

Antenna Site Preparation and Mount Installation Guide

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11717 Exploration Lane, Germantown, MD 20876 T: 301.428.5500 F: 301.428.1868/2830

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Important safety information

For you own safety and protection, read this safety section carefully. Keep this safety information where you can refer to it if necessary.

This section includes:

- Types of warnings used in this manual on page iii
- General site preparation safety on page v
- Installation safety policies on page vi
- Additional safety information in this Guide on page ix

Types of warnings used in this manual

This section introduces the various types of warnings used in this document to alert you to possible safety hazards that could be encountered during site preparation activities.



Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury.

CAUTION

Indicates a situation or practice that might result in property damage.



Electric shock hazard: Where you see this symbol and DANGER heading, strictly follow the warning instructions to avoid electric shock injury or death.



Fall hazard: Where you see this symbol and DANGER heading, strictly follow the warning instructions to avoid personal injury or death from falling.



Potential radio frequency (RF) hazard: Where you see this alert symbol and CAUTION heading, strictly follow the warning instructions to avoid possible injury to eyes or other personal injury.

General site preparation safety

Observe the following precautions while preparing a site for installation of a satellite antenna.



Only Hughes-certified installers can install or service Hughes earth stations and components. All Hughes-certified installers must expressly acknowledge the requirements for Hughes installations.

If you work on a roof, tower, or other high structure or use a ladder or scaffold to access the work site, follow these precautions to prevent personal injury or death:



- Walk only on sound roof structures.
- Make sure the antenna assembly and installation surface are structurally sound so they can support all loads (equipment weight, ice, and wind).
- Use appropriate safety equipment (for example, a lifeline), depending on the work location.
- Follow all safety precautions from the manufacturers of all safety equipment and other equipment used.
- Perform as many procedures as possible on the ground.

 Hughes earth stations are not designed or licensed for aeronautical, maritime or other boat- or ship-based installations or use.



• The Hughes installation policy and requirements are mandatory for all installations, including those made within the Continental United States as well as Hawaii, Alaska, Puerto Rico, the U.S. Virgin Islands, and other U.S. territories, as well as for installations outside the United States. Other governments may impose additional requirements to these on earth station installations outside the U.S. and its territories.

Installation safety policies	Unless explicitly authorized in writing, Hughes installations must use only Hughes-certified indoor units (IDUs) and outdoor units (ODUs), including antennas, in approved configurations.	
	Site preparation practices must conform to the requirements in this <i>Site Preparation and Mount Installation Guide</i> and in the <i>Hughes Network Systems Policy for the Installation and</i> <i>Operation of Two-Way Satellite Antennas</i> (H30794). This section, <i>Important safety information</i> , summarizes but does not take the place of the installation policy document. The policy document details the installer's responsibilities. You must read the policy document, sign it, and return the form it contains certifying that you have read it and will abide by the policy.	
	The requirements of the Hughes installation policy are mandatory for all installations in and outside of the United States. Governments outside of the United States may impose additional requirements.	

RF radiation safety All Hughes earth stations have RF radiation levels between the feed horn and the reflector that exceed the maximum permissible exposure (MPE) limits set by the Federal Communications Commission (FCC). In certain operating modes, the earth station can produce RF radiation that exceeds the MPE limit in the space projecting outward in front of the reflector toward the satellite. This section addresses safety policies and practices with respect to possible radiation exposure.

ODUs must be installed in a manner that prevents human exposure to potentially harmful levels of radiation. The general public, especially children, cannot be allowed to access the space between the feed horn and reflector or the space projecting outward in front of the reflector toward the satellite. To accomplish these objectives, there must be *controlled access* to the ODU. There are two acceptable ways to accomplish controlled access:

- By mounting the antenna above a prescribed height
- By enclosing the ODU in a fence with a locked gate or, in the case of a roof installation, limiting access by means of a locked access door or locked permanently mounted ladder

More specific requirements and instructions regarding controlled access, fenced installations, and signs for fenced and roof installations are included in the cautions below and in *RF radiation safety* on page 28.



Note: A safety mechanism in all Hughes earth stations monitors and averages radiated power over time to ensure that MPE levels are not exceeded in the space in front of the antenna. Because installers do not configure or operate the mechanism, it is not described further in this *Guide*.

Observe these precautions to avoid exposure to RF radiation, a potential safety hazard:

- The antenna must be installed in a location or manner not readily accessible to children and in a manner that prevents human exposure to potentially harmful levels of radiation.
- Antennas mounted in Puerto Rico, the continental United States, or at any site with greater than a 30° elevation angle must be installed such that the lower lip of the antenna reflector is at least 5 ft above any surface upon which a person might be expected to stand, and 3 ft 3 in. from any opening (such as a door or window) in a building or adjacent structure.
- Antennas mounted in Canada, Alaska, Hawaii, or any site with less than a 30° elevation must be installed such that the lower lip of the antenna reflector is at least 5 ft 9 in. above any surface upon which a person might be expected to stand, and 3 ft 3 in. from any opening (such as a door or window) in a building or adjacent structure.



- The antenna must be mounted such that no object which could reasonably be expected to support a person is within 6 ft 7 in. of the edges of a cylindrical space extending outward from the antenna reflector toward the satellite.
- If the above distance requirements cannot be met, the antenna must be mounted in a controlled area inaccessible to the general public, such as a fenced enclosure or a roof.
- The antenna must be mounted such that there is no object outside the controlled area which could reasonably be expected to support a person within 6 ft 7 in. of tthe edges of a cylindrical space extending outward from the antenna reflector toward the satellite.
- A fenced installation must have a locked entry, and the fenced area must be large enough to protect the general public from exposure to potentially harmful levels of radiation.
- Access to a roof installation in a commercial, industrial, or institutional environment must be limited by a door or a permanently fastened ladder that is locked to deny access to the general public.

Failure to observe these cautions could result in injury to eyes or other personal injury.

• All installations of any type or size must carry an industry standard and government approved *Radiation Hazard Caution* label on the feed arm.



• A fenced or roof installation in a commercial, industrial, or institutional environment must carry a *Radiation Hazard Caution* sign on the access door, gate, or permanently mounted access ladder that is within plain sight of anyone approaching the antenna from the front or sides of the reflector.

Failure to observe these cautions could result in injury to eyes or other personal injury.

Additional safety information in this Guide

Additional safety information is presented where necessary throughout this *Site Preparation Guide*. Aside from this section, *Important safety information*, most of the safety information is included in these sections:

- Safety while conducting a site survey is discussed in *Site survey safety* on page 14.
- Safety concerning installation of antenna mounts is discussed in Chapter 4 – *Antenna mounts*, on page 23. This chapter includes information concerning satellite antennas and RF radiation.

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About this document

Scope

This *Site Preparation and Mount Installation Guide* provides information for preparing installation sites for Hughes satellite antennas. This information applies to all antenna sizes, except where a particular antenna size is specified.

Major topics include:

- Safety requirements
- Site requirements
- Site survey
- Determining the best location for the antenna installation
- Other planning considerations such as permits, tools and materials, and personnel requirements
- Instructions for installing antenna mounts

This Guide does not include:

- Instructions for assembling and installing the antenna
- Cable information
- Grounding information

For antenna assembly and installation, see the applicable antenna assembly manual. (See *Related publications* on page xii.) For cable specifications, see the indoor unit (IDU) instruction manual. For grounding information, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the National Electrical Code (NEC).

Audience

This *Guide* is written for qualified telecommunications personnel who plan and prepare for installation of Hughes satellite antennas. The tasks described in this *Guide* should be performed by qualified personnel who are familiar with local codes and are capable of properly applying the information presented.

Organization	This <i>Guid</i>	<i>e</i> includes the followi	ng chapters:
	-	 Overview briefly de N System and system 	escribes the content of this <i>Guide</i> components.
	-	onsidered and planned	<i>nts</i> discusses requirements that I for prior to installing the
	-	 Site survey presents ation site survey. 	s guidelines for conducting a
	-	-	esents general information and rinstalling antenna mounts.
	-	-	<i>mount</i> explains how to install a nt installation environments.
	-	on-penetrating mount	<i>netrating mount</i> explains how to in several different installation
		<i>– Installing a pole m</i> oole mounts.	<i>punt</i> explains how to install two
	-	 <i>Installing a pedesta</i> of pedestal mounts. 	<i>al mount</i> explains how to install
Related publications		•	llation instructions, see the nna you are installing.
	Hughes N	etwork Systems Polic	wo-way antennas is contained in <i>by for the Installation and</i> <i>te Antennas</i> (H30794).
Mount and antenna sizes and terminology	In this <i>Guide</i> , .74 <i>m</i> mount refers to a mount for a .74 m antenna. Mounts for other antenna sizes are referred to in the same way (for example, .98 <i>m</i> mount. and 1.2 <i>m</i> mount). Mount refers to the mast the antenna is installed on and the structure that supports it.		
Revision record	This table	shows the revision re	cord for this document.
	Revision	Date of issue	Scope
	А	April 18, 2005	Production release
	В	December 9, 2005	Added information for .74 m and 1.8 m antennas
	С	April 10, 2006	Updated brand references

Chapter 1 Overview

This chapter briefly describes:

- *The HN System* on page 2
- Installing to Ka-band standards on page 3

The HN System

The HN System consists of satellites that communicate with remote terminals, also known as indoor units (IDUs). Signals are received by an outdoor unit (ODU) and transmitted to the IDU through an intra-facility link (IFL) cable. See Figure 1. The system is managed by a Network Operations Center (NOC). The system provides Internet and/or corporate intranet connectivity via satellite through remote terminals.

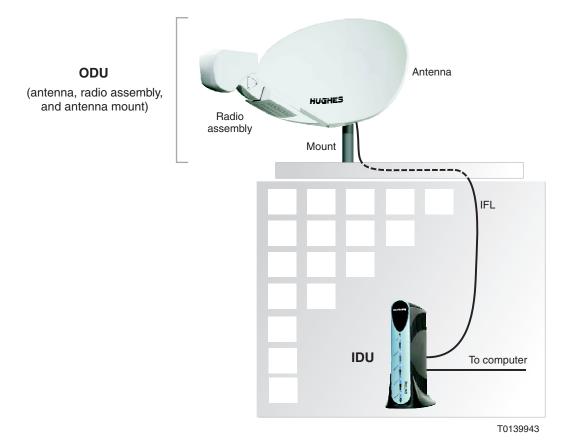


Figure 1: Remote site components

ODU refers to the antenna, radio assembly, and antenna mount. Most of the information in this *Guide* concerns preparation for ODU installation, especially installation of the antenna and antenna mount.

The satellite and NOC are not shown in Figure 1. The satellite provides a two-way communication path between the remote site and the NOC. The NOC is usually connected to the Internet, corporate intranet, or both.

Installing to Ka-band standards

Technical and safety standards for Ka-band operation are more stringent than standards for Ku-band operation. Most of the antennas referred to in this *Site Preparation and Mount Installation Guide* are *Ku-band Ka-band-ready*—this means they can be installed for Ku-band operation initially and later upgraded for Ka-band operation. Most of the antenna *mounts* described in this *Guide* are *Ku-band Nka-band qualified*, meaning they are suitable for Ku-band *or* Ka-band operation. Some antennas and mounts are designed for Ku-band only. Table 3 on page 24 and Table 13 on page 80 identify which antennas and mounts are suitable or upgradeable for Ka-band operation and which are not.

Unless otherwise specified, sites should be prepared and mounts should be installed according to the instructions in this *Guide* so the site will be suitable for Ku-band or Ka-band. (Two non-penetrating mounts are exceptions; they cannot be used for Ka-band. These two mounts are listed in Table 13.)

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Chapter 2 General requirements

This chapter covers general requirements that need to be considered and planned for prior to installing the antenna:

- Permits, inspections, and approvals on page 6
- Possible restrictions on page 6
- Personnel requirements on page 6
- Tools needed for installation on page 7
- Parts and materials needed for installation on page 9

To avoid delays, make sure you have the tools and materials required for installation before you go to the installation site. Review the tools listed in Table 1 on page 7 and the parts and materials listed in Table 2 on page 9. *Prior to installation*, make arrangements to obtain any tools or materials you don't have.

Permits, inspections, and approvals	It is the responsibility of the customer to obtain all required permits, inspections, and approvals before equipment installation begins to avoid any delay in installation and subsequent operation.
	Each site should conform to the following codes and standards, as they may apply to the site.
	 Applicable local building codes and uniform building codes NEC (electrical code) (in the United States) Electronic Industries Association (EIA) standards European Telecommunications Standards Institute (ETSI) standards National Fire Codes by the National Fire Protection Association (NFPA) (in the United States) Life Safety Code, NFPA 101 (in the United States) Protection of Electronic Computer/Data Processing Equipment, NFPA 75 Any other applicable codes, standards, or regulations
	The information in this document <i>does not replace</i> any applicable local building codes, standards, or regulations.
	Construction work or site modifications must be performed by qualified electrical, mechanical, and structural contractors. All work should be in accordance with the recommendations provided in this document and any applicable codes.
Possible restrictions	Be sure to take into account possible design restrictions, such as:
	Building management policies concerning constructionOther construction plans and maintenance workBudget constraints
Personnel requirements	Installers must be qualified to perform antenna installation tasks. Installers must understand:
	• Electronics fundamentals
	Cabling and connection practices
	Electrical circuits and grounding practicesThe importance of safety precautions
	Installers must also be familiar with:
	 Satellite communication fundamentals Applicable electrical, building, fire, and safety codes and regulations

Tools needed for installation

To avoid delays, make sure you have the tools needed for installation *before you go to the installation site*. Review the tools listed in Table 1 and obtain any tools you don't have. *Additional* tools you will need are listed in the section where each specific type of installation is described.

\checkmark	Tool	Type, purpose, or comment
	Ladder	May or may not be required; depends on building.
	Rope	May be needed to hoist tools and equipment to a roof. Rope must be strong enough to hoist the ODU, antenna, ballast, and IFL cable (separately). Must be long enough to reach from the roof to the loading point.
	Shovel or post-hole digger	For digging hole for pole mount or fence posts.
	Bucket	May be needed for mixing quick setting concrete.
	Electric drill	Cordless drill preferred for work on roof. Drill with power cord required for heavy-duty work.
	Drill bits for wood and masonry	Needed for trimast wall installations.
	Drill stop	To help achieve proper depth when drilling pilot holes.
	Silicone sealant	For application to drilled holes or mast foot.
	Wrench, open-end, 7/16 in.	
	Wrench, open-end, 1/2 in.	For adjusting canister set screws.
	Wrench, open-end, 9/16 in.	
	Wrench, open-end, 3/4 in.	
	Wrench, socket, 7/16 in.	
	Wrench, socket, 1/2 in.	
	Wrench, socket, 9/16 in.	
	Wrench, socket, 3/4 in.	
	Wrench, socket, 1-1/8 in.	
	Wrench, ratchet with short extension, 1/2-in. drive	
	Wrench, ratchet with short extension, 3/8-in. drive	

Table 1: Recommended tools for antenna mount installation

\checkmark	ΤοοΙ	Type, purpose, or comment
	Carpenter's bubble level	To make sure the mast is plumb.
	Screwdrivers: Flathead and Phillips, small and medium size	
	Fence wire cutters	For preparing wire fencing.
	Utility knife	For safety, use only a knife with a retractable blade.
	Flashlight	For lighting.
	Gear bag, large backpack, or padded bag	To haul tools and materials to the roof.
	Back brace	To protect against back injury while hoisting or lifting equipment and installation materials.
	Pencil or permanent marker	For marking.
	Hard hat	For safety.

Table 1: Recommended tools for antenna mount installation (Continued)

Parts and materials needed for installation

The parts and materials you need depend on the type of mount you are installing, as shown in Table 2. *Additional* parts and materials you will need, if any, are listed in the section where each specific type of installation is described. Table 2 does not include the mount or hardware included with the mount. You must supply all required parts and materials that are not provided with the mount.

\checkmark	Items you must supply	Type, purpose, or comment		
All installations				
	Fencing materials: • Door and hinges • Lock • Fencing • Posts • Fencing attachment hardware	In the continental United States, any installation in which the bottom lip of the antenna reflector is less than 5 ft above ground or less than 3 ft 3 in. from a window or door must be fenced as specified in <i>Fence requirements</i> on page 32. Fencing requirements are different for sites in Canada, Alaska, Hawaii, or any other location where the elevation is less than a 30°. For details, see <i>Fence</i> <i>requirements</i> on page 32.		
Metal pole (but not the trimast) or pedestal mount				
	40-lb bags of quick-setting concrete or Quickcrete. Quantity: as needed			
Non-penetrating mount				
	Rubber pad	Keeps the mount from sliding. The pad shipped with the mount can be used when the mount is installed on a roof covered with rubber membrane, loose gravel over a rubber membrane (a gravel roof), or a corrugated metal roof. If the mount is installed on a tar and gravel roof (with gravel embedded in the tar), the foam pad must be thicker than the provided pad. In this case you will have to obtain the thicker pad.		
	Snow shovel or heavy-duty push broom	Required only for roofs covered with gravel. Used to move roof gravel away from the installation site.		
	Ballast calculation software tool, ballast calculation method, or manufacturer's specifications	Used to calculate or provide the amount of ballast for a non-penetrating mount. For more information, see Ballast Calculation Tool User Guide (1033658-0001). If the tool is unavailable, use ballast calculation methods or specifications provided by manufacturer.		
	Cinder or concrete blocks	Number of pounds called for by ballast calculation tool, other ballast calculation, or ballast specification.		
	Tethering cable, wire, or rope	If maximum wind speeds can exceed 125 mph, a non-penetrating mount must be tethered to a permanent structure.		

Table 2: Parts and materials needed for antenna mount installations

Cable The required cable type for the IFL depends on the IDU type. For cable specifications, see the IDU manual. Adhere strictly to the cable specifications and installation instructions or the installation may fail.

This chapter covers the following topics:

- What is a site survey? on page 11
- Preparing for the site survey on page 12
- Site survey safety on page 14
- Determine the IDU location on page 15
- Select the ODU installation location on page 15
- Determine how the antenna will be mounted on page 20
- *Plan for IFL routing* on page 21
- Weather considerations on page 22

What is a site survey? The site survey consists of gathering information by phone and a site visit. The site survey verifies the type of equipment required, the exact IDU and ODU installation locations, and the anticipated installation effort. This information helps ensure the timely installation of the satellite antenna.

The site survey and all site preparation activities must be completed *before* any site work begins.

Site survey tasks The survey should include these tasks (and possibly others), as applicable:

- Determine where the IDU will be located and make sure the location is appropriate.
- Evaluate possible locations for installing the ODU and determine which is best.
 - Verify the line-of-sight for the selected location as explained in *Checking the line-of-sight* on page 17.
- Make sure the planned antenna installation method (including the antenna mount) is appropriate
- Evaluate IFL routing.
 - Identify inside wiring distribution pathways.
 - Identify building parts that may be used as electrical grounds for outdoor equipment.
 - Make sure no problems are anticipated in running the IFL cable.

Preparing for the site	To prepare for the site survey:
survey	• Read the installation specification.
	• Call your contact person at the site to find out basic information such as the type of building where the IDU and ODU will be installed.
	• Make sure you have the tools and other items you will need.
	These tasks are discussed in detail in the following sections.
Installation specification	If the installation is part of a business enterprise network, each installer is provided with an <i>installation specification</i> that defines how the customer's specific equipment is to be installed. Review the installation specification. The installation specification should provide the following details:
	 Customer name, address, and telephone number. Date and time of appointment. Type of antenna mount installation method to be used. Any unique information or procedures that may be needed during the installation. Explanation of any non-standard work. Satellite parameters. Equipment parameters.

information by phone

Obtaining preliminary Try to gather as much information about the installation site as possible. Try to find out about the following:

- Confirm the date and time of the installation.
- Determine or confirm the type of building where the equipment will be installed. The following information helps you determine or confirm the type of antenna mount that can be used, what materials you may need, and related information:
 - Type of building:
 - Commercial, industrial, institutional, small office/home office (SOHO), or residential
 - Single-story or multi-story
 - Shopping mall or strip mall
 - Type of roof:
 - · Flat or pitched
 - Type of roof covering (for example, shingles or tar and gravel)
 - Type of wall (for example, wood or cinder blocks)
- Confirm that any electrical, construction, or other permits have been obtained.

Items to take on a site visit Before beginning the site survey, make sure you have all necessary information (such as names and phone numbers) for accessing all parts of the building you will need to evaluate. Typically you will need to evaluate the surface or area used to install the mount, equipment rooms, IFL route, and grounding location.

When you visit the site, take the following items:

- Cell phone or 2-way radio.
- Compass.
- Inclinometer.
- Straight edge.
- Paper and pencil or pen for drawings.
- Tape measure.
- Building map, if possible.
- Key if required for access to roof or other locations.
- If an anti-ice antenna is to be installed, confirm that a separate electrical circuit has been or will be installed. The circuit must include a circuit breaker or ground fault interrupter (GFI) with an identifying label.

Site survey safety

Observe the following safety cautions and warnings while conducting the site survey. In addition, consider any cautions and warnings that accompany the instructions for the antenna mounting method you plan to use. Various antenna mounting methods are described in later sections of this Guide.



Observe all cautions and warnings in Important safety information on page iii.



- · Before starting the installation procedure, make sure there are no power lines closer than 20 ft.
- If the satellite reflector contacts electric power lines, you will be killed or seriously injured.

If you work on a roof, tower, or other high structure or use a ladder or scaffold to access the work site, follow these precautions to prevent personal injury or death:



- · Walk only on sound roof structures.
- · Make sure the antenna assembly and installation surface are structurally sound so they can support all loads (equipment weight, ice, and wind).
- Use appropriate safety equipment (for example, a lifeline), depending on the work location.
- Follow all safety precautions from the manufacturers of all safety equipment and other equipment used.
- Perform as many procedures as possible on the ground.

installation

Planning for a safe Read the following and make sure the installation site and the method chosen for installing the antenna mount conform to the specified requirements:

- Chapter 2 General requirements
- Hughes Network Systems Policy for the Installation and **Operation of Two-Way Satellite Antennas** (H30794)

Determine the IDU location	 The tasks in this section are done at the installation site. Make sure you know where the IDU will be installed. For enterprise installations, the installation specification often specifies where the IDU will be located. If the IDU location is not specified, evaluate the site and determine where the IDU will be located. The IDU is typically located in an equipment room or closet, although a smaller IDU may be located in an office. Typically, the IDU and ODU are installed as close to each other as possible, to minimize IFL cable runs. Make sure the IDU is installed with sufficient ventilation space, as specified in the IDU installation manual.
Select the ODU installation location	 The tasks in this section are done at the installation site. For enterprise installations, the installation specification often specifies: The ODU location The preferred mount type and acceptable alternatives If the installation location has not been specified, you must select a location based on the criteria listed below. Even if a location is specified, evaluate it to make sure it meets all of the listed criteria. Proper antenna location is very important for achieving a high signal quality factor (SQF). Most sites have a number of acceptable installation locations.
	 When evaluating a possible ODU installation location, consider all of the following: Conformance to the installation specification. Safety requirements as detailed in <i>Important safety information</i> on page iii and other parts of this <i>Guide</i>. IDU location—The ODU should be as close as possible to the IDU. Clear view of the southern sky. Unobstructed line-of-sight to the target satellite—See <i>Checking the line-of-sight</i> on page 17. Maximum cable length as determined by application and cable type. Customer preferences.

• Proximity to human activities—Make sure the antenna does not present any hazard to customer site personnel, customers, or passersby.



Choose an installation location away from where people are likely to work, ride, or play.

- Location safe from disruption; for example, not where a vehicle might strike the antenna.
- Mounting surface—The mounting surface must be safe and sound.
- Installer safety—Make sure the installer can safely install the ODU in the selected location.
- Conformance with the NEC (electrical code) and local building codes and regulations.
- No nearby electrical equipment such as air-conditioning units Electrical equipment can cause signal interference.
- Aesthetics—The installation should be aesthetically acceptable to the customer, not obtrusive with respect to the landscape.

Also:

- Investigate the load carrying requirements of the supporting surface, the mast, the antenna, and the antenna's connection to the mast.
- Make sure the antenna system (including anchors, and/or safety cables, if used), roof materials, and the supporting structure can support all loads and reactions imposed by the antenna system.

Checking the line-of-sight Make sure there is an unobstructed line-of-sight from the antenna to the satellite, as illustrated in Figure 2.

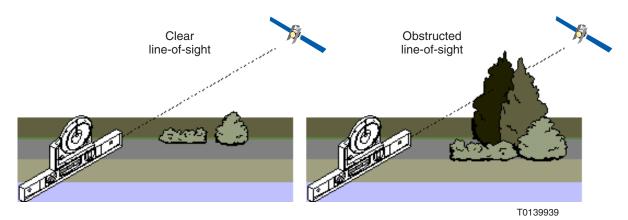


Figure 2: Line-of-sight check

To check the line-of-sight, you need:

- A compass
- An inclinometer
- A straight edge
- The azimuth and elevation values from the installation specification or as determined by the IDU installation software.

Determine and evaluate the line-of-sight as follows:

- 1. Go to the proposed antenna installation location.
- 2. Face south and hold the compass level so the needle can rotate freely.

When the needle stops rotating, it is pointing north.



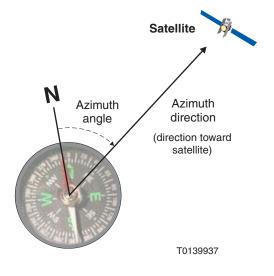
Note: Keep the compass away from metal, such as a metal structure, or even a large metal belt buckle. Metal can adversely affect the compass reading.

3. Carefully—so you do not disturb the needle—rotate the body of the compass until the needle aligns with the 0° or *N* mark on the compass.

The compass is now aligned with magnetic north.

4. Visualize an imaginary line from the center of the compass to and beyond the azimuth value determined by the installation software (for example, 30°).

This line is the azimuth direction that will be used later to point the antenna reflector. See Figure 3.



View from above

Figure 3: Determining the azimuth direction

- 5. Use a rock or other object to mark the location where you are standing.
- 6. Pick a landmark in the distance that aligns with the magnetic azimuth bearing, or mark the azimuth direction in some other way.

7. Use an inclinometer and a straight edge to determine the elevation angle, as shown in Figure 4.

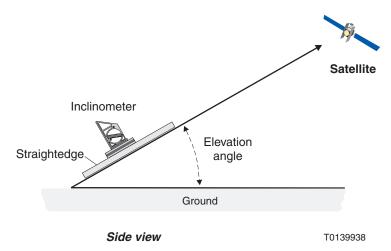


Figure 4: Determining the elevation

8. Align the straight edge with both the azimuth direction and elevation angle.

The straight edge, when aligned with both the azimuth direction and elevation, indicates the line-of-sight.

9. Make sure nothing blocks the line-of-sight. The line-of-sight cannot be blocked by buildings, other structures, plants, or trees. Examine nearby plants and trees and consider how they might grow and eventually block the signal. If it is fall or winter, consider spring and summer leaf growth. Ask the customer if they have any plans (such as landscaping) that might obstruct the satellite signal. *If anything blocks the line-of-sight, find another installation location.*

Determine how the antenna will be mounted

The tasks in this section are done at the installation site.

If the antenna mount type has not be specified, determine what type of mount is most suitable. Various types of antenna mounts can be used depending on the antenna size and the installation environment—flat or pitched roof, wall, or ground level. Mount types include:

- Trimast mount
- Non-penetrating mount
- Metal pole mount
- Pedestal mount

For enterprise business installations, use the mount type specified in the installation specification. For the installer's reference, mount options for each antenna size and model are listed in Table 3 on page 24.

For detailed information and installation instructions for each type of mount, see:

- Chapter 5 *Installing a trimast mount*, on page 37
- Chapter 6 Installing a non-penetrating mount, on page 79
- Chapter 7 Installing a pole mount, on page 91
- Chapter 8 Installing a pedestal mount, on page 107

Plan for IFL routing	The tasks in this section are done at the installation site.
	Typically the IFL cable(s) is installed after the outdoor equipment is installed. However, the IFL cable route must be considered prior to choosing an antenna installation location.
IFL planning factors	Determine the best route for the IFL cable and how much work will be required to install the IFL. Consider:
	 Building point of entry (POE) IDU location Routing alternatives Availability of conduits or cable risers (Plenum-rated IFL cables may be run through conduit,
	but should never be run through the same conduit as power cables.)
	• Cable riser capacity. Any constraints?
	Access to cable risers
	• Need for wall or roof penetration? If so, where? How? Difficulty?
	• Inside wiring distribution pathways
	• Power availability and grounding requirements
Determining cable length	Measure the distance of the proposed cable route between the antenna and the IDU. Add 20 ft for service loops (10 ft for inside the building, 10 ft for outside).
Choosing the route	Generally, the first choice for IFL cabling is to use an existing portal conduit. If a conduit is not available, recommend a solution. Other possibilities are:
	Entry through a stairwell or other spaceNew drilling (vertical or horizontal)
Cable grade	Make sure the installation will use the correct type and grade of cable, as specified in the installation specification or IDU manual. If the cable in an existing installation is out of specification, replace it.

Weather considerations Consider the anticipated weather. Weather conditions can affect installation safety and equipment performance. • Sofety Installation safety and equipment performance.

- Safety Installation safety can be affected by lightning, the effects of precipitation on work surfaces, wind, and similar factors.
- Equipment performance Equipment operation can be affected by rain fade, overcast skies, antenna icing, and wind. All of these factors can all affect signal reception.

Resolve any anticipated weather-related problems. If necessary, reschedule the installation.

Chapter 4 Antenna mounts

This chapter includes:

- Mount types for various antennas on page 24
- Safety during mount installation on page 26

Mount types for various antennas

Table 3 lists the different types of mounts that may be used for various Hughes antennas. It also shows where in this *Guide* you can find the installation instructions for each type of mount. Figure 5 on page 25 illustrates the various types of mounts.

For each antenna, more than one mount type is listed. Factors such as the specific antenna installation location determine which type should be used. For example, will the antenna be installed on a roof or on the ground? If on a roof, what type of roof is it? For enterprise business installations, the mount type should be specified in the installation specification.

Antenna				
Model	Ku-band Ka-band -ready	Mount options (see notes)	For installation instructions, see	
.74 m Model AN6-074-DF	Yes	 Trimast Non-penetrating mount Pole mount with concrete base Pole mount with concrete base and struts 	 Configuring a trimast on page 38 Installing a trimast on a wood-frame roof on page 46 	
.74 m Model AN4-074-DF	No	 Trimast Non-penetrating mount Pole mount with concrete base Pole mount with concrete base and struts 	 Installing a trimast mount on page 37 Installing a trimast on a concrete or block wall on page 71 	
.74 m Model AN6-074S	Yes	 Trimast Non-penetrating mount Pole mount with concrete base Pole mount with concrete base and struts 	 Non-penetrating mounts on page 80 Installing a pole mount with a concrete base on page 92 Installing a pole mount with struts on page 100 Installing a pedestal mount with a pier foundation on page 108 Installing a pedestal mount with spread footing on page 116 	
.98 m Model AN6-098-DF	Yes	 Trimast Non-penetrating mount Pole mount with concrete base Pole mount with concrete base and struts 		
1.2 m Model AN6-120-DF	Yes	 Non-penetrating mount Pole mount with concrete base Pedestal mount with pier foundation Pedestal mount with spread footing 		
1.8 m Model AN4-180	Yes	 Non-penetrating mount Pedestal mount with pier foundation Pedestal mount with spread footing 		

Table 3: Mounting options for various antennas

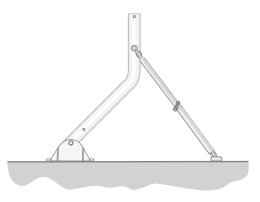
Notes:

A trimast may be installed on a roof or wall.

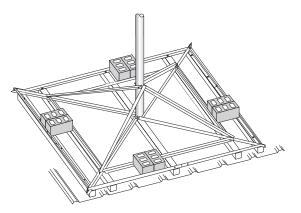
A non-penetrating mount may be installed on a roof or on the ground.

Anti-ice antenna models are available but are not listed here.

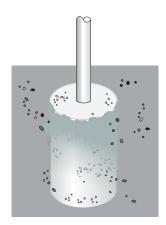
Antennas: *Ku-band Ka-band-ready* means the antenna is suitable for Ku-band and can be upgraded for Ka-band. Mounts: All listed mount options are Ku-band/Ka-band qualified (suitable for both Ku-band and Ka-band) except for two non-penetrating mounts, as listed in Table 13 on page 80.



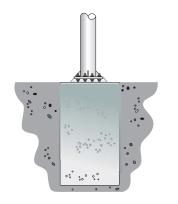




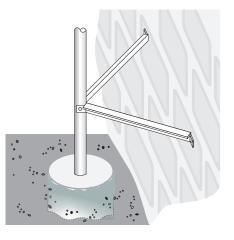
Non-penetrating mount



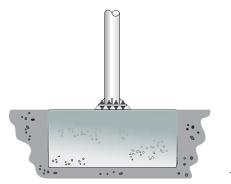
Pole mount with concrete base



Pedestal mount with pier foundation



Pole mount with concrete base and struts



T0139935

Pedestal mount with spread footing

Figure 5: Various mounts used to install Hughes antennas

Location and mount types	Installations in a commercial, industrial, or institutional environment usually require a non-penetrating mount. If a non-penetrating mount cannot be used, a trimast wall mount is often the second choice. A trimast wall mount can be attached to wall studs or masonry.		
	Small office/home office (SOHO) and residential installations usually require a roof mount or wall mount. If these cannot be used, a ground-level metal pole mount is often the next choice. Non-penetrating mounts are rarely, if ever, used for SOHO and residential installations because the roof is usually not big enough or strong enough.		
	Installation of each type of mount is explained in the subsequent chapters in this <i>Guide</i> .		
Safety during mount installation	The safety information in this section applies to installation of antenna mounts for all HN System antenna sizes, except where a mount for a specific antenna size is specified. The chapter includes:		
	 General safety concerning antenna mounts on page 27 RF radiation safety on page 28 		
	See also the safety information in <i>Important safety information</i> on page iii.		
	Mount installation instructions are included in:		
	 Chapter 5 – Installing a trimast mount, on page 37 Chapter 6 – Installing a non-penetrating mount, on page 79 Chapter 7 – Installing a pole mount, on page 91 Chapter 8 – Installing a pedestal mount, on page 107 		
	For official, detailed safety information concerning Hughes satellite antenna installation, see <i>Hughes Network Systems Policy for the</i> <i>Installation and Operation of Two-Way Satellite Antennas</i> (H30794).		

General safety concerning When installing antenna mounts, strictly observe all of the following safety warnings and cautions.



Observe all cautions in *Important safety information* on page iii.



- Install the satellite antenna mount only as described in this manual.
- Only Hughes-certified installers can install Hughes earth stations.

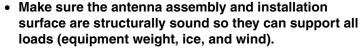


Before starting any installation procedure, make sure there are no power lines closer than 20 ft. If the satellite antenna contacts electric power lines, you will be killed or seriously injured.

\land DANGER

If you work on a roof, tower, or other high structure or use a ladder or scaffold to access the work site, follow these precautions to prevent personal injury or death:

• Walk only on sound roof structures.



- Use appropriate safety equipment (for example, a lifeline), depending on the work location.
- Follow all safety precautions from the manufacturers of all safety equipment and other equipment used.
- Perform as many procedures as possible on the ground.

\land DANGER



- Call local utility companies before digging to avoid striking underground cables, pipes, or lines.
- Striking or cutting underground cables, pipes, or lines can cause personal injury or property damage.

RF radiation safety

This section presents RF safety information that applies to the installation of antennas and antenna mounts. Under certain circumstances, fencing may be required. For details, see *Fence requirements* on page 32. The installer may be required to post signs and/or labels to warn of possible RF radiation hazards.

Requirements for such signs and labels are given in *Radiation* hazard caution signs and labels on page 34.

Observe these precautions to avoid exposure to RF radiation, a potential safety hazard:

- The antenna must be installed in a location or manner not readily accessible to children and in a manner that prevents human exposure to potentially harmful levels of radiation.
- Antennas mounted in Puerto Rico, the continental United States, or at any site with greater than a 30° elevation angle must be installed such that the lower lip of the antenna reflector is at least 5 ft above any surface upon which a person might be expected to stand, and 3 ft 3 in. from any opening (such as a door or window) in a building or adjacent structure.
- Antennas mounted in Canada, Alaska, Hawaii, or any site with less than a 30° elevation must be installed such that the lower lip of the antenna reflector is at least 5 ft 9 in. above any surface upon which a person might be expected to stand, and 3 ft 3 in. from any opening (such as a door or window) in a building or adjacent structure.



- The antenna must be mounted such that no object which could reasonably be expected to support a person is within 6 ft 7 in. of the edges of a cylindrical space extending outward from the antenna reflector toward the satellite.
- If the above distance requirements cannot be met, the antenna must be mounted in a controlled area inaccessible to the general public, such as a fenced enclosure or a roof.
- The antenna must be mounted such that there is no object outside the controlled area which could reasonably be expected to support a person within 6 ft 7 in. of the edges of a cylinder extending from the antenna reflector.
- Any fence must have a locked entry, and the fenced area must be large enough to protect the general public from exposure to potentially harmful levels of radiation.
- Access to a roof installation in a commercial, industrial, or institutional environment must be limited by a door or a permanently fastened ladder that is locked to deny access to the general public.

Failure to observe these cautions could result in injury to eyes or other personal injury.

RF safety for non-penetrating The following RF safety warnings and instructions apply to non-penetrating mounts on the ground level.



Any non-penetrating mount installed on the ground must be enclosed with a fence such that the prescribed area around the antenna is not accessible to children or the general public. For specific instructions, see *Fence requirements* on page 32.

For sign and label requirements, see *Radiation hazard caution signs and labels* on page 34.

RF safety for roof mounts The following RF safety warnings and instructions apply to non-penetrating mounts and mounts on wood-frame roofs.

These cautions apply to roof installations in a commercial, industrial, or institutional environment:



- Access to the roof installation must be limited by a door or a permanently fastened ladder that is locked to deny access to the general public.
- The roof installation must carry a *Radiation Hazard Caution* sign on the access door or permanently mounted access ladder that is within plain sight of anyone approaching the antenna from the front or sides of the reflector.

For sign and label requirements, see *Radiation hazard caution signs and labels* on page 34.

RF safety for wall mounts The following RF safety warnings and considerations apply to mounts on wood, cinder block, or concrete walls.

- The antenna system must be installed in a location or manner not readily accessible to children and in a manner that prevents human exposure to potentially harmful levels of radiation.
- In any wall installation in Puerto Rico, the continental United States, or at any site with greater than a 30° elevation angle, the antenna must be mounted such that the lower lip of the antenna reflector is at least 5 ft above any surface upon which a person might be expected to stand, and 3 ft 3 in. from any opening (such as a door or window) in a building or adjacent structure.



- In any wall installation in Canada, Alaska, Hawaii, and any site with less than a 30° elevation must be installed such that the lower lip of the antenna reflector is at least 5 ft 9 in. above any surface upon which a person might be expected to stand, and 3 feet 3 in. from any opening (such as a door or window) in a building or adjacent structure.
- The antenna must be mounted such that no object which could reasonably be expected to support a person is within 6 ft 7 in. of the edges of a cylinder extending from the antenna reflector.
- Make sure the tenants and owners of the building understand they MUST detach the IDU power cord from the power source before approaching the antenna closer than the prescribed distances.

For sign and label requirements, see Radiation hazard caution signs and labels on page 34.

RF safety for pole and pedestal The following RF safety warnings, requirements, and instructions apply specifically to pole mount and pedestal mount installations.

- The antenna system must be installed in a location or manner not readily accessible to children and in a manner that prevents human exposure to potentially harmful levels of radiation.
- A pole mount or pedestal mount installation requires a surrounding fence. See *Fence requirements* on page 32.
- The antenna must be mounted such that no object which could reasonably be expected to support a person is within 6 ft 7 in. of the edges of a cylinder extending from the antenna reflector.
- Make sure the tenants and owners of the building understand they MUST detach the indoor unit (IDU) power cord from the power source before approaching the antenna closer than the prescribed distances.

For sign and label requirements, see *Radiation hazard caution signs and labels* on page 34.

Fence requirements To protect against possible radiation hazards or injury, installations as described below must be enclosed by a fence:

- In the continental United States, any installation in which the bottom lip of the antenna reflector is less than 5 ft above ground or less than 3 ft 3 in. from a window or door must be fenced as specified in this section.
- In Canada, Alaska, and Hawaii or any other location where the elevation is less than a 30°, a fence must be installed as specified in this section if the bottom lip of the antenna reflector is less than 5 ft 9 in. above ground or less than 3 ft 3 in. from a window or door.

All fenced installations must have a locked entry and must carry a *Radiation Hazard Caution* sign on the fence gate. For sign requirements, see *Radiation hazard caution signs and labels* on page 34.

Fencing and wall installations

A wall can be used as one side of a fence around the antenna installation as long as the wall is at least 6 feet high and there is no door or window within 3 ft 3 in. of the lower lip of the antenna reflector. The usual requirement for minimum distance from the



back of the antenna to the fence does not apply if the antenna is mounted on the wall.

Minimum dimensions for fences

All fences must meet the minimum dimensions listed below:

- Height: The minimum fence height is 6 ft.
- **Back:** The minimum distance from the back of the antenna to the fence is one antenna diameter.
- **Sides:** The minimum distance from the side of the antenna to the fence is one antenna diameter.
- Front: The minimum distance from the front of the antenna to the fence can be estimated using Table 4. Distances are given in meters.

Measure the distance in meters from the lower lip of the antenna reflector to the ground, confirm the elevation angle, and then read the required minimum distance from the front of the antenna to the fence.

Elevation	Distance – ground to bottom lip of reflector (m)				
angle	0	0.5	1.0	1.5	2.0
		.74 m a	intenna		
15°	8.4	7.8	7.2	6.7	6.1
30°	4.0	3.8	3.5	3.3	3.0
45°	2.5	2.4	2.2	2.1	1.9
60°	1.7	1.6	1.5	1.4	1.4
75°	1.2	1.1	1.1	1.0	1.0
		.98 m a	Intenna		
15°	8.9	8.3	7.7	7.2	6.6
30°	4.3	4.1	3.8	3.5	3.3
45°	2.7	2.6	2.4	2.3	2.1
60°	1.9	1.8	1.7	1.7	1.6
75°	1.4	1.3	1.3	1.3	1.2
1.2 m antenna					
15°	9.3	8.7	8.2	7.6	7.0
30°	4.6	4.3	4.0	3.8	3.5
45°	2.9	2.8	2.6	2.5	2.3
60°	2.1	2.0	1.9	1.8	1.8
75°	1.6	1.5	1.5	1.5	1.4

Table 4: Requirements for minimum distance from front of antenna to fence (m)

Elevation	Distance – ground to bottom lip of reflector (m)				
1.8 m antenna					
15°	10.5	9.9	9.4	8.8	8.2
30°	5.2	5.0	4.4	3.9	3.4
45°	5.2	5.0	4.4	3.9	3.4
60°	5.2	5.0	4.4	3.9	3.4
75°	2.1	2.1	2.0	2.0	2.0

Table 4: Requirements for minimum distance from front of antenna to fence (m) (Continued)

Fencing materials

A chain link fence is recommended because it provides an unobstructed view of the fenced area. The fence must be equipped with a door that can be securely locked. The fencing material must be such that it renders the fenced area inaccessible to the general public, especially children. The fence posts must be installed such that a person cannot dislodge them.

Fences must be installed according to local code. Remember that a permit may be required.

Radiation hazard caution signs All installations of any type or size must carry an industry and labels standard and government approved Radiation Hazard Caution label conspicuously displayed on the following surfaces:

- On the back of the antenna reflector, where visible to an approaching person
- On the feed horn, radio assembly, and/or feed arm

A Radiation Hazard Caution sign is required within plain sight of anyone approaching the antenna from the front or sides of the reflector, as follows:

- Installation surrounded by a fence Permanently affix the sign to the fence gate.
- Roof installation Permanently affix the sign to the roof access door or permanently mounted access ladder.

The following requirements apply to such signs and labels concerning radiation hazards.

• All installations of any type or size must carry industry standard and government approved *Radiation Hazard Caution* labels on the feed arm.



• A fenced or roof installation in a commercial, industrial, or institutional environment must carry a *Radiation Hazard Caution* sign on the access door, gate, or permanently mounted access ladder that is within plain sight of anyone approaching the antenna from the front or sides of the reflector.

Failure to observe these warnings could result in injury to eyes or other personal injury.

- All Radiation Hazard Caution signs and labels provided by Hughes for use during installation are compliant with ANSI/IEEE C95.2-1999. Any additional signs used during the installation that are not provided by Hughes must also be in compliance with ANSI/IEEE C95.2-1999.
- The signal word as defined in Section 3.4 of ANSI/IEEE C95.2-1999 in any replacement signs shall be "CAUTION."



- The RF energy advisory symbol as defined in Section 3.5.2 of ANSI/IEEE C95.2-1999 shall be used on all replacement signs and labels.
- All text on any signs and labels shall be in at least English and Spanish for terminals installed in the United States. For earth stations installed in countries other than the United States national regulations may require that caution signs in the national language(s) are additionally posted (for example, French in Canada and Portuguese in Brazil).

36 | Chapter 4 • Antenna mounts 1035678-0001 Revision C This chapter includes:

- Configuring a trimast on page 38
- Installing a trimast on a wood-frame roof on page 46
- Installing a trimast on a wood wall on page 56
- Installing a trimast on a wood deck post on page 64
- Installing a trimast on a concrete or block wall on page 71

Configuring a trimast

The *trimast* mount (model TM6-1, P/N 1031929-0006) is a compact mount that can be configured to make it suitable for a number of different installation environments. As shown in Figure 6, the trimast consists of a mast with adjustable struts and a mounting foot (mast foot).

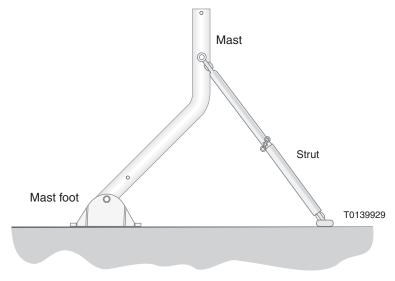
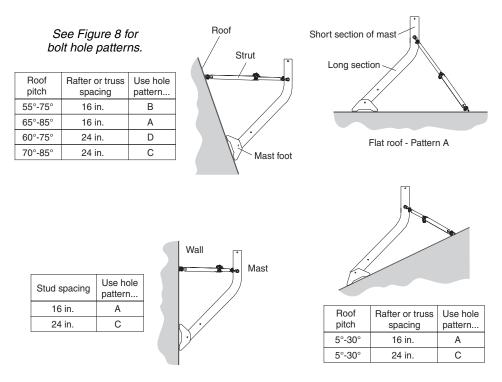
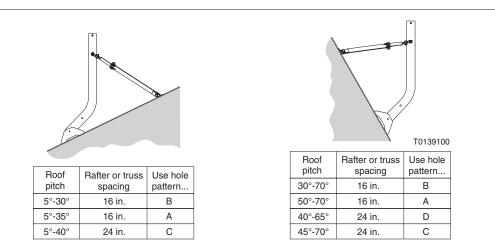


Figure 6: Trimast mount on a flat roof

Read all safety information in *Safety during mount installation* on page 26 before installing the mount. As shown in Figure 7, a trimast can be used to mount an antenna on a flat roof, pitched roof, or wall installation.

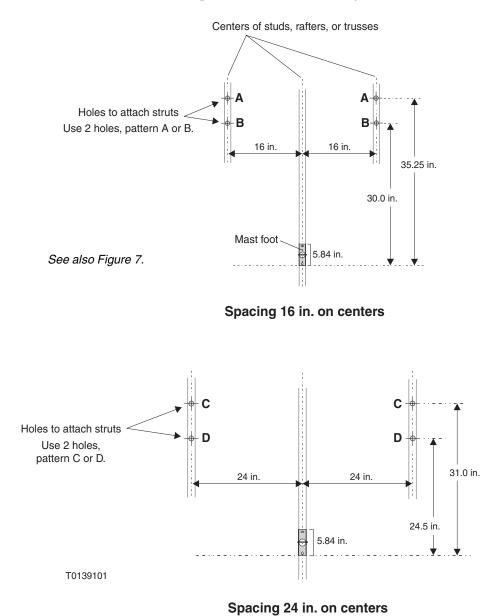


Configuration 1 - Mast foot attached to long section of the mast



Configuration 2 - Mast foot attached to short section of the mast

Figure 7: Trimast configuration guide



Patterns A, B, C, and D, referred to in Figure 7, are patterns for bolt placement, as shown in Figure 8.

Figure 8: Hole patterns A, B, C, and D for trimast mounting bolts

For trimast installations, refer to this section (*Configuring a trimast*) and the section that applies to the type of mount you are installing:

- Installing a trimast on a wood-frame roof on page 46
- Installing a trimast on a wood wall on page 56
- Installing a trimast on a wood deck post on page 64
- Installing a trimast on a concrete or block wall on page 71

Trimast configurations and strut adjustments

Always use both support struts that are a part of the trimast. The support struts can be installed on the trimast in two configurations referred to as *configuration 1* and *configuration 2*. These two configurations are shown in Figure 7 on page 39.

The struts are attached using lag bolts in one of four possible patterns, as shown in Figure 8 on page 40. The locations of the holes for the lag bolts are determined by roof pitch and the distance between trusses or rafters. Figure 8 shows where to drill holes for the lag bolts for various trimast configurations.

Figure 8 is a guide that should apply to most installations. You can use a different hole pattern as long as the struts are installed symmetrically.

In some circumstances, the mast may be installed using either configuration 1 or configuration 2. You may also have a choice of bolt hole patterns. For example, the mast can be installed in either configuration on a roof with a pitch of 5° to 30° and 16-in. rafter spacing. Also, if configuration 2 were used, either hole patterns A or B could be used.

The flexibility of the trimast enables you to use a configuration that may improve the look angle to the satellite or avoid obstructions such as dormers or roof peaks.

Strut length If necessary to plumb the mast, the two support struts may be set at slightly different lengths. However, the struts should always be set at the same angle.

To help ensure attachment in the center of rafters and trusses, the support struts' lengths can be adjusted, and the struts can be rotated. For more information, see *Adjusting the support struts* on page 43.

Preparing to install the trimast The trimast is shipped from the factory in configuration 1, with **using configuration 1** the mast foot attached to the long section of the mast, as shown in

Figure 7. The support struts are attached to the short section of the mast. For shipping purposes, the ends of the struts that attach to the roof or wall are secured to the mast foot.

To prepare the trimast for installation:

- 1. Use a 1/2-in. wrench to remove the 5/16-in. nuts from the mast foot.
- 2. Remove the arms from the carriage bolt.
- 3. Re-install the nuts on the bolt to re-secure the mast foot.

configuration 2

Reassembling the trimast for To use configuration 2, you detach the mast foot and reattach it to the short section of the mast. Then you attach the support struts to the long section of the mast.

To reassemble the trimast for configuration 2:

- 1. Before proceeding, make sure the roof pitch and configuration calls for mast configuration 2.
- 2. Use a 1/2-in. wrench to remove the two nuts and flat washers that hold the support struts to the mast foot.
- 3. Remove the two carriage bolts.
- 4. Relocate the mast foot at the opposite, short section of the mast, as shown in Figure 9.



Figure 9: Relocating the mast foot

Orient the foot as shown in Figure 9 so you can push the bolts in place from inside the mast pipe.

- 5. Align the bolt holes with the square holes on the mast.
- 6. Reinstall the carriage bolts, flat washers, and nuts.
- 7. Use a 1/2-in. wrench to remove the nut and flat washer on the carriage bolt holding the two struts to the mast.
- 8. Remove the carriage bolt.

9. Relocate the struts to the opposite, long section of the mast. See Figure 10. Use the round hole, not the square hole.

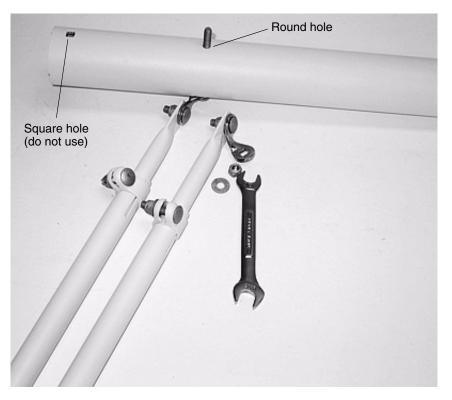


Figure 10: Relocating struts

- 10. Position the strut holders over the hole.
- 11. Install the carriage bolts, flat washers, and nuts.

Adjusting the support struts The support struts can be adjusted in the following ways:

- The strut lengths can be adjusted.
- The struts can be rotated to adjust the orientation of the lag bolt mounting brackets so they line up with centers. The mounting brackets can be rotated also.
- The struts revolve forward or back around the axis of the carriage bolt. They should always be revolved symmetrically; that is, in the same direction and angle from the mast pipe.

Before adjusting the struts, review Figure 7 on page 39 and Figure 8 on page 40 to determine the installation configuration and lag bolt hole pattern. Mark the mounting hole pattern on the mounting surfaces. Usually, you install the mast foot before adjusting the arms.

To adjust the length of the struts:

- Strut collars
- 1. Use a 1/2-in. wrench to loosen the nuts on the strut collars (see Figure 11).

Figure 11: Strut collars

- 2. Pull on the arms until you achieve the length that enables you to center the mounting bracket holes on the mounting hole marks.
- 3. Tighten the strut collar nuts securely.

You may need to adjust the strut lengths again to make the mast plumb.

- To rotate the struts or installation washers:
 - 1. Use a 1/2-in. wrench to loosen the nut on the strut collar. See Figure 11.
- Rotate the arm in either direction until the mounting bracket hole is centered on the mounting hole mark. See Figure 12.

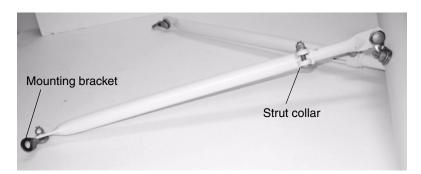


Figure 12: Aligning the mounting bracket

- 3. Tighten the strut collar nut securely.
- 4. To rotate the mounting bracket, use a 1/2-in. wrench to loosen the mounting bracket nut.
- 5. Adjust the bracket and tighten the nut.
- 6. Revolve the struts together.
 - The struts can be revolved forward or backward around the axis of the carriage bolt. See Figure 13. Do not install the struts in asymmetrical configurations.



Figure 13: Revolving the struts

Installing a trimast on a wood-frame roof

The instructions in this section apply to trimast mounts for:

- .74 m antennas (all models)
- .98 m antenna

If specified in a customer-specific installation specification, you can install the antenna on a wood-frame roof, as explained in this section.



- Before installing the mount, read all safety information in Safety during mount installation on page 26.
- For RF safety information, see *RF safety for wall mounts* on page 31. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs*

and labels on page 34.

• In a commercial, industrial, or institutional environment, use a non-penetrating mount unless the customer-specific specification states that one of the other installation methods documented in this manual is to be used.



- A roof installation may void the building's roof warranty, so exercise extreme care. Contact your Hughes installation management team if you have any questions.
- Make sure the tenants and owners of the building understand that they *must* detach the IDU power cord from the power source before going on the roof.

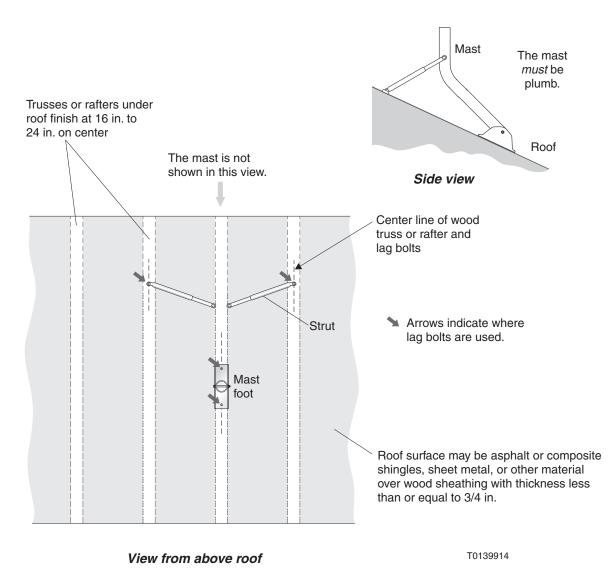


Figure 14 illustrates a typical trimast installation on a wood-frame roof.

Figure 14: Installing the mount on a wood-frame roof

Roof requirements For installation of the trimast mount, a wood-frame roof must meet all of the requirements stated in this section.

CAUTION

- Trusses or rafters must be spaced from 16 in. to 24 in. apart on center.
- The roof surface must consist of relatively thin, resilient materials, such as asphalt or composite shingles, sheet metal, or similar materials, over wood sheathing with a thickness that must not exceed 3/4 in.
- A satellite antenna cannot be installed on slate roofs or Spanish tile roofing made of clay or other brittle materials.
- The roof pitch (also called slope) must be between 3:12 and 12:12.
- Center hole lag bolts *must* be centered in the truss or rafter.
- The wood-frame roof interior must be unfinished so that placement of lag bolts can be verified and the roof reinforced if necessary.
- Install the satellite antenna only as described in this manual.

The minimum size for roof truss members is 2 in. x 4 in. Roof rafters must be nominal 2x material (such as 2 in. x 4 in. or 2 in. x 6 in.) and must be spaced 16 in. to 24 in. apart on center.

All center hole lag bolts must be centered in the truss or rafter to which they are attached. For this reason, you must be able to locate trusses and rafters and their centers with a high degree of accuracy. This can be difficult to do. You need experience in home construction to be able to determine the exact location of trusses or rafters. Stud finders can give false readings on a multi-layered surface such as a roof.

Large timber roofs with frequent spacing of members are also permitted. These are constructed of wood members larger than the nominal 2x sizes, and include post and beam structures with members from 4 in. x 4 in. and larger. The members cannot be spaced more than 24 in. on center. Their physical properties must match or exceed those of Spruce-Pine-Fir No. 2. **Parts and materials** Table 5 lists the parts and materials needed to install a trimast on a wood-frame roof.

Table 5: Parts and materials needed to install a trimast on a
wood-frame roof

Part	Туре	Quantity	
Lag bolts	3/8 in. x 4-in.	4	
Flat washers	3/8 in.	4	
Flat washers - large	3/8 in.	2	
Silicone sealant			
See also parts and materials listed in Table 2 on page 9.			

- **Tools** Table 6 lists the recommended tools for installing a trimast on a wood-frame roof.
 - Table 6: Tools needed to install a trimast on a wood-frame roof

ΤοοΙ	Type, purpose, or comment	
Carpenter's bubble level	To make sure the mast is plumb	
Pencil or chalk		
Ruler		
Socket wrenches	1/2 and 9/16-in.	
Drill	3/8-in. electric	
Drill bits	3/8-, 1/4-, and 1/8-in.	
Torque wrench	Capable of torque up to 18 ft-lb	
Ladder		
See also tools listed in Table 1 on page 7.		

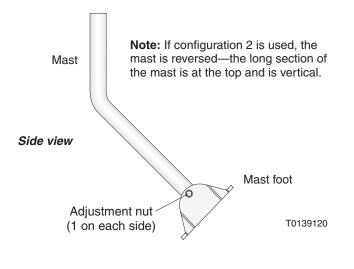
Installing the trimast This section explains how to install the trimast on a wood-frame roof. Some of the installation steps will be easier if you have an assistant.

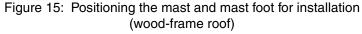


Note: The installation will not be successful if the mast is not plumb. Keep in mind that small movements by the mast foot are amplified at the end of the mast. Re-plumb the mast whenever instructed to do so and whenever you feel it is necessary.

To install the trimast, follow these steps:

- 1. Make sure the trusses or rafters (also called *members*) are spaced from 16 in. to 24 in. on center. Keep in mind that 2-in. x 4-in. and 2-in. x 6-in. members are actually 1-1/2 in. thick.
- 2. Make sure the trimast is correctly configured. Placement of the trimast support struts varies according to the pitch of the roof and the distance between trusses or rafters. See Configuring a trimast on page 38. Figure 8 on page 40 explains how to configure the trimast, depending on the roof angle and truss or rafter spacing.
- 3. Carefully determine and mark the truss or rafter center line. The mast foot must be accurately positioned on the truss or rafter center line (step 5) to ensure that the mast installation is secure and to allow you to plumb the mast (step 6).
- 4. Loosen the adjustment nuts and position the mast and mast foot as shown in Figure 15.





5. Place the mast foot so its mounting holes are centered on the truss or rafter center line at the location where you plan to install it, as shown in Figure 16.

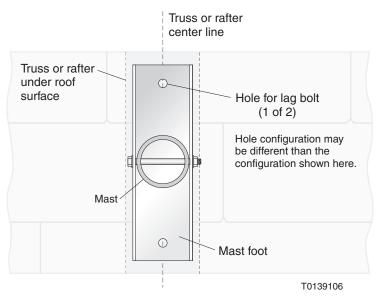


Figure 16: Aligning the mast foot on the truss or rafter center line (wood-frame roof)

6. Loosen the adjustment nuts and plumb the mast in two perpendicular directions, as shown in Figure 17.

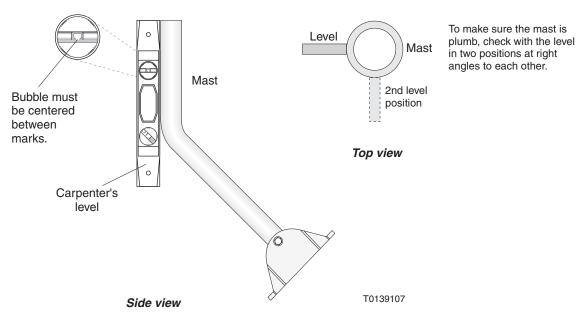


Figure 17: Plumbing the mast (wood-frame roof)

7. If you successfully plumb the mast, tighten the nuts and proceed to step 8.



Note: If you cannot make the mast plumb at this point, you must find another installation site.

8. With the mast foot bolt holes on the truss or rafter center line (as shown in Figure 16), mark the center of the mast foot top hole.

D

Note: You must mark the center of the bolt holes accurately to keep the mast plumb. Use a self-centering nail set or similar product, or use a No. 6 washer to guide the pencil as it marks the hole center.

9. Drill a hole on the center mark as follows:



- Note: Use a drill stop to avoid drilling too deeply.
- a. Drill a 1/8-in. pilot hole, 2 in. deep.
- b. Drill into the pilot hole—drill a 1/4-in. hole 4 in. deep.
- c. Drill into the 1/4-in. hole—drill a 3/8-in. hole to a depth equal to the unthreaded portion of the 3/8-in. x 4-in. lag bolt.
- 10. Apply silicone sealant in the hole and to the entire back side of the mast foot. Apply enough so that it will press out around the edges when the plate is fastened down.
- 11. Install a 3/8-in. washer on a 3/8-in. x 4-in. lag bolt.
- 12. Use a 9/16-in. socket wrench to screw the lag bolt into the top hole of the mast foot. You may need to swing the mast out of the way temporarily. Tighten the bolt snugly so the mast foot can barely move.



Note: Do not pound the lag bolts into the truss or rafter with a hammer or mallet. Doing so may split the wood and render the truss or rafter unusable.

13. Re-plumb the mast in two perpendicular directions as you did in step 6.You may need to make adjustments to the mast and/or the mast foot. If you adjust the mast foot, do not move the center

of the bottom hole off the center line more than 1/16-in.

- 14. Tighten the bolt so that the mast foot cannot move.
- 15. Tighten the adjustment nuts.
- 16. Re-plumb the mast.

(Tightening the nuts can move the mast off plumb.)

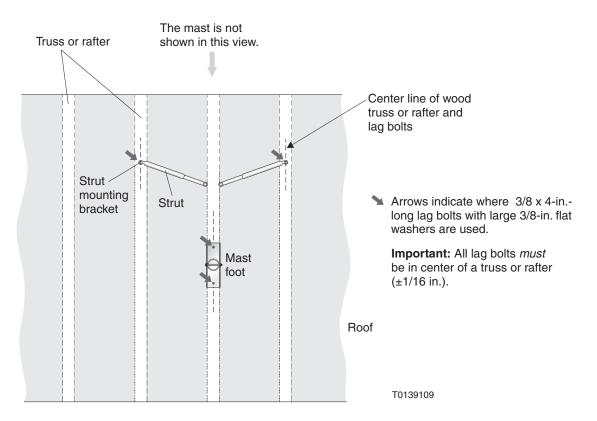
- 17. Repeat steps 8 and 9 to drill holes for the bottom hole. Do not let the mast foot move when you drill the hole.
- 18. Fill the hole with silicone sealant.
- 19. Install a 3/8-in. washer on the 3/8-in. x 4-in. lag bolt.
- 20. Use a 9/16-in. socket wrench to screw the lag bolt into the bottom hole. Do not tighten the bolt fully.
- 21. Re-plumb the mast and tighten the lag bolt.
- 22. Use a torque wrench with a 1/2-in. socket to torque the mast adjustment nuts to 18 ft-lb.
- 23. After torquing, confirm that the mast is plumb.



Note: Do not proceed if the mast is not plumb. If you cannot plumb the mast, repeat the previous installation steps or find another installation site.

Installing the support struts

- 1. Mark the support strut mounting hole pattern as specified in Figure 8 on page 40. Refer also to Figure 18.
- 2. Center the right strut or left strut mounting bracket hole on its mark.



View from above roof

Figure 18: Marking holes for the strut mounting brackets (wood-frame roof)

- 3. Drill a hole on the center mark as described in step 9 in the previous section (*Installing the trimast*).
- 4. Fill the hole with silicone sealant, and apply silicone sealant to the bottom of the strut mounting bracket.

5. Install a large 3/8-in. flat washer on the 3/8-in. x 4-in. lag bolt as shown in Figure 19.

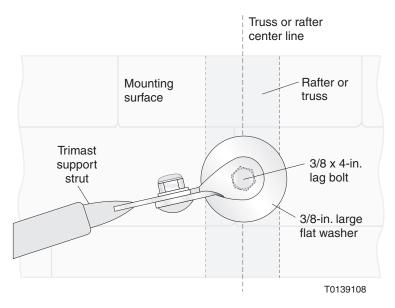


Figure 19: Installing the lag bolt and large flat washer

6. Use a 9/16-in. socket wrench to screw the lag bolts into the hole.



Note: Do not pound the lag bolts into the truss or rafter with a hammer or mallet.

7. Position the other strut mounting bracket hole so it is centered on its mark.

Refer to Figure 18.

- 8. Repeat steps 2 through 5 for the remaining strut.
- 9. Re-plumb the mast. If you had to loosen the adjustment nuts to plumb the mast, tighten them again to 18 ft-lb. You can adjust the struts' length to plumb the mast.



Note: If you cannot make the mast plumb, you must find another installation site.

10. Place the industry standard *Radiation Hazard Caution* sign on the access door or permanently mounted ladder so it will be within plain sight of anyone approaching the antenna from the front of the reflector. Requirements for this sign are given in *Radiation hazard caution signs and labels* on page 34.

The mast and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

Installing a trimast on a wood wall

The instructions in this section apply to mounts for:

- .74 m antennas (all models)
- .98 m antenna

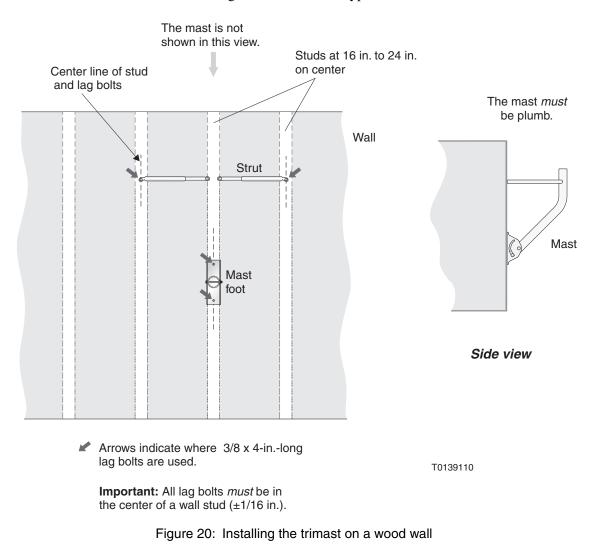
This section explains how to install the trimast mount on a wood wall. The wall studs must be wood, with a minimum nominal size of 2 in. x 4 in. and a stud spacing of 16 in. to 24 in. on center.

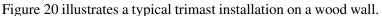
All center hole lag bolts must be centered in the stud to which they are attached. For this reason, you must be able to locate studs and the center of studs with a high degree of accuracy, which can be difficult to do. You need experience in home construction to be able to determine the exact location of studs. Stud finders can give false readings. If possible, confirm the location of the studs and their centers from both the outside and inside of the building.

A CAUTION



- Before installing the mount, read all safety information in Safety during mount installation on page 26.
- For RF safety information, see *RF safety for wall mounts* on page 31. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs and labels* on page 34.





Before you begin, make sure the studs are spaced from 16 in. to 24 in. on center. Remember that 2-in. x 4-in. and 2-in. x 6-in. members are actually 1-1/2 in. thick. Also, because small movements by the mast foot are amplified at the end of the mast, re-plumb where these instructions tell you to do so.

The arched mast foot should prevent damage to any siding when the lag bolts are tightened down into the studs. **Parts and materials** Table 7 lists the parts and materials needed to install a trimast on a wood wall.

Table 7: Parts and materials needed to install a trimast on a wood wall

Part	Туре	Quantity
Lag bolts	3/8 in. x 4-in.	4
Flat washers	3/8 in.	4
Flat washers - large	3/8 in.	2
Silicone sealant		
See also parts and materials listed in Table 2 on page 9.		

- **Tools** Table 8 lists the recommended tools for installing a trimast on a wood wall.
 - Table 8: Tools needed to install a trimast on a wood wall

ΤοοΙ	Type, purpose, or comment
Carpenter's bubble level	To make sure the mast is plumb
Pencil or chalk	
Ruler	
Socket wrenches	1/2 and 9/16-in.
Drill	3/8-in. electric
Drill bits	3/8-, 1/4-, and 1/8-in.
Torque wrench	Capable of torque up to 18 ft-lb
Ladder	
See also tools listed in Table 1 on page 7.	

Installing the mast This section explains how to install the trimast on a wood-frame roof. Some of the installation steps will be easier if you have an assistant.



Note: The installation will not be successful if the mast is not plumb. Keep in mind that small movements by the mast foot are amplified at the end of the mast. Re-plumb the mast whenever instructed to do so and whenever you feel it is necessary.

To install the trimast, follow these steps:

- 1. Carefully determine and mark the center line of the stud on which you will install the mast foot.
- 2. Loosen the adjustment nuts and position the mast and mast foot as shown in Figure 21.

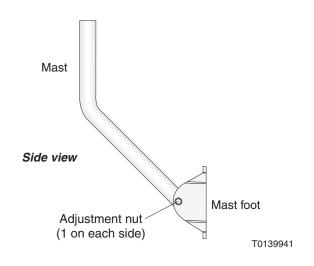


Figure 21: Positioning the mast and mast foot for installation (wood wall)

3. Place the mast foot so its mounting holes are centered on the stud center line at the location where you plan to install it, as shown in Figure 22.

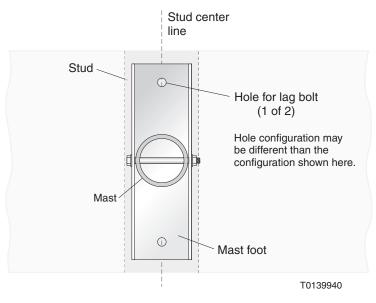


Figure 22: Aligning the mast foot on the stud center line (wood wall)

4. Loosen the adjustment nuts and plumb the mast in two perpendicular directions, as shown in Figure 23.

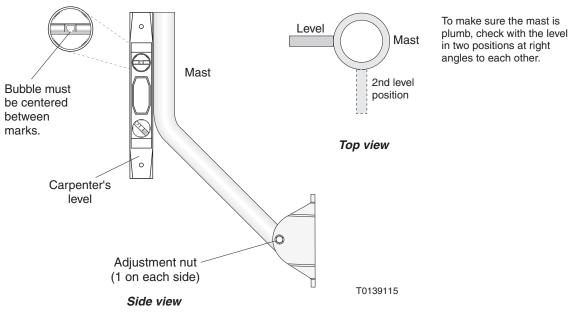


Figure 23: Plumbing the mast (wood wall)

5. If you successfully plumb the mast, tighten the nuts and proceed to step 7.



Note: If you cannot make the mast plumb at this point, you must find another installation site.

- 6. With the mast foot bolt holes on the stud center line (as shown in Figure 22), mark the center of the mast foot top hole.
- 7. Drill a hole on the center mark as follows:



- Note: Use a drill stop to avoid drilling too deeply.
- a. Drill a 1/8-in. pilot hole, 2 in. deep.
- b. Drill into the pilot hole—drill a 1/4-in. hole 4 in. deep.
- c. Drill into the 1/4-in. hole—drill a 3/8-in. hole to a depth equal to the unthreaded portion of the 3/8-in. x 4-in. lag bolt.
- 8. Apply silicone sealant in the hole and to the entire back side of the mast foot. Apply enough so that it will press out around the edges when the plate is fastened down.
- 9. Install a 3/8-in. washer on a 3/8-in. x 4-in. lag bolt.
- 10. Use a 9/16-in. socket wrench to screw the lag bolt into the top hole of the mast foot. You may need to swing the mast out of the way temporarily. Tighten the bolt snugly so the mast foot can barely move.



Note: Do not pound the lag bolts into the stud with a hammer or mallet. Doing so may split the wood and render the stud unusable.

11. Re-plumb the mast in two perpendicular directions as you did in step 4.

You may need to make adjustments to the mast and/or the mast foot. If you adjust the mast foot, do not move the center of the bottom hole off the center line more than 1/16-in.

- 12. Tighten the bolt so that the mast foot cannot move.
- 13. Tighten the adjustment nuts.
- 14. Re-plumb the mast.

(Tightening the nuts can move the mast off plumb.)

- 15. Repeat steps 6 and 7 to drill holes for the bottom hole. Do not let the mast foot move when you drill the hole.
- 16. Fill the hole with silicone sealant.
- 17. Install a 3/8-in. washer on the 3/8-in. x 4-in. lag bolt.

- 18. Use a 9/16-in. socket wrench to screw the lag bolt into the bottom hole. Do not tighten the bolt fully.
- 19. Re-plumb the mast and tighten the lag bolt.
- 20. Use a torque wrench with a 1/2-in. socket to torque the mast adjustment nuts to 18 ft-lb.
- 21. After torquing, confirm that the mast is plumb.
- Note: Do not proceed if the mast is not plumb. If you cannot plumb the mast, repeat the previous installation steps or find another installation site.

Installing the struts

- 1. Mark the support strut mounting hole pattern A or C as specified in Figure 8 on page 40. Refer also to Figure 24.
- 2. Center the right or left strut mounting bracket hole on its mark.

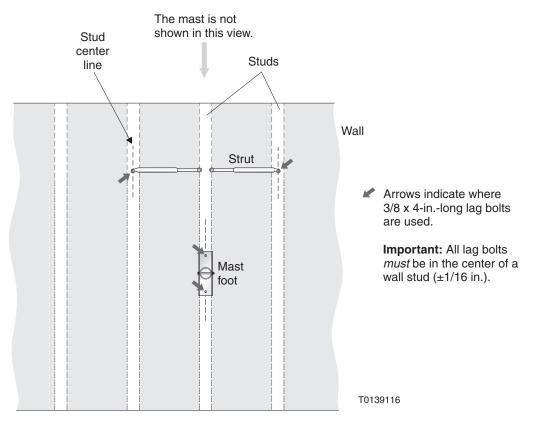


Figure 24: Marking holes for the strut mounting brackets (wood wall)

- 3. Drill a hole on the center mark as described in step 7 in the previous section (*Installing the trimast*).
- 4. Fill the hole with silicone sealant, and apply silicone sealant to the bottom of the strut mounting bracket.
- 5. Install a 3/8-in. washer on the 3/4-in. x 4-in. lag bolt.
- 6. Use a 9/16-in. socket wrench to screw the lag bolts into the hole.



Note: Do not pound the lag bolts into the stud with a hammer or mallet. Doing so may split the wood and render the stud unusable.

- 7. Position the other strut mounting bracket hole so it is centered on its mark.
 - Refer to Figure 24.
- 8. Repeat steps 2 through 6 for the remaining strut.
- 9. Re-plumb the mast. If you had to loosen the adjustment nuts to plumb the mast, tighten them again to 18 ft-lb. You can adjust the struts' length to plumb the mast.



Note: If you cannot make the mast plumb, re-install the mast in a different location.

The mast and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

Installing a trimast on a wood deck post

The instructions in this section apply to trimast mount installation for the following .74 m antennas only:

- Model AN4-074-DF
- Model AN6-074S

You can install the antenna on a 6-in. x 6-in. wood deck support post. The post must be securely attached at top and bottom and must be no more than 8 ft tall.

The deck post wood must be Southern Pine or other wood with material properties that match or exceed those of Southern Pine. Any wood that does not match or exceed the material properties of Southern Pine requires must be evaluated and approved by a qualified engineer before it can used.

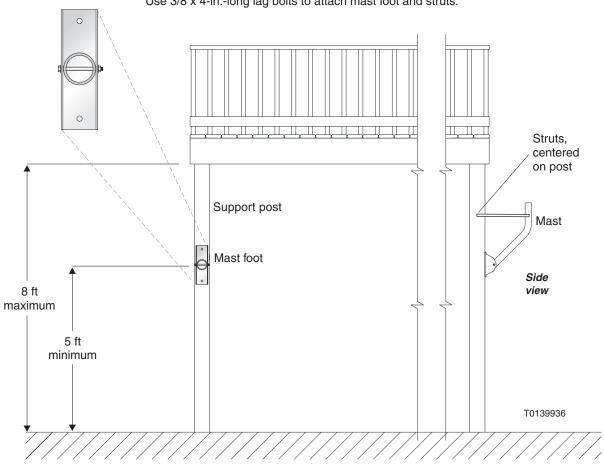


- *Before installing the mount,* read all safety information in *Safety during mount installation* on page 26.
- For RF safety information, see *RF safety for wall mounts* on page 31. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs and labels* on page 34.



- Do not install the antenna on an unsupported wood post of any size.
- Install the antenna only on a deck post made of wood.
- Install the antenna only as described in this manual.

Figure 25 illustrates the installation of a trimast on a wood deck post.



Use 3/8 x 4-in.-long lag bolts to attach mast foot and struts.

Figure 25: Trimast installation on a wood deck support post

Parts and materials Table 9 lists the parts and materials needed to install a trimast on a wood deck post.

Table 9: Parts and materials needed to install a trimast on a
wood deck post

Part	Туре	Quantity
Lag bolts	3/8 in. x 4 in.	4
Washers	3/8 in.	4
Silicone sealant		

Tools Table 10 lists the recommended tools for installing a trimast on a wood deck post.

Table 10: Tools needed to install a trimast on a wood deck post

ΤοοΙ	Type, purpose, or comment
Carpenter's bubble level	To make sure the mast is plumb
Pencil or chalk	
Ruler	
Socket wrenches	1/2 and 9/16 in.
Drill	3/8-in. electric
Drill bits	3/8, 1/4, and 1/8 in.
Torque wrench	Capable of torque up to 18 ft-lb
Ladder	
See also tools listed in Table 1 on page 7.	

Installing the mast This section explains how to install the trimast on a wood deck post. Some of the installation steps will be easier if you have an assistant.



Note: The installation will not be successful if the mast is not plumb. Keep in mind that small movements by the mast foot are amplified at the end of the mast. Re-plumb the mast whenever instructed to do so and whenever you feel it is necessary.

To install the trimast, follow these steps:

- 1. Carefully determine and mark the center line of the deck post where you will install the mast foot.
- 2. Loosen the adjustment nuts and position the mast and mast foot as shown in Figure 26.

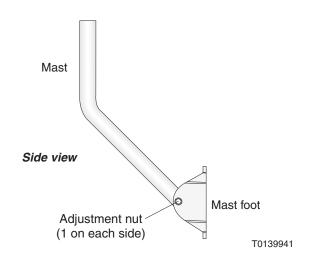


Figure 26: Positioning the mast and mast foot for installation (wood deck post)

3. Place the mast foot so its mounting holes are centered on the deck post center line at the location where you plan to install it, as shown in Figure 27.

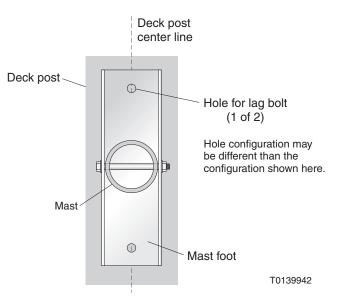


Figure 27: Aligning the mast foot on the deck post center line

4. Loosen the adjustment nuts and plumb the mast in two perpendicular directions, as shown in Figure 28.

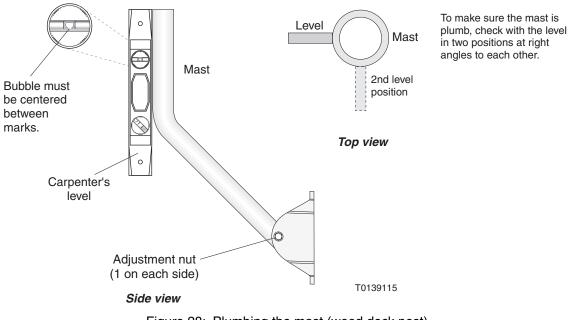


Figure 28: Plumbing the mast (wood deck post)

5. If you successfully plumb the mast, tighten the nuts and proceed to step 7.



Note: If you cannot make the mast plumb at this point, you must find another installation site.

- 6. With the mast foot bolt holes on the deck post center line (as shown in Figure 27), mark the center of the mast foot top hole.
- 7. Drill a hole on the center mark as follows:



- Note: Use a drill stop to avoid drilling too deeply.
- a. Drill a 1/8-in. pilot hole, 2 in. deep.
- b. Drill into the pilot hole—drill a 1/4-in. hole 4 in. deep.
- c. Drill into the 1/4-in. hole—drill a 3/8-in. hole to a depth equal to the unthreaded portion of the 3/8-in. x 4-in. lag bolt.
- 8. Apply silicone sealant in the hole and to the entire back side of the mast foot. Apply enough so that it will press out around the edges when the plate is fastened down.
- 9. Install a 3/8-in. washer on a 3/8-in. x 4-in. lag bolt.
- 10. Use a 9/16-in. socket wrench to screw the lag bolt into the top hole of the mast foot. You may need to swing the mast out of the way temporarily. Tighten the bolt snugly so the mast foot can barely move.



Note: Do not pound the lag bolts into the deck post with a hammer or mallet. Doing so may split the wood and render the post unusable.

11. Re-plumb the mast in two perpendicular directions as you did in step 4.

You may need to make adjustments to the mast and/or the mast foot. If you adjust the mast foot, do not move the center of the bottom hole off the center line more than 1/16-in.

- 12. Tighten the bolt so that the mast foot cannot move.
- 13. Tighten the adjustment nuts.
- 14. Re-plumb the mast.

(Tightening the nuts can move the mast off plumb.)

- 15. Repeat steps 6 and 7 to drill holes for the bottom hole. Do not let the mast foot move when you drill the hole.
- 16. Fill the hole with silicone sealant.

- 17. Install a 3/8-in. washer on the 3/8-in. x 4-in. lag bolt.
- 18. Use a 9/16-in. socket wrench to screw the lag bolt into the bottom hole. Do not tighten the bolt fully.
- 19. Re-plumb the mast and tighten the lag bolt.
- 20. Use a torque wrench with a 1/2-in. socket to torque the mast adjustment nuts to 18 ft-lb.
- 21. After torquing, confirm that the mast is plumb.

Note: Do not proceed if the mast is not plumb. If you cannot plumb the mast, repeat the previous installation steps or find another installation site.

Installing the struts Attach the struts to the sides of the deck post, as shown in Figure 25 on page 65.

- 1. Mark the center line on the left side of the deck post.
- 2. Align the bolt hole at the end of the left support strut with the center line such that the hole is bisected by the center line and the strut is at a 90° angle to the post.
 You may need to use a 1/2-in. wrench to loosen the strut adjustment nut so you can rotate, shorten, or extend it.
- 3. Mark the center of the bolt hole and drill a hole on the center mark as you did in step 7 in the previous section (*Installing the mast*).
- 4. Install a 3/8-in. washer on a 3/8-in. x 4-in. lag bolt.
- 5. Use a 9/16-in. socket wrench to install the lag bolt through the end of the strut.
- 6. Repeat steps 1 through 5 for the right side of the deck post.
- 7. Make sure the mast is still plumb.



Note: If you cannot make the mast plumb, re-install the mast in a different location.

The mast and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

Installing a trimast on a concrete or block wall

The instructions in this section apply to mounts for:

• .74 m antennas (all models)

and labels on page 34.

• .98 m antenna

This section explains how to install the trimast mount on a concrete wall or cinder block (concrete masonry) wall. For this type of installation, observe all of the following instructions and requirements:



- Before installing the mount, read all safety information in Safety during mount installation on page 26.
- For RF safety information, see *RF safety for wall mounts* on page 31. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs*

CAUTION

- Attach the satellite antenna only to a concrete wall or concrete masonry (cinder block) wall that is at least 8 in. thick.
- Do not attach the satellite antenna to stucco or to masonry veneered surfaces.
- Do not install drill holes or install anchors within 12 in. of any discontinuous surface, such as a window, door, or edge of a wall.
- Anchors cannot be installed in mortar joints or within 2 in. of mortar joints.
- Install the antenna only as described in this manual.
- You must use the specified Hilti sleeve anchors.
- Install only the four anchors specified; do not install additional anchors.
- The satellite antenna cannot be installed on masonry veneered wall construction or on any synthetic stucco wall surface, also called exterior insulation and finish systems (EIFS).
- You must use the support struts, and they must not be installed within 12 in. of any discontinuous surface.
- Bolts must be anchored and tightened to 10 ft-lb.

To manipulate the support struts, follow the instructions in the section *Adjusting the support struts* on page 43.

Figure 29 illustrates the installation of a trimast on a concrete or cinder block wall.

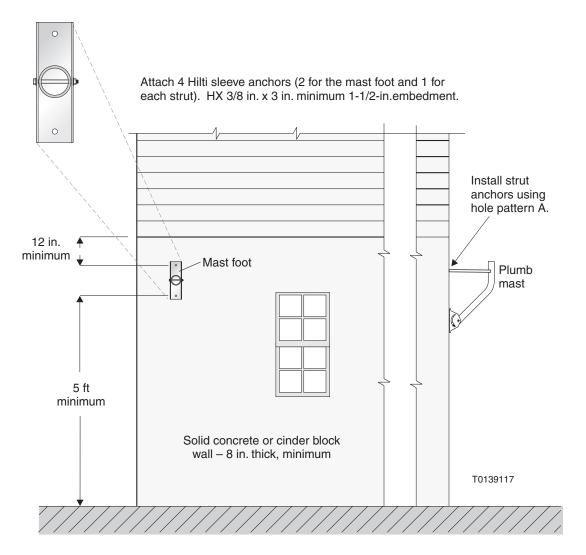


Figure 29: Attaching the mast foot to a concrete or block wall

Parts Table 11 lists the parts and materials needed to install a trimast on a concrete or block wall.

Table 11: Parts and materials needed to install a trimast on a concrete or block wall

Item	Туре	Quantity
Hilti sleeve anchors	3/8 in. x 3 in.	4
See also parts and materials listed in Table 2 on page 9.		

Tools Table 12 lists the recommended tools for installing a trimast on a concrete or cinder block wall.

Table 12: Tools needed to install a trimast on a concrete or block wall

Tool	Type, purpose, or comment	
Ladder		
Carpenter's bubble level	To make sure the mast is plumb	
Pencil	Carpenter's	
Tape measure	25 ft	
Hammer		
Drill	3/8-in., electric	
Masonry drill bits	3/8-in. (and 1/4-in. if needed)	
Wrench	9/16 and 1/2-in. or adjustable (1/4-in. if needed)	
Torque wrench	7/16, 9/16, and 1/2-in. sockets capable of torque to 18 ft-lb	
Blow-out air bulb	To clean out mounting holes	
See also tools listed in Table 1 on page 7.		

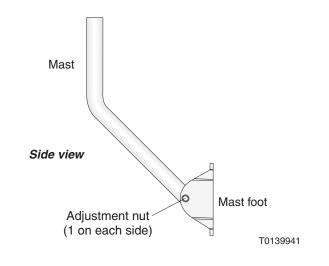
Installing the trimast This section explains how to install the trimast on a concrete or block wall. Some of the installation steps will be easier if you have an assistant.

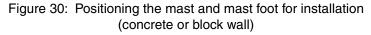


Note: The installation will not be successful if the mast is not plumb. Keep in mind that small movements by the mast foot are amplified at the end of the mast. Re-plumb the mast whenever instructed to do so and whenever you feel it is necessary.

To install the trimast, follow these steps:

1. Loosen the adjustment nuts and position the mast and mast foot as shown in Figure 30.





- 2. Place the mast foot against the wall in a vertical position, as shown in Figure 31.
- 3. Mark the wall with a pencil to show the location of:
 - The two mast foot holes
 - The two mounting holes for the support struts

Refer to Figure 8 on page 40; use hole pattern A and use the measurements shown for hole pattern A.

Locate the hole pattern and mark the holes so that:

- No hole will be drilled closer than 12 in. from any discontinuous surface, such as a window, door, or edge of a wall.
- If you are installing on a cinder block surface, you will not drill into the mortar between the blocks or within 2 in. of any mortar joint.

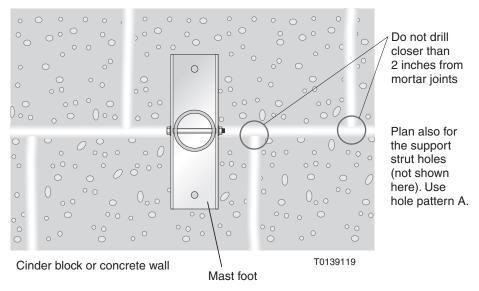


Figure 31: Placing the mast foot on the wall (concrete or block wall)

4. Loosen the adjustment nuts and plumb the mast in two perpendicular directions, as shown in Figure 32.

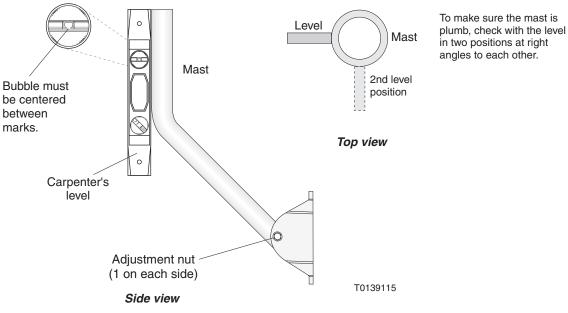


Figure 32: Plumbing the mast (concrete or block wall)

5. If you successfully plumb the mast, tighten the nuts and proceed to step 7.



Note: If you cannot make the mast plumb at this point, you must find another installation site.

- 6. Use a 3/8-in. masonry drill bit to drill 3/8-in. x 3-in. holes where you made the pencil marks.Be careful to drill exactly on the marks.
- 7. Clean out the holes with a blow-out air bulb.
- 8. With the bolts flush to the top of the nuts, tap the 3/8-in. sleeve anchors into the holes.
- 9. Remove the bolts with a 9/16-in. wrench.
- 10. Place the mast foot back on the wall, and carefully center the mast foot holes over the holes you just drilled.
- 11. Plumb the mast.

- 12. Using a torque wrench, insert two bolts into the mast foot and tighten them to 10 ft-lb.
- 13. Verify that the mast is still plumb and tighten the two adjustment nuts to 18 ft-lb.
- 14. Insert two bolts into the strut brackets and tighten them to 10 ft-lb.
- 15. Plumb the mast.



Note: If you cannot make the mast plumb, you must find another installation site.

The mast and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

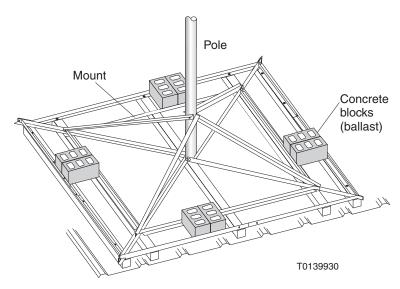
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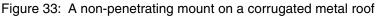
Chapter 6 Installing a non-penetrating mount

This chapter includes:

- Non-penetrating mounts on page 80
- Installing a non-penetrating mount on a rubber or gravel roof on page 83
- Installing a non-penetrating mount on a corrugated metal roof on page 85

A non-penetrating mount such as the one shown in Figure 33 may be the best mounting option in many situations.





CAUTION



Read all safety information in *Safety during mount installation* on page 26 before installing the mount.

Non-penetrating mounts

The following sections explain how to install non-penetrating mounts for antennas on various types of roof materials.

Table 13 explains which non-penetrating mount should be used, depending on the antenna and mast size. Use only the mounts listed for each antenna size (.74 m, .98 m, 1.2 m, or 1.8m).

Antenna size	Mount	Ku-band/ Ka-band qualified	Description and comments
.74 m and .98 m	Model NPM-2KA P/N 9011386-0002, 9011386-0006	Yes	4-ft x 4-ft base with 2-3/8-in. mast
.74 m, .98 m, and 1.2 m	Model NPM-4KA	Yes	6.5-ft x 6.5-ft with 2-7/8-in. mast
	P/N 9012417-0001		Use this mount if it is required by the installation specification (if applicable), ballast calculation software tool, or other ballast calculation.
			<i>Mast adapter required</i> if this mount is used with model AN6-098-DF .98 m antenna.
.98 m and 1.2 m	Model NPM-4 P/N 9200375-0001	No	6.5-ft x 6.5-ft base with 2-7/8-in. mast
1.8 m	Model NPM-6 P/N 3001506-0001	No	10-ft x 10-ft base with 4-in. mast
1.8 m	Model NPM-6KA P/N TBD	Yes	10-ft x 10-ft base with 5-in. mast

Table 13: Non-penetrating mounts for various antennas

All listed mounts include a pad.

Ku-band/Ka-band qualified - Suitable for Ku-band or Ka-band. No indicates suitable for Ku-band only.

CAUTION



- In a commercial, industrial, or institutional environment, install the satellite antenna assembly using a non-penetrating mount unless the customer-specific specification specifies another method.
- Follow the mount manufacturer's assembly instructions.
- A roof installation may void the building's roof warranty. Exercise extreme care when working on a roof.

Safety Observe the following safety precautions when installing a non-penetrating mount.

CAUTION



- Before installing the mount, read all safety information in Safety during mount installation on page 26.
- For RF safety information, see RF safety for non-penetrating mounts on the ground on page 30 or RF safety for roof mounts on page 30, as appropriate. Ground-level installations require fencing as an RF safety precaution. See Fence requirements on page 32. Requirements for RF safety signs and labels are included in Radiation hazard caution signs and labels on page 34.

If wind speeds at the installation site can exceed 125 mph, the non-penetrating mount must be tethered to a permanent structure and secured with ballast.

installation location

Selecting a suitable A non-penetrating mount may be installed on a flat roof, concrete slab, or other flat, level surface. A non-penetrating mount cannot be used on surfaces that are not level or on walls.

> Most non-penetrating mounts will be installed on flat roofs comprised of one of the following level surfaces:

- Rubber membrane
- Loose gravel on rubber membrane
- Corrugated metal
- Tar and gravel (gravel embedded in tar)

When using a non-penetrating mount, install the antenna no higher than 50 ft above grade, and use the specified ballast.

Required tools Table 14 lists the recommended tools for installing a non-penetrating mount.

ΤοοΙ	Type, purpose, or comment
Carpenter's bubble level	To make sure the mast is plumb
Snow shovel or heavy-duty push broom	To move roof gravel away from the installation site
Retractable blade utility knife	To cut pad if necessary
Socket or open-ended wrenches	Per manufacturer's instructions
Ladder	If needed
Brush	If needed to apply glue
See also tools listed in Table 1 on page 7.	

Table 14: Tool list for installing a non-penetrating mount

requirements

Calculating ballast Use the antenna ballast calculation software tool to calculate the number and/or weight of cinder blocks required, and to determine the correct placement of blocks. Do not count the antenna weight as ballast weight. For information on how to use the calculation tool, refer to Ballast Calculation Tool User Guide (1033658-0001).

> The recommended ballast material is concrete cap block, with nominal dimensions of 4 x 8 x 16 in. These blocks weigh between 25 and 30 lb. each, depending on local variation. To ensure the correct ballast weight, determine the average weight of the blocks that will be used.

Roof pad A roof pad is recommended to prevent roof damage. Place the pad under all ballast and under the mast pipe. When a roof pad is used, take into account its effect on friction when calculating wind speeds expected to result in sliding.

Installing a non-penetrating mount on a rubber or gravel roof

This section explains how to install a non-penetrating mount on a flat roof covered with:

- Rubber
- Gravel on rubber
- Tar and gravel

- *Before installing the mount,* read all safety information in *Safety during mount installation* on page 26.
- For RF safety information, see *RF safety for wall mounts* on page 31. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs and labels* on page 34.

For required parts and materials, see Table 2 on page 9. You also need a rubber pad, as explained in the next section.

To install a non-penetrating mount on a roof covered with a rubber membrane, loose gravel on rubber membrane, or tar and gravel, follow these steps:

1. If the cap sheet is covered with gravel, use a push broom or snow shovel to clear the gravel from the area where the mount will be installed, as shown in Figure 34.



Figure 34: Clearing gravel from the installation location

- 2. Place the pad on the roof surface where the mount will be assembled. Use the thicker foam pad if installing on a tar and gravel roof.
- 3. Assemble the mount according to the manufacturer's instructions.

The entire mount base must rest on the rubber pad.

- 4. Place the concrete blocks on the mount. Use the amount of ballast called for by the ballast calculation software tool.
- Use a carpenter's bubble level to verify that the mast is vertical. Apply the level in at least two locations at right angles to each other, as shown in Figure 35. If the mounting surface is not level, use any manufacturer-provided adjustments such as leveling screws or shims until the mount is level.

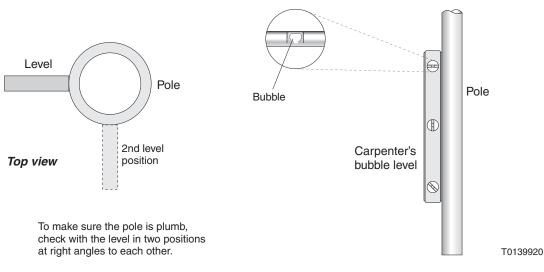


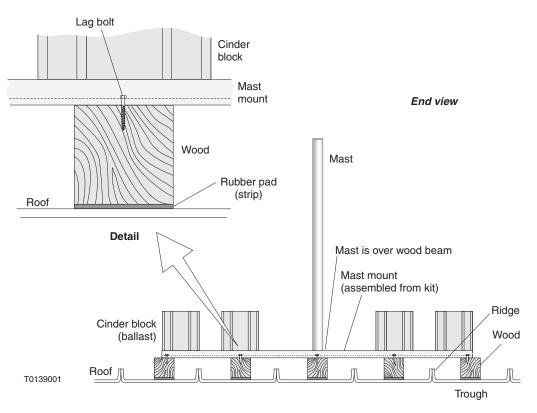
Figure 35: Plumbing the mast

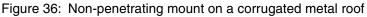
- 6. When the mount installation is complete, replace any gravel up to the outside edges of the mount. Do not replace gravel in the area inside the mount base. Leave the rubber pad exposed.
- 7. Place the industry standard *Radiation Hazard Caution* sign on the access door or permanently mounted ladder so it will be within plain sight of anyone approaching the antenna from the front or sides of the reflector. Requirements for this sign are given in *Radiation hazard caution signs and labels* on page 34.

Installing a non-penetrating mount on a corrugated metal roof

This section explains how to install the standard non-penetrating roof mount on a corrugated metal roof. The key to a secure corrugated metal roof installation is proper installation of cedar or redwood lumber beams in the corrugated roof troughs. The non-penetrating mount is attached to the beams, as shown in Figure 36.

- *Before installing the mount,* read all safety information in *Safety during mount installation* on page 26.
- For RF safety information, see *RF safety for wall mounts* on page 31. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs and labels* on page 34.







Note: A similar type of roof is a standing seam roof or horizontal seam roof. For these types of roofs, refer to *Standing Seam*, *Raised Seam, and Corrugated Roof Build-Up Procedures* (Hughes Field Service Bulletin FSB_050524_01A).

- **Parts and materials** The parts and materials needed to install a non-penetrating mount are listed in Table 2 on page 9. For a corrugated metal roof installation, you also need:
 - Five wood beams. See *Beam specifications* on page 86.
 - Twelve lag bolts, 2 in. long.
 - Glue and application brush Enough glue to fasten rubber pad strips to wood beams.

Beam specifications Use cedar or redwood beams. Do not use pressure-treated wood because it causes metal roofs to corrode.

Requirements for the beam dimensions are given in Table 15.

Dimension	Requirement
Length	For a 4-ft x 4-ft mount: 6 ft For a 6.5-ft x 6.5-ft mount: 8 ft
Height	The beams must be high enough to keep the mount above the corrugated roof ridges. See Figure 36. This requirement depends on the height of the roof ridges and the height of the roofing material when compressed.
Width	The beam width must allow water to flow the trough after the beam is placed. See Figure 36.

Table 15: Beam dimensions for a corrugated metal roof

Often, 4-in. x 4-in. beams meet the requirements in Table 15. However, before installing any beams, make sure they meet these requirements.

Installing the mount To install the mount:

- 1. Obtain five redwood or cedar beams.
- 2. Select an area of the roof that is supported by a load-bearing wall or column to install the mount.
- 3. Cut the rubber pad into strips that are at least 1/4-in. narrower than the supporting beam.Take into account for the actual dimension of lumber sizes.For example, a 4-in. x 4-in. beam is actually 3-1/2 in. wide.
- 4. Use a brush to apply glue to the supporting beams' edges.
- 5. Fasten one pad strip to one edge of each beam. See Figure 36.
- 6. Lay out the beams as shown in Figure 36. The roof must be clean and free of dirt or other debris. Lay the beams so each piece:
 - Is pad side down, with pad between the roof and lumber.
 - Is in the trough.
 - Parallel to the ridges.
 - Will allow water to flow down the troughs.
 - Is equally spaced to support the mast, mount braces and sides, and concrete blocks, as shown in Figure 36.

Also make sure the mast is over a wood beam, as shown in Figure 36.

7. Assemble the mount by following the manufacturer's instructions, but assemble the mount on the beams instead of on a rubber pad.

- 8. Position the mount:
 - Make sure the mount is evenly positioned on the beams.
 - Make sure a beam is directly under the mast.
 - Place the mount so beams will be under the rails at the inward and outward edges of the ballast locations, when the ballast is installed, as shown in Figure 37. Ballast is not added until step 1, but is shown in Figure 37 to illustrate where it should be placed.

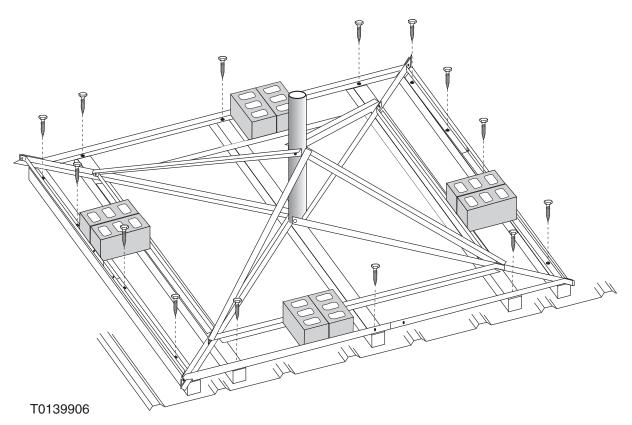


Figure 37: Location of beam, mast, and ballast

9. Use the 2-in. lag bolts to bolt the mount to the beams. Install the bolts through the holes in the mount's outer frame and into the wood. Use at least four bolts on the outer beams and two bolts on the inner beams (as shown in Figure 37).

- *Final steps* 1. Add the amount of ballast required by the ballast calculation software tool or other calculation method.
 - 2. Follow any tie-down requirements if they are included in an installation specification.
 - 3. Use a carpenter's bubble level to verify that the mast is vertical.

Apply the level in at least two locations at right angles to each other, as shown in Figure 35 on page 84.

If the mounting surface is not level, use any manufacturer-provided adjustments such as leveling screws or shims until the mount is level.

4. Place the industry standard *Radiation Hazard Caution* sign on the access door or permanently mounted ladder so it will be within plain sight of anyone approaching the antenna from the front or sides of the reflector. Requirements for this sign are given in *Radiation hazard caution signs and labels* on page 34.

The mast and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

| Chapter 6 • Installing a non-penetrating mount 1035678-0001 Revision C

This chapter includes:

- Installing a pole mount with a concrete base on page 92
- Installing a pole mount with struts on page 100

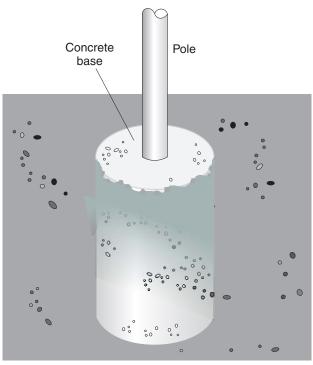
This chapter describes two options for mounting an antenna on a pole set in concrete.

Installing a pole mount with a concrete base

The instructions in this section apply to mounts for:

- .74 m antennas (all models)
- .98 m antenna
- 1.2 m antenna

The satellite antenna can be installed on a metal pole set in a concrete base, as shown in Figure 38. The Az/El assembly and reflector attach directly to the pole.



T0139931

Figure 38: Pole mount with a concrete base

and labels on page 34.



Before installing the mount, read all safety information in Safety during mount installation on page 26.
For RF safety information, see RF safety for pole and pedestal mounts on page 32. Some installations require fencing as an RF safety precaution. This installation requires a surrounding fence. See Fence requirements on page 32. Requirements for RF safety signs and labels are included in Radiation hazard caution signs **Tools** Table 16 lists the recommended tools for installing a pole mount with a concrete base.

Tool	Type, purpose, or comment	
Carpenter's bubble level	To make sure the pole is plumb.	
Hack saw	A hack saw is needed only if you want to saw off the end of the pole to prevent rotation (as an alternative to welding angle irons to the pole).	
See also tools listed in Table 1 on page 7.		

Table 16: Tool list for installing a metal pole mount with concrete base

Parts and materials Table 17 lists the parts and materials needed to install a metal pole mount with a concrete base. Make sure all items conform to the specifications in the table.

Table 17:	Parts and materials fo	r a metal pole mount wi	th concrete base

Item	Details	Quantity
Metal pole	Schedule 40 galvanized pipe, ASTM 53. See measurement specifications in Table 18 on page 94.	1
Pipe adapter	 The pipe adapter makes it possible to install the canister, which requires a pipe with a smaller outside diameter than the pole outside diameter. Factory adapter – The end with the larger outside diameter fits over the pole, and the adapter is secured with screws. Fabricated adapter – See Table 18 on page 94 for specifications and <i>Fabricated adapters</i> on page 97 for fabrication instructions. 	1
Screws	5/16 in18 x 1.5 in. square head. Used to secure the pipe adapter to the pole. Supplied with the adapter. Not needed if adapter is fabricated.	8
Concrete or Quickcrete	Required number of 40-lb bags of quick-setting concrete or Quickcrete. All concrete should conform to building code standards and have a minimum compressive strength of 3000 PSI at 28 days, as per ACI-318-77.	Enough to fill hole
Optional		
HRS angles	1-in. x 1 in. x 1/4-in. HRS angle iron, ASTM A36 structural steel, 12 in. long. Angle irons are not necessary if you cut the bottom of the pole at a 45° angle.	2 or more
See also parts	and materials listed in Table 2 on page 9.	

Installation specifications Table 18 lists the hole, pole, and adapter specifications which you must observe when installing the mount.

Specification	Antenna size			
Specification	.74 m	.98 m	1.2 m	
	Hole specification	ons		
Hole diameter, minimum (Hole depth is given below as part of the pipe length calculation.)	18 in.	18 in.	18 in.	
	Pipe diamete	r		
Nominal pipe size	2.5 in.	3 in.	3.5 in.	
Outside diameter	2.88 in.	3.5 in.	4 in.	
Pipe len	gth calculation (Refer to F	igure 39 on page 95.)		
Pole length above ground (a)	60 in.	60 in.	66 in.	
Hole depth—may be deeper due to frost line (b)	18 in.	24 in.	30 in.	
Pipe length (a + b)	78 in. (longer if hole depth >18 in.)	84 in. (longer if hole depth >24 in.)	96 in. (longer if hole depth >30 in.)	
Length added by adapter (c)	10 in.	10 in.	8 in.	
Pipe length plus adapter (a + b + c)	88 in. (for 18-indeep hole)	94 in. (for 24-indeep hole)	104 in. (for 30-indeep hole)	
Note	Pole above ground (60 in.) plus adapter (10 in.) <i>must equal</i> <i>70 in.</i>	Pole above ground (60 in.) plus adapter (10 in.) <i>must equal</i> <i>70 in.</i>	Pole above ground (66 in.) plus adapter (8 in.) <i>must equal 74 in.</i>	
	Adapter			
Hughes part number	9200358-0004	9012559-0001	3000356-0001	
Specifications for adapter if fabricated	12-in. length of 2.0 in. NPS, 2-3/8 in. outside diameter, schedule 40 steel pipe, ASTM 53.	 10-in. length of 2.0 in. NPS, 2-3/8 in. outside diameter, schedule 40 steel pipe, ASTM 53. Pipe cap (to be welded) at least .25 in. thick. 	 10-in. length of 2.5 in. NPS, 2.88 in. outside diameter, schedule 40 steel pipe, ASTM 53. Pipe cap (to be welded) at least .25 in. thick. 	

Table 18: Installation specifications for a pole mount with concrete base



Note: All installations must conform to all requirements specified in *Safety during mount installation* on page 26.

Installing the mount Figure 39 illustrates how the pole mount is installed on a concrete base. Detailed instructions follow this illustration.

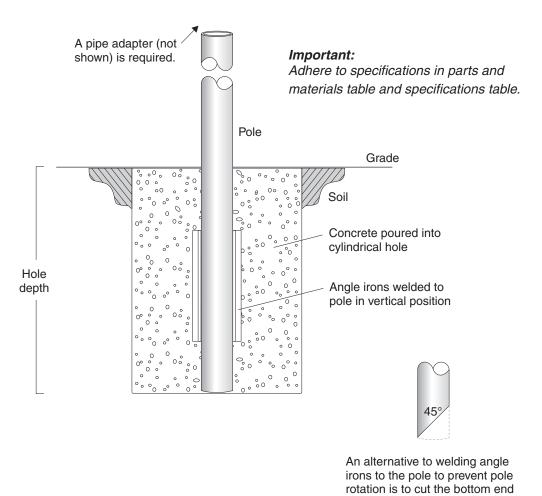


Figure 39: Installation of pole mount with concrete base

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of the pipe at a 45° angle.

Note these important requirements for installing the pole mount:

- The hole must be at least the minimum depth listed in Table 18 (but deeper if required because of the local frost line).
- The soil bearing capacity must be at least 2000 PSF.
- Concrete must be poured against undisturbed soil.

Preparing the pole and hole To install the pole mount, refer to Figures 40 through 42 and follow these steps:

1. To prevent pole rotation, weld two 12-in. lengths of angle iron on opposite sides of the pole in a vertical position, as shown in Figure 40.

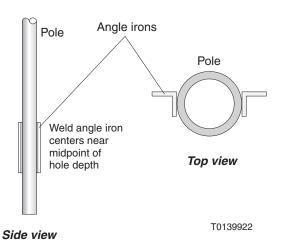


Figure 40: Angle irons welded to pole

An acceptable alternative is to saw off the bottom end of the pole at a 45° angle, as shown in Figure 39.

With either method, the pole will not rotate when the concrete hardens

2. Dig a hole according to the specifications in Table 18 on page 94. Refer to Figure 39.

If the work site is in an area where the frost line is below the minimum hole depth (from Table 18), dig the hole at least 6 in. deeper than the frost line. If you are not sure of the local frost line, consult with local building officials. If you dig deeper than the minimum hole depth, the pole must be longer—by as much as the additional hole depth.

Installing the pipe adapter You must install a pipe adapter at the top of the pole so that the antenna canister can be installed on the adapter when the antenna is installed. To accommodate the canister, the adapter is smaller in diameter than the pole.

Factory-manufactured adapters

Part numbers for factory-manufactured pipe adapters are listed in Table 18 on page 94. The adapter you should use depends on the antenna size. If necessary, the adapter can be fabricated.

Install a factory-manufactured adapter as follows:

- 1. Fit the adapter over the top of the pole.
- 2. Use the eight square-head screws provided with the adapter to secure the adapter to the pole.

Fabricated adapters

If you need to fabricate the pipe adapter, obtain a length of pipe that meets the specifications in Table 18 on page 94, and follow these instructions, depending on the antenna size:

For a .74 m antenna:

- 1. Lay the pole on a flat, level surface suitable for welding. Use a level to make sure the surface and pole are level.
- 2. Insert 2 in. of the 12-in. adapter pipe into the pole. The adapter must extend 10 in. beyond the top of the pole.
- 3. Make sure the adapter is horizontally aligned with the pole and level.

Use a level to make sure the adapter is level.

4. Keep the adapter level and aligned with the pole, and slip-weld it to the pole.

For .98 m and 1.2 m antennas:

- 1. Weld a cap (minimum .25 in. thick) to the top of the pole.
- 2. Lay the pole on a flat, level surface suitable for welding. Use a level to make sure the surface and pole are level.
- 3. Place the adapter pipe (10 in. long) so that one end is against the welded cap.
- 4. Make sure the adapter is horizontally aligned with the pole and level.

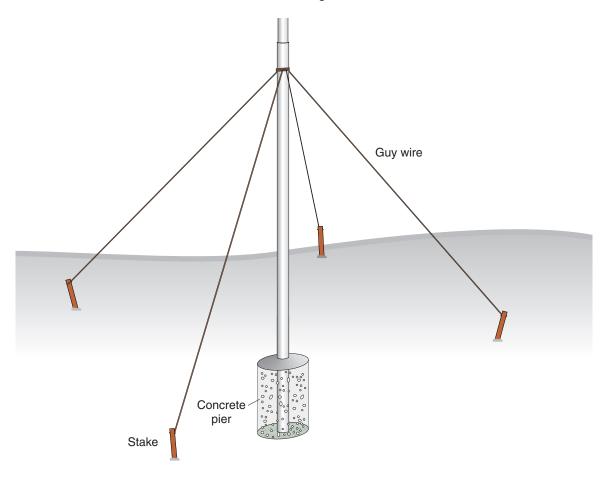
Use a level to make sure the adapter is level.

5. Keep the adapter level and aligned with the pole, and weld it to the cap.

concrete

Installing the pole and pouring Install the pole, plumb it, and pour concrete, as follows:

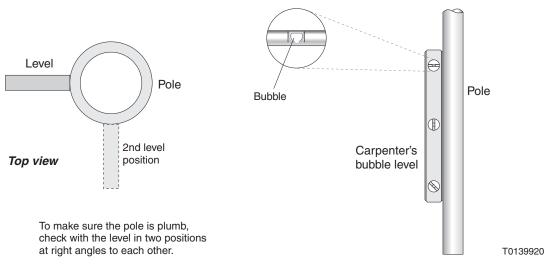
- 1. Place the pole in the hole (centered) so its bottom end rests on the bottom of the hole.
- 2. Use rocks or guy wires to stabilize the pole vertically, as shown in Figure 41.



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Figure 41: Staking the pole to allow concrete to dry

3. With a carpenter's bubble level, plumb the pole along its sides.



Use at least two different locations at right angles to each other, as shown in Figure 42.

Figure 42: Plumbing the pole (pole mount with concrete base)

4. When the pole is plumb, use the rocks or guy wires (Figure 41) to hold it in place.



Note: *The pole must be plumb.* Make sure the pole is securely held in place while the concrete is drying.

- 5. Confirm that the pole is still plumb and adjust it if necessary.
- 6. Prepare the quick-drying concrete or Quickcrete according to the manufacturer's directions.
- 7. Fill the hole with concrete.
- 8. Before the concrete hardens, confirm that the pole is still plumb and adjust it if necessary.



Note: Allow the concrete to dry at least 24 hr before installing the antenna.

The pole and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

Installing a pole mount with struts

The instructions in this section apply to mounts for:

- .74 m antennas (all models)
- .98 m antenna

The .antenna can be installed on a metal pole set in a concrete base and supported by struts, as shown in Figure 43. The Az/El assembly and reflector attach directly to the pole.

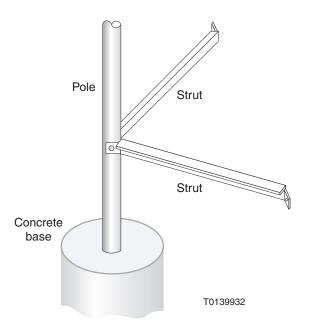


Figure 43: Pole mount with concrete base and struts



Before installing the mount, read all safety information in Safety during mount installation on page 26.
For RF safety information, see RF safety for pole and pedestal mounts on page 32. Some installations require fencing as an RF safety precaution. This installation requires a surrounding fence. See Fence requirements on page 32. Requirements for RF safety signs and labels are included in Radiation hazard caution signs and labels on page 34.



Note: The methods you plan to use to attach the struts to the pole and to the wall must be approved by a local civil engineer, as explained in the section, *Preparing the pole and hole* on page 103. To avoid delay, plan to have this done before you install the mount. **Parts and materials** Table 19 lists the parts and materials needed to install a metal pole mount with struts. Make sure all items conform to the specifications in the table.

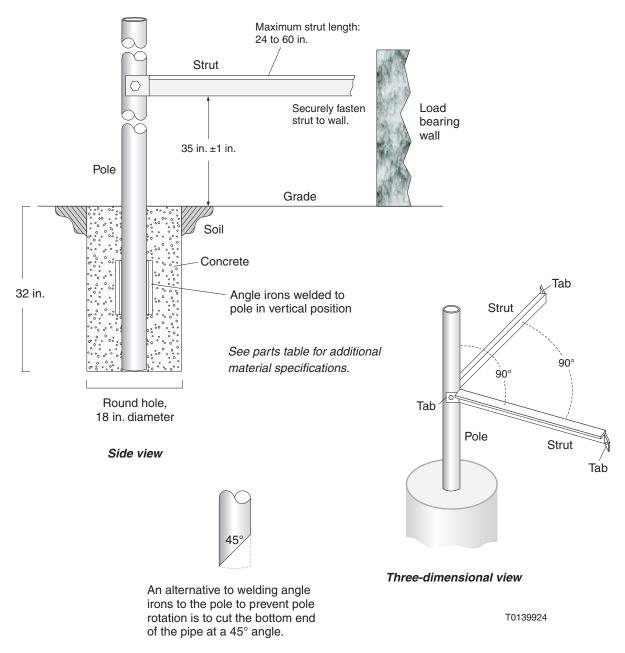
	· · · · ·	
Item	Details	Quantity
Metal pole	2 in. NPS, 2-3/8 in. outside diameter, schedule 40 galvanized pipe, ASTM 53.	1
	Pipe length calculation:	
	Pole length above ground	
	Hole depth (may be deeper due to frost line) +32 in.	
	Pipe length (longer if hole depth >32 in.) 102 in.	
Struts	Minimum 1.5 in x 1.5 x .188 in. angle iron, ASTM A36 structural steel. Length: 24 in. minimum to 60 in. maximum.	2
Fasteners, struts to pole	Fasteners such as bolts (or struts may be welded to pole). Method to be used for securing the struts to the pole should be approved by a local civil engineer. Refer to Figure 45 on page 103.	2
Fasteners, struts to wall	Fasteners suitable for securing struts to wall. Method to be used for securing the struts to the wall should be approved by a local civil engineer.	2
Concrete or Quickcrete	Required number of 40-lb bags of quick-setting concrete or Quickcrete. All concrete should conform to building code standards and have a minimum compressive strength of 3000 PSI at 28 days, as per ACI-318-77.	Enough to fill hole
	Optional	
HRS angles	1-in. x 1-in. x 1/4-in. HRS angle iron, ASTM A36 structural steel, 12 in. long. Angle irons are not necessary if you cut the bottom of the pole at a 45° angle.	2 or more
See also parts	and materials listed in Table 2 on page 9.	

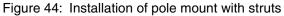
Table 19: Parts and materials needed for metal pole mount with struts

Tools Table 20 lists the recommended tools for installing a pole mount with struts.

ΤοοΙ	Type, purpose, or comment	
Carpenter's bubble level	To make sure the pole is plumb.	
See also tools listed in Table 1 on page 7.		

Installing the mount Figure 44 illustrates how the pole mount is installed set into a concrete base and supported with struts. Detailed instructions follow this illustration.





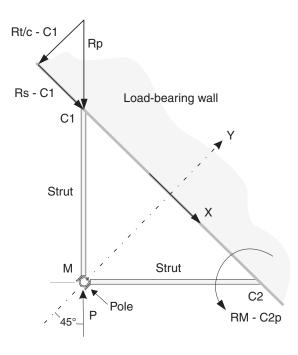
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Note these important requirements for installing the pole mount with struts:

- The hole must be at least 32 in. deep (but deeper if required because of the local frost line).
- The soil bearing capacity must be at least 2000 PSF.
- Concrete must be poured against undisturbed soil.

Preparing the pole and hole

Before you begin installation, make sure the methods you plan to use for securing the struts to the pole and to the wall are approved by a local civil engineer. The information in Figure 45 is provided for use by the engineer who performs this evaluation.



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Notes

The mast must be installed as instructed in this manual.

Reaction loads are provided only as a reference.

Hughes does not represent or warrant that any particular design or size of foundation is appropriate for any locality or earth.

Since antenna azimuth pointing varies, loading is shown at worst case. However, worst case loading can be as shown or 90° from the location shown. Therefore reactions are considered to be equal at Cl and C2. Worst case envelope reactions for both Cl and C2 are shown in table as "C."

Key

- c Compression
- Cl and C2 Strut attachments to load bearing wall
- Cp RM Cp is the reaction moment located at connection C1 or C2 due to force P
- M Location of pole (mast)
- P Force due to wind
- RM Reaction moment due to force P
- Rp Reaction due to wind force (P)
- Rs Shear reaction component due to force P
- Rt Tension reaction component due to force P

Reactions of the mount materials to force due to wind

Wind speed		Reaction	
and force	Rt/c - C	Rs - C	RM - Cp
125 mph (P = 412 lb)	295 lb	295 lb	24270 in-lb
150 mph (P = 593 lb)	420 lb	420 lb	35500 in-lb

Figure 45: Strut reaction loads

To install the pole mount, refer to Figures 44 through 47 and follow these steps:

1. To prevent pole rotation, weld two 8-in. lengths of angle iron on opposite sides of the pole in a vertical position, as shown in Figure 46.

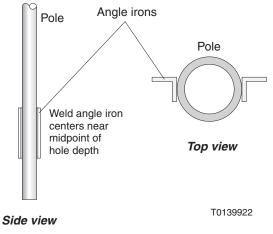


Figure 46: Angle irons welded to pole

2. Dig a hole at least 18 in. in diameter and at least 32 in. deep. See Figure 44.

If the work site is in an area where the frost line is below 24 in., dig the hole at least 6 in. deeper than the frost line. If you are not sure of the local frost line, consult with local building officials. If you dig deeper than 24 in., the pole must be longer—add the depth beyond 24 in.

Installing the pole and struts and pouring concrete

uts Install the pole, plumb it, and pour concrete, as follows:

- 1. Place the pole in the hole (centered) so its bottom end rests on the bottom of the hole.
- 2. At each end of both struts, cut off a small section of the horizontal part of the angle and make a tab to use to fasten the strut to the pole and to the wall.

Each tab can be bent as necessary to fit against the pole or wall.

- 3. Secure the struts to the pole.
 - Bolts or welding are suggested, but the method used must be approved by a local civil engineer. See *Preparing the pole and hole* on page 103.

The struts must be perpendicular to the pole and to each other. See Figure 44.

4. Secure the struts to the wall.

Wall anchors are suggested, but the method used must be approved by a local civil engineer.

5. With a carpenter's bubble level, plumb the pole along its sides.

Use at least two different locations at right angles to each other, as shown in Figure 47.

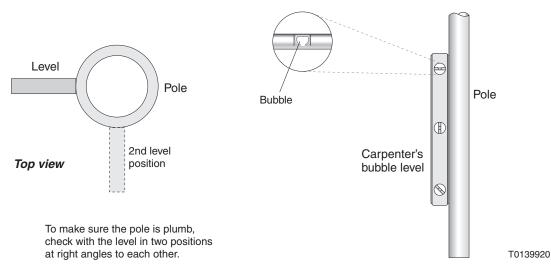


Figure 47: Plumbing the pole (pole mount with struts)



Note: *The pole must be plumb.* Make sure the pole is securely held in place while the concrete is drying.

- 6. Prepare the quick-drying concrete or Quickcrete according to the manufacturer's directions.
- 7. Fill the hole with concrete.
- 8. Before the concrete hardens, confirm that the pole is still plumb and adjust it if necessary.



Note: Allow the concrete to dry at least 24 hr before installing the antenna.

The pole and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

106 | Chapter 7 • Installing a pole mount 1035678-0001 Revision C This chapter includes:

- *Installing a pedestal mount with a pier foundation* on page 108
- Installing a pedestal mount with spread footing on page 116

A pedestal mount is a specialized type of pole mount where the pole is mounted on concrete, but it rests on a flat metal pedestal, as shown in Figure 48 on page 108 and Figure 54 on page 116.

Installing a pedestal mount with a pier foundation

The instructions in this section apply to:

- 1.2 m antenna mount
- 1.8 m antenna mount

A *pedestal mount* refers to a metal pole welded to a small pedestal at the base of the pole, as shown in Figure 48. The antenna can be installed on a pedestal mount using either:

- A concrete pier foundation See Figure 49 on page 111.
- A concrete spread footing See Figure 55 on page 119.

This section explains how to install a pedestal mount with a pier foundation, as shown in Figure 48.

When a pedestal mount is used, the Az/El assembly and reflector attach directly to the pole.

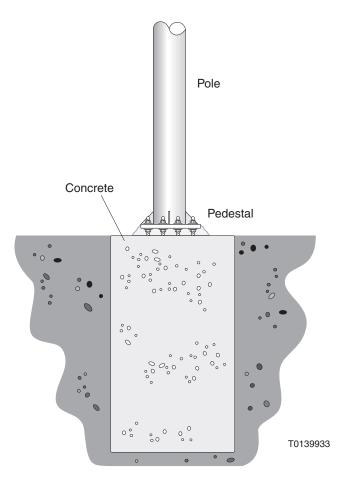


Figure 48: Pedestal mount with concrete pier foundation

The choice between using a pier foundation or a spread footing depends on the bearing capacity of the soil as determined by a local engineer. A pier foundation requires a specific lateral soil bearing capacity, while a spread footing requires a specific compressive soil bearing capacity. For example, a pier foundation cannot be used in sandy soil because sandy soil has a low lateral bearing capacity.

This section explains how to install a pedestal mount with a concrete pier foundation. Installing a pedestal mount with a concrete spread footing is explained in *Installing a pedestal mount with spread footing* on page 116.



- *Before installing the mount,* read all safety information in *Safety during mount installation* on page 26.
- For RF safety information, see *RF safety for pole and pedestal mounts* on page 32. This installation requires a surrounding fence. See *Fence requirements* on page 32. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs and labels* on page 34.

Parts and materials Table 21 lists the parts and materials you need to install a pedestal mount with a pier foundation. Make sure all items conform to the specifications in the table.

Item	Details	Quantity
Metal pole with pedestal	For 1.2 m antenna: Hughes P/N 9012560-0001. 2.5 in. NPS, 2-7/8 in. outside diameter, schedule 80 galvanized pipe, ASTM 53, 32 in. long.	1
	For 1.8 m antenna: P/N 9012560-0002. 5 in. NPS, 5.5625 in. outside diameter, schedule 80 galvanized pipe, ASTM 53, 52 in. long.	
	Both: The pole is provided with the pedestal attached, or the pedestal may be fabricated by the installer. The pedestal must conform with ASTM A36 for structural steel.	
Anchor bolts	3/4-10 x 20 in. A490 or GR8 with nuts and washers as shown in Figure 49. An acceptable alternative is to use A490 or G8 hook bolts.	8
Concrete or Quickcrete	Required number of 40-lb bags of quick-setting concrete or Quickcrete. All concrete should conform to building code standards and have a minimum compressive strength of 3000 PSI at 28 days, as per ACI-318-77.	Enough to fill the hole
No. 6 rebar	Each piece is 35 in. long	6 pieces (18 ft)
No. 3 rebar	Each piece is 20 in. long	6 pieces (10 ft)
Wire	12-16 AWG. Used to tie rebar to construct lattices. Also used as spacers to position lattices.	Estimate: 6 ft
	Optional	
Leveling grout	Use around pedestal edge If required by customer or local code.	

Table 21: Parts and materials needed for pedestal mount with a pier foundation

Tools Table 22 lists the recommended tools for installing a pedestal mount with a pier foundation.

Table 22:	Tool list for	pedestal	mount with	a pier	foundation
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Tool	Type, purpose, or comment	
Template (wood)	Used to position anchor bolts for pedestal. Provided.	
Carpenter's bubble level To make sure the pole is plumb.		
See also tools listed in Table 1 on page 7.		

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Installing the mount Figure 49 illustrates how the pedestal mount is installed on a concrete pier foundation. Detailed instructions follow this illustration.

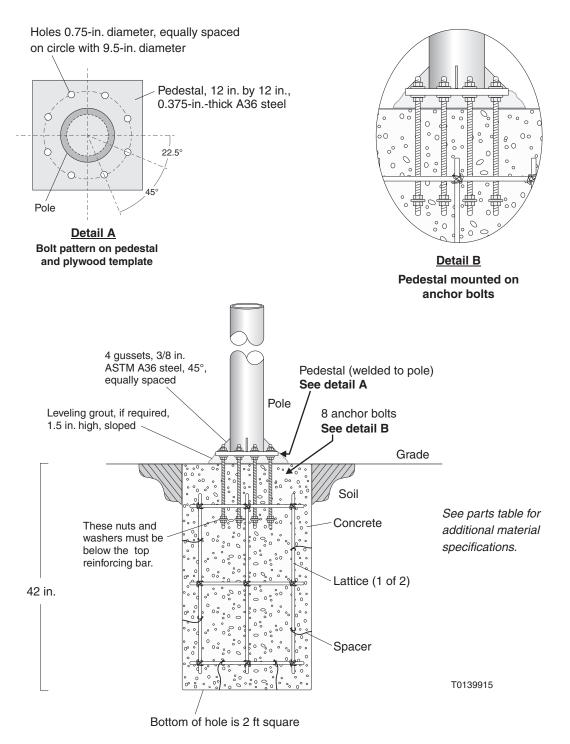


Figure 49: Installation of a pedestal mount with concrete pier foundation

Note these important requirements for installing a pedestal mount with a pier foundation:

- The hole must be at least 42 in. deep (but deeper if required because of the local frost line).
- The soil bearing capacity must be at least 2000 PSF.
- Concrete must be poured against undisturbed soil.

Preparing the lattices and hole

e To install the pedestal mount on a concrete pier foundation, refer to Figures 49 through 53 and follow all numbered steps:

1. Using 12 lengths of standard reinforcement bars, construct 2 lattices as shown in Figure 50. Tie the bars with wire where they intersect.

Fasten the lattice securely enough so it can stand vertically while concrete is poured around it. The purpose of the lattice is to strengthen the concrete, not to support the pole.

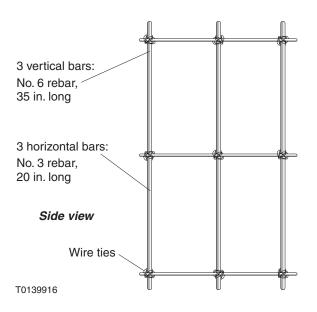


Figure 50: Lattice construction for pier foundation

2. Dig a square hole 2 ft x 2 ft and at least 42 in. deep. See Figure 49.

If the work site is in an area where the frost line is below 42 in, dig the hole at least 6 in. deeper than the frost line. If you are not sure of the local frost line, consult with local building officials. If you dig deeper than 42 in., the pole must be longer—add the depth beyond 42 in.

3. Place the lattices in the hole as shown in Figure 51.

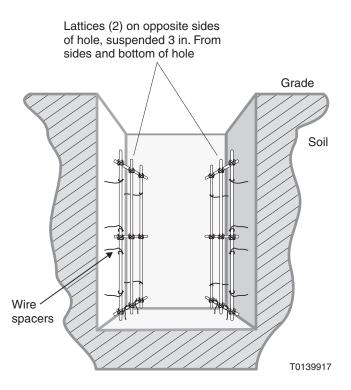


Figure 51: Lattice placement in the hole

- 4. Suspend each lattice with wire spacers, 3 in. from the bottom and sides of the hole, as shown.
- 5. Measure to make sure that when the pedestal anchors are installed, the bottom sets of nuts and washers will be below the top reinforcing rod as shown in Figure 49.

The lattices and spacers remain in the concrete.

Pouring concrete and setting The plywood template with eight holes, shown in Figure 52, *the anchor bolts* temporarily takes the place of the pedestal shown in Figure 49 on page 111. The template keeps the anchor bolts straight and in the proper orientation while the concrete is poured.

Install the anchor bolts and pour the concrete as follows:

1. Install the top washer and hex nut on each of the eight anchor bolts as shown in Figure 52.

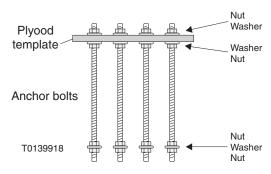


Figure 52: Anchor bolts and template

- 2. Insert an anchor bolt into one of the holes in the plywood template.
- 3. Install another washer and hex nut below the template, and tighten the nut.
- 4. Repeat steps 1 through 3 for the remaining anchor bolts. At this point all eight anchor bolts are attached to the template as shown in Figure 52.
- 5. Install two hex nuts with a washer between them on the bottom end of each anchor bolt. These nuts and washer anchor the bolt in the concrete.
- 6. Make sure the lattices are in place (Figure 51).
- 7. Prepare the quick-drying concrete or Quickcrete according to the manufacturer's directions.
- 8. Fill the hole with concrete.
- 9. While the concrete is still wet, push the anchor bolts into the concrete, at the center of the pier foundation, until the template rests on the surface of the concrete. Make sure the bolts are vertical.
- 10. When the concrete is dry, remove the plywood template.
- 11. Screw the lower hex nuts as far down on the anchor bolts as possible.



Note: Allow the concrete to dry at least 24 hr before installing the pole.

Installing the pole Install the pole as follows:

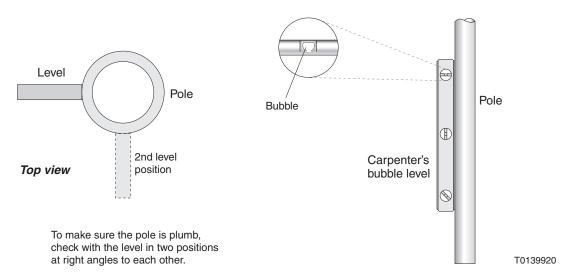
Note: The pole may be supplied with the pedestal attached. If necessary, the installer can fabricate the pedestal and weld it to the pole (and make a plywood template for the anchor bolts). Refer to Figure 49, Detail A.

- 1. Stand the pole up vertically and fit the pedestal at the bottom of the pole onto the eight anchor bolts.
- 2. Adjust the lower hex nuts until the pole is vertical.
- 3. Place a washer and nut on each anchor bolt, above the pedestal.

The nuts above and below the pedestal allow you to plumb the pole.

4. Use a carpenter's bubble level to plumb the pole along its sides.

Use at least two different locations at right angles to each other, as shown in Figure 53.





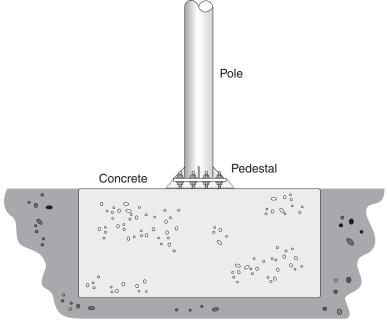
- 5. Tighten or loosen the nuts above and below the pedestal as necessary to plumb the pole.
- 6. Confirm that the pole is plumb and adjust it if necessary.



Note: The pole must be plumb.

The mast and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors,*

	<i>Ground Blocks, and Ground Block Location</i> (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.		
Installing a pedestal	The instructions in this section apply to mounts for:		
mount with spread footing	 1.2 m antenna 1.8 m antenna		
	A pedestal mount refers to a metal pole welded to a small pedestal at the base of the pole, as shown in Figure 54. The antenna can be installed on a metal pole using either:		
	 A concrete pier foundation – See Figure 49 on page 111. A concrete spread footing – See Figure 55 on page 119. 		
	This section explains how to install a pedestal mount with a spread footing, as shown in Figure 54.		
	When a pedestal mount is used, the Az/El assembly and reflector attach directly to the pole. You do not need the trimast.		



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Figure 54: Pedestal mount with spread footing

The choice between using a pier foundation or a spread footing depends on the bearing capacity of the soil as determined by a local engineer. A pier foundation requires a specific lateral soil bearing capacity, while a spread footing requires a specific compressive soil bearing capacity. For example, a pier foundation cannot be used in sandy soil because sandy soil has a low lateral bearing capacity. A pier foundation is less expensive than a spread footing.

This section explains how to install a pedestal mount with a concrete spread footing. Installing a pedestal mount with a concrete pier foundation is explained in *Installing a pedestal mount with a pier foundation* on page 108.



- Before installing the mount, read all safety information in Safety during mount installation on page 26.
- For RF safety information, see *RF safety for pole and pedestal mounts* on page 32. This installation requires a surrounding fence. See *Fence requirements* on page 32. Requirements for RF safety signs and labels are included in *Radiation hazard caution signs and labels* on page 34.

Parts and materials Table 23 lists the parts and materials you need to install a pedestal mount with a spread footing. Make sure all items conform to the specifications in the table.

Item	Details	Quantity
Metal pole with pedestal	For 1.2 m antenna: Hughes P/N 9012560-0001. 2.5 in. NPS, 2-7/8 in. outside diameter, schedule 80 galvanized pipe, ASTM 53, 32 in. long.	1
	For 1.8 m antenna: P/N 9012560-0002. 5 in. NPS, 5.5625 in. outside diameter, schedule 80 galvanized pipe, ASTM 53, 52 in. long.	
	Both: The pole is provided with the pedestal attached, or the pedestal may be fabricated by the installer. The pedestal must conform with ASTM A36 for structural steel.	
Anchor bolts	3/4-10 x 20 in. A490 or GR8 with nuts and washers as shown in Figure 55. An acceptable alternative is to use A490 or G8 hook bolts.	8
Concrete or Quickcrete	Required number of 40-pound bags of quick-setting concrete or Quickcrete. All concrete should conform to building code standards and have a minimum compressive strength of 3000 PSI at 28 days, as per ACI-318-77.	
No. 5 rebar	Each piece is 42 in. long	10 pieces (35 ft)
Wire	12-16 AWG. Used to tie rebar to construct lattices. Also used as spacers to position lattices.	Estimate: 14 ft
	Optional	
Leveling grout	Use around pedestal edge If required by customer or local code.	
See also parts	and materials listed in Table 2 on page 9.	

Table 23: Parts and materials needed for a pedestal mount with spread footing

Tools Table 24 lists the recommended tools for installing a pedestal mount on a spread footing.

Table 24:	Tool list for a	pedestal	mount with s	pread footing
	1001 101 01 0	pouoolui	ino and main o	produi rooting

ΤοοΙ	Type, purpose, or comment			
Template (wood)	Used to position anchor bolts for pedestal. Provided.			
Carpenter's bubble level	To make sure the pole is plumb.			
See also tools listed in Table 1 on page 7.				

Installing the mount Figure 55 illustrates how the pedestal mount is installed on a concrete spread footing (pad). Detailed instructions follow this illustration.

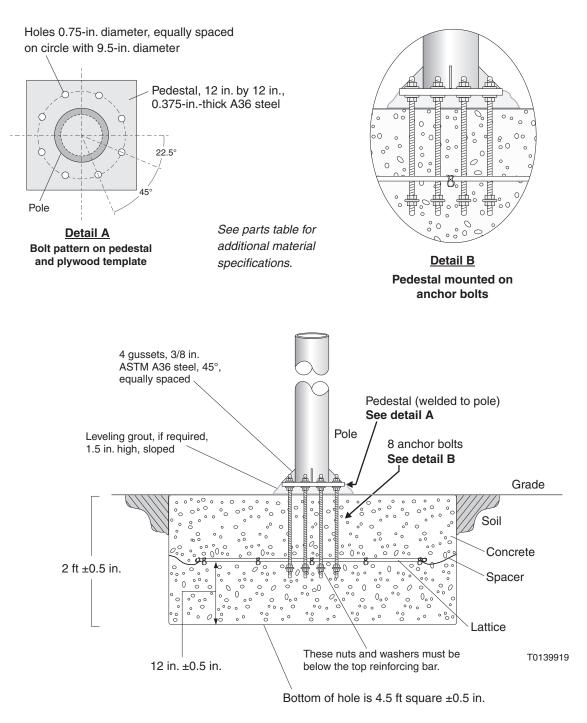


Figure 55: Installation of a pedestal mount with concrete spread footing

Note these important requirements for installing a pedestal mount with a spread footing:

- The hole must be at least 2 ft deep, ±0.5 in. (but deeper if required because of the local frost line).
- The soil bearing capacity must be at least 2000 PSF.
- Concrete must be poured against undisturbed soil.

Preparing the lattices and hole

Ie To install the pedestal mount with spread footing, refer to Figures 56 through 58 and follow all numbered steps:

1. Using 10 lengths of No. 5 reinforcement bars, construct a lattice as shown in Figure 56. Tie the bars with wire where they intersect.

Fasten the lattice securely enough so it can lay horizontally while concrete is poured around it. The purpose of the lattice is to strengthen the concrete, not to support the pole.

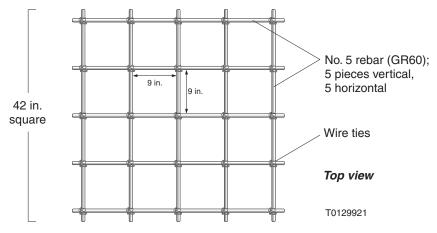


Figure 56: Lattice construction for spread footing

2. Dig a square hole 4.5 ft x 4.5 ft and at least 2 ft deep. See Figure 55.

If the work site is in an area where the frost line is below 2 ft, dig the hole at least 6 in. deeper than the frost line. If you are not sure of the local frost line, consult with local building officials. If you dig deeper than 2 ft, the pole must be longer—add the depth beyond 2 ft.

- 3. Place the lattice in the center of the hole. Place the lattice horizontally so it is parallel with the bottom of the hole.
- 4. Using wire spacers, suspend the lattice in the center of the hole, 12 in. (±0.5 in.) from the bottom.
- 5. Measure to make sure that when the pedestal anchors are installed, the bottom sets of nuts and washers will be below the top reinforcing rod as shown in Figure 55.

The lattices and spacers remain in the concrete.

the anchor bolts

Pouring concrete and setting The plywood template with eight holes, shown in Figure 57, temporarily takes the place of the pedestal shown in Figure 55 on page 119. The template keeps the anchor bolts straight and in the proper orientation while the concrete is poured.

Install the anchor bolts and pour the concrete as follows:

1. Install the top washer and hex nut on each of the eight anchor bolts as shown in Figure 57.

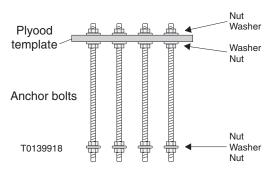


Figure 57: Anchor bolts and template

- 2. Insert an anchor bolt into one of the holes in the plywood template.
- 3. Install another washer and hex nut below the template, and tighten the nut.
- 4. Repeat steps 1 through 3 for the remaining anchor bolts. At this point all eight anchor bolts are attached to the template, as shown in Figure 57.
- 5. Install two hex nuts with a washer between them on the bottom end of each anchor bolt. These nuts and washer anchor the bolt in the concrete.
- 6. Make sure the lattice is in place.
- 7. Prepare the quick-drying concrete or Quickcrete according to the manufacturer's directions.
- 8. Fill the hole with concrete.
- 9. While the concrete is still wet, push the anchor bolts into the concrete, at the center of the footing, until the template rests on the surface of the concrete. Make sure the bolts are vertical.
- 10. When the concrete is dry, remove the plywood template.
- 11. Screw the lower hex nuts as far down on the anchor bolts as possible.



Note: Allow the concrete to dry at least 24 hr before installing the pole.

Installing the pole Install the pole as follows:

À

Note: The pole may be supplied with the pedestal attached. If necessary, the installer can fabricate the pedestal and weld it to the pole (and make a plywood template for the anchor bolts). Refer to Figure 55, Detail A.

- 1. Stand the pole up vertically and fit the pedestal at the bottom of the pole onto the eight anchor bolts.
- 2. Adjust the lower hex nuts until the pole is vertical.
- 3. Place a washer and nut on each anchor bolt, above the pedestal.

The nuts above and below the pedestal allow you to plumb the pole.

4. Use a carpenter's bubble level to plumb the pole along its sides.

Use at least two different locations at right angles to each other, as shown in Figure 58.

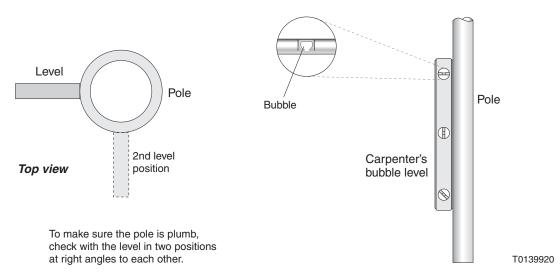


Figure 58: Plumbing the pole (pedestal mount with spread footing)

- 5. Tighten or loosen the nuts above and below the pedestal as necessary to plumb the pole.
- 6. Confirm that the pole is plumb and adjust it if necessary.



Note: *The pole must be plumb.*

The pole and antenna must be grounded. For details, refer to your training, best grounding practices, *HNS Broadband Requirements for RG-6 and RG-11 IFL Cable Connectors, Ground Blocks, and Ground Block Location* (Hughes Field Service Bulletin 050518_01C), and applicable parts of the NEC.

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Acronyms and abbreviations

Α

ACI – American Concrete Institute ANSI – American National Standards Institute

ASTM – American Society for Testing and Materials

AWG - American Wire Gauge

Az/El – Azimuth and elevation

Ε

EIA - Electronic Industries Association

EIFS – Exterior insulation and finish systems

ETSI – European Telecommunications Standards Institute

F

FCC - Federal Communications Commission

ft – Foot

ft-lb - Foot-pound

G

GFI – Ground fault interrupter

Η

hr – Hour

I

IDU – Indoor unit

IEEE – Institute of Electrical and Electronic Engineers

IFL – Intra-facility link

in. – Inch

in-lb - Inch-pound

L

lb – Pound

М

MPE - Maximum permissible exposure

mph – Miles per hour

Ν

NEC - National Electrical Code

NFPA - National Fire Protection Association

NOC - Network Operations Center

0

ODU – Outdoor unit

Ρ

P/N – Part number

PSF - Pounds per square foot

S

SOHO - Small office/home office

SQF - Signal quality factor

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