

Shively Labs[®]

Circularly Polarized FM Broadcast Antenna

Model 6812C



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 6812C 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, filters, 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 basic understanding of your antenna: its proper and safe installation, startup, and operation, and troubleshooting 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.

Check the shipment.

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

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

Unpack

- a. Find Box 1; it is marked "Open This Box First."
- 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 sales order number (S/O) handy; it's on the top right corner of the folder.

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.

Check 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 support pipe or tower and each other. Study this manual and the installation drawings (if applicable) 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 manual 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.
- 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.

Storage prior to installation

Keep the antenna system dry. Never store it outdoors. If the antenna gets wet, you will need to dry it before applying transmitter power.

Bay spacing

Table 1. Bay spacing chart

Frequency	"0.85-Wave" Spacing	"Half-Wave" Spacing	Special Spacing
88 - 98 MHz ("Low-Band")	108 in (2.74 m)	63-1/2 in (1.61 m)	11803 x spacing ÷ frequency ; round to closest 1/8"
98 - 108 MHz ("High-Band")	98 in (2.49 m)	57 in (1.45 m)	11803 x spacing ÷ frequency ; round to closest 1/8"

Special spacing example:

For an antenna at 99.3 MHz and 0.75 spacing:

$$11803 \times 0.75 / 99.3 = 89.146 \text{ inches spacing; round to } 89\text{-}1/8\text{'}$$

Prepare the mounting location.

- Starting at the top of the array, find the location of each bay on the tower leg or the support pipe in accordance with [Table 1](#) and [Figure 1](#) on page 4 through [Figure 8](#) on page 11, as applicable. Mark the mount locations.
- Mark the location of any accessory mounts, such as for the transformer or special coax input line sections, to make sure they will fit as planned.
- Watch carefully for any interferences by tower members or guy wires which were not accounted for in the design.

CAUTION

If you don't get good electrical contact between the antenna and the tower, the antenna may not perform as designed and may produce stray signals that will interfere with other services on the tower.

- To ensure good electrical contact between the antenna and the tower, remove the paint and any rust at the support pipe and antenna mount locations before installing the antenna.
- After installing the antenna, be sure to touch up the paint where you removed it.

Bolt tightening

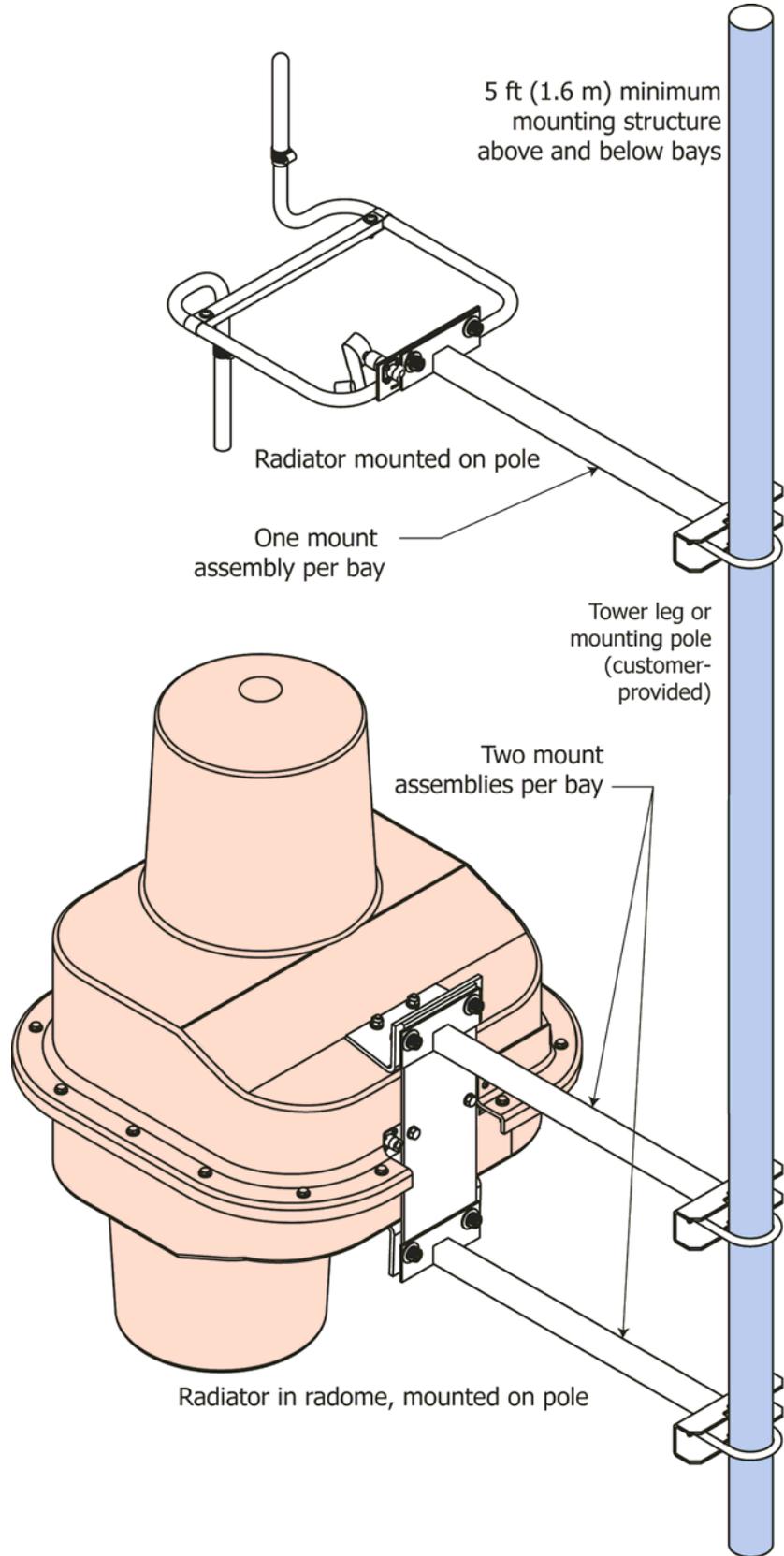
NOTE

Use an anti-seize compound to minimize galling on stainless steel threads.

Table 2. Torque specifications

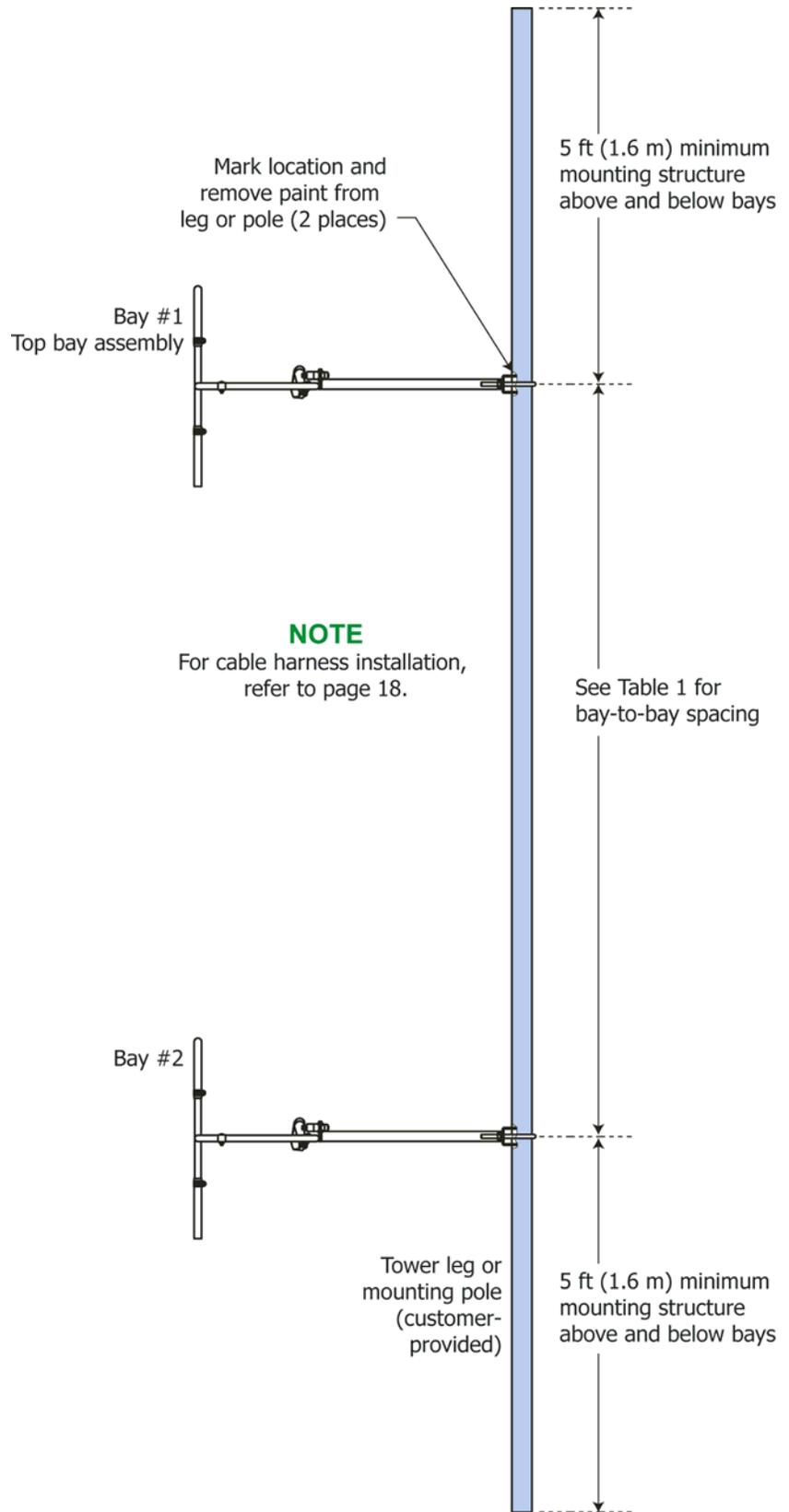
Hardware size	Torque (dry)	Torque (lubricated)
1/4-20 (radome flanges)	5 lb-ft (0.69 kg-m)	*** lb-ft (***) kg-m)
5/16-18 (1-5/8" EIA flanges)	9 lb-ft (1.2 kg-m)	*** lb-ft (***) kg-m)
3/8-16 (3-1/8" EIA flanges)	17 lb-ft (2.3 kg-m)	*** lb-ft (***) kg-m)

Figure 1. Tower layout, single antenna bay



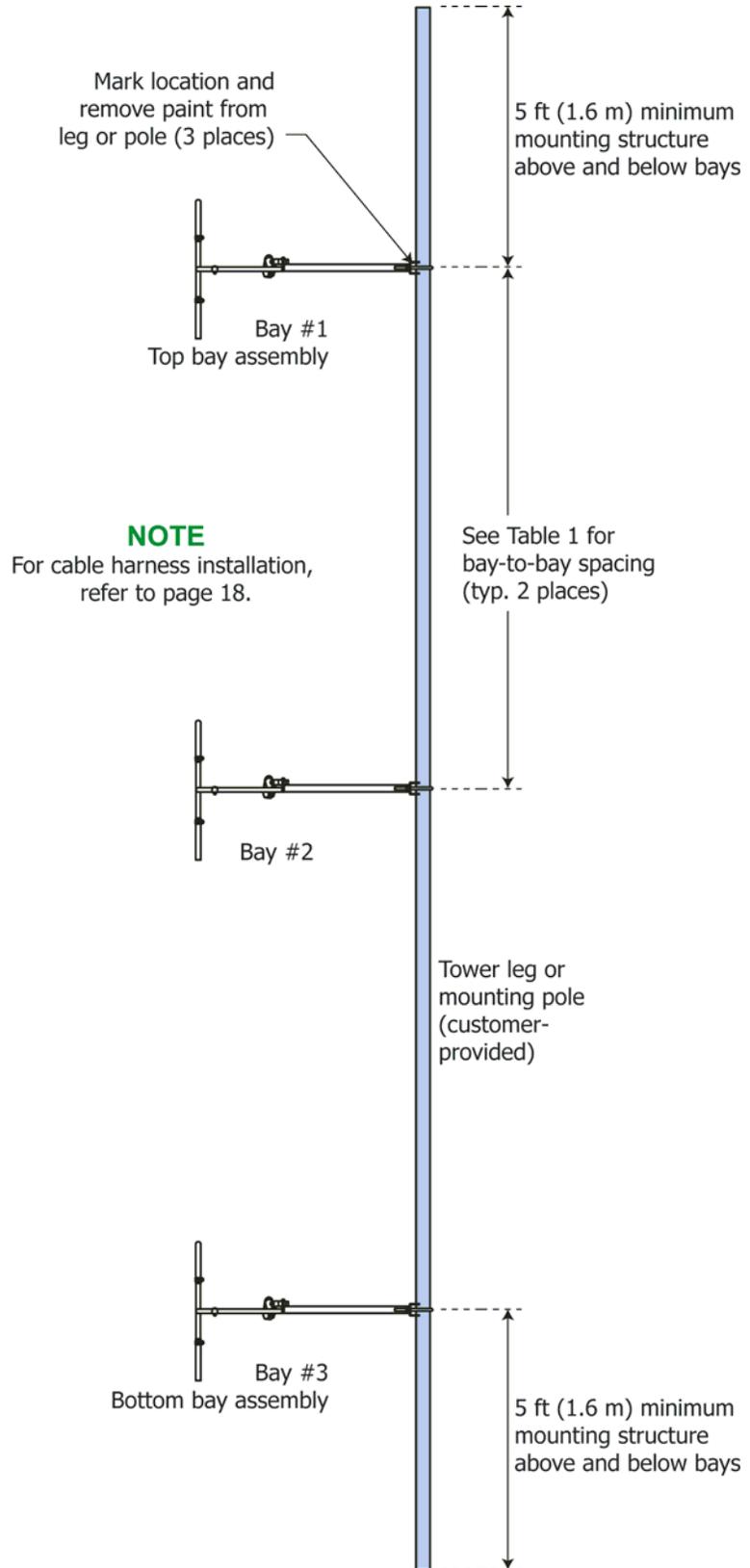
Precautions and Preparation

Figure 2. Tower layout, two-bay antenna



Precautions and Preparation

Figure 3. Tower layout, three-bay antenna



Precautions and Preparation

Figure 4. Tower layout, four-bay antenna

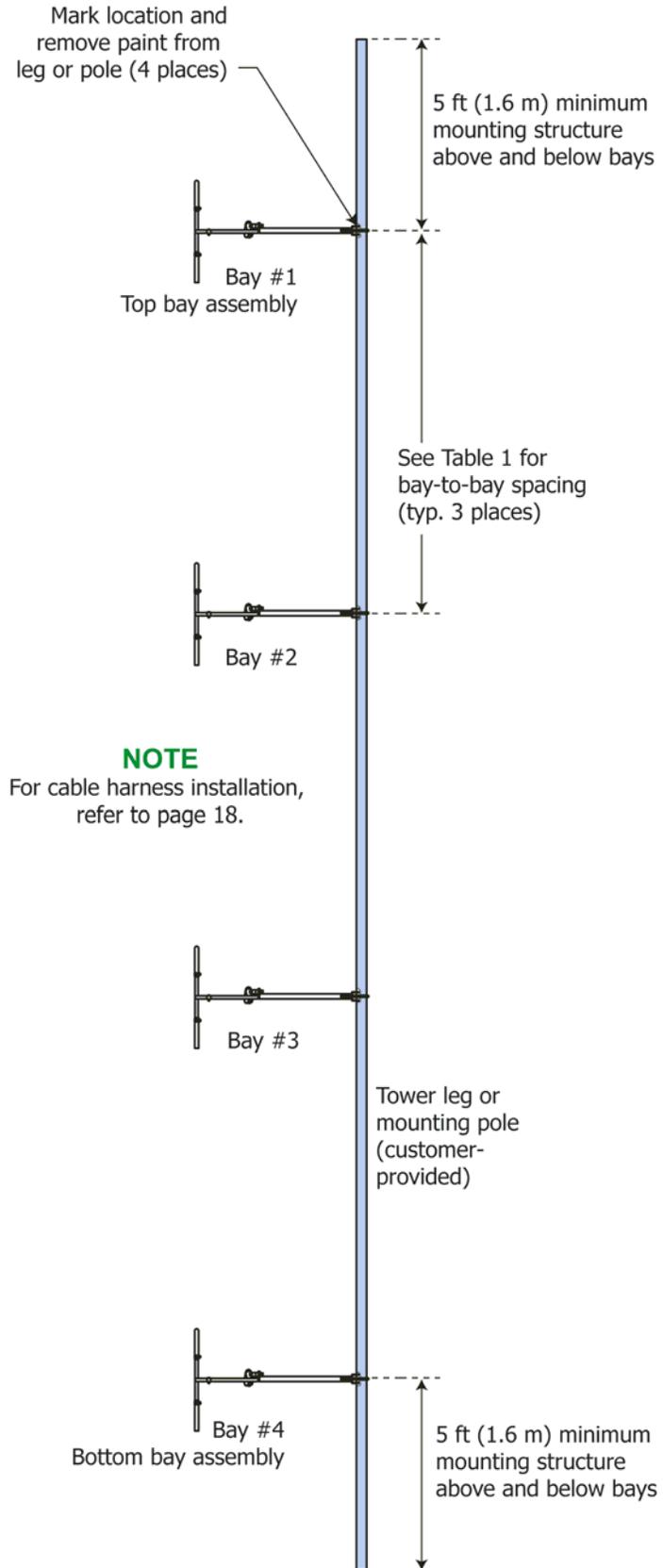
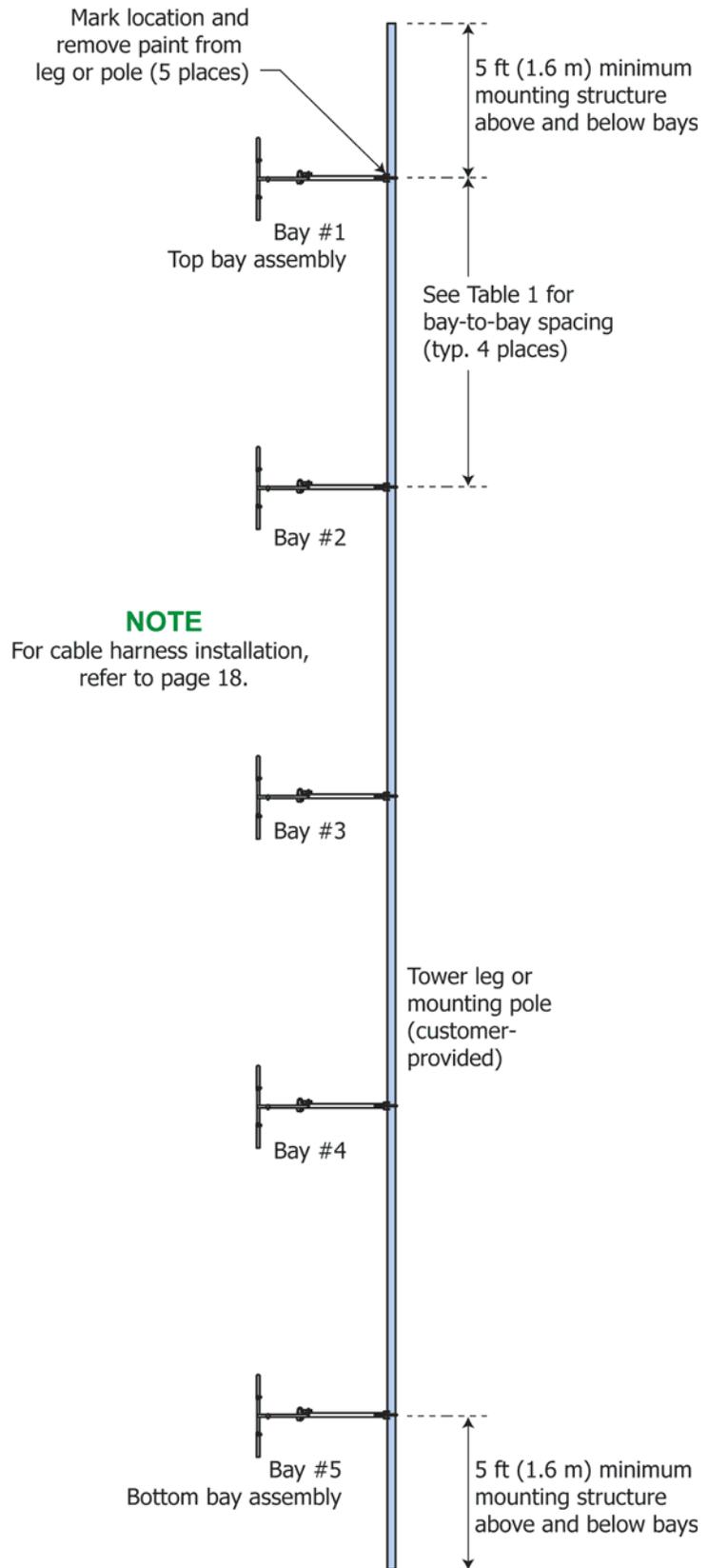
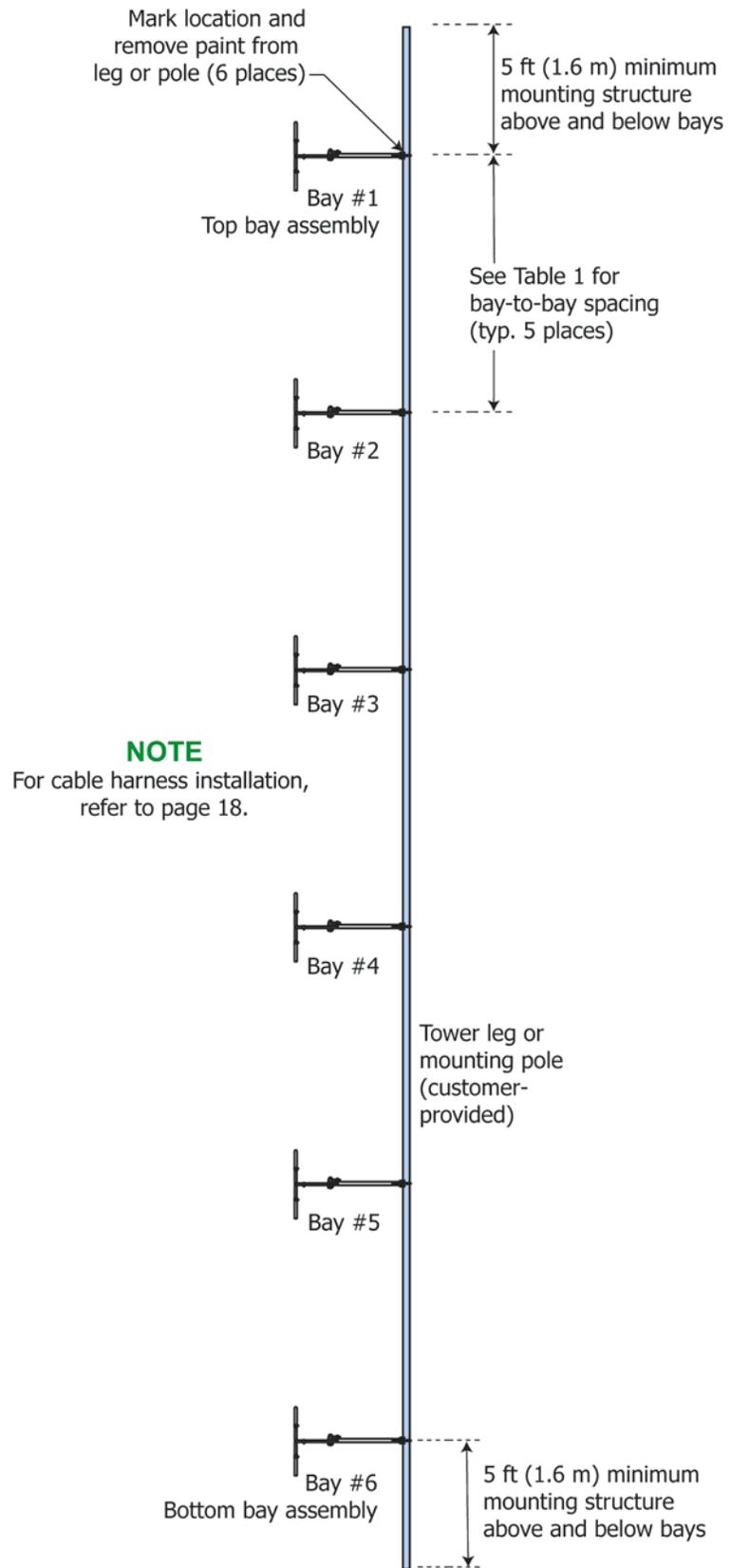


Figure 5. Tower layout, five-bay antenna



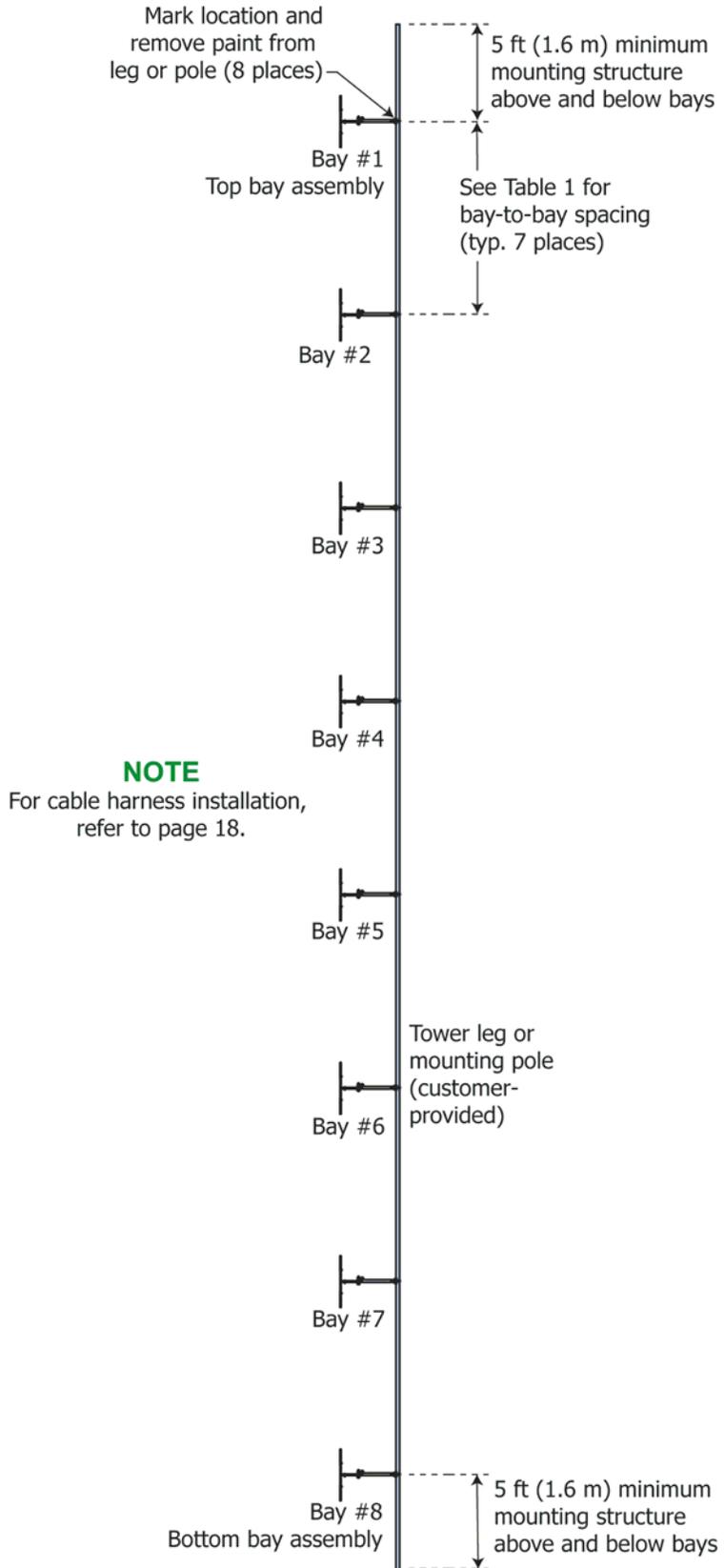
Precautions and Preparation

Figure 6. Tower layout, six-bay antenna



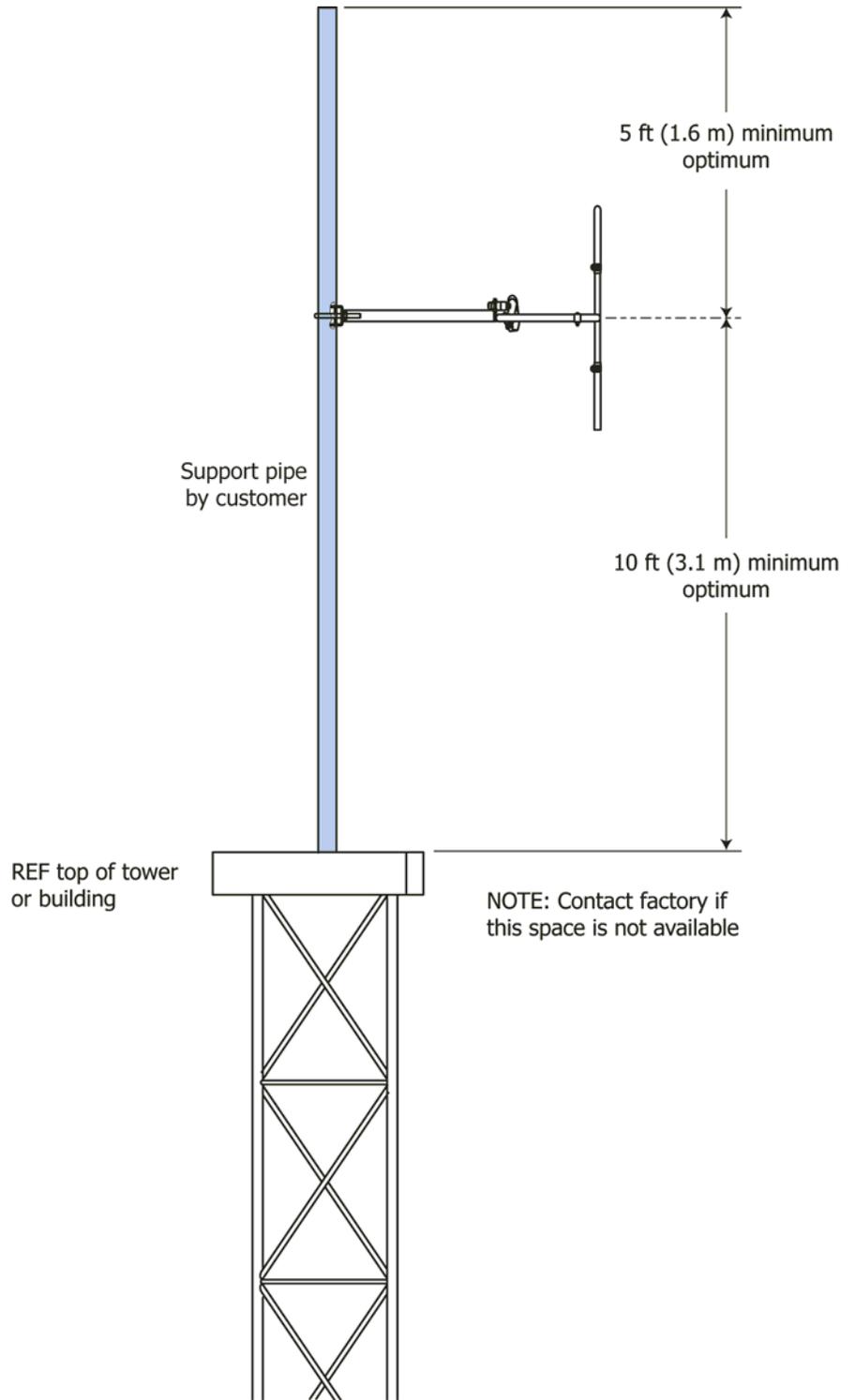
Precautions and Preparation

Figure 7. Tower layout, eight-bay antenna



Precautions and Preparation

Figure 8. Tower layout, antenna on top-mounted pole



2

Antenna Installation

Precautions

Important

Improper antenna mounting is a leading cause of poor performance in 6812C antennas. It is very important to install the antenna as indicated and to position it away from other metallic structures.

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.

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.

Options

The 6812C antenna is designed to mount directly to a tower leg or to a customer-supplied vertical pipe, which in turn is mounted on the tower.

For the mounts to fit, the tower leg or pipe must be between 1" and 3-1/2" (25.4 and 89 mm) nominal outside diameter. Shively can accommodate other pipe sizes if necessary by special order.

Install the support pipe (if applicable)

If you are using a support pipe, mount it securely as shown in [Figure 9](#). It must stand off from the tower as described in [Table 3](#).

Each installation is a little different, but follow these general guidelines:

- a. The pipe must extend at least five feet (1500 mm) above the top bay and five feet below the bottom bay.
- b. If your support pipe is mounted on top of a tower or building, there must be at least ten feet (3.1 m) of vertical clearance between the bottom antenna bay and the top of the tower or building (see [Figure 8](#) on page 11).

Figure 9. Support pipe or tower leg installation

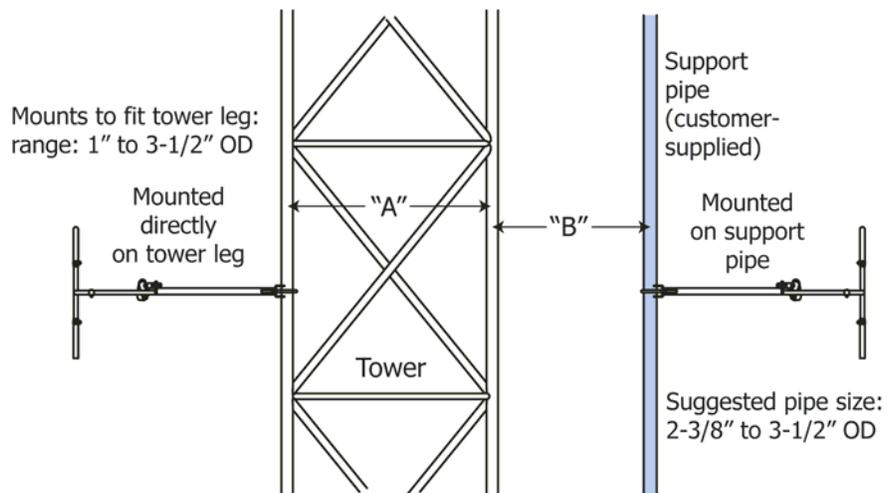


Table 3. Side-mounted support pipe standoff for towers over 4 feet face

Tower face "A"	Support pipe standoff "B"
48" - 60" (1219 - 1500 mm)	24" (610 mm)
over 60" (1500 mm)	36" (915 mm)

Install the radomes (if applicable)

NOTE

Radomes are interchangeable. Use any radome on any antenna bay.

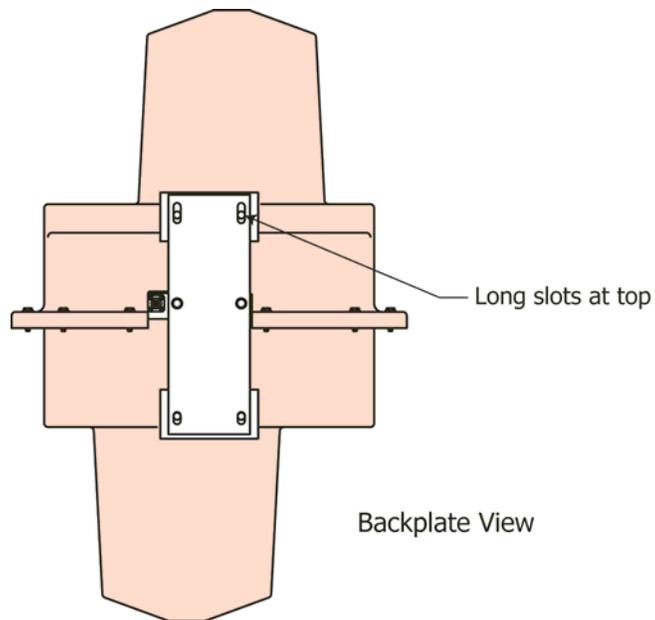
- Locate a top radome half (Figure 10, 19; wide overlapping flange) and a bottom half (20; narrow flat flange and drain holes) that are pre-drilled with matching flange bolt holes.
- Using the 5/16" hardware (25, 26, 27, and 28), attach the angle mount brackets (21) to the backing mounts (23) inside the radome halves.
- Fit the radome halves over the antenna radiator ...
- Insert the flange hardware (29) into the flange bolt holes. Install washers and nuts, but do not fully tighten yet.
- Using the 5/16" hardware (25, 26, 27, and 28), attach the backplate (22) to the radome halves, with the spacer plate (24) in between.

NOTE

Install the backplate with its long slots at the top (see Figure 10).

- Insert the 3/8" hardware (30, 31, 32, and 33) to attach the backplate (22) to the angle mount brackets (21), but do not tighten fully yet.

Figure 10. Radome backplate orientation



- When all hardware is in place, tighten everything to complete radome assembly.
- Seal the radome with RTV sealant (34) as shown in Figure 11. Seal around the coax connector, along both sides of the backplate, and in the small gaps at the ends of the radome flange.

Antenna Installation

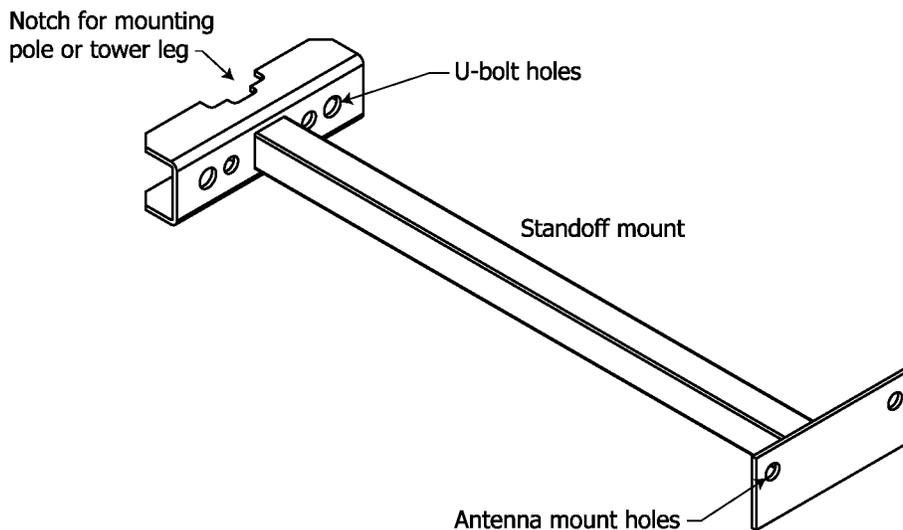
Figure 11. Sealing the radome with RTV sealant



Install the antenna on the tower

Figure 12. Standoff mount

Radiators are mounted to the tower or support pipe by means of standoff mounts (Figure 12 on page 15). One mount is required for each bay without radomes (Figure 13 on page 16); two mounts per bay for an antenna with radomes (Figure 14 on page 17).



Important!

Feedstrap orientation is critical to performance. In general, all the feedstraps in a Model 6812C antenna will be oriented the same. *Install each radiator in accordance with its labeled bay number.*

Also, be very careful not to disturb or damage the feed strap when handling the radiator.

NOTE

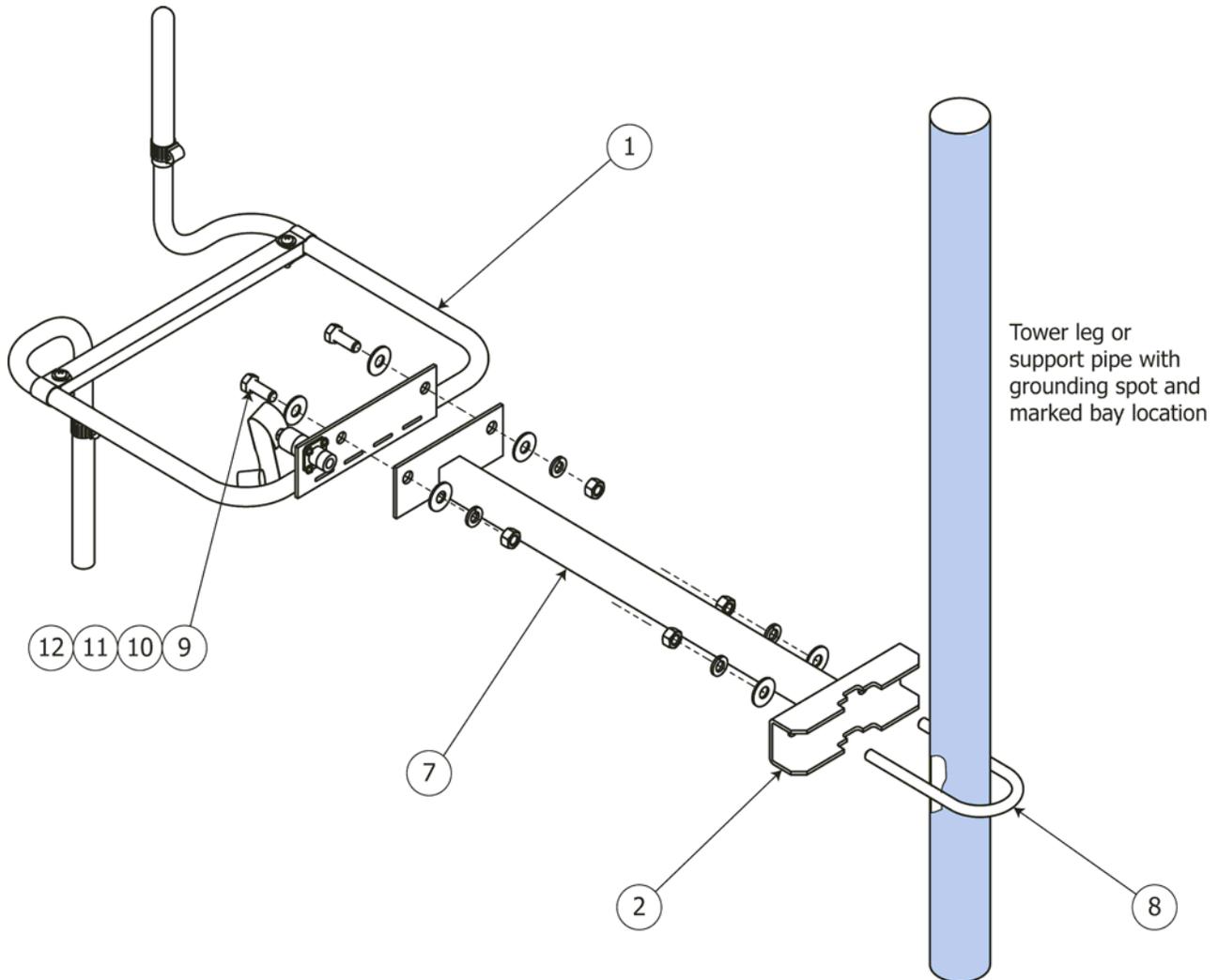
Radiators are labeled with their respective bay numbers (bay #1 is the topmost bay).

Antenna Installation

Antenna without radomes

- a. Using the hardware (9, 10, 11, & 12) that came with the mount assembly (2), attach the mount to the backplate of radiator #1, as shown in Figure 13. Tighten in accordance with Table 2 on page 3.
- b. Repeat for the remaining radiators, if applicable.

Figure 13. Installation of radiator without radome, exploded view



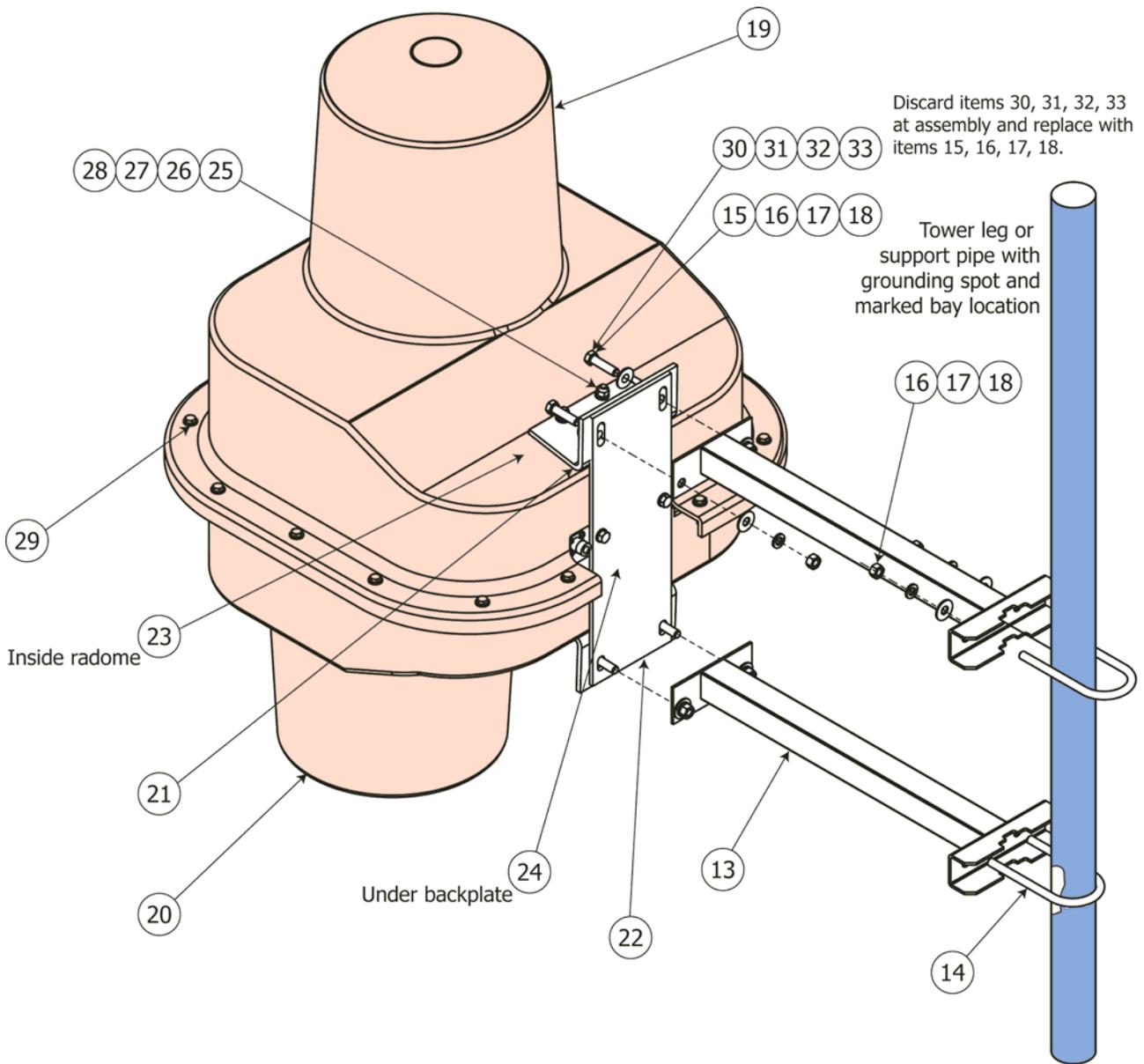
- c. Position radiator #1 at the topmost mark you made on the tower or support pipe.
- d. Using the U-bolt (8) with nuts, and washers, clamp the mount and the radiator assembly to the tower leg or support pipe.
- e. Repeat for the remaining radiators, ensuring they are in the proper sequence and oriented correctly.
- f. Sight vertically along the array to ensure the radiators are aligned and set at the correct azimuth before finally securing them to the support pipe.

Antenna Installation

Antenna with radomes

- g. Touch up the paint on the tower leg and/or support pipe as necessary to protect from corrosion.
- a. Remove the four bolts (30) securing the backplate (22) to the angle mount brackets (21).
- b. Using the hardware (15, 16, 17, & 18) that came with the mount assembly (2), attach the mount to the backplate and angle mount brackets of radiator #1, as shown in Figure 14. Tighten in accordance with Table 2 on page 3.
- c. Repeat for the other radiators, if applicable.

Figure 14. Installation of radiator with radome, exploded view



- d. Position radiator #1 at the topmost mark you made on the tower or support pipe.

Antenna Installation

- e. Using two U-bolts (8) with nuts and washers, clamp the mounts and the radiator/radome assembly to the tower leg or support pipe, as shown in [Figure 14](#).
- f. Repeat for the remaining radiators, ensuring they are in the proper sequence and oriented correctly.
- g. Sight vertically along the array to ensure the radiators are aligned and set at the correct azimuth before finally securing them to the support pipe.
- h. Touch up the paint on the tower leg and/or support pipe as necessary to protect from corrosion.

Install the interbay cable harness

CAUTION

Tighten the coax connector nuts finger-tight only. Using pliers or other mechanical means to tighten the connectors may damage them.

CAUTION

The minimum bend radius of the RF cable is 1 inch (25.4 mm).

Attach and secure the bay cables

CAUTION

To prevent damage, secure all coax to minimize wind-induced motion and chafing.

- a. Locate the end of the harness that is marked "Bay 1." Attach that end to radiator #1, the top bay.

CAUTION

Do not use metal ties, which can damage the cable.

- b. Using tie-wraps, secure the excess bay cable in one of the two ways shown in [Figure 15](#) on page 19 (scenes from our test rack).
- c. Attach and secure the cable harness to the remaining radiators.

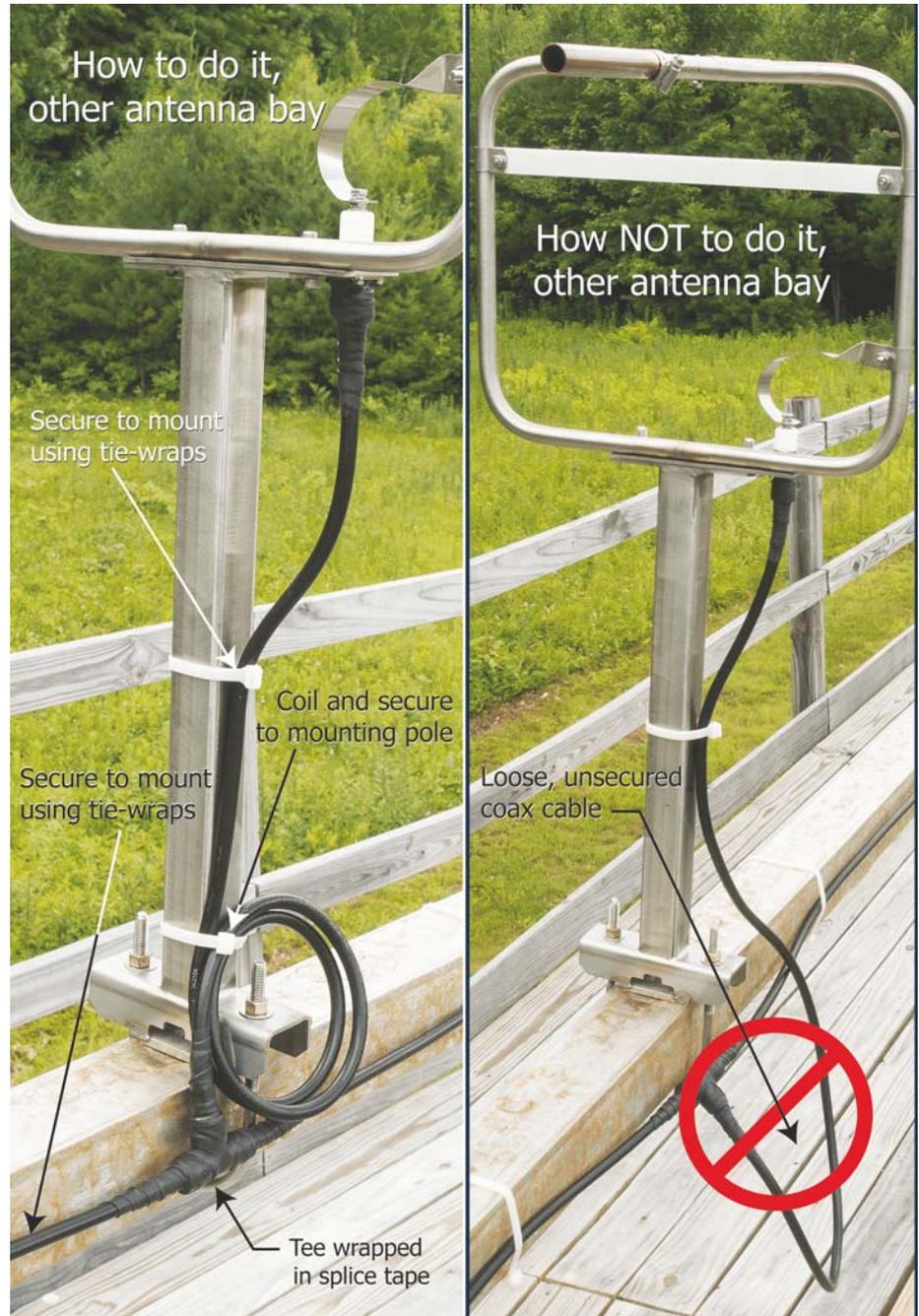
Antenna Installation

Figure 15. Securing of top and/or bottom antenna bay cable, right and wrong



Antenna Installation

Figure 16. Securing of other antenna bay cable, right and wrong



Secure the interbay cables

- (Full-wave-spaced antenna): secure the interbay cables to the tower leg or outriggered pole as shown in [Figure 17](#) on page 21.
- (Half-wave spaced antenna, outriggered pole mount): Wrap and secure the interbay cables ([Figure 18](#) on page 22):

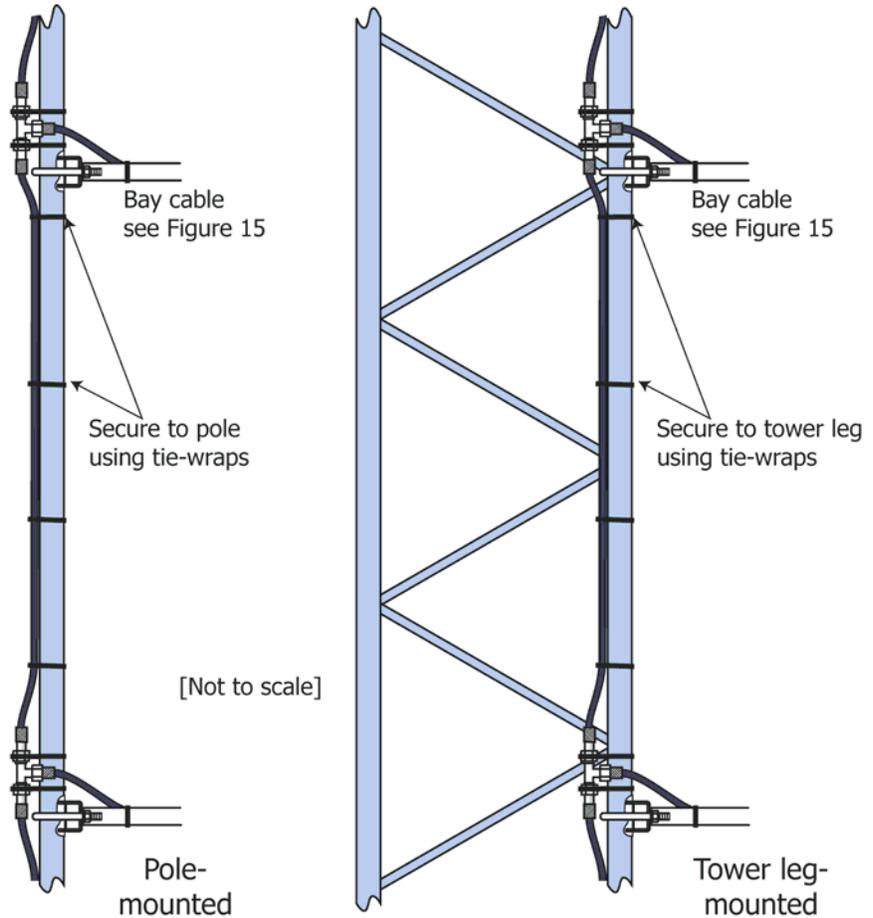
CAUTION

Do NOT wrap the interbay cables in a one-way spiral. This will adversely affect the VSWR of your antenna.

Antenna Installation

- (1) Loosen the connectors at the ends of the interbay cable a little to allow the cable to swivel.

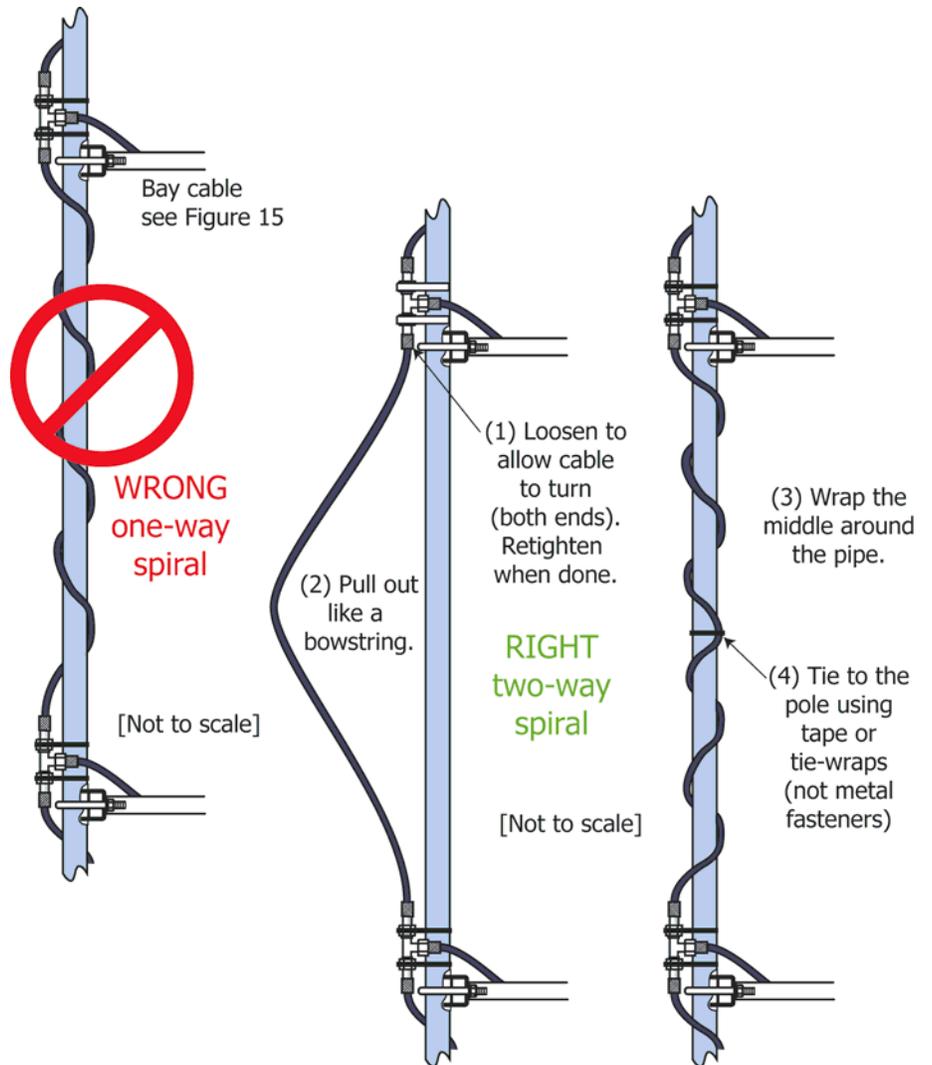
Figure 17. Securing the interbay cables, full-wave-spaced antenna



- (2) Grasp the center of the cable and pull it out gently like a bowstring.
 - (3) Wrap the center of the cable around the pole to create a two-way spiral, as shown in [Figure 18](#) on page 22.
 - (4) Using tie-wraps, secure the wrapped cable to the pole.
 - (5) Repeat for the other interbay cables, if applicable.
- c. (Half-wave spaced antenna, tower leg mount): Coil and secure the interbay cables ([Figure 19](#) on page 23):
- (1) Loosen the connectors at the ends of the interbay cable a little to allow the cable to swivel.
 - (2) Coil the excess cable and secure the coil to the tower, using tie-wraps (not metal fasteners).
 - (3) Repeat for the other interbay cables, if applicable.

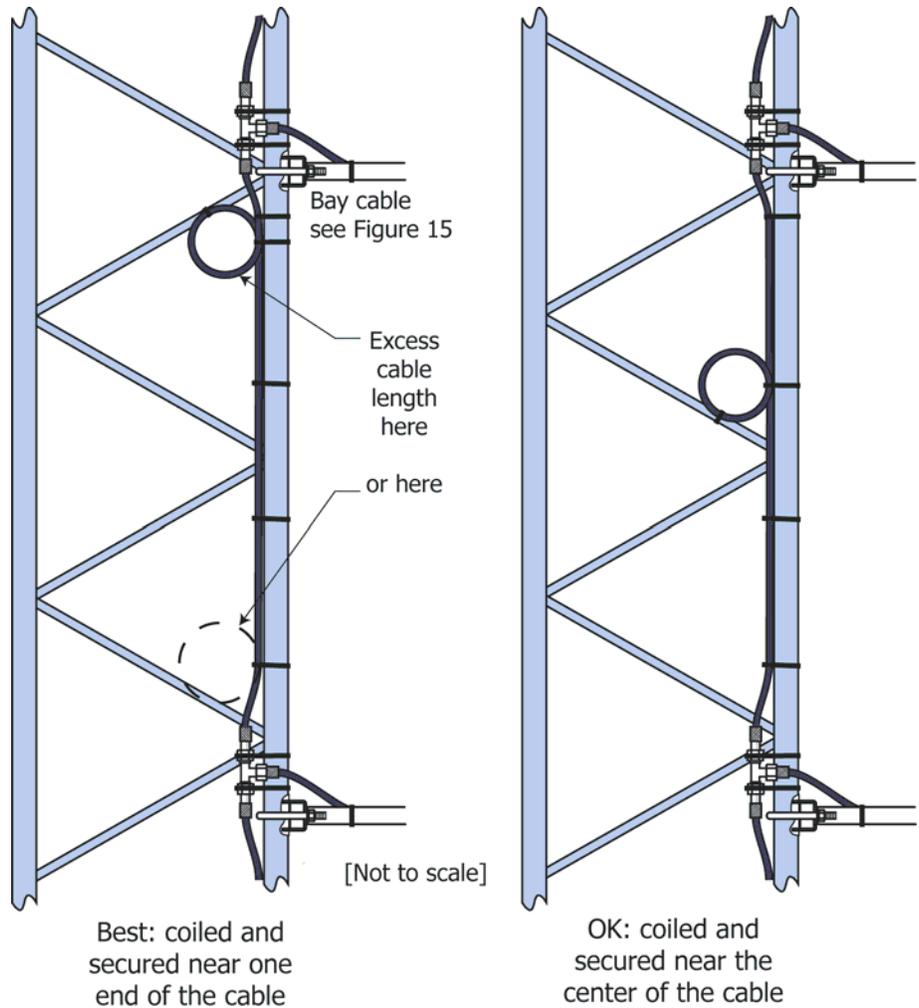
Antenna Installation

Figure 18. Securing the interbay cables, half-wave-spaced antenna mounted on an outrigged pole



Antenna Installation

Figure 19. Securing the interbay cables, half-wave-spaced antenna mounted on a tower leg



Apply the splicing tape

NOTE

Splicing tape must be applied both to seal the joint from water AND to insulate the cable electrically from the tower.

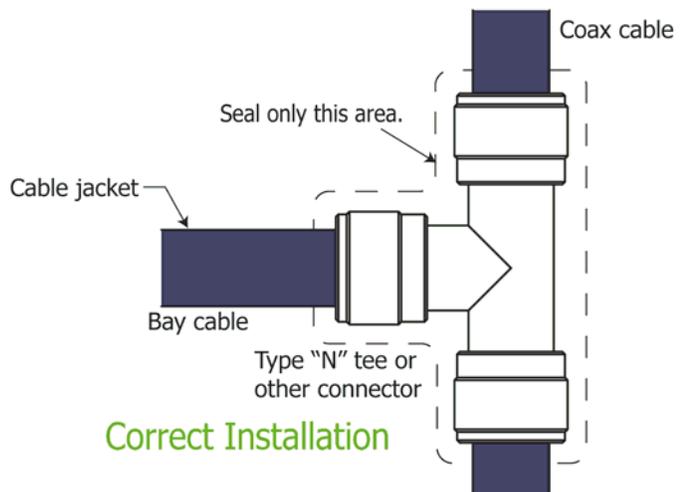
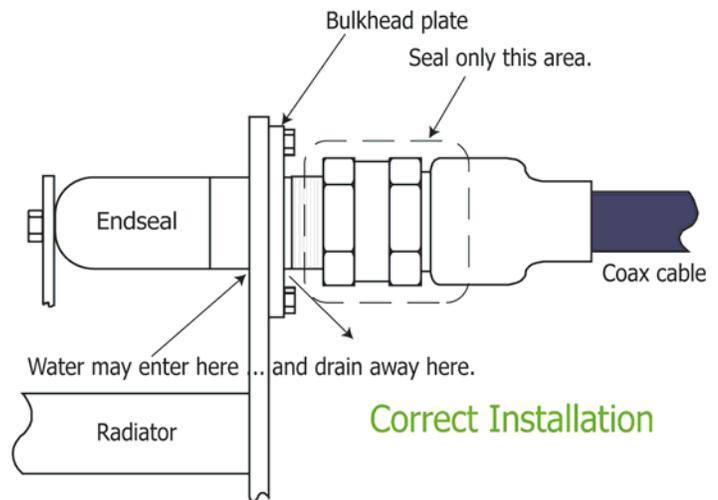
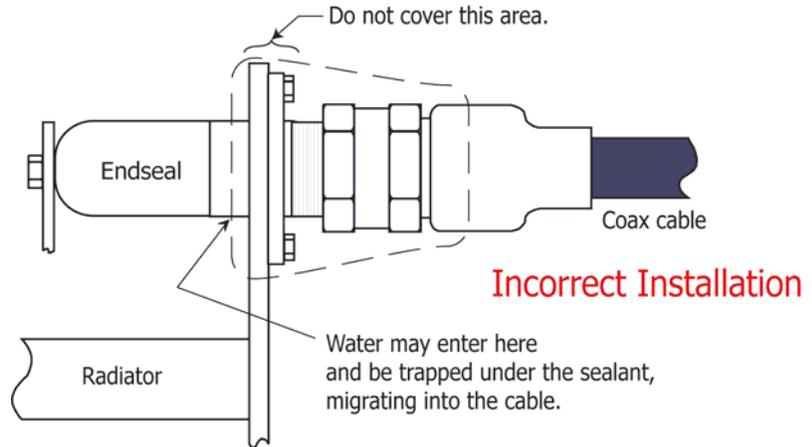
CAUTION

If splicing tape is not applied correctly, water can get into the coax connections and affect the performance and reliability of your antenna.

- Make sure the fittings and coax are clean and dry. Apply Scotch 130C Linerless Rubber Splicing Tape with the tacky side up (see [Figure 20](#) on page 24).
- Stretch tape and apply half-lapped to form a smooth, void-free splice. Wrap tightly in and around the area where the connection is made. Make sure the joint is fully covered. Do not seal up against the bulkhead plate on the radiator connector.
- Inspect the connections carefully, ensuring that the joints are fully sealed and that all metal parts of the connections are completely covered with splicing tape to insulate the harness from the tower. If more splicing tape is needed, simply add it to the existing wrap. It adheres well to itself.

Antenna Installation

Figure 20. Proper and improper application of splicing tape



3

Installing the De-icer System (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 21](#) on page 26.
- Electrical specifications: [Table 4](#) on page 27.
- Bay junction box: [Figure 22](#) on page 28.
- Thermostat readings: [Table 5](#) on page 28.

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.

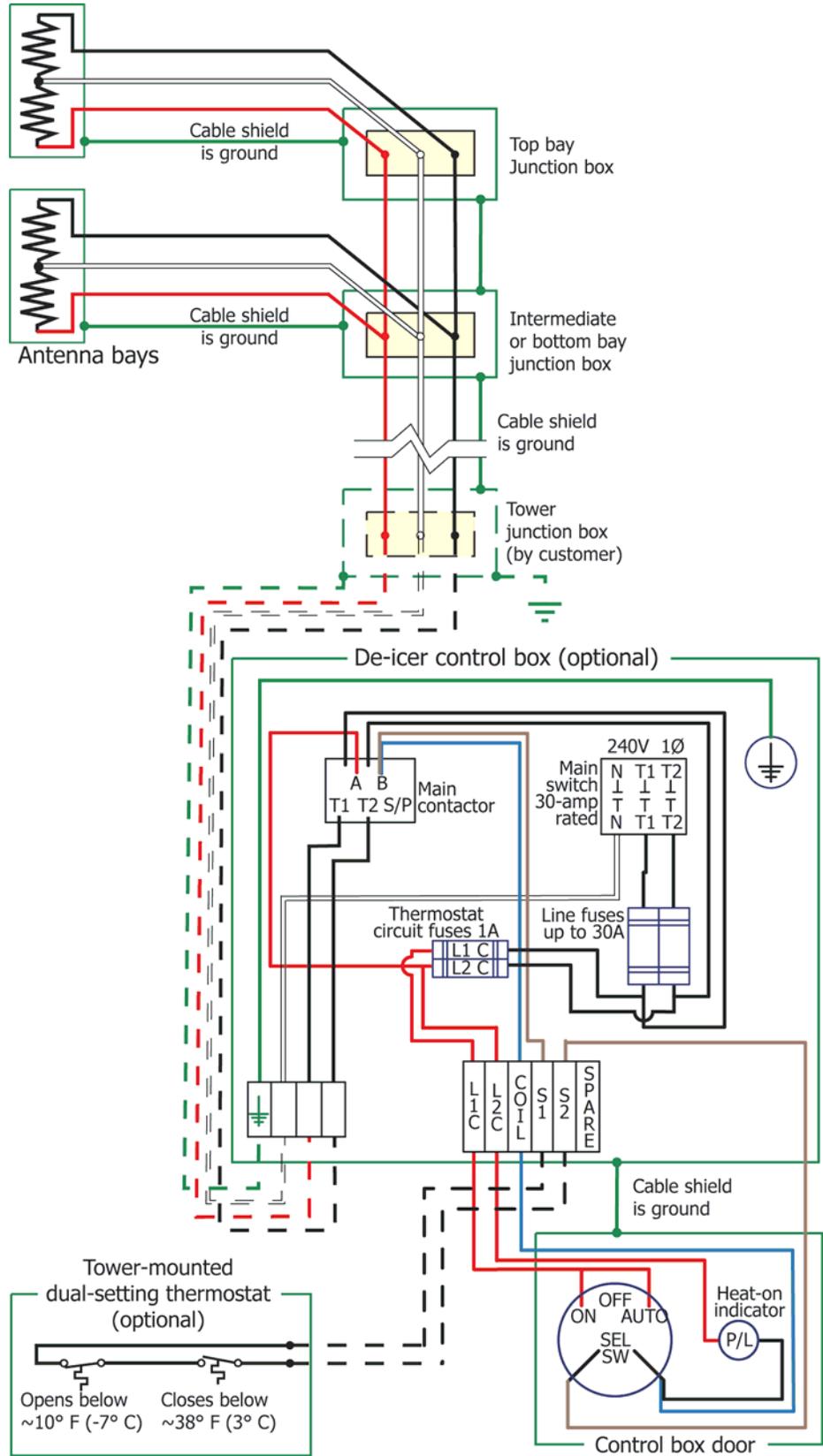
Shively Labs deicers are designed to prevent ice from forming on antenna elements and are not designed to melt ice that has already formed. For this reason, Shively Labs recommends that the system be installed with a tower-mounted dual-setting thermostat assembly (Shively Labs Model 55522-G502) and de-icer control box (Shively Labs Model 94068) that ensure the deicers 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 4](#) shows approximate heater leg resistances and current draw, respectively.

Installing the De-icer System (if applicable)

Figure 21. 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 and weather-tight fittings at all junctions.

Table 4. De-Icer specifications

	Heater Leg Resistance, Ω	Heater Leg (T1 or T2) Current Draw, amps
1-Bay	203	0.6
2-Bay	101	1.2
3-Bay	68	1.8
4-Bay	51	2.4
5-Bay	41	3.0
6-Bay	34	3.6
8-Bay, single circuit	25	4.7

De-icer installation

Installing the de-icer harness

CAUTION

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

- a. Install the main de-icer harness with its bay junction boxes as shown in [Figure 21](#) on page 26 and [Figure 22](#) 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 [21](#) 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.

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 5](#) on page 28.
- 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 21](#) on page 26.

Figure 22. Bay junction box installation

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

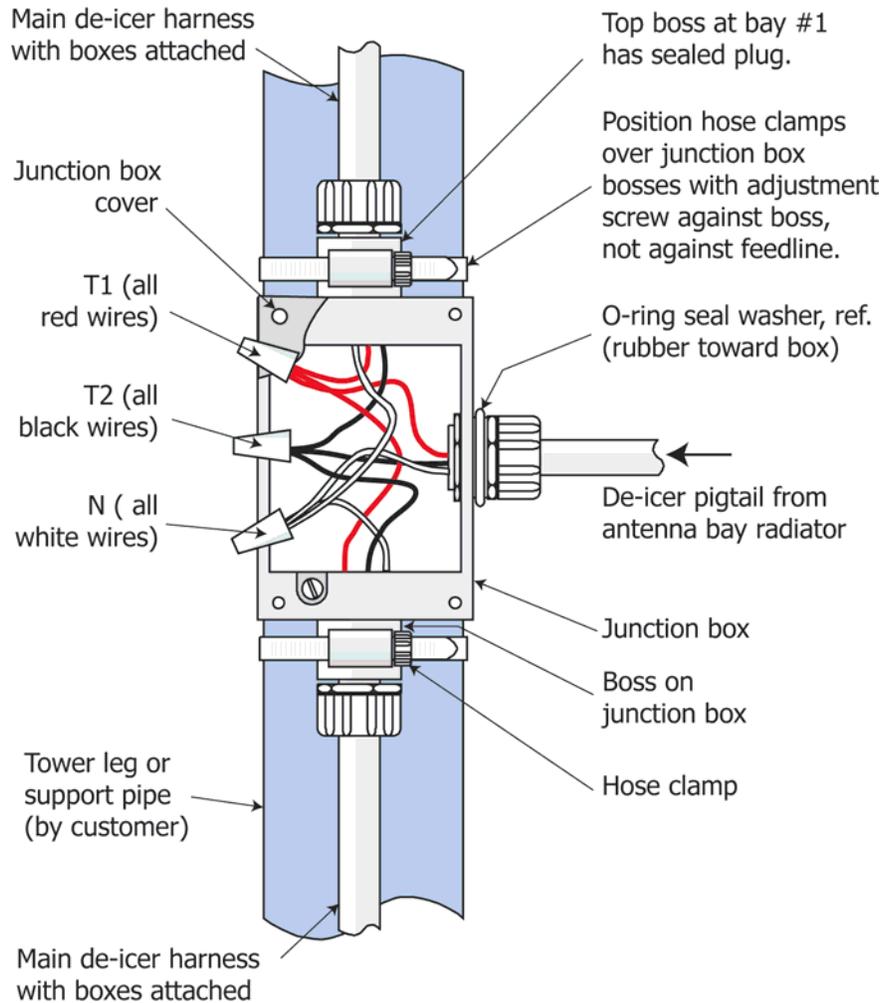


Table 5. Thermostat readings

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

Precautions

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.

The antenna

System sweep (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.

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.

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 (if applicable).
- The de-icer system, if purchased, has been checked out in accordance with [Chapter 3](#).
- All radiators are operating and VSWR is low.
- System sweep data, if desired, have been recorded.

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

Operation

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 5](#) of this manual.

The de-icer system

CAUTION

Don't leave the de-icer on for extended periods when the weather is above 60° F (16° C); doing so may shorten the life of the heater element(s).

Startup and Operation

There is a generous margin of safety built into the de-icer system, and operation for prolonged periods below 60° F (16° 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.

5

Maintenance and Troubleshooting

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.

Maintenance log

Shively recommends that you keep a maintenance log, recording important performance parameters such as VSWR readings, de-icer current draw, maintenance done on the tower and the antenna, and severe weather events. This information can be valuable for identifying and solving problems. [Sample maintenance log](#) on page 34 shows a suggested log form.

Physical inspection

Important

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

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.

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.

Paint

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

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

Radome removal and reinstallation

If it becomes necessary to remove a standard radome to gain access to the radiator, first remove the radiator from the tower and bring it to the ground. If the antenna is to be operated without that radiator, be sure to observe all precautions.

On the ground, merely remove the bolts ([Figure 14](#), 29) that secure the radome halves together, and the four additional 3/8" bolts (15 - 18) securing the radome backplate (22) to the radome, and lift the radome away from the radiator. Reinstall the radome and the radiator in the reverse order of removal. Re-seal the radome, using Dow Corning 732 Multipurpose RTV or equivalent.

Return policy

When returning any material to the factory, be sure to call your salesman 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

Contact 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

Internal arcing is caused by physical damage to transmission line, feedline, or radiators. Damage may have been caused by ice, lightning, tower work, or many other factors. Replace damaged components.

Broad spectrum RF noise

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. Check your antenna mounts and other tower components to be sure that the tower paint was scraped away during installation and that all mounting hardware is tight.

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. Possible causes include:

- Wrong antenna for the application and frequency. Occasionally incorrect frequency information is provided to Shively or an antenna designed for another application is used.
- Defective cable connector in the cable harness.
- Incorrect assembly of the antenna (for example, an upside-down radiator; radiators out of sequence). The assembly must be exactly as shown in the installation drawing.
- Damaged radiator feed strap(s). The feed strap is the metal 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 in 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. (Check with the tower owner to see whether anyone has been working on the tower.)
- Paint applied to the radiators, for example during a recent tower painting.
- De-icer failure may have allowed ice buildup or melted the solder from the domes, spacers, and bushings at the ends of the vertical arms.

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 32 for troubleshooting.

Maintenance and 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.

Sample maintenance
log

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

6

Figure 23. Components, bay assembly

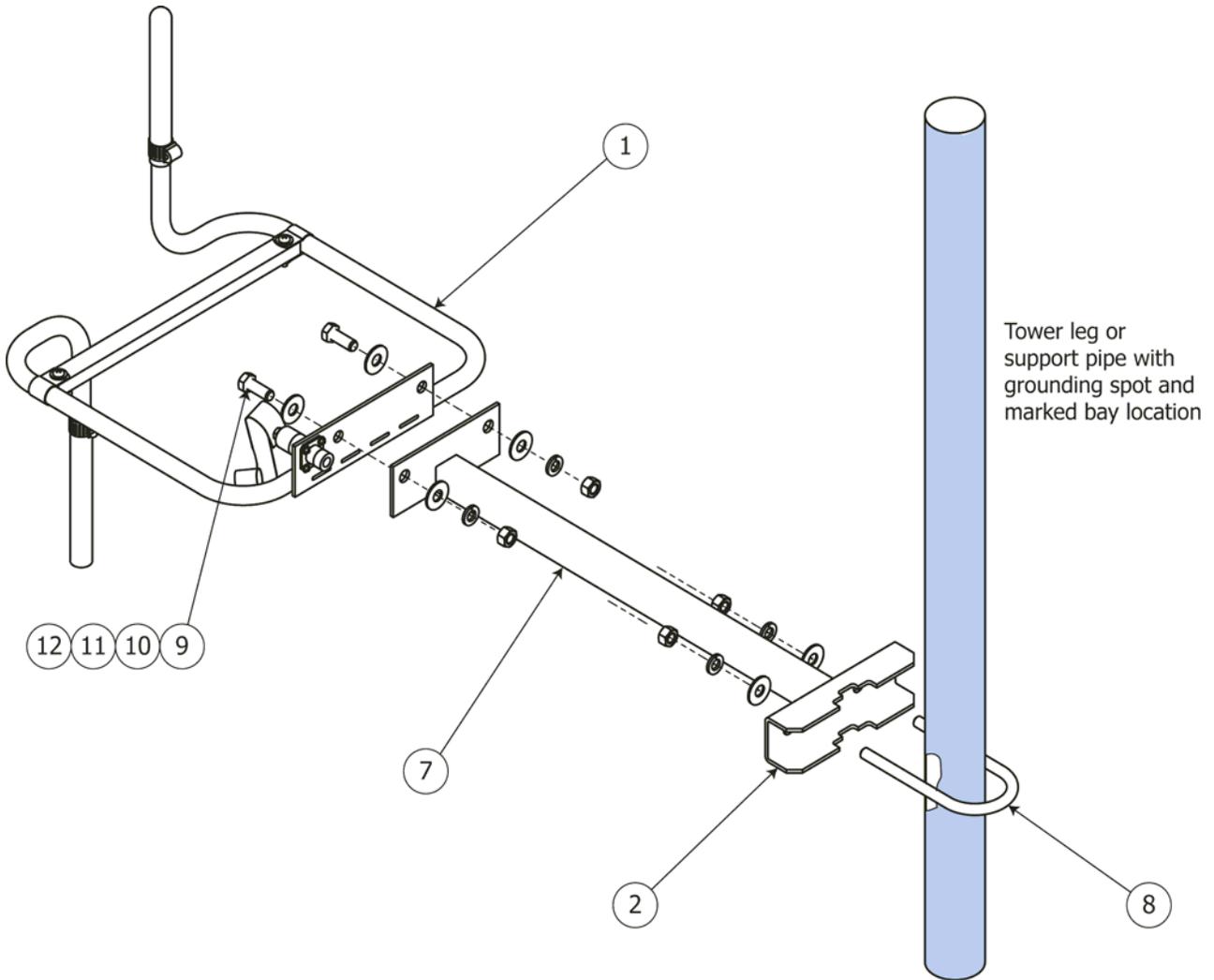


Table 6. Components, antenna assembly

Part Number	Description	1-Bay Qty.	2-Bay Qty.	3-Bay Qty.	4-Bay Qty.	5-Bay Qty.	6-Bay Qty.	8-Bay Qty.
1. 51814-G505-G3 or 51814-G505-G8 or 51814-G5xx-G3 or 51814-G5xx-G8	Bay assembly, low-band Bay assembly, high-band Bay assembly, low-band with radome Bay assembly, high-band with radome	1	2	3	4	5	6	8

Parts

Table 6. Components, antenna assembly (continued)

Part Number	Description	1-Bay Qty.	2-Bay Qty.	3-Bay Qty.	4-Bay Qty.	5-Bay Qty.	6-Bay Qty.	8-Bay Qty.
2. 51650-G504 or 51650-G505	Kit, mount, without radomes (see Table 7) Kit, mount, with radomes (see Table 8)	1	2	3	4	5	6	8
3. 55170-G503	Radome assembly, (see Table 9)	1	2	3	4	5	6	8
4. 92042-01	Tape, splice, 10-foot roll	1	2	3	4	5	6	8
5. TY529MX	Ty-Wrap, T&B HD	0	10	20	30	40	50	60
6. 97510-G502 or 97510-G503 or 97511-G502 or 97511-G503	Harness, cable low-band 2-bay center-fed, full-wave-spaced Harness, cable low-band 2-bay center-fed, half-wave-spaced Harness, cable high-band 2-bay center-fed, full-wave- spaced Harness, cable high-band 2-bay center-fed, half-wave- spaced		1					
97697-G502 or 97698-G502	Harness, cable low-band 3-bay end-fed, full & half-wave- spaced Harness, cable high-band 3-bay end-fed, full & half- wave-spaced			1				
97512-G502 or 97512-G503 or 97513-G502 or 97513-G503	Harness, cable low-band 4-bay center-fed, full-wave-spaced Harness, cable low-band 4-bay center-fed, half-wave-spaced Harness, cable high-band 4-bay center-fed, full-wave- spaced Harness, cable high-band 4-bay center-fed, half-wave- spaced				1			
98442-G502 or 98443-G503	Harness, cable low-band 5-bay end-fed, full & half-wave- spaced Harness, cable high-band 5-bay end-fed, full & half- wave-spaced					1		
97514-G502 or 97514-G503 or	Harness, cable low-band 6-bay center-fed, full-wave-spaced Harness, cable low-band 6-bay center-fed, half-wave-spaced						1	

Parts

Table 6. Components, antenna assembly (continued)

Part Number	Description	1-Bay Qty.	2-Bay Qty.	3-Bay Qty.	4-Bay Qty.	5-Bay Qty.	6-Bay Qty.	8-Bay Qty.
97515-G502	Harness, cable high-band 6-bay center-fed, full-wave-spaced						1	
or 97515-G503	Harness, cable high-band 6-bay center-fed, half-wave-spaced						1	
97516-G502	Harness, cable low-band 8-bay end-fed, full-wave-spaced							1
or 97516-G503	Harness, cable low-band 8-bay end-fed, half-wave-spaced							1
97517-G502	Harness, cable high-band 8-bay end-fed, full-wave-spaced							1
or 97517-G503	Harness, cable high-band 8-bay end-fed, half-wave-spaced							1

Table 7. Components, mount kit 51650-G504 (per antenna bay without radome)

Part Number	Description	Qty.
7. 51650-G502	Standoff, mount, 6812C without radomes	1
8. 55020-48	U-bolt, 3/8-16 x 4"	1
55020-49	U-bolt, 3/8-16 x 2-1/2"	1
9. 03/8-16SS016HM	Bolt, hex head 3/8-16 x 1" long, 18-8 SS	2
10. 03/8SSF	Washer, flat 3/8" 304 SS	6
11. 03/8-16SS	Nut, hex 3/8-16	4
12. 03/8SSS	Washer, lock 3/8", 304 SS	4

Table 8. Components, mount kit 51650-G505 (per antenna bay with radome)

Part Number	Description	Qty.
13. 51650-G503	Standoff, mount, 6812C with radomes	2
14. 55020-48	U-bolt, 3/8-16 x 4"	2
55020-49	U-bolt, 3/8-16 x 2-1/2"	2
15. 03/8-16SS024HM	Bolt, hex head 3/8-16 x 1-1/2" long, 18-8 SS	4
16. 03/8SSF	Washer, flat 3/8", 304 SS	16
17. 03/8-16SS	Nut, hex 3/8-16 SS	12
18. 03/8SSS	Washer, lock 3/8", 304 SS	12

Parts

Table 9. Components, radome assembly 55170-G503 (per antenna bay)

Part Number	Description	Qty.
19. 54008-01-TOP	Radome, gray, top half	1
20. 54008-02-BOT-TOM	Radome, gray, bottom half	1
21. 55034-G501	Bracket, angle mount	2
22. 55169-01	Plate, radome back	1
23. 53330	Mount, backing, radome mount	2
24. 55168	Plate, spacer	1
25.	Bolt, hex head, 5/16-18 x 1-1/4" long SS	8
26.	Nut, hex, 5/16-18 SS	8
27.	Washer, flat, 5/16" SS	16
28.	Washer, lock, 5/16" SS	8
29. 93585-G501	Kit, radome flange hardware	1
30.	Bolt, hex head, 3/8-16 x 1-1/4" SS	4*
31.	Nut, hex, 3/8-16 SS	4*
32.	Washer, flat, 3/8" SS	8*
33.	Washer, lock, 3/8" SS	4*
34. DO_87500	Sealant, Dow Corning 732, 3-oz (see Chapter 7 for SDS)	A/R

* Discard at assembly and replace with items 15, 16, 17, & 18.

Parts

Figure 24. Components, radome assembly

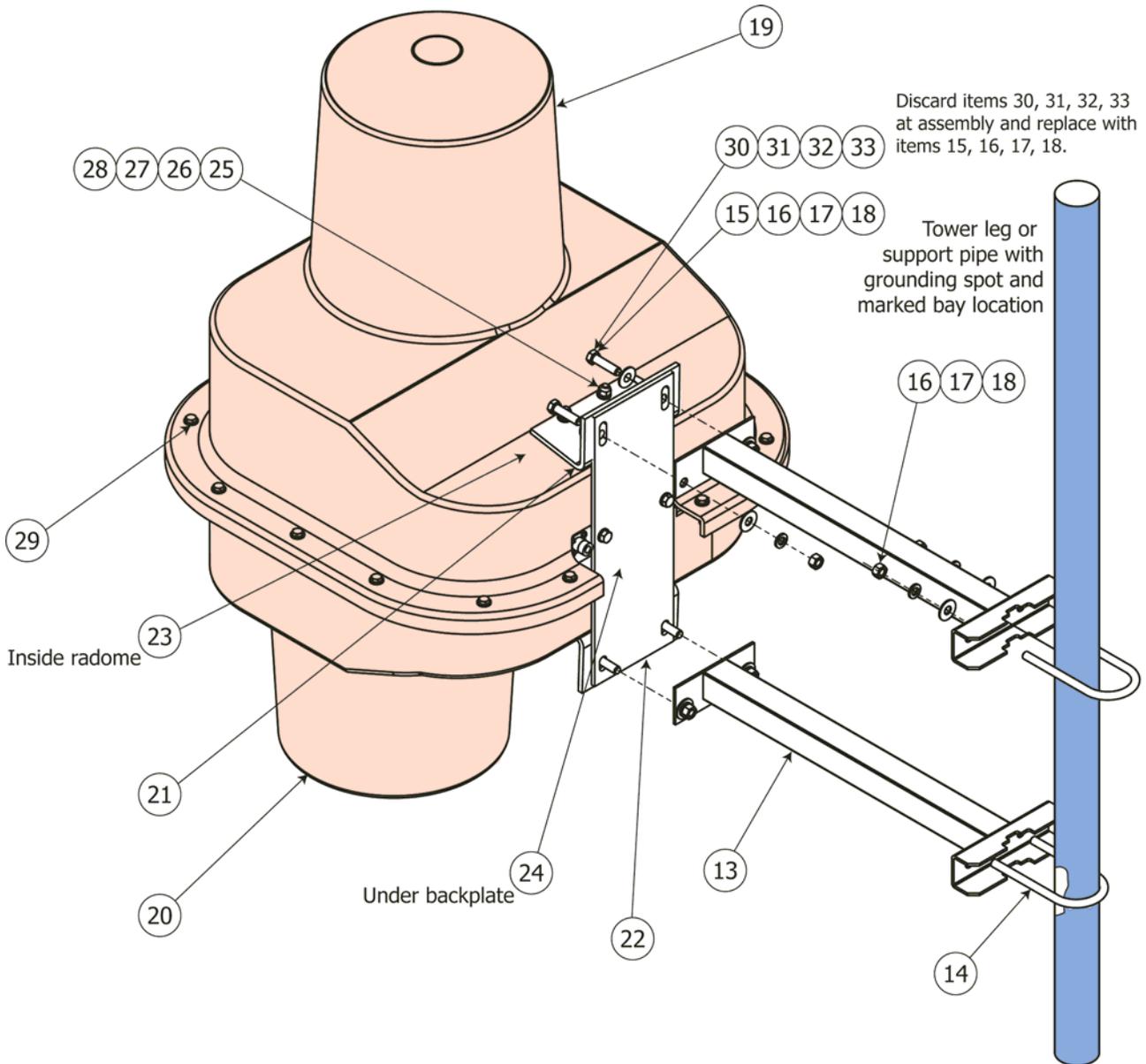


Table 10. Accessories and optional items

Part Number	Description	Qty.
35. 99952-G502	Fine matcher, 1-5/8"	1
36. 9068-328	• O-ring, silicone, 1-5/8" EIA flange	1
37. 99952-G501	Fine matcher, 3-1/8"	1
38. 9068-340	• O-ring, silicone, 3-1/8" EIA flange	1
39. Various	Mount assembly, fine matcher	2

Dow Corning 732
Multi-Purpose Sealant,
Clear

The SDS for Dow Corning 732 begins on the next page.

**DOW CORNING(R) 732 MULTI-PURPOSE
SEALANT CLEAR**

Version 1.4 Revision Date: 09/28/2015 SDS Number: 809362-00005 Date of last issue: 06/09/2015
Date of first issue: 11/21/2014

SECTION 1. IDENTIFICATION

Product name : DOW CORNING(R) 732 MULTI-PURPOSE SEALANT CLEAR

Product code : 000000000001892070

Manufacturer or supplier's details

Company name of supplier : Dow Corning Corporation

Address : South Saginaw Road
Midland Michigan 48686

Telephone : (989) 496-6000

Emergency telephone : 24 Hour Emergency Telephone : (989) 496-5900
CHEMTREC : (800) 424-9300

Recommended use of the chemical and restrictions on use

Recommended use : Adhesive, binding agents

SECTION 2. HAZARDS IDENTIFICATION**GHS Classification**

Not a hazardous substance or mixture.

GHS Label element

Not a hazardous substance or mixture.

Precautionary Statements : **Prevention:**
P271 Use only outdoors or in a well-ventilated area.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Chemical nature : Silicone elastomer

Hazardous ingredients

Chemical name	CAS-No.	Concentration (% w/w)
Silicon dioxide	7631-86-9	>= 5 - < 10

SECTION 4. FIRST AID MEASURES

If inhaled : If inhaled, remove to fresh air.

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Get medical attention if symptoms occur.

In case of skin contact : Wash with water and soap as a precaution.
Get medical attention if symptoms occur.

In case of eye contact : Flush eyes with water as a precaution.
Get medical attention if irritation develops and persists.

If swallowed : If swallowed, DO NOT induce vomiting.
Get medical attention if symptoms occur.
Rinse mouth thoroughly with water.

Most important symptoms and effects, both acute and delayed : None known.

Protection of first-aiders : No special precautions are necessary for first aid responders.

Notes to physician : Treat symptomatically and supportively.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Water spray
Alcohol-resistant foam
Carbon dioxide (CO₂)
Dry chemical

Unsuitable extinguishing media : None known.

Specific hazards during fire fighting : Exposure to combustion products may be a hazard to health.

Hazardous combustion products : Carbon oxides
Silicon oxides
Formaldehyde

Specific extinguishing methods : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Use water spray to cool unopened containers.
Remove undamaged containers from fire area if it is safe to do so.
Evacuate area.

Special protective equipment for fire-fighters : Wear self-contained breathing apparatus for firefighting if necessary.
Use personal protective equipment.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protec- : Follow safe handling advice and personal protective equip-

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tive equipment and emergency procedures	ment recommendations.
Environmental precautions	: Discharge into the environment must be avoided. Prevent further leakage or spillage if safe to do so. Retain and dispose of contaminated wash water. Local authorities should be advised if significant spillages cannot be contained.
Methods and materials for containment and cleaning up	: Soak up with inert absorbent material. For large spills, provide diking or other appropriate containment to keep material from spreading. If diked material can be pumped, store recovered material in appropriate container. Clean up remaining materials from spill with suitable absorbent. Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable. Sections 13 and 15 of this SDS provide information regarding certain local or national requirements.

SECTION 7. HANDLING AND STORAGE

Technical measures	: See Engineering measures under EXPOSURE CONTROLS/PERSONAL PROTECTION section.
Local/Total ventilation	: Use only with adequate ventilation.
Advice on safe handling	: Handle in accordance with good industrial hygiene and safety practice. Take care to prevent spills, waste and minimize release to the environment.
Conditions for safe storage	: Keep in properly labeled containers. Store in accordance with the particular national regulations.
Materials to avoid	: Do not store with the following product types: Strong oxidizing agents

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Ingredients	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Silicon dioxide	7631-86-9	TWA (Dust)	20 Million particles per cubic foot (Silica)	OSHA Z-3
		TWA (Dust)	80 mg/m ³	OSHA Z-3

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			/ %SiO ₂ (Silica)	
		TWA	6 mg/m ³ (Silica)	NIOSH REL

Engineering measures : Processing may form hazardous compounds (see section 10).
 Ensure adequate ventilation, especially in confined areas.
 Minimize workplace exposure concentrations.

Personal protective equipment

Respiratory protection : No personal respiratory protective equipment normally required.

Hand protection

Remarks : Wash hands before breaks and at the end of workday.

Eye protection : Wear the following personal protective equipment:
 Safety glasses

Skin and body protection : Skin should be washed after contact.

Hygiene measures : Ensure that eye flushing systems and safety showers are located close to the working place.
 When using do not eat, drink or smoke.
 Wash contaminated clothing before re-use.
 These precautions are for room temperature handling. Use at elevated temperature or aerosol/spray applications may require added precautions.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : paste

Color : colorless

Odor : Acetic acid

Odor Threshold : No data available

pH : Not applicable

Melting point/freezing point : No data available

Initial boiling point and boiling range : Not applicable

Flash point : Not applicable

Evaporation rate : Not applicable

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Flammability (solid, gas)	:	Not classified as a flammability hazard
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapor pressure	:	Not applicable
Relative vapor density	:	No data available
Relative density	:	1.04
Solubility(ies)		
Water solubility	:	No data available
Partition coefficient: n-octanol/water	:	No data available
Autoignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity		
Viscosity, dynamic	:	Not applicable
Explosive properties	:	Not explosive
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.
Molecular weight	:	No data available

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Not classified as a reactivity hazard.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	Use at elevated temperatures may form highly hazardous compounds. Can react with strong oxidizing agents. Acetic acid is formed upon contact with water or humid air. Hazardous decomposition products will be formed at elevated temperatures.
Conditions to avoid	:	None known.
Incompatible materials	:	Oxidizing agents
Hazardous decomposition products		
Thermal decomposition	:	Formaldehyde

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SECTION 11. TOXICOLOGICAL INFORMATION**Information on likely routes of exposure**

Skin contact
Ingestion
Eye contact

Acute toxicity

Not classified based on available information.

Ingredients:**Silicon dioxide:**

Acute oral toxicity : LD50 (Rat): > 3,300 mg/kg
Assessment: The substance or mixture has no acute oral toxicity
Remarks: Information taken from reference works and the literature.

Acute inhalation toxicity : LC50 (Rat): > 2.08 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist
Assessment: The substance or mixture has no acute inhalation toxicity
Remarks: Information taken from reference works and the literature.

Acute dermal toxicity : LD50 (Rabbit): > 5,000 mg/kg
Assessment: The substance or mixture has no acute dermal toxicity
Remarks: Information taken from reference works and the literature.

Skin corrosion/irritation

Not classified based on available information.

Product:

Result: No skin irritation
Remarks: Based on data from similar materials

Ingredients:**Silicon dioxide:**

Result: No skin irritation
Remarks: Information taken from reference works and the literature.

Serious eye damage/eye irritation

Not classified based on available information.

Product:

Result: No eye irritation
Remarks: Based on data from similar materials

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Ingredients:

Silicon dioxide:

Result: No eye irritation

Remarks: Information taken from reference works and the literature.

Respiratory or skin sensitization

Skin sensitization: Not classified based on available information.

Respiratory sensitization: Not classified based on available information.

Ingredients:

Silicon dioxide:

Assessment: Does not cause skin sensitization.

Test Type: Skin: test type not specified

Species: Guinea pig

Remarks: Information taken from reference works and the literature.

Germ cell mutagenicity

Not classified based on available information.

Ingredients:

Silicon dioxide:

Genotoxicity in vitro : Result: negative
Remarks: Information taken from reference works and the literature.

Genotoxicity in vivo : Application Route: Ingestion
Result: negative
Remarks: Information taken from reference works and the literature.

Germ cell mutagenicity - Assessment : Animal testing did not show any mutagenic effects.

Carcinogenicity

Not classified based on available information.

IARC No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

NTP No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Not classified based on available information.

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STOT-single exposure

Not classified based on available information.

STOT-repeated exposure

Not classified based on available information.

Aspiration toxicity

Not classified based on available information.

SECTION 12. ECOLOGICAL INFORMATION**Ecotoxicity**

No data available

Persistence and degradability

No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS**Disposal methods**

Resource Conservation and Recovery Act (RCRA) : This product has been evaluated for RCRA characteristics and does not meet the criteria of hazardous waste if discarded in its purchased form.

Waste from residues : Dispose of in accordance with local regulations.

Contaminated packaging : Empty containers should be taken to an approved waste handling site for recycling or disposal.
If not otherwise specified: Dispose of as unused product.

SECTION 14. TRANSPORT INFORMATION**International Regulation****UNRTDG**

Not regulated as a dangerous good

IATA-DGR

Not regulated as a dangerous good

IMDG-Code

Not regulated as a dangerous good

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Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

Domestic regulation

49 CFR

Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know

CERCLA Reportable Quantity

Ingredients	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Acetic acid	64-19-7	5000	*
Acetic anhydride	108-24-7	5000	*

*: Calculated RQ exceeds reasonably attainable upper limit.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards : No SARA Hazards

SARA 302 : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Pennsylvania Right To Know

Dimethyl siloxane, hydroxy-terminated	70131-67-8	70 - 90 %
Silicon dioxide	7631-86-9	5 - 10 %
Distillates (petroleum), hydrotreated middle	64742-46-7	0.1 - 1 %
Acetic acid	64-19-7	0 - 0.1 %
Acetic anhydride	108-24-7	0 - 0.1 %

New Jersey Right To Know

Dimethyl siloxane, hydroxy-terminated	70131-67-8	70 - 90 %
Silicon dioxide	7631-86-9	5 - 10 %

California Prop. 65 This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

The ingredients of this product are reported in the following inventories:

NZIoC : All ingredients listed or exempt.

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REACH : All ingredients (pre-)registered or exempt.

TSCA : All chemical substances in this material are included on or exempted from listing on the TSCA Inventory of Chemical Substances.

PICCS : All ingredients listed or exempt.

KECI : All ingredients listed, exempt or notified.

ENCS/ISHL : All components are listed on ENCS/ISHL or exempted from inventory listing.

IECSC : All ingredients listed or exempt.

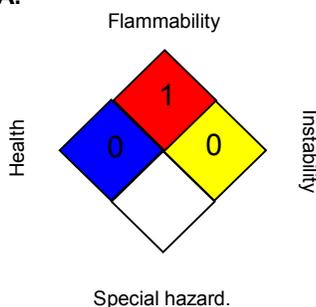
AICS : All ingredients listed or exempt.

DSL : All chemical substances in this product comply with the CEPA 1999 and NSNR and are on or exempt from listing on the Canadian Domestic Substances List (DSL).

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	0
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 = Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Full text of other abbreviations

NIOSH REL : USA. NIOSH Recommended Exposure Limits

OSHA Z-3 : USA. Occupational Exposure Limits (OSHA) - Table Z-3 Mineral Dusts

NIOSH REL / TWA : Time-weighted average concentration for up to a 10-hour workday during a 40-hour workweek

OSHA Z-3 / TWA : 8-hour time weighted average

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AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Sources of key data used to compile the Material Safety Data Sheet : Internal technical data, data from raw material SDSs, OECD eChem Portal search results and European Chemicals Agency, <http://echa.europa.eu/>

Revision Date : 09/28/2015

Items where changes have been made to the previous version are highlighted in the body of this document by two vertical lines.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and shall not be considered a warranty or quality specification of any type. The information provided relates only to the specific material identified at the top of this SDS and may not be valid when the SDS material is used in combination with any other materials or in any process, unless specified in the text. Material users should review the information and recommendations in the specific context of their intended manner of handling, use, processing and storage, including an assessment of the appropriateness of the SDS material in the user's end product, if applicable.

SAFETY DATA SHEET



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