

## Installation and tuning of a 3-stub fine-matching transformer

### Mount and connect the transformer:

- Using two power divider mounting kits, mount the transformer onto the mounting structure.
- Use additional mounts (supplied by customer) to support the coax sections between the transformer and the antenna input.

#### CAUTION

Stressing a coax connection after assembly can detune the system and compromise reliability. Therefore, never make a connection and then bend or twist the cable, or use the connector to force the coax into shape. Form the cable first, then attach it to the connector.

#### CAUTION

The minimum bending radius for 7/8" coax is 5" (12.7 cm). Do not bend it too tightly; you may damage it.

#### CAUTION

Do not overtighten the connectors. Overtightening may damage them.

- Connect the transformer output to the antenna input, with a new, lightly lubricated O-ring.
- Form any excess cable into loops, along the mounting pole or tower leg.
- Secure the cables and the cable loops to the mounting structure to prevent wind or vibration damage, using Shively-supplied cable clamps or an approved equivalent.
- Connect the transmission line to the input of the transformer, with a new O-ring. Torque the flange hardware as follows:
  - 9 lb-ft (1.2 kg-m) for 5/16" hardware on a 1-5/8" flange, or
  - 17 lb-ft (2.3 kg-m) for 3/8" hardware on a 3-1/8" flange.
- Secure the transmission line cable to the mounting pole or tower leg, using customer-supplied cable clamps.

### Before tuning:

#### CAUTION

If all moisture is not removed from the interior of the system, it will condense when the weather cools. The condensed moisture (water) will cause arcing and permanent physical destruction of the coaxial system, including the transmitter output network.

Ensure the antenna system is leak-tested, pressurized, and purged.

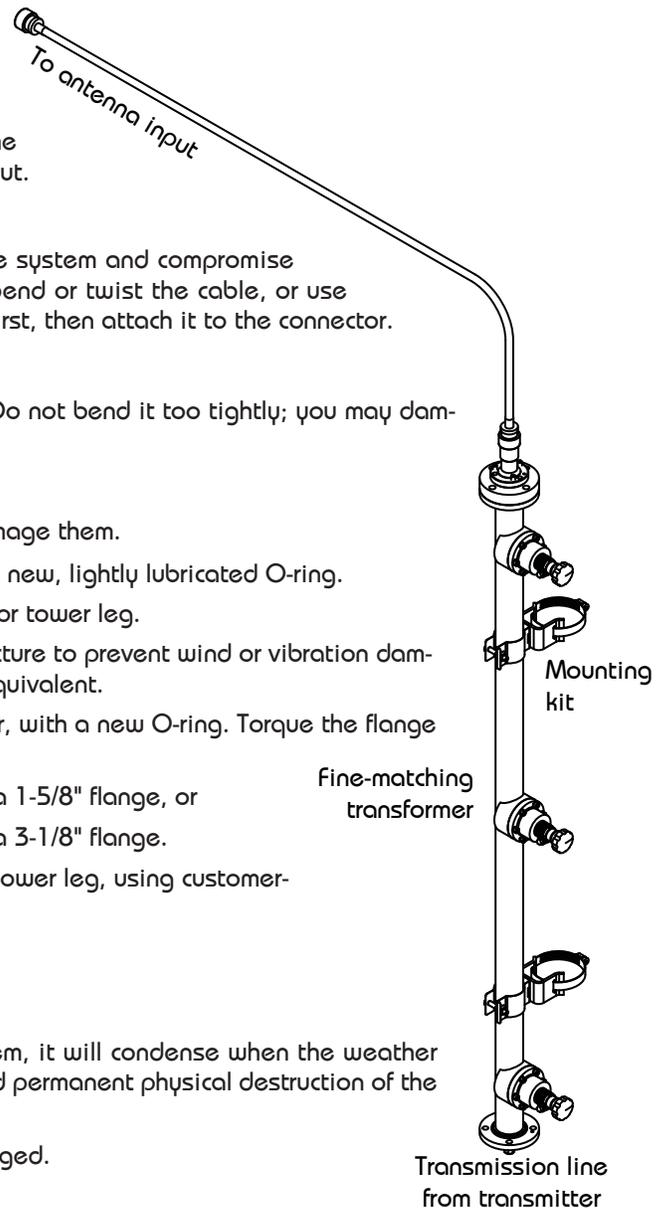
### Initial characterization:

We strongly recommend initial characterization as the best way to identify both initial problems and possible future system damage.

### Important

In the days before the hazards of intense RF power were realized, it was common practice to have a technician climb the tower and adjust the impedance match using the transmitter as a signal source and reading the VSWR or return power on the transmitter. This practice **MUST NOT** be used, as few transmitters can be operated at a low enough power level to avoid exposing the rigger to an unsafe RF level. For reference, see 29 CFR, Section 1910.97, the OSHA standard for exposure to non-ionizing radiation.

To test and adjust VSWR safely, use low-power test equipment, such as a network analyzer or an impedance bridge. If you don't have access to low-power test equipment, please call Shively Labs before proceeding.



### Document No. [ts-3-stub\\_xfmr\\_installation \(150622\)](#)

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## WARNING

Whenever a rigger is on the tower in the area of the antenna, shut off the transmitter signal and lock and tag it out so that it cannot be turned on accidentally.

Low-power test equipment should be used to prevent excessive radiation exposure to the person doing the adjusting.

A high transmission line VSWR may indicate damaged transmission line and is likely to cause problems in the future, including serious damage to your equipment.

### Read transmission line VSWR.

The first step is to characterize the transmission line by itself.

- Briefly disconnect the transmission line from the transformer input. Seal the transformer input to prevent the entry of moisture.
- Terminate the coax transmission line in an instrument-quality 50-ohm load.
- Measure and record the voltage standing wave ratio (VSWR) across the operating band. File this information for future reference.
- The VSWR of the transmission line should be within the manufacturer's specifications. If it is, proceed. If not, you should call the manufacturer before connecting the antenna. Problems must be worked out with the design engineer on a case-by-case basis.

### Read transmission line TDR.

- Terminate the coax transmission line in a short circuit.
- Make a time domain reflectometer (TDR) plot. Label and file the plot for future reference.

### Read system VSWR.

You tested the VSWR of the transmission line alone. Now test the VSWR of the system as a whole.

- Remove the load and connect the transmission line to the transformer input, with an O-ring to seal the connection.
- Repeat the purge process after sealing the line.
- Measure VSWR. VSWR at this point should be around 1.3 : 1 or better. If it is not, check to be sure all the radiators are functioning (below).
- Record the reading and file it for future reference.

### Check radiator function.

Again using the low-power test equipment to provide a signal to the antenna and read VSWR, have the rigger detune each radiator in turn.

Each time, a deflection in VSWR should be apparent. The deflection for various bays should be similar, but not necessarily identical.

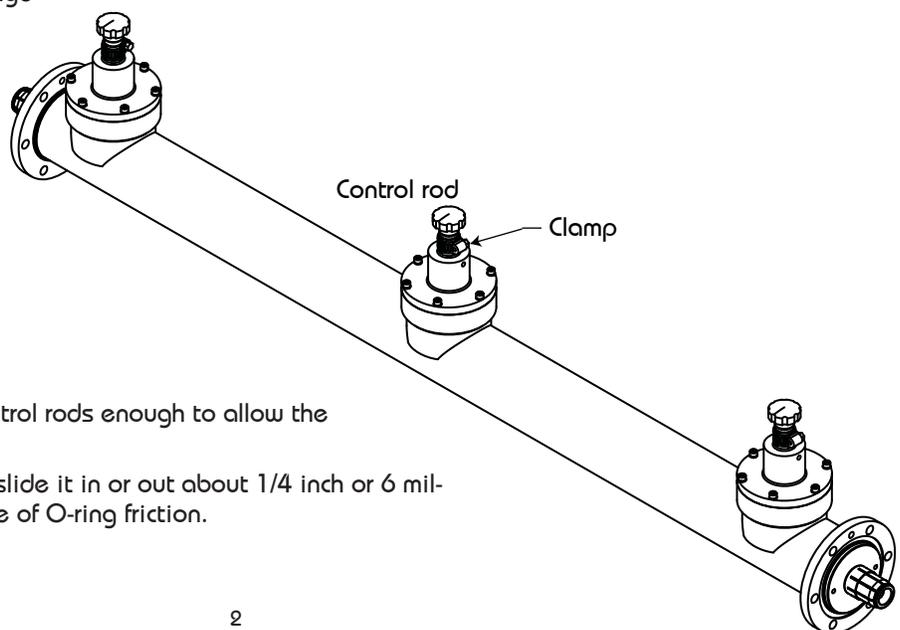
If the VSWR of the array does not change when a radiator is detuned, that bay or associated cable is not functioning. Check to be sure the radiator and cable were installed properly, including the inner conductor connector.

If you cannot find the problem, please call Shively Labs before proceeding.

### Trim impedance.

Adjust the transformer as follows:

- Loosen the hose clamps on the control rods enough to allow the rods to move.
- Grasp one of the control rods and slide it in or out about 1/4 inch or 6 millimeters. It will move stiffly because of O-ring friction.



- c. Read the VSWR. If the reading went down, move the control rod again in the same direction. If the VSWR went up, move the same rod in the opposite direction. Repeat until no further improvement is seen.
- d. Adjust the second and third rods in the same manner.

#### NOTE

If you get "lost," return all three rods to the factory setting (all the way out) and start over.

- e. Return to the first rod, and so forth, until you have the lowest possible VSWR or return power reading. This is the optimal transformer setting at this frequency.
- f. VSWR for each frequency at this point should be within specification (see the antenna data sheet). If it is not, call Shively Labs to help identify the problem.
- g. When you have set the transformer, use a sharp point to scribe the shaft of each control rod where it leaves the flange collar. Record the settings of the control rods and file this information for future reference.
- h. Tighten the hose clamps. If the clamps are left loose, vibration and/or line pressure may change the adjustments.