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GENERAL DYNAMICS

SATCOM Technologies

OPERATION & MAINTENANCE MANUAL FOR VERTEXRSI MODEL 13.1 METER SATELLITE EARTH STATION ANTENNA MODEL 13.1 KPC/KPK

600-0295

**Revision C
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ESD: **The Electrostatic Sensitive Device (ESD) appears at the beginning of any procedure or procedural step that includes the handling of equipment sensitive to damage from electrostatic discharge.**

General Warnings and Cautions are also provided at the front of the document. These Warnings and Cautions should be read by anyone who is involved with installation, has access to the equipment or is assigned to perform maintenance on the equipment.

CAUTIONARY NOTICE

Although SATCOM Technologies has attempted to detail in this document all areas of possible danger to personnel in connection with the use of this equipment, personnel should use caution when installing, operating and servicing this equipment. Care should be taken to avoid electrical shock, whether the hazard is caused by design or malfunction. SATCOM Technologies is specifically not liable for any damage or injury arising from a technician's failure to follow the instructions contained in this document or his failure to exercise due care and caution in the installation, operation and service of this equipment. SATCOM Technologies shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

This document is intended as a general guide for trained and qualified personnel who are aware of the dangers of handling potentially hazardous electrical and electronic circuits. This document is not intended to contain a complete statement of all safety precautions that should be observed by personnel in using this or other electronic equipment.

ELECTRICAL HAZARDS

The antenna and feed system supplied by SATCOM Technologies is designed to be integrated with various types of electronic equipment. This system, if integrated with high power amplifiers or traveling wave tubes, will be capable of transmitting microwave energy at varying power levels. If transmitting microwave power, SATCOM Technologies cautions the end-user to review all applicable local, federal and international regulations and to comply with all such regulations in the operation and maintenance of the integrated system.

The electrical currents and voltages associated with this equipment, whether supplied by SATCOM Technologies or others, are dangerous. Personnel must at all times observe safety regulations.

- It is recommended that a lockout/tagout process be utilized while servicing the antenna system. In the United States, see OSHA 1910.147.
- Always disconnect power before opening covers, doors, enclosures, gates, panels or shields.
- Always use grounding sticks and short out high voltage points before servicing.
- Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields.
- Keep away from live circuits.
- Know your equipment and do not take risks.
- Always remove all power to the system prior to working on the antenna, the reflector assembly, the reflector backup assembly or the feed assembly.
- Always tag all circuits noting that the power is OFF, the date and your name, prior to commencing any work on that system.

In case of emergency, be sure that power is disconnected.

POTENTIAL DAMAGE TO ANTENNA

The antenna limit switches and resolvers have been pre-set to allow for maximum antenna performance. Any subsequent adjustment may jeopardize antenna performance and/or result in damage to the antenna.

SAFETY NOTICE

The following safety procedures are listed to remind those performing any work on the antenna system that safety rules must be observed. Failure to observe safety rules may result in serious injury or death. Always work safely and in accordance with established procedures.

- It is recommended that a lockout/tagout process be utilized while servicing the antenna system. In the United States, see OSHA 1910.147.
- Care shall be taken in all operations to safeguard other people as well as property and to comply with all local safety procedures as established by the customer's site representative, as well as local building codes and fire protection standards.
- All persons performing work on the antenna system shall also comply with the Occupational Safety and Health Act (OSHA) standards and all other federal state and local laws, ordinances, regulations and codes relating to designated work.
- Unless the customer's representative on site specifically designates an individual responsible for site safety, the SATCOM Technologies Site Supervisor shall be responsible for and establish a site safety program for the SATCOM Technologies installation work. The site safety program shall incorporate all SATCOM Technologies safety procedures and requirements
- Never make internal adjustments or perform maintenance or service when alone or fatigued.

ELECTROMAGNETIC RADIATION

- It is recommended that a lockout/tagout process be utilized while servicing the antenna system. In the United States, see OSHA 1910.147.
- Do not stand in the direct path of the feed system when the system is transmitting!
- Do not work on the feed system when the system is on!

ALWAYS WORK SAFELY!

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1.0 INTRODUCTION

The purpose of this manual is to provide information for the operation and maintenance of the Model 13.1-meter kingpost antenna. Should any repair or maintenance problems arise which are not discussed within this manual, such problems should be referred to the equipment manufacturer:

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2600 N. Longview St.
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A listing of antenna components and characteristics are included, followed by various operation and maintenance procedures where applicable.

Refer to preceding Table of Contents to locate section(s) describing operational or maintenance information required.

2.0 ANTENNA COMPONENTS AND CHARACTERISTICS

The VertexRSI Kingpost Pedestal Antenna is designed and engineered for maximum life and minimum maintenance. The high gain feed system and rigid reflector assembly are supported by the all-steel, four-point mount Kingpost Pedestal. The design of the system assures survival of winds up to 125 miles per hour at any look angle while still allowing fast and accurate transition between satellites under normal operating conditions.

This section lists a brief general description of the antenna system. More detailed operation and maintenance instructions are covered in subsequent sections. All pertinent antenna system drawings are referenced in the Project Print Pack shipped with the antenna.

2.1 Pedestal Assembly

A two-axis elevation-over-azimuth kingpost pedestal is used to accurately position the RF axis of the antenna. The assembly consists of all-steel construction and includes the following:

- Kingpost pedestal
- Rear support legs (2)
- Jack drive assemblies
- AZ and EL Azimuth pintle assemblies
- Azimuth drive pivot (deadman) assembly

Damage, repair, or standard maintenance should be addressed of immediately on all parts of the antenna structure to avoid any weather accelerated deterioration. Refer to Section 3.0 for maintenance schedules and procedures.

Kingpost travel capabilities:

Elevation Axis Travel:	0 to 90 continuous
Azimuth Axis Travel:	180 total in three increments of 70 each, 15 overlap between the 70 segments.

2.2 Reflector Assembly

A 13.1-meter diameter modified paraboloid reflector, constructed from 36 high accuracy panels, is combined with a high performance cassegrain feed system to give maximum efficiency with low sidelobes.

2.3 Elevation Drive Assembly

Basic characteristics of the elevation drive assembly:

Anti-Backlash Worm gear screw jack

- Capacity: 50 tons
- Ratio: 32:1, 48 revolutions of the input shaft for 1 inch of jack extension or retraction
- Jack stroke: 85½ inches with rod end and stop sleeve installed
- Travel limits: External stop nut attached to ends of jack screw

Gearmotor

- Gearmotors vary according to the Control System. Refer to the Print Pack shipped with the antenna.

2.4 Azimuth Drive Assembly

Basic characteristics of the azimuth drive assembly:

Anti-Backlash Worm gear screw jack:

- Capacity: 50 tons
- Ratio: 32:1 ratio, 48 revolutions of the input shaft for 1 inch of jack extension or retraction.
- Jack stroke: 102 inches with rod end and stop sleeve installed.
- Travel limits: External stop nut attached to ends of jack screw.

Gearmotor

- Gearmotors vary according to the Control System. Refer to the Print Pack shipped with the antenna.

2.5 Polarization Drive Assembly (For LP Feeds With External Pol Drive Only)

Polarization rotation is accomplished by a motorized chain drive attached to the feed support tube. The feed support tube turns on three grooved load rollers.

The drive assembly is powered by a synchronous motor that drives a right-angle dual-output gearbox. A drive sprocket is attached to one output shaft, while a speed reducer and transducer are connected to the other.

In this manner, a 1:1 ratio is obtained between the rotation of the feed tube (as turned by the chain and drive sprocket) and the transducer. A limit switch provides an electrical interlock.

Polarization drive speed is nominally 1 /sec.

2.6 Couplings

The gear motors are coupled to screw jacks with three-jaw finished bore couplings and elastomer inserts. With the jaw-engaging couplings, there is no alignment necessary. Each half is installed on its respective shaft. The insert is placed into either half and the engagement is made when the gearbox is mated with its adapter flange.

2.7 Limit Switches

Limit switches are provided on the elevation and the azimuth axes to prevent structural and/or electrical damage due to excessive rotation (overtravel) of the system. The limit switches are activated by tripping the lever arm against an adjustable stop angle. The lever arms and the stops are adjustable to the travel range.

2.8 Angular Position Indication

Angular position indication is given by two size 11 (standard) or size 20 (high accuracy) transducers or optical encoders, depending on the Control System. Refer to the PROJECT CONFIGURATION for the specific Control System utilized. One transducer is mounted on each axis (azimuth and elevation). Their electrical outputs are monitored as digital readouts integral with the antenna position controller.

Additional optional position indication is provided by direct reading mechanical vernier and protractor arrangements, one on the azimuth axis and one on the elevation axis. The protractor and the vernier are installed so that the scribed mark at zero (0) on the protractor and the similar mark at zero (0) on the vernier are precisely aligned when the antenna is at zero look angle (azimuth or elevation). For any rotation about either axis, the mark at zero (zero mark) on the vernier will line up with the antenna look angle (in degrees) on the protractor. When the zero mark on the vernier falls between two degree marks on the protractor, the vernier may be read to determine the look angle to the nearest five (5) minutes of arc. For example, if the zero mark on the vernier falls between 23 degrees and 24 degrees on the protractor, and the mark at 15 on the vernier is aligned with any mark on the protractor, the look angle is 23 degrees and 15 minutes (23 and 15'). Note that while the vernier can be read on either side of the zero mark, it should always be read in the direction of the increasing angle on the protractor.

2.9 Reflector Backup Structure

The reflector backup structure is comprised of 24 steel radial rib trusses emanating from a center hub structure. Interconnecting hoop members are provided to furnish the structure with maximum stiffness capability. The truss work on the rear of the reflector is provided to eliminate surface distortion which may result from dead weight deflections of the supporting members causing rotations at the panel supports.

2.10 Reflector Panels

Thirty-six trapezoidal aluminum reflector panels are provided with each reflector. The panels are designed to meet the stiffness and load requirements for the overall specification. The panels will support, without permanent deformation of surface accuracy, a carefully placed 300-pound soft-bottom shoe load.

2.11 Subreflector Support Assembly

The subreflector support structure consists of four spars fastened together by an apex assembly to form a space truss protruding from the main reflector backup structure. The spars have been structurally optimized to minimize the RF blockage and relative displacements between the subreflector, feed launcher, and main reflector axis.

WARNING! REMOVE POWER TO SYSTEM PRIOR TO MANUALLY DRIVING ANTENNA. REMOVE RATCHET FROM THE END OF THE JACK INPUT SHAFT OR GEARMOTOR SHAFT BEFORE RETURNING POWER. INJURY TO PERSONNEL AND/OR DAMAGE TO THE EQUIPMENT MAY RESULT, IF NOT REMOVED.

2.12 Manual Operation Of Drive Assemblies

The jack drive assemblies can be manually operated by means of a ratchet rotation or an electric drill with a socket fitting on the end of the jack input shaft. It can also be driven at the end of the motor shaft under the plug on the end of the fan shroud.

2.13 Azimuth Jack Assembly Repositioning Procedure

When an azimuth look angle is desired which is outside the range of the existing jack position, the following steps are the recommended repositioning procedures under calm wind conditions.

Note: If the antenna is equipped with the optional Jack Sector Transfer Pin, refer to Appendix A.

1. Clean the dirt and grease from the exposed portion of the azimuth jack screw.
2. Drive the reflector to its highest elevation look angle.
3. Disconnect azimuth limit switch.
4. Retract (or extend) the azimuth jack its full travel.
5. Secure antenna so that the pedestal cannot rotate in azimuth. This should be done in a manner that will not damage the protective finish, whether paint or galvanizing.

Note: One such securing method is to place a twelve-ton hydraulic jack beneath the 1" thick plate on the bottom of the pedestal (the plate that forms half the clevis for the azimuth jack trunnion), with a nominal 2" wooden board between the jack and the pedestal bottom. Tighten the jack until the wood shows some deformation, but avoid forcing the jack until the wood splits.

6. Remove the six bolts securing the deadman pivot and azimuth jack to the deadman base.
7. Extend (or retract) jack until the six bolt holes in the deadman pivot match the corresponding holes in the deadman base in the adjacent position, rotating the jack about its trunnion axis by hand.
8. Replace the six bolts, washers, and nuts that hold the deadman assembly together with new hardware and tighten sequentially, alternate rather than adjacent bolts until all bear the torque value 580 to 640 lb.-ft. dry or 440 to 485 lb.-ft. lubricated.
9. Remove hydraulic jack or other means of securing method.
10. Repeat Steps 4 through 9 if the next base position is the desired one.

11. Connect and re-adjust limit switch, making sure limits are within travel range of jack.
12. Recoat exposed jack screw with lubricant method mentioned in Section 3.5.

2.14 Material Finishes

2.14.1 Reflector Panels

All aluminum materials have been cleaned, acid-dipped, and neutralized. The face of the main reflector panels have a coat of flat white heat diffusing paint. For field touch-up of the reflector surface refer to Section 3.1.

WARNING! HIGH GLOSS OR SEMI-GLOSS PAINT SHALL NOT BE USED ON REFLECTOR PANEL FACE OR SUBREFLECTOR SURFACE.

2.14.2 Steel Structure

The steel structure of the VertexRSI Kingpost Pedestal Antenna includes the following:

- Kingpost pedestal (hot dip galvanized)
- Rear support legs (hot dip galvanized)
- Jack drive assemblies (primed and painted silver)
- Reflector backup structure (hot dip galvanized)
- Ladders and platforms (hot dip galvanized)

2.14.3 Finish Options

As an option, some parts of the antenna structure may be painted after hot dip galvanizing or painted with site specific colors. If any discrepancies occur that are not specifically covered in the accompanying documentation or questions about a particular finish arise, contact SATCOM Technologies' Customer Service.

3.0 RECOMMENDED MAINTENANCE SCHEDULES AND PROCEDURES

3.1 Pedestal/Reflector Assembly Protective Finish

The pedestal/reflector assembly should be inspected at least quarterly and should be maintained as follows:

Note: The following describes processes and materials to repair finishes typical to the standard product. In the event of a customer specific finish, please refer to the accompanying documentation or contact SATCOM Technologies' Customer Service.

1. Remove accumulations of dirt and/or grease using a solution of hot water and detergent. Follow cleaning with a clear water rinse.
2. Repair damaged or deteriorated surface finishes as follows.

3.1.1 Galvanized Steel, Reflector Back-Up Structure And Pedestal Assembly

Reference the following General Dynamics SATCOM Technologies documents and procedure when touch-up of surface panels is necessary:

- 400-0259 Manufacturing Process Specification (Galvanized Surfaces Only)
 - 450-0072 Paint Requirement (Painted Surfaces Only)
 - 460-0043 Manufacturing Process Specification (Painted Surfaces Only)
1. Clean thoroughly using a solvent for greasy areas; hot water and detergent for dirt accumulations.
 2. Wire brush to remove oxidation.
 3. Where the galvanized finish is damaged, apply a coat of cold galvanizing type paint, aerosol or liquid in accordance with General Dynamics SATCOM Technologies procedure 400-0259.
 4. Where the painted finish is damaged, apply a coat of gloss white per 460-0043.

3.1.2 Reflector surface panels (painted aluminum)

Reference the following General Dynamics SATCOM Technologies documents and procedure when touch-up of surface panels is necessary:

- 450-0009 Paint Requirement (Flat White)
 - 450-0072 Paint Requirement (Primer)
 - 460-0009 Manufacturing Process Specification (For Coating Steel or Aluminum)
 - 460-0043 Manufacturing Process Specification (Priming)
1. Lightly sand damaged area.
 2. Clean sanded area to remove any particles left by sanding.
 3. Apply one coat of primer.
 4. Allow primer to air dry.
 5. Apply the first coat of flat white paint.
 6. Allow first coat of flat white paint to dry thoroughly.
 7. Apply second coat of flat white paint.

3.1.3 Miscellaneous Painted Aluminum Components

Reference the following General Dynamics SATCOM Technologies documents and procedure when touch-up of surface panels is necessary:

- 450-0001 Paint Requirement (Gloss White)
- 450-0072 Paint Requirement (Primer)
- 460-0009 Manufacturing Process Specification (For Coating Steel or Aluminum)
- 460-0043 Manufacturing Process Specification (Priming)
 1. Lightly sand damaged area.
 2. Clean sanded area to remove any particles left by sanding.
 3. Apply one coat of primer.
 4. Allow primer to air dry.
 5. Apply the first coat of paint.
 6. Allow first coat of paint to dry thoroughly.
 7. Apply second coat of paint.

3.1.4 Miscellaneous Painted Steel Components

Reference the following General Dynamics SATCOM Technologies documents and procedure when touch-up of surface is necessary:

- 450-0001 Paint Requirement (Gloss White)
- 450-0072 Paint Requirement (Primer)
- 460-0009 Manufacturing Process Specification (For Coating Steel or Aluminum)
- 460-0043 Manufacturing Process Specification (Priming)
 1. Lightly sand damaged area.
 2. Clean sanded area to remove any particles left by sanding.
 3. Apply one coat of primer.
 4. Allow primer to air dry.
 5. Apply the first coat of paint.
 6. Allow first coat of paint to dry thoroughly.
 7. Apply second coat of paint.

3.2 Assembly Hardware

Specification for Structural Joints Using ASTM A325 or A490 Bolts taken from the ninth edition of the Manual of Steel Construction, Allowable Stress Design. Fasteners meeting the American Society for Testing and Materials (ASTM) A325 Specification or the Federal Specification, FF-S-85C, for grade 5 steel, are considered to be high strength fasteners.

Note: Galvanized ASTM A325 high strength structural bolts should not be reused. Retightening previously tightened bolts which have been loosened by tightening adjacent bolts are not considered to be a reuse.

3.3 Foundation Anchor Bolts (and Other Galvanized Steel)

Deteriorated surface finish on protruding anchor bolts and other galvanized steel shall be repaired as follows:

1. Clean thoroughly using a solvent for greasy areas; hot water and detergent for dirt accumulations.
2. Wire brush to remove rust and oxides.
3. Apply a coat of a cold galvanizing type paint (either aerosol or liquid).

3.4 Lubrication Schedule

Table 1 identifies the items on the antenna which require lubrication. Figure 1 shows typical locations and number of grease fittings. Refer to the installation assembly drawings for locations requiring lubrication.

3.5 Jacks And Gearboxes

The gearing in the machine screw jacks must be lubricated with Almagard #3751 grease.

Note: Almagard #3751 is the standard recommended grease.

Refer to the Project Print Pack shipped with the antenna to confirm site specific lubricants. For normal operation, jacks should be greased at least once a month. Under severe use, (i.e. steptrack operation on one satellite or many changeovers between satellites daily) jacks should be lubricated twice a month. There are two (2) grease fitting locations on each wormscrew jack both on the worm shaft housing, and a plug on the screw housing.

At the screw housing location, remove the plug; at the worm shaft housing location, fill alternately until grease comes out the plug hole in the screw housing. Replace the plug.

Important: DO NOT MIX GREASES.

Every two months, remove the boot. The exposed jack screw should be cleaned and coated with a thin coating of the Almagard #3751 grease.

The grease should be painted on with a paint brush so that a film of at least .03 inches remains on all exposed surfaces of the jack screw and the boot replaced. Annually the boot should be removed and the jack screw extended to the limit before cleaning and coating. In this case, the housing lubrication should be delayed until after the boot is replaced and the jack screw retracted to the operating point in order to insure maximum grease retention.

Improved boot life can be obtained by coating the boot with a silicone-based protectant, such as Armor All[®], every two months.

The gearmotor lubrication levels should be checked at least every two (2) months and new lubricant should be added as necessary. Refer to the Project Print Pack shipped with the antenna for the proper lubricant. It is not necessary to change out the oil in the gearboxes for the life of the antenna.

3.6 Bearing Lubrication

The following paragraphs describe the function, location, and lubrication of the remaining moving mechanisms of the antenna system which require lubrication.

The bearings used on the pedestal assembly are the elevation axis bearing (2), the azimuth axis bearing (2), and the elevation and azimuth drive jack rod end bushing (1).

Bearings should be lubricated at least every two months. Clean all dirt off the grease fittings prior to lubricating bearings. Inject Almagard #3751 grease, using a conventional pump-type grease gun.

3.7 Elevation Axis Bearings

The reflector is attached to the pedestal at the elevation axis through two self aligning spherical bushings, which are installed in the Pedestal Assembly.

The elevation axis grease fittings are located on the elevation lugs protruding from the pedestal.

3.8 Azimuth Axis Bearings

The azimuth axis of the antenna is defined by the bearings at the upper and lower pintles on the back side of the pedestal. The upper bearing is a self aligning spherical bushing. The lower pintle uses a radial bearing and a thrust bearing. Grease fittings are provided on their respective housings.

3.9 Drive Assembly Bearings

A spherical bushing is used at the end of the elevation jack screw drive assembly to provide pivoting action at this point. A spherical bushing is also used at the end of the azimuth jackscrew drive assembly for pivoting action.

The elevation drive assembly bearing grease fitting is located on the hub jack lug.

The azimuth jackscrew assembly bearing grease fitting is located at the azimuth jackscrew rod end.

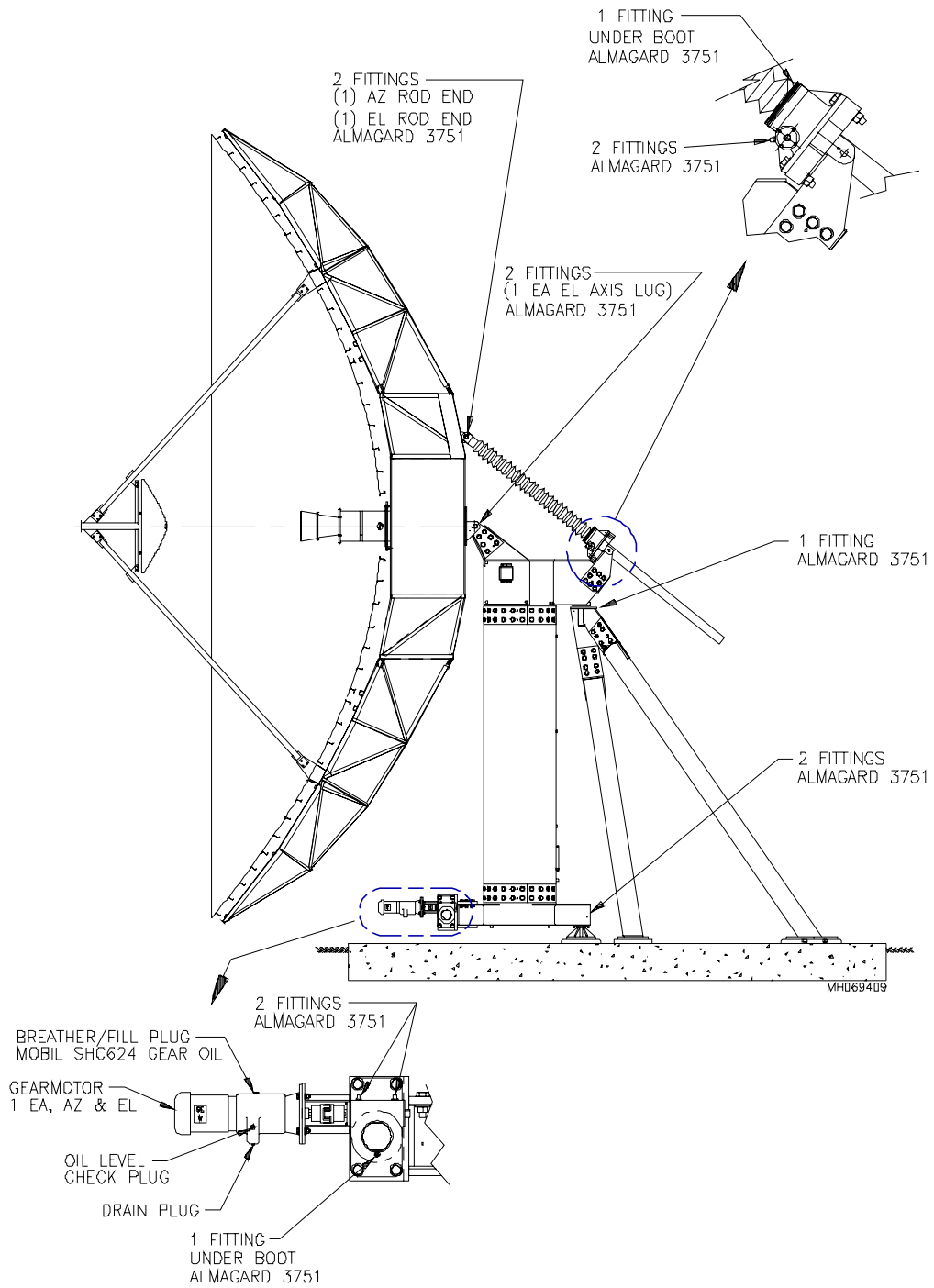


Figure 1. Antenna Lubrication Points

Table 1. Lubrication Schedule

ITEM	FREQUENCY	LUBRICANT	REMARKS
1. Screw Jack Housing	Normal Operation: Once per month. Severe Operation: Twice per month	Lubrication Engineers Almagard 3751 Grease	Grease fitting on head of jack, 2 places. See Section 3.5 for additional remarks.
2. Elevation Bearings	Every 2 Months	Lubrication Engineers Almagard 3751 Grease	Grease fitting on pedestal elevation lug, 1 place each side
3. Azimuth Bearings	Every 2 Months	Lubrication Engineers Almagard 3751 Grease	Grease fittings on azimuth axis bearing housing, 2 each per upper and lower bearing
4. Azimuth Rod End Bearing	Every 2 Months	Lubrication Engineers Almagard 3751 Grease	Grease fitting on end of rod end
5. Elevation Rod End Bearing	Every 2 Months	Lubrication Engineers Almagard 3751 Grease	Grease fitting in hub jack lug
6. Jack Screws	Every 2 Months	Lubrication Engineers Almagard 3751 Grease	During periodic maintenance, jack screw boots are to be removed and the screws lubricated as described in Section 3.5.
7. Az & EL Drive Gearboxes	Every 2 Months	Mobil SHC-624 Gear Oil	Oil plug on Gearbox housing

* Almagard 3751 is the recommended standard grease. Mobil SHC 629 is the recommended standard oil. Refer to the Project Print Pack shipped with the antenna for specific lubricants used.

Table 2. Jack Grease Chart

JACK SIZE	APPLICATION	GREASE CAPACITY		*RELUBRICATION AMOUNT	
		SHOTS	WEIGHT	SHOTS	WEIGHT
5 TON	3.5M	26	13 OZ.	3	1.5 Oz.
10 TON	4.6M/6.1M El.	50	25 Oz. or 1# 19 Oz.	5	2.5 Oz.
20 TON	6.1M Az./7.2M El. 8.1M El./9.0M El.	105	52.5 Oz. or 3# 4.5 Oz.	10	5 Oz.
25 TON	7.2M Az./8.1 Az. 9.0M El High Wind	140	70 Oz. or 4# 6 Oz.	10	5 Oz.
35 TON	9.0M Az./11M El.	140	70 Oz. or 4# 6 Oz.	10	5 Oz.
50 TON	11M Az./13M Az. & El. 9.0M Az High Wind	275	137.5 Oz or 8# 9.5 Oz.	15	7.5 Oz.
75 TON	15M/18M	400	200 Oz. or 12# 8 Oz.	15	7.5 Oz.
100 TON	21M	800	400 Oz. or 25#	15	7.5 Oz.

* Each grease fitting

3.10 Lightning Protection

The elevation and azimuth axis bearings are protected by looping ground cables from reflector to pedestal and from pedestal to perimeter ground.

Lightning rods are provided on the top radial beam and reflector apex.

The lightning rods and ground cables must be checked periodically to insure continuity of conductance (good metal to metal contact) to prevent damage to bearings during electrical storms.

3.11 Rod End Anti-Rotation Screw Adjustment

The anti-rotation setscrews in the jack rod ends of the antenna should be checked and adjusted during routine maintenance every three months or as necessary. Each rod end has three tapped holes in a circular pattern around the pin connecting the jack to the pedestal or reflector. Each hole contains a setscrew which is adjusted to minimize the tendency of the jack screw to rotate when the jack is extended or retracted. Figure 2 shows a typical anti-rotation setscrew location.

3.11.1 Inspection

The proper adjustment of the anti-rotation screws can be verified by watching the rod end of the jack during jack extension, such as during a tracking step. If the rod end rotates more than 5 degrees at the start of a step, the setscrews should be adjusted by the following procedure.

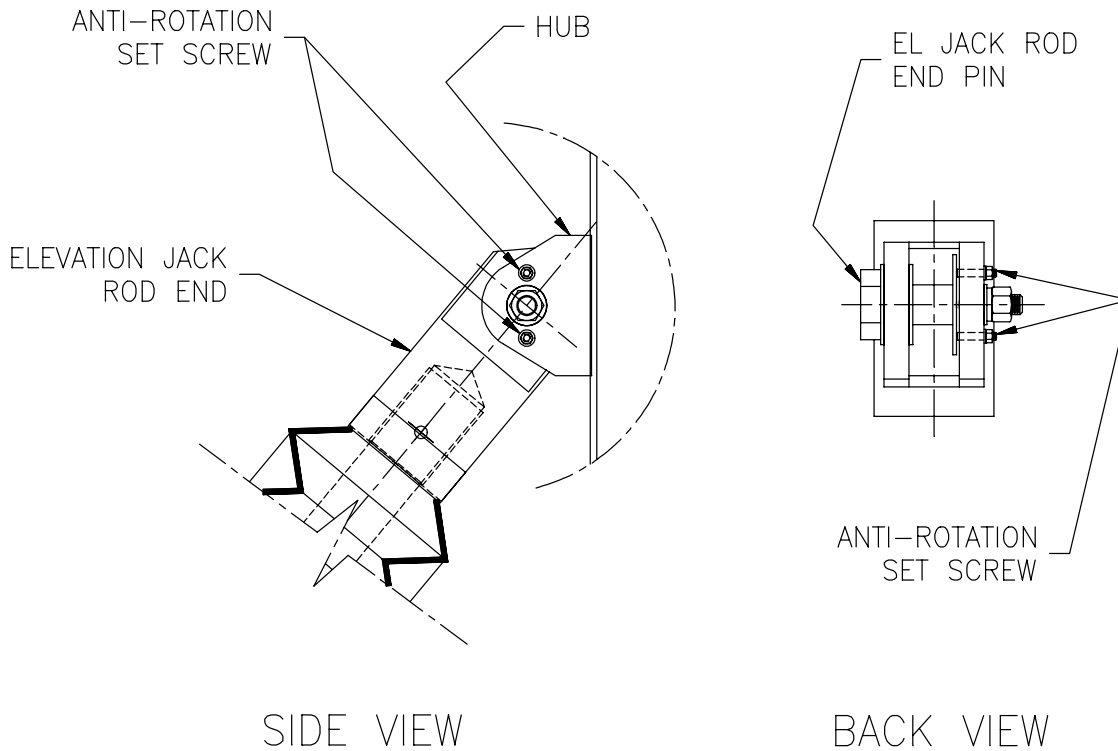


Figure 2. Anti-Rotation Setscrew Location

3.11.2 Adjustment

1. Examine the rod end near the pin. If tapped holes are visible, check each hole for a setscrew.
2. If no tapped holes are visible, remove the retaining ring and washer from one side of the pin. If no setscrews are found, replace the washer and retaining ring. Remove the retaining ring and washer from the other side.
3. Remove the setscrews from each hole.

Note: On some sizes of antennas there may be a "jam" screw on top of the adjusting screw. Both must be removed.

4. If the setscrews are damaged, replace them with new setscrews.
5. Adjust each screw such that it just contacts the washer inside the joint.
6. Replace the jam screws, washer and retaining ring.
7. Extend or retract the jack and observe the joint.
8. If the rotation is still excessive tighten the setscrews $\frac{1}{2}$ turn. Repeat Steps 7 and 8 until the rotation is less than 5 degrees.

4.0 OPERATION

4.1 Electrical Installation and Operation

SATCOM Technologies provides different electrical installations to interface with various antenna control systems to provide the antenna with varied levels of control; from simple jog to a sophisticated steptack system. For job specific Control System information see the Project Print Pack shipped with the antenna.

Operation & Maintenance Manuals for all General Dynamics SATCOM Technologies control system components are provided as part of the Control System.

5.0 WARRANTY

SATCOM Technologies warrants the items ordered hereunder at the time of shipment to be free from defects in material, workmanship, and to conform to the contract specification. SATCOM Technologies' liability under this Warranty shall terminate one (1) year after date of acceptance or eighteen (18) months from the date of shipment, whichever comes first. Some individual products include extended warranties as stated in brochure(s) and extended warranties may be purchased as requested and quoted. Written notice of any defects shall be given SATCOM Technologies upon discovery and SATCOM Technologies shall promptly correct such defects by repair or replacement, at its option, without charge, either FCA SATCOM Technologies' plant or service in the field.

IN NO EVENT SHALL SATCOM TECHNOLOGIES' LIABILITY UNDER THIS WARRANTY EXCEED THE COST OF REPAIR OR REPLACEMENT OF SUCH DEFECTIVE ITEM AND UNDER NO CIRCUMSTANCES SHALL SATCOM TECHNOLOGIES BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES.

Specifically excluded from this Warranty are:

- a. Defects or nonconformance caused by and resulting from improper operation, maintenance, or storage of the equipment.
- b. Items of characteristically indeterminate life, such as bulbs, fuses, etc.

THIS WARRANTY CONSTITUTES SATCOM TECHNOLOGIES' SOLE AND EXCLUSIVE LIABILITY HEREUNDER AND BUYER'S SOLE AND EXCLUSIVE REMEDY FOR DEFECTIVE OR NONCONFORMING ITEMS AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS IMPLIED OR STATUTORY (INCLUDING THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE).

APPENDIX A. AZIMUTH JACK ASSEMBLY REPOSITIONING PROCEDURE

The following repositioning procedures should be followed under calm wind conditions (Less than 10 mph).

Note: This procedure applies to antennas equipped with the optional pin and clevis arrangement for securing the antenna during jack sector repositioning.

1. Clean the dirt and grease from the exposed portion of the jack screw.
2. Drive the reflector to its highest elevation look angle. (RF axis vertical)
3. Disconnect azimuth limit switch.
4. Retract (or extend) the azimuth jack so that the lug on the bottom of the pedestal is aligned with the desired stationary clevis on the foundation.
5. Attach the pedestal lug to the stationary clevis using the 3/4" ball lock pin (also called the transfer pin) tied to the lower pedestal.
6. Remove the six bolts securing the deadman pivot to the deadman base.
7. Extend (or retract) the azimuth jack until the six bolt holes in the deadman pivot match the corresponding holes in the deadman base in the adjacent position.
8. Replace the six bolts, washers, and nuts that hold the deadman assembly together.
9. Tighten, sequentially, alternate rather than adjacent bolts until all are securely tightened.
10. Remove the 3/4" holding pin from the clevis and return it to the pin storage pipe on the pedestal before driving Azimuth Jack.

CAUTION! DO NOT DRIVE AZIMUTH JACK WITH THE PEDESTAL LOCKED TO THE STATIONARY CLEVIS. INJURY TO PERSONNEL AND/OR DAMAGE TO THE EQUIPMENT MAY RESULT IF THE HOLDING PIN IS NOT REMOVED.

11. Repeat Steps 4 through 10 if the next base position is the desired one.
12. Connect and readjust limit switch, ensuring limits are within travel range of jack.
13. Recoat exposed jack screw in accordance with Table 1 and Section 3.5.