

3 Installation and Commissioning

3.1 General Information

The Scanner Unit comprises the following main elements, each of which is supplied in its own packing, together with relevant Installation Drawings:

Turning Unit	with/without Integral Transceiver Despatch Kit 65830660 (Installation Drawing 65830050)
Support Casting	(Installation Drawing A0/65612050-054)
Antenna	12ft or 9ft Despatch Kit 65612610 (Installation Drawing A0/65612050-054)

Installation of the Scanner Unit entails carrying out the following operations, preferably in the sequence outlined below:

1. Preparation of the site.
2. Bolting the Turning Unit to the mounting platform (ship's structure) as detailed in Installation Drawing 65830050 supplied with the Turning Unit.
3. Bolting the Support Casting to the Turning Unit as detailed in Installation Drawing 65612050-054 supplied with the Antenna.
4. Bolting the Antenna to the Support Casting as detailed in Installation Drawing 65612050-054 supplied with the Antenna.
5. Laying in and installing the cables for the Motor and the Turning Unit in accordance with the appropriate Cabling Schedules. This includes RF Feeder co-ax in bulkhead systems.

Figures 1.1 to 1.5 also show installation details which are intended to duplicate those provided with the equipment. However, as it is possible that changes may occur to the details which may not be reflected in this manual, the installation drawings supplied with the equipment take precedence in the event of differences arising.

3.2 Turning Unit

CAUTION: *The weight and spread of the Antenna can cause a free-standing Turning Unit to topple over. The Turning Unit should therefore be bolted down onto its mounting platform before attaching the Antenna and Support Casting to the Turning Unit.*

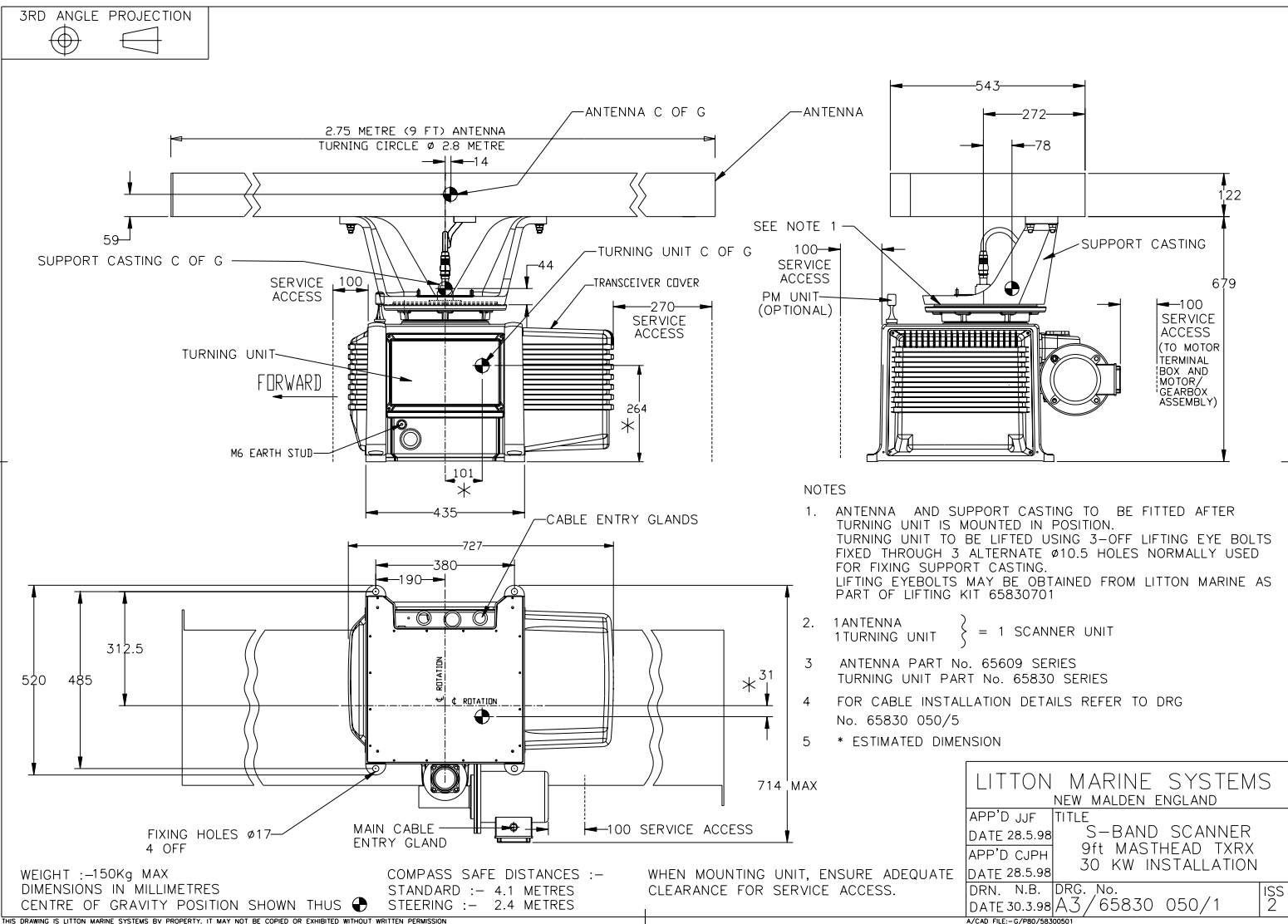


Figure 1.1 - S-Band Scanner 9ft Masthead Tx/Rx 30kW Installation

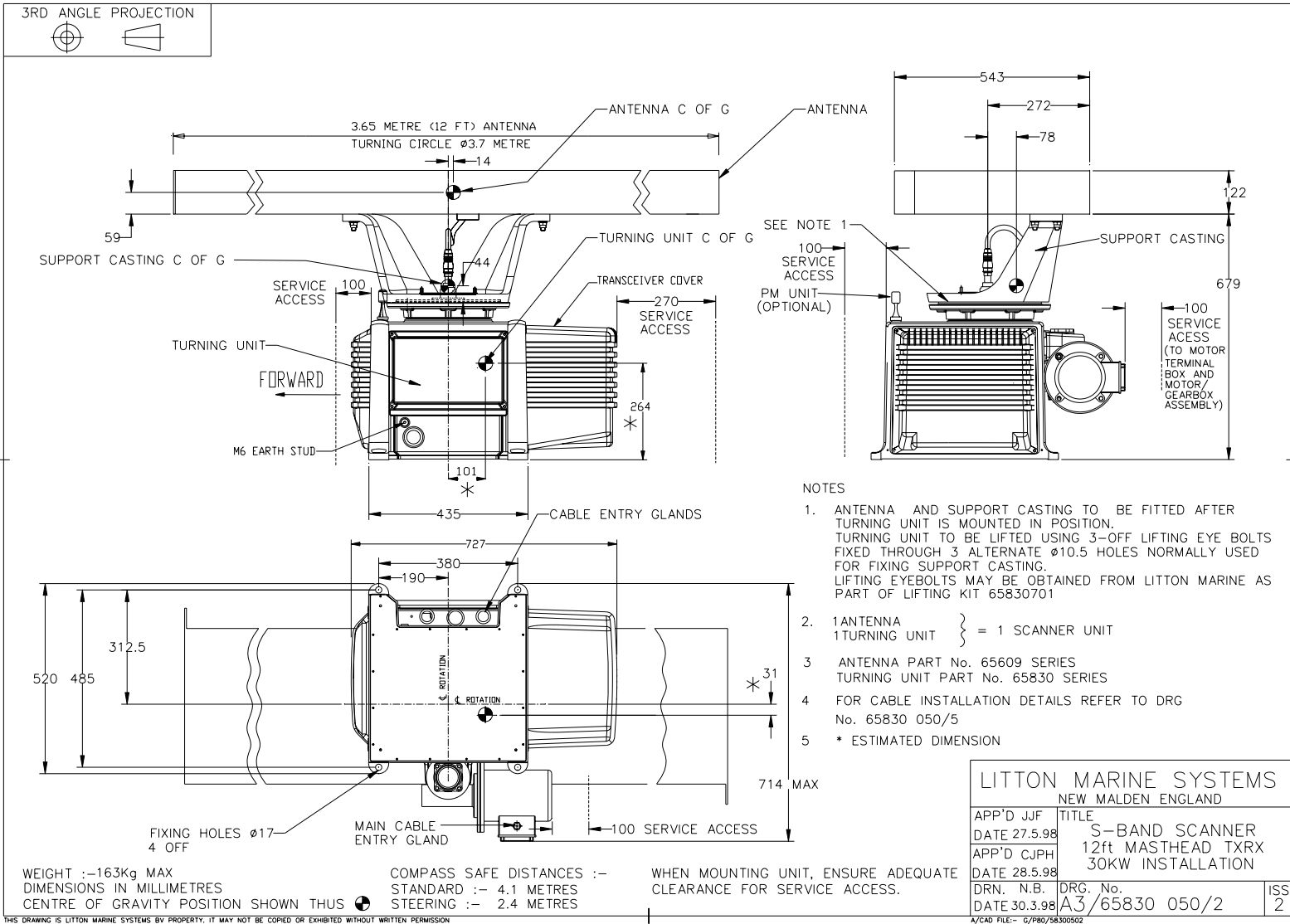


Figure 1.2 - S-Band Scanner | 12ft Masthead Tx/Rx 30kW Installation

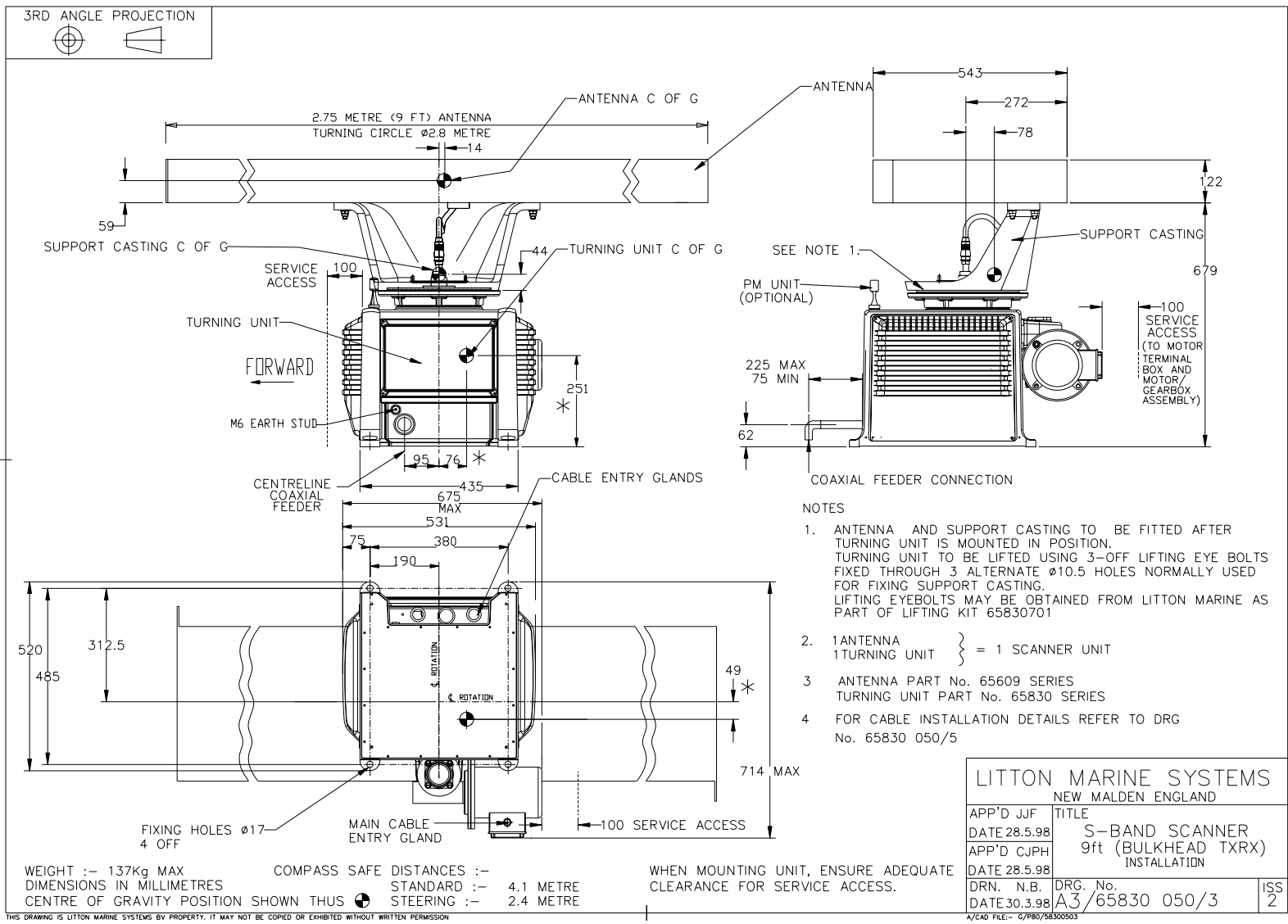


Figure 1.5 - S-Band Scanner 9ft (Bulkhead Tx/Rx) Installation

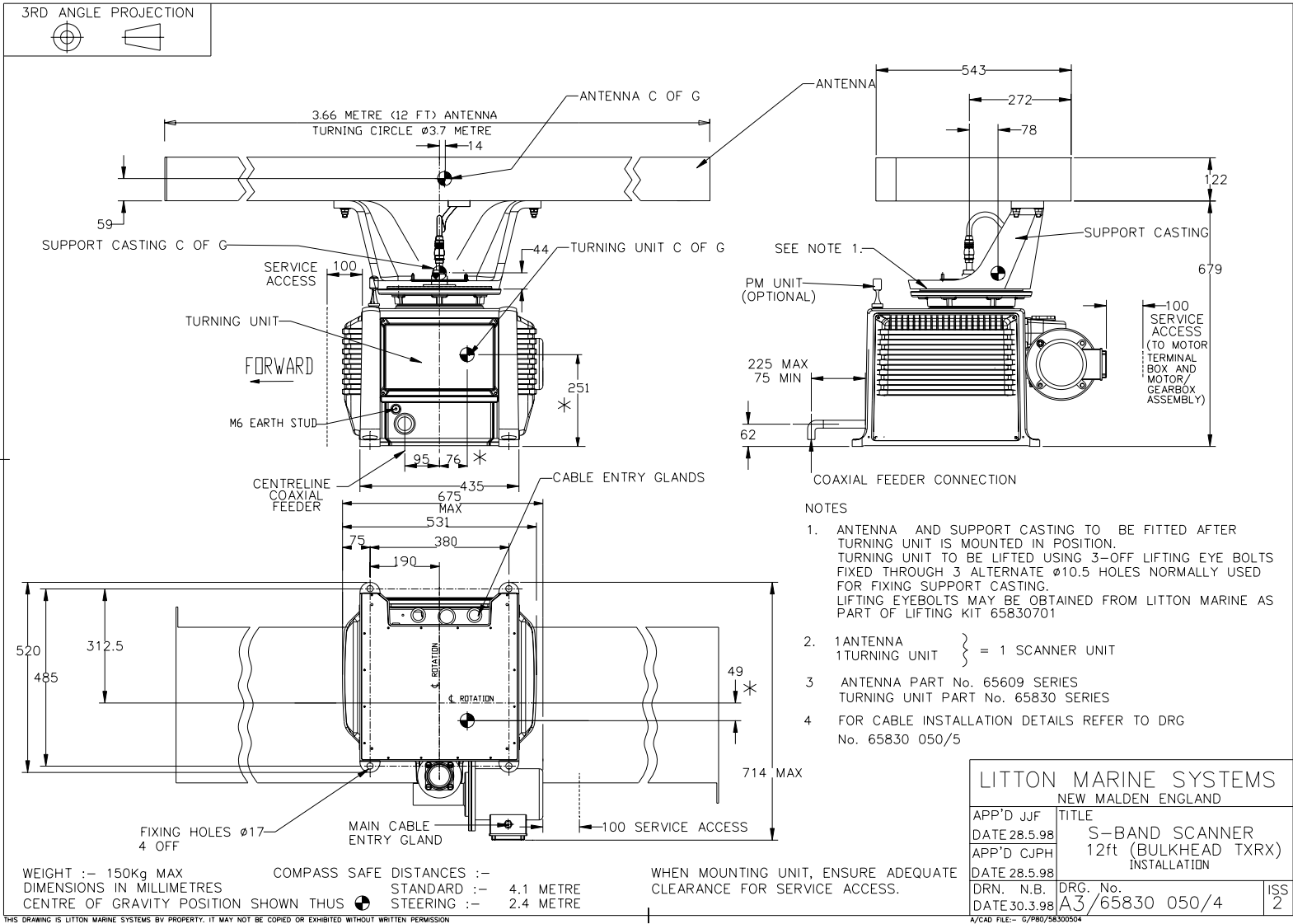


Figure 1.4 - S-Band Scanner | 12ft (Bulkhead Tx/Rx) Installation

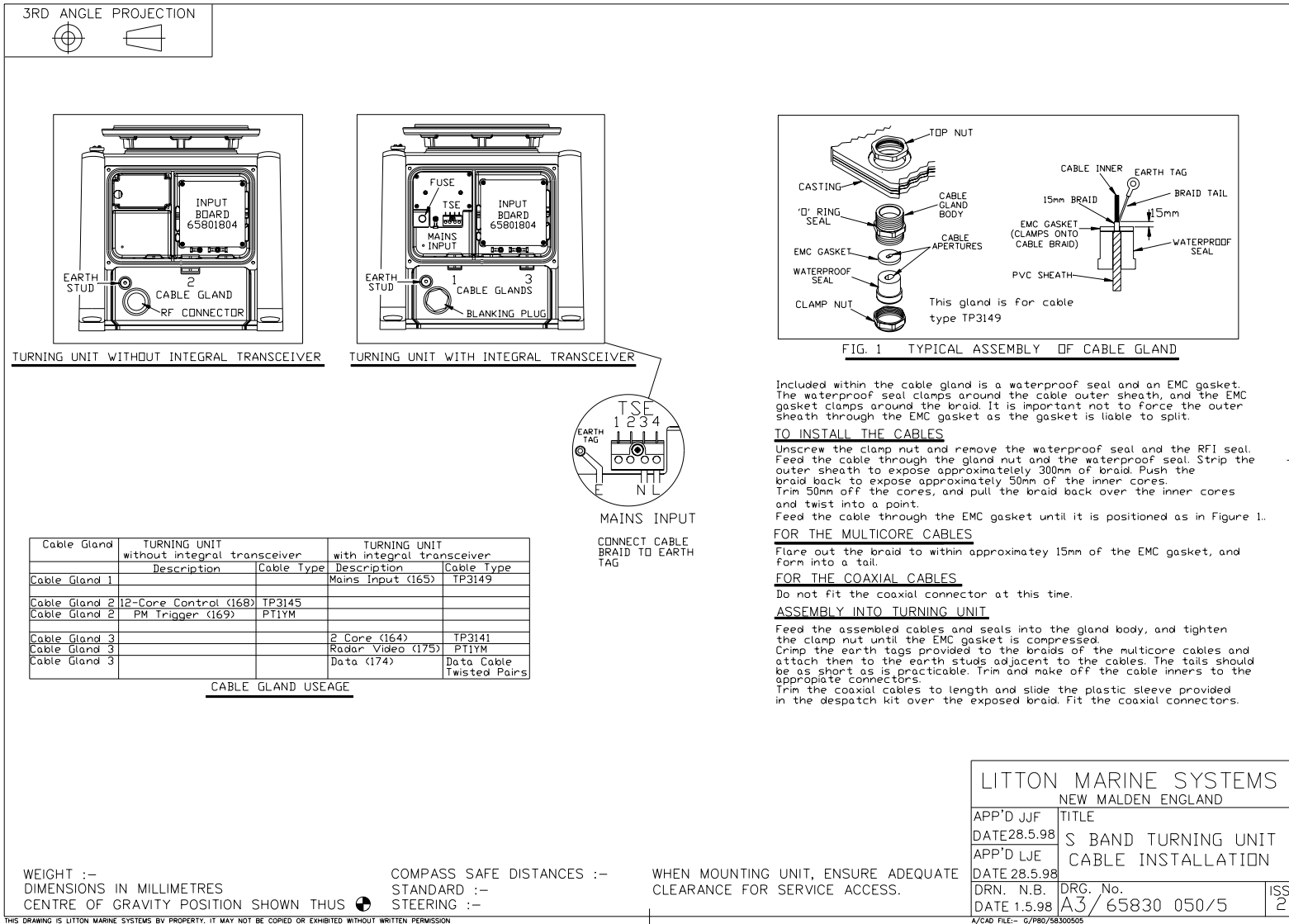


Figure 1.5 - S-Band Turning Unit Cable Installation

S-Band Scanner Units and Transceivers

If it is necessary to lift the Turning Unit by crane, three lifting eyebolts (part of Lifting Kit 65830701 available from Litton Marine Systems) must first be attached securely to the torque tube in three positions as shown in Figure 1.6. The eyebolts are fitted in a symmetrical pattern in three of the six holes normally used for attaching the Support Casting to the Turning Unit. If M12 eyebolts are supplied in the lifting kit, fit the associated M12 washers, and screw the eyebolts into the threaded hole positions. If M10 eyebolts are supplied, the associated M10 nuts and washers must be used to fix the eyebolts, as shown in Figure 1.6. One large diameter washer and two nuts supplied with the kit are used with each eyebolt as a safety measure. The M10 nuts are prevented from turning by hexagonal recesses in the casting. Remove the eyebolts and nuts after the Turning Unit has been bolted to the mounting platform. (Reference should be to "BS4278 Eyebolts for Lifting Purposes" and the safe use of lifting equipment in accordance with the Health and Safety at Work Act, Part I Section 6.)

NOTE - Under no circumstances should a combined Turning Unit and Antenna Unit be lifted by the Antenna Unit. To do so would be dangerous and would result in damage to the Antenna Unit.

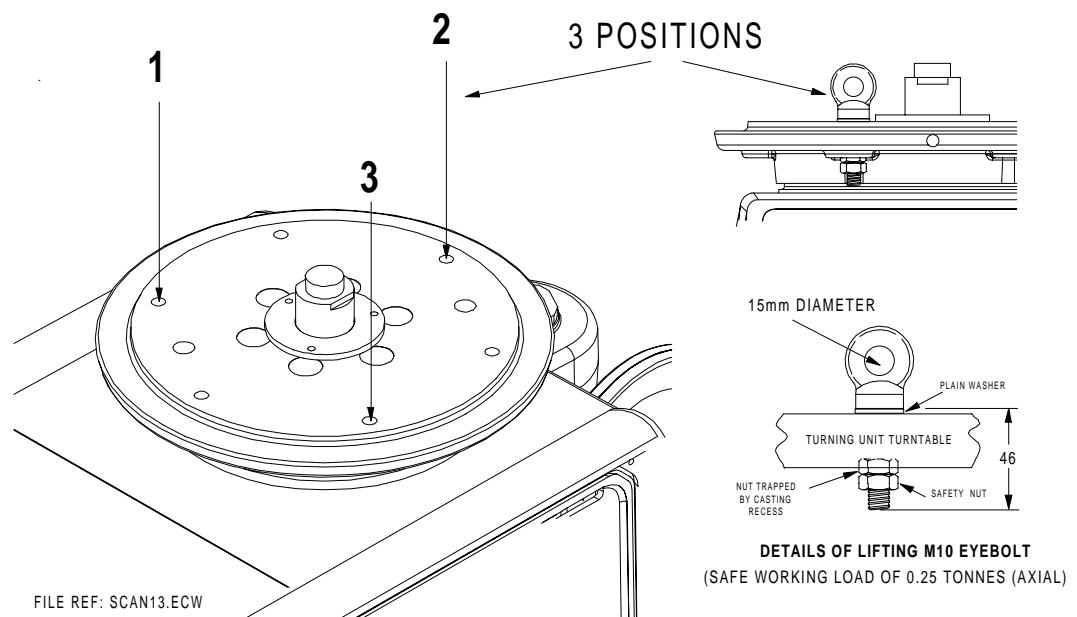


Figure 1.6 - Attachment of Lifting Eyebolts

The Turning Unit is attached to the mounting platform using the fixings supplied in the Turning Unit Despatch Kit 65830660.

Figure 1.7 below shows how these are fitted. Ensure that all threads and bushes are coated with Densopaste.

Note - The Turning Unit is bolted directly to the mounting platform without any intervening washer, except for the purpose of levelling the mounting so that the Turning Unit casting is not subject to twist when the bolts are tightened. M16 washers may be used as shims, or purpose made parts produced locally may be used.

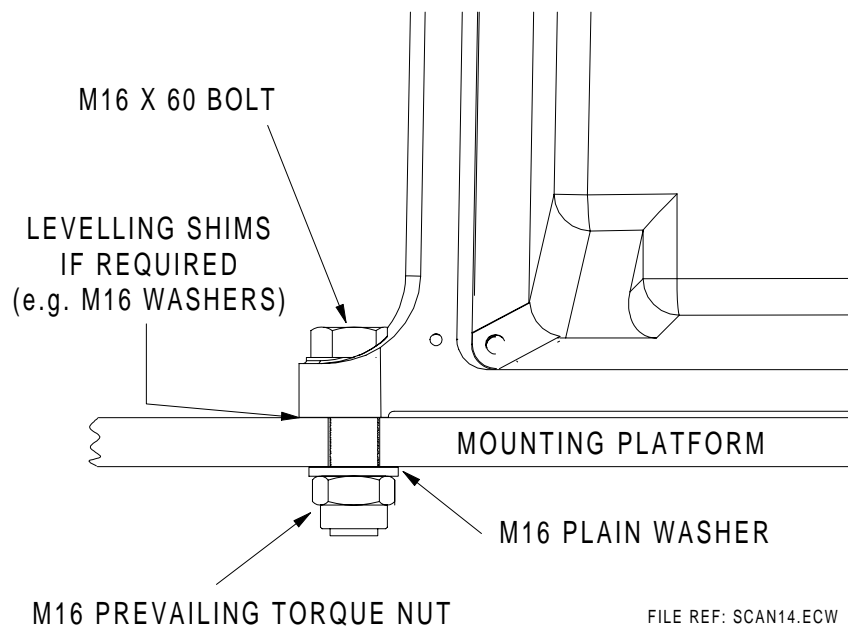


Figure 1.7 - Fixing the Turning Unit to the Mounting Platform

3.2.1 Support Casting

The Support Casting is fitted to the Turning Unit torque tube using Fixing Kit 65612611, which is part of the Antenna Despatch Kit 65612610.

Figure 1.8 below shows how these are fitted. Ensure that all threads and bushes are coated with Densopaste.

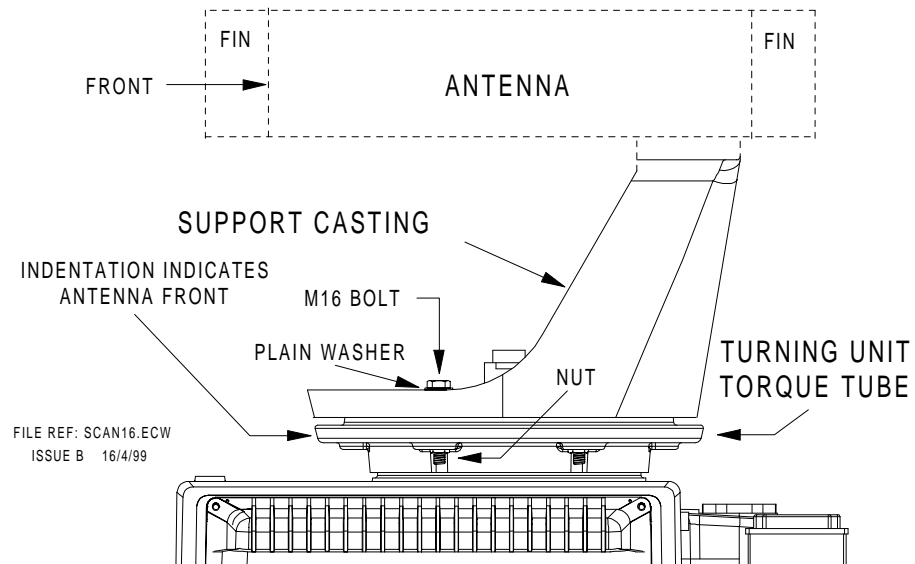


Figure 1.8 - Fixing the Support Casting to the Torque Tube

3.3 Antenna

The Antenna is fitted to the Support Casting using the parts listed below which are supplied with the antenna.

- 4 off M12 Stainless Steel Prevailing Torque Nuts
- 4 off M12 Stainless Steel Plain Washers
- 2 off Lock Tabs

Figure 1.9 shows how these are fitted. Ensure that all threads and bushes are coated with Densopaste.

NOTE - The lock tab ends must be bent as shown to prevent rotation of the nuts.

The next step is to mate the S-Band co-axial cable from the Antenna with the Turning Unit RF connector and to wrap the mated connector with self amalgamating tape as an additional precaution against water ingress.

Chapter 1

S-Band Scanner Units and Transceivers

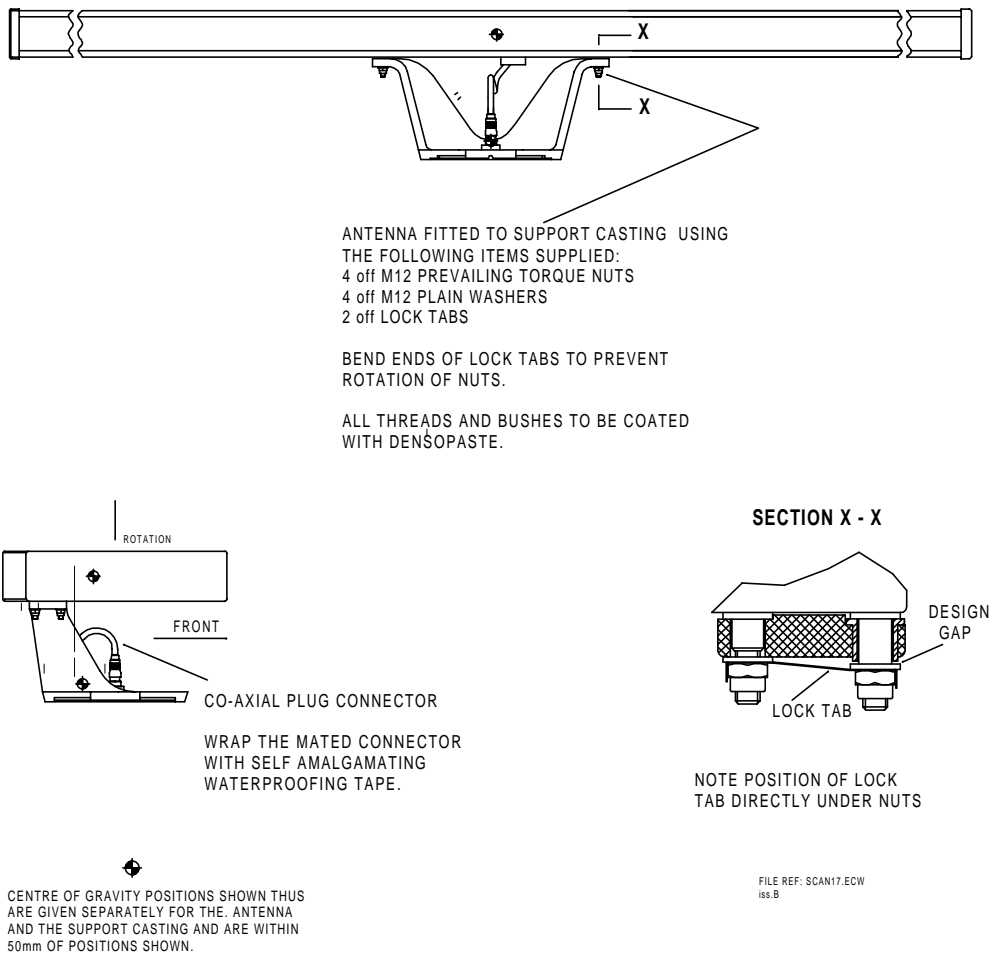


Figure 1.9 - Fixing the Antenna to the Support Casting

Pulse Bearing PCB Assembly

The position of the link LK1 fitted to the Pulse Bearing PCB Assembly 65801805 (Refer to Figure 2.8).

Note - This link does not physically affect the rotational speed of the scanner, but does affect the ability of the phase-locked loop within the board to track the scanner rotational speed.

The factory default setting is 'LOW' speed.

Note - With no jumper fitted, the PCB defaults defaults to HIGH speed configuration.

With the jumper in the position marked '1' (pins 1 & 2 - the lower pair), the PCB is configured for LOW speed operation.

With the jumper in the upper pair position (pins 2 & 3), the PCB is configured for HIGH speed operation.

The link is set during installation and commissioning. The link can be moved with the PCB in place.

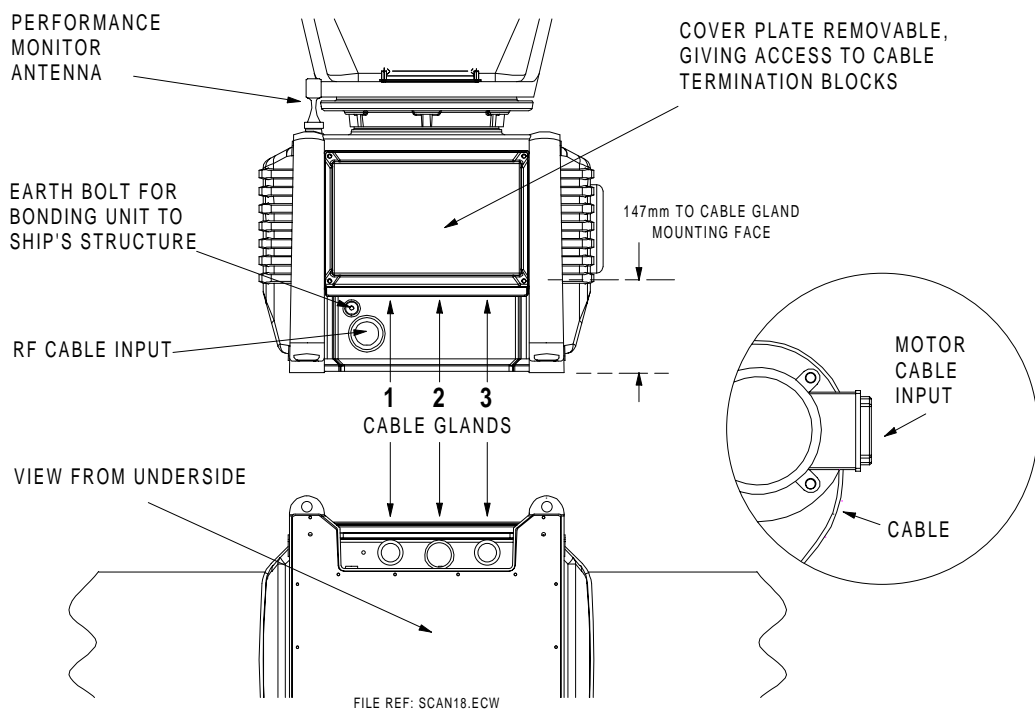
3.3.2 Cabling Information

Figure 1.10 below shows the cable entry points. Three of these are via cable glands labelled 1, 2, & 3, details of which are given in the accompanying table.

The RF Cable input is only required when the Transceiver is mounted below decks (Bulkhead).

The Motor supply cable is connected directly to the Motor termination blocks mounted in the box on the side of the Motor.

A 6mm stud is provided for bonding the unit to the Ship's structure. This is an important safety requirement, and the stud must not be used for any other connection.



NOTE: TURNING UNIT WITHOUT INTEGRAL TRANSCEIVER SHOWN ABOVE. REFER TO THE TABLE ON PAGE 3.19 FOR DETAILS OF THE CABLES FITTED FOR THE DIFFERENT VARIANTS.

Figure 1.10 - Turning Unit - Cable Entry Locations

Chapter 1

S-Band Scanner Units and Transceivers

The diagrams below show details of the Input Board 65801804 or 65801813 and the Mains Input connector (Integral Transceiver only) TSE. These are revealed on removal of the cover plate, which is retained by 4 fixing screws (see Figure 3.38). Links 3 and 4 on the Input Board should be set as shown in Figure 1.11. Link 5 is fitted. Details of the Motor connections are described separately in Section 2.3.2.

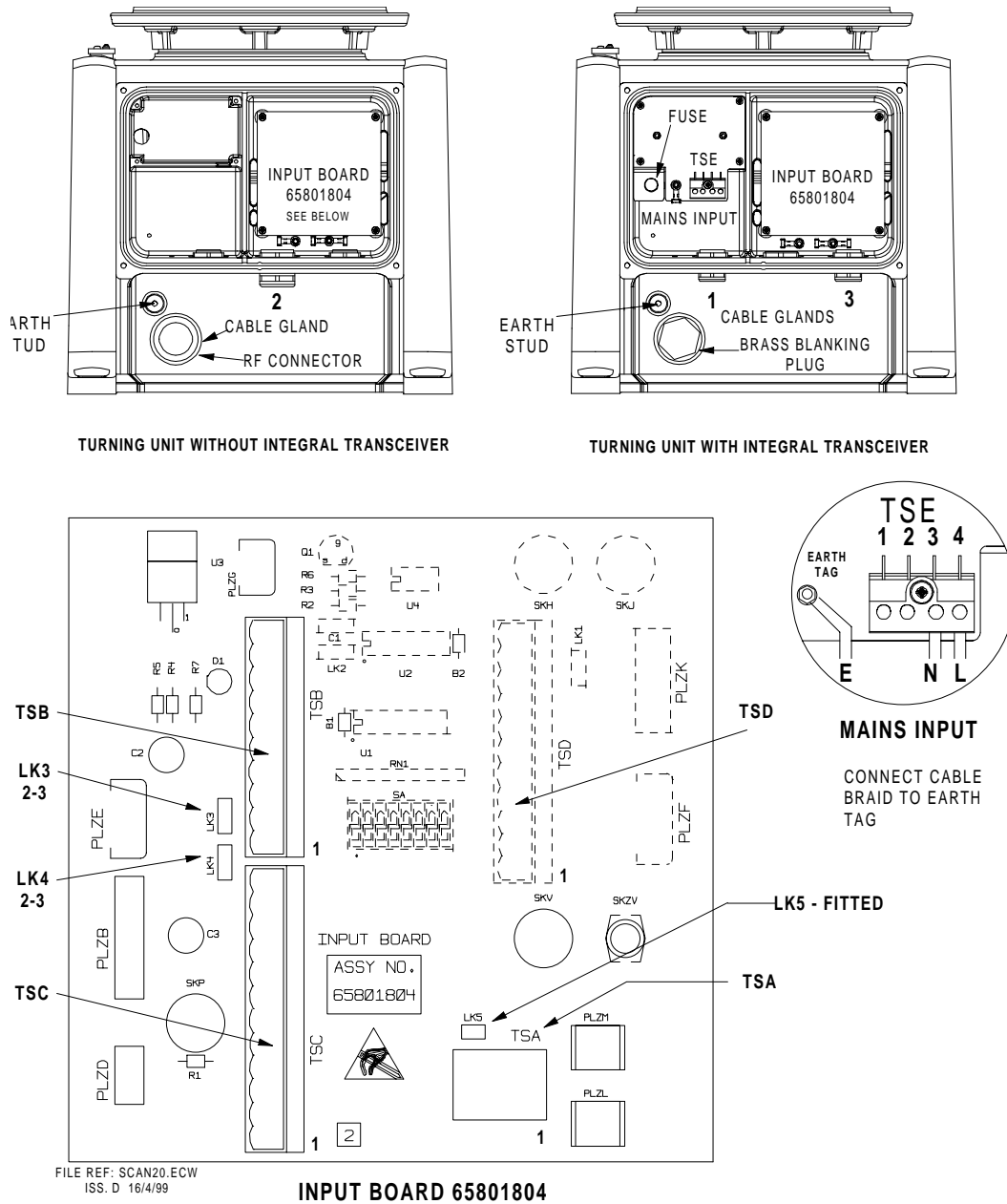


Figure 1.11 - Turning Unit - Input Board and Mains Input Details

S-Band Scanner Units and Transceivers

The Table below shows the route by which each cable enters the Turning Unit (with or without an Integral Transceiver). Ref to Ship's Manual 65800010B Chapter 3, for details of how to terminate the cables into their connector blocks, and for cabling schedules (Section 3.2) and system diagrams (Section 3.1). The numbers in parentheses e.g. (168) refer to the cable schedule number.

Each of the Cable Glands has a waterproof seal and a separate EMC seal, both of which must be installed as shown in Figure 1.12.

Details of terminating the R.F. Feeder Cable (S-Band Co-ax) are in Section 2.4.2

Cable Gland	TURNING UNIT without Integral Transceiver		TURNING UNIT with Integral Transceiver	
	Description	Cable Type	Description	Cable Type
Cable Gland 1	-	-	Mains Input (165)	TP3149
Cable Gland 2	12-Core (168)	TP3145	-	-
Cable Gland 2	PM Trigger (169)	75 Ω Co-ax	-	-
Cable Gland 3	-	-	2-Core (164)	TP3141
Cable Gland 3	-	-	Radar Video (175)	75 Ω Co-ax
Cable Gland 3	-	-	Data (174)	T/Pairs
RF Connector	RF Feed	S-Band Co-ax	-	-

Turning Unit - Cable Entry Details

3.3.3 Motor Connections

Various motor types are available to cater for the different mains supplies, and the standard/high speed antenna rotation rate variants.

The following table gives the available Motor alternatives:

Mains Supply Characteristics	Motor Type for Standard Speed Antenna	Motor Type for High Speed Antenna
110/120 Volts, 1 ϕ (50/60 Hz)	91003757	91003759
220/240 Volts, 1 ϕ (50/60 Hz)	91003758	91003760
110/120 Volts, 3 ϕ (50/60 Hz)	91003752	91003754
220/240/380/440 Volts, 3 ϕ (50/60 Hz)	91003751	91003753

As can be seen from the table, the same 3-phase motor type is used for both 220/240V and 380/440V supplies. In addition to the wiring up of the mains supply to these motors, the windings must also be correctly configured for the appropriate voltage. Information for configuring the motor is supplied with the motor.

For all motor types, the mains cable must first be fed through the cable gland on the motor termination box housing. The cable braid **must be connected** to the motor chassis as a safety feature, and the individual insulated conductors connected to the appropriate terminals as detailed for each motor type in the following section. Ensure that the cable is not under strain in the termination box area, and that sufficient slack is available to remake the connection, should this ever be necessary e.g. if a motor is changed in service. Also ensure that the insulated conductors are terminated appropriately, using ring crimp terminals on threaded studs.

Ensure that any gasket fitted for sealing the terminal box cover is correctly seated when the cover is re-secured.

Single Phase Motor Connections

Make connections according to the label on the inside of the termination box cover. Ensure that the rated motor volts are matched to the supply.

Cable Schedule No 166 Reference	Description	Motor Label Reference
TSH1	AC LINE	L, L1 or U1
TSH2	AC NEUTRAL	N, L2, U2 or V1

Three Phase Motor Connections

For dual voltage motors, ensure that windings are configured for the appropriate voltage. Delta connected windings are for low voltage operation, Star for high voltage.

The label on the inside or outside of the termination box cover, will give details of mains supply connections, and of the winding re-configuration details for alternate voltages if appropriate.

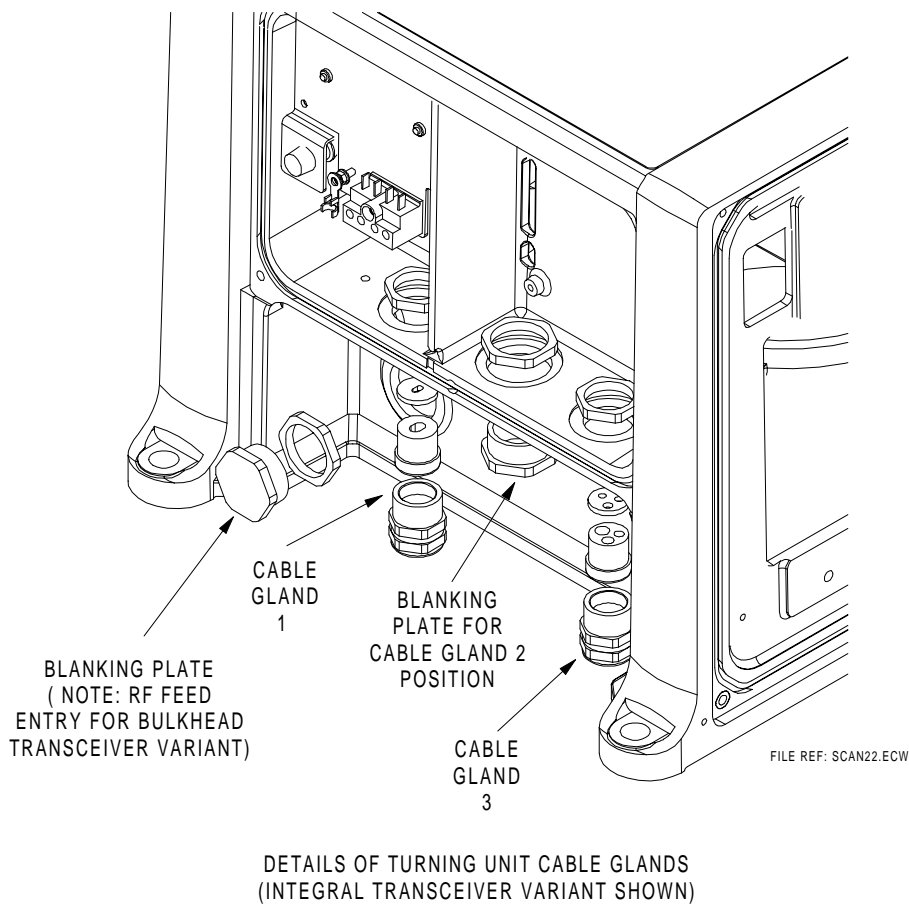
Ensure that the rated motor volts are matched to the supply. If the motor rotates in the wrong direction, reversal of any two phases will correct this (the radar antenna should rotate anti-clockwise when viewed from below).

Note that if the motor rotates slowly it indicates that it is configured for the wrong voltage.

Cable Schedule No 166 Reference	Description	Motor Label Reference
TSH1	AC LINE 1	L1 or U1
TSH2	AC LINE 2	L2 or V1
TSH3	AC LINE 3	L3 or W1

3.3.4 Fitting the Cable Glands

The installation cables are connected into the Turning Unit via the appropriate cable glands (see earlier table). The body of the gland fits through a hole in the casting and is held in position by the Top Nut. Note the 'O' ring seal, which is fitted below the casting surface (input side). Two seals are provided with each gland as shown in Figure 1.12 below. The lower seal provides for waterproofing, and the upper for EMC. Some glands are designed to take a single cable whilst others are intended for several cables. Blanking plugs are supplied to seal unused cable entries in the glands.



Note - Cable Glands and Blanking Plates are normally factory fitted to the Turning Unit.

Figure 1.12 - General View of the Cable Glands

S-Band Scanner Units and Transceivers

The waterproofing seal works by clamping onto the cable PVC sheath whereas the EMC seal clamps onto the cable braid. **It is important not to force the outer sheath through the EMC seal, as the seal is liable to split.** The braid is also formed into a tail which is grounded by means of an adjacent earth tag. The fitting procedure is detailed in Figure 1.14.

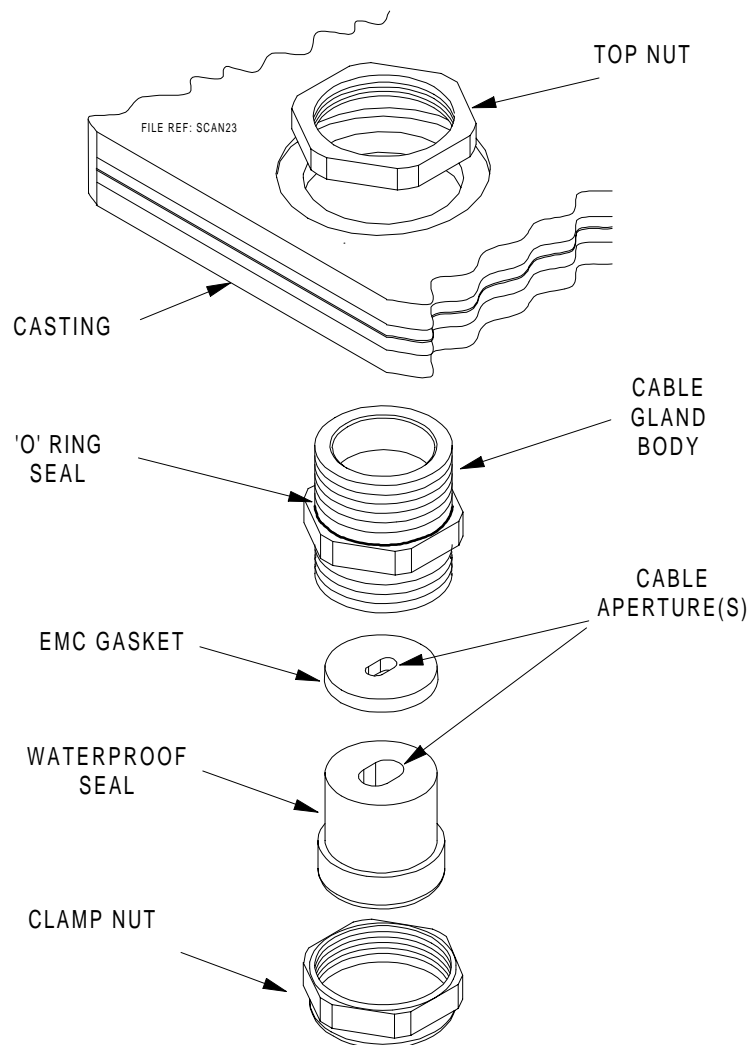
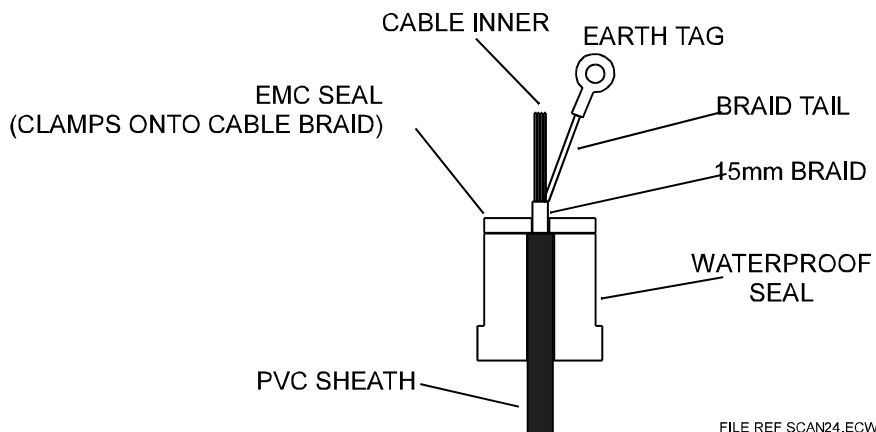


Figure 1.13 - Detailed view of a Cable Gland



Included within the cable gland is a waterproof seal and an EMC seal. The waterproof seal clamps around the cable outer sheath, and the EMC seal clamps around the braid. **It is important not to force the outer sheath through the EMC seal as the seal is liable to split.**

To install the cables:

Unscrew the gland nut and remove the waterproof seal and the EMC seal. Feed the cable through the gland nut and the waterproof seal. Strip the outer sheath to expose approximately 300mm of braid. Push the braid back to expose approximately 50mm of the inner cores. Trim 50mm off the inner cores, and pull the braid back over the inner cores and twist into a point. Feed the braid through the EMC seal until the cable is positioned as in Figure 1.13

For the multicore cables:

Flare out the braid to within approximately 15mm of the EMC seal, and form into a tail.

For the coaxial cables:

Do not fit the coaxial connector at this time.

Assembly into Turning Unit.

Feed the assembled cables and seals into the gland body, and tighten the gland nut until the EMC seal is compressed. Crimp the earth tags provided to the braids of the multicore cables and attach them to the earth studs adjacent to the cables. The tails should be as short as is practicable. Trim and make off the cable inner to the appropriate terminal blocks. Trim the coaxial cables to length and slide the plastic sleeve provided in the despatch kit over the exposed braid. Fit the coaxial connectors, and plug them into the appropriate sockets.

Figure 1.14 - Cable Installation Details

3.3.5 Performance Monitor

The Performance Monitor comprises the Performance Monitor Antenna, the Performance Monitor module, and an associated cable. The equipment is normally factory fitted.

3.4 S-Band Bulkhead Transceiver

The Bulkhead Transceiver 6583 IA is installed below decks in a suitable location such as the ship's equipment room. The installation should pay due regard to accessibility for maintenance and servicing, ventilation and the distance between the Transceiver and the Scanner Unit. For maximum performance, this should be kept as short as practicable, as the loss per metre of the S-Band co-ax is typically 8.3 dB per 100 metres, i.e. 1.7dB for 20 metres. This loss applies to both the transmitted RF pulse and the received signals.

The maximum permissible separation between the Turning Unit and the Transceiver Unit is 30 metres, and that between the Transceiver (or Turning Unit) and Display is 67 metres. Separation up to 300m is possible if a special low loss co-axial cable is used for the video.

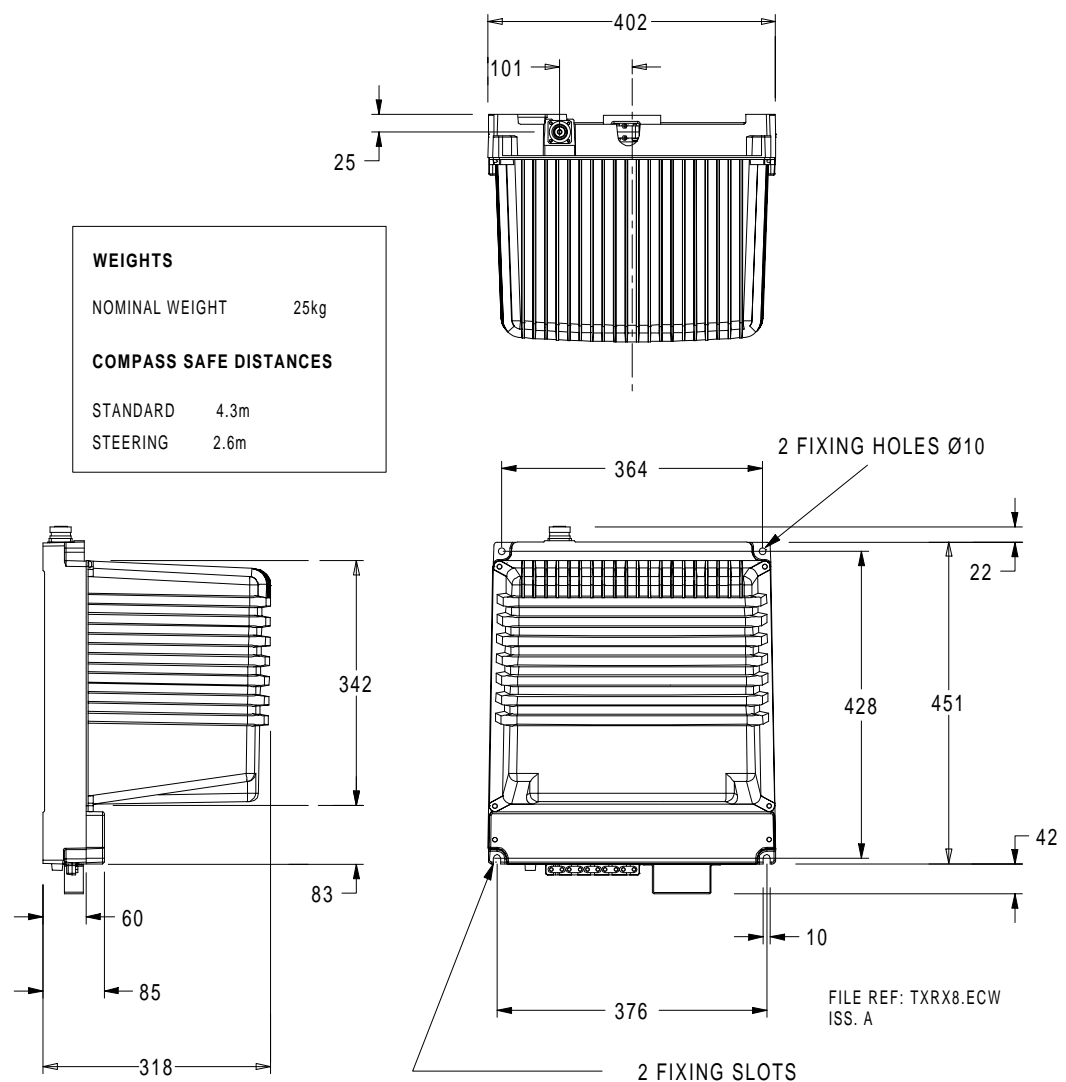


Figure 1.15 - Dimensions - Bulkhead Transceiver

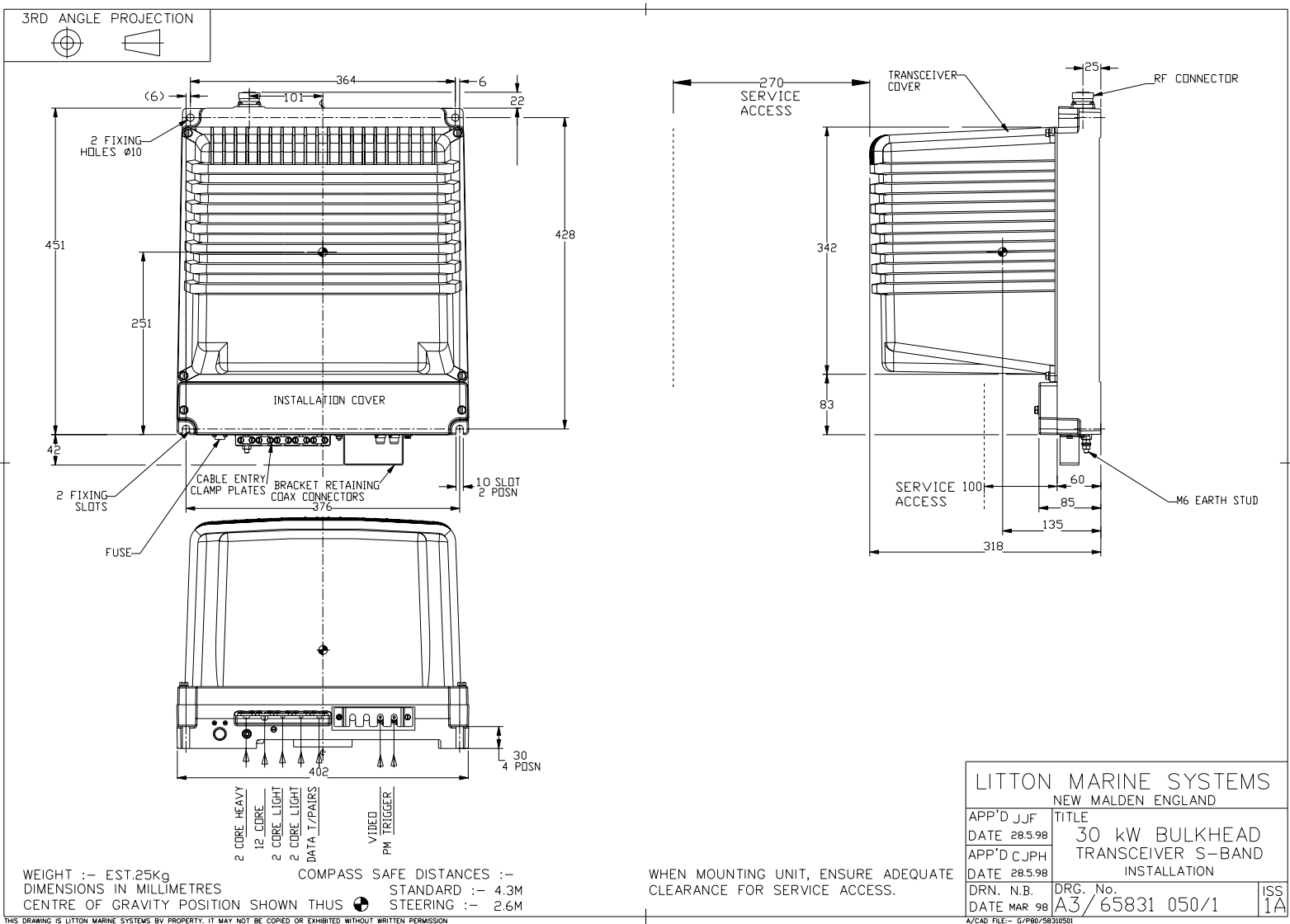


Figure 1.16 - S-Band Bulkhead Transceiver 30kW Installation

S-Band Scanner Units and Transceivers

The Transceiver may be attached to the bulkhead by several methods. The actual method chosen will depend on individual circumstances, but due regard must be given to the likely vibration and shock loading which may be experienced. The available methods include through bolting to the bulkhead, or mounting on studs provided by the shipyard.

Notes - The positions of the four fixings for the unit are not on a rectangle - i.e., the horizontal spacing of the top fixings is 364mm compared with 376mm for the lower fixings.

When choosing the installation location for the Transceiver, due regard must be made for the routing of the RF Feeder coax.

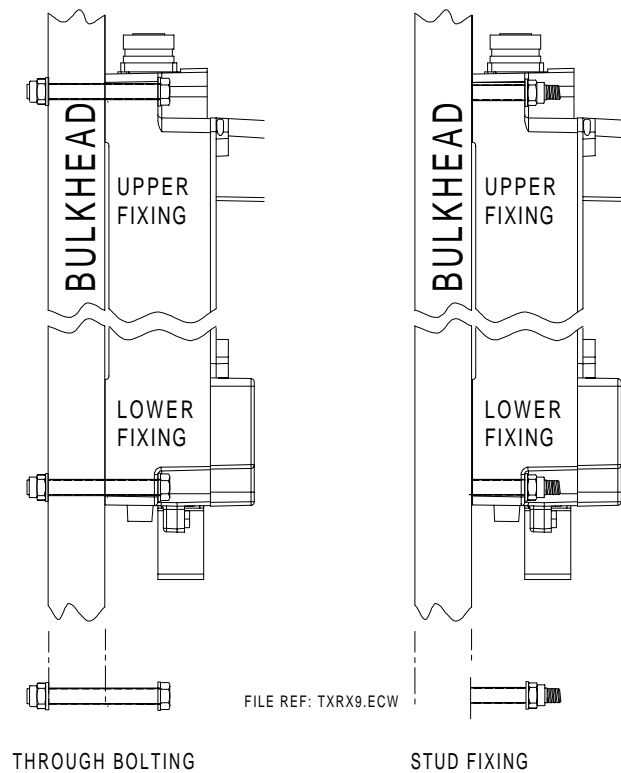


Figure 1.17 - Bulkhead Transceiver - Mounting Alternatives

3.4.1 Cabling Information

Figure 1.18 below shows details of the cable inputs. The cable cover plate, which is secured by two fixing screws, is shown removed. Note that the co-ax cables are retained by a cable retainer which must be fitted after the cables are in place. All other cables, with the exception of the RF Feeder S-Band co-ax, are individually clamped on their cable braids to provide emc shielding. The braids are also made off as tails and connected to earth tags provided. The a.c. mains input is connected to TSE as shown.

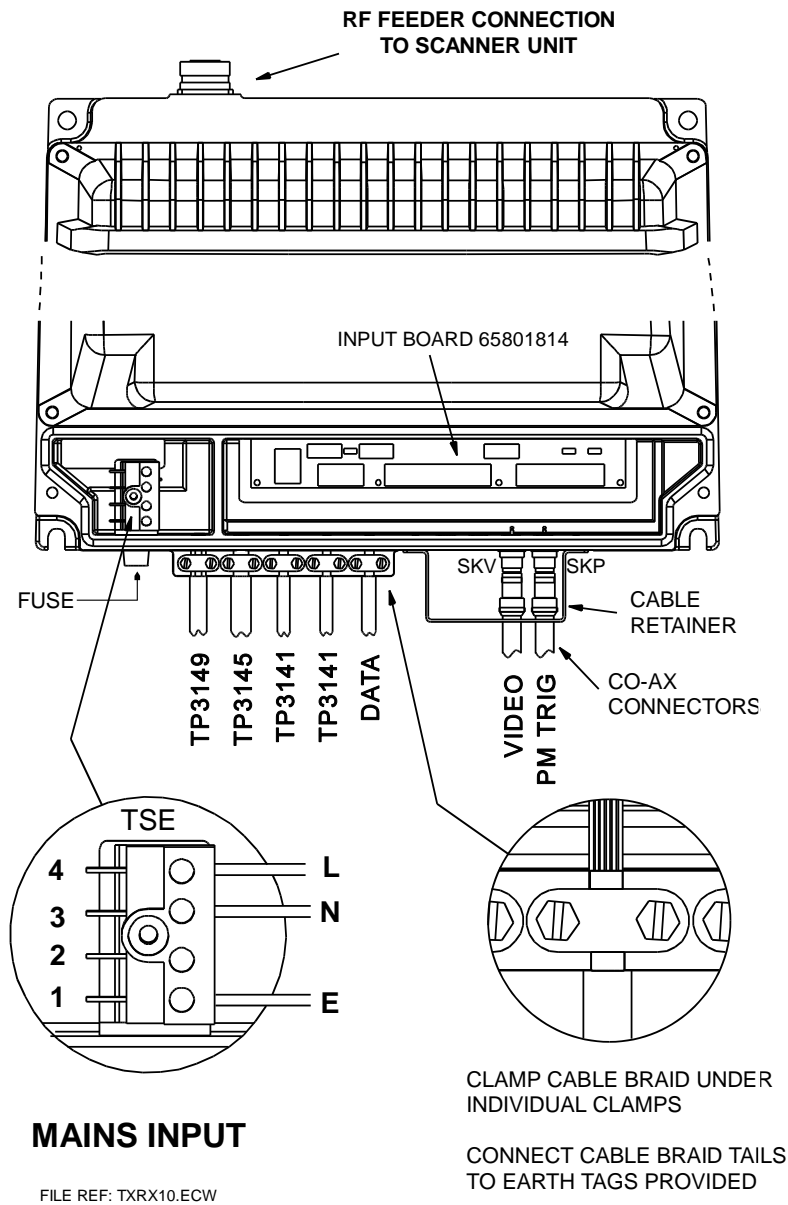


Figure 1.18 - Bulkhead Transceiver - Cable Input Details

S-Band Scanner Units and Transceivers

A 6mm stud is provided adjacent to the cable input clamps for bonding the unit to the ship's structure. This is an important safety requirement and the stud must not be used for any other connection.

Figure 1.19 below shows details of the Input Board 65801814. Refer to the cabling schedules for details of the connections, which are made via the two part connectors provided. Links 2 and 3 on the Input Board should be set as shown. Link 1 is not fitted.

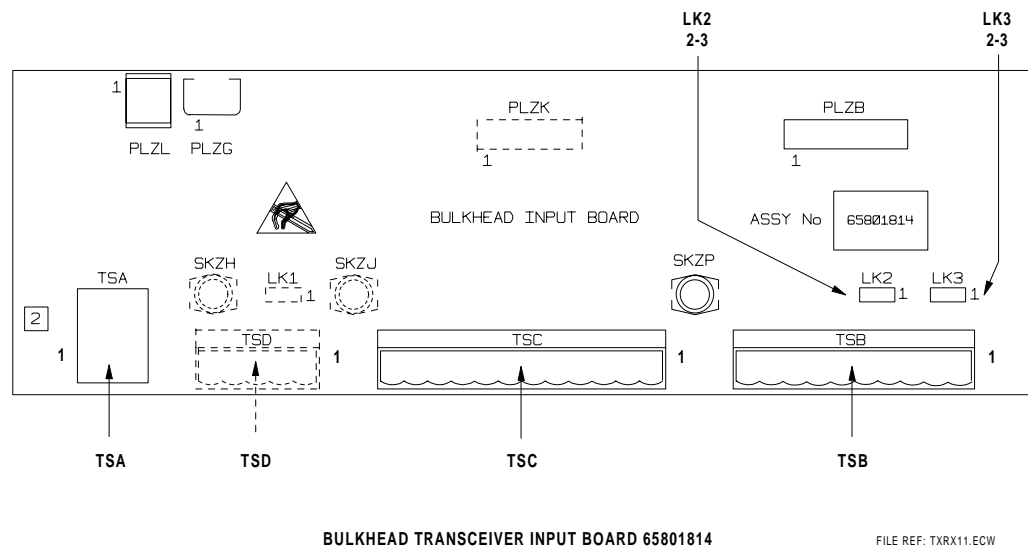


Figure 1.19 - Bulkhead Transceiver - Input Board Details

3.4.2 Fitting the R.F. Feeder Cable (S-Band Co-ax)

General Information

1. A radio frequency (R.F.) coaxial cable is used for the run between the Bulkhead Transceiver Unit and the Turning Unit with S-Band radars. The cable used is Andrew Antennas Heliax LDF5-50A 7/8in. 50-ohm - overall diameter 28mm (1.1in.).

(Figures 1.20 to 1.29 are reproduced by permission of Andrew Antennas).

2. Although apparently robust, the cable must be protected against strain and kinking, and must be treated with the utmost care at all times. The ends of the cable must be kept sealed against the ingress of moisture before the connectors are assembled.
3. Wherever possible, bends should have as great a bending radius as practicable. A single bend may be made when necessary with a minimum bending radius (measured from the axis of the cable) of 250mm (10in.).
4. For convenience, the upper (Turning Unit) connector can be fitted prior to installation of the cable, but due to the possibility of movement of the inner conductor relative to the outer conductor, the following precautions must be taken:-
 - 4.1 Any bend required within 1m (3ft) of the cable end must be preformed before carrying out the cutting and assembly procedure detailed in subsequent paragraphs. Note that no bend may be nearer that 250mm (10in.) from the end of the cable (see para 8.1)
 - 4.2 To allow for relative movement between the Turning Unit and mast, whenever possible a double bend should be formed in the cable so as to produce an offset immediately below the Turning Unit.
 - 4.3 The cable and assembled connector should be fitted to the Turning Unit so that a minimum amount of distortion of the cable occurs between the connector and the pre-formed bend.
 - 4.4 The cable should be installed and secured in position (using the waveguide supports shown in Figure 1.29) as far as is practicable before the lower (Transceiver Unit) connector is fitted to the cable. The precautions given in sub-para. 4.1 above must be observed if a bend is required adjacent to the Transceiver Unit.

ASSEMBLING THE CONNECTORS

General

5. A straight connector (Type L45DM) is used to terminate the feeder cable at each end.

Tools required

6. The normal tools found in an Engineer's tool kit, plus a hacksaw (with a fine-toothed blade) and 1 1/4 in. open-ended spanners, will be sufficient for fitting the connectors to the cable.

Procedure

7. The procedure which follows is applicable to the straight connectors at each end of the feeder cable. Note that it is most important that swarf and other foreign matter should be prevented from entering the cable.
8. Prepare the cable end and assemble the connector as follows:-
 - 8.1 Ensure that the end of the cable is straight for at least 10 in. (250mm). Using a knife, remove approximately 1 in. of the jacket. Deburr the sharp end of the cut outer conductor (see Figure 1.20).

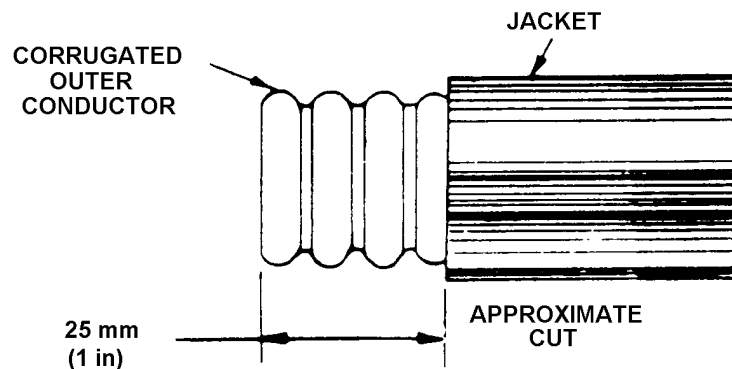


Figure 1.20 - Preparing the Cable

- 8.2 Scribe a line on a ridge of the exposed corrugated outer conductor (Figure 1.21). Using a straight-edged piece of heavy paper, wrapped around the cable as a cutting guide, remove the jacket to the dimension shown in Figure 1.21.

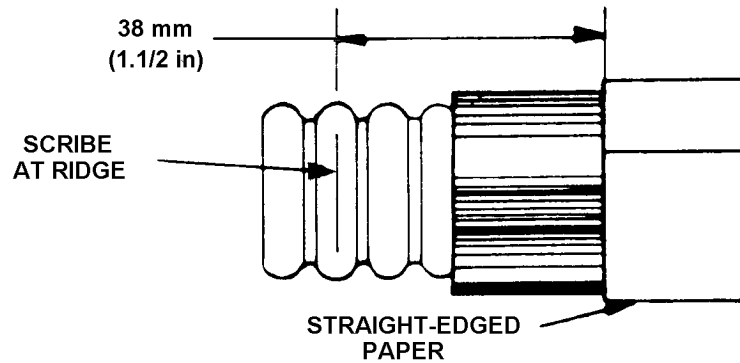


Figure 1.21 - Second Jacket Cut

- 8.3 Clean the outer conductor with solvent and then add the small thick O-ring gasket to the second fully-exposed corrugation groove from the jacket (see Figure 1.22). Apply a thin coating of silicone grease to the outer surface of the gasket and the gasket lead chamfer in the clamping nut, using the finger tip.

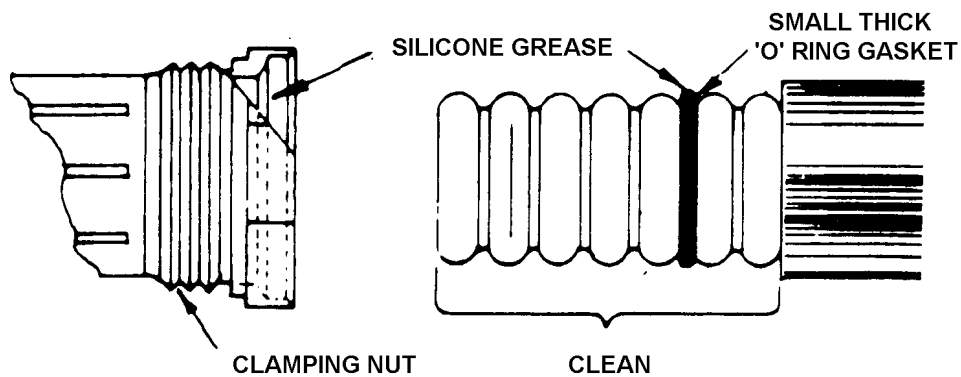


Figure 1.22 - Installing the Gasket

S-Band Scanner Units and Transceivers

- 8.4 Push the clamping nut onto the cable, using a twisting motion to ensure that the spring contacts snap into the first groove (see cutaway view in Figure 1.24). Grip the clamping nut with one hand and align the edge with the line scribed in sup-para. 4.2 above. Using a hacksaw with a fine-toothed blade, carefully cut the cable flush with the end of the clamping nut (see Figure 1.23).

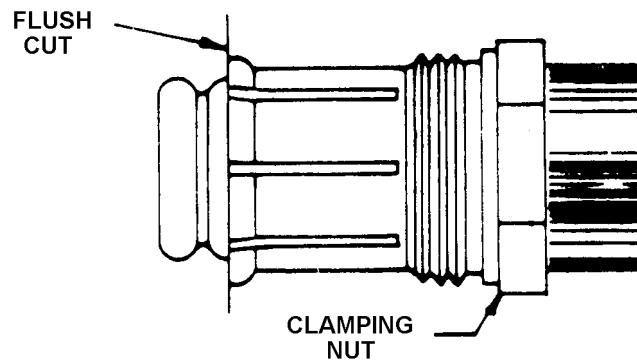


Figure 1.23 - Adding the Clamping Nut and Cutting the Cable

- 8.5 Using the tip of a knife, work around the entire circumference separating all foam completely from the edge of the outer conductor. This is to ensure a good electrical contact between the outer conductor and the outer body of the connector. (See the enlarged cutaway view in Figure 1.25 which (at the arrow) shows the eventual positive grip of the outer conductor between the clamping nut and the outer body of the connector).
- 8.6 Use a knife to remove all burrs from the inside edges of the outer and inner conductors. Use a wire brush or scraper to remove all copper particles from the foam (Figure 1.23).

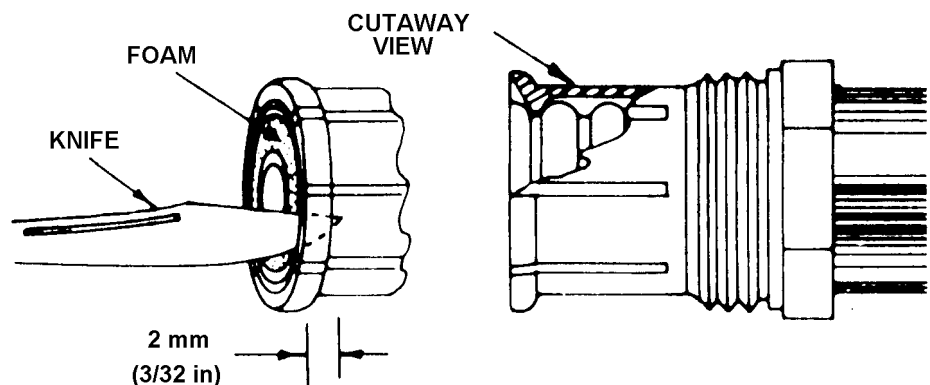


Figure 1.24 - Detaching Foam and Removing Burrs

- 8.7 Screw the outer body on to the clamping nut and tighten with the 1 1/4in. spanners. Hold the clamping nut and turn the connector outer body; do not turn the clamping nut. Unscrew and remove the outer connector body and inspect the end of the outer conductor for good metal-to-metal contact (Figure 1.25).

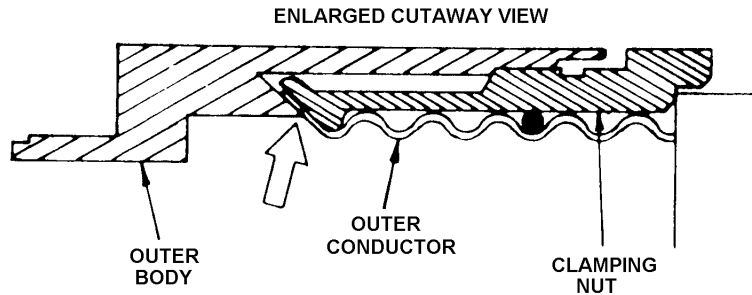


Figure 1.25 - Enlarged Cutaway View

- 8.8 Place a 'pin' through the hole in the self-tapping inner connector (Figure 1.26) and use it as a 'tommy bar' to tap the connector into the inner conductor. To aid tapping, use a small amount of solvent as a lubricant. If tapping becomes difficult, 'back off' the inner connector after every few turns. Tap until the inner connector 'bottoms' against the inner conductor and then tighten. Remove the 'pin' from the inner connector.

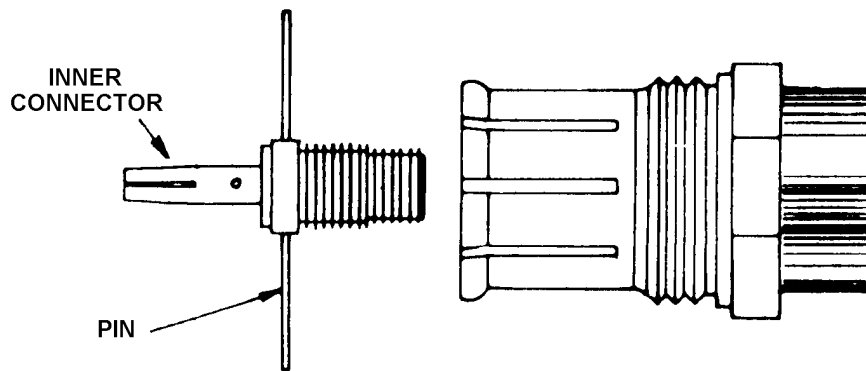


Figure 1.26 - Installing the Inner Connector

- 8.9 Place the large thin O-ring in the gasket groove in the clamping nut (Figure 1.27) and coat the outer surface of the gasket lightly with silicone grease. Screw the outer body of the connector on to the clamping nut and tighten with spanners. Turn the outer body only; do not turn the clamping nut.

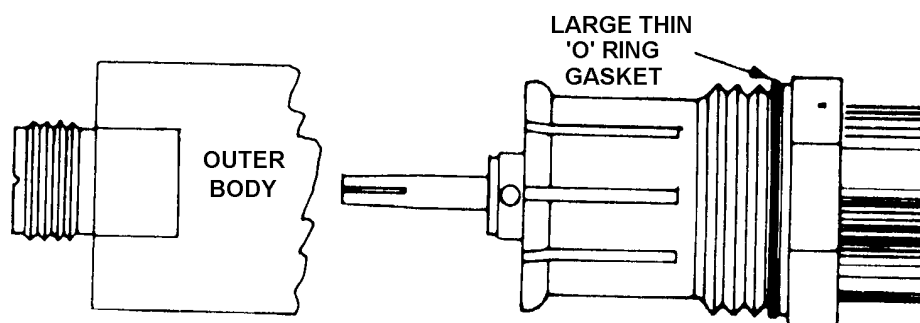


Figure 1.27 - Installing the Outer Body

FITTING THE DECK GLAND

9. The 7/8in. R.F. feeder cable passes through its own separate deck gland (Andrew Feed-Thru Kit Type 40656-1), positioned near to the foot of the mast. The gland kit comprises a rubber boot, metal flange halves, eight Lock-o-seal washers and an adjustable clamp (Jubilee clip). In addition eight 1/4in. bolts (of a suitable length), flat washers, lock washers and nuts will be required. See Figure 1.28.
10. To fit the deck gland proceed as follows:-
 - 10.1 Cut a 75mm (3in.) diameter hole in the deck and, having installed and secured the cable from the Turning Unit downwards, pass the Transceiver Unit end down through the hole.
 - 10.2 Apply silicone grease to the hole and to the slit and tapered edge of the rubber boot.
 - 10.3 Place the boot around the feeder, slide the boot down into the hole in the deck and then mark the location of the eight holes for the fixing bolts.
 - 10.4 Withdraw the boot from the hole and drill eight 8mm (5/16in.) mounting holes through the deck.
 - 10.5 Slide the boot back into the hole in the deck and position the flange halves in the groove in the boot.

- 10.6 Align the flange holes with the boot holes and secure the assembly in position with eight 1/4in. bolts, flat washers, lock washers and nuts, together with the Lock-o-seal washers provided in the gland kit. Note that the bolts are inserted downwards and that the Lock-o-seal washers only go under the bolt heads.
- 10.7 Fit the adjustable clamp (Jubilee clip) around the boot and tighten to ensure a leakproof seal.

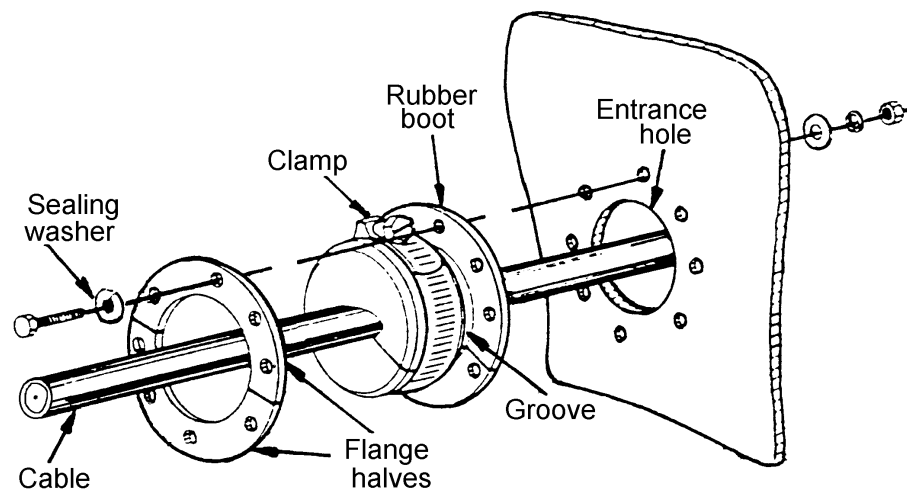


Figure 1.28 - Deck Gland Details

INSTALLING THE CABLE

1. Cable Hangers are supplied (Andrew Hanger Kit Type 42396A-5) for supporting the cable along the cable run between the Scanner Unit and the Bulkhead Transceiver. Each kit contains 10 Hangers plus their associated Support Brackets (Andrew Type 42241). Normally, a hanger is attached to a cable tray, using suitable bolts, at a recommended spacing of 0.9 metres (3 feet). The support brackets must be fitted to the hangers to prevent distortion when the hanger is wrapped around the coax as shown in Figure 1.29.
2. Figure 1.29 also shows additional hardware (not supplied in the Installation Kit) which facilitate special mounting arrangements. If required, these are obtainable from Andrew Corporation.

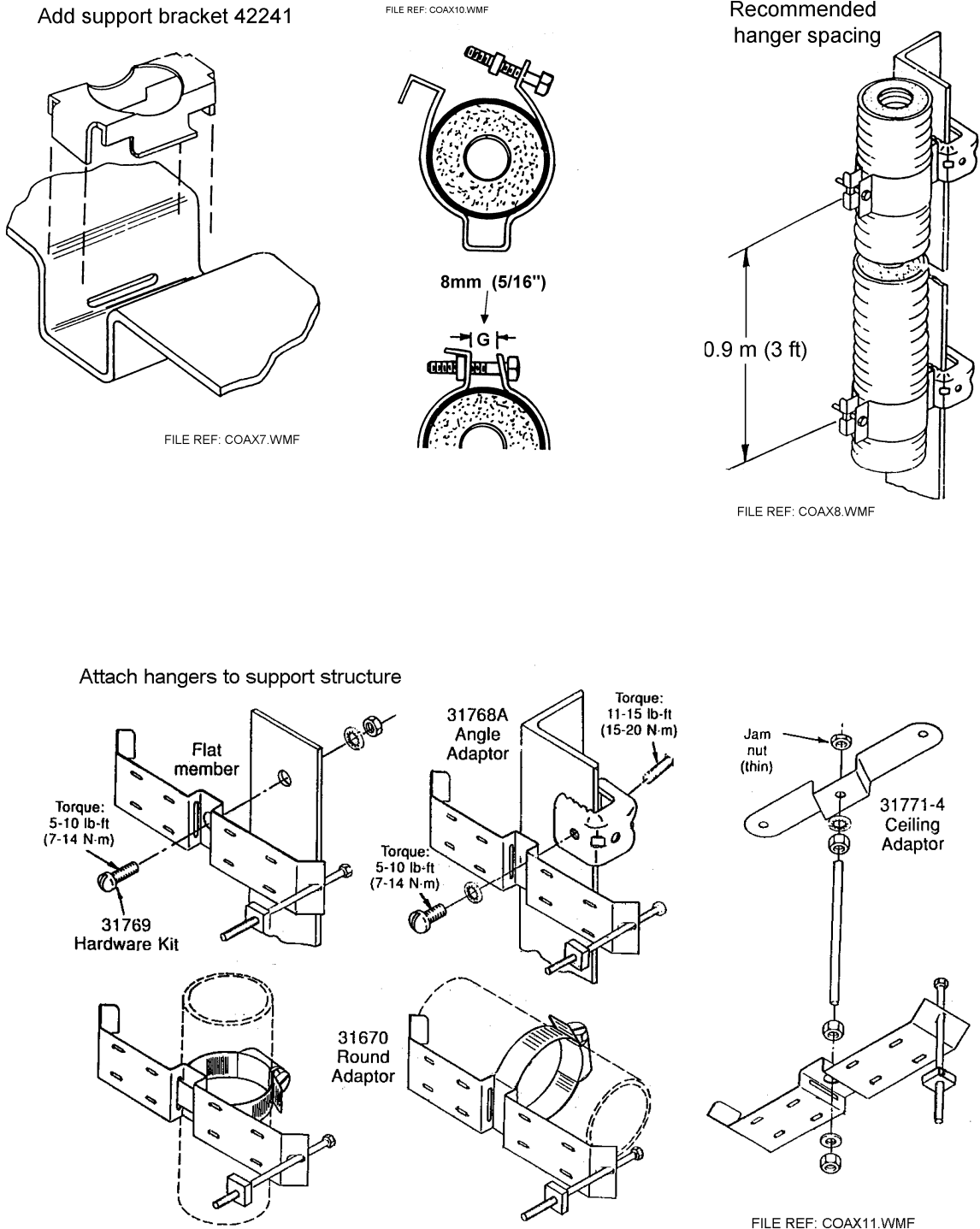


Figure 1.29 - Deck Gland Details

3.5 Initialisation and Commissioning

The S-Band Scanner Unit and Transceiver are only part of a complete BridgeMaster E Series Radar, and cannot be operated independently. For details of complete system installations refer to the BridgeMaster E, Ship's Manual 65800010B.

After a complete system has been installed it must be Initialised and Commissioned as detailed in Chapter 4 of the BridgeMaster E, Ship's Manual 65800010B.