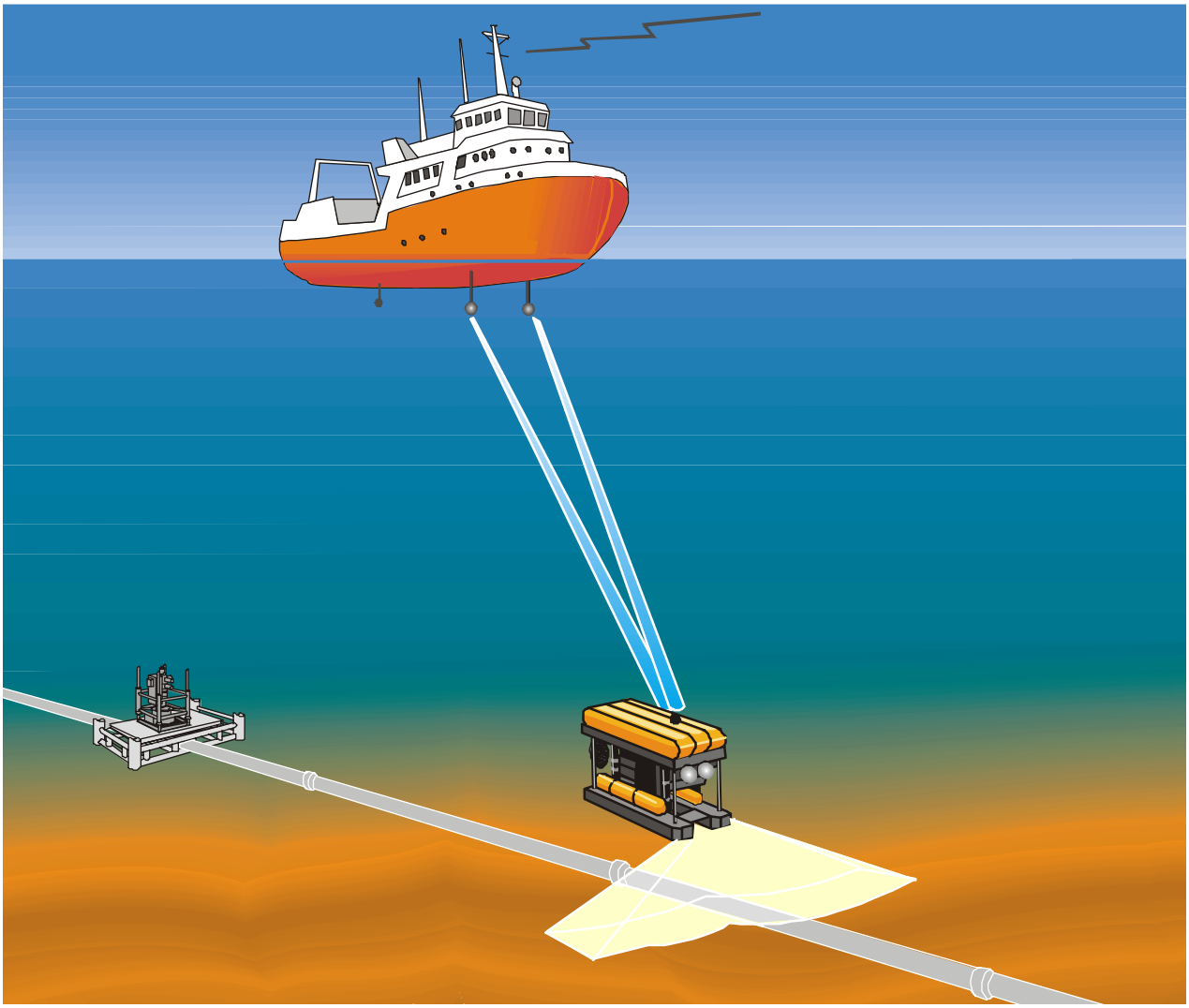
Instruction manual

KONGSBERG

HiPAP hull units

High Precision Acoustic Positioning hull units



HiPAP hull units

High Precision Acoustic Positioning hull units

Instruction manual

857-160639 / AA000

Note

Kongsberg Simrad AS makes every effort to ensure that the information contained within this document is correct. However, our equipment is continuously being improved and updated, so we cannot assume liability for any errors which may occur.

Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to install, operate or maintain the equipment.

Kongsberg Simrad AS disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

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Sections

This book is the Instruction manual for the Kongsberg Simrad HiPAP hull units system. It describes how to operate, to install and to maintain the various units used by the HiPAP hull units system.

1 Introduction

2 System description

3 Operation

4 Maintenance

5 Equipment handling

6 Installation

7 Technical specification

8 Cable layout and interconnections

9 Spare parts

10 HiPAP/HPR Test and alignment procedures

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12 Main index

Remarks

References

Further information about the HiPAP system may be found in the following manuals:

- APOS Instruction manual
- HiPAP Instruction manual

The reader

The maintenance information in this manual is intended to be used by a trained maintenance technician or engineer, with experience of electronic and digital circuitry, computers and electromechanical design. The level of information is based on Kongsberg Simrad's maintenance philosophy: The onboard technical personnel shall, with the help of the documentation and the system's built-in test functions, be able to identify malfunctions, locate the fault, and replace major parts, modules and components on the "Line Replaceable Unit" (LRU) level. He/she will however not attempt to repair the LRUs.

The installation information in this manual is intended for the design and installation engineers at the shipyard performing the installation. The information is supplied as the basis for the shipyard's own installation drawings applicable to the vessel. On completion of the installation, this section may be used for reference purposes during system maintenance.

Note

Distributed copies of this manual will not be updated. If your system software is updated, you will be provided with copies of the latest revision of the manual.

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Rev	Comments
A	Original issue.
B	Majority of documents reregistered to simplify updating and storage.
C	Updated to implement new disclaimer page and version D of the Test and alignment procedure. refer to EM 160639C.
D	C&C updated for minor corrections. Refer to EM 160639D.
E	The manual is updated to new layout. Implemented gate valve position indicator and electrical actuator. Drawings are implemented in the text. Refer to EM 160639E.
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G	Implemented the new HiPAP 350 hull unit. Updated various drawings. Minor corrections in the text. Refer to EM 160639G.
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I	Updated the hoisting system interconnection drawing (Cd5139a). Implemented Gate valve positioning indicator for HiPAP 350. Implemented drawings for HL 2180. Minor corrections in the text. Refer to EM 857-160639I.

J	Updated Remote Control operation description. Updated drawings for HiPAP 500 HL 2180, 350 mm Gate valve and the Electrical actuator. Minor corrections in the text. Refer to EM 857-160639J.
K	Updated electrical actuator information. Minor corrections in the text. Refer to EM 857-160639K.
L	Implemented the HL 4570. New hoist control cabling and drawings. Updated the Electrical system section and the electrical check procedure. Minor corrections in the text. Refer to EM 857-160639L.
M	Updated the HCU wiring diagram and the lubrication section. Minor corrections in the text. Refer to EM 857-160639M.

To assist us in making improvements to the product and to this manual, we would welcome comments and constructive criticism. Please send all such - in writing or by e-mail - to:

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High voltage safety warning

The voltages used to power this equipment are potentially lethal. Even 110 volts can kill.

Whenever possible, the following precautionary measures should be taken before any work is carried out inside the equipment:

- Switch off all high-voltage power supplies.
- Check the operation of any door interlocks and any other safety devices.
- Completely discharge all high-voltage capacitors.

It should be noted that interlocks and safety devices are normally located only at regular access points, and high voltages may be exposed during dismantling.

NEVER WORK ALONE ON HIGH-VOLTAGE EQUIPMENT!

FIRST AID IN THE EVENT OF ELECTRIC SHOCK

Normally, even a high voltage electric shock will not kill instantly. The victim can still be revived even when his breathing and heart-beat have ceased.

Could **YOU** save someone's life? In the event of electric shock, the correct actions, performed quickly may well save the victim's life. **Make sure you know what to do!**

Immediate action

While shouting for help, remove the source of power from the victim. Switch off the supply if possible, or using a dry, non-conductive material (rubber gloves, broom handle etc.) to insulate yourself, separate the victim from the source. If the voltage exceeds 1000 volts, switch off the supply and be ready to catch the victim. Take care- do not become a victim yourself.

Commence first aid on the spot. Continue to shout for assistance till someone arrives.

1 Lay the victim flat on his back and loosen any tight clothing (collar, tie, belt etc.).

2 Open his mouth and check for and remove any false teeth, chewing gum etc.

3 Check if the victim is breathing. If not, check if his heart is beating. The pulse is normally easily found in the main arteries of the neck, either side of the throat, up under the chin.

If his heart is beating but he is not breathing, commence **ARTIFICIAL RESPIRATION**. If the victim's heart is not beating, commence **EXTERNAL CARDIAC MASSAGE (ECM).** Continue to shout for assistance till someone arrives.

EXTERNAL CARDIAC MASSAGE

1 Kneel beside the victim. Place the heel of one hand in the centre of his chest, at a position half way between the notch between the collar-bones at the top of his chest, and the dip in the breast-bone at the base of his rib cage. Place the other hand on top of the first.

2 Keeping the arms straight and using your entire weight, press down rapidly so that the breast bone is depressed four- five cm, then release the pressure. Repeat rhythmically at a rate of one cycle per second. This will be hard work, but keep going. His life depends on YOU. Do not worry about breaking his ribs - these will heal if he survives.

ARTIFICIAL RESPIRATION

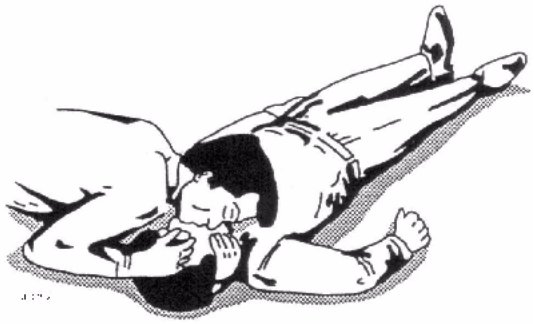
1 Kneel besides the victim's head. Place one hand under his neck and lift, allowing his head to fall back. This will lift his tongue and open the air passage in his throat.

2 Place the palm of the hand on his forehead to maintain the "chin-up" position.

3 Using the index finger and thumb of the same hand, pinch the victim's nostrils closed. Open his mouth.

4 Take a deep breath and cover his mouth with yours. Blow steadily into his lungs to expand his chest. Remove your mouth from his to allow the air to escape from his chest. You should be able to see his chest deflate.

5 Repeat the "inflation-deflation" cycle at a rate of about 12 cycles per minute till the victim begins to breath normally again.



COMBINING EMC AND ARTIFICIAL RESPIRATION

If you are alone, perform **ONE** cycle of artificial respiration for every **FIVE** cycles of EMC. This will be hard work, but keep going. His life depends on **YOU**!

If there are other people available to help, one should perform the EMC while one performs the artificial respiration for every five cycles of EMC. It will be much more efficient with two people.

Once the victim's heart is beating and he is breathing, roll him onto his side and support him in that position. As consciousness returns he may vomit, and this will allow any liquid to drain out of his mouth.

Remove the victim to a hospital as soon as possible, but do not interrupt the artificial respiration and EMC cycles till his heart beat and breathing returns.

If started quickly and performed correctly, the resuscitation methods described will keep a sufficient volume of oxygenated blood flowing trough the victims body to allow full recovery.

Proficiency in the resuscitation methods can only be achieved trough training. All personnel concerned should attend courses on a regular basis. Remember, someone's life could depend on you.

DO YOU KNOW WHAT TO DO?

1 INTRODUCTION

Manual content

This is the Instruction manual for the Kongsberg Simrad hull units used with the High Precision Acoustic Positioning (HiPAP) system. The manual contains the descriptions and illustrations required to install and maintain the hull units.

The system is described down to the circuit board level, named as Line Replaceable Units (LRUs), and block diagrams are used to simplify the descriptions.

The manual also defines the equipment responsibility, and provides general information about preservation, packing and storage of the units.

Abbreviations

The following abbreviations are used in the text:

ACS	Acoustic Control System
BOP	Blow Out Preventer
HL	Hull Unit
HCU	Hoist Control Unit
TD	TransDucer
N/A	Not Applicable
RCU	Remote Control Unit

General guidelines

WARNING **Kongsberg Simrad AS accepts no responsibility for any damage or injury to the system, ship or personnel caused by drawings, instructions and procedures not prepared by Kongsberg Simrad.**

Training courses are available from Kongsberg Simrad AS.

Installation

The guidelines for installation presented in this manual must be regarded as a base for detailed plans prepared by the installation shipyard. These plans must include drawings, instructions and procedures specific to the ship in which the equipment is to be installed. These drawings must be approved by the local maritime classification society.

Note *Detailed mechanical drawings for the installation of the hull unit must be provided by the shipyard. All drawings must be approved by the vessel's classification society and/or local maritime authorities before the system is installed.*

WARNING **The installation instructions given in this document must be followed. Failure to do so may render the guarantee void.**

Maintenance

The technical descriptions included in this manual are intended to to be used by maintenance technician and/or fitters.

Note *If your organization (or vessel) does not have the appropriate personnel available, you are strongly advised to contact either Kongsberg Simrad or your dealer for assistance.*

Supply conditions

Equipment responsibility

Upon receipt of the equipment the system owner or installation shipyard automatically becomes fully responsible for the equipment, unless otherwise stated in the contract. This responsibility covers the storage period before installation, the actual installation, commissioning, and the period between the completion of the commissioning and the acceptance of the equipment by the end user (normally the owner of the vessel or platform into which the equipment is to be installed).

Reception, unpacking and storage

A special document is provided to describe the specific procedures for reception, unpacking, repacking and storage of system components and spare parts.

Project management

Project manager

Kongsberg Simrad AS will normally appoint a dedicated project manager for the delivery project. The manager will follow up the installation and delivery, and will be the installation shipyard's and end user's point of contact.

Installation performed by Kongsberg Simrad

Kongsberg Simrad AS will assist during the installation if specified in the contract or requested by the installation shipyard or customer. Before any installation work by Kongsberg Simrad AS can begin, all cables (at least those which are in any way connected with the system) must be run and connected to their respective terminations. These cables together with the transducer installation will then be checked by the Kongsberg Simrad AS engineers before they are used.

Depending upon the availability of electrical power either from the generators on board or from ashore, the equipment related to the system, and the various parts of the system will be tested during the Setting to Work (STW) period. This requires that interfaces to equipment delivered by other subcontractors are ready for integration testing.

During this period delays may occur if any of the equipment related to the system is not available for testing as and when it is required by Kongsberg Simrad AS. During sea trials, the vessel must be at Kongsberg Simrad's disposal when required, even though we cannot be held responsible for expenses relating to the running costs of the vessel.

After completion of the commissioning, the equipment should be officially handed over to the end user and the appropriate documents signed in accordance with the contract. All defects or deviations from the contract must be specified in detail in these documents. It should be noted that if such defects or deviations are not specified, they cannot be used by any of the parties concerned as valid reason for not signing the documents.

Installation, supervision and commissioning

Electrical and mechanical installation

Unless otherwise stated, the installation shipyard is responsible for the installation of the entire system. In addition, the shipyard is responsible for providing and connecting all cables other than special cables supplied with the equipment. The actual installation and cable laying must comply with the vessel's classification rules and the recommendations given in this manual.

During the installation period, the equipment must be covered in such a way that it is protected from dust, paint spray/splashes and welding/cutting sparks. Precautions must be taken to ensure that no part of the equipment is used as a work platform, or for any other purpose for which it was not designed.

Any damage incurred during the installation period, even with a Kongsberg Simrad AS representative present, is the installation shipyard's responsibility unless it can be proven that the damage was due to production or material defects in the equipment delivered by Kongsberg Simrad AS, or irresponsibility by Kongsberg Simrad AS personnel.

Pre-commissioning and acceptance tests

Pre-commissioning and acceptance tests may be conducted by Kongsberg Simrad AS personnel if this is specified in the contract. The personnel must have available standard equipment and tools, and necessary power supplies for the entire period of installation, commissioning and testing.

Installation tests

The Kongsberg Simrad AS installation period (after shipyard installation) is normally divided into three consecutive phases:

- The initial start-up and dock-side testing period. This period is normally known as Setting-to-Work (STW).
- Dock-side commissioning under operational conditions. This commissioning period is normally ended with a Harbour Acceptance Test (HAT).
- Sea Acceptance Test (SAT) with final commissioning under operational conditions at sea.

The extent of the tests is normally defined in the contract.

If required during a contractual test period, the shipyard must provide assistance necessary for the rapid and efficient completion of the work even when the work is to be performed outside normal working hours. This requirement includes assistance from subcontractors when applicable. Excessive waiting time resulting from delays caused by the shipyard will be charged to the shipyard.

Guarantee period

The guarantee period for the system (as specified in the contract) normally begins as soon as acceptance documents have been signed.

2 SYSTEM DESCRIPTION

Purpose

The purpose of the hull unit is to enable the transducer to be lowered out through the vessel's hull to a depth below aerated water and other sources of acoustic noise.

Caution ***Once the transducer is lowered, the depth of water under the vessel must be monitored closely. It is recommended that the vessel's speed be kept below 10 knots when the transducer is in the lowered position.***

Overview

The HiPAP system is available with two different hull unit models:

- HiPAP 500
- HiPAP 350

The two models have common software and hardware platforms and thereby offer the same kind of additional functionality and options.

HiPAP 500

The HiPAP 500 has a full spherical transducer body including 241 transducer elements. This model has close to full accuracy in the half sphere coverage sector and is the preferred system where the best possible performance is required.

The following HiPAP 500 hull units are available:

HL 3770 with HiPAP 500 transducer for 500 mm gate valve

This is the normally supplied hull unit for HiPAP 500. It is supplied with 500 mm transducer dock to fit on a 500 mm gate valve.

HL 2180 with HiPAP 500 transducer for customized mounting

This hull unit has reduced length and is designed in stainless steel for low magnetic permeability. This unit is without transducer dock.

HL 4570 with HiPAP 500 transducer for 500 mm gate valve

This is the normally supplied hull unit for HiPAP 500. It is supplied with 500 mm transducer dock to fit on a 500 mm gate valve.

HL 6120 with HiPAP 500 transducer for 500 mm gate valve

This hull unit has extended length for HiPAP 500. It is supplied with 500 mm transducer dock to fit on a 500 mm gate valve.

HiPAP 350

The HiPAP 350 has a spherical transducer with a cylindric body including 46 transducer elements. This model has good accuracy in the +/- 60° coverage sector and is suited for operations where the major positioning targets are within this sector.

The following HiPAP 350 hull units are available:

HL 3770 with HiPAP 350 transducer for 350 mm gate valve

This is a hull unit for HiPAP 350. It is supplied with 350 mm transducer dock to fit on a 350 mm gate valve.

HL 3770 with HiPAP 350 transducer for 500 mm gate valve

This is a hull unit for HiPAP 350. It is supplied with 500 mm transducer dock to fit on a 500 mm gate valve.

HL 2180 with HiPAP 350 transducer for customized mounting

This hull unit has reduced length and is designed in stainless steel for low magnetic permeability. This unit is without transducer dock.

HL 6120 with HiPAP 350 transducer for 350 mm gate valve

This hull unit has extended length for HiPAP 350. It is supplied with 350 mm transducer dock to fit on a 350 mm gate valve.

HL 6120 with HiPAP 350 transducer for 500 mm gate valve

This hull unit has extended length for HiPAP 350. It is supplied with 500 mm transducer dock to fit on a 500 mm gate valve.

Hull unit system

The Kongsberg Simrad HiPAP hull unit is a retractable hull unit system comprising the following main parts:

- Hull unit assembly (same for all HiPAP systems)
  - Hoist motor and gearbox
  - Gantry
  - Shaft sleeve

Specific for each type of HiPAP hull unit:

  - Transducer dock with service hatch
  - Mounting flange
  - Transducer shaft
  - Transducer
  - Gate valve including:
    * Position indicator (switch)
    * Electrical actuator (option)

- Hoist Control Unit (same unit for all HiPAP systems)
- Remote Control Unit (same unit for all HiPAP systems)

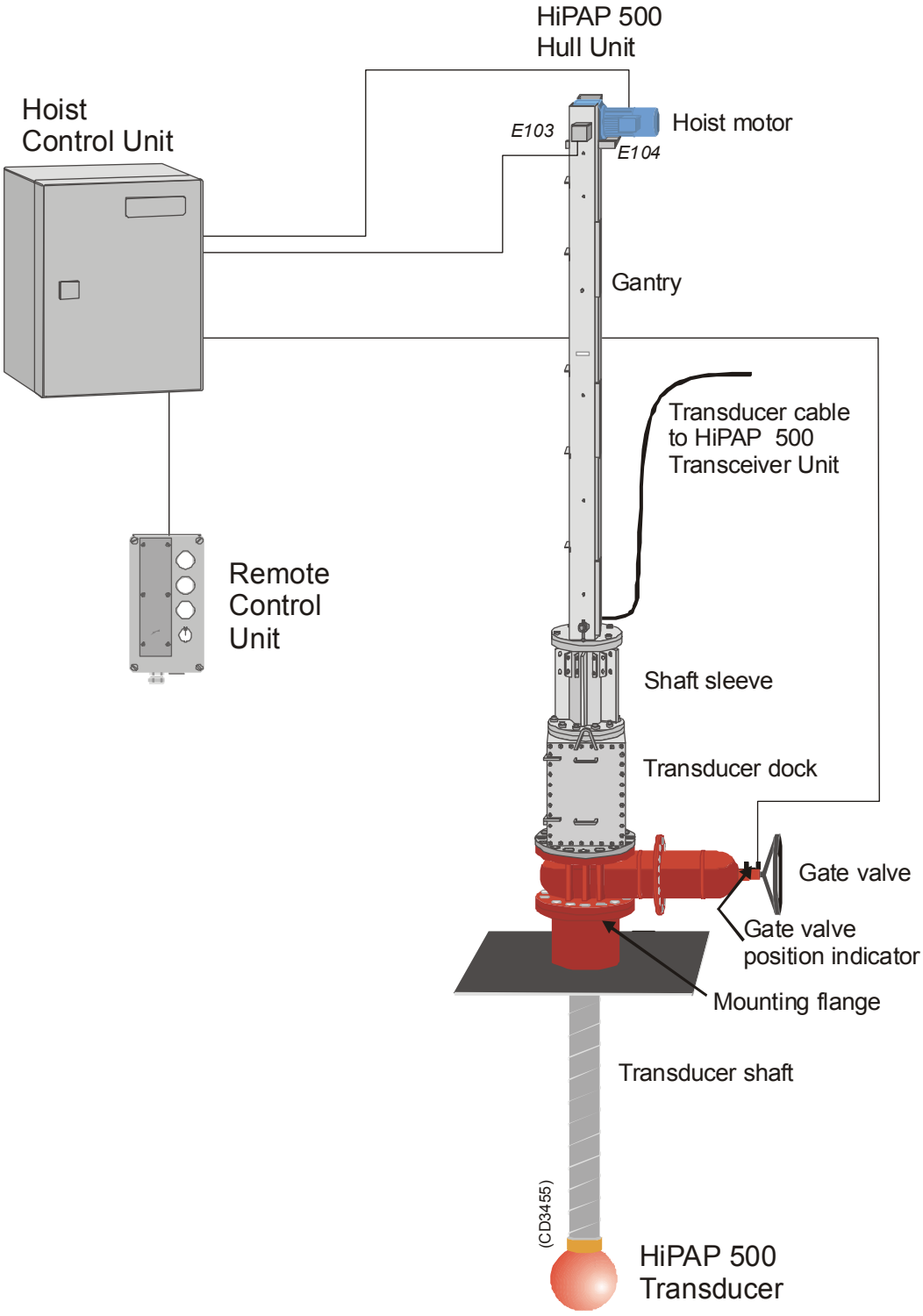


Figure 2 HiPAP 500 - system configuration

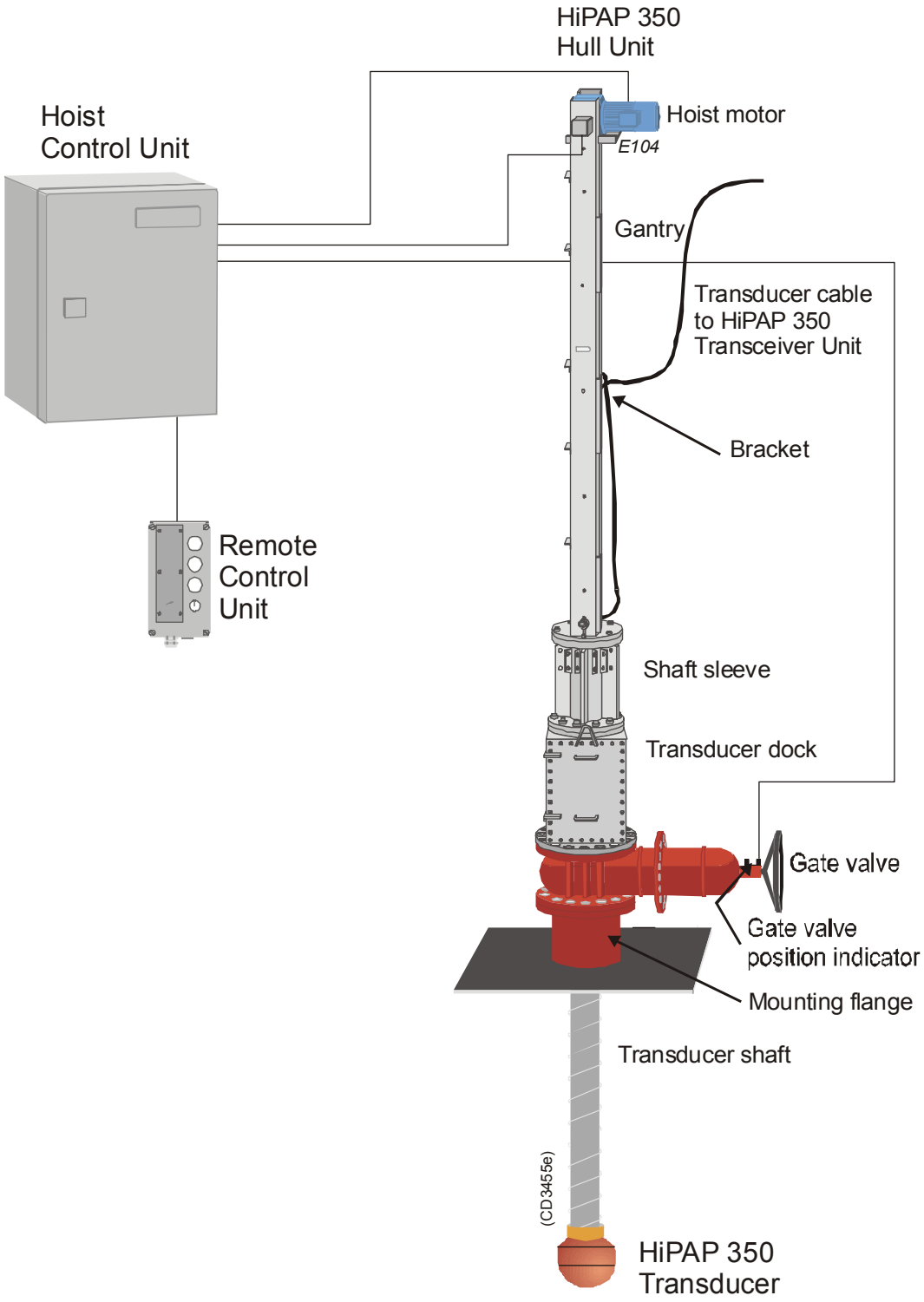


Figure 3 HiPAP 350 - system configuration

Hoist motor and gearbox

The hoist motor and gearbox are mounted on the hoist platform. This platform is at the top of the hull unit, mounted between the tops of the gantry girders.

The transducer is raised and lowered by this electric motor, which has a lifting capacity of 1000 Kp.

A crank handle is provided, which can be attached to one end of the motor shaft, to enable you to raise or lower the transducer manually in the event of a power failure or for maintenance purposes.

Gantry

The hull unit gantry consists of two vertical, parallel steel girders, welded to a plate at their lower ends and with the hoist motor platform bolted to their upper ends. The girders support the transducer shaft when it is raised, and hold guide rails to ensure the shaft is correctly aligned. The upper and lower limit switches are mounted onto one of the girders.

Shaft sleeve

The shaft sleeve is located in the bottom of the hull unit gantry. The sleeve is bolted to the transducer dock, which in turn is to be bolted to the gate valve. The shaft sleeve absorbs the forces created by the water flow acting on the transducer and the transducer shaft.

To prevent water leakage and to ensure smooth raising and lowering of the transducer, the shaft sleeve is fitted with Lion twin-set packing seals at its upper end and a scraper at its lower end. The space between the seals is filled with grease to lubricate the seals and provide extra watertight security.

When the sleeve is sufficiently filled, a thin film of grease will be observable on the transducer shaft. Grease refilling and level checking screws are located on the shaft sleeve.

Note

It is important that the shaft sleeve is kept watertight, and that the transducer shaft raising and lowering actions are as smooth as possible. If the system is in frequent use, the shaft sleeve may be exposed to sea growth, dirt and pollution as the transducer shaft is raised. Frequent inspections, and greasing when necessary, are strongly recommended.

The transducer dock (service dock) consists of a steel box which holds the transducer when the shaft is in the fully raised position. One side of the transducer dock comprises a service hatch. If the transducer is raised and the gate valve shut, the hatch may be opened to expose the transducer for maintenance or exchange. Zinc anodes are mounted inside the transducer dock.

Mounting flange

The mounting flange is welded to the vessels hull, and serves as a base for the transducer raise/lower arrangement. The height of the mounting flange varies according to the specific installation requirements of the vessel, though the standard height is 200 mm. The mounting flange carries the gate valve which permits onboard maintenance or replacement of the transducer.

Transducer shaft

The transducer shaft is a stainless-steel tube which supports the transducer at its lower end. It is supported at the top by guide rails and the raise/lower drive chains within the hull unit gantry, and it moves through the shaft sleeve. The signal cable between the transducer and the transceiver unit runs up the inside of the shaft, exiting at the top through sealing glands.

The transducer shaft is raised and lowered by drive chains, driven via a gearbox by the motor mounted on the hoist platform. The tension in the drive chain is adjusted using a threaded bolt mechanism.

Transducer

The transducer is bolted to the lower end of the transducer shaft. When the shaft is raised, the transducer is stored in the transducer dock. during these periods the gate valve can be closed to protect the transducer completely from the open sea environment.

Gate valve

The gate valve shuts off the opening in the vessel's hull when the transducer is raised. The gate valve is supplied with a position indicator.

- An electrical actuator is available as an option. The actuator is described in this manual.

Gate valve position indicator

The purpose of the gate valve position indicator is to give a feedback indication of the position of the gate valve. The feedback is done by use of switches.

The gate valve position indicator is mounted directly onto the gate valve.

It consists of a slider sliding on a threaded spindle and two switches operated by the slider.

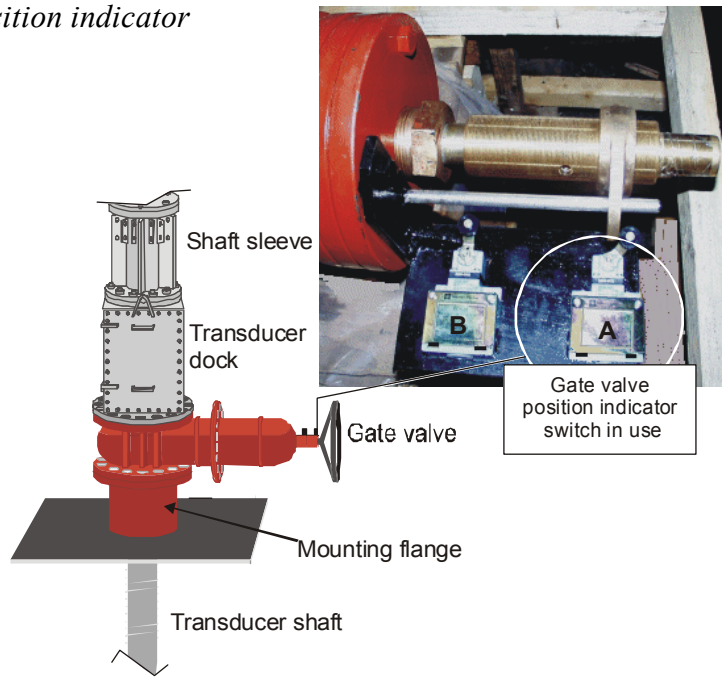
Switch A - is operated when the gate valve is fully open.

Switch B - is operated when the gate valve is fully closed. In the middle position no switch is operated.

The Hoist Control Unit uses the fully open indication (switch A) ***only!***

The Hoist Control Unit will not allow the hoist motor to move the transducer shaft unless the gate valve is fully open.

Figure 4 Gate valve with position indicator



Hoist Control Unit

Introduction

The Hoist Control Unit (HCU) is standard unit used with all types of hull units. This unit is a steel cabinet with hinged front door.

The unit is designed to be mounted on a bulkhead close to the hull unit gantry. For safety reasons there must be a clear line of sight from the HCU to the hull unit.

External connections

All cables to the HCU enter the unit through cable gland located in the base of the unit.

The connections are as follows:

- Controlled mains supply to hull unit raise/lower motor.
- 7 x 2-core signal cable from Remote Control Unit (remote control).
- 6-core signal cable from the hull unit (limit switches etc.).
- 2 cables (4-core) to Gate Valve Open/Closed switch (if mounted).

Remote Control Unit

General

The Remote Control Unit (RCU) is standard unit used with all types of hull units. This unit is an aluminium cabinet with removable front panel.

It holds the control buttons and indicator lamps required to enable the safe operation of the hull unit from a remote location.

→ *Refer to the figure on page 35.*

This unit is designed to be mounted on a bulkhead, and will usually be located in the vicinity of the system operator station. This enables the system operator to control the hull unit raising and lowering operations without being at the physical location of the hull unit.

External connections

The RCU is connected to the Hoist Control Unit via a cable. There are no practical restrictions on the distance between the two units.

The connection is as follows:

- 7 x 2-core signal cable to the Hoist Control Unit

Electrical system

Introduction

The raise/lower system for the hull unit comprises three main components:

- Hoist Motor (mounted on the hull unit)
- Hoist Control Unit (HCU)
- Remote Control Unit (RCU)

Note

The technical description of the HCU electrical system, and the connections to the other two main units, are described in this section.

Hoist Control Unit

The HCU controls the raising and lowering of the hull unit. The unit consists of a +24 Vdc linear power supply, main relays controlling the hoist motor, and control relays controlled from the operator Switch S1, or from the RCU (if used).

The main relays K02 and K03 connect the 3-phase mains power to the hoist motor. The motor's direction of rotation depends on the mains supply phase sequence, and the HCU performs the raise/lower function by using K02 and K03 to change the phase sequence.

The HCU contains a switch S1 to operate the hull unit locally, while a RCU can operate the hull unit remotely.

→ *HCU switch S1 location, see page 33.*

- Fuse F01 protects the +24 Vdc power supply used by the relay circuits.
- Fuse F02 is mounted with relay K03 and it protects the hoist motor.

Remote Control Unit

The RCU is an independent unit, usually mounted on the bridge in the vicinity of the system operator's console. This unit controls the hoist motor in the same way as S1 in the HCU. To use the RCU, S1 in the HCU must be in position **REMOTE**.

→ *RCU buttons, see page 35.*

Circuit description

References

Refer to the following drawings:

→ *Interconnection diagram, hoisting system on page 219.*

→ *Wiring diagram, Hoist Control Unit on page 220.*

→ *Circuit diagram, Hoist Control Unit on pages 221 and 222.*

→ *Wiring diagram, Remote Control Unit on page 223.*

Power supplies

The HCU can be supplied with 230, 380, 440 Vac 3-phase mains input. The acceptable mains voltage depends on links set within the HCU and the type of motor mounted on the hull unit.

+24 Vdc power supply

The +24 Vdc power supply is derived from a 1-phase voltage taken from the 3-phase mains input. It enters through the automatic circuit breaker F01 (2A), and is connected to transformer T01. Links on T01 must be set according to the mains voltage supplied. Refer to the HiPAP hull units wiring diagram, which shows the links required for 380/440 Vac as default.

T01 delivers a voltage of 18 Vac, and D04 (a varistor) cuts off any voltages spikes above this limit. The rectifier D05 delivers +24 Vdc across the decoupling capacitor C01 to the control circuits. The connections for the +24 Vdc power supply are made on the terminal block HCTB2.

Motor power supply

The 3-phase mains power enters on the motor protection fuse F02, and is passed to the relays K02 and K03. Activation of one of the relays will supply the 3-phase voltage to the hoist motor. K02 delivers the opposite phase sequence to that delivered by K03. This shifting of phases controls the direction of motor rotation.

- Activating K02 causes the motor to raise the hull unit.
- Activating K03 causes the motor to lower the hull unit.
- Contacts 21 and 22 on K02 and K03 prevent the relays being activated simultaneously.

Relay control

Before the relays K02 or K03 activate and start the motor, several independent events must take place simultaneously. The control circuit is a serial link of several switches with each switch representing one event. When all the switches are closed and the circuit is complete, the relay will be activated by supplying +24 Vdc across its coil. A break in the series circuit will halt the raise/lower action.

→ *For more details, refer to circuit diagram on pages 221 and 222.*

The designs of the raising and lowering circuits are identical for both local and remote control.

LOWER/DOWN in remote control

The RCU uses relays K01 and K04 for control of K02 and K03 respectively.

- A1 on K03 connects to +24 Vdc through the following circuit:
  - S1 (S1 set to REMOTE)
  - to K04/4-7 (closed when K04 activated)
  - to +24 Vdc
- A2 on K03 connects to ground through the following circuit:
  - K02/21-22 (K02 inactive)
  - to HCTB1/18
  - to lower limit switch (switch closed until activated)
  - to HCTB1/16
  - to motor protection relay F02/96-95
  - to HCTB1/20
  - to Gate valve if mounted (if not, HCTB1/20-21 linked)
  - to ground in HCTB1/21

→ *For more details, refer to circuit diagram on pages 221 and 222.*

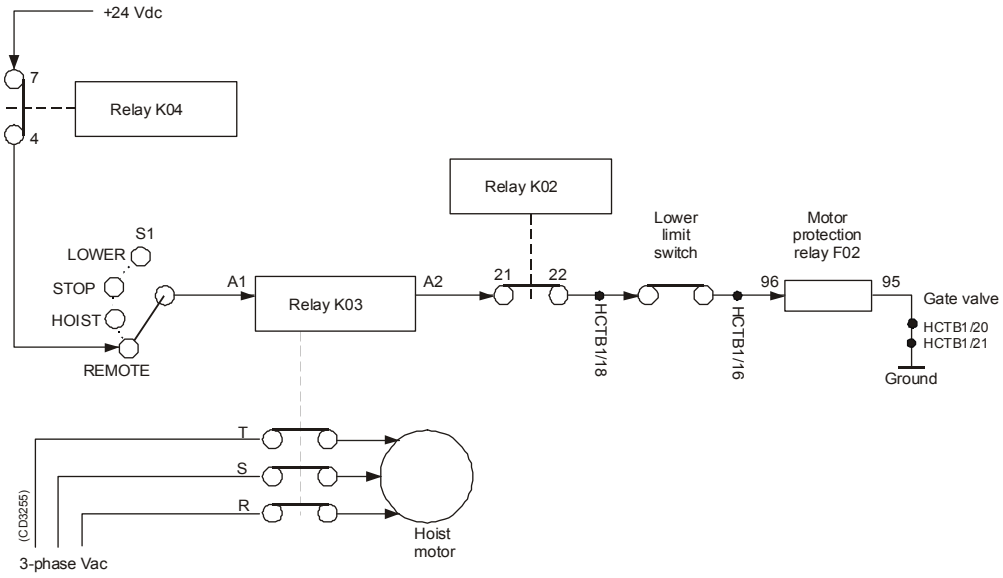


Figure 5 Lowering in remote mode

Relay K04 circuit

When in the remote mode relay K04 must be activated (K04/4-7 closed) to activate relay K03. To activate relay K04, the **LOWER/DOWN** button (S3) on the RCU must be pressed. S3 has two switches working in opposition:

- one is normally closed
- the other is normally open.

The S3 switches will only "switch" when S3 is pressed. Pressing S3 activates K04 and deactivates K01.

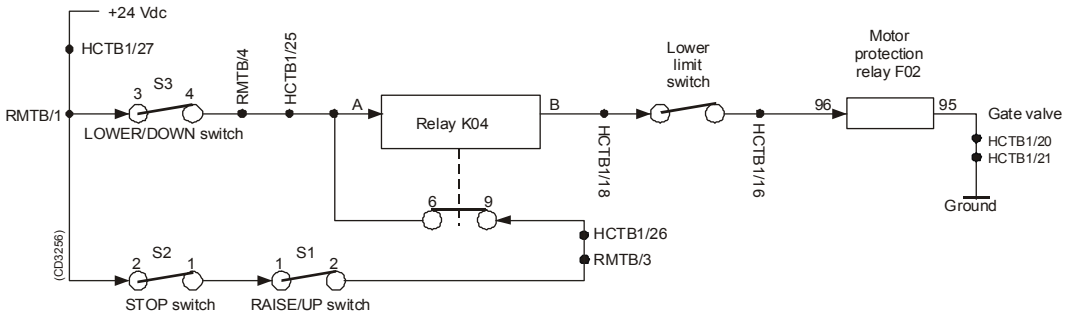


Figure 6 K04 control

- A on K04 connects to +24 Vdc through the following circuit:
  - HCTB1/25 (Down)
  - to RMTB/4 (Down)
  - to LOWER/DOWN switch S3/4-3 in the RCU (S3 activated)
  - to +24 Vdc via RMTB/1 and HCTB1/27.

To keep relay K04 active when **LOWER/DOWN** switch S3 is released, the **RAISE/UP** switch S1 provides +24 Vdc via relay K04/6-9 itself, when STOP switch S2 is not pressed.

- A on K04 connects to +24 Vdc through the following circuit:
  - K04/6-9
  - to HCTB1/26 (Down hold)
  - to RMTB/3 (Down hold)
  - to RAISE/UP switch S1/2-1 in the RCU (S1 inactive)
  - to STOP switch S2/1-2 in the RCU (S2 inactive)
  - to +24 Vdc via RMTB/1 and HCTB1/27.

- B on K04 connects to ground through the following circuit:
  - HCTB1/18
  - to lower limit switch (switch closed until activated)
  - HCTB1/16
  - to motor protection relay F02/96-95
  - to HCTB1/20
  - to Gate valve if mounted (if not, HCTB1/20-21 inked)
  - to ground in HCTB1/21

→ *For more details, refer to circuit diagram on pages 221 and 222.*

RAISE/UP in remote control

- A1 on K02 connects to +24 Vdc through the following circuit:
  - S1 (S1 set to REMOTE)
  - to K01/4-7 (closed when K01 activated)
  - to +24 Vdc
- A2 on K02 connects to ground through the following circuit:
  - K03/21-22 (K03 not active)
  - to HCTB1/15
  - to upper limit switch (switch closed until activated)
  - to HCTB1/16
  - to motor protection relay F02/96-95
  - to HCTB1/20
  - to Gate valve if mounted (if not, HCTB1/20-21 linked)
  - to ground in HCTB1/21

→ *For more details, refer to circuit diagram on pages 221 and 222.*

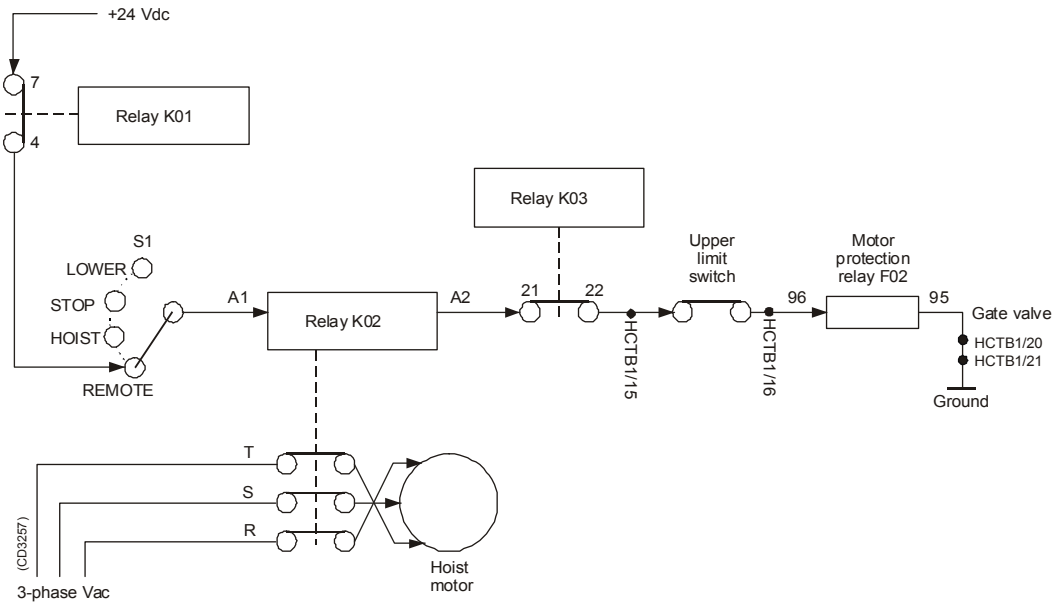


Figure 7 Raise in remote mode

Stop

Pushing the **STOP** button breaks the +24 Vdc (up/down hold) needed to keep relay K01 and K04 active.

Relay K01 circuit

When in the remote mode, relay K01 must be activated (K01/4-7 closed), to activate relay K02.

To activate relay K01, the **RAISE/UP** button (S1) on the RCU must be pressed. S1 has two switches working in opposition:

- One is normally closed
- the other is normally open.

The S3 switches will only "switch" when S3 is pressed. Pressing S3 activates K04 and deactivates K01.

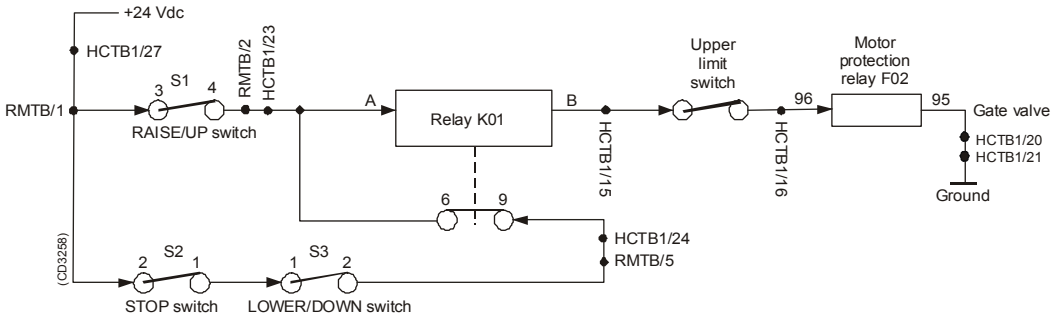


Figure 8 K01 control

- A on K01 connects to +24 Vdc through the following circuit:
  - HCTB1/23 (Up)
  - to RMTB/2 (Up)
  - to RAISE/UP switch S1/4-3 in RCU (S1 activated)
  - to +24 Vdc via RMTB/1 and HCTB1/27

To keep relay K01 active when RAISE/UP switch S1 is released, the **LOWER/DOWN** switch S3 provides +24 Vdc via relay K01/6-9 itself, when STOP switch S2 is not pressed.

- A on K01 connects to +24 Vdc through the following circuit:
  - K01/6-9
  - to HCTB1/24 (Up hold)
  - to RMTB/5 (Up hold)
  - to LOWER/DOWN switch S3/2-1 in the RCU (S3 inactive)
  - to STOP switch S2/1-2 in the RCU (S2 inactive)
  - to +24 Vdc via RMTB/1 and HCTB1/27

- B on K01 connects to ground through the following circuit:
  - HCTB1/15
  - to upper limit switch (switch closed until activated)
  - HCTB1/16
  - to motor protection relay F02/96-95
  - to HCTB1/20
  - to Gate valve if mounted (if not, HCTB1/20-21 linked)
  - to ground in HCTB1/21

→ *For more details, refer to circuit diagram on pages 221 and 222.*

Lamps

There are three lamps on the RCU to assist the operator:

- **RAISE/UP**
- **STOP**
- **LOWER/DOWN**

→ *For description refer to page 36.*

RAISE/UP

This light connects permanently, via dimmer potentiometer, to +24 Vdc on RMTB/1, and to ground through the following circuit:

- RMTB/7
- to HCTB1/17
- to upper limit switch (switch open until activated)
- to ground in HCTB1/28

LOWER/DOWN

This light connects permanently, via dimmer potentiometer, to +24 Vdc on RMTB/1, and to ground through the following circuit:

- RMTB/8
- to HCTB1/14
- to lower limit switch (switch open until activated)
- to ground in HCTB1/28

STOP

This light connects permanently, via dimmer potentiometer, to +24 Vdc on RMTB/1, and to ground through the following circuit:

- RMTB/6
- to HCTB1/22
- to K03/62-61 (K03 not activated)
- to K02/62-61 (K02 not activated)
- to ground in HCTB1/28

Lowering in local control

S1 connects A1 on K03 to +24 Vdc.

- A2 connects to ground through the following circuit:
  - K02/21-22 (K02 inactive)
  - to HCTB1/18
  - to lower limit switch (switch closed till activated)
  - to HCTB1/19
  - to motor protection relay F02/96-95
  - to HCTB1/20
  - to Gate valve if mounted (if not, HCTB1/20-21 linked)
  - to ground in HCTB1/21

→ *For more details, refer to Hoist Control Unit circuit diagrams in the Drawing file section.*

→ *For more details, refer to circuit diagram on pages 221 and 222.*

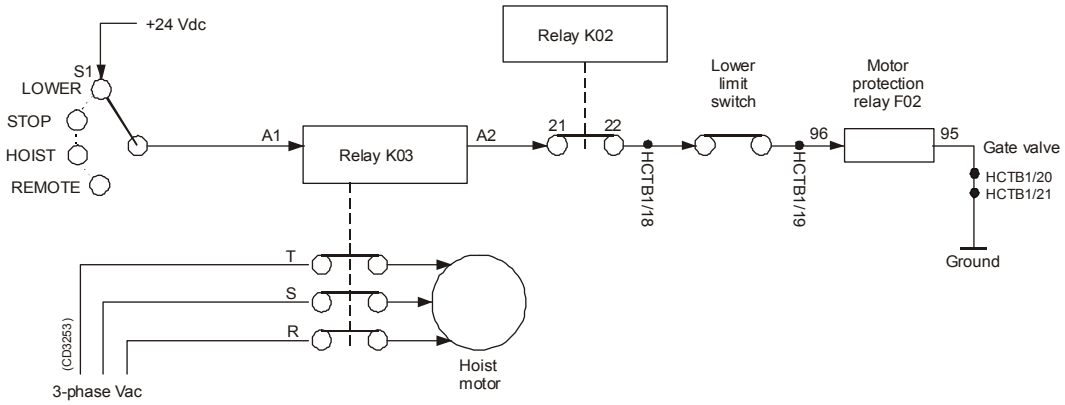


Figure 9 Lowering in local mode

Hoisting in local control

S1 connects A1 on K02 to +24 Vdc.

- A2 connects to ground through the following circuit:
  - K03/21-22 (K03 inactive)
  - to HCTB1/15
  - to upper limit switch (switch closed till activated)
  - to HCTB1/16
  - to motor protection relay F02/96-95
  - to HCTB1/20
  - to Gate valve if mounted (if not, HCTB1/20-21 linked)
  - to ground in HCTB1/21

→ *For more details, refer to circuit diagram on pages 221 and 222.*

→ *For more details, refer to Hoist Control Unit circuit diagrams in the Drawing file section.*

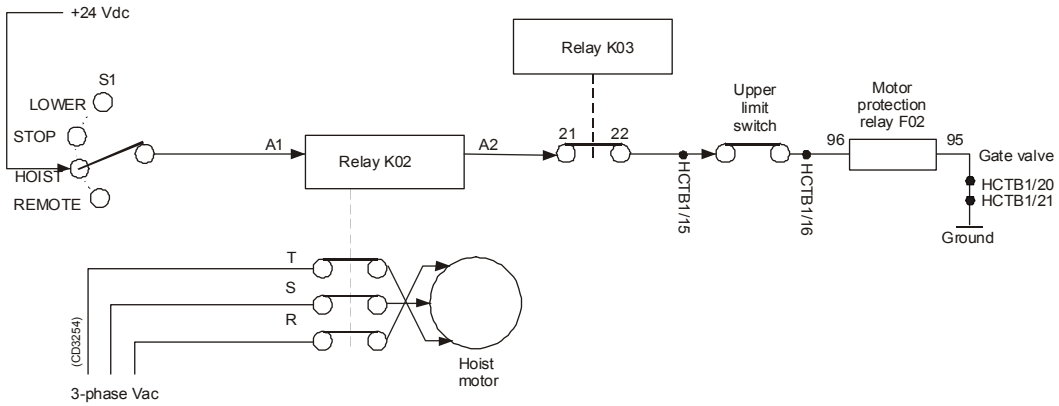


Figure 10 Hoisting in local mode

Stop

When set to STOP, S1 disconnects the +24 Vdc supply from relays K02 and K03, preventing them from activating.

Electrical actuator (option)

General

The electrical actuator is used to open and close the gate valve automatically.

- The actuator is a high value electro-mechanical devise.
- The actuator is designed to be mounted directly on the gate valve.

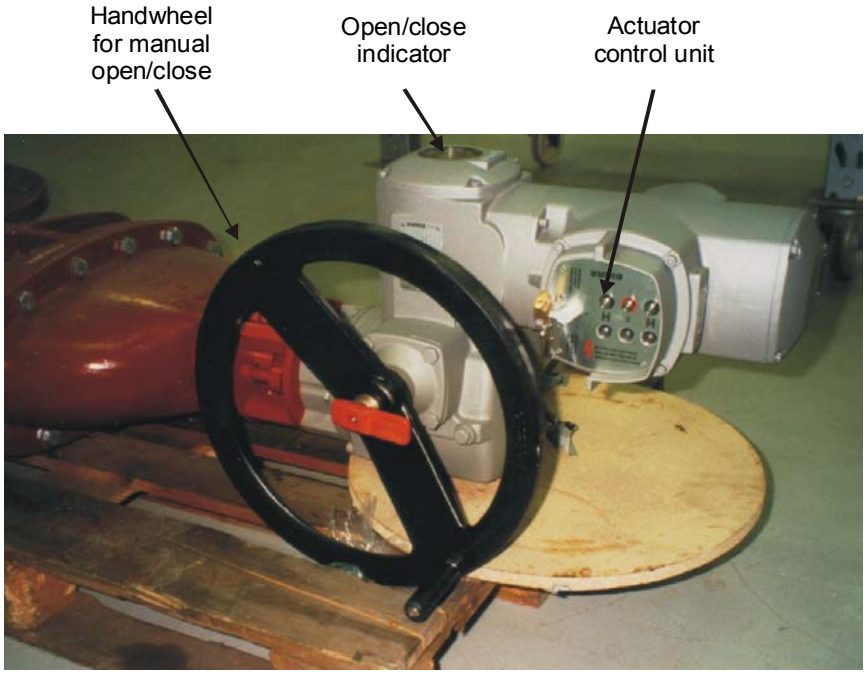


Figure 11 Standard gate valve with electrical actuator

System

The electrical actuator system comprises of three main units:

- Actuator
- Remote station
- Local control unit

The system units contains the electronic circuitry and relays required to open and close the gate valve. The actuator and the actuator control units are connected to the Hoist Control Unit of the hull unit.

The gate valve can be operated as follows:

- Manual by use of a hand wheel, or
- Automatically by use of:
  - The actuator local-/remote control unit, or
  - The control buttons on the actuator control unit.

For operation of the buttons and the select switch:

→ *Refer to the auma multi-turn actuators* Operation instructions *supplied with the actuator.*

Interlocks prevents:

- To lower the hull unit if the gate valve is closed.
- To close the gate valve if the hull unit is lowered.

Selection of remote or local operation is done at:

- The actuator *local control unit*.

Local control unit

The actuator local control unit is used to open and close the gate valve in the vicinity of the hull unit. The local control unit holds:

- Five lamps
- Two buttons
- One switch

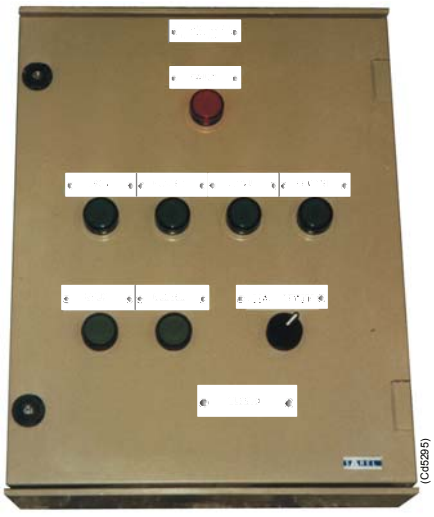


Figure 12 Actuator local control unit

Lamps

The function of the lamps are as follows:

FAULT	When lit, it indicates torque overload / phase failure or other faults.

→ *Refer to the auma multi-turn actuators* Operation instructions *supplied with the actuator.*

OPEN	The lamp is flashing when the gate valve is opening. When the gate valve is fully open the lamp will lit constantly.
CLOSED	The lamp is flashing when the gate valve is closing. When the gate valve is fully closed the lamp will lit constantly.
LOCAL	When lit, it indicates LOCAL operation.
REMOTE	When lit, it indicates REMOTE operation.

Pushbuttons

The function of the pushbuttons are as follows:

OPEN	Push the button, and the gate valve is opening.
CLOSE	Push the button, and the gate valve is closing.

Switch

This switch is used to switch between local and remote control. You can also stop the open/close action by turning the switch to remote (if the switch is in local position).

The function of the switch is:

LOCAL	Local position, activates local control of the gate valve operation.
REMOTE	Remote position, activates remote control of the gave valve operation.

Remote station

The actuator remote station is normally mounted close to the operators station. This enables the operator to operate the gate valve from the operator's room. The remote station holds:

- Five lamps
- Two buttons

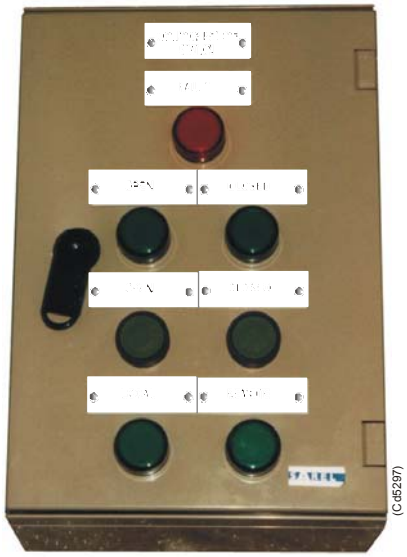


Figure 13 Actuator remote station

Lamps

The function of the lamps are as follows:

FAULT	When lit, it indicates torque overload / phase failure or other faults.
LOCAL	When lit, it indicates LOCAL operation.
REMOTE	When lit, it indicates REMOTE operation.
OPEN	The lamp is flashing when the gate valve is opening. When the gate valve is fully open the lamp will lit constantly.
CLOSED	The lamp is flashing when the gate valve is closing. When the gate valve is fully closed the lamp will lit constantly.

Pushbuttons

The function of the pushbuttons are as follows:

OPEN	Push and hold the button to open the gate valve. When the button is not pushed, the opening of the gate valve will stop.
CLOSED	Push and hold the button to close the gate valve. When the button is not pushed, the closing of the gate valve will stop.

Electrical connections

The cables are connected to the actuator via the actuator terminal compartment. All cables are yard supply.

3 OPERATION

Overview

This section presents the operation of the HiPAP hull units. The operation is the same for all types of HiPAP hull units.

Hoist control operation

General

The hull unit will normally be controlled from the operator's position using the Remote Control Unit (RCU).

However, in the event that the hull unit must be raised or lowered for maintenance purposes, the HCU must be used. The HCU is in the vicinity of the hull unit and the maintenance engineer must have a clear view of the hull unit while it is being raised or lowered. The engineer will therefore be in a much better position to be able to start and stop the unit as required.

The HCU incorporates a rotary switch, S1, which is used to raise or lower the hull unit locally.

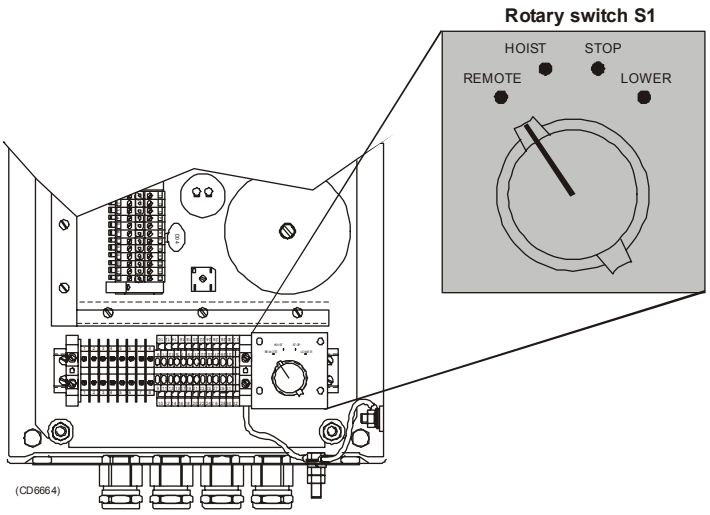


Figure 14 Hoist Control Unit - switch S1

Lowering the hull unit

1 Ensure no maintenance work is being performed on the hull unit.

2 Check to ensure there are no obstructions around the hull unit which could prevent it from moving (or jam it while it is moving).

3 Open the HCU door.

4 Set rotary switch S1 to **LOWER**.

5 Once the hull unit has reached the required position, set the switch S1 to **STOP**.

- The hull unit will stop automatically when it reaches its fully lowered position. Once it has stopped, set the switch to **STOP** to prevent the unit from moving in the event of a fault.

6 Close the HCU door.

Raising the hull unit

1 Ensure no maintenance work is being performed on the hull unit.

2 Check to ensure there are no obstructions around the hull unit which could prevent it from moving (or jam it while it is moving).

3 Open the HCU door.

4 Set rotary switch S1 to **HOIST**.

5 Once the hull unit has reached the required position, set the switch S1 to **STOP**.

- The hull unit will stop automatically when it reaches its fully raised position. Once it has stopped, set the switch to **STOP** to prevent the unit from moving in the event of a fault.

6 Close the HCU door.

Stopping the hull unit

If the hull unit must be stopped at any position other than fully raised or fully lowered, set the rotary switch to **STOP** at the appropriate time.

Always set the switch to STOP before commencing maintenance work on the hull unit.

Remote operation of the hull unit

Once you have completed all operations requiring local control of the hull unit, ensure all personnel, tools etc. are clear of the hull unit and set the rotary switch S1 to **REMOTE**. The hull unit is then controlled by the RCU located in the vicinity of the operator's console.

WARNING **When the system is under remote control the hull unit will move without warning, so ensure personnel and equipment are kept well clear. Always set the rotary switch S1 to STOP before approaching the hull unit.**

Remote control operation

The operator uses the control buttons on the RCU to raise and lower the hull unit from the vicinity of the Operator Station.

The RCU holds the following three control buttons (with indicator lamps):

- **RAISE/UP**
- **STOP**
- **LOWER/DOWN**

The unit also holds a dimmer potentiometer for adjusting the light intensity.

Figure 15 Remote Control Unit

Control buttons

The control buttons have the following functions:

RAISE/UP	This control button initiates the transducer raising function.
STOP	This control will stop all movement of the hull unit. It can be activated at any time. To continue the operation, you must press the **RAISE/UP** button or the **LOWER/DOWN** button.
LOWER/ DOWN	This control initiates the transducer lowering function.

Indicator lamps

The indicator lamps operate as follows:

RAISE/UP	This lamp will be lit when the hull unit is in the fully raised position.
STOP	This lamp will be lit whenever the hull unit is stationary.
LOWER/ DOWN	This lamp will be lit when the hull unit in the fully lowered position.

Note *The **STOP** button can be pressed at any time to stop the unit.*

Note *If movement of the shaft is obstructed between the raised and lowered positions, (for example you could have pressed the **LOWER/DOWN** button without first opening the gate valve), a motor protection relay will trip and cut off power to the hoist motor. The **STOP** lamp will be lit. To restart the motor, it must be reset.*

Motor reset

To reset the motor, press the Reset button on the motor protection relay in the HCU.

→ *Refer to the figure on page 48.*

Note *When the system is not in use and the hull unit is fully raised, you are advised to keep the gate valve closed.*

Manual operation of the hoist motor

A hand crank is provided, which can be attached to one end of the motor shaft, to enable you to raise or lower the transducer manually in the event of a power failure or for maintenance purposes.

- The motor has an internal brake mechanism which must be released manually, if you are to use the hand crank.
- The hand crank is stowed on the hoist platform, and must be fitted to the motor shaft for use.

Note

Ensure that power to the hull unit is switched off before using the handle.

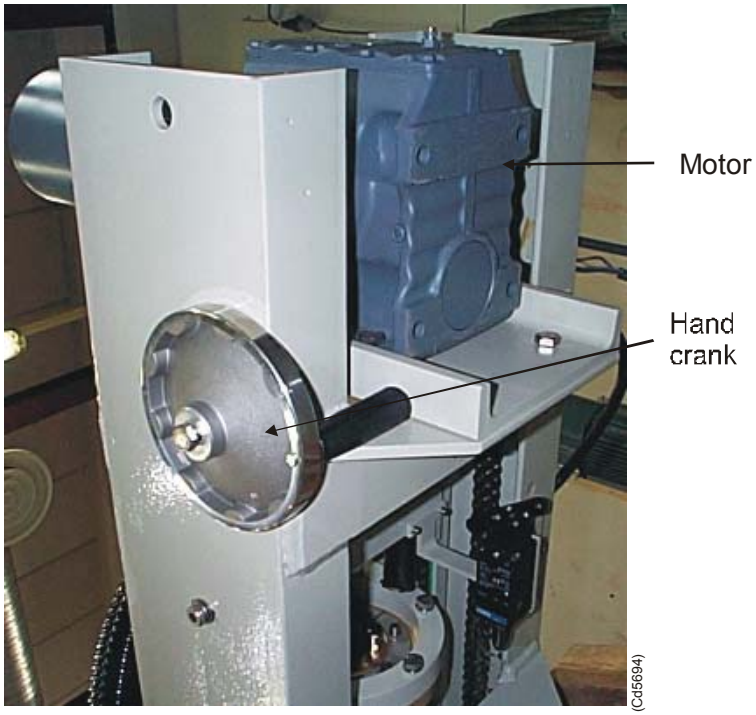


Figure 16 Hand crank stowed

Procedure

1. Loosen the hand crank from the hoist platform.
2. Put the on the hand crank on the top of the motor.
3. Tighten the screw (on the top of the motor/gearbox - see figure below) until you are able to turn the motor shaft with the hand crank.

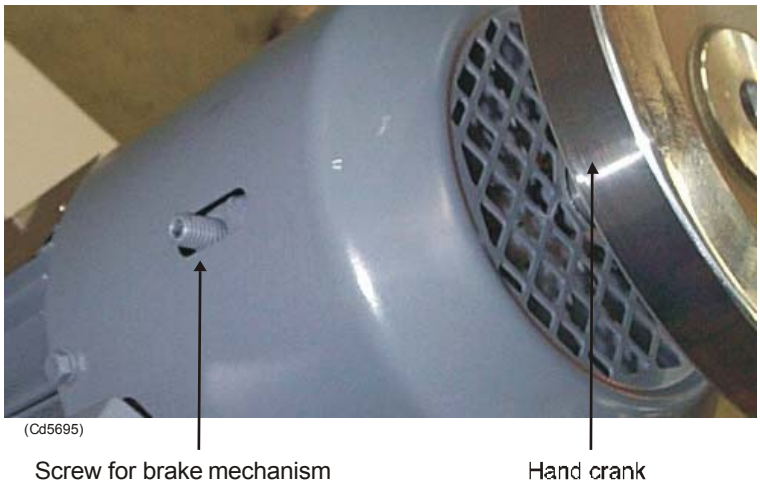


Figure 17 Brake mechanism screw

Note *After the manual operation is completed remember to:*
- Loosen the screw.
- Remove the hand crank and put it back into storage.

WARNING **For safety reasons, always keep the gate valve closed when the hull unit is in fully raised position and the break is released.**

Gate valve operation

General

If an electrical actuator is fitted, the gate valve will normally be open/closed from the operator's position using the actuator remote/local unit or the buttons on the actuator control unit.

Note

To operate the actuator, the Hoist Control Unit of the hull unit must be powered up.

However, in the event that the gate valve must be closed or opened for maintenance purposes, use the manual hand wheel.

Manual operation

Engaging manual operation

Caution

Manual operation must only be engaged if the motor stands still.

1 Lift the change-over lever in the centre of the hand wheel approximately 85 degrees while you slightly are turning the hand wheel.

2 Release the change-over lever
(snap back to initial position by spring action).
- The manual drive remains engaged.
- If the lever does not snap back, just push it firmly back into initial position.

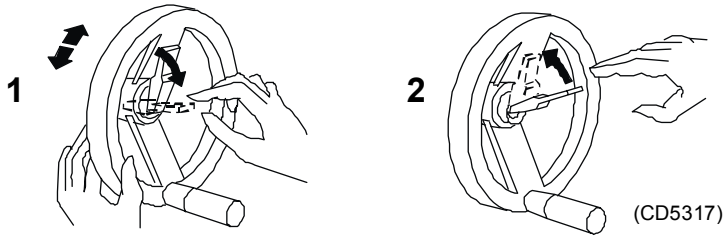


Figure 18 Change-over to manual drive

Manual operation

If power tools are used for manual operation, maximum permissible speed is 300 rpm.

Disengage manual operation

Manual drive disengages automatically when the motor is started.

Using the actuator remote control unit

Opening the gate valve

1 Ensure no maintenance work is being performed on the hull unit.

2 Ensure that the transducer is fully raised.

3 Check for any obstructions around the opening which could prevent it from opening (or jam it while it is opening).

4 Select the required control unit (Remote or Local).

5 Press the required **OPEN** button.
- The CLOSED lamp will extinguish.
- The OPEN lamp will start flashing on both the Local and Remote control units.
- When the gate valve is fully opened, the OPEN lamp will lit constantly.

6 The positioning indicator on the actuator gives a feedback indication of the position of the gate valve.

Closing the gate valve

1 Ensure no maintenance work is being performed on the hull unit.

2 Ensure that the transducer is fully raised.

3 Check to ensure there are no obstructions around the opening which could prevent it from closing (or jam it while it is moving).

4 Select the required control unit (Remote or Local).

5 Press the required **CLOSE** button.
- The OPEN lamp will extinguish.
- The CLOSE lamp will start flashing on both the Local and Remote control units.
- When the gate valve is fully closed, the CLOSED lamp will lit constantly.

6 The positioning indicator on the actuator gives a feedback indication of the position of the gate valve.

4 MAINTENANCE

Overview

This section contains information to enable the maintenance engineer to perform all normal preventive and corrective maintenance on the HiPAP hull units system.

The procedures are identical for the HiPAP 500 and the HiPAP 350.

It includes maintenance for:

- Hull Unit
- Hoist Control Unit (HCU)
- Remote Control Unit (RCU)

Drawings referred to in the text are listed as references, and are located in the *Drawing file* section.

Spare parts are defined according to Kongsberg Simrad's maintenance philosophy. They are listed in the *Spare Parts* section.

Safety

Working on live electrical equipment is dangerous. Refer to standard company/vessel safety procedures before commencing maintenance work.

→ *See also High voltage safety warning on page XVII in this manual.*

Note

After any maintenance work, the system must be checked to ensure it works correctly. Refer to the procedure in the Test and alignment procedures *section.*

Watertightness test

If maintenance work must be performed on the "wet" sections of the hull unit, always perform a watertightness test before breaking the watertight integrity of the hull unit.

→ *Refer to page 54.*

Torques

All the nuts and bolts used in the system must be tightened to their recommended torques to prevent leaks or damage to the threads. The recommended tightening torques for the various sizes of threads are as follows:

Nut/bolt torques	
Thread size (mm)	**Torque (Nm)**
M4	2.7
M5	5.4
M6	9.3
M8	22
M10	44
M12	76
M16	187
M20	300
M24	629

Tools

Standard tools

A standard mechanical tool set will be required for:

- Perform the majority of the maintenance described in this manual.
- Perform the installation, removal and replacement of modules and parts described in this manual.

This set should at the minimum contain the following tools:

- Standard screwdrivers in different widths and lengths
- Allen key in metric size
- Phillips screwdrivers in various sizes
- Pozidrive screwdrivers in various sizes
- Flat nosed pliers
- Lap jointed pliers
- Wire cutters
- Wire stripper
- Soldering iron
- Open ended and ring spanners in metric sizes
- Adjustable spanners
- Socket set
- Knife
- A standard electrical tool set may be required to perform repairs to cables etc.
- In addition, the normal heavy tools designed for installation work is required.
- Grease gun with appropriate nipple connector (if required).
- Grounding bracelet

The following expendables are recommended:

- Solders
- Wire straps in different sizes
- Isolating plastic tape

Special tools

If special tools are required for a particular procedure, they will be listed at the beginning of that procedure.

Before you start

Before you start performing any maintenance, inform the control room that you are about to carry out maintenance on the hull unit, and that the hull unit will be switched off while the maintenance is being carried out.

Preventive maintenance schedule

General

Maintenance routines must be performed regularly and effectively to ensure that the equipment is kept in top condition. Effective maintenance is even more important with the equipment described in this manual, as a faulty unit could have disastrous consequences in the presence of an inflammable atmosphere.

The chart below states the **maximum** recommended intervals at which the various routines should be performed - the intervals should be decreased if the system is used excessively, or if the maintenance engineer considers it necessary.

Maintenance chart

Routine	Frequency
Hull unit general inspection	Annual
Filling motor gearbox	Annual
Filling shaft sleeve	Annual
Cleaning transducer	Annual
Lubricating drive chains/sprockets	2 months
Cleaning transducer shaft	2 months
Hoist Control Unit general inspection	Annual
Remote Control Unit general inspection	Annual
Gate valve OPEN/CLOSE	2 weeks

Lubrication

Several parts of the hull unit must be inspected to ensure the correct amounts of lubricants are present. The following points must be checked:

1 The gearbox - Oil level shall be to the top screw on the side of the unit.

- Oil type: *SAE 30 motor oil*

→ *Refer to the filling procedure on page 56.*

2 The shaft sleeve - The transducer shaft must be covered with a **thin** film of grease.

- Grease type: *Esso Cazar K1* (or equivalent)

→ *Refer to the lubrication procedure on page 76.*

3 The drive chains and sprockets - The drive chains must be lightly greased to ensure smooth operation and prevent corrosion.

- Grease type: *BIRAL VG/HT* (or equivalent).

→ *Refer to the lubrication procedure on page 60.*

4 The transducer shaft guide rails - The guide rails ensure the transducer shaft remains correctly orientated relative to the vessel at all times. These guides must be checked at regular intervals and adjusted as necessary.

- Grease type: *BIRAL VG/HT* (or equivalent).

→ *Refer to the procedure on page 62.*

5 **Limit switches** - The limit switches are activated by rotating arms. These arms are mounted on bearings, and are fitted with wheels to reduce friction. A few drops of oil on the moving parts at regular intervals will help to keep the switches trouble-free.

Special attention

Special attention must be given to the shaft sleeve and transducer shaft. The sleeve contains several seals, and these will wear as the transducer is lowered and raised. It is therefore important that you:

- Keep the transducer shaft clean, and remove growth and dirt.
- Keep the transducer shaft oiled at all times.
- Keep the shaft sleeve filled with oil at all times.

If the shaft becomes dirty or the shaft sleeve runs dry, the seals will wear faster. This will in turn lead to leaks, and the seals will then need to be replaced.

Hull unit general inspection

General

The hull unit must be inspected at regular intervals, and before use if it has not been used for an extended period.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Trained maintenance/inspection engineer.

Vessel location - Afloat.

Special tools - None.

Spare parts - Depending on the results of the inspection.

Procedure

1 Switch off power to the system in the Hoist Control Unit.

2 Check all power and signal cables for signs of damage or overheating.

3 Open all the junction boxes and check all cable terminations to ensure they are tight. Close the boxes firmly on completion.

4 Check all cable glands to ensure they seal correctly.

- Refer to the *Cable gland assembly procedure* in the *Cable layout and interconnections* section if a gland is found to be loose.

5 Check around the hull unit, especially around the mounting flange for signs of water leakage.

- If water is detected, find the leak. Tighten the bolts to close the leak, or refer to the appropriate procedure and replace the appropriate seals.

6 Check for signs of damage to the transducer shaft, for example scratches on the shaft surface, or sea growth. Clean as necessary.

- If serious damage is detected, the shaft may need to be replaced. If in doubt, consult Kongsberg Simrad or your dealer.

7 Check the motor gear box for signs of oil leaks.

8 Check the oil level in the gear box and fill as necessary.

→ *Refer to page 56.*

9 Check the transducer shaft to ensure that it is correctly lubricated.

- The shaft should be covered with a thin film of grease when it is raised. Refill the shaft sleeve as necessary.

→ *Refer to the procedure on page 76.*

10 Check the entire hull unit assembly for signs of corrosion.

- If required, clean the corroded areas and apply the appropriate preservation mediums.

11 Check the tension of the drive chains and adjust if necessary.

→ *Refer to page 62.*

12 Check that the upper and lower limit switches are securely and correctly located, and operate correctly.

13 On completion of the inspection (other units may also need to be inspected) re-apply power to the system.

14 Hoist the transducer to its upper position.

15 Inspect the transducer.

→ *Refer to page 68 for instructions on cleaning the transducer.*

→ *Refer to page 80 for instructions on replacing the zinc anode.*

If necessary, check that the system operates correctly by performing the system test procedure described in the *Test and alignments procedures* section.

Refer to the *Spare Parts* section for a full list of all the spares available for the hull unit.

Hoist Control Unit

Internal layout

The Hoist Control Unit (HCU) contains the electronic circuitry and relays required to raise and lower the hull unit.

A rotary control switch (S1) within the cabinet enables the operator/maintenance engineer to raise or lower the hull unit locally.

An additional position on the switch changes control of the hull unit to a remote control unit, usually located in the vicinity of the system's display monitor. The switch will normally be set to this "Remote position to enable the hull unit to be controlled from the operator's console.
The units and components are laid out as shown below.

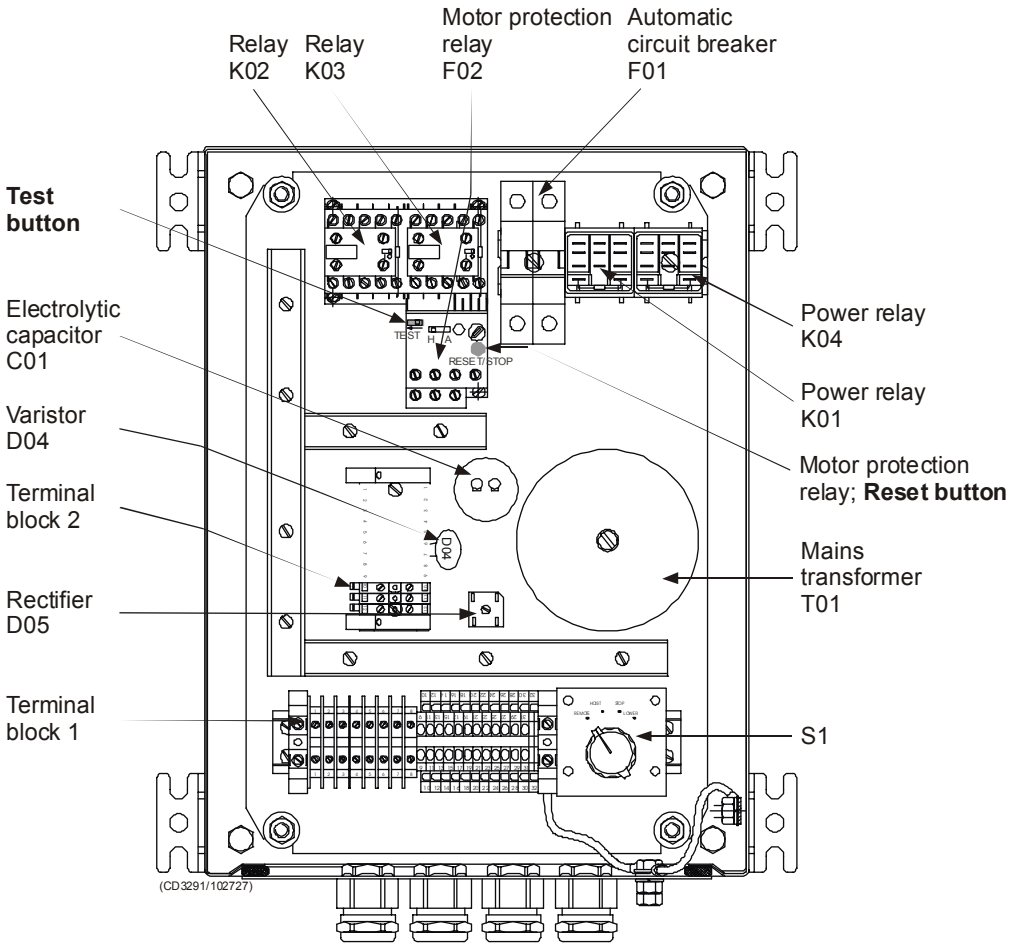


Figure 19 Hoist Control Unit - internal layout

Hoist Control Unit inspection

The HCU must be inspected at regular intervals, and before use if it has not been used for an extended period.

Logistics

Special tools - None.

Spare part - Depending on results of inspection.

References

→ *Interconnection diagram, hoisting system on page 219.*

→ *Wiring diagram, Hoist Control Unit on page 220.*

→ *Circuit diagram, Hoist Control Unit on pages 221 and 222.*

→ *Wiring diagram, Remote Control Unit on page 223.*

Procedure

1 Switch off all power to the system and remove the system fuses.

- Power to the unit can be switched off using breaker F01. However this will not disconnect the mains voltage from the unit, so we recommend that you also remove the fuses in the ship's ac supply to the unit.
- Label the fuse panel to inform others that maintenance work is being carried out.

2 Check that all cable glands are correctly and tightly mounted into the unit, and seal on the cables passing through them.

3 Check also that there is no tension on the cables.

4 Open the HCU.

5 Check for signs of condensation or corrosion.

- Dampness or corrosion indicates either that the equipment room is not properly ventilated and dry, or that the unit's door is not closed correctly. Investigate, and correct the fault.

6 Check that all cable terminations are tight, and that there is no indication of overheating.

- If a cable termination is not tight, the bad connection will probably result in overheating, leading to more serious damage.

7 Check that all component units (relays, breakers, circuit boards etc.) are tight on their mounting rails.

8 Check that all manually operable switches and breakers operate smoothly.

- Refer to *Corrective Maintenance* for part replacement procedures.

- Refer to *Spare Parts* for a complete list of the spare parts available.

9 On completion of the inspection (other units in the system may also need to be inspected) replace the system fuses and apply power to the system.

10 If necessary, check that the system operates correctly by performing the appropriate test procedures.

Remote Control Unit

Internal layout

The Remote Control Unit (RCU) parts and cabling are laid out as shown in the figure below.

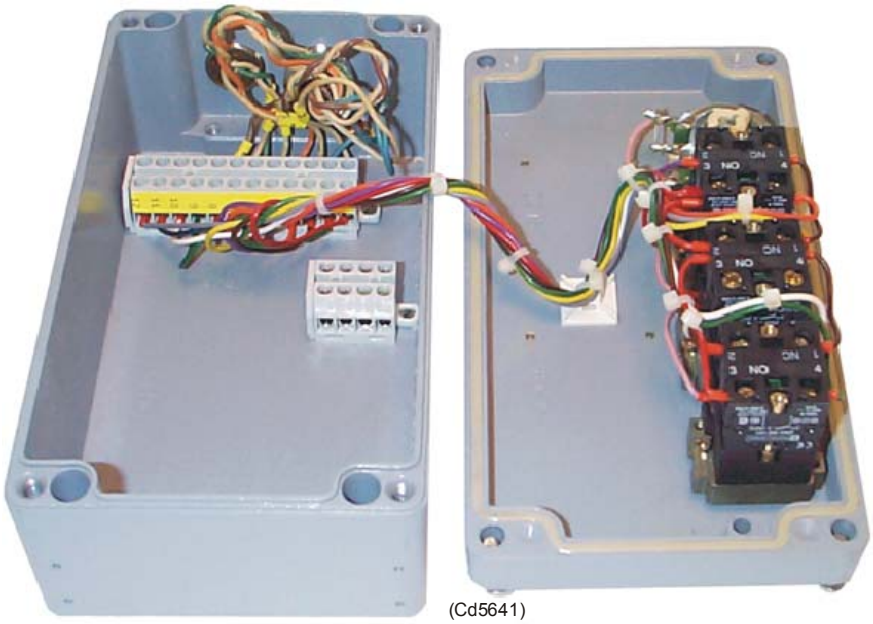


Figure 20 Remote Control Unit - internal layout

Remote Control Unit inspection

The RCU must be inspected at regular intervals, and before use if it has not been used for an extended period.

Logistics

Special tools - None.

Spare part - Depending on results of inspection.

References

→ *Interconnection diagram, hoisting system on page 219.*

→ *Wiring diagram, Hoist Control Unit on page 220.*

→ *Circuit diagram, Hoist Control Unit on pages 221 and 222.*

→ *Wiring diagram, Remote Control Unit on page 223.*

Procedure

1 Switch off all power to the system and remove the system fuses.

- Power to the RCU can be switched off using breaker F01 in the HCU.

Note

This will not disconnect the mains voltage from the Hoist Control Unit, so if you intend to perform maintenance on that unit we recommend that you also remove the fuses in the ship's ac supply to the unit.

- Label the fuse panel to inform others that maintenance work is being carried out.

2 Check that the cable gland is correctly and tightly mounted into the unit, and seals on the cable passing through it. Check also that there is no tension on the cable.

3 Open the RCU and check for signs of condensation or corrosion.

- Dampness or corrosion indicates either that the compartment is not properly ventilated and dry, or that the unit's cover is not closed correctly. Investigate, and correct the fault.

4 Check that all cable terminations are tight, and that there is no indication of overheating.

- If a cable termination is not tight, the bad connection will probably result in overheating, leading to more serious damage.

5 Check that all component units (pushbuttons, lamps etc.) are tightly secured into the unit.

6 Check that the pushbuttons operate smoothly.

7 Replace the front panel onto the unit.

8 On completion of the inspection (other units in the system may also need to be inspected) replace the system fuses and apply power to the system. If necessary, check that the system operates correctly by performing the appropriate test procedures.

9 Once power is restored, check that the hull unit is clear to be lowered, then operate the RCU to ensure it operates correctly and that the lamps function.

10 Check that the light dimmer operates correctly.

Watertightness test

General

The hull unit compartment is of necessity located in the keel of the vessel below the water-line. Maintenance on the hull unit must therefore be carried out with care to ensure that no water leaks occur.

It is important to check that the gate valve below the hull unit is closed and watertight before any maintenance procedure is performed that involves breaking the watertight integrity of the hull unit.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Anyone trained in the procedure.

Vessel location - Afloat.

Special tools - None.

Procedure

The procedure is as follows:

1 Fully raise the hull unit.

2 Switch off all power to the system.

3 Close the gate valve.

4 Check the gate valve is sealed by opening the air-vent cock on the top of the transducer dock.

- A small amount of water should flow out as the pressure within the transducer dock equalises with the ambient air pressure.

5 When the water stops flowing, crack open the gate valve and close it again.

- Water should start flowing out of the air-vent when the valve is cracked open, and should cease soon after it is closed again. This action will prove that the lack of water flow is because the gate valve is sealed, and not merely because the air-vent cock is blocked.

Once the test has been performed satisfactorily, you can assume that it is safe to continue with the required maintenance routines.

Caution ***If for any reason there is a delay between performing the watertightness test and starting the maintenance, play safe - perform the test again.***

Corrective maintenance

Overview

Corrective maintenance for the following are included:

- Hoist motor
- Drive chains
- Opening the service dock
- Lifting the hull unit
- Transducer
- Transducer cables
- Shaft sleeve
- Transducer, marine growth removal
- Zinc anode
- Transducer shaft
- Limit switches
- Gate valve
- Hoist Control Unit
- Remote Control Unit
- Electrical actuator
- Test procedure

General

Corrective maintenance on the hull unit system will be required when the system malfunctions. The design does not include a built-in test system, so troubleshooting must be based on the manuals, drawings and diagrams.

Unless trained and experienced personnel are available, all major repair work must be carried out by Kongsberg Simrad or an appointed dealer.

Caution ***Neither Kongsberg Simrad nor our dealers will take responsibility for damage or injury to the ship, system or personnel resulting from incorrect maintenance performed on the system.***

Hoist motor, gear box lubrication

The oil level in the motor gearbox must be checked at regular intervals, and new oil must be added when required.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Maintenance engineer.

Vessel location - N/A.

Special tools - None.

Spare parts - Oil type, SAE 30 motor oil.

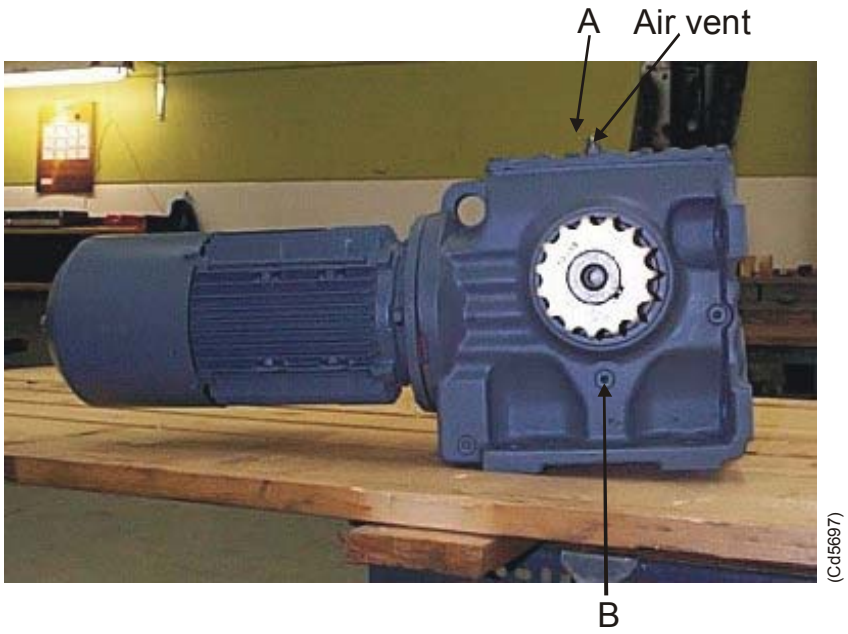


Figure 21 Hoist motor and gearbox

Procedure

1. Switch off power to the system in the HCU.
2. Thoroughly clean the gearbox and the surrounding area, removing all dirt and loose debris (paint flakes etc).
3. Remove the filler cap (A) and the level screw (B).
4. Fill the gearbox with *SAE 30 motor oil*, to the level hole.
5. Replace the level screw and the filler cap.
6. Wipe off any excess oil or drips.

Hoist motor, replacement

Logistics

Safety - Refer to the general safety procedures.

Personnel - Two trained maintenance engineers.

Vessel location - N/A.

Special tools - Lifting apparatus may be required.

Spare parts -
Motor and gearbox: 331-045952
Motor (stand-alone): 331-084150
Four mounting nuts/washers for motor.

→ Centa -*motor manufacturer, http://www.centa.no.*

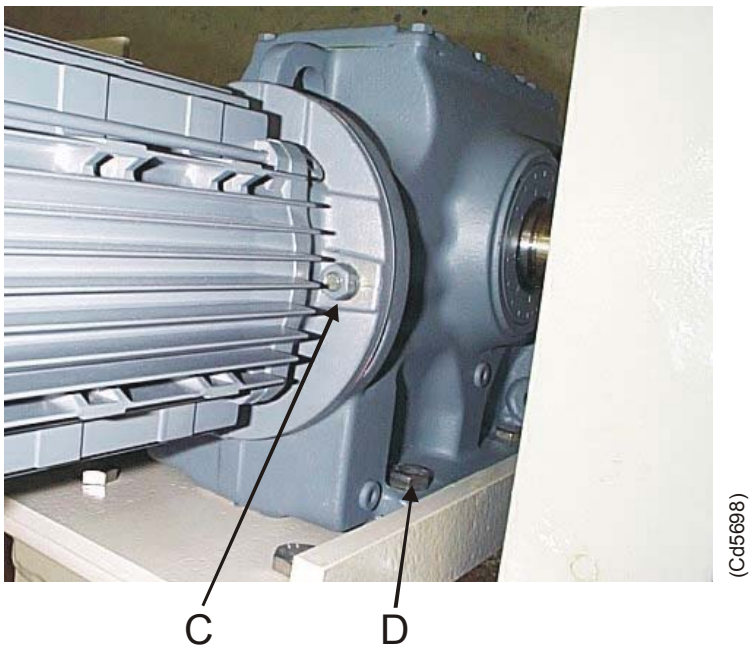


Figure 22 Replacing the Hoist motor and/or gearbox

Procedure

1. Switch off power to the system in the HCU.
2. Clamp the transducer shaft to prevent it from sinking when the motor is disconnected.
3. Open the junction box on the motor, label and disconnect all the cables.
4. Unscrew the four mounting nuts (C).
5. Pull the motor straight off the gearbox.

If the motor is to be sent away for repair, close the gap in the motor brake by mounting the cover plate. (This cover plate was supplied initially with the hull unit, and was used for this purpose prior to the motor installation.)

Reassembly:

6 Insert the new motor, and secure it in position with the four nuts.

7 Reconnect the cables.

8 Remove the transducer shaft clamp.

9 Perform the system test as described in the *Test and alignment procedures* section.

Hoist motor, gear box replacement

The motor assembly on the top of the gantry comprises two main parts; the motor and the gearbox. This procedure explains how to replace the gear box.

Logistics

Safety - Refer to the general safety procedures. Note that the various parts are heavy.

Personnel - Two trained maintenance engineers.

Vessel location - N/A.

Special tools -A lifting apparatus may be required.

Spare parts -
Motor and gearbox: 331-045952
Gear box (stand-alone): . . . S62A B3 A+B 1:158.08 Ritzel Ø12
Four mounting bolts M12x50, M12 nuts, washers and spring washers.

Procedure

→ *Refer to figure on page 57.*

1 Switch off power to the system in the HCU.

2 Clamp the transducer shaft to prevent it from sinking when the motor is removed.

3 Slacken the drive chains and lift them off the drive sprockets.

4 Support the motor/gearbox unit then remove the four mounting nuts/bolts/washers (D) which secure the gearbox to the motor platform on the hull unit gantry.

5 Lift the motor/gearbox off the top of the hull unit and place it on a clean, stable work bench.

6 Remove the sprocket wheels from the drive shaft using a wheel puller.

7 Fit the sprocket wheels onto the new gearbox.

8 Move the motor to the new gearbox if necessary.

9 Lift the motor/gearbox assembly onto the hull unit motor platform and secure it in position using the four mounting nuts/bolts/washers (D).

10 Lift the drive chains onto the sprocket wheels, then check/adjust the tensions in the chains.

→ *Refer to procedure on page 60.*

11 Reconnect the electrical cables.

12 Remove the transducer shaft clamp.

Drive chains, lubrication

The drive chains must be kept lubricated to ensure smooth operation and to prevent corrosion. Inspect the chains at regular intervals, and before use if the hull unit has not been used for an extended period.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Maintenance engineer.

Vessel location - N/A.

Special tools - None.

Spare parts - Grease type . . . . . BIRAL VG/HT or similar.

Procedure

1 Switch off power to the system in the HCU.

2 Inspect the drive chains looking for corrosion or dry areas.

- If old grease has congealed or is badly contaminated with dirt etc, clean the effected areas using a scraper, solvents and cloths.

3 Inspect the sprockets for signs of wear and corrosion.

4 Clean off any corrosion with a chemical rust remover.

5 Check the tension in the drive chains, adjust the tension if necessary.

→ *Refer to paragraph on page 62.*

6 Lubricate the chain and sprockets using grease type *BIRAL VG/HT* or similar. Apply using a suitable brush.

7 Wipe off excess grease and clean up any drips.

Drive chains, tension

To operate correctly without damaging the various shafts and bearings, the drive chains must be at the correct tension. The chains' tensioning devices are located on either side of the base of the hull unit gantry. There is one device for each drive chain. The devices raise or lower the lower sprocket bearings independently, so adjustment of one chain has no effect on the other.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Trained maintenance engineers.

Vessel location - N/A.

Special tools - 12 mm block. Spring-balance (0 - 15 kg).

Spare parts - None.

Test procedure

1 Ensure there is sufficient water below the vessel.

2 Open the gate valve.

3 Lower the transducer shaft to the fully lowered position.

4 Switch off power to the system in the HCU.

5 Place a 12 mm block against the inside of the gantry frame, midway between the chain sprockets.

6 Using a spring-balance, pull the chain against the block.

- The tensions must be adjusted such that a force of 9-10 kg is required to pull the chain against the block.

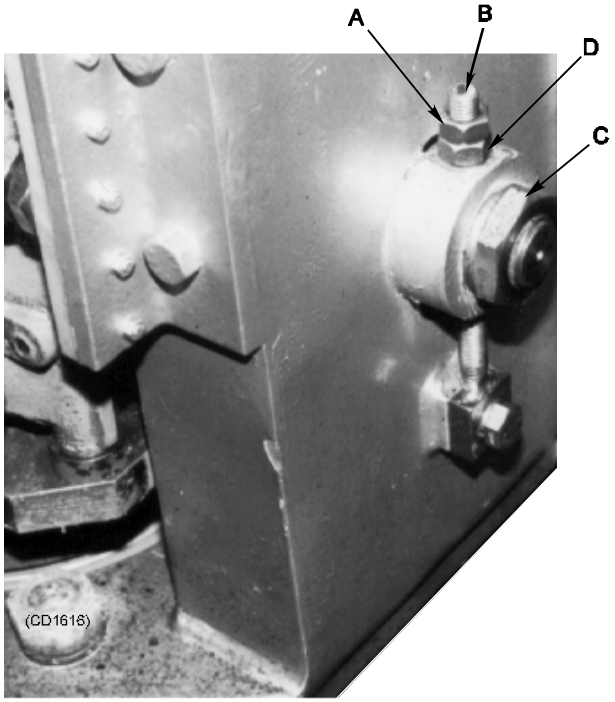


Figure 23 Tensioning the drive chains

Adjusting the tension

1 Slacken lock-nut (A) on tension adjustment thread (B).

2 Slacken sprocket bearing nut (C) by 1/2 turn.

3 Adjust tension adjustment nut (D) to achieve the correct tension in the chain.

4 Tighten the sprocket bearing nut and the lock-nut.

5 On completion, check the chain tension. It may have altered as the nuts were tightened.

Drive chains, replacement

The drive chains transmit the force from the hoist motor to the transducer shaft, to raise or lower the shaft.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Trained maintenance engineers/fitters.

Vessel location - N/A.

Spare parts -
Duplex chain (top) 529-047577
Duplex chain (bottom) 529-047575
Guide rail 599-051130
Guide rail 599-051126
Joint 529-047580

Procedure

Both drive chains should be replaced at the same time.

1 Slacken the chains.

2 Find and remove the joints, and disconnect the chains from the transducer shaft.

3 Replace the chain.

4 Adjust the tension.

→ *Refer to paragraph on page 62.*

Opening the service dock

If the hull unit has a service dock, gaining access the transducer and the other "wet" parts of the hull unit is a simple operation.

Logistics

Safety - Refer to the general safety procedures. Perform a watertightness test before breaking the watertight integrity of the hull unit.

Personnel - Two trained maintenance engineers/fitters.

Vessel location - N/A.

Special tools - Length of hose pipe. Jubilee clip.

Spare parts - Hatch seal 540-084245

Procedure

1 Raise the transducer to the fully housed position.

2 Switch power off at the HCU.

3 Close the gate valve and perform the watertightness test.

→ *Refer to page 54.*

4 Secure one end of a suitable length of hose to the drain tap on the inspection hatch, and place the other end in the bilge or in a suitable container.

5 Open the air vent on the top of the inspection dock, and the drain tap, and drain the inspection dock.

6 Slacken and remove the retaining bolts/nuts around the inspection hatch perimeter, then using suitable lifting apparatus carefully remove the inspection hatch.

WARNING ***The hatch is heavy. If the operation is being conducted while the vessel is at sea, ensure the hatch is lashed to prevent it swinging should the vessel roll.***

7 Use a sponge or cloths to soak up any remaining water and wipe clean the interior of the dock and gate valve.

8 Perform the required maintenance routines.

9 On completion of the maintenance work, ensure that no rubbish, tools etc. have been left in the dock, then replace the inspection hatch.

10 Tighten all the hatch bolts to the correct torque.

11 Perform the system test as described in the *Test and alignment procedures* section.

Lifting the hull unit

If the hull unit does not have a service dock, the entire hull unit must be lifted off the gate valve to gain access to the transducer.

Logistics

Safety - Refer to the general safety procedures. Perform a watertightness test before breaking the watertight integrity of the hull unit.

Personnel - Three to four trained maintenance engineers/fitters

Vessel location - N/A.

Special tools - None.

Spare parts - None.

Procedure

1 Raise the transducer to the fully housed position.

2 Switch off power to the system at the HCU.

3 Close the gate valve, and perform the watertightness test.

→ *Refer to page 54.*

4 Write down the colour coding and connections, then remove all electrical cables to and from the hull unit.

5 Secure a tackle capable of lifting the entire hull unit (1500 kg) to the deckhead above the hull unit, and attach the tackle to the unit using the lifting eyes provided.

6 Tighten the lifting tackle, taking the weight of the hull unit.

7 Mark the positions of the bracing beams and the transducer dock relative to the gate valve to minimize changes in the hull unit alignment.

8 Remove the bracing beams supporting the hull unit.

9 Remove the bolts attaching the transducer dock to the gate valve flange.

- The water contents of the dock will leak out, but not under pressure. The dock must remain attached to the unit to protect the transducer.

10 Carefully hoist the hull unit off the gate valve.

- If there is not enough headroom above the unit to enable it to be raised high enough for the engineer to gain access to the transducer, the transducer dock may be pulled to one side and the unit laid on the deck alongside the gate valve.

- The hull unit must be supported to ensure it does not swing if the vessel moves. Protect the gate valve with a wooden cover to ensure the mating surface is not damaged during the operation.

11 Lower the transducer using the hand crank until the transducer is fully exposed.

- If the motor is not accessible for manual operation, the transducer dock may have to be removed to gain access.

12 Perform the required maintenance routines.

13 On completion of the maintenance work, ensure that no rubbish, tools etc. have been left in the dock, then replace the hull unit by following the above procedure in reverse.

14 Tighten all the bolts to the correct torques.

15 Reconnect all the electrical cables.

16 Perform the system test as described in the *Test and alignment procedures* section.

Transducer, replacement

The following procedure describes the removal of the transducer for repair or service under normal conditions.

- A new transducer can be installed by following the same procedure in reverse.

Caution ***The transducer locating pin and zero mark must be in the correct positions.***

Logistics

Safety - Refer to the general safety procedures. Note that the various parts are heavy.

Personnel - Three to four trained maintenance engineers/fitters.

Vessel location - N/A.

Special tools - Depending on procedure.

Spare parts - Depending on procedure.

Procedure

1 Gain access to the transducer.

→ *Refer to pages 63/ 64.*

2 Remove loose marine growth, seaweed or mud using a stiff, plastic-bristled brush and copious amounts of water.

3 Place suitable planks and pads onto the gate valve, then using the crank handle lower the transducer onto the pads so it will not fall as the bolts are removed.

- Ensure the transducer face is not damaged.

4 Flatten down the lugs on the retention plates and remove the bolts attaching the transducer to the shaft flange.

Caution ***The transducer weighs approximately 60/30 kg, and must be securely supported during the removal procedure.***

5 Using the crank handle, raise the shaft away from the transducer.

- The transducer may be retained on the shaft by a vacuum within the flange, and some force may be required to remove it.

6 Remove the transducer to an appropriate work area. Extreme care must be used to ensure the transducer face is not damaged during the operation.

7 Replace the transducer.

- The replacement procedure is the reverse of the removal procedure.
- Ensure that the transducer alignment pin is fitted to orientate the transducer correctly.
- Ensure that the O-rings and lock-plates are renewed, see figure below.

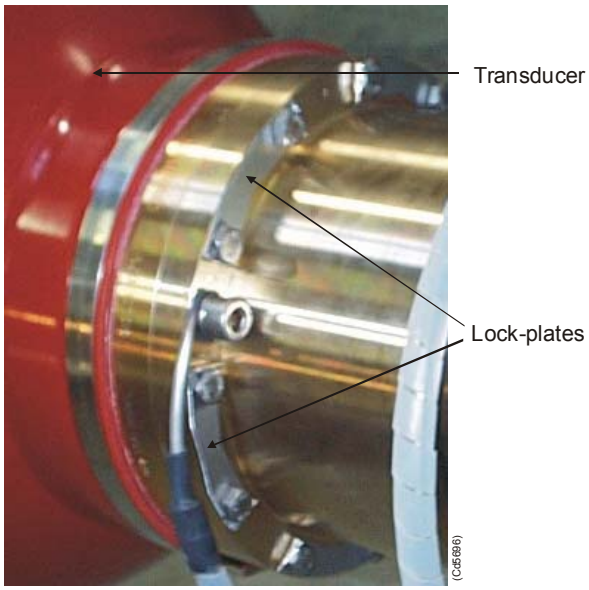


Figure 24 Lock-plates

Transducer, marine growth removal

Any marine growths on the transducer face, such as weed or crustaceans, can dramatically reduce the efficiency and accuracy of the system. The transducer must therefore be inspected and cleaned at regular intervals.

If the hull unit is fitted with a service dock, open the dock to gain access to the transducer. If the hull unit is not fitted with a transducer service dock and the vessel is not in a dry dock, the transducer must be checked for damage and marine growths either by lifting up the hull unit, or by sending a diver down.

Logistics

Safety - Refer to the general safety procedures. Perform a watertightness test before breaking the watertight integrity of the hull unit.

Personnel - Trained maintenance engineers/fitters.

Vessel location - N/A.

Special tools - Wooden or plastic scraper. Stiff, plastic-bristled brush.

Spare parts - None.

Procedure

1 Gain access to the transducer.

→ *Refer to pages 64.*

2 Remove loose marine growth, seaweed or mud using a stiff, plastic-bristled brush and copious amounts of water.

3 Carefully remove any crustaceans, for example barnacles, using a round-edged wooden or plastic scraper.

- Great care must be taken to ensure that the face of the transducer is not damaged.

Caution ***A wire brush or a high-pressure hose must not be used !***

4 When all accessible parts of the transducer, the shaft and the internal surfaces of the dock have been cleaned, dried and inspected, paint the internal surfaces of the dock with suitable preservation and anti-fouling paints.

Caution ***The transducer face, shaft and anodes must not be painted.***

5 Close the hull unit. Refer to point 1 in this procedure.

HiPAP 500 transducer cable, replacement

HiPAP 500 cable is one complete length of eight cables which go from the transducer to the transceiver unit.

→ *Refer to page 168.*

Logistics

Safety - Refer to the general safety procedures.

Personnel - Two to three trained maintenance/electrical engineers.

Vessel location - N/A.

Special tools - None.

Spare parts - Cable 380-089919

Procedure

1 Switch off power to the system in the Hoist Control Unit.

2 Switch off power to the Transceiver Unit.

3 Unplug the transducer cable from the Transceiver Unit.

4 Remove all cable clips etc. that secure the transducer cable to the bulkhead/conduits etc.

5 Open the transducer dock.

→ *Refer to the procedure on page 63.*

6 Remove the transducer.

→ *Refer to the procedure on page 66.*

7 Remove the four "extended-head" bolts securing the support plate.

- Access is through the four holes in the plug plate.

8 Remove the eight bolts located around the circumference of the connector plate.

- The connector plate should now be free.

9 Remove the jubilee clip that holds the flexible cable hose onto the elbow on the top of the transducer shaft.

10 Remove the flexible cable hose from the elbow.

11 Unbolt the elbow from the bracket on the top of the transducer shaft.

12 Remove the six socket-head screws that secure the two half-ring plates in position on the top of the transducer shaft, and remove the two half-ring plates.

13 Pull up the upper gland block, lift the O-rings off the block and let them hang on the cable.

- This will reduce the likelihood of the O-rings being damaged and will reduce the force required to pull the block down the shaft.

It should now be possible to pull and feed the transducer cable down the transducer shaft and out at the service dock.

14 Tie a suitable length of rope to the transceiver plug before it falls down the transducer shaft to enable the new cable to be pulled up through the shaft.

15 Withdraw the cable and transceiver connector from the service dock.

16 Check the O-rings on the upper gland block on the new cable, replace as necessary.

- Leave the O-rings on the cable above the gland block to reduce the pull required and reduce the likelihood of damage as they are pulled up the shaft.

17 Tie the rope to the transceiver connector on the new cable and carefully pull the cable up through the shaft.

18 Once the connector is accessible at the top of the shaft, remove the rope and continue to pull the cable up by hand.

19 At the appropriate time, feed the upper gland block into the bottom of the shaft.

20 Orient the support plate correctly, locate it in the bottom of the shaft, then secure it using the four "extended head" screws.

21 Remove the four spacer screws (located beside the access holes for the "extended head" screws).

22 Orient the connector plate correctly, locate it in the bottom of the shaft, then secure it using the eight screws.

Note

Do not use any washers or packing pieces here. If the screws must be replaced, ensure the new screws are the same length. The connector plate must be loose to allow some movement as the connectors on the cables and the transducer mate.

23 Remove any twists from the cable in the shaft.

24 Lift the upper gland block up out of the shaft and fit the O-rings.

25 Orient the upper gland block correctly, fit it into the top of the shaft, then replace the two half-rings to hold the block in position.

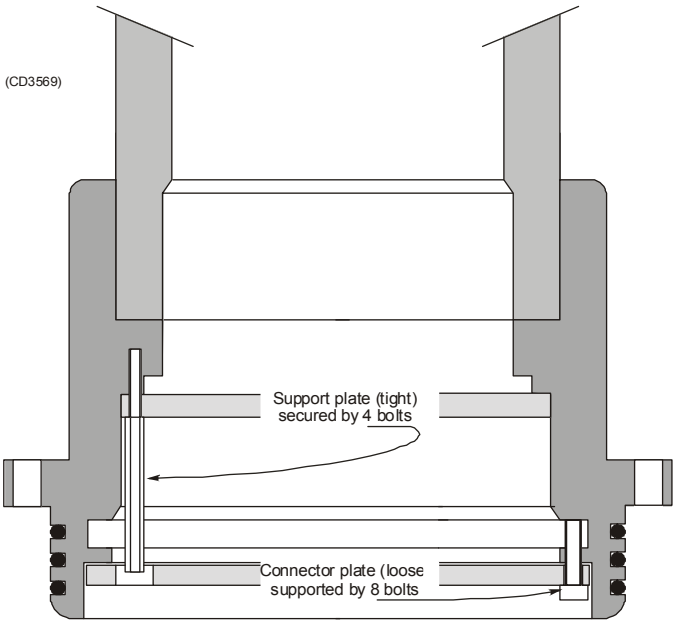


Figure 25 Securing the support and connector plates

26 Replace the six socket-head screws to secure the half-rings in position.

27 Reassemble the bracket and elbow onto the top of the shaft, and fit the flexible hose onto the elbow. Secure it in position using the jubilee clip.

28 Replace the transducer.

→ *Refer to page 66.*

29 Close the service dock.

30 Connect the transducer cable to the transceiver unit, and replace any cable clips.

31 Perform the system test as described in the *Test and alignment procedures* section.

HiPAP 350 transducer cables, replacement

HiPAP 350 cable comprises of two separate cables.

→ *Refer to page 169.*

Logistics

Safety - Refer to the general safety procedures.

Personnel -
Two to three trained maintenance/electrical engineers.

Vessel location - N/A.

Special tools - None.

Spare parts -
Cable1 (TD end) 380-214659
Cable2 (TC end) 380-214686

Cable 1

Cable from the top of the transducer (bottom of the transducer shaft) to the top of the transducer shaft, into the junction box.

Procedure

1 Switch off power to the system in the Hoist Control Unit.

2 Switch off power to the Transceiver Unit.

3 Open the transducer dock.

→ *Refer to the procedure on page 63.*

4 Remove the transducer.

→ *Refer to the procedure on page 66.*

5 Remove the four "extended-head" bolts securing the support plate.
- Access is through the four holes in the plug plate.

6 Remove the eight bolts located around the circumference of the connector plate.
- The connector plate should now be free.

7 Open the junction box at the top of the transducer shaft. Disconnect the d-subs. Remove bolts from nipple plate at the rear side of the junction box.

8 Remove the six socket-head screws that secure the two half-ring plates in position on the top of the transducer shaft, and remove the two half-ring plates.

9 Pull up the upper gland block, and remove the o-ring.
- This will reduce the likelihood of the O-ring being damaged and will reduce the force required to pull the block down the shaft.

It should now be possible to pull and feed the transducer cable down the transducer shaft and out at the service dock.

10 Tie a suitable length of rope to the upper connector plate.

11 Withdraw the cable through the service dock.

12 Check the O-rings on the upper gland block on the new cable, replace as necessary.

- Leave the O-rings on the cable above the gland block to reduce the pull required and reduce the likelihood of damage as they are pulled up the shaft.

13 Tie the rope to the transceiver connector on the new cable and carefully pull the cable up through the shaft.

14 Once the connector is accessible at the top of the shaft, remove the rope and continue to pull the cable up by hand.

15 At the appropriate time, feed the upper gland block into the bottom of the shaft.

16 Orient the support plate correctly, locate it in the bottom of the shaft, then secure it using the four "extended head" screws.

17 Remove the four spacer screws (located beside the access holes for the "extended head" screws).

18 Orient the connector plate correctly, locate it in the bottom of the shaft, then secure it using the eight screws.

Note

Do not use any washers or packing pieces here. If the screws must be replaced, ensure the new screws are the same length. The connector plate must be loose to allow some movement as the connectors on the cables and the transducer mate.

19 Remove any twists from the cable in the shaft.

20 Lift the upper gland block up out of the shaft and fit the O-rings.

21 Orient the upper gland block correctly, fit it into the top of the shaft, then replace the two half-rings to hold the block in position.

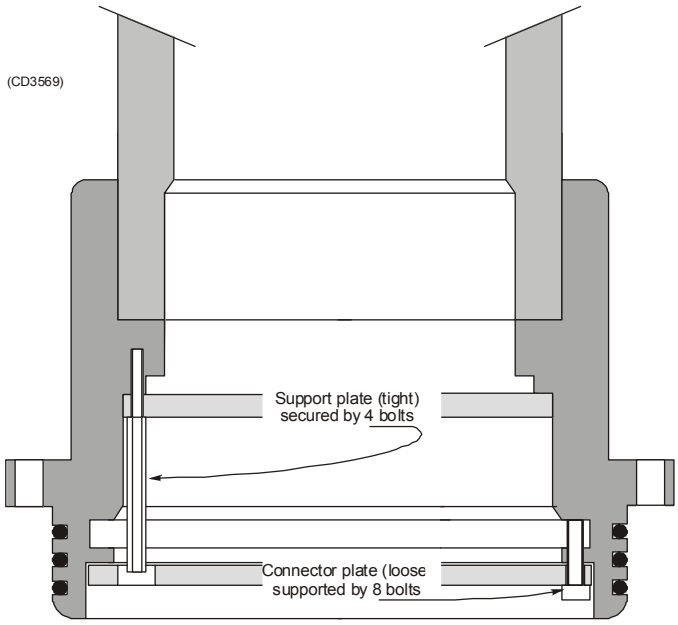


Figure 26 Securing the support and connector plates

22 Replace the six socket-head screws to secure the half-rings in position.

23 Reassemble the bracket and elbow onto the top of the shaft, and fit the flexible hose onto the elbow. Secure it in position using the jubilee clip.

24 Replace the transducer.

→ *Refer to page 66.*

25 Close the service dock.

26 Connect the transducer cable to the transceiver unit, and replace any cable clips.

27 Perform the system test as described in the *Test and alignment procedures* section.

Cable 2

Cable from the junction box to the Transceiver Unit, via the bracket on the hull unit.

Procedure

1 Switch off power to the system in the Hoist Control Unit.

2 Switch off power to the Transceiver Unit.

3 Unplug the transducer cable from the transducer end.

4 Remove all cable clips etc. that secure the transducer cable.

5 Open the junction box at the top of the transducer shaft. Disconnect the d-subs. Remove bolts from nipple plate at the rear side of the junction box.

6 Unbolt the cable bracket from the gallow.

7 Replace the cable.

8 Close the junction box.

Shaft sleeve, lubrication

The transducer shaft must be inspected at regular intervals and the shaft sleeve filled with grease as necessary.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Trained maintenance engineer..

Vessel location - N/A.

Special tools - None.

Spare parts - Grease type, ESSO CAZAR K1 or similar.

Procedure

1 Switch off power to the system at the HCU.

2 Clean the shaft sleeve, the filler and level/air vent screws and the surrounding area, removing all dirt and loose debris (paint flakes etc).

3 Remove the air vent screw.

Caution ***If the vent screw is not removed, the shaft seals can be damaged.***

4 Fill the sleeve with grease, type *ESSO CAZAR K1* or similar, until the grease appears at the air vent hole.

5 Replace the air vent screw.

6 Wipe off any excess grease.

Shaft sleeve, disassembly

Note

If the shaft sleeve must be disassembled for any reason, you are strongly recommended to ask for assistance from Kongsberg Simrad. If the transducer adapter is not replaced correctly, you risk loosing the transducer.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Two trained maintenance engineers/fitters.

Vessel location - N/A.

Special tools - Depending on required procedure.

Spare parts -
Grease type, ESSO CAZAR K1 or similar
Set of seals and bearings, refer to spare parts list Loctite 577.

Procedure

1 Switch off power to the system on the Hoist Control Unit.

2 Dismount the hull unit.

→ *Refer to page 64.*

3 Lower the transducer manually, and clean it using a stiff, plastic-bristled brush and copious amounts of water. On completion, dry the unit carefully.

4 Remove the transducer from the end of the shaft.

5 Remove the transducer cable.

→ *Referring to the procedure on page 69.*

6 Remove the transducer adaptor from the end of the shaft.

7 Remove the transducer dock from the hull unit.

8 Loosen the nuts/bolts holding the upper and lower clamping rings to decompress the seals, then remove the shaft sleeve from the hull unit.

9 Replace the upper shaft bearing and seals as follows:

a Remove the six nuts holding the upper gland clamping ring onto the sleeve.

b Lift off the upper gland clamping ring.

c In preparation for replacement, unscrew the six spacing bolts till the ends of the threads are flush with the surface of the clamping ring.

d Extract the two parts of the upper sleeve seal and the upper sleeve bearing from the sleeve.

e Clean the grease from the upper (internal) part of the shaft sleeve.

f Fit a new upper shaft bearing and seals into the top of the sleeve.

g Place the upper clamping ring in position and secure it loosely using the nuts.

10 Replace the lower shaft bearing and seals as follows:

a Remove the six socket-head screws securing the lower clamping ring onto the bottom of the shaft sleeve, then remove the ring.

b Extract the lower sealing ring and the lower shaft bearing.

c Clean the grease from the lower (internal) part of the shaft sleeve.

d Fit a new scraper ring into the lower clamping ring.

e Fit a new lower shaft bearing and new lower shaft seal, ensuring they are correctly orientated.

f Locate the lower clamping ring on the bottom of the shaft sleeve, and hold it loosely in position with the six socket-head screws.

11 Mount the shaft sleeve onto the hull unit gantry.

Note

Ensure the shaft passes smoothly through the bearings and seals. If the seals are pinched or otherwise damaged, they must be replaced.

12 Mount the transducer dock onto the shaft sleeve.

13 Replace the transducer adaptor onto the bottom of the shaft.

- Ensure the holes and bolts are scrupulously clean and all traces or grease and old loctite are removed.
- Use new O-rings. Use Loctite 577 on the bolts, and tighten them to a torque of 20 Nm.

14 Using new O-rings and lock-plates, remount the transducer.

15 Remount the hull unit onto the gate valve.

16 Ensure the gantry is correctly orientated, then bolt it firmly into position and refit the gantry braces.

- Ensure that the gantry is replaced as exactly as possible in its original position.

17 Tighten all the mounting bolts for the dock, shaft sleeve and gantry to the appropriate torques.

18 Tighten the six socket-head screws holding the lower clamping ring onto the shaft sleeve to a torque of 22 Nm.

19 Tighten the upper shaft seals against the shaft by tightening the six nuts around the upper clamping ring.

20 Once the upper seals are tight, tighten the six spacing bolts to hold the clamping ring away from the top of the shaft sleeve.

→ *Refer to page 76.*

21 Perform a system test to ensure the hull unit operates correctly.

Zinc anode, inspection and replacement

Logistics

Safety - Refer to the general safety procedures.

Personnel - Two trained maintenance engineers/fitters.

Vessel location - N/A.

Special tools - None.

Spare parts - Zinc anode, 629-076530

Procedure

1 Switch off power to the system at the HCU.

2 Open the service dock.

→ *Refer to page 63.*

3 Clean the transducer and service dock using a stiff, plastic-bristled brush and copious amounts of water.

4 Inspect the sacrificial anodes.

- The anodes are bolted to the underside of the shaft sleeve.

→ *Refer to the figure on page 184.*

- If the anodes are severely corroded, replace them. If not, assess the extent of the corrosion and the time since the previous inspection, and estimate when the anodes will require replacing.
- Program another inspection for a date some time before the anodes will need to be replaced.

5 On completion, close the service dock.

Transducer shaft, guide rails adjustment

Logistics

Safety - Refer to the general safety procedures.

Personnel - Trained maintenance engineer.

Vessel location - N/A.

Special tools - None.

Spare parts - None.

Procedure

The guide rails ensure the transducer is aligned correctly. When the shaft is fully lowered there must be no space between the guide rails and the adjustable sliders (2/3) on figure 27.

1 Fully lower the transducer shaft.

2 Slacken the lock nuts and adjust the sliders until they are tight against the guide rails.

3 Tighten the lock nuts and re-check the clearance.

4 Raise the transducer shaft and check the clearances at several places as it is raised.

- If the clearances between the sliders and the rails changes (2/3) as the shaft is raised, the rails will need to be adjusted.

Note

These adjustments could effect the system alignment. If in doubt, contact Kongsberg Simrad AS for assistance.

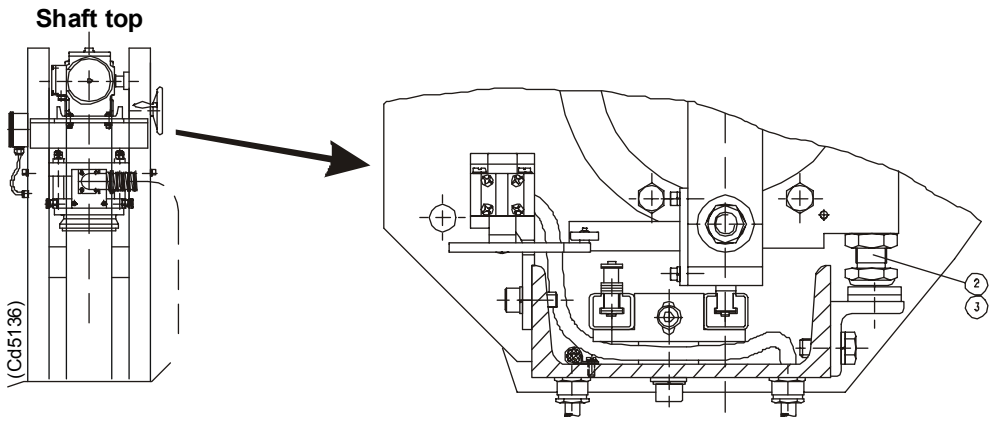


Figure 27 Shaft top - indicating the adjustable sliders

Limit switches, replacement

Two limit switches are mounted on the gantry; one to stop the drive motor when the shaft is fully down, and one to stop the motor when the shaft is fully raised. The two limit switches are identical.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Trained maintenance engineer.

Vessel location - N/A.

Special tools - None.

Spare parts - Limit switch 350-087309

Procedure

1 Switch off power from the system on the Hoist Control Unit.

2 Note the connections, then disconnect the cables from the limit switch.

3 Remove the mounting bolts and replace the switch.

4 Set up the switches as follows:

a Adjust the lower limit switch so that the springs are compressed 2-3 mm when the transducer shaft is fully lowered.

b Retract the transducer shaft fully and adjust the upper limit switch such that it operates when there is approximately 15-20 mm clearance between the top of the transducer adapter and the bottom of the shaft sleeve.

Gate valve, replacement

General

This procedure explains how to replace the gate valve.

Note

The vessel must be in a dry dock while this procedure is performed.

Logistics

Safety - Refer to the general safety procedures. Note that the various parts are heavy.

Personnel - Three to four trained maintenance engineers/fitters.

Vessel location - Dry dock.

Special tools - 2 winches or cranes.
(1 for hull unit - 1500 kg, and 1 for gate valve - 500 kg.)

Spare parts -
Gate valve DN500 . . . . . HDV-088347
Gate valve DN350 . . . . . HDV-041672

Procedure

The hull unit must be lifted to enable the old gate valve to be taken out and a new valve to be fitted. Check that all electrical cables to the hull unit have enough slack such that they will not be placed under tension as the hull unit is lifted.

Note

If an electrical actuator (option) is fitted, it must be removed before you take out the gate valve.

1 Fully raised the transducer.

2 Place the vessel in dry dock.

3 Mount a suitable lifting apparatus to the deck head above the hull unit, and attach it to the top of the hull unit.

4 Remove all the gantry braces, and disconnect cables as necessary.

5 Take the weight of the hull unit on the lifting apparatus.

6 Remove the upper and lower mounting nuts/bolts to unbolt the gate valve from the transducer dock and the mounting flange.

7 Lift the hull unit clear of the gate valve.

8 Pull the old gate valve out.

- Note that the gate valve is heavy. Lifting apparatus will be required.
- Great care must be exercised to ensure the mating surfaces of the mounting flange and the transducer dock are not damaged.

9 Clean the mating surfaces and replace all O-rings.

10 Manoeuvre the new gate valve into position and lower it carefully onto the mounting flange.

11 Check that it is aligned correctly, then secure it into position.

→ *Refer to the torques listed on page 42.*

12 Lower the hull unit onto the gate valve.

13 Check that it is aligned correctly, then secure it into position.

→ *Refer to the torques listed on page 42.*

14 Replace all the gantry braces.

15 Check all electrical cables and connections.

16 Perform the system test described in the *Test and alignments procedures* section.

Replacement of the gate valve position indicator

General

This procedure explains how to replace the complete gate valve position indicator.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Two trained maintenance engineers/fitters.

Spare parts - As required.

References

→ *Interconnection diagram, hoisting system on page 219.*

Procedure

The positioning indicator is standard. It is mounted directly on the gate valve with two bolts.

1 Fully raise the transducer.

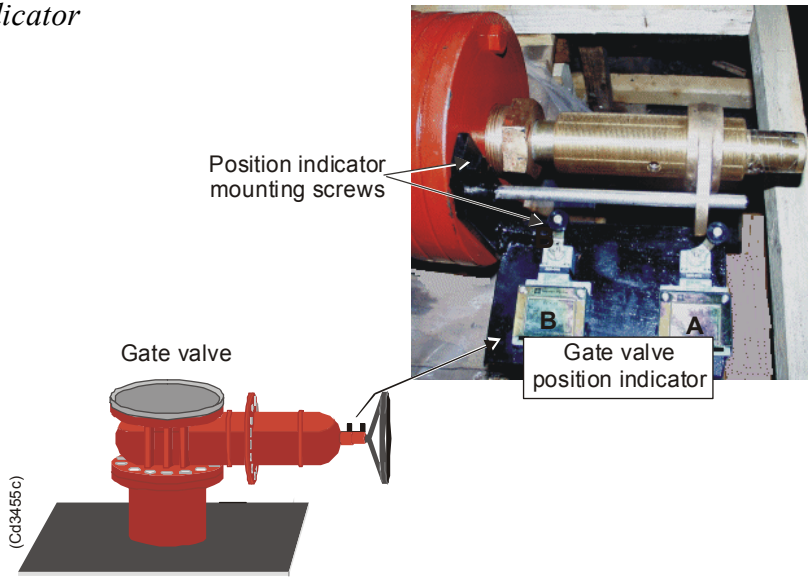
2 Remove the switch unit.

→ *See procedure on page 86.*

3 Remove the gate valve wheel.

4 Unscrew the two bolts holding the positioning indicator (see figure below).

Figure 28 Position indicator



5 To mount the new position indicator unit, proceed in revers order.

Replacement of a position indicator switch unit

General

This procedure explains how to replace a position indicator switch unit.

Logistics

Safety - Refer to the general safety procedures.

Personnel - One trained maintenance engineers/fitters.

Spare parts - As required. Switch, see mounted switch.

References

→ *Interconnection diagram, hoisting system on page 219.*

Procedure

1 Disconnect the switch cable. This is done as follows:

- Unscrew the two screws holding the lid on the top of the switch unit, see figure below (1).
- Open the switch unit lid, see figure below (2).
- Connection 13 and 14 is used. Refer to Interconnection diagram, hoisting system.

2 Unscrew the two switch unit fasting screws, see figure below(2).

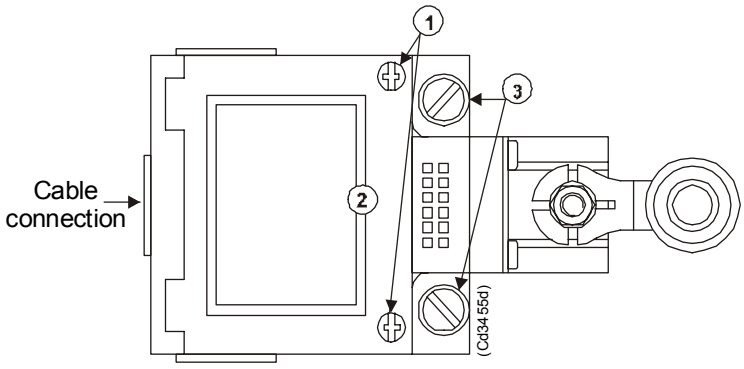


Figure 29 Position indicator switch unit

3 Remove the defect switch unit.

4 Mounting the new switch unit, proceed in revers order.

Hoist Control Unit

General

Troubleshooting is based on this manual, drawings and diagrams, and the engineer's knowledge of the system.

There is no formal *Troubleshooting* plan for this unit. The maintenance engineer's experience and general knowledge of electromechanical systems, and the simplicity of the unit, should enable any faults to be discovered and rectified quickly.

Unless trained and experienced personnel are available, all major repair work must be carried out by Kongsberg Simrad engineers or an authorised dealer. Neither y Kongsberg Simrad or our dealers will accept responsibility for damage or injury to the vessel, system or personnel resulting from incorrect maintenance performed on the system.

Logistics

Special tools - None.

Spare part - Refer to the *Spare Parts* section.

References

→ *Interconnection diagram, hoisting system on page 219.*

→ *Wiring diagram, Hoist Control Unit on page 220.*

→ *Circuit diagram, Hoist Control Unit on pages 221 and 222.*

→ *Wiring diagram, Remote Control Unit on page 223.*

Replacement of Hoist Control Unit parts

General

The relays and switches within the unit can be replaced individually. The replacement procedures for these items are similar.

Procedure

1 Inform the system supervisor that the system will be out of use while maintenance is performed.

2 Switch off all power to the system and remove the system fuses on the ship's supply.

3 Open the door to the cabinet.

4 Identify the defective unit.

→ *The Hoist Control Unit - internal layout is shown in the figure on page 48.*

5 Attach identification labels to all cables connected to that unit, and the terminals to which those cables are connected.

6 Disconnect the cables.

7 Detach the unit by slackening/removing the appropriate screws and/or unclipping the unit from the mounting rail.

8 Mount the replacement unit and reconnect the wires.

9 Check the connections against the circuit diagram to ensure they are correct.

10 Check the cabinet to ensure that all connections are tight.

11 Remove all tools and rubbish.

12 Close the cabinet door correctly.

13 Take the appropriate safety measures, then replace the fuses.

14 Apply power to the system.

15 Perform a system test as necessary to ensure the maintenance has been conducted successfully.

16 Inform the system supervisor that the system is now back in operation.

Remote Control Unit

General

Troubleshooting is based on the maintenance manual, drawings and diagrams, and the engineer's knowledge of the system.

There is no formal *Troubleshooting* plan for this unit. The maintenance engineer's experience and general knowledge of electromechanical systems, and the simplicity of the unit, should enable any faults to be discovered and rectified quickly.

Unless trained and experienced personnel are available, all major repair work should be carried out by Kongsberg Simrad engineers or an authorised dealer. Neither Kongsberg Simrad or our dealers will accept responsibility for damage or injury to the vessel, system or personnel resulting from incorrect maintenance performed on the system.

Logistics

Special tools - None

Spare parts - Refer to the Spare Parts section.

References

→ *Interconnection diagram, hoisting system on page 219.*

→ *Wiring diagram, Hoist Control Unit on page 220.*

→ *Circuit diagram, Hoist Control Unit on pages 221 and 222.*

→ *Wiring diagram, Remote Control Unit on page 223.*

Replacement of Remote Control Unit parts

General

The switches and lamps within the unit can be replaced individually.

Button replacement

1 Inform the system supervisor that the system will be out of use while maintenance is performed.

2 Switch off all power to the system and remove the system fuses on the ship's supply.

3 Remove the front of the Remote Control Unit.

4 Attach identification labels to all cables connected to the defective switch, and the terminals to which those cables are connected.

5 Disconnect the cables.

6 Unscrew the mounting bolt and remove the defective switch.

7 Mount the replacement switch and reconnect the wires.

8 Check the connections against the circuit diagram to ensure they are correct.

9 Check the unit to ensure that all connections are tight.

10 Remove all tools and rubbish. Replace the front of the unit correctly.

11 Take the appropriate safety measures, then replace the fuses and apply power to the system.

12 Perform a system test as necessary to ensure the maintenance has been conducted successfully.

13 Inform the system supervisor that the system is now back in operation.

Lamp replacement

1 Unscrew the lens on the button containing the defective lamp, and remove the coloured filter.

2 Remove the defective lamp from the button by pushing it in and turning it 45° anti-clockwise.

- A short length of 6 mm diameter plastic tube will be a useful tool in this operation. A pair of "snipe-nose" pliers (insulated) may be required to extract the lamp as it is located quite deep within the holder.

3 Insert a new lamp into the holder, push it in and turn it 45° clockwise to secure it.

4 Replace the coloured filter and lens onto the button.

5 Perform a system test as necessary to ensure the maintenance has been conducted successfully.

Note

The Remote Control Unit is a "Repair by replacement" item. If further repairs are necessary, the entire unit should be removed and replaced by a new unit. The faulty unit should then be returned to Kongsberg Simrad for repair.

Electrical actuator (option)

The electrical actuator must be inspected at regular intervals, and before use if it has not been used for an extended period.

Logistics

Special tools - None.

Spare part - Depending on results of inspection.

References

→ *Wiring diagram on page 227.*

→ *The auma multi-turn actuators* Operation instructions *supplied with the actuator.*

→ auma - *actuator manufacturer, http://www.auma.com.*

Inspection

The actuator requires periodic checks. Approximately 6 month after commissioning and every year, check:

1 Bolts between actuator and valve are tightened properly.

2 All cables are correctly and tightly mounted into the unit.

3 If necessary, check that the system operates correctly by performing the appropriate test procedures.

Lubrication

The gear-housing was filled with lubricant at the factory. This filling lasts for several years of service.

Note *Detailed maintenance instruction are available on request.*

Lubrication of the valve stem must be done separately.

1 Bolts between actuator and valve are tightened properly.

Electrical connections

→ *See References above.*

Actuator local control unit, inspection

The local control unit must be inspected at regular intervals, and before use if it has not been used for an extended period.

Logistics

Special tools - None.

Spare part - Depending on results of inspection.

References

→ *Wiring diagram on page 227.*

Procedure

1 Switch off all power to the system and remove the system fuses.

2 Check that the cable gland is correctly and tightly mounted into the unit, and seals on the cable passing through it. Check also that there is no tension on the cable.

3 Open the front panel door.

- Use required key.

4 Check for signs of condensation or corrosion.

- Dampness or corrosion indicates either that the compartment is not properly ventilated and dry, or that the unit's cover is not closed correctly. Investigate, and correct the fault.

5 Check that all cable terminations are tight, and that there is no indication of overheating.

- If a cable termination is not tight, the bad connection will probably result in overheating, leading to more serious damage.

6 Check that all component units (pushbuttons, lamps etc.) are tightly secured into the unit.

7 Check that the pushbuttons operate smoothly.

8 Replace the front panel onto the unit.

9 On completion of the inspection (other units in the system may also need to be inspected) replace the system fuses and apply power to the system. If necessary, check that the system operates correctly by performing the appropriate test procedures.

10 Once power is restored, check that the hull unit is clear to be opened/closed, then operate the u to ensure it operates correctly and that the lamps function.

Actuator remote station, inspection

The remote control unit must be inspected at regular intervals, and before use if it has not been used for an extended period.

Logistics

Special tools - None.

Spare part - Depending on results of inspection.

References

→ *Wiring diagram on page 227.*

Procedure

1 Switch off all power to the system and remove the system fuses.

2 Check that the cable gland is correctly and tightly mounted into the unit, and seals on the cable passing through it. Check also that there is no tension on the cable.

3 Open the front panel door.

4 Check for signs of condensation or corrosion.

- Dampness or corrosion indicates either that the compartment is not properly ventilated and dry, or that the unit's cover is not closed correctly. Investigate, and correct the fault.

5 Check that all cable terminations are tight, and that there is no indication of overheating.

- If a cable termination is not tight, the bad connection will probably result in overheating, leading to more serious damage.

6 Check that all component units (pushbuttons, lamps etc.) are tightly secured into the unit.

7 Check that the pushbuttons operate smoothly.

8 Replace the front panel onto the unit.

9 On completion of the inspection (other units in the system may also need to be inspected) replace the system fuses and apply power to the system. If necessary, check that the system operates correctly by performing the appropriate test procedures.

10 Once power is restored, check that the hull unit is clear to be opened/closed, then operate the u to ensure it operates correctly and that the lamps function.

Replacement of remote station and local control unit parts

The corrective maintenance are similar for the remote station and the local control unit, and these are therefore described in this common paragraph.

Logistics

Special tools - None

Spare parts - Refer to the *Spare Parts* section.

References

→ *Wiring diagram on page 227.*

General

The switches and lamps within the unit can be replaced individually.

Before you start:

1 Inform the system supervisor that the system will be out of use while maintenance is performed.

2 Switch off all power to the system and remove the system fuses on the ship's supply.

3 Open the the remote station/local control unit front door.

Button replacement

1 Attach identification labels to all cables connected to the defective switch, and the terminals to which those cables are connected.

2 Disconnect the required cables.

3 Unscrew the mounting bolt and remove the defective switch.

4 Mount the replacement switch and reconnect the wires.

5 Check the connections against the circuit diagram to ensure they are correct.

6 Check the unit to ensure that all connections are tight.

7 Remove all tools and rubbish. Replace the front of the unit correctly.

8 Take the appropriate safety measures, then replace the fuses and apply power to the system.

9 Perform a system test as necessary to ensure the maintenance has been conducted successfully.

10 Inform the system supervisor that the system is now back in operation.

Lamp replacement

1 Unscrew the lens on the button containing the defective lamp, and remove the coloured filter.

2 Remove the defective lamp from the button by pushing it in and turning it 45° anti-clockwise.

- A short length of 6 mm diameter plastic tube will be a useful tool in this operation. A pair of "snipe-nose" pliers (insulated) may be required to extract the lamp as it is located quite deep within the holder.

3 Insert a new lamp into the holder, push it in and turn it 45° clockwise to secure it.

4 Replace the coloured filter and lens onto the button.

5 Perform a system test as necessary to ensure the maintenance has been conducted successfully.

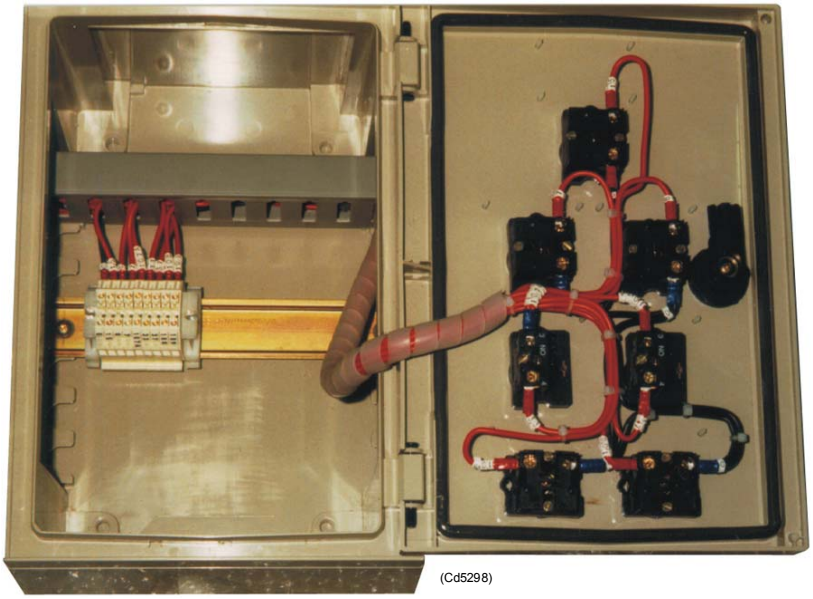


Figure 30 Actuator remote station - internal layout

Local control unit switch replacement

Replacing a switch is similar to replacing a pushbutton. See the button replacement paragraph.

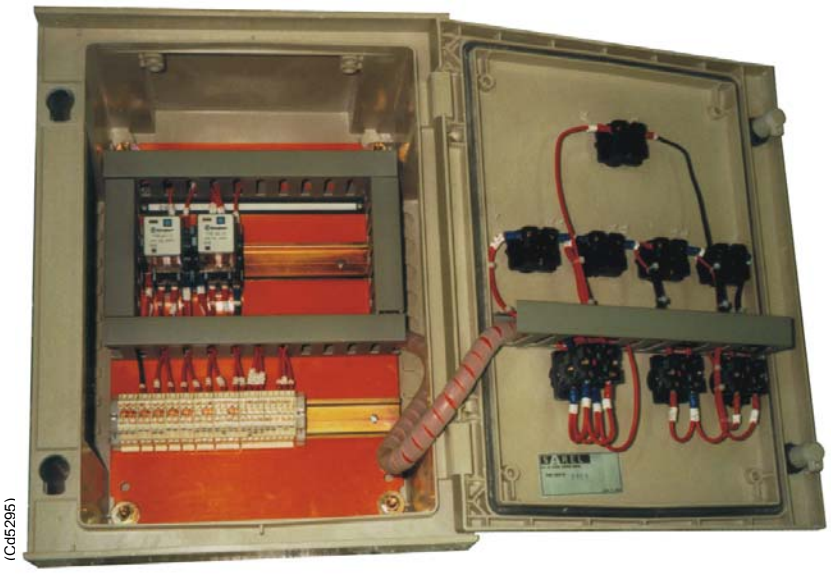


Figure 31 Actuator local control unit - internal layout

Test procedure

General checks

On completion of any maintenance on the hull unit, the system must be checked to ensure the maintenance was successful and to ensure the hull unit may be operated safely.

→ *Refer to the Hull unit raise/lower checks in the Test and alignment procedures.*

System alignment

One of the most important variables that will effect system accuracy is the alignment of the transducer with respect to the vessel's fore-and-aft axis. After any maintenance procedure which could effect the alignment of the transducer (removal of the transducer, adjustment of guide rails etc.), or if the maintenance engineer suspects that the transducer has moved out of alignment, an alignment test should be conducted. The system software can then be set up to take into account any misalignments in the system. Contact Kongsberg Simrad AS for assistance with the alignment checks.

→ *Refer to the Hull unit installation alignment procedure.*

5 EQUIPMENT HANDLING

Introduction

This section describes how to pack and unpack, clean, preserve and store electronic, electro-mechanical and mechanical units supplied by Kongsberg Simrad AS.

The units may be supplied as spare parts, or as parts of a delivery.

Transportation

General specifications

Unless otherwise stated in the accompanying documentation, electronic, electro-mechanical and mechanical units supplied by Kongsberg Simrad can be transported using all methods approved for delicate equipment; e.g. by road, rail, air or sea. The units are to be transported in accordance with general or specific instructions for the appropriate unit(s), using pallets, transport cases, or carton boxes as appropriate.

Note

Special local restrictions concerning air transportation may be applied to units containing certain types of batteries. The units should be checked and the regulations investigated by the packer/shipper before the unit is dispatched.

Local transportation

All local transportation must be carried out according to the same specifications as for the initial delivery. In general, all units must be handled with care. The carton or case containing the equipment must be kept dry at all times, and must be sheltered from the weather. It must not be subjected to shocks, excessive vibration or other rough handling.

The carton or case will normally be marked with text or symbols indicating which way up it is to be placed. Follow any instructions given and ensure the case is always placed with its “top” uppermost.

The carton or case must not be used for any purpose for which it was not intended (e.g. step, table, etc.), and in the absence of other information, no other cartons or cases must be stacked on top of it.

Lifting

A heavy crate will normally be marked with its weight, and the weights of other cartons or crates will normally be entered on the packing list.

- Always check the weight of a crate before attempting to lift it.
- Always use lifting apparatus that is certified for the load.

Heavy units may be equipped with lifting lugs for transportation by crane within the workshop or installation area. Before a crane is used, check:

- The applicable weight certificate for the crane.
- The security of the lifting lugs.

Ensure that all available lifting lugs are used. Ensure the unit remains under control during the operation to avoid damage to the unit, equipment or personnel.

Heavy units may be transported using a fork-lift truck. Special attention must then be paid to the position of the unit's centre of gravity. The units must be properly secured to the truck.

Initial preservation

Introduction

When a system, a unit or a spare part has been delivered to the customer, it may be subject to long-time storage prior to installation and use. During this storage period, certain specifications must be met.

The equipment must be preserved and stored in such a way that it does not constitute any danger to health, environment or personal injury.

Specific specifications are presented below.

→ *For further information about storage, refer to page 104.*

→ *For further information about re-packing, refer to page 107.*

→ *For further information about temperature protection, refer to page 108.*

Original packing crate

1 The equipment must be stored in its original transportation crate.

2 Ensure that the units are clearly separated in the shelves and that each unit is easily identifiable.

3 The crate must not be used for any purpose for which it was not intended (eg. work platform etc.).

4 The crates must not be placed on top of each other, unless specific markings permit this.

5 The crates must not be placed directly on a dirt floor.

6 Do not open the crate for inspection unless special circumstances permit so.

- "Special circumstances" may be suspected damage to the crate and its content, or inspections by civil authorities.
- If any units are damaged, prepare an inspection report stating the condition of the unit and actions taken. Describe the damage and collect photographic evidence if possible. Re-preserve the equipment.
- If the units are not damaged, check the humidity absorbing material. If required, dry or replace the bags, then repack the unit(s) according to the packing instructions.

7 If the crate has been opened, make sure that is it closed and sealed after the inspection.

- Use the original packing material as far as possible.

→ *Refer to the information on page 107.*

Ambient temperature and humidity

1 The storage room/area must be dry, with a non condensing atmosphere. It must be free from corrosive agents.

2 The storage area's mean temperature must not be lower than -30°C, and not warmer than +70°C.

- If other limitations apply, the crates will be marked accordingly.

Note *Transducers must not be stored in temperatures below -20°C.*

3 The crate must not be exposed to moisture from fluid leakages.

4 The crate must not be exposed to direct sunlight or excessive warmth from heaters.

Shock and vibration

1 The crate must not be subjected to excessive shock and vibration.

- Normal vibrations from vehicle, vessel or other transportation movements are permitted.

ESD precautions

→ *Refer to the information on page 107.*

Batteries

If the unit contains normal batteries, these may have been disconnected/isolated before the unit was packed. These must only be reconnected before the installation starts. Units containing batteries are marked.

Caution ***Units containing lithium or alkaline batteries must be handled separately and with care. Such units are marked accordingly. Do not attempt to recharge such batteries, open them or dispose of them by incineration. Refer to the applicable product data sheets.***

Inspection and unpacking

Inspection on receipt

An inspection must be carried out immediately after the unit(s) have arrived at their destination.

- Check all wooden or cardboard boxes, plastic bags and pallets for physical damage. Look for signs of dropping, immersion in water or other mishandling.
- If damage is detected externally, you will have to open the packaging to check the contents.
  - Request a representative of the carrier to be present while the carton is opened, so any transportation damage can be identified.
- If any units are damaged, prepare an inspection report stating the condition of the unit and actions taken. Describe the damage and collect photographic evidence if possible. Send the inspection report to Kongsberg Simrad as soon as possible.
- If the units are not damaged, check the humidity absorbing material. If required, dry or replace the bags, then repack the unit(s) according to the packing instructions.

Unpacking

General unpacking procedure

Normal precautions for the handling, transportation and storage of fragile electronic equipment must be undertaken.

Note *If the unit is not to be prepared for immediate use, you may consider storing it unopened in its original packing material. However, it may be useful to open the case to check its contents for damage and retrieve any accompanying documentation.*

- Check the carton before opening it to ensure it shows no signs of dropping, immersion in water or other mishandling.
  - If the carton shows signs of such damage, refer to the paragraph covering Inspection on receipt.
- Place the carton on a stable work bench or on the floor with the top of the carton uppermost.
- In the absence of other instructions, always open the top of the carton first. The contents will normally have been lowered into the carton from above, so this will usually be the easiest route to follow.
  - Care must be used when opening the carton to ensure the contents are not damaged.

Caution ***Do not use a knife to open cardboard cartons - the contents may lie close to the surface, and may be damaged by the blade.***

- If the carton has been closed using staples, remove the staples from the carton as you open it. This will reduce the possibilities of scratch injury to yourself and damage to the contents.
- If a wooden crate has been closed using screws, always remove them using a screw-driver. Do not attempt to prise the lid off with a crow-bar or similar.
- Once the carton is open, carefully remove all loose packing and insulation material. Check for manuals and other documents that may have been added to the carton during packing, and put these to one side. Check also for special tools, door keys etc.

Electronic and electro-mechanical units

Caution ***Beware of the dangers of Electro-Static Discharge (ESD) both to yourself and to the equipment, when handling electronic units and components. Refer to the precautions starting on page 107.***

Electronic and electro-mechanical units will normally be wrapped in a clear plastic bag. Lift the unit, in its bag, out of the carton and place it in a stable position on the floor/work bench.

Note *Cables must **never** be used as carrying handles or lifting points.*

Inspect the unit for damage before opening the plastic bag.

Note *Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to the manufacturers with the seal broken, the contents will be assumed to have been used and the customer will be billed accordingly.*

Assuming all is well, open the bag and remove the unit.

Open the unit and check inside. Remove any packing and desiccant material that may be inside.

Mechanical units

Mechanical units may be heavy. Using a suitably certified lifting apparatus, lift the unit out of the crate and place it in a stable position on the floor/work bench.

Note *Cables must never be used as carrying handles or lifting points.*

Inspect the unit for damage and remove any packing material that may be inside the unit.

Transducers

Transducers may be supplied mounted to a hull unit (if any), or packed separately. Crates are normally identified by the order number and the serial number.

The transducer face must be protected by a rigid, padded cover (e.g. a wooden box lined with foam rubber) all the time it is exposed to the risk of physical damage.

Note *Once the units are unpacked, great care must be taken to ensure that transducers and cabling are not exposed to any mechanical stress.*

Re-packing

If the unit is not to be installed immediately, re-pack it in its original packing material to prevent damage in the intervening period.

→ *Refer to the information on page 107.*

Storage

Pre-installation

The equipment should be stored in its original transportation crate until ready for installation. The crate must not be used for any purpose for which it was not intended (eg. work platform etc.).

Once unpacked, the equipment must be kept in a dry, non condensing atmosphere, free from corrosive agents and isolated from sources of vibration.

Note *Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to the manufacturers with the seal broken, the contents will be assumed to have been used and the customer will be billed accordingly.*

The unit must be installed in its intended operating position as soon as possible after unpacking.

If the unit contains normal batteries, these may have been disconnected/isolated before the unit was packed. These must then be reconnected during the installation procedure. Units containing batteries are marked.

Caution

Units containing lithium or alkaline batteries must be handled separately and with care. Such units are marked accordingly. Do not attempt to recharge such batteries, open them or dispose of them by incineration. Refer to the applicable product data sheets.

After use

Introduction

If a unit is removed from its operating location and placed into storage, it must be properly cleaned and prepared before packing.

Cleaning cabinets

If the unit may have been exposed to salt atmosphere while it was in use, it must be thoroughly cleaned both internally and externally to prevent corrosion.

- Wipe the cabinet externally using a damp cloth and a little detergent. Do not use excessive amounts of water as the unit may not be water tight. On completion, dry the unit thoroughly.
- All surfaces must be inspected for signs of corrosion, eg. flaking/bubbling paint, stains etc. Damaged or suspect areas must be cleaned, prepared and preserved using the correct preservation mediums for the unit. The mediums to be used will usually be defined in the units' maintenance manual.
- All surfaces must be inspected for signs of corrosion, eg. flaking/bubbling paint, stains etc. Damaged or suspect areas must be cleaned, prepared and preserved using the correct preservation mediums for the unit.
- Open the unit, and using a vacuum cleaner, remove all dust etc. from the unit. Great care must be taken to ensure the circuit boards and modules are not damaged in the process.

Mechanical units

If the mechanical unit may have been exposed to a salt atmosphere while it was in use, it must be thoroughly cleaned both internally and externally to prevent corrosion.

- If the construction materials and type of unit permits, wash the unit using a high-pressure hose and copious amounts of fresh water.

Examples:

- The lower parts of hull units (outside the hull)
- Subsea units

- Ensure that all traces of mud and marine growth are removed. Use a wooden or plastic scraper to remove persistent growth, barnacles etc. On completion, dry the unit thoroughly.

Caution ***Do not use a high pressure hose in the vicinity of cables or transducers. Do not use sharp or metal tools on a transducer face.***

- If the materials or type of unit prevents the use of a high-pressure hose, wipe the unit using a cloth dampened with water containing a little detergent.

  Example:

  - The upper parts of hull units (inside the hull)
  - Hydraulic systems

- Do not use excessive amounts of water as some components on the unit may not be water tight. Wipe off the detergent with a damp cloth, then dry the unit thoroughly.
- All surfaces must be inspected for signs of corrosion, eg. flaking/bubbling paint, stains etc. Damaged or suspect areas must be cleaned, prepared and preserved using the correct preservation mediums. The mediums to be used will normally be defined in the unit's maintenance manual.

Cables

Wipe clean all exposed cables, and check for damage. If a cable shows signs of wear or ageing, contact Kongsberg Simrad for advice.

Internal batteries

If the unit contains batteries, these may discharge slowly during storage. If the unit is to be stored for an extended period, disconnect or remove all internal batteries.

A suitable piece of insulating material can be placed between the battery and the electrical contacts to prevent electrical discharge. The battery can then remain in the unit, reducing the risk of it being misplaced during the storage period.

Caution ***Units containing lithium or alkaline batteries must be handled separately and with care. Such units are marked accordingly. Do not attempt to recharge such batteries, open them or dispose of them by incineration. Refer to the applicable product data sheets.***

Dehumidifier

Place a suitably sized bag of desiccant material (silica gel or similar) into the unit to keep the electronic components as dry as possible.

Coatings

Spray the unit externally with a corrosion inhibitor (e.g. a light oil) before packing.

Re-packing

The unit should be stored and transported in its original packing material and/or crate. In the event that this material is not available, proceed as follows:

- Small units must be protected from damp by being placed within a plastic bag at least 0.15 mm thick. An appropriate quantity of desiccant material should be placed inside this bag, and the bag sealed. The sealed unit must then be placed in an appropriate carton or crate, and supported in the container by appropriate shock-absorbing insulation (polystyrene foam chips etc.).
- Large units must be placed in a suitable cardboard box or wooden crate. The unit must be protected against physical damage by means of shock-absorbing insulation mats. The box must be clearly marked with its contents, and must be stored in a dry and dust-free area.
- Ensure that the resulting unit is weather proof as required by the current and expected environment.

ESD precautions

Electrostatic Discharge (ESD)

Electro-Static Discharge (ESD) is the transfer of an electrostatic charge between two bodies at different electrostatic potentials, caused either by direct contact or induction by an electrostatic field.

The passing of a charge through an electronic device can cause localised overheating, and it can also “puncture” insulating layers within the structure of the device. This may deposit a conductive residue of the vaporised metal on the device, and thus create a short circuit. This may result in a catastrophic failure, or degraded performance of the device.

Protection

ESD Protection during transport and storage

Sensitive electronic equipment must be transported and stored in protective packing bags, boxes and cabinets. The equipment must NOT be transported or stored close to strong electrostatic, electro-magnetic or radioactive fields.

Unpacking and servicing ESD sensitive equipment

If it is necessary to open and touch the electronics inside the boxes/cabinets, then the following precautions MUST be taken:

- The working area must be covered by an approved conductive service mat that has a resistance of between 50kΩ and 2 MΩ, and is connected directly to a reliable earth point via its earthing cord.
- The service personnel involved must wear a wrist-band in direct contact with the skin, connected to the service mat.
- Printed circuit boards and other components should be placed on the conductive service mat during installation, maintenance etc.

Caution ***If, for any reason, it is necessary to move the circuit board or components from the conductive service mat, they must be placed in an approved anti-static transportation container (e.g. static shielding bag) before transportation.***

- During installation and servicing, all electrical equipment (soldering irons, test equipment etc.) must be earthed.

Temperature protection

If the unit must be protected against extremes of temperature, the carton/crate must be lined on all walls, base and lid with 5 cm thick polyurethane or polystyrene foam.

These units will be identified as delicate in the system's maintenance manual.

The package must then be clearly marked:

Must not be transported or stored in temperatures below -5 degrees Celsius.

Other units can normally be stored in temperatures between -30°C and +70°C, though refer to the system's Technical Specifications document for details.

Transducers must not be stored in temperatures below -20°C.

6 INSTALLATION

Overview

This section contains the descriptions and drawing references required to install the Kongsberg Simrad HiPAP hull units.

Note *Detailed mechanical drawings for the installation of the hull unit must be created and provided by the shipyard for the specific vessel. All drawings must be approved by local maritime authorities prior to the start of the installation.*

WARNING **The installation instructions given in this manual must be followed. Failure to do so may render the guarantee void.**

Configuration

The Kongsberg Simrad HiPAP hull units is a retractable hull unit system comprising the following main parts:

- Hull unit assembly (same for all HiPAP systems)
  - Hoist motor and gearbox
  - Support gantry
  - Shaft sleeve

Specific for each type of HiPAP hull unit:

  - Transducer dock with service hatch
  - Mounting flange
  - Transducer shaft
  - Transducer
  - Gate valve including:
    * Position indicator (switch)
    * Electrical actuator (option)
- Hoist Control Unit (same unit for all HiPAP systems)
- Remote Control Unit (same unit for all HiPAP systems)

Installation procedures overview

Installation of the Kongsberg Simrad HiPAP hull units includes the following:

1 Installation planning:
- Location of the hull unit

2 Installation of the hull unit:
- Installation of the mounting flange
- Installation of the gate valve
- Installation of the gantry with transducer dock, transducer shaft and transducer
- Installation of the hoist motor

3 Installation of the Hoist Control Unit

4 Installation of the Remote Control Unit

5 Connection of the system cabling

6 Test and alignment of the installed hull unit and associated units.

Refer to the required *Installation procedures* for further information.

The installation procedures for the other units in the system (Transceiver Unit, Display Unit etc.) are described in the HiPAP Instruction manual.

Installation requirements

Supply power

The supply voltage to the equipment is to be kept within ± 15% of the installation's nominal voltage. The maximum transient voltage variations on the main switchboard's bus-bars which can occur (except under fault conditions) are not to exceed -15% to +20% of nominal voltage.

Environmental requirements

Vibrations

If the vibration velocity amplitude at the base of the installed equipment is expected to exceed 10 mm/s in the range 5-50 Hz, constantly during operational life, special precautions may have to be taken.

Temperature, humidity and corrosion

All the equipment, unless otherwise specified, should be kept in an operational environment at room temperature.

Sonar room requirements

General

The sonar room should be large enough to house all the system units, with enough space to allow maintenance to be performed efficiently. The maintenance engineer should be able to have all the cabinet doors open without undue restriction to his/her movements.

The room should be easily accessible, via a hatch or door. It would be advantageous if the entry was large enough to allow installation and removal of the equipment contained in the compartment without the requirement for disassembly.

Lights must be permanently installed in the sonar room. A voice intercom terminal, with connections to the Operator Station and the bridge, is highly recommended.

Ventilation

The room must be connected to the vessel's ventilation system to ensure a supply of cooling air to the units. It is recommended that the temperature should be between +5 and +40°C, and relative humidity should not exceed 80%. The MTBF (Mean Time Between Failure) will decrease if these limits are exceeded.

If a ventilation system is not available, install two 3" pipes from the equipment room to a suitable fresh air location on deck. The fresh air should enter the room as close to the floor as possible, and should be extracted from as high as possible. Funnels should be located below the pipes to collect any condensation which may form. To ensure the best possible ventilation, the air outlet on deck should be located four metres higher than the air inlet, and goose-necks or hats should be mounted on the tubes to prevent the ingress of rain or sea water.

Bilge pump system

The room must be serviced by a bilge pump system. If it is impractical to connect the room to the vessel's bilge pump, a separate pump must be installed to drain the room in the event of water ingress.

Precautions and requirements

Before starting the installation, the following actions must be taken:

- Inform the supervisor/coordinator that the work is about to be carried out.
- Collect the required documentation and read the applicable procedures ***before*** commencing work.
- Collect the required tools. Normally only a standard tool set will be required. If special tools are necessary to perform a task, the procedure will list those required.
- Ensure that all power is switched off to the system, and remove the fuses. If power is required to perform a task, the procedure will state so.
- Label the on/off switches, circuit breakers and fuses with notes clearly stating that work is being carried out on the system.

General installation information

Introduction

The installation of the hull unit and associated units includes as follows:

- Selection of the hull unit location.
- Installation of the hull unit. This includes:
  - Installation of the mounting flange at the site chosen for the hull unit.
  - Installation of the gate valve.
  - Mounting of the hull unit assembly (transducer dock, shaft sleeve, gantry, transducer).
  - Mounting of the hoist motor.
- Mounting of the hoist control and remote control units.
- Control signal and power supply cabling, described in the *Cable layout and interconnections* section.
- Test and alignment, described in the *Test and alignments* section.

References

Refer to the following drawings and diagrams:

→ *HiPAP hull units - outline dimensions, refer to the Drawing files section.*

Logistics

Safety - Refer to the local general safety procedures.
Note that the parts of the hull unit are heavy. Use only suitable and properly certified lifting apparatus to move the units.

Personnel - Trained mechanical fitters/welders and electricians.

Vessel location - The vessel must be in a dry dock during the installation of the mounting flange and gate valve. The hull unit gantry can be installed while the vessel is afloat if necessary.

Special tools -
Certified lifting apparatus suitable for the various parts.
Cutting/welding equipment.

Choice of location

Selecting the optimum location for the hull unit is of vital importance for the overall system performance. All external noise sources (sea noise, machinery noise, air bubbles etc), and also the individual performance of the ship, must be taken into consideration. The hull unit location must be selected by a skilled engineer with experience in positioning system theory and hull unit installation. The supplier will assist if required.

The compartment within which the hull unit is to be mounted must be accessible under all conditions. The access door/hatch should be large enough to allow the installation and removal of the hull unit without the requirement to disassemble it. The hull unit will pass through a hole of 800 mm diameter, provided there are no obstructions either side of the hole. The compartment should also be connected to the ship's ventilation system. In tropical regions an air dehumidifier is recommended to reduce the likelihood of problems and corrosion due to condensation. The compartment should also be supported by a central or separate bilge pump.

The installation must be carried out according to the arrangement drawings designed specifically for the vessel. The hull unit should be located within 1/6 to 1/3 of the ship's length between perpendiculars (LBP), measured from the fore perpendicular (FP). Deviations from this specification should not be made without consulting the supplier. In all cases, it is imperative that the transducer array has a free view under the keel when it is in its operational position.

The location must be as close to the keel as possible. The vertical distance from the lower edge of the keel to the top of the mounting flange must be discussed with the supplier.

Additional points

- Water inlets and protruding elements that might cause turbulence around the transducer must not be located forward of the flange.
- Reinforcing plates and braces must be added to the vessel where the hull unit installation might weaken the hull construction.
- The Hoist Control Unit must be mounted on the bulkhead in the vicinity of the hull unit. The Hoist Control Unit controls the hull unit hoisting and lowering operations locally, therefore for safety reasons it should be mounted with a free line of sight to the hull unit.
- The assistance of a dockyard crane will be required to lower the hull unit into the vessel.

- Heater elements of approximately 1000 watts should be installed close to the bottom of the hull unit to prevent the unit icing up in cold weather.
- If there is any chance of damage caused by welding or other work during the installation or a maintenance period, the hull unit must be protected with heat resistant material.
- The installation must be approved by a appropriate classification society.
- When the vessel has been launched, the air must be released from the transducer dock through the air vent cock.

Installation of the mounting flange

General

The mounting flange is welded into a hole cut in the vessel's bottom and provides a secure base for the hull unit assembly.

The HiPAP 500 hull unit must be mounted on the DN500 mounting flange.

The HiPAP 350 hull unit can be mounted on the DN500 or a DN350 mounting flange.

Note

Cut the mounting flange to the shortest possible length for installation.

→ *Refer to figure on page 217 and 218.*

DN500 mounting flange

The DN500 mounting flange comprises a steel cylinder with inner and outer diameters of 506 mm and 546 mm respectively, topped by a flange ring with an outer diameter of 670 mm.

The flange ring contains 20 equally spaced holes, each bored and tapped to receive M24 studs. The holes are on a pitch circle diameter of 620 mm, with a pitch of 18°.

→ *Refer to figure on page 217.*

The flange welded around the top of the cylinder enables a gate valve to be bolted onto the top.

Note

The total height of the mounting flange will depend on the requirements for the specific installation. The standard height is 600 mm, though other sizes can be provided on request.

DN350 mounting flange

The DN350 mounting flange comprises a steel cylinder with inner and outer diameters of 406 mm and 350 mm respectively, topped by a flange ring with an outer diameter of 505 mm.

The flange ring contains 16 equally spaced holes, each bored and tapped to receive M20 studs. The holes are on a pitch circle diameter of 460 mm, with a pitch of 22.5°.

→ *Refer to figure on page 218.*

The flange welded around the top of the cylinder enables a gate valve to be bolted onto the top.

Note

The total height of the mounting flange will depend on the requirements for the specific installation. The standard height is 600 mm, though other sizes can be provided on request.

Installation accuracy and tolerances

It is very important for the system accuracy that the angular orientation of the hull unit is as accurate as possible. This implies that the welding of the mounting flange into the hull, must be completed with tolerances according to the following three offset angles:

Roll angle: - The upper surface of the mounting flange must be horizontal in the athwartships direction when the ship is floating at its normal trim, tolerance $\pm$ 1°.

Pitch angle: - The upper surface of the mounting flange must be horizontal in the fore-and-aft direction when the ship is floating at its normal trim, tolerance $\pm$ 1°.

Azimuth angle: - No angular requirements.

Logistics

Safety - Refer to the general safety procedures. Note that the mounting flange is heavy. Use only properly certified lifting apparatus to move the unit.

Personnel - Minimum 3 trained mechanical fitters/welders.

Vessel location - The vessel must be in a dry dock during the installation of the mounting flange.

Special tools - Certified lifting apparatus. Cutting equipment. Welding equipment.

References

Refer to the following drawings and diagrams:

→ *DN500 mounting flange - installation w/gate valve on page 217.*

→ *DN350 mounting flange w/gate valve, see page 218.*

Installation procedure

1 Decide the location of the hull unit.

2 Cut out a hole in the vessel's hull with a diameter large enough to accommodate the mounting flange.

- The exact size of the hole must be determined by the shipyard.

3 Orientate the mounting flange correctly, then weld it into position.

4 Check the flange surface to ensure that it is level, undamaged and clean, then cover it for protection.

5 Brace the flange to the hull plating and the surrounding hull frames by welding on several strengthening plates.

- The exact dimensions of the plates must be determined by the shipyard.

Steel hulled vessels

Note *The mating surface of the flange unit must be protected with a wooden cover at all times till the gate valve is about to be installed.*

WARNING **The security of the welding is critical to the safety of the vessel. Welding must only be carried out by a certified welder, and the installation must be approved by the local classification authorities.**

Wooden hulled vessels

The installation shipyard must write a suitable procedure appropriate to the vessel and the classification rules.

Installation of a gate valve

Introduction

This section describes the installation of a gate valve.

- The HiPAP 500 hull units must be mounted on a DN500 gate valve.
- The HiPAP 350 hull unit can be mounted on either the DN350 or the DN500 gate valve. Details of both are given here.

Location of the unit

The gate valve is installed between the mounting flange and the hull unit transducer dock.

Logistics

Safety - Refer to the general safety procedures. Note that the gate valve is heavy. Use only properly certified lifting apparatus to move the unit.

Personnel - Minimum 3 trained mechanical fitters.

Vessel location - The vessel must be in a dry dock during the installation of the gate valve.

Special tools - Certified lifting apparatus.

References

→ *DN350 mounting flange w/gate valve on page 218.*

→ *DN500 mounting flange w/gate valve on page 217.*

O-ring and flange gasket

A standard delivery includes both o-ring and a flange gasket.

- Normally the o-ring is to be used to seal the connection, but some flanges do not have an o-ring groove and hence the flange gasket must be used.

Caution ***The o-ring and the gasket are not to be used together.***

- The design of the gate valves can differ from one supplier to another. If the space around the nut is insufficient for using a standard tool, that is usually solved by modifying (bending) a spanner.
- In worst case it may be necessary to remove the stud bolt, drill out the hole threads and fit a regular hex bolt with washer and nut.

Procedure

1 Ensure that the mounting flange has been installed correctly, the installation has been inspected, and that any offsets are within tolerance. Ensure that its mating surface is clean and undamaged.

2 Manoeuvre the gate valve down into the hull unit room.

- Take great care not to damage the mating surfaces of the valve.

3 Remove the protective cover from the mating surface on the mounting flange.

4 Check to ensure the mating surface of the flange is clean and undamaged.

5 Secure the stud bolts into position in the mounting flange.

6 Wipe a thin film of sealing compound onto the flange, then lay the O-ring into position.

7 Orientate the gate valve so that the wheel points in the desired direction.

8 Check to ensure the mating surface on the valve is clean and undamaged.

9 Lower the valve carefully onto the mounting flange.

- Take great care to ensure the studs protruding from the mounting flange do not damage the mating surface on the gate valve.

10 Place first the washers, then the nuts, onto the studs, and tighten them all to finger-tight.

11 Check to ensure the valve is orientated and aligned correctly.

12 Disconnect and remove the lifting apparatus.

Installation of the gantry

General

The flange at the bottom of the assembly is to be mated to the gate valve flange. The mating surface of the hull unit must be protected with wooden covers at all times until the moment of installation.

The hull unit assembly is normally transported in a wooden crate.

References

→ *Hull unit - outline dimensions, refer to the Drawing files section.*

Logistics

Safety - Refer to the general safety procedures. Note that the parts of the hull unit are heavy. Use only suitable and properly certified lifting apparatus to move the units.

Personnel - Four trained mechanical/electrical fitters.

Vessel location - The vessel must be in a dry dock during the installation of the mounting flange and gate valve. The hull unit gantry can be installed while the vessel is afloat if necessary.

Special tools - Two certified lifting apparatus (cranes/tackles), each with the capacity to support the entire hull unit (Approx. 1.5 tonnes depending on type).

Procedure

1 Manoeuvre the unit into the hull unit compartment, taking care not to damage the unit.

- The mating surface of the transducer dock flange must be protected at all times during the operation.

2 Raise the unit using two cranes/tackles, one of which must be attached to the top of the unit.

3 Rotate the unit to the upright position without any part touching the deck.

4 Once the entire weight of the unit is supported by the crane attached to the top of the unit, release the crane attached to the lower end.

- The unit is now hanging from one crane.

5 Manoeuvre the unit over the gate valve.

6 Orientate the unit such that the hoist motor shaft points *forward*, and lower the unit carefully.

7 Stop lowering when the bottom flange of the transducer dock approaches the gate valve.

8 Remove the protective cover from transducer dock and gate valve flanges and check that the mating surfaces are clean and undamaged.

9 Wipe a film of sealing compound onto the gate valve's mounting face, then lay into position the O-ring seal.

10 Carefully lower the gantry down onto the gate valve.

- Make sure that the studs mate correctly and easily with their corresponding holes in the transducer dock flange.

11 Place the nuts and washers onto all the stud bolts (ensuring that the required washers are used).

12 Tighten all the nuts to finger tight, then working alternately on opposite sides of the dock, tighten the nuts in stages to a final torque of 470 Nm.

Note

The gantry will be subjected to large forces as the vessel moves through the water, and as it pitches and rolls. The gantry must therefore be supported against the vessel's hull in two directions 90° apart, using steel braces of suitable dimensions. These braces must be BOLTED into position to allow later maintenance or possible removal of the hull unit. Refer to the drawing.

13 Ensure that no units or protrusions will obstruct the vertical movement of the hull unit or the cables from the motor and transducer.

Mounting the hoist motor

Introduction

The hull unit is delivered with the motor dismounted. It must therefore be fitted during the installation. It is recommended to fit the motor after the hull unit has been installed in the vessel.

Procedure

1 Remove the plate covering the motor shaft key-way on the gearbox.

2 Mount the motor onto the gearbox using all the bolts provided.

3 Remove the oil filler and level plugs from the gearbox, and fill the gearbox with oil type SAE 30 if necessary.

4 Cut away the plastic vent plug on the oil filler plug to allow the gearbox to “breathe”.

If the hull unit is to be hoisted manually, the motor brake must first be released. This is achieved by locating the brake release screw into the hole in the side of the motor and pushing it sideways while operating the hand crank. The brake must always be reset after the manual operation is completed. If the brake is not reset, the motor will continue to run after the power is switched off by the limit switches and this will result in damage to the hull unit.

Hull unit surface protection

General

The hull unit must be protected against corrosion, especially those parts which are open to the sea. The HiPAP hull unit has two zinc anodes mounted on the shaft sleeve to protected against galvanic corrosion. However, all exposed surfaces must be painted with a primer and topcoat/antifouling paint.

Logistics

Safety - Refer to the general safety procedures. Switch off all power to the hull unit before commencing the work.

Personnel - Painter.

Vessel location - The vessel must be in a dry dock if parts open to the sea are to be painted. Dry parts within the vessel's hull can be painted at any time.

Special tools - Primer, undercoat, topcoat, anti-fouling paint as for remainder of vessel's hull. Painting tools.

Caution ***The transducer face, shaft and zinc anodes must NEVER be painted.***

Installation of the Hoist Control Unit

Introduction

This section describes the installation of the Hoist Control Unit (HCU) used with the Kongsberg Simrad HPR and HiPAP hull units.

The connections for the power and interface cables to the Hoist Control Unit are described herein, while the full installation of the cables is described in detail in the *Cable layout and Interconnection* section.

The HCU is fitted with four mounting lugs. Holes can be drilled in the bulkhead and bolts, nuts and washers used to secure the unit, or studs can be welded to the bulkhead and the unit secured to these.

Unit location

The HCU will normally be mounted in the close vicinity of the hull unit.

- The lengths of the system cables do not place any practical restrictions on the distance between the Hoist Control Unit and the hull unit into which it is connected.
- The HCU is designed to be mounted on a bulkhead, but can be mounted directly onto the hull unit gantry if necessary.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Minimum 2 trained mechanical/electrical workers

Vessel location - No special requirements. The watertight integrity of the vessel will not be effected.

Special tools - None

References

→ *Interconnection diagram, hoisting system on page 219.*

→ *Wiring diagram, Hoist Control Unit on page 220.*

→ *Wiring diagram, Remote Control Unit on page 223.*

→ *Circuit diagram, Hoist Control Unit on pages 221 and 222.*

→ *Hoist Control Unit - outline dimensions on page 144.*

Procedure

Caution ***For safety reasons, the Hoist Control Unit must be mounted such that the operator has a direct and unimpeded line of sight from the cabinet to the hull unit.***

Note *The Hoist Control Unit is not fitted with vibration/shock dampers as standard. Refer to the Technical Specifications section for vibration/shock requirements.*

1 Select an appropriate location in which to mount the unit.

2 Check on the other side of the bulkhead to ensure there will be no "surprises" when the holes are bored or welding is performed.

3 Bore the holes to fit M8 bolts, or weld four M8 x 12 mm long studs to the appropriate positions on the bulkhead.

4 Lift the cabinet against the bulkhead and align the mounting holes/studs.

5 Locate the bolts/studs through the holes, place washers onto the threads, then screw nuts onto them.

6 Ensure the cabinet is positioned correctly, then tighten the nuts to a torque of 22 Nm.

7 Referring to the relevant cabling documentation and interconnection diagrams, connect in the cables.

8 Once all the cables have been installed and the installation has been checked, remove all "foreign" matter from the cabinet and shut the door.

Installation of the Remote Control Unit

General

This section describes the installation of the Remote Control Unit (RCU) used with the Kongsberg Simrad HiPAP hull units.

Installation of the cables is described in detail in the *Cable layout and interconnections* section.

Location of the unit

The RCU will normally be installed in the vicinity of the system's operator unit(s).

- The RCU cables can be as long as necessary, so there is no practical restriction on the distance between the Remote Control Unit and the Hoist Control Unit into which it is connected.
- The RCU is designed to be mounted on a bulkhead.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Minimum1 mechanical/electrical workers

Vessel location - No special requirements.

Special tools - None

References

→ *Interconnection diagram, hoisting system on page 219.*

→ *Wiring diagram, Hoist Control Unit on page 220.*

→ *Circuit diagram, Hoist Control Unit on pages 221 and 222.*

→ *Wiring diagram, Remote Control Unit on page 223.*

→ *Remote Control Unit - outline dimensions on page 147.*

Installation procedure

1 Select an appropriate location in which to mount the unit.

2 Mark the positions of the required four holes on the selected bulkhead.

→ *The location of the holes are shown in the figure on page 147.*

3 Check to see what is on the other side of the bulkhead to ensure there will be no "surprises" when you drill the holes.

4 Drill the four holes in the bulkhead, each with diameter 6 mm.

5 Open the Remote Control Unit by removing the four screws securing the front cover in position.

6 Hold the unit in place and bolt it to the bulkhead using four M5 screws, nuts and washers.

7 Referring to the cable gland assembly procedure and wiring diagrams located in the *Cable layout and interconnections* document, and the terminal block diagram in figure 32, install the interface cable.

8 Once the interface cable to the Hoist Control Unit has been installed and the installation checked, remove all "foreign" matter from the unit and replace the front panel.

Pin allocations

The Remote Control Unit contains one terminal block, shown below. The other end of the cable is connected into the Hoist Control Unit.

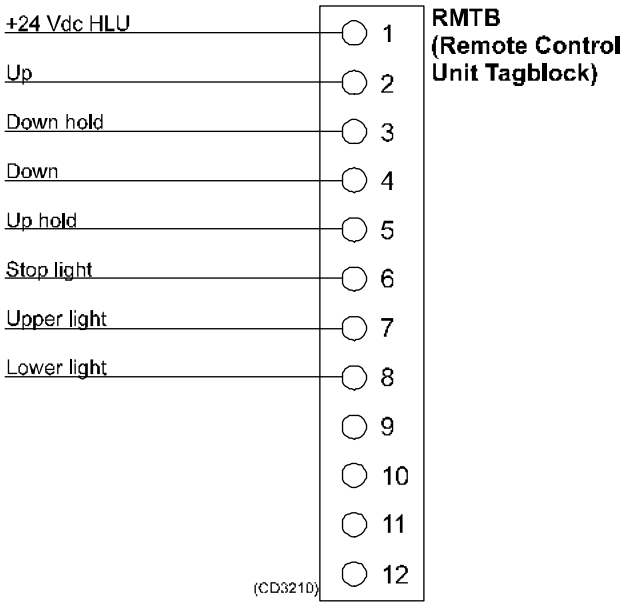


Figure 32 Cable connections

Electrical actuator (option)

General

The system includes the the following units:

- Actuator
- Remote control unit
- Local control unit

Location of the unit

The actuator is installed on the hull unit gate valve.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Minimum1 mechanical/electrical workers.

Vessel location - No special requirements. The watertight integrity of the vessel will not be effected.

Special tools - None.

References

→ *Wiring diagrams refer to pages 226 and 227.*

→ *Actuator - outline dimensions refer to page 151.*

→ auma - *actuator manufacturer, http://www.auma.com.*

Mounting procedure

The mounting is normally done by the supplier.

1 Check that the output drive flange fits the valve.

Note *Spigot at the flanges must be loose fit.*

- For output drive form A, the thread must correspond with thread of the valve stem. If not ordered explicitly with thread, the stem nut is supplied unbored or with pilot bore.

Note *For more information, refer to the auma multi-turn actuators* Operation instructions *supplied with the actuator.*

2 Check that bore and keyway correspond with the input shaft of the valve.

3 Clean the mounting surfaces of the actuator and valve thoroughly.

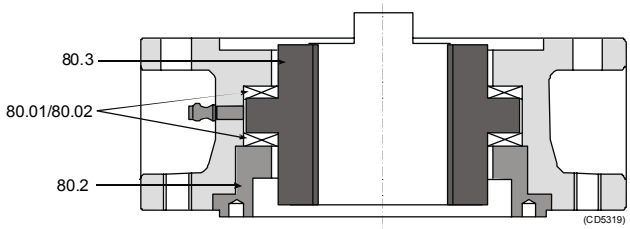


Figure 33 Output drive A, stem nut

4 Apply grease on the shaft input.

5 Place the actuator on the valve and fasten the with the bolts (quality minimum 8.8) firmly crosswise.

Switch settings

The switches are mounted on the Logic board.

For location and layout of the logic board refer to:

→ *The auma multi-turn actuators* Operation instructions *supplied with the actuator.*

Limit switches

The limit switches are normally preset by the supplier.

Note

Fore more information about the Limit switch setting - refer to the auma multi-turn actuators Operation instructions *supplied with the actuator.*

Torque switch

The torque switch is normally preset by the supplier.

Caution

The setting must only be changed with the consent of the valve manufacturer.

Note

Torque switch setting - refer to the auma multi-turn actuators Operation instructions *supplied with the actuator.*

Standard switch settings are:

Switch	**Settings**	
DIP-switch S2-2	1,2	OFF
	3,4	ON
	5	OFF
	6	ON
S1-2	1	
S3-2	1	

Wiring diagrams

The actuator contains one terminal block.

→ *Wiring diagram refer to page 226.*

The other end of the cable is connected into the local control unit.

→ *Actuator system wiring diagram, refer to page 227.*
For more information contact Kongsberg Simrad.

Installation of the remote station

General

This section describes the installation of the actuator remote station.

Location of the unit

The actuator remote control unit will normally be installed in the vicinity of the system's operator unit(s). The actuator remote control unit cables can be as long as necessary, so there is no practical restriction on the distance between the actuator remote control unit and the actuator.

The actuator remote control unit is designed to be mounted on a bulkhead.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Minimum1 mechanical/electrical workers.

Vessel location - No special requirements. The watertight integrity of the vessel will not be effected.

Special tools - None.

References

→ *Wiring diagram refer to page 227.*

Procedure

1 Select an appropriate location in which to mount the unit.

2 Mark the positions of the required four holes on the selected bulkhead.

3 Check to see what is on the other side of the bulkhead to ensure there will be no "surprises" when you drill the holes.

4 Drill the four holes in the bulkhead, each with diameter 6 mm.

5 Open the unit by removing the four screws securing the front cover in position.

6 Hold the unit in place and bolt it to the bulkhead using four M5 screws, nuts and washers.

7 Referring to the cable gland assembly procedure and wiring diagrams, install the interface cable.

8 Once the interface cable to the actuator local control unit has been installed and the installation checked, remove all "foreign" matter from the unit and replace the front panel.

Installation of the local control unit

General

This section describes the installation of the actuator local control unit.

Location of the unit

The actuator local control unit will normally be installed in the vicinity of the hull unit.

The actuator remote control unit is designed to be mounted on a bulkhead.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Minimum1 mechanical/electrical workers

Vessel location - No special requirements. The watertight integrity of the vessel will not be effected.

Special tools - None

References

→ *Wiring diagram refer to page 227.*

Procedure

1 Select an appropriate location in which to mount the unit.

2 Mark the positions of the required four holes on the selected bulkhead.

→ *Refer to figure on page 135.*

3 Check to see what is on the other side of the bulkhead to ensure there will be no “surprises” when you drill the holes.

4 Drill the four holes in the bulkhead, each with diameter 6 mm.

5 Open the unit by removing the screws securing the front cover in position.

6 Hold the unit in place and bolt it to the bulkhead using four screws, nuts and washers.

7 Referring to the cable gland assembly procedure and wiring diagrams, install the interface cable.

8 Once the interface cable to the unit has been installed and the installation checked, remove all “foreign” matter from the unit and replace the front panel.

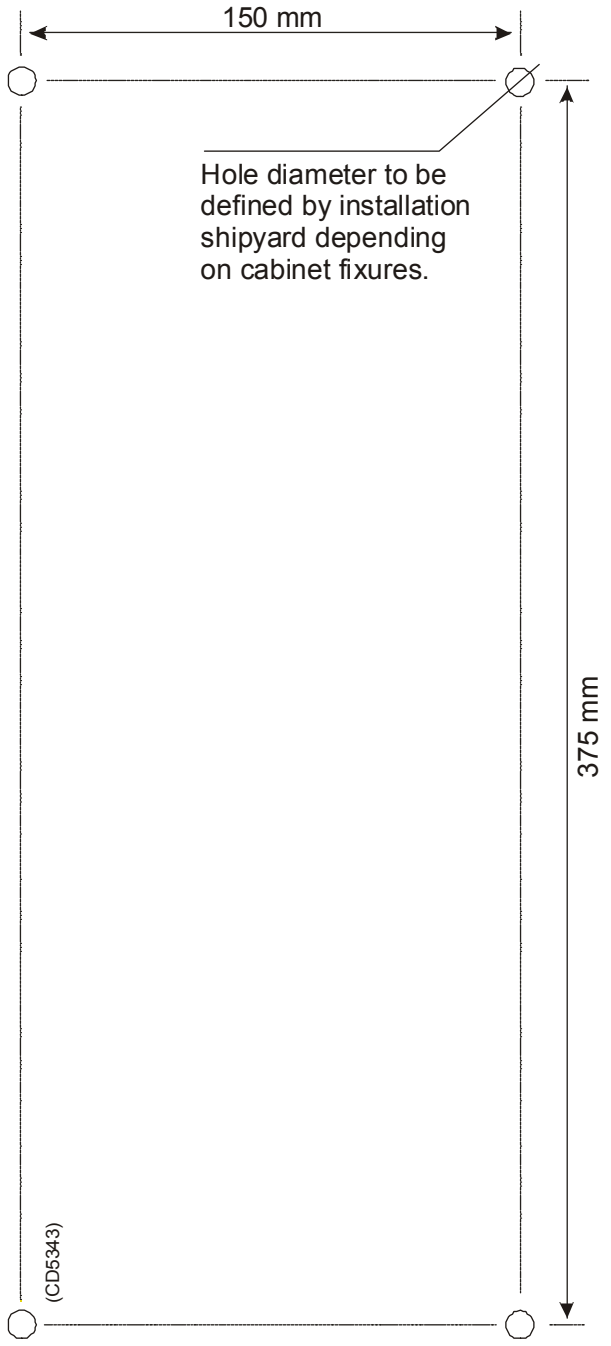


Figure 34 Mounting holes for Local Control Unit

7 TECHNICAL SPECIFICATION

Overview

This section describes the technical specification of the HiPAP hull units system.

Note *The exact measurements will depend on the actual units delivered.*

Packed dimensions and weights

Note

All packed dimensions and weights are approximate and will depend on the packing materials available at the time of dispatch.

HiPAP 500 gantry with dock

Packing material	Wooden crate
HiPAP Order number	122-089790
Dimensions L-W-H	Approx. 620 cm x 80 cm x 80 cm
Volume	5,6 m^3
Weight	1500 kg

HiPAP 350 gantry with dock

Packing material	Wooden crate
HiPAP Order number	122-214181
Dimensions L-W-H	Approx. 620 cm x 80 cm x 80 cm
Volume	5,6 m^3
Weight	1450 kg

Hull units outline dimensions

HiPAP 500

→ *Outline dimensions - HiPAP 500 HL 3770, see page 211.*
→ *Outline dimensions - HiPAP 500 HL 6120, see page 213.*
→ *Outline dimensions - HiPAP 500 HL 2180, see page 215.*
→ *Outline dimensions - HiPAP 500 HL 4570, see page 214.*

HiPAP 350

→ *Outline dimensions - HiPAP 350 HL 3770, see page 212.*
→ *Outline dimensions - HiPAP 350 HL 2180, see page 216.*

500 mm mounting flange

Standard height	600 mm
Optional height	Specified by customer
Internal diameter	500 mm
Flange diameter	670 mm
Wall thickness	20 mm
Weight, standard	Approximately 90 Kg

Securing bolt holes:

Quantity	20
Diameter	26 mm
On a radius	310 mm

500 mm gate valve

Type	DN500
Height	350 mm
Length (from centre)	1335 mm
Internal diameter	500 mm
Flange diameter	670 mm
Weight	510 Kg

Securing bolt holes:

Quantity	20
Diameter	26 mm
On a radius	310 mm

350 mm mounting flange

Standard height	200 mm
Optional heights	Specified by customer
Internal diameter	350 mm
Flange diameter	505 mm
Wall thickness	28 mm
Weight, standard	Approximately 70 Kg

Securing bolt holes:

Quantity	16
Diameter	22 mm
On a radius	230 mm/Ø 460

350 mm gate valve

Type	DN350
Height	290 mm
Length (from centre)	940 mm
Internal diameter	350 mm
Flange diameter	505 mm
Weight	225 Kg

Securing bolt holes:

Quantity	16
Radius	22 mm
On a radius	230 mm

Gantry

An opening through deck is required for installation or removal of a hull unit.

- With service dock Ø 800 mm
- Without service dock Ø 700 mm

HL 3770 Gantry

Gantry type	HL 3770
Height (above dock)	5 m
Maximum diameter (bottom flange)	670 mm
Weight including transducer and service dock	1330 Kg
Distance of raise/lower travel (approx)	3.8 m

HL 2180 Gantry

Gantry type	HL 2180
Height (above dock)	3.4 m
Maximum diameter (bottom flange)	670 mm
Weight without transducer dock	1150 Kg
Distance of raise/lower travel (approx)	2.2 m

HL 4570 Gantry

Gantry type	HL 4570
Height (above dock)	5.8 m
Maximum diameter (bottom flange)	670 mm
Weight including transducer and service dock	1430 Kg
Distance of raise/lower travel (approx)	4.6 m

HL 6120 Gantry

Gantry type	HL 6120
Height (above dock)	7.35 m
Maximum diameter (bottom flange)	670 mm
Weight including transducer and service dock	1600 Kg
Distance of raise/lower travel (approx)	6.1 m

Lubrication

Gear oil	Mobilgear 636 (ISO VG 680) (Shell Tellius oils 32S)
Shaft grease	Esso CAZAR K1 (or equivalent)
Chain grease	Esso MP grease Beacon EP2 (or equivalent)

Equivalents

Equivalents to Esso CAZAR K1

BP Marine	Energrease PR1 (PR2)
Elf	Palissa 2
Shell	SRS2000W
Statoil	Greaseway CAH 90

Equivalents to Esso MP grease Beacon EP2

BP Marine	Energrease MM-EP 2

Hoist Control Unit

General

Caution ***The Hoist Control Unit is normally delivered without vibration damping devices. However, if the vibration velocity amplitude at the unit's mounting points is expected to exceed 10 mm/s in the range 5 - 50 Hz, constantly during operational life, special precautions are to be taken.***

Unit dimensions

Height	400 mm
Width (cabinet)	300 mm
Depth (cabinet)	210 mm
Depth overall	250 mm
Weight	12 kg

Power supply

Voltage	230 / 440 Vac, 3-phase
Frequency	50 - 60 Hz
Power consumption	750 - 1100 W depending on application

Note *The power supply to the Hoist Control Unit must be kept within ±10% of the unit's nominal voltage. The maximum transient voltage variations on the main switchboard's bus-bars which could occur (except under fault conditions), are not to exceed -15% to +20% of the nominal voltage.*

Environment

Temperature:

Storage	-20 to +65° C
Operational	0 to +55° C

Humidity:

Storage	90% relative
Operational	80% relative

Degree of protection	IP 54

Note *The unit must be kept in an operational environment with the room temperature and humidity within the specified limits, and in a corrosive, salt and dust-free atmosphere.*

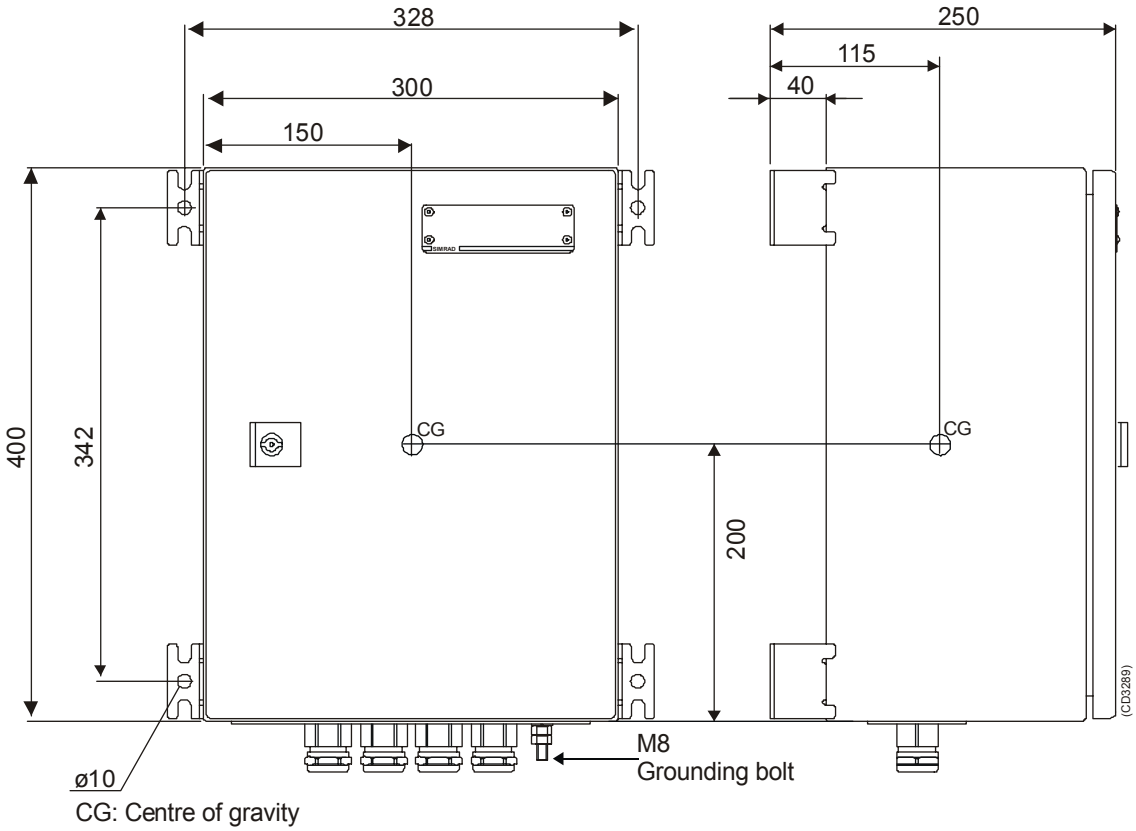


Figure 35 Hoist Control Unit - outline dimensions

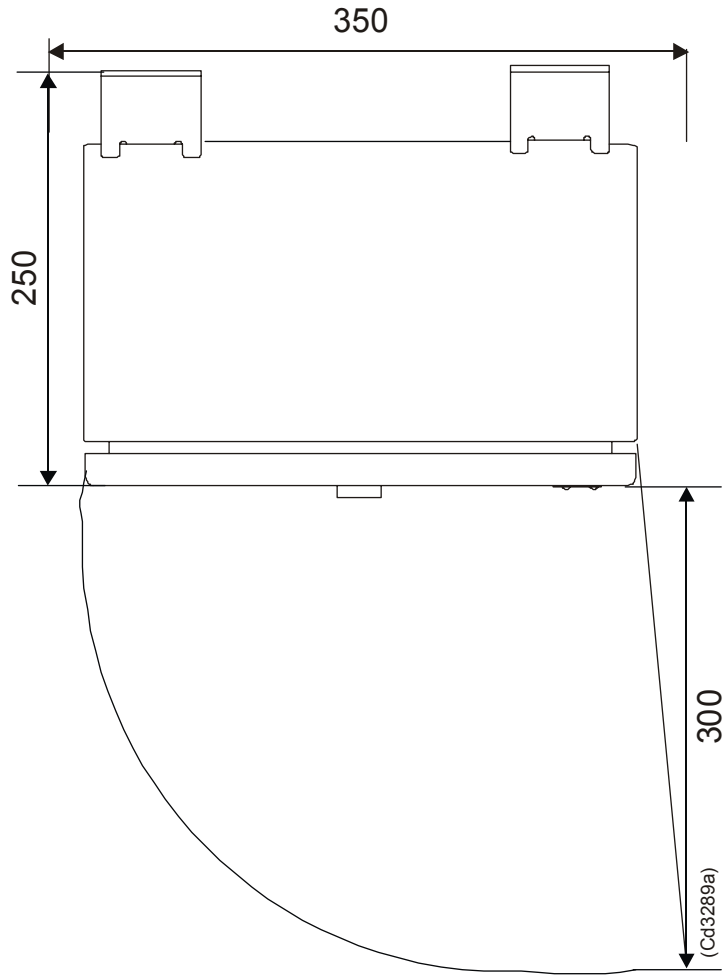


Figure 36 Hoist Control Unit - maintenance acess

Remote Control Unit

Unit dimensions

Height	220 mm
Width	120 mm
Depth overall	100 mm
Weight	1.5 kg

The Remote Control Unit is supplied with 24 Vdc from the Hoist Control Unit.

Power supply

Voltage	24 Vdc
Power consumption	6 W

The unit must be kept in an operational environment with the room temperature and humidity within the specified limits and in a dust-free atmosphere.

Environment

Temperature:

Storage	-20 to +65° C
Operational	0 to +55° C

Humidity:

Storage	10 - 90% relative
Operational	30 - 80% relative

Degree of protection	IP 54

Cabling

The Remote Control Unit is supplied without cables. All required cabling must be made available and installed by the installation shipyard.

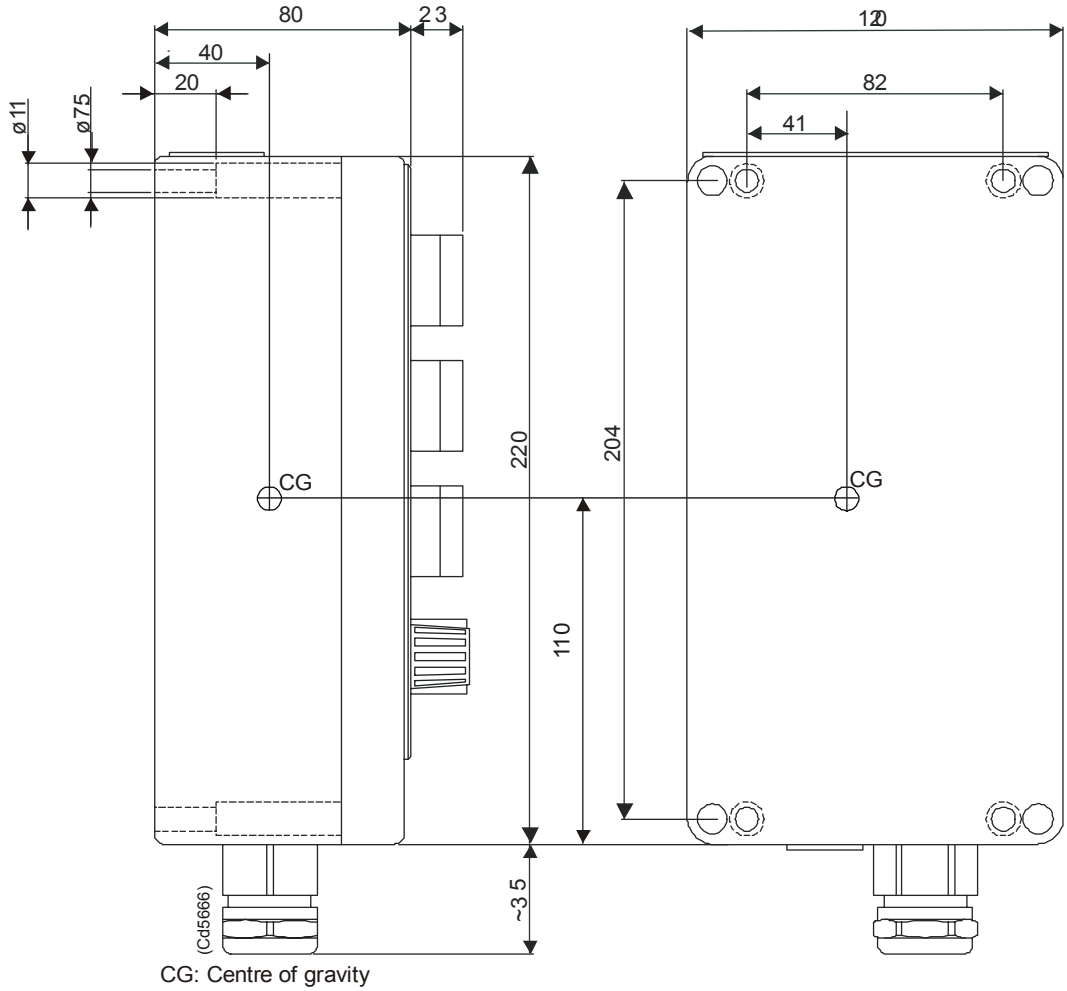


Figure 37 Remote Control Unit - outline dimensions

Raise and lower motor

Motor type	SEW EURODRIVE S62 DT80N4BM/HF
Input voltage	230/440 Vac
Frequency	60 Hz
Phase	3 Phase
Rated power	750 W
Speed	1500 RPM
Ingress Protection (water)	IP 54

Transducers

HiPAP 500

Shape	Spherical
Diameter	392 mm
Weight	60 kg

HiPAP 350

Shape	Spherical w/ cylindric body
Diameter	320 mm
Weight	30 kg

Actuator (option)

Unit dimensions

→ *Actuator - outline dimensions refer to page 151.*

Electrical motor

→ *Auma multi-turn actuators* Operation instructions manual *supplied with the actuator.*

Remote station

Unit dimensions

Height	300 mm
Width	200 mm
Dept	160 mm

Local control unit

Unit dimensions

Height	430 mm
Width	330 mm
Dept	200 mm

Evironment temperature

→ *Auma multi-turn actuators* Operation instructions manual *supplied with the actuator.*

Note

The unit must be kept in an operational environment with the room temperature and humidity within the specified limits, and in a corrosive, salt and dust-free atmosphere.

Outline dimensions

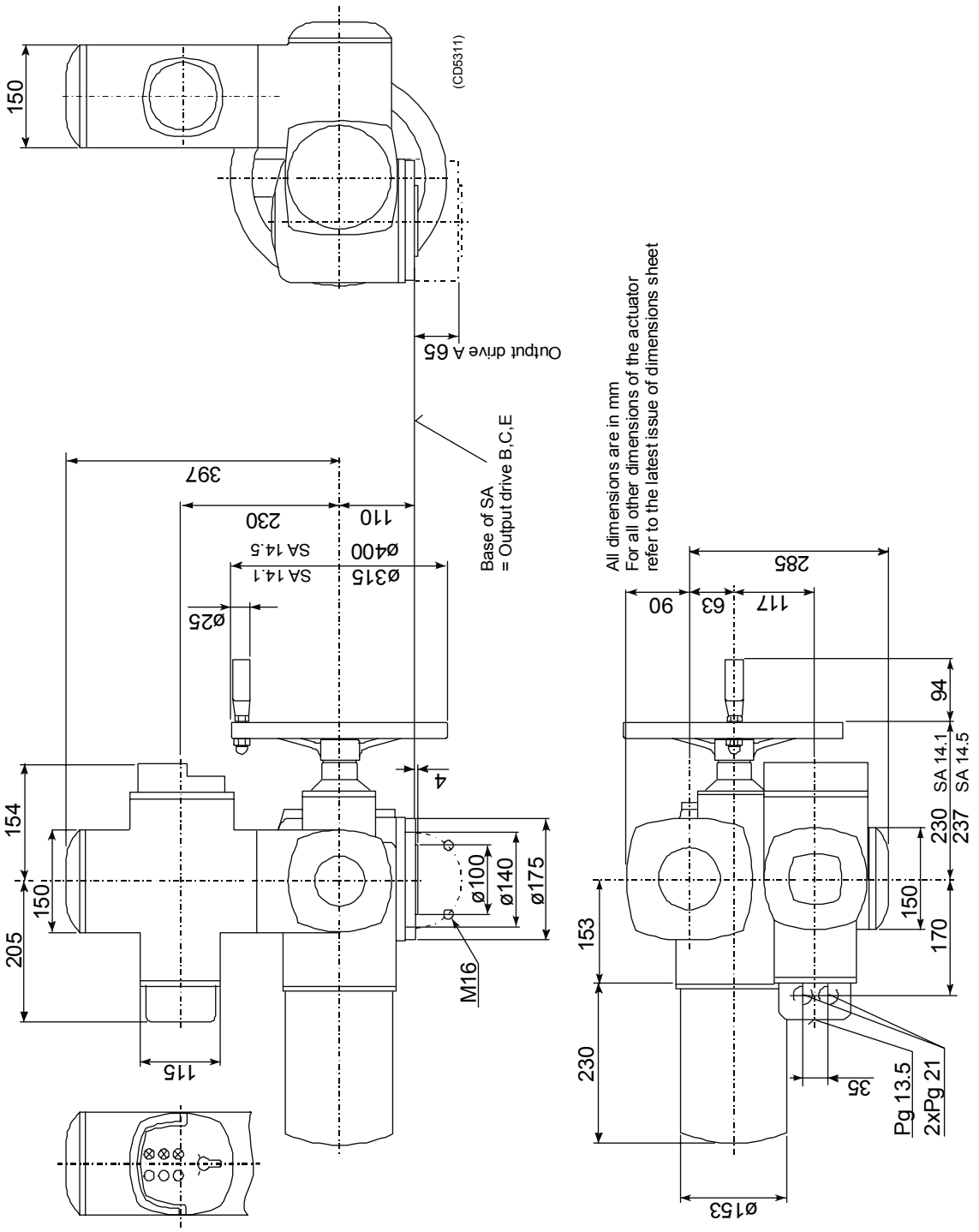


Figure 38 Actuator - outline dimensions

8 CABLE LAYOUT AND INTERCONNECTIONS

Overview

This section describes the general installation requirements regarding cables. It then describes all the cables connected to the HiPAP hull units and associated units, and explains how to perform the interconnections between those units.

Note

All cable connections must be made in accordance with the guidelines laid down by the vessel's classification society.

If no such guidelines exist, Kongsberg Simrad recommends that the *Den norske Veritas (DnV) Report No. 80-P008, "Guidelines for Installation and Proposal for Test of Equipment"* be used as a guide.

Cable gland assembly procedure

Purpose

Cable glands are used whenever a cable passes through a water-tight bulkhead or into a cabinet, to seal the opening through which the cable passes and to protect the cable from abrasion on the edges of the hole. Follow the guidelines detailed here when installing cables through cable glands.

Note *There are many different types of cable gland on the market. This procedure describes the types used (now and previously) as standard in the units manufactured by Kongsberg Simrad. The cable glands are not supplied with the system.*

Even though the cabinets from Kongsberg Simrad may be prepared for specific types, the installation shipyard will be responsible for selecting cable gland types and installing them.

Note *The screen in transducer cables must never be connected to ship's ground in the cable glands!*

General procedure

1 Ensure all the cables to be connected are completely isolated from any power sources.

- I.e. Switch off and remove the supply fuses from any units or systems into which the cables are already connected.

2 Select the cable to be connected into the cabinet, and select the cable gland through which the cable is to pass.

Note *A **minimum** of 5 cm (recommended 5 - 10 cm) of slack cable must be allowed, both inside and outside the cabinet, when installing cables. This is to allow for vibration damping, maintenance and measurement errors. Always double-check your measurements before taking any irreversible actions.*

3 Depending on whether the cable has already been installed in conduits, either.

c (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,

or:

d (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

*The cable's outer insulation will extend into the cable gland to a point approximately 5 mm **outside** the outer surface of the cabinet wall into which the cable gland is secured.*

4 Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.

5 Leaving an appropriate length of the screen exposed from the insulation, cut off the remainder.

Securing and terminating the cables

1 Referring to the wiring diagram and ensuring that there is 5 to 10 cm. slack cable inside the cabinet, prepare and connect the cable cores to the appropriate terminals within the cabinet.

2 Secure the cable within the cabinet using cable clips.

3 Check the terminal connections against the wiring diagram to ensure they are correct.

Follow the same procedure for all the cables and cable glands. Once all the cables have been fitted:

4 Check the cabinet to ensure all tools and rubbish are removed, then close the cabinet door.

Once all the system cables are connected and checked:

5 Take the appropriate safety measures, then replace the fuses and apply power to the system.

6 Perform a system test to ensure the installation has been conducted successfully.

Multi-diameter modules

Multi-diameter cable glands are now available from several sources, and these types are becoming increasingly popular due to ease of use. Only a brief description of the system will be presented her, further information with technical specifications and installation descriptions must be obtained from the manufacturer(s).

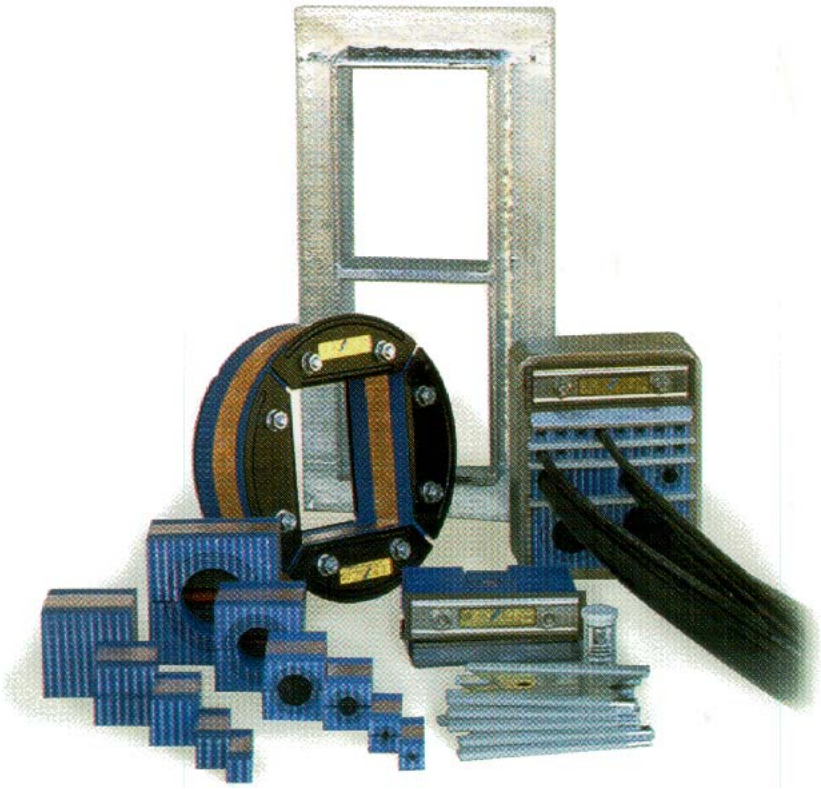


Figure 39 Multi-diameter modules (example)

The illustrations and examples here are from the following manufacturer:

```
Roxtec AB
Bx 540
S-371 23 Karlskrona, SWEDEN
http://www.roxtec.se
```

To use this sealing system, you first need to cut an opening in the wall (bulkhead, cabinet etc) you wish to penetrate, and this hole must be sized to fit one of the standard rectangular or circular frames provided by the manufacturer.

After the frame has been mounted, the cables can be pulled through, and in most cases the opening will be large enough even to accept the plugs on the cables.

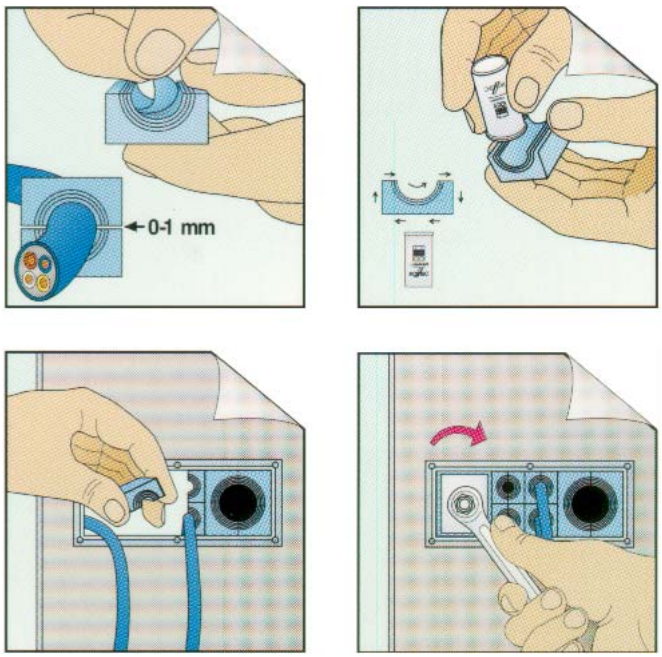


Figure 40 Multi-diameter system - Principal procedure

Once the cables are through, each cable is secured with a square module, which is adjusted to fit the cable's outer diameter.

When the required number of modules are installed, the assembly is tightened with a compression unit.

This system is available with a large number of various modules and compression units, and it will also comply to screening and EMC requirements.

Standard type

1 Ensure that all the cables to be connected, are completely isolated from any power sources.

- Switch off and remove the supply fuses from any units or systems into which the cables are already connected.

2 Select the cable to be connected into the cabinet, and select the cable gland through which the cable is to pass.

3 Slacken and remove the compression nut from the cable gland, and extract the compression seal and the screen collar from the body of the gland.

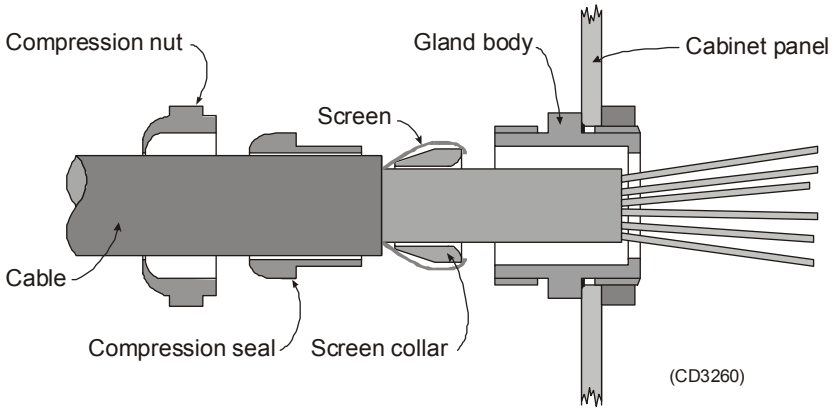


Figure 41 Standard cable gland assembly

Note

*A **minimum** of 5 cm (recommended 5 - 10 cm) of slack cable must be allowed, both inside and outside the cabinet, when installing cables. This is to allow for vibration damping, maintenance and measurement errors. Always double-check your measurements before taking any irreversible actions.*

4 Depending on whether the cable has already been installed in conduits, either:

e (installed) measure the maximum length of cable required to reach from the final cable clip outside the cabinet to the terminal blocks inside the cabinet, add 20 cm, then remove the excess cable,

or:

f (loose cable) measure the maximum length of wire required to reach from the cable gland to the terminal blocks inside the cabinet, add 20 cm. and mark the cable.

Note

*The cable's outer insulation will extend into the cable gland to a point approximately 5 mm **outside** the outer surface of the cabinet wall into which the cable gland is secured.*

5 Taking care not to damage the screening, carefully remove the outer insulation from the required cable length.

6 Leaving 12 mm of the screen exposed from the insulation, cut off the remainder.

7 Taking care not to damage the screening, slide the compression nut (smallest diameter first) over the cable and onto the intact insulation.

8 Taking care not to damage the screening, slide the compression seal (rounded end first) over the cable and onto the intact insulation.

9 Slide the screen collar (narrow end first) onto the cable and fit it underneath the screen. Slide it as close to the intact outer insulation as possible.

10 If the screen extends beyond the "flat" end of the screen collar, fold any excess length over the end of the collar such that the screen will be gripped between the collar and the gland body when the parts are assembled.

11 Carefully thread the cable through the gland body till the screen collar is tight into the gland body.

12 Slide the compression seal into the gland body till the shoulder is hard up against the gland body.

13 Slide the compression nut over the compression seal and engage the threads.

14 While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.

15 Referring to the wiring diagram and ensuring that there is 5 to 10 cm. slack cable inside the cabinet, prepare and connect the cable cores to the appropriate terminals within the cabinet.

16 Secure the cable within the cabinet using cable clips.

17 Check the terminal connections against the wiring diagram to ensure they are correct.

Follow the same procedure for all the cables and cable glands. Once all the cables have been fitted:

18 Check the cabinet to ensure all tools and rubbish are removed, then close the cabinet door.

Once all the system cables are connected and checked:

19 Take the appropriate safety measures, then replace the fuses and apply power to the system.

20 Perform a system test to ensure the installation has been conducted successfully.

Additional type 1 (842-093878)

1 Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.

2 Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.

→ *Refer to figure 42.*

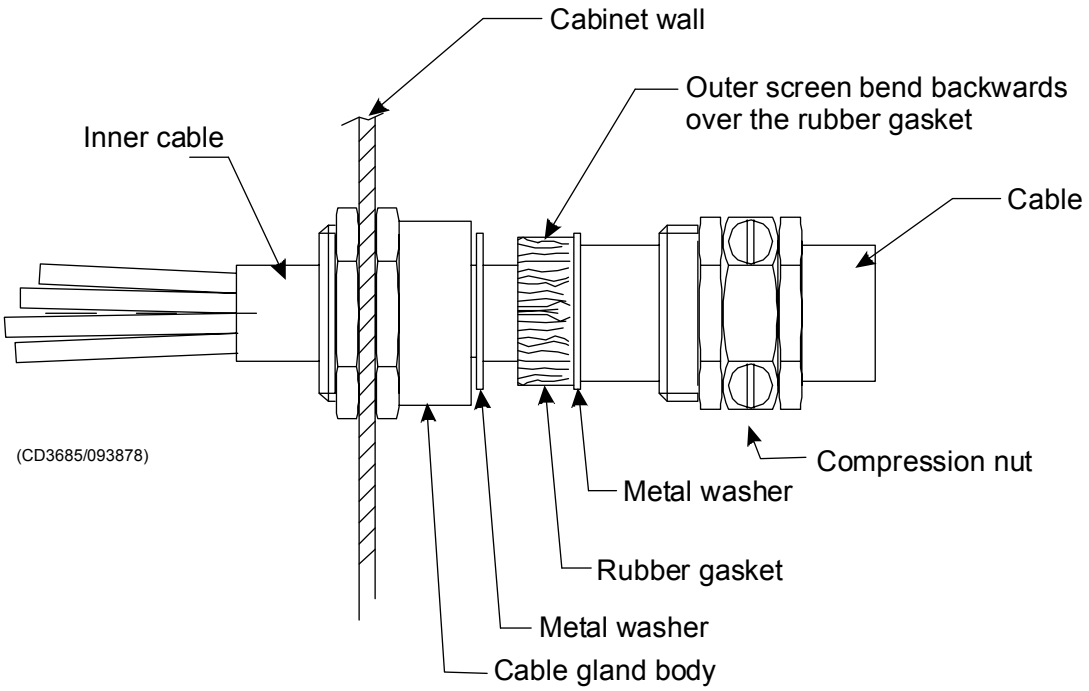


Figure 42 Cable gland, type 1 (842-093878)

3 Bend the screen over the rubber gasket.

4 Push the rubber gasket and the two metal washers carefully into the cable gland body.

5 While holding the gland body to prevent it turning, and pressing the cable into the gland, tighten the compression nut onto the gland body.

Additional type 2 (541-093642)

1 Mount the cable gland body, and tighten it with the nuts on each side of the cabinet wall.

2 Slide the metal washers, the rubber gasket and the compression nut onto the cable in the order indicated in the figure.

→ *Refer to figure 43.*

3 Bend the screen over the compression cone.

4 Push the compression conne, the washers and the rubber sealing washer into the cable gland body.

5 Close the mounting nut.

6 Close and tighten the compression nut on the other side of the cabinet wall.

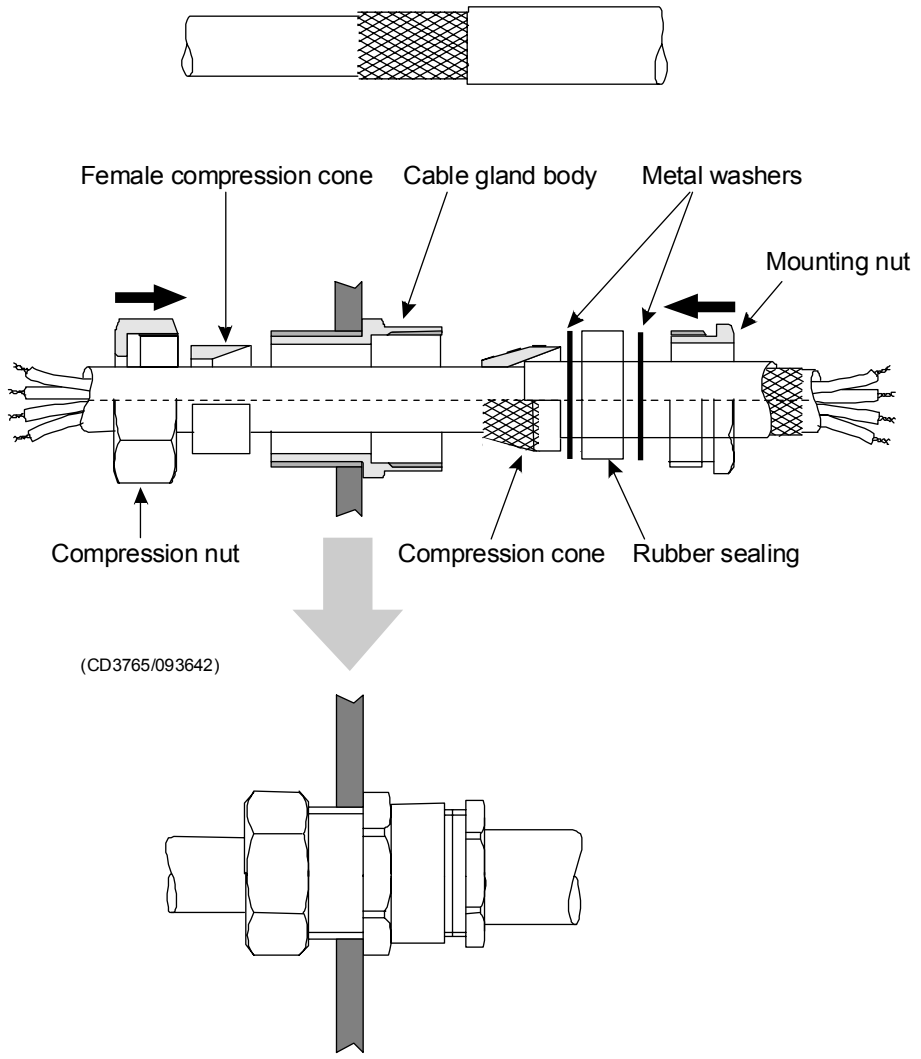


Figure 43 Cable gland, type 2 (541-093642)

Basic cabling requirements

Cable trays

All permanently installed cables associated with the system must be supported and protected along their entire lengths using conduits and/or cable trays. The only exception to this rule is over the final short distance (max. 0.5 metre) as the cables run into the cabinets/units to which they are connected. These short unsupported lengths are to allow the cabinets to move on their shock mounts, and to allow maintenance and replacements.

- Wherever possible, cable trays must be straight, accessible and placed so as to avoid possible contamination by condensation and dripping liquids (oil, etc.). They must be installed remote from sources of heat, and must be protected against physical damage. Suitable shields must be provided where cables are installed in the vicinity of heat sources.
- Unless it is absolutely unavoidable, cables should not be installed across the vessel's expansion joints. If the situation is unavoidable, a loop of cable having a length proportional to the possible expansion of the joint must be provided. The minimum internal radius of the loop must be at least twelve times the external diameter of the cable.
- Where a service requires duplicate supply lines, the cables must follow separate paths through the vessel whenever possible.
- Signal cables must not be installed in the same cable tray or conduit as high-power cables.
- Cables containing insulation materials with different maximum-rated conductor temperatures should not be bunched together (that is, in a common clip, gland, conduit or duct). When this is impractical, the cables must be carefully bunched such that the maximum temperature expected in any cable in the bunch is within the specifications of the lowest-rated cable.
- Cables with protective coverings which may damage other cables should not be bunched together with other cables.
- Cables having a copper sheath or braiding must be installed in such a way that galvanic corrosion by contact with other metals is prevented.
- To allow for future expansion of the system, all cables should be allocated spare conductor pairs. Also, space within the vessel should be set aside for the installation of extra cables.

Radio Frequency interference

All cables that are to be permanently installed within 9 m (30 ft) of any source of Radio Frequency (RF) interference such as a transmitter aerial system or radio cabin, must, unless shielded by a metal deck or bulkhead, be adequately screened by sheathing, braiding or other suitable material. In such a situation flexible cables should be screened wherever possible.

It is important that cables, other than those supplying services to the equipment installed in a radio room, are not installed through a radio room. Cables which must pass through a radio room must be screened by a continuous metal conduit or trunking which must be bonded to the screening of the radio room at its points of entry and exit.

Physical protection

Cables exposed to the risk of physical damage must be enclosed in a steel conduit or protected by a metal casing unless the cable's covering (e.g. armour or sheath) is sufficient to protect it from the damage risk.

Cables exposed to an exceptional risk of mechanical damage (for example in holds, storage-spaces and cargo-spaces) must be protected by a suitable casing or conduit, even when armoured, if the cable covering does not guarantee sufficient protection for the cables.

Metallic materials used for the physical protection of cables must be suitably protected against corrosion.

Grounding

All metallic cable coverings (armour, lead sheath etc.) must be electrically connected to the vessel's hull at both ends except in the case of final sub-circuits where they should be connected at the supply end only.

Grounding connections should be made using a conductor which has a cross-sectional area related to the current rating of the cable, or with a metal clamp which grips the metallic covering of the cable and is bonded to the hull of the vessel. These cable coverings may also be grounded by means of glands specially intended for this purpose and designed to ensure a good earth connection. The glands used must be firmly attached to, and in good electrical contact with, a metal structure grounded in accordance with these recommendations.

Electrical continuity must be ensured along the entire length of all cable coverings, particularly at joints and tappings. In no case should the lead-sheathing of cables be used as the only means of grounding cables or units.

Metallic casings, pipes and conduits must be grounded, and when fitted with joints these must be mechanically and electrically grounded.

Cable connections

All cable connections are shown on the applicable cable plan and interconnection diagrams.

Where the cable plan shows cable connections outside an equipment box outline, the connections are to be made to a plug or socket which suits the plug or socket on that particular item of equipment.

Where two cables are connected in series via a junction box or terminal block, the screens of both cables must be connected together but not grounded.

Cable terminations

Care must be taken to ensure that the correct terminations are used for all cable conductors, especially those that are to be connected to terminal blocks. In this case, crimped sleeve-terminations must be fitted to prevent the conductor core from fraying and making a bad connection with the terminal block. It is also of the utmost importance that where crimped terminations are used, the correct size of crimp and crimping tool are used. In addition, each cable conductor must have a minimum of 15 cm slack (service loop) left before its termination is fitted.

Cable identification

Cable identification codes corresponding to the cable number shown in the cable plan must be attached to each of the external cables. These identification codes should be positioned on the cable in such a way that they are readily visible after all panels have been fitted. In addition, each cable conductor should be marked with the terminal board number or socket to which it is connected.

HiPAP cable plan

This section describes only those cables associated with the hull unit and its control units.

The cable plan defines the main interconnection cables between the individual system cabinets an units. Each cable is then listed including the required cable specification.

All other system cables are fully described in the system *Installation manual*.

→ *Refer to the relevant cable plans and wiring diagrams for details of the terminations and connections.*

Caution ***All power must be switched off to the system prior to the cable installation.***

All cables must be available at the units, properly installed in cable ducting. Care must be taken not to exceed the physical limitations of the cables.

Note *Special system requirements, adaptions or components may introduce special drawings and cables.*

Note *In order to meet the EMC requirements, dedicated grounding cables have been used to connect the various system units to the vessel's ground. These cables are identified as "X" on the cable plan drawings. The braided grounding cable required is supplied with the system. These cables must not be longer than 1 metre.*

The cabling for a HiPAP 500 system and a HiPAP 350 system are in principle the same and most of the cables are identical. The only system specific cable is:

- Transducer cable from the transceiver unit to the transducer.

All cables used are specified in the following sections.

Cable specifications

Each individual cable is identified on the cable plans. The cables fall into two categories:

- Cables provided by the installation shipyard.
- System cables supplied with the delivery.

Shipyard cables

The cables to be provided by the shipyard are identified as such in the cable listing.

Note

The cable specifications given are the minimum specifications.

For each cable the following is provided:

- Connection to be made on each end of the cable (including system units, terminal block identification and plug/socket to be used).
- Number of cores.
- Recommended cable type.
- Minimum cable specifications.

Caution

Any special requirements must be considered in addition to those listed. Kongsberg Simrad accepts no responsibility for damage to the system or reduced operational performance if this is caused by improper cabling.

System cables

Several cables will be supplied with the system. Such cables normally comprise power cables for peripheral equipment, and interconnection cables for computers and/or workstations. These cables are normally packed with the units.

Cable connections

All cables must be terminated correctly. The required information is provided in the applicable interconnection drawings.

Special cables

Special system applications or requirements may result in additional or modified cable runs.

Hull unit cables

Note

The description on the following pages includes cables for both the HiPAP 500 and the HiPAP 350 systems. The cables are described in alphabetical order.

HiPAP 500 system

Figure 44 gives an overview of the cables used for:

- HiPAP 500 hull unit

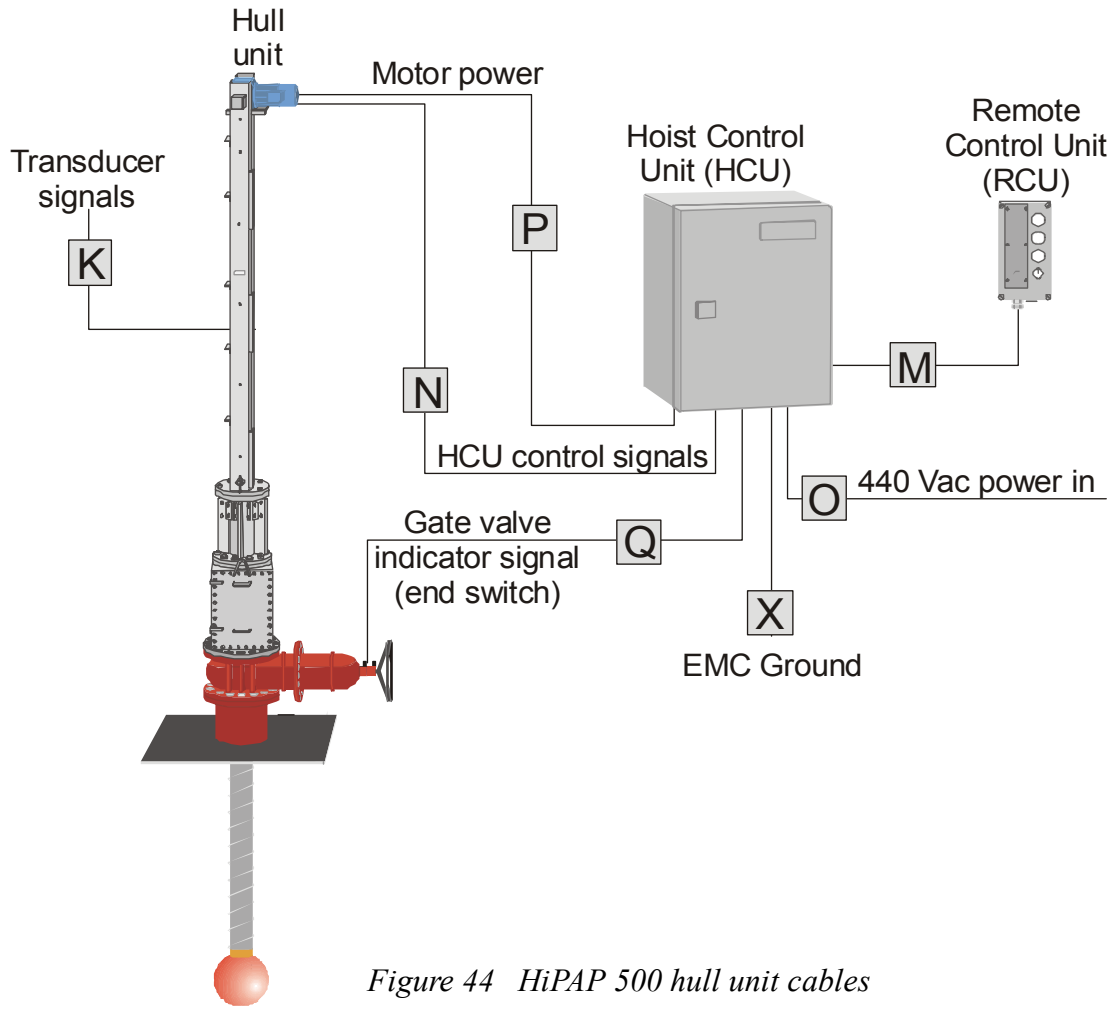


Figure 44 HiPAP 500 hull unit cables

HiPAP 350 system

Figure 45 gives an overview of the cables used for:

- HiPAP 350 hull unit

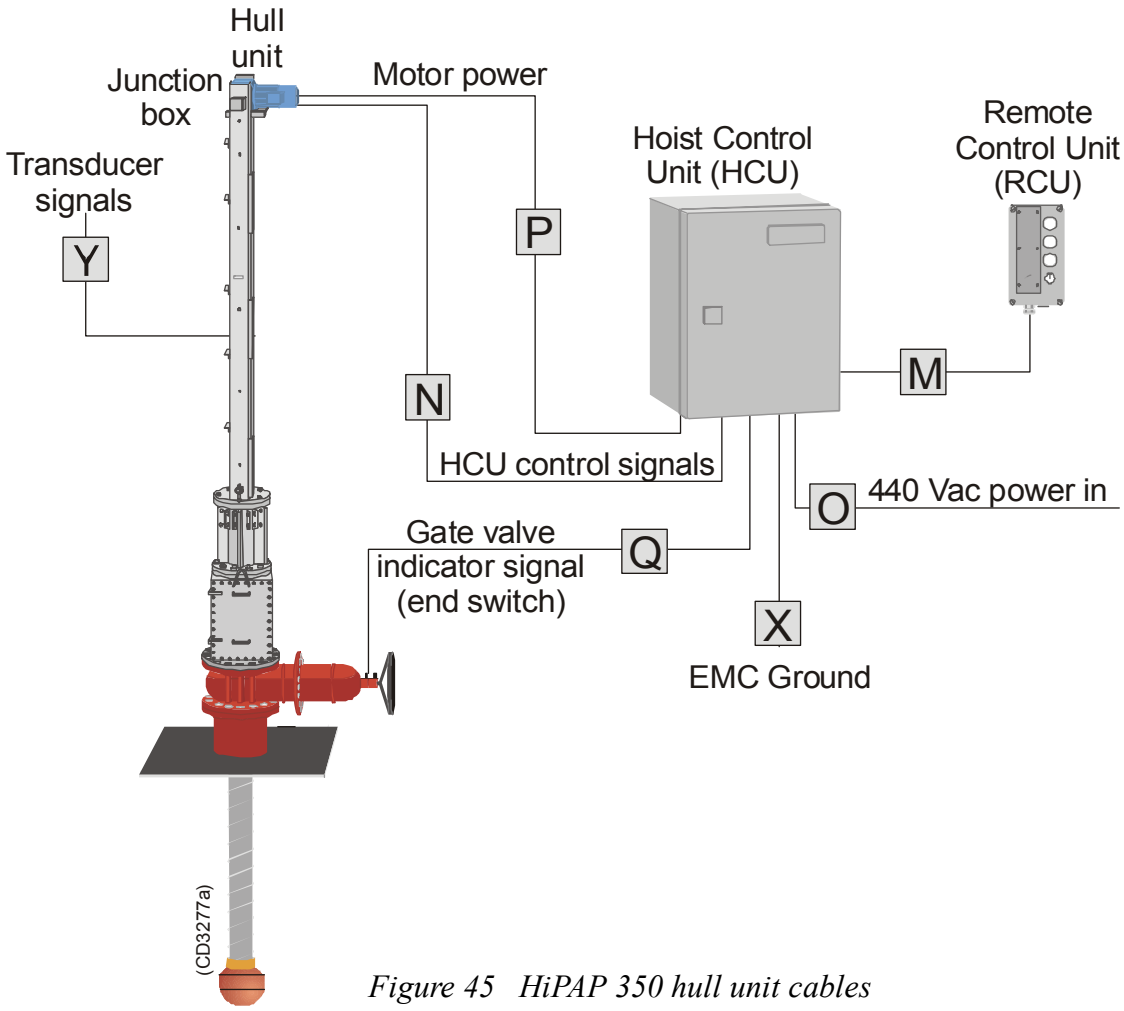


Figure 45 HiPAP 350 hull unit cables

Cable K **(HiPAP 500 system)**
Transducer cable from Transceiver Unit to Transducer

- Kongsberg Simrad supply.
- The transducer cable is screened and consists of 8 flat cables (round w/scr.).
- The hull unit end is permanently attached to the transducer, the free end terminates in a plug for connection to the transceiver unit.
- Standard length approximately 5 m (from the top of the transducer shaft).

Cable M **Cable from Hoist Control Unit to Remote Control Unit**

- Shipyard supply.
- RCOP 7 x 2 / 0.4 mm^2 with overall braided screen, 60 V.
- Both ends terminated in terminal blocks, refer to the interconnection drawing.
- Maximum length: No practical limit.

Cable N **Cable from Hoist Control Unit to Hull Unit Junction Box**

- Shipyard supply.
- RCOP 6/ 0.75 mm^2 with overall braided screen, 750 V.
- Both ends terminated in terminal blocks, refer to the interconnection drawing.
- Maximum length: No practical limit.

Cable O **Cable from 440 Vac / 3-phase / 3A to Hoist Control Unit**

- Shipyard supply.
- RCOP 4 / 1.5 mm^2 with overall braided screen, 750 V.
- Hoist Control Unit end terminated in terminal block, refer to the interconnection drawing.
- Maximum length: No practical limit.

Cable P **Cable from Hoist Control Unit to Hoist Motor**

- Shipyard supply.
- RCOP 4 / 1.5 mm^2 with overall braided screen, 750 V.
- Hoist Control Unit end terminated in terminal block, refer to the interconnection drawing. The motor end connects to the dedicated power inlet tags on the motor.

Cable Q **Cable from Hoist Control Unit to Gate valve position indicator**

- Shipyard supply.
- RCOP 4 / 1.5 mm^2 with overall braided screen, 750 V.
- Hoist Control Unit end terminated in terminal block, refer to the interconnection drawing.
- Maximum length: No practical limit.

Cable X **Cable from Hoist Control Unit to EMC ground**

- Kongsberg Simrad supply.
- Braided copper wire.
- Both ends terminated at M8 screws.
- Length: 300 mm.

Cable Y **(HiPAP 350 system)**
Transducer cable from Transceiver Unit to Transducer

- Kongsberg Simrad supply.
- The transducer cable is screened and consists of 2 flat cables (round w/scr.).
- The HiPAP 350 transducer cable comprises of two separate cables as follows:
  - Cable 1:
    From top of the transducer (bottom of the transducer shaft) to the top of the transducer shaft, into the junction box.
  - Cable 2:
    From the junction box to the transceiver unit, via the bracket on the hull unit.
    * Standard length approximately 7.5 m.

Cables interconnection

Cable K

This cable connects the HiPAP 500 hull unit with the HiPAP 500 transceiver unit. The cable is connected to the transceiver unit via the connector on the left side of the unit.

Figure 46 shows:

- The connections of all the transducer elements to the different plugs and cables. The connection is shown from the transducer element to the RX/TX channel on the TRB board.

Figure 47 shows:

- The connections of element 1 to 16 in detail from top of transducer (P1/J302), to transceiver (P501/P2) and to TRB board (P2). This connection is similar for the rest of the transducer elements.

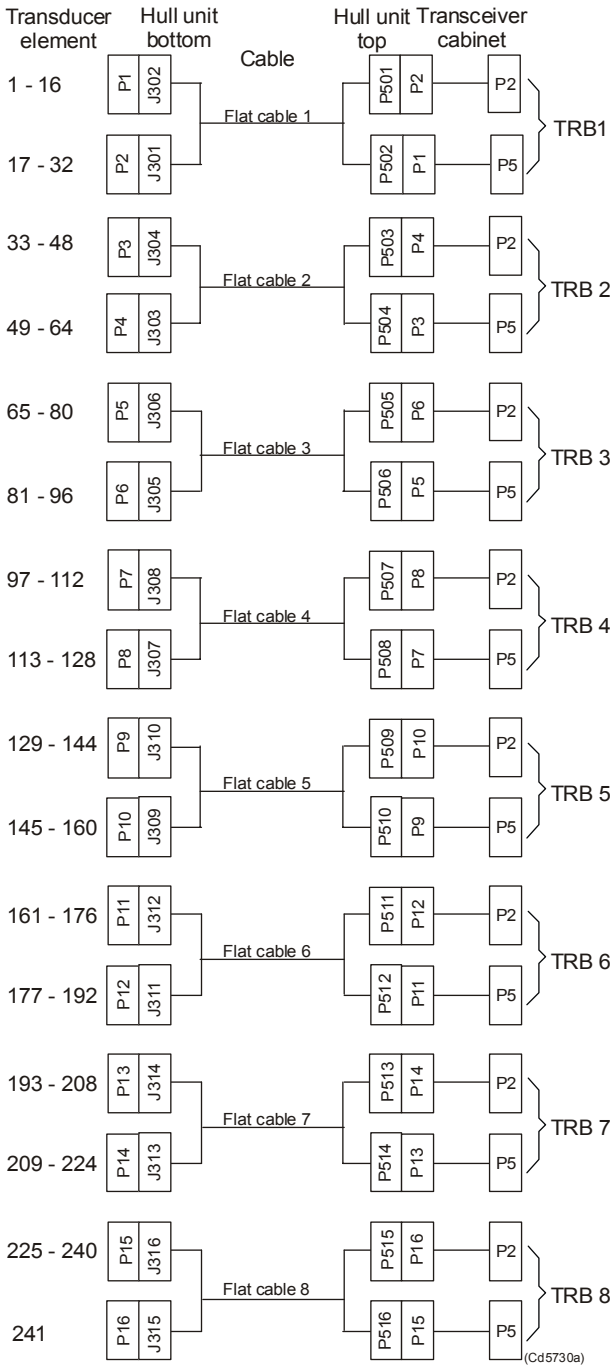


Figure 46 HiPAP 500 cable connectors - diagram

Connections and pin layout for element (1 to 16) are illustrated in the figure on the following page.

Cable M

This cable connects the Hoist Control Unit with the Remote Control Unit. Both ends are connected into terminal blocks within the respective units.

- *Interconnection diagram - hoist system, see page 219.*

Cable N

This cable connects the Hoist Control Unit to the Junction Box on the hull unit. The cable is supplied by the manufacturers, and is fitted with the appropriate terminations.

- *Interconnection diagram - hoist system, see page 219.*

Cable O

This is the 440 Vac power cable from the vessel's main supply to the Hoist Control Unit. The cable is connected into the terminal block in the unit.

- *Interconnection diagram - hoist system, see page 219.*

Cable P

This is the 440 Vac power cable from the Hoist Control Unit to the Hoist Motor on the hull unit. The cable is connected to the terminal block in the Hoist Control Unit, and to the dedicated connection tags on the motor.

- *Interconnection diagram - hoist system, see page 219.*

Cable Q

This is the signal cable from the Hoist Control Unit to the Gate valve position indicator. The cable is connected into the Hoist Control Unit terminal block.

- *Interconnection diagram - hoist system, see page 219.*

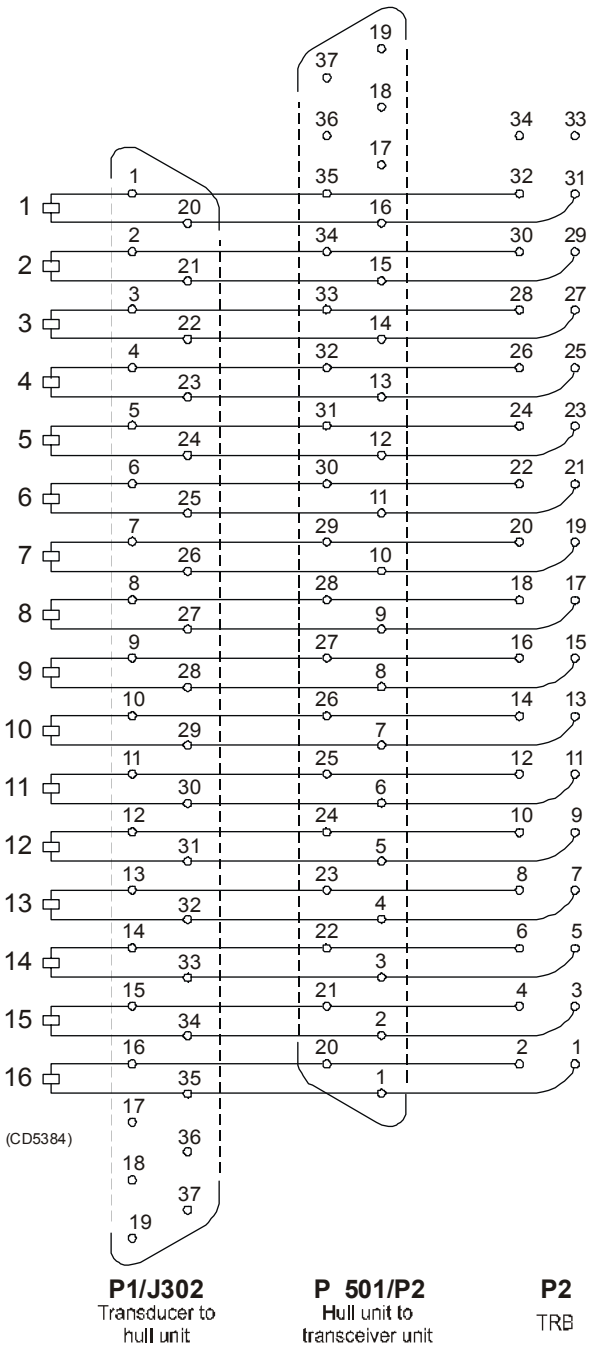


Figure 47 Cable K connections

Cable Y

Cable Y connects the HiPAP 350 hull unit with the HiPAP 350 transceiver unit. Inside the hull unit is a similar cable, connecting the transducer elements to the top of the hull unit.

Cable Y is connected to the transceiver unit via the connector on the left side of the unit. The cable comprises of two separate cables inside, where one cable consists of 2 flat cables (a) and one consists of 1 flat cable (b) - the second half is not used.

Figure 48 shows:

- The connection of all the transducer elements to the different plugs and cables. The connection is shown from the transducer element via the hull unit connectors to the RX/TX channel on the TRB board.

Figure 49 shows:

- The connections of element 1 to 16 in detail from top of transducer (J1/P1), to connection box (J101/P101), to transceiver (J201/P201) and to TRB board (P2). This connection is similar for the rest of the transducer elements.

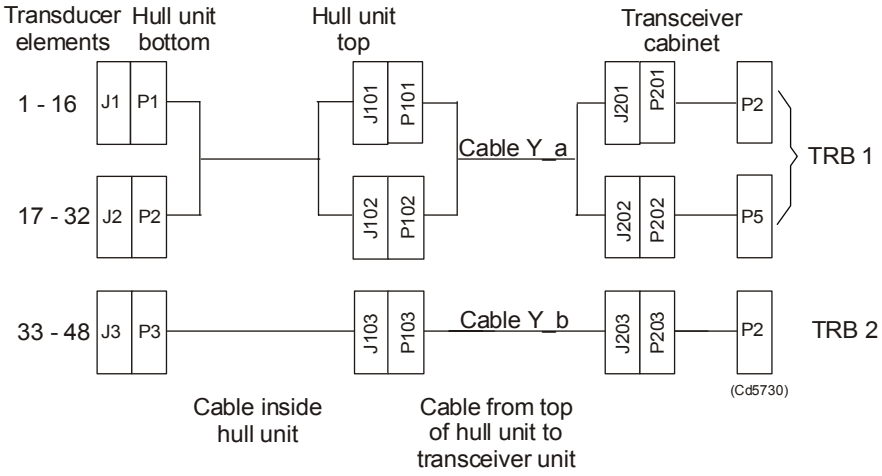


Figure 48 HiPAP 350 cable connectors - diagram

Connections and pin layout for (element 1-16) are illustrated in the figure on the following page.

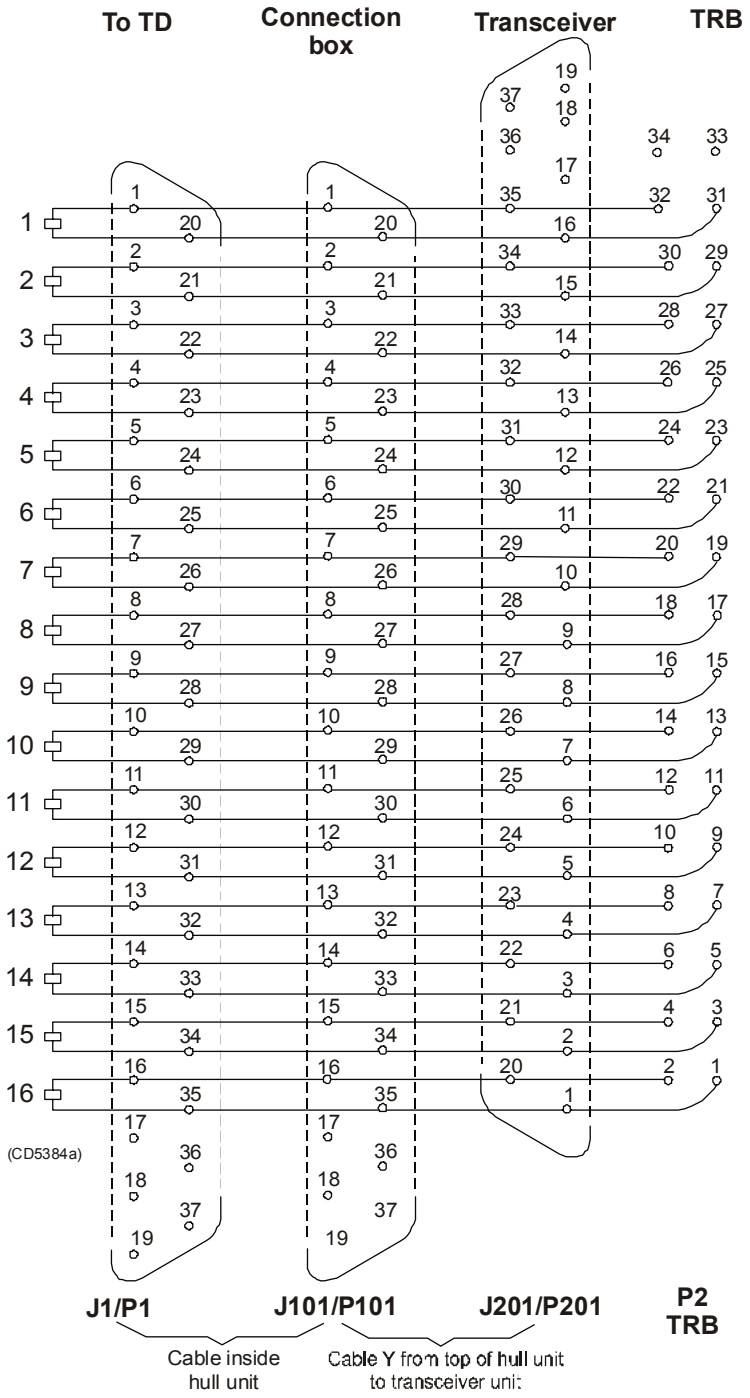


Figure 49 Cable Y connections

Cable installation

This procedure describes how to install the cables between the a hull unit and the Hoist Control Unit.

Logistics

Safety - Refer to the general safety procedures.

Personnel - Trained electrical fitter.

Ship location - No special requirements. The watertight integrity of the vessel will not be effected.

Special tools - None.

References

→ *Refer to the drawings in the Drawing file section.*

Installation procedure

1 Remove the junction box lid.

→ *Refer to the Cable gland installation procedure on page 153.*

2 Dismantle the appropriate cable gland.

3 Thread the various parts onto the cable in the correct order.

4 Pass the cable into the junction box.

5 Connect the cable terminations into the junction box terminal block.

- Ensure all connections are made firmly.
- Refer to the diagrams and drawings listed above.

6 Reassemble the cable gland and tighten it to ensure a water proof seal, ensuring enough slack is left in the cable so none of the wires is under tension.

7 When all cables have been connected, check the entire assembly to ensure all the connections are correct and tight.

8 Replace the junction box lid, using a thin film of silicon grease on the seal to ensure the box will be water proof.

Actuator connections (option)

This section describes the cabling and interconnections in the actuator system.

The following drawings are included:

- Actuator panel - internal layout, see page 226.
- Actuator system - wiring diagram, see page 227.

Cables

All cables between the actuator and the control units are supplied by the yard.

The interconnection are as follows:

- 24 Vdc - supply and control signals from the Hoist Control Unit of the hull unit to the local control unit.
- Signal cable from the remote station to the local control unit.
- Signal cable from the local control unit to the actuator.
- 3 phase 440 V supply to the actuator.

9 SPARE PARTS

This section lists the parts and modules defined by Kongsberg Simrad as *Line Replaceable Units (LRUs)*. The required mounting components (such as nuts, bolts, washers etc.) are identified on the diagrams, but have not been allocated order numbers as we regard these items as standard commercial parts available from retail outlets around the world.

Codes used

The following codes are used in the parts lists:

Part no. - Kongsberg Simrad's part number.

Item name -The name of the item.

Technical data - Technical specifications and any other relevant information.

Drw. ref. - Reference number of the production or illustration drawing where the item is included. If a number is given here, the drawing will be included in the manual's/document's drawing file.

Drw. pos. - The item's position number on the drawing referenced above.

No. in sys. - The quantity of the item used in the system. *Note that this information is not provided for standard components such as nuts, bolts and washers.*

Rec. spares - The quantity of the item recommended to be carried as spares onboard the vessel. *Note that this information is not provided for standard components such as nuts, bolts and washers.*

Supplier - The actual supplier or manufacturer of the item if different from Kongsberg Simrad. A blank field indicates items manufactured, altered or adjusted by Kongsberg Simrad.
GA = standard items generally available from many retail outlets.

Supp. code- The actual supplier or manufacturer part number if different from Kongsberg Simrad's.

Consumables and repair kits

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
	Technical data	**Drw. pos.**	**Rec.spares**	**Supp. code**
N/A	SAE 30 motor oil	-	-	GA
-	For gearbox	-	-	-
654-095602	Esso Cazar K1	-	-	GA
-	For shaft sleeve	-	-	-
N/A	Esso MP grease Beacon EP2	-	-	GA
-	For drive chains	-	-	-
KIT-103324	Set of seals and bearings	-	1	-
-	For shaft sleeve	-	0	-

Main units spare parts list

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
-	Technical data	Drw. pos.	Rec.spares	Supp. code
HCU-102818	Hoist Control Unit	-	1	-
-	Complete assembly	-	0	-
RCU-102819	Remote Control Unit	-	1	-
-	Complete assembly	-	0	-
122-089790	HiPAP 500 HL3770 Hull Unit	-	-	-
-	See note below	-	-	-
122-213410	HiPAP 500 HL6120 Hull Unit	-	-	-
-	See note below	-	-	-
122-214181	HiPAP 350 HL3770 Hull Unit	-	-	-
-	See note below	-	-	-
HDV-103235	500 mm transducer dock with service hatch	-	1	-
-	-	-	0	-
HDV-088347	DN500 gate valve	-	1	-
-	-	-	0	-
N/A	Gate valve position indicator *	-	0	-
-	-	-	-	-

* Depending on delivery.

Note

The hull unit part number is for a complete system.
This system includes:
- a HiPAP transducer
- transducer shaft
- transducer shaft sleeve
- motor and transducer dock (with service hatch)
It does not include the Hoist Control Unit and Remote Control Unit, gate valve, gate valve position indicator and mounting flange.

Hull Unit assembly spare parts list

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
-	Technical data	Drw. pos.	Rec.spares	Supp. code
331-045952	Motor with gearbox	-	1	SEW
-	S62 DT80N4BM/HF 2WE	-	0	See tech. data
331-084150	Motor alone	-	-	SEW
-	DFT80N4BM/HF 2WE	-	-	See tech. data
529-084151	Gearbox alone	-	-	SEW
-	-	-	-	-
350-087309	Limit switch	-	2	-
-	-	-	0	-
TDH-089996	HiPAP 500 Transducer	-	1	-
-	Complete spare parts kit	-	0	-
380-089919	HiPAP 500 Transducer cable	-	1	-
-	From hull unit to transceiver	-	0	-
TDH-212000	HiPAP 350 Transducer	-	1	-
-	Complete spare parts kit	-	0	-
380-214659	HiPAP 350 Transducer cable - Cable 1	-	1	-
-	From topp of transducer to the top of the transducer shaft	-	0	-
380-214686	HiPAP 350 Transducer cable - Cable 2	-	1	-
-	From hull unit to transceiver	-	0	-

Chains

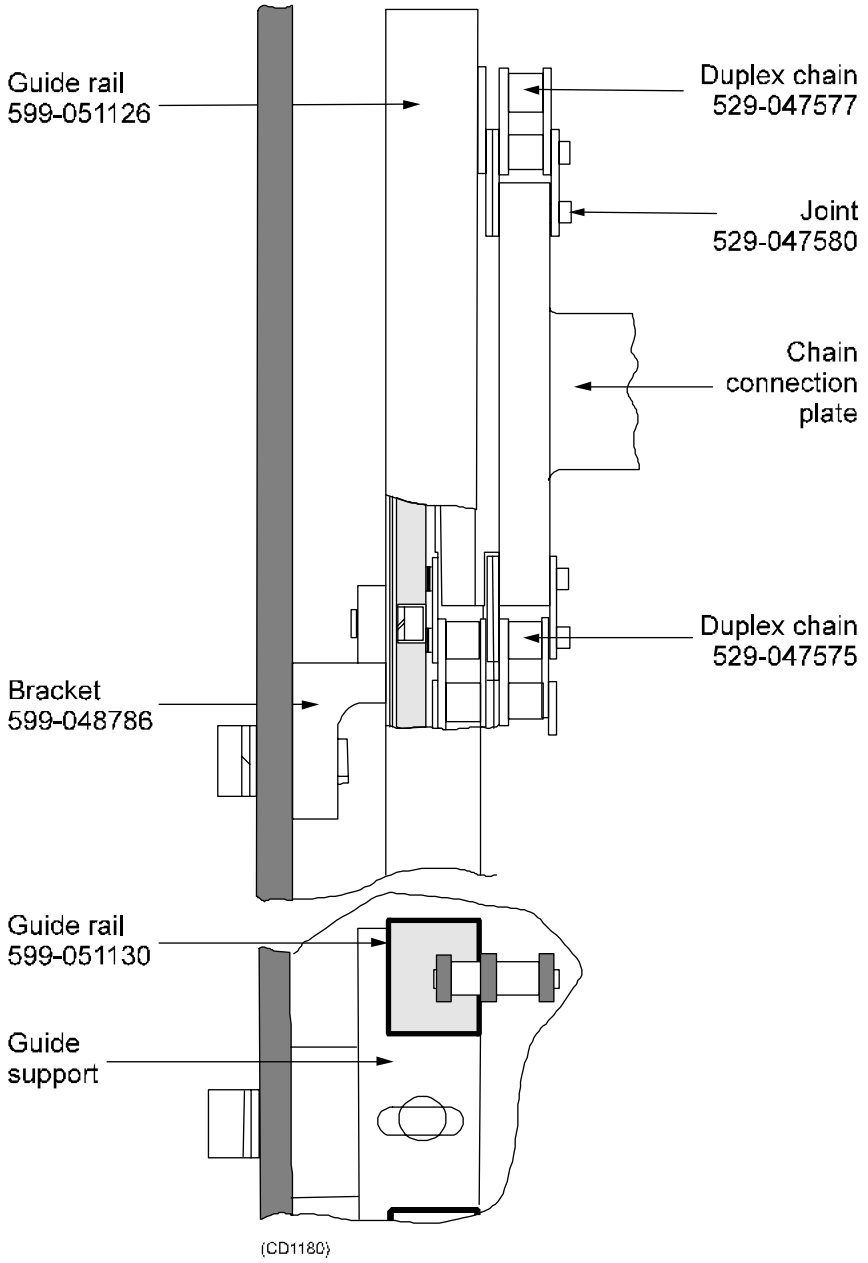


Figure 50 Chains and guide rails

Chains spare parts list

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
-	Technical data	Drw. pos.	Rec.spares	Supp. code
529-047575	Duplex chain	-	2	-
-	Length = 8305.24 mm (523 links)	-	0	-
529-047577	Duplex chain	-	2	-
-	Length = 206.44 mm (13 links)	-	0	-
529-047580	Joint no. 26	-	6	-
-	P = 0.625	-	0	-
599-051126	Guide rail	-	2	-
-	-	-	0	-
599-048786	Bracket	-	12	-
-	-	-	0	-
599-051130	Guide rail	-	2	-
-	-	-	0	-
599-048785	Guide support	-	2	-
-	-	-	0	-

Dock

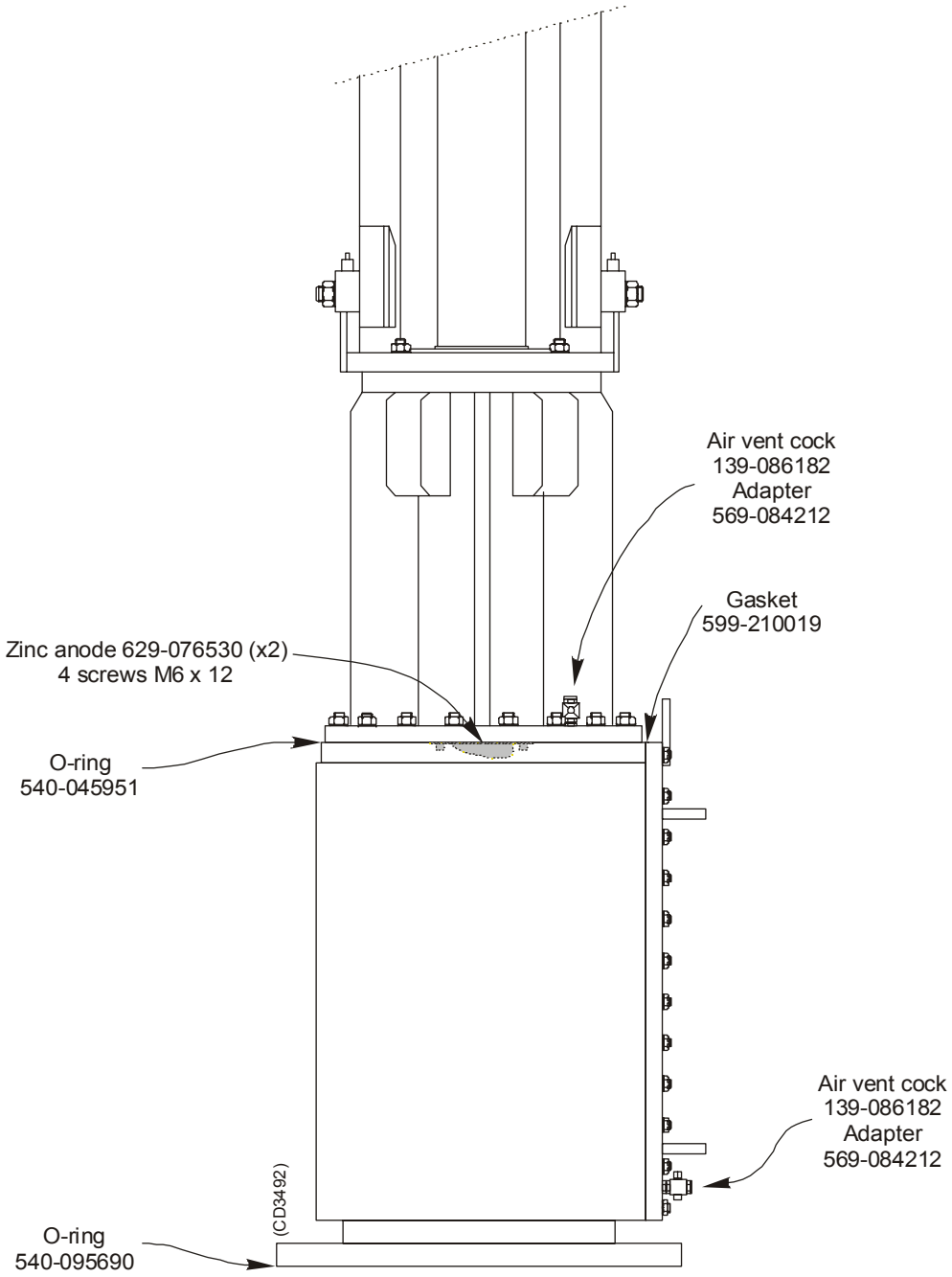


Figure 51 Service dock O-rings, cocks and zinc anode

Dock spare parts list

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
-	Technical data	Drw. pos.	Rec.spares	Supp. code
540-045951	O-ring (shaft sleeve - dock)	-	1	-
-	381.2 x 8.2 MIL413B / SMS1817	-	0	-
540-095690	O-ring (dock - gate valve)	-	1	-
-	522.0 x 8.4 N SKEGA 4666142 Nitril 6370001	-	0	-
540-084245	Service hatch seal	-	1	-
-	10 mm Ø	-	1	-
139-086182	Air vent / Drain cock	-	2	-
-	Stainless steel SS316 3/8" with handle. Also used on shaft sleeve.	-	1	-
569-084212	Adapter 3/8"	-	2	-
-	Also used on shaft sleeve.	-	1	-
629-076530	Zinc anode	-	2	-
-	Coral type Z-5	-	2	-

Transducer shaft sleeve

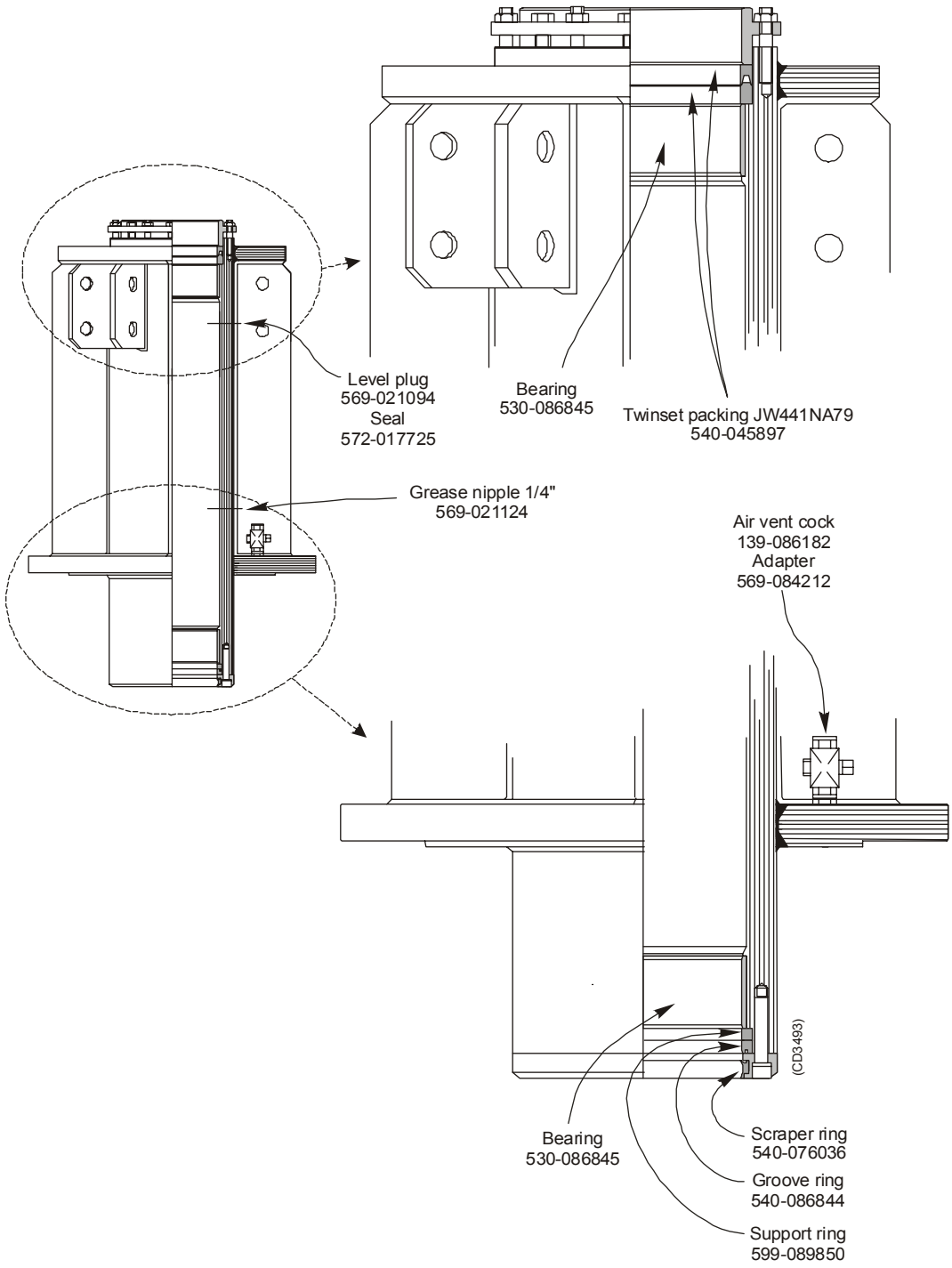


Figure 52 Transducer shaft sleeve

Transducer shaft sleeve spare parts list

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
	Technical data	**Drw. pos.**	**Rec.spares**	**Supp. code**
530–086845	Bearing	–	2	–
–	One at top, one at bottom of shaft sleeve	–	0	–
540–045897	Twin–set packing	–	1	–
–	JW441NA79	–	0	–
569–021124	Grease nipple	–	1	–
–	R 1/4”	–	1	–
139–086182	Air vent / drain cock	–	2	–
–	Stainless steel SS316 3/8” with handle. Also used on transducer dock.	–	1	–
569–084212	Adapter 3/8”	–	2	–
–	Also used on transducer dock.	–	1	–
540–086844	Groove ring	–	1	–
–	NI300–150–170–15	–	0	–
599–089850	Support ring	–	1	–
–	–	–	0	–
540–076036	Scraper ring	–	1	–
–	DA17–1500–N90	–	0	–
569–021094	Plug	–	1	–
–	R 1/4”	–	1	–
572–017725	Seating gasket	–	1	–
–	R 1/4”	–	1	–

Transducer shaft sleeve-top

Note *The mounting components (nuts, bolts, washers etc.) on the drawing below are considered "standard" hardware items. Kongsberg Simrad order numbers are therefore not given.*

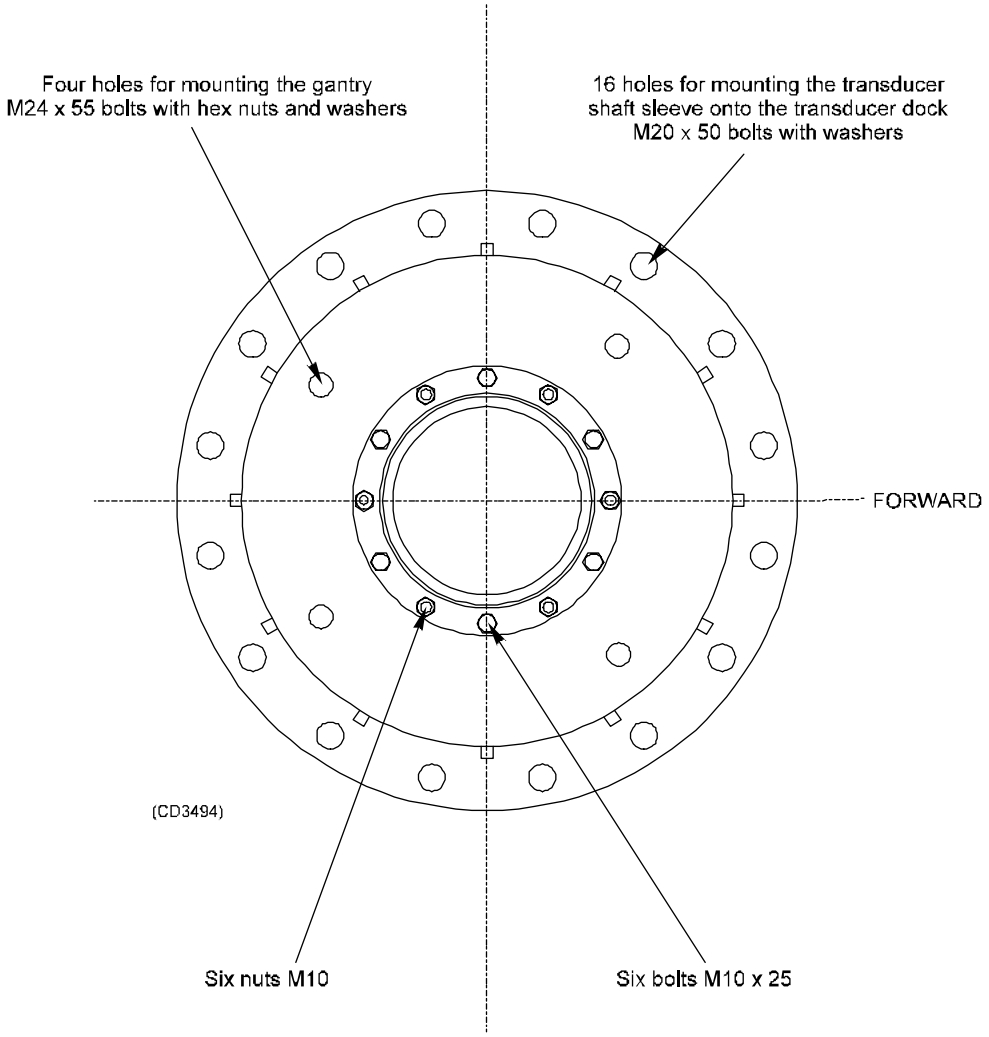


Figure 53 Transducer shaft sleeve - top view with mounting components

Transducer

Standard transducer spare parts list

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
-	Technical data	Drw. pos.	Rec.spares	Supp. code

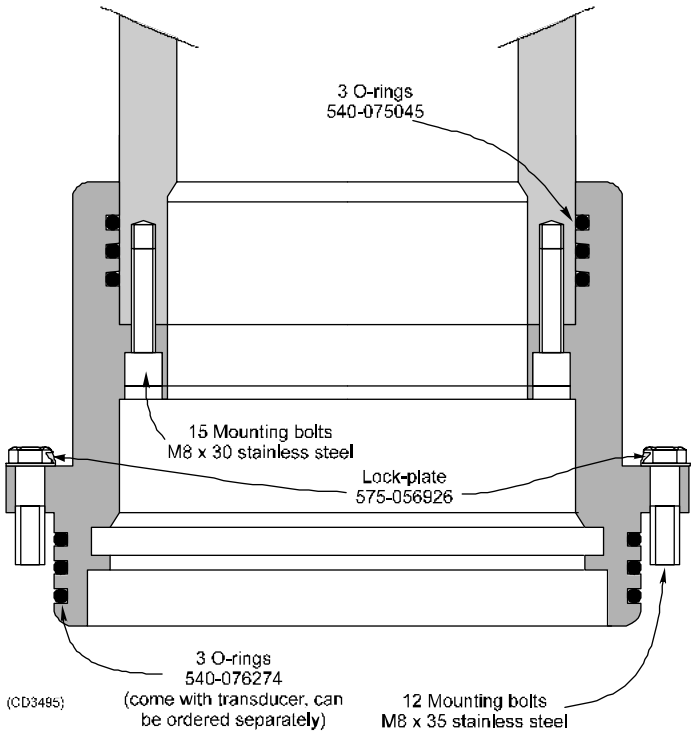


Figure 54 Mounting the transducer

540–075045	O–ring	–	3	–
–	149.3 x 5.7 MIL413C	–	–	–
540–076274	O–ring	–	3	–
–	180.0 x 4.0 N SKEGA 465833	–	–	–
575–056926	Lock–plate	–	6	–
–	–	–	–	–

Remote Control Unit

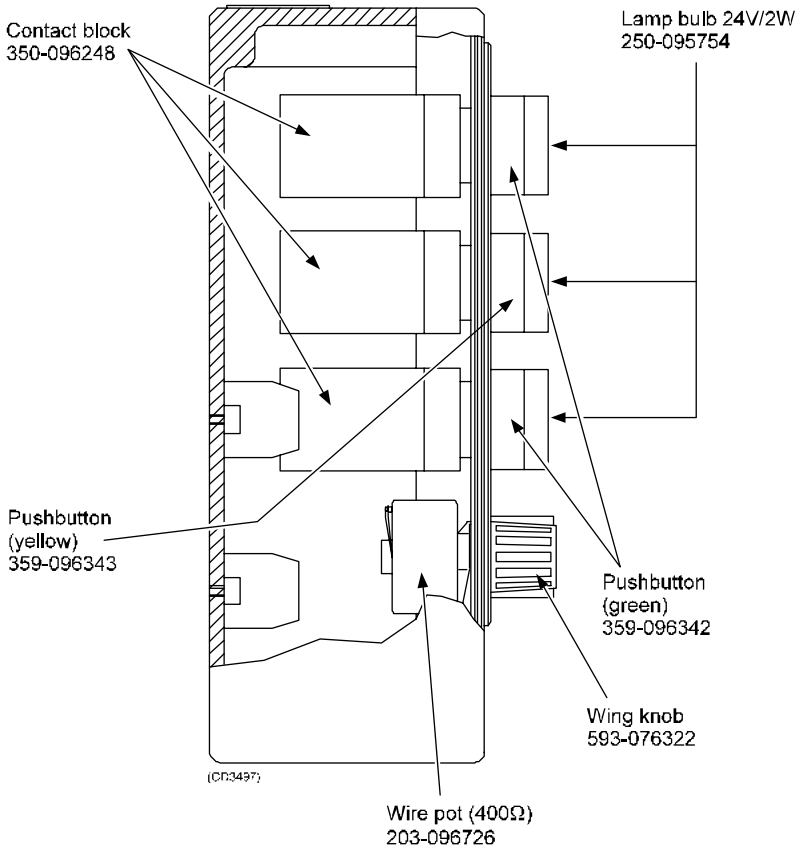


Figure 55 Remote Control Unit - parts identification

Remote Control Unit spare parts list

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
-	Technical data	Drw. pos.	Rec.spares	Supp. code
250–095754	Lamp bulb 24 V / 2 W	–	3	–
–	DLP–CE024. 85 mA	–	–	–
350–096248	Contact block	–	3	–
–	ZB2–BW265	–	–	–
359–096342	Push button / illuminated, green	–	2	–
–	ZB2–BW33	–	–	–
359–096342	Push button / illuminated, yellow	–	1	–
–	ZB2–BW35	–	–	–
203–096726	Wire potentiometer	–	1	–
–	400 Ω, 10%, 30 W.	–	–	–
593–076322	Wing knob	–	1	–
–	–	–	–	–

Hoist Control Unit

The Hoist Control Unit - internal layout is shown in the figure on page 48.

Hoist Control Unit spare parts

Part no.	Item name	Drw. ref.	No. in sys.	Supplier
-	Technical data	Drw. pos.	Rec.spares	Supp. code
351–093666	Remote switch	–	1	–
–	–	S1	–	–
251–057328	Automatic breaker	–	1	–
–	S272-K 2A	–	–	–
352–103085	Thermal relay	–	1	–
–	Current limit 1.8 – 2.6 A	F02	–	–
352–075772	Power relay	–	2	–
–	RM738024 24 Vdc	K01/04	–	–
221–076438	Mains transformer	–	1	–
–	Ulveco N12272–TD	T01	–	–
242–084064	Rectifier	–	1	–
–	KBPC806 600 V 8 A	D05	–	–
213–084668	Capacitor	–	1	–
–	Electrolitic 4700 μF –10+50% 63 V	C01	–	–
204–075163	Varistor	–	1	–
–	SIOV–S20K300 300 V RMS	D04	–	–

10 TEST AND ALIGNMENT PROCEDURES

This section presents checks, tests and alignment procedures that must be conducted on the hull unit before it is put into operational service.

Introduction

Purpose

After the physical installation has been carried out, all the system units must be checked to ensure that the units have been installed correctly.

This document contains the instructions and procedures required for the Hull Unit, before it is put into operation**.**

Test certificates

Once the testing engineer has performed or witnessed the performance of a test or part of a test, he should sign on the dotted line under each check/test to certify that the unit or system has passed that particular part of the procedure.

The use of these fields is optional, but we recommend that they are properly filled in for future references.

Note

If the testing engineer is not satisfied with the standard of any part of the installation, he must contact the personnel who performed the installation to have the work rectified and brought up to the required standards.

Visual inspections

After the installation has been carried out, all the system units must be checked visually to ensure the system has been installed correctly.

The testing engineer must ensure that the units have been mounted in the correct locations, correctly orientated (that is, the right way up) and are correctly secured to the bulkhead/deck/mounting brackets. The inspection engineer must understand that correct installation of some parts of the Hull Unit is critical to the safety of the vessel.

WARNING **These checks must be completed before any power is switched onto the system.**

Test and alignments

The following related test procedures must also be performed:

- HiPAP/HPR 400 Test and alignment
  (included in the HiPAP Instruction manual doc. no. 164055).
- The HiPAP/HPR Customer Acceptance Test (CAT)
  (included in the HiPAP Instruction manual doc. no. 164055).

Test procedures introduction

In all cases the step-by-step instructions must be followed if the tests are to be trustworthy.

In order to verify that the HiPAP/HPR system work properly, the following tests must be carried out:

- Inspection of the Hull Unit
- Inspection of the Hoist Control Unit
- Inspection of the Remote Control Unit
- Cabling installation checks
- Hull Unit raise/lower manual checks
- Electrical check

Follow the procedures and fill in the tables. Once the system has been tested, sign the signature page
(use the last page of this section).

The test results will be:

OK	when the test is done satisfactory.
FAIL	if the test fails.
NA	if the test is non-applicable.

Inspection of the hull unit

General

After the installation has been completed, all parts of the Hull Unit must be checked to ensure a secure and safe installation. These checks must be performed before the system is switched on for the first time.

WARNING **The correct installation of the Hull Unit is critical to the safety of the vessel.**

Logistics

Safety - N/A.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - N/A.

References - Hull Unit Installation manual.

Special tools - None.

Procedure

Start at the bottom of the unit. Refer to the installation drawings and cable diagrams in the *Drawing* section of this manual, and any relevant drawings and procedures which may have been prepared for the vessel by the shipyard.

1 Perform a close visual inspection of the vessel's hull, both internally and externally, in the area around the mounting flange.

2 Check that the hull plates have not buckled during the cutting and welding processes. Check that hull strengthening plates have been fitted as per the drawings, and that all welds are strong and watertight.

3 Ensure that all exposed metal surfaces have been properly painted with the appropriate preservation mediums to prevent corrosion.

4 Perform a close visual check of the mounting flange installation.

- Ensure that the unit is mounted properly, that all joints are satisfactory and that the unit has been correctly braced to the vessel's hull.

Caution ***If the installation of this part of the Hull Unit is not correctly performed, the safety of the vessel will be compromised.***

5 Ensure the unit is mounted properly using the o-rings provided and the correct type and number of bolts, nuts and washers.

6 Ensure all the bolts are correctly tightened.

Caution ***If the installation of this part of the Hull Unit is not correctly performed, the safety of the vessel will be compromised.***

7 Ensure the painted parts are properly painted with the appropriate preservation mediums to prevent corrosion.

8 Check that the Hull Unit assembly is correctly orientated and installed, and that the upper part of the gantry is suitably supported to the hull with reinforcing braces.

9 Check that the braces are ***BOLTED*** into position, ***NOT WELDED***.

10 Ensure all nuts and bolts used are suitable for the application, and that the appropriate flat and shake-proof washers are used.

11 Ensure all nuts and bolts are correctly tightened.

12 Ensure all applicable metal surfaces are properly painted with the appropriate preservation mediums to prevent corrosion.

13 Ensure the guide rails, sprockets and drive chains within the gantry have sufficient grease to ensure smooth raising and lowering of the shaft.

- Type shall be ESSO MP grease Beacon EP 2.

14 Wipe off any excess grease.

15 Check that there is sufficient oil in the shaft sleeve.

- Type shall be 1 litre oil type ESSO CAZAR K1.
- When sufficiently filled, a thin film of oil should be noticeable on the transducer shaft as it is raised. Oil filling and level plugs are located on the side of the shaft sleeve. Check that the filler and level screws are tight and not leaking. Clean up any oil spillage.

16 Check that the limit switches are properly secured into the gantry.

- Limit switch operation will be checked during the ”Setting to work” phase.

17 Check that the self-locking electric motor is correctly mounted, and that all securing bolts are tight.

18 Find the hand crank stowed on top of the Hull Unit, and check that the hand crank fits in position on the hoist motor shaft.

19 Replace the hand crank into position.

20 Check that the motor gearbox is filled with oil, and that there are no oil leaks.

- Type shall be SAE 30 motor oil.

Test certificate

Inspection of the Hull Unit	
Item to be checked	**Checked (sign)**
Hull Unit installation and preservation correct	
Mounting flange installation and preservation correct	
Gate valve installation and preservation correct	
Gantry installation and preservation correct	
Guide rail, sprockets and drive chains lubricated	
Sleeve filled, no oil leaks	
Limit switches correct	
Motor and hand crank correct, gearbox full and sealed	
The installation of the Hull Unit has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Inspection of the Hoist Control Unit

General

The Hoist Control Unit must be located as close as practically possible to the Hull Unit, preferably within the same compartment. For safety reasons there should be a clear line of sight between the two units. The Hoist Control Unit is designed to be bolted to a bulkhead.

Logistics

Safety - N/A.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - N/A.

References - Drawings from the Installation manual.

Special tools - None.

Procedure

1 Perform a close visual inspection of the cabinet.

2 Check that the unit is installed in the correct location, and is suitably orientated to enable easy maintenance.

3 Check that the unit is not damaged, and that the paintwork is clean.

4 If the unit is secured to mounting brackets, check that the brackets are manufactured correctly and are bolted or welded securely to the bulkhead.

5 If bolts have been used, ensure they are of an appropriate size and number to ensure the brackets are secure.

6 If the brackets are welded, ensure the welds are satisfactory and strong enough to hold the brackets and unit.

7 Check that the cabinet is securely fastened to the bulkhead/mounting brackets using four M8 bolts.

8 Check that the correct flat and shake-proof washers have been used, and that all the bolts are tight.

9 Check that the braided ground conductor is correctly installed.

10 Check that all welds/brackets have been painted with the correct preservation medium to prevent corrosion.

Test certificate

Inspection of the Hoist Control Unit	
Item to be checked	**Checked (sign)**
Bolted/Welded	
Bolts / ground conductor correct	
Paintwork correct	
The installation of the Hull Unit has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Inspection of the Remote Control Unit

General

The Remote Control Unit will normally be located close to the operator station to allow the operator immediate control of the Hull Unit. The Remote Control Unit is designed to be bolted to a bulkhead.

Logistics

Safety - N/A.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - N/A.

References - Drawings included in this manual.

Special tools - None.

Procedure

1 Perform a close visual inspection of the unit.

2 Check that the unit is installed in the correct location, and is suitably orientated to enable easy operation and maintenance.

3 Check that the unit is not damaged, and that the paintwork is clean.

4 Check that the unit is securely fastened to the bulkhead/mounting brackets using four M5 screws, nuts and washers.

Test certificate

Inspection of the Remote Control Unit	
Item to be checked	**Checked (sign)**
Remote Control Unit correct	
The installation of the Hull Unit has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Cabling installation checks

General

This is the test procedures for the system's power and signal interface cables.

WARNING **These checks must be completed before any power is switched onto the system.**

Logistics

Safety - N/A.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - N/A.

References - Drawings included in this manual.

Special tools - None.

Visual inspection of the cabling

Refer to the cable plans and interconnection diagrams, and check all power and inter-connection cables. Any locally fitted plugs and connectors must also be checked to ensure the correct types have been used for the specific locations. (Sealed/spark-proof connectors in areas where flammable gasses may accumulate, etc.)

Ensure all cable connections have been made according to the cable plan, and that all connections are tight and secure. Ensure all cables are correctly laid in conduits, or are otherwise protected according to the regulations and recommendations laid down by the vessel's registering authority. Ensure all protective covers are fastened correctly.

Cable connections and continuity

General

After the cable connections have been completed and the visual inspection has been carried out, all the cable cores must be checked for correct connection and continuity. Refer to the cable plans and interconnection diagrams, and check all interconnection cables. Any locally fitted plugs and connectors must also be checked for shorts or open circuits. Ensure all cable connections have been made according to the cable plan, and that all connections are tight and secure.

WARNING **These checks must be completed before any power is switched onto the system.**

Procedure

The check procedure will require pairs of engineers, equipped with the appropriate cable plans and wiring diagrams, two-way communication devices and tool kits. The ”tester” will require continuity test equipment, the assistant will require a suitable shorting strap.

Note *The exact resistance values will depend on the type and lengths of the cables and the units to which the cables are connected. If in doubt, check with the manufacturers.*

Follow the check procedure below for each cable core:

1 The test engineers must position themselves one at each extremity of the cable to be checked.

2 Good communications must be established.

3 Ensure the cable to be tested is not connected to any power source.

Note *If a cable terminates in a plug at the unit, the test will be more easily conducted if the plug is disconnected.*

4 Select one pair of cable cores, and check that the cores are connected to the correct terminals in the unit.

5 The tester then connects his continuity tester to the two terminals in question and checks the continuity.

Note *If a low resistance exists between the two cores, this may indicate the cores are connected to circuits or units with low internal resistance. If this is the case, disconnect the cores from the terminal block and test again. The resistance should be approaching RW. If so:*

6 The assistant then shorts the two cores together, and the tester repeats the test. The Resistance should be $\approx 0\Omega$..

7 The assistant then removes the shorting strap, and the resistance should go up to $\approx \infty\ \Omega$ again.

8 The tester then checks each core’s resistance to ground, (this should be $\approx \infty\ \Omega$), and each core’s resistance to all the other cores in the cable, (this should be $\approx \infty\ \Omega$).

9 Assuming the test results are correct, the cores must then be reconnected to the terminal block (if they had been removed), and the terminals checked to ensure they are correct and tight.

On completion, move on to the next pair of cores and repeat the tests till the entire cable has been checked.

Test certificate

Cable connections and continuity	
Item to be checked	**Checked (sign)**
Connector type	
Cable continuity	
The installation of the Hull Unit has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Hull unit raise/lower manual checks

General

This procedure is a mechanical test during which the Hull Unit is operated manually. This test checks that the Hull Unit is free to move without striking any obstructions and that the transducer cables are not going to become caught on anything during the lowering and raising operations. This check is to be used before the Hull Unit is powered up for the first time, and after any major maintenance or replacement has been carried out on the unit.

WARNING **Before lowering the Hull Unit, ensure there is a sufficient depth of water beneath the vessel's hull. If the vessel is in dry dock, check in the Hull Unit compartment and under the vessel to ensure no-one is working on the equipment and there are no obstructions. Rope off the area under the hull to ensure no one goes into the area while the hull unit is being operated.**

Logistics

Safety - N/A.

Personnel - Experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Vessel location - N/A.

References - Drawings from the Installation manual.

Special tools - None.

Procedure

1. Check around the Hull Unit and ensure there are no obstructions liable to hinder the lowering or raising of the unit.
2. If the vessel is in a dry dock, check under the vessel to ensure the transducer will not strike an obstruction when it is lowered.
3. Remove the hand crank lever from the hoist platform and place it in position on the hoist motor shaft.
4. Release the motor brake by tightening the screw on the side of the motor, and lower the transducer approximately 30 cm.
5. Reset the brake by slackening the screw.
6. Check that the cable is free to follow the transducer shaft as it is lowered, and is not liable to be caught on any obstructions.

- Remember that the cable may swing some distance from the Hull Unit in rough seas, so check to the full radius of the cable.

7 Repeat steps 1 to 6 until the Hull Unit is fully lowered.

8 Follow the same procedure to raise the Hull Unit again, paying particular attention to the cable.

9 If the vessel is floating, release any air which may be trapped in the mounting flange by cracking open the air vent cock.

Test certificate

Hull Unit raise/lower manual checks	
Item to be checked	**Checked (sign)**
Manually (by hand crank) lower/rise transducer shaft	
Transducer cable free to move	
The installation of the Hull Unit has been checked according to the procedures defined in the installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Electrical check

General

This procedure checks the electrical operation of the hull unit and sets up the limit switches.

It must be conducted after all inspections, cable connection checks and the manual operation check have been performed, but before the hull unit is operated under power for the first time.

→ *Refer to page 204.*

Logistics

Safety - N/A.

Personnel - Min 2 experienced engineer from the shipyard's quality assurance department. Installation supervisor.

Note

When performing the Remote Control Unit test, one engineer must operate the Remote Control Unit, while the other inspects the hull unit and operates the Hoist Control Unit. Communication between the two engineers is essential.

Vessel location - N/A.

References -

→ *Interconnection diagram, hoisting system on page 219.*

Special tools - None.

Procedure

1 Open the Gate Valve.

2 Lower the transducer manually by using the hand crank. approx. 50 cm down.

Note

Remember to release the brake.

3 Remove the hand crank.

4 Switch power on, using breaker F01 on the Hoist Control Unit (HCU).

→ *Location, see figure on page 48.*

5 Switch S1 in the HCU to **HOIST** and then **STOP** in rapid succession.

- The transducer shaft should move upwards. If the transducer moves downwards interchange two leads of the motor supply.

6 Switch to **LOWER**.

7 After a few seconds, operate the **lower limit switch** manually.

- Verify correct function of the switch. Lowering transducer should stop when operating the limit switch.

8 Switch to **HOIST**.

9 After a few seconds, operate the **upper limit switch** manually.

- Verify correct function of the switch. Raising the transducer should stop when operating the limit switch.

10 Switch to **HOIST**. Let the transducer move all the way up to the fully raised position.

Caution **Check the water depth/clearance under the ship/transducer before proceeding!**

11 Switch to **LOWER**. Let the transducer go all the way down to the fully out position.

12 Switch to **HOIST**. Let the transducer go all the way up to the fully raised position.

13 Release any air which may have accumulated in the transducer dock and gate valve using the air vent cock.

14 Set switch S1 to **REMOTE**.

- This to check remote operation, using the Remote Control Unit (RCU).
- The **RAISE/UP** and **STOP** lamps on the RCU should light.

15 Press **LOWER/DOWN** and monitor the lowering of the transducer.

16 After a few seconds, press **STOP**.

- The **STOP** lamp shall be lit.

17 Press **LOWER/DOWN**.

18 After a few seconds, press the **Test** button on the protection relay (F02), in the HCU.

→ *Test button location, see figure on page 48.*

- The **STOP** lamp shall be lit.

19 Press the **Reset** button (blue) on the protection relay (F02), in the HCU.

→ *Reset button location, see figure on page 48.*

20 Press **LOWER/DOWN.**

- Verify that the **LOWER/DOWN** and **STOP** lamps are lit when the lower limit is in fully out position.

21 Press **RAISE/UP**, and monitor the raising of the transducer.

- Verify that the **RAISE/UP** and **STOP** lamps are lit when the transducer is in the fully raised position.

22 Check that the lamp dimmer operates correctly.

Test certificates

Electrical check	
Item to be checked	**Checked (sign)**
DOWN/UP function-local	
Lower limit switch	
Upper limit switch	
DOWN function-remote	
STOP function-remote	
UP function-remote	
The installation of the Hull Unit has been checked according to the procedures defined in the Installation manual. Comments concerning inaccuracies, faults and/or poor workmanship have been filed as a separate report.	
Shipyard's quality assurance department Signature Date	
Installation team supervisor Signature Date	

Remarks and signatures

Remarks

Remarks (if any) must be noted here or in a separate report.

Signatures

Checked by:

Place Date Signature

Approved by:

Place Date Signature

11 DRAWING FILE

Overview

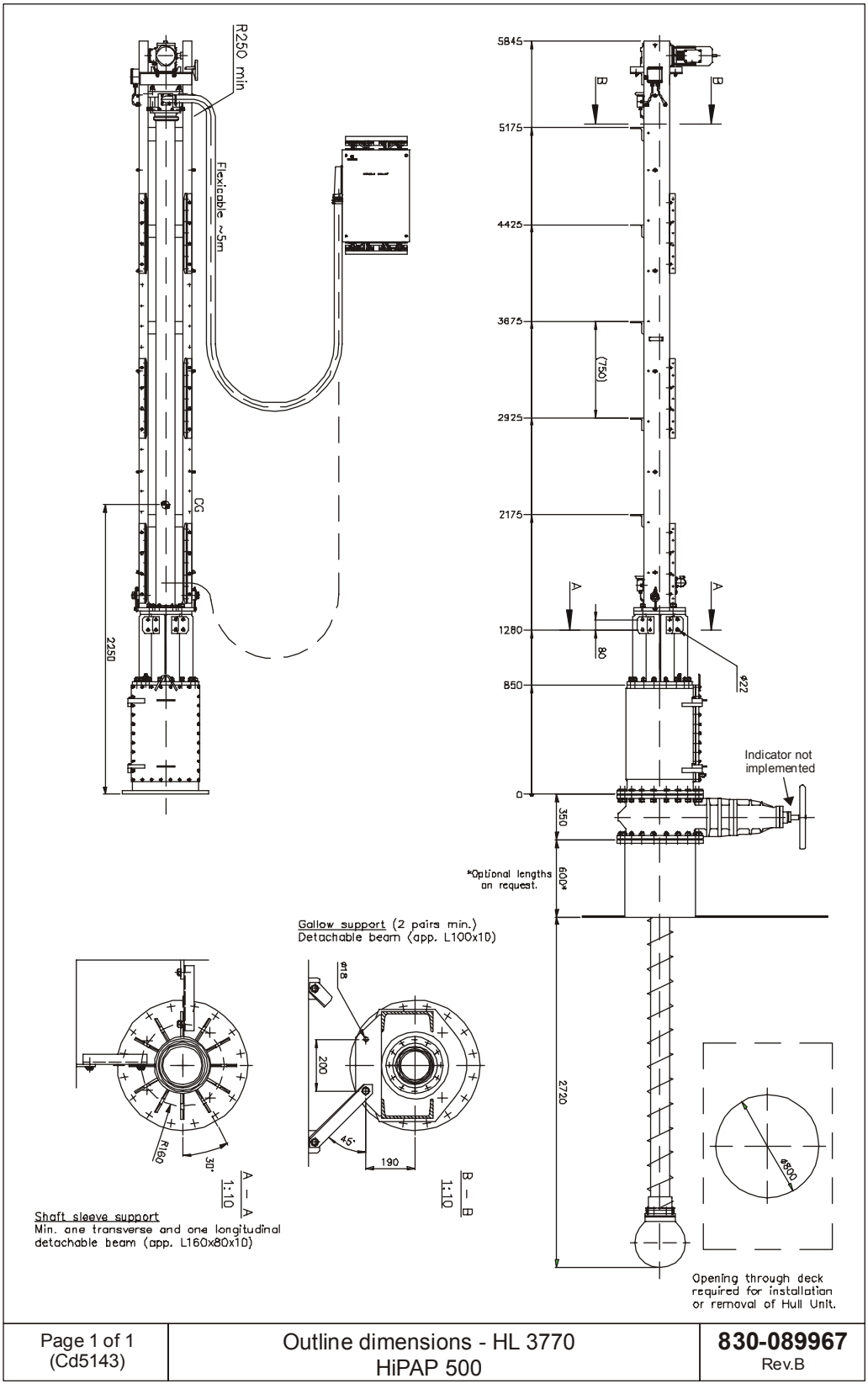
This section contains illustrations referred to in various sections in this manual. The illustrations are based on the original system drawings and wiring diagrams.

- The illustrations are not in scale.
- The original drawings are available in electronic format (AutoCAD) upon request.

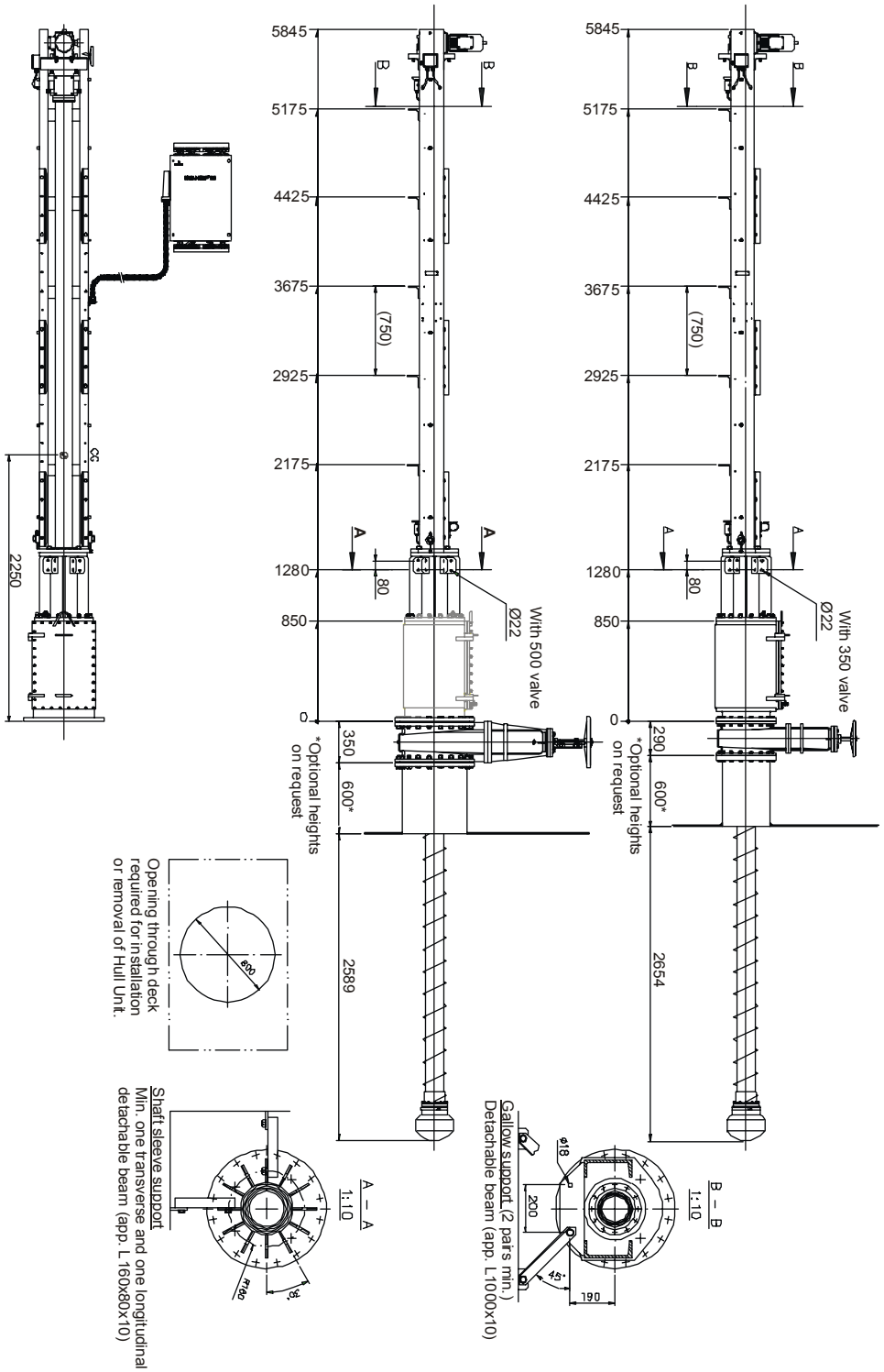
Drawings

The following illustrations are implemented:

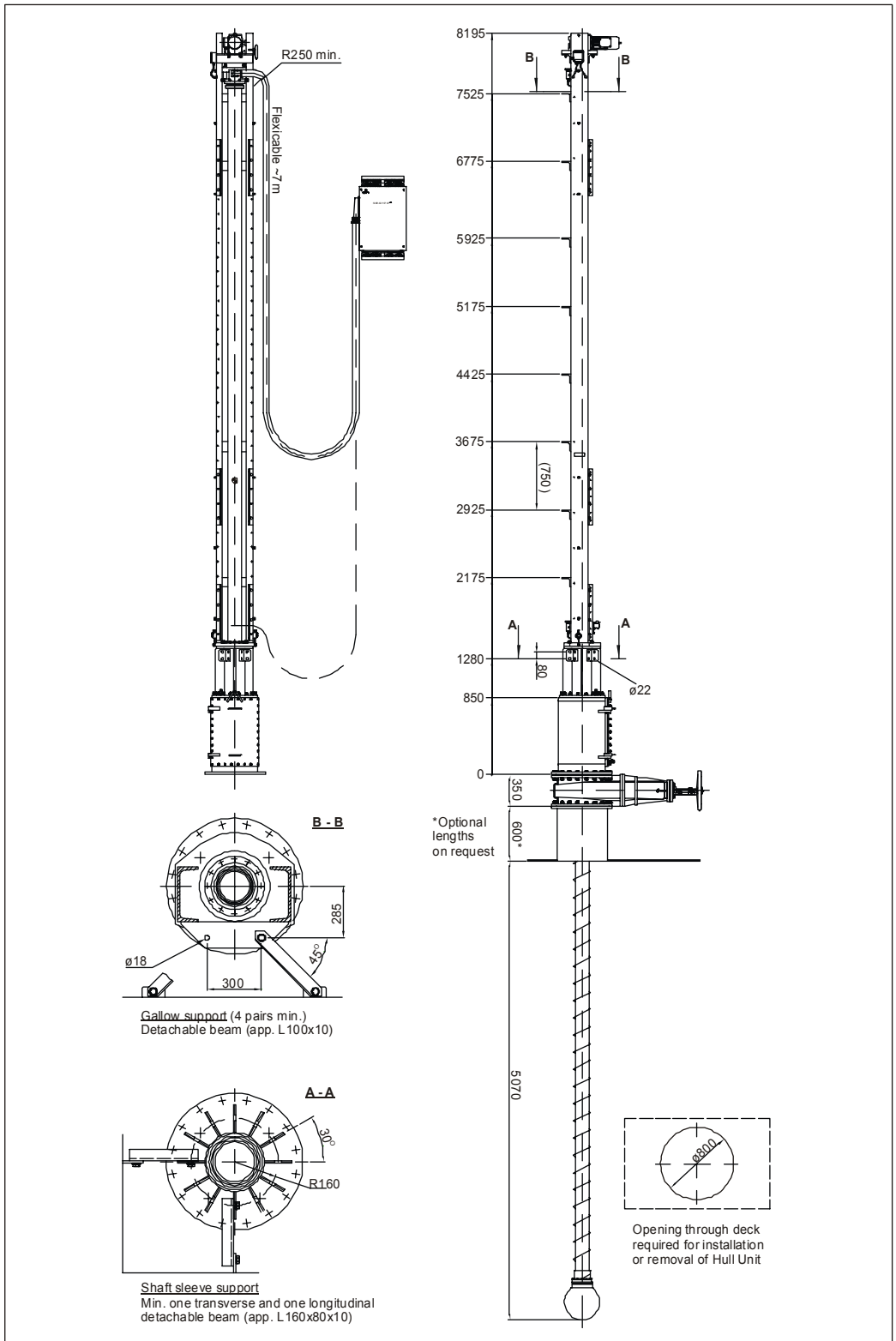
- **Installation**
  - DN500 mounting flange with gate valve, see page 217.
  - DN350 mounting flange with gate valve, see page 218.
- **Outline dimensions**
  - HiPAP 500 HL 3770,see page 211.
  - HiPAP 350 HL 3770, see page 212.
  - HiPAP 500 HL 6120, see page 213.
  - HiPAP 500 HL 4570, see page 214.
  - HiPAP 500 HL 2180, see page 215.
  - HiPAP 350 HL 2180, see page 216.
  - Actuator - outline dimensions, see page 226.
- **Interconnection and circuit diagrams**
  - Interconnection diagram - hoist system, see page 219.
  - Wiring diagram - Hoist Control Unit, see page 220.
  - Wiring diagram - Remote Control unit, see page 223.
  - Circuit diagram - Hoist Control Unit on pages 221 and 222.
  - Actuator internal - wiring diagram, see page 226.
  - Electrical actuator system - wiring diagram, see page 227.
- **Transducer cables**
  - HiPAP 500, see page 224.
  - HiPAP 350, see page 225.



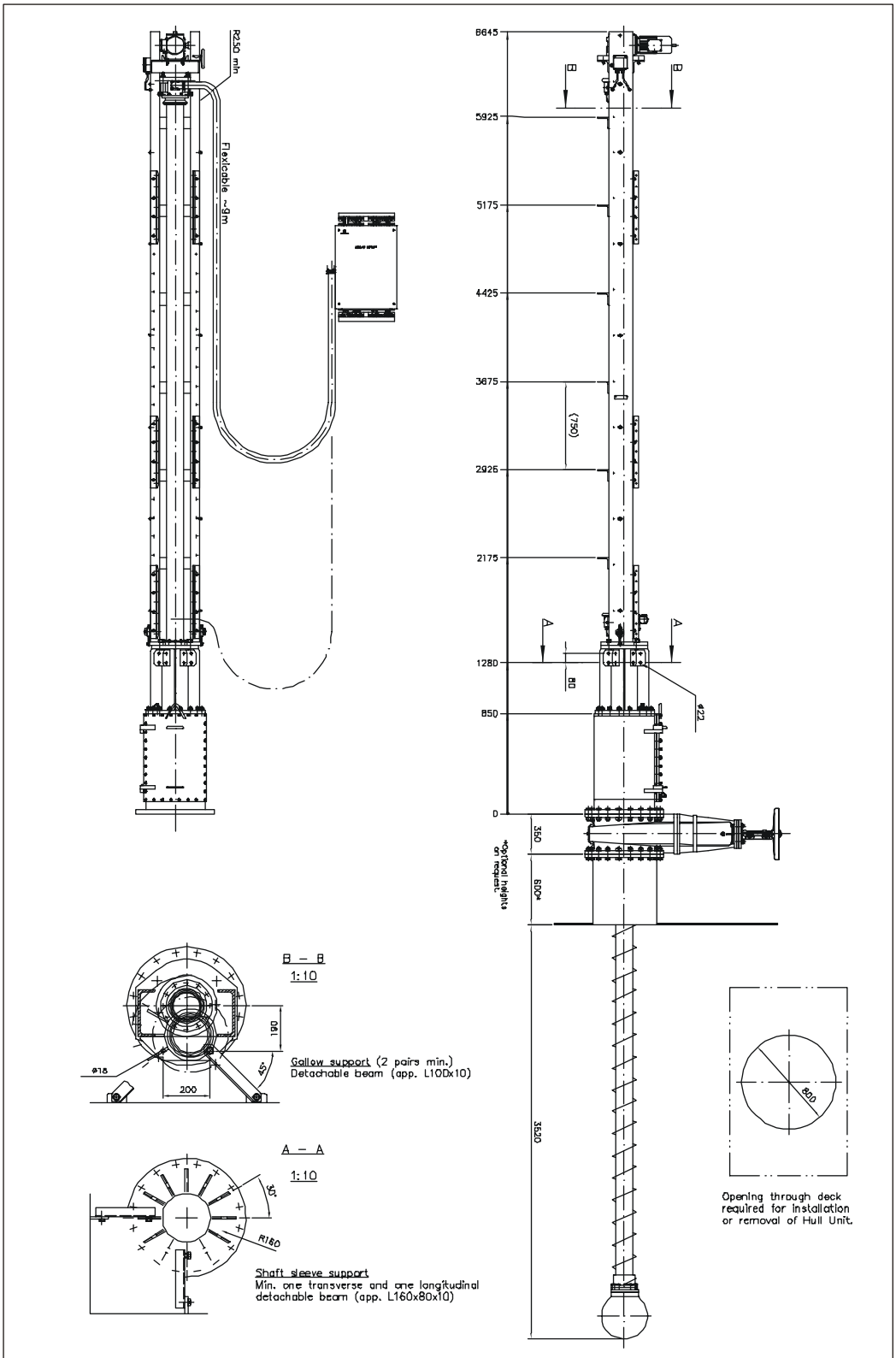
Page 1 of 1 (Cd5143)	Outline dimensions - HL 3770 HiPAP 500	**830-089967** Rev.B



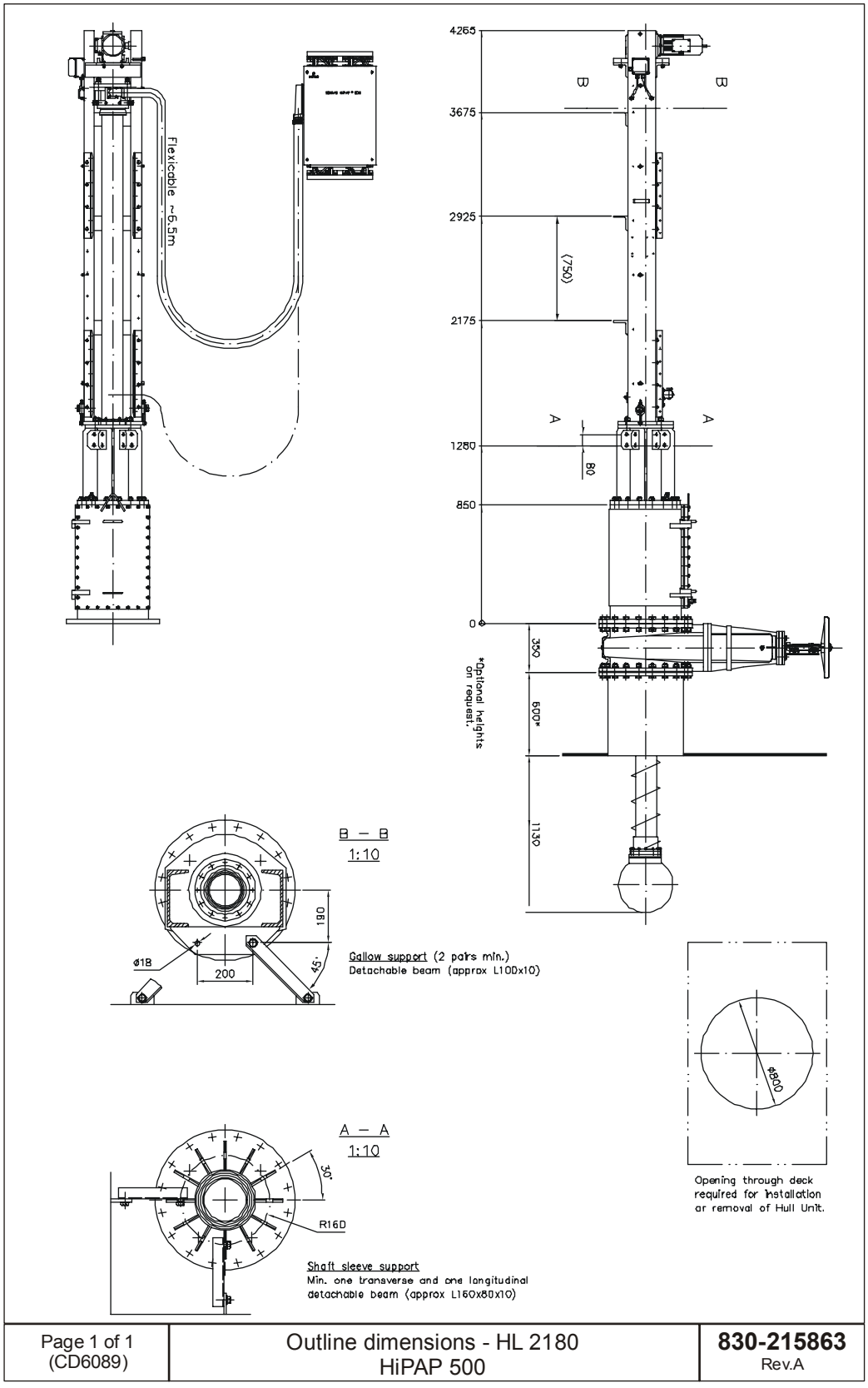
Page 1 of 1 (CD5631)	Outline dimensions - HL 3770 HiPAP 350	**214461** Rev.A



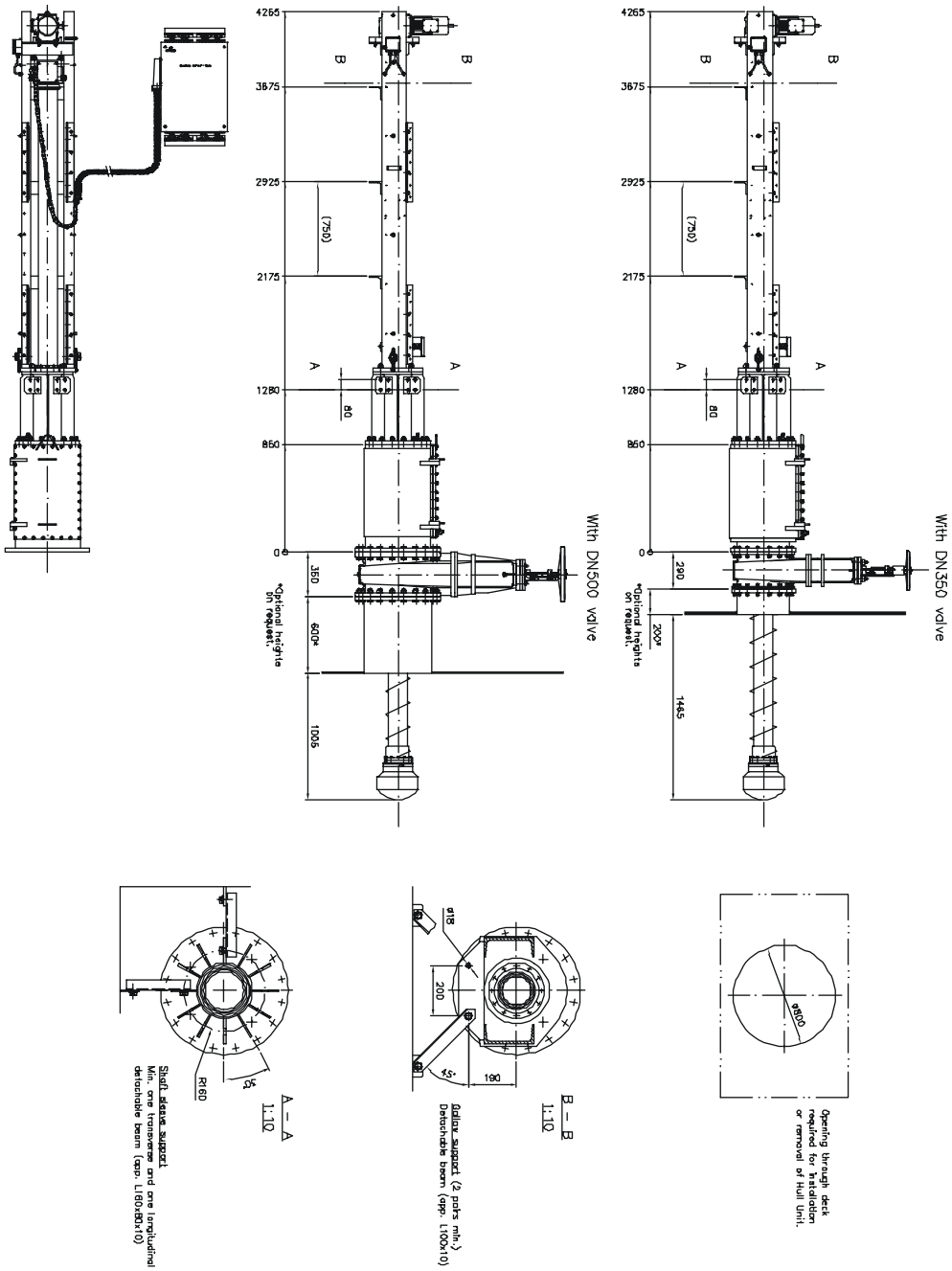
Page 1 of 1 (CD5383)	Outline dimensions - HL 6120 HiPAP 500	**830-213021** Rev.A



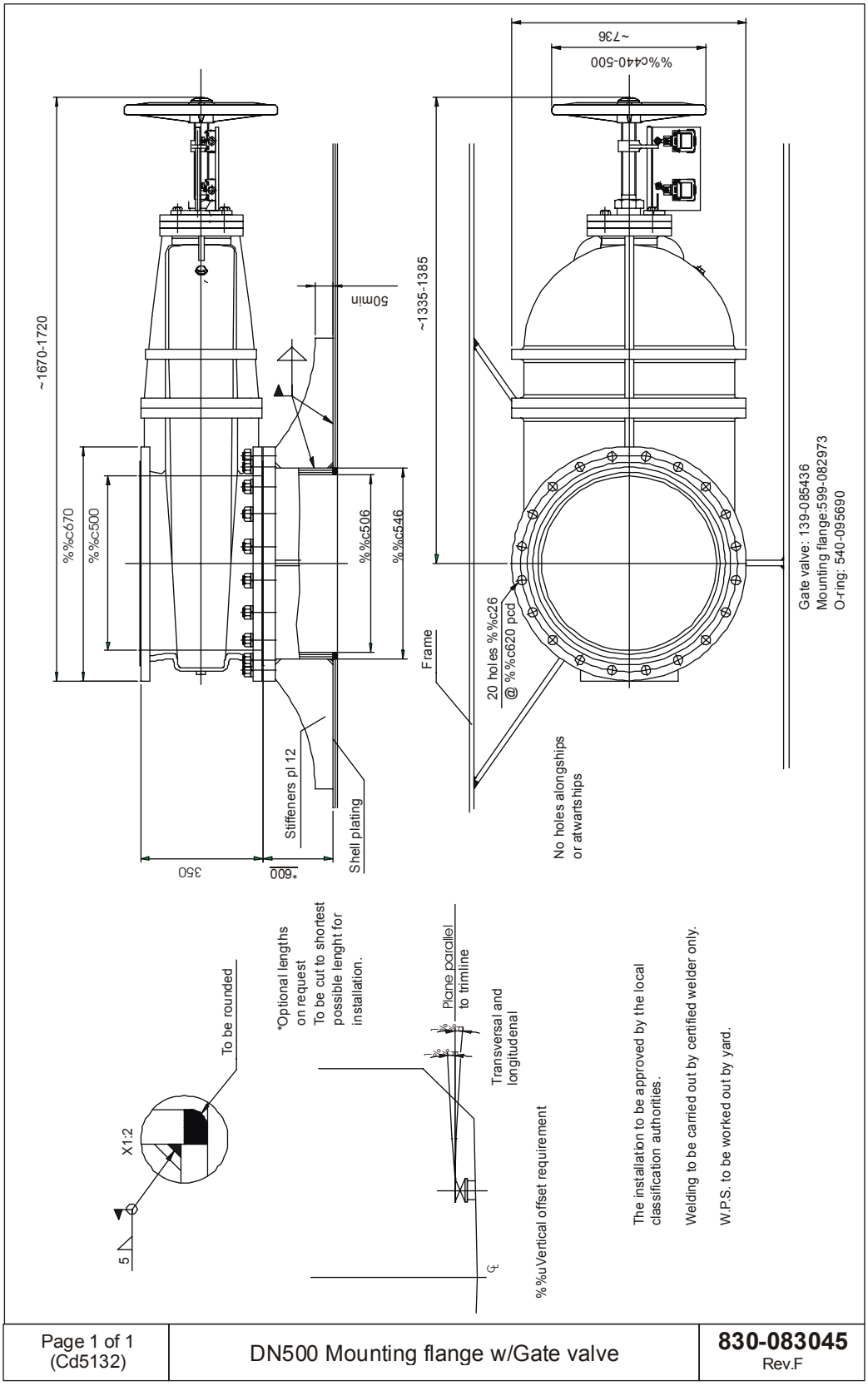
Page 1 of 1 (CD6565)	Outline dimensions - HL 4570	**830-216642** Rev.A

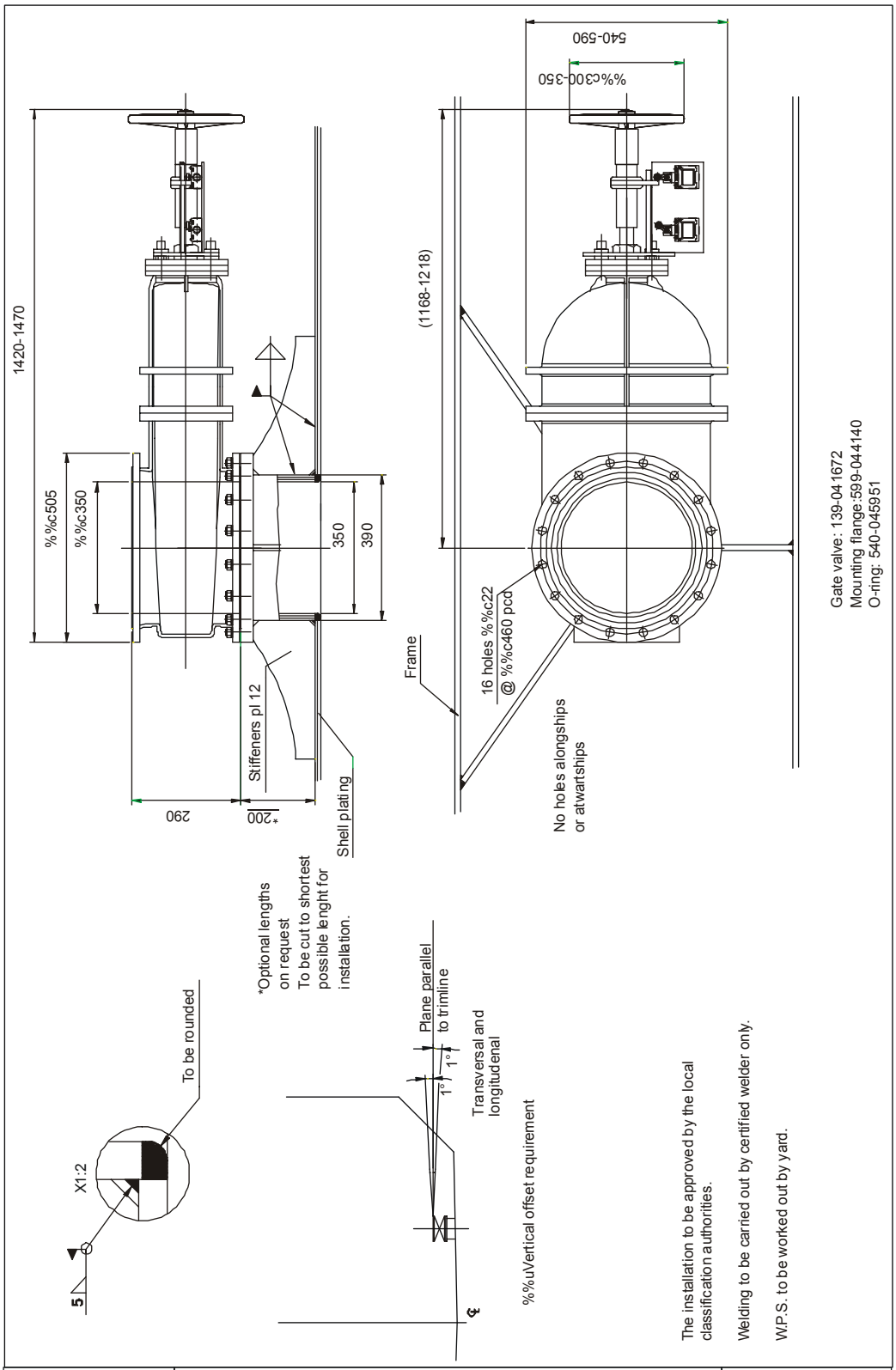


Page 1 of 1 (CD6089)	Outline dimensions - HL 2180 HiPAP 500	**830-215863** Rev.A

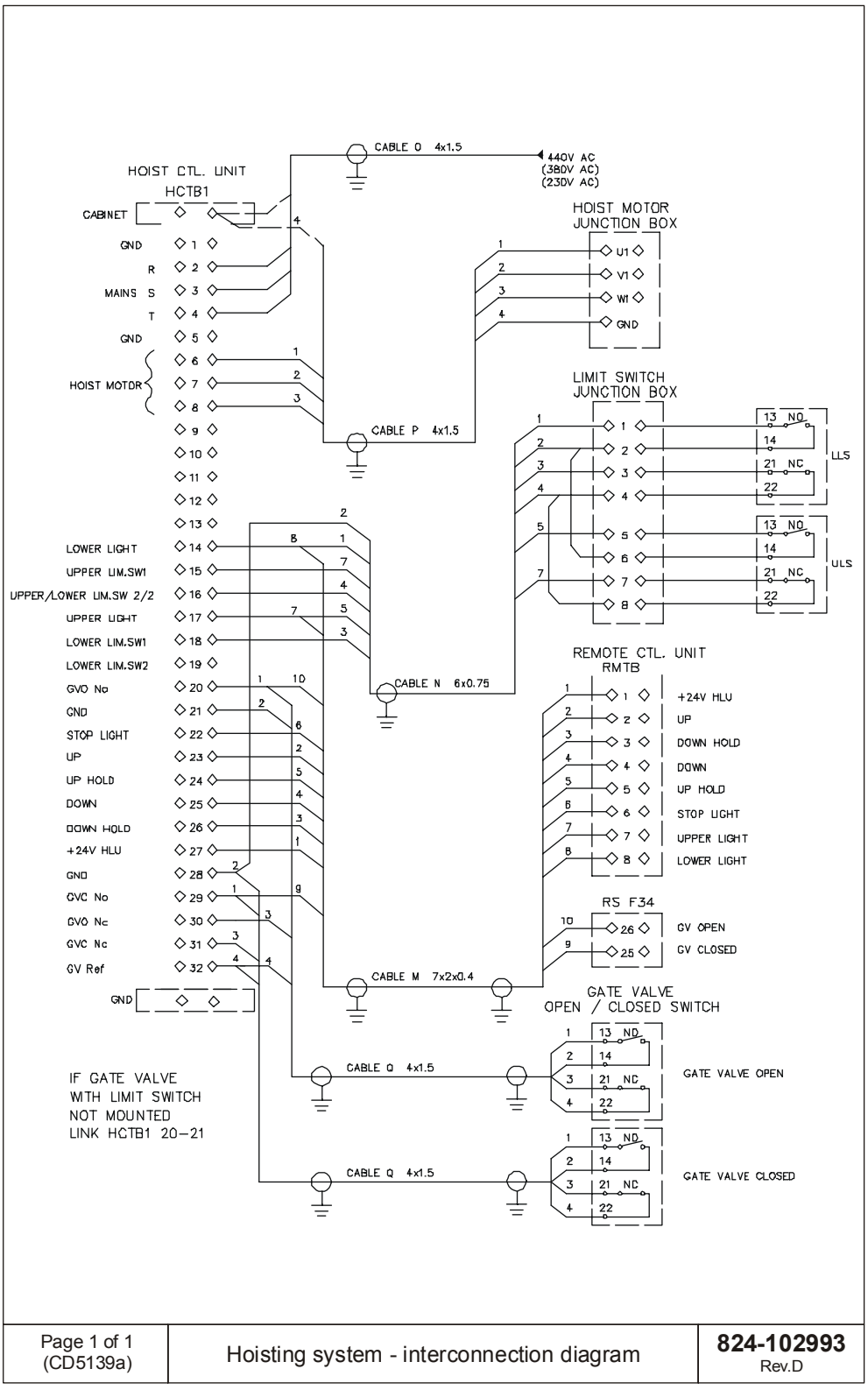


Page 1 of 1 (CD6090)	Outline dimensions - HL 2180 HiPAP 350	**830-215864** Rev.A

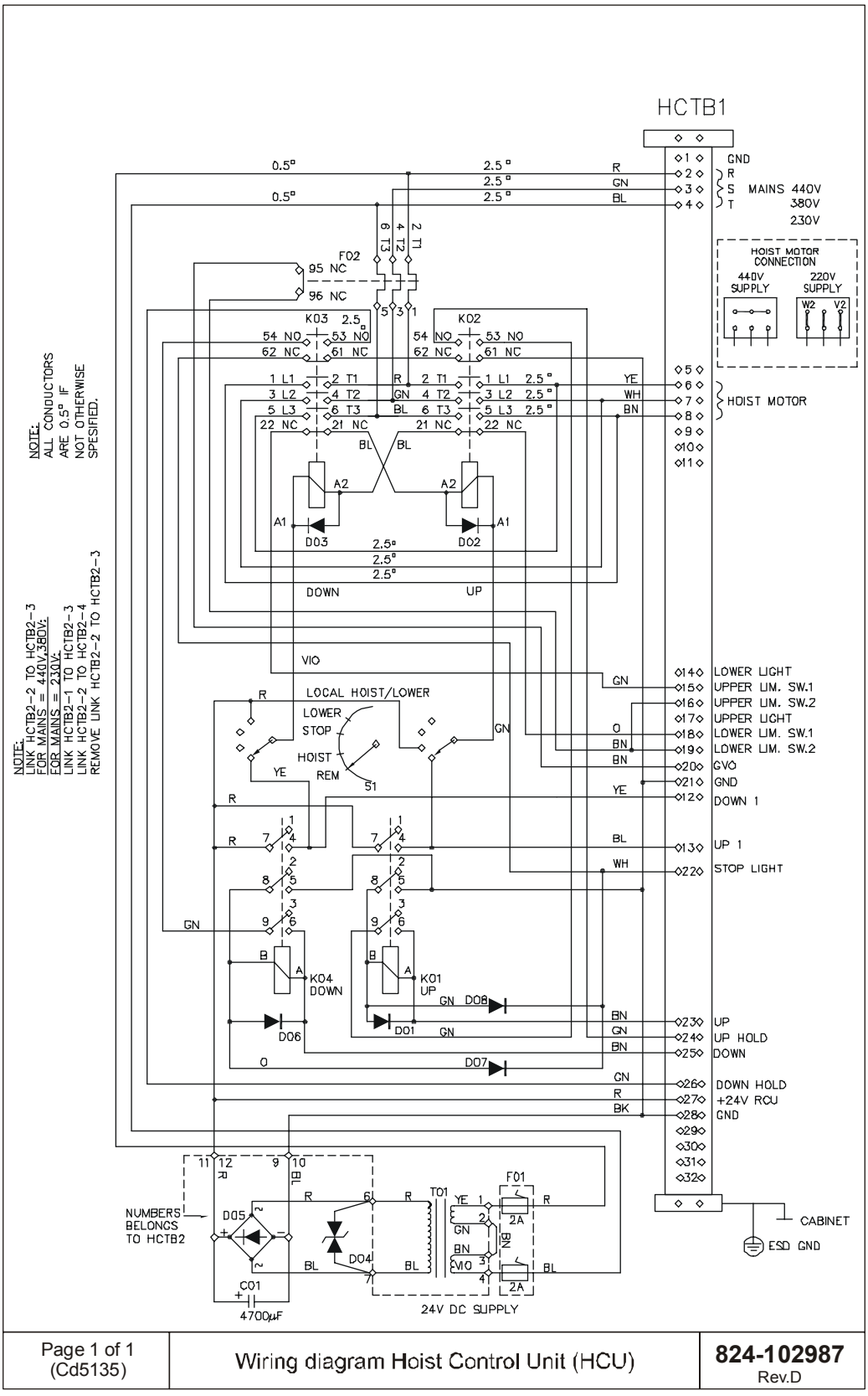

~1670-1720
%%c670
%%c500
%%c506
%%c546
50min
Stiffeners pl 12
Shell plating
350
*600
~1335-1385
~736
%%c440-500
Frame
20 holes %%c26
@ %%c620 pcd
No holes alongships
or atwartships
Gate valve: 139-085436
Mounting flange:599-082973
O-ring: 540-095690
To be rounded
X1:2
5
*Optional lengths
on request
To be cut to shortest
possible lenght for
installation.
Plane parallel
to triniline
Transversal and
longitudenal
%%u Vertical offset requirement
The installation to be approved by the local
classification authorities.
Welding to be carried out by certified welder only.
W.P.S. to be worked out by yard.
Page 1 of 1
(Cd5132)
DN500 Mounting flange w/Gate valve
830-083045
Rev.F



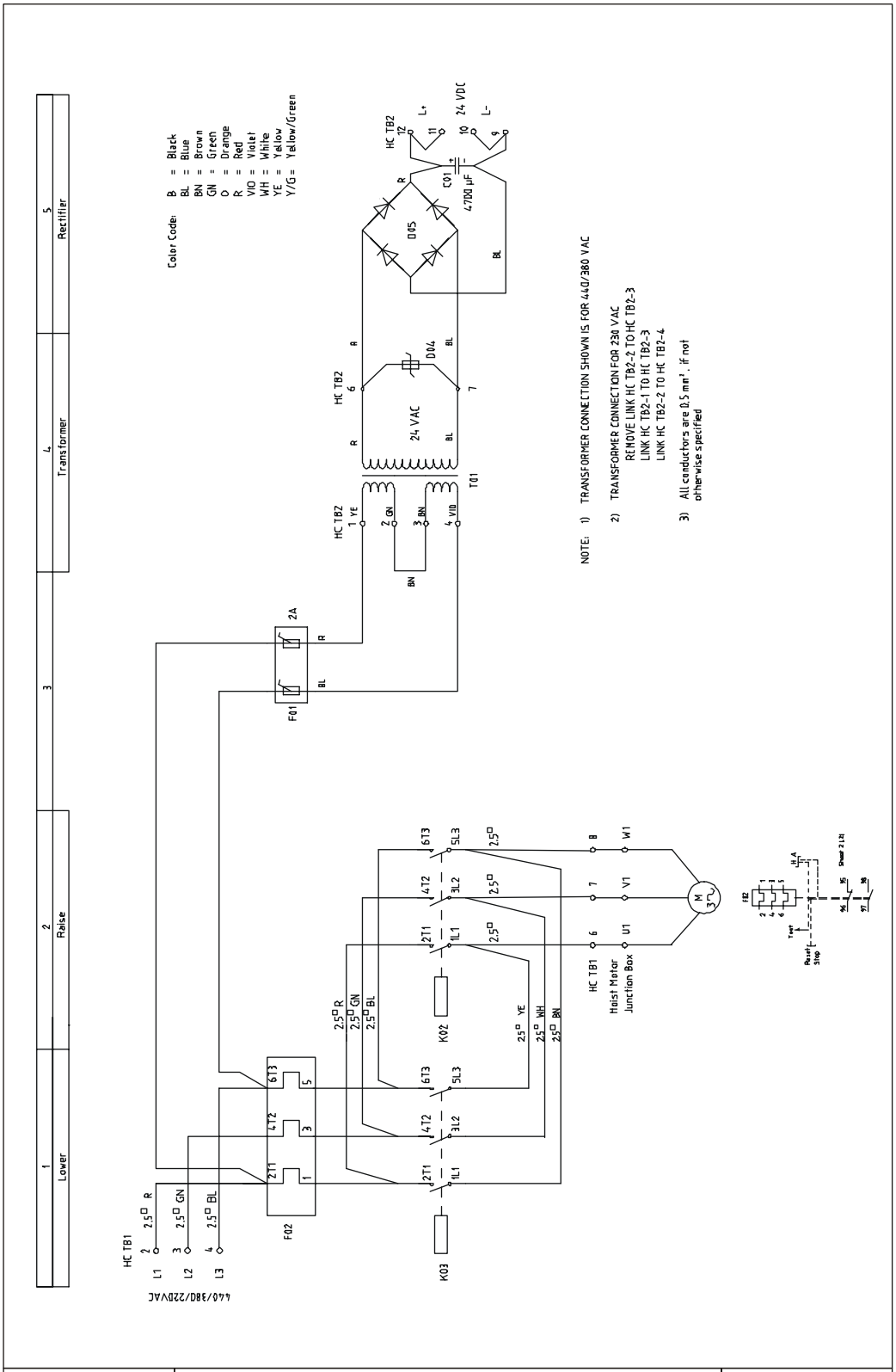
Page 1 of 1 (Cd5402)	DN350 mounting flange w/gate valve	**830-214043** Rev.C



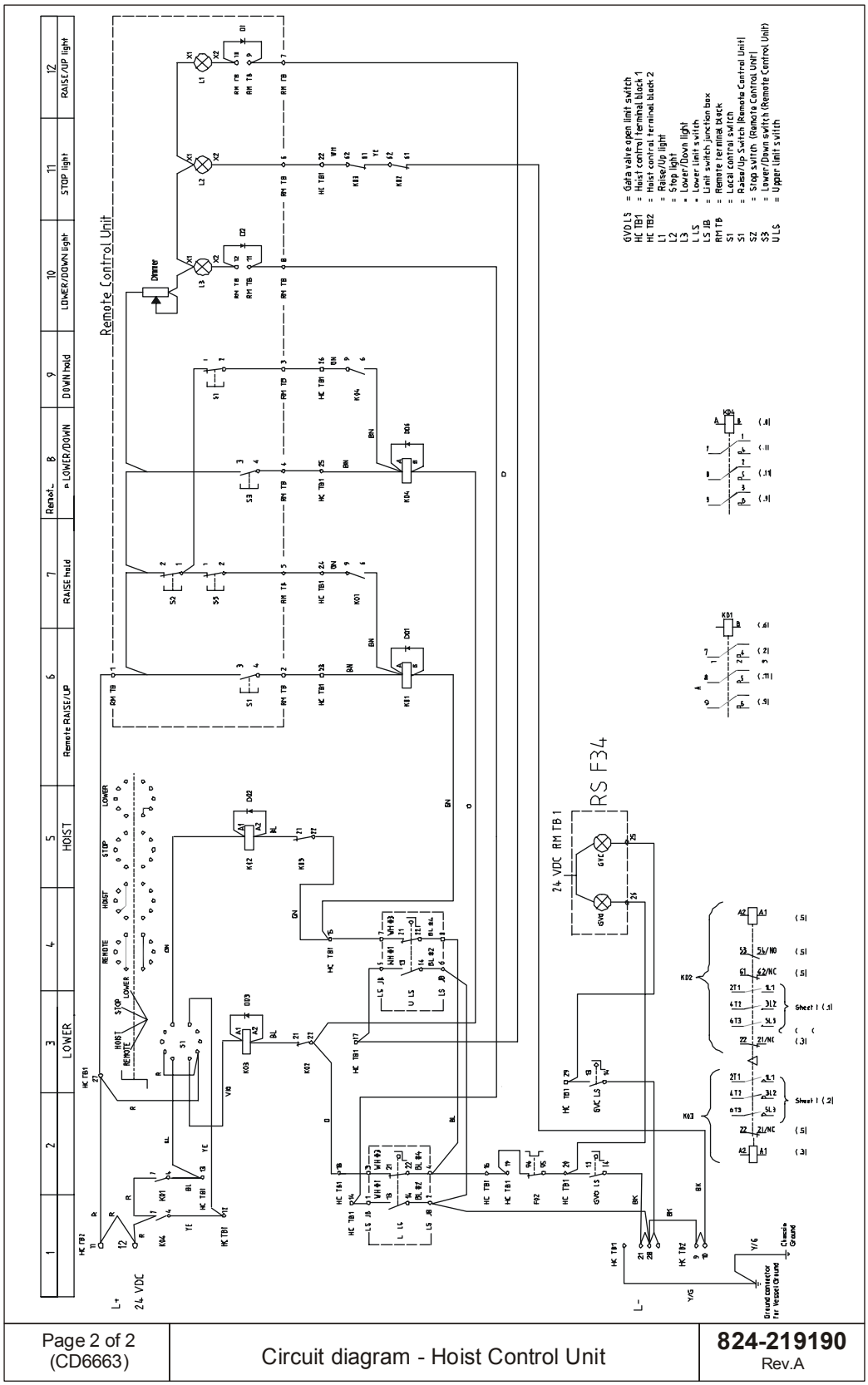
Page 1 of 1 (CD5139a)	Hoisting system - interconnection diagram	**824-102993** Rev.D



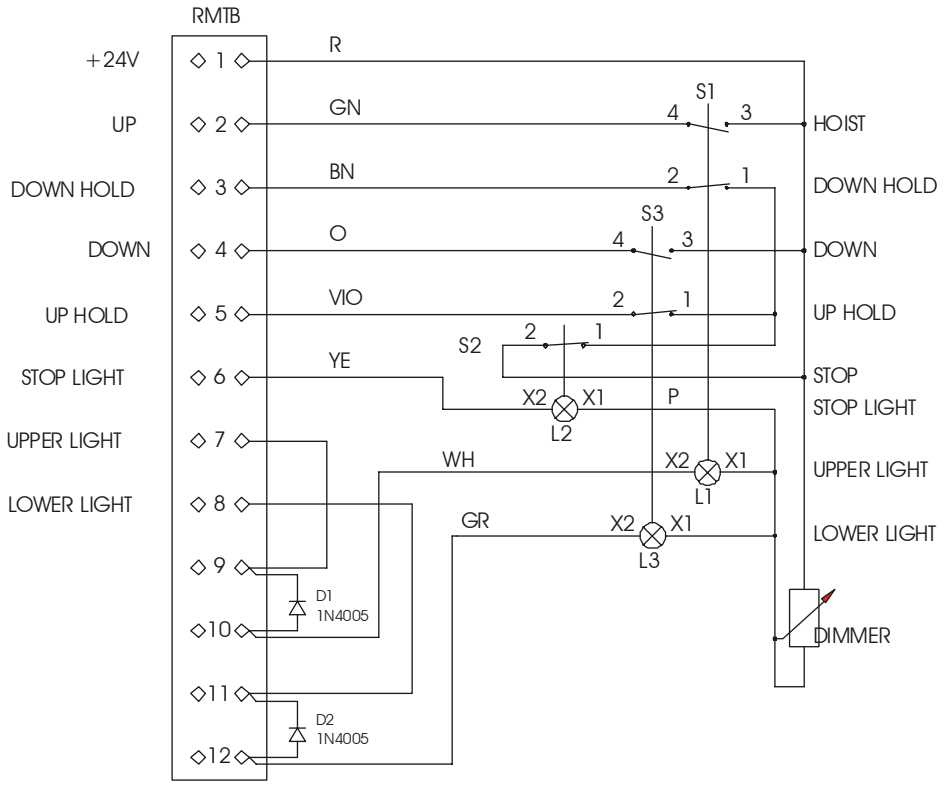
Page 1 of 1 (Cd5135)	Wiring diagram Hoist Control Unit (HCU)	**824-102987** Rev.D



Page 1 of 2 (CD6662)	Circuit diagram - Hoist Control Unit	**824-219190** Rev.A

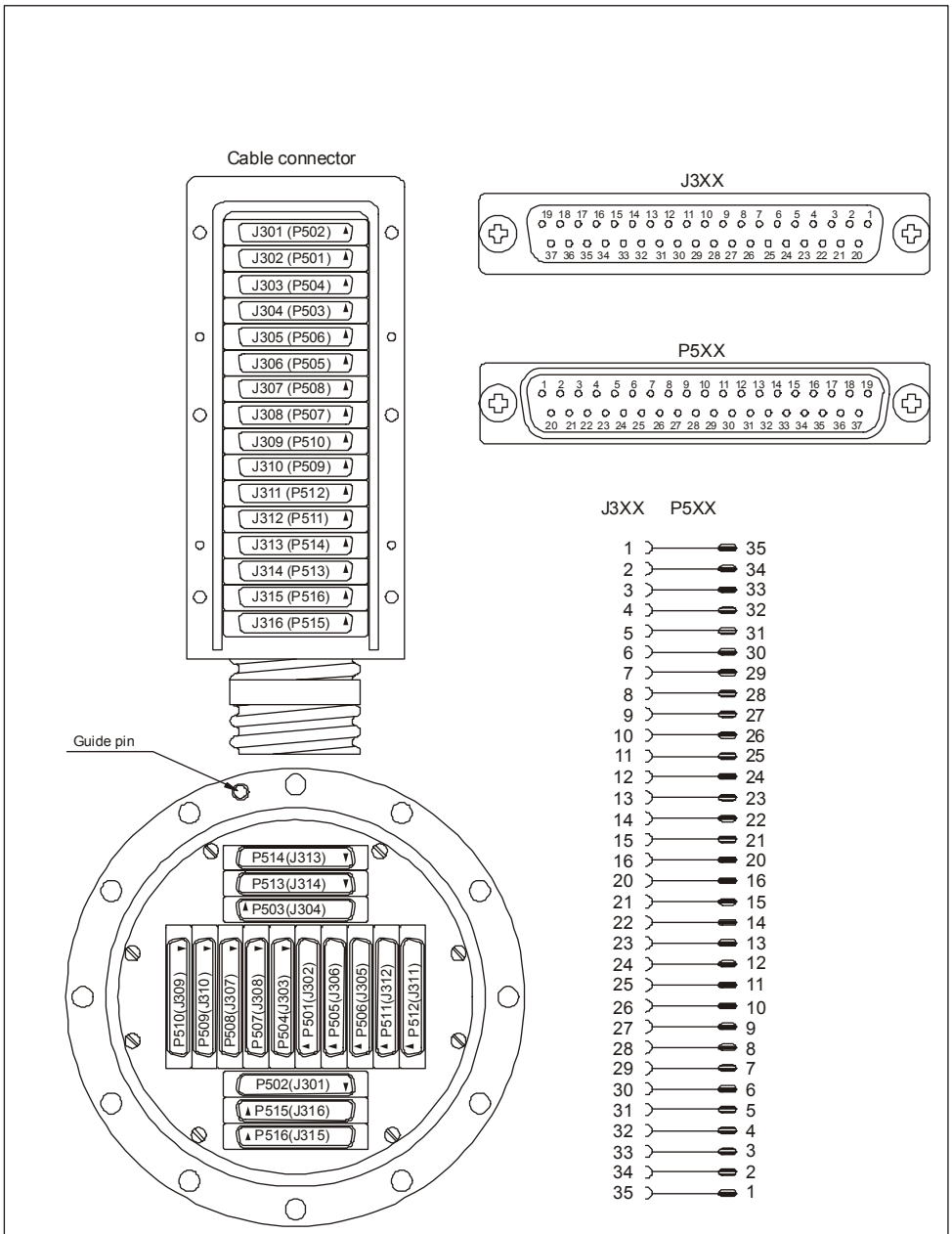


Page 2 of 2 (CD6663)	Circuit diagram - Hoist Control Unit	**824-219190** Rev.A

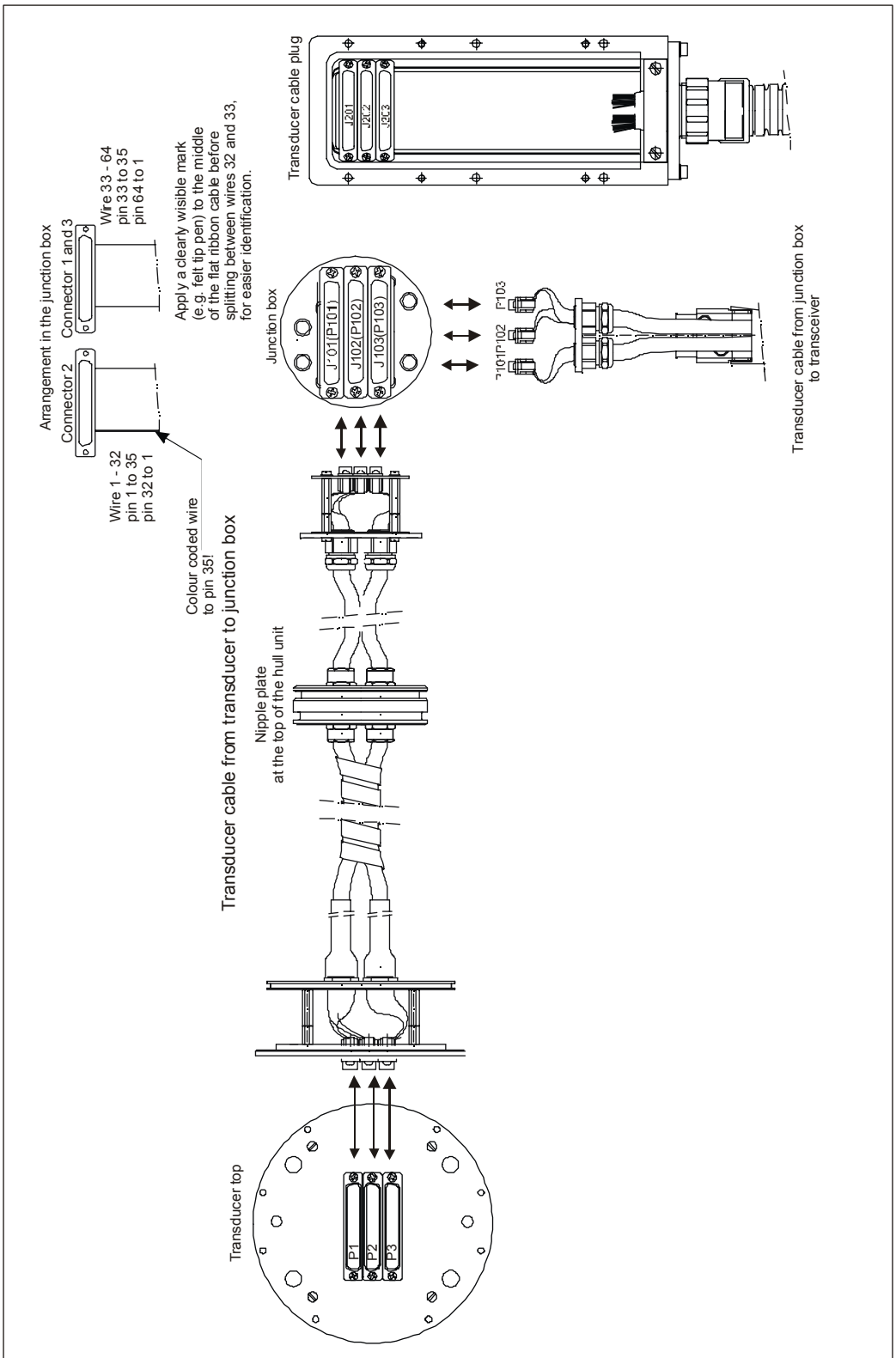


Note: All conductors, 0.5°

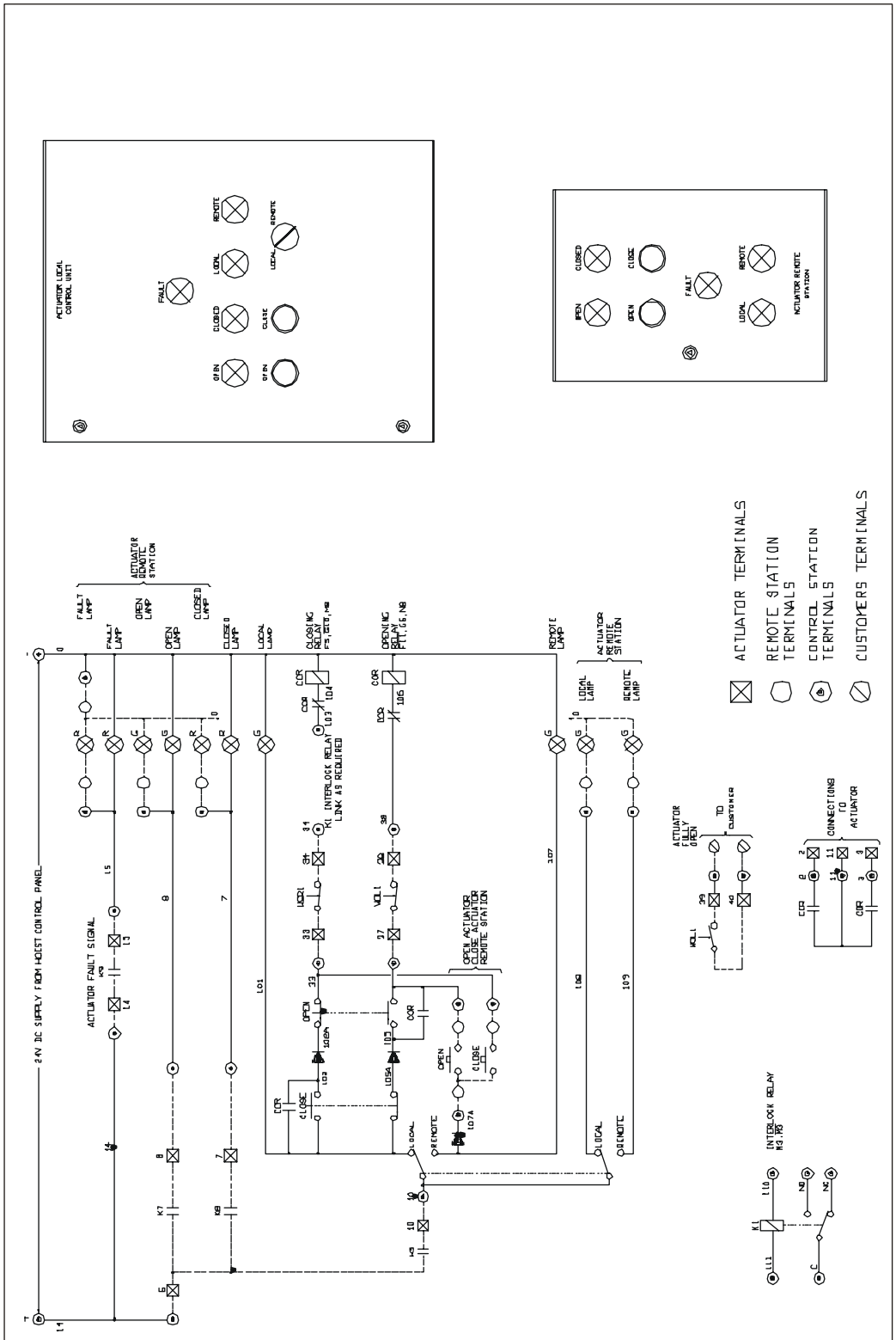
Page 1 of 1 (Cd5140)	Wiring diagram RCU	**824-094181** Rev.D



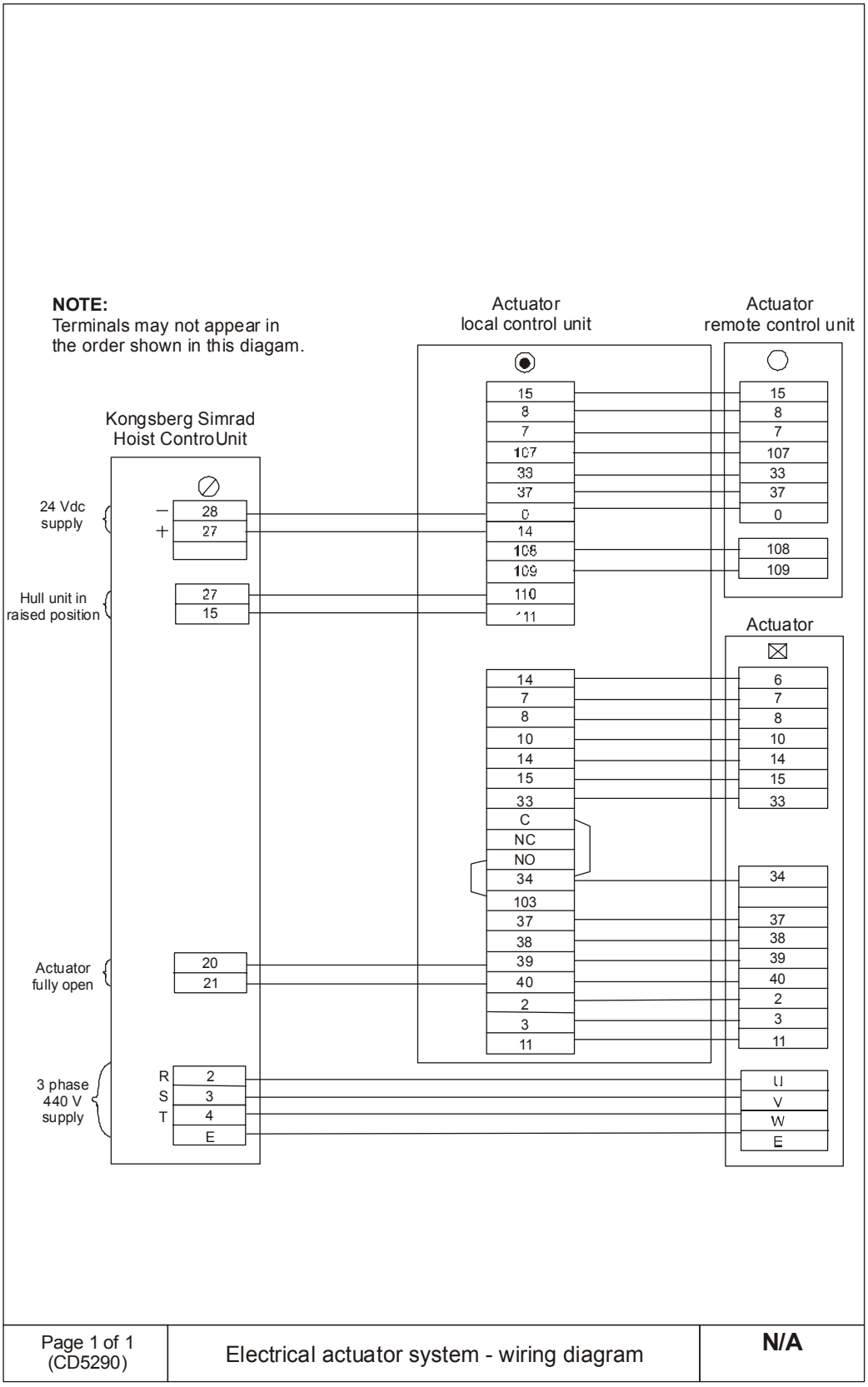
Page 1 of 1 (CD3102B)	Transducer cable connections HiPAP 500 Hull Unit	**824-109091** Rev.B



Page 1 of 1 (CD5632)	HiPAP 350 Transducer cables - connectors	**N/A**



Page 1 of 1 (CD6255)	Actuator control panel	**0107C2393** Rev.12.07.01



Page 1 of 1 (CD5290)	Electrical actuator system - wiring diagram	**N/A**

12 MAIN INDEX

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Kongsberg Simrad HiPAP hull units
Instruction manual

Kongsberg Simrad HiPAP hull units
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