

Type ES93( )

## **9.3-Meter ESA**



*9.3-Meter Earth Station Antenna*

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# 9.3-Meter Earth Station Antenna

## Introduction

Like all Andrew earth station antennas, the 9.3-Meter Earth Station Antenna provides high gain and exceptional pattern characteristics. The electrical performance and exceptional versatility provides the ability to configure the antenna with your choice of linearly- or circularly-polarized 2-port or 4-port combining network. That versatility is provided at the time of initial purchase, as well as in the future, as your satellite communication requirements evolve.

The aluminum reflector is precision formed for accuracy and strength requiring minimal assembly. The reflector assembly is 30-feet (9.3-meters) in diameter and segmented in a twenty piece configuration to reduce shipping volume and facilitate transport to remote sites. Reflector panels are chromate converted and painted with a highly reflective white paint.

The versatile tripod mount can be purchased with motorizable capabilities. The tripod mount features 180 degree azimuth coverage in three continuous 120 degree overlapping ranges and executes 90 degree continuous elevation adjustment. This large adjustment range provides non-critical foundation orientation and the ability to view geostationary satellites from horizon-to-horizon, from any location worldwide.

The motorizable tripod mount features self-aligning bearings for the elevation pivots, resulting in "zero" backlash. This mount has the ability to be upgraded for High-Speed motorized operation, including steptracking/Smartrack™ applications. The motorizable mount type is indicated by the **ES93** or **ES93HS** letters within the antenna type number. The addition of the letter "HS" within the antenna type number indicates that the mount includes High-Speed azimuth/elevation machine jackscrews. The azimuth/elevation jackscrews are equipped for integration with the optional motor drive systems. A cross-axis grounding kit is supplied with each mount to ensure electrical interconnectivity of the complete structure.

The aluminum enclosure and hot-dipped galvanized steel mount maintain pointing accuracy and ensures durability and reliability. The antenna and mount with enclosure will survive 125 mph (200 km/h) wind, in any position of operation, without damage or permanent deformation in moderate coastal/industrial areas. Severe conditions require additional protection.

Andrew provides a complete line of available options, including motor drive systems (with power interfaces addressing domestic and international standards), remote micro-processor antenna control for motor drive systems, pressurization equipment, and interconnecting HELIAX® cables and waveguide.

## **Proprietary Data**

The technical data contained herein is proprietary to Andrew Corporation. It is intended for use in operation and maintenance of Andrew supplied equipment. This data shall not be disclosed or duplicated in whole or in part without express written consent of Andrew Corporation.

## **Information and Assistance**

Andrew Corporation provides a world-wide technical support network. Refer to the technical assistance portion of this manual for the contact numbers appropriate to your location.

## **Notice**

The installation, maintenance, or removal of antenna systems requires qualified, experienced personnel. Andrew installation instructions have been written for such personnel. Antenna systems should be inspected by qualified personnel to verify proper installation, maintenance and condition of equipment.

Andrew Corporation disclaims any liability or responsibility for the results of improper or unsafe installation and maintenance practices.

All designs, specifications, and availabilities of products and services presented in this manual are subject to change without notice.

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## **Technical Assistance**

### **24-hour Technical Assistance**

For technical assistance, call the following numbers at anytime.

<b>Call From</b>	<b>Call To</b>	<b>Telephone</b>	<b>Fax</b>
North America (toll free)	U. S. A.	(800)-255-1479	(800)-349-5444
Any Location (International)	U. S. A.	(708)-349-3300	(708)-349-5410

### **Customer Service Center**

The Andrew Customer Service Center gives you direct access to the information and personnel service you need, such as the following:

- Place or change orders
- Check price and delivery information
- Request technical literature

You can call from any of the following:

<b>Call From</b>	<b>Telephone</b>	<b>Fax</b>
North America	800-255-1479 (toll free)	(800)-349-5444 (toll free)
United Kingdom	00-800-0-255-1479 (toll free)	00-800-0-349-5444 (toll free)
Australia	0011-800-0-255-1479 (toll free)	0011-800-0-349-5444 (toll free)
China	00-800-0-255-1479 (toll free)	00-800-0-349-5444 (toll free)
New Zealand	00-800-0-255-1479 (toll free)	00-800-0-349-5444 (toll free)
Hong Kong	001-800-0-255-1479 (toll free)	001-800-0-349-5444 (toll free)

# How to Use This Manual

## Overview

The scope of this manual is intended to provide station personnel with the base installation, operation, and maintenance requirements necessary for a 9.3-Meter C-Band Earth Station Antenna. This manual provides a convenient reference for authorized operator/service personnel requiring technical information on general system or specific subsystem equipment.

The tables and figures presented in this manual are used as communication aids for the installation, operation, and maintenance of the 9.3-Meter Earth Station Antenna. These tables and figures instantly convey messages, as well as make the procedures easier to understand. This manual uses tables and figures for the following references:

- **Tables** The tables allow you to locate information quickly and easily.
- **Drawings** The drawings supplement the installation instructions by using a combination of graphics and verbiage to assist you in simplifying complex procedures and clarifying components.
- **Photographs** The photographs compliment the installation instructions by providing actual examples of the steps being performed, which allow you to view the installation in concrete form.

## Content

The manual is divided into five distinct sections, each dealing with a specific technical topic relating to either system or component subsystem information. The sections contained in this manual are described and listed under the following technical headings:

- **How to Use This Manual** Describes the manual's purpose, content, and communication aids. Additionally, this section lists the related documentation for the 9.3-Meter Earth Station Antenna.
- **Getting Started** Provides the preliminary information needed to perform a successful installation. This section should be reviewed prior to the installation. The warnings, recommended tools, parts verification, instructions on reporting lost or damaged equipment, and installation checklist are located in this section.
- **Installation Procedures** Provides the procedures for the different phases of a 9.3-Meter Earth Station Antenna base installation. This section will help you easily find requirements for an individual task, as well as displays the sequence for each task execution.
- **Operation** Describes the controls, functions, and general operating procedures required for proper operation of the 9.3-Meter Andrew Earth Station Antenna.
- **Preventive Maintenance** Describes preventive maintenance procedures that are required to maintain proper functional operation of your new Andrew Earth Station Antenna.

# Getting Started

## Overview

The installation, operation, and maintenance of the 9.3-Meter Earth Station Antenna requires qualified and experienced personnel. Andrew installation, operation, and maintenance instructions are illustrated for such personnel. Additionally, the antenna should be inspected by qualified personnel to verify proper installation, maintenance, and condition of equipment as described in Preventive Maintenance. The basic equipment and accessories are either manufactured or design controlled by Andrew Corporation.

The prerequisite information necessary for the 9.3-Meter Earth Station Antenna can be found in this section. Furthermore, this section should be reviewed BEFORE performing the installation, operation, or maintenance. Recommended warnings, recommended tools, and the antenna parts can be verified and/or determined with such a review.

## Warnings

When installing the 9.3-Meter Earth Station Antenna, be conscious of the recommended warnings presented below. For further information or clarification of this information, contact the Customer Service Center. The recommended warnings are as follows:

1. Electrical shock from voltages used in this antenna system may cause personal injury or death. Prior to making any electrical connections or performing maintenance or repair, ensure that the power is removed. Electrical connections should be made only by qualified personnel in accordance with local regulations.
2. Installation of antennas may require persons to work at elevated work stations. Whenever persons are working at eight or more feet above the ground and not on a guarded platform, they should wear safety belts with at least one (preferably two) lanyard.
3. Never stand underneath any object while it is being lifted.
4. Always wear a hard hat, especially if someone is above you.
5. Make sure no person is in or under the reflector while it is being lifted or positioned; personal injury can result if the reflector assembly falls.
6. Personnel should never be hoisted in or out of the reflector by the crane; personal injury may result.
7. Andrew earth station antennas supplied to standard product specifications will survive 125 mph winds in any operational position in moderate coastal/industrial areas. Severe conditions require additional protection. Should it be expected that winds will exceed 125 mph, it is recommended that Andrew antennas be steered to specific azimuth and elevation orientations to minimize wind forces upon the structure and thereby increase the probability of survival.
8. It is recommended that all cross-axis waveguide and coaxial cables are secure such that high winds will not cause excessive flexing. Position the antenna to an elevation of 90 degrees. The azimuth jackscrew should be placed in the center of its travel.
9. When the antenna is transmitting, severe eye injury or injury to other parts of the body can result from exposure to radio frequency (RF) energy. The antenna must be turned off before entering the area in front of the reflector and near the feed.

**NOTE:** Failure to follow an installation procedure could result in damage to equipment or personal injury.

Additional warnings will be displayed throughout this manual for your awareness. These warnings can be identified in warning boxes as shown in the following sample.



Andrew disclaims any liability or responsibility for the results of improper or unsafe installation, operation, or maintenance practices.

**Recommended Tools**

Andrew supplies all appropriate hardware/parts required for the installation of your 9.3-Meter Earth Station Antenna. All tools necessary for the installation process should be provided by the installation crew. Andrew recommends the following tools to be used for a proper installation of the 9.3-Meter Earth Station Antenna.

Tool	Size	Quantity	
Open End or Combination Wrenches	1/4 Inch	2	
	5/16 Inch	2	
	3/8 Inch	2	
	7/16 Inch	2	
	1/2 Inch	2	
	9/16 Inch	2	
	3/4 Inch	2	
	7/8 Inch	2	
	1-1/16	2	
	1-1/8 Inch	2	
	1-7/16 Inch	2	
	1-5/8 Inch	2	
	1-7/8 Inch	2	
	Drive Sockets	5/16 Inch	2
		7/16 Inch	1
1/2 Inch		2	
9/16 Inch		2	
3/4 Inch		2	
15/16 Inch		2	
1-1/16 Inch		1	
1-1/8 Inch		2	
1-7/16 Inch		1	
1-7/8 Inch		1	
Breaker Bar	3/4 Inch	2	
Crane	18 Ton Minimum Capacity, extended end	1	
Nylon Web Slings (2000 pound breaking strength)	3 Inch by 20 Foot	4	
Rope or Cord (2000 pound breaking strength)	50 Foot	1	
Shackles	5/8 Inch	4	
Ladder	10 Foot Step	2	
Ladder	18 Foot Extension	2	
Drift Pin	5/8 to 7/8 Inch	2	
Drift Pin	1/4 to 1/2 Inch	2	
Spud Wrench	1-1/8 Inch	2	
Screw Drivers	Standard/Phillips	1	
Bucket Truck		1	
Allen Wrenches	Set	1	
Torque Wrench	250 ft/lb	1	
Adjustable Wrenches	8 and 12 Inch	1	
Drill	Electric	1	
Tape Measure (or other measuring device)	Standard	1	
Felt-tip Marker (or other marking device)	Standard	1	
Hammer	Standard	1	
Rubber Mallet	Standard	1	
Pry Bar	Standard	1	
Tin Snips	Standard	1	
Safety Gloves (each installer)	Standard	1	

**Table 2-1. Recommended Tools**

## **Parts Verification**

Andrew Corporation thoroughly inspects and carefully packs all equipment before shipment. If you find that there are missing components, please refer to page 9 for step-by-step instructions on how to properly report the equipment loss.

## **Reporting Equipment Loss or Damage**

If you find that there was damage caused to the equipment during the shipping process, a claim should be filed with the carrier. Follow the "Reporting Visible Loss or Damage" or "Reporting Concealed Damage" procedures when filing a claim with the carrier.

## **Reporting Visible Loss or Damage**

Make a note of any loss or evidence of external damage on the freight bill or receipt, and have it signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier refusing to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

## **Reporting Concealed Damage**

Concealed damage means damage which does not become apparent until the unit has been unpacked. The contents may be damaged in transit due to rough handling, even though the carton may not show external damage. If you discover damage after unpacking the unit, make a written request for an inspection by the carrier's agent, then file a claim with the carrier since such damage is most likely the carrier's responsibility.

## **Inventory Equipment Received**

After opening your shipment, an inventory of the parts should occur immediately. Check each item received in your shipment against the packing slip included with the shipment. If any items are missing, please notify Andrew Corporation immediately by contacting the Customer Service Center.



## **Returning Equipment**

Andrew Corporation tries to ensure that all items arrive safe and in working order. Occasionally, despite these efforts, equipment is received which is not in working condition. When this occurs, and it is necessary to return the equipment to Andrew Corporation for either repair or replacement, return can be expedited by following the procedure listed below:

### **Step 1**

Call the Andrew Customer Service Center and request a Return Material Authorization (RMA) number, as well as an address to forward the material.

### **Step 2**

Tag or identify the defective equipment, noting the defect or circumstances. Also, be sure to write the RMA number on the tag. It would be helpful to reference the sales order and purchase order, as well as the date the equipment was received.

### **Step 3**

Pack the equipment in its original container with protective packing material. If the original container and packing material are no longer available; pack the equipment in a sturdy corrugated box, and cushion it with appropriate packing material.

### **Step 4**

Be sure to include the following information when returning the equipment:

- Your Company Name
- Your Company Address
- City, State, and Zip Code
- Telephone Number
- RMA Number
- Problem Description
- Contact Name

**NOTE:** Absence of the RMA number will cause a delay in processing your equipment for repair. Be sure to include the RMA number on all correspondence.

### **Step 5**

Ship the equipment to Andrew Corporation using UPS, U.S. Postal Service, or other appropriate carrier; freight prepaid and insured. The material should be forwarded to the address given by the Andrew contact in Step 1.

# Installation Procedures

## Overview

This section provides installation procedures for the 9.3-Meter Andrew Earth Station Antenna. The installation procedures include instructions on the following antenna components:

- Mount
- Reflector
- Enclosure
- Reflector-to-Mount Assembly
- Subreflector
- Feed System (C-band)

## Foundation Preparation

Before beginning the installation process on the ground mount assembly, ensure that the foundation has been prepared. Foundation specifications are provided by Andrew and may be used as a reference by civil engineering personnel when preparing the foundation for local soil conditions. These specifications are available before the shipment arrives by contacting the Customer Service Center or your Account Manager.

- Foundation should be dimensioned as detailed in Figure 1.
- Sweep foundation clear of any dirt or debris.
- To ensure smooth surface for mount, scrape foundation pads as shown in Figure 2.
- Studs should extend 3 in. above the ground and are 7/8 in. in diameter
- Apply stick wax to stud threads to ease later connections.

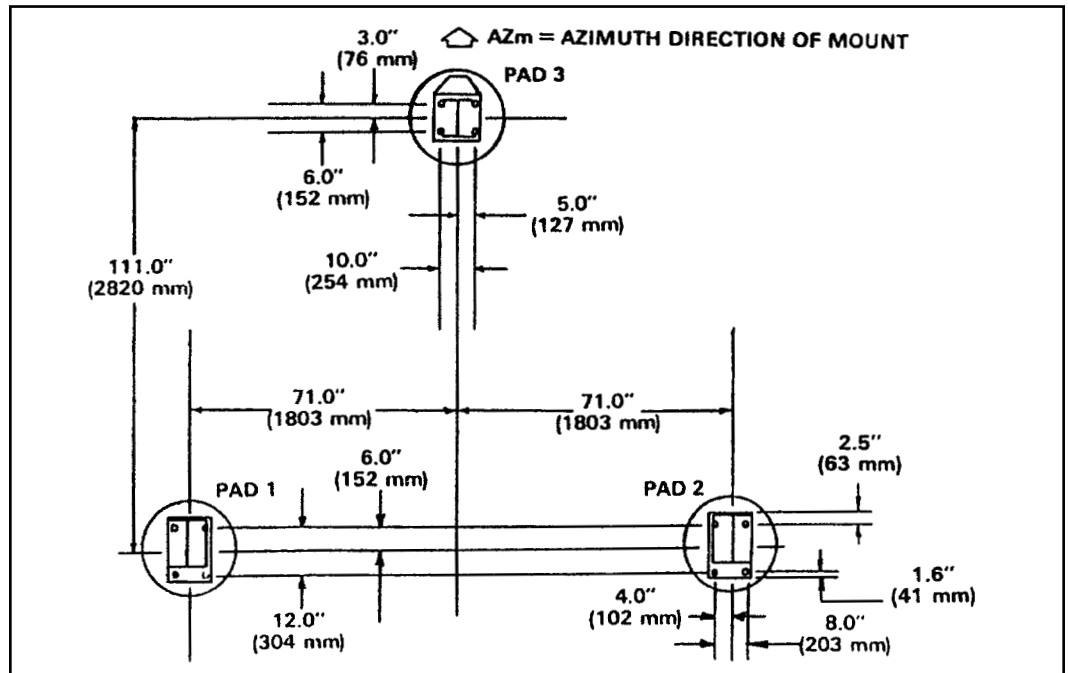


Figure 1



Figure 2

## A-325 Tensioning

During the installation process, there are several references to the A-325 hardware tensioning procedure. The A-325 hardware must be properly tensioned to avoid slippage between bolted surfaces under high loads. Slippage can cause the corresponding assembly to move, causing antenna misalignment. When designated, the A-325 hardware should be tightened according to the following tensioning procedure.

**NOTE:** Tensioned bolts are for final connections only and should not be loosened for reuse.

- Step 1** Lubricate the bolt threads with the provided stick wax to reduce friction.
- Step 2** Insert the bolt, and add a flat washer—if required. **Do not** allow wax under the flat washer.
- Step 3** Add the nut, and finger tighten.
- Step 4** After the connections are complete, tighten the bolts until the surfaces are joined and the nuts are snug (for example, full effort of a person using an ordinary spud wrench). Do not proceed with Steps 5 and 6, unless the connection is final and is not intended to be loosened again.
- Note:** If the bolts are loosened after Steps 5 and 6, discard and replace with new hardware.
- Step 5** Using a felt-tip marker, mark the nuts and the ends of the bolts with a straight line as shown in Figure 3-1a and Figure 3-1b.
- Step 6** Tighten the nuts further with an extra long wrench until the nuts are moved 1/3 turn (120 degrees) as shown in **Figure 3-1a** for bolt lengths less than four diameters and 1/2 turn (180 degrees) as shown in **Figure 3-1b** for bolt lengths over four diameters.

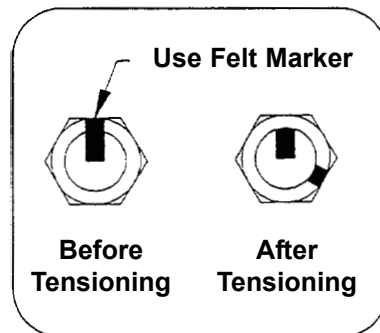


Figure 3-1a: A-325 Tensioning Procedure For bolts less than 4 diameters

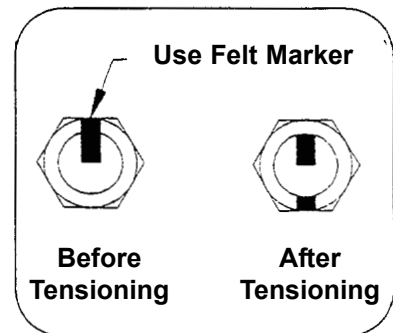


Figure 3-1b: A-325 Tensioning Procedure For bolts over 4 diameters

## Tripod Ground Mount Assembly

### Azimuth Beam Assembly

#### Step 1

The three-point mount is an elevation-over-azimuth mount optimized for geostationary satellite applications. The mount enables continuous elevation adjustment from 0 to 90°. Azimuth adjustment is  $\pm 90^\circ$  and divided into three 120° ranges with 30° overlap. Follow the subsequent procedures for proper installation of tripod ground mount assembly.

All ground mount hardware is type A-325. Lubricate all A325 bolt threads with supplied stick wax. **Note:** Do not tighten hardware until ground mount installation is complete unless otherwise instructed. Grease all ground mount pivot assemblies using supplied 49208 grease cartridges.

#### Step 2

Attach 200056 and 200057 supports to upper portion of 200112 beam assembly as shown in Figure 3.

- Use 7/8 x 2-1/4 in (57 mm) hardware

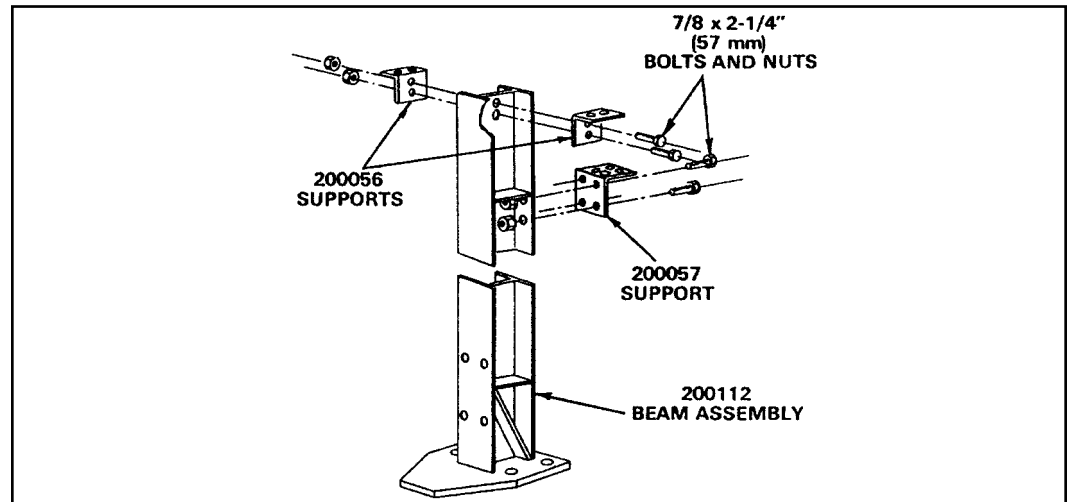


Figure 3

#### Step 3

Raise beam/support assembly. Apply supplied RTV to flange surface and attach 201022 pivot assembly to bottom portion of 200112 beam as shown in Figure 4.

- Use 7/8 by 2-3/4 in. (70 mm) bolts, flatwashers and nuts

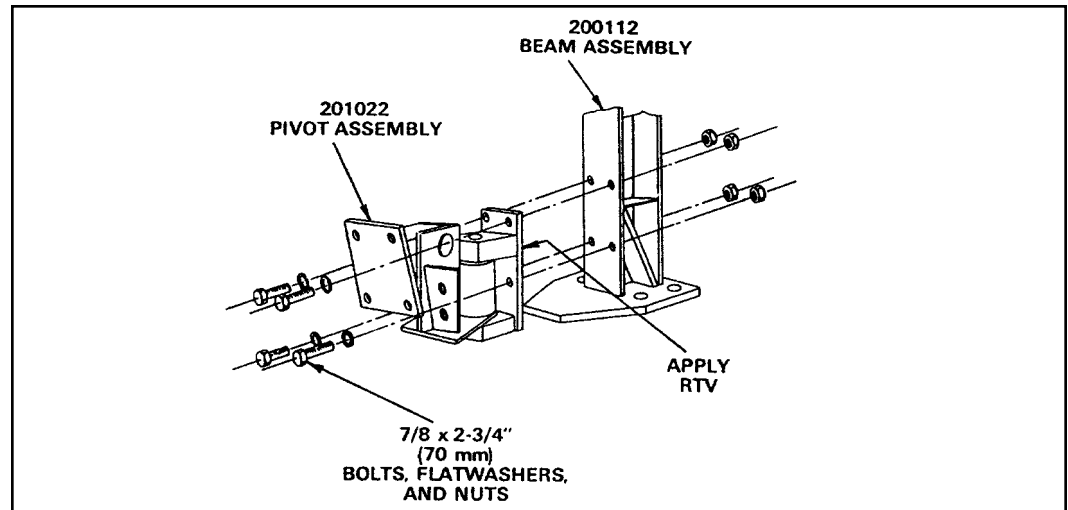


Figure 4

**Step 4**

Raise 201112 azimuth beam assembly and attach to front foundation pad as shown in Figure 5.

- Use 1 in. (25 mm) flatwashers and hex nuts

**Note:** Hex nuts and flatwashers supplied with 201680 anchor bolt kit

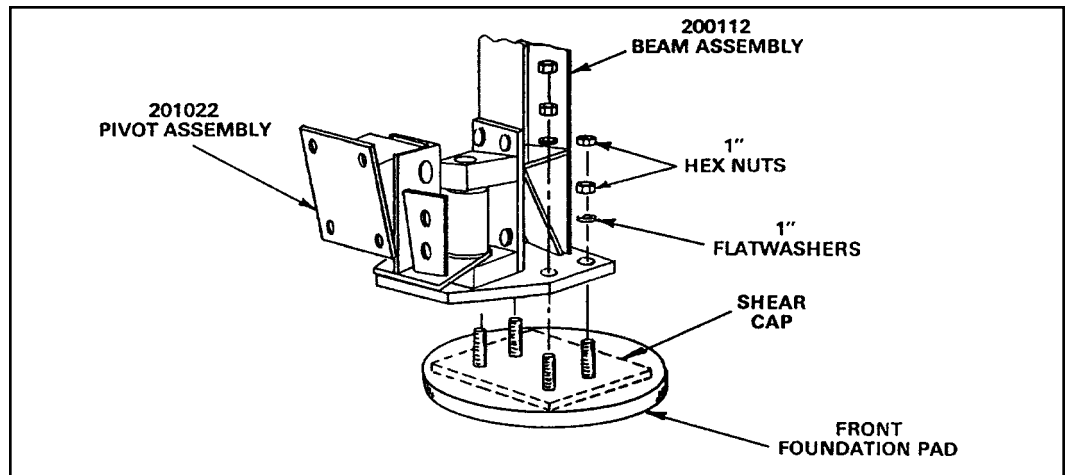


Figure 5

## Support Legs Assembly

### Step 1

Attach 200068 joint assembly to 200114A beam assembly as shown in Figure 6. Attach 200083 angles to 200114A beam assembly as shown in Figure 6.

- Use 7/8 x 2-1/4 in (57 mm) bolts and nuts for each connection

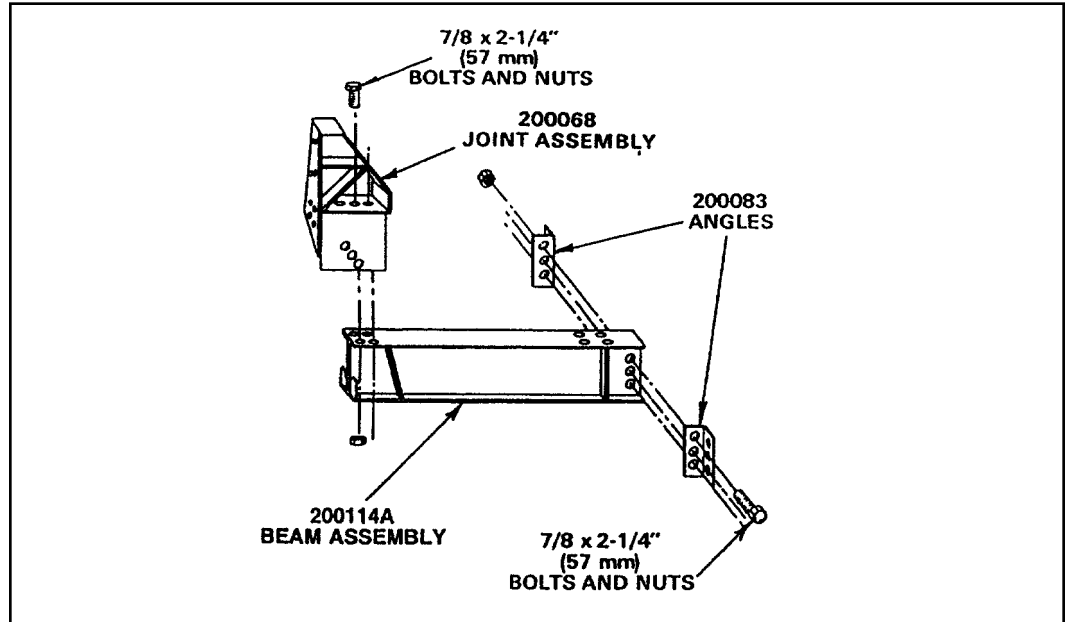


Figure 6

### Step 2

Attach 200088 joint assembly to 200114A beam assembly as shown in Figure 7.

- Use 7/8 x 2-1/4 in (57 mm) bolts and nuts

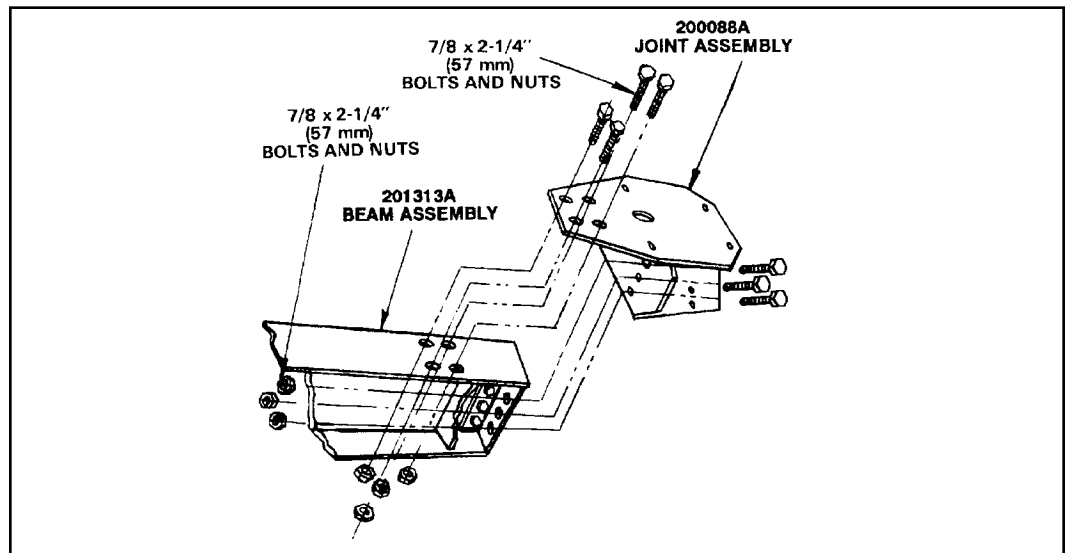


Figure 7

### **Step 3**

Raise 200114A beam assembly to upright position and attach 200109 supports to 200068 joint assembly as shown in Figure 8.

- Use 7/8 x 2-1/4 in (57 mm) bolts and nuts
- Insert bolts from 200068 joint assembly to supports
- Supports should be installed back-to-back with the flat of angle facing upwards
- Tighten supports until assembly can support itself

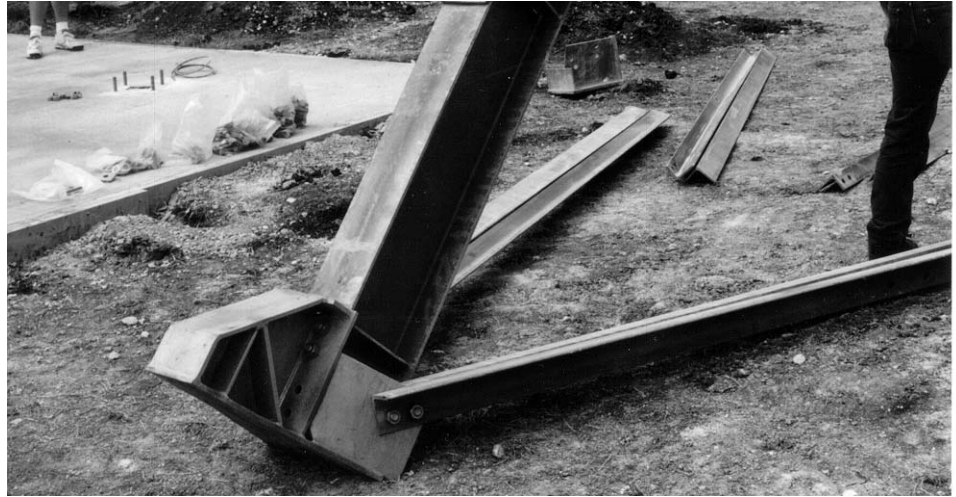


Figure 8

### **Step 4**

Attach 200063/200064 rear pad assemblies to 200109 supports as shown in Figure 9.

- Use 7/8 x 2-1/4 in (57 mm) bolts and nuts
- Insert bolt from inside of rear pad assembly to outside of support
- Supports should be installed back-to-back with the edges forward and the flats of angles facing rear



Figure 9

### Step 5

Attach 200108 supports to 200063/200064 rear pad assemblies and 200088 joint assembly as shown in Figure 10.

- Use 7/8 x 2-1/4 in (57 mm) bolts and nuts
- Insert bolt from inside of joint assembly to outside of support
- Supports should be installed back-to-back with the edges forward and the flats of angles facing rear



Figure 10

### Step 6

Attach 200873 supports between angle pairs as shown in Figure 11. Select corresponding mounting holes so that 200873 supports are parallel to 200114A beam assembly.

- Use 7/8 x 2-3/4 in (70 mm) hardware
- Supports attached with edges inward and flats facing up.

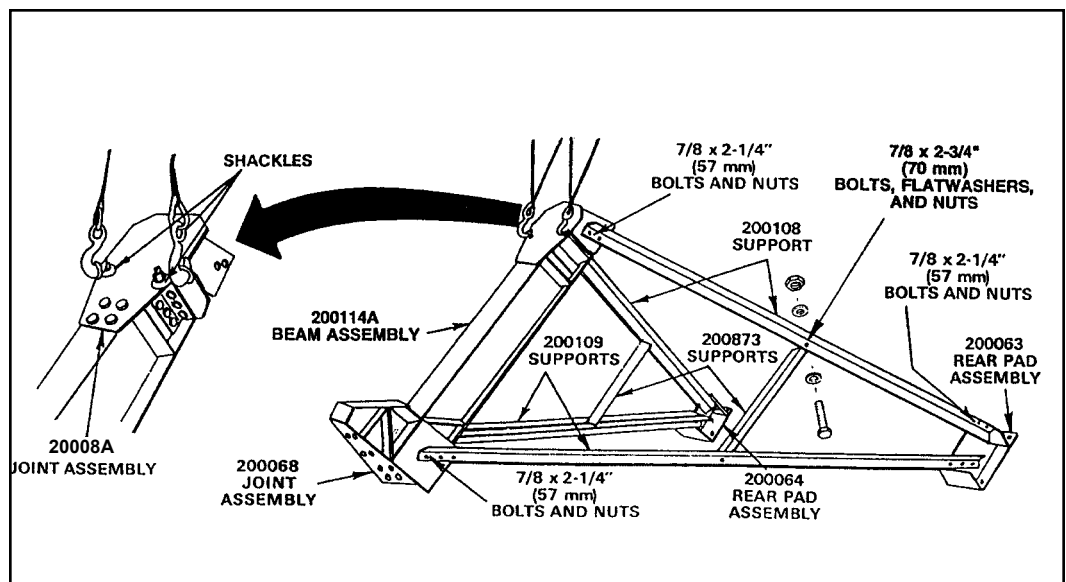


Figure 11



## Step 7

Refer to Figure 12. Raise and attach assembled beam/support assembly to 200112 beam assembly using 7/8 by 2-1/4 in (57 mm) hardware and corresponding rear foundation pads as shown using 1 in flat washers and hex nuts. Ensure all A-325 mounting hardware is in place. Begin A-325 tensioning procedure at pads, and work upward. **Note:** Do not tighten 201022 pivot assembly hardware at this time.

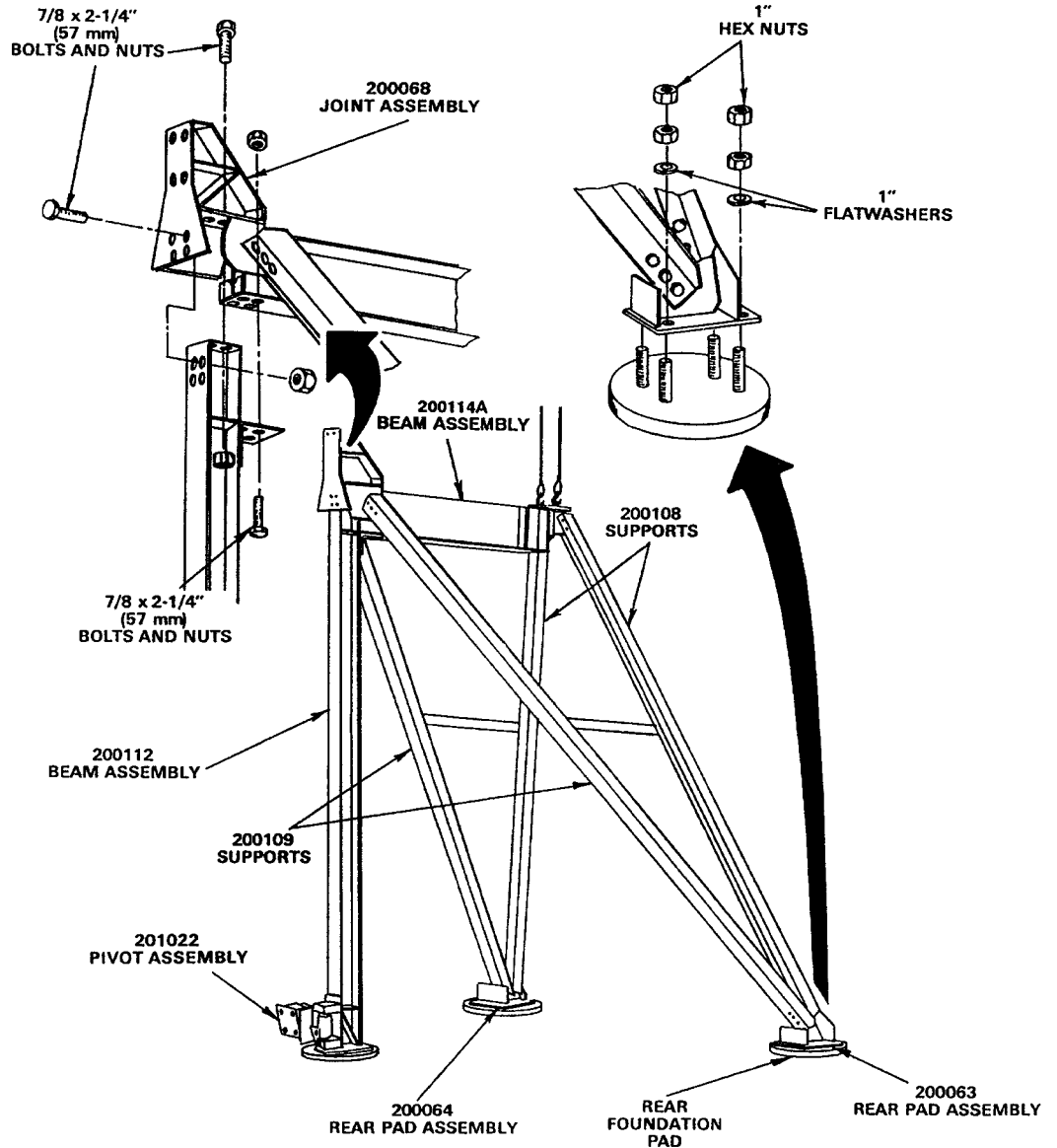


Figure 12

## Panning Frame Assembly

### Step 1

Refer to Figures 13A and 13B. Determine azimuth range requirements from APPENDIX 'A' (page 65) and loosely attach 200035 outrigger assembly (if required) to appropriate side of 200031A panning assembly.

- Use 7/8 x 2-1/4 in (57 mm) hardware and apply supplied RTV to flange surfaces as indicated.

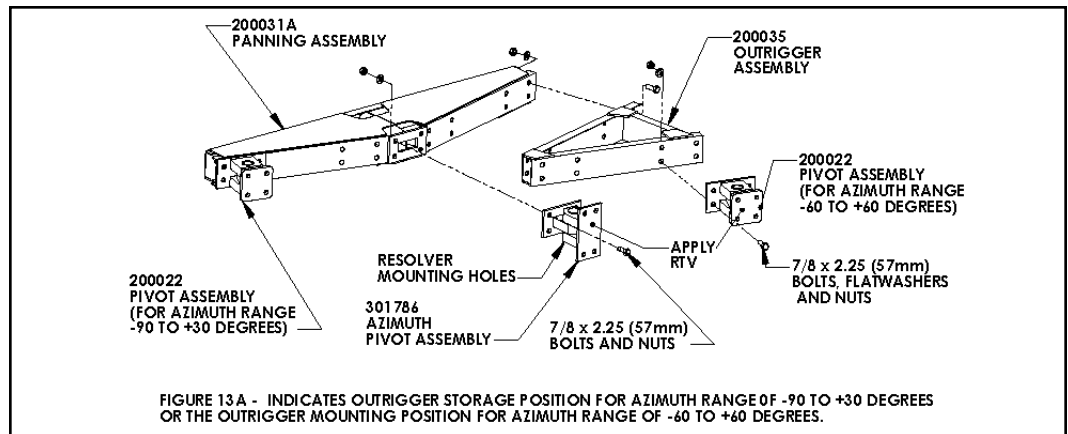


Figure 13A

### Step 2

### Step 3

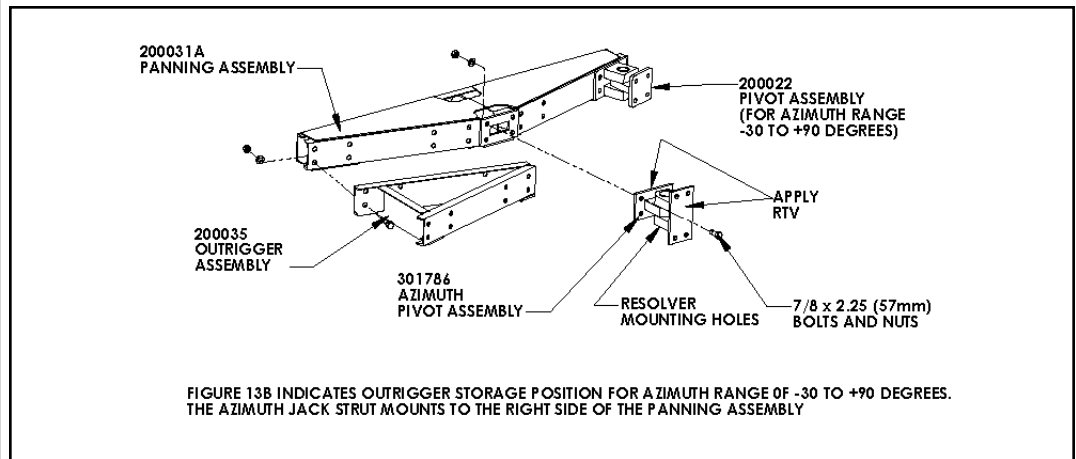


Figure 13B

Apply supplied RTV to flange surfaces and loosely attach 200022 pivot assembly to outrigger as shown.

- Use 7/8 x 2-1/4 in (57 mm) hardware and apply supplied RTV to flange surfaces as indicated

Attach 301786 azimuth pivot assembly to panning assembly as shown using 7/8 by 2-1/4 inch (57 mm) bolts and nuts. **Note:** Mounting hardware attaching 301786 azimuth pivot assembly to 200031A panning assembly must be positioned as shown with resolver mounting holes on 301786 azimuth pivot assembly positioned in downward direction.

**Step 4**

Refer to Figure 14. Apply supplied RTV to flange surfaces and loosely attach 200699/200021 elevation pivot assemblies to rear of enclosure drum assembly

- Use 3/4 by 3.0 inch (75 mm) hardware

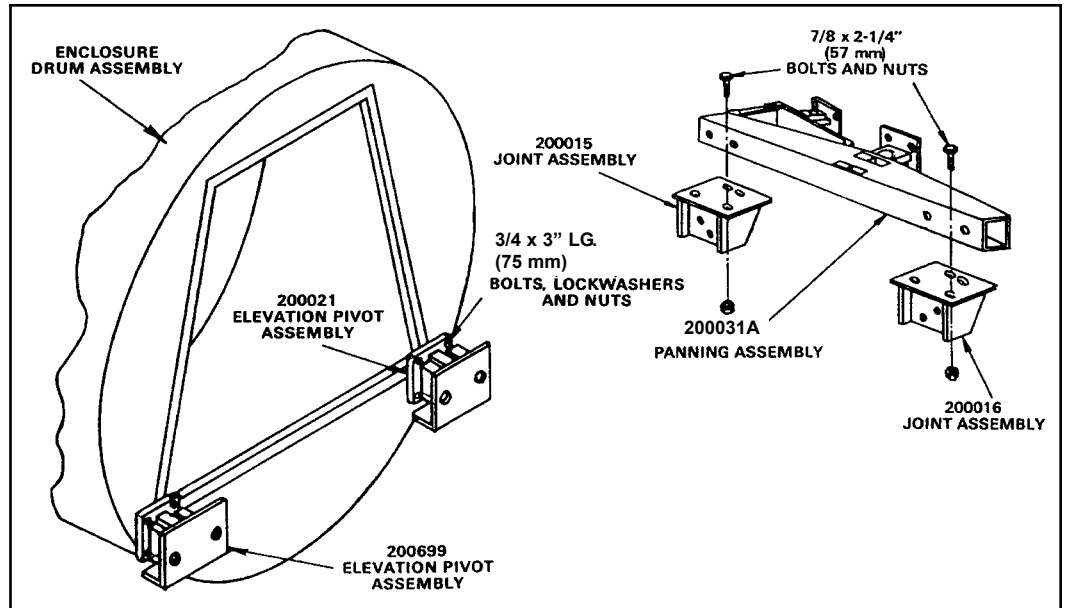


Figure 14

**Step 5**

Slightly raising assembly and loosely attach 200016/200015 joint assemblies to bottom portions of panning assembly.

- Use 7/8 by 2-1/4 inch (57 mm) hardware

**Step 6**

Refer to Figure 15. Raise assembled panning/pivot assembly and loosely attach 301786 azimuth pivot assembly to upper portion of 200068 joint assembly as shown.

- Use 7/8 by 2-1/2 inch (64 mm) hardware

**Note:** Position mounting hardware as shown to ensure proper panning frame clearance. Install 7/8 inch flatwashers between 301786 pivot assembly and 200068 joint assembly.

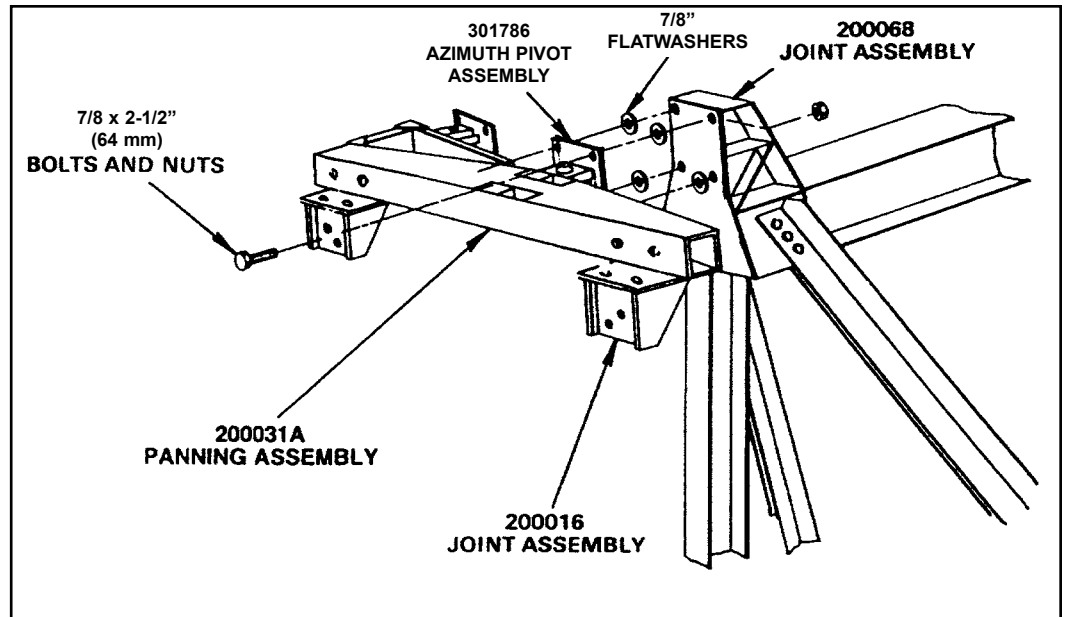


Figure 15

### Step 7

Refer to Figure 16. Attach 200107 support pairs back-to-back with 45967 spacer at midpoint. Loosely attach support pairs to corresponding tabs on 200015/200016 joint assemblies and 201022 pivot assembly as shown.

- Use 7/8 by 2-1/4 in (57 mm) hardware

**Note:** Angles are attached edge out with flat of angle facing inward.

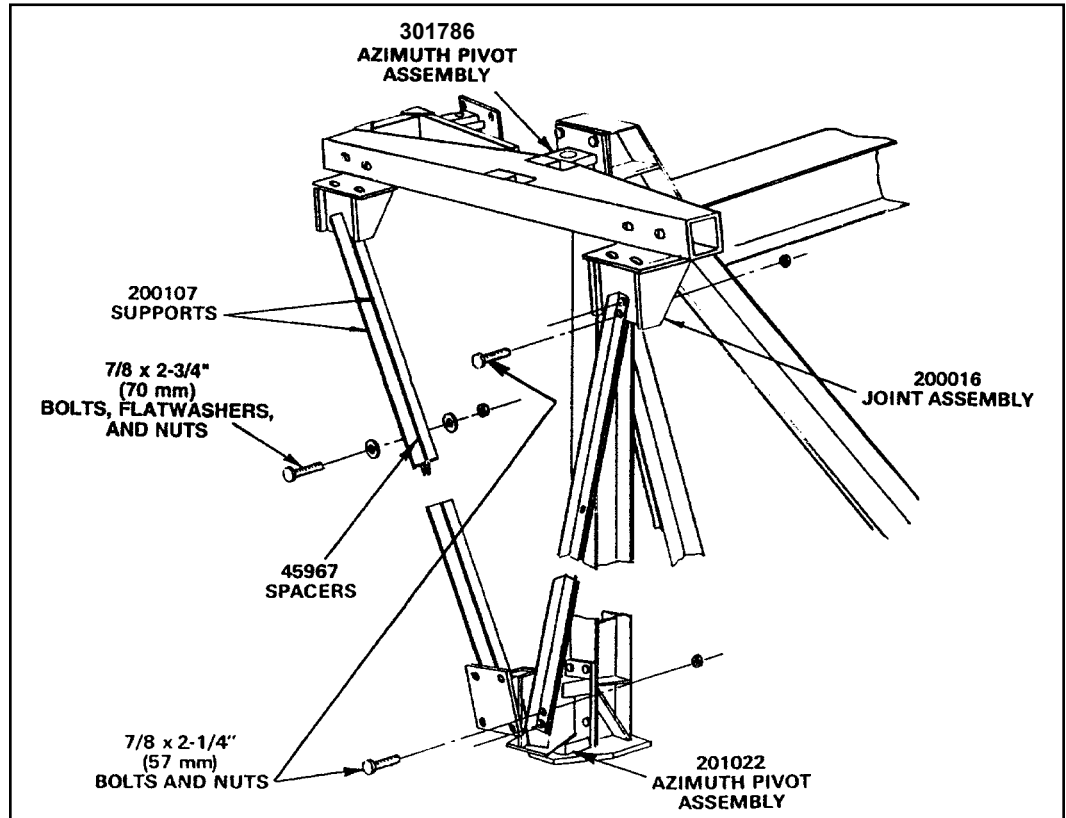


Figure 16

### Step 8

Align panning frame/azimuth pivot assembly by swinging panning frame through its entire arc. Slightly snug panning frame/pivot assembly hardware, and again swing panning frame through its entire arc. Continue this procedure until mounting hardware is ready for tensioning.

**Note:** Do not tighten hardware on 301786/201022 azimuth pivot assemblies at this time.

## Azimuth Jack Screw Assembly

### Step 1

Refer to Figure 17. Apply RTV to flange surface and attach 200013-4/301841 azimuth jackscrew to 201021 azimuth pivot assembly as shown.

- Use 1-1/4 by 3-1/2 in (89 mm) bolts, lock washers and nuts

**Note:** Mounting hardware is included with corresponding jack assembly hardware kit.

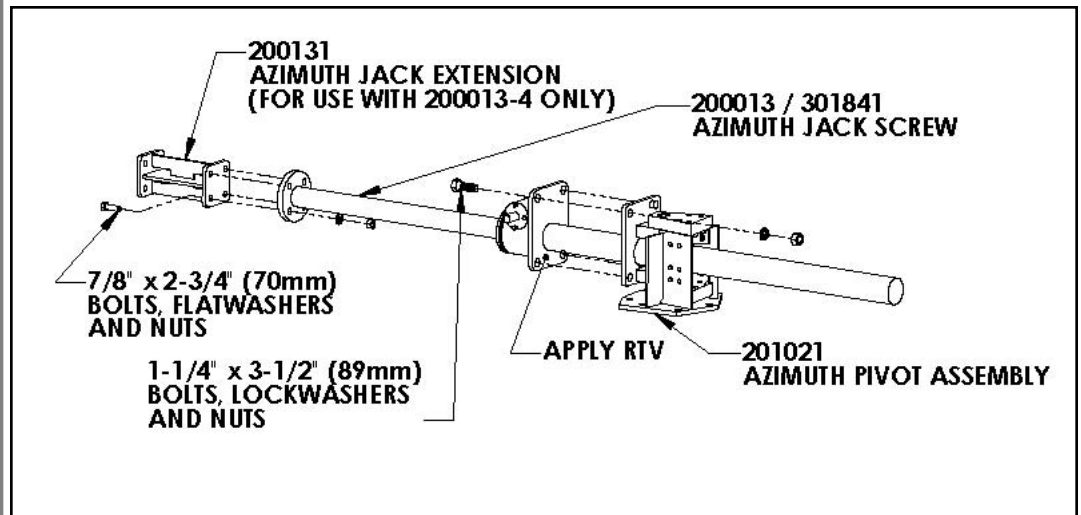


Figure 17

### Step 2

Attach 200131 azimuth jack extension to 200013-4 azimuth jack screw (manual, low- and medium-speed applications only) as shown.

- Use 7/8 by 2-3/4 inch (70 mm) bolts, flat washers and nuts.

**Note:** Type 301841 azimuth jack screw is used only for high-speed applications.

### Step 3

Refer to Figure 18. Raise the azimuth pivot/jack screw assembly, and attach to 200088A joint assembly.

- Use 1 by 2-1/2 inch (63 mm) hardware.

**Note:** Mounting position of azimuth/pivot jack screw assembly is dependent upon azimuth range requirements and corresponds with mounting position of 200035 outrigger assembly (if utilized).

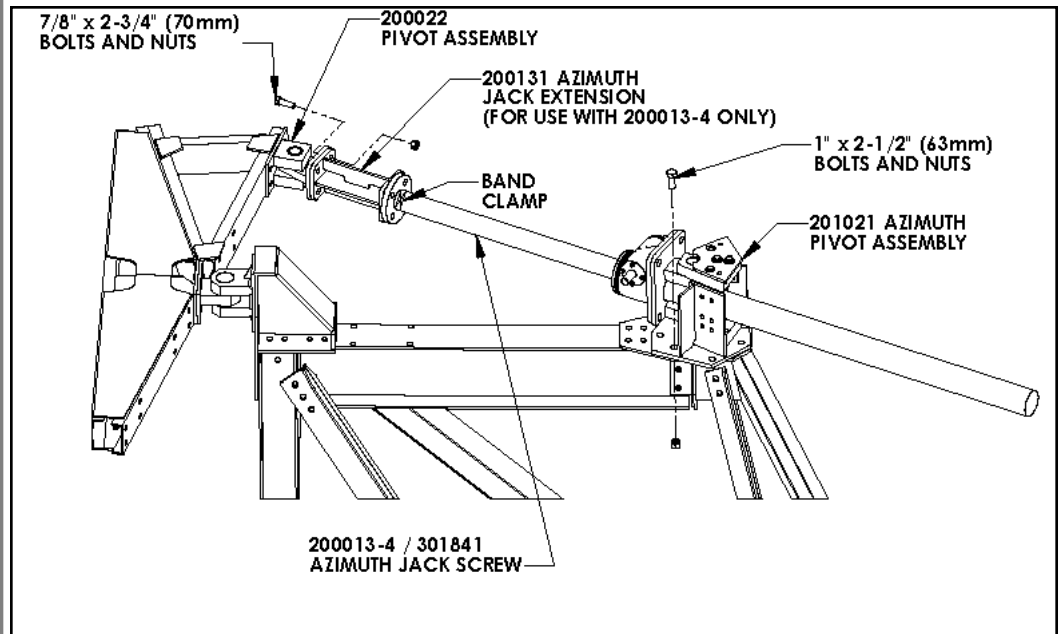


Figure 18

### Step 4

Refer to Figures 19A and 19B. After azimuth pivot/jack screw assembly has been attached to the joint assembly, attach remaining hardware as shown to 1/2" (13 mm) stud and apply supplied Loctite to all nuts.

### Step 5

Position panning assembly to 0° azimuth and align 200022 pivot assembly with corresponding azimuth jack screw or 200131 azimuth jack extension. Remove band clamp from jack screw boot. Rotate jack screw to extend to pivot assembly. Attach jack screw to pivot assembly.

- Use 7/8 by 2-3/4 in (70 mm) bolts and nuts (P/O jack assembly hardware kit.)

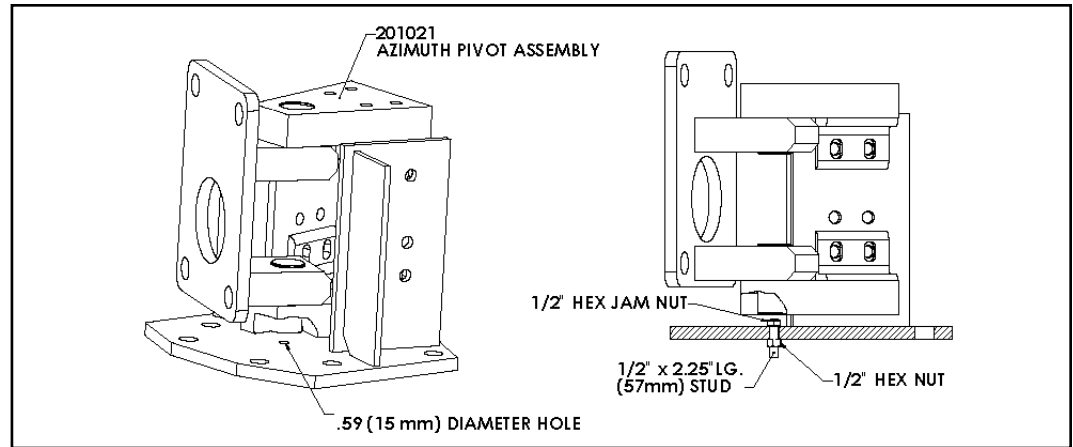


Figure 19A

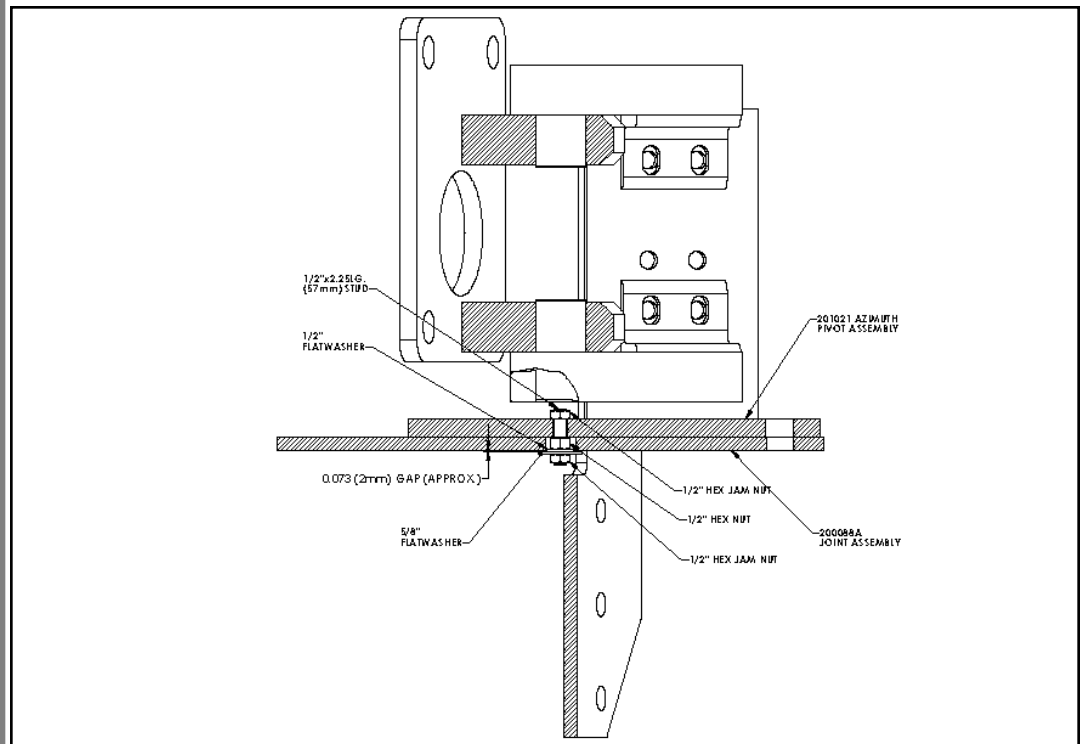


Figure 19B

**Step 6** Replace previously removed jack screw band clamp assembly.

**Note:** Attach jack extension to pivot assembly using 7/8 by 2-3/4 in (70 mm) bolts and nuts (P/O jack assembly hardware kit), for 200013-4 azimuth jack applications.

For motorized mounts only, remove oil plug on motor assembly gearbox and replace with supplied vent plug packaged with the motor assembly.

**Note:** Ensure hole in vent plug is positioned downward.



**Elevation  
Jackscrew  
Assembly  
Step 1**

Refer to Figure 20. Apply supplied RTV to indicated flange surfaces and attach 200013-3/200048 elevation jack screw to 200128 elevation extension assembly as shown.

- Use 1-1/4 by 3-1/2 in (89 mm) bolts, washers and nuts

**Note:** Mounting hardware is included with corresponding jack assembly hardware kit.

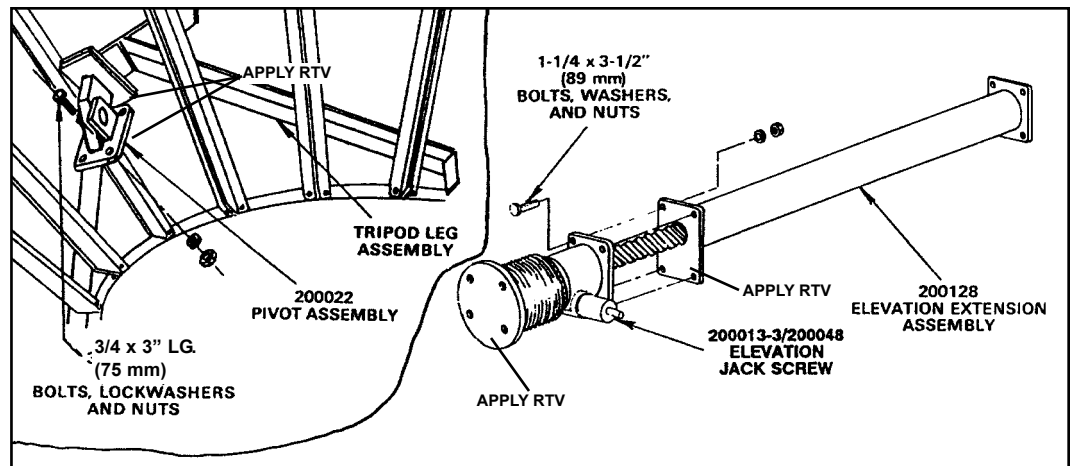


Figure 20

**Step 2**

Attach 200022 pivot assembly to enclosure tripod leg assembly **Note:** This may also be performed during reflector assembly.

- Use 3/4 by 3.0 in (75 mm) bolts, lockwashers and nuts.

### Step 3

Refer to Figure 21. Apply supplied RTV to flange surface and attach remaining end of 200128 elevation extension assembly to corresponding 201022 pivot assembly as shown.

- Use 7/8 by 2-1/4 in (57 mm) hardware.

For motorized mounts only, remove oil plug on motor assembly gearbox and replace with supplied vent plug packaged with the motor assembly only **after** elevation jack is in final operating position.

**Note:** Ensure hole in vent plug is positioned downward.

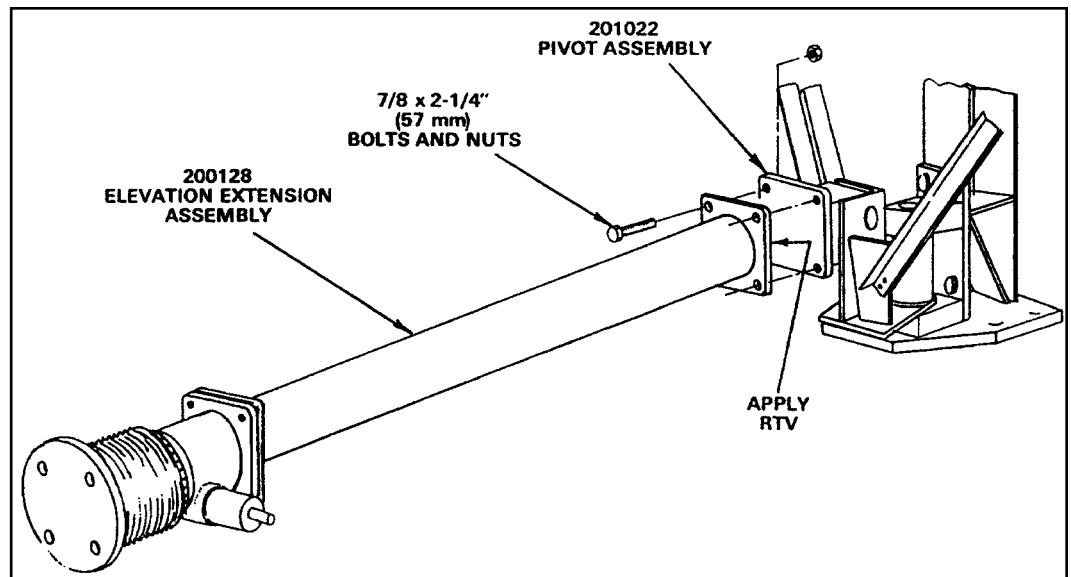


Figure 21

## Grounding Cable Attachment

**Note:** Thoroughly clean exposed portions of grounding cables, unplated portion of universal terminals and corresponding mounting surfaces using a wire brush. Liberally apply supplied 203233-2 conductive grease to all connection surfaces prior to and after installation. Thoroughly remove conductive grease from hands and tools using soap and water.

### Step 1

Refer to Figure 22. Remove existing 7/8 by 2-1/4 in (57 mm) hardware at indicated positions and install grounding cables as shown.

- Use supplied 7/8 by 2-3/4 in (70 mm) hardware

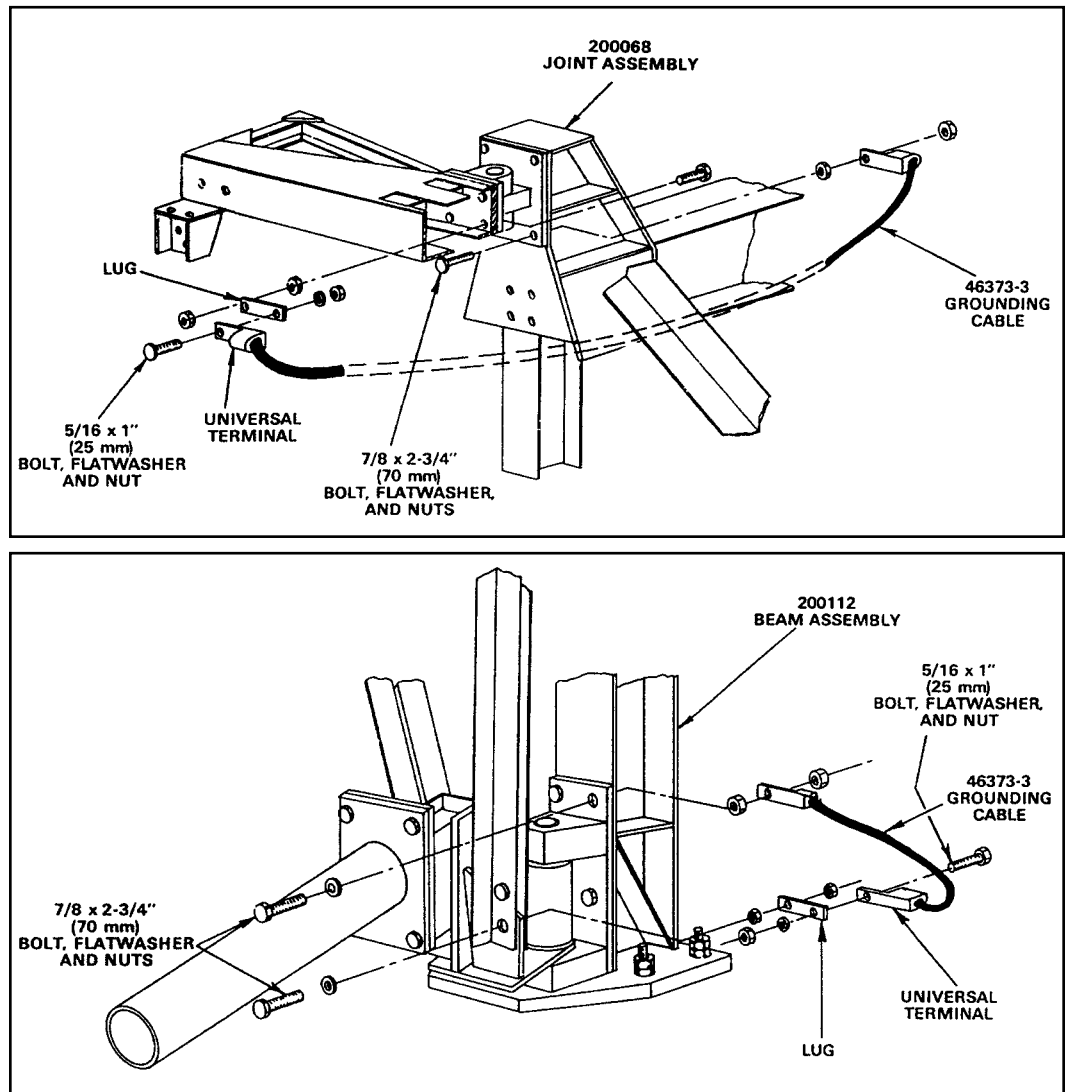


Figure 22

## Step 2

Refer to Figure 23. Remove existing 7/8 by 2-1/4 in (57 mm) hardware from both elevation pivot/joint assemblies at indicated positions and install grounding cables as shown.

- Use supplied 7/8 by 2-3/4 in (70 mm) bolts and nuts

**Note:** Supplied 3/4 in hardware is installed after reflector to ground mount installation.

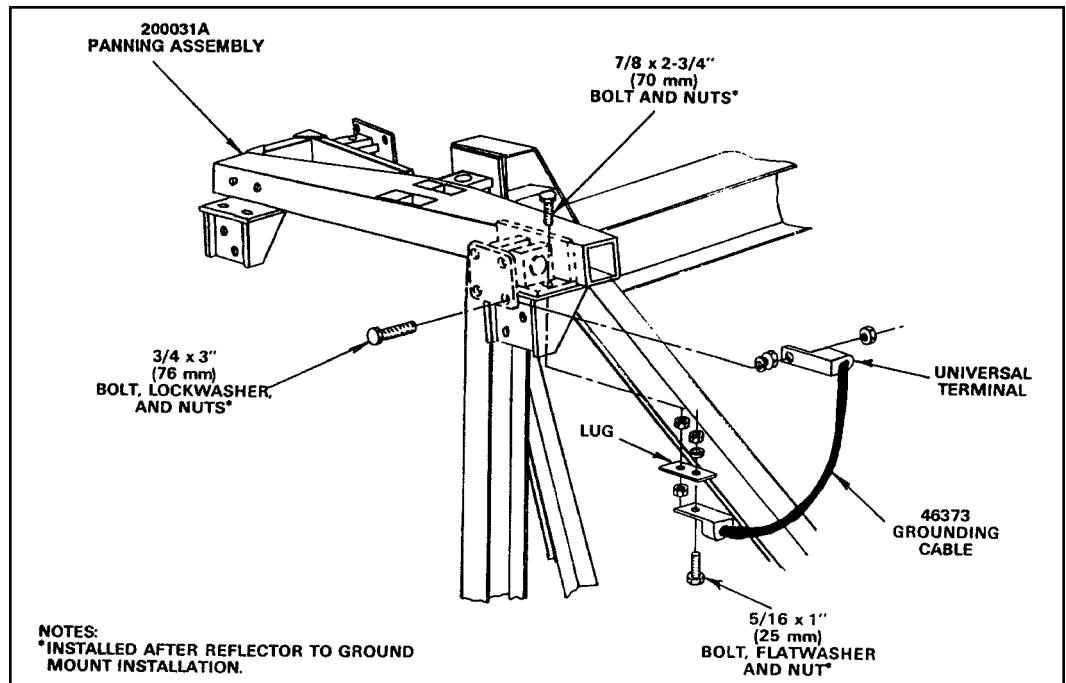


Figure 23

## Step 3

Securely tighten all remaining ground mount/jack assembly hardware per hardware tensioning procedure.

The tripod ground mount assembly is now completed with the necessary operational essentials. All ground mount options have separate instructional bulletins located in the parts kit that contain the option.

The next step in the installation process is the reflector assembly. Proceed to the next page to begin installation of the reflector.

## **Reflector/ Backstructure Assembly**

### **Feed Rotating Tube Assembly**

#### **Step 1**

Type A-325 hardware is utilized during the reflector attachment to the ground mount. Use of A-325 hardware eliminates slippage between mating surfaces under high loading conditions as well as the need for future retightening. Refer to the A-325 tensioning procedure in preceding installation text. **CAUTION:** Adhere to any special instructions stenciled on crate relative to crate opening, contents removal and/or personnel safety.

Refer to Figure 24. Position six temporary supports in center of assembly area 60" apart in a 7 ft (2 m) diameter circle. Place drum assembly on temporary supports as shown with drum tab positioned opposite ground mount assembly.

**Note:** Supports should be approximately 18 in (457 mm) high and placed between bolt holes on bottom of drum assembly.

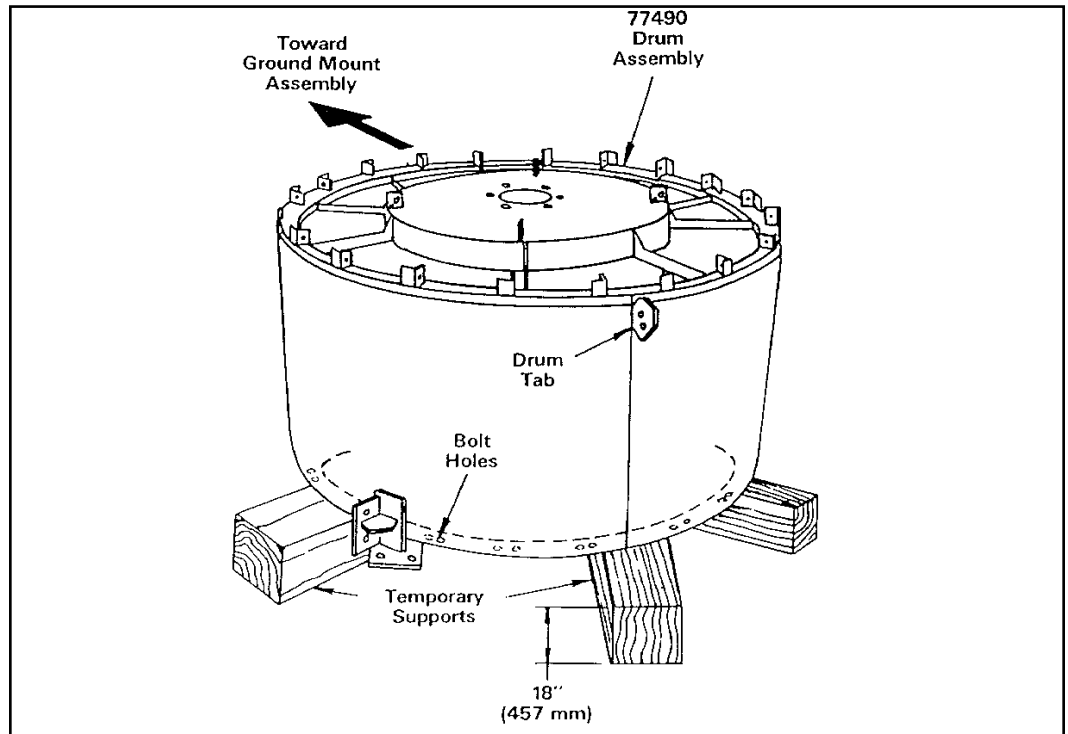


Figure 24

## Step 2

Refer to Figure 25. Align tabs on feed rotating tube assembly 77639 or non-rotating tube 78334 with corresponding angle brackets on drum assembly. Apply supplied RTV as shown and attach rotating tube to center of drum assembly.

- Use 3/8 x 1-1/2 in (38 mm) bolts, lock washers and nuts

If 78334 non-rotating tube is used unbolt flange assembly, apply RTV to both flange faces and assemble to drum.

- Use 3/8 x 2 in (51 mm) hardware provided

## Step 3

Attach feed support angles to feed rotating tube tabs and drum assembly angle brackets.

- Use 1/2 x 1-1/8 in (29 mm) shoulder bolts, lock washers and nuts

**Note:** Ensure shoulder bolts are fully seated and feed support angles are installed edge down with flat of angles facing upward.

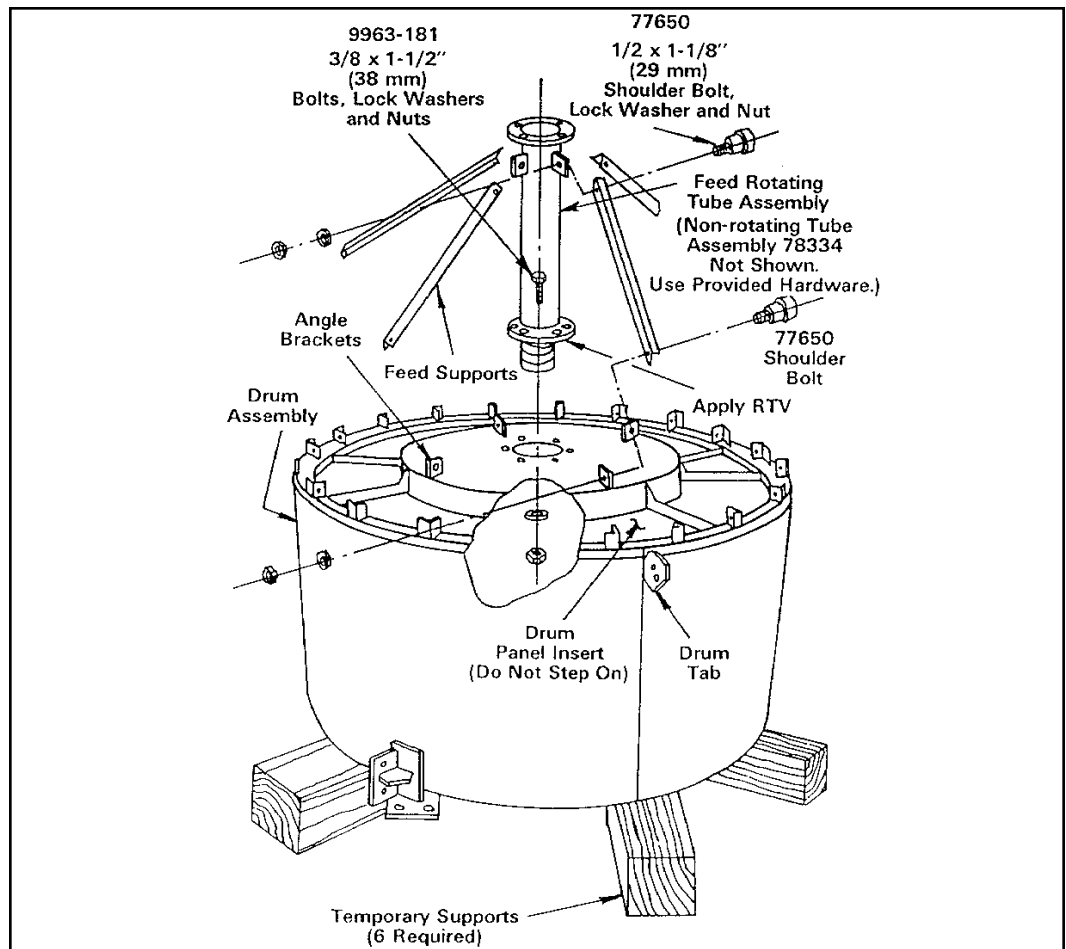


Figure 25

## Jack Tripod Assembly

### Step 1

Refer to Figure 26. Assemble jack tripod by connecting tripod braces to tripod leg.

- Use 3/4 x 5-1/2 in (140 mm) bolts, lock washers and nuts

### Step 2

Attach jack tripod assembly braces to corresponding drum pivot/mount assemblies as shown.

- Use 3/4 x 2 in (51 mm) bolts, lock washers and nuts

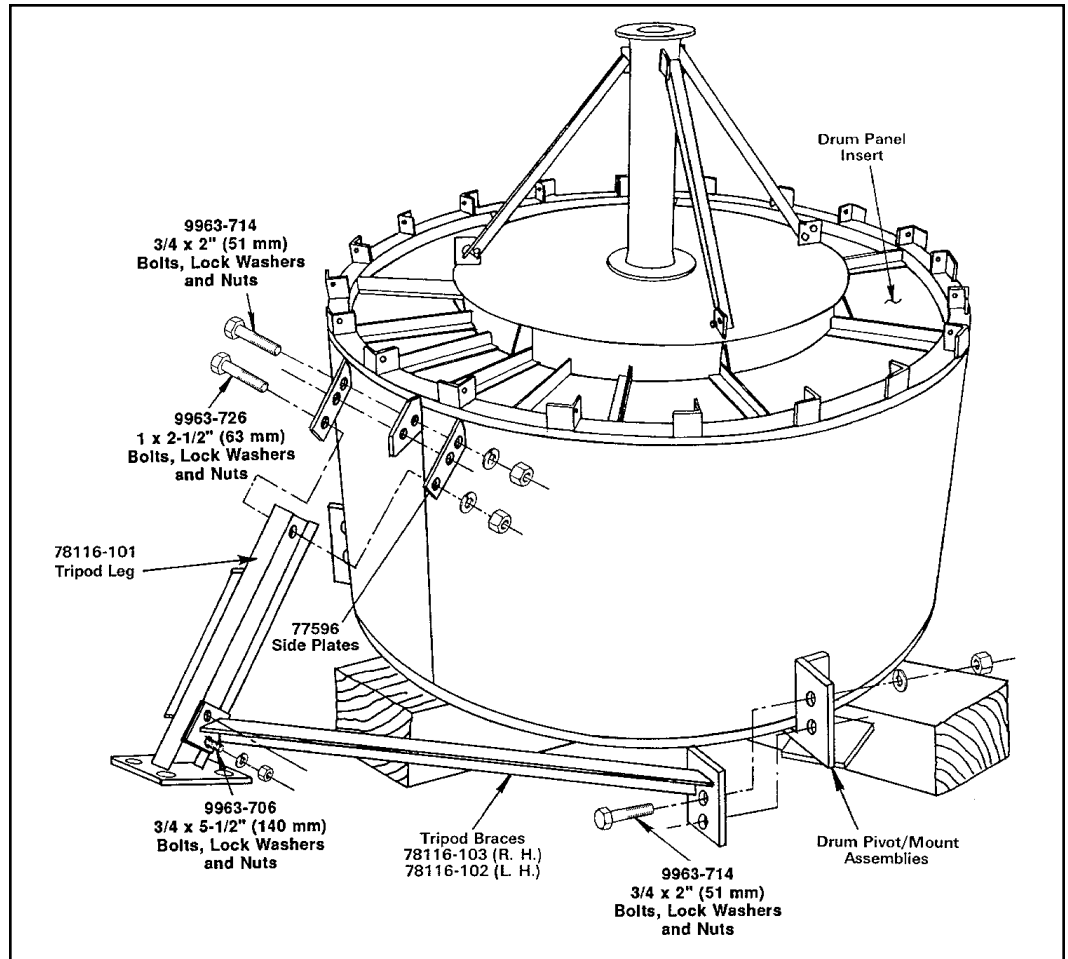


Figure 26

### Step 3

Attach side plates to jack tripod assembly leg.

- Use 1 x 2-1/2 in (64 mm) bolt, lock washer and nut

### Step 4

Attach side plates to drum tab.

- Use 3/4 x 2 in (51 mm) bolt, lock washer and nut

**Note:** Keep angled corners of side plates toward drum assembly.

## Reflector Assembly

### Step 1

Refer to Figure 27. Assemble 20 right- and left-hand back-to-back strut assembly pairs Type 78082 and 78083 as shown.

- Use 1/2 x 1-1/2 in (38 mm) bolts, spacers, lock washers and nuts. Tighten strut spacer bolt.

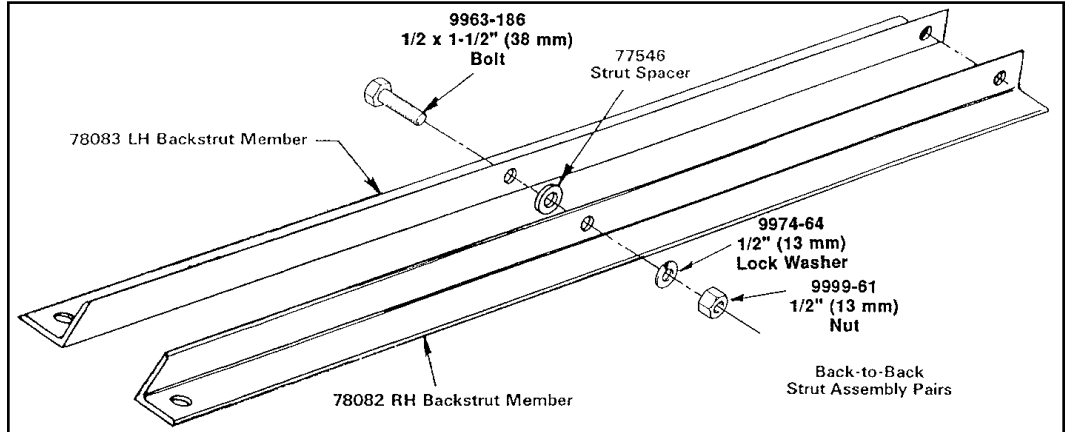


Figure 27

### Step 2

Refer to Figure 28. From inside of drum assembly, attach end of back-to-back strut assembly (slanted angles) to lower ring on drum assembly.

- Use 1/2 x 4-1/2 in (114 mm) bolts, special washers, lock washers and nuts. Tighten until snug.

**Note:** Special washers must be installed between back-to-back strut and lower ring of drum.

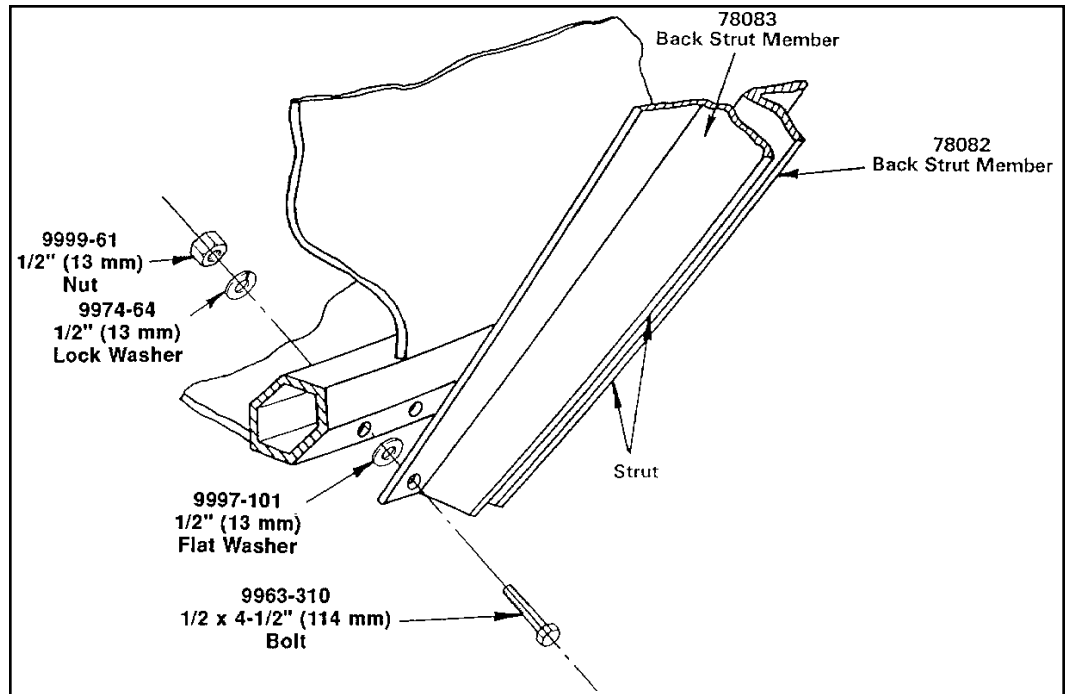


Figure 28



### Step 3

Refer to Figure 29. Carefully remove reflector panel segments from packing crates. Begin with center flash panel (if applicable) and attach to corresponding angle tab on upper drum ring as shown.

- Using 5/8 x 1-3/4 in (44 mm) bolt, spacer, lock washer and nut. Tighten the panel to drum angle hardware until lock washer is compressed, then back off one half turn. Do not over-torque.

**Note:** Use 10 ft temporary support to raise outer portion of reflector segment. Use additional temporary supports as necessary to provide support prior to installation of adjacent reflector segment panel. Pad top of temporary support to prevent damaging reflector segment panel. Do not step on drum panel inserts.

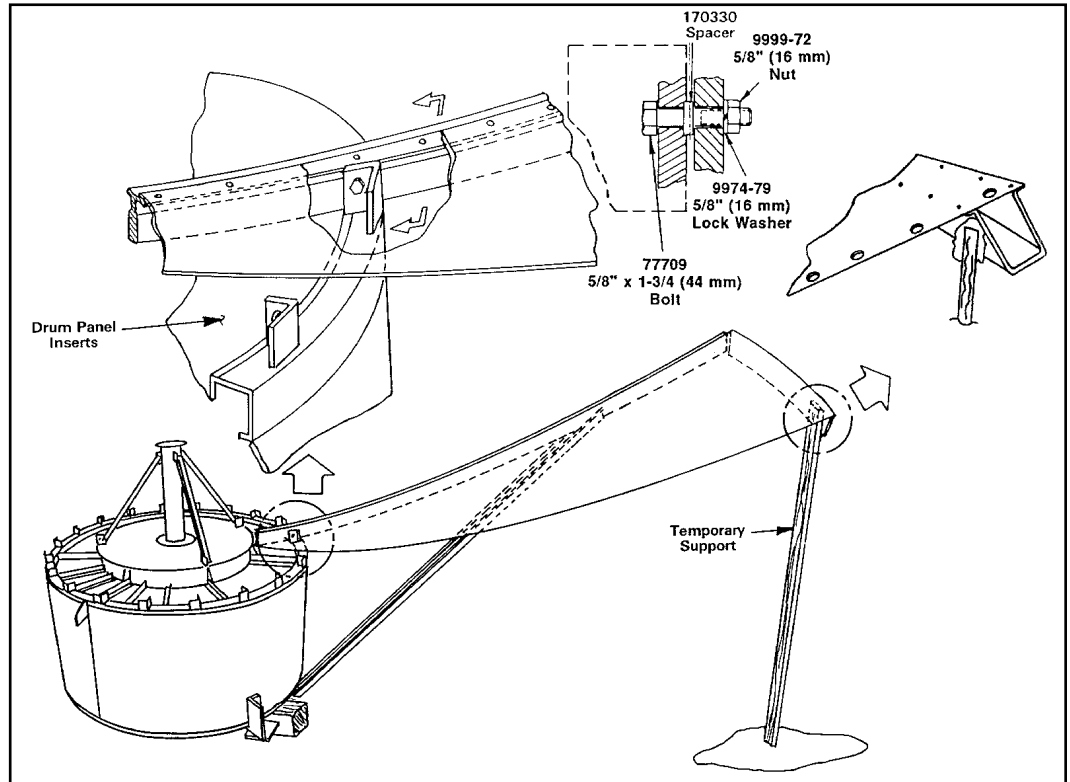


Figure 29

#### Step 4

Refer to Figure 30. Install reflector segment formed tee section between corresponding back strut members and attach.

- Use 1/2 x 1-7/16 in (37 mm) eccentric bolt, lock washer and nut

**Note:** Ensure eccentric bolt is fully seated and bolt head marking is positioned at right angle to panel segment. It is recommended stick wax be applied to the shaft of the eccentric bolt to facilitate its insertion and later adjustment. All 20 eccentric bolt head markings must be at right angles to panel.

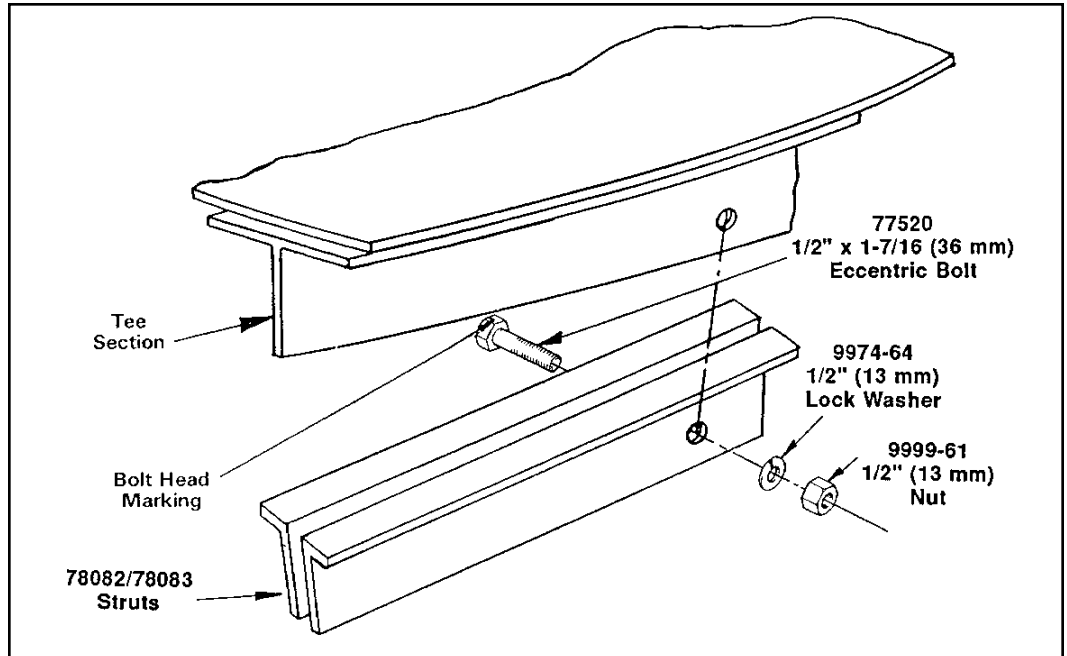


Figure 30

#### Step 5

Refer to Figure 31. Install remaining reflector panels opposite each other to balance the enclosure assembly being sure to install panel segment seam hardware finger tight in holes 1-28. Note that screw locations in reflector segments are numbered 1-31 from the center out. Panel segment seams are numbered 1-20. Use special nut with shoulder at hardware location 17 on all 20 panel segment seams. Tighten until nut shoulder is properly seated inside the formed Tee section hole.

**Note:** Do not place hardware in holes 29-31 at this time.

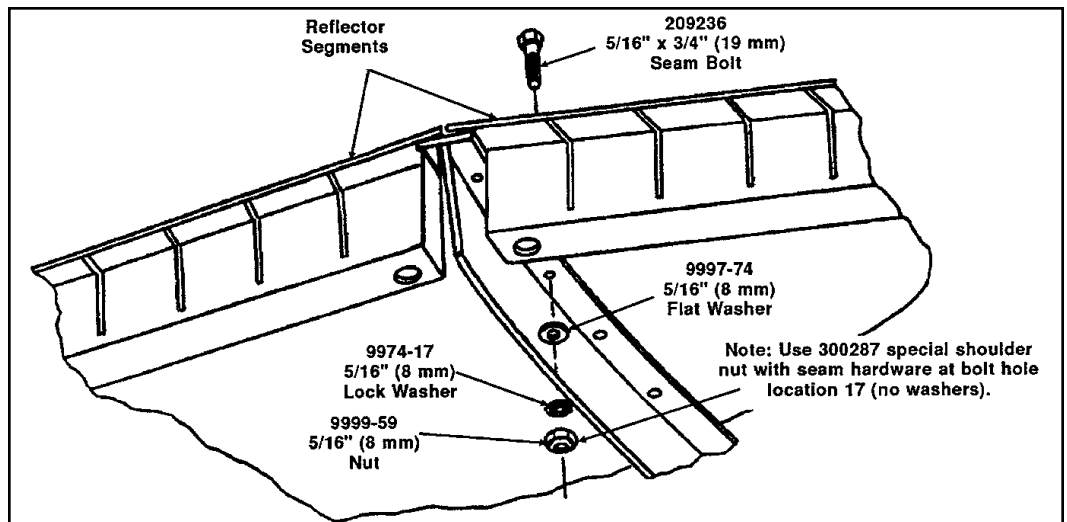


Figure 31

**Step 6**

Refer to Figure 32. Loosely attach 300177 Subreflector Strut Supports to reflector as shown ensuring brackets are installed on seam hole positions 15 and 16. Position brackets clockwise as shown using brackets and hardware supplied as part of 300175 Subreflector Strut Kit.

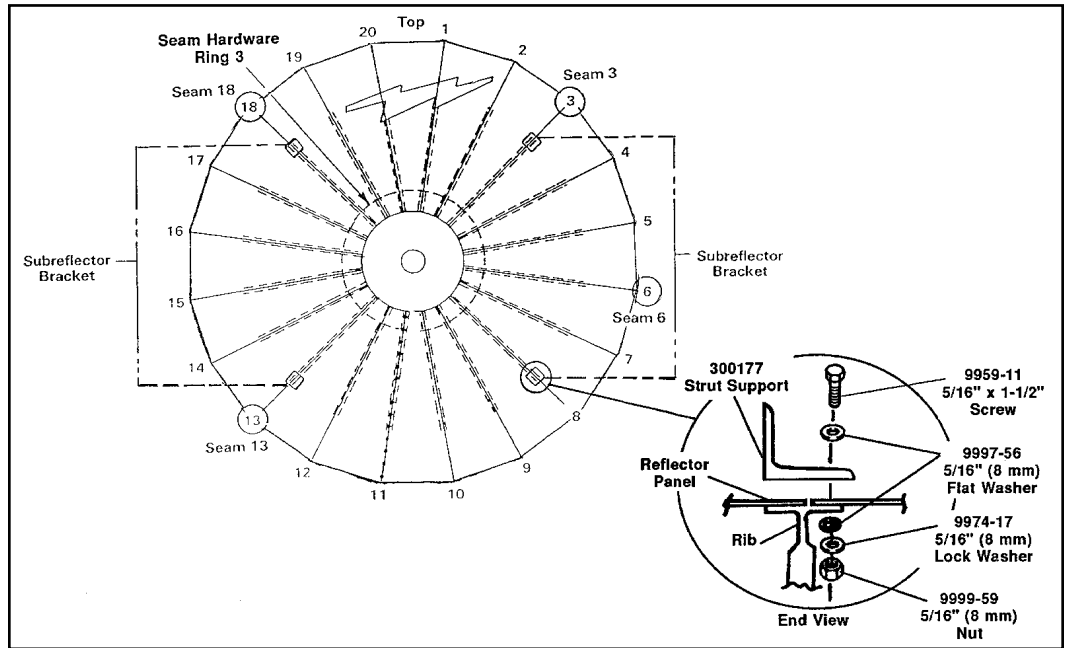


Figure 32

**Subreflector Assembly**

**Step 1**

Refer to Figure 33. Carefully remove subreflector subassembly and attached floating ring from wooden crate. Remove six 3/4 in (19 mm) jam nuts and washers which attach floating ring to subreflector assembly. Lift floating ring from adjustment studs.

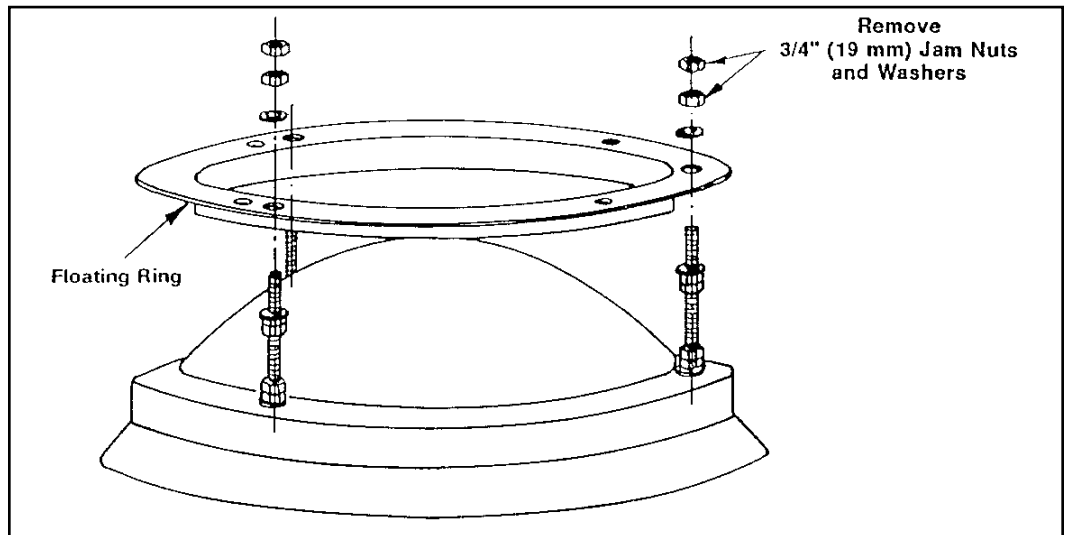


Figure 33

**Step 2**

Refer to Figure 34. Attach 300178 Subreflector Strut Brackets to 300174 Strut Assemblies.

- Use 1/2 x 2-1/2 in (64 mm) galvanized bolts, 300022 backup plates, lock washers and nuts.

**Note:** All strut brackets should face counterclockwise as shown.

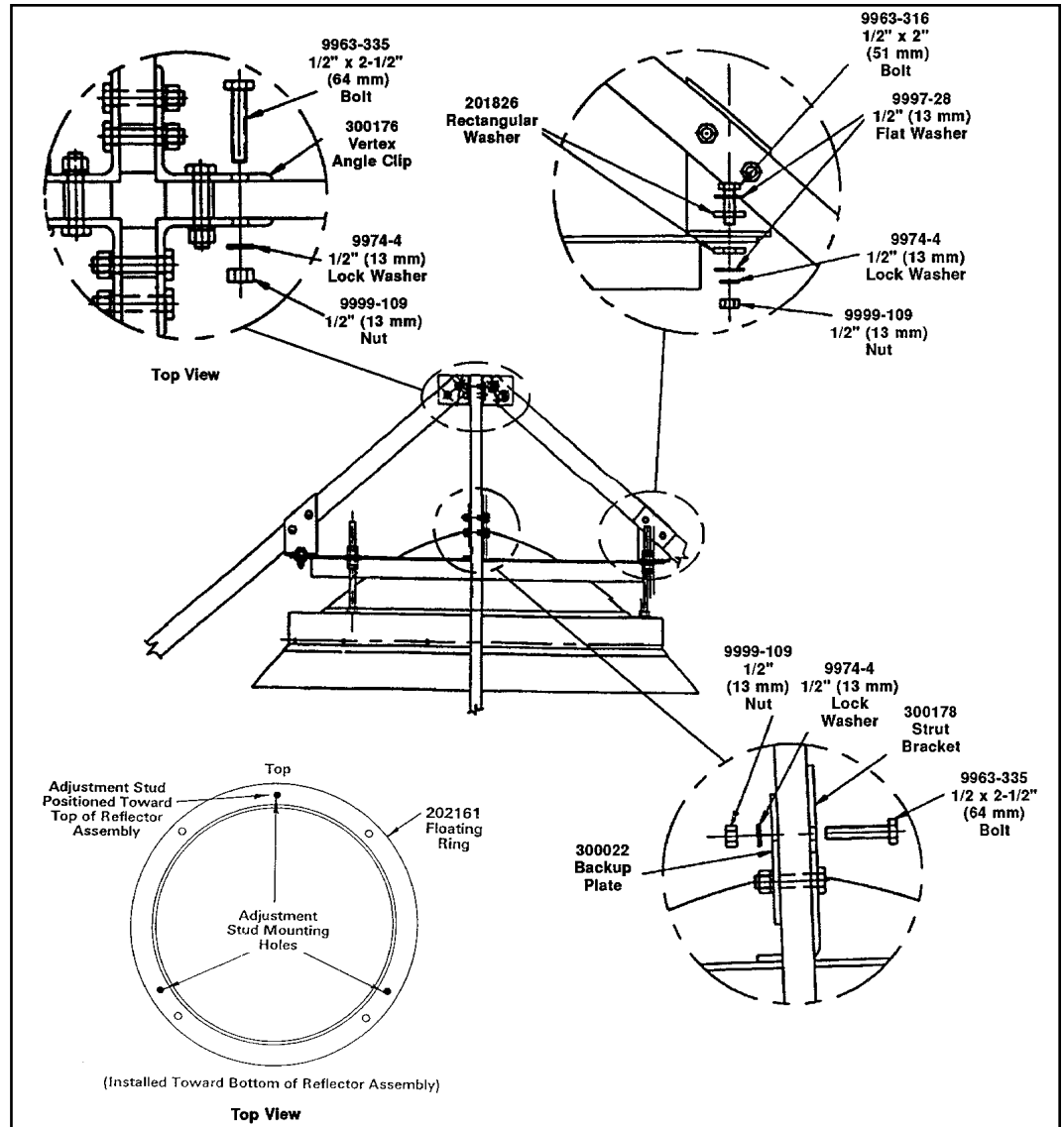


Figure 34

**Step 3**

Assemble 300174 strut assemblies as shown.

- Use 300176 angles and 1/2 x 2 in (51 mm) galvanized bolts, lock washers and nuts.

**Step 4**

Attach floating ring to corresponding strut brackets.

- Use 1/2 x 2 in (51 mm) galvanized bolts, rectangular washers, flat washers, lock washers and nuts.

**Step 5**

Securely tighten all strut assembly hardware.

**Note:** Apply stick wax to strut bracket and floating ring surface contact areas to ensure free movement during adjustment of subreflector.

**Step 6**

Attach 202123B subreflector subassembly to floating ring. Ensure top subreflector subassembly adjustment stud, opposite of notch in subreflector subassembly, is positioned toward top of reflector assembly. Lift subreflector subassembly and insert 8 in (203 mm) subreflector studs into three mounting holes provided in floating ring. Install 3/4 in (19 mm) flat washer and two 3/4 in (19 mm) jam nuts stud as shown. Snug hardware.

**Step 7** Refer to Figure 35. Raise preassembled subreflector subassembly and strut assembly and attach to subreflector supports as shown.

- Use 1/2 x 2-1/2 in (64 mm) galvanized bolts, flat washers, lock washers and nuts.

**Step 8** Securely tighten mounting hardware. Mount tabs on strut assemblies to right side of subreflector brackets to keep struts aligned with corresponding reflector segment sections.

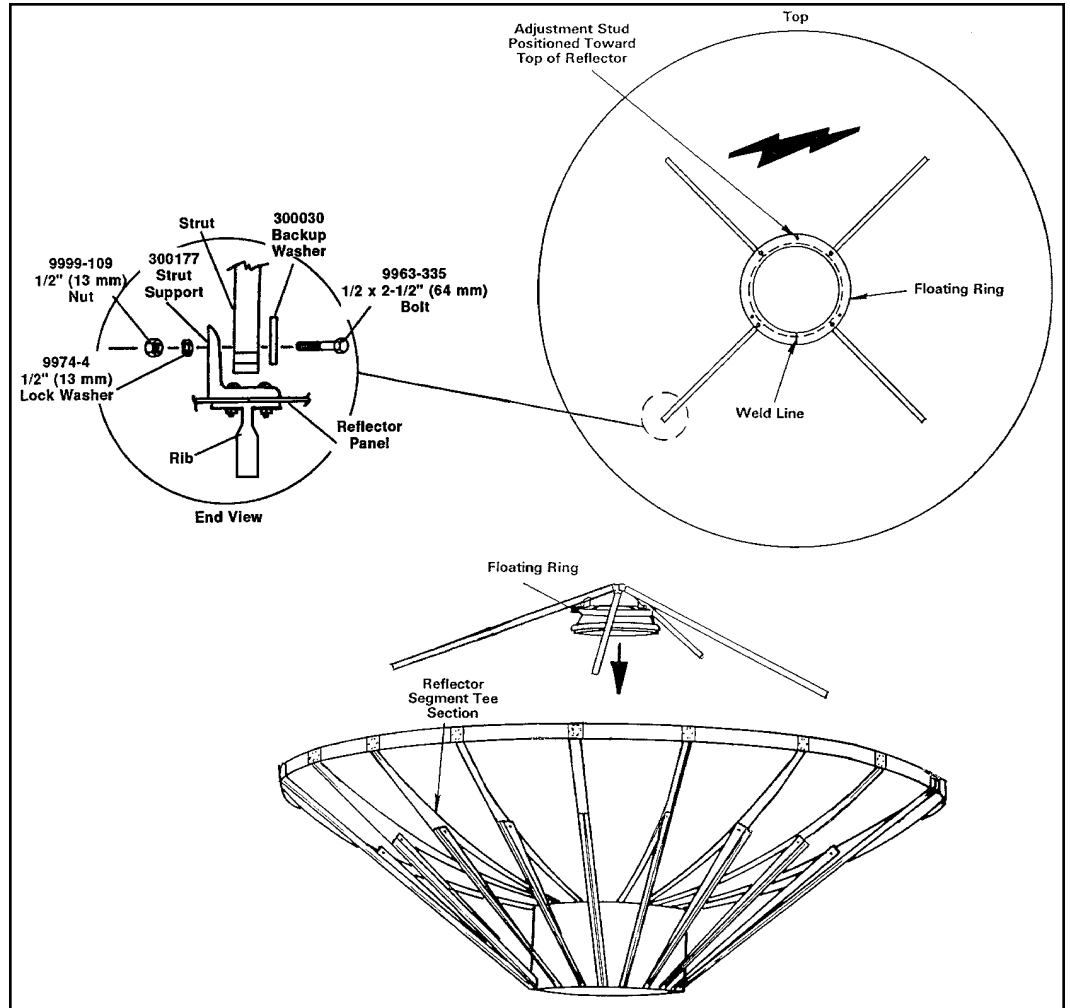


Figure 35

## Theodolite Assembly

Refer to Figure 36. The Andrew Theodolite Kit (223711) contains 1 theodolite mounting assembly and 1 alignment stick assembly. A Wild T2 or Topcon DT-05A theodolite is used but not included as part of the Andrew Theodolite Kit.

**Note:** The theodolite mounting assembly comes preassembled. The theodolite mounting assembly includes the lift/adaptor flange mount assembly, X/Y translation stage and tribrach. Refer to the theodolite operation manual for theodolite operation instructions.

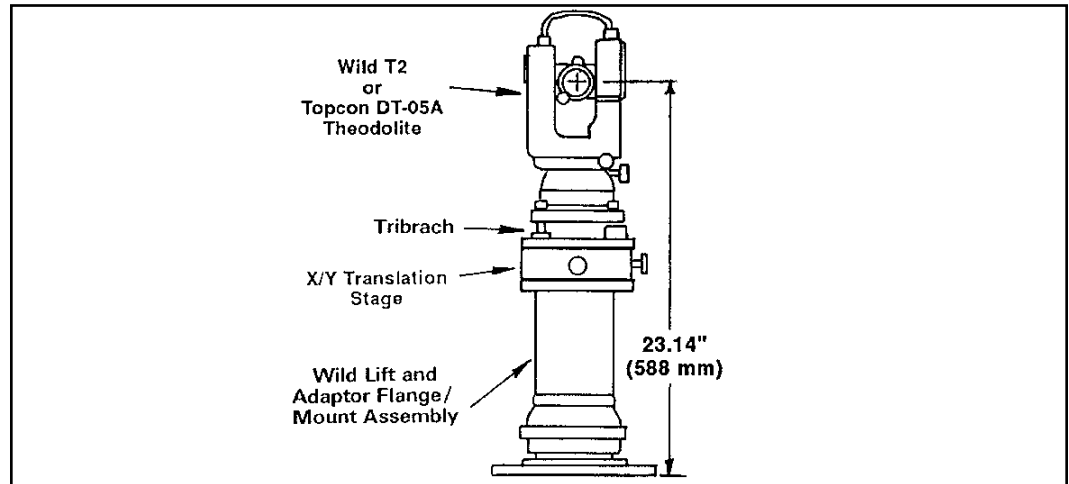


Figure 36

## Theodolite Installation

### Step 1

Refer to Figure 36. Before installing theodolite kit onto the torque tube assembly, be sure to set the height of the theodolite and support assembly as illustrated. Ensure all hardware connecting the torque tube assembly to the enclosure are fully tightened.

**Note:** Any loose hardware will cause improper theodolite alignment.

**Step 2**

Refer to Figure 37. Install theodolite support assembly to feed support tube. Secure theodolite support assembly by attaching lower flange adaptor to feed support tube.

- Use 3/8 x 1-1/2 in (38 mm) bolts, lock washers and nuts

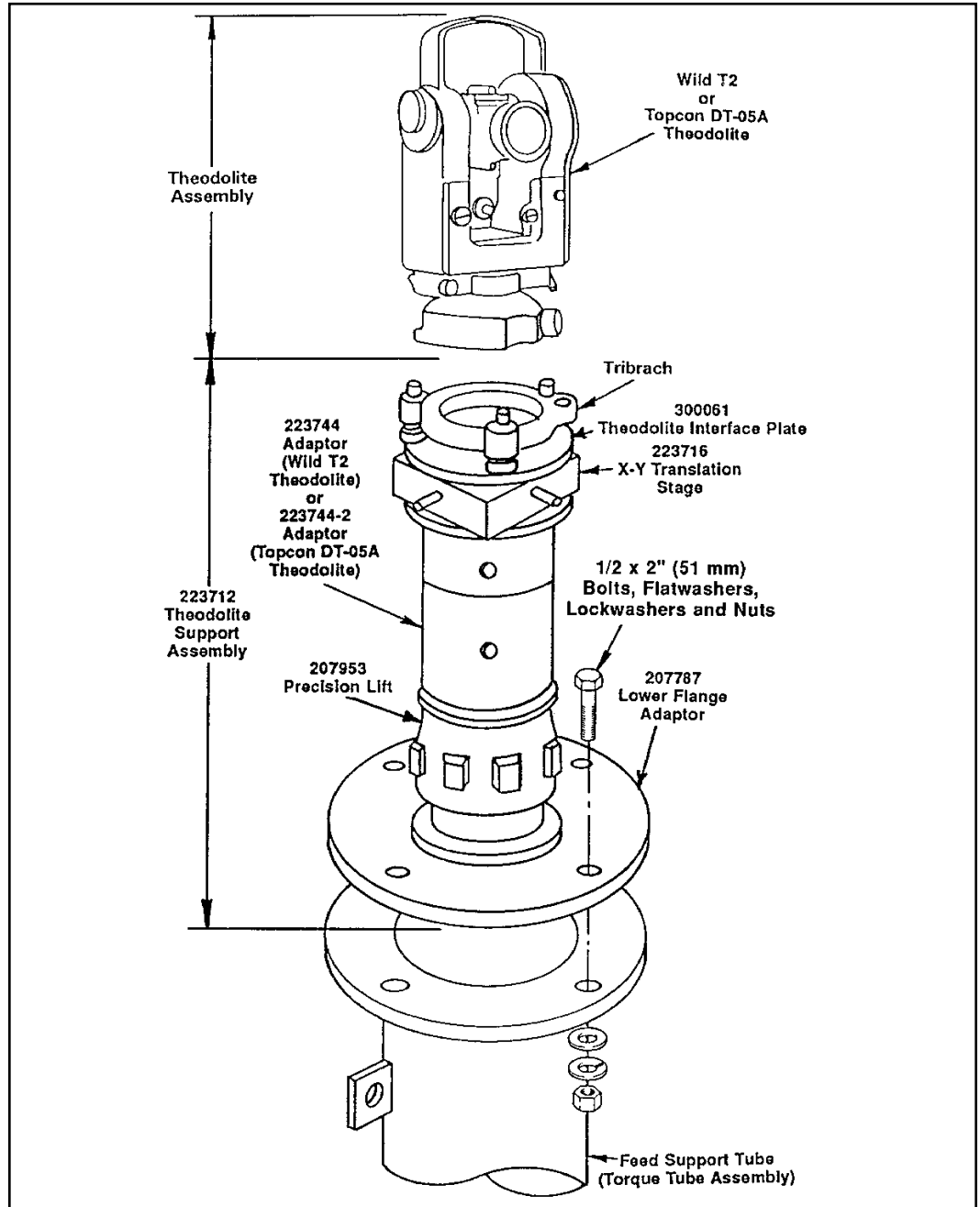


Figure 37

## Theodolite Leveling

### Step 1

Refer to Figure 38. Assemble 3 brass rod holders as shown. The brass rod holders used for calibration of the theodolite to the reflector and subsequent alignment of the reflector, must be installed in the third seam holes at the panel seams shown.

### Step 2

Before taking any readings, allow the theodolite to become acclimated to ambient conditions for at least 15 to 20 minutes prior to operation.

### Step 3

Notice proper installation orientation setting of tribrach assembly and the position of the tribrach leveling screws with relation to the brass rod holders. After installation of theodolite onto the torque tube assembly, it is necessary to level the theodolite to the reflector. This procedure is performed by adjusting the three leveling screws of the tribrach assembly.

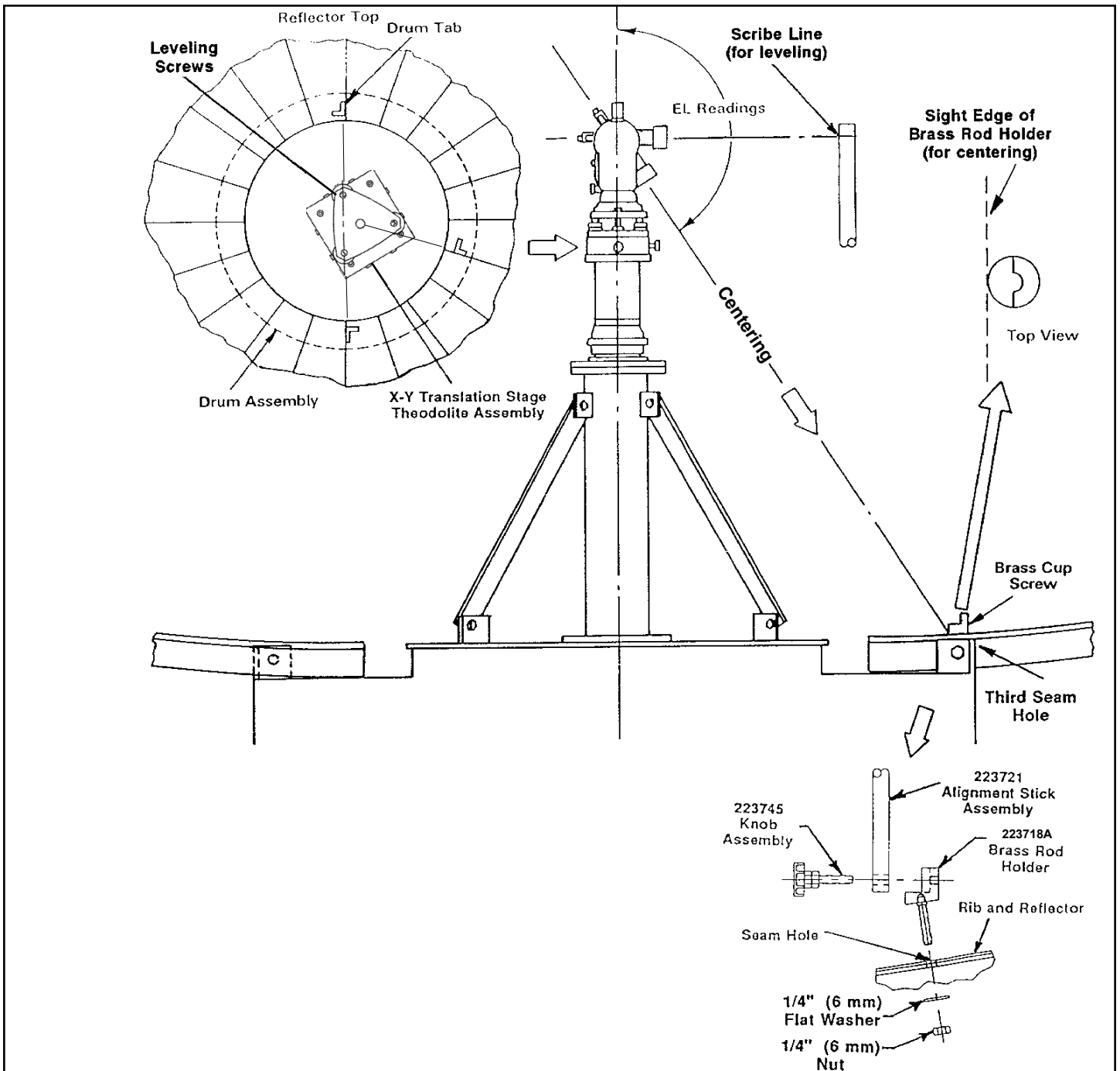


Figure 38



**Step 4** Refer to Figures 38 and 39. With the height of the theodolite and its support kit set as indicated in Figure 24, the theodolite should sight near the scribe line of the alignment stick when theodolite elevation is set to  $90^{\circ} 00' 00''$ . If not, set the theodolite elevation angle to  $90^{\circ}$  and move the theodolite up or down until it sights on the scribe line using the rotary precision lift. Be careful not to turn entire torque tube while turning precision lift.

**Step 5** Focus and adjust theodolite elevation to the scribe line and record this reading as R1. Relocate stick, rotate theodolite, focus and adjust theodolite elevation to scribe line and record this reading as R2. Add R1 and R2 readings and divide by 2. Record this reading as R3. Adjust theodolite elevation angle to new angle R3. Rotate the tribach assembly adjustment screw (in line with the alignment stick) up or down until the theodolite is sighted on the scribe line. Repeat this procedure for the diagonally opposed alignment stick positions.

**Note:** Only 2 of the 3 tribach adjustment screws should be used for leveling. Mark or identify 1 of the 3 and only use the remaining 2 adjustment screws.

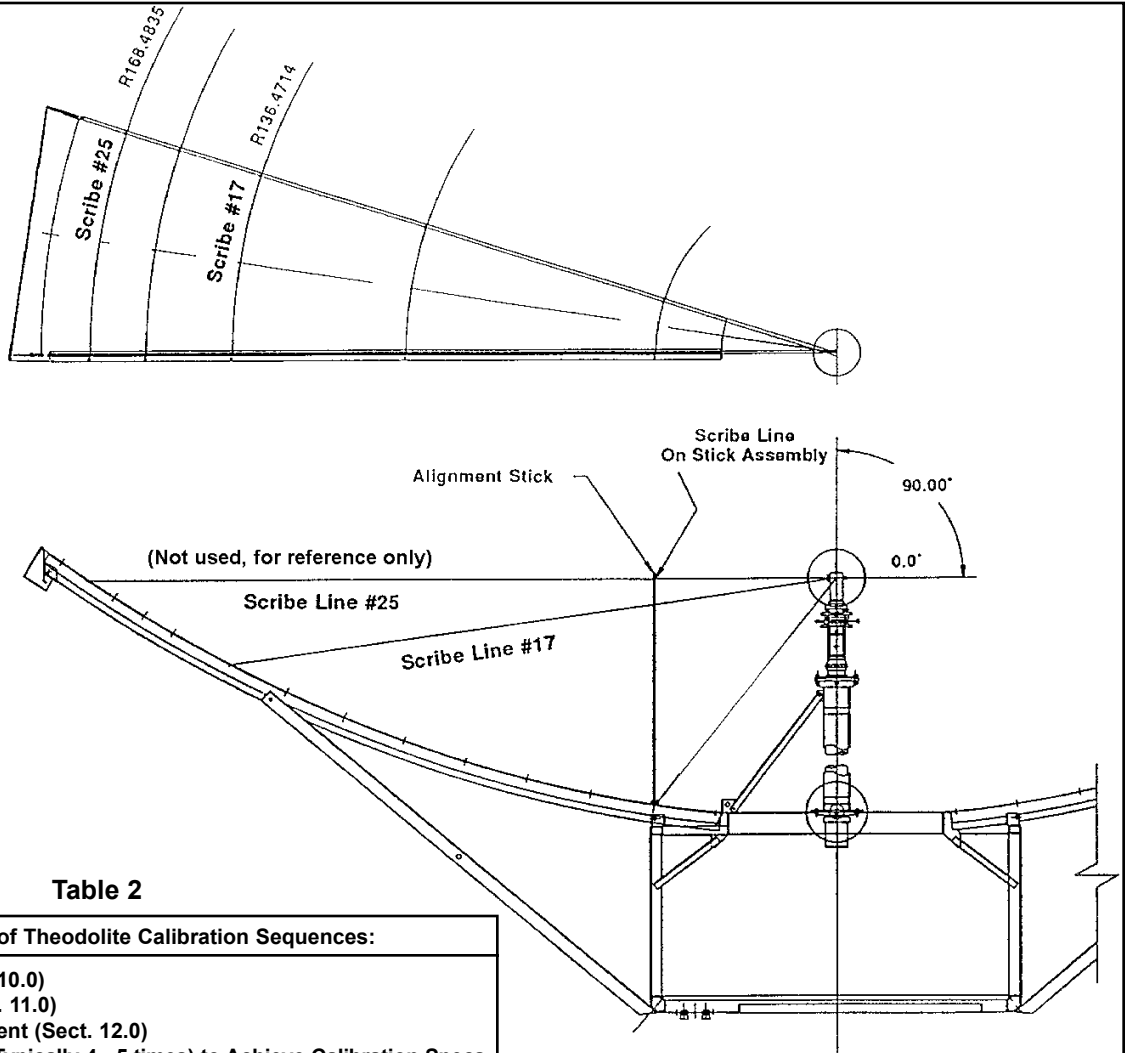


Table 2

Brief Description of Theodolite Calibration Sequences:
1. Theodolite Leveling (Sect. 10.0)
2. Theodolite Centering (Sect. 11.0)
3. Theodolite Height Adjustment (Sect. 12.0)
4. Repeat 1 - 3 as Necessary (Typically 4 - 5 times) to Achieve Calibration Specs.
Theodolite Calibration Specifications:
1. Leveling: All 3 Stick Positions Within 15 Seconds of Each Other.
2. Centering: All 3 Center Reading to be Within 15 Seconds of Each Other.
3. Height: All 3 Level Position Readings Within 10 Seconds of $90^{\circ} 00' 00''$ .
4. Ready for Reflector Panel Adjustment (Sect. 13.0).

Figure 39

## **Theodolite Centering**

- Step 1** Refer to Figures 38 and 39. Centering of the theodolite is performed using the X-Y translation stage. This device has 2 sets of micrometer adjustments and 2 sets of long locking adjustment screws which are opposed at 90°.
- Step 2** During initial adjustment, ensure that the long screws are unscrewed counterclockwise to provide free movement.
- Note:** The screws will be utilized later to lock the device in place after the centering procedure is complete.
- Step 3** Refer to Figure 38. Centering is performed by focusing the theodolite on the intersection of the brass rod holder and the reflector skin.
- Step 4** Ensure theodolite center axis is in line with the adjustable axis of the X-Y translation stage. Focus and adjust the theodolite elevation adjustment until the edge of the rod holder is sighted. Note and record this reading as T1. Repeat this procedure 180° apart and record the new reading as T2. Add T1 and T2 and divide by 2. Record this number as T3. Adjust the elevation axis angle of the theodolite to T3. Using the micrometer adjustment of the X-Y translation, move theodolite until the crosshair is focused to the edge of the rod holder.
- Step 5** Repeat the above procedure for the other axis of the X-Y translation stage 90° opposite to the first one.
- Step 6** Repeat steps 4 and 5 until the theodolite crosshair focuses to all 3 rod holder edge locations within 15 seconds.

## **Theodolite Height Adjustment**

- Step 1** Refer to Figure 39. The height adjustment of the theodolite is performed utilizing the precision lift assembly. This device can lower or raise the theodolite to the desired height by rotating the large rim located at the center of the upper body of the device.
- Step 2** Upon completion of the leveling and centering procedure, the theodolite must be adjusted in-line with the scribe line on the alignment stick.
- Step 3** Adjust the elevation angle of the theodolite to exactly 90°, 00' and 00". With the theodolite set to this angle, focus to the scribe line on the alignment stick and make any up or down adjustment as necessary using the lift assembly. Be careful not to rotate torque tube when turning the precision lift.
- Step 4** Move the alignment stick 180° and check if the theodolite is lining up with the scribe line. Repeat this procedure with the diagonal stick locations. Repeat theodolite leveling, centering and height adjustment procedures to achieve calibration specifications, per Table 2.

### **Notice**

The above described sequences must be followed in order to properly calibrate the theodolite to the reflector assembly. Deviation from the above procedures and sequence will make it more difficult to calibrate the device and may result in incorrect alignment of the reflector panels.

## Reflector Panel Adjustment

- Step 1** Refer to Figure 40. Each panel segment has a scribe line, which defines the circumference of all corresponding screw locations at the number 17 position.
- Step 2** Adjust panel segment using cambolts on back struts to move the panel to the highest possible position. Using the theodolite, target the surface of each panel segment at scribe line 17. Record these measurements for each cam bolt (Refer to Table 3). Average these values.
- Step 3** Add the average value for the highest and lowest panel positions and divide by two. The result is the optimum theodolite elevation angle for scribe line 17.
- Step 4** After adjusting all panel segments at scribe line 17, tighten all segment hardware at seam screw locations 23 through 28.
- Step 5** Work clockwise, tightening 2 seam screw rows each time around the reflector (23-24, etc.)
- Note:** Do not step or lean in the area of reflector seam screw locations 23 through 31 during this tightening sequence.
- Step 6** Remove special brass rod holders and replace with panel segment hardware. Tighten all remaining seam hardware beginning with that corresponding to the circumference of panel segment screws 22. Work clockwise around the reflector tightening each row of corresponding panel segment screws down to the circumference of panel segment screws 1.
- Note:** Do not overtorque seam hardware.
- Step 7** Insert hardware in holes 29 - 31 in all panels and tighten three at a time in clockwise direction.
- Note:** Do not force the fasteners thru the holes by prying with a drift pin or hammering on them.
- Step 8** Connect and tighten 40 joiner strips with supplied hardware (refer to Figure 41) and sub-reflector bracket connection hardware. Double-check for loose strut connection and panel connection hardware.

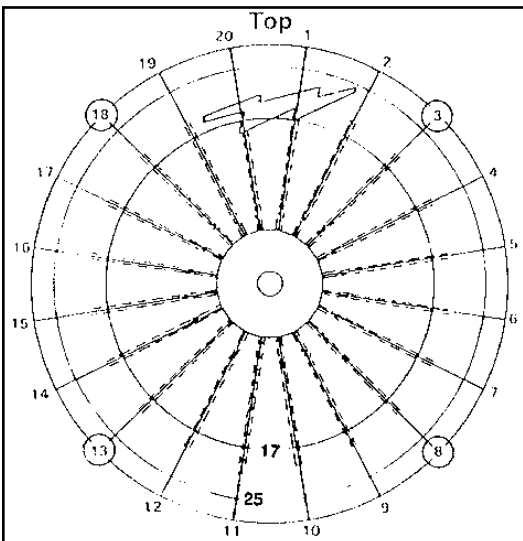


Figure 40

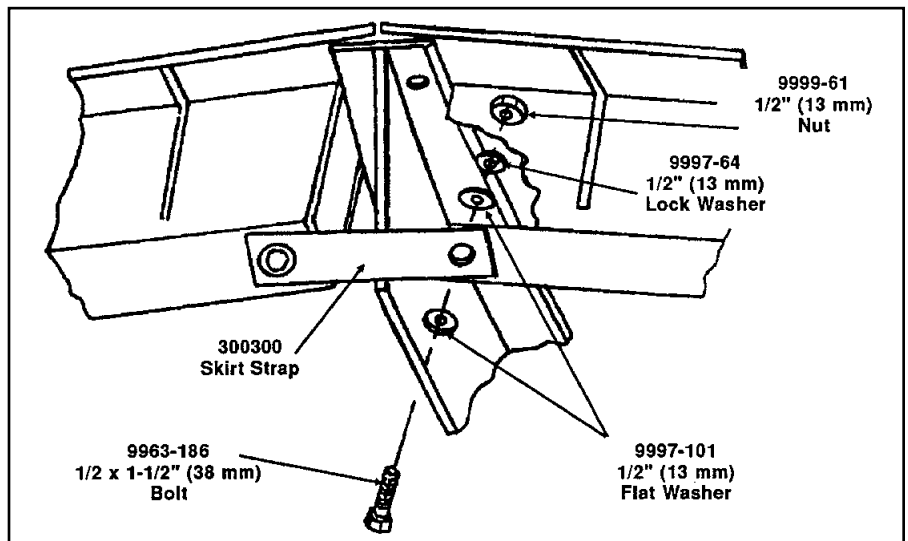


Figure 41

<b>Theodolite alignment data worksheet</b>	
<b>Lowest cam bolt position:</b>	<b>Highest cam bolt position:</b>
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
Average Lowest Position =	
Average Highest Position =	
The average is the sum divided by 20	
ALP + AHP divided by 2 =	
This is the optimum theodolite elevation angle for aligning line 17.	

Table 3

## Subreflector Adjustment

- Step 1** Refer to Figure 42. Use tape measure to set rim of subreflector to required distance of 119.110 in (302.6 cm) measured from the top of first seam hardware to the aperture plane of the subreflector using three subreflector adjustment studs.
- Step 2** Attach right angle viewing piece to theodolite. Move subreflector laterally to align the subreflector so it is centered with the theodolite while set at vertical ( $0^{\circ} 00' 00''$ ). A hole is provided at the center of the subreflector to facilitate alignment.
- Step 3** Ensure subreflector is centered and set at required distance. Snug adjustment hardware after centering and height adjustments are complete.
- Step 4** Check distance between subreflector aperture plane and first seam reflector hardware.

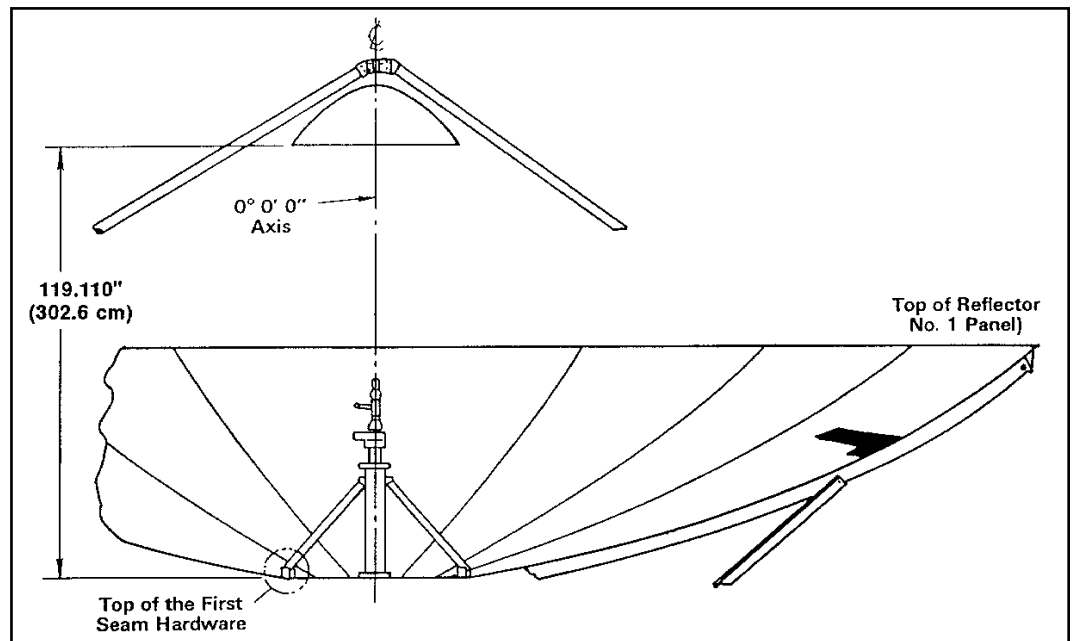


Figure 42

## Subreflector Offset Tilt Adjustment

### Step 1

Refer to Table 4 and Figure 43. Adjust top subreflector jam nuts (two) the distance indicated according to the offset pointing angle in Table 4. Make the desired adjustment using the floating ring and subreflector jam nuts.

**Note:** Before making any adjustment, mark the starting position of the jam nuts in relation to the floating ring with a pencil, then mark the floating ring to indicate the proper distance of the turn.

Table 4

Offset Operating Angle	Top Stud Nut Adjustment
10° - 20°	1-3/4 turns
30°	1-5/8 turns
40°	1-1/2 turns
50°	1 turn
60°	7/8 turn

### Step 2

Table 4 shows the distance the subreflector must be lowered. Use only the top adjustment stud to obtain the proper offset tilt.

### Step 3

Once the offset tilt adjustment is completed, do not disturb adjustments.

### Step 4

Match mark the subreflector subassembly and the floating ring. Remove 3/4" (19 mm) jam nuts and washers and lower the subreflector subassembly. Place subreflector subassembly in safe location to secure it from damage during reflector/backstructure installation.

### Step 5

Remove theodolite and theodolite mounting assembly from feed support tube.

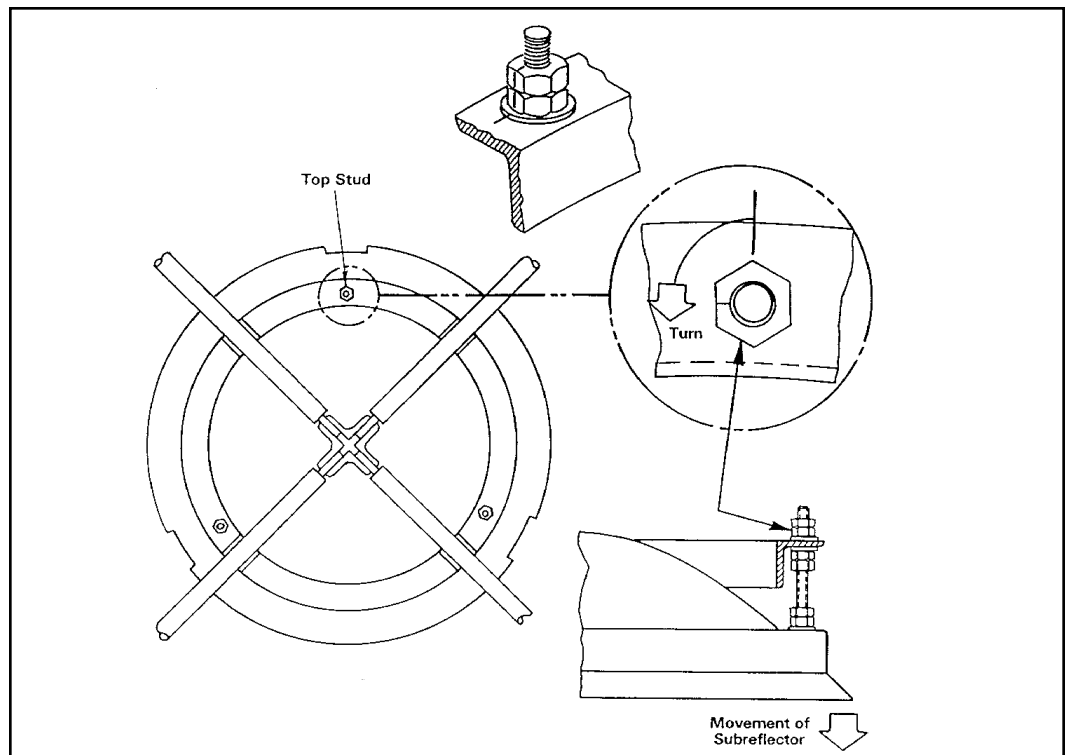


Figure 43

# Reflector/Back-structure to Ground Mount Assembly Installation

## Step 1

Refer to Figure 45. Attach 5/8 in (16 mm) shackles with corresponding 20 ft (6 m) chokers to four drum assembly angle brackets as shown. Attach 15 ft (4.5 m) tag line to forward left of jack tripod assembly.

**Note:** Two front chokers should be approximately 4 in (102 mm) longer than rear chokers.

## Step 2

Extend azimuth jack until panning assembly is facing forward position (AZ = 0°).

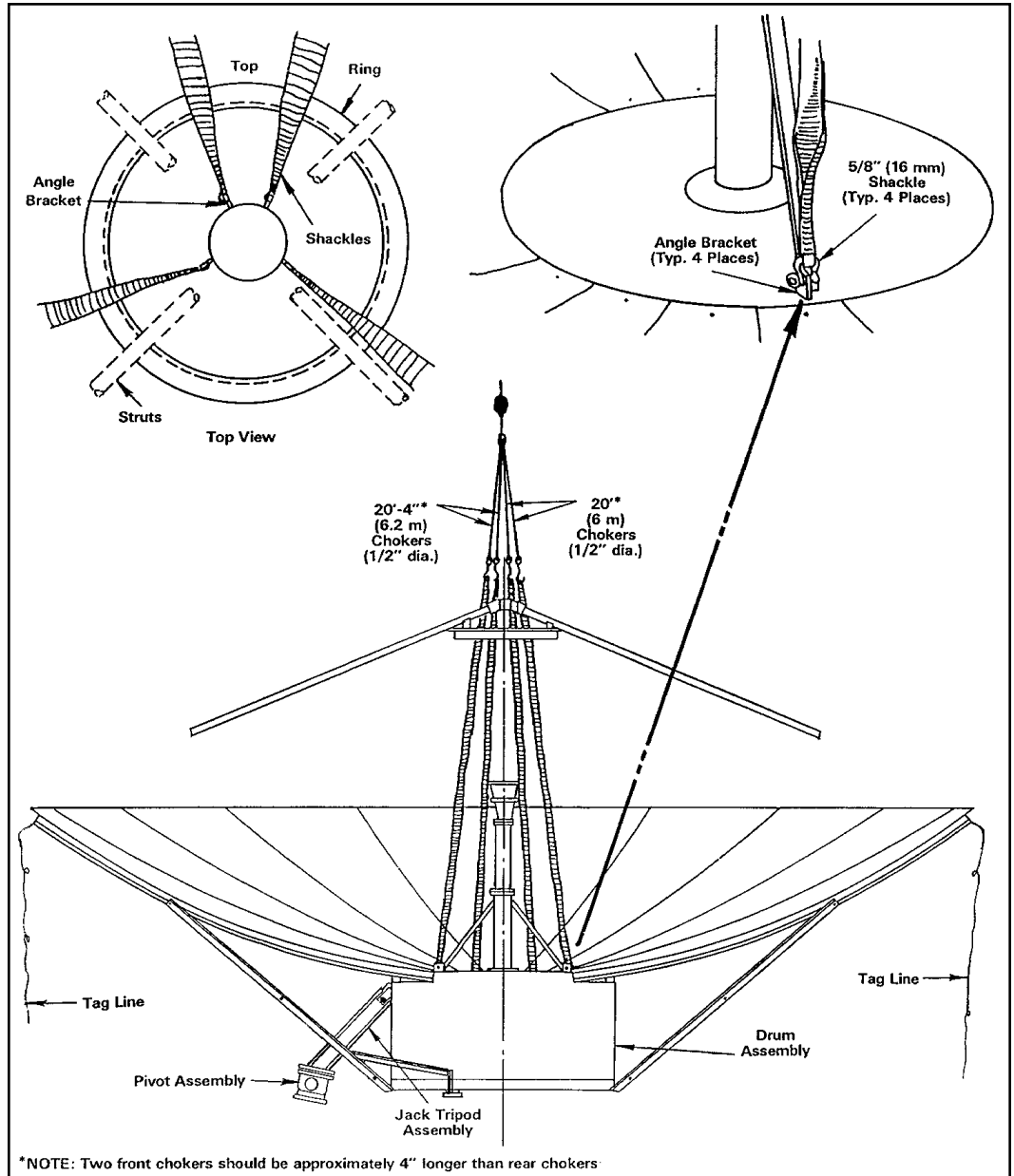


Figure 45

**Step 3**

Refer to Figure 46. Extend elevation jack extension assembly to 7 ft (2 m) dimension as shown. Raise assembly and secure to forward ground mount beam assembly, using 6 ft (2 m) choker and winch assembly.

**Warning:** Do not attempt to raise reflector/backstructure if winds exceed 25 mph. Raise reflector/backstructure assembly and align with corresponding elevation jack/panning frame assemblies using tag lines for guidance.

**Note:** A minimum of three tag lines should be used during high wind conditions. Do not exert force while using the tag lines during reflector installation as this will distort the panel surfaces.

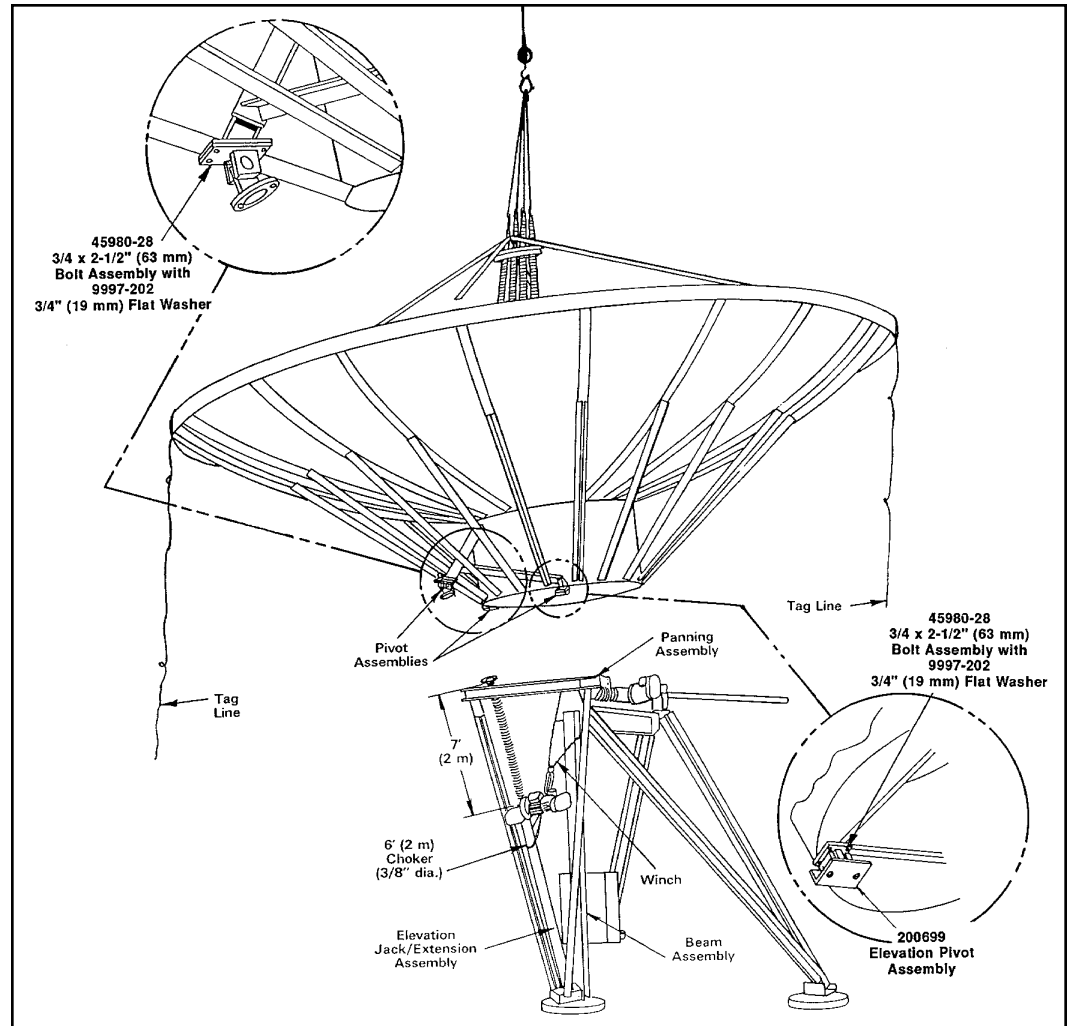


Figure 46

**Step 4**

Connect reflector/backstructure pivot assemblies to panning frame assembly.

- Use 7/8 x 2-1/4 in (57 mm) bolts and nuts

**Step 5**

Attach tripod pivot assembly to elevation jack assembly.

- Use 7/8 x 2-1/2 in (63 mm) bolts, flat washers and nuts

**Step 6**

Securely tighten mounting hardware on both sides of pivot assembly according to A-325 Hardware Tensioning Procedure.

**Step 7**

Install subreflector subassembly.

- Use 3/4 in (19 mm) jam nuts and washers making sure the subreflector is repositioned in the exact location determined at the conclusion of its adjustment. Secure all hardware.



# Operation

## Overview

After you have completed the assembly of your antenna, you are now ready to become operational. In order to operate the earth station antenna, you will need to direct it to the desired satellite adjusting both the elevation and azimuth angles appropriately. The following procedures provide details on how to correctly position your antenna on the desired satellite.

## Acquiring A Satellite

There are several procedures that may be used to properly acquire the satellite. Andrew recommends that a spectrum analyzer be used. The following procedures provide explanation as to how to use the spectrum analyzer.

While viewing the spectrum analyzer screen, a signal as shown in Figure 4-1 will probably be observed. Additionally, some transponder signals may be observed above the noise signal as shown.

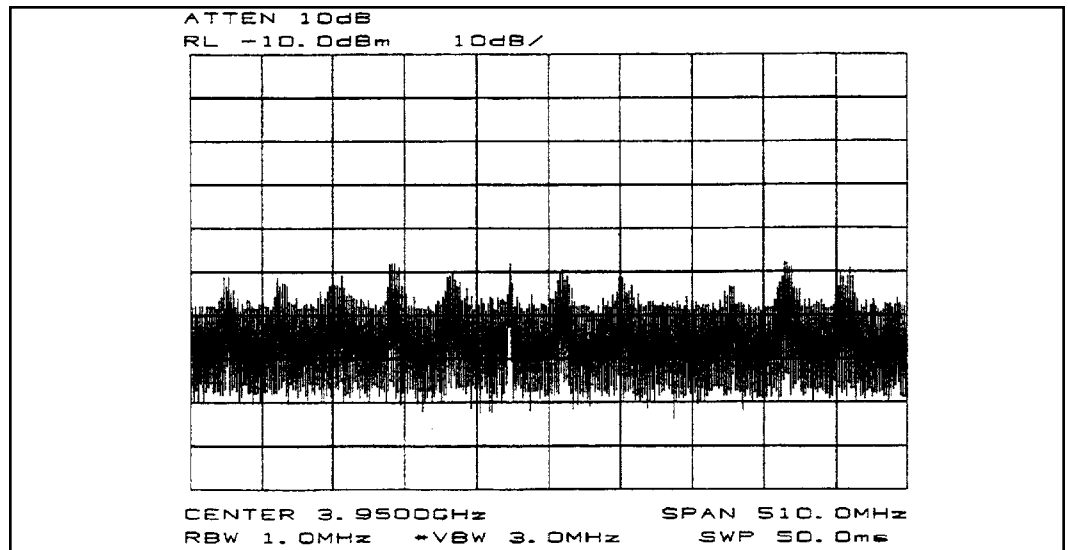


Figure 4-1: Minimum transponder Signal on Spectrum Analyzer

The following steps provide the procedure for acquiring a satellite.

- Step 1** Begin by obtaining the correct Az/EI pointing data for the satellite of interest.
- Step 2** Using an inclinometer, position the antenna to the specified elevation angle.
- Step 3** Manually move the antenna in the azimuth (scanning back-and-forth around the direction of the specified azimuth angle) to achieve the maximum (greatest amplitude) transponder signals.
- Scan in one direction until the amplitude continues to diminish and then scan in the opposite direction until the same condition occurs.
  - Return to the position yielding the greatest amplitude.
- The maximum azimuth excursion from the original setting should not exceed plus or minus 1.5 degrees or the antenna may begin to access a different satellite.
- Step 4** With the antenna positioned in azimuth such that the transponder signals are maximized, follow the same procedure manually moving the antenna in elevation (scanning up-and-down) to further maximize the transponder signals.
- Step 5** Repeat this procedure alternating between the azimuth and elevation excursions of the antenna to peak the transponder signal amplitude.
- Step 6** With the antenna peaked in azimuth and/or elevation, check to see if you're peaked on a sidelobe. Move the antenna in azimuth while observing the spectrum analyzer screen. Refer to Figure 4-2.

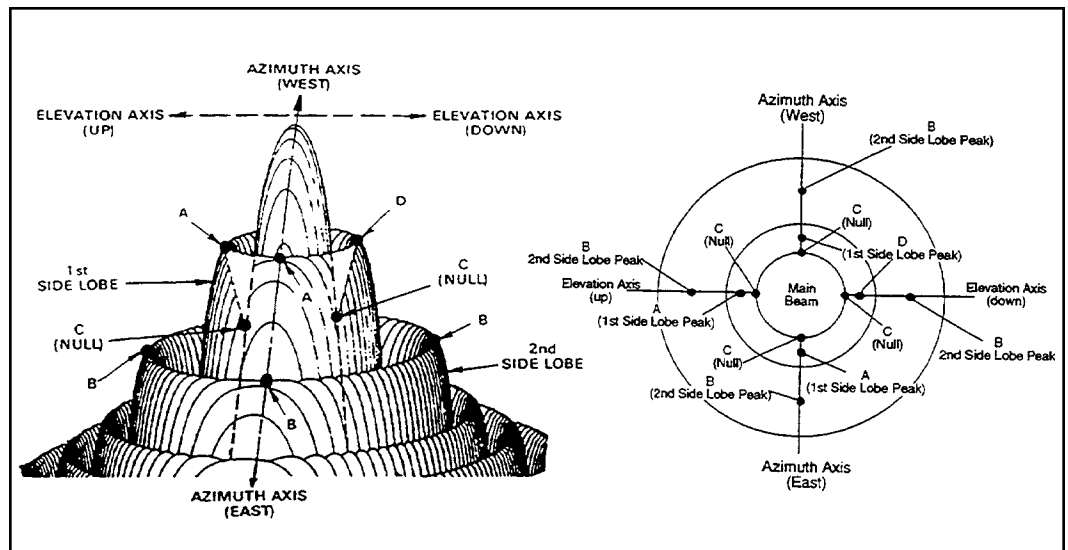


Figure 4-2: Antenna Radiation Pattern Topographical Diagram with Plan View

**Step 7** Move the antenna in azimuth to obtain a null, then move  $\pm$  in elevation to obtain a large peak signal. If not, move the antenna in the opposite azimuth direction through the peak and again move  $\pm$  in elevation to obtain a large peak signal. If a larger peak is not found, you were on the main lobe.

**Step 8** If your antenna is equipped with a linear polarizer, the antenna is aligned in azimuth and elevation (signal maximized) and 24 transponder signals (12 horizontal and 12 vertical) are noted, the polarization adjustment is set incorrectly and must be modified. If 12 transponder signals are noted, they may or may not be the properly polarized signals. Therefore 24 transponder signals must be visually noted in order to determine the proper polarization setting.

**Step 9** Rotate the feed assembly clockwise until 24 transponder signals are noted and of approximately equal amplitude.

**NOTE:** It is more accurate and visually easier to minimize the alternate set of transponder signals rather than maximizing the transponder of interest.

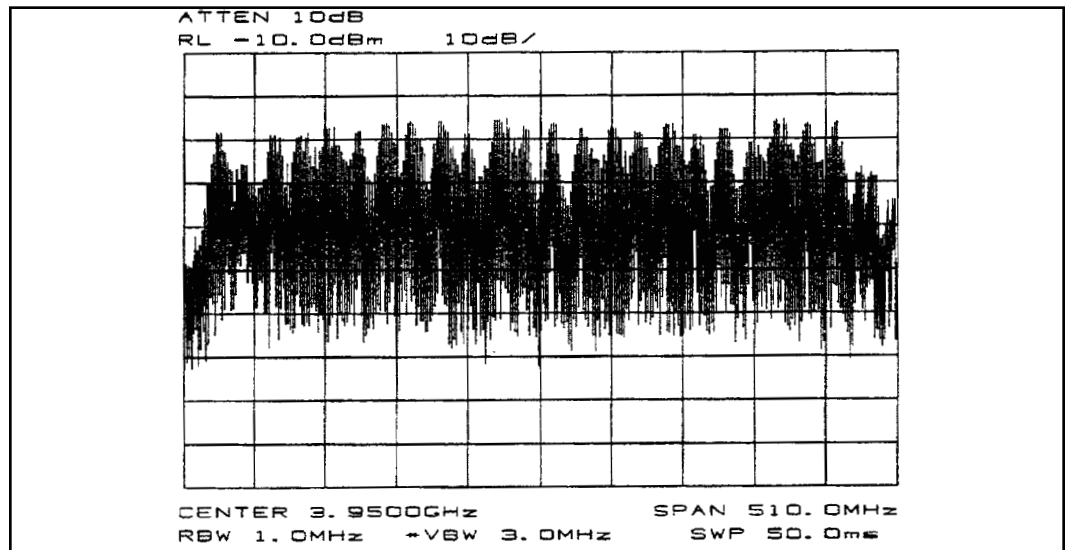


Figure 4-3: Polarization at 45 degrees from Optimum Setting

**Step 10**

With all 24 transponder signals of approximately equal amplitude appearing on the spectrum analyzer screen determine the specific antenna system and satellite parameters. Rotate the feed assembly as required until the appropriate (odd or even) transponder signals are maximized.

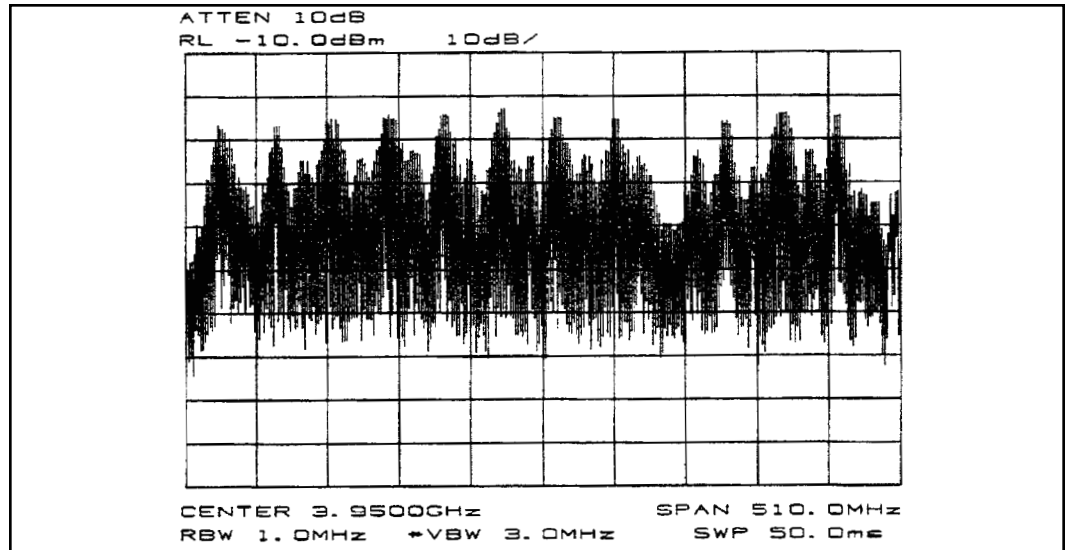


Figure 4-4: Maximizing Odd Transponders

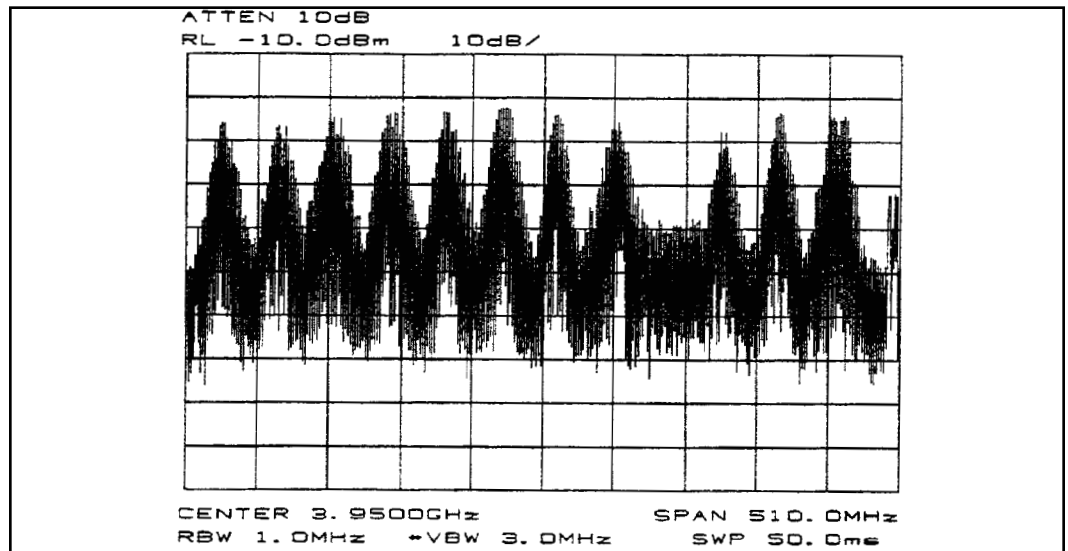


Figure 4-5: Optimum Polarization Setting

## **Subreflector Adjustment**

After the satellite has been acquired and testing has taken place with the spectrum analyzer, the subreflector may need to be adjusted to maximize optimum performance of your antenna. The following procedures should be followed if a subreflector adjustment is required to maximize optimum performance.

**NOTE:** All INTELSAT Type Approved antennas do not require subreflector adjustment.

Before proceeding, azimuth and elevation patterns should be conducted to determine the adjustments that need to be made. The goal is to achieve a high peak on the main lobe and even distances between the main lobe and sidelobes.

**NOTE:** No adjustments should be made in the receive band.

If your pattern dictates a need to adjust the azimuth angle (the left sidelobe requires adjustment), the west side (northern hemisphere) of the subreflector should be adjusted outward by loosening the screws on the subreflector and adjusting the left side (northern hemisphere) outward. An easy way to remember this adjustment feature is through the acronym WOLD (West Out Left Down).

If your pattern dictates a need to adjust the elevation angle (the right sidelobe requires adjustment), the bottom side of the subreflector should be adjusted downward by loosening the screws between the subreflector and the struts and adjusting the bottom side of the subreflector downward. An easy way to remember this adjustment is through the acronym BOLD (Bold Out Left Down).

Each of these adjustments should be repeated until each sidelobe is of equal distance from the peak of the mainlobe.

After the BOLD and WOLD adjustments have been made, it may be necessary to adjust the main lobe. The goal is to achieve a high null depth (distance between lower intersection of sidelobes and top of main lobe) as shown in Figure 4-5.

In order to adjust the main lobe pattern characteristics **ALL** subreflector adjustment screws should be adjusted at the same degree (Note: Because the azimuth and elevation adjustments have been set, it is very important that the null depth adjustment be carefully conducted. Be careful not to alter any previous adjustments that have been made to the subreflector. Follow the procedure listed below when adjusting the null depth of the main lobe.

C-band feeds - Adjustment screws are 3/4 X 10. Move 1 turn per 1dB of imbalance.

Ku-band feeds - Adjustment screws are 1/4 X 20. Move 1 turn per 1 dB of imbalance.

All adjustments should be continued until the desired pattern is achieved. Upon completion the antenna should be properly aligned with the satellite for maximum performance.

# Preventive Maintenance

## Overview

This section contains periodic preventive maintenance instructions for the 9.3-Meter Earth Station Antenna. Included in this section are inspection and preventive maintenance procedures including cleaning and lubrication, painting, and an operational voltage/current checkout procedure deemed within the capabilities of the average station technician. Refer to applicable vendor manuals for any repair procedures not included in this section yet designated as capable of being performed in the “field” rather than requiring specialized facilities, tools, and/or test equipment as well as technically trained personnel.

An operational checkout procedure provides an accurate indication of the overall earth station performance and should be performed at intervals of approximately three months. This procedure is essentially performed during the various modes of normal operation of the earth station. In addition, the operational checkout procedure should be performed after any repairs or adjustments have been made, or whenever the earth station is suspected of degraded operation. If any discrepancy in performance exists and the condition cannot be readily remedied to return the earth station to a proper operating condition, the appropriate troubleshooting procedures should be referenced to locate the fault. After the trouble is determined and the repairs affected, a final operational checkout procedure should be performed to verify that all discrepancies have been corrected.

The following paragraphs describe the inspection and preventive maintenance procedures for the earth station. These instructions include general cleaning and inspection, the preservation of metal parts and lubrication. Periodic replacement of assemblies or components as a preventive measure is not required. Malfunctions of the earth station can be traced to components, assemblies, and parts through the use of applicable troubleshooting procedures.

## General Cleaning

To prevent the excessive accumulation of dust and dirt as well as the removal of such contaminants, thoroughly clean the equipment whenever visually inspecting the earth station components. No special cleaning procedures are required. However, a thorough cleaning in accordance with the following procedures is required to assure continued trouble-free operation.

## Electrical Parts

Minor cleaning, such as the removal of dust and loose foreign particles can be accomplished by one of the following:

- Vacuuming
- Using a soft brush or lint-free cloth
- Blowing out the dust and dirt with low pressure (5 to 25 psi), dry compressed air

When using air to blow off the contaminants, either avoid or be careful when directing the air stream on delicate parts. To remove imbedded dirt, grease, or oil from electrical parts; use a 50 percent solution of isopropyl (rubbing) alcohol and apply with a soft bristle brush. It may be necessary to brush some parts vigorously with a stiff bristle brush to remove imbedded and hardened dirt particles. If possible, avoid excessive use of cleaning solvent on electrical insulation. After cleaning, allow the cleaned parts to dry for 10 to 15 minutes before placing the equipment into operation.

## **Mechanical Parts**

Clean mechanical parts by first removing dust, dirt, and other loose contaminants with a scraper, stiff brush (bristle or wire in the case of rust or other corrosion), or cloth or compressed air at 25 to 40 psi. Any accumulated imbedded dirt, corrosion, grease, or oil deposits that require further cleaning may be removed with a bristle or wire brush and a cleaning solvent such as trichlorethylene or equal. After cleaning, allow cleaned parts to dry for 10 to 15 minutes before placing the equipment into operation.

## **Inspection**

The frequency of inspection is contingent upon the user's individual standards and the operational environment in which the earth station is located. However, a visual inspection of the earth station components should be performed at least semi-annually. Where there are no established wear limits, perform a visual inspection to locate worn or damaged parts which could cause improper functioning of the earth station. It is recommended that the mechanical and electrical inspection be performed on the assembled or partially disassembled equipment to determine the extent of disassembly required prior to completely disassembling a suspected malfunctioning component or module. In the absence of any special inspection requirements, operational tests are the most effective means in isolating parts and assemblies requiring further inspection. Any condition noted during inspection that may preclude continued proper operation of the earth station prior to the next scheduled inspection should be noted. The discrepant condition should be corrected (repaired or replaced) immediately or at the conclusion of the inspection procedure.

## **Local Control/Motor Drive Controller**

Inspection of the local control/motor drive controller conforms generally to standard visual inspection procedures on electromechanical equipment. In addition to these standard procedures, perform the following checks and visual inspections for the specific conditions noted:

- Check the front panel for illegible and indistinct panel markings.
- Check the three position selector switches (Azimuth Slow/Fast, Elevation Slow/Fast, and Polarization CCW/CW) for smooth operation, audible clicking at each actuation (left to center and return) and spring return from right to center. For each of the two position selector switches (Azimuth-East/West, Elevation-Up/Down, and Local/Remote) check for smooth operation and audible clicking at each actuation.
- Inspect all wiring and cables for discolorization and burned insulation, dirt, breaks, security of connection and other signs of deterioration. Examine connections for dirt, flux, corrosion, and mechanical defects. Check for loose or broken lacing and cut, brittle, abraded, frayed, or cracked insulation.
- Examine connectors for corrosion, broken inserts and stripped threads. Check connector shells for distortion and dents, and contact pins for bends, misalignment, or other deformities. Check connector inserts for carbon tracking indicating arc-over.
- Check all electrical components for dirt, cracks, chips, breaks, discoloration and other signs of deterioration and damage. A discolored, blistered, or burnt condition is evidence of overload. Measure actual value of suspect electrical components and compare against specified value.

- Check transformer for an excessive wax deposit on the surface, discoloration, or a pungent odor indicative of burning varnish denoting overheating or a total breakdown.
- Check all terminal boards for broken or missing terminals and stripped threads. Check tightness of lead attaching hardware.
- Check each starter for a make-after-break provision through the release of one pushbutton as the alternate pushbutton is pressed.
- Check the relays and contactors for free operation of the armatures and contact condition. The contacts are usable even though pitted, burned, worn, or discolored. The contacts or contactor or relay assembly should be replaced only when the contact material has been completely torn away or worn off.
- Visually inspect all mechanical parts for freedom of operation without binding or interference. Check for security of all hardware and stripped or otherwise damaged threads. Check metallic parts for corrosion, dents, distortion, and other deformation.
- Check for evidence of water inside the enclosure. If any water is in evidence, clean area thoroughly and check that all seals are intact and if not, use a coating of RTV-108 (silicone rubber sealant) to seal any exposed electrical fitting, bolt hole, or other possible water entry to the enclosed electrical components in order to maintain a waterproof condition.
- Check or change humidity absorber.

## **Antenna**

Inspection of the antenna conforms generally to standard visual inspection procedures performed on electromechanical equipment. In addition to these procedures, perform the following checks and visual inspections for the specific conditions noted:

- Inspect all wiring and cables particularly the network to enclosure and enclosure to mount interfaces for discoloration and burned insulation, moisture entry, corrosion, dirt, breaks, security of connection, and other signs of deterioration. Examine connections for dirt, corrosion, and mechanical defects. Check for loose or broken lacing and cut, abraded, frayed, brittle, and cracked insulation.
- Examine connectors for corrosion, broken inserts and stripped threads. Check connector shells for distortion and dents, and contact pins for bends, misalignment or other deformities. Check connector inserts for cracks, and carbon tracking, burns or charring indicating arc-over.
- Check all electrical component for dirt, cracks, chips, breaks, discoloration, and other signs of deterioration and damage. A discolored, blistered, or burnt condition is evidence of overload.



- Operate the azimuth and elevation drives as well as the feed rotation in both the plus and minus direction from the local control/motor drive controller at least once every three months during antenna down time. Check the mechanical limit switches provided at the end points stop the antenna and feed movement, and limit travel to prevent structural interference and damage. Check the mechanical limit switches for corrosion and water entry and the arm on each feed limit switch for free movement without binding. Be certain both feed rotation limit switch arms are not distorted and ride centrally on the actuating cam to open their corresponding limit switch.
- Inspect the azimuth and elevation jackscrew boots for security of attachment at both ends, for abrasion, tears, cuts, brittleness and other damage that may expose the jackscrew to the environment (water, dust, etc.). Minor repairs can be made with RTV-108 silicone rubber sealant.
- Visually inspect the feed window for dirt and the feed, feed supports, feed window, and reflector for distortion, foreign object damage and environmental deterioration due to ice and snow, dust, rain, hail, and high winds, etc. which may cause electrical component and/or structural deformation.
- Check the cable attachment to the resolvers and to the LNA or LNB's and enclosure mount interface for security, the cable routing for secure hanger attachment and the cable insulation for cuts, cracking, abrasion, and other deterioration. Check the LNA or LNB's and the resolvers for a secure mechanical attachment. Ensure proper torquing of polarization drive gear box setscrews and appropriate tensioning of corresponding drive chain assembly, if applicable.
- Check (if applicable) that the drain holes in the bottom of the enclosure are not obstructed and there is no evidence of water accumulation. Check the enclosure doors for proper closure and that the door seals are intact, not torn, abraded or otherwise damaged. Check that all other seals are intact and if not, use a coating of RTV-108 (silicone rubber sealant) to seal any exposed electrical fitting, bolt hold, or other possible water entry to electrical components in order to maintain a weatherproof condition. If the enclosure is provided with a vent fan, check for free operation of the fan blade. The fan bearings are permanently lubricated; any binding, abnormal noise or vibration necessitates replacement of the fan assembly. Check and replace the fan filter element if it appears dirty or obstructed with dust.
- Visually inspect all mechanical parts for freedom of operation with no misalignment, binding or interference. Check all cabling for sufficient slack to prevent cable strain as well as adequate restraint to prevent abrasion or chaffing during antenna and feed movement.

## **Drive System Voltage and Current Checks**

- Check security of antenna mounting and interconnecting assembly hardware. Be certain all electrical grounding connections (including cross-axis grounding straps) are intact and secure, not corroded or broken. Thoroughly clean any noticeable corroded portions of grounding cables, unplated portion of universal terminals and corresponding mounting surfaces using a wire brush. Replace rather than tighten any loose A-325 structural hardware. The hardware distorts at initial installation and once loosened will not maintain the required high strength friction connection. All other assembly and installation hardware should be tightened to its original torqued condition. When installing new structural hardware, do not use a wrench with a lever arm longer than two feet.
- Examine painted aluminum and galvanized surfaces and touch-up where required.

At the conclusion of the installation procedure prior to turning the system over to the station facility, an installation acceptance check off sheet was prepared and duly signed off if installed by Andrew crew. Part of this check off included voltage readings retaken to determine if proper voltage was available. Current readings were also taken as a reference for future comparison to serve as a troubleshooting aid in determining possible equipment degradation and shortened life. Any current reading taken during the following procedure that varies by more than five percent from the pre-established reference values necessitates troubleshooting the particular system involved to determine the cause and required corrective action.

### **Step 1**

Approximately every three months and during a period of down time, disconnect as applicable the RF transmitter and all power supplies. The main disconnect switch in the main load center box at the antenna site must be in the ON position and the LOCAL/REMOTE switch in the local control motor drive controller must be in the LOCAL position.

### **Step 2**

Open the outer local control/motor drive controller door at the antenna site to gain access to the conductors supplying power to the azimuth, elevation, and polarization drive motors.

**NOTE:** During the following procedures, the antenna drives (azimuth, elevation, and polarization) will be powered to rotate the antenna and feed in both directions of travel. Check that this condition can be tolerated from a safety as well as an operational standpoint, and that the electrical limits are not reached before the testing is concluded. Reaching an electrical limit before concluding a test necessitates rotating the antenna or feed in the opposite direction a sufficient distance to permit retesting in the desired direction.

### **Step 3**

Turn the FEED CCW/CW switch to either the CW or CCW position and while the feed is rotating, carefully use a clamp on ammeter in accordance with the ammeter manufacturer's instructions to take current readings off each of the three conductors (phases) connected to the load side of the polarization motor circuit breaker. Record the current draw in the equipment log and compare the readings to the reference values entered in the installation/acceptance check off. If the readings differ by more than five percent, refer to appropriate troubleshooting information and perform applicable corrective action. Then take voltage readings off each of the three conductors; the readings should agree with each other within two percent.

- Step 4** Repeat preceding step (3) with the FEED CCW/OFF/CW switch in the alternate operating position.
- Step 5** Turn the AZIMUTH EAST/WEST switch to either position and while the antenna is rotating, carefully use a clamp on ammeter in accordance with the ammeter manufacturer's instructions to take current readings off each of the three conductors (phases) connected to the load side of the azimuth drive motor circuit breaker. Record the current draw in the equipment log and compare the readings to the reference values entered in the installation/acceptance check off. If the readings differ by more than five percent, refer to appropriate troubleshooting information and perform applicable corrective action. Then take voltage readings off each of the three conductors; the readings should agree with each other—within two percent.
- Step 6** Repeat steps (5) with the AZIMUTH EAST/WEST switch in the alternate operating position.
- Step 7** Turn the ELEVATION DOWN/UP switch to either position and while the antenna is rotating, carefully use a clamp on ammeter in accordance with the ammeter manufacturer's instructions to take current readings off each of the three conductors (phases) connected to the load side of the elevation drive motor circuit breaker. Record the current draw in the equipment log and compare the readings to the reference values entered in the installation/acceptance check off. If the readings differ by more than five percent, refer to appropriate troubleshooting information and perform applicable corrective action. Then take voltage readings off each of the three conductors; the readings should agree with each other within two percent.
- Step 8** Repeat steps (7) with the ELEVATION DOWN/UP switch in the alternate operating position.
- Step 9** If all voltage and current readings are within tolerance, close the local control/motor drive controller and place the LOCAL/REMOTE switch in the REMOTE position to return antenna control to the studio. Then close and lock the outer local control/motor drive controller door.

## **Preservation of Component Parts**

### **Aluminum Parts**

When preserving the component parts, refer to the following paragraphs in this section.

Remove all loose paint and corrosion by scraping, wire brushing, or using steel wool. If using steel wool near the feed window, make sure that none remains on the feed horn window. Edges of existing paint can be blended with the metal surface by using a fine grit sandpaper. Wipe the surface to be painted with a soft rag dampened in trichlorethylene, lacquer thinner or equal. Be certain to remove all loose paint, corrosion, imbedded dirt, grease, and oil deposits or the paint will not adhere to the surface. Lacquer thinner will dissolve paint if applied heavily and rubbed vigorously. The reflector may be washed with plain water if necessary. Do not use bleach, soap solutions, or kerosene as it is difficult to remove the residue. Allow the cleaned surface to dry thoroughly before priming.

Prime the cleaned surface by applying zinc chromate primer. The primer can be applied with a brush, roller, or pressurized spray. If necessary, thin the primer with lacquer thinner to the proper consistency. Feather primer onto adjacent painted surfaces;. Allow primer to thoroughly dry before applying the finish paint coat.

Paint all RF surfaces, such as the inside of the main reflector and subreflector with a high-reflectance white paint. This type of paint disperses light rays, reducing the focusing effect of the sun's radiation, thereby reducing heat build-up caused by the focused sun' rays on the feed system. Rear surfaces of the reflector and subreflector may be painted with a flat white enamel paint. The paint can be applied with a brush, roller, or pressurized spray. If necessary, thin the paint with the appropriate thinner to the proper consistency. Thoroughly paint over the primed surfaces and blend with the existing painted surface.

### **Galvanized Surfaces**

Remove all loose paint and corrosion by scraping, wire brushing, or using steel wool. Edges of existing paint can be blended with the metal surface by using a fine grit sandpaper. Wipe the surface to be painted with a soft rag dampened in trichlorethylene, lacquer thinner, or equal. be certain to remove all loose paint, corrosion, imbedded dirt, grease, and oil deposits or the paint will not adhere to the surface. Lacquer thinner will dissolve paint if applied heavily and rubbed vigorously. Do not use bleach, soap solutions, or kerosene as it is difficult to remove the residue. Allow the clean surface to dry thoroughly before painting.

Paint the cleaned surface with a zing-rich paint. The paint can be applied with a brush, roller, or pressurized spray. If necessary, thin the paint with the appropriate thinner to the proper consistency. Thoroughly paint over the cleaned surface and blend with the existing painted surface.

### **Lubrication**

For long life and trouble-free operation be certain not to extend the lubrication schedule beyond the frequency recommended in the Lubrication Chart. The frequency should be shortened if the antenna is subjected to an adverse environment (e.g., high temperature, extended periods of rainfall, high humidity, dust storms, etc). Any component or part should immediately be lubricated if during inspection or operation, rough, jarring, or intermittent motion is noted, or if squeaky or other unusual noises are heard. Lubrication is required on all metal-to-metal rolling or sliding parts. Us the lubricants recommended. Do not over lubricate. Over lubrication can often be as damaging as under lubrication. Prior to the application of lubricant to any parts, use a clean cloth and/or bristle brush

and remove any old lubricant to prevent an excessive build-up. Remove indicated access plugs from square tube weldment and apply lubricant to panning frame tube assembly and corresponding thrust pads. Securely replace access plugs in square tube weldment. Be certain to remove any protective caps and clean off each lubrication fitting prior to injecting fresh grease. The elevation and azimuth jackscrew assemblies are equipped with a grease fitting and corresponding pipe plug on opposite sides of the jack housing. Remove the appropriate pipe plug and fill with grease until lubricant seeps from the pipe plug opening. Replace and securely tighten pipe plug.

The following is a list of the lubricant characteristics:

- Mobil Temp SHC32 A non-soap hydrocarbon fluid type grease. Operating temperature range is -65 degrees to 350+ degrees Fahrenheit (-54 degrees to 177+ degrees Celsius).
- Mobil SHC624 A low temperature synthetic oil for worm gear reducers. Operating temperature range is -40 degrees to 125+ degrees Fahrenheit (-40 degrees to 52+ degrees Celsius).
- Moly Grease A grease lubricant containing molybdenum disulfide. Operating temperature range is -85 degrees to 300+ degrees Fahrenheit (-29 degrees to 149+ degrees Celsius).

## **Jackscrews/Motors**

Periodically inspect lifting screws on jackscrew assemblies to ensure adequate lubrication. Loosen Jackscrew boot clamps to expose the lifting screw assembly. Fully extend jackscrew assembly being careful not to exceed preset mechanical limits. Brush thin coating of Mobil SHC32 grease on exposed lifting screw. Replace boot and attach corresponding boot clamps. If lifting screw is rusty, remove existing lubricant with solvent and wire brush rusted area. Rinse with solvent and apply fresh grease.

Periodically inspect and remove dust or dirt deposits from the motor housings to avoid hindering the heat exchange with the ambient air. Slight dirt accumulation on the air vent screw through splash oil cannot be avoided; however, keep vent screw clean to ensure proper pressure compensation.

## **Gear Motor/Housing Fill Drain Requirements**

Lube points 2, 3, 7 and 8, shown in the Lubrication Chart, require removal of the indicated drain plugs and collecting/measuring the amount of SHC624 drain oil using measuring cup. The specified amount of oil must be added to the gear motor/housing (after installing the drain plug) via the fill/vent plug opening using supplied funnel. Addition of the oil requires use of an appropriate filling utensil. Use of a modified level stick will not correctly gauge the appropriate amount of oil in the gear housings.

## Lubrication Chart

Lube Point No.	Components to be Lubricated	Frequency (Months)				Type of Service	Type of Lube	No. of Lube Points or Quantity
		1	3	6	12			
1.	Elevation Jackscrew Housing		X			Pressure Fitting	SHC32	1
2. <sup>1</sup>	Elevation Jackscrew Gear Housing Fill and Drain		I*	C**		Pipe Plugs	SHC624	10 Oz
3. <sup>2</sup>	Elevation Drive Intermediate Gearbox Fill and Drain		I*	C**		Pipe Plugs	SHC624	34 Oz.
4.	Elevation Jackscrew Pivot Pin, upper		X			Pressure Fitting	SHC32	1
5.	Azimuth Jackscrew Pivot Pin, front		X			Pressure Fitting	SHC32	1
6.	Azimuth Jackscrew Housing		X			Pressure Fitting	SHC32	2
7. <sup>1</sup>	Azimuth Jackscrew Gear Housing Fill and Drain		I*	C**		Pipe Plugs	SHC624	4 Oz.
8. <sup>2</sup>	Azimuth Drive Intermediate Gearbox Fill and Drain		I*	C**		Pipe Plugs	SHC624	34 Oz.
9.	Polarization Drive Gear			X		Brush	SHC32	Minimum Surface Coverage
10.	Feed Rotation Worm Gear Pillow Blocks			X		Pressure Fitting	SHC32	2

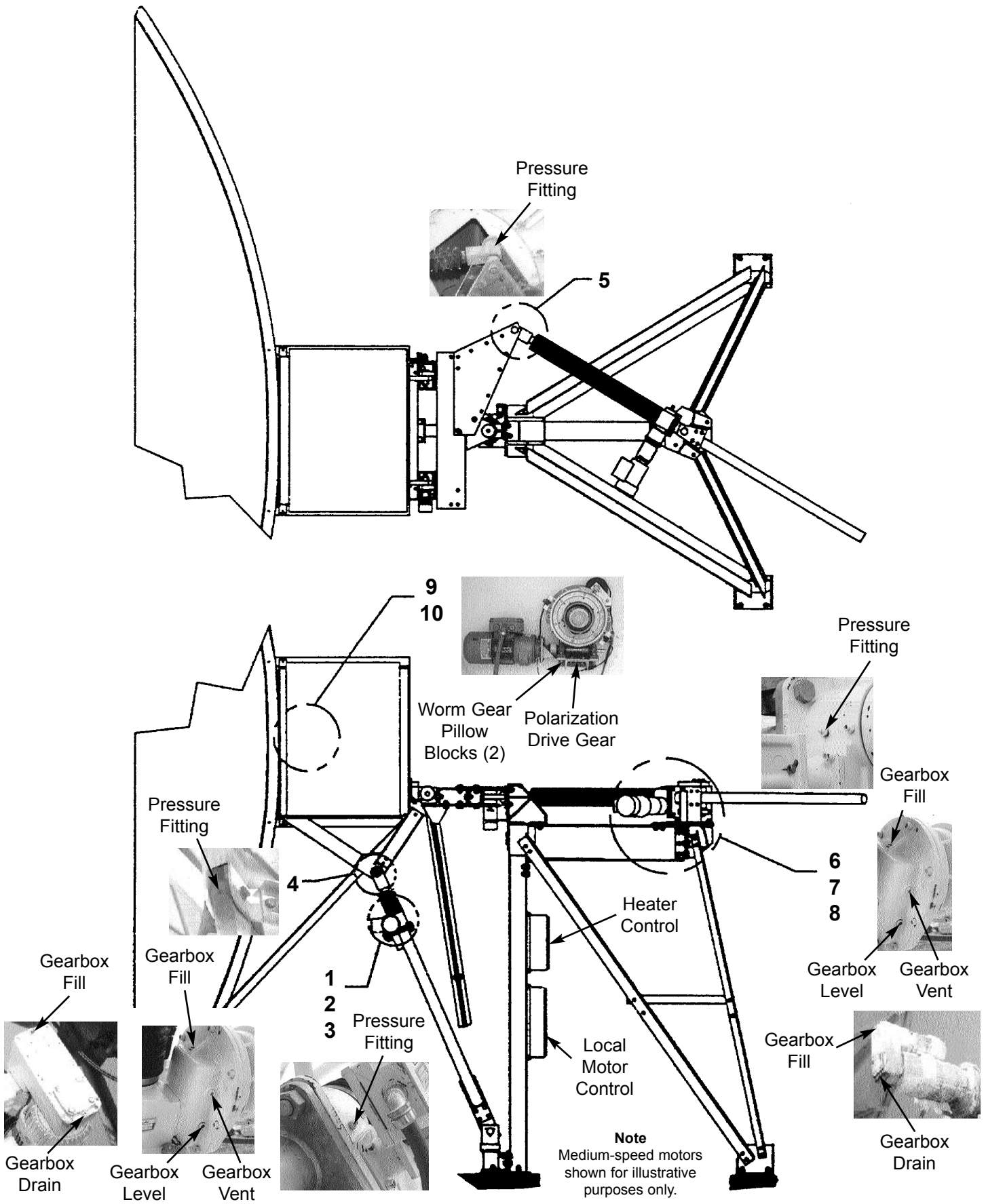
X = Lubricate      I = Inspect      C = Change

\* Inspection requires checking for visible signs of oil leakage, draining replacing and adding oil to ensure appropriate oil level requirements. Excessively dirty oil will require fresh oil replacement. If oil leakage is found to be excessive, refer to appropriate troubleshooting information and perform applicable corrective action. Periodic inspection procedures can be less frequent after first or second scheduled inspections.

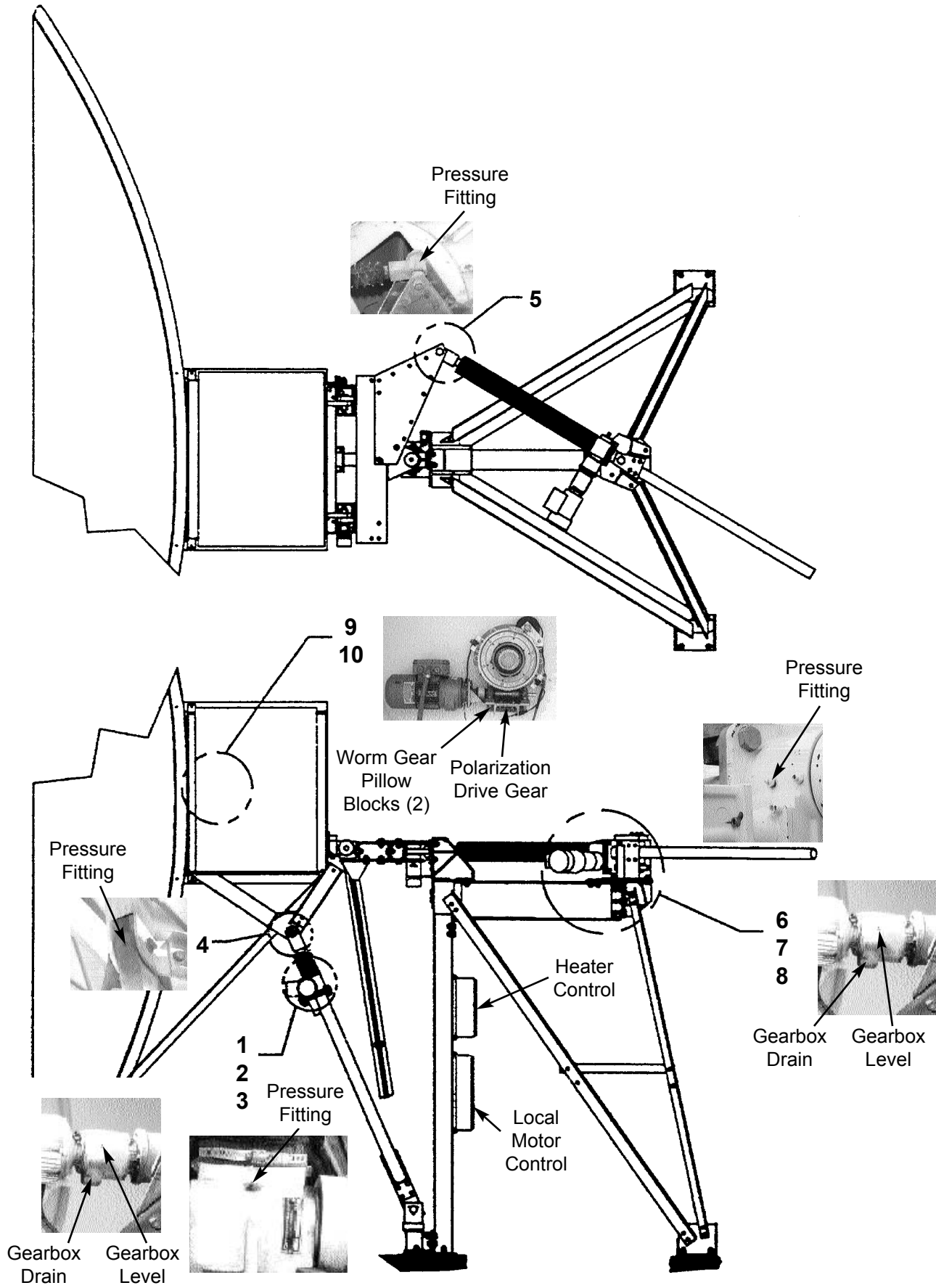
\*\* Initial oil change requirements include flushing gear boxes with a standard cleaning agent.

1 Type 'HS' and 'STHS' drives only. 10 oz. required for gearbox on Type 'MS' drives.

2 Type 'HS' and 'STHS' drives only.



### High-Speed Antenna Lubrication Points



**Medium-Speed Antenna Lubrication Points**



## APPENDIX 'A'

This section contains the formulas for determining the pointing capabilities of the modular mount earth station antenna.

Formulas for calculating true azimuth (**AZ**), true elevation (**EL**), relative angle between true azimuth and mount pointing angle (**dAZ**) and strut lengths of the earth station are given below:

Given the earth station latitude, longitude, azimuth setting of mount (**AZm**) and satellite longitude (over the equator), the following calculations can be made:

For earth stations north of the equator:

$$\mathbf{AZ} = 180^\circ + \text{arc tan} (\tan \theta / \sin \alpha )$$

For earth stations south of the equator:

$$\mathbf{AZ} = 360^\circ - \text{arc tan} (\tan \theta / \sin |\alpha| )$$

Where:

**AZ** = true azimuth to view satellite, in degrees East (clockwise) of True North.

$\alpha$  = earth station latitude in degrees.

$\theta$  = satellite longitude minus earth station longitude, in degrees.

**NOTE:** Earth station latitude values are positive for sites located north of the equator and negative for sites south of the equator. Longitude values are positive for earth station sites or satellite positions west of Greenwich and negative east of Greenwich.

$$\mathbf{dAZ} = \mathbf{AZ} - \mathbf{AZm}$$

Where:

**AZm** = azimuth at which mount is set in degrees East (clockwise) of True North.

**dAZ** = relative angle between true azimuth angle looking at satellite and mount pointing direction in degrees.

$$\mathbf{EL} = 90^\circ - \mathbf{T} - \mathbf{R}$$

Where:

**EL** = true elevation angle to view satellite in degrees.

$$\mathbf{R} = \text{arc cos} (\cos \theta \cos \alpha)$$

$$\mathbf{T} = \text{arc tan} [\sin R / (6.6166 - \cos R)]$$

Pin to pin length of elevation strut in inches:

$$\text{Equation (1): } \mathbf{XEL} = \sqrt{26259.7740 - 14970.1377 [\cos(27.0362^\circ + \mathbf{EL})]}$$

**For the -90° to +30° dAZ Range:**

Pin to pin length of azimuth strut in inches:

$$\text{Equation (2): } \mathbf{LAZ} = \sqrt{7571.2865 - 6181.928 [\cos(105^\circ + \mathbf{dAZ})]}$$

**For the -60° to +60° dAZ Range:**

Pin to pin length of azimuth strut in inches:

$$\text{Equation (3): } \mathbf{LAZ} = \sqrt{7571.2865 - 6181.928 [\cos(75^\circ - \mathbf{dAZ})]}$$

**For the -30° to +90° dAZ Range:**

Pin to pin length of azimuth strut in inches:

$$\text{Equation (4): } \mathbf{LAZ} = \sqrt{7571.2865 - 6181.928 [\cos(105^\circ - \mathbf{dAZ})]}$$

**NOTE:** Azimuth strut pin-to-pin length values are based upon strut attachment to **right** portion of structure as viewed from rear of antenna for -60 to +60° and -30 to +90° azimuth ranges. Values for -90 to +30° azimuth range are based on strut attachment to **left** portion of structure as viewed from rear of antenna.

**APPENDIX 'B'**  
**Sector Change Process**

The following is a generalized procedure of the actions required to change the 9.3M tripod mount from an existing azimuth range (sector) to a new one. (For example: from Azimuth range -60/+60 to -90/+30. Refer to APPENDIX 'A'.)

**A. Tools Required:**

- a. (2) Spud Wrenches
- b. (2) 1 7/16" open end wrenches
- c. (2) 1 5/8" open end wrenches
- d. 1 5/8" Socket for 3/4" drive
- e. 1 7/16 Socket for 3/4" drive
- f. 3/4" Drive ratchet
- g. (2) 9/16" wrenches
- h. (2) come-alongs
- i. (2) Tag lines
- j. (2) Experienced riggers
- k. Extension Ladder (Man lift Recommended)
- l. 9/64" Allen Wrench Set
- m. (2) 1/2" wrenches
- n. 9/16" socket & ratchet
- o. Safety Harnesses
- p. Hammer
- q. Set of Replacement Hardware

**B. Procedure:**

- 1. Disable Tracking System.
- 2. Remove vertical handrails from Maintenance Platform and Landing Platform. (to allow antenna to go to a high elevation angle for less wind loads).
- 3. Loosen or remove upper mechanical Elevation limit.
- 4. Increase Elevation Angle to maximum while watching for interference near Elevation Pivot Assembly.
- 5. Retract Azimuth Jackscrew within about 1 foot of full retraction.
- 6. Stabilize reflector using (2) come-alongs. Attach between panning assembly support legs 200107 and rear support legs 200109. Repeat on opposite side.
- 7. Loosen and Remove Jackscrew hardware between 200035 outrigger and 200022 pivot assembly.
- 8. Adjust jackscrew to full retraction using hand wheel.
- 9. Loosen/Remove Jackscrew Pivot Assembly hardware except for 1/2"x2.25" Lg. stud, as shown in Figure 19A on page 24 of manual.
- 10. Remove maintenance platform attachments if present. (i.e. - ladder)
- 11. Secure Azimuth Jackscrew with rope to landing platform for safety.
- 12. Swivel Jack and Azimuth Pivot Assembly 201021 slowly toward opposite side of panning assembly until mount holes in Azimuth Pivot Assembly line up. Use Spud wrench to assist further alignment.
- 13. Insert new A325 Hardware to secure Azimuth Pivot Assembly in new position.
- 14. Extend Jackscrew.
- 15. Swing Antenna using come-alongs and/or tag-lines to align Jackscrew pivot connection with panning frame holes. Use Spud wrench to assist further alignment.
- 16. Connect using new hardware.



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