User's Guide for:

SeaSonde® Radial Site Long Range Transmit Antenna Installation

CODAR Ocean Sensors, Ltd.
1914 Plymouth St., Mountain View, CA 94043 USA

Telephone: 408-773-8240
Fax: 408-773-0514

www.codar.com
email: support@codar.com

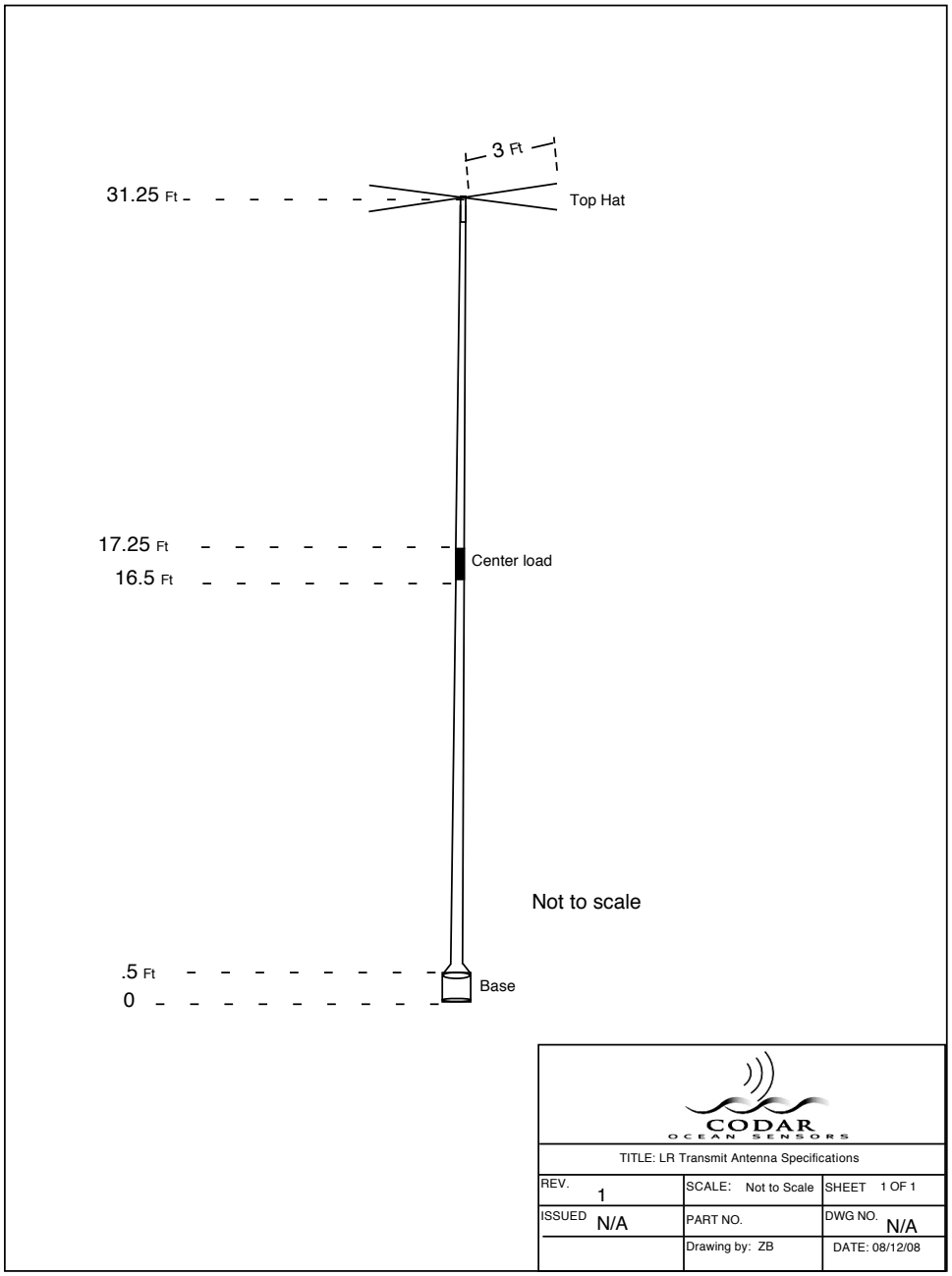
2008-09-05

Table of Contents

Introduction

This guide describes how to install a CODAR Long Range SeaSonde® transmit antenna.

When assembled and raised, the long range transmit antenna is approximately 9.5 m (31.25 ft) tall and weighs approximately 45 kg (100 lb). The basic antenna assembly consists of two long sections with a tuning coil connecting them. A “top hat” adapter is mounted at the top of the antenna assembly. Nine ground plane wires, 7 m long, are connected to the base and form a semicircle on the ground.



The following chapters include:

Preparation
Site planning, parts inventory, parts inspection, pre-installation assembly.

Installation
On-site assembly and installation.

Checklists
Parts inventory and tools checklists.

Drawings
Drawings and plans for mounting bases and bolt hole patterns.

Preparation

In this chapter:
- Site Planning
- Inventory
- Inspection
- Tuning Coil Jumper Strap
- Ready for Installation

Site Planning
Summary:

- Plan antenna location with respect to receive antenna and other vertical structures.
- Plan cable routes between SeaSonde transmitter and transmit antenna.
- Plan antenna support.
- Plan to protect against animal damage.
- Plan to protect area around antenna.

The long-range transmit antenna should be located *at least* 60 m away from the receive antenna.

The transmit antenna should be at least 60 m away from any structures that contain metal (including wiring of any sort) and are taller than 12 m, for example, fence posts or light poles.

The transmit antenna should be at least 25m away from vertical structures that do not contain metal and are taller than 12 m, such as trees and wooden posts.

If you are unable to locate the transmit antenna as recommended, locate it to maximize the distance to any vertical structure and minimize the number of vertical structures within 60 m of the antenna.

Ensure that the cable can reach the transmitter. The standard long-range transmit antenna cable is 75 meters long. Ensure there is enough slack at each end for position ad-

justments and to ease installation. Account for any other reductions in distance imposed by the cable route.

Animals (rodents in particular) can gnaw through cables. Plan to avoid this potential damage. Covering the cable with plastic split loom tubing (1/2 inch nominal size) is an inexpensive way to protect the cable. Running the cable through conduit is also an option. Conduit can be buried. Schedule 40 PVC pipe can be used as conduit.

People should not touch the antenna or risk tripping over the wires on the ground that radiate in a semicircle from the base of the antenna. Consider a non-metallic fence, markers and/or signage, especially if the site is accessible to the public. A minimum keep-out area is a 7 m radius circle centered at the antenna.

Plan how to support the antenna. Antenna support depends on the characteristics of the site. If the site's soil can be excavated, it is common to use a reinforced-concrete in-ground pier. Plans for such a pier are included in this guide. A drawing of the antenna feed is also included and shows the mounting bolt hole pattern. For temporary or short-term installations, the antenna can be bolted to a sturdy plywood base (not supplied), which sits on the ground, and stabilized with guy ropes. The base should be 0.75 - 1 m in diameter or square, with four holes drilled in the center and matching the antenna feed bolt hole pattern.

Decide whether guy ropes will be needed. If the support is very stable (for example, a concrete pier), guy ropes are not needed. Guy ropes should be made of *non-conductive* material. ***Do not use metal guy wire or cable***. For long-term installations, Kevlar rope with UV-resistant outer braid is recommended. To reduce cost, nylon can be used for short-term installations. If guy ropes are needed, plan how they will be anchored. Simple or cork screw stakes are commonly used. Metal stakes can be used. Determine the required length. Guy ropes and stakes are not provided with the transmit antenna and must be procured separately.

Inventory

If the installation site is remote, a missing part or tool will delay the installation. Ensure that you have all the required parts, tools and support equipment before departure. Checklists are provided in this guide.

Pack a clean work surface in your field kit. A piece of cardboard, paper, or cloth will work. The surface will be placed under threaded antenna parts to keep them clean. In addition, many small parts are used to assemble the antenna. The small parts are difficult to find if dropped in grass or dirt. A surface under the work area makes it easy to find dropped items.

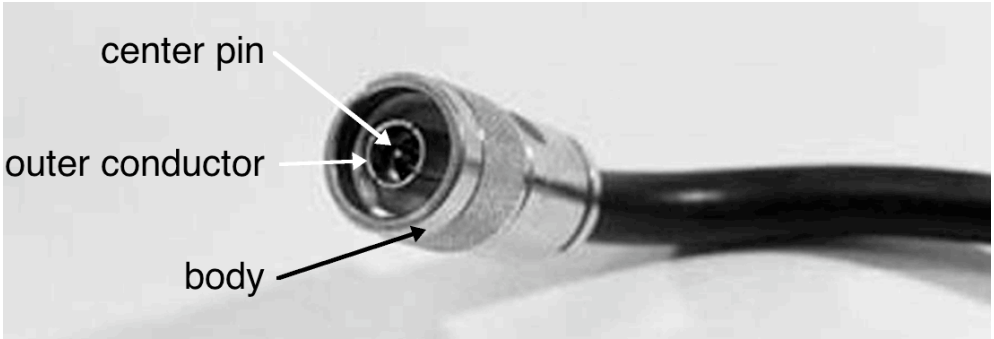
Include spare fasteners in your field kit, in case any are lost. Spare fasteners must be made of the material specified in the checklists. In particular, do not replace stainless steel parts with non-stainless steel.

Inspection
Summary procedure:

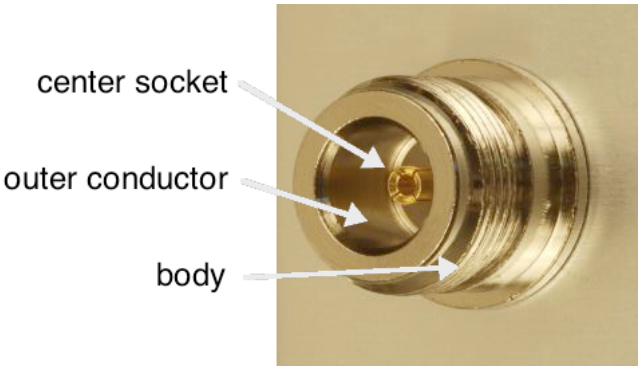
- Inspect physical condition.
- Perform electrical continuity checks.

A damaged or malfunctioning part will delay installation. The following inspections and tests should be performed prior to departure to a remote installation site.

The transmit cable and corresponding connectors on the antenna and transmitter are Type N coaxial connectors. Each connector has two conductors, a central pin or socket and an outer hollow cylinder. The conductors are enclosed by a threaded metal body.



Male Type N Connector



Female Type N Connector

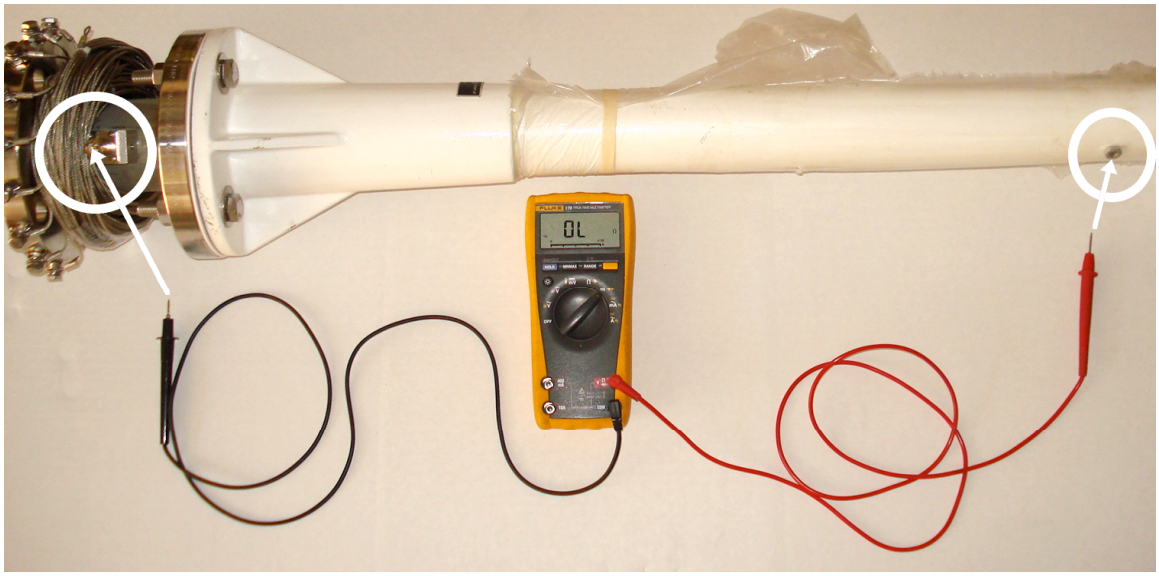
Inspect the physical condition of all electrical connectors.

- ☐ Connector bodies should not be bent or damaged.
- ☐ Connectors should be securely attached to cables.
- ☐ Connector pins, sockets and outer conductors should not be bent or loose.
- ☐ Connector pins and outer conductors should not extend beyond the connector body.

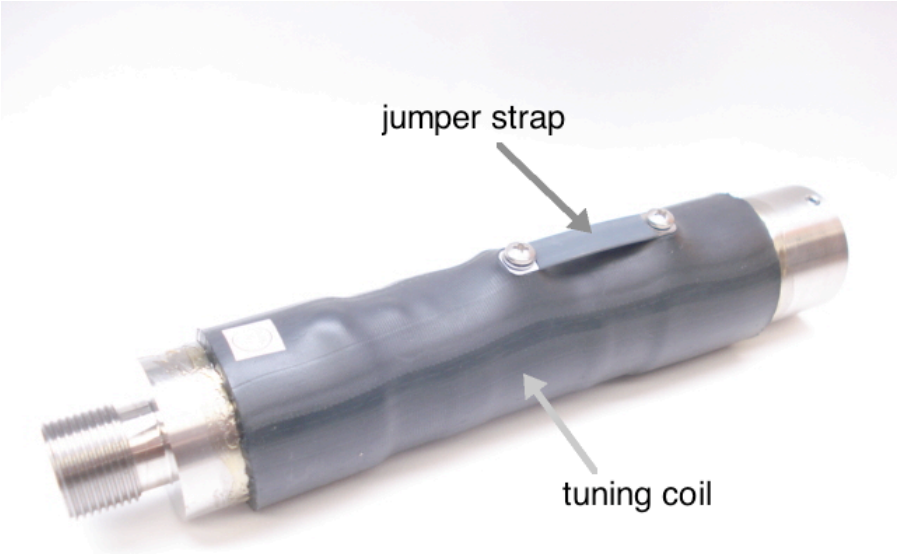
Perform electrical continuity checks with an ohmmeter or multimeter. Remember, zero or low resistance indicates continuity, the ability to conduct electricity. Infinite or large resistance indicates no continuity. Some meters have a continuity test mode.

Continuity checks for the spooled cable are performed easily while the cable is on the spool.

- ☐ On the spooled transmit cable, measure continuity between the connector center pins at the two ends of the cable. There should be continuity (very low or zero resistance).
- ☐ On the spooled transmit cable, measure continuity between the connector outer conductors at the two ends of the cable. There should be continuity.
- ☐ On the spooled transmit cable, measure the continuity between a connector center pin and the outer conductor of the same connector. There should be no continuity (very high or infinite resistance). Repeat for the antenna cable connector at the other end of the cable.
- ☐ A lightning arrester with a Type N female connector is mounted on the spool-shaped ground-plane feed subassembly, attached to the lower antenna section. Measure the resistance between the center socket of the connector and the lightning arrester housing. Be careful. Do not bend or damage the center socket when measuring. There should be no continuity.
- ☐ There is an exposed metal fitting on the lower antenna section, 0.75 m above the base. Measure the resistance between the center socket of the lightning arrester connector and the metal fitting. There should be continuity. (There is an epoxy seal opposite the metal fitting. Be careful. Do not remove or damage the seal.)



Tuning Coil Jumper Strap
The tuning coil is shipped with a metal jumper strap installed. If you plan to transmit at a frequency greater than 4.6 MHz, leave the tuning coil installed.



If you plan to transmit at a frequency less than or equal to 4.6 MHz, the jumper strap must be removed.

The tuning coil jumper strap is held in place by screws and star washers at its upper and lower ends. To remove the jumper strap:

- ☐ Loosen, but do not remove, the lower screw (nearest the female end of the tuning coil).
- ☐ Remove the upper retaining screw (nearest the male end of the tuning coil).
- ☐ Rotate the strap 180 degrees around the lower screw.
- ☐ Replace and tighten the upper screw and star washer. Tighten enough so that the screw stays in place. Do not overtighten.
- ☐ Tighten the lower screw enough so the strap does not move. Do not overtighten.

Ready for Installation
A crew of at least three strong people is needed to raise the antenna.

Transport all the parts and tools to the installation site.

Installation

In this chapter:
- Installing Cable
- Assembling Top Hat Adapter
- Assembling Antenna
- Raising and Securing Antenna

Installing Cable
Summary:

- Locate antenna site.
- Unspool and route cable.

Exercise care when installing the cable. Do not sharply bend the cable. (Minimum bending radius is 4 inches.) Do not exert excessive pulling tension on the cable. (Maximum pulling tension is 230 lb.) Do not pull on the connectors. Do not damage the connectors. Do not crush the cable or allow it to kink.

- ☐ Find the desired transmit antenna location. Ensure that the distance between the SeaSonde electronics and antenna is as planned. Pace off the distance or measure with a rangefinder or tape.

- ☐ Start at the SeaSonde electronics and ensure the transmit cable can be mated to the transmitter (or optional LP-100 lightning protection kit, if installed) and is properly routed.

- ☐ Unspool the transmit cable from the SeaSonde electronics to the antenna site. The easiest way is to insert a 1 m pipe through the spool and have two people walk the pipe and spool to the antenna site.

- ☐ Double-check the routing and ensure there is enough slack to mate the connectors at each end.

- ☐ If needed, install split loom tubing or other protection around the cable to avoid damage by animals.

Assembling Top Hat Adapter
The top hat adapter is so named because it fits over the top of the antenna. It consists of a metal sleeve and four stiff wire elements. The wire elements are held in place by a washer-like retainer and four fasteners. The top hat adapter is secured to the antenna with set screws.

Summary:

- Mark wire elements for safety.
- Loosen retaining washer screws.
- Insert wire elements.
- Tighten retaining washer screws.

Injury warning: the wire elements may cause injury to eyes or other parts of the body. Mark the end of each wire, so that it is seen easily. Safety glasses are recommended.

☐ Place a piece of adhesive tape on one end of each wire, so that it is seen easily.

☐ Using a 9/64 inch hex (Allen) driver or key, loosen the four cap screws that hold the retaining washer in place at the end of the top hat adapter. Loosen just enough to slip the wire elements snugly between the retaining washer and one of the grooves in the top hat adapter.

☐ Insert a wire element between the retaining washer and a groove in the top hat adapter. Repeat for all four wire elements.

☐ Tighten the four cap screws on the top hat adapter.

☐ Set the top hat adapter aside. It will be installed on the antenna a few steps later.

Assembling Antenna
Summary:

- Arrange antenna sections.
- Lubricate and screw together upper antenna section and tuning coil. Tighten set screws.
- Lubricate and screw together lower antenna section and tuning coil. TIghten set screws.
- Install guy rope collar and guy ropes if used.
- Install top hat adapter.

☐ Lay out the two antenna sections on the ground and arranged end-to-end for assembly. The tuning coil is installed between the lower and upper antenna sections. Ensure that the connecting parts remain clean by placing a clean surface (cardboard, paper, a towel or rag, etc.) under them.

☐ Ensure that the tuning coil jumper strap is in the correct position. It should be installed (secured with both screws) when transmitting greater than 4.6 MHz. It should

be uninstalled (removed from the upper screw) when transmitting less than or equal to 4.6 MHz. If the tuning coil jumper strap must be uninstalled, follow the instructions earlier in this guide.

- ☐ Liberally coat the female threaded section at the bottom of the upper antenna section with a moisture-proof insulating lubricant. *Dow Corning 4 Electrical Insulating Compound* is recommended.
- ☐ Liberally coat the male threaded section of the tuning coil with moisture-proof insulating lubricant.
- ☐ Tightly screw the tuning coil onto the upper antenna section.
- ☐ Tighten the two set screws at the bottom of the upper antenna section using a 3/32 inch hex (Allen) driver or key.
- ☐ Liberally coat the female threaded section of the tuning coil with moisture-proof insulating lubricant.
- ☐ Liberally coat the male threaded section at the top of the lower antenna section with moisture-proof insulating lubricant.
- ☐ Tightly screw the tuning coil with upper antenna section onto the lower antenna section. Use a strap wrench if necessary.
- ☐ Tighten the two set screws at the bottom of the tuning coil using a 3/32 inch hex (Allen) driver or key.
- ☐ (Optional.) If using guy ropes, slip the top of the antenna through the center hole of the guy rope collar. The eye bolts on the guy rope collar should point downward, i.e., the eyes should be closest to the ground when the antenna is raised. Slide the collar to the center of the antenna until it stops in place at the metal fitting of the upper antenna section.

☐ (Optional.) If using guy ropes, attach four ***non-conductive*** guy ropes to the four guy-rope-collar eye-bolts.

☐ Begin installing the top hat adapter by placing it over the top of the upper antenna section. Ensure that the top of the antenna is completely inserted in the top hat adapter.

☐ Tighten the three upper top hat adapter set screws (cup point with red marking) using a 3/32-inch hex (Allen) driver or key.

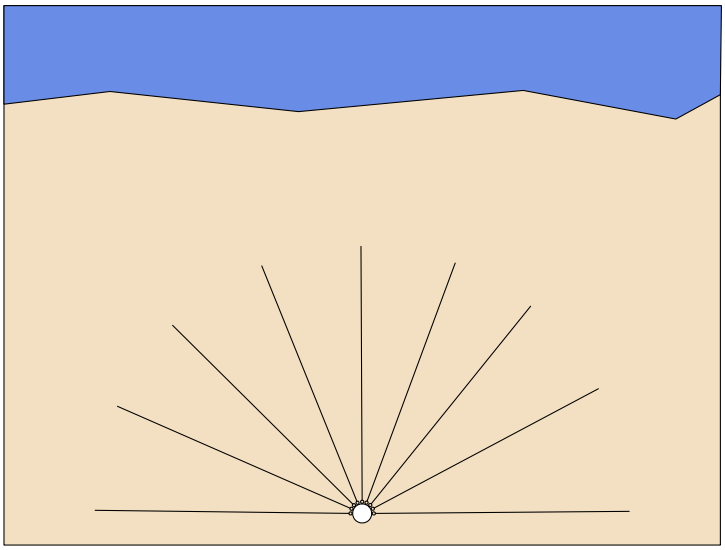
☐ Tighten the three lower top hat adapter set screws (soft point, green-tipped) using a 3/32-inch hex (Allen) driver or key.

☐ Remove the adhesive tape markers from the top hat adapter wire elements.

Raising and Securing Antenna
Summary:

- Orient antenna.
- Raise antenna.
- Place antenna on support and tighten fasteners.
- Secure guy ropes if used.
- Release and arrange ground plane wires. Stake if needed.
- Mark keep-out area if needed.
- Take up cable slack.

☐ There are nine ground-plane wires connected to the ground-plane feed assembly and secured with bolts. Locate the center bolt of the nine. Rotate the antenna so that, when it is raised, the head of the center bolt will be toward the sea.



Ground Plane Wire Orientation
(schematic; not to scale)

- ☐ If needed, attach a temporary base to the ground plane feed assembly base.
- ☐ Hold the antenna base in position while others lift the antenna at its middle (near the tuning coil) and raise the antenna by walking it toward the base.
- ☐ If using a permanent support, lift the antenna and place the ground plane feed assembly over the support bolts. Install and tighten support nuts.
- ☐ If using guy ropes, secure them while one or more people hold the antenna in place.
- ☐ The ground plane wires are wrapped around and secured to the ground plane feed assembly. Remove the material that secures the ground plane wires.
- ☐ Unwrap the ground plane wires from the ground plane feed assembly.
- ☐ Arrange the ground plane wires so that they are evenly spaced and fan out in a 180 degree arc. The loose end of the center ground plane wire should be closest to the sea.
- ☐ If the ground plane arc is not properly oriented, reorient it by moving one or more of the ground plane wires on the antenna feed (base). Determine which wire “points” directly to the sea. This will be the center wire. There should be four wires on either side of the center wire. If not, move a wire from the side that has more than four wires to the other side by removing its fastener and reattaching it to a threaded hole on the opposite side of the arc. Repeat if necessary until there are four wires on either side of the center wire.
- ☐ If needed, secure the ends of the ground plane wires with long nails or irrigation hose stakes to keep them in their proper orientation. Metal stakes can be used.
- ☐ If needed, mark or secure the area with non-metallic fence, markers and/or signage to keep people from tripping over the ground plane wires or touching the antenna.
- ☐ Take up any cable slack at the antenna by looping the cable into a 0.3 m diameter coil at base of antenna.
- ☐ Connect the transmit cable to the lightning arrester at the base of the antenna.
- ☐ Connect the transmit cable to the transmitter connector or the optional LP-100 lightning protection kit.

Checklists

Antenna Parts Checklist
Parts marked “not supplied” are not supplied by CODAR and must be procured from other sources.

Note that many parts are pre-assembled. For example, the antenna feed is completely assembled and mated to the lower antenna section.

Check	Quantity	Description
		UPPER ANTENNA SECTION PARTS
	1	transmit antenna, upper section
	2	set screw, cup point, 10-32 x 3/8", 3/32" hex socket, stainless steel
		LOWER ANTENNA SECTION PARTS (The fasteners and gasket listed mate the lower antenna section to the antenna feed subassembly.)
	1	transmit antenna, lower section
	4	cap bolt (full thread), 1/2-13 x 2-3/4”, stainless steel
	8	flat washer, 1/2”, stainless steel
	4	lock washer, 1/2”, stainless steel
	4	nut, 1/2-13, stainless steel
	1	(optional), teflon gasket (Gasket goes between lower antenna section and antenna feed.)
		ANTENNA FEED PARTS
	1	spool-shaped base, stainless steel
	9	ground plane wires, 25 feet long, stainless steel
	9	bolt, 1/4-20 x 3/8”, stainless steel (fastens ground plane wire to antenna feed)
	9	lock washer, 1/4” (on ground plane wire bolt)
	9	flat washer, 1/4” (on ground plane wire bolt)
	1	antenna feed connector, Type N, attached to base

Check	Quantity	Description
	1	lightning arrester with Type N connector, attached to antenna feed connector
		TUNING COIL ASSEMBLY PARTS
	1	tuning coil
	1	tuning coil jumper strap, stainless steel, with black shrink tube insulation
	2	screw, phillips head, 10-32 x 1/4”, stainless steel
	2	internal star washer, #10, stainless steel
	2	set screw, cup point, 10-32 x 3/8", 3/32" hex socket, stainless steel
		TOP HAT ASSEMBLY PARTS
	1	top hat adapter, stainless steel sleeve
	4	antenna element, 0.062” diameter, 3 feet long, titanium alloy (6 AL/4V ELI)
	1	retaining washer, 1” outside diameter, with five holes
	4	cap screw, 8-32 x 7/16", 9/64" hex socket, stainless steel
	4	internal star washer, #8
	3	set screw, cup point, 10-32 x 3/16", 3/32" hex socket, stainless steel, red marking on threads (inserted in upper holes of top hat adapter)
	3	set screw, soft point (nylon), 10-32 x 3/16", 3/32" hex socket, stainless steel, green tipped (inserted in lower holes of top hat adapter)
		MOUNTING HARDWARE
	4	bolt, 5/8”-11, length as required
	4	nut, 5/8”-11
	4	lock washer, 5/8”
	4	flat washer, 5/8”

Check	Quantity	Description
	4	(optional, not supplied) guy ropes, non-conductive, length as required (10 m nominal). For long-term installations, Kevlar with UV-resistant outer braid is recommended. To reduce cost, nylon can be used for short-term installations.
	4	(optional, not supplied) stakes or anchors to tie down guy ropes
	1	(for temporary install, not supplied) base, plywood, 0.75 - 1 m diameter or square, holes drilled with antenna feed bolt hole pattern
		CABLE
	1	cable, RG-8 with male N-type connectors, 75 m
		OPTIONAL EQUIPMENT
	1	lightning protection kit, CODAR part LP-100
	as required	(not supplied) non-metallic fencing, markers, and/or signage
	as required	(not supplied) split loom tubing, plastic, 1/2 inch nominal, or conduit, (e.g., Schedule 40 PVC), 1/2 inch nominal, (to protect cables from animal damage)

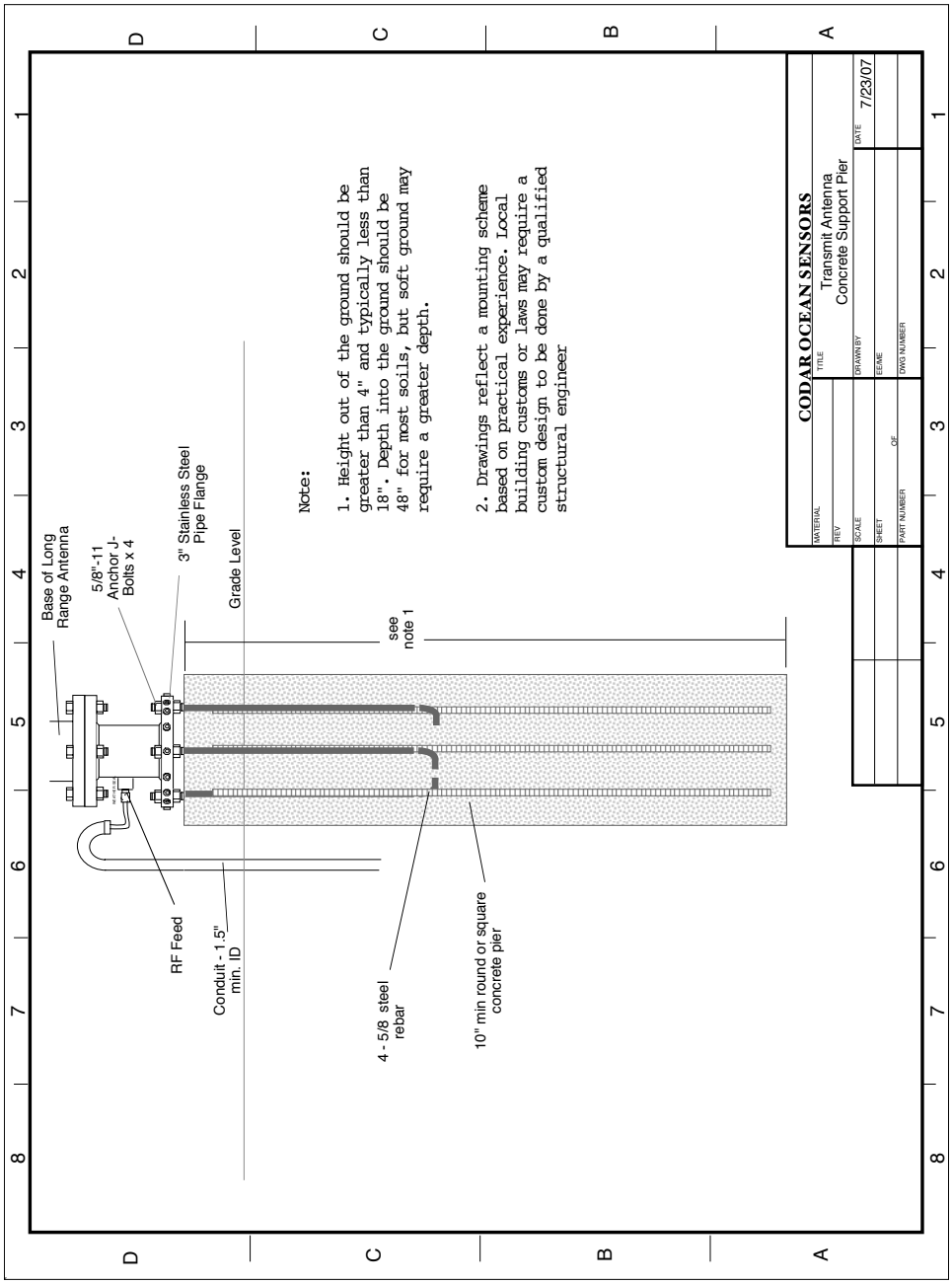
Tool Checklist (Tools not supplied.)

Check	Quantity	Description
	1	hex (Allen) driver or key, 3/32"
	1	hex (Allen) driver or key, 9/64"
	1	strap wrench
	as required	hammer(s) to drive ground plane wire stakes and guy rope stakes
	1	ohmmeter or multimeter for continuity checks
	1	tape measure or rangefinder
	as required	Moisture-proof insulating silicone grease. Dow Corning 4 Electrical Insulating Compound is recommended.

Check	Quantity	Description
	as required	clean working surface (cardboard, towel, etc.)
	1	(optional) pipe, 1 m long, to put through cable spool

Drawings

Concrete Support Pier



Antenna Feed