303766P001
Rev. C
DECEMBER 2007

30KW S-BAND/U ANTENNA GROUP

TYPE
03R039
09N-011
02R-039B

TECHNICAL MANUAL

Consillium

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303766P001
Rev. C
DECEMBER 2007

S-BAND ANTENNA GROUP INCLUDING 12 FEET ANTENNA AND PEDESTAL WITH 30 kW TRANSCEIVER UPMAST

TYPE

03R-039
09N-011
02R-039B

TECHNICAL MANUAL

CONSILIUM SELESMAR s.r.l.
Head Office & Plant
Via Romita, 26 - 50020 Montagnana V. P. (Florence) Italy
Tel.: +39/0571/68121 Telefax +39/0571/670798

APPLICATION FOR MANUAL REVISIONS

Upon receipt of this manual, please fill in the necessary data. It is important that the addressee be the end user so that the operating personnel will receive all revisions to the manual

EQUIPMENT NAME .....

SERIAL No..... MODEL .....

MANUAL TITLE .....

..... MANUAL PART NUMBER.....

ISSUED INDEX..... REVISION INDEX.....

PURCHASING AGENCY .....

NAME OF USER.....

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RECORD OF CHANGES

RCS CODE/REV. INDEX	DATE	PURPOSE OF THE CHANGE	CHANGE REQUESTED BY
Revision A	30/11/2000	First Emission	
Revision B	June 2004	General Revision	
Revision C	December 2007	Replaced pag. B and pag. 7.2.	Request of Changes 034/07

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WARNINGS

HIGH VOLTAGE

Radar equipment requires the use of high voltage, which can cause injury, or loss of life. Danger exists only when the units are opened exposing internal circuits, as when servicing the equipment. The Manufacturer Radar has been carefully designed to protect personnel from possible injury from high voltages.
Nevertheless, it is recommended that the Line Switch always be opened as an added protection when inspecting or servicing the equipment.
Although every effort has been made to eliminate danger to personnel, no responsibility is accepted for any injury or loss of life suffered in connection with this equipment.

X-RAY RADIATION

X-RAY radiation may be generated by Transceiver units and care must be taken to avoid possible harmful effects when they are opened for maintenance. When power is on, care should be taken not to approach **closer than 1 ft. from the unit unless front cover is in place.**

RADIO-FREQUENCY RADIATION

Harmful effects (particularly to the eyes) may be caused by exposure of any part of the human body to radio-frequency mean power densities in excess of 100 mW/cm2. This power density is exceeded at a distance of 1 ft. or less, from the 12 ft. X-Band aerial (when stationary).
The system is however designed to disable radiation when the antenna is not rotating.
The pedestals have also been predisposed for the installation of an external safety switch, which can be mounted on, or near the platform. This switch removes power from the Pedestal eliminating the possibility of accidental operation during servicing and also causes disabling of transmission.
Whenever it is necessary to disconnect the waveguide system from a radar transmitter for maintenance purpose, the transmitter output should, when practicable, be terminated in a matched load. If this is not possible, care should be taken to avoid standing in front of an open-ended waveguide from which power is being radiated.
NEVER look down a waveguide from which power is being radiated.

SAFETY SWITCH

The Unit is provided of a safety switch, which disable the Antenna movement during maintenance operations.

SAFETY PRECAUTIONS

Purpose

The safety precautions described in this paragraph are applicable to 30 kW S-BAND/U Antenna Group. Depending upon the material to be highlighted, the following attention letter headings are used in the technical manual content.

WARNING

THIS IS OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION AND STATEMENT WHICH. IF NOT STRICTLY FOLLOWED, COULD RESULT IN INJURY TO OR DEATH OF PERSONNEL

WARNING

THIS IS OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION AND STATEMENT WHICH. IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO, OR DESTRUCTION OF, UNIT OR LOSS OF EMISSION EFFECTIVENESS.

NOTE

An essensial operating or maintenance procedure, condition or statement which must be highlighted

Whenever a precaution, relating specifically to a part of the technical manual is needed, the information is given in the relevant part of the manual. Warnings and Cautions precede applicable text.

Safety Operations

During normal operation (front cover closed), the unit can be quickly disconnected from the main power line, setting to OFF the relevant circuit breaker located on the electric switchboard.

During maintenance (front cover opened) it is possible to turn-on the unit by setting to SERVICE MODE the SW2 switch, mounted on the RTM Supply Assy. This switch is connected in parallel with the relay, controlled by the POWER ON command, and during normal operation must be set to NORMAL. During maintenance, in order to prevent RTM occasional turning-on it is better to disconnect and insulate, momentarily, PWON terminal from the relevant terminal board.

NOTE

Main power line is always present on terminal board and on fuses

Safety Summary

The following are general safety precautions that are not related to any specific procedure and therefore do not appear elsewhere in this technical manual. These are recommended precautions that personnel must understand and apply during most phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUIT

Operating personnel must at all times observe all safety regulations.
Do not replace components or make adjustments inside the unit with the high voltage supply turned ON. Under certain conditions, dangerous potentials may exist when the power breaker is in the OFF position, also due to charges retained by capacitors. To avoid casualties, always remove power and discharge to ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person initiate servicing or adjusting the unit except in the presence of someone capable of helping help.

RESUSCITATION

Personnel working with or near high voltage should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

Warning Information

The following warnings appear in the text of this technical manual, and are repeated here for emphasis.

WARNING

USE EXTREME CARE WHEN WORKING ON THE UNIT ONCE THE COVER HAS BEEN OPENED. THE MAGNETRON ASSEMBLY OPERATES AT VOLTAGES THAT MAY PROVE FATAL

WARNING

BEWARE OF HIGH VOLTAGE CAPACITORS. IT IS NECESSARY TO SHORT-CIRCUIT THEIR LEADS BEFORE PERFORMING ANY MAINTENANCE ACTION ON THEM.

WARNING

ON THE ELECTRIC SWITCHBOARD, SET TO OFF THE POWER BREAKER DEDICATED TO THE PRESENT EQUIPMENT AND HANG TO IT A PLACARD READING: “WORK IN PROGRESS-DO NOT SWITCH ON”

WARNING

USE EXTREME CARE WHEN WORKING ON THE EQUIPMENT ONCE THE FRONT COVER HAS BEEN OPENED. THE MAGNETRON ASSEMBLY OPERATES AT VOLTAGES THAT MAY PROVE FATAL

WARNING

SET MAIN LINE BREAKER TO OFF BEFORE REPLACING ANY FUSE. FUSES ARE UNDER VOLTAGE LEVELS WHICH MAY PROVE FATAL.

CHAPTER 1
DESCRIPTION AND MAIN CHARACTERISTICS

1.1 Introduction

1.1.1 Manual Applicability

The present technical manual provides information, data and procedures relevant to the general description, the operation, the functional description, the scheduled maintenance, the troubleshooting, the corrective maintenance and the replaceable parts' list of the S-Band 30 kW Antenna Group, from now on called 30 kW S-BAND/U Antenna Group.

The present technical manual contents is arranged in 10 Chapters as follows:

Warnings

Chapter 1 DESCRIPTION AND MAIN CHARACTERISTICS

Chapter 2 OPERATION

Chapter 3 FUNCTIONAL DESCRIPTION

Chapter 4 PREVENTIVE MAINTENANCE

Chapter 5 TROUBLESHOOTING

Chapter 6 CORRECTIVE MAINTENANCE

Chapter 7 PART LIST

Chapter 8 INSTALLATION

Chapter 9 FIGURES

1.1.2 Purpose of the Equipment

The 30 kW S-BAND/U Antenna Group (Chapter 9, Figure 9.1.1), when connected to a RTM-S Power Supply and to a Display Unit, performs the echoes transmission and reception in the surrounding area.

The equipment purposes are the following:

- to transmit and to receive the RF to/from the S-Band Antenna Unit
- to accept and to process data from the S-Band Antenna
- to receive radar controls from the Display Unit
- to transmit radar data and controls to the Display Unit
- to accept mains AC voltage from the Ship Main Line
- to control the antenna pedestal start and movement

1.1.3 List of Abbreviation

Measurement abbreviations are according to MIL STD-12; other terms and abbreviations used in the present manual are listed in Table 1.1.1 - List of Abbreviations.

Table 1.1.1 - List of Abbreviations

ABBREVIATION	MEANINGS
AC	Alternating Current
AZ	Antenna Azimuth Pulse
DC	Direct Current
dB	Decibel
dBm	Decibel referred to 1 mW
HL	Heading Line
HV	High Voltage
IF	Intermediate Frequency
LED	Light Emitting Diode
LO	Local Oscillator
LV	Low Voltage
MDS	Minimum Detectable Signal
MTBF	Mean Time Between Failures
PRF	Pulse Repetition Frequency
PS	Power Supply
RC	Resistor - Capacitor
RF	Radio Frequency
R.P.M.	Revolutionsper Minute
RTM	Receiver Transmitter Modulator
STC	Sensitivity Time Control
TTL	Transistor-Transistor Logic
VCO	Voltage Controlled Oscillator
WG	Waveguide

1.2 Physical description

1.2.1 Composition

The 30 kW S-BAND/U Antenna Group (Chapter 9, Figure 9.1.1) is composed of the following Units:

- TRANSCEIVER (pos. 1) which generates the transmitting pulses and converts the received echoes
- Antenna Pedestal S/U (pos. 2) which allows the Antenna rotation
- the 12' transmitting/receiving Antenna (pos. 3)

The group is designed for maximum resistance to the severe environmental conditions in which they must operate. Its weight and dimensions are limited to reduce the effect of load on the masts.

Table 1.2.1 - Equipment, Accessories And Document Supplied lists the Equipment, Accessories and Document Supplied.

Table 1.2.1 - Equipment, Accessories And Document Supplied

POS.	DESCRIPTION	CODE	WIDTH (mm)	HEIGHT (mm)	DEPTH (mm)	WEIGHT (kg)
1	30 kW S-Band Receiver Transmitter Modulator Up and Down	09N-011	535	481	297	
2	S Band Antenna Pedestal Normal Speed	03R-039	660	650	430	115
3	12' S Band Antenna	02R-039/B	Length 3662 (circle 3700)			80
4	Technical manual	303733P001				

1.2.2 TRANSCEIVER Unit

The TRANSCEIVER is composed of a metal cabinet (Chapter 9, Figure 9.1.2 pos. 1), made of Alloy, treated with anticorrosive paint in order to be resistant to the saline atmosphere. The cover (Chapter 9, Figure 9.1.2 pos. 2) is closed by means of six screws (Chapter 9, Figure 9.1.2 pos. 3).

The cabinet is fitted with four rear hoisting attacks (Chapter 9, Figure 9.1.2 pos. 4) fixing the unit to the S Band Antenna Pedestal.

In the bottom part of the cabinet, is located the screw (Chapter 9, Figure 9.1.2 pos. 5) for the ground connection of the Unit to the ship structure.

The connection with the S Band Antenna Pedestal is performed by means of two cables, which exit the Unit through a communicating hole (Chapter 9, Chapter 9, Figure 9.1.3 pos. 7).

The connection with the RTM-S Power Supply and to the Display Unit, through the RTM-S Power Supply, is performed by means of two cables entering in the unit through two stuffing tubes located on the lateral part of the unit. When the cables are not mounted, the hole is closed by a plate (Chapter 9, Figure 9.1.2 pos. 6) provided with a gasket.

Table 1.2.1 - Equipment, Accessories And Document Supplied lists the cabinet dimensions; Table 1.2.2 - Transceiver Unit Composition lists the main assemblies composing the Unit and, with reference to Chapter 9, Figure 9.1.3, their position inside the Unit.

Table 1.2.2 - Transceiver Unit Composition

DESCRIPTION	Position
Noise Source	1
Magnetron	2
LNFE Assy	3
POWER MOS Board	4
RTM CONT B Board	5
NIFB Assy	6

1.2.3 Antenna Pedestal S/U

The Pedestal, which supports the 12' S-Band Antenna, can assume the configurations:

- 03R-039: equipped with a three-phase electrical motor and an optical sensor for the Antenna position detection

1.2.3.1 03R-039 Pedestal

The Pedestal (Chapter 9, Figure 9.1.4), consists mainly of:

- The Motor Group (pos. 1) - The Motor Group function is to provide the necessary power generate to the antenna rotation
- The Rotating Flange (pos. 2) - The Rotating Flange's function is to transfer to the antenna the motion provided by the Driving Belt. Flange the 12' antenna is mounted on the Rotating; the antenna is fixed to the Rotating Flange by means of studs and nuts (pos. 3 and 4)
- The S Band Rotating Joint (pos. 5) - The joint is rotating with the antenna, and the lower part, called Cable with Connector Assy, is fixed to the Pedestal structure through a proper bar. The fixed part is connected with the cable from the TRANSCEIVER which enters the Pedestal through a flange. When the Pedestal is not connected, the hole is closed with a cover provided with a gasket (pos. 8)

By loosing and removing four nuts (Chapter 9, Figure 9.1.4 pos. 7) it is possible to remove the cover (Chapter 9, Figure 9.1.4 pos. 8) and to access to the inside of the pedestal.

By referring to Chapter 9, Figure 9.1.5, the following components can be localised in the pedestal:

- The Gear Reduction Group (pos. 1) - The Gear Reduction Group's function is to reduce the motor angular velocity
- The Driving Belt (pos. 2) - The Driving Belt function is to transmit the motion provided by the Gear Reduction Group to the antenna. As result, the antenna angular speed is greater than 20 rpm for 50 Hz and for 60 Hz
- The Indicator Unit (pos. 3) - The Indicator Unit function is to generate the Heading Line (HL) pulse and the pulses indicating the antenna position (AZ)
- The Antisign Board (pos. 4) - The Board receives the pulses from the Indicator Unit and sends them to the TRANSCEIVER
- The Cable for the Signal - The Cable function is to connect the antenna to the Transceiver equipment. The upper part of the cable is the Rotating Joint (Chapter 9, Figure 9.1.4 pos.

5) rotating with the antenna,. The lower part, called Cable with Connector Assy (pos. 5), is fixed to the Pedestal structure through a proper bar (pos. 6). The fixed part is connected to the cable from the TRANSCEIVER, which enters the Pedestal through a flange; when the Pedestal is not connected, the hole is closed with a cover provided with a gasket (Chapter 9, Figure 9.1.4 pos. 6)

- The Power Supply Cable - The Power Supply Cable function is to provide the necessary power to the pedestal internal circuits and components. It connects the Pedestal to the TRANSCEIVER and allows the signals transmission from the Unit to the TRANSCEIVER and the feeding of the Motor Group. The cable comes out the Pedestal trough the proper stuffing tube
- The Stuffing Tube for the Safety Switch

The Pedestal can be equipped with the Performance Monitor Arm as part of the Performance Monitor kit (Chapter 9, Figure 9.1.1 pos. 4).

Table 1.2.1 - Equipment, Accessories And Document Supplied lists the Pedestal dimensions.

1.2.4 Antenna

The antenna available is the 12' S Assy 02R-039/B. The antenna is mounted on the Pedestal by means of its support. The Antenna is fixed to the Support by means of eight bolt and nuts.
Table 1.2.1 - Equipment, Accessories And Document Supplied lists the Antenna dimensions.

1.3 Functional description

1.3.1 Transceiver Unit

The 30 kW S-Band Up or Down TRANSCEIVER is mainly divided into Receiver and Transmitter sections both enclosed in a solid state modular R.F. Head (Chapter 9, Figure 9.1.6).

The Transmitter generates the R.F. energy in the S-Band range and pulses, modulated with a peak power of 30 kW; the pulses, whose length and PRF are in accordance with the selections, are radiated by the Antenna. The transmission pulses can be selected on Short, Medium and Long Pulse according to the range scale selected on the Display Unit.

The Receiver enables the echo reception and subsequent amplification in NIFB Assy.

The Unit also includes the circuits to generate the voltage required for its operation.

1.4 Technical characteristics

1.4.1 Transceiver Unit

Tables from Table 1.4.1 - Transceiver Unit Technical Characteristics to Table 1.4.4 - 12' S Band Antenna Technical Characteristics list the main features with respect to the inherent capabilities of the present configuration.

Table 1.4.1 - Transceiver Unit Technical Characteristics

DIMENSIONS AND WEIGHTS	
Length	665 mm
Width	410 mm
Height	1000 mm
Weight	130 Kg
REQUIRED POWER	
Alternatives	220/380 VAC, 3Φ, 50 Hz or
	255/440 VAC, 3Φ, 60 Hz
Power consumption	4200 VA
Rotating Speed	> 20 Antenna RPM
ENVIRONMENTAL DATA	
Operating temperature	-25°C / +55°C
Storage temperature	-25°C / +70°C
Relative humidity	Up to 95% at +40°
Water resistance, Salt spray, Vibrations etc	as per IEC 60945
Wind resistance, relative wind	100 knots
CHARACTERISTICS	
Modulator	Solid state (MOSFET)
Nominal Peak Power	30 kW
Frequency range	3040÷3060 MHz
Nominal pulse lengths	60/250/800 ns
Pulse repetition frequency	3000/1500/750 Hz
IF amplifier	Logarithmic
IF centre frequency	50 MHz
IF- Bandwidth	16÷20/4÷5/1,5÷2 MHz
Overall noise figure	3,5 dB

Table 1.4.2 - Pedestal Type 03r-039 Technical Characteristics

DIMENSIONS AND WEIGHTS	
Length	3662 mm
Width	550 mm
Height	340 mm
Weight	90 Kg
Swing circle	3700 mm
CHARACTERISTICS	
Antenna type	End Fed Slotted Waveguide
Frequency	3040 ÷ 3060 MHz
Polarisation	Vertical
Horizontal Beam –width at –3 dB	2°
Horizontal side lobes: 10° better than Outside 10° better than	 26 dB 30 dB
Vertical Beam –width at –3 dB	22°

Table 1.4.3 - Pedestal Type 03R-040 Technical Characteristics

PARAMETER	DATA
Power Supply: Star Connection Electrical Motor Power	 380V 50 Hz/440V 60 Hz 3Φ 6.4 KVA
Rotating Speed:	> 40 rpm at 100 knots
Environmental Conditions: Operating Temperature: Storage Temperature: Relative Humidity: Rain Proof: Wind Speed: Heater (Optional)	 -25°C thru to +55°C -25°C thru to +70°C up to 95% at 40°C According to IEC 945 Chapt. 8 para 8 100 Knots for operation in environmental temperature below -20°C

Table 1.4.4 - 12' S Band Antenna Technical Characteristics

PARAMETER	DATA
Array Type	End Fed Slotted Waveguide
Frequency	3023 - 3075 MHz
Polarisation	Vertical
Horizontal Beam-Width At -3 Db	2°
Vertical Beam-Width At -3 Db	22°
Horizontal Side Lobes: 10° Better Than Outside 10° Better Than	 26 dB 30 dB
Environmental Conditions: Operating Temperature: Storage Temperature: Relative Humidity: Rain Proof: Wind Speed	 -25°C thru to +55°C -25°C thru to +70°C up to 95% at 40°C According to IEC 945 Chapt. 8 para 8 100 Knots

CHAPTER 2
OPERATION

2.1 Introduction

2.1.1 Purpose

The present Chapter provides the operating instructions, information and procedures required to enable operating personnel to efficiently and effectively operate on the 30 kW S-BAND/U Antenna Group in accomplishing its designated tasks.

The Chapter is divided in:

Paragraph 2.2 Controls and indicators
Paragraph 2.3 Semi-operative controls

The equipment does not require personnel on steady watch conditions, but requires general monitoring during normal operating situations. Since the equipment has no operating controls, paragraph 2.2 is not applicable. All semi-operative controls are located inside the unit.

2.2 Controls and indicators

Since the equipment has no operating controls, this paragraph is not applicable.

2.3 Semi-operative controls

The 30 kW S-BAND/U Antenna Group equipment is fitted with some semi-operative controls only on the TRANSCEIVER Unit; these controls are accessible when the unit front cover is opened. The semi-operative control location is shown in Chapter 9, Figure 9.1.7 and in Figure 9.1.8 and their description is given in Table 2.3.1 - Semi-operative Controls Location of the the RTM 30S/U/D Cabinet and in Table 2.3.2 - Semi-operative Controls Location of the RTM CONT B board.

Table 2.3.1 - Semi-operative Controls Location of the the RTM 30S/U/D Cabinet

POS.	CODE	TYPE	FUNCTION
1	SW2	Interlock	TRANSCEIVER cover interlock switch for disabling the High Voltage generation

Table 2.3.2 - Semi-operative Controls Location of the RTM CONT B board

POS.	CODE	TYPE	FUNCTION
1	P17	Switch	It defines the S1 rotary switch functions
2	S1	10-position rotary switch	It selects the function to be monitorized by the LED BAR as follow: a) P17 in OPEN position Pos. Function 0 Ready 1 Tuning 2 Magnetron current 3 Power Level 4 Temperature 5 Configuration of P3, P4, P5, P7, P11, P13 AND P6 6 Configuration of P8, P10, P12, P14, P15, P16, P17 AND P18 7 Not used 8-9 Reserved b) P17 in CLOSE position Pos. Function 0 STC Amplification 1 STC Slope 2 P.M. Open 3 P.M. Amp. 4 VD Level 5 S.P. Adjustment 6 TR Delay 7-9 Reserved
3	S2	10 position rotary switch	It selects the TRANSCEIVER unit operation mode as follow: Pos. Function 0 TRANSCEIVER under external control 1 1 TRANSCEIVER under external control 2 2 TRANSCEIVER in local stand-by 3 TRANSCEIVER in local with short pulse 4 TRANSCEIVER in local with medium pulse 5 TRANSCEIVER in local with long pulse 6 Not used 7 TRANSCEIVER in local with Performance Monitor 8-9 Not used
4	U31	10-segments LED BAR indicator	When lit-up, it visualizes the following parameters: Pos. Function 1-8 Status or value of the selected function (hexadecimal value displayed) (1 LSB, 8 MSB) 9 Rx Line Status 10 Tx Line Status
5	D23	LED	It indicates the presence of signal NOISE ENABLING in the Performance Monitor circuit
6	D1	LED	It indicates the presence of the +5 V
7	R63	Local Tuning potentiometer	In local, it controls the VCO tuning

CHAPTER 3
FUNCTIONAL DESCRIPTION

3.1 Introduction

The present chapter provides the functional and detailed description of the main functions and operations performed by the 30 kW S-BAND/U Antenna Group.

Functional diagrams are used to depict signal processing: text is used to support diagrams as necessary for clarity purposes. The descriptions are structured in paragraphs as described in the following.

Paragraph 3.2, Functional description, provides a general functional description, functional areas identification and main interconnections among them. This allows the pointing out of the main function relationship and unit performance. As “functional area” it is intended a group of circuits, or other devices, which operate together to accomplish a well defined function. Each of the major functions of the Unit shown in the functional block diagram (Chapter 9, Figure 9.1.9) is described in details on separate functional block diagrams whose description is given as follows:

Paragraph 3.3, Technical Description: functional block diagrams show the development of a function from input to output in detail. Main assemblies and subassemblies (modules and cards) are shown and identified by code name and part number (P/N).
Functional block diagrams show the development of a function from input to output in detail. Main assemblies and subassemblies (modules and cards) are shown and identified by code name and part number (P/N).

Hardware blocks are used in the signal paths to describe the processing functions performed. For a better understanding, the signal functions on circuit blocks are tagged by letters whose meanings are described in the list of abbreviations (Table 1.1.1 - List of Abbreviations). Signals flow are mainly laid down from left to right and from top to bottom therefore subassemblies can be illustrated more than once to ensure logical signal flow. Signals, on functional block diagram, appear with their official code name as per the Manufacturer electric schematic diagrams and tabular interconnection lists.

Comments for clarity on signal paths are indicated parenthesis; this sometimes identifies their operational accomplishment. Timing diagrams and word-code bit structure figures are also given as necessary for a better understanding of the described function. Logic terms and principles used in this technical manual comply with standard engineering practices.

Logic symbols (gates) are used if they represent more appropriately, in a simplified form, the logic function performed even by complex parts of hardware.

Where necessary, functional description of power supplies and minor

assemblies are referred to schematic diagrams.

NOTE

The schematic block diagrams of Chapter 3 show all the functions that the hardware boards could potentially support, while the related functional description refers only to the functions implemented in the customised present configuration.

3.2 Functional description

The functional block diagram of the 30 kW S-BAND/U Antenna Group equipment is shown in Chapter 9, Figure 9.1.9.

Each block represents a functional area, which is described in detail in the following function of the present chapter. The blocks indicated by dotted lines represent circuits assembled on the chassis of the Unit.

Basically, the unit performs the following functions:

- it generates the power supply voltages required for they unit functioning
- it generates the R.F. pulses which will be radiated by the Antenna; the pulses, in S-band wave length (3050 ±30 MHz) and with 30 kW peak nominal power, can be selected among the following:

PULSE TYPE	DURATION	PRF
SHORT PULSE	nominal 60 ns	3000 Hz
MEDIUM PULSE	nominal 250 ns	1500 Hz
LONG PULSE	nominal 800 ns	750 Hz

- it receives the echoes reflected from targets and it converts and amplifies them
- it monitors the correct operations of Unit

The Electronic provides, as well, the proper DC Power Supply voltages: +15V, -15V, +5V, (LVPS area in RTM CONT B Board), and the High Voltages, (HVPS area in POWER MOS Board). The Electronic Assy, also contains, on RTM CONT B Board, the circuit to generate the DC voltage for heating the Magnetron Filament (VFIL).

The Electronic, (RTM CONT B Board), generates the Trigger signal and the Trigger pulse required to drive the Modulator circuitry, (POWER MOS Board). For every pulse supplied, the Modulator powers the Magnetron cathode with a High Voltage pulse which causes it to oscillate for the pulse duration time, in accordance with the range scale selected by the operator, (Short, Medium, Long Pulse). R.F. pulses generation is performed by the Magnetron inside the "R.F. HEAD" block.
The Magnetron output R.F. signal is sent to the Antenna via the Circulator and the waveguide path.

The second main function carried out by the Unit is to convert the receiving R.F. energy, reflected from targets, into intermediate frequency, (I.F.) to amplify it. This is provided by the R.F. HEAD block mainly consisting of:

- Limiter
- Integrated Low Noise Front End composed of:
  - Image Rejection Filter
  - L.N.A.
  - Mixer
  - L.O.
  - IF LOG. Amplifier

The echo signal received by the Antenna arrives, through the Limiter and the Low Noise Amplifier, to the Mixer where it is mixed with the signal forwarded by the Local Oscillator. The resulting beat is the 50 MHz IF signal which is forwarded to the IF LOG. AMPLIFIER. The Limiter is used to avoid an output above a scheduled value; the Limiter output is a constant value and an higher output causes a short-circuit. The Low Noise Amplifier and the Image Rejection Filter are used to suitably amplify the echo signal to improve the noise figure of the receiver. The Local Oscillator is integrated directly into the L.N.F.E. It can be tuned up to the Magnetron transmission frequency trough the VCO voltage level. The IF LOG. AMPLIFIER dynamics is of the logarithmic type, with nominal central frequency of 50 MHz; the amplified signal is then detected and sent out from the unit, (VIDEO signal), as described in the following paragraph.

3.3 Transceiver unit technical description

3.3.1 General

The Transceiver is composed of the following components:

- the POWER MOS Board
- the RTM CONT B Board
- the Solid State R.F. Head
- the NIFB Log Amplifier

Hereafter, the technical description of each component is given; in Chapter 9, Figure 9.1.18 the cabling of the Transceiver is illustrated.

3.3.2 POWER MOS Board

Basically the POWER MOS board, performs the following main functions:

- it generates the High Voltage Power Supply (HVPS)
- it generates the High Voltage Pulses for the Magnetron
- it generates the +15V ISO and 120 V voltages

3.3.2.1 High Voltage Power Supply (HVPS) Generator Circuit

The HVPS Generator Circuit purpose (Chapter 9, Figure 9.1.10) is to generate the high voltage (700 V) necessary to the Magnetron for the generation ofv the transmission pulse.

The HVPS starts functioning when the signal, output of the COMPARATOR, is active; the signal is active when:

- the signal HVON, from the MICROPROCESSOR of RTM CONT B Board, is available. This signal is used mainly when switching on, when the unit is not ready to operate because the Magnetron requires three minutes of warm-up time
- the signal HVSTOP, which disables the circuit when the 15VDC ISO voltage is absent
- the HVPS Generator Circuit generates the correct high voltage value

When the high voltage is generated, the COMPARATOR sends the Microprocessor of the RTM CONT the signal HVOK and the LED DL1 (HVOK), mounted on the POWER MOS Board, lights.

The signals used in this circuit are:

- 70 Vdc from TRANSCEIVER 30S Power Supply Unit
- 18 VAC from the RTM CONT B Board
- LPA (Long Pulse Adjustment), MPA (Medium Pulse Adjustment) and SPA (Short Pulse Adjustment) from MICROPROCESSOR of RTM CONT B Board
- HVON from MICROPROCESSOR of RTM CONT B Board

The 70 Vdc is applied to the RECTIFIER through a protecting fuse, external to the board, and its presence is visualised when the LED DL2 (MAIN VOLTAGE), mounted on the board, is lit.

The 70 Vdc (VMOD) is applied to the primary of the HVPS TRANSFORMER which, controlled by the MOSFET, generates, as output, the required high voltage (700 V).

The MOSFET activation is controlled by a circuit, which, also, protects the MOSFET itself.

The circuit is composed by the blocks COMPARATOR, POTENTIOMETER and FLYBACK CONTROLLER. When the COMPARATOR recognises that the output voltage is present, it activates the FLYBACK CONTROLLER which receives as input the output voltage adjusted by the POTENTIOMETER according to the pulse length (signals LPA, MPA and SPA).

This way, it is possible to control the Magnetron output power.

3.3.2.2 Pulse Generator Circuit

The Pulse Circuit Generator function (Chapter 9, Figure 9.1.11) is to generate the necessary high voltage supplying the Magnetron, in accordance with the previous selections.

The Input Pushing Trigger is TRPUSH and the input Pulling Trigger is TRPULL; both from RTM CONT B Board. To the Pulse Circuit Generator is applied also the 700 V from the HVPS Generator Circuit.

To one terminal of the primary windings of the PULSE TRANSFORMER is applied the 700 V whilst the second terminal is connected to the MOSFET (push and pull).

The pulse is generated in accordance with TRPULL and will be pushed in accordance with TRPUSH; in fact the current flows only when the Transformer is grounded with the TRPULL. Every time there is 700 V on the primary, there is, as well, -8000 V on the secondary windings of the PULSE TRANSFORMER. According to this configuration, the R.F. is sent to the antenna from the Magnetron.

To get the best operating conditions for the Magnetron, there is also a need to generate a voltage, named VFIL which is applied to a section of the secondary windings of the PULSE TRANSFORMER. As result, the FIL signal, sent to the Magnetron, has always a potential greater than the K potential.

While the TRANSCEIVER is Transmitting, the CURRENT TRANSFORMER generates the signal MCUR which:

- is used in this circuit
- is sent to the Microprocessor of the RTM CONT B board

3.3.2.3 15V ISO and 120 V Generation

In the POWER MOS Board there are also (Chapter 9, Figure 9.1.11):

- the 18 Vac circuit. This voltage, coming from the RTM CONT B Board, is applied to the ADAPTER which generates:
  - .the signal HVSTOP which disables the high voltage generation when the 18 Vac is absent
  - .the +15V ISO used to supply the Pulse Generator Circuit
- the 120 V obtained from the 700 V, whose function is to make the Performance Monitor function

3.3.3 RTM CONT B Board

The RTM CONT B board is located inside the Transceiver Unit cover and its function is to control the Transceiver operations.

The RTM CONT B board is divided in the following main circuits:

- Low Voltage Power Supply, LVPS
- Microprocessor and Gate Array
- Pulse Length Generator
- Azimuth and Heading Line Signal Circuit Generator
- Performance Monitor

3.3.3.1 Low Voltage Power Supply Circuit (LVPS)

The LVPS function is to generate the low DC voltages, (5V, -15V, 15 V), necessary to supply the Transceiver electronic circuits. As input, the circuit receives the 70 Vdc voltage from the External S-Band PSU (Chapter 9, Figure 9.1.12). These voltages are rectified, filtered and stabilised by suitable solid state components in order to get as output:

- 5 V, -15 V, + 15 V to supply all other electronic circuits
- VFIL, according with the selected Pulse

3.3.3.2 Microprocessor and Gate Array

3.3.3.2.1 General description

The heart of RTM CONT B Board, and generally of whole Transceiver, is an advanced 8 Bit MCU, (Micro-controller Unit), with highly sophisticated, on chip, peripheral capabilities. It performs the following functions:

- managing all functions of the Transceiver Unit on the basis of commands/data from the Display Unit
- preparing the feed-back signals to be sent out to the Indicator unit
- executing all internal processing to ensure the Transceiver Unit control and monitoring

The Microprocessor used in the Board is the 68HC711E9 and the on-chip memory system includes 8 Kbytes ROM, 512 bytes EEPROM, 256 bytes RAM and a Gate Array type XCS10XL. Major peripheral functions are provided on-chip.
An eight-channel A/D Converter is included, with eight bits of resolution.
Asynchronous Serial Communications Interface (SCI) and a separate synchronous Serial Peripheral Interface (SPI) are included.
The main 16-bit, free-running Timer system has three input-capture lines, five output-compare lines and a Real Time Interrupt function. An 8-bit pulse Accumulator sub-system can count external events or measure external periods. A Watch-dog system protects against software failures.

The Transceiver unit management is performed by the Microprocessor, which does not require any external PROM or RAM elements: its own memory, in fact, has sufficient capacity to store both the Operative Program and Temporary data. The necessary clock pulses are generated by a 10 MHz crystal oscillator.

In Chapter 9, Figure 9.1.13 are displayed the Microprocessor and the Gate Array general configuration, the main sub-systems and how they relate to the pins of the MCU.

3.3.3.2.2 Functions Performed

The main functions performed by the Microprocessor with the by Gate Array, on the basis of commands and selections, Remote (from Display Unit) or Local (Through the Selectors) are:

- to initialise the Transceiver operations
- to generate the trigger pulse for POWER MOS Board and the trigger (TR) and pre-trigger, (PRTR) pulse for both the Display Unit and the P.M. function
- to generate the PRESTC waveform for the NIFB Assy (STC) and the selection commands for band-width of Receiver
- to generate:

  .the VCO forwarded to Mixer

.the control signals forwarded to POWER MOS Board

- to receive the command allowing the Antenna rotation
- to perform the Hour Meter control
- to perform the processing on various sensor signals in order to monitor the correct operations of the TRANSCEIVER unit
- to provide indications on a LED type meter

3.3.3.2.3 Input Signals

Table 3.3.1 - Microprocessor Input Signals lists the Microprocessor input signals and their meaning; Table 3.3.2 - Gate Array Input Signals lists the Gate Array input signals and their meaning.

Table 3.3.1 - Microprocessor Input Signals

SIGNAL	FROM	MEANING
TEMP	On board sensor	Temperature value; to be displayed on LED Meter
AZ	Antenna Pedestal	Antenna azimuth pulse
HL	Antenna Pedestal	Antenna ship bow pulse
TUNE	Display Unit	Tuning value in remote position not serial
VFIL	On board circuit	Presence of the voltage for the Magnetron
+15V	On board circuit	Presence of the voltage
MCUR	POWER MOS Board	Magnetron cathode current pulse sample; to be displayed on LED Meter.
PWLEV	On board circuit	Information about the Power Level; to be displayed on the LED BAR
VDLEVEL	Antenna Pedestal	Main bang Video signal level; to be displayed on LED Meter

Table 3.3.2 - Gate Array Input Signals

SIGNAL	FROM	MEANING
INTEXT	Internal link	External Trigger/Internal Trigger selection
MPLC	POWER MOS Board	Magnetron transmission current
HVOK	POWER MOS Board	Transmission enabling from the High Voltage Power Supply
LINE	Power Supply Unit	Main power supply voltage frequency
PMON	Display Unit	Performance Monitor circuit switching on
SC1, SC2	Display Unit	Transmission control signals
EXTTR	External Unit	External Trigger
SLK	Unit interlock	High voltage generation disabling
EXTBLK	Antenna Pedestal Safety Switch	Consens to the transmission coming from Safety Switch
P3-P18	On board links	Links for the board configuration
P55-P58	Indication selector (S1)	4 bit for the selector position
P59-P63	Remote/Local selector (S2)	4 bit for the selector position
MINUS	MINUS push-button (S3)	Input of the MINUS push-button
PLUS	PLUS push-button (S3)	Input of the PLUS push-button
CK	Local Oscillator	Input of the 50 MHz clock
WRITE	Microprocessor	Write enabling
READ	Microprocessor	Read enabling
TR	Microprocessor	Transmission trigger
TRSTC	Microprocessor	Pre-trigger for the STC generation
DATA BUS	Microprocessor	Bit DB0-BD7 of the Data Bus
ADDRESS BUS	Microprocessor	Bit AD0-AD4 of the Address Bus

3.3.3.2.4 Output Signals

Table 3.3.3 - Microprocessor Output Signals lists the Microprocessor output signals and their meaning; Table 3.3.4 - Gate Array Output Signals lists the Gate Array output signals and their meaning.

Table 3.3.3 - Microprocessor Output Signals

SIGNAL	TO	MEANING
WRITE	Gate Array	Write Enabling
READ	Gate Array	Read Enabling
TR	Gate Array	Transmission Trigger
TRSTC	Gate Array	Pre-Trigger For The STC Generation
DATA BUS	Gate Array	Bit DB0 - BD7 Of The Data Bus
ADDRESS BUS	Gate Array	Bit AD0 - AD4 Of The Address Bus
DATA BUS	D/A converter	For The Generation Of The VCO Signal

Table 3.3.4 - Gate Array Output Signals

SIGNAL	TO	MEANING
XIRQ	Microprocessor	
IRQ	Microprocessor	Video Data Reception/Transmission Interrupt
CK10	Microprocessor	10 Mhz Clock
CS0 - CS5	Digital Potentiometers	Digital Potentiometer Chip Select
U/D, INC	Digital Potentiometers	Digital Potentiometer Control Signals
SWFIL1 - SWFIL3	LVPS Circuit	Magnetron Filament Voltage Control Signals
FAN	Unit Fans	Switching On Signal When The Temperature Is Greater Than 40 °C
ANTS	Power Supply	Antenna Switching On Signal
HRM	Power Supply	Hour-Meter Switching On Signal
SPA, MPA, LPA	Power Mos Board	HVPS Circuit Control Signals
HVON	Power Mos Board	HVPS Circuit Switching On Signal
SWB1 - SWB2	Nifb Assy	Signals For The Control Of The NIFB Bands
TRPM	Performance Monitor Circuit	Trigger For The Generation Of The Performance Monitor Ring
TRPS	Power Mos Board	Trigger PUSH For The Transmission Pulse Generation
TRPL	Power Mos Board	Trigger PULL For The Transmission Pulse Generation
GSTC	On Board Level Adapter	Gate For The STC Signal Generation
VDSTAN	Display Unit	Video Output Enabling
/VDSTAN	Display Unit	Enabling For The Output Of The Video Combined With The Digital Signals
RXCOMB	Display Unit	Serial Reception Of The Combined Video
TXCOMB	Display Unit	Serial Transmission Of The Combined Video
DISTX	Display Unit	Enabling For The Combined Transmission On The Video

3.3.3.3 Pulse Length Generator Function

The Pulse Length Generator Function (Chapter 9, Figure 9.1.13) provides the length of the pulse generated in accordance with the previous selections. In the inputs to Pulse Length Generator are the following signals: TR (Internal Trigger),BLANK, HVOK, MONOPULSE. The outputs from the PULSE GENERATOR are: TRPS and TRPL.

Upon reception of the HVOK signal, and the incoming trigger, the PULSE GENERATOR provides the GO signal. GO is an input signal in the Pulse Length Generator. This Pulse Length Generator, receiving the information relevant the Pulse Length forwards the Pulse according with the selected length. The Comparator output is the signal TTL MONOPULSE, which is an input in PAL as well. Receiving the MONOPULSE signal, TRPS and TRPL signals are generated and trough the DRIVERS are forwarded to POWER MOS Board, HVPS Area.

3.3.3.4 Azimuth and Heading Line Signal Circuit Generator

The antenna Unit must constantly forward its Azimuth position and Heading Line to the Display unit. The function of this circuit (Chapter 9, Figure 9.1.14) is to process the incoming signal AZIN and HLIN and forward to the micro controller the signal AZ and HL for blanking function.

The output signal AZOUT and HLOUT are used on the Display Unit.

3.3.3.5 Performance Monitor Function

The Performance Monitor functions (Chapter 9, Figure 9.1.15) are to monitor Transceiver performance in order to allow the Noise Ring presentation on PPI.

In the related circuit there is a diode, operating as a rivelator when the RF is received or as noise generator when the signal NE is available. When the diode is operating as rivelator he is synchronised with the peak power of the signal and the rivelator circuit can rivelate the power present at the diode starting, (GSTC triggers) 1/16 in advance of normal trigger and finishing when MCUR signal is present.

The TRPM trigger is an incoming trigger in the PM circuit and his function is to allow the generation of the NE, Noise Enabling, signal. At the same circuit will arrive, generated by the PWLEVEL, the SN, Source Noise signal as well. The delay between TRPM and NE signal is a function of SN voltage value; therefore the Noise Ring will bed function of the distance.

When the command PMON, Performance Monitor ON, is available, in the PM circuit there is the 120 Voltage as well, forwarded by POWER MOS Board and supplying a neon lamp in Antenna. A neon lamp, placed in front of the Antenna, on a monitor arm protruding from the antenna pedestal, is excited at each antenna scan by the radiated RF pulse energy, when the radiation beam crosses over. The result is that when the Performance Monitor is switched on and the neon lamp is radiated by the Magnetron RF, the RF energy causes a current variation on neon lamp and a signal is generated. A detector circuit provides to pick up this signal and to generate the signal NO, Noise Open, opening the Noise Ring.

The Neon Lamp function is to verify as well the Magnetron functioning and to provide a general idea on the output power on air.

According to the VDLEVEL signal, the proper circuit generates the NT (Noise Thickness) signal; in case of VD variation also a thickness variation occurs.

3.3.4 Solid State R.F. Head

The RF Head (Chapter 9, Figure 9.1.16) is composed of a solid state MAGNETRON stage connected to a CIRCULATOR and ending with a flange to be connected to a RF Coaxial Cable in order to transfer the RF PULSE to the

Antenna for it to be radiated.

The apposite end of the CIRCULATOR is fitted with the LIMITER and the L.N.F.E (Low Noise and Front End) composed of: the IMAGE REJECTION FILTER, the LOW NOISE AMPLIFIER, two BALANCED MIXER and the LOCAL OSCILLATOR.

The RF Head is designed to generate RF pulses in the S-Band range up to 30 kW and to process the received echo from targets, converting it into Intermediate Frequency which is then sent to the NIFB Assy.

During the transmission time, the MAGNETRON receives a high voltage trigger pulse, whose length (short/medium/long) is determined by the operator settings on Display, and generates high power RF pulses in the S-Band range until the high voltage pulse is applied to its cathode.

The RF energy generated is sent to the CIRCULATOR, and from this to the waveguide which delivers the energy for the radiating Antenna.

The CIRCULATOR is a 2-way microwave device used as a RF switch or to send the transmission pulses to the Antenna or to apply the received echoes to the Receiver.

The LIMITER device protects the highly sensitive Radar Receiver from high power RF signals, whilst maintaining low insertion loss levels throughout the Receiver.

In the receiving phase, the RF Head amplifies the S-Band echo signals provided by the Antenna by means of the LOW NOISE AMPLIFIER, and converts it into a 50 MHz signal (IF OUT), equivalent to the central frequency of the IF Amplifier, by means of the two MIXERS which receive the signal generated by the LOCAL OSCILLATOR (VCO).

3.3.5 NIFB Assy

The NIFB Assy function (Chapter 9, Figure 9.1.17) is to amplify the echo signals delivered by the RF HEAD Assy. It is composed of a Group Amplifier stages, cascade connected, with specific components so to obtain a logarithmic dynamic characteristic. The central frequency is 50 MHz and the bandwidth is 1.5 MHz for Long Pulse, 4.8 MHz for Medium Pulse and 21 MHz for Short Pulse.

To maintain the target echo signals free from any possible external induction that can degrade the performance of the Unit the DC power supply voltages and the band switching commands are applied to the module by means of a FILTER. The distortion effect that can be introduced on the IF signal caused by the presence of ripple on the DC power supply voltage, increased stage after stage in the cascade amplifier of the IF strip, can be reduced or strongly attenuated by the use of the FILTER. The purpose of this circuit, made up by coils and capacitors of suitable value, is to improve the filtering action on the DC voltage that powers each of the amplifier stages and on the signals to avoid the induction of an undesirable alternating signal component over the target signal.

The IF LOG AMPLIFIER Assy is located frontally, onto the POWER MOS mechanical box and the filter EMI Assy is located externally, on the lower side of the TRANSCEIVER box; the connection is provided by means of cables.

3.4 Antenna pedestal

3.4.1 General

This Chapter contains a description of the Antenna Pedestal S/U, and of the circuits, mainly forming the unit.

3.4.2 Pedestal Type 03R-039

As said in Chapter 1, the Pedestal, whose block diagram is shown in Chapter 9, Figure 9.1.9, is used with 12' S Band Antennas. It is equipped with a three-phase motor powered by the Transformer in the Transceiver.

The motor windings should be connected either in a star or in a triangle configuration depending on the mains voltage available, in the following manner:

Δ	3x220V 50 Hz or 3x255V 60 Hz
Y	3x380V 50 Hz or 3x440V 60 Hz

NOTE

Motors are set by the Manufacturer for 3x380V 50 Hz main supply.
The motor setting can be modified according to the ship's supply on the motor terminal board.

The motion is transmitted to the Antenna through the Gear Reduction Unit with a reduction ratio of 20.8:1 and a Driving Belt with a reduction ratio of 3:1; the final Antenna angular speed is greater than 20 rpm both at 60 Hz and at 50 Hz with a wind speed of 100 knots.

On the Antenna shaft is mounted the Optical Read-out, which generates the pulses used to determine the Antenna data (Azimuth) and the Heading Line.

The Optical read-out unit is composed of a disk rotating with the Antenna shaft and an optical sensor composed of a light generator and a Photo-diode. When in front of the optical sensor passes a hole of the disk, a pulse is generated by the Photo-diode. The pulse is sent to the Transceiver through the SIGNAL CONDITIONER circuit, mounted on the ANTSIGN BOARD, which adapt the amplitude of the pulses from the Read-out to that necessary to the Transceiver circuits.

The Heading Line pulses are obtained by means of another optical sensor, equal to the previous one, which generates a pulse when a deeper hole passes through the sensor.

The ANTSIGN BOARD is also used as support for the SAFETY SWITCH wiring (TB5). This switch positioned outside the Pedestal, when open, disable, in the Transceiver the power supply for the MOTOR thus realising a safety condition when personnel have to operate on the Pedestal both for maintenance and for repairing. The wiring from the switch enter in the Pedestal through the smaller stuffing tube. The installation is compulsory and it is recommended to install it the at the bottom of the stairs giving access to the Antenna.

WARNING

BEFORE PERFORMING ANY SERVICE ON THE ANTENNA, SWITCH TO OFF POSITION THE SAFETY SWITCH

The Pedestal is connected to the TRANSCEIVER by means of a cable, which enter the Pedestal through the bigger stuffing tube.

CHAPTER 4
PREVENTIVE MAINTENANCE

4.1 Introduction

This chapter provides the necessary information to execute the preventive maintenance operations which must be carried out in order to ensure the 30 kW S-BAND/U Antenna Group equipment full efficiency.

The maintenance procedures are described in tabular form (Card); each card lists the operations, which must be performed, their periodicity, the personnel required, the materials and the time required for their performance.

4.2 Preventive maintenance procedure

The preventive Maintenance procedures are given by means of cards. Each card, besides indicating the operations to be performed during the maintenance execution, lists the following indications:

- PERIODICITY: it is an alphanumeric code to identifying the maintenance action described. The following periodicity symbols, as appropriate, are used in the order of increasing periodicity interval as listed in the following:

  .M: Monthly

  .S: Semi-Annual

  .A : Annually

  .WR: When Required

The Table 4.2.2 - List of the Preventive Maintenance Cards lists the Preventive Maintenance cards and, for each of them, indicates the periodicity and the required time.

- PERSONNEL: it indicate the number and the typology of the personnel able to perform the maintenance operations. On the assumption that the qualification, knowledge, experience and skill needed to fulfil the task assigned are proportional to the ranks, the following abbreviations are used:

  .ST: is a qualified persons with not less than ten years of experience on the job

  .JT: is a qualified person with more than four years of experience on the job

  .R: is a young technician with less than four years of experience on the job, he can be either qualified or undergoing qualification

- REQUIRED INSTRUMENTS: it indicates the tools or the instruments which are used in the card operations; Table 4.2.1 - List of Recommended Tools and Instruments lists the tools, the instruments and the material required to perform the Preventive Maintenance operations
- REQUIRED TIME: it indicates the total time required to perform the card operations
- SAFETY PRECAUTIONS: it indicates the precaution to be followed in order to ansure a safety Preventive Maintenance operation execution

Table 4.2.1 - List of Recommended Tools and Instruments

PR.	DESCRIPTION	TYPE	NOTE
1	Digital Multimeter	CHAUVIN ARNOUX CPA 9651 (3:5)	or equivalent
2	Oscilloscope	Tektronics	
3	30W welders		
4	Solder		
5	Desoldering tool	SILVERSTAT	
6	Vacuum cleaner		
7	Set of screwdrivers	USAG	Insulating handle
8	Set of open wrenches	USAG	
9	Set of communication tools		

Table 4.2.2 - List of the Preventive Maintenance Cards

PROG.	OPERATION	PERIODICITY	REQUIRED TIME
Card 1	Check of the External Conservation Status	S1	15'
Card 2	Internal inspection and general cleaning of the 30 kW S-BAND/U Antenna Group unit	S2	15'
Card 3	Internal inspection and general cleaning of the Antenna Pedestal S/U Unit	S3	15'
Card 4	Replacement of the Magnetron	8000 hours	45'
Card 5	Trigger Delay Adjustment	WR	30'
Card 6	VCO Calibration	WR	30'
Card 7	Optical Read-out Alignment	WR	30'
Card 8	Performance Monitor Assy calibration (if present)	WR	30'

CARD 1

UNIT	OPERATION	PERIODICITY
30 kW S-BAND/U Antenna Group	Check of the External Conservation Status	S1
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1R	None	15 minutes

SAFETY PRECAUTIONS

On the electric switchboard, set to OFF the power breaker relevant to the unit and hang to it a placard reading "WORK IN PROGRESS - DO NOT SWITCH ON"

STEP	SEQUENCE OF OPERATIONS
1.	Check that no parts of the plastic covering the antenna have been painted.
2.	Check the casing conservation state.
3.	Grease the fastening screws of the cover to avoid corrosion and facilitate future inspections.
4.	If paint has been scratched off at any point, proceed as follows: – Carefully degrease the part to be painted – Smooth lightly with emery paper – Clean with a dry brush – Apply a coat of anticorrosive – When the applied anticorrosive is dry, paint with a brush or, better still, by spraying.

CARD 2

UNIT	OPERATION	PERIODICITY
TRANSCEIVER	Internal inspection and general cleaning of the TRANSCEIVER unit	S2
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1R	Set of screwdrivers, Electro Contact Cleaner, Soft brush, Primer, Paint, Emery paper, Soft cloth	15 minutes

SAFETY PRECAUTIONS

On the electric switchboard, set to OFF the power breaker relevant to the unit and hang to it a placard reading "WORK IN PROGRESS - DO NOT SWITCH ON"

STEP	SEQUENCE OF OPERATIONS
	Internal Multipin Connectors and Cables Inspection
1.	By means of the proper screwdriver, unscrew the 6 screws (Chapter 9, Figure 9.1.19 pos. 1) locking the front cover (Chapter 9, Figure 9.1.19 pos. 2) and open the former.
2.	Check the conditions of each connector electric contacts (pins and plugs), connector packing and of its cable. Clean contacts by using Electro Contact Cleaner. Repair or replace, if necessary, any defective parts.
	Check for Loose Screws
3.	Check, carefully, that all cabinet internal screws are not loose, especially the screws fastening terminal lugs on TB.
4.	Replace or tighten firmly as necessary.
	General Cleaning
5.	By using a soft brush and alcohol, remove dust, ash and grease from the internal components.
6.	Dry the surfaces by using an unfraid soft cloth.
7.	Reinstall the front cover and tighten the twelve screws as necessary.
8.	By using a soft brush and alcohol, remove dust, ash and grease from the external surfaces of RTM cabinet.
9.	Dry the surfaces by using an unfraid soft cloth.
	Detailed Overall Inspection and Cleaning
10.	Check the state of preservation of the TRANSCEIVER unit cabinet.
11.	If paint has been scratched off at any point, proceed as follows: – carefully degrease the part to be painted – smooth lightly with emery paper – apply a coat of primer – when the primer is dry, paint by brush or better still by spraying – with a brush remove any dust deposited inside the unit – with a jet of compressed air eliminate all traces of dust
12.	On the electric switchboard set to ON the power breaker relevant to unit under test and remove the warning placard.

CARD 3

UNIT	OPERATION	PERIODICITY
Antenna Pedestal S/U	Internal inspection and general cleaning of the Antenna Pedestal S/U Unit	S3
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1R	Set of screwdrivers, Electro Contact Cleaner, Soft brush, Primer, Paint, Emery paper, Soft cloth	15 minutes

SAFETY PRECAUTIONS

On the electric switchboard, set to OFF the power breaker relevant to the unit and hang to it a placard reading "WORK IN PROGRESS - DO NOT SWITCH ON"

STEP	SEQUENCE OF OPERATIONS
1.	By means of the open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.23 pos. 1) fixing the cover (Chapter 9, Figure 9.1.23 pos. 2) and remove the former.
2.	Check the internal state of casing and if paint has been scratched off at any point, proceed as per Card 1
3.	Check: – the power connection cable; – the electrical and electronic circuits and mechanical components. Remove and replace components if and when necessary.
4.	Cleaning is necessary only when layers, often dark layers, can be clearly seen on some area. If these layers are visible, they must be removed with a dry cloth. Only if really necessary, repeat the procedure with a cloth dampened in carbon tetrachloride. A special brush for cleaning, of appropriate size, may also be used. If and when necessary use an air-brush to remove dust from inside the pedestal
5.	Check the Antenna position indicator components. Replace components or the unit according to the needs
6.	Check the Driving Belt tension and integrity. Replace the belt if necessary.
7.	Reassemble the cover using the reverse procedure.
8.	Grease the fastening nuts of the cover to avoid corrosion and facilitate future inspections

CARD 4

UNIT	OPERATION	PERIODICITY
TRANSCEIVER	Replacement of the Magnetron	WR (8000 hours)
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1JT	Set of screwdrivers, Silicone grease compound 340	45 minutes

SAFETY PRECAUTIONS

On the electric switchboard, set to OFF the power breaker relevant to the unit and hang to it a placard reading "WORK IN PROGRESS – DO NOT SWITCH ON"

STEP	SEQUENCE OF OPERATIONS
	Removal
1.	By means of the proper screwdriver, unscrew the 6 screws (Chapter 9, Figure 9.1.19 pos. 1) locking the front cover (Chapter 9, Figure 9.1.23 pos. 2) and open the former.
2.	Disconnect the Magnetron (Chapter 9, Figure 9.1.21 pos. 1), by extracting it from the relevant site.
3.	By means of the proper screwdriver, unscrew the six screws (Chapter 9, Figure 9.1.21 pos. 2) fixing the Magnetron (Chapter 9, Figure 9.1.21 pos. 3) to the support (Chapter 9, Figure 9.1.21 pos. 4).
4.	Remove the Magnetron from its support.
	Installation
5.	Before fastening the Magnetron to the proper seat, spread a layer of silicone grease on the Magnetron surface which is in contact with the cabinet rear wall in order to increase the Magnetron heating surface dissipation.
6.	In order to install the new Magnetron, perform the removal operations in reverse order without closing the cover.
7.	Position selector S2 of RTM CONT B Board (Chapter 9, Figure 9.1.22 pos. 3) on position 2.
8.	Perform the following operations: – position the power breaker to ON; – remove the Power Supply cover; – on the Power Supply, position the switch SW1 on position SERVICE MODE; – wait for 15 minutes. As an alternative, set the Display in Stand-by and wait for 15 minutes.
9.	By following the procedures of Card 6, perform the VCO calibration.
10.	By following the procedures of Card 8, perform the calibration of the Performance Monitor circuit (if present).
11.	Perform the following operations: – on the Power Supply, position the switch SW1 on position NORMAL – on RTM CONT B Board, position S1 (Chapter 9, Figure 9.1.22 pos. 2) and S2 on 0 (zero) – close the front cover and tighten the 6 screws as necessary

CARD 5

NOTE

The operations described in this card are necessary only when the RTM is connected to Display Systems type PRORA, SELESCAN or MASTERMATE of first generation. For the NAVBAT and MASTERMATE displays, the adjustment can be made directly on the display.

UNIT	**OPERATION**	**PERIODICITY**
TRANSCEIVER	Trigger Delay Adjustment	WR
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1ST, 1JT	Set of screwdrivers, Set of Allen wrenches, Set of Voice Communication	30 minutes

SAFETY PRECAUTIONS

Follow the standard safety rules

STEP	**SEQUENCE OF OPERATIONS**

NOTE

The voice communication device (telephone set or walkie-talkie) must be provided between the RTM operator and the Display operator.

WARNING

HIGH VOLTAGES ARE PRESENT INSIDE THE UNIT.
DO NOT OPEN THE CABINET COVER BEFORE THE MAIN LINE BREAKER HAS BEEN TURNED OFF. ALL WORK PERFORMED ON THE RTM MUST BE CAREFULLY RECORDED IN THE UNIT LOGBOOK.
BEFORE STARTING ANY MAINTENANCE WORK, IT IS MANDATORY THAT, FOR THE SAFETY OF PERSONNEL, ALL HIGH-VOLTAGE CAPACITORS BE SHORT-CIRCUITED BY MEANS OF A WELL INSULATED SCREWDRIVER OR OTHER SUITABLE TOOL.
BEFORE CONNECTING INSTRUMENTATION USED FOR PERFORMING MEASUREMENTS INSIDE THE UNIT, IT IS ADVISABLE TO SWITCH OFF THE POWER SUPPLY. DO NOT ALTER THE SETTING OF THE SEMIOPERATIVE CONTROLS UNLESS A SPECIFIC ADJUSTMENT IS REQUIRED AND THE NECESSARY TEST EQUIPMENT IS AVAILABLE.

1. On the Display, set the range selector to the shorter range.
2. Takes as a reference an object that can be detected on the Display and measure accurately its distance from the Antenna.
3. Ask to the Display operator to read the distance of the object on the Display.
4. Compare the above measurement with the range displayed on the Display
5. If the distances are the same, stop the procedure.
6. If the distances are not the same, operate on the RTM as follow:
   - on the Display switch OFF the RTM Unit;
   - unscrew the 6 screws (Chapter 9, Figure 9.1.19 pos. 1) locking the front cover (Chapter 9, Figure 9.1.19 pos. 2) and open the former;
   - on the TRANSCEIVER unit, pull the switch SW2 (Chapter 9, Figure 9.1.20 pos. 1);
   - on the RTM CONT B Board, perform the jumper P17(Chapter 9, Figure 9.1.22 pos. 1);
   - on the RTM CONT B Board, position the selector S1 (Chapter 9, Figure 9.1.22 pos. 2) on position 6;

(Continue)

CARD 5 (Continues)

STEP	SEQUENCE OF OPERATIONS
	– on the Display switch on the RTM unit; – by means of the push-buttons plus and minus of the RTM CONT B Board (Chapter 9, Figure 9.1.22 pos. 11), adjust the trigger until the distance displayed on the Display and the distance measured are equal; – on the Display switch off the RTM Unit; – on RTM CONT B Board, position S1 and S2 (Chapter 9, Figure 9.1.22 pos. 3) on 0 (zero); – remove the jumper P17.
7.	Reinstall the front cover and tighten the 6 screws as necessary.

CARD 6

UNIT	**OPERATION**	**PERIODICITY**
TRANSCEIVER	VCO Calibration	WR
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1ST	Set of screwdrivers, Set of Allen wrenches, Oscilloscope, Multimeter	30 minutes

SAFETY PRECAUTIONS

Follow the standard safety rules

STEP	**SEQUENCE OF OPERATIONS**

WARNING

HIGH VOLTAGES ARE PRESENT INSIDE THE UNIT. DO NOT OPEN THE CABINET COVER BEFORE THE MAIN LINE BREAKER HAS BEEN TURNED OFF. ALL WORK PERFORMED ON THE RTM MUST BE CAREFULLY RECORDED IN THE UNIT LOG BOOK. BEFORE STARTING ANY MAINTENANCE WORK, IT IS MANDATORY THAT, FOR THE SAFETY OF PERSONNEL, ALL HIGH-VOLTAGE CAPACITORS BE SHORT-CIRCUITED BY MEANS OF A WELL INSULATED SCREWDRIVER OR OTHER SUITABLE TOOL.
BEFORE CONNECTING INSTRUMENTATION USED FOR PERFORMING MEASUREMENTS INSIDE THE UNIT, IT IS ADVISABLE TO SWITCH OFF THE POWER SUPPLY. DO NOT ALTER THE SETTING OF THE SEMIOPERATIVE CONTROLS UNLESS A SPECIFIC ADJUSTMENT IS REQUIRED AND THE NECESSARY TEST EQUIPMENT IS AVAILABLE.

1. By means of the proper screwdriver, unscrew the 6 screws (Chapter 9, Figure 9.1.19 pos. 1) locking the front cover (Chapter 9, Figure 9.1.19 pos. 2) and open the former.
2. On RTM CONT B Board, position S1 (Chapter 9, Figure 9.1.22 pos. 2) on 1 (one) and S2 (Chapter 9, Figure 9.1.22 pos. 3) on 2 (two).
3. On the TRANSCEIVER unit, pull SW2 (Chapter 9, Figure 9.1.20 pos. 1).
4. Remove the Power Supply cover.
5. On the RTM 30S Power Supply, position SW1 on SERVICE MODE and wait for 3 minutes.
6. When the RTM is ready, on RTM CONT B board perform the following operations:
   - position S2 on 5
   - rotate the potentiometer R63 (Chapter 9, Figure 9.1.22 pos. 7) completely CCW
   - rotate the potentiometer R63 CW and verify that the indication of the LED BAR (Chapter 9, Figure 9.1.22 pos. 4) starting from the minimum reaches the maximum and return to the minimum.
7. On RTM CONT B Board, rotate R63 in order to reach the maximum indication on the LED BAR and, by means of the Multimeter, on TB12 (Chapter 9, Figure 9.1.22 pos. 8), measure the value of VCO and take note of its value.
8. On RTM CONT B Board, perform the following operations:
   - rotate R63 to obtain the minimum level;
   - connect the Multimeter between the pin VCO of TB10 and the ground
   - by operating on R44 (Chapter 9, Figure 9.1.22 pos. 9), adjust the output voltage to VCO (measured at step 7) -2 V
   - rotate R63 until the maximum voltage is read on the Multimeter
   - by operating on R48 (Chapter 9, Figure 9.1.22 pos. 10), adjust the output voltage to VCO (measured at step 7) +2 V
   - rotate R63 in order to reach the maximum indication on the LED BAR

(Continue)

CARD 6 (Continues)

STEP	SEQUENCE OF OPERATIONS
	NOTE *The following adjustment is necessary only when the RTM is connected to Display Systems type PRORA, SELESCAN or MASTERMATE of first generation. For the NAVBAT and MASTERMATE displays, the adjustment can be made directly on the display.*
9.	If necessary, perform the following operations: – on the RTM CONT B Board, perform the jumper P17 (Chapter 9, Figure 9.1.22 pos. 1); – position S1 on position 4; – act on the push-buttons plus and minus of the RTM CONT B Board (Chapter 9, Figure 9.1.22 pos. 11), in order to obtain a LED BAR indication of about 128; – remove the jumper P17.
10.	Perform the following operations: on the Power Supply, position the switch SW1 on position NORMAL; on RTM CONT B board, position S1 and S2 on 0 (zero).
11.	Reinstall the cover of the Power Supply.
12.	Close the front cover of the TRANSCEIVER and tighten the 6 screws as necessary.

CARD 7

UNIT	OPERATION	PERIODICITY
Antenna Pedestal S/U	Optical Read-out Alignment	WR
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1ST	Set of screwdrivers, Set of open wrenches	30 minutes

SAFETY PRECAUTIONS

Be sure the unit is switched OFF; set the safety switch to OFF and hang to it a placard reading "WORK IN PROGRESS DO NOT SWITCH ON".

STEP	SEQUENCE OF OPERATIONS
1.	By means of the open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.23 pos. 1) fixing the cover (Chapter 9, Figure 9.1.23 pos. 2) and remove the former.
2.	Rotate the Antenna by hand to athwartship position to align the Antenna Beam with the ship's bow
3.	By using the proper screwdriver, loose the screws fixing the Antenna Generator Disk to the Belt Pulley.
4.	Rotate the Antenna Generator Disk until the bow indication on the disk (a lug deeper) is in the Optical Read-out unit.
5.	Fix the screws fixing the Antenna Generator Disk.
6.	Reassemble the cover using the reverse procedure.
7.	Grease the fastening nuts of the cover to avoid corrosion and facilitate future inspections

CARD 8

NOTE

The operations described in this card are necessary only when the RTM is connected to Display Systems type PRORA, SELESCAN or MASTERMATE of first generation. For the NAVBAT and MASTERMATE displays, the adjustment can be made directly on the display.

UNIT	**OPERATION**	**PERIODICITY**
TRANSCEIVER	Performance Monitor calibration (if present)	WR
PERSONNEL	**REQUIRED INSTRUMENTS**	**REQUIRED TIME**
1ST	Set of screwdrivers, Set of Allen wrenches, Set of Voice Communication, Oscilloscope, Multimeter	30 minutes

SAFETY PRECAUTIONS

Follow the standard safety rules

STEP	**SEQUENCE OF OPERATIONS**
	NOTE *The voice communication device (telephone set or walkie-talkie) must be provided between the RTM operator and the Display operator.*
	WARNING HIGH VOLTAGES ARE PRESENT INSIDE THE UNIT. DO NOT OPEN THE CABINET COVER BEFORE THE MAIN LINE BREAKER HAS BEEN TURNED OFF. ALL WORK PERFORMED ON THE RTM MUST BE CAREFULLY RECORDED IN THE UNIT LOG BOOK. BEFORE STARTING ANY MAINTENANCE WORK, IT IS MANDATORY THAT, FOR THE SAFETY OF PERSONNEL, ALL HIGH-VOLTAGE CAPACITORS BE SHORT-CIRCUITED BY MEANS OF A WELL INSULATED SCREWDRIVER OR OTHER SUITABLE TOOL. BEFORE CONNECTING INSTRUMENTATION USED FOR PERFORMING MEASUREMENTS INSIDE THE UNIT, IT IS ADVISABLE TO SWITCH OFF THE POWER SUPPLY. DO NOT ALTER THE SETTING OF THE SEMIOPERATIVE CONTROLS UNLESS A SPECIFIC ADJUSTMENT IS REQUIRED AND THE NECESSARY TEST EQUIPMENT IS AVAILABLE.
1.	By means of the proper screwdriver, unscrew the 6 screws (Chapter 9, Figure 9.1.19 pos. 1) locking the front cover (Chapter 9, Figure 9.1.19 pos. 2) and remove the former.
2.	On the TRANSCEIVER, pull SW2 (Chapter 9, Figure 9.1.20 pos. 1).
3.	On the Display, select Performance Monitor ON and tune the RTM.
4.	On the Display check that the Noise Ring is placed at the correct distance, otherwise adjust the distance by performing the following operations: – on the RTM CONT B Board, perform the jumper P17 (Chapter 9, Figure 9.1.22 pos. 1); – on the RTM CONT B Board, position S2 (Chapter 9, Figure 9.1.22 pos. 3) on position 2; – by acting on the push-buttons plus and minus of the RTM CONT B Board (Chapter 9, Figure 9.1.22 pos. 11), position the ring to the proper distance; – remove the jumper P17.

(Continue)

Card 8 (CONTINUES)

STEP	SEQUENCE OF OPERATIONS
5.	On the Display check that the Noise Ring aperture is the correct one, otherwise adjust the opening by performing the following operations: – on the RTM CONT B Board, perform the jumper P17; – position S1 (Chapter 9, Figure 9.1.22 pos. 2) on position 3; – by acting on the push-buttons plus and minus of the RTM CONT B Board, set the correct aperture; – remove the jumper P17.
6.	On the Display check that the Noise Ring thickness varies by varying the tuning.
7.	On the Display check that when the RTM is tuned, the thickness of the noise ring is between 1.5 and 2 NM. Otherwise adjust the thickness by performing the following operations: – on the RTM CONT B Board, perform the jumper P17; – position S1 on position 4; – by acting on the push-buttons plus and minus of the RTM CONT B Board, set the correct thickness; – remove the jumper P17.
8.	Perform the following operations: – on RTM position the switch SW1 on position NORMAL – on RTM CONT B board, position S1 and S2 on 0 (zero)
9.	Close the front cover of the TRANSCEIVER unit and tighten the 6 screws as necessary.

CHAPTER 5
TROUBLESHOOTING

5.1 Introduction

5.1.1 General

This chapter indicates the procedures to be followed locate the faulty component when a trouble is met in the 30 kW S-BAND/U Antenna Group unit.

5.1.2 Organisation

The troubleshooting procedures are described by means of flow charts. When the faulty component is located, refer to Chapter 6 for its replacement.

5.1.3 Personnel

The personnel involved in the troubleshooting procedures must be made of skilled technician and must have a good knowledge of the equipment.

5.1.4 Tools and Instruments

For the execution of the troubleshooting procedures, besides usual tools (screwdrivers, pliers, etc.), the following instruments are required:

Table 5.1.1 - List of Recommended Instruments

POS.	DESCRIPTION	TYPE	NOTE
1	Digital Multimeter	CHAUVIN ARNOUX CPA 9651 (3:5)	or equivalent
2	Oscilloscope	Tektronix	or equivalent

5.2 Troubleshooting Procedures

5.2.1 Safety Precautions

WARNING

OPERATE WITH CARE ON THE RTM UNIT BECAUSE OF HIGH VOLTAGES AND HIGH POWER.

5.2.2 Troubleshooting Operations

Table 5.2.1 lists the possible failures which can arise met during the equipment functioning. If another type of failure is met, call the Manufacturer Service.

Table 5.2.2 - List of Main Possible Failures

PR.	FAULT	REMEDY
1	With RTM switched on, on the Display no signal is received	Figure 9.1.24
2	The RADAR Antenna does not rotate	Figure 9.1.25
3	The Display does not receive the Video Signal	Figure 9.1.26
4	The Display does not receive the signal AZ	Figure 9.1.27
5	The Display does not receive the signals HL	Figure 9.1.28
6	At the switching on, the Antenna does not rotate	By using the Multimeter, measure the power supply on the Motor Group wiring; Then: - if the power supply is present, replace the Motor (para 6.2.2.2) - if the power supply is not present, replace 3 Φ Filter (para 6.2.2.4)
7	There is not H.L. or Antenna data signal	Replace in sequence: - the Antsign Board (para 6.2.2.6) - the Optical Read-out or the Encoder (para 6.2.2.7 or 6.2.2.8)

CHAPTER 6
CORRECTIVE MAINTENANCE

6.1 General

6.1.1 Introduction

This chapter provides the procedure, which must be followed to replace a faulty component of the 30 kW S-BAND/U Antenna Group Unit according to the troubleshooting procedures of Chapter 5.

6.1.2 Safety Precautions

If not otherwise specified in the procedures, during the corrective maintenance operations, the following safety rules must be followed:

- each maintenance operation must be carried out only after the equipment has been switched OFF

WARNING

SET TO OFF THE MAIN BREAKER OF THE EQUIPMENT AND HANG TO IT A PLACARD READING "WORK IN PROGRESS DO NOT SWITCH ON".

- before removing any component, be sure the spare part is available
- verify the integrity of the spare part and, if possible, perform a functional test

6.1.3 Personnel

The replacement operations must be carried out by skilled personnel with a good knowledge of the equipment.

6.1.4 Required Tools and Instruments

To carry out the replacement operations described in this chapter, only normal workshop tools (as screwdrivers, wrenches etc.) are required.

The tools required to perform the corrective maintenance operations are:

- set of screwdrivers

- set of open wrenches
- set of socket wrenches
- soldering iron

6.2 Corrective maintenance procedures

This paragraph provides a detailed description of the operations to be carried out in order to replace a damaged component. Table 6.2.1 - List of the Corrective Maintenance Procedures lists the Corrective Maintenance procedures.

Table 6.2.1 - List of the Corrective Maintenance Procedures

PARA	COMPONENT TO BE REPLACED
6.2.1	Replacement Procedures for the TRANSCEIVER Unit
6.2.1.1	Replacement of a Fuse
6.2.1.2	Replacement of the POWER MOS Board
6.2.1.3	Replacement of the LNFE Assy
6.2.1.4	Replacement of the RTM CONT B Board
6.2.1.5	Replacement of the NIFB Assy
6.2.1.6	Replacement of the Magnetron
6.2.2	Replacement Procedures for the Antenna Pedestal S/U Unit
6.2.2.1	Driving Belt Replacement
6.2.2.2	Motor Replacement
6.2.2.3	Reduction Group Replacement
6.2.2.4	3 Φ Filter Replacement
6.2.2.5	Rotating Joint Replacement
6.2.2.6	Antsign Board Replacement
6.2.2.7	Optical Read-out Board Replacement
6.2.2.8	Antenna Generator Disk Replacement

6.2.1 Replacement Procedures for the TRANSCEIVER Unit

6.2.1.1 Replacement of a Fuse

a) Required Tools

- set of screwdrivers

b) Removal

1. By means of the proper screwdriver, unscrew the six screws (Chapter 9, Figure 9.1.29 pos. 1) locking the front cover (Chapter 9, Figure 9.1.29 pos. 2) and open the former
2. By means of the hands, unscrew the fuse-holder cap

(Chapter 9, Figure 9.1.30 pos. 1)

3. Remove the fuse from the fuse-holder

c) Installation

1. In order to install the new fuse, perform the removal operations in reverse order

6.2.1.2 Replacement of the POWER MOS Board

a) Required Tools

- set of open wrenches
- set of screwdrivers

b) Removal

1. By means of the proper screwdriver, unscrew the six screws (Chapter 9, Figure 9.1.29 pos. 1) locking the front cover (Chapter 9, Figure 9.1.29 pos. 2) and open the former
2. Remove the POWER MOS Board (Chapter 9, Figure 9.1.30 pos. 2) cabling by tacking note of its disposition
3. By means of the proper open wrench, unscrew the nuts (Chapter 9, Figure 9.1.30 pos. 3) fastening the POWER MOS Assy to the frame and remove the Assy
4. By means of the proper open screw, unscrew the nuts fastening the POWER MOS board to the Assy and remove the board

c) Installation

1. In order to install the new Electronics Assy with POWER MOS board, perform the removal operations in reverse order
2. By following the procedures of Card 8 of Chapter 4, calibrate the Performance Monitor circuit (if present); during the calibration do not take into account the steps relevant to the Noise Ring distance

6.2.1.3 Replacement of the LNFE Assy

a) Required Tools

- set of screwdrivers
- set of Allen wrenches

b) Removal

1. By means of the proper screwdriver, unscrew the six screws (Chapter 9, Figure 9.1.29 pos. 1) locking the front cover (Chapter 9, Figure 9.1.29 pos. 2) and open the former

2. Disconnect the LNFE Assy (Chapter 9, Figure 9.1.30 pos. 4) cabling by tacking note of its disposition
3. By means of the proper Allen wrench, unscrew the four nuts (Chapter 9, Figure 9.1.30 pos. 5) fixing the LNFE Assy to the support (Chapter 9, Figure 9.1.30 pos. 6)
4. Remove the LNFE Assy from its support

c) Installation

1. In order to install the new Front End, perform the removal operations in reverse order
2. By following the procedures of Card 6 of Chapter 4, calibrate the VCO

6.2.1.4 Replacement of the RTM CONT B Board

a) Required Tools

- set of open wrenches

b) Removal

1. By means of the proper screwdriver, unscrew the six screws (Chapter 9, Figure 9.1.29 pos. 1) locking the front cover (Chapter 9, Figure 9.1.29 pos. 2) and open the former
2. Remove the RTM CONT B Board (Chapter 9, Figure 9.1.31 pos. 2) cabling by tacking note of its disposition
3. By means of the proper open wrench, unscrew the nuts (Chapter 9, Figure 9.1.31 pos. 3) fastening the RTM CONT B Assy to the cover and remove the Assy
4. By means of the proper open screw, unscrew the nuts fastening the RTM CONT B Board to the Assy and remove the board

c) Installation

1. In order to install the new RTM CONT B Board, perform the removal operations in reverse order
2. Carry out the following operations:
   - by following the procedures of Card 5 of Chapter 4, adjust the Trigger Delay
   - by following the procedures of Card 6 of Chapter 4, calibrate the VCO
   - by following the procedures of Card 8 of Chapter 4, calibrate the Performance Monitor circuit (if present); during the calibration do not take into account the steps relevant to the Noise Ring distance

6.2.1.5 Replacement of the NIFB Assy

a) Required Tools

- set of screwdrivers

b) Removal

1. By means of the proper screwdriver, unscrew the six screws (Chapter 9, Figure 9.1.29 pos. 1) locking the front cover (Chapter 9, Figure 9.1.29 pos. 2) and open the former
2. Remove the NIFB Assy (Chapter 9, Figure 9.1.31 pos. 4) cabling by tacking note of its disposition
3. By means of the proper screwdriver, unscrew the four screws (Chapter 9, Figure 9.1.31 pos. 5) fastening the NIFB Assy to the Electronics Assy mechanical frame and remove the NIFB

c) Installation

1. In order to install the new NIFB Assy, perform the removal operations in reverse order
2. By following the procedures of Card 6 of Chapter 4, calibrate the VCO

6.2.1.6 Replacement of the Magnetron

To replace the Magnetron, perform the procedures of Card 4 of Chapter 4.

6.2.2 Replacement Procedures for the Antenna Pedestal S/U Unit

6.2.2.1 Driving Belt Replacement

a) Required Tools

- Set of open wrenches
- Set of Allen keys
- Set of screwdrivers

b) Removal

1. By using the proper open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.32 pos. 1) fixing the cover (Chapter 9, Figure 9.1.32 pos. 2) and remove the former
2. Disconnect the connector of the Cable Assy (Chapter 9, Figure 9.1.33 pos. 1) from the one coming from the RTM
3. By using the proper open wrench, loose and remove the bolts (Chapter 9, Figure 9.1.33 pos. 2) fixing the antirotating structure (Chapter 9, Figure 9.1.33 pos. 3) to the Pedestal

structure

4. By using the proper open wrench, loose the four bolts (Chapter 9, Figure 9.1.34 pos. 1) fixing the Motor and the Gear Reduction Group plate (pos. 2)
5. By acting on the Motor, push the plate in order to release the Driving Belt (Chapter 9, Figure 9.1.34 pos. 4)
6. Remove the Driving Belt from its seats by paying attention to not damage the Cable Assy and the Rotating Joint

c) Installation

1. In order to install the new Driving Belt, perform the removing steps in reverse order

6.2.2.2 Motor Replacement

a) Required Tools

- Set of open wrenches
- Set of Allen keys
- Set of screwdrivers

b) Removal

1. By using the proper open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.32 pos. 1) fixing the cover (Chapter 9, Figure 9.1.32 pos. 2) and remove the former
2. By using the proper screwdriver, remove the Motor cabling from the 3 Φ Filter (Chapter 9, Figure 9.1.33 pos. 5) tacking note of its position
3. By using the proper open wrench, loose the stuffing tube (Chapter 9, Figure 9.1.34 pos. 3) of the Motor power supply cable
4. By using the proper Allen key, loose and remove the nuts (Chapter 9, Figure 9.1.34 pos. 4) fixing the Motor to the plate (Chapter 9, Figure 9.1.34 pos. 2)
5. Extract the Motor from the structure, paying attention. Not to damage the power supply cable

c) Installation

1. In order to install the new Motor, perform the removal steps in reverse order

6.2.2.3 Reduction Group Replacement

a) Required Tools

- Set of open wrenches
- Set of Allen keys
- Set of screwdrivers

b) Removal

1. Remove the Motor as described in para 6.2.2.2
2. By using the proper screwdriver, remove the cable-tightener (Chapter 9, Figure 9.1.33) from the Reduction Group
3. By using the proper open wrench, loose and remove the bolts fixing the Reduction Group (Chapter 9, Figure 9.1.33) to the plate (Chapter 9, Figure 9.1.34 pos. 2)
4. Extract the Reduction Group from the Pedestal structure paying attention. Not to damage the internal components

c) Installation

1. In order to install the new Reduction Group, perform the removal steps from in reverse order

6.2.2.4 3 Φ Filter Replacement

a) Required Tools

- Set of open wrenches
- Set of Allen keys
- Set of screwdrivers

b) Removal

1. By using the proper open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.32 pos. 1) fixing the cover (Chapter 9, Figure 9.1.32 pos. 2) and remove the former
2. By using the proper screwdriver, remove the 3Φ Filter (Chapter 9, Figure 9.1.33 pos. 5) cabling tacking note of its original position
3. By using the proper Allen key, loose and remove the screws fixing the 3Φ Filter and remove the filter

c) Installation

1. In order to install the new 3Φ Filter, perform the removing steps in reverse order

6.2.2.5 Rotating Joint Replacement

a) Required Tools

- Set of open wrenches

b) Removal

1. Disconnect the connector of the Antenna cable from the Rotating Joint (Chapter 9, Figure 9.1.32 pos. 3)
2. By using the proper open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.32 pos. 1) fixing the cover (Chapter 9, Figure 9.1.32 pos. 2) and remove the former
3. By using the proper open wrench, loose and remove the nuts fixing the Rotating Joint to the flange (Chapter 9, Figure 9.1.32 pos. 4)
4. By using the proper open wrench, loose and remove the bolts (Chapter 9, Figure 9.1.33 pos. 2) fixing the antirotating structure (Chapter 9, Figure 9.1.33 pos. 3) to the Pedestal structure
5. Pull the Rotating Joint until the connector of the Antenna Cable is visible
6. Disconnect the Cable Assy connector from the Rotating Joint
7. Remove the Rotating Joint

c) Installation

1. In order to install the new Rotating Joint, perform the removal steps in reverse order.

6.2.2.6 Antsign Board Replacement

a) Required Tools

- Set of open wrenches
- Set of screwdrivers

b) Removal

1. By using the proper open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.32 pos. 1) fixing the cover (Chapter 9, Figure 9.1.32 pos. 2) and remove the former
2. Remove the connectors from the Antsign Board (Chapter 9, Figure 9.1.33 pos. 8) tacking note of their position
3. By using the proper screwdriver, loose and remove the screws fixing the board and remove the former

c) Installation

1. In order to install the new board, perform the removal steps in reverse order

WARNING

THE CONNECTORS OF THE BOARD ARE OF DIFFERENT TYPE SO IT IS NOT POSSIBLE TO INSERT A CONNECTOR IN A WRONG POSITION.
WHEN INSERTING THE CONNECTORS DO NOT FORCE THEM; IF THE INSERTION IS NOT EASY, IT MEANS THAT THE CONNECTOR IS NOT INSERTED IN THE PROPER POSITION.

6.2.2.7 Optical Read-out Board Replacement

a) Required Tools

- Set of open wrenches
- Set of screwdrivers

b) Removal

1. By using the proper open wrench, loose and remove the four nuts (Chapter 9, Figure 9.1.32 pos. 1) fixing the cover (Chapter 9, Figure 9.1.32 pos. 2) and remove the former
2. Remove the flat cable connector (Chapter 9, Figure 9.1.33 pos. 9) from the Optical Read-out Board (Chapter 9, Figure 9.1.33 pos. 10)
3. By using the proper screwdriver, loose and remove the screws (Chapter 9, Figure 9.1.33 pos. 11) fixing the board to the support and remove the board

c) Installation

1. In order to install the new board, perform the removal steps in reverse order

6.2.2.8 Antenna Generator Disk Replacement

a) Required Tools

- Set of open wrenches
- Set of screwdrivers

b) Removal

1. By following the steps of previous para 6.2.2.1, remove the Driving Belt
2. By following the steps of previous para 6.2.2.7, remove the Optical Read-out Board
3. By using the proper tools, remove the Belt Pulley from the shaft and remove the pulley
4. By using the proper screwdriver, loose and remove the screws (Chapter 9, Figure 9.1.33 pos. 12) fixing the

Antenna Generator Disk (Chapter 9, Figure 9.1.33 pos. 13) to the Belt Pulley and remove the disk

c) Installation

1. In order to install the new disk, perform the removal steps in reverse order.
2. By following the steps of Card 7 of Chapter 4, align the Antenna Generator Disk with the ship's bow.

6.2.3 Belt installation tension

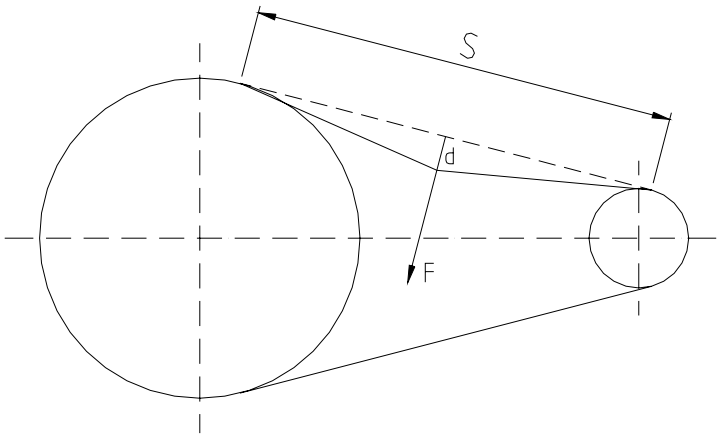
The required level of pre-tension will lie between the maximum and minimum values calculated from the formulae below.

As a general guide the lower level will be applicable to lightly loaded, smooth running drives, whereas drives subjected to high shock loads or frequent starts will be tensioned at the higher level.

Deflecting Force (F)

1 Maximum pre-tension

$$F = \frac{P \times 50}{V} = 36.2 \text{ Kg}$$



2 Minimum pre-tension

$$F = \frac{P \times 25}{V} = 18.1 \text{ Kg}$$

Belt deflection

$$d = \frac{S}{50} = 6.3\text{mm}$$

Where
S = Belt span (mm)
P = Transmitted power (KW)
V = Belt speed m/s

Note

$$V = \frac{\text{Pitch} \times N \times \text{rpm}}{60000} \quad \text{(m/s)}$$

N = Grooves on driver
Rpm = rpm of driver

CHAPTER 7
PART LIST

7.1 Introduction

This chapter provides the list of the 30 kW S-BAND/U Antenna Group replaceable parts.

7.1.1 Part List

The parts list is divided into major assemblies. All parts attached to the assemblies are listed in Part List Tables. The Parts List Tables consist of eight columns as follows:

- Column 1: POS. (Position): the column reports the replaceable parts position in the reference figure
- Column 2: DESCRIPTION: the column includes the descriptive identification data of the replaceable part
- Column 3: DRAWING SPECIFICATION NUMBER OR TYPE: the column reports the drawing specification number or the type of the replaceable part assigned by the supplier
- Column 4: REQUIRED QUANTITY (N): the column indicates, for each replaceable part, how many of them are assembled on the equipment

7.1.2 Part Location Illustration

Figures from Chapter 9, Figure 9.1.35 to Figure 9.1.38 provide the location of the components. The position numbers of items shown in the figure are referenced in the related Parts List Tables.

7.2 Part list tables

Table 7.2.1 - List of Items Shown in Chapter 9, Figure 9.1.35

POS.	DESCRIPTION	DRAWING SPECIFICATION NUMBER OR TYPE	REQUIRED QUANTITY (N)
Ref	30 kW S-BAND/U Antenna Group Unit	LSSGRP001	1
1	Parts List of the RTM 30S/U/D Unit	303770A1	1
2	Antenna Pedestal S/U Unit: - Type 03R-039	 303830A1	 1
3	Performance Monitor Arm for Pedestal 03R-039	303813A1	1

Table 7.2.2 - Parts List of the RTM 30S/U/D Unit
(Figure 9.1.36)

POS.	DESCRIPTION	DRAWING SPECIFICATION NUMBER OR TYPE	REQUIRED QUANTITY (N)
1	POWER MOS Board	972551A3	1
2	RTM CONT B Board	972981A2	1
3	NIFB Assy	303186A2	1
4	Fuse 3.15A 250V DLY (F1)	54F010P020	1
5	Fuse 2A 250V DLY (F2)	54F010P018	1
6	LNFE Assy	302311A5	1
7	S Band Magnetron	89A505P020	1
8	Noise Generator Assy	302237A2	1

Table 7.2.3 - Parts List of the Antenna Pedestal S/U Unit Type 03R-039
(Figure 9.1.37 and Figure 9.1.38)

POS.	DESCRIPTION	DRAWING SPECIFICATION NUMBER OR TYPE	MOUNTED QUANTITY (N)
1	Motor Group	71M416P001	1
2	Rotating Joint	89A068P003	1
3	Gear Reduction Group	36G106P001	1
4	Driving Belt	36A004P010	1
5	Antenna Generator Disk	302660P002	1
6	Optical Read-out Board	972671A1	1
7	Flat Cable with 8 Wires	302445A1	1
8	Antsign Board	972661A1	1
9	Cable Assy with 7/16” Connector	56C034P003	1
10	3Φ Filter	302891A2	1

CHAPTER 8
INSTALLATION

S-band Antenna Group including 12 feet Antenna and Pedestal with 30 kW Transceiver upmast

TABLE OF CONTENTS

8.1 Introduction

This chapter of the Technical manual can be used as a self-contained Installation Manual for the S-band Antenna Group including 12 feet Antenna and Pedestal with 30 kW Transceiver upmast. It contains necessary information, pictures and drawings to handle, assemble and install this unit as a part of the complete Radar Equipment. Actions how to prepare this unit for the Radar Equipment Setup Procedure are also described.

8.1.1 Shipping

Following general rules apply:

- Inspection for damage during transport
- When the unit(s) arrives at destination, inspection should be performed immediately to register any damage that may have occurred during transfer
- The customer is normally responsible for insurance during the transportation. If any damage is found, both the insurance company and the shipping agent must be informed immediately

8.1.2 Unpacking

The unit parts are placed in cardboard boxes covered with a plastic sheet. Each box includes a protecting polyurethane box shaped for the contained parts.

The following rules should be observed:

- Units must be transferred on board still packed into their boxes
- When the units are removed from their boxes they must be left in their protective plastic cover until installation

It is advisable to keep the packing material for possible future use the plastic sheet in which the unit is wrapped can be used to protect it during installation and maintenance procedures.

In addition to the various main parts forming the unit (see par. 8.3.2 below) there is further materiel included in the delivery. Those additional things are:

- Technical Manual with Installation Manual included
- Installation Kit (Terminals, clamps, connectors etc.)
- Standard Spare Part Kit (Fuses etc.)

The Installation Kit and the Spare Part Kit is necessary for the installation and operation of the equipment, and must be kept by them who perform the installation work. Contents of the Kits should be checked immediately after unpacking, using the materials list contained in the box. The Manufacturer will

not accept claims for missing items unless presented immediately after unpacking.

8.1.3 Storage

After the material contained in the boxes has been inspected in the presence of customer and it has been verified that no damage has occurred, the unit shall be stored in its original packing until the time of installation. The storage premises must be dry and well protected.

If the units must be kept in storage for more than one month, it is advisable to insert hygroscope substances, such as silicon gel salts, in the crates. See par. 8.2 Specification, (Environmental Conditions)

8.1.4 Handling

The antenna and the pedestal must be run up the mast separately and then assembled.

The pedestal with attached transceiver is lifted by crane. Use slings attached to the four eyebolts fitted on top of the pedestal.

Minimum angle at the base is 60º. See Figure 1 (Lifting by crane)

The pedestal contains delicate electronic components - handle accordingly. The antenna is also lifted by crane using its two eye-bolts. The antenna surface is sensitive to impacts and pressure. Any deformation of the antenna surface can reduce the radar performance.

8.2 Specifications

30kW S-Band/U Antenna Group

8.2.1 Dimensions and weights (also see outline drawings)

Length	959 mm
Width	481 mm
Height	1000 mm
Weight of pedestal with transceiver	165 Kg
Weight of antenna	90 Kg
Swing circle with 12 ft antenna	3700 mm

8.2.2 Required power

Alternatives	220/380 VAC, 3Φ, 50 Hz or
	255/440 VAC, 3Φ, 60 Hz
Power consumption	4200 VA

8.2.3 Environmental Data

Operating temperature	-25°C / +55°C
Storage temperature	-25°C / +70°C
Relative humidity	Up to 95% at +40°
Water resistance, Salt spray, Vibrations etc	as per IEC 60945
Wind resistance, relative wind	100 knots

8.3 Installation

30kW S-Band/U Antenna Group

8.3.1 Installation Principles

In order to obtain the best radar performance and accessibility, the following precautions should be used:

- Space for the antenna to swing freely. See 8.2 above (Specifications; Antenna)
- Safety and easy access for maintenance purposes. It is preferable to use a platform with safety handrail. Figure 2 (Suggested Masthead mounting)
- The antenna to be accessible in all directions
- Avoid exposure to exhaust fumes from the funnel
- Avoid strong vibrations
- Avoid interference between two antennas
- Avoid obstacles in the radar beam, especially ahead of athwartships directions

If two radar sets are installed, their antennas should be installed on different levels.

The antennas can be mounted, either on a single mast construction, so they are on top of each-other, as illustrated in Figure 2 (Suggested Masthead mounting),

or the antennas can be mounted on a platform, Figure 3 (Suggested Antenna mounting), one on portside and one on starboard side.

The following formula and drawing, as illustrated in Figure 4 (Antenna Position), will help you to determine the correct distance and height between the two radar antennas. The 25° angle on the drawing is the actual vertical beam-width with a safety margin included.

Example:

“H=L/3”,

H = height between the two antennas

L = the distance between the two antennas

If the distance L is 6m, then the height should be 6/3 = 2m.

Blind sectors towards the bow and within a few degrees on port and/or starboard side caused by the structure of the ship must be avoided with great care. In case of a blind sector at the bow in mid-ships’ position, it is advisable to mount the antennas on the starboard side of the ships’ keel-line.

When obstacles are sufficiently far from the antenna, they will result in a blind sector on the radar display with approximately the same amplitude as observed by the human eye, but these obstacles can produce false echoes. An echo produced by an obstacle close to the antenna, can be suppressed by reflecting the antenna-beam skywards by mounting a reflector made of metal, as also illustrated in Figure 2 (Suggested Masthead mounting). This solution however does not eliminate the blind sector, but will reduce false echoes produced by the obstacle. The best position for the reflector can be found by testing out different positions.

It is highly recommended that the shipyard submit the drawings of the radar antenna position(s) to the Manufacturer for approval.

The Installation consists of following basic steps:

- Mount the Antenna Pedestal without the antenna on the mast
- Make relevant cable connections
- Install and connect the Performance Monitor arm
- Install the Safety Switch
- Mount the Antenna on the Antenna Pedestal

NOTE

Antenna pedestal should be installed in such way that the performance monitor arm is not facing funnels or other big ship obstruction. Sector blanking is enabled to prevent false echoes caused by funnels and/or big ship construction (see above). If performance monitor arm is positioned, within this blanking area, the pedestal must be turned because the radar performance monitor is not working where there is no transmission in the sector of its sensor.

Installation of Safety Switch is compulsory. It is recommended to be installed at the bottom of the stairs giving access to the Antenna Pedestal. The waterproof switch is supplied by Manufacturer, but a connection cable (2x2,5mm^2) should be provided by the shipyard.

The Antenna Group must be covered by plastic sheet during any painting performed after the installation.

NOTE

In no case, the Antenna Array should be used to hoist the assembly up the mast.

8.3.2 Mechanical installation

The S-band/U Antenna Group consists of following units and type designations:

Pedestal with transceiver	03R039 with 09N-011
12 feet antenna	02R-039B
Performance monitor arm	303813A1
Safety switch	74X376P001

8.3.2.1 Pedestal with transceiver

Prepare the platform for mounting of the pedestal, with its transceiver. Hole diameters and distances are evident from drawing: Figure 5 (Dimension Drawing).

The pedestal should be mounted with the transceiver unit pointed astern. However the antenna swinging plane must be horizontal in all directions when ship is upright on even keel. Consider giving ample space for service, especially astern of the antenna group. If such space can not be achieved, contact Manufacturer for installation alternatives.

NOTE

The plastic protection cover on the pedestal rotary joint must not be removed until just before mounting the antenna. Anyhow the rotary joint must not be left uncovered when the antenna is not mounted

NOTE

The fixing materials to fasten the antenna pedestal to the ship's platform are not provided by the manufacturer. Assuming a platform plate thickness of 20 mm, four M20 stainless steel bolts of 80 mm length, with relative nuts grooves and washers, must be used. The tightening couple is 256 Nm

8.3.2.2 Antenna

The antenna and the pedestal must be run up the mast separately and then assembled.

The installation procedure of the antenna with fixed coax cable to the antenna pedestal consists of the following steps:

- Remove the bolts from the Antenna shaft, which will be used to fasten the Antenna (Antenna Support) to the Pedestal
- The Antenna must be lifted in the mounted eye-bolts. Also see 8.1.4 above, Handling
- With the antenna hoisted, lay it on the pedestal matching the six leading bolts with the relevant
- wholes, taking care that the front of the antenna is orientated at the same direction as the arrow on the antenna shaft
- Tighten all antenna attaching bolts. The tightening couple is 130Nm
- Insert the 90 degrees connector of the antenna coax cable on the rotary joint connector and secure it by fastening the attaching ring

8.3.2.3 Safety Switch

Installation of safety switch is compulsory. The safety switch is supplied by the Manufacturer.

It is recommended to place the safety switch at the bottom of the stairs that are giving access to the radar mast. The switch must be mounted with the cable glands pointing down. Connect the cable as described in 8.3.3 below Electrical installation.

8.3.2.4 Performance Monitor Arm

To install the P.M. Arm proceed as follows:

- Open the cover of the pedestal
- Remove the 4 screws securing the small plate on the Antenna Pedestal
- Install the O-ring on the fixing plate of the P.M. ARM
- Draw the cable from the PM-arm through the supporting plastic pipe and through the hole in the cast wall over the antenna generator disk as evident from Figure 9 (Pedestal)
- Mount the PM-arm angled upwards
- Connect cable as described in 8.3.3 below Electrical installation

8.3.3 Electrical installation

The electrical installation in the 30 kW S-Band/U Antenna Group consists or cabling and connection to terminals, Figure 6 (Terminals Drawing), as described below.

8.3.3.1 Multicore Cable

Also see Annex 8.5.1 Multicore Cabling and Termination Principles.

NOTE

Use the installation materials for the Multicore cable which are delivered by the manufacturer to ensure proper connection

Normally the cable (16 core+3 Coax), P/N 55M45455P002(3), is delivered to a length of 60m. The Multicore cable includes wires for Power, Video, Trigger and Antenna data. It shall be used for connection between the Antenna Group and the External S-Band PSU, as well as for connection between the External S-Band PSU and the display/interswitch unit. It is required to handle this cable with particular care.

The Antenna end of the multi-core cable shall be connected to :

- TB 9&10 and J1/J3 on the RTM Control B Board in the transceiver and according to separate system drawings relevant to the application of the 30 kW S-Band/U Antenna Group. Also see Figure 7 (Cabling) and Figure 8 (Control B board Drawing)

- TB Filter at the inside bottom of the pedestal chassi, Figure 9 (Pedestal), for the 3 phase motor power cores
- TB 1 at the inside left bottom of the transceiver chassi, according to system drawings relevant to the application of the 30kW S-Band/U Antenna Group

Terminals, clamps and connectors etc. included in the Installation Kit must be used. Content of the installation Kit can vary depending on the Application of the 30kW S-Band Antenna Group. E.g. if Multicore cable is already terminated in factory corresponding parts are excluded.

For the termination of the Multicore Cable in the External S-Band PSU see Installation Manual for that unit.

8.3.3.2 Safety Switch

The safety switch is supplied by the Manufacturer. Cable from the switch (normally placed at bottom of Radar Antenna mast) to the Transceiver unit is not included.

- Check the Safety Switch is placed as described in par. 8.3.2 (Manual Installation)
- Connect the two poles of the safety switch, Figure 10 (Safety Switch), to TB1 SF/SFR placed down left at the inside of the transceiver chassis (see Figure 7 (Cabling)).
- The cable gland not used must be properly sealed
- Carefully make sure that the switch is closed in “I” (On) position and open in “0” (Off) position.

8.3.3.3 Performance Monitor Arm

- Open the cover of the pedestal
- After mounting the PM-Arm as described in 8.3.2 above connect the PM-Arm cable to the plug and put it in the socket at TB1 RM/RM05 on the ANT.SIGN.PCB. placed at the inside bottom of the pedestal chassis. Figure 9 (Pedestal)

8.3.3.4 Grounding

Connect a tinned braided copper wire (>25mm^2) between the Ground Terminal on the Antenna Pedestal and the radar mast.

8.3.3.5 Installation Check-out

After wiring connections, before closing the antenna pedestal following procedures and controls must be carried out to prevent any failure due to incorrect installation.

- Clean the circuit boards with an antistatic brush
- Use a vacuum cleaner to remove any possible particles from the cabinets
- Check for proper cable bends to assure a proper amount of slack
- Check that ground connections are dully tightened as well as terminal connections on the terminal boards
- Check if cable glands have a firm grip around the cables

8.3.4 Pre Setup Procedures

This paragraph provides information concerning the preliminary controls and procedures to be performed as a completion of the electrical installation and before supplying the unit with power and before performing the System Setup Procedure:

NOTE

Powering the Radar System is not included in the Pre Setup Procedure

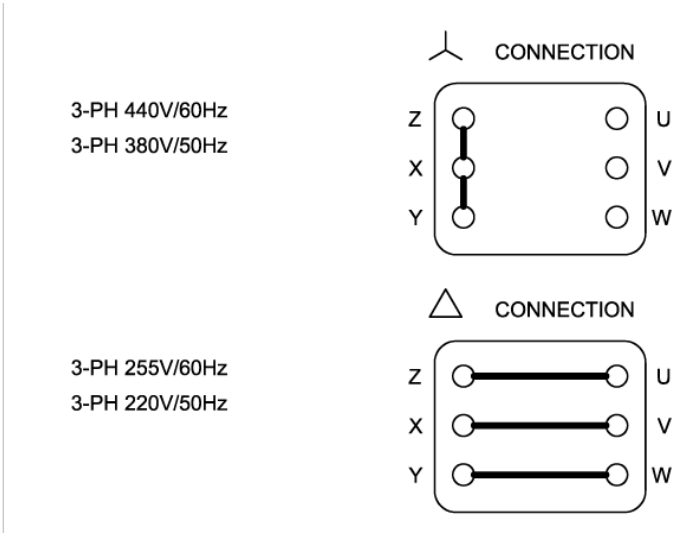
- Carry out a careful visual inspection of the installed components referring to the layouts of the unit and to the interconnection drawings
- Carefully check the integrity of the fuses
- Check that the switches S1 and S2 on the transceiver Control B board are in position “0”

NOTE

Following items must be thoroughly checked:

8.3.4.1 Antenna Turning Motor power Voltage and Phase

Check inside the Antenna Turning Motor junction box that the Star or Delta configuration corresponds to the used 3 phase ship main power and frequency, as described below:



Also check that TB 3 in the External S-Band PSU is configured for same power (see separate manual).

8.3.4.2 Head Line alignment procedure

If the equipment is not equipped with a 360 degree software adjustment, a course alignment of the radar headline should be carried out as follows before the final set up procedure.

- Turn the Radar main switch off and, to make sure that the Antenna Motor can not be started, switch the Safety Switch Off (0)
- Remove one Pedestal side cover by loosing the 4 fixing bolts
- By using the proper Allen Keys (hexagonal keys), loosen the six screws fixing the Antenna Generator Disk to the Belt Pulley.
- Rotate the Antenna by hand to athwartship position to align the Antenna Beam with the ship's bow
- Rotate the Antenna Generator Disk until the bow indication on the disk (the deeper slot) is in the Optical Read-out unit gap. Figure 9 (Pedestal)
- Tighten the six hexagonal screws fixing the Antenna Generator Disk
- Remount the cover of the Antenna Pedestal
- Turn the Safety Switch to position On (I)

8.4 Installation figures and drawings

The following figures and drawings are included after this page:

Figure 1 (Lifting by crane)

Figure 2 (Suggested Masthead mounting)

Figure 3 (Suggested Antenna mounting)

Figure 4 (Antenna Position)

Figure 5 (Dimension Drawing)

Figure 6 (Terminals Drawing)

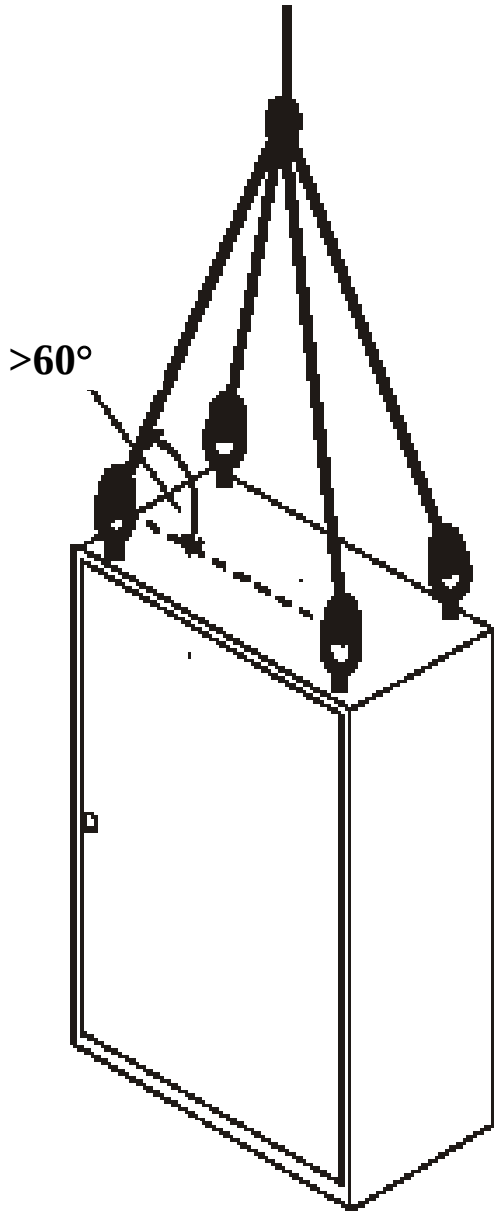
Figure 7 (Cabling)

Figure 8 (Control B board Drawing)

Figure 9 (Pedestal)

Figure 10 (Safety Switch)

Fig 1 Lifting by crane



WARNING Never pass or stay under any lifted object.

Fig 2 Suggested Masthead Antenna mounting

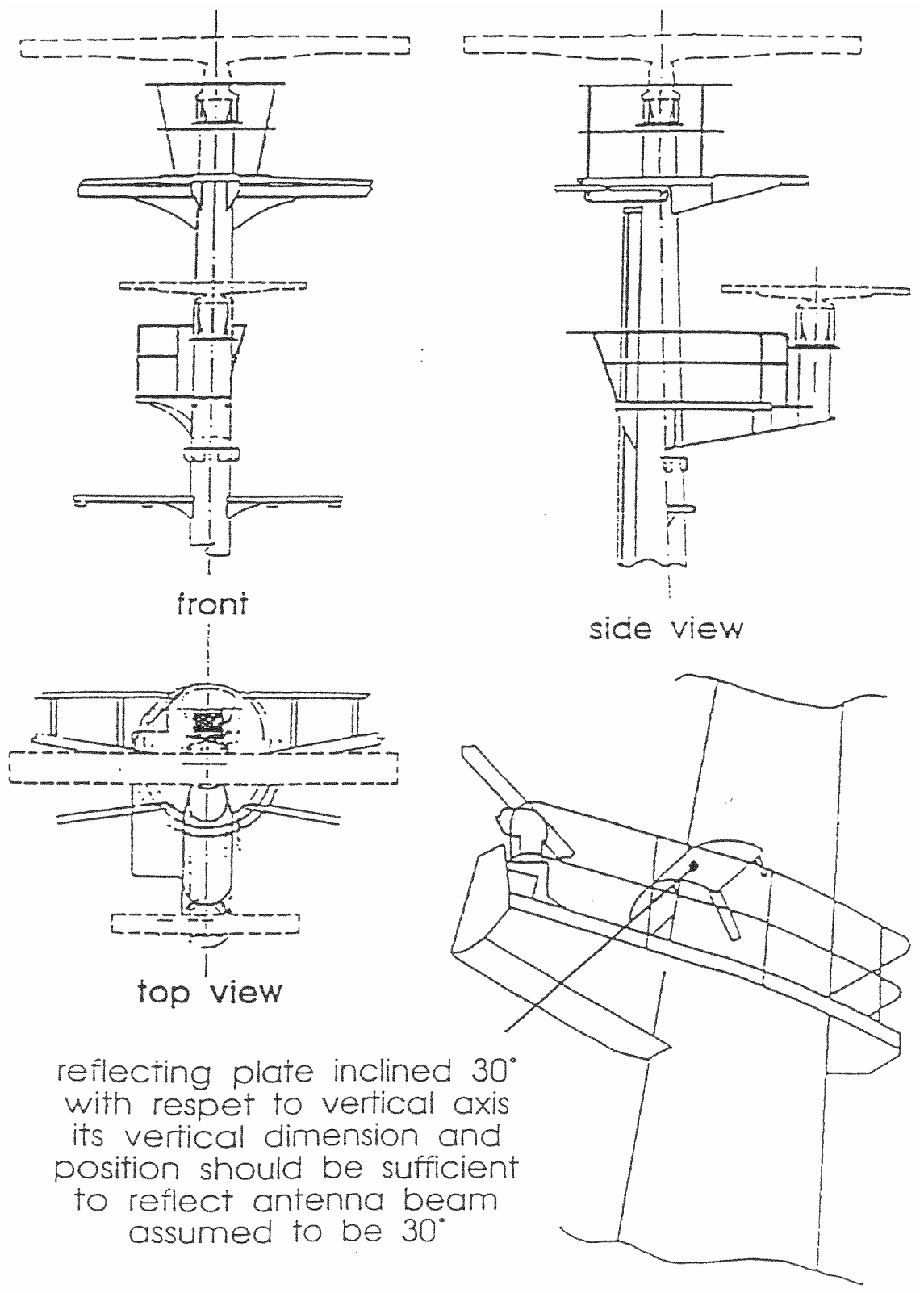


Fig 3 Suggested Antenna mounting

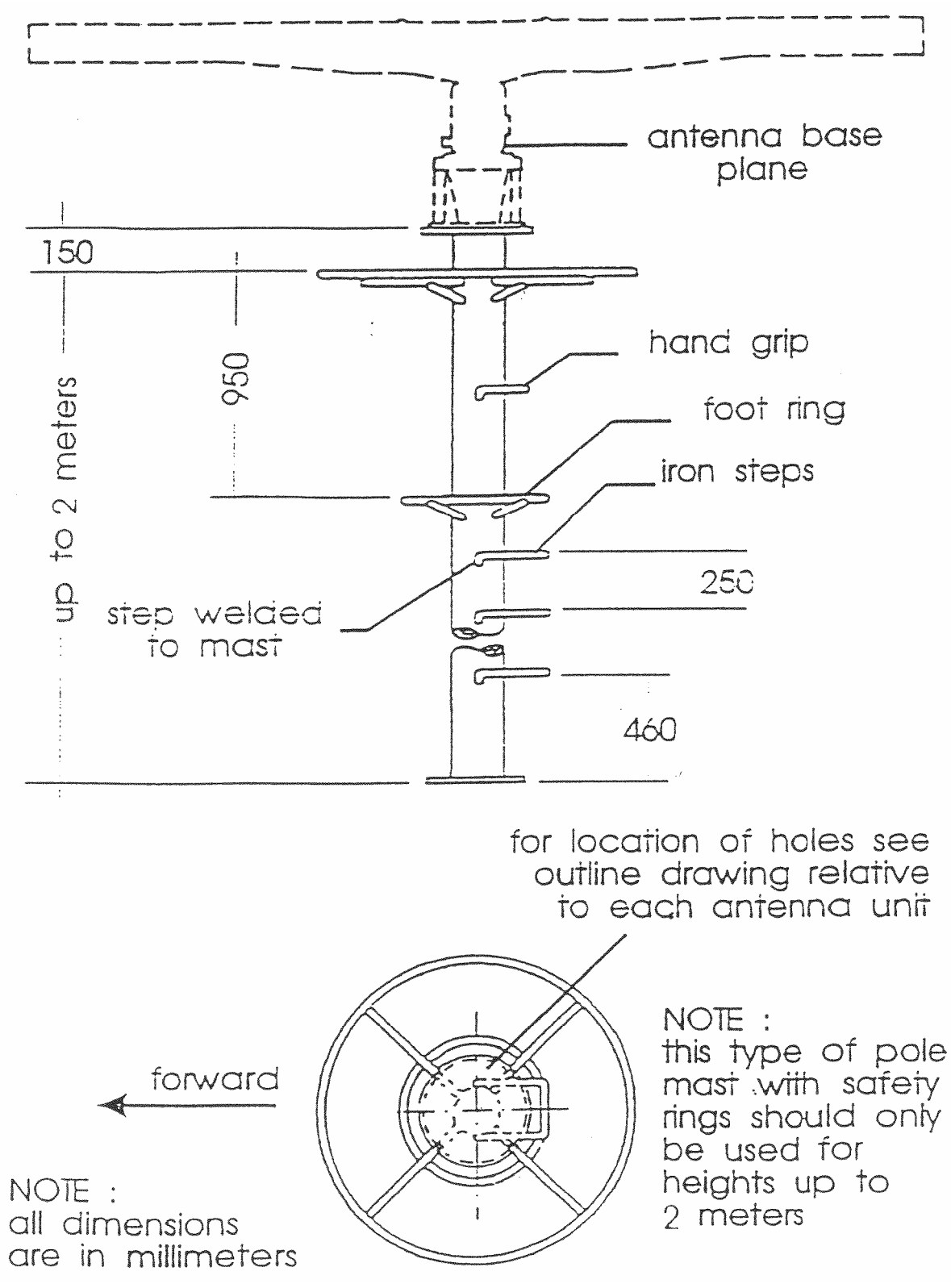


Fig 4 Atenna positions

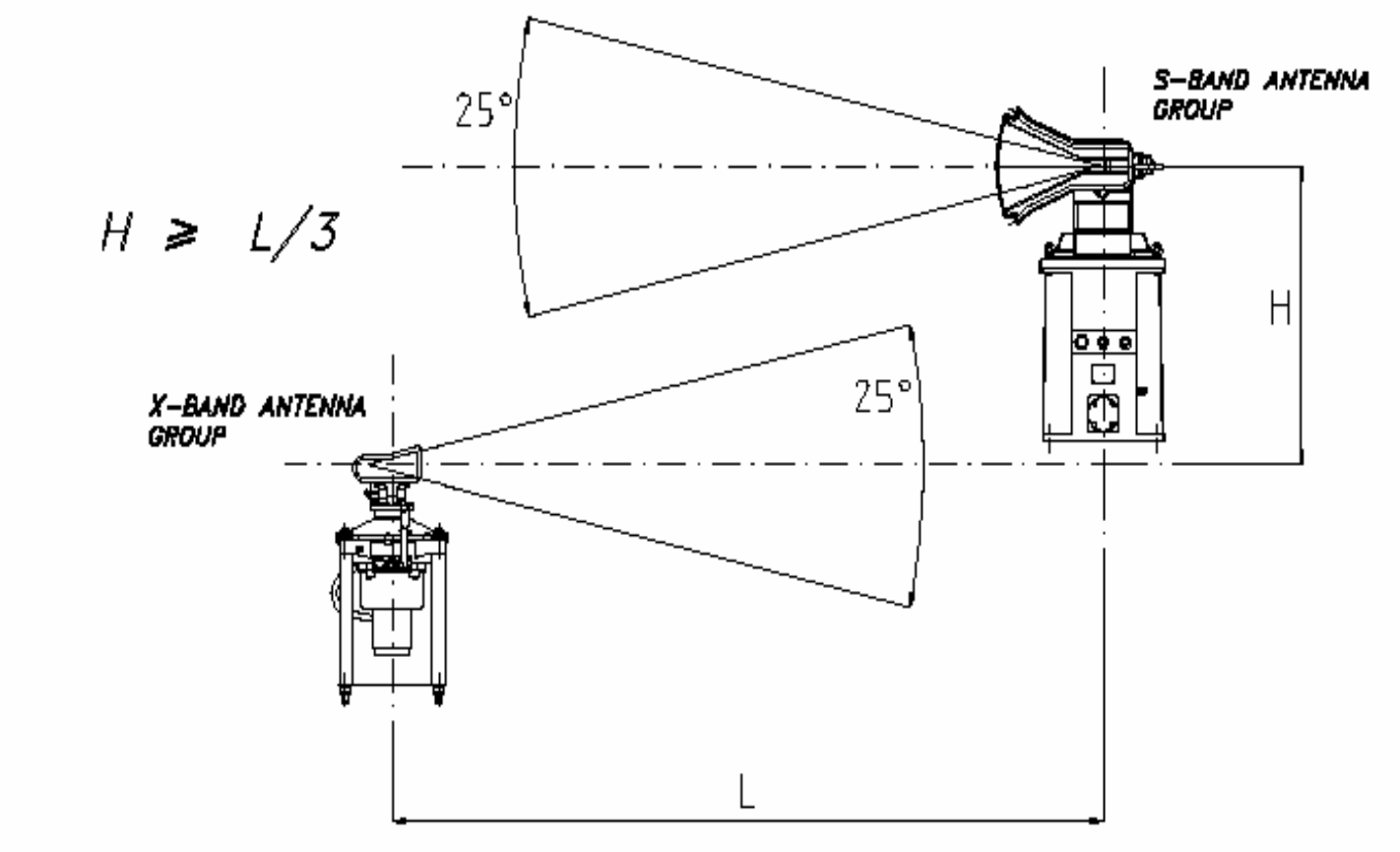


Fig 5 Dimension drawing

All dimensions are in mm

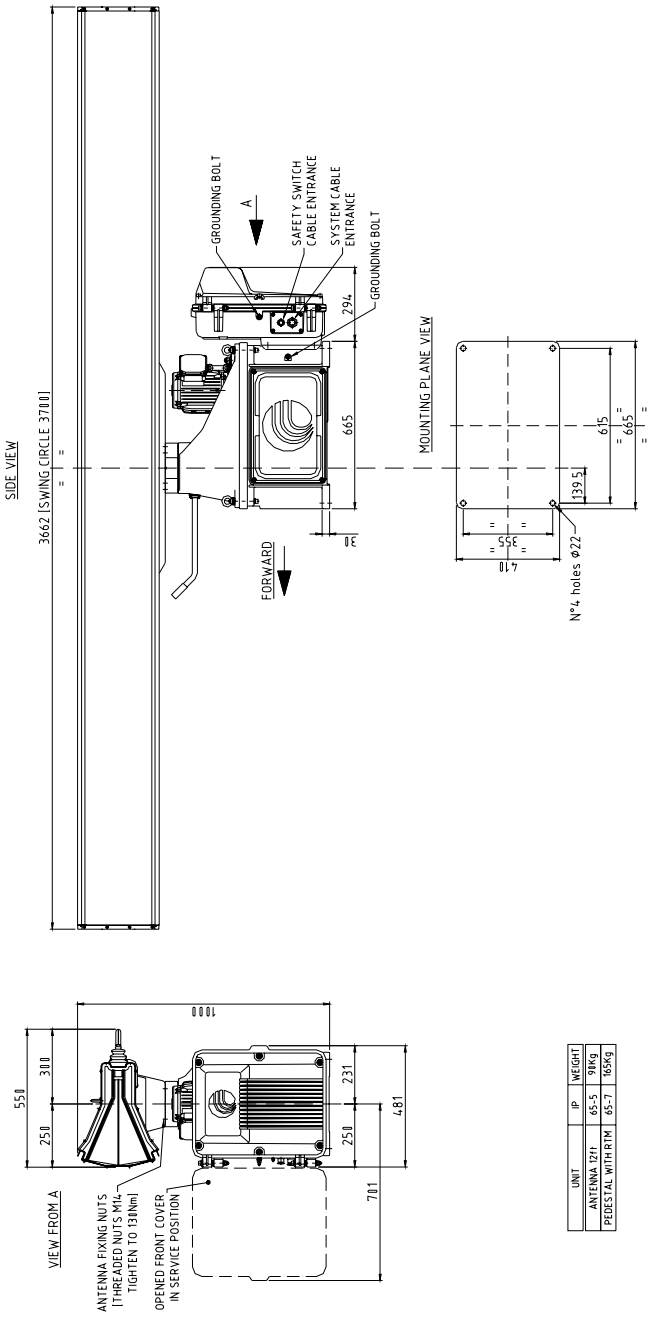


Fig 6 Terminals drawing

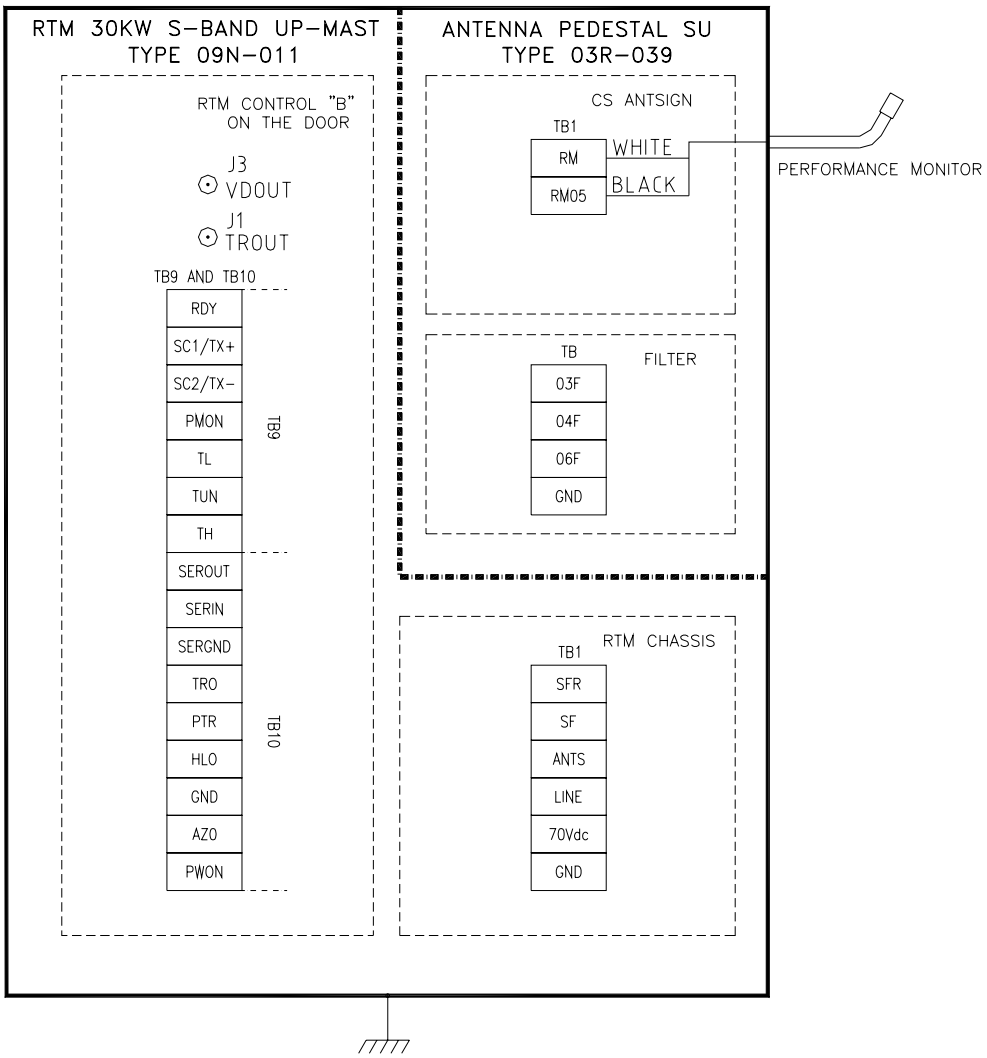


Fig 7 Cabling

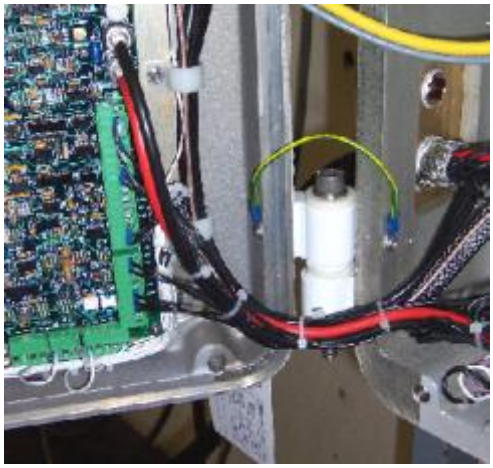
30kW S-Band/U Antenna Group

Fix the cable inside the unit:

A

Route the cable inside the unit following the existing cabling to obtain free installation when closing the door.
Connect the cables on the terminal boards on the RTM control-B:

B



Verify that you have free installation when closing the door:

C

Fig 8 Control B Board

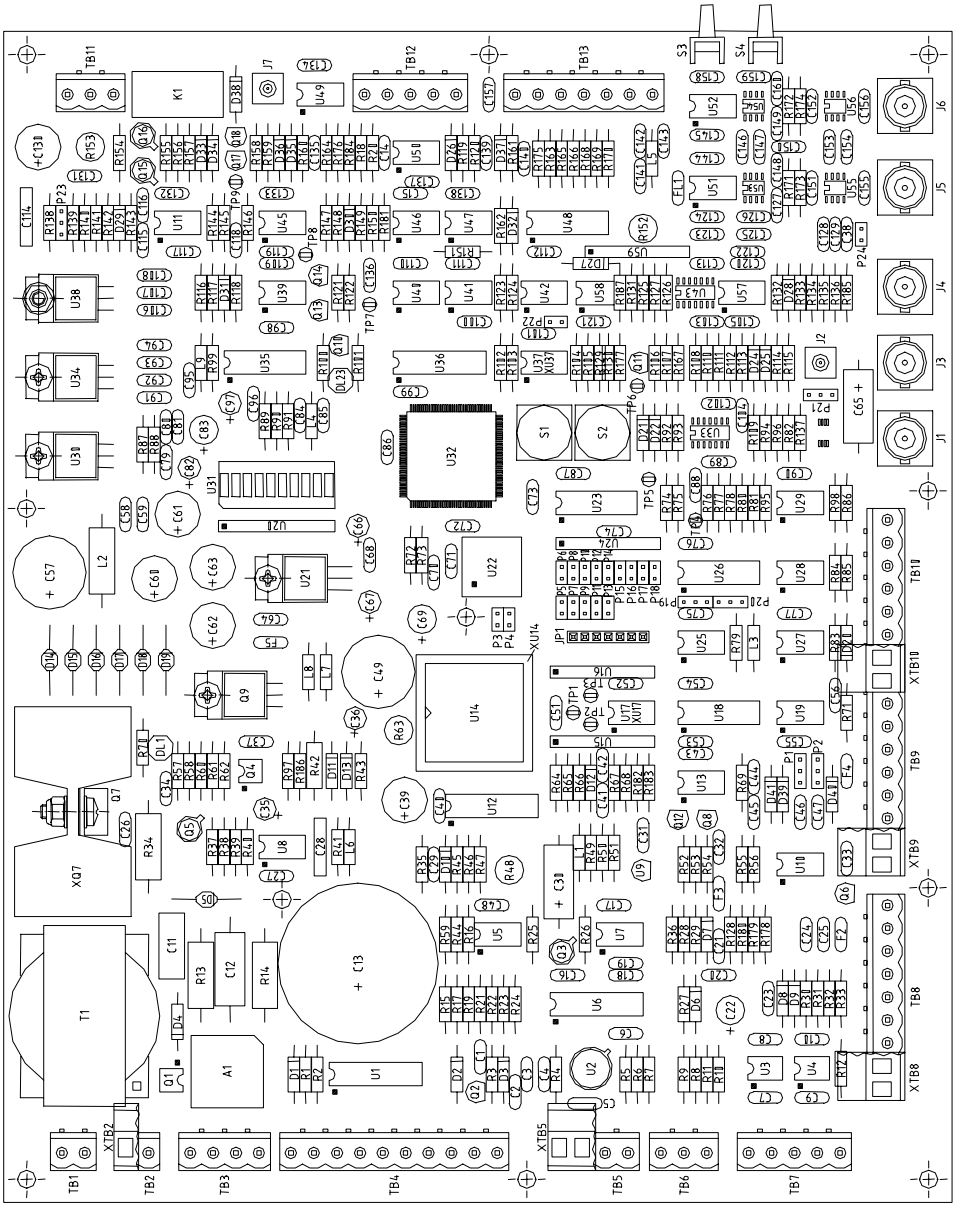
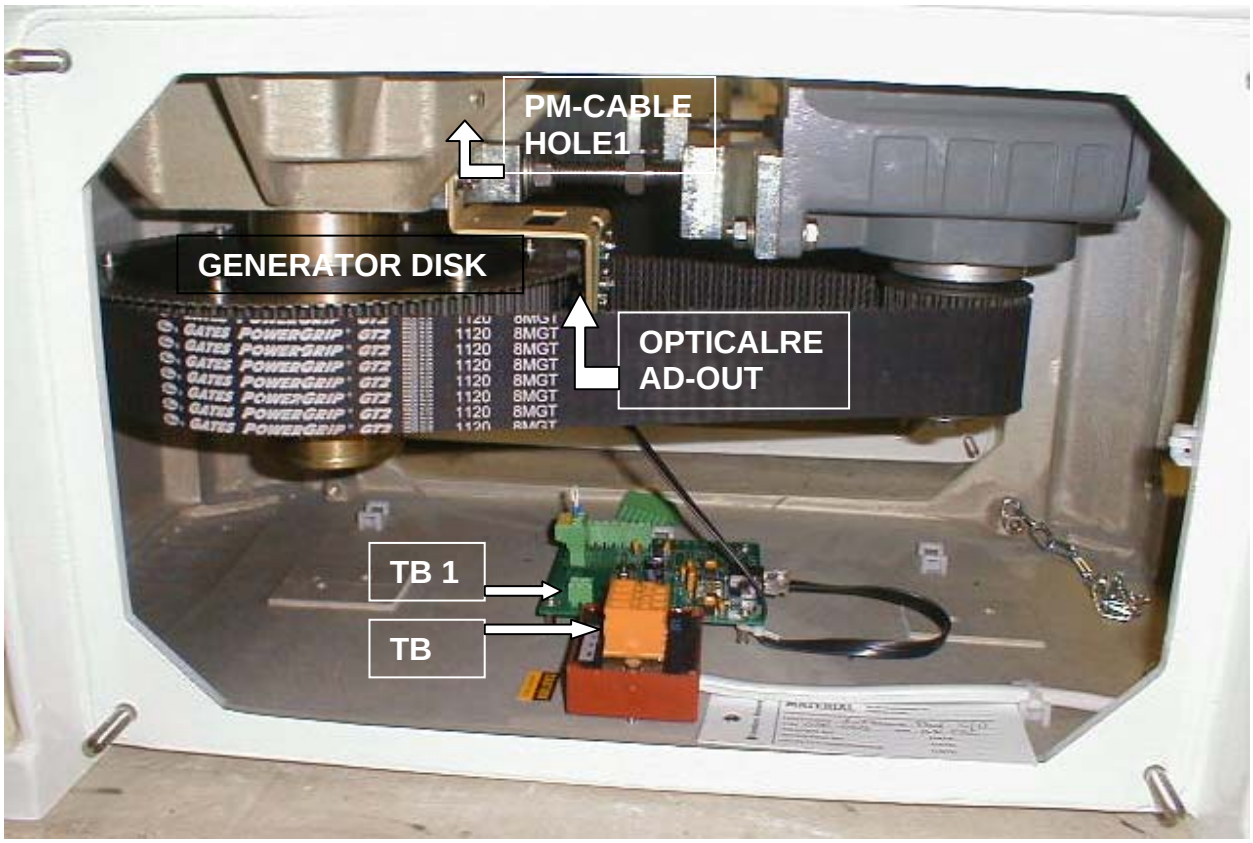


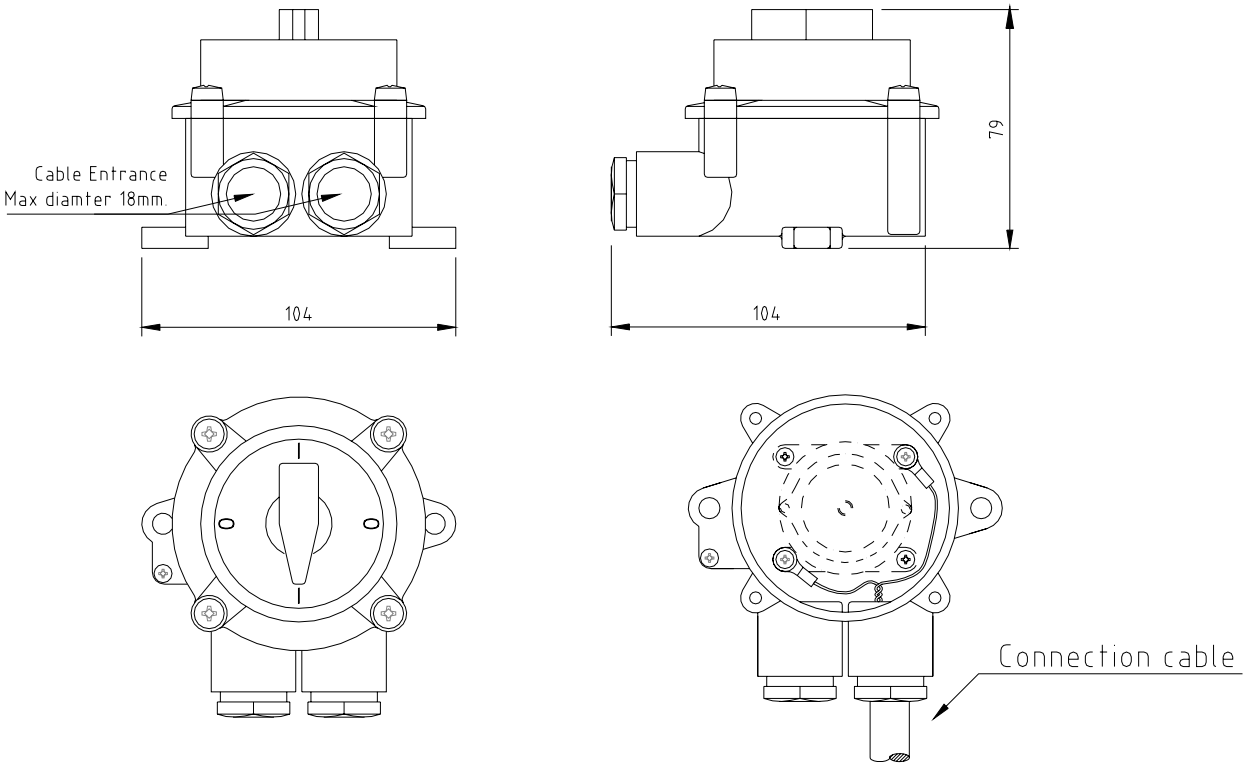
Fig 9 Pedestal



Antenna Pedestal TB1: PM-Arm
TB Antenna motor 3 Phase Main Power

Fig 10 Safety Switch

All dimensions are in mm



8.5 Annex

Special extensive illustrated instructions are included in this paragraph

8.5.1 Multicore Cabling and Termination Principles

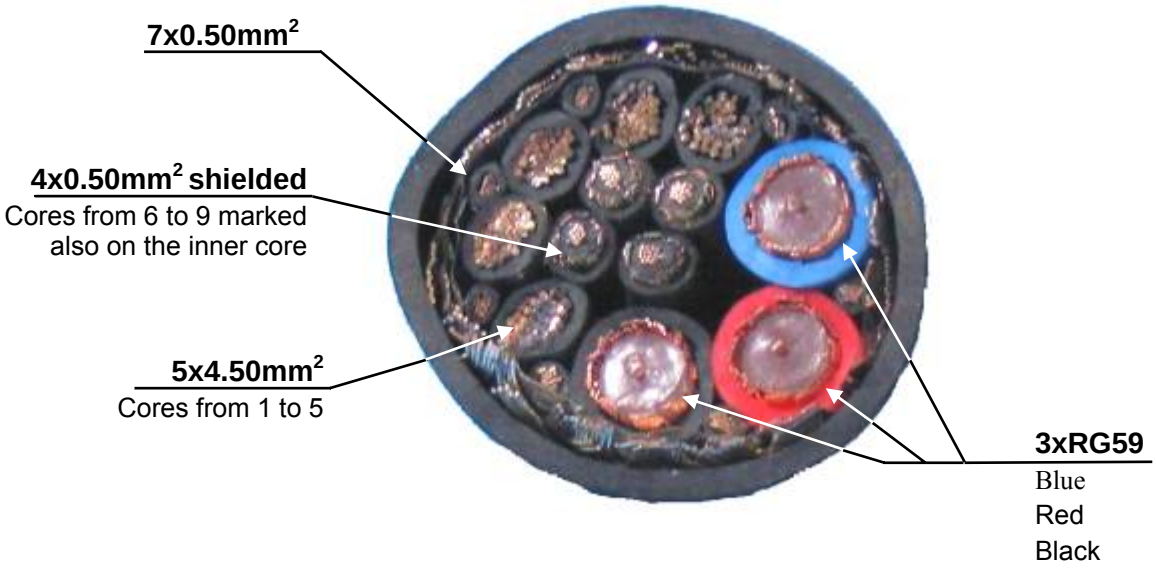
55M455P002(3)
MULTI CORE CABLING AND TERMINATION PRINCIPLES FOR

- X-Band Antenna Group including 6 or 9 feet Antenna and Pedestal with 25 kW Transceiver upmast
- X-Band Antenna Group including 6 or 9 feet Antenna and Pedestal with 12 kW Transceiver upmast
- 30kW S-Band Transceiver downmast excluding Power Supply Unit
- S-Band Antenna Group including 12 feet Antenna and Pedestal with 30 kW Transceiver upmast
- External Power Supply Unit for S-Band Transceiver

Installation Instructions

Multicore Cable Technical Specification

Core overview of Multicore Cable:



Cable handling

Dismantle the outer isolation of the cable for 70 cm, however in case of 12 or 25 kW X-Band/U Antenna Group the length must be 180 cm.
Remove most of the shield, let it be 5 cm with shield perceptive to vision:

Main Shield and inner shields handling

Take back the shield:

Dismantle the outer isolation of the 0.5 mmq shielded cable. (Let it remain 4 cm with isolated shielded cable).
Open the shield near the outer isolation, and pull out the centre cable without cutting the shield:

Insert the shields from the inner cables into the main cable shield and take back the shields:

Cable Holder installation

See below, the correct procedure for installation of cable, in to the cable holder.
Refer to the "*Main Shield and inner shields handling"* for shields handling.
Fix the shields with tape:

Insert the cable in the unit, and fix the cable to the cable holder

Cable Gland Installation

See below, the correct procedure for installation of cable, in to the cable gland:
Pass the wires trough the cable gland:

Refer to "*Main Shield and inner shields handling"* section, for shields handling.
Turn the shields over the first metal ring, and trim exceeding shields:

Insert the cable with all parts in to the cable gland:

After that, tight it hard, and be sure that the shield will remain inside the cable gland:

Put some silicon compound, in the remaining space between the cable gland bolt and the cable.

0.5 mmq cores

Cut the core to the wanted length and dismantle the core for 10mm:

Insert and crimp the blue-end terminal:

Note: End terminal should always be used.

Double connection in one terminal (yellow terminal):

Triple connection in one terminal (grey terminal):

4.5 mmq cores

Cut the core to the wanted length and dismantle the core for 10mm:

Cut-out a few conductors in order to make easy the insertion of the grey-end terminal:

Insert and crimp the grey-end terminal:

Note: <u>End terminal should always be used</u>.

RG coaxial cables

Mechanical details of BNC connector:

Cut the cable to the wanted length.
Dismantle the outer isolation of the RG coaxial cable without damaging the shield, and put the related part of the BNC connector as below:

Details related to the ring of the BNC connector.

Take back the shield on the ring and trim exceeding shield:

Dismantle the outer isolation of the centre core without damaging the centre core and be sure that the shield is not shorted with the centre core:

Solder the centre core with the BNC pin.
Be careful not damage the isolation (i.e. burned) during the solder process:

Mount the BNC connector as below:

Shielded conductors

Cut the cable to the wanted length.

Dismantle the outer isolation of the 0.5 mmq shielded cable. (Let it remain 4 cm with isolated shielded cable):

Open the shield near the outer isolation, and pull out the centre cable without cutting the shield:

Refer to the "*Main Shield and inner shields handling"* for shields handling.

CHAPTER 9
FIGURES