightly together with a few close twins of small copper wire.

   b. Spot solder with a hot iron, taking care not to overheat the cable.

7. Join the other end of the jumper and Balun in a similar fashion

8. Remove excess braid with a pair of sharp scissors.

9. Install C-52 fitting on downlead.

10. Center conductors of downlead and adjacent side of Balun may be twisted together.

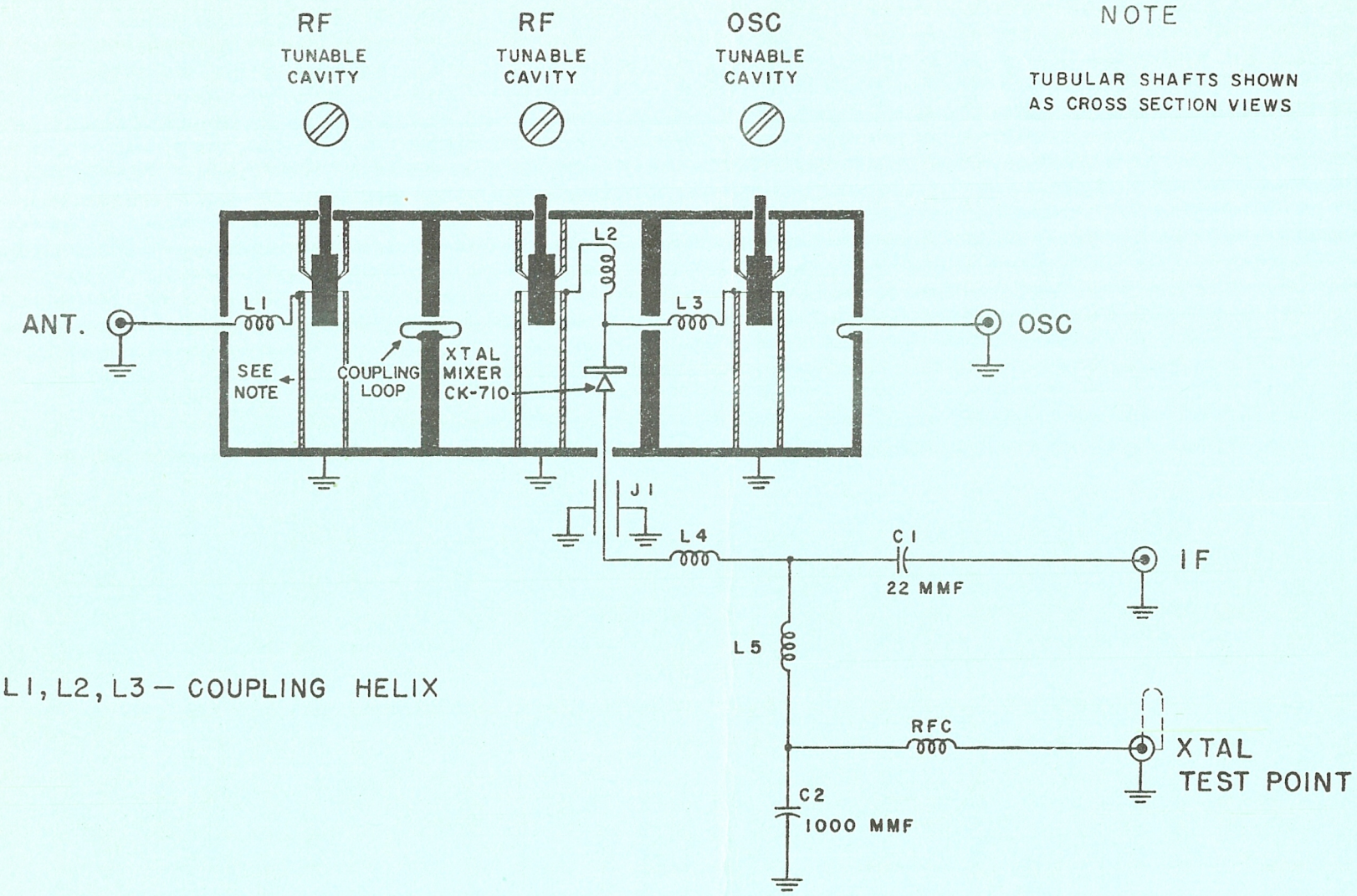
INSTALLATION

1. Using pliers, carefully bend center conductors around antenna terminals.

2. Support downlead to mast so there is no strain on Balun terminals. Try to keep Balun behind driven element of array.

3. Connect downlead to UHF converter input.

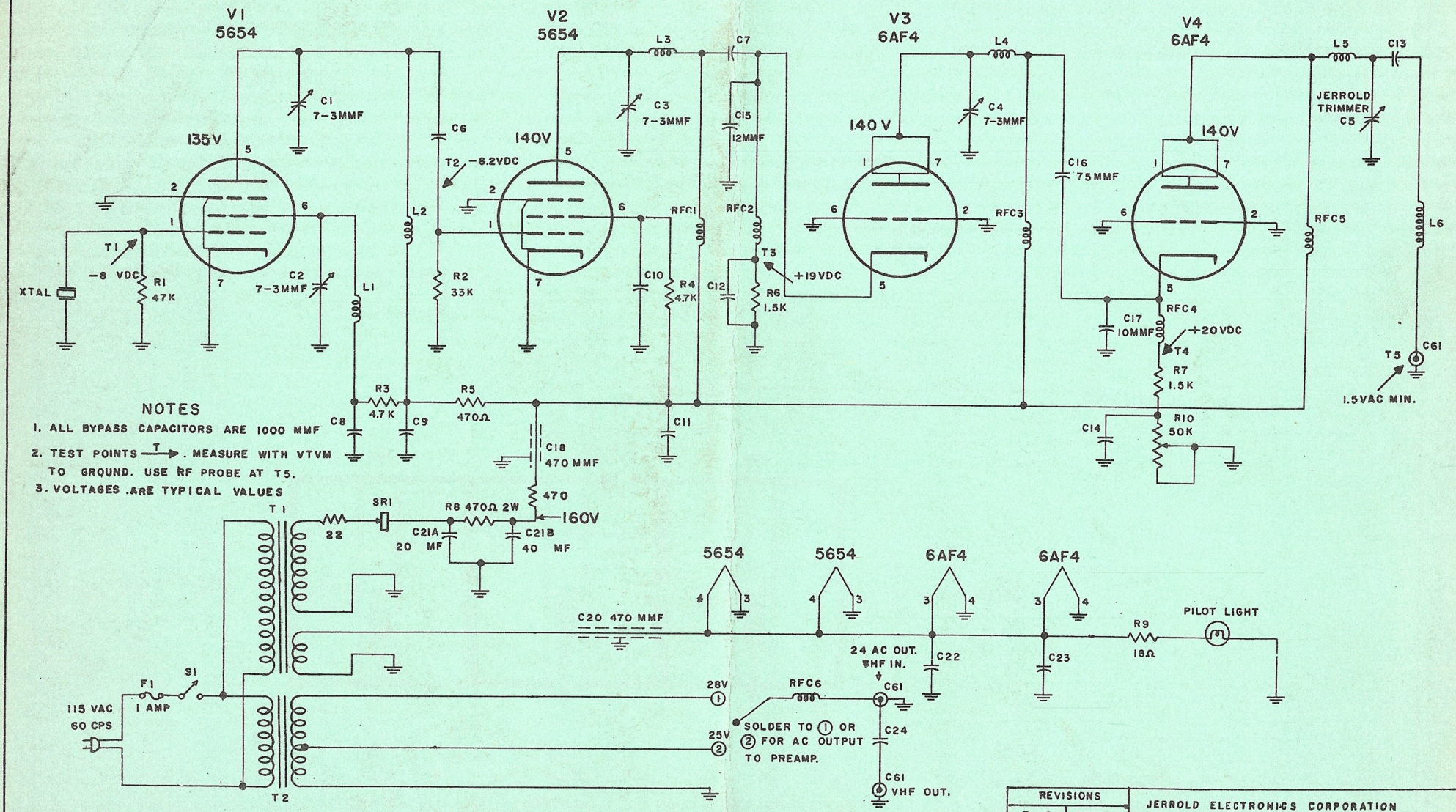
4. Apply Jerrold weatherproof compound, #2100, to all exposed joints and connectors.



JERROLD
UHF CONVERTER HEAD

JERROLD ELECTRONICS CORP.
DWG. NO. 1386

FIGURE 1



NOTES

1. ALL BYPASS CAPACITORS ARE 1000 MMF
2. TEST POINTS → T ←. MEASURE WITH VTVM TO GROUND. USE RF PROBE AT T5.
3. VOLTAGES ARE TYPICAL VALUES

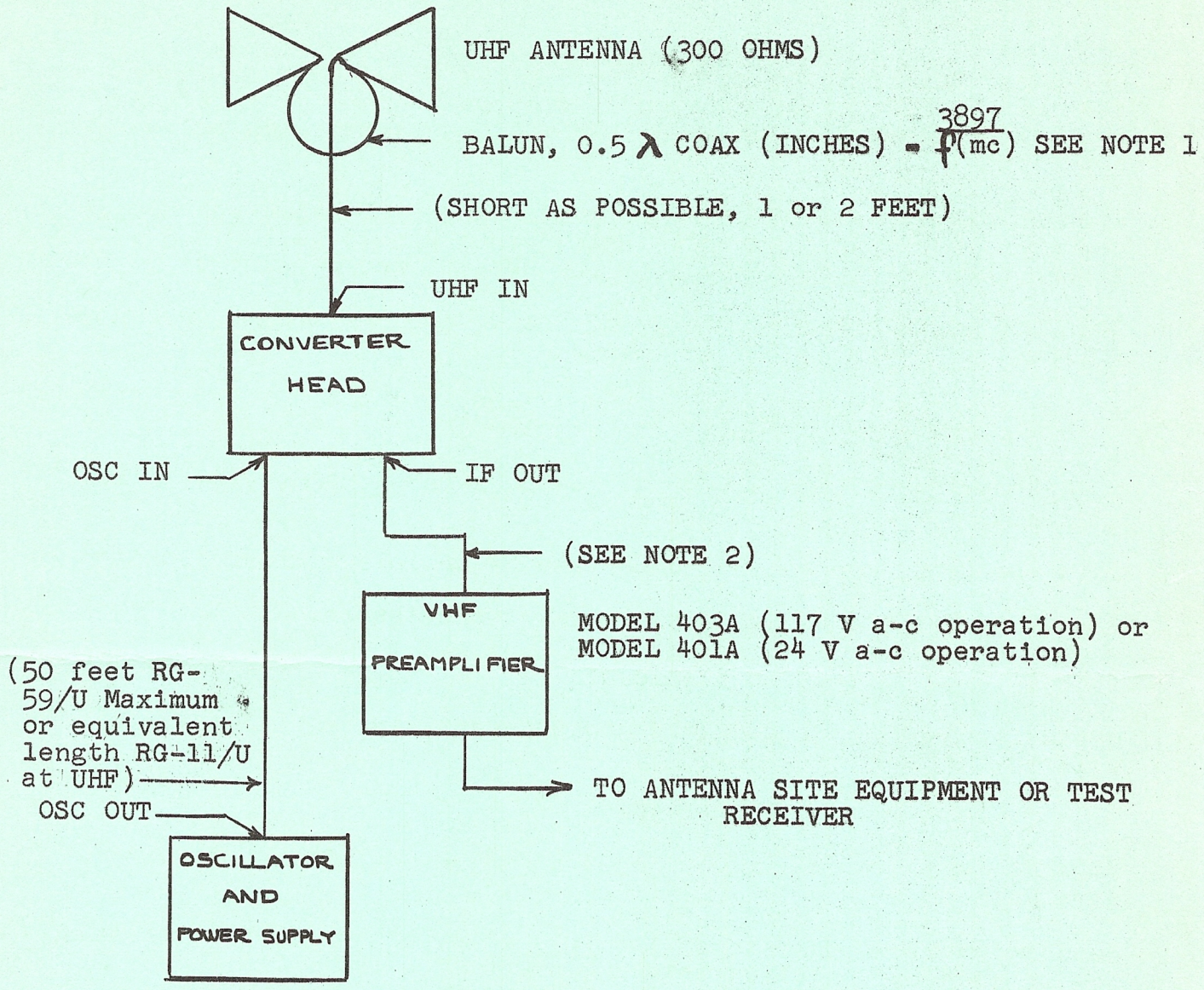
UHF CRYSTAL CONTROLLED OSCILLATOR

FIGURE 2

REVISIONS	
7-54	ECO-220

JERROLD ELECTRONICS CORPORATION
DRAWING NO. 1408 BY D. LEVINSON
DATE: 28 SEPT. 1953

FIGURE 3: UHF CONVERTER - INSTALLATION BLOCK DIAGRAM



NOTE 1. To determine mid-frequency f of any UHF channel (14-83).

(a) From channel number subtract 14
(b) Multiply result by 6
(c) Add 473

Example: Mid Freq. f of Channel 6:

(a) 61 - 14 = 47. (b) 47 X 6 = 282. (c) 282 + 473 = 755.

NOTE 2: Preamp may be located at top or base of tower, depending on signal strength and line loss.

For antenna mounting use Model 401A, and obtain 24 V from special output connection on oscillator power supply. For normal installation at base of tower, Model 403A is operated from 117 V a-c outlet.