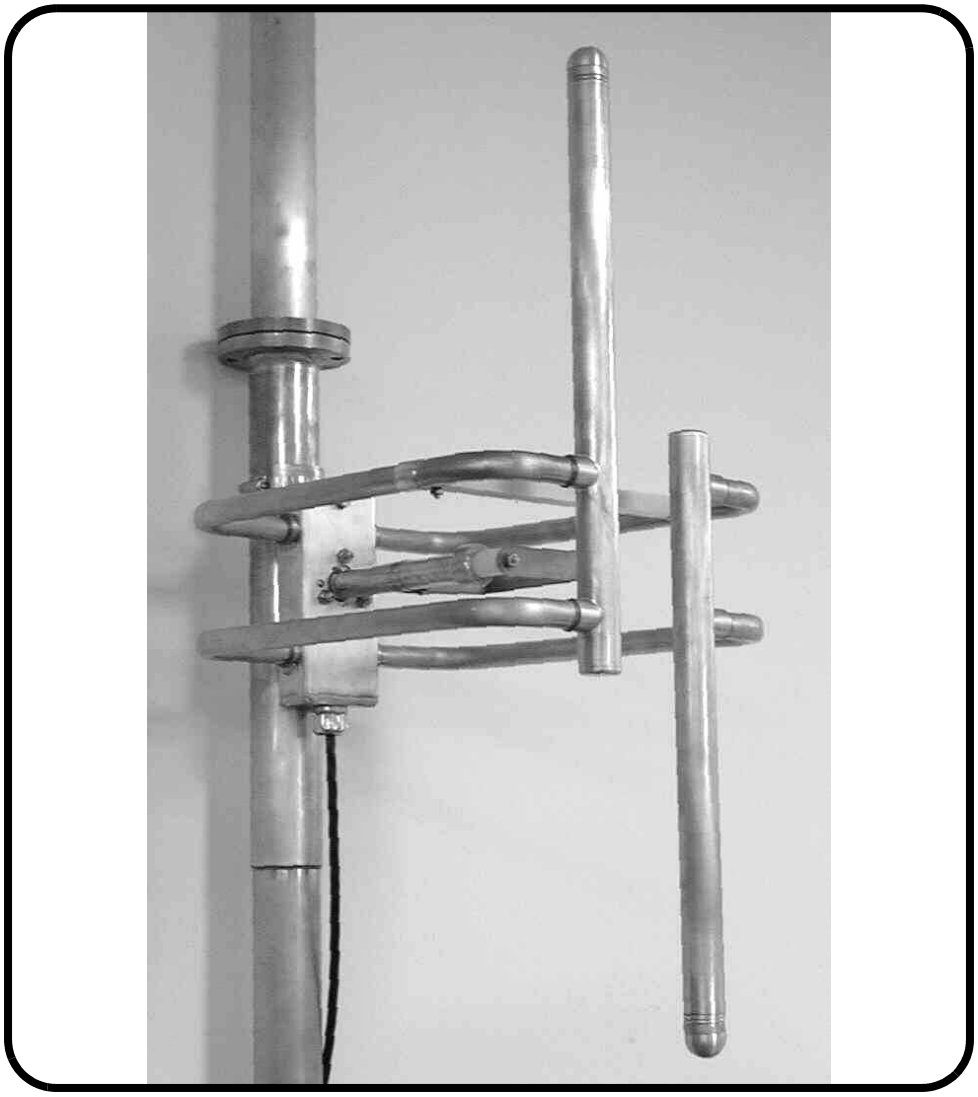
Shively Labs®

Circularly Polarized FM Broadcast Antenna

Model 6813



Instruction Manual
Installation, Operation, & Maintenance

Congratulations!

Thank you for purchasing one of the finest FM broadcast antennas on the market today. The Shively Labs Model 6813 is widely recognized as the top-of-the-line in its class for its superior performance and durability.

Your purchase is backed by the best technical support in the industry. Shively is a leading manufacturer in the broadcast industry, providing an extensive range of antennas, transmission line and components. Our technical staff has a wealth of experience in the broadcast industry and is standing by to serve you in any way.

This manual is intended to give you a good basic understanding of your antenna: its proper and safe installation, startup, and operation, and trouble-shooting and maintenance information to keep it working satisfactorily for years to come. *Please have everyone involved with the antenna read this manual carefully, and keep it handy for future reference.*

Meanwhile, please feel free to contact your sales representative at Shively Labs at any time if you need information or help. Call or write:

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IMPORTANT

Please read this manual in its entirety before beginning installation of your antenna!

Failure to follow the installation and operation instructions in this manual could lead to failure of your equipment and might even void your warranty!

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1 Precautions and Preparation

Precautions

WARNING

Don't expose personnel to the medical hazards of intense radio frequency (RF) radiation. Whenever working on the tower in the area of the antenna, turn off all transmitters and lock them out so that they cannot be turned on accidentally.

For reference on RF safety, see CFR 29, Section 1910.97, the OSHA standard for exposure to non-ionizing radiation.

Receiving

As soon as you receive your antenna, *BEFORE* signing for the shipment:

a. Check to be sure all the material has arrived.

NOTE

The box number and the total number of boxes are marked on each box; for example, "Box 2 of 5" means "box number 2 of a total of five boxes."

b. Check for evident damage to any of the boxes.

c. If any boxes are missing, or if any are obviously damaged, describe the problem in a WRITTEN note on the shipping papers BEFORE signing them. Then call Shively right away, and we'll do everything we can to correct the situation.

Important!

Never store the antenna system outdoors, boxed or otherwise. Take pains to keep the antenna components dry. You will need to purge moisture from the interior of the antenna components before applying transmitter power, and purging will be much more time-consuming if the components get wet.

Unpacking

a. Find Box 1; it is marked "Open This Box First." It contains the transformer and two copies of the installation drawing. The parts list on one sheet of the installation drawing shows what box each item is in.

b. Then open the boxes and examine for shipping damages. File any necessary claims with the carrier immediately.

c. If all the boxes are present and in good condition but material seems to be missing, please contact Shively Labs immediately, using the telephone or Fax number on the inside cover of this manual. For the best service, have our shop order number (S/O) handy; it's in the block at the bottom right corner of the installation drawing.

d. Along with your antenna you will get a spare parts kit. Place this in a safe place until it is needed.

CAUTION

All contact surfaces and openings to the interior of the components are protected from contamination and from physical damage by caps and plastic bags. Do not remove this protection until ready to connect the components.

Checking the system

Remember!

It is YOUR responsibility to ensure that your installation meets all applicable codes and the centerline-of-radiation requirements of your FCC construction permit.

Shively has planned the installation of the antenna based upon information provided by you. If this information contained errors, the parts and mounting hardware will have been designed incorrectly and will cause expensive delays in installation. *Therefore, we recommend that you recheck the installation parameters during this planning stage.*

Check all the parts to be sure that they will fit the tower and each other. Study the installation drawings carefully to confirm that the information used in designing the antenna and mounts was, in fact, accurate.

Have a reliable tower person, familiar with antennas and coaxial line, inspect the tower and review the installation drawings before the full rigging crew arrives.

If design problems are found, contact Shively Labs immediately. Pay particular attention to:

- Frequency of the antenna.
- Fit of the mounts to the tower members.
- Freedom from interference by gussets, leg flanges, guys and their attachment points, tower face members, obstruction lights, and other components.
- Compatibility of transmission line and antenna input terminals.
- Location of the transmission line run relative to the antenna input terminal.
- Use of non-metallic guy sections on the tower in the region to be occupied by the FM antenna. Ensure that there are no metal guys within ten feet (three meters) of any radiator.
- Availability of proper electrical service for de-icers, if applicable.
- The adequacy of the tower structure and guys to carry the wind-load placed upon them by the antenna, particularly if radomes are used.

You gave Shively this information at the time of purchase, but a last check at this time can catch an error, which will be easier to correct before installation begins.

Study your antenna

CAUTION

These procedures are guidelines. Assemble components exactly in accordance with the installation drawing. If you don't, the antenna may not perform as expected.

It will be easiest to mount the radiators, feedline mounts, and radomes (if applicable) onto the feedline sections before the feedline sections are mounted on the tower.

Determine what, if any, icing protection your antenna has.

If your antenna element looks like Figure 3 on page 6, go to Bay Installation (without radomes) on page 5.

If your radomes look like Figure 6 on page 13 (standard radomes), go to Bay Installation (with standard radomes) on page 9.

If your radomes look like Figure 9 on page 18 (XXL radomes), go to Bay Installation (with XXLR radomes) on page 15.

If your antenna has de-icers, go to De-Icer Installation (if applicable) on page 25.

Bolt & torque specifications

Figure 1. Flange bolt tightening sequence

Table 1. Torque specifications, flange bolts

Transmission Line Size	Bolt Size	Torque	
7/8"	1/4-20	7 ft-lb	9 N-m
1-5/8"	5/16-18	12 ft-lb	16 N-m
2-1/8"	3/8-16	21 ft-lb	28 N-m

2 Bay Installation (without radomes)

Precautions

WARNING

Don't expose personnel to the medical hazards of intense radio frequency (RF) radiation. Whenever working on the tower in the area of the antenna, turn off all transmitters and lock them out so that they cannot be turned on accidentally.

Installing the back support mounts

a. Pair up the feedline sections and the radiator assemblies, using the bay number (Figure 2, 1) stenciled on each piece.

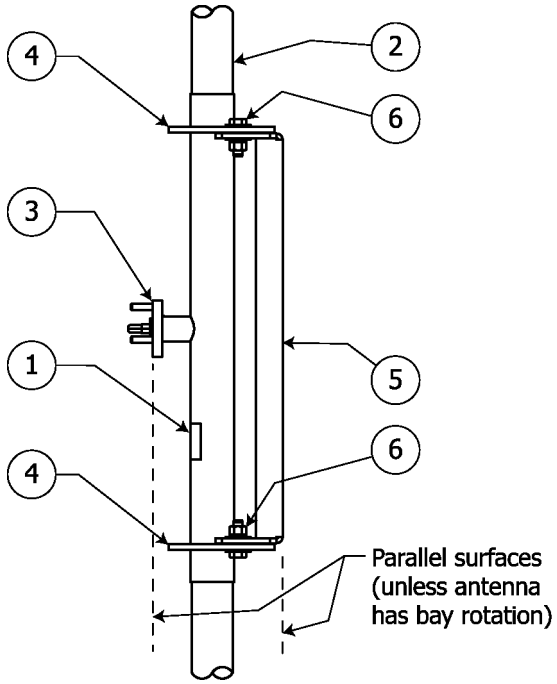
b. Lay a feedline section (2) horizontally, supported off the ground, with its baymount flange (3) pointing downward.

c. Study your installation drawing. There is a detail identifying the correct azimuth rotation of the antenna bays from the tower mounting surface.

d. Now look at the feedline, with its upper and lower ring flanges (4). The upper feedline mount flange has a series of notches cut into it. The center notch is exactly opposite the baymount flange. Each notch represents five degrees (5°) of azimuth rotation. Align the centered mark on the back support mount (5) to the notch representing the azimuth rotation identified on the installation drawing.

e. Using a mounting hardware kit (6: four bolts with nuts and washers), secure the back support mount to the upper feedline mount flange and lower feedline mount flange.

Figure 2. Back support mount installation



1	Bay number marking	4	Ring flange (2 per feedline section)
2	Feedline section	5	Back support mount
3	Baymount flange	6	Mounting hardware kit

NOTE

Use shims or washers as necessary to fit the back support mount to the mount flanges.

NOTE

You may need to save final tightening of this hardware until the feedline is installed on the tower.

f. Repeat the above steps for the remaining feedline sections.

Installing the bay radiators

It will be easiest to mount the radiators onto the feedline sections before the feedlines are mounted on the tower.

a. Pair up the feedline sections (Figure 3, 1) and the radiator assemblies (2), using the bay number marking (3) on each piece.

b. Attach the bay radiator to the feedline:

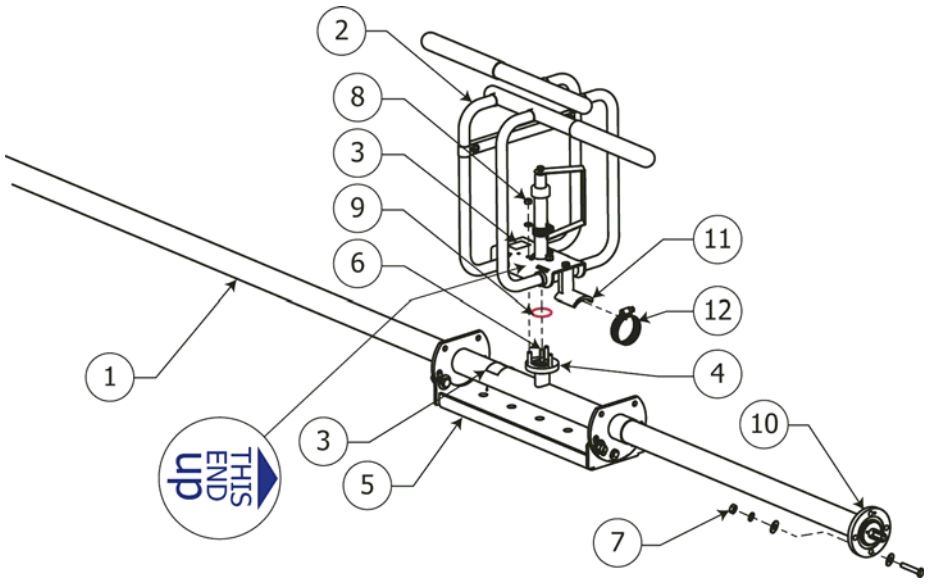
(1) Roll the feedline section over so that the baymount flange (4) points upward. Secure the feedline section by clamping the back support mount (5), to prevent its turning with the weight of the radiator.

CAUTION

All contact surfaces and openings to the interior of the components are protected from contamination and from physical damage by protective covers and plastic bags. Do not remove this protection until ready to connect the components.

(2) Remove the plastic bag and protective cover from the baymount flange.

Figure 3. Radiator installation



1	Feedline section	7	Feedline flange hardware
2	Radiator assembly	8	Baymount flange hardware
3	Bay number markings	9	O-ring
4	Baymount flange	10	Top feedline flange
5	Back support mount	11	Mounting saddle
6	Inner conductor connector	12	Clamp

(3) Make sure an inner conductor connector (Figure 3, 6) is in place in the inner conductor of the baymount flange of the feedline.

NOTE

Feedline flange hardware (7) and baymount flange hardware (8) are shipped separately in plastic bags. Each bag contains the hardware for one flange. O-rings (9) are also shipped in a separate bag.

CAUTION

Be sure the baymount flange O-ring is properly seated in its groove and not pinched between the flange contact surfaces.

(4) Coat the baymount flange O-ring lightly with O-Lube (supplied with the antenna), then install it in the O-ring groove in the baymount flange.

Important

Be very careful not to disturb or damage the feedstrap when handling the radiator.

(5) Remove the matching radiator assembly from its protective plastic bag.

CAUTION

Feedstrap orientation is critical to performance. In general, the feed-straps in a full-wave-spaced antenna will all be oriented the same, while those in a half-wave-spaced antenna will alternate. *Install each radiator in accordance with its stenciled bay numbers and its "This end up" sticker.*

CAUTION

Be sure the radiator's inner conductor fits cleanly over the baymount's inner conductor connector (Figure 3, 6). If any of the fingers of the con-nector are forced outside the radiator's inner conductor (we call this a "split bullet"), this will cause arcing and damage to the antenna.

(6) Align the radiator (2) with the baymount flange as shown in Figure 3, with the top (see "This End Up" sticker) pointing toward the top feedline flange (10). Carefully place the radiator into position over the flange studs and inner conductor connector.

(7) First snug the baymount flange hardware, then tighten in the sequence shown in Figure 1 on page 3. Torque in accordance with Table 1 on page 3.

(8) Clamp the mounting saddle (Figure 3, 11) to the feedline, using a clamp (12).

c. Repeat the above steps for the remaining feedline sections.

d. Antenna bay installation is complete. Proceed to Chapter 5, Antenna Installation on the Tower on page 21.

3 Bay Installation (with standard radomes)

Precautions

WARNING

Don't expose personnel to the medical hazards of intense radio frequency (RF) radiation. Whenever working on the tower in the area of the antenna, turn off all transmitters and lock them out so that they cannot be turned on accidentally.

Installing the back support mounts

a. Pair up the feedline sections and the radiator assemblies, using the bay number (Figure 4, 1) stenciled on each piece.

b. Attach the back support mount to the feedline:

   (1) Lay a feedline section (2) horizontally, supported off the ground, with its baymount flange (3) pointing downward.

   (2) Study your installation drawing. There is a detail identifying the correct azimuth rotation of the antenna bays from the tower mounting surface.

   (3) Now look at the feedline, with its upper and lower ring flanges (4). The upper ring flange has a series of notches cut into it. The center notch is exactly opposite the baymount flange. Each notch represents five degrees (5°) of azimuth rotation. Align the centered mark on the back support mount (5) to the notch representing the azimuth rotation identified on the installation drawing.

   (4) Using a mounting hardware kit (6: four bolts with nuts and washers), secure the back support mount to the upper ring flange and lower ring flange.

NOTE

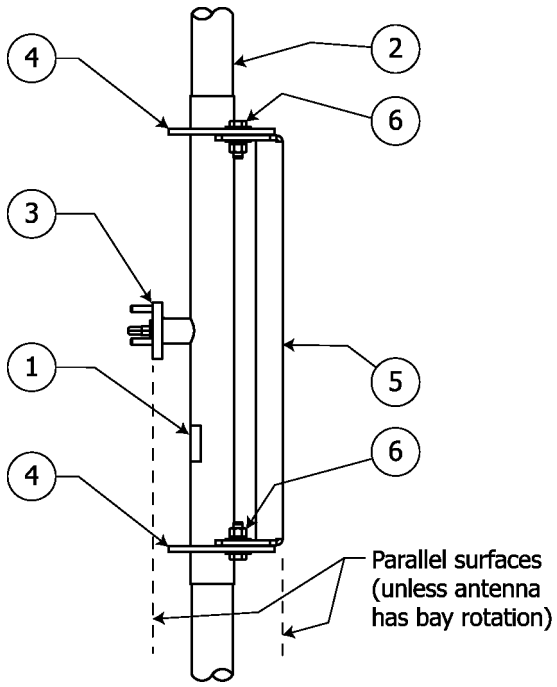
Use shims or washers as necessary to fit the back support mount to the mount flanges.

NOTE

You may need to save final tightening of this hardware until the feedline is installed on the tower.

c. Repeat the above steps for the remaining feedline sections.

Figure 4. Back support mount installation



1	Bay number marking	4	Ring flange (2 per feedline section)
2	Feedline section	5	Back support mount
3	Baymount flange	6	Mounting hardware kit

Installing the bay radiators

It will be easiest to mount the radiators onto the feedline sections before the feedlines are mounted on the tower.

a. Pair up the feedline sections (Figure 5, 1) and the radiator assemblies (2), using the bay number marking (3) on each piece.

b. Attach the bay radiator to the feedline:

(1) Roll the feedline section over so that the baymount flange (4) points upward. Secure the feedline section by clamping the back support mount (5), to prevent its turning with the weight of the radiator.

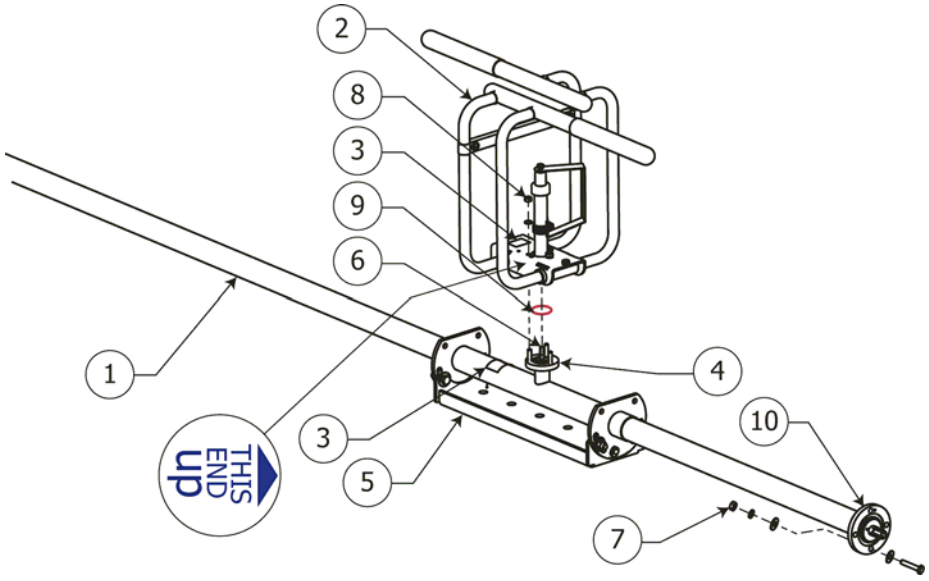
CAUTION

All contact surfaces and openings to the interior of the components are protected from contamination and from physical damage by protective covers and plastic bags. Do not remove this protection until ready to connect the components.

(2) Remove the plastic bag and protective cover from the baymount flange.

(3) Make sure an inner conductor connector (6) is in place in the inner conductor of the baymount flange of the feedline.

Figure 5. Radiator installation



1	Feedline section	6	Inner conductor connector
2	Radiator assembly	7	Feedline flange hardware
3	Bay number markings	8	Baymount flange hardware
4	Baymount flange	9	O-ring
5	Back support mount	10	Top feedline flange

NOTE

Feedline flange hardware (7) and baymount flange hardware (8) are shipped separately in plastic bags. Each bag contains the hardware for one flange. O-rings (9) are also shipped in a separate bag.

CAUTION

Be sure the baymount flange O-ring is properly seated in its groove and not pinched between the flange contact surfaces.

CAUTION

All O-rings are made of silicone. Do not lubricate them with silicone grease, as this will soften the O-ring. Use only a light lubricating coat of O-Lube (provided) or petroleum jelly; too much may hamper electrical contact and contaminate the interior of the system.

(4) Coat the baymount flange O-ring lightly with O-Lube (supplied with the antenna), then install it in the O-ring groove in the baymount flange.

Important

Be very careful not to disturb or damage the feed strap when handling the radiator.

(5) Remove the matching radiator assembly (2) from its protective plastic bag.

CAUTION

Feedstrap orientation is critical to performance. In general, the feed-straps in a full-wave-spaced antenna will all be oriented the same, while those in a half-wave-spaced antenna will alternate. *Install each radiator in accordance with its stenciled bay numbers and its "This end up" sticker.*

CAUTION

Be sure the radiator's inner conductor fits cleanly over the baymount's inner conductor connector. If any of the fingers of the connector are forced outside the radiator's inner conductor (we call this a "split bul-let"), this will cause arcing and damage to the antenna.

(6) Align the radiator with the baymount flange as shown in Figure 5 on page 11, with the top (see "This End Up" sticker) pointing toward the top feedline flange (10). Carefully place the radiator into position over the flange studs and inner conductor connector.

(7) First snug the baymount flange hardware (8) in the sequence shown in Figure 1 on page 3, then tighten it in accordance with Table 1 on page 3.

c. Repeat the above steps for the remaining feedline sections.

d. Antenna bay installation is complete. Proceed to Chapter 5, Antenna Installation on the Tower on page 21.

Installing the radomes

You can most easily install your standard radomes on the ground at this time.

NOTE

Radome halves are match-marked in pairs (A and A, B and B, etc.). In order to align the flange bolt holes, be sure to pair them according to their match-markings (Figure 6, 1).

NOTE

Radome match-markings bear no relation to radiator and feedline mark-ings. Install any radome pair on any bay.

a. Select a pair of radome halves match-marked with the same letter designation (A and A, B and B, etc.).

b. Identify the top radome half (2: wide, overlapping mating flange) and the bottom radome half (3: narrow mating flange and drain holes).

c. Separate the top radome mount (4) and the bottom radome mount (5) into their two parts by removing the hardware (6). Keep the hardware for reinstallation.

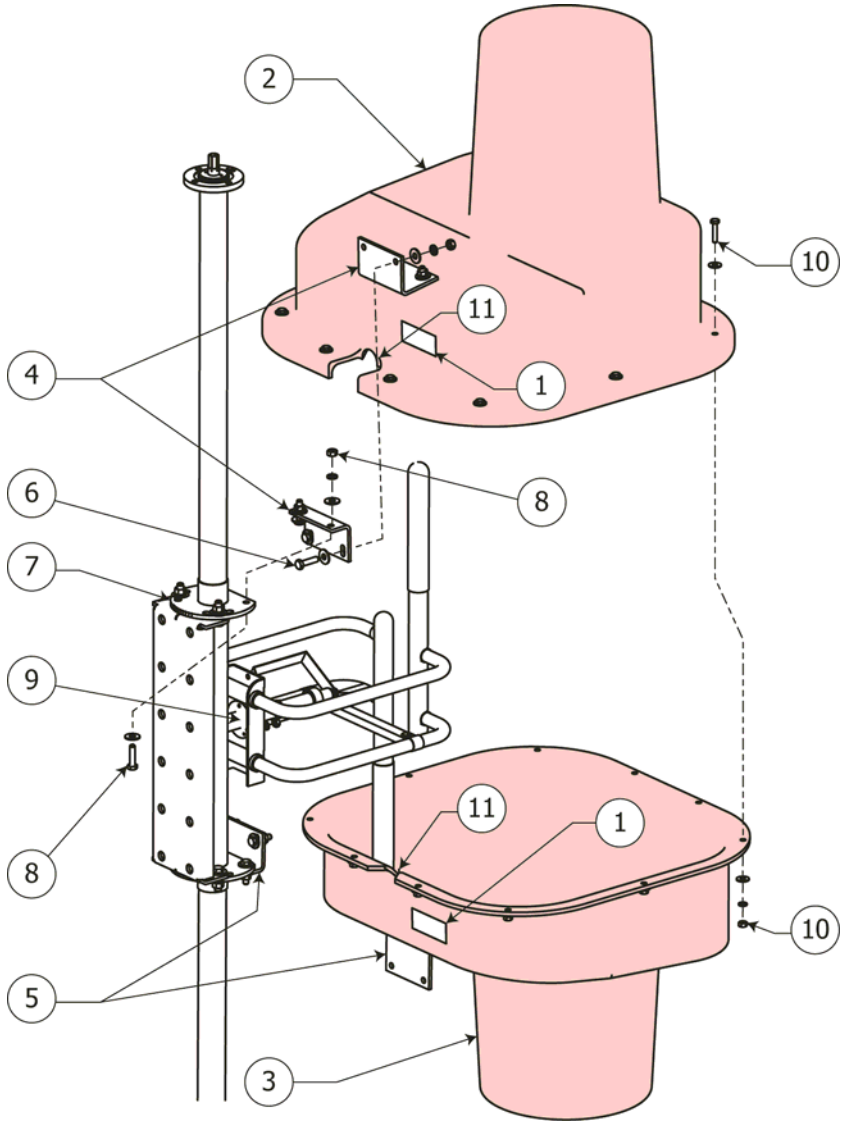
d. Each radome half has a double notch under the mount; the larger outer notch fits over the feedline and the smaller inner notch fits against the baymount.

e. Bolt the removed sections of the radome mounts (4) and (5) to the ring flanges (7), using the hardware (8).

f. Carefully place the top radome half in place, slipping it under the radiator and up against the baymount (9).

g. Slip the removed part of the radome mount into place. Using the hardware removed in step c above, bolt it to the part left on the radome half.

Figure 6. Standard radome installation



1	Match markings	7	Ring flange
2	Top radome half	8	Hardware
3	Bottom radome half	9	Baymount
4	Top radome mount	10	Radome flange hardware kit
5	Bottom radome mount	11	Gap at feedline
6	Hardware		

h. Carefully place the bottom radome half in place, slipping it under the radiator and up against the baymount, with its flange inside the larger flange of the upper radome half. Secure it in place in the same manner as the top radome half, in steps e and f above.

i. Using the flange hardware kit, (10), fasten the two radome halves together loosely, starting near the feedline and working around both sides to the outer edge. It may be necessary to squeeze the radome flanges together to start the nuts.

j. Tighten all hardware securely.

CAUTION

Be very careful to seal the joint completely. If water enters the radome, the antenna will not perform as expected, and may cause damage to your entire system.

k. Seal the gap (11) where the radome encircles the baymount with the silicone sealant supplied with the antenna.

l. Repeat the above steps for the remaining radiators.

m. Antenna bay installation is complete. Proceed to Chapter 5, Antenna Installation on the Tower on page 21.

4 Bay Installation (with XXLR radomes)

Precautions

WARNING

Don't expose personnel to the medical hazards of intense radio frequency (RF) radiation. Whenever working on the tower in the area of the antenna, turn off all transmitters and lock them out so that they cannot be turned on accidentally.

Installing the radome backplates

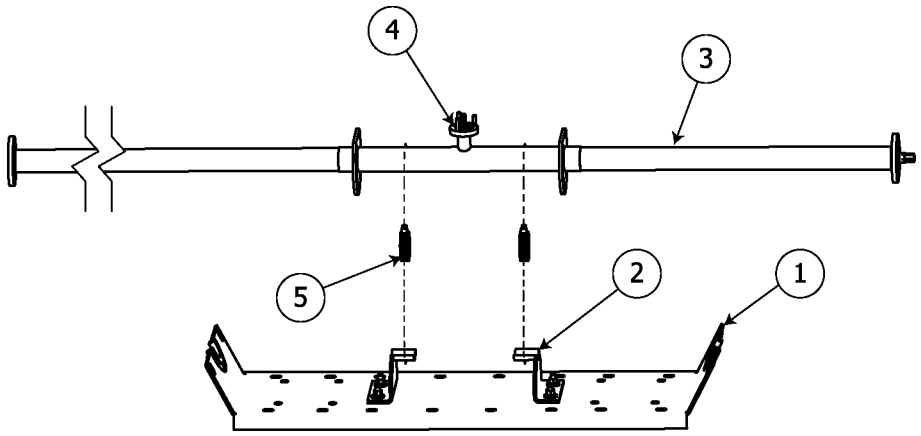
a. Lay a radome backplate (Figure 7, 1) horizontally, with the saddles (2) pointing upward.

b. Lay a feedline section (3) onto the backplate saddles, with the baymount (4) pointing upward and centered between the saddles.

c. Using two clamps (5), secure the feedline to the backplate saddles.

d. Repeat the above steps for the remaining feedline sections.

Figure 7. Radome backplate installation



1	Radome backplate	4	Baymount
2	Saddle (2)	5	Clamp (2)
3	Feedline section		

Installing the bay radiators

It will be easiest to mount the radiators onto the feedline sections before the feedlines are mounted on the tower.

a. Pair up the feedline/backplate assemblies (Figure 8, 1) and the radiator assemblies (2), using the bay number markings (3) on the radiators and feedlines.

b. Attach the bay radiator to the feedline:

(1) Lay a feedline/backplate assembly horizontally, supported off the ground, with its baymount flange (4) pointing upward. Secure it by clamping the radome backplate, to prevent its turning with the weight of the radiator.

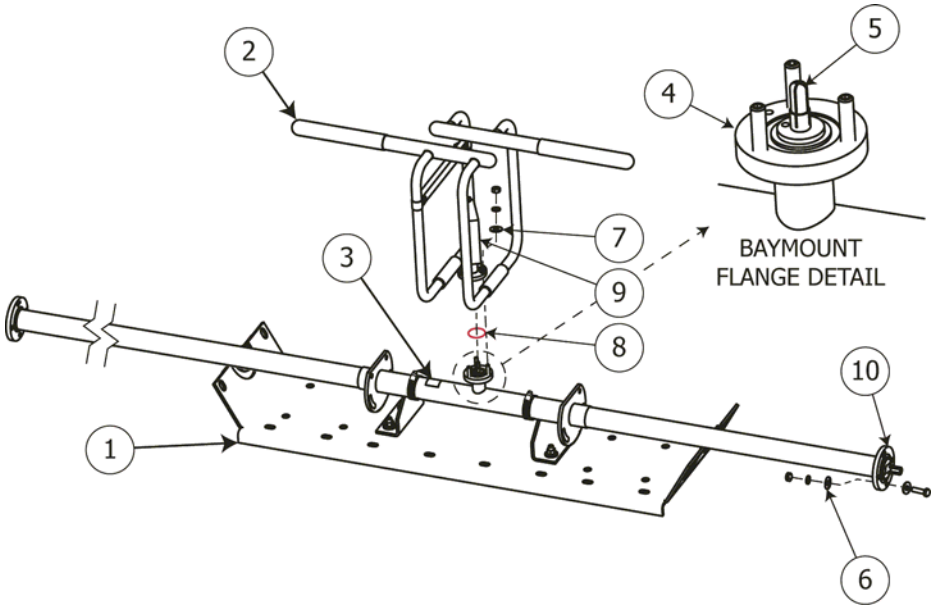
CAUTION

All contact surfaces and openings to the interior of the components are protected from contamination and from physical damage by protective covers and plastic bags. Do not remove this protection until ready to connect the components.

(2) Remove the plastic bag and protective cover from the baymount flange (4).

(3) Make sure an inner conductor connector (5) is in place in the inner conductor of the baymount flange of the feedline.

Figure 8. Radiator installation



Important

Be very careful not to disturb or damage the feedstrap when handling the radiator.

1	Feedline/backplate assembly	6	Feedline flange hardware
2	Radiator assembly	7	Baymount flange hardware
3	Bay number markings	8	O-ring
4	Baymount flange	9	Feedstrap
5	Inner conductor connector	10	Top feedline flange

NOTE

Feedline flange hardware (6) and baymount flange hardware (7) are shipped separately in plastic bags. Each bag contains the hardware for one flange. O-rings (8) are also shipped in a separate bag.

CAUTION

All O-rings are made of silicone. Do not lubricate them with silicone grease, as this will soften the O-ring. Use only a light lubricating coat of O-Lube (provided) or petroleum jelly; too much may hamper electrical contact and contaminate the interior of the system.

CAUTION

Be sure the baymount flange O-ring is properly seated in its groove and not pinched between the flange contact surfaces.

(4) Coat the baymount flange O-ring lightly with O-Lube (supplied with the antenna), then install it in the O-ring groove in the baymount flange.

Important

Be very careful not to disturb or damage the feedstrap when handling the radiator.

(5) Remove the matching radiator assembly (2) from its protective plastic bag.

CAUTION

Feedstrap orientation is critical to performance. In general, the feed-straps (9) in a full-wave-spaced antenna will all be oriented the same, while those in a half-wave-spaced antenna will alternate. *Install each radiator in accordance with its stenciled bay numbers and its "This end up" sticker.*

CAUTION

Be sure the radiator's inner conductor fits cleanly over the baymount's inner conductor connector. If any of the fingers of the connector are forced outside the radiator's inner conductor (we call this a "split bul-let"), this will cause arcing and damage to the antenna.

(6) Align the radiator with the baymount flange as shown in Figure 8, with the top (see "This End Up" sticker) pointing toward the top feedline flange (10). Carefully place the radiator into position over the flange studs and inner conductor connector.

(7) Secure the radiator to the baymount flange, using the baymount flange hardware (7). First snug hardware in the sequence shown in Figure 1 on page 3, then tighten them in accordance with Table 1 on page 3.

c. Repeat the above steps for the remaining bay radiators.

Installing the radomes

You can most easily install your radomes on the ground at this time. Radomes are shipped assembled and therefore do not need match-markings.

a. Identify the top radome half (Figure 9, 1: wide, overlapping mating flange) and the bottom radome half (2: narrow mating flange and drain holes).

b. Separate the radome halves, keeping the 1/4" radome flange hardware (3) for installation.

c. Remove the closure plate hardware (4) at the edges where the mount will slip under the closure plates. Loosen the remaining closure plate hardware and leave the top closure plate (5) and bottom closure plate (6) in place on the radomes.

d. Install the tower mounts (7) onto the backplate, using the 1/2" bolts and hardware (8).

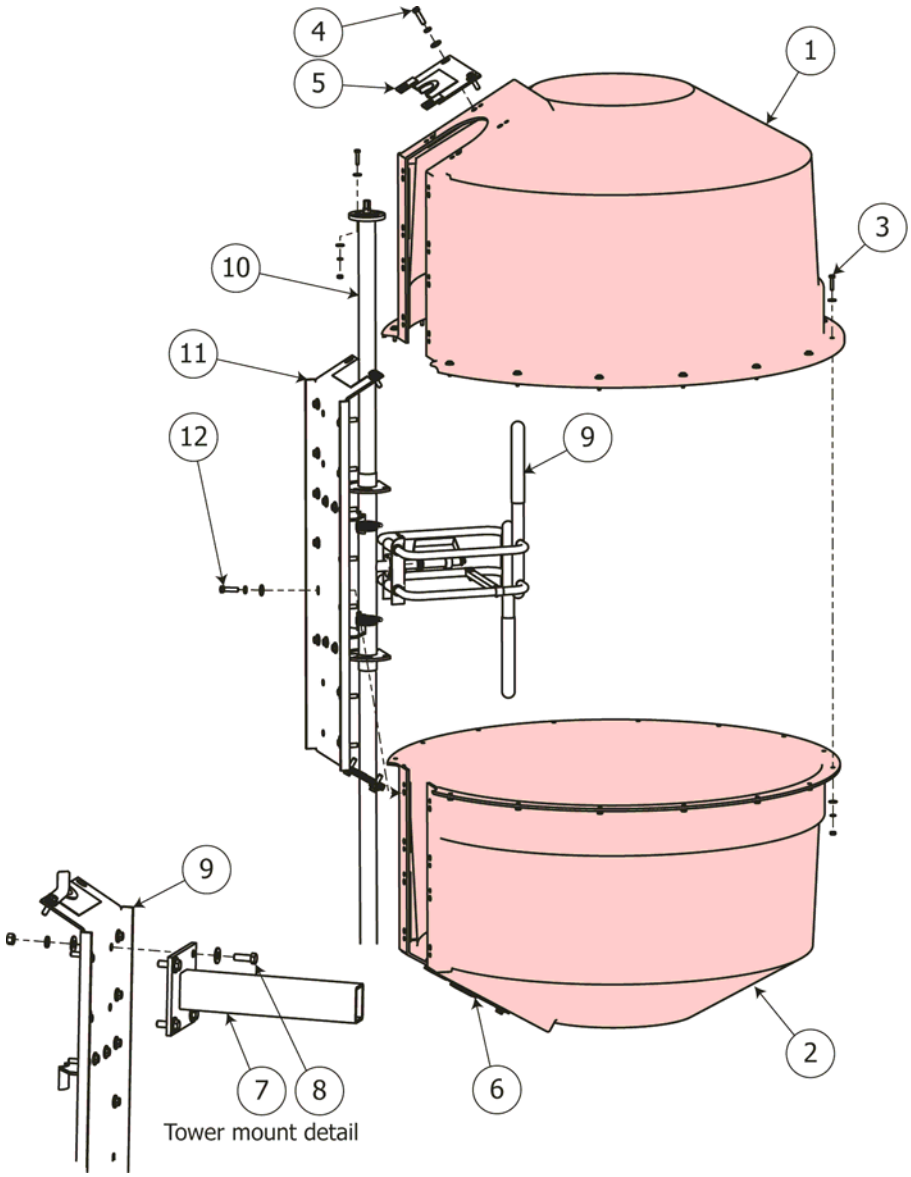
e. Install the radome:

(1) Place the top radome half (1) over the bay radiator (9) and feedline (10) and into the radome backplate (11), slipping the ends of the backplate under the top closure plate (5).

(2) Place the bottom radome half (2) over the radiator (7) and feedline (8) and into the backplate and top radome half, inserting the end of the radome backplate under the bottom closure plate (6).

(3) Bolt the radome halves loosely to the backplate with the radome-backplate hardware (12).

Figure 9. XXLR Radome installation



1	Top radome half	7	Tower mount (2)
2	Bottom radome half	8	1/2" bolt & hardware
3	Radome flange hardware	9	Bay radiator
4	Closure plate hardware	10	Feedline section
5	Top closure plate	11	Radome backplate
6	Bottom closure plate	12	Radome-backplate hardware

NOTE

You may have to squeeze the radome flanges together slightly with a clamp to start the nuts. Get all these nuts and bolts in place before tightening them.

(4) Fasten the two radome halves together with the 1/4" radome flange hardware (3), starting at the feedline side and working around both sides to the outer edge. Tighten the radome flange hardware.

f. Reinstall the closure plate hardware (4) and tighten it.

g. Tighten the radome-backplate hardware (12).

Important

Be very careful to seal the radome completely. If water enters the radome, the antenna will not perform as expected, and may cause damage to your entire system.

h. Seal the closure plates and the joints where the radome meets the backplate with the silicone sealant supplied with the antenna.

i. Repeat the above steps for the remaining radiators.

j. Antenna bay installation is complete. Proceed to Chapter 5, Antenna Installation on the Tower on page 21.

5 Antenna Installation on the Tower

Precautions

WARNING

Don't expose personnel to the medical hazards of intense radio frequency (RF) radiation. Whenever working on the tower in the area of the antenna, turn off all transmitters and lock them out so that they cannot be turned on accidentally.

Installing the feedline assemblies on the tower

Feedline mounts vary from installation to installation, to accommodate various tower and mounting pole requirements. Figure 10 shows several common configurations. Your feedline mounts may be one of the common designs shown; if they are not, they will be shown in detail on your installation drawing.

Before you begin installation, study the mounts, the mounting tower leg(s) or pole, and your installation drawing carefully, to determine which mount(s) will be used for each component.

a. Prepare the tower for mounts:

   (1) On the tower, starting at the top, use a steel measuring tape to find the location of each bay in accordance with the installation drawing. Mark the mount locations.

   (2) Mark the specified location of any accessory mounts, such as for the transformer or special coax input line sections, to make sure they will fit as planned.

   (3) Watch carefully for any interferences by tower members or guy wires which were not accounted for in the design.

   (4) Where the mounts will be in contact with the tower leg(s) or mounting pole, scrape the tower paint away to ensure good electrical contact.

b. Install the feedline sections:

CAUTION

Feedline flanges are match-marked. Assemble components in accordance with their match-markings (see Figure 11) and the installation drawing. If you don't, the antenna will not perform as expected.

CAUTION

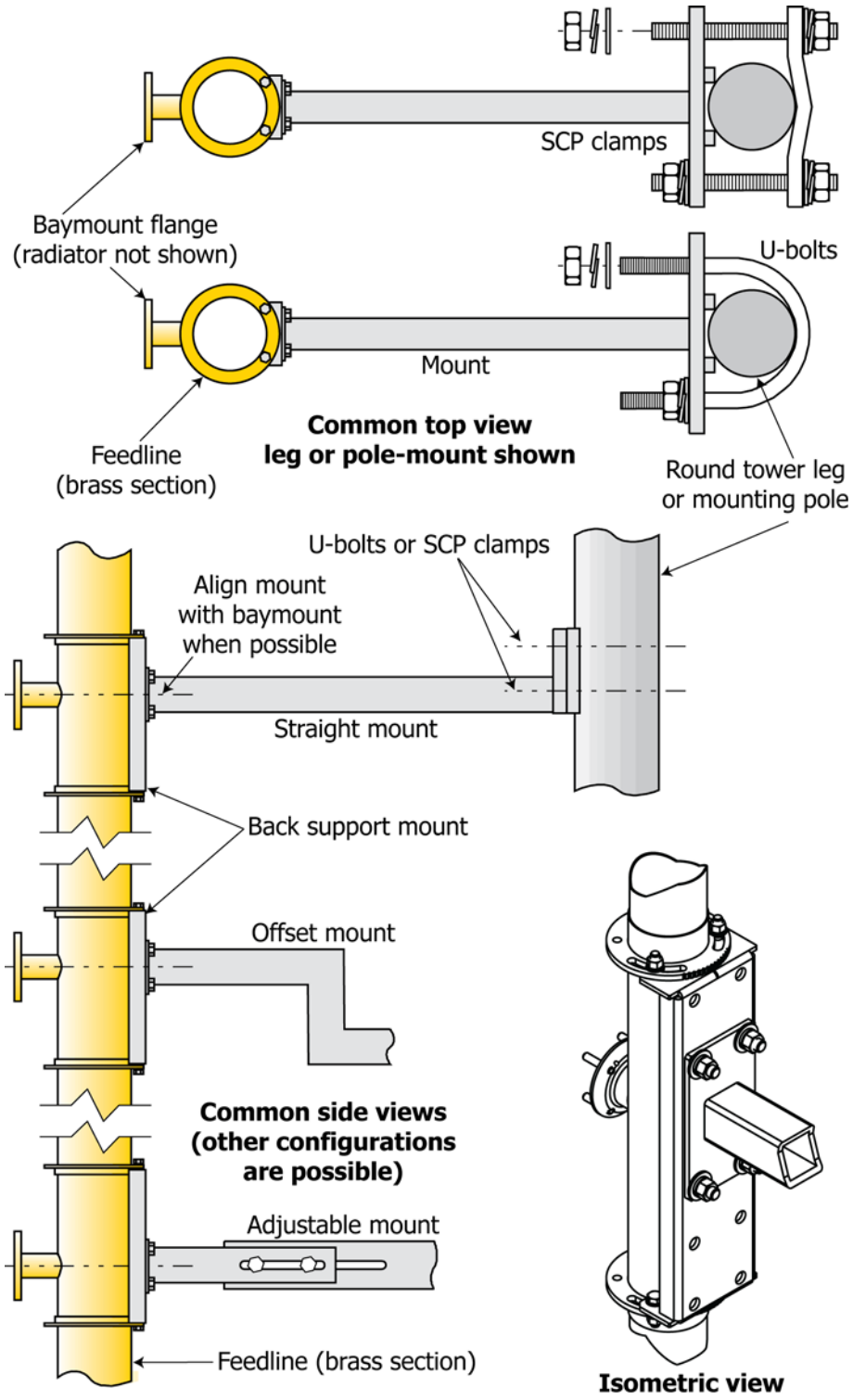
Secure each feedline section to its mount before installing the next section, tightening in accordance with Figure 1 and Table 1.

   (1) Starting at the top of the antenna array, install the feedline and feedline mounts carefully, in accordance with your installation drawing and the illustrations in this chapter.

Figure 10. Common feedline mount configurations

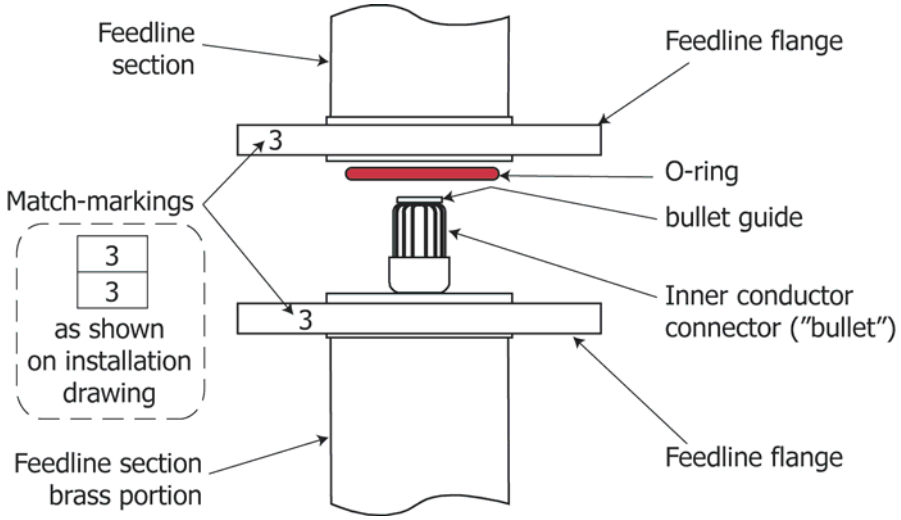
Important

Be very careful not to disturb or damage the feed strap when handling the radiator.



Mounts may vary from bay to bay, especially on tapered towers or where tower obstructions exist. See your installation drawing for your mount configuration and special requirements, if any.

Figure 11. Feedline flange detail



Important!

To avoid damage to the antenna, always lift, position, and attach each section individually. Never try to transport connected feedline sections! This rule is often violated and is frequently the cause of expensive damage to feedline.

CAUTION

The feedline inner conductors include "bullet guides" (see Figure 11) to help prevent split bullets. Be sure the bullet guides are in place before assembly.

CAUTION

Do not overtighten the feedline flange hardware (see Table 1 on page 3). Only the contact surfaces should touch, as shown in Figure 11.

(2) As each feedline section is lifted into place, remove the plastic bags and protective covers from the flanges and install an O-ring, lubricating it with a light coat of petroleum jelly (provided with the antenna).

NOTE

In most cases, the mounts are reversible to clear tower cross-members and other obstructions.

(3) Align the mounts to the tower leg(s) or mounting pole, then secure them to the back support mount using box bolts.

(4) Last, secure the mounts to the tower in accordance with your installation drawing (commonly using 1/2" hardware, supplied with the antenna).

(5) When all mounts are in place, sight along them vertically and align them before finally tightening the hardware.

c. Touch up any exposed metal on the tower or pole.

If any problems appear during this process, please call Shively Labs and discuss them with the installation designer.

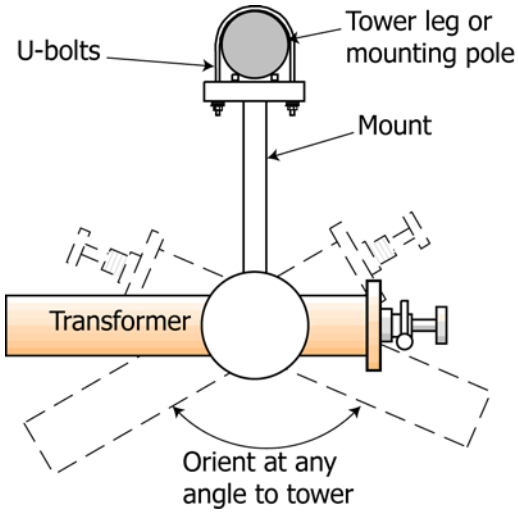
Installing the transformer

One of the unique features of Shively Labs antenna systems is the adjustable impedance-matching transformer provided with the antenna. It allows the installer to compensate for changes in the input impedance caused by the installation (tower, conduit, ladder, etc.).

NOTE

The transformer may be oriented in whichever direction you wish (see Figure 12). Make it easy for yourself to reach for adjustment at startup.

Figure 12. Transformer Installation, top view



Install the transformer between your transmission line and the feedline. The male end (with the inner conductor connector in place) always goes at the top. Transformer mounts are generally similar to feedline mounts and should be installed in the same manner.

6 De-Icer Installation (if applicable)

Precautions

WARNING

Installation should be performed only by personnel experienced in RF systems, qualified in electrical work, and familiar with this equipment.

WARNING

Don't expose personnel to the medical hazards of intense radio frequency (RF) radiation. Whenever working on the tower in the area of the antenna, turn off all transmitters and lock them out so that they cannot be turned on accidentally.

CAUTION

All parts of the de-icer system within approximately 20 feet (6 meters) of any radiator must be shielded from RF energy, and the entire outdoor portion of the system must be made waterproof.

CAUTION

An improperly installed de-icer can overheat and damage your antenna.

De-icer system description

The de-icer system consists of the heating elements in the bays, their branch cables, and the main harness. The main harness consists of a bay junction box for each antenna bay, interbay cables, and a "pigtail" of wires about 10 feet (3 meters) long which you will connect to the tower junction box you are to provide. The following will help in installation:

- System electrical schematic: Figure 13 on page 26.
- Electrical specifications: Table 2 on page 27.
- Bay junction box: Figure 14 on page 28.
- Thermostat readings: Table 3 on page 29.

Your system may also include specially-ordered items, such as a ground-mounted main control box, a power cable extending up the tower, or a tower-mounted dual-setting thermostat.

Dual-setting thermostat

CAUTION

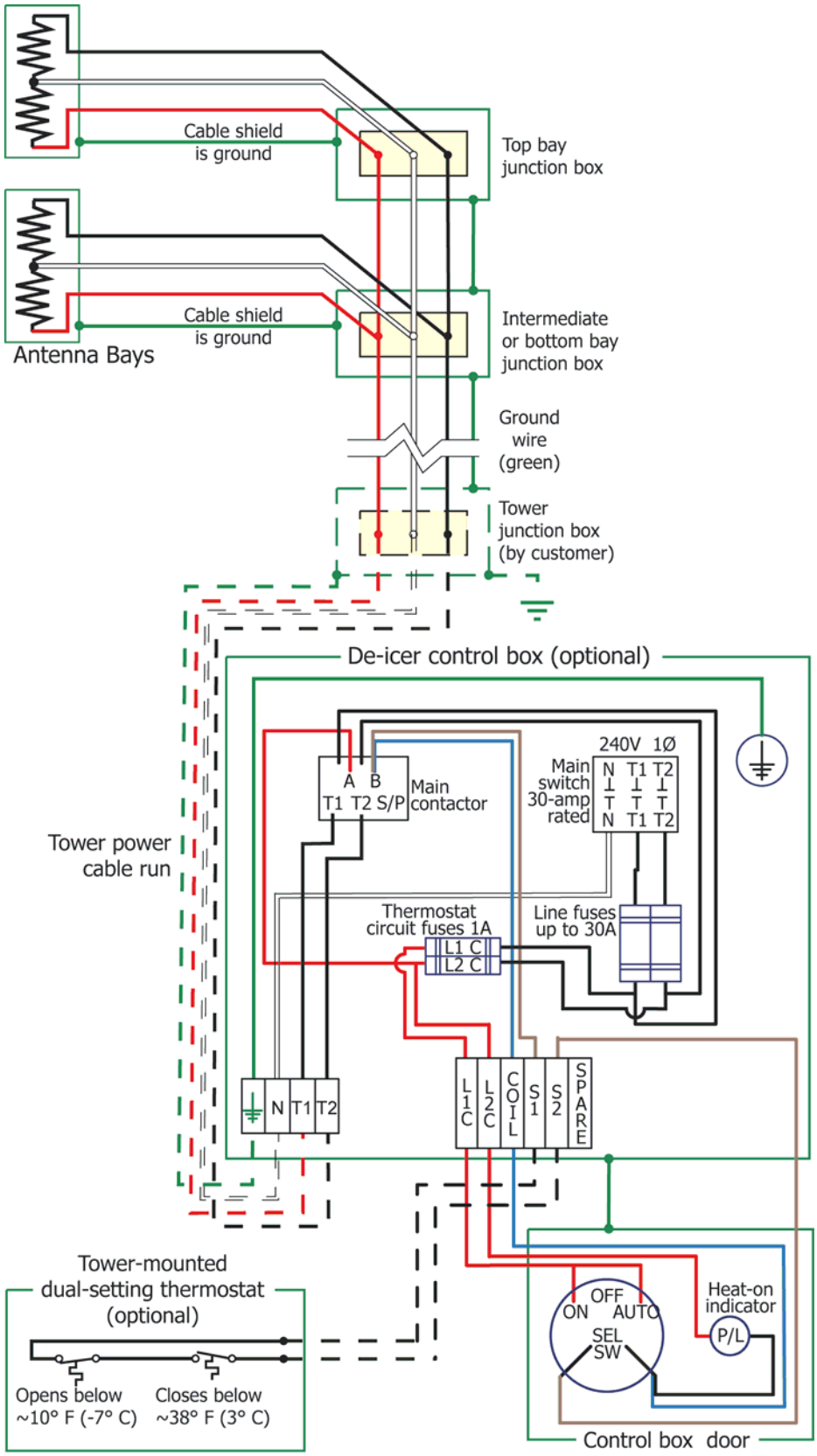
Remember that conditions may be favorable for icing on the tower, even if they are not on the ground.

Shively Labs de-icers are designed to prevent ice from forming on antenna elements and are not designed to melt ice that has already formed. For this reason, Shively Labs recommends that the system be installed with a tower-mounted dual-setting thermostat assembly (Shively Labs Model 55522-G502) and de-icer control box (Shively Labs Model 94068) that ensure the de-icers are operated in the temperature range ice is most likely to form.

Electric power

The de-icer system requires 220 VAC, 50 - 60 Hz., single-phase. Table 2 on page 27 shows approximate heater leg resistances and current draw, respectively, measured at the tower junction box (Figure 13 on page 26).

Figure 13. De-icer electrical schematic diagram



NOTE

Customer-supplied items are shown in broken lines.

NOTE

A liquid-tight conduit connector (3/8" conduit size by 1/2" hub size) for the harness entry to the tower junction box, is packed loose with the de-icer harness.

NOTE

Shively recommends the use of shielded braided polyethylene-covered wire or rubber-sheathed flexible metal conduit or rigid conduit and weather-tight fittings at all junctions.

Table 2. De-icer specifications

	Low-Band (88.0-97.9 MHz		High-Band (98.0-108.0 MHz)	
	Heater Leg Resistance, Ω	Heater Leg (T1 or T2) Current Draw, amps	Heater Leg Resistance, Ω	Heater Leg (T1 or T2) Current Draw, amps
1-Bay, single circuit	85	1.3	75	1.5
2-Bay	42	2.6	38	2.9
3-Bay	28	3.9	25	4.4
4-Bay	21	5.2	19	5.8
5-Bay	17	6.5	15	7.3
6-Bay	14	7.8	13	8.8
7-Bay	12	9.1	11	10.2
8-Bay	11	10.4	9	11.7
10-Bay	8	13.0	8	14.6
12-Bay	7	15.6	6	17.5
14-Bay, each of 2 circuits	12	9.1	12	10.2
16-Bay, each of 2 circuits	12	10.4	8	11.7

Installing the de-icers

Installing the de-icer harness

a. Install the main de-icer harness with its bay junction boxes as shown in Figure 13 on page 26 and Figure 14 on page 28. Connect the leads from each bay's de-icer pigtail to the main harness in that bay's junction box as shown.

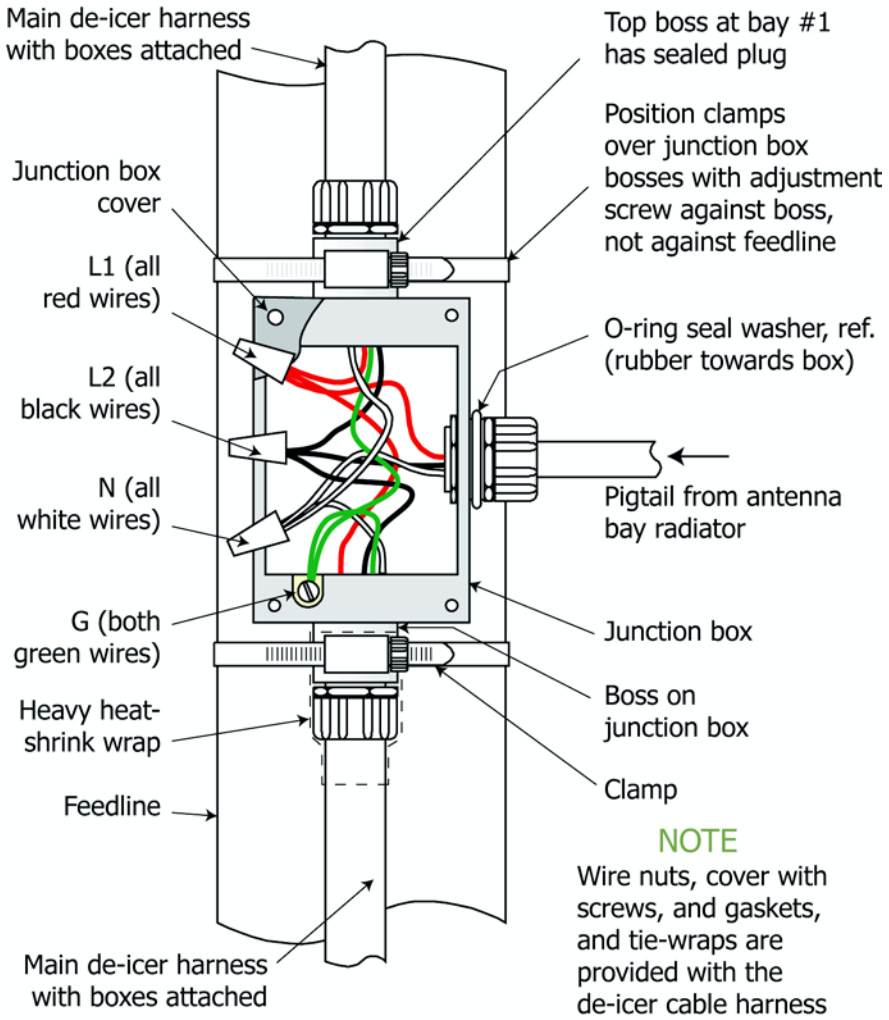
CAUTION

It is important to ground both the tower junction box and the control box, as shown in the schematic diagrams.

b. Furnish a tower junction box as shown schematically in Figure 13 to connect the antenna's de-icer harness to the main power.

c. Using tie-wraps, secure the entire length of the de-icer harness to the RF feedline at about 24" (60 cm) intervals. Run the ten-foot de-icer pigtail along a feedline mount to the tower junction box and secure it to the mount and the tower.

Figure 14. Bay junction box installation



CAUTION

Shively Labs's de-icer control box, Model 94068, is designed for interior installation only.

NOTES

Wire nuts, cover with screws, and gaskets, and tie-wraps are provided with the de-icer cable harness.

The antenna pigtail grounds to the box via its braided sheath.

The ground screw may be in a different location from that shown.

Installing the thermostat (if applicable)

If you are using a thermostat, you may locate and mount it at your discretion. We recommend mounting it as close as practical to the antenna.

CAUTION

When testing the thermostat, be sure to have one or both thermostat leads disconnected before taking resistance readings. Otherwise, readings may be affected by other components.

a. Before you connect the thermostat, measure the resistance across the thermostat circuit and from it to ground to ensure that there are no short-circuits. Thermostat readings should be as shown in Table 3 on page 29.

b. Mount the thermostat near the antenna and connect the thermostat leads to points S1 and S2 in the control box as shown in the schematic diagram, Figure 13 on page 26.

Table 3. Thermostat readings

Reading Location	Ambient Temperature	Resistance = 0 ohms (short circuit)	Resistance = infinite ohms (open circuit)
Leg-to-Ground	Any	Defective thermo-stat or shorted leads	OK
Leg-to-Leg	Above about 38° F(3.3° C)	Defective thermo-stat or shorted leads	OK
	Between about 10° and about 38° F (-6.7° to 3.3° C)	OK	Defective thermo-stat or broken leads
	Below about 10° F (-6.7° C)	Defective thermo-stat or shorted leads	OK

7 Startup and Operation

Precautions

Important

Shively Labs will not accept responsibility for antenna failure after operation without proper purging or positive pressure of dry air or dry nitrogen.

Pressurization

After the antenna is installed and all lines are connected, it is necessary to check the system for leaks, purge with dry gas (cylinder dry nitrogen or air from a compressor-dehydrator) to remove all moisture, and leave the system pressurized with dry gas to avoid future infiltration of moisture. These steps must be taken before RF power is applied to the system.

CAUTION

When pressurizing the system, never use a "garage" air compressor, as it will not clean the air and will blow both moisture and contaminants such as oil and graphite into the coaxial system.

Test for leaks

a. Connect a source of dry gas (cylinder nitrogen or air from a compressor-dehydrator) to the system as shown in Figure 15 on page 32.

CAUTION

Be sure to use a good quality pressure gauge which will read accurately in the 5 - 20 psig (35 - 135 kPa) range; don't depend on the cylinder gauge, which will not be accurate at a low pressure.

b. Pressurize the system to seven (7) psig, then close the shutoff valve. Give the system one half hour to stabilize, then record the pressure and the temperature.

c. Wait twenty-four hours, then read the pressure and the temperature again and use the pressure correction formula at left to obtain a corrected pressure for comparison.

d. If the system loses pressure at an unacceptably high rate, re-pressurize it, leaving the gas supply on. A rule of thumb is that the final pressure should not be less than half the initial pressure after twenty-four hours.

e. Find the leak(s), using a leak detector or soap bubbles. (The most common cause of leakage is an O-ring pinched in a flange.)

f. Correct any leaks that are found. Then repeat the leak test until the results are satisfactory.

Pressure Correction:

$$P_c = \frac{(P_R + 14.7)(T_1 + 460)}{(T_2 + 460) - 14.7}$$

where P_C = corrected final pressure, psig

P_R = final pressure as read, psig

T_1 = beginning temperature, degrees F.

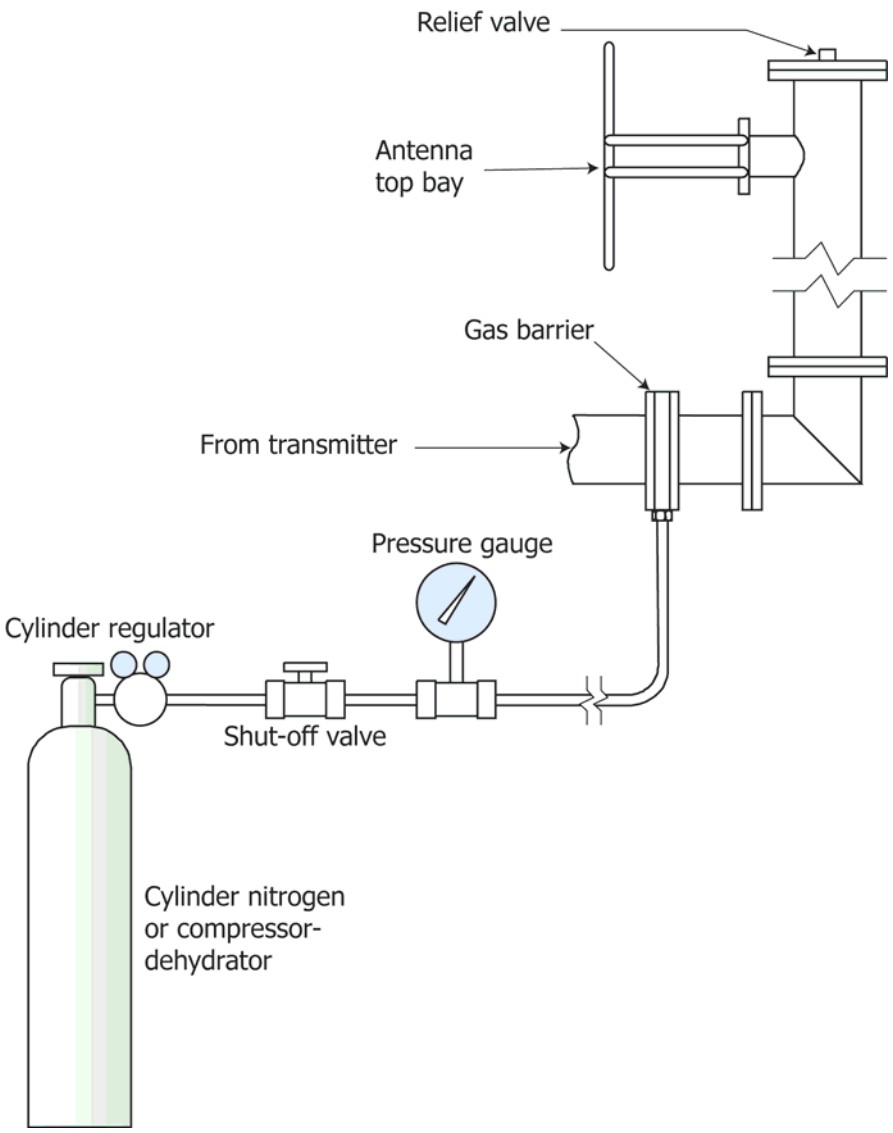
T_2 = final temperature, degrees F.

Purge the system

All pressurized Shively Labs antennas have a pressure relief valve at the top of the feedline (center-fed feedlines have a relief valve at each end). This valve is set to open at about 10 psig. So, to purge the system, it is not necessary to send a worker to the top of the antenna to open a valve or loosen a flange. Simply raise the internal pressure enough to open the relief valve. When the purge is complete, lower the pressure and the valve will close.

When the system is new, and any time that it has been opened, it must be purged with dry gas before operation to eliminate moisture. The dry gas used may be dry cylinder nitrogen or air from a compressor-dehydrator.

Figure 15. Pressurized gas schematic



CAUTION

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

Purge your system as follows:

a. If you have any liquid water in your transformer or your transmission line, use a vacuum pump to dry the transmission line and transformer. Apply as much vacuum as you can to the system and hold the vacuum for 8 hours. This should remove any liquid water. [A vacuum pump can be rented or borrowed from a refrigeration contractor.]

b. Determine how wet the system is and thus how much purging will be required. If a system of rigid line carefully protected from weather and assembled in dry weather is average, a system exposed to moisture during storage or installation will be relatively wet. New semi-flex transmission line, delivered pressurized with dry gas, will be relatively dry; used semi-flex will be extremely wet.

c. Determine the volume of dry gas to use for the purge. Table 4 shows approximate volumes inside various coax sizes. Add the length of the antenna to the length of the transmission line to determine the overall length of the system. You may ignore the volume inside the radiators. We suggest three volume changes of dry gas for an "average" system.

Table 4. Volume of coax per 1000 feet of length

Coax Size	Volume
1-5/8"	13 cu ft. (0.37 m^3)
3-1/8"	50 cu. ft. (1.4 m^3)
4-1/16"	90 cu. ft. (2.6 m^3)
6-1/8"	200 cu. ft. (5.7 m^3)
9-3/16"	450 cu. ft. (13 m^3)

NOTE

A standard nitrogen cylinder (9 inch diameter by 55 inches tall) contains about 200 cubic feet (5.7 m^3) of gas.

CAUTION

Do not raise pressure over 20 psig (~135 kPa), even briefly. Increase pressure slowly, noting that it takes time for the entire system to fill with the new pressure and the pressure gauge to stabilize.

d. Connect a source of dry gas (cylinder nitrogen or air from a compressor-dehydrator) to the system as shown in Figure 15. Raise the gas pressure to 12 or 13 psig (83 - 90 kPa).

CAUTION

You must blow dry gas *through* the system, not just maintain a pressure. The gas *volume* accomplishes the purge.

e. If the relief valve has opened, the nitrogen cylinder will slowly drain or the compressor-dehydrator will not shut down.

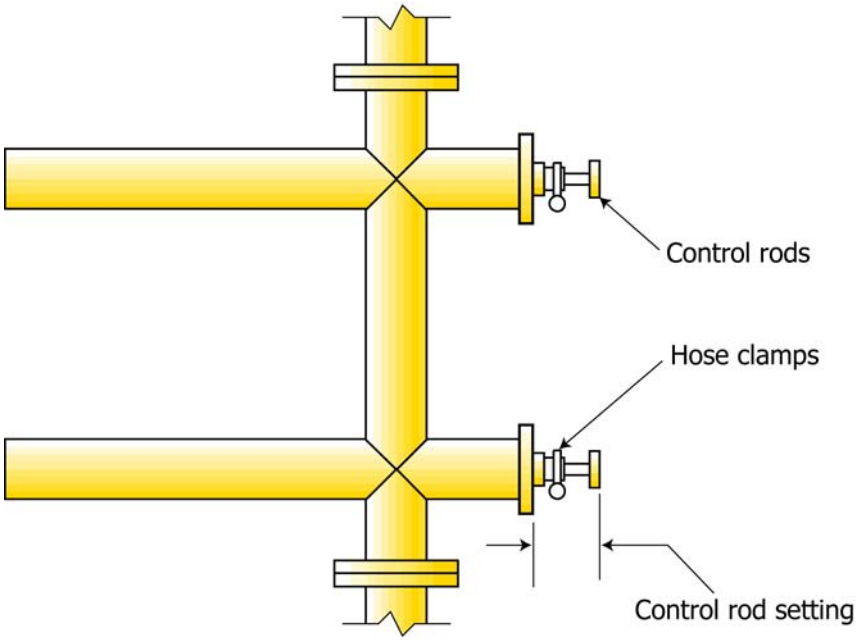
Leave the system pressurized

After completion of the purge, reduce the supply pressure to about 5 to 7 psig (35 to 48 kPa), allowing the pressure relief valve to close and seal the system.

After the pressure has stabilized, keep careful note of cylinder pressure or compressor-dehydrator running time, to be sure that no large leaks have been overlooked. This is especially important immediately after installation or any subsequent opening and reassembly.

Impedance trimming

Figure 16. Impedance-matching transformer



The transformer has been factory-adjusted to 50 ohms at your frequency. You will find a scribed line on each control rod shaft. It can be operated at that setting, but it will give optimal performance on your tower if you readjust it after installation.

Adjust the transformer as follows:

a. Loosen the hose clamps on the control rods enough to allow the rods to move.

b. Grasp either control rod 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.

Table 5. Factory control rod settings

Nominal Transformer Size	Factory Control Rod Setting (Figure 16 on page 34)
1-5/8″	3-3/4" ± 1/16" (95 ± 1.5 mm)
3-1/8"	2-3/4" ± 1/16" (69 ± 1.5 mm)
4-1/16"	3-1/2" ± 1/16" (89 ± 1.5 mm)

d. Keep adjusting the same rod until no further improvement is seen. Adjust the second rod in the same manner. If you get "lost," return both rods to the factory setting (Table 5) 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.

f. VSWR at this point should be below 1.10 : 1. 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 where it leaves the flange collar.

h. Record the control settings of the two control rods and file this information with this manual for future reference.

i. Tighten both hose clamps. If the clamps are left loose, vibration may change the adjustments.

Sweeping the system (recommended)

Shively Labs strongly recommends that you perform a system sweep of your transmission line and antenna while you have the installation crew on site. Should any problems arise later with your antenna, it will be extremely helpful to know what the system's characteristics were when it was new. We recommend you perform a system sweep after installation.

CAUTION

A high voltage standing wave ratio (VSWR) may indicate damaged transmission line or incorrectly assembled components. This condition will cause serious damage to your equipment when full power is applied.

Many riggers can sweep your system after installation or recommend a contractor to perform it. Alternatively, Shively Labs makes available instructions for system sweep on our Web site, www.shively.com and can provide field service.

Checkout

Before beginning checkout of the antenna system, be sure the following items have been done:

- The antenna system has been installed in accordance with this manual and the installation drawing.
- The de-icer system, if purchased, has been checked out in accordance with Chapter 6.
- All radiators are operating; impedance has been trimmed, and VSWR is low.
- The transformer settings and system sweep data have been recorded.
- The system is gas-tight and purged.

Check the system out as follows:

a. Bring up RF power slowly and observe transmitter readings, stability, and general operation.

b. Run at about half power for at least an hour, reading forward and reflected power, stability, etc.

c. If the system is stable and seems to be operating properly, bring it up to full power. Take initial readings, and repeat the readings periodically.

d. Performance readings should not change, and there should be no evidence of heating in the antenna system.

If any problem is found, fix it now. Call Shively Labs if you need help or advice.

Operating the antenna

CAUTION

Don't exceed the rated power capacity of the antenna.

To obtain the best performance and dependability, read and follow the maintenance and troubleshooting recommendations in Chapter 8 of this manual.

Operating the de-icer system

CAUTION

Don't leave the de-icer on for extended periods when the weather is above 50° F (10° C); doing so may shorten the life of the heater element(s).

There is a generous margin of safety built into the de-icer system, and operation for prolonged periods below 50° F (10° C) will not harm the system. If icing conditions are expected, the heaters should be turned on in advance as a preventive measure. It is much easier to prevent ice formation than to remove a heavy coating.

Shively Labs de-icer control system

If you have the Shively Labs de-icer control box and dual-setting thermostat, you have the choice of manual or automatic operation. There are three switch settings: AUTOMATIC, OFF, and MANUAL.

- When the switch is set to AUTOMATIC, the thermostat turns the heaters on and off according to the temperature.
- When the switch is set to OFF, the thermostat is overridden and the heaters will stay off no matter what the temperature.
- When the switch is set to MANUAL, the thermostat is overridden and the heaters will stay on no matter what the temperature.

8 Maintenance

Precautions

WARNING

Maintenance should be performed only by personnel experienced in RF systems and familiar with this equipment.

WARNING

Don't expose personnel to the medical hazards of intense radio frequency (RF) radiation. Whenever working on the tower in the area of the antenna, turn off all transmitters and lock them out so that they cannot be turned on accidentally.

Important

When you have had the system open for repair, you must purge it again as described in Purge the system on page 31. Never begin operating the system under power until you are sure all the moisture has been purged from it. You can do permanent damage to the entire system, including the transmitter.

CAUTION

When removing or replacing radiators on the tower, never let the weight of the radiator hang on the inner conductor without bolting. This will damage the connector and possibly the inner conductor itself. Support the weight of the radiator until the flange bolts are tightened.

CAUTION

All O-rings are made of silicone. Do not lubricate them with silicone grease, as this will soften the O-ring. Use only a light lubricating coat of O-Lube (provided) or petroleum jelly; too much may hamper electrical contact and contaminate the interior of the system.

Be sure the O-ring is properly seated in its groove and not pinched between the flange contact surfaces.

Maintenance log

Shively recommends that you keep a maintenance log; in it record performance parameters such as readings of VSWR and de-icer current draw.

Such a log can be invaluable in spotting and identifying problems. Sample maintenance log on page 41 shows a suggested log form you may use if you like.

Physical inspection

The antenna system should operate for years if properly installed and maintained. Shively Labs recommends that as a minimum, the antenna should be physically inspected *at least once a year*.

In addition, inspect the antenna after severe weather events, and after climbers have been on the tower working on equipment above the antenna.

Important

Give your antenna a full inspection at least once per year!

In addition to checking the general condition of the antenna and coax:

- Replace dented, broken or bent components.
- Inspect radomes for cracks and plugged drain holes.
- Re-tighten all hardware, hose clamps, and U-bolts to installation specifications.
- Inspect hose clamps and U-bolts carefully for signs of wear or fatigue caused by vibration or tower movement.

Checking the de-icers

Periodically (we suggest at the end of each winter season), check the condition of the de-icer wiring with an ammeter; compare the legs of the system with each other and with initial readings taken at installation. If an ammeter is not available, resistance readings of each leg will suffice.

Paint

The radiators should never be painted (a coating of paint affects VSWR), and they need no surface protection, since they are made of copper and brass. This includes Teflon or other "ice-prevention" coatings.

It is not necessary to paint the feedline, although no harm will result from doing so.

Removing a radiator for repair

In some cases, a damaged radiator may be removed and returned to the factory for repair. The system can then be sealed with a pressure cap, and operation of the antenna can resume with proportional power reduction and increased VSWR.

See the Shively Web site, www.shively.com, for part numbers of pressure caps and other components.

Operating with missing bays may not be possible with some transmitters or antennas that have only a few bays, since some transmitters will not operate into loads with high VSWRs. Contact Shively Labs before attempting this process.

Return policy

When returning any material to the factory, be sure to call your sales representative and obtain an returned material authorization (RMA) number first. Use this number in all correspondence. This number helps us to track your returned item. It will expedite repair or replacement and prevent loss of your material.

Troubleshooting

Cantact Shively Labs if necessary to help find the cause of your problem. Outside of 8:00 AM to 5:00 PM Eastern Time, call (207) 329-5118.

Internal arcing

The following may cause internal arcing:

- Physical damage to transmission line, feedline, or radiators. Damage may have been caused by ice, lightning, tower work, or many other factors. Damage may cause arcing directly or by allowing water inside the system.
- Missing or misaligned O-ring, if the system has been opened recently.
- Loss of pressurization.

Broad spectrum RF noise

This indicates that some metal components are not in good electrical contact with the tower. First, check your antenna mounts, then other tower components, to be sure that the tower paint has been scraped away and that all mounting hardware is tight.

Any metal part in poor contact with the tower will constitute a non-linear junction and cast a broad-spectrum signal. This includes antennas, transmission line, mounts, ladders, and other electrical components.

High VSWR at startup or during operation

High VSWR (Voltage Standing Wave Ratio) is caused by any factor which changes the impedance match between the transmitter and the antenna system.

The following may cause high VSWR:

- Wrong antenna for the application and frequency. Make sure the antenna is the correct frequency.
- Split bullet in the transmission line or in the baymount (see Figure 11 on page 23). A split bullet is an inner conductor connector misaligned such that one or more of its contact arms is stuck outside the conductor instead of inside. (A missing bullet will cause infinite VSWR.)
- Mismatched assembly of the antenna. The bays must be paired properly with their respective feedline sections, and the assembly must be exactly as shown in the installation drawing.
- Radiators out of sequence (especially on a center-fed, null-filled, or half-wave-spaced system).
- Damaged feed strap(s) on a radiator. The feed strap is the brass strip that extends back from the end seal. The length, angle, and straightness of the feed strap are critical to the radiator's performance.
- Components of other services have entered the RF field (later installations or broken components).
- Physical damage to the transmission line, feedline, or radiators. This may be from ice, lightning, tower work, or any other source.
- Paint applied to the radiators, possibly during a recent tower painting.
- Failure of de-icers, causing excessive ice buildup on one or more radiators.
- Domes missing from vertical arms. An overheating de-icer can melt the solder from domes, spacers, and bushings at the ends of the vertical arms.

Erratic VSWR during impedance trimming

If VSWR readings during transformer adjustment as described in Impedance trimming on page 34 do not respond reasonably consistently to transformer adjustments, then either there is residual water in the transformer, or the transformer is damaged.

Follow this sequence of actions:

a. Repeat the purging process as described in Purge the system on page 31.

b. Try again to trim impedance.

c. If VSWR is still erratic, Your transformer is probably damaged. Contact Shively Labs.

Change in coverage

Changes in broadcast coverage may be caused by the same factors that produce VSWR changes. If coverage seems to have changed, look for VSWR changes and use High VSWR at startup or during operation on page 39 for troubleshooting.

It is important to recognize, however, that apparent changes in coverage may be due to subjective factors or faults of the receiving equipment. Before doing more than checking the VSWR, be sure that an actual coverage change has occurred.

Pressure loss or excessive gas usage

Failure to hold pressure may be caused by the following:

- O-ring missing or poorly installed in transmission line, feedline, or baymount flange.
- Leaky end seal (see Figure 3 on page 6 or Figure 5 on page 11 or Table 8 on page 16 as applicable).
- Loose connecting hardware between line segments or between the baymount and the radiators.
- Mechanical damage to transmission line, transformer, or antenna. Check for leaks using soap solution.

Sample maintenance log

DATE	DE-ICER CURRENT (or resistance)			VSWR	GAS PRESS	OBSERVATIONS Visual Inspection of Antenna, Obstruction Lighting; Hardware Checked; Tower Repairs Accomplished; etc.
	BLACK (b-neut)	NEUT (red-bl)	RED (r-neut)			

9 Parts

Bay components

Table 6. Components, 6813 bay radiator, without deicers or radome & with hardware (per antenna bay)

	Part Number	Description
1.	99006-G504-G1	6813 Bay radiator assembly, low-band 88-90 MHz
	99006-G504-G2	6813 Bay radiator assembly, low-band 90-92 MHz
	99006-G504-G3	6813 Bay radiator assembly, low-band 92-94 MHz
	99006-G504-G4	6813 Bay radiator assembly, low-band 94-96 MHz
	99006-G504-G5	6813 Bay radiator assembly, low-band 96-98 MHz
	99006-G502-G6	6813 Bay radiator assembly, high-band 98-100 MHz
	99006-G502-G7	6813 Bay radiator assembly, high-band 100-102 MHz
	99006-G502-G8	6813 Bay radiator assembly, high-band 102-104 MHz
	99006-G502-G9	6813 Bay radiator assembly, high-band 104-106 MHz
	99006-G502-G10	6813 Bay radiator assembly, high-band 106-108 MHz

Table 7. Components, 6813 bay radiator, with standard radome & with hardware (per antenna bay)

	Part Number	Description
2.	99006-G506-G1	6813 Bay radiator assembly, low-band 88-90 MHz
	99006-G506-G2	6813 Bay radiator assembly, low-band 90-92 MHz
	99006-G506-G3	6813 Bay radiator assembly, low-band 92-94 MHz
	99006-G506-G4	6813 Bay radiator assembly, low-band 94-96 MHz
	99006-G506-G5	6813 Bay radiator assembly, low-band 96-98 MHz
	99006-G505-G6	6813 Bay radiator assembly, high-band 98-100 MHz
	99006-G505-G7	6813 Bay radiator assembly, high-band 100-102 MHz
	99006-G505-G8	6813 Bay radiator assembly, high-band 102-104 MHz
	99006-G505-G9	6813 Bay radiator assembly, high-band 104-106 MHz
	99006-G505-G10	6813 Bay radiator assembly, high-band 106-108 MHz

Table 8. Radomes, Stand-Alone (per antenna bay)

	Part Number	Description
3.	97049-G505	Radome, standard, gray
4.	55177-G509	Radome assembly, XXLR, gray
5.	98315-G501	Kit, radome mounting hardware

Table 9. Components, 6813 bay with de-icers (per antenna bay)

	Part Number	Description
6.	99006-G503-G1	6813 Bay radiator assembly, low-band 88-90 Mhz
	99006-G503-G2	6813 Bay radiator assembly, low-band 90-92 Mhz
	99006-G503-G3	6813 Bay radiator assembly, low-band 92-94 Mhz
	99006-G503-G4	6813 Bay radiator assembly, low-band 94-96 Mhz
	99006-G503-G5	6813 Bay radiator assembly, low-band 96-98 Mhz
	99006-G501-G6	6813 Bay radiator assembly, high-band 98-100 Mhz
	99006-G501-G7	6813 Bay radiator assembly, high-band 100-102 Mhz
	99006-G501-G8	6813 Bay radiator assembly, high-band 102-104 Mhz
	99006-G501-G9	6813 Bay radiator assembly, high-band 104-106 Mhz
	99006-G501-Gl0	6813 Bay radiator assembly, high-band 106-108 Mhz

Table 10. Components, De-Icer System (per array)

	Part Number	Description
7.	95130-G501	Harness & junction box assembly, 1-bay end-fed
8.	95130-G502	Harness & junction box assembly, 2-bay end-fed
9.	95130-G503	Harness & junction box assembly, 3-bay end-fed
10.	95130-G504	Harness & junction box assembly, 4-bay end-fed
11.	95130-G505	Harness & junction box assembly, 5-bay end-fed
12.	95130-G506	Harness & junction box assembly, 6-bay end-fed
13.	95130-G507	Harness & junction box assembly, 7-bay end-fed
14.	95130-G508	Harness & junction box assembly, 8-bay end-fed
15.	95130-G510	Harness & junction box assembly, 10-bay end-fed
16.	95130-G512	Harness & junction box assembly, 12-bay end-fed
17.	95130-G514	Harness & junction box assembly, 14-bay end-fed
18.	95131-G505	Harness & junction box assembly, 16-bay center-fed
19.	2426-2524	Connector, T&B liquid-tight

Table 11. Components, Mount System

	Part Number	Description
20.	97858-01	Kit, universal mount hardware
21.	98359-G502	Saddle assembly, 1-5/8"
22.	98361-G501	Base assembly, mount, universal
23.	01/2-13SS	Nut, hex 1/2-13 SS
24.	01/2-13SS024HM	Bolt, hex head 1/2-13 x 1-1/2" SS
25.	01/2SSF	Washer, flat 1/2" SS
26.	01/2SSS	Washer, lock 1/2" SS

Feed system components

Table 12. Components, Feed System

	Part Number	Description
1.	98284-G500	Feedline section below tee, (spool piece)
2.	98284-G511	Feedline, 1-5/8", single bay "L" section, with universal mount
3.	98284-G501	Feedline, 1-5/8", standard "L" section, with universal mount
	98284-G505	Feedline, 1-5/8", 1/2-wave "L" section, with universal mount
4.	98284-G509	Feedline, 1-5/8", standard above tee "L" section, with universal mount
	98284-G510	Feedline, 1-5/8", 1/2-wave above tee "L" section, with universal mount
5.	98284-G506	Feedline, 1-5/8", standard top section, with universal mount
	98284-G502	Feedline, 1-5/8", 1/2-wave top section, with universal mount
6.	98284-G503	Feedline, 1-5/8", standard intermediate section, with universal mount
	98284-G504	Feedline, 1-5/8", 1/2-wave intermediate section, with universal mount
7.	98284-G508	Feedline, 1-5/8", standard bottom section, with universal mount
	98284-G512	Feedline, 1-5/8", 1/2-wave bottom section, with universal mount
8.	52018-G503	Tee assembly, 1
9.	158F-324	Elbow, 1-5/8", flanged (3.06" x 3.06")
10.	318F-322	Elbow, 3-1/8", 90° flanged (4" x 4")
11.	82912-G501	Kit, hardware, 1-5/8" flange
12.	82912-G503	Kit, hardware, 3-1/8" flange
13.	93584-G501	Kit, hardware, 7/8" baymount
14.	93585-G501	Kit, hardware, 6813 radome flange
15.	93585-G503	Kit, hardware, XXL radome flange
16.	9068-215	O-ring, 7/8" flange
17.	9068-328	O-ring, 1-5/8" flange
18.	9068-340	O-ring, 3-1/8" flange
19.	078F-188	Spool piece, 7/8" x 3-1/2" long
20.	158F-188	Spool piece, 1-5/8" x 6" long

Accessories and optional items

Table 13. Accessories and Optional Items

	Part Number	Description
1.	53520-G503	Transformer, fine-matching, 1-5/8"
2.	96751-G502	Kit, spare parts, 6813
3.	6114-250	Clamp, Hi-Torque hose (1-5/8" feedline)
4.	6114-300	Clamp, Hi-Torque hose (de-icer boxes)
5.	6114-400	Clamp, Hi-Torque hose (3-1/8" feedline)
6.	158F-620	Adapter, 1-5/8" flange to 7/8" flange
7.	318F-630	Adapter, 3-1/8" to 1-5/8"
8.	TY529MX	Tie-Wrap, T&B heavy-duty x 30" long
9.	DO_87500-10	Dow-Corning 732 RTV sealant, 10-oz tube
10.	57658-01	Strap, grounding
11.	95133-01	Mount, back support