

**INSTALLATION AND OPERATION MANUAL
FOR SEA TEL MODEL
SERIES 04 KU-BAND TVRO ANTENNA**



WARNING: Antenna Pedestal *must be properly restrained (stowed)* to prevent damage to wire rope isolators, isolator springs and/or antenna pedestal mechanism during underway conditions *when power is removed from the antenna assembly.*

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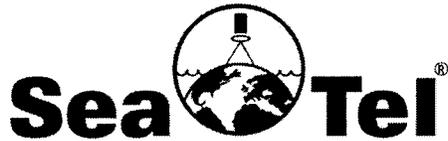


The Series 04 Family of Marine Stabilized Antenna Pedestals with DAC-2200 Antenna Control Unit complies with the requirements of European Norms and European Standards EN 60945 (1997) and prETS 300 339 (1998-03). Sea Tel European Union Declaration of Conformity for this equipment is contained in this manual.

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Sea Tel®
Marine Stabilized Antenna Systems
European Union Declaration of Conformity
Marine Navigational Equipment

The EU Directives Covered by this Declaration:

European Norms and European Standards EN 60945 (1997) and IEC 1000 (1995).

The Product Covered by this Declaration:

Series 04 Family of Marine Stabilized Antenna Pedestals with DAC-2200 Antenna Control Unit and TSC-10 Touch Screen Controller.

The Basis on which Conformity is being Declared:

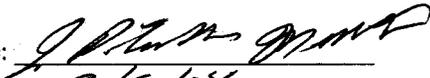
The product identified above complies with the requirements of the above EU Directives by meeting the following standards:

*** EN 60945 (1997) "Marine Navigational Equipment - General Requirements – Methods of Testing and Required Test Results":**

- Conducted Emissions (Clause 9.1 & 9.2)
- Radiated Emissions (Clause 9.1 & 9.3)
- Conducted Low Frequency (Audio) Interference (Clause 10.1 & 10.2)
- Conducted Radio Frequency Interference (Clause 10.3) & IEC 1000-4-6 (1995)
- Radiated Radio Frequencies (Clause 10.4) & IEC 1000-4-3 (1995)
- Fast Transients on Signal/Control Lines (Clause 10.5) & IEC 1000-4-4 (1995)
- Surges on AC Power Lines (Clause 10.6) & IEC 1000-4-5 (1995)
- Power Supply Short-Term Variation (Clause 10.7)
- Power Supply Failure (Clause 10.8)
- Electrostatic Discharge (Clause 10.9) & IEC 1000-4-2 (1995)
- Compass Safe Distance (Clause 11.2, Measurement Only)

The technical documentation required to demonstrate that this product meets the requirements of the EMC Directive has been compiled by the signatory below and is available for inspection by the relevant enforcement authorities. The CE mark was first applied in June 8, 2004.

Authority: Mr. J. Patrick Matthews
President

Signature: 
Date: 7/6/04

Attention

The specifier, purchaser, installer or user is responsible for assuring adherence to special measures and limitations which must be observed when this product is placed into service, or modified, in order to ensure its compliance with the above directives.

TVRO LNBs which are mounted on the Marine Stabilized Antenna Pedestal must be CE marked separately by the manufacturer of those components.



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1. Introduction

1.1. General Description of system

This shipboard TeleVision Receive Only (TVRO) system provides you with maritime satellite TV programming while you are in port or underway. Your Series 04 Antenna system will receive signals of adequately high E.I.R.P. levels (see the Specifications section of this manual), in linear or circular polarization mode from any of the geosynchronous TV satellites at Ku-band. This input will be distributed to all of your satellite TV receivers which will provide the Audio/Video to your televisions. Many satellites also provide CD quality audio programming which may also be routed to your stereo.

The Series 04 system is a fully stabilized antenna that has been designed and manufactured so as to be inherently reliable, easy to maintain, and simple to operate. Except for start-ups, or when changing to operate with different transponders or satellites, the equipment essentially permits unattended operation.

The Series 04 system consists of two major groups of equipment; an above-decks group and a below-decks group. Each group is comprised of the items shown, and listed, below. All equipment comprising the Above Decks is incorporated inside the radome assembly and is integrated into a single operational entity. For inputs, this system requires only an unobstructed line-of-sight view to the satellite, Gyro Compass input and AC electrical power. The IF signals from the antenna are distributed to the satellite receivers by the matrix switch. Video and Audio outputs from your satellite receivers are available for distribution and monitoring.

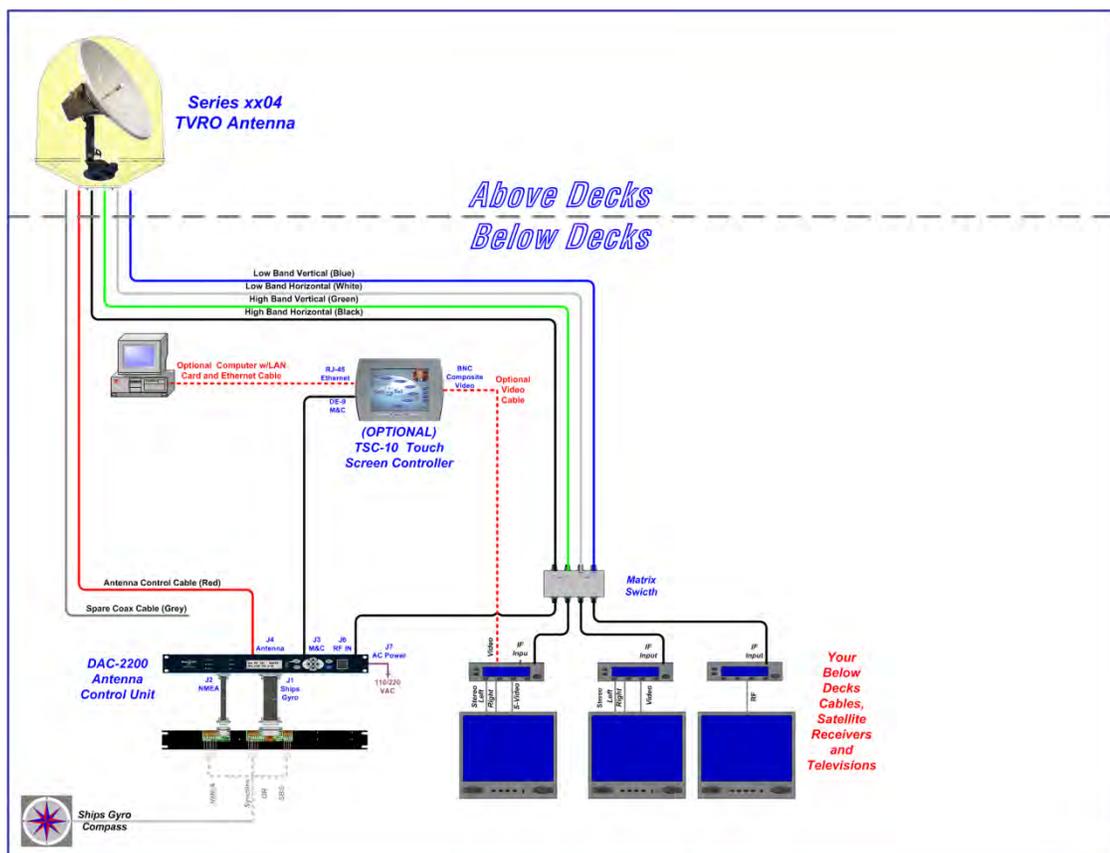


Figure 1-1 Series 04 Simplified Block Diagram Components

For more information about these components, refer to the Basic System Information section of this manual.

A. Above-Decks Equipment (ADE) Group

1. Stabilized antenna pedestal with built-in GPS
2. Antenna Reflector
3. Feed Assembly with LNB
4. Radome Assembly

B. Below-Decks Equipment Group

5. DAC-2202 Antenna Control Unit
6. 2 or 4 input **active** Matrix Switch with desired number of outputs (one output to the ACU plus enough outputs for the installed satellite receivers).
7. Satellite Video Receiver(s) & Television(s)
8. Control, RF and Video cables

1.2. General scope of this manual

This manual describes the Sea Tel Model xx04 Antenna (also called the Above Decks Equipment), its operation and installation. The Below Decks Equipment is described in the manuals provided with your DAC-2202 Antenna Control Unit. Refer to those manuals for their installation and operating instructions.

1.3. Quick Overview of contents

The information in this manual is organized into chapters. Operation, basic system information, installation, setup, functional testing, maintenance, specifications and drawings relating to this TVRO Antenna are all contained in this manual

2. Operation

Operation of your system is accomplished from the Antenna Control Unit (ACU). Please refer to the operation section of the DAC-2202 Antenna Control Unit manual.

2.1. System Power-up

Turn ON the power switch on the front panel of the ACU. The Series 04 Antenna receives its DC power from the Antenna Control Unit (ACU) when the ACU is energized.

The ACU supplies +30 VDC and FSK Modulated RS422 at 70 KHz (TX) & 120 KHz (RX) to the ADE on the Antenna Control Coax Cable.

2.2. Antenna Initialization

A functional operation check can be made on the antenna stabilization system by observing its behavior during the 4 phases of initialization.

Step 1. Turn on the AC power switch at the ACU front panel. Verify the level platform motor drives the level cage CCW to the stop and then CW 45 degrees.

Step 2. Verify the antenna moves forward or back to bring the top of the level cage to a level position in the fore/aft direction. This step takes approximately 10 seconds and will result in the dish being at 45 degrees in elevation. The level cage may still be tilted left or right at this time.

Step 3. After the level cage is positioned in the fore/aft direction, verify the antenna moves left or right to bring the top of the level cage to a level position in the left/right direction. This step also takes approximately 10 seconds.

Step 4. After the level cage is positioned in the left/right direction, verify the antenna moves CW (up) in azimuth to the upper stop where the Relative position of the antenna will be 700.0 degrees. From this point on the encoder will increment and/or decrement the Relative position of the antenna. Next, the antenna will drive CCW (down) in azimuth to a Relative position of 630.0.

The antenna will report its status, the PCUs model number & software version and the position information (current Relative, Azimuth and Elevation) to the ACU.

If any of these steps fail, or the ACU reports model number as "xx04" re-configure the PCU as described in section the Setup section of the AU manual. If initialization still fails, refer to the troubleshooting section of this manual.

2.3. Antenna Stabilization

After initialization is complete, real-time stabilization of the antenna is an automatic function of the PCU.

2.4. Antenna Pedestal Operation

Operation of the stabilized antenna Pedestal Control Unit (PCU) is accomplished remotely by the DAC-2202 Antenna Control Unit (ACU). Refer to the Operation section of the DAC-2202 Antenna Control Unit (and/or TSC-10 Touch Screen Controller) manual for more specific operation details. There are no other operating instructions applicable to the pedestal assembly by itself.

2.5. Tracking Operation

Tracking optimizes the antenna pointing, in very fine step increments, to maximize the level of the satellite signal being received. The mode of tracking used in this antenna is a variation of Conical Scanning called DishScan. Tracking is controlled by the ACU. You can toggle Tracking ON/OFF from the ACU, or from the optional Touch Screen Controller.

DishScan continuously drives the antenna in a very small circular pattern at 60 RPM. The ACU evaluates the received signal throughout each rotation to determine where the strongest signal level is (Up, Right, Down or Left) and issues the appropriate Azimuth and/or Elevation steps to the antenna, as needed.

The pedestal cannot control tracking. Refer to the ACU manual for more Tracking information.

2.6. Antenna Polarization Operation

Your feed is equipped with a polarization motor and potentiometer feedback. Therefore, it can be used for Linear or Circular, by simply installing the correct (linear or circular) Low Noise Block converter (LNB).

There is a ½ wave length phase card installed in the feed assembly. This causes the received satellite linear polarity to be mirrored/reversed in the feed. Therefore, to adjust polarization UP the LNB (as viewed from the back side of the reflector) must rotate CCW and to adjust polarity DOWN the LNB must rotate CW.

When adjusting polarity UP (from the ACU), the displayed polarization value in the ACU will increment up. When adjusting DOWN, the displayed polarization value in the ACU will decrement down.

When you have a circular Polarized LNB installed (like the US DBS LNB) there is no need to adjust the polarization angle of the feed.

Refer to the maintenance section of this manual for procedures to change LNBs and optimize polarization while in Auto-Pol mode.

You may adjust the SKEW setting to add or subtract additional polarization angle skew for any satellite that may require it or as required to optimize signal quality levels.

2.7. Low Noise Block Converter Operation

There are no operating instructions or controls applicable to the LNB. This unit is energized whenever the matrix switch and satellite receiver(s) have AC power connected to them.

Satellite signals are either circular polarized (spiraling plane down from the satellite) or linear polarized (fixed plane down from the satellite). The pedestal will receive circular polarization signals when a circular LNB is installed on the back of the dish. Conversely, the pedestal will only receive linear polarized signals when a linear LNB is installed.

2.8. Radome Assembly Operation

When operating the system it is necessary that the radome access hatch (and/or side door) be closed and secured in place at all times. This prevents rain, salt water and wind from entering the radome. Water and excessive condensation promote rust & corrosion of the antenna pedestal. Wind gusts will disturb the antenna pointing.

There are no other operating instructions applicable to the radome assembly by itself.=

3. Basic System Information

This section provides you with some additional information about the satellites you will be using, basics of the your Series 04 antenna system and other equipment within your system configuration.

3.1. Satellite Basics

The satellites are in orbit at an altitude of 22,753.2 Statute Miles positioned directly above the equator. Their orbital velocity matches the Earth's rotational speed, therefore, each appears to remain at a fixed position in the sky (as viewed from your location).

The satellites are simply relay stations that are able to receive signals from one location on the globe and re-transmit them to a much larger area on the globe than a local TV Station antenna could do. Because of their high vantage point, they are able to cover an area that is larger than a continent.

Your Series 04 antenna can be used with any of the Ku-Band (10.95-12.75GHz) satellites in this orbit that have a strong enough receive signal level in your location. Your antenna is capable of Linear or Circular signal reception, but requires that you have the appropriate LNB installed for the linear or circular signal and for the specific frequency range of that satellite.

If you could see the satellites in their positions above the equator, they would appear to form an arc as shown here (as viewed from a position in the Northern Hemisphere). When you are on the same longitude as the satellite, its' horizontal and vertical signals will be purely aligned to your horizon. When the satellite is east or west of your longitude, the satellite signals will appear to be rotated clockwise or counter-clockwise from pure horizontal and vertical. Both horizontal and vertical signals from a satellite will appear to be rotated the same amount and are always perpendicular to each other. The amount of rotation is dependent on how far east or west the satellite is from you and how close you are to the Equator.

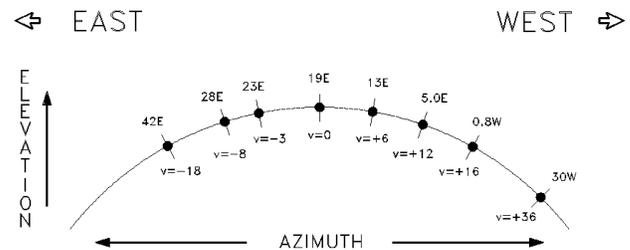


Figure 3-1 Arc of viewable Satellites

3.1.1. Ku-Band Frequency (10.95-12.75GHz)

At these frequencies the signal from the satellite travels only in a straight line and is affected by weather changes in the atmosphere. There are several conditions that can cause a temporary loss of satellite signal, even within an area where the signal level is known to be adequate. The most common of these *normal* temporary losses are **blockage** and **rain fade**. They will normally interrupt services only as long as the cause of the loss persists.

Blockage - Blockage is loss due to an object in the path of the signal from the satellite to the dish. If an object that is large and dense is positioned in the path of the signal from the satellite, it will prevent sufficient signal from arriving at the dish. The signal can not bend around, or penetrate through, these objects. The reception will be degraded or completely interrupted until the object is no longer in the path of the signal to the dish. The dish is actively driven to remain pointed at the satellite (toward the equator) so, as the boat turns a mast or raised structure on the boat may become positioned between the satellite and the dish. Blockage may also be caused a person standing near the radome, tall mountains, buildings, bridges, cranes or other larger ships near your boat. Signal will be lost when the boat is housed inside an enclosure that the signal cannot penetrate, like a paint shed or a berth with a roof. Moving or rotating the boat to position the antenna where it has an unobstructed view to the desired satellite will restore the antennas ability to receive the satellite signal.

Rain Fade - Atmospheric conditions that may cause sufficient loss of signal level include rain, snow, heavy fog and some solar activities such as sun spots and solar flare activity. The most common of these is referred to as "rain fade". Rain drops in the atmosphere reduce the signal from the satellite. The heavier the rain, the greater the signal loss. When the amount of loss is high enough, the antenna will not be able to stay locked onto the satellite signal. Once the amount of rain has decreased sufficiently, the antenna will re-acquire the satellite signal. In strong signal areas, rain fall of about four inches per hour will cause complete loss of signal. In weaker signal areas, lighter rainfall might cause the signal to be lost.

3.1.2. Signal level

The level of the receive signal on a point on the globe is dependant upon how powerful the transmission is and how wide the signal beam is coverage area is. Focusing the signal into a narrower beam concentrates its energy over a smaller geographic area, thereby increasing the signal level throughout that area of coverage. This makes it possible for you to use a smaller antenna size to receive that satellite signal. The antenna system must be geographically located in an area where the signal level from the satellite meets (or exceeds) the minimum satellite signal level required for your size of antenna (refer to the Specifications section of this manual) to provide suitable reception. This limits the number of satellites that can be used and the geographic areas where the ship can travel where the signal level is expected to be strong enough to continue providing uninterrupted reception. When travelling outside this minimum signal coverage area, it is normal for the system to experience an interruption in its ability to provide the desired satellite services until entering (or re-entering) an area of adequate signal level (refer to the satellite footprint information). Systems with larger diameter dish antennas can receive signal further out towards the fringe of a given satellites coverage area.

3.1.3. Satellite Footprints

The focused beam(s) from the satellites are normally aimed at the major land masses where there are large population centers. Footprint charts graphically display the signal level expected to be received in different geographic locations within the area of coverage. The signal will always be strongest in the center of the coverage area and weaker out toward the outer edges of the pattern. The Drawing section of this manual contains footprint charts of satellites that are expected to provide adequate signal level for your size antenna. The coverage areas are intended to be a guide to reception, however, the actual coverage area and signal level and vary. Also the signal strength is affected by weather.

3.1.4. Satellite polarization

Satellites may transmit their signals in one of two different polarization modes, linear (like a flat ribbon down from the satellite) or circular (like a twisted ribbon spiraling down from the satellite). The series 04 antennas can receive either linear or circular satellite signals, but not at the same time.

The feed assembly installed on your antenna is designed to be fitted with a linear LNB (to receive horizontal and vertical linear polarized satellite transmissions) or a circular LNB (to receive left hand or right hand circular polarized satellite transmissions). A motor, which is controlled by the ACU (Auto or Manual polarization), adjusts the "polarization" angle of the LNB installed on the feed.

When you have a linear LNB installed on the back of the dish (see the Maintenance section of this manual), polarization adjustment is required to optimize the alignment of the LNB to match the angle of the signal from the satellite. Auto-Polarization mode of the ACU normally will keep the polarization optimized for you. When you are on the same longitude as the satellite, its' horizontal and vertical signals will be purely aligned to your horizon. When the satellite is east or west of your longitude, the satellite signals will appear to be rotated clockwise or counter-clockwise from pure horizontal and vertical. Both horizontal and vertical signals from a satellite will appear to be rotated the same amount and are always perpendicular to each other. The amount of rotation is dependent on how far east or west the satellite is from you and how close you are to the Equator.

When you have a circular LNB installed on the back of the dish (again see the Maintenance section of this manual) no periodic polarization adjustments are required to optimized the satellite signal. However, you will leave Auto-Polarization mode ON in the ACU.

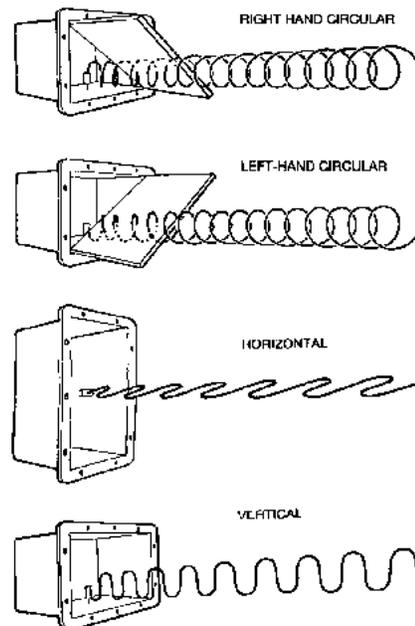


Figure 3-2 Satellite Signal Polarization

3.2. **Antenna Basics**

The satellite dish is mounted on a three jointed pedestal. As your boat rolls, pitches and turns in the water, these three joints move to keep the dish pointed at the satellite. The following information is provided to explain some of the basic functions of the antenna:

3.2.1. **Azimuth**

The clockwise, or counter-clockwise, rotation of the antenna is called Azimuth rotation. The antenna can rotate a total of 690 degrees between two mechanical stops. Azimuth drive, provided by the azimuth motor, is required during stabilization, searching, tracking and unwrap operations of the antenna. As the boat turns, azimuth is driven in the opposite direction so the dish remains pointed at the desired satellite. The actual azimuth pointing angle to the satellite is determined by the ship's latitude & longitude and the longitude of the satellite. It is important to know that the antenna should be pointed (generally) toward the equator.

If the ship is in the Northern Hemisphere, the azimuth angle to the satellite would be 180 degrees true (relative to true north) if the satellite is on the same longitude as the ship. If the satellite is east or west of your longitude, the azimuth will be less than, or greater, than 180 degrees respectively.

When checking for blockage you can visually look over the antenna radome toward the equator to see if any objects are in that sighted area. If you are not able to find any satellites it may also be useful to remove the radome top to see if the dish is aimed the correct direction (towards the equator).

3.2.2. **Elevation**

The antenna can physically be rotated in elevation from -15 degrees (lower stop) to +120 degrees (upper stop). However, you will only be pointing elevation between 00.0 (horizon) and 90.0 (zenith). Elevation drive, provided by the elevation motor, is required during stabilization, searching and tracking operations of the antenna. The actual elevation pointing angle to the satellite is determined by your latitude & longitude and the longitude of the satellite. In general terms, the elevation angle will be low when the ship is at a high latitude and will increase as the ship gets closer to the equator.

Additionally, from any given latitude, the elevation will be highest when the desired satellite is at the same longitude that you are on (refer to figure 3-1). If the desired satellite is east, or west, of your longitude the elevation angle will be lower.

3.2.3. **Antenna Reflector/Feed Assembly**

Comprised of a hydro-formed aluminum reflector with a Cassegrain feed assembly. The feed assembly is fitted with a polarization motor and a potentiometer for position feedback required for linear signal operation. A variety of interchangeable LNBS can be easily fitted to the feed, allowing it to be used for a linear or circular reception from a variety of satellites.

When a linear LNB is installed, the ACU automatically adjusts the feed by remotely controlling the 24 volt DC motor, using the potentiometer feedback for Linear polarization position (Auto-Polarization mode).

When a circular LNB is installed, no polarization adjustment is required. The ACU automatically adjusts the feed, as in linear operation, but the circular LNB receives the signal properly regardless of its polarization position.

3.2.4. **Antenna polarization**

When you have a linear LNB installed the polarization needs to be periodically adjusted, Auto-Polarization will automatically accomplish this for you. You do not need to adjust the "polarization" of the antenna when you have a circular LNB installed, but rotation of the LNB does not have any detrimental effect, so Auto-Pol should remain ON.

There is a 1/2 wave length phase card installed in the feed assembly. This causes the received satellite linear polarity to be mirrored/reversed in the feed. Therefore, to adjust polarization UP the LNB (as viewed from the back side of the reflector) must rotate CCW and to adjust polarity DOWN the LNB must rotate CW.

Polarization adjustment to optimize Auto-Pol is required when initially setting up the system or after you have installed a different LNB (refer to the Maintenance Section of this manual).

3.2.5. **Interchangeable LNBS**

Series 04 antenna can easily be fitted with a variety of LNBS. The feed is capable of receiving linear or circular polarization signals, however, the LNB must match the type of polarization and the frequency band of the desired satellite. You must also have the correct receiver(s) installed below decks to decode each of the desired programming packages (as an example; To receive DirecTV in the US you must have DirecTV receivers installed, but DirecTV Latin America programming requires different receivers).

Refer to the Maintenance section of this manual for the procedure used to change an LNB. The LNBs which may be used with this system are:

US Circular LNB - This LNB is used to receive DirecTV, Dish Network or Bell TV programming.

DLA Circular LNB - This LNB is used to receive DirecTV Latin America programming.

European Quad Universal Linear LNB - This LNB is very popular for use in Europe. It can be used to receive low band horizontal & vertical AND/OR high band horizontal & vertical linear services at the same time. It can be used to receive one high band satellite or one low band satellite. Or it can receive both high & low band satellites at the same time, as long as they are at the same longitude position. It can **NOT** be used to receive two satellites at **different** longitude locations at the same time.

3.2.6. Stabilization

The Series 04 antennas are stabilized in three axes of motion. Stabilization is the process of de-coupling the ship's motion from the antenna. Simply put, this allows the antenna to remain pointed at the satellite while the boat turns, rolls or pitches under it. To accomplish this, the Pedestal Control Unit (PCU) on the antenna pedestal senses any motion of the antenna and immediately applies drive to the appropriate motor(s) to oppose the sensed motion. Azimuth (AZ), Elevation (EL) and Cross-Level (left-right tilt) are actively stabilized automatically by the PCU as part of its normal operation.

3.2.7. Search Pattern

Whenever the desired satellite signal is lost (such as when the antenna is blocked), the Antenna Control Unit will automatically initiate a search to re-acquire the desired signal.

The search is conducted with alternate azimuth and elevation movements. The size and direction of the movements are increased and reversed every other time resulting in an expanding square pattern.

When the antenna finds the desired satellite signal, the ACU will automatically stop searching and begin Tracking the signal. Tracking optimizes the pointing of the antenna to get the highest signal level from the satellite.

3.2.8. Tracking Receiver - Satellite Identification Receiver

The Satellite Identification Receiver located in the Antenna Control Unit (ACU) is used to acquire, identify and track a specific satellite by a unique network ID code (NID). The receiver must be set up properly for the satellite you wish to find & track. These receiver settings should be saved to expedite finding, or re-acquiring, the desired satellite in the future.

When searching for a desired satellite, this receiver compares any satellite ID it finds to the saved satellite ID code. If the ID code does not match the antenna will continue searching until the correct satellite is found. The system must have adequate satellite signal level, AND the matching ID, to stop searching (and continue tracking the desired satellite).

If you have the optional Touch Screen Controller (TSC-10) you can setup multiple "favorite satellites" and subsequently switch to different "favorite" satellite with two touches on the main (home) screen.

3.2.9. Tracking

The Series 04 antenna actively optimizes the pointing of the dish for maximum signal reception. This process is called tracking and is accomplished by continuously making small movements of the dish while monitoring the level of the received signal. Evaluation of this information is used to continuously make minor pointing corrections to keep the signal level "peaked" as part of normal operation.

3.2.10. Unwrap

Mechanical stops limit the azimuth rotation to a total of 690 degrees. The mechanical stops are at Relative 020.0 and 700.0. When the azimuth rotation is within 3 degrees of either mechanical stop, the antenna will be driven 360 degrees away from that stop. This "Unwraps" (unwinds) the cables that are routed through the pedestal assembly so that they do not become too severely twisted. It also repositions the antenna to a point which is closer to the middle of its mechanical stops. UNWRAP should occur when the Relative position of the antenna is at 023.0 or 697.0.

By rotating 360 degrees the azimuth position of the antenna will have returned to the previous Azimuth position and will resume tracking the desired satellite. Unwrap will occur whenever the boat has turned far enough in one direction for it to be required. It is normal for the satellite signal to be lost, and the television picture to "freeze frame", until the antenna completes unwrap and resumes tracking the satellite.

3.3.1. Antenna ADE Assembly

The Above Decks Equipment consists of an Antenna Pedestal inside a Radome assembly. The pedestal consists of a satellite antenna dish & feed with a linear, or a circular Low Noise Block converter (LNB) with polarization motor mounted on a stabilized antenna pedestal. The radome provides an environmental enclosure for the antenna pedestal assembly inside it. This keeps wind, water condensation and salt-water spray off the antenna pedestal assembly. This prevents damage and corrosion that would shorten the expected life span of the equipment.

The antenna control cable is connected between the antenna radome assembly and the antenna control unit. This cable provides DC voltage to the antenna and all control signals to and from the antenna.

Up to five other RG-6 (or better) coax cables are connected from the antenna radome assembly to the below decks equipment. One of these cables is the Antenna Control Cable, which has the DC operating voltage for the antenna and the antenna control communication between the Antenna Control Unit and the Pedestal Control Unit. Up to four cables carry the intermediate frequency (950-2050MHz) signals from the antenna assembly directly to the matrix switch and the DC Voltage & Tone switching from the Matrix Switch to the LNB. All four should be provided, even if you are only currently using two for the LNB you presently have installed on your antenna. These cables ultimately provide the input signal into the satellite receiver(s). And finally, one coax is installed as a spare.



Figure 3-4 Series 04 Above Decks Equipment

3.3.2. Antenna Control Unit

The Antenna Control Unit allows the operator to control and monitor the antenna pedestal with dedicated function buttons, LED's and a 2 line display. The ACU and its Terminal Mounting Strip are normally mounted in a standard 19" equipment rack. The ACU should be mounted in the front of the equipment rack where it is easily accessible. The Terminal Mounting Strip is normally mounted on the rear of the equipment rack. It is recommended that the antenna control panel be mounted near one of the Satellite Receiver locations where you can see the television screen while you are controlling the antenna.

The Antenna Control Unit is connected to the antenna, ships Gyro Compass and to the optional Touch Screen Controller (when included).



Figure 3-5 DAC-2202 Antenna Control Unit

The Antenna Control Unit (ACU) communicates via an 70/120 KHz full duplex data link with the Pedestal Control Unit (PCU) located on the antenna. This control signal is sent up the Antenna Control Coax cable along with the DC voltage for the antenna power. The Pedestal Control Unit stabilizes the antenna against the ship's roll, pitch, and turning motions. The ACU is the operator interface to the PCU and provides the user with a choice of positioning commands to point the antenna, search commands to find the satellite signal and tracking functions to maintain optimum pointing.

3.3.3. Power Supply

AC Voltage - An appropriate source of AC Voltage will also be required for the ACU, satellite receivers and television monitors. Refer to the manuals for these devices for voltage and power consumption of each. Total power consumption will depend on the number of satellite receivers and television monitors used.

3.3.4. Satellite Receivers

The Series 04 system, with the appropriate LNB installed, can be used with standard European satellite receivers, and Integrated Receiver-Decoders (IRD). Both can receive “free” programming, but an IRD is required when the desired programming is encrypted. When authorized, it will decode the encrypted signals for use. Authorizing the receiver-decoder is a process of registering your receiver(s) and paying subscription fees to the service provider. The service provider then arranges for a signal to be sent through the satellite to your receiver-decoder, which will “enable” it to decode the programming you subscribed to.

A coax connection from the antenna (via the matrix switch) provides signal input to the receiver. The receiver also outputs voltage and tone control to the matrix switch to select the correct band and polarization signal for the channel you want to watch. A coax connection from the TV OUTPUT jack on the satellite receiver is connected to the ANTENNA INPUT on the television. Alternately, individual audio/video, Audio & S-Video, or SCART cable connections may be made between the satellite receiver and the television.

3.3.5. Television/Monitor

An appropriate television monitor is used to view the satellite television programming and the on screen displays from the receiver. Your television/monitor must be able to display the video standard outputted from the satellite receiver. In some areas the satellite receiver may pass several different video formats, depending on the program being watched. You may need a video standards converter for each television/monitor which is not capable of displaying the signal being received (NTSC, PAL or SECAM video input) “Multi-Standard” televisions/monitors are able to automatically display any of the major video standard inputs. Consult your Television/Monitor manual for specifics.

3.3.6. Matrix Switch

The Matrix Switch routes the satellite signal from one of the IF cables to one of your receivers. As you change channels on the satellite receiver, it uses the voltage, and/or tone, to select the correct signal input for the channel you have selected.

Each output of the matrix switch is controlled by voltage, and/or tone, from the satellite receiver connected to that output connector. Voltage level on the coax selects which polarity, Tone selects which band of the input signals gets routed to that output connector, therefore, to that receiver. Each output of the matrix switch operates independently of the others, therefore, allows the satellite receivers to operate independently also.

The matrix switch is normally installed with the Below Decks Equipment. The antenna IF coax cables are connected to its LNB inputs and a coax cable (RG-6 OR greater) is connected from one of its outputs to each satellite receiver. One of these outputs must be connected the tracking receiver in the ACU.

Sea Tel recommends that an ACTIVE Matrix be used in all installations. Matrix switches with 4, 8, 12 and 16 outputs are available.

4. Installation

Below are basic steps to guide you in installing this equipment, but you may choose to complete the installation steps in a different order. Read this complete section before starting. Installation of the DAC-2202 Antenna Control Unit may have already have been performed using its Installation and Operation manual instructions.

The following instructions describe the installation procedures for installing the Series 04 Antenna (ADE).

4.1. General Cautions & Warnings



CAUTION - Allow only an **authorized dealer** to install or service the your Sea Tel Television Receive Only System components. Unauthorized installation or service can be dangerous and can invalidate the warranty.



WARNING: Assure that all nut & bolt assemblies are tightened according the tightening torque values listed below:

Bolt Size	Inch Pounds
1/4-20	75
5/16-18	132
7/16-14	376
1/2-13	517



NOTE: All nuts and bolts should be assembled using the appropriate Loctite thread-locker product number for the thread size of the hardware.

Loctite #	Description
222	Low strength for small fasteners.
243	Medium strength, oil tolerant.
262	Permanent strength for up to 3/4" diameter fasteners.
271	Permanent strength for up to 1" diameter fasteners.
290	Wicking, High strength for fasteners which are already assembled.

4.2. Site Survey

The site survey is performed to decide where the best location for the equipment to be installed is. The radome assembly (ADE) should be installed at a location aboard ship where:

1. The antenna has a clear line-of-sight to as much of the sky (horizon to zenith at all bearings) as is practical.
2. The antenna is a minimum of 15 feet from the ship's radar, especially high power radar arrays.
3. The antenna is not mounted on the same plane as the ship's radar, so that it is not directly in the radar beam path.
4. The antenna is a minimum of 15 Feet from high power short wave transmitting antennas are not in close proximity.
5. The antenna must be installed in a rigid mounting location that will not flex, or sway, in ship's motion or vibration.
6. The Above Decks Equipment (ADE) and the Below Decks Equipment (BDE) should be positioned as close to one another as possible. This is necessary to reduce the losses associated with long cable runs.

If these conditions cannot be entirely satisfied, the site selection will inevitably be a "best" compromise between the various considerations. However, the warranty of the antenna will not cover physical or electrical (RF) damage of the antenna due to the compromised location.

4.3. Preparing For The Installation

4.3.1. Unpack Shipping Crates

Exercise caution when unpacking the equipment crate(s). Carefully inspect the radome surface for evidence of shipping damage.

4.3.2. Installing The Cables

Install appropriate cables from ADE to the BDE Location. Exercise caution during the cable installation to assure that the cables are not severely bent (proper bend radius) or twisted and that connectors are not damaged. Ensure that the cables have been run through watertight fittings and/or will not permit water entry into the boat when the installation is completed.

4.4. Preparing the ADE for Lift

	<p>WARNING: Hoisting with other than a webbed four-part sling may result in catastrophic crushing of the radome. Refer to the specifications and drawings for the fully assembled weight of your model Antenna/Radome and assure that equipment used to lift/hoist this system is rated accordingly.</p>
	<p>CAUTION: The antenna/radome assembly is very light for its size and is subject to large swaying motions if hoisted under windy conditions. Always ensure that tag lines, attached to the radome base frame, are attended while the antenna assembly is being hoisted to its assigned location aboard ship.</p>

1. The antenna pedestal is shipped completely assembled in its radome.
2. Remove the shipping nuts which mount the ADE to the pallet.
3. Attach a four part web strap lifting sling to the four lifting pad eyes on the radome lip.
4. Using the web strap lifting sling arrangement, and with a tag line attached near the radome base, hoist the antenna assembly to its assigned location aboard the ship by means of a suitably sized crane or derrick.
5. The radome assembly should be positioned with the BOW marker aligned as close as possible to the centerline of the ship. Small variations from actual alignment can be compensated with the AZIMUTH TRIM adjustment in the ACU, so precise alignment is not required.
6. Bolt the radome base directly to the ship's deck or mounting plate (flat mounting area).

4.5. Antenna Pedestal Mechanical Checks

1. Open the radome hatch, or remove the top, to access the antenna pedestal.
2. Inspect the pedestal assembly and reflector for signs of shipping damage.
3. Remove the web strap shipping restraints from the pedestal. **Save these straps to restrain the antenna in the event that the AC power will be turned off while the ship is underway.**
4. Cut and discard the large white tie-wraps from the pedestal.
5. Check that the antenna moves freely in azimuth, elevation, and cross level without hitting any area of the interior of the radome.
6. Check that the antenna assembly is balanced front to back, top to bottom and side to side by observing that it remains stationary when positioned in any orientation. (Refer to the maintenance section of this manual for complete information on balancing the antenna).
7. Check that all pedestal wiring and cabling is properly dressed and clamped in place.
8. See cable terminations section below.

4.6. Cable Terminations



CAUTION: Rough handling, tight bending, kinking, crushing and other careless handling of the cables and their connectors can cause severe damage.

The cables must be routed from the above-decks equipment group through the deck and through various ship spaces to the below-decks equipment group. When pulling the cables in place, avoid sharp bends, kinking, and the use of excessive force. After placement, seal the deck penetration gland and tie the cables securely in place.

4.6.1. At The Radome

The coax cables must be inserted through the cable strain relief(s) at the base of the radome. Apply RTV to the strain relief joints and tighten the compression fittings to make them watertight. The cables are color coded for easy connection identification. (Refer to the System Block Diagram for cable color assignment).

4.7. Final Checks

Double check all your work and do a good visual inspection. Rotate the antenna in azimuth to assure rotation is free and there is no binding or fouling in the cables you installed. Rotate the antenna in elevation and Cross-Level to assure that the pedestal moves freely and that there is no binding.

4.8. Power-Up – Observe the Antenna

When all the hardware and cables have been installed, have someone turn the ACU power ON. This will energize the antenna and it will begin **Initialization**. Observe initialization of the antenna to verify that each phase of the initialization is completed satisfactorily (refer to Initialization Sequence in the Maintenance section of this manual).

Close and fasten the radome hatch. Assure that the radome hatch is closed and secured when entry into the radome is no longer required.

4.9. Setup

Refer to the Setup information in the next section of this manual. Also refer to the Setup instructions the Antenna Control Unit manual to assure that the ACU settings and parameters are set correctly.

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5. Setup

Below are basic steps to guide you in setting up the ACU. Assure that the Antenna Pedestal (ADE) has been properly installed before proceeding.

5.1. Operator Settings

Refer to the Operation chapter of the ACU manual to set the Ship information. Latitude and Longitude should automatically update when the GPS engine mounted on the antenna pedestal triangulates an accurate location, but you may enter this information manually to begin. You will have to initially enter the current heading of the ship after which the Gyro Compass will keep the ACU updated.

Then set the Satellite information for the satellite you will be using. The receiver settings are especially important.

After the Ship and Satellite setting have been made you should be able to target the desired satellite. Continue with the setup steps below to optimize the parameters for your installation.

5.2. Optimizing Targeting

1. First, assure that all of your Ship & Satellite settings in the ACU are correct.
2. Target and/or Locate the desired satellite.
3. Verify positive satellite ID, (by monitoring a Spectrum Analyzer, checking for Receive signal indication by the satellite receiver, and/or decoded NID by the ACU itself)
4. Access the ACU's Setup mode parameter "**AUTO TRIM**"
5. Press the **Right** or **Left** arrow, the display should now read AUTO TRIM SETUP. If it reads AUTO TRIM LOCKED, the antenna is either not pointed at the correct satellite or is not receiving a matched NID, and this feature is not available for use, Return to step 1 to verify all settings and continue on to locate the desired satellite.
6. Press the **Enter** key, the display should now read AUTO TRIM SAVED.
7. Target an azimuth value of 000.0 degrees
8. Target the desired satellite by its' longitudinal position (i.e. 22W)
9. Verify the Antenna locks onto the correct satellite within +/- 1.0 degrees.
10. Access the Setup Mode **SAVE NEW PARAMETERS** window.
11. Press the **Right** or **Left** arrow
12. Press **Enter** and verify positive feedback that parameters were saved.

5.3. Optimizing Auto-Polarization TVRO

If your system is fitted with a circular LNB, you do not need to optimize the polarity angle and can skip this procedure. This procedure optimizes the linear polarization of the feed. Start by following the procedure to mechanically calibrate the feed assembly. Verify that tracking is ON and that the antenna is peaked on your targeted satellite.

Assure that you are in Auto-Pol mode (POL TYPE parameter in the ACU is set to 0072) and set one of your satellite receivers to view its signal level display. Go to the SKEW parameter in the Tracking Receiver Setup menu of the ACU.

Default setting is 0000 and may be incremented, or decremented, to adjust polarization while in Auto-Pol mode. Each increment equals one degree of polarization rotation (0003 = +3 degrees), each decrement below 0 for minus polarization (-0002 = -2 degrees). Adjust the SKEW value by pressing the UP arrow to increment or the DOWN arrow to decrement the value, wait at least 5-10 seconds between each sent command to allow sufficient time for the feed to drive, until you see the quality level on the receiver optimized and then hit the ENTER key to submit the new value.

At the SAVE NEW PARAMETERS menu, press the RIGHT arrow and then press ENTER. Verify Parameters SAVED is displayed.

As part of normal operation, it may be required to adjust the SKEW parameter value when you command the antenna to target another satellite or satellite beam. This will only be the case if desired satellite is transmitting on a polarization angle that is offset from what is considered nominally vertical or horizontal.

5.4. Radiation Hazard and Blockage Mapping

The ACU can be programmed with ship relative azimuth limits to enhance operation where there are known blockage regions. Tracking and auto Search are suspended when the antenna is pointed within this region to speed signal re-acquisition when the ship turns and the antenna comes out of signal blockage. The BLOCKED condition is displayed in the TRACKING window. AZ LIMIT 1 is the Lower Relative AZ limit for pattern blockage mapping. AZ LIMIT 2 is the Upper Relative AZ limit for pattern blockage mapping.

The ACU also provides a contact closure to ground on the SW1 terminal (J3-11) on the Terminal Mounting Strip when the antenna is pointed within the blockage region or the system is searching, targeting or unwrapping. The contact closure is a transistor switch with a current sinking capability of 1 Amp. This signal can be used to control dual antenna coax switches to select IF signal connections from a second antenna when the primary antenna is blocked.

Programming instructions:

Determine the Relative AZ limits that cause signal blockage by monitoring the REL display readings or by graphing the expected blockage pattern. The Relative angles are with respect to the Pedestal reference, which is normally pointed at the bow (360.0 Relative). In a dual cable-wrap antenna system, one of the antennas may be pointed aft so its relative limits will be with respect to aft. The relative angles must be in the range of 0 to 360 degrees (0000-3600). Convert the relative readings to limit values by multiplying by 10. Enter the beginning of the blockage region as AZ LIMIT 1 and the end of the region (clockwise direction from AZ LIMIT 1) as AZ LIMIT 2.

EXAMPLE: A drill ship has two antennas mounted in the front of the ship with a derrick blocking the antenna's view to the rear. The Port antenna is mounted referenced to the bow and is blocked from 160 to 175 degrees. The Starboard antenna is mounted reference to the stern and is blocked from 355 to 375 degrees relative to the stern. (375-360=015).

The limits for the port antenna are:

$$\text{AZ LIMIT 1} = 160 \times 10 = 1600$$

$$\text{AZ LIMIT 2} = 175 \times 10 = 1750$$

The limits for the starboard antenna are:

$$\text{AZ LIMIT 1} = 355 \times 10 = 3550$$

$$\text{AZ LIMIT 2} = 15 \times 10 = 0150$$

Note: The AZ LIMITS of the starboard antenna are entered as 355 to 375 degrees. This defines a blockage zone of 20 degrees. If the limits were entered as 015 to 355, the blockage zone would be 340 degrees.

5.5. Default Setup Parameters – Series 04

The following table shows the factory default parameters for the DAC-2202 interfaced to a Series 04 Antenna PCU. When the installation & setup of your system is finished you can record the “optimized” settings for your system in the “My Parameters” column. Refer to the Setup Flow-Charts and individual parameter setting information in the Setup section of your DAC-2202 manual for how to enter/change the parameters.



The Factory Default parameters listed below are values that were required for initial system testing only. You are required to optimize these settings for each installation. System failures that have been determined to be due to improper value settings for these parameters will not be covered under warranty.

PARAMETER	Factory Default	My Parameters
EL TRIM	0	
AZ TRIM	0	
AUTO THRES	100	
EL STEP SIZE	0	0*
AZ STEP SIZE	0	0*
STEP INTEGRAL	0	0*
SEARCH INC	10	
SEARCH LIMIT	100	
SEARCH DELAY	30	
SWEEP INC	0090	
SYSTEM TYPE	77	
GYRO TYPE	0002	
POL TYPE	72	
POL OFFSET	30	
POL SCALE	90	90*
AZ LIMIT 1	0	
AZ LIMIT 2	0	
EL LIMIT 12	90	
AZ LIMIT 3	0	
AZ LIMIT 4	0	
EL LIMIT 34	90	
AZ LIMIT 5	0	
AZ LIMIT 6	0	
EL LIMIT 56	90	
AZ LIMIT 7	0	
AZ LIMIT 8	0	
EL LIMIT 78	90	
TX POLARITY	2	2*
TRACK DISP	0000	0000*

*** Do NOT adjust these parameters to any other values then that of factory defaults.**

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6. Functional Testing

If not already ON, Turn ON the Power switch on the front panel of the ACU.

6.1. (OPTIONAL) TSC-10 Touch Screen Controller Checks

Refer to the functional testing chapter of the TSC-10 manual for check to perform.

6.2. ACU / Antenna System Check

1. Press RESET on the ACU front panel to initialize the system. Verify the display shows "SEA TEL INC - MASTER" and the ACU software version number. Wait 10 seconds for the display to change to "SEA TEL INC - REMOTE" and the PCU software version number. If the display shows "REMOTE INITIALIZING", wait approximately 2 minutes for the antenna to complete initialization and report the Antenna Model and PCU software version. If "REMOTE NOT RESPONDING" is displayed, refer to the Troubleshooting Section of this manual.
2. Press the **NEXT** key repeatedly to display the **Ship, Satellite, Antenna** and **Status** menu displays. This verifies that the displays change in the correct response to the keys.

6.3. Latitude/Longitude Auto-Update check

This verifies that the GPS antenna mounted on the antenna pedestal is automatically updating the current ship's position information. If the GPS is not updating the ACU properly, refer to the Troubleshooting Section of this manual.

1. Press the **NEXT** key repeatedly to display the **Ship** menu. Press **ENTER** to access edit mode and view the current Latitude value.
2. Press the **LEFT** arrow key to bring the cursor up under the ones digit, press **UP** and then hit **ENTER**. The display should immediately show a latitude value one degree higher. If the GPS engine mounted on the Antenna Pedestal is working properly the incorrect value will be overwritten within several seconds (back to the correct current value).
3. This test does not need to be repeated in the Longitude menu.

6.4. Azimuth & Elevation Drive

This check verifies that the antenna moves in the correct direction in response to the keys. If the antenna is not driving properly, refer to the Troubleshooting Section of this manual.

1. Press the **NEXT** key several times to display the **Antenna** menu.
2. Press the **Tracking** key to toggle Tracking OFF.
3. Press the **UP** arrow key repeatedly and verify that the antenna moves up in elevation.
4. Press the **DOWN** arrow key repeatedly and verify that the antenna moves down in elevation.
5. Press the **RIGHT** arrow key repeatedly and verify that the antenna moves up in azimuth.
6. Press the **LEFT** arrow key repeatedly and verify that the antenna moves down in azimuth.

6.5. *Four Quadrant Tracking Test*

This verifies that the antenna moves in the correct response to the keys, that Tracking is signaling correctly and that the Tracking commands are being carried out (antenna drives to peak).

1. Press the **NEXT** key several times to display the **Antenna** menu.
2. Note the current peak ACG value. Press the **Tracking** key to toggle Tracking OFF, press the **UP** arrow key repeatedly to move the antenna up in elevation until AGC falls about 100 counts. Turn Tracking ON and verify that the antenna moves back down in elevation and that the AGC rises to its' previous high value.
3. Note the current peak ACG value. Press the **Tracking** key to toggle Tracking OFF, press the **DOWN** arrow key repeatedly to move the antenna down in elevation until AGC falls about 100 counts. Turn Tracking ON and verify that the antenna moves back up in elevation and that the AGC rises to its' previous high value.
4. Note the current peak ACG value. Press the **Tracking** key to toggle Tracking OFF, press the **RIGHT** arrow key repeatedly to move the antenna up in azimuth until AGC falls about 100 counts. Turn Tracking ON and verify that the antenna moves back down in azimuth and that the AGC rises to its' previous high value.
5. Note the current peak ACG value. Press the Tracking key to toggle Tracking OFF, press the **LEFT** arrow key repeatedly to move the antenna down in azimuth until AGC falls about 100 counts. Turn Tracking ON and verify that the antenna moves back up in azimuth and that the AGC rises to its' previous high value.

7. Troubleshooting and Maintenance

This section describes the theory of operation to aid in troubleshooting and adjustments of the antenna system. Refer to the Trouble shooting section of the DAC-2200 for additional troubleshooting details.

7.1. Warranty Information

Sea Tel Inc. supports its Series 04 systems with a **TWO YEAR** warranty on parts and **ONE YEAR** warranty on labor.

What's Covered by the Limited Warranty?

The Sea Tel Series 04 Limited Warranty is applicable for parts and labor coverage to the complete antenna system, including all above-decks equipment (radome, pedestal, antenna, motors, electronics, wiring, etc.) and the Antenna Control Unit (ACU).

What's **NOT** Covered by the Limited Warranty?

It does **not** include Television sets, DBS/DTH receivers, multi-switches or other distribution equipment, whether or not supplied by Sea Tel commonly used in TVRO Systems. Televisions, DBS/DTH receivers and accessories are covered by the applicable warranties of the respective manufacturers.

Factory refurbished components used to replace systems parts under this warranty are covered by this same warranty as the original equipment for the balance of the original warranty term, or ninety (90) days from the date of replacement, whichever occurs last. Original Installation of the Series 04 system must be accomplished by or under the supervision of an authorized Sea Tel dealer for the Sea Tel Limited Warranty to be valid and in force.

Should technical assistance be required to repair your system, the first contact should be to the agent/dealer you purchased the equipment from.

Please refer to the complete warranty information included with your system.

7.2. Recommended Preventive Maintenance

Ensure that all of the normal operating settings (LAT, LON, HDG, SAT and all of the Tracking Receiver settings) are set correctly. Refer to the Functional Testing section of this manual for instructions to conduct the tests below.

7.2.1. Check ACU Parameters

Assure that the parameters are set correctly (you may wish to record them in the Factory Default Settings, in section 5 of this manual).

7.2.2. Latitude/Longitude Auto-Update check

Refer to the Latitude & Longitude Update check procedure in the Functional Testing section of this manual.

7.2.3. Heading Following

Refer to the Heading Following verification procedure in the Functional Testing section of this manual.

7.2.4. Azimuth & Elevation Drive

Refer to the Azimuth & Elevation Drive check procedure in the Functional Testing section of this manual.

7.2.5. Test Tracking

Refer to the four quadrant Tracking check procedure in the Functional Testing section of this manual.

7.2.6. Visual Inspection - Radome & Pedestal

Conduct a good, thorough, visual inspection of the radome and antenna pedestal. Visually inspect the inside surface of the radome top and of the antenna pedestal. Look for water or condensation, rust or corrosion, white fiberglass powder residue, loose wiring connections, loose hardware, loose or broken belts or any other signs of wear or damage.

1. Radome Inspection - The radome top/bottom flanges are properly sealed to prevent wind, saltwater spray and rain from being able to enter the radome. Re-seal any open ("leaky") areas with marine approved silicone sealant. If heavy condensation, or standing water, is found inside the radome,

isolate and seal the source of the leak, and then dry out the radome. Small (1/8 inch) holes may be drilled in the recesses of the base pan of the radome to allow standing water to “weep” out.

1. Antenna Pedestal Inspection - The springs (or rubber vibration dampeners) should not be completely compressed, or otherwise damaged. The plated and painted parts should not be rusted or corroded. The harnesses should not be frayed and all the connectors should be properly fastened and tightened. All hardware should be tight (no loose assemblies or counter-weights). Replace, re-coat, repair and/or tighten as necessary.

7.2.7. Mechanical Checks

Turn the antenna control unit OFF

1. Inspect inside of radome for signs that the dish or feed have been rubbing against the inside of the fiberglass radome.
2. Rotate the pedestal through its full range of azimuth motion. The antenna should rotate freely and easily with light finger pressure.
3. Rotate the pedestal through full range of elevation rotation. The antenna should rotate freely and easily with light finger pressure.
4. Tilt the pedestal through full range of left-right cross-level rotation. The antenna should rotate freely and easily with light finger pressure.
5. Rotate the level cage through the full 90 degrees of rotation from CCW stop to CW stop. The level cage antenna should rotate freely and easily with light finger pressure. Attached cables should not cause the cage to spring back more that a few degrees from either stop when released.
6. Inspect all drive belts for wear (black dust on/under the area of the belt).

7.2.8. Check Balance

Check the balance of the antenna, re-balance as needed (refer to the Balancing the Antenna procedure below).

7.2.9. Observe Antenna Initialization

Observe the Antenna Initialization as described in the Troubleshooting section below.

7.3. Troubleshooting

Below are theory and diagnostic tests to assist you with troubleshooting the antenna. Refer to the previous section to check settings and do some initial functional testing prior to beginning troubleshooting.

7.3.1. Theory Of Stabilization Operation

The antenna system is mounted on a three axis stabilization assembly that provides free motion with 3 degrees of freedom. This assembly allows the inertia of the antenna system to hold the antenna pointed motionless in inertial space while the ship rolls, pitches and yaws beneath the assembly. Three low friction torque motors attached to each of the three free axes of the assembly provide the required force to overcome the disturbing torque imposed on the antenna system by cable restraints, bearing friction and small air currents within the radome. These motors are also used to re-position the antenna in azimuth and elevation.

The Pedestal Control Unit (PCU) uses inputs from the level cage sensors to calculate the amount of torque required in each axis to keep the antenna pointed within +/-0.5 degrees. The primary sensor input for each loop is the rate sensor mounted in the Level Cage Assembly. This sensor reports all motion of the antenna to the PCU. The PCU immediately responds by applying a torque in the opposite direction to the disturbance to bring the antenna back to its desired position. Both the instantaneous output of the rate sensor (Velocity Error) and the integrated output of the rate sensor (Position Error) are used to achieve the high pointing accuracy specification.

The calculated torque commands sent to each of three Brush-Less Servo Amplifiers. These amplifiers provide the proper drive polarities and commutation required to operate the Brush-Less DC Servo Motors in torque mode. The Torque acting on the mass of the antenna cause it to move, restoring the rate sensors to their original position, and closing the control loop.

Since the rate sensors only monitor motion and not absolute position, a second input is required in each axis as a long term reference to keep the antenna from slowly drifting in position. The Level and Cross Level reference is provided by a two axis tilt sensor in the level cage assembly. The Azimuth reference is provided by combining the ships gyro compass input and the antenna relative position.

7.3.2. Initialization Sequence

A functional operation check can be made on the antenna stabilization system by observing its behavior during the 4 phases of initialization.

Step 1. Turn on the AC power switch at the ACU front panel. Verify the level platform motor drives the level cage CCW to the stop and then CW 45 degrees.

Step 2. Verify the antenna moves forward or back to bring the top of the level cage to a level position in the for/aft direction. This step takes approximately 10 seconds and will result in the dish being at 45 degrees in elevation. The level cage may still be tilted left or right at this time.

Step 3. After the level cage is positioned in the for/aft direction, verify the antenna moves left or right to bring the top of the level cage to a level position in the left/right direction. This step takes approximately 10 seconds.

Step 4. After the level cage is positioned in the left/right direction, verify the antenna moves CW (up) in azimuth to the 700.0 degrees, and then down CCW to 630.0 Relative position. From this point on the Encoder will increment and/or decrement the Relative position of the antenna. The antenna will report the PCUs' Model number & Software version to the DAC-2202 ACU.

If any of these steps fail, or the DAC-2202 reports model number as "xx04", re-configure the PCU as described in section the Setup section of this manual. If initialization still fails, refer to the troubleshooting information below or the troubleshooting section of the Touch Screen Controller manual.

7.3.3. Troubleshooting using DacRemP

While troubleshooting a Sea Tel 3-Axis Antenna System, you must classify the fault you are dealing with as a failure within one of 3 major system functions, Targeting, Stabilization, and Tracking. Should there be a failure with any one of these functions, your system will not operate properly. A few simple checks may help determine which fault (if any) that you are dealing with. The matrix below lists some test(s) and which of the DacRemP graph selection would be best to use to identify a fault. The end of this chapter contains examples on how to use DacRemP to diagnose a fault.

Targeting: is the ability to accurately point the antenna to an angular position in free space and is controlled by the ACU. (Does the system drive to the Azimuth, Elevation, and Polarity positions within 1 degree of the desired satellite?)

Stabilization: is the process of de-coupling the ships motion from the antenna and is controlled by the PCU. (Does the system maintain the satellite link after turning off TRACKING?)

Tracking: is the process of issuing fine adjustments to the **pointing** angle of the antenna to optimize the received signal level and is controlled by the ACU. (Does the system pass a four quadrant-tracking test?)

Functional Test(s)	DacRemP Graph Selection to use	System Function(s)
Four Quadrant Tracking.	ADMC (Position)	Tracking
Azimuth Encoder Verification.	ADMC (Position)	Targeting
Sea Trial	ADMC (Position)	Targeting Tracking Stabilization
Side Lobe Plots	ADMC (Position)	Tracking
Targeting Alignment (AZ & EL Trims)	ADMC (Position)	Targeting
Determine Blockage Mapping	ADMC (Position)	Tracking
Unwrap recovery (Limited Az systems only)	ADMC (Position)	Stabilization
Pedestal Gain Verification	DISPVC (Loop Error)	Stabilization
Home switch (flag) verification (Unlimited Az systems only)	DISPV (Ref)	Stabilization
Remote Tilt Verification	DISPV (Ref)	Targeting Stabilization

Level cage alignment Verification (sensor alignment)	DISPV (Ref)	Targeting Stabilization
Rate Sensor Output Verification	DISPW (Rate)	Stabilization
Level and CL fine balance Verification	DISPTC (Drive)	Stabilization
AZ Friction Torque Test	DISPTC (Drive)	Stabilization
DishScan Drive/Phase	DishScan XY	Tracking Stabilization

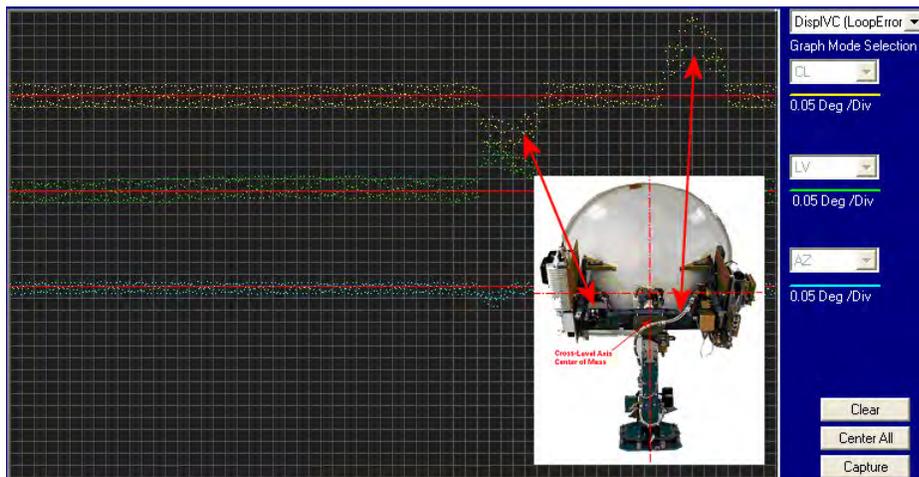
7.3.4. Antenna Loop Error Monitoring

The DacRemP **DISPIVC** graph chart provides a means for monitoring the accumulated velocity errors of the antenna for diagnostic purposes. If this error is excessive, it indicates external forces are acting on the antenna. These forces may be the result of but not restricted to static imbalance, excessive bearing friction, cable binding, or wind loading. If these forces cause the antenna to mis-point by more than 0.5° from the desired position the PCU will flag a “Stab Limit” error.

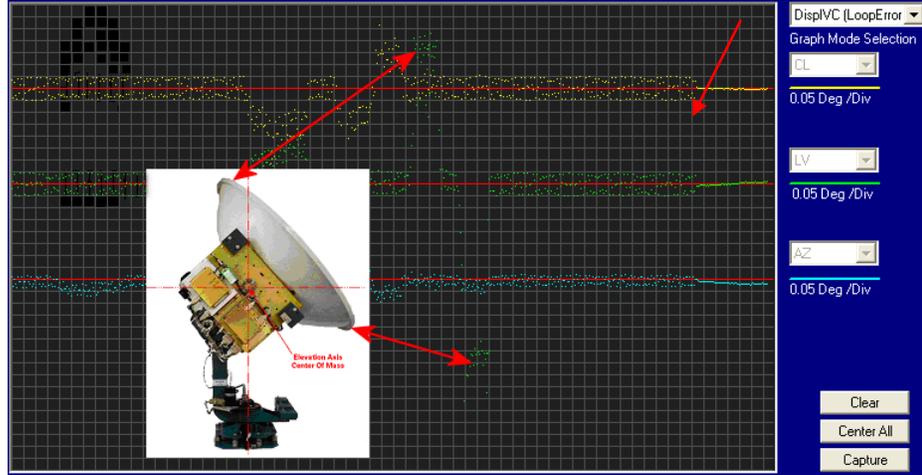
- To view the position error, select the **DisplVC (LoopError)** graph chart.



- This chart displays sensed axis errors via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 0.05°/ vertical division.
- The normal trace average will plot its display ± 3 divisions from the red reference line. Any trace line average plotted above this is of concern and troubleshooting required. The example below shows the forces exerted onto the antenna as a resultant of DishScan Drive. The example below shows the results of various forces put upon antenna.



- Cross-Level Axis physically moved CCW (down to the left.) and then CW (up to the right.)
Elevation Axis physically moved CW. (reflector slightly pushed up) and then physically moved CCW. (reflector slightly pushed down.) At the end of chart recording shows



- DishScan Drive turned Off, notice the lack of accumulated IVC errors.

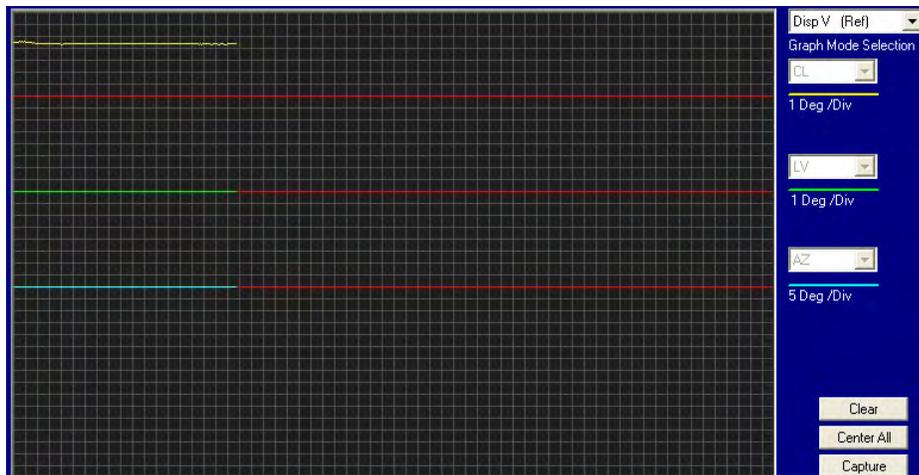
7.3.5. Reference Sensor Monitoring

The DacRemP **DISPV** graph chart provides a means for monitoring the output of the 2 Axis Tilt Sensor and the Home Switch sensor for diagnostic purposes. The Tilt sensor (located inside the Level Cage Assembly) is the primary input for the antenna's reference to the horizon (0° Elevation and 90° Cross-Level). While the Home Switch Sensor (located at the antenna base) is used to calibrate the antenna's position relative to the vessels BOW.

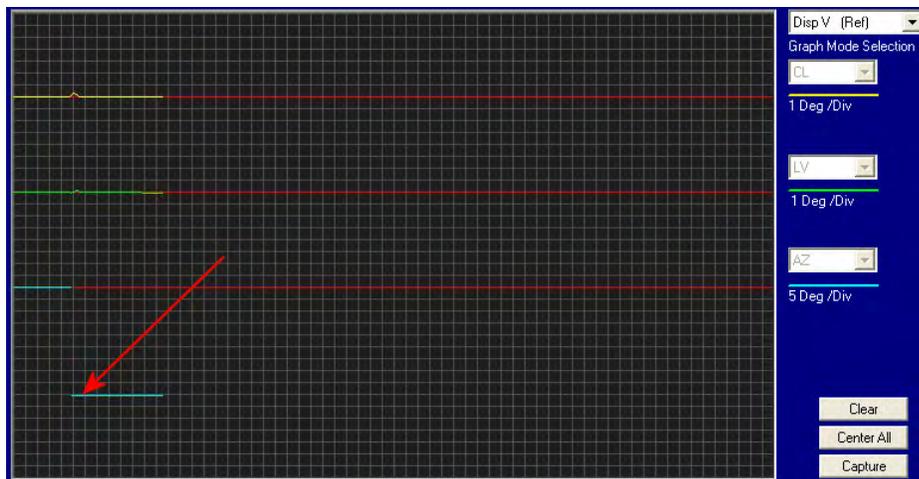
- To view the reference sensors, select the **Disp V (Ref)** graph chart.
- This chart displays the output of the Tilt Sensor via two traces, CL (Cross Level), LV (Elevation) at a fixed 1°/ vertical division, and the home flag logic level via a single trace, AZ (Azimuth).



- The normal trace display for the Tilt Sensor, after performing remote tilt calibration, will be ± 4 divisions from the red reference line. Any trace line average plotted above this is of concern and troubleshooting required. See below for a screen capture of an antenna that is Level in both the Cross-Level and Elevation Axis.
- The Cross Level Tilt display should plot on the red reference line when the level cage is level, referenced to the horizon. It should decrease (plots below red line) when the antenna is tilted to the left and increase (plots above red line) when tilted to the right. See below for a screen capture of an abnormal CL trace Plot, it is an indication that the antenna that is either listed to the right approx. 4 degrees or the PCU requires too much CL tilt bias.



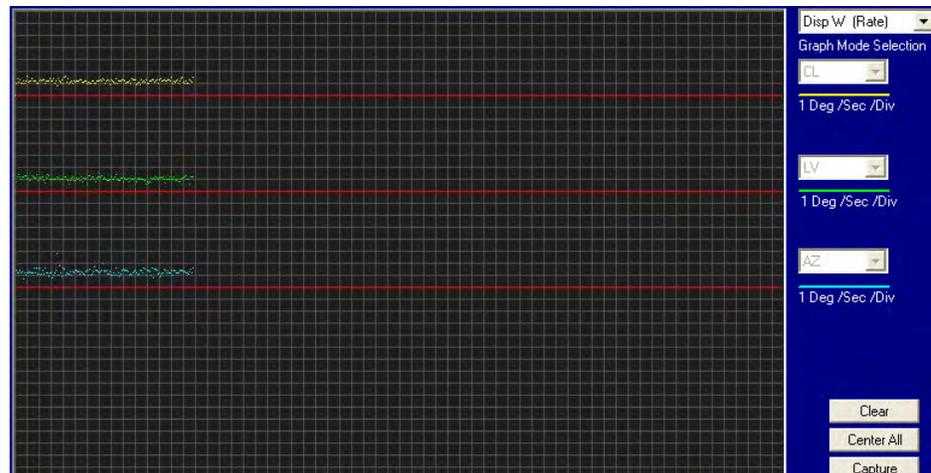
- The Level tilt display should plot on the red reference line when the level cage is level, referenced to the horizon. It should decrease (plots below red line) when the antenna is tilted forward (EL down) and increase (plots above red line) when tilted back (EL up).
- The Azimuth display for the Home Switch will normally display a logic level high (plots directly on Red reference line after clicking on the **Center All** button) when the home flag is NOT engaged and changing to a logic level low when engaged. See below for a screen capture of an antenna that was driven so that the Home Flag switch is engaged.



7.3.6. Open Loop Rate Sensor Monitoring

The DacRemP **DISPW** graph chart provides a means for monitoring the output of the 3 solid state rate sensors (located inside the Level Cage Assembly) for diagnostic purposes. The rate sensors are the primary inputs to the PCU for stabilization.

- To monitor the rate sensors, select the **Disp W (Rate)** graph chart
- This chart displays sensed output from the 3 rate sensors via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 1°/Second/vertical division.
- A normal trace display will be ± 1 divisions from the red reference line. The example shown below shows an antenna that is NOT currently sensing motion in any axis.



- The Cross Level display should decrease (plots below red line) as the antenna is tilted to the left and increase (plots above red line) as the antenna tilted to the right.
- The Level display should decrease (plots below red line) as the antenna is tilted forward and increase (plots above red line) as the antenna is tilted back.
- The Azimuth display should decrease (plots below red line) as the antenna is rotated CCW and increase (plots above red line) as the antenna is rotated CW. In the example below, the output of the Azimuth rate sensor is plotted above the reference line, indicating that the antenna was driven CW in Azimuth. Due to the in-practicality of driving an axis at a consistent rate, verification of rate sensor output is, for the most part restricted to a positive or negative response of the Level Cage movement (plotting above or below the red reference line of each axis).



7.3.7. Motor Drive (Torque Command) Monitoring

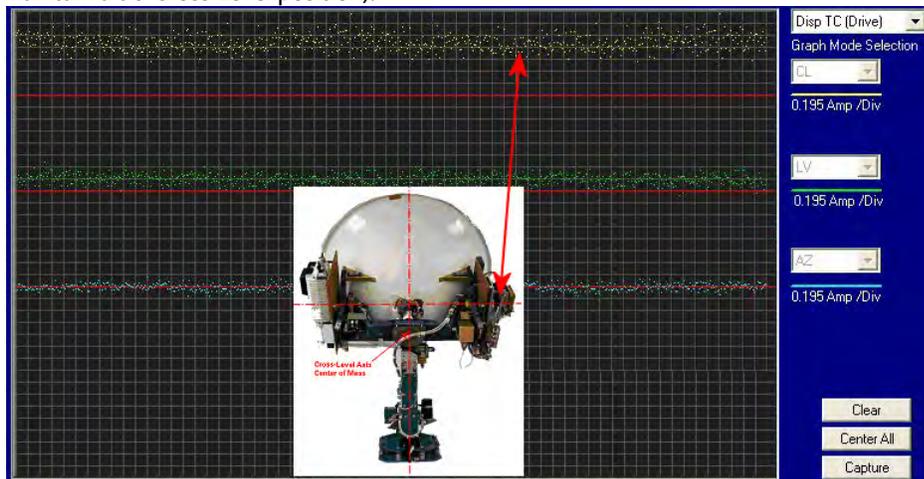
The DacRemP **DISPTC** graph chart provides a means for monitoring torque commands required for each motor for diagnostic purposes and verifying antenna balance. By observing each trace, the required drive of the antenna via the motor driver PCB may be established.

- To view the Torque Commands, select the graph chart.
- This chart displays the Torque Command errors for each axis via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 0.195amps/vertical division.

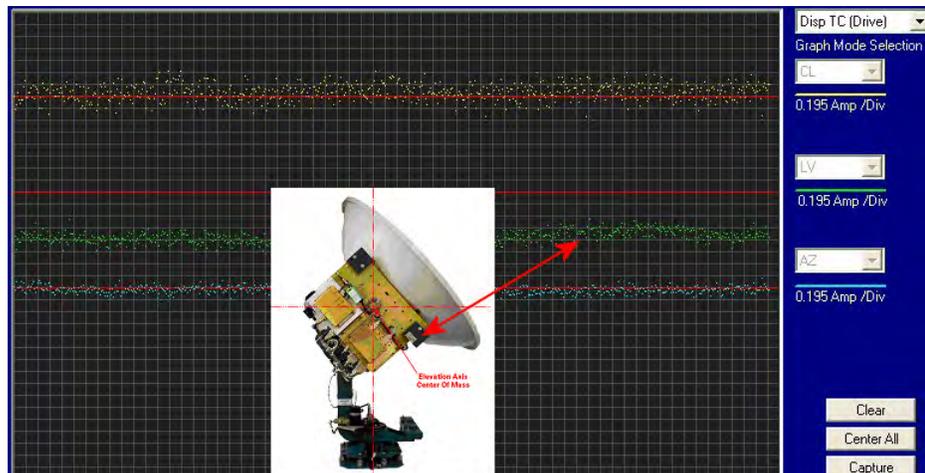


- A normal trace display will be ± 1 divisions from the red reference line while under calm sea conditions and with DishScan Drive turned off. See example below
- The Cross Level display will decrease (plots below red line) as the antenna requires drive to the left and increase (plots above red line) as the antenna requires to the right.

Example: The antenna pictured in the screen capture below is imbalanced so that it is “Right Heavy”. The CL trace is plotting above the red reference line (indicating that drive CCW is required to maintain a 90° Cross-Level position).



- The Level display should decrease (plots below red line) as the antenna requires drive forward (Up in elevation) and increase (plots above red line) as the antenna requires drive back (Down in elevation).
- Example: The antenna pictured in the screen capture below is imbalanced so that it is “Front Heavy”. The LV trace is plotting above the red line (indicating that drive CW is required to maintain the current elevation position).

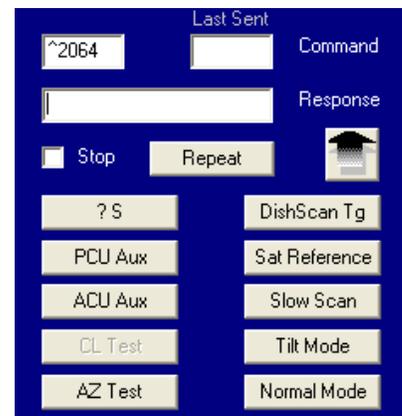


- The Azimuth display should decrease (plots below red line) as the antenna is driven CCW and increase (plots above red line) as the antenna is rotated CW.

7.3.8. Open Loop Motor Test

The **DacRemP Comm Diagnostics** Window provides a means to enter in Remote Commands for driving each individual torque motor to test that motors functionality. By driving each axis and observing the resulting motion of the antenna, a coarse operational status of the motor and motor driver may be established.

- To manually drive the motors, select the “**Comm Diagnostics**” window under to the Tools submenu or Press “CTRL + C”
- Using the small field in the upper left hand corner of the window, type in the remote command and verify the motor appropriately drives in the direction commanded.
- To drive the Cross Level motor, key in ^1064, ^1128 or ^1192 and press **ENTER** to drive the Cross Level axis LEFT, OFF or RIGHT respectively.
- To drive the Level motor, key in ^2064, ^2128 or ^2192 and press **ENTER** to drive the level axis FORWARD, OFF or BACKWARD respectively.
- To drive the Azimuth motor, key in ^3064, ^3128 or ^3192 and press **ENTER** to drive the azimuth axis CW, OFF or CCW.



7.3.9. To Disable/Enable DishScan

To be able to use Step Track, or to revert to Conscan, as your active tracking mode you will have to disable DishScan.

Select the **DISHSCAN** parameter window on the ACU:

1. Press the RIGHT arrow, then press the UP arrow and last press the ENTER key to turn DishScan mode ON.
2. Press the RIGHT arrow, then press the DOWN arrow and last press the ENTER key to turn DishScan Mode OFF.

If you change this remote parameter, you must save the change using REMOTE PARAMETERS.

If DishScan is **OFF** and the **Step Integral** parameter is set to **0000**, you will get a **constant ERROR 0016** (DishScan error) and you will see **zeros** flashing in the lower left of the Azimuth and Elevation ENTRY menu displays. This is a visual indication that DishScan is turned OFF.

7.3.10. Satellite Reference Mode

The ships gyro compass input to the ACU may be accurate and stable in static conditions and yet may NOT be accurate or stable enough in some underway dynamic conditions. If there is no gyro compass or if the input is corrupt, not stable or not consistently accurate the tracking errors will become large enough to cause the antenna to be mis-pointed off satellite.

Satellite Reference Mode will uncouple the gyro reference from the azimuth rate sensor control loop. When operating in Satellite Reference Mode changes in ships gyro reading will not directly affect the azimuth control loop. The Pedestal Control Unit will stabilize the antenna based entirely on the azimuth rate sensor loop and the tracking information from DishScan. This will keep the azimuth rate sensor position from eventually drifting away at a rate faster than the tracking loop can correct by using the tracking errors to regulate the rate sensor bias.

Satellite Reference Mode can be used as a diagnostic mode to determine if tracking errors are caused by faulty gyro inputs.

Satellite Reference Mode **MUST be used when:**

- No Gyro Compass is available
- Frequent or constant ACU Error Code 0001 (Gyro Compass has failed)
- Gyro Compass output is NMEA heading
- Flux Gate Compass is being used
- GPS Satellite Compass is being used

To view, or change, the Satellite Reference Mode status, select the SAT REF remote parameter:

1. Press the RIGHT arrow, then press the UP arrow and last press the ENTER key to turn Satellite Reference Mode ON.
2. Press the RIGHT arrow, then press the DOWN arrow and last press the ENTER key to turn Satellite Reference Mode OFF.

If you change this remote parameter, you must save the change using REMOTE PARAMETERS.

7.3.11. To Read/Decode an ACU Error Code 0008 (Pedestal Error):

Select the REMOTE COMMAND window on the ACU and;

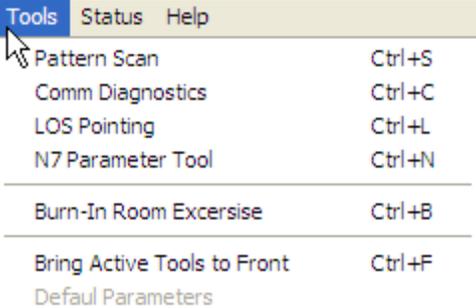
1. Using the LEFT/RIGHT and UP/DOWN arrow keys set the Remote Command value to ""S0000" (the S must be upper case) and press ENTER.
2. Press ENTER key once more to display the REMOTE MONITOR window. SABC@ will be displayed (S followed by 3 letters and a symbol (checksum)). The fourth letter (**C above**) is the pedestal error letter. **Ref** is an AZ Reference, encoder or Home Flag error. **AZ** is Azimuth, **LV** is Level (Elevation) and **CL** is Cross-Level. Decode the letter code using the chart below:

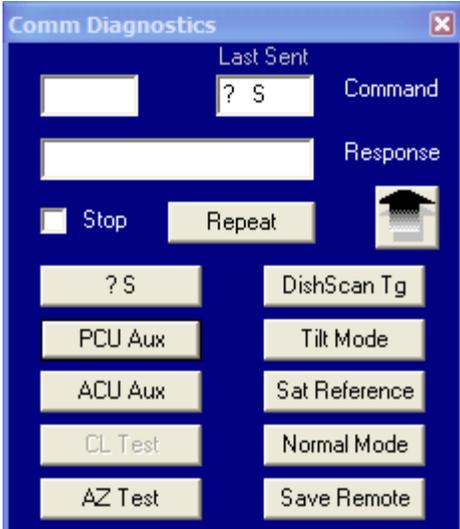
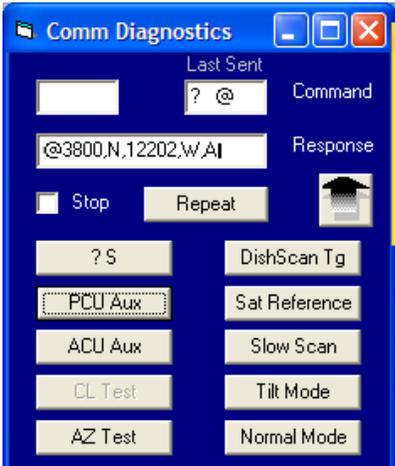
Letter	REF	AZ	LV	CL	Description of Pedestal Error
@	0	0	0	0	None
A	0	0	0	1	CL
B	0	0	1	0	LV
C	0	0	1	1	CL + LV
D	0	1	0	0	AZ
E	0	1	0	1	AZ + CL
F	0	1	1	0	AZ + LV
G	0	1	1	1	AZ + LV + CL
H	1	0	0	0	Ref
I	1	0	0	1	Ref + CL
J	1	0	1	0	Ref + LV
K	1	0	1	1	Ref + LV + CL
L	1	1	0	0	Ref + AZ
M	1	1	0	1	Ref + AZ + CL

N	1	1	1	0	Ref + AZ + LV
O	1	1	1	1	Ref + AZ + LV + CL
P	0	0	0	0	Stab Limit
Q	0	0	0	1	Stab Limit + CL
R	0	0	1	0	Stab Limit + LV
S	0	0	1	1	Stab Limit + CL + LV
T	0	1	0	0	Stab Limit + AZ
U	0	1	0	1	Stab Limit + AZ + CL
V	0	1	1	0	Stab Limit + AZ + LV
W	0	1	1	1	Stab Limit + AZ + LV + CL
X	1	0	0	0	Stab Limit + Ref
Y	1	0	0	1	Stab Limit + Ref + CL
Z	1	0	1	0	Stab Limit + Ref + LV
[1	0	1	1	Stab Limit + Ref + LV + CL
\	1	1	0	0	Stab Limit + Ref + AZ
]	1	1	0	1	Stab Limit + Ref + AZ + CL
^	1	1	1	0	Stab Limit + Ref + AZ + LV
_	1	1	1	1	Stab Limit + Ref + AZ + LV + CL

7.3.12. Remote GPS LAT/LON Position:

The above decks equipment has an integrated on board Furuno GPS antenna system. The Latitude and Longitude position information provided are utilized to calculate the Azimuth, Elevation, Cross-level and Polarity pointing angles of the desired satellite. The DacRemP “**Comm Diagnostics**” Window provides a means to query the GPS antenna to verify proper operation. The procedure below describes this process.

<p>3. Select the “Comm Diagnostics” window under to the Tools submenu or Press “CTRL + C”</p>	
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<p>Left mouse click on the  icon.</p>	
<p>Left Mouse click on the “?@ PCU GPS position, 1 min (1 Nm)”</p>	<pre>? V PCU Version ? v References ? x IVC Loop Error ? y Torque Drive ? @ PCU GPS position, 1 min (1 Nm) ----- ^0067 DishScan Toggle ^0071 Sat Reference Mode ^0070 Slow Scan Mode ^0084 Tilt/Test Mode ^0000 Normal Mode ^0087 Save PCU Parameters ----- ^0090 Reboot PCU ^0082 Clear AZ HF Err Reset PCU Error Status</pre>
<p>In the “Response” window verify proper GPS position to within 1 nautical mile of your current position.</p> <p>The Latitude & Longitude position of the GPS will be displayed in the following format: “@ LAT,N,LON,E,A”</p> <p>Where LAT and LON are in degrees and minutes, LAT will be followed by N or S (North or South), LON will be followed by E or W (East or West), then a status character and finally a checksum character.</p>	
<p>Furuno default value is in Japan at 34.4N 135.2E (@3444,N,13521,E,,_).</p> <p>After acquiring a good fix at Sea Tel the string is @3800,N,12202,W,A^ for our 38N 122W Latitude and Longitude position.</p> <p>The status character tells you the status of the GPS. “,” (Comma) = GPS has NOT</p>	

acquired a proper fix, "N" = GPS fix is NOT valid "A" = GPS has acquired a valid fix.	
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7.4. Maintenance

Below are some procedures for removing/replacing some of the major components on the antenna.

7.4.1. Replacing or Changing LNBS

Series 04 antenna can be easily fitted with a variety of LNB assemblies. The feed is capable of receiving linear or circular polarization signals, however, the LNB must match the desired satellite polarization mode. Below are the instructions to install and align a replacement LNB, or switch to a different LNB. . When a Linear LNB is installed POL OFFSET parameter must be optimized.

NOTE: Linear polarization skew is intentionally REVERSED from actual received satellite polarization by the ½ wave length phase card (refer to basic system information). Therefore, to adjust polarization UP the LNB (as viewed from the back side of the reflector) must rotate CCW and to adjust polarity DOWN the LNB must rotate CW.

1. Open the radome hatch or remove radome top.

Target a Satellite **Longitude** that is the same as the Ships current Longitude. This will cause Auto-Polarization to rotate the current LNB to a vertical position (straight up), and the ACU polarization will be 120.

You may need to rotate the antenna to access the back of the dish.

Note that with the Cross-Level beam level, the body of the current LNB is vertical (straight up).



If you are replacing the LNB with the same style LNB, loosen the Allen set screws on the existing LNB mounting collar (three set screws, 120 degrees apart) and extract it from the mounting collar. If you are changing the LNB to a different style LNB, loosen the four screws that attach the mounting collar to the driven gear and remove the LNB and mounting collar.

Insert the new LNB (same style) into the mounting collar, assure it is seated all the way into the mounting collar tube, rotate the LNB as needed to align the center of the body of the LNB to a vertical position (straight up) and tighten the set screws. Mount the (different style) new LNB into the mounting collar. Assure that the LNB is seated all the way into the mounting collar tube, rotated to align the center of the body of the LNB to a vertical position (straight up) and tighten the setscrews.



<p>Transfer the coax cables from the old LNB to the new LNB, assure that the correct color coax is attached to the correct port on the LNB as well as the below deck active matrix switch. Below is Sea Tel's recommended coax color code.</p> <p>Dual Circular LNB RHCP (Blue) LHCP (White)</p> <p>Dual Linear LNB Vertical (Blue) Horizontal (White)</p> <p>Quad Linear LNB Horizontal High (Black) Vertical High (Green) Horizontal Low (White) Vertical Low (Blue)</p>	
<p>Close the radome hatch or re-install the radome top and tighten radome hardware. Verify that the LNB operating properly and resume normal operation.</p>	

7.4.2. Replacing the PCU

It is highly recommended that all saved Parameters in the suspected failed Pedestal Control Unit (P/N 122203) be recorded so they can be duplicated in the replacement PCU. Use either the DAC2200 or DacRemP to record the following parameter settings; Remote Command responses to N0999, N1999, N2999, N3999, N7999 commands and the Remote Monitor message of the Remote command S0000.

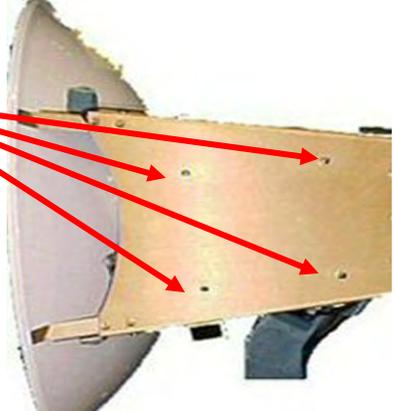
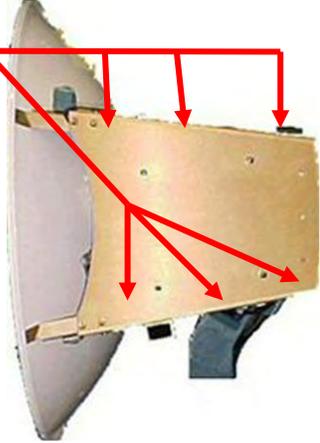
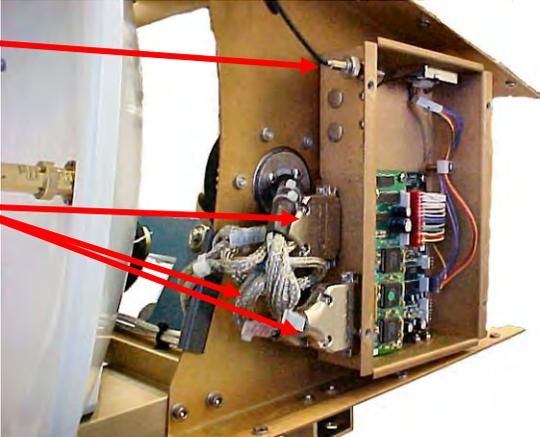
Left Side EI Pan Cover must be removed to access the (PCU)

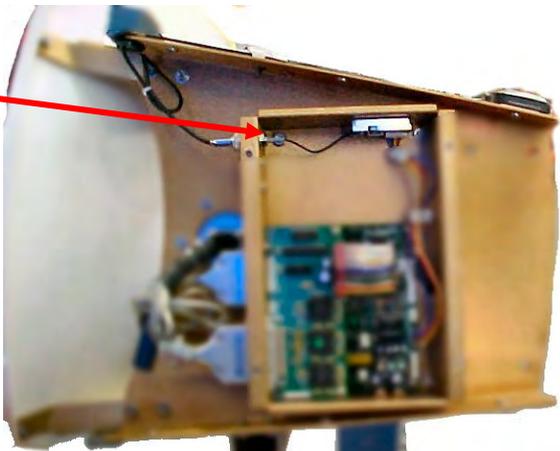
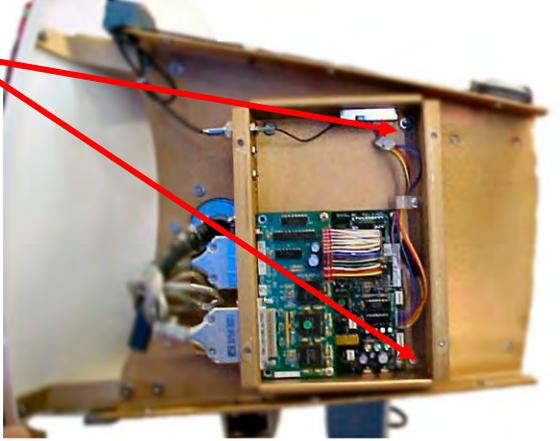
Tools Required:

- 1/2" Nut driver or Wrench
- #2 Phillips Head Screwdriver
- 3/8" Nut driver or Wrench
- 2 mm Flat Blade Screw Driver
- Loctite 222 or equiv.



NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

<p>1. Remove the four 10/32 x 3/8" screws attaching El Pan Cover to PCU Assembly.</p>	
<p>Remove the six 10/32 x 3/8" screws attaching El Pan Cover to El Pan bottom. Remove the El Pan Cover.</p>	
<p>Remove the BNC cable from the GPS antenna. Loosen the 4-40 retaining screws on each of the Pedestal Harness D-Sub connectors and unplug all 3 connectors.</p>	

<p>Being careful not to damage the BNC-HIROSE Pigtail cable, remove the 10/32 Hex nut and #10 flat washer.</p>	
<p>Remove the remaining two 10/32 Hex nuts and #10 flat washers. Using caution, as antenna will drop hard to the right due the weight imbalance, remove PCU.</p>	
<p>Replace PCU Assembly and secure to El pan using Loctite 222 and the hardware removed in steps 6 and 7. Re-Connect D-sub connectors and BNC connector removed in steps 4 and 5.</p>	
<p>Re-install EL P Cover and secure using Loctite 222 and the hardware removed in steps 1 and 2. Check and/or adjust Antenna balance. Configure the new PCU by following the procedure in paragraph 7.5.</p>	
<p>Place a light weight bubble level on top of the level cage. Check to see if the level cage is level front/back and left/right. If either axis is not level follow the "Tilt Adjustment" procedure below.</p>	

7.4.3. Replacing Level Cage or Level Cage Belt

This procedure to remove and replace Level Cage Assembly (P/N 122208-1) includes step to replace & tension the level cage belt. If you are only replacing the level cage belt, jump to step 9.

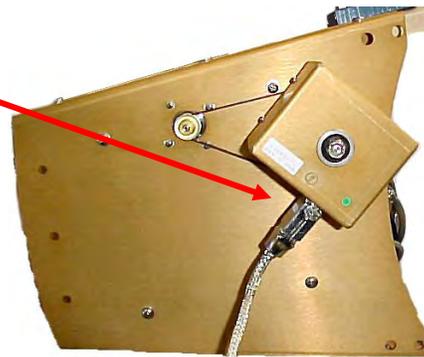
Tools Required:

- ½" Nut driver or Wrench
- #1 Phillips Head Screwdriver
- 2 mm Flat Blade Screwdriver

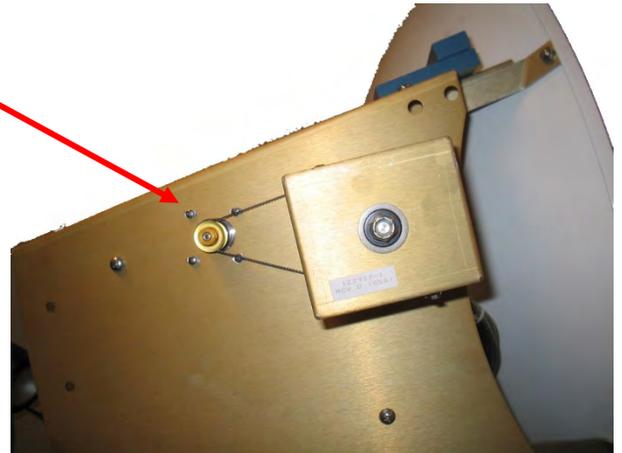


NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

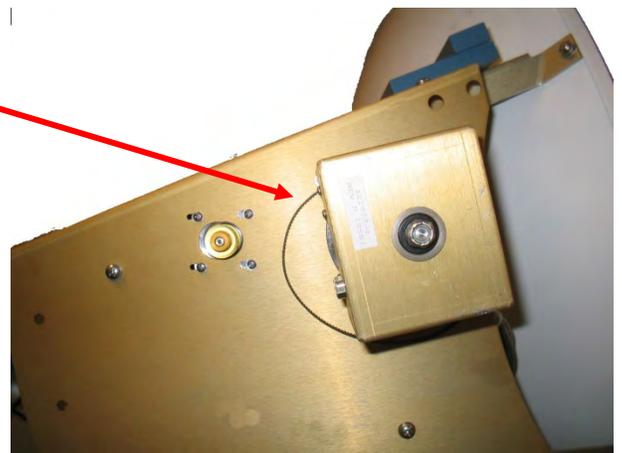
1. Using 2mm flat blade Screwdriver loosen screws securing D-Sub Connector to Level Cage Assembly.

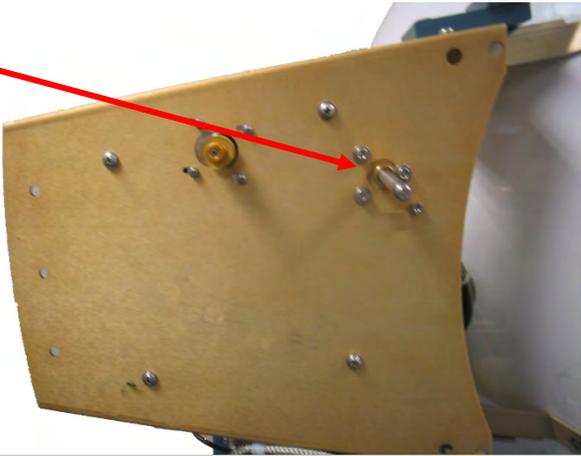


Using a #1 Phillips Screwdriver, loosen the four 4/40 screws attaching Level Cage Stepper Motor to El Pan.

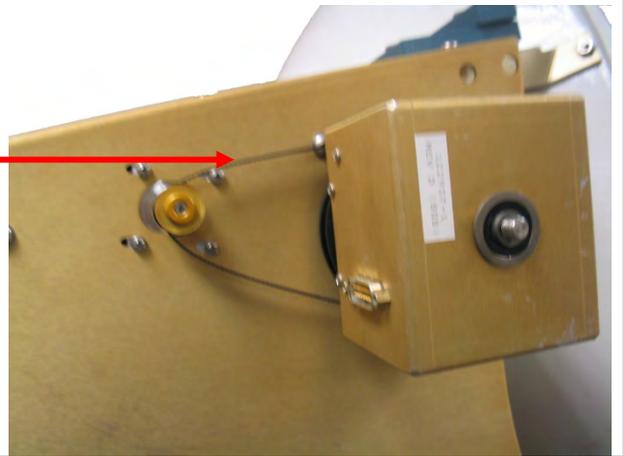


Slide sprocket assembly towards reflector and remove belt from Level Cage Stepper Motor sprocket.

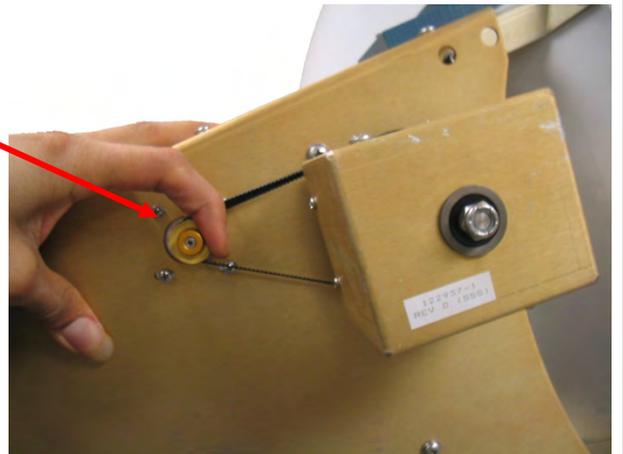


<p>With the cage rotated to the CW stop, Observe orientation of the 15 Pin D-sub connector.</p> <p>Using 1/2" Nut Driver or Wrench, remove jam nut securing Level Cage Assembly to spindle.</p>	
<p>Do Not remove Level Standoff.</p>	
<p>Install new level cage onto spindle with the D-sub connector in the same orientation observed in step 5. Secure with jam nut removed in step 4. Tighten the Jam nut just enough to capture the level cage between the standoff and the Jam nut, then tighten the Jam nut 1/8th turn to slightly pre-load the bearings.</p> <p>Rotate Level Cage assembly by hand and verify exactly 90 degrees range of motion, and that the cage rotates freely and "Stops" do not rub against body of El Pan.</p> <p>Slip the belt over the body of the level cage assembly.</p>	

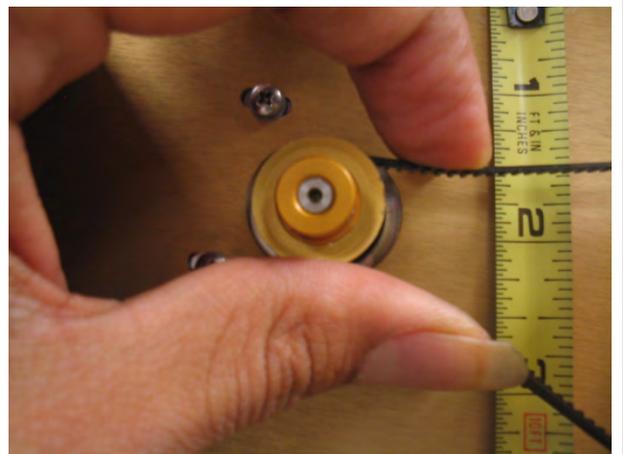
Plug the level cage cable back into the D-Sub connector and tighten retaining screws.
Place the belt onto the level cage pulley.
Place the belt onto Stepper Motor sprocket.



Tension belt by sliding Motor sprocket assembly by hand away from level cage and tighten the four 4/40 screws loosened in step 2 with Loctite 222.



Rotate Level Cage by hand to the CCW and CW stop and check belt tension. Tension on belt should just enough to engage drive to level cage. (approx. 3/16" play when pinched) If belt tension is tighter at the CCW stop than the CW stop or vice versa than readjust for proper tension with the level cage oriented where belt tension was greatest.
Check and/or adjust Antenna balance.



7.4.4. To Adjust Tilt:

Select the REMOTE TILT window on the ACU and;

1. Set a bubble (or bulls-eye) level on top of the Level Cage assembly. **NOTE:** If the level cage is not within 4 degrees of level fore/aft or left/right, replace the Level Cage assembly.
2. If the level cage is within 4 degrees in BOTH For/Aft and Left/Right, use the **UP/DOWN** arrow keys to adjust LV (fore/aft) until the level cage is level in this axis.
3. Use the **LEFT/RIGHT** arrow keys to adjust CL (left/right) until the level cage is level in this axis.
4. Once the level cage is level in both axes, wait for 30 seconds then press the **ENTER** key.
5. Press **ENTER** to step the menu to **REMOTE PARAMETERS**.

- Press the **LEFT** arrow key and then press the **ENTER** key to save the settings in the PCU.

This saves the new tilt bias settings in the PCU. Reset or re-initialize the antenna to verify that the Level cage is properly level with the new settings.

7.4.5. Replacing Level Cage Stepper Motor

Right Side El Pan Cover must be removed to replace the Level Cage Stepper Motor Assembly.

Tools Required:

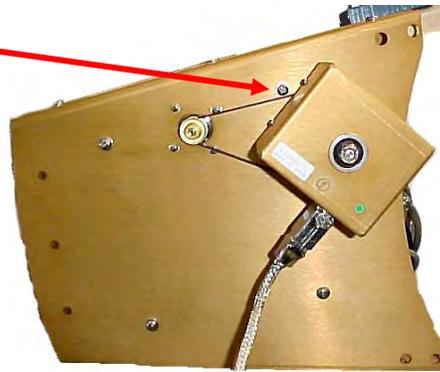
- 1/2" Nut driver or Wrench
- #2 Phillips Head Screwdriver
- 3/8" Nut driver or Wrench
- 2 mm Flat Blade Screw Driver
- Loctite 222 or equiv.



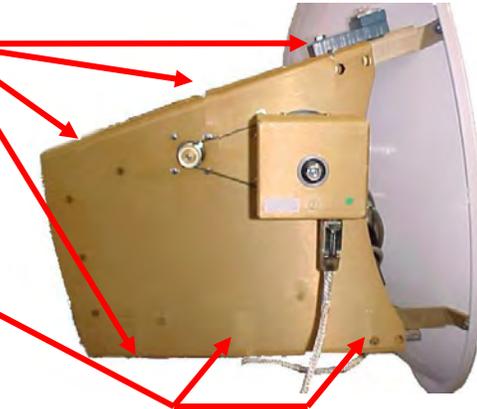
NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

<p>1. Using the 1/2" wrench, remove the 5/16-18 x 1/2" bolt securing inside EL Pan bottom to Spindle Plate.</p>	
<p>Remove the three 10/32 x 3/8" screws attaching El Pan Cover to POL AUX Relay Assembly.</p>	

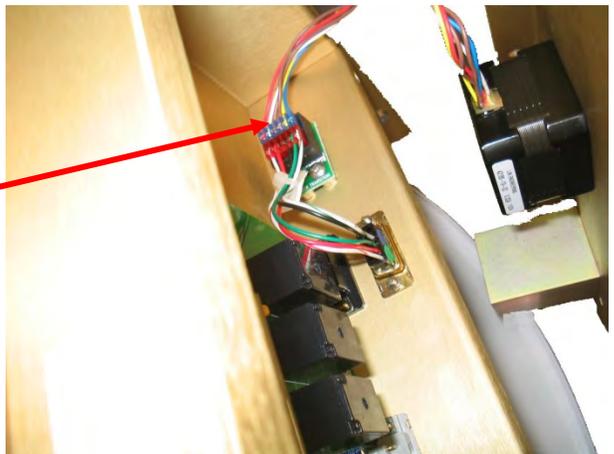
Rotate Level Cage clockwise as required to access this 10/32 x 3/8" screw and remove. Removing the Level cage assembly and or belt is not required.



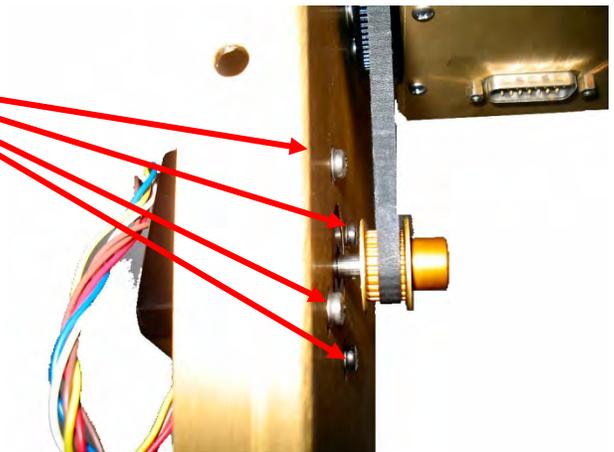
Remove the four 10/32 x 3/8" screws attaching El Pan cover to El Pan bottom. Remove the two 10/32 x 1/2" screws attaching P-clamps to El Pan Cover (and El Pan bottom).

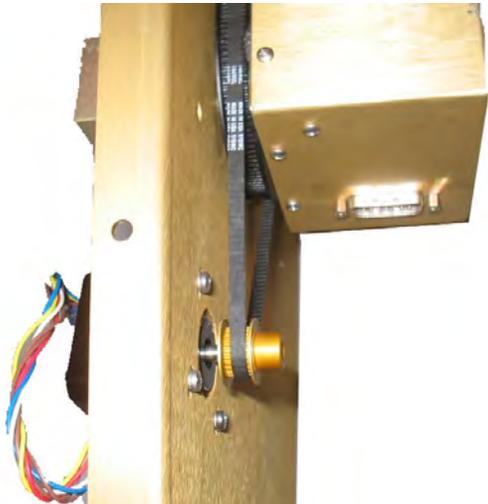
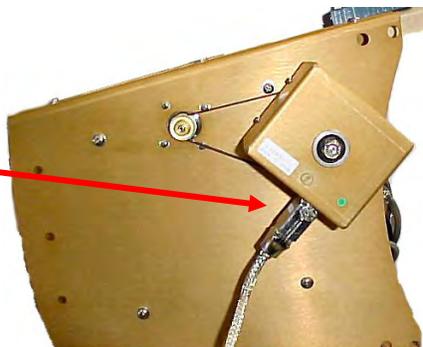
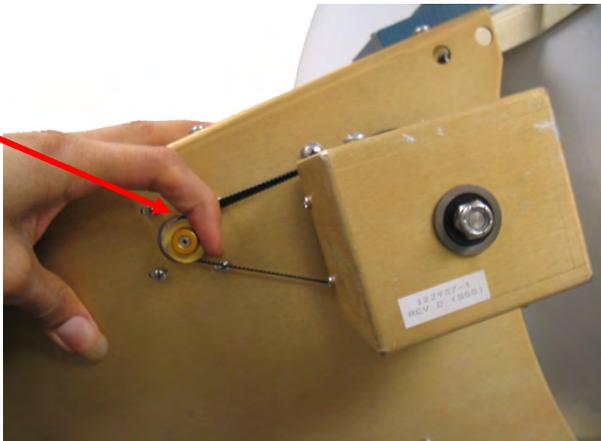


Using 2mm flat blade screwdriver loosen the retaining screws from the D-sub connector and remove the level cage cable. Carefully pull El Pan Cover away to expose Level Cage Motor Wiring Harness and disconnect IDC connector from Motor Termination PCB.



Remove the four screws securing Level Cage Motor assembly to El Pan. Save Hardware for future use.



<p>Install replacement Level Cage Motor assembly into El Pan with belt around sprocket and loosely secure with hardware removed in step 9.</p>	
<p>Re-Install right El pan and secure using Loctite 222 and all hardware removed in steps 1, 2, 3, 5 and 6. Plug the level cage cable into the D-sub connector on the Level Cage Assembly and tighten the retaining screws using 2mm flat blade screwdriver.</p>	
<p>Tension belt by sliding Motor sprocket assembly by hand away from level cage and tighten the four 4/40 screws with Loctite 222.</p>	

Rotate Level Cage by hand to the CCW and CW stop and check belt tension. Tension on belt should just enough to engage drive to level cage. (approx. 3/16" play when pinched). If belt tension is tighter at the CCW stop than the CW stop or vice versa than repeat step 13 for proper tension with the level cage oriented where greatest belt tension was observed.

Check and/or adjust Antenna balance



7.4.6. Replacing Azimuth Double Stacked Motor w/ Encoder

Tools Required:

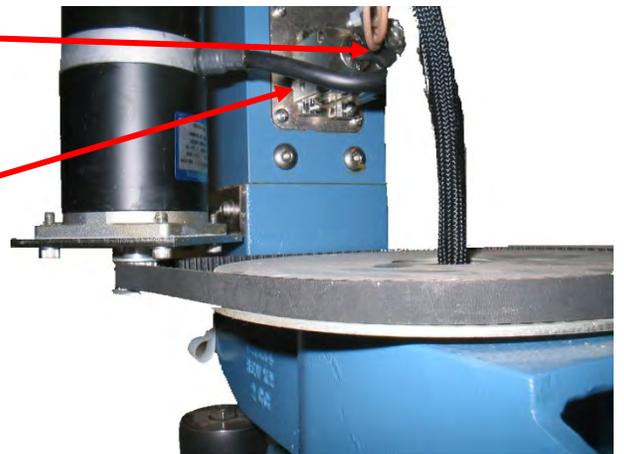
- 7/16" Wrench
- 9/64" Allen Head Wrench
- 5/32" Allen Head Wrench
- Snips / Flush Cutters
- 2 mm Flat Blade Screwdriver
- Loctite 222 or equiv.



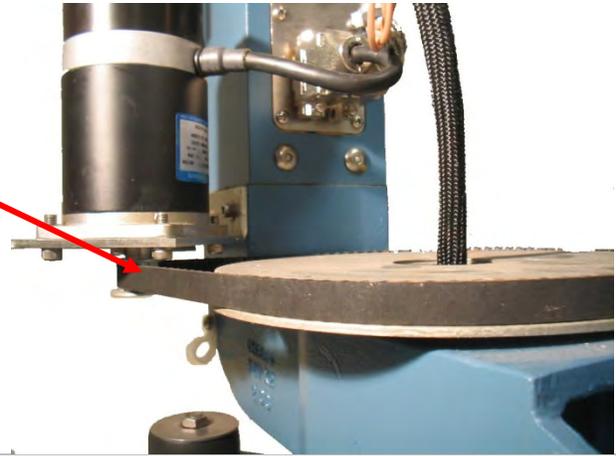
NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

1. Using snips, cut Tie Wrap holding AZ Motor Harness and Pedestal Interface Harness together.

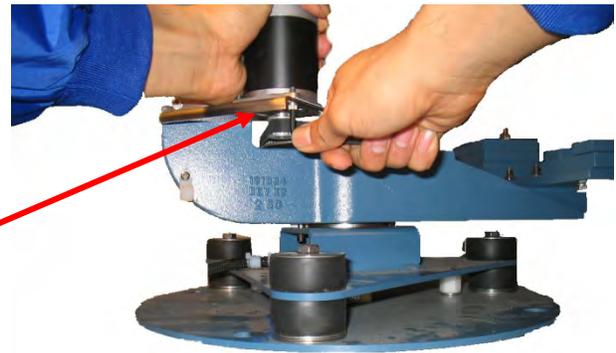
Using 2mm Flat Blade Screwdriver, loosen qty two retaining screws on AZ Motor harness and remove from AZ Post Connector panel.



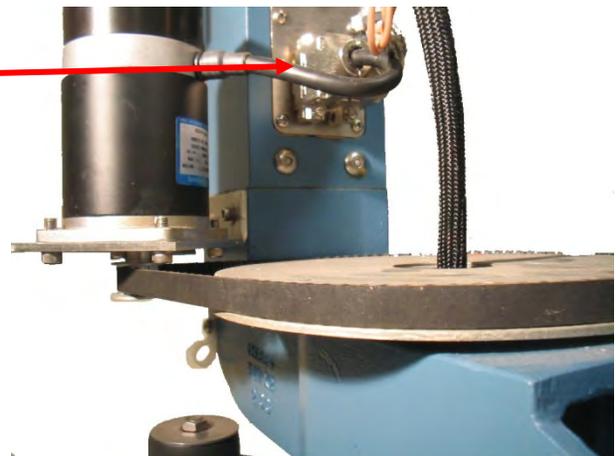
Using a 9/64" Allen Wrench, remove the four Allen head screws (bottom side of motor bracket) securing AZ motor and remove Motor Assembly. Save hardware for future use.



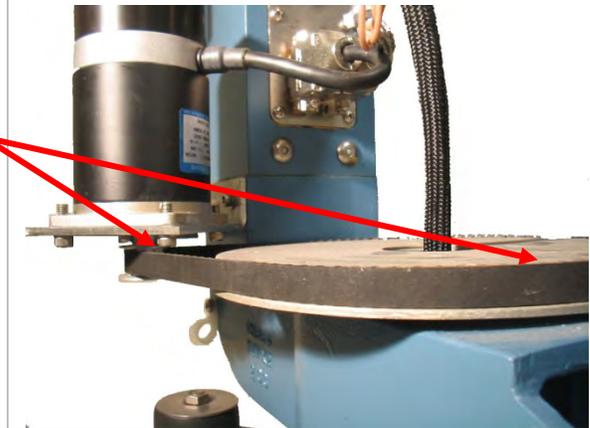
Insert replacement motor assembly into mounting bracket with cable harness towards AZ Pulley.
Place AZ Belt around Az motor sprocket.
Tension belt by pulling motor assembly away from AZ pulley. Secure motor to bracket using Loctite 222 and hardware removed in step 1.



Re-connect Az Motor Harness to AZ Post Connector Panel and secure two retaining screws loosened in step 1.



Rotate Antenna (by hand) from CCW stop to CW stop while observing belt. Check to see the belt does not rub against motor mounting hardware and that the belt remains level with pulleys. ****Failure of this step normally indicates improper sprocket placement on the Azimuth Motor shaft****



7.4.7. Replacing Azimuth Belt

Tools Required:

- 7/16" Wrench
- 9/64" Allen Head Wrench
- 5/32" Allen Head Wrench
- Snips / Flush Cutters
- 2 mm Flat Blade Screwdriver
- Loctite 222 or equiv.



NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

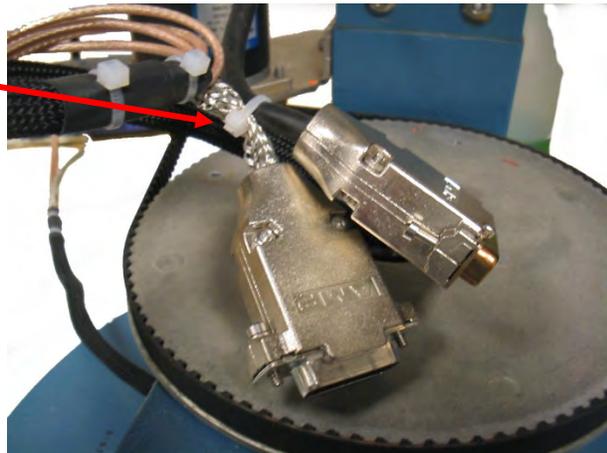
1. Observe and verify Colored Coax heat shrink matches silkscreen on AZ Post Connector panel.
Using a 7/16" Wrench, remove the four coax connectors.



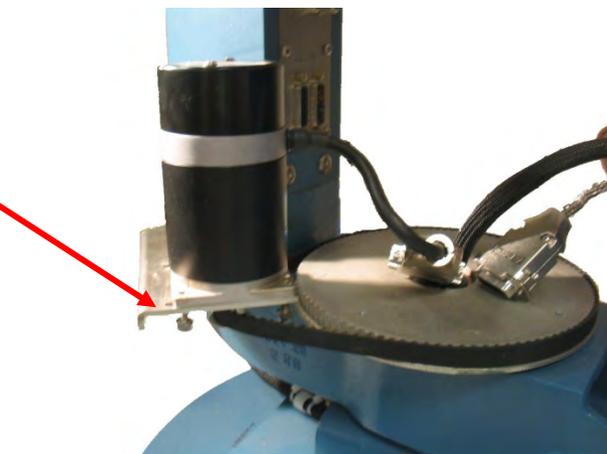
Using a 2mm Flat blade screwdriver loosen retaining screws securing both D-Sub connectors to AZ Post Connector Panel and remove.



Using snips, cut the Tie Wrap holding AZ Motor Wire harness and Pedestal Interface Harness together.



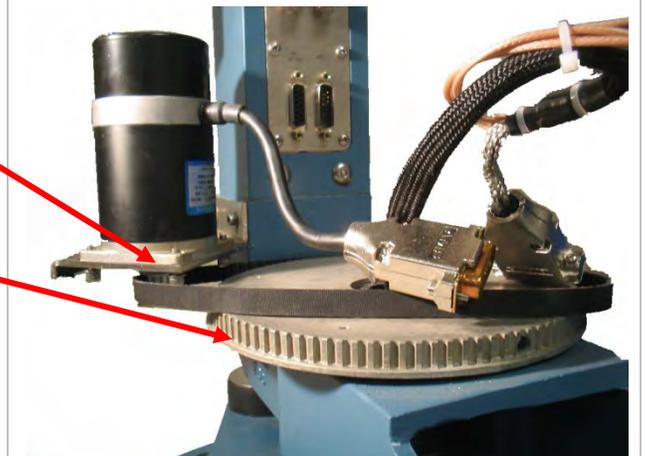
Using a 9/64" Allen Wrench, loosen the four Allen head screws (bottom side of the motor bracket) securing AZ motor and slide the motor in toward the Azimuth driven sprocket (complete removal of hardware is not required).



If not broken, remove the old belt from AZ driven sprocket and AZ motor sprocket.



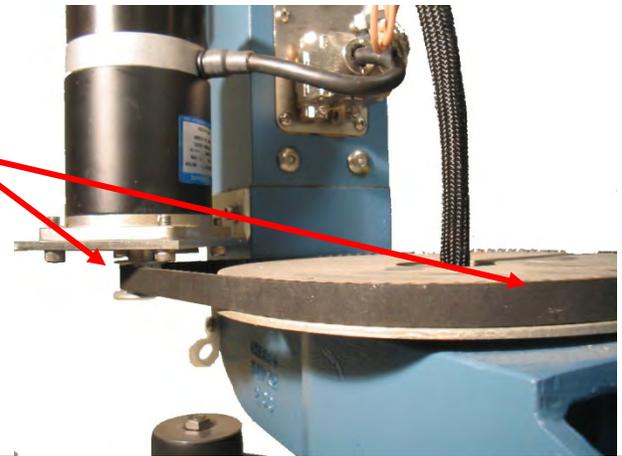
Place replacement belt around Azimuth motor sprocket, with interface harness and RF cables through the center of the belt. Place the belt don onto the teeth of the Azimuth driven sprocket.



Tension belt by pulling motor assembly away from Azimuth driven sprocket and secure motor to bracket using Loctite 222 and hardware loosened in step 5.



Rotate Antenna from CCW stop to CW stop while observing belt. Check to see the belt does not rub against motor mounting hardware and that the belt remains level with both sprockets.



7.4.8. Replacing Elevation Drive Motor

The following procedure for replacing Elevation belt with the factory installed spare belt on CL beam.

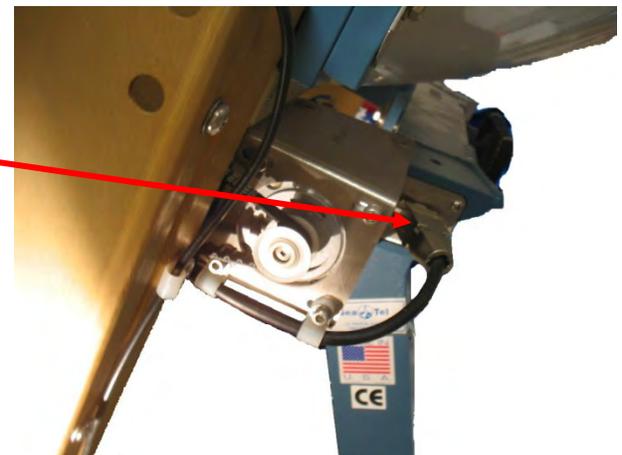
Tools Required:

- 9/64" Allen Head Wrench
- 5/32" Allen Head Wrench
- Snips / Flush Cutters
- 2 mm Flat Blade Screwdriver
- Loctite 222 or equiv.

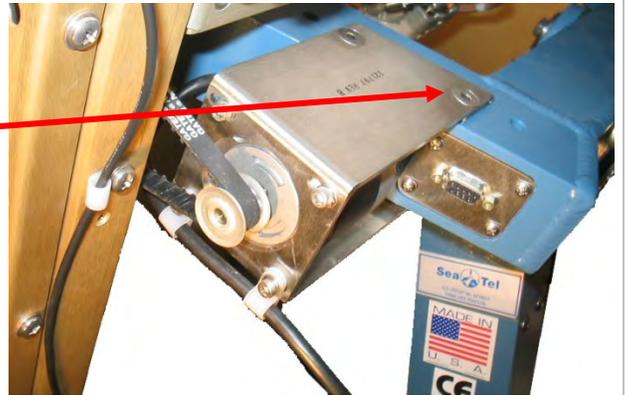


NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

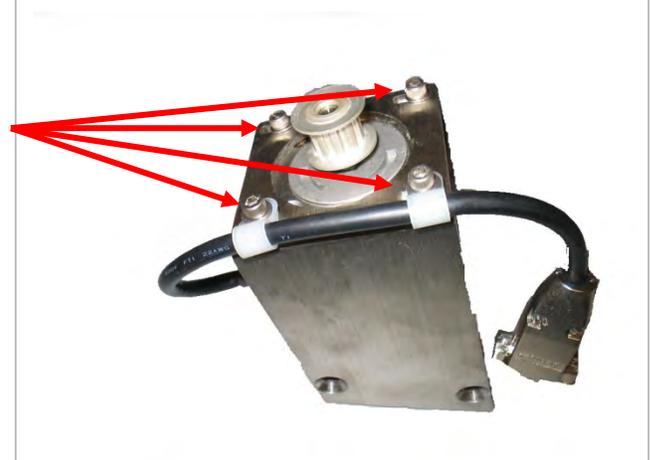
1. Using 2mm Flat Blade Screwdriver, loosen two retaining screws on EL Motor harness and remove it from AZ post.



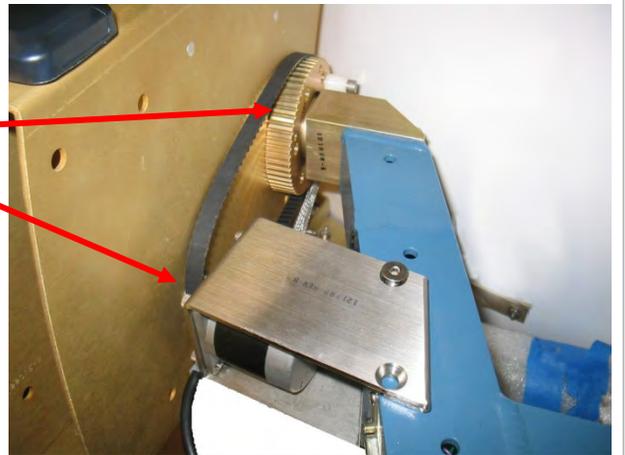
Using a 5/32" Allen Wrench, remove the four Allen Head screws attaching elevation motor bracket to CL beam and remove motor assembly.



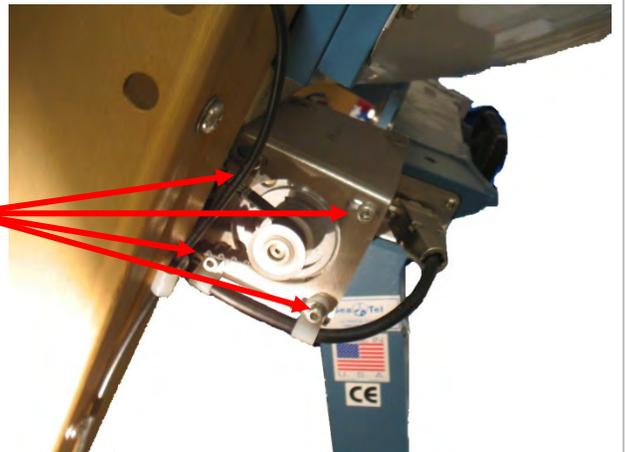
Observe cable orientation in reference to bracket and then remove Motor from bracket.
 Using a 9/64" Allen Wrench, remove the four Allen Head screws attaching motor to bracket. Remove save hardware for future use.
 Install replacement motor, and cable, onto the bracket (with cable in the same orientation observed in step 3) using the hardware removed in step 3. Do not tighten at this time.



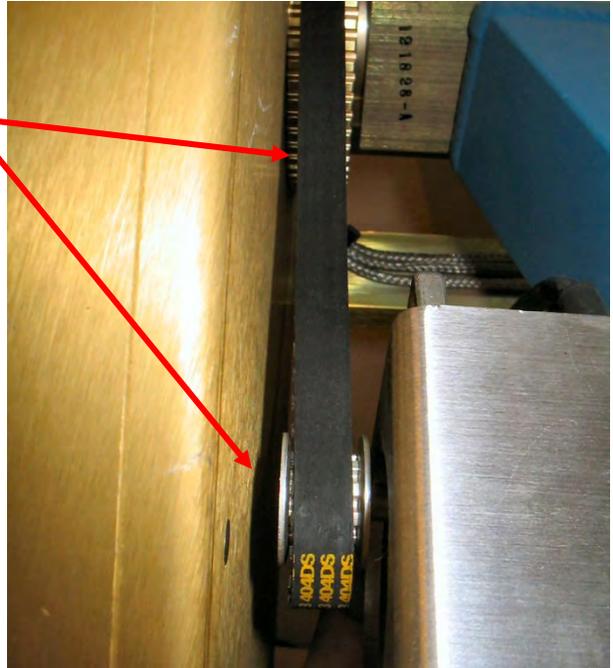
Re-install bracket onto CL beam using two of the Allen head screws removed in step 2, do not fully tighten.
 Place belt around elevation driven sprocket and then elevation motor sprocket.
 Install the other two allen head screws and Secure motor bracket onto CL Beam using Loctite 222 on all four screws.



Reconnect EL Motor harness removed in step 1 and secure with two retaining screws. Rotate reflector from upper physical stop to access the Elevation motor mounting hardware. Push back on the motor body to tension the elevation belt and tighten the four mounting screws with Loctite 222.



Rotate reflector from upper physical stop to lower physical stop and verify that the motor sprocket and the belt do not rub against elevation pan and that the belt runs inline with both sprockets. (Failure of this step is normally due to incorrect sprocket placement on elevation motor assembly). Check and/or adjust antenna balance.



7.4.9. Replacing Elevation Drive Belt

The following procedure for replacing Elevation belt with the factory installed spare belt on CL beam. If the spare belt (on the CL Beam) has already been used you must contact Sea Tel Service Department for assistance.

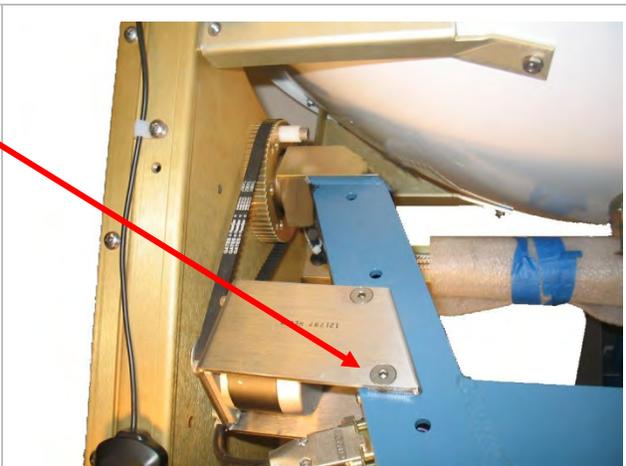
Tools Required:

- 9/64" Allen Head Wrench
- 5/32" Allen Head Wrench
- Snips / Flush Cutters
- 2 mm Flat Blade Screwdriver
- Loctite 222 or equiv.



NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

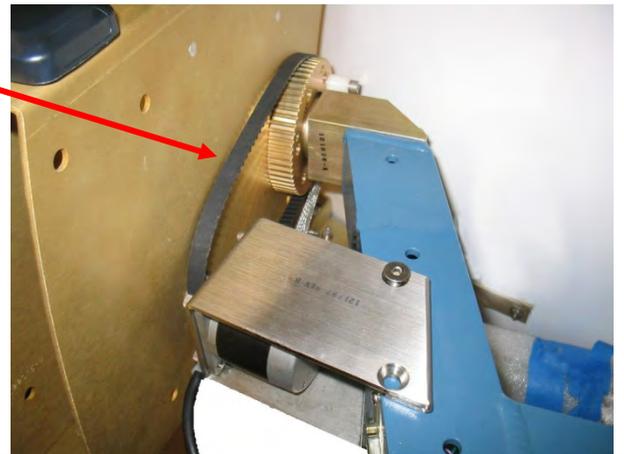
1. Using a 5/32" Allen Wrench, remove the two Allen Head screws which are farthest from the reflector (top and bottom) to enable you to swivel the elevation motor forward Toward the reflector. Loosen the two forward screws.



Using Snips, cut tie wrap(s) securing spare elevation belt to CL beam. Use caution as to not cut belt.



Install replacement belt around the elevation driven sprocket and elevation motor sprocket. Swivel the elevation motor bracket to CL beam (away from the reflector) and re-install the two screws removed in step 1. Using Loctite 222 tighten all four screws removed/loosened in step 1.



Rotate reflector from upper physical stop to access the Elevation motor mounting hardware. Push back on the motor body to tension the elevation belt and tighten the four mounting screws with Loctite 222.



Rotate reflector from upper physical stop to lower physical stop and verify that the motor sprocket and the belt do not rub against elevation pan and that the belt runs inline with both sprockets. Incorrect belt travel is most frequently caused by incorrect sprocket placement on elevation motor shaft. Check and/or adjust antenna balance.



7.4.10. Replacing CL Drive Motor

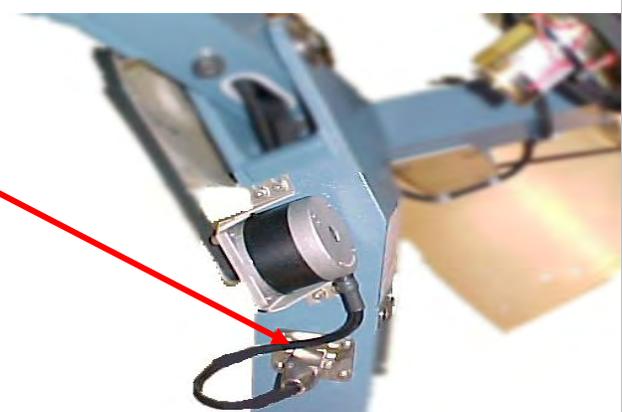
Tools Required:

- 9/64" Allen Head Wrench
- 5/32" Allen Head Wrench
- Snips / Flush Cutters
- 2 mm Flat Blade Screwdriver
- Loctite 222 or equiv.

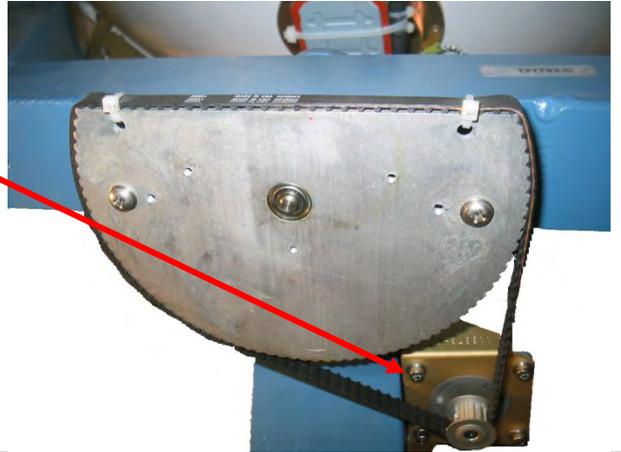


NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

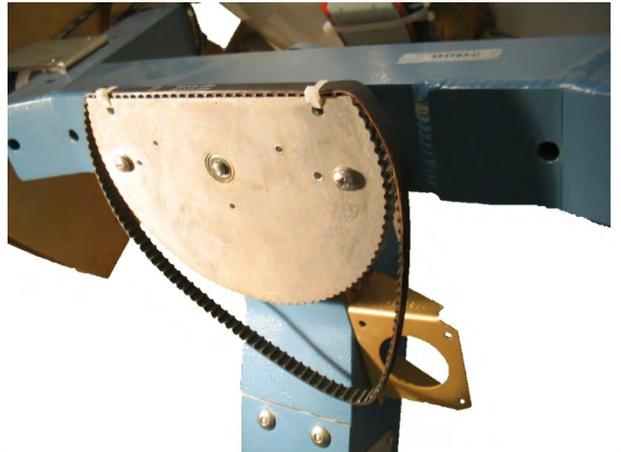
1. Using a 2mm Flat Blade Screwdriver, loosen two retaining screws on CL Motor harness and remove from AZ post.



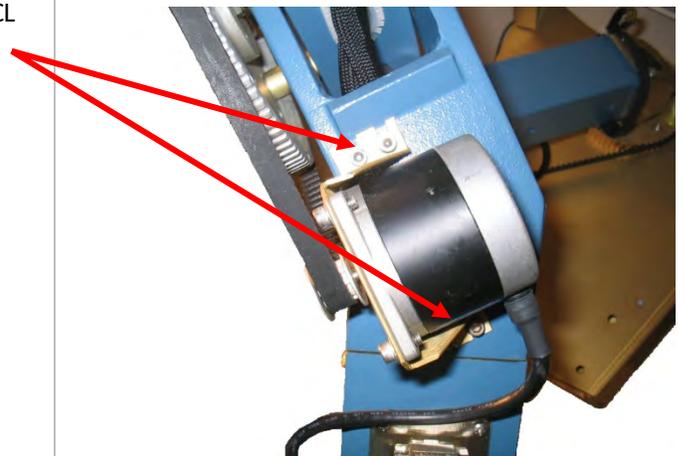
Using a 9/64" Allen Wrench, remove the four Allen Head screws securing Cross Level Motor to the C/L bracket. Save hardware for future use.
Remove CL Motor from bracket.

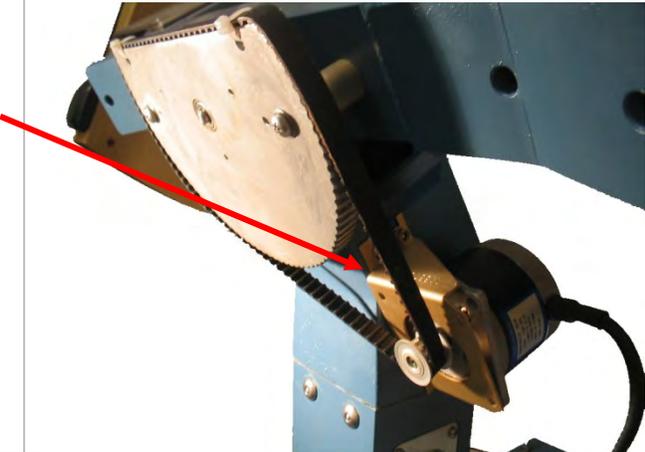


Install replacement Motor Assembly onto CL Motor Bracket and using the hardware removed in step 2. Tighten the four screws with Loctite 222.



Loosen four Allen Head Screws securing CL Motor Bracket to AZ Post. Complete removal of hardware is not required.



<p>Install belt around CL Motor Sprocket. Tension belt by pulling the motor bracket down towards the antenna base and tighten the four screws with Loctite 222.</p>	
<p>Rotate CL beam from CCW stop to CW stop (Left to right as viewed from behind reflector) and verify CL belt does not rub against AZ Post and runs inline with both sprockets. Incorrect belt travel is most frequently caused by incorrect sprocket placement on elevation motor shaft.</p>	

7.4.11. Replacing CL Drive Belt

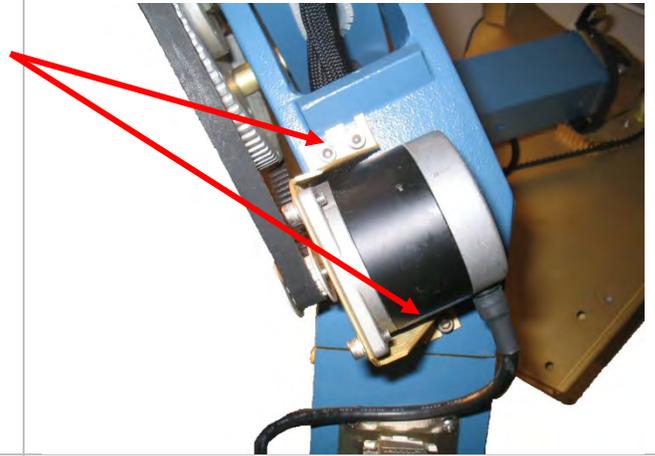
Tools Required:

- 9/64" Allen Head Wrench
- 5/32" Allen Head Wrench
- Snips / Flush Cutters
- 2 mm Flat Blade Screwdriver
- Loctite 222 or equiv.

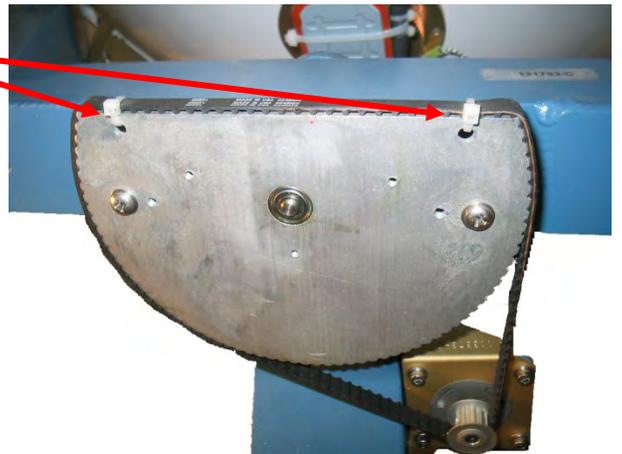


NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

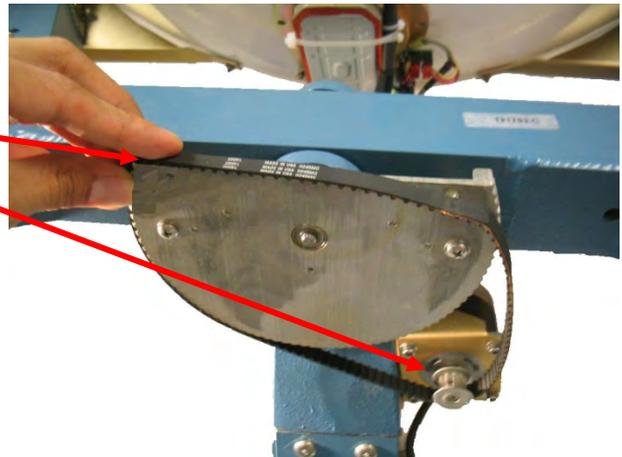
1. Loosen four Allen Head Screws securing CL Motor Bracket to AZ Post. Complete removal of hardware is not required for belt removal.

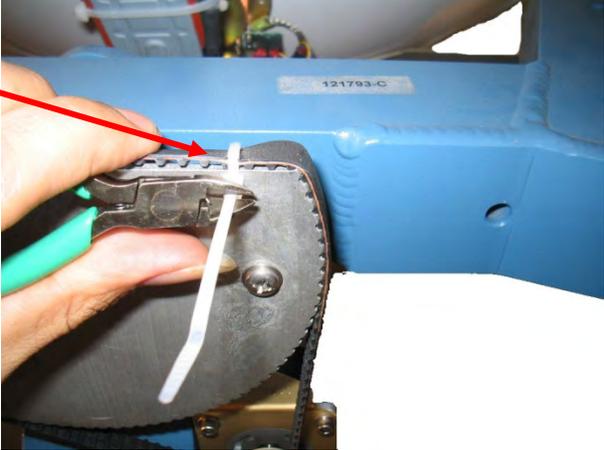
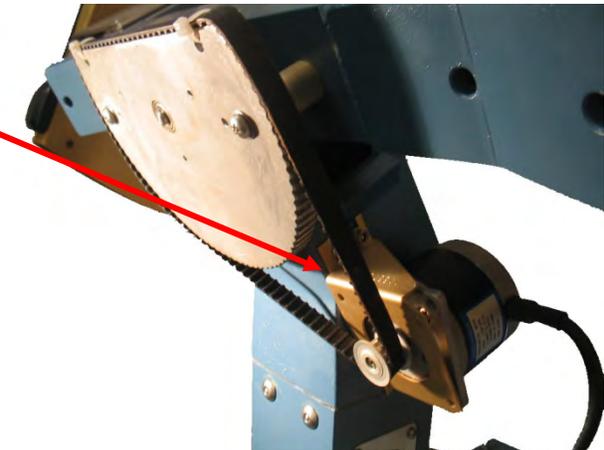


- Cut the two Tie Wraps securing old CL belt to Pulley.
Remove CL Belt from Pulley and CL motor sprocket.



- Install replacement belt around CL motor sprocket and then around CL pulley.



<p>Align belt flush to CL Pulley and secure with two tie wraps (as removed in step 2). Trim the excess off the tie-wraps.</p>	
<p>Tension belt by pulling the motor bracket down towards the antenna base and tighten the four screws with Loctite 222.</p>	
<p>Rotate CL beam from CCW stop to CW stop (Left to right as viewed from behind reflector) and verify CL belt does not rub against AZ Post and runs inline with both sprockets. Incorrect belt travel is most frequently caused by incorrect sprocket placement on elevation motor shaft.</p>	

7.4.12. Replacing the Polang Relay Assembly

Right Side El Pan Cover removal is required to access the Polang Relay Assembly P/N 122202

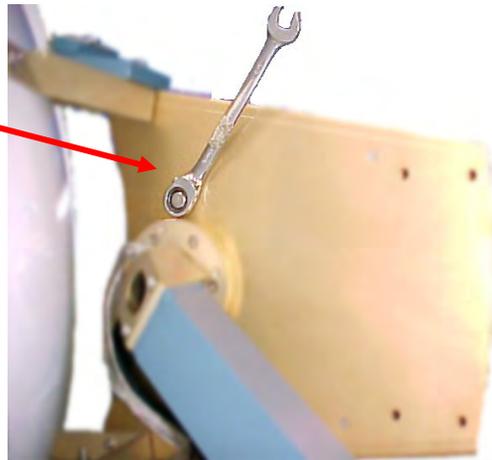
Tools Required:

- 1/2" Nut driver or Wrench
- #2 Phillips Head Screwdriver
- 3/8" Nut driver or Wrench
- 2 mm Flat Blade Screw Driver
- Loctite 222 or equiv.

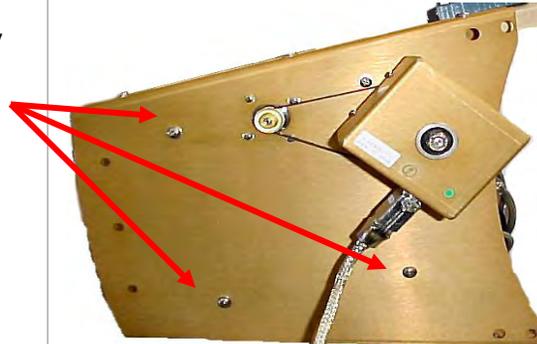


NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

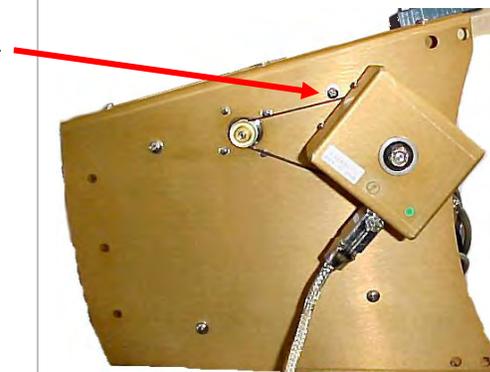
1. Using the 1/2" wrench, remove the 5/16-18 x 1/2" bolt securing inside EL Pan bottom to Spindle Plate.

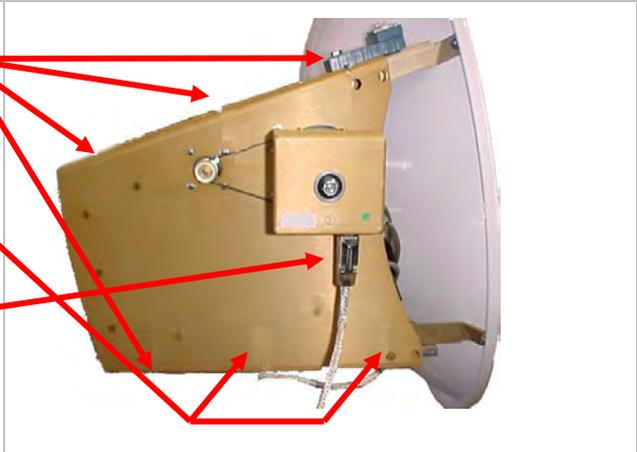
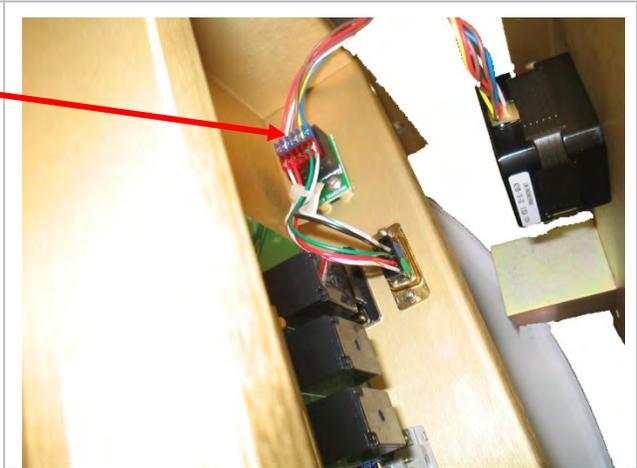
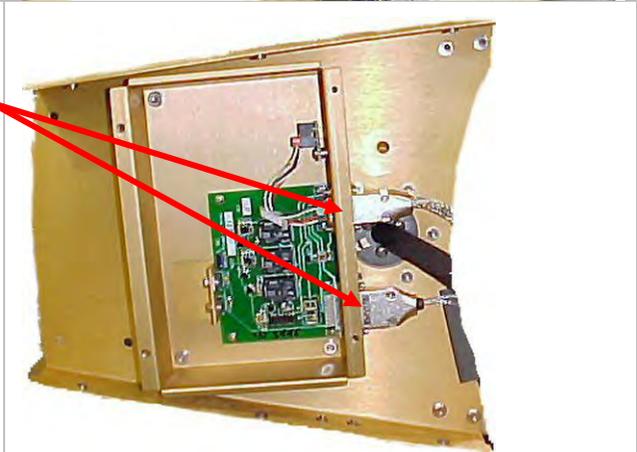


Remove the three 10/32 x 3/8" screws attaching EL Pan Cover to the Polang Relay Assembly.

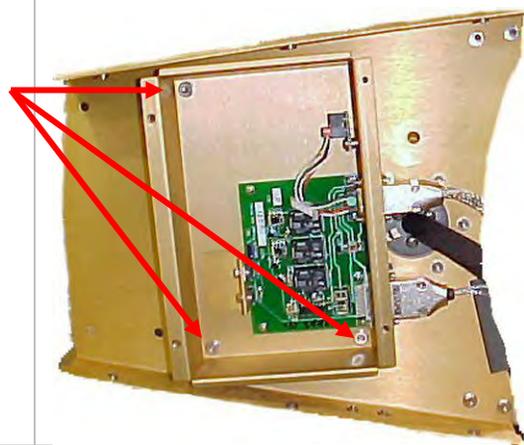


Rotate Level Cage clockwise as required to access this 10/32 x 3/8" screw and remove. Removing the Level cage assembly and or belt is not required.



<p>Remove the four 10/32 x 3/8" screws attaching El Pan cover to El Pan bottom. Remove the two 10/32 x 1/2" screws attaching P-clamps to El Pan Cover (and El Pan bottom). Using 2mm flat blade screwdriver loosen the retaining screws from the D-sub connector and remove the level cage cable.</p>	 A photograph of the exterior of the antenna. Red arrows point to four screws along the top edge of the metal housing, two screws on the side near a P-clamp, and a D-sub connector with a cable attached to the bottom.
<p>Carefully pull El Pan Cover away to expose Level Cage Motor Wiring Harness and disconnect IDC connector from Motor Termination PCB.</p>	 A close-up photograph of the interior of the antenna housing. A multi-colored wiring harness is visible, connected to a green IDC connector. A red arrow points to the IDC connector.
<p>Using a 2mm Flat blade Screwdriver, loosen the 4-40 retaining screws on D-Sub connectors and remove Polang Relay Harnesses.</p>	 A photograph of the interior of the antenna housing. A green printed circuit board (PCB) is visible, with a D-sub connector and a Polang Relay Harness attached to it. Red arrows point to the D-sub connector and the Polang Relay Harness.

Using 3/8" Nut Driver, remove the three 10/32 Hex Nuts and #10 Flat Washers and then remove the Polang Relay Assembly.



Replace the Polang Relay Assembly and secure with Loctite 222 and the hardware removed in step 10.

Re-Install connections removed in steps 9, 8 and 7.

Re-Install right EI pan and secure using Loctite 222 and hardware removed in steps 1 through 6.

Check and/or adjust Antenna balance.

7.4.13. Replacing 24VDC Polang Motor Assembly

Series 04 Polang Motor replacement procedure is as follows.

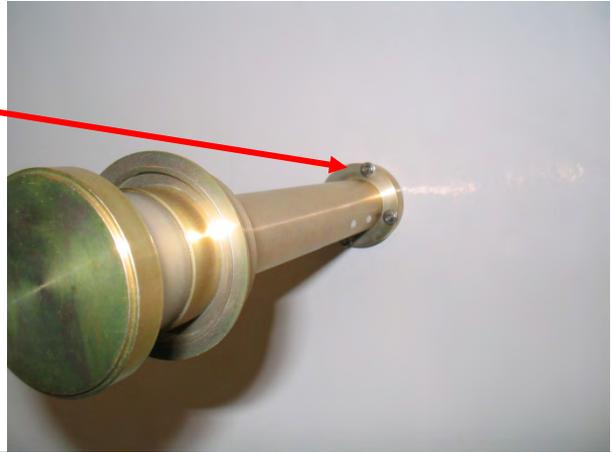
Tools Required:

- 1/4" and 7/16" Open Ended Wrench
- 5/64", 7/64", and 5/32" Allen Wrench's
- Snips/ Cutters
- Loctite 222 or equiv.

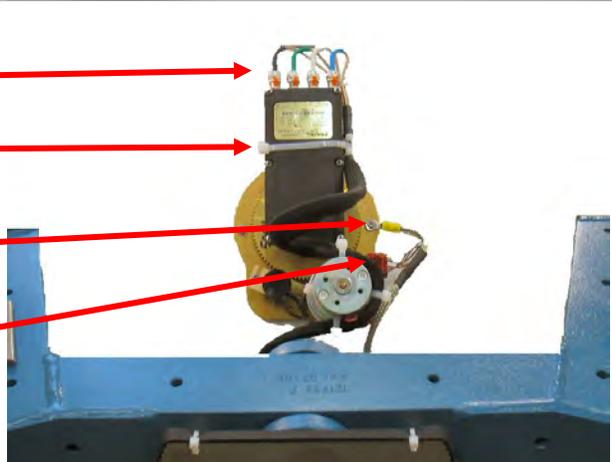


NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

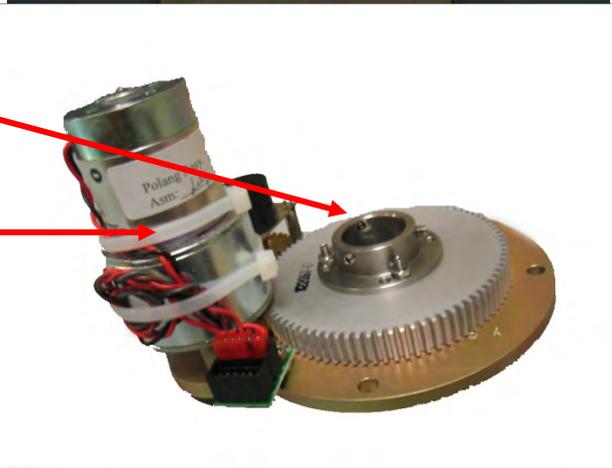
1. Using a 1/4" Wrench, remove the four 4-40 Small Pattern Hex Nuts and Washers. Remove Vertex Feed Tube and set aside. Save all Hardware for future use.



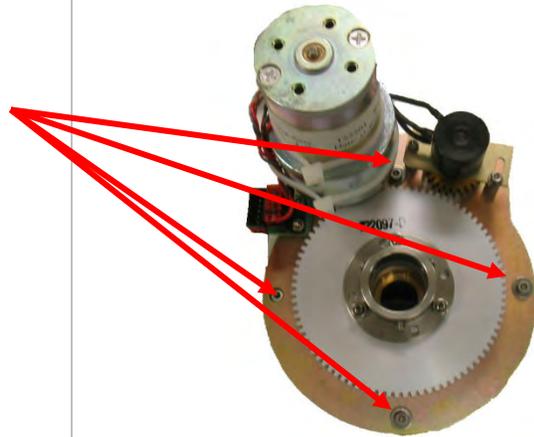
- Using the 7/16" Wrench, remove the RF Cables connecting to LNB.
- Using snips, cut tie wrap(s) securing harness to LNB if needed.
- Using the 7/64" Allen Head remove Polang Harness ground Lug attached to Polang plate.
- Unplug Polang Harness IDC connection.



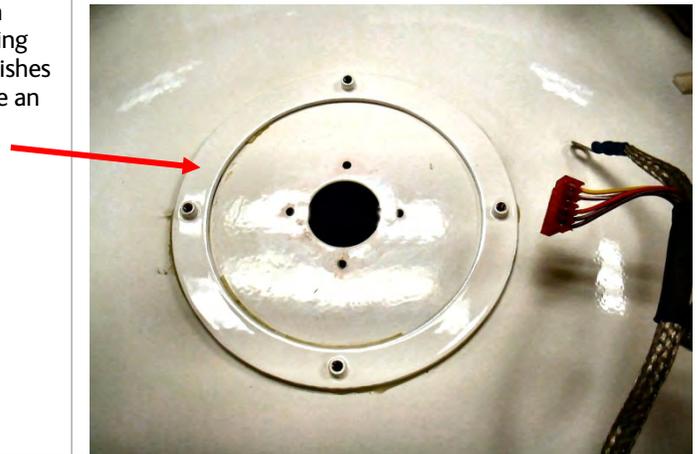
- Using a 5/64" Allen Wrench, loosen the three setscrews in LNB Mounting Cuff and remove LNB from feed assembly. (Photo shown without LNB installed for setscrew location clarity).
- Using snips, cut tie wraps securing harness to Polang Motor assembly.



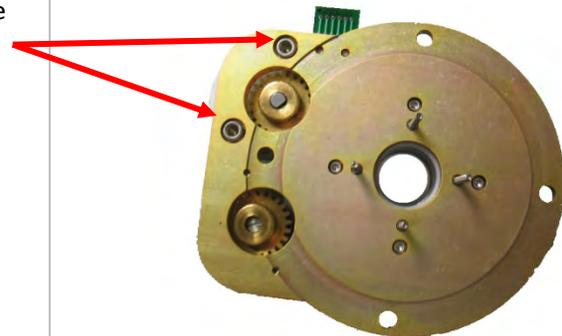
Using a 7/64" Allen Wrench, remove 3 screws (4 if Polang Harness Shield was grounded at Motor Termination PCB).



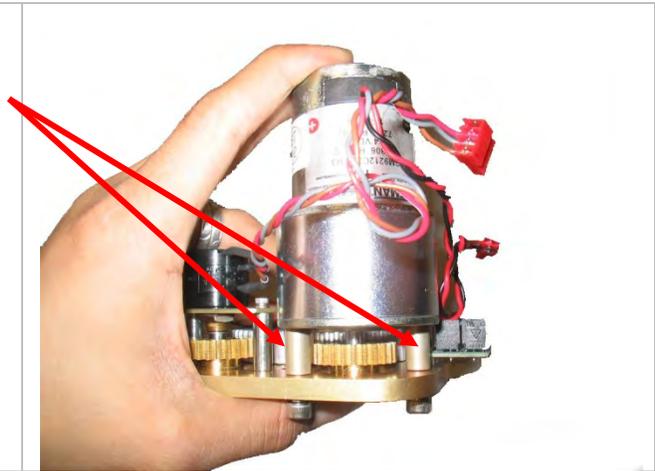
Carefully remove Polang Assembly from reflector. Do Not Pry off the retaining ring epoxied to reflector. (4004 and 5004 dishes are as shown, 3004 systems do not have an epoxy ring installed).



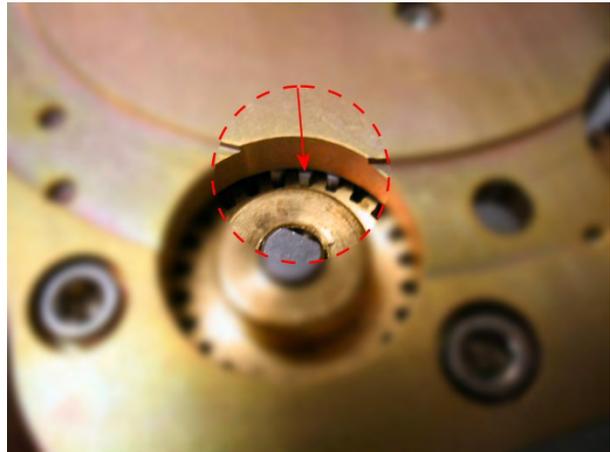
From the back side of feed assembly, Use a 5/32" Allen Wrench to remove the screws securing 24V Polang Motor to bracket assembly. Save all hardware for future use. Remove Polang Motor and set aside.



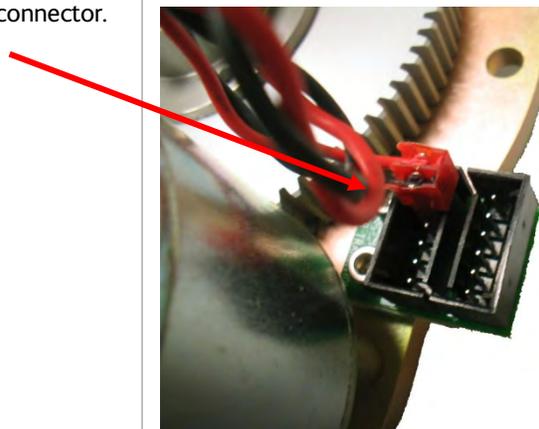
Install replacement Polang Motor, using Loctite 222 and the hardware removed in the step 9, with body of motor mounted flush on standoffs.



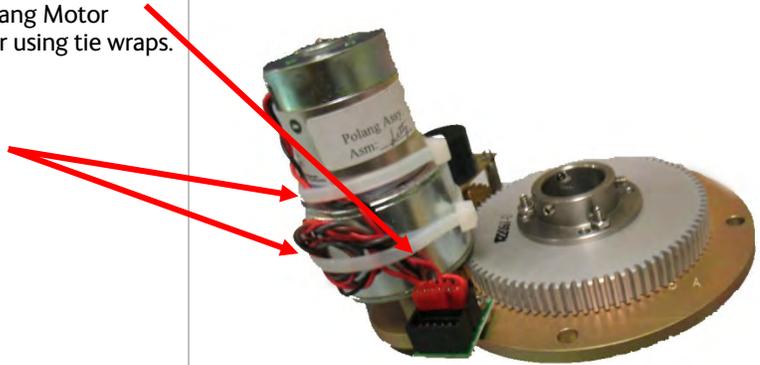
View Polang Assembly from bottom and verify that the Polang Motor sprocket is fully engaged with Polang gear.



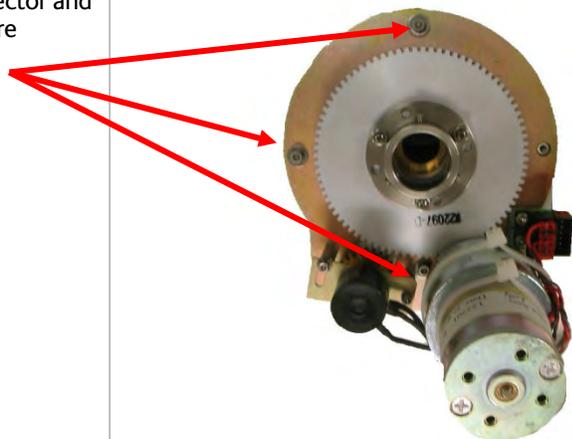
Reconnect POL Motor 2 Pin IDC connector.



Reconnect POL Pot IDC connector.
Secure both POL Pot and Polang Motor harness to body of Pol Motor using tie wraps.

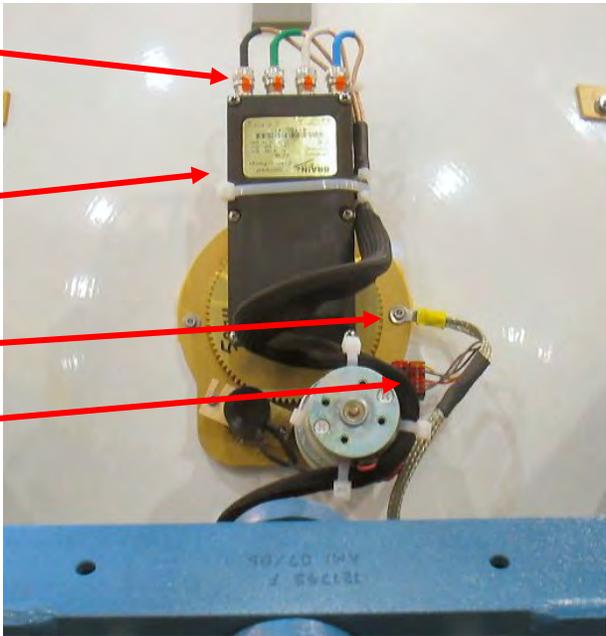


Install feed assembly back onto reflector and secure with Loctite 222 and hardware removed in step 8.



Install the replacement Vertex Feed Tube with the phase card oriented in the horizontal axis (ref. to reflector).
Secure with the Loctite 222 and hardware removed in step 1.



<p>Re-Install LNB and secure with setscrews loosened in step 5.</p> <p>Reconnect RF cables removed in step 2.</p> <p>Secure RF Cable Harness with a tie wrap around body of LNB and with enough service loop to allow full range of LNB travel.</p> <p>Secure POL Harness ground lug to feed Plate with hardware removed in step 4.</p> <p>Reconnect POL Harness to Motor Termination PCB removed in step 5.</p>	
<p>Rotate reflector by hand from upper elevation stop to lower elevation stop and verify LNB and/or Feed harnesses do not hit CL beam.</p> <p>Check and Adjust antenna balance.</p> <p>If system is configured with Linear LNB follow instructions for adjusting POL Pot. For systems configured with a Circular LNB no further adjustments are needed.</p>	

7.4.14. Replacing Polang Potentiometer Assembly

Tools Required:

- 1/2" Open Ended Wrench
- 3/32" Allen Wrench
- Snips/ Cutters
- Loctite 222 or equiv.



NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

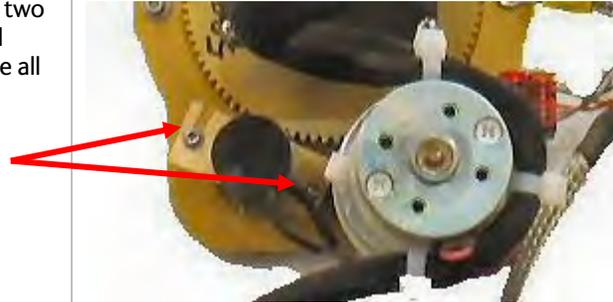
Using snips, cut tie wrap securing Pol Pot wires to Polang motor assembly.



Disconnect Pol Pot IDC connector from motor termination PCB.



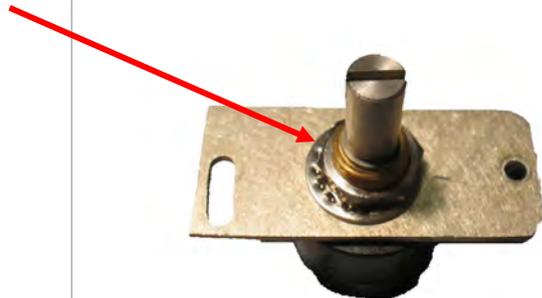
Using a 3/32" Allen Wrench remove the two screws attaching Pol Pot bracket to feed bracket. Remove Pol Pot assembly. Save all hardware for future use.



Using a 3/32" Allen Wrench remove setscrew securing sprocket to Potentiometer and remove sprocket.

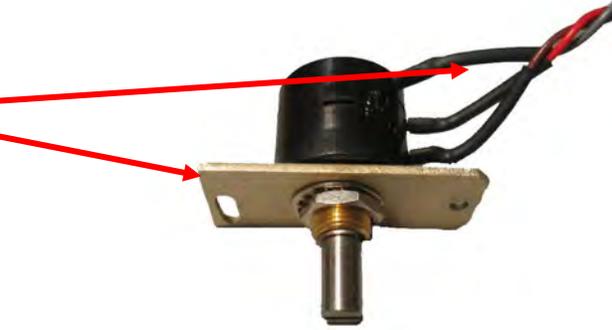


Using a 1/2" wrench remove nut and lock washer securing Pol Pot to bracket. Save all hardware for future use.



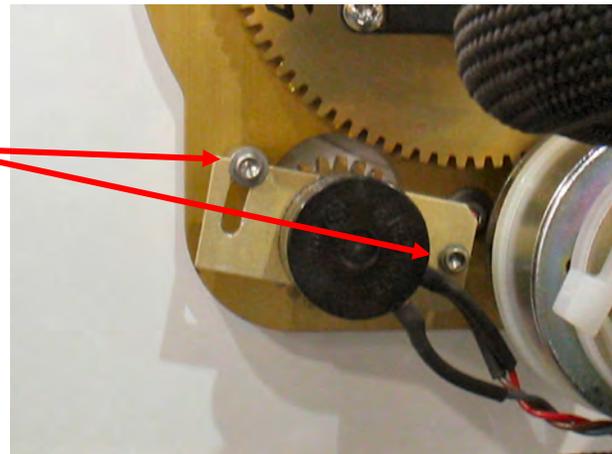
Install replacement Pol Pot onto bracket and with wires exiting away from slot in bracket, secure with hardware removed in step 5.

Install Pol Pot sprocket onto the new Potentiometer using set-screw removed in step 4.



Install Pol Pot assembly back onto Feed assembly using hardware removed in step 3. Do not engage onto gear at this time.

Follow the below Pol Pot alignment procedure for setting Pol Pot to its center of range.



Step 1: In the ACU setup menu, go to Pol Type parameter and set to Polang to manual Mode:

2. Get into the 'SETUP' mode by pressing and holding the two



LEFT & RIGHT

arrows until the 'EL TRIM' window appears.

Briefly release and then push and release



both **LEFT & RIGHT** arrow keys again. The 'SAVE NEW PARAMETERS' window should now be displayed.

Push the **'UP'** arrow key until the 'Pol Type' parameter is displayed.



Use the **LEFT & RIGHT** arrow keys to select appropriate digits then use the

'UP & DOWN' arrow keys to change value. For Manual Polarization Mode set Pol Type to 9. (To put antenna into Auto Polarization Mode set to Pol Type to 72)

Step 2: Press  'ENTER' key to go to Pol Offset window and verify setting is 0030. (If necessary use arrow keys to select appropriate digits and change accordingly).

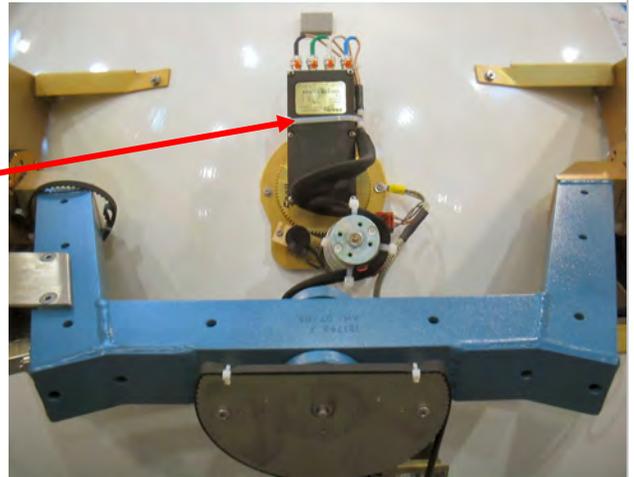
Step 3: Press  'ENTER' key to go to Tx Pol parameter and ensure 2 is entered. (If necessary use arrow keys to select appropriate digits and change accordingly).

Step 4: Press  'NEXT' key to select Antenna Window.

Step 5: Press  'ENTER' key until 'Pol xxxx' is displayed.

(Steps 7-12 requires assistance to observe and operate antenna simultaneously)

Step 7: Enter radome and observe physical alignment of LNB. For the xx04 series, the LNB should be aligned in a Vertical orientation, If not continue on to step 8, else skip ahead to step 9.

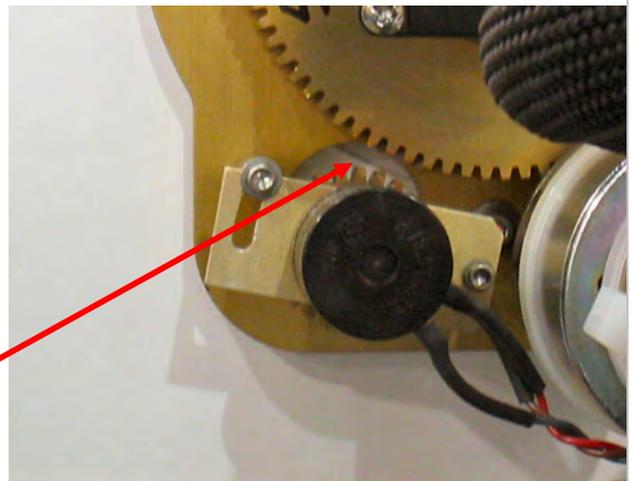


Step 8: Using the DAC2202 ACU drive the feed assembly to vertical.

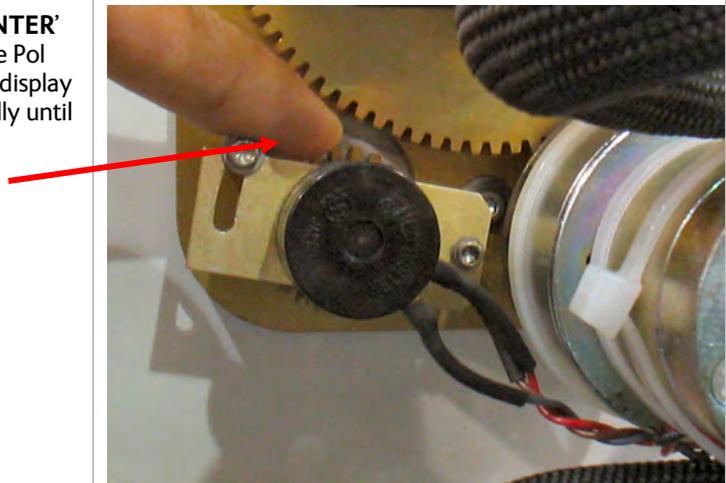
3. Press the  'RIGHT' arrow key to display cursor to the right of the displayed Pol Value

Using the  'UP & DOWN' arrow keys to increment & decrement Pol Value, drive the LNB to achieve a vertical orientation of the LNB as described in Step 7.

Step 9: Verify Pol Pot sprocket is out of alignment with the main driven gear.



Step 10: On the ACU, push **ENTER** 'ENTER' key so that the cursor is not within the Pol display (failure to do this will result in display not changing). Rotate the pot manually until a count of 120 is achieved.



Step 11: Reengage Pol Pot gear with the driven gear, while trying to maintain the 120 Pol Value set in step 10 and tighten the mounting plate screw loosened in step 9. (A Pol Value Variance of ± 3 counts is acceptable while trying to reengage the gears)

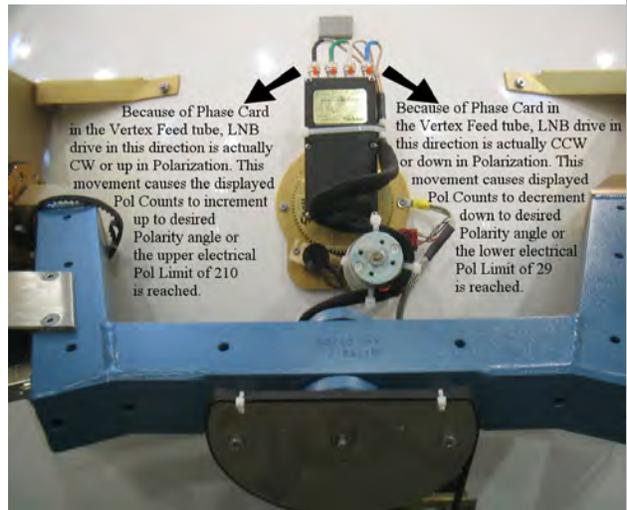


Step 12: Drive Polang to upper and lower electrical limits and verify drive direction & full range of motion of feed assembly.

4. On the ACU **▶** 'RIGHT' arrow key to display cursor underneath Pol Value

Press the **▲** 'UP' key to drive feed fully CW and verify Pol value of 210.

Press the **▼** 'DOWN' key to drive feed fully CCW and verify Pol Value of 29.



Step 13: In the ACU setup menu, go to Pol Type parameter and set antenna back to Auto Pol Mode:

5. Briefly release and then push and

release both **◀** **▶** **LEFT & RIGHT** arrow keys again. The 'SAVE NEW PARAMETERS' window should now be displayed.

Push the  'UP' arrow key a few times until the 'Pol Type' parameter is displayed.

Use the   **LEFT & RIGHT** arrow keys to display a cursor under appropriate

Pol value digits then use the  'UP & DOWN' arrow keys to change value. Then

Press  'ENTER' key. For Auto Polarization Mode set to Pol Type to 72. (To put antenna into Manual Polarization Mode set Pol Type to 9)

7.4.15. Removing & Replacing the Feed Tube

Series 04 Vertex Feed Tube replacement procedure

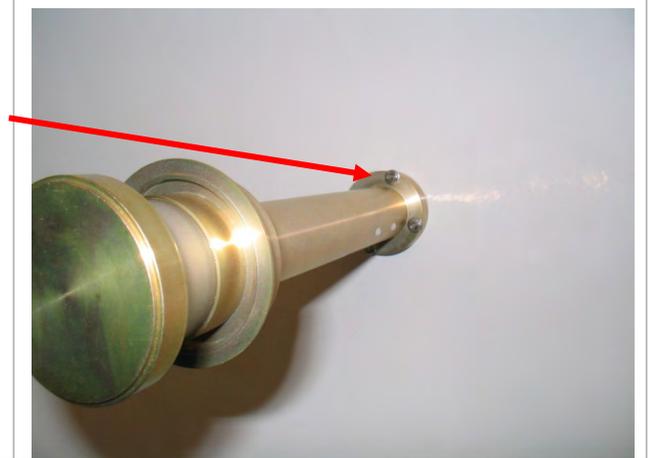
Tools Required:

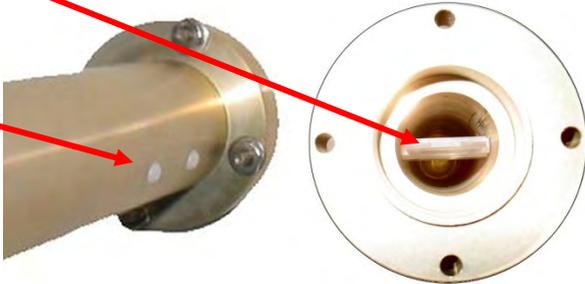
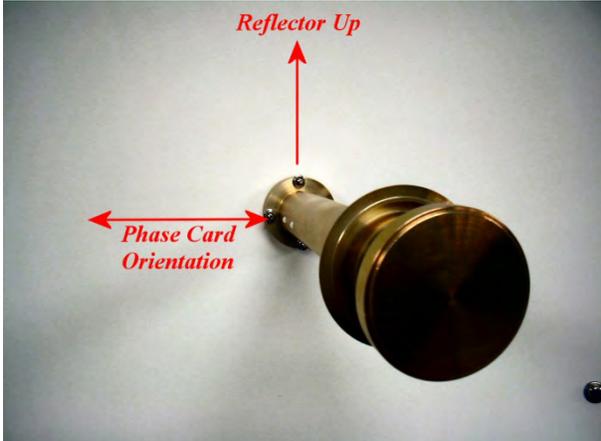
- 1/4" Open Ended Wrench
- 5/64", 7/64", and 5/32" Allen Head Wrench
- Snips/ Cutters
- Loctite 222 or equiv.



NOTE: Unless otherwise indicated, all nuts and bolts should be assembled with Loctite 222 or its equivalent.

1. Using a 1/4" Wrench remove the four 4-40 Small Pattern Hex Nuts and Washers. Remove Vertex Feed Tube and set aside. Save all Hardware for future use.



<p>Before installing replacement Vertex Feed Tube it is necessary to observe orientation of the inner 1/2 wavelength phase card. *Orientation can also be observed from outside of feed tube by the 4 (2 each side) protruding white plastic phase card mounting points.</p>	
<p>Install the replacement Vertex Feed Tube with the phase card oriented in the horizontal axis (ref. to reflector). Secure with the Loctite 222 and hardware removed in step 1. Check and/or adjust antenna balance</p>	

7.4.16. Balancing the Antenna

The antenna and equipment frame is balanced at the factory however, after disassembly for shipping or maintenance, balance adjustment may be necessary. Balancing must be done with the power supply turned off. No belt removal is required to balance the antenna pedestal. Balancing is accomplished by adding or removing balance trim weights at strategic locations to keep the antenna from falling forward/back or side to side. The antenna system is not pendulous so 'balanced' is defined as the antenna remaining at rest when left in any position. The antenna should be balanced within one or two ounces at the typical trim weight location of 2 feet from the axis of rotation.

The recommend balancing order is Elevation Axis with the antenna pointed at the horizon (referred to as front to back balance). Elevation Axis with the antenna pointed at zenith (referred to as top to bottom balance). Then Cross Level axis at any elevation position (referred to as side to side balance). The balance about azimuth axis is accomplished by accurately positioning the cross level beam in the azimuth stabilization assembly. This adjustment is done at the factory using special alignment tools. Do NOT attempt to adjust the cross level beam position in the field without the proper test fixtures.

7.5. Pedestal Control Unit Configuration – 6004

The PCU is designed to be used with a variety of antenna pedestal models. So, the PCU must be configured correctly for the model number of the antenna it is mounted on. The configuration information that is unique to each pedestal model is stored in a Non Volatile Random Access Memory (NVRAM) in the PCU enclosure. If the PCU is replaced or the NVRAM in the PCU should become corrupt, the PCU must be re-configured to operate with the pedestal it is installed on. The default configuration for the PCU is model **xx04**. *In this configuration the Level Cage will drive normally but the PCU will not drive any of the three torque motors to prevent damage to the unknown pedestal.*

7.5.1. To configure the PCU:

1. Select the REMOTE COMMAND window on the ACU.
2. Refer to the table below to key in the appropriate value for you model antenna to enter in the next step. **EXAMPLE:** For a **6004** Model Antenna, select system type 0073.
3. Using the **LEFT/RIGHT** and **UP/DOWN** arrow keys set the Remote Command value to "**N0073**" and press **ENTER**. The display should now show "N0073".
4. Press **ENTER** several times to select **REMOTE PARAMETERS**. Press **LEFT** arrow and then **ENTER** to save the system type in the PCU.
5. Press **RESET** and the displayed Remote Version Number should now display "**6004 VER 2.nn**".

7.5.2. Model Configuration Numbers

The following table shows the current mode configuration values for Series 06 pedestals.

MODEL	Configuration Number
xx03a	N 0000 Turns off all drive motors
6003A or 6004	N 0073

7.6. *Antenna Stowing Procedure*

	<p>WARNING: Antenna Pedestal <i>must be properly restrained (stowed)</i> to prevent damage to wire rope isolators, isolator springs and/or antenna pedestal mechanism during underway conditions <i>when power is removed from the antenna assembly</i>.</p>
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The normal operating condition for the Sea Tel Antenna system is to remain powered up at all times. This ensures that the antenna remains actively stabilized to prevent physical damage to the antenna pedestal and reduce condensation and moisture in the radome to prevent corrosion. If, for some reason, the antenna must be powered down during underway transits, it should be secured with nylon straps regardless of sea conditions to prevent damage to the antenna system. Refer to the procedure below to secure the antenna pedestal.

Equipment & Hardware needed:

- Two (2) Nylon web straps with buckle or ratchet mechanism. *Nylon straps should be rated to 300 lbs. Max rated capacity.*

Stowing procedure:

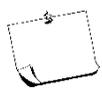
1. Point the antenna to Zenith, (90 degree elevation angle), straight up.

Install one strap through the hole in one side elevation beam, down under the upper base plate, through the other elevation beam hole. Cinch or ratchet the web strap to just restrain the antenna.

Install another web strap, or a large tiwrap, around the azimuth tongue counter-weights and down under one corner of the upper base plate to restrain azimuth rotation of the antenna.



CAUTION: *Tighten the straps ONLY tight enough to restrain the antenna. When restrained the antenna will only be able to move about an inch in any direction. DO NOT OVER-TIGHTEN.*

	<p>NOTE: Remove the straps, and/or Tiwraps, <i>before applying power</i> and returning the antenna to normal operating condition.</p>
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8. Specifications

The specifications of your Series 04 antenna system are below.

8.1. Installed Weight

	3004	4004	5004
General Assembly:	100 lbs. (45.4 kg)	101 lbs. (45.8 kg)	115 lbs. (52.2 kg)
Radome Assembly (dry*):	75 lbs. (34.0 kg)	90 lbs. (40.8 kg)	95 lbs. (43.1 kg)
Total Weight (dry):	175 lbs. (79.4 kg)	191 lbs. (86.6 kg)	210 lbs. (95.3 kg)

***NOTE: Radome panels can absorb up to 50% moisture by weight.**

8.2. Antenna Reflector/Feed Assembly

	3004	4004	5004
Diameter:	30 inch (76.2 cm)	40 inch (101.6 cm)	50 inch (127 cm)
Antenna Gain @ 12 GHz	39 dB typical	41 dB typical	43 dB typical
Minimum EIRP	45 dB	43 dB	41 dB
Type	Hydro-formed Aluminum reflector		
Feed	Cassegrain feed with ring focus splash plate		
Polarization	Linear or Circular, with ½ wave phase card*		
Polarization control	Remotely skewed adjustment using 24 volt DC motor, with potentiometer feedback for Linear and Circular feeds (Auto-Polarization mode is default).		

***NOTE: Linear polarization skew is intentionally REVERSED from actual received satellite polarization by the ½ wave length phase card (refer to basic system information).**

8.3. Radome Assembly

Size:	3004	4004	5004
Diameter:	40 inch (101.6 cm)	51.75 inches (131.3 cm)	61 inch (155 cm)
Height:	48.9 inch (124.2 cm) MAX	59 inches (149.9 cm) MAX	66 inch (167.6 cm) MAX
Type/Material:	Rigid fiberglass dome		
Wind:	Withstand relative average winds up to 100 MPH from any direction.		
Radome RF attenuation (dry *):	1.5 dB at 12 GHz		

***NOTE: Radome panels can absorb up to 50% moisture by weight. Soaked panels will also have higher attenuation.**

8.4. *Stabilized Pedestal Assembly*

Stabilization:	Three axis: Train, Cross-level, and Level
Positioning:	Two Axis (Azimuth, Elevation)
AZ Drive motor:	Double stacked size 23 Brushless DC Motor w/Encoder
EL/CL Drive motors:	Size 23 Brushless DC Motors
Angular motion range:	
Elevation:	-15 to +120 degrees
Azimuth:	+/- 345 degrees (015 to 705)
Cross-Level:	Up to +/- 30 degrees
Stabilization Accuracy	0.2 degree PEAK error under maximum ship's motion condition
Elevation Pointing	00.0 (horizon) to 90.0 (zenith)
Relative Azimuth Pointing:	020.0 to 700.0 (Unwrap should occur at 023.0 or 697.0)
Specified Ship Motions (for stabilization accuracy tests):	
Roll:	+/- 15 degrees at 8-12 sec periods
Pitch:	+/- 10 degrees at 6-12 sec periods
Yaw:	+/- 8 degrees at 15 to 20 sec periods
Turning rate:	Up to 12 deg/sec and 15 deg/sec/sec
Headway:	Up to 50 knots
Mounting height:	Up to 150 feet.
Heave	0.5G
Surge	0.2G
Sway	0.2G
Maximum ship motion:	
Roll:	+/- 25 degrees w/6 sec periods
Pitch:	+/- 15 degrees w/6 sec periods
Yaw:	+/- 8 degrees w/6 sec periods
Tangential Acceleration:	+/- 0.5 g
Surge/Sway/Heave:	+/- 0.2 g
Turning rate:	12 deg/sec @ 5 deg/sec/sec
Headway:	Up to 30 knots

8.5. *Pedestal Control Unit (PCU) Assembly*

The PCU Assembly contains 2 Printed Circuit Boards (PCBs). One is the main control board and the other is the Motor Driver for the 3 Brushless DC Drive motors (AZ/EL/CL).

Connectors	
Antenna Pedestal	44 Pin D-Sub connector
Motor Interface	25 Pin D-Sub connector
M&C Interface	15 Pin D-Sub connector
GPS Input	BNC connector
Controls	None
M&C Interface	9600 Baud RS-422

8.6. *Interchangeable LNB Options*

The Series 04 antenna can be easily fitted with a variety of LNB assemblies. The feed is capable of receiving linear or circular polarization however the LNB must match the satellite programming type desired. Below are the LNBs which may be used with this system.

8.6.1. US Circular LNB

Type:	Dual output
LNB Manufacturer:	Wistron Neweb, but may vary
RF Frequencies:	12.2 - 12.7 GHz
IF Frequency:	950 - 1450 MHz
LO Frequency:	11.250 GHz
Noise Figure:	1.1 dB max.
Polarization modes:	LHCP or RHCP circular
Polarization control:	18VDC (LHCP) or 13VDC (RHCP) voltage switched

8.6.2. DLA Circular LNB

Type:	Dual output
LNB Manufacturer:	Eagle Aspen, but may vary
RF Frequencies:	11.45 - 12.2 GHz
IF Frequency:	950 - 1700 MHz
LO Frequency:	10.5 GHz
Noise Figure:	1.1 dB max.
Polarization modes:	LHCP or RHCP circular
Polarization control:	18VDC (LHCP) or 13VDC (RHCP) voltage switched

8.6.3. European Quad Universal Linear LNB

Type:	Quad output
LNB Manufacturer:	Brainwave, but may vary
	Low Band High Band
RF Frequencies:	10.7 - 11.7 GHz 11.7 - 12.75 GHz
IF Frequencies:	950 - 1950 MHz 1100 - 2150 MHz
LO Frequencies:	9.75 GHz 10.6 GHz
Noise Figure:	0.7 dB typical
Polarization modes:	2 Horiz., 2 Vert. Outputs
Band Selection:	2 Hi, 2 Lo band outputs

8.7. Environmental Conditions

Temperature:	-30 degrees C to 55 degrees C.
Humidity:	Up to 100% @ 40 degrees C, Non-condensing.
Spray:	Resistant to water penetration sprayed from any direction.
Icing:	Survive ice loads of 4.5 pounds per square foot. Degraded RF performance will occur under icing conditions.
Rain:	Up to 4 inches per hour. Degraded RF performance may occur when the radome surface is wet.
Wind:	Withstand relative average winds up to 100 MPH from any direction.
Vibration:	Withstand externally imposed vibrations in all 3 axes, having displacement amplitudes as follows:
Frequency Range, Hz	Peak Single Amplitude
4 - 10	0.100 inches (0.1G to 1.0G)
10 - 15	0.030 inches (0.3G to 0.7G)
15 - 25	0.016 inches (0.4G to 1.0G)
25 - 33	0.009 inches (0.6G to 1.0G)
Corrosion	Parts are corrosion resistant or are treated to endure effects of salt air and salt spray. The equipment is specifically designed and manufactured for marine use.

8.8. Control and IF Coax Cables

8.8.1. Antenna Control Cable (Provided from ACU-MUX)

RS-422 Pedestal Interface

Type	Shielded Twisted Pairs
Number of wires	
Wire Gauge	24 AWG or larger
Communications Parameters:	9600 Baud, 8 bits, No parity
Interface Protocol:	RS-422
Interface Connector:	DE-9P

8.8.2. Antenna L-Band TVRO IF Coax Cables (Customer Furnished)

2, 4 or 6 cables are required dependant upon which feed/LNB configuration your antenna is fitted with. Due to the dB losses across the length of the RF coaxes at L-Band, Sea Tel recommends the following 75 ohm coax cable types (and their equivalent conductor size) for our standard pedestal installations:

Run Length	Coax Type	Conductor Size
up to 75 ft	LMR-300-75	18 AWG
up to 150 ft	RG-11 or LMR-400-75	14 AWG
up to 200 ft	LDF4-75 Heliax	10 AWG
Up to 300 ft	LMR-600-75	6 AWG

For runs longer than 300 feet, Sea Tel recommends Single-mode Fiber Optic Cables with Fiber Optic converters.

8.8.3. Multi-conductor Cables (Customer Furnished)

Due to the voltage losses across the multi-conductor cables, Sea Tel recommends the following wire gauge for the AC & DC multi-conductor cables used in our standard pedestal installations:

Run Length	Conductor Size
up to 50 ft	20 AWG (0.8 mm)
up to 100 ft	18 AWG (1.0 mm)
up to 150 ft	16 AWG (1.3 mm)
up to 250 ft	14 AWG (1.6 mm)
Up to 350 ft	12 AWG (2.0 mm)

8.8.4. Fiber Optic Transmitter (CFE Optional)

Model:	Ortel Model 3112A
Frequency Range:	950-2050 MHz
Noise Figure:	45 dB
Impedance:	75 ohm
Connectors:	
RF	Type F
Fiber	FC/APC "Tight Fit"

8.8.5. Gyro Compass Interface Cable (Customer Furnished)

Type:	Multi-conductor, Shielded
Number of wires	4 Conductors for Step-By-Step Gyro, 5 Conductors for Synchro
Wire Gauge:	see Multi-conductor Cables spec above
Insulation:	600 VAC

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9. Drawings

This section contains all the drawings that apply to your Sea Tel Model 5004 Antenna. Spare parts kits are included as a quick reference to the most common part numbers you might need. The drawings are organized into two groups:

9.1. Series 04 Model Specific Drawings

Drawing	Title	
121987_G	System Block Diagram	9-3
122220_C	General Assembly, 3004	9-6
121988_B	General Assembly, 4004	9-8
122221_B	General Assembly, 5004	9-10
122234_F	Antenna Assembly, 3004	9-12
121990_C	Antenna Assembly, 4004	9-14
122235_E1	Antenna Assembly, 5004	9-16
122968-1_G	Radome Assembly, 40" w/lip	9-18
122970-1_F1	Radome Assembly, 48" w/lip	9-21
122969-1_J	Radome Assembly, 60" w/lip	9-24
122663_B4	Radome Installation Arrangement	9-27

9.2. Series 04 General Drawings

Drawing	Title	
123550-1_B	Series 04 Standard Spare Parts Kit	9-28
123551-1_D1	Series 04 Premium Spare Parts Kit	9-29
121986_B2	Schematic, Antenna RF System xx04	9-30
122373_B2	Antenna Pedestal Schematic	9-31
113480_C1	RF Cable Assembly	9-32

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SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122220	C	GENERAL ASS'Y, 3004	
2	1 EA	122201	E	POLANG ASS'Y	
3	1 EA	129131-1	B1	PEDESTAL ASS'Y, 3004	
4	1 EA	122203	G1	PCU ENCLOSURE ASS'Y, XX04	
5	1 EA	121966-2	D1	GPS ANTENNA, RETERMINATED, 21.0 L	
6	1 EA	122937-1	L	LEVEL CAGE ASS'Y, BOTTOM EXIT, 080 P,	
7	1 EA	122202	A4	POLANG RELAY ASS'Y	
8	1 EA	124829-1	A	VERTEX FEED, 30 IN DBS	
9	1 EA	115075-2	G2	LNB MOD, DUAL DLA	
9	1 EA	122386	D1	FILTERED LNB ASS'Y, QUAD, XX98, XX04	
9	1 EA	127444-1	X2	LNBF MOD, DUAL DBS, CAL AMP	
10	1 EA	122363-1	E	MODEM ASS'Y, 70 KHz, ADE	
11	1 EA	116676	B2	TERMINAL MOUNTING STRIP ASS'Y, ACU	
12	1 EA	125411-1	J	DAC-2202, DVB RCVR, COAX IF	
14	1 EA	119732	A2	MULTI-SWITCH, 4/8/12 OUTPUT, (REF. US	SEE DASH #
15	1 EA	129934-X		(REFSEE DASH #)TSC-10A LCD KIT,	
16	1 EA	121485-2	G	HARNESS ASS'Y, REFLECTOR	
17	1 EA	122223-5	F1	HARNESS ASS'Y, PEDESTAL, REFERENCE	
18	1 EA	122224-2	A2	HARNESS ASS'Y, INTERFACE, DBS04	
19	1 EA	122225-2	F1	HARNESS ASS'Y, PEDESTAL, 3BLDC, DBS04	
20	1 EA	122370	C2	HARNESS ASS'Y, BASE SPINDLE, DBS04	
21	4 EA	122372		CABLE ASS'Y, RG-179, COLOR CODED, (RE	SEE DASH #.
22	5 EA	113480		CABLE ASS'Y, RF, RG6/RG11/CDF40, (REF	SEE DASH #.
24	2 EA	111115-6	B	CABLE ASS'Y, F(M)-F(M), 6 FT.	
25	1 EA	120643-X	A	(REFSEE DASH #)CABLE ASS'Y, RS232, 9	
27	8 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
31	1 EA	122968-1	G	RADOME ASS'Y, XX04 GA INSTALL, 40 IN,	

Sea Tel
COBHAM

SYSTEM BLOCK DIAGRAM, EXTERNAL, 3004

PROD FAMILY LIT	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 121987-3	REV G
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SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	121988	B	GENERAL ASS'Y, 4004	
2	1 EA	122201	E	POLANG ASS'Y	
3	1 EA	129131-2	B1	PEDESTAL ASS'Y, 4004	
4	1 EA	122203	G1	PCU ENCLOSURE ASS'Y, XX04	
5	1 EA	121966-2	D1	GPS ANTENNA, RETERMINATED, 21.0 L	
6	1 EA	122937-1	L	LEVEL CAGE ASS'Y, BOTTOM EXIT, 080 P,	
7	1 EA	122202	A4	POLANG RELAY ASS'Y	
8	1 EA	122237	A1	VERTEX FEED, 40 IN., 4004	
9	1 EA	122386	D1	FILTERED LNB ASS'Y, QUAD, XX98, XX04	
9	1 EA	127444-1	X2	LNBF MOD, DUAL DBS, CAL AMP	
9	1 EA	115075-2	G2	LNB MOD, DUAL DLA	
10	1 EA	122363-1	E	MODEM ASS'Y, 70 KHz, ADE	
11	1 EA	116676	B2	TERMINAL MOUNTING STRIP ASS'Y, ACU	
12	1 EA	125411-1	J	DAC-2202, DVB RCVR, COAX IF	
14	1 EA	119732	A2	MULTI-SWITCH, 4/8/12 OUTPUT, (REF. US	SEE DASH #
15	1 EA	129934-X		(REFSEE DASH #)TSC-10A LCD KIT,	
16	1 EA	121485-2	G	HARNESS ASS'Y, REFLECTOR	
17	1 EA	122223-5	F1	HARNESS ASS'Y, PEDESTAL, REFERENCE	
18	1 EA	122224-2	A2	HARNESS ASS'Y, INTERFACE, DBS04	
19	1 EA	122225-2	F1	HARNESS ASS'Y, PEDESTAL, 3BLDC, DBS04	
20	1 EA	122370	C2	HARNESS ASS'Y, BASE SPINDLE, DBS04	
21	4 EA	122372		CABLE ASS'Y, RG-179, COLOR CODED, (RE	SEE DASH #.
22	5 EA	113480		CABLE ASS'Y, RF, RG6/RG11/CDF40, (REF	SEE DASH #.
24	2 EA	111115-6	B	CABLE ASS'Y, F(M)-F(M), 6 FT.	
25	1 EA	120643-X	A	(REFSEE DASH #)CABLE ASS'Y, RS232, 9	
27	8 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
31	1 EA	125594-1	C	RADOME ASS'Y, XX04 GA INSTALL, 50 IN,	

<h1>Sea Tel</h1> <p><i>COBHAM</i></p>				
SYSTEM BLOCK DIAGRAM, EXTERNAL, 4004				
PROD FAMILY LIT	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 121987-4	REV G

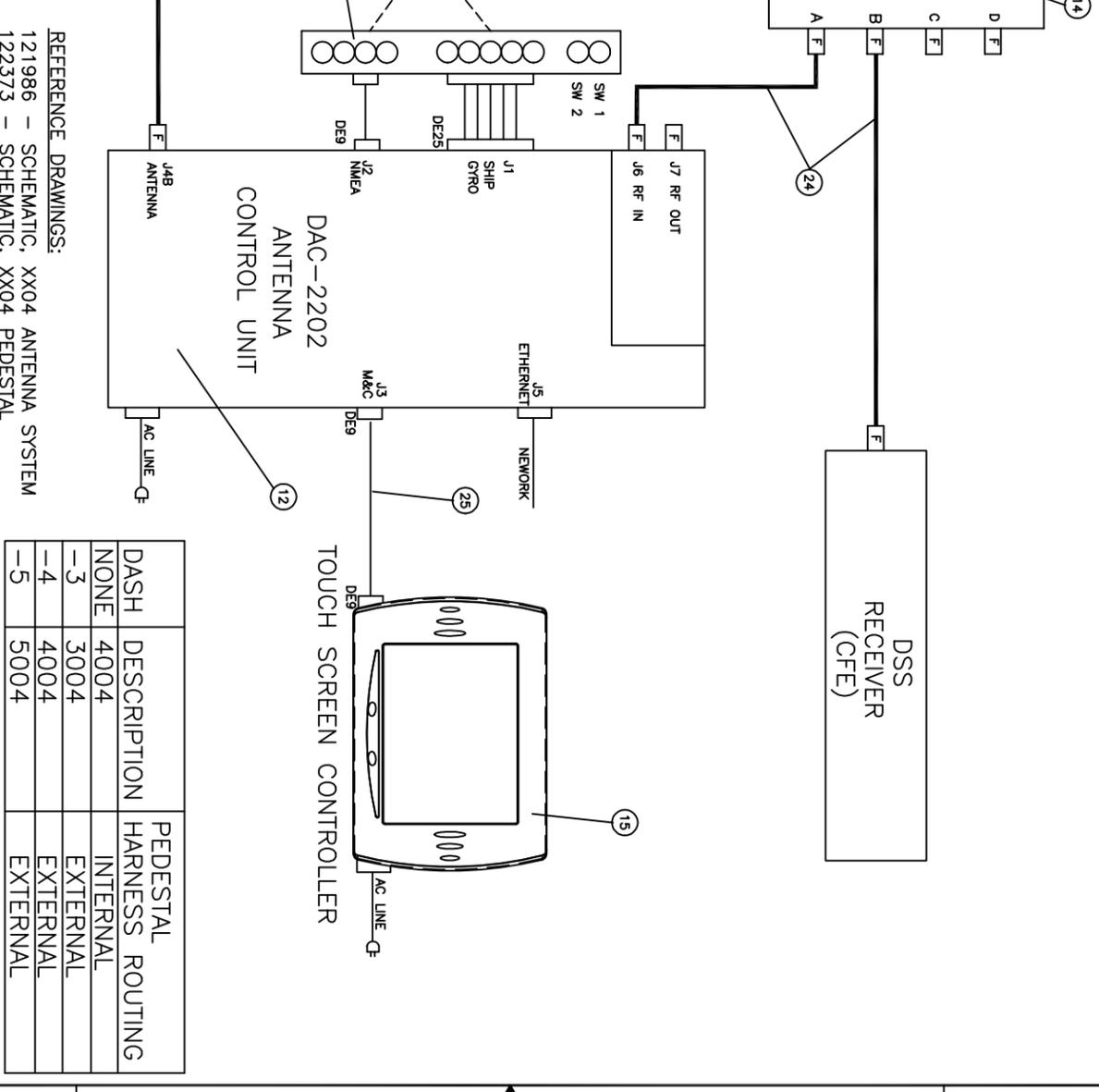
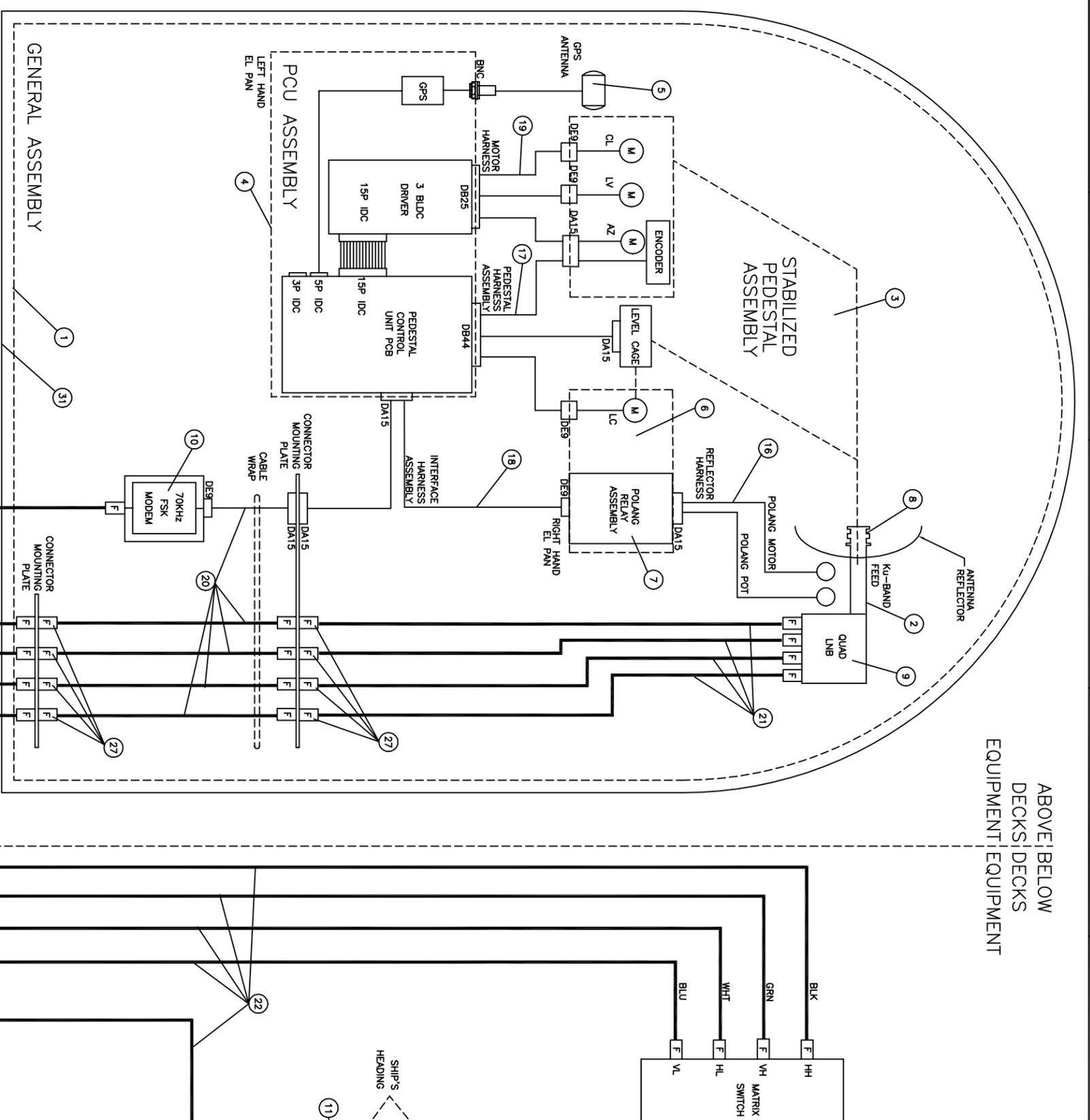
SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122221	B	GENERAL ASS'Y, 5004	
2	1 EA	122201	E	POLANG ASS'Y	
3	1 EA	129131-3	B1	PEDESTAL ASS'Y, 5004	
4	1 EA	122203	G1	PCU ENCLOSURE ASS'Y, XX04	
5	1 EA	121966-2	D1	GPS ANTENNA, RETERMINATED, 21.0 L	
6	1 EA	122937-1	L	LEVEL CAGE ASS'Y, BOTTOM EXIT, 080 P,	
7	1 EA	122202	A4	POLANG RELAY ASS'Y	
8	1 EA	125780	X1	VERTEX FEED, 49 IN, KU-BAND, RX ONLY,	
9	1 EA	127444-1	X2	LNBF MOD, DUAL DBS, CAL AMP	
9	1 EA	115075-2	G2	LNB MOD, DUAL DLA	
9	1 EA	122386	D1	FILTERED LNB ASS'Y, QUAD, XX98, XX04	
10	1 EA	122363-1	E	MODEM ASS'Y, 70 KHz, ADE	
11	1 EA	116676	B2	TERMINAL MOUNTING STRIP ASS'Y, ACU	
12	1 EA	125411-1	J	DAC-2202, DVB RCVR, COAX IF	
14	1 EA	119732	A2	MULTI-SWITCH, 4/8/12 OUTPUT, (REF. US	SEE DASH #
15	1 EA	129934-X		(REFSEE DASH #)TSC-10A LCD KIT,	
16	1 EA	121485-2	G	HARNESS ASS'Y, REFLECTOR	
17	1 EA	122223-5	F1	HARNESS ASS'Y, PEDESTAL, REFERENCE	
18	1 EA	122224-2	A2	HARNESS ASS'Y, INTERFACE, DBS04	
19	1 EA	122225-2	F1	HARNESS ASS'Y, PEDESTAL, 3BLDC, DBS04	
20	1 EA	122370	C2	HARNESS ASS'Y, BASE SPINDLE, DBS04	
21	4 EA	122372		CABLE ASS'Y, RG-179, COLOR CODED, (RE	SEE DASH #.
22	5 EA	113480		CABLE ASS'Y, RF, RG6/RG11/CDF40, (REF	SEE DASH #.
24	2 EA	111115-6	B	CABLE ASS'Y, F(M)-F(M), 6 FT.	
25	1 EA	120643-X	A	(REFSEE DASH #)CABLE ASS'Y, RS232, 9	
27	8 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
31	1 EA	122969-1	J	RADOME ASS'Y, XX04 GA INSTALL, 60 IN,	

Sea Tel <i>COBHAM</i>				
SYSTEM BLOCK DIAGRAM, EXTERNAL, 5004				
PROD FAMILY LIT	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 121987-5	REV G

REV	ECO#	DATE	DESCRIPTION	BY
E	5985	12-19-07	ITEM 9 WS 115075-1	SL
F	6095	0-05-08	ITEM 3 WAS 121989-2	SL
G	6534	03-25-09	ROLL-BACK ECO 6095: ITEM 3 WS 127783-2; REF ECO 6568: DEL ITEM 26; ITEM 15 WS 122073; ITEM 25 WS 122505-15; DEL ITEM 13, 23, 28, 29, 30; ITEM 27 QTY WS 4; ADD ITEM 9 (122386); ADD REF DOC 122373; ADD DASH-3 (3004), -4 (4004), -5 (5004).	AMN

REVISION HISTORY



DASH	DESCRIPTION	PEDESTAL HARNESS ROUTING
NONE	4004	INTERNAL
-3	3004	EXTERNAL
-4	4004	EXTERNAL
-5	5004	EXTERNAL

REFERENCE DRAWINGS:
121986 - SCHEMATIC, XX04 ANTENNA SYSTEM
122373 - SCHEMATIC, XX04 PEDESTAL

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
X.X = ±.050
X.XX = ±.020
X.XXX = ±.005
ANGLES: ±.5°

INTERPRET TOLERANCING PER ASME Y14.5M - 1994
MATERIAL:
SEE BOM

DRAWN BY: LK
DRAWN DATE: 10-02-03
APPROVED BY:
TITLE: SYSTEM BLOCK DIAGRAM

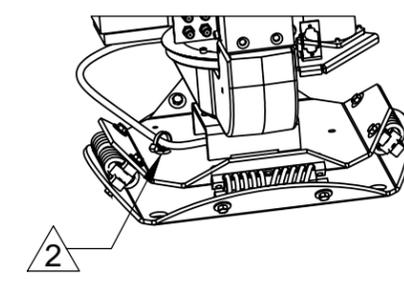
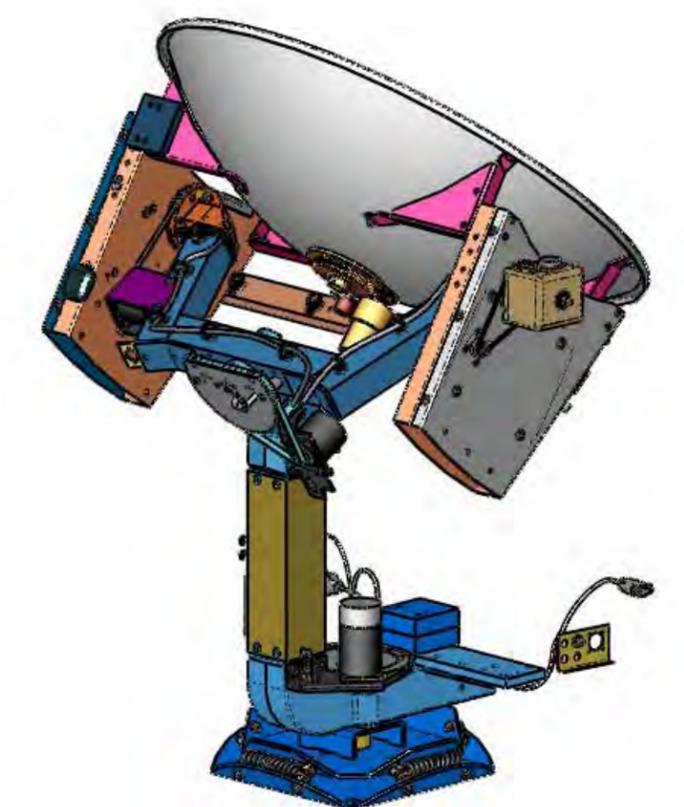
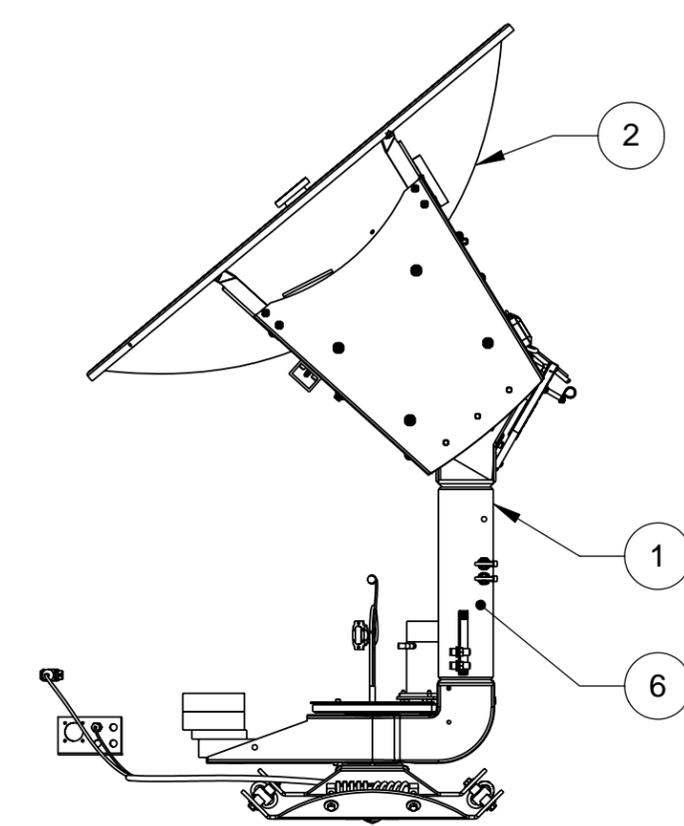
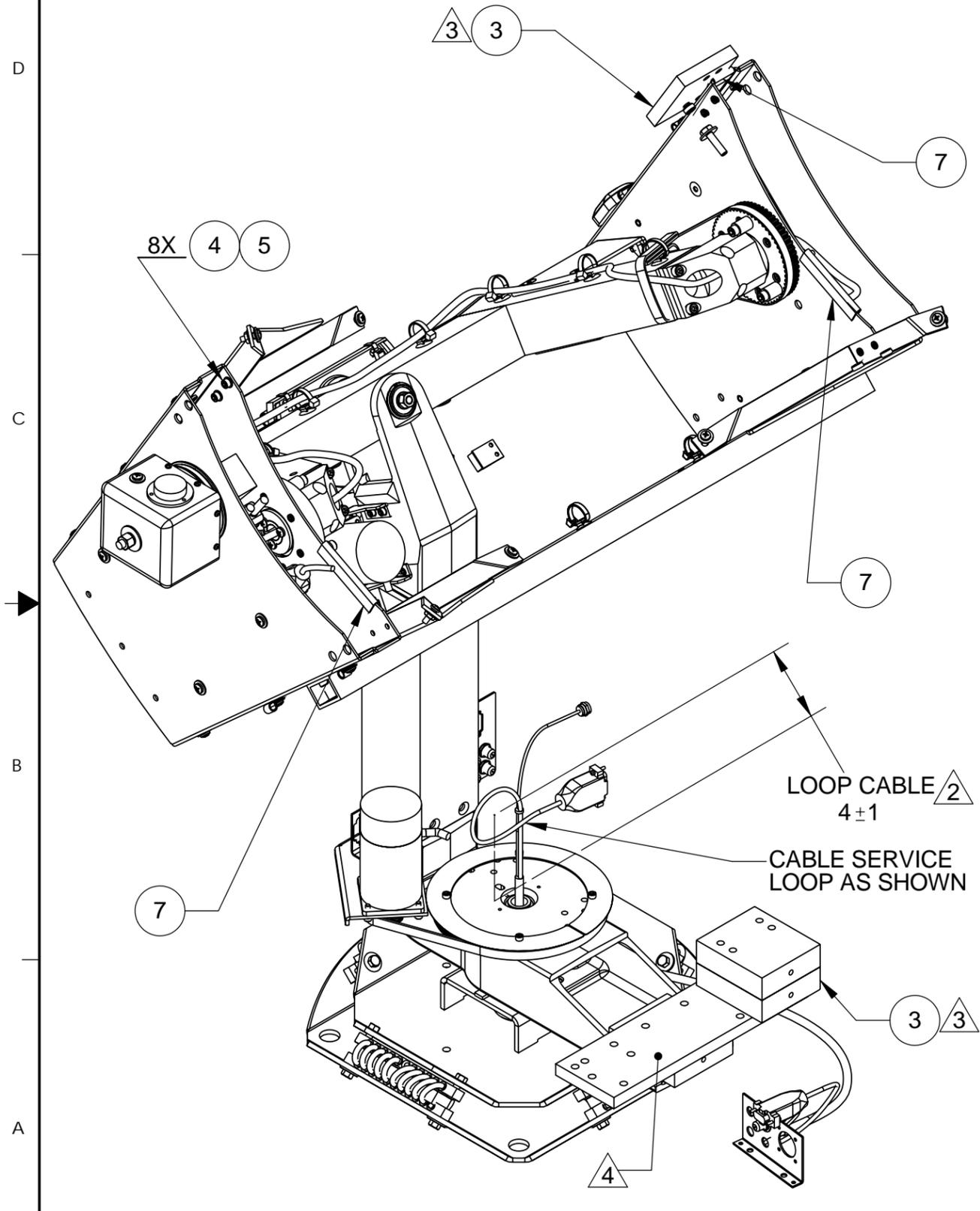
FINISH: N/A
3rd ANGLE PROJECTION
SIZE: B
SCALE: 1:2
DRAWING NUMBER: 121987
FIRST USED: 4004
SHEET NUMBER: 1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	129131-1	B1	PEDESTAL ASS'Y, 3004	
2	1 EA	122234	F	ANTENNA ASS'Y, 3004	
3	1 EA	122911	B	WEIGHT CONFIGURATION, 3004	
4	8 EA	114593-164		SCREW, SOCKET HD, 10-32 x 1/2, S.S.	
5	8 EA	114580-011		WASHER, FLAT, #10, S.S.	
6	1 EA	121655-2	F	LABELS INSTALLATION, XX04	
7	5 IN	122447-13	A	STRIP, NYLON WEAR	

<h1>Sea Tel</h1> <p><i>COBHAM</i></p>				
<p>GENERAL ASS'Y, 3004</p>				
<p>PROD FAMILY SERIES 04</p>	<p>EFF. DATE 12/1/2009</p>	<p>SHT 1 OF 1</p>	<p>DRAWING NUMBER 122220</p>	<p>REV C</p>

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
B	6385	9-22-08	ADDED NOTE 4; UPDATED ITEM 3 WEIGHT CONFIGURATION.	SMS
C	6597	03-20-09	RECREATED DRAWING; PEDESTAL (ITEM 1) WS 121989-1	HT



REFERENCE: SYSTEM BLOCK DIAGRAM 121987

NOTES: UNLESS OTHERWISE SPECIFIED

- 1. APPLY ADHESIVE PER SEATEL SPEC 121730.
- 2. FOR PROPER SPOOLING OF INTERFACE HARNESS, INSTALL SERVICE LOOP, ATTACH CONECTORS AND SET PEDESTAL TO CENTER OF AZIMUTH RANGE. THEN LOOSEN P-CLIP, REMOVE ALL TWISTING FROM HARNESS AND RETIGHTEN P-CLIP.
- 3. BALANCE WEIGHTS SHOWN TYPICAL. ADJUST TRIM WEIGHTS AND HARDWARE AS NECESSARY.
- 4. DO NOT PLACE ANY TRIM WEIGHTS BELOW MOUNTING PLATE 115420-2.

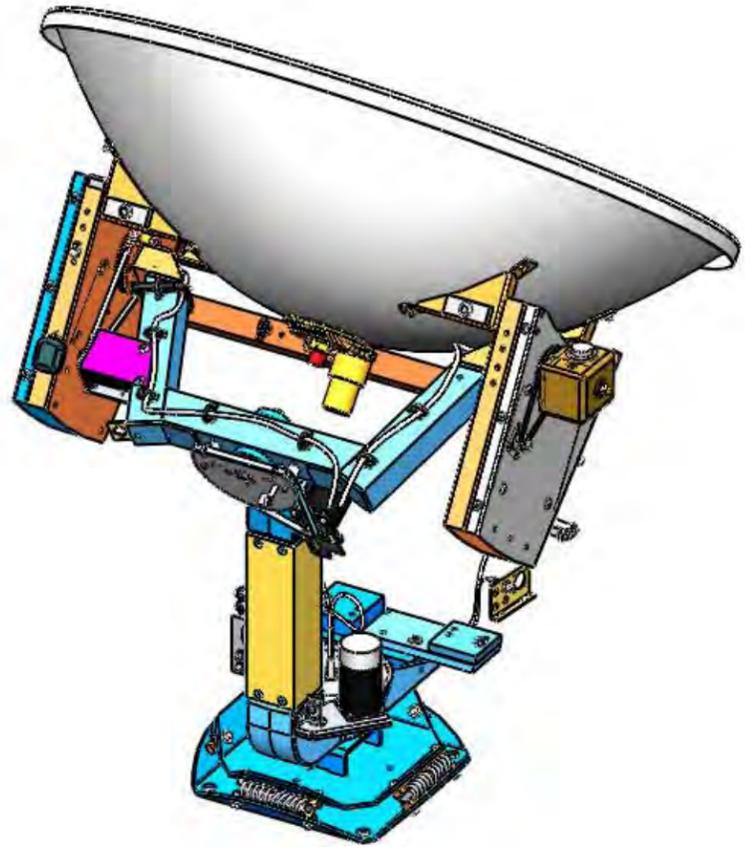
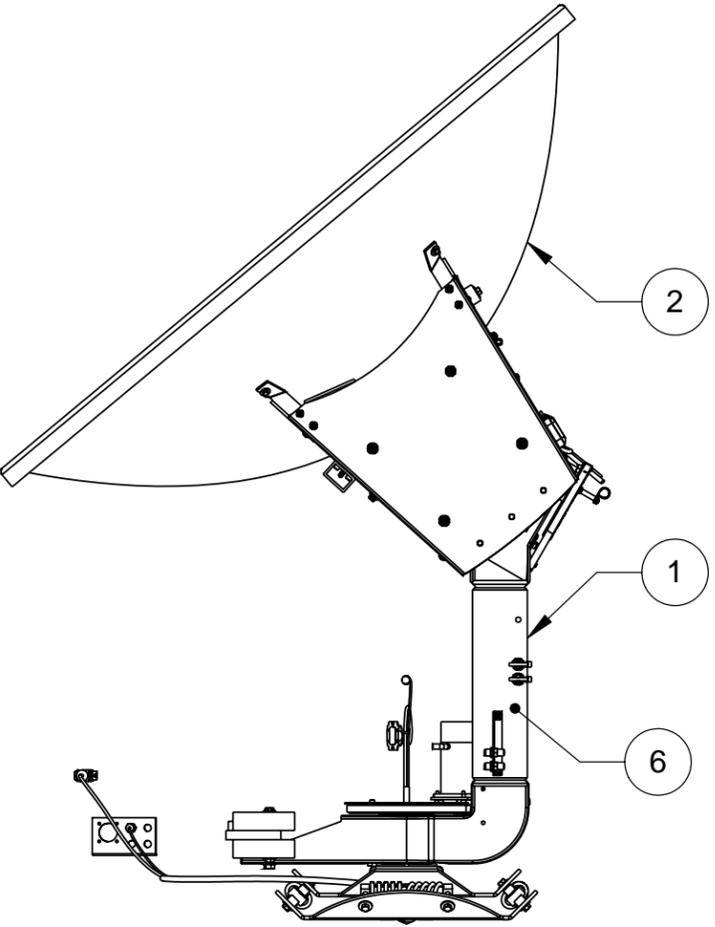
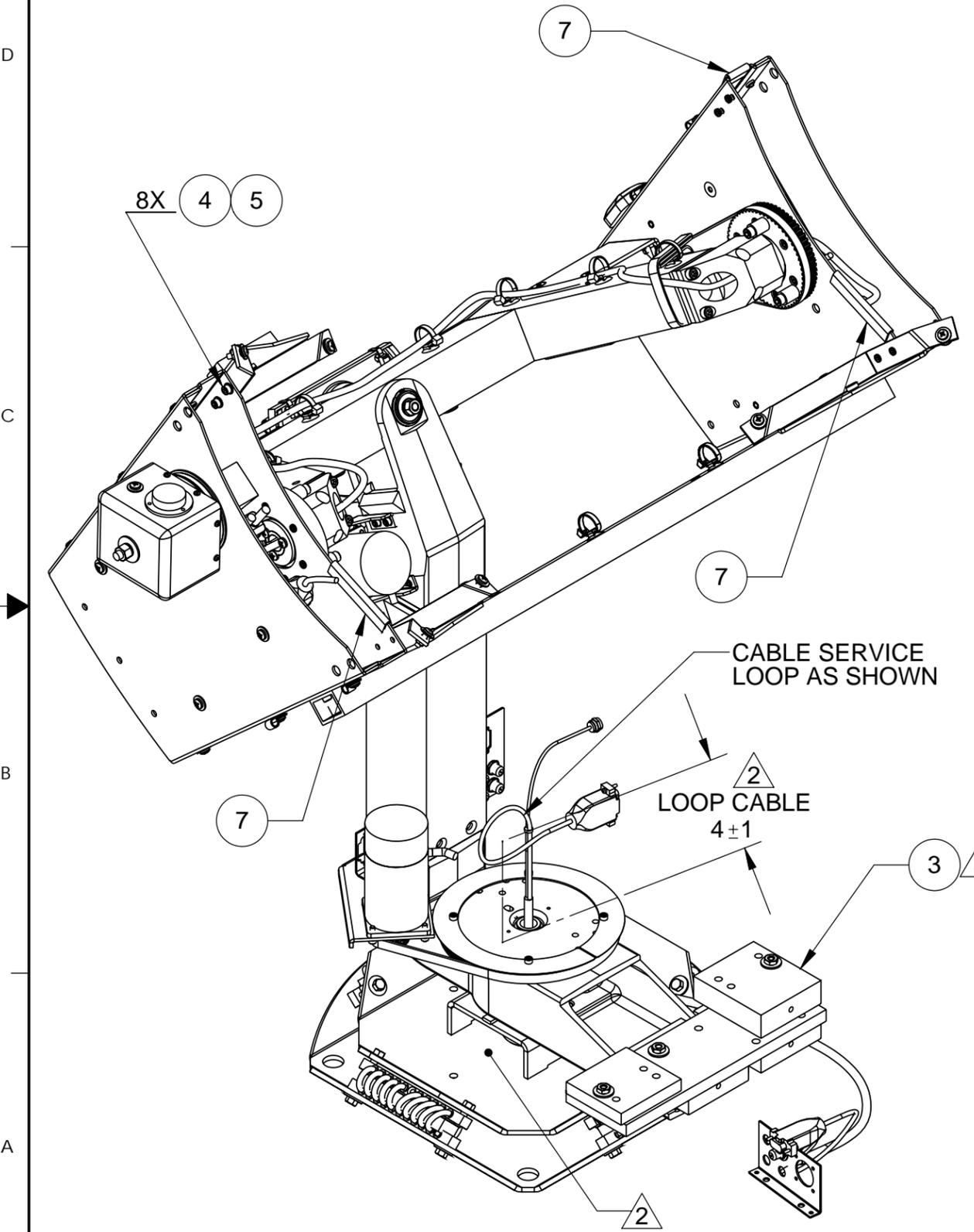
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994		DRAWN BY: P. McCANN		Sea Tel COBHAM Tel. 925-798-7979 Fax. 925-798-7986	
MATERIAL: N/A		DRAWN DATE: 10-08-03			
FINISH: N/A		APPROVED BY:		TITLE: GENERAL ASSEMBLY, 3004	
3rd ANGLE PROJECTION		APPROVED DATE:			
SIZE: B		SCALE: 1:10		DRAWING NUMBER: 122220	
FIRST USED: 3004		SHEET NUMBER: 1 OF 1		REV: C	

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	129131-2	B1	PEDESTAL ASS'Y, 4004	
2	1 EA	121990	C	ANTENNA ASS'Y, 4004	
3	1 EA	122865	A	WEIGHT CONFIGURATION, 4004	
4	8 EA	114593-164		SCREW, SOCKET HD, 10-32 x 1/2, S.S.	
5	8 EA	114580-011		WASHER, FLAT, #10, S.S.	
6	1 EA	121655-2	F	LABELS INSTALLATION, XX04	
7	5 IN	122447-13	A	STRIP, NYLON WEAR	

<h1>Sea Tel</h1> <p><i>COBHAM</i></p>				
<p>GENERAL ASS'Y, 4004</p>				
PROD FAMILY SERIES 04	EFF. DATE 12/1/2009	SHT 1 OF 1	DRAWING NUMBER 121988	REV B

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A3	6095	03-06-08	ADD REFERENC. UPDATE DWG PER RED LINE.	SL
B	6597	03-20-09	RECREATE DRAWING; PEDESTAL ASSY (ITEM 1) WS 121989-2	HT



REFERENCE: SYSTEM BLOCK DIAGRAM 121987

NOTES: UNLESS OTHERWISE SPECIFIED

- 1. APPLY ADHESIVE PER SEATEL SPEC 121730.
- 2. FOR PROPER SPOOLING OF INTERFACE HARNESS, INSTALL SERVICE LOOP, ATTACH CONECTORS AND SET PEDESTAL TO CENTER OF AZIMUTH RANGE. THEN LOOSEN P-CLIP, REMOVE ALL TWISTING FROM HARNESS AND RETIGHTEN P-CLIP.
- 3. BALANCE WEIGHTS SHOWN TYPICAL. ADJUST TRIM WEIGHTS AND HARDWARE AS NECESSARY.

VIEW W/O ANTENNA ASS'Y FOR CLARITY

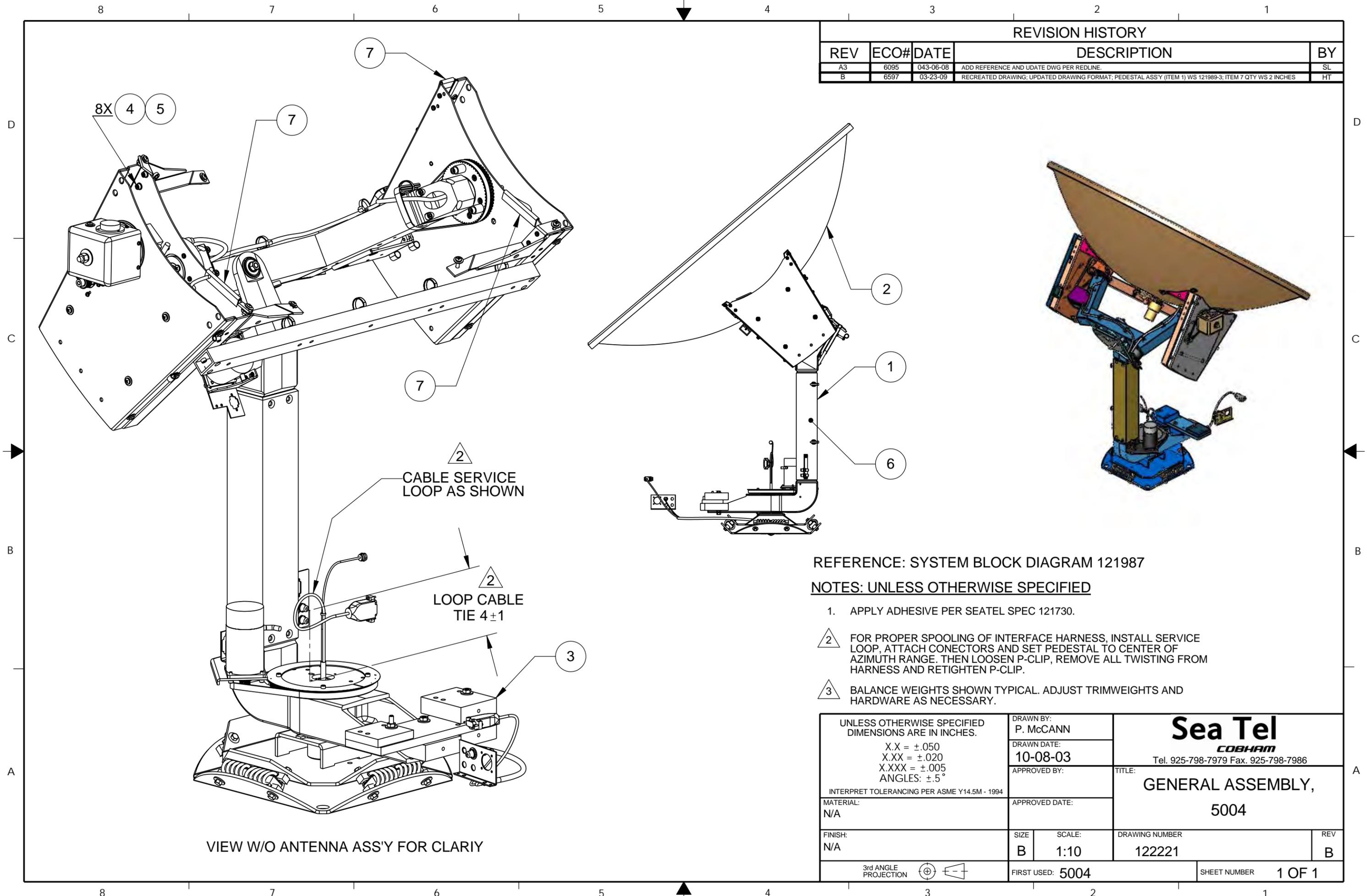
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5°		DRAWN BY: P. McCANN		Sea Tel COBHAM Tel. 925-798-7979 Fax. 925-798-7986	
INTERPRET TOLERANCING PER ASME Y14.5M - 1994		DRAWN DATE: 10-08-03			
MATERIAL: N/A		APPROVED BY:		TITLE: GENERAL ASSEMBLY, 4004	
FINISH: N/A		APPROVED DATE:		DRAWING NUMBER 121988	
3rd ANGLE PROJECTION		SIZE B	SCALE: 1:10	FIRST USED: 4004	REV B
				SHEET NUMBER	1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	129131-3	B1	PEDESTAL ASS'Y, 5004	
2	1 EA	122235	E1	ANTENNA ASS'Y, 5004	
3	1 EA	122890	A	WEIGHT CONFIGURATION, 5004	
4	8 EA	114593-164		SCREW, SOCKET HD, 10-32 x 1/2, S.S.	
5	8 EA	114580-011		WASHER, FLAT, #10, S.S.	
6	1 EA	121655-2	F	LABELS INSTALLATION, XX04	
7	5 IN	122447-13	A	STRIP, NYLON WEAR	

<h1 style="margin: 0;">Sea Tel</h1> <p style="margin: 0;"><i>COBHAM</i></p>				
<p>GENERAL ASS'Y, 5004</p>				
PROD FAMILY SERIES 04	EFF. DATE 12/1/2009	SHT 1 OF 1	DRAWING NUMBER 12221	REV B

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A3	6095	043-06-08	ADD REFERENCE AND UPDATE DWG PER REDLINE.	SL
B	6597	03-23-09	RECREATED DRAWING; UPDATED DRAWING FORMAT; PEDESTAL ASSY (ITEM 1) WS 121989-3; ITEM 7 QTY WS 2 INCHES	HT



2
CABLE SERVICE LOOP AS SHOWN

2
LOOP CABLE TIE 4±1

VIEW W/O ANTENNA ASS'Y FOR CLARIY

REFERENCE: SYSTEM BLOCK DIAGRAM 121987

NOTES: UNLESS OTHERWISE SPECIFIED

1. APPLY ADHESIVE PER SEATEL SPEC 121730.
2. FOR PROPER SPOOLING OF INTERFACE HARNESS, INSTALL SERVICE LOOP, ATTACH CONECTORS AND SET PEDESTAL TO CENTER OF AZIMUTH RANGE. THEN LOOSEN P-CLIP, REMOVE ALL TWISTING FROM HARNESS AND RETIGHTEN P-CLIP.
3. BALANCE WEIGHTS SHOWN TYPICAL. ADJUST TRIMWEIGHTS AND HARDWARE AS NECESSARY.

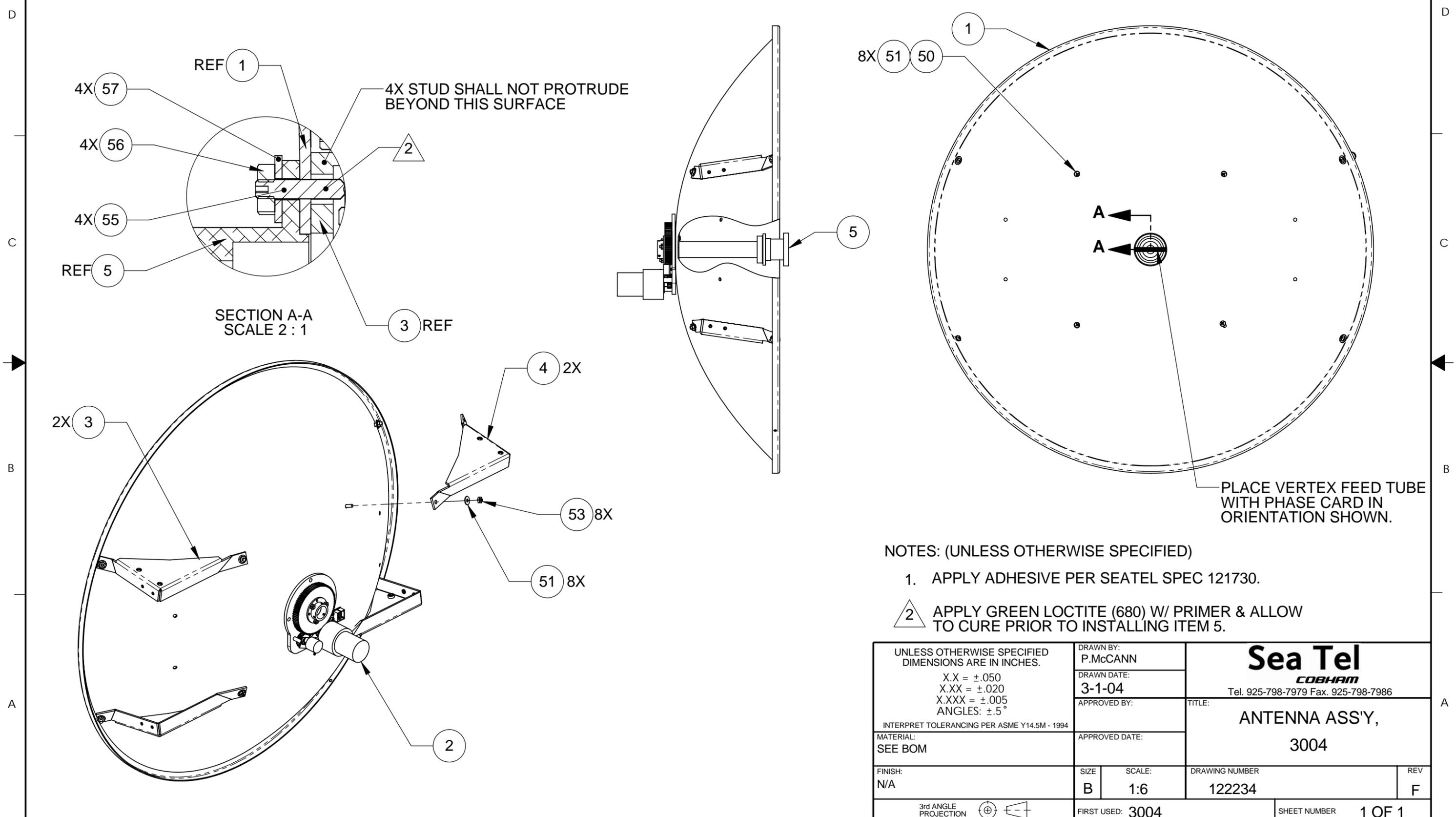
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5°		DRAWN BY: P. McCANN		Sea Tel <i>COBHAM</i> Tel. 925-798-7979 Fax. 925-798-7986	
INTERPRET TOLERANCING PER ASME Y14.5M - 1994		DRAWN DATE: 10-08-03			
MATERIAL: N/A		APPROVED BY:		TITLE: GENERAL ASSEMBLY, 5004	
FINISH: N/A		APPROVED DATE:		DRAWING NUMBER 122221	
3rd ANGLE PROJECTION		SIZE B	SCALE: 1:10	FIRST USED: 5004	REV B
				SHEET NUMBER	1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122180	B1	REFLECTOR MACHINING, 30 IN, RX ONLY	
2	1 EA	122201	E	POLANG ASS'Y	
3	2 EA	122181-1	C	CLIP, 30 IN. REFLECTOR, RX ONLY	
4	2 EA	122181-2	C	CLIP, 30 IN. REFLECTOR, RX ONLY	
5	1 EA	124829-1	A	VERTEX FEED, 30 IN DBS	
50	8 EA	114588-830		SCREW, PAN HD, PHIL, 10-32 x 5/8, S.S	
51	16 EA	122076-333		WASHER, FLAT, #10, 18-8 SS, (.5 OD x	
53	8 EA	114583-011	A	NUT, HEX, 10-32, S.S.	
55	4 EA	114590-110		SCREW, SOCKET SET-CUP, 4-40 x 1/2, S.	
56	4 EA	114583-005		NUT, HEX, 4-40, S.S.	
57	4 EA	114580-005		WASHER, FLAT, #4, S.S.	

<h1 style="margin: 0;">Sea Tel</h1> <p style="margin: 0;"><i>COBHAM</i></p>				
<p>ANTENNA ASS'Y, 3004</p>				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 1	DRAWING NUMBER 122234	REV F

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
E	5212	6-8-06	ITEM 55 WS 114592-409; EDIT SECTION LINE.	SL
F	6534	03-24-09	DELETED ITEM 52; UPDATED DRAWING FORMAT.	HT



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. APPLY ADHESIVE PER SEATEL SPEC 121730.

2. APPLY GREEN LOCTITE (680) W/ PRIMER & ALLOW TO CURE PRIOR TO INSTALLING ITEM 5.

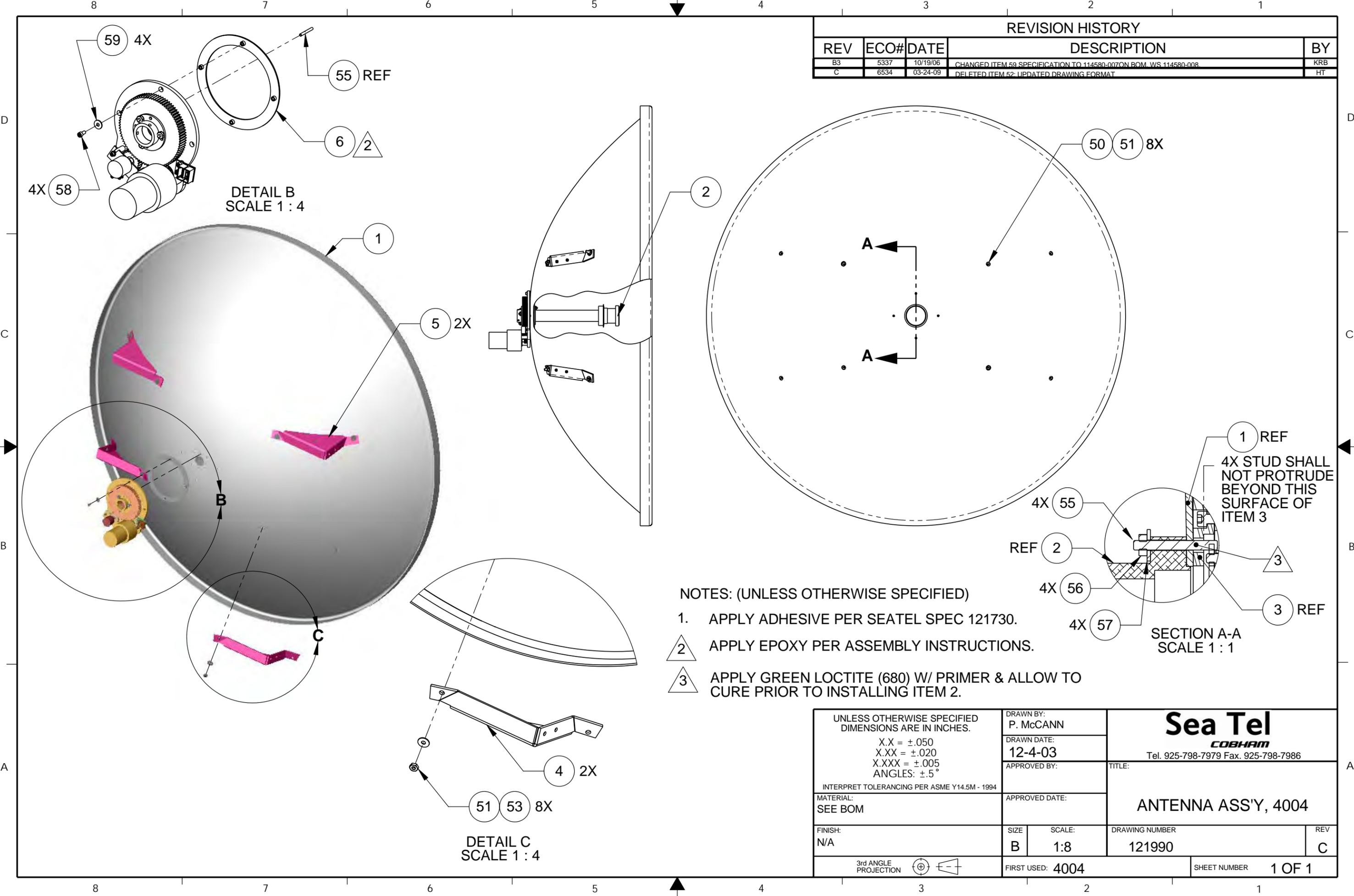
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994		DRAWN BY: P.McCANN		Sea Tel <i>COBHAM</i> Tel. 925-798-7979 Fax. 925-798-7986	
MATERIAL: SEE BOM		DRAWN DATE: 3-1-04			
FINISH: N/A		APPROVED BY:		TITLE: ANTENNA ASS'Y, 3004	
SIZE: B		APPROVED DATE:			
FIRST USED: 3004		SCALE: 1:6		DRAWING NUMBER 122234	
3rd ANGLE PROJECTION		SHEET NUMBER		REV F	
		1 OF 1			

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122092	C	REFLECTOR MACHINING, 40 IN	
2	1 EA	122237	A1	VERTEX FEED, 40 IN., 4004	
3	1 EA	122201	E	POLANG ASS'Y	
4	2 EA	122034-1	B	CLIP, 40 IN. REFLECTOR	
5	2 EA	122034-2	C	CLIP, 40 IN. REFLECTOR	
6	1 EA	122365	A	EPOXY PLATE	
50	8 EA	114588-830		SCREW, PAN HD, PHIL, 10-32 x 5/8, S.S	
51	16 EA	122076-333		WASHER, FLAT, #10, 18-8 SS, (.5 OD x	
53	8 EA	114583-011	A	NUT, HEX, 10-32, S.S.	
55	4 EA	114592-868		STUD, FULLY THREADED, 4-40 x 1 IN, S.	
56	4 EA	114583-005		NUT, HEX, 4-40, S.S.	
57	4 EA	114580-005		WASHER, FLAT, #4, S.S.	
58	4 EA	114593-121		SCREW, SOCKET HD, 6-32 x 5/16, S.S.	
59	4 EA	114580-007		WASHER, FLAT, #6, S.S.	

<h1 style="margin: 0;">Sea Tel</h1> <p style="margin: 0;"><i>COBHAM</i></p>				
<p>ANTENNA ASS'Y, 4004</p>				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 121990	REV C

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
B3	5337	10/19/06	CHANGED ITEM 59 SPECIFICATION TO 114580-007 ON BOM. WS 114580-008.	KRB
C	6534	03-24-09	DELETED ITEM 52- UPDATED DRAWING FORMAT	HT



NOTES: (UNLESS OTHERWISE SPECIFIED)

- 1. APPLY ADHESIVE PER SEATEL SPEC 121730.
- 2. APPLY EPOXY PER ASSEMBLY INSTRUCTIONS.
- 3. APPLY GREEN LOCTITE (680) W/ PRIMER & ALLOW TO CURE PRIOR TO INSTALLING ITEM 2.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5°	DRAWN BY: P. McCANN		<h1>Sea Tel</h1> <p>COBHAM</p> <p>Tel. 925-798-7979 Fax. 925-798-7986</p>	
	DRAWN DATE: 12-4-03			
INTERPRET TOLERANCING PER ASME Y14.5M - 1994	APPROVED BY:		TITLE: ANTENNA ASS'Y, 4004	
MATERIAL: SEE BOM	APPROVED DATE:		DRAWING NUMBER 121990	REV C
FINISH: N/A	SIZE B	SCALE: 1:8	FIRST USED: 4004	SHEET NUMBER 1 OF 1

3rd ANGLE PROJECTION

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122169	B	REFLECTOR MACHINING, 50 IN	
2	1 EA	122201	E	POLANG ASS'Y	
3	2 EA	122171-1	A	CLIP, 50 IN. REFLECTOR	
4	2 EA	122171-2	A	CLIP, 50 IN. REFLECTOR	
5	1 EA	125780	X1	VERTEX FEED, 49 IN, KU-BAND, RX ONLY,	
7	1 EA	122365	A	EPOXY PLATE	
50	8 EA	114588-829		SCREW, PAN HD, PHIL, 10-32 x 1/2, S.S	
51	16 EA	122076-333		WASHER, FLAT, #10, 18-8 SS, (.5 OD x	
53	8 EA	114583-011	A	NUT, HEX, 10-32, S.S.	
55	4 EA	114592-360	A2	STUD, FULLY THREADED, 4-40 x 1-1/4, S	
56	4 EA	114583-005		NUT, HEX, 4-40, S.S.	
57	4 EA	114580-005		WASHER, FLAT, #4, S.S.	
59	4 EA	114593-121		SCREW, SOCKET HD, 6-32 x 5/16, S.S.	
60	4 EA	114580-007		WASHER, FLAT, #6, S.S.	

Sea Tel				
COBHAM				
ANTENNA ASS'Y, 5004				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 122235	REV E1

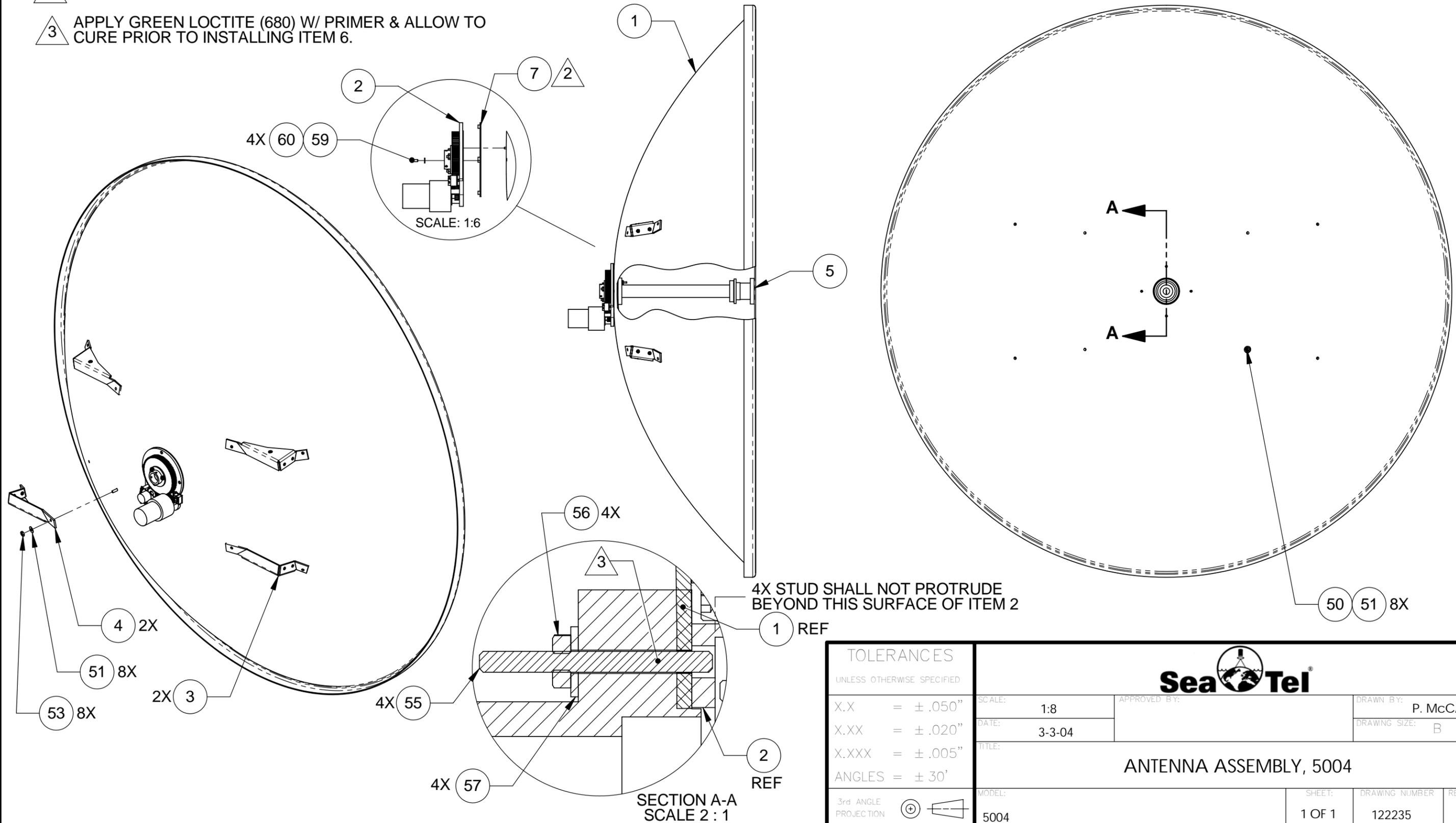
REV.	ECO#	DATE	DESCRIPTION	BY
B	4551	08-18-04	ITEM 51: 122076-333 WS 114580-012	SCC
B1	N/A	10-27-05	NOTE 2 WS " APPLY LOCTITE RED PER SEATEL SPEC 121730 & ALLOW TO CURE PRIOR TO INSTALLING ITEM 6."	SL
C	5141	2-28-06	DELETED ISO DAMP WASHERS; ITEM 50 WS 114588-830	RJW
D	5261	7-31-06	INCREASED WIDTH OF FEED ADAPTER HD PER PRINT; ITEM 55 WS 114592-409	RJW
E	5285	9-26-06	VERTEX FEED REPLACED: ITEM 5 WS 122358; ITEM 6 DELTD; ITEMS 54 & 58 DELETED	RJW
E1	5340	10-19-06	SWITCHED NOTES 2 & 3 INDICATORS, REMOVED BUBBLES 6 & 31, CHANGED QTY'S FOR ITEMS 3 & 4 TO 2 EA. WS. 4 EACH	KRB

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. APPLY ADHESIVE PER SEATEL SPEC 121730.

2. APPLY EPOXY PER ASSEMBLY INSTRUCTIONS.

3. APPLY GREEN LOCTITE (680) W/ PRIMER & ALLOW TO CURE PRIOR TO INSTALLING ITEM 6.



TOLERANCES	
UNLESS OTHERWISE SPECIFIED	
X.X	= ± .050"
X.XX	= ± .020"
X.XXX	= ± .005"
ANGLES	= ± 30'
3rd ANGLE PROJECTION	

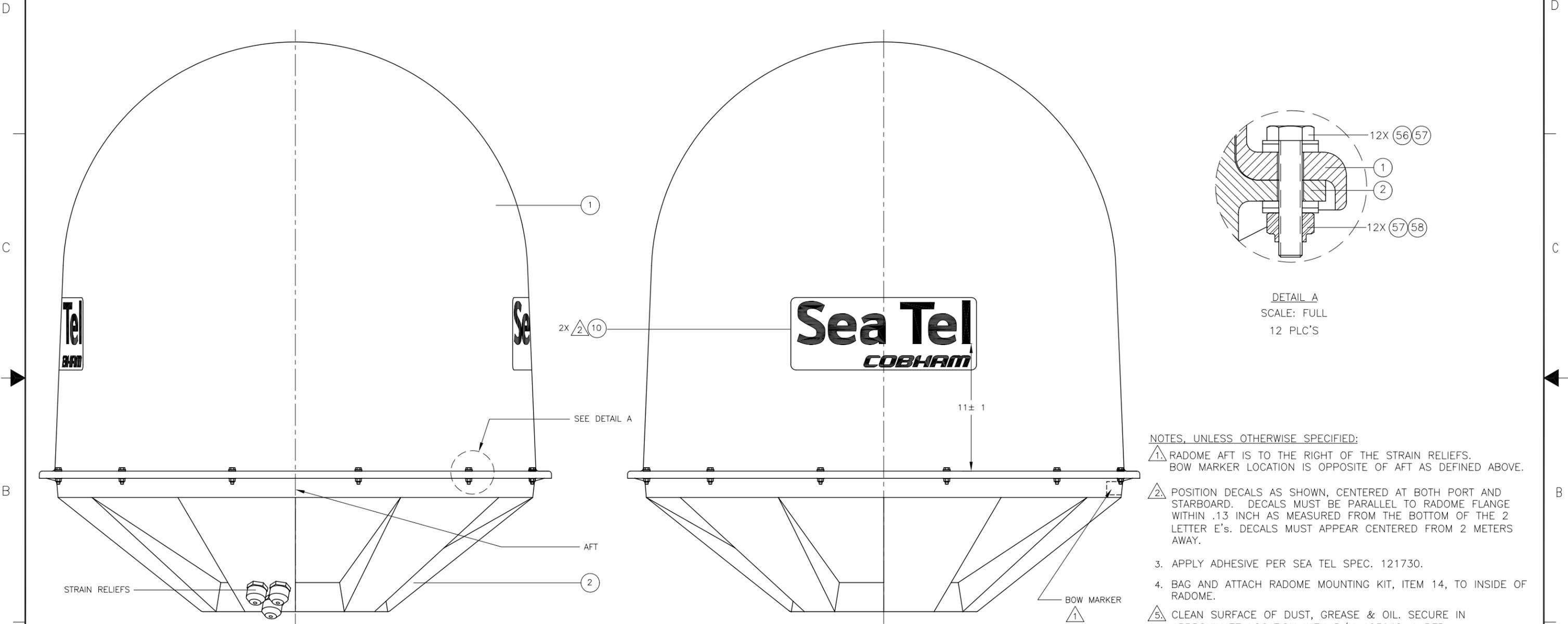
SCALE: 1:8	APPROVED BY:	DRAWN BY: P. McCANN	
DATE: 3-3-04		DRAWING SIZE: B	
TITLE: ANTENNA ASSEMBLY, 5004			
MODEL: 5004	SHEET: 1 OF 1	DRAWING NUMBER: 122235	REVISION: E1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122348-2	A	RADOME TOP, 40 IN, W/ LIP, FOAM, WHIT	
2	1 EA	124197-1	X3	RADOME BASE FAB ASS'Y, 40 IN, W/ LIP,	
3	3 EA	124903-1	B1	STRAIN RELIEF ASS'Y	
4	1 EA	118576	C	MOUNTING KIT, PEDESTAL	
5	10 EA	119801-012	B	CABLE TIE, NYLON, 4 IN, NATURAL	
6	1 EA	111679-7	O	CABLE CLAMP, NYLON, .50 DIA, #8 MTG H	
7	4 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
8	.1 OZ	116702		ADHESIVE/SEALANT, E6000	
10	2 EA	110481-4	G	DECAL, LOGO, SEA TEL, 16 X 6.3 IN	
11	1 EA	109783-2		WRENCH, L	
14	1 EA	123549	F	KIT, RADOME HARDWARE MOUNTING	NOT SHOWN
53	7 EA	114588-191		SCREW, PAN HD, PHIL, 8-32 x 5/16, S.S	
54	14 EA	114580-009		WASHER, FLAT, #8, S.S.	
55	7 EA	125806-1	A	ROTALOC HEX NUT, BONDING, F1-B38-8-32	
56	12 EA	114586-540		SCREW, HEX HD, 1/4-20 x 1-1/4, S.S.	
57	24 EA	123665-416		WASHER, BONDED SEALING, 1/4, .275 IDX	
58	12 EA	119906-029		NUT, NYLON INSERT, 1/4-20	

<h1 style="margin: 0;">Sea Tel</h1> <p style="margin: 0;"><i>COBHAM</i></p>				
<p>RADOME ASS'Y, XX04 GA INSTALL, 40 IN, WHITE</p>				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 122968-1	REV G

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
F2	5104	11/7/07	ITEM 2 WAS 122349-2 (SEE ECO 5104)	CK
G	6646	5-1-09	REMOVED ITEMS 50-52, 60 & 61; ITEM 53 WAS QTY 1 OF 114588-196; ITEM 54 WAS QTY 7; ITEM 55 WAS QTY 1 OF 114583-009	K.D.H.



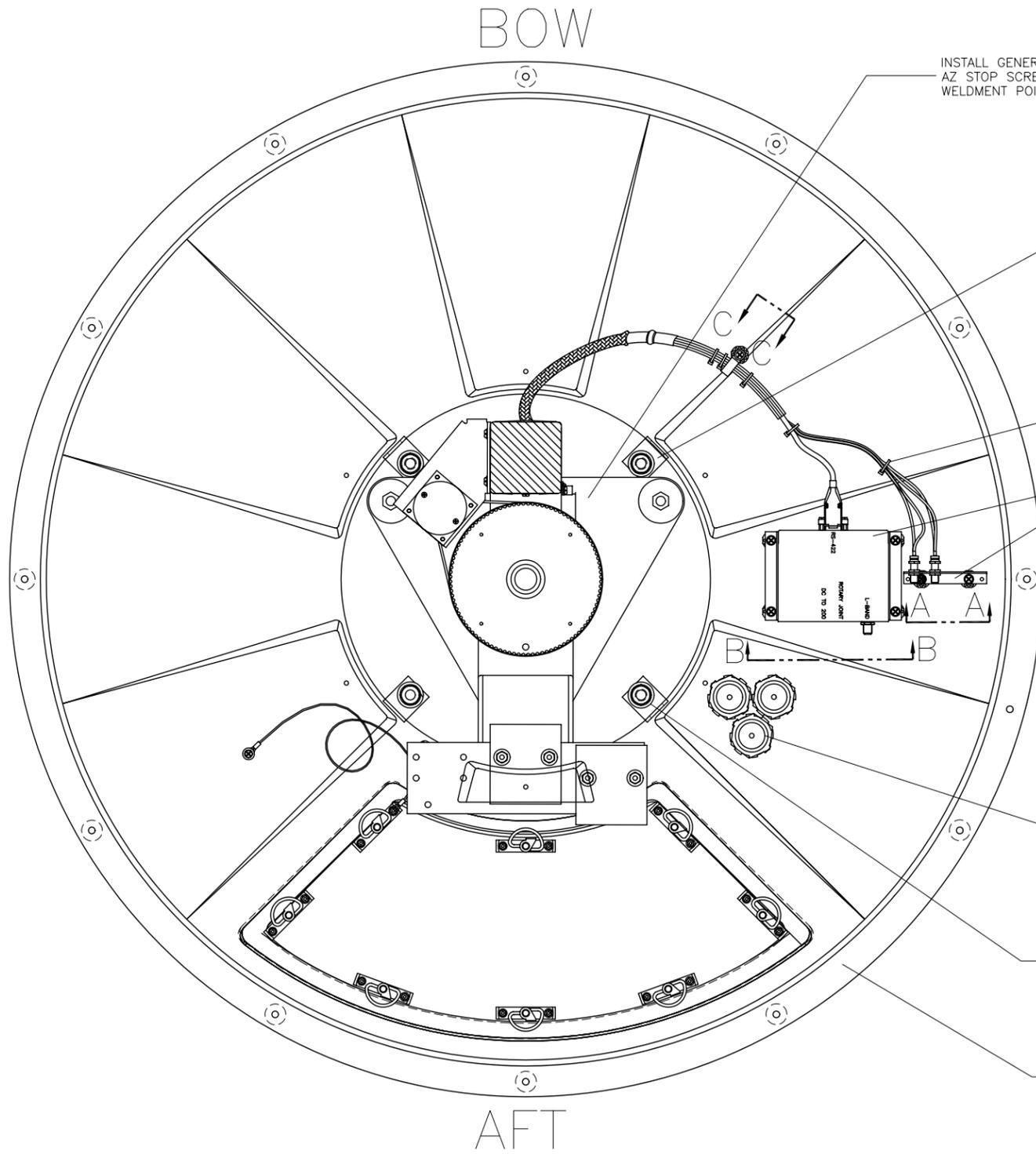
- NOTES, UNLESS OTHERWISE SPECIFIED:
1. RADOME AFT IS TO THE RIGHT OF THE STRAIN RELIEFS. BOW MARKER LOCATION IS OPPOSITE OF AFT AS DEFINED ABOVE.
 2. POSITION DECALS AS SHOWN, CENTERED AT BOTH PORT AND STARBOARD. DECALS MUST BE PARALLEL TO RADOME FLANGE WITHIN .13 INCH AS MEASURED FROM THE BOTTOM OF THE 2 LETTER E's. DECALS MUST APPEAR CENTERED FROM 2 METERS AWAY.
 3. APPLY ADHESIVE PER SEA TEL SPEC. 121730.
 4. BAG AND ATTACH RADOME MOUNTING KIT, ITEM 14, TO INSIDE OF RADOME.
 5. CLEAN SURFACE OF DUST, GREASE & OIL. SECURE IN APPROXIMATE LOCATION WITH P/N 125948-1 PER MANUFACTURERS SPECIFICATIONS.

DASH	DESCRIPTION
-1	WHITE WITH FOAM
-2	KOREAN NAVY GREY WITH FOAM

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994	DRAWN BY: SCC		 Tel. 925-798-7979 Fax. 925-798-7986	
	DRAWN DATE: 5-3-04			
	MATERIAL: N/A	APPROVED BY:		TITLE: RADOME ASS'Y, 40 INCH, GA INSTALL
FINISH: N/A	SIZE: B	SCALE: 1:8	DRAWING NUMBER: 122968	REV: G
3rd ANGLE PROJECTION			FIRST USED: 3004	SHEET NUMBER: 1 OF 2

8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

D
C
B
A



INSTALL GENERAL ASSEMBLY SO THAT AZ STOP SCREW IN BASE SPINDLE WELDMENT POINTS TOWARD BOW.

SHIPPING BRACKETS PART OF SHIP STOWAGE KIT

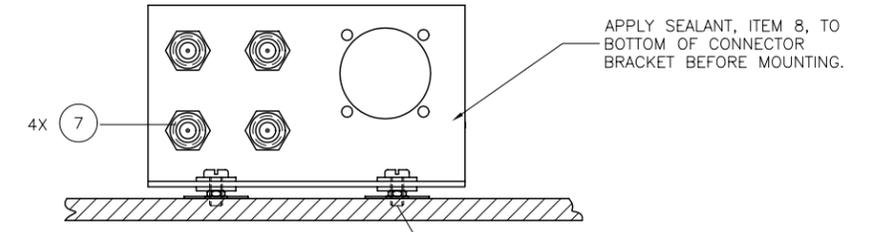
5

ATTACH AT APPROXIMATE LOCATIONS SHOWN. ENSURE THERE IS NO INTERFERENCE WITH GA.

3X 3

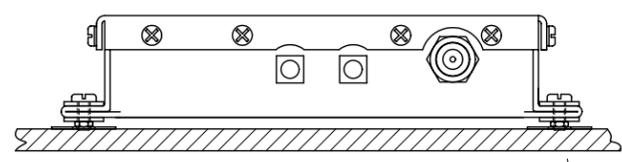
P/O 4

2

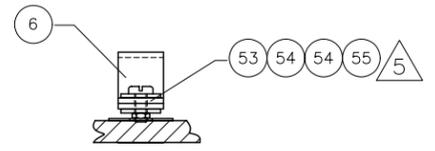


VIEW A-A
SCALE: FULL

2X 53 54 54 55 5



VIEW B-B
SCALE: FULL



VIEW C-C
SCALE: FULL

SIZE	SCALE:	DRAWING NUMBER:	REV:
D	1:3	122968	G
FIRST USED: 3004		SHEET NUMBER: 2 OF 2	

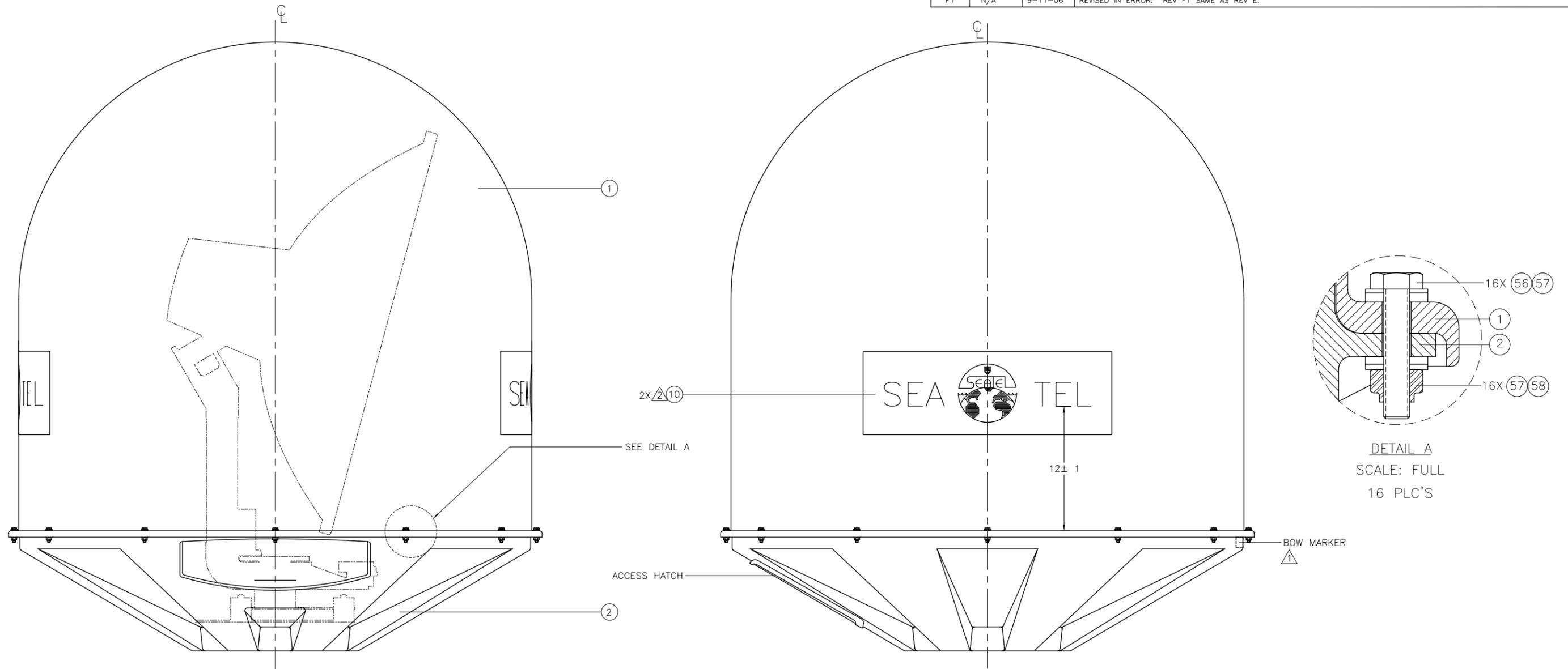
8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122351-2	C1	RADOME TOP, 48 IN, W/ LIP, FOAM, WHIT	
2	1 EA	122784	C	RADOME BASE FAB ASS'Y, 48 IN, W/ LIP,	
3	3 EA	124903-1	B1	STRAIN RELIEF ASS'Y	
4	1 EA	118576	C	MOUNTING KIT, PEDESTAL	
5	10 EA	119801-012	B	CABLE TIE, NYLON, 4 IN, NATURAL	
6	1 EA	111679-7	O	CABLE CLAMP, NYLON, .50 DIA, #8 MTG H	
7	4 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
8	.1 OZ	116702		ADHESIVE/SEALANT, E6000	
10	2 EA	110481-3	G	DECAL, LOGO, SEA TEL, 25.8 X 10 IN	
11	1 EA	109783-2		WRENCH, L	
14	1 EA	123549	F	KIT, RADOME HARDWARE MOUNTING	
50	2 EA	114588-148		SCREW, PAN HD, PHIL, 6-32 x 1/2, S.S.	
51	12 EA	114580-007		WASHER, FLAT, #6, S.S.	
52	6 EA	114583-007		NUT, HEX, 6-32, S.S.	
53	1 EA	114588-196		SCREW, PAN HD, PHIL, 8-32 x 5/8, S.S.	
54	2 EA	114580-009		WASHER, FLAT, #8, S.S.	
55	1 EA	114583-009		NUT, HEX, 8-32, S.S.	
56	12 EA	114586-540		SCREW, HEX HD, 1/4-20 x 1-1/4, S.S.	
57	24 EA	123665-416		WASHER, BONDED SEALING, 1/4, .275 IDX	
58	12 EA	119906-029		NUT, NYLON INSERT, 1/4-20	
60	4 EA	114588-150		SCREW, PAN HD, PHIL, 6-32 x 5/8, S.S.	
61	4 EA	121226-3012		SPACER, #6 X .25 OD X .125, ALUM, ALO	

<h1>Sea Tel</h1> <p><i>COBHAM</i></p>				
RADOME ASS'Y, XX04 GA INSTALL, 48 IN, WHITE/FOAM				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 122970-1	REV F1

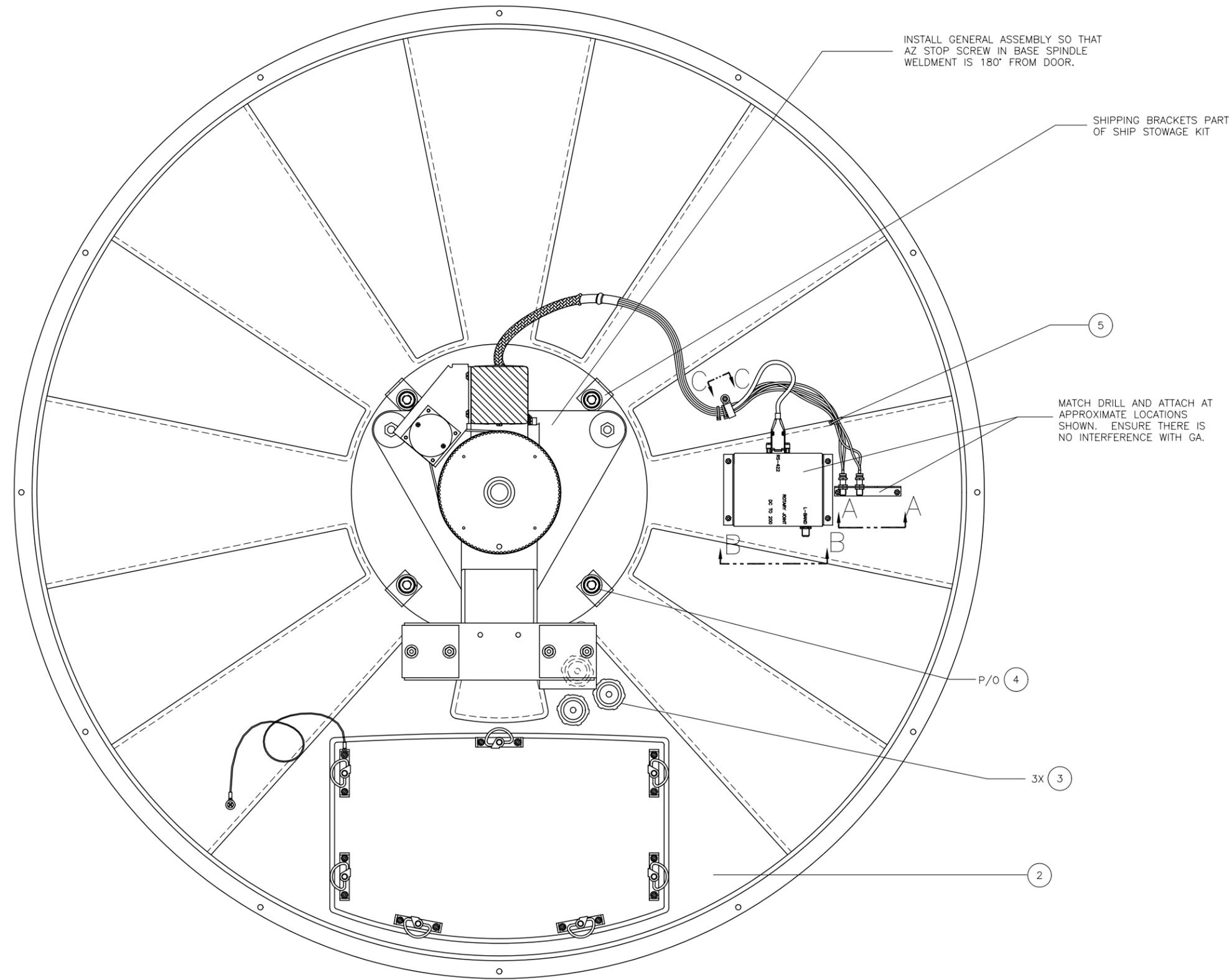
REV.	ECO#	DATE	DESCRIPTION	BY
X1	NA	5-3-04	NEW DRAWING	SCC
A	4521	7-13-04	REMOVED ITEM 9 P/N 122465. RELEASED TO PRODUCTION.	V.S.
B	4594	09-10-04	DEL ITEMS 13, 59. ITEM 4:118576 WS 118569. ITEM 56: QTY 12 WS 8. ADD ITEM 14. DEL DETAIL B.	SCC
"	"	"	LOCALIZE NOTES ON SHT 2. ADD GLOBAL NOTES 3, 4 TO SHT 1.	
C	4651	11-11-04	DEL ITEM 12. ITEM 50:QTY 2 WS 6. ITEM 56 WS 114586-537; ITEM 57:123665-416 WS 114580-029. ADD ITEMS 60, 61.	SCC
C1	N/A	12-2-04	ADDED DASH 3	LK
D	4716	01-24-05	REPLACE ACORN NUTS WITH NYLOCS. ITEM 56 WS 114586-538; ITEM 58 WS 120731-360.	SCC
E	5050	11-14-05	ITEM 3 WAS P/N 109258-8.	V.S.
F	5236	8-17-06	IN TITLE, RADOME WS 48 INCH. ITEM 1 WS 122351-2, ITEM 2 WS 122784 DASH 1 ONLY.	SL
F1	N/A	9-11-06	REVISED IN ERROR. REV F1 SAME AS REV E.	SL



DASH	DESCRIPTION
-1	WHITE WITH FOAM
-2	FRENCH NAVY GREY WITH FOAM
-3	IRISH NAVY GREY WITH FOAM

- NOTES, UNLESS OTHERWISE SPECIFIED:
- 1 BOW MARKER LOCATION DIRECTLY OPPOSITE FROM ACCESS HATCH.
 - 2 POSITION DECALS AS SHOWN, CENTERED AT BOTH PORT AND STARBOARD. DECALS MUST BE PARALLEL TO RADOME FLANGE WITHIN .13 INCH AS MEASURED FROM THE BOTTOM OF THE 2 LETTER E's. DECALS MUST APPEAR CENTERED FROM 2 METERS AWAY.
 - 3. APPLY ADHESIVE PER SEA TEL SPEC. 121730.
 - 4. BAG AND ATTACH RADOME MOUNTING KIT, ITEM 14, TO INSIDE OF RADOME.

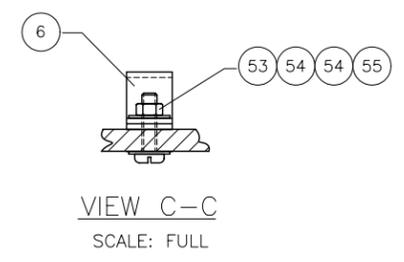
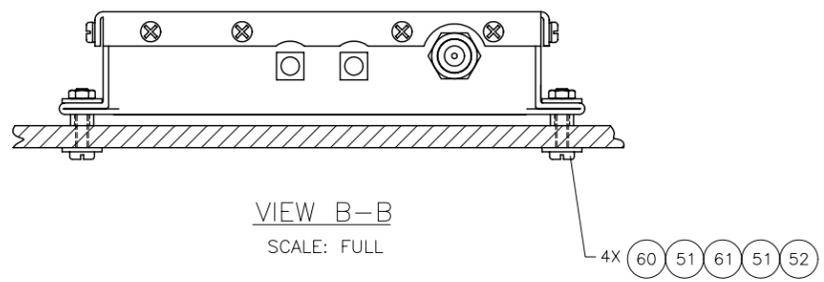
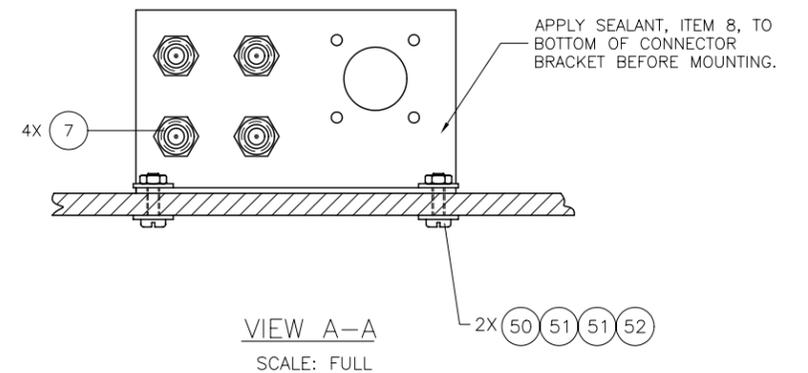
TOLERANCES				
UNLESS OTHERWISE SPECIFIED				
X.X	= ± .050"	SCALE: 1:10	APPROVED BY:	DRAWN BY: SCC
X.XX	= ± .020"	DATE: 5-3-04		DRAWING SIZE: B
X.XXX	= ± .005"	TITLE: RADOME ASSEMBLY, 48 INCH, GA INSTALL		
ANGLES	= ± 30'	MODEL: 4004	SHEET: 1 OF 2	DRAWING NUMBER: 122970
3rd ANGLE PROJECTION				REVISION: F1



INSTALL GENERAL ASSEMBLY SO THAT
AZ STOP SCREW IN BASE SPINDLE
WELDMENT IS 180° FROM DOOR.

SHIPPING BRACKETS PART
OF SHIP STORAGE KIT

MATCH DRILL AND ATTACH AT
APPROXIMATE LOCATIONS
SHOWN. ENSURE THERE IS
NO INTERFERENCE WITH GA.



11 ATTACH TO THE OUTSIDE OF
ACCESS HATCH WHEN DOME IS
SEALED FOR SHIPPING.

TOLERANCES UNLESS OTHERWISE SPECIFIED		SCALE: 1:3		APPROVED BY:		DRAWN BY: SCC	
X.X	= ± .050"	DATE:	4/1/04	TITLE:		DRAWING SIZE: D	
X.XX	= ± .020"	RADOME ASSEMBLY, 48 INCH, GA INSTALL					
X.XXX	= ± .005"						
ANGLES	= ± 30'	MODEL:	4004	SHEET:	2 OF 2	DRAWING NUMBER:	122970
3rd ANGLE PROJECTION				REVISION:	F1		

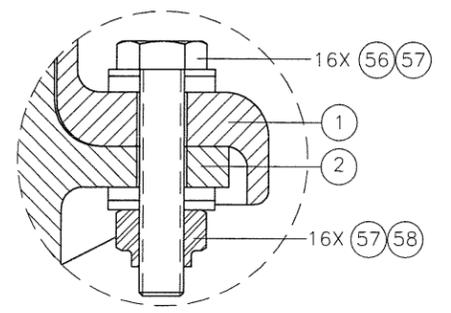
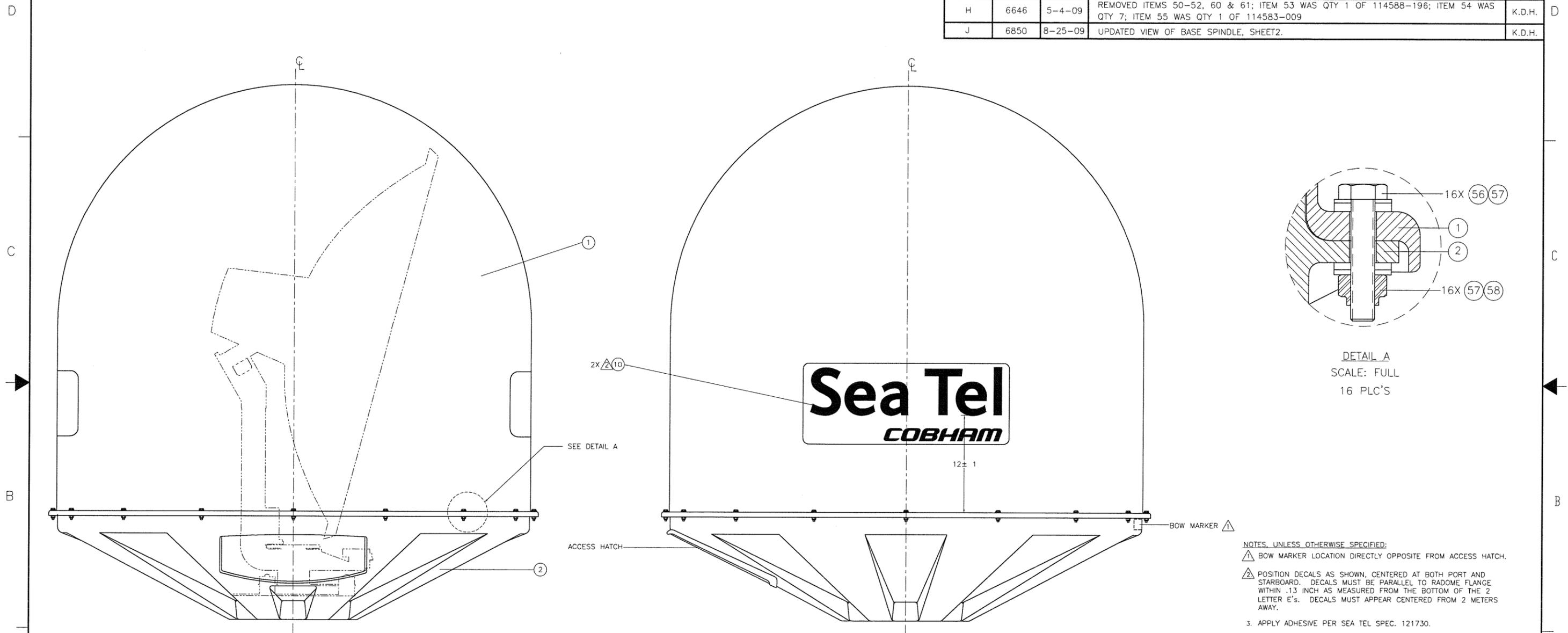
SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122874-2	C	RADOME TOP, 60 IN W/ LIP, ZERO DRAFT,	
2	1 EA	126983-1	B1	RADOME BASE FAB ASS'Y, 60 IN, WHITE,	
3	3 EA	124903-1	B1	STRAIN RELIEF ASS'Y	
4	1 EA	118576	C	MOUNTING KIT, PEDESTAL	
5	10 EA	119801-012	B	CABLE TIE, NYLON, 4 IN, NATURAL	
6	1 EA	111679-7	O	CABLE CLAMP, NYLON, .50 DIA, #8 MTG H	
7	4 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
8	.1 OZ	116702		ADHESIVE/SEALANT, E6000	
10	2 EA	110481-3	G	DECAL, LOGO, SEA TEL, 25.8 X 10 IN	
11	1 EA	109783-2		WRENCH, L	
14	1 EA	123549	F	KIT, RADOME HARDWARE MOUNTING	
53	7 EA	114588-191		SCREW, PAN HD, PHIL, 8-32 x 5/16, S.S	
54	14 EA	114580-009		WASHER, FLAT, #8, S.S.	
55	7 EA	125806-1	A	ROTALOC HEX NUT, BONDING, F1-B38-8-32	
56	16 EA	114586-540		SCREW, HEX HD, 1/4-20 x 1-1/4, S.S.	
57	32 EA	123665-416		WASHER, BONDED SEALING, 1/4, .275 IDX	
58	16 EA	119906-029		NUT, NYLON INSERT, 1/4-20	

<h1 style="margin: 0;">Sea Tel</h1> <p style="margin: 0;"><i>COBHAM</i></p>				
<p>RADOME ASS'Y, XX04 GA INSTALL, 60 IN, WHITE</p>				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 2	DRAWING NUMBER 122969-1	REV J

8 7 6 5 4 3 2 1

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
F	5768	8-15-07	ITEM 2 WAS P/N 123126	MSF
G	5779	8-21-07	ITEM 2 WAS P/N 126982-X	MSF
G1	N/A	3-19-09	ITEM 10 & TITLE BLOCK UPDATED; -6, -7 & -8 ADDED	MSF
H	6646	5-4-09	REMOVED ITEMS 50-52, 60 & 61; ITEM 53 WAS QTY 1 OF 114588-196; ITEM 54 WAS QTY 7; ITEM 55 WAS QTY 1 OF 114583-009	K.D.H.
J	6850	8-25-09	UPDATED VIEW OF BASE SPINDLE, SHEET2.	K.D.H.



DETAIL A
SCALE: FULL
16 PLC'S

- NOTES, UNLESS OTHERWISE SPECIFIED:
- ▲ BOW MARKER LOCATION DIRECTLY OPPOSITE FROM ACCESS HATCH.
 - ▲ POSITION DECALS AS SHOWN, CENTERED AT BOTH PORT AND STARBOARD. DECALS MUST BE PARALLEL TO RADOME FLANGE WITHIN .13 INCH AS MEASURED FROM THE BOTTOM OF THE 2 LETTER E's. DECALS MUST APPEAR CENTERED FROM 2 METERS AWAY.
 - 3. APPLY ADHESIVE PER SEA TEL SPEC. 121730.
 - 4. BAG AND ATTACH RADOME MOUNTING KIT, ITEM 14, TO INSIDE OF RADOME.
 - ▲ CLEAN SURFACE OF DUST, GREASE & OIL. SECURE IN APPROXIMATE LOCATION WITH P/N 125948-1 PER MANUFACTURERS SPECIFICATIONS.

DASH	DESCRIPTION
-1	WHITE WITH FOAM
-2	FRENCH NAVY GREY WITH FOAM
-3	US NAVY GREY WITH FOAM
-4	NATO GREY WITH FOAM
-5	ICELANDIC NAVY GREY WITH FOAM, MATTE FINISH
-6	WINDOW GREY, MATT PER RAL 7040
-7	JET BLACK PER RAL 9005
-8	MATTERHORN WHITE PER RAL 68003

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994	DRAWN BY: SCC	Sea Tel <i>COBHAM</i> Tel. 925-798-7979 Fax. 925-798-7986
	DRAWN DATE: 4-20-04	
MATERIAL:	APPROVED BY: <i>[Signature]</i>	TITLE: RADOME ASS'Y, 60 INCH, GA INSTALL
	APPROVED DATE: 9/3/09	DRAWING NUMBER: 122969
FINISH:	SIZE: B	SCALE: 1:12
3rd ANGLE PROJECTION	FIRST USED: 5004	SHEET NUMBER: 1 OF 2
		REV: J

8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

D

D

C

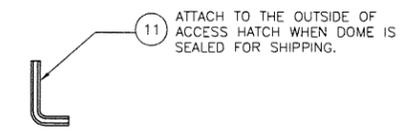
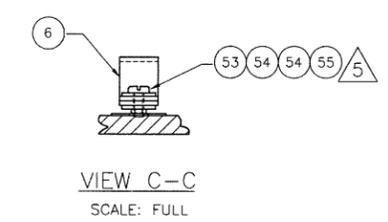
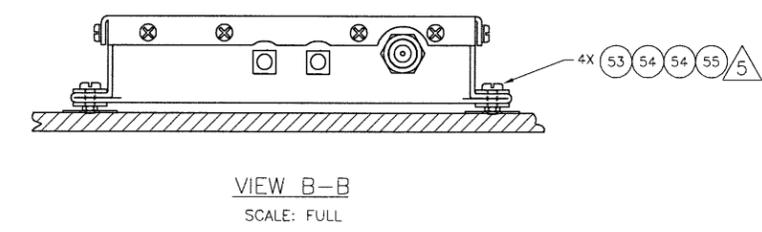
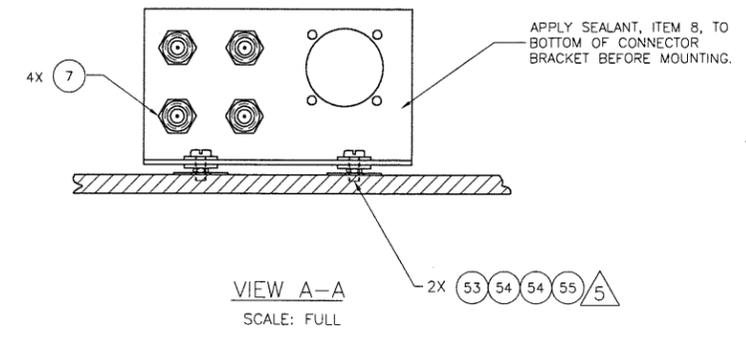
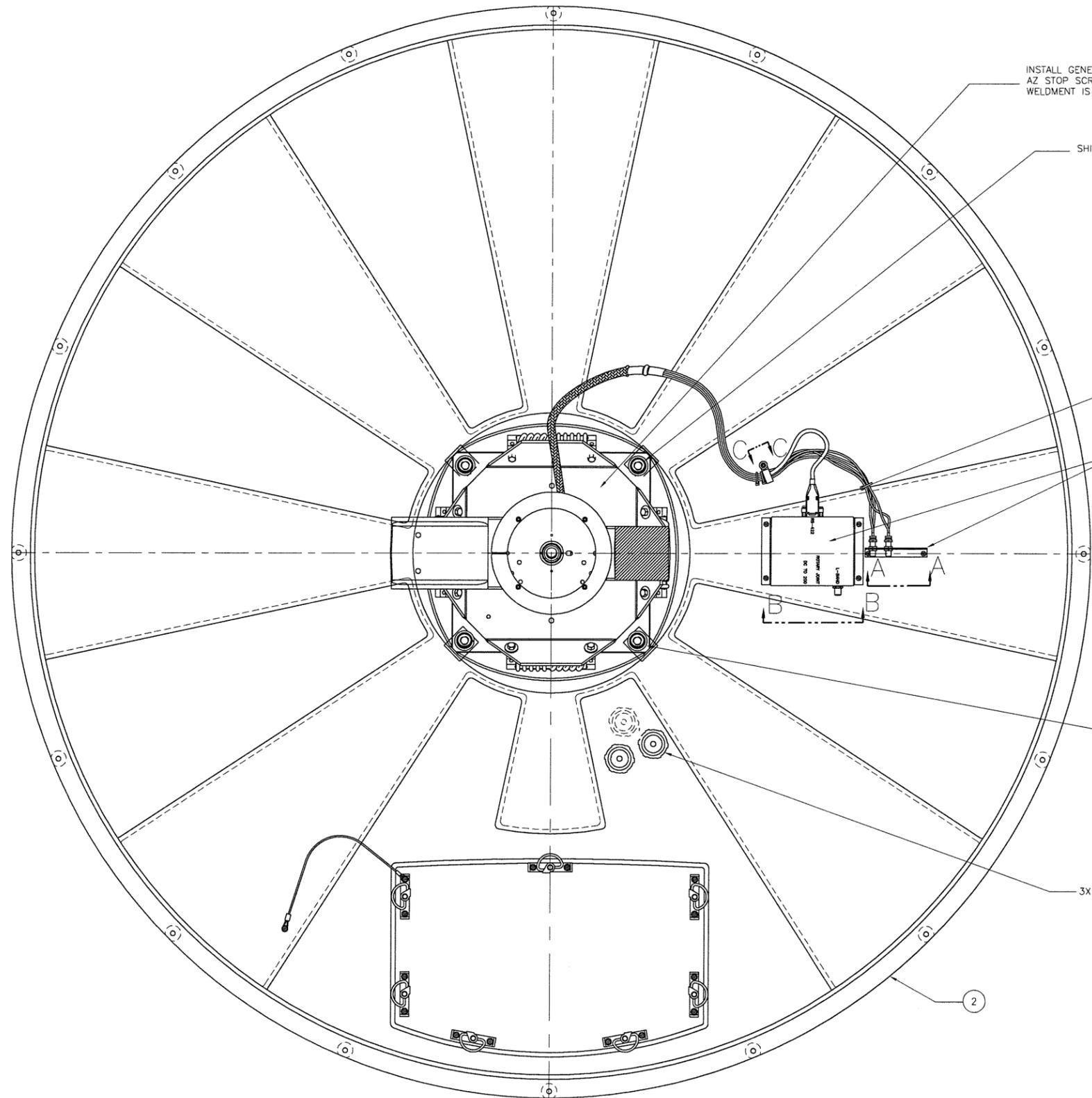
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B

B

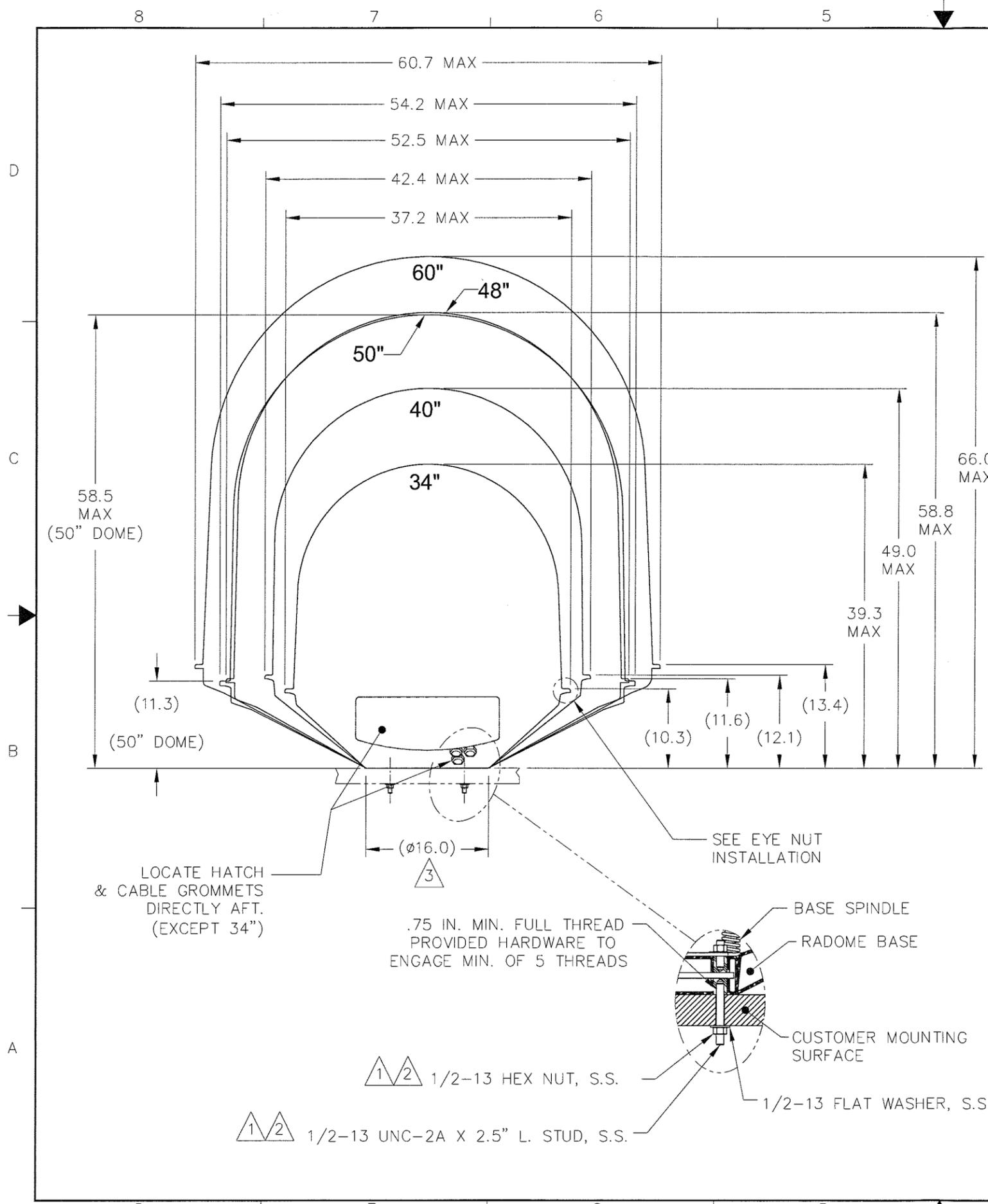
A

A

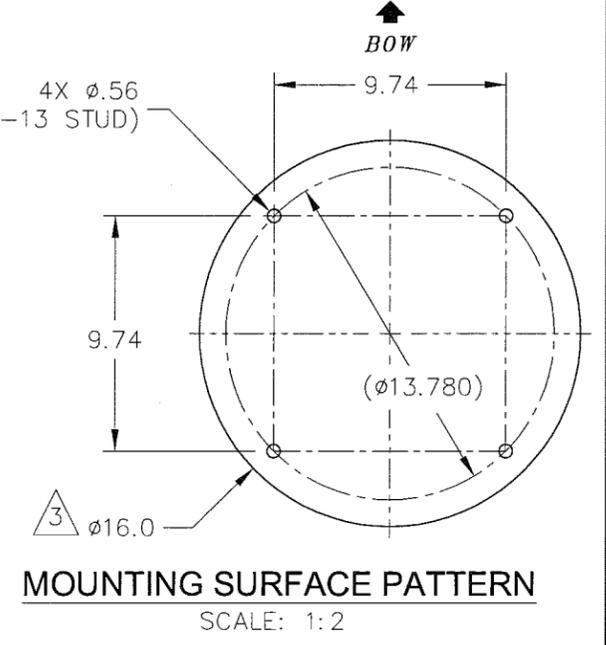
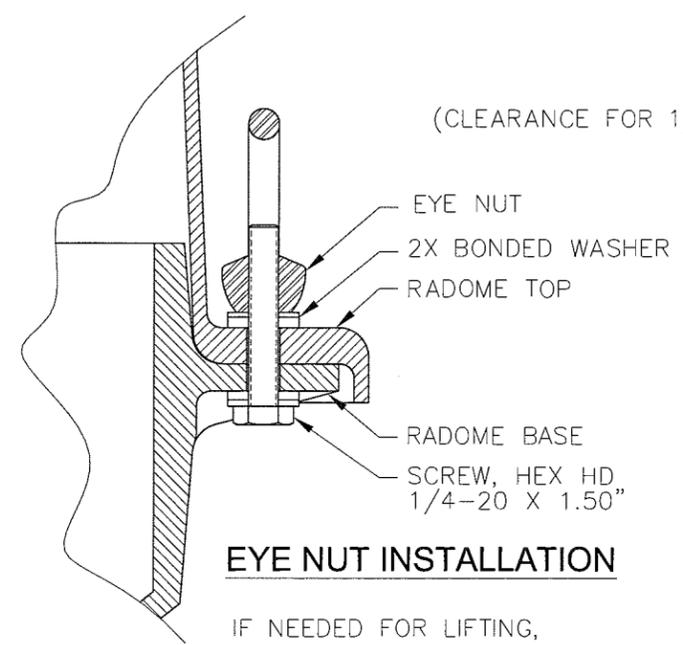


SIZE B	SCALE:	DRAWING NUMBER: 122969	REV: J
SHEET NUMBER:			2 OF 2

8 7 6 5 4 3 2 1



REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
B2	N/A	6-1-05	DIMENSIONS VERIFIED AND CORRECTED TO CURRENT BUILD.	L.R.
B3	N/A	11/18/05	DETAIL FOR EYE NUT INSTALL. REDRAWN TO SHOW MORE REDOME REFERENCE OUTLINE.	AEF
B4	N/A	9-8-06	ADD 50 INCH READOME. NOTE "LOCATE HATCH & CABLE GROMMETS DIRECTLY AFT (EXCEPT 34") " WS "LOCATE HATCH (48" & 60" ONLY) & CABLE GROMMETS DIRECTLY AFT."	SL
B5	6789	8-3-09	ADDED SHEET 2 WITH METRIC DIMENSIONS; UPDATED TITLE BLOCK	K.D.H.



IF NEEDED FOR LIFTING, INSTALL 4X EYE NUTS. (PART OF RADOME KIT P/N: 123549) EQUALLY SPACED.

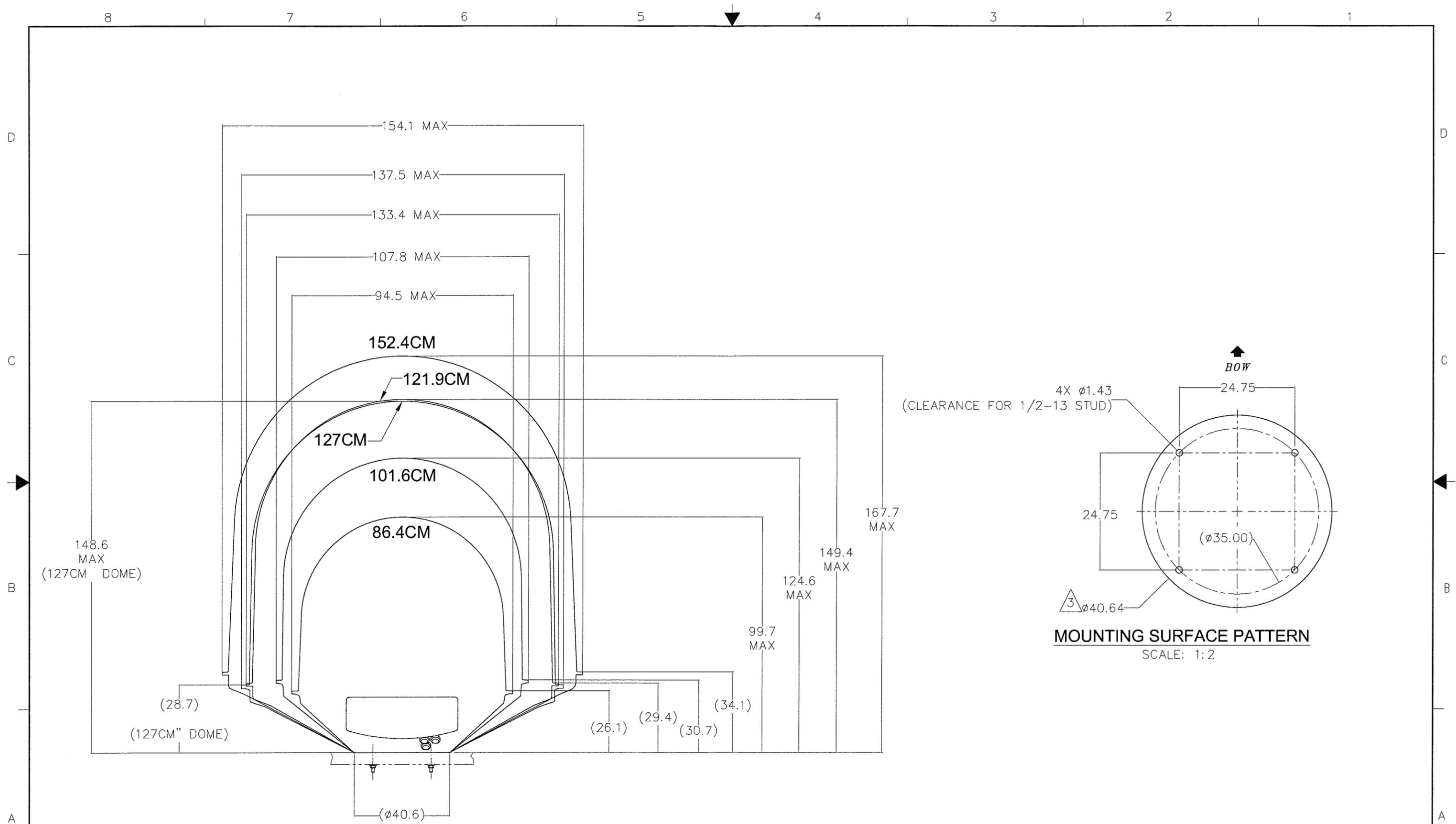
NOTES: UNLESS OTHERWISE SPECIFIED

- 1 INDICATED ITEMS ARE PART OF MOUNTING KIT P/N: 123549
- 2 APPLY ADHESIVE PER SEATEL SPEC. 121730. LOCTITE 271 (RED) PROVIDED WITH MOUNTING KIT, P/N 123549
- 3 MINIMUM DIAMETER OF MAST MOUNTING PLATE EQUAL TO RADOME BASE DIAMETER.

REFERENCE DRAWINGS

122356 RADOME ASS'Y, 60"
122353 RADOME ASS'Y, 48"
122350 RADOME ASS'Y, 40"
122326 RADOME ASS'Y, 34"

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = \pm .050 X.XX = \pm .020 X.XXX = \pm .005 ANGLES: \pm .5"	DRAWN BY: P. McCANN	 Tel. 925-798-7979 Fax. 925-798-7986	
	DRAWN DATE: 3-4-04		
INTERPRET TOLERANCING PER ASME Y14.5M - 1994	APPROVED BY:	DRAWING NUMBER: 122663	REV: B5
MATERIAL: ---	APPROVED DATE: 8/1/09	FIRST USED: ---	SHEET NUMBER: 1 of 2
FINISH: ---	SIZE: B	SCALE: 1/15	



METRIC DIMENSIONS IN CM

SIZE	SCALE:	DRAWING NUMBER:	REV:
B	1/15	122663	B5
SHEET NUMBER:			2 OF 2

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	114789-810		TRANSPORT CONTAINER	
1	1 EA	123550-1	B	SPARE PARTS KIT, XX04, STANDARD	
9	1 EA	122937-1	L	LEVEL CAGE ASS'Y, BOTTOM EXIT, 080 P,	
10	1 EA	124115-2	A	MOTOR KIT, XX04, LEVEL CAGE	
13	1 EA	124109-2	A	POLANG POT KIT, XX04	
16	1 EA	124108-2	A	MOTOR KIT, XX04, POLANG	(PRIME FOCUS)
17	1 EA	116281-1	H	PCB ASS'Y, SHIELDED POL. AUX. RELAY,	
18	1 EA	121966-2	D1	GPS ANTENNA, RETERMINATED, 21.0 L	

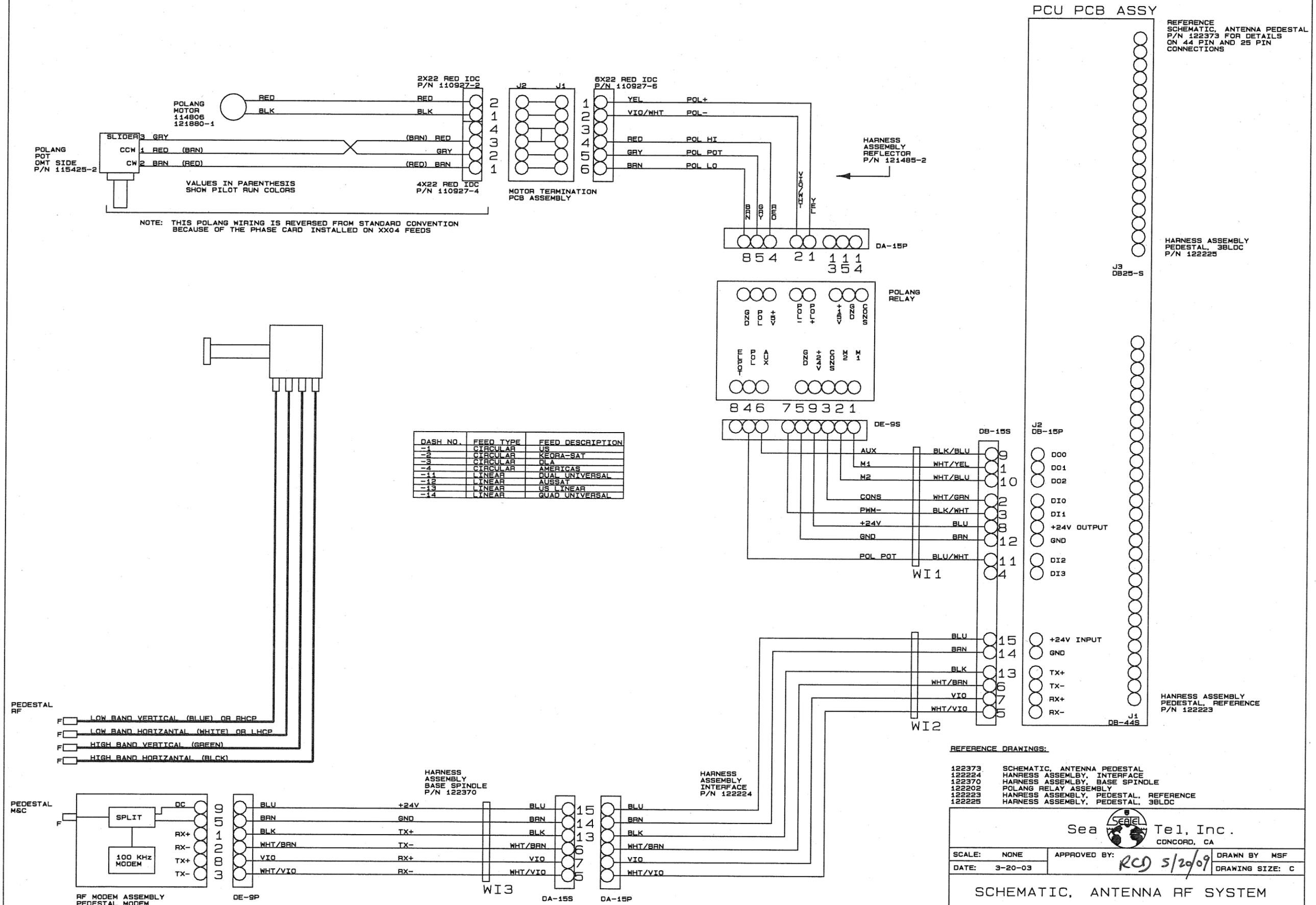
<h1 style="margin: 0;">Sea Tel</h1> <p style="margin: 0;"><i>COBHAM</i></p>				
<p>SPARE PARTS KIT, XX04, PREMIUM</p>				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 1	DRAWING NUMBER 123551-1	REV D1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	124112-3	A	MOTOR KIT, XX04, AZ	(AZ)
4	1 EA	124110-2	A	MOTOR KIT, XX04, CROSS LEVEL/ELEVATIO	(EL & CL)
7	1 EA	122363-1	E	MODEM ASS'Y, 70 KHz, ADE	
8	1 EA	122203	G1	PCU ENCLOSURE ASS'Y, XX04	(FLASH PROGRAMMABLE)

<h1>Sea Tel</h1> <p><i>COBHAM</i></p>				
<p>SPARE PARTS KIT, XX04, STANDARD</p>				
PROD FAMILY COMMON	EFF. DATE 12/1/2009	SHT 1 OF 1	DRAWING NUMBER 123550-1	REV B

REV.	ECO#	DATE	DESCRIPTION	BY
A	N/A	12-23-03	INITIAL RELEASE	MSF
A1	N/A	2-19-04	P/N 121880-1 & NOTE ADDED ON POLANG POT & POLANG MOTOR	MSF
B	4381	4-20-04	ADDED COLOR CAGE & LABELING	MSF
B1	N/A	01/24/05	FIXED WIRE COLORS ON RF PEDESTAL MODEM ASSY	DO
B2	N/A	6-20-09	WIRE COLOR CORRECTED ON P/N 122370 WAS TYPO	MSF



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CONCORD, CA

SCALE: NONE APPROVED BY: *RCJ 5/29/09* DRAWN BY: MSF

DATE: 3-20-03 DRAWING SIZE: C

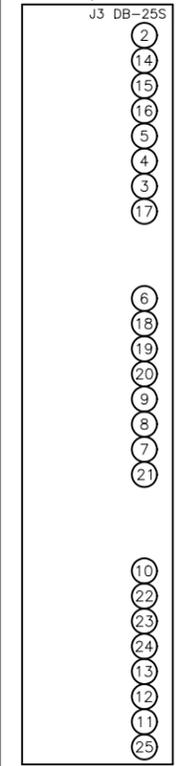
SCHEMATIC, ANTENNA RF SYSTEM

MODEL: XX04	SHT 1 OF 1	DRAWING NUMBER: 121986	REV.: B2
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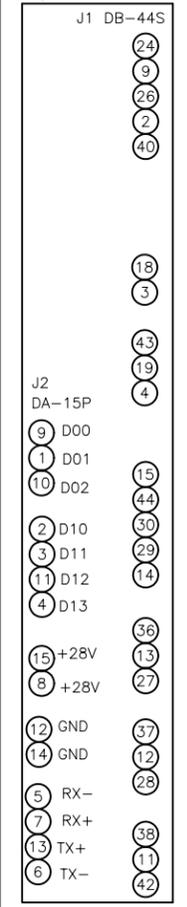
REV.	ECO#	DATE	DESCRIPTION	BY
A	4225	12-8-03	RELEASED TO PRODUCTION	P.M.
A1	N/A	12-29-03	UPDATED DWG REF. PEDESTAL HARNESSSES (WS 120923-1 & 120924)	LK
B	4376	4-15-04	CHG WIRE COLOR ON BLDC MOTOR 121951	SCC
B1	N/A	1-28-05	J4 PIN 11 WS PIN 14. ENCODER P/N WS GIVEN (AS 116053). ENCODER IS PART OF MOTOR 121951.	AMN
B2	N/A	02-01-05	CORRECTED P/N ON LEVEL CAGE FROM 119528-1 TO 122937-1	AEF

PCU ENCLOSURE ASS'Y
P/N 121185

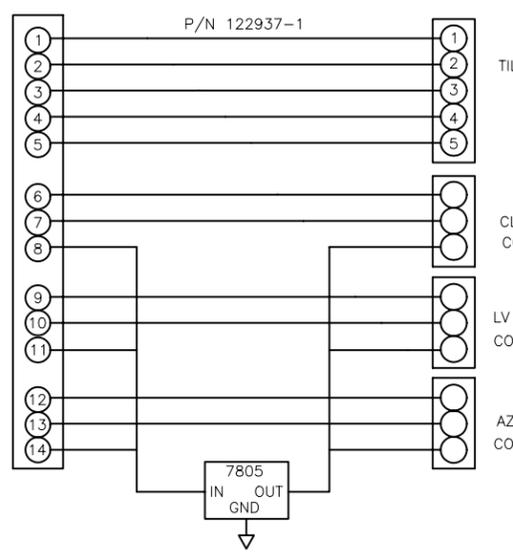
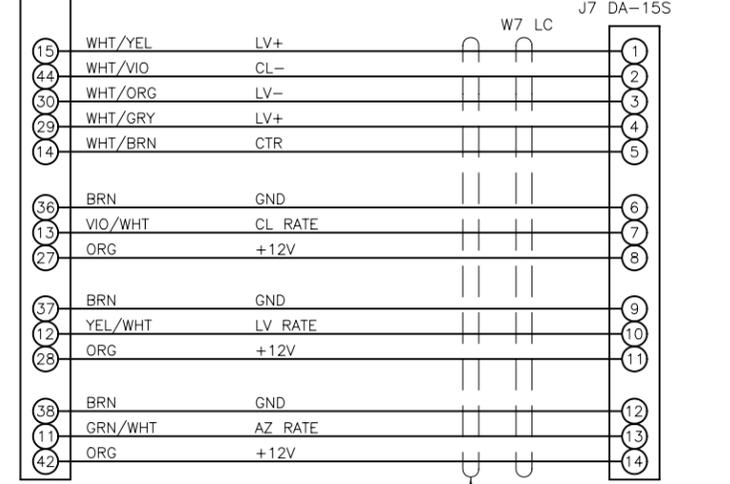
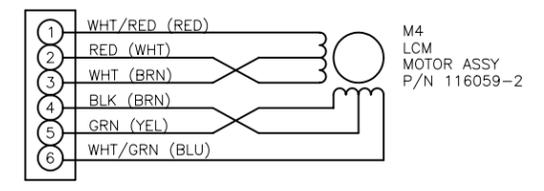
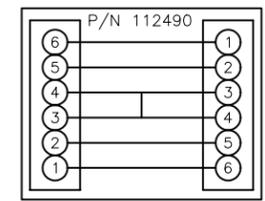
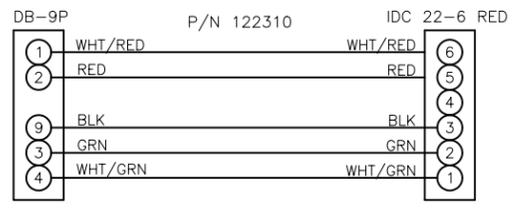
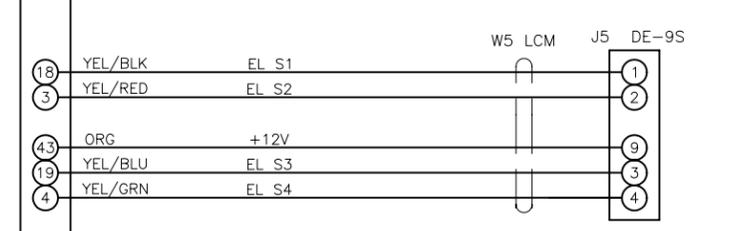
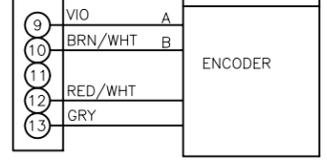
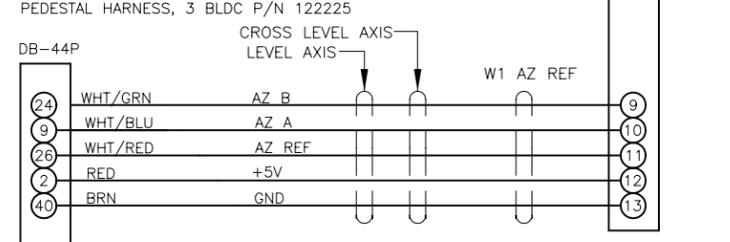
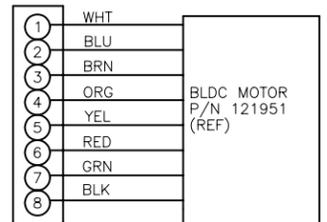
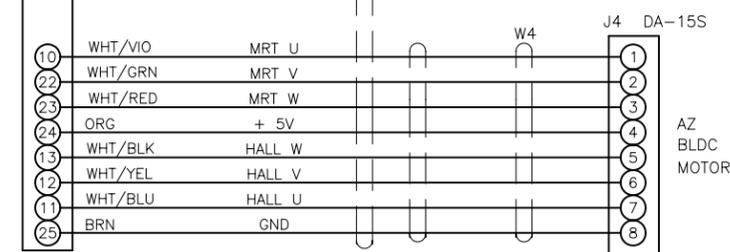
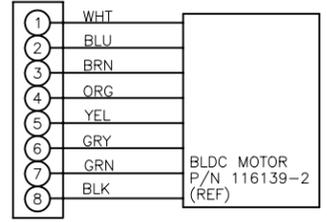
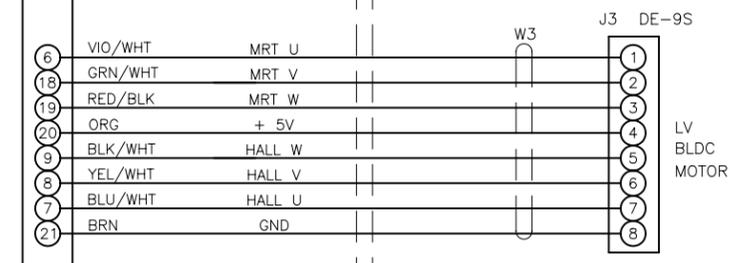
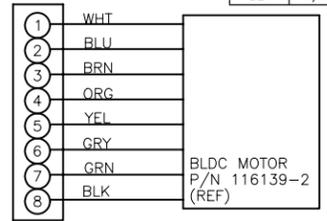
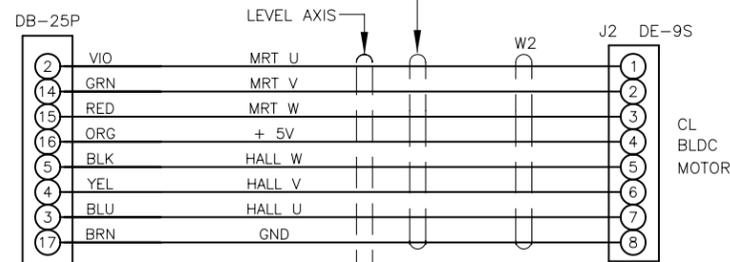
PCB ASSY, MOTOR DRIVE,
3BLDC P/N 120850



PCB PCU ASS'Y
P/N 121171



SEE ANTENNA RF SYSTEM SCHEMATIC
FOR FURTHER DETAILS ON THIS CONNECTION

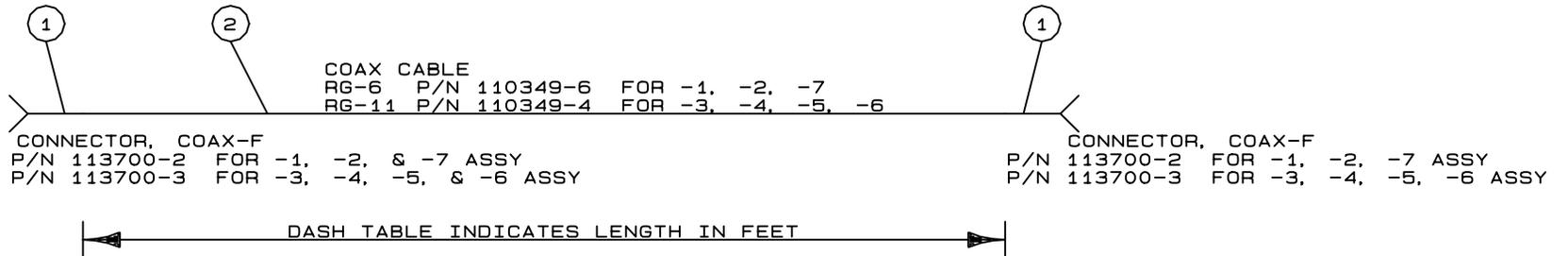


NOTES: UNLESS OTHERWISE SPECIFIED
1. FOR WIRE LENGTHS AND ASSEMBLY DETAILS. SEE
PEDESTAL HARNESS ASSEMBLY.

REFERENCE DRAWINGS:
121172 PCU PCB SCHEMATIC
121986 ANTENNA SYSTEM SCHEMATIC

TOLERANCES		SCALE: NONE		APPROVED BY: [Signature]		DRAWN BY: McCANN	
UNLESS OTHERWISE SPECIFIED:		DATE: 9-18-03		DRAWING SIZE: C			
X.X	= ± .050"	SCHEMATIC, ANTENNA PEDESTAL					
X.XX	= ± .020"						
X.XXX	= ± .005"						
ANGLES	= ± 30'						
3rd ANGLE PROJECTION	[Symbol]	MODEL: XX04	SHEET: 1 OF 1	DRAWING NUMBER: 122373	REVISION: B2		

REV	DATE	DESCRIPTION	BY
A	2-3-95	113700-2 WAS 109390-2 ON -1 & -2 ASSY'S	MP
B	12-22-95	113700-3 WS 109390-3, -5 ADDED	MP
C	1-23-96	-6 ADDED	MP
C1	4-26-04	-7 ADDED	MSF



DASH	ITEM	QTY	SEATEL P/N	DESCRIPTION	VALUE	NOTES
-1	1	2	113700-2	SEALED F CONNECTOR	RG-6	
	2	1	110349-6	COAX CABLE (BELDEN 9114 OR 9116)	RG-6 75 OHM	50 FEET
-2	1	2	113700-2	SEALED F CONNECTOR	RG-6	
	2	1	110349-6	COAX CABLE (BELDEN 9114 OR 9116)	RG-6 75 OHM	100 FEET
-3	1	2	113700-3	CONNECTOR COAX-F	RG-11	
	2	1	110349-4	COAX CABLE (BELDEN 8213)	RG-11 75 OHM	150 FEET
-4	1	2	113700-3	CONNECTOR COAX-F	RG-11	
	2	1	110349-4	COAX CABLE (BELDEN 8213)	RG-11 75 OHM	200 FEET
-5	1	2	113700-3	CONNECTOR COAX-F	RG-11	
	2	1	110349-4	COAX CABLE (BELDEN 8213)	RG-11 75 OHM	100 FEET
-6	1	2	113700-3	CONNECTOR COAX-F	RG-11	
	2	1	110349-4	COAX CABLE (BELDEN 8213)	RG-11 75 OHM	50 FEET
-7	1	2	113700-2	SEALED F CONNECTOR	RG-6	
	2	1	110349-6	COAX CABLE (BELDEN 9114 OR 9116)	RG-11 75 OHM	20 FEET

REFERENCE DRAWINGS:

110933 CABLE ASSY, RG-59 F-F (INCHES)
 111115 CABLE ASSY, RG-59 F-F (FEET)

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 CONCORD, CA

SCALE:	APPROVED BY:	DRAWN BY PGB
DATE: 8-30-94		DRAWING SIZE: A

RF CABLE ASSEMBLY

SHEET 1 OF 1	DRAWING NUMBER 113480	REV. C1
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