

# INSTRUCTION MANUAL



## ***CM375 Portable 10-Meter Mast***

Revision: 10/14



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**DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.** FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at [www.campbellsci.com](http://www.campbellsci.com) or by telephoning (435) 227-9000 (USA). You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

## General

- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

## Utility and Electrical

- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines**.
- Maintain a distance of at least one-and-one-half times structure height, 20 feet, or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.

## Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

## Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.

# ***PLEASE READ FIRST***

## **About this manual**

Please note that this manual was originally produced by Campbell Scientific Inc. (CSI) primarily for the US market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

<b>Area:</b>	1 in <sup>2</sup> (square inch) = 645 mm <sup>2</sup>
<b>Length:</b>	1 in. (inch) = 25.4 mm
	1 ft (foot) = 304.8 mm
	1 yard = 0.914 m
	1 mile = 1.609 km
<b>Mass:</b>	1 oz. (ounce) = 28.35 g
	1 lb (pound weight) = 0.454 kg
<b>Pressure:</b>	1 psi (lb/in <sup>2</sup> ) = 68.95 mb
<b>Volume:</b>	1 US gallon = 3.785 litres

In addition, part ordering numbers may vary. For example, the CABLE5CBL is a CSI part number and known as a FIN5COND at Campbell Scientific Canada (CSC). CSC Technical Support will be pleased to assist with any questions.

## **About sensor wiring**

Please note that certain sensor configurations may require a user supplied jumper wire. It is recommended to review the sensor configuration requirements for your application and supply the jumper wire is necessary.



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# CM375 Portable 10-Meter Mast

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## 1. Overview

The CM375 is a corrosion-resistant 10 m (30 ft) mast for applications requiring a tall yet portable instrument mount. It consists of six galvanized pipes, a stainless-steel base, guy cables, 1 m crossarm and mount, and grounding kit. Duckbill anchor kits (required) and a guy-wire tensioning kit (recommended) are ordered separately. All of the components fit inside a 2 m (80 in) bag allowing the CM375 to be carried from site to site (see FIGURE 1-1).



FIGURE 1-1. 21720 tote

### 1.1 Specifications

<b>Weight:</b>	30 kg (66 lb)
<b>Mast:</b>	9.2 m (30 ft) total length; consists of five 1.82 m (6 ft) and one 1 m (39 in) sections
<b>Main Mast Diameter:</b>	48.26 mm (1.9 in)
<b>Top Section Mast Diameter:</b>	44.2 mm (1.74 in)
<b>Base Radius:</b>	6 m (20 ft) to each of three guy points, 120 degrees apart
<b>Guy Configuration:</b>	Three guy cables at two levels; guyed at 3.6 m (12 ft) and at 7.2 m (24 ft)
<b>Recommended Guy Wire Pretension:</b>	100 lb each; check and adjust guy wire tension at least once a month, and after wind gusts exceeding 50 mph
<b>Maximum Weight of Mounted Equipment:</b>	34 kg (75 lb)

**Maximum Allowable  
Wind Gust<sup>i</sup>:**136 kmh<sup>-1</sup> (85 mph)

The wind gust value assumes:

- Proper installation
- Proper anchoring:
  - Adequate soil (guy anchors/base support)
  - Guy anchors at 20-ft from base with 120 degrees of separation
  - Proper guy tension (100 lb each)
- No ice buildup
- Standard air quality or wind assessment configuration (see Table below)

Standard Air Quality Configuration		Standard Wind Assessment Configuration	
Height	Component	Height	Component
9.1 m	CM204 crossarm with a Wind Monitor and a 43502/43347 Aspirated Shield & RTD attached	9.1 m	Two CM202 crossarms with a 03101 Wind Sentry Anemometer attached to each crossarm
		8.5 m	CM202 with 03301 Wind Sentry Wind Vane attached
3 m	41003-5 Radiation Shield housing an HMP45C Temperature/RH Probe; Antenna; CM202 crossarm with a 43502/43347 Aspirated Shield & RTD attached	3 m	41003-5 Radiation Shield housing an HMP45C Temperature RH Probe; Antenna; CM202 crossarm with a 03101 Wind Sentry Anemometer attached
1.5 m	SP20 20-W Solar Panel	1.5 m	SP20 20-W Solar Panel
1 m	ENC16/18 Enclosure housing a CR1000 datalogger and PS100 Power Supply	1 m	ENC12/14 Enclosure housing a CR1000 datalogger and PS100 Power Supply

## 1.2 Guy Duckbill Anchor Kits

A choice of duckbill anchor kits is offered for the CM375. The 19282 Guy Duckbill Standard Anchor Kit is adequate for most sandy and loamy soils. Clay soils and other soils with higher corrosive properties will require the 25699 Guy Duckbill Heavy Duty Anchor Kit. These corrosive soils, also known as aggressive soils, have one or more of the following properties:

- High electrical conductivity (>0.33 dS m<sup>-1</sup>)
- High acidity (pH <5)
- High chloride concentration (>1000 ppm)
- High sulfate concentration (>500 ppm)
- Poor aeration

Both the 19282 and 25699 have one drive rod. The 19282 also has three duckbill anchors with a cable attached to each of them; at the end of the cable is a loop for connecting the guy wires. The 25699 has a threaded rod attached to each of the three duckbill anchors instead of the cable; at the end of the threaded rod is a metal ring for connecting the guy wires.

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<sup>i</sup> The amount of wind gust that this mount can withstand is affected by quality of anchoring and installation, guy wire tension, soil type, guy angle, and the number, type, and location of instruments fastened to the CM375.

## 2. Tools List (for tripod, mast, enclosures, and crossarms)

- 1/2-in. and 7/16-in. open end wrenches
- adjustable wrench
- Phillips head screw drivers (medium, small)
- Straight bit screwdrivers (large, medium)
- 12-in. torpedo level
- side-cut pliers
- pencil
- tape measure
- compass and site declination angle
- shovel
- sledge hammer (for driving ground rod and stakes)
- step ladder

## 3. CM375 Installation

### 3.1 Site Selection

Select a site free from overhead power lines, and 30 m (100 ft) in any direction from trees, buildings, and other obstructions (see FIGURE 3-1).



FIGURE 3-1. Assembled CM375

## 3.2 Assembling Mast Sections

**Step 1:** Remove mast sections and other bundled hardware from tote; unzip and loosen straps (see FIGURE 3-2).

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**NOTE**

Sections are numbered for sequential assembly (see FIGURE 3-3).

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FIGURE 3-2. CM375 in opened tote

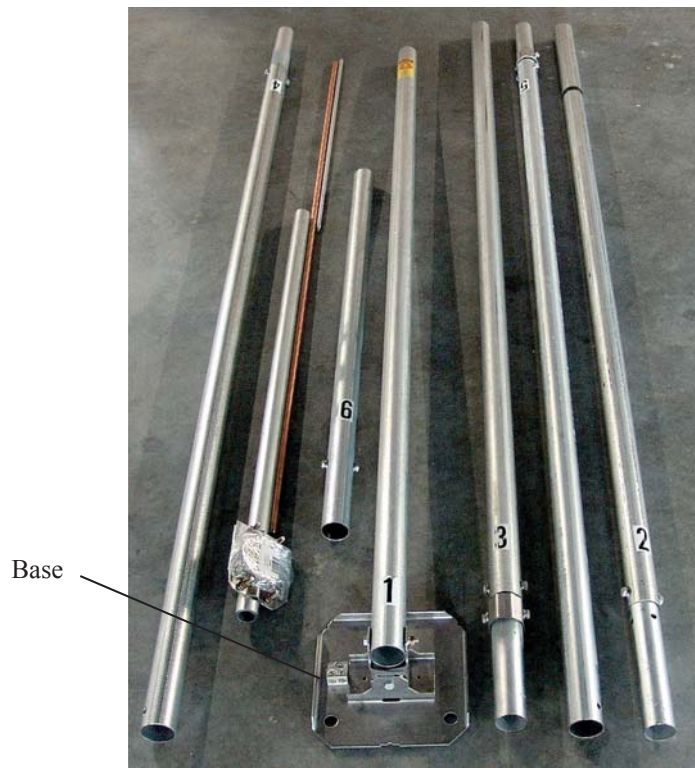


FIGURE 3-3. Mast base, sections, and lightning rod kit

**Step 2:** Place Section 1 at deployment location with base oriented, as shown in FIGURE 3-4 and mast pointing NORTH.

**NOTE**

A compass is included in the optional “Tensioning Kit” for your use.



*FIGURE 3-4. Mast Section 1 oriented on base*

**Step 3:** Use spikes provided (3 each) to anchor base to site (see FIGURE 3-5).

**WARNING**

**Always maintain a safe distance between the mast and any overhead power lines. Contact local utilities prior to assembling the mast to locate any buried utility lines in the area the mast is to be installed.**

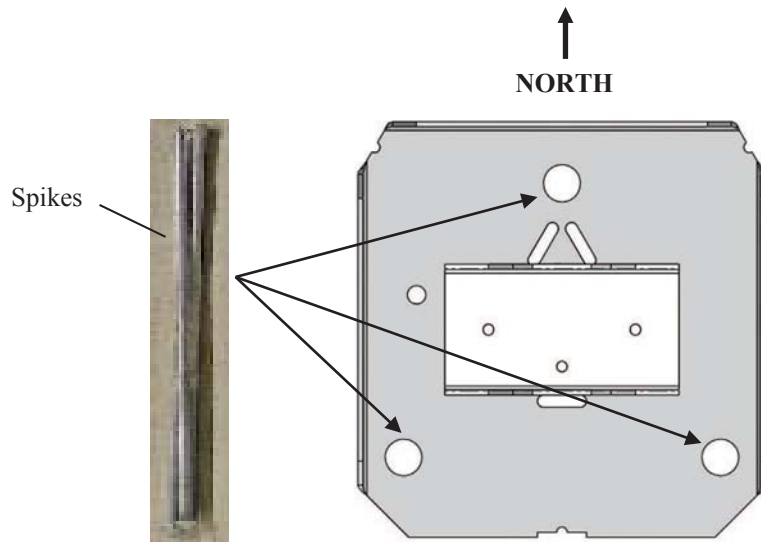


FIGURE 3-5. Spike installation

**Step 4:** Insert the Section 2 coupler into the top of Section 1 (see FIGURE 3-6).

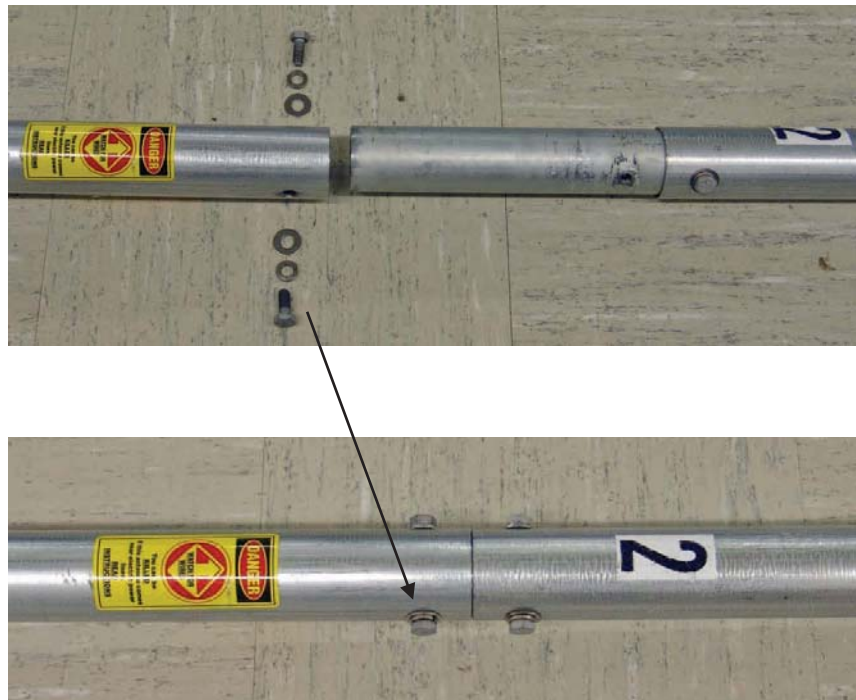


FIGURE 3-6. Coupler installed in top of mast Section 1

**Step 5:** Secure joint with 2 flat washers, 2 lock washers and 2 bolts from the hardware bag (see FIGURE 3-7).



FIGURE 3-7. Bag containing hardware

**Step 6:** Assemble Section 3 to the top of Section 2 (see FIGURE 3-8).

**NOTE**

The BLACK tape around Section 2 is a reference (11 foot level) for optional sensor mounts.



FIGURE 3-8. Mast Section 2 and mast Section 3

**Step 7:** Remove the collars from Section 3 and place next to the mounting holes in Section 2 (see FIGURE 3-8 and FIGURE 3-9).

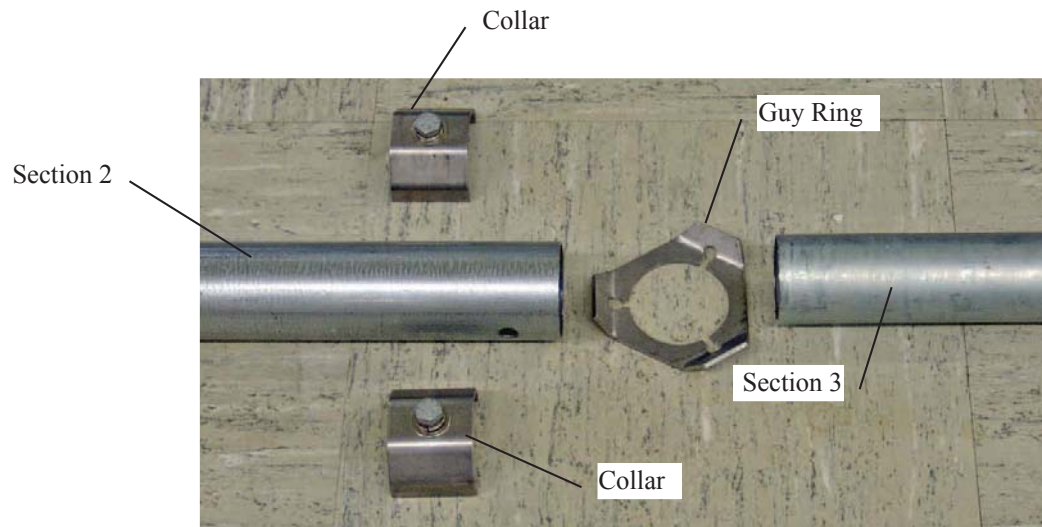


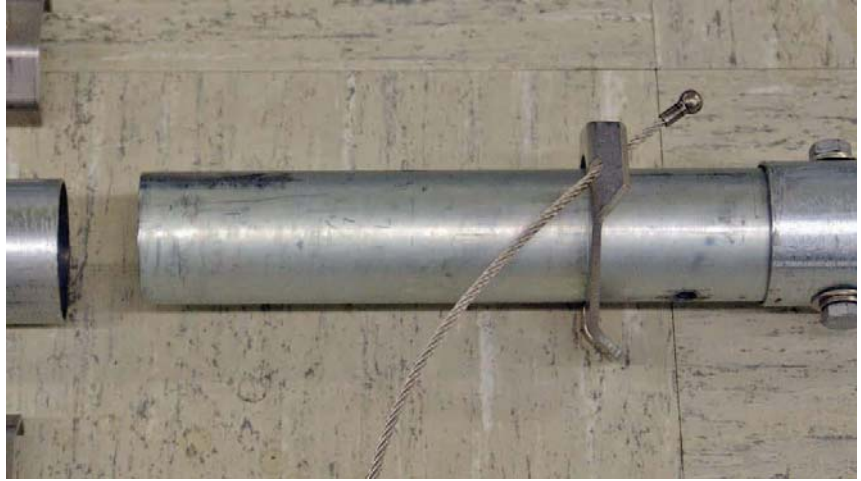
FIGURE 3-9. Guy ring, mast Section 2 and mast Section 3

**Step 8:** Remove guy ring from bottom guy kit, pn 21663 (see FIGURE 3-9 and FIGURE 3-10).



FIGURE 3-10. 21663 bottom guy kit

**Step 9:** Place ball end of each guy cable into its slot in the guy ring and place guy ring onto coupler of Section 3 (see FIGURE 3-11).

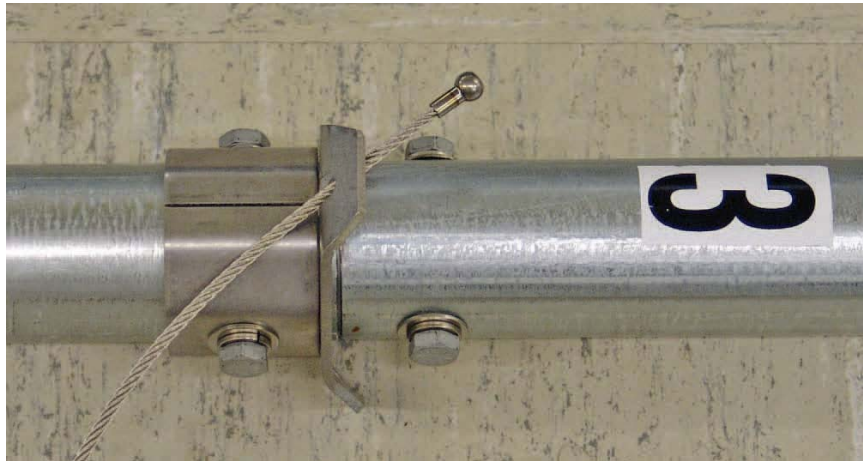


*FIGURE 3-11. Guy cable inserted into guy ring*

**NOTE**

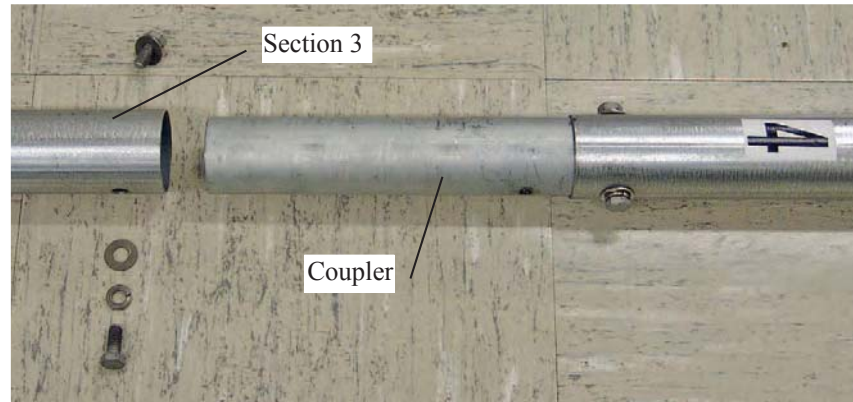
Only one of the three cable ends is shown.

**Step 10:** Slide coupler into Section 2 mast and assemble collars, as shown in FIGURE 3-12.



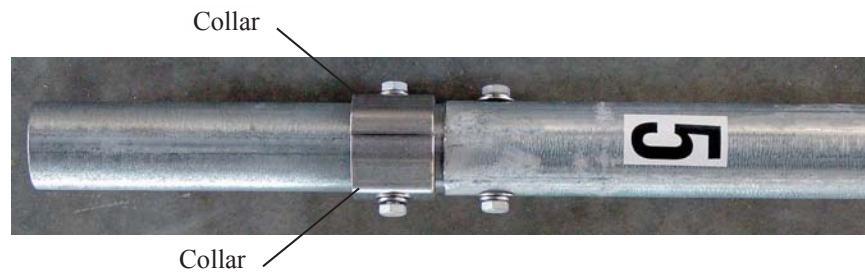
*FIGURE 3-12. Mast Section 3 and guy ring/collar assembly*

**Step 11:** Slide coupler end of Section 4 into the top of Section 3, and secure with remaining components from hardware bag (see FIGURE 3-13).



*FIGURE 3-13. Mast Section 4 ready to be installed in mast Section 3*

**Step 12:** Remove collars from Section 5 (see FIGURE 3-14).



*FIGURE 3-14. Mast Section 5*

**Step 13:** Remove the guy collar from the 21661 guy kit (FIGURE 3-15).



FIGURE 3-15. 21661 guy kit

**Step 14:** Place the guy cable ball ends into the guy ring, and then slide the guy ring onto the bottom end of Section 5 oriented as shown in FIGURE 3-16. Align the holes in Section 4 and Section 5, and reassemble the collars.

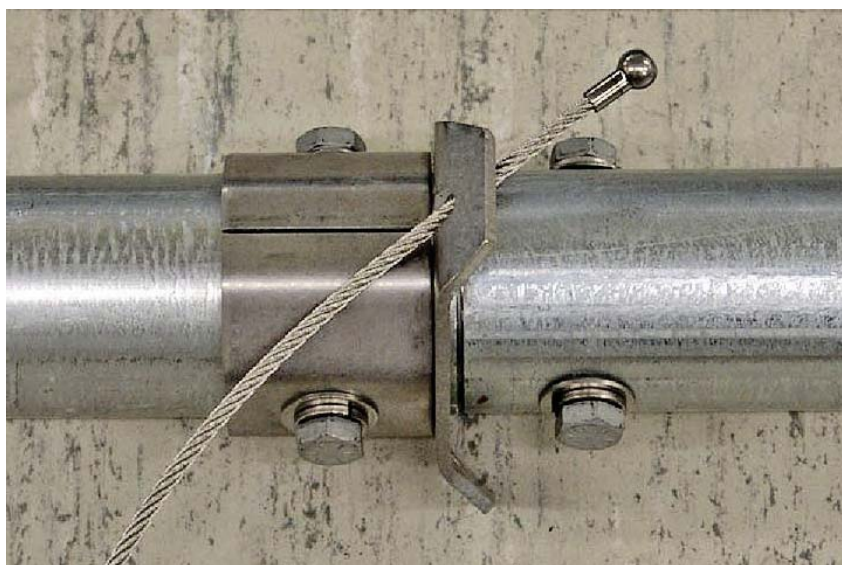


FIGURE 3-16. Mast Section 5 and guy ring/collar assembly

**Step 15:** Remove the hardware from Section 6. Insert Section 6 into the top of Section 5 and secure with hardware (FIGURE 3-17).

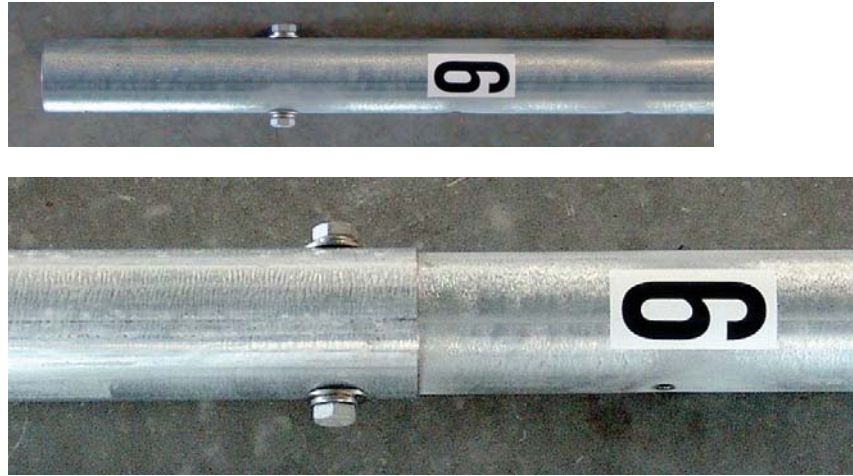


FIGURE 3-17. Mast Section 6

### 3.3 Lightning Rod Assembly and Mounting Instrumentation

**Step 1:** Fit lightning rod assembly (from pn 21660) to top of Section 6 mast (see FIGURE 3-18).



FIGURE 3-18. Lightning rod assembly

**Step 2:** Place clamp onto top of mast Section 6 and tighten (see FIGURE 3-19).

**Step 3:** Insert rod into clamp and tighten (see FIGURE 3-19).

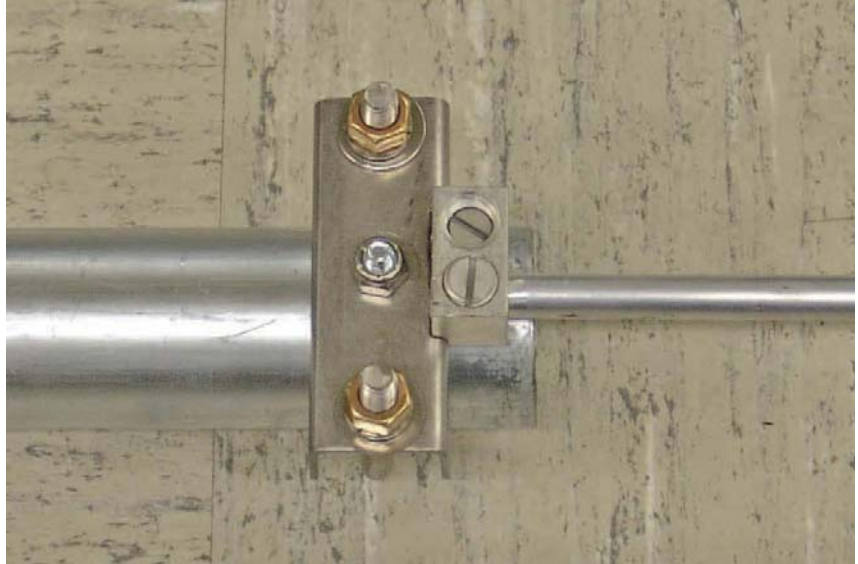


FIGURE 3-19. Installed lightning rod

**Step 4:** Assemble enclosures, sensors and tie cables to mast, as required.

### 3.4 Anchor Installation



FIGURE 3-20. Tape measure in slot for South anchor

**Step 1:** For the South anchor, place tape measure into slot in base centering tape within notch on edge of base. Measure to 20 ft (see FIGURE 3-20).

**Step 2:** At 20 ft, install the duckbill anchor with drive rod (see FIGURE 3-21). The anchor needs to be driven into the ground at a 45° angle (see FIGURE 3-22). Drive anchor until the loop or metal ring is several inches above the ground.

**WARNING**

Always maintain a safe distance between the mast and any overhead power lines. Contact local utilities prior to assembling the mast to locate any buried utility lines in the area the mast is to be installed.

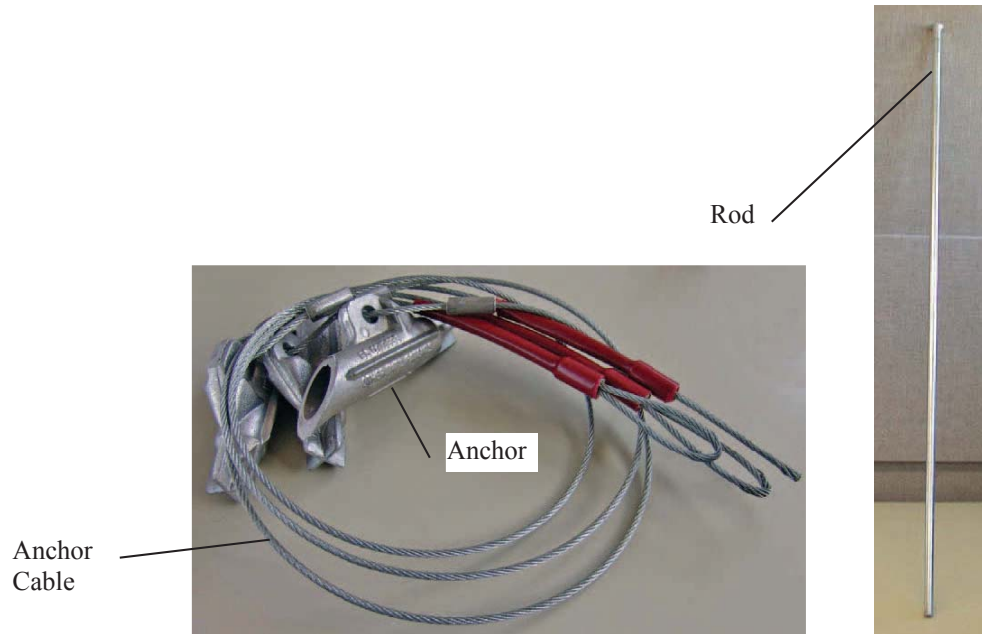


FIGURE 3-21. 19282 duckbill anchor and cable assembly (left). The 25699 has a threaded rod instead of the cable. The drive rod (right) is used for both the 19282 and 25699.

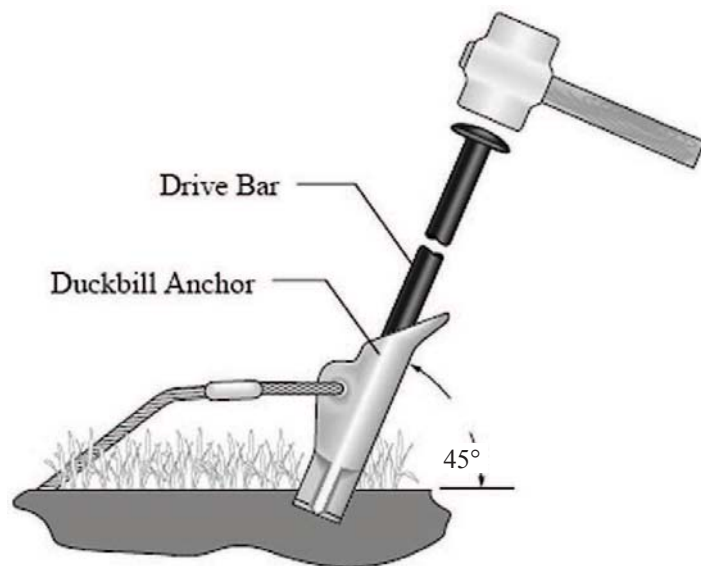
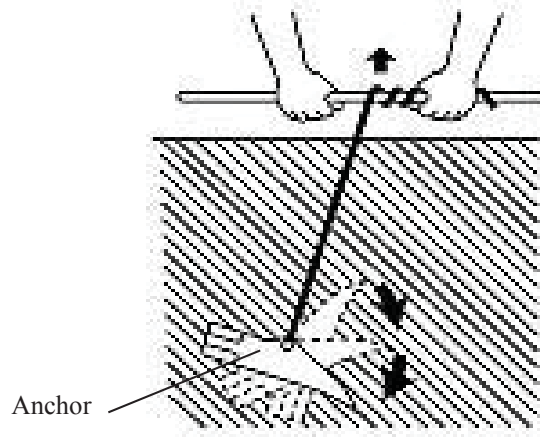


FIGURE 3-22. Anchor driven into ground at 45° angle

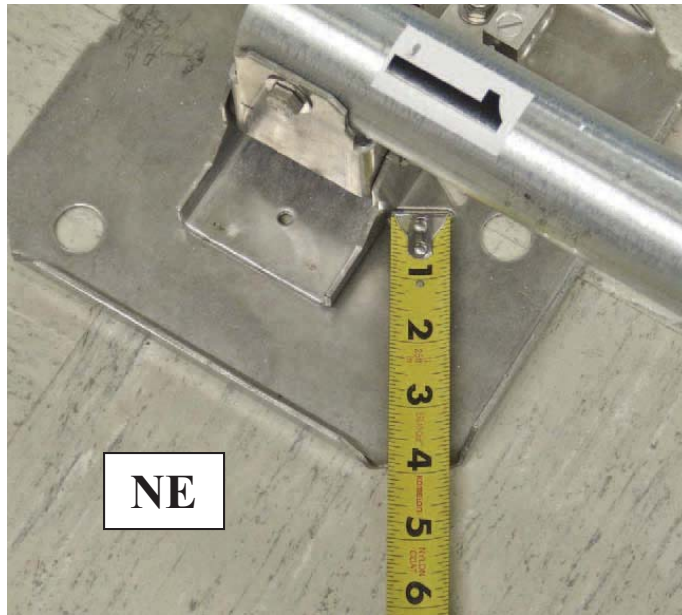
**Step 3:** With a rod through the loop or metal ring, pull up on the cable or threaded rod until the anchor rotates and locks (see FIGURE 3-23).



*FIGURE 3-23. Locking anchor*

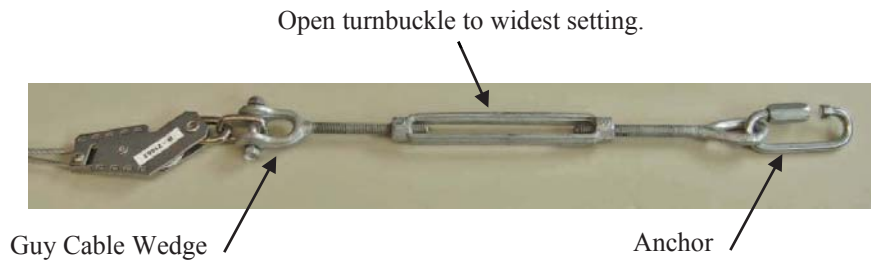
**Step 4:** Fill-in the hole around the cable or threaded rod with loose dirt and tamp firm.

**Step 5:** Repeat process for the NE (FIGURE 3-24) and NW anchors.



*FIGURE 3-24. Tape measure in slot for Northeast anchor*

**Step 6:** Attach guy wires to anchors by first opening the turnbuckle to the widest setting. Attach turnbuckle to wedge end of the guy cable, and then attach the other end of the turnbuckle to an anchor (see FIGURE 3-25).



*FIGURE 3-25. Turnbuckle fastened to guy cable and anchor*

**Step 7:** If using rope ratchet to assist assembly, set to 7 feet and attach to tension clamp on cable and to anchor end. Do this for both NE and NW anchors and top and bottom guy cables (see FIGURE 3-26 and FIGURE 3-27).

**NOTE**

Do not connect the SOUTH cables at this time.



*FIGURE 3-26. Top and bottom guy cables fastened to an anchor*



FIGURE 3-27. Rope ratchet assists assembly

**Step 8:** Course adjustments to cable length are made by loosening screw clamp and then releasing wedge with a blade screwdriver (see FIGURE 3-28). This allows the cable to be adjusted through the wedge clamp.

**NOTE**

Retighten screw when adjustment is complete.



FIGURE 3-28. Adjusting cable through wedge clamp

### 3.5 Raise, Plumb Mast and Final Cable Tensioning

**Step 1:** With NW and NE cables attached to anchors have one person lift mast, while another person pulls on the SOUTH cables to bring mast to an upright position (see FIGURE 3-29). If using rope ratchets, adjust them to allow further steps.



FIGURE 3-29. Raising the mast

**Step 2:** Attach SOUTH cables to anchor. While first person holds mast and uses a post level (available at most hardware stores or online), the second person adjusts each of the bottom guy cable wedge clamps, maintaining level in all directions (see FIGURE 3-30). The rope ratchet can be used to temporarily remove the load from the wedge assembly during wedge adjustments.



FIGURE 3-30. Post level ensures vertical mast

**Step 3:** Repeat process with the top guy cables to establish a straight mast.

**Step 4:** Apply further tensioning using the turnbuckles (see FIGURE 3-31).



FIGURE 3-31. Adjusting turnbuckles

**Step 5:** Adjust each cable turnbuckle to maintain plumb and increase cable tension. A deflection of 3 inches when using a 4.4 pound (20 Newton) perpendicular force, 68 inches from the duckbill anchor loop equates to 100 pounds of tension in the cables (see FIGURE 3-32).

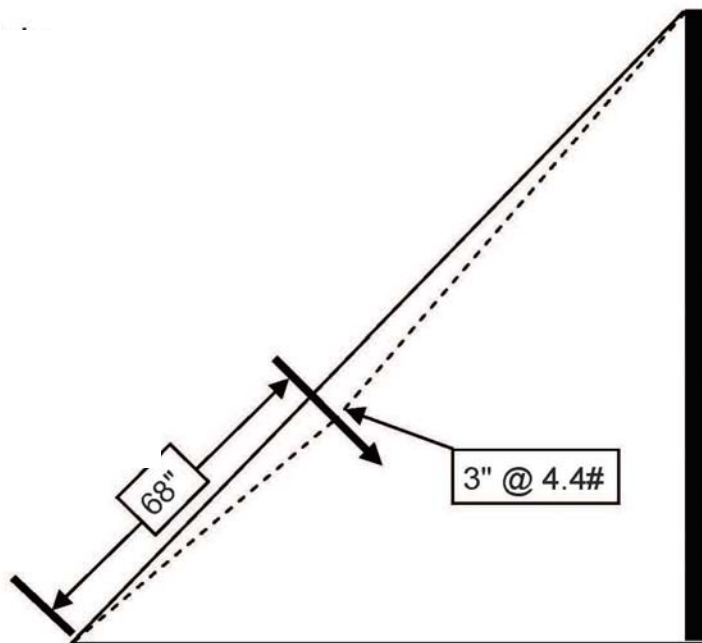


FIGURE 3-32. Guy cables with 100 lb of tension

**Step 6:** After tensioning the top guy cables, recheck the bottom guy cables.

Adjust, as necessary.

## **4. Maintenance**

Check and adjust guy cable tension at least once a month, and after wind gusts exceeding 50 mph.



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