Science Equipment Operations Manual

Project Name: MBARI
Shipyard: Freire S.A.
Vessel Name: David Packard

MacGregor Ref: 4/10070
Date of Issue: 12/10/2023
Revised: 05/02/2025

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Revision history

Rev.	Date (dd.mm.yyyy)	Reason to issue	Prepared	Checked	Approved
5	05.02.2025	Updated electrical	EXTMV	GR	GR
4	13.01.2025	Added Radio Controls and ROV OHC Calibration	EXTMV	GR	GR
3	12.04.2024	Added As Built and Pentagon 7seas	EXTMV	FFA	FFA
2	10.01.024	Update Content	EXTMV	FFA	FFA
1	02.02.2023	First Issue	EXTMV	HD	HD

Section 1

Personnel Safety Precautions

DESCRIPTION	DOC/DRW #	REV #	PAG #
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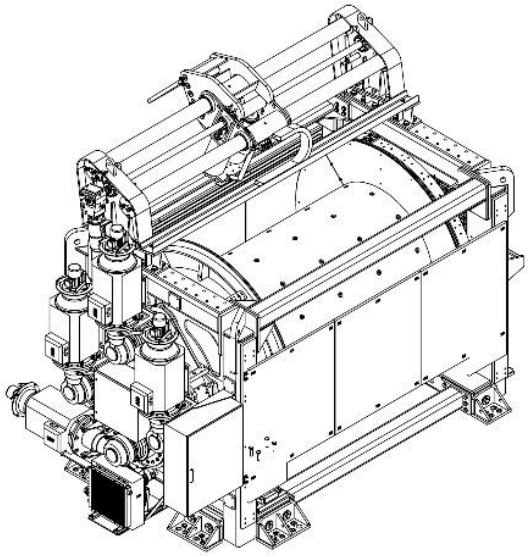
PERSONNEL SAFETY PRECAUTIONS



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WARNING

THIS PRODUCT MUST BE USED IN ACCORDANCE WITH MACGREGOR BODØ INSTRUCTIONS AND LIMITATIONS AND APPLICABLE INDUSTRY STANDARDS. FAILURE TO FOLLOW THESE INSTRUCTIONS AND LIMITATIONS COULD RESULT IN EQUIPMENT MALFUNCTION, PROPERTY DAMAGE, SERIOUS INJURY OR DEATH.

General

OPERATION AND MAINTENACE OF THE WINCH SYSTEM SHALL BE EXECUTED IN ACCORCANCE WITH REQUIREMENTS OF THIS INSTRUCTION AND WITH VESSEL SAFETY REGULATIONS.

THE DECK MACHINERY MUST BE OPERATED BY QUALIFIED PERSONNEL THAT HAVE STUDIED THE DOCUMENTATION, INSTRUCTIONS AND REQUIREMENTS.

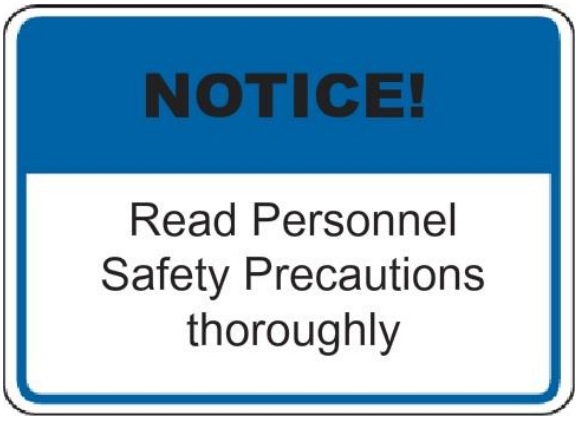
NEGLIGENCE OF OPERATIONS AND LIMITATIONS SPECIFIED IN THIS INSTRUCTION CAN CAUSE FAILURE OF EQUIPMENT, DAMAGE OF PROPERTY OR INJURY OF PERSONNEL.

Introduction

Typical sources of danger for personnel during operation and maintenance of winches are:

- Rotation of drums
- Level wind screws (where applicable)
- Warping heads and lifters of anchor winches
- Tension of ropes
- High voltage in electric equipment
- High pressure in hydraulic equipment
- Remote operated winches

When working with these topics is in general a high level of attention recommended. In addition, routine maintenance will decrease the possibility of malfunction and failure of the deck machinery, which can be a source of danger for personnel safety.



Working with winches and rotating machinery

Working with winches and rotating machinery such as warping heads and capstans involves health and safety risks and requires a high level of attention. For safety reasons please note the following:

- Never place any part of your body into running machinery.
- Never wear jewelry or loose-fitted clothing when working around winches and rotating machinery as it can attach to the rotating or moving components. Personnel with long hair are recommended to tie the hair back or use hair nets.
- Personnel wearing gloves around rotating or moving parts must be aware the risk of injuries if a glove gets trapped in rotating or moving components.
- Use of protective eyewear is recommended.
- MacGregor Bodø deck machinery will not normally require use of hearing protection. However, use of hearing protection must be considered together with use of other deck machinery.
- When using Portable Remote control panels, operators must make sure they are located in a secure place.
- Operators must know where the Emergency Stop buttons are located.
- Control and test of the equipment before operating is advised.

As a vessel deck may contain several types of deck machinery from various suppliers, MacGregor Bodø's deck machinery must be included in a complete safety analysis. A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.

Working with wire ropes

Working with wires ropes connected to winches and rotating machinery involves health and safety risks. For safety reasons please note the following:

- It is highly recommended that during winch and equipment operations, only necessary personnel to be allowed on restricted area. Restricted area to be defined by ship management.
- Keep away from hanging loads and overhead equipment.
- Personnel must pay special attention when working with and around wire ropes as it may come under tension suddenly.
- Never stand across a wire rope.
- Always keep out of the line of force of any load.
- Personnel should not stand in the bight of a rope at any time.
- Avoid crossing wire ropes. If this is necessary, one must pay special attention when crossing.
- Wires ropes under tension can part. Personnel must therefore ensure that they stand in a position of safety away from where a line may snap back if it parts.
- Use of protective eyewear is recommended.
- Gloves should always be used when handling wire ropes due to the possibility of hand injuries arising from broken wires. However, personnel wearing gloves must be aware the risk of injuries if a glove gets trapped within ropes wires (particularly on drum ends).
- Use of jewelry or loose-fitted clothing when working with ropes/wires is not recommended.

A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.
More information about this topic can be found in MacGregor Bodø's "Guidance for Wire Rope Spooling".

Working with hydraulic systems

Hydraulic systems often store hot and pressurized fluid. For safety reasons please note the following:

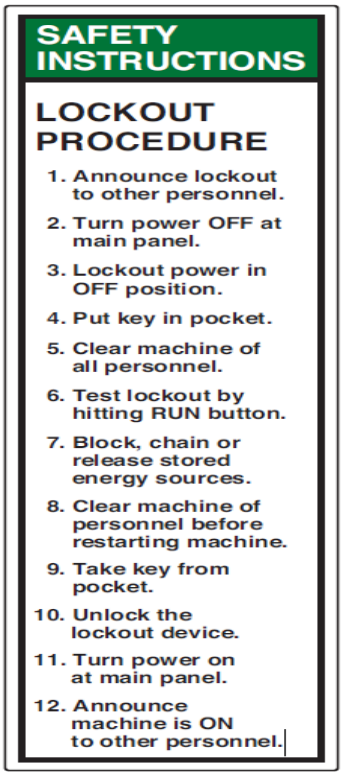
- All maintenance and repair of hydraulic systems can only be carried out by qualified personnel.
- Personnel are exposed to 3 kinds of hazards:
  - Burns from hot, high-pressure fluid.
  - Bruises, cuts or abrasions from failing hydraulic lines.
  - Injections of fluid into the skin.
- Before work: Review the Material Safety Data Sheets for all chemicals used. Know location of emergency shower, eyewash station and other first aid equipment.
- During work: Always use protection goggles, chemical-resistant gloves and solid workwear.
- After work: Cleanse and wash affected skin and apply moisturizing cream. Immediately change and wash affected workwear.
- Never use bare fingers or hands to find leaks in the hydraulic system. Pinhole leaks in the hydraulic system can cause a jet of hydraulic fluid that easily can penetrate the skin and cause severe internal damage to the body.
- Hydraulic systems can contain high pressure even when switched off. One must therefore always assure that pressure in the hydraulic system is released before disassembly of hydraulic components. Be aware that hydraulic supply can come from more than one hydraulic power unit.
- Use extreme caution when disconnecting hydraulic components and lines as hot hydraulic oil can cause severe burns to the body.
- It is forbidden to tighten connections when hydraulic pumps are running (mainly to prevent oil leakage).
- Pump room can be a zone with high level of noise, it is therefore recommended to use ear protection inside pump rooms.
- If hydraulic fluid is spilled it must be cleaned up immediately.
- Hydraulic systems under maintenance and repair should be locked and tagged according to a Lock-out/Tag-out procedure.

As a vessel may contain several types of hydraulic systems from various suppliers and with different pressure levels, Macgregor Bodø's deck machinery and its hydraulic components must be included in a complete safety analysis. A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.

Working with electric systems

Electricity is a very potent energy form and if used carelessly it can cause severe injury to the human body. For safety reasons please note the following:

- All maintenance and repair of electric systems can only be carried out by qualified personnel.
- Qualification and personal protection needed for working on electric systems are dependent on which voltage level the system has.
- Electric systems can contain high voltage even when switched off.
- Make sure that the electric system is switched off and de-energized before disassembly of electric components.
- ***NOTICE,** Main boards usually have main power and heating which comes from separate circuits. The same applies to I / O circuit boxes and panels that can contain both 230VAC and 24VDC.Starter controls panels may have control power supply from separated starter cabinets.
- Do not wear conductive articles like jewelry, clothing, watches etc. when working with or near electric systems.
- Use of protective eyewear is recommended.
- Protective gloves made of rubber or leather is recommended although it can make work with electric components and equipment harder.
- Only use insulated tools when working with or near electric systems.
- Fuses or safety breakers must not be replaced or reset until it is determined that a circuit is safe to operate.
- Do not bypass any protective system or device designed to protect employees from contact with electrical energy.
- Water and other conductive fluids are electric components worst enemy and can damage or reduce service life to electric components and subsequently make a threat for personnel.
- Electric systems under maintenance and repair should be locked and tagged according to a Lock-out/Tag-out procedure.



As a vessel may contain several types of electric systems from various suppliers and with different voltage levels, MacGregor Bodø's deck machinery and its electric components must be included in a complete safety analysis. A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.

← Example of Lockout procedure.

Maintenance and machinery control

A routine periodic maintenance is important in order to decrease the personnel safety risk. The periodic maintenance will reduce the possibility for malfunctions or breakage on the equipment which will secure operators and personnel working on deck or close to machinery.

The most basic maintenance is performed by operators on a daily basis and is normally a visual control of the system.

A daily visual check/inspection should include the following:

- Mechanical system
  - Check for cracks or other damage in load-carrying structures.
  - Check for loose bolt and screw connections and bolt locks for defects.
  - Check wire ropes, shackles and other lifting or pulling equipment for defects and make sure they are in good working conditions.
  - Check brake parts for damage or defect, and brake lining for excessive wear.
- Hydraulic system
  - Check oil level and oil color in oil tank(s) and oil level in level glass on winch drive units (where applicable).
  - Check for hydraulic oil leaks, especially around couplings, hose and pipe connections, oil tanks and hydraulic power units.
- Electric system
  - Check electric cables and components for damages.
  - Check fuses.

During operation of winches and deck machinery it is necessary to pay attention to the condition of the machinery and deck equipment.
If any of the following occurs, operations must be stopped immediately:

- Malfunctions in control.
- Unusual sounds.
- Unusual working movements.
- Unusual observations and occurrences.
- Leakages in the hydraulic system.
- Overheating of hydraulic oil and electric components.
- Blown fuses.

More information about maintenance can be found in Macgregor Bodø's "MAINTENANCE GUIDELINES FOR MACGREGOR BODØ HYDRAULIC DECK MACHINERY"

Personnel Safety Precautions

CRANES

MACGREGOR

Rev.	Date	Reason for issue	Prepared	Checked	Approved
03	15.03.2022	Removed table and added text	ÅS		
02	03.03.2022	Added text and table	ÅS		
01	24.02.2022	Printed	ÅS		

Personnel Safety Precautions for Cranes

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General

OPERATION AND MAINTENACE OF THE CRANE SYSTEM SHALL BE EXECUTED IN ACCORCANCE WITH REQUIREMENTS OF THIS INSTRUCTION AND WITH VESSEL SAFETY REGULATIONS.

THE DECK MACHINERY MUST BE OPERATED BY QUALIFIED PERSONNEL THAT HAVE STUDIED THE DOCUMENTATION, INSTRUCTIONS AND REQUIREMENTS.

NEGLIGENCE OF OPERATIONS AND LIMITATIONS SPECIFIED IN THIS INSTRUCTION CAN CAUSE FAILURE OF EQUIPMENT, DAMAGE OF PROPERTY OR INJURY OF PERSONNEL.

Introduction

Typical sources of danger for personnel during operation and maintenance of cranes are:

- Hanging load
- Overload
- Tension of ropes
- High voltage in electric equipment
- High pressure in hydraulic equipment
- OIl leaks and oil spill
- Remote operated cranes
- Electric power lines
- High wind speed
- Heel + trim of crane above specified limit.
- Movements out of control
- Loose parts on crane
- Bearing structures, additional equipment, with cracks or any damage.

When working with these topics is in general a high level of attention recommended. In addition, routine maintenance will decrease the possibility of malfunction and failure of the deck machinery, which can be a source of danger for personnel safety.

GENERAL SAFETY INFORMATION

Operation only by trained/qualified personnel that have studied the documentation, instructions and requirements.
Safety devices not to be tampered with.
Prescribed safe distances to be maintained.
Safe distances from electric power lines to be maintained.
Be alert to faults during crane operation.
Do not operate the crane when the wessel's heel + trim is higher than maximum designed value. (Ref: dimension sketch)
Do not operate the crane when wind speed makes it indefensible.

SAFETY FOR USE OF CRANE.

Operating of the cranes requires skill, ability and experience.

Therefore only entrust persons with the operation of the cranes:

1. Who are physically and mentally suitable for this (not tired, and not under influence of alcohol, drugs or medication).
2. Who handle the crane responsibly and reliably.
3. Who have the right qualifications (training, crane operator's license).
4. Who can prove that they have been instructed on how to operate the unit described here and who are familiar with the content of these operation instructions. This also applies to the operating instructions for ancillary equipment used on the crane.

OPERATORS DUTIES AND RESPONSIBILITIES

1. Duties: The operator should carry out the following duties: crane (enabling the power circuits, operating the machine, etc.); assembling/disassembling the optional parts (grab, hook, etc.); servicing the machine, he should therefore perfectly know the safety rules and the relevant devices installed for this purpose, the usage of the commands of handling and the techniques of loads slinging.

2. Leaving control valve or radio control with hanging load in crane is prohibited .

3. Responsibilities: The operator is directly responsible for every action he takes within the above mentioned duties.

ACTIONS AT ERROR

If you notice the following injuries or disorders of the CRANE / A-FRAME and accessories, Operation must be stopped immediately.

- Damage or cracks on the supporting components
- Defect bearings
- Defect on the hydraulic system or safety devices.
- Loose screw connections.
- Inadequate secured bolt connections.
- Leakages in the hydraulic components or the connection of these.
- Unusual sounds.
- Unusual fast or slow working movements.
- Malfunctions in control.
- Unusual high heating of the hydraulic components.

With these injuries, it may no longer be guaranteed a safe CRANE operation.
There is an acute accident and mortal danger.

DAILY VISUAL INSPECTION

Check:

-
- Coupling, hose connections and elements of the hydraulic system for damage or hydraulic oil leaks.
- Oil leakage can cause accident and pollute the environment
- Tension of the bolt and screw connections.
- Bolt locks for defects
- The radio/valve controls move easily and sets back by itself.
- Bearing structures, additional equipment, for cracks or any damage.
- When laser measurement are used, these must be checked for external damage before use. Functional tests must be performed without load before use.
- Check that the emergency stop works as expected.
- Check radio control for damage/defects.

When you discover such defects, CRANE shall not be used.

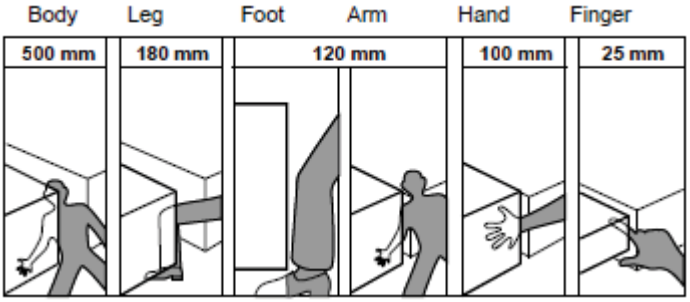
If your crane is equipped with safety devices such as an emergency CUT-OFF, an overload protection system or a rope winch limit stop, always carry out a function test on them before operation.

The winch must not be manipulated to drive at a speed higher than max. speed specified by winch supplier.

If the safety devices do not work or is manipulated, operation of the crane is strictly prohibited.

AVOID DANGER OF CRUSHING

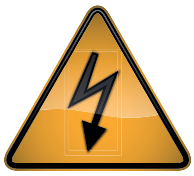
Avoid operating situations in which there is a risk of you or bystanders being crushed by the crane, or load.
The crush point is not regarded as a danger point for the body parts stated if the safety distances highlighted below are complied with and it is ensured that the next-biggest body part cannot penetrate. Required minimum distances:



If the distances are not complied with there is danger of injury and even death.

LOADING

- Use the deck crane only to hoist the load and never break, hit, pull (towing) load, press and run against fixed obstacles or towing.
- Do not lift the load higher than necessary for moving in the work area.
- Transport of people are only allowed in the special personnel basket which is designed for this purpose.
- The specific regulations in each country shall be complied.
- Lift the load of center of gravity. Secure the load against slippage.
- Using the deck crane, grab the control stick and press it firmly until the deck crane responds.
- Then, through slow and steady pushing the control stick to speed up the deck crane function.
- Move the lifted load so that this does not violate the deck crane or other obstacles
- Loading should only be hung and removed by complete standstill of the deck crane.
- Make sure the person hanging on or taking off the load is no longer in the danger area before moving the load arm.
- Do not run the deck crane at full operating speed to estimates, this increases wear and shortens life of the deck crane.
- Do not run the deck crane at full working speed to the end, this increases wear and shortens the life of the deck crane.
- Use approved lifting straps / chains with a higher strength than the weight of the load.



Keep distance from power lines

Keep the required minimum distances away from power lines. If this is not possible because of the particular work being carried out the lines must be disconnected (switched off).
The appearance and height of electric power lines gives no indication of their voltage.
In the case of lines where the voltage is not known a distance of at least 5 metres between the crane and the line must be maintained. This also applies to all load lifting gear and ancillary equipment attached to the crane.
Take into account that in a wind a power line can sway out or the load arm of the crane can be caused to swing by sudden movements (also upwards). Even unintentional approaching can lead to flashover. Flashover can occur even on just approaching a power line.

This entails the risk of fatal injury for the crane operator and auxiliary personnel.

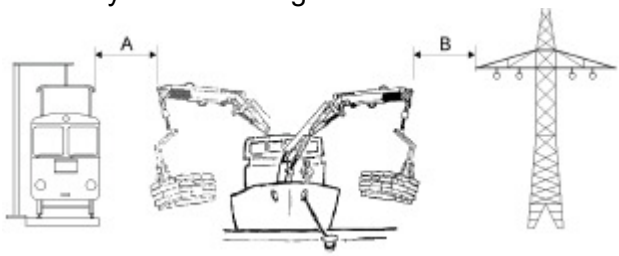
Safe distances from electric power lines

For overhead power lines and contact lines of electric railways the following minimum distances apply:

A

= DC
up to ..... à 1.500 V ..... 1,0 m
over ..... à 1.500 V ..... 1,5 m

~ AC
up to ..... à 1.000 V ..... 1,0 m
over ..... à 1.000 V ..... 1,5 m



B

up to ..... 1.000 V ..... 1,0 m
1.000 ..... 110.000 V ..... 3,0 m
110.000 ..... 220.000 V ..... 4,0 m
220.000 ..... 380.000 V ..... 5,0 m
unknown voltage ..... 5,0 m

Please observe the following in connection with load lifting gear:

The weights of the load lifting gear and accessory equipment count as part of the load.
The load lifting gear must be matched to the crane in terms of size and lifting capacity.
A type plate must be attached to the load lifting gear showing details such as manufacturer, type designation, manufacture number, weight, operating pressure, capacity, maximum permissible lifting capacity and year of manufacture.
The maximum lifting capacity of your crane is always determined by the weakest unit of load lifting gear used.
Please therefore always observe the lifting capacities stated on the load lifting gear.
Familiarize yourself with the content of the operating instructions of the respective load carrying equipments.

Hook:

On your crane only use certified load hooks which match your crane and the load to be lifted.
The lifting capacity of the load hook and the shackle must correspond to the maximum lifting capacity of the crane.
Fasten and secure the load hook properly.
Ensure that the safety catch closes again by spring pressure after the load has been hooked.

Safety Instructions radio controller

- The radio system serves to control machines and for data transfer. Observe the job safety and accident prevention.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved by the manufacturer for these uses.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The radio control system safety devices must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete E-STOP system are impermissible.

Working with hydraulic systems

Hydraulic systems often store hot and pressurized fluid. For safety reasons please note the following:

- All maintenance and repair of hydraulic systems can only be carried out by qualified personnel.
- Personnel are exposed to 3 kinds of hazards:

  o Burns from hot, high-pressure fluid.
  o Bruises, cuts or abrasions from failing hydraulic lines.
  o Injections of fluid into the skin.

- Before work: Review the Material Safety Data Sheets for all chemicals used. Know location of emergency shower, eyewash station and other first aid equipment.
- During work: Always use protection goggles, chemical-resistant gloves and solid workwear.
- After work: Cleanse and wash affected skin and apply moisturizing cream. Immediately change and wash affected workwear.
- Never use bare fingers or hands to find leaks in the hydraulic system. Pinhole leaks in the hydraulic system can cause a jet of hydraulic fluid that easily can penetrate the skin and cause severe internal damage to the body.
- Hydraulic systems can contain high pressure even when switched off. One must therefore always assure that pressure in the hydraulic system is released before disassembly of hydraulic components. Be aware that hydraulic supply can come from more than one hydraulic power unit.
- Use extreme caution when disconnecting hydraulic components and lines as hot hydraulic oil can cause severe burns to the body.
- It is forbidden to tighten connections when hydraulic pumps are running (mainly to prevent oil leakage).
- Pump room can be a zone with high level of noise, it is therefore recommended to use ear protection inside pump rooms.
- If hydraulic fluid is spilled it must be cleaned up immediately.
- Hydraulic systems under maintenance and repair should be locked and tagged according to a Lock-out/Tag-out procedure.

As a vessel may contain several types of hydraulic systems from various suppliers and with different pressure levels, Macgregor deck machinery and its hydraulic components must be included in a complete safety analysis. A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.

Working with electric systems

Electricity is a very potent energy form and if used carelessly it can cause severe injury to the human body. For safety reasons please note the following:

- All maintenance and repair of electric systems can only be carried out by qualified personnel.
- Qualification and personal protection needed for working on electric systems are dependent on which voltage level the system has.
- Electric systems can contain high voltage even when switched off.
- Make sure that the electric system is switched off and de-energized before disassembly of
- electric components.
- *NOTICE, Main boards usually have main power and heating which comes from separate circuit The same applies to I / O circuit boxes and panels that can contain both 230VAC and 24VDC. Starter controls panels may have control power supply from separated starter cabinets.
- Do not wear conductive articles like jewelry, clothing, watches etc. when working with or near electric systems.
- Use of protective eyewear is recommended.
- Protective gloves made of rubber or leather is recommended although it can make work with electric components and equipment harder.
- Only use insulated tools when working with or near electric systems.
- Fuses or safety breakers must not be replaced or reset until it is determined that a circuit is safe to operate.
- Do not bypass any protective system or device designed to protect employees from contact with electrical energy.
- Water and other conductive fluids are electric components worst enemy and can damage or reduce service life to electric components and subsequently make a threat for personnel.
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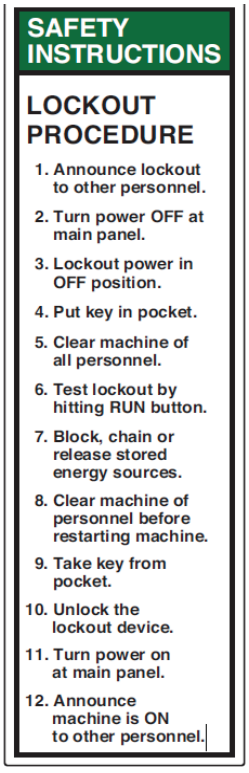

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suppliers and with different voltage levels, MacGregor Bodø's deck machinery and its electric components must be included in a complete
safety analysis. A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.

Example of Lockout procedure.

MACGREGOR

Designed to perform with the sea

Wherever needed, you can rely on our support.
We serve our products globally:

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- Allset
- ASCA
- Becker
- BMH
- Conver-OSR
- Grampian Hydraulics
- Flintstone
- Greer Marine
- Hamworthy
- Hatlapa
- Hydramarine
- Hägglunds
- Interschalt
- KGW
- KYB - ASCA
- KYB - Kayaba Industries / Navire Cargo Gear
- Luezhoe
- MacGregor
- MacGregor-Conver
- MacGregor-Hägglunds
- MacGregor-Kayaba
- MacGregor-Navire
- Navire Cargo Gear
- Nordströms
- Ozean Service & Reparatur
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- Plimsoll
- Pusnes
- Porsgrunn
- Rapp
- Triplex
- Vestnorsk Hydraulikkservice (VN

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Section 2

Handling, Installation, Storage & Transit

Installation Procedures

DESCRIPTION	DOC/DRW #	REV #	PAG #
ROV Overhead Crane	25479	D	3
A-Frame	25480	B	5
CTD Davit	25482	A	7

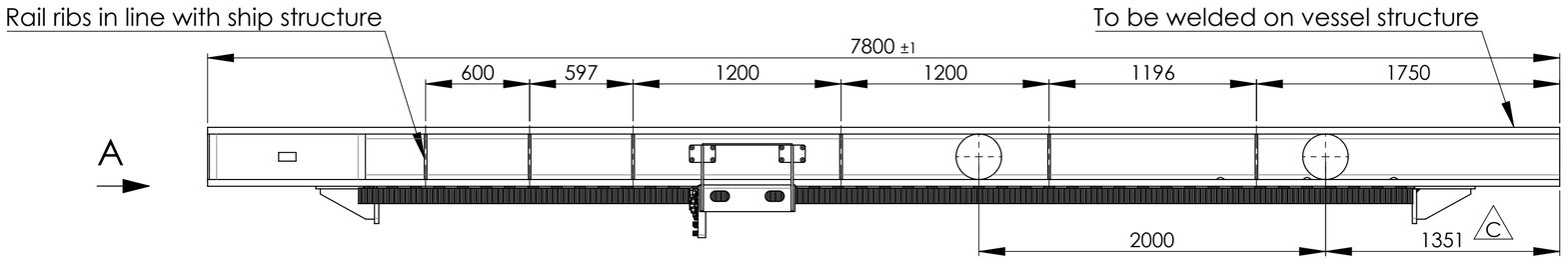
Lifting Arrangements

DESCRIPTION	DOC/DRW #	REV #	PAG #
CTD Winch	2000005765	A	9
Levelwind w/ Slack Wire Compensator	2000004325	A	10
A-Frame	A-Frame Lifting	1	11
CTD Davit	CTD Davit Lifting	1	12

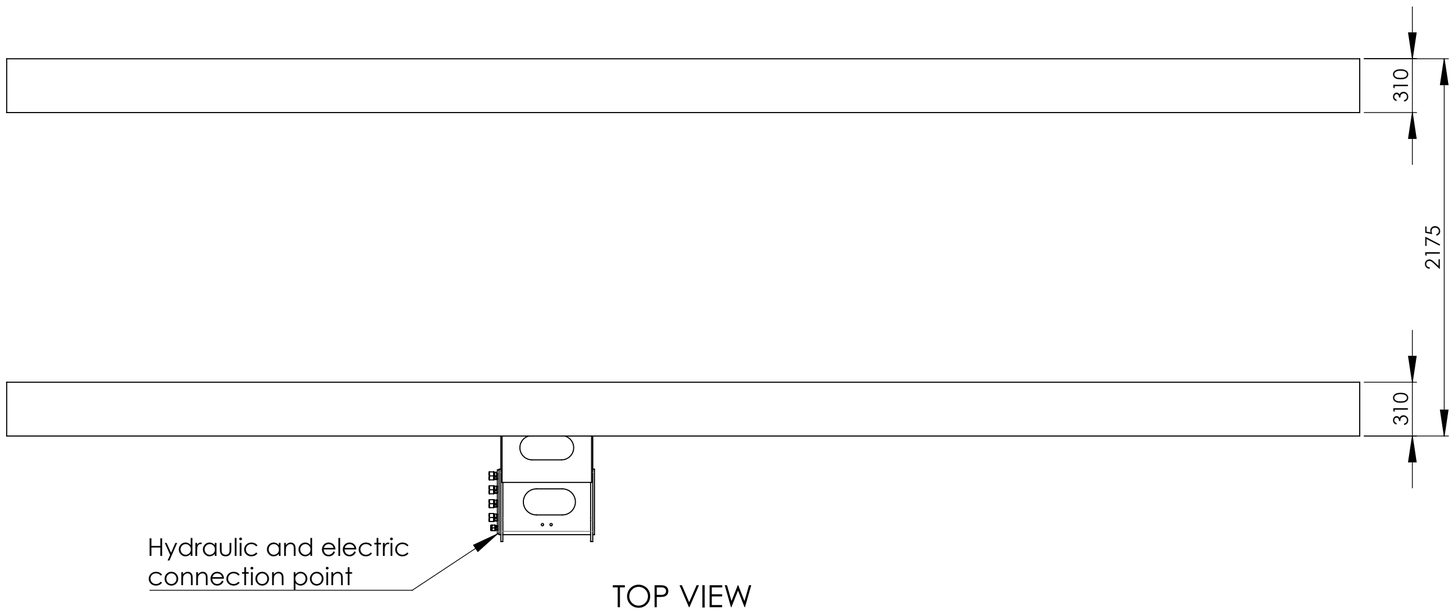
Hydraulic Connection Points

DESCRIPTION	DOC/DRW #	REV #	PAG #
CTD Winch	RH326078	A	13
Traction Winch	RH326075	0	14
Storage Drum	RH326077	0	15
Levelwind w/ Slack Wire Compensator	RH326076	0	16
ROV OHC Valve Central	24859	D	17
CTD Davit Valve Central	24820	C	18
A-Frame Valve Central	24821	D	19
HPU Brake	2000004113	A	20
HPU Gear Cooling	2000004110	A	21

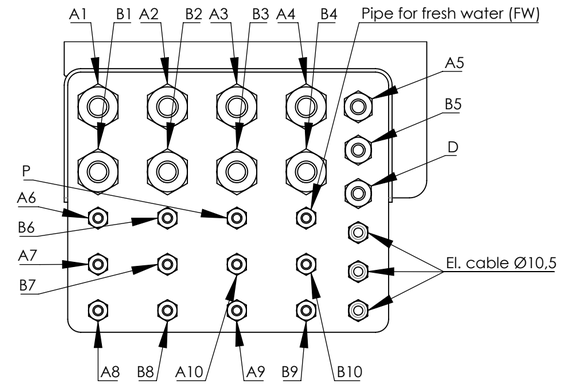
Hydraulic connection points		
Port	**Pipe dimensions**	**Thread dimensions in connection plate**
A1, B1, A2, B2, A3, B3, A4, B4	Ø25 x 2,5	G1"
A5, B5	Ø16 x 2	G1/2"
A6, B6, A7, B7, A8, B8, A9, B9, A10,B10, P, FW	Ø12 x 1,5	G3/8"
D	Ø18 x 2	M20X1,5



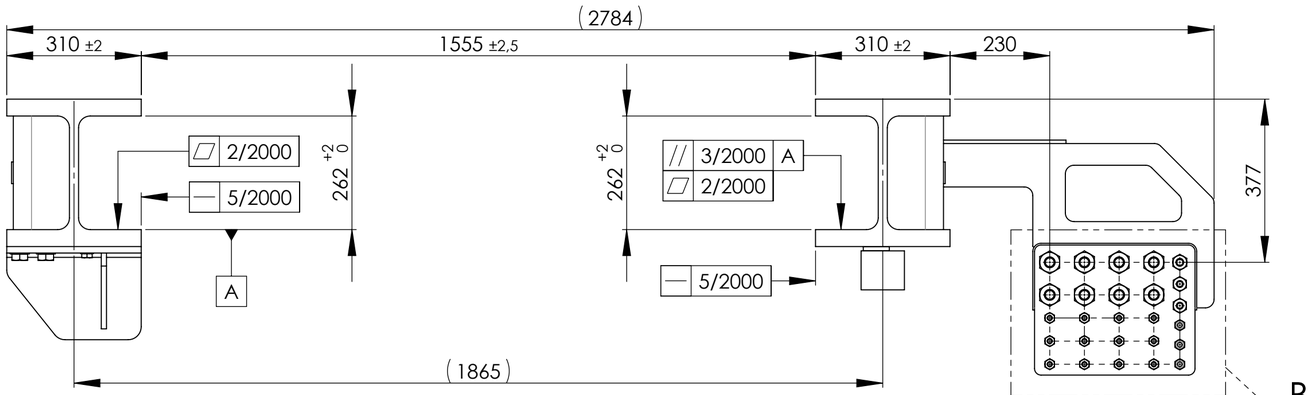
STARBOARD SIDE SEEN FROM FORE PORT SIDE



TOP VIEW



DETAIL B
SCALE 1 : 5



AFT SIDE FORE SIDE

VIEW A
SCALE 1 : 10

Reference dimension sketch: 20673

REV.	DESCRIPTION	DATE	APPROVED
REVISIONS			
D	Added new sheet for sheave installation	21/05/2023	SS
C	Changed distance of opening for service and assembling.	26.08.2022.	KJ
B	Updated Service holes position.	25.08.2022.	KJ
A	Released.	19.07.2022.	KJ

OVERHEAD CRANE
ROV LARS
INSTALLATION

MACGREGOR

Unspec. tolerances in compliance with	NS-ISO 2768 M
Scale	1:25
Projection	
Format	A2
MPS no.	
Drawing no.	25479
Revision	D
SHEET1 OF 2	
Weight (kg)	4268.2 Kg
Date	19.07.2022
Created by	KJ
Approved date	21/05/2023
Approved by	SS

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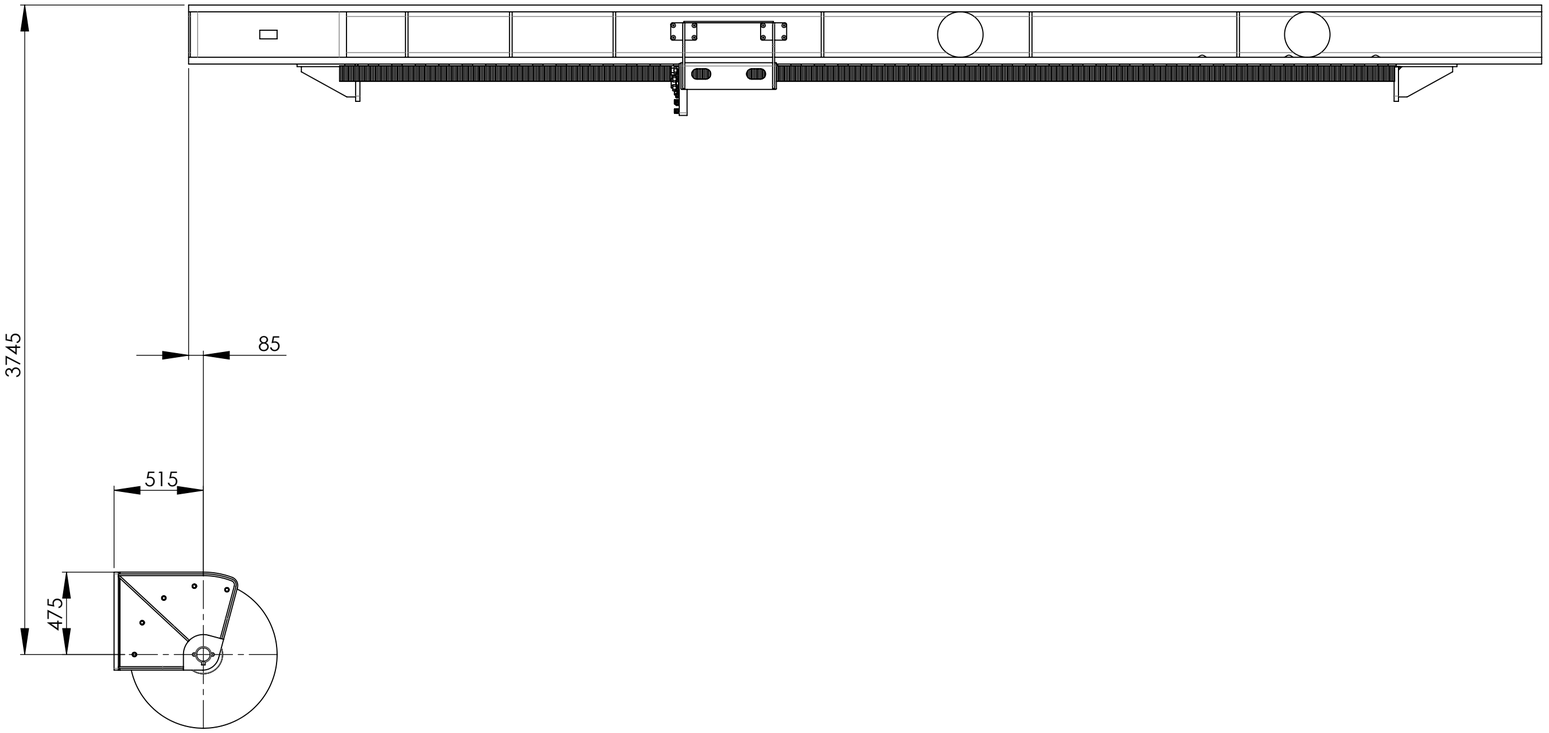

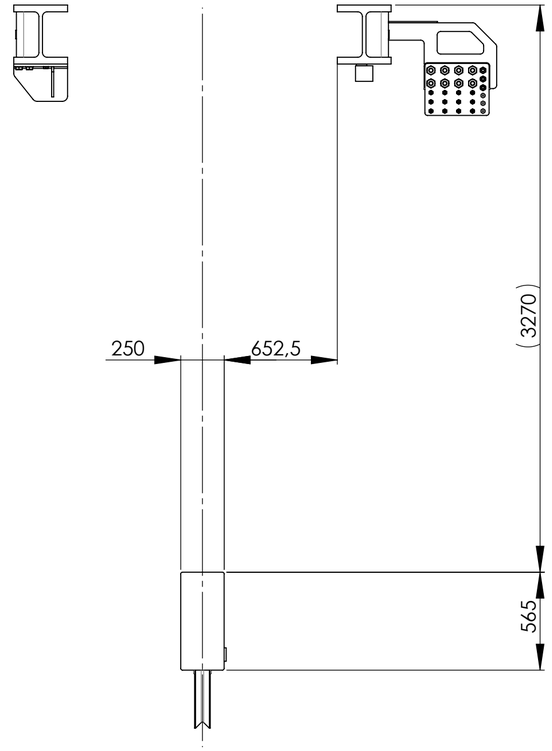

REV.	DESCRIPTION	DATE	APPROVED
D	Added new sheet for sheave installation	21/05/2023	SS
C	Changed distance of opening for service and assembling.	26.08.2022.	KJ
B	Updated Service holes position.	25.08.2022.	KJ
A	Released.	19.07.2022.	KJ

REVISIONS

OVERHEAD CRANE
ROV LARS
INSTALLATION

MACGREGOR

Unspec. tolerances in compliance with	NS-ISO 2768 M
Scale	1:25
Projection	
Format	A2
MPS no.	
Drawing no.	25479
Revision	D
SHEET2 OF 2	
Weight (kg)	4462.7 Kg
Date	19.07.2022
Created by	KJ
Approved date	21/05/2023
Approved by	SS

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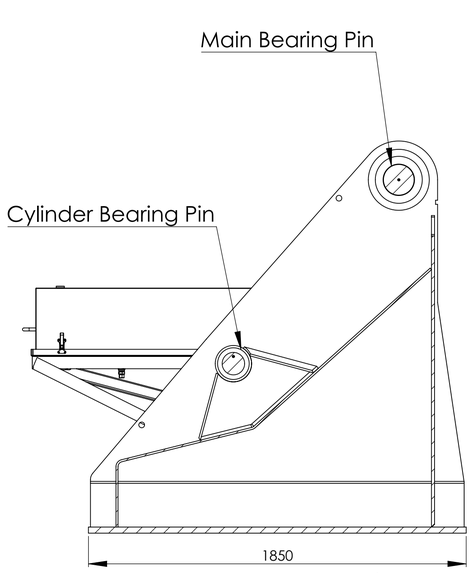
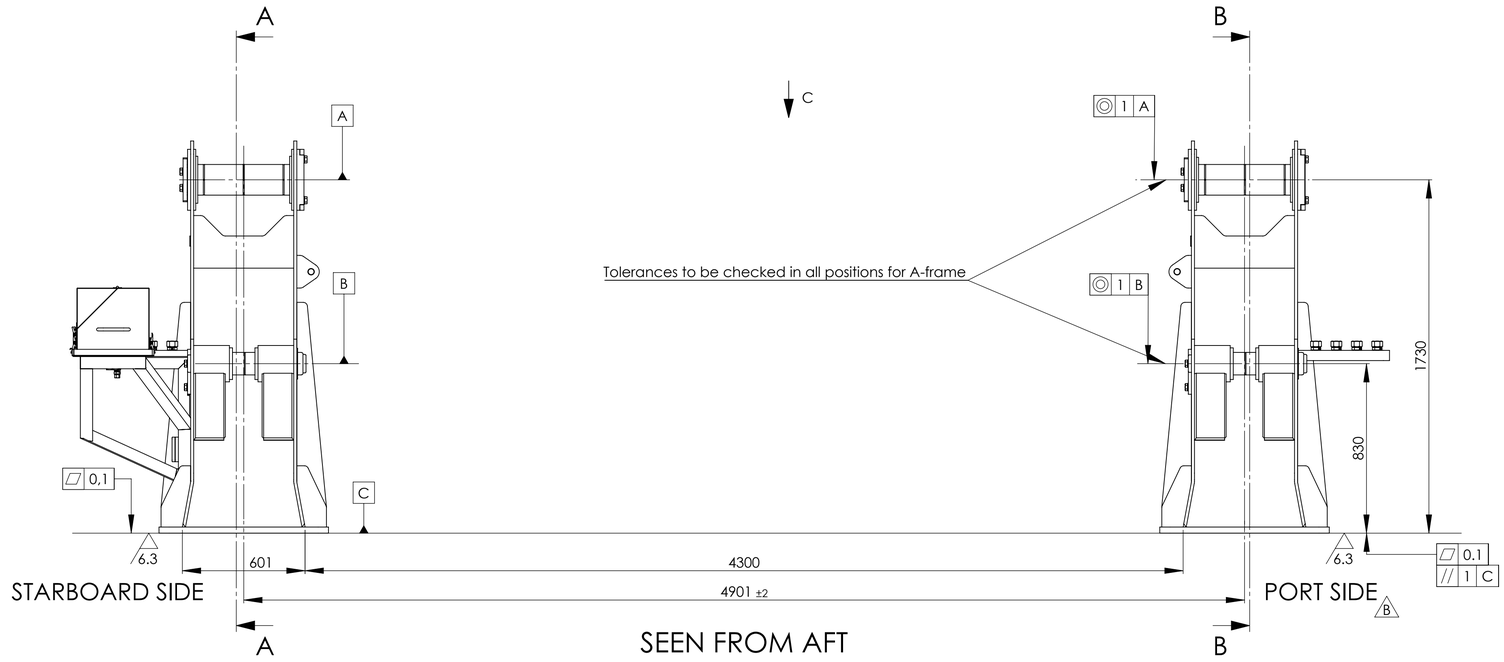


SECTION A-A B

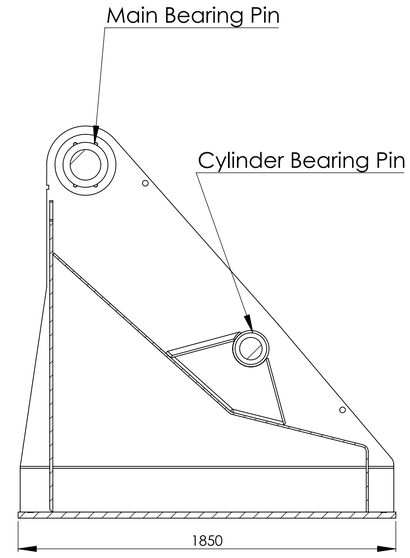


STARBOARD SIDE

PORT SIDE B

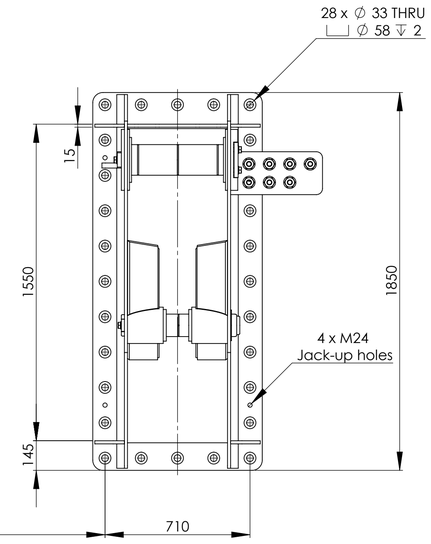
SEEN FROM AFT B

Tolerances to be checked in all positions for A-frame



SECTION B-B

VIEW C



TIGHTENING TORQUE			
SCREWS MARKED WITH: T. USE tightening torque. Torque Units [Nm]			
dim \ matr	**8.8**	**10.9**	**12.9**
M8	24	33	40
M10	47	65	79
M12	81	114	136
M16	197	277	333
M20	385	541	649
M24	665	935	1120
M27	961	1350	1620
M30	1310	1840	2210
M36	2280	3210	3850
Lubricate threads and flanges with MoSo2 or similar.			

REFERENCES	
Description	**Drawing no.**
Dimensional Sketch	20549
Valve Central	24821
Main hydraulic diagram	24854
Electrical diagram	E-4501

REV.	DESCRIPTION	DATE	APPROVED
B	Changed the view perspective annotation	24. 10. 2022.	BH
A	Released	10. 10. 2022.	BH

REVISIONS

FRAME
A-FRAME STERN
INSTALLATION

MACGREGOR

Unspec. tolerances in compliance with

Scale 1:15

Projection

Format A1

MPS no.

Drawing no. 25480

Revision B

SHEET1 OF 2

Weight (kg) Kg

Date

Created by

Approved date 12/01/2023

Approved by SS

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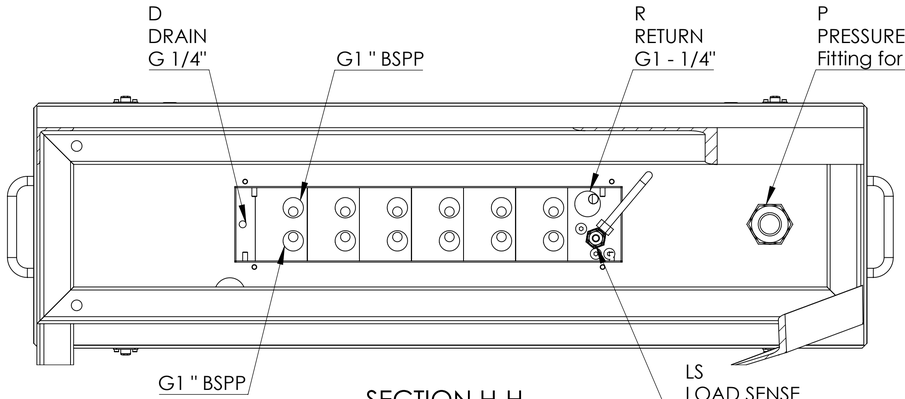
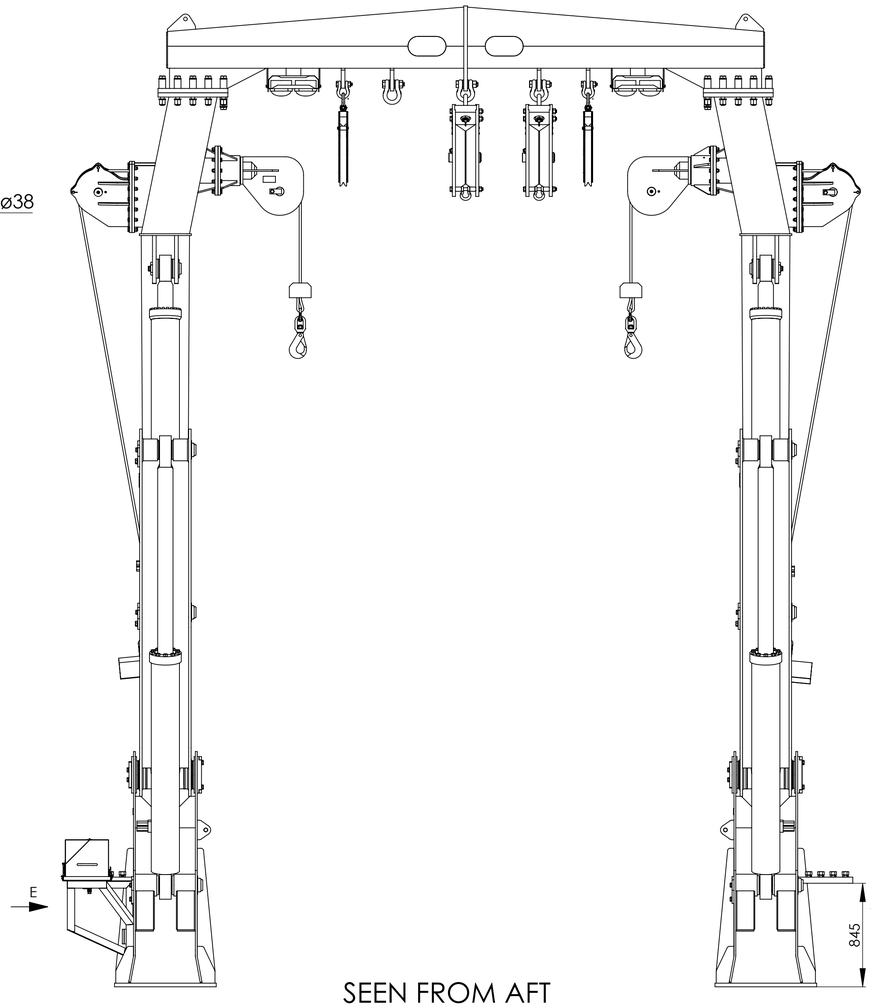
Hydraulic connection points		
Port	Pipe dimensions	Thread dimensions in connection plate
A,B	∅25x2,5	G1"

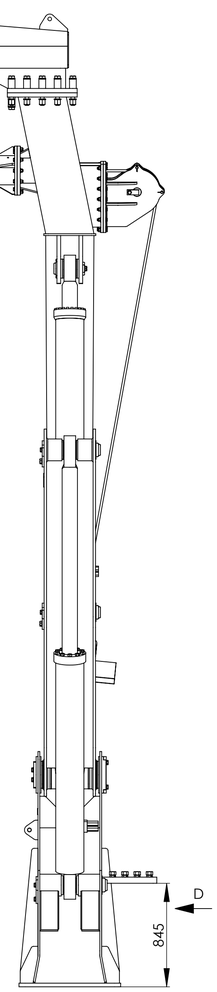


SECTION H-H
SCALE 1 : 10

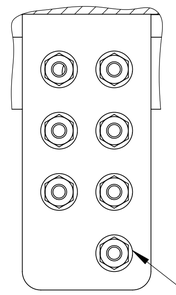


STARBOARD SIDE

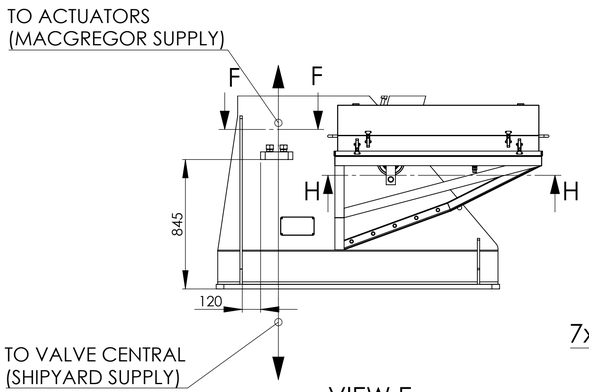
SEEN FROM AFT



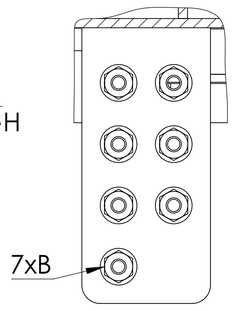
PORT SIDE



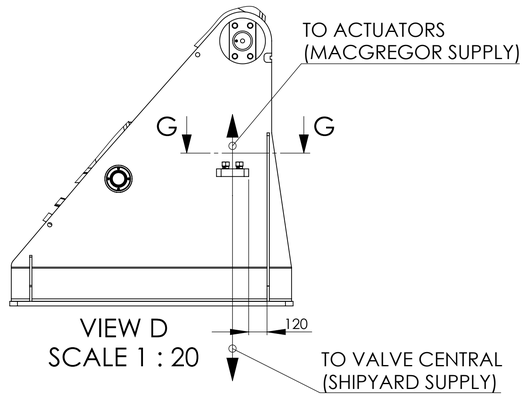
SECTION G-G
SCALE 1 : 5



VIEW E
SCALE 1 : 20



SECTION F-F
SCALE 1 : 5



VIEW D
SCALE 1 : 20

REV.	DESCRIPTION	DATE	APPROVED
B	Changed the view perspective annotation	24. 10. 2022.	BH
A	Released	10. 10. 2022.	BH

REVISIONS

FRAME
A-FRAME STERN
INSTALLATION

MACGREGOR

Unspec. tolerances in compliance with	Weight (kg) Kg
	Date
Scale 1:25 Projection	Created by
Format A1	Approved date 12/01/2023
MPS no.	Approved by SS
Drawing no. 25480	Revision B

SHEET2 OF 2

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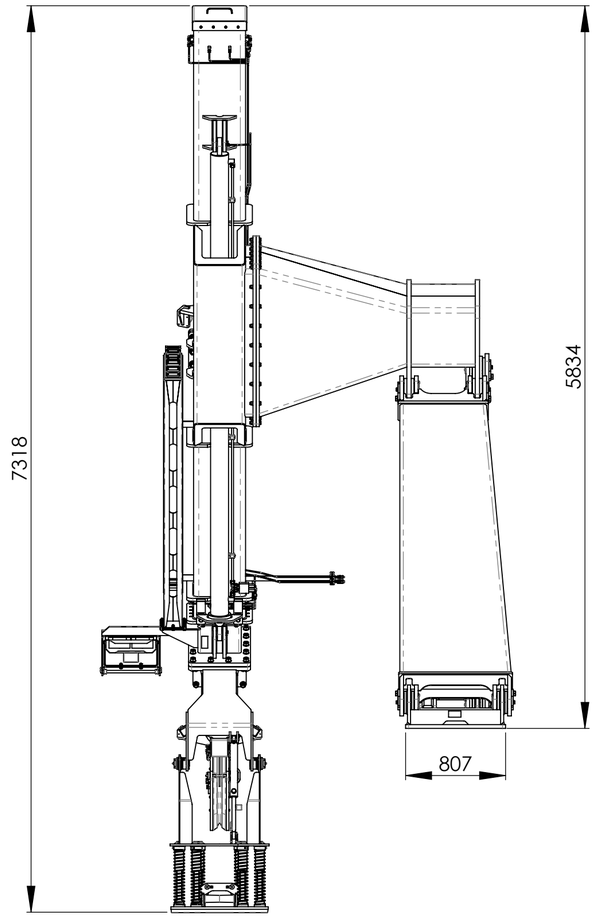
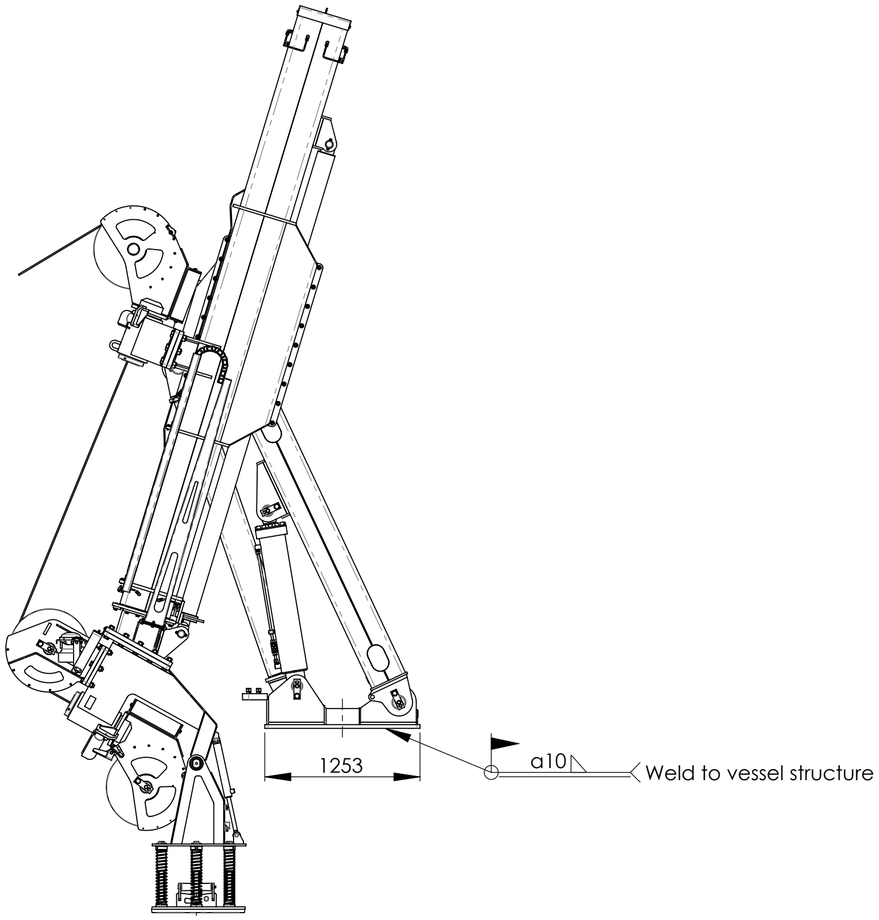
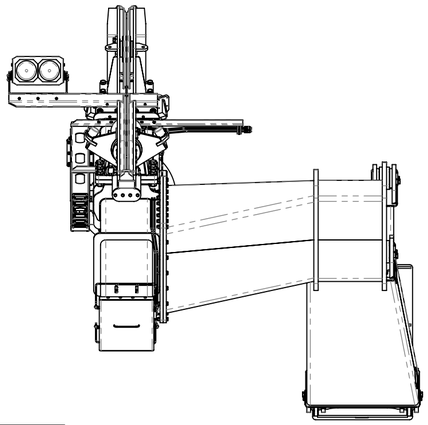


Seen from Starboard



Seen from AFT



Seen from above

REFERENCES	
Description	**Drawing no.**
Dimensional Sketch	20547
Valve Central	25331
Main hydraulic diagram	24856
Electrical diagram	E-4503
Note: Valve central is delivered separately and installed on the port side of the CTD DAVIT.	

REV.	DESCRIPTION	DATE	APPROVED
A	Released	10. 10. 2022.	BH

REVISIONS

DAVIT
CDT DAVIT
INSTALLATION

MACGREGOR

Unspec. tolerances in compliance with	
Weight (kg)	Kg
Date	10.10.2022
Scale 1:35	Projection
Created by	BH
Format A2	
Approved date	11/10/2022
MPS no.	
Approved by	HK
Drawing no. 25482	Revision A
SHEET1 OF 2	

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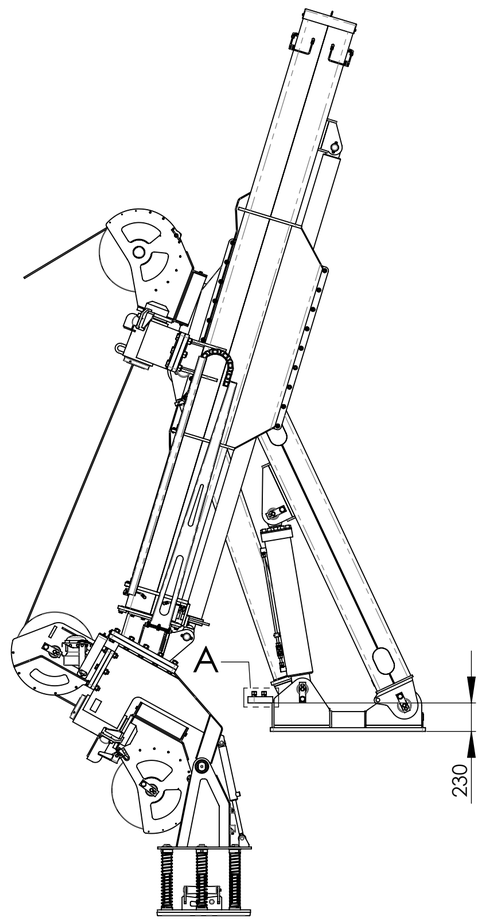
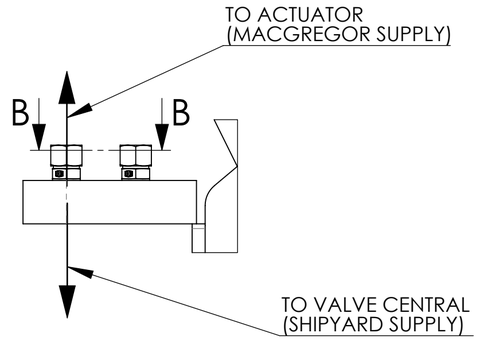
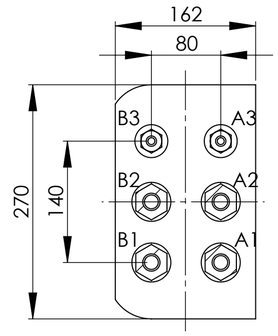
Hydraulic connections part		
Port	Pipe dimension	Thread dimension
A1,A2,B1,B2	∅20x2	G 3/4"
A3,B3	∅12x1.5	G 3/8"





DETAIL A
SCALE 1 : 5



SECTION B-B
SCALE 1 : 5

REV.	DESCRIPTION	DATE	APPROVED
A	Released	10. 10. 2022.	BH
REVISIONS			

DAVIT
CDT DAVIT
INSTALLATION

MACGREGOR

Unspec. tolerances in compliance with	
Weight (kg)	Kg
Date	10.10.2022
Scale 1:35 / Projection	Created by BH
Format A2	Approved date 11/10/2022
MPS no.	Approved by HK
Drawing no. 25482	Revision A

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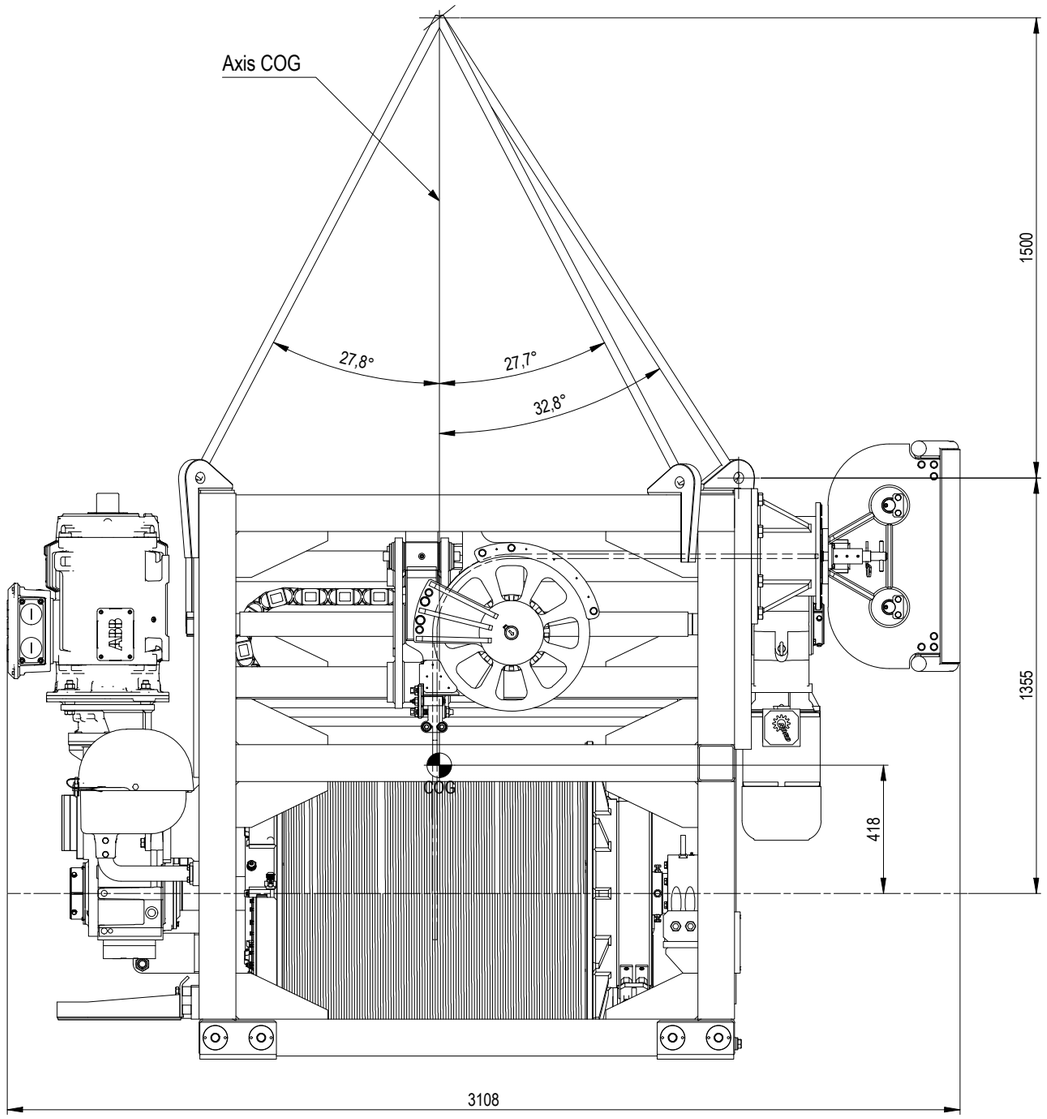
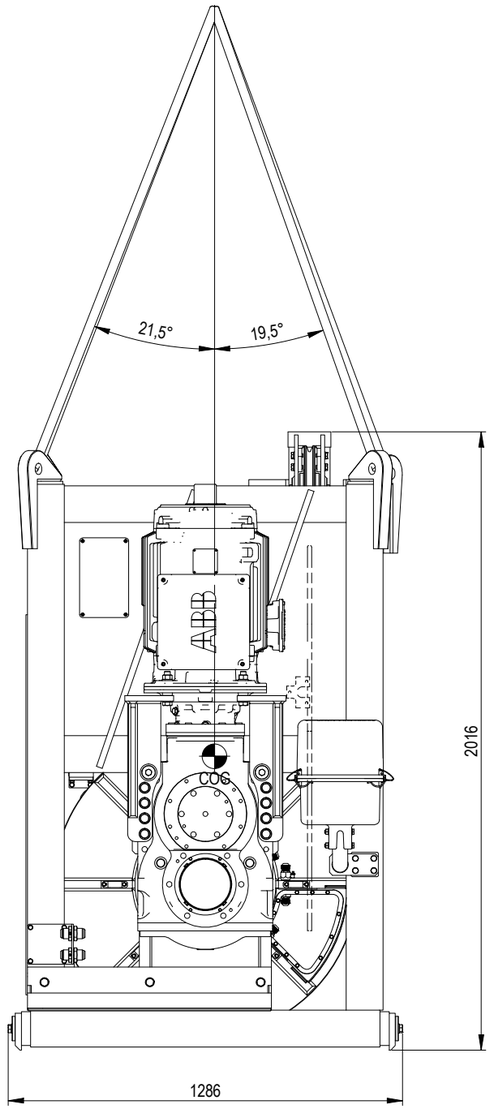
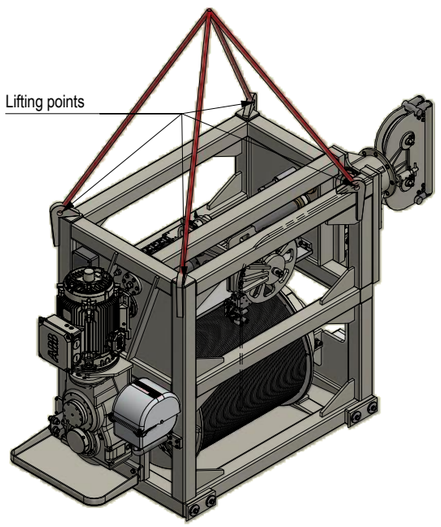
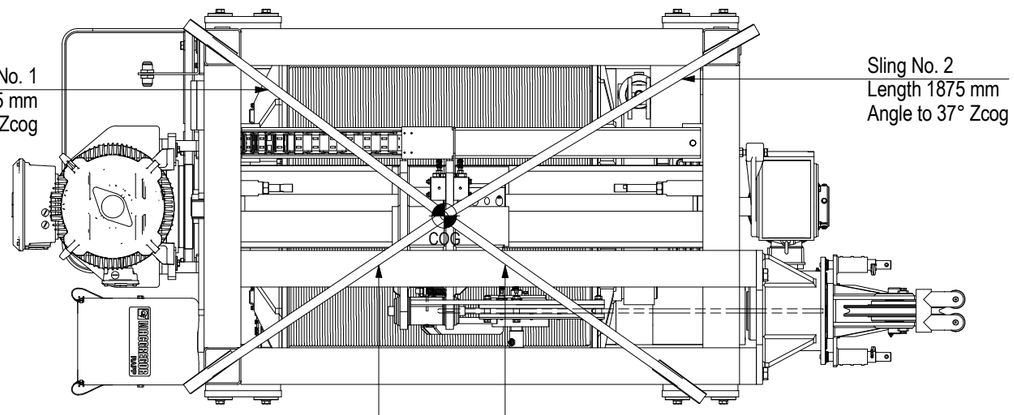
SHEET2 OF 2





ISO VIEW (1 : 40)





Designed by	Date	Modified by	ECO / CO			
P Pantovic	09.02.2022.	P Pantovic	ECO-2056698			

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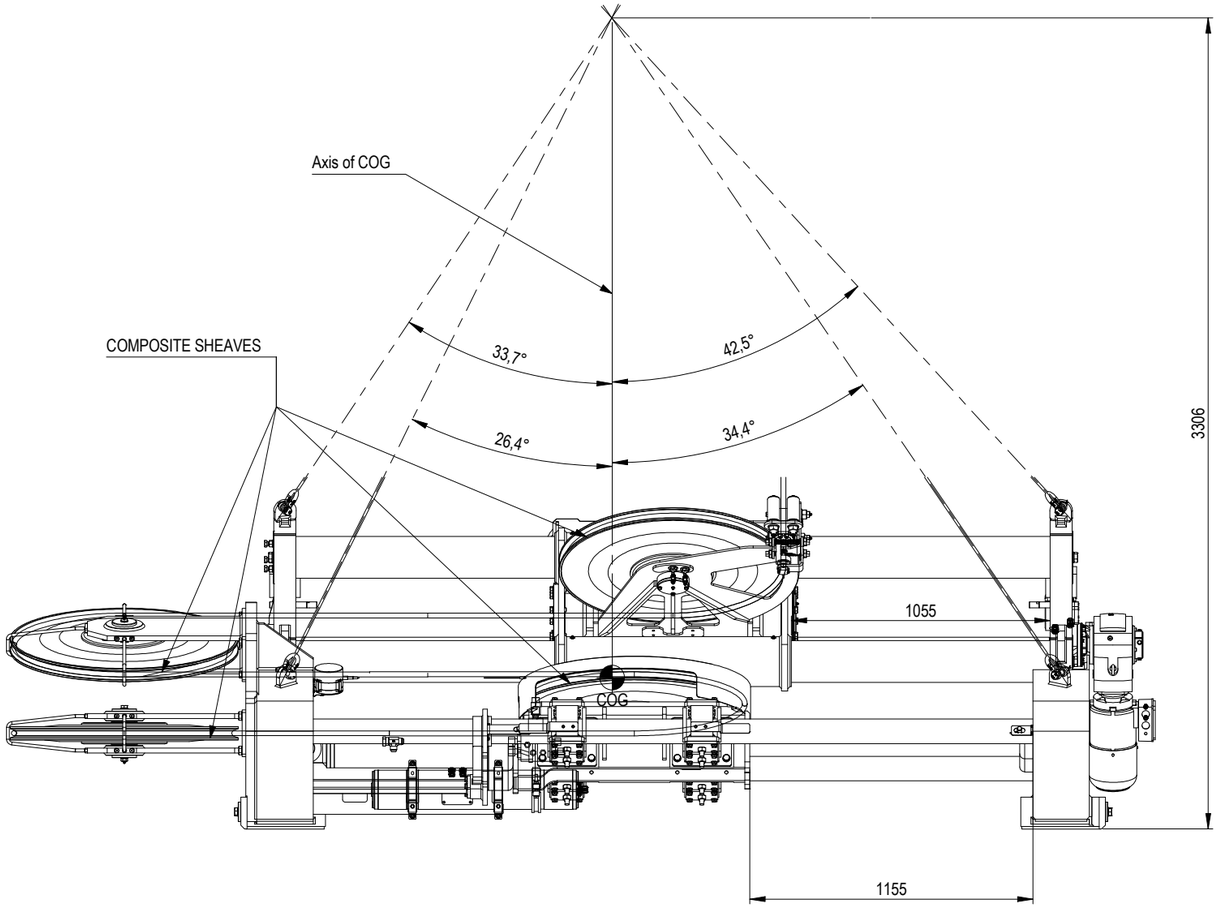
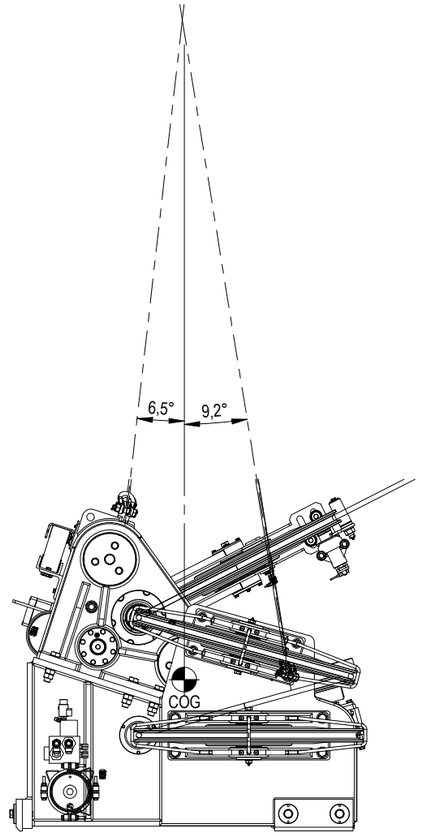
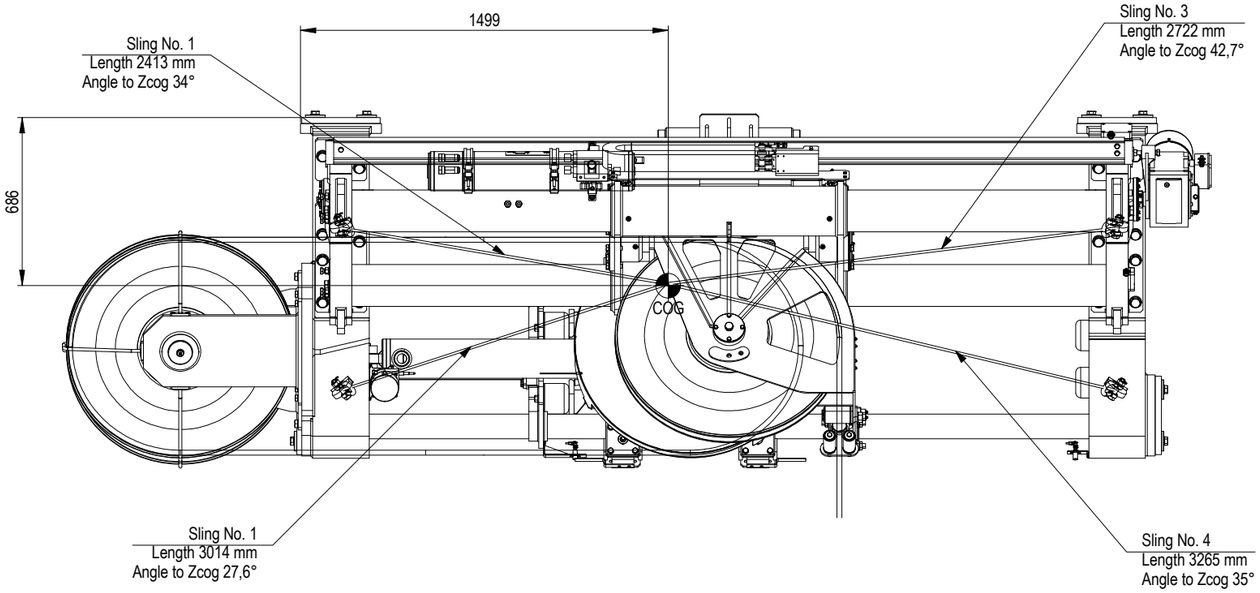
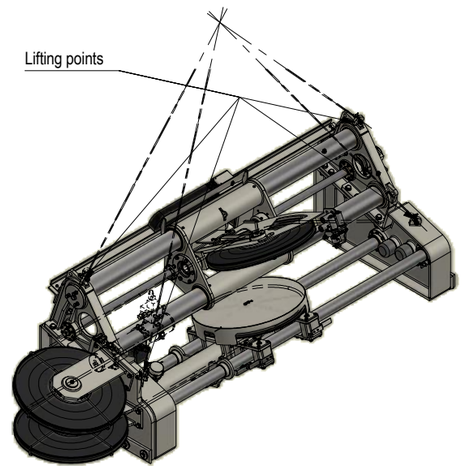
Name	Weight (kg)
LIFTING ARRANGEMENT	5979
Description	Scale (A3)
A301592 (6.5km x 266kg/km=1729kg)	1 : 20
Document ID	Revision / Sheet
2000005765	A / 1 / 1









Designed by	Date	Modified by	ECO / CO			
P Pantovic	27.12.2021.	P Pantovic	ECO-2056483			

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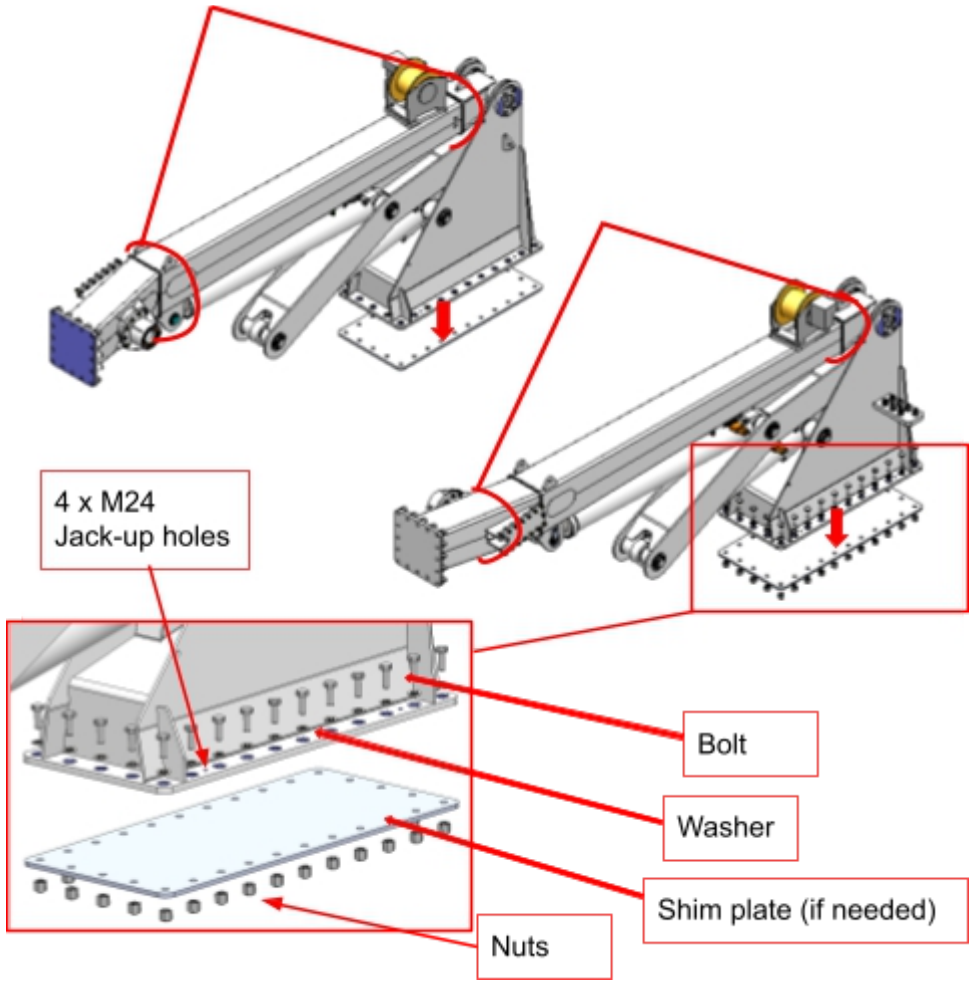
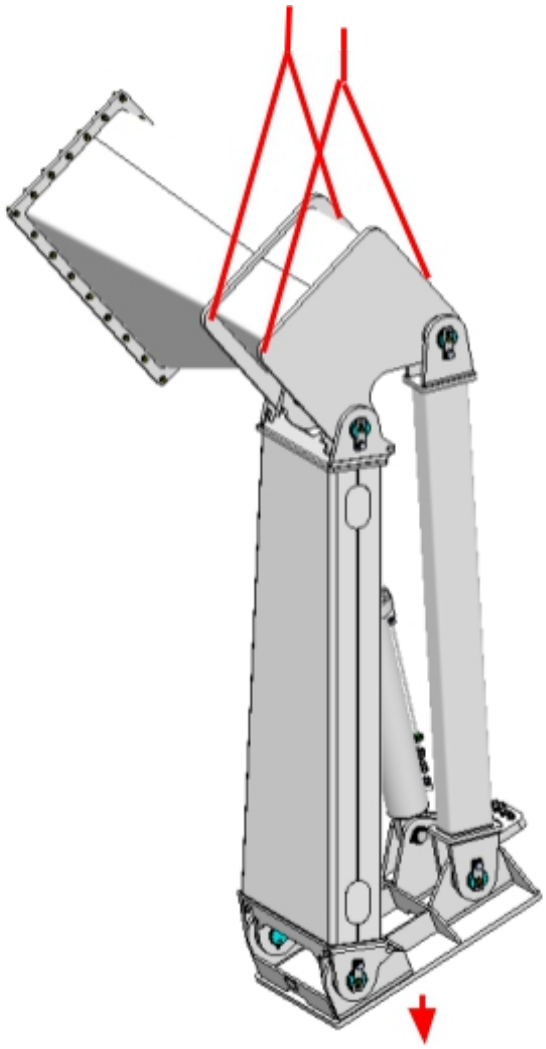
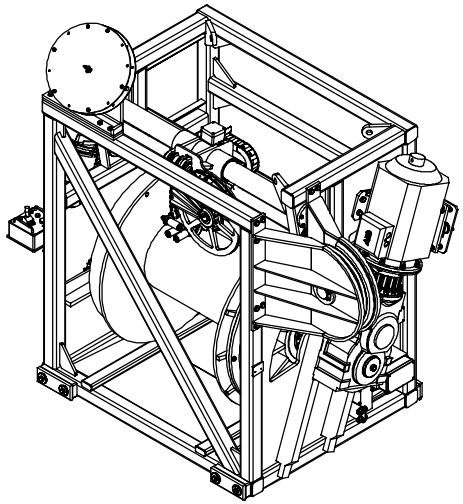
Name	Weight
LIFTING ARRANGEMENT	4540 kg
Description	Scale (A3)
LEV. WITH SLACK WIRE, LSWC5000/01L1	1 : 25
Document ID	Revision / Sheet
2000004325	A / 1 / 1

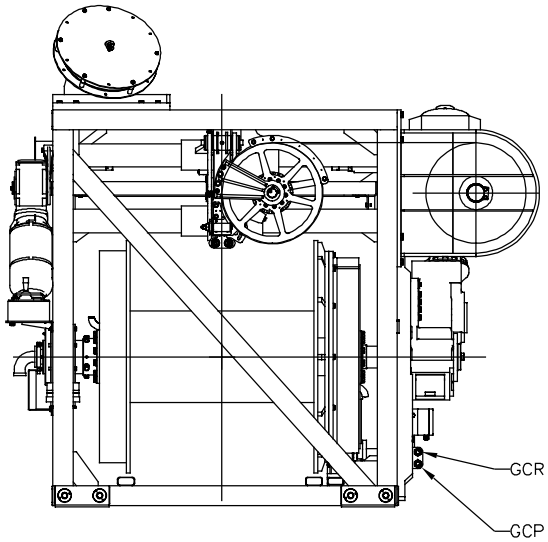
C6925885EDD145B7ABC879F8072E1EEF

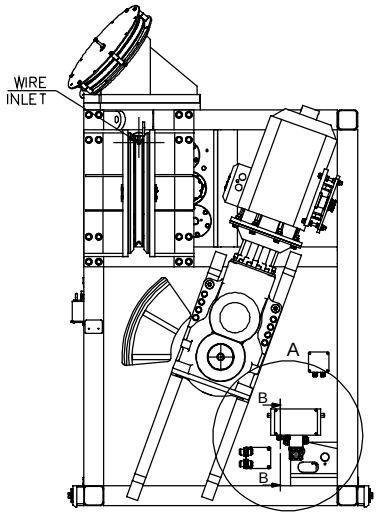
Item	Activity	Illustration/picture/drawing	Comments
1.	Lift assembled foundations with Gantry legs and cylinders. Position them in the centerlines using lifting lines. (see picture). Ref. drw. For foundation positioning: 25480 Installation drawing(Sheet 2). Mount to deck by using Bolts: ISO 4017 M30- 10.9 Apply torque of 1840 Nm. Weight of PORT and STARBOARD foundation assemblies is approx. **4600 kg** each.		

Item	Activity	Illustration/picture/drawing	Comments
1.	Lift assembly of foundation, arm, outer boom and cylinder. Weld the foundation to the deck of the vessel. Welding to be done according to drw. 25482 CTD DAVIT Installation.		

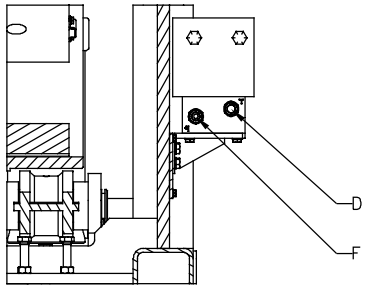
ISO VIEW



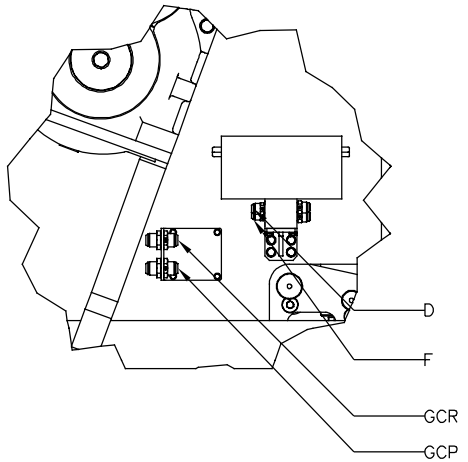




B-B



A



HYDRAULIC CONNECTION TYPE:
37° FLARED TUBING (ISO 8434-2)

GCR: ø20x2 mm
GCP: ø15x1,5 mm
F: ø15x1,5 mm
D: ø15x1,5 mm

NOTE:
DIFFERENCES IN POSITION OF CONNECTIONS MAY OCCUR WITH AS BUILT PRODUCT. PLEASE CHECK FOR CONNECTION MARKINGS ON THE WINCH.

Rev.ID	Description of revision	Date/Sign
E		
D		
C		
B		
A	Drawing updated	041220 HKJ

Tot.weight NA

RAPP MARINE Phone: 75 55 01 00 E-mail : office@rappmarine.com

Drawn DimDi | Date 09.08.18 | Control DimDi | Approved

Scale NA

Connection drawing
Hydraulic connection points

Part list RHP131566-7972

Subst.for: | Subst.by:

Drg.no. RH326078

Rev. ID. A | Approved HKJ | Date 04.12.20

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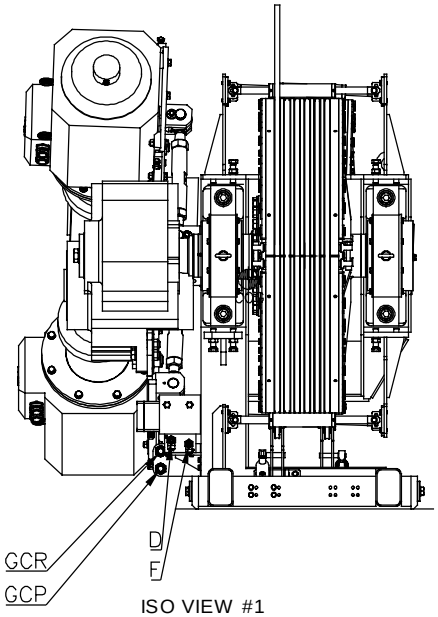
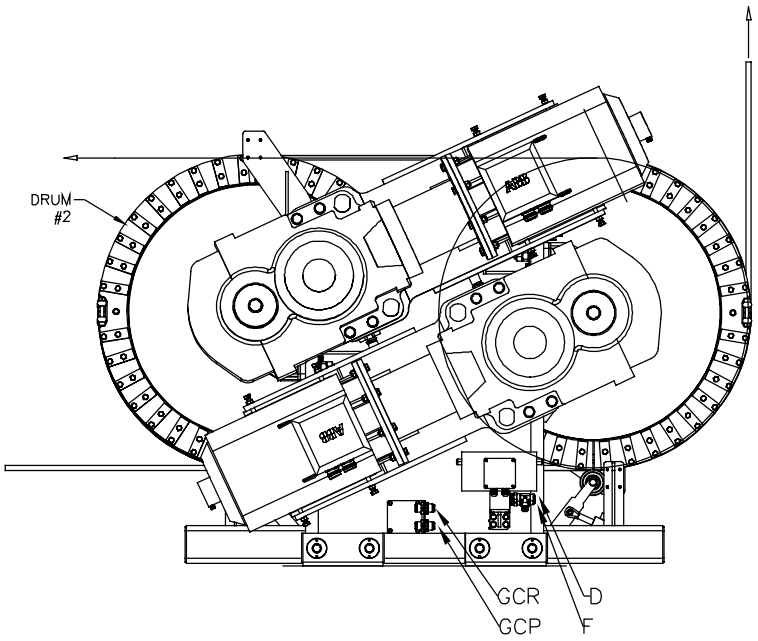
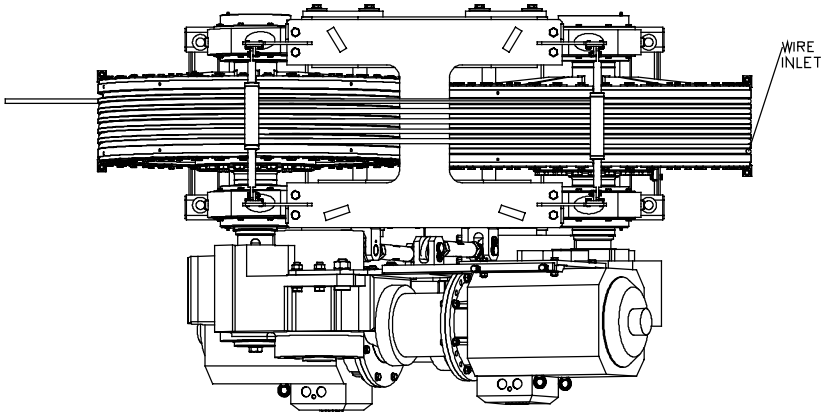
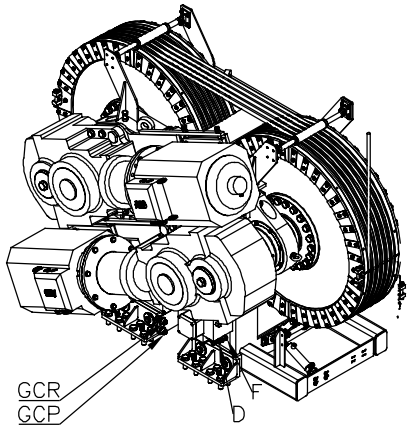


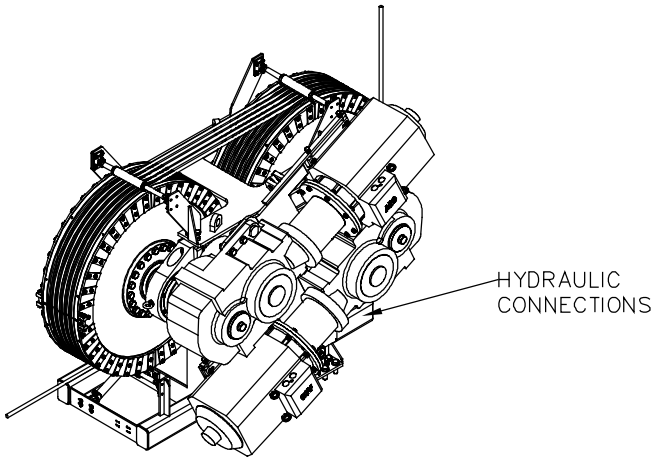
ISO VIEW #1







ISO VIEW #2



HYDRAULIC CONNECTION TYPE:
37° FLARED TUBING (ISO 8434-2)

GCR: ø30x2 mm
GCP: ø25x2 mm
F: ø20x2 mm
D: ø20x2 mm

NOTE:
DIFFERENCES IN POSITION OF CONNECTIONS MAY OCCUR WITH AS BUILT PRODUCT. PLEASE CHECK FOR CONNECTION MARKINGS ON THE WINCH.

Rev.ID	Description of revision	Date/Sign
E		
D		
C		
B		
A		

Tot.weight

RAPP MARINE Phone: 75 55 01 00 E-mail : office@rappmarine.com

Drawn DimDi | Date 09.08.18 | Control DimDi | Approved

Scale NA

Connection drawing
Hydraulic connection points

Part list RHP131566-7966

Subst.for: | Subst.by:

Drg.no. RH326075

Rev. ID. 0 | Approved | Date

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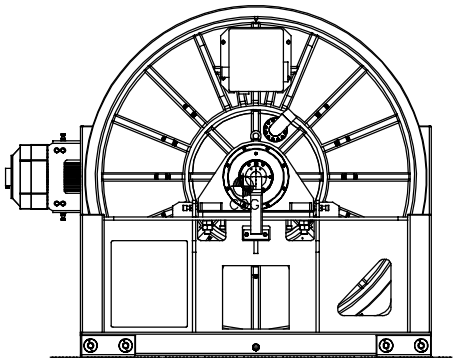
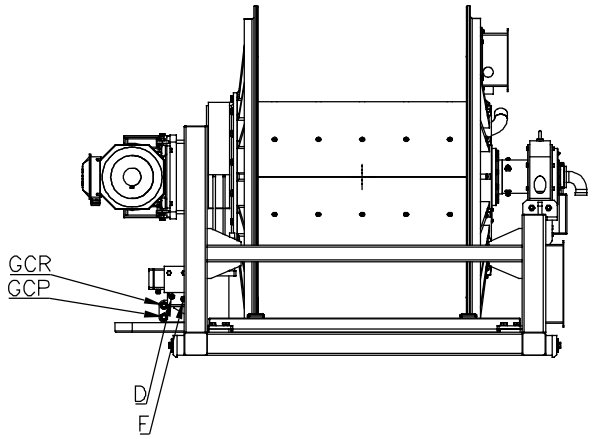
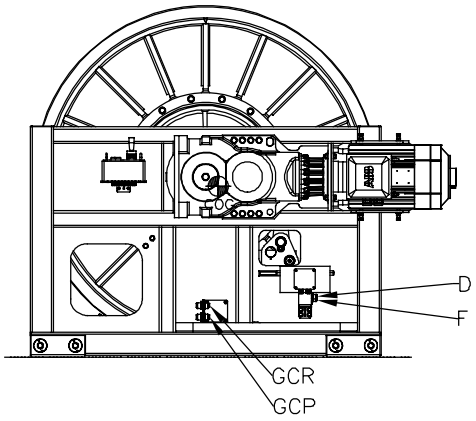
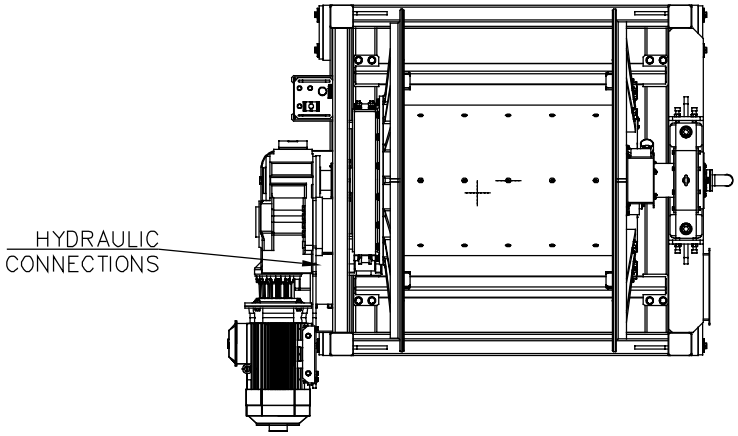
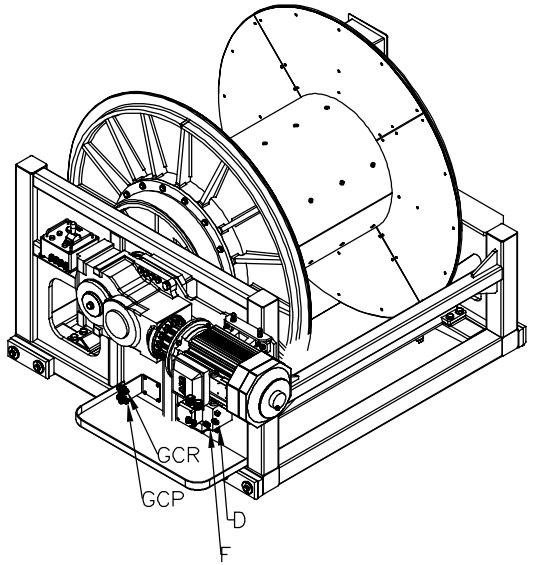






ISO VIEW





HYDRAULIC CONNECTION TYPE:
37° FLARED TUBING (ISO 8434-2)

GCR: ø20x2 mm
GCP: ø20x2 mm
F: ø15x1,5 mm
D: ø15x1,5 mm

NOTE:
DIFFERENCES IN POSITION OF CONNECTIONS MAY OCCUR WITH AS BUILT PRODUCT. PLEASE CHECK FOR CONNECTION MARKINGS ON THE WINCH.

Rev.ID	Description of revision	Date/Sign
E		
D		
C		
B		
A		

Tot.weight NA

RAPP MARINE Phone: 75 55 01 00 E-mail : office@rappmarine.com

Drawn DimDi | Date 09.08.18 | Control DimDi | Approved

Scale NA

Connection drawing
Hydraulic connection points

Part list RHP131566-7970

Subst.for: | Subst.by:

Drg.no. RH326077

Rev. ID. 0 | Approved | Date

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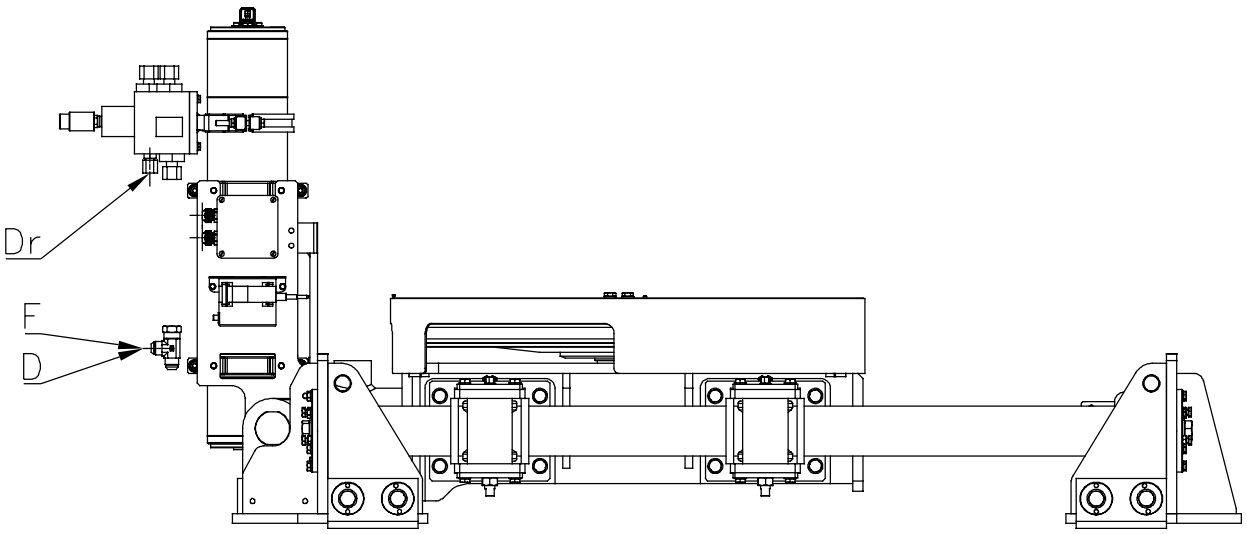

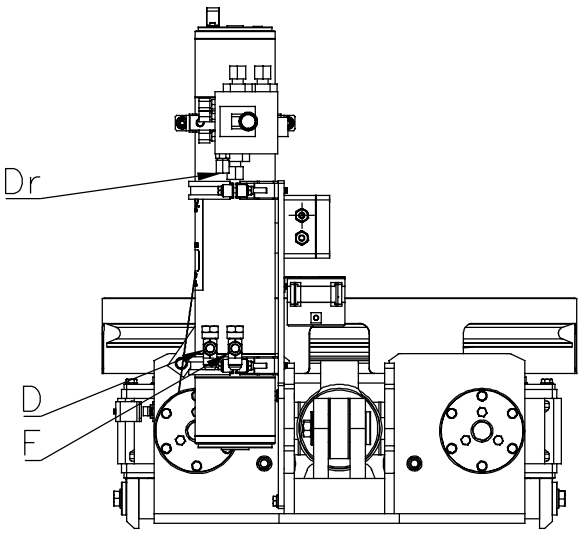

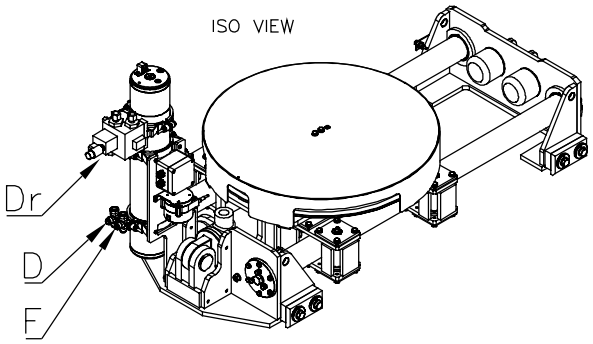

HYDRAULIC CONNECTION TYPE:
37° FLARED TUBING (ISO 8434-2)

F: ø25x2 mm
D: ø25x2 mm
Dr: ø15x1,5 mm

NOTE:
DIFFERENCES IN POSITION OF CONNECTIONS MAY OCCUR WITH AS BUILT PRODUCT. PLEASE CHECK FOR CONNECTION MARKINGS ON THE WINCH.

Rev.ID	Description of revision	Date/Sign
E		
D		
C		
B		
A		

Tot.weight

RAPP MARINE Phone: 75 55 01 00 E-mail : office@rappmarine.com

Drawn DimDi | Date 09.08.18 | Control DimDi | Approved

Scale NA

Connection drawing
Hydraulic connection points

Part list RHP131566-7967

Subst.for: | Subst.by:

Drg.no. RH326076

Rev. ID. 0 | Approved | Date

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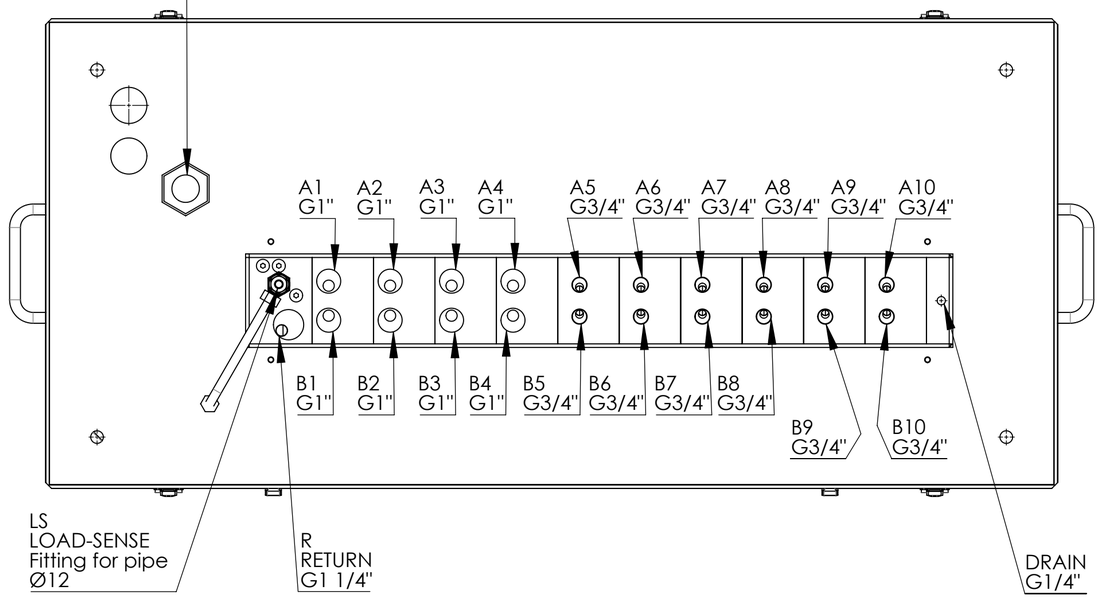

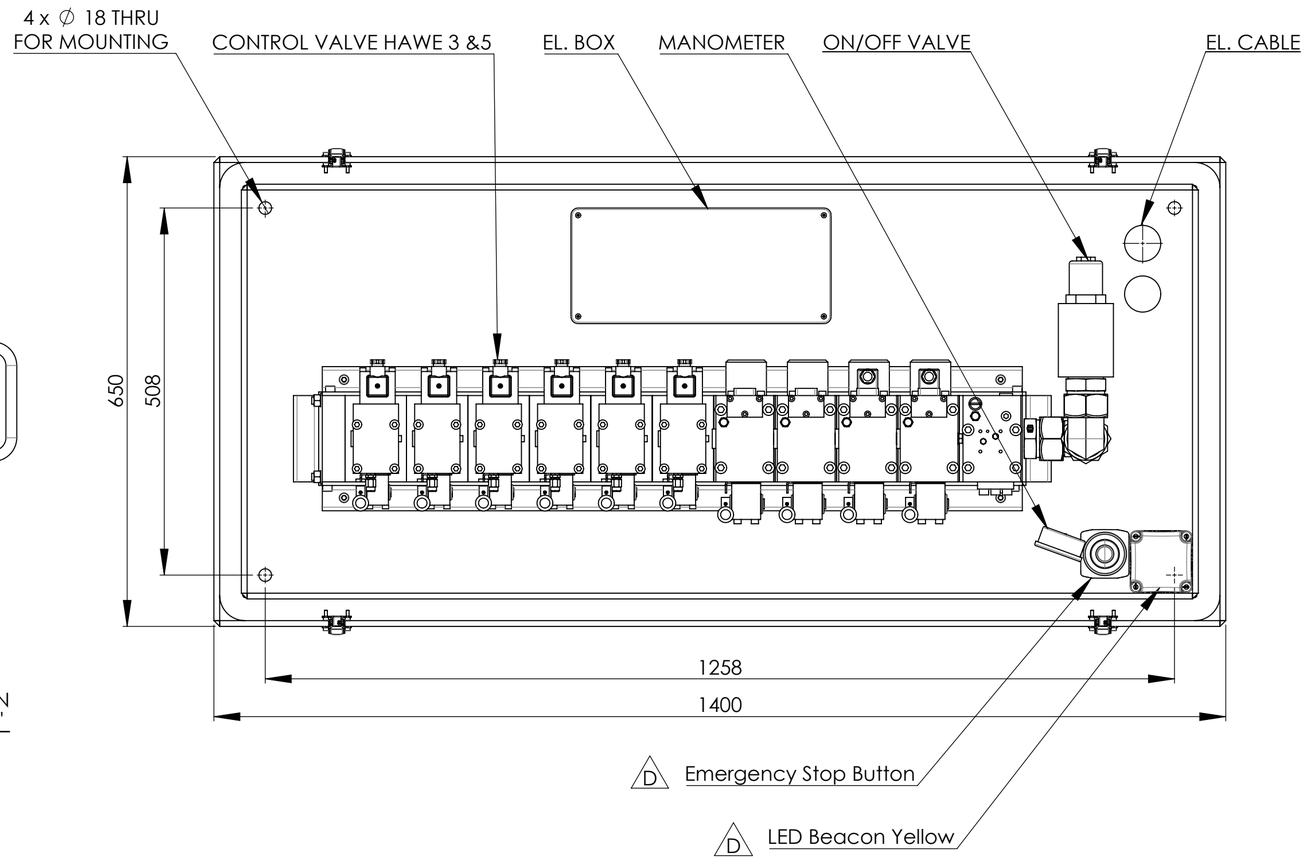

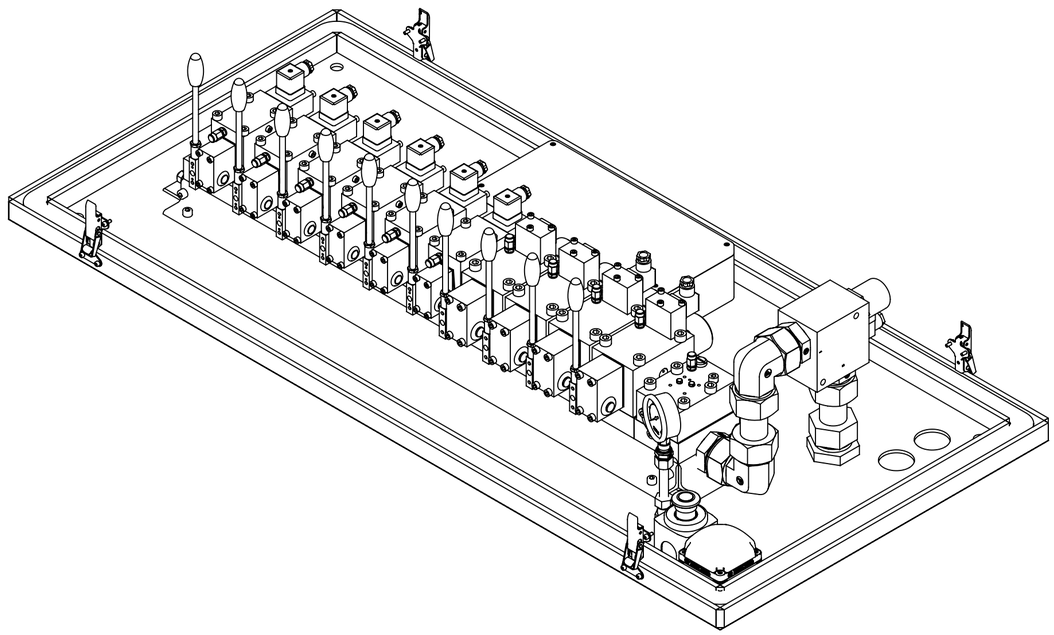

PROJECT: 4/60185 MBARI

REV.	DESCRIPTION	DATE	APPROVED
D	Added LED Beacon and Emergency stop button	11.01.2023	CI
C	Drawing updated	02/02/2022	SS
B	Added one more section.	14/12/2021	HK
A	Released	26/11/2021	SS

REVISIONS

OVERHEAD CRANE
ROV LARS
VALVE CENTRAL

MACGREGOR

Unspec. tolerances in compliance with

Scale 1:6

Projection

Format A2

MPS no.

Drawing no. 24859

Revision D

SHEET2 OF 2

Weight (kg)	226.2 Kg
Date	02.07.2014
Created by	HK
Approved date	11.01.2023
Approved by	LS

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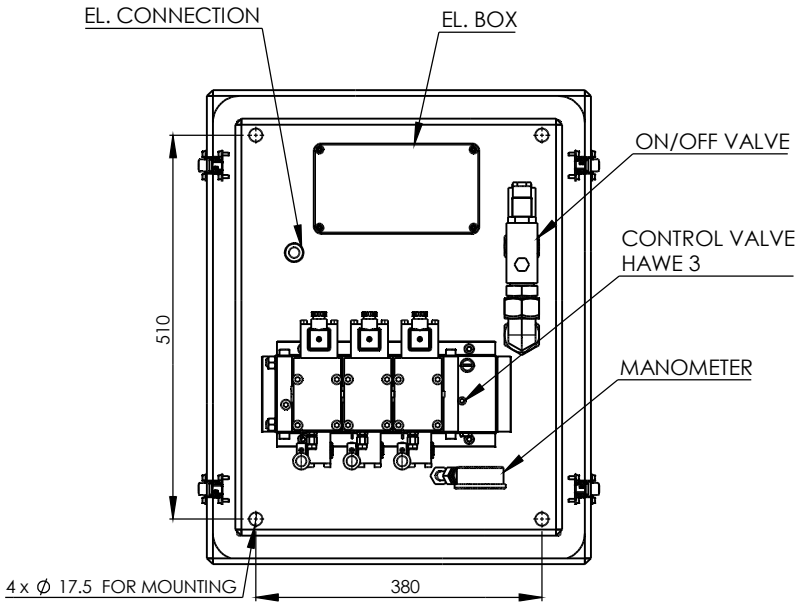

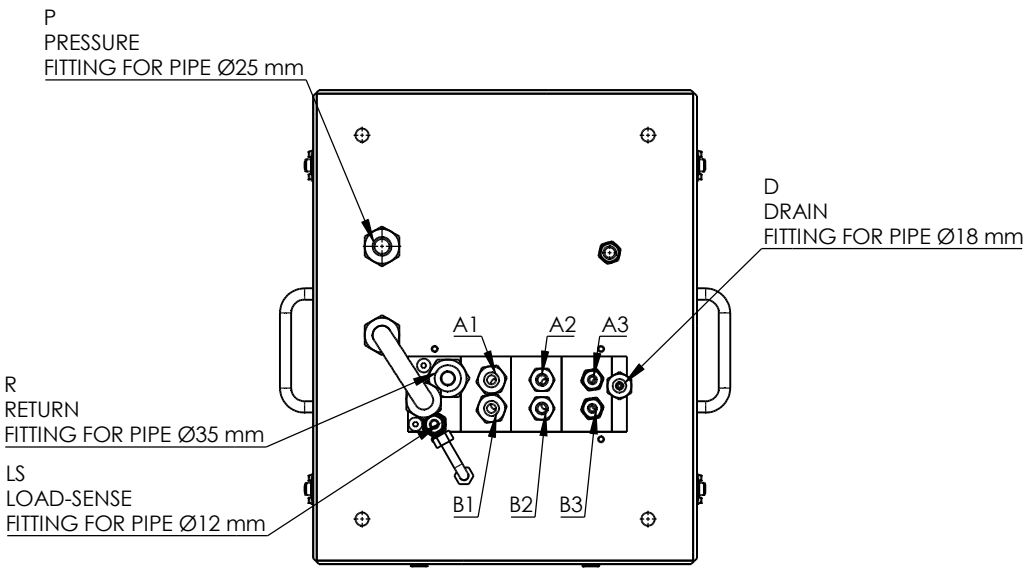

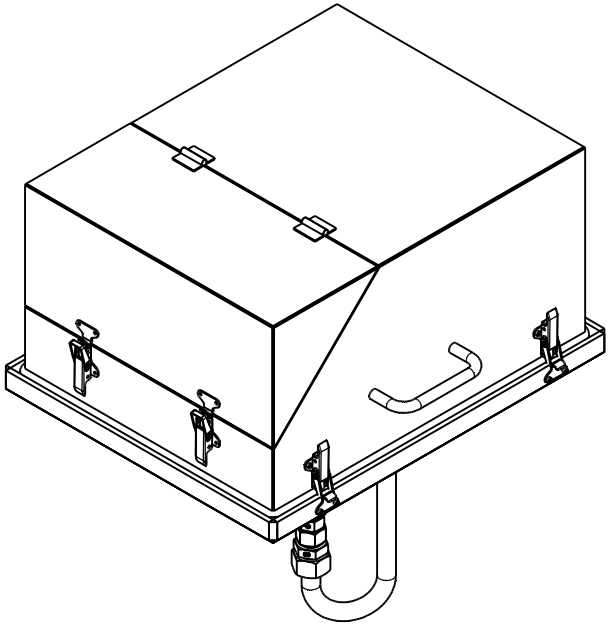

PROJECT: 4/60185 MBARI

TRIPLEX DESIGN
DAVIT
VALVE CENTRAL

REV.	DESCRIPTION	DATE	APPROVED
C	Updated after reorganizing dim sketch/main assembly	17/05/2022	SS
B	Diameter of return fitting changed to Ø35mm.	13/12/2021	AT
A	Released	04/11/2021	AT

REVISIONS

MACGREGOR

Unspec. tolerances in compliance with	NS-ISO 2768 M
Scale	1:5
Projection	
Format	A2
MPS no.	400180306
Drawing no.	24820
Revision	C
SHEET 2 OF 2	
Weight (kg)	63.1 Kg
Date	04.11.2021
Created by	AT
Approved date	04.06.2022
Approved by	OPF

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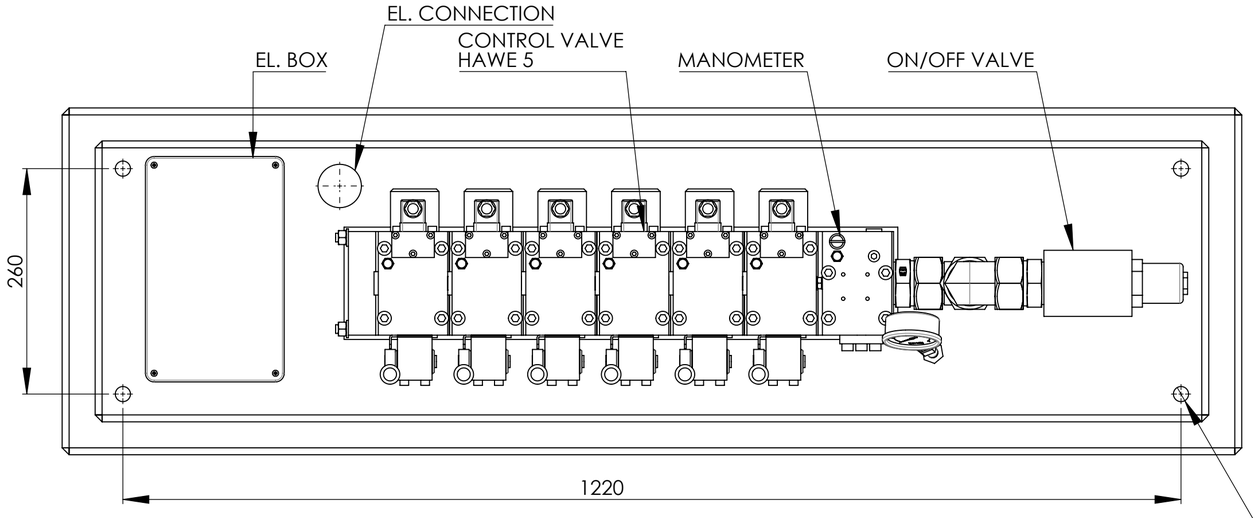

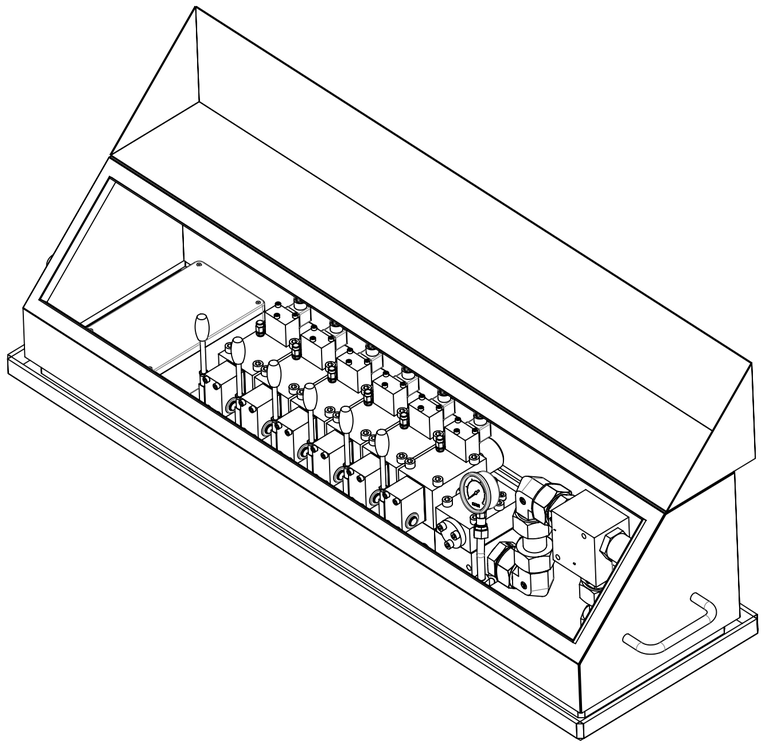

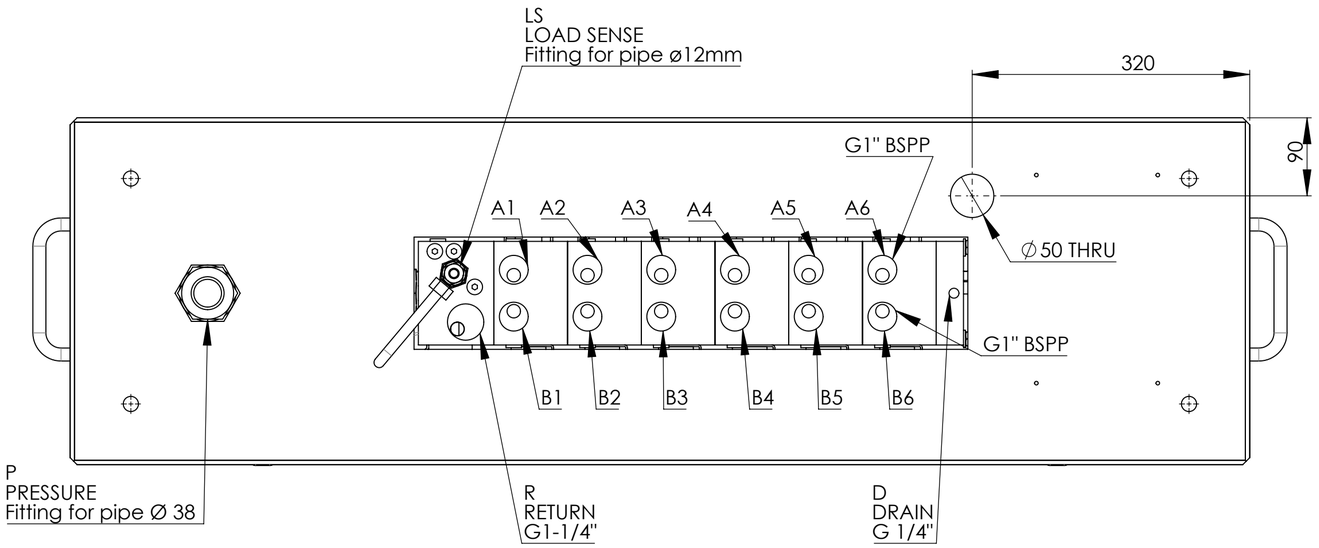

NOTE !
Dimension of the hydraulic connections acc. to hydraulic diagram.

PROJECT: 4/60185 MBARI

REV.	DESCRIPTION	DATE	APPROVED
REVISIONS			
D	Added MPS number	02.05.2022	OPF
C	Valve central dimensions changed	06/01/2022	SS
B	Connections for pressure and drain changed	13/12/2021	SS
A	Released	04.11.2021	CI

FRAME
A-FRAME STERN
VALVE CENTRAL

MACGREGOR

Unspec. tolerances in compliance with

Scale 1:5 | Projection

Format A2

MPS no. 400185989

Drawing no. 24821

Revision D

SHEET2 OF 2

Weight (kg)	153.0 Kg
Date	04.11.2021
Created by	CI
Approved date	02.05.2022
Approved by	LS

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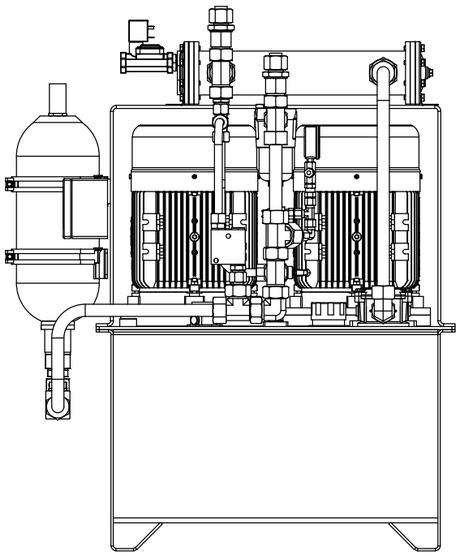
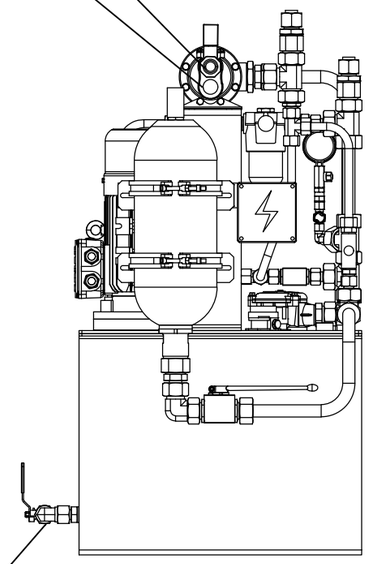
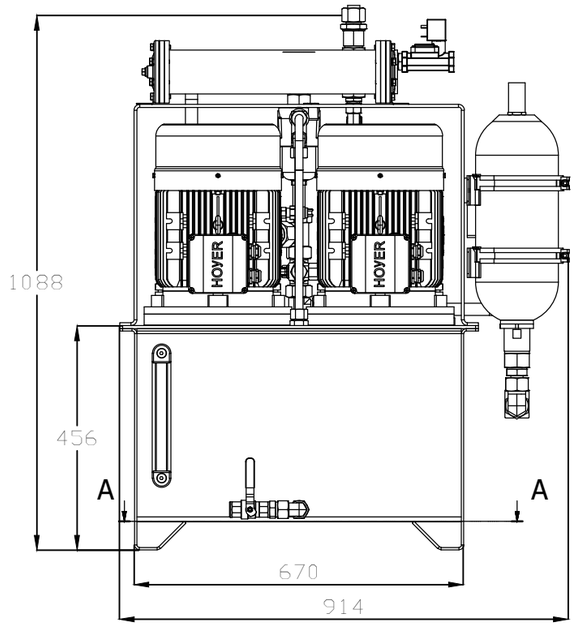
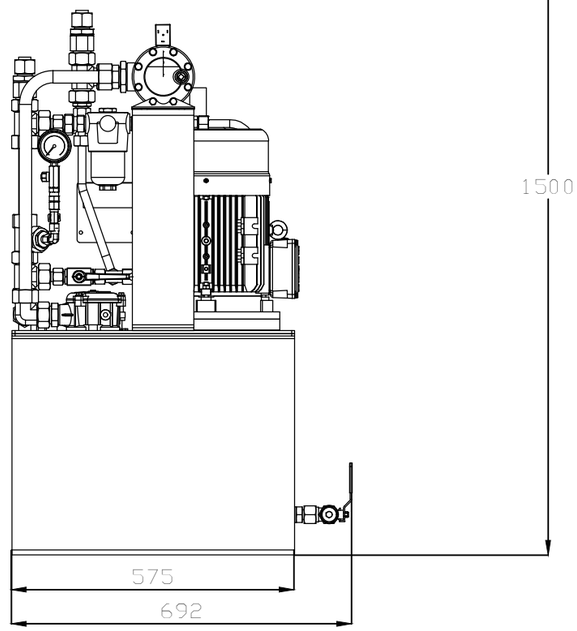
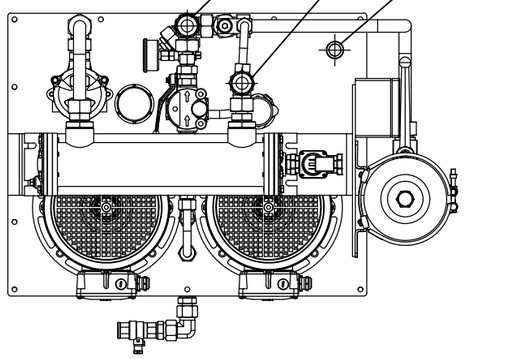




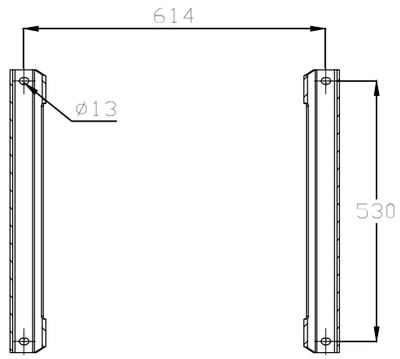


Approx. min. maintenance height

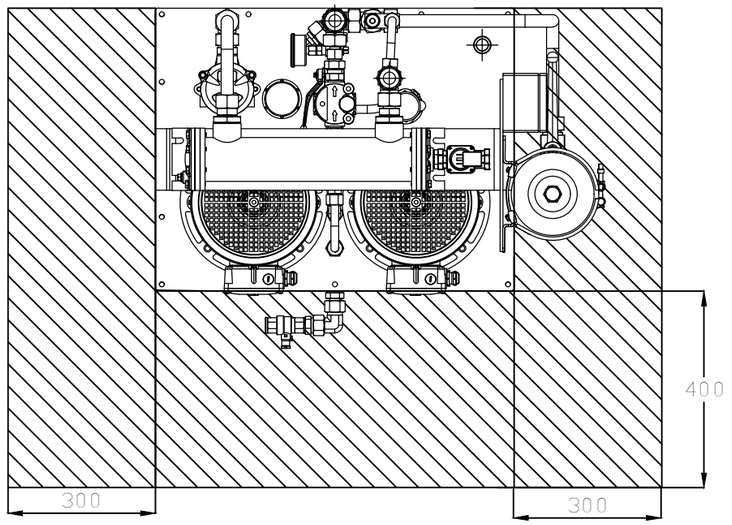


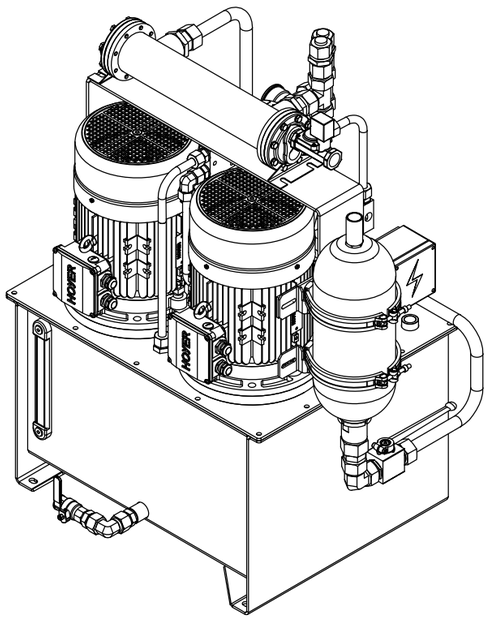


A-A (1:8)



Recommended maintenance area





Ref. Hyd. schematic drawing RH322323

*Weight excluding oil

Designed by	Modified by	Date	ECO			
H Johansen		17-Dec-21				

MACGREGOR

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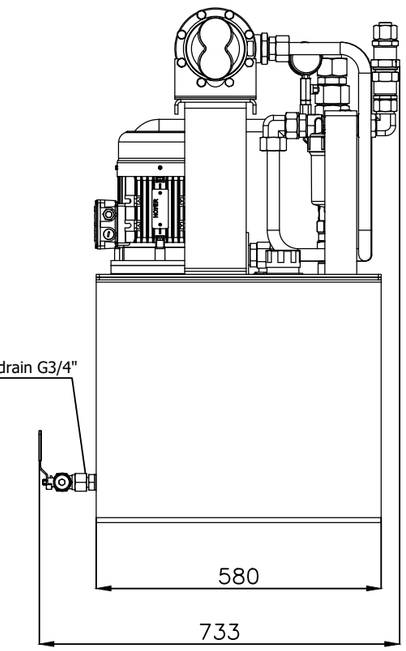
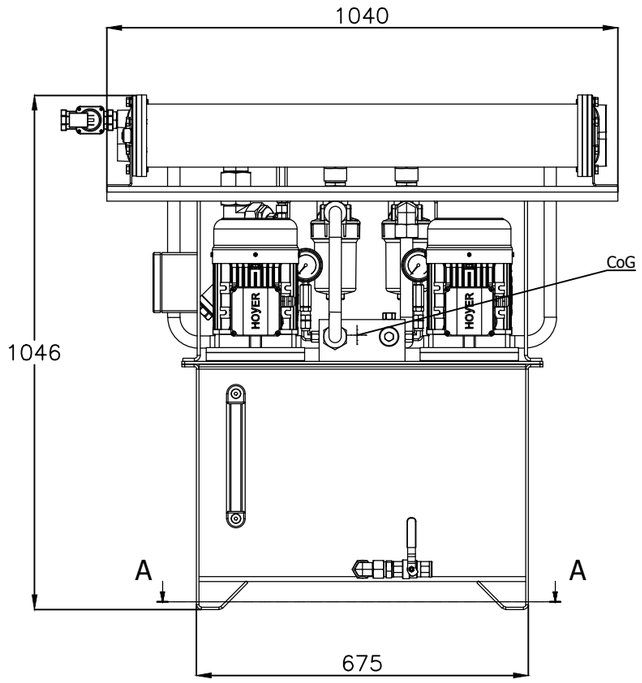
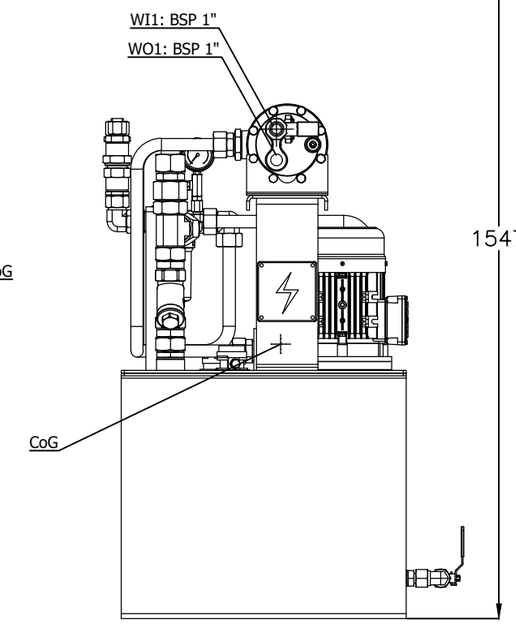
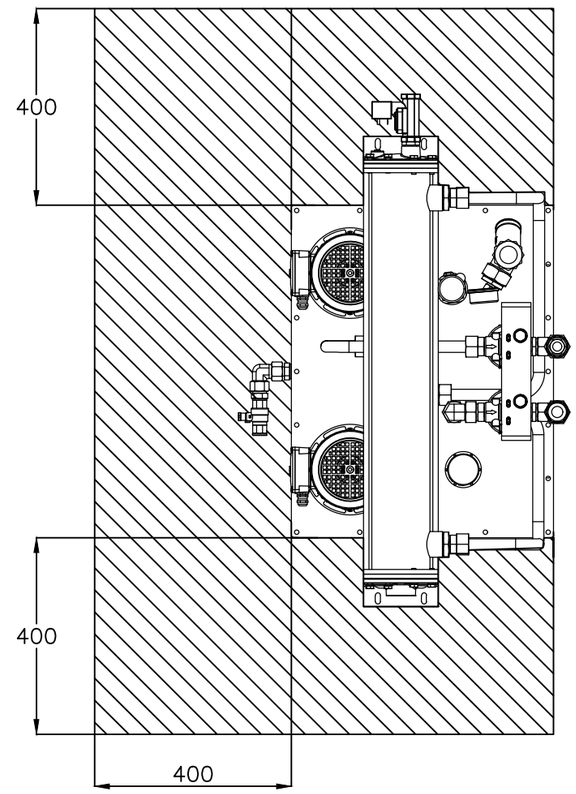
Name	Weight
Dimension Drawing / Connection Drawing	300 kg
Description	Scale (A3)
HPU Servo Sys., cooler & accum. 70L (109L)	1: 12, 5
Document ID 2000004113	Revision A



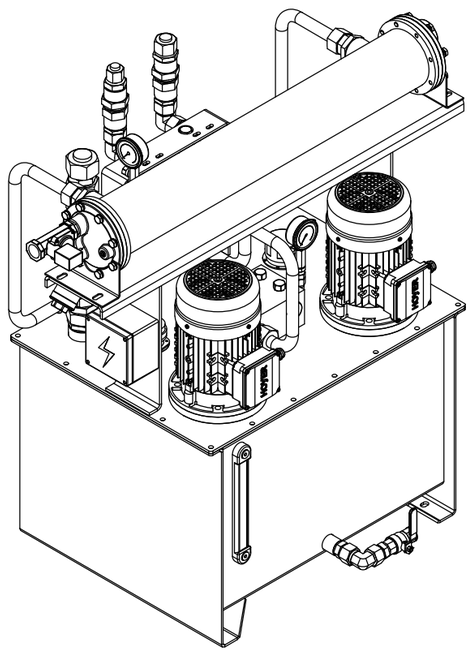




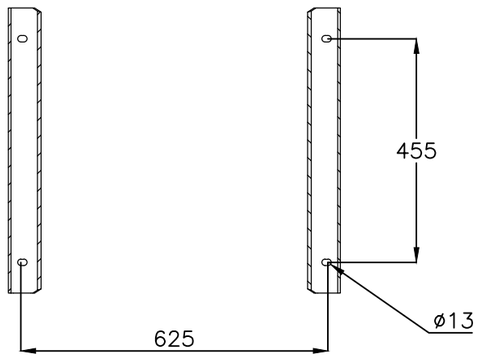
Approx. min. maintenance height

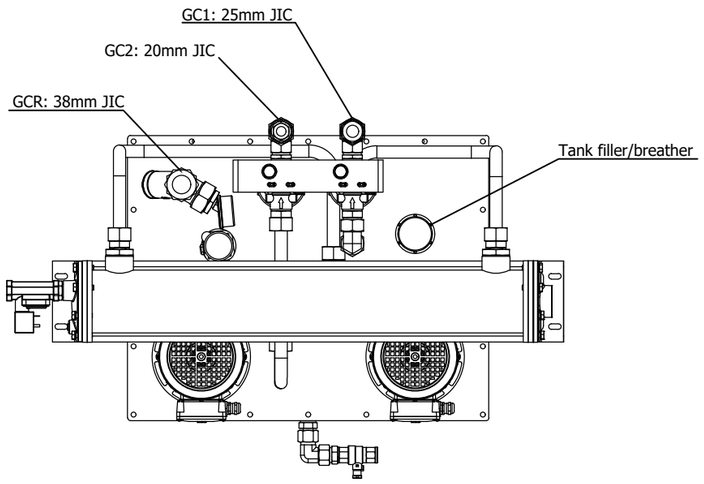


Recommended maintenance area



A-A (1:8)





Ref. Hyd. schematic drawing RH325930

*Weight excluding oil

Designed by	Modified by	Date	ECO			
H Johansen		17-Dec-21				

MACGREGOR

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Name	Weight
Dimension Drawing / Connection Drawing	240 kg *
Description: HPU Gear Cooling 120L (155L)	Scale (A3): 1:12,5
Document ID: 2000004110	Revision: A

Section 2

Handling, Installation, Storage & Transit

Annex A – Installation & PHS&T

DESCRIPTION	DOC/DRW #	REV #	PAG #
Cranes			
A-Frame Installation	02146	-	2
ROV OHC	02147		17
CTD Davit	02148		30
KN-75 Main Crane	KN-75		36
Winches			
EN-IM Mechanical Installation	6837	3	40
EN-IM Installation of Electrical System	4251	6	47
Hydraulic Systems Installation	3035	12	76
Winch Alignment	6440	6	105
Guidance to Wire Spooling	1389	10	116
RM Standard for Packing	5867	3	138
RM Standard for Packing Materials and Products	5953	-	156
RM Packing of Electrical Cabinets	6267	4	157
RM Standard for Preservation	5866	4	169
RM Preservation Manual	6243	6	183
RM Preservation of Winches, Reels, and Storage Drums	5952	-	186
RM Standard Preservation Materials and Products	5954	-	188

Installation

Dear Customer,

Thank you for choosing a product from MACGREGOR.

In order for the Crane to be reliable for a long time and to be a good investment read the installation instructions carefully.

Personnel Safety Precautions

OPERATION AND MAINTENACE OF THE CRANE SYSTEM SHALL BE EXECUTED IN ACCORCANCE WITH REQUIREMENTS OF THIS INSTRUCTION AND WITH VESSEL SAFETY REGULATIONS.

THE DECK MACHINERY MUST BE OPERATED BY QUALIFIED PERSONNEL THAT HAVE STUDIED THE DOCUMENTATION, INSTRUCTIONS AND REQUIREMENTS.

NEGLIGENCE OF OPERATIONS AND LIMITATIONS SPECIFIED IN THIS INSTRUCTION CAN CAUSE FAILURE OF EQUIPMENT, DAMAGE OF PROPERTY OR INJURY OF PERSONNEL.

Introduction

Typical sources of danger for personnel during operation and maintenance of cranes are:

- Hanging load
- Overload
- Tension of ropes
- High voltage in electric equipment
- High pressure in hydraulic equipment
- OIl leaks and oil spill
- Remote operated cranes
- Electric power lines
- High wind speed
- Heel + trim of crane above specified limit.
- Movements out of control
- Loose parts on crane
- Bearing structures, additional equipment, with cracks or any damage.

When working with these topics is in general a high level of attention recommended. In addition, routine maintenance will decrease the possibility of malfunction and failure of the deck machinery, which can be a source of danger for personnel safety.

GENERAL SAFETY INFORMATION

Operation only by trained/qualified personnel that have studied the documentation, instructions and requirements.
Safety devices not to be tampered with.
Prescribed safe distances to be maintained.
Safe distances from electric power lines to be maintained.
Be alert to faults during crane operation.
Do not operate the crane when the wessel's heel + trim is higher than maximum designed value. (Ref: dimension sketch)
Do not operate the crane when wind speed makes it indefensible.

SAFETY FOR USE OF CRANE.

Operating of the cranes requires skill, ability and experience.

Therefore only entrust persons with the operationof the cranes:

1. Who are physically and mentally suitable for this (not tired, and not under influence of alcohol, drugs or medication).
2. Who handle the crane responsibly and reliably.
3. Who have the right qualications(training, crane operator's license).
4. Who can prove that they have been instructed on how to operate the unit described here and who are familiar with the content of these operation instructions This also applies to the operating instructions for ancillary equipment used on the crane.

OPERATORS DUTIES AND RESPONSIBILITIES

1. Duties: The operator should carry out the following duties: crane (enabling the power circuits, operating the machine, etc.); assembling/disassembling the optional parts (grab, hook, etc.); servicing the machine, he should therefore perfectly know the safety rules and the relevant devices installed for this purpose, the usage of the commands of handling and the techniques of loads slinging.

2. Leaving control valve or radio control with hanging load in crane is prohibited .

3. Responsibilities: !e operator is directly responsible for every action he takes within the above mentioned duties.

ACTIONS AT ERROR

If you notice the following injuries or disorders of the CRANE / A-FRAME and accessories, Operation must be stopped immediately.

- Damage or cracks on the supporting components
- Defect bearings
- Defect on the hydraulic system or safety devices.
- Loose screw connections.
- Inadequate secured bolt connections.
- Leakages in the hydraulic components or the connection of these.
- Unusual sounds.
- Unusual fast or slow working movements.
- Malfunctions in control.
- Unusual high heating of the hydraulic components.

With these injuries, it may no longer be guaranteed a safe CRANE operation.
There is an acute accident and mortal danger.

DAILY VISUAL INSPECTION

Check:

- Coupling, hose connections and elements of the hydraulic system for damage or hydraulic oil leaks.
- Oil leakage can cause accident and pollute the environment
- Tension of the bolt and screw connections.
- Bolt locks for defects
- The radio/valve controls move easily and sets back by itself.
- Bearing structures, additional equipment, for cracks or any damage.
- When laser measurement are used, these must be checked for external damage before use. Functional tests must be performed without load before use.
- Check that the emergency stop works as expected.
- Check radio control for damage/defects.

When you discover such defects, CRANE shall not be used.

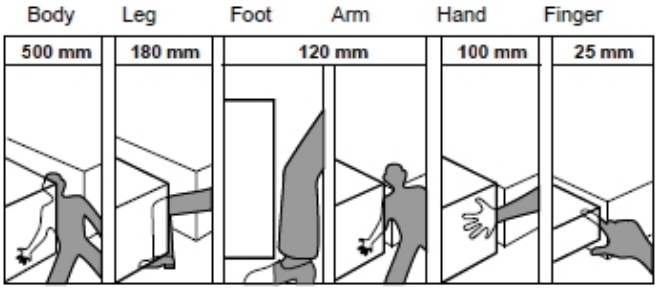
If your crane is equipped with safety devices such as an emergency CUT-OFF, an overload protection system or a rope winch limit stop, always carry out a function test on them before operation.

The winch must not be manipulated to drive at a speed higher than max. speed specified by winch supplier.

If the safety devices do not work or is manipulated, operation of the crane is strictly prohibited.

AVOID DANGER OF CRUSHING

Avoid operating situations in which there is a risk of you or bystanders being crushed by the crane, or load.
The crush point is not regarded as a danger point for the body parts stated if the safety distances highlighted below are complied with and it is ensured that the next-biggest body part cannot penetrate. Required minimum distances:



If the distances are not complied with there is danger of injury and even death.

LOADING

- Use the deck crane only to hoist the load and never break, hit, pull (towing) load, press and run against fixed obstacles or towing.
- Do not lift the load higher than necessary for moving in the work area.
- Transport of people are only allowed in the special personnel basket which is designed for this purpose.
- The specific regulations in each country shall be complied.
- Lift the load of center of gravity. Secure the load against slippage.
- Using the deck crane, grab the control stick and press it firmly until the deck crane responds.
- Then, through slow and steady pushing the control stick to speed up the deck crane function.
- Move the lifted load so that this does not violate the deck crane or other obstacles
- Loading should only be hung and removed by complete standstill of the deck crane.
- Make sure the person hanging on or taking off the load is no longer in the danger area before moving the load arm.
- Do not run the deck crane at full operating speed to estimates, this increases wear and shortens life of the deck crane.
- Do not run the deck crane at full working speed to the end, this increases wear and shortens the life of the deck crane.
- Use approved lifting straps / chains with a higher strength than the weight of the load.

Keep distance from power lines

Keep the required minimum distances away from power lines. If this is not possible because of the particular work being carried out the lines must be disconnected (switched off).
The appearance and height of electric power lines gives no indication of their voltage.
In the case of lines where the voltage is not known a distance of at least 5 metres between the crane and the line must be maintained. This also applies to all load lifting gear and ancillary equipment attached to the crane.
Take into account that in a wind a power line can sway out or the load arm of the crane can be caused to swing by sudden movements (also upwards). Even unintentional approaching can lead to flashover. Flashover can occur even on just approaching a power line.

This entails the risk of fatal injury for the crane operator and auxiliary personnel.

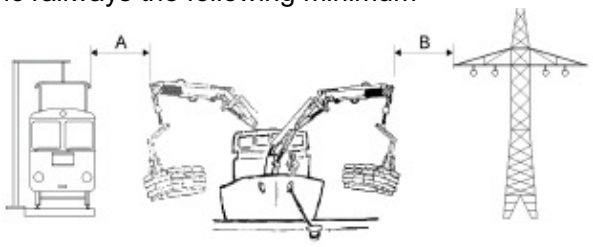
Safe distances from electric power lines

For overhead power lines and contact lines of electric railways the following minimum distances apply:

A

= DC
up to ..... à 1.500 V ..... 1,0 m
over ..... à 1.500 V ..... 1,5 m

~ AC
up to ..... à 1.000 V ..... 1,0 m
over ..... à 1.000 V ..... 1,5 m



B

up to ..... 1.000 V ..... 1,0 m
1.000 ..... 110.000 V ..... 3,0 m
110.000 ..... 220.000 V ..... 4,0 m
220.000 ..... 380.000 V ..... 5,0 m
unknown voltage ..... 5,0 m

Please observe the following in connection with load lifting gear:

The weights of the load lifting gear and accessory equipment count as part of the load.
The load lifting gear must be matched to the crane in terms of size and lifting capacity.
A type plate must be attached to the load lifting gear showing details such as manufacturer, type designation, manufacture number, weight, operating pressure, capacity, maximum permissible lifting capacity and year of manufacture.
The maximum lifting capacity of your crane is always determined by the weakest unit of load lifting gear used.
Please therefore always observe the lifting capacities stated on the load lifting gear.
Familiarize yourself with the content of the operating instructions of the respective load carrying equipments.

Hook:

On your crane only use certified load hooks which match your crane and the load to be lifted.
The lifting capacity of the load hook and the shackle must correspond to the maximum lifting capacity of the crane.
Fasten and secure the load hook properly.
Ensure that the safety catch closes again by spring pressure after the load has been hooked.

Safety Instructions radio controller

- The radio system serves to control machines and for data transfer. Observe the job safety and accident prevention.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved by the manufacturer for these uses.
- Modificationsto the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The radio control system safety devices must not be modi€ed, removed or bypassed. In particular, modi€cations to any part of the radio system's complete E-STOP system are impermissible.

Working with hydraulic systems

Hydraulic systems often store hot and pressurized fluid. For safety reasons please note the following:

- All maintenance and repair of hydraulic systems can only be carried out by qualified personnel.
- Personnel are exposed to 3 kinds of hazards:

o Burns from hot, high-pressure fluid.
o Bruises, cuts or abrasions from failing hydraulic lines.
o Injections of fluid into the skin.

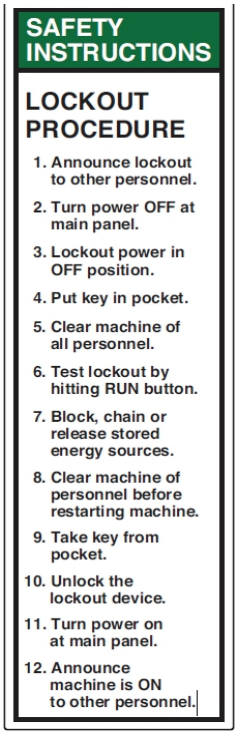
- Before work: Review the Material Safety Data Sheets for all chemicals used. Know location of emergency shower, eyewash station and other first aid equipment.
- During work: Always use protection goggles, chemical-resistant gloves and solid workwear.
- After work: Cleanse and wash affected skin and apply moisturizing cream. Immediately change and wash affected workwear.
- Never use bare fingers or hands to find leaks in the hydraulic system. Pinhole leaks in the hydraulic system can cause a jet of hydraulic fluid that easily can penetrate the skin and cause severe internal damage to the body.
- Hydraulic systems can contain high pressure even when switched off. One must therefore always assure that pressure in the hydraulic system is released before disassembly of hydraulic components. Be aware that hydraulic supply can come from more than one hydraulic power unit.
- Use extreme caution when disconnecting hydraulic components and lines as hot hydraulic oil can cause severe burns to the body.
- It is forbidden to tighten connections when hydraulic pumps are running (mainly to prevent oil leakage).
- Pump room can be a zone with high level of noise, it is therefore recommended to use ear protection inside pump rooms.
- If hydraulic fluid is spilled it must be cleaned up immediately.
- Hydraulic systems under maintenance and repair should be locked and tagged according to a Lock-out/Tag-out procedure.

As a vessel may contain several types of hydraulic systems from various suppliers and with different pressure levels, Macgregor deck machinery and its hydraulic components must be included in a complete safety analysis. A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.

Working with electric systems

Electricity is a very potent energy form and if used carelessly it can cause severe injury to the human body. For safety reasons please note the following:

- All maintenance and repair of electric systems can only be carried out by qualified personnel.
- Qualification and personal protection needed for working on electric systems are dependent on which voltage level the system has.
- Electric systems can contain high voltage even when switched of.
- Make sure that the electric system is switched of and de-energized before disassembly of
- electric components.
- NOTICE, Main boards usually have main power and heating which comes from separate circuit The same applies to I / O circuit boxes and panels that can contain both 230VAC and 24VDC. Starter controls panels may have control power supply from separated starter cabinets.
- Do not wear conductive articles like jewelry, clothing, watches etc. when working with or near electric systems.
- Use of protective eyewear is recommended.
- Protective gloves made of rubber or leather is recommended although it can make work with electric components and equipment harder.
- Only use insulated tools when working with or near electric systems.
- Fuses or safety breakers must not be replaced or reset until it is determined that a circuit is safe to operate.
- Do not bypass any protective system or device designed to protect employees from contact with electrical energy.
- Water and other conductive fluids are electric components worst enemy and can damage or reduce service life to electric components and subsequently make a threat for personnel.
- Electric systems under maintenance and repair should be locked and tagged according to a Lockout/ Tag-out procedure.



Example of Lockout procedure.

As a vessel may contain several types of electric systems from various suppliers and with diferent voltage levels, MacGregor Bodø's deck machinery and its electric components must be included in a complete safety analysis. A complete safety regulation and correct personal protective equipment should be detailed in the vessel's Safety Management System.

Safety Instructions for Installation and Operation HBC radiocontrol

- The radio system serves to control machines and for data transfer. Observe the job safety and accident prevention.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved by the manufacturer for these uses.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The radio control system safety devices must not be modified, removed or bypassed. In particular, modificationsto any part of the radio system's complete E-STOP system are impermissible.

Electrical Connection

Warning – shock hazard!

- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.
- Switch of the supply voltage before opening the receiver. There is a risk of fatality from touching live parts inside the housing!

INSTALLATION

BASE INSTALLATION

The deck area where the Stern A-Frame is to be installed must be reinforced and supported from underneath in relation to the loads that the Stern A-Frame will carry.

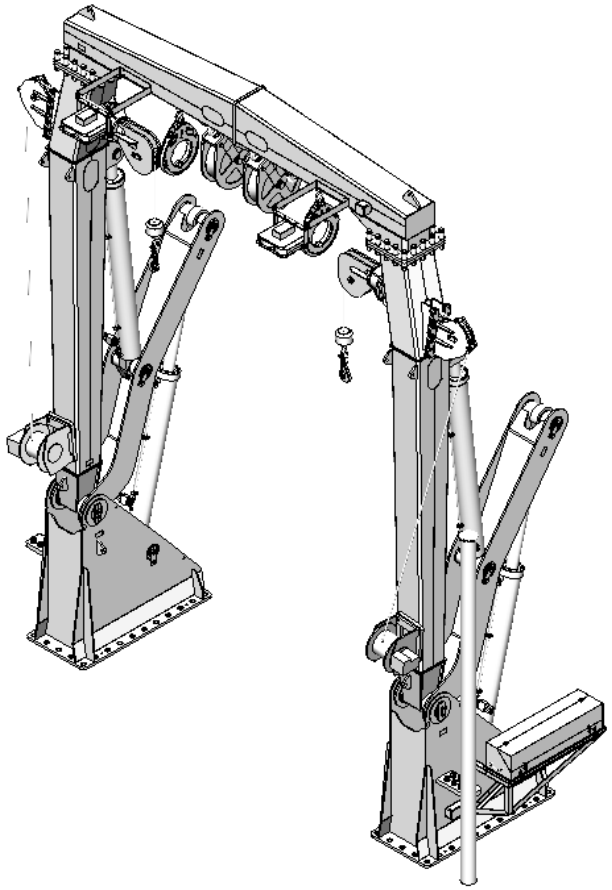
Table of tightening torques screw connections

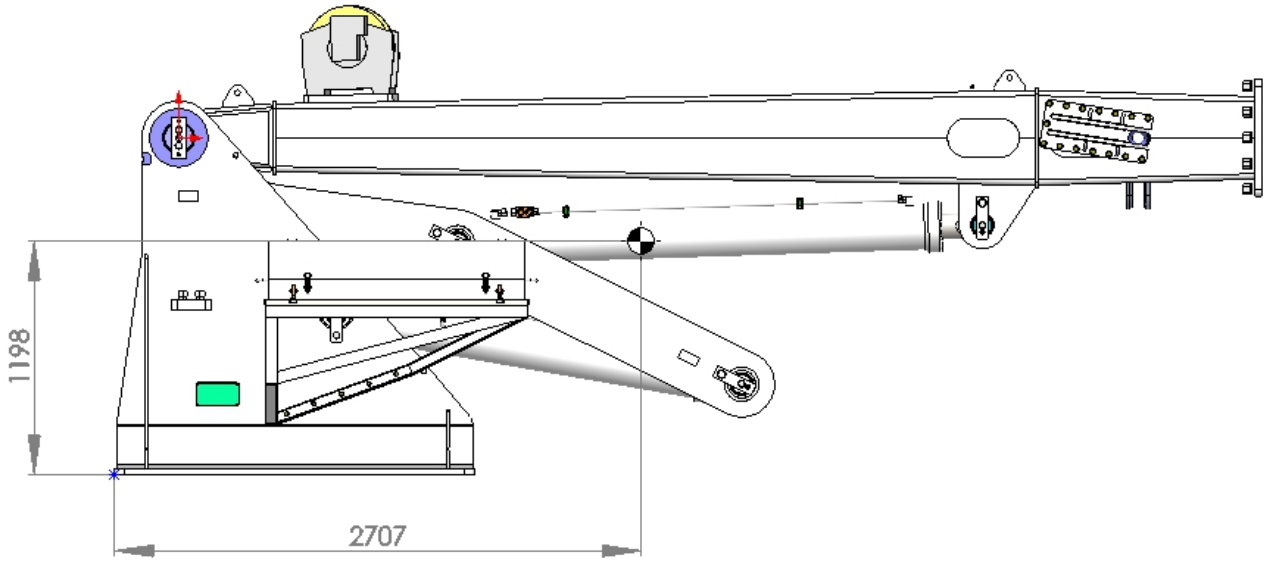
MAKE-UP TORQUE			
dim \ matr	**8.8**	**10.9**	**12.9**
M8	24	47	33
M10	47	65	79
M12	81	114	136
M16	197	277	333
M20	385	541	649
M24	665	935	1120
M27	961	1350	1620
M30	1310	1840	2210
M36	2280	3210	3850
Where hardened washer is not used, lubricate screw head with MoSo2 or similar.			

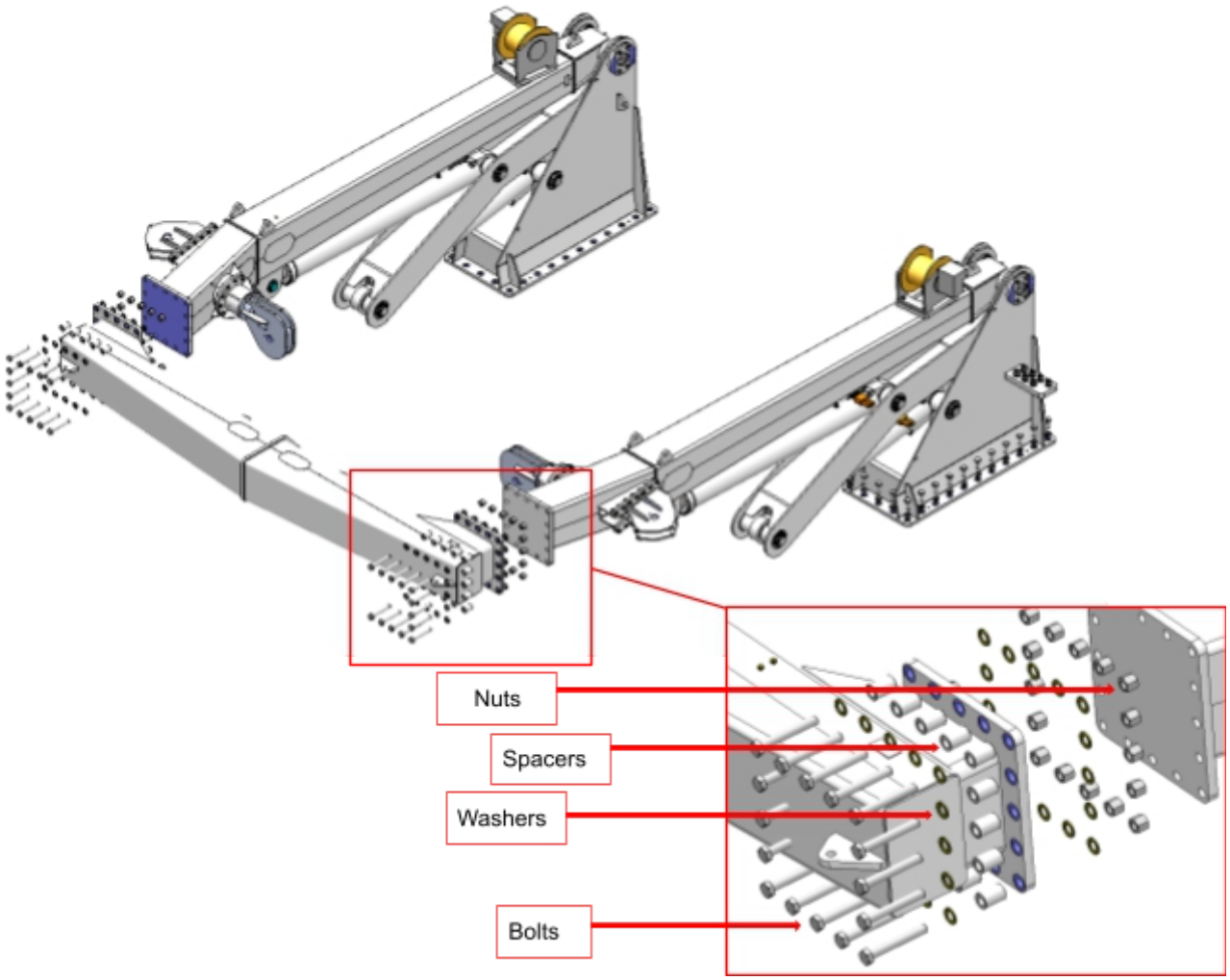
HYDRAULIC SYSTEM

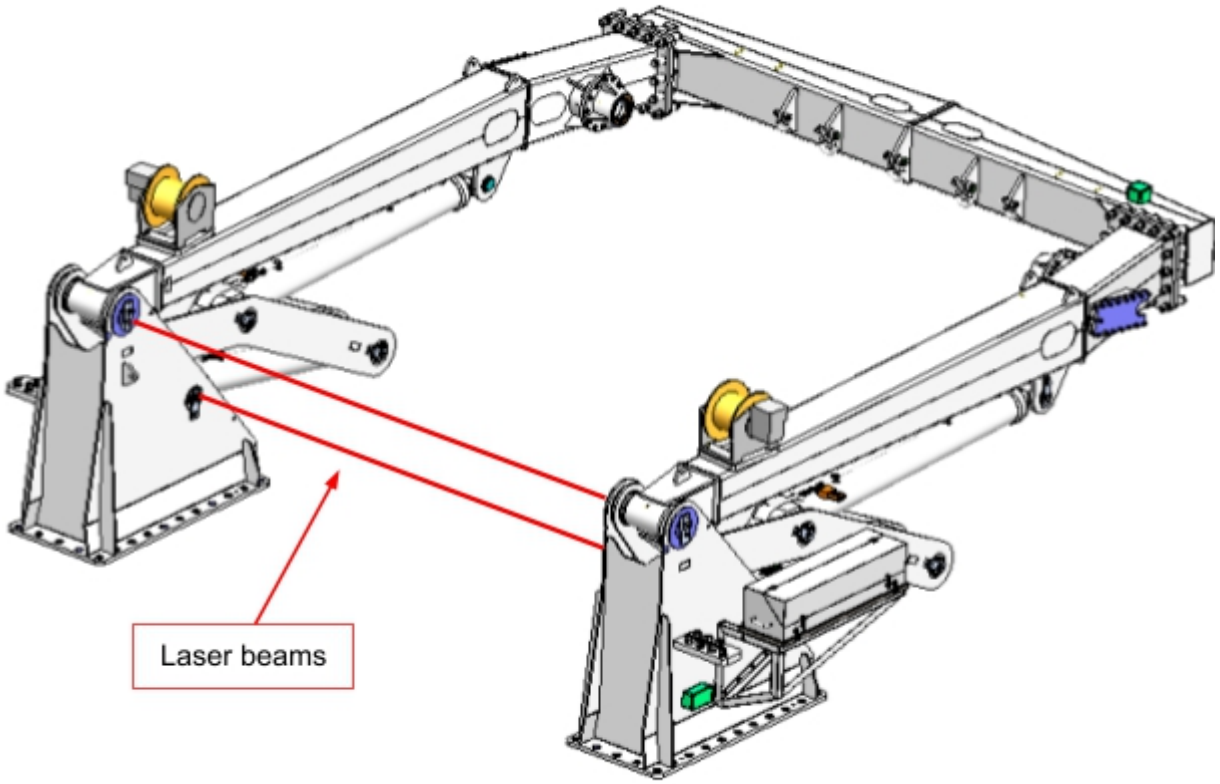
The hydraulic pipe layout should be installed with reference to existing pipe installation charts. It is important to keep all components clean while installing the hydraulic pipe system.

A-Frame Stern Installation Instruction



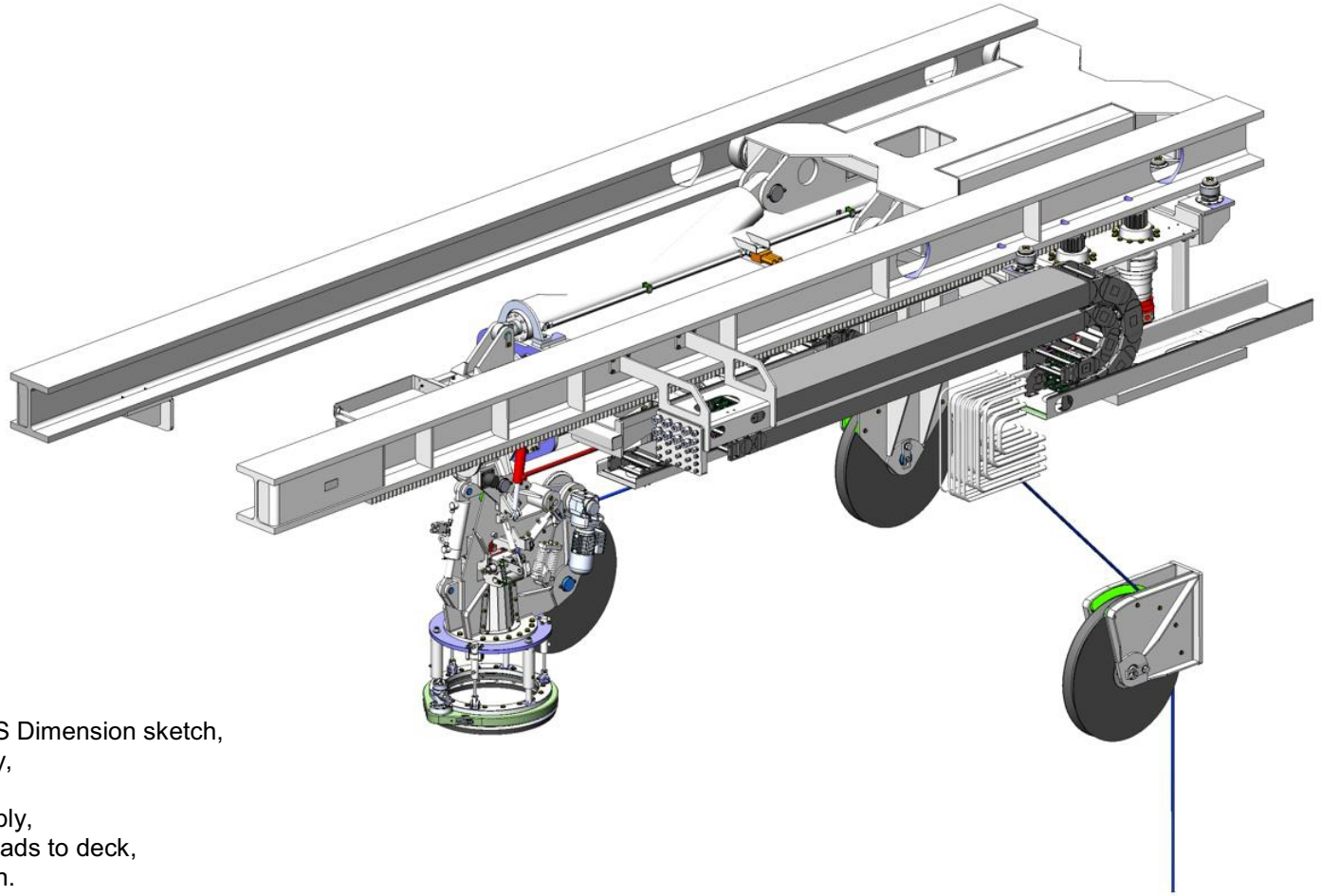
	COG of assembled foundations with gantry legs and cylinders, on Starboard and Port side of the vessel.		

2.	Connect Gantry beam to gantry legs by tightening Bolts and nuts on Starboard and Port side. Bolts: ISO 4014 M30 x 220 - 10.9 Apply torque of 1840 Nm. Mass of Gantry Beam assembly is approx **1000 kg.** (Ref. drawings 24959 Main assem. And 24957 Gantry beam)		

3.	Check if foundation on Starboard and Port side are in tolerance line. Use a laser mounted at the end and in the center of the bearing pin(needs to be perpendicular). The laser shall hit the other bearing pin in the center with tolerance of 0-1mm. This procedure needs to be done from Starboard to Port side and from Port to Starboard on main bearing pin and cylinder bearing pin. (Ref. drw. 25480 Installation-Sheet 2)		

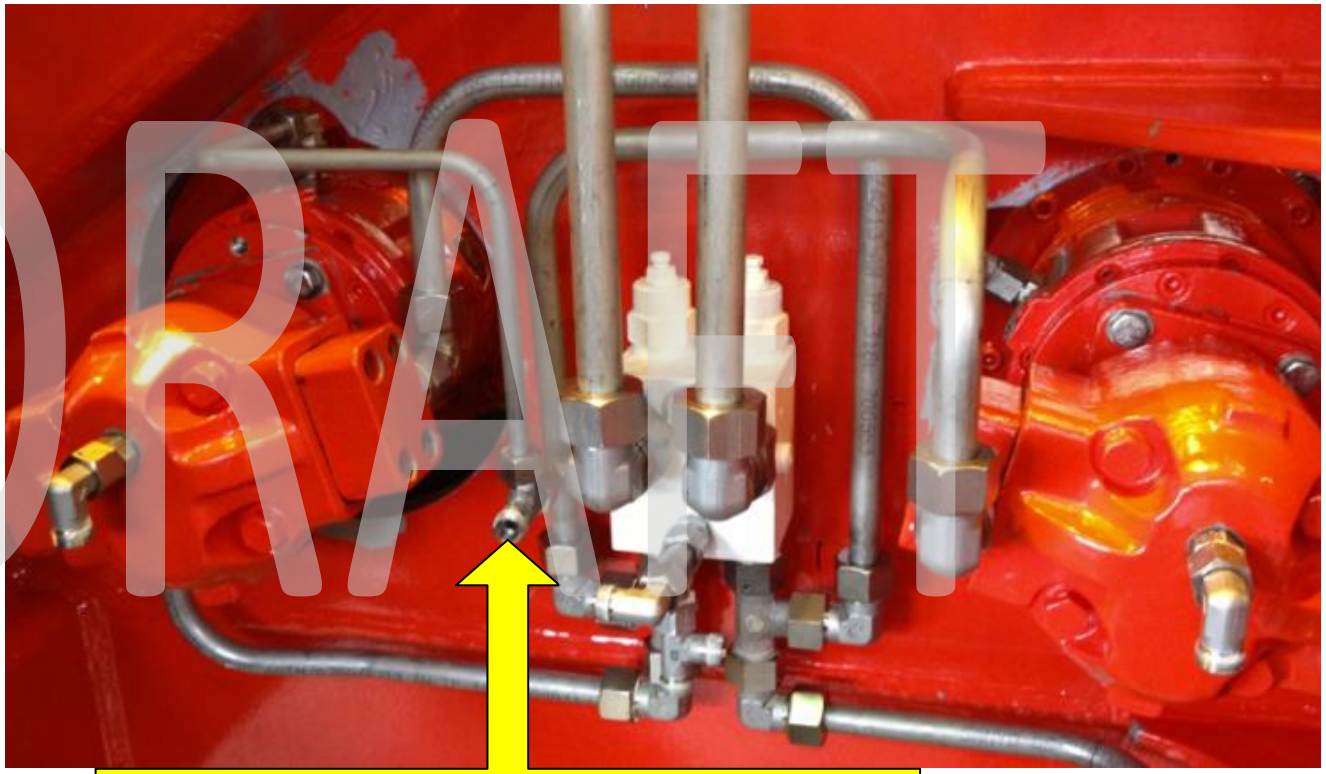
4.	Function test to be done without loads to check if everything is aligned.		
5.	Hydraulic connections according to drawing 25480 Installation drawing.		

ROV LARS
INSTALLATION INSTRUCTION

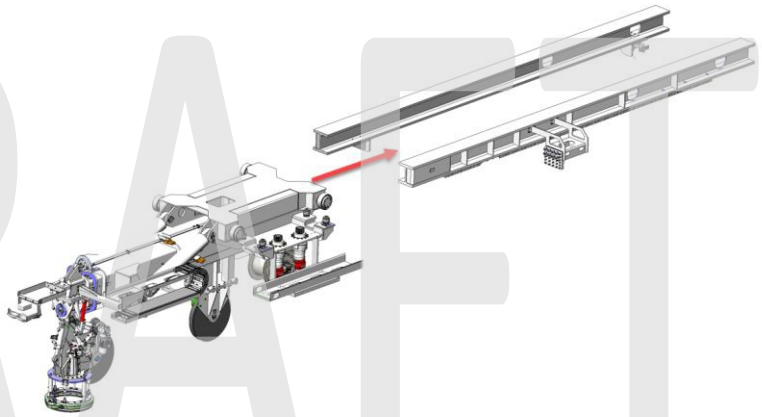
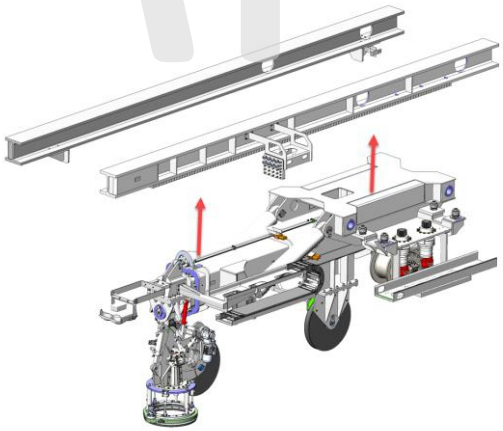


References:

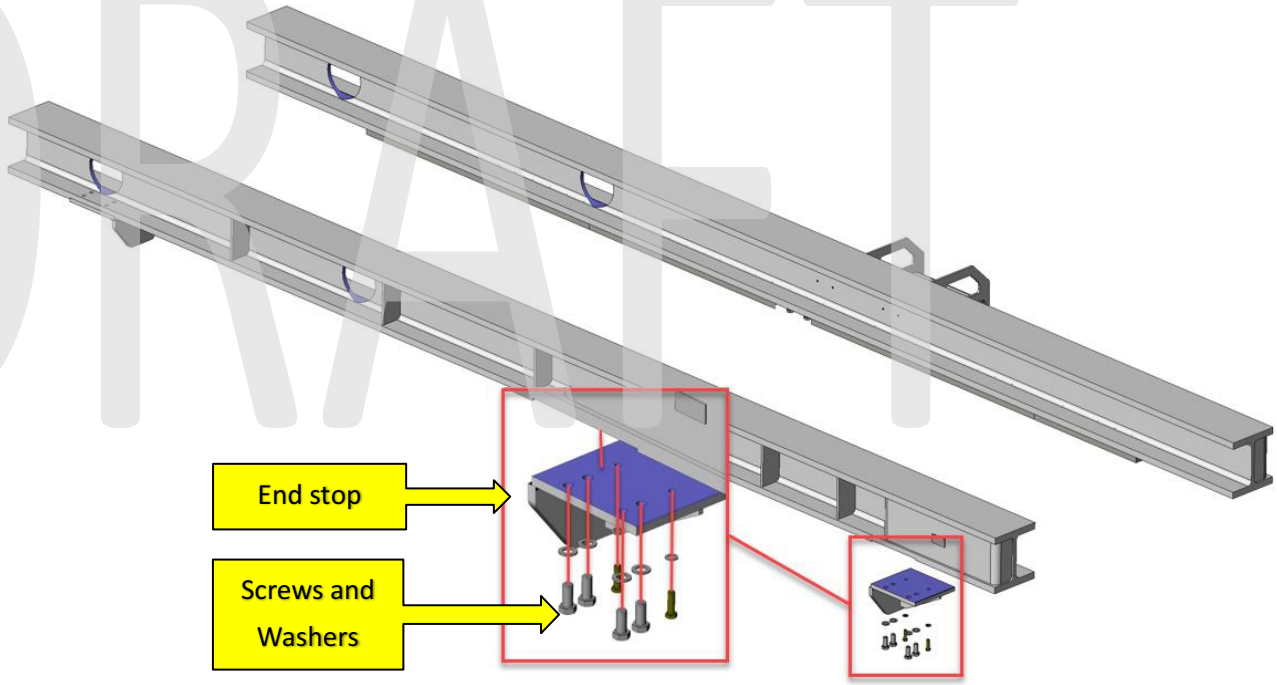
20673 ROV OH LARS Dimension sketch,
25234 Main assembly,
25001 Frame rail,
25004 Trolley assembly,
24891 ROV LARS Loads to deck,
25479 Rail Installation.

Description	Ilustration
In order to release the pressure on the spring brake and rotate the pinion motors and pipes/hoses will need to be reconnected after the trolley is installed in the rails.	

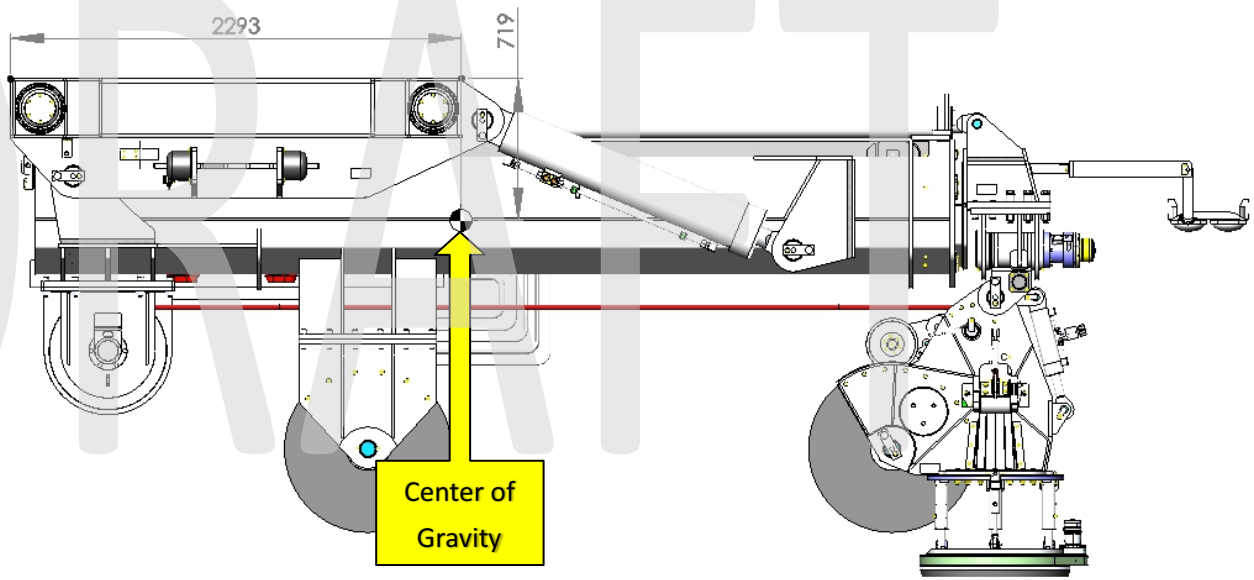
DRAFT

Description	Ilustration
Rails to be installed acc. to drw. no. **25479 Rail installation.** Moving parts can be installed in two ways:	
1. Inserting the complete assembly from STB side into the rails.	
2. Inserting the complete assembly from underneath by removing the wheels from Trolley and reassembling them through holes on the rails.	

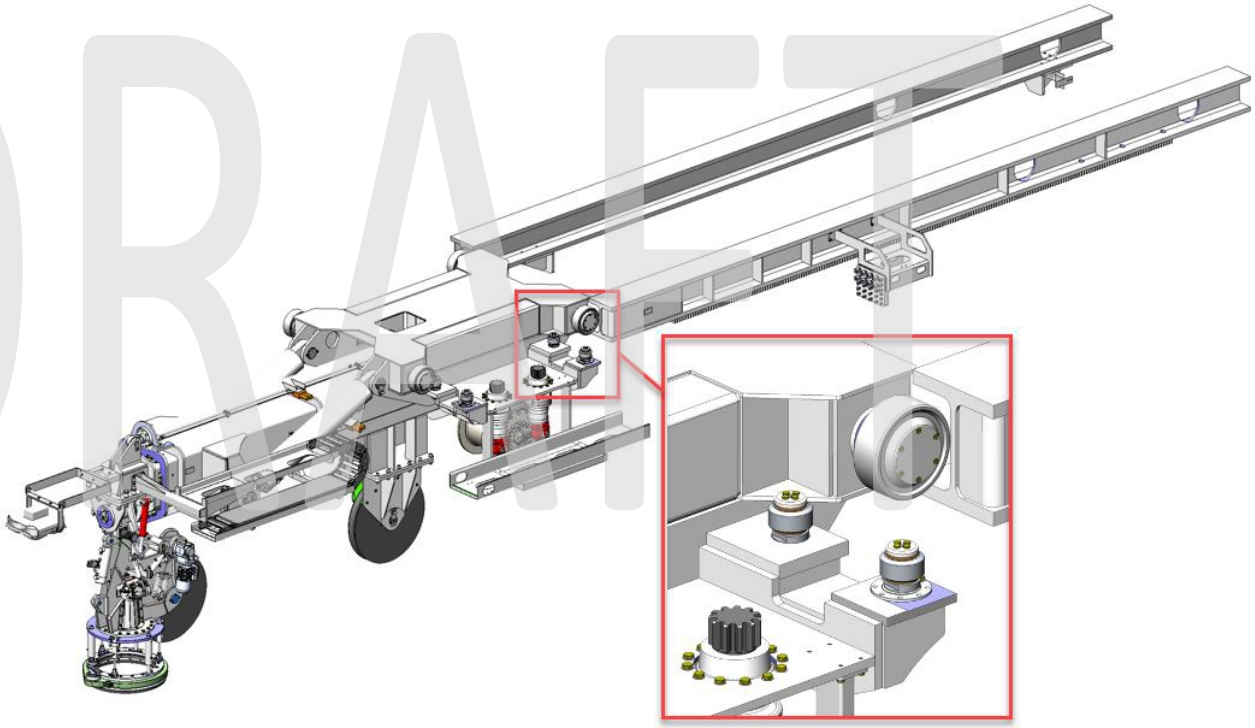
DRAFT

1. Inserting the complete assembly from STB side into the rails	
Description	**Ilustration**
1. Remove STB End stop, screws and washers from Rail.	

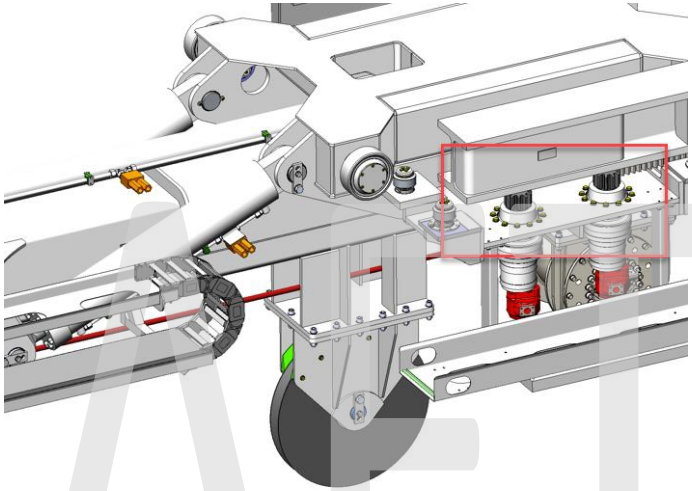
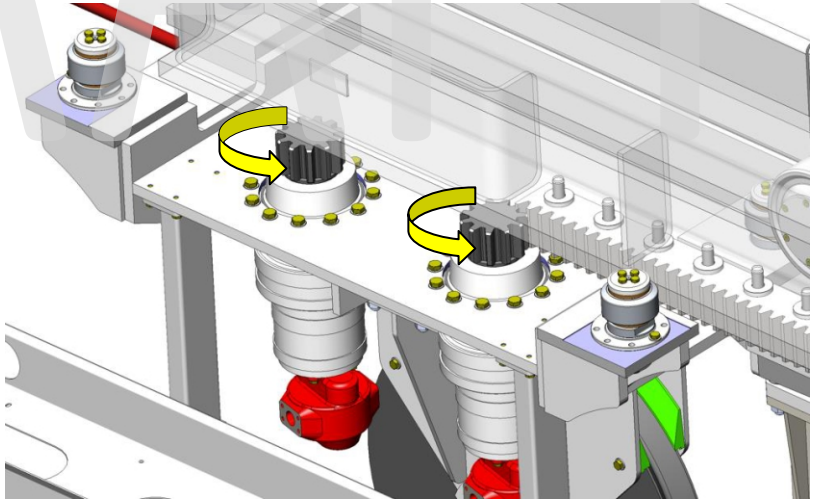
DRAFT

Description	Ilustration
Weight of Trolley with moving parts (approx.) is 8000 kg.	

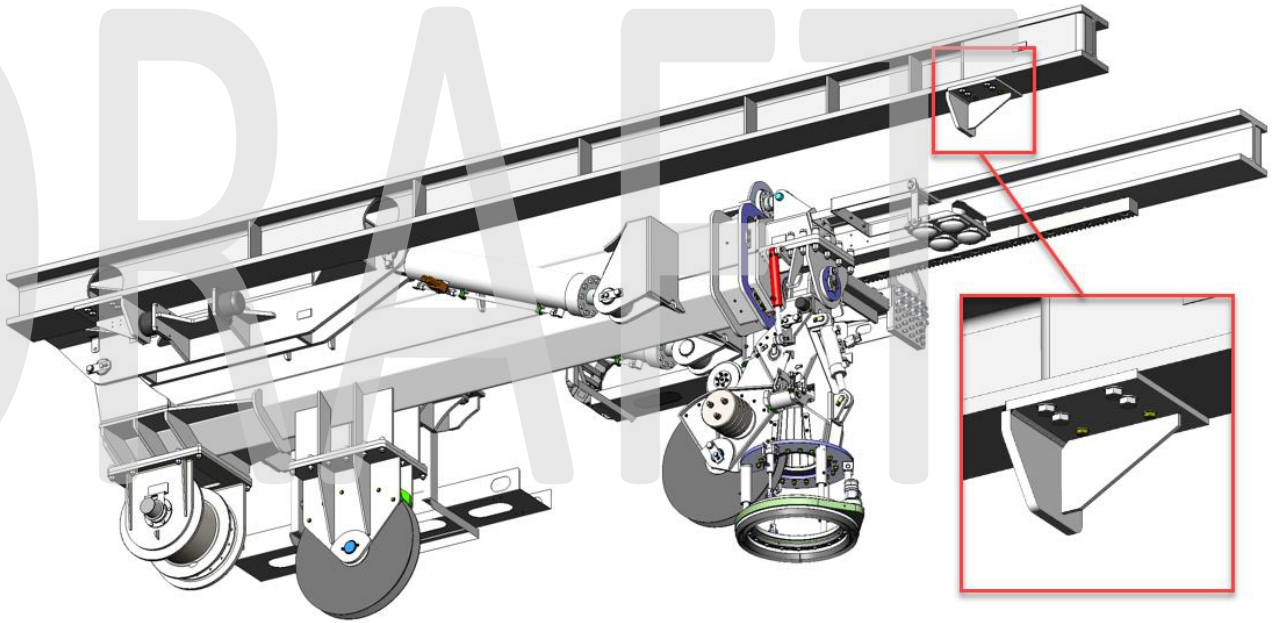
DRAFT

Description	Ilustration
2. Main wheels, guide wheels and pinions are on the fore side of the trolley and special attention is to be made here when inserting the crane.	

DRAFT

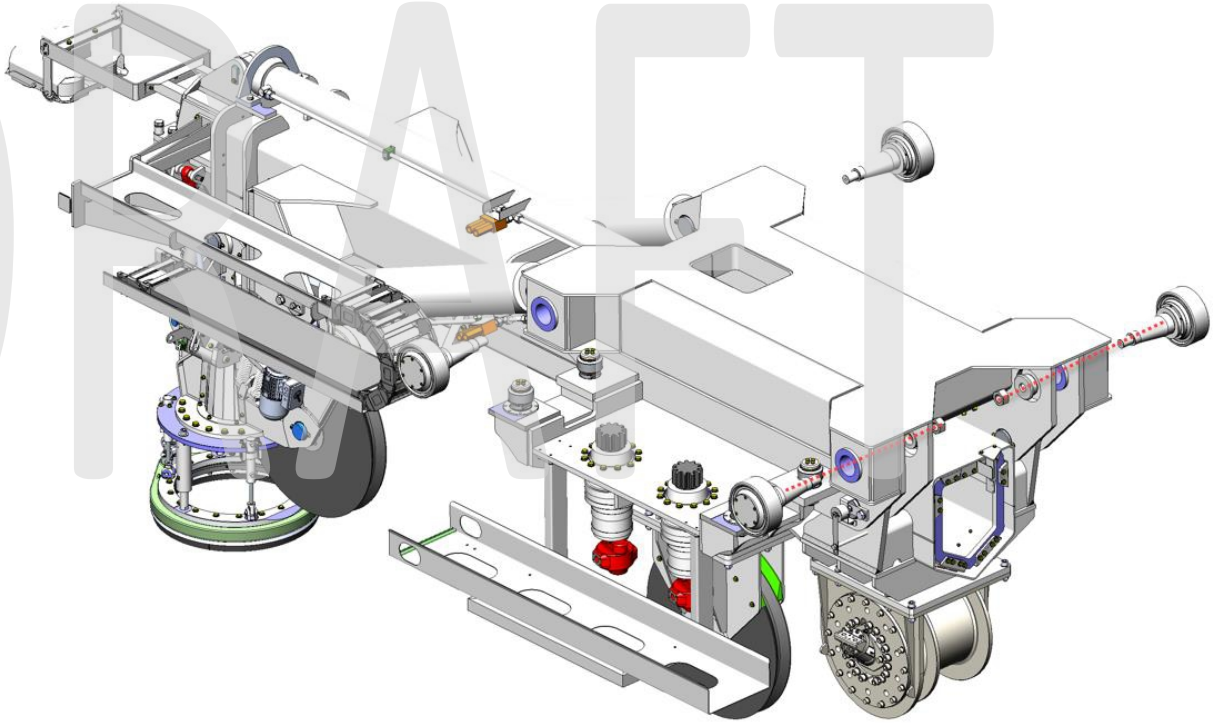
Description	Illustration
3. Apply pressure with hand pump to enable rotation of pinion. Align pinion with rack tooths.	
	

DRAFT

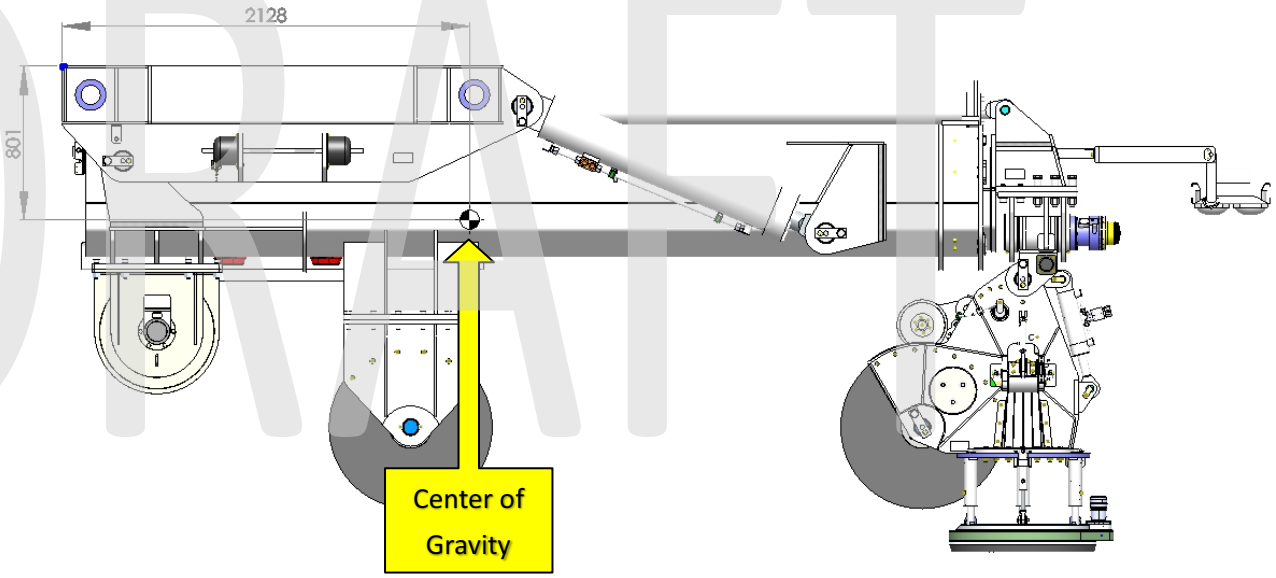
Description	Ilustration
4. Move trolley and moving parts to PORT side. Return STB End stop. Apply torque of 935 Nm (screws M24) and 197 Nm (screws M16).	

DRAFT

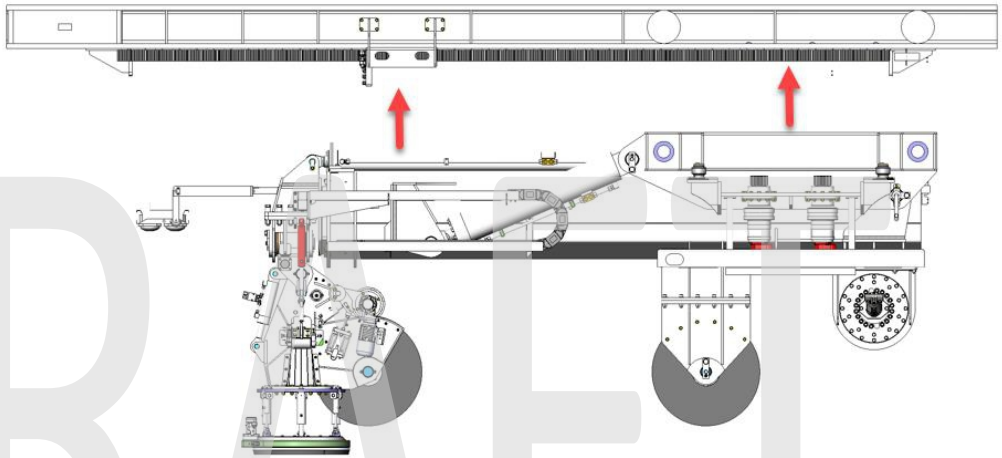
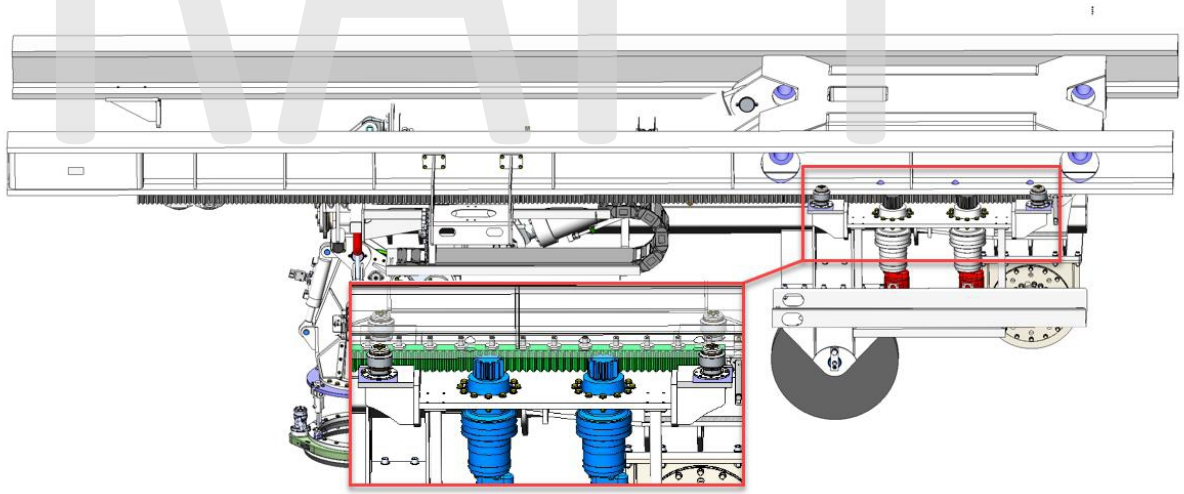
2. Inserting the complete assembly from underneath

Description	Ilustration
1. When inserting Trolley from underneath, all four Main wheels must be removed from trolley. Remove Washers and Nuts from Main wheels, and remove Wheels from Trolley.	

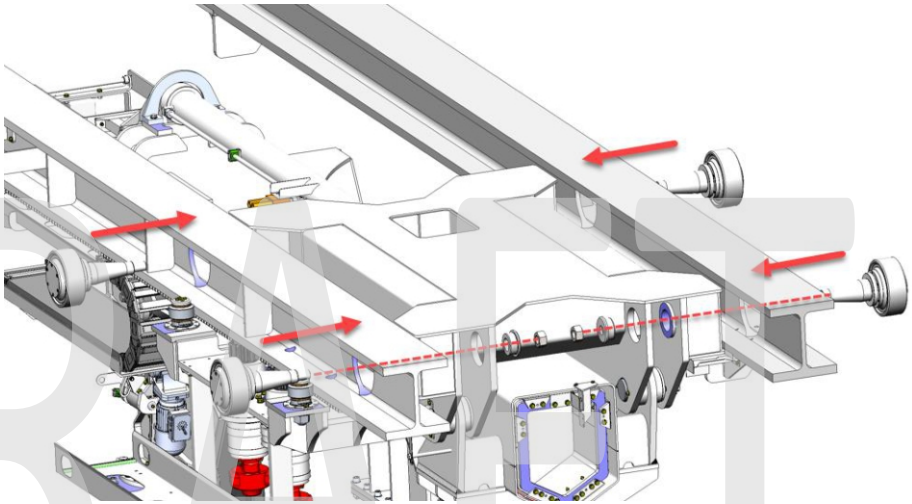
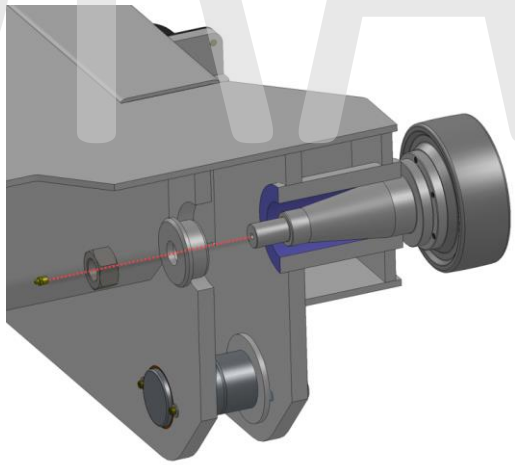
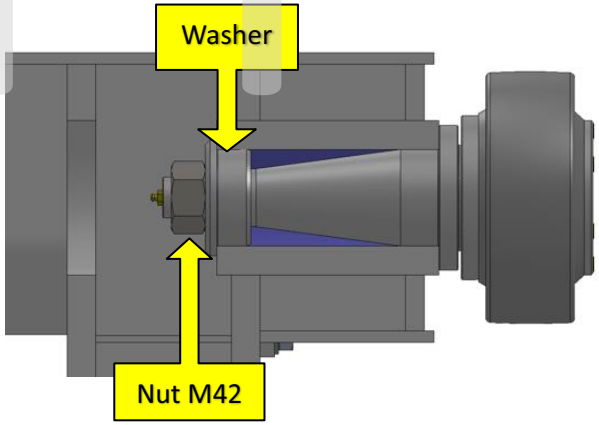
DRAFT

Description	Illustration
Weight of Trolley (without Wheels – 4 pcs.) with moving parts is 7800 kg (approx.). One wheel has a weight of 60 kg (approx.).	

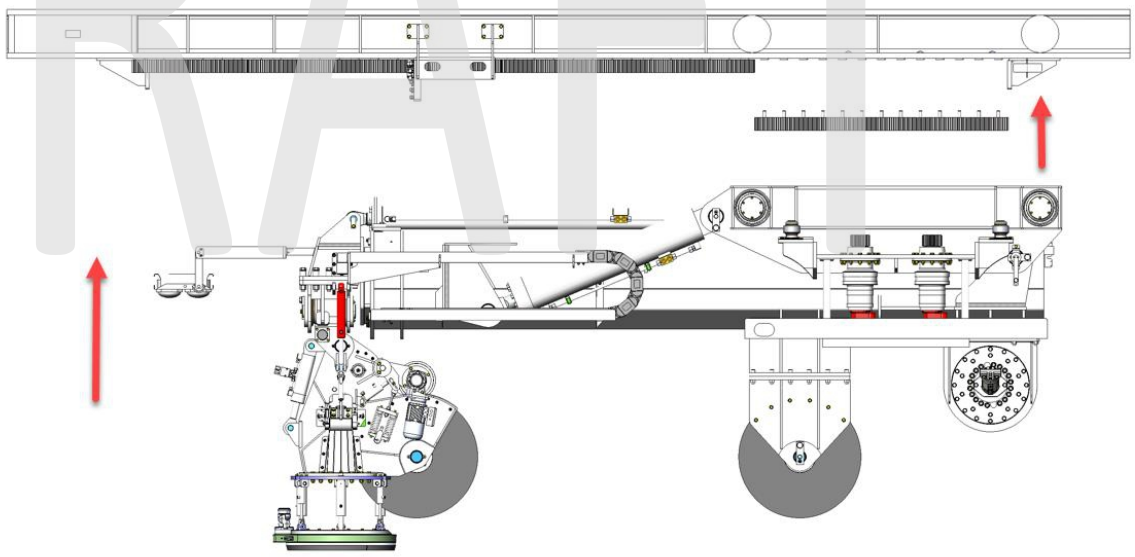
DRAFT

Description	Illustration
2. Lift up Trolley and moving parts up to mounting position on Rails.	
3. Apply pressure with hand pump to enable rotation of pinion. Align pinion with rack tooths.	

DRAFT

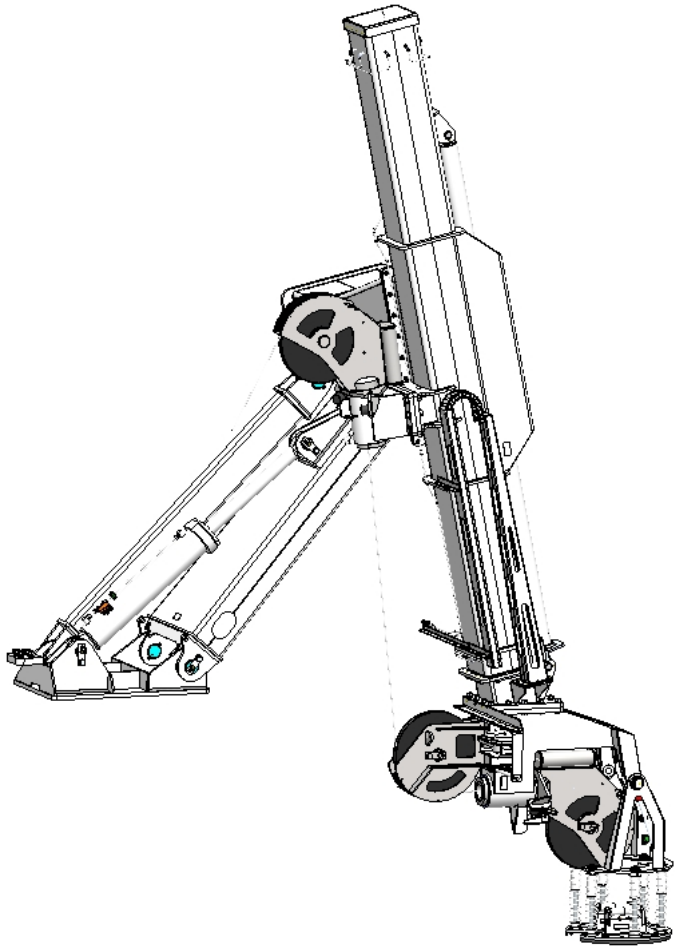
Description	Illustration
4. Align the holes on Trolley (Wheels) with holes on Rails (FORE and AFT side). Assemble Main wheels with Trolley through the holes on Rails using Washers and Nuts. Apply torque of 4604 Nm.	
	
	

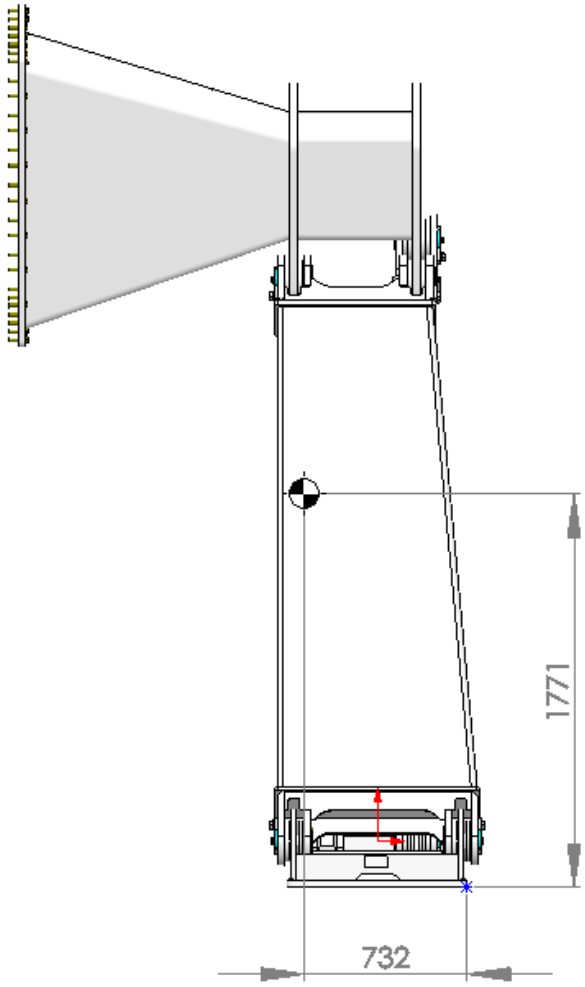
DRAFT

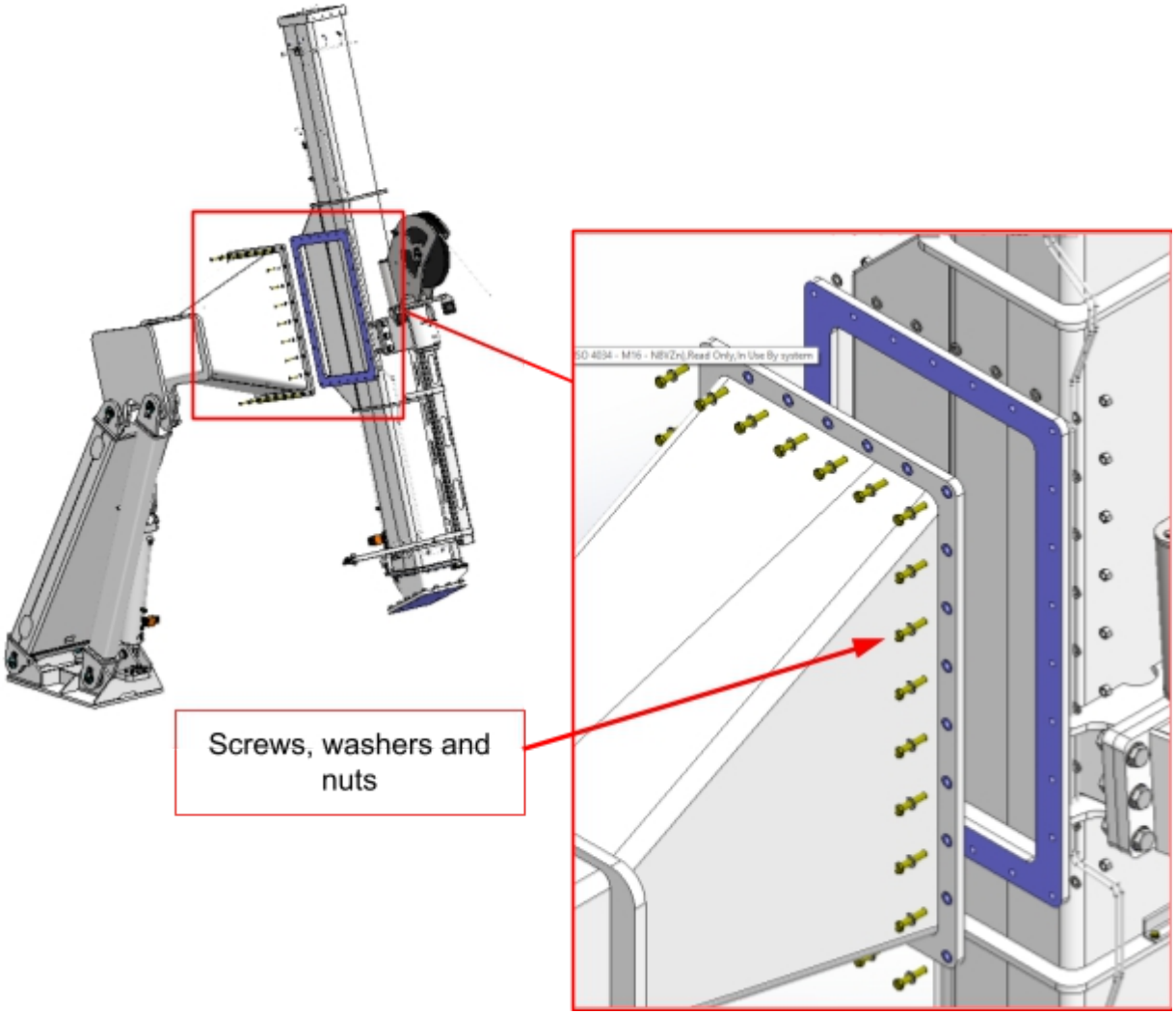
Description	Illustration
5. If a hand pump cannot be used, then one Rack section can be removed from Rail (first Rack from the PORT side). Lift Trolley and moving parts up to Rail.	 

DRAFT

CTD DAVIT INSTALLATION INSTRUCTION

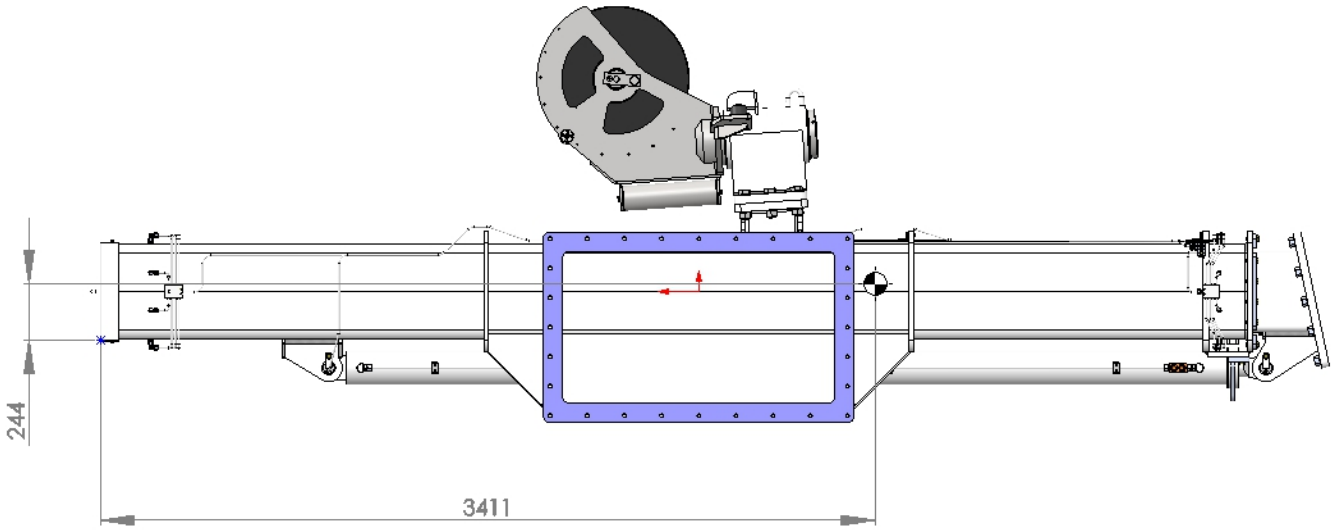


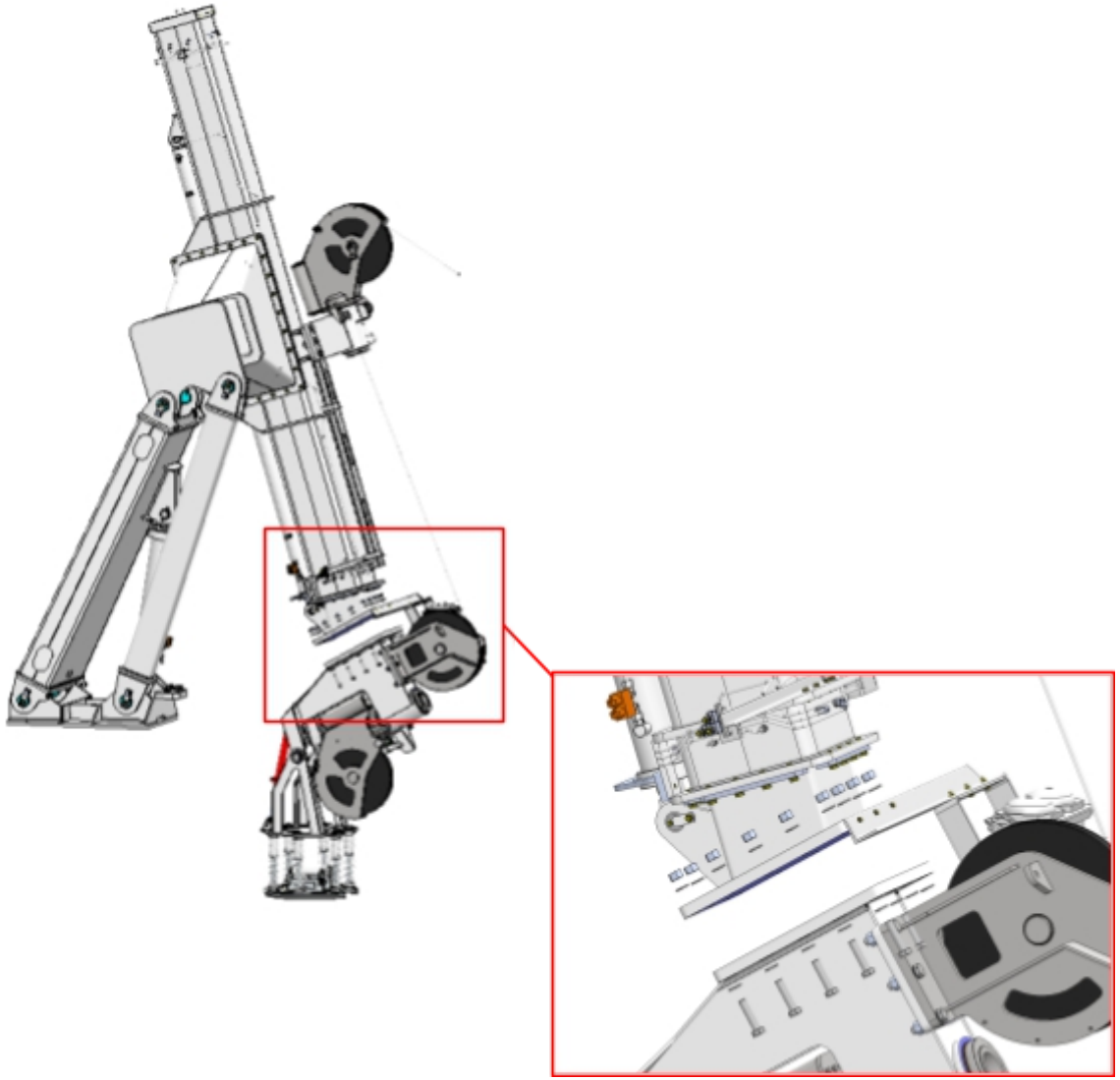
	COG of foundation, arm, outer boom and cylinder assembly. Weight of shown assembly is approx.: **2600kg.**		

2.	Connect telescope assembly to assembly of foundation, arm, outer boom and cylinder. Use screws: ISO4014 M16x80- 8.8 and washers DIN125 A17. Apply torque of 197 Nm. (Ref. drw. 25059 main assembly, 24914 telescope assembly and 25487 shipment plan)		

COG of Telescope assembly.

Weight of Telescope assembly approx.: **3000kg.**



3.	Connect Wire block with docking head to telescope assembly. Use screws ISO4014 M24x100-10.9 and nuts M24. Apply torque of 1840 Nm. Weight of Wire block and docking head assembly approx.: **1300kg.**		

4.	Hydraulic connections according to drawing 25482 Installation drawing.		

ASSEMBLY

COLUMN INSTALLATION

The deck area where the crane is to be installed must be reinforced and supported from underneath in relation to the loads that the crane will carry.

It must not be welded closer to the leveled flange more than 250 mm.

INSTALLATION OF CRANE ON COLUMN

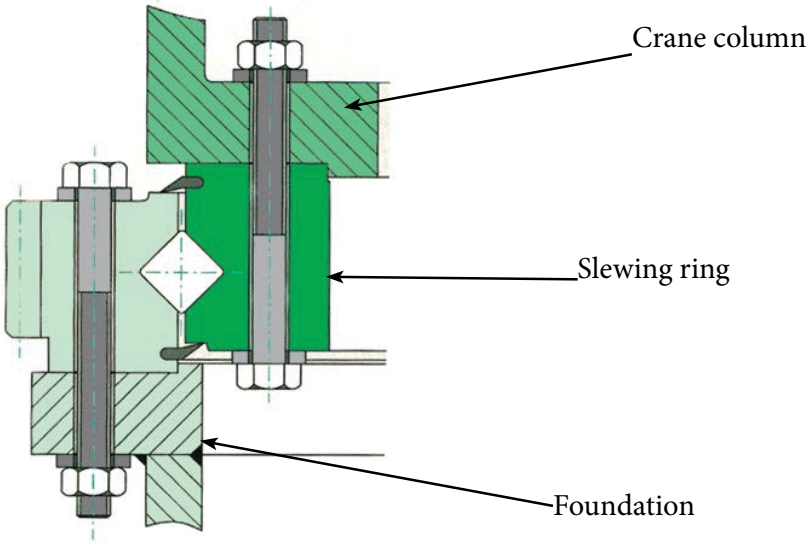
The entire crane undergoes a trial assembly in the factory before being dismantled for transportation.
The crane is delivered with the main slewing bearing mounted and gearbacklash finally
Adjusted. The slewing bearing must not be desmantled during the crane installation.

The crane is lowered into position. The bolts of the sleeve ring should be tightened diagonally with the same torque.Pipes are then connected.

ELECTRICAL JUNCTION BOX

This must be positioned inside a dry room where the temperature will not rise above 50 C.
The box has a socket on the outside where the portable control panels flexible cable is to be connected.
The positioning of the junction box will therefore determine the length of this flexible control cable.

Tightening torque for slewing ring



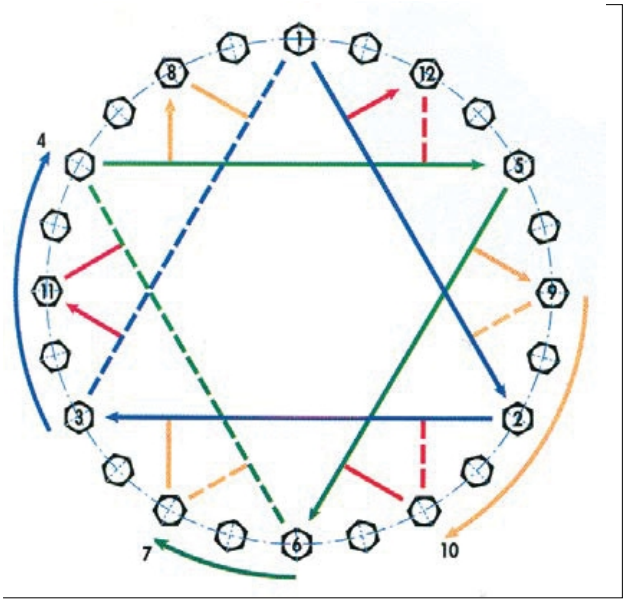
Each crane is delivered with a !xation kit of bolts, washers, (nuts and spacers) for !xing the crane to the foundation.

"e minimum lenght of the bolts has to be at least 5 times the bolt diameter.

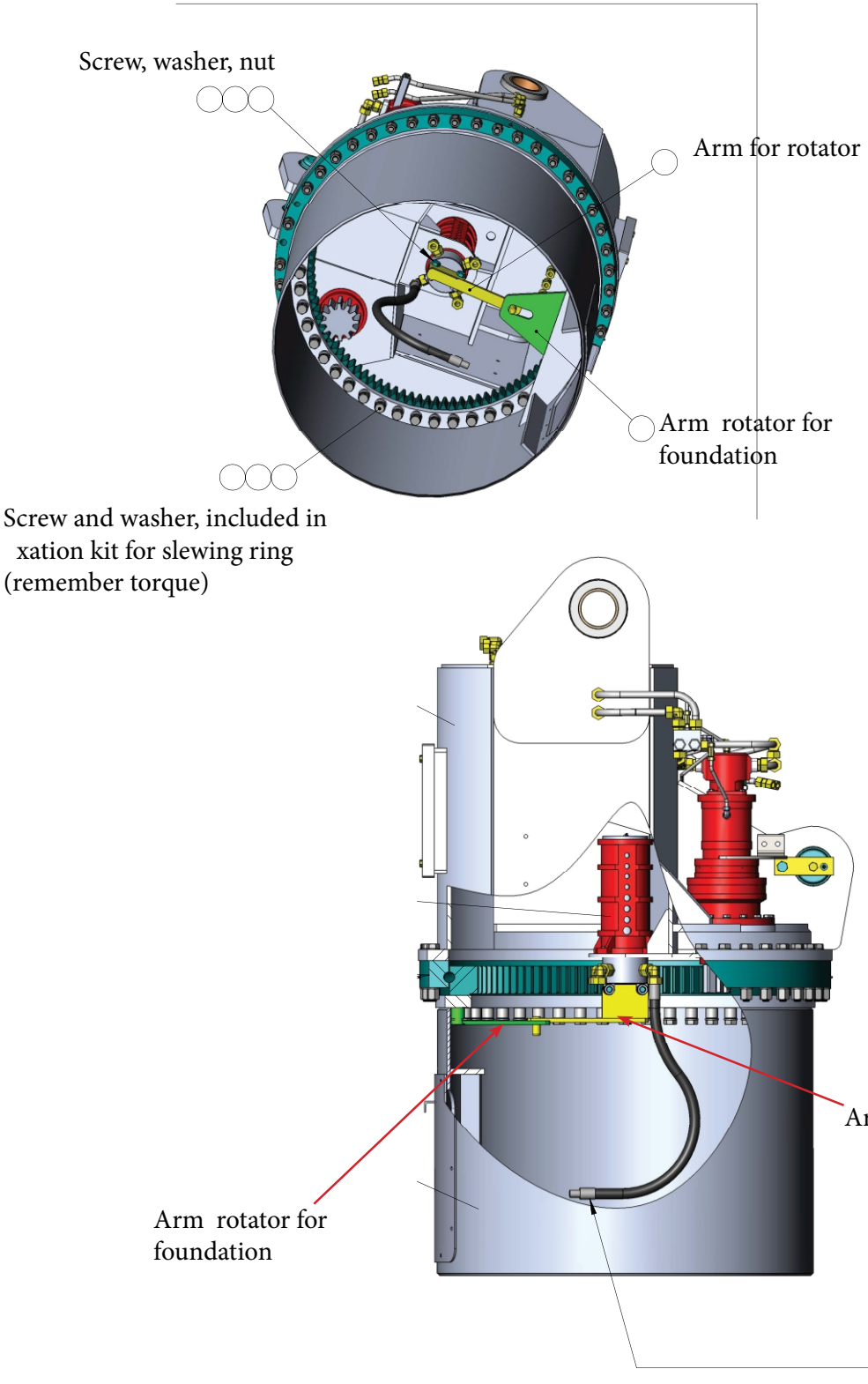
If not otherwise indicated please refer to the attached table for torque values.

During the operation it is useful, that the crane con!guration will give less moment to the foundation. Relieve the pressure from the crane so that foundation and slewing ring is lying #at against each other.

"e tightening has to be carried out in accordance with sketch below.



Kit for connection to rotating coupling



HYDRAULIC SYSTEM

The hydraulic pipe layout should be installed with reference to existing pipe installation charts.
It is important to keep all components clean whilst installing the hydraulic pipe system.
The same applies to the electric pump unit if this is included in the installation.
The pump should be placed under the deck as close to the oil tank as possible.
The oil tank should be positioned higher than the pump.

STARTING UP

The pumps can be started up after the crane is installed, the pipe system connected and the oil tank filled with the correct oil.
It is important that the pumps are run for 15 mins. before any manoeuvring valves are operated. This is to allow for the filtration of the oil in the pipe system.
After this the hydraulic cylinders must be moved their entire length backwards and forwards to ensure that they fill up with oil. While this operation is beeing carried out the crane MUST be held safely by another crane.
When all these functions have been thoroughly tried and tested the gaskets in the high pressure filters must be changed. The main filter for each spool on the proportional valves should also be thoroughly cleaned at this time.
To prevent the cylinders dropping when the crane is loaded and the pump pressure is "off", the overcentre valves on the cylinders should be adjusted inwards until the crane holds the load.

IMPORTANT:

The bearing race on sleewing bearing must be lubricated before use. See lubrication chart.

01	28.02.2022	Issued for release	J.P.	J.J.	J.J
Rev./ Status	Date	Description	Made by	Checked by	Appr. by

Customer: N/A

General instruction

Project:

Mechanical installation of MacGregor Deck Machinery

Purchase order no.:	Order date:
N/A	N/A

Commission no.:	Document file:
N/A	**Mechanical installation of deck machinery**

Date:	Name:	Identification no.:
23.02.2022	J. Pettersen	**EN-IM Mechanical installation of deck machinery**

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2. Requirements to foundations 3

3. Installation procedures 4

4. Control of installation 6

1. Depreservation and preparation for installation

Deck machinery and hydraulic equipment must be preserved and packed at the manufacturer to provide guaranteed time of storage, provided that the buyer fulfills storage instructions.

Depreservation of external and internal surfaces of equipment is allowed just before installation, connection to hydraulic system etc.

Winch supporting surfaces are to be depreserved just before installation of the winch on the foundation. Depreservation to be done by scraping bright supporting surface and sponging it with cleaning cloth moistened in solvent.

Screws and level wind are to be depreserved just before the winch trial run. Depreservation is to be done by removing surplus preservative. The diamond screw and working surfaces of the level wind guide shaft must be oiled with a layer of lubricant.

Prior to installation of deck machinery, proper foundations for winches must be ready in accordance with the requirements of this document.

By the time of the installation the shipyard must prepare the following:

- Oil and grease for gearboxes and spooling arrangement.
- Ropes of required type and size.
- Device for rope winding.

2. Requirements to foundations

Deck machinery (winches) and power packs must be installed on foundations.

On the dimensional drawings for the winches the following characteristics are normally given:

- Weight;
- Dimensions;
- Service areas;
- Deck interface of the machinery;
- Size, strength class and number of fastening bolts;
- Angle of rope (chain) run-down;
- Flatness of support surface (table for unspecified tolerances);

Foundation stoppers to be mounted if specified at the dimensional drawing or in the loads to deck document.

Strength and quality of foundations must meet requirements of the Ship Classification Rules.

3. Installation procedures

Winches are to be installed on foundations in accordance with the diagram (fig. 1) and procedure of installation below.

- Place un-machined shims of thickness 20-25 mm on the surfaces of the deck foundation. Two shims on each side.
- Move the winch into position on the deck foundation and make sure that all shims are bearing.
- Fit the hold-down bolts. Tighten the bolts lightly.
- Check the drum for easy rotation.
- Now machine new shims of thickness according to the exact measurement of the space between the foundation parts on each screw position.
- Remove the hold-down bolts and the un-machined shims.

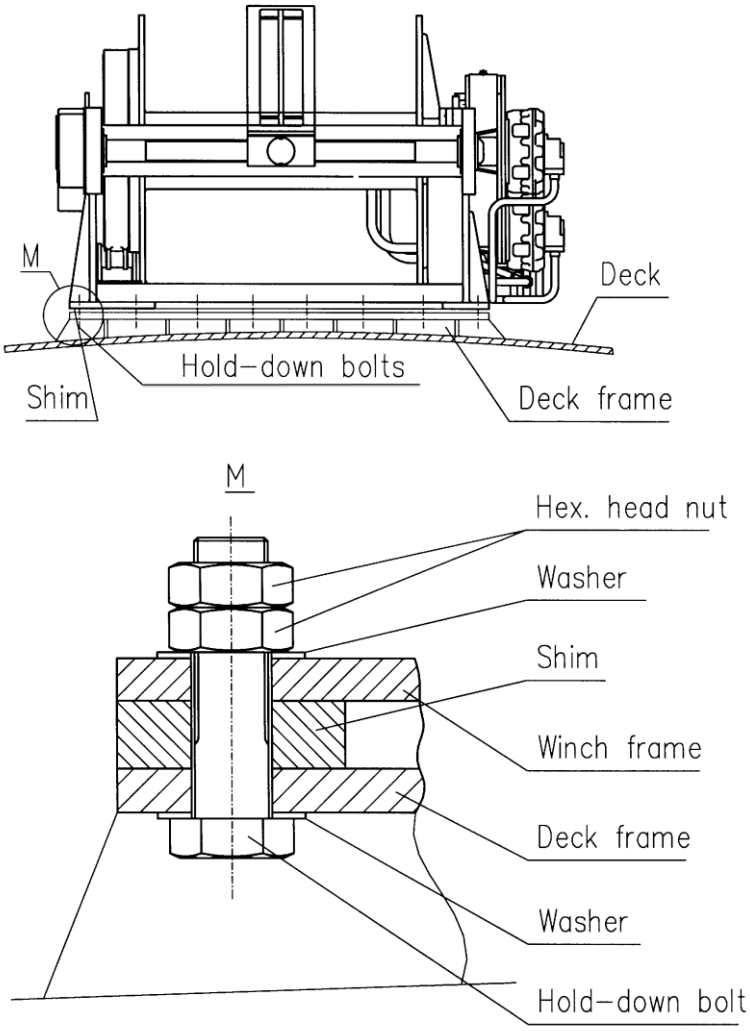
M
Deck
Hold–down bolts
Shim
Deck frame
M
Hex. head nut
Washer
Shim
Winch frame
Deck frame
Washer
Hold–down bolt

Fig. 1.

- Fit the new machined shims under the hold-down bolts and make sure that each of the shims are located in the correct place in relation to the measurement.

- Check the clearance between the shim and the support surface of the winch and between the shim and the foundation. The clearance gauge 0.06 mm thick shall not pass by 2/3 of the support surface.

- Fit the hold-down bolts. Tighten the bolts with prescribed tightening torque, shown on the dimensional drawing for the winch.

- Check the drum for easy rotation. If the drums do not rotate as freely as they did before tightening, the foundation alignment is not good.

- Loosen bolts, check shims and repeat procedure until all bolts are tight and drums are free.

The checklist must be filled out for each winch with the results of the installation control.

Note! Installation procedure for gear drive winches is described in a separate instruction.

4. Control of installation

Results of the control of the deck machinery installation shall be presented to the representative of MacGregor.

This documentation shall present the following parameters.

1. For deck machinery:

    - Clearances on connections to the support surfaces;

    - Parameters of fastening bolts tightness;

    - Coordinates for the first block (wire guides) position.

2. For oil and grease selection:

    - Type/brand of oil/grease;

    - Certificates for oil quality;

    - Oil analysis results.

Note! One copy of above documentation shall be submitted to the representative of MacGregor.

Item	Description		Check point	Remarks	Accepted date / sign.	
1	Winches	A	No mechanical defects			
		B	Foundation type, accepted			
		C	Foundation stoppers mounted according to dim. sketches			
		D	Correct distance to first block			
		E	Block mounted in center line of drum			
		F	Service distances correct			
		G	Support of connection pipes			
		H				
2	Gear winches	A	Installed according to MacGregor instructions			
		B	Run out tolerances checked after installation			
		C	Pull test for foundation stiffness			
		D	Correct type of gear oil filled			
		E				
3	Servicing	A	Future servicing of all components possible			
		B				

A GENERAL INSTRUCTION:

INSTALLATION OF ELECTRICAL SYSTEMS

Read these installation instructions carefully and take note of the content before installing, maintenance or repair to the electrical system.

MACGREGOR

Revision history

06	23/08/19	Added info on ferrite rings, page 11 + new company logo and web address	ST	TR	MB
05	14/02/19	Updated EMC information. Also, other minor corrections and new layout.	TAA	RAJ	MB
04	07/04/16	Added extra; regards to motor and encoder cables	TR	ØS	BB
03	12/04/15	Added extra info	RAJ	BB	BB
02	18/03/15	Added extra info	RAJ	BB	BB
01	11/02/13	Added extra info	TR	BB	BB
00	20/01/11	Issued for Project Acceptance	TAA	HD	BB
Rev.	**Date DD/MM/YY**	**Description**	**Made by**	**Checked by**	**Approved by**

Terms and abbreviations

Term / abbr.	**Definition**
CAN	Controller Area Network
EL	Electric / Electrical
CAN	Controller Area Network
CANOpen	A communication protocol and device profile specification for embedded systems used in automation.
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
HF	High Frequency
Inverter	An inverter converts the DC voltage to AC voltage.
I/O	Input / Output
MRU	Motion Reference Unit
NMEA	National Marine Electronics Association
PE	Protective Earth
PLC	Programmable Logic Controller
RS-232	Standard for serial binary single-ended data and control signals
VFD	Variable Frequency Drive

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Introduction

This manual should give the reader sufficient general knowledge to install any delivered Rapp Marine electrical system.

Contact information

If you have any questions, please do not hesitate to contact us:

Phone	+47 75 55 01 00
Service phone, 24 hours	+47 91 81 29 99
Fax	+47 75 55 01 11
E-mail	rapp.office.no@macgregor.com
Service inquiries	rapp.service.no@macgregor.com
Spare parts	rapp.parts.no@macgregor.com
Home page	www.macgregor.com
Address	Nordstrandveien 41, 8012 Bodø, NORWAY

Warnings

Frequency drives and/or inverters;
power supplies that have been powered up can remain charged for about 25 minutes after disconnected.

Pressure switches, pressure sensors and temperature sensors
can have locked in pressure on the sensor side. If removing unit is necessary, make sure that the pressure is released before removing the component.

Prepare for installation

Before installation, electrical equipment must be carefully taken out of container.
IMPORTANT! Packaging/preservation material must not be removed before final powering of system.
For termination of cables, remove only necessary wrapping to get access to cable gate and termination points.

Check all items in the shipment for damage and compare the contents with the packing list, enclosed with the shipment. Inform Rapp Marine AS as soon as possible if you notice any damaged or missing components.

Make sure that ventilation holes of electric motors for input and outlet of cooling air are not plugged.

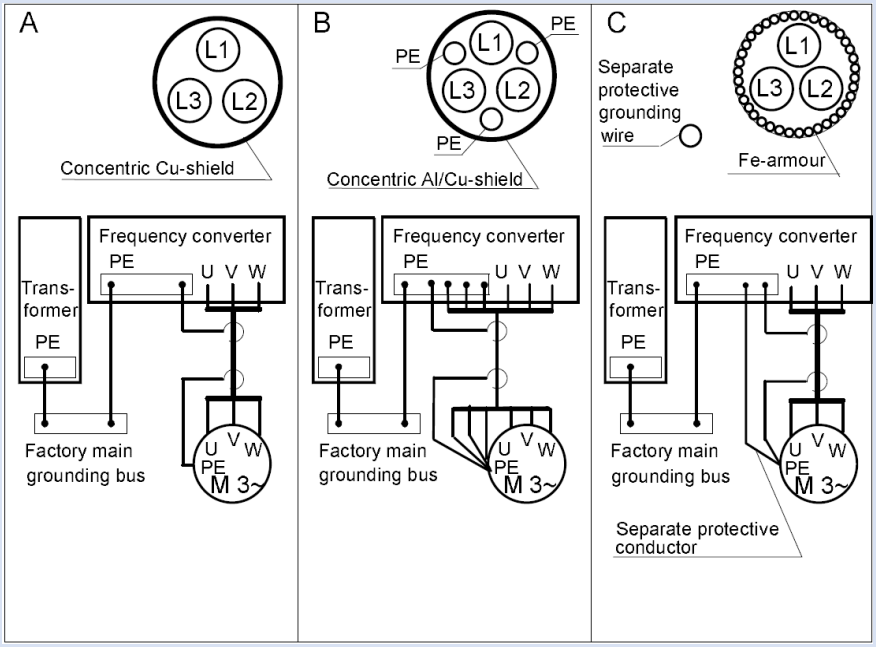
For further and general guidelines on topic,
please see the Rapp Marine **Preservation Manual** Doc ID#6243

Electrical installation

Cables

All cables used in the system must be according or equivalent to Rapp Marines drawings and within class regulation on-board the ship, such as ABS, DNV, LOYDS or others.

NOTE! Cables between motor, frequency inverter/brake choppers, brake resistance and control panels, must be **EMC/EMI screened.**



A.
Shield which also have requirement to be PE conductor

B.
Symmetric PE conductors

C.
Shielded cable and separate PE conductor

For recommended cables, see Appendix A; a list in end of this document.

Cable type and quality, examples

Cable types have to be suited for the working environment (examples);

- Outdoors on deck:
  Cable(s) must be of a quality that can withstand sun light/UV radiation, or else be sufficient protected from it (by protection hose)
- Outdoor temperature:
  Select cables that can handle the normal working temperatures on deck.
- Oil or chemical environments:
  Cable type must be resistant to oil or chemicals
- Cables in a drag-chain:
  Flexible cable, designed for bending

Make sure that all cables used for connection of electrical equipment doesn't have broken cores or damages of insulation.

Device net and CANOpen net cables must only be *special* cables.
-The net can have a drop cable of max 4m (T arm)

NOTE! Cables connected to solenoid boxes filled with oil, shall have oil-resistant insulation.

Cables for VFD controlled motor and/or brake resistor

- Screened cable
- Cable with 3+3 Cores twisted concentrically (this is a symmetrical cable with 3 conductors for power, and 3 conductors for PE),
  or a screened 3 conductor cable with screen suitable for PE,
  or separate PE conductor on the outside of the cable.
- EMC cable glands for connecting the cables to the motor
- EMC clamp inside the cabinet
- Motor cable: Maximum length 40m (if there is need for longer, contact Rapp Marine)
- Brake resistor cable: Max length 20m (if there is need for longer, contact Rapp Marine)

Encoder cables

- Screened twisted Pair cable
- Fine stranded cable (never compromise on the size):
  0.25mm2 is the size for encoder cables, based on the pins in the encoder plug and the terminals in the encoder board
- Distance between the motor/power cables and encoder cables:
  Minimum 500mm

Cable Sizes

All cable sizes to be used in the system to be according Rapp Marine`s drawings or equivalent and within regulation on board the ship as ABS, DNV, LOYDS or others.

Rapp Marine has specified minimum cable sizes normal for cables. Due to applicative use and overrating of motors, the cable size will not match nominal current of the motor.

Cable Glands

Cable gland on electric motors with frequency drives/inverters and cable glands for cables to the brake resistor from the chopper, must to be of type with EMC screening.

The opening/inlet of the cable glands is recommended to point down (if possible) to avoid water penetrating.

Unused cable glands must be plugged or sealed.

Protection of electric cables

All cables for connection of electrical equipment shall be laid inside the pipes/ cable tray or have other protection against mechanical damage.

Motor cable must be supported and/or fastened minimum at each 0.5 meter.
Signal cable 0.2m and within regulation on board the ship as ABS, DNV, LOYDS or others.

Categorization of cables

Category definitions:

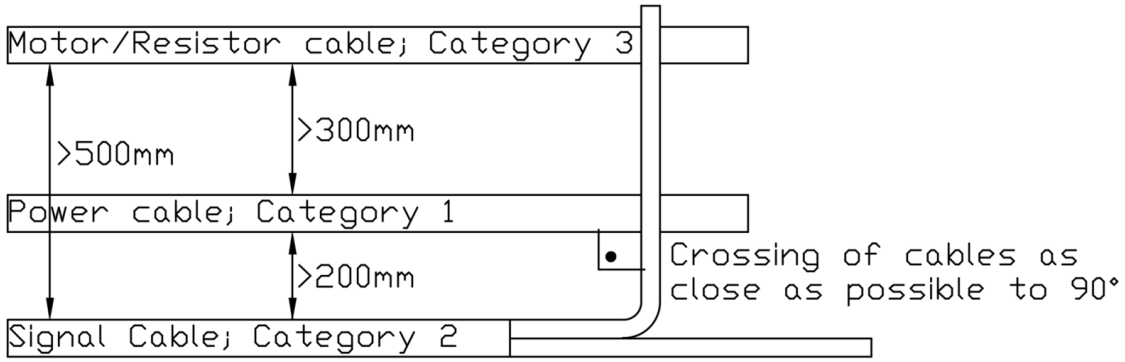
- **CATEGORY 1**
  EMI-generating, not EMI-susceptible cables:
  - Power supplies 24V / 230V / 400V / 690V

- **CATEGORY 2**
  Moderately EMI-generating, EMI-susceptible cables:
  - Signal cables, analogue/digital

- **CATEGORY 3**
  Highly EMI-generating cables:
  - Motor cables (VFD) and brake resistor

Separate laying of cables

Power cables / motor cables and cables to the brake resistor must be installed **minimum 500 mm from the signal and encoder cables**, when laying on a cable tray.



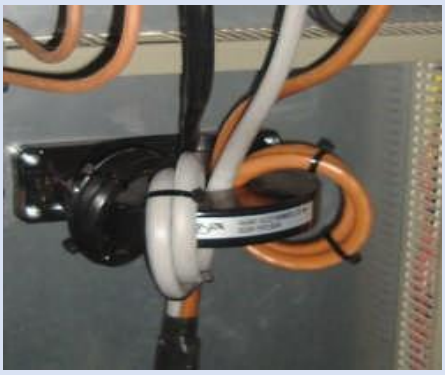
- ✓ Between cables in category 2 and 3;
  cable through walls/floors must be separated with as good distance as possible.
- ✓ Between cables in category 1 and 3;
  a distance of minimum 300 mm (between power cables and signal cables).
- ✓ Between power cables and signal cables in category 1 and 2;
  a distance of minimum 200 mm.

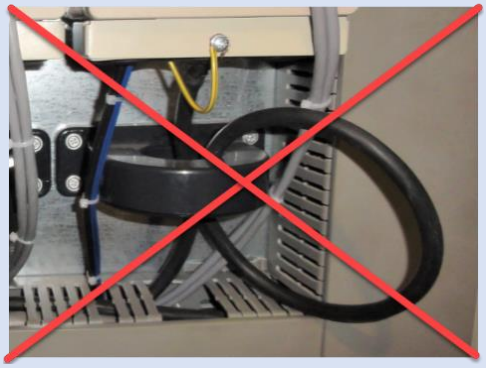
Chokes / Ferrite rings (common mode filter)

All frequency drives/inverter outputs to electric motors must have installed a choke/ferrite ring. Some of the ABB drives have them placed on the inside of the frequency drives/inverter. To reduce EMC, the cable must be connected direct to the drive.

IMPORTANT! Minimum 2 coils around the choke (cable to pass 3 times through the coil.)

System inverters from ABB have built in common mode filter in the cabinet.





Each conductor have to be through the coil, screen removed.

When three (3) blue ferrite rings are delivered, make sure to:

- ✓ Mount them as close to converter/connection points as possible
- ✓ Lead all three (3) phase conductors through

Safety Grounding

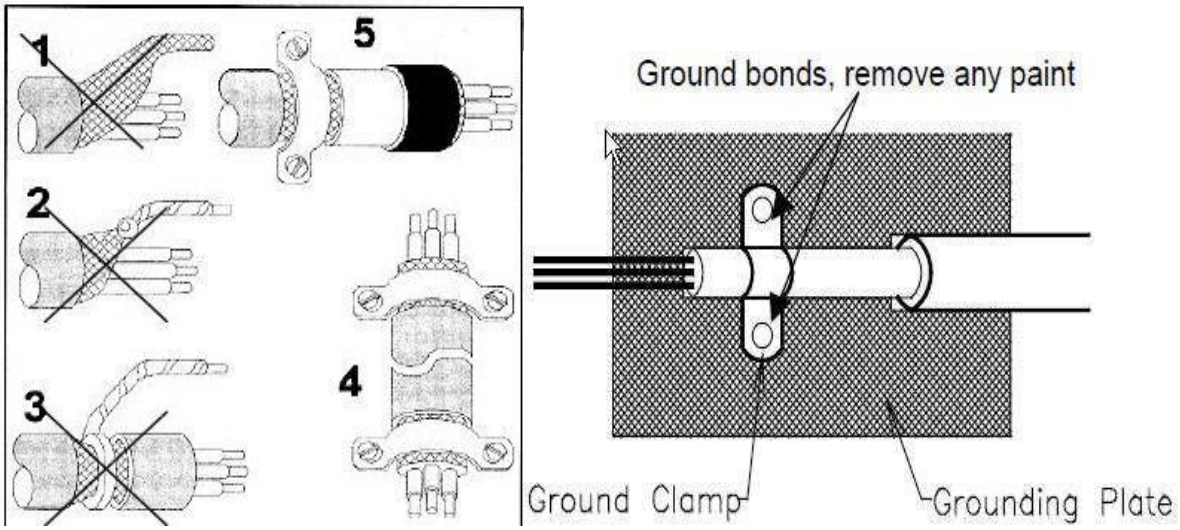
- ✓ All electrical equipment with metal housings shall be properly grounded.

- ✓ For connection of electrical equipment to the ground, use grounded terminals in connection box.
- ✓ All cabinets must be grounded to deck.
- ✓ The main earth reference points shall be earth bosses welded to the structure, and as close as possible to the cabinets.
- ✓ Electric winches to be grounded to deck
  NOTE! The bolt connections between the winch frame and deck are not accepted as ground connections due to paint.
- ✓ Electric motors to be grounded to the winch or to deck.
- ✓ Electric motors from 5,5kw shall have earthing to deck.
- ✓ VFD motors shall have ***stainless steel earth braids*** to grounding point on deck.

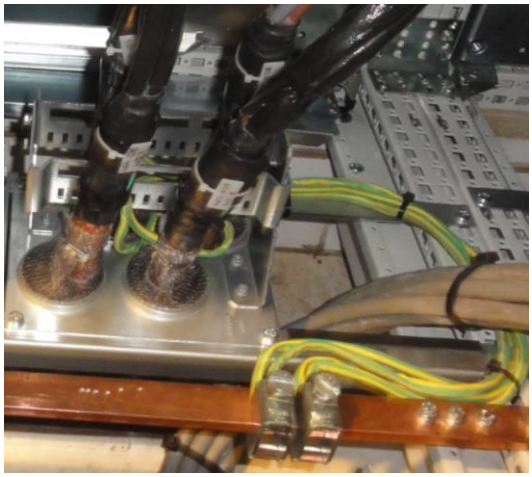
EMC Grounding

When using the screen as a ground cable on the connection to the frequency drives/inverters, the cable have to be with a ground clamp or similar. This to ensure 360 degrees grounding to reduce EMC noise. When ground clamp is used, do not tighten the clamp too much.

NOTE! If the clamp provided is not suitable due to cable size, **the company installing the equipment is responsible** to find suitable solutions and clamps.



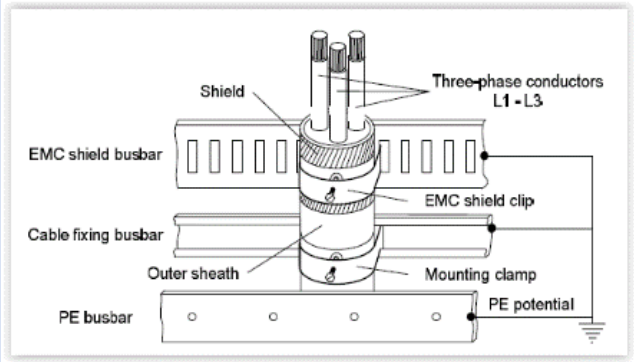
Number 1, 2, 3 shows not *proper ways to earth a cable screen.*
- A combination of 2 and 5 is preferred (as showed in picture below).



Some examples of EMC ground system used in switchboards:

Screen clamp

EMC Shield clip



EMC shield tube

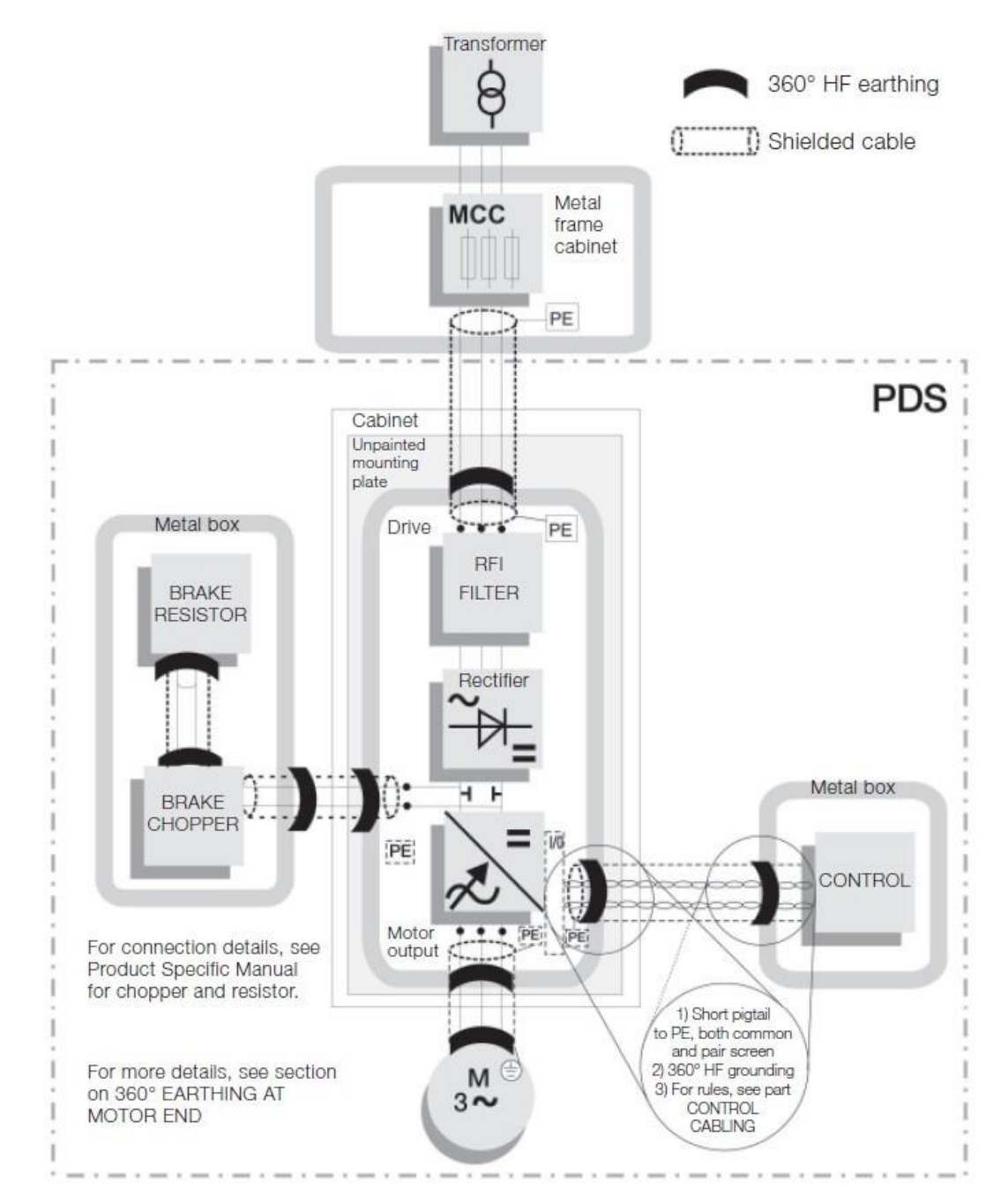


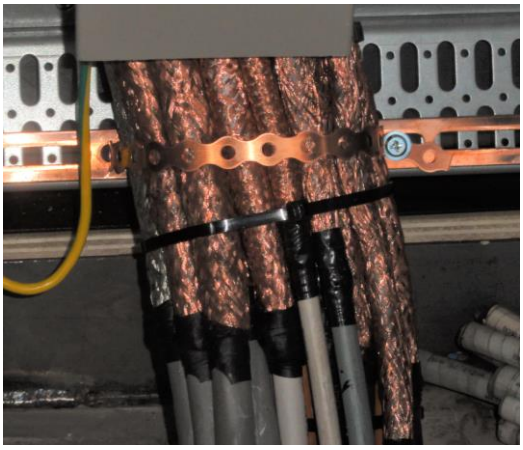
Figure from ABB Technical guide No. 3:
EMC compliant installation and configuration for a PDS.

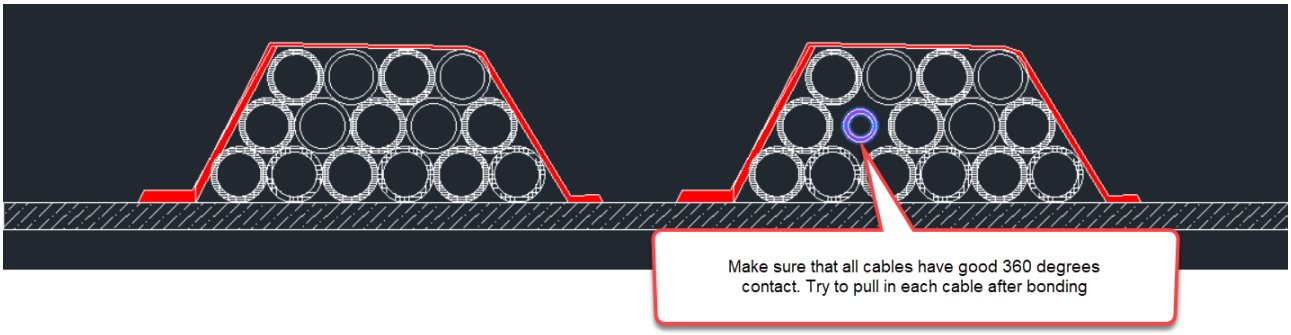
All cabinets with frequency converters shall have a bonding at each 1m of cabinet doors. Required bonding is **steel earth braids**; a flat wide braided strap wire.

- Cabinets with total less than 40kw installed frequency drives/inverters, shall have a 16mm² bounding.
- Cabinets with total from or more than 40kw installed frequency drives/inverters, shall have a 50mm² bounding.

NOTE! A cabinet welded to the deck will **still** require the bonding, as the cabinet is powder coated**.**

For sensor and communication cables, the screen ought to be connected at the entrance of the cabinet, and the isolation must be retained close to the termination point.



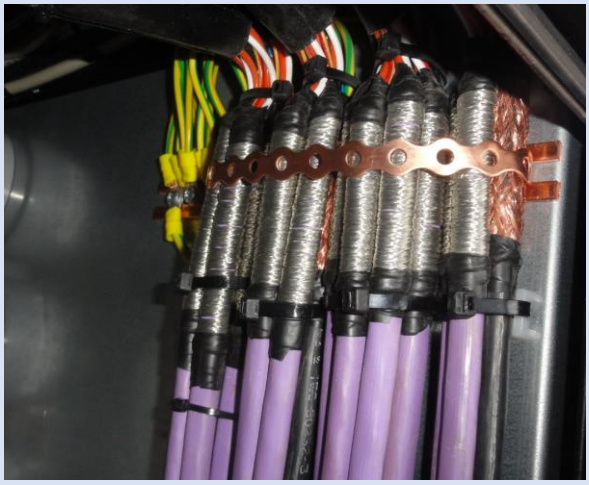


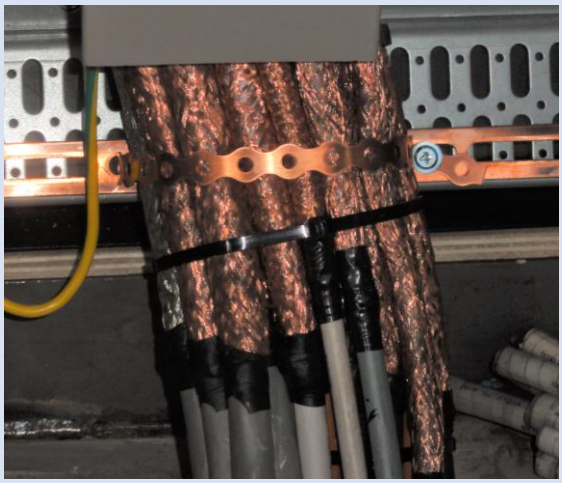
When more than 3 cables are bundled together it is required that there is a minimum 20 cm of strip-off of the outside isolation. Make sure that the cables in center are not lose.

Encoder cables are normally wired directly into the encoder card on the inverter, and grounded to ground terminal on encoder card.

IMPORTANT! Grounding of screen in both ends on sensors/valves on winches and control panels, is important to prevent antenna effect and distribution of electric noise.

Example of a bridge panel's 360° degrees HF earthing:





- The 360° degrees HF earthing point need to have a **steel earth braid**;
a flat wide braided strap wire

Encoder Connections

Encoder with plug, and encoder with 8 conductors must be wired.

Make sure that when soldering the female plug, also check that the numbering is according to the drawing.

**If the Frequency inverter/ Drive is shared between two winches, the encoder is connected directly to relay on the terminal row.*

Encoder card ABB

Encoder card Omron Sx

Terminal X1 has the following terminal configuration starting from the left:

Table 3 Encoder interface, terminal X1

X1	Name	Function	Remarks
1	Gnd	Signal ground	
2	A	Signal A	See the specification Table 5.
3	A'	Signal A' (inverted)	
4	B	Signal B	
5	B'	Signal B' (inverted)	
6	½ V_{sup}	Half power supply voltage	Used for non-differential encoder inputs
7	V_{sup}	Supply voltage to encoder; +24 VDC or +5 VDC.	Correct supply voltage must be set with S1 on the option board

NOTE: When the encoder is powered by an external supply (i.e. not by the Encoder option board itself) a +5V or +24V voltage source should be used.

Terminal Connections

The electrical motors can normally use different voltage supplies depending on connections of star or delta in the terminal connections, In accordance with the plate on the motor jumpers/loops to be installed corresponding to the supplied voltage from the starter or inverter.

NOTE! On a start/delta starter the jumpers have to be removed.

Terminal Torques

Motor terminals should be torqued as follows:

Thread dim.	M4	M5	M6	M8	M10	M12	M16
Torque (Nm)	0,8-1,2	1,8-2,5	2,7-4	5,5-8	9-13	14-20	27-40

NOTE! All 6 terminal bolts* have to be torqued

Rapp electrical motor should be torqued as follows:

Thread dim.	M5	M12 delivered before 2011	M12 delivered from 2011
Torque (Nm)	0,8	12	20

NOTE! All 6 terminal bolts* have to be torqued

Frequency inverters/drives should be torqued as follows:

Thread dim.	M4	M5	M6	M8	M10	M12	M16
Torque (Nm)	1,2-1,5	2,5	4-5	9-10	18-22	31-39	79-98

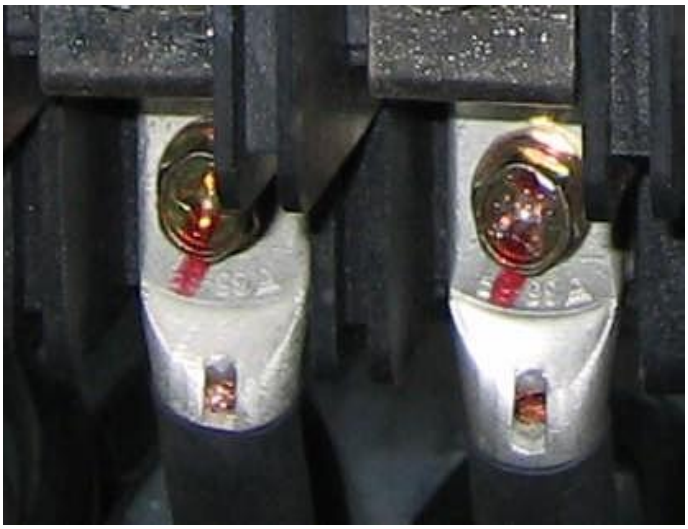
NOTE! Contactors and fuses might be marked with torque settings.

* *Bolt no. U1 – V1 – W1 – U1 – U2 – W2. See check list table on next page.*

After torqueing the bolts; mark them and make a **check list** with following info.:

Motor no.	Bolt no..	Torque	Sign.	Date
	U1			
	V1			
	W1			
	U2			
	V2			
	W2			

Example:



Climatic Requirements

Indoors equipment's

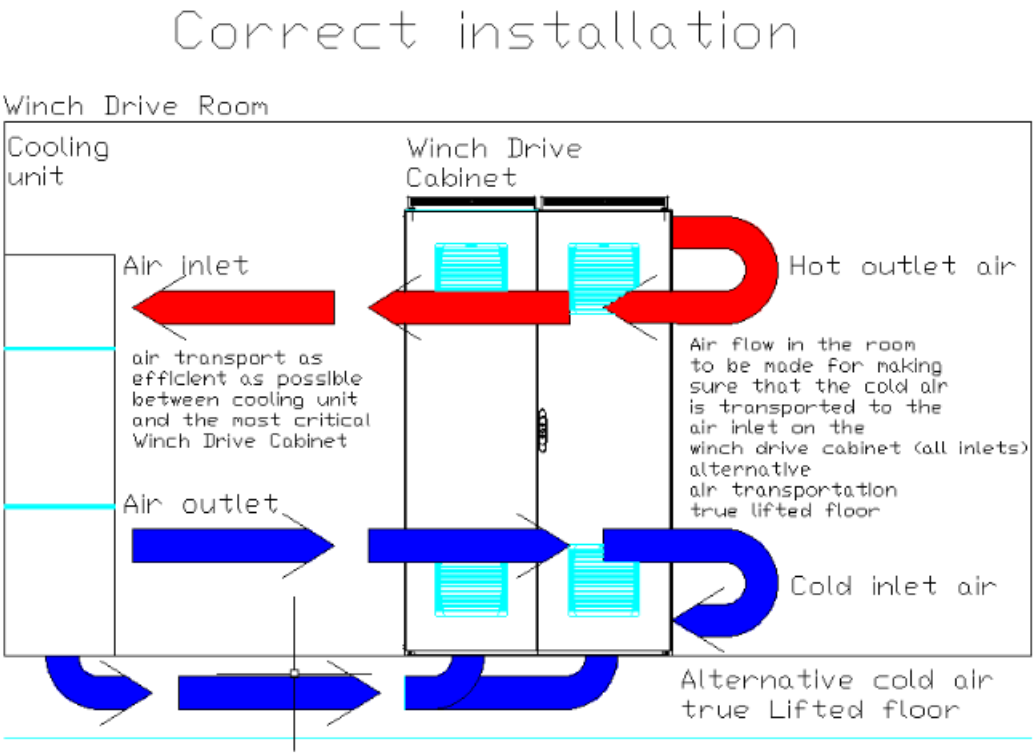
EL motors, control panels, frequency inverters/drives and magnetic starters shall all be installed in spaces having temperature from +1 to +40°C and relative humidity 70%.

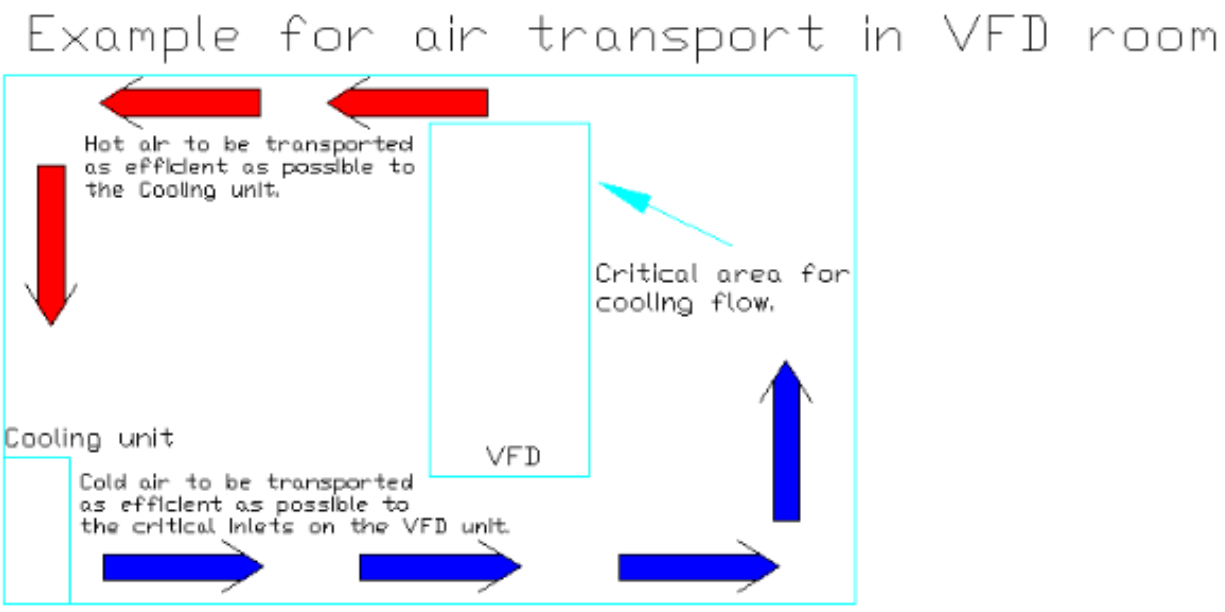
-At **max** humidity 98% and temperature +35°C.

Operational conditions shall be according to above, to exclude ingress of water, oil and other liquids, as well as impurities onto above electric equipment.

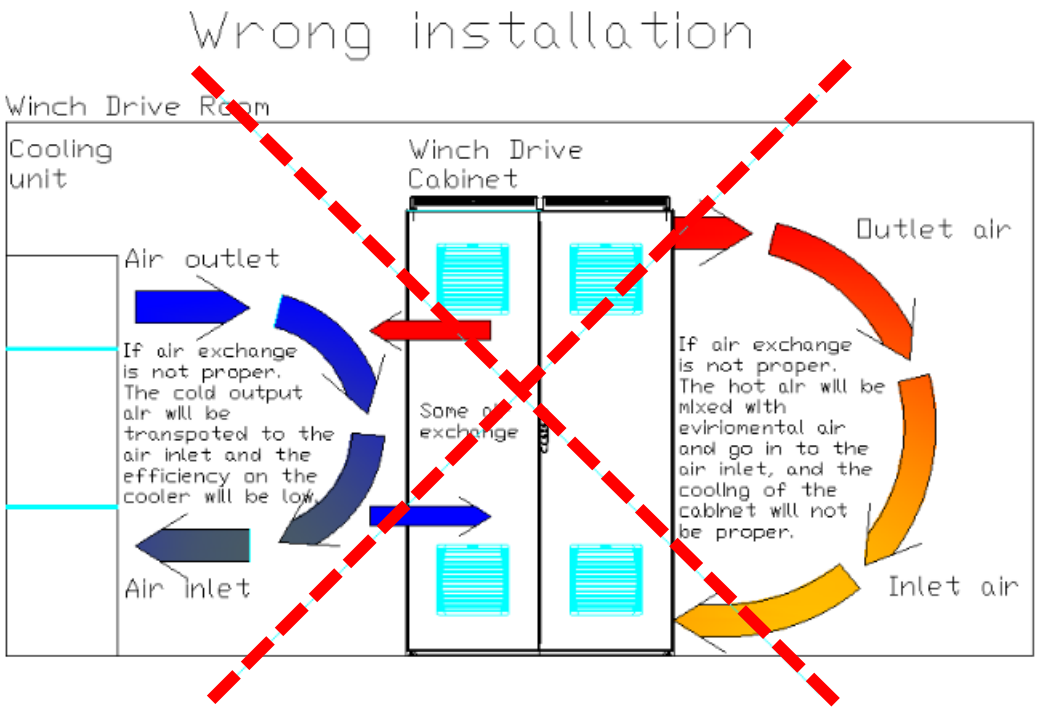
The VFDs require an ***air cooling unit*** installed in the room, to maintain a controlled air temperature not higher than 40°C degrees in the room. Size of cooling capacity need to be according to requirement in the project specific "Technical specification". The cooling air needs to be designed so that cold air in flows into the bottom of the room and air locks are avoided.

Optimal Cooling





Do not make the cooling like this:



Outdoors equipment's

Electric motors, Control panels, Frequency inverters/ Drives and magnetic starters shall be installed with heater unit inside. This is for reducing possibility of humidity inside the unit.

Equipment's installed outdoors is designed for a temperature from -40 to +40°C and relative humidity 70% at max humidity 98% and temperature +35°C, if not differently stated in contract.

Operational conditions shall be such as to exclude ingress of water, oil and other liquids, as well as impurities onto above electric equipment.

Sealing / Solenoid boxes

After connection of cables, all cable inputs of EL equipment shall be sealed and waterproof. Junction boxes mounted by the shipyard shall be waterproof. Solenoid box must be filled with hydraulic oil.

Foundations and shock-absorbers

Foundations for control panels shall be reliable and provide proper operation in different sailing conditions. Rigid fastening of panels to supporting surfaces is acceptable, but shock-absorbers can be also used.

Maximum allowed movement from foundation surfaces is 0.5 mm.

For further and general guidelines on topic “Installation of the winches”, please see the Rapp Marine **Mechanical Installation** document.

Example:

CAN Open and Device Net Connections

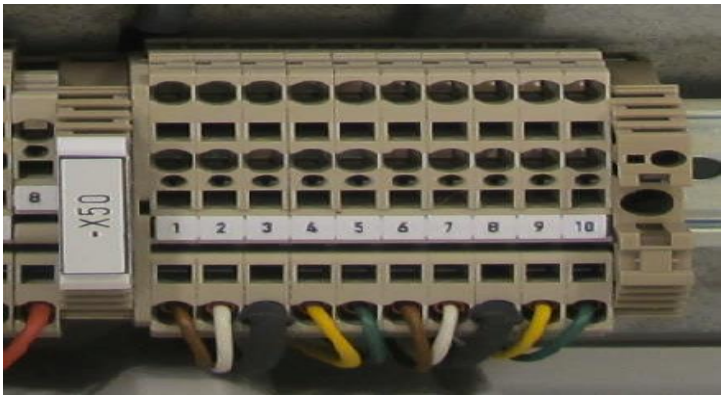
The connection of the CAN bus (Can open) and the device net is similar, but they are two separate systems.

The **CAN Bus** is used between the PLC (Cort 21), Multi I/O cards and the Joystick panels.

The **device net** is used between the PLC (Drm 21) and the Frequency converter.

In the special cable used for these connections there are 2 pairs surrounded by screening mesh.

Red and Black is one pair. Power
White and Blue is one pair. Signals



1. Black – Power 0V
2. Blue - Signal Low
3. Screen
4. White - Signal Hi
5. Red - Power +24V

IMPORTANT!

- ✓ The screen on the cable must be isolated and only be connected to the correct terminal.
- ✓ Keep wires short after stripping the cable
- ✓ Never connect the shield to the ground system

Termination of Cat.7 cables

- ✓ When connecting the cables for the Cat.7 Network
- ✓ Keep the wires as short as possible.
- ✓ Connect the shield conductor to the S connector.
- ✓ Clamp the shield (screen) of the cable in the clamping saddle, and secure the cable with it
- ✓ Test and verify connections with network tester
- ✓ Deliver test report to Rapp representatives.

Pin Nr	Color	Pair
1	Orange / White	2
2	Orange	2
3	Green / White	3
4	Blue	1
5	Blue / White	1
6	Green	3
7	Brown / White	4
8	Brown	4
S	Shield	

Cables that are not used

When using multi conductor cables there is always some spare conductors. Please isolate them in both ends so they can do no harm, keep them long so they can be used if we need more conductors.

Exceptions for cables to solenoid valve plug, where there‘s no room for spare conductors.

Cable tags inside cabinets

When stripping cables inside cabinets, please tag the cable where the cable is stripped and the isolated unused conductors (marker or pen is OK)

MRU Positioning

The maximum cable distance from the PLC to the MRU must not exceed 15 meters.
-This is due to RS232 / NMEA Signal

Encoder placing

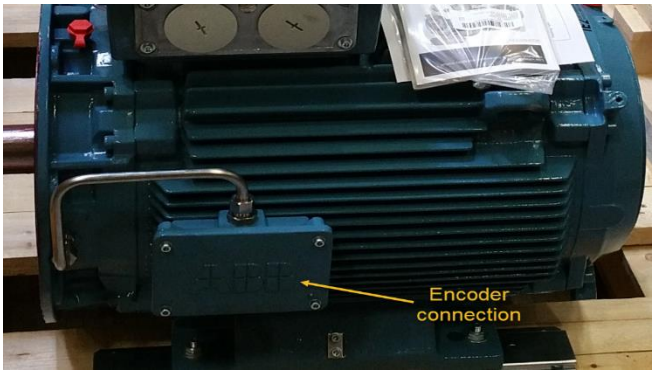
The placing of the encoder is either *in front* or *in the back* of the motor, and connected either with plug or connection box. The encoder with plug is usually placed under a cover.

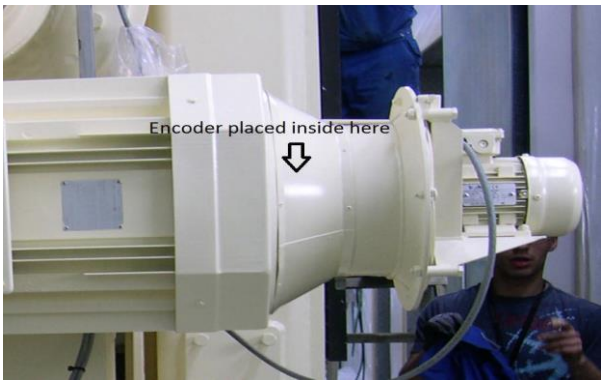
Sometimes an **external cooling fan** can cover them.
-If so;

- ✓ make a hole for cable gland in the funnel
- ✓ solder the connector plug, and
- ✓ fasten the cable with cable ties

to prevent the encoder from getting damaged by the external cooling fan.

Encoders for spooling motors comes with a cable, they are connected via a connection box.





Roxtec Cable Transits

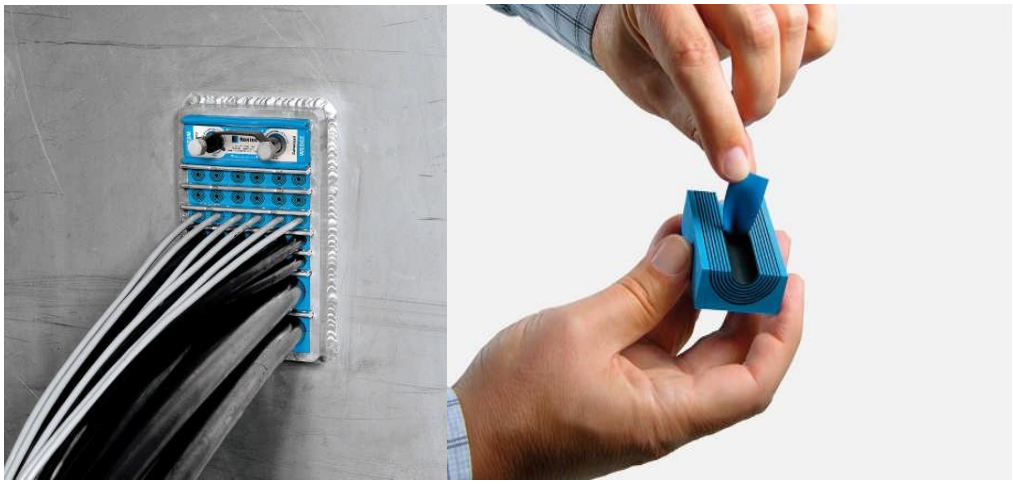
In cabinets with Roxtec Cable Transits, the cabinet is supplied with Roxtec modules ready for use.

Where there are section separation inside the ship, it is recommended to use EMC Roxtec to reduce the EMC/EMI noise problems, but not to use them on penetration to outside deck due to risk of water entrance into the cable.

The modules are easily shaped;
peel off the onion shaped half's of rubber to fit the diameter of the cable.

If the modules supplied with the cabinet doesn't fit the cables that is used under the installation, the installing company must supply new modules and install them according to Roxtec specifications.

For more information and installation instructions, visit www.roxtec.com



APPENDIX A – Recommended cables

Cable list and approved alternatives

	Supplier/Vendor	**Main supply / Motor Cables** (frequency controlled)	**Normal power cables** (heating, small pump motors, signals)	**Signal cables** (twisted pair)	**CANBus / Device net** (special cable)	**Ethernet cables**
Preferred cables by Rapp:	Lapp Group	Öflex 2YSLCYK-JB	Öflex 855CP, Öflex Robust 215C	Unitronic FD CP (TP) pluss	Unitronic Device Net Thick (Pur) (2x18AWG+2x15AWG)	Etherline Cat 7 Lapp group Pur
Alternative 1	**Belden Cable**				Belden 3082A / Belden 3082F (2x18AWG+2x15AWG)	
Alternative 2	**Amo Kabel**		EFK 300CP	EFK Li9YC11Y	N/A	
Alternative 3	**DDA Cables**	2YSLCYK-J 0,6-1kV			N/A	
Alternative 4	**BV Twentsche Kabelfabriek**			Marine Com YOZc 250V	N/A	
Alternative 5	**Helukabel**			Super Paar Tronic 340 C Pur	Device Net Pur Cable 81909	Helucat 600IND S-FTP Cat.7
Alternative 6	**Ünika**	RFOU VFD 06/1kV	RFOU / BFOU	U-HFAT m/ (I) / (C) / (I+C)	N/A	
Alternative 7	**Nexans**	MPRXCX Flexiship EMC (Symetrical 3+3)	MPRXCX	TCX©/(I)	Devicenet PUR Cables	LANmark-7 Cat.7

02	01.09.16	Revision, sec. 2.2.3 re: Through-hole connections	ST	BB	BB
01	01.06.12	Revision, sec.2.2.6. re: Cleanliness level.	SMA	HD	BB
00	02.01.10	Issued for Project Acceptance	SMA	HD	BB
Rev./ Status	Date	Description	Made by	Checked by	Appr. by

U:\System\INSTRUKS\Installasjons Instr El & Hyd\IMHydraulic2011\Originaler i word doc\EN-IM Installation of Hydraulic System, June2012 rev 01.doc

Customer: N/A

General instruction.

Project:

Installation of Rapp Marine Hydraulic Deck Machinery.

Purchase order no.:	Order date:
N/A	N/A

Commission no.:	Document file:
N/A	**Installation of hydraulic systems**

Date:	Name:	Identification no.:
23.11.2018	BB	**EN-IM installation of hydraulic system**
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Introduction:

This manual should give the reader sufficient knowledge to install any RAPP Marine AS hydraulic system in this delivery.
The manual is divided into main sections as follows:

- Depreservation and preparation for installation
- Hydraulic installation
- Climatic requirements
- Requirements to pipe lines
- Requirements to installation tubing and hoses
- Protection of tubing and valves during installation
- Requirements to arrangement of pump room
- Requirements to cleanliness
- Preparation to filling oil tank

If you have any questions, please do not hesitate to contact us:

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2.1.0 DE preservation and preparation for installation

After the equipment is received, following things need to be done.

The parts shall carefully be taken out of the container and preservation material removed.

Check all items in the shipment for damage and compare the contents with the packing list, enclosed with the shipment. Inform the Rapp Marine A/S as soon as possible if you notice any damaged or missing components.

All equipment to be installed indoors, shall be stored in dry and warm environment. Storage longer than 6 months requires special protection against corrosion. All primed components shall be treated with anti corrosion oil/paint.

During installation all plugs and protection for pumps and hydraulic valves shall not be removed before the pipe or hose is connected.

It is strictly forbidden to connect hydraulic equipment to hydraulic system, until piping system and hydraulic tank are accepted after flushing. Due to this the proper adapters shall be made prior to the start of installation.

CAUTION:

THE CIRCUITS BEHIND THE CONNECTIONS MIGHT BE PRESSURIZED.

CONNECTIONS TO BE OPENED CAREFULLY.

2.2.0 Hydraulic installation

Today's high pressure hydraulic systems demand a high level of cleanliness in order to operate satisfactorily.

Valves, pumps and motors have fine tolerances that prohibit pollutants. It is commonly agreed upon within the field of hydraulics that pollutants in the hydraulic fluid cause 8 out of 10 problems in hydraulic systems.

Based on this it is imperative that all components, that from time to time is in contact with the hydraulic fluid, is free of pollutants.

Polluted hydraulic fluid causes:

- excessive wear - reduced life-time;
- frequent change of filter elements - high cost;
- seized or clogged valves - stop in operation/down-time/lost income.

The installation instructions below must be complied with in order to avoid unpleasant surprises during trial-run and regular operation.

Note! The yard is responsible for the hydraulic installation being in accordance with specifications supplied by Rapp Hydema A/S.

2.2.1 Climatic requirements

The winches are installed on the open deck and are intended for installation on ships of unlimited area of operation.

Electric equipment to be installed on winches is placed in junction boxes filled with oil.

All other equipment with electric components shall be installed in dry warm room. Operating conditions must be such as to exclude ingress of water or other liquids.

In case of special requirements to components, protection class (**IP**) to be indicated on dimensional drawings.

2.2.2 Requirements to pipe lines

Hydraulic diagrams of the supplier show required diameter and thickness of pipes in accordance with standards DIN 2391C (NS 2503) for pressure lines -seamless, cold-treated precision steel tubing and DIN 2448 (NS 583) for return and suction lines - steel tubing. Above standards specify certain ratio between diameter, thickness and pressure of working fluid.

In system design Rapp Marine A/S using following pipe sizes:

Nominal size - ∅ x thickness, mm	**Internal ∅, mm**	**St. 52.4 – max. Working pressure, bar**
12 x 1.5	9	304
15 x 1.5	12	239
20 x 2	16	256
25 x 2	21	202
25 x 3	19	335
30 x 2	26	167
30 x 3	24	275
38 x 3	32	214
38 x 4	30	300
50 x 3	44	167
50 x 5	40	290
60 x 3	54	138
60 x 5	50	239
75 x 3	DN65/70	76
80 x 10	60	384
90 x 3.5	DN80	154
100 x 4	DN100	113
115 x 4	DN100	97
140 x 4.5	DN125	91

On diagrams minimum allowable sizes of pipes are indicated.

Ensure that the wall thickness of pipes you have chosen is sufficient to withstand pressure in the system considering required safety coefficient and test pressure.

Note! The shipyard takes responsibility for the choice of fittings for pipes, laid outside the package delivery.

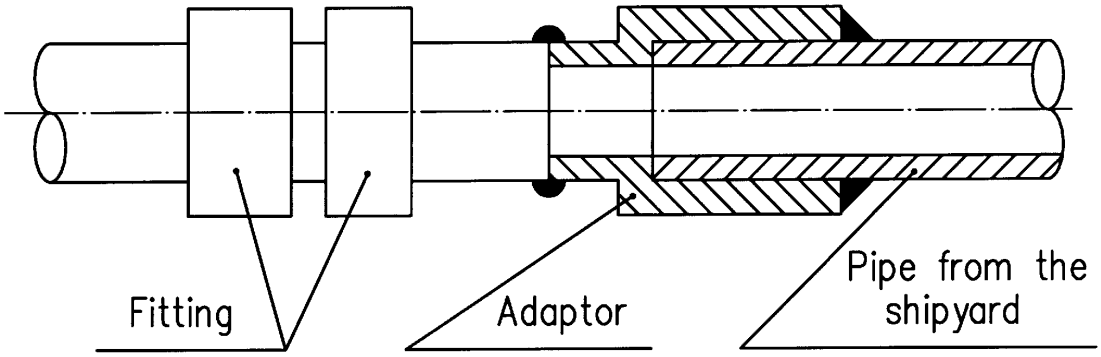
For pipe connections the supplier uses fittings approved for max. pressure:

- Parker Triple-Lok 37 deg. non collar;
- Ermeto;
- GS-Hydro.

Note! Parts from different types/brands of fittings shall not be mixed or interchanged.

For installation of return pipe lines PN16 flanges shall be used.

Diameter and thickness of tubes to be installed by the shipyard shall correspond to those specified on drawings, for each external connection there will be supplied an adaptor (see fig.) suitable for the tube size.



Material of adapter corresponds to the group of weldability of steels.

Connections of this type exclude ingress of the welding scale into the system and does not require special flaring equipment for pipes.

Tubing dimensions for components not supplied by Rapp Marine A/S, but connected to the same system, must given by the individual supplier.

Note! Rapp Marine A/S is not responsible for tube connections to components they do not supply. Each individual supplier shall in this case be consulted.

2.2.3 Requirements to installation tubing and hoses

In order to get a "silent and soundless" system it is imperative that the number of bends are kept at a minimum, and that necessary bends are as "slack" as possible (2…3 of outside pipe diameter). This is particularly important with suction lines to the pumps.

General requirements

- Choice of flanges and fittings must be approved by Rapp Marine A/S.
- All tubing shall be rinsed inside as described in the installation instruction.
- Use TIC welding.
- All welded tubing must be pressure tested prior to installation on board.
- Welded tubing shall be pickled and post treated.
- Outside and inside burr shall be removed from the cut ends of the tubing.
- All components shall be completely rid of pollutants prior to installation.
- The number of angle fittings for the complete system must be kept at a minimum.

Bending the tube

All tubing must be cold when bent, never use heat.

Use pipe bending machines for bending. Thus you will avoid reduction of the tube inner diameter at the bend.

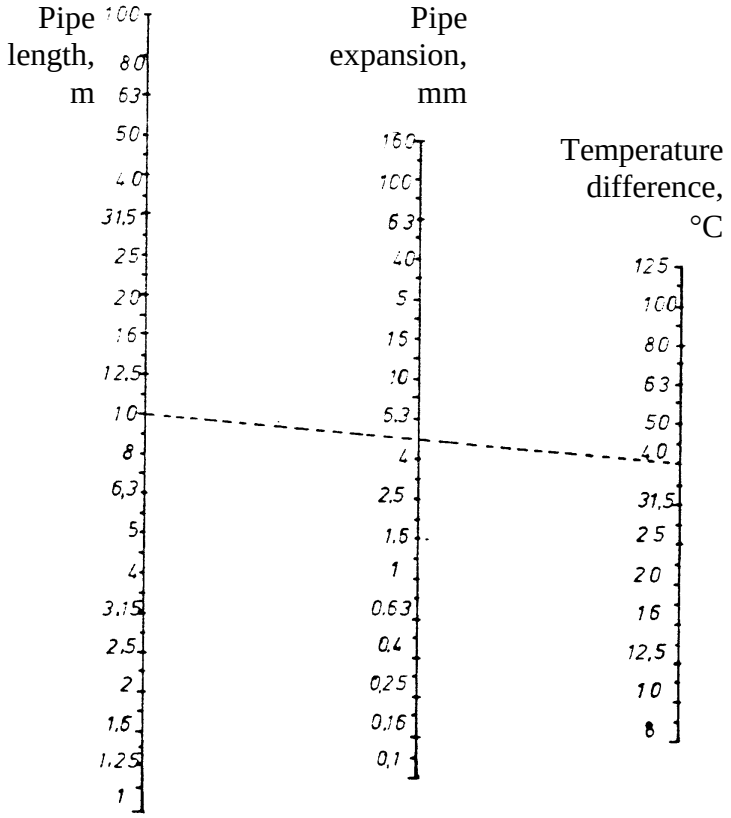
Tube expansion due to temperature changes

Hydraulic deck arrangements are exposed to extensive temperature variations.

On our latitudes the temperature may vary from -40°C on a winter day to +75°C during operation in summer. This means a temperature difference of 115°C.

As the coefficient of expansion for steel is approx. (12 x 10 6K1) a temperature difference of 115°C will give a longitudinal expansion of 1,4 mm per meter tubing.

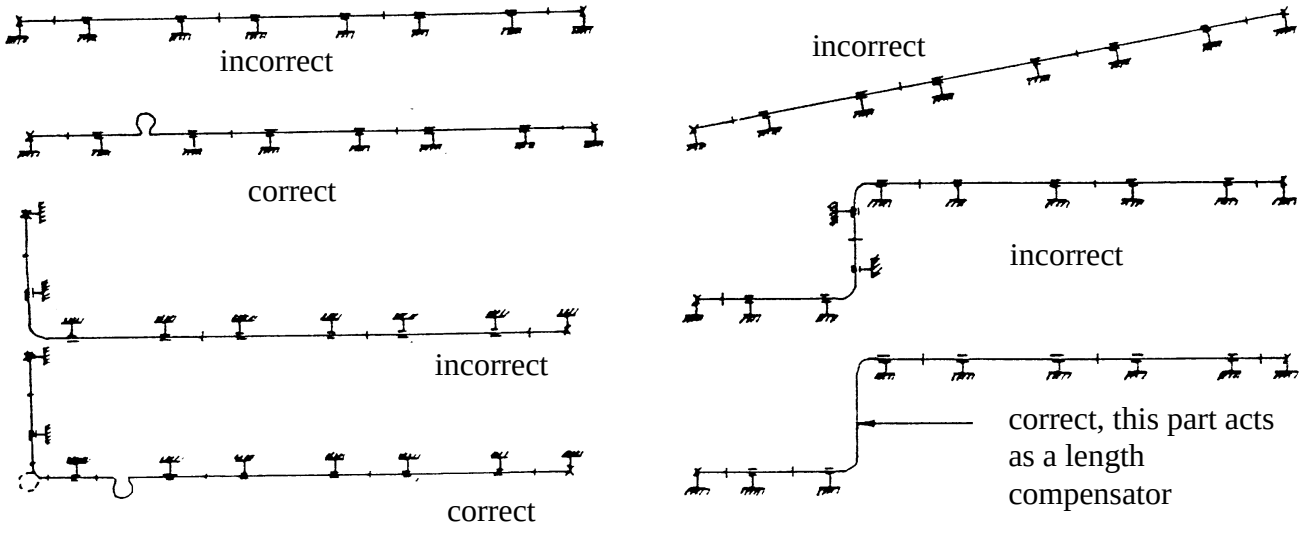
To calculate steel pipe expansion follow next diagram:



Choose first point on the left graph as pipe length. Choose second point on the right graph as temperature difference. Draw line between those points and find out value of pipe expansion from intersection point on the mid graph.

Long lines must have an expansion “bend” along the line, to avoid problem.

Tube bends for length compensation must, however, not be “locked”.



If space permits, the length compensator placed in the corner as indicated

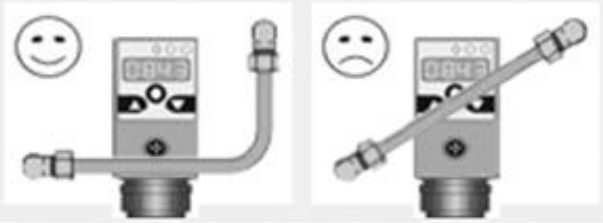
Tube line fabrication guide for leak free systems

Every hydraulic, pneumatic and lubrication system requires some form of tube fabrication and fitting installation for completion. Proper fabrication and installation are essential for the overall efficiency, leak free performance, and general appearance of any system.

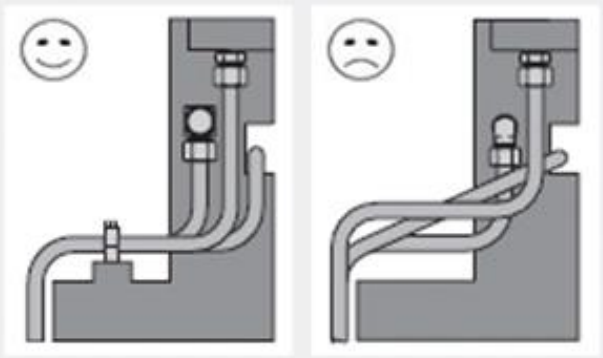
After sizing the tube lines and selecting the appropriate style of fitting, consider the following in the design of your system:

1. Accessibility of joints
2. Proper routing of lines
3. Adequate tube line supports
4. Available fabricating tools

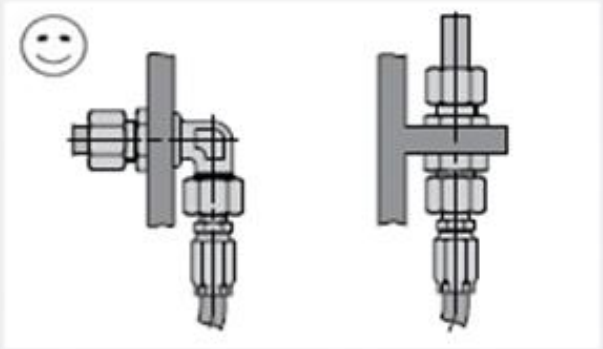
- Keep tube lines away from components that require regular maintenance:



- Right-angled – parallel – clear
- Have a neat appearance and allow for easy trouble-shooting, maintenance and repair:

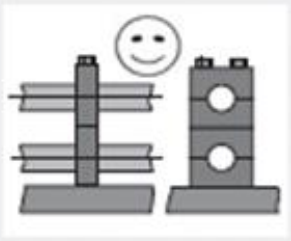


- Example for tube to hose connection:

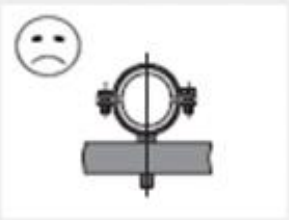


Tube line fabrication guide for leak free systems

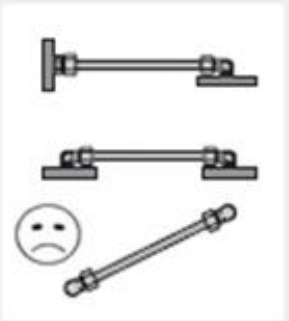
- Do not use tube lines to support other tubes
- Always fix tubes onto a rigid point with tube clamps
- Do not use cable channels to support tubes



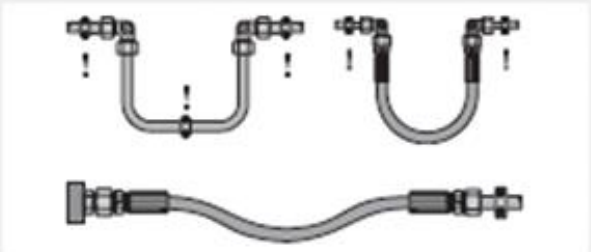
- Use appropriate tube clamps:



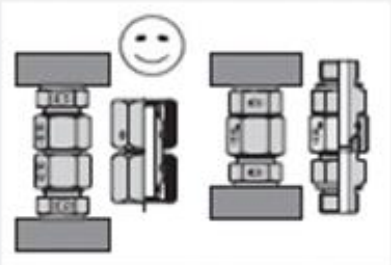
- Avoid excessive strain on joint: A strained joint will eventually leak



- Allow for expansion effects

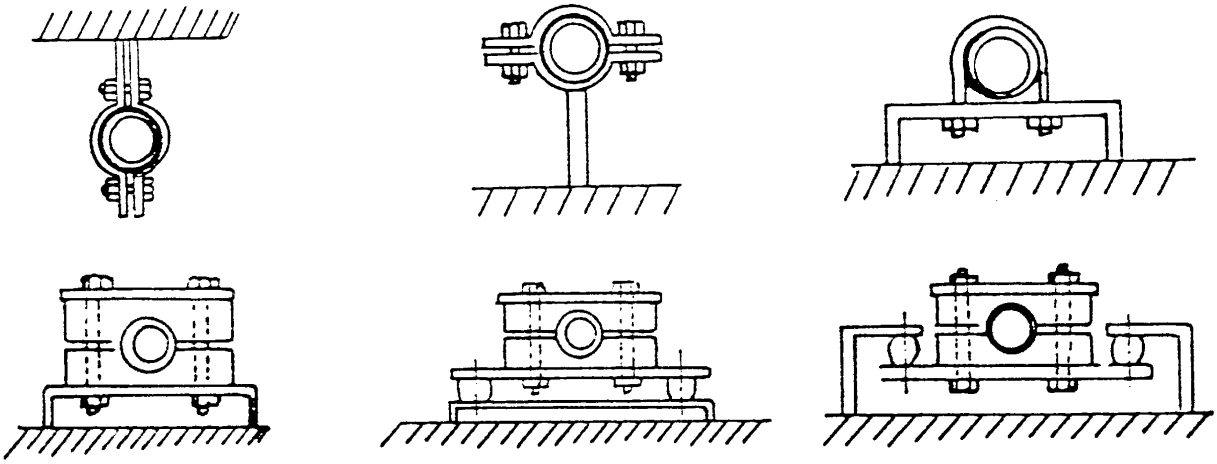


- Avoid short tube length:
- ⚠ Short tube lengths increase chance of fatigue fractures
- Use adapter GZR or swivel connector for swivel fittings instead of short tube lengths



Tube clamps / brackets

Proper clamping is important. Careful consideration must be taken when choosing type of clamps. Correct use of these must be closely observed. Next figure shows some examples of clamp types:



The tube clamp shall prevent cross line vibrations and at the same time allow for a certain longitudinal movement.

The clamp must be mechanically strong enough to absorb all forces from the tubing., i.e. the weight of the tubing, reactions from pressure shocks and forces due to longitudinal changes in the tubing.

It must not wear on the tubing and not be worn by the tube movements. Use of sound absorbing material in the clamp is an advantage.

The clamp must be easy to install, and allow for adjustments due to difference in distance between centers in tubing where several parallel tube lines are located. The clamp must also allow for separate removal of the tubing.

Only elastic clamps may be used (plastic or rubber type).

The distance between the clamps will vary, depending on the stress normally imposed on the tubing (pressure, oil velocity, vibration) as well as the tube dimensions.

Normally a distance between the clamps equal to 25...50 times the outside tube diameter is sufficient.

Assembly Information

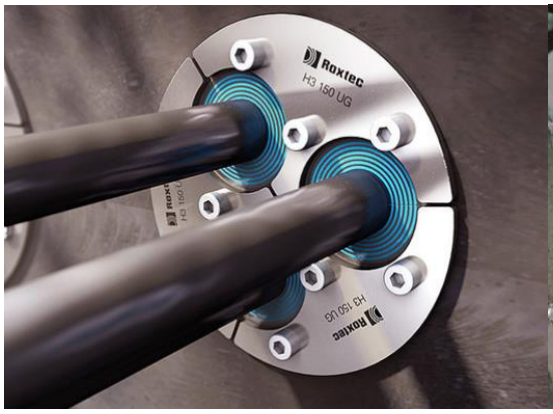
Maximum distance between clamps for hydraulic Piping

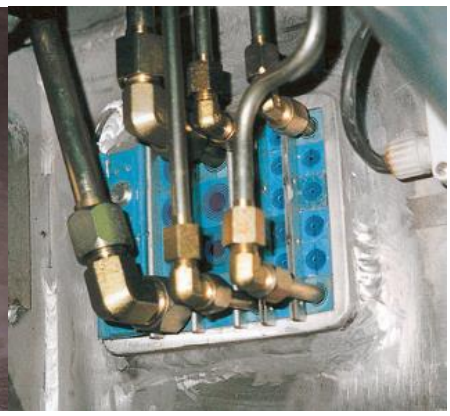
O.D x W.T	Marine Hydraulics	Industrial Hydraulics
20 x 2	1,1 m	1,2 m
25 x 2,5	1,3 m	1,5 m
30 x 3	1,4 m	2,1 m
38 x 4	1,5 m	2,1 m
42 x 4	1,6 m	2,3 m
46 x 8,5	1,7 m	2,7 m
50 x 3	1,7 m	2,7 m
50 x 5	1,8 m	2,7 m
56 x 8,5	1,9 m	2,8 m
60 x 3	1,9 m	3,0 m
60 x 5	2,0 m	3,0 m
66 x 8,5	2,0 m	3,2 m
75 x 3	2,1 m	3,5 m
80 x 10	2,2 m	3,6 m
90 x 3,5	2,3 m	3,7 m
90 x 5	2,4 m	3,7 m
97 x 12	2,5 m	4,0 m
100 x 4	2,4 m	4,0 m
115 x 4	2,6 m	4,3 m
115 x 15	2,7 m	4,3 m
130 x 15	2,9 m	4,6 m
140 x 4,5	2,8 m	4,9 m
150 x 15	3,1 m	5,0 m
165 x 15	3,0 m	5,2 m
190 x 20	3,5 m	5,4 m
220 x 6	3,5 m	5,8 m
250 x 25	4,0 m	6,0 m
273 x 6	3,5 m	5,4 m

Vibration calculations are based on ship with maximum propellervelocity of 2 rev/sec. and maximum 6 propeller blades / frequency 12 Hz.

Trough-hole connections

Through-hole connections, bulkhead pipe layout, deck penetrations for hydraulic pipes.
All through-hole connections are recommended to be with elastic bulkhead sealing system, to avoid structural born noise.





Pressure testing of welded tubing

It is permitted to use on the return and suction lines welded tubes. All welded tubes must be pressure tested prior to connection to the system.

Pressure testing of the piping system must be carried out before the system is put into operation.

If nothing else is specified, a test pressure 1.5 times nominal working pressure, limited to maximum 70 bar overpressure (above maximum working pressure).

NOTE! It is the piping system that is to be tested, not the power pack and other hydraulic components (pumps, motors, and cylinders).

Hoses installation

Different types of hydraulic hoses are to be used in the system for connection of equipment staying on rubber legs (such as pump units).

Check pressure ratio indicated on the hose prior to connection. For pressure lines only high pressure hoses shall be used.

Rapp Marine AS supplied standard length suction hoses, which are not permitted to cut. During installation of suction hoses good alignments of the connected ends must be considered. This is important to avoid leaks. Use bend-type of clamps. For more secure tightness use two clamps on each end of hose.

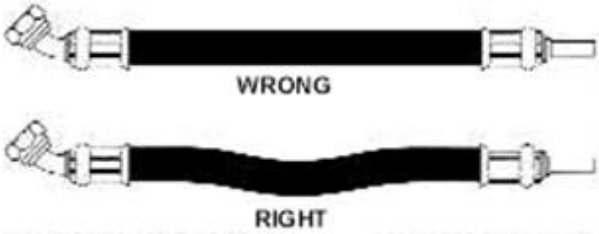
During installation

As a “rule-of-thumb” for minimum bending radius of the hose the following may be used:

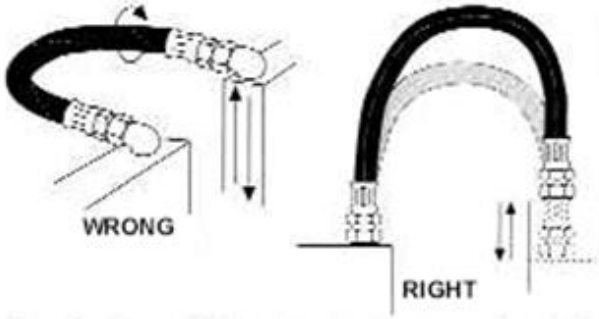
Outside hose diameter - D, mm	0…25	25…40	40…55	55…>
Minimum bending radius, mm	6 x D	7 x D	8 x D	9 x D

HOSE ASSEMBLY ROUTING TIPS

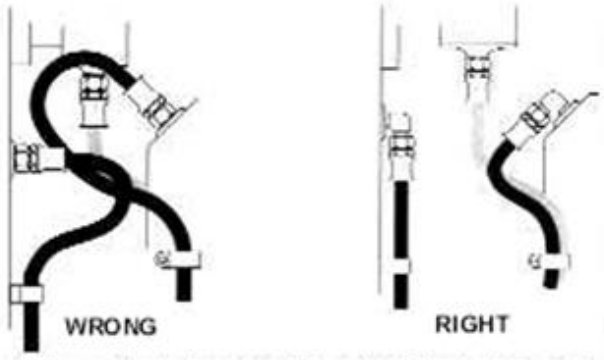
Proper hose installation is essential for satisfactury performance. If hose length is excessive, the appearance of the installation will be unsatisfactury and unnecessary cost of equipment will be involved. If hose assemblies are too short to permit adequate flexing and changes in length due to expansion or contraction, hose service life will be reduced.
The following diagrams show proper hose installations which provide maximum performance and cost savings. Consider these examples in determining length of a specific assembly.



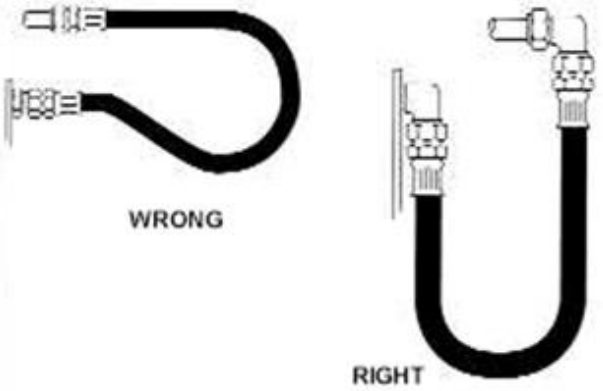
When hose installation is straight, allow enough slack in hose line to provide for length changes which will occur when pressure is applied.



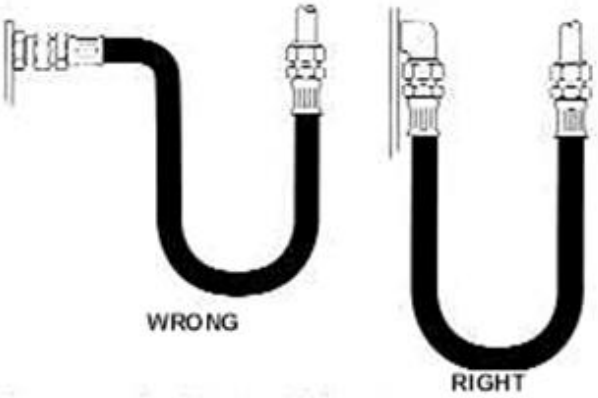
Prevent twisting and distortion by bending hose in same plane as the motion of the boss to which hose is connected.



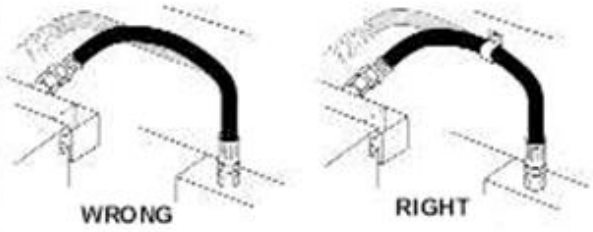
Route hose directly by using 45° and/or 90° adaptors and fittings. Avoid excessive hose length to improve appearance.



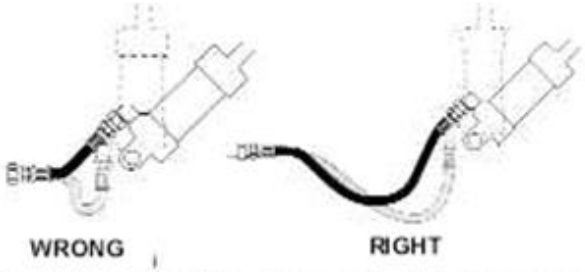
When radius is below the required miimum, use an angle adaptor to avoid sharp bends.



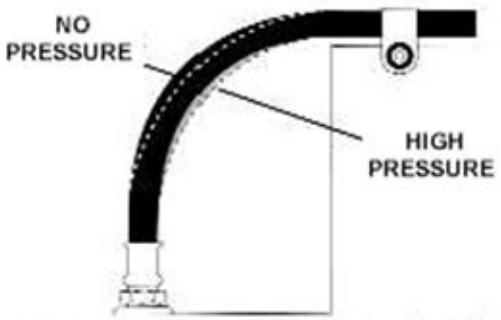
Use proper angle adaptors to avoid sharp twist or bend in hose.



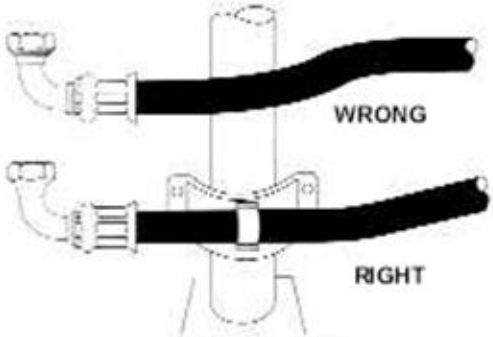
Avoid twisting of hose lines bent in two planes by clamping hose at change of plane.



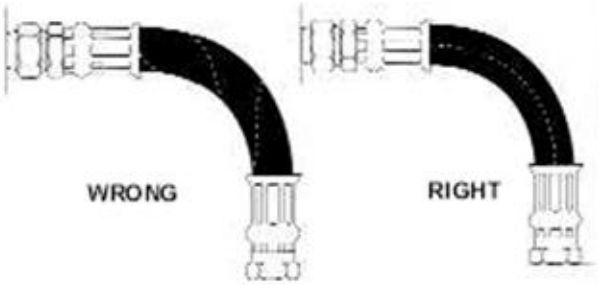
Adequate hose length is necessary to distribute movement on flexing applications and to avoid abrasion.



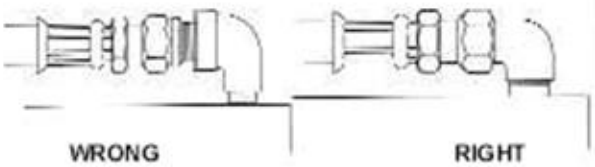
To allow for length changes when hose is pressurised, do not clamp at bends so that curves will absorb changes. Do not clamp high and low pressure lines together.



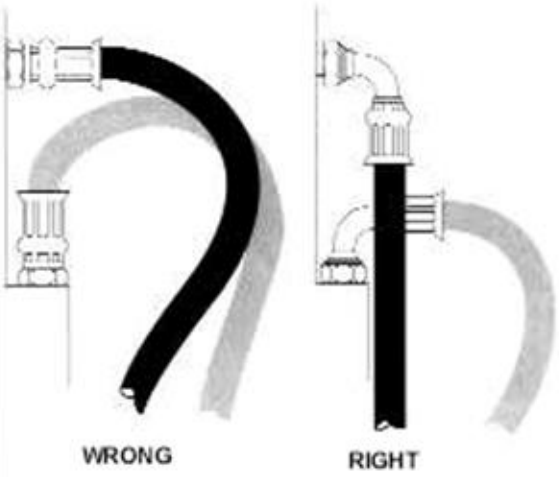
High ambient temperatures shorten hose life. Make sure hose is kept away from hot parts. If possible, insulate the hose.



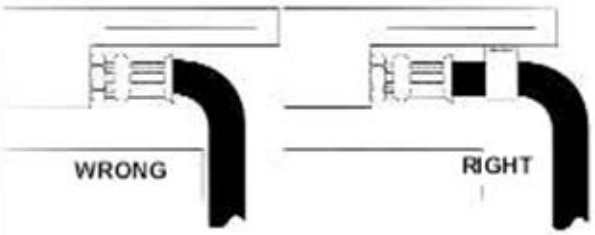
When installing hose, make sure it is not twisted. Pressure applied to a twisted hose can result in hose failure or loosening of connections.



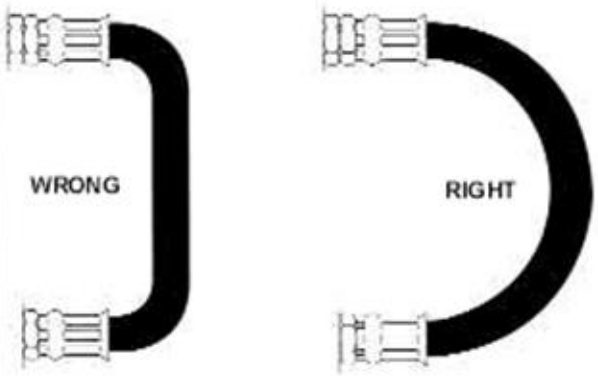
Reduce number of pipe thread joints by using proper hydraulic adaptors instead of pipe fittings.



Elbows and adaptors should be used to relieve strain on the assembly, and to provide neater installations which will be more accessible for inspection and maintenance.



Run hose in the installation so that it avoids rubbing and abrasion. Often, clamps are required to support long hose runs or to keep hose away from moving parts. Use clamps of the correct size. Too large a clamp allows hose to move inside the clamp and cause abrasion.



To avoid hose collapse and flow restriction, keep hose bend radii as large as possible. Refer to hose specification tables for minimum bend radii.

2.2.4 Protection of tubing and valves during installation

During installation ensure that tube ends, filter openings, valves, etc. remain closed until you are ready to complete the installation and fill the tank.

USE PLASTIC PLUGS OR CAPS - NOT RAGS OR PAPER PLUGS

Note! Remember to remove plugs before final hook-up!

2.2.5 Requirements to arrangement of pump room

Installation of equipment in the pump room shall be made in strict conformity with hydraulic diagram and specifications from the supplier.

Arrangement of the pump room shall provide access to equipment for adjustment and repair.

Oil tank

If oil tank is not part of Rapp Marine AS delivery, but other supplier or manufactured by yard, written acceptance of tank drawing is required. In this case order from Rapp Hydema A/S mounting equipment for oil tank – parts for connection of oil level switch, return filters etc.

Hydraulic oil tank must be made from stainless steel or painted inside with oil resistance paint.

Hydraulic oil tank shall be installed as follows:

It is important that the tank is situated as close as possible to the hydraulic oil pumps. The minimum distance between tank bottom and center of the pumps to be 200 mm (vertically).

The oil tank must not be positioned directly connected to the side of the ship or close to the cooling tanks room, stable temperature reduces risk for condensation inside the oil tank.

Service and inspection through the manholes must be possible.

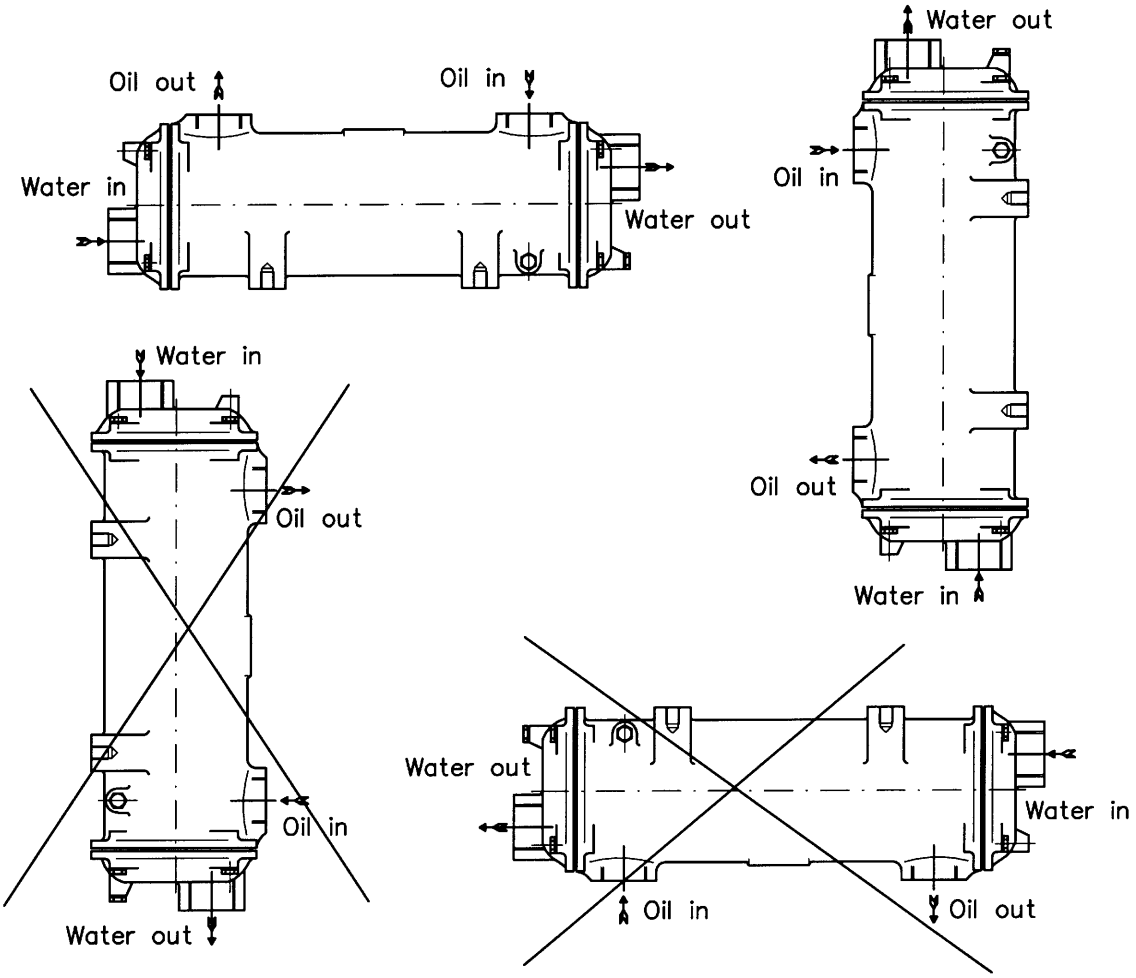
Oil cooler

Service distance as indicated on dimensional sketch to get access for service of oil cooler. To avoid extra oil spill during servicing all ball and check valves to be installed as close to the cooler as possible.

The water IN end shall be positioned so that “UP STREAM” cooling is achieved.

Normally every cooler has its own separate pump for cooling water supply. If not, the supplier shall be contacted for approval.

Also ensure that the cooling water pump has sufficient capacity.



Hydraulic pumps

All el. motors shall be installed on “rubber legs”/rubber elements or other elastic surfaces. These are normally NOT supplied.

The electric motors can be positioned horizontally or vertically for best use of space in the hydraulic room. During installation pay special attention to the future servicing, as per dimensional sketches.

For connection of hydraulic pumps to the system use hydraulic hoses. This to avoid extra vibration forces from the pumps to the pipe lines.

Do not use 90° fittings direct mounted on the pumps outlets. For most types of hydraulic pumps it is allowed to turn their sections (both pressure and suction sections) in relation to each other. Use this possibility to optimize pipe layout from the pumps.

Filters

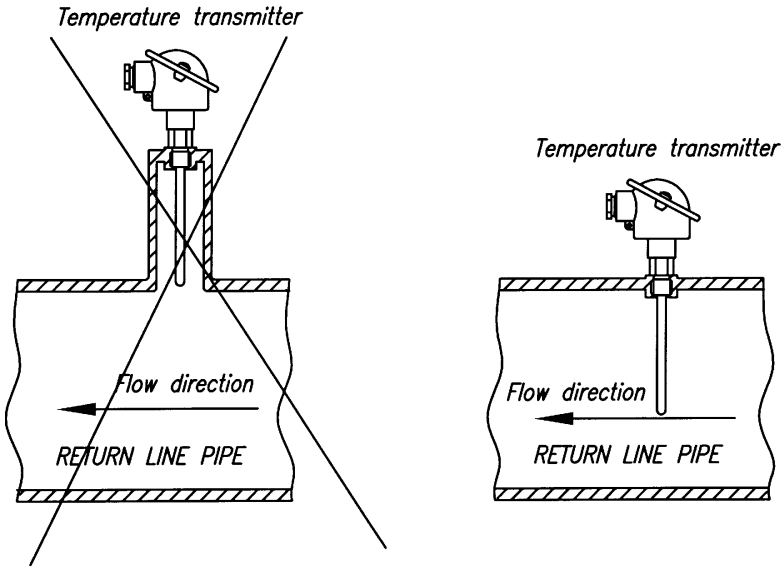
Service distance and accessibility for filter replacement shall be provided.

It must be easy to inspect the filter indicators.

Pipe length from the pump to the filter to be as short as possible.

Temperature transmitter

The temperature transmitter shall be positioned before the oil cooler and assembled with the temperature detector directly in contact with the main flow. See fig. below:



If diameter of pipe is not big enough for this type of installation, use one of the 90° bends in the return line.

Valves

The hydraulic and electro/magnetic valves shall be easily available for service, testing and adjustment.

Electrohydraulic valves without waterproof protection shall be installed in dry environment correspondent to the **IP** class.

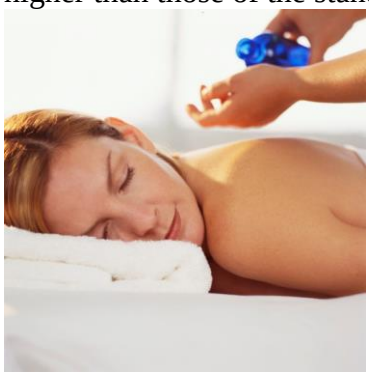
"No system has ever failed from being too clean"

2.2.6 Requirements to cleanliness

This Part is based on NS 5910 - "Cleaning of hydraulic pipe systems".

The objective of this standard is to ensure that hydraulic system has a proper initial cleanliness level to ensure that desired reliability and expected life can be obtained

The standard can be a supplement to, but cannot replace the recommendations of the supplier of the components and the customer requirements, especially when their requirements are higher than those of the standard.



Clean oil for proper function.

Tube treatment and cleaning

All tubes must be 100% clean before the installation starts.

Precision steel tubing is normally without solid pollutants (except shaving from cutting). Preferably the tubes are to be cleaned by blowing (compressed air) special soft plugs through the tubes. If such equipment is not available, pull a clean cloth rag (not polishing yarn or paper) through the tube, then oil it before plugging the ends.

Other kinds of tubing must be cleaned with a suitable solvent such as white spirit, trichlorethylene or similar, before being pickled in an acid solution.

Welding connections at flanges, bends, branch-outs must be made completely mechanically clean from particles before cleaning and pickling.

When cutting the tubing, the tubing must be carefully rinsed and inspected.

Any sandblasting must be carried out with special care, as the sand tend to settle in corners, bends, etc. inside the tubing.

During any sandblasting ensure that all open hydraulic connection points are sealed.

Requirements for achieving a desired level of cleanliness.

Flushing the system

The main purpose of flushing is to achieve the cleanliness level specified by the supplier of the system or the components.

The level of particles content (ISO 4406-1999, max.: 18/16/13). *

Actions to achieve a satisfactory cleanliness level in a hydraulic system comprise of:

1) cleaning and internal surface treatment of tubes;

2) drying of fitted piping system;

3) flushing;

4) verification of cleanliness level.

Presupposition for retaining a high cleanliness level after flushing are the selection of suitable and properly located system filters, and that oil filling is done through a system filter or another suitable filter.

In the design phase it is important to plan for system flushing.

Circuits shall be connected in series, when flushing. Areas without circulation shall not exist.

Flushing units capacity shall be calculated to ensure high oil flow for efficient cleaning of the internal surfaces of the system pipes .

Components which may prevent high flow velocity or which may be damaged in high flow velocity or high particle content shall be disconnected from the circuit.

It shall be possible to flush all connections of the piping.

All equipment supplied by Rapp Hydema A/S is cleaned, flushed and ready for operation. If the shipyard uses assemblies or components which turned out to be un-cleaned, they shall be flushed separately. This is also valid where space does not allow flushing of installed piping system.

It is important that a representative flushing fluid sample can be taken.

Components cleanliness level

Components and assemblies are often connected to the pipe system after flushing. The cleanliness of these components and assemblies should be at least as good as the desired cleanliness of the main system.

The component suppliers should be able to give information about the cleanliness level of the components.

Note! If the components contain anticorrosion agents which are not compatible with the system fluid, the components shall be flushed using system fluid with 5-10% degreasing agents added. The degreasing agent shall not influence component seals.

Cleaning and internal treatment of tubes

Mechanical cleaning of tubes

Welded tubes shall be mechanically cleaned internally to grade St. 2 according to SIS 05 59 00.

Grinding or brushing is recommended. Sand-blasting shall not take place.

Note! After mechanical cleaning, tube and tube flanges shall be smooth and free from slag, welding beads, baking, pores and foreign particles.

Chemical cleaning of tubes

Tubes with scale and/or corrosion shall be treated according to the following procedure:

Alkaline degreasing;

Water rinsing;

Pickling;

Water rinsing;

Neutralization;

Water rinsing;

Drying.

The current guidelines from the Directorate of Labor Inspection and the National Pollution Control Authority are to be followed.

Alkaline degreasing

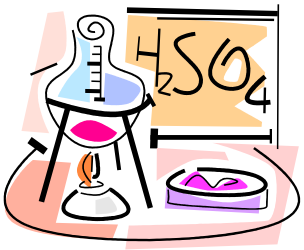
The tubes shall be cleaned with an approved degreasing agent.

Note! Oil and grease reduce the effect of the pickling process. An alkaline bath which removes most of the organic dirt (lacquer, oil, fat) may consist of 10% NaOH (caustic soda) and 90% water. Treatment time is approximately one hour at 90°C. Certain types of fat are not removed by this procedure.

Water rinsing

The tubes shall be thoroughly washed with fresh water.

Pickling



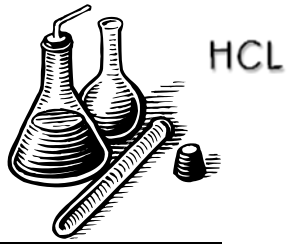
Pickling by sulphuric acid

The tubes are preferably pickled in a sulphuric acid bath consisting of 10-25% H_2SO_4 (sulphuric acid) in water, 1-2 ml/l inhibitor (hexamine).

Maximum bath temperature 80°C. Alternatively the tubes are filled completely with pickling fluid.

Note! Always pour acid concentrates into water, not vice versa. The acids must be treated carefully as they are highly corrosive. Protect skin and eyes and follow the recommendations of the acid supplier.

Alternative pickling



Hydrochloric acid pickling

50% hydrochloric acid in water (hydrochloric acid in 35-38% concentration, non-arsenic) 1-2 ml/l inhibitor (hexamine).

Maximum bath temperature 35°C.

Pickling time 10-60 min.

Hydrochloric acid is very reactive and leads to immediate corrosion if neutralization measures are not taken immediately after the pickling. Also pickling in hydrochloric acid may lead to hydrogen embrittlement in the steel if the inhibitor is not effective enough.

Phosphoric acid pickling

Phosphoric acid pickling gives a small amount of corrosion and normally requires neutralization.

Water rinsing

The tubes shall be washed thoroughly with fresh water immediately after the acid pickling.

Neutralization

The tubes shall be washed with an adequate neutralizing liquid.

Note! An adequate neutralizing liquid may consist of 2% Na3PO4 (triosodiumphosphate) in water. Bath temperature 80-90°C. Treatment time 1-2 minutes.

Water rinsing

The tubes shall be washed thoroughly with fresh water to remove the neutralizing liquid.

Drying

The tubes shall be dried with warm, dry air within 30 minutes after rinsing.

Surface treatment

To maintain the obtained cleanliness until installation, the tubes shall be treated with a suitable protection liquid. The liquid used should give corrosion protection for at least five months and shall not alter the properties of the flushing fluid or the system fluid.

Storing of tubes and tube parts

Cleaned and surface treated tubes and fittings shall be capped immediately and should be stored in a dry place.

Drying of piping systems

Before the piping system is connected to machines, panels, pump stations etc. all tubes shall be thoroughly blown through with dry, filtered compressed air or nitrogen. Dew point is to be 45°C at normal atmospheric pressure.

Sizing of external flushing filters

It is a generally good economy to use large flushing filter; the smallest flushing filter which should be accepted has a pressure drop through a clean element of 5% of the opening pressure of the bypass valve or the indicator setting, calculated at the relevant flushing fluid viscosity.

Criteria for proper flushing

A flushing procedure should be adapted to the practical conditions. Certain main criteria shall, however, be fulfilled to obtain a satisfactory result (see level of cleanliness).

The reservoir of a flushing unit shall be cleaned to the level required for the system.

The system shall be filled through a suitable filter. Air should not be brought into the system when filling. If necessary, top up and bleed the system.

Removing particles from internal surfaces

To remove contaminants effectively from internal surfaces, the main requirement is that the flushing fluid has a turbulent flow. This condition is fulfilled when Reynolds number is larger than 3000.

If the flushing is done with Reynolds number smaller than 3000, there will be different degrees of laminar flow within the tubes. In the area close to the tube wall, where the particles are situated, the fluid velocity is approximately zero. This stationary fluid does not possess the ability to remove particles from tube and component walls.

With Reynolds number larger than 3000 there will be a turbulent flow. Having this condition t01he fluid wipes the surfaces with high energy and tears off the contaminants effectively.

Flushing Procedures and Formula

The aim of flushing is to remove contamination from the inside of pipes and components which are introduced during system assembly or maintenance. This is accomplished by passing fluid through the system, usually at a velocity higher than that during normal operation.

Omission or curtailment of flushing will inevitably lead to rapid wear of components, malfunction and breakdown.

Reynolds N^{o} (Re): A non-dimensional number that provides a qualification of the degree of turbulence within a pipe or hose.

Laminar Flow | Turbulent Flow

Laminar Flow - Reynolds N^{o} < 2,000
Transitional Flow - Reynolds N^{o} 2,000 - 4,000
Turbulent Flow - Reynolds N^{o} > 4,000

The flow condition in a pipe or hose can be assessed using Reynolds N^{o} as follows:

$$Re = \frac{Ud}{\nu} \times 1{,}000 \quad \text{or} \quad Re = 21{,}200 \times Q / (\nu \times d)$$

Re = Reynolds N^{o}
U = Mean flow velocity (m/s)
d = Pipe internal diameter (mm)
ν = Kinematic viscosity of fluid in cSt (mm^2/s)
Q = Flow rate (L/min)

It is often difficult to obtain a Reynolds number larger than 3000. The following methods are recommended to increase the Reynolds number:

Increasing the fluid flow “Q”.

This may not be practically acceptable and this is expensive as it requires a larger flushing power unit.

Reduction of the viscosity “v”

In most cases this is the best way to achieve a turbulent flow. The reduction may be obtained by increasing the temperature, thus lowering the viscosity.

If a special flushing fluid is used, it shall be compatible with the system oil which is to be used in operation. The only general recommendation is to use the same type of fluid, possibly with a lower viscosity.

Note! When studying the equation for the Reynolds number, it may look as if a reduction of the tube diameter may contribute to increase Reynolds number. The pressure drop through a tube, however inversely proportionally with the inside tube diameter to the 5th power. Narrow tubes are therefore very difficult to flush because the flow resistance becomes too high.

The use of vibration, high frequency sound or changing flow direction, will contribute to a faster removal of particles. This is, however, a supplement and not an alternative to turbulent flow.

A turbulent fluid flow will also ensure transportation of the contaminants from the system to the filters.

Selection of filtration performance

The filters used for flushing are quite decisive for two essential reasons. They set the final cleanliness level which can be expected and how fast this level can be reached.

The choice of an optimal filtration ratio is important. Using filters with a poor filtration ratio, situations may arise where the specified cleanliness level is not achieved, or is achieved after a very long flushing time.

Filtration performance is measured according to ISO 4572.

ISO 4572 defines Beta ratio (filtration ratio) as the relationship between the number of particles greater than a given size upstream of the filter, and the number of particles greater than the same size downstream of the filter. If there are 20 times as many particles greater than 5 μm in the oil upstream of the filter compared to downstream of the filter, the Beta ration for μm equals 20. This may be presented as: Beta-5 = 20.

Filters with Beta-5 values considerably higher than 1 should be used.

Recommended minimum value is Beta-5 equal to 20.

External flushing filters

In several cases external filters are used during flushing.

The reason for this may be that the selected filter rating deviates from that of the system filters, or it may be for economical reasons.

Minimum flushing time

The flushing time depends on the system capacity and its complexity. Even if samples from the system indicate that the specified cleanliness level is reached after a short time, the flushing shall continue for at least three hours at turbulent flow. The probability of removing particles sticking hard to the tube walls therefore increase.

Verification of the cleanliness level

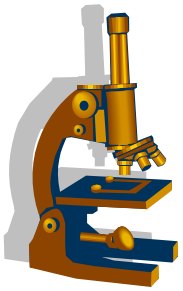
The obtained cleanliness level shall be documented before flushing operation may be considered as finalized. Use particle counting or comparison membrane.

Particle counting

The use of an automatic particle counting is the fastest method for particle counting in a flushing fluid sample. See ISO 4402.

When required cleanliness level is specified according to ISO 4406-1999, it is sufficient to count particles larger than 4,6 and 14 µm.

Particles may alternatively be separated on a membrane filter and counted by using a microscope. See ISO 5884.



Comparison membrane

The equipment for microscopic particle counting may also be used by applying comparison membrane. The procedure is the same except for the counting.

Instead of counting particles, the relevant test membrane is compared to a reference membrane by using a microscope. For a trained operator it is easy to ascertain that the sample is equal to or better than the reference. The reference membrane should be made for the relevant type of system, and it shall represent the cleanliness level required.

Note! The membranes shall be compared using a microscope only. Dye pigment and other substances which create color nuances may give completely misleading results. Samples should be verified by counting of particles.

Cleanliness level (only for particles counting) defined in other standards shall correspond to ISO 4406-1999 level 18/16/13:

ISO 4406	NAS 1638	SAE 749
18/16/13	7	4

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Solid contaminant codes

In addition to ISO 4406: 1999, other standards are used to express the fluid cleanliness level. A comparison between the codes is given below.

ISO 4406: 1999	ISO 4406: 1987	NAS 1638 CLASS
13/11/8	11/8	2
14/12/9	12/9	3
15/13/10	13/10	4
16/14/9	14/9	-
16/14/10	14/10	5
17/15/9	15/9	-
17/15/10	15/10	-
17/15/12	15/12	6
18/16/10	16/10	-
18/16/11	16/11	-
18/16/13	16/13	7
19/17/12	17/12	-
19/17/14	17/14	8
20/18/12	18/12	-
20/18/13	18/13	-
20/18/15	18/15	9
21/19/13	19/13	-
21/19/16	19/16	10
22/20/13	20/13	-
22/20/17	20/17	11

☆

Components	ISO Code
Servo control valves	16/14/11
Proportional valves	17/15/12
Valve & piston pumps/motors	18/16/13
Directional & pressure control valves	18/16/13
Gear pumps/motors	19/17/14
Flow control valves	20/18/15
Cylinders	20/18/15

☆

Especially cold environment

In cold environment the flushing of pipe systems may suffer from loss of heat. To verify that the Reynolds number is larger than 3000, the temperature shall be checked at the estimated coldest spot of the system. The flushing is only real when the lowest temperature gives a Reynolds number larger than 3000. See data for the viscosity and temperature of the relevant flushing fluid.

Under specially cold conditions, the pipe system etc. should be insulated to keep the temperature above the necessary minimum level.

2.2.7 Preparation to filling oil tank

Check again cleanliness of the oil tank and suction lines. This is very important in case suction filters are not used in the system.

Before first filling of oil tank it must be inspected and approved be representative of Rapp Hydema A/S.

Use only oil recommended by Rapp Hydema A/S, see “Oil and Lubricant Requirements”.

Inspect the oil drums to see if they are properly sealed. Let drums rest for 1…2 hours by the oil tank to separate water or other contaminants.

Ensure that oil pump, hoses, other relevant equipment are clean and have not been used for pumping motor oil or other fluids.

Always use filter 10μm between drum and tank, new oil is not clean. It is possible to use one of the system return filters.

There may be water/contaminants even in new, sealed oil drums. Therefore it is a good rule to leave the last 5-6 cm oil in the drum.

It is necessary to have spare amount of oil for topping up oil tank after pumps start and oil is pumped to the system pipelines. Volume of the system pipes can be up to 20% of the oil tank volume. Spare oil is also used for compensating loss of oil during trouble shouting / servicing of hydraulic system.

Title: Winch Alignment		Date: 06.11.2018	Doc. Id: 6440	Version: 6
Author: Tobias Schaer	Approver: Ben Bolsøy			Page: 1 (11)
Doc. Applies to: Rapp Marine		Department: Engineering & Technology		

1. Introduction & FAQ

The information contained in this procedure is to allow installing personnel to correctly align Rapp Marine winches that have a WDU-style gearbox. This is typically present for multi-motor winches, both electrical and hydraulic.

There are two parts to the procedure: winch alignment (also known as "clocking") and contact pattern test (also called "blueprint test"). Three check forms are provided, one each for Winch Alignment, Foundation Deflection, and Maintenance.

Note: The blueprint test must only be repeated if no factory test data is available.

1.1. What is a WDU?

A WDU is a *Winch Drive Unit* and is a large gearbox mounted to the drum shaft of some Rapp winches. Onto this gearbox, hydraulic motors may be mounted directly, or electric motors are mounted via angle gearboxes.

1.2. What are gearbox runouts?

When a WDU is manufactured, the gears inside must be aligned so that they do not cause the main output shaft to experience uneven forces, leading to high wear on the gears.

The gearbox *runout numbers* record this alignment from the gearbox manufacturer.

1.3. What's the objective of the procedure?

When installing the winch on the vessel, it must be perfectly aligned on its foundation to avoid wobble and wear. Aligning the winch is done by measuring the actual gearbox runout, and adjusting the winch (using shims and bolts, procedure below) until the factory runouts are achieved.

1.4. Why does gearbox orientation matter?

The gearbox is typically aligned right-side up, and the runout numbers match this orientation. See ***Figure 1*** . But the gearbox may be mounted sideways on a winch (***Figure 2***) – but the original "up" direction must still be used as "up" when doing the winch alignment.

2. Required Equipment & Materials

The following are required for installation:

- Check Form 1 from factory (for reference numbers)
- Blank Check Form 1 to be filled out (included in this document)
- Clocking device
- Gear marking compound (blueprint ink – only needed if factory runouts are not known)
- Spanners for adjustment bolts
- Shims (should be provided)
- Chockfast

Also required is the ability to turn the winch, either manually with brakes free and chain hoist, or with winch in operation.

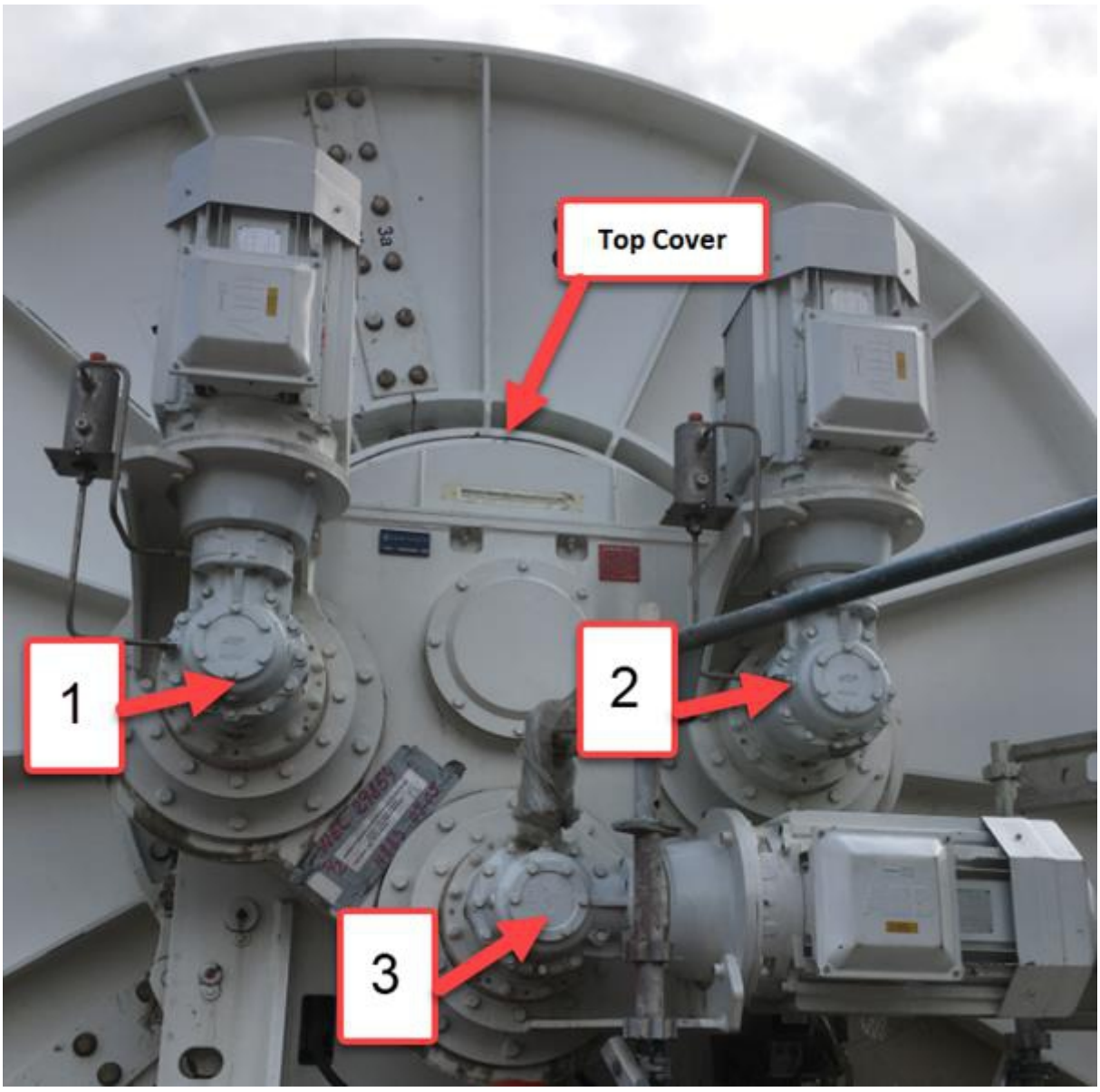

Figure 1: WDU gearbox right side up. Up is where the top cover is.

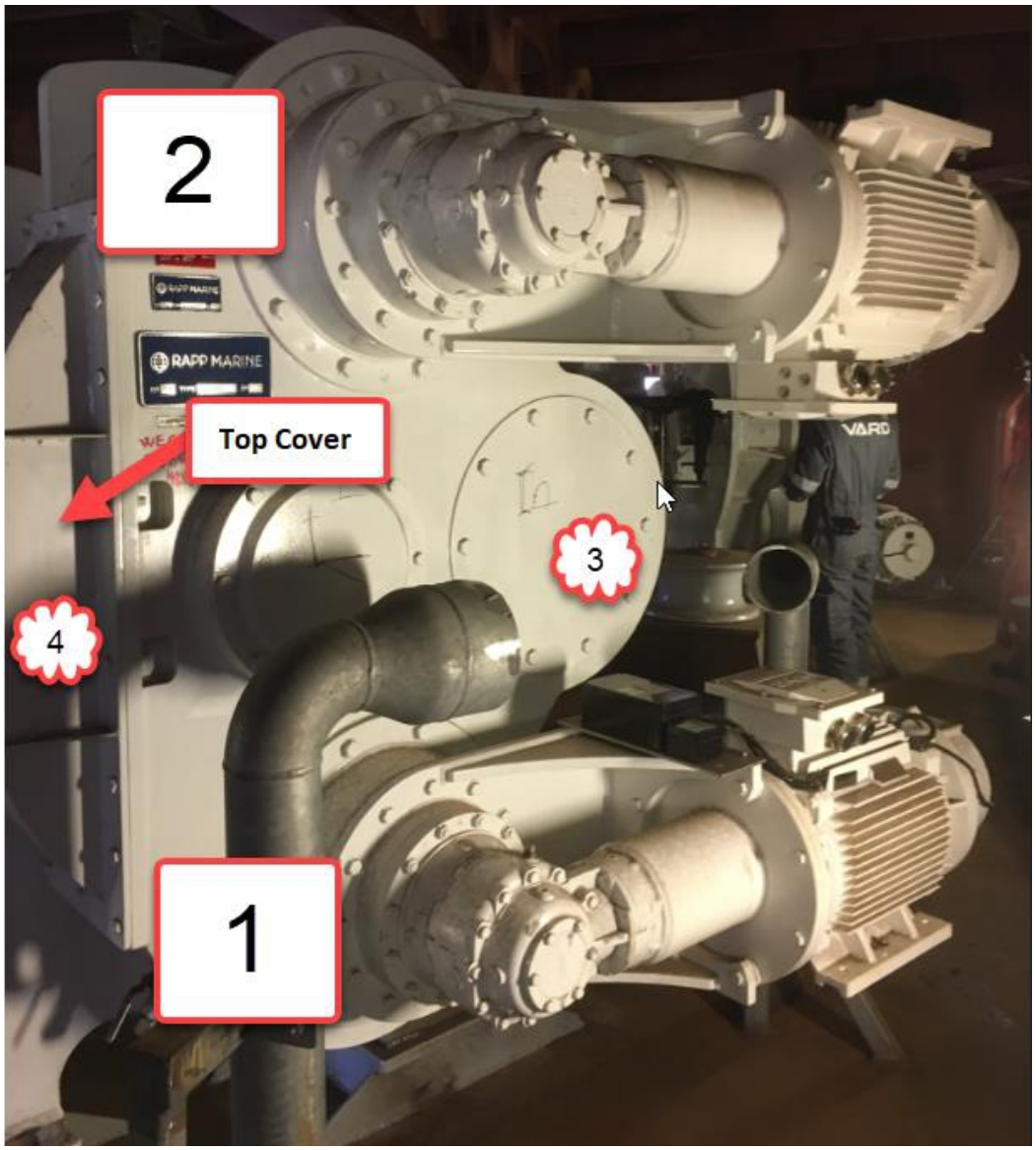

Figure 2: WDU mounted sideways. "Up" direction for clocking is still towards the top cover!

3. Installation Procedure

The following is to be carried out on board the vessel at winch installation time.

1. Deck machinery covered by the Scope of Delivery, Part 1 of Installation Manual, shall be installed on foundations.
2. Strength and quality of foundations shall meet requirements of the Ship Classification Rules.
3. A copy of a filled out *Check Form 1 – Winch Alignment* should be provided with the winch. These are numbers from the factory. Check the winch serial number (a 4-digit code on the winch tag plate) and gearbox serial numbers against ones written in the form. Contact Rapp Marine site personnel or project management if the form has not been provided.

4. Winches shall be installed on foundations in accordance with Figure 3, and follow the installation procedure given below, beginning before the winch is moved on the foundation:
   - 4.1. Prepare gearbox side: Checks if shims have already been welded under winch feet from gearbox side, otherwise place shims of thickness 20-25 mm on the surfaces of the deck foundation on the gearbox side of the winch, one shim under each frame corner.
   - 4.2. Prepare bearing side: Fit adjusting bolts on the bearing side of the winch. Adjust bolts to be the same height as shims on gearbox side.
   - 4.3. Move the winch into position on the deck foundation.
   - 4.4. Fit the hold-down bolts on both sides of the winch. Tighten gearbox side bolts. At this point the installation of the winch to the vessel, for example hydraulic lines, electrical connections etc. can proceed. It is helpful to the alignment procedure if the winch can rotate under its own power.
   - 4.5. Mount the clocking device on the winch and check rotation as described in Steps 1.1 to 1.3 of *Check form 1 – Winch alignment*. Adjust the clock so it gives 0mm deflection at the 0 degree position (Up direction for clocking – See "Why does gearbox orientation matter?" above).
   - 4.6. When gearbox side of the winch frame is fixed, use the adjusting bolts together with hold-down bolts on the non-motor side of the winch to roughly line up winch drum axle position (see Figure 4). From now on all adjustment manipulations are performed on the non-motor side of the winch.
   - 4.7. Turn the drum to get initial values of the gearbox runouts (clocking values) (4 readings, one each at 0 degrees, 90 degrees, 180 degrees and 270 degrees). Write these down.
   - 4.8. Make an adjustment based on the drawings in Figure 5 and Figure 6. Turn the drum again to see the new gearbox runouts. Write these down again.
   - 4.9. Repeat above step until the runout figures match, as close as possible, those achieved at the factory (the filled-in Check Form 1 that came with the winch) *Note: it is important that the factory numbers be matched, and not improved upon.*
   - 4.10. Once the winch has been aligned, apply chockfast on each bolt position. This typically takes 24 hours to set properly.
   - 4.11. Fit the hold-down bolts. Tighten the bolts with prescribed tightening torque, shown on dimensional drawing for the winch.
   - 4.12. Check the drum for easy rotation.
5. Record the final runout figures in *Check Form 1 – Winch Alignment.*
6. Once the winch is in operation and has wire spooled on to it, a deflection test must be performed as per *Check Form 2 – Foundation Deflection.*
7. Forward copies of Check Form 1 and 2 to Rapp Marine, or to Rapp onsite representatives.

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Signs on winches.

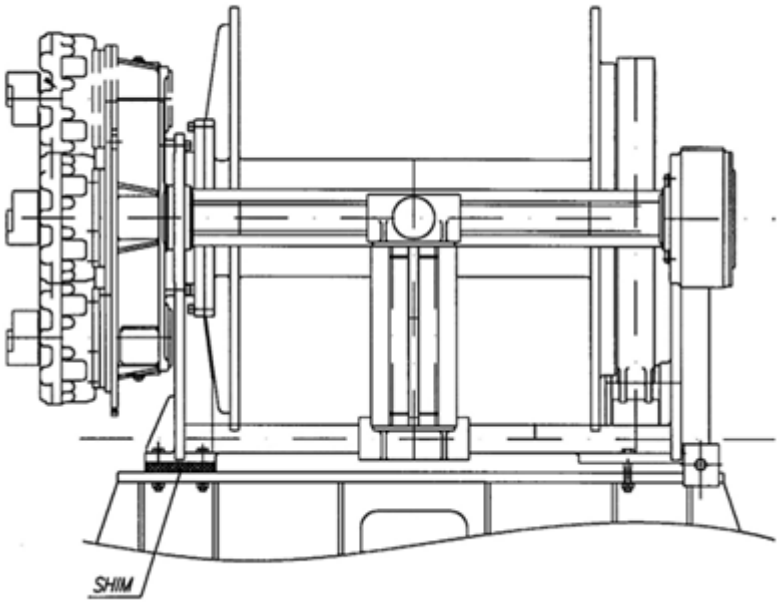


Figure 3: Winch foundation with shims on gearbox side

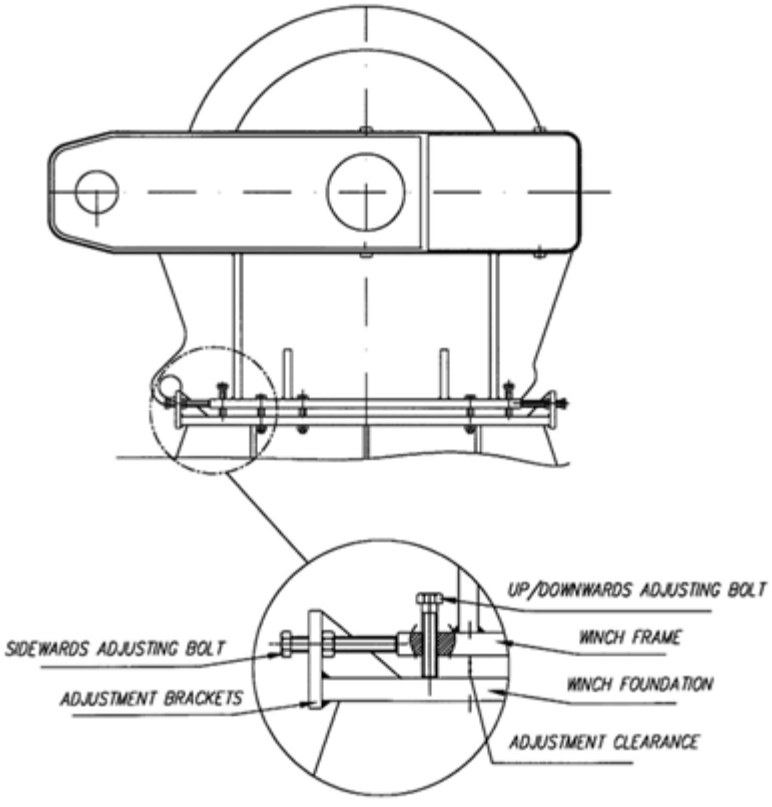


Figure 4: Aligning the winch using adjustment bolts

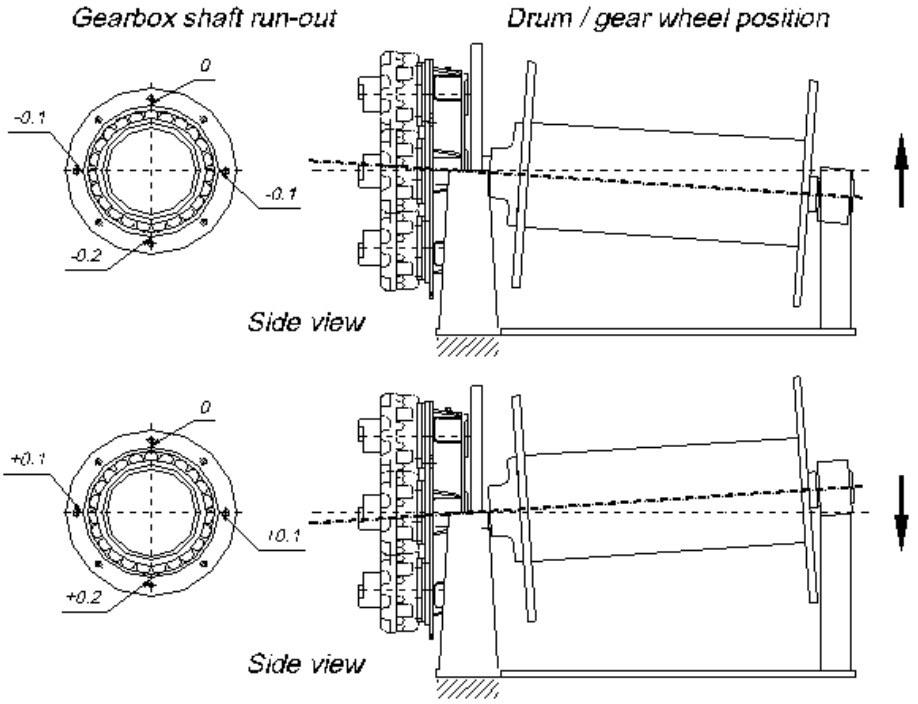


Figure 5: Example runouts (clocking values) due to vertical misalignment

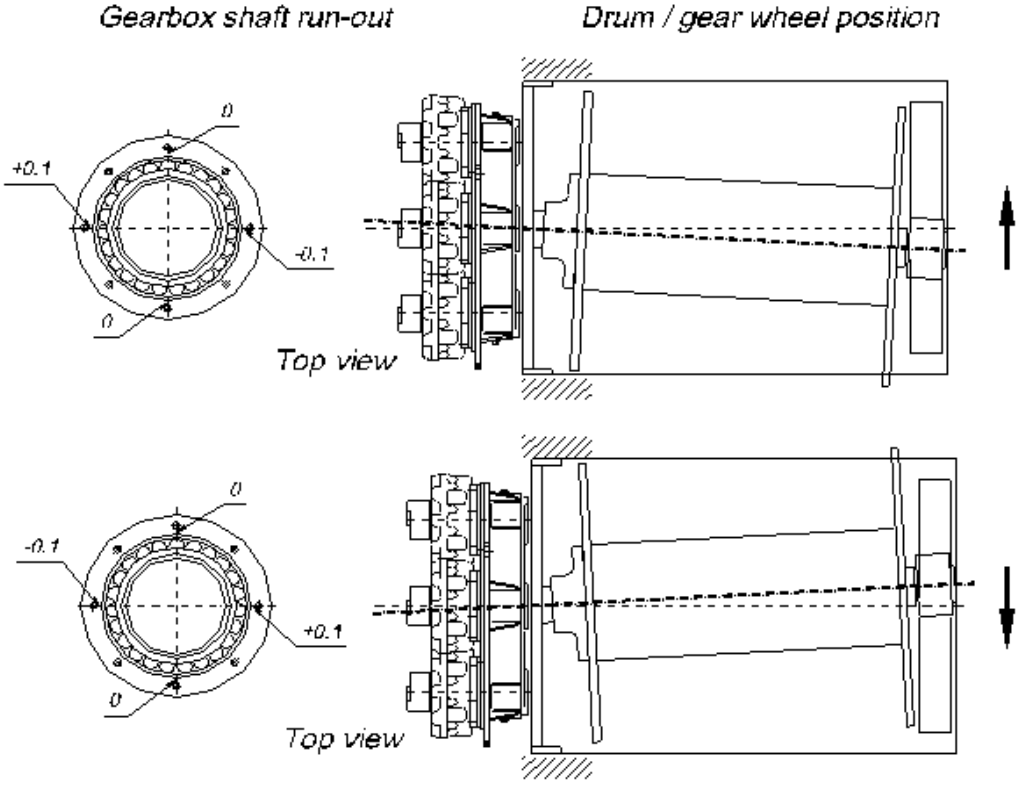


Figure 6: Example runouts (clocking values) due to horizontal misalignment

4. Contact Pattern Test (Blue Print Test)

In case there is a lack of factory original test data for the winch/gearbox, the alignment has to be performed based on visual inspection of contact distribution pattern between each pinion and gear wheel. This procedure is often referred to as a *blue print test*.

The overall winch installation is carried out as described in Section 3. However teeth imprints pattern is used for "navigation" of alignment instead of reference to clock indicator reference figures.

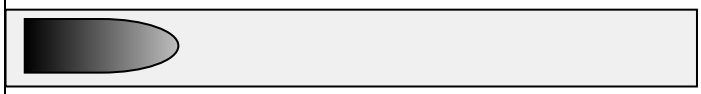
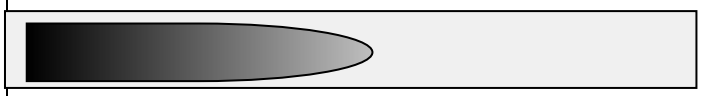
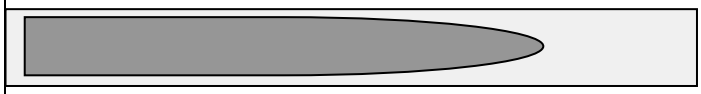
Satisfactory contact distribution pattern is to be in range 80% - 100%, see illustrated reference patterns in *Table 1* below. Each and every tooth on all pinions has to be inspected for proper contact.

For the blue print test, following procedure is suggested:

1. Lubrication oil inside WDU to be drained.
2. Pinion inspection covers to be opened.
3. Pinions and gear wheel teeth rim to be wiped off excess of oil/debris.
4. "Blue paint" to be applied to the teeth of all *pinions* only.
5. Winch to be run with 10-30% load of max pull.
6. Imprint marks on all pinions and gear wheel to be thoroughly inspected and evaluated.

If distribution pattern shows insufficient contact, the winch has to be re-aligned (see Section 3) and re-checked as per steps 3, 4, 5 & 6 above.

Table 1

Contact area after the test	Contact area approx., %
	**10-20**
	**30-40**
	**50-70**
	80-90
	100

5. CHECK FORM 1 – WINCH ALIGNMENT

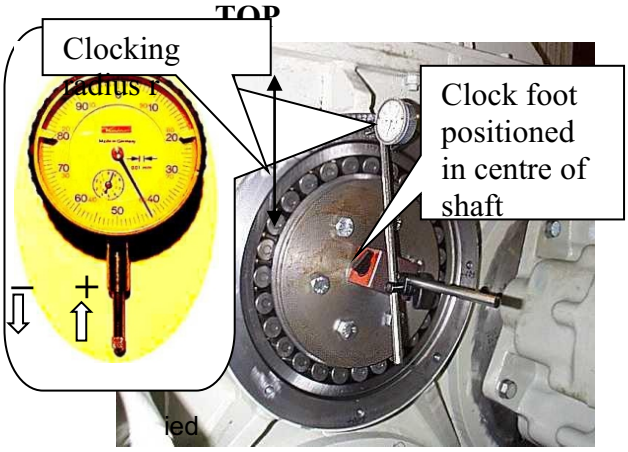


Figure 1: Clocking device setup

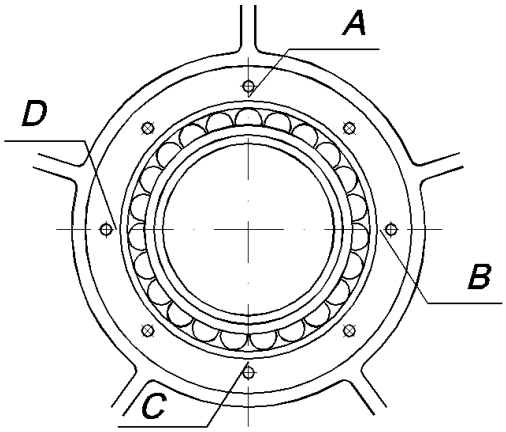


Figure 2: Measurement Points

Alignment of winch during installation

This test applies only for winches with WDU gearboxes.

1. Dismantle gearbox main bearing cover. Keep all parts (cover, spacing ring if present and bolts) together.
2. Mount clock indicator on the gearbox shaft face as shown on Fig.1, and align with Point A. Set clock needle to zero.
3. Rotate the winch drum/gearbox shaft slowly without load. Make a few turns to ensure the clock returns to zero when circle has completed.
4. In *Table 1* below, Test No. 1 is for runout numbers obtained at the factory. If the numbers are not available, they are often found written on the back side of the bearing cover. Copy these into Test No. 1
5. Perform the winch alignment as in Section 3, Step 4. Record in *Table 1* below, in the entry for Test No. 2 data measured in mm during the test. Specify only results obtained in points A, B, C and D Fig.2. **Important:** *while clocking watch the sign of deviation (+) or (-)! The sign has to be mentioned in Table 1.*
6. Try to achieve results as close as possible to the factory figures. **Deviation from these figures should not exceed +/- 0,03mm** at each of check points – B, C & D.
7. When field alignment is completed, send a copy of the completed form to Rapp Marine AS

Winch Data

Winch model	Winch ID No.	Gearbox ID No.	Vessel name (project No.)	HA No.

Table 1: Test Data

No.	Type	Measurements, mm (+) or (-)				Date	Tested by
		A	*B*	*C*	*D*		
1	Dynamic, unloaded. (**Factory**)	***0.00***					
2	Dynamic, unloaded. (**Shipyard**)	***0.00***					

6. CHECK FORM 2 – FOUNDATION DEFLECTION

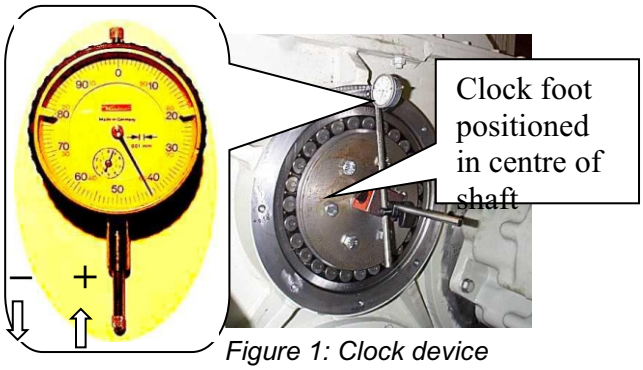


Figure 1: Clock device

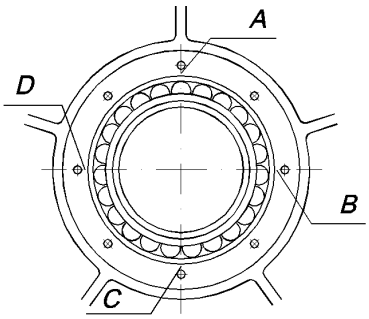


Figure 2: Measurement Points

Deflection test at shipyard

In addition to alignment of winch (Check Form 1), the shipyard performs a foundation deflection test to estimate winch drum, frame and deck foundation deflection under the maximum load.

1. Dismantle gearbox main bearing cover. Keep all parts (cover, spacing ring if present and bolts) together.
2. Load is to be applied with the wire in two different positions, one at each end of the drum.
3. Load, winding type and traction diameter is logged in *Table 1* during the test. (Max. allowed distortion/deflection of the winch main shaft is **as per listed in drawing RH315495**.)
4. Axial movement of bearing house to be eliminated by using a thrust disc or equal to eliminate original clearance in the gearbox (internal clearance in bearing is still to be intact).
    a. Pre-load the winch with 10% of nominal winch pull, or 2 ton minimum.
    b. Set two clock indicators on the gearbox shaft in position A and B, adjust clock radius(r) as suggested in table below and set indicator scale for 0.
5. Measure net movement in position A and B when increasing winch pull to maximum nominal pull. Result to be logged in *Table 2* during the test. Calculate gearbox shaft movements as square root of sum $A^2 + B^2$.

Clock indicator radius to be used as following figures:

WDU2500/4500 (**r** 137 mm)	WDU7501/10000(**r** 164mm)	WDU20000/26000(**r** 195mm)

Winch Data

Winch model	Winch ID No.	Gearbox ID No.	Vessel name (project No.)	HA No.

Table 1: Load conditions

Wire position on the drum		Load, ton	Winding, over / under	Traction diameter, mm
a)	Close to the gearbox side			
b)	Close to bearing side			

Table 2: Winch Deflection Under Load

TYPE of TEST		A	B	C	D	Date	Tested by
Static load. **Shipyard**	a)	Δ	Δ	-x-	-x-		
	b)	Δ	Δ	-x-	-x-		

7. CHECK FORM 3 – MAINTENANCE-/REPAIR WORK

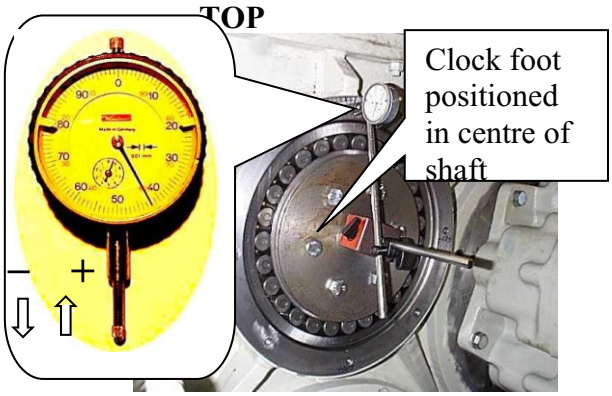


Figure 1: Clock device setup

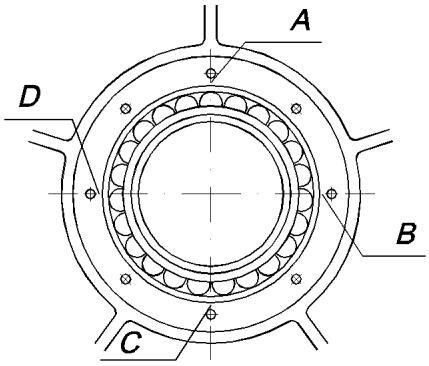


Figure 2: Measurement Points

Maintenance on board vessel.

In case of maintenance-/repair work of any kind that may influence on foundation alignment or strength, or repairs to the gearbox, the unloaded alignment and foundation deflection must both be rechecked.

1. Repeat the alignment check as in Check Form 1, and make any adjustments necessary to return the runout numbers to what was obtained at the factory. Copy the original numbers into *Table 1* below (Test 1/**Factory**) and fill in the new numbers (Test 2/**Field**) when alignment is complete.
2. Repeat the deflection test as in Check Form 2, noting down the load condition in *Table 2*, and the deflection values in *Table 3*

Winch Data

Winch model	Winch ID No.	Gearbox ID No.	Vessel name (project No.)	HA No.

Table 1: Winch alignment

Nr./TYPE of TEST		Measurements, mm (+) or (-)				Date	Tested by
		A	B	C	D		
1	Dynamic, unloaded. (**Factory**)	***0.00***					Fill in from Check Form 1
2	Dynamic, unloaded. **(Field)**	***0.00***					

Table 2: Load conditions

Wire position on the drum		Load, ton	Winding, over / under	Traction diameter, mm
a)	Close to the gearbox side			
b)	Close to bearing side			

Table 3: Winch Deflection Under Load

TYPE of TEST			Measurements, mm (+) or (-)				Date	Tested by
			A	B	C	D		
1	Static load. (**Shipyard**)	a)	Δ	Δ	-x-	-x-		
		b)	Δ	Δ	-x-	-x-		

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Guidance for wire spooling		01.09.2021	1389	10
Author:	Approver:			Page:
Christian Saue	Mads Bergdal			1 (22)
Doc.Applies to:		Department		
MacGregor Bodø		Engineering & Technology		

Purpose:

The purpose with this procedure is to describe and Quality secure wire spooling process.

Scope:

The procedure goes for everybody who do wire spooling operations on behalf of Rapp Marine..

Responisibillity:

Quality – HSE Manager are formally responsible for this routine and must ensure that it is updated. Persons managing or involved in work covered by the procedure are responsible for taking note of and observing its contents, pointing out faults and coming up with proposals for changes/improvements.

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General Information

This guide contains instructions and guidelines for wire spooling on to a plain (smooth) drum as well as a drum fitted with a bolt on Lebus sleeve. The purpose of these instructions and guidelines is to ensure successful spooling and to enhance the service life of the wire rope.

1. The Wire rope

1.1 Measuring the Wire Rope

Before installation it is of the utmost importance to check the diameter of the delivered rope. Make sure that the rope diameter meets the specified requirements for the given machine or equipment.

Should the rope diameter be undersized, the stresses experienced by the rope will be higher than what it was designed for, resulting in an increased probability of breaking the rope. Should the rope diameter be oversized, pinching in the grooves of the sheave and drum will cause the rope to wear out prematurely.

1.2 How to Measure the Size of a Wire Rope

The size of a wire rope is the diameter or circumference of a circumscribed circle which will enclose all the strands. Measurements are to be taken three places along the length of the wire rope, at least 5 feet apart. The diameter of the rope is equal to the average of the three measurements.

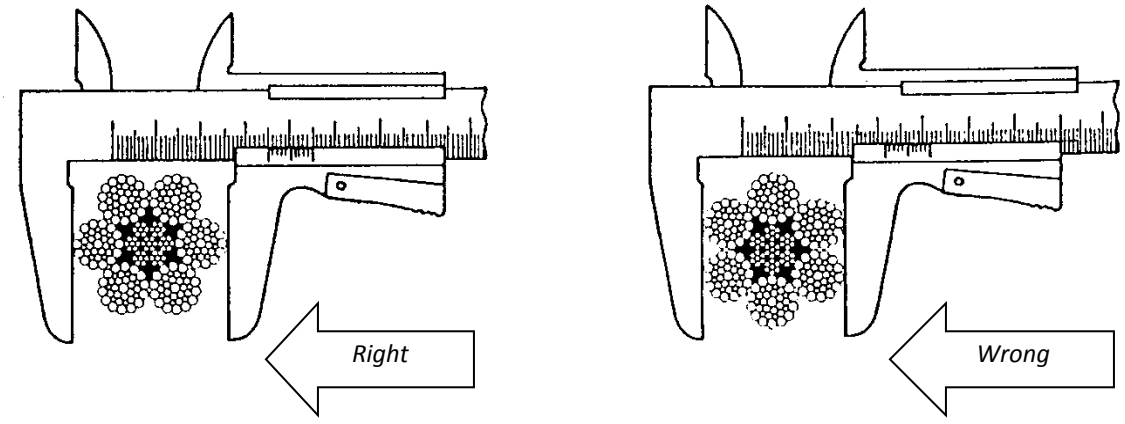


Fig. 1

Tolerances:
See wire-rope suppliers catalog for tolerances.
Tolerances according to NS 5200, ISO 2408 and API 9A.

1.3 “Breaking in” The Wire Rope

After installing a new wire rope it is recommended to do several run-throughs with low tension and low speed. This will gradually “break in” the wire rope, making it settle and adjust to the operating conditions. This process will make the strands fit the permanent “grooves”. There will be a certain change in length, and the wire rope diameter will be slightly reduced as the strands and wire core are compacted. Breaking in the wire rope will make it more resistant against damage when maximum load is applied. The cost associated with the time spent on “breaking in” the rope is considered a good investment as it will save the cost of the rope several times over in repairs and downtime.

2. Handling the wire rope

2.1 Unreeling and Uncoiling

Wire rope is shipped in cut lengths, either in coils or on reels. Great care should be taken when the rope is unpacked as it can be permanently damaged by improper unreeling or uncoiling. Looping the rope over the head of the reel or pulling the rope off a coil while it is lying on the ground, will create loops in the line. Pulling on a loop will, at the very least, produce imbalance in the rope and may result in open or closed kinks. A light coil of rope may be unrolled along the ground but should always be kept under control. A reel may be placed on a turntable, or mounted on stands and supported by a bar or tube through the hole in its center.

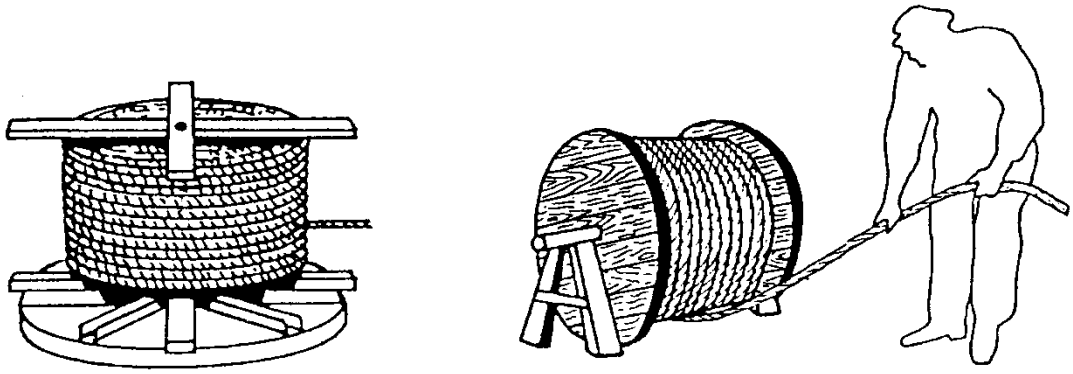


Fig.2

2.2 Winding onto Drum or Reel

When winding a rope onto a machine drum or onto another reel, make sure that it bends in the same direction. Re-reel from the top of one reel to the top of another, or from the bottom of one reel to the bottom of another. Follow the same procedure when winding onto machine drums. It is also necessary to apply a tensioning load to the rope to achieve good spooling. A simple brake such as a plank, rigged to rub against the reel flanges will provide ample rope tension throughout the winding.

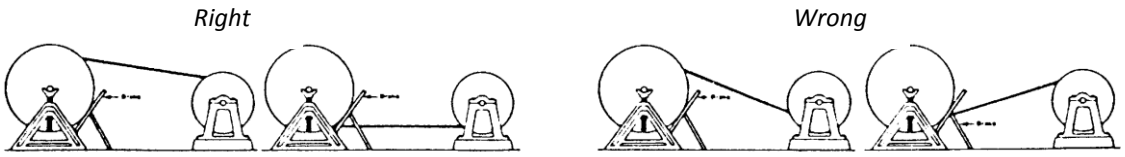


Fig. 3

WARNING **Using wire rope that has been spliced, wire rope with wire marks connected to it (e.g. fire rope) or 3-part wire rope will make it impossible to obtain optimal spooling.**

3. Installation of Wire Rope

3.1 Drums – Plain (Smooth)

Installation of wire rope onto a plain (smooth) faced drum requires a great deal of care. The starting position should be at the drum end so that each turn of the rope will wind tightly against the preceding turn (see figure).

Close supervision should be maintained during the installation to ensure that:

1. The rope is properly attached to the drum.
2. Appropriate tension on the rope is maintained as it is wound on to the drum.
3. Each turn is guided as close to the preceding turn as possible, so that there are no gaps between turns.
4. There are at least three dead turns on the drum when the rope is fully unwound during normal operating cycles.

Loose and uneven windings on a plain (smooth) faced drum can, and usually will, create excessive wear, crushing and distortion of the rope. Resulting in decreased operating performance and a reduction in the rope's effective strength

For right-hand lay rope, use right hand.

For left-hand lay rope, use left hand.

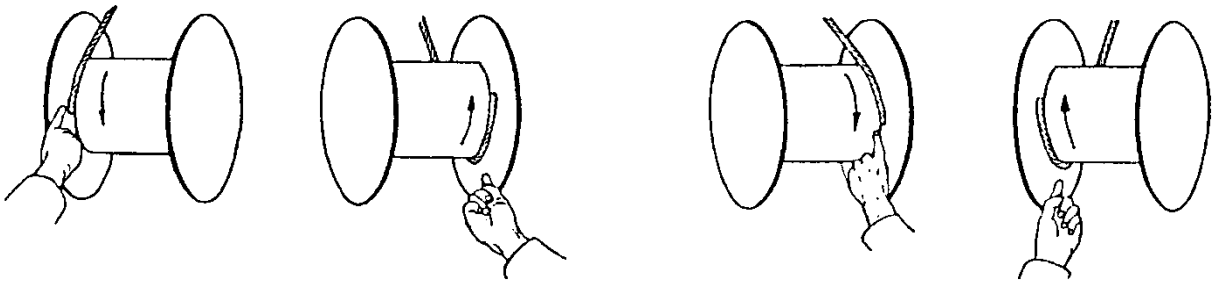


Fig. 4

3.2 Drums – Bolt on Lebus sleeve

Spooling on to a drum with a bolt on Lebus sleeve should be more or less automatic due to its fixed pattern. However, close supervision should be maintained during the installation to ensure that:

1. The wire rope is properly attached to the drum (strung up and anchored in the rope clamps on the flange).
2. Appropriate tension on the rope is maintained as it is wound onto the drum.
3. Every winding spools tightly into its designated groove. A mallet can be used to tap the windings tightly into the grooves.
4. When the wire rope rises from one layer to the next, the wire rope crosses half a winding after half a revolution of the drum in order to maintain the pyramid pattern.
5. There are at least three dead turns on the drum when the rope is fully unwound during normal operating cycles.

Even though correct spooling is achieved, the first layer will eventually lose some of its pretension and become slack. When this occurs, the first layer has to be re-spooled to prevent the tensioned top layers from crushing the bottom layers. This has to be done in intervals throughout the lifetime of the wire rope.

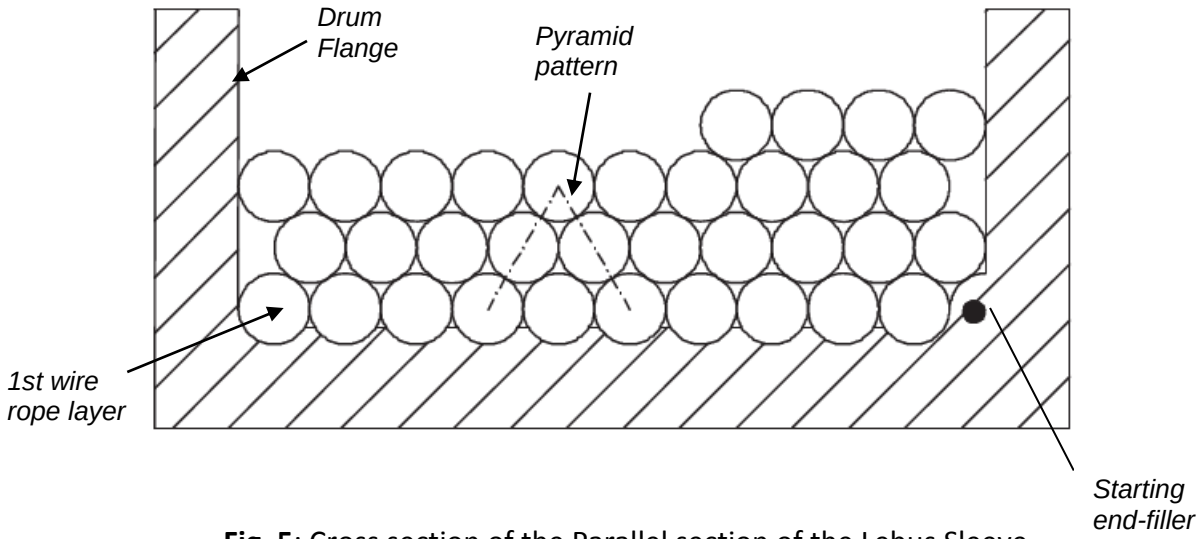


Fig. 5: Cross section of the Parallel section of the Lebus Sleeve.

3.3 Fleet Angle

The fleet angle is the included angle between the rope running to or from the extreme left or right of the drum and a line drawn from the center of the sheave normal to the axis of the drum. When determining the fleet angle for grooved drums, the pitch angle of the helical groove should also be taken into account. If the fleet angle is larger than the recommended limits, the rope may rub badly against the flanges of the grove in the sheave or be subjected to crushing and abrasion of the drum. Too small a fleet angle will cause the rope to pile up against the flange head – damaging both rope and equipment. Severe scuffing of the grooved drums can be the result when the rope wears against the groove walls. This action also bruises and crushes the rope. The appropriate fleet angle will reduce the possibility of damaging the wire rope.

3.3.1 Winch without Level Winding Device

The fleet angle for grooved and smooth drums should lie between 1/4° and 1 1/2°. The distance between the sheave and the drum center line should be 15 to 20 times the length of the drum.

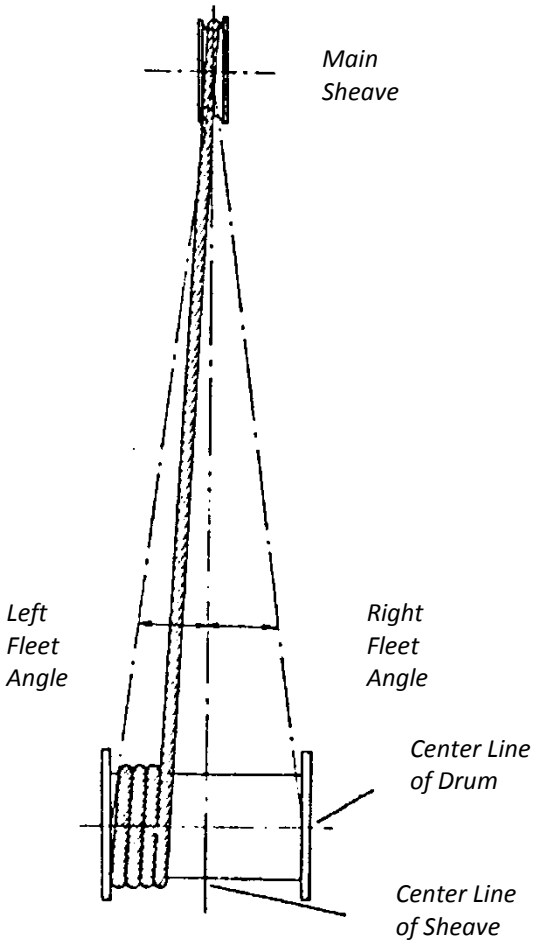


Fig. 6

3.3.2 Winch with Level Winding Device

The maximum fleet angle (**φ**) for grooved and smooth drums with a level winding device is 6°. For winches with a level winding device the drum fleet angle (Lebus fleet angle) must also be considered. The drum fleet angle is the included angle between the wire rope running from the level wind to the drum and a line drawn from the level wind normal to the axis of the drum; see ***α*** in the figure below. The drum fleet angle should lie between ½ ˚ and 1 ½ ˚.

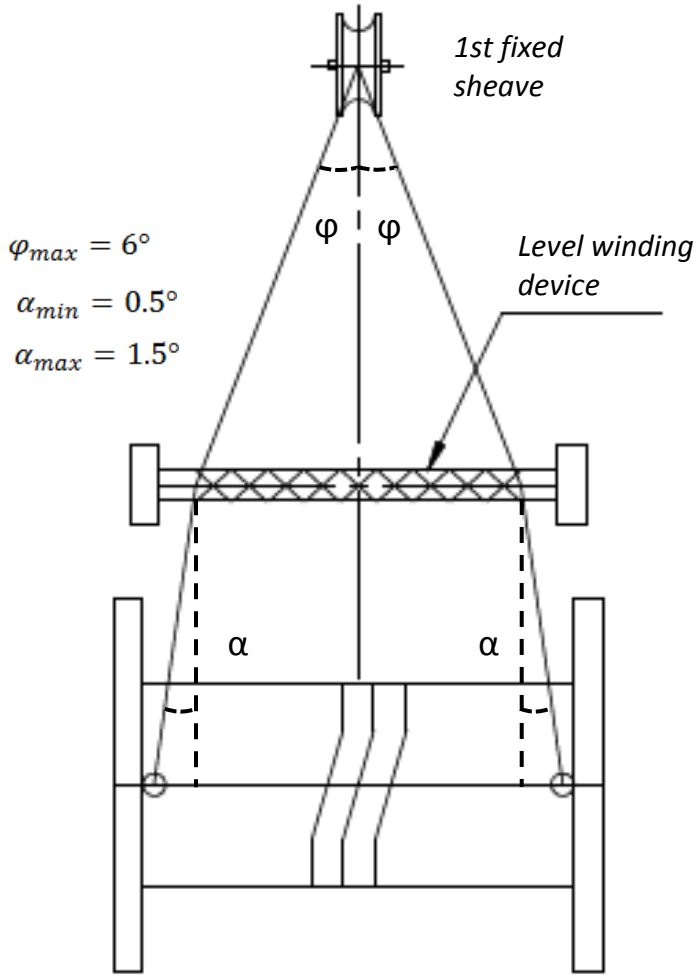


Fig. 7

4. Important Considerations

4.1 Drum (Plain, smooth surface.)

4.1.1 Drum flanges

Check that drum flanges are parallel.

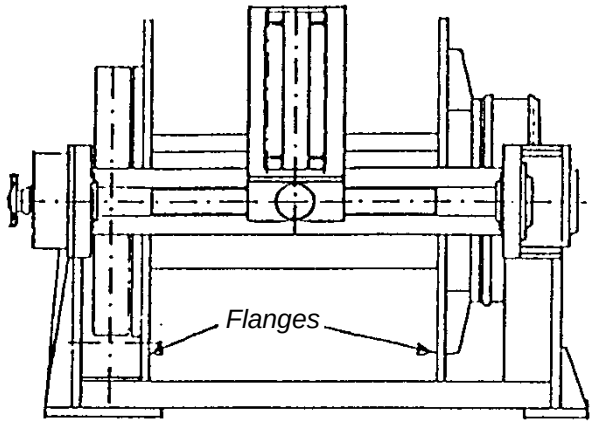


Fig. 8

4.1.2 Level Wind Carriage Position

Check that distance X between the flange and guide roller B is equal to the Y-distance between the opposite flange and guide roller A. Distance X and Y have to be equal for the level wind carriage to operate symmetrically relative to the radial center of the drum.

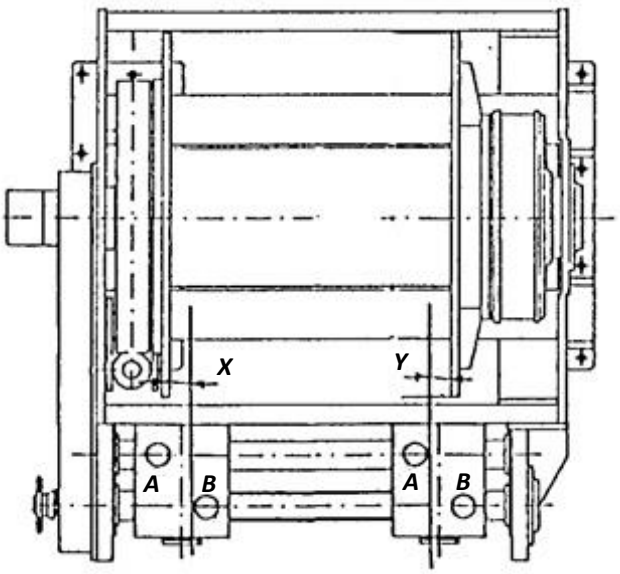


Fig. 9

4.1.3 Roller Distance

Check that the distance between the rollers is equal to the wire diameter + 1 to 2 mm*. The roller distance is measured in parallel, perpendicular to the drum center. See **Fig. 10**

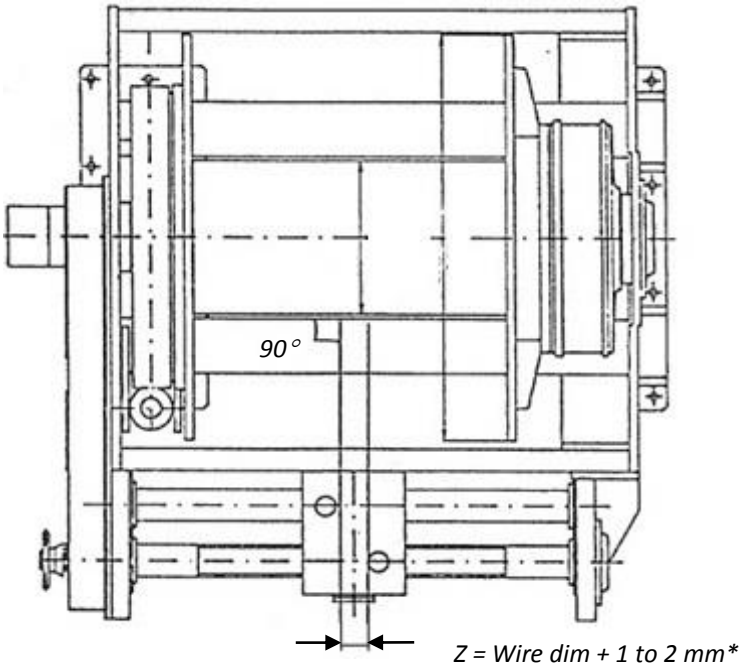


Fig. 10

***For smaller wire rope diameters 1 mm is sufficient, for larger wire rope diameters (greater than 25 mm) use 2 mm clearance.**

4.1.4 Roller Angle

Check that the vertical angle of the guide rollers relative to the drum is 90°.

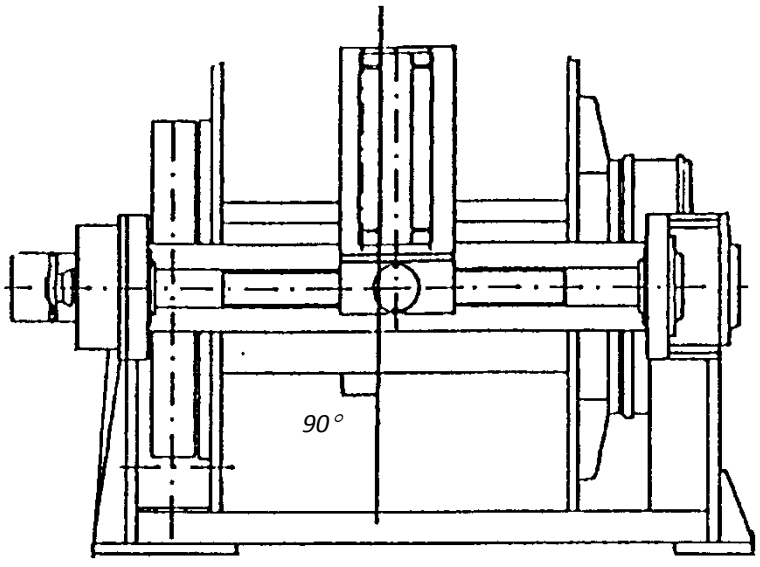


Fig. 11

4.1.5 Arc Radius

The radius of the arc between the drum core and the drum flange (R_t) has to be smaller or equal to the radius of the wire rope (R_w). It must be possible for the wire rope to fill the radius (R_t) from the very first layer.

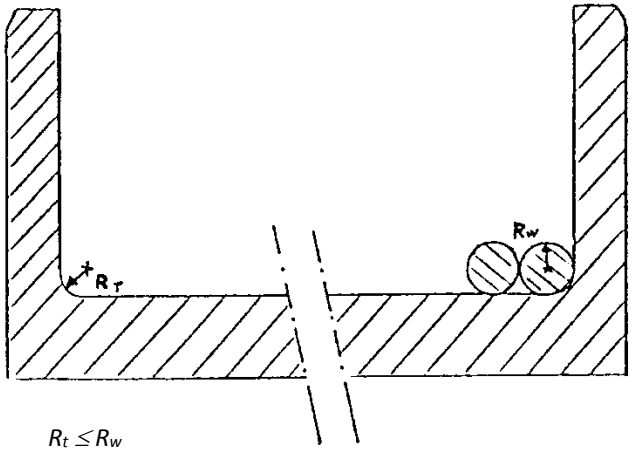


Fig. 12

4.2 Drum with bolt on Lebus sleeve

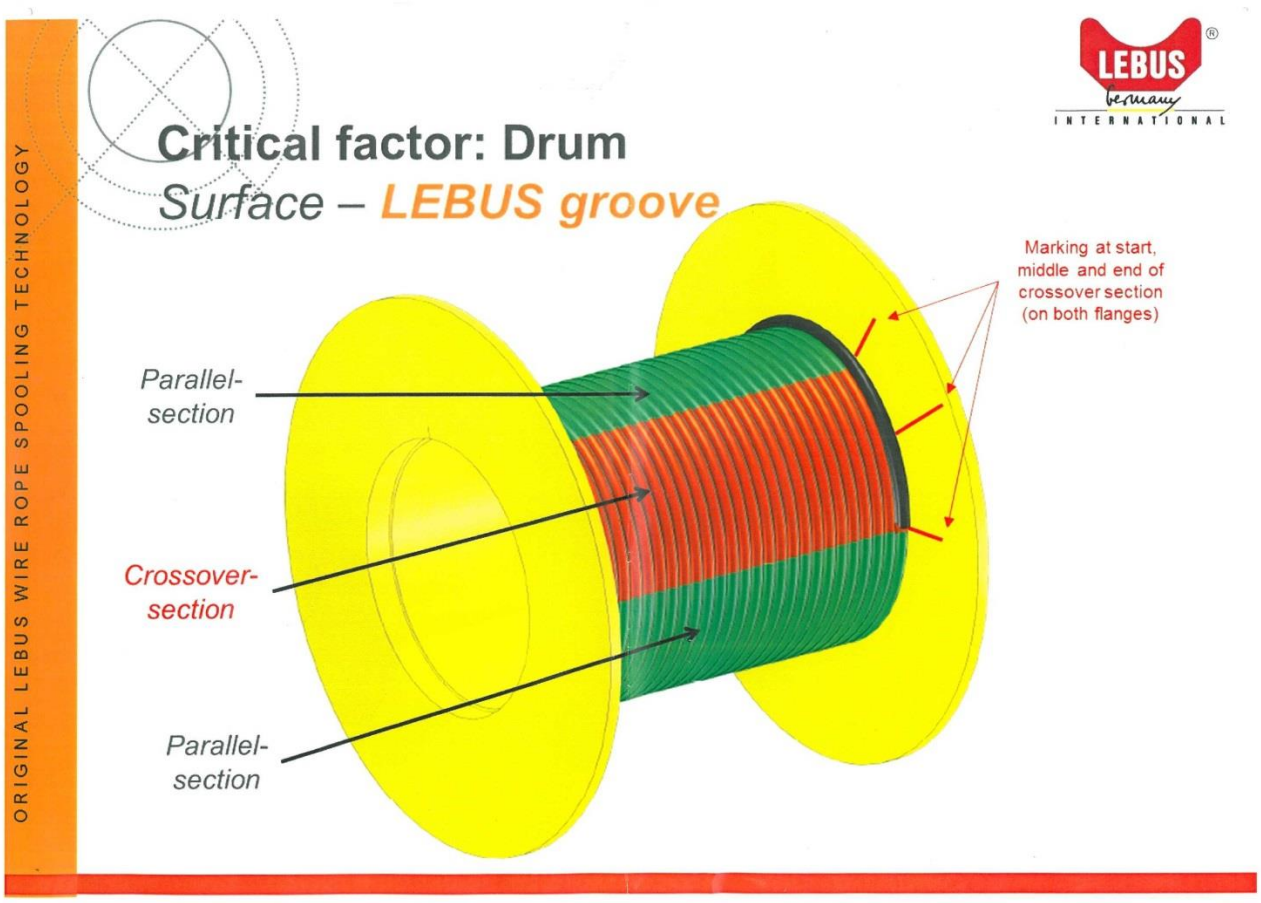


Fig. 13: Shows the different sections of a Lebus sleeve.

WARNING **As the wire rope is spooled onto the drum it can be hard to keep track of where the crossover section starts and ends. Therefore, it is strongly recommended to mark both flanges with the start, middle and end of the crossover section (as seen in Fig.13).**

When spooling on to a drum with a Lebus sleeve some considerations have to be made. Section 4.1.1 – 4.1.4 also apply to spooling with Lebus.

4.1.1 Drum flanges
4.1.2 Level Wind Carriage Position
4.1.3 Roller Distance
4.1.4 Roller Angle

After these considerations have been conducted, proceed with the following steps:

4.2.1 Gear ratio for spooling

Check that the gear ratio is according to the calculations for the Lebus sleeve and spec.

4.2.2 Lebus Sleeve position

Check that the distance between the Lebus sleeve and the drum flanges is uniform on both sides around the sleeve. Check that the sleeve has the right direction on the drum. This is done by checking the direction signs on the sleeve.

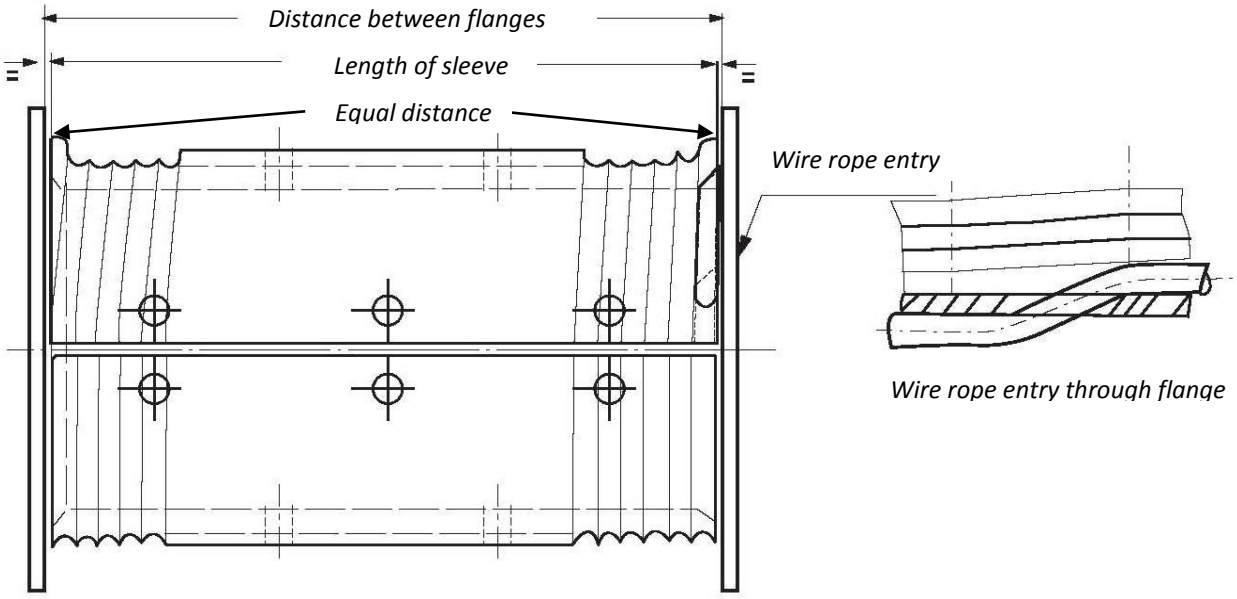


Fig. 14

4.2.3 Lebus sleeve position 2

Check that the Lebus sleeve is positioned so that the crossover area lines up with the cable entrance hole in the drum. This is crucial for achieving perfect spooling with a Lebus sleeve. See points **A** and **B** in the figure below.

WARNING **This is the most important checkpoint. Inaccurate alignment of the cable entrance hole is one of the leading causes for unsuccessful spooling.**

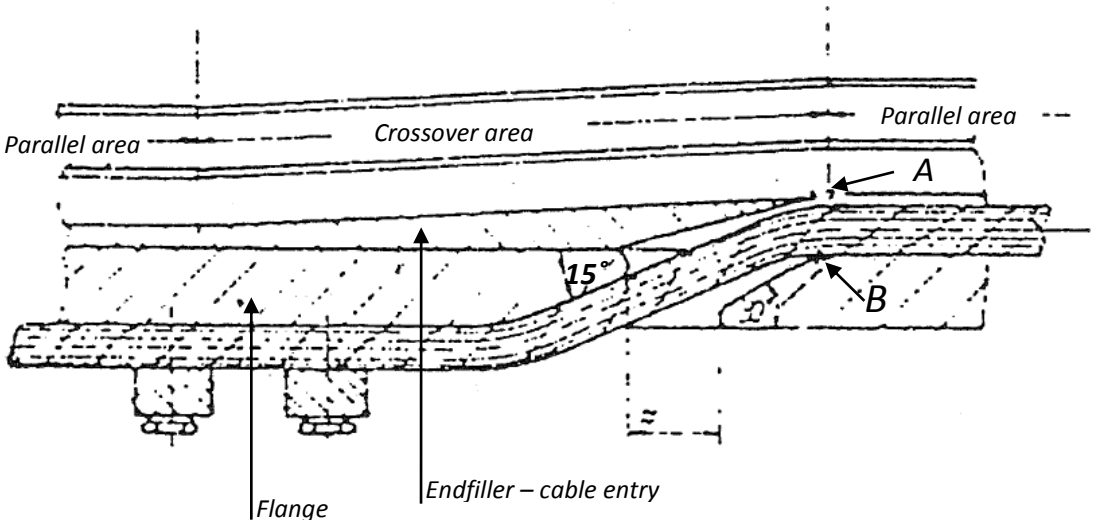


Fig. 15: Illustrates a right hand cable entry, for a left hand cable entry it would be in the opposite direction.

If done correctly, point B on the flange should align perfectly with the boundary line between the crossover - and parallel area (A).

4.2.4 Lebus sleeve position 3

Check that the sleeve grooves on the top sleeve are aligned with the grooves on the bottom half.

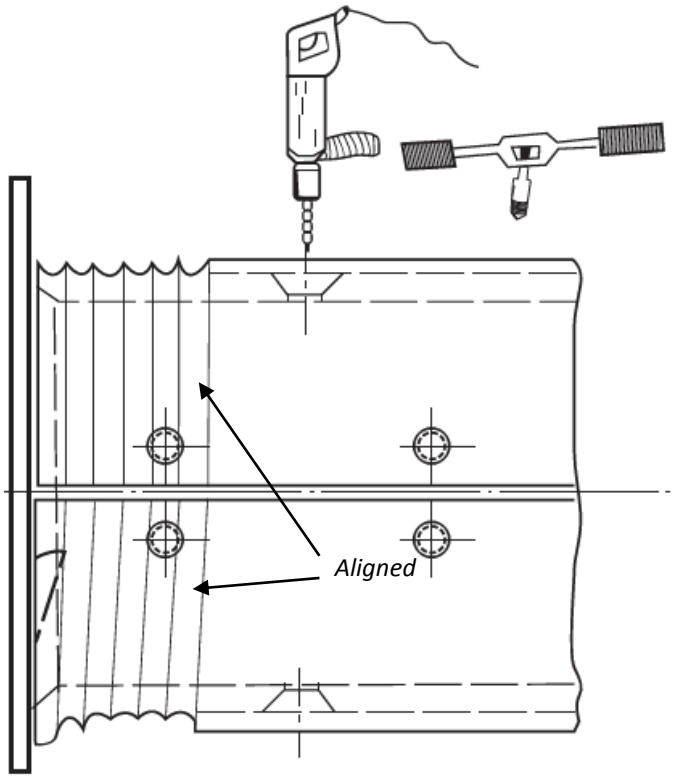


Fig. 16

4.2.5 Lebus sleeve position 4

Check that the gap between the sleeve halves is uniform along the whole length of the sleeve.

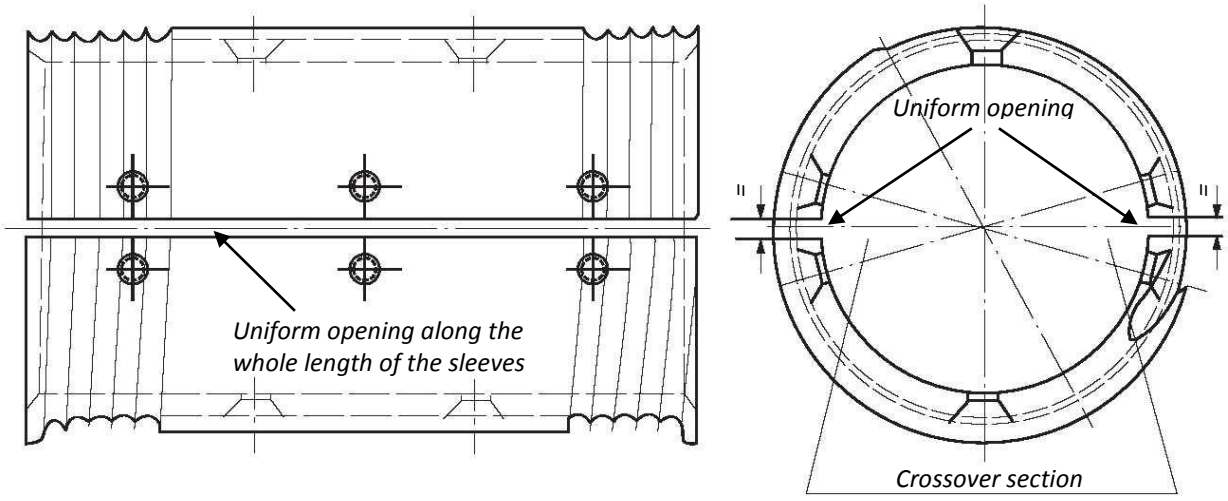


Fig. 17

4.3 Level Wind Carriage Calculations

The movement of the level wind carriage is calculated by RAPP MARINE A/S for the specified wire rope and winch. Should the wire rope be changed to a wire rope with a different diameter, the ratio between the drum- and diamond screw rotation has to be changed.

The amount of windings for the first layer is calculated based on the wire diameter. In order to achieve optimal spooling it is crucial to make sure that the calculations apply to the real conditions. Spooling the first layer correctly is paramount to the end result, seeing as the first layer works as a track for subsequent layers.

Some winches have single ratio, others have double.

The following formulas are to be used for calculation of chain sprockets:

The calculations are based on estimating the number of all-around windings on the 1st layer and the number of full threads or full + ½ thread on the diamond screw.

Number of windings: $$A = \frac{Distance\ between\ Drum\ flanges}{Wire\ Diameter} - 1(approx.)$$

Number of threads $$G = \frac{Length\ thread\ area}{Pitch\ threads}$$

Diamond screw:

Ratio: $$i = \frac{A}{G}$$

Single ratio: $$i = \frac{Z1\ (sprocket\ drum)}{Z2\ (sprocket\ diamond\ screw)}$$

Double ratio: $$i = \frac{Z1*Z3}{Z4*Z2}$$

1st ratio:

2ND ratio.:

Z2=Sprocket intermediate
Z1=Sprocket drum
Z4=Sprocket diamond screw
Z3=Sprocket intermediate

See **Fig.18** next page.

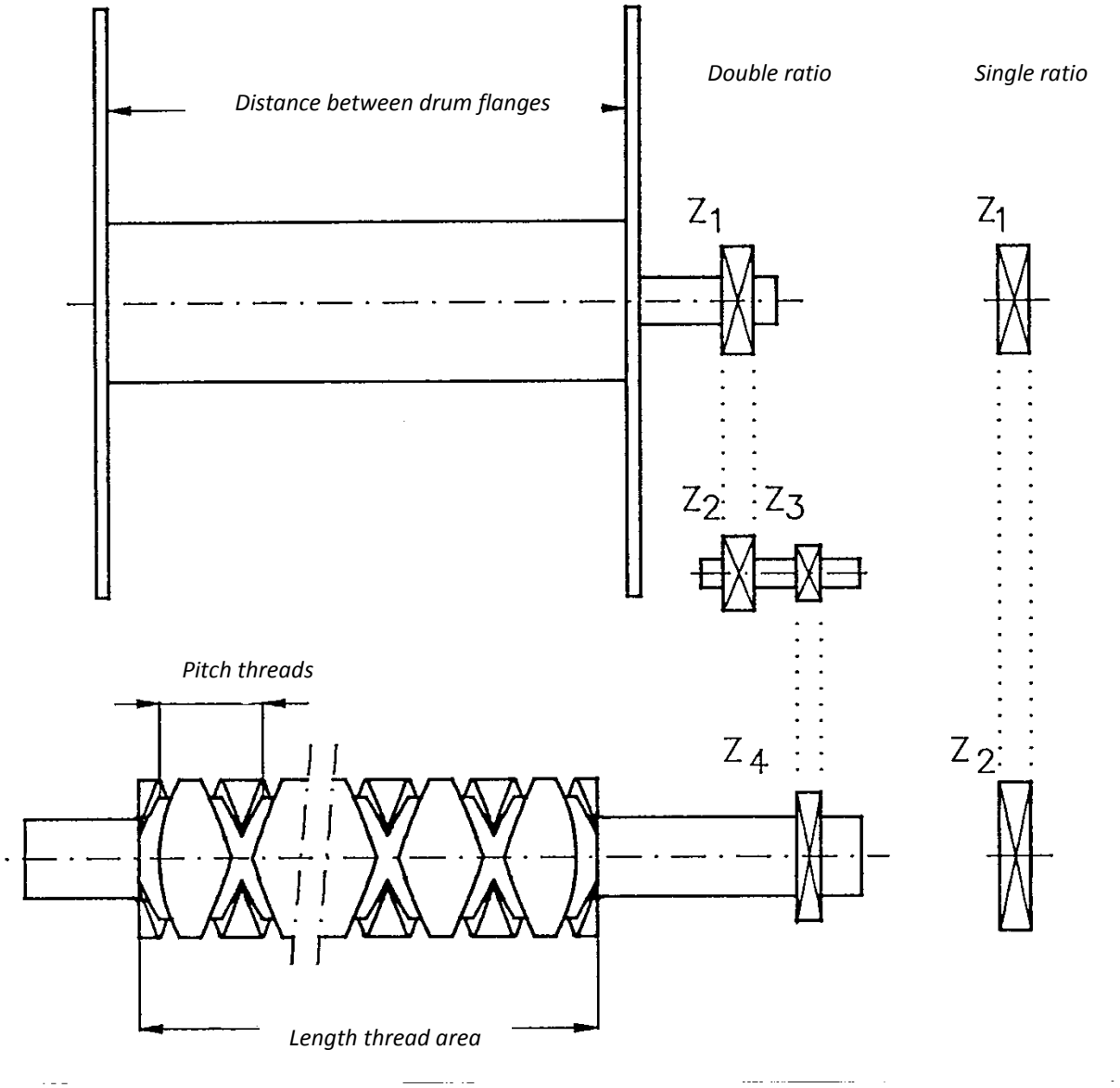

Distance between drum flanges
Double ratio
Single ratio
Z1
Z1
Z2
Z3
Pitch threads
Z4
Z2
Length thread area

Fig. 18

5. Spooling

5.1 The 1st layer

It is important to keep adequate wire tension to prevent the 1st layer from shifting and the upper layers from pulling down into the lower layers; creating nests which can destroy the wire. Preferably, a tensioning device that is self-powered should be used at the dock. This is better than dragging the chain overboard at sea, because you can make timing adjustments on the first layer without the risk of losing the wire. Another reason is that the technician and the crew can take the time to do it right - one less reason for prolonged sea trials.

In general the following tension settings apply:

Single Winches	
When spooling	***Tension***
Wire	~20% of the pull on the winch, or ~50% of the recommended work load on the cable.
Rope	~20% of the pull on the winch (*), or ~50% of the recommended work load on the cable. (*)
Cable (signal cable, umbilical etc.)	~20% of the pull on the winch, or maximum ~50% of the recommended work load on the cable.

(*) Depends on the application + Lebus pitch – rope diameter.

Traction winch system	
When spooling	***Tension***
Wire	~50% - 100% of the pull on the winch storage drum.
Rope	~50% - 100% of the pull on the winch storage drum. (*)
Cable	~50% - 100% of the pull on the winch, or maximum ~50% of the recommended work load on the cable.

(*) Depends on the application + Lebus pitch – rope diameter.

5.2 Before starting

Before starting, the winch should be run until the level wind carriage is in the middle of the diamond screw turn-around and the cable entrance in the drum is located at the top of the drum for overwound spooling, and at the bottom for underwound spooling.

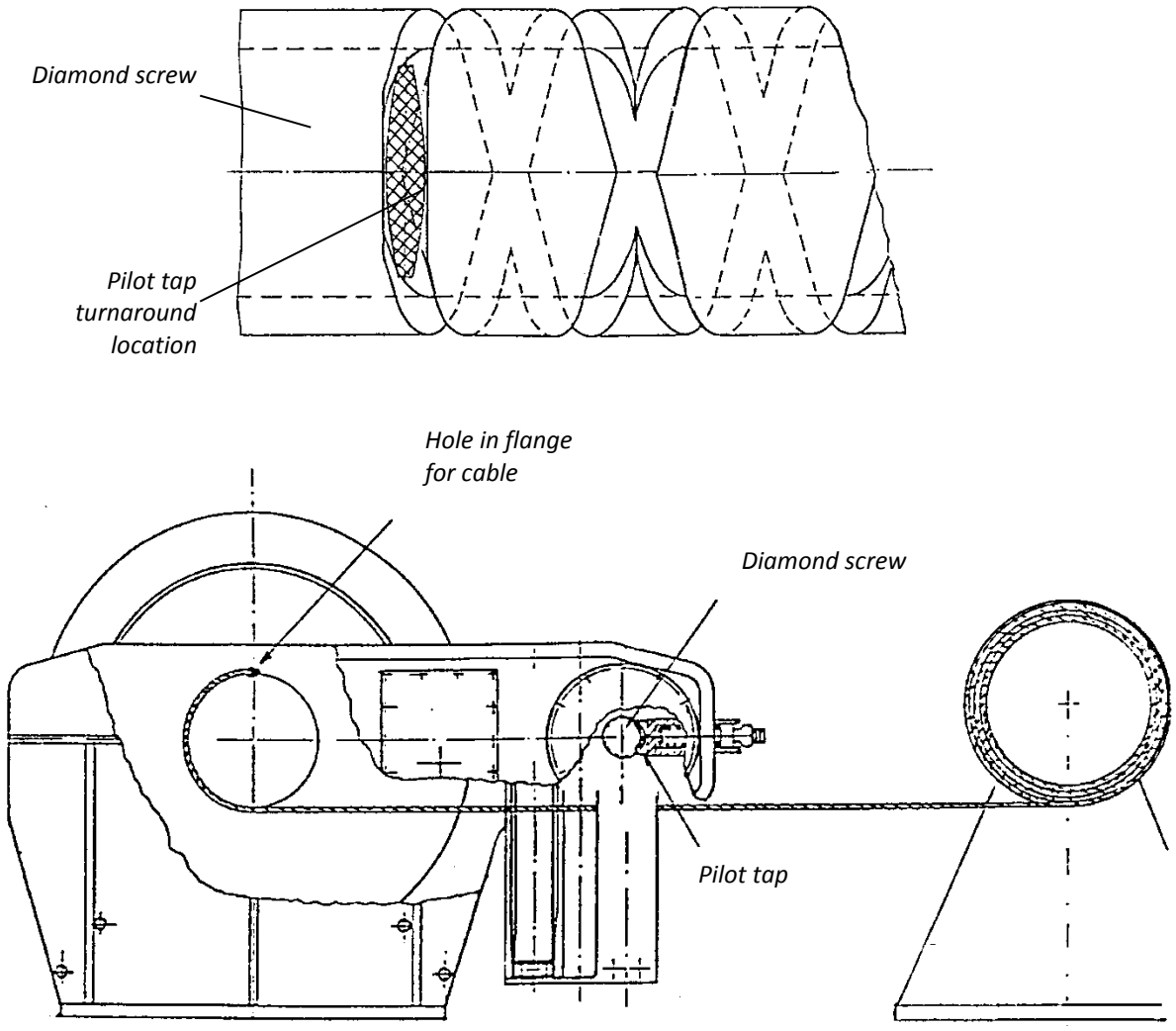


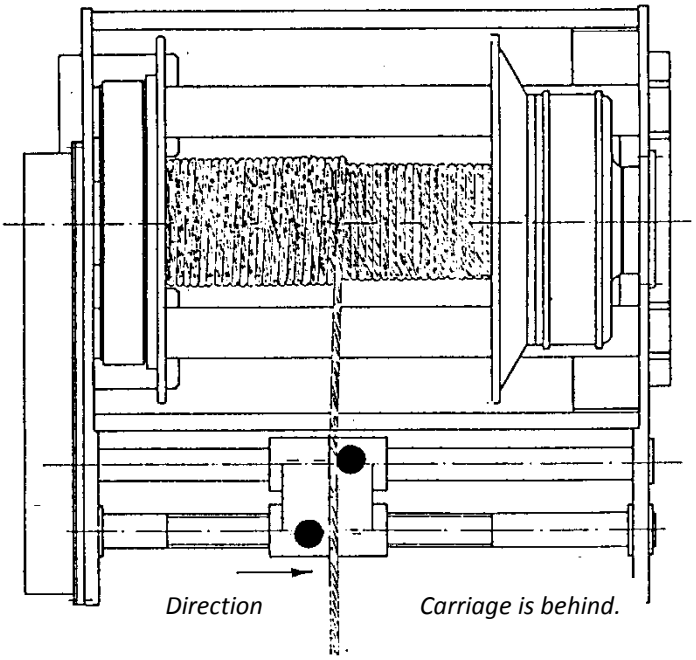
Fig. 19 Details show an underwound set up.

The wire rope may now be hauled in.
If the timing of the level wind carriage is in sync with the position of the wire on the drum after 2 to 3 layers, the spooling is deemed successful.

5.3 Correction Procedure

If the level wind carriage gets ahead of where the cable is wound on to the drum, then there are too many windings on the 1st layer. If the level wind carriage gets behind, then there are too few windings on the 1st layer.

Carriage is behind.
Too few windings on the 1st layer.



Carriage is ahead.
Too many windings on the 1st layer.

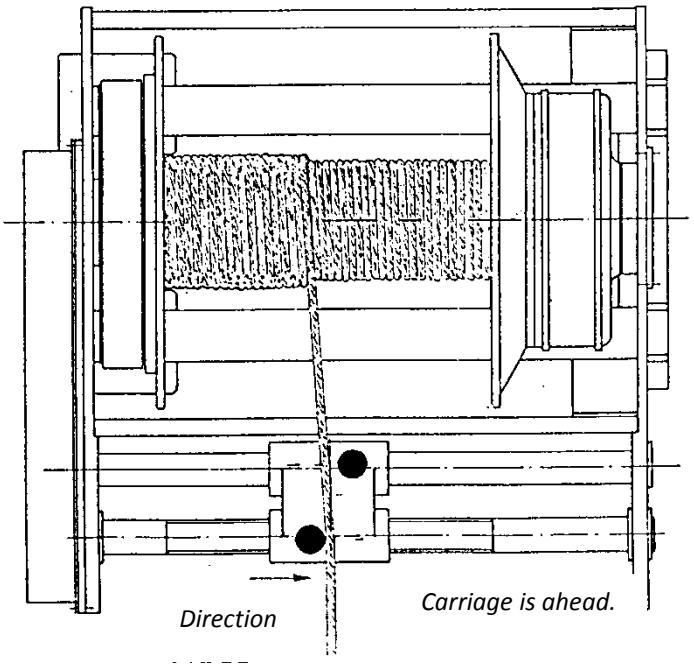


Fig. 20

The easiest way to change the number of windings on the first layer is to go back to the very beginning and change the location of the wire anchor in relation to the pilot tap and diamond screw. This requires disconnecting the level wind drive chain. If the timing is done at sea you must leave about 4 or 5 windings on the drum and make sure the wire anchor is secured. Then you can disconnect the chain and move the carriage ahead or back slightly.

Approved wire spooling: The spooling repeated twice from first layer without adjustments of the wire carriage.

5.4 Final adjustment

Minimum alignment errors can be corrected for smooth drums by retiming the level wind carriage when approximately half (½) of the fishing length remains to be spooled. This requires disconnecting the chain between the drum and the level winds respective sprockets. By doing this correction, the error is minimized by putting half of the error at each extreme of the wire length.

Title: RM Standard for Packing		Date: 12.11.2015	Doc. Id: 5867	Version: 3
Author: Stian Pedersen Lillevik	Approver: Inge H. Andersen			Page: 1 (18)
Doc. Applies to: Rapp Marine		Department: Operations		

1. Introduction

1.1. Purpose of procedure

The purpose of the RM Standard for Packing is to ensure that the goods are safely and securely packed to avoid any damage to the goods or personnel during handling and shipment.

A good standard of packing will prevent cost and schedule consequences during installation, due to substandard packing and subsequently damages to the goods.

The Standard will also help securing that the goods can leave the supplier without undue delay or deviation.

1.2. Extent / Scope

The RM Standard for Packing applies for all products, manufactured by main- or sub-suppliers, which are part of a Rapp Marine delivery.

Departments affected by this standard are:

- Production
- Project Management
- Sales and Marketing
- Purchase and Logistic

The RM standard for packing aim to ensure that packing is done in such a manner that it will maximize the safety and security of personnel during handling and lifting of the goods.

The RM standard for packing will contain the minimum requirements that is needed to maintain the integrity of the goods and avoid damages during handling, transport and storage.

The Packing shall withstand all foreseeable forces, to which the goods may be exposed, during handling, shipment and storage.

Before packing, the goods shall be preserved and protected against high and low temperatures, humidity, wind, dust, debris, sand and liquid during transport to and storage at Customer/Yard. See also Doc. No. 5866 - RM Standard for Preservation.

IMPORTANT: *Additional Customer or Project specific requirements may apply.*

The basic assumption is that the personnel assigned to do the packing are qualified to perform the stated tasks in the procedure.

1.3. Abbreviations

HSE Health Safety and Environment
IATA International Air Transport Association
IMO International Maritime Organization
IPPC International Plant Protective Convention
RM Rapp Marine
SVP Senior Vice President
SWL Safe Working Load

1.4. Reference documents

Doc. No.	Document Title
5866	RM Standard for Preservation

2. Responsibilities

*Operations (Purchase & Logistic) is responsible for the content of this standard, the maintenance and improvement of the same and the implementation in the departments to whom it applies.

It is the responsibility of the Sales and Marketing Department to make the RM standard for Packing known to the Customer and that any additional requirements are included in the contract and the technical specification.

It is the responsibility of the Purchase and Logistic Department to make the RM standard for Packing and any additional requirements known to main- and sub-suppliers and that the requirements are fully understood.

The supplier is responsible for performing preparations for shipment, the physical packing, labelling and handling of goods before shipment.

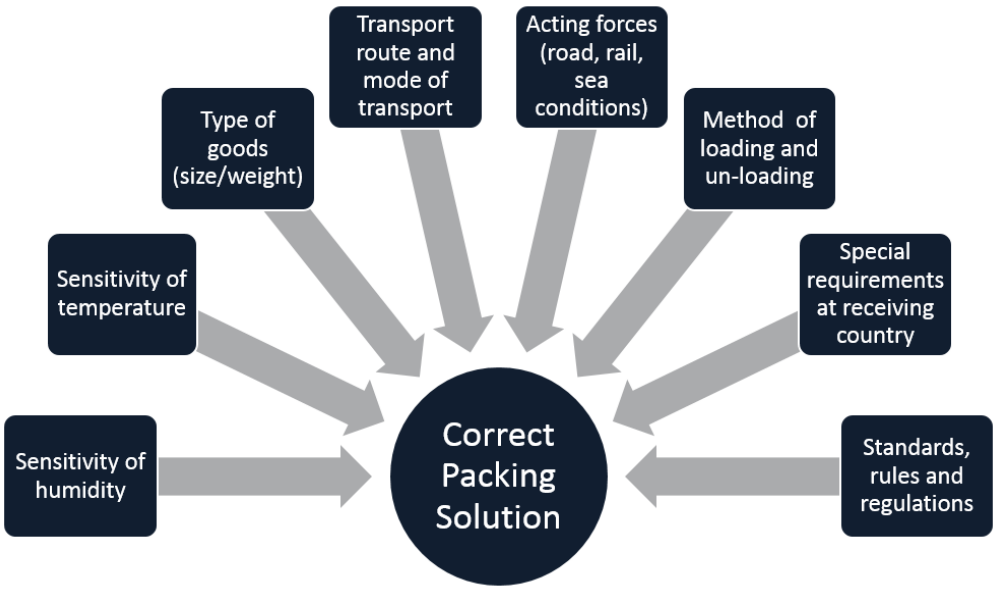
The supplier is responsibility for coordination of shipments of goods from the supplier according to the information provided on the Sales Order.

It is the responsibility of the supplier that the freight manifest and packing lists are correct. The Logistic department distributes other documentation.

Responsibility for loading, please see Section 7 – Handling and Loading, of this presentation.

It is the responsibility of all personnel, for whom this standard applies, to know, perform and act in accordance with the standard and to participate in identifying its weaknesses and proposing improvements.

3. Preparation for packing



First and foremost, transport packing must serve to maintain the integrity of the goods. Protect against damage during handling, transport, storage and maximize safe and secure handling.

The packing solution must be able to meet the national and international standards, rules and regulations for cargo shipment, as well as special requirements in the country of origin and the receiving country.

Control measurements of outer dimensions shall be taken on larger products to ensure that the goods is not “oversize” and will fit into the light-opening of any container.

To avoid oversize loads and to fit the goods into a container, it may be necessary to disassemble parts of the product, e.g. motors, sheaves etc.

The Packing shall be performed in a manner that protect against/absorb unintended shock or impact of forces, of any kind, given by the nature of the road/rail infrastructure or the sea transport conditions, such as heavy seas.

Wave forces and movement during sea transport shall be given special attention and the goods shall be secured against forces in all directions.

The packing solution shall be as individual as the product itself and perfectly match the consistency, size and dimensions of the product.

The Packing shall be robust, easy to handle and take up as little space as possible and take into account the ability to be stacked.

The packing must be versatile enough to facilitate the possibility of multiple stages in transit before the goods reaches its final destination. This includes multiple off-loading, re-loading and possibly storage of the goods

Note that sea transport packing may have to be checked and approved by authorized personnel (Marine Warranty Surveyor) before shipment.

If product requires heating during transport, the shipping documentation shall also include wiring diagram for temporary heating during transport.

*Before packing, it must be taken in considiration the customers requirements. Customer might require special type of packing such as shipping marks, additional protecion agains dust etc.

4. Packing Material / Products

In the following is described the RM Standard packing material and products that shall be used.

WOOD - used for shipping crates, foundations, skids, edge protection, fill etc.

- All wood shall be untreated – no paint, no coating, no waterproofing.
- If especially required wood shall be certified according to government agriculture rules and IPPC.
- Screws shall be used for assembly of crates, foundations, skids etc. DO NOT USE NAILS.

PLYWOOD - used for crates and boxes, covers etc. DO NOT USE CHIPWOOD.

PROFILES - Lightweight metal profiles for protection of edges and corners of crates and boxes.

METAL - may be used for bearings, brackets, foundations etc. Take measures to avoid galvanic corrosion where metal is touching metal.

PLASTIC FILM - min. 0,2mm thickness – Flameproof if required (Cover Guard).

BUBBLE PLASTIC - min. bubble diam. 10mm / bubble height 4mm.

TAPE - self-adhesive type – Make: Sure Tape.

STEEL BAND – used for strapping and securing goods.

PLASTIC WRAPPING - may be used with restrictions and shall not replace steel bands as protection for sideways movements.

FASTENERS - bolts, washers and nuts shall to be of same material grade as used on the goods being secured.

FILL MATERIAL - only use wood, corrugated cardboard, paper or bubble plastic.

IMPORTANT: *Be aware that special requirements for the recipient country may apply.*

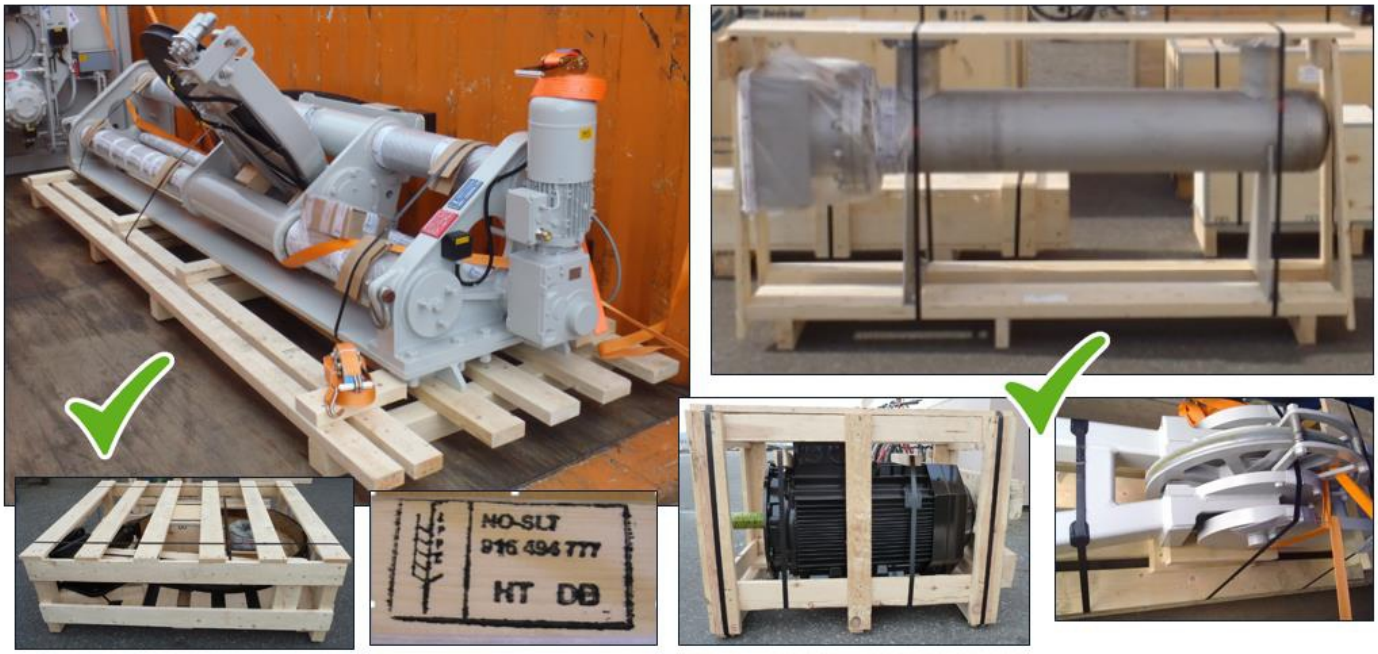
5. Packing

The packing solution shall be as individual as the product itself and perfectly match the consistency, size and dimensions of the product.

The Packing shall be robust and able to withstand impact forces during handling and shipping.

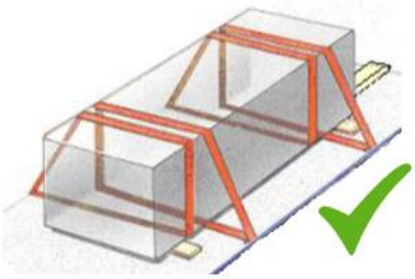
If it is possible, the packing shall take into account the ability to be stacked.

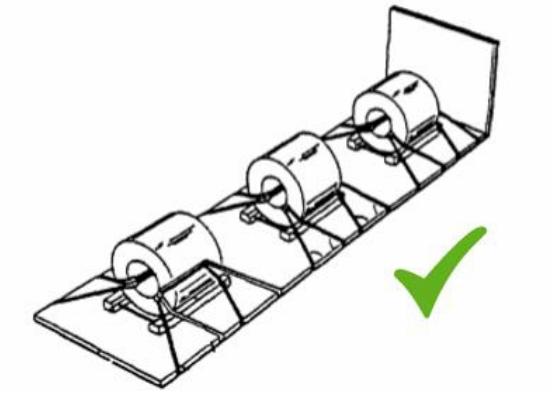
The packed goods must be easy to handle and the packing must facilitate multiple off-loading, re-loading and possibly storage of the goods.



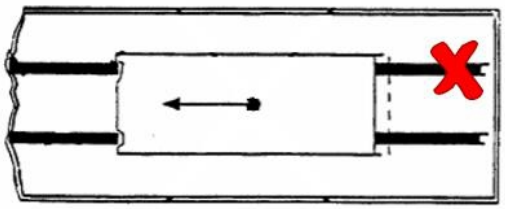
IMPORTANT: *Only screws must be used for assembly of crates, foundations, skids etc.*
DO NOT USE NAILS

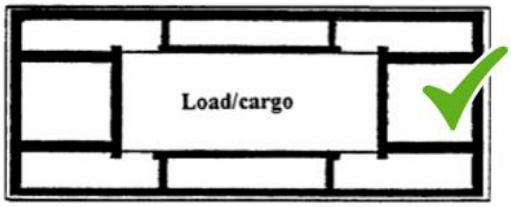
Use loop lashing to prevent sideways movement on heavy goods and secure each single item independently.



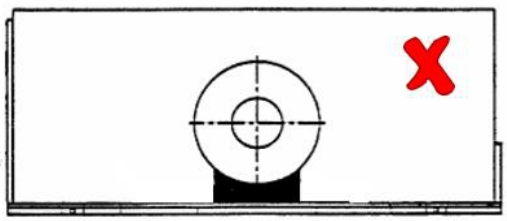


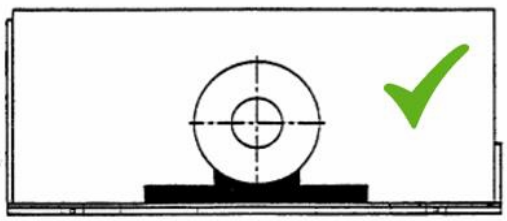
Secure load from sideways movement in crates or containers.



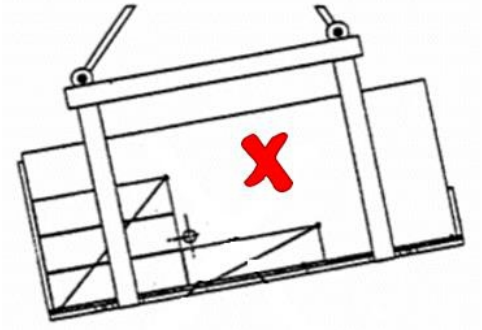


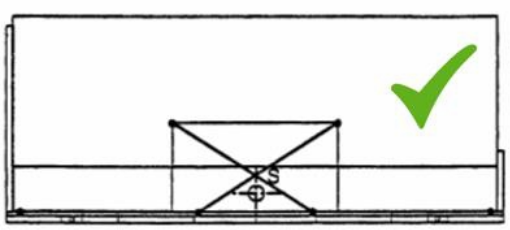
Distribute heavy loads over larger area.





If possible, centre of gravity must be in centre of foundation, crate, skid or container.





Corners and edges of freight crates built of Wood or Plywood shall be protected by lightweight metal profiles. Top cover shall be framed by lightweight metal profile.

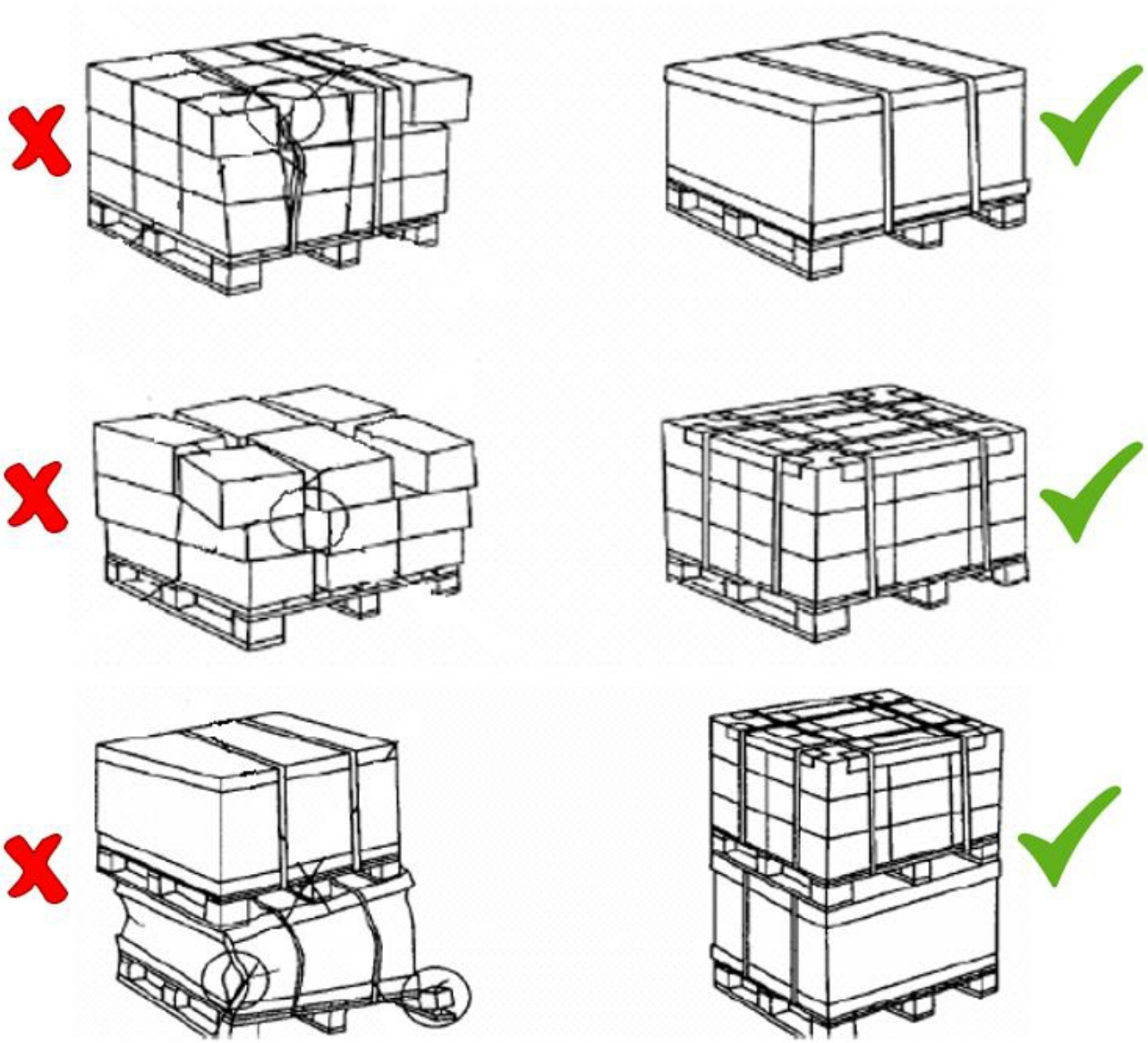
Airfreight crates shall be fitted with an easy accessible and watertight sniffer hole (dim. 15x15cm).

IMPORTANT: *DO NOT USE CHIPBOARD.*

All components packed in crates or boxes shall be secured against movement in all directions. Especially heavy components shall be secured in a safe and secure manner.

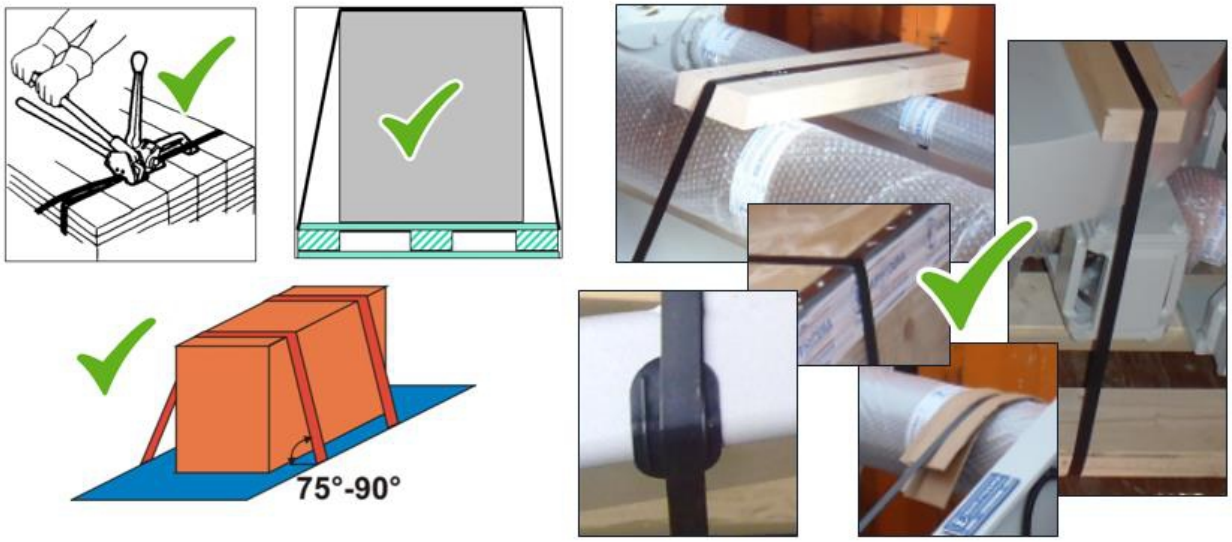
If fill material is needed, only use wood, corrugated cardboard, paper or bubble plastic.

Plastic wrapping shall only be used in combination with steel band strapping – NEVER on its own.



Steel band straps are used for securing loads onto pallets, crates, skids, foundations etc.
When used for top-over lashing, please observe that angle of band should be between 75° and 90 °
to prevent goods from shifting.

When using steel bands strapping, edges and surfaces of goods and packing crates must be protected.
Material used for protection shall be wood, metal profiles, corrugated cardboards or thick plastic profiles.



Check that lifting and latching points are clearly marked with SWL, that they are easy accessible and fit the required shackles.

6. Labelling

When packing is finished, goods shall be marked with labels for handling according to international freight standards.

All goods, each pallet, package or component shall be clearly labelled with:

- Sales order number.
- Customer reference – if required.
- Name and address of the recipient.
- Sender name and address.
- Sender contact person – in case of questions regarding the shipment.
- Gross Weight.

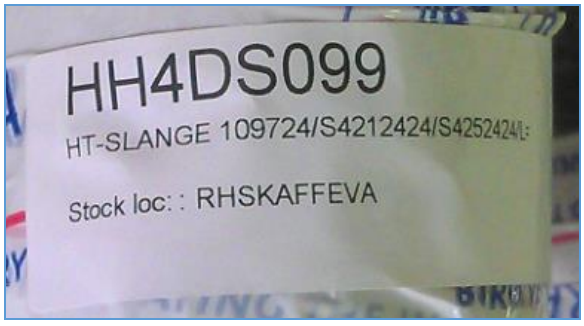
The labels shall be attached to min. two sides of the goods, pallet, package or component. Sniffer holes in airfreight crates shall be clearly marked with printed label saying “SNIFFER HOLE”.

IMPORTANT: *The labels shall be printed – NOT HANDWRITTEN.*

A printed, NOT handwritten, packing list must be attached to each goods, pallet, package or component so that it is evident:

- Who sent it.
- Who shall receive it.
- Which products are packed
- Which vessel/Installation is it intended for.
- Weight.
- Dimensions.
- Number of packages.

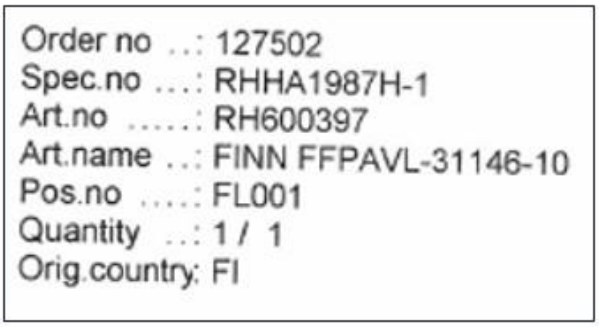
For loose items in a box/crate, each item shall be labelled with item number and item name. The labels shall be printed – NOT handwritten.

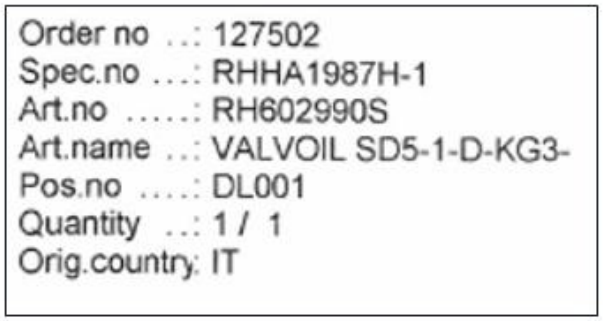


When packing hydraulic and electric parts, special labelling applies.
For easier installation at recipient, each item shall be marked with the following information:

- Order number.
- Spec. number.
- Article number.
- Article name.
- Pos. number.
- Quantity.
- Originator country.

The labels shall be printed – NOT handwritten.



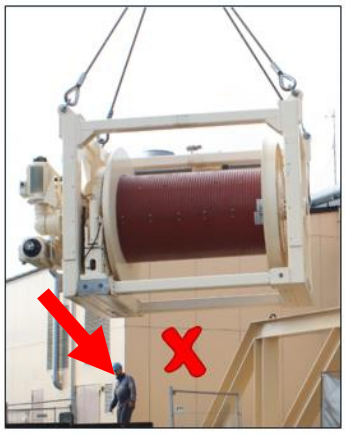


*Before labelling goods, customer requirements must be taken in consideration. Customer might need to know what type of crates; pallets or boxes are used. Shipping documents as custom invoice, packing lists, AWB should be approved by customer before shipment

7. Handling and Loading

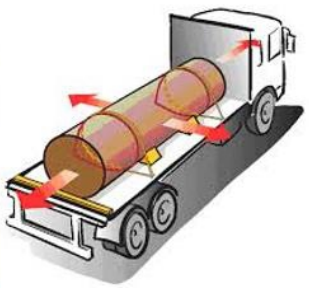
Personnel involved in handing and loading of goods shall have the necessary competence for the operation. All handling and loading shall be done in accordance with the HSE requirements. Prior to handling/loading commences the goods shall be sufficiently secured.

The secure load shall be handled in such a way that the load remains stable during the entire operation. Maximum attention shall be taken to avoid risk of damage to personnel and goods. If required area shall be cordoned off prior to the operation and loads shall NEVER be carried over personnel.



The supplier is responsible for the actual handling, lifting and loading operation.

<u>Road transport – goods directly on vehicle:</u>
When goods is loaded on the vehicle where the driver is present, it is the driver/vehicle owner's responsibility that the goods are placed correctly on the vehicle and securely fastened to avoid shifting of the load during transport.



NOTE: National and International rules and regulation for rail transport applies.

Road / Rail transport – goods in container:

The supplier is responsible for secure loading in containers and that the goods are securely fastened to avoid shifting of the load during transport.

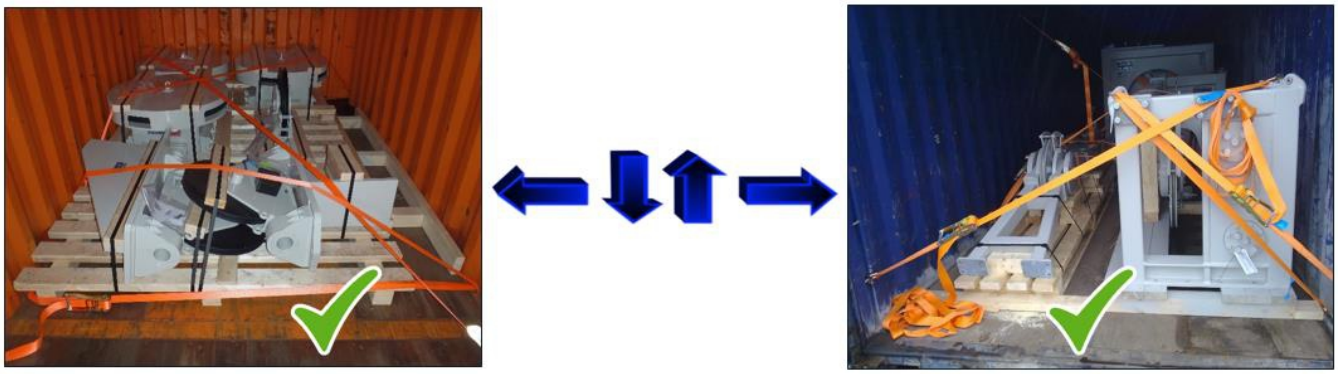
NOTE: National and International rules and regulation for road and rail transport applies.

Sea transport – goods in container:

The supplier is responsible for secure loading in containers and that the goods are securely fastened to avoid shifting of the load during transport.

Special note shall be taken to wave forces and movement during sea transport. It is enormous forces at work when the vessel moves in big waves and the goods shall be secured against more of less constant forces in all directions.

Not everybody is allowed to secure goods in overseas containers. Authorized personnel (Marine Warranty Surveyor) shall check and approve the securing of the goods before shipment.



NOTE: National and International rules and regulation for sea transport (IMO) applies.

Air transport – goods in crates and boxes:
The supplier is responsible for secure loading in crates or boxes and that the goods are securely fastened to avoid shifting of the load during transport.

Airfreight rules and regulations may require special packing of goods in a primary protection, a secondary form of packing and a ridged outer form of packing.

The primary protected goods must be packed in secondary packing in such a way that, under normal conditions of transport, packing cannot break. The secondary packing must be secured in the outer packing with suitable fill/cushioning material.

Pay special attention to weight restriction.

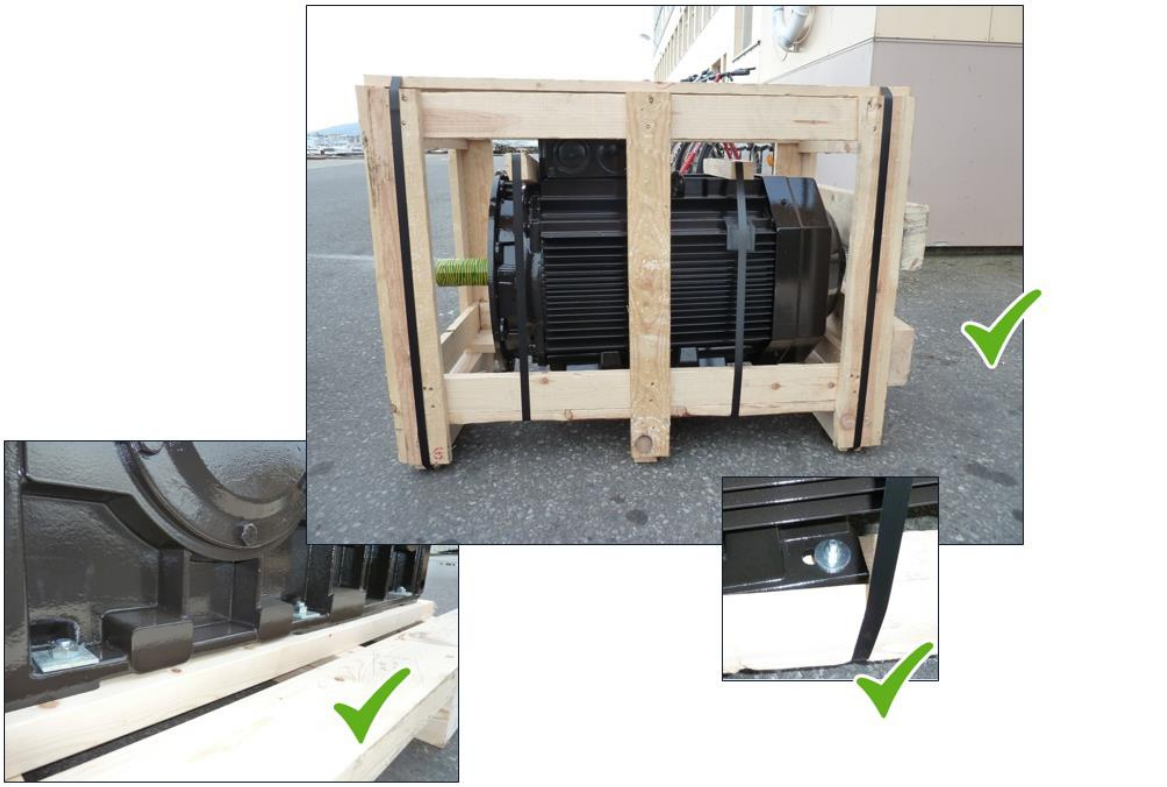
Airfreight crates shall be fitted with a clearly marked and easy accessible sniffer hole (dim. 15x15cm). Sniffer hole shall be protected against ingress of dust and liquid.

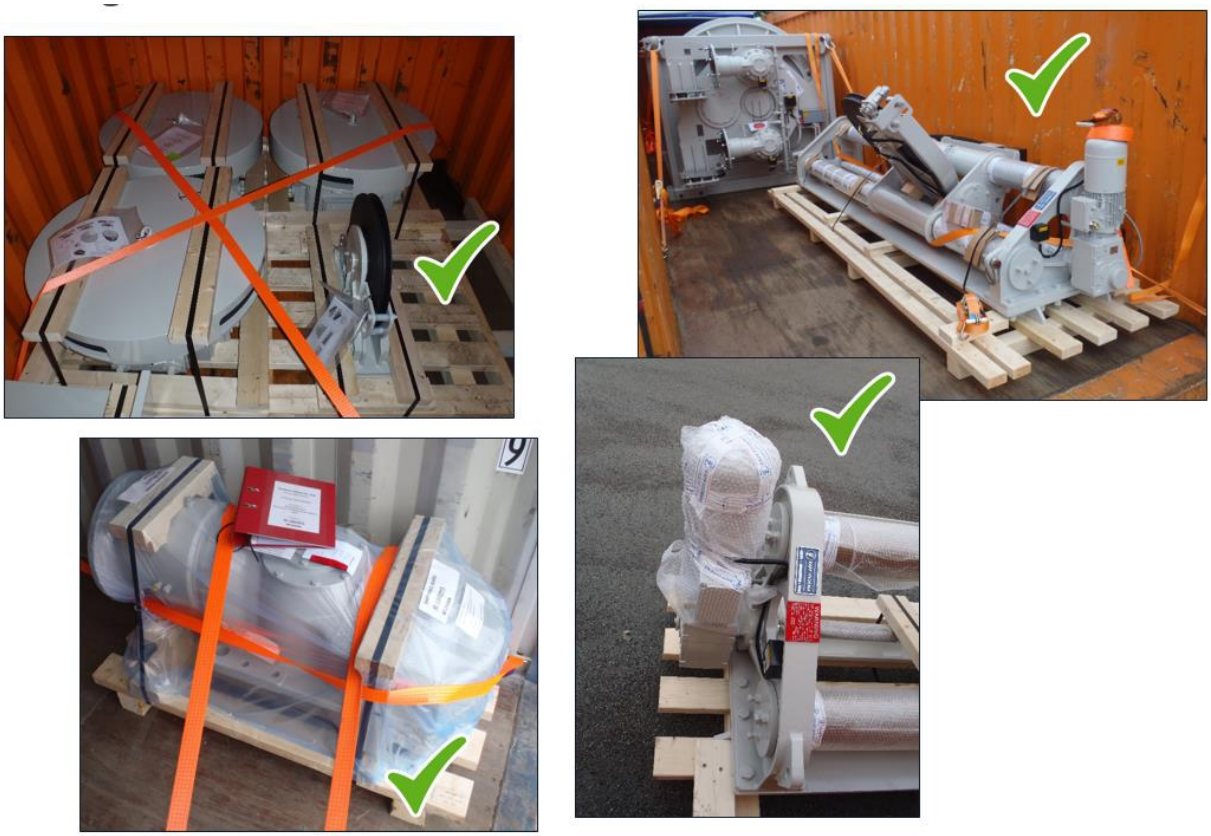
NOTE: National and International rules and regulation for air transport (IATA) applies.

8. Packing Posters

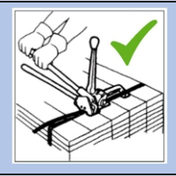
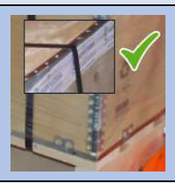
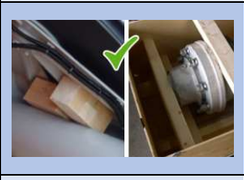
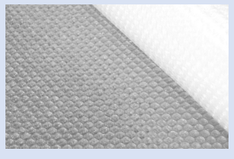
Poster showing Packing material/products		Packing Poster
Presentation of RM standard for Packing		RM Standard for Packing

9. Best Practice





RM standard packing material/products

Image	Material / Product	Info	Image	Material / Product	Info
	Wood – used for shipping crates, foundations, skids, edge protection, fill etc.	All wood shall be untreated – no paint, no coating, no waterproofing. IPPC marked if required.		**Self-adhesive tape**	Make: Suretape
	Plywood - used for crates and boxes, covers etc.	Min. thickness 6 mm DO NOT USE CHIPWOOD		**Steel Band** – used for strapping and securing goods	Approved standard tools and steel band
	Screws - used for assembly of crates, foundations, skids etc.	DO NOT USE NAILS.		**Steel Band Protection** – used to protect edges and surfaces	Wood Metal Profiles Plastic Profiles Cardboard
	**Profiles** - used for protection of edges and corners of crates and boxes.	Lightweight metal profiles		**Plastic Wrapping** - used with restrictions	Only to be used in combination with steel band strapping Min. thickness 0,02mm 100% sunlight stabilized
	Metal - used for bearings, brackets, foundations etc.	Take measures to avoid galvanic corrosion where metal is touching metal.		**Fasteners** – bolts, washers and nuts	Must to be of same material grade as used on the goods being secured
	Plastic film – used for covering of goods	Min. 0,2mm thickness 100% sunlight stabilized Flameproof is required (Cover Guard)		**FILL MATERIAL** – used to avoid movement of goods during transport	Only use wood, corrugated cardboard, paper or bubble plastic.
	**Bubble Plastic** – used for covering of goods	Min. bubble diam. 10mm Min. bubble height 4mm 100% sunlight stabilized		**Labelling**	Only use printed labels DO NOT use handwritten

Title: Packing of Cabinets		Date: 23.09.2019	Doc. Id: 6267	Version: 4
Author: Ben Bolsøy	Approver: Ben Bolsøy			Page: 1 (12)
Doc. Applies to: MacGregor Bodø		Department: Engineering & Technology		

Purpose:
To secure that the electrical cabinets are correct packed when leaving the factory in order to make sure no dust or dirt is entering the cabinets when standing on the yard before installing.

Scope:
This procedure goes for all deliveries to customers of goods mentioned in this document.

Responsibility:
The logistic manager are responsible to make sure all parties that are involved in packing of cabinets understand the procedure.

Description:

Packing philosophy

The main reason to pack the cabinets like this is to prevent damage by dust and debris that comes flying in a highly dusty environment like a Shipyard. Mostly heavy particles will settle and fall, and as long as we can minimise the risk of that happening inside the vfd`s and inside electronic components.

By minimising the area that the yard is going to open (by using small windows) we can have the plastic cover on until we need to put power on the cabinets.

We need to label the goods so that we can tell the yard where they need to open and connect, and in the same time that there is no other place they need to open. If the plastic is opened or broken when we arrive, we will void the warranty of the cabinets.

VFD Cabinets

Parts used: 300 & 200mm Sticky wrapping plastic

1. Start by packing the top side of the DC bus rails, make sure the film is covering most of the DC Bus rail and down on the side of the fuses. This is mostly to prevent dust and debris to fall and attach to the top side of the copper rails. Also, to make the cleaning easier.

2. Cover the top of the vfd. make sure the film sticks to the back wall, split it for the cables and let it go down on the front of the vfd. its easiest to use the 300mm film for this. Take some of the 200mm film and twist around the cables to make sure there is no openings so dust and debris can fall inn to the vfd. If needed tape the film to the back wall to make sure it holds its position

Make sure its sealed between the cables down to the vfd

3. Loosen the front frame from the cabinet and secure it. Disconnect all the plugs going to the vfd control card. Wrap all of the plugs (exept for the PTC / Encoder plug, Purple wires) Wrap them togheter to the frame and shave the PTC connector loose. Wrap over the realys in the top of the frame

4. Wrap the front of the vfd securing all the air holes and entries are covered. Make sure you curve in between the control cards. So, you can mount the frame back without damaging the film. Cut an opening around the encoder connection, place an small piece of film over it to cover and attach the label for “Encoder Connection”.

Now the yard can open a small piece to connect the encoder, instead of taking of all the plastic cover

5. Cover the front of the terminal row with plastic film, place the lable “Terminal Connections” on top of

it.

6. Cover the fans in the bottom of the vfd, place plastic film over it, **and remember to punch a small hole in the plastic so "moist/water" can drain out**

7. Mount the protection grill in the top. Fasten the plastic in the upper lip, outside the cabinet and cover the whole front of the protection grill and down passed the realys. The more that is sealed the less will be able to enter inside

8. Cover the back of the lamps and switches and the back of the exhaust filter

9. Cover the font of the lamp and switches, and the air vents in the front of the cabinet

Cabinets with components

1. Start by covering the components from top to bottom in the cabinet.and make sure it fits all the way to the side son no debris can enter. Cut out or cover separately where the yard needs to connect inside the cabinet. Make lables to indicate where the yard can open / remove the plastic.

2. Cover all electronics in the door, and cover fan and exhaust vents, lamps and switches

3. Other components like contactors and brake chopper need to be packed in the same way, so it can't be damaged

Cleaning and removal

1. Vacume the cabinets and use compressed air to get the dust out of the cabinet if needed
2. Use a moist cloth to clean the interior of the cabinet, start from the top so everything can fall to the bottom.
3. When removing the plastic inside the cabinet, start at the top at the DC bus rails, then take of the cover on the top of the vfd`s. make sure nothing falls inn to the vfd drives.
4. Fasten all the protection covers that has been dismantled so the cabinet is safe

Title: RM Standard for Preservation		Date: 12.11.2015	Doc. Id: 5866	Version: 4
Author: Stian Pedersen Lillevik	Approver: Inge H. Andersen			Page: 1 (14)
Doc. Applies to: Rapp Marine		Department: Operations		

1. Introduction

1.1. Purpose of procedure

The purpose of this procedure is to set the standard for preservation for Rapp Marine (RM).

It shall identify the necessary activities involved in preserving the deliveries from main- and sub-supplier, so that the product will maintain the quality and functionality from delivery until Harbour Acceptance Test (HAT) has commenced.

We preserve the products to avoid any damages, due to high and low temperatures, humidity, wind, dust, sand and liquid, during storage at manufacturer, transport to Yard/Customer and storage/installation at Yard/Customer.

We also preserve the products to avoid cost and schedule consequences due to substandard preservation and subsequently damages to the product.

1.2. Extent / Scope

The RM Standard for Preservation applies for all products, manufactured by main- or sub-suppliers, which are part of a Rapp Marine delivery.

Departments affected by this standard are:

- Production
- Project Management
- Sales and Marketing
- Purchase and Logistic
- Engineering & Technology

Initial preservation is based on 6 months of storage AFTER delivery from supplier.

IMPORTANT: Additional Customer or Project specific requirements may apply.

The product shall be protected against high and low temperatures, humidity, wind and in gress of dust, debris, sand and liquid during transport to and storage/installation at fabrication yard or Customer.

The product shall also be protected against sandblasting, spatter from welding, grinding, painting and other forces during storage and installation at fabrication yard or Customer before HAT.

HSE considerations shall be taken into account in the choice of preservation material.

The basic assumption is that the personnel assigned to do the preservation are qualified to perform the stated tasks in the procedure.

1.3. *Abbreviations

HAT Harbour Acceptance Test
HPU Hydraulic Pump Unit
HSE Health Safety Environment
RM Rapp Marine
SVP Senior Vice President
VCI Vapour Corrosion Inhibitor

1.4. *Reference documents

Doc. No.	Document Title
6104	Checklist for preservation - Mechanical
6100	Checklist for preservation - Hydraulic
6095	Checklist for preservation - Electrical
5867	RM Standard for Packing

2. Responsibilities

*Operations (Purchase & Logistic) is responsible for the content of this standard, the maintenance and improvement of the same and the implementation in the departments to whom it applies.

It is the responsibility of the Sales and Marketing Department to make the RM standard for Preservation known to the Customer and that any additional requirements are included in the contract and the technical specification.

It is the responsibility of the Purchase and Logistic Department to make the RM standard for Preservation and any additional requirements known to main- and sub-suppliers and that the requirements are fully understood.

The Manufacturer/Supplier is responsible for the maintenance preservation at their facilities before delivery and for the initial preservation to RM standard upon delivery.

The installation Yard or Customer is responsible for maintaining the initial preservation from Manufacturer/ Supplier. Preservation maintenance at Customer/Yard shall be part of the basis for the warranty period.

It is the responsibility of all personnel, for whom this standard applies, to know, perf orm and act in accordance with the standard and to participate in identifying its weaknesses and proposing improvements.

3. Documentation requirements

The Preservation at the manufacturer/supplier shall be documented by means of checklists and by photos.

It is the responsibility of the personnel responsible for the preservation to fill out and sign the preservation checklists mentioned in sub-section 1.4 of this standard.

Photos shall document all preservation.

When the checklists have been filled out and signed, they shall be included in the MC Dossier together with the photos, so they are available for the Finished Control Team.

The Supplier shall issue an instruction to the installation Yard or Customer on how to maintain the initial preservation during storage and installation. As a minimum, it shall contain the following:

- Instruction on how to carry out preservation maintenance.
- List of what preservation material/products to use.
- Toxicological data sheets for preservation material/products.
- Requirements to storage conditions – indoor/outdoor etc.
- Requirement to temporary heating during storage – if required.
- De-preservation instructions.
- Safe disposal of used preservation material.

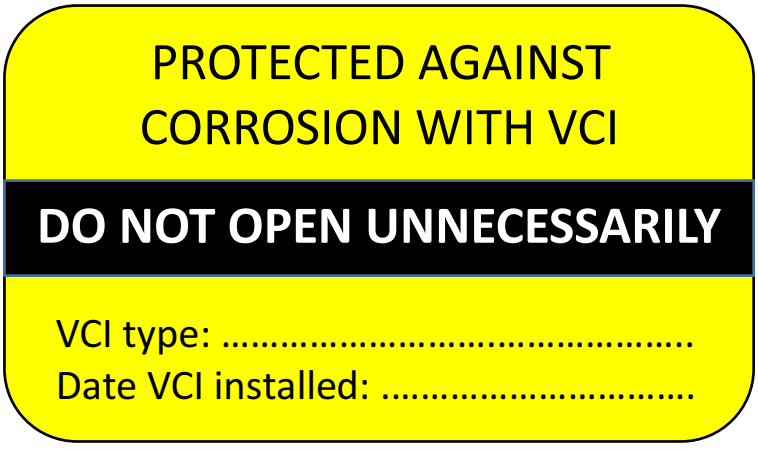
Instruction shall also include other warranty requirements.

4. Preservation Products

Listed in below table is the RM standard preservation materials/products.
Use of equivalent material/products are allowed as long as the standard of quality remain the same.

Preservation Material / Product	Make / Type
Teflon based oil	Interflon fin lube TF
Teflon based coating	Interflon fin film WB
Tectyl	Tectyl Multi Purpose 506
Grease	Acid-free sticky type for industrial use
Vaseline	Resin and acid-free type for industrial use
Sewn Geotextile	Polyfelt min. Class 2 - 100% sunlight stabilized polypropylene fibre
Plastic film	Min. 0,2mm - 100% sunlight stabilized - Flameproof is required (Cover Guard)
Bubble Plastic	Min. bubble diam. 10mm / bubble height 4mm - 100% sunlight stabilized
Wrapping Plastic	Min. thickness 0,02mm - 100% sunlight stabilized
Aluminium sheeted glass fibre cloth	WG200-1AF - 100% sunlight stabilized
Self-adhesive tape	Suretape (PC622).
Plywood	Min. thickness 6 mm
Vapour Corrosion inhibitor (VCI)	Zerust, Cortec or Silica Gel
VCI Label	Size: 10 x 6 cm / Colour: Yellow, black stripe, see example below
Denso Tape	Denso Tape

In all instances where VCI is used, it shall be indicated with visibly printed label on the outside, with VCI type used and date. See example below:



5. Preservation of Winches, Reels and Storage Drums

In the following, all winch, reel, storage drum and sheave products will only be referred to as product.

In the table is listed the preservation activities for the winch components and the corresponding preservation aid.

Preservation activities varies, as the components varies, for the different type of winches. Preserve the relevant component for the winch in question.

IMPORTANT: *Verify whether additional Customer or Project specific requirements applies before preservation commences.*

Note: *The table may continue on the next page*

Product Component	Preservation activity to be carried out	Preservation Aid
Gearbox	- Drain gearbox for oil. - Install drain plug. - Plug Filling with breather cap. - Flush gearbox with oil before shipment (only if winch is stored before delivery).	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring. - Breather Cap. - Flushing oil type according to lubrication chart.
Chain-box	- Grease chain-box inside - Cover all surfaces of chains, sprockets and diamond screw bearing with grease.	- Acid-free sticky grease.
Hydraulic Motor on winch (all)	- Drain hyd. motors for oil. - Install drain plug. - Flush hyd. motors with oil before shipment (only if winch is stored before delivery).	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring. - Flushing oil type according to lubrication chart.
Dismantled Hydraulic Motor (all)	- Drain hyd. motors for oil. - Install drain plug. - Flush hyd. motors with oil before shipment (only if motor is stored before delivery). - Grease motor shaft, wrap it in bubble plastic and tape. - Spray flange face with Teflon based coating. - Wrap the whole motor in bubble plastic and tape.	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring. - Flushing oil type according to lubrication chart. - Acid-free sticky grease. - Interflon Film WB. - Bubble plastic. - Self-adhesive tape.
Flange connection on winch for dismantled hydraulic motor	- Cover flange face with gasket and plywood cover. - Fasten Plywood cover with min 4 bolts and tape all way round.	- Gasket. - Plywood cover, 6mm thickness. - Bolts and nuts - Self-adhesive tape.
Hydraulic Valve-box (all)	- Drain hyd. valve boxes for oil. - Spray inside of valve boxes with Teflon based oil.	- Interflon Fin Lube TF

Hydraulic Ports (all)	- Plug all ports with steel flanges / plugs.	- Steel Blind flange and gasket. - Standard steel plugs of same material grade as port.
*Diamond Screw	- Grease diamond screw. - Cover all surface with Denso tape. - Spray ends and top with Teflon based coating if these parts cannot be covered with Denso tape.	- Acid-free sticky grease. - Denso tape - Teflon based spray
*Guide Shaft	- Grease Guide shaft. - Cover all surface with Denso tape. - Spray ends and top with Teflon based coating if these parts cannot be covered with Denso tape.	- Acid-free sticky grease. - Denso tape - Teflon based spray
Drum (with wire)	- Cover drum fully with Geo-textile. - Cover Geo-textile fully with Plastic film and tape. - Make cover dust and liquid proof.	- Geo-textile, min. class 2. - Plastic film - min. 0,2mm - Self-adhesive tape.
Brake Cylinder	- Drain brake cylinder for oil. - Drain plug installed on In/outlet. - Flush brake cylinder with oil before shipment (only if winch is stored before delivery).	- Remaining oil film will act as preservation. - Steel plug with seal ring. - Flushing oil type according to lubrication chart.
Brake Cylinder Rod	- Grease brake cylinder rod. - Wrap rod in bubble plastic and tape.	- Acid-free sticky grease. - Bubble plastic. - Self-adhesive tape.
Brake Cylinder Seals	- Grease or spray seals with Teflon based coating. - Wrap in plastic and tape.	- Acid-free sticky grease or Interflon Film WB. - Wrapping plastic. - Self-adhesive tape.
Shaft Seals	- Grease or spray seals with Teflon based coating. - Wrap in plastic and tape.	- Acid-free sticky grease or Interflon Film WB. - Wrapping plastic. - Self-adhesive tape.
Sheaves	- Spray with Teflon based coating.	- Interflon Film WB.
All other machined surfaces	- Spray with Teflon based coating.	- Interflon Film WB.
Oil tank (self-contained units)	- Drain tank for oil. - Close all openings with flanges/plugs. - Breather cap wrapped in plastic, taped and strapped onto unit or packed separately. - Grease all adjustment screws. - Wrap all adjustment screws in plastic and tape.	- Remaining oil film will act as preservation. - Steel Blind flange and gasket. - Steel Drain plug with seal ring. - Breather cap. - Acid-free sticky grease. - Wrapping plastic. - Self-adhesive tape. - Plastic strips
Instruments (glass fronted)	- Cover instrument glass with plywood and tape.	- Plywood, 6 mm thickness. - Self-adhesive.
All grease nipples	- Cover with grease nipple cap.	- Plastic cap.
*Open Shaft	- Cover surface with Denso tape.	- Denso tape

6. Preservation of Hydraulic Pump Unit (HPU)

In the table is listed the preservation activities for the HPU components and the corresponding preservation aid.
Preservation activities varies, as the components varies, for the different type of HPU's.
Preserve the relevant component for the HPU in question.

For purchased goods, observe Supplier's requirements when using VCI.

In all instances where VCI is used, it shall be indicated with visibly printed label on the outside, with VCI type used and date.

IMPORTANT: *Verify whether additional Customer or Project specific requirements applies before preservation commences.*

HPU Component	Preservation activity to be carried out	Preservation Aid
Oil Tank	- Drain tank for oil. - Install drain plug.	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring
Flange connections (all)	- Close openings with flanges.	- Steel Blind flange and gasket.
Screw connections (all)	- Close openings with plugs.	- Standard steel plugs of same material grade as port.
Adjustment Screws	- Grease all adjustment screws. - Wrap in plastic and tape.	- Acid-free sticky grease. - Wrapping plastic. - Self-adhesive tape.
Breather Cap (filling)	- Pack breather cap separately in bubble plastic and tape. - Cap strapped to the unit or packed separately.	- Bubble plastic. - Self-adhesive tape. - Plastic strips.
Hydraulic Hoses	- Pack hoses separately in bubble plastic and tape. - Hoses strapped to the unit or packed separately.	- Bubble plastic. - Self-adhesive tape. - Plastic strips.
Electric Motors	- Pack motors separately in bubble plastic. - Place VCI on the inside of bubble plastic, tape and make wrapping dust and liquid proof. - Place VCI label on outside of wrapping.	- Bubble plastic. - VCI - Self-adhesive tape. - VCI label.
Hydraulic Coolers	- Pack coolers separately in bubble plastic, taped and make wrapping dust and liquid proof.	- Bubble plastic. - Self-adhesive tape.
Instruments (glass fronted)	- Cover instrument glass with plywood and tape.	- Plywood, 6 mm thickness. - Self-adhesive tape.

7. Preservation of Electrical components

In the table is listed the preservation activities for electrical components and the corresponding preservation aid.
Preservation activities varies, as the products varies. Perform the relevant preservation activities for the component in question.

For purchased goods, observe Supplier's requirements when using VCI.

In all instances where VCI is used, it shall be indicated with visibly printed label on the outside, with VCI type used and date.

IMPORTANT: *Verify whether additional Customer of Project specific requirements applies before preservation commences.*

Note: *The table may continue on the next page*

Electrical Component	Preservation activity to be carried out	Preservation Aid
Junction and Termination Boxes (loose boxes)	- Seal cable entry holes temporarily with threaded plastic or metal blind plug. - Place VCI inside. - Coat gasket with Vaseline. - Close junction box and make it dust and liquid proof. - Wrap box in plastic and tape. - Place VCI label on outside of plastic wrapping.	- Threaded plastic blind plug or metal plug of the same material as the component. - VCI - Resin and acid-free Vaseline. - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - VCI label.
Junction and Termination Boxes (part of assembled product)	- Place VCI inside. - Coat gasket with Vaseline. - Close junction box and make it dust and liquid proof. - Place VCI label on outside of box.	- VCI - Resin and acid-free Vaseline. - VCI label.
Transmitters	- Place VCI inside. - Coat gasket with Vaseline. - Close transmitter and make it dust and liquid proof. - Place VCI label on outside of wrapping.	- VCI - Resin and acid-free Vaseline. - VCI label.
Sensitive components inside panels and cabinets	- Wrap items independently in bubble plastic. - Place VCI inside wrapping and tape. - Place VCI label on outside of plastic wrapping.	- Bubble plastic. - VCI - Self-adhesive tape. - VCI label.
VFD (when shipped loose)	- Wrap VFD in bubble plastic. - Place VCI inside bubble plastic. - Wrap in plastic and tape. - Make wrapping dust and liquid proof. - Place VCI label on outside of plastic wrapping.	- Bubble plastic. - VCI - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - VCI label.

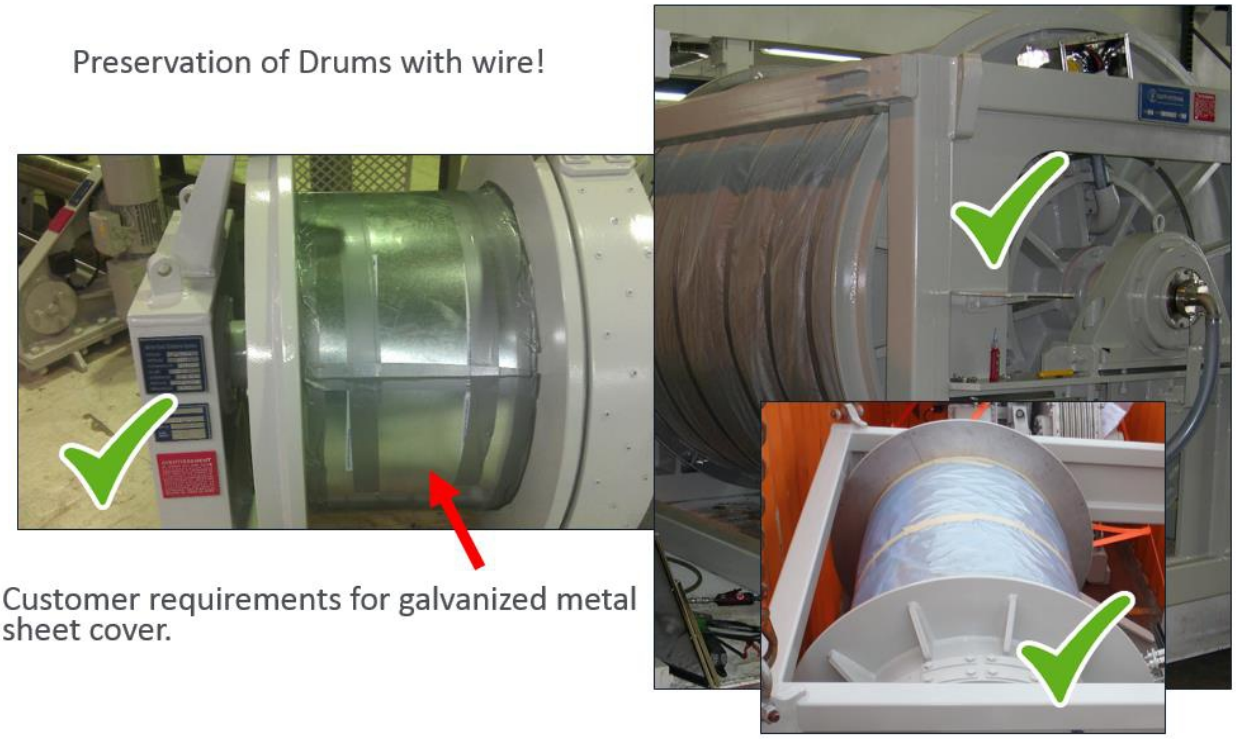
Panels and Cabinets	- Seal cable entry holes temporarily with threaded plastic or metal blind plug. - When necessary install drain plug. - Leave drain plug open. - Place VCI inside. - Coat gasket with Vaseline. - Close cabinet and make it dust and liquid proof. - Wrap cabinet in plastic and tape. - Place VCI label on outside of plastic wrapping. - Cover cabinet with customized hood. - Place VCI label on outside of hood.	- Threaded plastic blind plug or metal plug of the same material as the component. - Plastic drain plug or metal plug of the same material as the component. - VCI - Resin and acid-free Vaseline. - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - VCI label. - Customized Hood made of aluminium sheeted glass fibre cloth.

8. Preservation Posters

Poster showing Preservation material/products		Preservation Poster 1
Poster showing Preservation standard/methodes for Winches, Reels and Storage Drums		Preservation Poster 2
Poster showing Preservation standard/methodes for Hydraulic Pump Unit and Electrical Components		
Presentation of RM standard for Preservation		RM Standard for Preservation

9. Best Practice

Preservation of Drums with wire!



Customer requirements for galvanized metal sheet cover.

Preservation of Seals!

Open shaft

Greased Chain box!

Sealing of connection ports!
Steel plugs and steel flanges.

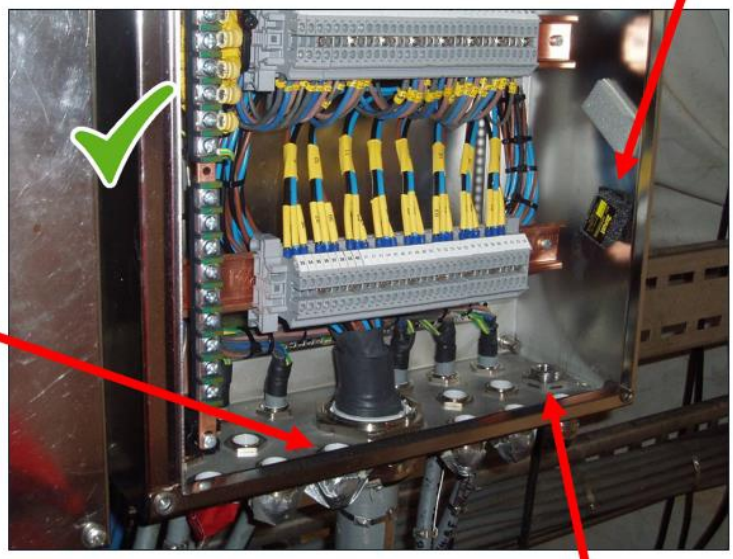
Typical Steel Drain plug!

Typical Grease nipple cover cap!

Preservation of Diamond Screw and Shafts!

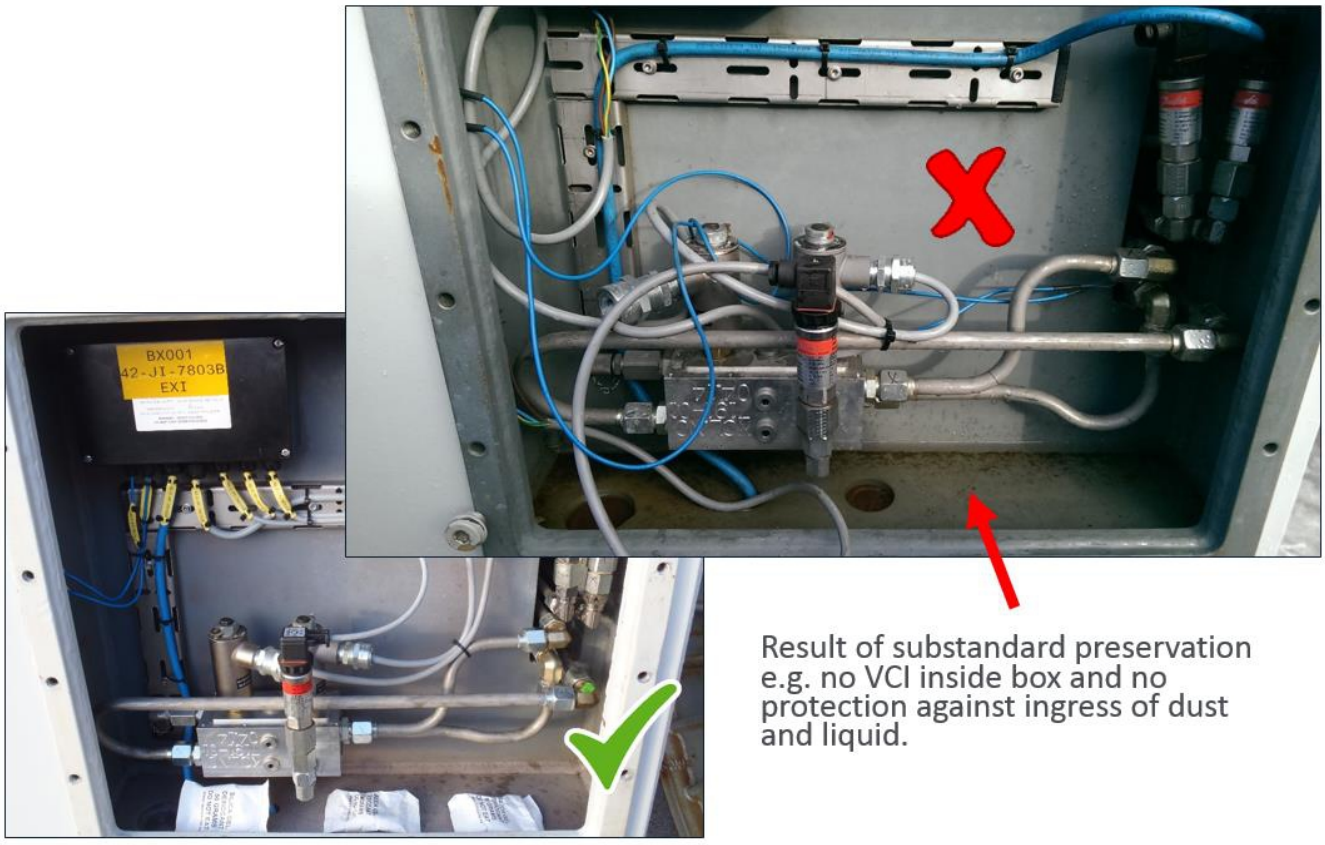
VCI placed inside.

All cable entry holes shall be sealed temporarily with a threaded plastic or metal blind plug.



IMPORTANT: the metal plug shall be of the same material as the component being plugged.

Drain plug shall be installed and left "open".



Result of substandard preservation e.g. no VCI inside box and no protection against ingress of dust and liquid.

Potential damage to inside of cabinet due to ingress of dust and liquid due to substandard or missing preservation (open door).

Damage to outside of cabinet due to substandard or missing preservation.

Title: Preservation manual		Date: 26.01.2018	Doc. Id: 6243	Version: 6
Author: Stian Pedersen Lillevik	Approver: Stian Pedersen Lillevik			Page: 1 (3)
Doc. Applies to: Rapp Marine		Department: RH		

Purpose:
How to maintain and preserve goods manufactured and delivered by Rapp Marine AS

Scope:
This procedure goes for all deliveries to customer of goods mentioned in this document.

Responsibility:
The logistics team leader are responisble to inform personell that can be affected by this procedure.

How to maintain and preserve goods manufactured and delivered by Rapp Marine AS

The purpose of this instruction, is to describe how to perform an inspection on arrival and further to store and preserve goods manufactured and delivered by Rapp Marine AS

How to check and inspect a delivery.

If possible, the inspection shall be supervised by Rapp personnel or personnel appointed by Rapp Marine AS.
Check in following order;

- **all goods are delivered according to packing list.**
- **all goods are delivered without any visible damage.**
- **all goods are delivered according to pictures from sender.**
- **all goods are packed and preserved according to Rapp standard (appendix 1).**
- **If damages, immediately contact your Rapp Marine contact for further action.**

If it`s necessary to open or remove the preservation (plastic, grease, boxes etc.) make sure that goods are re-preserved in the same or better manner than before. This must be done before goods are delivered to warehouse/storage location.

How to store and preserve winches and parts for winches.

- **All goods should be stored in a dry and protective warehouse.**
- Main gearboxes (WDU) are drained for oil. If stored longer than 3 months, the gear must be filled with preservation oil.
- *The planetary/angular – Brevini gears are drained for oil. If the gears are to be stored longer than 2 months, they must be filled with preservation oil.*
- *Do not take the protective covers (zinc or plastic) of the spooled drum. If there are any suspicions that cable/wire are damaged, the protection can be removed and inspected. After inspection, the protection must be put back in the same condition as before removal.*
- *Electric motors/gears that are not assembled on the winch are more exposed for damage and must be stored indoors in a dry and dust free environment. Check that all machined parts are well covered with grease and plastic wrapping.*
- *The shaft seals, brake cylinder seals, the break cylinder rods to be crosschecked that they are covered with oil/grease and wrapped in plastic/densotape.*
- *The level wind shafts to be crosschecked that they are well covered with grease and wrapped in plastic. Ensure that the level wind drive motor are wrapped in plastic to avoid dust and rain.*
- *The deck sheaves must be checked that they are well greased and protected with plastic cover before storing them in the warehouse.*
- *HPU`s are usually boxed. Remove lid if so and inspect for damages. HPU itself must be protected from dust, moist and rain. If possible HPU`s must be stored inside. The HPU oil reservoir are drained for oil.*
- Spare parts can contain all different kind of goods like drives, motors, gears etc general, the spare parts must be stored in a dry and dust free place with between +10 to 40 C and a relative humidity of 95% max.

How to store and preserve Variable frequency drives (VFD), panels and electrical components.

- *Motor drive units are disassembled from the cabinet before shipping to avoid any contamination during shipment and at the shipyard. All the motor drivers need to be stored in a dry warehouse completely protected against dust and moist.*
- *Temperature for storing goods under this section, are between +10 to 40 C and a relative humidity of 95% max.*
- *If there are any danger that the goods are going to be exposed for high humidity, rain, dust ore other type of contamination, goods must be covered in form of tarp or thick plastic on all sides including the bottom. This plastic cover will protect the goods for a period.*
  Note; the plastic cover can collect moist over time, and must be checked and vented for moist/water from time to time.
- *All the electrical local panels, radio controls, and HMI (touchscreens) that are not installed, should be stored in a dry, dust-free place to avoid contamination. If they need to be installed, cover them with a protective plastic cover after installation to avoid contamination and ensure that they are "visible" so they are not destroyed. If possible, tag/label the panels with signs like "Warning, Caution, Fragile" etc.*
- *Goods under this section must not be exposed for shock that are over 100m/s^2 (330 ft. s^2), 11m/s.*

Disposal of goods if necessary.

The goods contain raw materials that should be recycled to preserve energy and natural resources. The package materials are environmentally compatible and recyclable.
All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. Most recyclable parts are marked with recycling marks.
If recycling is not feasible, all parts excluding electrolytic DC capacitors (C1-1 to C1-x) and printed circuit boards can be land filled. They are classified as hazardous waste within the EU. They must be removed and handled according to local regulations.
For further information on environmental aspects and more detailed recycling instructions, please contact your local authorities.

*Appendix

1) Rapp Marine standard packing and preserving of goods doc no 5952, 5953 and 5954

Preservation of Winches, Reels and Storage Drums

Product Component	Preservation activity to be carried out	Preservation Aid
Gearbox	- Drain gearbox for oil. - Install drain plug. - Plug Filling with breather cap. - Flush gearbox with oil before shipment (only if winch is stored before delivery).	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring. - Breather Cap. - Flushing oil type according to lubrication chart.
Chain-box	- Grease chain-box inside - Cover all surfaces of chains, sprockets and diamond screw bearing with grease.	- Acid-free sticky grease.
Hydraulic Motor on winch (all)	- Drain hyd. motors for oil. - Install drain plug. - Flush hyd. motors with oil before shipment (only if winch is stored before delivery).	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring. - Flushing oil type according to lubrication chart.
Disassembled Hydraulic Motor (all)	- Drain hyd. motors for oil. - Install drain plug. - Flush hyd. motors with oil before shipment (only if motor is stored before delivery). - Grease motor shaft, wrap it in bubble plastic and tape. - Spray flange face with Teflon based coating. - Wrap the whole motor in bubble plastic and tape.	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring. - Flushing oil type according to lubrication chart. - Acid-free sticky grease. - Interflon Film WB. - Bubble plastic. - Self-adhesive tape.
Flange connection on winch for disassembled hydraulic motor	- Cover flange face with gasket and plywood cover. - Fasten Plywood cover with min 4 bolts and tape all way round.	- Gasket. - Plywood cover, 6mm thickness. - Bolts and nuts - Self-adhesive tape.
Hydraulic Valve-box (all)	- Drain hyd. valve boxes for oil. - Spray inside of valve boxes with Teflon based oil.	- Interflon Fin Lube TF
Hydraulic Ports (all)	- Plug all ports with steel flanges / plugs.	- Steel Blind flange and gasket. - Standard steel plugs of same material grade as port.
Diamond Screw	- Grease diamond screw. - Wrap in plastic and tape. - Make cover dust and liquid proof. - Spray ends and top with Teflon based coating.	- Acid-free sticky grease. - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - Interflon Film WB.
Guide Shaft	- Grease Guide shaft. - Wrap in plastic and tape. - Make cover dust and liquid proof. - Spray ends and top with Teflon based coating.	- Acid-free sticky grease. - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - Interflon Film WB.
Drum (with wire)	- Cover drum fully with Geo-textile. - Cover Geo-textile fully with Plastic film and tape. - Make cover dust and liquid proof.	- Geo-textile, min. class 2. - Plastic film - min. 0,2mm - Self-adhesive tape.
Brake Cylinder	- Drain brake cylinder for oil. - Drain plug installed on In/outlet. - Flush brake cylinder with oil before shipment (only if winch is stored before delivery).	- Remaining oil film will act as preservation. - Steel plug with seal ring. - Flushing oil type according to lubrication chart.
Brake Cylinder Rod	- Grease brake cylinder rod. - Wrap rod in bubble plastic and tape.	- Acid-free sticky grease. - Bubble plastic. - Self-adhesive tape.
Brake Cylinder Seals	- Grease or spray seals with Teflon based coating. - Wrap in plastic and tape.	- Acid-free sticky grease or Interflon Film WB. - Wrapping plastic. - Self-adhesive tape.
Shaft Seals	- Grease or spray seals with Teflon based coating. - Wrap in plastic and tape.	- Acid-free sticky grease or Interflon Film WB. - Wrapping plastic. - Self-adhesive tape.
Sheaves	- Spray with Teflon based coating.	- Interflon Film WB.
All other machined surfaces	- Spray with Teflon based coating.	- Interflon Film WB.
Oil tank (self-contained units)	- Drain tank for oil. - Close all openings with flanges/plugs. - Breather cap wrapped in plastic, taped and strapped onto unit or packed separately. - Grease all adjustment screws. - Wrap all adjustment screws in plastic and tape.	- Remaining oil film will act as preservation. - Steel Blind flange and gasket. - Steel Drain plug with seal ring. - Breather cap. - Acid-free sticky grease. - Wrapping plastic. - Self-adhesive tape. - Plastic strips
Instruments (glass fronted)	- Cover instrument glass with plywood and tape.	- Plywood, 6 mm thickness. - Self-adhesive.
All grease nipples	- Cover with grease nipple cap.	- Plastic cap.

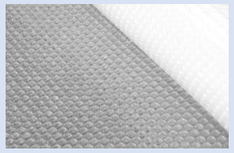
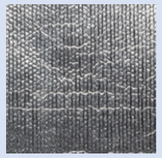
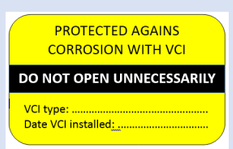
Preservation of Hydraulic Pump Unit (HPU)

HPU Component	Preservation activity to be carried out	Preservation Aid
Oil Tank	- Drain tank for oil. - Install Drain plug.	- Remaining oil film will act as preservation. - Steel Drain plug with seal ring.
Flange connections (all)	- Close openings with flanges.	- Steel Blind flange and gasket.
Screw connections (all)	- Close openings with plugs.	- Standard steel plugs of same material grade as port.
Adjustment Screws	- Grease all adjustment screws. - Wrap in plastic and tape.	- Acid-free sticky grease. - Wrapping plastic. - Self-adhesive tape.
Breather Cap (filling)	- Pack breather cap separately in bubble plastic and tape. - Strap the cap to the unit or pack separately.	- Bubble plastic. - Self-adhesive tape. - Plastic strips.
Hydraulic Hoses	- Pack hoses separately in bubble plastic and tape. - Strap the hoses to the unit or pack separately.	- Bubble plastic. - Self-adhesive tape. - Plastic strips.
Electric Motors	- Pack motors separately in bubble plastic. - Place VCI on the inside of bubble plastic, tape and make wrapping dust and liquid proof. - Place VCI label on outside of wrapping.	- Bubble plastic. - VCI - Self-adhesive tape. - VCI label.
Hydraulic Coolers	- Pack coolers separately in bubble plastic, taped and make wrapping dust and liquid proof.	- Bubble plastic. - Self-adhesive tape.
Instruments (glass fronted)	- Cover instrument glass with plywood and tape.	- Plywood, 6 mm thickness. - Self-adhesive tape.

Preservation of Electrical Components

Electrical Component	Preservation activity to be carried out	Preservation Aid
Junction and Termination Boxes (loose boxes)	- Seal cable entry holes temporarily with threaded plastic or metal blind plug. - Place VCI inside. - Coat gasket with Vaseline. - Close junction box and make it dust and liquid proof. - Wrap box in plastic and tape. - Place VCI label on outside of plastic wrapping.	- Threaded plastic blind plug or metal plug of the same material as the component. - VCI - Resin and acid-free Vaseline. - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - VCI label.
Junction and Termination Boxes (part of assembled product)	- Place VCI inside. - Coat gasket with Vaseline. - Close junction box and make it dust and liquid proof. - Place VCI label on outside of box.	- VCI - Resin and acid-free Vaseline. - VCI label.
Transmitters	- Place VCI inside. - Coat gasket with Vaseline. - Close transmitter and make it dust and liquid proof. - Place VCI label on outside of wrapping.	- VCI - Resin and acid-free Vaseline. - VCI label.
Sensitive components inside cabinets	- Wrap items independently in bubble plastic. - Place VCI inside wrapping and tape. - Place VCI label on outside of plastic wrapping.	- Bubble plastic. - VCI - Self-adhesive tape. - VCI label.
VFD (when shipped loose)	- Wrap VFD in bubble plastic. - Place VCI inside bubble plastic. - Wrap in plastic and tape. - Make wrapping dust and liquid proof. - Place VCI label on outside of plastic wrapping.	- Bubble plastic. - VCI - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - VCI label.
Cabinets and Panels	- Seal cable entry holes temporarily with threaded plastic or metal blind plug. - When necessary install drain plug. - Leave drain plug open. - Place VCI inside. - Coat gasket with Vaseline. - Close cabinet and make it dust and liquid proof. - Wrap cabinet in plastic and tape. - Place VCI label on outside of plastic wrapping. - Cover cabinet with customized hood. - Place VCI label on outside of hood.	- Threaded plastic blind plug or metal plug of the same material as the component. - Plastic drain plug or metal plug of the same material as the component. - VCI - Resin and acid-free Vaseline. - Plastic film - min. 0,2mm or Bubble plastic. - Self-adhesive tape. - VCI label. - Customized Hood made of aluminium sheeted glass fibre cloth.

RM standard preservation material/products

Image	Material / Product	Make / Type	Image	Material / Product	Make / Type
	Teflon based oil	Interflon fin lube TF or equivalent product		Bubble Plastic	Min. bubble diam. 10mm / bubble height 4mm - 100% sunlight stabilized
	Teflon based coating	Interflon fin film WB or equivalent product		Wrapping Plastic	Min. thickness 0,02mm - 100% sunlight stabilized
	Tectyl	Tectyl Multi Purpose 506 or equivalent product		Aluminium sheeted glass fibre cloth	WG200-1AF - 100% sunlight stabilized or equivalent product
	Grease	Acid-free sticky type for industrial use		Self-adhesive tape	Suretape
	Vaseline	Resin and acid-free type for industrial use		Plywood	Min. thickness 6 mm
	Sewn Geotextile	Polyfelt min. Class 2 - 100% sunlight stabilized polypropylene fibre		Vapour Corrosion inhibitor (VCI)	Zerust, Cortec or Silica Gel
	Plastic film	Min. 0,2mm - 100% sunlight stabilized - Flameproof is required (Cover Guard)		VCI Label	Size: 10 x 6 cm Colour: Yellow, black stripe

Note: Use of equivalent material/products are allowed as long as the standard of quality remain the same

Section 3

Technical Description

Technical Specifications

DESCRIPTION	DOC/DRW #	REV #	PAG #
Technical Specification Winches	140041.12	12	2
Technical Specification Deck Handling	10190007.09	9	31

MBARI
“New Research Vessel”

TECHNICAL SPECIFICATION FOR ELECTRIC DRIVEN RESEARCH WINCH SYSTEM.

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REVISION HISTORY

Rev.	Date	Done by	Approved by	Comment/ Changes
00	07.01.2019	DHN		Issued for review
01	21.03.2019	DHN		ROV winch – alternative as TRW-system
02	08.04.2019	DHN		ROV Winch – alternative with direct pull winch removed. Dim. sketch number for TRW corrected.
03	07.06.2019	DHN		CTD winch redesigned – RH328323 Storage drum redesigned – RH328252 Level wind incl. slack wire compensator redesigned – RH328253
04	05.05.2020	WSB		Cable and slip rings included, HPU's included, misc. corrections. Issued as draft.
05	14.05.2020	WSB		Misc corrections /adjustments after review. Released for bid.
06	17.07.2021	DHN	WSB	Set-up of traction winch system "mirrored" as per final winch room layout. • Traction Winch RH329031 replacing RH327920 • Level Wind w/Slack Wire Compensator RH330303 replacing RH328781
07	03.08.2021	RAJ	JFN	Main supply voltage changed to 480V 60Hz
08	31.08.2021	DHN/RAJ	WSB	Various updates as per client remarks. -
09	17.09.2021	WSB	WSB	Various updates as per discussions with Freire, as per B731-Techspec-MBARI-140041.07 10190007 dated 16.09.2021.
10	04.10.2021	WSB	WSB	Motor size Storage Reel corrected from IEC225 to IEC200. Technical Specification 15110.01-800-00 is referred to. Index / chapter numbering is corrected.
11	21.12.21	FFA	FFA	HPU dim. drawings updated. Performance and pull diagram updated for ROV & CTD system Dimensional drawing CTD updated RAL-code confirmed
12	21.01.2021	FFA	FFA	Dimensional drawing and weight CTD updated Dimensional drawing TRW Updated Dimensional drawing Level wind/SWC updated Dimensional drawing storage drum updated

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1. GENERAL DESIGN CRITERIA FOR THE EQUIPMENT

- ✓ Ambient operating temperature for winches and handling equipment installed on deck -20°C to + 45°C with 100% relative humidity
- ✓ Operating temperature for equipment installed under deck/indoor 0°C to + 40°C with 50% relative humidity
- ✓ Survival temperature (not operating) - 30°C to + 60°C
- ✓ Operational limit: Winches are designed for operation at Sea State 5, but we cannot guaranty that all the scientific equipment will be possible to launch and recover at this sea state.
- ✓ Recovery limit: Winches are designed for recovery at Sea State 6, but we cannot guaranty that all the scientific equipment will be possible to recover at this sea state.
- ✓ Main Power supply 480V 60Hz
- ✓ Control System voltage AC230V60Hz
- ✓ All Electric motors are TEFC (total enclosed fan cooled) anti-condensation heaters, above 10kW. Insulation Class F and thermal rated with Class B temperature rise.
- ✓ Electric motors for the winch drives have internal PTC temperature sensor
- ✓ All electric winch drive motors have enclosed rating IP56
- ✓ All HPU electric motors have enclose rating IP54
- ✓ Enclosure rating for other electric equipment (installed on deck or under deck):
  - Encoders IP66
  - Proximity switches IP67
  - Load Cells IP66
  - Control Panels on deck/hangar IP66
- ✓ Enclosure rating for other electric equipment (installed under deck and in control rooms):
  - VFD Cabinets without AC IP54
  - Starters for HPU's IP54
  - Control Panels IP22
- ✓ Scientific winches are designed and produced in accordance with DNV Lifting Appliances for Offshore Crane No.2,22 -2013 and with Subpart 189.35 of 46 CFR Subchapter U Based on Dynamic Amplifying Factor (DAF) 1.8
- ✓ Certification of winches is not included.
- ✓ Equipment is delivered according to Technical Specification 18110.01-800-00 MNV Contract Spec_RevD_2021_04_08_FINAL, limited to section 070, 300, 301, 302, 303, 304, 305, 324, 556, 710 and 711
- ✓ All winches and sheaves have included foundations for installation to reinforced ship deck structure provided by the customer.
- ✓ Basis for our drag force/dynamic calculations:
  - Friction factor for cable/wire (C_{df}) 0,03
  - Drag factor for "tools" (C_{dz}) 2,5
  - Average hauling speed 1,0 – 1,7m/s
  - Vessel motion 1m/s
- ✓ All storage/take-up drums has 3 – 4mm wear plates of stainless steel installed inside the drum shield.
- ✓ All drum core's and sheave diameters in the total winch and handling system complies with the rope/cable/wire manufacture minimum bending requirement or better.
- ✓ On research winches, functionality for constant speed setting (compensate for change in diameter for different wire layers).
- ✓ MacGregor will fulfill DNV requirements of Class Notation Cyber Secure Essential (+) with OHS (Overboard Handling System) to a security level SP3; and collaborate with Shipyard's

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consultant.

- ✓ MacGregor will collaborate with Shipyard's consultant (TSI) in respect of Noise & Vibration recommendations

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2. CLARIFICATIONS

- ✓ The estimated noise level for airborne noise is stated under each winch in this specification. The noise level will vary from nominal to maximum speed of the winch.
  Note: The noise data recorded during FAT might be different from the noise recorded after installation on the ship in a closed winch room – due to other background noise and structural vibrations.
  It's important to categorize the maximum noise requirements between "unmanned" and "manned" in the different compartments like, Main Winch Room and "Working Deck". During "launch/recovery" operation, the winches are working at very slow speed and could comply with a "manned" requirement without ear protectors, in opposite to the operation when the scientific package is in water and the winches are working at full speed and maximum noise level – "unmanned" requirement.
- ✓ To make sure that the winches and handling system is designed and dimensioned to handle the related dynamic loads, we strongly suggest that all the scientific packages are identified and described with size and weight along with planned maximum cast depth.
- ✓ Winch system described is not EX certified
- ✓ Minimum cross section on power cable to be 1,5mm², signal cables may be below this
- ✓ Cable, cable glands, terminal pads etc internally on equipment are of IEC, DIN EN standard.
- ✓ Cable types and sizes prescribed on cable diagram are according to IEC, DIN EN standards.
- ✓ Cable glands related to external connections on equipment are considered Yard supply.
- ✓ Electric starters are furnished with disconnecting switch.
- ✓ Wire routing still to be agreed upon/confirmed.
- ✓ Type of slip rings still to be agreed upon/confirmed.
- ✓ Type of cable/rope/wire still to be confirmed/approved by CUSTOMER.
- ✓ CUSTOMER needs to confirm the speed and acceleration at the overboard sheave.
- ✓ To make sure that the winches and handling system is designed and dimensioned to handle the related dynamic loads, we strongly suggest that all the scientific packages are identified and described with size and weight along with planned maximum cast depth.

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3. RESERVATIONS AND LIMITATIONS

General

Based on a cast depth, our presented dynamic studies of winch/cable loads need to be further discussions/considerations as to the related MBL/RWL and operational safety factors – see graphs under items
For this above reason, we cannot guarantee the service life of any of the EM/EOM/COAX cables included into this specification.

The wire routing for the required locations of deployment, involve several guide sheaves with 90°bending, reverse bending and bending in different planes.
For this reason, the service life of the cables/rope/wire will be reduced.

Integration towards third party's systems and such is not included, but may be subject to variations after necessary interface details of such is submitted to MacGregor. Variations may or may not be subject to additional cost.

Cable Loading During Operations

Cable Conditioning: "Spin Out" during the Initial Deployment All new cables/wires need to be relieved of the constructional stretch and cast that become stored within the armor package as a part of the normal manufacturing process. This initial "spin out" can be accomplished by deploying the cable/wire to full depth with either the payload attached or just a clump weight while allowing it to rotate freely. While one such deployment may not completely relieve the cable of all trapped energy, it has been shown to remove a significant portion of it. If a full-depth spin out can't be performed, going through this process to the depth of the project at hand will still aid in conditioning the cable. A record of all such cable/wires conditioning will help to ensure they are performed each time the cable is used on a project that exceeds the previous deepest deployment.

Further, over time the cable/wire might be subject to diametrical contraction due to elongation, compression and wear when loaded/used. Also, a large variation in linepull might result in diametrical variation of the cable/wire in respect to the underlying layers spooled on the drum.

For the above reasons, we cannot guarantee any changes to occur in the quality of the spooling on the winches. It might be necessary to make a complete rewind to ensure quality of the spooling on the winches after some time in operation.

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Cable spooling

MacGregor cannot take the full liability for the final result of the spooling of customer supplied cables unless any errors are directly caused by the winch not being in compliance to the agreed technical specifications. In such a case MacGregor liability shall be limited to rectifying the non-compliance on the winch.

The condition of a customer supplied cable and its conformity with respective data sheet is the customer's sole liability at and upon arrival at mutually agreed place of delivery.

Cable termination

It is the Customer responsibility to perform termination of winch end and mission equipment end. The Customer holds the liability of the integrity and conducting performance of the cable under and after the work of termination. It is also the Customer's responsibility to control the integrity / performance of cable before work of termination is initiated.

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4. CTD WINCH

1.ea Research Winch HW515T90.
Drum winch with top inlet 90-degree spooling.
Spooling with 90deg swivel function.

Winch model HW-515-T90 acc. to drawing 2000004676

Wire capacity: 6650m of cable 8,18 mm in 25 layers.
Drum size: dia. 502/990 x 982mm
Singe motor drive – ABB electric motor, IEC 200 – High output motor.
Planetary/bevel/parallel gearbox – BPH323, ratio 35,67:1
SWL 4,0 tons
Electro hydraulic actuated band brake with capacity SWLx1,8
Electric driven and synchronized level wind for 8,18 mm cable.
Lebus sleeve for 8,18 mm cable.
Tension control.
Slip ring prepared for and included; 4 pass - 7A/1000V. Focal 180
Cable included, 6500m of Rochester A301592
Winding of 6500 m of cable A301592 under tension is included.
Type of electric system: Frequency controlled system.
Active Heave Compensation (AHC) included.
Est. weight 4250kg – ex. cable

Winch performance as described in table below is related to:

Power Requirement 46kW

Wire layer	Dia.(mm)	Nominal speed				Maximum speed			
		Motor speed		1336	RPM	Motor speed		2806	RPM
First layer	510	4,0	t/	60	m/min.	1,9	t/	126	m/min.
Half length	739	2,8	t/	87	m/min.	1,3	t/	183	m/min.
Top layer	903	2,3	t/	106	m/min.	1,1	t/	223	m/min.

Table based upon 6500meter of 8,18mm cable

Control panel for local and emergency control installed close to the winch:

- ✓ Activate winch switch
- ✓ Control here
- ✓ Alarms
- ✓ Joystick for Pay-out and haul in
- ✓ Emergency stop switch
- ✓ Manual spooling
- ✓ “one button launch & recovery”

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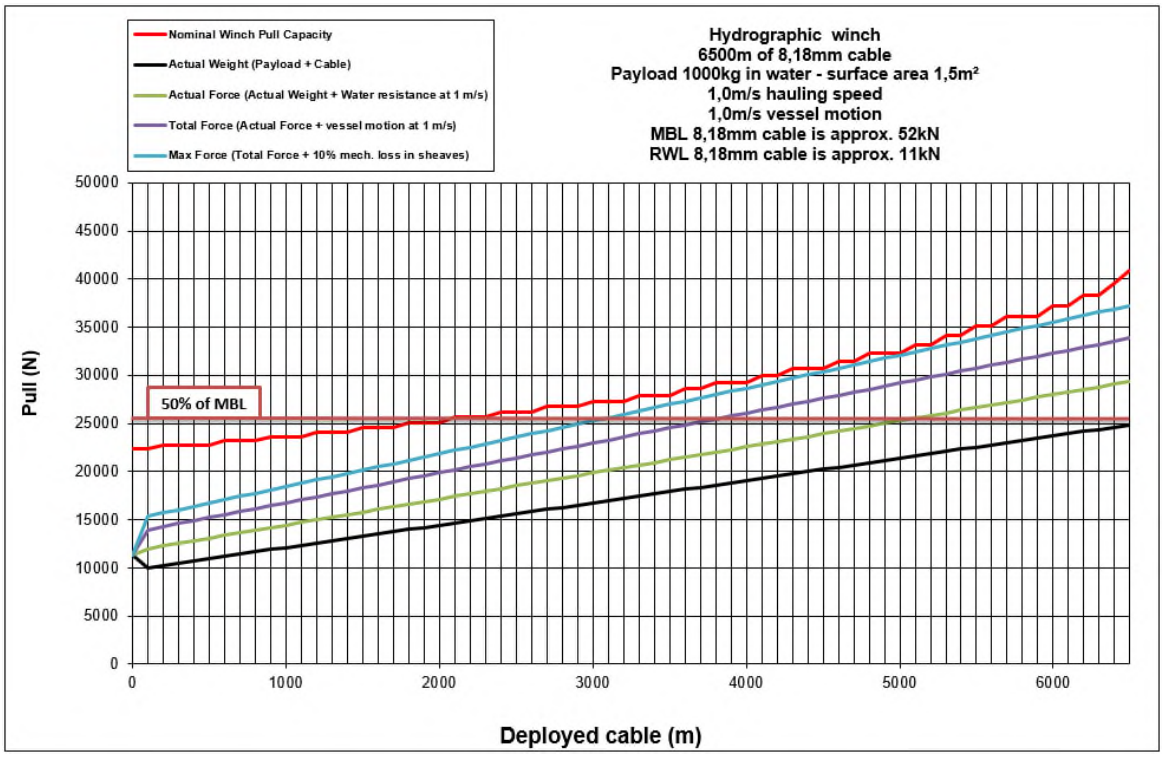
Performance and Pull diagram
Diagram showing load case with deployed 6500m of cable at nominal load.



Active Heave Compensation capabilities
Diagram for definition of required acceleration (dw/dt) and speed (m/s) based on pure Wave height Hs5 and period10s. Vessel movement must be calculated by ship designer to verify that acceleration and speed at position of overboard sheave does not succeed these values.
If so, power requirement of winch has to be recalculated and corrected.

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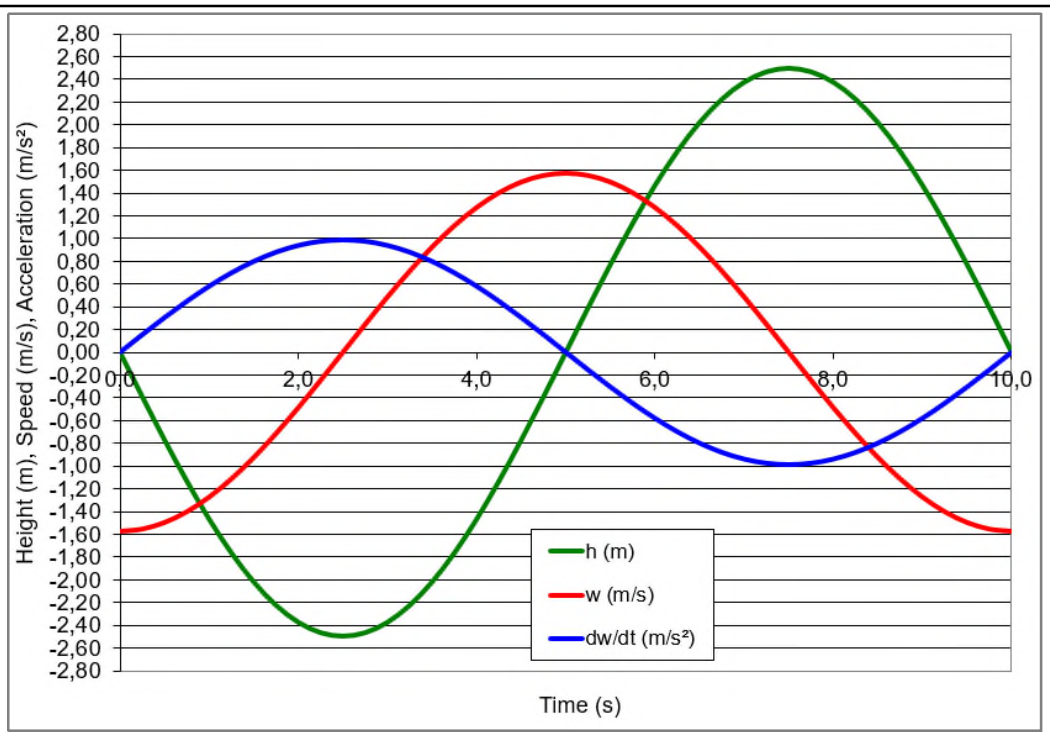

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Image of winch (side operation)

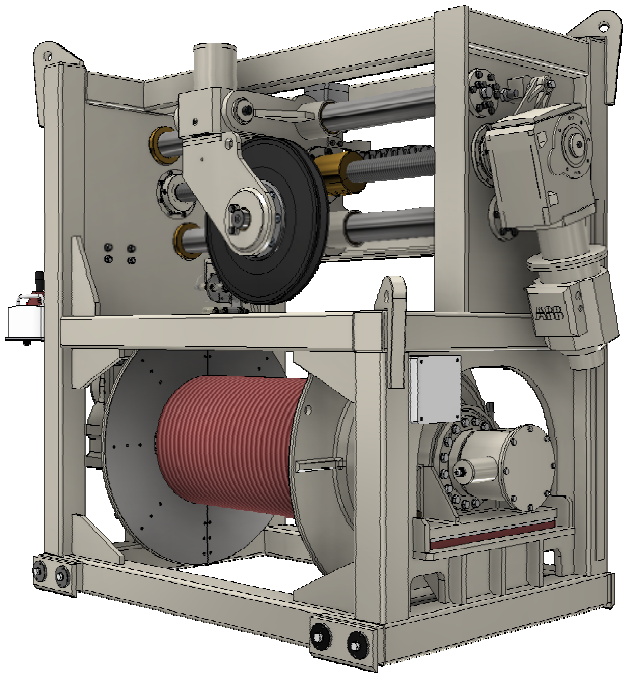

Image: Iso view of winch (image might deviate from actual product)

Image of winch (aft operation)

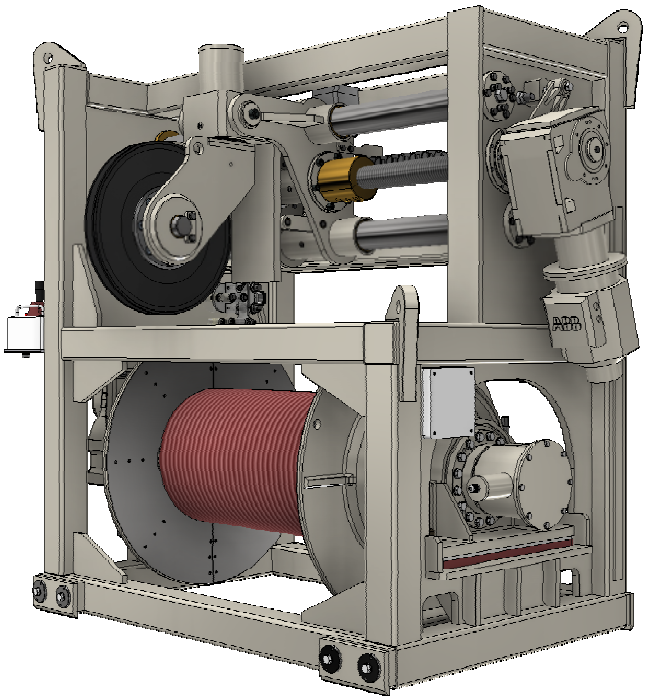

Image: Iso view of winch (image might deviate from actual product)

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5. ROV WINCH – TRACTION WINCH

General Technical Requirement for the System:

Cable spec:

Umbilical wire, length	= 5000 meters
Diameter	= 20,0 +/-0,3mm (Fibron, ref dwg RM0058)
Weight	= 1,26kg/m in air – 0,94kg/m in seawater.

Minimum bending diameter is 800mm (dynamic)

ROV/Cage.

Weight ROV/TMS/WP in air	= 5760kg.
Weight ROV/TMS/WP in sea	= 250kg. (ROV considered buoyant)

Wire + ROV/Cage in max water debt:

Max. dept = 5000meter, cable weight (5000m x 0,92kg/m)	=	4600 kg
ROV/TMS/WP in sea water	=	250 kg
Total weight in sea water (at 5000m depth)	=	4850 kg

Drum parameters on winch:

1. Drum flange diameter = 2050mm
2. Drum length = 2000mm
3. Drum core min. = 1505mm
4. Wire dia = 20,0mm
5. Wire capacity: = 5000m
6. Wire turns = 99,5
7. wire layer = 11

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1.ea ROV Winch – TRW SYSTEM

15T Traction Winch System for AHC comprising of

1ea. Traction Winch
Model: TRW-4004E-01R1.
Drawing: 400092475.
Traction heads with PCD 1238mm fitted with split sleeve for easy replacement/change.
Dual Electric Motor drive/ABB air cooled high output type/IEC225.
Sleeves for 20 mm. dia cable.
Traction head sleeves is of split type design.
Deck interface: Winch equipped with brackets for welded connection to deck.

Image of winch

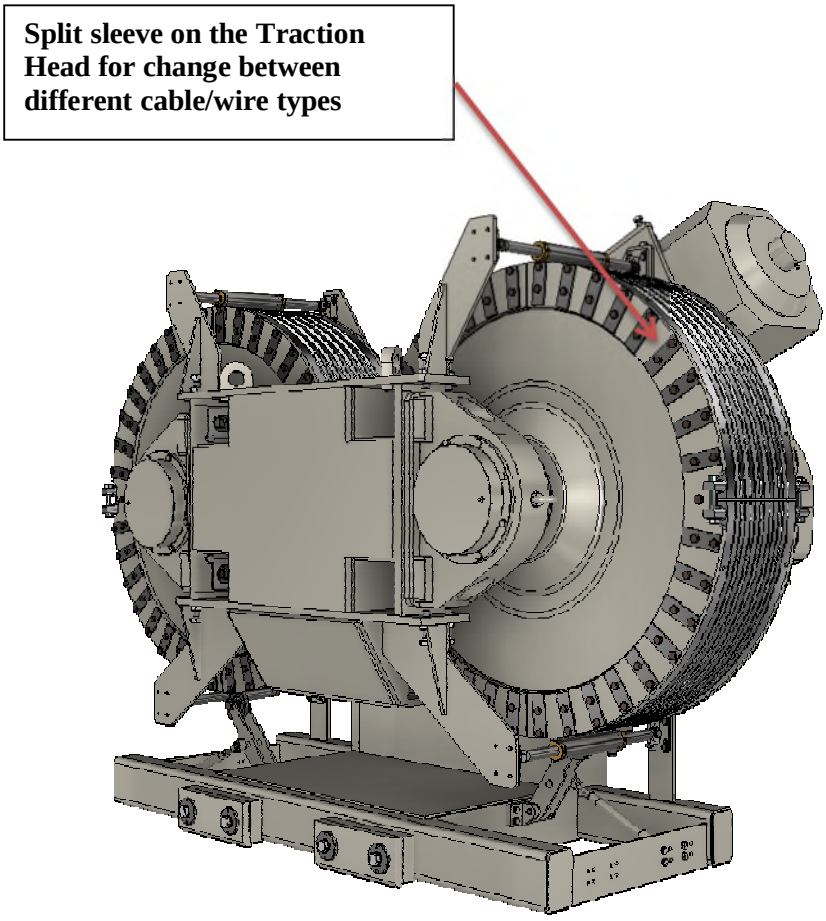

Image: Iso view of winch (image might deviate from actual product)

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1ea. Combined Level Wind incl Slack Wire Compensator.
Model: ELSWC5000-L2000.
Drawing: 400092566

Level Wind
Electric driven and electronic synchronized.
Sheave PCD diameter: 1ea. 900 mm.
Material in sheave: Composite.

Slack Wire Compensator
Sheave PCD diameter: 2ea. 900mm + 1ea. 900mm.
Material in sheave: Composite The Slack Wire Compensator's position is logically positioned in relation to the operational sequence of the Traction Winch and the Storage drum.

Deck interface: Winch equipped with brackets for welded connection to deck.

Image of level wind

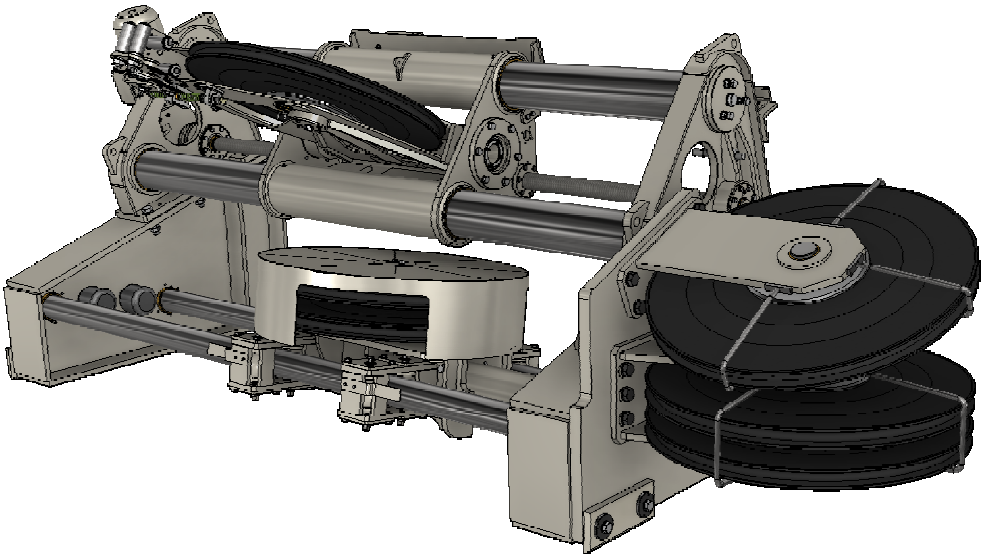

Image: Iso view of winch (image might deviate from actual product)

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1ea. Storage Drum.

Model: RW-2372EB

Drawing: 400092447

Storage Drum size: dia. 1470/2050 x 2000mm.
Lebus sleeve with PCD=1525mm. Mounted with wear plates on drum shields.
Deck interface: Winch equipped with brackets for welded connection to deck.
Maximum storage capacity is 5000m. of 20mm. dia. cable at 9 layers and OD=1950mm.
Single motor drive/ABB air cooled high output/M3BP200 frame.
Slipring included, type Focal 176/291, 5 pass 4500V/20A, 4 pass 1000V/7A, 6 SM fibre pass.
Cable is not included.
Winding of 5000 m of cable Fibron 20 mm umbilical, acc. to dwg. RM0058 under tension, is included. **Cable must be provided by customer to MacGregor facilities to conduct the winding. Required time of delivery for cable and cable sample will be advised by MacGregor.**
Maximum cast depth: 4050m (4700m. cable deployed).

Image of winch

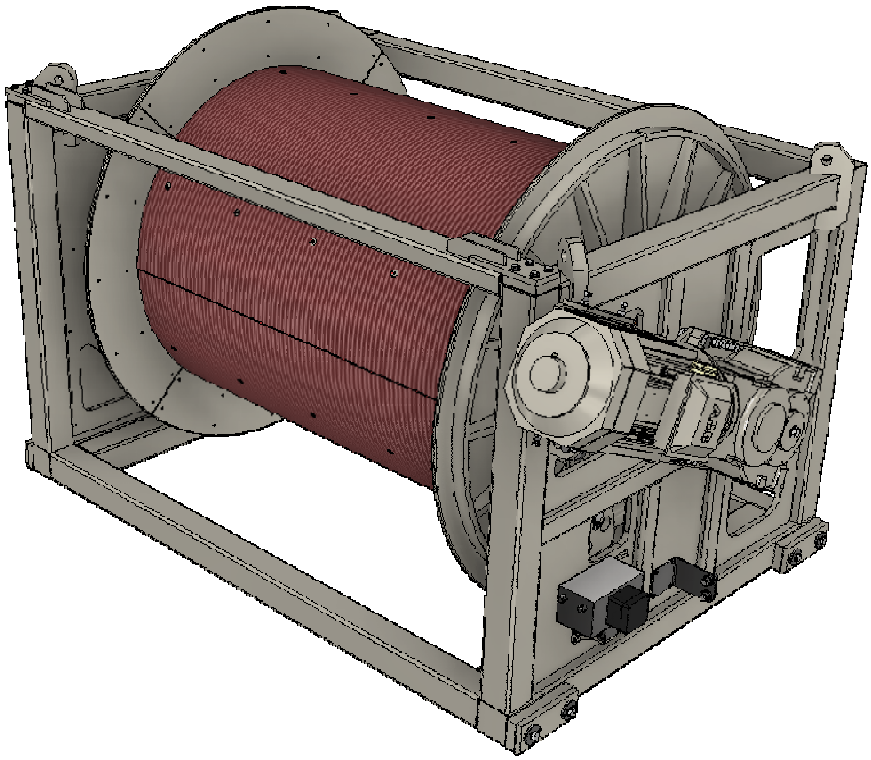

Image: Iso view of winch (image might deviate from actual product)

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Control panel for local and emergency control installed close to the winch:

- ✓ Activate / select winch switch
- ✓ Control here
- ✓ Alarms
- ✓ Joystick for Pay-out and haul in
- ✓ Emergency stop switch
- ✓ Manual spooling

Total Combined winch system performance:

SWL 15,0 tons.
Hydraulic operated fail safe brake with capacity SWLx1,8
Constant Tension control.
Local and Remote control.

Winch performance at power requirement 190kW – including driving one Storage Drum and one Level Wind.

Peak power requirement for AHC operation (HS5 Period10) is 225kW - including driving one Storage Drum and one Level Wind.

Wire layer	Dia.(mm)	Electric motor at 1500 RPM	Electric motor at 2500 RPM
Traction head	1238	**15,0** t/ **60.0** m/min.	**9,0** t/ **100.0** m/min.

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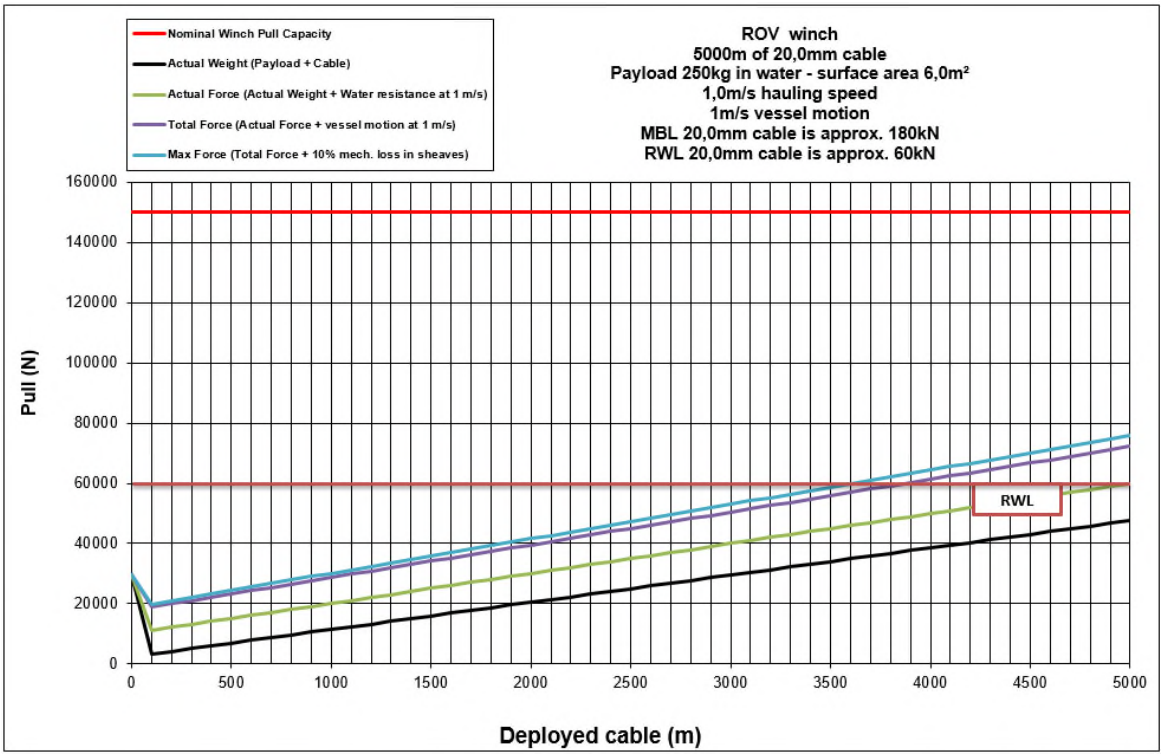
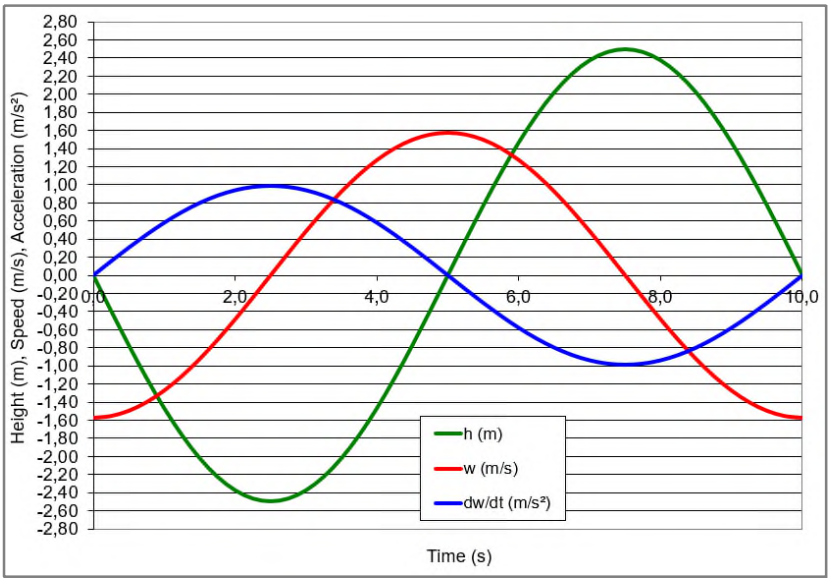
Performance and Load diagram

Diagram showing load cases with deployment of 5000m of cable:



Active Heave Compensation capabilities
Diagram for definition of required acceleration (dw/dt) and speed (m/s) based on pure Wave height Hs5 and period10s. Vessel movement must be calculated by ship designer to verify that acceleration and speed at position of overboard sheave does not succeed these values.
If so, power requirement of winch has to be recalculated and corrected.



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6. MAIN DRIVE SYSTEM FOR THE WINCHES

Electric main drive system
Main power 480V/60Hz
Power requirement: 190kW (peak power 225kW)
Dimensional sketch: RH330319
Single line diagram: RH330320

CTD Winch

- 2 ea. Frequency converter low noise regenerating for the drive of:
  1 off for main drive CTD Winch (5).
  1 of level wind CTD Winch (5)

ROV TRACTION WINCH SYSTEM

- 2 ea. Frequency converter low noise regenerating for the drive of:
  1 off for Traction Winch (6).
- 1 ea. Frequency converter low noise regenerating for the drive of:
  1 off for Storage winch (6).
- 1 ea. Frequency converter low noise regenerating for the drive of:
  1 off for Level wind (6).

NOTE!! The Frequency Drives are AFE type meaning that the vessels main Switch Board and electric system need to have the facility to receive all the regenerated power from the winches. PMS integration with floating limits.

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7. HYDRAULIC BRAKE AND COOLING SYSTEM

Hydraulic one line diagram TBC

Item 7a **Hydraulic system for brake and slack wire compensator.**
1 ea. Hydraulic Power Unit (HPU), mainly comprising of:
2ea. Elec. hydraulic power pack 3,0 kW/3x480V/60Hz/IP55
S6-40% load rating, fixed displacement hydraulic pumps, included Oil tank, oil cooler and Accumulator.
2 ea. Starters as part of the complete control system.
Prepared for bio degradable oil, type and brand to be sent to MacGregor for approval.
According to dim sketch 2000004113

Item 7b **Hydraulic cooling system for the winch drive gearboxes.**
1 ea. Hydraulic Power Unit (HPU), mainly comprising of:
2ea. Elec. hydraulic power pack 1,5 kW/3x480V/60Hz/IP55
S1-100% load rating, including fixed displacement hydraulic pumps, oil reservoir as well as filters, necessary valves, thermal switch, check valves and hoses.
Oil cooler approx. 30kW cooling capacity at 38°C water temperature installed on HPU
2 ea. Starters as part of the complete control system.
Prepared for bio degradable oil, type and brand to be sent to MacGregor for approval.
According to dim sketch 2000004110.

Required fresh water cooling supply@ maximum 38°C is
8a = 25l/min & 8b = 50l/min.
Note: The water supply on/off solenoid valves for water inlet are yard supply, but controlled from the MacGregor control system.
Water pressure shall be sufficient to overcome cooler cross port pressure at max. 2 bar.

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8. COMMON CONTROL SYSTEM

8.1 Integration:

The Pentagon provide a wide range of opportunities to integrate third party equipment/suppliers, here under.:

- ✓ Power Management System (PMS)
- ✓ Integration true OPC/UA, winch data and alarms.

8.2 Motion Reference Unit:

Required available signal from Kongsberg MRU-H, generation 5 unit or similar**.**
MRU is optional, not included in this quote.

8.3 Over stern/over the side operation

System is integrated with radio control for handling, ref specification 101900007.09

The radio control has following functions for the winches:

- ✓ Activate winch switch
- ✓ Control here
- ✓ Alarms
- ✓ Joystick for Pay-out and haul in (switching between the three winches)
- ✓ Tension control
- ✓ Display for speed, length and tension monitoring
- ✓ Emergency stop switch

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9.4 Common Control in Control Room

Pentagon™, Computerized Winch Control System

Pentagon Control/monitoring panel for remote control and automatic control of winches under item 5 & 6 – dwg.RH311505 with the following functions:

Pentagon Research system with touch screen for:

- ✓ Automatic pay-out and haul back at pre-set lengths, speed and tension.
- ✓ AHC – active heave compensation control for the winches
- ✓ Alarms
- ✓ Joystick for Pay-out and haul in for one winch at the time.
- ✓ Length, speed and tension monitoring
- ✓ Switching between winches
- ✓ Split screen when operating two winches simultaneously.
- ✓ Emergency switch
- ✓ Settings of display and system
- ✓ Setting control priority
- ✓ Logging facility of relevant winch data.

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9. CONTROL FEATURS

Speed control accuracy on the electric driven winches

Down to 0,1m/s in normal mode and down to 0,02m/s in “creep mode”
In the Rapp control system, we have two modes of manual control. When the operator wants to have a very fine and accurate control he switches over to “creep control” which will give **continuous variable speed in increments of down to 0.02m/s**

Monitoring systems for cable/wire/rope tension, length and speed

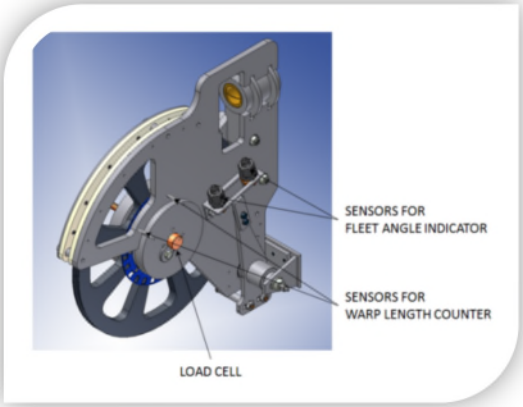
Standard System # 1 for research winches: Calculated values

- ✓ Using the encoders on the electric motors for calculation of length and speed.
- ✓ Using the torque loading (from the VFD) on the electric motors for calculation of tension.

System # 2 for research winches: Measured values

- ✓ Load cell in the spooling sheave or in deck sheave for measurement of tension.
- ✓ Encoder in the spooling sheave or in deck sheave for counting of revolution with corresponding calculation of length and speed.

The monitoring system to be used is chosen by the operator from the control system.
System #1 and system #2 is back up to each other – means we have 100% redundancy.



Electric driven and synchronized level wind system

- ✓ Synchronized based on a fixed adjustable pitch (ratio between the winch drum and the movement of the level wind carrier)
- ✓ Fleet angle sensor spooling (sensing the fleet angle on the wire between the layer on the drum and the level wind carrier)
- ✓ Combination of synchronized spooling and fleet angle sensor (fleet angle sensor will “reset” position of the level wind carrier if the synchronized spooling is lacking behind or is ahead). This is a feature used when spooling long cables – 5000m or more.

Tension control/auto rendering and heave compensation

- ✓ All winches has tension control and “auto rendering” features – means that that the winch will stop/or give out at the pre-set tension.
- ✓ Active Heave Compensation (AHC) is included for the winches.

Safety system in winch room

- ✓ Flashing lights when winches are in operation

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10. DOCUMENTATION AND ASSISTANCE INCLUDED

Service and assistance included:

A) 3 ea hard copy and electronic (pdf) Engineering manuals in English language including:

- Hydraulic system schematics
- Electric wiring diagrams.
- General installation instruction.
- Dimension sketches of winches.
- Dimension sketches of control panels and cabinets.
- Flushing and cleaning procedures for hydraulic pipes.

B) 3 ea hard copy and electronic (pdf) Operational manuals and spare part catalogues in English language including:

- All relevant drawings with part lists and specifications.
- Operational instruction for the Pentagon control system and winches.
- Manufacturer's test certificates of winches.
- Lubrication chart
- Manufacturer´s test certificates of winches.
- On board Repair Part List as recommended by MacGregor, based on:
  - Cruise duration of 21 days in remote areas
  - Frequency semi –annual or greater (daily, weekly, monthly etc)
  - Hourly maintenance of under 2000 hrs frequency
  - The list shall contain prices of the parts.
- Vendor Recommended Spares List as recommended by MacGregor:
  - Items required for preventive maintenance cycles greater than semi – annual, and greater than 2000 hrs.
  - The list shall contain items not readily stocked by vendor, with a greater than 90 day lead time. Frequency semi –annual or greater (daily, weekly, monthly etc)
  - The list shall contain prices and weights of the parts.

C) Project and production QA will be provide as following:

- Project schedule plan with progress reporting

D) Start-up assistance/training:

- Technical supervision and inspection of installation, start up assistance and dock trials will be carried out by one of our service engineers. According to mutually agreed and approved protocols. Included are travel expenses, lodging and labour hours for inspection and guidance.
  A total stay of 10 days (one trip) at the yard is included. Each working day shall not exceed 10 hours and shall be executed mainly during normal working hours and normal working week. We require a notice from the yard 20 days before such assistance is to be performed.

- Assistance during full scale trials out at sea, according to mutually agreed and approved protocols, including training of crew in operation and maintenance from one of our

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engineers is included with a stay of maximum 10 days out at sea. This activity is to take place after dock testing and will be executed by personnel departing from Norway. Customer is responsible for covering cost of travel and other related expenses arising from travels to and from the place of execution.

- If the allocated number of work hours for supervision and trials are exceeded due to reasons and delays at the yard which are beyond MacGregor´s control and/or responsibility, MacGregor will charge EURO. 1890,- per additional working day (Monday – Friday) at the yard, plus expenses.

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- The hydraulic- and electric installation, winch foundations and alignments must be completed before the trials can start at shipyard. MacGregor's representative's involvement during start-up and final testing/sea trials is limited to ensuring that pipes are properly sealed and do not show any leakage under working conditions i.e. full system pressure and that all equipment supplied by MacGregor is operating as specified.

- MacGregor is not responsible for installation that has been carried out differently from submitted specifications.
  MacGregor is not responsible for starting prime movers or supervision of same during start-up or trials.
  The yard and-/or the owner are responsible for allocating their own personnel to carry out any supervision or remedial work required at their own expense.

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11. ALIGNMENT AND FOUNDATION OF WINCHES ON BOARD THE VESSEL

All winches mounted on board the vessel shall by Ship Yard be aligned in accordance with normal practice for this kind of machinery and as per instructions from MacGregor found in engineering manual.

Design, engineering and production of deck foundations for specific winches are the buyer's (shipyard or vessel owner) responsibility. Such foundations must comply with:

- Common practice and well-known engineering principals for marine rotating appliances for installation on deck.
- Class society requirements for marine rotating appliances for installation on deck (e.g. DNVGL Rules for Ship, section – Foundations for deck machinery, towing equipment and lifting appliances).

For the main winches, deck foundation must have sufficient stiffness to avoid excessive deflections, in respect to the above, under winch load. If not otherwise specified, such winch load is to be taken as rated line pull for the winch at half/mid wire layer (ref. performance table for actual winch). Deflection values, as result of structure analysis, can be submitted to MacGregor for information and comments/ evaluation.

12. SURFACE TREATMENT

Products manufactured by MacGregor, in this case all items in this technical specification are surface treated according to our standard specification:

- Shot blasting to Grade SA 2,5-3,0/ISO standard 8501-1.
- Zinc metallizing Minimum Thickness 60µ but average 80µ
- Tie coat (primer) Thickness Intercure 202, 50% diluted
- Hi-build Thickness Intercure 202
- Top coat Thickness Interfine 691

Total thickness paint is minimum 240µ but average will be above 315µ

- Color code RAL-9016 Confirmed

Note:
Sand blasting and zinc metallizing does not apply for Electric motors with aluminum housing, Delicate hydraulic components, Stainless steel components, Aluminum components, and if there are used Allen bolts with strength class 12,9.

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13. SPARE PARTS FOR WINCHES

Standard package of spare parts and special tools not included – To Be Considered

14. LICENCE PRODUCTION/COUNTRY OF ORIGIN

MacGregor has an international production and service organization where components, complete products and services listed in the technical specification could have a different country of origin than Norway. Shipyard and the owners accept accordingly this information as a general and final notification that some of the specified products (or services) may have been manufactured at different locations and consequently have another country of origin than Norway.

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For the main winches, deck foundation must have sufficient stiffness to avoid excessive deflections, in respect to the above, under winch load. If not otherwise specified, such winch load is to be taken as rated line pull for the winch at half/mid wire layer (ref. performance table for actual winch). Deflection values, as result of structure analysis, can be submitted to MacGregor for information and comments/ evaluation.

November 4th, 2021

MacGregor

_____sign_____

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TECHNICAL SPECIFICATION

CNP Freire Vigo. Spain **Att: Ramón Borrás**	**Date:**	**15.09.21**
	Our ref.:	Andreas Vie Murvold
	Direct phone:	+47 95 70 14 12
	Direct mail:	Andreas.Murvold@macgregor.com
	Your ref.:	016-2020
	Project no.:	4/60185
	Project description:	MBARI
	RFQ Doc. No.	

TECHNICAL SPECIFICATION NO.: 10190007-09

Dear Ramón Borrás

We thank you for your enquiry and look forward to learning of your comments to our technical specification in due course.

Kindly note that this document “Technical Specification” represents our understanding of the technical specifications / requirements as presented to us in your enquiry.

If responding to our technical specification, please refer to our technical spec. number stated in the heading of this document. The reference will assist us to quickly identify your project in our records.

Yours sincerely,
Macgregor Norway AS, TRIPLEX site

Andreas Vie Murvold

MacGregor Norway AS, Triplex site
Heimgardsveien 21
6530, Norway
914 248 965 MVA

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post@triplex.no
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REVISION TABLE

Rev. no.	Sent Date	Approved By	Description
01	31.01.2019	JKH	Preliminary Technical Specification
02	15.03.2019	AVM	Updated according to18110.01rev C
03	03.07.2019	AVM	Updated Item 2 and 2.1. Added HPU Updated Item 3
04	10.07.2019	AVM	General Update
05	28.04.2020	AVM	Updated based on Shipyard RFQ
06	15.05.2020	AVM	Main crane and AUV docking head as an option.
07	26.03.2021	AVM	Updated based on the latest communication with yard.
08	11.07.2021	AMV	Updated main crane, and documentation schedule. Removed one HPU.
09	15.09.2021	AMV/FM	Removed Spare Parts – To Be Considered

SCOPE OF SUPPLY

Item no.	QTY	Drawing no.	Rev. no.	Description
1	1	20549	01	Stern A-frame 100 kN
2	1	20673	02	Overhead Crane
2.1	1	20673	01	Docking Head
3	1	20547	02	CTD Davit
4	1	1998565	01	2x75kW HPU
5	1	23460	03	KNR- 60
5.1	1	23412	01	AUV Docking Head

OPTIONS

Option no.:	QTY	Description

CLARIFICATIONS

Needs to be agreed upon before signing a PO.

#	Item no.:	Description

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GENERAL DESIGN CRITERIA

TEMPERATURES			FROM	TO
A	Ambient operating temperature with 100% relative humidity	Equipment installed on deck	+ 40°C	-10 °C
B	Operating temperature with relative humidity up to 70 %	Equipment installed under deck/indoor	+ 40°C	0°C
C	Seawater temperature		+ 32°C	-2°C

ELECTRIC / POWER				
A	Power supply Voltage (HPU)	480V, 60Hz - 3 phases	☐ Fixed ☐ Variable	
B	Control system Voltage	AC 230V, 60Hz		
C	Enclosure rating for el equip. installed on deck	Encoders & Load Cells Control Panels on deck/hangar Proximity switches Radio remote controls with Gore-Tex	IP IP IP IP	66 66 67 65
D	Enclosure rating for el. equip. installed under deck	Starters for HPU's Control Panels	IP IP	55 65
E	Floodlights	LED Type	lm	9000

MATERIALS			
A	Major steel structures (According to the applicable rules and regulations)	minimum type	S355
B	Hydraulic pipes	up to OD42mm	Stainless Steel
C	Hydraulic fittings	up to OD42mm	Stainless Steel
D	Hose ends	up to OD42mm	Stainless Steel
E	Grease lines & grease nipples		Stainless Steel
F	Cylinders piston rods		Stainless Steel + Hard Chrome
G	All bushings		Bronze material
H	Hydraulic hoses	rubber in accordance with	EN 857

HYDRAULICS			
A	Oil type *(oil itself not included)*	☐ Mineral oil ☒ Bio oil	Type if applicable: Type if applicable:
B	Cooling system	☒ Freshwater ☐ Seawater ☐ Air	

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DESIGN & TESTING OF LIFTING APPLIANCES		
A	Design of according to	USCG 46 CFR 189.35 – Weight Handling Gear requirements
B	3rd party Class Certification of the equipment in this specification:	☐ Included ☒ Not Included
B 1	Class society if Class Certification included	
B 2	Type of Class Certification if included	☐ Design Approval ☐ Type Approval?
	FAT Witness by Class Surveyor	☐ Included ☒ Not Included
C	Testing according to Norwegian Maritime Authority (NMA) according to ILO convention No. 152 rules	☒ Included ☐ Not Included
D	FAT test report	Will be issued for each item

SURFACE TREATMENT / COLOR		
A	Surface treatment: All products	Metallized – See surface treatment
B	Color Item	RAL 9016 White (Gloss: High)
C	Color Macgregor letters	RAL 3000 Red

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ITEM 1: 100 kN - 170° STERN A-FRAME

Illustration 1 – Illustration of a 170° Stern A-Frame

DESCRIPTION
Complete stern a-frame with 170° stroke, 2 LED floodlights,2 Aux winches, 3 pad eyes and 4 sheave block (included) ● Distance between the legs (free space) 4 300mm ● Distance from deck up to main sheave 6 100mm ● Distance of block aft of transom minimum 5 855mm ● Distance of block forward of transom minimum 4 600mm The A-Frame is bolted to the deck. Bolts are shipyard scope of supply, and not included in Macgregor Scope of supply.

#	TECHNICAL DATA – A-FRAME		
A	According to dimensional sketch	20549	
1	P1 (Working area 40°-170°) – SDL	100	kN
2	P2 (Winch Working Area 10°-170°)	SWL 2x3	Ton
3	Hydraulic pressure	200	Bar
4	Tilting time out/in	120/120	Seconds
5	Recommended oil flow	200	L/min
6	Weight of crane (moving parts) approx.	10000	Kg
7	Weight of foundation approx.	2x1 900	Kg

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STERN A-FRAME CONTROLS	
EMERGENCY CONTROL	Operated from levers on directional valves mounted in stainless steel cabinet with access through hinged hatch. The Emergency control cabinet can be located at a desirable location for optimal operation. This control is used for emergency operations. Normal operation is from the radio control panel.
RADIO REMOTE CONTROL	The A-Frame will be delivered with complete HBC radio control of all functions, including receiver cabinet with power supply and required relays. Portable control unit with belt, antenna in drip proof box, battery charger and two batteries are also included.
	Additional information: 1. All movement functions of the A-Frame take place from this control panel. 2. All movement functions of the aux winches take place form this control panel. 3. All motions can be controlled at step-less variable speed (infinite variable) from zero to full speed. 4. Operating simultaneously different functions is fully possible. Each function will be clearly marked. 5. HPU with necessary performance can be started from a starter switch on the radio remote console.
CONTROL STATION PANEL The control station panel will be delivered as a part of the Winch scope.	One (1) remote control panel for stern control room with the following functions: 1. Start/Stop HPU 2. One 2- ways joystick for the tilt function. 3. Two 2- ways joysticks for Hoist/pay-out of the winches 4. Emergency switch *Figure 1 - Remote Control Pane*

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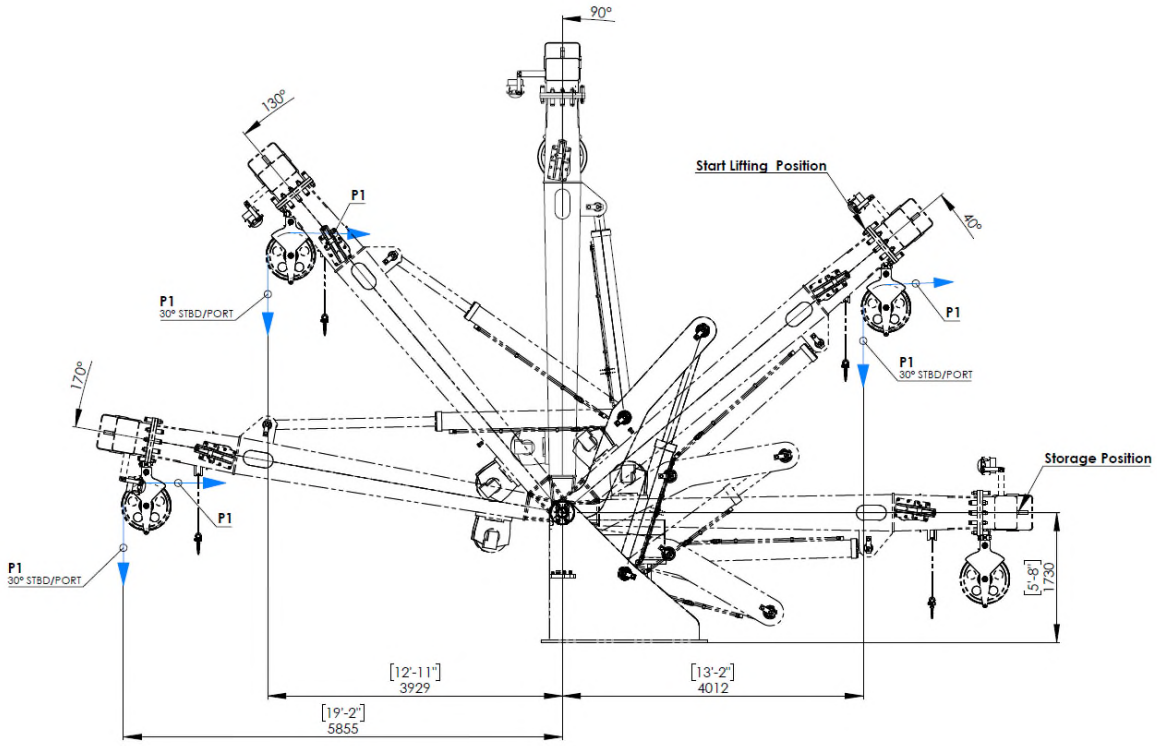

Illustration 2 – Side illustration Stern A-frame

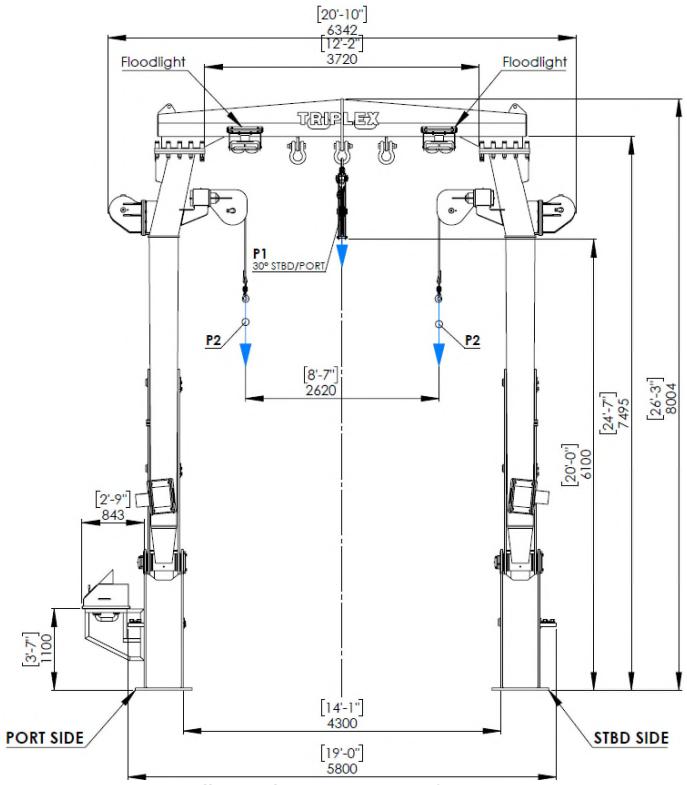

Illustration 3 –Stern A-frame

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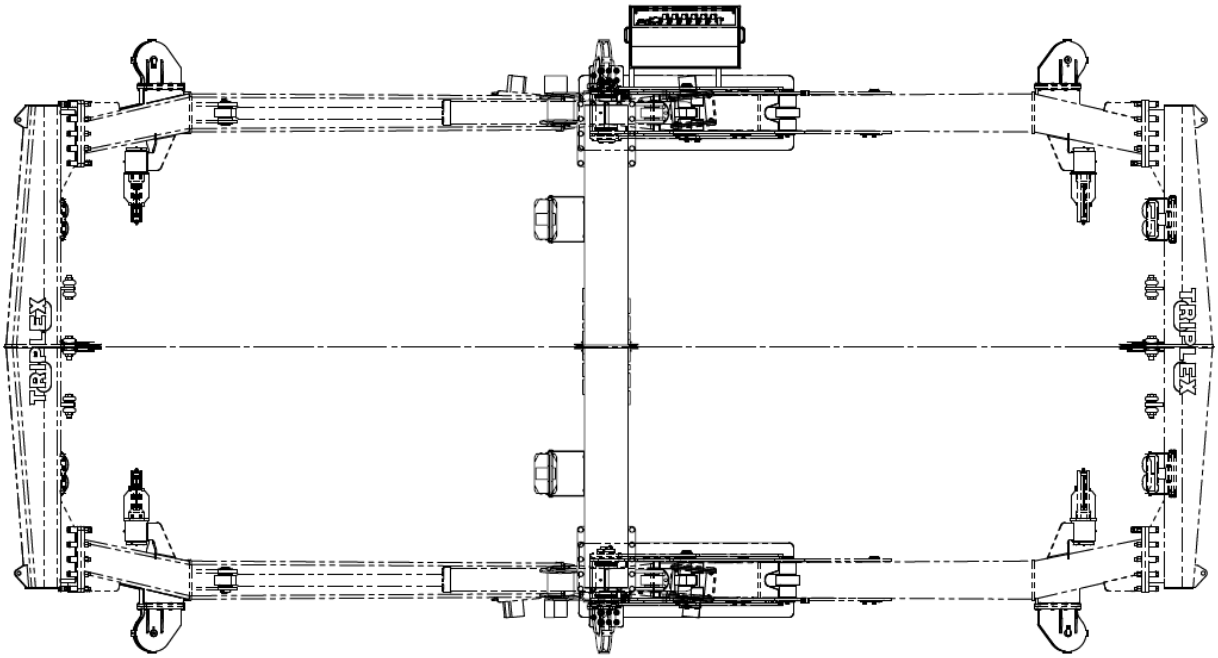

Illustration 4 – Stern A-Frame

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ITEM 2: 200 kN OVERHEAD CRANE

Illustration 5 – OHC Crane

DESCRIPTION
Complete OHC crane, including docking head (see ITEM 2.1 DOCKING HEAD) ● For installation to the hangar ceiling. The OCH is designed to launch and recover and ROV, with a dedicated lifting line winch mounted on the crane, routed through the Docking head.

#	TECHNICAL DATA - OHC			
A	According to dimensional sketch	20673		
1	Design line tension (cast pos.) – DL		200	kN
2	Luffing load- Auxiliary Winch (lashed) – SWL		6	Ton
3	Line Speed (on 2. Layer)		35	m/min
4	Working pressure		200	Bar
5	Recommended oil flow		220	L/min
6	Mass of rail (approx.)		4 500	Kg
7	Mass of moving parts (approx.)		10 000	Kg

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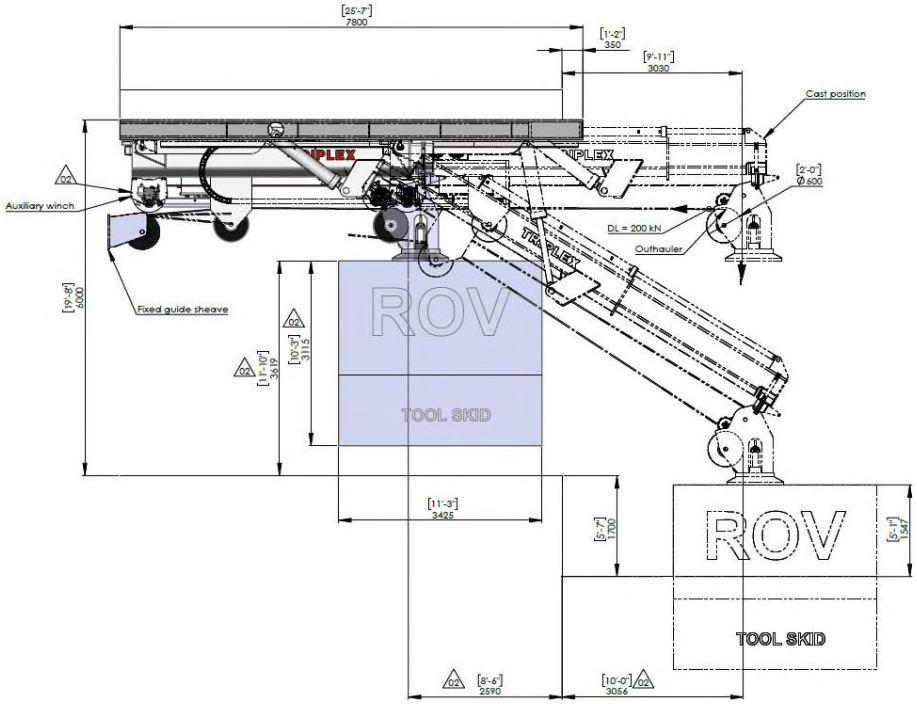

Illustration 6 –OHC Crane

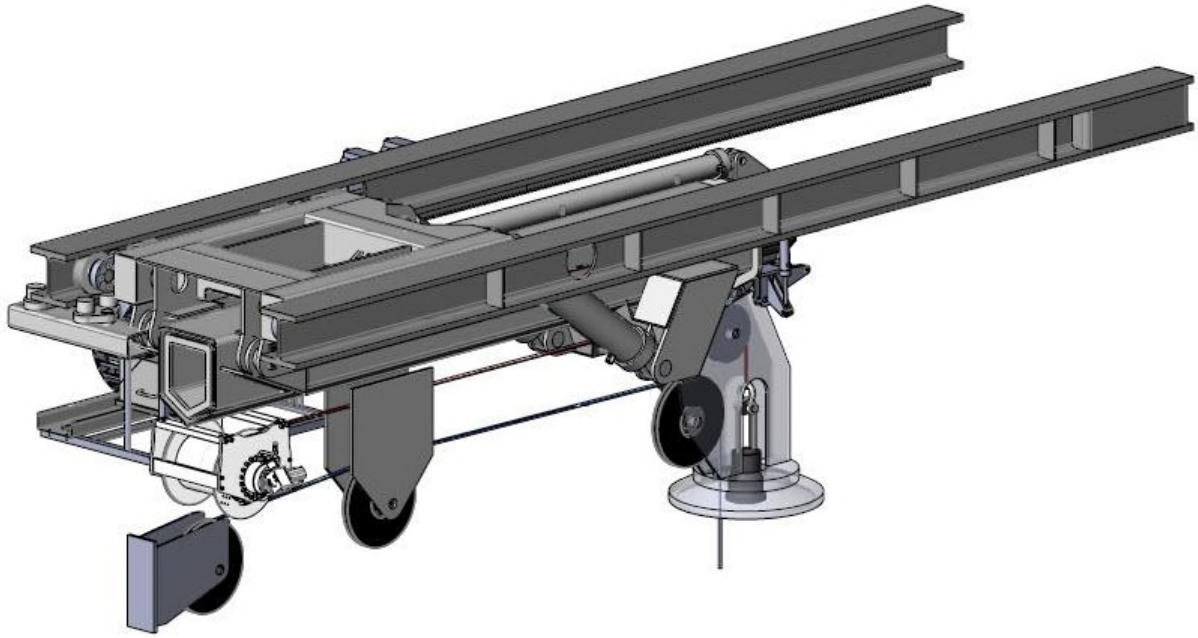

Illustration 7 –OHC Crane

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OHC CONTROLS (INCLUDING THE DOCKING HEAD)	
EMERGENCY CONTROL	Operated from levers on directional valves mounted in stainless steel cabinet with access through hinged hatch. The Emergency control cabinet can be located at a desirable location for optimal operation. This control is used for emergency operations. Normal operation is from the radio control panel.
RADIO REMOTE CONTROL 	The crane will be delivered with complete HBC radio control of all functions, including receiver cabinet with power supply and required relays. Portable control unit with belt, antenna in drip proof box, battery charger and two batteries are also included. Additional information: 1. All movement functions of the OHC will take place from this control panel. 2. All motions can be controlled at step-less variable speed (infinite variable) from zero to full speed. This includes the functions for the docking head. 3. Operating simultaneously different functions is fully possible. Each function will be clearly marked. 4. HPU with necessary performance can be started from a starter switch on the radio remote console.
CONTROL STATION PANEL HANGAR The control station panel will be delivered as a part of the Winch scope.	One (1) remote control panel for hangar control room with the following functions: 5. Start/Stop HPU 6. All movement functions of the OHC will take place from this control panel. 7. Emergency switch *Figure 2- Remote Control Panel*

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ITEM 2.1 DOCKING HEAD

Illustration 8–Docking Head

DESCRIPTION
One (1) docking head for handling a ROV with the max weight of 6 Ton The docking head is designed to be mechanically interfaced to the OHC. Its main purpose is to secure a ROV during launch and recovery at the side of the vessel. Load always in a vertical position during operation. Damping of transverse and longitudinal movements **Functions:** ● 180 deg rotating snubber ● ROV latching ● Lock swing in longitudinal direction Information about the Bullet is required before final drawing of the Docking Head can be released.

DOCKING HEAD CONTROL	
EMERGENCY CONTROL	See the control for the OHC (one common control).
RADIO REMOTE CONTROL 	See the control for the OHC. One common radio control.

ITEM 3: 3T CTD DAVIT

Illustration 9 –CTD Davit

DESCRIPTION
Complete CTD Davit, including docking head. ● For deck installation on vessel side (outside – open deck) Including sheaves to handle 0.322'' conducting cable and 0,393 EOM Cable

#	TECHNICAL DATA - CRANE		
A	According to dimensional sketch	20547	
1	DLT-P1 (cast position)	73,5	kN
2	SWT-P1 (towing in cast)	14	kN
3	Luffing load	12	kN
4	Working pressure at consumer	200	bar
5	Tilting time	18	s
6	Telescoping time	40	s
7	Recommended oil flow	80	l/min
8	Mass of crane (approx.)	6 400	kg
9	Mass of foundation	700	Kg

The information contained in this document is confidential and is for the attention of the named recipients only.

CTD DAVIT CONTROLS	
EMERGENCY CONTROL	Operated from levers on directional valves mounted in stainless steel cabinet with access through hinged hatch. The Emergency control cabinet can be located at a desirable location for optimal operation. This control is used for emergency operations. Normal operation is from the radio control panel.
RADIO REMOTE CONTROL 	The CTD davit will be delivered with complete HBC radio control of all functions, including receiver cabinet with power supply and required relays. Portable control unit with belt, antenna in drip proof box, battery charger and two batteries are also included. Additional information: 1. All movement functions of the CTD Davit will take place from this control panel. 2. All motions can be controlled at step-less variable speed (infinite variable) from zero to full speed. 3. Operating simultaneously different functions is fully possible. Each function will be clearly marked. 4. HPU with necessary performance can be started from a starter switch on the radio remote console.
CONTROL STATION PANEL The control station panel, will be delivered as a part of the Winch scope.	One (1) remote control panel for stern control room with the following functions: 5 Start/Stop HPU 6 One 2- ways joystick for the tilt function. 7 Emergency switch *Figure 3 - Remote Control Pane*

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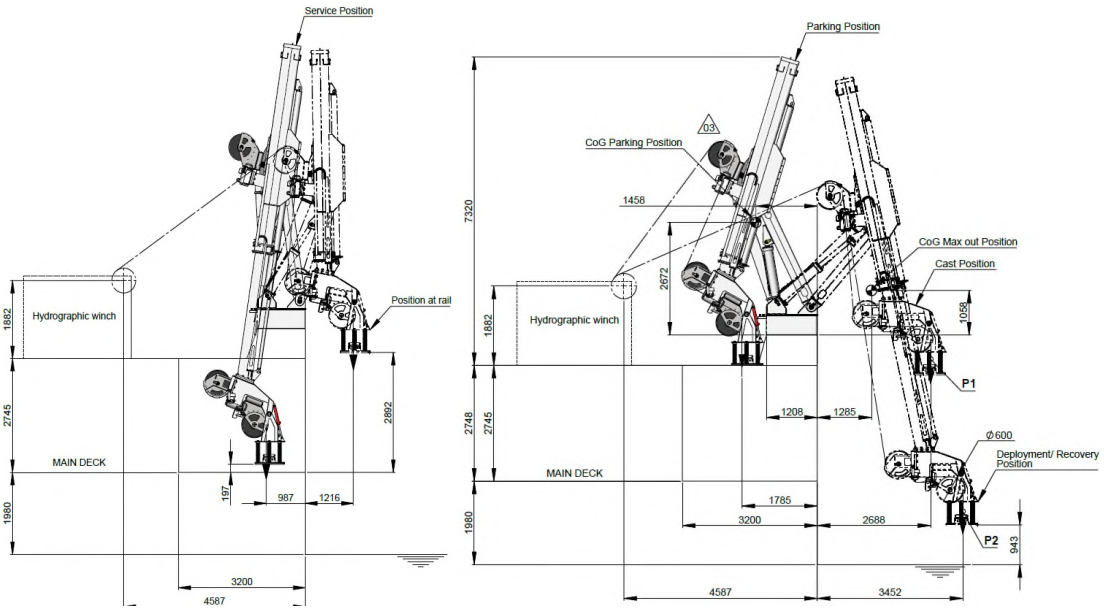

Illustration 10 - Dimensional drawings

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ITEM 4: 1ea 2x75kW HPU

Illustration 11 – HPU

DESCRIPTION
1 ea. Electro-Hydraulic Power unit. One unit dedicated to item 1-5. Electric motors 75 kW AC480V, 3-phase 60HZ IP 54, with direct- coupled (by flexible coupling) hydraulic variable displacement piston pumps. It will further be equipped with: ● Fill cap ● High pressure, return and drain filters ● Level & heating indicators ● Reservoir heater ● Low level switch for motor and reservoir heater stop ● Connections required for supply, return and drain ● Gate valves ● Gauges ● Manhole ● Drain connection with ball valve shut-off and plug ● Soft Starters for el. Motors with remote control connections ● The aggregates will have flexible rubber connections to the frame ● The HPU will be of low noise level type (low flow/pressure – pulsation led to low noise emission) ● Each pressure line from pumps equipped with pressure valve, pressure filter, check ● Oil Flow: 400 L/min (2 pumps with 200L/min each) ● Working pressure: 210 bar

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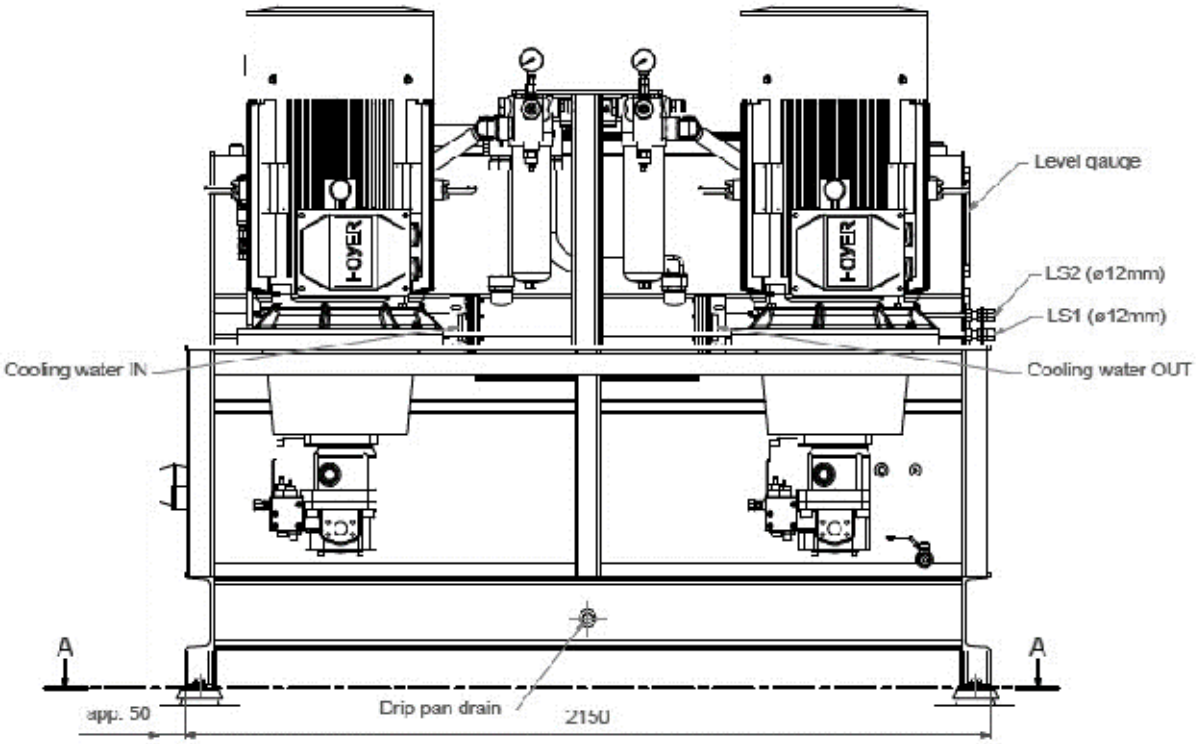

Illustration 12 – HPU

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ITEM 5: KN-75 CRANE

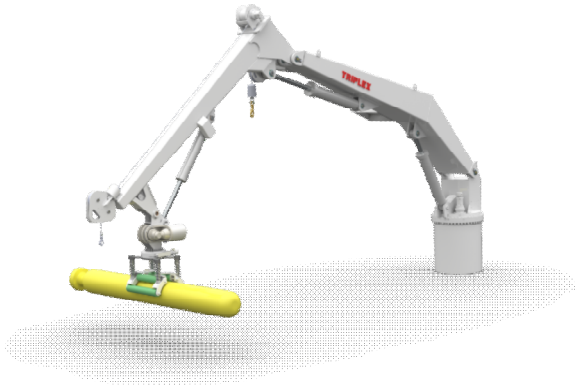

Illustration 13 – KN-75 crane

DESCRIPTION
Complete knuckle boom. Crane with two winches and docking head for AUV. The maximum reach of the winch hook (SWL 2.5 T) is 13.2 m. Winch with SWL 2.5 tons lifting capacity with 40 m certified wire and safety hook. Winch mounted on jib with wire guided through free-rotating double sheave head Separate winch with 8.2 tons lifting capacity with a maximum reach 9.0 m. Winch mounted on the main boom, with wire routed through a sheave on the side. Slewing angle is limited to 3x360°, to prevent damage on the electrical cabling for the Docking Head. The limitation system is equipped with alarms and indicators to help the operator during operation of the crane. Pedestal 1.395 m (to be agreed upon) with machined flange, including bolts and nuts for mounting of crane to pedestal. The pedestal has a hinged hatchway. AUV Docking Head, the crane will be equipped with all the necessary piping and cabling necessary for the AUV docking Head in item 5.1

#	TECHNICAL DATA - CRANE		
A	According to dimensional sketch	23460	
B	Type of crane	Shipboard	
2	Dimensioned lifting capacity	75	Tm
3	SWL-1 in port or at sea	2.5	Tons
4	SWL-2 in port	8.2	Tons
5	SWL-3 AUV Docking Head	1.0	Tons
6	Slewing torque	150	kNm
7	Slewing angle	360 °	°
8	Working pressure	230	Bar
9	Line speed at rec. flow	30	m/min
10	Required oil supply	200	l/min
11	Max heel when slewing	10	°
12	Slewing speed	1.0	Rpm

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13	Weight without crane pedestal, approx.	11 560	Kg
14	Weight crane pedestal, approx.	1 200	Kg

#	TECHNICAL DATA – CRANE PEDESTAL	
A	Dimensional drawing of pedestal:	TBA-rev
1	Height of pedestal	to be agreed upon
2	Location of service hatch(es)	to be agreed upon

CRANE CONTROLS	
EMERGENCY CONTROL	Operated from levers on directional valves mounted in stainless steel cabinet with access through hinged hatch. The Emergency control cabinet can be located at a desirable location for optimal operation. This control is used for emergency operations. Normal operation is from the radio control panel.
RADIO REMOTE CONTROL	The crane will be delivered with complete HBC radio control of all functions, including receiver cabinet with power supply and required relays. Portable control unit with belt, antenna in drip proof box, battery charger and two batteries are also included.
	Additional information: 1. All movement functions of the crane and both winches take place from this control panel. 2. All functions of the Docking Head take place from this control panel. 3. All motions can be controlled at step-less variable speed (infinite variable) from zero to full speed. 4. Operating simultaneously different functions is fully possible. Each function will be clearly marked. 5. HPU with necessary performance can be started from a starter switch on the radio remote console.

ADDITIONAL		
DESCRIPTION	**INCLUDED / NOT INCLUDED**	**INFORMATION / REFERENCE**
MOPS (Manual Overload Protection System)	☐ Included ☒ Not Included	Only applicable for offshore cranes
AOPS (Automatic Overload Protection System)	☐ Included ☒ Not Included	Only applicable for offshore cranes
Constant tension (CT)	☐ Included ☒ Not Included	
Personnel Lift	☐ Included ☒ Not Included	
Operators Platform	☐ Included ☒ Not Included	
Operators Cabin	☐ Included ☒ Not Included	
Crane Boom Rest	☐ Included ☒ Not Included	
Floodlights	☒ Included ☐ Not Included	1 x LED
Load Indicator	☐ Included ☒ Not Included	
Lubrication system	☐ Included ☒ Not Included	

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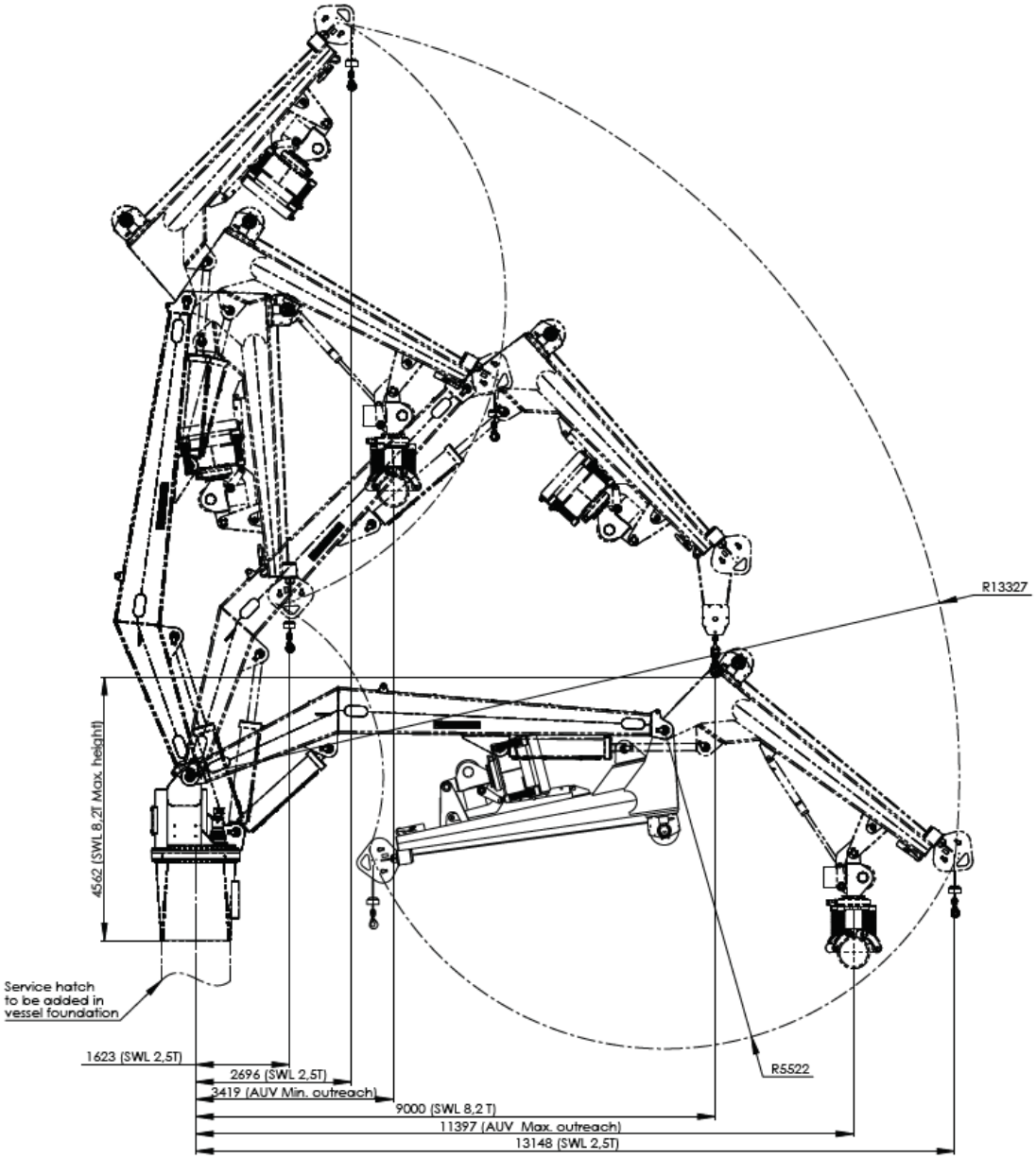

Illustration 14 –KNR-75 with Docking Head

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ITEM 5.1 AUV DOCKING HEAD

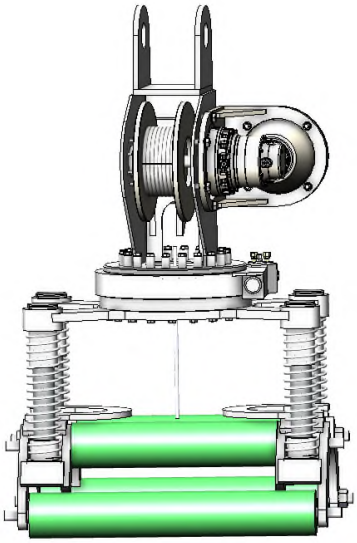

Illustration 15 –AUV Docking Head

DESCRIPTION
AUV Docking head mounted on the crane as shown in illustration 10, and all functions can be controlled by the crane's radio remote control. The docking head will be equipped with one electrical winch for securing the AUV during Launch and Recovery, the winch will have a hook which is manually attached or detached to the lifting point of the AUV-

TECHNICAL DATA DOCKING HEAD According to dimensional sketch 23412	
Working Pressure	230 Bar
AUV Max weight	1 Ton
DAF (inboard)	1.7
DAF (Outboard)	2.25
Mass of Docking Head (approx.)	1 400 kg

DOCKING HEAD CONTROL	
EMERGENCY CONTROL	See the control for the Main Crane (one common control).
RADIO REMOTE CONTROL	See the control for the Main Crane. One common radio control.

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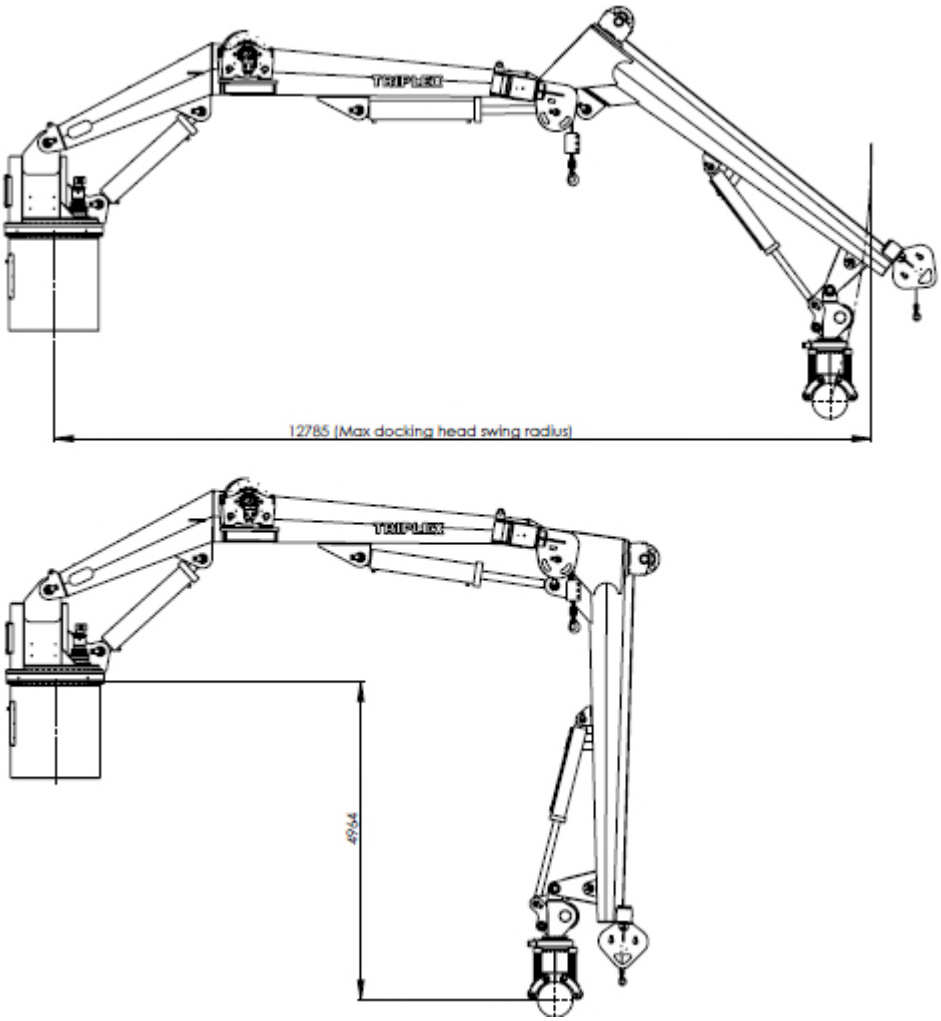

Illustration 16 –KN-75 with Docking Head

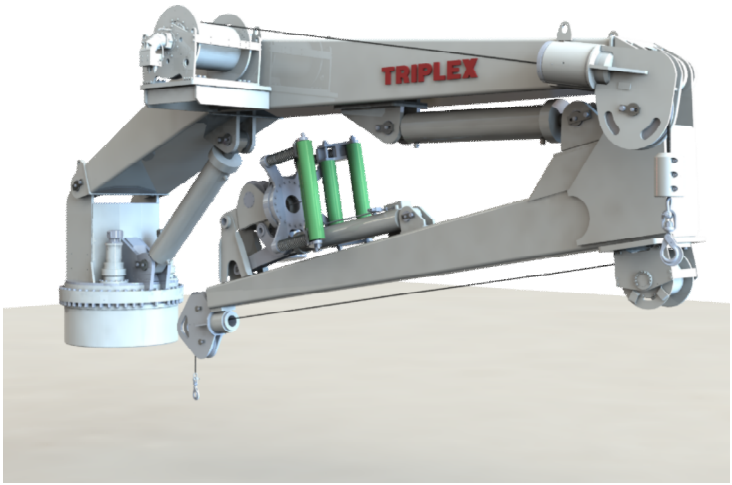

Illustration 17 –KN-75 with Docking Head

1

GENERAL TERMS, DOCUMENTATION AND ASSISTANCE

CONTACT PERSON / PROJECT MANAGER

Contact person (single point of contact) and/or project manager:
Will be appointed and presented towards a confirmed order.

LICENSE PRODUCTION / COUNTRY OF ORIGIN

Macgregor Norway AS has an international production and service organization.
The products, components and services in this technical specification may have countries of origin other than Norway.

SPARE PARTS

To Be Considered

START-UP ASSISTANCE

Macgregor service engineer to perform:

- technical supervision and inspection of installation
- start-up

STAGE	DESCRIPTION	DAY(S)
1	Shop Inspections and Factory Acceptance Tests (FAT) for the handling system at our site in Europe.	
2	Technical assistance and inspection of installation at the shipyard	12 days
3	Start up and Performance Test at the shipyard (HAT)	8 days
4	Training of the crew	12 days

A total stay of 32 days (two trips) at the yard is included.

Training of crew at the yard includes one session in the classroom and one session onboard.

Lodging and travel expenses are included.
Each working day shall not exceed 10 hours and shall be executed mainly during normal working hours and normal working week, between Monday and Friday.

If the allocated number of work hours for supervision and trials are exceeded due to reasons and delays at the yard which are beyond Macgregor's control and/or responsibility, Macgregor will charge EUR 1 890,- per service engineer per additional working day at the yard, plus expenses.

We require a notice from the customer/yard 30 days before such assistance is to be performed. We also require the customer/yard to fill out a "pre commissioning checklist" to make sure that everything is ready for us to start working. This shall be returned to Macgregor at latest 30 Days before commissioning.

The information contained in this document is confidential and is for the attention of the named recipients only.

DOCUMENTATION

Included for the equipment listed in "scope of supply".
Delivered electronically (PDF file / DWG file) to the customer/shipyard.

When the below listed terms are confirmed by the customer by **July 2021**, we commit to the following documentation time schedule:

1. Signed contract
2. Approval of technical specification
3. Confirmation of cable/wire size and type including technical data
4. Confirmed vessel GA (for designing wire routing and related sheaves)

DOCUMENTATION TIME SCHEDULE:

MECHANIC / HYDRAULIC / ELECTRIC DOCUMENTATION		
WHAT	**WHEN**	**DESCRIPTION**
Priority 1	**End of November 2021**	1. Outline dimensions of all major equipment 2. Pedestal / foundation drawing 3. Load to deck + Weight and COG
Customer to provide comments/approval of the above priority 1 documentation within 14 days – after the documentation is sent from MacGregor Norway, Triplex site. *Priority 1.1, 1.2, 1,3 documentation requires customer approval by date, signature and/or company stamp.*		
Priority 2	**End of February 2022**	1. Hydraulic main piping diagram 2. Electric single-line diagram of the system 3. Outline dimensions of cabinets, panels and other smaller items

TEST PLANS AND INSTALLATION DOCUMENTATION		
WHAT	**WHEN**	**DESCRIPTION**
Priority 3	**End of July 2022**	1. FAT test plan and procedure 2. Draft HAT test plan and procedures 3. Complete installation documentation and related procedures 4. Detailed electric single-line diagram of the system with cable dimensions and locations 5. Piping diagrams with locations and size of pipe connections, flexible hoses and counter flanges

OPERATIONAL MANUAL		
WHAT	**WHEN**	**DESCRIPTION**
Priority 4	**6 weeks** *(from the last equipment shipping date)*	Operational manual to be delivered (electronic – pdf format) in English language including: 1. All relevant drawings with part lists and specifications 2. Operational instruction for the system 3. Lubrication charts 4. Manufacturer´s test certificates 5. Manufacturing Record Book (MRB) / as build drawings

NOTE: *The delivery dates for documentation (priority 1 to 4) and the equipment delivery dates are only valid when comments/approval from customer/shipyard is received within the above deadlines.*

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SURFACE TREATMENT PROCEDURE

Macgregor has developed its own surface treatment procedures. Please see procedure and painting specification below.

All above quoted equipment will be delivered surface treated according to our standard specification:

SURFACE PREPARATION			
STEP	**DESCRIPTION**	**QUALITY**	**STANDARD**
1.1	All parts are grit blasted to standard:	Sa 2,5	ISO 8501-1 (2007)
1.2	Roughness	min. segment 2 (G 201) 50-70 µm (microns)	ISO 8503-1 (2012)
COATING			
STEP	**DESCRIPTION**	**QUALITY**	**STANDARD**
2.	Metallized (thermally sprayed with sink, Zn)	75 µm	
3.	All surfaces: Applied "tie-coat"	40 µm	Carboguard E 19
	Welds, corners, angles & notches: "stripe-coat"		Carboxane 2000 WG
4.	All surfaces: Applied full coat	125 µm	Carboxane 2000 WG
5.	Topcoat applied, all surfaces:	75 µm	Carboxane 2000 TC
Total film thickness included thermally sprayed zinc: **315 microns**			

GENERIC TYPE: Two component silane modified multi-polymer.
Compatible coatings: Zinc epoxies, polyurethanes, most epoxies or others as recommended by Carboline Norge AS.

Coating system in accordance with the requirements in NS-EN ISO 12944-5 (C5-M).

Surface treatment is according to MACGREGOR NORWAY AS, Triplex site standard.

Alternative treatment and paint type / quality can be agreed at an additional cost within 2 months after signing the contract.

Ref: 5.1.0 SURFACE TREATMENT

Section 4

Operating Instructions

Main Mechanical Drawings

DESCRIPTION	DOC/DRW #	REV #	PAG #
CTD Winch	2000004676	B	4
Traction Winch	400092475	A	5
Levelwind with Slack Wire Compensator	400092566	A	7
Storage Drum	400092447	C	8
Aux Winch ROV Overhead Crane	2000003571	D	9
Aux Winch KN-75 Main Crane Docking Head	2000004293	D	10
Aux Winch A-Frame	SE-27	-	11
Aux Winch KN-75 Main Crane	SE-45V	-	12
A-Frame	20549	A	13
ROV Overhead Crane	20673	A	14
CTD Davit	20547	A	15
KN-75 Main Crane	23460	A	16

Section 4

Operating Instructions

Hydraulic Diagrams

DESCRIPTION	DOC/DRW #	REV #	PAG #
Brake and Cooling System	2000004171	A	17
HPU Gear Cooling	2000008163	A	18
HPU Brake	2000008113	A	19
CTD Winch	RH411171	A	20
Traction Winch	RH411181	C	21
Storage Drum	RH411171	A	22
Levelwind with Slack Wire Compensator	RH319631	F	23
Deck Handling Equipment	S1739	05	24
A-Frame	24854	A	25
KN-75 Main Crane	24855	A	26
CTD Davit	24856	A	27
ROV Overhead Crane	24857	B	28

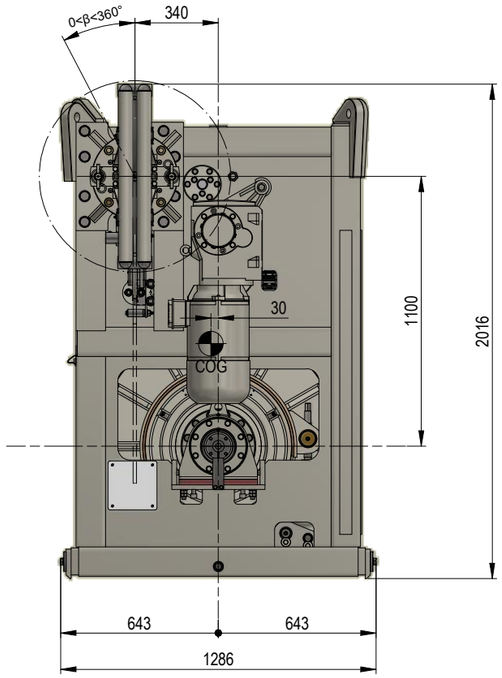
Section 4

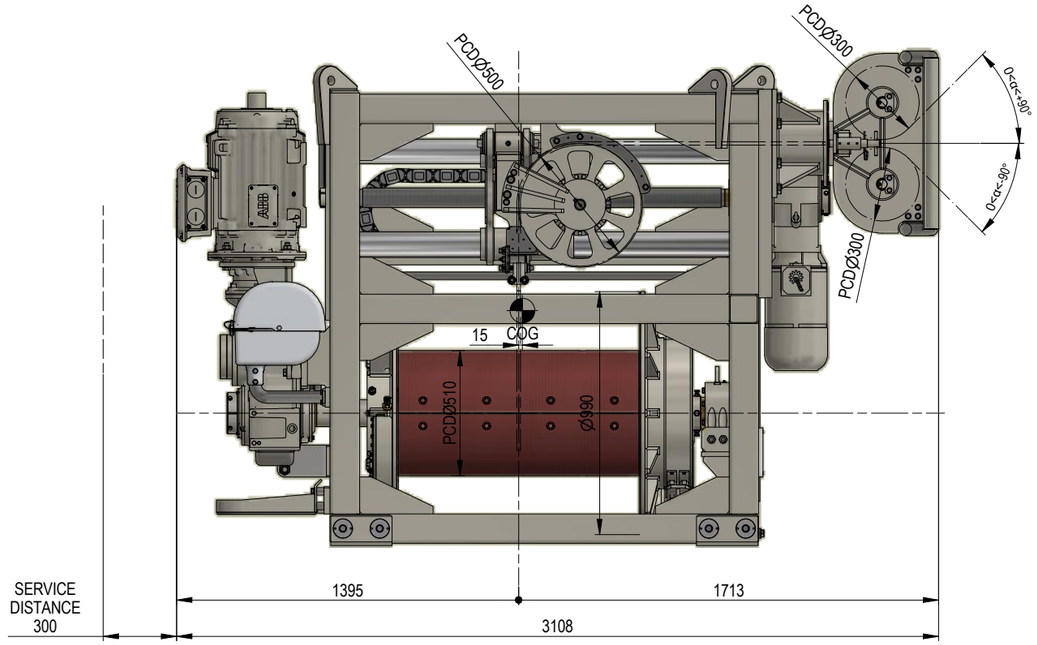
Operating Instructions

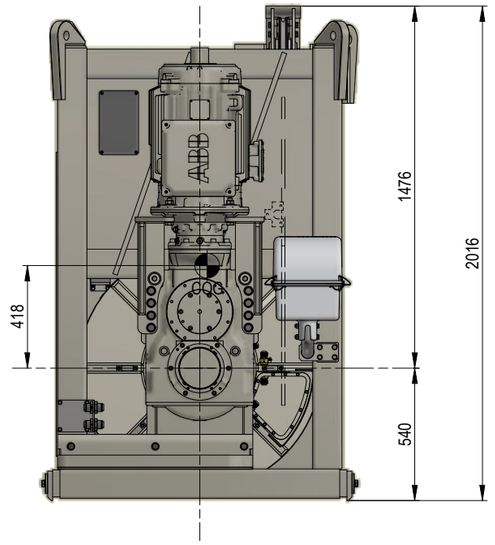
Electrical Diagrams

DESCRIPTION	DOC/DRW #	REV #	PAG #
Winches			
Electrical Documentation	10070	I	30
Deck Handling Equipment			
General	E-4500	5	217
A-Frame	E-4501	4	225
ROV OHC	E-4502	4	268
CTD Davit	E-4503	7	326
Main HPU	E-4504	4	355
KN-75 Main Crane	E-4505	6	391
Control Panels			
Drive Cabinet	2000005807	A	431
Control Panel Overview	2000005332	D	432
Deck Control Panel	2000004949	A	433
Control Room Panel	2000003404	B	434
Bridge Panel	2000005997	A	435
Aft Control Room Panel	2000005996	A	436
Aft Control Room Panel	2000005995	A	437

Section 4

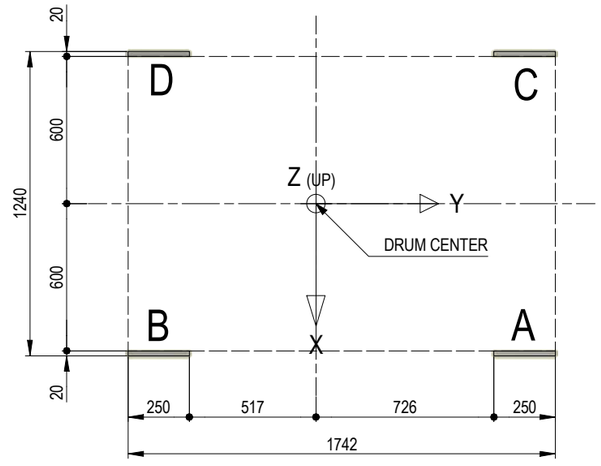


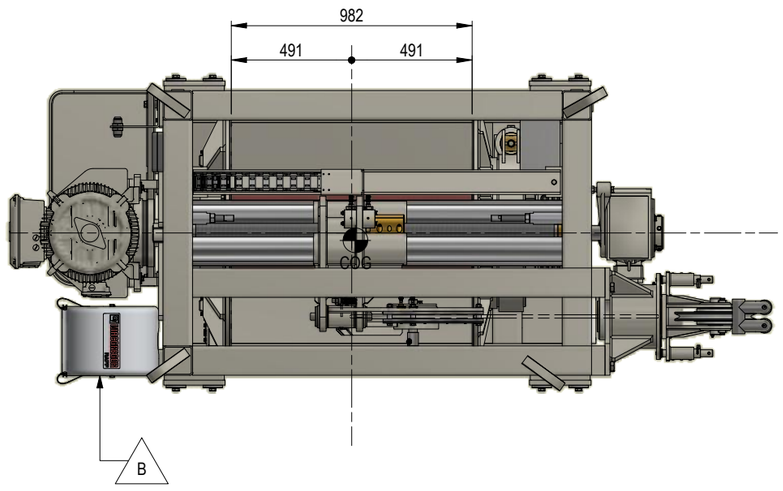


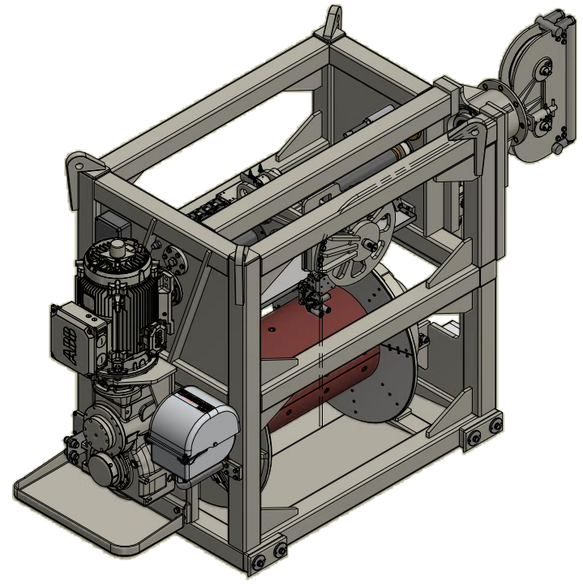


ISO VIEW (1 : 30)

FOUNDATION PLAN
A (1 : 25)







Old number - RH330463

NOTE:
For specific foundation forces, contact MacGregor

B

Unspecified Tolerances According to:	
Standard	Tolerance Class
NS-ISO 2768-1	m Medium
NS-ISO 2768-2	K

Designed by	Date	Modified by	ECO / CO			
RZAVA	05.11.2021.	P Pantovic	ECO-2056698			

MACGREGOR

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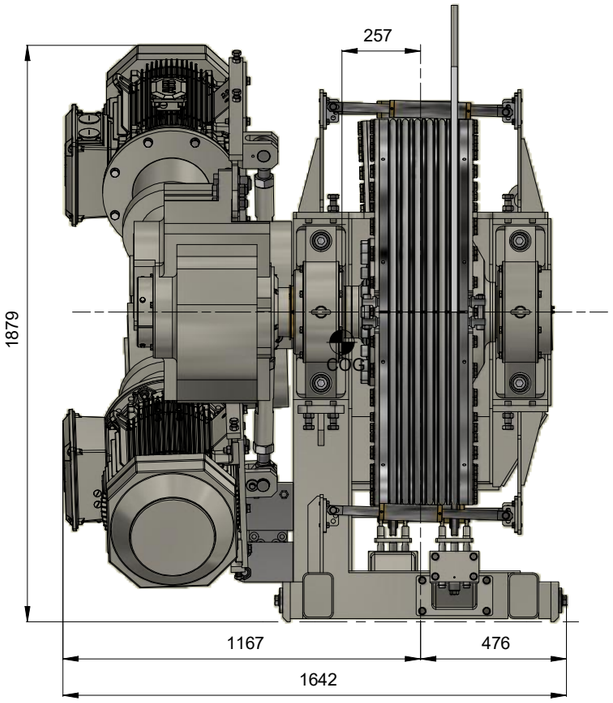
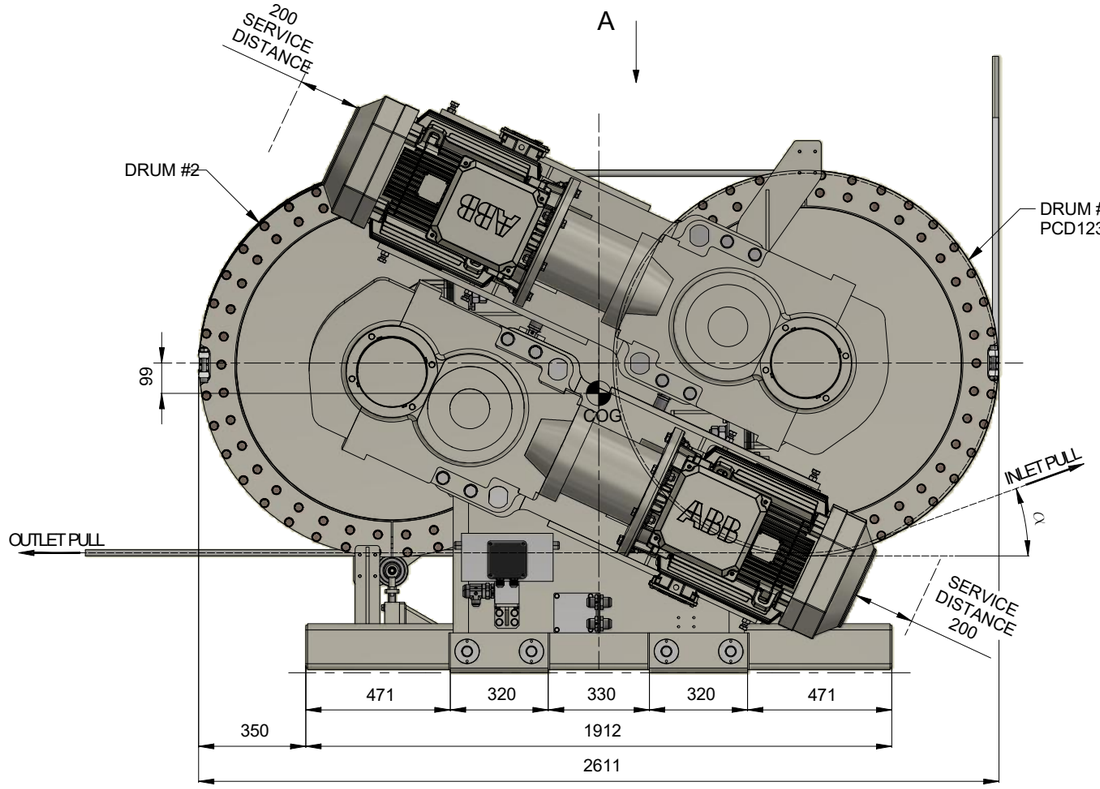
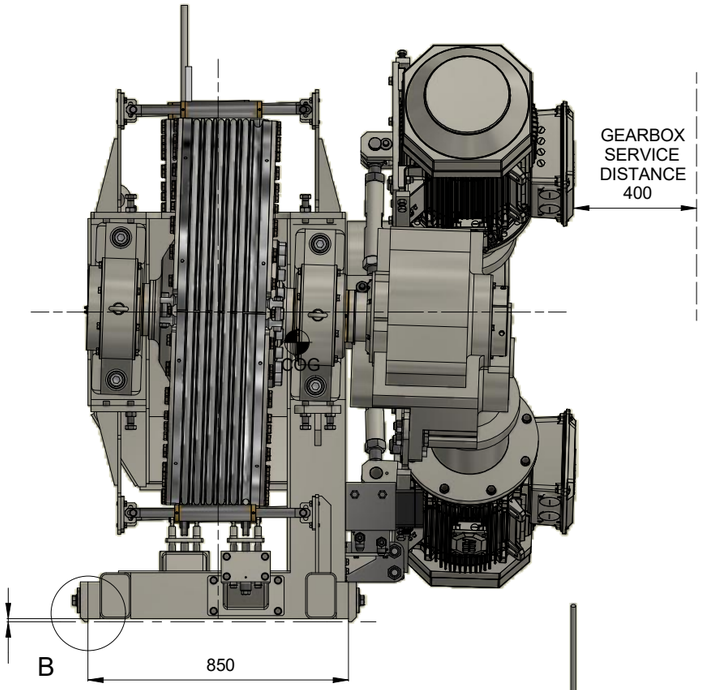
Name	Weight (kg)
DIMENSIONAL SKETCH	4250
Description	**Scale (A3)**
HW-515E-F-T90/URP	1 : 25
Document ID	**Revision** / **Sheet**
2000004676	B / 1 / 1







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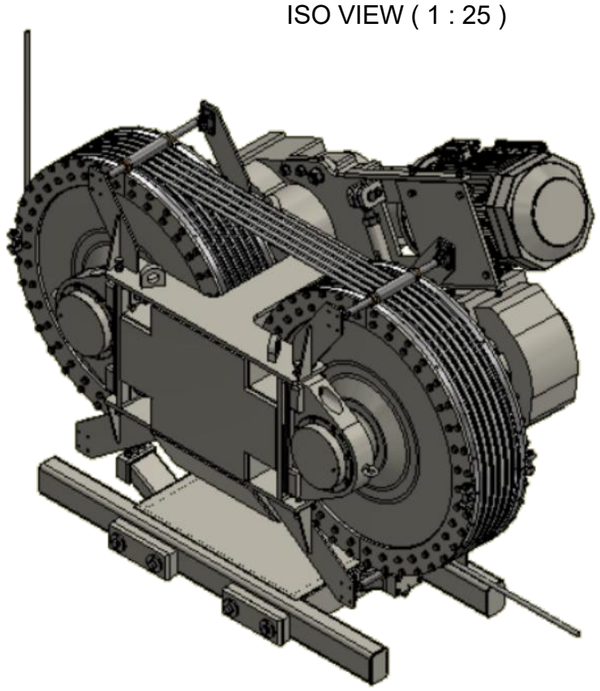

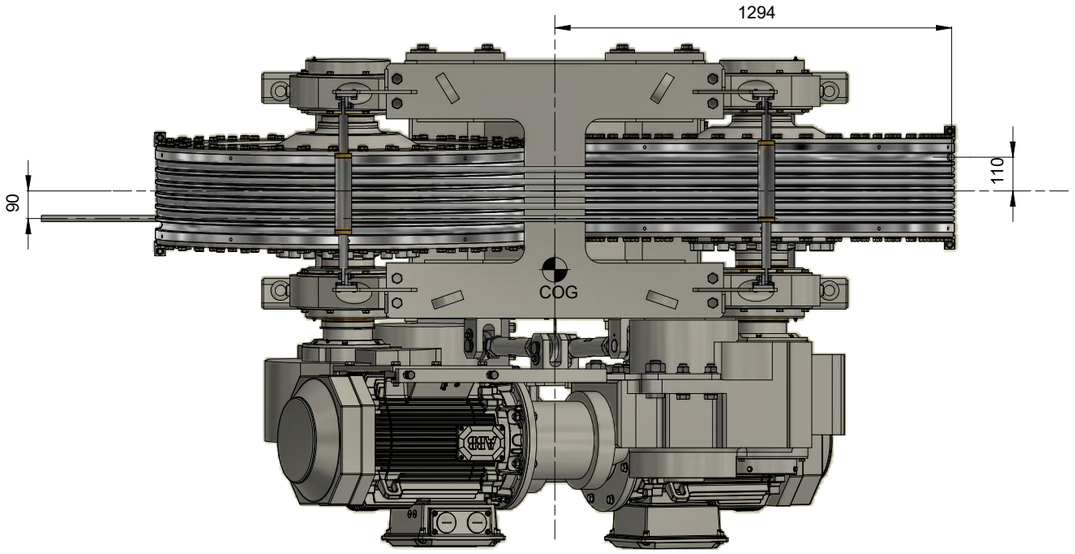

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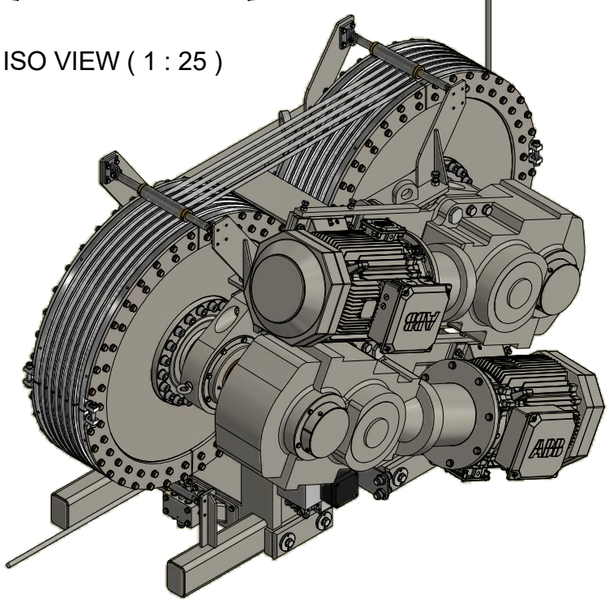

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
1		Issued for comments	04.10.2019.	RHDHN
2		Sales number RH329031 replaced with production number	13.10.2021/RZPPA	RZPPA
A		Production model introduced	26.10.2021/PETRODO	RZPPA

Weight 7400 kg

Scale (A3) 1 : 20 *Sheet* 1 / 2

TRACTION WINCH
TRW-4004E-01R1
DIMENSIONAL SKETCH

MACGREGOR
Designed to perform with the sea

Drw number 400092475-DIM

Material (for part)

Status Proposal

Drawn by / Date (dd/mm/yy) IVITOD 04.10.2019.

Checked by / Date (dd/mm/yy) RHDHN 04.10.2019.

Partlist

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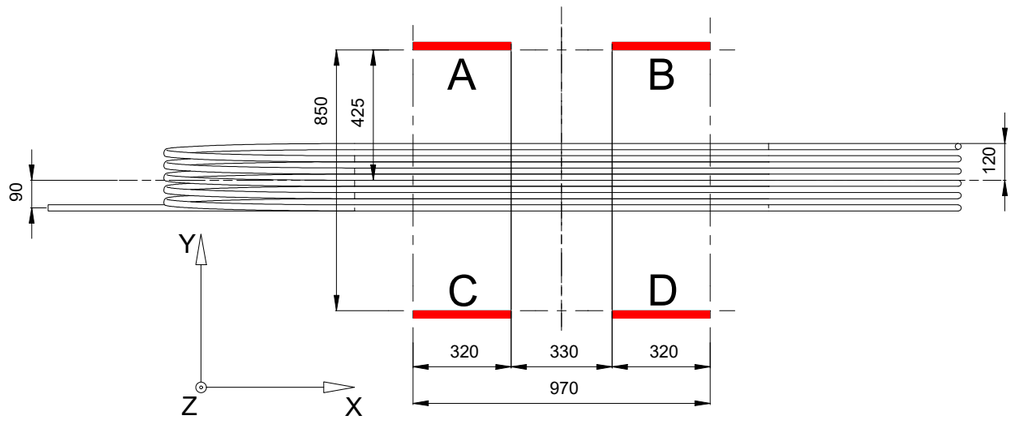
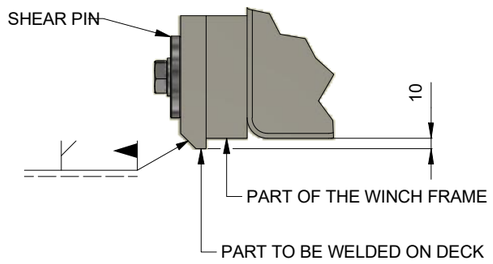
ALTERNATIVE #1
WELDED CONNECTION

FOUNDATION PLAN (1 : 20)
WELDING PADS

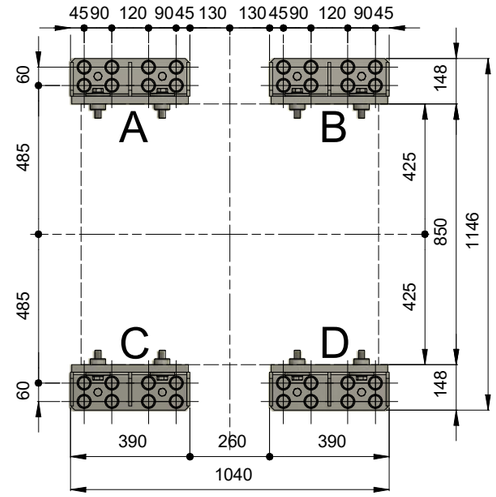


WELDING PAD DETAIL
B (1 : 6)

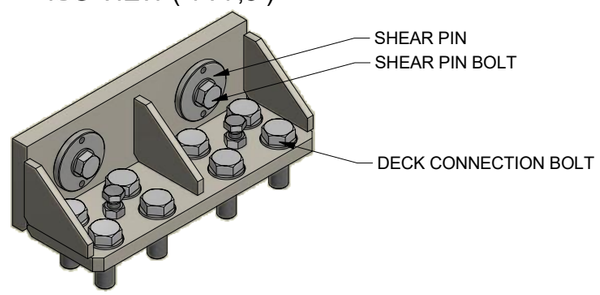


ALTERNATIVE #2
BOLTED CONNECTION

FOUNDATION PLAN (1 : 20)
BOLTED CONNECITON



BOLTED CONNECTION DETAIL
ISO VIEW (1 : 7,5)



TIGHTENING TORQUE:
SHEAR PIN BOLTS - M20 - 250 Nm
DECK CONNECTION BOLTS - M24 - 665 Nm
Apply threadlocker (Loctite 243 or similar) on all threads

For specific foundation forces, please contact RAPP MARINE.

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
1		Issued for comments	04.10.2019.	RHDHN
2		Sales number RH329031 replaced with production number	13.10.2021/RZPPA	RZPPA
A		Production model introduced	26.10.2021/PETRODO	RZPPA

Weight 7400 kg	TRACTION WINCH TRW-4004E-01R1 DIMENSIONAL SKETCH			MACGREGOR Designed to perform with the sea
Scale (A3) 1 : 20 *Sheet* 2 / 2				*Drw number* 400092475-DIM
Material (for part)	*Status* Proposal	*Drawn by / Date (dd/mm/yy)* IVITOD 04.10.2019.	*Checked by / Date (dd/mm/yy)* RHDHN 04.10.2019.	*Partlist*

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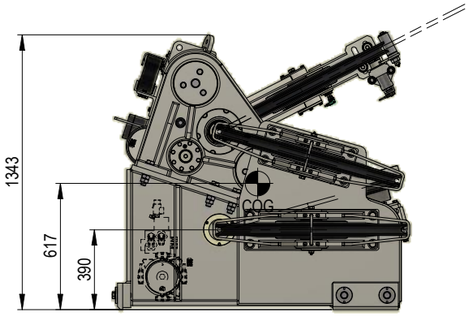
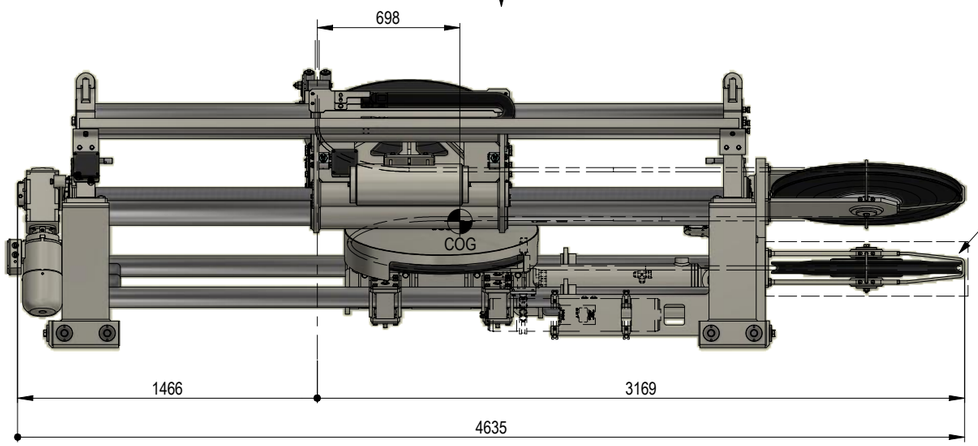
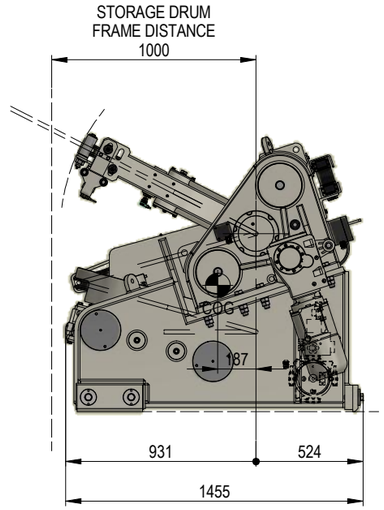
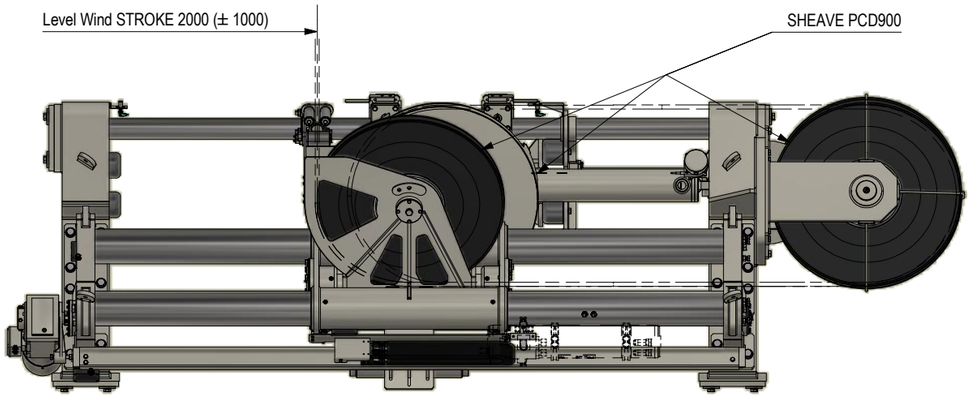
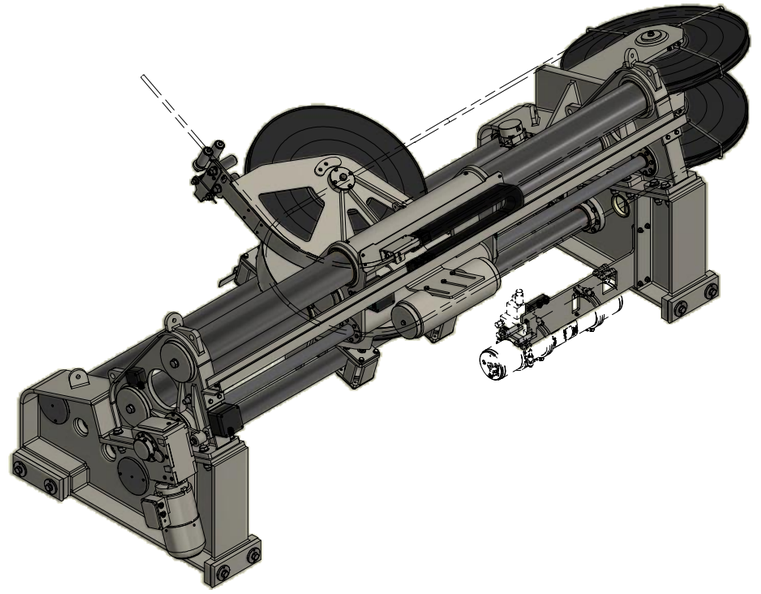


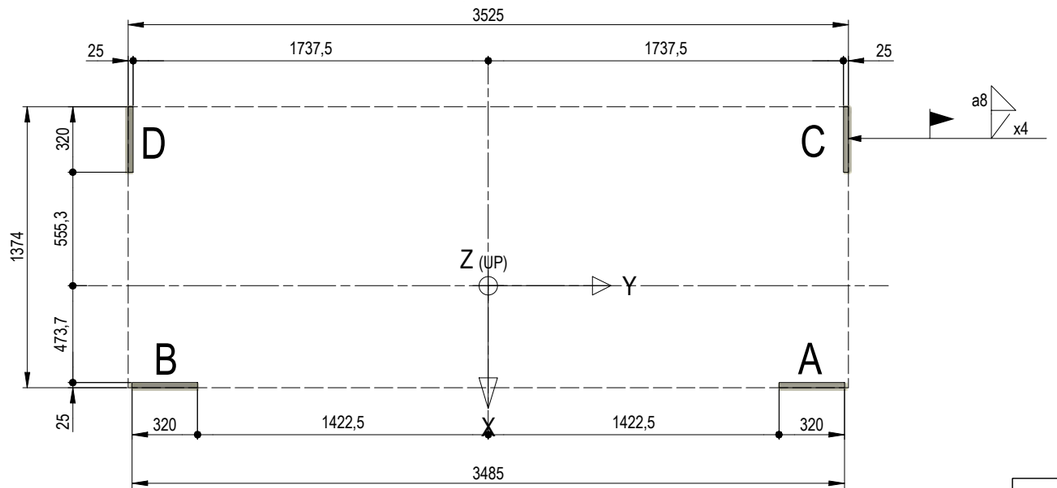








FOUNDATION PLAN
A (1 : 30)



NOTE:
For specific foundation forces, please contact MACGREGOR.

Unspecified Tolerances According to:	
Standard	Tolerance Class
NS-ISO 2768-1	m Medium
NS-ISO 2768-2	K

Designed by	Date	Modified by	ECO / CO
P Pantovic	27.12.2021.	P Pantovic	ECO-2056483

MACGREGOR

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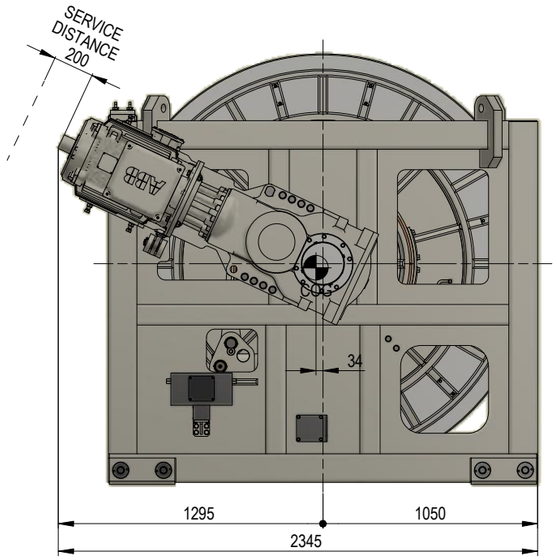
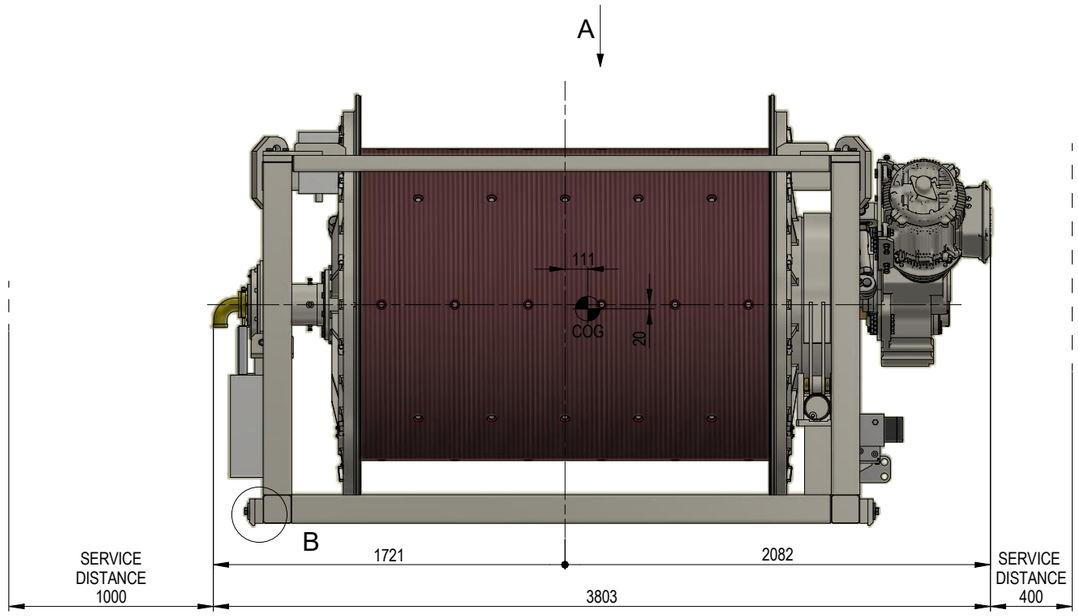
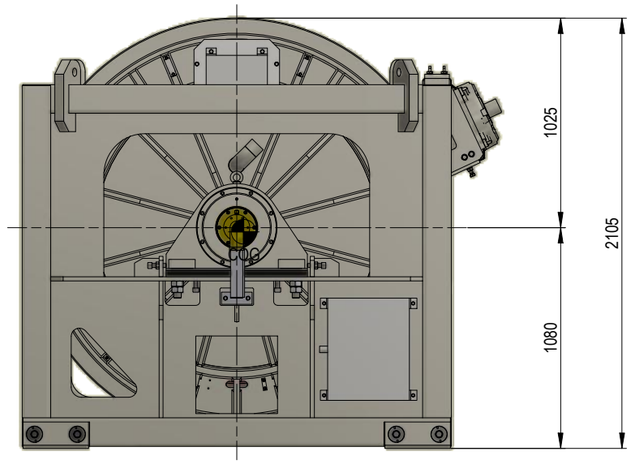
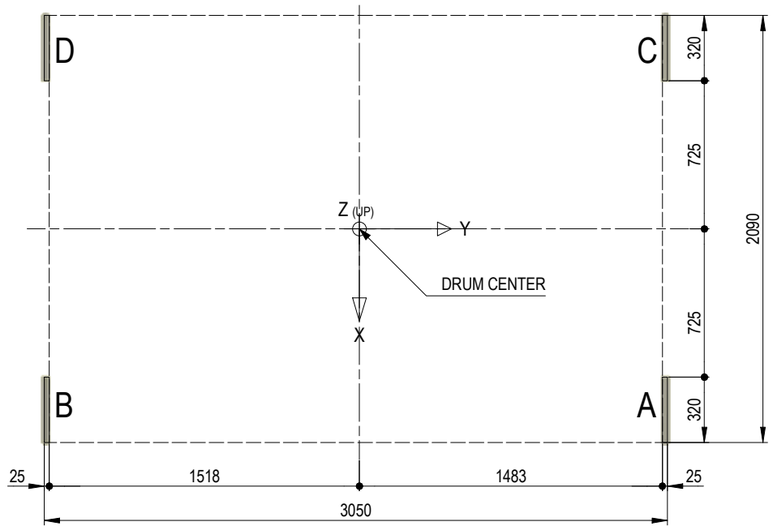
Name	Weight
DIMENSIONAL SKETCH	4540 kg
Description	Scale (A3)
LEV. WITH SLACK WIRE, LSWC5000/01L1	1 : 30
Document ID: 400092566-DIM	Revision: A / Sheet: 1 / 1

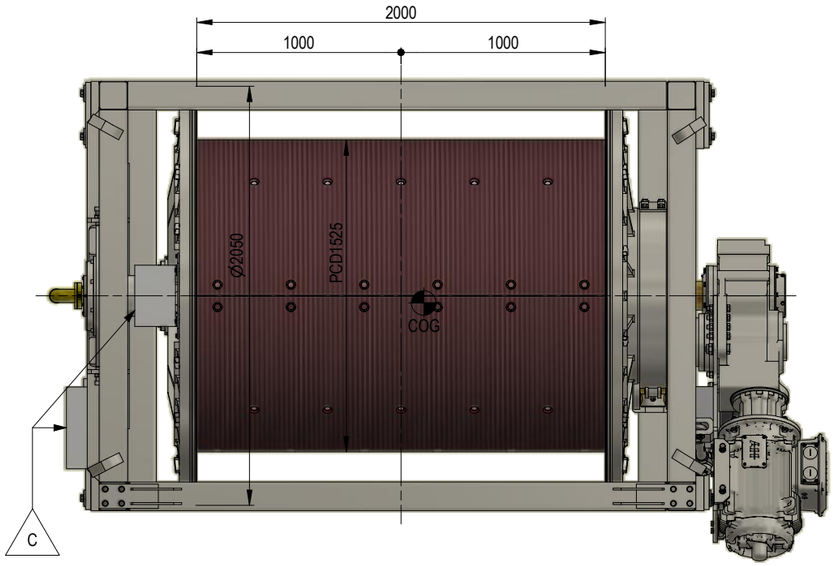




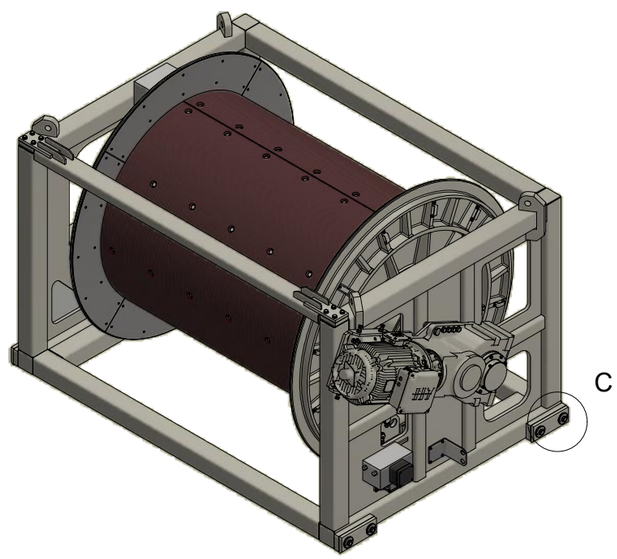


FOUNDATION PLAN
A (1 : 30)



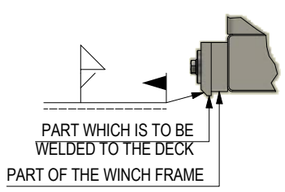


ISO VIEW (1 : 40)

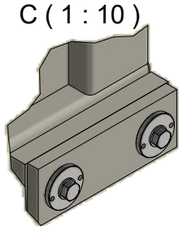


WELDING PAD DETAIL

B (1 : 15)



C (1 : 10)



NOTE:
For specific foundation forces, please contact MACGREGOR.

Designed by	Date	Modified by	ECO / CO			
RZAVA	02.08.2019.	P Pantovic	ECO-2056896			

MACGREGOR

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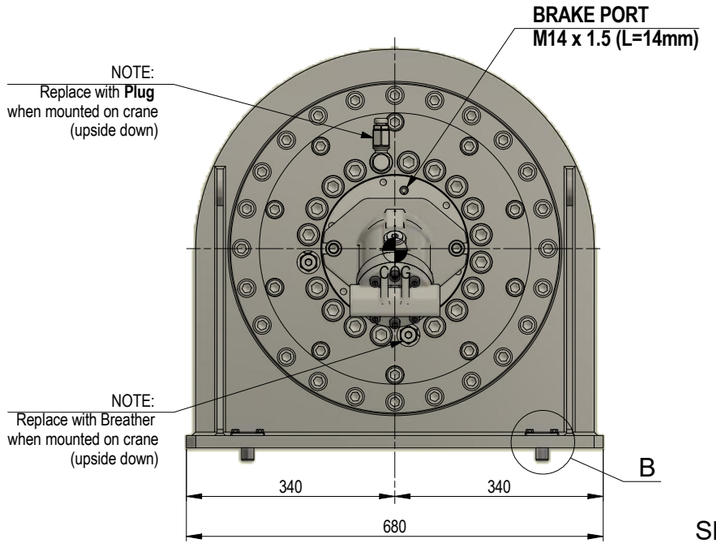
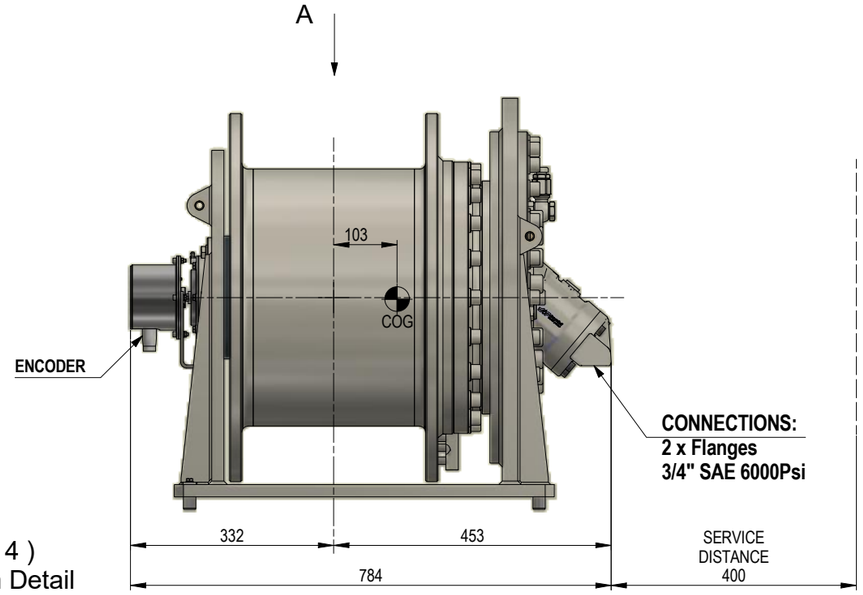
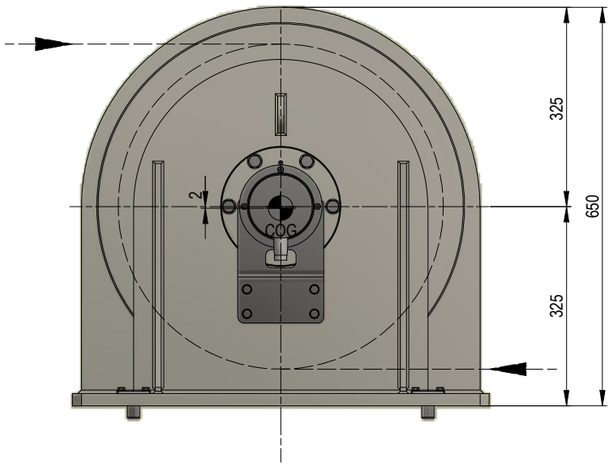
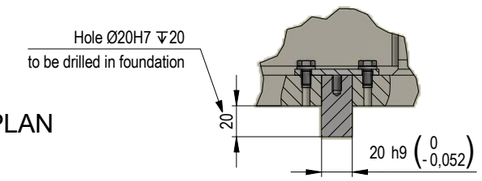
Name		Weight
DIMENSIONAL SKETCH		9500 kg
Description		Scale (A3)
RW-2372BS, OLN		1 : 30
Document ID	Revision	Sheet
400092447-DIM	C	1 / 1



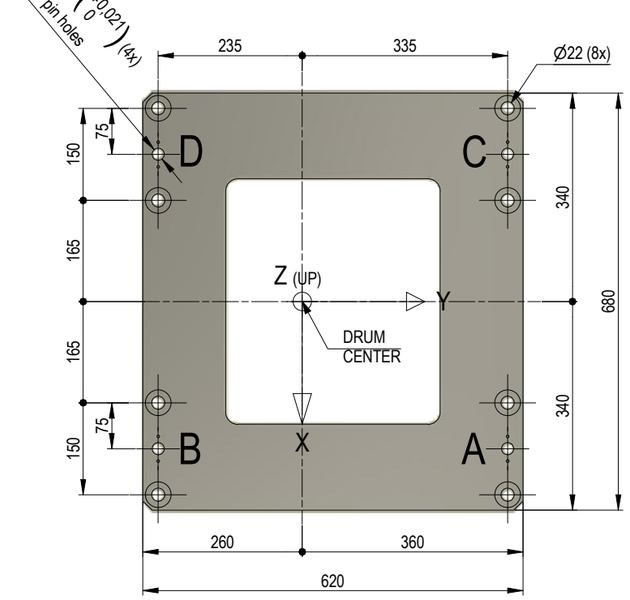


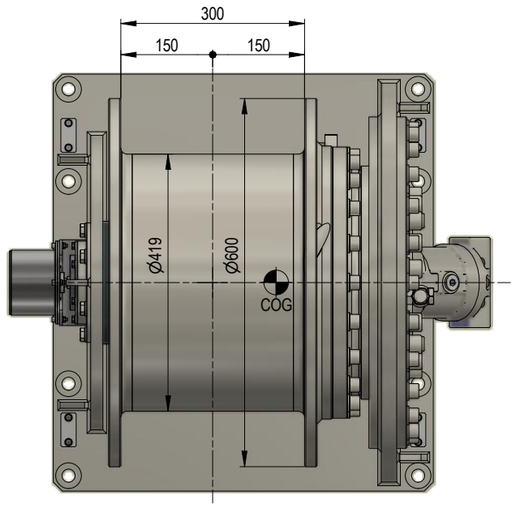


B (1 : 4)
Shear Pin Detail

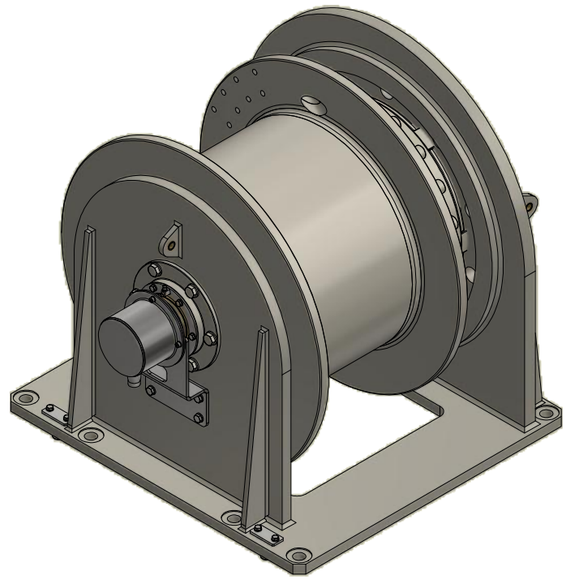


FOUNDATION PLAN
A (1 : 10)





ISO VIEW (1 : 10)



Requirements:
1. Foundation deflection - ref. dwg. RH315495
2. Foundation/brake bolts: M20, grade 8.8. Tightening torque 385Nm.
3. Alignment and installation instruction as per order conf. and tech.spec.
4. Shear pins to be used instead of stop blocks.

Foundation forces:
For specific foundation forces, contact Macgregor

NOTE:
Make sure that not less than 5 windings of rope is left on drum during operation!

Designed by	Date	Modified by	ECO / CO			
I Todorovic	30.11.2021.	B Simic	ECO-2058000			

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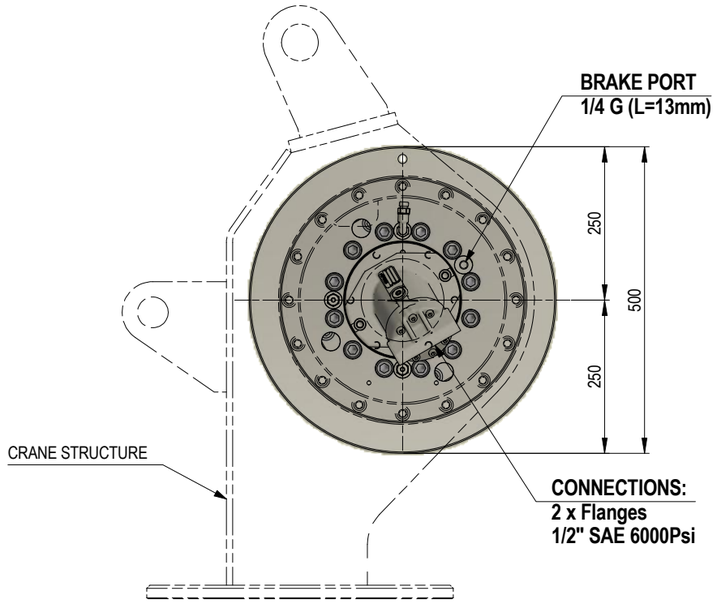
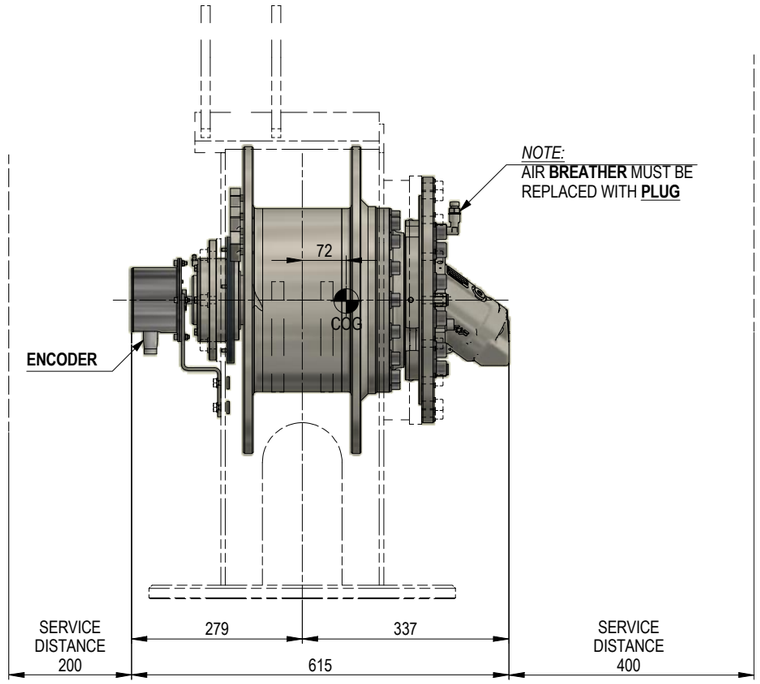
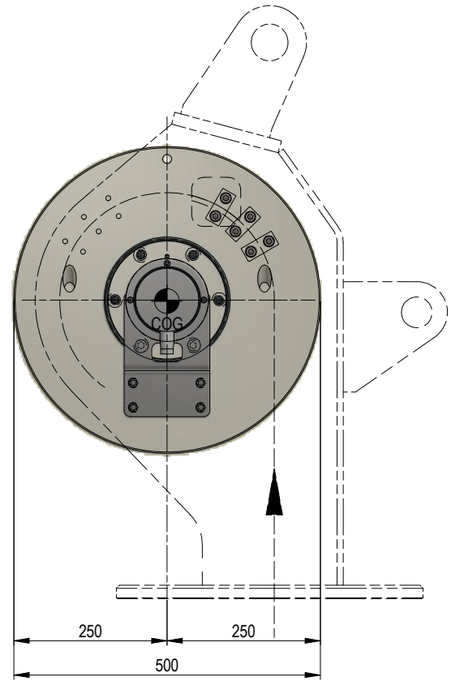
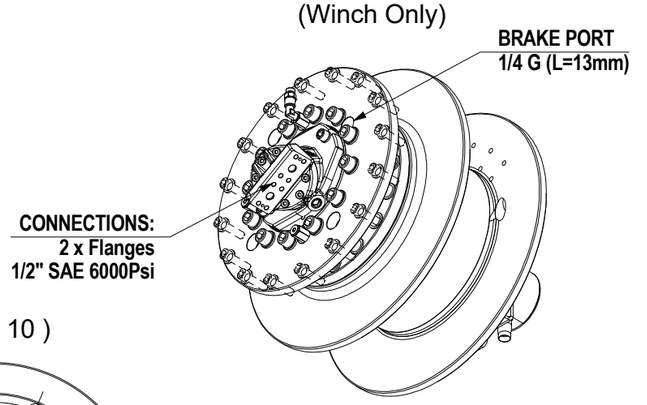
Name	Weight
DIMENSIONAL SKETCH	540 kg
Description	**Scale (A3)**
GILSON WINCH, GW-1000-ROV, LU, RO	1 : 10
Document ID	**Revision** / **Sheet**
2000003571	D / 1 / 1

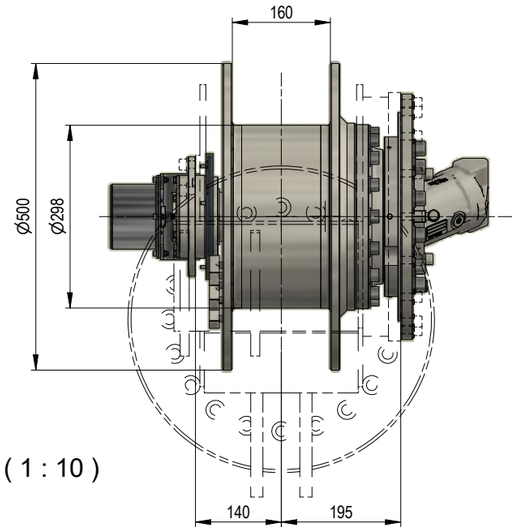




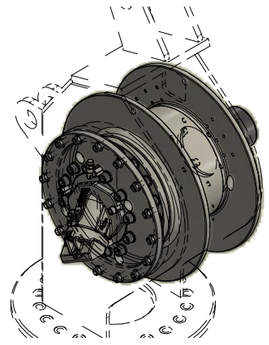


ISO VIEW (1 : 10)
(Winch Only)

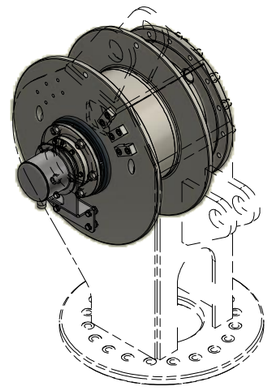




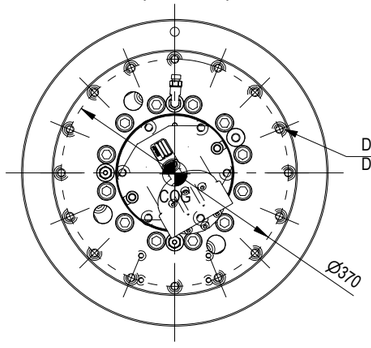
ISO VIEW (1 : 15)



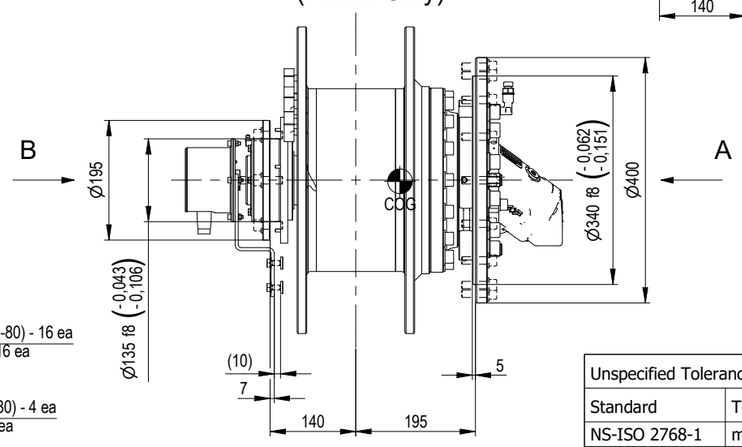
ISO VIEW (1 : 15)



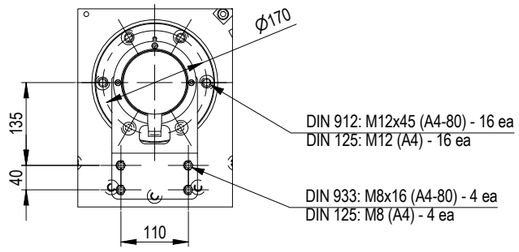
A (1 : 10)



INSTALATION DETAILS (1 : 10)
(Winch Only)



B (1 : 10)



NOTE:
Make sure that not less than 5 windings of rope is left on drum during operation!

Unspecified Tolerances According to:	
Standard	Tolerance Class
NS-ISO 2768-1	m Medium
NS-ISO 2768-2	K

Designed by	Date	Modified by	ECO / CO			
I Todorovic	24.12.2021.	B Simic	ECO-2058000			

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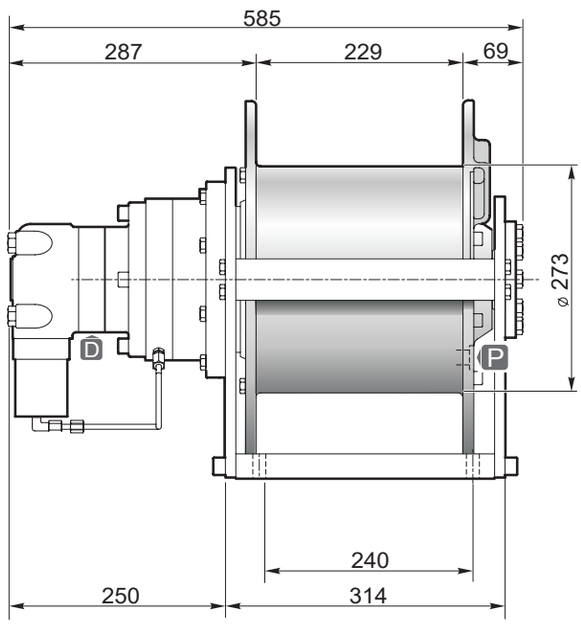
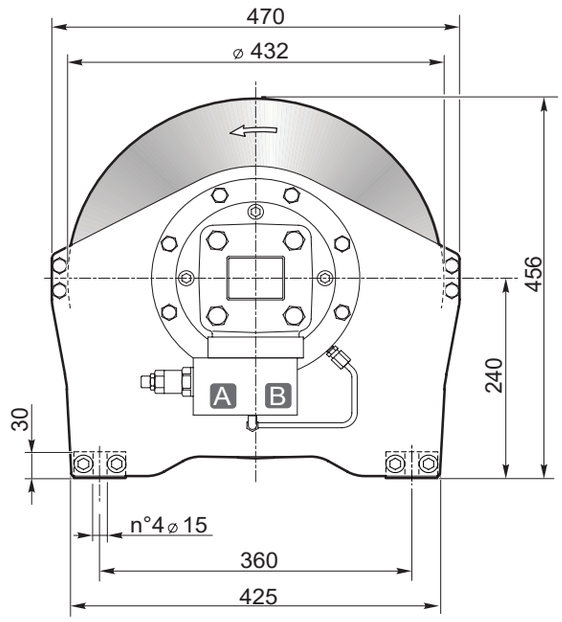
Name	Weight
DIMENSIONAL SKETCH	178 kg
Description	Scale (A3)
GILSON WINCH, GW-1000-UV, LO	1 : 10
Document ID: 2000004293	Revision: D / Sheet: 1 / 1

SE27/3





Rope layer	n°	1	2	3	4
Line pull	[daN]	3550	3250	3000	2750
Rope speed with 60 [L/1']	[m/1']	24	26	28.5	31
Rope capacity smooth drum	[m]	14	29	45	63
Rope capacity grooved drum	[m]	13	27	42	59

Hoisting pressure	[bar]	200
Max-min pump flow	[L/1']	100/15
Motor displacement	[cm^3]	326
Gear ratio	1:	6.5
Advised rope diameter	[mm]	14

A	*Hoisting port*	3/4"
B	*Lowering port*	

D	*Drain port*	1/4"
P	*Lubrication oil plug*	3/8"

kg *Weight*	160

Available accessories **A-B-C1-C2-D-E-F1-F2** 63

Drum Smooth 1 Grooved 2

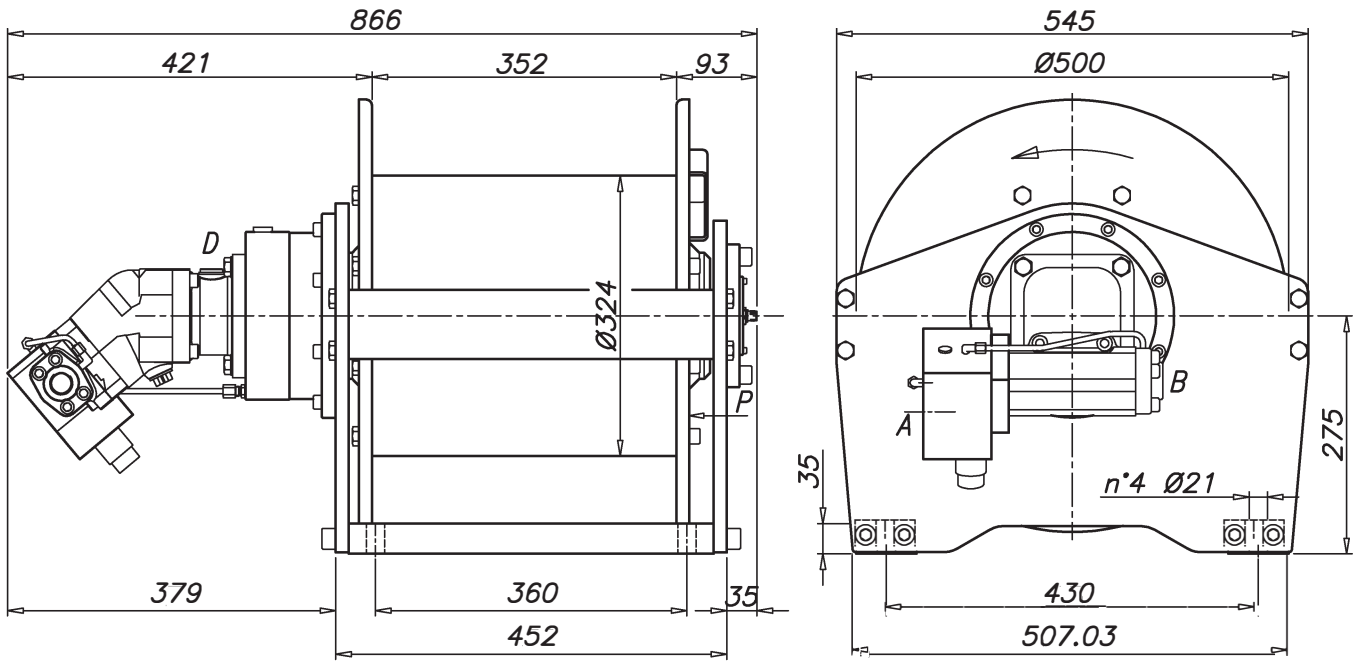
- *Hoisting with counter clockwise rotation of the drum (or clockwise if required).*
- *Negative multi-disc brake, with 120 daNm of static torque.*
- *Gear lubrication oil bath.*
- *Maximum back pressure on return line: 5 bar.*
- *Always keep at least 4 wraps of rope on the drum for safety reasons.*
- *The equipment is classified under UNI ISO 4301/1.*
- *To fix the winch use screws M14 12.9 grade.*
- *Technical features may change with no previous notice from the manufacturer.*

THE PRESENT EQUIPMENT CAN'T BE USED TO LIFT PEOPLE

HYDRAULIC WINCH

SE45V ELD

NO PAINT



Rope layer	n°	1	2	3	4
Line pull	daN	5770	5270	4860	4500
Rope speed with 180 l/1'	m/1'	54.5	59.5	65	70
Rope capacity smooth drum	m	23	47	74	103
Rope capacity grooved drum	m				

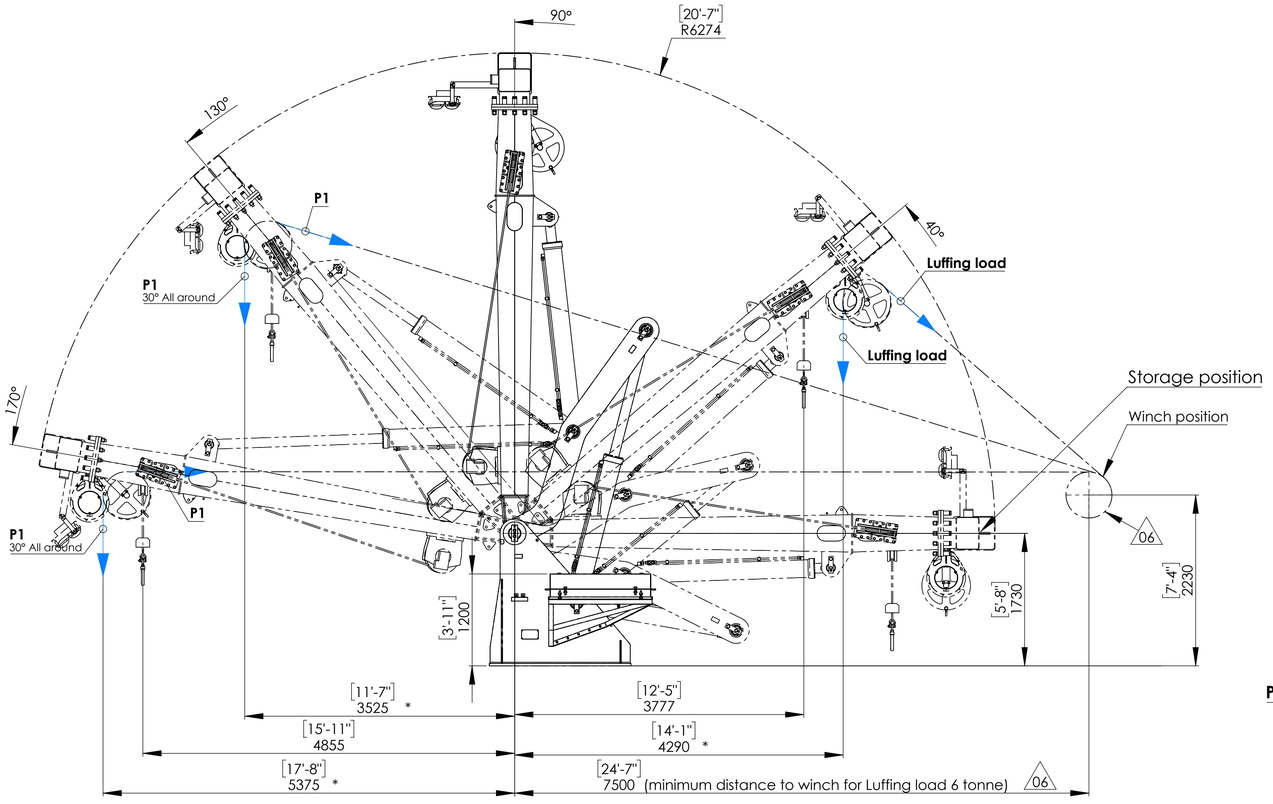
Hoisting pressure	260 bar
Max–min pump delivery	190/25 l/1'
Motor displacement	64 cm^3
Gear ratio	1:51,6

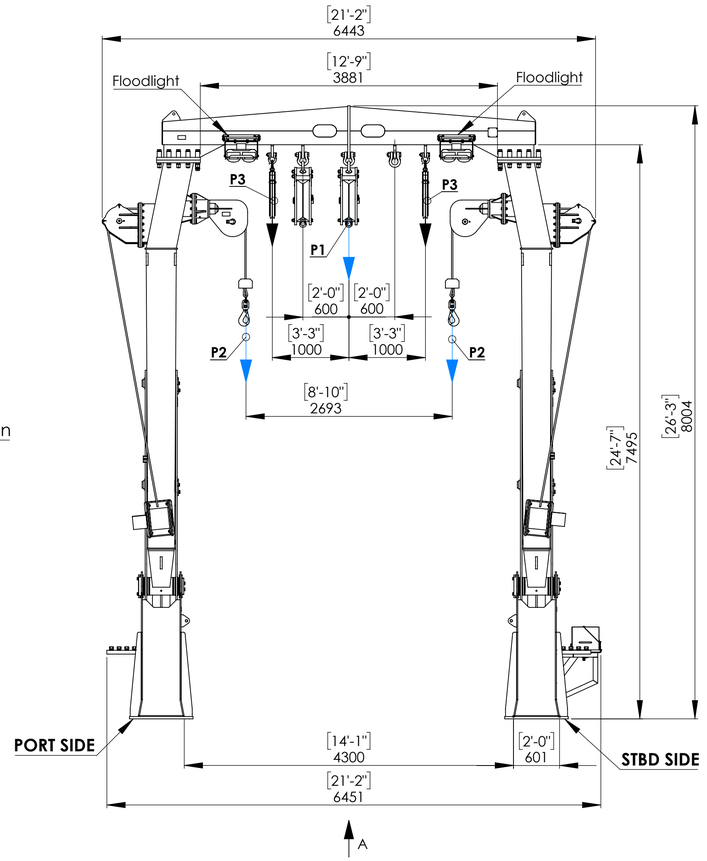
A = Hoisting port	1" BSPP	D= Drain port	1/2" BSPP	Adviced rope size	16 mm
B = Lowering port	3/4" BSPP	P= Lubrication oil plug	1/2" BSPP	Weight	290 Kg

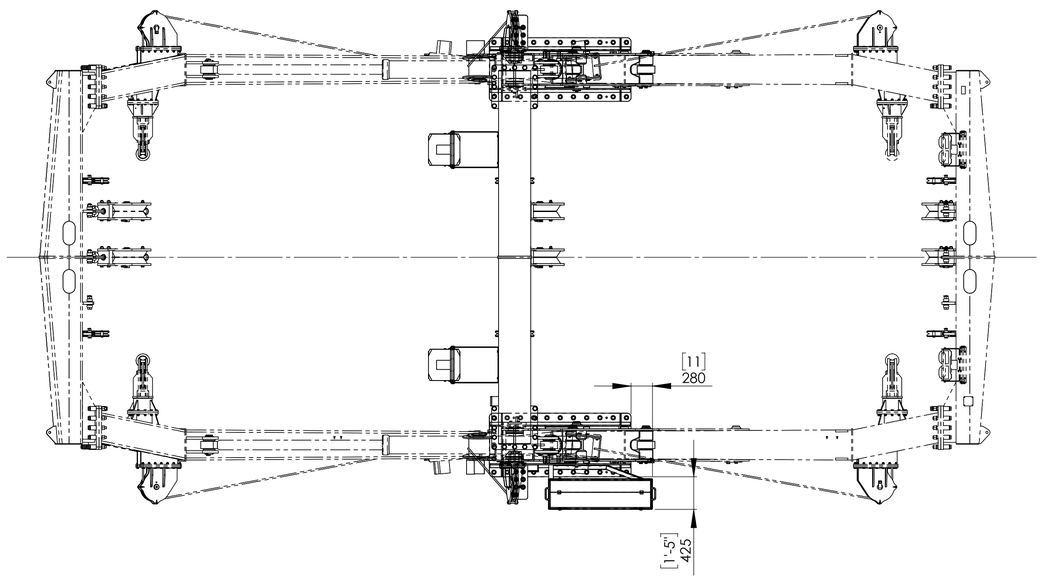
THE PRESENT EQUIPMENT CAN'T BE USED TO LIFT PEOPLE.

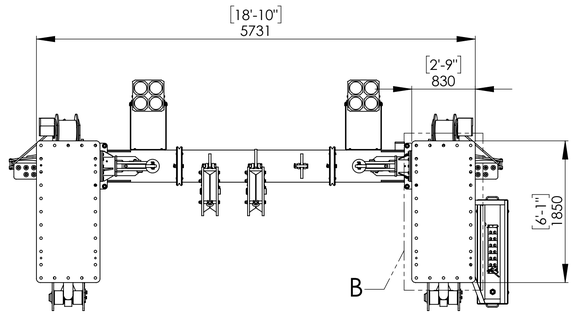
- Hoisting with counter clockwise rotation of the drum (or clockwise if required)
- Negative multi–disc brake,with 44 daN.m of static torque.
- Gear lubrication oil bath.
- Maximum back pressure on return line : 5 bar.
- Always keep at least 4 twists of rope on the drum,for safety reasons.
- The equipment is classified under **UNI ISO 4301/1.**
- To fix the winch use screws **M20 10.9 class.**
- Technical features may change with no previous notice from manufacturer.

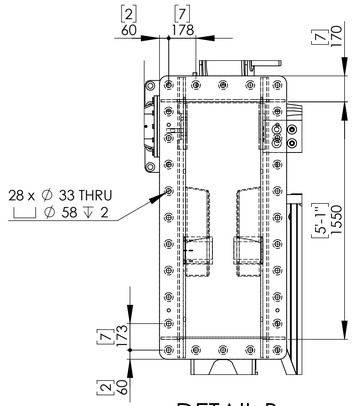
TECHNICAL DATA	
P1 (Working area 40°-170°)	SDL = 100 kN
P2 (Winch working area 10°-170°)	SWL = 2 x 3 tonne
P3 (Working area 40°-170°)	SDL= 50 kN
Luffing load (center sheave 40°-170°)	SWL = 6 tonne
Luffing load - Vertical hanging (center pad eye 40°-170°)	SWL = 6 tonne
Hydraulic pressure	200 bar
Tilting time out/in	100 s / 100 s
Recomended oil flow	160 l/min
Weight of crane (moving parts) approx.	12800 kg











DETAIL B
SCALE 1 : 20

VIEW A

* Dimensions may vary with different block

REV.	DESCRIPTION	DATE	APPROVED
A	Added lufing load for 6t vertical hanging	15/12/2022	SS
06	Changed position of main winch, added valve central, speed of tilting and weight. Revision 06 acc to PDM.	26.01.2022	CI
03	Changed dimensional sketch according to the customer comments.	17.12.2021	CI
01	Added winches, valve central and wireblocks.	22.03.2019	KJ

REVISIONS

FRAME
A-FRAME
DIMENSION SKETCH

MACGREGOR

Unspec. tolerances in compliance with	
Weight (kg)	Kg
Date	08.01.2019
Scale 1:40	Projection
Created by	SS
Format A1	
Approved date	15/12/2022
MPS no.	
Approved by	SS
Drawing no. 20549	Revision A
SHEET1 OF 1	

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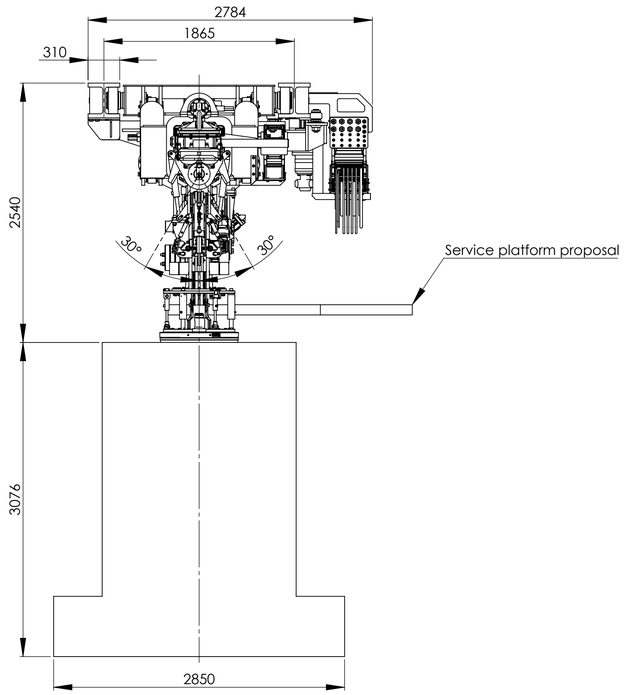
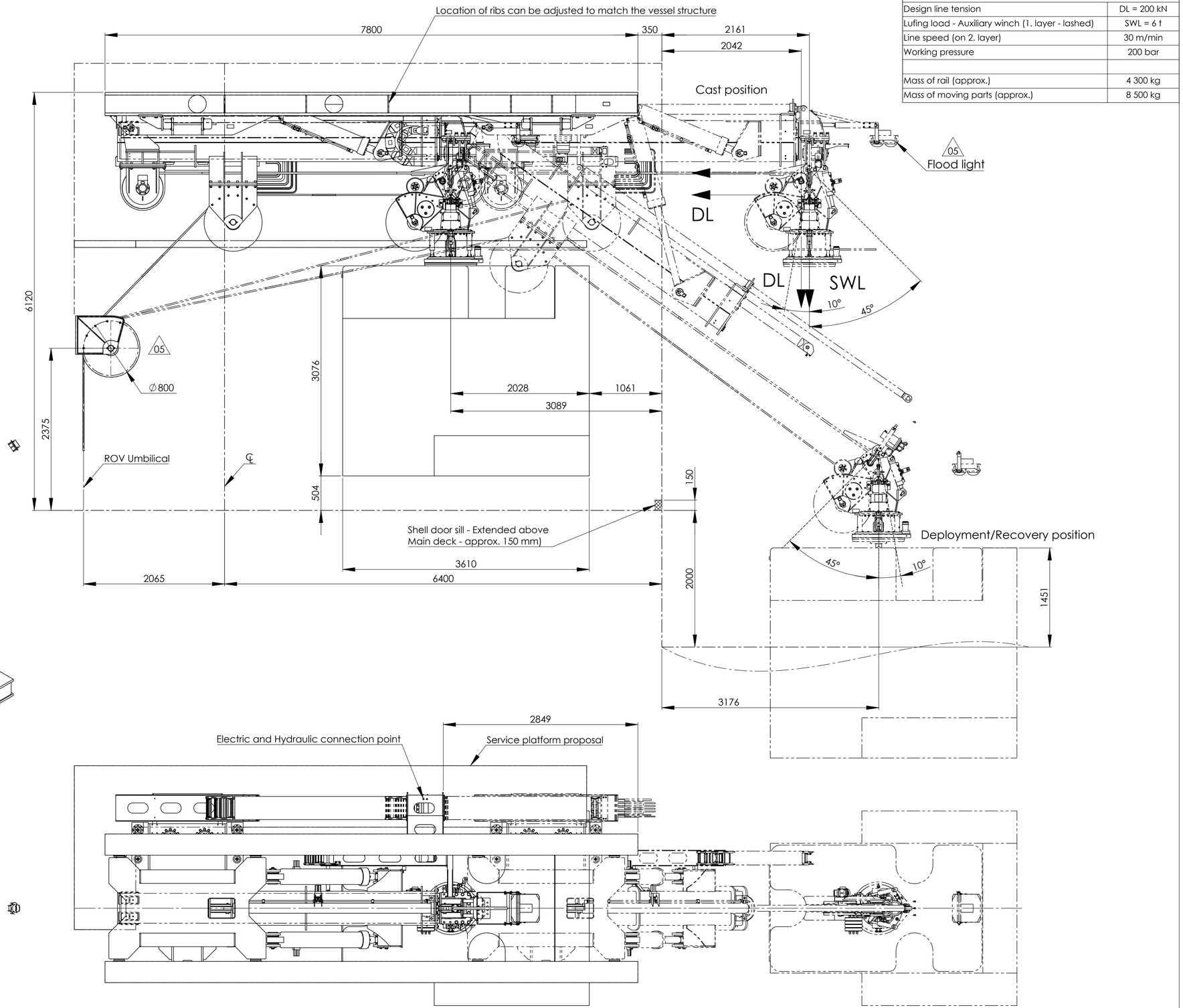
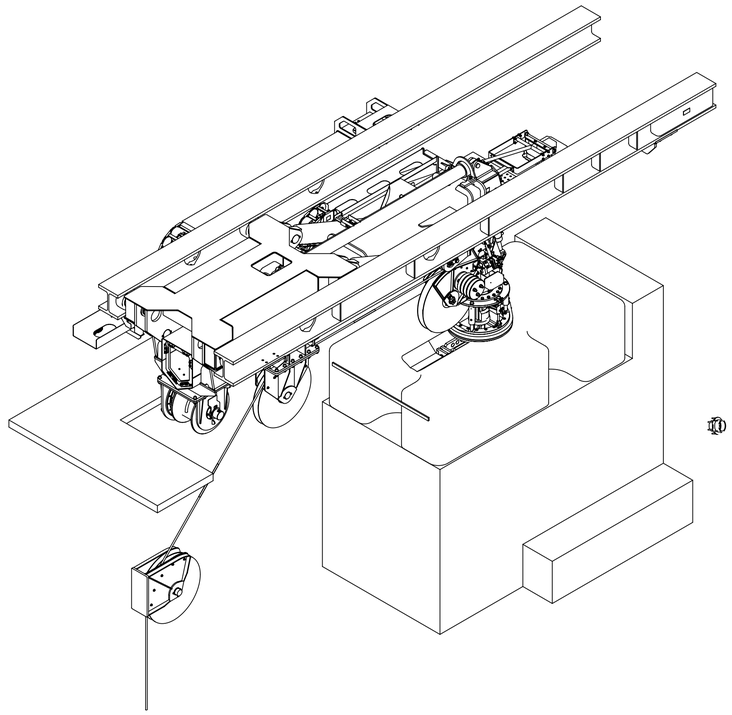
TECHNICAL DATA	
Design line tension	DL = 200 kN
Lufing load - Auxiliary winch (1. layer - lashed)	SWL = 6 t
Line speed (on 2. layer)	30 m/min
Working pressure	200 bar
Mass of rail (approx.)	4 300 kg
Mass of moving parts (approx.)	8 500 kg







REV.	DESCRIPTION	DATE	APPROVED
A	Approved by customer	03.10.2023	LS
05	Guide block and Flood light positions changed. Updated Mass of moving parts (tech. data)	24.03.2022.	KJ
04	Updated acc. to comments from client.	29.12.2021.	KJ
03	Redesigned.	29.11.2021.	HK
02	Added auxiliary winch, docking head redesigned and updated according to latest GA.	28.06.2019.	LK

REVISIONS

OH CRANE
ROV LARS
DIMENSION SKETCH

MACGREGOR

Unispec. tolerances in compliance with	NS-ISO 2768 M
Scale	1:30
Projection	
Format	A1
MPS no.	
Drawing no.	20673
Revision	A
SHEET1 OF 1	
Weight (kg)	
Date	31.01.2019
Created by	HK
Approved date	
Approved by	

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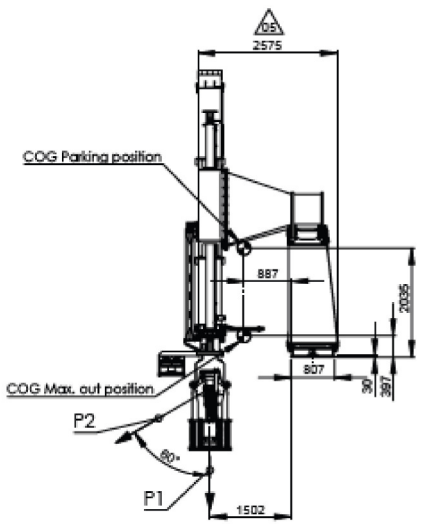
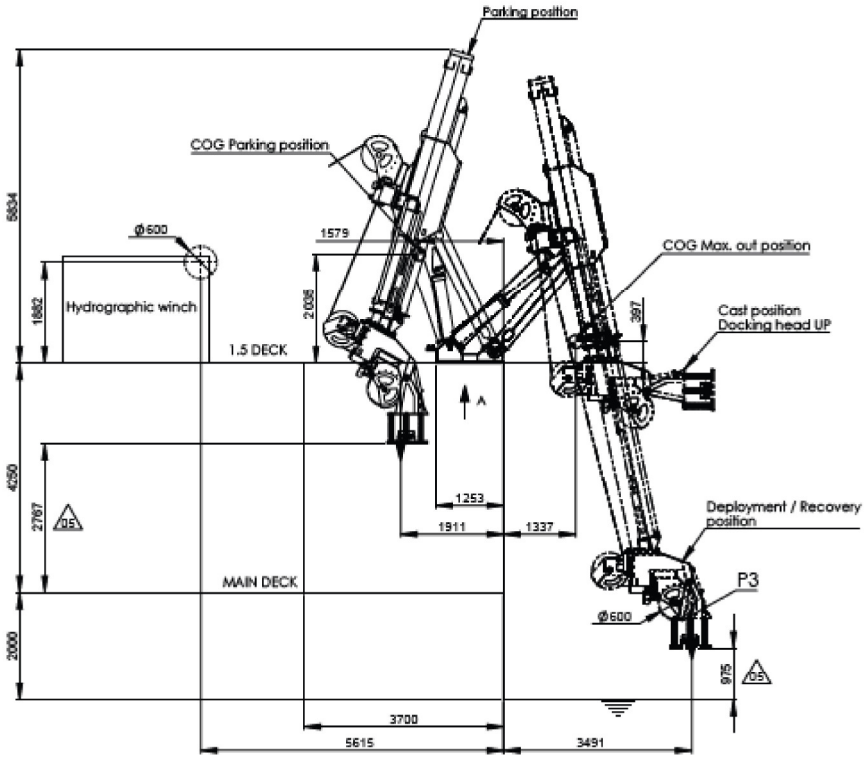
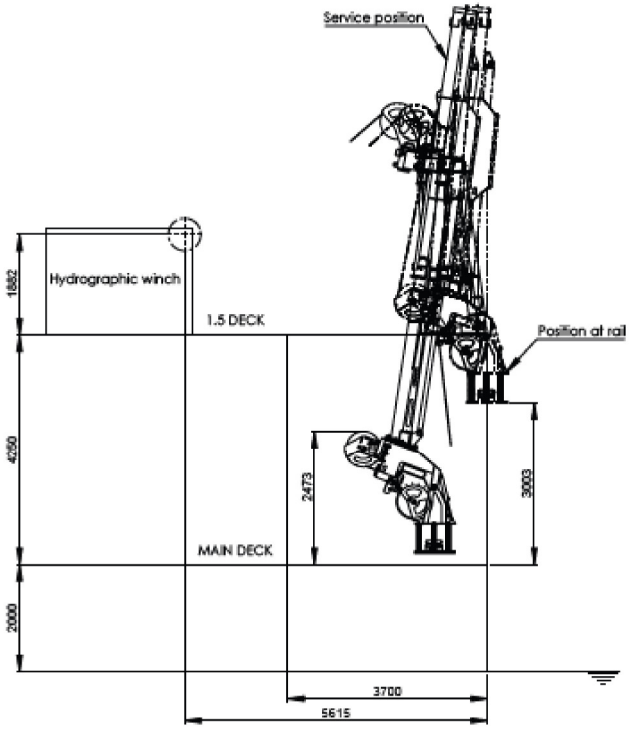
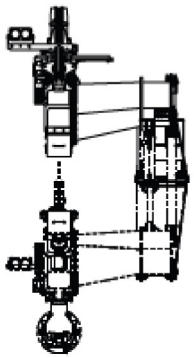
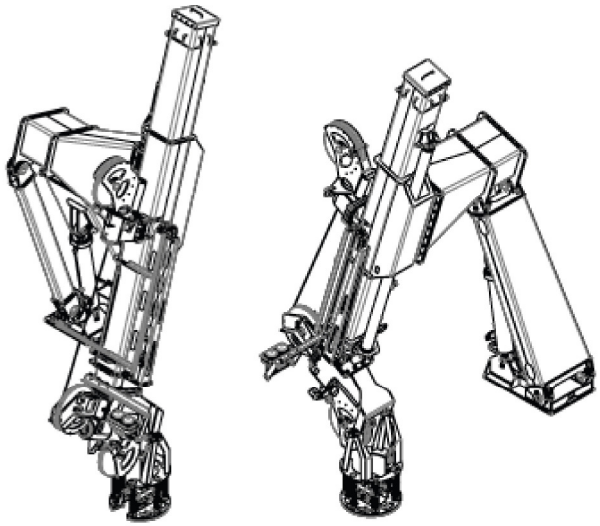
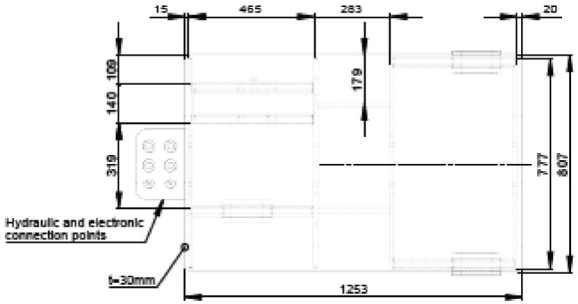












VIEW A
SCALE 1 : 10
FOUNDATION FOOTPRINT

TECHNICAL DATA	
P1 - (Cast position)	DLT = 73,5 kN
P2 - (Towing in Cast position)	SWL = 3,2 tonne
P3 - Luffing load	12 kN
Working pressure at consumer	200 bar
Tilting time	18 s
Telescoping time	40 s
Recomended oil flow	80 l/min
Mass of moving parts (approx.)	7 110 kg
Mass of foundation (approx.)	550 kg

REV.	DESCRIPTION	DATE	APPROVED
A		02.09.2020.	
06	Changed technical data: SWL= 160t to SWL= 32T	16. 12. 2022.	BH
05	Foundation redesigned, length increased on starboard side.	17.11.2021.	AT
04	Docking head UP dimension added	26.10.2021.	EJ
03	Printing error corrected. CAD-model	06.05.2020.	EK

REVISIONS

DAVIT
CTD DAVIT
DIMENSION SKETCH

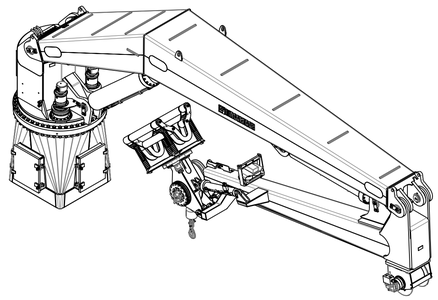
MACGREGOR

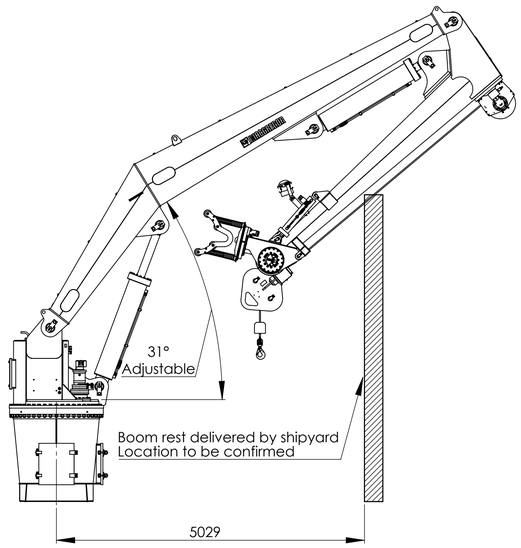
Scale 1:50 | Projection
Format A1
Weight Kg
Date 07.01.2019
Checked by ÅS
Approved date
Approved by

Drawing no. 20547
Revision A

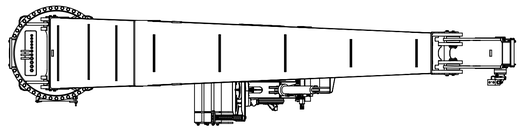
According to International Standard ISO 16016, this document is the property of MacGregor. The disclosing and contents, such as to make public, copied or otherwise

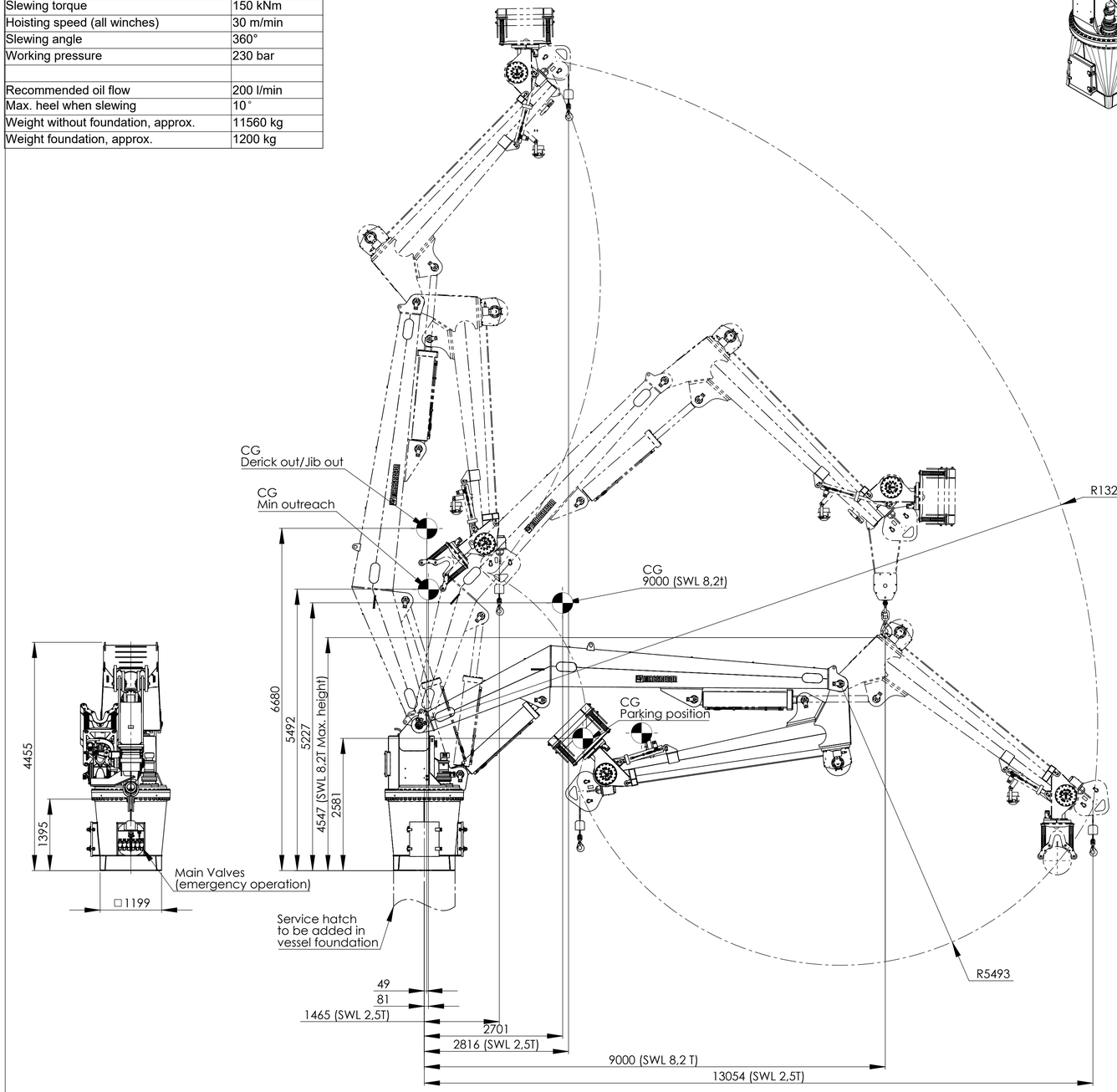
TECHNICAL DATA	
Dimensioned lifting capasity	75 tm
SWL-1 in port or at sea	2,5 tons
SWL-2 in port	8,2 tons
SWL-3 AUV Docking Head	2 tonne
Slewing speed	1,0 rpm
Slewing torque	150 kNm
Hoisting speed (all winches)	30 m/min
Slewing angle	360°
Working pressure	230 bar
Recommended oil flow	200 l/min
Max. heel when slewing	10 °
Weight without foundation, approx.	11560 kg
Weight foundation, approx.	1200 kg

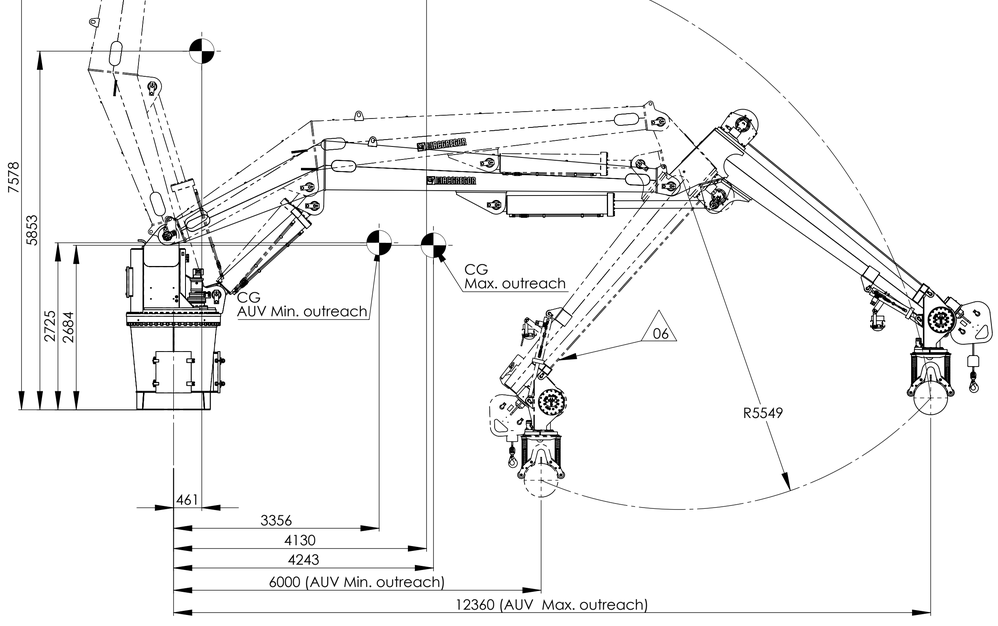


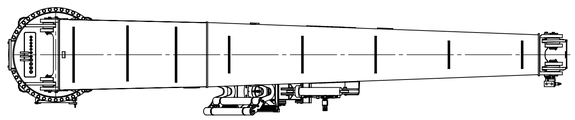


STORAGE POSITION









REV.	DESCRIPTION	DATE	APPROVED
	REVISIONS		
A		15.03.2022	
A	Approved by Customer on 30.11.2021	11.03.2022	HK
06	Docking head changed position.	18.11.2021	PM
05	Center of gravity added for all configurations.	20.09.2021	AT
04	Redesigned from KN-60. Increased outreach for 8,2t.	17.08.2021	HK

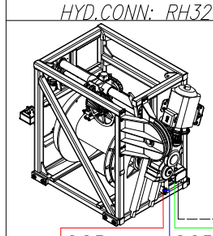
TRIPLEX DECK CRANE
KN-75/2,5/8,2/__/__
DIMENSION SKETCH

MACGREGOR

Unspec. tolerances in compliance with	Weight (kg)
	Date 27.03.2020
Scale 1:50 / Format A1 / Projection	Created by HK
	Approved date
MPS no.	Approved by
Drawing no. 23460 SHEET1 OF 1 / Revision A	According to international laws this drawing is the property of MacGregor. The drawing and contents can not be made public, copied or otherwise used without our approval.

DECK MOUNTED (DECK 01)

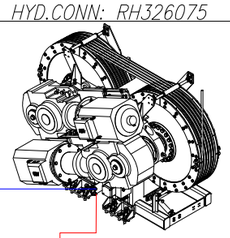
CTD WINCH
HW-515E-T90
HYD.DWG.: RH411171
HYD.CONN: RH326078



GCP GCR F D

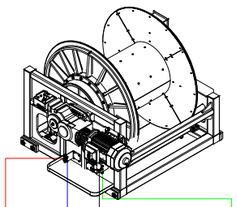
WINCH ROOM MOUNTED

TRACTION WINCH
TRW-4004E-L1
HYD.DWG.: RH411181
HYD.CONN: RH326075



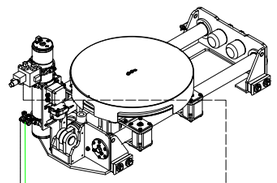
GCR GCP D F

STORAGE DRUM
RW-2372EB
HYD.DWG.: RH411171
HYD.CONN: RH326077



GCP GCR D F

SLACK WIRE COMPENSATOR
ELSWC5000-L2000
HYD.DWG.: RH319631
HYD.CONN: RH326076



D F Dr

Internal Piping on winches
Delivered by MacGregor

Piping Delivered by Yard

ø 20 x 2
ø 25 x 2
ø 15 x 1,5
ø 15 x 1,5
ø 25 x 2
ø 20 x 2
ø 15 x 1,5
ø 12 x 1,5
ø 15 x 1,5
ø 20 x 2
ø 15 x 1,5
ø 15 x 1,5
ø 25 x 3
ø 25 x 3
ø 15 x 1,5
ø 25 x 2
ø 25 x 2
ø 25 x 2
ø 25 x 2
ø 25 x 2
ø 25 x 2
ø 25 x 2
ø 25 x 2

Counter stream
Fresh water, max inlet temperature 38°C
50 L/min
Max△P-Cooler: 1 Bar

Counter stream
Fresh water, max inlet temperature 38°C
25 L/min
Max△P-Cooler: 1 Bar

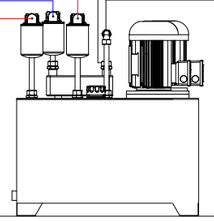
ø 20 x 2 — 7/9 l/min. — WP Max 5 Bar — 803
ø 25 x 2 — 16/19 l/min. — WP Max 2 Bar — 804
ø 38 x 2,5 — 30 l/min. — WP Max 2 Bar — 805
ID min. ø1" — Max. 10 Bar — 807
Dimensions (min. ID) are based on fluid speed of max 1,5 m/s on pressure lines and 1 m/s on return lines
ID min. ø1" — 807

Note 1.

ø 25 x 2 — Inst. 70 l/min. — WP Max 130 Bar — 806
ø 25 x 2 — Inst. 70 l/min. — WP Max 2 Bar — 804
ø 15 x 1,5 — 808
ID min. ø1" — Max. 10 Bar — 807
Dimensions (min. ID) are based on fluid speed of max 1,5 m/s on pressure lines and 1 m/s on return lines
ID min. ø1" — 807

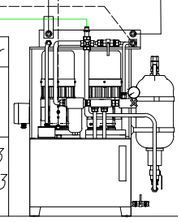
GC2 GC1 GCR WI WO

801
Relief valve setting: TBA
HYDRAULIC POWER PACK (HPU)-GEAR COOLING
HYD. DWG: 2000008163
DIM./CON.DWG: 2000004110



P D Dr WI WO

Relief valve setting:130 Bar
HYDRAULIC POWER PACK (HPU)- BRAKE CONTROL
HYD. DWG: 2000008113
DIM./CON.DWG: 2000004113



802

Internal Piping on HPU's delivered by Macgregor

NOTE 1:
External pipes in accordance to DIN2391C (NS2503)
Ref: installation instruction
Fitting type:
JIC Triple-Lok 37deg.

NOTE 2:
HPU's 801 and 802
-To be installed as close as possible to the winches (no more than 25m eq. piping length)
-Hoses 803-808
to be installed directly on the HPUs

809 TESTING EQUIPMENT

Note 1.: 70 l/min when accumulator is unloading

RHHA10070H-1

Designed by	Modified by	Date	ECO			
H Johansen		21-Dec-21	ECO-2056654			

MACGREGOR

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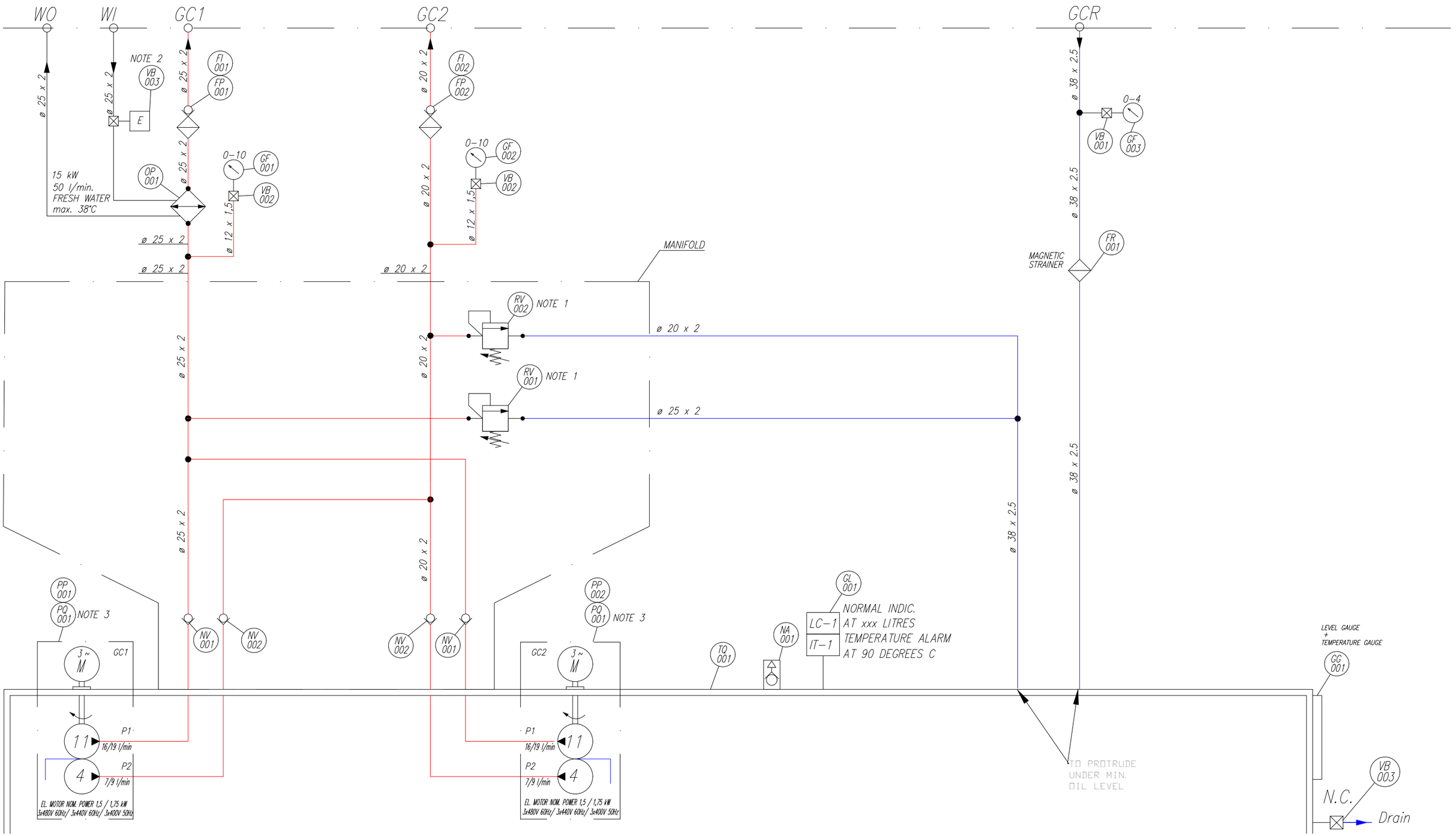
Name: MBARI 4/10070 HYDRAULIC SYSTEM
Weight: % kg
Description: BRAKE & GEAR COOL. (Old no. RH330398)
Scale (A3): %
Document ID: 2000004171
Revision: A



(Note: This diagram is developed from RH325930)

NOTES:

1. Default setting 4 bar. To be adjusted at HAT, for optimal flow.
2. Valve to be open when oil temperature in side of the tank is above XX °C. FC valve.
3. Only one of the pumps will run at a time. (Designed with two pumps in order to achieve redundancy)
4. Dim. DWG / Connect. DWG: 2000004110
5. Oil specification GEAR OIL ISO VG 68
6. This system to be installed acc. to RAPP MARINE'S "Installation instruction for high pressure hydraulic systems", Doc.: 3035

SUCTION / RETURN LINES
PRESSURE LINES
DRAIN LINES
CONTROL LINES

Designed by	Modified by	Date	ECO			
H Johansen		05-Apr-22				

MACGREGOR

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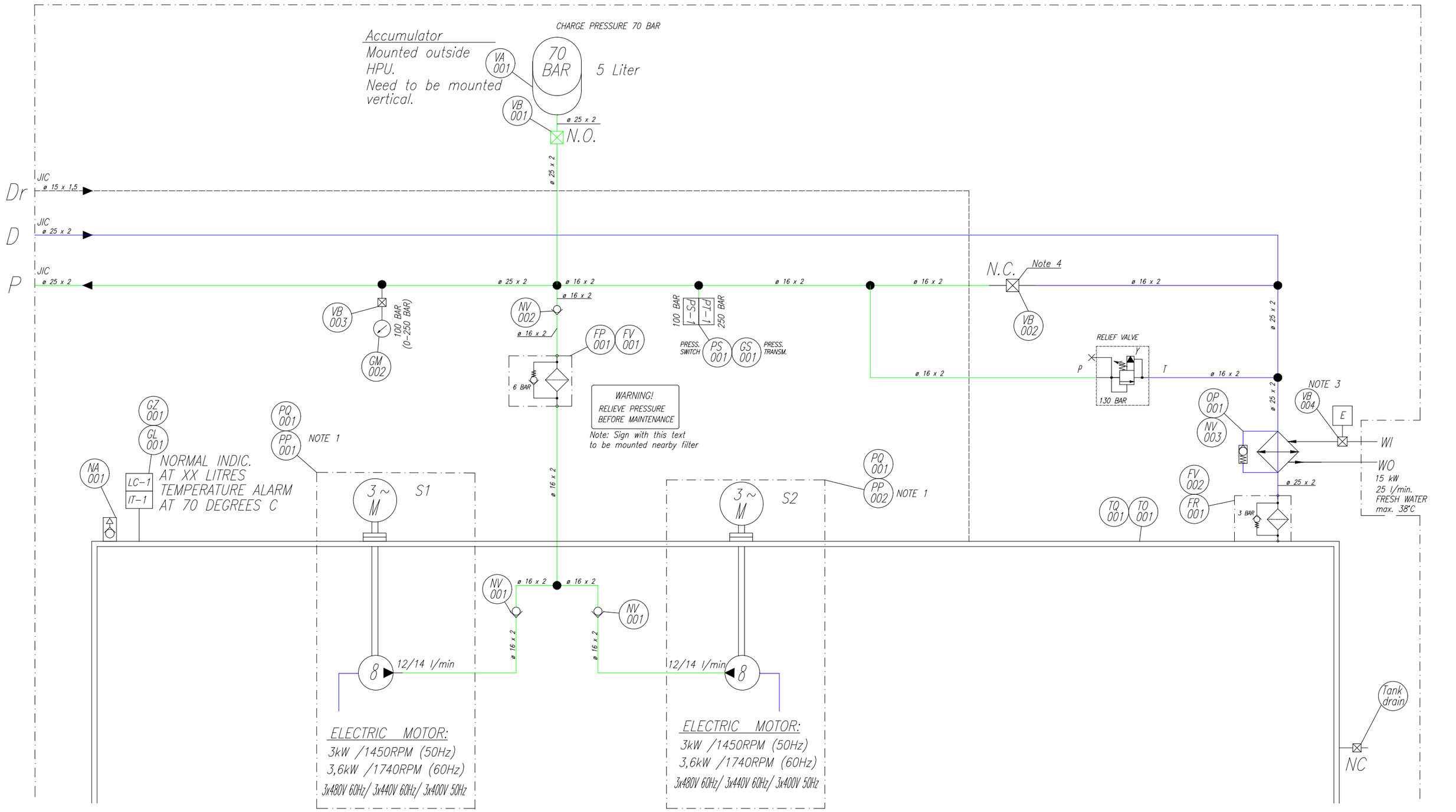
Name	Weight
Hydraulic Diagram	0 kg
Description	Scale (A3)
HPU for Gear Cooling	
Document ID: 2000008163	Revision: A



(Note: This diagram is developed from RH322323)

TANK DESIGN SPECIFICATION:
OPERATING OIL VOLUME: APPROX. 70 LITRES
TYPE OF OIL: HYDRAULIC OIL ISO VG 46

1. Only one of the pumps will run at a time. (Designed with two pumps in order to achieve redundancy)
2. General note: Dim. sketch / Conn. dwg.: 2000004113
3. Valve to be open when oil temperature in side of the tank is above xx °C, FC Valve.
4. Pressure must be relieved before maintenance (including replacement of filter element)

SUCTION / RETURN LINES
PRESSURE LINES
DRAIN LINES
CONTROL LINES

Designed by	Modified by	Date	ECO			
H Johansen		04-Apr-22	ECO-2057101			

MACGREGOR

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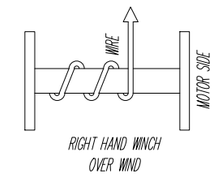
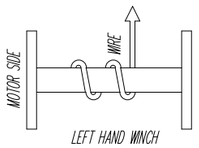
Name	Weight
Hydraulic Diagram	0 kg
Description	Scale (A3)
HPU for Brake, with cooler & accum.	
Document ID	Revision
2000008113	A

PIPING/ TUBING ON USA - MOUNTED WINCHES:

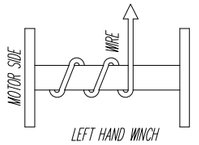
1/2" x .049 (ø 12 x 1.5)
3/4" x .049 (ø 15 x 1.5 / ø 20 x 2)
1" x .072 (ø 25 x 3)
1 1/4" x .095 (ø 30 x 3)
1 1/2"x .134 (ø 30 x 3)
1 1/2" sch 80 (ø 50 x 5)
2" sch 80 (ø 60 x 5)



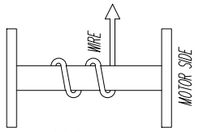
RIGHT HAND WINCH
OVER WIND



LEFT HAND WINCH
UNDER WIND



LEFT HAND WINCH
OVER WIND

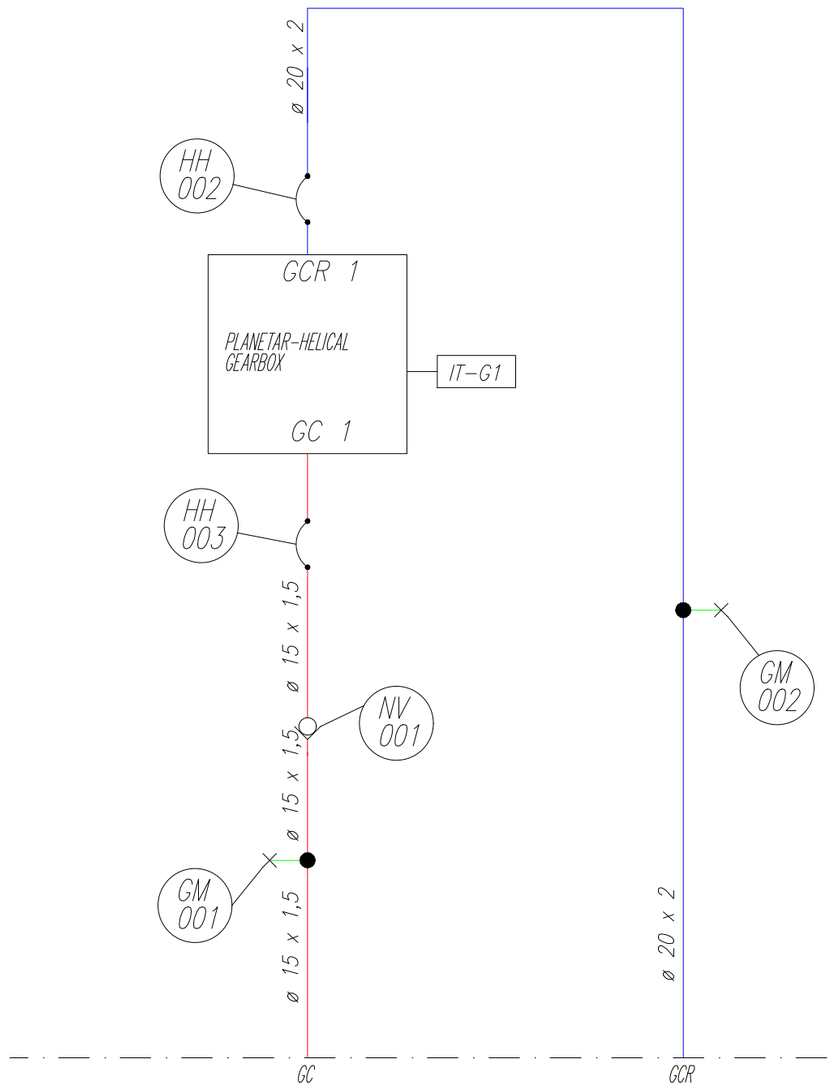


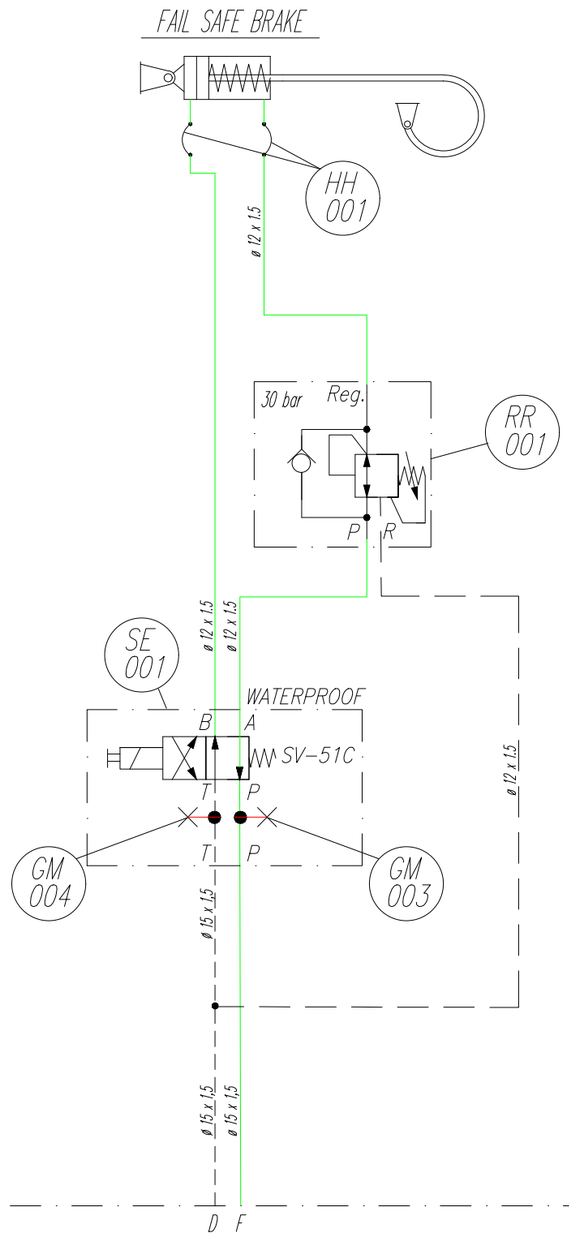
RIGHT HAND WINCH
UNDER WIND

DRAIN
SERVO
RETURN
PRESSURE

Note 1)
Gear cooling inlet to be in the center of the angle gearbox, and gear cooling outlet to be on the top of the angled part.
If plug on the outlet is located down, input part on the gear to be turned in position.

PIPE LENGTHS, FITTINGS AND BENDS ARE THUS TO BE CHOSEN WITH CARE. PLEASE CONSULT SYSTEM DEPARTMENT.





XQ 001 Extra mounting equipment.

Designed by	Modified by	Date	ECO			
H Johansen		21-Feb-22	ECO-2056897			

MACGREGOR

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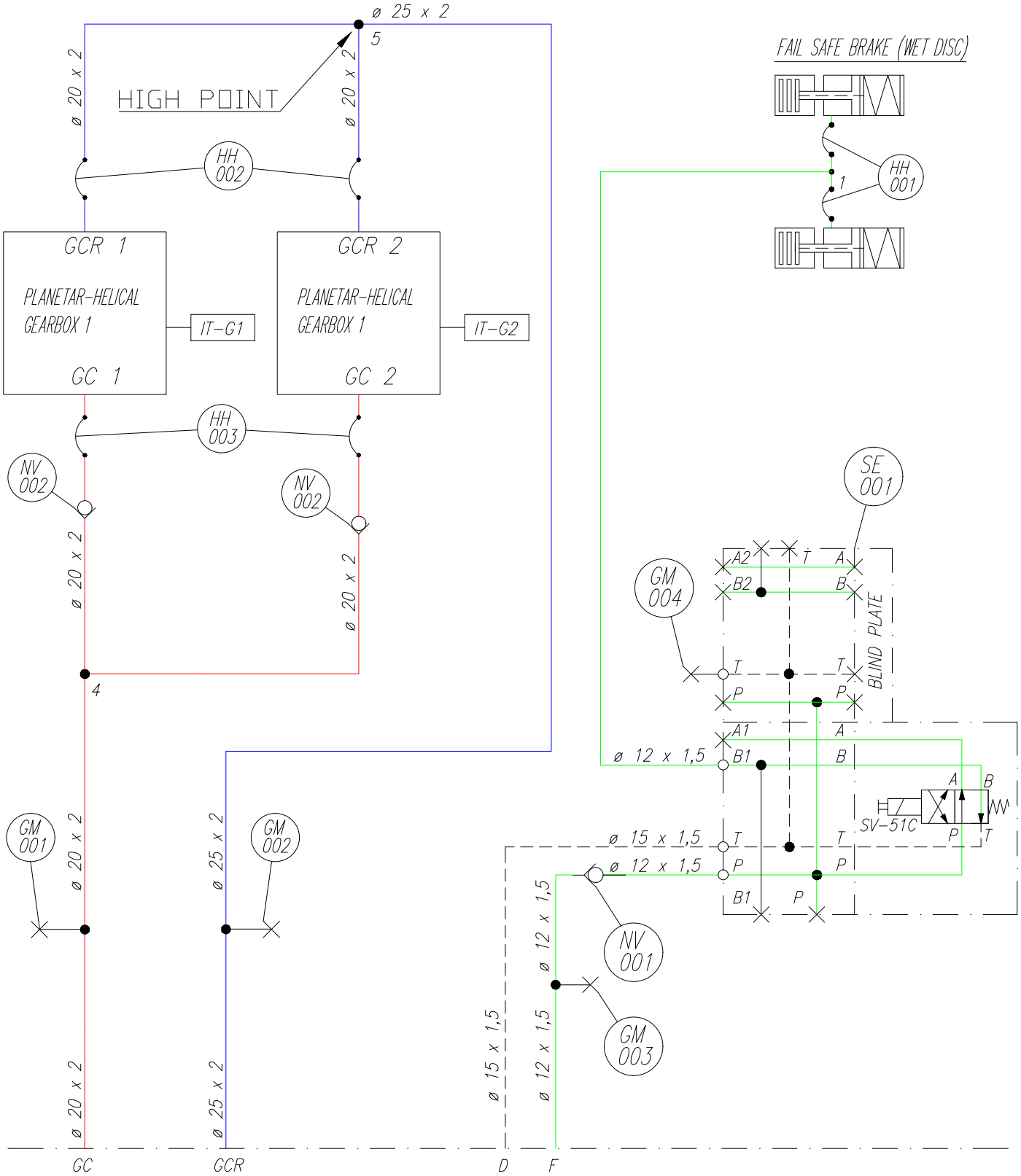
Name	Weight
HYDRAULIC BRAKE & COOLING SYSTEM,	0 kg
Description	Scale (A3)
Document ID: RH411171	Revision: A



Designed by	Modified by	Date	ECO			
H Johansen		21-Feb-22	ECO-2056897			

MACGREGOR

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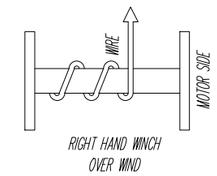
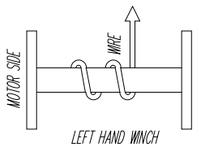
Name	Weight
HYDRAULIC BRAKE & COOLING SYSTEM,	0 kg
Description	Scale (A4)
Document ID: RH411181	Revision: C

PIPING/ TUBING ON USA - MOUNTED WINCHES:

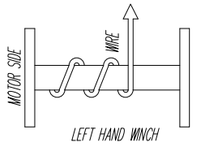
1/2" x .049 (ø 12 x 1.5)
3/4" x .049 (ø 15 x 1.5 / ø 20 x 2)
1" x .072 (ø 25 x 3)
1 1/4" x .095 (ø 30 x 3)
1 1/2"x .134 (ø 30 x 3)
1 1/2" sch 80 (ø 50 x 5)
2" sch 80 (ø 60 x 5)



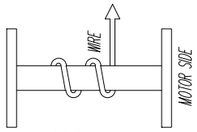
RIGHT HAND WINCH
OVER WIND



LEFT HAND WINCH
UNDER WIND



LEFT HAND WINCH
OVER WIND

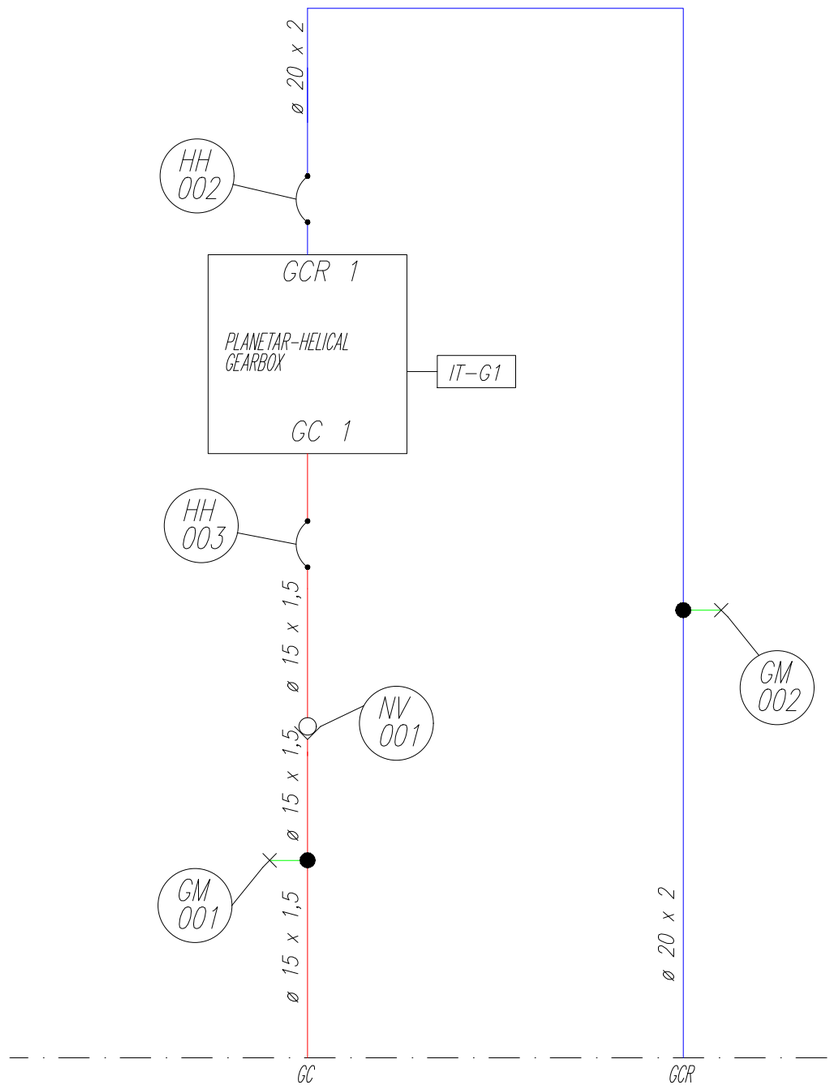


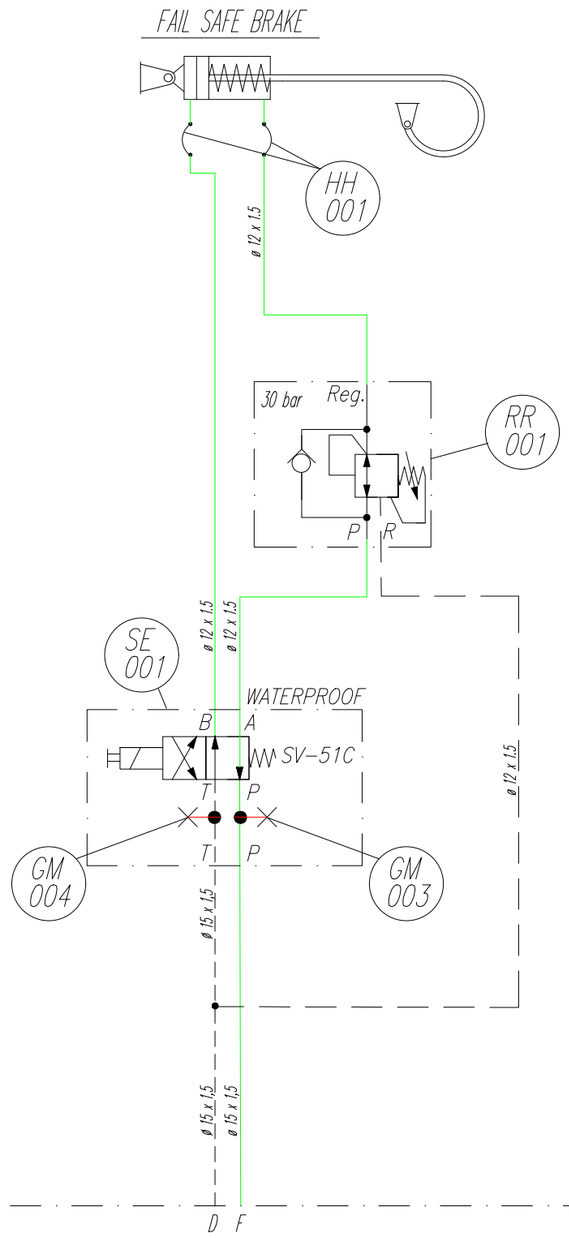
RIGHT HAND WINCH
UNDER WIND

DRAIN
SERVO
RETURN
PRESSURE

Note 1)
Gear cooling inlet to be in the center of the angle gearbox, and gear cooling outlet to be on the top of the angled part.
If plug on the outlet is located down, input part on the gear to be turned in position.

PIPE LENGTHS, FITTINGS AND BENDS ARE THUS TO BE CHOSEN WITH CARE. PLEASE CONSULT SYSTEM DEPARTMENT.





XQ 001 Extra mounting equipment.

Designed by	Modified by	Date	ECO			
H Johansen		21-Feb-22	ECO-2056897			

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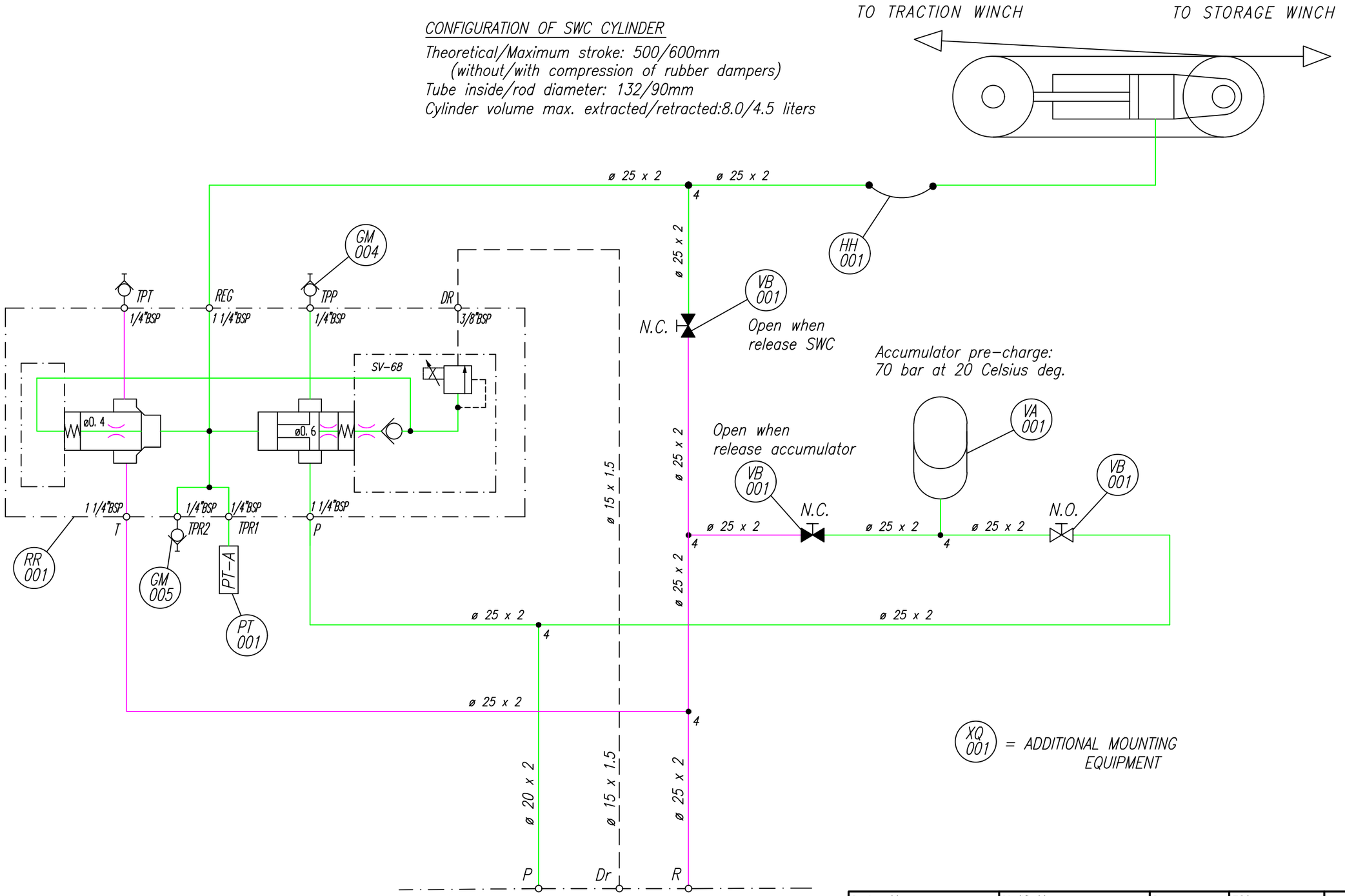
Name	Weight
HYDRAULIC BRAKE & COOLING SYSTEM,	0 kg
Description	Scale (A3)
Document ID: RH411171	Revision: A

CONFIGURATION OF SWC CYLINDER

Theoretical/Maximum stroke: 500/600mm
(without/with compression of rubber dampers)
Tube inside/rod diameter: 132/90mm
Cylinder volume max. extracted/retracted:8.0/4.5 liters



XQ 001 = ADDITIONAL MOUNTING EQUIPMENT

Part list: RHHSWC-E

Designed by	Modified by	Date	ECO			
D Boc		03.06.2022	ECO-2057408			

MACGREGOR

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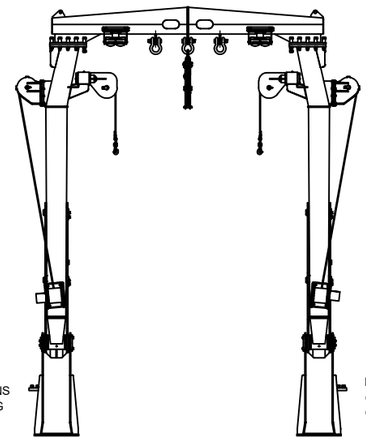
Name	Weight
Hydraulic Diagram	
Description	Scale (A3)
Slack Wire Compensator	
Document ID: RH319631	Revision: F

STERN A-FRAME



HYDRAULIC CONNECTIONS ON PORT LEG

HYDRAULIC CONNECTIONS ON STB LEG

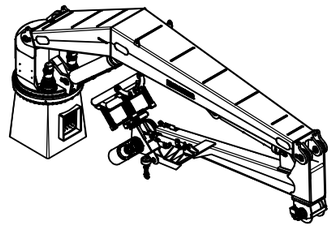
STERN A-FRAME
Dim.drw. : 20549
Hydr. drw. : 24854
200 l/min
210 bar

VALVE CENTRAL
Delivered loose
Drw.no.: 24821

P R D LS

Ø38x4 Ø38x3 Ø30x2 Ø12x1.5

MAIN CRANE



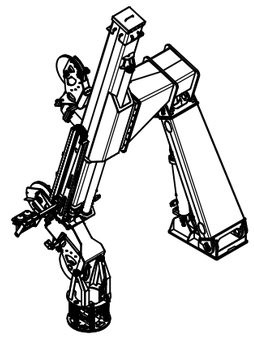
MAIN CRANE KN-75
Dim. drw. : 23460
Hydr. drw. : 24855
200 l/min
210 bar

VALVE CENTRAL
IN FOUNDATION
Drw.no.: 24845

P R D LS

Ø38x4 Ø38x3 Ø30x2 Ø12x1.5

CTD DAVIT



CTD DAVIT
Dim.drw. : 20547
Hydr. drw. : 24856
80 l/min
210 bar

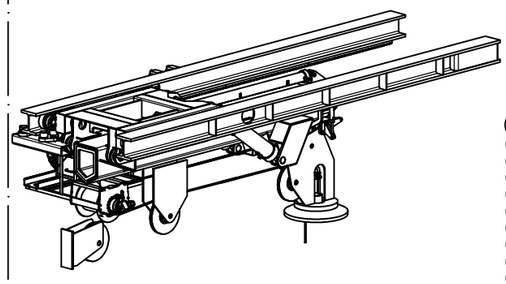
Ø20x2 Ø20x2 Ø20x2 Ø20x2 Ø12x1.5 Ø12x1.5

VALVE CENTRAL
Delivered loose
Drw.no.: 24820

P R D LS

Ø25x2.5 Ø38x3 Ø18x2 Ø12x1.5

ROV LARS



ROV LARS
Dim.drw. : 20673
Hydr. drw. : 24857
200 l/min
210 bar

Ø25x2.5 Ø25x2.5 Ø25x2.5 Ø25x2.5 Ø25x2.5 Ø25x2.5 Ø20x2 Ø20x2 Ø12x1.5 Ø12x1.5 Ø12x1.5 Ø12x1.5 Ø12x1.5 Ø12x1.5 Ø12x1.5 Ø18x2

VALVE CENTRAL
Delivered loose
Drw.no.: 24859

P R D LS

Ø38x4 Ø38x3 Ø30x2 Ø12x1.5

PORTABLE VERTICAL HYDRAULIC CAPSTANS CVH-3500

Drw.no.: 55303

Ø25x3 Ø25x3 Ø25x3 Ø25x3

DIRECTIONAL CONTROL VALVE PS
70 l/min
110 bar

DIRECTIONAL CONTROL VALVE STB
70 l/min
110 bar

Ø25x3 Ø20x2 Ø12x1.5 Ø25x3 Ø20x2 Ø12x1.5

Ø25x3 Ø30x2 Ø12x1.5

PANTOGRAPHIC SHELL DOORS

Drw. no.: PF731/1/200

Ø16x2.5 Ø16x2.5 Ø16x2.5 Ø16x2.5 Ø16x2.5 Ø16x2.5 Ø12x2 Ø12x2

DIRECTIONAL CONTROL VALVE LP
16 l/min
250 bar

DIRECTIONAL CONTROL VALVE UP
16 l/min
250 bar

Ø20x3 Ø20x2 Ø12x1.5 Ø20x3 Ø20x2 Ø12x1.5

Ø20x3 Ø20x2 Ø12x1.5

Shut-off valves are shipyard supply. See note.
To be installed as close as possible to valve central.

Ø30x2
Ø60x3
Ø50x5
Ø12x1.5

Shu ttle valves are shipyard supply.

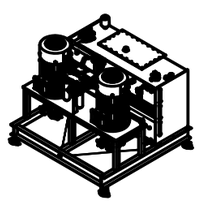
Ø50x5 Ø60x3 Ø30x2 Ø12x1.5

Hoses and shut-off valves are shipyard supply.
See note for shut-off valves.

P R D LS

HYDRAULIC POWER PACK
Dimensional drawing no. : 1998565
Hydraulic drawing no. : 2350417
Electrical drawing no. : E-4504
2 x 87.5 kW / 480V / 60Hz
2 x 200 l/min = 400 l/min
Maximum working pressure: 250 bar
Maximum back pressure on drain line : 2 bar
Maximum back pressure on return line : 5 bar

OIL COOLER
Fresh water supply: 280 l/min
Max pressure: 3 bar
Max temperature: 38° C



Note:

- FLARE FITTINGS acc. to SAE J 514 (ISO 8434-2)
- Pipe Ø50x5: FLANGE 1 1/ 2" SAE 6000 psi on HPU
- Pipe Ø60x3: FLANGE 2 " SAE 3000 psi on HPU
- HOSE FITTING CONNECTION acc. to ISO 12151-5
- All exposed hydraulic hoses to be abrasion and UV protected
- Shut-off valves for pressure, return and drain lines must include indicators. Shut-off valves are a recommendation.

Pressure testing:

- Pressure Line 375 bar
- Return Line 135 bar
- Drain Line 135 bar
- LS Line 375 bar

Fluid Cleanliness: ISO Class 17-15-12

Released for Production !

PROJECT : 4/60185 MBARI

Ver.	Description	Date	By
05	Updated pipe dim. acc. to JIC standard. Added additional ship equipment.	17.11.2021	HK
04	Updated pipe dim. to 60x2 and SELELJ.	16.09.2021	HK
03	Added ROV LARS and connection to other ship equipment.	13.12.2021	HK
02	Fluid cleanliness changed to 17-15-12.	26.11.2021	HK
01	Released.	25.11.2021	HK

Qty. | Pos. | Description | Material | Drawing no. | Rev | Comment

MBARI
HANDLING EQUIPMENT
HYDRAULIC DIAGRAM

Unspec. tolerances in compliance with
Weight (kg)
Date 25.11.2021
Scale % Projection
Created by HK
Format A1
Approved date
MPS no.
Approved by
Drawing no. S1739
Revision 05

MACGREGOR

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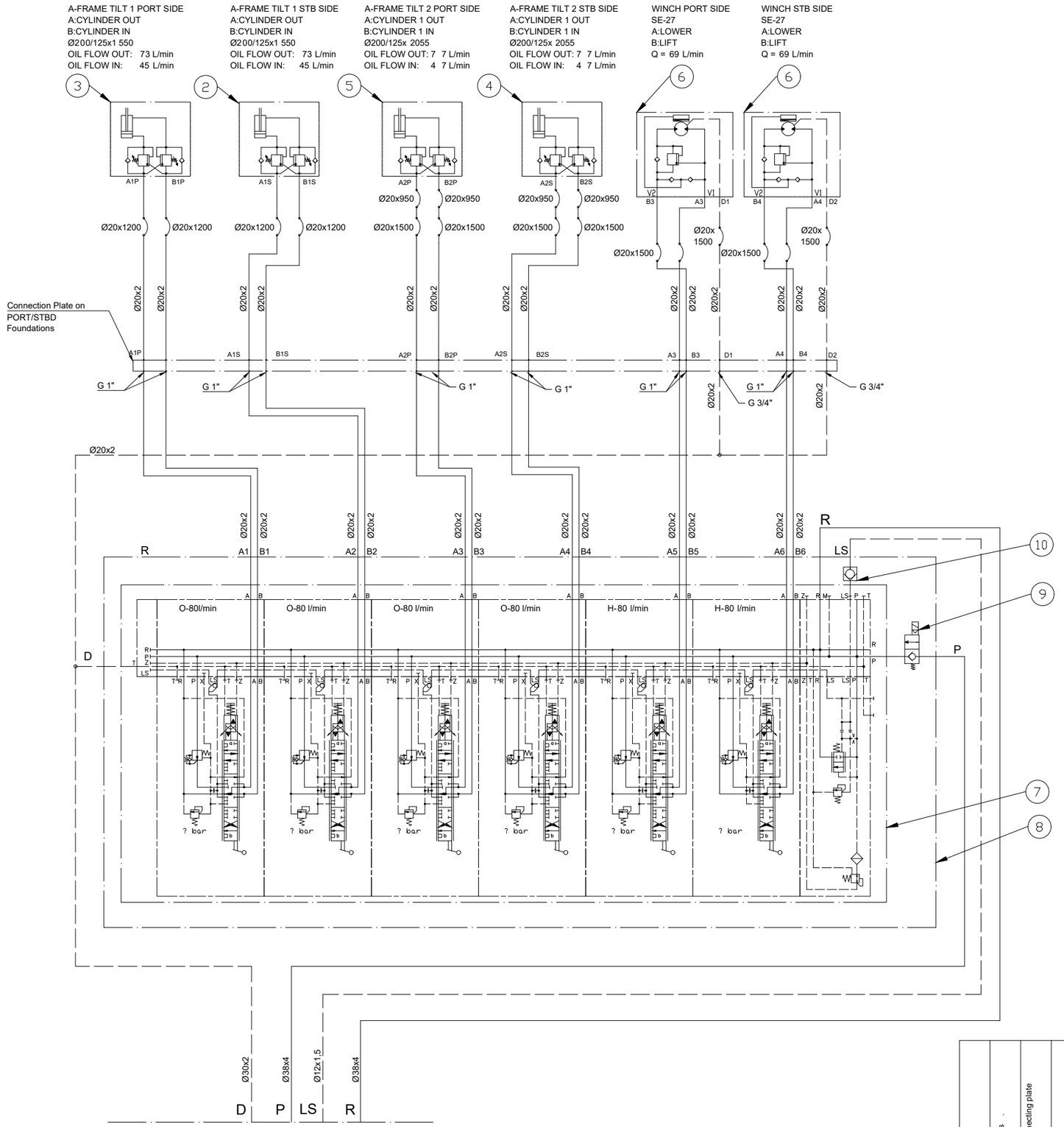

Main hydraulic diagram: S173 9

NOTE: Additional pipes and hoses for protection of electrical cables will be needed during the assembly.

NOTE !
- JIC 37° FLARE FITTINGS acc. to ISO 8434- 2
- FITTINGS MATERIAL : ACID PROOF
- H.P.HOSES acc. to ISO 12151-6
- HOSE COUPLING MATERIAL : ACID PROOF

PROJECT : 4/60185 MBARI

Qty.	Pos.	Description	Material	Drawing no.	Rev	Comment
1	10	CHECK VALVE	07511041			RHD-12 L
1	9	VALVE ON/OFF	07843016			SV-13
1	8	VALVE CENTRAL	400185989	24821		
1	7	CONTROL VALVE	400202238			HAWE 6 SL.
2	6	WINCH	07610233			DINAMIC SE27 3V CW
1	5	CYLINDER TILT 2 PORT	400052574	20175		FJ Ø200/125X2055
1	4	CYLINDER TILT 2 STB	400052573	20175		FJ Ø200/125X2055
1	3	CYLINDER TILT 1 PORT	400052670	20181		FJ Ø200/125X1550
1	2	CYLINDER TILT 1 STB	400052669	20181		FJ Ø200/125X1550
1	1	A-FRAME	400186005	24954		

Ver.	Rev	Description
A	04	As built 26.06.2023 KRK.
	03	Changed standard for fittings . 27.12.2022 SS.
	02	Removed hoses from connecting plate 12.10.2022 SS.
	01	Added note and BOM 11.08.2022 SS.
		Released 12.04.2022 SS

TRIPLEX FRAME
A-FRAME STERN
HYDRAULIC DIAGRAM

MACGREGOR

Unspec. tolerances in compliance with

Weight (kg)

Date 12.04.2022

Scale %

Projection

Created by SS

Format A2

Approved date

MPS no.

Approved by

Drawing no. 24854

Revision A

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SWING
A: COUNTER CLOCKWICE
B: CLOCKWICE

MAIN DERRICK
A = DOWN = CYL IN
B = UP = CYL OUT

JIB
A = JIB OUT = CYL OUT
B = JIB IN = CYL IN

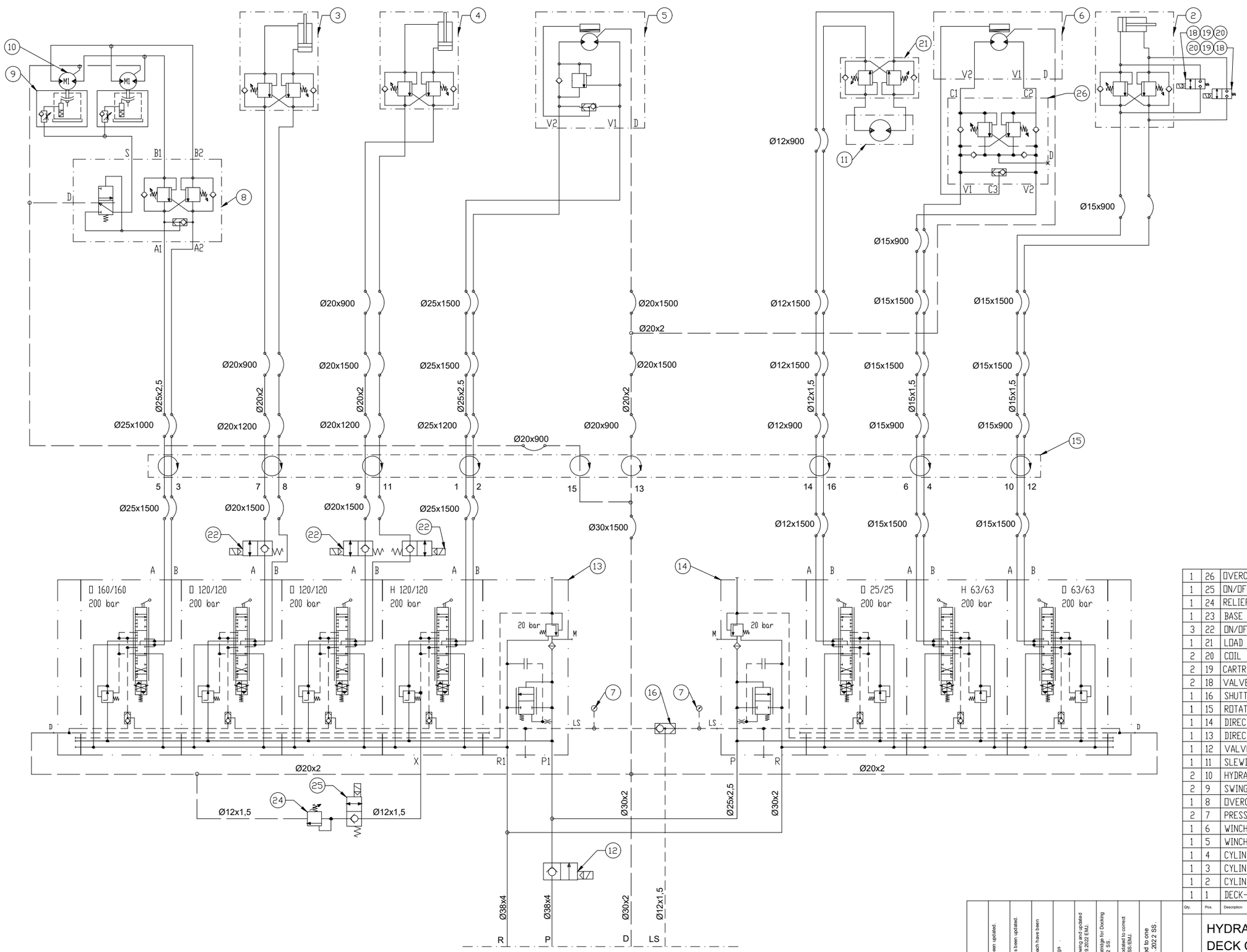
WINCH 1
A = WINCH OUT = LOWER V1
B = WINCH IN = LIFT/HOIST V2

SLEWING DOCKING HEAD
A:CLOCKWICE
B:COUNTER CLOCKWICE

WINCH DOCKING HEAD
A = WINCH OUT = LOWER V1
B = WINCH IN = LIFT/HOIST V2

TILT DOCKING HEAD
B = TILT OUT = CYL OUT
A = TILT IN = CYL IN

NOTE !
- JIC 37° FLARE FITTINGS acc. to ISO 8434-2
- FITTINGS MATERIAL : ACID PROOF
- H.P.HOSES acc. to ISO 12151-6
- HOSE COUPLING MATERIAL : ACID PROOF
- DRILLING ESV : 1775A28



Main hydraulic diagram: S173 9

Pos.	Qty.	Description	Material		Drawing no.
1	26	OVERCENTRE VALVE	HRODC013		VAA-B-SICN150-ST-VF-05.71.45
1	25	ON/OFF VALVE	07843017		VEI-8A-2A-06-NC
1	24	RELIEF VALVE	07842716		HAWE MVS 42 C
1	23	BASE BLOCK X PORT	6783943O3		HAWE 5 SUBPLATE
3	22	ON/OFF VALVE	07843008		VEI-C-12
1	21	LOAD HOLDING VALVE	07845019		HAWE LHK 22G
2	20	COIL	400112838		VDC 740-224
2	19	CARTRIDGE	400161192		DTDA-MCN
2	18	VALVE BLOCK	07843020		GCU/S
1	16	SHUTTLE VALVE	07834001		WV-12
1	15	ROTATING COUPLING	07820007		BINI DI-125-16
1	14	DIRECTIONAL VALVE	400202459		HAWE 3
1	13	DIRECTIONAL VALVE	400067999		HAWE 5
1	12	VALVE ON/OFF	07843016		SV-13-20-C
1	11	SLEWING RING W/MOTOR	400191273		P-10411/2 W/MOTOR MPY160CP
2	10	HYDRAULIC MOTOR-SWING	07821006		HAMWORTHY 1911
2	9	SWINGGEAR	07611015		HAMWORTHY RE-1023
1	8	OVERCENTERVALVE	07845002		INTEGR CXP6397-02
2	7	PRESSURE GAUGE	07872002		0-250 BAR 1/4"R
1	6	WINCH	400192348		RHMGW0100B
1	5	WINCH	400033552		SE-45V
1	4	CYLINDER, JIB	05160130	14843	Ø250/125X1400
1	3	CYLINDER, MAIN DERRICK	05160130	14843	Ø250/125X1400
1	2	CYLINDER, JIB-AUV DH	05160236	15743	Ø110/60x525
1	1	DECK-CRANE	400186065	24966	KN-75

Ver.	Rev	
A	09	As built. 26.09.2023 KRK.
	08	Winch no.6 & BOM have been updated. 19.05.2023 KRK.
	07	Hydraulic winch system has been updated. 19.03.2023 KRK.
	06	Hydraulic valves limit outreach have been added. 14.03.2023 KRK.
	05	Changed standard for fittings . 27.12.2022 SS
	04	Added LHK on docking slewing and updated valves for docking tilt. 23.09.2022 EMJ.
	03	Added Valve block and Cartridge for Docking head cylinder . 19.08.2022 SS
	02	Added note and BOM , updated to correct spool sizes. 11.08.2022 SS/ EMJ.
	01	Both sections conected to one P,R,D,LS 31.05.2022 SS.
		Released. 30.03.2022 SS.

HYDRAULIC DIAGRAM
DECK CRANE TYPE KN-75
60185, MBARI

MACGREGOR

Unspec. tolerances in compliance with
Weight (kg)
Date 30.03.2022
Scale N/A
Projection
Created by HK
Format A1
Approved date
MPS no.
Approved by
Drawing no. 24855
Revision A

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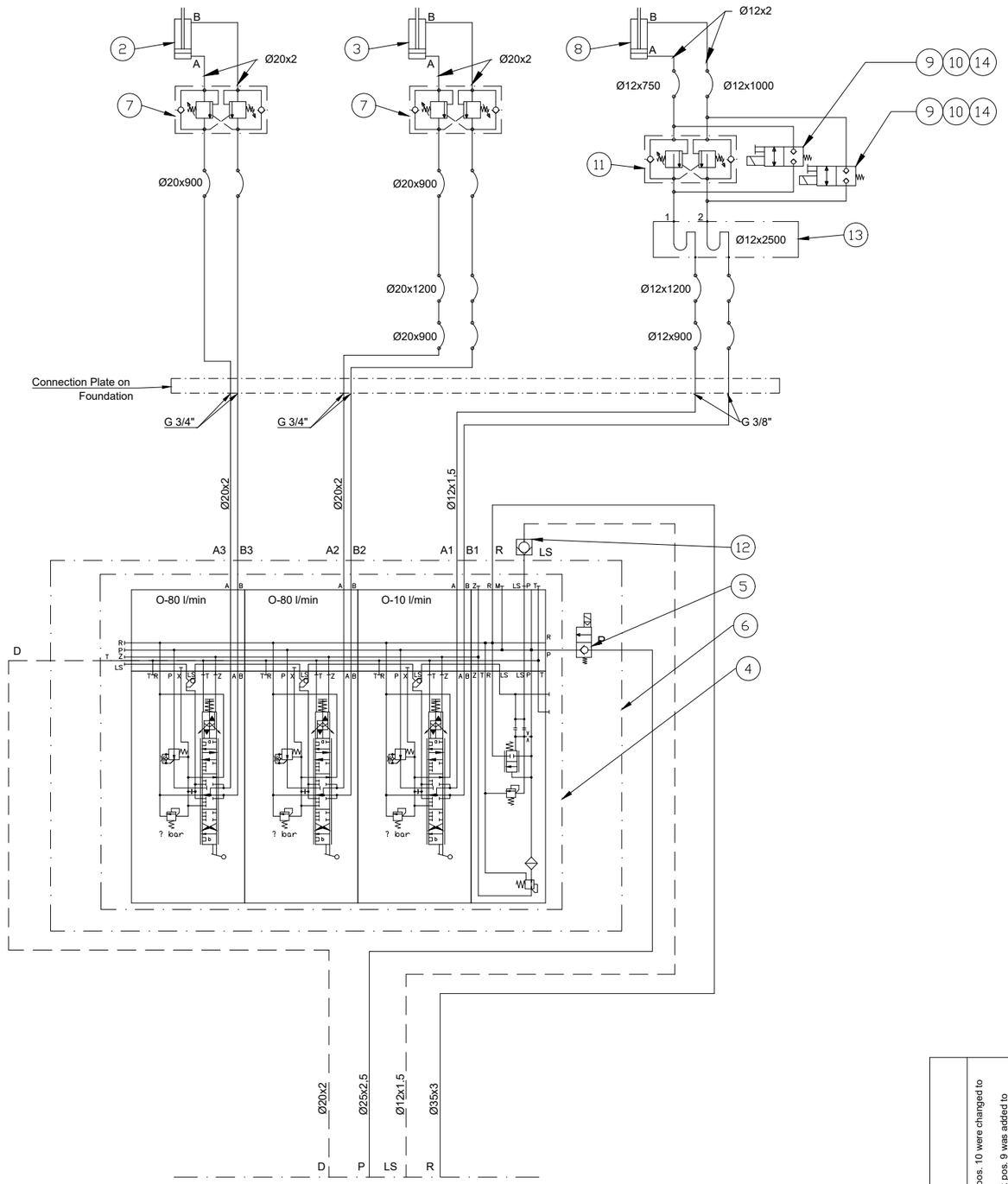
CYLINDER LUFFING
A:CYLINDER OUT
B:CYLINDER IN
Ø180/100x880
OIL FLOW OUT: 75 L/min
OIL FLOW IN: 5 2 L/min

CYLINDER TELESCOPE
A:CYLINDER OUT
B:CYLINDER IN
Ø125/ 80x3645
OIL FLOW OUT: 80 L/min
OIL FLOW IN: 3 9 L/min

CYLINDER DOCKING HEAD
A:CYLINDER OUT
B:CYLINDER IN
Ø50/30x350
OIL FLOW OUT: 10 L/min
OIL FLOW IN: 10 L/min



Main hydraulic diagram : S173 9

NOTE: Additional pipes and hoses for protection of electrical cables will be needed during the assembly.

NOTE !
- JIC 37° FLARE FITTINGS acc. to ISO 8434- 2
- FITTINGS MATERIAL : ACID PROOF
- H.P.HOSES acc. to ISO 12151-6
- HOSE COUPLING MATERIAL : ACID PROOF

PROJECT : 4/60185 MBARI

Qty.	Pos.	Description	Material	Drawing no.	Rev	Comment
2	14	COIL	400112838			24 VDC 740-224
1	13	E-CHAIN	400065118	20882		
1	12	CHECK VALVE	07511041			RHD-12 L
1	11	OVER CENTRE VALVE	07845019			LHK 22G
2	10	CARTRIDGE	400161192			DTDF-MCN
2	9	VALVE BLOCK	07843020			GCU/S
1	8	CYLINDER	05160155	12940		KM Ø50/25-350
2	7	OVER CENTRE VALVE	07845020			LHK-33
1	6	VALVE CENTRAL	400180306	24820		
1	5	VALVE ON/OFF	07843007			VEI-
1	4	CONTROL VALVE	400073970			HAWE-3 5SL.
1	3	CYLINDER TELESCOPE	400064044	20864		KM Ø125/80-3645
1	2	CYLINDER LUFFING	400064313	16542		MA Ø180/100-880
1	1	CTD DAVIT	400186055	25059		

Ver.	Rev	Description
A	05	As built. 26.06.2023 KRK. Symbol of cartridges pos. 10 were changed to correct. One more valve block pos. 9 was added to BOM. Two coils pos. 14 have been added to diagram and BOM. 15.05.2023 KRK.
	04	Changed standard for fittings . 27.12.2022 SS.
	03	Threads on connectionplate added 12.10.2022 SS
	02	Added note and BOM 11 .08.2022 SS
	01	Released 08.05.202 2 SS

DAVIT
CDT DAVIT
HYDRAULIC DIAGRAM

MACGREGOR

Unspec. tolerances in compliance with
Weight (kg)
Date 11.04.2022
Scale %
Projection
Created by SS
Format A2
Approved date
MPS no.
Approved by
Drawing no. 24856
Revision A

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ROV DOCKING HEAD

MAIN BOOM
A = CYL OUT
B = CYL IN
Ø200/100x1050
OIL FLOW OUT: 60 L/min
OIL FLOW IN: 45 L/min

TROLLEY MOTOR
A = LARS STBD
B = LARS PORT
Q =113 L/min

TELESCOPE BOOM
A = CYL OUT
B = CYL IN
Ø125/90 x 2700
OIL FLOW OUT: 80 L/min
OIL FLOW IN: 37 L/min

WINCH
A:LOWER
B:LIFT
Q = 120 L/min

ALONG TILT CYLINDER
A = CYLINDER OUT
Ø80/45 x 200
OIL FLOW OUT: 23 l/min
OIL FLOW IN: 18 l/min

LATCH CYLINDER 1
A = CYLINDER OUT
Ø25/12 x 75
OIL FLOW OUT: 1 l/min
OIL FLOW IN: 1 l/min

LATCH CYLINDER 2
A = CYLINDER OUT
Ø25/12 x 75
OIL FLOW OUT: 1 l/min
OIL FLOW IN: 1 l/min

DH TWIST
A = CCW
OIL FLOW: 16 l/min

OUT HAULER CYLINDER
A = CYL OUT
B = CYL IN
OIL FLOW: 16 L/min

RESEARCH SHEAVE ACROSS TILT
V1: AFT
V2: FORWARD
OIL FLOW: ? L/min

SPRING PLATE CYLINDERS (x3)
Ø32/20 x 100

Piping motor cable
Piping for sensor cable
Piping for floodlight cable
Fresh water nozzle on tip sheave
Docking head connection plate
Energy Chain Telescope Boom
Inner energy chain on trolley
Outer energy chain on trolley

NOTE: Additional pipes and hoses for protection of electrical cables will be needed during the assembly.

NOTE !
- JIC 37° FLARE FITTINGS acc. to ISO 8434-2
- FITTINGS MATERIAL : ACID PROOF
- H.P.HOSES acc. to ISO 12151-6
- HOSE COUPLING MATERIAL : ACID PROOF

BOM ON SHEET 2

PROJECT : 4/60185 MBARI

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MAIN HYDRAULIC DIAGRAM: S-1739

Ver.	Description	Date	By
B	Over center valve added on roller cylinder	05.02.2024	SS.
A	As built.	26.06.2023	KRK.
11	Changed standard for fittings .	27.12.2022	SS.
10	Added id. names on hyd. valves on the docking head.	15.12.2022	KRK.
09	Change BOM pos 12- Overcenter valve to 1302-SS.	13.12.2022	SS.
08	Updated electrical cables dimension in energy chain from Ø18 to Ø10.	21.11.2022	KRK.
07	Added constant tension function to Winch. Updated BOM list.	04.11.2022	KRK.
06	Added hoses length, added connection plate on docking head.	12. 10.2022	EMJ.
05	Updated hydraulic on docking head.	07.09.2022	EMJ.
04	Changed hydraulic rotator with hydraulic cylinder for the swing.	09.08.2022	HK
03	Added note.	08.07.2022	EMJ.
02	Changed valve no. in pos section, added pipe for all motor, added accumulator on swing for damping.	10.02.2022	HK
01	Released.	06.01.2022	HK

Pos.	Description	Material	Drawing no.	Rev	Comment
	OVERHEAD CRANE ROV LARS HYDRAULIC DIAGRAM		Unspec. tolerances in compliance with		Weight (kg)
					Date 05.01.2022
			Scale %	Projection	Created by HK
			Format A1		Approved date
			MPS no.		Approved by
	MACGREGOR		Drawing no. 24857	Revision B	According to international laws this drawing is the property of Triplex MacGregor. The drawing and content can not be made public, copied or otherwise used without our approval.

1	39	MINIMESS	HGMAS002	-	2703-01-18.10
1	38	COUNTERBALANCE VALVE	HR□□C002	-	VBS□-SE-NA-05.41.62-03-04-35
1	37	NEEDLE VALVE W. cap	RH601138S	-	2N25-P2W-S
1	36	THR□TTLE VALVE w.check	HVMHW002	-	RD 21
1	35	RELIEF VALVE	HRVDE006	-	R5V10-4931L-A-1-25
1	34	SINGLE B□X	400208302	-	MACGREG□R
1	33	REDUCING RELIEF VALVE	HRR□C007	-	VRP-R-VU-05.90.19-03-02-06
1	32	MAN□METER	07872002		
2	31	VALVE PRESS.REDUCTI□N	07841001		1PD25
3	30	CLAMPS ACCUMULAT□RS	400110763		
11	29	C□IL	400112838		VDC 740-224
2	28	SHUTTLE VALVE	07834002		WV-12
2	27	VALVE N□N-RETURN	07511041	--	RHD-12-L
3	26	BALL VALVE	07541022	--	3KH 3/8 R 500 BAR
3	25	VALVE PRESS.LIMITING	400110039	--	HAWE MV 53 G1/2
1	24	SHUTTLE VALVE	400110662	--	WV-16
3	23	ACCUMULAT□R	400110124	--	1,4L
3	22	HYDRAULIC CYLINDER	400089806	23072	Ø32/20 X 100
2	21	HYDRAULIC CYLINDER	400202351	25511	Ø50/30 X 290
1	20	HYDRAULIC CYLINDER	400191141	25241	Ø40/28 X 81
1	19	SLEWING GEAR W/MOTOR	400191339	25288	--
2	18	HYDRAULIC CYLINDER	400089791	23084	Ø25/12 X 75
11	17	CATRIDGE	400161192	--	SUN DTDA-MCN
11	16	VALVE BLOCK	07843020	---	SUN GCU/S - 3/8"
5	15	LOAD HOLDING VALVE	07845019	---	HAWE LHK 22G
1	14	HYDRAULIC CYLINDER	400191142	25240	Ø80/45-200 DT -20°C
1	13	WINCH DRIVE UNIT	400200296	-	PWD3300.CF/92/SH11CR55VM2
1	12	□VERCENTERVALVE	07845002	-	INTEGR CXP6397-02
2	11	HYDRAULIC M□T□R	07821004	-	HAMW□RTHY 2210
1	10	HYDRAULIC CYLINDER	400181574	24943	FJ Ø125/90-2700 DT -20°C
1	9	HYDRAULIC CYLINDER	400181672	24938	FJ 200/100X1070 DT-20°C
1	8	HYDRAULIC CYLINDER	400181575	24938	FJ 200/100X1070 DT-20°C
1	7	ENERGY CHAIN	400192208	25221	igus
1	6	ENERGY CHAIN	400191432	25044	igus
1	5	ENERGY CHAIN	400191433	25045	igus
1	4	VALVE □N/□FF	07843016		SV-
1	3	DIRECTIONAL VALVE	400202262		HAWE
1	2	VALVE CENTRAL	400186081	24859	
1	1	R□V LARS	400191402	25234	

NOTE !
-JIC 37° FLARE FITTINGS acc. to ISO 8434-2
- FITTINGS MATERIAL : ACID PROOF
- H.P.HOSES acc. to ISO 12151-6
- HOSE COUPLING MATERIAL : ACID PROOF

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Qty.	Pos.	Description	Material	Drawing no.	Rev	Comment

OVERHEAD CRANE
ROV LARS
HYDRAULIC DIAGRAM

MACGREGOR

Unspec. tolerances in compliance with

Weight (kg)

Date 05.01.2022

Scale %

Projection

Created by HK

Format A3

Approved date

MPS no.

Approved by

Drawing no. 24857

Revision B

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Ver.

Rev

Customer: CNP Freire

Project: MBari

Document Type	Drawing number	Drawing Description	BOM Article number
Front page	FP		
Drawing list	DL		
Cable list	CD		400209341
Termination list	TL	Termination list	
Installation Notes	00-IS		
Locations	00-LO	Locations	
Cable Diagram	00-CD	Ship Connections	
Circuit Diagram	00-CC	Ship Connections	
Cable Diagram	01-CD	Main VFD Cabinet Pentagon	400092375
Circuit Diagram	01-CC	Main VFD Cabinet Pentagon	400092375
Panel Layout	01-GA	Main VFD Cabinet Pentagon	400092375
Part list	01-PL	Main VFD Cabinet Pentagon	400092375
Cable Diagram	02-CD	CTD Winch	400182376
Circuit Diagram	02-CC	CTD Winch	400182376
Panel Layout	02-GA	CTD Winch	400182376
Cable Diagram	03-CD	ROV Traction Winch	400182377
Circuit Diagram	03-CC	ROV Traction Winch	400182377
Panel Layout	03-GA	ROV Traction Winch	400182377
Cable Diagram	04-CD	Levelwind & Slack Wire Compensator	400182378
Circuit Diagram	04-CC	Levelwind & Slack Wire Compensator	400182378
Panel Layout	04-GA	Levelwind & Slack Wire Compensator	400182378
Cable Diagram	05-CD	Storage Drum	400182467
Circuit Diagram	05-CC	Storage Drum	400182467
Panel Layout	05-GA	Storage Drum	400182467
Cable Diagram	06-CD	Local Panel CTD Winch	400182468
Circuit Diagram	06-CC	Local Panel CTD Winch	400182468
Panel Layout	06-GA	Local Panel CTD Winch	400182468
Cable Diagram	07-CD	Deck Panel ROV Winch System	400182477
Circuit Diagram	07-CC	Deck Panel ROV Winch System	400182477

Status	Change	Date	Name		
				Date	17/11-2021
	Removed CP02	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ

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Customer: CNP Freire

Project: MBari

Document Type	Drawing number	Drawing Description	BOM Article number
Panel Layout	07-GA	Deck Panel ROV Winch System	400182477
Cable Diagram	08-CD	ROV Control Room Panel Winches	400182478
Circuit Diagram	08-CC	ROV Control Room Panel Winches	400182478
Panel Layout	08-GA	ROV Control Room Panel Winches	400182478
Cable Diagram	10-CD	AFT Control Station Panel Winches	400186798
Circuit Diagram	10-CC	AFT Control Station Panel Winches	400186798
Panel Layout	10-GA	AFT Control Station Panel Winches	400186798
Cable Diagram	11-CD	AFT Control Station Panel A-Frame Stern	400186799
Circuit Diagram	11-CC	AFT Control Station Panel A-Frame Stern	400186799
Panel Layout	11-GA	AFT Control Station Panel A-Frame Stern	400186799
Cable Diagram	16-CD	Brake HPU System	NA
Circuit Diagram	16-CC	Brake HPU System	NA
Panel Layout	16-GA	Brake HPU System	NA
Cable Diagram	17-CD	Gear Cooling HPU System	NA
Circuit Diagram	17-CC	Gear Cooling HPU System	NA
Panel Layout	17-GA	Gear Cooling HPU System	NA
Cable Diagram	18-CD	Connections To Triplex System	NA
Circuit Diagram	18-CC	Signal Connections	NA
Cable Diagram	19-CD	Hangar Control Panel	400209341
Circuit Diagram	19-CC	Hangar Control Panel	400209341
Panel Layout	19-GA	Hangar Control Panel	400209341
Part list	19-PL	Hangar Control Panel	400209341
Cable Diagram	20-CD	Overhead Crane Outhauler Motor	NA
Cable Diagram	21-CD	AFT Control Station Panel CTD Davit	400248137
Circuit Diagram	21-CC	AFT Control Station Panel CTD Davit	400248137
Panel Layout	21-GA	AFT Control Station Panel CTD Davit	400248137

				Date	17/11-2021
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	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
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Front page	FP	Front page			1	
		Front page			2	
Drawing list	DL	Drawing list			1	
		Drawing list			2	
		Drawing list			3	
		Drawing list			4	
		Drawing list			5	
		Drawing list			6	
Cable list	CD	Cable list			1	
		Cable list			2	
Termination list	TL	Termination list			1	
		Termination list			2	
		Termination list			3	
		Termination list			4	
		Termination list			5	
		Termination list			6	
		Termination list			7	
		Termination list			8	
		Termination list			9	
		Termination list			10	
		Termination list			11	
		Termination list			12	
		Termination list			13	
		Termination list			14	
		Termination list			15	
		Termination list			16	
		Termination list			17	
		Termination list			18	
		Termination list			19	
		Termination list			20	
		Termination list			21	
Installation Notes	00-IS				1	
Locations	00-LO	Locations				
		System Equipment Overview			1	
		Cabinet Overview			2	
		Network Topology Emergency Stop			3	
Cable Diagram	00-CD	Ship Connections				
		Supply from Ship Power Supply Connections		=SHIP	1	
		Supply from Ship Signal Connections		=SHIP	2	
Circuit Diagram	00-CC	Ship Connections				
		Power Connections 440VAC, 230VAC	+Power	=SHIP	1	
		PMS, Alarm, Internet Optional Alarm	+Signal	=SHIP	2	
Cable Diagram	01-CD	Main VFD Cabinet Pentagon				
		WCS01 Cabinet		=WCS01	1	
		Cable list	+UH01	=WCS01	11	

				Date	17/11-2021
	Updated after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
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Document Type	Drawing number	Title	Location (+)	Function (=)	Sheet	Rev.
Circuit Diagram	01-CC	Main VFD Cabinet Pentagon				
		Cabinet Overview		=WCS01	1	
		Main Power input 1 Control Power, Charging Circuit	+UH01	=WCS01	2	
		Control Inputs Contactor Control	+UH01	=WCS01	3	
		Fan Thermal Switch Control Card Power	+UH01	=WCS01	4	
		Reference Overview	+UH01	=WCS01	5	
		Levelwindes Frequency Inverter	+UH01	=WCS01	6	
		Levelwindes Encoder Cards, PTC Connection	+UH01	=WCS01	7	
		Levelwindes Brakes & Heating	+UH01	=WCS01	8	
		Levelwind Storage Drum Emergency Control Connection	+UH01	=WCS01	9	
		Levelwind CTD Winch Emergency Control Connection	+UH01	=WCS01	10	
		Levelwindes Storage Drum & CTD Winch Frequency Inverter References	+UH01	=WCS01	11	
		Levelwindes Frequency Inverter	+UH01	=WCS01	12	
		Levelwindes Safe Torque Off	+UH01	=WCS01	13	
		Traction Winch, SD & CTD Winch Frequency Inverter	+UH02	=WCS01	14	
		Traction Winch, SD & CTD Winch Encoder Cards	+UH02	=WCS01	15	
		Traction Winch, SD & CTD Winch PTC Connections	+UH02	=WCS01	16	
		Traction Winch, SD & CTD Winch Brake & Heating	+UH02	=WCS01	17	
		Traction Winch Emergency Control Connection	+UH02	=WCS01	18	
		Storage Drum Emergency Control Connection	+UH02	=WCS01	19	
		CTD Winch Emergency Control Connection	+UH02	=WCS01	20	
		Traction Winch Frequency Converter Referenceses	+UH02	=WCS01	21	
		Storage Drum & CDT Winch Frequency Converter Referenceses	+UH02	=WCS01	22	
		Traction Winch, SD & CTD Winch Frequency Converters	+UH02	=WCS01	23	
		Traction Winch, SD & CTD Winch Winch System Deactivation / Activation	+UH02	=WCS01	24	
		Pentagon Control Cabinet Main Power Connections	+UH03	=WCS01	25	
		Pentagon Control Cabinet 230V Distribution, Cabinet Cooling	+UH03	=WCS01	26	
		Pentagon Control Cabinet Heating Distribution, Cabinet Heating	+UH03	=WCS01	27	
		Pentagon Control Cabinet 24V Power Supply	+UH03	=WCS01	28	
		Pentagon Control Cabinet VFD Controlcard Powersupply	+UH03	=WCS01	29	
		Pentagon Control Cabinet Network and Switches	+UH03	=WCS01	30	
		Pentagon Control Cabinet PLC & I/Os	+UH03	=WCS01	31	
		Pentagon Control Cabinet PLC & I/Os	+UH03	=WCS01	32	
		CAN Bus Connection	+UH03	=WCS01	33	
		Pentagon Control Cabinet Brake HPU 1	+UH03	=WCS01	34	
		Pentagon Control Cabinet Gear Cooling HPU	+UH03	=WCS01	35	
		Pentagon Control Cabinet Gear Temp, Brake Inhibit, Traction Winch	+UH03	=WCS01	36	
		Pentagon Control Cabinet Gear Temp Storage Drum & CDT Winch	+UH03	=WCS01	37	
		Pentagon Control Cabinet Storage Drum, Levelwinde / SWC Sensors	+UH03	=WCS01	38	
		Pentagon Control Cabinet CTD Winch, Levelwinde Sensors	+UH03	=WCS01	39	

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				Date	17/11-2021	CNP Freire MBari		
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Document Type	Drawing number	Title	Location (+)	Function (=)	Sheet	Rev.
		Pentagon Control Cabinet Deck Sheave, Traction Winch System Load Cell	+UH03	=WCS01	40	
		Pentagon Control Cabinet Emergency Control & Emergency Stop	+UH03	=WCS01	41	
		Pentagon Control Cabinet Control Panel, Traction Winch & Storage Drum	+UH03	=WCS01	42	
		Pentagon Control Cabinet Control Panel, CTD Winch	+UH03	=WCS01	43	
		Pentagon Control Cabinet Control Room Panels 24VDC	+UH03	=WCS01	44	
		PMS & System Alarms	+UH03	=WCS01	45	
		Pentagon Control Cabinet External Emergency Stop	+UH03	=WCS01	46	
		Outhauler Motor Encoder, PTC, Heat, References	+UH01	=WCS01	47	
		Pentagon Control Cabinet MRU & ABB IMACS Signals	+UH03	=WCS01	48	
Panel Layout	01-GA	Main VFD Cabinet Pentagon				
		Panel Layout		=WCS01	1	
		Panel Layout		=WCS01	2	
Part list	01-PL	Main VFD Cabinet Pentagon				
		Part list		=WCS01	1	
		Part list		=WCS01	2	
		Part list		=WCS01	3	
		Part list		=WCS01	4	
		Part list		=WCS01	5	
Termination list	01-TL	Termination list				
		Termination list	+UH01	=WCS01	31	
Cable Diagram	02-CD	CTD Winch				
		CTD Winch		=HW01	1	
		Connection Point Overview		=HW01	2	
		Cable list		=HW01	7	
Circuit Diagram	02-CC	CTD Winch				
		Winch Internal Connection Box	+UC01	=HW01	1	
		Emergency Control	+UC01	=HW01	2	
Panel Layout	02-GA	CTD Winch				
		Winch Internal Connection Box	+UC01	=HW01	1	
		Winch Internal Connection Box	+UC01	=HW01	2	
Termination list	02-TL	Termination list				
		Termination list		=HW01	26	
Cable Diagram	03-CD	ROV Traction Winch				
		ROV Traction Winch		=TRW01	1	
		Connection Point Overview		=TRW01	2	
		Cable list		=TRW01	10	
Circuit Diagram	03-CC	ROV Traction Winch				
		Winch Connection Box	+UC01	=TRW01	1	
Panel Layout	03-GA	ROV Traction Winch				
		Winch Connection Box	+UC01	=TRW01	1	
		Winch Connection Box	+UC01	=TRW01	2	
Termination list	03-TL	Termination list				
		Termination list		=TRW01	30	

				Date	17/11-2021
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	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
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Document Type	Drawing number	Title	Location (+)	Function (=)	Sheet	Rev.
Cable Diagram	04-CD	Levelwind & Slack Wire Compensator Levelwind & Slack Wire Compensator Connection Point Overview Cable list		 =LEV01 =LEV01 =LEV01	 1 2 8	
Circuit Diagram	04-CC	Levelwind & Slack Wire Compensator Level Wind Connection Box Internal Connection	 +UC01	 =LEV01	 1	
Panel Layout	04-GA	Levelwind & Slack Wire Compensator Level Wind Connection Box Internal Connection Level Wind Connection Box Internal Connection	 +UC01 +UC01	 =LEV01 =LEV01	 1 2	
Termination list	04-TL	Termination list Termination list Termination list		 =LEV01 =LEV01	 27 28	
Cable Diagram	05-CD	Storage Drum Storage Drum Connection Point Overview Cable list		 =RW01 =RW01 =RW01	 1 2 9	
Circuit Diagram	05-CC	Storage Drum Winch Connection Box	 +UC1	 =RW01	 1	
Panel Layout	05-GA	Storage Drum Winch Connection Box Winch Connection Box	 +UC1 +UC1	 =RW01 =RW01	 1 2	
Termination list	05-TL	Termination list Termination list		 =RW01	 29	
Cable Diagram	06-CD	Local Panel CTD Winch Local Panel CTD Winch		 =WP01	 1	
Circuit Diagram	06-CC	Local Panel CTD Winch Winch 1, EMS, Spooling, Heater	 +WP01	 =WP01	 1	
Panel Layout	06-GA	Local Panel CTD Winch Panel layout	 +WP01	 =WP01	 1	
Cable Diagram	07-CD	Deck Panel ROV Winch System Deck Panel ROV Winch System		 =WP02	 1	
Circuit Diagram	07-CC	Deck Panel ROV Winch System Circuit Diagram Traction Winch, EMS, Spooling, Heater Activate Circuit Diagram Storage Drum Emergency Control Switches	 +WP02 +WP02 +WP02	 =WP02 =WP02 =WP02	 1 2 3	
Panel Layout	07-GA	Deck Panel ROV Winch System Panel Layout	 +WP02	 =WP02	 1	
Cable Diagram	08-CD	ROV Control Room Panel Winches Control Room Panel Cable list	 +CP01	 =CP01 =CP01	 1 3	
Circuit Diagram	08-CC	ROV Control Room Panel Winches Panel PC, 1 Joystick Panel PC, 1 Joystick Panel PC, 1 Joystick	 +CP01 +CP01 +CP01	 =CP01 =CP01 =CP01	 1 2 3	

				Date	17/11-2021
	Updated after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
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Panel Layout	08-GA	ROV Control Room Panel Winches Panel Layout	 +CP01	 =CP01	 1	
Termination list	08-TL	Termination list Termination list	 +CP01	 =CP01	 22	
Cable Diagram	10-CD	AFT Control Station Panel Winches Control Room Panel Cable list	 +CP03	 =CP03 =CP03	 1 4	
Circuit Diagram	10-CC	AFT Control Station Panel Winches Panel PC, 1 Joystick Panel PC, 1 Joystick Panel PC, 1 Joystick	 +CP03 +CP03 +CP03	 =CP03 =CP03 =CP03	 1 2 3	
Panel Layout	10-GA	AFT Control Station Panel Winches Panel Layout	 +CP03	 =CP03	 1	
Termination list	10-TL	Termination list Termination list	 +CP03	 =CP03	 23	
Cable Diagram	11-CD	AFT Control Station Panel A-Frame Stern Control Room Panel		 =CP04	 1	
Circuit Diagram	11-CC	AFT Control Station Panel A-Frame Stern Tilt Control, CAN-bus Winch STBD Control, CAN-bus Winch PORT Control, CAN-bus	 +CP04 +CP04 +CP04	 =CP04 =CP04 =CP04	 1 2 3	
Panel Layout	11-GA	AFT Control Station Panel A-Frame Stern Panel Layout	 +CP04	 =CP04	 1	
Cable Diagram	16-CD	Brake HPU System Brake HPU System Cable list		 =HPUBR01 =HPUBR01	 1 5	
Circuit Diagram	16-CC	Brake HPU System HPU Brake, Connection Box	 +UC01	 =HPUBR01	 1	
Panel Layout	16-GA	Brake HPU System HPU Brake, Connection Box HPU Brake, Connection Box	 +UC01 +UC01	 =HPUBR01 =HPUBR01	 1 2	
Termination list	16-TL	Termination list Termination list		 =HPUBR01	 24	
Cable Diagram	17-CD	Gear Cooling HPU System Gear Cooling HPU System Cable list		 =HPUGC01 =HPUGC01	 1 6	
Circuit Diagram	17-CC	Gear Cooling HPU System HPU Gear Cooling Connection Box	 +UC01	 =HPUGC01	 1	
Panel Layout	17-GA	Gear Cooling HPU System HPU Gear Cooling Connection Box HPU Gear Cooling Connection Box	 +UC01 +UC01	 =HPUGC01 =HPUGC01	 1 2	
Termination list	17-TL	Termination list Termination list		 =HPUGC01	 25	

			Date	17/11-2021	
	Updated after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

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Document Type	Drawing number	Title	Location (+)	Function (=)	Sheet	Rev.
Cable Diagram	18-CD	Connections To Triplex System Triplex System		 =TRIP01	 1	
Circuit Diagram	18-CC	Signal Connections Systems Connection EtherCAT to TRIPLEX	 +Signal	 =TRIP01	 1	
Cable Diagram	19-CD	Hangar Control Panel Cable Diagram		 =WP03	 1	
Circuit Diagram	19-CC	Hangar Control Panel Supply and Heating Circuit Diagram PLC Supply, Emergency Stop & Touch Panel Circuit Diagram PLC & I/Os Circuit Diagram Trolley/Telescope Control Tilt/DH Tilt Control Winch/Damper Control ROV Winch Control & Signaling	 +WP03 +WP03 +WP03 +WP03 +WP03 +WP03 +WP03	 =WP03 =WP03 =WP03 =WP03 =WP03 =WP03 =WP03	 1 2 3 4 5 6 7	
Panel Layout	19-GA	Hangar Control Panel Panel Layout		 =WP03	 1	
Part list	19-PL	Hangar Control Panel Part list Part list		 =WP03 =WP03	 1 2	
Cable list	19-	Hangar Control Panel Cable list Termination list	 +WP03 +WP03	 =WP03 =WP03	 12 32	
Cable Diagram	20-CD	Overhead Crane Outhauler Motor		 =OHC	 1	
Cable Diagram	21-CD	AFT Control Station Panel CTD Davit Cable Diagram		 =CP06	 1	
Circuit Diagram	21-CC	AFT Control Station Panel CTD Davit Tilt Control, CAN-bus Telescope Control, CAN-bus Docking Head Control, CAN-bus	 +CP06 +CP06 +CP06	 =CP06 =CP06 =CP06	 1 2 3	
Panel Layout	21-GA	AFT Control Station Panel CTD Davit Panel Layout	 +CP06	 =CP06	 1	

Status	Change	Date	Name	Standard		Version	Index	Repl. by
				Date	17/11-2021	CNP Freire		
	Updated after CP02 removed	28.11.2022	ANP	User	GSK	MBari		
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ			

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Drawing list

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Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WD1	FD 855 CP 3G0.75	=WCS01-X201	+UH03	=HW01-X2	+UC01		7,6
-WD2	FD 855 CP 4G0.75	=WCS01-X500	+UH01	=HW01-X400	+UC01		8,3
-WD3	2YSLCYK-JB 3x2.5+3x0.5	=WCS01-TA3	+UH01	=HW01-MA2			12,2
-WD4	FD 855 CP 3G1.5	=WCS01-X300	+UH01	=HW01-MA2			8,9
-WD5	FD 855 CP 4G0.75	=WCS01-X501	+UH02	=HW01-X400	+UC01		8,3
-WD6	2YSLCYK-JB 3x35+3x6	=WCS01-TA7	+UH02	=HW01-MA1			26,9
-WD7	FD 855 CP 3G1.5	=WCS01-X301	+UH02	=HW01-MA1			8,9
-WD8	FD 855 CP 3G0.75	=WCS01-X201	+UH02	=TRW01-X2	+UC01		7,6
-WD9	2YSLCYK-JB 3x70+3x10	=WCS01-TA4	+UH02	=TRW01-MA1			36,4
-WD10	FD 855 CP 3G1.5	=WCS01-X301	+UH02	=TRW01-MA1			8,9
-WD11	2YSLCYK-JB 3x70+3x10	=WCS01-TA5	+UH02	=TRW01-MA2			36,4
-WD12	FD 855 CP 3G1.5	=WCS01-X301	+UH02	=TRW01-MA2			8,9
-WD13	FD 855 CP 3G0.75	=WCS01-X202	+UH03	=LEV01-X2	+UC01		7,6
-WD14	2YSLCYK-JB 3x2.5+3x0.5	=WCS01-TA2	+UH01	=LEV01-MA1			12,2
-WD15	FD 855 CP 3G1.5	=WCS01-X200	+UH01	=LEV01-MA1			8,9
-WD16	FD 855 CP 3G1.5	=WCS01-X300	+UH01	=LEV01-MA1			8,9
-WD17	FD 855 CP 3G0.75	=WCS01-X201	+UH02	=RW01-X2	+UC1		7,6
-WD18	2YSLCYK-JB 3x16+3x2.5	=WCS01-TA6	+UH02	=RW01-MA1			20,2
-WD19	FD 855 CP 3G1.5	=WCS01-X301	+UH02	=RW01-MA1			8,9
-WD20	FD 855 CP 3G1.5	=WCS01-X302	+UH03	=WP01-X300	+WP01		8,9
-WD21	FD 855 CP 3G1.5	=WCS01-X302	+UH03	=WP02-X300	+WP02		8,9
-WD22	FD 855 CP 4G0.75	=WCS01-X500	+UH01	=WP02-X400	+WP02		8,3
-WD23	FD 855 CP 7G0.75	=WCS01-X501	+UH02	=WP02-X400	+WP02		10,6
-WD24	FD 855 CP 3G1.5	=WCS01-X402	+UH03	=CP01-X1	+CP01		8,9
-WD25	FD 855 CP 3G1.5	=WCS01-X402	+UH03	=CP03-X1	+CP03		8,9
-WD26	2YSLCY-JB BK 4G1.5	=WCS01-X10	+UH03	=HPUBR01-MA1			11,4
-WD27	2YSLCY-JB BK 4G1.5	=WCS01-X10	+UH03	=HPUBR01-MA2			11,4
-WD28	2YSLCYK-JB 3x2.5+3x0.5	=WCS01-X10	+UH03	=HPUGC01-MA1			12,2
-WD29	2YSLCYK-JB 3x2.5+3x0.5	=WCS01-X10	+UH03	=HPUGC01-MA2			12,2
-WD30	FD 855 CP 3G1.5	=WCS01-X2	+UH03	=WP03-X1	+WP03		8,9
-WD31	FD 855 CP 3G1.5	=WCS01-X302	+UH03	=WP03-X300	+WP03		8,9
-WD32	2YSLCYK-JB 3x2.5+3x0.5	=WCS01-TA13	+UH01	=OHC-MA1	+X23		12,2
-WD33	FD 855 CP 3G1.5	=WCS01-X300	+UH01	=OHC-MA1	+X23		8,9
-WDS1	Supply Cable From Ship Supply 3X	=WCS01-QB1	+UH01	=SHIP-X1	+480VAC		6,7
-WDS2	Supply Cable From Ship Supply 2X	=WCS01-X3	+UH03	=SHIP-X4	+230VAC		6
-WDS3	Supply Cable From Ship Supply 2X	=WCS01-X2	+UH03	=SHIP-X3	+230VAC		6
-WF1	DeviceNet Unitronic Thick 1x2xAWG18+1x2xAWG15	=WCS01-X50	+UH03	=CP01-X50	+CP01		12,2
-WF2	EtherLine 4x2xAWG22 CAT7	=WCS01-RJ3	+UH03	=CP01-XG3	+CP01		8,7

Status	Change	Date	Name					
				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Cable list
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK			
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ			
				Standard		Version / Index / Repl. by		

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Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WF3	EtherLine 4x2xAWG22 CAT7	=WCS01-RJ4	+UH03	=CP01-XG4	+CP01		8,7
-WF5	DeviceNet Unitronic Thick 1x2xAWG18+1x2xAWG15	=WCS01-X50	+UH03	=CP03-X50	+CP03		12,2
-WF6	EtherLine 4x2xAWG22 CAT7	=WCS01-RJ5	+UH03	=CP03-XG3	+CP03		8,7
-WF7	EtherLine 4x2xAWG22 CAT7	=WCS01-RJ6	+UH03	=CP03-XG4	+CP03		8,7
-WF8	DeviceNet Unitronic Thick 1x2xAWG18+1x2xAWG15	=CP04-X50	+CP04	=CP03-X50	+CP03		12,2
-WF9	DeviceNet Unitronic Thick 1x2xAWG18+1x2xAWG15	=CP04-X50	+CP04	=CP06-X50	+CP06		12,2
-WF13	EtherLine 4x2xAWG22 CAT7	=WCS01-RJ1	+UH03	=TRIP01-X91	+TRIP01		8,7
-WF14	EtherLine 4x2xAWG22 CAT7	=WCS01-RJ8	+UH03	=WP03-RJ1	+WP03		8,7
-WF15	EtherLine 4x2xAWG22 CAT7	=WCS01-RJ2	+UH03	=WP03-RJ2	+WP03		8,7
-WFS1	Ship Cable Ethernet	=WCS01-RJ7	+UH03	=SHIP-X4	+Ethernet		4,2
-WFS2	Ship Cable Ethernet	=WCS01-RJ9	+UH03	=SHIP-X5	+MRU		4,2
-WG1	FD CP (TP) plus 6x2x0.75	=WCS01-X104	+UH03	=HW01-X1	+UC01		12,8
-WG2	FD CP (TP) plus 4x2x0.25	=WCS01-TA3.KF2:X82	+UH01	=HW01-MA2			7,4
-WG3	FD CP (TP) plus 1x2x0.75	=WCS01-X70	+UH01	=HW01-MA2			6,6
-WG4	FD CP (TP) plus 4x2x0.25	=WCS01-TA7.KF2:X82	+UH02	=HW01-MA1			7,4
-WG5	FD CP (TP) plus 1x2x0.75	=WCS01-X71	+UH02	=HW01-MA1			6,6
-WG6	FD CP (TP) plus 2x2x0.5	=WCS01-X100	+UH03	=TRW01-X1	+UC01		8,9
-WG7	FD CP (TP) plus 4x2x0.25	=WCS01-TA4.KF2:X82	+UH02	=TRW01-MA1			7,4
-WG8	FD CP (TP) plus 1x2x0.75	=WCS01-X71	+UH02	=TRW01-MA1			6,6
-WG9	FD CP (TP) plus 4x2x0.25	=WCS01-TA5.KF2:X82	+UH02	=TRW01-MA2			7,4
-WG10	FD CP (TP) plus 1x2x0.75	=WCS01-X71	+UH02	=TRW01-MA2			6,6
-WG11	FD CP (TP) plus 8x2x0.75	=WCS01-X103	+UH03	=LEV01-X1	+UC01		15,2
-WG12	FD CP (TP) plus 4x2x0.25	=WCS01-TA2.KF2:X82	+UH01	=LEV01-MA1			7,4
-WG13	FD CP (TP) plus 2x2x0.75	=WCS01-X101	+UH03	=RW01-X1	+UC1		8,9
-WG14	FD CP (TP) plus 4x2x0.25	=WCS01-TA6.KF2:X82	+UH02	=RW01-MA1			7,4
-WG15	FD CP (TP) plus 1x2x0.75	=WCS01-X71	+UH02	=RW01-MA1			6,6
-WG16	FD CP (TP) plus 10x2x0.75	=WCS01-X401	+UH03	=WP01-X1	+WP01		17,3
-WG17	FD CP (TP) plus 8x2x0.75	=WCS01-X400	+UH03	=WP02-X1	+WP02		15,2
-WG18	FD CP (TP) plus 6x2x0.75	=WCS01-X400	+UH03	=WP02-X2	+WP02		12,8
-WG19	FD CP (TP) plus 4x2x0.75	=WCS01-X40	+UH03	=CP01-X40	+CP01		12,2
-WG20	FD CP (TP) plus 4x2x0.25	=WCS01-X40	+UH03	=CP03-X40	+CP03		7,4
-WG24	FD CP (TP) plus 4x2x0.75	=WCS01-X30	+UH03	=HPUBR01-X1	+UC01		12,2
-WG25	FD CP (TP) plus 4x2x0.75	=WCS01-X31	+UH03	=HPUGC01-X1	+UC01		12,2
-WG26	FD CP (TP) plus 4x2x0.25	=WCS01-TA13.KF2:X82	+UH01	=OHC-MA1	+X22		7,4
-WG27	FD CP (TP) plus 1x2x0.75	=WCS01-X70	+UH01	=OHC-MA1	+X22		6,6
-WGS1	Ship Signal Cable 6x2x0.75	=WCS01-X82	+UH03	=SHIP-X1	+PMS		7,9
-WGS2	Ship Signal Cable 4x2x0.75	=WCS01-X80	+UH03	=SHIP-X3	+CSCS		6,5
-WGS3	Ship Signal Cable 4x2x0.75	=WCS01-X81	+UH03	=SHIP-X2	+Alarm		6,5

Status	Change	Date	Name	Standard		Version	Index	Repl. by
				Date	17/11-2021	CNP Freire MBari		
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK			
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ			

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Cable list

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WD1	Ölflex FD 855 CP 3G0.75	=WCS01-X201	+UH03	=HW01-X2	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X201:3	01/17.D2	=HW01-X2:1	02/1.D7	
	2	=WCS01-X201:4	01/17.D2	=HW01-X2:2	02/1.D7	
	GNYE	=WCS01-X201:PE	01/17.D2	=HW01-X2:PE	02/1.D7	
	SH1	EMC	02/1.D7	EMC	01/17.D3	
-WD2	Ölflex FD 855 CP 4G0.75	=WCS01-X500	+UH01	=HW01-X400	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X500:4	01/10.D1	=HW01-X400:4	02/2.D3	
	2	=WCS01-X500:5	01/10.D1	=HW01-X400:5	02/2.D3	
	3	=WCS01-X500:6	01/10.D2	=HW01-X400:6	02/2.D3	
	GNYE	=WCS01-X500:PE	01/10.D2	=HW01-X400:PE	02/2.D4	
	SH1	EMC	02/2.D4	EMC	01/10.D2	
-WD3	Ölflex Servo	=WCS01-TA3	+UH01	=HW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-TA3:U2	01/6.D3	=HW01-MA2:U	01/6.E3	
	BK	=WCS01-TA3:V2	01/6.D3	=HW01-MA2:V	01/6.E3	
	GY	=WCS01-TA3:W2	01/6.D3	=HW01-MA2:W	01/6.E3	
	GNYE	PE	01/6.D3	=HW01-MA2:PE	01/6.E3	
	GNYE	PE	01/6.D3	=HW01-MA2:PE	01/6.E3	
	GNYE	PE	01/6.D3	=HW01-MA2:PE	01/6.E3	
	SH1	EMC	01/6.D3	EMC	01/6.E3	
-WD4	Ölflex FD 855 CP 3G1.5	=WCS01-X300	+UH01	=HW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X300:3	01/8.D4	=HW01-MA2:H1	01/8.F4	
	2	=WCS01-X300:4	01/8.D5	=HW01-MA2:H2	01/8.F4	
	GNYE	=WCS01-X300:PE	01/8.D5		01/8.F5	
	SH1	EMC	01/8.D5	EMC	01/8.F5	
-WD5	Ölflex FD 855 CP 4G0.75	=WCS01-X501	+UH02	=HW01-X400	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X501:7	01/20.D1	=HW01-X400:1	02/2.D1	
	2	=WCS01-X501:8	01/20.D1	=HW01-X400:2	02/2.D1	
	3	=WCS01-X501:9	01/20.D2	=HW01-X400:3	02/2.D2	
	GNYE	=WCS01-X501:PE	01/20.D2	=HW01-X400:PE	02/2.D2	
	SH1	EMC	01/20.D2	EMC	02/2.D2	
-WD6	Ölflex Servo	=WCS01-TA7	+UH02	=HW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-TA7:U2	01/14.D6	=HW01-MA1:U	01/14.F6	
	BK	=WCS01-TA7:V2	01/14.D6	=HW01-MA1:V	01/14.F6	
	GY	=WCS01-TA7:W2	01/14.D6	=HW01-MA1:W	01/14.F6	
	GNYE	PE	01/14.D6	=HW01-MA1:PE	01/14.F6	
	GNYE	PE	01/14.D6	=HW01-MA1:PE	01/14.F6	
	GNYE	PE	01/14.D6	=HW01-MA1:PE	01/14.F6	
	SH1	EMC	01/14.D6	EMC	01/14.F6	

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Termination list Termination list	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK				
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ				
Status	Change	Date	Name	Standard		Version	Index	Repl. by	

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WD7	Ölflex FD 855 CP 3G1.5	=WCS01-X301	+UH02	=HW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X301:7	01/17.D7	=HW01-MA1:1HE1	01/17.F7	
	2	=WCS01-X301:8	01/17.D7	=HW01-MA1:1HE2	01/17.F7	
	GNYE	=WCS01-X301:PE	01/17.D7		01/17.F7	
	SH1	EMC	01/17.D7	EMC	01/17.F7	
-WD8	Ölflex FD 855 CP 3G0.75	=WCS01-X201	+UH02	=TRW01-X2	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X201:1	01/17.D1	=TRW01-X2:1	03/1.D7	
	2	=WCS01-X201:2	01/17.D1	=TRW01-X2:2	03/1.D7	
	GNYE	=WCS01-X201:PE	01/17.D1	=TRW01-X2:PE	03/1.D7	
	SH1	EMC	03/1.D7	EMC	01/17.D2	
-WD9	Ölflex Servo	=WCS01-TA4	+UH02	=TRW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-TA4:U2	01/14.D1	=TRW01-MA1:U	01/14.F1	
	BK	=WCS01-TA4:V2	01/14.D1	=TRW01-MA1:V	01/14.F1	
	GY	=WCS01-TA4:W2	01/14.D1	=TRW01-MA1:W	01/14.F1	
	GNYE	PE	01/14.D2	=TRW01-MA1:PE	01/14.F1	
	GNYE	PE	01/14.D2	=TRW01-MA1:PE	01/14.F1	
	GNYE	PE	01/14.D2	=TRW01-MA1:PE	01/14.F1	
	SH1	EMC	01/14.D2	EMC	01/14.F2	
-WD10	Ölflex FD 855 CP 3G1.5	=WCS01-X301	+UH02	=TRW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X301:1	01/17.D4	=TRW01-MA1:1HE1	01/17.F4	
	2	=WCS01-X301:2	01/17.D4	=TRW01-MA1:1HE2	01/17.F4	
	GNYE	=WCS01-X301:PE	01/17.D4		01/17.F4	
	SH1	EMC	01/17.D4	EMC	01/17.F4	
-WD11	Ölflex Servo	=WCS01-TA5	+UH02	=TRW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-TA5:U2	01/14.D3	=TRW01-MA2:U	01/14.F3	
	BK	=WCS01-TA5:V2	01/14.D3	=TRW01-MA2:V	01/14.F3	
	GY	=WCS01-TA5:W2	01/14.D3	=TRW01-MA2:W	01/14.F3	
	GNYE	PE	01/14.D3	=TRW01-MA2:PE	01/14.F3	
	GNYE	PE	01/14.D3	=TRW01-MA2:PE	01/14.F3	
	GNYE	PE	01/14.D3	=TRW01-MA2:PE	01/14.F3	
	SH1	EMC	01/14.D3	EMC	01/14.F3	
-WD12	Ölflex FD 855 CP 3G1.5	=WCS01-X301	+UH02	=TRW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X301:3	01/17.D5	=TRW01-MA2:1HE1	01/17.F5	
	2	=WCS01-X301:4	01/17.D5	=TRW01-MA2:1HE2	01/17.F5	
	GNYE	=WCS01-X301:PE	01/17.D5		01/17.F5	
	SH1	EMC	01/17.D5	EMC	01/17.F5	

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Termination list Termination list	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK				
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ				
Status	Change	Date	Name	Standard		Version	Index	Repl. by	

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WD13	Ölflex FD 855 CP 3G0.75	=WCS01-X202	+UH03	=LEV01-X2	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X202:1	01/38.D6	=LEV01-X2:1	04/1.D8	
	2	=WCS01-X202:2	01/38.D6	=LEV01-X2:2	04/1.D8	
	GNYE	=WCS01-X202:PE	01/38.D6	=LEV01-X2:PE	04/1.D8	
	SH1	EMC	04/1.D8	EMC	01/38.D6	
-WD14	Ölflex Servo	=WCS01-TA2	+UH01	=LEV01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-TA2:U2	01/6.D2	=LEV01-MA1:U	01/6.E2	
	BK	=WCS01-TA2:V2	01/6.D2	=LEV01-MA1:V	01/6.E2	
	GY	=WCS01-TA2:W2	01/6.D2	=LEV01-MA1:W	01/6.E2	
	GNYE	PE	01/6.D2	=LEV01-MA1:PE	01/6.E2	
	GNYE	PE	01/6.D2	=LEV01-MA1:PE	01/6.E2	
	GNYE	PE	01/6.D2	=LEV01-MA1:PE	01/6.E2	
	SH1	EMC	01/6.D2	EMC	01/6.E2	
-WD15	Ölflex FD 855 CP 3G1.5	=WCS01-X200	+UH01	=LEV01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X200:1	01/8.D1	=LEV01-MA1:BR1	01/8.F1	
	2	=WCS01-X200:2	01/8.D1	=LEV01-MA1:BR2	01/8.F1	
	GNYE	=WCS01-X200:PE	01/8.D1		01/8.F1	
	SH1	EMC	01/8.D1	EMC	01/8.F1	
-WD16	Ölflex FD 855 CP 3G1.5	=WCS01-X300	+UH01	=LEV01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X300:1	01/8.D3	=LEV01-MA1:H1	01/8.F3	
	2	=WCS01-X300:2	01/8.D4	=LEV01-MA1:H2	01/8.F4	
	GNYE	=WCS01-X300:PE	01/8.D4		01/8.F4	
	SH1	EMC	01/8.D4	EMC	01/8.F4	
-WD17	Ölflex FD 855 CP 3G0.75	=WCS01-X201	+UH02	=RW01-X2	+UC1	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X201:5	01/17.D3	=RW01-X2:1	05/1.D4	
	2	=WCS01-X201:6	01/17.D3	=RW01-X2:2	05/1.D4	
	GNYE	=WCS01-X201:PE	01/17.D3	=RW01-X2:PE	05/1.D4	
	SH1	EMC	05/1.D4	EMC	01/17.D3	
-WD18	Ölflex Servo	=WCS01-TA6	+UH02	=RW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-TA6:U2	01/14.D4	=RW01-MA1:U	01/14.F4	
	BK	=WCS01-TA6:V2	01/14.D4	=RW01-MA1:V	01/14.F4	
	GY	=WCS01-TA6:W2	01/14.D4	=RW01-MA1:W	01/14.F4	
	GNYE	PE	01/14.D5	=RW01-MA1:PE	01/14.F4	
	GNYE	PE	01/14.D5	=RW01-MA1:PE	01/14.F4	
	GNYE	PE	01/14.D5	=RW01-MA1:PE	01/14.F4	
	SH1	EMC	01/14.D5	EMC	01/14.F5	

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	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK				
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ				
Status	Change	Date	Name	Standard		Version	Index	Repl. by	

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WD19	Ölflex FD 855 CP 3G1.5	=WCS01-X301	+UH02	=RW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X301:5	01/17.D6	=RW01-MA1:1HE1	01/17.F6	
	2	=WCS01-X301:6	01/17.D6	=RW01-MA1:1HE2	01/17.F6	
	GNYE	=WCS01-X301:PE	01/17.D6		01/17.F6	
	SH1	EMC	01/17.D6	EMC	01/17.F6	
-WD20	Ölflex FD 855 CP 3G1.5	=WCS01-X302	+UH03	=WP01-X300	+WP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X302:1	01/27.D6	=WP01-X300:1	06/1.D8	
	2	=WCS01-X302:2	01/27.D6	=WP01-X300:2	06/1.D8	
	GNYE	=WCS01-X302:PE	01/27.D7	=WP01-X300:PE	06/1.D8	
	SH1	EMC	06/1.D8	EMC	01/27.D7	
-WD21	Ölflex FD 855 CP 3G1.5	=WCS01-X302	+UH03	=WP02-X300	+WP02	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X302:3	01/27.D7	=WP02-X300:1	07/1.D8	
	2	=WCS01-X302:4	01/27.D7	=WP02-X300:2	07/1.D8	
	GNYE	=WCS01-X302:PE	01/27.D7	=WP02-X300:PE	07/1.D8	
	SH1	EMC	07/1.D8	EMC	01/27.D7	
-WD22	Ölflex FD 855 CP 4G0.75	=WCS01-X500	+UH01	=WP02-X400	+WP02	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X500:1	01/9.D1	=WP02-X400:7	07/3.D4	
	2	=WCS01-X500:2	01/9.D1	=WP02-X400:8	07/3.D5	
	3	=WCS01-X500:3	01/9.D2	=WP02-X400:9	07/3.D5	
	GNYE	=WCS01-X500:PE	01/9.D2	=WP02-X400:PE	07/3.D5	
	SH1	EMC	01/9.D2	EMC	07/3.D6	
-WD23	Ölflex FD 855 CP 7G0.75	=WCS01-X501	+UH02	=WP02-X400	+WP02	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X501:1	01/18.D1	=WP02-X400:1	07/3.D1	
	2	=WCS01-X501:2	01/18.D1	=WP02-X400:2	07/3.D2	
	3	=WCS01-X501:3	01/18.D2	=WP02-X400:3	07/3.D2	
	4	=WCS01-X501:4	01/19.D1	=WP02-X400:4	07/3.D3	
	5	=WCS01-X501:5	01/19.D1	=WP02-X400:5	07/3.D3	
	6	=WCS01-X501:6	01/19.D2	=WP02-X400:6	07/3.D4	
	GNYE	=WCS01-X501:PE	01/19.D2	=WP02-X400:PE	07/3.D4	
	SH1	EMC	07/3.D4	EMC	01/18.D2	
-WD24	Ölflex FD 855 CP 3G1.5	=WCS01-X402	+UH03	=CP01-X1	+CP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X402:1	01/44.D1	=CP01-X1:1	08/1.D1	
	2	=WCS01-X402:2	01/44.D1	=CP01-X1:2	08/1.D1	
	GNYE	=WCS01-X402:PE	01/44.D2	PE	08/1.D2	
	SH1	EMC	08/1.D2	EMC	01/44.D2	

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	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WD25	Ölflex FD 855 CP 3G1.5	=WCS01-X402	+UH03	=CP03-X1	+CP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X402:3	01/44.D2	=CP03-X1:1	10/1.D1	
	2	=WCS01-X402:4	01/44.D2	=CP03-X1:2	10/1.D1	
	GNYE	=WCS01-X402:PE	01/44.D2	PE	10/1.D2	
	SH1	EMC	01/44.D3	EMC	10/1.D2	
-WD26	Ölflex Servo	=WCS01-X10	+UH03	=HPUBR01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-X10:1	01/25.D2	=HPUBR01-MA1:U	01/25.E2	
	BK	=WCS01-X10:2	01/25.D2	=HPUBR01-MA1:V	01/25.E2	
	GY	=WCS01-X10:3	01/25.D2	=HPUBR01-MA1:W	01/25.E2	
	GNYE	=WCS01-X10:PE	01/25.D2	=HPUBR01-MA1:PE	01/25.E2	
-WD27	Ölflex Servo	=WCS01-X10	+UH03	=HPUBR01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-X10:4	01/25.D3	=HPUBR01-MA2:U	01/25.E3	
	BK	=WCS01-X10:5	01/25.D3	=HPUBR01-MA2:V	01/25.E3	
	GY	=WCS01-X10:6	01/25.D3	=HPUBR01-MA2:W	01/25.E3	
	GNYE	=WCS01-X10:PE	01/25.D3	=HPUBR01-MA2:PE	01/25.E3	
-WD28	Ölflex Servo	=WCS01-X10	+UH03	=HPUGC01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-X10:7	01/25.D3	=HPUGC01-MA1:U	01/25.E3	
	BK	=WCS01-X10:8	01/25.D4	=HPUGC01-MA1:V	01/25.E4	
	GY	=WCS01-X10:9	01/25.D4	=HPUGC01-MA1:W	01/25.E4	
	GNYE	=WCS01-X10:PE	01/25.D4	=HPUGC01-MA1:PE	01/25.E4	
	GNYE	=WCS01-X10:PE	01/25.D4	=HPUGC01-MA1:PE	01/25.E4	
	GNYE	=WCS01-X10:PE	01/25.D4	=HPUGC01-MA1:PE	01/25.E4	
	SH1	EMC	01/25.D4	EMC	01/25.E4	
-WD29	Ölflex Servo	=WCS01-X10	+UH03	=HPUGC01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-X10:10	01/25.D4	=HPUGC01-MA2:U	01/25.E4	
	BK	=WCS01-X10:11	01/25.D4	=HPUGC01-MA2:V	01/25.E4	
	GY	=WCS01-X10:12	01/25.D4	=HPUGC01-MA2:W	01/25.E4	
	GNYE	=WCS01-X10:PE	01/25.D5	=HPUGC01-MA2:PE	01/25.E5	
	GNYE	=WCS01-X10:PE	01/25.D5	=HPUGC01-MA2:PE	01/25.E5	
	GNYE	=WCS01-X10:PE	01/25.D5	=HPUGC01-MA2:PE	01/25.E5	
	SH1	EMC	01/25.D5	EMC	01/25.E5	
-WD30	Ölflex FD 855 CP 3G1.5	=WCS01-X2	+UH03	=WP03-X1	+WP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X2:3	01/26.D2	=WP03-X1:1	19/1.D3	
	2	=WCS01-X2:4	01/26.D2	=WP03-X1:2	19/1.D3	
	GNYE	=WCS01-X2:PE	01/26.D2	=WP03-X1:PE	19/1.D3	
	SH1	EMC	01/26.D2	EMC	19/1.D3	

Status	Change	Date	Name	Standard	
				Date	17/11-2021
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ

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-WD31	Ölflex FD 855 CP 3G1.5	=WCS01-X302	+UH03	=WP03-X300	+WP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X302:5	01/27.D7	=WP03-X300:1	19/1.D1	
	2	=WCS01-X302:6	01/27.D8	=WP03-X300:2	19/1.D1	
	GNYE	=WCS01-X302:PE	01/27.D8	=WP03-X300:PE	19/1.D1	
	SH1	EMC	01/27.D8	EMC	19/1.D2	
-WD32	Ölflex Servo	=WCS01-TA13	+UH01	=OHC-MA1	+X23	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=WCS01-TA13:U	01/6.D4	=OHC-MA1:U	01/6.E4	
	BK	=WCS01-TA13:V	01/6.D4	=OHC-MA1:V	01/6.E4	
	GY	=WCS01-TA13:W	01/6.D4	=OHC-MA1:W	01/6.E4	
	GNYE	=WCS01-TA13:PE	01/6.D4	=OHC-MA1:PE	01/6.E4	
	GNYE	=WCS01-TA13:PE	01/6.D4	=OHC-MA1:PE	01/6.E4	
	GNYE	=WCS01-TA13:PE	01/6.D4	=OHC-MA1:PE	01/6.E4	
	SH1	EMC	01/6.E4	EMC	01/6.D4	
-WD33	Ölflex FD 855 CP 3G1.5	=WCS01-X300	+UH01	=OHC-MA1	+X23	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X300:5	01/47.D3	=OHC-MA1:H1	01/47.F3	
	2	=OHC-MA1:H2	01/47.F3	=WCS01-X300:6	01/47.D3	
	GNYE		01/47.E3	=WCS01-X300:PE	01/47.D3	
	SH1	EMC	01/47.E3	EMC	01/47.D3	
-WDS1	Ship Internal Supply Cable To Winch System	=WCS01-QB1	+UH01	=SHIP-X1	+480VAC	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-QB1:2	01/2.D1	=SHIP-X1:1	00/1.D2	
	2	=WCS01-QB1:4	01/2.D1	=SHIP-X1:2	00/1.D2	
	3	=WCS01-QB1:6	01/2.D1	=SHIP-X1:3	00/1.D2	
	GNYE	PE Bar	01/2.E1	=SHIP-X1:PE	00/1.D2	
-WDS2	Ship Internal Supply Cable To Winch System	=WCS01-X3	+UH03	=SHIP-X4	+230VAC	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X3:1	01/27.D1	=SHIP-X4:1	00/1.D6	
	2	=WCS01-X3:2	01/27.D1	=SHIP-X4:2	00/1.D6	
	GNYE	=WCS01-X3:PE	01/27.D1	=SHIP-X4:PE	00/1.D6	
-WDS3	Ship Internal Supply Cable To Winch System	=WCS01-X2	+UH03	=SHIP-X3	+230VAC	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	1	=WCS01-X2:1	01/26.D1	=SHIP-X3:1	00/1.D5	
	2	=WCS01-X2:2	01/26.D1	=SHIP-X3:2	00/1.D5	
	GNYE	=WCS01-X2:PE	01/26.D1	=SHIP-X3:PE	00/1.D5	

Status	Change	Date	Name	Standard	
				Date	17/11-2021
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WF1	DeviceNet Thick	=WCS01-X50	+UH03	=CP01-X50	+CP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	Shield	=WCS01-X50:3	01/33.D2	=CP01-X50:3	08/2.D6	
	WH	=WCS01-X50:4	01/33.D3	=CP01-X50:4	08/2.D6	
	BU	=WCS01-X50:2	01/33.D2	=CP01-X50:2	08/2.D6	
	TW1					
	RD	=WCS01-X50:5	01/33.D3	=CP01-X50:5	08/2.D7	
	BK	=WCS01-X50:1	01/33.D2	=CP01-X50:1	08/2.D6	
	TW2					
	SH1	EMC	01/33.E3	EMC	08/2.E7	
-WF2	EtherLine CAT7	=WCS01-RJ3	+UH03	=CP01-XG3	+CP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU	=WCS01-RJ3:5	01/30.D3	=CP01-XG3:5	08/1.D5	
	BU	=WCS01-RJ3:4	01/30.D3	=CP01-XG3:4	08/1.D5	
	TW1					
	WHOR	=WCS01-RJ3:1	01/30.D3	=CP01-XG3:1	08/1.D5	
	OR	=WCS01-RJ3:2	01/30.D3	=CP01-XG3:2	08/1.D5	
	TW2					
	WHGN	=WCS01-RJ3:3	01/30.D4	=CP01-XG3:3	08/1.D5	
	GN	=WCS01-RJ3:6	01/30.D4	=CP01-XG3:6	08/1.D5	
	TW3					
	WHBN	=WCS01-RJ3:7	01/30.D4	=CP01-XG3:7	08/1.D5	
	BN	=WCS01-RJ3:8	01/30.D4	=CP01-XG3:8	08/1.D5	
	TW4					
	SH1	=WCS01-RJ3:S	01/30.D4	=CP01-XG3:S	08/1.D5	
-WF3	EtherLine CAT7	=WCS01-RJ4	+UH03	=CP01-XG4	+CP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU	=WCS01-RJ4:5	01/30.D4	=CP01-XG4:5	08/1.D6	
	BU	=WCS01-RJ4:4	01/30.D4	=CP01-XG4:4	08/1.D6	
	TW1					
	WHOR	=WCS01-RJ4:1	01/30.D4	=CP01-XG4:1	08/1.D6	
	OR	=WCS01-RJ4:2	01/30.D4	=CP01-XG4:2	08/1.D6	
	TW2					
	WHGN	=WCS01-RJ4:3	01/30.D4	=CP01-XG4:3	08/1.D6	
	GN	=WCS01-RJ4:6	01/30.D5	=CP01-XG4:6	08/1.D6	
	TW3					
	WHBN	=WCS01-RJ4:7	01/30.D5	=CP01-XG4:7	08/1.D6	
	BN	=WCS01-RJ4:8	01/30.D5	=CP01-XG4:8	08/1.D6	
	TW4					
	SH1	=WCS01-RJ4:S	01/30.D5	=CP01-XG4:S	08/1.D7	
-WF5	DeviceNet Thick	=WCS01-X50	+UH03	=CP03-X50	+CP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	Shield	=WCS01-X50:3	01/33.D2	=CP03-X50:3	10/2.D6	
	WH	=WCS01-X50:4	01/33.D3	=CP03-X50:4	10/2.D6	
	BU	=WCS01-X50:2	01/33.D2	=CP03-X50:2	10/2.D6	
	TW1					
	RD	=WCS01-X50:5	01/33.D3	=CP03-X50:5	10/2.D7	
	BK	=WCS01-X50:1	01/33.D2	=CP03-X50:1	10/2.D6	

Status	Change	Date	Name	Standard	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
	TW2 SH1	 EMC	 01/33.E4	 EMC	 10/2.E7	
-WF6	EtherLine CAT7	=WCS01-RJ5	+UH03	=CP03-XG3	+CP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU BU TW1 WHOR OR TW2 WHGN GN TW3 WHBN BN TW4 SH1	=WCS01-RJ5:5 =WCS01-RJ5:4 =WCS01-RJ5:1 =WCS01-RJ5:2 =WCS01-RJ5:3 =WCS01-RJ5:6 =WCS01-RJ5:7 =WCS01-RJ5:8 =WCS01-RJ5:S	01/30.D6 01/30.D6 01/30.D6 01/30.D6 01/30.D6 01/30.D6 01/30.D6 01/30.D7 01/30.D7	=CP03-XG3:5 =CP03-XG3:4 =CP03-XG3:1 =CP03-XG3:2 =CP03-XG3:3 =CP03-XG3:6 =CP03-XG3:7 =CP03-XG3:8 =CP03-XG3:S	10/1.D5 10/1.D5 10/1.D5 10/1.D5 10/1.D5 10/1.D5 10/1.D5 10/1.D5 10/1.D5	
-WF7	EtherLine CAT7	=WCS01-RJ6	+UH03	=CP03-XG4	+CP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU BU TW1 WHOR OR TW2 WHGN GN TW3 WHBN BN TW4 SH1	=WCS01-RJ6:5 =WCS01-RJ6:4 =WCS01-RJ6:1 =WCS01-RJ6:2 =WCS01-RJ6:3 =WCS01-RJ6:6 =WCS01-RJ6:7 =WCS01-RJ6:8 =WCS01-RJ6:S	01/30.D7 01/30.D7 01/30.D7 01/30.D7 01/30.D7 01/30.D7 01/30.D7 01/30.D7 01/30.D7	=CP03-XG4:5 =CP03-XG4:4 =CP03-XG4:1 =CP03-XG4:2 =CP03-XG4:3 =CP03-XG4:6 =CP03-XG4:7 =CP03-XG4:8 =CP03-XG4:S	10/1.D6 10/1.D6 10/1.D6 10/1.D6 10/1.D6 10/1.D6 10/1.D6 10/1.D6 10/1.D7	
-WF8	DeviceNet Thick	=CP04-X50	+CP04	=CP03-X50	+CP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	Shield WH BU TW1 RD BK TW2 SH1	=CP04-X50:3 =CP04-X50:4 =CP04-X50:2 =CP04-X50:5 =CP04-X50:1 EMC	11/1.D7 11/1.D7 11/1.D6 11/1.D7 11/1.D6 10/2.E8	=CP03-X50:3 =CP03-X50:4 =CP03-X50:2 =CP03-X50:5 =CP03-X50:1 EMC	10/2.D6 10/2.D6 10/2.D6 10/2.D7 10/2.D6 11/1.E7	

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WF9	DeviceNet Thick	=CP04-X50	+CP04	=CP06-X50	+CP06	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	Shield	=CP04-X50:3	11/1.D7	=CP06-X50:3	21/1.D7	
	WH	=CP04-X50:4	11/1.D7	=CP06-X50:4	21/1.D7	
	BU	=CP04-X50:2	11/1.D6	=CP06-X50:2	21/1.D6	
	TW1					
	RD	=CP04-X50:5	11/1.D7	=CP06-X50:5	21/1.D7	
	BK	=CP04-X50:1	11/1.D6	=CP06-X50:1	21/1.D6	
	TW2					
	SH1	EMC	11/1.E8	EMC	21/1.E7	
-WF13	EtherLine CAT7	=WCS01-RJ1	+UH03	=TRIP01-X91	+TRIP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU	=WCS01-RJ1:5	01/30.D1	=A-FRAME STERN-X91:5	18/1.D1	
	BU	=WCS01-RJ1:4	01/30.D1	=A-FRAME STERN-X91:4	18/1.D1	
	TW1					
	WHOR	=WCS01-RJ1:1	01/30.D1	=A-FRAME STERN-X91:1	18/1.D1	
	OR	=WCS01-RJ1:2	01/30.D1	=A-FRAME STERN-X91:2	18/1.D2	
	TW2					
	WHGN	=WCS01-RJ1:3	01/30.D1	=A-FRAME STERN-X91:3	18/1.D2	
	GN	=WCS01-RJ1:6	01/30.D1	=A-FRAME STERN-X91:6	18/1.D2	
	TW3					
	WHBN	=WCS01-RJ1:7	01/30.D1	=A-FRAME STERN-X91:7	18/1.D2	
	BN	=WCS01-RJ1:8	01/30.D1	=A-FRAME STERN-X91:8	18/1.D2	
	TW4					
	SH1	=WCS01-RJ1:S	01/30.D1	=A-FRAME STERN-X91:S	18/1.D2	
-WF14	EtherLine CAT7	=WCS01-RJ8	+UH03	=WP03-RJ1	+WP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU	=WCS01-RJ8:5	01/30.D2	=WP03-RJ1:5	19/2.D6	
	BU	=WCS01-RJ8:4	01/30.D2	=WP03-RJ1:4	19/2.D6	
	TW1					
	WHOR	=WCS01-RJ8:1	01/30.D3	=WP03-RJ1:1	19/2.D6	
	OR	=WCS01-RJ8:2	01/30.D3	=WP03-RJ1:2	19/2.D6	
	TW2					
	WHGN	=WCS01-RJ8:3	01/30.D3	=WP03-RJ1:3	19/2.D6	
	GN	=WCS01-RJ8:6	01/30.D3	=WP03-RJ1:6	19/2.D6	
	TW3					
	WHBN	=WCS01-RJ8:7	01/30.D3	=WP03-RJ1:7	19/2.D6	
	BN	=WCS01-RJ8:8	01/30.D3	=WP03-RJ1:8	19/2.D6	
	TW4					
	SH1	=WCS01-RJ8:S	01/30.D3	=WP03-RJ1:S	19/2.D6	

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-WF15	EtherLine CAT7	=WCS01-RJ2	+UH03	=WP03-RJ2	+WP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU	=WCS01-RJ2:5	01/30.D1	=WP03-RJ2:5	19/2.D7	
	BU	=WCS01-RJ2:4	01/30.D2	=WP03-RJ2:4	19/2.D8	
	TW1					
	WHOR	=WCS01-RJ2:1	01/30.D2	=WP03-RJ2:1	19/2.D8	
	OR	=WCS01-RJ2:2	01/30.D2	=WP03-RJ2:2	19/2.D8	
	TW2					
	WHGN	=WCS01-RJ2:3	01/30.D2	=WP03-RJ2:3	19/2.D8	
	GN	=WCS01-RJ2:6	01/30.D2	=WP03-RJ2:6	19/2.D8	
	TW3					
	WHBN	=WCS01-RJ2:7	01/30.D2	=WP03-RJ2:7	19/2.D8	
	BN	=WCS01-RJ2:8	01/30.D2	=WP03-RJ2:8	19/2.D8	
	TW4					
	SH1	=WCS01-RJ2:S	01/30.D2	=WP03-RJ2:S	19/2.D8	
-WFS1	Ship Ethernet Cable	=WCS01-RJ7	+UH03	=SHIP-X4	+Ethernet	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU	=WCS01-RJ7:5	01/30.D8	=SHIP-X4:1	00/2.D6	
	BU	=WCS01-RJ7:4	01/30.D8	=SHIP-X4:2	00/2.D6	
	TW1					
	WHOR	=WCS01-RJ7:1	01/30.D8	=SHIP-X4:3	00/2.D6	
	OR	=WCS01-RJ7:2	01/30.D8	=SHIP-X4:4	00/2.D6	
	TW2					
	WHGN	=WCS01-RJ7:3	01/30.D8	=SHIP-X4:5	00/2.D6	
	GN	=WCS01-RJ7:6	01/30.D8	=SHIP-X4:6	00/2.D6	
	TW3					
	WHBN	=WCS01-RJ7:7	01/30.D8	=SHIP-X4:7	00/2.D7	
	BN	=WCS01-RJ7:8	01/30.D8	=SHIP-X4:8	00/2.D7	
	TW4					
	SH1	=WCS01-RJ7:S	01/30.D8	EMC	00/2.D7	
-WFS2	Ship Ethernet Cable	=WCS01-RJ9	+UH03	=SHIP-X5	+MRU	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WHBU	=WCS01-RJ9:5	01/30.D5	=SHIP-X5:1	00/2.D7	
	BU	=WCS01-RJ9:4	01/30.D5	=SHIP-X5:2	00/2.D7	
	TW1					
	WHOR	=WCS01-RJ9:1	01/30.D5	=SHIP-X5:3	00/2.D7	
	OR	=WCS01-RJ9:2	01/30.D5	=SHIP-X5:4	00/2.D7	
	TW2					
	WHGN	=WCS01-RJ9:3	01/30.D5	=SHIP-X5:5	00/2.D8	
	GN	=WCS01-RJ9:6	01/30.D5	=SHIP-X5:6	00/2.D8	
	TW3					
	WHBN	=WCS01-RJ9:7	01/30.D6	=SHIP-X5:7	00/2.D8	
	BN	=WCS01-RJ9:8	01/30.D6	=SHIP-X5:8	00/2.D8	
	TW4					
	SH1	=WCS01-RJ9:S	01/30.D6	EMC	00/2.D8	

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-WG1	Unitronic Lapp Cable 6x2x0.75	=WCS01-X104	+UH03	=HW01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X104:1	01/39.D1	=HW01-X1:1	02/1.D1	
	BN	=WCS01-X104:2	01/39.D1	=HW01-X1:2	02/1.D1	
	TW1					
	GN	=WCS01-X104:3	01/39.D2	=HW01-X1:4	02/1.D1	
	YE	=WCS01-X104:4	01/39.D2	=HW01-X1:8	02/1.D2	
	TW2					
	GY	=WCS01-X104:5	01/39.D2	=HW01-X1:12	02/1.D3	
	PK	=WCS01-X104:6	01/39.D3	=HW01-X1:18	02/1.D4	
	TW3					
	BU	=WCS01-X104:7	01/39.D3	=HW01-X1:22	02/1.D4	
	RD	=WCS01-X104:8	01/39.D4	=HW01-X1:24	02/1.D5	
	TW4					
	BK	=WCS01-X102:3	01/37.D3	=HW01-X1:29	02/1.D6	
	VT					
	TW5					
	GYPK					
	RDBU					
	TW6					
	SH1	EMC	01/39.D4	EMC	02/1.D6	
-WG2	Unitronic Lapp Cable 4x2x0.25	=WCS01-TA3.KF2:X82	+UH01	=HW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-TA3.KF2:X82:5	01/7.B4	=HW01-MA2:7	01/7.E4	
	BN	=WCS01-TA3.KF2:X82:6	01/7.B4	=HW01-MA2:8	01/7.E4	
	TW1					
	GN	=WCS01-TA3.KF2:X82:3	01/7.B4	=HW01-MA2:5	01/7.E4	
	YE	=WCS01-TA3.KF2:X82:4	01/7.B4	=HW01-MA2:6	01/7.E4	
	TW2					
	GY	=WCS01-TA3.KF2:X82:2	01/7.B4	=HW01-MA2:4	01/7.E4	
	PK	=WCS01-TA3.KF2:X82:1	01/7.B3	=HW01-MA2:3	01/7.E3	
	TW3					
	BU	=WCS01-TA3.KF2:X81:5	01/7.B3	=HW01-MA2:2	01/7.E3	
	RD	=WCS01-TA3.KF2:X81:4	01/7.B3	=HW01-MA2:1	01/7.E3	
	TW4					
	SH1	=WCS01-TA3.KF2:X82:7	01/7.B4	=HW01-MA2:9	01/7.E4	
-WG3	Unitronic Lapp Cable 1x2x0.75	=WCS01-X70	+UH01	=HW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X70:3	01/7.D7	=HW01-MA2:PTC1	01/7.F7	
	BN	=WCS01-X70:4	01/7.D7	=HW01-MA2:PTC2	01/7.F7	
	TW1					
	SH1	EMC	01/7.D7	EMC	01/7.F7	

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-WG4	Unitronic Lapp Cable 4x2x0.25	=WCS01-TA7.KF2:X82	+UH02	=HW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-TA7.KF2:X82:5	01/15.B7	=HW01-MA1:4	01/15.E7	
	BN	=WCS01-TA7.KF2:X82:6	01/15.B8	=HW01-MA1:3	01/15.E8	
	TW1					
	GN	=WCS01-TA7.KF2:X82:3	01/15.B7	=HW01-MA1:6	01/15.E7	
	YE	=WCS01-TA7.KF2:X82:4	01/15.B7	=HW01-MA1:5	01/15.E7	
	TW2					
	GY	=WCS01-TA7.KF2:X82:2	01/15.B7	=HW01-MA1:7	01/15.E7	
	PK	=WCS01-TA7.KF2:X82:1	01/15.B7	=HW01-MA1:8	01/15.E7	
	TW3					
	BU	=WCS01-TA7.KF2:X81:5	01/15.B7	=HW01-MA1:1	01/15.E7	
	RD	=WCS01-TA7.KF2:X81:4	01/15.B7	=HW01-MA1:2	01/15.E7	
	TW4					
	SH1	=WCS01-TA7.KF2:X82:7	01/15.B8	=HW01-MA1:PE	01/15.E8	
-WG5	Unitronic Lapp Cable 1x2x0.75	=WCS01-X71	+UH02	=HW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X71:7	01/16.D4	=HW01-MA1:1TP1	01/16.F4	
	BN	=WCS01-X71:8	01/16.D4	=HW01-MA1:1TP2	01/16.F4	
	TW1					
	SH1	EMC	01/16.D4	EMC	01/16.F4	
-WG6	Unitronic Lapp Cable 2x2x0.5	=WCS01-X100	+UH03	=TRW01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X100:1	01/36.D1	=TRW01-X1:1	03/1.D1	
	BN	=WCS01-X100:2	01/36.D1	=TRW01-X1:2	03/1.D1	
	TW1					
	GN	=WCS01-X100:3	01/36.D2	=TRW01-X1:5	03/1.D2	
	YE	=WCS01-X100:4	01/36.D2	=TRW01-X1:9	03/1.D2	
	TW2					
	SH1	EMC	01/36.D2	EMC	03/1.D2	
-WG7	Unitronic Lapp Cable 4x2x0.25	=WCS01-TA4.KF2:X82	+UH02	=TRW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-TA4.KF2:X82:5	01/15.B2	=TRW01-MA1:4	01/15.E2	
	BN	=WCS01-TA4.KF2:X82:6	01/15.B2	=TRW01-MA1:3	01/15.E2	
	TW1					
	GN	=WCS01-TA4.KF2:X82:3	01/15.B2	=TRW01-MA1:6	01/15.E2	
	YE	=WCS01-TA4.KF2:X82:4	01/15.B2	=TRW01-MA1:5	01/15.E2	
	TW2					
	GY	=WCS01-TA4.KF2:X82:2	01/15.B1	=TRW01-MA1:7	01/15.E1	
	PK	=WCS01-TA4.KF2:X82:1	01/15.B1	=TRW01-MA1:8	01/15.E1	
	TW3					
	BU	=WCS01-TA4.KF2:X81:5	01/15.B1	=TRW01-MA1:1	01/15.E1	
	RD	=WCS01-TA4.KF2:X81:4	01/15.B1	=TRW01-MA1:2	01/15.E1	
	TW4					
	SH1	=WCS01-TA4.KF2:X82:7	01/15.B2	=TRW01-MA1:PE	01/15.E2	

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-WG8	Unitronic Lapp Cable 1x2x0.75	=WCS01-X71	+UH02	=TRW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X71:1	01/16.D1	=TRW01-MA1:1TP1	01/16.F1	
	BN	=WCS01-X71:2	01/16.D1	=TRW01-MA1:1TP2	01/16.F1	
	TW1					
	SH1	EMC	01/16.D2	EMC	01/16.F2	
-WG9	Unitronic Lapp Cable 4x2x0.25	=WCS01-TA5.KF2:X82	+UH02	=TRW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-TA5.KF2:X82:5	01/15.B4	=TRW01-MA2:4	01/15.E4	
	BN	=WCS01-TA5.KF2:X82:6	01/15.B4	=TRW01-MA2:3	01/15.E4	
	TW1					
	GN	=WCS01-TA5.KF2:X82:3	01/15.B3	=TRW01-MA2:6	01/15.E3	
	YE	=WCS01-TA5.KF2:X82:4	01/15.B4	=TRW01-MA2:5	01/15.E4	
	TW2					
	GY	=WCS01-TA5.KF2:X82:2	01/15.B3	=TRW01-MA2:7	01/15.E3	
	PK	=WCS01-TA5.KF2:X82:1	01/15.B3	=TRW01-MA2:8	01/15.E3	
	TW3					
	BU	=WCS01-TA5.KF2:X81:5	01/15.B3	=TRW01-MA2:1	01/15.E3	
	RD	=WCS01-TA5.KF2:X81:4	01/15.B3	=TRW01-MA2:2	01/15.E3	
	TW4					
	SH1	=WCS01-TA5.KF2:X82:7	01/15.B4	=TRW01-MA2:PE	01/15.E4	
-WG10	Unitronic Lapp Cable 1x2x0.75	=WCS01-X71	+UH02	=TRW01-MA2		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X71:3	01/16.D2	=TRW01-MA2:1TP1	01/16.F2	
	BN	=WCS01-X71:4	01/16.D2	=TRW01-MA2:1TP2	01/16.F2	
	TW1					
	SH1	EMC	01/16.D3	EMC	01/16.F3	

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-WG11	Unitronic Lapp Cable 8x2x0.75	=WCS01-X103	+UH03	=LEV01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X103:1	01/38.D1	=LEV01-X1:1	04/1.D1	
	BN	=WCS01-X103:2	01/38.D1	=LEV01-X1:2	04/1.D1	
	TW1					
	GN	=WCS01-X103:3	01/38.D2	=LEV01-X1:4	04/1.D1	
	YE	=WCS01-X103:4	01/38.D2	=LEV01-X1:8	04/1.D2	
	TW2					
	GY	=WCS01-X103:5	01/38.D2	=LEV01-X1:12	04/1.D3	
	PK	=WCS01-X103:6	01/38.D3	=LEV01-X1:18	04/1.D3	
	TW3					
	BU	=WCS01-X103:7	01/38.D3	=LEV01-X1:22	04/1.D4	
	RD	=WCS01-X103:8	01/38.D4	=LEV01-X1:24	04/1.D5	
	TW4					
	BK	=WCS01-X103:9	01/38.D4	=LEV01-X1:28	04/1.D5	
	VT	=WCS01-X103:10	01/38.D4	=LEV01-X1:33	04/1.D6	
	TW5					
	GYPK	=WCS01-X103:11	01/38.D5	=LEV01-X1:36	04/1.D7	
	RDBU					
	TW6					
	WHGN					
	BNGN					
	TW7					
	WHYE					
	YEBN					
	TW8					
	SH1	EMC	01/38.D5	EMC	04/1.D7	
-WG12	Unitronic Lapp Cable 4x2x0.25	=WCS01-TA2.KF2:X82	+UH01	=LEV01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-TA2.KF2:X82:5	01/7.B2	=LEV01-MA1:7	01/7.E2	
	BN	=WCS01-TA2.KF2:X82:6	01/7.B2	=LEV01-MA1:8	01/7.E2	
	TW1					
	GN	=WCS01-TA2.KF2:X82:3	01/7.B2	=LEV01-MA1:5	01/7.E2	
	YE	=WCS01-TA2.KF2:X82:4	01/7.B2	=LEV01-MA1:6	01/7.E2	
	TW2					
	GY	=WCS01-TA2.KF2:X82:2	01/7.B2	=LEV01-MA1:4	01/7.E2	
	PK	=WCS01-TA2.KF2:X82:1	01/7.B2	=LEV01-MA1:3	01/7.E2	
	TW3					
	BU	=WCS01-TA2.KF2:X81:5	01/7.B1	=LEV01-MA1:2	01/7.E1	
	RD	=WCS01-TA2.KF2:X81:4	01/7.B1	=LEV01-MA1:1	01/7.E1	
	TW4					
	SH1	=WCS01-TA2.KF2:X82:7	01/7.B2	=LEV01-MA1:9	01/7.E2	
-WG13	Unitronic Lapp Cable 2x2x0.75	=WCS01-X101	+UH03	=RW01-X1	+UC1	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X101:1	01/37.D1	=RW01-X1:1	05/1.D2	
	BN	=WCS01-X101:2	01/37.D1	=RW01-X1:2	05/1.D2	
	TW1					
	GN	=WCS01-X101:3	01/37.D2	=RW01-X1:3	05/1.D2	
	YE	=WCS01-X101:4	01/37.D2	=RW01-X1:4	05/1.D2	
	TW2					

Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
	SH1	EMC	01/37.D2	EMC	05/1.D2	
-WG14	Unitronic Lapp Cable 4x2x0.25	=WCS01-TA6.KF2:X82	+UH02	=RW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-TA6.KF2:X82:5	01/15.B6	=RW01-MA1:4	01/15.E6	
	BN	=WCS01-TA6.KF2:X82:6	01/15.B6	=RW01-MA1:3	01/15.E6	
	TW1					
	GN	=WCS01-TA6.KF2:X82:3	01/15.B5	=RW01-MA1:6	01/15.E5	
	YE	=WCS01-TA6.KF2:X82:4	01/15.B5	=RW01-MA1:5	01/15.E5	
	TW2					
	GY	=WCS01-TA6.KF2:X82:2	01/15.B5	=RW01-MA1:7	01/15.E5	
	PK	=WCS01-TA6.KF2:X82:1	01/15.B5	=RW01-MA1:8	01/15.E5	
	TW3					
	BU	=WCS01-TA6.KF2:X81:5	01/15.B5	=RW01-MA1:1	01/15.E5	
	RD	=WCS01-TA6.KF2:X81:4	01/15.B5	=RW01-MA1:2	01/15.E5	
	TW4					
	SH1	=WCS01-TA6.KF2:X82:7	01/15.B6	=RW01-MA1:PE	01/15.E6	
-WG15	Unitronic Lapp Cable 1x2x0.75	=WCS01-X71	+UH02	=RW01-MA1		Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X71:5	01/16.D3	=RW01-MA1:1TP1	01/16.F3	
	BN	=WCS01-X71:6	01/16.D3	=RW01-MA1:1TP2	01/16.F3	
	TW1					
	SH1	EMC	01/16.D3	EMC	01/16.F3	

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				Date	17/11-2021
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	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG16	Unitronic Lapp Cable 10x2x0.75	=WCS01-X401	+UH03	=WP01-X1	+WP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X401:1	01/43.D1	=WP01-X1:1	06/1.D1	
	BN	=WCS01-X401:2	01/43.D1	=WP01-X1:2	06/1.D1	
	TW1					
	GN	=WCS01-X401:3	01/43.D2	=WP01-X1:3	06/1.D1	
	YE	=WCS01-X401:4	01/43.D2	=WP01-X1:4	06/1.D2	
	TW2					
	GY	=WCS01-X401:5	01/43.D2	=WP01-X1:5	06/1.D2	
	PK	=WCS01-X401:6	01/43.D2	=WP01-X1:6	06/1.D2	
	TW3					
	BU	=WCS01-X401:7	01/43.D2	=WP01-X1:7	06/1.D3	
	RD	=WCS01-X401:8	01/43.D3	=WP01-X1:8	06/1.D3	
	TW4					
	BK	=WCS01-X401:9	01/43.D3	=WP01-X1:9	06/1.D3	
	VT	=WCS01-X401:10	01/43.D3	=WP01-X1:10	06/1.D4	
	TW5					
	GYPK	=WCS01-X401:11	01/43.D4	=WP01-X1:11	06/1.D4	
	RDBU	=WCS01-X401:12	01/43.D4	=WP01-X1:12	06/1.D5	
	TW6					
	WHGN	=WCS01-X401:13	01/43.D4	=WP01-X1:13	06/1.D5	
	BNGN	=WCS01-X401:14	01/43.D4	=WP01-X1:14	06/1.D5	
	TW7					
	WHYE	=WCS01-X401:15	01/43.D5	=WP01-X1:16	06/1.D6	
	YEBN	=WCS01-X401:16	01/43.D5	=WP01-X1:15	06/1.D5	
	TW8					
	WHGR	=WCS01-X401:17	01/43.D6	=WP01-X1:17	06/1.D6	
	GRBN	=WCS01-X401:18	01/43.D6	=WP01-X1:18	06/1.D7	
	TW9					
	WHPK					
	PKBN					
	TW10					
	SH1	EMC	06/1.D7	EMC	01/43.D7	

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				Date	17/11-2021
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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG17	Unitronic Lapp Cable 8x2x0.75	=WCS01-X400	+UH03	=WP02-X1	+WP02	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X400:1	01/42.D1	=WP02-X1:1	07/1.D1	
	BN	=WCS01-X400:2	01/42.D1	=WP02-X1:2	07/1.D1	
	TW1					
	GN	=WCS01-X400:3	01/42.D2	=WP02-X1:3	07/1.D2	
	YE	=WCS01-X400:4	01/42.D2	=WP02-X1:4	07/1.D2	
	TW2					
	GY	=WCS01-X400:5	01/42.D2	=WP02-X1:5	07/1.D2	
	PK	=WCS01-X400:6	01/42.D2	=WP02-X1:6	07/1.D2	
	TW3					
	BU	=WCS01-X400:7	01/42.D2	=WP02-X1:7	07/1.D3	
	RD	=WCS01-X400:8	01/42.D3	=WP02-X1:8	07/1.D3	
	TW4					
	BK	=WCS01-X400:9	01/42.D3	=WP02-X1:9	07/1.D4	
	VT	=WCS01-X400:10	01/42.D3	=WP02-X1:10	07/1.D4	
	TW5					
	GYPK	=WCS01-X400:11	01/42.D4	=WP02-X1:11	07/1.D5	
	RDBU	=WCS01-X400:12	01/42.D4	=WP02-X1:12	07/1.D5	
	TW6					
	WHGN	=WCS01-X400:13	01/42.D4	=WP02-X1:13	07/1.D5	
	BNGN	=WCS01-X400:14	01/42.D4	=WP02-X1:14	07/1.D5	
	TW7					
	WHYE	=WCS01-X400:15	01/42.D5	=WP02-X1:15	07/1.D6	
	YEBN					
	TW8					
	SH1	EMC	07/1.D7	EMC	01/42.D5	
-WG18	Unitronic Lapp Cable 6x2x0.75	=WCS01-X400	+UH03	=WP02-X2	+WP02	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X400:16	01/42.D5	=WP02-X2:3	07/2.D2	
	BN	=WCS01-X400:17	01/42.D6	=WP02-X2:4	07/2.D2	
	TW1					
	GN	=WCS01-X400:18	01/42.D6	=WP02-X2:5	07/2.D2	
	YE	=WCS01-X400:19	01/42.D6	=WP02-X2:6	07/2.D2	
	TW2					
	GY	=WCS01-X400:20	01/42.D6	=WP02-X2:7	07/2.D3	
	PK	=WCS01-X400:21	01/42.D7	=WP02-X2:8	07/2.D3	
	TW3					
	BU	=WCS01-X400:22	01/42.D7	=WP02-X2:9	07/2.D4	
	RD	=WCS01-X400:23	01/42.D8	=WP02-X2:10	07/2.D4	
	TW4					
	BK	=WCS01-X400:24	01/42.D8	=WP02-X2:11	07/2.D5	
	VT					
	TW5					
	GYPK					
	RDBU					
	TW6					
	SH1	EMC	01/42.D8	EMC	07/2.D6	

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG19	Unitronic Lapp Cable 4x2x0.75	=WCS01-X40	+UH03	=CP01-X40	+CP01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X40:1	01/46.D1	=CP01-X40:1	08/3.D6	
	BN	=WCS01-X40:2	01/46.D1	=CP01-X40:2	08/3.D6	
	TW1					
	GN	=WCS01-X40:3	01/46.D1	=CP01-X40:3	08/3.D6	
	YE	=WCS01-X40:4	01/46.D2	=CP01-X40:4	08/3.D7	
	TW2					
	GY	=WCS01-X40:5	01/46.D2	=CP01-X40:5	08/3.D7	
	PK	=WCS01-X40:6	01/46.D2	=CP01-X40:6	08/3.D7	
	TW3					
	BU					
	RD					
	TW4					
	SH1	EMC	08/3.D8	EMC	01/46.D3	
-WG20	Unitronic Lapp Cable 4x2x0.25	=WCS01-X40	+UH03	=CP03-X40	+CP03	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X40:7	01/46.D3	=CP03-X40:1	10/3.D6	
	BN	=WCS01-X40:8	01/46.D3	=CP03-X40:2	10/3.D6	
	TW1					
	GN	=WCS01-X40:9	01/46.D3	=CP03-X40:3	10/3.D6	
	YE	=WCS01-X40:10	01/46.D3	=CP03-X40:4	10/3.D7	
	TW2					
	GY	=WCS01-X40:11	01/46.D4	=CP03-X40:5	10/3.D7	
	PK	=WCS01-X40:12	01/46.D4	=CP03-X40:6	10/3.D7	
	TW3					
	BU					
	RD					
	TW4					
	SH1	EMC	10/3.D8	EMC	01/46.D4	
-WG24	Unitronic Lapp Cable 4x2x0.75	=WCS01-X30	+UH03	=HPUBR01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X30:1	01/34.D1	=HPUBR01-X1:1	16/1.D2	
	BN	=WCS01-X30:2	01/34.D1	=HPUBR01-X1:2	16/1.D2	
	TW1					
	GN	=WCS01-X30:3	01/34.D2	=HPUBR01-X1:3	16/1.D2	
	YE	=WCS01-X30:4	01/34.D2	=HPUBR01-X1:4	16/1.D2	
	TW2					
	GY	=WCS01-X30:5	01/34.D3	=HPUBR01-X1:5	16/1.D3	
	PK	=WCS01-X30:6	01/34.D3	=HPUBR01-X1:6	16/1.D3	
	TW3					
	BU					
	RD					
	TW4					
	SH1	EMC	16/1.D3	EMC	01/34.D3	

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG25	Unitronic Lapp Cable 4x2x0.75	=WCS01-X31	+UH03	=HPUGC01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X31:1	01/35.D1	=HPUGC01-X1:1	17/1.D2	
	BN	=WCS01-X31:2	01/35.D1	=HPUGC01-X1:2	17/1.D2	
	TW1					
	GN	=WCS01-X31:3	01/35.D2	=HPUGC01-X1:3	17/1.D2	
	YE	=WCS01-X31:4	01/35.D2	=HPUGC01-X1:4	17/1.D3	
	TW2					
	GY	=WCS01-X31:5	01/35.D3	=HPUGC01-X1:5	17/1.D3	
	PK					
	TW3					
	BU					
	RD					
	TW4					
	SH1	EMC	17/1.D5	EMC	01/35.D3	
-WG26	Unitronic Lapp Cable 4x2x0.25	=WCS01-TA13.KF2:X82	+UH01	=OHC-MA1	+X22	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-TA13.KF2:X82:5	01/47.B2	=OHC-MA1:7	01/47.E2	
	BN	=WCS01-TA13.KF2:X82:6	01/47.B2	=OHC-MA1:8	01/47.E2	
	TW1					
	GN	=WCS01-TA13.KF2:X82:3	01/47.B1	=OHC-MA1:5	01/47.E1	
	YE	=WCS01-TA13.KF2:X82:4	01/47.B1	=OHC-MA1:6	01/47.E1	
	TW2					
	GY	=WCS01-TA13.KF2:X82:2	01/47.B1	=OHC-MA1:4	01/47.E1	
	PK	=WCS01-TA13.KF2:X82:1	01/47.B1	=OHC-MA1:3	01/47.E1	
	TW3					
	BU	=WCS01-TA13.KF2:X81:5	01/47.B1	=OHC-MA1:2	01/47.E1	
	RD	=WCS01-TA13.KF2:X81:4	01/47.B1	=OHC-MA1:1	01/47.E1	
	TW4					
	SH1					
-WG27	Unitronic Lapp Cable 1x2x0.75	=WCS01-X70	+UH01	=OHC-MA1	+X22	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X70:5	01/47.D2	=OHC-MA1:PTC1	01/47.F2	
	BN	=WCS01-X70:6	01/47.D2	=OHC-MA1:PTC2	01/47.F2	
	TW1					
	SH1					

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WGS1	Ship Signal Cable 4x2x0.75	=WCS01-X82	+UH03	=SHIP-X1	+PMS	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X82:1	01/45.D1	=SHIP-X1:1	00/2.D1	
	BN	=WCS01-X82:2	01/45.D1	=SHIP-X1:2	00/2.D1	
	TW1					
	GN	=WCS01-X82:3	01/45.D2	=SHIP-X1:3	00/2.D1	
	YE	=WCS01-X82:4	01/45.D2	=SHIP-X1:4	00/2.D1	
	TW2					
	GY	=WCS01-X82:5	01/45.D2	=SHIP-X1:5	00/2.D2	
	PK	=WCS01-X82:6	01/45.D2	=SHIP-X1:6	00/2.D2	
	TW3					
	BU	=WCS01-X82:7	01/45.D3	=SHIP-X1:7	00/2.D2	
	RD	=WCS01-X82:8	01/45.D3	=SHIP-X1:8	00/2.D2	
	TW4					
	BK					
	VT					
	TW5					
	GYPK					
	RDBU					
	TW6					
	SH1	EMC	00/2.D2	EMC	01/45.D3	
-WGS2	Ship Signal Cable 4x2x0.75	=WCS01-X80	+UH03	=SHIP-X3	+CSCS	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X80:3	01/35.D8	=SHIP-X3:1	00/2.D5	
	BN	=WCS01-X80:4	01/35.D8	=SHIP-X3:2	00/2.D5	
	TW1					
	GN					
	YE					
	TW2					
	GY					
	PK					
	TW3					
	BU					
	RD					
	TW4					
	SH1	EMC	00/2.D5	EMC	01/35.D8	
-WGS3	Ship Signal Cable 4x2x0.75	=WCS01-X81	+UH03	=SHIP-X2	+Alarm	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	WH	=WCS01-X81:1	01/45.D7	=SHIP-X2:1	00/2.D4	
	BN	=WCS01-X81:2	01/45.D7	=SHIP-X2:2	00/2.D4	
	TW1					
	GN	=WCS01-X81:3	01/45.D7	=SHIP-X2:3	00/2.D4	
	YE	=WCS01-X81:4	01/45.D7	=SHIP-X2:4	00/2.D4	
	TW2					
	GY					
	PK					
	TW3					
	BU					
	RD					
	TW4					

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
	SH1	EMC	00/2.D4	EMC	01/45.D8	

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General Installation Notes

Note 1!
Electrical installation to be installed according to
Rapp Marine Electrical Installation Procedure (Document ID: 4251),
Good craftsmanship and National regulations

Note 2!
Cable ID description:
WDS= Power cables, Ship power supply (Cable type, not specified by Rapp Marine)
WD= Power cables
WG= Signal cables
WGS= Signal cables, Ship signals (Cable type, not specified by Rapp Marine)
WF= Data cables / Communication Bus

Note 3!
Cable types to be evaluated by the yard
in accordance with aplicable regulations
and installation enviroment,
Cables have to be equal or better then Rapp Marine suggestions
All cables must be of screened type

Note 4!
Motor cabel conductor sizes are minimum sizes
Max cable length 40m, For lengths over 40m contact Rapp Marine

Note 5!
Distance between motor and high power cables to encoder and signal cables
to be MIN 500mm

Note 6!
Encoder plugs for encoders is
delivered by Rapp Marine
Must be Soldered by Yard under installation

Note 7!
Yard to supply all cables in cable list
Exceptions are indicated in the cabel list

Note 8!
Cables for main supply VFD cabinet & from VFD cabinet to motors
must be "Symetrical Cables with screen"
(3x Cables) (3x + 3xPE Cables)

Note 9!
Device Net / Can Bus Cables must be of approved type:
Unitronic DeviceNet (Thick) or Belden 3082

Note 10!
Standard cable entries in cabinets is from the bottom
Products are delivered without cable glands for
external / yard cables

Note 11!
All cable shields must be connected with 360 degree
connection to ground (PE), or suitable EMC connection
in both ends.
This is to reduce the EMI from the VFD cabinet

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Location Overview System Equipment

=WCS01 Main VFD Cabinet

=HW01 CTD Winch

=TRW01 ROV System Traction Winch
=LEV01 ROV System Levelwinde/Slack Wire
=RW01 ROV System Storage Drum
=DS01 ROV System Load Cell

=WP01 Local Control Panel CTD Winch
=WP02 Local Control Panel Traction System
=WP03 Hangar Control Panel

=CP01 ROV Control Room Panel Winches

=CP03 AFT Control Station Panel Winches
=CP04 AFT Control Station Panel A-Frame Stern
=CP06 AFT Control Station Panel CTD Davit

=TRIP01 Triplex Communication

=HPUBR01 Brake HPU
=HPUGC01 Gear Cooling HPU

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Locations
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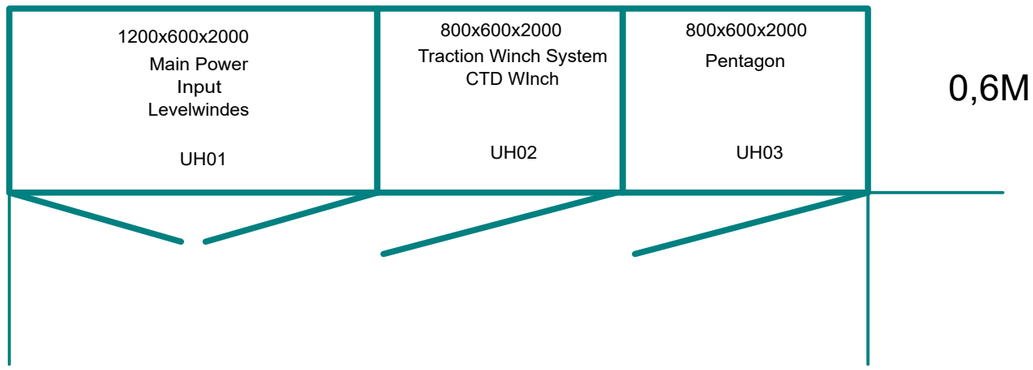
Cabinet Overview

WCS01
2000005807



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				User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-00 LO	Rev. I

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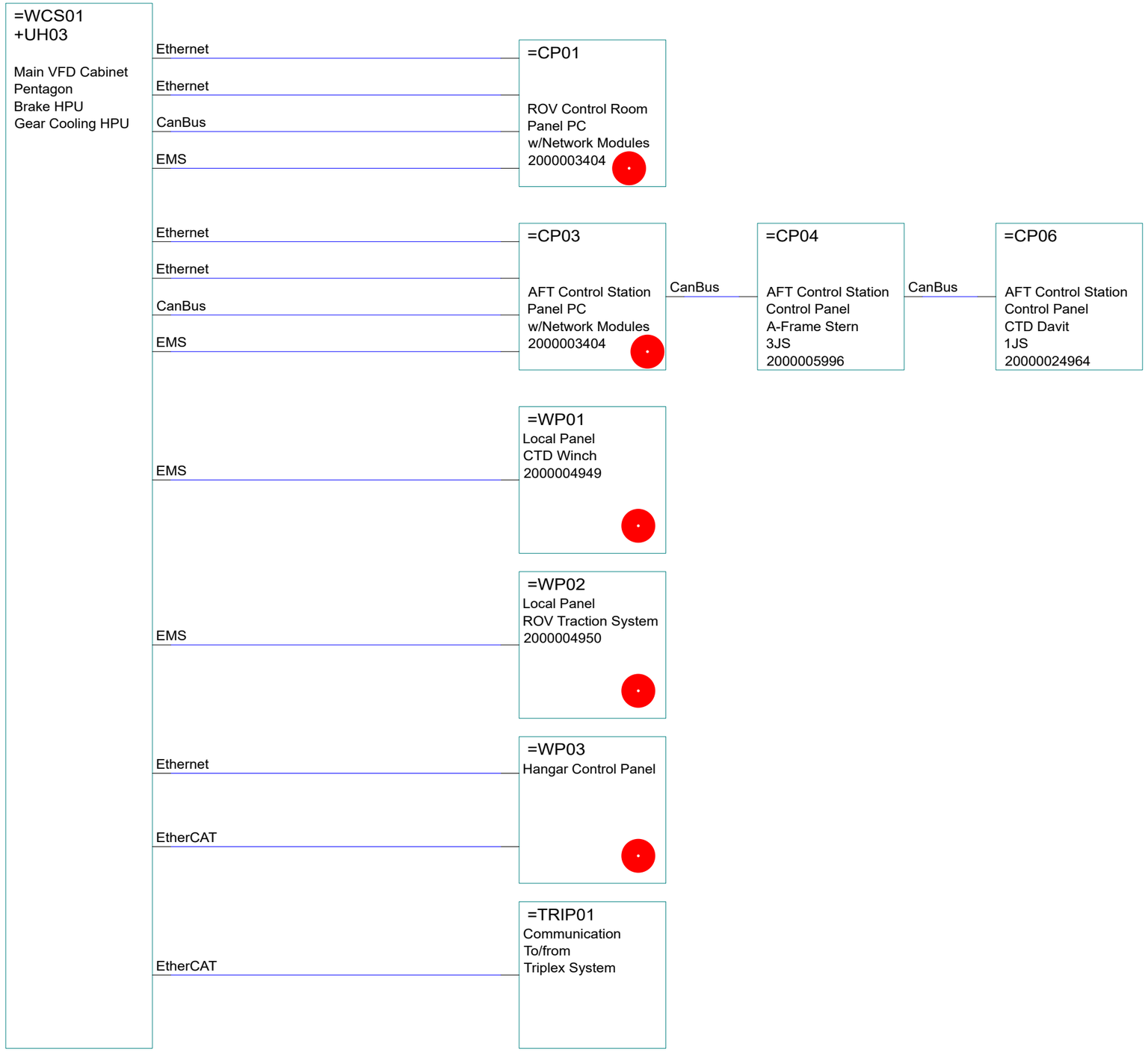
8E590EA796A34668A4F8439EFF11211F



= Emergency stop button

= Machine stop button

				Date	17/11-2021
	Removed CP02	28.11.2022	ANP	User	GSK
	Added WP03 panel	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Locations
Network Topology
Emergency Stop

10070-00 LO Rev. I

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+480VAC

Power Supply
480VAC
60Hz

-WDS1 Supply Cable From Ship Supply 3X → =WCS01+UH01 480VAC → 01/1.A1

-WDS1 = 200kW Main Power

+230VAC
Control & Heating
Power

-WDS2 Supply Cable From Ship Supply 2X → =WCS01+UH03 230VAC HT → 01/1.C1

-WDS2 = 20A Heater

-WDS3 Supply Cable From Ship Supply 2X → =WCS01+UH03 230VAC CTRL → 01/1.C1

-WDS3 = 20A Control Power

				Date	17/11-2021	CNP Freire MBari		MACGREGOR	Ship Connections Supply from Ship Power Supply Connections Cable Diagram		=SHIP
				User	GSK						
				Approved	RAJ					10070-00 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Sheet 1 / Next 2

8E590EA796A34668A4F8439EFF11211F

+PMS

PMS Connections

-WGS1 Ship Signal Cable 6x2x0.75 =WCS01+UH03 PMS 01/1.D1

IGBT ON
System Active
- Potential free contact

Actual Power +/-
From IGBT
- Signal Out 4-20mA

Regeneration Power Limit
From PMS
- Signal In 4-20mA

Harbour Mode
From PMS
- 24VDC To Potential Free Contact

Power Available
From PMS
- Signal In 4-20mA

+CSCS

IAS connection
Cooling Water
Control System

-WGS2 Ship Signal Cable 4x2x0.75 =WCS01+UH03 CSCS 01/1.D1

CSCS = Cooling Control System.
Output from the Pentagon system for control of
the cooling water valve for the HPU.(Potential free contact)

+Ethernet

Etnernet
Internett Conn

-WFS1 Ship Cable Ethernet =WCS01+UH03 Ethernet 01/1.D1

Internet
Connection To Internet for the Pentagon system.

+Alarm

Alarm/Light
Connections

-WGS3 Ship Signal Cable 4x2x0.75 =WCS01+UH03 Alarm 01/1.D1

Alarm/Light
Output from the Pentagon system for activation
of Alarm/Light etc.(2xPotential free contact)

+MRU

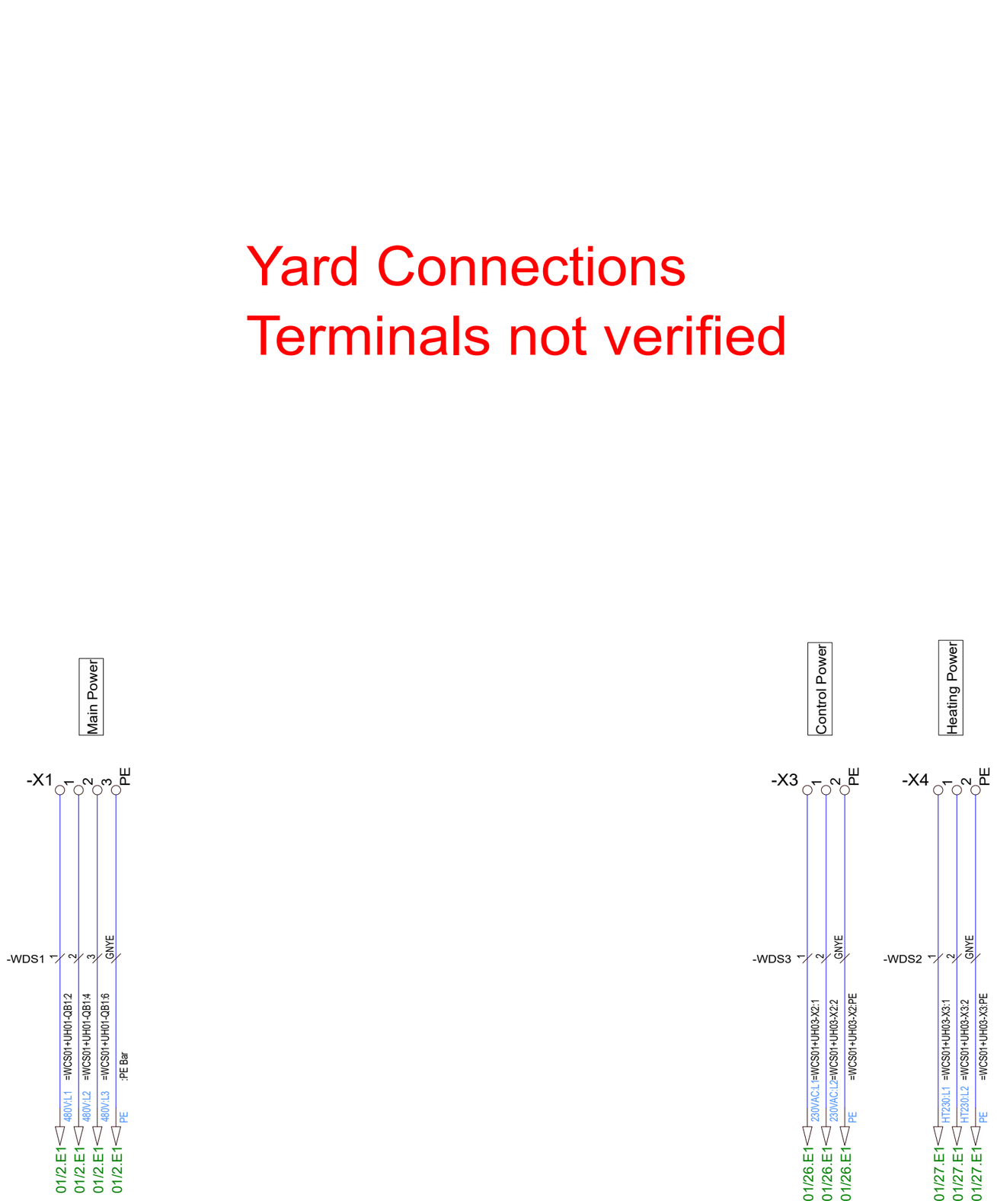
Ethernet

-WFS2 Ship Cable Ethernet =WCS01+UH03 Ethernet 01/1.D1

Ethernet
MRU Connection to the Pentagon system.

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Ship Connections Supply from Ship Signal Connections Cable Diagram		=SHIP	
				User	GSK						
	Added MRU connection	21.11.2022	ANP	Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-00 CD Rev. I	Sheet 2 Next 1

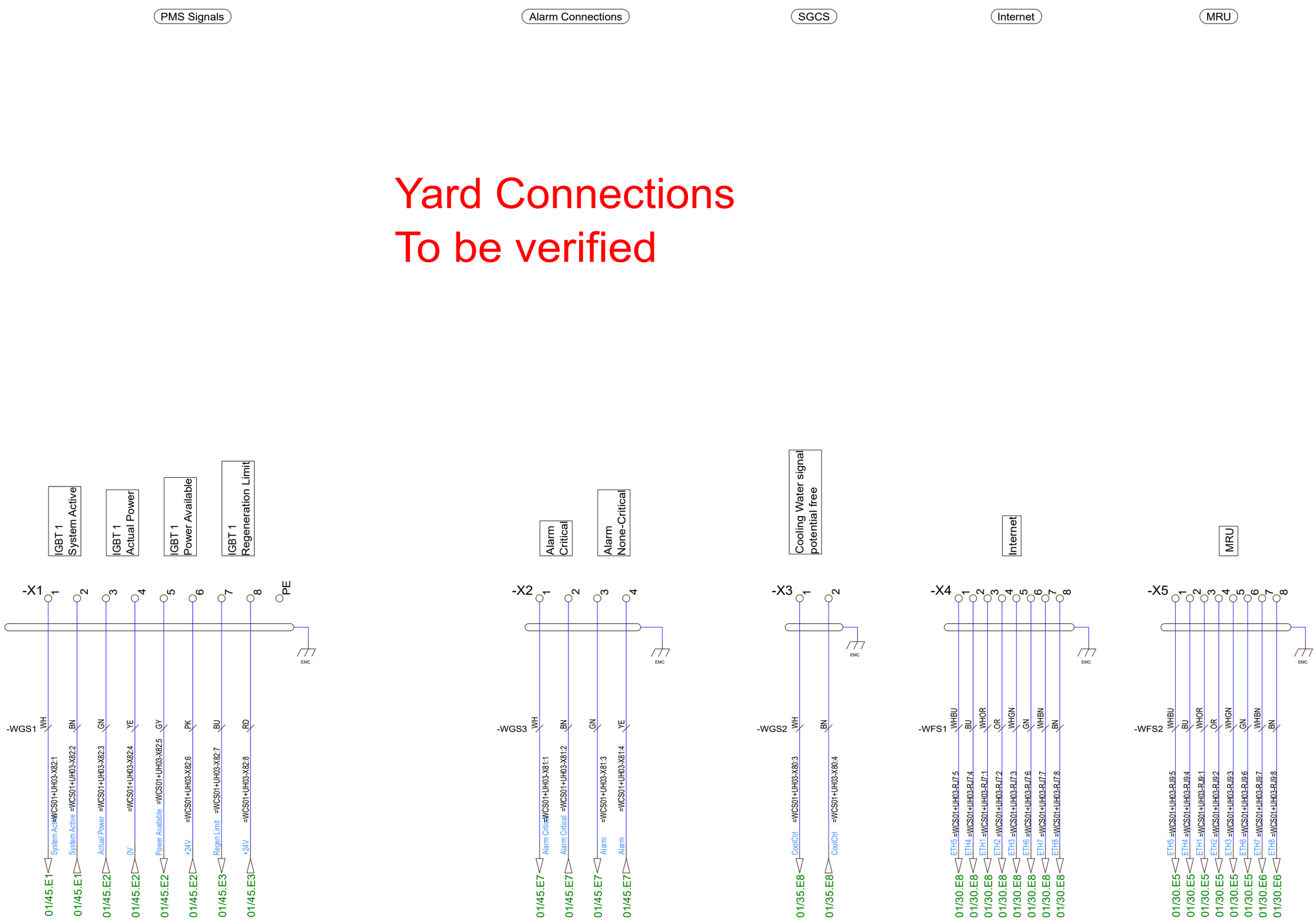
Yard Connections
Terminals not verified



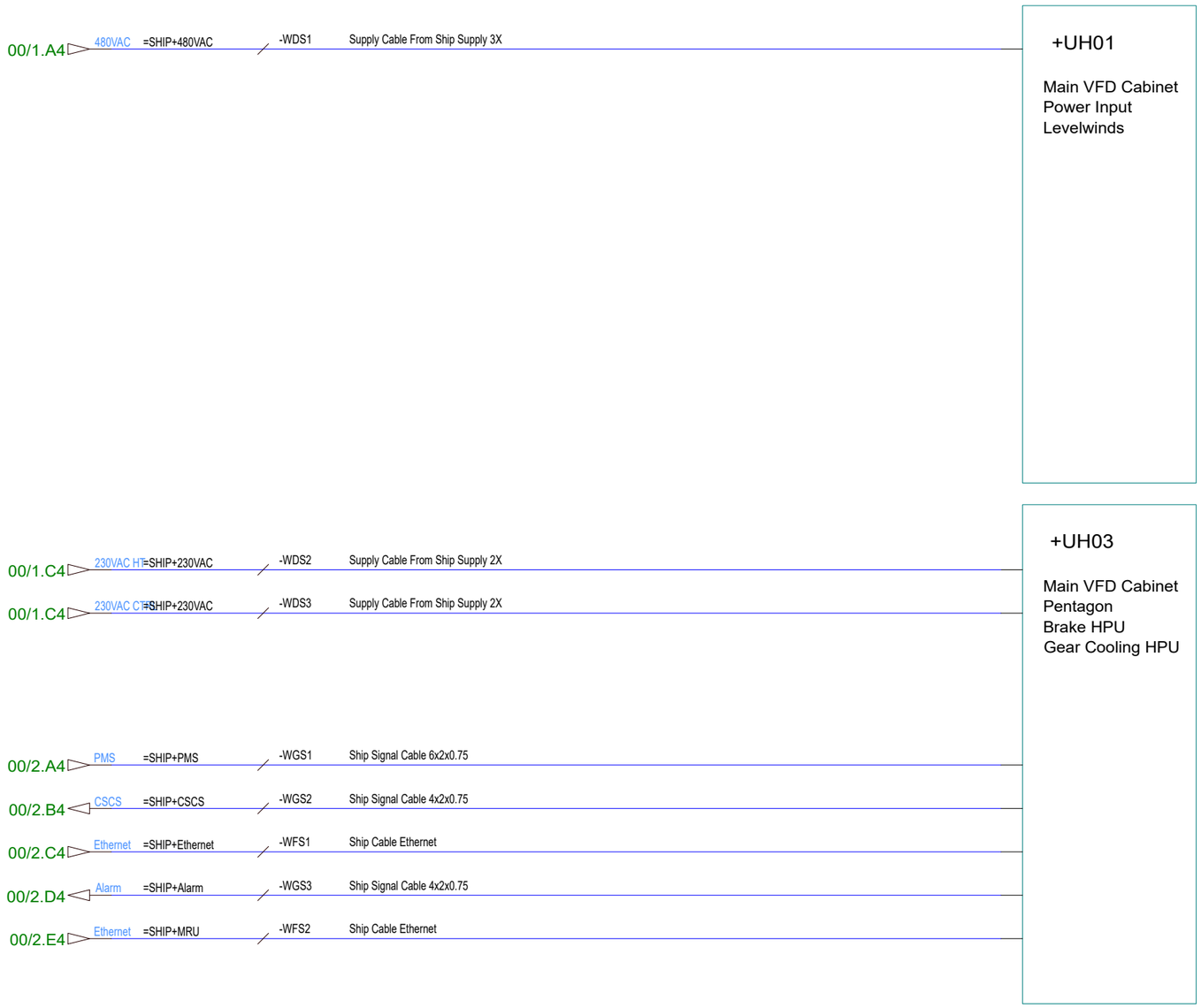
				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Ship Connections Power Connections 440VAC, 230VAC		=SHIP	
				User	GSK					+Power	
				Approved	RAJ				10070-00 CC	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 2

PMS Signals | Alarm Connections | SGCS | Internet | MRU

Yard Connections
To be verified



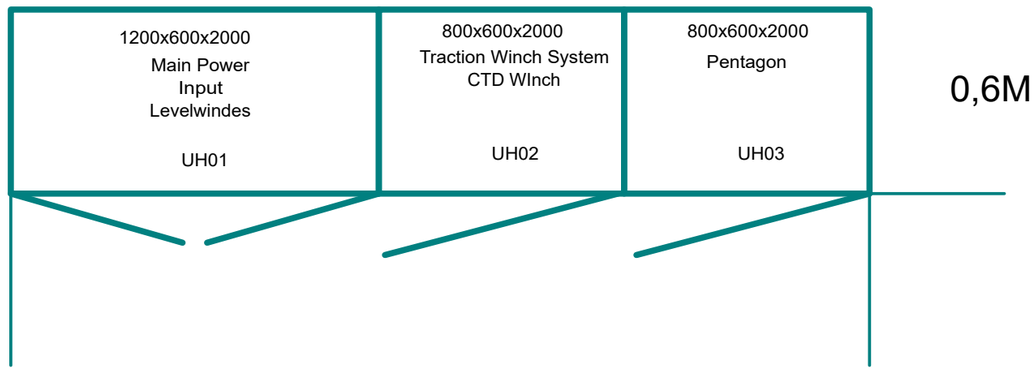
				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Ship Connections PMS, Alarm, Internet Optional Alarm		=SHIP
				User	GSK					+Signal
	Added MRU Connection	21.11.2022	ANP	Approved	RAJ				10070-00 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 2 / Next 1



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon WCS01 Cabinet		=WCS01	
	Added MRU Connection	21.11.2022	ANP	User	GSK						
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CD	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1

Cabinet Overview

WCS01
2000005807



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Cabinet Overview	400092375	=WCS01	
				User	GSK						
	AS BUILT	19.08.2022	SS	Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-01 CC	Rev. I

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Next 2

8E590EA796A34668A4F8439EFF11211F

Main Power Input
480V

Cabinet Cooling

LCL Filter Fan

Charging Circuit

IGBT Supply Unit

-Q1 /3.F6

-QB1 400A 170M5808D;3

+UH03-QA17:2 480V:L1 /25.D1
+UH03-QA17:4 480V:L2 /25.D1
+UH03-QA17:6 480V:L3 /25.D1

-WDS1 GNYE

PE Bar

=SHIP+Power-X1:1 480V:L1 00/1.E2
=SHIP+Power-X1:2 480V:L2 00/1.E2
=SHIP+Power-X1:3 480V:L3 00/1.E2
=SHIP+Power-X1:PE PE 00/1.E2

-EC1 L N PE

-BT1 °C

-RF1 X50

-Q3 /3.F7

-QB2 Fuse NH00 16A 690V GL/GG;4

-F3.1 -F3.2 C14G16 1-50A 1-50A

-Q2 /3.F6

-RA2 5 Ohm

-RA3 5 Ohm

230V:L1 /3.A1
230V:L2 /3.A1

-RF1 LCL Filter

/4.B2 /2.B5

-TA1 210A AC DC

/5.B1 + -

-FE1

-QA1 450A -QA2 450A

TB1 DC+ /6.A1
TB1 DC- /6.A1

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Main Power input 1 Control Power, Charging Circuit IGBT Modules	400092375	=WCS01 +UH01
				User	GSK					
	AS BUILT	19.08.2022	SS	Approved	RAJ					
Status	Change	Date	Name	Standard		Version / Index / Repl. by			10070-01 CC	Rev. I
										Sheet 2 / Next 3

Emergency Control Start

Contactor Control

/2.D6 230V:L1
/2.D6 230V:L2

230V:L1 /8.A1
230V:L2 /8.A1
+24V-XPOW1 /4.A1
0V-XPOW1 /4.A1

-TA1
IGBT Control
Run Enable
/5.B1
DigIn 2
XDI 2

-K1
12 14
11
/3.E5

-TA1
IGBT Control
Charging Circuit
/5.B2
XRO1
COM NC NO
XRO1 12 11 13

-TA1
IGBT Control
Main Contactor
/5.C2
XRO3
COM NC NO
XRO3 32 31 33

-TA1
Feedback
Main Contactor
/5.B1
DigIn 3
XDI 3

-Q3
13
/3.F7
14

-Q1
13
/3.F6
14

-Q2
A1
/3.E6
A2

-Q1
A1 1+ 2+
Electronic Coil
/3.E6
A2 3-

-Q3
A1
/3.E7
A2

Emergency Control

EM.CTRL /12.D7

-K1
A1
/3.E5
A2

0V /9.A1

-K1
/3.D5
/3.C5
11 12
14
21 22
24

-Q2
/3.C6
/2.C6

-Q1
/3.C6
/2.A6
/3.C8
5 6
3 4
1 2
13 14
21 22

-Q3
/3.C7
/2.C5
/3.B7
1 2
3 4
5 6
13 14

				Date	17/11-2021	CNP Freire MBari		MACGREGOR	Main VFD Cabinet Pentagon Control Inputs Contactor Control Control Power Indication	400092375	=WCS01 +UH01
	AS BUILT	19.08.2022	SS	User	GSK						
Status	Change	Date	Name	Approved	RAJ					10070-01 CC	Rev. I
				Standard		Version	Index	Repl. by			Sheet 3 Next 4

BLCL Filter Temp Sensor

Power to Control Card

Common 0V Digital Inputs

Safe Torque Off Interlock

/3.A8 +24V-XPOW1

/3.A8 0V-XPOW1 -Q1:3-

+24V-XPOW1 /12.E1

0V-XPOW1 /12.E1

-RF1 X50 3 9

/2.B8

-TA1

IGBT Control
Filter Temp Fault
/5.B1
DigIn 1

XDI 1

-TA1

IGBT Control
BCU-02 Control Card
/5.C2
24V DC
+ -

XPOW 1 2

-TA1

IGBT Control
0V Common Dig In
/5.B2
DICOM

XD24 3

-TA1

IGBT Control
/5.C2
Safe Torque Off

XSTO 1 2 3 4

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Fan Thermal Switch Control Card Power	400092375	=WCS01
				User	GSK					+UH01
	AS BUILT	19.08.2022	SS	Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-01 CC	Rev. I

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ACS880-204-0210A-5

210A -TA1

XDI	Ref
DigIn 1	/4.B2
DigIn 2	/3.B5
DigIn 3	/3.B8
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/4.B4
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/3.B6
XRO2	
XRO3	/3.B6

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/4.B4

XSTO	Ref
Safe Torque Off	/4.B7

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS | Control Panel/ PC Connection | Control Panel BUS

X12

-TA1.PH1
DPMP-02 R6/7

-TA1.KF1
FECA-01
Adress:
X1 X2

-WF2
Patch Cord 1.5M Cat.6 SFTP
-TA2.KF1:X1 EtherCAT /11.D1

-WF1
Patch Cord 1.5M Cat.6 SFTP
+UH03-XF1:X1 EtherCAT /30.B1

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Reference Overview	400092375	=WCS01
				User	GSK					+UH01
	AS BUILT	19.08.2022	SS	Approved	RAJ					
Status	Change	Date	Name	Standard		Version / Index / Repl. by			10070-01 CC Rev. I	Sheet 5 / Next 6

Levelwinde Storage Drum

Levelwinde CTD Winch

Out Hauler OHC

/2.D8 TB1 DC+ -QA1 → TB1 DC+ /14.A1

/2.D8 TB1 DC- -QA2 → TB1 DC- /14.A1

-FE2

-QA3 FR27UQ69V50T 50-250A

-QA4 FR27UQ69V50T 50-250A

-QA5 FWP-10A14F 1-50A

-QA6 FWP-10A14F 1-50A

-QA7 FWP-10A14F 1-50A

-QA8 FWP-10A14F 1-50A

-QA18 FWP-10A14F 1-50A

-QA19 FWP-10A14F 1-50A

-TA2 5,5kW-10,5A DC/AC

UDC+ UDC- PE

/11.A1 U2 V2 W2

EMC

-WD14 BN BK GY GNYE,GNYE,GNYE

=LEV01 U V W PE

-MA1 M 3 ~

2,2kW
5,22A
400V/50Hz

-TA3 5,5kW-10,5A DC/AC

UDC+ UDC- PE

/11.A5 U2 V2 W2

EMC

-WD3 BN BK GY GNYE,GNYE,GNYE

=HW01 U V W PE

-MA2 M 3 ~

5.5kW
11,4A
400V/50Hz

-TA13 0,75kW-2,1A AC/AC

L1 L2 L3 PE

UDC- R- R+

/47.A5 U V W PE

EMC

-WD32 BN BK GY GNYE,GNYE,GNYE

=OHC U V W PE

-MA1 M 3 ~

Out Hauler Motor
0.25kW
0,76A
400V/50Hz

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwindes Frequency Inverter	400092375	=WCS01
				User	GSK					+UH01
	AS BUILT	19.08.2022	SS	Approved	RAJ					
Status	Change	Date	Name	Standard		Version / Index / Repl. by			10070-01 CC	Rev. I
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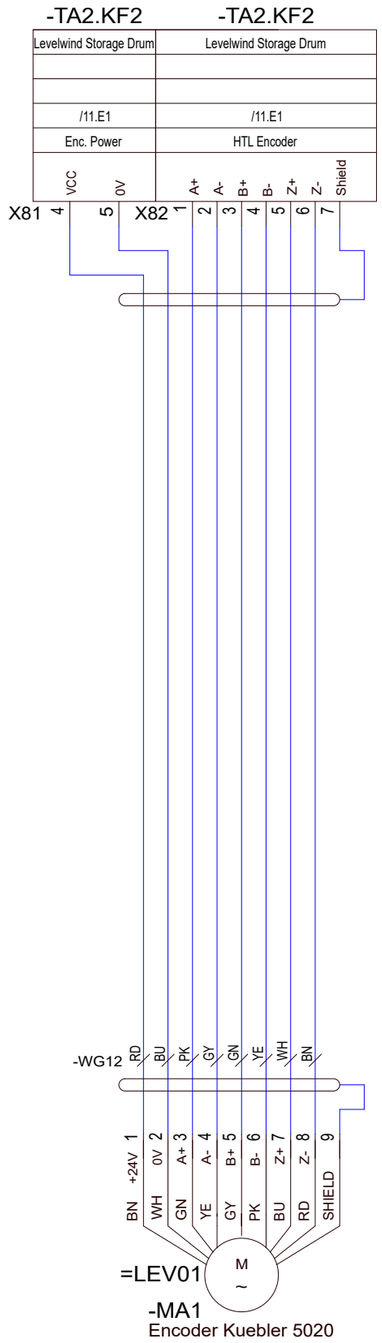

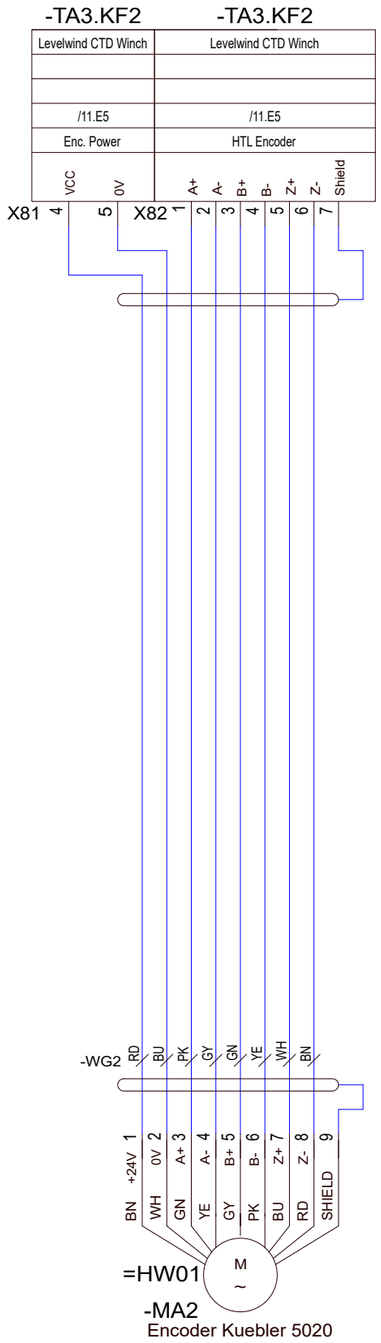

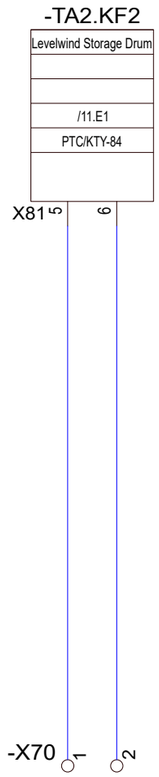

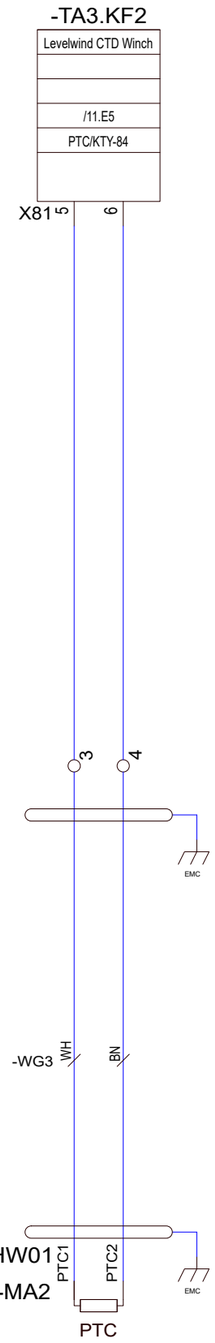

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwindes Encoder Cards, PTC Connection	400092375	=WCS01	
				User	GSK					+UH01	
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I	Sheet 7
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 8

Brake LW Storage Drum

Brake LW CTD Winch

Motor Heating LW Storage Drum

Motor Heating LW CTD Winch

/3.A8 230V:L2
/3.A8 230V:L1

230V:L2 /26.A1
230V:L1 /26.A1
HT230:L1 /17.A1
HT230:L2 /17.A1

/12.F6 11 -K2 12 14

/9.F7 11 -K4 12 14

/10.F7 11 -K5 12 14

/9.F7 11 -K6 12 14 /9.F7 21 -K6 22 24

/10.F7 11 -K7 12 14 /10.F7 21 -K7 22 24

-X200 1 Glass Fuse 5x20mm 1A 2 PE
3 Glass Fuse 5x20mm 1A 4 PE

-X300 1 Glass Fuse 5x20mm 1A 2 PE
3 Glass Fuse 5x20mm 1A 4 PE

EMC

-WD15 1 2 GNYE

-WD16 1 2 GNYE

-WD4 1 2 GNYE

=LEV01 BR1 BR2
-MA1 Motor Brake

=LEV01 H1 H2
-MA1 Heater

=HW01 H1 H2
-MA2 Heater

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwindes Brakes & Heating	400092375	=WCS01 +UH01
				User	GSK					
	AS BUILT	19.08.2022	SS	Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-01 CC	Rev. I
										Sheet 8
										Next 9

Emergency JOG

Brake Lift & Heating

24VDC
0V
/3.D5
-K1:A2

24VDC
0V
/10.A1
/10.A1

-TA2

Levelwind Storage Drum	Levelwind Storage Drum
Spool Left	Spool Right
/11.A1	/11.A1
DigIn 1	DigIn 2

XDI 1 XDI 2

-TA2

Levelwind Storage Drum
Brake Lift
/11.B2
XRO1
COM NC NO

XRO1 12 11 13

-X500 1 2 3 PE

EMC

-WD22 1 2 3 GNYE

=WP02+WP02-X400:7 24VDC
=WP02+WP02-X400:8 Haul In
=WP02+WP02-X400:9 Pay Out
=WP02+WP02-X400:PE PE

07/3.E4
07/3.E5
07/3.E5
07/3.E5

-K4 A1 /9.F7 A2
-K6 A1 /9.F8 A2

-K4 /9.D7
/8.C1 11 12 14 21 22 24

-K6 /9.D8
/8.B3 11 12 14 21 22 24 /8.B4

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwind Storage Drum Emergency Control Connection Brake and Motor Heating Control	400092375	=WCS01	
				User	GSK					+UH01	
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I	Sheet 9
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 10

Emergency JOG

Brake Lift & Heating

/9.A8 24VDC
/9.A8 0V

24VDC /12.A1
0V /12.A1

-TA3 -TA3

Levelwind CTD Winch	Levelwind CTD Winch
Spool Left	Spool Right
/11.A5	/11.A5
DigIn 1	DigIn 2

XDI 1 XDI 2

-TA3

Levelwind CTD Winch
Brake Lift
/11.B6
XRO1
COM NC NO

XRO1 12 11 13

-X500 4 5 6 PE

EMC

-WD2 1 2 3 GNYE

=HW01+UC01-X400:4 =HW01+UC01-X400:5 =HW01+UC01-X400:6 =HW01+UC01-X400:PE

24VDC Haul In Pay Out PE

02/2.E3 02/2.E3 02/2.E3 02/2.E4

-K5 A1 A2 /10.F7

-K7 A1 A2 /10.F8

-K5 /10.D7

/8.C2 11 12 14 21 22 24

-K7 /10.D8

/8.B4 11 12 14 21 22 24 /8.B5

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwind CTD Winch Emergency Control Connection Brake and Motor Heating Control	400092375	=WCS01
				User	GSK					+UH01
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 10 / Next 11

Levelwinde
Storage Drum

ACS880-104-0011A-5
5,5kW-10,5A -TA2

XDI	Ref
DigIn 1	/9.B1
DigIn 2	/9.B2
DigIn 3	/12.B6
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/12.B1
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/9.B7
XRO2	
XRO3	

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/12.E1

XSTO	Ref
Safe Torque Off	/13.B1

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS | Control Panel/ PC Connection | Control Panel BUS

X12

-TA2.PH1
ACS-AP-W

-TA2.KF1
FECA-01
Adress:
X1 X2

/5.D6 EtherCAT -TA1.KF1:X2

-WF2 Patch Cord 1.5M Cat.6 SFTP

Levelwinde
CTD Winch

ACS880-104-0011A-5
5,5kW-10,5A -TA3

XDI	Ref
DigIn 1	/10.B1
DigIn 2	/10.B2
DigIn 3	/12.B7
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/12.B2
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/10.B7
XRO2	
XRO3	

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/12.E2

XSTO	Ref
Safe Torque Off	/13.B3

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS | Control Panel/ PC Connection | Control Panel BUS

X12

-TA3.PH1
ACS-AP-W

-TA3.KF1
FECA-01
Adress:
X1 X2

-WF3 Patch Cord 1.5M Cat.6 SFTP

-TA13.KF1:X1 EtherCAT /47.D5

-WF4 Patch Cord 1.5M Cat.6 SFTP

FEN-31
-TA2.KF2

X81	Ref
Power Latch	/12.B4
Enc. Power	/7.B1
PTC/KTY-84	/7.B6

X22	Ref
TTL Encoder	

X82	Ref
HTL Encoder	/7.B2

X84	Ref
Power	
Dig In 1	
Dig In 2	

DIP Sw.	Pos
DIP 1	0
DIP 2	0
DIP 3	0
DIP 4	0

Internal Pull-Up Resistor
DIP Switches
Located under plastic cover
Default position 0

FEN-31
-TA3.KF2

X81	Ref
Power Latch	/12.B4
Enc. Power	/7.B3
PTC/KTY-84	/7.B7

X22	Ref
TTL Encoder	

X82	Ref
HTL Encoder	/7.B4

X84	Ref
Power	
Dig In 1	
Dig In 2	

DIP Sw.	Pos
DIP 1	0
DIP 2	0
DIP 3	0
DIP 4	0

Internal Pull-Up Resistor
DIP Switches
Located under plastic cover
Default position 0

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwindes Storage Drum & CTD Winch Frequency Inverter References	400092375	=WCS01
				User	GSK					+UH01
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I
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0V Common
Digital Signals

Encoder Power Latch
Frequency Converters

Emergency JOG mode
Activation

/10.A8 24VDC
/10.A8 0V

24VDC /17.A1
0V /17.A1

-TA2	-TA3	-TA13
Levelwind Storage Drum	Levelwind CTD Winch	Out Hauler Motor
/11.B2	/11.B6	/47.B6
DICOM	DICOM	DICOM

XD24 3 XD24 3 XD24 3

Open J6 on the ZCU Card

-TA2.KF2	-TA3.KF2	-TA13.KF2
Levelwind Storage Drum	Levelwind CTD Winch	Out Hauler Motor
/11.E1	/11.E5	/47.E5
Power Latch	Power Latch	Power Latch
+15V VCC +24V	+15V VCC +24V	+15V VCC +24V

X81 1 2 3 X81 1 2 3 X81 1 2 3

/12.F7
11
-K3
12 14

-TA2	-TA3
Levelwind Storage Drum	Levelwind CTD Winch
JOG Mode	JOG Mode
/11.B1	/11.B5
DigIn 3	DigIn 3

XDI 3 XDI 3

-TA2	-TA3	-TA13
Levelwind Storage Drum	Levelwind CTD Winch	Out Hauler Motor
/11.B2	/11.B6	/47.B6
24V DC	24V DC	24V DC
+ -	+ -	+ -

XPOW 1 2 XPOW 1 2 XPOW 1 2

/4.A8 +24V-XPOW1
/4.A8 0V-XPOW1

+24V-XPOW1 /23.E1
0V-XPOW1 /23.E1

Emergency Stop &
Emergency Control

EM.Stop /23.D6
/3.D5 EM.CTRL -K1:A1 EM.CTRL /23.D7

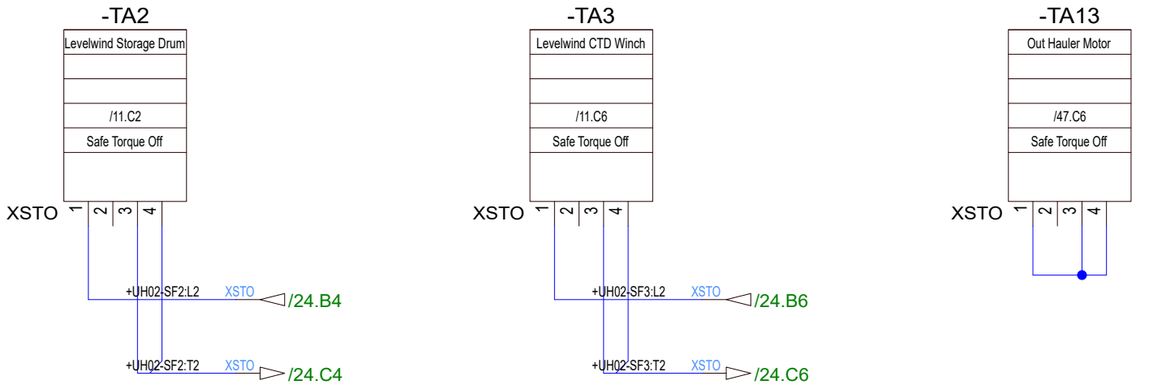
-K2 A1
/12.F6 A2

-K3 A1
/12.F7 A2

-K2
/12.E6
/8.B1 11 12 14 21 22 24

-K3
/12.E7
/12.B6 11 12 14 21 22 24

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwindes Frequency Inverter Signal Reference and Latched Inputs	400092375	=WCS01	
				User	GSK					+UH01	
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I	Sheet 12
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 13



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Levelwindes Safe Torque Off	400092375	=WCS01	
				User	GSK					+UH01	
	AS BUILT	19.08.2022	SS	Approved	RAJ						
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8E590EA796A34668A4F8439EFF11211F

Traction Winch Motor 1

Traction Winch Motor 2

Storage Drum

CTD Winch

/6.A8 TB1 DC+

/6.A8 TB1 DC-

-QA9 -QA10 400A 400A

-QA11 -QA12 400A 400A

-QA13 -QA14 250A 250A

-QA15 -QA16 250A 250A

-FE3

-FE4

-FE5

-FE6

UDC+ UDC-

-TA4 110kW-170A

-TA5 110kW-170A

-TA6 75kW-110A

-TA7 75kW-110A

DC AC

PE

/21.A1 U2 V2 W2

/21.A5 U2 V2 W2

/22.A1 U2 V2 W2

/22.A5 U2 V2 W2

EMC

-WD9 BN BK GY GNYE.GNYE.GNYE

-WD11 BN BK GY GNYE.GNYE.GNYE

-WD18 BN BK GY GNYE.GNYE.GNYE

-WD6 BN BK GY GNYE.GNYE.GNYE

=TRW01 U V W PE

=RW01 U V W PE

=HW01 U V W PE

-MA1 M 3 ~

-MA2 M 3 ~

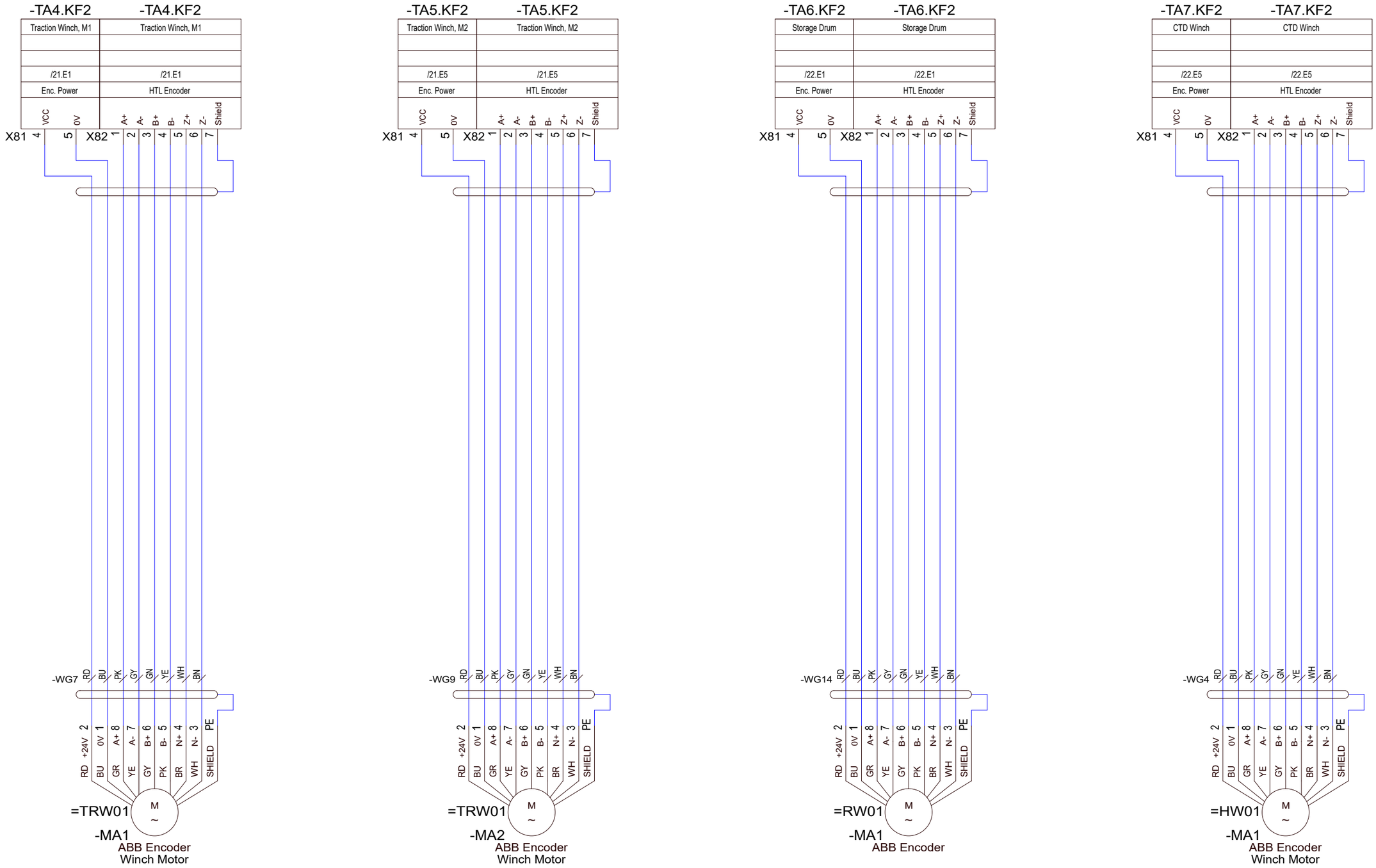
Winch Motor
68kW
Max Rating 150A
400V/50Hz

Winch Motor
68kW
Max Rating 150A
400V/50Hz

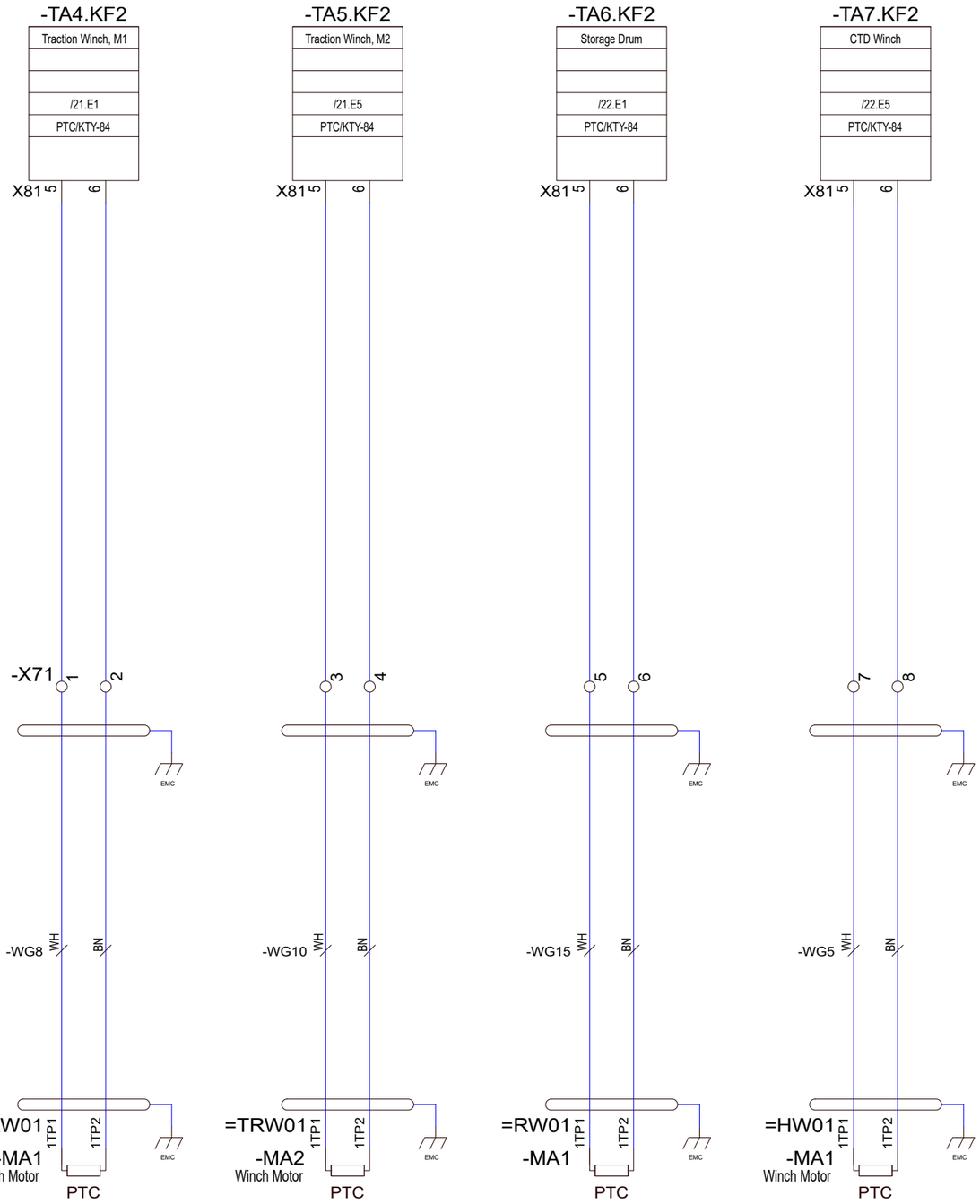
47kW
Max Rating 60A
400V/50Hz

Winch Motor
47kW
Max Rating 92A
400V/50Hz

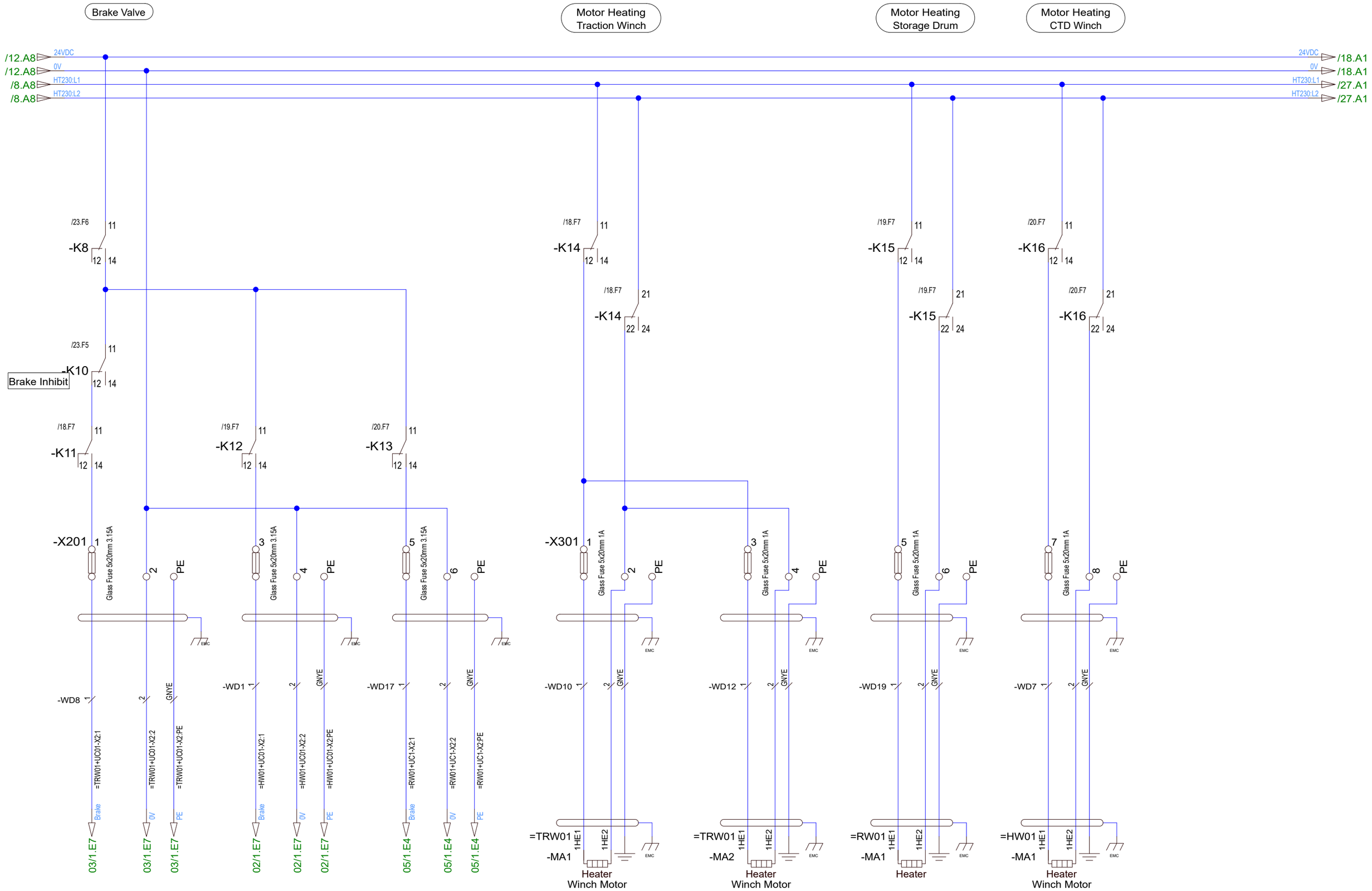
				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Traction Winch, SD & CTD Winch Frequency Inverter	400092375	=WCS01 +UH02
	AS BUILT	19.08.2022	SS	User	GSK					
				Approved	RAJ				10070-01 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 14 Next 15



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Traction Winch, SD & CTD Winch Encoder Cards	400092375	=WCS01 +UH02
	AS BUILT	19.08.2022	SS	User	GSK					
				Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-01 CC	Rev. I
										Sheet 15
										Next 16



				Date	17/11-2021	CNP Freire MBari		MACGREGOR	Main VFD Cabinet Pentagon Traction Winch, SD & CTD Winch PTC Connections	400092375	=WCS01 +UH02
	AS BUILT	19.08.2022	SS	User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-01 CC Rev. I	Sheet 16 Next 17



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Traction Winch, SD & CTD Winch Brake & Heating	400092375	=WCS01	
				User	GSK					+UH02	
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I	Sheet 17
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 18

Emergency JOG

Brake & Heating Control

/17.A8 24VDC
/17.A8 0V

24VDC /19.A1
0V /19.A1

-TA4	-TA5
Traction Winch, M1	Traction Winch, M2
Haul In	Haul In
/21.A1	/21.A5
DigIn 1	DigIn 1
XDI 1	XDI 1

-TA4	-TA5
Traction Winch, M1	Traction Winch, M2
Pay Out	Pay Out
/21.A1	/21.A5
DigIn 2	DigIn 2
XDI 2	XDI 2

-TA4	-TA5
Traction Winch, M1	Traction Winch, M2
Brake Lift	Brake Lift
/21.B2	/21.B6
XRO1	XRO1
COM NC NO	COM NC NO
XRO1 12 11 13	XRO1 12 11 13

-K11 A1 /18.F7 A2
-K14 A1 /18.F8 A2

-X501 1 2 3 PE
EMC

-WD23 1 2 3

1 =WP02+WP02-X400:1 24VDC 07/3.E1
2 =WP02+WP02-X400:2 Haul In 07/3.E2
3 =WP02+WP02-X400:3 Pay Out 07/3.E2
PE

-K11 /18.D7
/17.C1 11 12 14 21 22 24

-K14 /18.D8
/17.B4 11 12 14 21 22 24
/17.B4

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Traction Winch Emergency Control Connection	400092375	=WCS01 +UH02
	AS BUILT	19.08.2022	SS	User	GSK					
Status	Change	Date	Name	Approved	RAJ				10070-01 CC	Rev. I
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Emergency JOG

Brake & Heating Control

/18.A8 24VDC
/18.A8 0V

24VDC /20.A1
0V /20.A1

-TA6
Storage Drum
Haul In
/22.A1
DigIn 1
XDI 1

-TA6
Storage Drum
Pay Out
/22.A1
DigIn 2
XDI 2

-TA6
Storage Drum
Brake Lift
/22.B2
XRO1
COM NC NO
XRO1 12 11 13

-X501 4 5 6 PE

EMC

-WD23 4 5 6 GNYE

=WP02+WP02-X400:4 24VDC → 07/3.E3
=WP02+WP02-X400:5 Haul In → 07/3.E3
=WP02+WP02-X400:6 Pay Out → 07/3.E4
=WP02+WP02-X400:PE PE → 07/3.E4

-K12 A1 /19.F7 A2
-K15 A1 /19.F8 A2

-K12 /19.D7
/17.C2 11 12 14 21 22 24

-K15 /19.D8
/17.B6 11 12 14 21 22 24
/17.B6

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Storage Drum Emergency Control Connection	400092375	=WCS01
				User	GSK					+UH02
	AS BUILT	19.08.2022	SS	Approved	RAJ					
Status	Change	Date	Name	Standard		Version / Index / Repl. by			10070-01 CC Rev. I	Sheet 19 / Next 20

Emergency JOG

Brake & Heating Control

/19.A8 24VDC
/19.A8 0V

24VDC /23.A1
0V /23.A1

-TA7
CTD Winch
Haul In
/22.A5
DigIn 1
XDI 1

-TA7
CTD Winch
Pay Out
/22.A5
DigIn 2
XDI 2

-TA7
CTD Winch
Brake Lift
/22.B6
XRO1
COM NC NO
XRO1 12 11 13

-X501 7 8 9 PE

EMC

-WD5 1 2 3 GNYE

=HW01+UC01-X400:1 24VDC 02/2.E1
=HW01+UC01-X400:2 Haul In 02/2.E1
=HW01+UC01-X400:3 Pay Out 02/2.E2
=HW01+UC01-X400:PE PE 02/2.E2

-K13 A1 /20.F7 A2
-K16 A1 /20.F8 A2

-K13 /20.D7
/17.C3 11 12 14 21 22 24

-K16 /20.D8
/17.B7 11 12 14
/17.B7 21 22 24

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon CTD Winch Emergency Control Connection	400092375	=WCS01
				User	GSK					+UH02
	AS BUILT	19.08.2022	SS	Approved	RAJ					
Status	Change	Date	Name	Standard		Version / Index / Repl. by			10070-01 CC Rev. I	Sheet 20 / Next 21

Traction Winch Motor 1

ACS880-104-0170A-5
110kW-170A -TA4

XDI	Ref
DigIn 1	/18.B1
DigIn 2	/18.B2
DigIn 3	/23.B6
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/23.B1
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/18.B6
XRO2	
XRO3	

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/23.D1

XSTO	Ref
Safe Torque Off	/24.B1

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS | Control Panel/ PC Connection | Control Panel BUS

X12

-TA4.PH1
DPMP-02 R6/7

-TA4.KF1
FECA-01
Adress:
X1 X2

/47.D8 EtherCAT +UH01-TA13.KF1:X2

-WF21 Patch Cord 1.5M Cat.6 SFTP

FEN-31
-TA4.KF2

X81	Ref
Power Latch	/23.B3
Enc. Power	/15.B1
PTC/KTY-84	/16.B1

X22	Ref
TTL Encoder	

X82	Ref
HTL Encoder	/15.B2

X84	Ref
Power	
Dig In 1	
Dig In 2	

DIP Sw.	Pos
DIP 1	0
DIP 2	0
DIP 3	0
DIP 4	0

Internal Pull-Up Resistor
DIP Switches
Located under plastic cover
Default position 0

Traction Winch Motor 2

ACS880-104-0170A-5
110kW-170A -TA5

XDI	Ref
DigIn 1	/18.B2
DigIn 2	/18.B3
DigIn 3	/23.B7
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/23.B2
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/18.B7
XRO2	
XRO3	

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/23.D2

XSTO	Ref
Safe Torque Off	/24.B2

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS | Control Panel/ PC Connection | Control Panel BUS

X12

-TA5.PH1
DPMP-02 R6/7

-TA5.KF1
FECA-01
Adress:
X1 X2

-TA6.KF1:X1 EtherCAT /22.D1

-WF5 Patch Cord 1.5M Cat.6 SFTP

-WF6 Patch Cord 1.5M Cat.6 SFTP

FEN-31
-TA5.KF2

X81	Ref
Power Latch	/23.B4
Enc. Power	/15.B3
PTC/KTY-84	/16.B2

X22	Ref
TTL Encoder	

X82	Ref
HTL Encoder	/15.B4

X84	Ref
Power	
Dig In 1	
Dig In 2	

DIP Sw.	Pos
DIP 1	0
DIP 2	0
DIP 3	0
DIP 4	0

Internal Pull-Up Resistor
DIP Switches
Located under plastic cover
Default position 0

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Traction Winch Frequency Converter Referenceses	400092375	=WCS01 +UH02
				User	GSK					
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I
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Storage Drum

ACS880-104-0110A-5
75kW-110A -TA6

XDI	Ref
DigIn 1	/19.B1
DigIn 2	/19.B2
DigIn 3	/23.B7
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/23.B2
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/19.B7
XRO2	
XRO3	

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/23.D3

XSTO	Ref
Safe Torque Off	/24.B3

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS | Control Panel/ PC Connection | Control Panel BUS

X12

-TA6.PH1
DPMP-02 R6/7

-TA6.KF1
FECA-01
Adress:
X1 X2

/21.D8 EtherCAT -TA5.KF1:X2

-WF6 Patch Cord 1.5M Cat.6 SFTP

CTD Winch

ACS880-104-0110A-5
75kW-110A -TA7

XDI	Ref
DigIn 1	/20.B1
DigIn 2	/20.B2
DigIn 3	/23.B8
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/23.B3
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/20.B7
XRO2	
XRO3	

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/23.D3

XSTO	Ref
Safe Torque Off	/24.B5

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS | Control Panel/ PC Connection | Control Panel BUS

X12

-TA7.PH1
DPMP-02 R6/7

-TA7.KF1
FECA-01
Adress:
X1 X2

-WF7 Patch Cord 1.5M Cat.6 SFTP

+UH03-XF1:X2 EtherCAT /30.B1

-WF8 Patch Cord 1.5M Cat.6 SFTP

FEN-31
-TA6.KF2

X81	Ref
Power Latch	/23.B4
Enc. Power	/15.B5
PTC/KTY-84	/16.B3

X22	Ref
TTL Encoder	

X82	Ref
HTL Encoder	/15.B5

X84	Ref
Power	
Dig In 1	
Dig In 2	

DIP Sw.	Pos
DIP 1	0
DIP 2	0
DIP 3	0
DIP 4	0

Internal Pull-Up Resistor
DIP Switches
Located under plastic cover
Default position 0

FEN-31
-TA7.KF2

X81	Ref
Power Latch	/23.B5
Enc. Power	/15.B7
PTC/KTY-84	/16.B4

X22	Ref
TTL Encoder	

X82	Ref
HTL Encoder	/15.B7

X84	Ref
Power	
Dig In 1	
Dig In 2	

DIP Sw.	Pos
DIP 1	0
DIP 2	0
DIP 3	0
DIP 4	0

Internal Pull-Up Resistor
DIP Switches
Located under plastic cover
Default position 0

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Storage Drum & CDT Winch Frequency Converter Referenceses	400092375	=WCS01
				User	GSK					+UH02
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 22 / Next 23

0V Common Digital Signals

Encoder Power Latch Frequency Converters

Emergency JOG mode Actiavation

/20.A8 24VDC

/20.A8 0V

24VDC /28.C1

0V /28.C1

-TA4	-TA5	-TA6	-TA7
Traction Winch, M1	Traction Winch, M2	Storage Drum	CTD Winch
/21.B2	/21.B6	/22.B2	/22.B6
DICOM	DICOM	DICOM	DICOM

XD24 3 XD24 3 XD24 3 XD24 3

Open J6 on the ZCU Card

-TA4.KF2	-TA5.KF2	-TA6.KF2	-TA7.KF2
Traction Winch, M1	Traction Winch, M2	Storage Drum	CTD Winch
/21.E1	/21.E5	/22.E1	/22.E5
Power Latch	Power Latch	Power Latch	Power Latch
+15V VCC +24V	+15V VCC +24V	+15V VCC +24V	+15V VCC +24V

X81 1 2 3 X81 1 2 3 X81 1 2 3 X81 1 2 3

-K9 12 14 /23.F7 11

-TA4	-TA5	-TA6	-TA7
Traction Winch, M1	Traction Winch, M2	Storage Drum	CTD Winch
JOG Mode	JOG Mode	JOG Mode	JOG Mode
/21.B1	/21.B5	/22.B1	/22.B5
DigIn 3	DigIn 3	DigIn 3	DigIn 3

XDI 3 XDI 3 XDI 3 XDI 3

Emergency Stop & Emergency Control

/12.D7 EM.Stop +UH01-K2:A1 +UH03-KF20:6 EM.Stop /41.C4

/12.D8 EM.CTRL +UH03-SF4:3 EM.CTRL /41.C1

+UH03-KF10:7 BrakeInhibit /36.C6

-K10 A1 /23.F5 A2

-K8 A1 /23.F6 A2

-K9 A1 /23.F7 A2

-TA4	-TA5	-TA6	-TA7
Traction Winch, M1	Traction Winch, M2	Storage Drum	CTD Winch
/21.B2	/21.B6	/22.B2	/22.B6
24V DC	24V DC	24V DC	24V DC
+ -	+ -	+ -	+ -

XPOW 1 2 XPOW 1 2 XPOW 1 2 XPOW 1 2

/12.E3 +24V-XPOW1 +UH03-TA12 XPOW:+ +24V-XPOW1 /29.C1

/12.E3 0V-XPOW1 +UH03-TA12 XPOW:- 0V-XPOW1 /29.C1

-K10 /23.E5

/17.C1 11 12 14 21 22 24

-K8 /23.E6

/17.B1 11 12 14 21 22 24

-K9 /23.E7

/23.B6 11 12 14 21 22 24

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Traction Winch, SD & CTD Winch Frequency Converters Signal Reference and Latched Inputs	400092375	=WCS01
				User	GSK					+UH02
	AS BUILT	19.08.2022	SS	Approved	RAJ					
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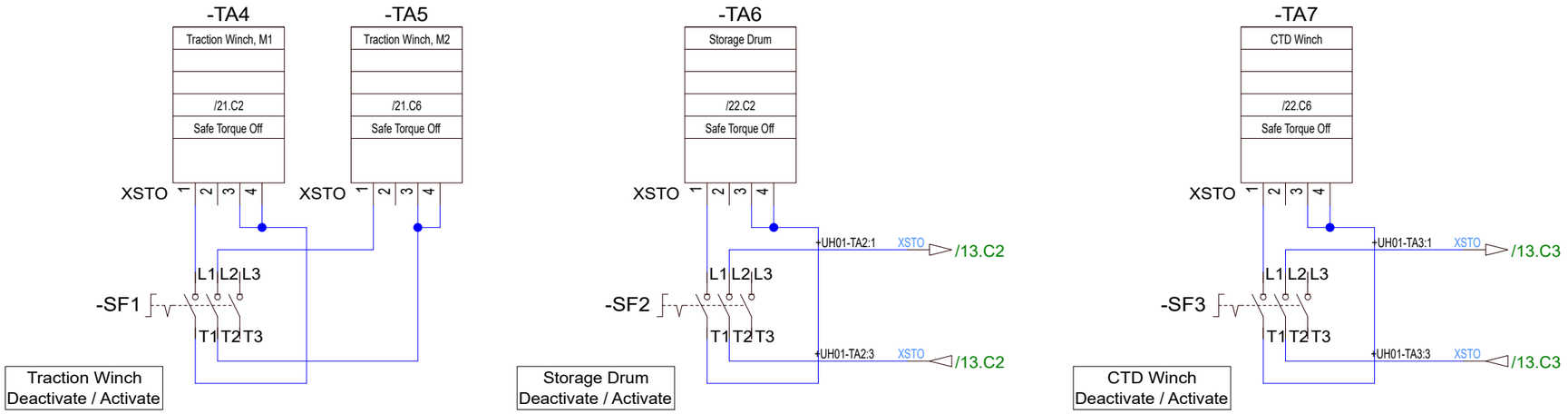
Winch System
Deactivation / Activation



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Traction Winch, SD & CTD Winch Winch System Deactivation / Activation Safe Torque Off	400092375	=WCS01 +UH02	
				User	GSK						
	AS BUILT	19.08.2022	SS	Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-01 CC Rev. I	Sheet 24 Next 25

480V Supply Input

Brake System 1 HPU Pump M1

Brake System 1 HPU Pump M2

Gear Cooling Pump M1

Gear Cooling Pump M2

-QA17
160A
Fuse NH00 35A 500V GL/GG;3

-FC1
6.3-10A
6,5A

-FC2
6.3-10A
6,5A

-FC3
2.5-4.0A
3,5

-FC4
2.5-4.0A
3,5A

-Q4 /34.F4

-Q5 /34.F5

-Q6 /35.F3

-Q7 /35.F4

/2.D2 480V:L1 +UH01-QB1:2
/2.D2 480V:L2 +UH01-QB1:4
/2.D2 480V:L3 +UH01-QB1:6

-X10 1 2 3 PE

-X10 4 5 6 PE

-X10 7 8 9 PE

-X10 10 11 12 PE

EMC

-WD26 BN BK GY GNYE

-WD27 BN BK GY GNYE

-WD28 BN BK GY GNYE,GNYE,GNYE

-WD29 BN BK GY GNYE,GNYE,GNYE

=HPUBR01 -MA1
HPU Motor
3kW
6,5A
400V/50Hz

=HPUBR01 -MA2
HPU Motor
3kW
6,5A
400V/50Hz

=HPUGC01 -MA1
HPU Motor
1,5kW
3,5A
400V/50Hz

=HPUGC01 -MA2
HPU Motor
1,5kW
3,5A
400V/50Hz

				Date	17/11-2021
				User	GSK
	AS BUILT	19.08.2022	SS	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Main VFD Cabinet Pentagon
Pentagon Control Cabinet
Main Power Connections

400092375

=WCS01
+UH03

10070-01 CC

Rev. I

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Next 26

Control Power 230V

230V Control Distribution

Cabinet Cooling

Cabinet Light

Service Socket

/8.A8 230V:L2
/8.A8 230V:L1

230V:L2 /28.A1
230V:L1 /28.A1

-X5 L1 L1 L1 L2 L2 L2

-FC5 1 3 2 4
C16A

-BT2 °C 1 2

-EA1 L1 L2

-XD1 L N
Service PC Only

-PE1 X1 Yellow 240V AC X2
Control Power

-EC2 L N PE

-X2 1 2 PE 3 4 PE 5 6 PE 7 8 PE

EMC

-WDS3 1 2 GNYE
230V/AC:L1=SHIP+Power-X3:1
230V/AC:L2=SHIP+Power-X3:2
PE =SHIP+Power-X3:PE
00/1.E5
00/1.E5
00/1.E5

-WD30 1 2 GNYE
230V/L2 =WP03+WP03-X1:1
230V/L1 =WP03+WP03-X1:2
PE =WP03+WP03-X1:PE
19/1.E3
19/1.E3
19/1.E3

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet 230V Distribution, Cabinet Cooling	400092375	=WCS01	
	Added WP03 connections	21.11.2022	ANP	User	GSK					+UH03	
	AS BUILT	19.08.2022	SS	Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-01 CC	Rev. I	Sheet 26 Next 27

Heating Supply

Cabinet Heating

Panel Heating WP01

Panel Heating WP02

Panel Heating WP03

/17.A8 HT230:L1

/17.A8 HT230:L2

-X6 L1 L1 L1 L2 L2 L2

-FC6 1 3 2 4

C16A

-PF2 X1 Yellow 240V AC Heating X2

-BT3 °C 1 2

+UH01 -EB1 L1 L2 Heater

-EB2 L1 L2 Heater

+UH01-K20:11 HT230:L1 /47.A1

+UH01-K20:21 HT230:L2 /47.A1

-X3 1 2 PE

-WDS2 1 2 GNYE

HT230:L1 =SHIP+Power-X4:1

HT230:L2 =SHIP+Power-X4:2

PE =SHIP+Power-X4:PE

00/1.E6

00/1.E6

00/1.E6

-X302 1 Glass Fuse 5x20mm 1A 2 PE

3 Glass Fuse 5x20mm 1A 4 PE

5 Glass Fuse 5x20mm 1A 6 PE

EMC

-WD20 1 2 GNYE

-WD21 1 2 GNYE

-WD31 1 2 GNYE

HT230:L1 =WP01+WP01-X300:1

HT230:L2 =WP01+WP01-X300:2

PE =WP01+WP01-X300:PE

HT230:L1 =WP02+WP02-X300:1

HT230:L2 =WP02+WP02-X300:2

PE =WP02+WP02-X300:PE

HT230:L1 =WP03+WP03-X300:1

HT230:L2 =WP03+WP03-X300:2

PE =WP03+WP03-X300:PE

06/1.E8

06/1.E8

06/1.E8

07/1.E8

07/1.E8

07/1.E8

19/1.E1

19/1.E1

19/1.E1

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet Heating Distribution, Cabinet Heating Control Panel Heating	400092375	=WCS01
	Added WP03 connections	21.11.2022	ANP	User	GSK					+UH03
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 27 / Next 28

24V Control Power
PLC Controller

24V Control Power
I/O & Components

/26.A8 230V:L2
/26.A8 230V:L1

-TA12:L 230V:L2 /29.A1
-TA12:N 230V:L1 /29.A1

-TA10
L N GND
230VAC
24VDC
ETH
10A
V+ V-

-XG1

-KF1 -KF14

PLC	
/31.A1	/32.B1
Coupler Supply	E-Bus Supply
+ -	1 +24V 5 0V

-FB1
Isolation
Guard
12-48V DC
IN Out
+ - + -
1 2 3 4 5
+UH02
PE

-K19
A1
A2
/28.F4

-KF3

Pentagon Control Cabinet
Ground Fault 24V DC
/31.B3
I8
8

-K19 12 14 11
/28.F4

-TA11
L N GND
230VAC
24VDC
ETH
20A
V+ V-

-XG2

-KF1 -KF20 -KF14

PLC		
/31.A1	/32.D5	/32.B1
Power Contacts	Power supply	Power Contacts
+ 24V 0V PE	4` 3`	2 +24V 3 0V 4 PE

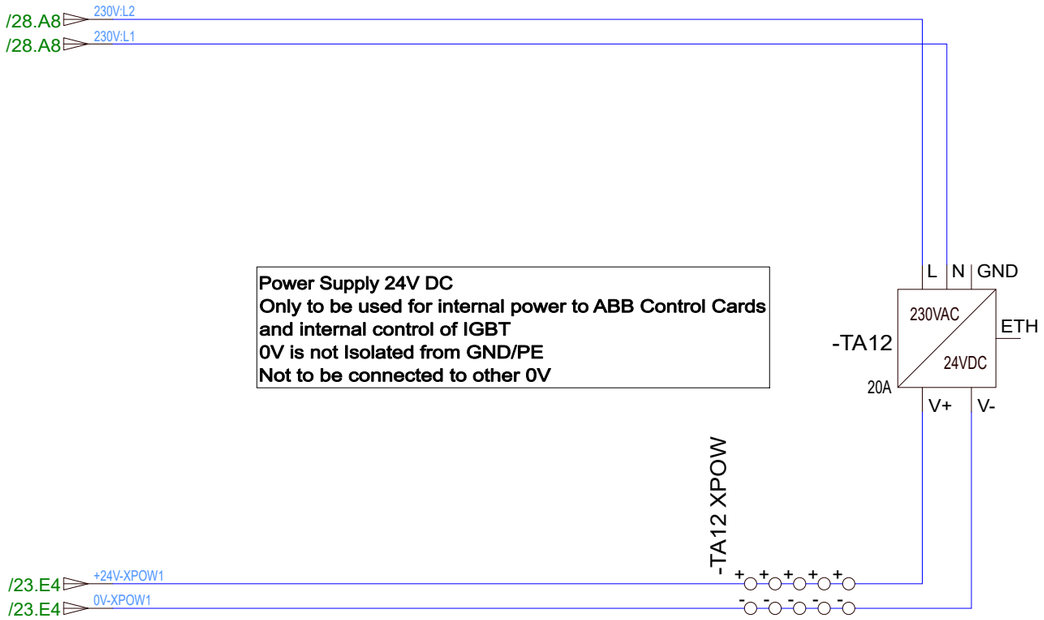
24V.XG1 /30.A1
0V /30.A1

/23.A8 24VDC
/23.A8 0V

24VDC /33.A1
0V /33.A1

-K19
/28.C4
/28.C5
11 12 14
21 22 24

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet 24V Power Supply	400092375	=WCS01 +UH03
	AS BUILT	19.08.2022	SS	User	GSK					
Status	Change	Date	Name	Approved	RAJ				10070-01 CC	Rev. I
				Standard		Version	Index	Repl. by		Sheet 28 Next 29



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet VFD Controlcard Powersupply	400092375	=WCS01 +UH03	
	AS BUILT	19.08.2022	SS	User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-01 CC Rev. I	Sheet 29 Next 30

8E590EA796A34668A4F8439EFF11211F

/28.C3 24V.XG1
/28.C3 0V

+ , PE -XF1
CU2508
X2 X4 X6 X8
X1 X3 X5 X7 X9

24V 0V -XF2
FL SWITCH 1008N
1 3 5 7
2 4 6 8

+ , -XF3
eWON Cosy 131
1 2 3 4 USB

/31.B3 EtherCAT -KF1:X001 -WF9 Patch Cord 1.5M Cat.6 SFTP
/5.E6 EtherCAT +UH01-TA1.KF1:X1 -WF1 Patch Cord 1.5M Cat.6 SFTP
/22.D8 EtherCAT +UH02-TA7.KF1:X2 -WF8 Patch Cord 1.5M Cat.6 SFTP
-WF10 Patch Cord 1.5M Cat.6 SFTP

/31.C3 Ethernet -KF1:X000
-WF12 Patch Cord 1.5M Cat.6 SFTP
-WF13 Patch Cord 1.5M Cat.6 SFTP
-SEDIN /48.A5

-MRU:RJ45 317265898 /48.A1

Pair	T568B	Pin
2	Orange/White	1
2	Orange	2
3	Green/White	3
1	Blue	4
1	Blue/White	5
3	Green	6
4	Brown/White	7
4	Brown	8
Screen	Screen	S

Patch Cord 1.5M Cat.6 SFTP

EtherCAT -RJ1 -WF13 =A-FRAME STERN+B11-X915:5 WHBU … =A-FRAME STERN+B11-X915:8 BN
ETH5 … ETH8 → 18/1.E1 18/1.E1 18/1.E1 18/1.E2 18/1.E2 18/1.E2 18/1.E2 18/1.E2

EtherCAT -RJ2 -WF11 =WP03+WP03-RJ2:5 WHBU … =WP03+WP03-RJ2:8 BN
ETH5 … ETH8 → 19/2.E7 19/2.E8 19/2.E8 19/2.E8 19/2.E8 19/2.E8 19/2.E8 19/2.E8

Ethernet -RJ8 -WF19 =WP03+WP03-RJ1:5 WHBU … =WP03+WP03-RJ1:8 BN
ETH5 … ETH8 → 19/2.E6 19/2.E6 19/2.E6 19/2.E6 19/2.E6 19/2.E6 19/2.E6 19/2.E6

Ethernet -RJ3 -WF14 =CP01+CP01:XG3:5 WHBU … =CP01+CP01:XG3:8 BN
ETH5 … ETH8 → 08/1.E5 08/1.E5 08/1.E5 08/1.E5 08/1.E5 08/1.E5 08/1.E5 08/1.E5

Ethernet -RJ4 -WF15 =CP01+CP01:XG4:5 WHBU … =CP01+CP01:XG4:8 BN
ETH5 … ETH8 → 08/1.E6 08/1.E6 08/1.E6 08/1.E6 08/1.E6 08/1.E6 08/1.E6 08/1.E6

-RJ9 -WF2 -WF20 =SHIP+Signal-X5:1 WHBU … =SHIP+Signal-X5:8 BN
ETH5 … ETH8 → 00/2.E7 00/2.E7 00/2.E7 00/2.E8 00/2.E8 00/2.E8 00/2.E8 00/2.E8

Ethernet -RJ5 -WF16 =CP03+CP03-XG3:5 WHBU … =CP03+CP03-XG3:8 BN
ETH5 … ETH8 → 10/1.E5 10/1.E5 10/1.E5 10/1.E5 10/1.E5 10/1.E5 10/1.E5 10/1.E5

Ethernet -RJ6 -WF17 =CP03+CP03-XG4:5 WHBU … =CP03+CP03-XG4:8 BN
ETH5 … ETH8 → 10/1.E6 10/1.E6 10/1.E6 10/1.E6 10/1.E6 10/1.E6 10/1.E6 10/1.E6

Ethernet Internet -RJ7 -WF18 -WFS1 =SHIP+Signal-X4:1 WHBU … =SHIP+Signal-X4:8 BN
ETH5 … ETH8 → 00/2.E6 00/2.E6 00/2.E6 00/2.E6 00/2.E6 00/2.E7 00/2.E7 00/2.E7

			Date	17/11-2021	CNP Freire MBari
	ETH Switch & Added WP03 conn.	21.11.2022	User	GSK	MACGREGOR
	AS BUILT	19.08.2022	Approved	RAJ	Main VFD Cabinet Pentagon Pentagon Control Cabinet Network and Switches
Status	Change	Date	Standard		400092375
			Version	Index / Repl. by	=WCS01 / +UH03
					10070-01 CC Rev. I
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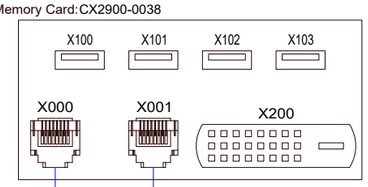
-KF1 CX5230-0175

Coupler Supply	Power Contacts	Power Contacts
/28.B2	/28.B6	

Memory Card: CX2900-0038



-KF2 -KF3 EL6070

License key terminal

TC1200-0240
TF6020-0240
TF6221-0240

-KF3 EL1008

8 Digital Inputs

	DI	Ref	Adress	Description
	I1	/34.B2		Brake HPU 1
	I2	/34.B2		Brake HPU 1
	I3	/34.B3		Brake HPU 1
	I4	/35.B1		Oil Level
	I5	/35.B2		Oil Temp
	I6	/35.B2		Oil Filter Alarm 1
	I7	/35.B3		Oil Filter Alarm 2
	I8	/28.B5		Ground Fault 24V DC

-KF4 EL1008

8 Digital Inputs

DI	Ref	Adress	Description
I1	/42.B2		Safer Input
I2	/42.B5		Storage Drum 1 Select
I3	/42.B5		Safer Input
I4	/42.B8		Spool L
I5	/42.B8		Spool R
I6	/43.B2		Safer Input
I7	/43.B5		Spool L
I8	/43.B5		Spool R

-KF5 EL1008

8 Digital Inputs

DI	Ref	Adress	Description
I1	/38.B2		End Sensor Drive
I2	/38.B2		End Sensor Bearing
I3	/38.B3		Counting Sensor 1
I4	/38.B3		Counting Sensor 2
I5	/38.B4		SWC Limit 1
I6	/38.B4		SWC Limit 2
I7	/43.B6		Launch & Recovery
I8			

-KF6 EL1008

8 Digital Inputs

DI	Ref	Adress	Description
I1	/39.B2		End Sensor Drive
I2	/39.B2		End Sensor Bearing
I3	/39.B3		Counting Sensor 1
I4	/39.B3		Counting Sensor 2
I5			
I6			
I7			
I8			

-WF9 Patch Cord 1.5M Cat.6 SFTP -XF1:X9 EtherCAT /30.B1

-WF12 Patch Cord 1.5M Cat.6 SFTP -XF2:1 Ethernet /30.B4

-KF7 EL3255

5-Ch Input Potentiometer

A-In	Ref	Adress	Description
Pot 1	/42.B2		Joystick
Pot 2	/42.B6		Joystick
Pot 3	/43.B2		Joystick
Pot 4			
Pot 5			

-KF8 EL3058

8 Analog Inputs 4-20mA

A-In	Ref	Adress	Description
I1	/34.B3		Brake HPU 1
I2	/36.B2		Gear Temp 1
I3	/36.B2		Gear Temp 2
I4	/37.B2		GearTemp 1
I5	/37.B3		GearTemp 1
I6			
I7			
I8			

-KF9 EL3058

8 Analog Inputs 4-20mA

A-In	Ref	Adress	Description
I1	/38.B2		Follow Up Sensor
I2	/38.B4		String Sensor
I3	/38.B5		Pressure Transmitter
I4	/39.B2		Follow Up Sensor
I5	/39.B4		Load Cell
I6	/40.B2		Load Cell
I7			
I8			

-KF10 EL2008

8 Digital Outputs

Outputs	Ref	Adress	Description
Out 1	/34.B4		Brake HPU 1
Out 2	/34.B5		Brake HPU 1
Out 3	/35.B4		Gear Cooling Start M1
Out 4	/35.B4		Gear Cooling Start M2
Out 5	/35.B5		Water Cooling Valve
Out 6	/36.B7		Brake Lift Inhibit
Out 7	/43.B6		Launch & Rec. IND
Out 8			

-KF11 EL2008

8 Digital Outputs

Outputs	Ref	Adress	Description
Out 1	/42.B2		Active
Out 2	/42.B3		In Control
Out 3	/42.B3		alarm
Out 4	/42.B4		Emergency Stop Light
Out 5	/42.B6		Active
Out 6	/42.B7		In Control
Out 7	/42.B7		alarm
Out 8	/43.B4		Emergency Stop Light

-KF12 EL2008

8 Digital Outputs

Outputs	Ref	Adress	Description
Out 1	/43.B2		Active
Out 2	/43.B3		In Control
Out 3	/43.B3		alarm
Out 4	/46.B2		Emergency Stop Light
Out 5	/46.B4		Emergency Stop Light
Out 6	/46.B5		Emergency Stop Light
Out 7			
Out 8			

-KF13 EL2624

4 Relay Outputs

Outputs	Ref	Adress	Description
Out 1	/45.B1		System Active
Out 2	/45.B7		Critical Alarm
Out 3	/45.B7		None Critical Alarm
Out 4			

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet PLC & I/Os	400092375	=WCS01 +UH03
				User	GSK					
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I
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-KF14 EL9410

E-Bus Supply
/28.B2

Power Contacts
/28.B7

-KF15 EL2535-0002

2 PWM Outputs

I/O	Ref	Adress	Description
PWM 1	/38.B6		SWC Valve
PWM 2			
I1			
I2			

-KF16 EL4024

4-ch analog out 4…20 mA

Outputs	Ref	Adress	Description
Output 1	/45.B2		Actual Power
Output 2			
Output 3			
Output 4			

-KF17 EL3054

4 Analog Inputs 4-20mA

A-In	Ref	Adress	Description
I1	/45.B2		Power Available
I2	/45.B3		Regeneration Limit
I3			
I4			

-KF23 EL6021

Serial RS422/RS485

I/O	Ref	Adress	Description
RS422/RS485	/48.D3		

-KF24 EL6021

Serial RS422/RS485

I/O	Ref	Adress	Description
RS422/RS485	/48.D1		

-KF25 EL6021

Serial RS422/RS485

I/O	Ref	Adress	Description
RS422/RS485	/48.D2		

-KF18 EL1918

8xDI TwinSAFE

Adress	

I/O	Ref	Adress	Description
I1	/42.B4		Emergency Stop
I2	/42.B4		Emergency Stop
I3	/43.B4		Emergency Stop
I4	/43.B4		Emergency Stop
I5			Emergency Stop
I6			Emergency Stop
I7			Emergency Stop
I8			Emergency Stop

-KF19 EL1918

8xDI TwinSAFE

Adress	

I/O	Ref	Adress	Description
I1	/46.B1		Emergency Stop
I2	/46.B2		Emergency Stop
I3	/46.B3		Emergency Stop
I4	/46.B3		Emergency Stop
I5	/46.B5		Emergency Stop
I6	/46.B5		Emergency Stop
I7			Emergency Stop
I8			Emergency Stop

-KF20 EL2911

4xDI, 1xOut TwinSAFE

Adress	

I/O	Ref	Adress	Description
I1			
I2			
I3			
I4			
Power supply	/28.B7		
Power supply			
Safe Output 1			
Safe Output 1	/41.B4		Emergency Stop

-KF21 EL6751

CANopen

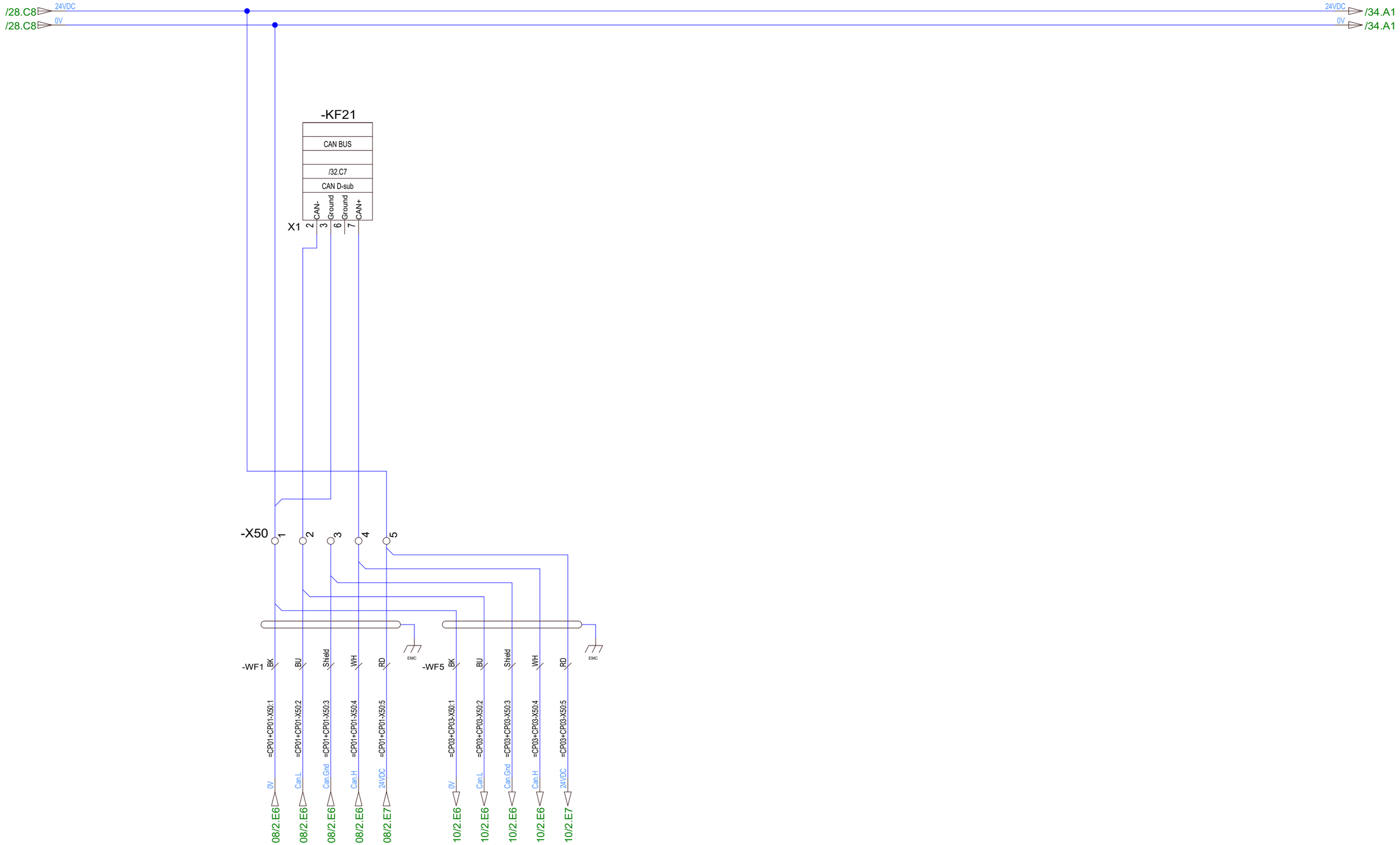
I/O	Ref	Adress	Description
CAN D-sub	/33.B2		CAN BUS

-KF22

Bus End Cover

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet PLC & I/Os
				User	GSK			
	AS BUILT	19.08.2022	SS	Approved	RAJ			
Status	Change	Date	Name	Standard		Version / Index / Repl. by		

400092375 | =WCS01 | +UH03 | 10070-01 CC | Rev. I | Sheet 32 | Next 33



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon CAN Bus Connection	400092375	=WCS01 +UH03	
				User	GSK						
	AS BUILT	19.08.2022	SS	Approved	RAJ						
Status	Change	Date	Name	Standard		Version / Index / Repl. by			10070-01 CC	Rev. I	Sheet 33 Next 34

Brake HPU 1
Oil Level, Oil Temp, Pressostat, Pressure Transmitter

Brake HPU 1
Motor 1

Brake HPU 1
Motor 2

/33.A8 24VDC
/33.A8 0V

24VDC /35.A1
0V /35.A1

-KF3	-KF3	-KF3	-KF8
Oil Level	High Oil Temp	Pressostat	Pressure Transmitter
Brake HPU 1	Brake HPU 1	Brake HPU 1	Brake HPU 1
/31.B3	/31.B3	/31.B3	/31.C2
I1	I2	I3	I1
1	5	2	1

-KF10	-KF10
Motor 1 Start	Motor 2 Start
Brake HPU 1	Brake HPU 1
/31.C5	/31.C5
Out 1	Out 2
1	5

-K17 12 14
/41.E2 11

Emergecy Control
Pump Start

-Q4 A1
/34.F4 A2

-Q5 A1
/34.F5 A2

-X30 1 Glass Fuse 5x20mm 3.15A
2 PE
3
4 PE
5
6 PE
EMC

-WG24 WH =HPUBR01+UC01-X1:1 24VDC 16/1.E2
BN =HPUBR01+UC01-X1:2 0V 16/1.E2
GN =HPUBR01+UC01-X1:3 Level 16/1.E2
YE =HPUBR01+UC01-X1:4 Temp 16/1.E2
GY =HPUBR01+UC01-X1:5 Pressostat 16/1.E3
PK =HPUBR01+UC01-X1:6 A In 16/1.E3

-Q4
/34.C4
/25.C2
1 2
3 4
5 6
13 14

-Q5
/34.C5
/25.C3
1 2
3 4
5 6
13 14

				Date	17/11-2021	CNP Freire	MACGREGOR	Main VFD Cabinet Pentagon	400092375	=WCS01	
				User	GSK	MBari		Pentagon Control Cabinet		+UH03	
	AS BUILT	19.08.2022	SS	Approved	RAJ			Brake HPU 1			
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-01 CC	Rev. I	Sheet 34 / Next 35

Gear Cooling HPU
Oil Level, Oil Temp, Oil Filter

Gear Cooling HPU
Water Valve / Cooling Signal

/34.A8 24VDC
/34.A8 0V

24VDC /36.A1
0V /36.A1

-KF3	-KF3	-KF3	-KF3
Gear Cooling	Gear Cooling	Gear Cooling	Gear Cooling
Oil Level	Oil Temp	Oil Filter Alarm 1	Oil Filter Alarm 2
/31.B3	/31.B3	/31.B3	/31.B3
I4	I5	I6	I7
6	3	7	4

-KF10	-KF10	-KF10
Gear Cooling	Gear Cooling	Gear Cooling
Gear Cooling Start M1	Gear Cooling Start M2	Water Cooling Valve
/31.D5	/31.D5	/31.D5
Out 3	Out 4	Out 5
2	6	3

-Q6 A1 /35.F4 A2
-Q7 A1 /35.F4 A2
-K18 A1 /35.F5 A2

/35.F5 -K18 11 12 14
-K18 22 24 /35.F5 21

-X31 1 Glass Fuse 5x20mm 3.15A 2 PE 3 4 PE 5 6 PE
-X80 1 Glass Fuse 5x20mm 3.15A 2 PE 3 4 PE

-WG25 WH =HPUGC01+UC01-X1:1 24VDC 17/1.E2
BN =HPUGC01+UC01-X1:2 Level 17/1.E2
GN =HPUGC01+UC01-X1:3 Temp 17/1.E2
YE =HPUGC01+UC01-X1:4 Filter Ind 17/1.E3
GY =HPUGC01+UC01-X1:5 Filter Ind 17/1.E3

-WGS2 WH =SHIP+Signal-X3:1 CoolCtrl 00/2.E5
BN =SHIP+Signal-X3:2 CoolCtrl 00/2.E5

EMC

-Q6 /35.C4
/25.C3 1 2 3 4 5 6 13 14

-Q7 /35.C4
/25.C4 1 2 3 4 5 6 13 14

-K18 /35.C5
/35.B7 11 12 14 22
/35.B8 21 24

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet Gear Cooling HPU	400092375	=WCS01
				User	GSK					+UH03
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 CC	Rev. I
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/35.A8 24VDC
/35.A8 0V

24VDC /37.A1
0V /37.A1

-KF8	-KF8
Traction Winch	Traction Winch
Gear Temp 1	Gear Temp 2
/31.C2	/31.D2
I2	I3
5	2

-KF10
Traction Winch
Brake Lift Inhibit
/31.D5
Out 6
7

/23.D6 BrakeInhibit+UH02-K10:A1

-X100 1 Glass Fuse 5x20mm 3.15A
2 PE
3
4 PE
EMC

-WG6
WH =TRW01+UC01-X1:1 24VDC 03/1.E1
BN =TRW01+UC01-X1:2 0V 03/1.E1
GN =TRW01+UC01-X1:5 Temp 03/1.E2
YE =TRW01+UC01-X1:9 Temp 03/1.E2

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet Gear Temp, Brake Inhibit, Traction Winch	400092375	=WCS01
				User	GSK					+UH03
	AS BUILT	19.08.2022	SS	Approved	RAJ					
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/36.A8 24VDC
/36.A8 0V

24VDC /38.A1
0V /38.A1

-KF8
Storage Drum
GearTemp 1
/31.D2
I4
6

-KF8
CTD Winch
GearTemp 1
/31.D2
I5
3

-X101 1 Glass Fuse 5x20mm 3.15A
2 PE 3 4 PE
EMC

-X102 1 Glass Fuse 5x20mm 3.15A
2 PE 3 4 PE

-WG13 WH BN GN YE

WH =RW01+UC1-X1:1 24VDC 05/1.E2
BN =RW01+UC1-X1:2 0V 05/1.E2
GN =RW01+UC1-X1:3 Temp 05/1.E2
YE =RW01+UC1-X1:4 Spare 05/1.E2

=HW01+UC01-X1:29 Temp 02/1.E6

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet Gear Temp Storage Drum & CDT Winch	400092375	=WCS01 +UH03	
	AS BUILT	19.08.2022	SS	User	GSK						
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				Standard		Version / Index / Repl. by					

/37.A8 24VDC
/37.A8 0V

24VDC /39.A1
0V /39.A1

-KF5	-KF5	-KF9	-KF5	-KF5	-KF5	-KF5	-KF9	-KF9
Storage Drum Levelwind	Storage Drum Levelwind	Storage Drum Levelwind	Storage Drum Levelwind	Storage Drum Levelwind	Storage Drum Levelwind	Storage Drum Levelwind	Storage Drum Levelwind	Storage Drum Levelwind
End Sensor Drive	End Sensor Bearing	Follow Up Sensor	Counting Sensor 1	Counting Sensor 2	SWC Limit 1	SWC Limit 2	String Sensor	Pressure Transmitter
/31.B5	/31.B5	/31.C4	/31.B5	/31.B5	/31.B5	/31.B5	/31.C4	/31.D4
I1	I2	I1	I3	I4	I5	I6	I2	I3
1	5	1	2	6	3	7	5	2

-KF15
Storage Drum Levelwind
SWC Valve
/32.B2
PWM 1
1 A1
5 A2
3 GND

-X103 1 Glass Fuse 5x20mm 3.15A
2 PE 3 4 PE 5 6 PE 7 8 PE 9 10 PE 11 12 PE
EMC

-WG11 WH =LEV01+UC01-X1:1 24VDC 04/1.E1
BN =LEV01+UC01-X1:2 0V 04/1.E1
GN =LEV01+UC01-X1:4 End Sensor 04/1.E1
YE =LEV01+UC01-X1:8 End Sensor 04/1.E2
GY =LEV01+UC01-X1:12 Follow Up 04/1.E3
PK =LEV01+UC01-X1:18 Counting 1 04/1.E3
BU =LEV01+UC01-X1:22 Counting 2 04/1.E4
RD =LEV01+UC01-X1:24 SWC Limit 04/1.E5
BK =LEV01+UC01-X1:28 SWC Limit 04/1.E5
VT =LEV01+UC01-X1:33 Sting 04/1.E6
GYPK =LEV01+UC01-X1:36 Pressure 04/1.E7

-X202 1 2 PE
EMC

-WD13 1 =LEV01+UC01-X2:1 +24V 04/1.E8
2 =LEV01+UC01-X2:2 0V 04/1.E8
GNYE =LEV01+UC01-X2:PE PE 04/1.E8

				Date	17/11-2021	CNP Freire	MACGREGOR	Main VFD Cabinet Pentagon	400092375	=WCS01	
				User	GSK	MBari		Pentagon Control Cabinet		+UH03	
	AS BUILT	19.08.2022	SS	Approved	RAJ			Storage Drum, Levelwinde / SWC Sensors			
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-01 CC Rev. I	Sheet 38 / Next 39

/38.A8 24VDC
/38.A8 0V

24VDC /40.A1
0V /40.A1

-KF6	-KF6	-KF9	-KF6	-KF6	-KF9
CTD Winch Levelwinde	CTD Winch Levelwinde	CTD Winch Levelwinde	CTD Winch Levelwinde	CTD Winch Levelwinde	CTD Winch Levelwinde
End Sensor Drive	End Sensor Bearing	Follow Up Sensor	Counting Sensor 1	Counting Sensor 2	Load Cell
/31.B6	/31.B6	/31.D4	/31.B6	/31.B6	/31.D4
I1	I2	I4	I3	I4	I5
1	5	6	2	6	3

-X104 1 Glass Fuse 5x20mm 3.15A 2 PE 3 4 PE 5 6 PE 7 8 PE

EMC

-WG1 WH =HW01+UC01-X1:1 24VDC 02/1.E1
BN =HW01+UC01-X1:2 0V 02/1.E1
GN =HW01+UC01-X1:4 End Sensor 02/1.E1
YE =HW01+UC01-X1:8 End Sensor 02/1.E2
GY =HW01+UC01-X1:12 Follow Up 02/1.E3
PK =HW01+UC01-X1:18 Counting 1 02/1.E4
BU =HW01+UC01-X1:22 Counting 2 02/1.F4
RD =HW01+UC01-X1:24 Loadcell 02/1.E5

				Date	17/11-2021	CNP Freire	MACGREGOR	Main VFD Cabinet Pentagon	400092375	=WCS01	
				User	GSK	MBari		Pentagon Control Cabinet		+UH03	
	AS BUILT	19.08.2022	SS	Approved	RAJ			CTD Winch, Levelwinde Sensors			
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/39.A8 24VDC
/39.A8 0V

24VDC /41.A1
0V /41.A1

-KF9

Deck Sheave TRW
Load Cell
/31.D4
I6

7

-X105 1 Glass Fuse 5x20mm 3.15A
2
PE
3
4
PE

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet Deck Sheave, Traction Winch System Load Cell	400092375	=WCS01	
				User	GSK					+UH03	
	AS BUILT	19.08.2022	SS	Approved	RAJ						
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Emergency Control Internal

Emergency Stop

/40.A8 24VDC

/40.A8 0V

24VDC /42.A1

0V /42.A1

-KF20

AUX / Pentagon Cabinet
Emergency Stop
/32.D5
Safe Output 1
+ -

6 7

/23.D7 EM.Stop

-SF4

2 1 2 1 3

Normal / Emergency Control

/23.D8 EM.CTRL

A1

-K17

A2

/41.E2

-K17

/41.C2

/34.C4

11 12 14

21 22 24

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet Emergency Control & Emergency Stop	400092375	=WCS01
				User	GSK					+UH03
	AS BUILT	19.08.2022	SS	Approved	RAJ					
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8E590EA796A34668A4F8439EFF11211F

/41.A8 24VDC
/41.A8 0V

24VDC /43.A1
0V /43.A1

-KF4	-KF7	-KF11	-KF11	-KF11	-KF18	-KF18	-KF11
Traction Winch	Traction Winch	Traction Winch	Traction Winch	Traction Winch	Traction Winch	Traction Winch	Traction Winch
Safer Input	Joystick	Active	In Control	alarm	Emergency Stop	Emergency Stop	Emergency Stop Light
/31.B4	/31.C1	/31.C6	/31.C6	/31.D6	/32.C3	/32.C3	/31.D6
I1	Pot 1	Out 1	Out 2	Out 3	I1	I2	Out 4
	0V Input 1 +10V				+ -	+ -	
1	1 2 9	1	5	2	1 2	9 10	6

-KF4
Traction Winch
Storage Drum 1 Select
/31.B4
I2
5

-KF4	-KF7	-KF11	-KF11	-KF11
Storage Drum	Storage Drum	Storage Drum	Storage Drum	Storage Drum
Safer Input	Joystick	Active	In Control	alarm
/31.B4	/31.C1	/31.D6	/31.D6	/31.D6
I3	Pot 2	Out 5	Out 6	Out 7
	0V Input 2 +10V			
2	4 5 12	3	7	4

-KF4	-KF4
Storage Drum LW	Storage Drum LW
Spool L	Spool R
/31.B4	/31.B4
I4	I5
6	3

-X400

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

EMC

-WG17

WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GYPK	RDBU	WHGN	BNGN	WHYE
=WP02+WP02-X1:1	=WP02+WP02-X1:2	=WP02+WP02-X1:3	=WP02+WP02-X1:4	=WP02+WP02-X1:5	=WP02+WP02-X1:6	=WP02+WP02-X1:7	=WP02+WP02-X1:8	=WP02+WP02-X1:9	=WP02+WP02-X1:10	=WP02+WP02-X1:11	=WP02+WP02-X1:12	=WP02+WP02-X1:13	=WP02+WP02-X1:14	=WP02+WP02-X1:15
24VDC	0V	Start	0V	A In	+10V	Active	In Control	Alarm	EM Loop 1	EM Loop 1	EM Loop 2	EM Loop 2	EM Light	Drum Select
07/1.E1	07/1.E1	07/1.E2	07/1.E2	07/1.E2	07/1.E2	07/1.E3	07/1.E3	07/1.E4	07/1.E4	07/1.E5	07/1.E5	07/1.E5	07/1.E5	07/1.E6

-WG18

WH	BN	GN	YE	GY	PK	BU	RD	BK	
=WP02+WP02-X2:3	=WP02+WP02-X2:4	=WP02+WP02-X2:5	=WP02+WP02-X2:6	=WP02+WP02-X2:7	=WP02+WP02-X2:8	=WP02+WP02-X2:9	=WP02+WP02-X2:10	=WP02+WP02-X2:11	
Start	0V	A In	+10V	Active	In Control	Alarm	Spool L	Spool R	
07/2.E2	07/2.E2	07/2.E2	07/2.E2	07/2.E3	07/2.E3	07/2.E4	07/2.E4	07/2.E5	

				Date	17/11-2021	CNP Freire	MACGREGOR	Main VFD Cabinet Pentagon	400092375	=WCS01
				User	GSK	MBari		Pentagon Control Cabinet		+UH03
	AS BUILT	19.08.2022	SS	Approved	RAJ			Control Panel, Traction Winch & Storage Drum	10070-01 CC	Rev. I
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/42.A8 24VDC
/42.A8 0V

24VDC /44.A1
0V /44.A1

-KF4	-KF7	-KF12	-KF12	-KF12	-KF18	-KF18	-KF11
CTD Winch	CTD Winch	CTD Winch	CTD Winch	CTD Winch	CTD Winch	CTD Winch	CTD Winch
Safer Input	Joystick	Active	In Control	alarm	Emergency Stop	Emergency Stop	Emergency Stop Light
/31.B4	/31.D1	/31.E1	/31.E1	/31.E1	/32.D3	/32.D3	/31.D6
I6	Pot 3	Out 1	Out 2	Out 3	I3	I4	Out 8
	0V / Input 3 / +10V				+ -	+ -	
7	6 / 7 / 14	1	5	2	3 / 4	11 / 12	8

-KF4	-KF4
CTD Winch Levelwinde	CTD Winch Levelwinde
Spool L	Spool R
/31.B4	/31.B4
I7	I8
4	8

-KF5	-KF10
CTD Winch Levelwinde	CTD Winch Levelwinde
Launch & Recovery	Launch & Rec. IND
/31.B5	/31.D5
I7	Out 7
4	4

-X401 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

EMC

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
-WG16	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GYPK	RDBU	WHGN	BNGN	WHYE	YEBN	WHGR	GRBN
	=WPO1+WP01-X1:1	=WPO1+WP01-X1:2	=WPO1+WP01-X1:3	=WPO1+WP01-X1:4	=WPO1+WP01-X1:5	=WPO1+WP01-X1:6	=WPO1+WP01-X1:7	=WPO1+WP01-X1:8	=WPO1+WP01-X1:9	=WPO1+WP01-X1:10	=WPO1+WP01-X1:11	=WPO1+WP01-X1:12	=WPO1+WP01-X1:13	=WPO1+WP01-X1:14	=WPO1+WP01-X1:16	=WPO1+WP01-X1:15	=WPO1+WP01-X1:17	=WPO1+WP01-X1:18
	24VDC	0V	Start	0V	A In	+10V	Active	In Control	Alarm	EM Loop 1	EM Loop 1	EM Loop 2	EM Loop 2	EM Light	Spool L	Spool R	Launch&Rec	Launch&Rec
	06/1.E1	06/1.E1	06/1.E1	06/1.E2	06/1.E2	06/1.E2	06/1.E3	06/1.E3	06/1.E3	06/1.E4	06/1.E4	06/1.E5	06/1.E5	06/1.E5	06/1.E6	06/1.E5	06/1.E6	06/1.E7

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Pentagon Control Cabinet Control Panel, CTD Winch	400092375	=WCS01 +UH03
	AS BUILT	19.08.2022	SS	User	GSK					
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ROV Control Room
Panel CP01

AFT Control Room
Panel CP03

/43.A8 24VDC
/43.A8 0V

24VDC /45.A1
0V /45.A1

-X402
1 Glass Fuse 5x20mm 3.15A 2 PE
3 Glass Fuse 5x20mm 3.15A 4 PE
EMC
EMC

-WD24 1 2 GNYE
-WD25 1 2 GNYE

=CP01+CP01-X1:1 24VDC
=CP01+CP01-X1:2 0V
:PE PE
=CP03+CP03-X1:1 24VDC
=CP03+CP03-X1:2 0V
:PE PE

08/1.E1
08/1.E1
08/1.E2
10/1.E1
10/1.E1
10/1.E2

				Date		CNP Freire MBari		Main VFD Cabinet Pentagon Pentagon Control Cabinet Control Room Panels 24VDC	400092375	=WCS01 +UH03
				User						
	AS BUILT	19.08.2022	SS	Approved					10070-01 CC	Rev. I
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MACGREGOR

/44.A8 24VDC
/44.A8 0V

+UH01-TA13:12 24VDC /46.A1
0V /46.A1

-KF13
PMS IGBT
System Active
/31.E2
Out 1
13 14

-KF16
PMS IGBT
Actual Power
/32.B3
Output 1
Out 1 0V

-KF17
PMS IGBT
Power Available
/32.B4
I1
Input +24V

-KF17
PMS IGBT
Regeneration Limit
/32.B4
I2
Input +24V

-KF13
System Alarms
Critical Alarm
/31.E2
Out 2
23 24

-KF13
System Alarms
None Critical Alarm
/31.E2
Out 3
33 34

-KF26 Signal Converter
In I | GND 1 | +24V | GND 3
Outputs
Inputs
Out I | GND | +24V | GND 3

-KF27 Signal Converter
Out I | GND 2 | +24V | GND 3
Inputs
Outputs
In I | GND 1 | +24V | GND 3

-KF28 Signal Converter
Out I | GND 2 | +24V | GND 3
Inputs
Outputs
In I | GND 1 | +24V | GND 3

-X82 1 2 3 4 5 6 7 8
EMC

-WGS1
WH System Active =SHIP+Signal-X1:1 → 00/2.E1
BN System Active =SHIP+Signal-X1:2 → 00/2.E1
GN Actual Pow=SHIP+Signal-X1:3 → 00/2.E1
YE 0V =SHIP+Signal-X1:4 → 00/2.E1
GY Power Avai=SHIP+Signal-X1:5 → 00/2.E2
PK +24V =SHIP+Signal-X1:6 → 00/2.E2
BU Regen Lim=SHIP+Signal-X1:7 → 00/2.E2
RD +24V =SHIP+Signal-X1:8 → 00/2.E2

-X81 1 2 3 4
EMC

-WGS3
WH Alarm Critical =SHIP+Signal-X2:1 → 00/2.E4
BN Alarm Criti=SHIP+Signal-X2:2 → 00/2.E4
GN Alarm =SHIP+Signal-X2:3 → 00/2.E4
YE Alarm =SHIP+Signal-X2:4 → 00/2.E4

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon PMS & System Alarms	400092375	=WCS01
				User	GSK					+UH03
	AS BUILT	19.08.2022	SS	Approved	RAJ					Rev.
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/45.A8 24VDC
/45.A8 0V

+UH01-TA13:12 24VDC /47.A1
+UH01-K20:A2 0V /47.A1

-KF19	-KF19	-KF12
ROV CTRL Room Panel	ROV CTRL Room Panel	ROV CTRL Room Panel
Emergency Stop	Emergency Stop	Emergency Stop Light
/32.C4	/32.C4	/31.E1
I1	I2	Out 4
+ -	+ -	
1 2	9 10	6

-KF19	-KF19	-KF12
AFT CTRL Room Panel	AFT CTRL Room Panel	AFT CTRL Room Panel
Emergency Stop	Emergency Stop	Emergency Stop Light
/32.D4	/32.D4	/31.E1
I3	I4	Out 5
+ -	+ -	
3 4	11 12	3

-KF19	-KF19	-KF12
Spare	Spare	Spare
Emergency Stop	Emergency Stop	Emergency Stop Light
/32.D4	/32.D4	/31.E1
I5	I6	Out 6
+ -	+ -	
5 6	13 14	7

-X40: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

EMC

-WG19

WH	BN	GN	YE	GY	PK
EM.Loop 1 =CP01+CP01-X40:1	EM.Loop 1 =CP01+CP01-X40:2	EM.Loop 2 =CP01+CP01-X40:3	EM.Loop 2 =CP01+CP01-X40:4	EM.Light =CP01+CP01-X40:5	0V =CP01+CP01-X40:6
08/3.E6	08/3.E6	08/3.E6	08/3.E7	08/3.E7	08/3.E7

-WG20

WH	BN	GN	YE	GY	PK
EM.Loop 1 =CP03+CP03-X40:1	EM.Loop 1 =CP03+CP03-X40:2	EM.Loop 2 =CP03+CP03-X40:3	EM.Loop 2 =CP03+CP03-X40:4	EM.Light =CP03+CP03-X40:5	0V =CP03+CP03-X40:6
10/3.E6	10/3.E6	10/3.E6	10/3.E7	10/3.E7	10/3.E7

				Date	17/11-2021	CNP Freire MBari	MACGREGOR
				User	GSK		
	AS BUILT	19.08.2022	SS	Approved	RAJ		
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Main VFD Cabinet Pentagon
Pentagon Control Cabinet
External Emergency Stop

400092375

=WCS01
+UH03

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Motor Heating Outh Hauler

/46.A8 24VDC
/46.A8 0V
/27.A8 HT230:L1
/27.A8 HT230:L2

-TA13.KF2

Out Hauler Motor	Out Hauler Motor
/47.E5	/47.E5
Enc. Power	HTL Encoder
VCC / 0V	A+ / A- / B+ / B- / Z+ / Z- / Shield

X81 4 5 — X82 1 2 3 4 5 6 7

-TA13.KF2

Out Hauler Motor
/47.E5
PTC/KTY-84

X81 5 6

-K20

11 — 12 14
21 — 22 24

-TA13

Out Hauler Motor
Brake Lift
/47.B6
XRO1
COM / NC / NO

XRO1 12 11 13

-K20 A1 A2

ACS880-01-02A1-5 0,75kW-2,1A -TA13

XDI	Ref
DigIn 1	
DigIn 2	
DigIn 3	
DigIn 4	
DigIn 5	
DigIn 6	

XD24	Ref
DIIL	
+24VD	
DICOM	/12.B2
+24VD	
DIOGND	

XDIO	Ref
DIO 1	
DIO 2	

XRO 1-3	Ref
XRO1	/47.B4
XRO2	
XRO3	

XAI	Ref
+VREF	
-VREF	
AGND	
AI 1	
AI 2	

XPOW	Ref
24V DC	/12.E3

XSTO	Ref
Safe Torque Off	/13.B4

XAO	Ref
AO 1	
AO 2	

XD2D	Ref
Drive To Drive Link	

Function	Jumper	Setting
A In 1	J1	V
A In 2	J2	V
D2D	J3	On
DI Com - DIOGND	J6	Split / Open

Control Panel BUS — Control Panel/ PC Connection — Control Panel BUS

X12

-TA13.PH1 DPMP-02

-TA13.KF1 FECA-01

Adress: X1 X2

/11.D8 EtherCAT -TA3.KF1:X2
-WF4 Patch Cord 1.5M Cat.6 SFTP
+UH02-TA4.KF1:X1 EtherCAT /21.D1
-WF21 Patch Cord 1.5M Cat.6 SFTP

-X300

5 Glass Fuse 5x20mm 1A 6 — PE — EMC

-X70

5 6

-WG26

RD BU PK GY GN YE WH BN

1 +24V — 2 0V — 3 A+ — 4 A- — 5 B+ — 6 B- — 7 Z+ — 8 Z- — 9 SHIELD

BN WH GN YE GY PK BU RD SHIELD

=OHC M ~ -MA1
Encoder Kuebler 5020
Out Hauler Motor

-WG27

WH BN

=OHC PTC1 PTC2 -MA1
Out Hauler Motor
PTC

-WD33

1 2 GNYE

=OHC H1 H2 -MA1
Heater
Out Hauler Motor

FEN-31 -TA13.KF2

X81	Ref
Power Latch	/12.B5
Enc. Power	/47.B1
PTC/KTY-84	/47.B2

X22	Ref
TTL Encoder	

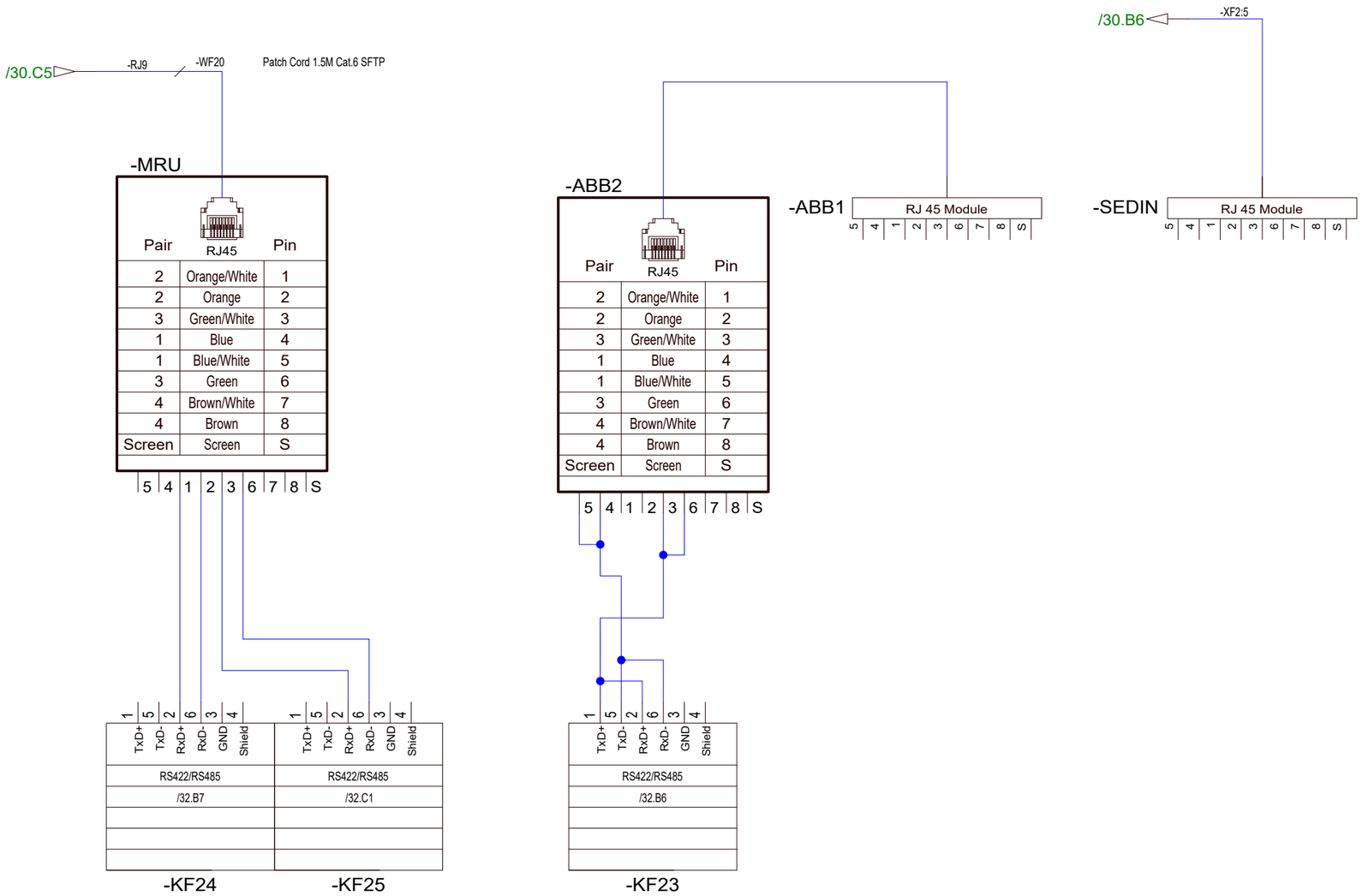
X82	Ref
HTL Encoder	/47.B1

X84	Ref
Power	
Dig In 1	
Dig In 2	

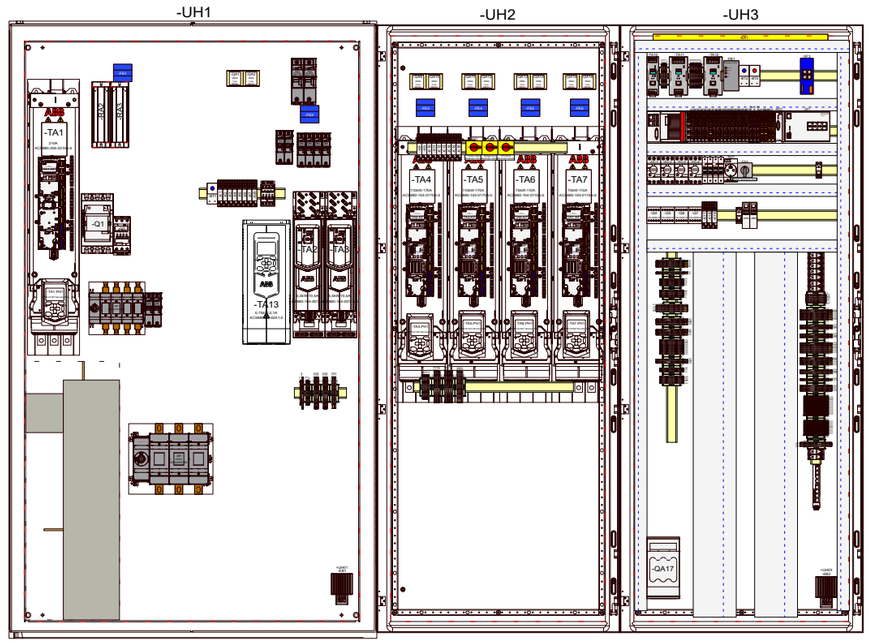
DIP Sw.	Pos
DIP 1	0
DIP 2	0
DIP 3	0
DIP 4	0

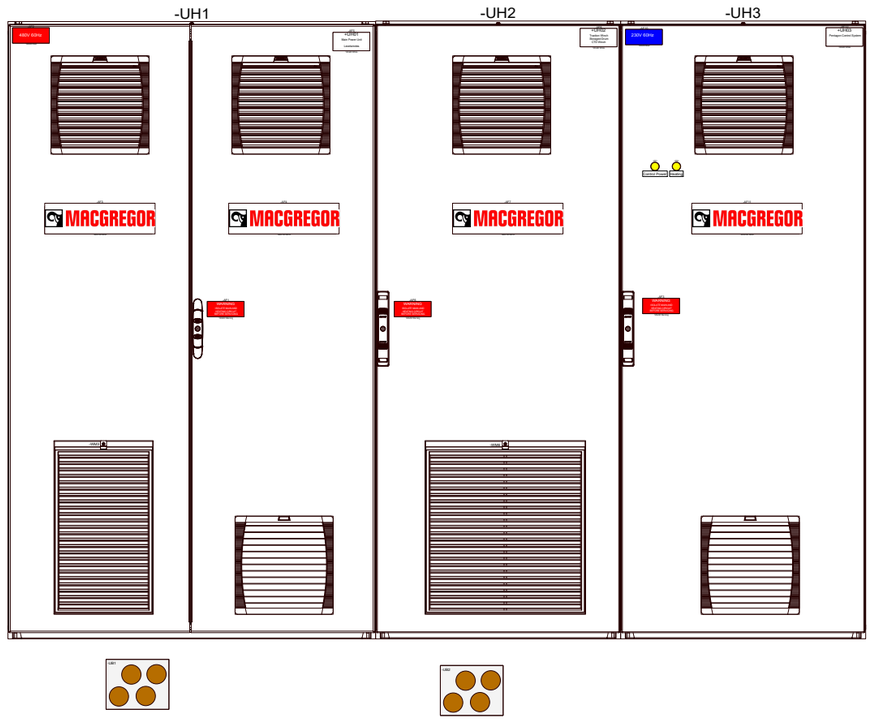
Internal Pull-Up Resistor
DIP Switches
Located under plastic cover
Default position 0

				Date		CNP Freire	MACGREGOR	Main VFD Cabinet Pentagon	400092375	=WCS01	
				User		MBari		Outhauler Motor		+UH01	
				Approved				Encoder, PTC, Heat, References			
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-01 CC	Rev. I	Sheet 47 / Next 48



				Date	0910424	CNP Freire	MACGREGOR	Main VFD Cabinet Pentagon	400092375	=WCS01	
				User	TR	MBari		Pentagon Control Cabinet		+UH03	
				Approved				MRU & ABB IMACS Signals			
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-01 CC Rev. I	Sheet 48 / Next 1





				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Panel Layout	400092375	=WCS01	
	Added WP03 connections	21.11.2022	ANP	User	GSK						
	AS BUILT	19.08.2022	SS	Approved	RAJ				10070-01 GA	Rev. I	Sheet 1
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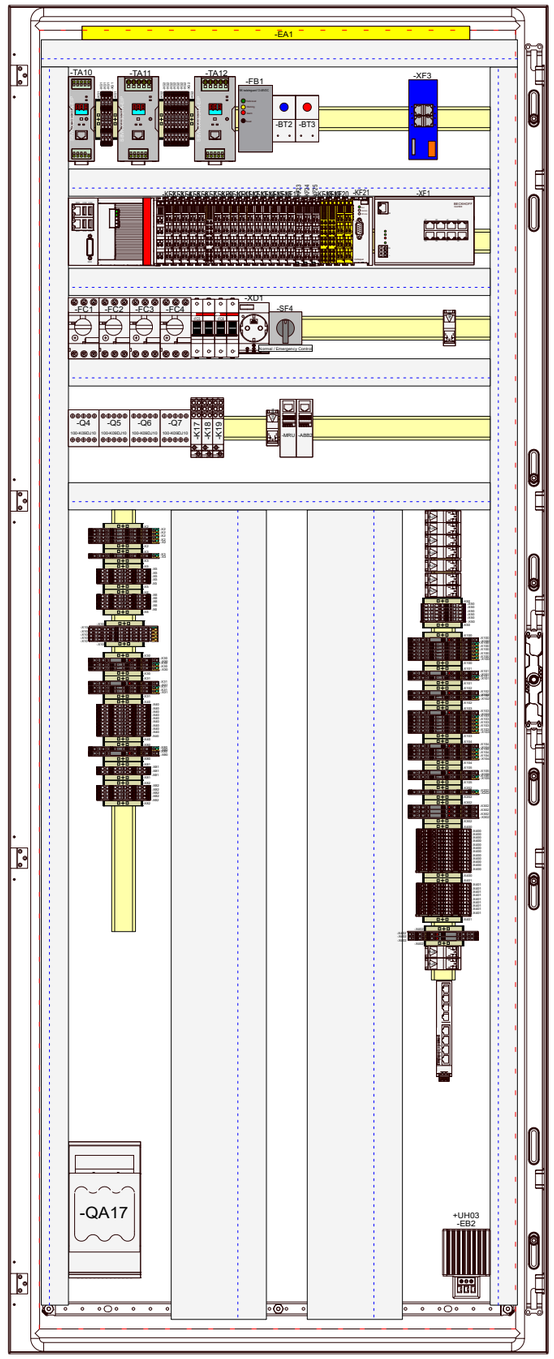
-UH3



				Date	17/11-2021	CNP Freire MBari		Main VFD Cabinet Pentagon Panel Layout	400092375	=WCS01	
	Added WP03 connections	21.11.2022	ANP	User	GSK						
	AS BUILT	19.08.2022	SS	Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-01 GA	Rev. I	Sheet 2 / Next 1

Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-AF1,-AF3,-AF6	120x50 Warning	EACVA074	3	Pcs	120x50 Red Engraved Sign plate Warning		
-AF2	120x50 Red	EACVA075	1	Pcs	120x50 Red Engraved Sign plate		
-AF3..-AF4,-AF7,-AF11	360x100 MCG	RMCLOGO1	4	Pcs	360x100Macgregor Logo		
-AF5,-AF8,-AF12	120x60 White	EACVA076	3	Pcs	120x60 White Engraved Sign plate		
-AF10	120x50 Blue	EACVA082	1	Pcs	120x50 Blue Engraved Sign plate		
-BT1,-BT2	Thermostat Blue/Fan	EACHE010-2	2	Pcs	Thermostat Blue/Fan ETR 201	Eldon	ETR Thermostat.pdf
-BT3	Thermostat Red/Heating	EACHE010-1	1	Pcs	Thermostat Red/Heating ETR 202	Eldon	ETR Thermostat.pdf
-EA1	Cabinet Fluorecent Light w/Switch	EACBU0050	1	Pcs	Cabinet Cooling Fan Filter	Cenika	Cenika Cabinet Lamp. pdf
-EB1,-EB2	EHG045	EACHE0111	2	Pcs	Heater 45W	Eldon	HEG Heater.pdf
-EC1,-EC2	Eldon EF700R5 Fan	EFTRN000-009	2	Pcs	Cabinet Cooling Fan	Eldon	EF500R5.pdf
-F3.1,-F3.2	C14G16	400202703	2	Pcs	Cylindrical fuse links 690 14x51mm 16A	Bussmann	A700000006914194.pdf
-F3.1,-F3.2,-QA5..-QA8	US141	EACFU280	6	Pcs	Ultrasafe Fuse Holder 14x51mm Fuses	Ferraz Shawmut	DS-Semiconductor-Modular-Fuse-Holders-UltraSafe-US14-EN.pdf
-FB1	NK isolateguard 12-48VDC	EACAL025	1	Pcs	Isolation Guard	Omron	Brosjyre Jordfeilmonitor 490500.pdf
-FC1,-FC2	MS 132-10	ESTPA2506	2	Pcs	Manual Motor Starter 6.3-10A	ABB	ABB MS-MO Series. pdf
-FC3,-FC4	MS 132-4	ESTPA2504	2	Pcs	Manual Motor Starter 2.5-4.0A	ABB	ABB MS-MO Series. pdf
-FC5,-FC6	ABB S202-C 16A	400091945	2	Pcs	Circuit Braker 16A 2P	ABB	ABB S-Series.pdf
-FE1..-FE6	TDK Toroids	EFTRN000-0035	6	Pcs	TDK Motor Cable Chokes Di39,2mm H56,4mm	TDK	TDK Ferrit Ring.pdf
-K1..-K19	G2R-2-SNI-24VDC	EACRE039	19	Pcs	Relay	Omron	G2R-Relays.pdf
-K1..-K19	P2RF-08-PU	EACRE041	19	Pcs	Relay base	Omron	G2R-Relays.pdf
-KF1	CX2900-0038	400092258	1	Pcs	40 GB CFast card, 3D flash, extended temperature range	Beckhoff	
-KF1	CX5230-0175	ECPPEB17	1	Pcs	Basic CPU module CX5230, 2 Cores, Microsoft Windows 10 IoT Enterprise 2019 LTSC, 64 bit, TwinCAT 3 runtime (XAR), no licenses included	Beckhoff	Datasheet

				Date		CNP Freire MBari	MACGREGOR	Main VFD Cabinet Pentagon Part list	400092375	=WCS01
				User						
	AS BUILT	19.08.2022	SS	Approved					10070-01 PL	Rev. I
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Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-KF2	EL6070	400092430	1	Pcs	License key terminal	Beckhoff	Documentation
-KF2	TC1200-0240	400180043	1	Pcs	TwinCAT 3 TC3 PLC, platform 40 (Performance)	Beckhoff	
-KF2	TF6020-0240	400186110	1	Pcs	TwinCAT 3 JSON Data Interface	Beckhoff	Datasheet
-KF2	TF6220-0240	400186111	1	Pcs	TwinCAT 3 EtherCAT Redundancy 250	Beckhoff	Datasheet
-KF3..-KF6	EL1008	ECPPEB04	4	Pcs	8 Digital Inputs	Beckhoff	Datasheet
-KF7	EL3255	ECPPEB16	1	Pcs	5-Ch Input Potentiometer	Beckhoff	Datasheet
-KF8,-KF9	EL3058	ECPPEB14	2	Pcs	8 Analog Inputs 4-20mA	Beckhoff	Datasheet
-KF10..-KF12	EL2008	ECPPEB06	3	Pcs	8 Digital Outputs	Beckhoff	Datasheet
-KF13	EL2624	ECPPEB07	1	Pcs	4 Relay Outputs	Beckhoff	Datasheet
-KF14	EL9410	ECPPEB18	1	Pcs	Power Supply Terminal fro E-bus	Beckhoff	Datasheet
-KF15	EL2535-0002	ECPPEB08	1	Pcs	2 PWM Outputs, 2 Digtal Inputs	Beckhoff	Datasheet
-KF16	EL4024	400090871	1	Pcs	4-channel analog output terminal 4…20 mA, 12 bit	Beckhoff	Datasheet
-KF17	EL3054	ECPPEB13	1	Pcs	4 Analog Inputs 4-20mA	Beckhoff	Datasheet
-KF18,-KF19	EL1918	ECPPEB09	2	Pcs	TwinSAFE 8 Digital Inputs	Beckhoff	Datasheet
-KF20	EL2911	ECPPEB10	1	Pcs	TwinSAFE 4 Digital Inputs, 1x Output	Beckhoff	Datasheet
-KF21	EL6751	400090873	1	Pcs	CANopen master/slave terminal	Beckhoff	Datasheet
-KF22	EL9011	ECPPEB02	1	Pcs	Bus end cap	Beckhoff	
-PF1,-PF2	800F-ALP	400188392	6	Pcs	Plastic Mounting Latch, Contact Block Holder	Allen Bradley	800f-sg001_-en-p. pdf"
-PF1,-PF2	800F-N7W	EACBU0094	2	Pcs	Led Module White 240V AC	Allen Bradley	800f-sg001_-en-p.pdf
-PF1,-PF2	800FP-P5	EACSW0253	2	Pcs	Lamphead Yellow Ø22.5	Allen Bradley	800f-sg001_-en-p.pdf
-PF1,-PF2	AB Indicator Lamp Yellow 240V AC	EACSW25	2	Pcs	Signal Lamp Yellow 240V AC	Allen Bradley	800f-sg001_-en-p.pdf
-Q1	ABB AF205-30-11-33	ESTPA316	1	Pcs	Contactor 205A/350A AC3/AC1 230V Electronic PLC Coil	ABB	ABB\ABB AF Contactors. pdfDatasheet
-Q3	ABB AF09-30-10-13	400090760	1	Pcs	Contactor 9A/25A AC3/AC1 100-250VAC Coil	ABB	ABB AF Contactors. pdf
-Q4..-Q7	100-K09DJ10	ESTPA1123	4	Pcs	Mini Contactor 24V, 9A AC3, 20A AC1	Allen Bradley	100-K Mini Contactor.pdf
-QA1,-QA2	Fuse SBFEC 450A 690V	400201775	2	Pcs	Square Body Flush End Size 1, 450A	Bussmann	BUS_Ele_SB_Flush_End _Contact.pdf

				Date	
				User	
	AS BUILT	19.08.2022	SS	Approved	
Status	Change	Date	Name	Standard	

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Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-QA3,-QA4	FR27UQ69V50T	EACFU291	2	Pcs	Ferrule FR247UQ 690V 27x60mm	Ferraz Shawmut	DS-Semiconductor-Protection-Cylindrical-Fuses-Protistor-Size-27x60-aR-URGD-600VAC-to-690VAC-EN.pdf
-QA3,-QA4	US27 1MI	EACFU290	2	Pcs	Ultrasafe Fuse Holder 27x60mm Fuses	Ferraz Shawmut	DS-Fuse-Holders-Modulostar-CMS27-Ultrasafe-US27-EN.pdf
-QA5..-QA8	FWP-10A14F	EACFU281	4	Pcs	Ferrule FWP 690/700V 14x51mm	Ferraz Shawmut	FWP Fuses.pdf
-QA9..-QA12	Fuse SBFEC 400A 690V	EACFU273	4	Pcs	Square Body Flush End Size 1, 400A	Bussmann	BUS_Ele_SB_Flush_End_Contact.pdf
-QA13..-QA16	Fuse SBFEC 250A 690V	EACFU270	4	Pcs	Square Body Flush End Size 1, 250A	Bussmann	BUS_Ele_SB_Flush_End_Contact.pdf
-QA17	Fuse NH00 35A 500V GL/GG	EACFU030	3	Pcs	Fuse NH00 35A 500V GL/GG	Siba	NH00 6-160A.pdf
-QA17	NH FUSE SWITCH-DISCON. SIZE 00 160 A	ESTPA261	1	Pcs	NH00 Fuse base 160A	Wöhner	woehner-33198000.pdf
-QB1	170M5808D	400182561	3	Pcs	HSDI Square Body DIN 43620, 400A 690V Size 2	Bussmann	Datasheet
-QB1	OS400D03K	400182421	1	Pcs	Fuse Switch	ABB	Datasheet
-QB1	OSS400G1L/3	400182423	2	Pcs	Terminal Shroud Cover 101,4mm (3pcs)	ABB	Catalogue
-RA1	ACS880 Charge Kit 13 R8i RRU	EFTRN7171	1	Pcs	Charge Kit DC	ABB	Datasheet
-RJ1..-RJ9	IE-XM-RJ45/IDC	400090935	9	Pcs	Mounting rail outlet, RJ45, RJ45 module, IP20, Cat.6A	Weidmuller	Datasheet
-SF1..-SF3	KG10A T203/58 VE21	400090765	3	Pcs	3 Pole 20A Main, Safety, Maintenance Switch	Kraus & Naimer	Datasheet
-SF4	K&N CG8-A220-VE21V (No-EM)	EACSW0193-01	1	Pcs	Rotary Switch 1P Double-throw Base Mounted (Normal-Emergency)	Kraus & Naimer	CG8_E.pdf

Status	Change	Date	Name		
	Added WP03 connections	21.11.2022	ANP	User	
	AS BUILT	19.08.2022	SS	Approved	
				Date	

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Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-TA1	ACS880-204-0210A-5	400182355	1	Pcs	IGBT Supply Unit 210A 500V	ABB	HW Manual
-TA1.KF1,-TA2.KF1,-TA3.KF1,-TA4.KF1,-TA5.KF1,-TA6.KF1,-TA7.KF1	FECA-01	EFTRN7017	7	Pcs	EtherCAT Adaptor	ABB	Datasheet
-TA1.PH1,-TA2.PH1,-TA3.PH1,-TA4.PH1,-TA5.PH1,-TA6.PH1,-TA7.PH1	ACS-AP-W	EFTRN7001-1	7	Pcs	Control Panel Bluetooth	ABB	Datasheet
-TA1.PH1,-TA4.PH1,-TA5.PH1,-TA6.PH1,-TA7.PH1	DPMP-02 R6/7 Mounting Plate	RHEFTRNABP-01	5	Pcs	Control Panel Mounting Kit, Bracket for R6/7 Modules	ABB	DPMP-02.pdf
-TA2.KF2,-TA3.KF2,-TA4.KF2,-TA5.KF2,-TA6.KF2,-TA7.KF2	FEN-31	EFTRN7002	6	Pcs	Encoder Card	ABB	FEN_31_UM_B_HTL_Encoder_Manual.pdf
-TA2,-TA3	ACS880-104-0011A-5	EFTRN7104	2	Pcs	VFD 5,5kW /10,5A 500V	ABB	Control Card
-TA4,-TA5	ACS880-104-0170A-5	EFTRN7116	2	Pcs	VFD 110kW /170A 500V	ABB	Control Card
-TA6,-TA7	ACS880-104-0110A-5	EFTRN7114	2	Pcs	VFD 75kW /110A 500V	ABB	Control Card
-TA10	S8VK-X24024A-EIP	EACTR035-10	1	Pcs	230/24V 10A Power Supply W/Display	Omron	S8VK-X.pdf
-TA11,-TA12	S8VK-X48024A-EIP	EACTR036-10	2	Pcs	230/24V 20A Power Supply W/Display	Omron	S8VK-X.pdf
-TA12 XPOW (+,+,+,+,+),-XG1 (+,+,+),-XG2 (+,+,+,+,+,+,+)	ZDK 2.5 +/-	EACPL02055	15	Pcs	Terminal 2 Levels +/- Marking	Weidmüller	ZDK 2.5.pdf
-U1..-U2,-U4,-U6,-U8,-U10..-U12			5,261	M	MOUNT		
-U1..-U3,-U5,-U7,-U9,-U13..-U15			9,2	M	CABLE DUCT		
-UB1,-UB2	ABB EMC 4x Cable Entry	EACPGE500	2	Pcs	ABB EMC Cable entry for 4 Cables	ABB	3axd50000004817.pdf
-UH1	MCD20126R5	EACBO607	1	Pcs	Floor Cabinet	Eldon	MCD Datasheet.pdf
-UH2,-UH3	MCS20086R5	EACBO550	2	Pcs	Floor Cabinet	Eldon	MCS Datasheet.pdf
-WF1..-WF20	Patch Cord 1.5M Cat.6 SFTP	ECPPE0471-3	20	M	Patch Cord 1.5M Cat.6 SFTP		
-WM1..-WM2,-WM4..-WM5	Eldon EFA500-700R5	EFTRN000-0081	4	Pcs	Cabinet Cooling Fan Filter	Eldon	EFA500-700R5.pdf
-WM3	ABB Door Filter 400MM	EFTRN000-013-00	1	Pcs	Cabinet Cooling Fan Filter	ABB	3AUA0000116873.pdf
-WM6	ABB Door Filter 600MM	EFTRN000-013-01	1	Pcs	Cabinet Cooling Fan Filter	ABB	3AUA0000116874.pdf
-X2..-X3,-X5..-X6,-X10,-X30..-X31,-X40,-X50,-X70..-X71,-X80..-X82,-X100..-X105,-X200..-X202,-X300..-X302,-X400..-X402,-X500..-X501,-XG1..-XG2	AEB 35 SC/1	EACPL0202-2	66	Pcs	AEB 35 SC/1 End Bracket	Weidmüller	Datasheet
-X2..-X3,-X30..-X31,-X80,-X100..-X105,-X200..-X202,-X300..-X302,-X402	ZAP ZDL 2.5	EACPL02149-02	27	Pcs	End Plate For ZDL 2.5 Terminal	Weidmüller	ZAP ZDL2.5.pdf

Status	Change	Date	Name	Standard		Version	Index	Repl. by
	Added WP03 connections	21.11.2022	ANP	User				
	AS BUILT	19.08.2022	SS	Approved				
				Date				

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Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-X2 (1,3,5,7),-X3 (1),-X30 (3, 5),-X31 (3,5),-X80 (3),-X100 (3,5,7,9,11),-X101 (3),-X102 (3),-X103 (3,5,7,9,11),-X104 (3,5,7),-X105 (3),-X202 (1)	ZDL 2.5/L/L/PE	EACPL021411	27	Pcs	Terminal 2 Tier. +PE	Weidmüller	ZDL 2.5 L-L-PE.pdf
-X5..-X6,-X40,-X70..-X71,-X81. .-X82,-XG1..-XG2	ZAP/TW ZDK2.5	400091997	9	Pcs	End Plate For ZDK2.5 Terminal	Weidmüller	Weidmuller\ZAP TW ZDK2.5.pdf
-X5 (L1,L1,L1,L1),-X6 (L1,L1, L1,L1)	ZDK 2.5 L1/L2	EACPL02055	8	Pcs	Terminal 2 Levels L1, L2 Marking	Weidmüller	ZDK 2.5.pdf
-X10 (1,4,7,10),-X500 (1,4),-X501 (1,4,7)	ZMAK 2.5	EACPL021403	9	Pcs	Terminal	Weidmüller	ZMAK 2.5.pdf
-X10,-X500..-X501	ZAP/ZMAK 2.5	EACPL02149-01	3	Pcs	End Plate For ZMAK2.5 Terminal	Weidmüller	ZMAK 2.5.pdf
-X30..-X31,-X80,-X100..-X105,-X201,-X402	Glass Fuse 5x20mm 3.15A	EACFU005	14	Pcs	Glass Fuse 5x20mm 3.15A		GSBGDG.pdf
-X30 (1),-X31 (1),-X80 (1),-X100 (1),-X101 (1),-X102 (1),-X103 (1),-X104 (1),-X105 (1),-X201 (1,3,5),-X402 (1,3)	ZDL 2.5/SI/DU/PE/LD 36V	EACPL0195	14	Pcs	Terminal Fuse 36V	Weidmüller	ZDL 2.5 SI-DU-PE-LD36V.pdf
-X40 (1,3,5,7,9,11,13,15,17),-X70 (1,3),-X71 (1,3,5,7),-X81 (1,3),-X82 (1,3,5,7)	ZDK 2.5/1.5	EACPL02055	21	Pcs	Terminal 2 Levels	Weidmüller	ZDK 2.5.pdf
-X50	ZAP/TW 2	EACPL02148	1	Pcs	End Plate For ZDU/ZPE 2.5/3AN Terminals	Weidmüller	ZAP TW 2 DB.pdf
-X50 (1-5)	ZDU 2.5/3AN	EACPL02140	5	Pcs	Terminal	Weidmüller	ZDU 2.5 3AN.pdf
-X200 (1,3),-X300 (1,3),-X301 (1,3,5,7),-X302 (1,3,5)	ZDL 2.5/SI/DU/PE/LD 230V	EACPL0196	11	Pcs	Terminal Fuse 250V	Weidmüller	ZDL 2.5 SI-DU-PE-LD36V.pdf
-X200,-X300..-X302	Glass Fuse 5x20mm 1A	EACFU0072	11	Pcs	Glass Fuse 5x20mm 1A		GSBGDG.pdf
-X400 (1,3,5,7,9,11,13,15,17, 19,21,23),-X401 (1,3,5,7,9,11, 13,15,17)	ZDT 2.5/2	EACPL021409	21	Pcs	Terminal 2 Levels	Weidmüller	ZDT 2.5 2.pdf
-X400,-X401	ZAP/TW ZDT2.5/2	EACPL02149-05	2	Pcs	End Plate For ZDT 2.5 Terminals	Weidmüller	ZAP TW ZDT2.5 2.pdf
-XD1	7Z-SD/230	EACPL052	1	Pcs	DIN Mountet Shuko Outlet	Cenika	Modular Shucko Outlet.pdf
-XF1	CU2508	ECPPEB21	1	Pcs	Real-time Ethernet Port Multiplier	Beckhoff	Datasheet
-XF2	FL SWITCH 1008N	400199566	1	Pcs	Switch 8port	Phoenix Contact	FL SWITCH 1008N. pdf
-XF3	eWON Cosy 131	ECPPA021	1	Pcs	VPN Access Gateway 4 Port+USB 12-24V DC	eWON	eWON Cosy Manual.pdf

				Date	
	Changed ETH Switch	21.11.2022	ANP	User	
	AS BUILT	19.08.2022	SS	Approved	
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Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
+UH01-WF2	Patch Cord 1.5M Cat.6 SFTP	=WCS01-TA1.KF1	+UH01	=WCS01-TA2.KF1	+UH01		5
+UH01-WF3	Patch Cord 1.5M Cat.6 SFTP	=WCS01-TA2.KF1	+UH01	=WCS01-TA3.KF1	+UH01		5
+UH01-WF4	Patch Cord 1.5M Cat.6 SFTP	=WCS01-TA3.KF1	+UH01	=WCS01-TA13.KF1	+UH01		5
+UH01-WF21	Patch Cord 1.5M Cat.6 SFTP	=WCS01-TA4.KF1	+UH02	=WCS01-TA13.KF1	+UH01		5
+UH02-WF5	Patch Cord 1.5M Cat.6 SFTP	=WCS01-TA5.KF1	+UH02	=WCS01-TA4.KF1	+UH02		5
+UH02-WF6	Patch Cord 1.5M Cat.6 SFTP	=WCS01-TA5.KF1	+UH02	=WCS01-TA6.KF1	+UH02		5
+UH02-WF7	Patch Cord 1.5M Cat.6 SFTP	=WCS01-TA7.KF1	+UH02	=WCS01-TA6.KF1	+UH02		5
+UH02-WF8	Patch Cord 1.5M Cat.6 SFTP	=WCS01-XF1	+UH03	=WCS01-TA7.KF1	+UH02		5
+UH03-WF1	Patch Cord 1.5M Cat.6 SFTP	=WCS01-XF1	+UH03	=WCS01-TA1.KF1	+UH01		5
+UH03-WF9	Patch Cord 1.5M Cat.6 SFTP	=WCS01-KF1	+UH03	=WCS01-XF1	+UH03		5
+UH03-WF10	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ1	+UH03	=WCS01-XF1	+UH03		5
+UH03-WF11	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ2	+UH03	=WCS01-XF1	+UH03		5
+UH03-WF12	Patch Cord 1.5M Cat.6 SFTP	=WCS01-XF2	+UH03	=WCS01-KF1	+UH03		5
+UH03-WF13	Patch Cord 1.5M Cat.6 SFTP	=WCS01-XF3	+UH03	=WCS01-XF2	+UH03		5
+UH03-WF14	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ3	+UH03	=WCS01-XF2	+UH03		5
+UH03-WF15	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ4	+UH03	=WCS01-XF2	+UH03		5
+UH03-WF16	Patch Cord 1.5M Cat.6 SFTP	=WCS01-XF3	+UH03	=WCS01-RJ5	+UH03		5
+UH03-WF17	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ6	+UH03	=WCS01-XF3	+UH03		5
+UH03-WF18	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ7	+UH03	=WCS01-XF3	+UH03		5
+UH03-WF19	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ8	+UH03	=WCS01-XF2	+UH03		5
+UH03-WF20	Patch Cord 1.5M Cat.6 SFTP	=WCS01-RJ9	+UH03	=WCS01-XF2	+UH03		5

Status	Change	Date	Name	Standard	
				Date	17/11-2021
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Main VFD Cabinet Pentagon
Cable list

400209341

=WCS01
+UH01

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
+UH01-WF2	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-TA1.KF1	+UH01	=WCS01-TA2.KF1	+UH01	
+UH01-WF3	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-TA2.KF1	+UH01	=WCS01-TA3.KF1	+UH01	
+UH01-WF4	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-TA3.KF1	+UH01	=WCS01-TA13.KF1	+UH01	
+UH01-WF21	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-TA4.KF1	+UH02	=WCS01-TA13.KF1	+UH01	
+UH02-WF5	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-TA5.KF1	+UH02	=WCS01-TA4.KF1	+UH02	
+UH02-WF6	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-TA5.KF1	+UH02	=WCS01-TA6.KF1	+UH02	
+UH02-WF7	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-TA7.KF1	+UH02	=WCS01-TA6.KF1	+UH02	
+UH02-WF8	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-XF1	+UH03	=WCS01-TA7.KF1	+UH02	
+UH03-WF1	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-XF1	+UH03	=WCS01-TA1.KF1	+UH01	
+UH03-WF9	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-KF1	+UH03	=WCS01-XF1	+UH03	
+UH03-WF10	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ1	+UH03	=WCS01-XF1	+UH03	
+UH03-WF11	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ2	+UH03	=WCS01-XF1	+UH03	
+UH03-WF12	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-XF2	+UH03	=WCS01-KF1	+UH03	
+UH03-WF13	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-XF3	+UH03	=WCS01-XF2	+UH03	
+UH03-WF14	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ3	+UH03	=WCS01-XF2	+UH03	
+UH03-WF15	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ4	+UH03	=WCS01-XF2	+UH03	
+UH03-WF16	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-XF3	+UH03	=WCS01-RJ5	+UH03	
+UH03-WF17	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ6	+UH03	=WCS01-XF3	+UH03	
+UH03-WF18	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ7	+UH03	=WCS01-XF3	+UH03	
+UH03-WF19	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ8	+UH03	=WCS01-XF2	+UH03	
+UH03-WF20	Patch Cord 1.5M Cat.6 SFTP RJ45	=WCS01-RJ9	+UH03	=WCS01-XF2	+UH03	

Status	Change	Date	Name	Standard	
				Date	17/11-2021
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ

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MACGREGOR

Termination list
Termination list

400092375

=WCS01
+UH01

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Yard Connections

Internal Connections

CTD Winch

=WCS01
+UH03

Main VFD Cabinet
Pentagon
Brake HPU
Gear Cooling HPU

-WG1 FD CP (TP) plus 6x2x0.75

-WD1 FD 855 CP 3G0.75

=WCS01
+UH01

Main VFD Cabinet
Power Input
Levelwinds

-WD2 FD 855 CP 4G0.75
-WG2 FD CP (TP) plus 4x2x0.25
-WD3 2YSLCYK-JB 3x2.5+3x0.5
-WD4 FD 855 CP 3G1.5
-WG3 FD CP (TP) plus 1x2x0.75

ENC
PWR
HEAT
PTC

M
3~

JOG Levelwind
-MA2
11,4A
400V/50Hz

=WCS01
+UH02

Main VFD Cabinet
Traction Winch
System
CTD WInch

-WD5 FD 855 CP 4G0.75
-WG4 FD CP (TP) plus 4x2x0.25
-WD6 2YSLCYK-JB 3x35+3x6
-WD7 FD 855 CP 3G1.5
-WG5 FD CP (TP) plus 1x2x0.75

ENC
PWR
HEAT
PTC

M
3~

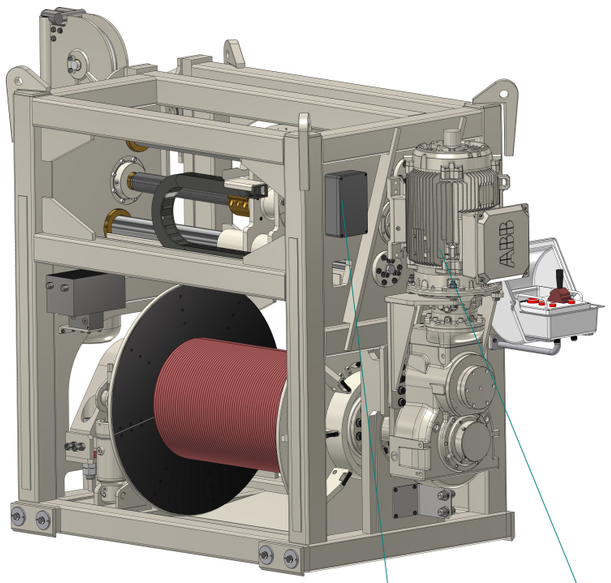
JOG Winch
-MA1
Winch Motor
Max Rating 92A
400V/50Hz

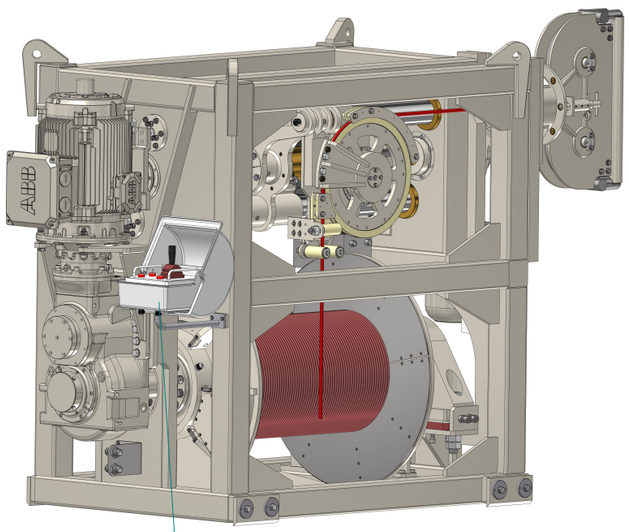
+UC01

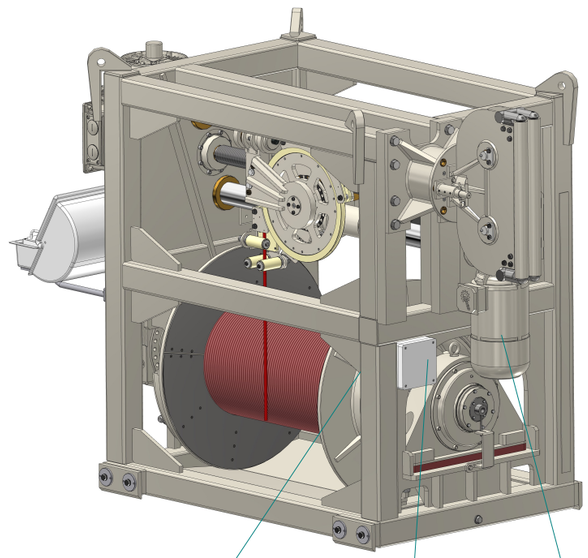
Winch Internal
Connection Box
Emergency Control

-UB1 -WG1 PUR 4x0.34mm2 Shld → -BG1 End Stop 1 /1.B1
-UB2 -WG2 PUR 4x0.34mm2 Shld → -BG2 End Stop 2 /1.B2
-UB3 -WG3 PUR 4x0.34mm2 Shld → -BG3 Angle Sensor analogue /1.B3
-UB4 -WG4 PUR 4x0.34mm2 Shld → -BG4 Block Count 1 /1.B3
-UB5 -WG5 PUR 4x0.34mm2 Shld → -BG5 Block Count 2 /1.B4
-UB6 -WG6 PUR 4x0.34mm2 Shld → Load Cell -BW1 Load Cell /1.B5
-UB7 -WG7 PUR 4x0.34mm2 Shld → Temp -BP1 Temp Sensor
-UB8 -WG8 Valve Cable 3x0.75+PE → -QM1 Solenoide Valve Brake

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	CTD Winch CTD Winch	400182376	=HW01	
				User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Rev. I	Sheet 1 / Next 2







=HW01
+UC01

=HW01
-MA1

=WP01

=HW01
+DRUM

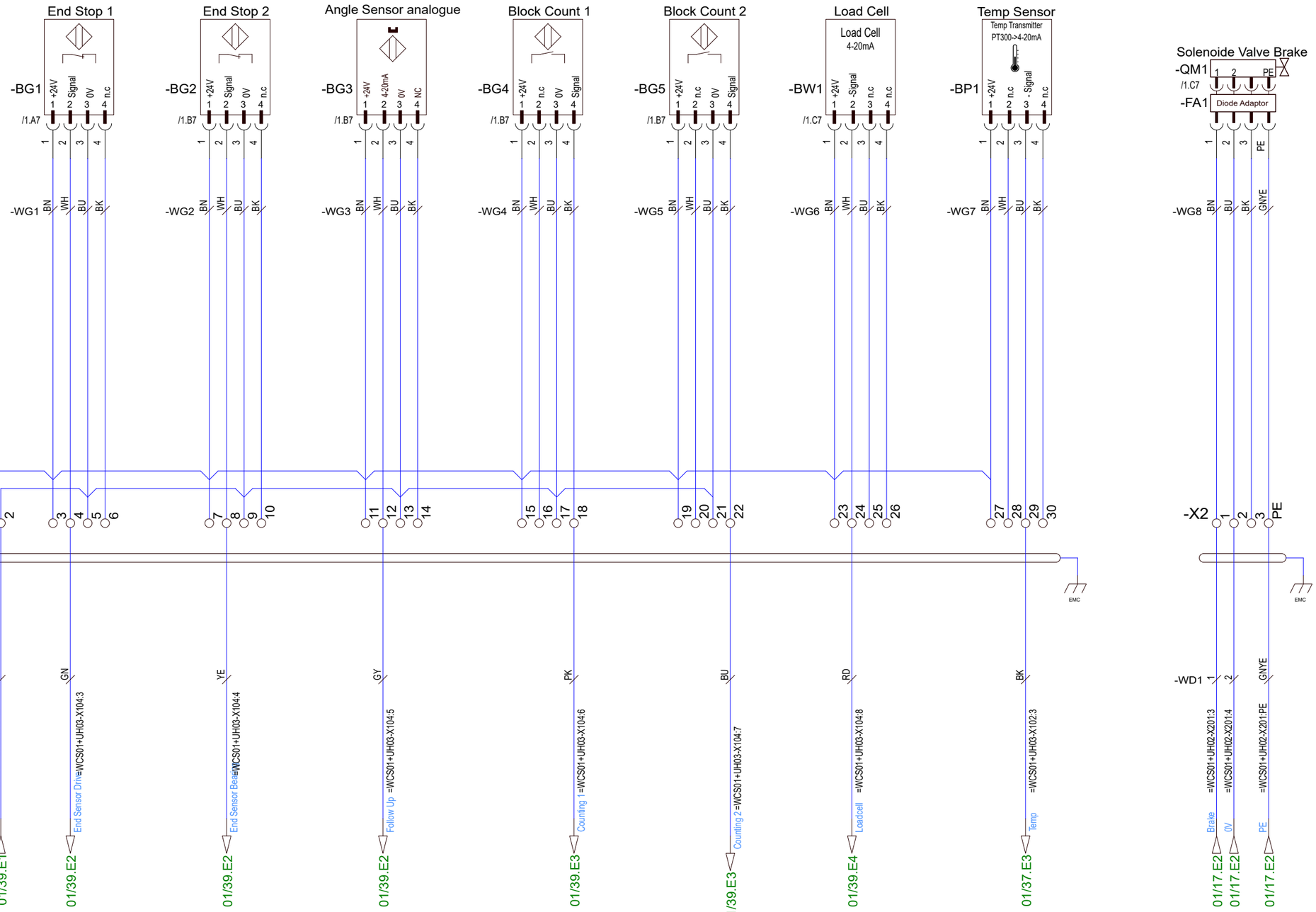
=HW01
+UC02

=HW01
-MA2

General Picture
Winch might be mirrored

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	CTD Winch Connection Point Overview	400182376	=HW01
				User	GSK					
				Approved	RAJ				10070-02 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 2 / Next 1

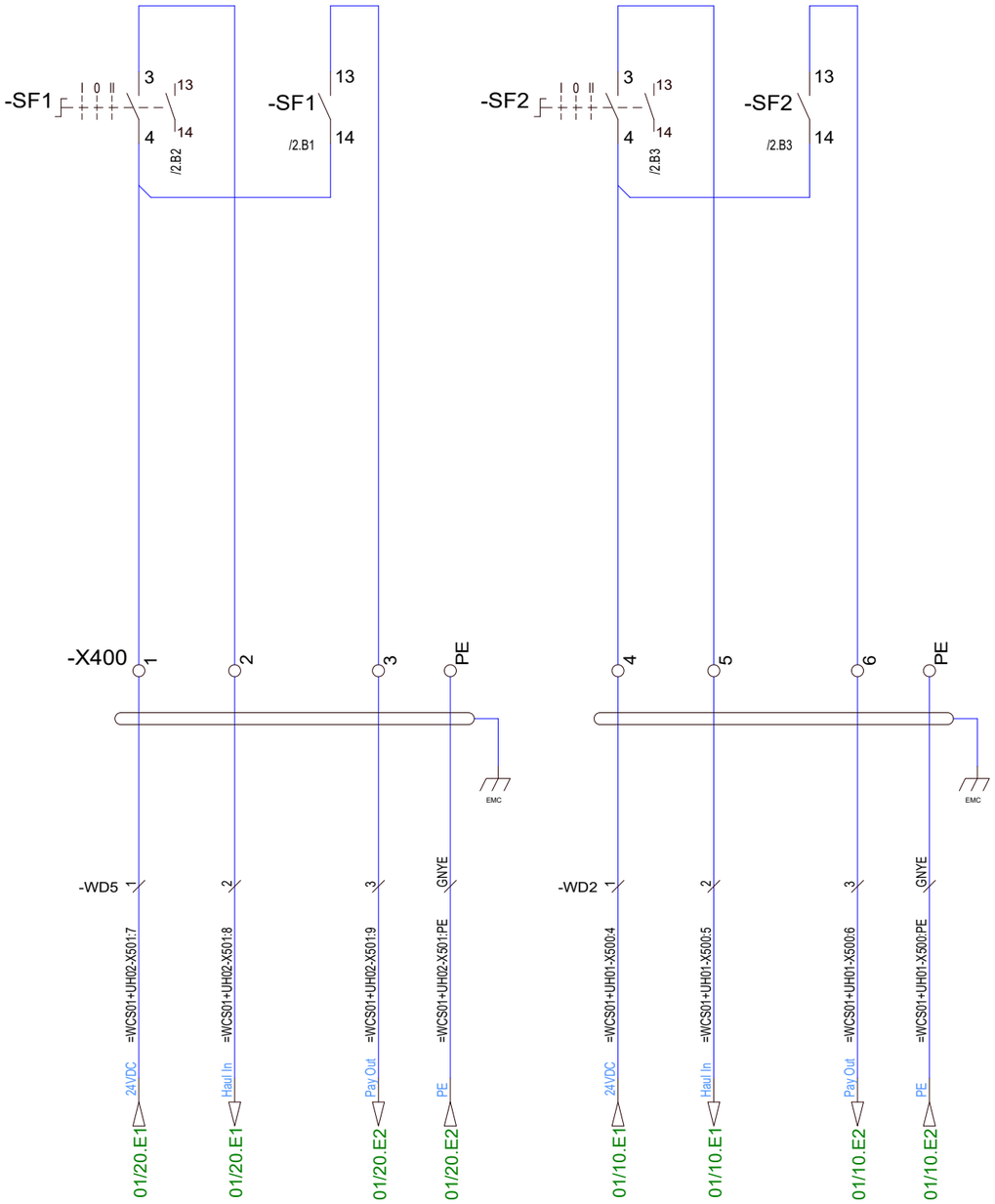
End Stop | Angle Sensor | Block Count | Load Cell | Gear Temp | Brake Solenoid Valve



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	CTD Winch Winch Internal Connection Box	400182376	=HW01 +UC01	
				User	GSK						
				Approved	RAJ				10070-02 CC	Rev. I	Sheet 1 Next 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			

Winch Emergency Control

Levelwind Emergency Control



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	CTD Winch Emergency Control	400182376	=HW01	
				User	GSK					+UC01	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-02 CC Rev. I	Sheet 2 / Next 1

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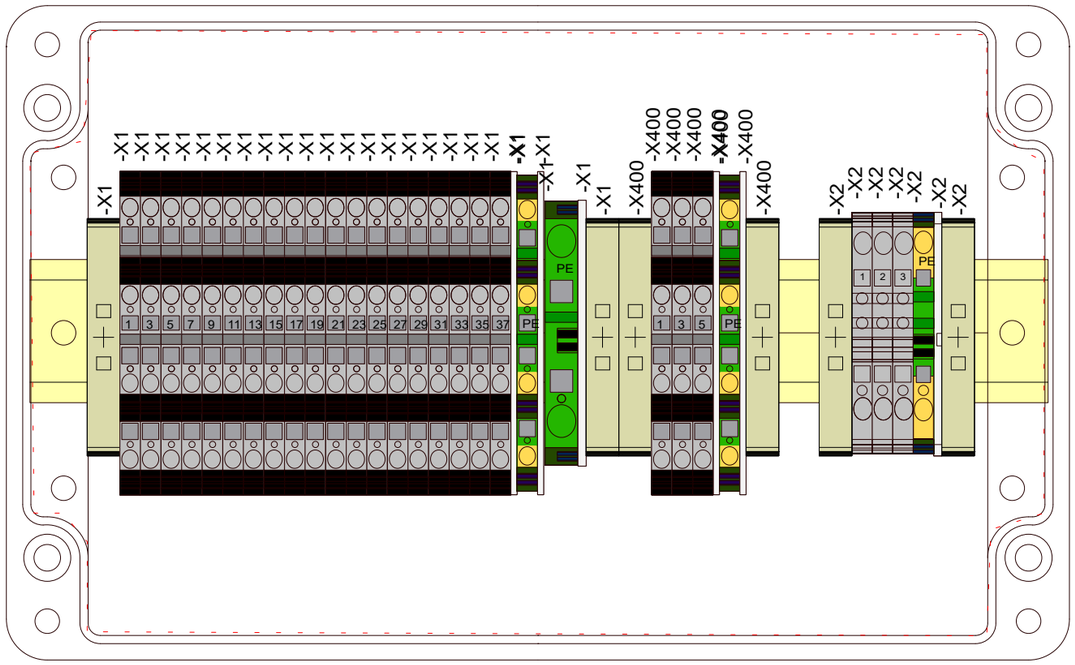
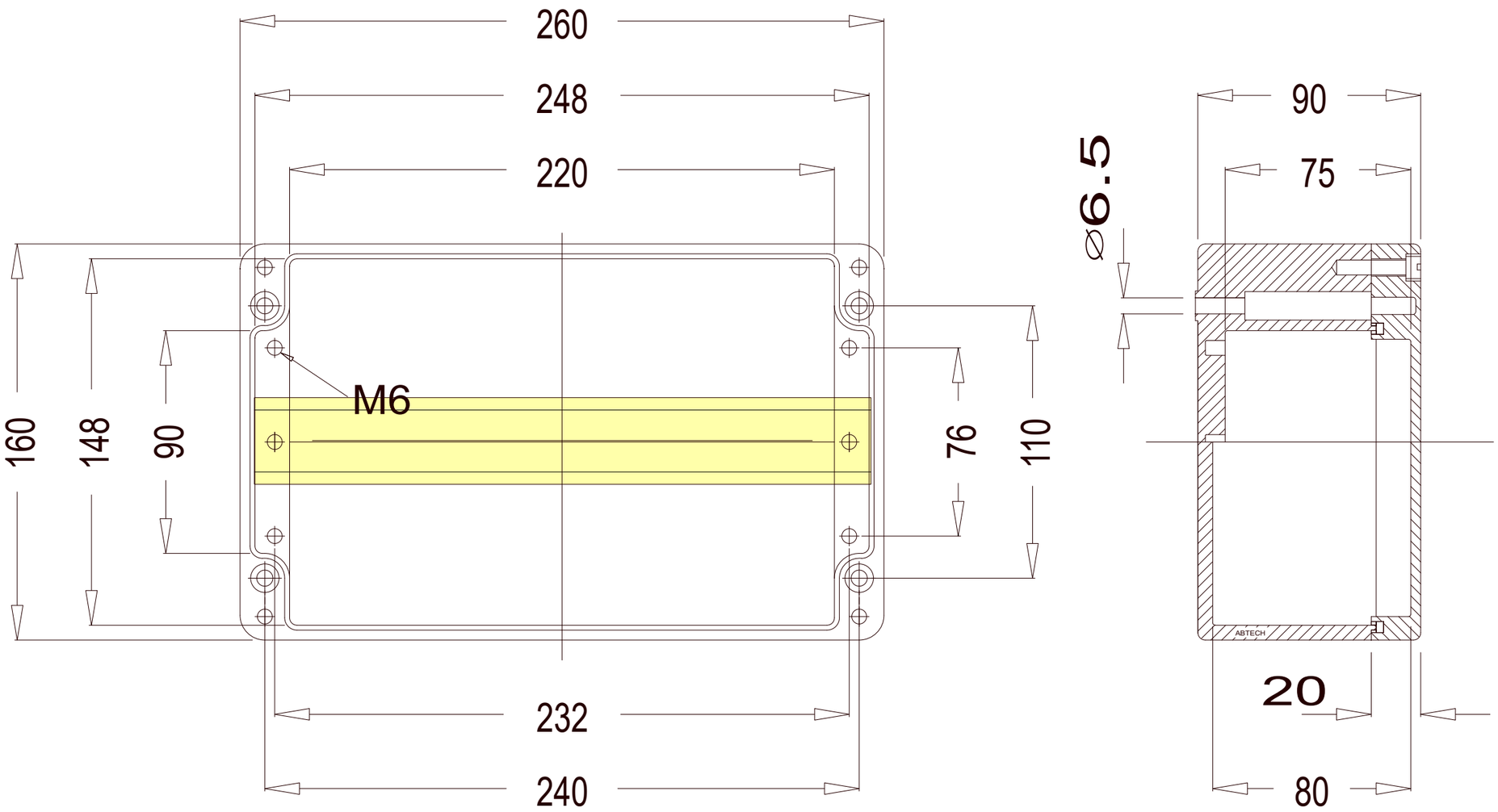

-X1
-X1
-X1



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	CTD Winch Winch Internal Connection Box	400182376	=HW01	
				User	GSK					+UC01	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Rev. I	Sheet 2 / Next 7

Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WG1	PUR 4x0.34mm2 Shld	=HW01	+UC01	=HW01-BG1	+UC01		4,8
-WG2	PUR 4x0.34mm2 Shld	=HW01	+UC01	=HW01-BG2	+UC01		4,8
-WG3	PUR 4x0.34mm2 Shld	=HW01-BG3		=HW01-X1	+UC01		4,8
-WG4	PUR 4x0.34mm2 Shld	=HW01	+UC01	=HW01-BG4	+UC01		4,8
-WG5	PUR 4x0.34mm2 Shld	=HW01	+UC01	=HW01-BG5	+UC01		4,8
-WG6	PUR 4x0.34mm2 Shld	=HW01-BW1		=HW01-X1	+UC01		4,8
-WG7	PUR 4x0.34mm2 Shld	=HW01	+UC01	=HW01-BP1	+UC01		4,8
-WG8	Valve Cable 3x0.75+PE	=HW01	+UC01	=HW01-QM1	+UC01		6,5

				Date	17/11-2021
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

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MBari

Version	Index	Repl. by

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CTD Winch
Cable list

400209341

=HW01

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG1	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=HW01 =HW01-WG1:1 =HW01-WG1:2 =HW01-WG1:3 =HW01-WG1:4	+UC01 02/1.B1 02/1.B1 02/1.B1 02/1.B1	=HW01-BG1 =HW01-X1:3 =HW01-X1:4 =HW01-X1:5 =HW01-X1:6	+UC01 02/1.D1 02/1.D1 02/1.D1 02/1.D1	
-WG2	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=HW01 =HW01-WG2:1 =HW01-WG2:2 =HW01-WG2:3 =HW01-WG2:4	+UC01 02/1.B2 02/1.B2 02/1.B2 02/1.B2	=HW01-BG2 =HW01-X1:7 =HW01-X1:8 =HW01-X1:9 =HW01-X1:10	+UC01 02/1.D2 02/1.D2 02/1.D2 02/1.D2	
-WG3	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=HW01-BG3 =HW01-WG3:1 =HW01-WG3:2 =HW01-WG3:3 =HW01-WG3:4	 02/1.B3 02/1.B3 02/1.B3 02/1.B3	=HW01-X1 =HW01-X1:11 =HW01-X1:12 =HW01-X1:13 =HW01-X1:14	+UC01 02/1.D3 02/1.D3 02/1.D3 02/1.D3	
-WG4	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=HW01 =HW01-WG4:1 =HW01-WG4:2 =HW01-WG4:3 =HW01-WG4:4	+UC01 02/1.B3 02/1.B3 02/1.B3 02/1.B4	=HW01-BG4 =HW01-X1:15 =HW01-X1:16 =HW01-X1:17 =HW01-X1:18	+UC01 02/1.D3 02/1.D3 02/1.D3 02/1.D4	
-WG5	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=HW01 =HW01-WG5:1 =HW01-WG5:2 =HW01-WG5:3 =HW01-WG5:4	+UC01 02/1.B4 02/1.B4 02/1.B4 02/1.B4	=HW01-BG5 =HW01-X1:19 =HW01-X1:20 =HW01-X1:21 =HW01-X1:22	+UC01 02/1.D4 02/1.D4 02/1.D4 02/1.D4	
-WG6	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=HW01-BW1 =HW01-WG6:1 =HW01-WG6:2 =HW01-WG6:3 =HW01-WG6:4	 02/1.B5 02/1.B5 02/1.B5 02/1.B5	=HW01-X1 =HW01-X1:23 =HW01-X1:24 =HW01-X1:25 =HW01-X1:26	+UC01 02/1.D5 02/1.D5 02/1.D5 02/1.D5	
-WG7	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=HW01 =HW01-WG7:1 =HW01-WG7:2 =HW01-WG7:3 =HW01-WG7:4	+UC01 02/1.B5 02/1.B6 02/1.B6 02/1.B6	=HW01-BP1 =HW01-X1:27 =HW01-X1:28 =HW01-X1:29 =HW01-X1:30	+UC01 02/1.D5 02/1.D6 02/1.D6 02/1.D6	
-WG8	Valve Cable BN BU BK GNYE	=HW01 =HW01-WG8:1 =HW01-WG8:2 =HW01-WG8:3 =HW01-WG8:PE	+UC01 02/1.B7 02/1.B7 02/1.B7 02/1.B7	=HW01-QM1 =HW01-X2:1 =HW01-X2:2 =HW01-X2:3 =HW01-X2:PE	+UC01 02/1.D7 02/1.D7 02/1.D7 02/1.D7	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground

			Date	17/11-2021	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

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MACGREGOR

Termination list
Termination list

400182376

=HW01

10070-02 TL

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Yard Connections

Internal Connections

Traction Winch

=WCS01
+UH03

Main VFD Cabinet
Pentagon
Brake HPU
Gear Cooling HPU

-WG6 FD CP (TP) plus 2x2x0.5

+UC01

Winch
Connection Box

-UB1 -WG1 PUR 4x0.34mm2 Shld → -BP1 Temp Sensor MA1

-UB3 -WG2 PUR 4x0.34mm2 Shld → -BP2 Temp Sensor MA2

-UB2 -WG3 Valve Cable 3x0.75+PE → -QM1 Brake Valve

=WCS01
+UH02

Main VFD Cabinet
Traction Winch
System
CTD WInch

-WD8 FD 855 CP 3G0.75

-WG7 FD CP (TP) plus 4x2x0.25 — ENC
-WD9 2YSLCYK-JB 3x70+3x10 — PWR
-WD10 FD 855 CP 3G1.5 — HEAT
-WG8 FD CP (TP) plus 1x2x0.75 — PTC

M 3~ -MA1 Winch Motor

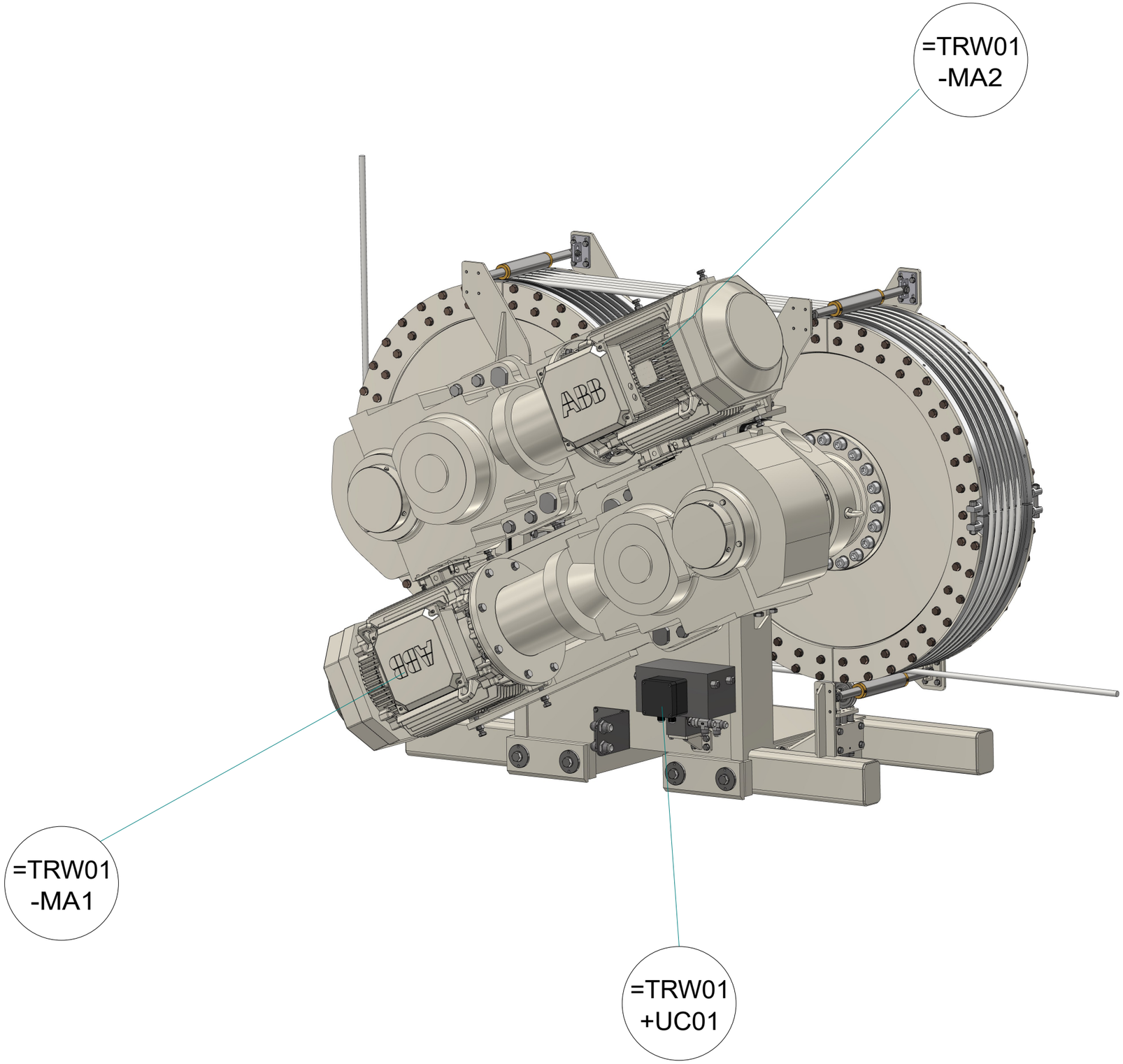
Max Rating 150A
400V/50Hz

-WG9 FD CP (TP) plus 4x2x0.25 — ENC
-WD11 2YSLCYK-JB 3x70+3x10 — PWR
-WD12 FD 855 CP 3G1.5 — HEAT
-WG10 FD CP (TP) plus 1x2x0.75 — PTC

M 3~ -MA2 Winch Motor

Max Rating 150A
400V/50Hz

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Traction Winch ROV Traction Winch	400182377	=TRW01
				User	GSK					
				Approved	RAJ				10070-03 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 2



Iso view of winch (image might deviate from actual product)

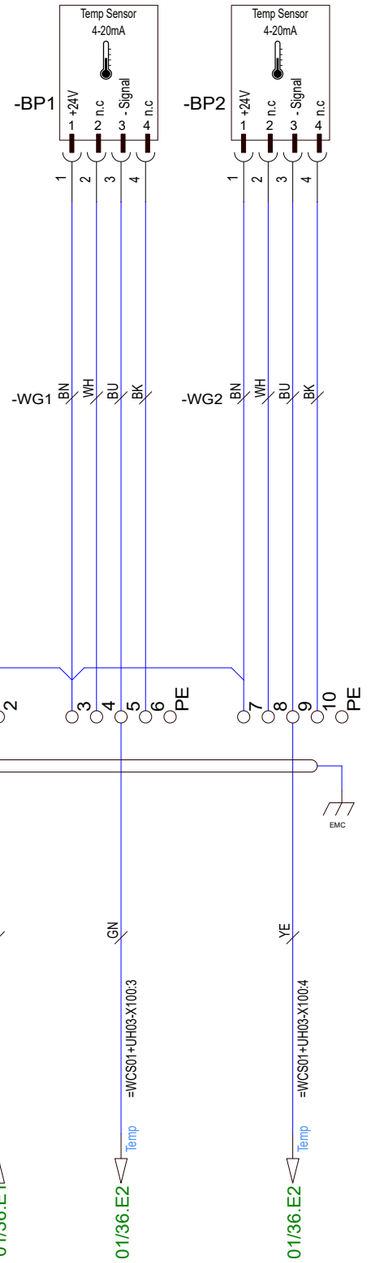
General Picture
Winch might be mirrored

				Date	17/11-2021	CNP Freire MBari		MACGREGOR	ROV Traction Winch Connection Point Overview	400182377	=TRW01
				User	GSK						
				Approved	RAJ					10070-03 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Sheet 2 / Next 1

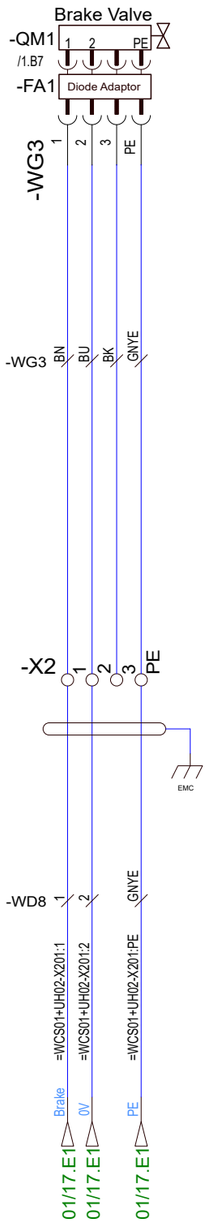
Gear Temp

Temp Sensor MA1

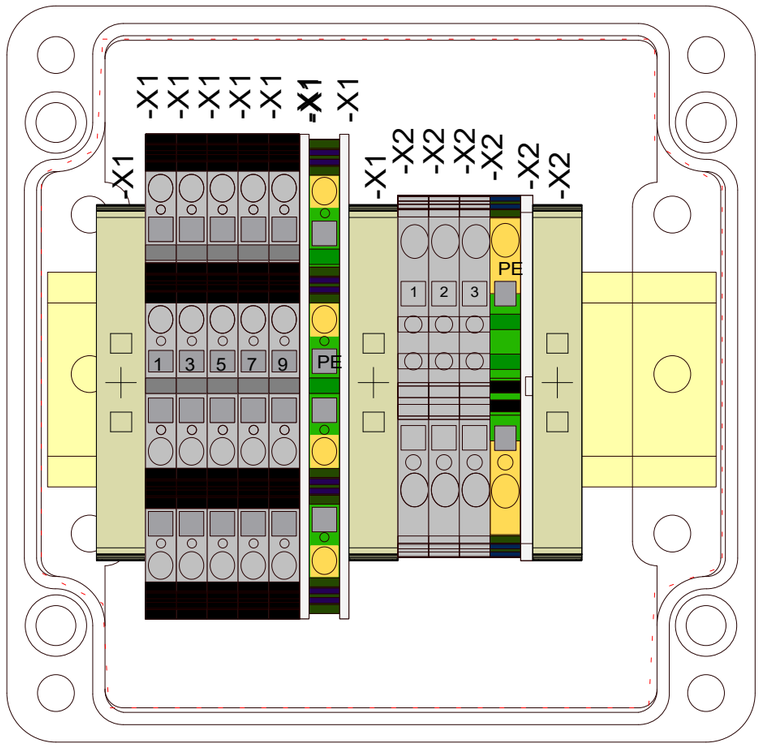
Temp Sensor MA2

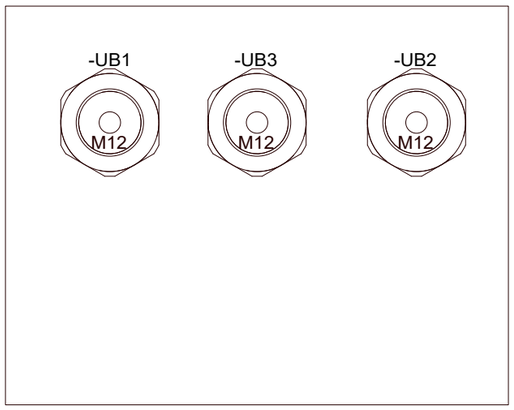


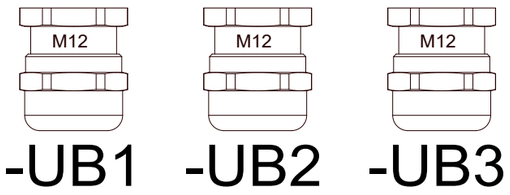
Brake Solenoid Valve



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Traction Winch Winch Connection Box	400182377	=TRW01	
				User	GSK					+UC01	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-03 CC	Rev. I	Sheet 1 / Next 1







				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Traction Winch Winch Connection Box	400182377	=TRW01	
				User	GSK					+UC01	
				Approved	RAJ				10070-03 GA	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 2

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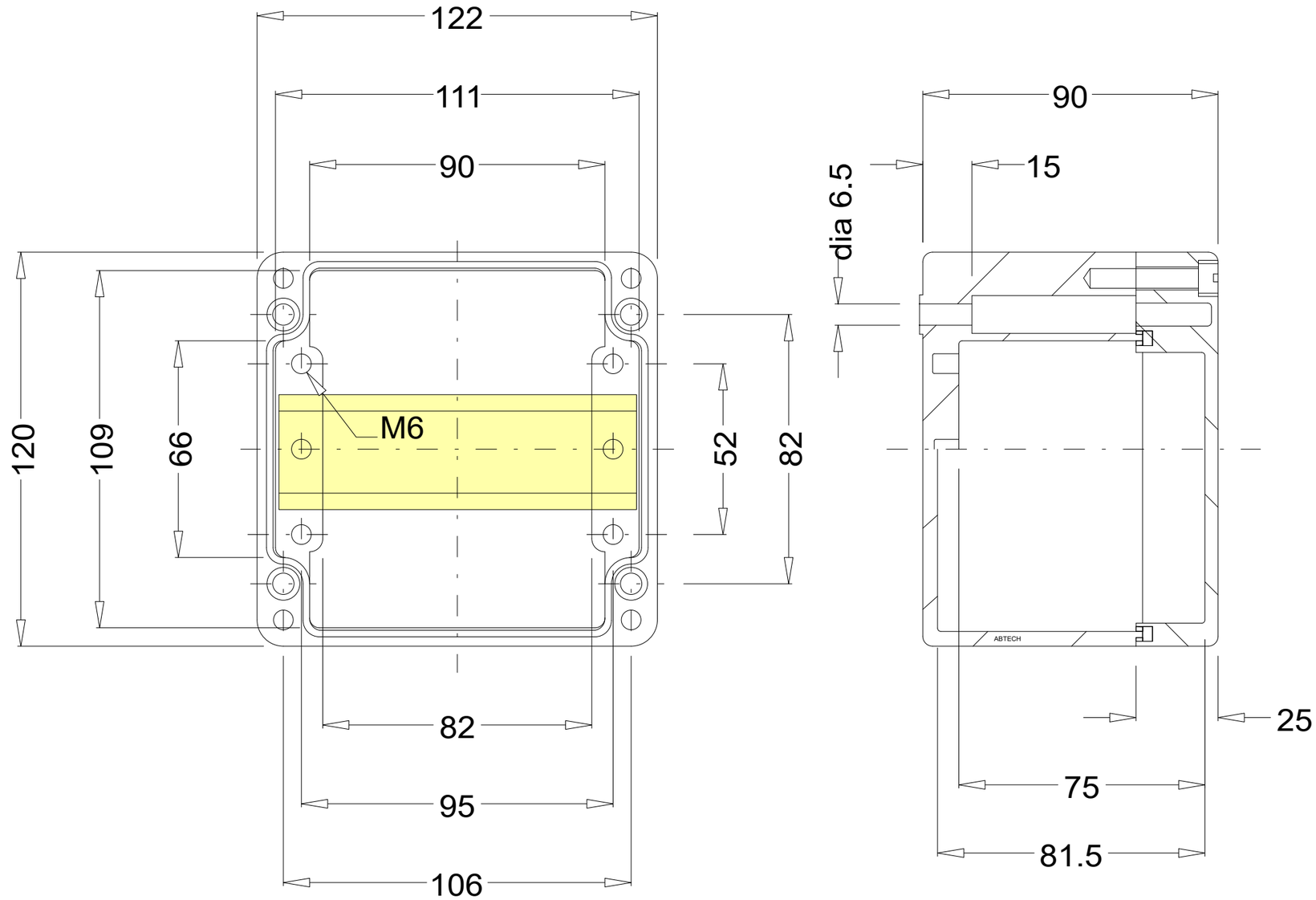


				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Traction Winch Winch Connection Box	400182377	=TRW01	
				User	GSK					+UC01	
				Approved	RAJ				10070-03 GA	Rev. I	Sheet 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 10

Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WG1	PUR 4x0.34mm2 Shld	=TRW01-BP1		=TRW01-X1	+UC01		4,8
-WG2	PUR 4x0.34mm2 Shld	=TRW01	+UC01	=TRW01-BP2	+UC01		4,8
-WG3	Valve Cable 3x0.75+PE	=TRW01	+UC01	=TRW01-QM1	+UC01		6,5

			Date	17/11-2021	
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

ROV Traction Winch
Cable list

400209341

=TRW01

10070-03 CD

Rev. I

Sheet 10
Next 30

Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG1	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=TRW01-BP1 =TRW01-WG1:1 =TRW01-WG1:2 =TRW01-WG1:3 =TRW01-WG1:4	 03/1.B1 03/1.B2 03/1.B2 03/1.B2	=TRW01-X1 =TRW01-X1:3 =TRW01-X1:4 =TRW01-X1:5 =TRW01-X1:6	+UC01 03/1.D1 03/1.D2 03/1.D2 03/1.D2	
-WG2	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=TRW01 =TRW01-WG2:1 =TRW01-WG2:2 =TRW01-WG2:3 =TRW01-WG2:4	+UC01 03/1.B2 03/1.B2 03/1.B2 03/1.B2	=TRW01-BP2 =TRW01-X1:7 =TRW01-X1:8 =TRW01-X1:9 =TRW01-X1:10	+UC01 03/1.D2 03/1.D2 03/1.D2 03/1.D2	
-WG3	Valve Cable BN BU BK GNYE	=TRW01 =TRW01-WG3:1 =TRW01-WG3:2 =TRW01-WG3:3 =TRW01-WG3:PE	+UC01 03/1.B7 03/1.B7 03/1.B7 03/1.B7	=TRW01-QM1 =TRW01-X2:1 =TRW01-X2:2 =TRW01-X2:3 =TRW01-X2:PE	+UC01 03/1.D7 03/1.D7 03/1.D7 03/1.D7	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Termination list Termination list	400182377	=TRW01	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK						
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ				10070-03 TL	Rev. I	Sheet 30 Next 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			

Yard Connections

Internal Connections

Levelwind/Slack Wire

=WCS01
+UH03

Main VFD Cabinet
Pentagon
Brake HPU
Gear Cooling HPU

-WG11 FD CP (TP) plus 8x2x0.75

-WD13 FD 855 CP 3G0.75

+UC01

-UB6 -WG1 PUR 4x0.34mm2 Shld → -BG1 End Stop 1 /1.B1

-UB7 -WG2 PUR 4x0.34mm2 Shld → -BG2 End Stop 2 /1.B2

-UB8 -WG3 PUR 4x0.34mm2 Shld → -BG3 Follow Up Sensor 1 /1.B3

-UB9 -WG4 PUR 4x0.34mm2 Shld → -BG4 Block Count /1.B3

-UB10 -WG5 PUR 4x0.34mm2 Shld → -BG5 Block Count /1.B4

-UB1 -WG6 PUR 4x0.34mm2 Shld → -BG6 SWC Limit Sensor 1 Pos In /1.B5

-UB2 -WG7 PUR 4x0.34mm2 Shld → -BG7 SWC Limit Sensor 2 Pos Out /1.B5

-UB3 -WG8 PUR 4x0.34mm2 Shld → -BG8 String Sensor

-UB4 -WG9 Valve Cable 3x0.75+PE → -BP1 Pressure Transmitter

-UB5 -WG10 Valve Cable 3x0.75+PE → -QM1 SWC Valve

=WCS01
+UH01

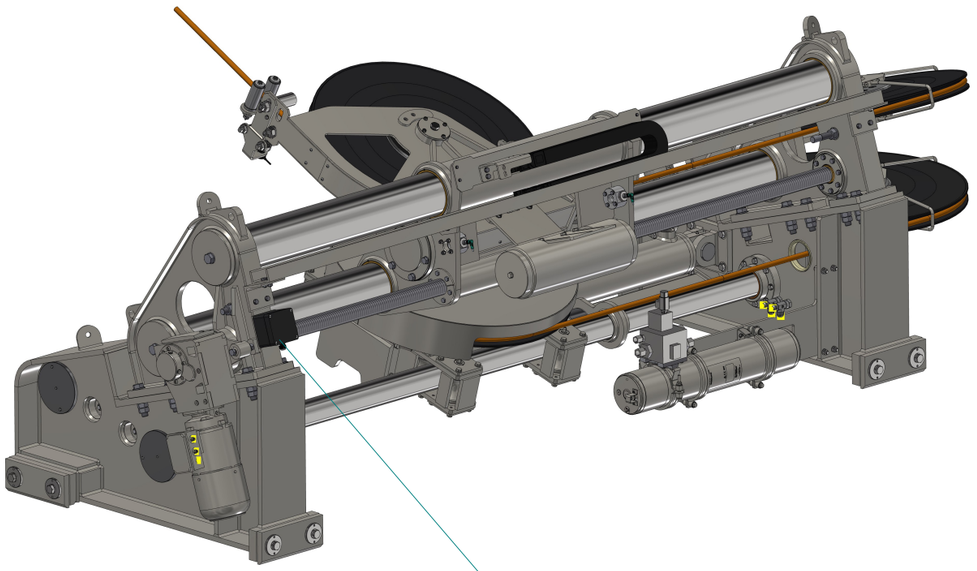
Main VFD Cabinet
Power Input
Levelwinds

-WG12 FD CP (TP) plus 4x2x0.25 → ENC
-WD14 2YSLCYK-JB 3x2.5+3x0.5 → PWR
-WD15 FD 855 CP 3G1.5 → BRAKE
-WD16 FD 855 CP 3G1.5 → HEAT

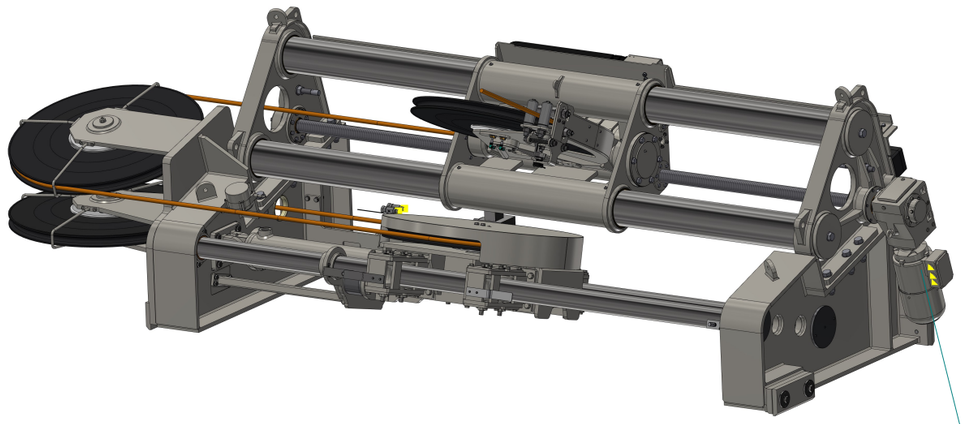
M 3~ -MA1

2,2kW
5,22A
400V/50Hz
GETBI1031 2.2kW

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Levelwind & Slack Wire Compensator Levelwind & Slack Wire Compensator	400182378	=LEV01	
				User	GSK						
				Approved	RAJ				10070-04 CD	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 2



=LEV01
+UC01



=LEV01
-MA1

Iso view of winch (image might deviate from actual product)

General Picture
Winch might be mirrored

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Levelwind & Slack Wire Compensator Connection Point Overview	400182378	=LEV01
				User	GSK					
				Approved	RAJ				10070-04 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 2 / Next 1

End Stop Levelwind

Angle Sensor Levelwind

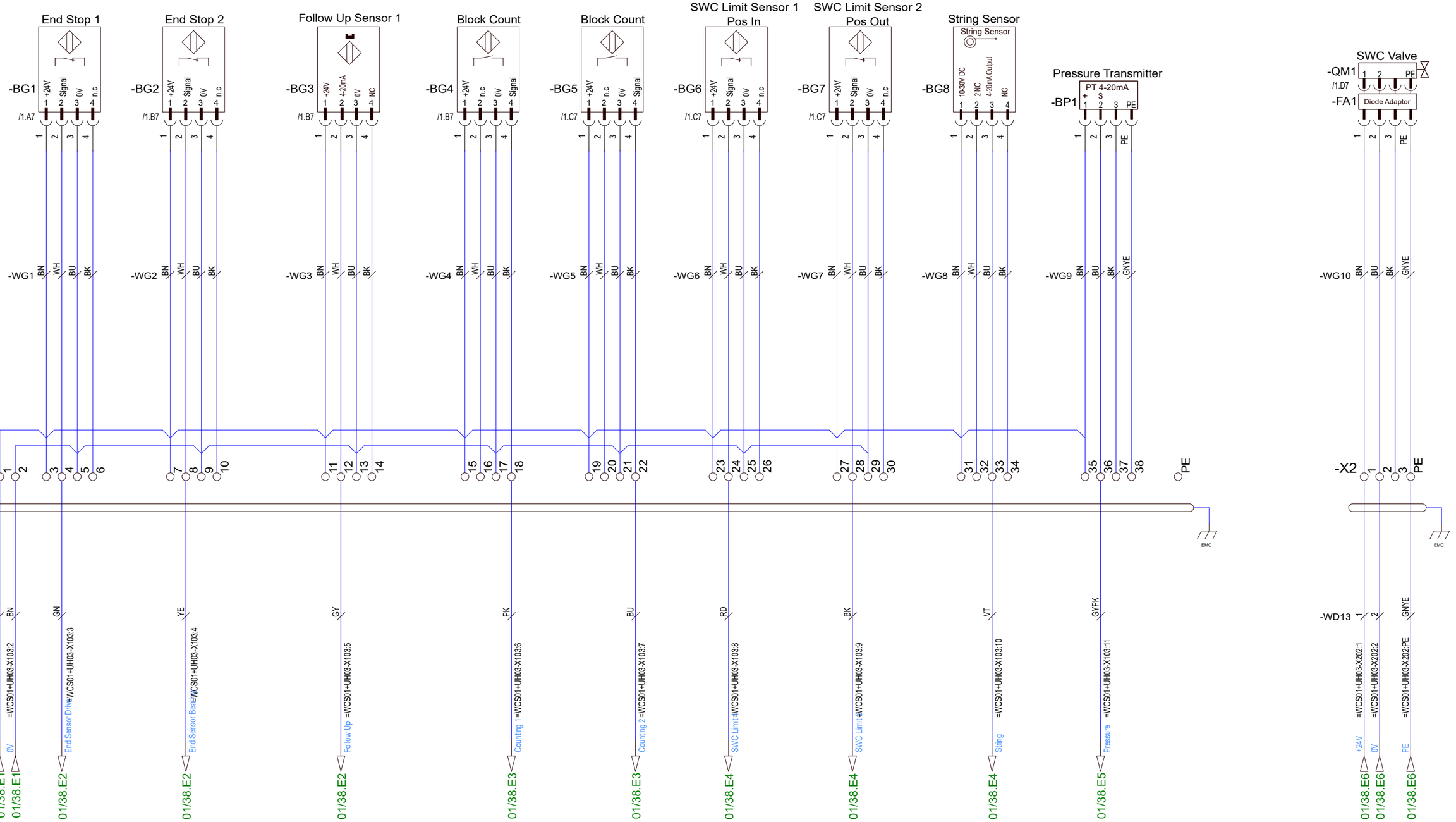
Block Count Levelwind

Limit Sensor Slack Wire

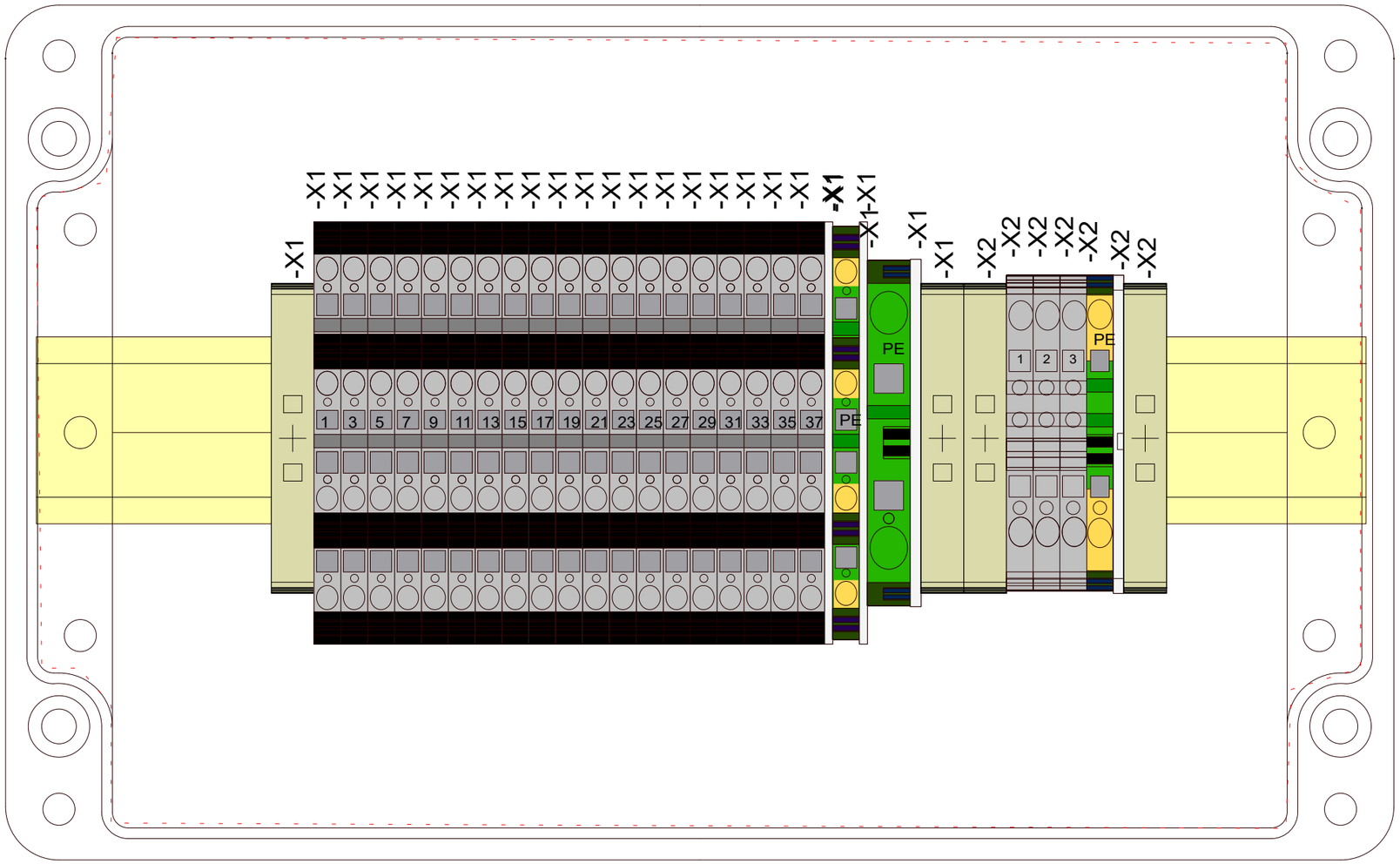
String Sensor Slack Wire

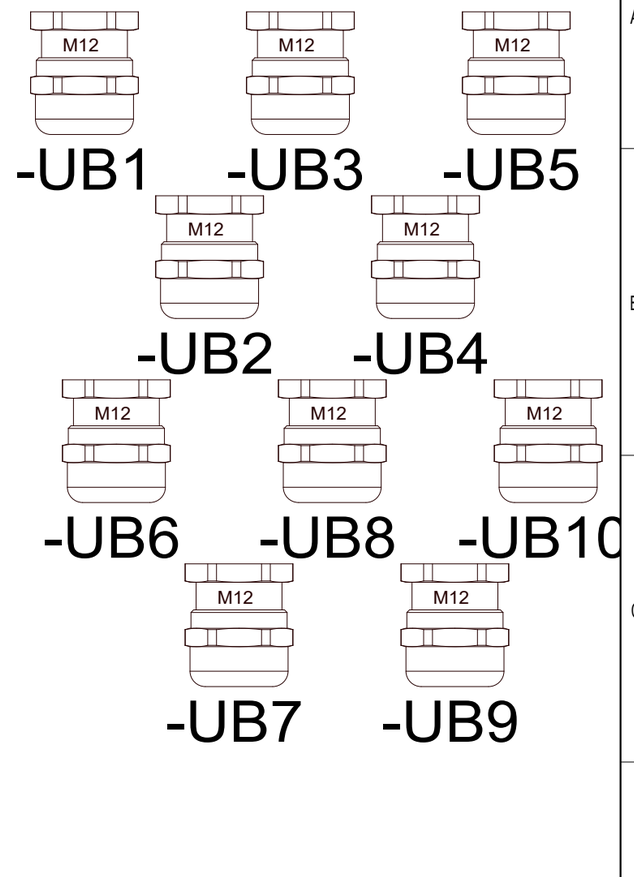
¨Pressure Transmitter

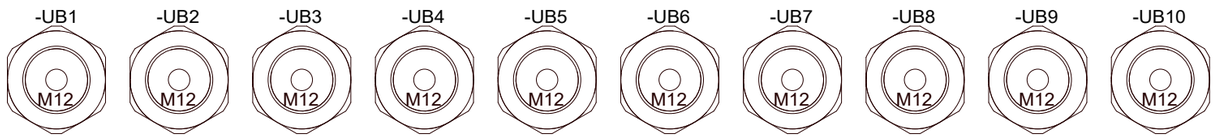
Brake Solenoid Valve



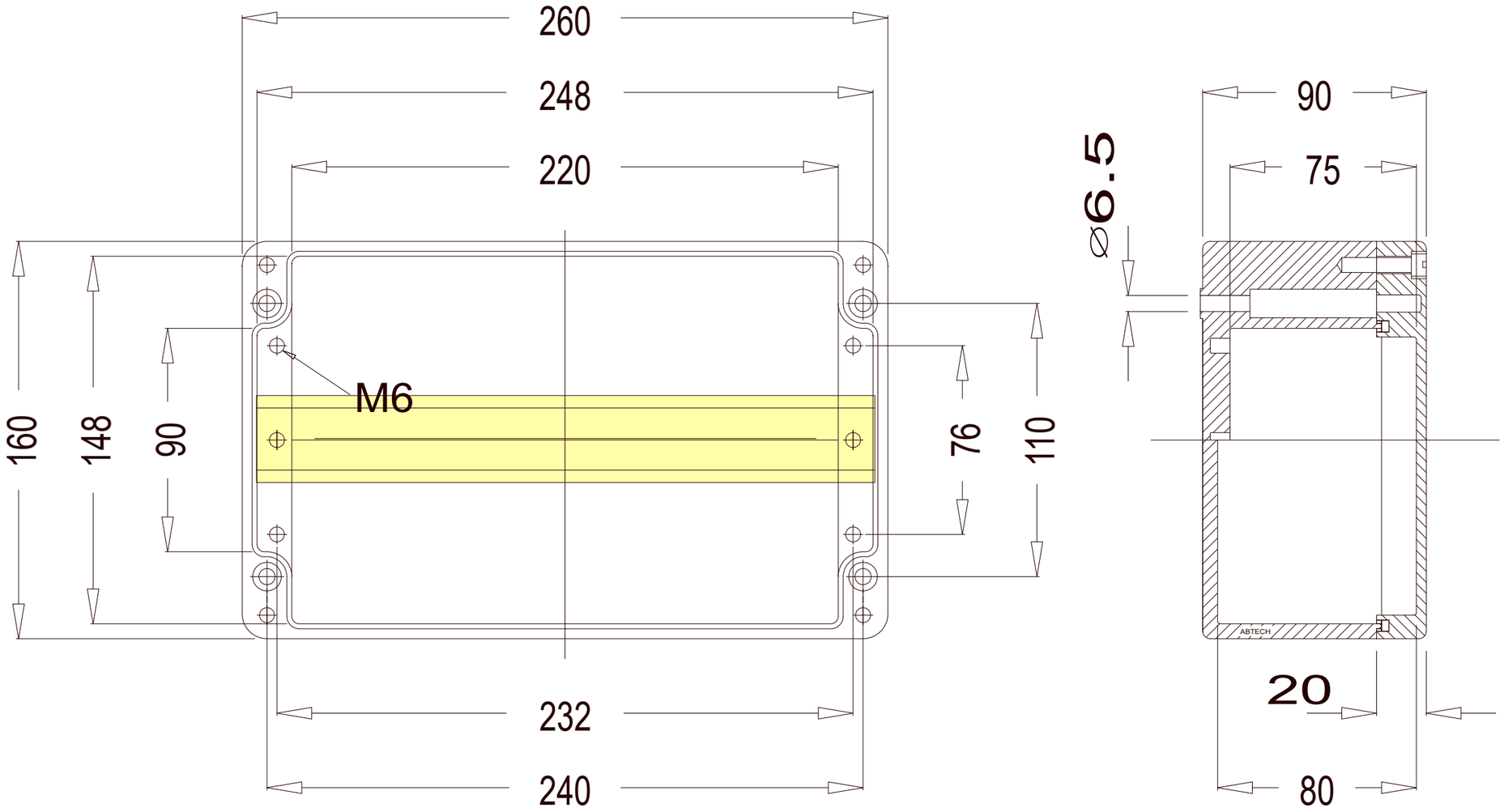
				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Levelwind & Slack Wire Compensator Level Wind Connection Box Internal Connection	400182378	=LEV01	
				User	GSK					+UC01	
				Approved	RAJ				10070-04 CC	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1







				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Levelwind & Slack Wire Compensator Level Wind Connection Box Internal Connection	400182378	=LEV01 +UC01
				User	GSK					
				Approved	RAJ				10070-04 GA	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 Next 2



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Levelwind & Slack Wire Compensator Level Wind Connection Box Internal Connection	400182378	=LEV01 +UC01	
				User	GSK						
				Approved	RAJ				10070-04 GA	Rev. I	Sheet 2 Next 8
Status	Change	Date	Name	Standard		Version	Index	Repl. by			

8E590EA796A340A8A4F8439EFF11211F

Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WG1	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG1	+UC01		4,8
-WG2	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG2	+UC01		4,8
-WG3	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG3	+UC01		4,8
-WG4	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG4	+UC01		4,8
-WG5	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG5	+UC01		4,8
-WG6	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG6	+UC01		4,8
-WG7	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG7	+UC01		4,8
-WG8	PUR 4x0.34mm2 Shld	=LEV01	+UC01	=LEV01-BG8	+UC01		4,8
-WG9	Valve Cable 3x0.75+PE	=LEV01-BP1		=LEV01-X1	+UC01		6,5
-WG10	Valve Cable 3x0.75+PE	=LEV01	+UC01	=LEV01-QM1	+UC01		6,5

			Date	17/11-2021	CNP Freire MBari
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

Version	Index	Repl. by

MACGREGOR

Levelwind & Slack Wire Compensator
Cable list

400209341

=LEV01

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG1	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG1:1 =LEV01-WG1:2 =LEV01-WG1:3 =LEV01-WG1:4	+UC01 04/1.B1 04/1.B1 04/1.B1 04/1.B1	=LEV01-BG1 =LEV01-X1:3 =LEV01-X1:4 =LEV01-X1:5 =LEV01-X1:6	+UC01 04/1.D1 04/1.D1 04/1.D1 04/1.D1	
-WG2	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG2:1 =LEV01-WG2:2 =LEV01-WG2:3 =LEV01-WG2:4	+UC01 04/1.B2 04/1.B2 04/1.B2 04/1.B2	=LEV01-BG2 =LEV01-X1:7 =LEV01-X1:8 =LEV01-X1:9 =LEV01-X1:10	+UC01 04/1.D2 04/1.D2 04/1.D2 04/1.D2	
-WG3	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG3:1 =LEV01-WG3:2 =LEV01-WG3:3 =LEV01-WG3:4	+UC01 04/1.B3 04/1.B3 04/1.B3 04/1.B3	=LEV01-BG3 =LEV01-X1:11 =LEV01-X1:12 =LEV01-X1:13 =LEV01-X1:14	+UC01 04/1.D3 04/1.D3 04/1.D3 04/1.D3	
-WG4	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG4:1 =LEV01-WG4:2 =LEV01-WG4:3 =LEV01-WG4:4	+UC01 04/1.B3 04/1.B3 04/1.B3 04/1.B3	=LEV01-BG4 =LEV01-X1:15 =LEV01-X1:16 =LEV01-X1:17 =LEV01-X1:18	+UC01 04/1.D3 04/1.D3 04/1.D3 04/1.D3	
-WG5	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG5:1 =LEV01-WG5:2 =LEV01-WG5:3 =LEV01-WG5:4	+UC01 04/1.B4 04/1.B4 04/1.B4 04/1.B4	=LEV01-BG5 =LEV01-X1:19 =LEV01-X1:20 =LEV01-X1:21 =LEV01-X1:22	+UC01 04/1.D4 04/1.D4 04/1.D4 04/1.D4	
-WG6	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG6:1 =LEV01-WG6:2 =LEV01-WG6:3 =LEV01-WG6:4	+UC01 04/1.B5 04/1.B5 04/1.B5 04/1.B5	=LEV01-BG6 =LEV01-X1:23 =LEV01-X1:24 =LEV01-X1:25 =LEV01-X1:26	+UC01 04/1.D5 04/1.D5 04/1.D5 04/1.D5	
-WG7	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG7:1 =LEV01-WG7:2 =LEV01-WG7:3 =LEV01-WG7:4	+UC01 04/1.B5 04/1.B5 04/1.B5 04/1.B5	=LEV01-BG7 =LEV01-X1:27 =LEV01-X1:28 =LEV01-X1:29 =LEV01-X1:30	+UC01 04/1.D5 04/1.D5 04/1.D5 04/1.D5	
-WG8	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=LEV01 =LEV01-WG8:1 =LEV01-WG8:2 =LEV01-WG8:3 =LEV01-WG8:4	+UC01 04/1.B6 04/1.B6 04/1.B6 04/1.B6	=LEV01-BG8 =LEV01-X1:31 =LEV01-X1:32 =LEV01-X1:33 =LEV01-X1:34	+UC01 04/1.D6 04/1.D6 04/1.D6 04/1.D6	

			Date	17/11-2021	CNP Freire MBari
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	
				Version	Index / Repl. by

MACGREGOR

Termination list
Termination list

400182378

=LEV01

10070-04 TL

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG9	Valve Cable	=LEV01-BP1		=LEV01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=LEV01-WG9:1	04/1.B6	=LEV01-X1:35	04/1.D6	
	BU	=LEV01-WG9:2	04/1.B7	=LEV01-X1:36	04/1.D7	
	BK	=LEV01-WG9:3	04/1.B7	=LEV01-X1:37	04/1.D7	
	GNYE	=LEV01-WG9:PE	04/1.B7	=LEV01-X1:38	04/1.D7	
-WG10	Valve Cable	=LEV01	+UC01	=LEV01-QM1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=LEV01-WG10:1	04/1.B8	=LEV01-X2:1	04/1.D8	
	BU	=LEV01-WG10:2	04/1.B8	=LEV01-X2:2	04/1.D8	
	BK	=LEV01-WG10:3	04/1.B8	=LEV01-X2:3	04/1.D8	
	GNYE	=LEV01-WG10:PE	04/1.B8	=LEV01-X2:PE	04/1.D8	

Status	Change	Date	Name	Standard	
				Date	17/11-2021
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Termination list
Termination list

400182378

=LEV01

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Yard Connections

Internal Connections

Storage Drum

=WCS01
+UH03

Main VFD Cabinet
Pentagon
Brake HPU
Gear Cooling HPU

-WG13 FD CP (TP) plus 2x2x0.75

=WCS01
+UH02

Main VFD Cabinet
Traction Winch
System
CTD WInch

-WD17 FD 855 CP 3G0.75

-WG14 FD CP (TP) plus 4x2x0.25 — ENC
-WD18 2YSLCYK-JB 3x16+3x2.5 — PWR
-WD19 FD 855 CP 3G1.5 — HEAT
-WG15 FD CP (TP) plus 1x2x0.75 — PTC

M
3~

-MA1

Max Rating 60A
400V/50Hz

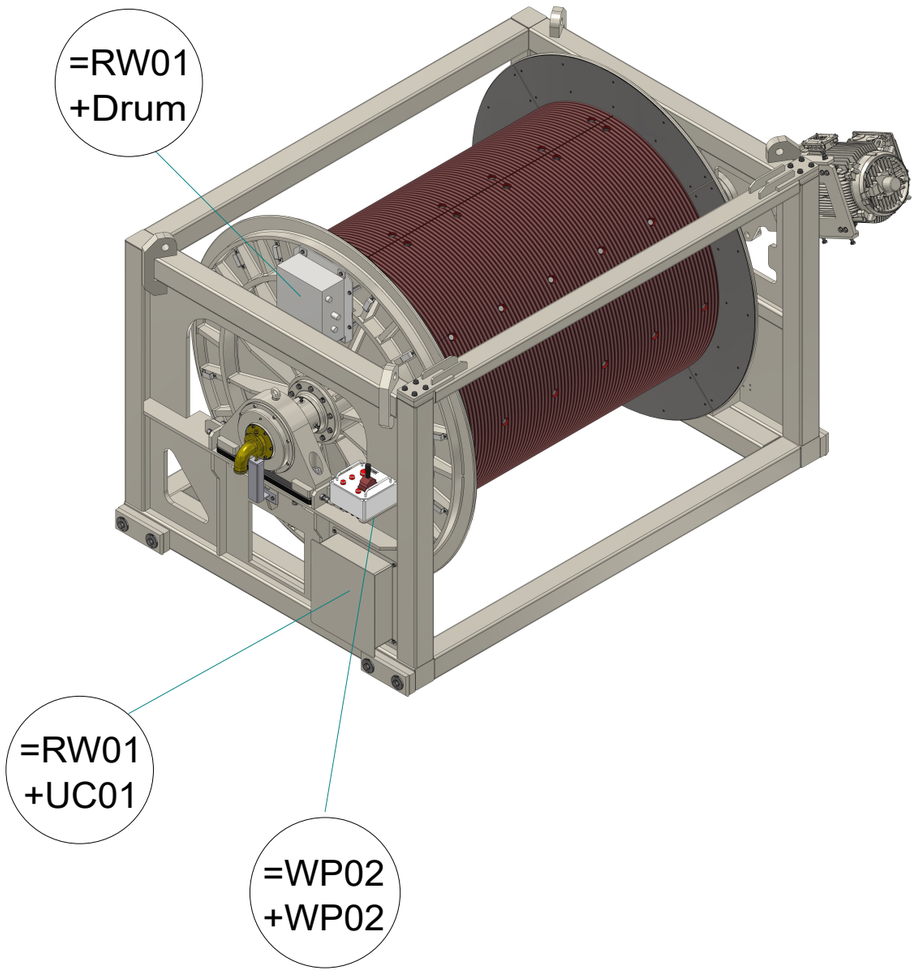
+UC1

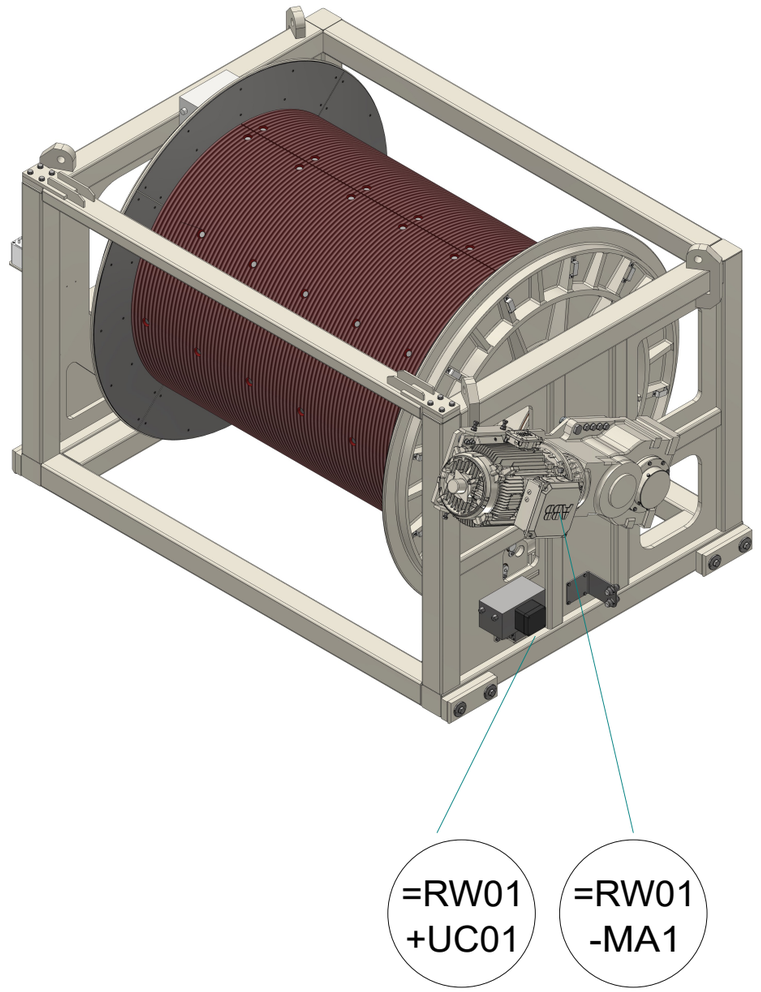
Winch Connection
Box

-UB13 -WG1 PUR 4x0.34mm2 Shld — Temp — -BP1 Temp Sensor

-UB14 -WG2 Valve Cable 3x0.75+PE — -QM1 Brake Valve

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Storage Drum Storage Drum	400182467	=RW01
				User	GSK					
				Approved	RAJ				10070-05 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 2





General Picture
Winch might be mirrored

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Storage Drum Connection Point Overview	400182467	=RW01	
				User	GSK						
				Approved	RAJ				10070-05 CD	Rev. I	Sheet 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1

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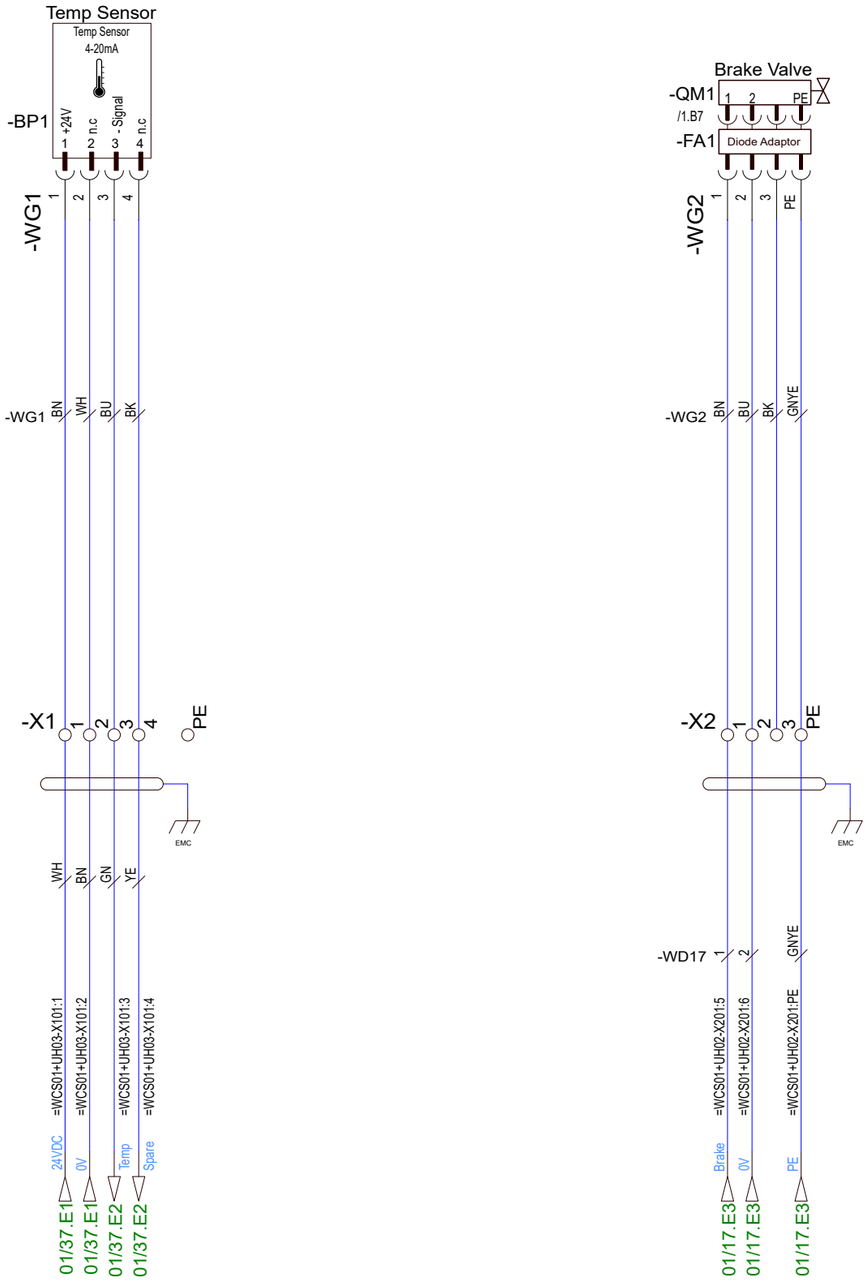
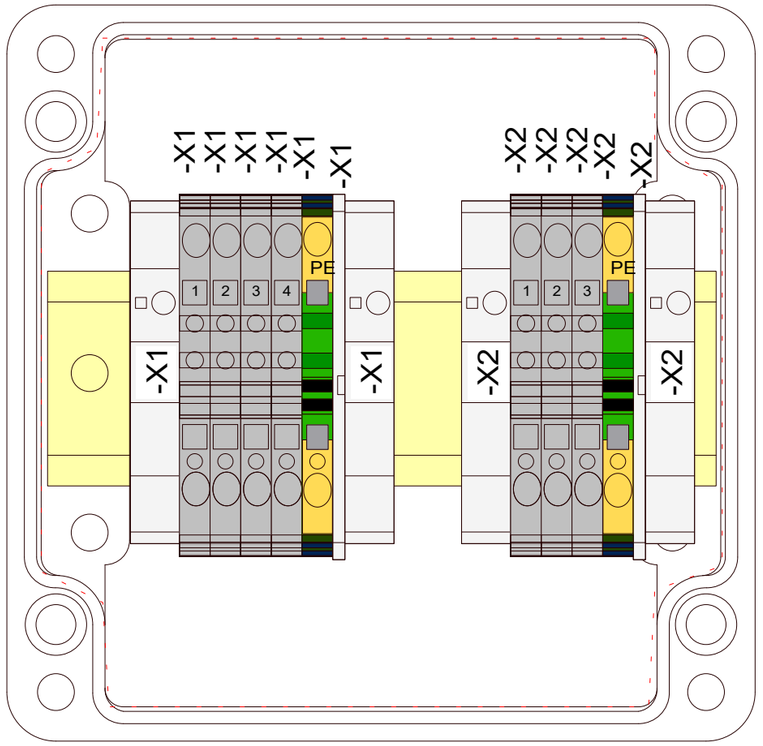
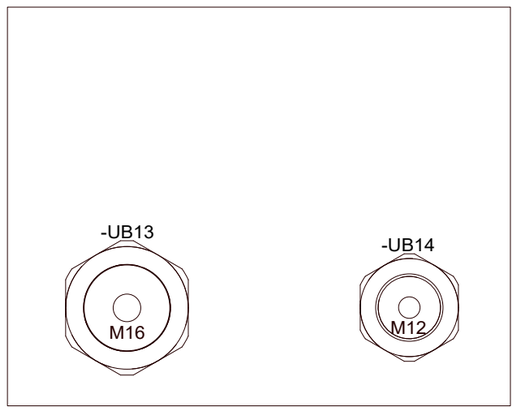
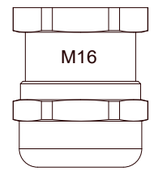
Gear Temp



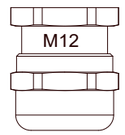
				Date	17/11-2021	CNP Freire MBari		Storage Drum Winch Connection Box	400182467	=RW01	
				User	GSK					+UC1	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-05 CC Rev. I	Sheet 1 / Next 1







-UB13



-UB14

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Storage Drum Winch Connection Box	400182467	=RW01	
				User	GSK					+UC1	
				Approved	RAJ				10070-05 GA	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 2

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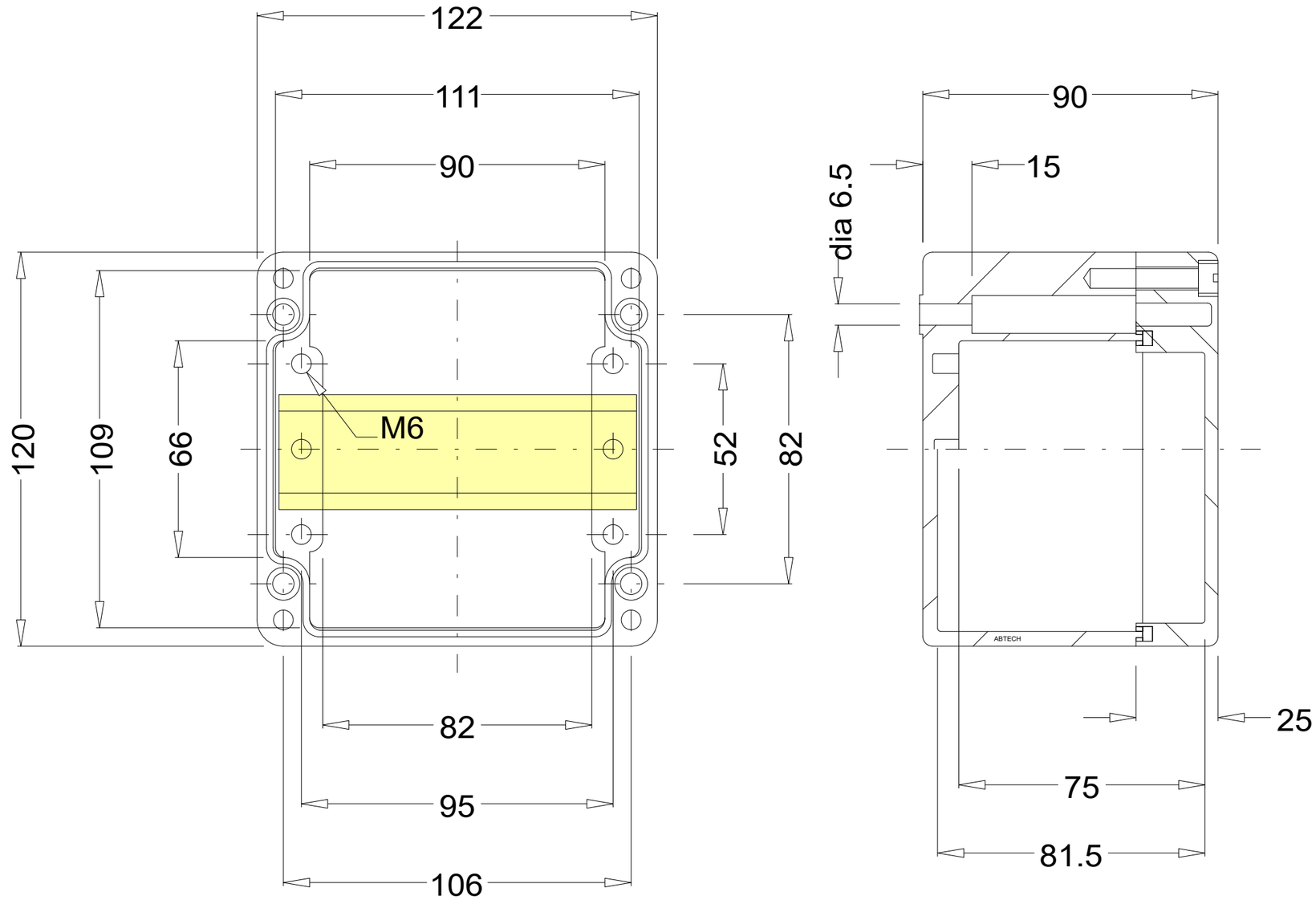

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Storage Drum Winch Connection Box	400182467	=RW01	
				User	GSK					+UC1	
				Approved	RAJ				10070-05 GA	Rev. I	Sheet 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 9

Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WG1	PUR 4x0.34mm2 Shld	=RW01	+UC1	=RW01-BP1	+UC1		4,8
-WG2	Valve Cable 3x0.75+PE	=RW01	+UC1	=RW01-QM1	+UC1		6,5

			Date	17/11-2021	
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Storage Drum
Cable list

400209341

=RW01

10070-05 CD

Rev. I

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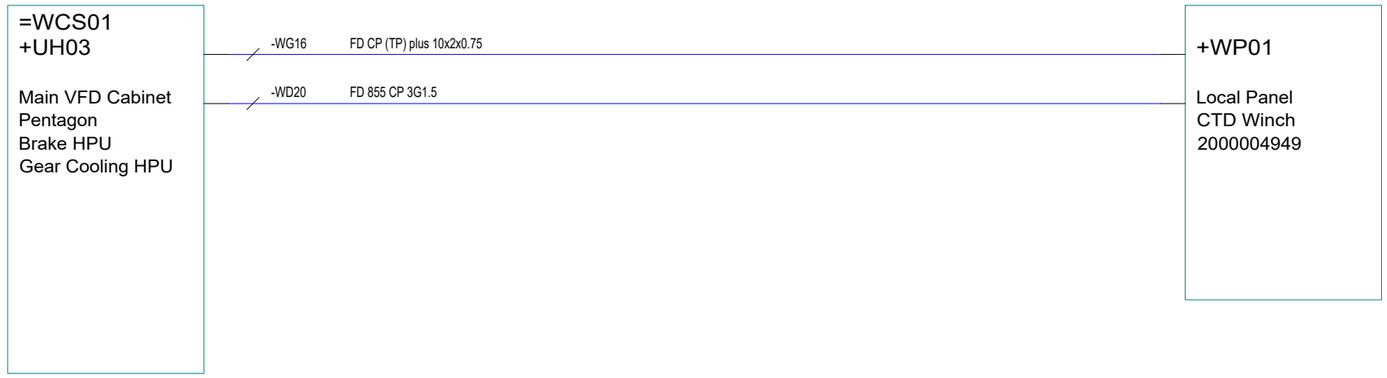
Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG1	Shielded Cable For M12 Pluggs BN WH BU BK SH1	=RW01 =RW01-WG1:1 =RW01-WG1:2 =RW01-WG1:3 =RW01-WG1:4	+UC1 05/1.B2 05/1.B2 05/1.B2 05/1.B2	=RW01-BP1 =RW01-X1:1 =RW01-X1:2 =RW01-X1:3 =RW01-X1:4	+UC1 05/1.D2 05/1.D2 05/1.D2 05/1.D2	
-WG2	Valve Cable BN BU BK GNYE	=RW01 =RW01-WG2:1 =RW01-WG2:2 =RW01-WG2:3 =RW01-WG2:PE	+UC1 05/1.B4 05/1.B4 05/1.B4 05/1.B4	=RW01-QM1 =RW01-X2:1 =RW01-X2:2 =RW01-X2:3 =RW01-X2:PE	+UC1 05/1.D4 05/1.D4 05/1.D4 05/1.D4	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Termination list Termination list	400182467	=RW01	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK						
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ				10070-05 TL	Rev. I	Sheet 29 Next 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			

Cables That Needs To Be Connected By Yard



				Date	17/11-2021	CNP Freire	MACGREGOR	Local Panel CTD Winch	400182468	=WP01	
				User	GSK	MBari		Local Panel CTD Winch			
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-06 CD Rev. I	Sheet 1 / Next 1

+24V | 0V | Safer Input | Joystick | Active | In control | Alarm | Emergency Stop | Emergency Stop Light | Spooling L/R | Launch & Recovery | Launch & Recovery Light | Panel Heater

-SF1 Blue 3 4 Red
-SF1 White CCW CW Blue Yellow
-PF1 Active - 24V DC Yellow +
-PF2 In Control - 24V DC Yellow +
-PF3 Alarm - 24V DC Red +
-SF2 11 /1.B5 21 X1 12 22 X2
-SF2 21 /1.B4 22
-SF2 X1- /1.B4 X2+
-SF3 23 24 /1.B6
-SF3 13 23 14 24 /1.B5
-SF4 3 /1.B7 1 a- 4 2 b+
-SF4 b- a+
-EB1 1 2 PE

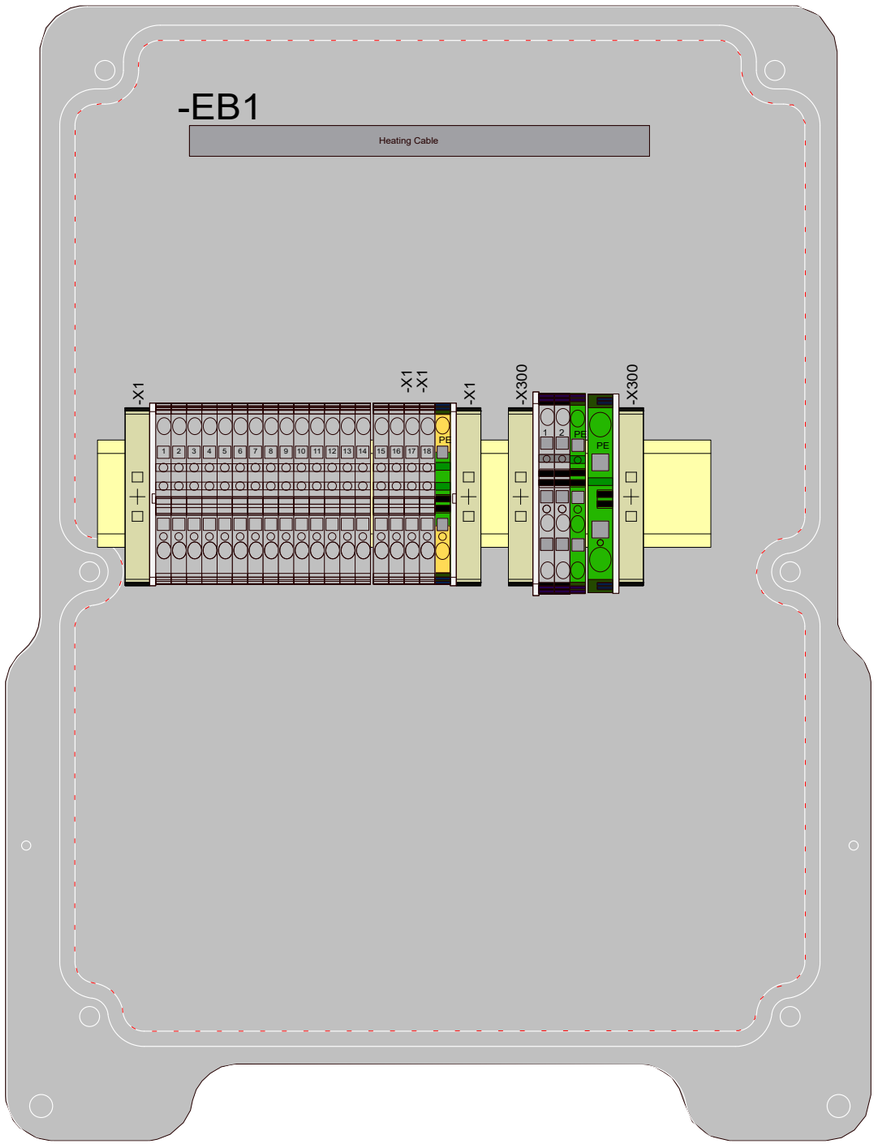
-X1: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 L 15 R 16 17 18 PE
-X300: 1 2 PE

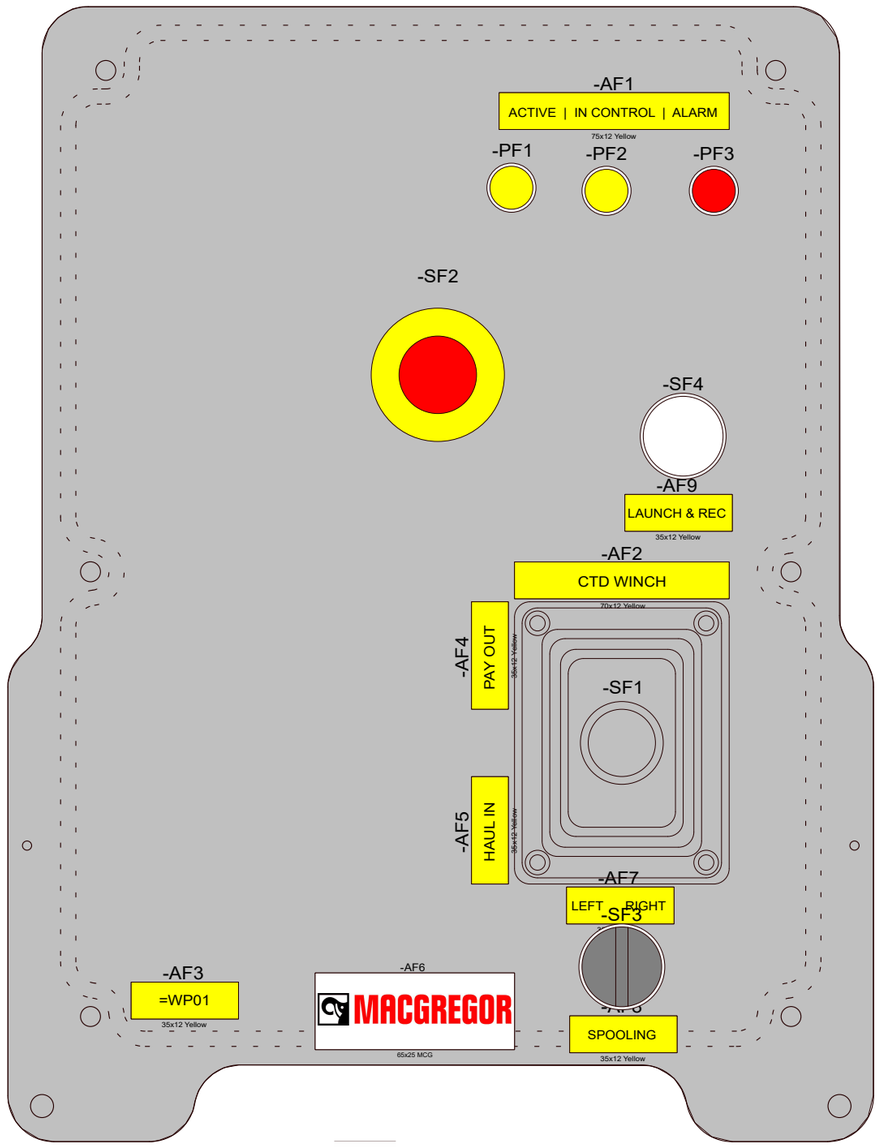
-WG16 WH BN GN YE GY PK BU RD BK VT GYPK RDBU WHGN BNGN YEBN WHYE WHGR GRBN
=WCS01+UHO3-X401:1 =WCS01+UHO3-X401:2 =WCS01+UHO3-X401:3 =WCS01+UHO3-X401:4 =WCS01+UHO3-X401:5 =WCS01+UHO3-X401:6 =WCS01+UHO3-X401:7 =WCS01+UHO3-X401:8 =WCS01+UHO3-X401:9 =WCS01+UHO3-X401:10 =WCS01+UHO3-X401:11 =WCS01+UHO3-X401:12 =WCS01+UHO3-X401:13 =WCS01+UHO3-X401:14 =WCS01+UHO3-X401:16 =WCS01+UHO3-X401:15 =WCS01+UHO3-X401:17 =WCS01+UHO3-X401:18
24VDC | 0V | Start | 0V | A In | +10V | Active | In Control | Alarm | EM.Loop 1 | EM.Loop 1 | EM.Loop 2 | EM.Loop 2 | EM.Light | Spool R | Spool L | Launch&Re | Launch&Re
01/43.E1 | 01/43.E1 | 01/43.E2 | 01/43.E2 | 01/43.E2 | 01/43.E2 | 01/43.E2 | 01/43.E3 | 01/43.E3 | 01/43.E3 | 01/43.E4 | 01/43.E4 | 01/43.E4 | 01/43.E4 | 01/43.E5 | 01/43.E5 | 01/43.E6 | 01/43.E6

-WD20 1 2 GNYE
=WCS01+UHO3-X302:1 =WCS01+UHO3-X302:2 =WCS01+UHO3-X302:PE
HTZ30\:L1 | HTZ30\:L2 | PE
01/27.E6 | 01/27.E6 | 01/27.E7

EMC | EMC

				Date	17/11-2021	CNP Freire	MACGREGOR	Local Panel CTD Winch	400182468	=WP01	
				User	GSK	MBari		Winch 1, EMS, Spooling, Heater		+WP01	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-06 CC	Rev. I	Sheet 1 / Next 1





-X1
DEK 5 FWZ 1-10

-X300
WAD 8 MC NE WS

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Local Panel CTD Winch Panel layout	400182468	=WP01	
				User	GSK					+WP01	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Rev. I	Sheet 1
									10070-06 GA		Next 1

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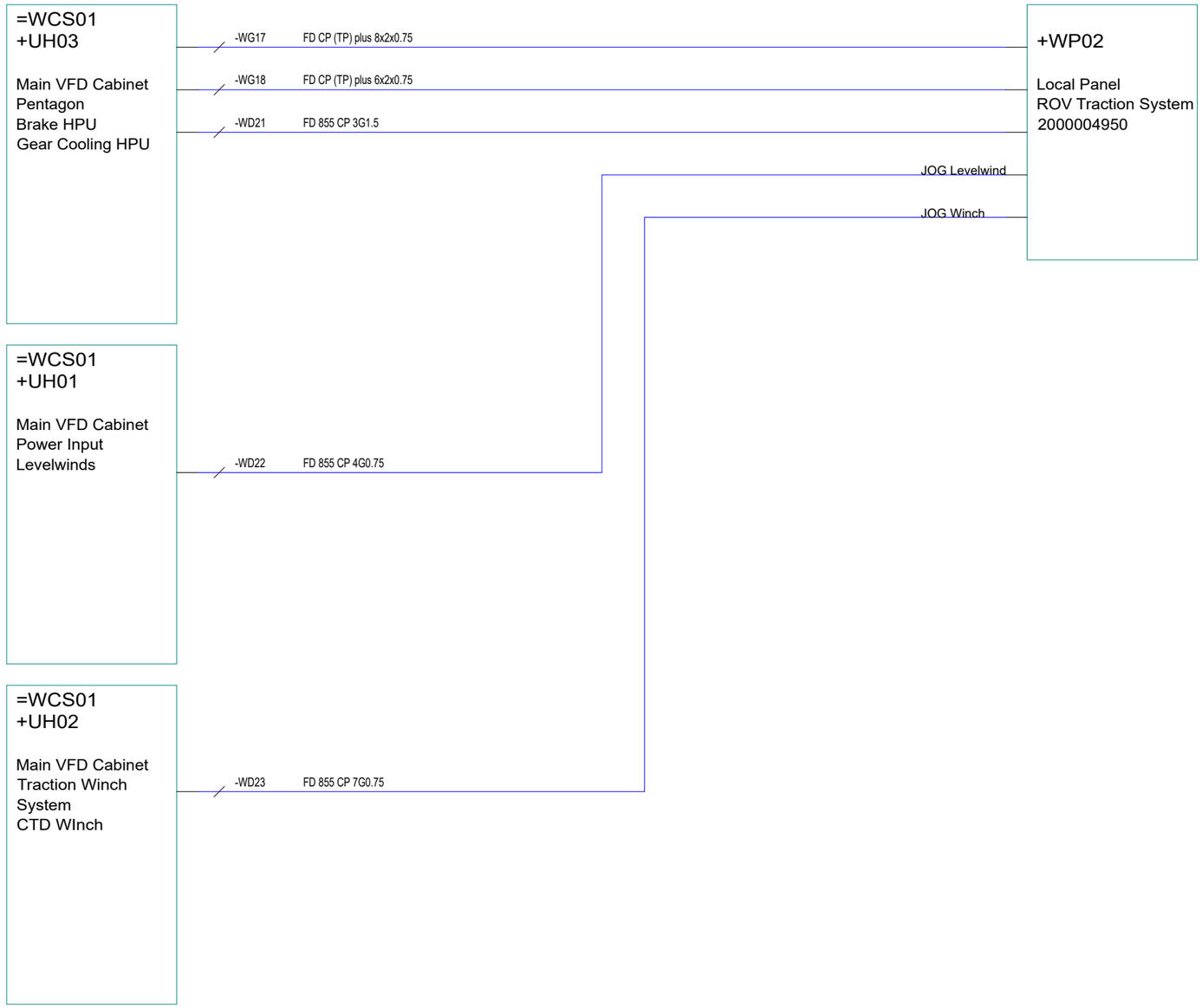
Cables That Needs To Be Connected By Yard

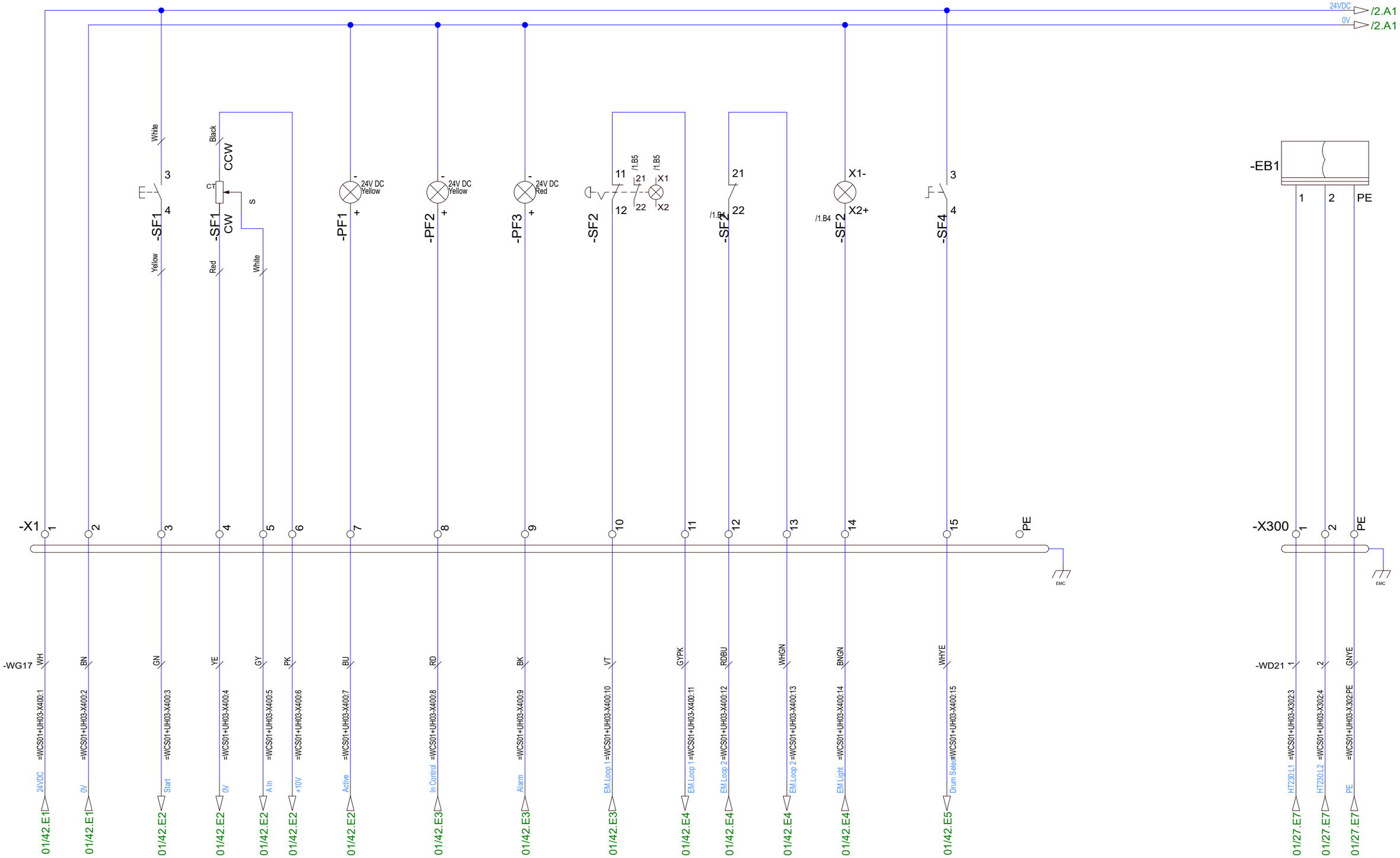


				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Deck Panel ROV Winch System Deck Panel ROV Winch System	400182477	=WP02	
				User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-07 CD	Rev. I

Sheet 1
Next 1

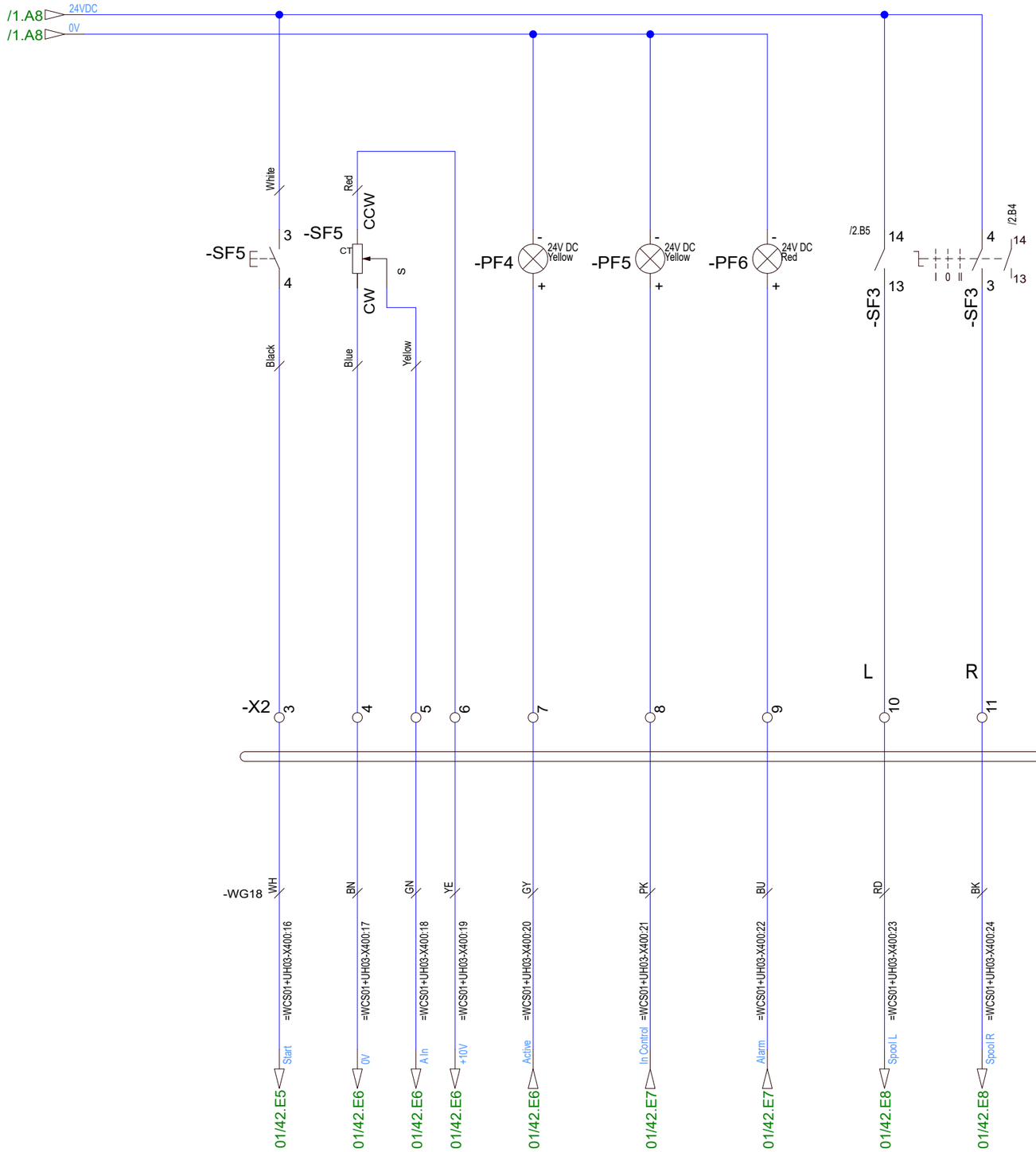
8E590EA796A34668A4F8439EFF11211F

+24V | 0V | Safer Input | Joystick | Active | In control | Alarm | Emergency Stop Loop 1 | Emergency Stop Loop 2 | Emergency Stop Light | TRW Activate /Deactivate | Panel Heater



				Date	17/11-2021	CNP Freire MBari		MACGREGOR	Deck Panel ROV Winch System Circuit Diagram Traction Winch, EMS, Spooling, Heater Activate	400182477		=WP02 +WP02	
				User	GSK								
				Approved	RAJ								
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Rev. I	Sheet 1 Next 2	

Safer Input | Joystick | Active | In control | Alarm | Spooling L/R

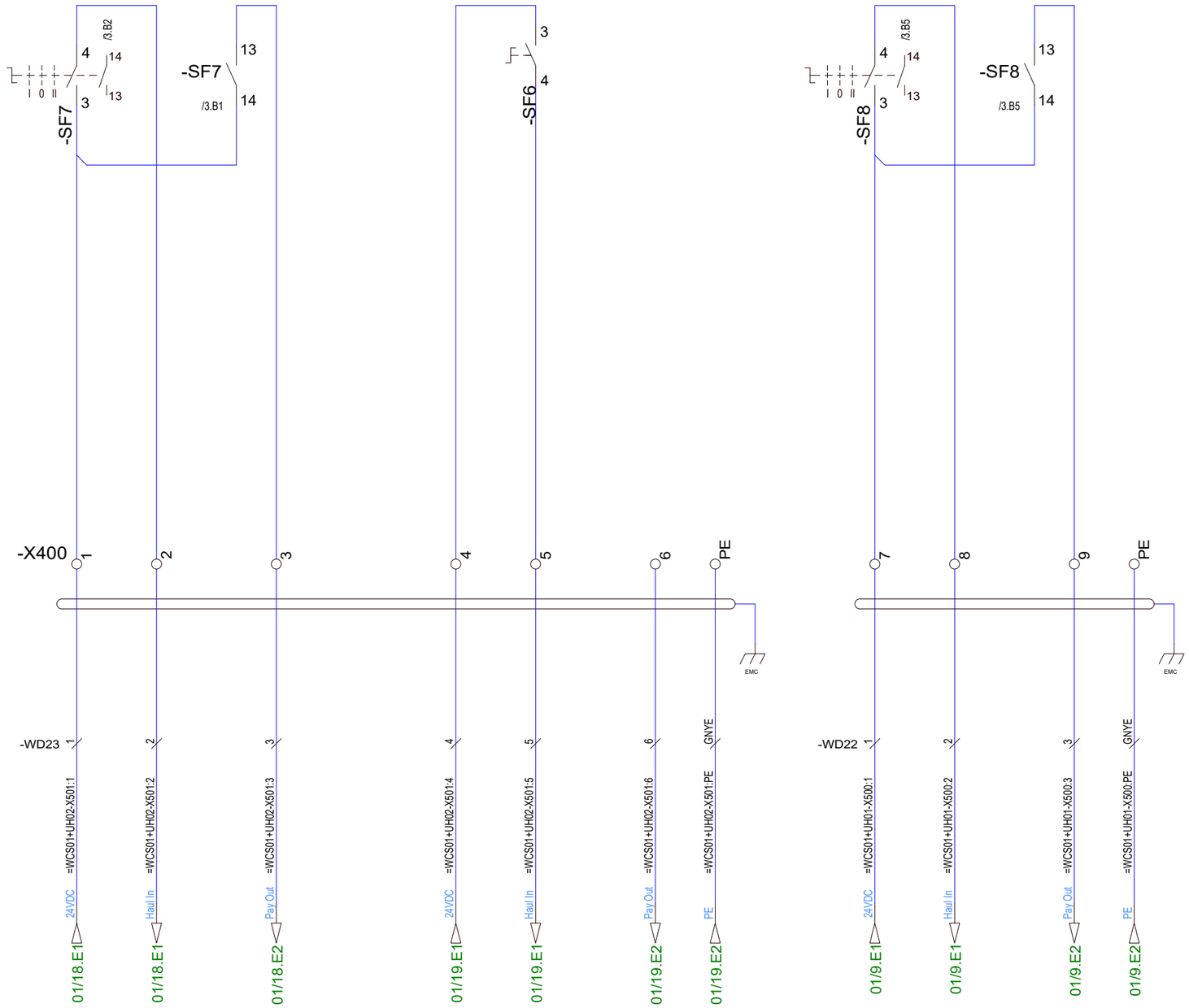


				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Deck Panel ROV Winch System Circuit Diagram Storage Drum	400182477	=WP02 +WP02
				User	GSK					
				Approved	RAJ				10070-07 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 2 Next 3

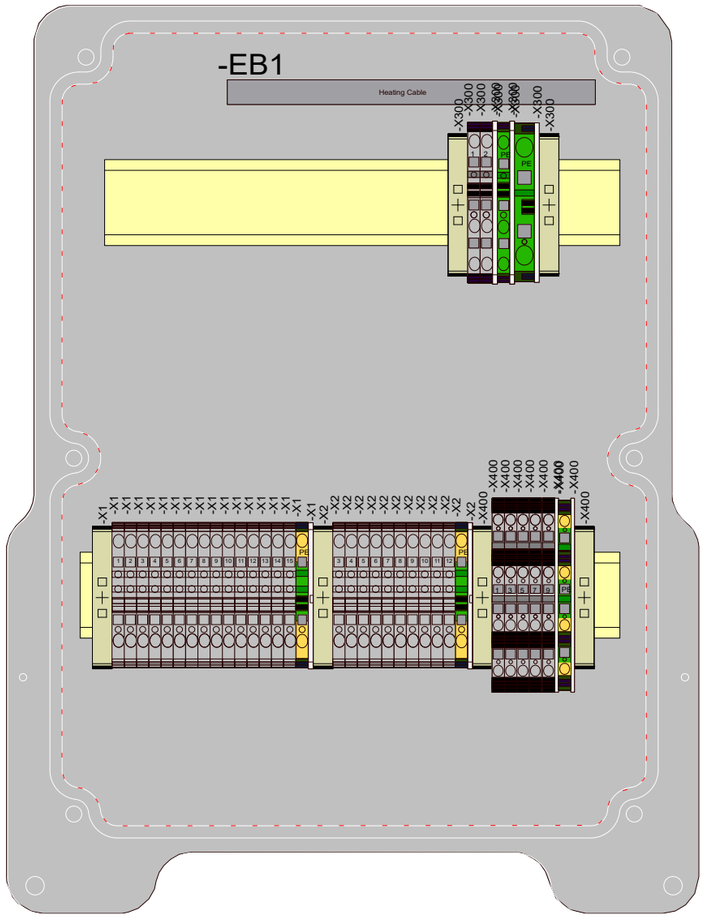
Traction Winch Emergency Control

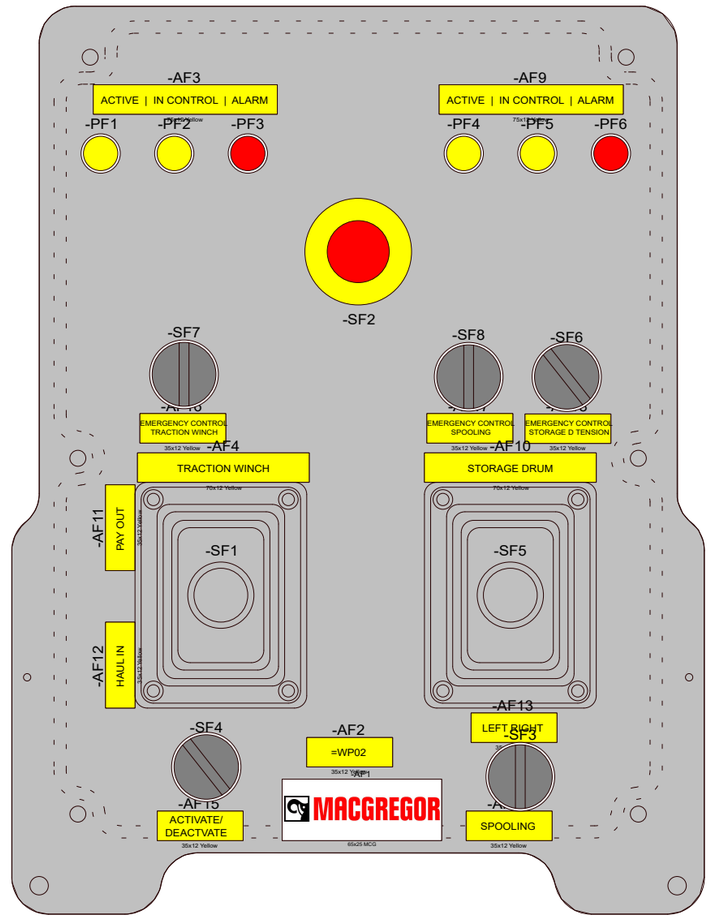
Storage Drum Tension Emergency Control

Levelwind Emergency Control



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Deck Panel ROV Winch System Emergency Control Switches	400182477	=WP02	
				User	GSK					+WP02	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by	Circuit Diagram	10070-07 CC Rev. I	Sheet 3 / Next 1





				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Deck Panel ROV Winch System Panel Layout	400182477	=WP02 +WP02
				User	GSK					
				Approved	RAJ				10070-07 GA	Rev. I
Status	Change	Date	Name	Standard		Version / Index / Repl. by				Sheet 1 Next 1

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Control Room Panel Winches Control Room Panel	400182478	=CP01	
				User	GSK						
				Approved	RAJ				10070-08 CD	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1

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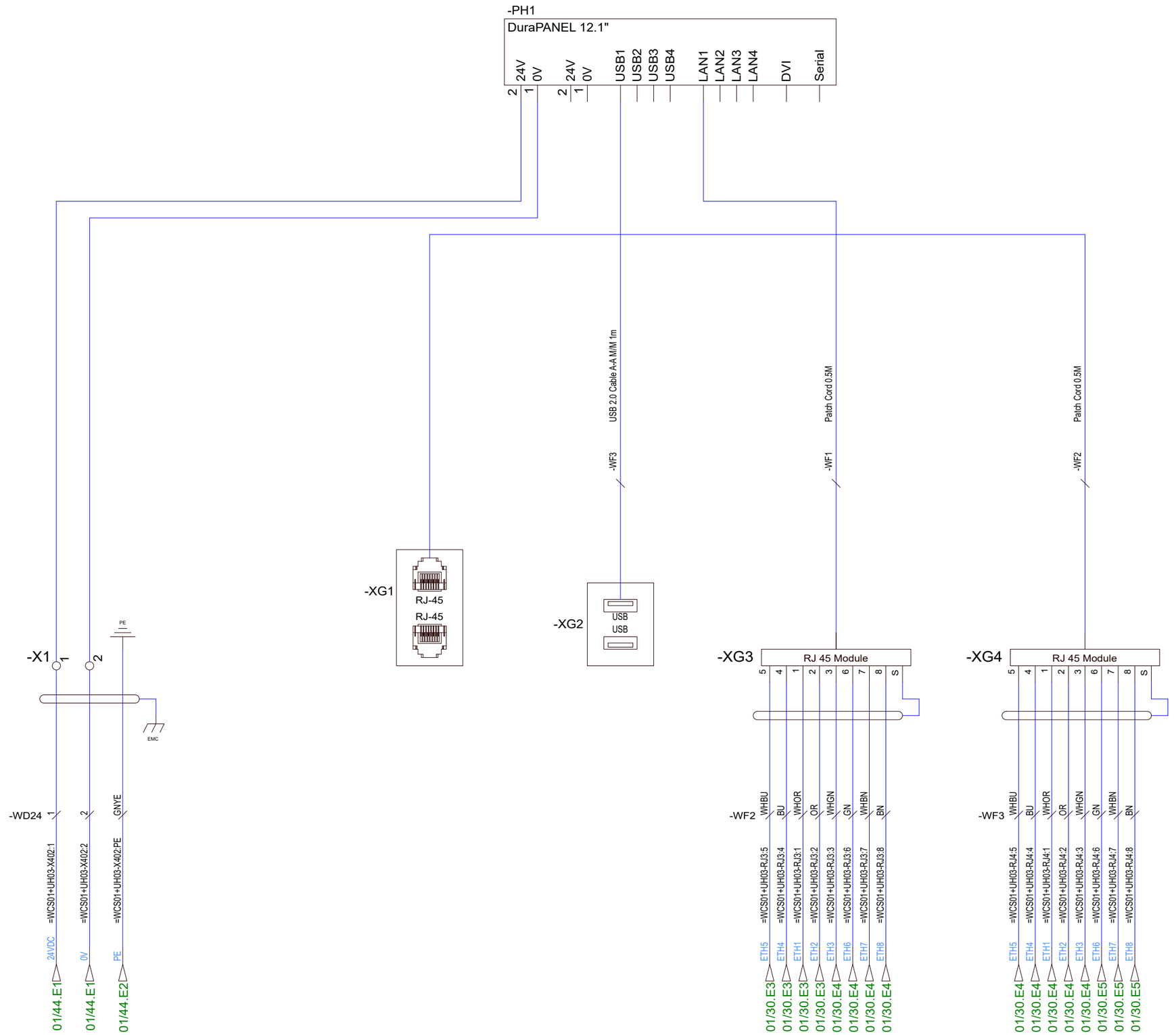
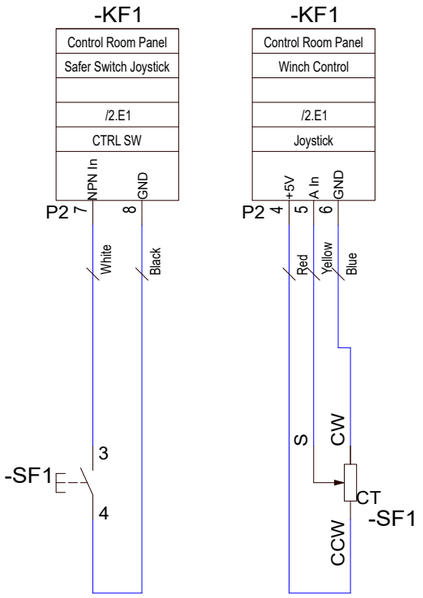


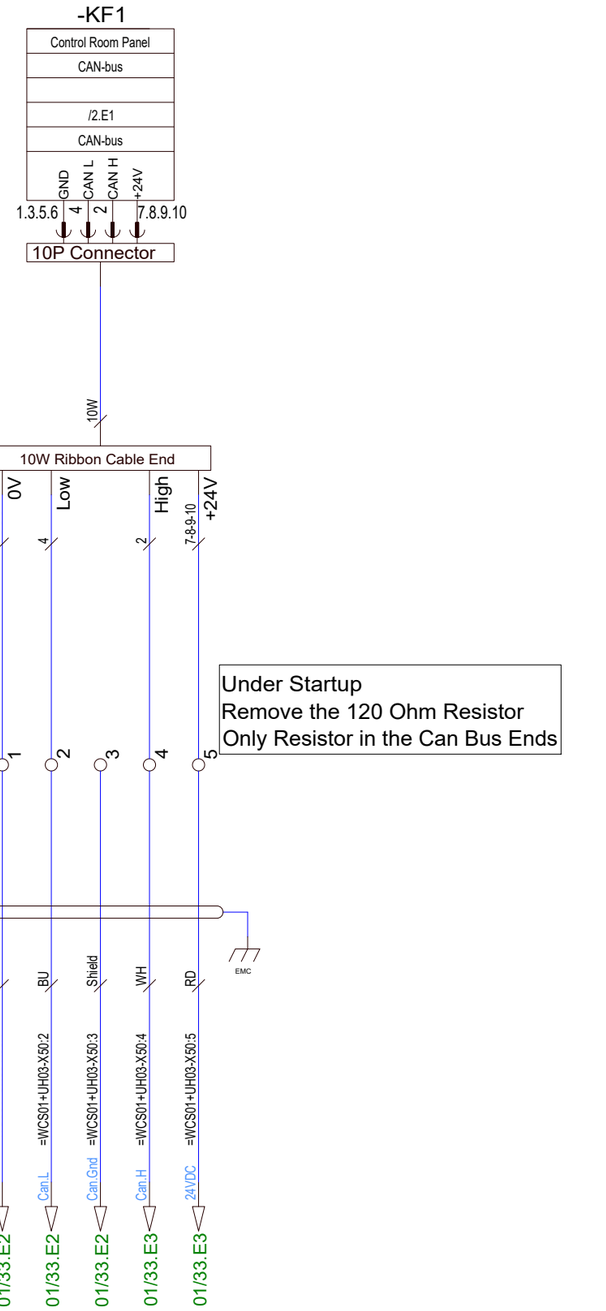
				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Control Room Panel Winches Panel PC, 1 Joystick	400182478	=CP01 +CP01	
				User	GSK						
				Approved	RAJ				10070-08 CC	Rev. I	Sheet 1 Next 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			

Activate

Joystick

CAN-bus





-KF1

CAN BUS JOYSTICK CARD

Adress	

I/O	Ref	Adress	Description
Joystick	/2.B2		Winch Control
Potmeter			
CAN-bus	/2.B6		CAN-bus
Serial Display			
CTRL SW	/2.B1		Safer Switch Joystick
MAN SW			
IN 1	/3.B2		Alarm Reset
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1	/3.B3		Reset Alarm Light
OUT 2	/3.B1		Alarm Buzzer
OUT 3			
OUT 4			

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Control Room Panel Winches Panel PC, 1 Joystick	400182478	=CP01 +CP01
				User	GSK					
	Removed unused CanBus Connection	28.11.2022	ANP	Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-08 CC	Rev. I

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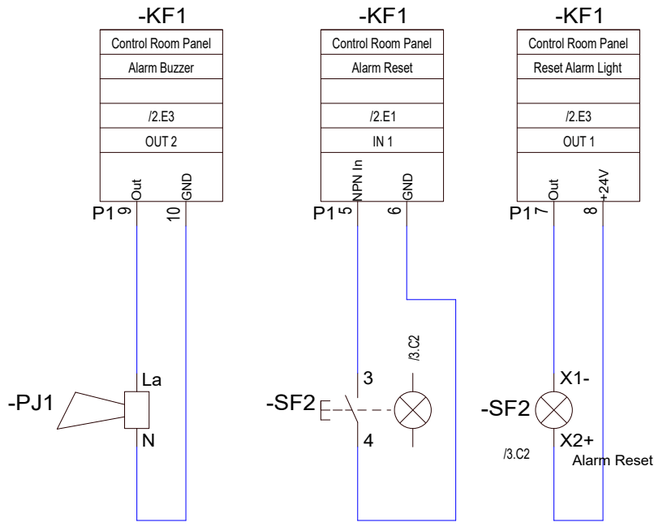
Alarm Buzzer

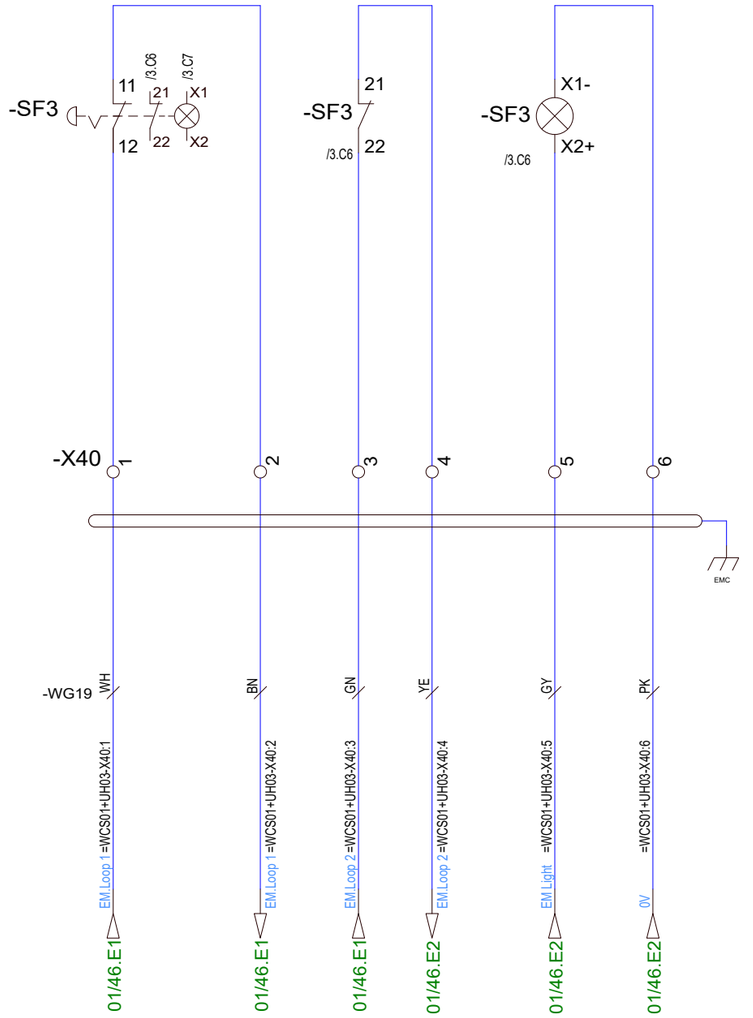
Alarm Reset Switch

Alarm Light

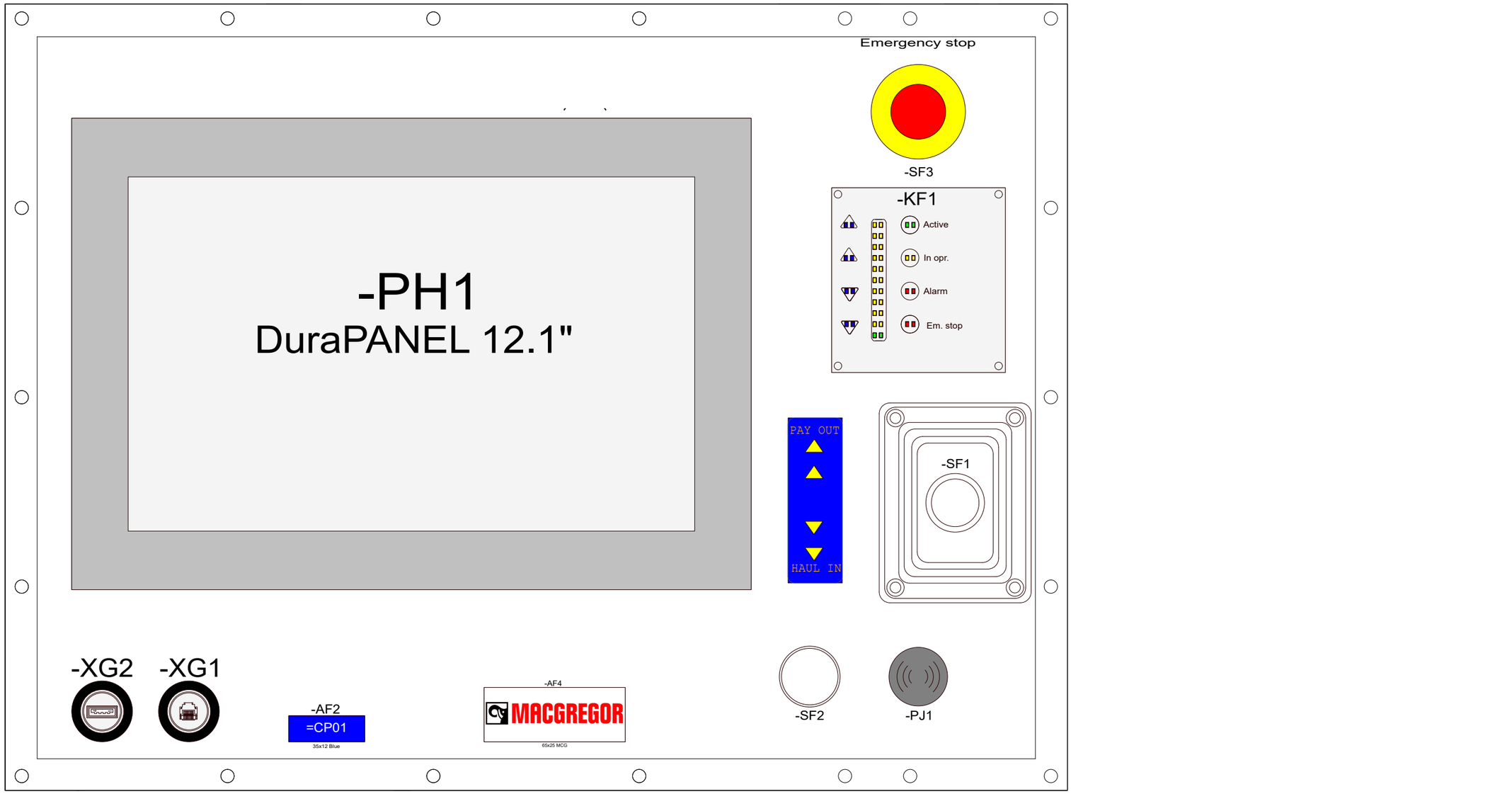
Emergency Stop Loop

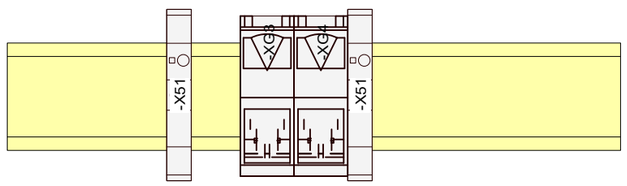
Emergency Stop Light

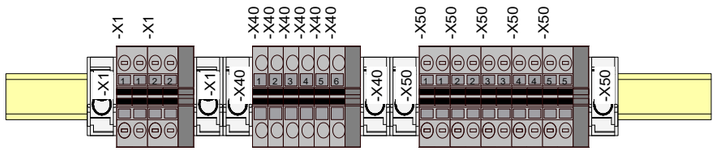




				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Control Room Panel Winches Panel PC, 1 Joystick	400182478	=CP01
				User	GSK					+CP01
				Approved	RAJ				10070-08 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 3 / Next 1







				Date	17/11-2021	CNP Freire MBari	MACGREGOR	ROV Control Room Panel Winches Panel Layout	400182478	=CP01
				User	GSK					+CP01
				Approved	RAJ				10070-08 GA	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 3

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Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
+CP01-WF1	Patch Cord 0.5M	=CP01-XG3	+CP01	=CP01-PH1	+CP01		5
+CP01-WF2	Patch Cord 0.5M	=CP01-XG4	+CP01	=CP01-XG1	+CP01		5
+CP01-WF3	USB 2.0 Cable A-A M/M 1m	=CP01-PH1	+CP01	=CP01-XG2	+CP01		5

				Date	17/11-2021
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

ROV Control Room Panel Winches
Cable list

400209341

=CP01
+CP01

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Sheet 3
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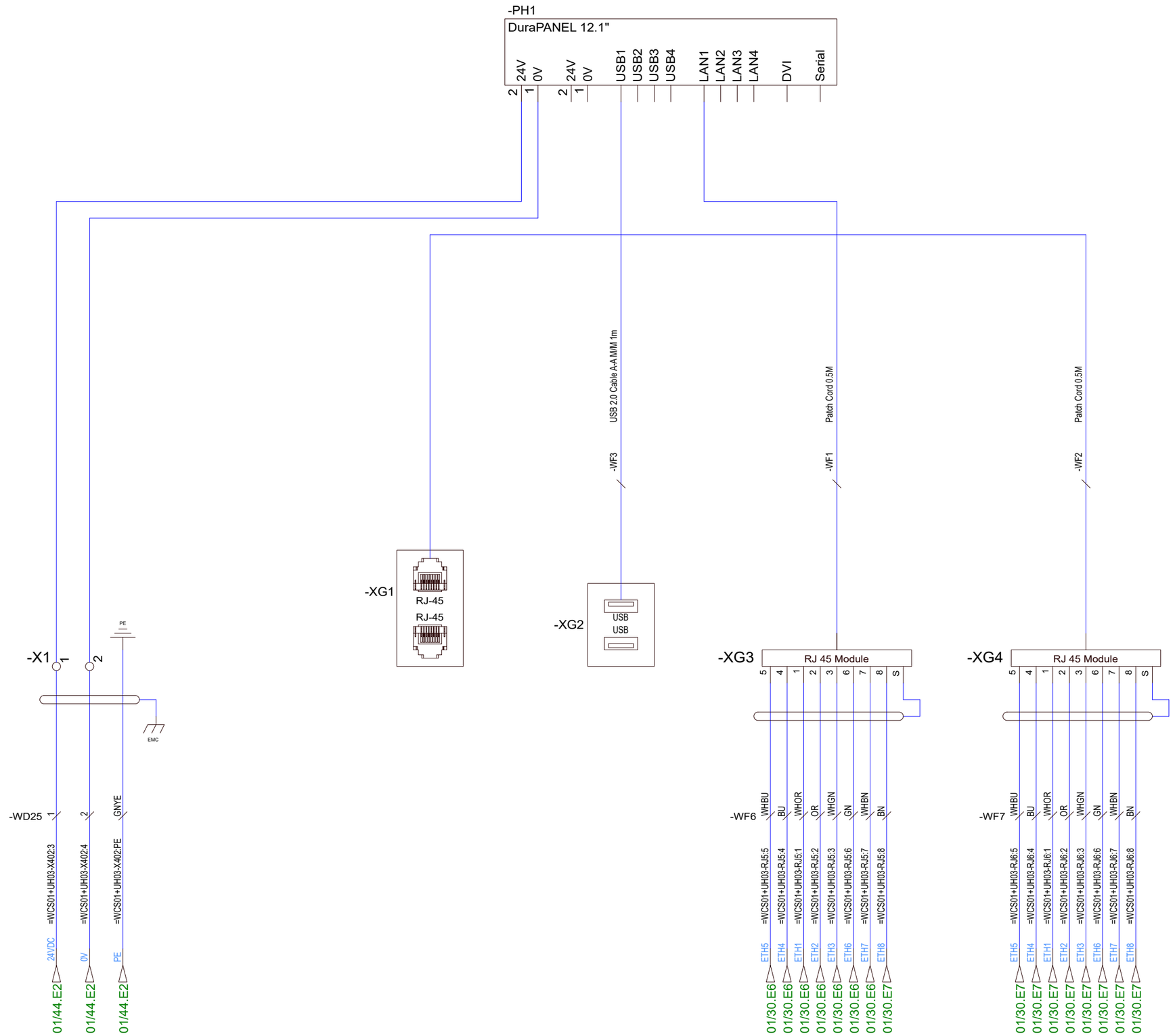
Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
+CP01-WF1	Patch Cord 0.5M RJ45	=CP01-XG3 =CP01-XG3:5	+CP01 08/1.D5	=CP01-PH1 =CP01-XG3:5	+CP01 08/1.D5	
+CP01-WF2	Patch Cord 0.5M RJ45	=CP01-XG4 =CP01-XG4:5	+CP01 08/1.D6	=CP01-XG1 =CP01-XG1:RJ-45	+CP01 08/1.D3	
+CP01-WF3	USB 2.0 Cable A-A M/M 1m USB	=CP01-PH1 =CP01-PH1:USB1	+CP01 08/1.A4	=CP01-XG2 =CP01-XG2:USB	+CP01 08/1.D4	

				Date	17/11-2021	CNP Freire MBari		Termination list Termination list	400182478	=CP01 +CP01
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK					
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ				10070-08 TL	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 22 Next 1

8E590EA796A34668A4F8439EFF11211F

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel Winches Control Room Panel	400186798	=CP03	
				User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-10 CD Rev. I	Sheet 1 / Next 1



				Date	17/11-2021	CNP Freire MBari		AFT Control Station Panel Winches Panel PC, 1 Joystick	400186798	=CP03	
				User	GSK					+CP03	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-10 CC Rev. I	Sheet 1 / Next 2

Activate

-KF1

Control Room Panel
Safer Switch Joystick
/2.E1
CTRL SW

P2 7 NPN In — White — 3 — -SF1 — 4

P2 8 GND — Black

Joystick

-KF1

Control Room Panel
Winch Control
/2.E1
Joystick

P2 4 +5V — Red — S — CW

P2 5 A In — Yellow — CT — -SF1

P2 6 GND — Blue — CCW

CAN-bus

-KF1

Control Room Panel
CAN-bus
/2.E1
CAN-bus

GND — CAN L — CAN H — +24V

1.3.5.6 — 4 — 2 — 7.8.9.10

10P Connector

10W

10W Ribbon Cable End

0V	Low	High	+24V
1-3-5-6	4	2	7-8-9-10

-X50 pins 1 2 3 4 5

Under Startup
Remove the 120 Ohm Resistor
Only Resistor in the Can Bus Ends

	BK	BU	Shield	WH	RD	
-WF5	=WCS01+UH03-X50:1	=WCS01+UH03-X50:2	=WCS01+UH03-X50:3	=WCS01+UH03-X50:4	=WCS01+UH03-X50:5	EMC
-WF8	=CP04+CP04-X50:1	=CP04+CP04-X50:2	=CP04+CP04-X50:3	=CP04+CP04-X50:4	=CP04+CP04-X50:5	EMC
	0V	Can L	Can Gnd	Can H	24VDC	
	01/33.E3	01/33.E3	01/33.E3	01/33.E4	01/33.E4	
	11/1.E6	11/1.E6	11/1.E7	11/1.E7	11/1.E7	

-KF1

CAN BUS JOYSTICK CARD

Adress

I/O	Ref	Adress	Description
Joystick	/2.B2		Winch Control
Potmeter			
CAN-bus	/2.B6		CAN-bus
Serial Display			
CTRL SW	/2.B1		Safer Switch Joystick
MAN SW			
IN 1	/3.B2		Alarm Reset
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1	/3.B3		Reset Alarm Light
OUT 2	/3.B1		Alarm Buzzer
OUT 3			
OUT 4			

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel Winches Panel PC, 1 Joystick
				User	GSK			
				Approved	RAJ			
Status	Change	Date	Name	Standard		Version / Index / Repl. by		

400186798 | =CP03 | +CP03

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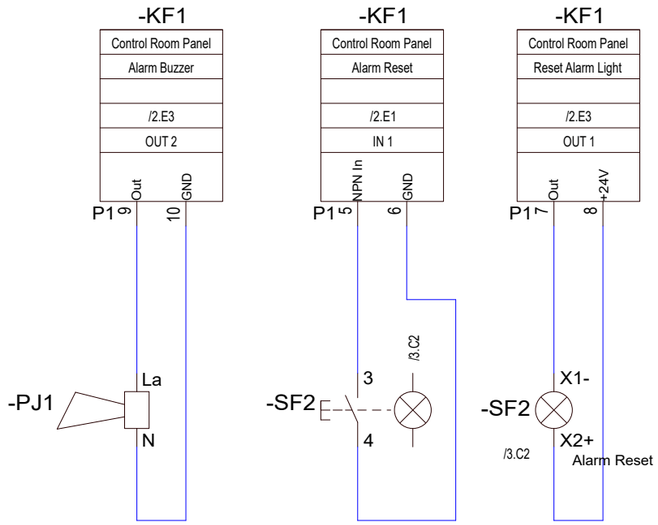
Alarm Buzzer

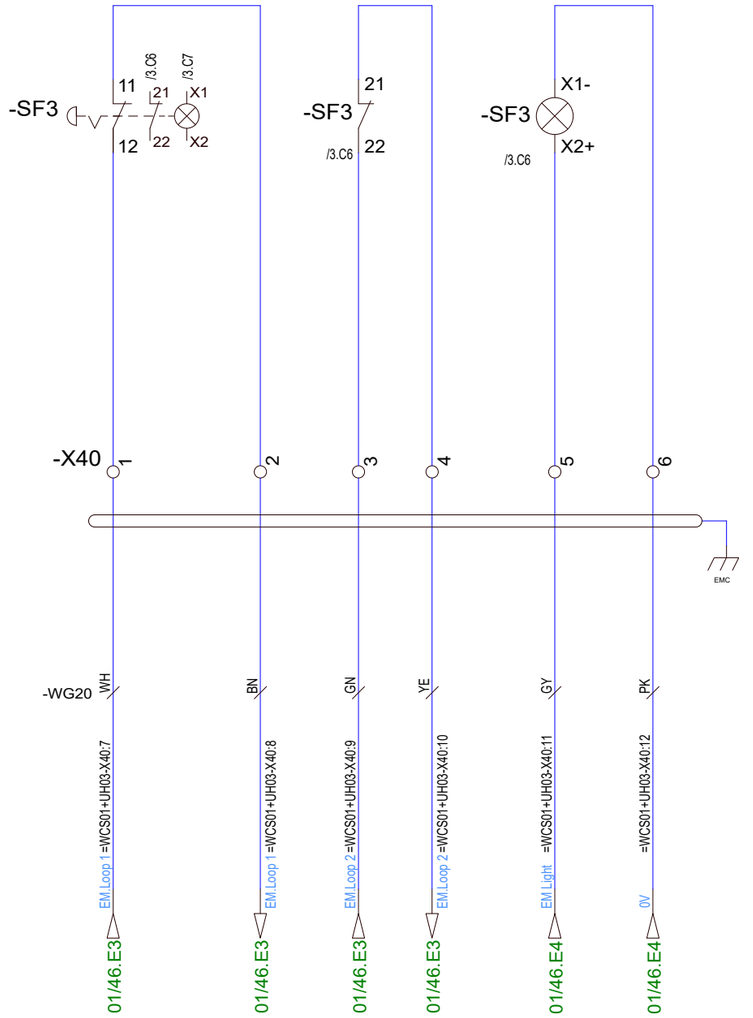
Alarm Reset Switch

Alarm Light

Emergency Stop Loop

Emergency Stop Light





				Date	17/11-2021	CNP Freire MBari		AFT Control Station Panel Winches Panel PC, 1 Joystick	400186798	=CP03	
				User	GSK					+CP03	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Rev. I	Sheet 3 / Next 1

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Emergency stop

-SF3

-PH1
DuraPANEL 12.1"

-KF1
Active
In opr.
Alarm
Em. stop

PAY OUT
HAUL IN

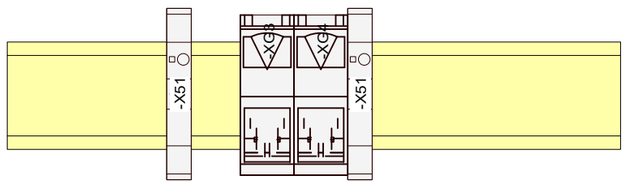
-SF1

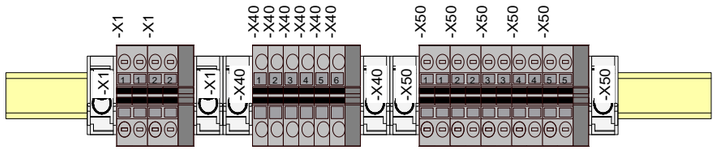
-XG2 -XG1

-AF2
=CP03
35x12 Blue

-AF4
MACGREGOR
65x25 MCG

-SF2 -PJ1





-X1 DEK 5 FWZ 1-10
-X40 DEK 5 FWZ 1-10
-X50 DEK 5 FWZ 1-10

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel Winches Panel Layout	400186798	=CP03
				User	GSK					+CP03
				Approved	RAJ				10070-10 GA	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 4

8E590EA796A34668A4F8439EFF11211F

Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
+CP03-WF1	Patch Cord 0.5M	=CP03-XG3	+CP03	=CP03-PH1	+CP03		5
+CP03-WF2	Patch Cord 0.5M	=CP03-XG4	+CP03	=CP03-XG1	+CP03		5
+CP03-WF3	USB 2.0 Cable A-A M/M 1m	=CP03-PH1	+CP03	=CP03-XG2	+CP03		5

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel Winches Cable list	400209341	=CP03 +CP03
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK					
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ				10070-10 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 4 Next 23

Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
+CP03-WF1	Patch Cord 0.5M RJ45	=CP03-XG3 =CP03-XG3:5	+CP03 10/1.D5	=CP03-PH1 =CP03-XG3:5	+CP03 10/1.D5	
+CP03-WF2	Patch Cord 0.5M RJ45	=CP03-XG4 =CP03-XG4:5	+CP03 10/1.D6	=CP03-XG1 =CP03-XG1:RJ-45	+CP03 10/1.D3	
+CP03-WF3	USB 2.0 Cable A-A M/M 1m USB	=CP03-PH1 =CP03-PH1:USB1	+CP03 10/1.A4	=CP03-XG2 =CP03-XG2:USB	+CP03 10/1.D4	

			Date	17/11-2021	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Termination list
Termination list

400186798

=CP03
+CP03

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8E590EA796A34668A4F8439EFF11211F

=CP03
+CP03

AFT Control Station
Panel PC
w/Network Modules
2000003404

-WF8 DeviceNet Unitronic Thick 1x2xAWG18+1x2xAWG15

+CP04

AFT Control Station
Control Panel
A-Frame Stern
3JS
2000005996

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel A-Frame Stern Control Room Panel	400186799	=CP04	
				User	GSK						
				Approved	RAJ				10070-11 CD	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1

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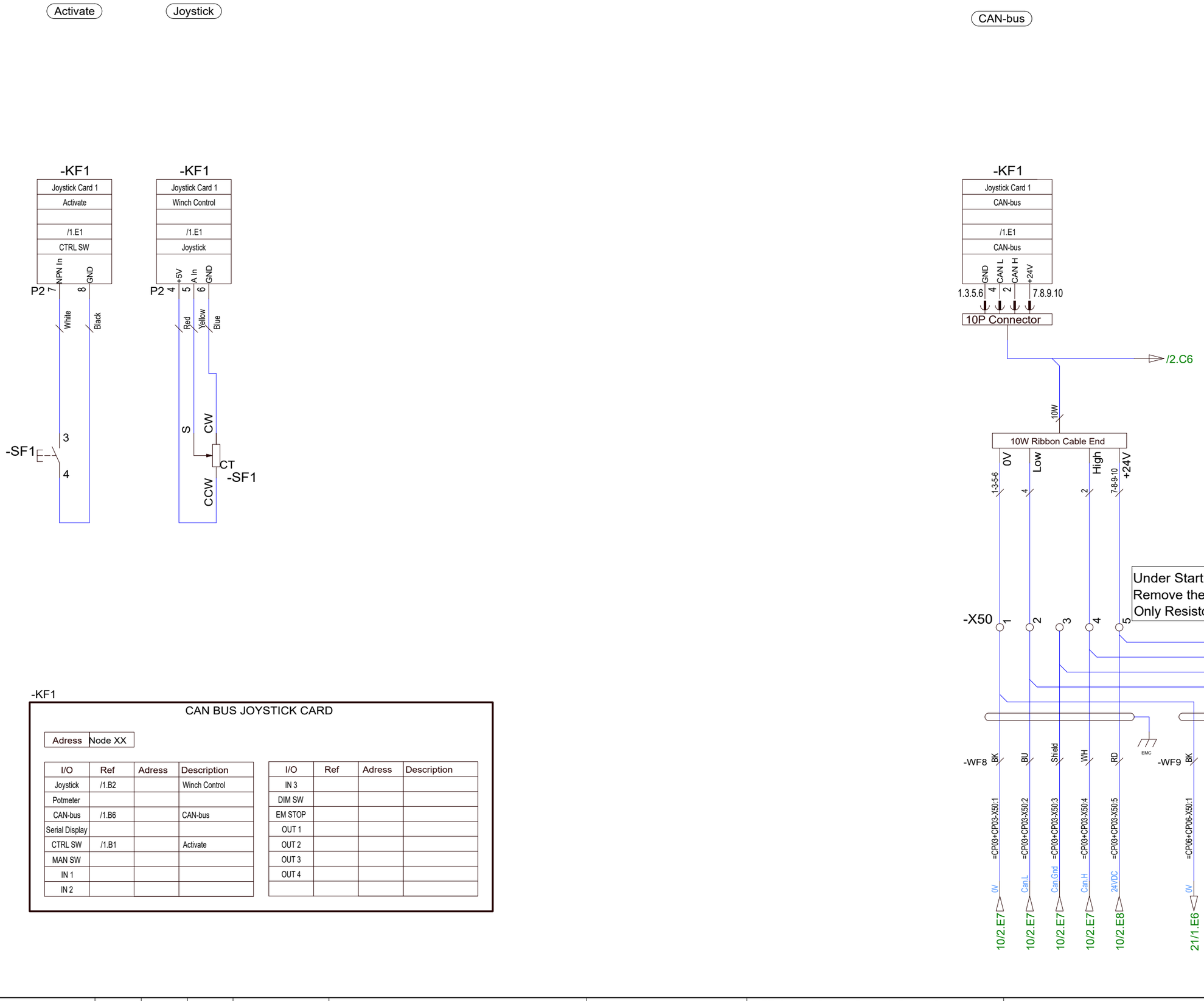

-KF1

CAN BUS JOYSTICK CARD

Adress	Node XX

I/O	Ref	Adress	Description
Joystick	/1.B2		Winch Control
Potmeter			
CAN-bus	/1.B6		CAN-bus
Serial Display			
CTRL SW	/1.B1		Activate
MAN SW			
IN 1			
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1			
OUT 2			
OUT 3			
OUT 4			

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel A-Frame Stern Tilt Control, CAN-bus
				User	GSK			
				Approved	RAJ			
Status	Change	Date	Name	Standard		Version / Index / Repl. by		

400186799 | =CP04 | +CP04

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-KF2

CAN BUS JOYSTICK CARD

Adress	Node XX

I/O	Ref	Adress	Description
Joystick	/2.B2		Winch Control
Potmeter			
CAN-bus	/2.B6		CAN-bus
Serial Display			
CTRL SW	/2.B1		Activate
MAN SW			
IN 1			
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1			
OUT 2			
OUT 3			
OUT 4			

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel A-Frame Stern Winch STBD Control, CAN-bus	400186799	=CP04
				User	GSK					+CP04
				Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-11 CC	Rev. I

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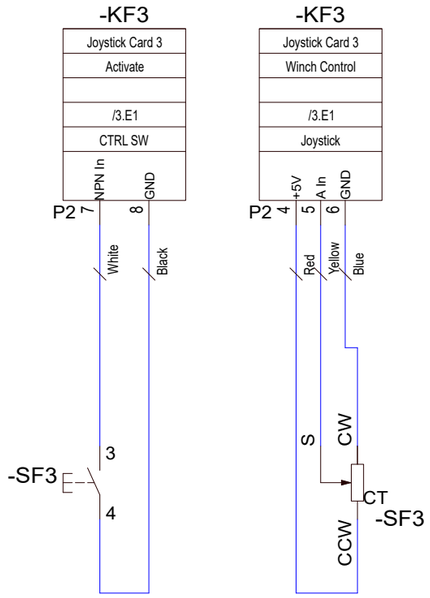
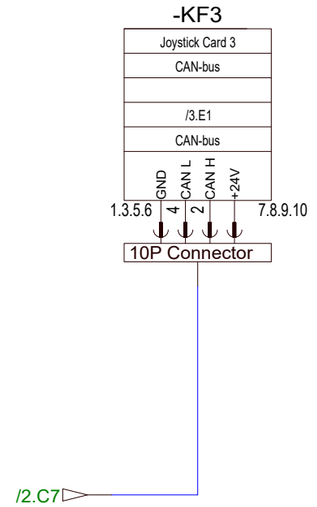
Activate

Joystick

CAN-bus





-KF3

CAN BUS JOYSTICK CARD

Adress	Node XX

I/O	Ref	Adress	Description
Joystick	/3.B2		Winch Control
Potmeter			
CAN-bus	/3.B6		CAN-bus
Serial Display			
CTRL SW	/3.B1		Activate
MAN SW			
IN 1			
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1			
OUT 2			
OUT 3			
OUT 4			

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel A-Frame Stern Winch PORT Control, CAN-bus	400186799	=CP04
				User	GSK					+CP04
				Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-11 CC	Rev. I

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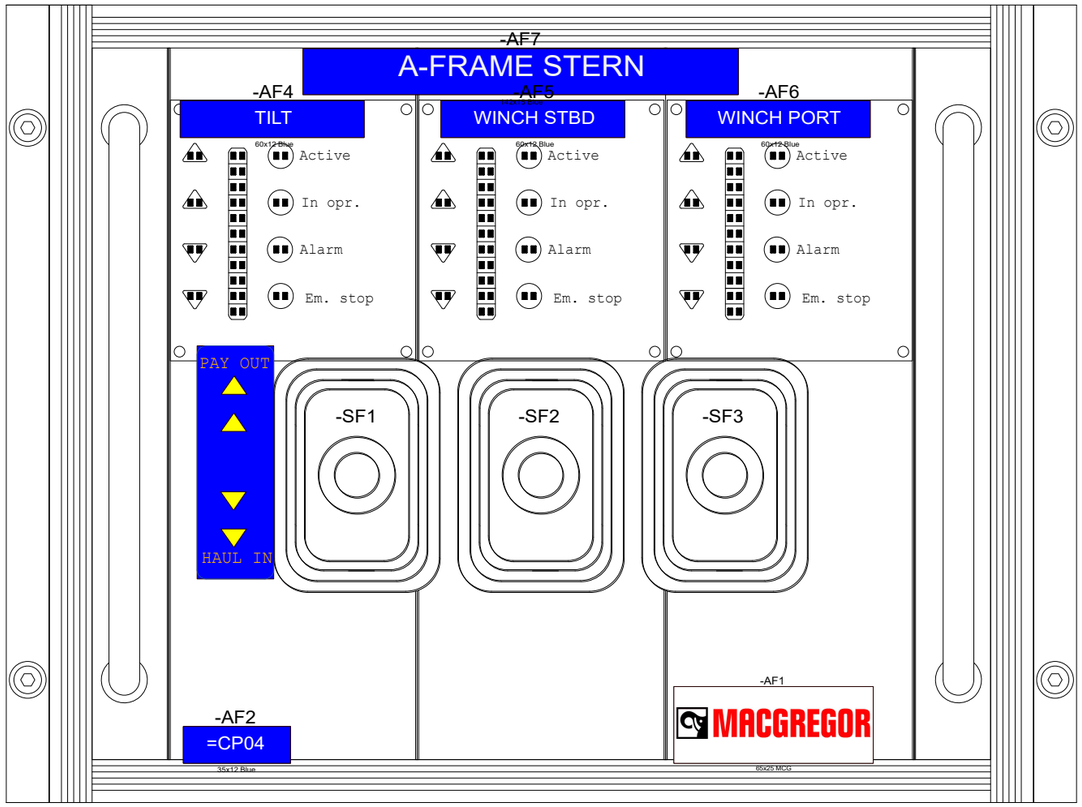

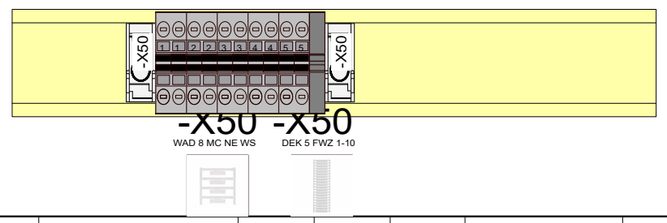

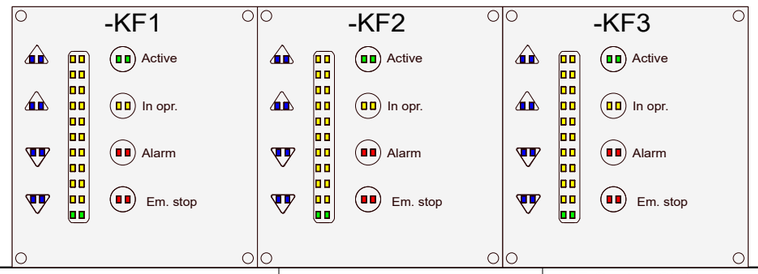

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	AFT Control Station Panel A-Frame Stern Panel Layout	400186799	=CP04
				User	GSK					+CP04
				Approved	RAJ				10070-11 GA	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 1

Yard Connections

Internal Connections

=WCS01
+UH03

Main VFD Cabinet
Pentagon
Brake HPU
Gear Cooling HPU

-WG24 FD CP (TP) plus 4x2x0.75

-WD26 2YSLCY-JB BK 4G1.5

-WD27 2YSLCY-JB BK 4G1.5

Brake HPU

+UC01

HPU Brake
Connection Box

-UB1 -WG1 Valve Cable 3x0.75+PE

-BZ1
Level & Temp Switch

-UB2 -WG2 M12 Plugg & Cable

-BP1
Pressure
Transmitter/Pressostat

M
3~

-MA1
HPU Motor
3kW
6,5A
400V/50Hz

M
3~

-MA2
HPU Motor
3kW
6,5A
400V/50Hz

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Brake HPU System Brake HPU System	NA	=HPUBR01	
				User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-16 CD	Rev. I

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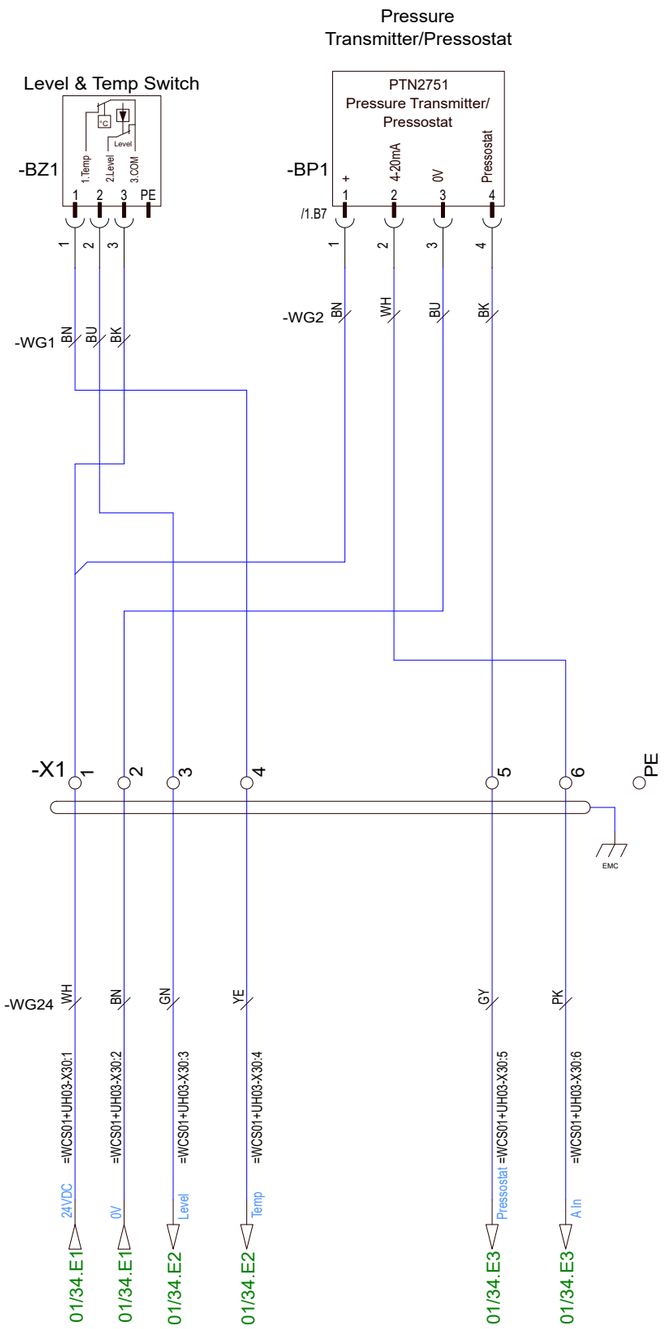
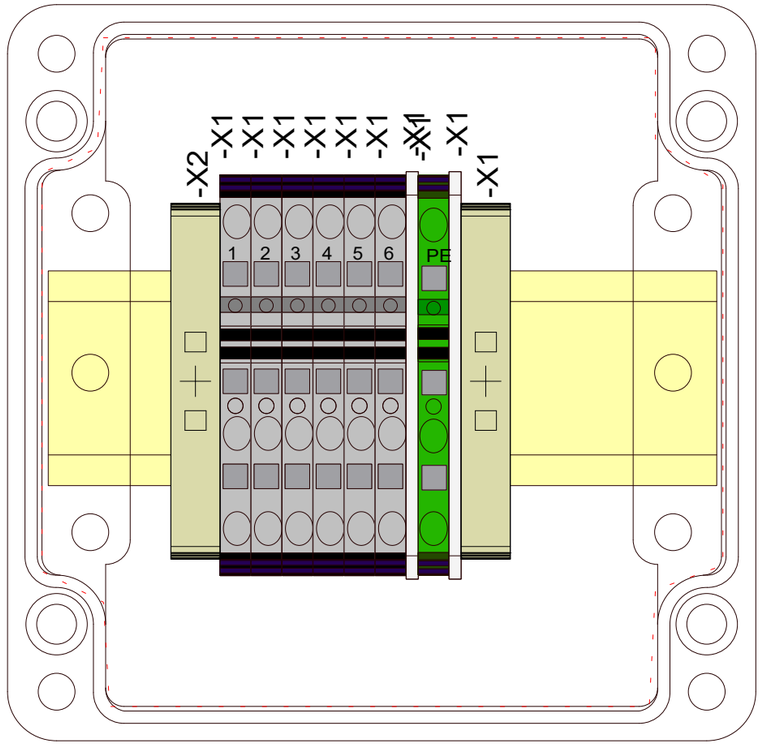
Next 1

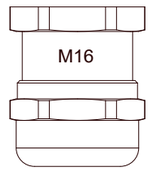


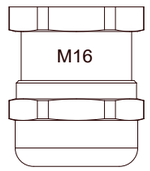
				Date	17/11-2021	CNP Freire	MACGREGOR	Brake HPU System	NA	=HPUBR01
				User	GSK	MBari		HPU Brake, Connection Box		+UC01
				Approved	RAJ				10070-16 CC	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 1



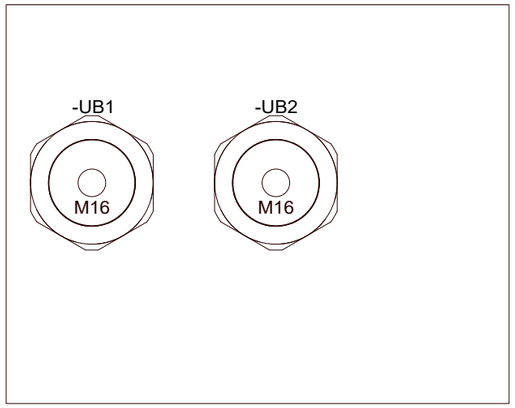
-X1
WAD 8 MC NE WS

-X1
DEK 5 FWZ 1-10





-UB1 -UB2



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Brake HPU System HPU Brake, Connection Box	NA	=HPUBR01	
				User	GSK					+UC01	
				Approved	RAJ				10070-16 GA	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 2

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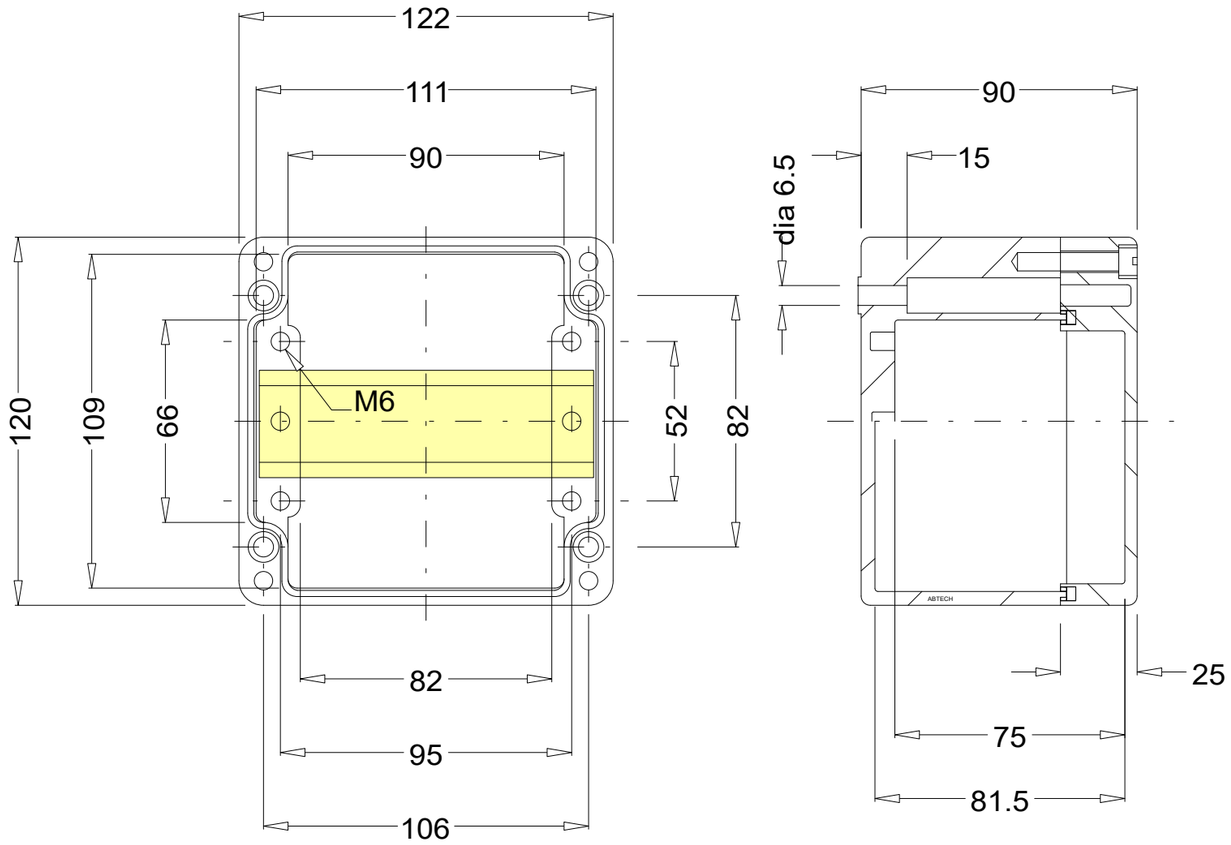

				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Brake HPU System HPU Brake, Connection Box	NA	=HPUBR01	
				User	GSK					+UC01	
				Approved	RAJ				10070-16 GA	Rev. I	Sheet 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 5

8E590EA796A34668A4F8439EFF11211F

Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WG1	Valve Cable 3x0.75+PE	=HPUBR01	+UC01	=HPUBR01-BZ1	+UC01		6,5
-WG2	M12 Plugg & Cable	=HPUBR01-X1	+UC01	=HPUBR01-BP1			6,5

				Date	17/11-2021
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

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MBari

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MACGREGOR

Brake HPU System
Cable list

400209341

=HPUBR01

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG1	Valve Cable	=HPUBR01	+UC01	=HPUBR01-BZ1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=HPUBR01-WG1:1	16/1.B2	=HPUBR01-X1:4	16/1.D2	
	BU	=HPUBR01-WG1:2	16/1.B2	=HPUBR01-X1:3	16/1.D2	
	BK	=HPUBR01-WG1:3	16/1.B2	=HPUBR01-X1:1	16/1.D2	
	GNYE					
-WG2	Cable For M12 Pluggs	=HPUBR01-X1	+UC01	=HPUBR01-BP1		
	BN	=HPUBR01-X1:1	16/1.D2	=HPUBR01-WG2:1	16/1.B3	
	WH	=HPUBR01-X1:6	16/1.D3	=HPUBR01-WG2:2	16/1.B3	
	BU	=HPUBR01-X1:2	16/1.D2	=HPUBR01-WG2:3	16/1.B3	
	BK	=HPUBR01-X1:5	16/1.D3	=HPUBR01-WG2:4	16/1.B3	

				Date	17/11-2021
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

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MBari

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MACGREGOR

Termination list
Termination list

NA

=HPUBR01

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Yard Connections

Internal Connections

Gear Cooling

=WCS01
+UH03

Main VFD Cabinet
Pentagon
Brake HPU
Gear Cooling HPU

-WG25 FD CP (TP) plus 4x2x0.75

-WD28 2YSLCYK-JB 3x2.5+3x0.5

-WD29 2YSLCYK-JB 3x2.5+3x0.5

+UC01

HPU Motor Cooling
Connection Box

-UB1 -WG1 Valve Cable 3x0.75+PE → -BZ1 Level & Temp Switch

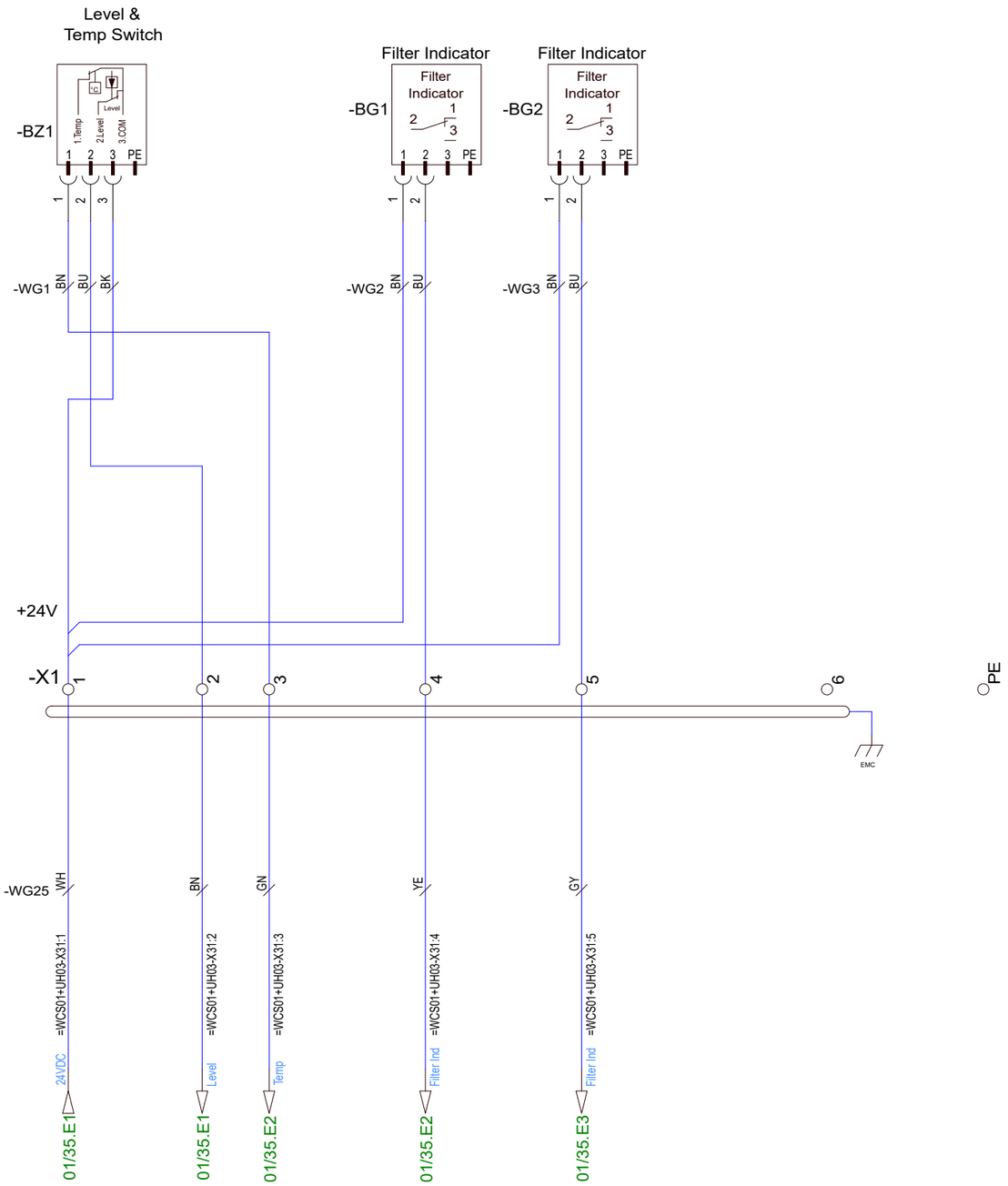
-UB2 -WG2 Valve Cable 3x0.75+PE → -BG1 Filter Indicator

-UB3 -WG3 Valve Cable 3x0.75+PE → -BG2 Filter Indicator

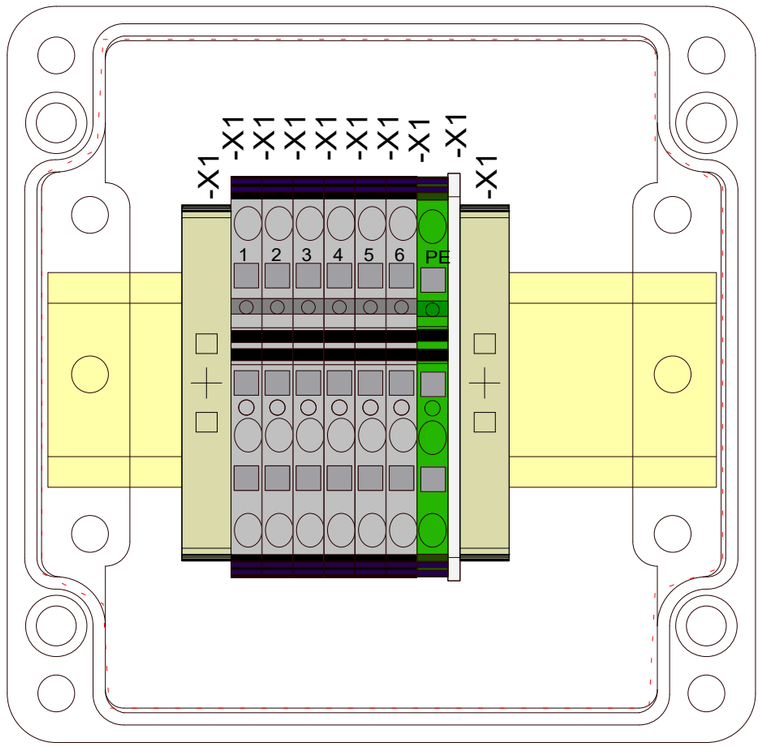
M 3~ -MA1
HPU Motor
1,5kW
3,5A
400V/50Hz

M 3~ -MA2
HPU Motor
1,5kW
3,5A
400V/50Hz

				Date	17/11-2021	CNP Freire MBari		MACGREGOR	Gear Cooling HPU System Gear Cooling HPU System	NA	=HPUGC01
				User	GSK						
				Approved	RAJ					10070-17 CD	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Sheet 1 / Next 1



				Date	17/11-2021	CNP Freire MBari		Gear Cooling HPU System HPU Gear Cooling Connection Box	NA	=HPUGC01	
				User	GSK					+UC01	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-17 CC Rev. I	Sheet 1 Next 1

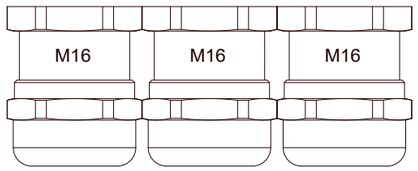


-X1

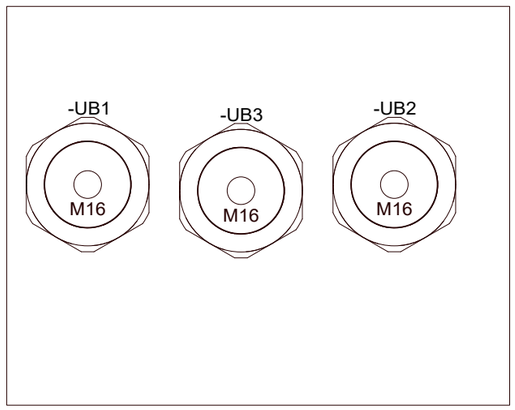
WAD 8 MC NE WS

-X1

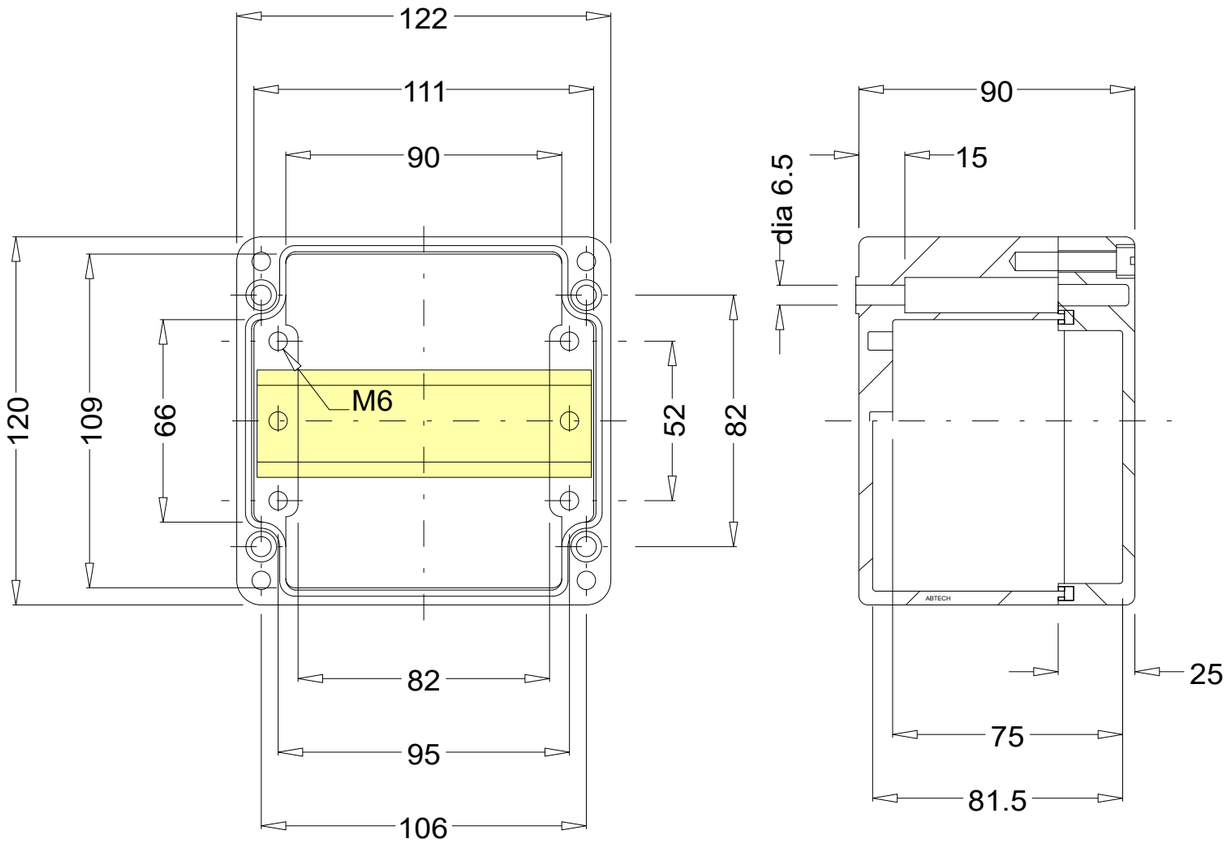
DEK 5 FWZ 1-10



-UB1-UB2-UB3



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Gear Cooling HPU System HPU Gear Cooling Connection Box	NA	=HPUGC01	
				User	GSK					+UC01	
				Approved	RAJ				10070-17 GA	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 2



				Date	17/11-2021	CNP Freire MBari		MACGREGOR	Gear Cooling HPU System HPU Gear Cooling Connection Box	NA	=HPUGC01
				User	GSK						+UC01
				Approved	RAJ					10070-17 GA	Rev. I
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Sheet 2 / Next 6

8E590EA796A34668A4F8439EFF11211F

Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
-WG1	Valve Cable 3x0.75+PE	=HPUGC01-BZ1		=HPUGC01-X1	+UC01		6,5
-WG2	Valve Cable 3x0.75+PE	=HPUGC01-BG1		=HPUGC01-X1	+UC01		6,5
-WG3	Valve Cable 3x0.75+PE	=HPUGC01-BG2	+UC01	=HPUGC01	+UC01		6,5

				Date	17/11-2021
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Gear Cooling HPU System
Cable list

400209341

=HPUGC01

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
-WG1	Valve Cable	=HPUGC01-BZ1		=HPUGC01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=HPUGC01-WG1:1	17/1.B2	=HPUGC01-X1:3	17/1.D2	
	BU	=HPUGC01-WG1:2	17/1.B2	=HPUGC01-X1:2	17/1.D2	
	BK	=HPUGC01-WG1:3	17/1.B2	=HPUGC01-X1:1	17/1.D2	
	GNYE					
-WG2	Valve Cable	=HPUGC01-BG1		=HPUGC01-X1	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=HPUGC01-WG2:1	17/1.B3	=HPUGC01-X1:1	17/1.D2	
	BU	=HPUGC01-WG2:2	17/1.B3	=HPUGC01-X1:4	17/1.D3	
	BK					
	GNYE					
-WG3	Valve Cable	=HPUGC01-BG2	+UC01	=HPUGC01	+UC01	Cable shield to be connected in both ends of the cable. Connectio by 360* connection to ground
	BN	=HPUGC01-X1:1	17/1.D2	=HPUGC01-WG3:1	17/1.B3	
	BU	=HPUGC01-WG3:2	17/1.B3	=HPUGC01-X1:5	17/1.D3	
	BK					
	GNYE					

			Date	17/11-2021	CNP Freire MBari
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

Version	Index	Repl. by

MACGREGOR

Termination list
Termination list

NA

=HPUGC01

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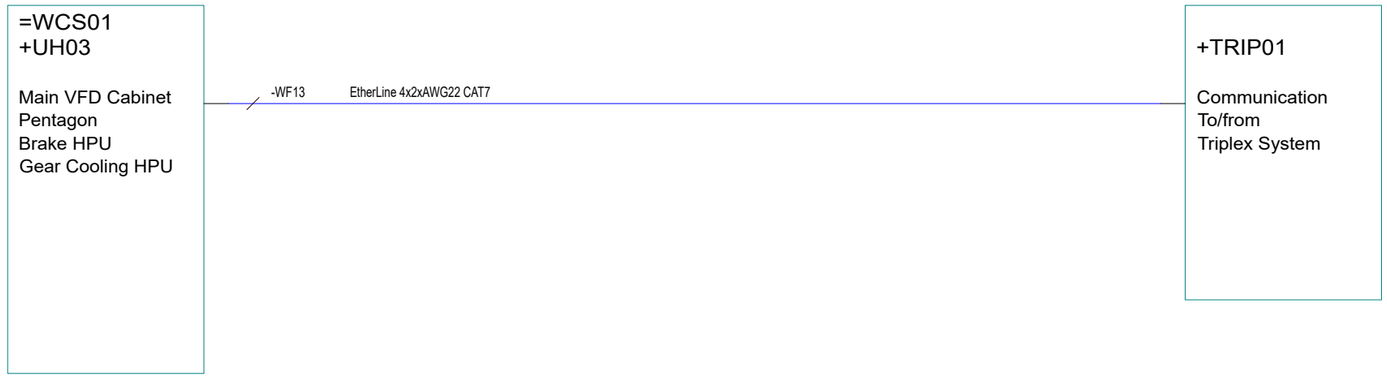
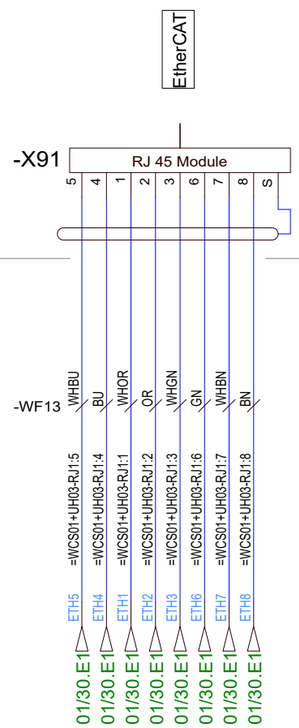


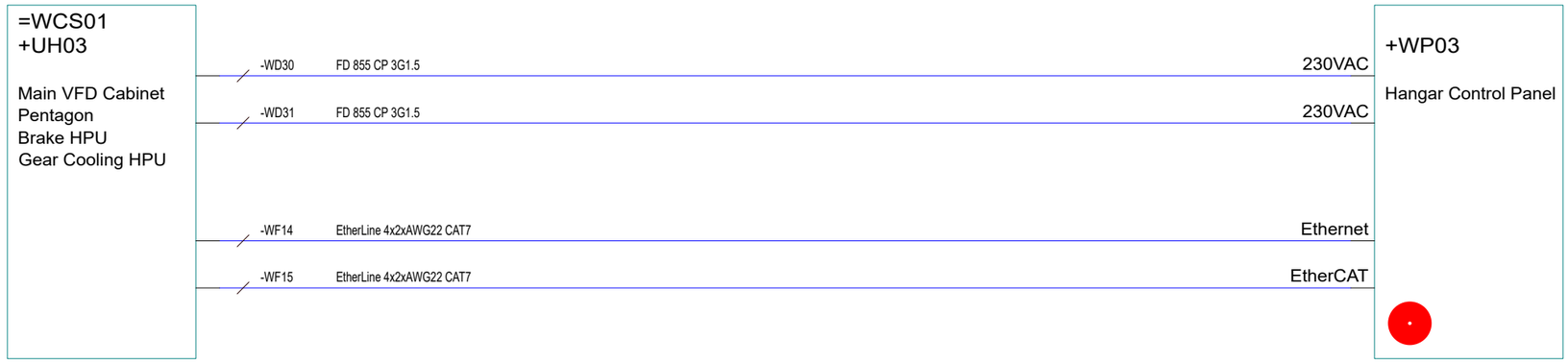
				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Connections To Triplex System Triplex System	NA	=TRIP01	
				User	GSK						
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-18 CD Rev. I	Sheet 1 Next 1

to TRIPLEX Handling System

=A-FRAME STERN
+B11
Control Cabinet



				Date	17/11-2021	CNP Freire MBari	MACGREGOR	Signal Connections Systems Connection EtherCAT to TRIPLEX	NA	=TRIP01	
				User	GSK					+Signal	
	Updated acc. Triplex drawings	28.11.2022	ANP	Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-18 CC	Rev. I	Sheet 1 / Next 1



= Emergency stop button

Cables Supplied & Connected by Customer
Cables Supplied & Connected by MacGregor

				Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel Cable Diagram	400209341	=WP03	
				User	ANP						
	Added WP03	21.11.2022	ANP	Approved	TR				10070-19 CD	Rev. I	Sheet 1
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8E590EA796A34668A4F8439EFF11211F

Panel Heater

Power Supply 230VAC

24V /2.A1

0V /2.A1

-EB1

1 2 PE

-TA1

V+ V-

5A

24VDC

230VAC

ETH

L N GND

-X300 1 2 PE

EMC

-WD31 1 2 GNYE

HTZ30:L1 =WCS01+UH03-X302:5

HTZ30:L2 =WCS01+UH03-X302:6

=WCS01+UH03-X302:PE

PE

01/27.E7

01/27.E8

01/27.E8

-X1 1 2 PE

EMC

-WD30 1 2 GNYE

230V:L2 =WCS01+UH03-X2:3

230V:L1 =WCS01+UH03-X2:4

=WCS01+UH03-X2:PE

PE

01/26.E2

01/26.E2

01/26.E2

				Date	21.11.2022	CNP Freire MBari		Hangar Control Panel Supply and Heating Circuit Diagram	400209341	=WP03	
				User	ANP					+WP03	
	Added WP03	21.11.2022	ANP	Approved	TR						
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-19 CC	Rev. I	Sheet 1 / Next 2

MACGREGOR

8E590EA796A34668A4F8439EFF11211F

PLC Supply

Emergency stop

Touch Operator Panel

/1.A8 24V -TA1:V+

/1.A8 0V -TA1:V-

-XG3 ' +

-KF1	-KF1
PLC	PLC
/3.B2	/3.B2
Coupler Supply	Power Contacts
+	- + - PE

-KF7	-KF7	-KF5
Control Panel	Control Panel	Control Panel
Emergency Stop	Emergency Stop	Emergency Stop Light
/3.C5	/3.C5	/3.B6
I1	I2	Out 1
1 Input + 2 Input -	5 Input + 6 Input -	1

11 12 -SF1.1

21 22 -SF1.2

-SF1 X2+ Red X1-

24V /4.A1

0V /4.A1

-XG3 ' +

-PH1

+1 -2 RJ45 RJ45 RJ45/ 1Gbit Serial USB2 USB1 EXP 2 EXP 1

RJ1-RJ2

Pair	T568B	Pin
2	Orange/White	1
2	Orange	2
3	Green/White	3
1	Blue	4
1	Blue/White	5
3	Green	6
4	Brown/White	7
4	Brown	8
Screen	Screen	S

Patch Cord 0.5M -WF1

Ethernet WCS01

-RJ1 RJ 45 Module 5 4 1 2 3 6 7 8 S

-WF14 WHBU BU WHOR OR WHGN GN WHBN BN

-RJ8:5 -RJ8:4 -RJ8:1 -RJ8:2 -RJ8:3 -RJ8:6 -RJ8:7 -RJ8:8

ETH5 ETH4 ETH1 ETH2 ETH3 ETH6 ETH7 ETH8

01/30.E2 01/30.E2 01/30.E3 01/30.E3 01/30.E3 01/30.E3 01/30.E3 01/30.E3

=WCS01
+UH03

-KF1:X1 EtherCAT /3.C1

Patch Cord 0.5M -WF2

EtherCAT WCS01

-RJ2 RJ 45 Module 5 4 1 2 3 6 7 8 S

-WF15 WHBU BU WHOR OR WHGN GN WHBN BN

-RJ2:5 -RJ2:4 -RJ2:1 -RJ2:2 -RJ2:3 -RJ2:6 -RJ2:7 -RJ2:8

ETH5 ETH4 ETH1 ETH2 ETH3 ETH6 ETH7 ETH8

01/30.E1 01/30.E2 01/30.E2 01/30.E2 01/30.E2 01/30.E2 01/30.E2 01/30.E2

			Date	21.11.2022	CNP Freire
			User	ANP	MBari
	Added WP03	21.11.2022	Approved	TR	MACGREGOR
Status	Change	Date	Standard		Version / Index / Repl. by

Hangar Control Panel
PLC Supply, Emergency Stop & Touch Panel
Circuit Diagram

400209341

=WP03
+WP03

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-KF1

EK1101

ID switch

Coupler Supply	Power Contacts
/2.B2	/2.B2

X1 X2

/2.C8 EtherCAT -RJ2 -WF2 Patch Cord 0.5M

-KF2

EL1008

8 Digital Inputs

DI	Ref	Adress	Description
I1	/4.B1		Selector
I2	/4.B2		Activate
I3	/5.B1		Float / Lock
I4	/5.B2		Float / Lock
I5	/5.B2		Twist CCW
I6	/5.B3		Twist CW
I7	/5.B3		Swing Left
I8	/5.B4		Swing Right

-KF3

EL1008

8 Digital Inputs

DI	Ref	Adress	Description
I1	/5.B4		Selector
I2	/5.B5		Activate
I3	/6.B1		Float / Lock
I4	/6.B2		On/Off
I5	/6.B2		Selector
I6	/6.B3		Activate
I7	/7.B1		On/Off
I8	/7.B2		Swich

-KF4

EL1008

8 Digital Inputs

DI	Ref	Adress	Description
I1	/7.B3		Swich
I2	/7.B4		Activate
I3	/7.B6		Switch
I4			
I5			
I6			
I7			
I8			

-KF5

EL2008

8 Digital Outputs

Outputs	Ref	Adress	Description
Out 1	/2.B4		Emergency Stop Light
Out 2	/7.B2		Indication
Out 3	/7.B3		Indication
Out 4	/7.B4		Indication
Out 5	/7.B6		Indication
Out 6			
Out 7			
Out 8			

-KF6

EL3255

5-Ch Input Potentiometer

A-In	Ref	Adress	Description
Pot 1	/4.B2		Joystick
Pot 2	/5.B5		Joystick
Pot 3	/6.B3		Joystick
Pot 4	/7.B5		Joystick
Pot 5	/7.B7		Adjustment

-KF7

EL1904

4 Digital Inputs

Adress	

I/O	Ref	Adress	Description
I1	/2.B3		Emergency Stop
I2	/2.B4		Emergency Stop
I3			
I4			

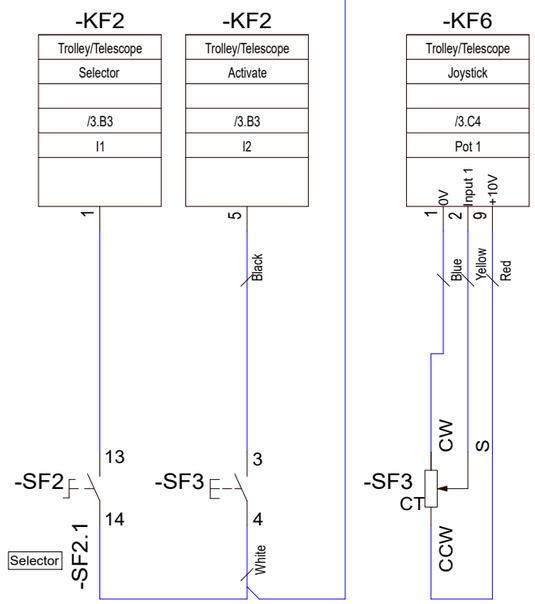
-KF8

Bus End Cover

				Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel PLC & I/Os Circuit Diagram	400209341	=WP03	
				User	ANP					+WP03	
	Added WP03	21.11.2022	ANP	Approved	TR				10070-19 CC	Rev. I	Sheet 3
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 4

Function Selection | Activate | Joystick

/2.A8 24V → 24V /5.A1
/2.A8 0V → 0V /5.A1



				Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel Trolley/Telescope Control Circuit Diagram	400209341	=WP03	
	As-Build update	30.01.2023	ANP	User	ANP					+WP03	
	Added WP03	21.11.2022	ANP	Approved	TR						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Rev. I	Sheet 4 / Next 5

Lock | Lock | Twist | Swing | Function Selection | Activate | Joystick

/4.A8 24V
/4.A8 0V

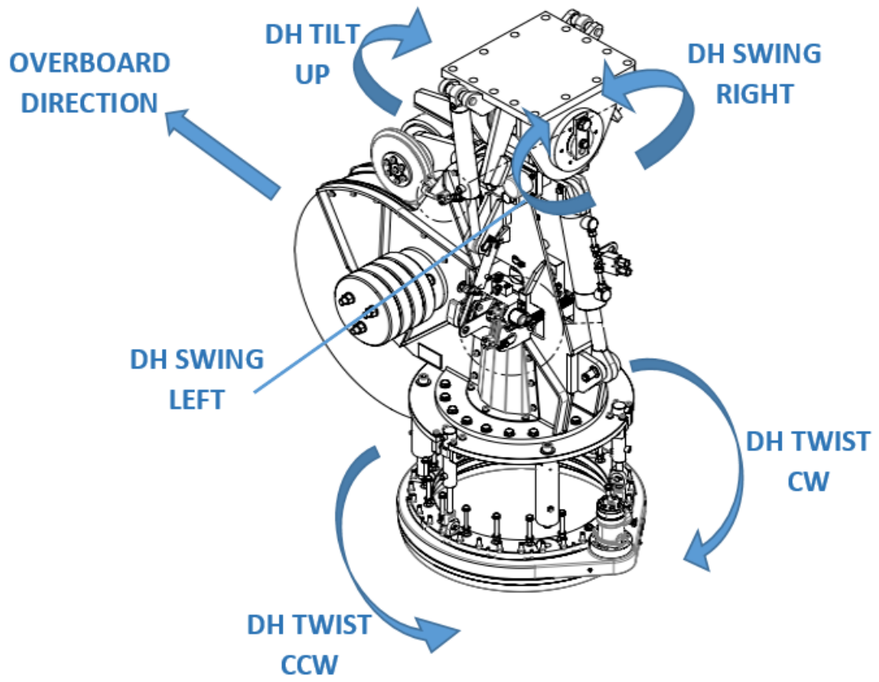
24V /6.A1
0V /6.A1

-KF2	-KF2	-KF2	-KF2	-KF2	-KF2	-KF3	-KF3
DH Tilt	DH Swing	DH Twist	DH Twist	DH Swing	DH Swing	Tilt/DH Tilt	Tilt/DH Tilt
Float / Lock	Float / Lock	Twist CCW	Twist CW	Swing Left	Swing Right	Selector	Activate
/3.B3	/3.B3	/3.B3	/3.B3	/3.B3	/3.B3	/3.B4	/3.B4
I3	I4	I5	I6	I7	I8	I1	I2
2	6	3	7	4	8	1	5

-KF6
Tilt/DH Tilt
Joystick
/3.C4
Pot 2
4 0V
5 Input 2
12 +10V
Blue
Yellow
Red

-SF4 13 14 -SF4.1 Float/Lock
-SF5 13 14 -SF5.1 Float/Lock
-SF6.2 23 24
-SF6 13 14 -SF6.1
-SF7.2 23 24
-SF7 13 14 -SF7.1
-SF8 13 14 -SF8.1 Selector
-SF9 3 4 White
Black

-SF9 CT
CW
S
CCW



				Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel Tilt/DH Tilt Control Circuit Diagram	400209341	=WP03 +WP03
	As-Build update	30.01.2023	ANP	User	ANP					
	Added WP03	21.11.2022	ANP	Approved	TR					
Status	Change	Date	Name	Standard		Version	Index	Repl. by		

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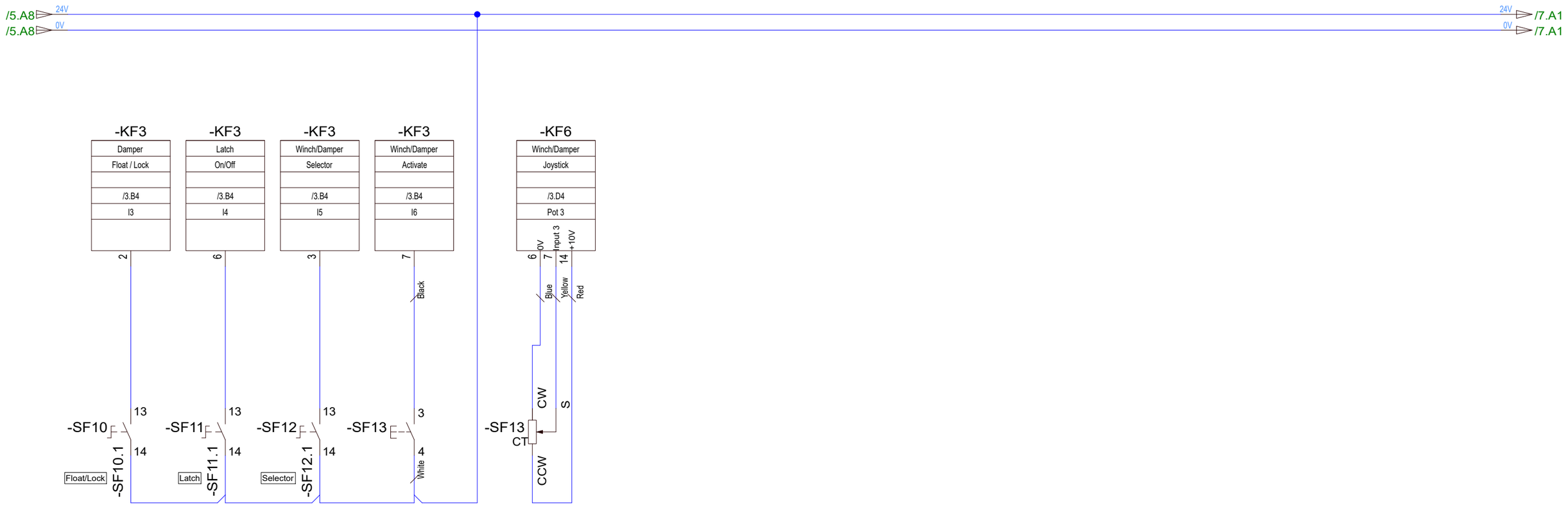
Lock | Latch | Function Selection | Activate | Joystick



				Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel Winch/Damper Control Circuit Diagram	400209341	=WP03 +WP03
	As-Build update	30.01.2023	ANP	User	ANP					
	Added WP03	21.11.2022	ANP	Approved	TR				10070-19 CC	Rev. I
Status	Change	Date	Name	Standard		Version / Index / Repl. by				Sheet 6 / Next 7

Light | Outhauler | CT Follow LARS | Activate | Joystick | Tension Activate | Tension Adjustment

/6.A8 24V
/6.A8 0V

-KF3	-KF5	-KF3	-KF5	-KF4	-KF5	-KF4
Light	Light	Outhauler	Outhauler	CT Follow LARS	CT Follow LARS	ROV Winch
On/Off	Indication	Swich	Indication	Swich	Indication	Activate
/3.B4	/3.B6	/3.B4	/3.B6	/3.B5	/3.B6	/3.B5
I7	Out 2	I8	Out 3	I1	Out 4	I2
4	5	8	2	1	6	5

-SF14 x2+ x1- /7.C2
-SF15 x2+ x1- /7.C3
-SF16 x2+ x1- /7.C4
Black

-SF14 I3 I1 II3 II1 x1- /7.C2 I4 I2 II4 II2 x2+
-SF15 I3 I1 II3 II1 x1- /7.C3 I4 I2 II4 II2 x2+
-SF16 I3 I1 II3 II1 x1- /7.C3 I4 I2 II4 II2 x2+
-SF17 3 4 White

-KF6
ROV Winch
Joystick
/3.D4
Pot 4
3

0V 10 Input 4 11 +10V
Blue Yellow Red
-SF17 CT CW S CCW

-KF4	-KF5
Tension Activate	Tension Activate
Switch	Indication
/3.B5	/3.B6
I3	Out 5
2	3

-SF18 x2+ x1- /7.C6
-SF18 I3 I1 II3 II1 x1- /7.C6 I4 I2 II4 II2 x2+

-KF6
Tension
Adjustment
/3.D4
Pot 5
8

0V 15 Input 5 16 +10V
Blue Yellow Red
2=S 1=CCW 3=CW -RA1

				Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel ROV Winch Control & Signaling Circuit Diagram
	As-Build update	30.01.2023	ANP	User	ANP			
	Added WP03	21.11.2022	ANP	Approved	TR			
Status	Change	Date	Name	Standard		Version / Index / Repl. by		

400209341 | =WP03 | +WP03
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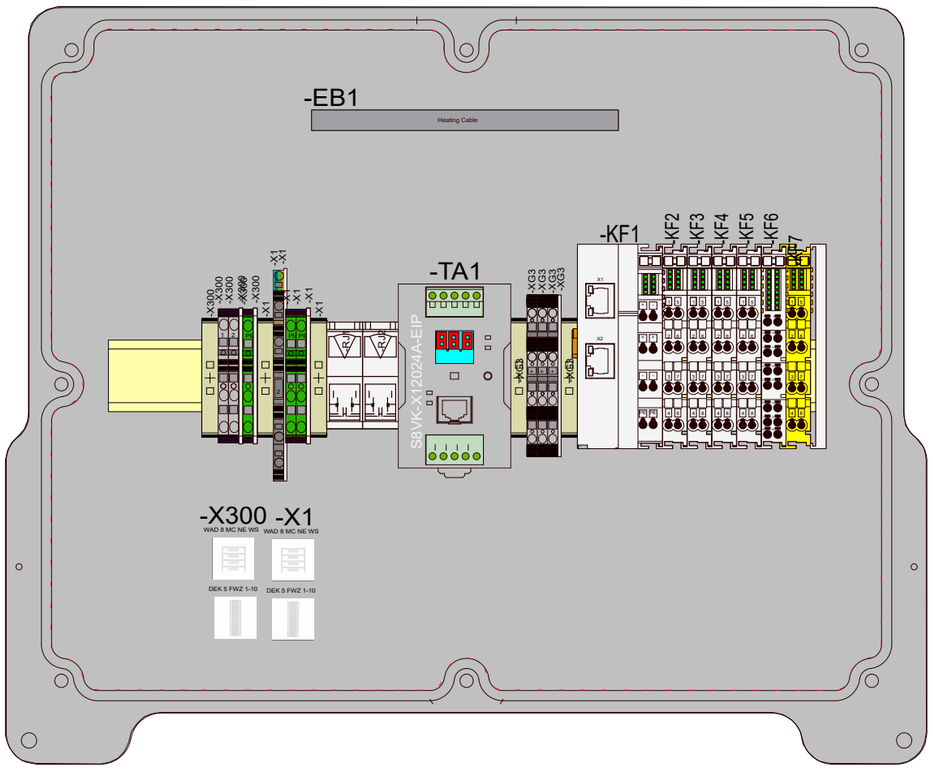
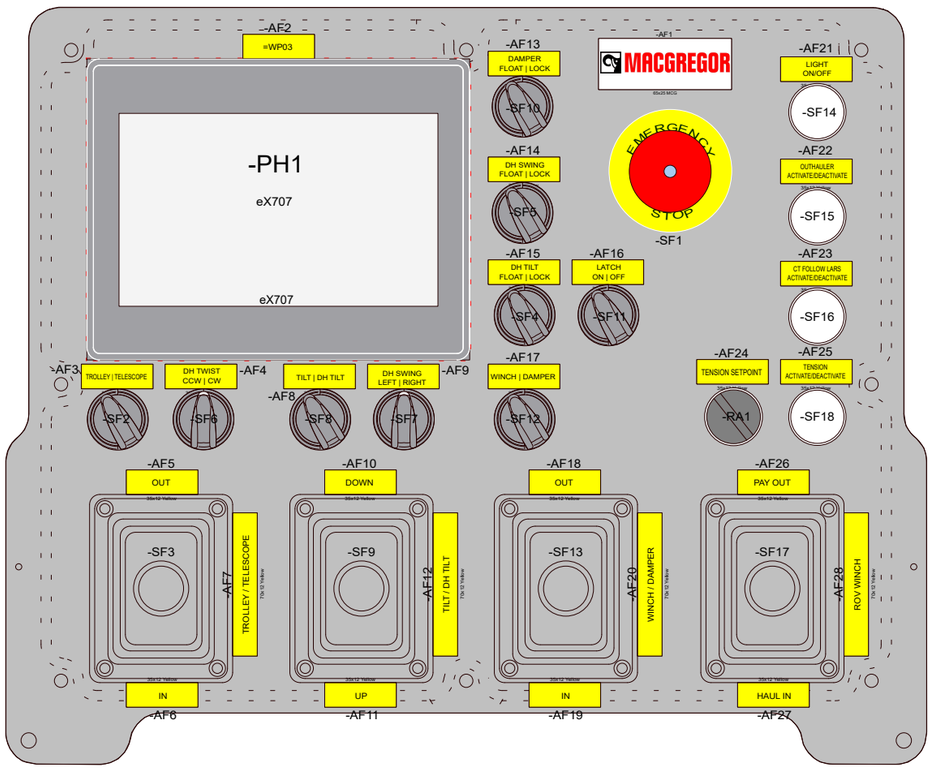
INNER VIEW



FRONT VIEW



NOTE: Dimension Sketch - PLM No. 2000012940

				Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel Panel Layout	400209341	=WP03	
				User	ANP						
	Added WP03	21.11.2022	ANP	Approved	TR					10070-19 GA	Rev. I
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8E590EA796A34668A4F8439EFF11211F

Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-AF1	65x25 MCG	CROMLOGO6	1	Pcs	65x25 Macgregor Logo		
-AF2..-AF6,-AF8..-AF11,-AF13..-AF19,-AF21..-AF27	35x12 Yellow	400090866	23	Pcs	35x12 Yellow Engraved Sign plate		
-AF7,-AF12,-AF20,-AF28	70x12 Yellow	400090867	4	Pcs	70x12 Yellow Engraved Sign plate		
-EB1	Heating Cable 5BTV2-CT 15W/M V/+10GR Assy	RHEACHE032	1	Pcs	Heating Cable 5BTV2-CT 15W/M V/+10GR Assy 60cm	Raychem	EN-RaychemBTVpipefreezeprotection-DS-H51086_tcm432-26253.pdf
-KF1	EK1101	ECPPEB01	1	Pcs	EtherCAT Coupler w ID settings	Beckhoff	Datasheet
-KF2..-KF4	EL1008	ECPPEB04	3	Pcs	8 Digital Inputs	Beckhoff	Datasheet
-KF5	EL2008	ECPPEB06	1	Pcs	8 Digital Outputs	Beckhoff	Datasheet
-KF6	EL3255	ECPPEB16	1	Pcs	5-Ch Input Potentiometer	Beckhoff	Datasheet
-KF7	EL1904	400209336	1	Pcs	4-channel digital input, 24 V DC, TwinSAFE	Beckhoff	Datasheet
-KF8	EL9011	ECPPEB02	1	Pcs	Bus end cap	Beckhoff	
-PH1	eX707	EPECC120	1	Pcs	Exorl 7" Touch Panel	EXOR	Exor\eX700 Series.pdfManual
-RA1	800FP-POT5A 5kohm IP66	EACPO012	1	Pcs	Potensiometre	Allen Bradley	800f-sg001_-en-p.pdf
-RJ1,-RJ2	IE-XM-RJ45/IDC	400090935	2	Pcs	Mounting rail outlet, RJ45, RJ45 module, IP20, Cat.6A	Weidmuller	Datasheet
-SF1	45-2D36.1920	EACSW0047	1	Pcs	E-Stop switch w/light IP69 Ø40mm	EAO	EAO_MC_45_Main-Catalogue_EN.pdf
-SF1	45-320.1E16	400187718	1	Pcs	RED Illumination element 24 VAC/DC	EAO	Datasheet
-SF1	45-2300.1000.000	400187718	1	Pcs	Holder for 3 elements EAO Serie 45	EAO	Datasheet
-SF1	800F-15YE112	400187723	1	Pcs	Emergency Stop Lable Ø60mm	Allen Bradley	800f-sg001_-en-p.pdf
-SF1.1,-SF1.2	45-312.1Z10	400187719	2	Pcs	Switching element NC 10A Front mounting	EAO	Datasheet
-SF2.1,-SF4.1..-SF6.1,-SF6.2,-SF7.1,-SF7.2,-SF8.1,-SF10.1..-SF12.1	800F-X10	EACSW1142	11	Pcs	Contact Element NO	Allen Bradley	800f-sg001_-en-p.pdf
-SF2,-SF4..-SF5,-SF8,-SF10..-SF12	800FP-SM22	EACSW114	7	Pcs	2-Pos Selector Switch 60*Maintained	Allen Bradley	800f-sg001_-en-p.pdf
-SF2,-SF4..-SF8,-SF10..-SF12	800F-ALP	400188392	9	Pcs	Plastic Mounting Latch, Contact Block Holder	Allen Bradley	800f-sg001_-en-p.pdf"
-SF3,-SF9,-SF13,-SF17	Joystick IP68+ w/ Topswitch Short	400212904	4	Pcs	Joystick IP68+ w/Topswitch Short Version		
-SF6,-SF7	800FP-SB32	400090891	2	Pcs	3-Pos Selector Switch, Spring Return	Allen Bradley	800f-sg001_-en-p.pdf

	As-Build New Joy.&Switch Types	18.01.2023	ANP	Date	21.11.2022	CNP Freire MBari	MACGREGOR	Hangar Control Panel Part list	400209341	=WP03
	Updated As-Build	28.11.2022	ANP	User	ANP					
	Added WP03	21.11.2022	ANP	Approved	TR					
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Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-SF14..-SF16,-SF18	10-2112.1069	EACBU014	4	Pcs	Single-Led Diode T5,5 24V White	EAO	Serie 10.pdf
-SF14..-SF16,-SF18	14-132.0252	EACSW000122	4	Pcs	Illuminated pushbutton, IP 67, Momentary 2xNC+2xNO	EAO	Serie 14.pdf
-SF14..-SF16,-SF18	704.600.2	EACSW0002	4	Pcs	Front Protective Ring IP67 (Transparent Silicone/Brass)	EAO	eao_704.600.2_-_Front_protective_ring.pdf
-SF14..-SF16,-SF18	704.602.7	EACSW0003	4	Pcs	Lens Plastic Round Flat (Transparent), W/Difusor & Front Protective ring	EAO	Serie 14.pdf
-SF14..-SF16,-SF18	704.609.9	EACSW0004	4	Pcs	Marking plate for lens round flat (Diffusor)	EAO	Serie 14.pdf
-TA1	S8VK-X12024A-EIP	EACTR034-10	1	Pcs	230/24V 5A Power Supply W/Display	Omron	S8VK-X.pdf
-U1			0,35	M	MOUNT		
-UC1	Console Deck Panel 400x450x340	EACBO401	1	Pcs	400x450x340mm Control Panel BBQ type	Molstad	Dim Sketch
-WF1,-WF2	Patch Cord 0.5M	ECPPE0471-1	2	M	Patch Cord 0.5M		
-X1	ZAP ZDL 2.5	EACPL02149-02	1	Pcs	End Plate For ZDL 2.5 Terminal	Weidmüller	ZAP ZDL2.5.pdf
-X1 (1)	ZDL 2.5/L/L/PE	EACPL021411	1	Pcs	Terminal 2 Tier. +PE	Weidmüller	ZDL 2.5 L-L-PE.pdf
-X1 (PE,PE),-X300 (PE)	ZPE 2.5/3AN	EACPL02025-1	3	Pcs	Terminal	Weidmüller	ZPE 2.5 3AN.pdf
-X1,-X300	DEK 5 FWZ 1-10	EACPL020T1-10	2	Pcs	Terminal No 1-10 (Dekafix)	Weidmüller	DEK 5 FWZ 1-10.pdf
-X1,-X300	WAD 8 MC NE WS	EACPL02150	2	Pcs	End Stop Label plate	Weidmüller	WAD 8 MC NE WS.pdf
-X1,-X300	ZAP/TW 2	EACPL02148	3	Pcs	End Plate For ZDU/ZPE 2.5/3AN Terminals	Weidmüller	ZAP TW 2 DB.pdf
-X1,-X300,-XG3	AEB 35 SC/1	EACPL0202-2	5	Pcs	AEB 35 SC/1 End Bracket	Weidmüller	Datasheet
-X300 (1-2)	ZDU 2.5/3AN	EACPL02140	2	Pcs	Terminal	Weidmüller	ZDU 2.5 3AN.pdf
-XG3	ZAP/TW ZDK2.5	400091997	1	Pcs	End Plate For ZDK2.5 Terminal	Weidmüller	Weidmuller\ZAP TW ZDK2.5.pdf
-XG3 (+,+,+)	ZDK 2.5 +/-	EACPL02055	3	Pcs	Terminal 2 Levels +/- Marking	Weidmüller	ZDK 2.5.pdf

Status	Change	Date	Name	Standard	
	As-Build New Joy.&Switch Types	18.01.2023	ANP	Date	21.11.2022
	Updated As-Build	28.11.2022	ANP	User	ANP
	Added WP03	21.11.2022	ANP	Approved	TR

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Hangar Control Panel
Part list

400209341

=WP03

10070-19 PL

Rev. I

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Cable	Cable type	Connection A Item designation	Location	Connection B Item designation	Location	Comment	OD mm.
+WP03-WF1	Patch Cord 0.5M	=WP03-PH1	+WP03	=WP03-RJ1	+WP03		5
+WP03-WF2	Patch Cord 0.5M	=WP03-KF1	+WP03	=WP03-RJ2	+WP03		5

			Date	17/11-2021	
	Updated Cables after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Hangar Control Panel
Cable list

400209341

=WP03
+WP03

10070-19 Rev. I

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Cable	Cable type Core	Connection A Item designation	Location	Connection B Item designation	Location	Instruction
+WP03-WF1	Patch Cord 0.5M RJ45	=WP03-PH1	+WP03	=WP03-RJ1	+WP03	
+WP03-WF2	Patch Cord 0.5M RJ45	=WP03-KF1	+WP03	=WP03-RJ2	+WP03	

			Date	17/11-2021	
	Updated Term. after CP02 removed	28.11.2022	ANP	User	GSK
	Updated after adding WP03	21.11.2022	ANP	Approved	RAJ
Status	Change	Date	Name	Standard	

CNP Freire
MBari

Version	Index	Repl. by

MACGREGOR

Hangar Control Panel
Termination list

400209341

=WP03
+WP03

10070-19 Rev. I

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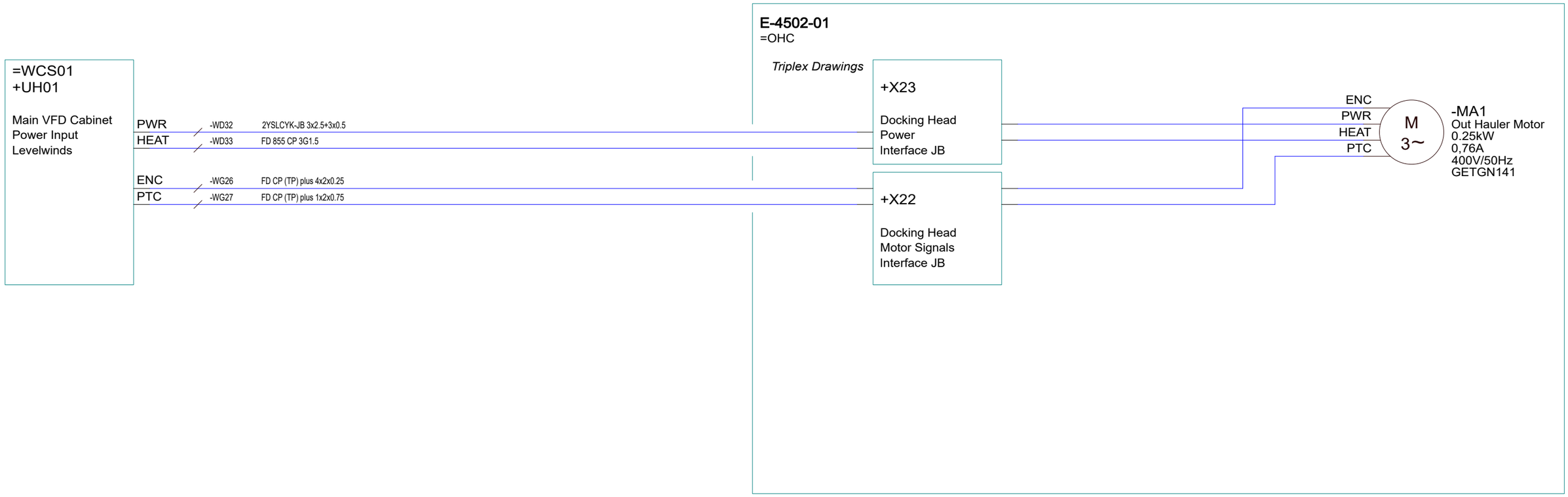
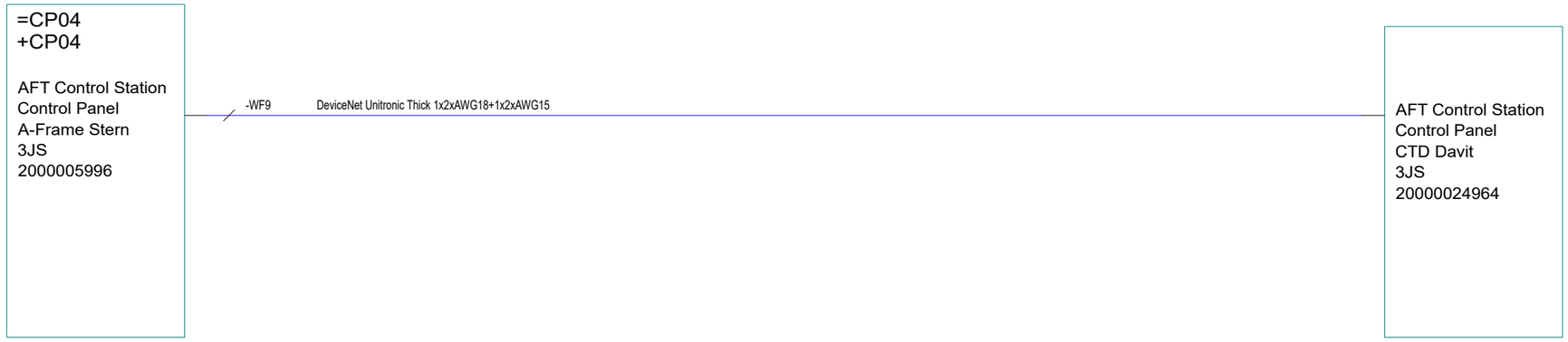
Next 1



				Date		CNP Freire		Overhead Crane Outhauler Motor	NA	=OHC	
				User		MBari					
				Approved							
Status	Change	Date	Name	Standard		Version	Index	Repl. by		10070-20 CD	Rev. I	Sheet 1 / Next 1

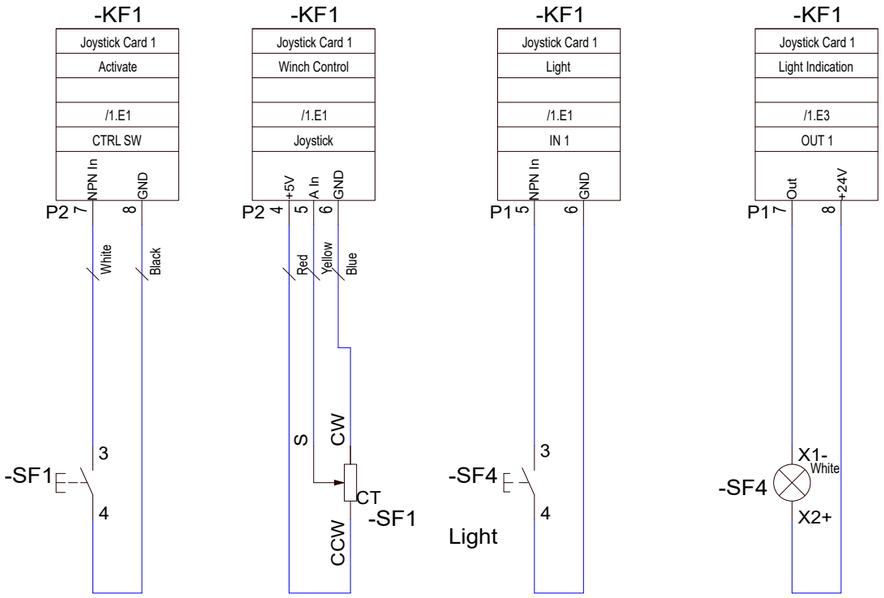


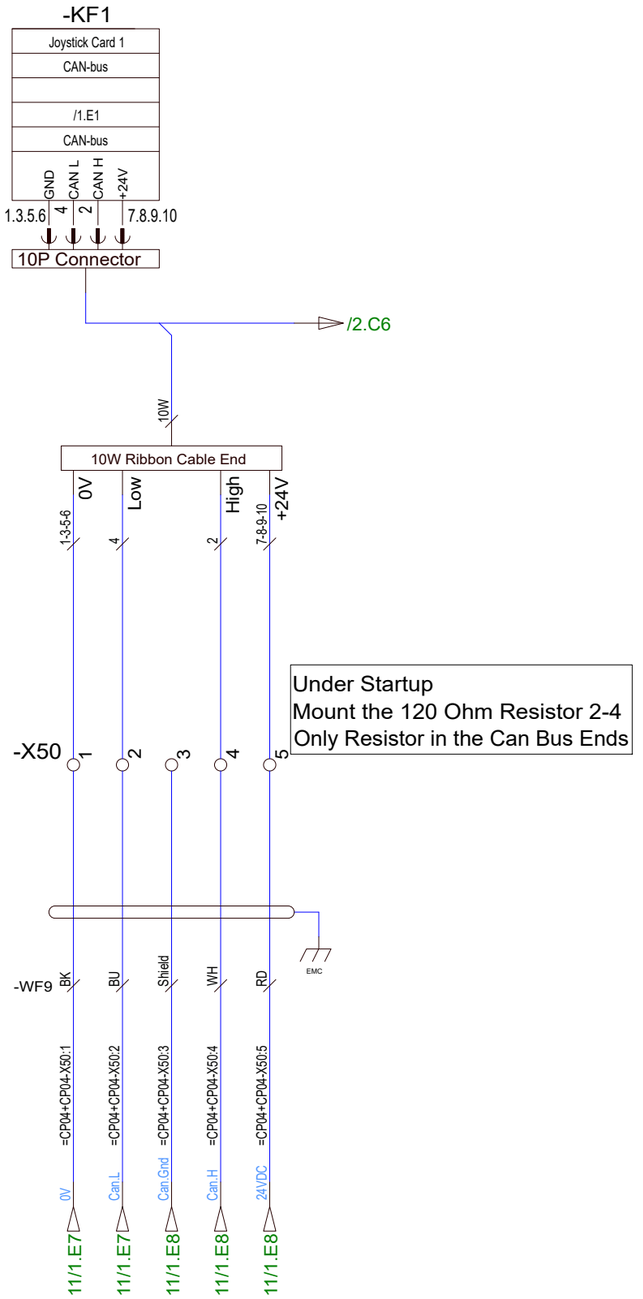
				Date	13/03-2024	CNP Freire MBari	MACGREGOR	AFT Control Station Panel CTD Davit Cable Diagram	400248137	=CP06	
				User	TR						
				Approved	RAJ				10070-21 CD	Rev. I	Sheet 1
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1

Activate

Joystick

CAN-bus





-KF1

CAN BUS JOYSTICK CARD

Adress	Node XX

I/O	Ref	Adress	Description
Joystick	/1.B2		Winch Control
Potmeter			
CAN-bus	/1.B6		CAN-bus
Serial Display			
CTRL SW	/1.B1		Activate
MAN SW			
IN 1	/1.B3		Light
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1	/1.B4		Light Indication
OUT 2			
OUT 3			
OUT 4			

				Date	13/03-2024	CNP Freire MBari	MACGREGOR	AFT Control Station Panel CTD Davit Tilt Control, CAN-bus	400248137	=CP06
				User	TR					+CP06
				Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-21 CC	Rev. I

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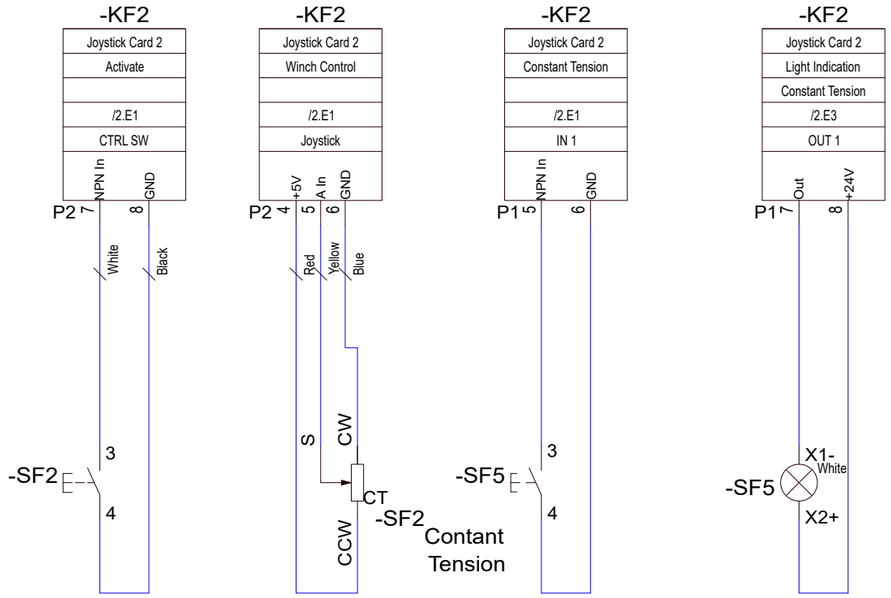
Next 2

Activate

Joystick

CAN-bus



-KF2

CAN BUS JOYSTICK CARD

Adress	Node XX

I/O	Ref	Adress	Description
Joystick	/2.B2		Winch Control
Potmeter			
CAN-bus	/2.B6		CAN-bus
Serial Display			
CTRL SW	/2.B1		Activate
MAN SW			
IN 1	/2.B3		Constant Tension
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1	/2.B4		Light Indication
OUT 2			
OUT 3			
OUT 4			

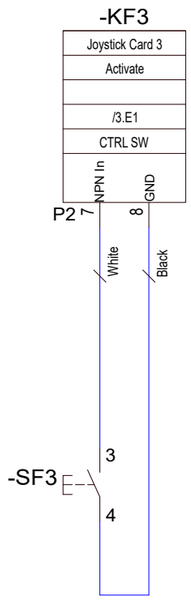
				Date	13/03-2024	CNP Freire MBari	MACGREGOR	AFT Control Station Panel CTD Davit Telescope Control, CAN-bus	400248137	=CP06
				User	TR					+CP06
				Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-21 CC	Rev. I

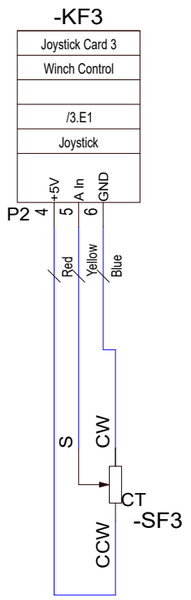
Sheet 2
Next 3

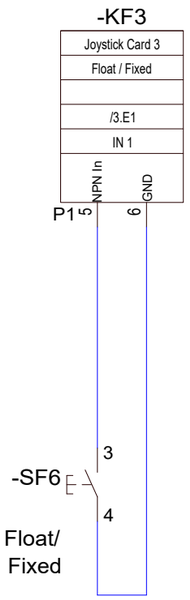
Activate

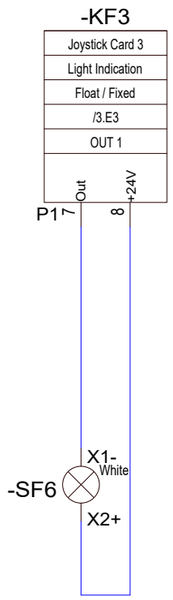
Joystick

CAN-bus









-KF3

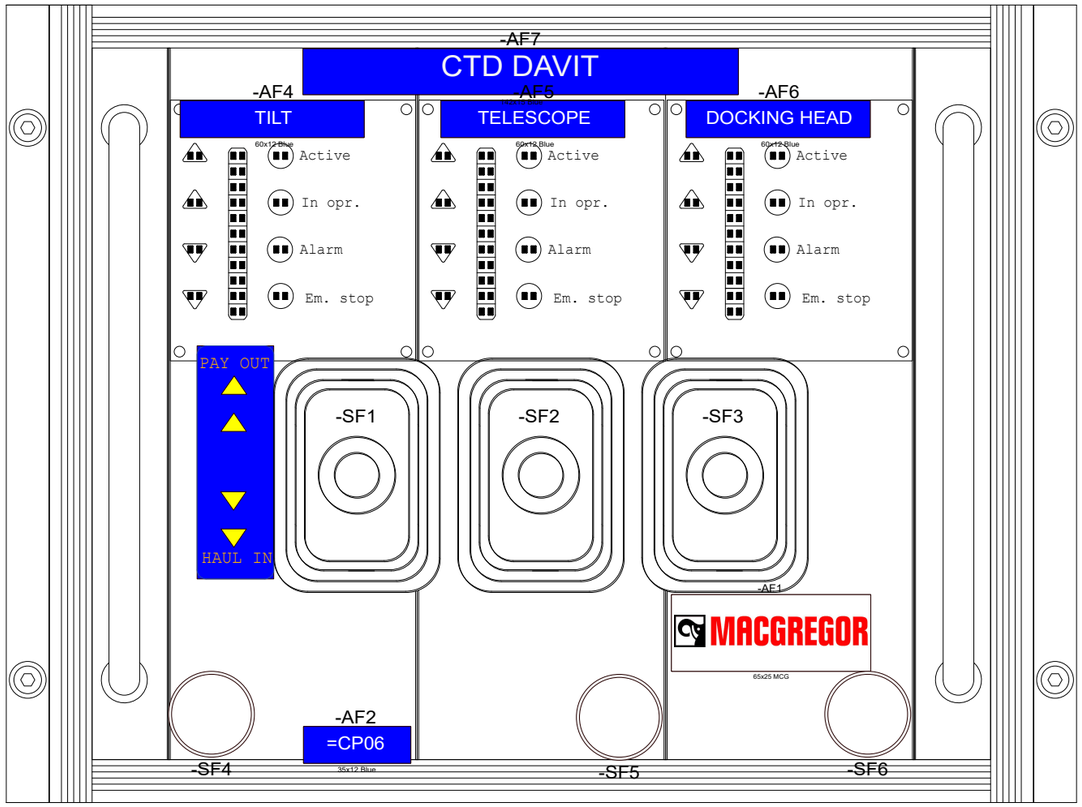
CAN BUS JOYSTICK CARD

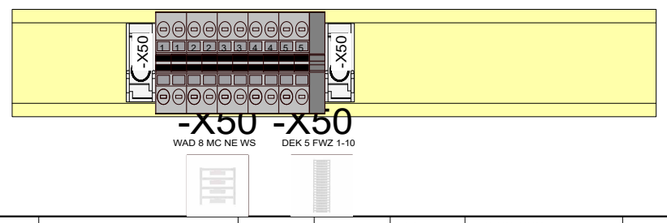
Adress	Node XX

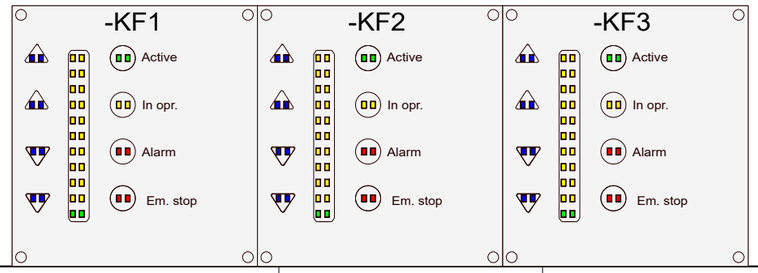
I/O	Ref	Adress	Description
Joystick	/3.B2		Winch Control
Potmeter			
CAN-bus	/3.B6		CAN-bus
Serial Display			
CTRL SW	/3.B1		Activate
MAN SW			
IN 1	/3.B3		Float / Fixed
IN 2			

I/O	Ref	Adress	Description
IN 3			
DIM SW			
EM STOP			
OUT 1	/3.B4	Float / Fixed	Light Indication
OUT 2			
OUT 3			
OUT 4			

				Date	13/03-2024	CNP Freire MBari	MACGREGOR	AFT Control Station Panel CTD Davit Docking Head Control, CAN-bus	400248137	=CP06
				User	TR					+CP06
				Approved	RAJ					
Status	Change	Date	Name	Standard		Version	Index	Repl. by	10070-21 CC	Rev. I
										Sheet 3
										Next 1







				Date	13/03-2024	CNP Freire MBari	MACGREGOR	AFT Control Station Panel CTD Davit Panel Layout	400248137	=CP06	
				User	TR					+CP06	
				Approved	RAJ						
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Rev. I	Sheet 1
									10070-21 GA		Next

=GENERAL

Customer : CNP Freire
Ship/Hull : MBARI
Project no. : 4/60185
Drawing no.: E-4500

Rev.	Description	Date	Rev. by	Standard	
05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ

4/60185
CNP Freire
MBARI

TRIPLEX
A MacGregor company

Front Page

=GENERAL

E-4500 - 00

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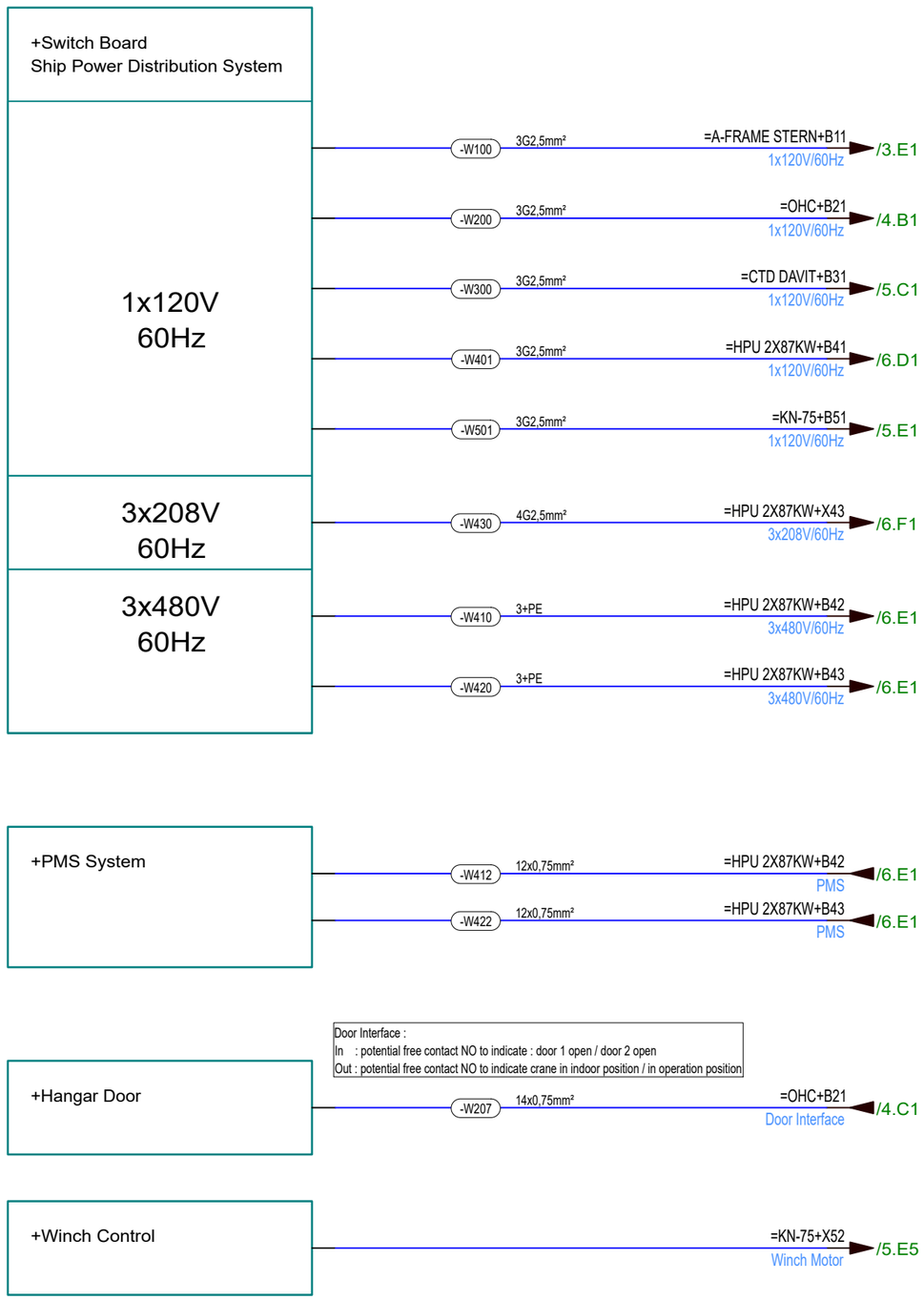

Rev.	Description	Date	Rev. by		
05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ

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CNP Freire
MBARI

TRIPLEX
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Single Line

=GENERAL

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Rev. 05

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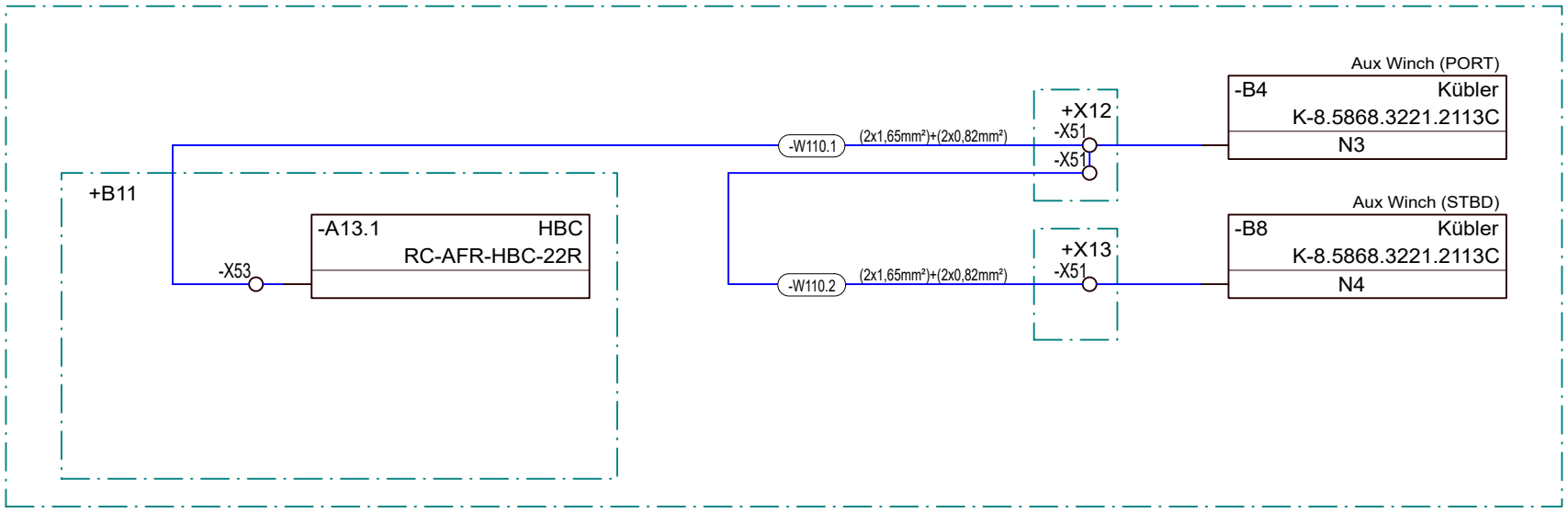
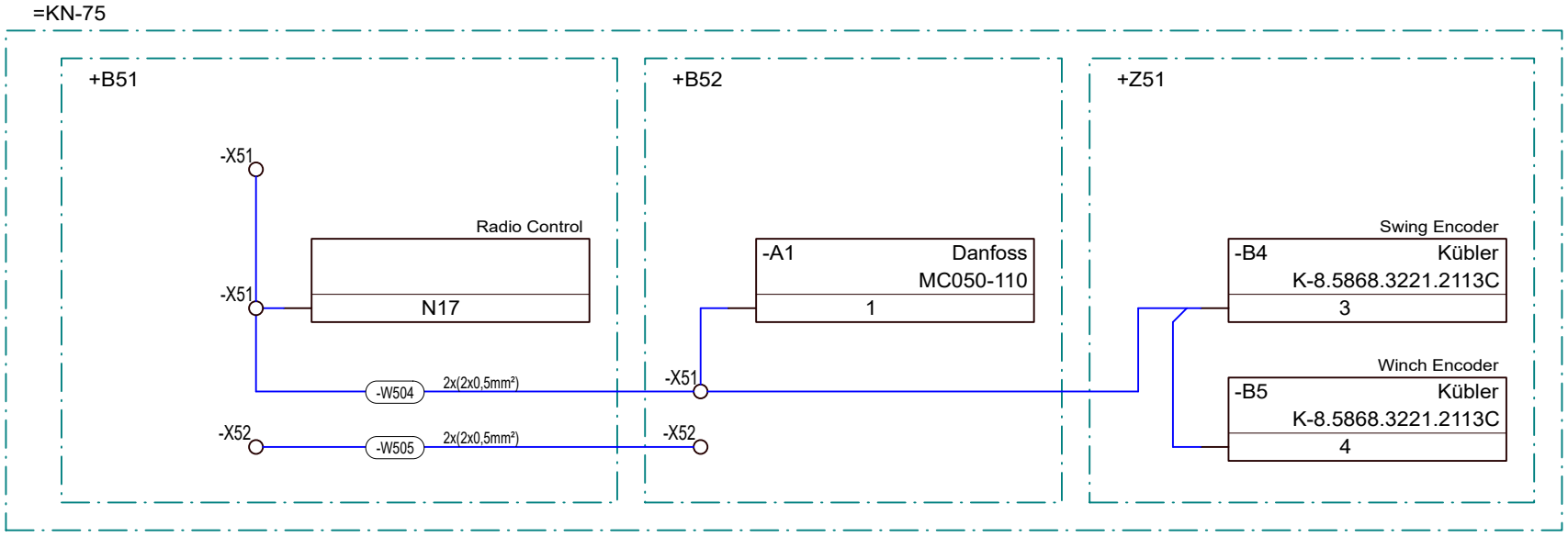
=A-FRAME STERN



=KN-75



4/60185
CNP Freire
MBARI

TRIPLEX
A MacGregor company

BUS

Rev.	Description	Date	Rev. by	Standard	
05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ

=GENERAL

E-4500 - 01

Rev. 05

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Etercat from Rapp Systems

=A-FRAME STERN

Etercat

+B11
Control Cabinet

Special pre terminated antenna cable, length must be specified and ordered with vendor.

-W102 4x0,34mm²

+Z10 Deck Equipment Area

-A13.2
Radio Control
Antenna

Stationary control panel is integrated in the winch control system console and will be communicating via CAN-bus.

Winch control system drawing: ....

+Z12 Crane Body

-W105 38x1,5mm²

+X11
JB Valves

-W108 4x2x0,75mm² Shielded

-W110.1 (2x1,65mm²)+(2x0,82mm²)

-W110.2 (2x1,65mm²)+(2x0,82mm²)

+X12
JB Sensor PS

-W109 3G2,5mm²

+X14
JB Floodlight

-W107 4x2x0,75mm² Shielded

+X13
JB Sensor SB

/1.B4 +Switch Board
1x120V/60Hz

-W100 3G2,5mm²

-W010 4x(2x0,5mm²) CAT7

Eldon
MAS0605030
HxWxD:600x500x300
IP 66
RAL 7035 (Grey)

Etercat =OHC+B21

/4.A1

05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ
Rev.	Description	Date	Rev. by	Standard	

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CNP Freire
MBARI

TRIPLEX
A MacGregor company

Single Line

A-Frame

=GENERAL

E-4500 - 01

Rev. 05

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=OHC

/3.F1
Etercat
=A-FRAME STERN+B11

-W010 4x(2x0,5mm²) CAT7

/1.B4 +Switch Board
1x120V/60Hz
-W200 3G2,5mm²

Door Interface :
In : potential free contact NO to indicate : door 1 open / door 2 open
Out : potential free contact NO to indicate crane in indoor position / in operation position

/1.E4 +Hangar Door
Door Interface
-W207 14x0,75mm²

-W011 4x(2x0,5mm²) CAT7

/5.A1
Etercat
=CTD DAV/IT+B31

+B21
Control Cabinet

Eldon
MAS0605030
HxWxD:600x500x300
IP 66
RAL 7035 (Grey)

Special pre terminated antenna cable, length must be specified and ordered with vendor.

-W202 4x0,34mm²

-W201 6x0,75mm²

-W204 20x1,5mm²

-W215 20x1,5mm²

-W206 18G1,5mm²

-W214 3G1,5mm²

-W205 18G1,5mm²

-W208 18G1,5mm²

+Z20 Deck Equipment Area

-A20.2

-S1

Stationary control panel is integrated in the winch control system console and will be communicating via CAN-bus.

Winch control system drawing: ....

+Z22 OHC

+Z23 Valves

+X21
JB Valves

+X24.1
OHC Trolley Interface JB

-WI-58 18G0,75mm²

+X24
OHC Trolley JB

+Rapp Drive

-W210 4G1,5mm²

-W211 3G1,5mm²

-W212 4x2x0,25

-W213 3G1,5mm²

+X23
DOC. HEAD Power Interface JB

+X22
DOC. HEAD Motor Signals Interface JB

+Z25 Docking Head

+X25.1
Docking Head Interface Right JB

-WI-57 18G0,75mm²

+X25
Docking Head Right JB

+X26.1
Docking Head Interface Left JB

-WI-59 18G0,75mm²

+X26
Docking Head Left JB

Rev.	Description	Date	Rev. by	Standard	
05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ

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CNP Freire
MBARI

TRIPLEX
A MacGregor company

Single Line

=GENERAL

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Rev. 05

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=CTD DAVIT

=OHC+B21 /4.F1
Etercat

-W011 4x(2x0,5mm²) CAT7

+B31
Control Cabinet

Special pre terminated antenna cable, length must be specified and ordered with vendor.

-W302 4x0,34mm²

+Z30 Deck Equipment Area

-A31.2
RC Antenna

Stationary control panel is integrated in the winch control system console and will be communicating via CAN-bus.

Winch control system drawing: ....

-W305 28x1,5mm² Shielded

+Z33 Valve Bank

+X31
Valve Central
Junction box

+Z31 Pedestal

+X32
JB Power

/1.B4 +Switch Board
1x120V/60Hz

-W300 3G2,5mm²

-W306 3G2,5mm²

-W012 4x(2x0,5mm²) CAT7

Eldon
MAS0605030
HxWxD:600x500x300
IP 66
RAL 7035 (Grey)

=KN-75

+Z50 Equipment Deck Area

A minimum of 1,5m spare cable inside cabinet.

+B51
Control Cabinet

-W502 Coax RG58U

-A1.2
HxWxD: 75x160x55

+Z51 Pedestal

+Z53 Valve Bank

-W503-1 14x1,5mm² Shielded
-W503-2 14x1,5mm² Shielded

+X51
JB Valves

-W504 2x(2x0,5mm²)
-W505 2x(2x0,5mm²)
-W506 10x1,5mm² Shielded
-W506.1 4x1,5mm²

+B52
Control Cabinet
Heavy Lift

-X53
Junction Box
Sensors

/1.C4 +Switch Board
1x120V/60Hz

-W501 3G2,5mm²

-W507 3G2,5mm²

+X52
JB Power

-W013 4x(2x0,5mm²) CAT7

Eldon
MAS0605030
HxWxD:600x500x300
IP 66
RAL 7035 (Grey)

/1.F4 =GENERAL+Winch Control
Winch Motor

=HPU 2X87KW+B41
Etercat
/6.A1

Rev.	Description	Date	Rev. by		
05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ

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Single Line

=GENERAL

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Rev. 05

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Printed: 05.02.2025 10:54

Template:

=HPU 2X87KW

=KN-75+B51 /5.F1 Elercat

+B41

Control Cabinet
Starters

Eldon
MAS0605030
HxWxD:600x500x300
IP 66
RAL 7035 (Grey)

-W013 4x(2x0,5mm²) CAT7

-W014 4x(2x0,5mm²) CAT7

-W441 12x0,75mm²

-W442 12x0,75mm²

-W401 3G2,5mm²

-W402 6x0,75mm²

-W411 12x0,75mm²

-W421 12x0,75mm²

-W432 12x0,75mm²

+X45
-S1
E-Stop External
To be placed in deck area.

Stationary control panel is integrated in the winch control system console and will be communicating via CAN-bus.

Winch control system drawing: ....

+Winch Control

+IMACS
HPU Remote Control

(Optional)

/1.C4 +Switch Board
1x120V/60Hz

/1.D4 +PMS System
PMS

/1.C4 +Switch Board
3x480V/60Hz

/1.D4 +PMS System
PMS

/1.D4 +Switch Board
3x480V/60Hz

/1.C4 +Switch Board
3x208V/60Hz

-W412 12x0,75mm²

-W410 3+PE

-W422 12x0,75mm²

-W420 3+PE

-W430 4G2,5mm²

+Z40 HPU Unit

+B42

Soft Starter 1
HPU

Eldon
MAS0806030
HxWxD:800x600x300
IP 66
RAL 7035 (Grey)

-W413 3+PE

-W414 2x0,75mm²

-W415 2x0,75mm²

-M1
3~
Pump Motor 1
480V/60Hz
87kW - 129A

Motor Heater
100W

PTC

+B43

Soft Starter 2
HPU

Eldon
MAS0806030
HxWxD:800x600x300
IP 66
RAL 7035 (Grey)

-W423 3+PE

-W424 2x0,75mm²

-W425 2x0,75mm²

-M2
3~
Pump Motor 2
480V/60Hz
87kW - 129A

Motor Heater
100W

PTC

+X41

Installed on
eqipment
by vendor.

CPG-320
HxWxD:360x160x91
IP 67

+X43
Oil Heater Switch

Rev.	Description	Date	Rev. by	Standard	
05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ

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CNP Freire
MBARI

TRIPLEX
A MacGregor company

Single Line

HPU

=GENERAL

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Rev. 05

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Printed: 05.02.2025 10:54

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-W010..-W014	CAT 7 LLDS BLUE LSZH 500 4x2x0.5	07915071		5	Pcs	CABLE, 4x2x0.5mm², SHIELDED	Nexans	
-W100,-W109,-W200,-W300,-W306,-W401,-W501,-W507	SHIP CABLE 3G2.5			8	Pcs	Cable Ship 3G2,5mm²	Draka (Or similar)	
-W102,-W202,-W302	HBC DECT 50M 4x0.34	6793400086		3	Pcs	Cable Antenna DECT 50M	HBC	
-W105	SHIP CABLE 38x1.5			1	Pcs	Cable Ship 38x1,5mm²	Draka (Or similar)	
-W107,-W108	SHIP CABLE 4PAIRx0.75 Shield			2	Pcs	Cable Ship 4x2x0,75mm²	Draka (Or similar)	
-W110.1,-W110.2,-W110.3,-W110.4	UNITRONIC BUS DN THICK FRNC			4	Pcs	CABLE, 2x1,65mm²+2x0,82mm², -25°C	Lapp	
-W201,-W402	SHIP CABLE 6x0.75			2	Pcs	Cable Ship 6x0,75mm²	Draka (Or similar)	
-W204,-W215	SHIP CABLE 20x1.5			2	Pcs	Cable Ship 20x1,5mm²	Draka (Or similar)	
-W205..-W206,-W208	SHIP CABLE 18G1.5 Shield			3	Pcs	Cable Ship 18G1,5mm², SHIELDED	Draka (Or similar)	
-W207	SHIP CABLE 14x0.75			1	Pcs	Cable Ship 14x0,75mm²	Draka (Or similar)	
-W210	SHIP CABLE 4G1.5 Shield			1	Pcs	Cable Ship 4G1,5mm², SHIELDED	Draka (Or similar)	
-W211,-W213	ØLFLEX FD 855 CP 3G1.5			2	Pcs	CABLE, 3x1,5mm², SHIELDED	Lapp	
-W212	UNITRONIC FD CP (TP) plus 4x2x0.25	07915073		1	Pcs	CABLE, 4x2x0,25mm², -40°C, OD 8,3mm	Lapp	
-W214	ROFLEX 3X1.5	07915019		1	Pcs	CABLE, 3x1,5mm²	Lapp	
-W305	SHIP CABLE 28x1.5 Shield			1	Pcs	Cable Ship 28x1,5mm²	Draka (Or similar)	
-W410,-W413,-W420,-W423	SHIP CABLE 3+PE			4	Pcs	Cable Ship 3+PE	Draka (Or similar)	
-W411..-W412,-W421..-W422,-W432,-W441..-W442	SHIP CABLE 12x0.75			7	Pcs	Cable Ship 12x0,75mm²	Draka (Or similar)	
-W414..-W415,-W424..-W425	SHIP CABLE 2x0.75			4	Pcs	Cable Ship 2x0,75mm²	Draka (Or similar)	
-W430	SHIP CABLE 4G2.5			1	Pcs	Cable Ship 4G2.5mm²	Draka (Or similar)	
-W502	COAX RG58U	07915201		1	Pcs	CABLE, COAX, SHIELDED	Nexans	
-W503-1,-W503-2	SHIP CABLE 14x1.5 Shield			2	Pcs	Cable Ship 14x1,5mm²	Draka (Or similar)	
-W504,-W505	BUS FD P CAN UL/CSA 2x2x0.5	07915043		2	Pcs	CABLE, 2x2x0,5mm²	Lapp	
-W506	SHIP CABLE 10x1.5 Shield			1	Pcs	Cable Ship 10x1,5mm²	Draka (Or similar)	
-W506.1	SHIP CABLE 4x1.5			1	Pcs	Cable Ship 4x1,5mm²	Draka (Or similar)	
-W508	ROFLEX 3G1	07915017		1	Pcs	CABLE, 3G1mm²	Lapp	

Rev.	Description	Date	Rev. by	Standard	
05	KN-75 Updates	05.02.2025	WJ	Date	14.10.2021
04	Update	22.12.2024	WJ	Drawn by	KS
03	Issued for production	07.07.2023	GM	Appr. by	WJ

4/60185
CNP Freire
MBARI

TRIPLEX
A MacGregor company

Part List

=GENERAL

E-4500 - 07

Rev. 05

1 / 1

=A-FRAME STERN

Customer : CNP Freire
Ship/Hull : MBARI
Project no. : 4/60185
Drawing no.: E-4501

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

4/60185
CNP Freire
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Front Page
A-Frame Stern

=A-FRAME STERN

E-4501- 00

Rev. 04

1 / 1

+Z10 Deck Equipment Area

Special pre terminated antenna cable, length must be specified and ordered with vendor.

+B11
Control Cabinet

-W102 4x0,34mm²

-A13.2 Antenna

+Z11 Valve Bank

+X11

JB Valves

-W105 38x1,5mm²

-WI-01 7G0,75mm² -S1 E-Stop

-WI-02 3G1mm² -H1 A-Frame Active

-WI-03 3G0,75mm² -Y1 A-Frame Stop

-WI-04 3G1mm² -Y2 Aux Winch STBD

-WI-05 3G1mm² -Y3 Link Cyl STBD

-WI-06 3G1mm² -Y4 Link Cyl PORT

-WI-07 3G1mm² -Y5 Leg Cyl STBD

-WI-08 3G1mm² -Y6 Leg Cyl PORT

-WI-12 3G1mm² -Y10 Aux Winch PORT

CPG-300
HxWxD:260x160x91
IP 67

-WI-11 7G0,75mm² -S3 Emergency Stop Portside

-WI-27 7G0,75mm² -S4 Emergency Stop Starbordside

/1.C1 =OHC+B21 Etercat -W010 4x(2x0,5mm²) CAT7

04	Issued for production	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company	Single Line A-Frame Stern
03	Issued for production	16.02.2023	EE	Drawn by	KS			
02	For customer review	29.08.2022	RSI	Appr. by	WJ			
Rev.	Description	Date	Rev. by	Standard				

=A-FRAME STERN

E-4501-01

Rev. 04 1/2

+B11
Control Cabinet

+Z10

+Z12 Crane Body

Port Side leg

+X12
JB Sensor PS

-W108 4x2x0,75mm² Shielded

-W110.1 (2x1,65mm²)+(2x0,82mm²)

-W109 3G2,5mm²

-WI-19 4x0,34mm² → -B1 Tilt lower right (PORT)

-WI-20 4x0,34mm² → -B2 Tilt upper right (PORT)

-WI-22 2x(2x0,25mm²)
-WI-23 2x(2x0,25mm²) → -B4 Aux Winch (PORT)

+X14
JB Floodlight

-WI-24 3G1,5mm²

+Z14 Gantry Beam

+X15
JB Floodlight

-WI-25 3G1,5mm² → -E1 Floodlight LED

-WI-26 3G1,5mm² → -E2 Floodlight LED

(2x1,65mm²)+(2x0,82mm²) -W110.2

+Z13 Starboard leg

+X13
JB Sensor SB

-W107 4x2x0,75mm² Shielded

-WI-15 4x0,34mm² → -B5 Tilt lower left (STBD)

-WI-16 4x0,34mm² → -B6 Tilt upper left (STBD)

-WI-18 2x(2x0,25mm²) → -B8 Aux Winch (STBD)

1x120V/60Hz -W100 3G2,5mm²

Eldon
MAS0605030
HxWxD:600x500x300
IP 66
RAL 7035 (Grey)

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

4/60185
CNP Freire
MBARI

TRIPLEX
A MacGregor company

Single Line
A-Frame Stern

=A-FRAME STERN

E-4501-01

Rev. 04

2 / 2

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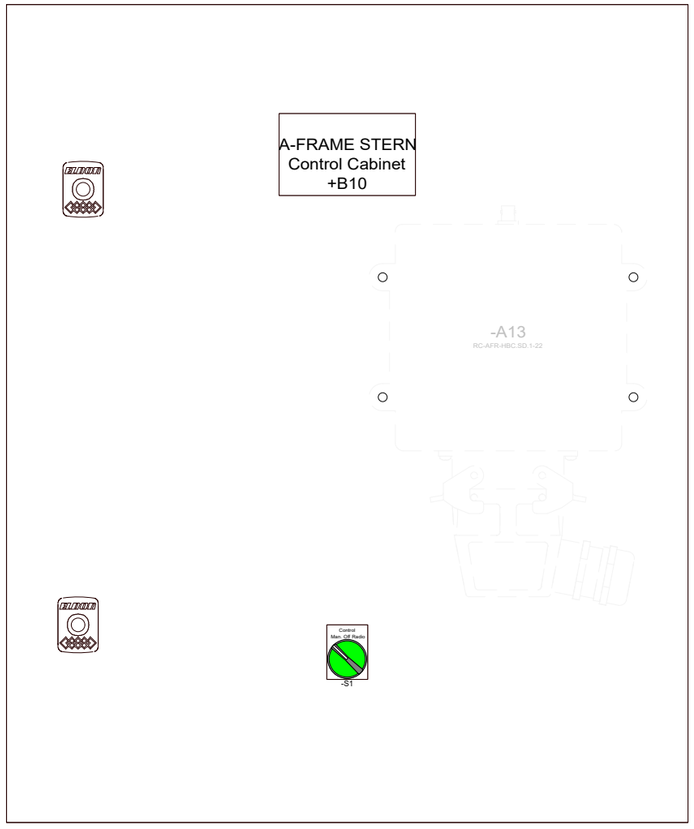

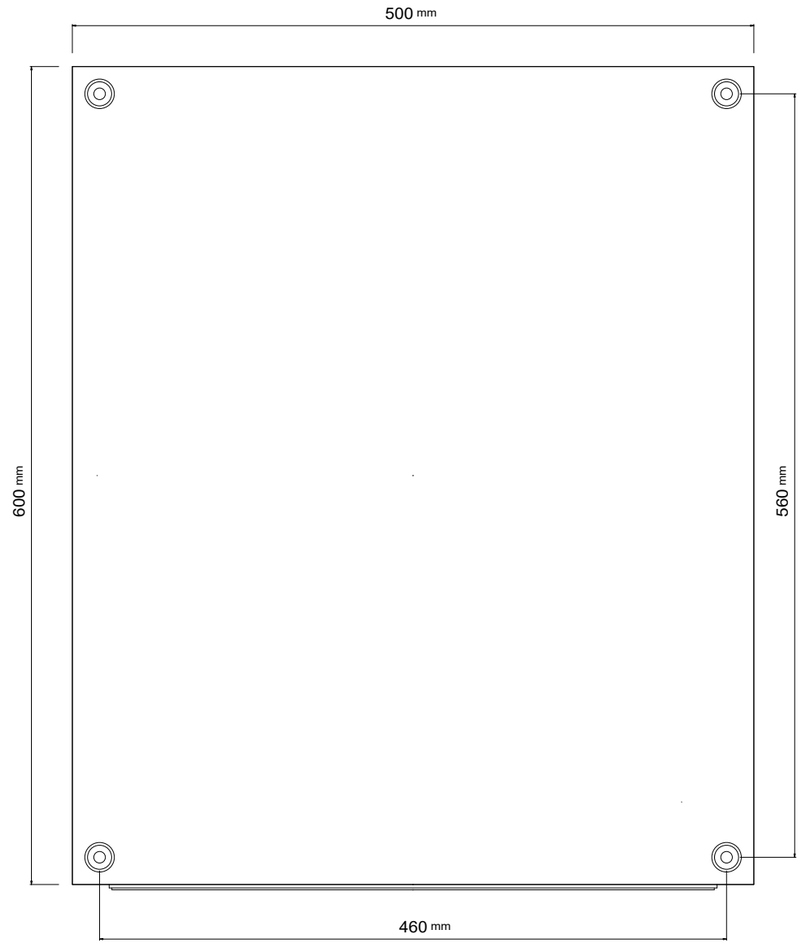

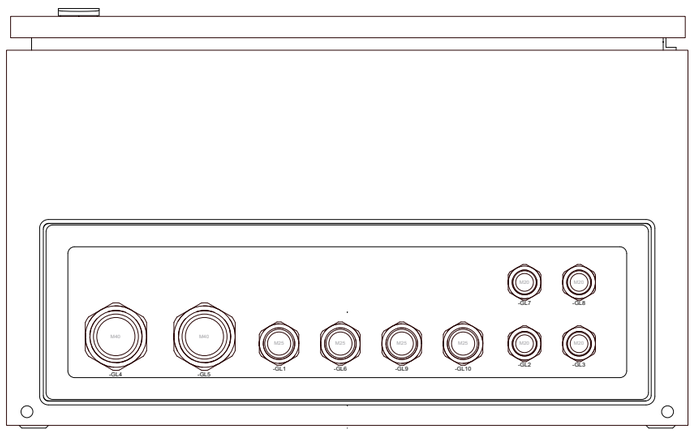

Product Data	
Manufacturer	Eldon
Article name	MAS0605030
WxHxD	600x500x300
IP	IP 66
RAL Code	RAL 7035 (Grey)
Material	Steel, Painted

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

4/60185
CNP Freire
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TRIPLEX
A MacGregor company

Layout
A-Frame Stern
Control Cabinet Radio - Outside

=A-FRAME STERN
+B11

E-4501-03
Rev. 04
1/10

Printed: 05.02.2025 10:58

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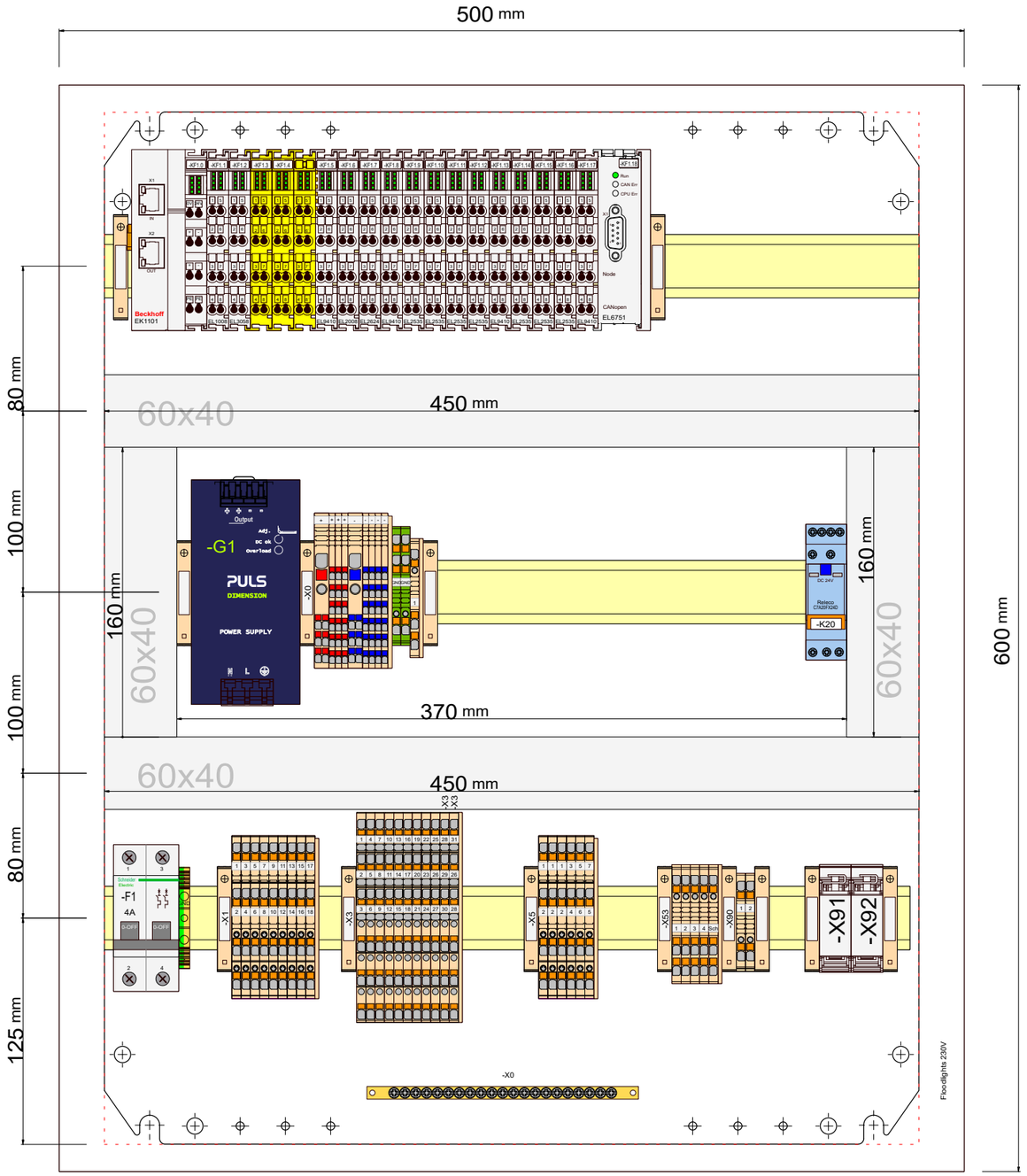
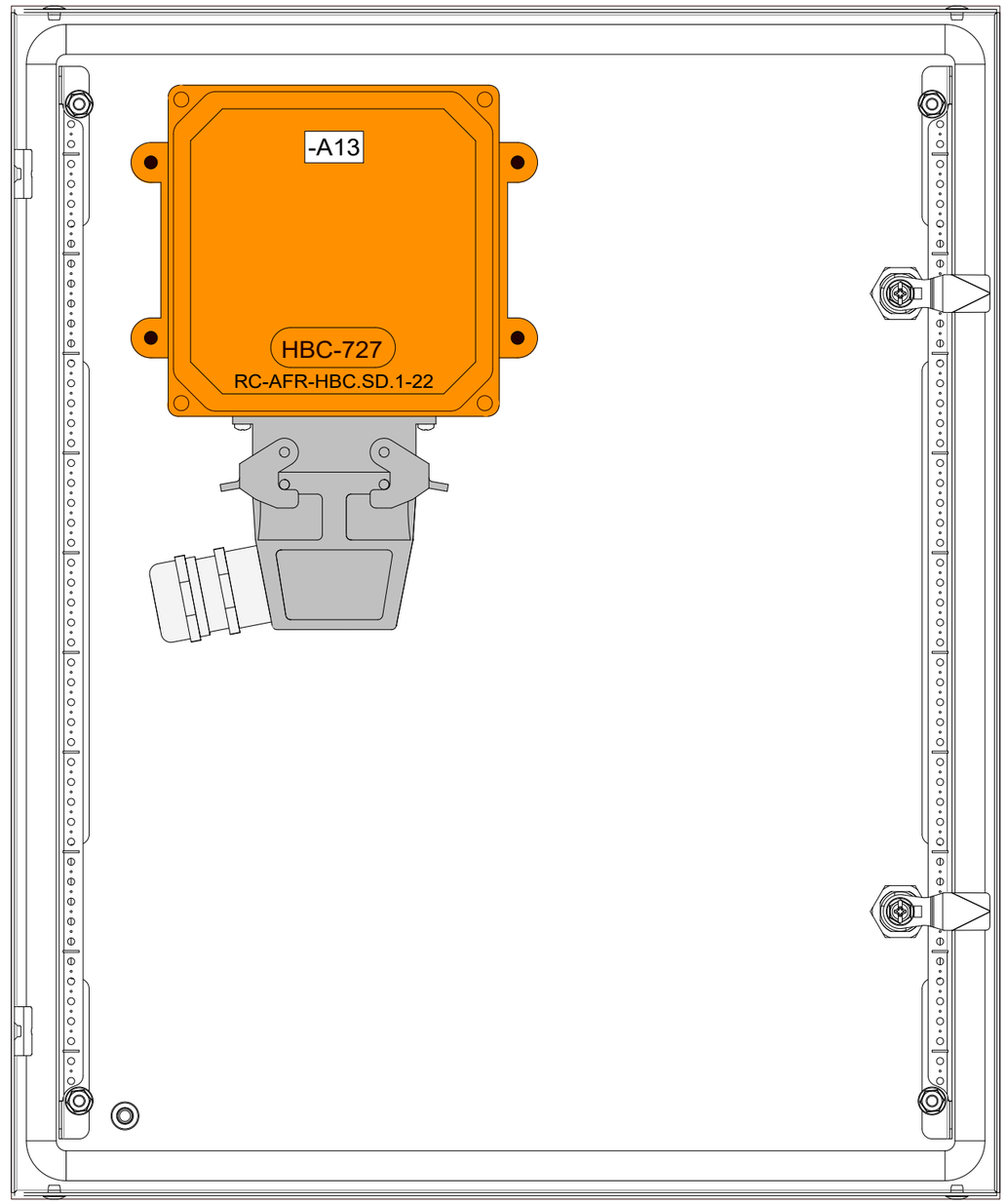
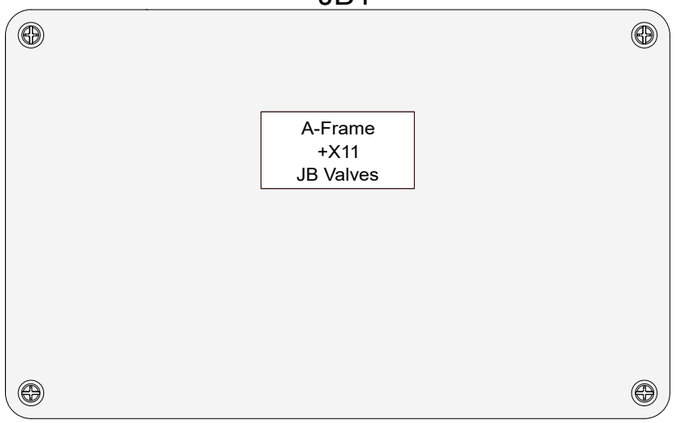




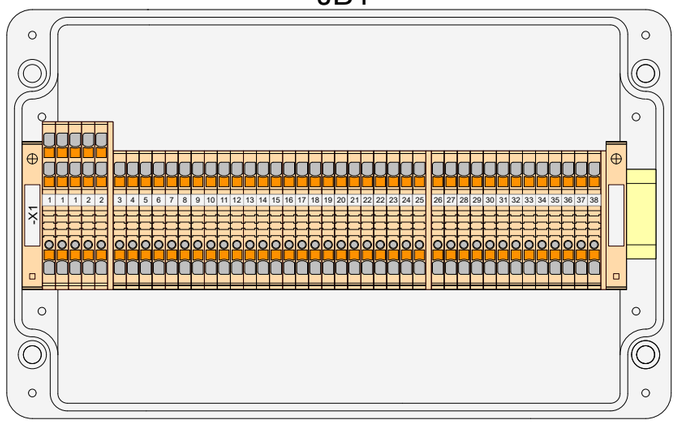
04	Issued for production	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company
03	Issued for production	16.02.2023	EE	Drawn by	KS		
02	For customer review	29.08.2022	RSI	Appr. by	WJ		
Rev.	Description	Date	Rev. by	Standard			

Layout A-Frame Stern Control Cabinet Radio - Inside	=A-FRAME STERN		E-4501-03
	+B11		Rev. 04 2 / 10

-JB1



-JB1



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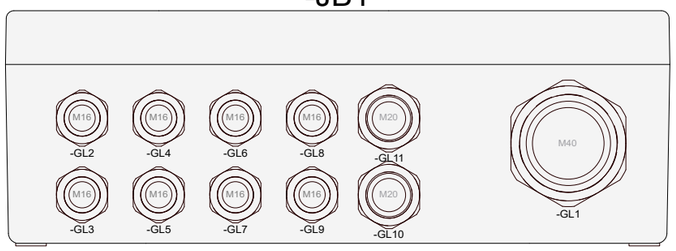
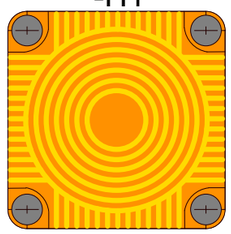


-JB1

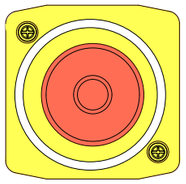
Bernstein
CPG-300
260x160x91
IP 67
RAL 7000 (Grey)

-H1



Inluded Cable Gland and 2 meter cable, ROFLEX 3G1 pre terminated.

-S1



Front View

Inluded Cable Gland and 2 meter cable, ROFLEX 7G0.75 pre terminated.

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

4/60185
CNP Freire
MBARI

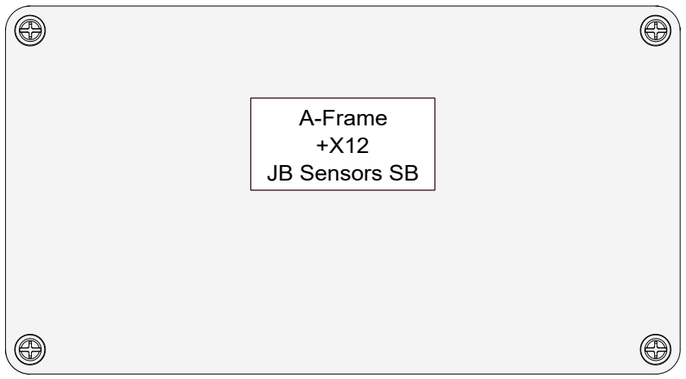
TRIPLEX
A MacGregor company

Layout
A-Frame Stern
JB Valves

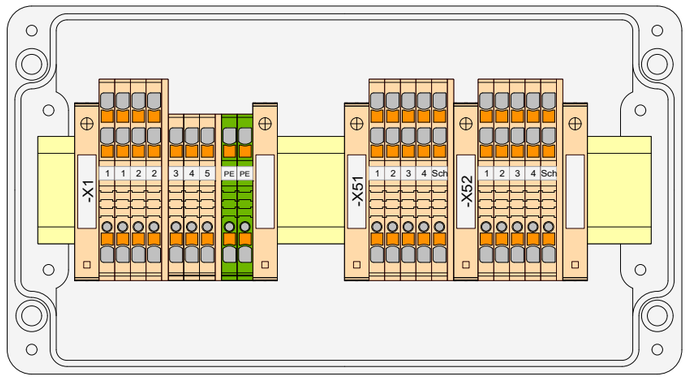
=A-FRAME STERN
+X11

E-4501-03
Rev. 04
3 / 10

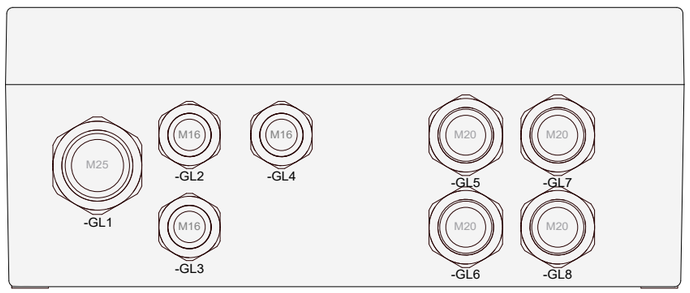
-JB1



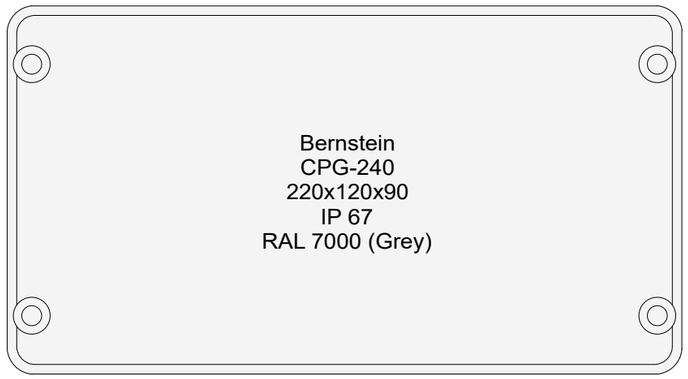
-JB1



-JB1



-JB1



Note:
Arrange glands to make room for aditional glands.
-GL4, -GL6 and -GL8 to be equped with sealing plug.

Rear View

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

4/60185
CNP Freire
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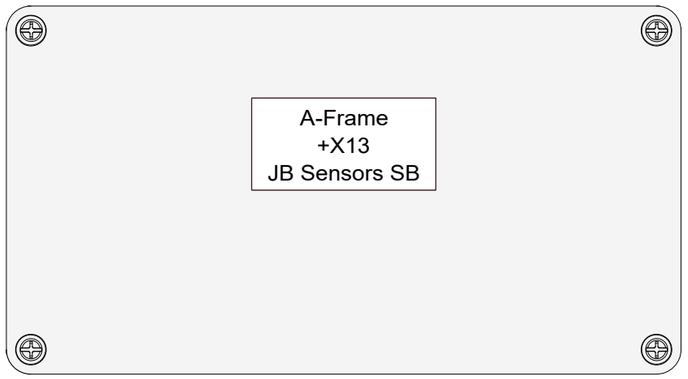
TRIPLEX
A MacGregor company

Layout
A-Frame Stern
JB Port Side Sensors

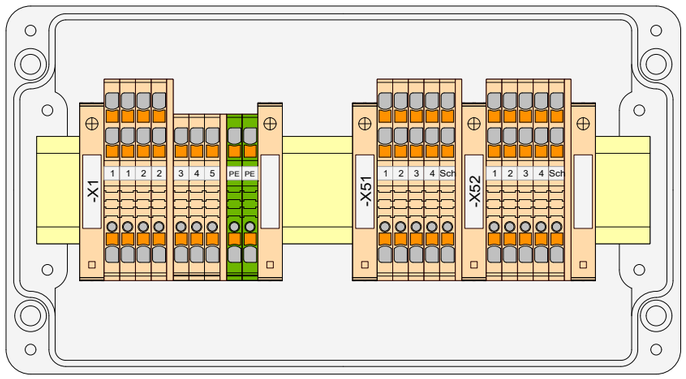
=A-FRAME STERN
+X12

E-4501- 03
Rev. 04
4 / 10

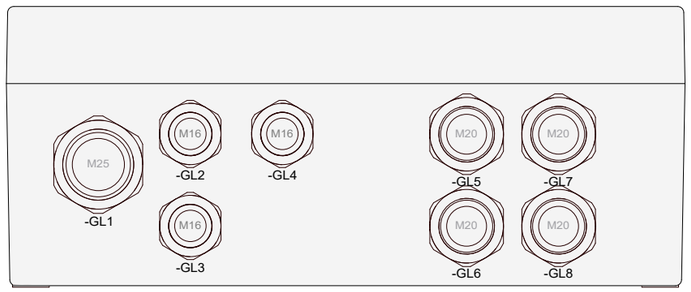
-JB2



-JB2

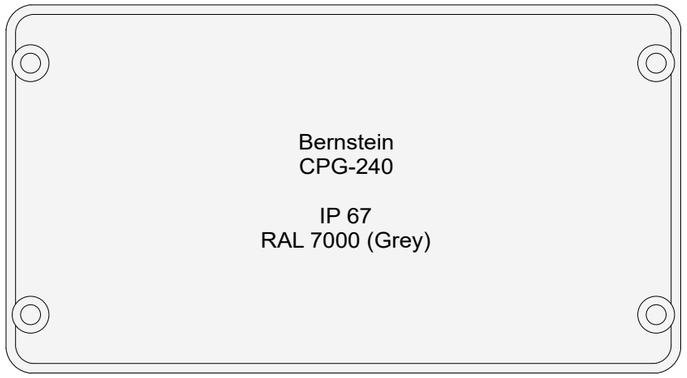


-JB2



Note:
Arrange glands to make room for aditional glands.
-GL4, -GL6 and -GL8 to be equped with sealing plug.

-JB2



Rear View

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

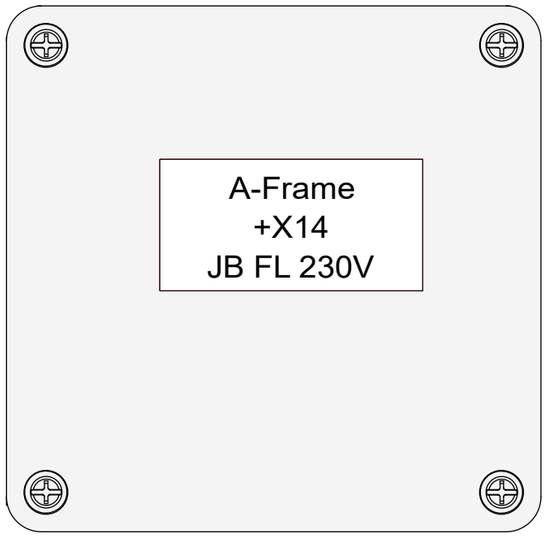
4/60185
CNP Freire
MBARI

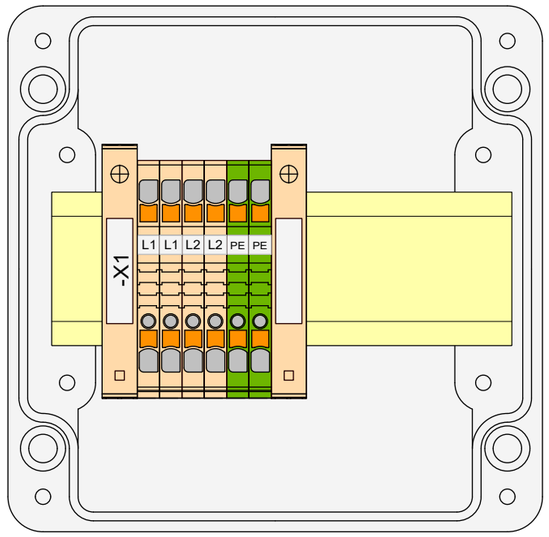
TRIPLEX
A MacGregor company

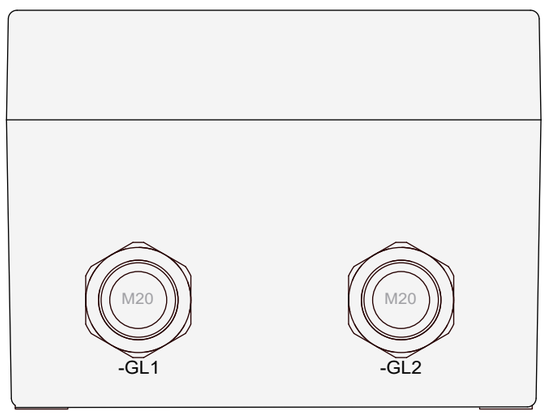
Layout
A-Frame Stern
JB Stbd. Side Sensors

=A-FRAME STERN
+X13

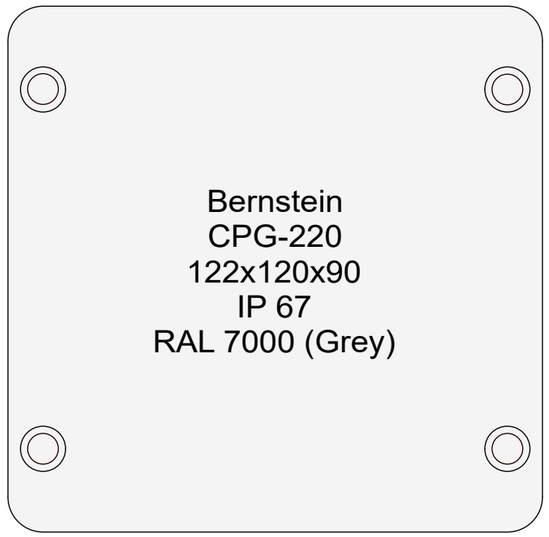
E-4501- 03
Rev. 04
5 / 10







Arrange glands to make room for aditional glands



Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

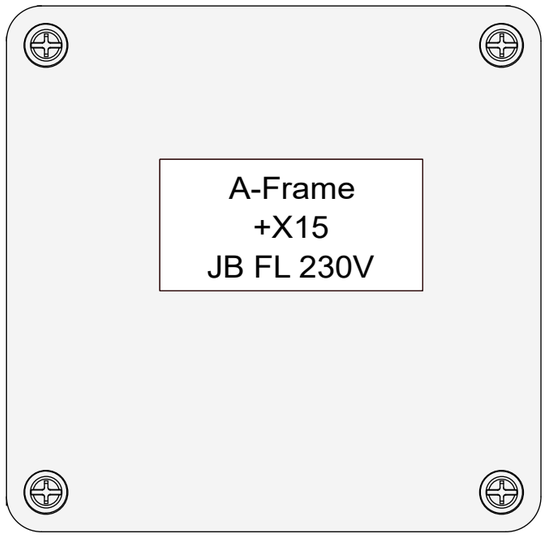
4/60185
CNP Freire
MBARI

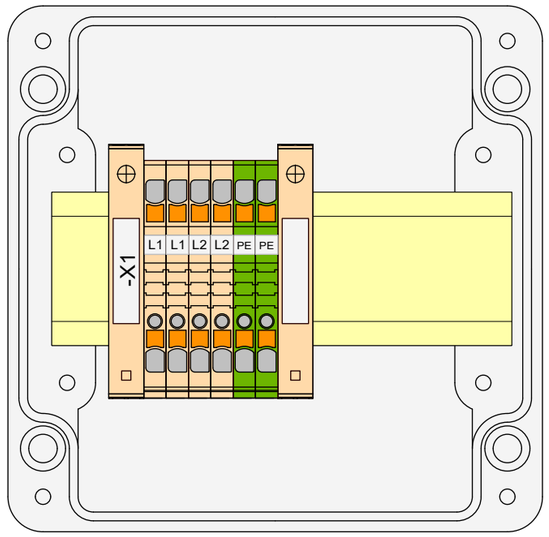
TRIPLEX
A MacGregor company

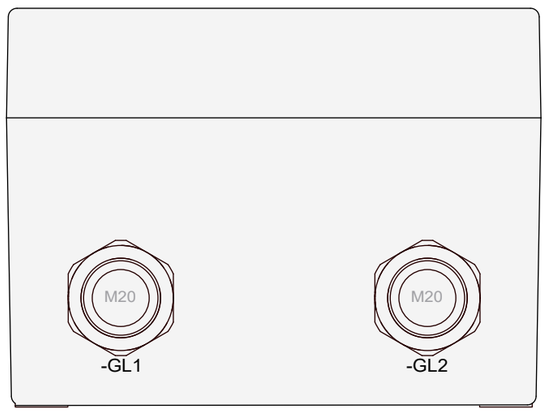
Layout
A-Frame Stern
JB Floodlights 230V

=A-FRAME STERN
+X14

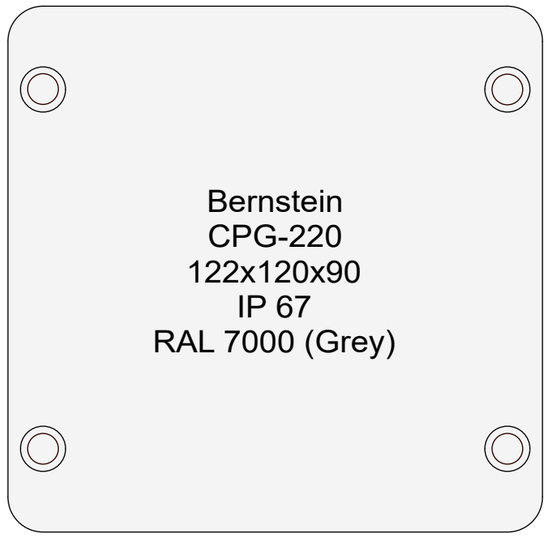
E-4501-03
Rev. 04
6 / 10







Arrange glands to
make room for
aditional glands



Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

4/60185
CNP Freire
MBARI

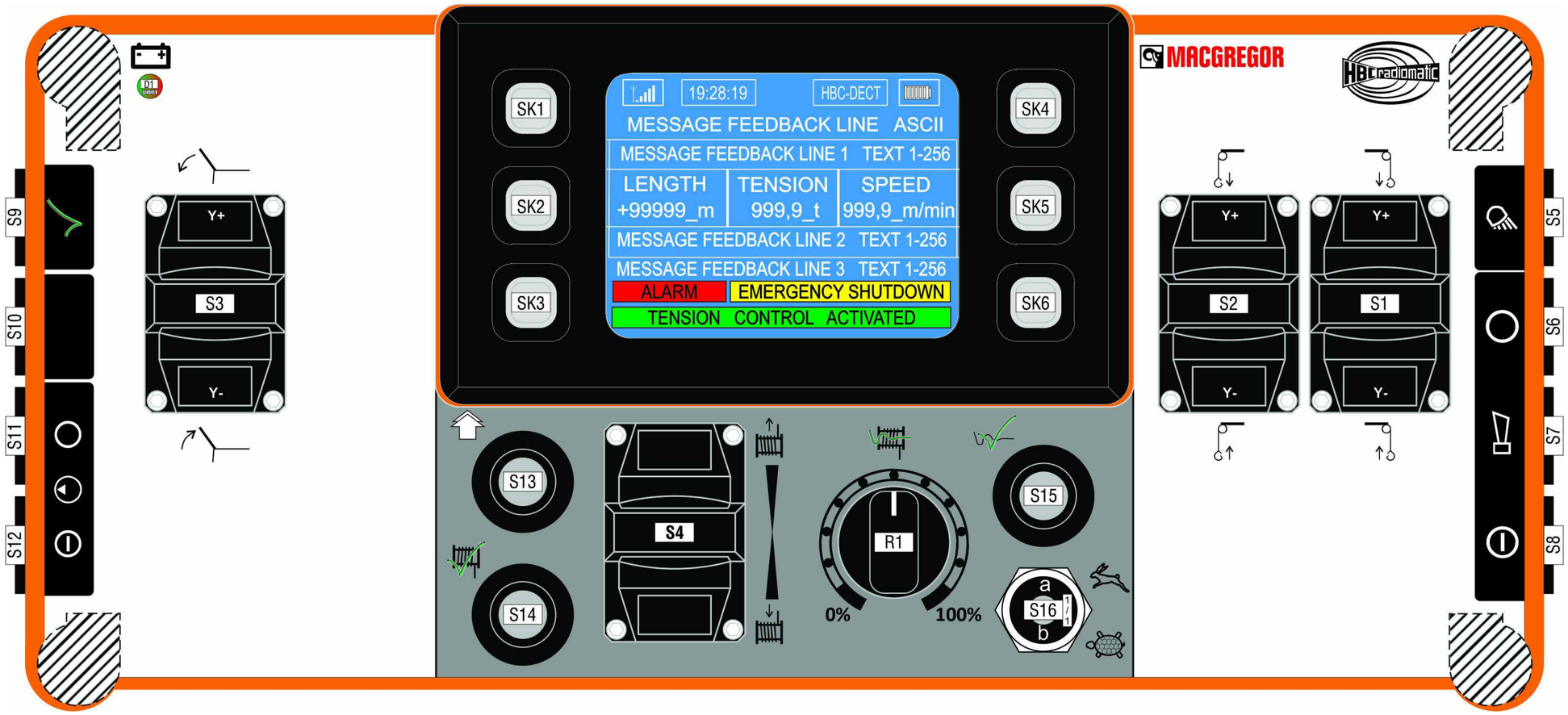
TRIPLEX
A MacGregor company

Layout
A-Frame Stern
JB Floodlights 230V

=A-FRAME STERN
+X15

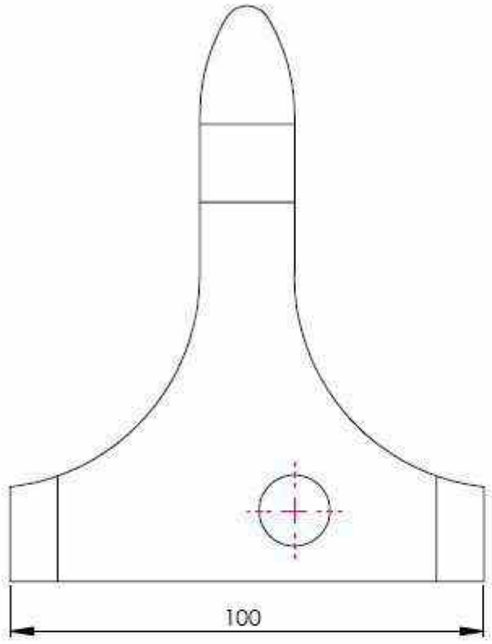
E-4501-03
Rev. 04
7 / 10

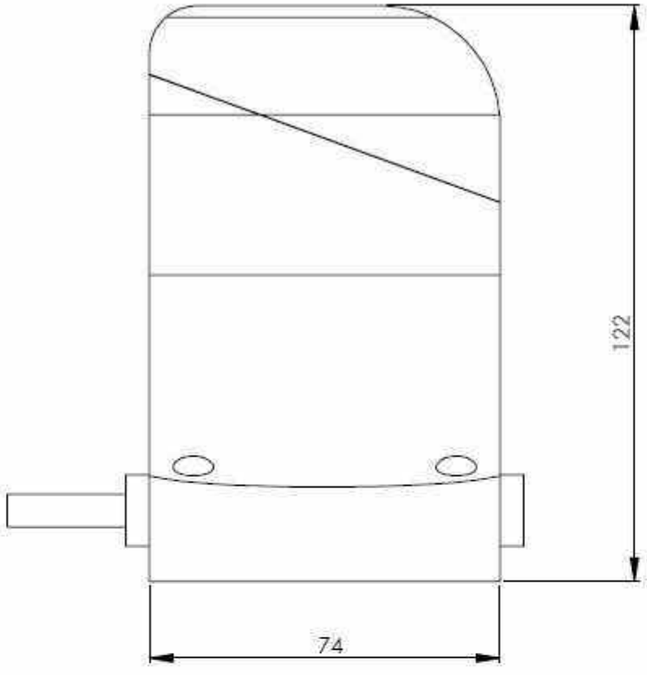
-A13.3

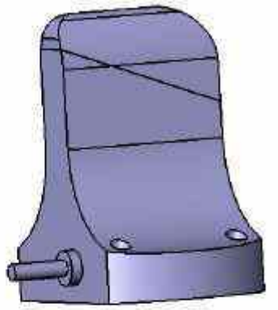


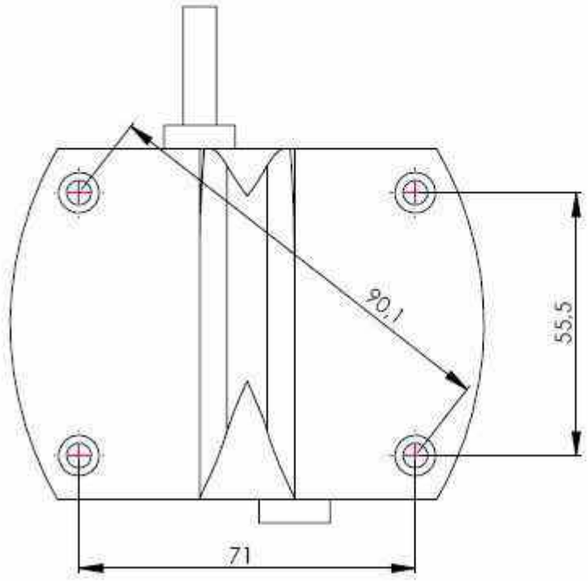
04	Issued for production	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company	Layout A-Frame Stern RC Transmitter	=A-FRAME STERN	E-4501-03
03	Issued for production	16.02.2023	EE	Drawn by	KS				+B11	Rev. 04 8 / 10
02	For customer review	29.08.2022	RSI	Appr. by	WJ					
Rev.	Description	Date	Rev. by	Standard						

04	Issued for production	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company	Layout A-Frame Stern RC Transmitter Side View	=A-FRAME STERN	E-4501- 03
03	Issued for production	16.02.2023	EE	Drawn by	KS				+B11	Rev. 04 9 / 10
02	For customer review	29.08.2022	RSI	Appr. by	WJ					
Rev.	Description	Date	Rev. by	Standard						









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Layout
A-Frame Stern
RC Antenna

=A-FRAME STERN
+B11

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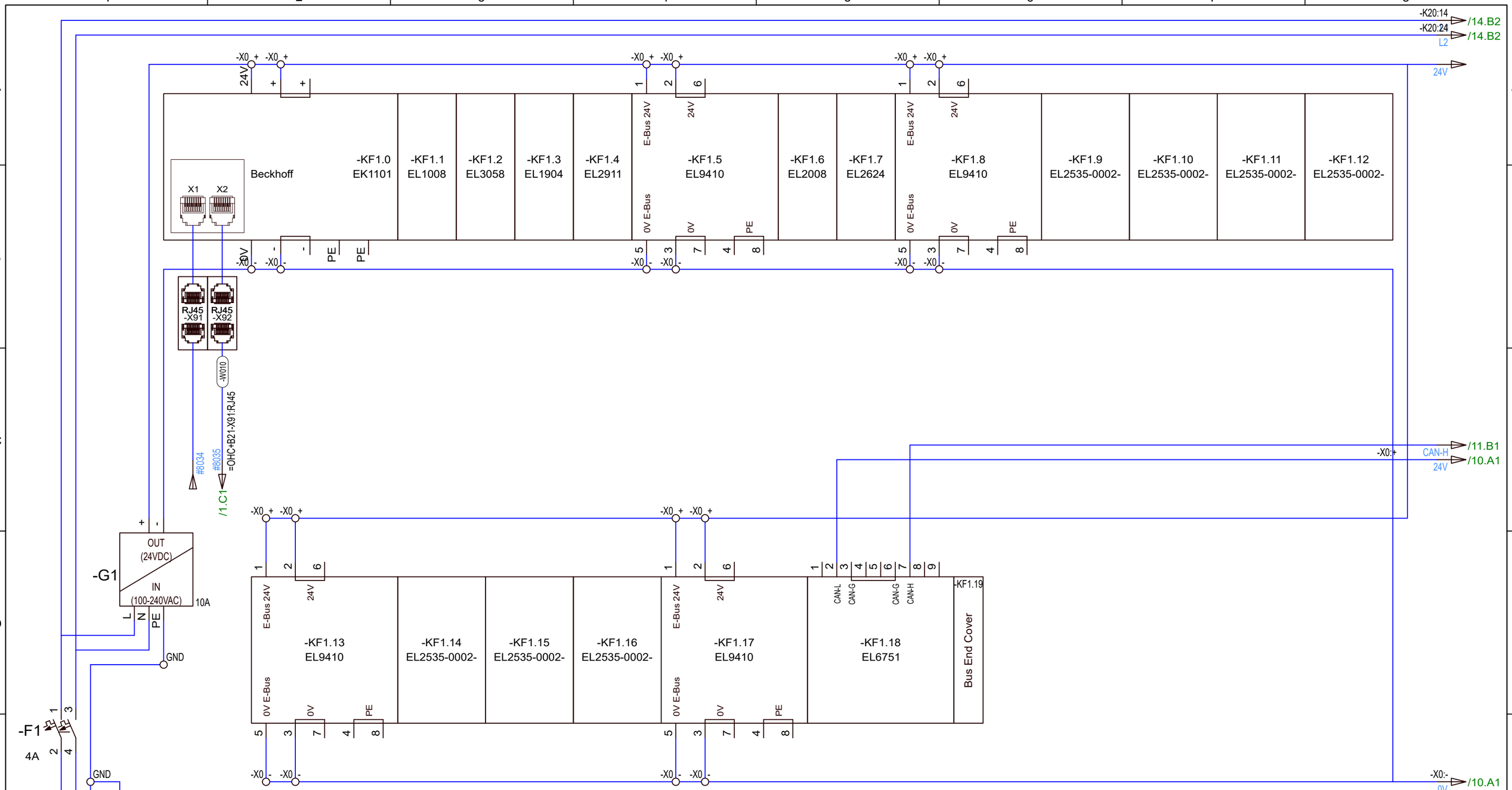
Template:



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Circuit Diagram
A-Frame Stern
Control Cabinet

=A-FRAME STERN
+B11

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-KF1.3 Beckhoff EL1904

Pin	Pin Description	IO Type	Ref	PLC Comment 1	PLC Comment 2	PLC Symboilic Adress
1		I1	/10.B1	Emergency Stop	+Z13-S1-1	DIN/DOUT
2						
3		I2	/10.B1	Emergency Stop	+Z13-S1-2	DIN/DOUT
4						
5		I3	/10.B3	Emergency Stop	A-Frame PORT	DIN/DOUT
6						
7		I4	/10.B3	Emergency Stop	A-Frame PORT	DIN/DOUT
8						

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Circuit Diagram
A-Frame Stern
IO List

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-KF1.1 Beckhoff EL1008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Input	DI1	/11.C1	Control Cabinet	Switch	A-Frame Stern	Manual Control	DI	
5	Digital Input	DI2	/11.C3	Control Cabinet	Switch	A-Frame Stern	Radio Control	DI	
2	Digital Input	DI3	/13.C2	Valve Bank	Switch	HPU	Start	DI	
6	Digital Input	DI4	/13.C4	Valve Bank	Switch	HPU	Stop	DI	
3	Digital Input	DI5						DI	
7	Digital Input	DI6						DI	
4	Digital Input	DI7						DI	
8	Digital Input	DI8						DI	

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Circuit Diagram
A-Frame Stern
IO List

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+B11

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-KF1.2 Beckhoff EL3058

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Analog Input	AI1	/14.B4	PS	Sensor		Tilt Lower Right	AI	4-20mA
5	Analog Input	AI2	/14.B5	PS	Sensor		Tilt Upper Right	AI	4-20mA
2	Analog Input	AI3	/14.B5	SPARE	-		-	AI	4-20mA
6	Analog Input	AI4	/15.B4	STBD	Sensor		Tilt Lower Left	AI	4-20mA
3	Analog Input	AI5	/15.B5	STBD	Sensor		Tilt Upper Left	AI	4-20mA
7	Analog Input	AI6	/15.B5	SPARE	-		-	AI	4-20mA
4	Analog Input	AI7						AI	4-20mA
8	Analog Input	AI8						AI	4-20mA

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Circuit Diagram
A-Frame Stern
IO List

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+B11

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-KF1.6 Beckhoff EL2008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Output	DO1	/10.B2	+Z13-S1	Emergency Stop		Light	DO	
5	Digital Output	DO2	/10.B4	A-Frame PORT	Emergency Stop		Light	DO	
2	Digital Output	DO3	/10.B6	A-Frame STBD	Emergency Stop		Light	DO	
6	Digital Output	DO4	/10.B7	Spare	Emergency Stop		Light	DO	
3	Digital Output	DO5	/13.C3	Valve Bank	Lamp	HPU	Run	DO	
7	Digital Output	DO6						DO	
4	Digital Output	DO7						DO	
8	Digital Output	DO8						DO	

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Circuit Diagram
A-Frame Stern
IO List

=A-FRAME STERN
+B11

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-KF1.7 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/11.C7	Control Cabinet	Relay	A-Frame Stern	Floodlight	RO	NO
2	Relay Output NO								
5	Com	RO2						RO	NO
6	Relay Output NO								
3	Com	RO3						RO	NO
4	Relay Output NO								
7	Com	RO4						RO	NO
8	Relay Output NO								

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Circuit Diagram
A-Frame Stern
IO List

=A-FRAME STERN
+B11

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-KF1.9 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/12.B2	Valve Bank	Winch STBD	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/12.B3					DI	
2	PWM Output B1	PWM2		Valve Bank	Winch STBD	Prop. Valve	In	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

-KF1.10 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/12.B3	Valve Bank	Link CYL STBD	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/12.B3					DI	
2	PWM Output B1	PWM2		Valve Bank	Link CYL STBD	Prop. Valve	In	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

-KF1.11 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/12.B4	Valve Bank	Link Cyl PORT	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/12.B4					DI	
2	PWM Output B1	PWM2		Valve Bank	Link Cyl PORT	Prop. Valve	In	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

-KF1.12 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/12.B4	Valve Bank	Leg Cyl STBD	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/12.B5					DI	
2	PWM Output B1	PWM2		Valve Bank	Leg Cyl STBD	Prop. Valve	In	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

-KF1.14 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/12.B5	Valve Bank	Leg Cyl PORT	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/12.B5					DI	
2	PWM Output B1	PWM2		Valve Bank	Leg Cyl PORT	Prop. Valve	In	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

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Circuit Diagram
A-Frame Stern
IO List

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+B11

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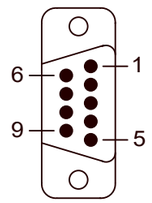
-KF1.18 Beckhoff EL6751

DSUB-9	Pin Description	IO Type	Ref
1		CAN	/1.E5
2	CAN-L		
3	CAN-G		
4			
5			
6	CAN-G		
7	CAN-H		
8			
9			



D-SUB
9-Pin
Male

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Circuit Diagram
A-Frame Stern
IO List

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+B11

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-KF1.18:2
/1.C8 24V
/1.E8 0V

-X0 -

-X0:+ 24V
-X0:- 0V
/11.C1
/11.E1

-KF1.3
+Z13-S1-1
Emergency Stop
DIN/DOUT
/1.B3
I1
+ -
1 2

-KF1.3
+Z13-S1-2
Emergency Stop
DIN/DOUT
/1.B3
I2
+ -
3 4

-KF1.6 DO1
+Z13-S1
Emergency Stop
Light
DO
1

-KF1.3
A-Frame PORT
Emergency Stop
DIN/DOUT
/1.B3
I3
+ -
5 6

-KF1.3
A-Frame PORT
Emergency Stop
DIN/DOUT
/1.B3
I4
+ -
7 8

-KF1.6 DO2
A-Frame PORT
Emergency Stop
Light
DO
5

-KF1.4 DIO1
A-Frame STBD
Emegrency Stop
IN
+ 1 - 2 /1.B3

-KF1.4 DIO2
A-Frame STBD
Emegrency Stop
IN
+ 5 - 6 /1.B3

-KF1.6 DO3
A-Frame STBD
Emergency Stop
Light
DO
2

-KF1.4 DIO3
Spare
+ 3 - 4 /1.B3

-KF1.4 DIO4
Spare
+ 7 - 8 /1.B3

-KF1.6 DO4
Spare
Emergency Stop
Light
DO
6

-X3 26 27 28 29 30 31
-X1 1 2 3 4 5 6
-X1 7 8 9 10 11 12
-X1 13 14 15 16 17 18

-W105 26 27 28 29 30 31
1 2 3 4 5 6
1 2 3 4 5 6

+Z13
+X11
-X1 26 27 28 29 30 31
-WI-01 1 2 3 4 5 6
+Z11 -S1 21 22
+Z11 -S1 23 24
+Z11 -S1 X1 X2

+Z10 Deck Equipment Area
-S3 21 22
-S3 23 24
-S3 X1 X2
-S4 21 22
-S4 23 24
-S4 X1 X2

Emergency Stop
Portside

Emergency Stop
Starbordside

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Circuit Diagram
A-Frame Stern
Control Cabinet

=A-FRAME STERN
+B11

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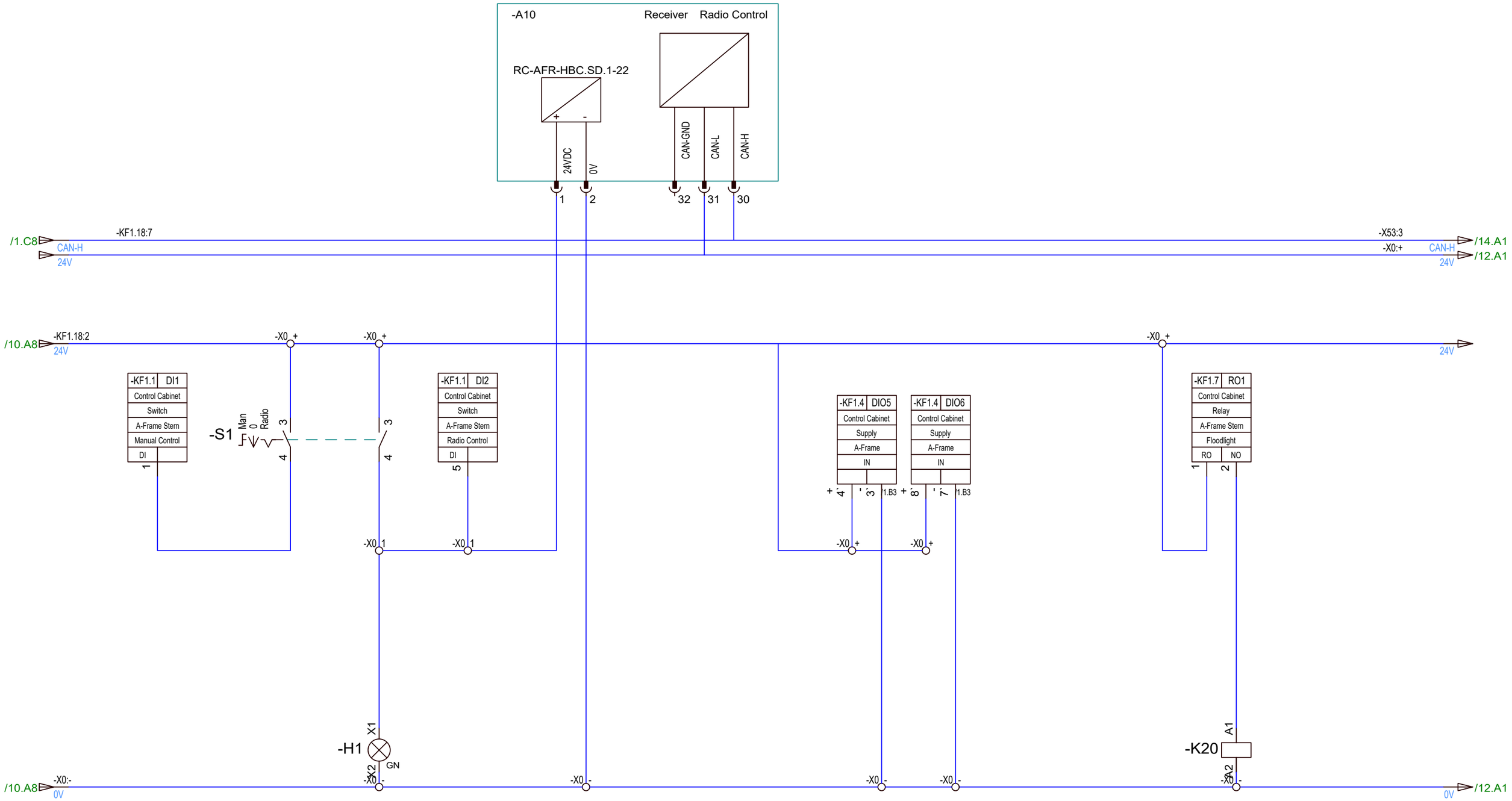

Control From Radio

Floodlights

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Circuit Diagram
A-Frame Stern
Control Cabinet

=A-FRAME STERN
+B11

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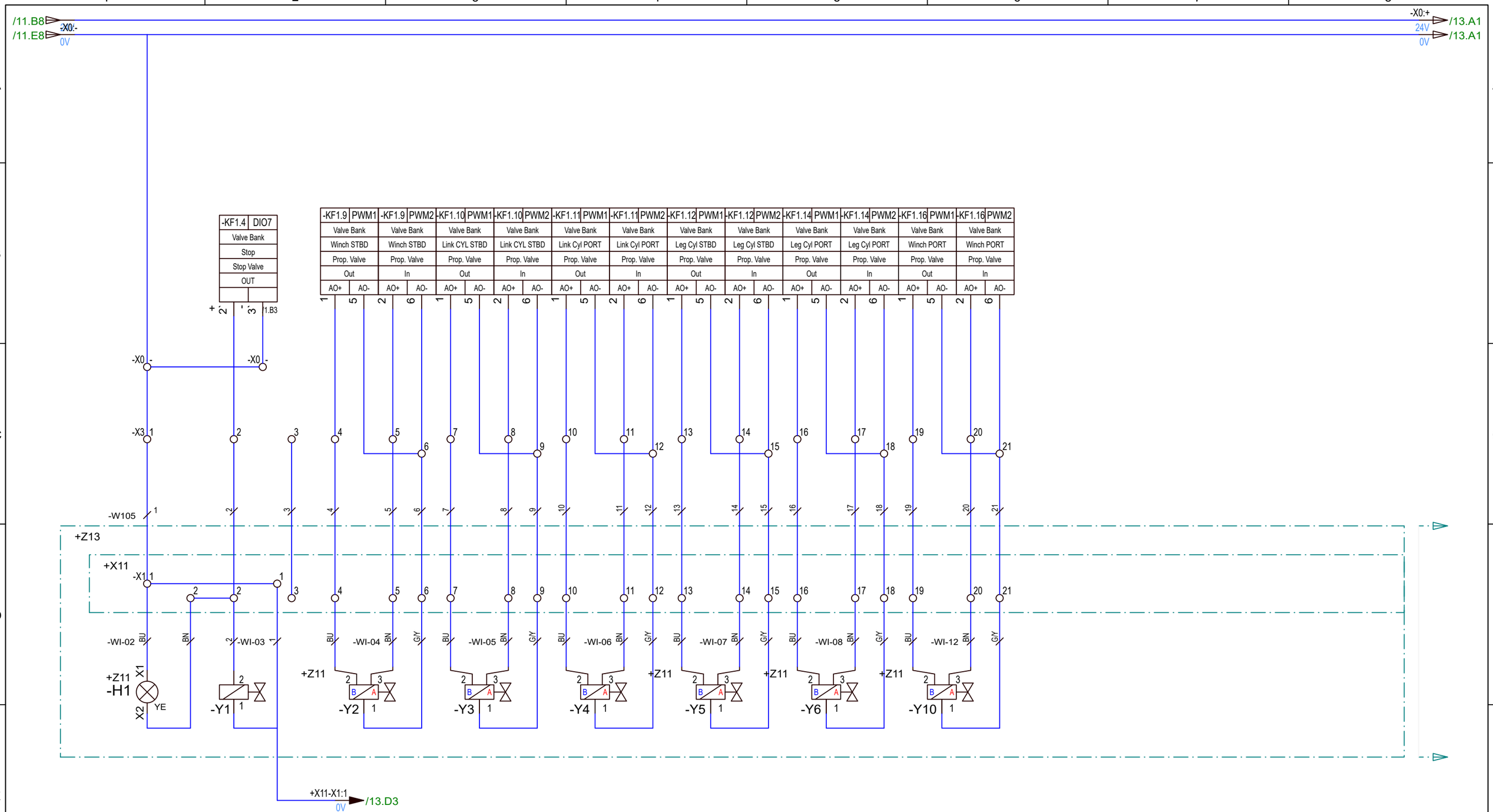

A-Frame Active	A-Frame Stop	Aux Winch STBD		Link Cyl STBD		Link Cyl PORT		Leg Cyl STBD		Leg Cyl PORT		Aux Winch PORT	
		2 Out	3 In	2 Out	3 In	2 Out	3 In	2 Out	3 In	2 Out	3 In	2 Out	3 In

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Circuit Diagram
A-Frame Stern
Control Cabinet

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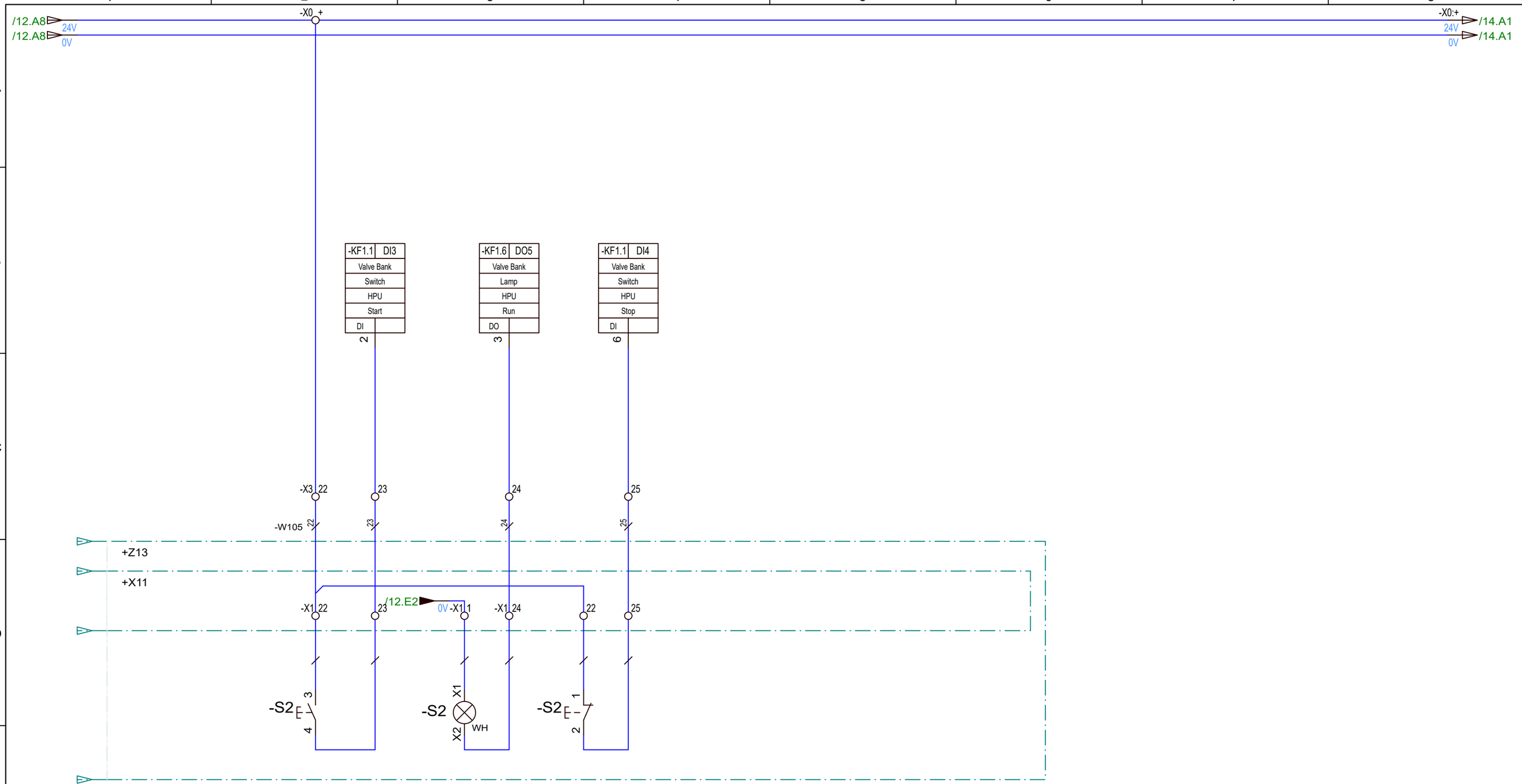

HPU Start Button		HPU Run Light		HPU Stop Button

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Circuit Diagram
A-Frame Stern
Control Cabinet

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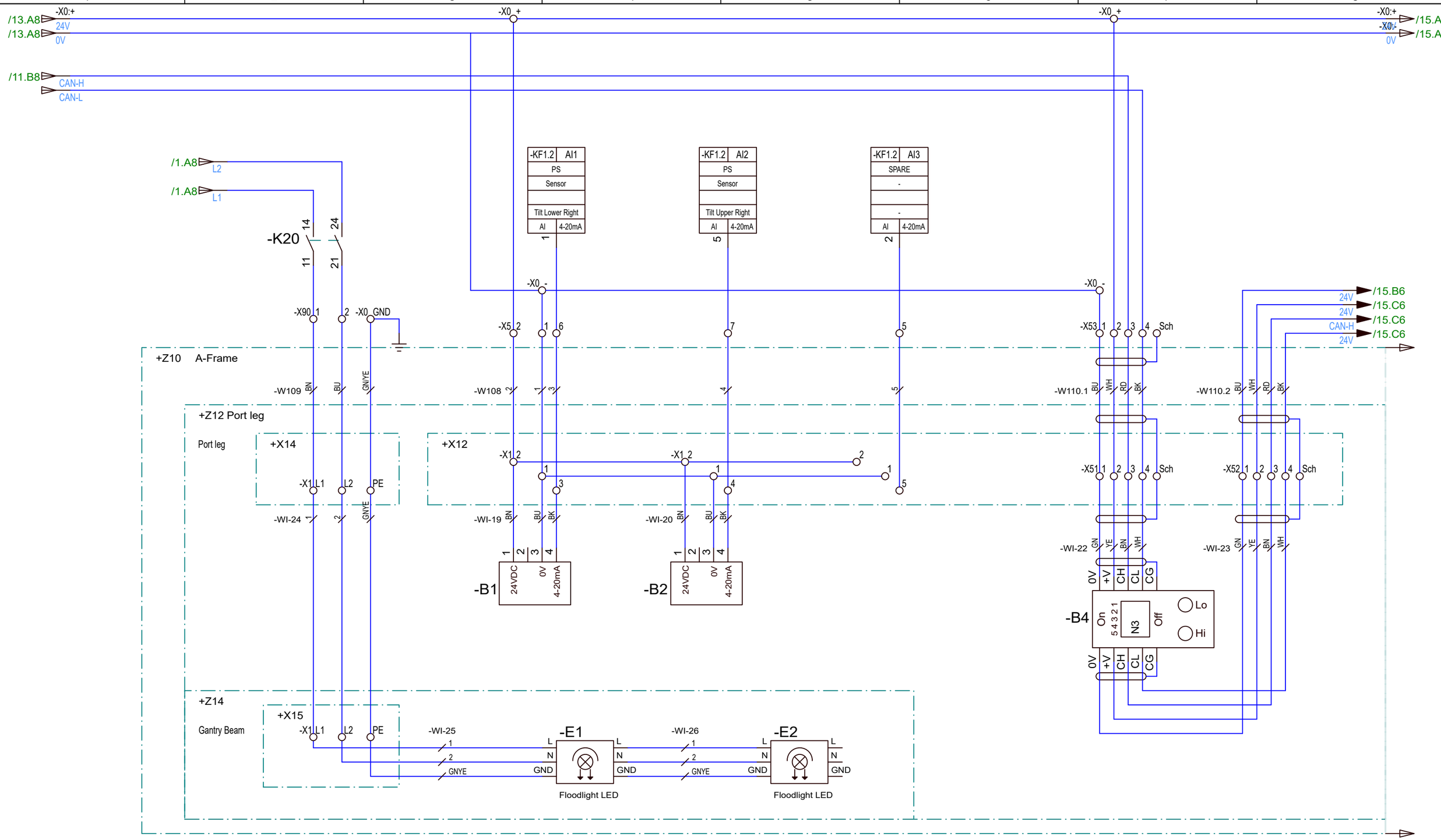

Tilt lower right (PORT)

Tilt upper right (PORT)

Aux Winch (PORT)

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Circuit Diagram
A-Frame Stern
Control Cabinet

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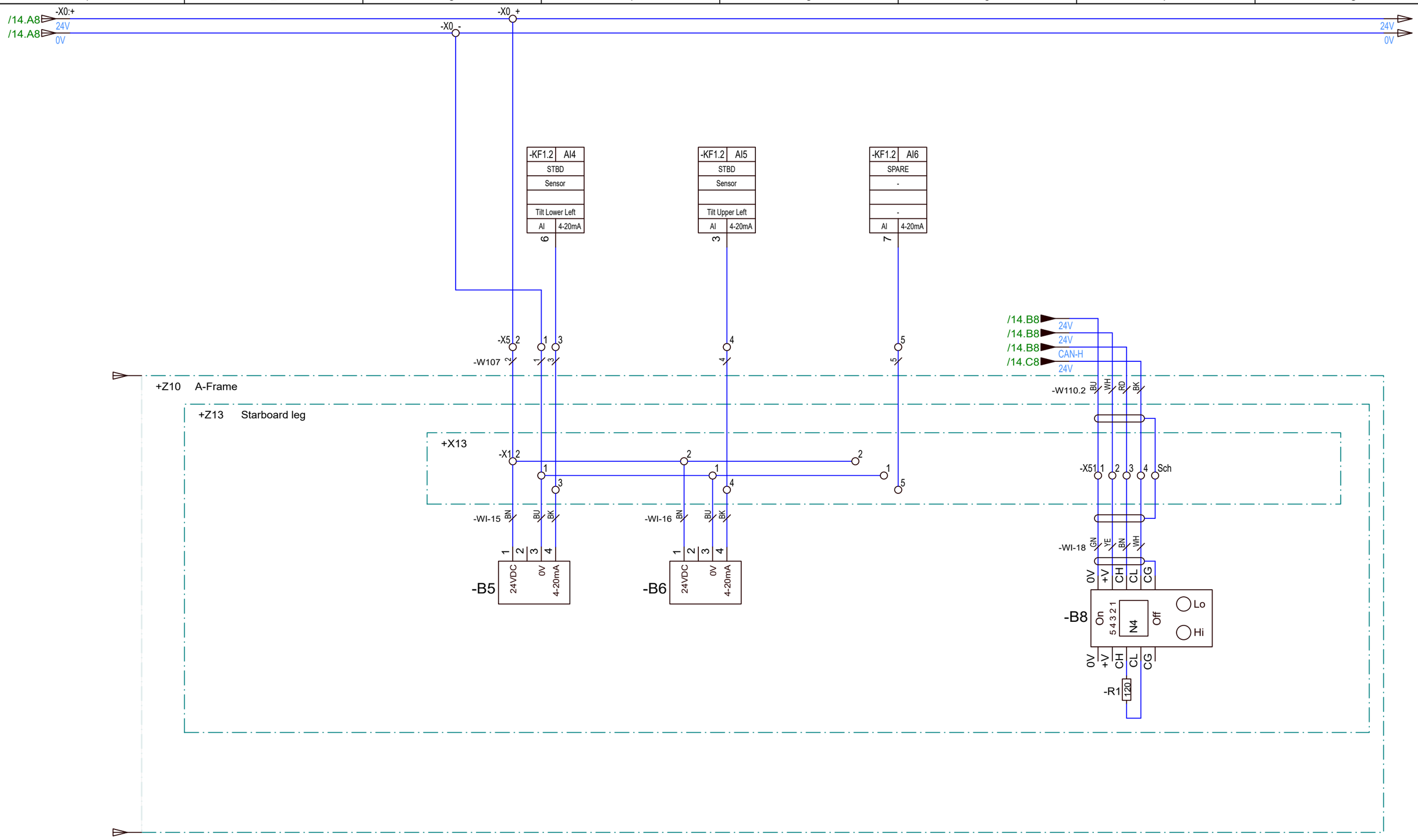

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Circuit Diagram
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Control Cabinet

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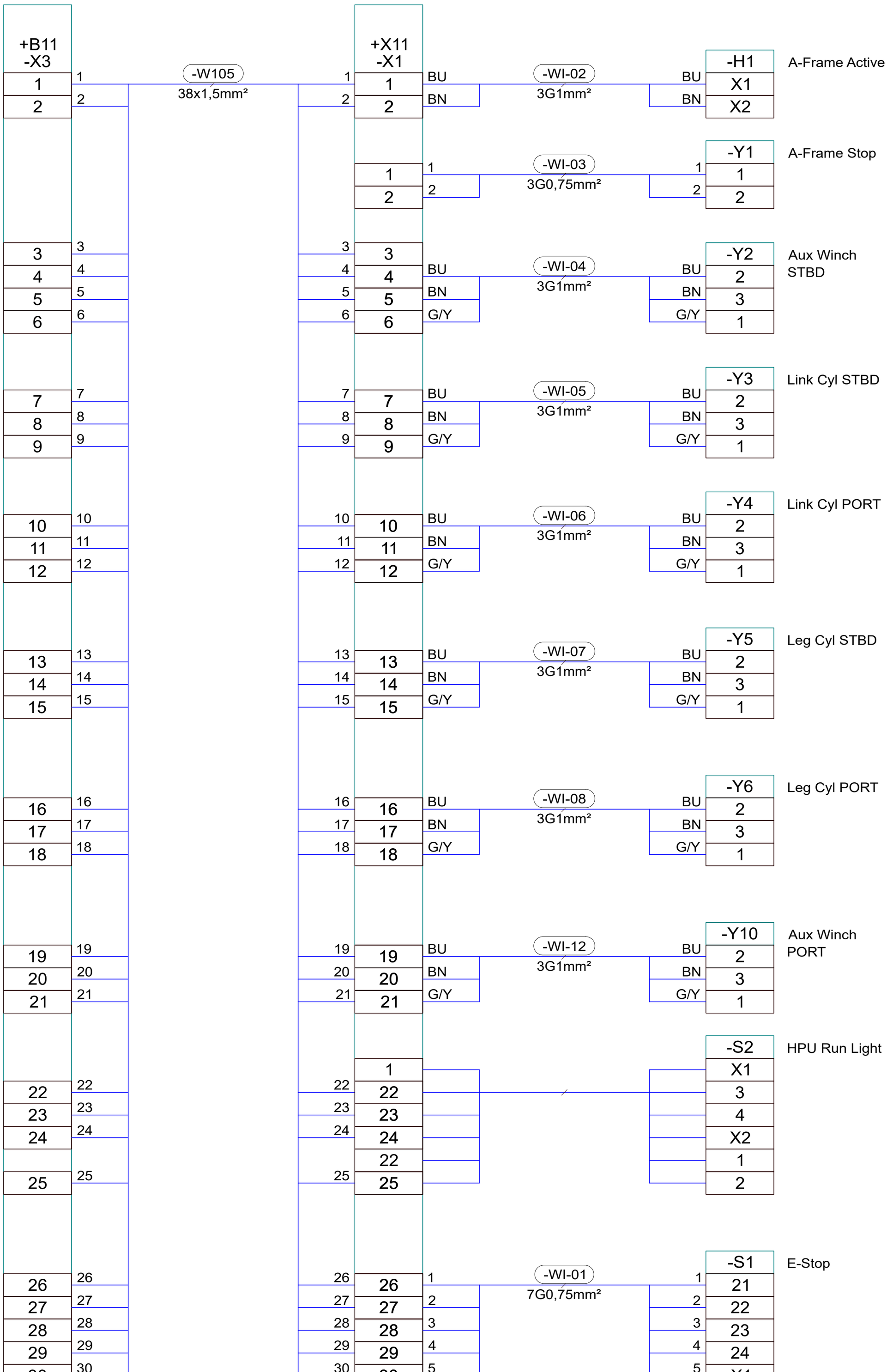

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Termination Diagram
A-Frame Stern

=A-FRAME STERN

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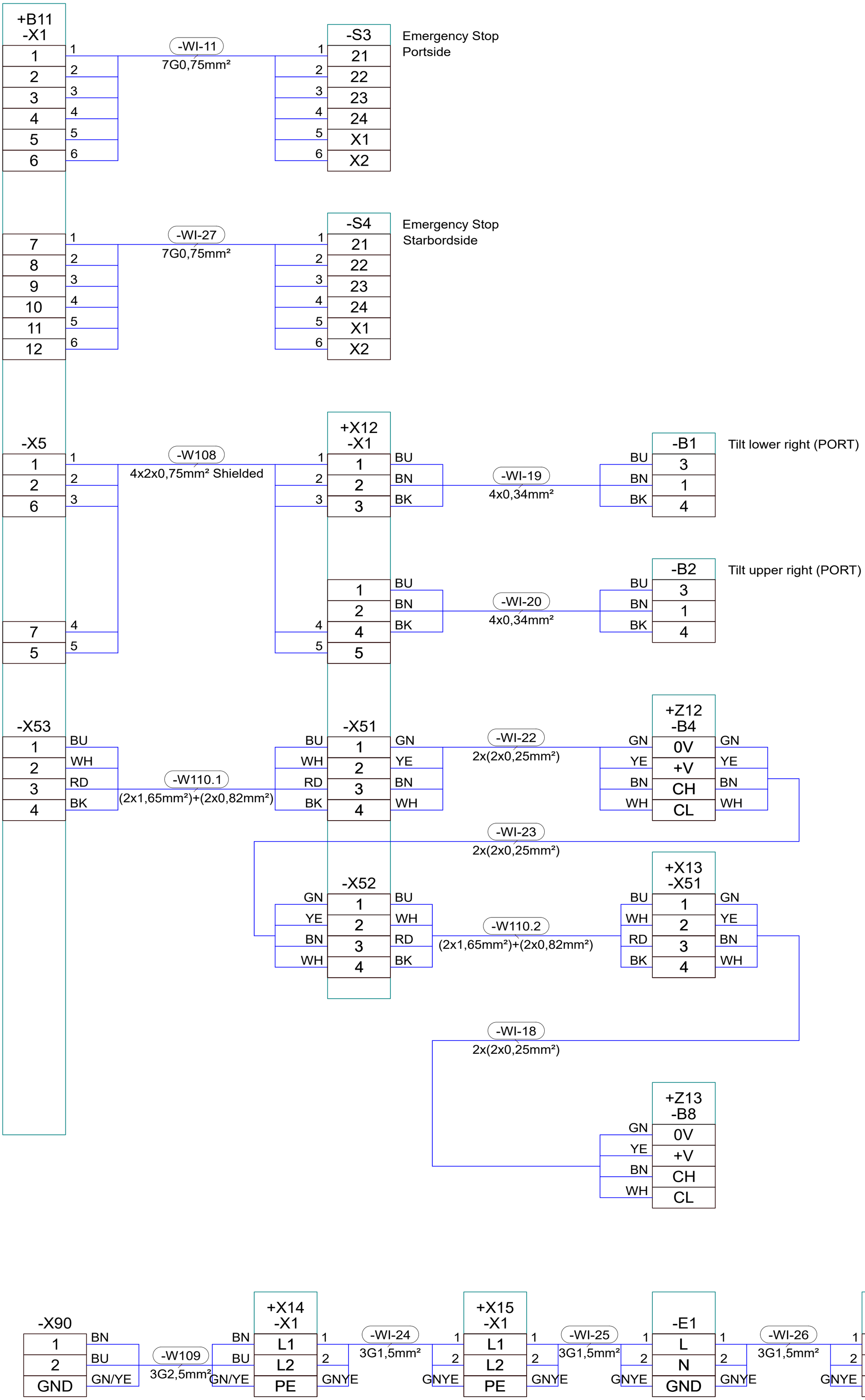

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Termination Diagram
A-Frame Stern

=A-FRAME STERN

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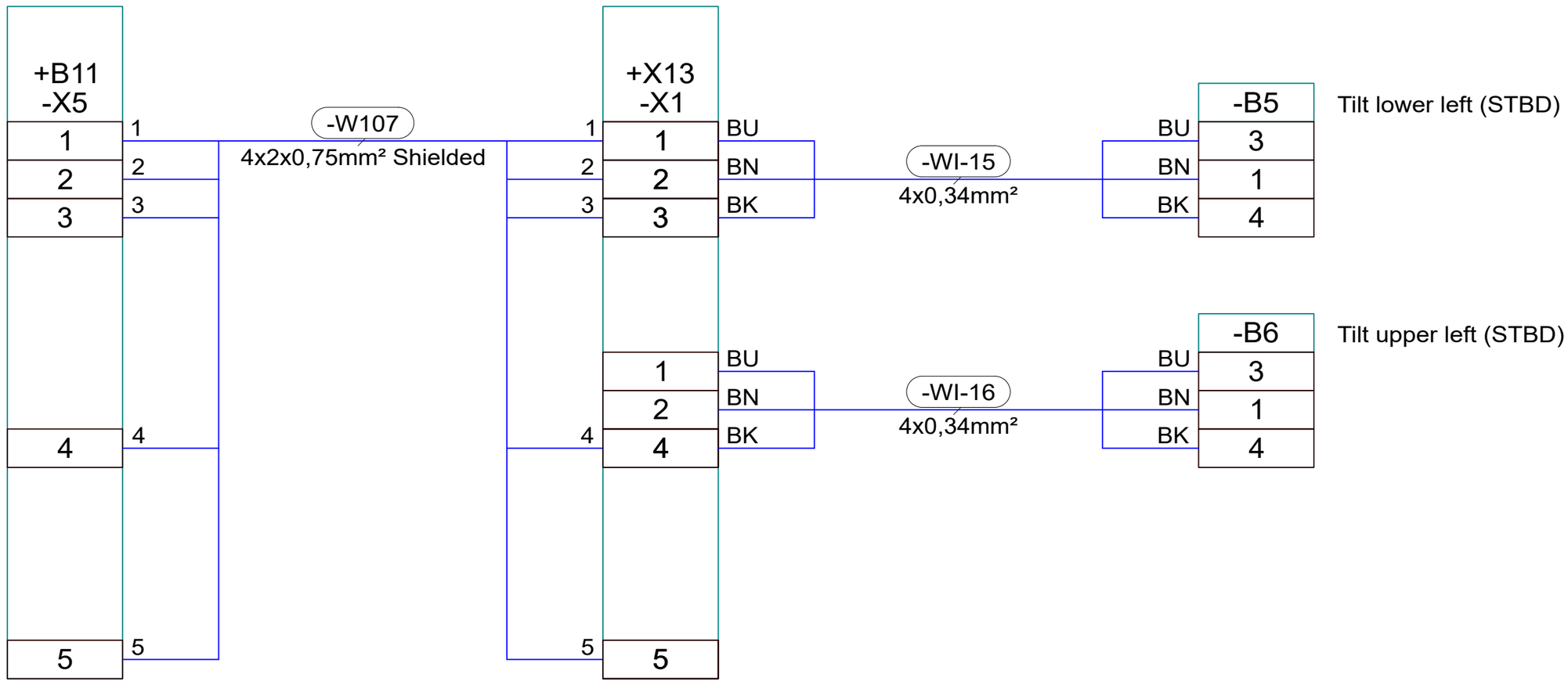

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04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

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Termination Diagram
A-Frame Stern

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-S3,-S4	XALK178W3B140G	400208317	4322660	2	Pcs	CONTR. PUSH, EM STOP	Schneider	
-WI-01	ROFLEX 7G0.75	07915015		1	Pcs	CABLE, 7G0,75mm²	Lapp	
-WI-02,-WI-04,-WI-05,-WI-06,-WI-07,-WI-08,-WI-12	ROFLEX 3G1	07915017		7	Pcs	CABLE, 3G1mm²	Lapp	
-WI-03	7074-18021-2360500	07930051		1	Pcs	CONNECTOR, VALVE, MURR, 5M, SS	Murr	
-WI-11,-WI-27	ØLFLEX FD 855 CP 7G0.75	400111231	10 905 14	2	Pcs	CABLE, 7x0,75mm², SHIELDED	Lapp	
-WI-15,-WI-16,-WI-19,-WI-20	V1-WV4A-10M-PUR-ABG0	07917048		4	Pcs	GIVER KABEL M12 4-PIN VINK 10M SKJERM	Pepperl & Fuchs	
-WI-18,-WI-22,-WI-23	BUS FD P CAN UL/CSA 2x2x0.25	07915044		3	Pcs	CABLE, 2x2x0,25mm²	Lapp	
-WI-24,-WI-25,-WI-26	ØLFLEX FD 855 CP 3G1.5			3	Pcs	CABLE, 3x1,5mm², SHIELDED	Lapp	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-A13	RC-AFR-HBC.SD.1-22	400198449		1	Pcs	A-Frame 19 with Display	HBC	
-CAB1	ADO201	07939034	24 138 75	1	Pcs	CABINET, DOORSTOPPER, ADO, ELDON	Eldon	
-CAB1	MAS0605030	400089006	24 174 95	1	Pcs	CABINET, 600x500x300 ELDON*	Eldon	
-DUCT1..-DUCT4	HA760040	07920015	12 857 18	1.22	M	CABLE TRAY, 60X40, GREY, W/LID	Tehalit Hager	
-F1	C60H/C 04-2	07938005	16 760 63	1	Pcs	SIKRING AUTOMAT 4A, 2-POL	Schneider	
-G1	CS10.241	07949016	66 040 29	1	Pcs	POWER SUPPLY, PULSE, 10A, 230/24	Puls	
-GL1,-GL10	WADI-TEC EMC M25 Ø13.5-18	07928085	12 492 72	2	Pcs	CABLE GLAND, BRASS, EMC, Ø13,5-18	Elis	
-GL2..-GL3,-GL7..-GL8	WADI-TEC EMC M20 Ø8-12.5	07928083	12 492 68	4	Pcs	CABLE GLAND, BRASS, EMC, Ø8-12,5	Elis	
-GL4,-GL5	WADI-TEC EMC M40 Ø24-30	400075304	12 492 78	2	Pcs	CABLE GLAND, BRASS, EMC, Ø24-30	Elis	
-GL6,-GL9	WADI-TEC EMC M25 Ø10-14.5	07928084	12 492 70	2	Pcs	CABLE GLAND, BRASS, EMC, Ø10-14,5	Elis	
-H1	ZBVB3	07924016	43 032 26	1	Pcs	LAMP, LED, GN, 24V	Schneider	
-K20	C7A20FX24D	07936015	43 783 87	1	Pcs	RELAY, RELECO, 2-POLE, 24V DC, 10A	Releco	
-K20	S7-I/O	07936015	43 783 87	1	Pcs	RELAY, SOCKET	Releco	
-KF1.0	EK1101	400142335		1	Pcs	EtherCAT Coupler w ID settings	Beckhoff	
-KF1.1	EL1008	400142339		1	Pcs	8 Digital Inputs	Beckhoff	
-KF1.2	EL3058	400142349		1	Pcs	8 Analog Inputs 4-20mA 2-wire	Beckhoff	
-KF1.3	EL1904			1	Pcs	TwinSAFE 4 Digital Inputs	Beckhoff	
-KF1.4	EL2911	400142346		1	Pcs	TwinSAFE 4 Digital Inputs, 1x Output	Beckhoff	
-KF1.5,-KF1.8,-KF1.13,-KF1.17	EL9410	400142412		4	Pcs	Power Supply Terminal fro E-bus	Beckhoff	
-KF1.6	EL2008	400142342		1	Pcs	8 Digital Outputs	Beckhoff	
-KF1.7	EL2624	400142344		1	Pcs	4 Relay Outputs	Beckhoff	
-KF1.9,-KF1.10,-KF1.11,-KF1.12,-KF1.14,-KF1.15,-KF1.16	EL2535-0002-	400142343		7	Pcs	2 PWM Outputs, 2 Digtal Inputs	Beckhoff	
-KF1.18	EL6751	400142409		1	Pcs	CANopen master/slave terminal	Beckhoff	
-KF1.19	EL9011	400142410		1	Pcs	Bus end cap	Beckhoff	
-R1..-R6	RND 155M207F249RTKRTB5K0	07998012		6	Pcs	Resistor, 249Ω, 0.6W, 1%	RND Components	
-R7,-R8	RND 155M207F120RTKRTB5K0	07998018		2	Pcs	Resistor, 120Ω, 0.6W, 1%	RND Components	
-RAIL1..-RAIL3	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	1.265	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S1	ZB4BK1333	07960019	43 025 24	1	Pcs	CONTR. SWITCH, 3 POS, LED GN	Schneider	
-S1	ZB4BZ009	07961012	43 027 45	1	Pcs	CONTR. ACC, SOCKET, METAL	Schneider	
-S1	ZBE101	07961013	43 004 23	2	Pcs	CONTR. ACC, CONTACTBLOCK, 1NO	Schneider	
-TAG1	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-TAG2	US-EMLP-HA 24	400075270		1	Pcs	TAG, SIGN, THERMOMARK CARD	Phoenix Contact	
-X0	AEP AP11			1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0..-X1,-X3,-X5,-X53,-X90	AEB 35 SC/1	400073887	12 654 34	15	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X0 (1),-X53 (1-4,Loop)	A3C 2.5	400069932	12 654 01	6	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X0 (-)	AAP11 6/6X1.5 LO-LI BL	400074009		1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (-,-,-,-)	AAP11 1.5 LI BL	400074009		4	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+)	AAP11 6/6X1.5 LO-LI RD	400074009		1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+,+,+)	AAP11 1.5 LI RD	400074009		3	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (GND)	JORDSKINNE 21	07918007		1	Pcs	RAIL, GRN, BRASS, 21 SLOT	Weidmüller	
-X0 (GND)	WPE 4	07918003	12 688 16	1	Pcs	-TERMINAL BLOCK, GND, 101010	Weidmüller	
-X0 (GND,GND)	A3C 2.5 PE	400074010	12 654 16	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X0,-X53	AEP 3C 2.5	400069937	12 694 11	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,3,5,7,9,11,13,15,17),-X5 (1,1,1,3,5,7)	A2T 2.5	400073880	12 654 14	15	Pcs	TERMINAL BLOCK, SNAP-IN, TWO HIGHTS	Weidmüller	
-X1,-X5	AEP 2T 2.5	400073883	12 694 40	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X3	AEP 3T 2.5	400209845	12 694 40	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X3 (1,4,7,10,13,16,19,22,25,28,31)	A3T 2.5			11	Pcs	TERMINAL BLOCK, SNAP-IN, THREE HIGHTS	Weidmüller	
-X90 (1-2)	A2C 2.5	400069931	12 654 00	2	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X91,-X92	IE-TO-RJ45-FJ-B	07930061		2	Pcs	CONNECTOR, FEMALE, RJ45, RAIL MOUNT	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1	ST-M 40 x 1.5	07928036	12 477 17	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø20-32	Lapp	
-GL2..-GL9	ST-M 16 x 1.5	07928032	12 477 13	8	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-GL10,-GL11	ST-M 20 x 1.5	07928033	12 477 14	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB1	CPG-300	07904005		1	Pcs	JUNCTION BOX, POLYESTER, 260x160x91	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.248	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1	AEP 3C 2.5	400069937	12 694 11	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1,1-2,2)	A3C 2.5	400069932	12 654 01	5	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (3-22,22-38)	A2C 2.5	400069931	12 654 00	37	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1	ST-M 25 x 1.5	07928034	12 477 15	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-GL2..-GL4	ST-M 16 x 1.5	07928032	12 477 13	3	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-GL5..-GL8	ST-M 20 x 1.5	07928033	12 477 14	4	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.2	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X51 (1,1-2,2-3,3-4,4,CAN-Loop)	A3C 2.5	400069932	12 654 01	9	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1	ST-M 25 x 1.5	07928034	12 477 15	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-GL2..-GL4	ST-M 16 x 1.5	07928032	12 477 13	3	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-GL5..-GL8	ST-M 20 x 1.5	07928033	12 477 14	4	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB2	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.2	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEP 3C 2.5	400069937	12 694 11	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1-2,2),-X51 (1-4,CAN-Loop,Sch),-X52 (1-4,Sch)	A3C 2.5	400069932	12 654 01	15	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (1,1,1,1-2,2,2,2-3,3-4,4-5,5)	A2C 2.5	400069931	12 654 00	14	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1,-X51..-X52	AEB 35 SC/1	400073887	12 654 34	7	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1,-GL2	ST-M 20 x 1.5	07928033	12 477 14	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB1	CPG-220	07904002		1	Pcs	JUNCTION BOX, POLYESTER, 122x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.105	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1 (L1,L1,L2,L2)	A2C 2.5	400069931	12 654 00	4	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1,-GL2	ST-M 20 x 1.5	07928033	12 477 14	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB2	CPG-220	07904002		1	Pcs	JUNCTION BOX, POLYESTER, 122x120x90	Bernstein	
-RAIL2	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.105	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG2	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1 (L1,L1,L2,L2)	A2C 2.5	400069931	12 654 00	4	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-H1	853 310 55	07959005		1	Pcs	LAMP, BEACON, LED, YE, FLASH, 24V	Werma	
-S1	XALK178W3B140G	400208317	4322660	1	Pcs	CONTR. PUSH, EM STOP	Schneider	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B1,-B2	ROTA LJ			2	Pcs	SENSOR, LENGTH, INDUCTIVE, CYLINDER, 4.. 20mA	ROTA	
-B4	K-8.5868.3221.2113C	07917203		1	Pcs	SENSOR, ROTATION, ABSOLUT, MULTITURN, 10x20mm	Kübler	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B5,-B6	ROTA LJ			2	Pcs	SENSOR, LENGTH, INDUCTIVE, CYLINDER, 4.. 20mA	ROTA	
-B8	K-8.5868.3221.2113C	07917203		1	Pcs	SENSOR, ROTATION, ABSOLUT, MULTITURN, 10x20mm	Kübler	
-R1	RND 155M207F120RTKRTB5K0	07998018		1	Pcs	Resistor, 120Ω, 0.6W, 1%	RND Components	
-S2				1	Pcs			
-S2	ZB4BW7L3741	07960023	43 014 34	1	Pcs	CONTR. PUSH, I-0 W/LED, DOUBLE	Schneider	
-S2	ZBE101	07961013	43 004 23	1	Pcs	CONTR. ACC, CONTACTBLOCK, 1NO	Schneider	
-S2	ZBE102	07961015	43 004 24	1	Pcs	CONTR. ACC, CONTACTBLOCK, 1NC	Schneider	
-S2	ZBVB1	07924015	43 032 23	1	Pcs	LAMP, LED, WH, 24V	Schneider	

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-E1,-E2	FL60 18000 850 120 M25 NB US	400110503		2	Pcs	FLOODLIGHT, LED, 160W, 120V, NARROW BEAM	Glamox	

Rev.	Description	Date	Rev. by		
04	Issued for production	05.02.2025	WJ	Date	14.10.2021
03	Issued for production	16.02.2023	EE	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

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Part List
A-Frame Stern

=A-FRAME STERN
+Z14

E-4501- 07
Rev. 04
12 / 12

Printed: 05.02.2025 10:58

Template:

=OHC

Customer : CNP Freire
Ship/Hull : MBARI
Project no. : 4/60185
Drawing no.: E-4502

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Front Page
OHC ROV LARS

=OHC

E-4502 - 00

Rev. 04 | 1 / 1

+Z20 Deck Equipment Area

Special pre terminated antenna cable, length must be specified and ordered with vendor.

+B21
Control Cabinet

-W202 4x0,34mm²

-A20.2

-W201 6x0,75mm²

-S1

+Z23 Valve Bank

+X21

JB Valves

-WI-01 7G0,75mm² -S1 E-Stop

-WI-02 3G1mm² -H1 YE OHC ROV Active

-WI-03 3G0,75mm² -Y1 OHC ROV Stop

-WI-04 3G1mm² -Y2 OHC ROV Main Boom

-WI-05 3G1mm² -Y3 OHC ROV Trolley Motor

-WI-06 3G1mm² -Y4 OHC ROV Telescope Boom

-WI-07 3G1mm² -Y5 OHC ROV Winch

-WI-08 3G1mm² -Y6 OHC ROV Along Tilt Cylinder

-WI-09 3G1mm² -Y7 OHC ROV Latch Cylinder

-WI-10 3G1mm² -Y8 OHC ROV DH Twist

-WI-11 3G1mm² -Y9 OHC ROV Out Hauler

-WI-12 3G1mm² -Y10 OHC ROV Research Sheave Across Tilt

-WI-13 3G1mm² -Y11 OHC ROV Spring Plate

CPG-320
HxWxD:360x160x91
ID:
400202650

/1.F1 =A-FRAME STERN+B11 Etercat -W010 4x(2x0,5mm²) CAT7

/1.B1 =CTD DAVIT+B31 Etercat -W011 4x(2x0,5mm²) CAT7

-W204 20x1,5mm²

-W215 20x1,5mm²

Door Interface -W207 14x0,75mm²

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Single Line
OHC ROV LARS

=OHC

E-4502 - 01

Rev. 04

1 / 3

Printed: 07-Jul-23 11:33

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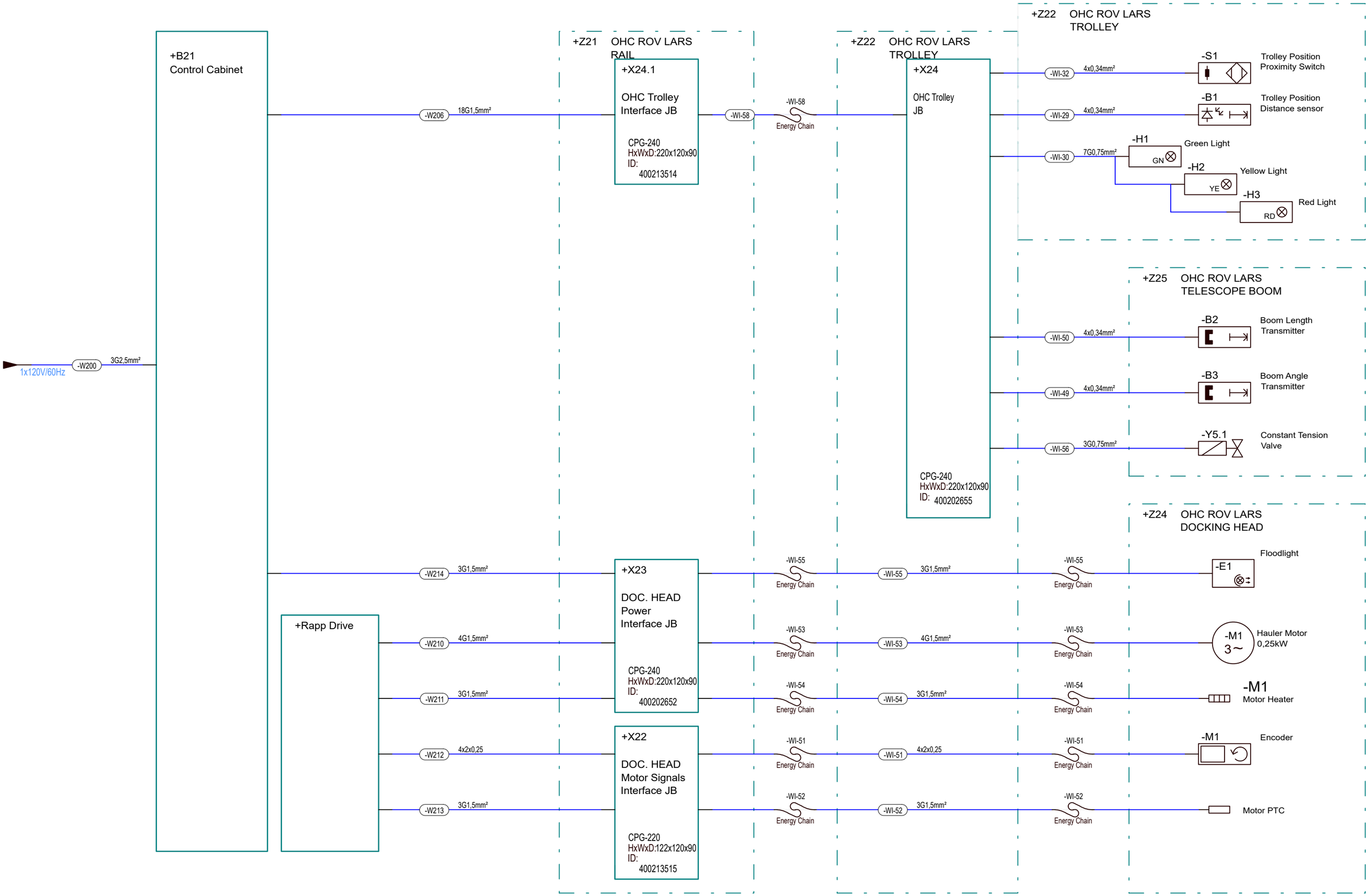

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Single Line
OHC ROV LARS

=OHC

E-4502 - 01

Rev. 04

2 / 3

Printed: 07-Jul-23 11:33

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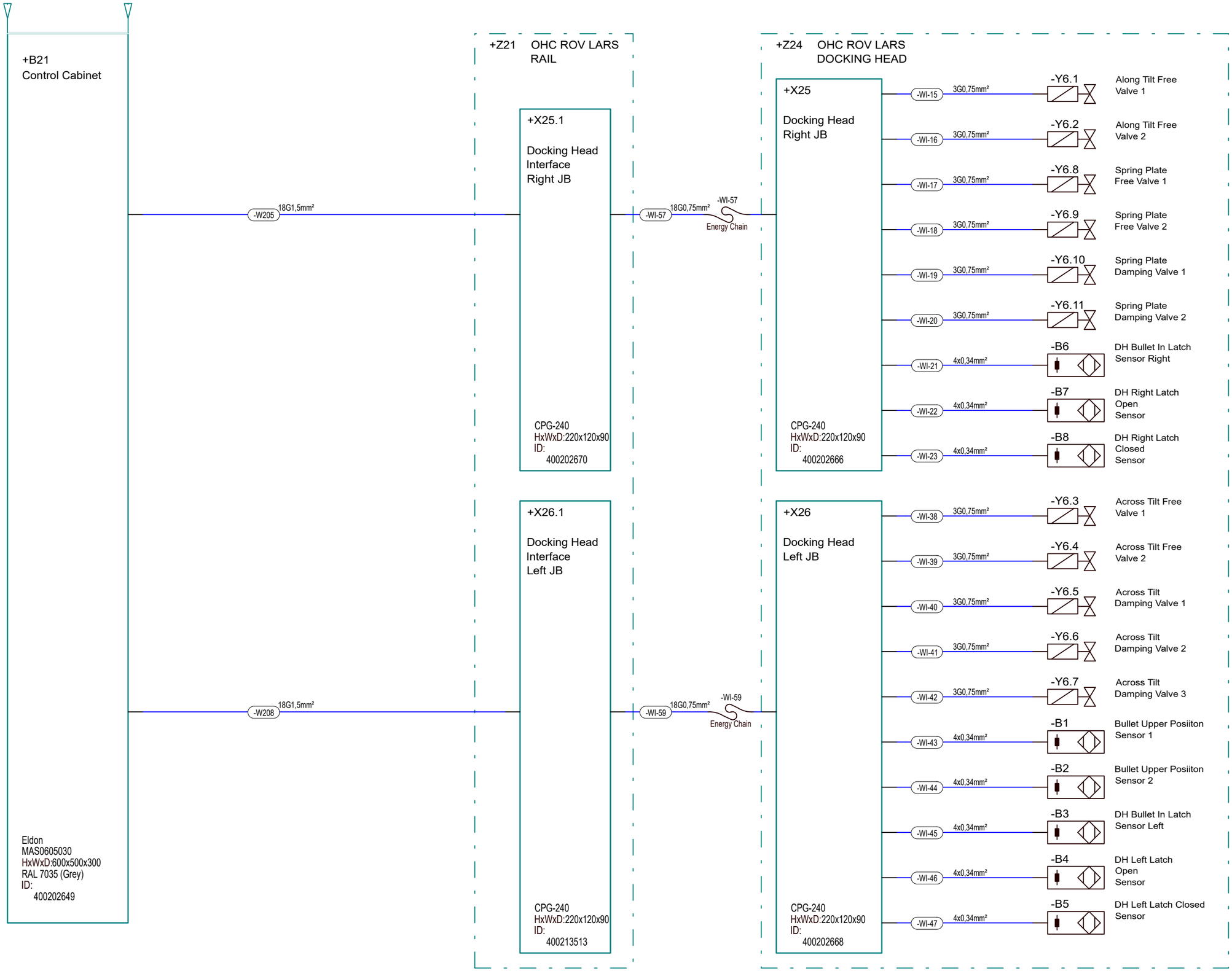

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

4/60185
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Single Line
OHC ROV LARS

=OHC

E-4502 - 01

Rev. 04

3 / 3

Printed: 07-Jul-23 11:33

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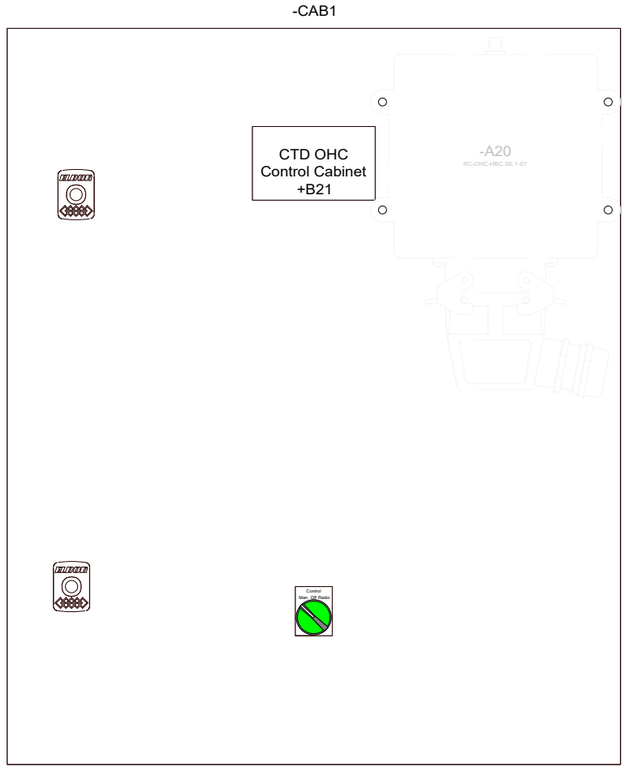

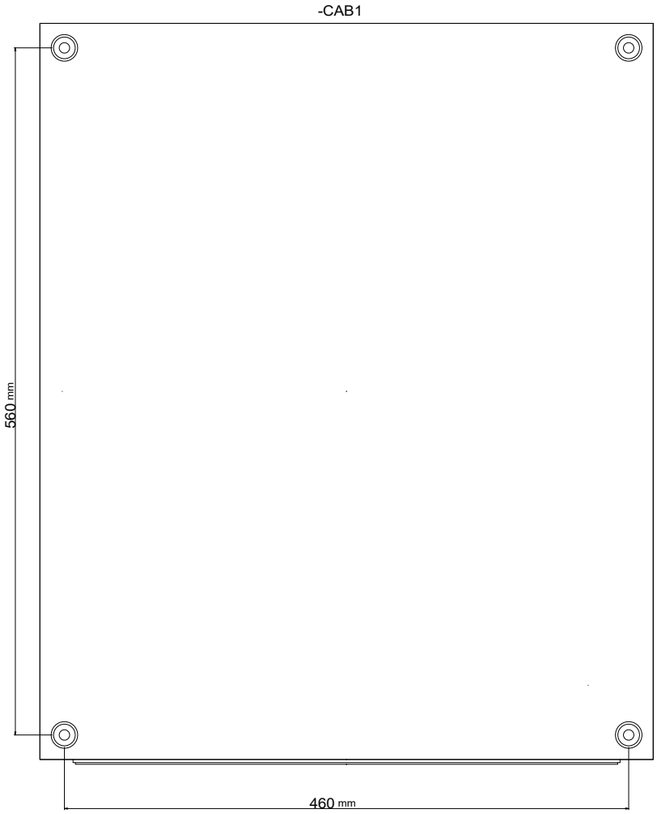

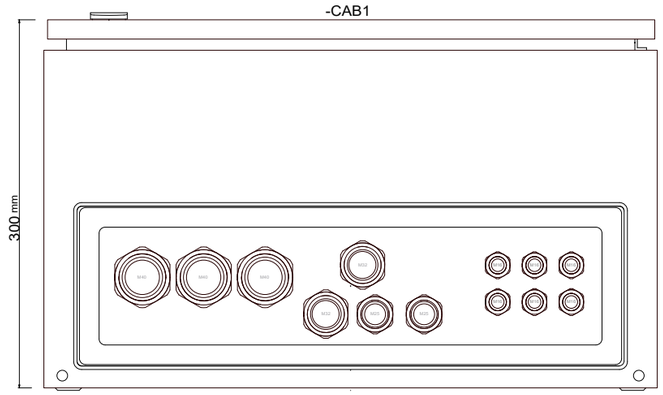

Product Data	
Manufacturer	Eldon
Article name	MAS0605030
WxHxD	600x500x300
IP	IP 66
RAL Code	RAL 7035 (Grey)
Material	Steel, Painted

04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE
Rev.	Description	Date	Rev. by	Standard	

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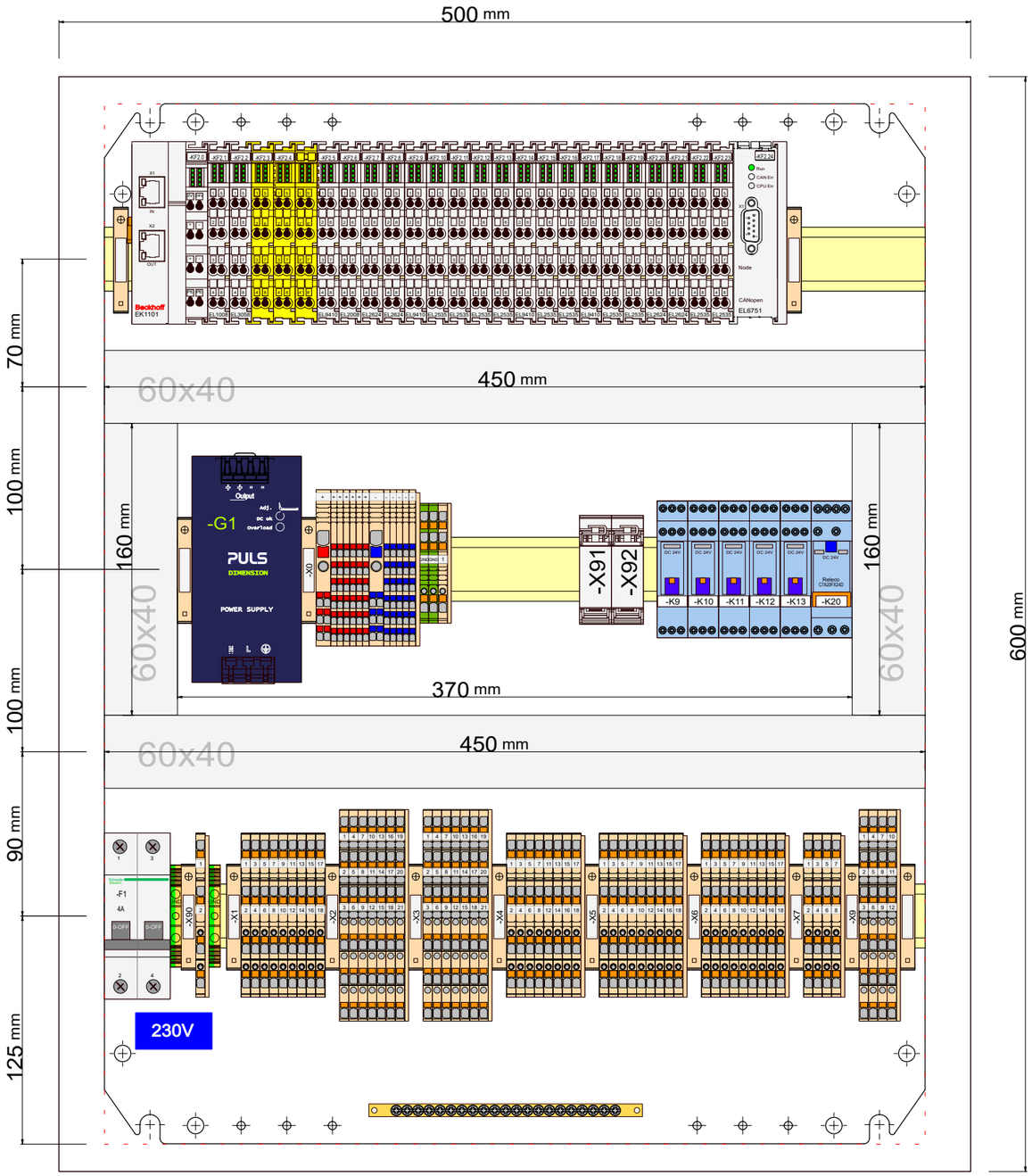
Layout
OHC ROV LARS
Control Cabinet Radio - Outside

=OHC
+B21

E-4502 - 03
Rev. 04
1 / 14



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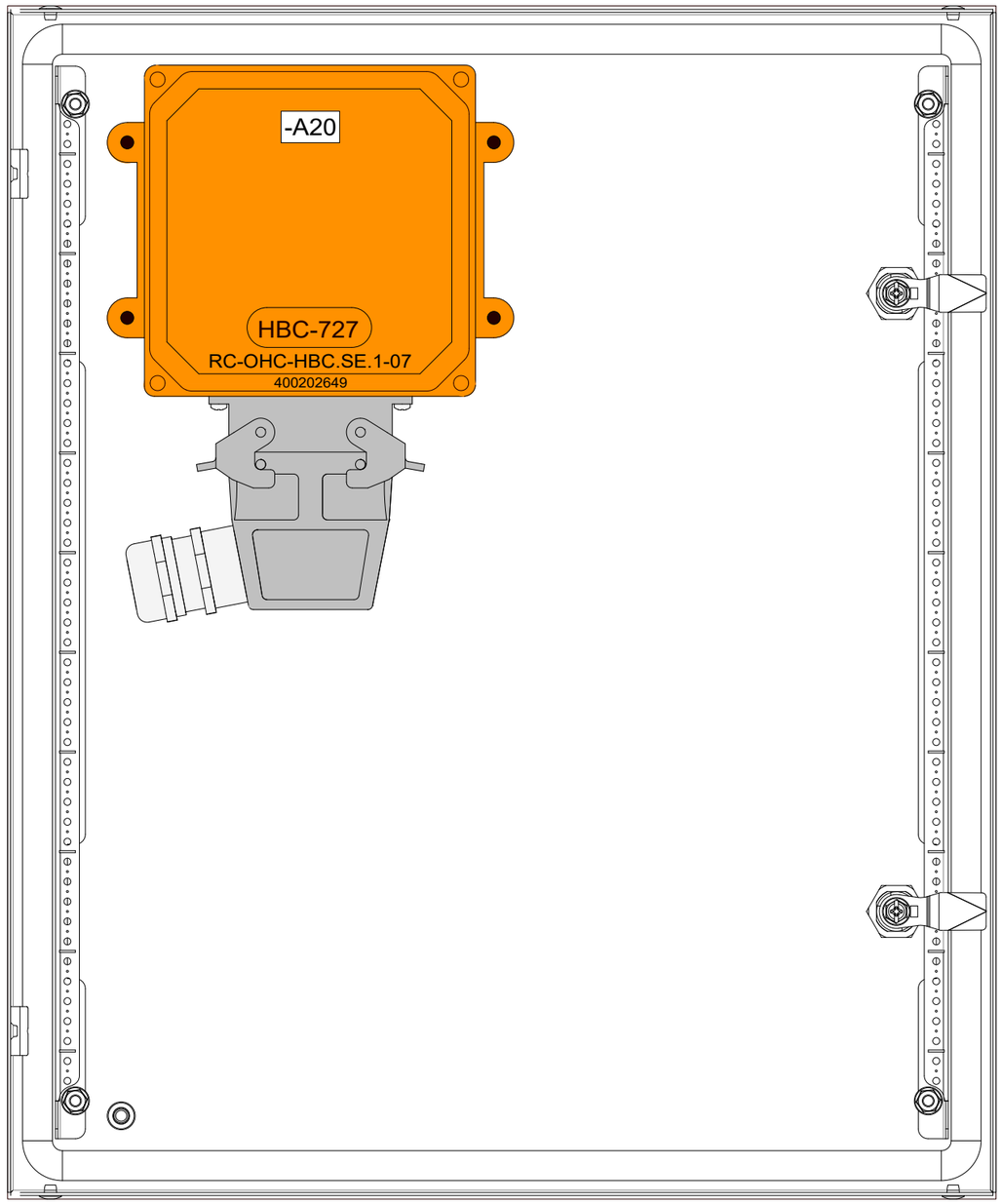

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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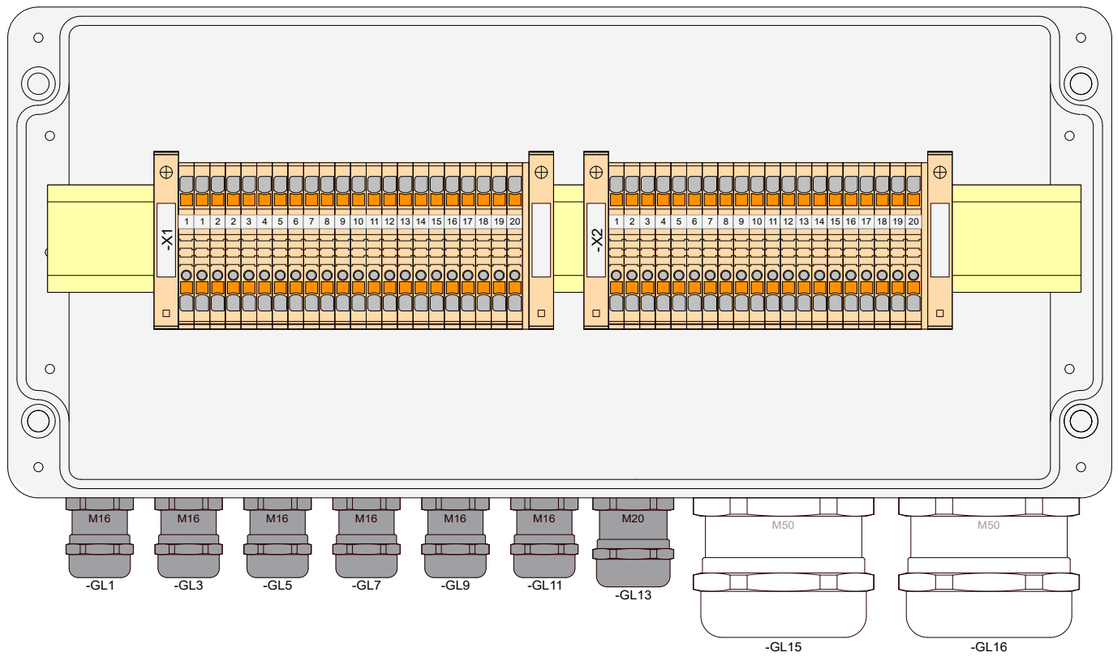
Layout
OHC ROV LARS
Control Cabinet Radio - Inside

=OHC
+B21

E-4502 - 03
Rev. 04
2 / 14



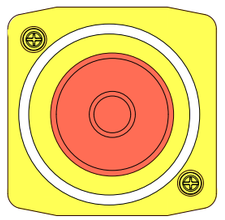
+X21
JB Valves

Bernstein
CPG-320
360x160x91
IP 67
RAL 7000 (Grey)

110 mm

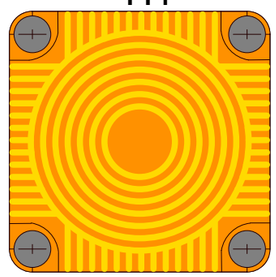
340 mm

-S1



Front View

-H1



Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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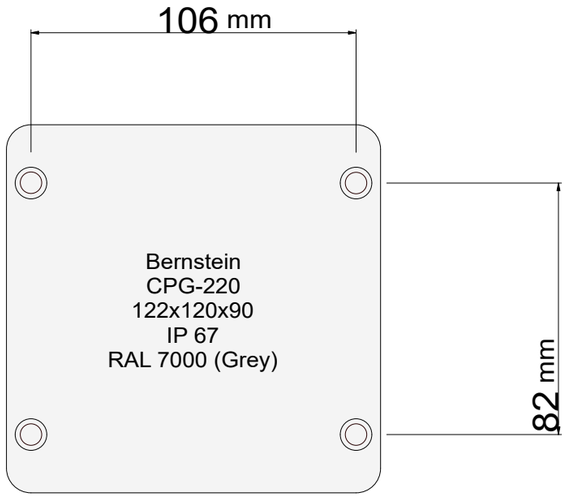
Layout
OHC ROV LARS
JB Valves

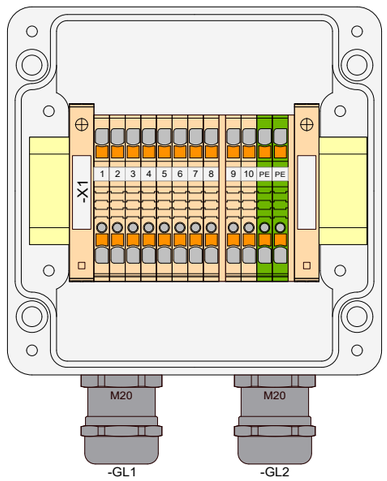
=OHC
+X21

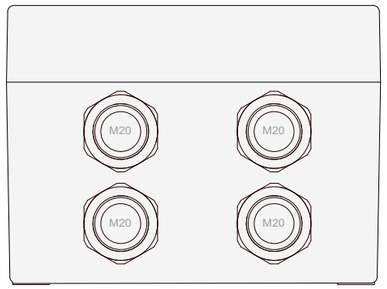
E-4502 - 03
Rev. 04
3 / 14

Printed: 07-Jul-23 11:33

Template:







Component installed on equipment

Product Data	
Manufacturer	Bernstein
Article name	CPG-220
WxHxD	122x120x90
IP	IP 67
RAL Code	RAL 7000 (Grey)
Material	Polyester

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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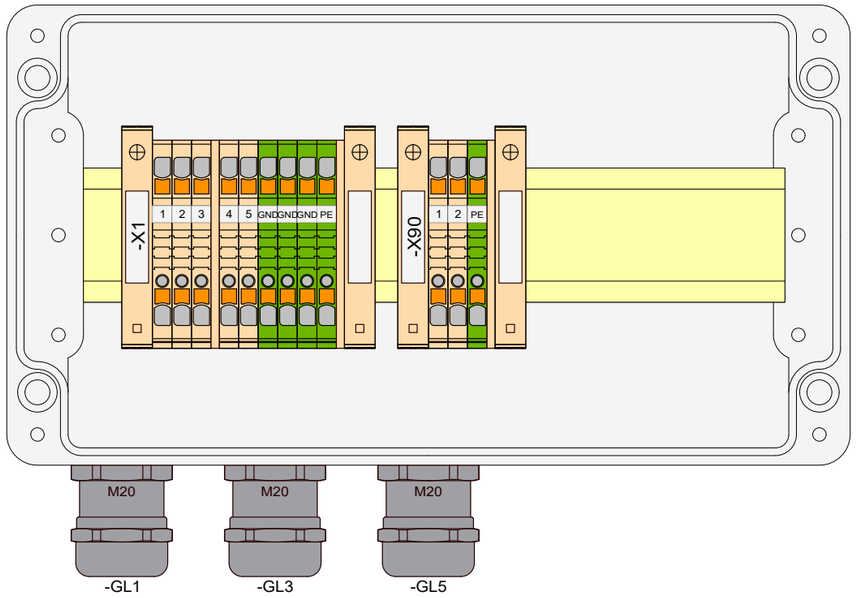
Layout
OHC ROV LARS
JB Motor Signals

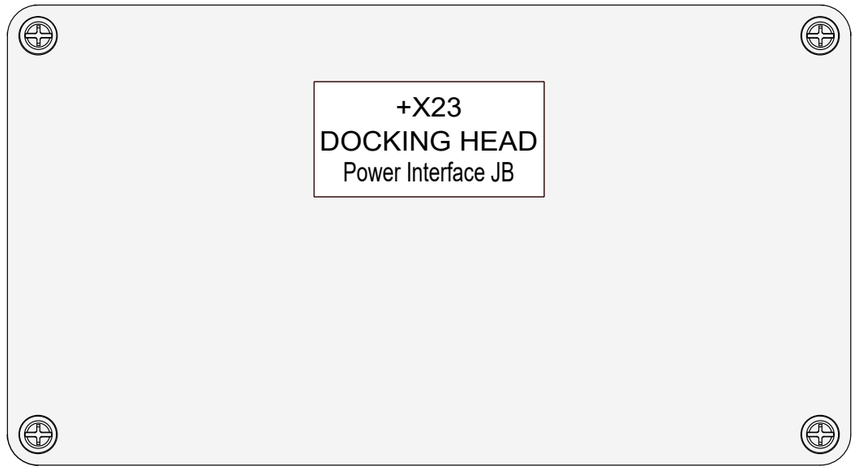
=OHC
+X22

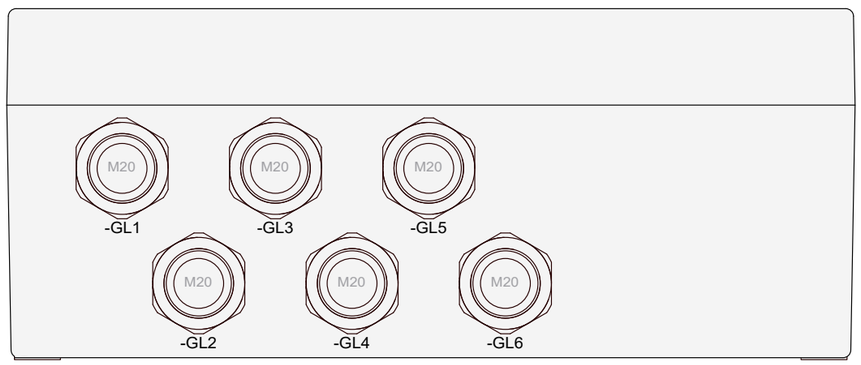
E-4502 - 03
Rev. 04
4 / 14

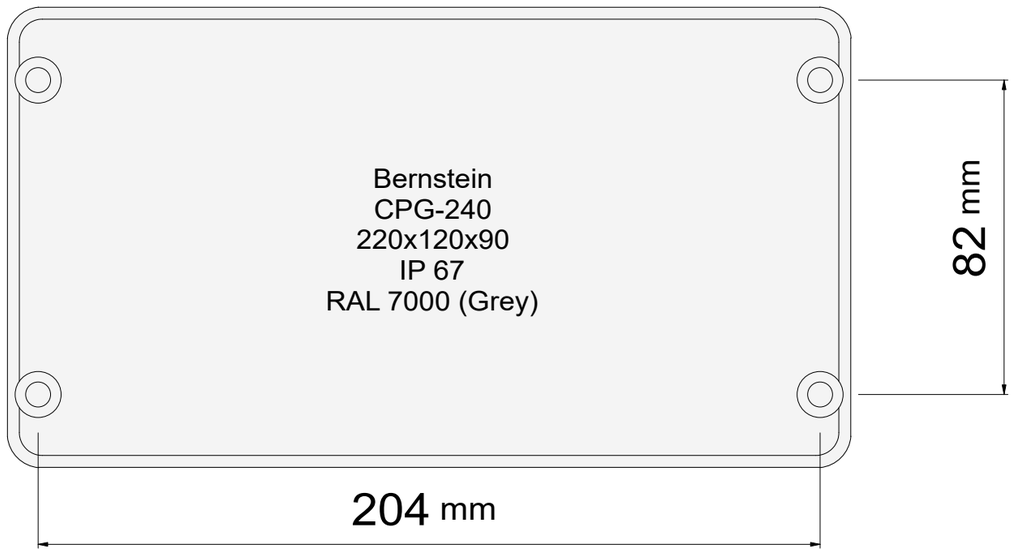
Printed: 07-Jul-23 11:33

Template:









Rear View

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Layout
OHC ROV LARS
JB Motor Power

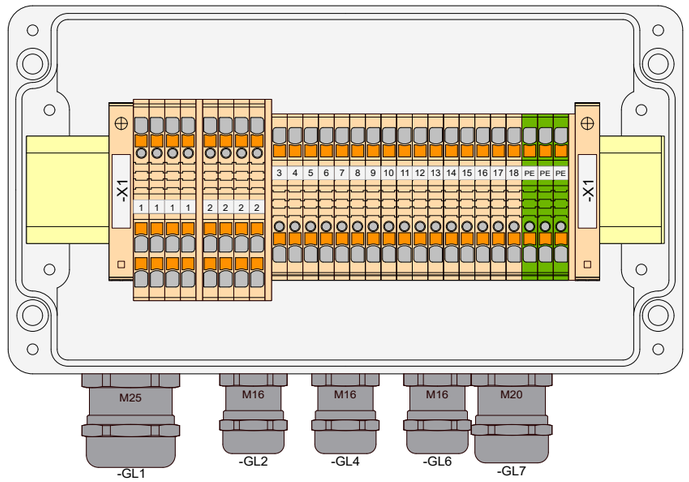
=OHC
+X23

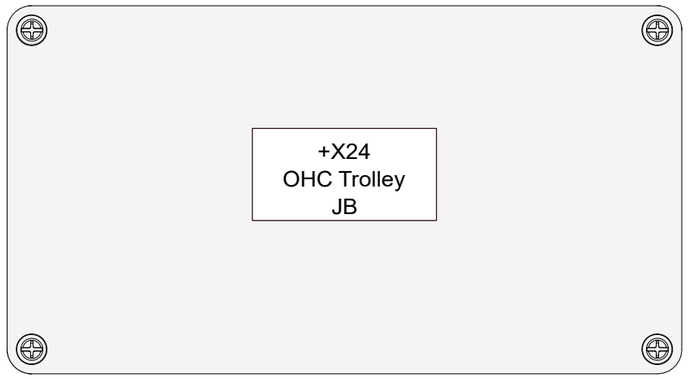
E-4502 - 03
Rev. 04
5 / 14

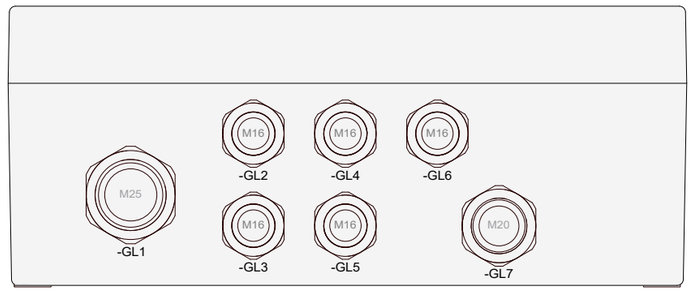
Printed: 07-Jul-23 11:33

Template:

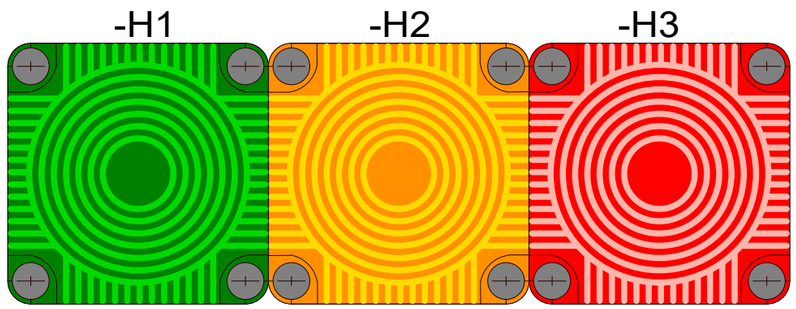
All -X1:1 to be lasked
All -X1:2 to be lasked







Rear View



Product Data	
Manufacturer	Bernstein
Article name	CPG-240
WxHxD	220x120x90
IP	IP 67
RAL Code	RAL 7000 (Grey)
Material	Polyester

ed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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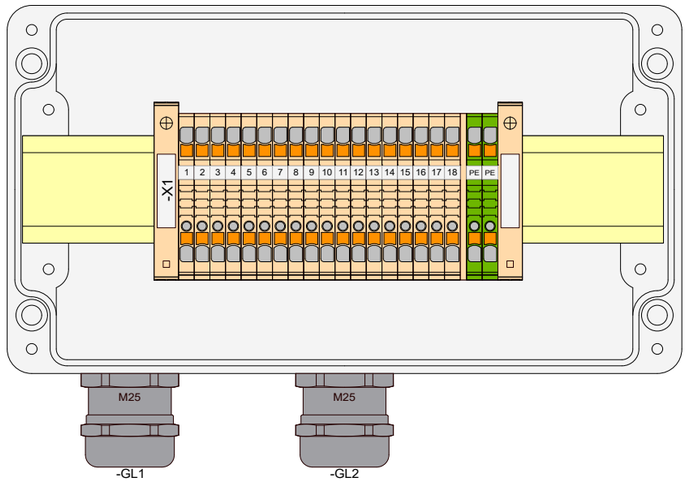
Layout
OHC ROV LARS
JB Sensors Crane

=OHC
+X24

E-4502 - 03
Rev. 04
6 / 14

-JB1



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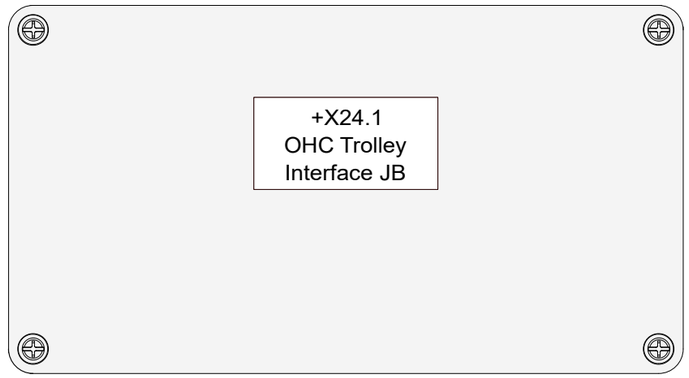

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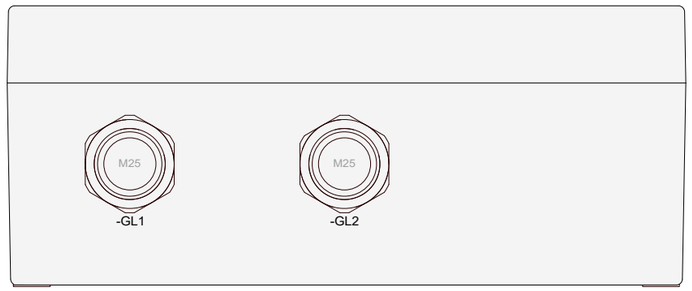

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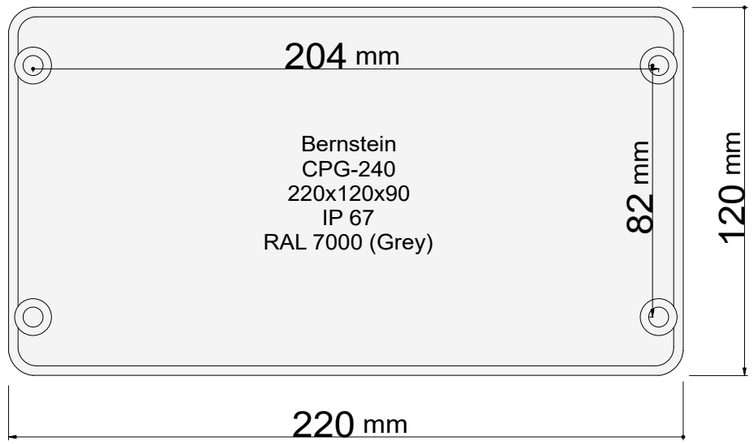

Rear View

Component installed on equipment

Product Data					
Manufacturer	Bernstein				
Article name	CPG-240				
WxHxD	220x120x90				
IP	IP 67				
RAL Code	RAL 7000 (Grey)				
Material	Polyester				

04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE
Rev.	Description	Date	Rev. by	Standard	

4/60185
CNP Freire
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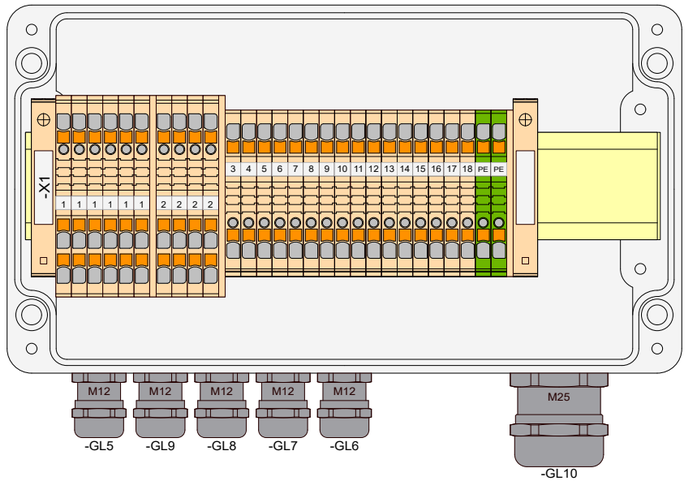
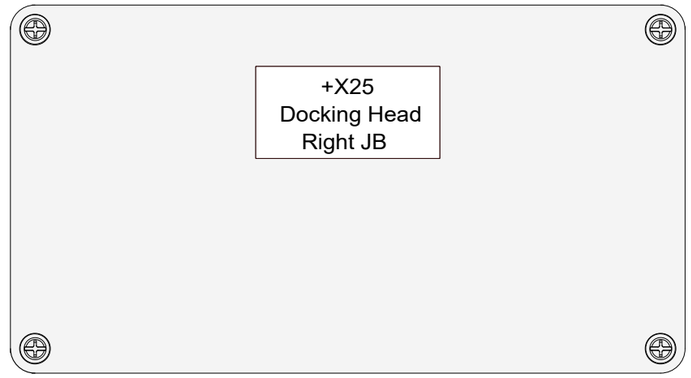
Layout
OHC ROV LARS
JB Sensors Crane Interface

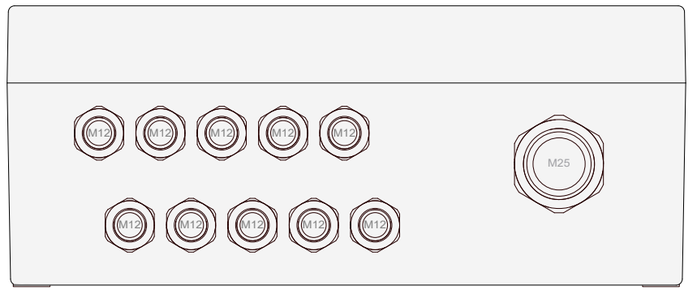
=OHC
+X24.1

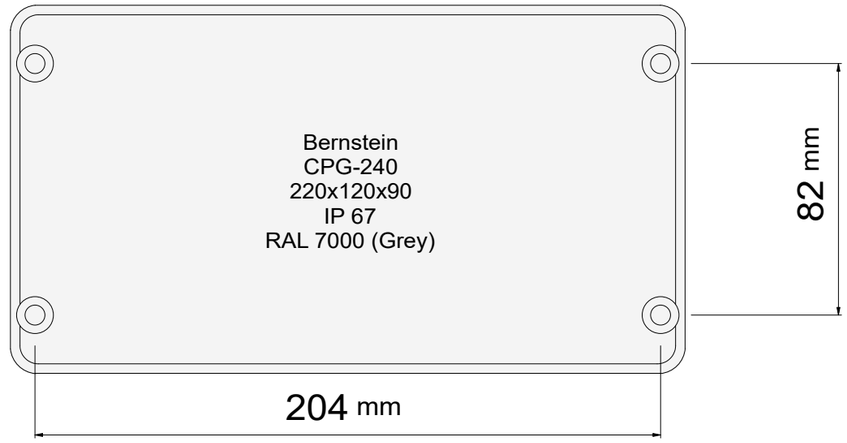
E-4502 - 03
Rev. 04
7 / 14

All -X1:1 to be lasked
All -X1:2 to be lasked









Rear View

Component installed on equipment

Product Data					
Manufacturer	Bernstein				
Article name	CPG-240				
WxHxD	220x120x90				
IP	IP 67				
RAL Code	RAL 7000 (Grey)				
Material	Polyester				

04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE
Rev.	Description	Date	Rev. by	Standard	

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CNP Freire
MBARI

TRIPLEX
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Layout
OHC ROV LARS
JB Docking Head Right

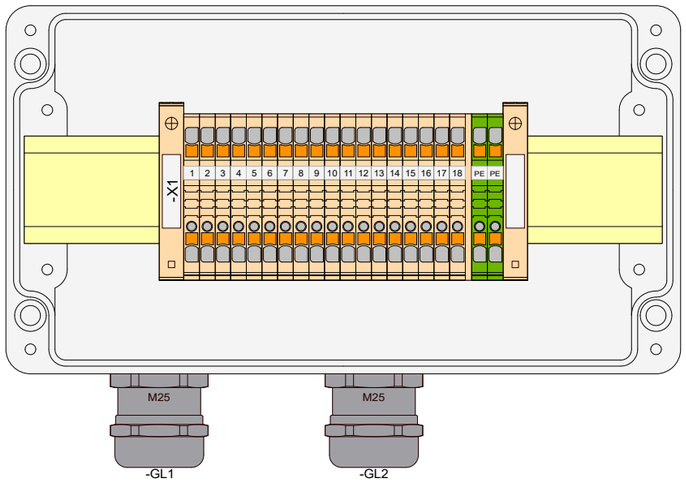
=OHC
+X25

E-4502 - 03
Rev. 04
8 / 14

Printed: 07-Jul-23 11:33

Template:

-JB1



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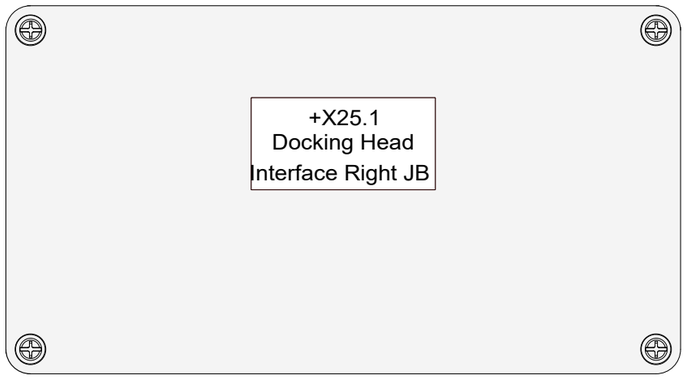

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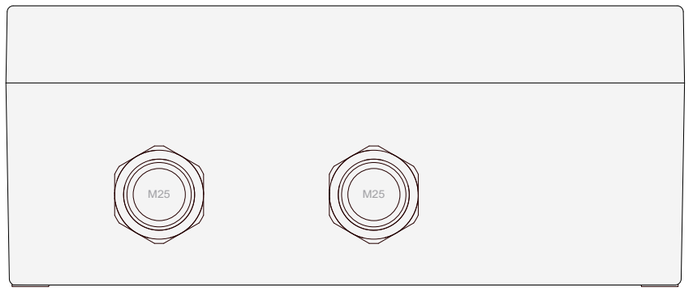

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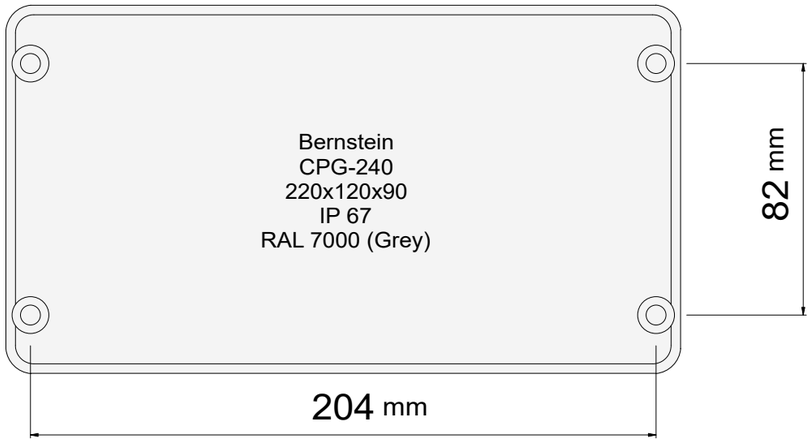

Rear View

Component installed on equipment

Product Data	
Manufacturer	Bernstein
Article name	CPG-240
WxHxD	220x120x90
IP	IP 67
RAL Code	RAL 7000 (Grey)
Material	Polyester

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Layout
OHC ROV LARS
JB Docking Head Interface

=OHC
+X25.1

E-4502 - 03
Rev. 04
9 / 14

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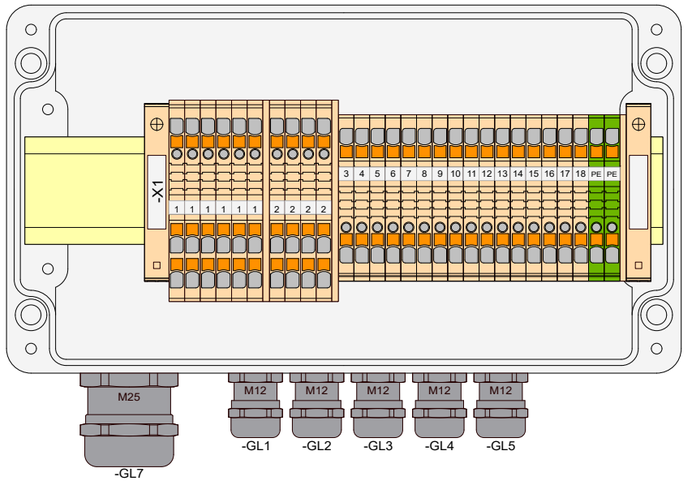
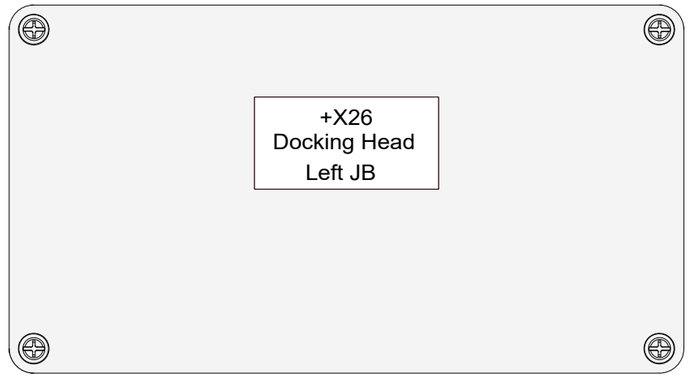
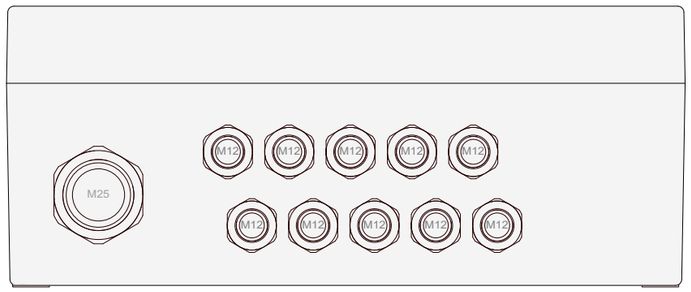
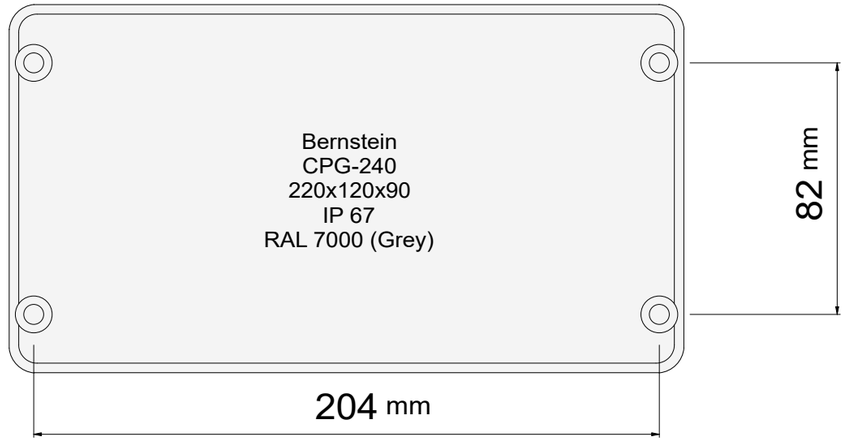
Template:

All -X1:1 to be lasked
All -X1:2 to be lasked









Rear View

Product Data	
Manufacturer	Bernstein
Article name	CPG-240
WxHxD	220x120x90
IP	IP 67
RAL Code	RAL 7000 (Grey)
Material	Polyester

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
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Layout
OHC ROV LARS
JB Docking Head Left

=OHC
+X26

E-4502 - 03
Rev. 04
10 / 14

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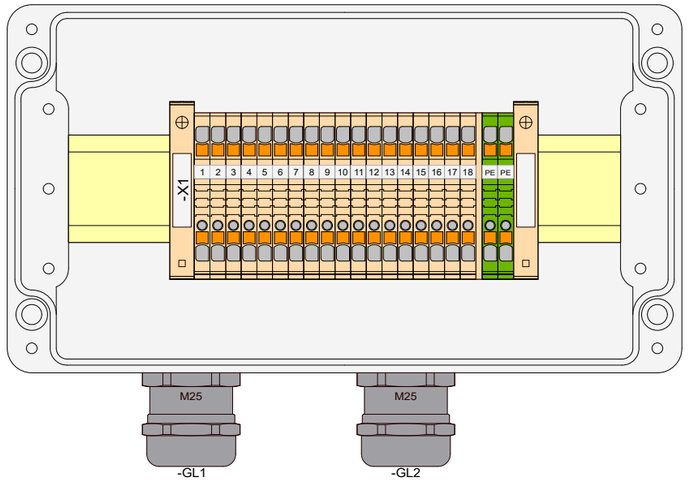
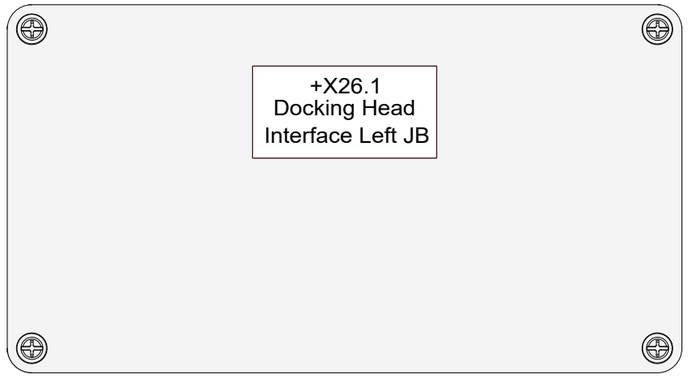
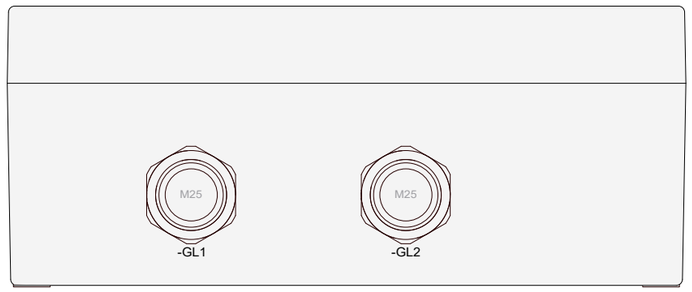
Template:







Rear View

Product Data	
Manufacturer	Bernstein
Article name	CPG-240
WxHxD	220x120x90
IP	IP 67
RAL Code	RAL 7000 (Grey)
Material	Polyester

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
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Layout
OHC ROV LARS
JB Docking Head Interface

=OHC
+X26.1

E-4502 - 03
Rev. 04
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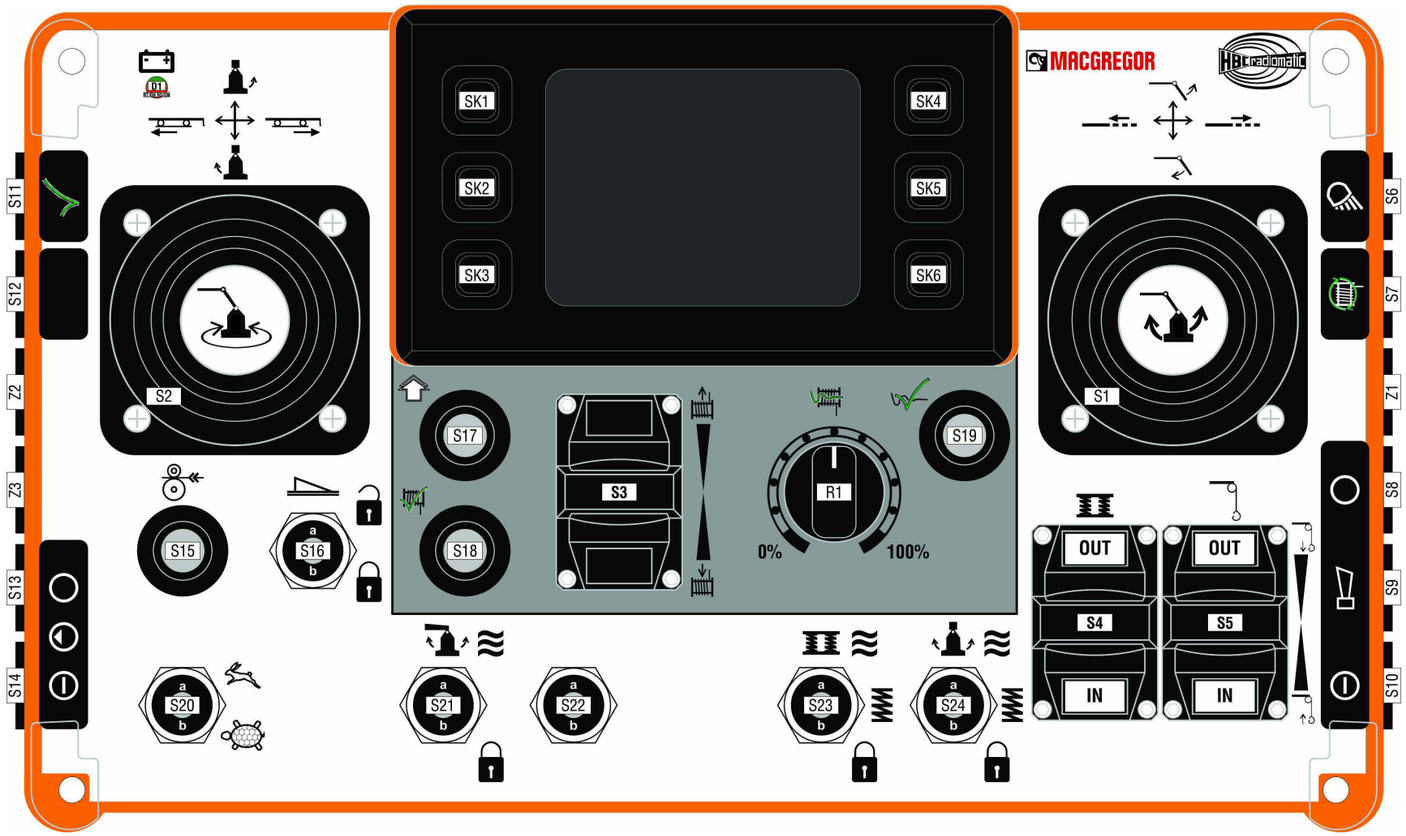
-A20.3



Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
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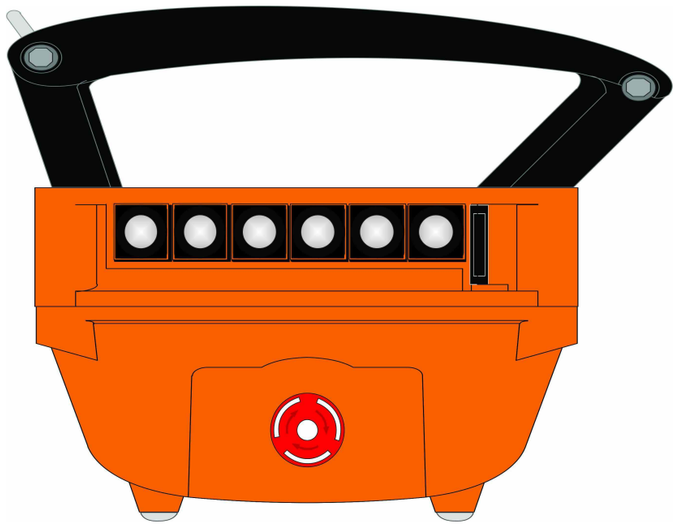
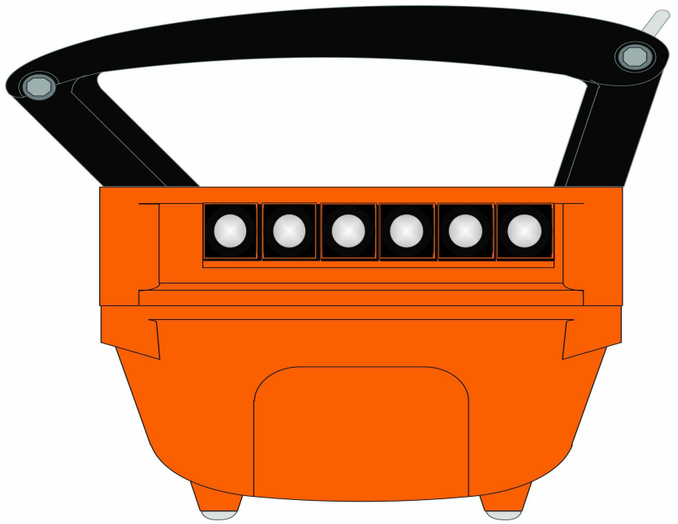
Layout
OHC ROV LARS
RC Transmitter

=OHC
+A20

E-4502 - 03
Rev. 04
12 / 14





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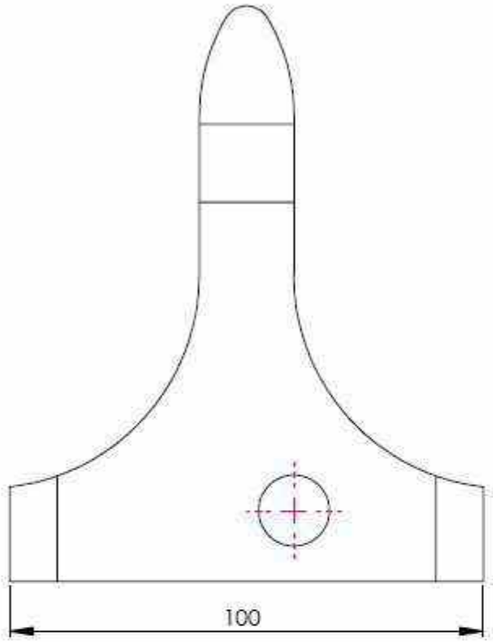
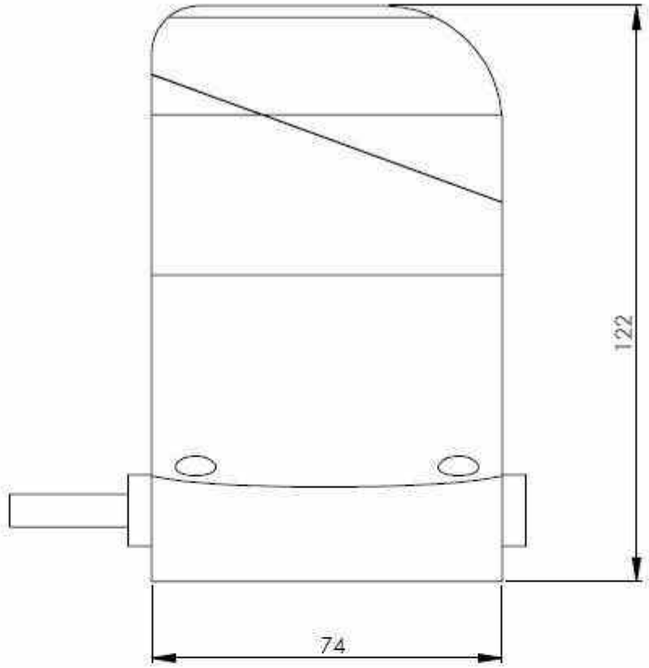
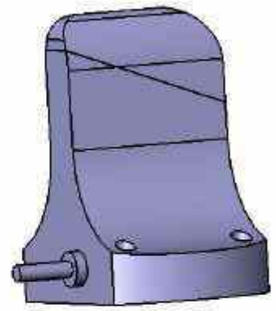
Layout
OHC ROV LARS
RC Transmitter Side View

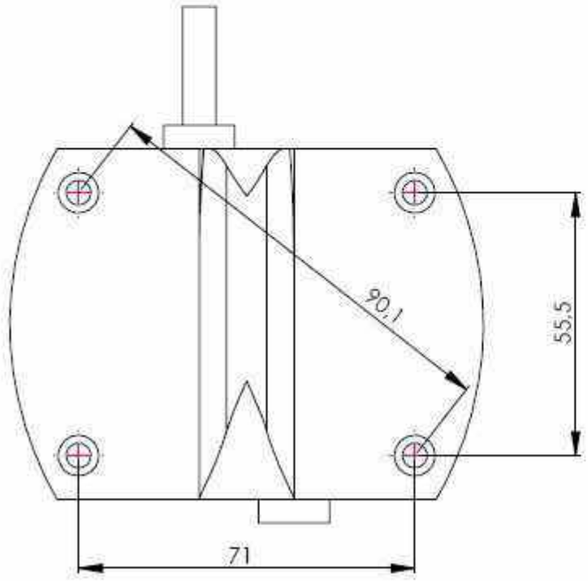
=OHC
+A20

E-4502 - 03
Rev. 04
13 / 14









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Layout
OHC ROV LARS
RC Antenna

=OHC
+A20

E-4502 - 03
Rev. 04
14 / 14

L1 /17.A7
L2 /17.A7
/10.A1 #9016

-X0 + -X0 + 24V + + 1 2 6 E-Bus 24V 24V

Beckhoff X1 X2

-KF2.0	-KF2.1	-KF2.2	-KF2.3	-KF2.4	-KF2.5	-KF2.6	-KF2.7	-KF2.8	-KF2.19	-KF2.20	-KF2.21	-KF2.22	-KF2.23	-KF2.18
EK1101	EL1008	EL3058	EL1904	EL2911	EL9410	EL2008	EL2624	EL2624	EL2535-0002-	EL2624	EL2624	EL2535-0002-	EL2535-0002-	EL2535-0002-

0V E-Bus 0V PE

-X0 - -X0 - 0V - - PE PE 5 3 7 4 8

RJ45 -X91 RJ45 -X92

=A-FRAME STERN+B11-X92:RJ45 -W010 #8035 /1.C2

=CTD DAVIT+B31-X91:RJ45 -W011 #8036 /1.C1

-G1 OUT (24VDC) IN (100-240VAC) 10A L N PE

-F1 4A GND

-W200 BN BU GNYE L1 L2 PE

+Switch Board

CAN-H /11.B1
CAN-L /11.B1

-KF2.9	-KF2.10	-KF2.11	-KF2.12	-KF2.13	-KF2.14	-KF2.15	-KF2.16	-KF2.17	-KF2.24	-KF2.25
EL9410	EL2535-0002-	EL2535-0002-	EL2535-0002-	EL2535-0002-	EL9410	EL2535-0002-	EL2535-0002-	EL9410	EL6751	Bus End Cover

CAN-L CAN-G CAN-G CAN-H

-X0:- #9016 /10.A1

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Circuit Diagram
OHC ROV LARS
Control Cabinet

=OHC
+B21

E-4502 - 04
Rev. 04
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Template:

-KF2.1 Beckhoff EL1008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Input	DI1	/11.C1	Control Cabinet	Switch	OHC	Manual Control	DI	
5	Digital Input	DI2	/11.C3	Control Cabinet	Switch	OHC	Radio Control	DI	
2	Digital Input	DI3	/12.B5	Control Cabinet	Contacts	OHC	Hangar Door 1 open	DI	
6	Digital Input	DI4	/12.B5	Control Cabinet	Contacts	OHC	Hangar Door 2 open	DI	
3	Digital Input	DI5		Control Cabinet	Switch	OHC	Pulse Switch	DI	
7	Digital Input	DI6	/14.A2	Trolley	Sensor	OHC	Prox Switch	DI	
4	Digital Input	DI7						DI	
8	Digital Input	DI8						DI	

-KF2.2 Beckhoff EL3058

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Analog Input	AI1	/14.A1	Trolley	Sensor	OHC	Distance Sensor	AI	4-20mA
5	Analog Input	AI2	/14.A5	Boom	Sensor	OHC	Angle Transmitter	AI	4-20mA
2	Analog Input	AI3	/14.A4	Boom	Sensor	OHC	Lenght Transmitter	AI	4-20mA
6	Analog Input	AI4						AI	4-20mA
3	Analog Input	AI5						AI	4-20mA
7	Analog Input	AI6						AI	4-20mA
4	Analog Input	AI7						AI	4-20mA
8	Analog Input	AI8						AI	4-20mA

-KF2.3 Beckhoff EL1904

Pin	Pin Description	IO Type	Ref	PLC Comment 1	PLC Comment 2	PLC Symboilic Adress
1	+	I1	/10.B1	Emergency Stop		DIN/DOUT
2	-					
3	+	I2	/10.B1	Emergency Stop		DIN/DOUT
4	-					
5	+	I3	/10.B3	Emergency Stop		DIN/DOUT
6	-					
7	+	I4	/10.B3	Emergency Stop		DIN/DOUT
8	-					

Rev.	Description	Date	Rev. by	Standard	
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Circuit Diagram
OHC ROV LARS
IO List

=OHC
+B21

E-4502 - 04
Rev. 04
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-KF2.4 Beckhoff EL2911

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	+	DIO1	/10.B5	Spare	Emergency Stop	OHC	IN		
2	-								
5	+	DIO2	/10.B5	Spare	Emergency Stop	OHC	IN		
6	-								
3	+	DIO3	/10.B6	Spare	Emergency Stop	OHC	IN		
4	-								
7	+	DIO4	/10.B7	Spare	Emergency Stop	OHC	IN		
8	-								
4`	+	DIO5	/11.C5	Control Cabinet	Supply	OHC	IN		
3`	-								
8`	+	DIO6	/11.C5	Control Cabinet	Supply	OHC	IN		
7`	-								
2`	+	DIO7	/13.B1	Valve Bank	OHC	Stop Valve	OUT		
3`	-								
6`		DIO8							
7`	-								

-KF2.6 Beckhoff EL2008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Output	DO1	/10.B2	Valve Bank	Emergency Stop	OHC	Light	DO	
5	Digital Output	DO2	/10.B4	Deck Area	Emergency Stop	OHC	Light	DO	
2	Digital Output	DO3	/10.B6	Spare	Emergency Stop	OHC	Light	DO	
6	Digital Output	DO4	/10.B7	Spare	Emergency Stop	OHC	Light	DO	
3	Digital Output	DO5	/14.A3	Trolley	Light	OHC	Green Light	DO	
7	Digital Output	DO6	/14.A3	Trolley	Light	OHC	Red Light	DO	
4	Digital Output	DO7	/14.A3	Trolley	Light	OHC	Yellow Light	DO	
8	Digital Output	DO8						DO	

-KF2.7 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/11.C7	Control Cabinet	Relay	OHC	Floodlight	RO	NO
2	Relay Output NO								
5	Com	RO2	/12.B1	Control Cabinet	Relay	OHC	In Indor Position	RO	NO
6	Relay Output NO								
3	Com	RO3	/12.B2	Control Cabinet	Relay	OHC	In Oper. Position	RO	NO
4	Relay Output NO								
7	Com	RO4	/12.B6	Control Cabinet	Relay	OHC	LauRec Position	RO	NO
8	Relay Output NO								

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Circuit Diagram
OHC ROV LARS
IO List

=OHC
+B21

E-4502 - 04
Rev. 04
3 / 17

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Template:

-KF2.8 — Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/14.A6		Valve	OHC	Constant Tension	RO	NO
2	Relay Output NO								
5	Com	RO2	/16.B1	Docking Head	Valves	OHC	Along Tilt Valve 1	RO	NO
6	Relay Output NO								
3	Com	RO3	/16.B2	Docking Head	Valves	OHC	Along Tilt Valve 2	RO	NO
4	Relay Output NO								
7	Com	RO4	/16.B2	Docking Head	Valves	OHC	Spring Free Valve1	RO	NO
8	Relay Output NO								

-KF2.10 — Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B2	Valve Bank	Main Boom	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va		/15.B2						
4	Digital Input	DI1	/13.B2					DI	
	PWM Output B1	PWM2		Valve Bank	Main Boom	Prop. Valve	In	AO+	PWM
6	PWM Output B2		/15.B3						
7	0Vb								
8	Digital Input	DI2						DI	

-KF2.11 — Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B3	Valve Bank	Trolley Motor	Prop. Valve	STBD	AO+	PWM
5	PWM Output A2								
3	0Va		/15.B3						
4	Digital Input	DI1	/13.B3					DI	
	PWM Output B1	PWM2		Valve Bank	Trolley Motor	Prop. Valve	PORT	AO+	PWM
6	PWM Output B2		/12.B8						
7	0Vb								
8	Digital Input	DI2						DI	

Rev.	Description	Date	Rev. by	Standard	
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03	For customer review	13.01.2023	GM	Drawn by	KS
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Circuit Diagram
OHC ROV LARS
IO List

=OHC
+B21

E-4502 - 04
Rev. 04
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-KF2.12 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B3	Valve Bank	OHC Telescope	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va		/15.B4						
4	Digital Input	DI1	/13.B4					DI	
	PWM Output B1	PWM2		Valve Bank	OHC Telescope	Prop. Valve	In	AO+	PWM
6	PWM Output B2		/12.B7						
7	0Vb								
8	Digital Input	DI2						DI	

-KF2.13 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B4	Valve Bank	OHC Winch	Prop. Valve	Lower	AO+	PWM
5	PWM Output A2								
3	0Va		/12.B7						
4	Digital Input	DI1	/13.B4					DI	
	PWM Output B1	PWM2		Valve Bank	OHC Winch	Prop. Valve	Lift	AO+	PWM
6	PWM Output B2		/12.B8						
7	0Vb								
8	Digital Input	DI2						DI	

Rev.	Description	Date	Rev. by	Standard	
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Circuit Diagram
OHC ROV LARS
IO List

=OHC
+B21

E-4502 - 04
Rev. 04
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-KF2.15				Beckhoff EL2535-0002-					
Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B5	Valve Bank	Along Tilt Cylinder	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va		/16.B6						
4	Digital Input	DI1	/13.B5					DI	
	PWM Output B1	PWM2		Valve Bank	Along Tilt Cylinder	Prop. Valve	In	AO+	PWM
6	PWM Output B2		/16.B6						
7	0Vb								
8	Digital Input	DI2						DI	

-KF2.16				Beckhoff EL2535-0002-					
Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B8	Valve Bank	Spring Plate	Prop. Valve	Out	AO+	PWM
5	PWM Output A2								
3	0Va		/16.B5						
4	Digital Input	DI1	/13.B8					DI	
	PWM Output B1	PWM2		Valve Bank	Spring Plate	Prop. Valve	In	AO+	PWM
6	PWM Output B2		/15.B2						
7	0Vb								
8	Digital Input	DI2						DI	

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				Standard	

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Circuit Diagram
OHC ROV LARS
IO List

=OHC
+B21

E-4502 - 04
Rev. 04
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-KF2.18 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B5	Valve Bank	Latch Cylinder	Prop. Valve	Out		
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/13.B6						
	PWM Output B1	PWM2		Valve Bank	Latch Cylinder	Prop. Valve	In		
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2							

-KF2.19 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
	PWM Output A1	PWM1	/13.B6	Valve Bank	DH Twist	Prop. Valve	Out		
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/13.B6						
2	PWM Output B1	PWM2		Valve Bank	DH Twist	Prop. Valve	In		
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2							

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Circuit Diagram
OHC ROV LARS
IO List

=OHC
+B21

E-4502 - 04
Rev. 04
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Template:

-KF2.20 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/16.B3	Docking Head	Valves	OHC	Spring Free Valve2	RO	NO
2	Relay Output NO								
5	Com	RO2	/16.B3	Docking Head	Valves	OHC	Spring Damping Valve1	RO	NO
6	Relay Output NO								
3	Com	RO3	/16.B4	Docking Head	Valves	OHC	Spring Damping Valve2	RO	NO
4	Relay Output NO								
7	Com	RO4	/15.B5	Docking Head	Valves	OHC	Across Tilt Free V.2	RO	NO
8	Relay Output NO								

-KF2.21 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/15.B4	Docking Head	Valves	OHC	Across Tilt Free V.1	RO	NO
2	Relay Output NO								
5	Com	RO2	/15.B5	Docking Head	Valves	OHC	Across Tilt Damp V.1	RO	NO
6	Relay Output NO								
3	Com	RO3	/15.B6	Docking Head	Valves	OHC	Across Tilt Damp V.2	RO	NO
4	Relay Output NO								
7	Com	RO4	/15.B6	Docking Head	Valves	OHC	Across Tilt Damp V.3	RO	NO
8	Relay Output NO								

-KF2.22 Beckhoff EL2535-0002-

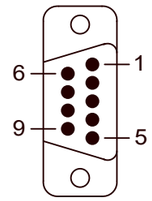
Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B7	Valve Bank	OUT Hauler	Prop. Valve	Out		
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/13.B7						
	PWM Output B1	PWM2		Valve Bank	OUT Hauler	Prop. Valve	In		
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2							

-KF2.23 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/13.B7	Valve Bank	Research Sheave	Prop. Valve	Tilt Out		
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/13.B8						
	PWM Output B1	PWM2		Valve Bank	Research Sheave	Prop. Valve	Tilt In		
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2							

-KF2.24 Beckhoff EL6751

DSUB-9	Pin Description	IO Type	Ref
1		CAN	/1.E7
2	CAN-L		
3	CAN-G		
4			
5			
6	CAN-G		
7	CAN-H		
8			
9			



D-SUB
9-Pin
Male

Rev.	Description	Date	Rev. by		
04	Issued for production	07.07.2023	GM	Date	14.10.2021
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Circuit Diagram
OHC ROV LARS
IO List

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/1.A8 #9016
/1.E8 #9016

-X0 -

-X0 -

-X0 -

-X0 -

#9016 /11.C1
#9016 /11.E1

-KF2.3
Emergency Stop
DIN/DOUT
/1.B3
I1
+ -
1 2

-KF2.3
Emergency Stop
DIN/DOUT
/1.B3
I2
+ -
3 4

-KF2.6 DO1
Valve Bank
Emergency Stop
OHC
Light
DO
1

-KF2.3
Emergency Stop
DIN/DOUT
/1.B3
I3
+ -
5 6

-KF2.3
Emergency Stop
DIN/DOUT
/1.B3
I4
+ -
7 8

-KF2.6 DO2
Deck Area
Emergency Stop
OHC
Light
DO
5

-KF2.4 DIO1
Spare
Emergency Stop
OHC
IN
+ 1 - 2 1.B3

-KF2.4 DIO2
Spare
Emergency Stop
OHC
IN
+ 5 - 6 1.B3

-KF2.6 DO3
Spare
Emergency Stop
OHC
Light
DO
2

-KF2.4 DIO3
Spare
Emergency Stop
OHC
IN
+ 3 - 4 1.B3

-KF2.4 DIO4
Spare
Emergency Stop
OHC
IN
+ 7 - 8 1.B3

-KF2.6 DO4
Spare
Emergency Stop
OHC
Light
DO
6

-X3 14 15 16 17 18 19

-X1 1 2 3 4 5 6

-X1 7 8 9 10 11 12

-X1 13 14 15 16 17 18

-W215 14 15 16 17 18 19

-W201 1 2 3 4 5 6

+Z23
+X21
14 15 16 17 18 19
-WI-01 1 2 3 4 5 6
+S1 21 22 23 24 X1 X2
Valve Bank

+Z20
+S1 21 22 23 24 X1 X2
Deck Equipment Area

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Circuit Diagram
OHC ROV LARS
Control Cabinet

=OHC
+B21

E-4502 - 04
Rev. 04
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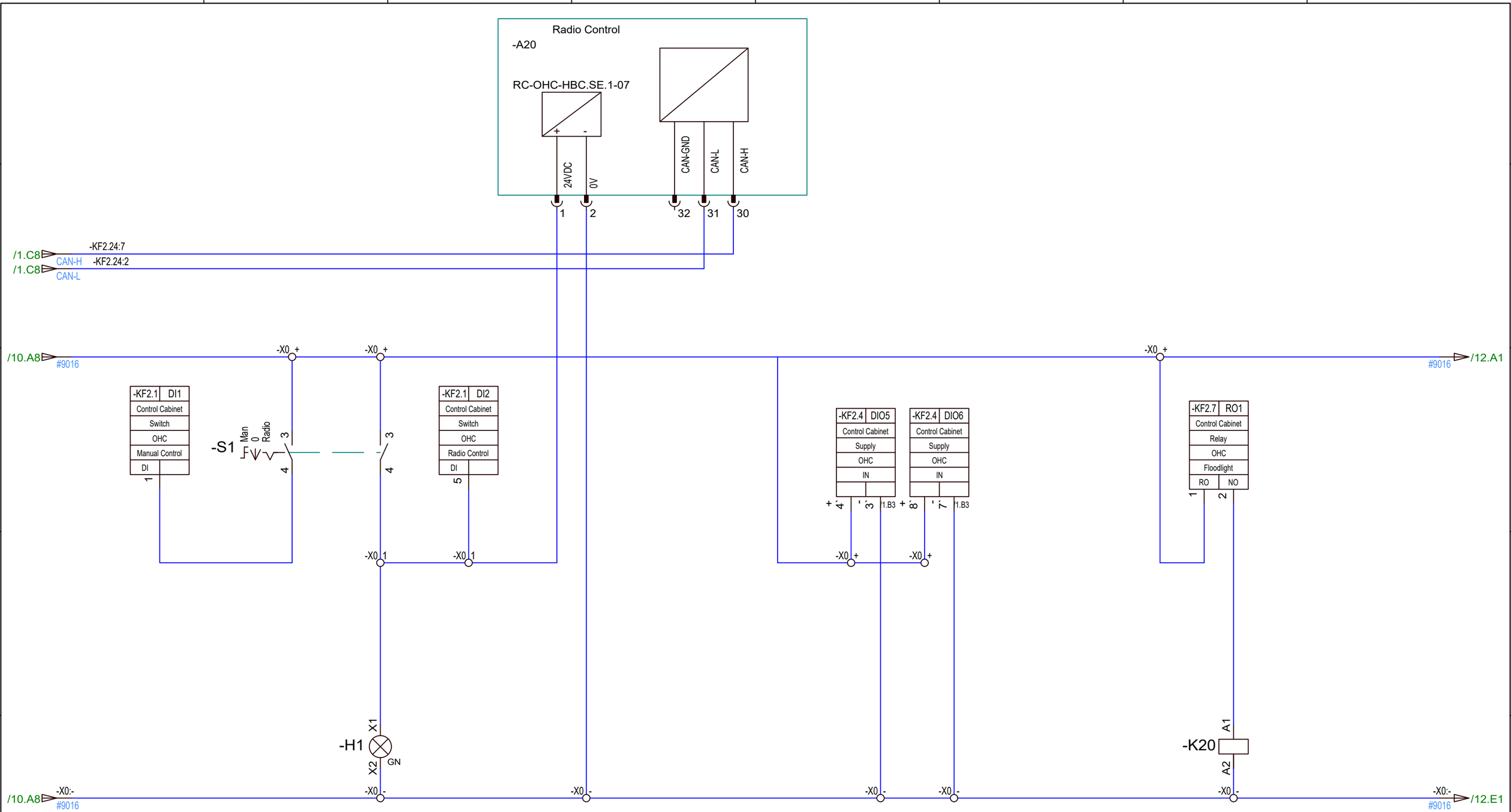

Control From Radio

Floodlight

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Circuit Diagram
OHC ROV LARS
Control Cabinet

=OHC
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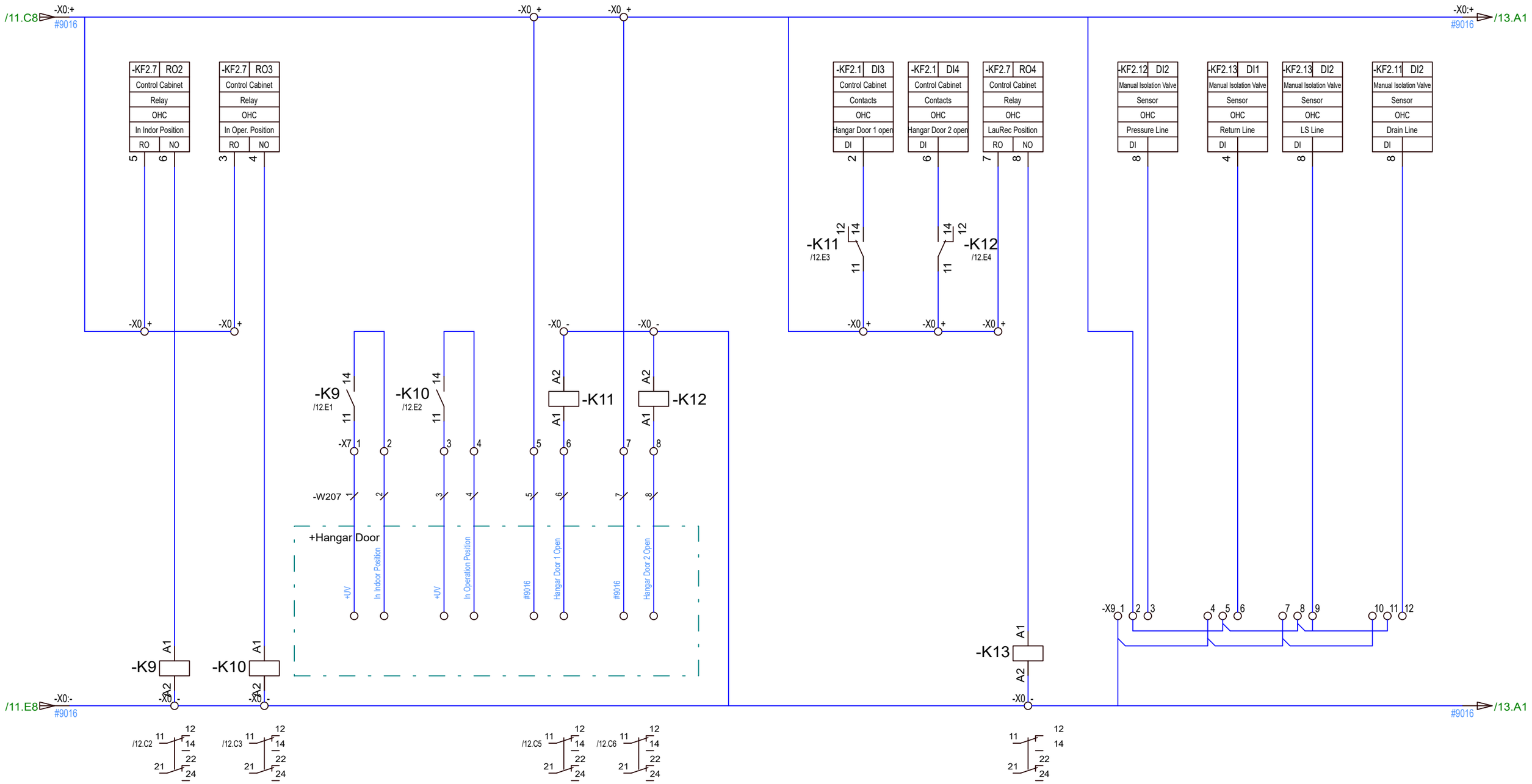

In Indoor Position	In Operation Position	Hangar Door 1 Open	Hangar Door 2 Open	Option In LauRec Position

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Circuit Diagram
OHC ROV LARS
Control Cabinet

=OHC
+B21

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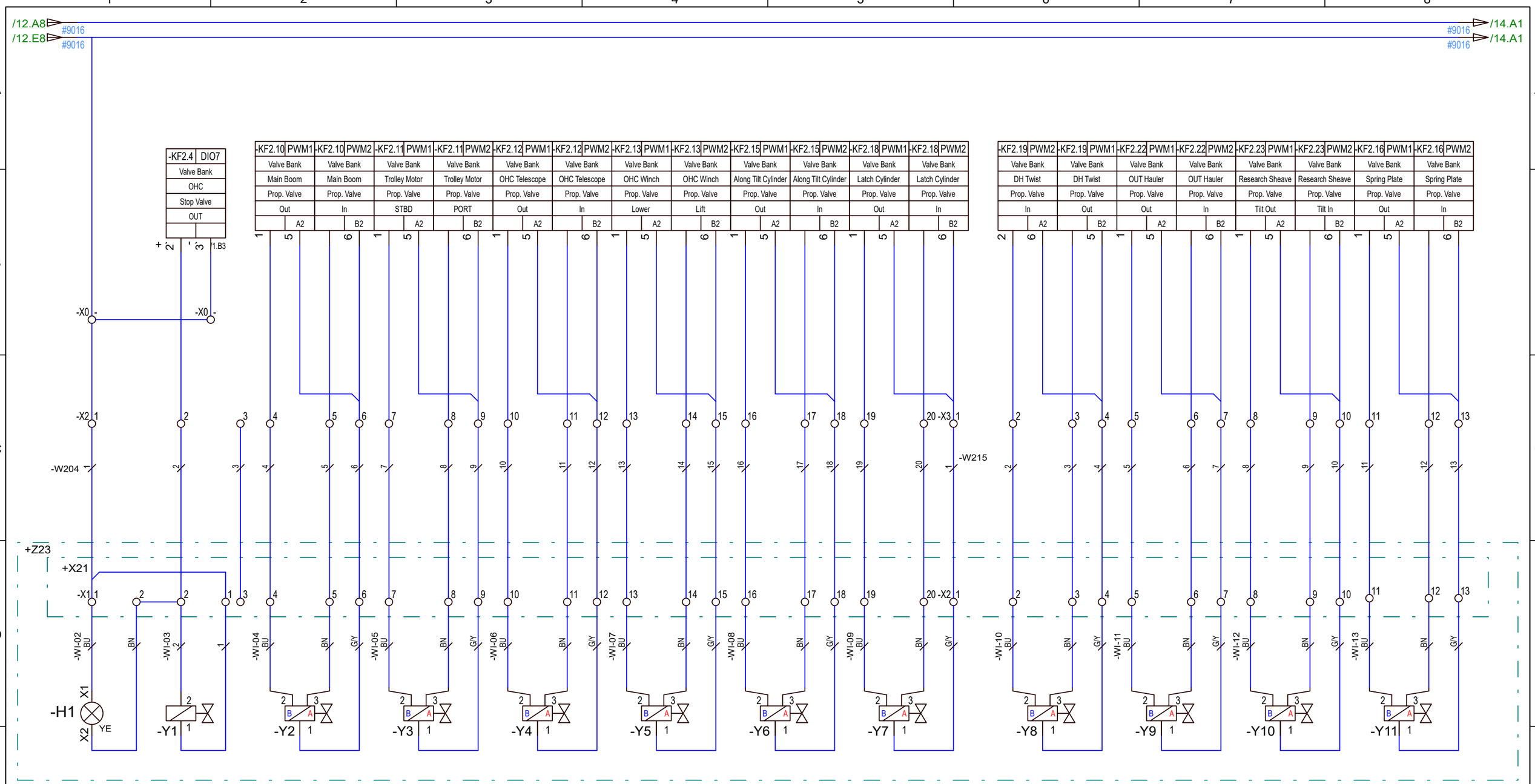

	OHC ROV Active	OHC ROV Stop	OHC ROV Main Boom		OHC ROV Trolley Motor		OHC ROV Telescope Boom		OHC ROV Winch		OHC ROV Along Tilt Cylinder		OHC ROV Latch Cylinder		OHC ROV DH Twist		OHC ROV Out Hauler		OHC ROV Research Sheave		OHC ROV Spring Plate	
			2 Out	3 In	2 STBD	3 PORT	2 Out	3 In	2 Lower	3 Lift	2 Out	3 In	2 Out	3 In	2 Out	3 In	2 Out	3 In	2 Out	3 In	2 Out	3 In

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Circuit Diagram
OHC ROV LARS
Control Cabinet - Valve Bank

=OHC
+B21

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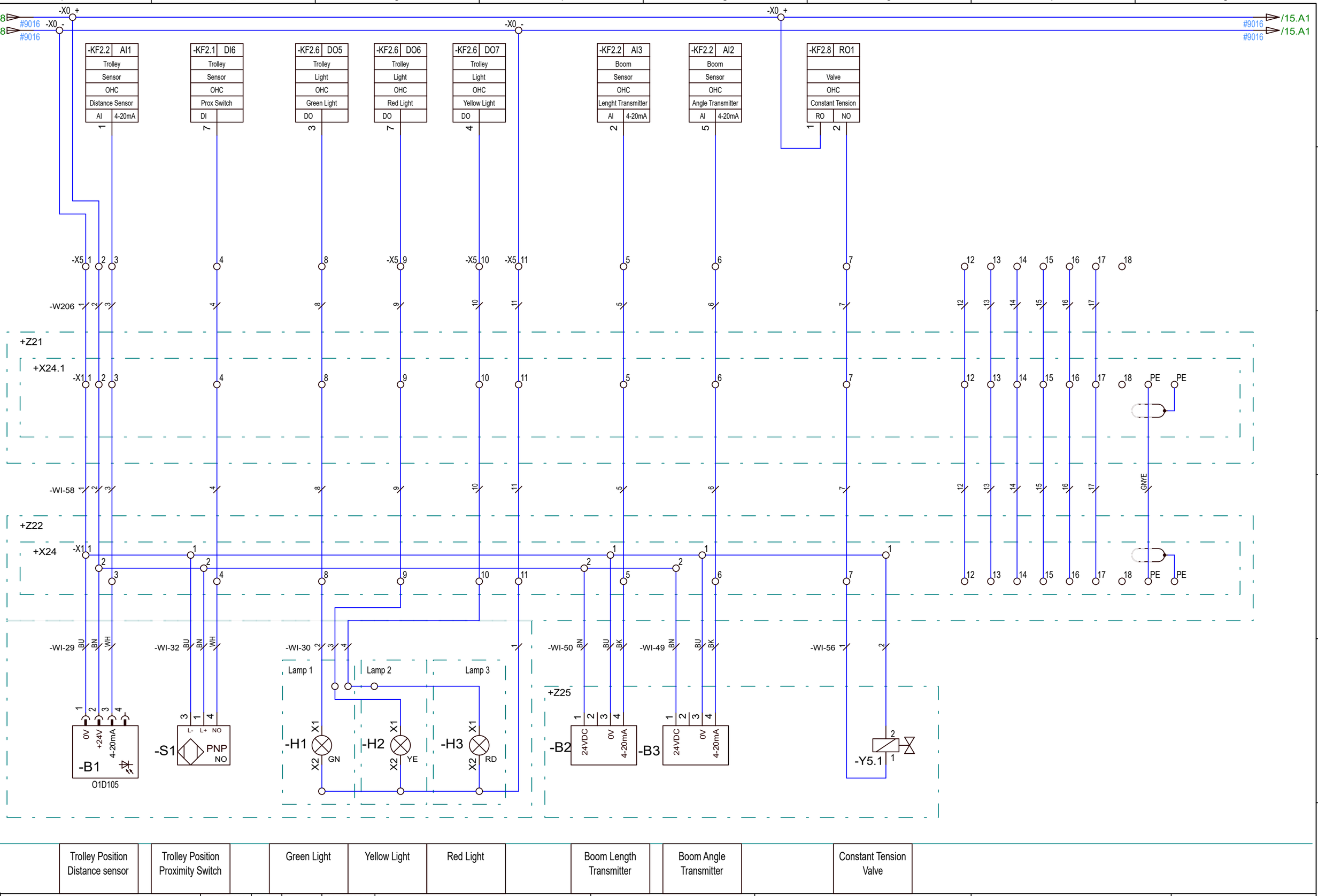

Trolley Position Distance sensor	Trolley Position Proximity Switch		Green Light	Yellow Light	Red Light		Boom Length Transmitter	Boom Angle Transmitter		Constant Tension Valve

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Circuit Diagram
OHC ROV LARS
Control Cabinet - Sensors

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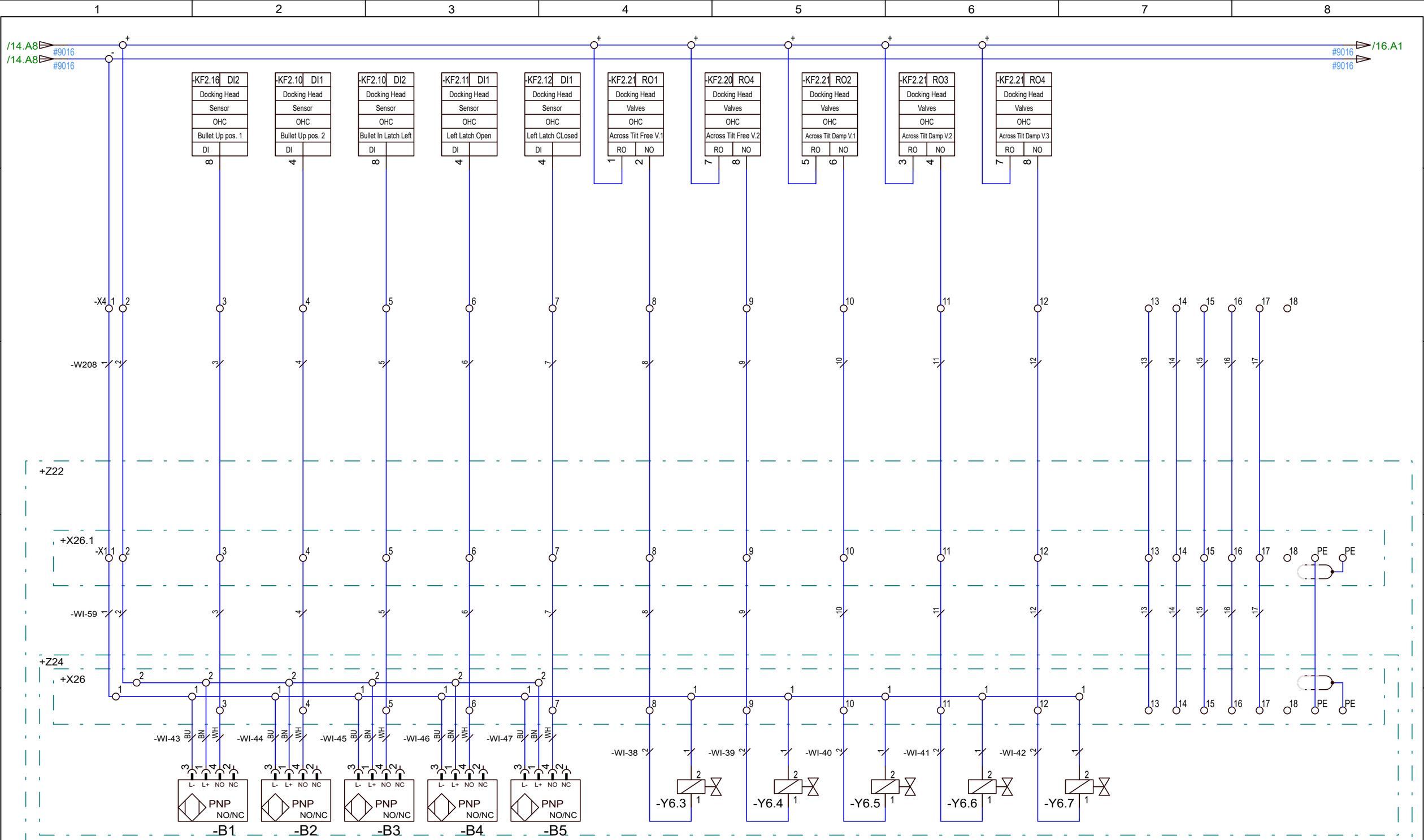

Bullet Upper Posiiton Sensor 1	Bullet Upper Posiiton Sensor 2	DH Bullet In Latch Sensor Left	DH Left Latch Open Sensor	DH Left Latch Closed Sensor		Across Tilt Free Valve 1	Across Tilt Free Valve 2	Across Tilt Damping Valve 1	Across Tilt Damping Valve 2	Across Tilt Damping Valve 3

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Circuit Diagram
OHC ROV LARS
Control Cabinet - DH Left JB

=OHC
+B21

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/15.A8
#9016
#9016

-KF2.8 RO2 | Docking Head | Valves | OHC | Along Tilt Valve 1 | RO NO | 5 6
-KF2.8 RO3 | Docking Head | Valves | OHC | Along Tilt Valve 2 | RO NO | 3 4
-KF2.8 RO4 | Docking Head | Valves | OHC | Spring Free Valve1 | RO NO | 7 8
-KF2.20 RO1 | Docking Head | Valves | OHC | Spring Free Valve2 | RO NO | 1 2
-KF2.20 RO2 | Docking Head | Valves | OHC | Spring Damping Valve1 | RO NO | 5 6
-KF2.20 RO3 | Docking Head | Valves | OHC | Spring Damping Valve2 | RO NO | 3 4
-KF2.16 DI1 | Docking Head | Sensor | OHC | Bullet in Latch Right | DI | 4
-KF2.15 DI1 | Docking Head | Sensor | OHC | Right Latch Open | DI | 4
-KF2.15 DI2 | Docking Head | Sensor | OHC | Rigt Latch Closed | DI | 8

-X6 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
-W205 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

+Z22

+X25.1
-X1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 PE PE
GNYE

+Z24
+X25
-X1 2 1 1 1 1 1 1 2 1 2 1 2
-X1 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 PE PE

-WI-15 -WI-16 -WI-17 -WI-18 -WI-19 -WI-20 -WI-21 -WI-22 -WI-23

-Y6.1 -Y6.2 -Y6.8 -Y6.9 -Y6.10 -Y6.11

-B6 -B7 -B8
BU BN WH
L- L+ NO NC
PNP NO/NC

Along Tilt Free Valve 1	Along Tilt Free Valve 2	Spring Plate Free Valve 1	Spring Plate Free Valve 2	Spring Plate Damping Valve 1	Spring Plate Damping Valve 2	DH Bullet In Latch Sensor Right	DH Right Latch Open Sensor	DH Right Latch Closed Sensor

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Circuit Diagram
OHC ROV LARS
Control Cabinet - DH Right JB

=OHC
+B21

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For detailed cable information see rapp documentation

For detailed cable information see rapp documentation

+B21

-X102 19 20

-W213 1 2

-TA14 1 2 3 4 5 6 7 8

-W212 RD BU PK GY GN YE WH BN

-TA15 U2 V2 W2 GND

-W210 1 2 3 GNYE

-TA15 1 2

-W211 1 2

/1.A8 /1.A8

L1 L2

14 24

-K20

11 21

-X90 1 -X90 2 GND

-W214 BN BU GNYE

+X22
JB Interface

-X1 9 10

-X1 1 2 3 4 5 6 7 8 PE

+X23
JB Motor Power

-X1 1 2 3 GND PE -X1 4 5

-X90 1 2 PE

-WI-52 1 2

-WI-51 RD BU PK GY GN YE WH BN

-WI-53 1 2 3 GNYE

-WI-54 1 2

-WI-55 2 1 GNYE

+Z24 Docking Head

n.c. 4 - Signal ω n.c. 2 +24V ⊥ 1

-BP1

Temp Transmitter
PT300->4-20mA

PT2 PT1

PT100

PTC

+t°c +t°c +t°c

2 1 8 7 6 5 4 3 PE

+ 24V 0V A+ A- B+ B- Z+ Z- GND

Encoder

U V W PE

-M1
3 ~

Hauler Motor

0,25kW

-M1

Motor Heater

L N GND

-E1

Floodlight

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Circuit Diagram
OHC ROV LARS
Control Cabinet - Motor Hauler

=OHC
+Rapp Drive

E-4502 - 04
Rev. 04
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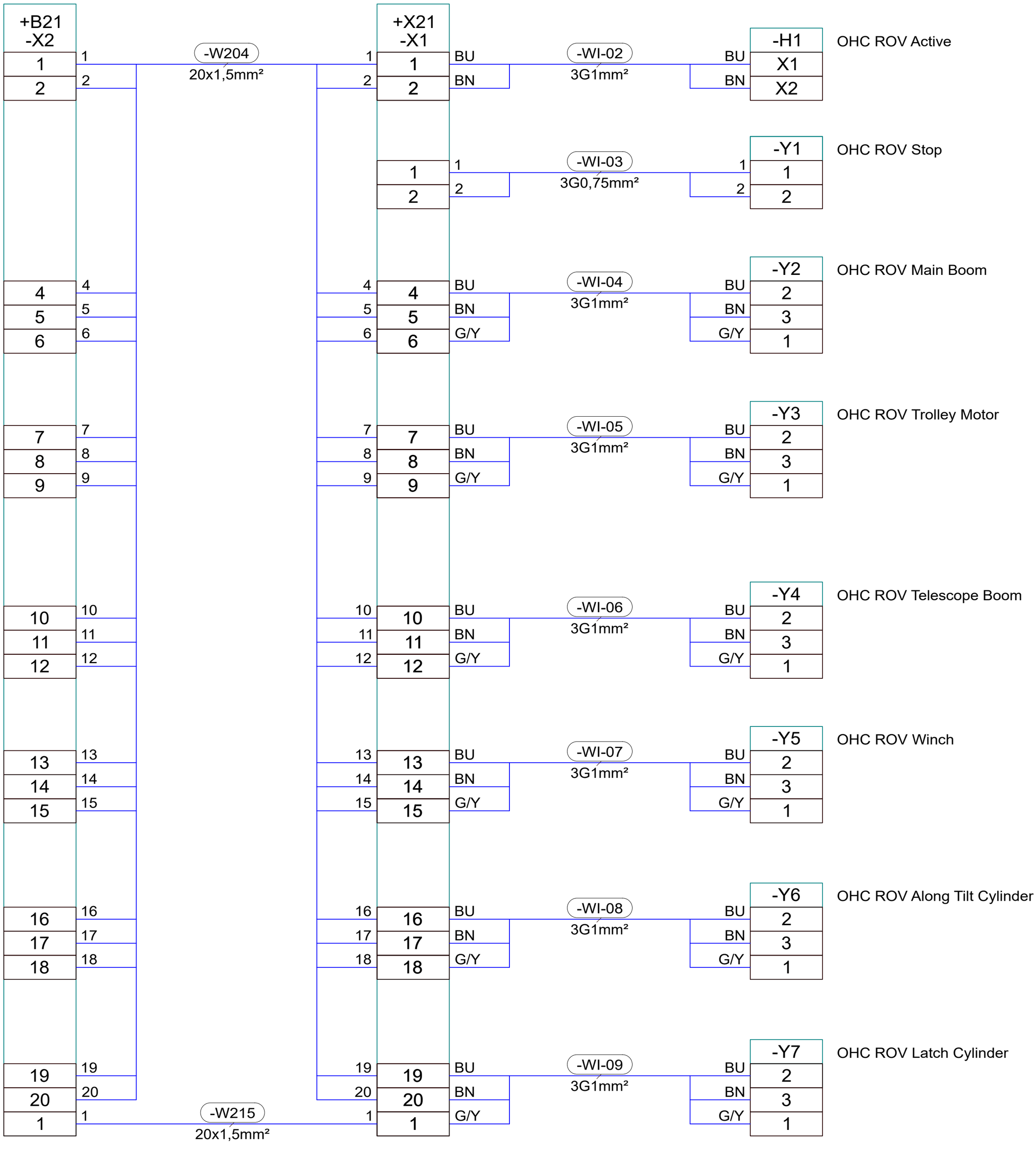

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Termination Diagram
OHC ROV LARS

=OHC

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Rev. 04

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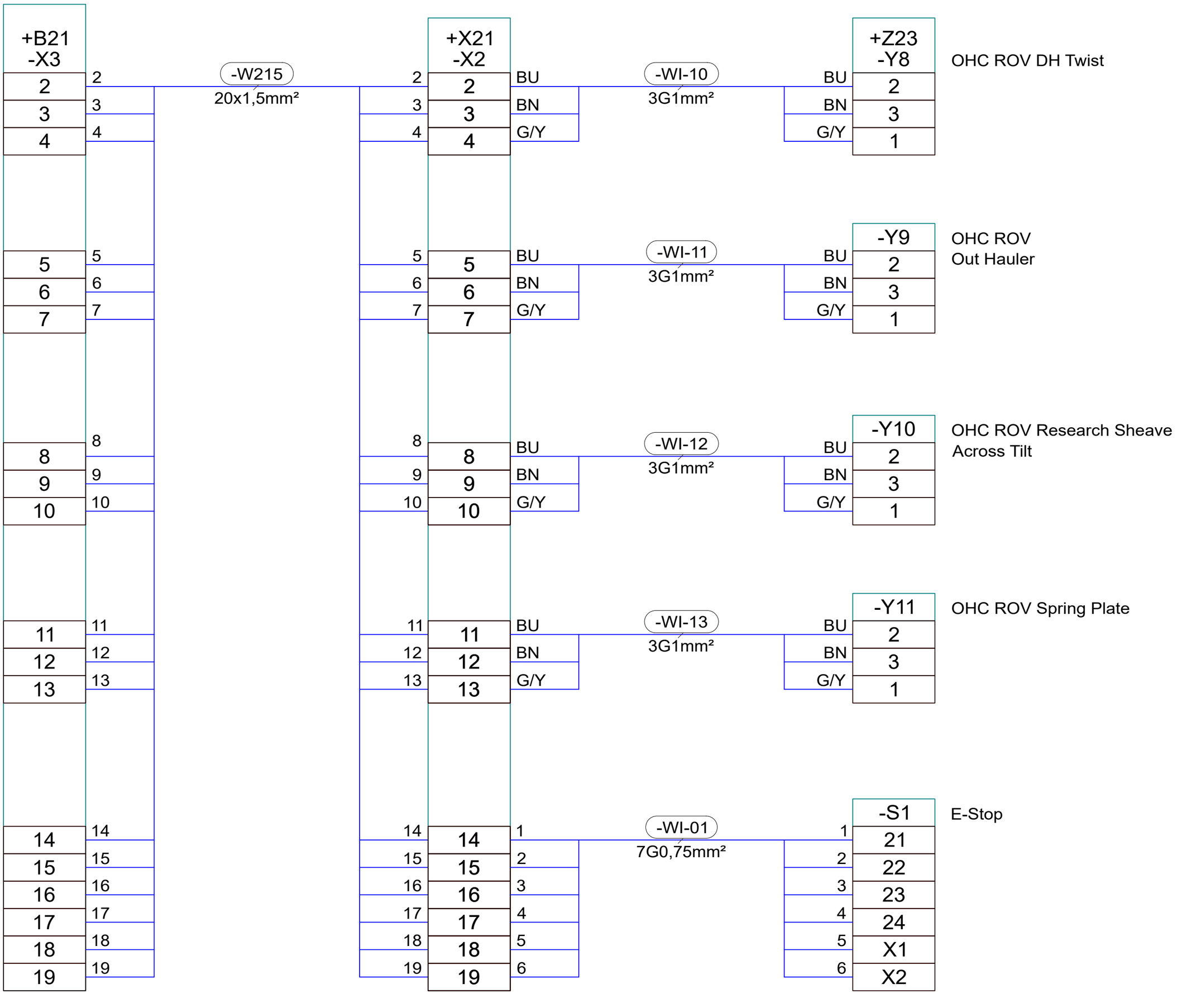

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Termination Diagram
OHC ROV LARS

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E-4502 - 05

Rev. 04

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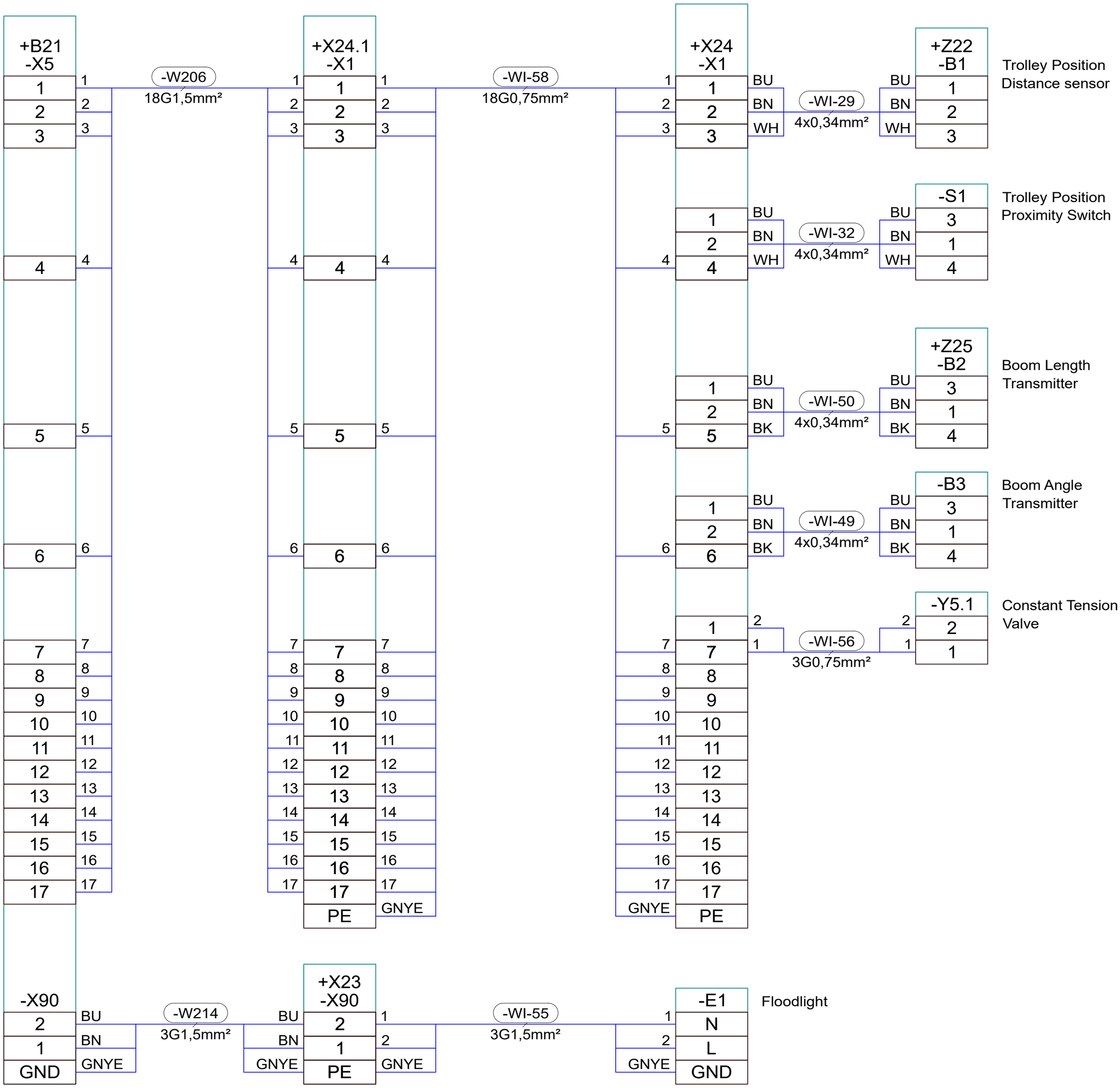

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Termination Diagram
OHC ROV LARS

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Rev. 04

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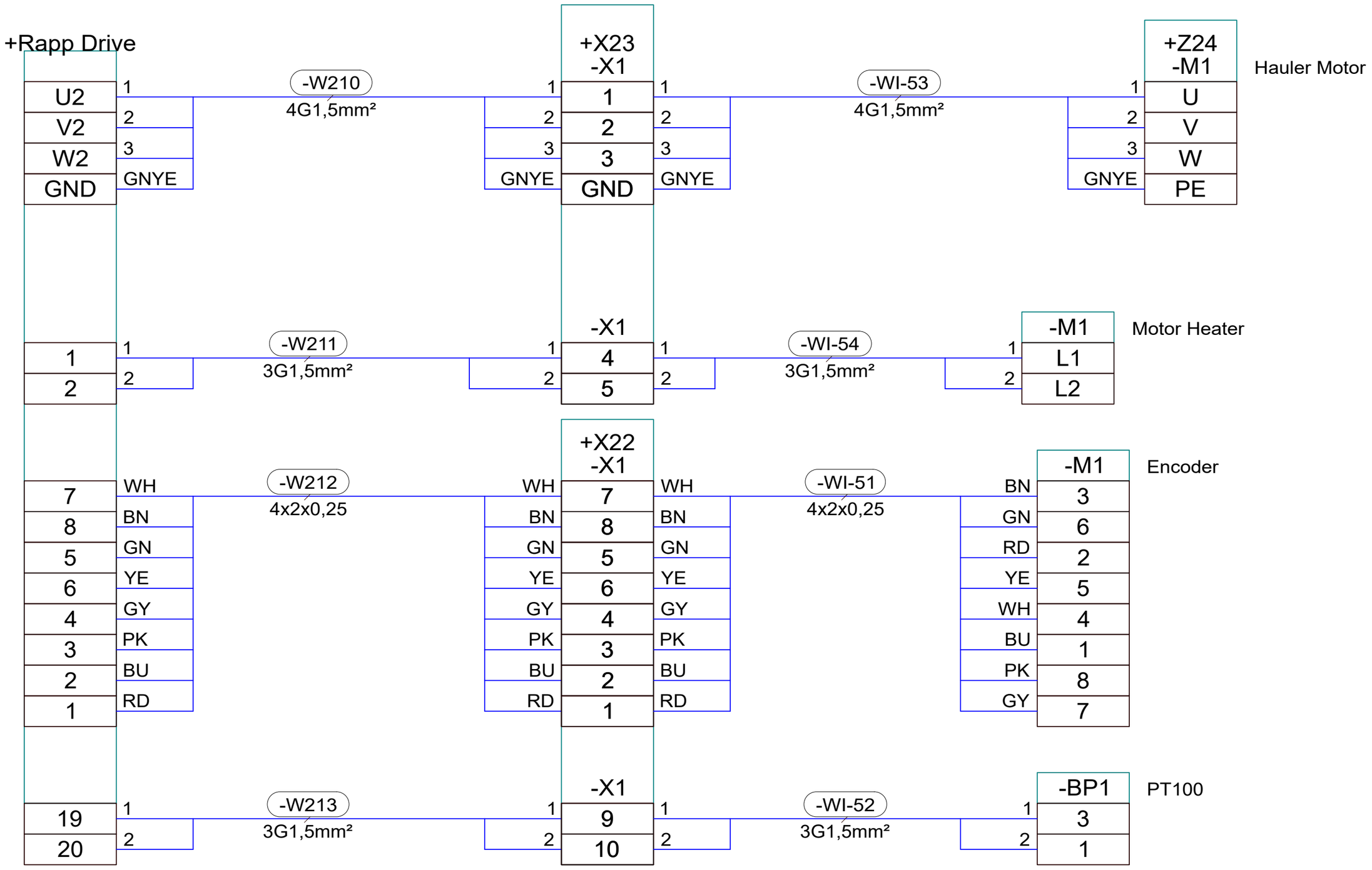

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OHC ROV LARS

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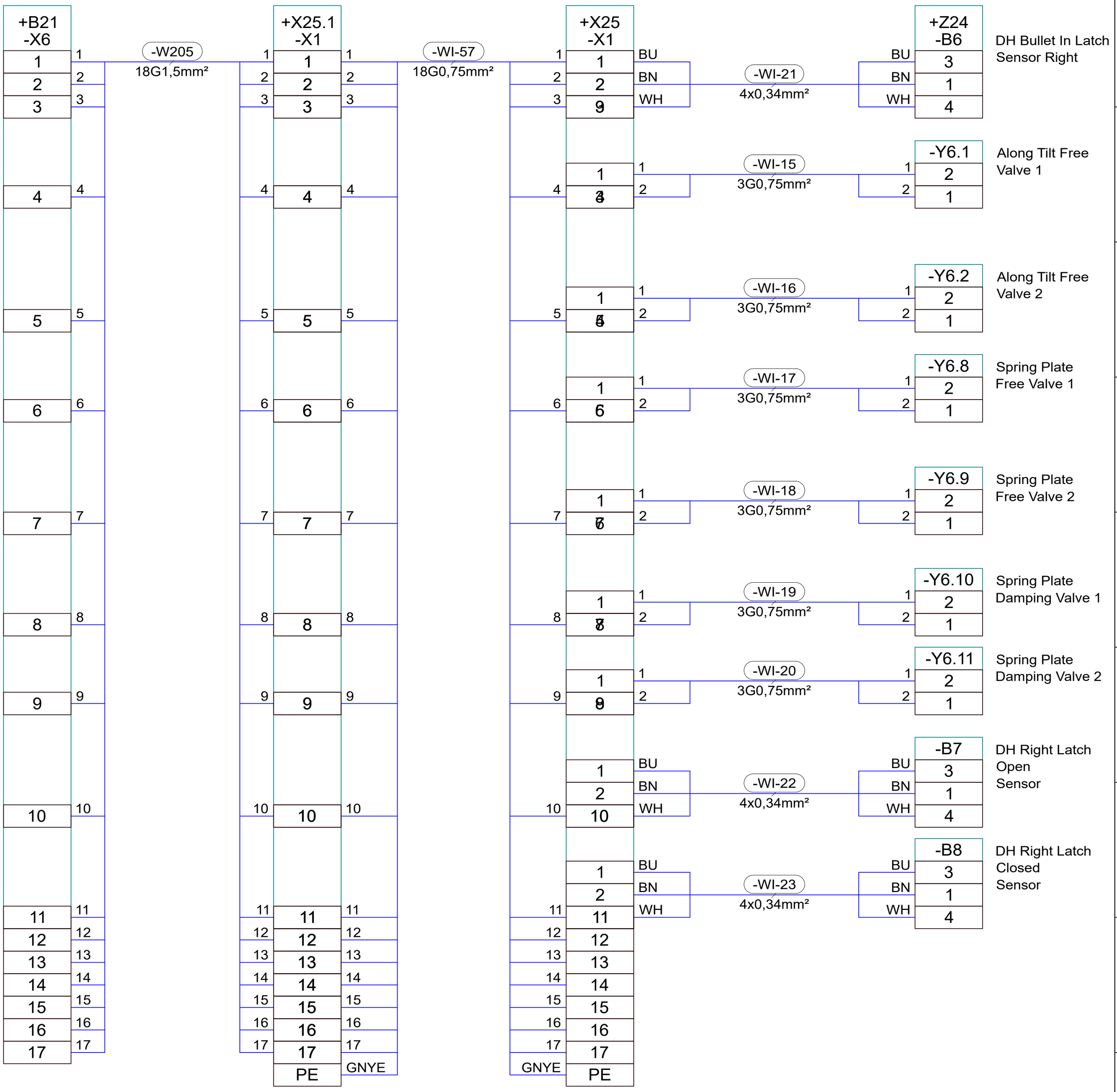

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Template:

+B21 -X4		-W208 18G1,5mm²		+X26.1 -X1		-WI-59 18G0,75mm²		+X26 -X1		-WI-43 4x0,34mm²		+Z24 -B1	Bullet Upper Posiiton Sensor 1
1	1		1	1	1		1	1	BU		BU	3	
2	2		2	2	2		2	2	BN		BN	1	
3	3		3	3	3		3	3	WH		WH	4	
4	4		4	4	4		4	1	BU	-WI-44 4x0,34mm²	BU	-B2	Bullet Upper Posiiton Sensor 2
5	5		5	5	5		5	2	BN		BN	3	
6	6		6	6	6		6	3	WH		WH	1	
7	7		7	7	7		7	4				4	
8	8		8	8	8		8	1	BU	-WI-45 4x0,34mm²	BU	-B3	DH Bullet In Latch Sensor Left
9	9		9	9	9		9	2	BN		BN	3	
10	10		10	10	10		10	3	WH		WH	1	
11	11		11	11	11		11	4				4	
12	12		12	12	12		12	1	BU	-WI-46 4x0,34mm²	BU	-B4	DH Left Latch Open Sensor
13	13		13	13	13		13	2	BN		BN	3	
14	14		14	14	14		14	3	WH		WH	1	
15	15		15	15	15		15	4				4	
16	16		16	16	16		16	1	BU	-WI-47 4x0,34mm²	BU	-B5	DH Left Latch Closed Sensor
17	17		17	17	17		17	2	BN		BN	3	
				PE	GNYE		GNYE	3	WH		WH	1	
								4				4	
								1	1	-WI-38 3G0,75mm²	1	-Y6.3	Across Tilt Free Valve 1
								8	2		2	2	
												1	
								1	1	-WI-39 3G0,75mm²	1	-Y6.4	Across Tilt Free Valve 2
								9	2		2	2	
												1	
								1	1	-WI-40 3G0,75mm²	1	-Y6.5	Across Tilt Damping Valve 1
								10	2		2	2	
												1	
								1	1	-WI-41 3G0,75mm²	1	-Y6.6	Across Tilt Damping Valve 2
								11	2		2	2	
												1	
								1	1	-WI-42 3G0,75mm²	1	-Y6.7	Across Tilt Damping Valve 3
								12	2		2	2	
												1	

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Termination Diagram
OHC ROV LARS

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-WI-01	ROFLEX 7G0.75	07915015		1	Pcs	CABLE, 7G0,75mm²	Lapp	
-WI-02,-WI-04,-WI-05,-WI-06,-WI-07,-WI-08,-WI-09,-WI-10,-WI-11,-WI-12,-WI-13	ROFLEX 3G1	07915017		11	Pcs	CABLE, 3G1mm²	Lapp	
-WI-03,-WI-15,-WI-16,-WI-17,-WI-18,-WI-19,-WI-20,-WI-38,-WI-39,-WI-40,-WI-41,-WI-42,-WI-56	7074-18021-2360500	07930051		13	Pcs	CONNECTOR, VALVE, MURR, 5M, SS	Murr	
-WI-21,-WI-22,-WI-23,-WI-43,-WI-44,-WI-45,-WI-46,-WI-47	V1-WV4A-5M-PUR	07917043		8	Pcs	SENSOR, CABLE, M12, 4-PIN, ANGLE, 5M	Pepperl & Fuchs	
-WI-29,-WI-32,-WI-49,-WI-50	V1-WV4A-30M-PUR	400090572		4	Pcs	SENSOR, CABLE, M12, 4-PIN, ANGLE, 30M	Pepperl & Fuchs	
-WI-30	ØLFLEX FD 855 CP 7G0.75	400111231	10 905 14	1	Pcs	CABLE, 7x0,75mm², SHIELDED	Lapp	
-WI-51	UNITRONIC FD CP (TP) plus 4x2x0.25	07915073		1	Pcs	CABLE, 4x2x0,25mm², -40°C, OD 8,3mm	Lapp	
-WI-52,-WI-54,-WI-55	ØLFLEX FD 855 CP 3G1.5			3	Pcs	CABLE, 3x1,5mm², SHIELDED	Lapp	
-WI-53	ØLFLEX FD 855 CP 4G1.5	400213974		1	Pcs	CABLE, 4x1,5mm², SHIELDED	Lapp	
-WI-57,-WI-58,-WI-59	ØLFLEX FD 855 CP 18G0.75	400213543		3	Pcs	CABLE, 18x0,75mm², SHIELDED	Lapp	

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-A20	RC-OHC-HBC.SE.1-07	400198450		1	Pcs	CTD OHC 07 with Display	HBC	
-CAB1	ADO201	07939034	24 138 75	1	Pcs	CABINET, DOORSTOPPER, ADO, ELDON	Eldon	
-CAB1	MAS0605030	400089006	24 174 95	1	Pcs	CABINET, 600x500x300 ELDON*	Eldon	
-DUCT1,-DUCT3..-DUCT5	HA760040	07920015	12 857 18	1.22	M	CABLE TRAY, 60X40, GREY, W/LID	Tehalit Hager	
-F1	iC60H/C 04-2	07938005	16 760 63	1	Pcs	FUSE, AUTOMAT, 4A, 2-POLE, C	Schneider	
-G1	CS10.241	07949016	66 040 29	1	Pcs	POWER SUPPLY, PULSE, 10A, 230/24	Puls	
-GL1,-GL9..-GL10	WADI-TEC EMC M40 Ø24-30	400075304	12 492 78	3	Pcs	CABLE GLAND, BRASS, EMC, Ø24-30	Elis	
-GL2,-GL3	WADI-TEC EMC M32 Ø17-24	07928087	12 492 76	2	Pcs	CABLE GLAND, BRASS, EMC, Ø17-24	Elis	
-GL4,-GL5	WADI-TEC EMC M25 Ø10-14.5	07928084	12 492 70	2	Pcs	CABLE GLAND, BRASS, EMC, Ø10-14,5	Elis	
-GL11..-GL15	WADI-TEC EMC M16 Ø5-8.5	07928081	12 492 64	5	Pcs	CABLE GLAND, BRASS, EMC, Ø5-8,5	Elis	
-GL16	WADI-TEC EMC M16 Ø4-6.5	07928080	12 492 62	1	Pcs	CABLE GLAND, BRASS, EMC, Ø4-6,5	Elis	
-H1	ZBVB3	07924016	43 032 26	1	Pcs	LAMP, LED, GN, 24V	Schneider	
-K9..-K13	C12A21X24D	07936028	43 791 08	5	Pcs	RELAY, RELECO, 2-POLE, 24V, DC, 5A	Releco	
-K9..-K13	S-12	07942015	43 791 01	5	Pcs	RELAY, SOCKET, RELECO, 2-POLE	Releco	
-K20	C7A20FX24D	07936015	43 783 87	1	Pcs	RELAY, RELECO, 2-POLE, 24V DC, 10A	Releco	
-K20	S7-I/O			1	Pcs	RELAY, SOCKET	Releco	
-KF2.0	EK1101	400142335		1	Pcs	EtherCAT Coupler w ID settings	Beckhoff	
-KF2.1	EL1008	400142339		1	Pcs	8 Digital Inputs	Beckhoff	
-KF2.2	EL3058	400142349		1	Pcs	8 Analog Inputs 4-20mA 2-wire	Beckhoff	
-KF2.3	EL1904			1	Pcs	TwinSAFE 4 Digital Inputs	Beckhoff	
-KF2.4	EL2911	400142346		1	Pcs	TwinSAFE 4 Digital Inputs, 1x Output	Beckhoff	
-KF2.5,-KF2.9,-KF2.14,-KF2.17	EL9410	400142412		4	Pcs	Power Supply Terminal fro E-bus	Beckhoff	
-KF2.6	EL2008	400142342		1	Pcs	8 Digital Outputs	Beckhoff	
-KF2.7,-KF2.8,-KF2.20,-KF2.21	EL2624	400142344		4	Pcs	4 Relay Outputs	Beckhoff	
-KF2.10,-KF2.11,-KF2.12,-KF2.13,-KF2.15,-KF2.16,-KF2.18,-KF2.19,-KF2.22,-KF2.23	EL2535-0002-	400142343		10	Pcs	2 PWM Outputs, 2 Digtal Inputs	Beckhoff	
-KF2.24	EL6751	400142409		1	Pcs	CANopen master/slave terminal	Beckhoff	
-KF2.25	EL9011	400142410		1	Pcs	Bus end cap	Beckhoff	
-R1,-R5	RND 155M207F120RTKRTB5K0	07998018		2	Pcs	Resistor, 120Ω, 0.6W, 1%	RND Components	
-R2..-R4	RND 155M207F249RTKRTB5K0	07998012		3	Pcs	Resistor, 249Ω, 0.6W, 1%	RND Components	
-RAIL1..-RAIL4	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	1.32	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S1	ZB4BK1333	07960019	43 025 24	1	Pcs	CONTR. SWITCH, 3 POS, LED GN	Schneider	

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-S1	ZB4BZ009	07961012	43 027 45	1	Pcs	CONTR. ACC, SOCKET, METAL	Schneider	
-S1	ZBE101	07961013	43 004 23	2	Pcs	CONTR. ACC, CONTACTBLOCK, 1NO	Schneider	
-TAG1	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-TAG2	US-EMLP-HA 24	400075270		1	Pcs	TAG, SIGN, THERMOMARK CARD	Phoenix Contact	
-X0	AEP 3C 2.5	400069937	12 694 11	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0	AEP AP11			1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0..-X7,-X9,-X90	AEB 35 SC/1	400073887	12 654 34	14	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X0 (1)	A3C 2.5	400069932	12 654 01	1	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X0 (-)	AAP11 6/6X1.5 LO-LI BL	400074009		1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (-,-,-,-,-)	AAP11 1.5 LI BL	400074009		5	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+)	AAP11 6/6X1.5 LO-LI RD	400074009		1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+,+,+,+,+,+)	AAP11 1.5 LI RD	400074009		6	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (GND)	JORDSKINNE 21	07918007		1	Pcs	RAIL, GRN, BRASS, 21 SLOT	Weidmüller	
-X0 (GND),-X90 (GND)	WPE 4	07918003	12 688 16	2	Pcs	-TERMINAL BLOCK, GND, 101010	Weidmüller	
-X0 (GND,GND)	A3C 2.5 PE	400074010	12 654 16	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1 (1,3,5,7,9,11,13,15,17),-X4 (1,3,5,7,9,11,13,15,17),-X5 (1,3,5,7,9,11,13,15,17),-X6 (1,3,5,7,9,11,13,15,17),-X7 (1,3,5,7),-X90 (1)	A2T 2.5	400073880	12 654 14	41	Pcs	TERMINAL BLOCK, SNAP-IN, TWO HIGHTS	Weidmüller	
-X2..-X3,-X9	AEP 3T 2.5	400209845	12 694 40	3	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X2 (1,1,4,4,7,10,13,16,19),-X3 (1,4,7,10,13,16,19),-X9 (1, 4,7,10)	A3T 2.5			20	Pcs	TERMINAL BLOCK, SNAP-IN, THREE HIGHTS	Weidmüller	
-X4..-X7,-X90	AEP 2T 2.5	400073883	12 694 40	5	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X91,-X92	IE-TO-RJ45-FJ-B	07930061		2	Pcs	CONNECTOR, FEMALE, RJ45, RAIL MOUNT	Weidmüller	
-X93 (1)	A3T 2.5 DL			1	Pcs	TERMINAL BLOCK, SNAP-IN, THREE HIGHTS	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL12	ST-M 16 x 1.5	07928032	12 477 13	12	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-GL13,-GL14	ST-M 20 x 1.5	07928033	12 477 14	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-GL15,-GL16	ST-M 50 x 1.5	07928037	12 477 18	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø26-38	Lapp	
-JB1	CPG-320	07904006		1	Pcs	JUNCTION BOX, POLYESTER, 360x160x91	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.337	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1 (1,1-2,2-20),-X2 (1-20)	A2C 2.5	400069931	12 654 00	42	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1,-X2	AEB 35 SC/1	400073887	12 654 34	4	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1,-X2	AEP 2C 2.5	400069933	12 694 10	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL4	ST-M 20 x 1.5	07928033	12 477 14	4	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB1	CPG-220	07904002		1	Pcs	JUNCTION BOX, POLYESTER, 122x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.11	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1-10)	A2C 2.5	400069931	12 654 00	10	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL6	ST-M 20 x 1.5	07928033	12 477 14	6	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.183	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEP 2C 2.5	400069933	12 694 10	3	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1-5),-X90 (1-2)	A2C 2.5	400069931	12 654 00	7	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (GND,GND,GND,PE),-X90 (PE)	A2C 2.5 PE	400074009	12 654 15	5	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1,-X90	AEB 35 SC/1	400073887	12 654 34	4	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1	ST-M 25 x 1.5	07928034	12 477 15	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-GL2..-GL6	ST-M 16 x 1.5	07928032	12 477 13	5	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-GL7	ST-M 20 x 1.5	07928033	12 477 14	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.208	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1	AEP 3C 2.5	400069937	12 694 11	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1,1,1-2,2,2,2)	A3C 2.5	400069932	12 654 01	8	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (3-18)	A2C 2.5	400069931	12 654 00	16	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE,PE)	A2C 2.5 PE	400074009	12 654 15	3	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1,-GL2	ST-M 25 x 1.5	07928034	12 477 15	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.209	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1-18)	A2C 2.5	400069931	12 654 00	18	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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-GL1..-GL9,-GL11	ST-M 12 x 1.5	07928031	12 477 12	10	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3-6,5	Lapp	
-GL10	ST-M 25 x 1.5	07928034	12 477 15	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.207	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1	AEP 3C 2.5	400069937	12 694 11	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1,1,1,1,1-2,2,2,2)	A3C 2.5	400069932	12 654 01	10	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (3-18)	A2C 2.5	400069931	12 654 00	16	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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-GL1,-GL2	ST-M 25 x 1.5	07928034	12 477 15	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.208	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1-18)	A2C 2.5	400069931	12 654 00	18	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Part List
OHC ROV LARS

=OHC
+X25.1

E-4502 - 07
Rev. 04
10 / 17

Printed: 07-Jul-23 11:33

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL6,-GL8..-GL11	ST-M 12 x 1.5	07928031	12 477 12	10	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3-6,5	Lapp	
-GL7	ST-M 25 x 1.5	07928034	12 477 15	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.208	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1	AEP 3C 2.5	400069937	12 694 11	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1,1,1,1,1-2,2,2,2)	A3C 2.5	400069932	12 654 01	10	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (3-18)	A2C 2.5	400069931	12 654 00	16	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
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Part List
OHC ROV LARS

=OHC
+X26

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Rev. 04
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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1,-GL2	ST-M 25 x 1.5	07928034	12 477 15	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.18	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1-18)	A2C 2.5	400069931	12 654 00	18	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1 (PE,PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
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Part List
OHC ROV LARS

=OHC
+X26.1

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Rev. 04
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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-S1	XALK178W3B140G	400208317	4322660	1	Pcs	CONTR. PUSH, EM STOP	Schneider	

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
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Part List
OHC ROV LARS

=OHC
+Z20

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Rev. 04
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Printed: 07-Jul-23 11:33

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B1	O1D105	07917210		1	Pcs	SENSOR, LENGTH, LASER, 0,2..10M	Ifm	
-H1	853 200 55	400063430		1	Pcs	LAMP, BEACON, LED, GN, 24V	Werma	
-H2	853 300 55	400063431		1	Pcs	LAMP, BEACON, LED, YE, 24V	Werma	
-H3	853 100 55	400063429		1	Pcs	LAMP, BEACON, LED, RD, 24V	Werma	
-S1	NEN20-18GM50-E2-V1	07917052		1	Pcs	SENSOR, PROX, Ø18, NO, SN20, M12	Pepperl & Fuchs	
-S2,-S3	NBB8-18GM50-A2-V1-M1	400112793		2	Pcs	SENSOR, PROX, Ø18, NO/NC, SN8, M12, -40. .70°C	Pepperl & Fuchs	

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
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02	For customer review	29.08.2022	RSI	Appr. by	EE

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Part List
OHC ROV LARS

=OHC
+Z22

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Rev. 04
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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-H1	853 300 55	400063431		1	Pcs	LAMP, BEACON, LED, YE, 24V	Werma	
-S1	XALK178W3B140G	400208317	4322660	1	Pcs	CONTR. PUSH, EM STOP	Schneider	
-Y1	HAWE STOP VALVE			1	Pcs	VALVE, ON/OFF	Hawe	
-Y2..-Y13	HAWE PROP VALVE			12	Pcs	VALVE, PROPOTIONAL	Hawe	

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Part List
OHC ROV LARS

=OHC
+Z23

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Rev. 04
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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B1..-B8	NBB4-12GM50-A2-V1-M1	400112792		8	Pcs	SENSOR, PROX, Ø12, NO/NC, SN4, M12, -40. .70°C	Pepperl & Fuchs	
-BP1	INO-OEM202P-PT300	400091230		1	Pcs	PT300 ->, 4-20mA Transmitter, AUTEK-INO-OEM202P-PT300--50/150°C-M12-Ø13,5x72	AUTEK	
-E1	FL60 9000 850 120 M24 MB	400072975		1	Pcs	FLOODLIGHT, LED, 80W, 120V, MEDIUM BEAM	Glamox	
-Y6.1,-Y6.2,-Y6.3,-Y6.4,-Y6.5, -Y6.6,-Y6.7,-Y6.8,-Y6.9,-Y6. 10,-Y6.11	HAWE STOP VALVE			11	Pcs	VALVE, ON/OFF	Hawe	

Rev.	Description	Date	Rev. by	Standard	
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Part List
OHC ROV LARS

=OHC
+Z24

E-4502 - 07
Rev. 04
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Printed: 07-Jul-23 11:33

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B2,-B3	ROTA LJ			2	Pcs	SENSOR, LENGTH, INDUCTIVE, CYLINDER, 4.. 20mA	ROTA	
-Y5.1	HAWE STOP VALVE			1	Pcs	VALVE, ON/OFF	Hawe	

Rev.	Description	Date	Rev. by		
04	Issued for production	07.07.2023	GM	Date	14.10.2021
03	For customer review	13.01.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	EE

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Part List
OHC ROV LARS

=OHC
+Z25

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Rev. 04
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Printed: 07-Jul-23 11:33

Template:

=CTD DAVIT

Customer : CNP Freire
Ship/Hull : MBARI
Project no. : 4/60185
Drawing no.: E-4503

07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ
Rev.	Description	Date	Rev. by	Standard	

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TRIPLEX
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Front Page
CTD Davit

=CTD DAVIT

E-4503 - 00

Rev. 07

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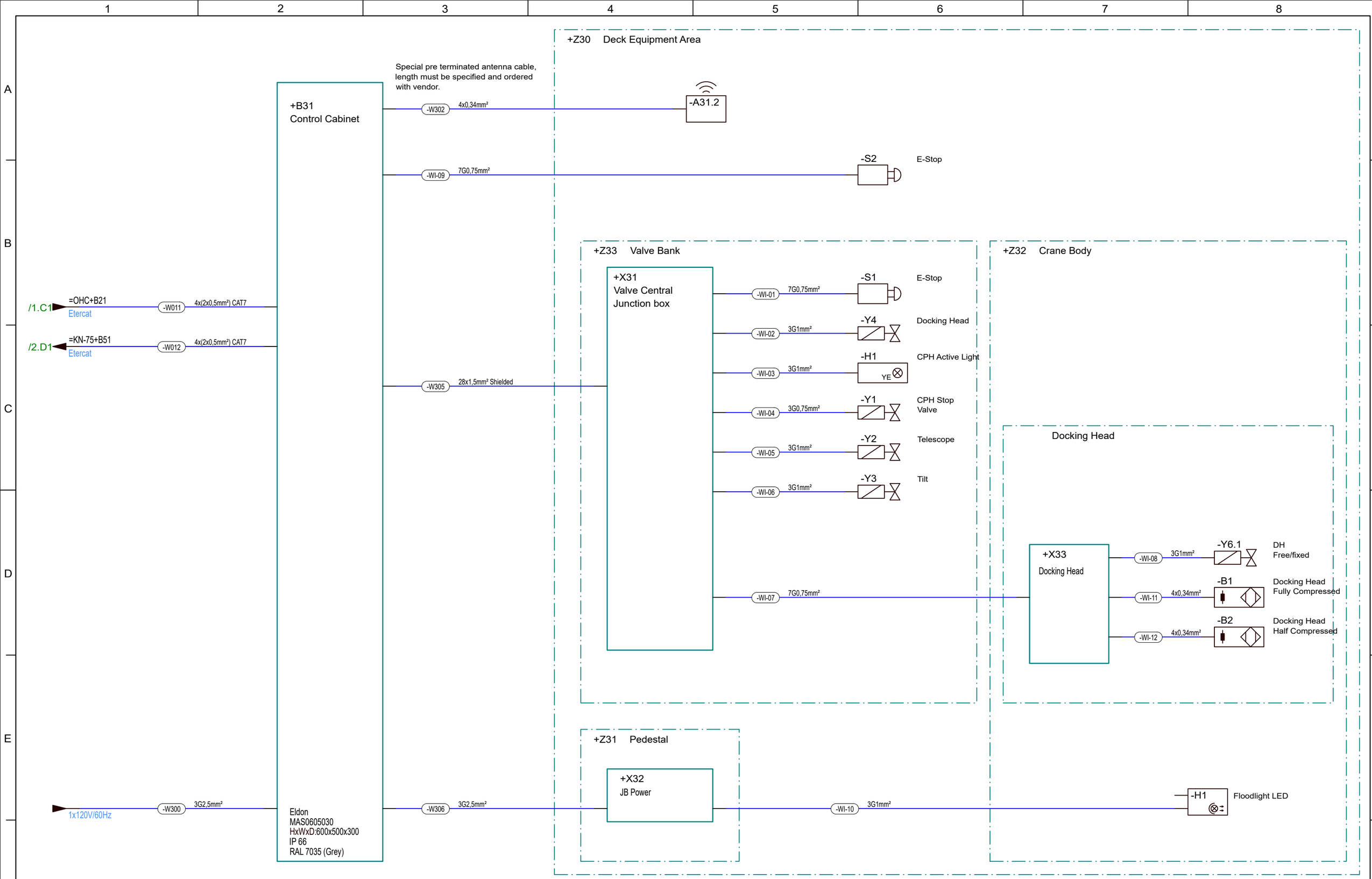

Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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Single Line
CTD Davit

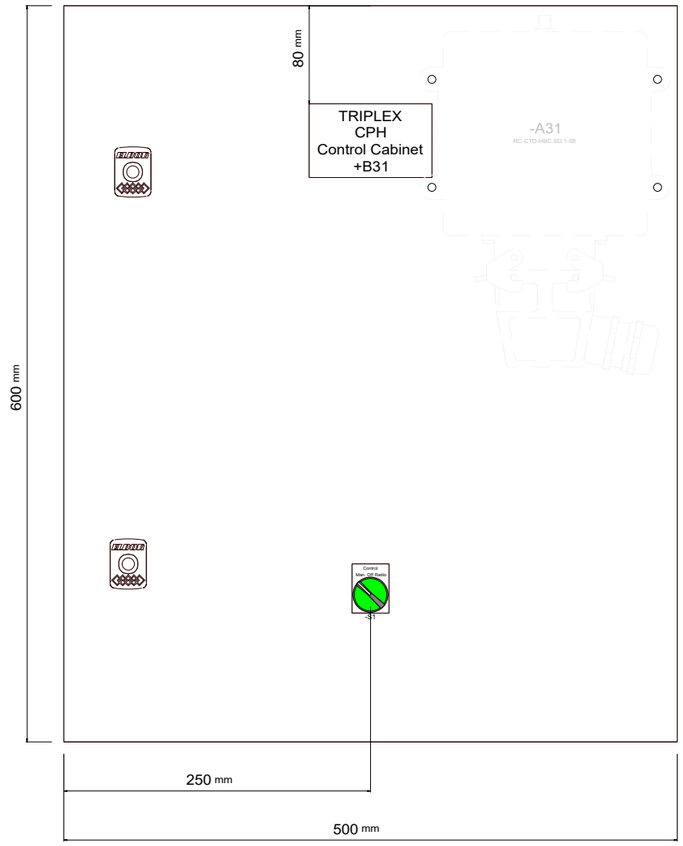
=CTD DAVIT

E-4503 - 01

Rev. 07

1 / 1

-CAB1



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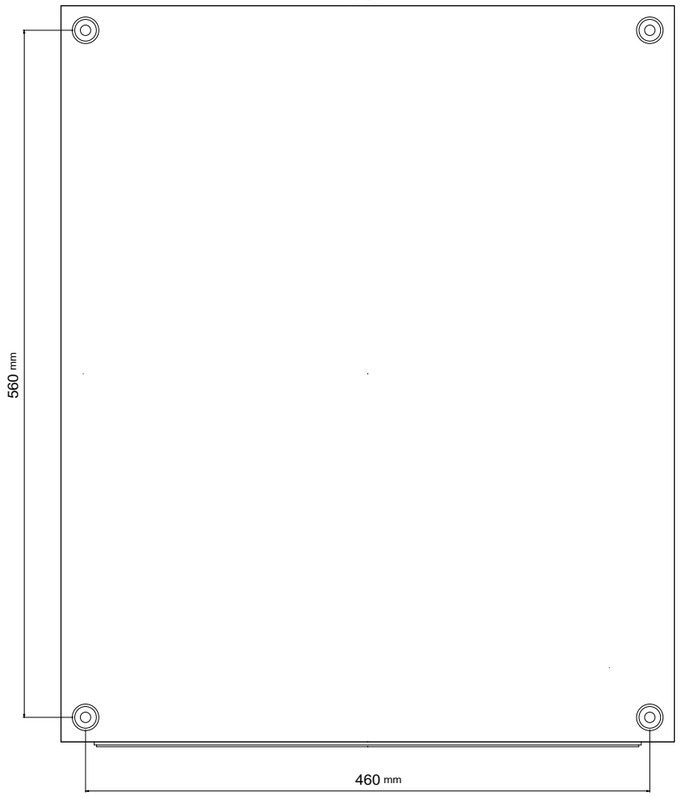

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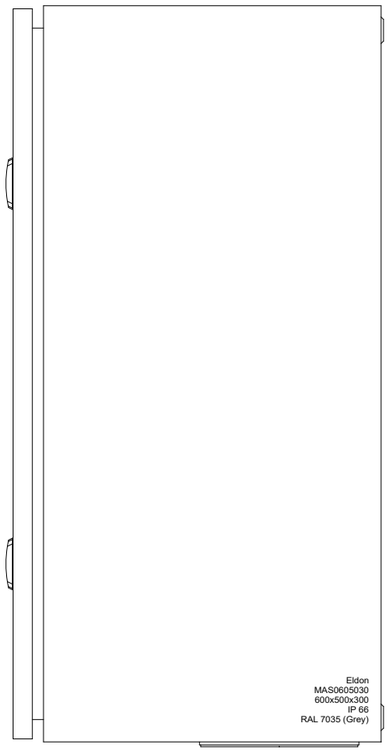

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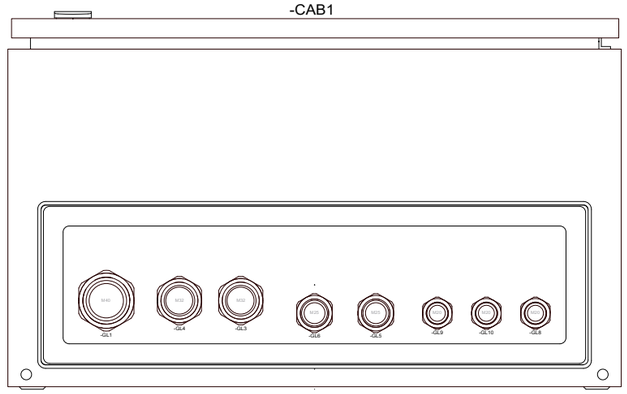

Product Data	
Manufacturer	Eldon
Article name	MAS0605030
WxHxD	600x500x300
IP	IP 66
RAL Code	RAL 7035 (Grey)
Material	Steel, Painted

Rev.	Description	Date	Rev. by		
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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Layout
CTD Davit
Control Cabinet Radio - Outside

=CTD DAVIT
+B31

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Rev. 07
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Printed: 05.02.2025 11:05

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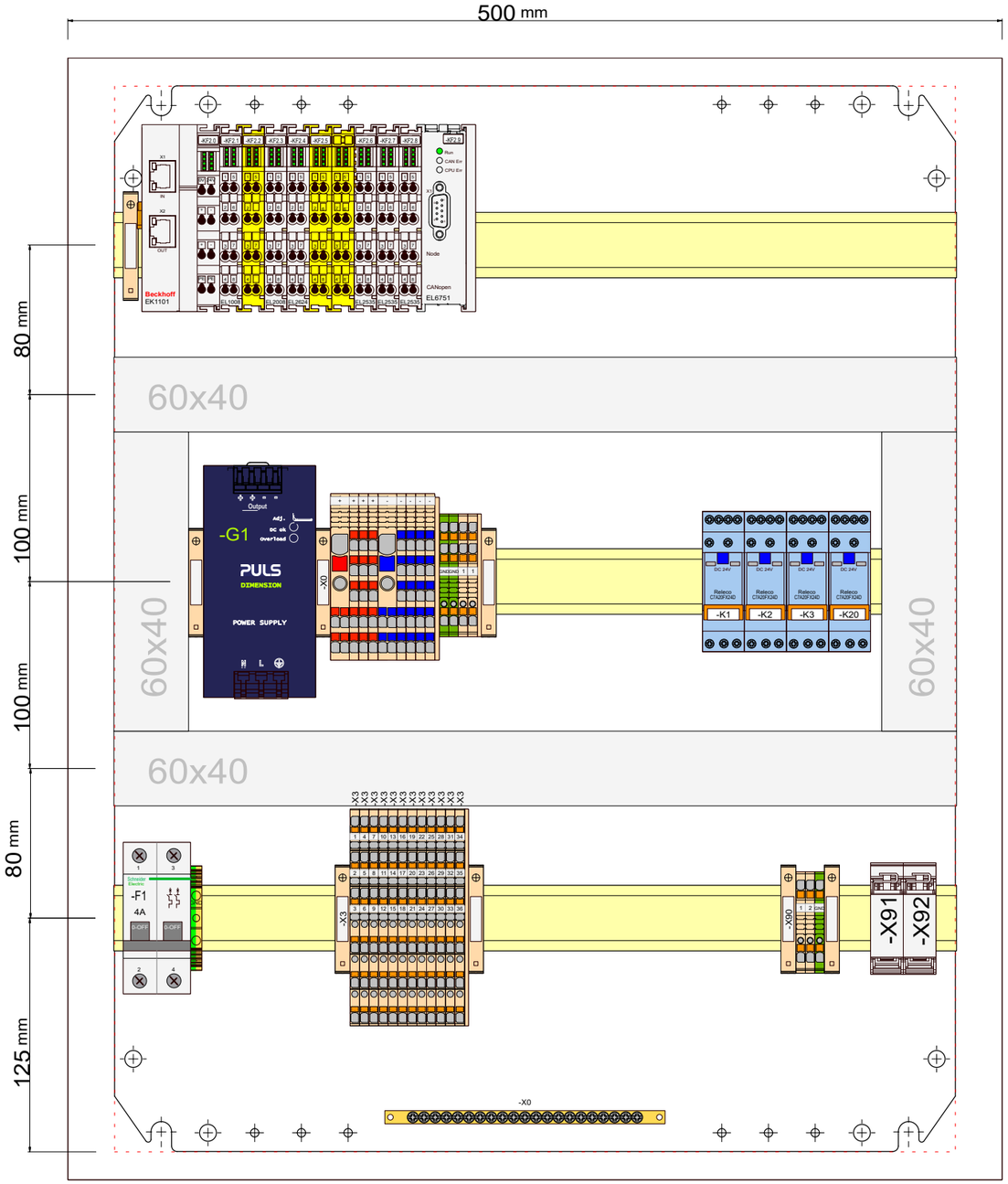

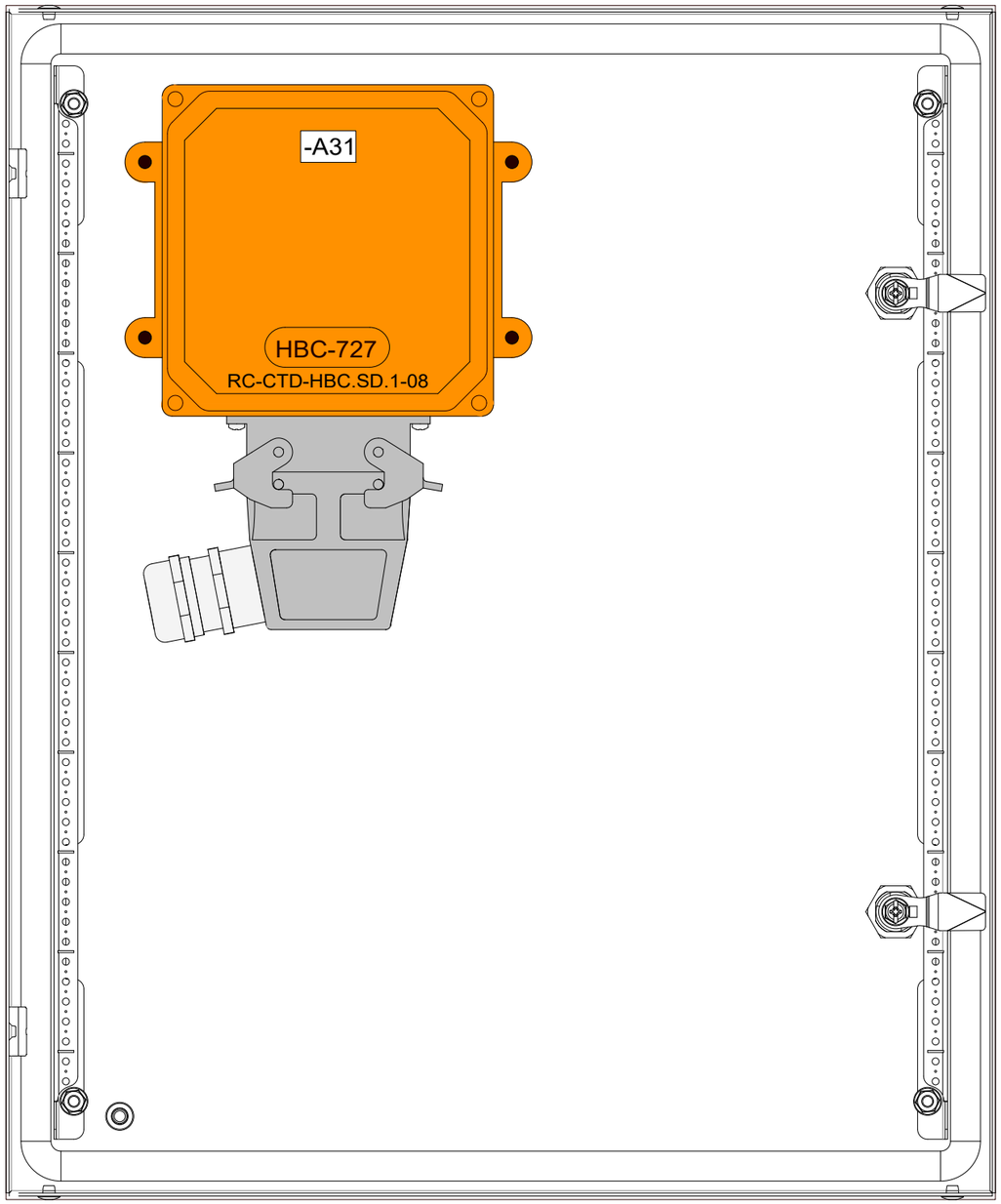

Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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A MacGregor company

Layout
CTD Davit
Control Cabinet Radio - Inside

=CTD DAVIT
+B31

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Rev. 07
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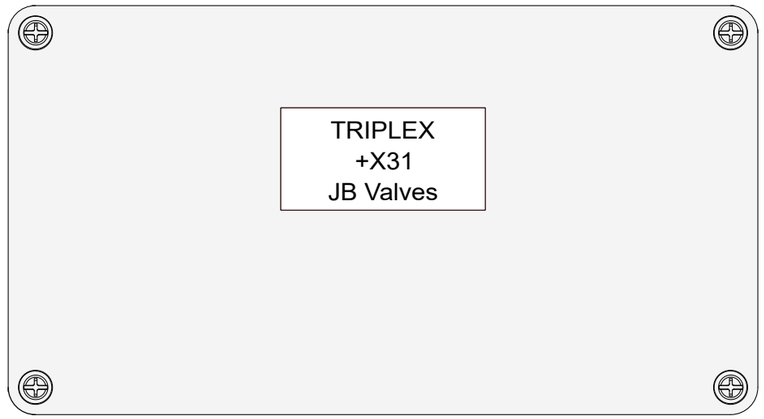

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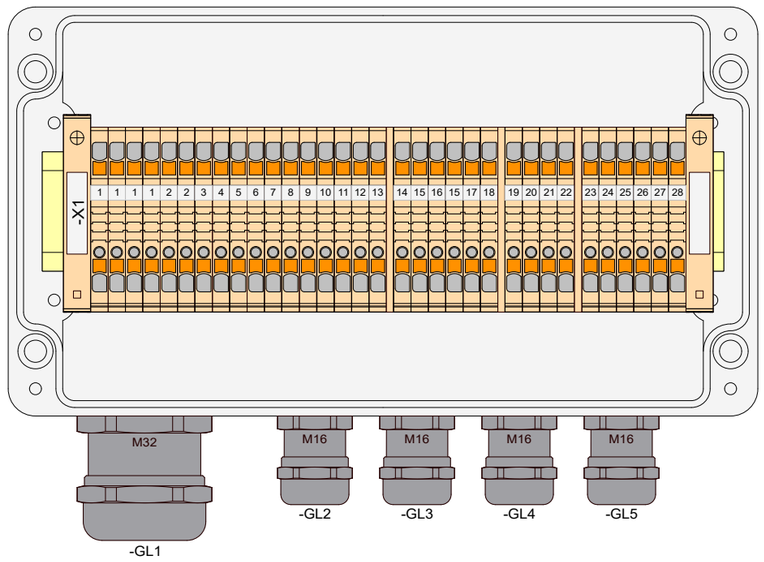
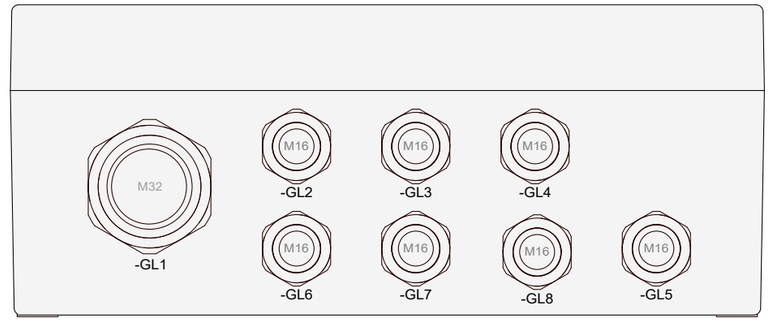


Rear View



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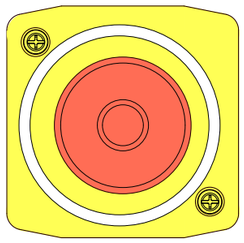
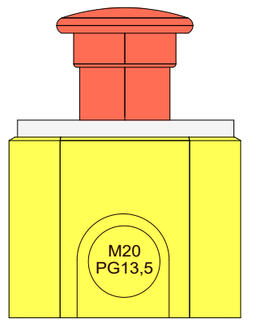
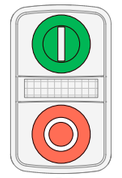


Front View

-S1



Top/Bottom View



-S2

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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Layout
CTD Davit
JB Valves

=CTD DAVIT | E-4503 - 03

+X31 | Rev. 07 | 3 / 8

Printed: 05.02.2025 11:05

Template:

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Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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Layout
CTD Davit
RC Transmitter

=CTD DAVIT
+A31

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Rev. 07
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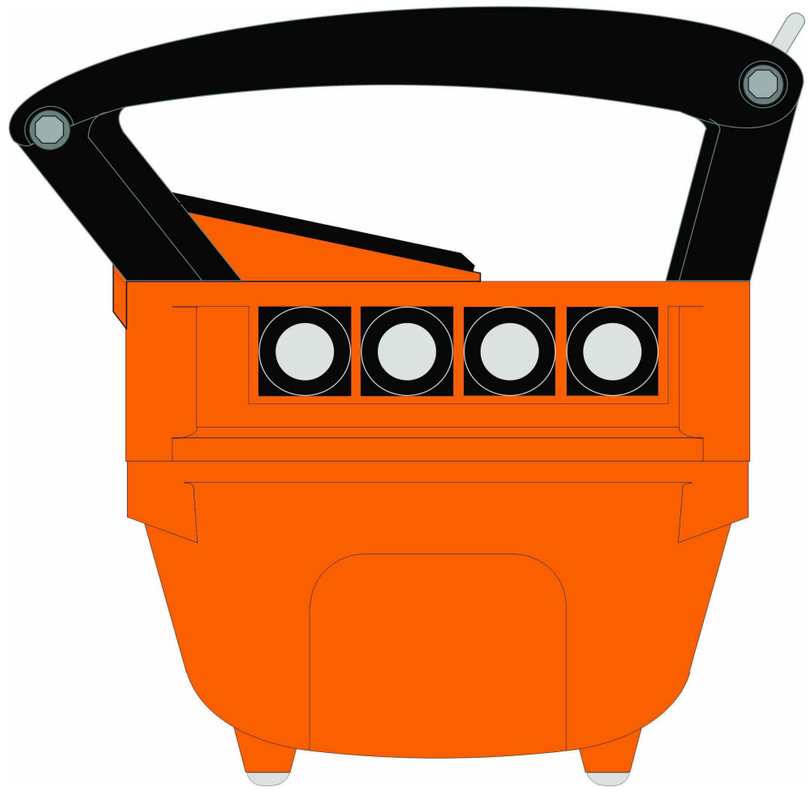
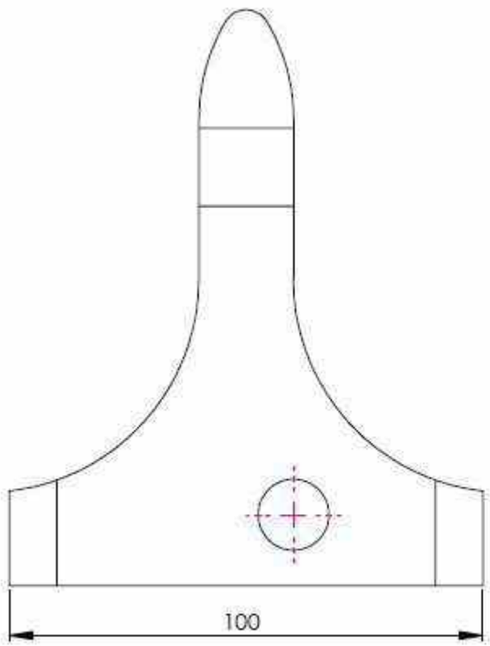
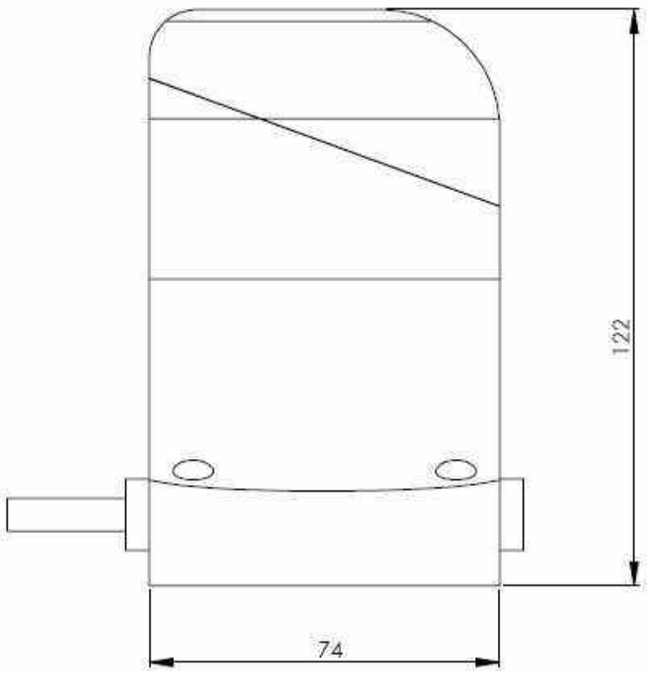
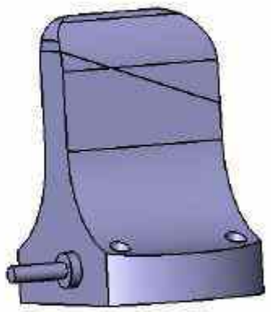
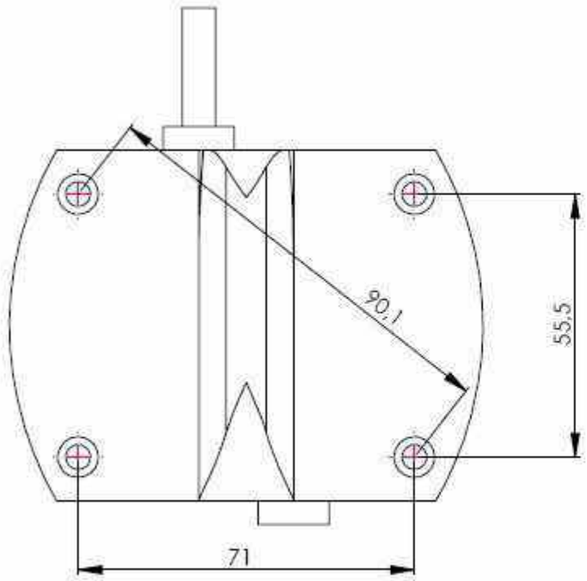


07	Update	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company	Layout CTD Davit RC Transmitter Side View	=CTD DAVIT		E-4503 - 03	
06	For customer review	22.12.2024	WJ	Drawn by	KS				+A31		Rev. 07	6 / 8
05	For customer review	24.02.2023	GM	Appr. by	WJ							
Rev.	Description	Date	Rev. by	Standard								









Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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Layout
CTD Davit
RC Antenna

=CTD DAVIT
+A31

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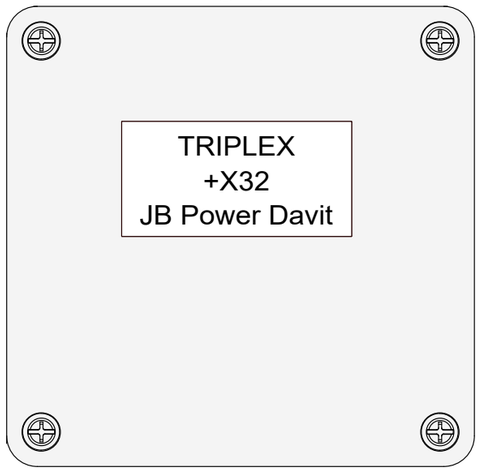
Rev. 07
7 / 8

-JB1



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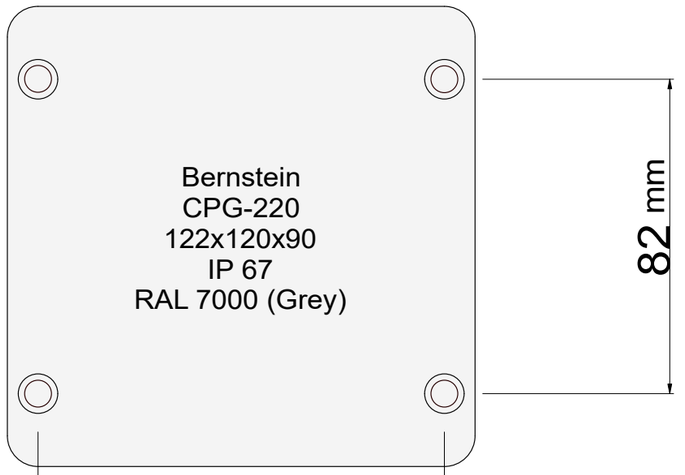

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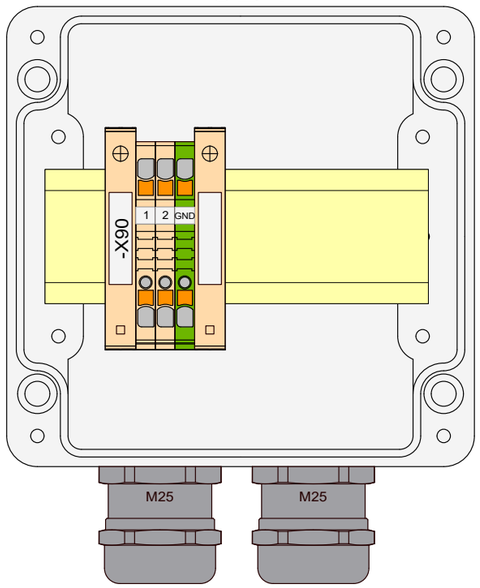

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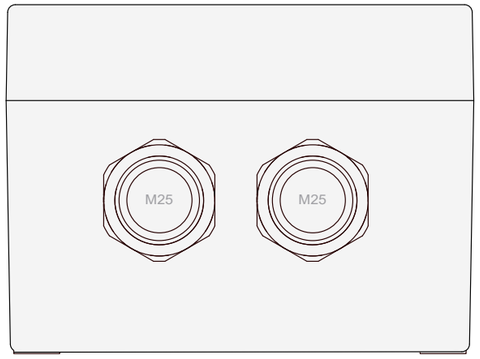

Rev.	Description	Date	Rev. by		
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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Layout
CTD Davit
JB Interface

=CTD DAVIT
+X32

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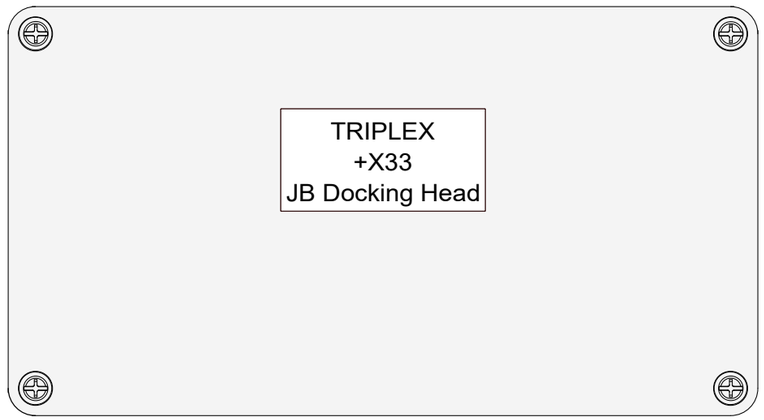

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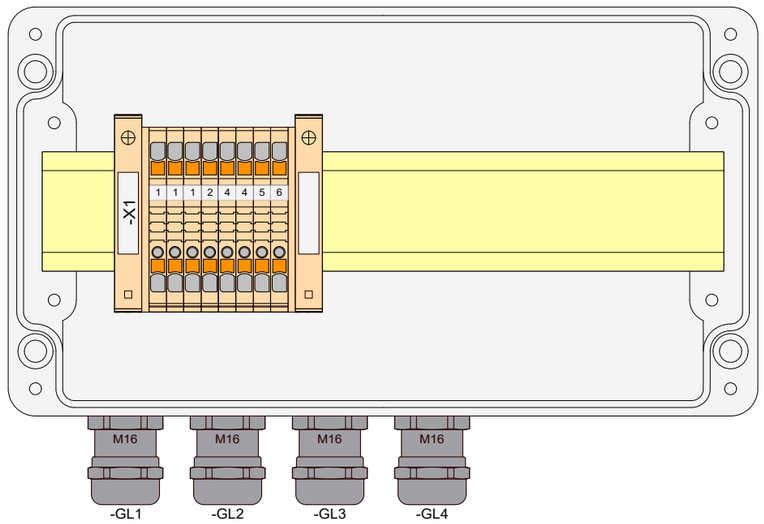
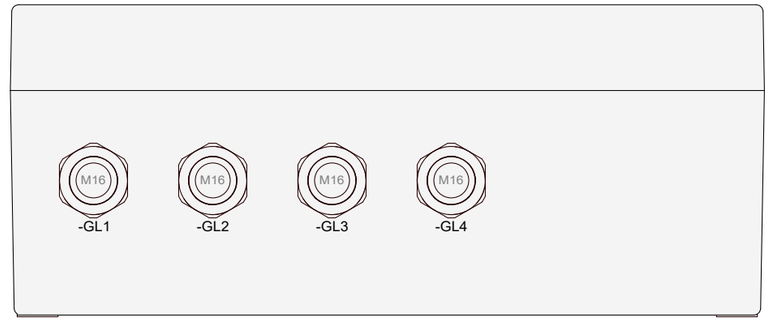


Rear View



Component installed on equipment

Rev.	Description	Date	Rev. by		
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
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Layout
CTD Davit
JB Docking Head

=CTD DAVIT
+X33

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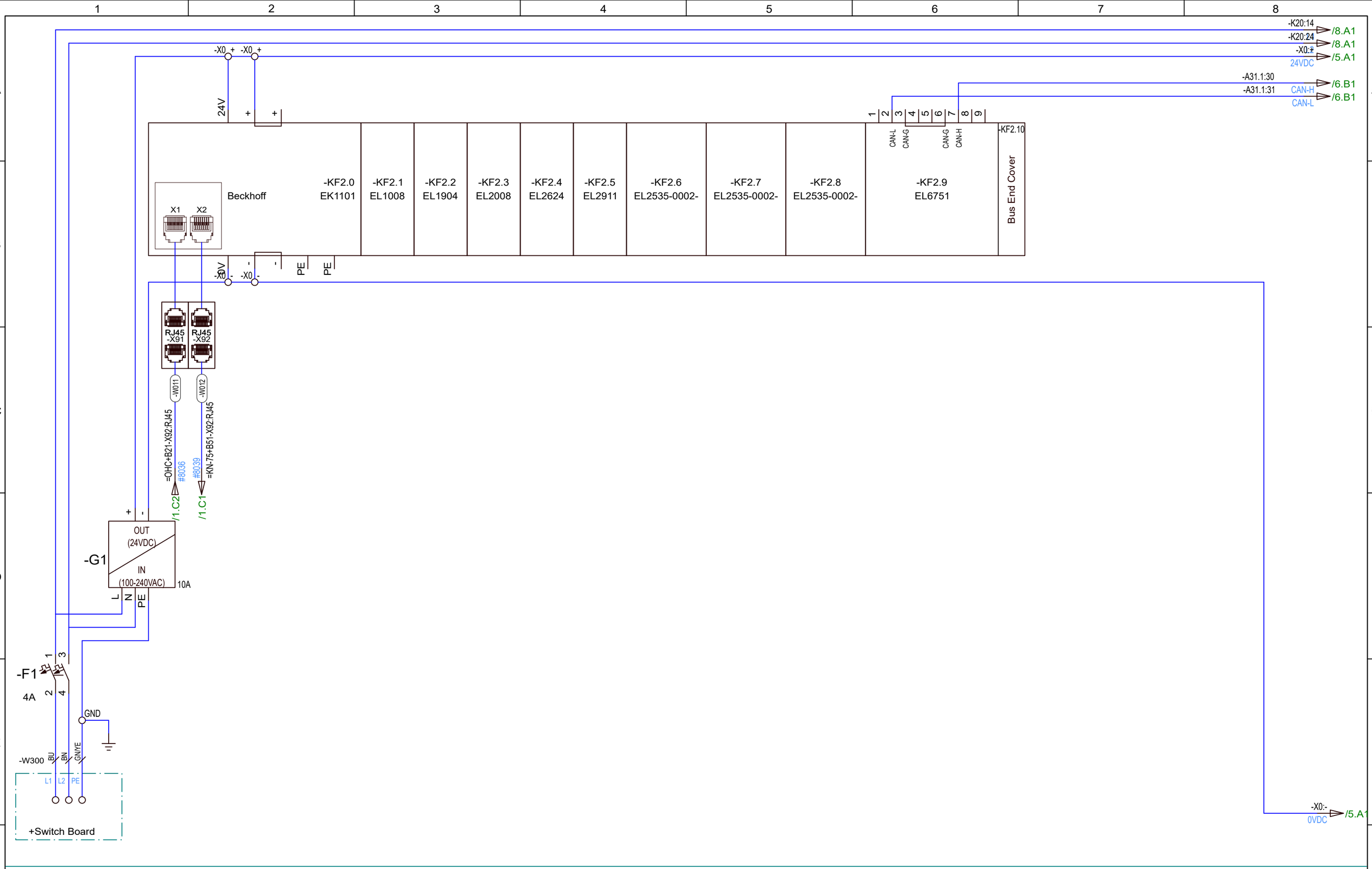

07	Update	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company	Circuit Diagram CTD Davit Control Cabinet	=CTD DAVIT	E-4503 - 04
06	For customer review	22.12.2024	WJ	Drawn by	KS				+B31	Rev. 07 1/ 8
05	For customer review	24.02.2023	GM	Appr. by	WJ					
Rev.	Description	Date	Rev. by	Standard						

-KF2.1 Beckhoff EL1008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Input	DI1	/6.C1	Control Cabinet	Switch	CTD	Manual Control	DI	
5	Digital Input	DI2	/7.B8	Valve Bank	Switch	HPU	Start		
2	Digital Input	DI3	/7.B8	Valve Bank	Switch	HPU	Stop		
6	Digital Input	DI4	/7.B6	Docking Head	Sensor	CTD	Fully Copressed	DI	
3	Digital Input	DI5	/7.B6	Docking Head	Sensor	CTD	Half Copressed	DI	
7	Digital Input	DI6						DI	
4	Digital Input	DI7						DI	
8	Digital Input	DI8						DI	

-KF2.2 Beckhoff EL1904

Pin	Pin Description	IO Type	Ref	PLC Comment 1	PLC Comment 2	PLC Symboilic Adress
1		I1	/5.B3	Emergency Stop		DIN/DOUT
2						
3		I2	/5.B4	Emergency Stop		DIN/DOUT
4						
5		I3	/5.B1	Emergency Stop		DIN/DOUT
7		I4	/5.B1	Emergency Stop		DIN/DOUT

-KF2.3 Beckhoff EL2008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Output	DO1	/5.B4	Deck Area	Emergency Stop		Light	DO	
5	Digital Output	DO2	/6.C6	Control Cabinet	CTD	Activate CTD Davit	Relay	DO	
2	Digital Output	DO3	/7.B7	Valve Bank	Lamp	HPU	Run Light	DO	
6	Digital Output	DO4	/5.B2	Valve Bank	Emergency Stop		Light	DO	
3	Digital Output	DO5						DO	
7	Digital Output	DO6	/6.C7	Control Cabinet	Relay	CTD	DH Free/Fixed	DO	
4	Digital Output	DO7						DO	
8	Digital Output	DO8						DO	

-KF2.4 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/8.B2	Control Cabinet	Switch	Floodlight	ON	RO	NO
2	Relay Output NO								
5	Com	RO2						RO	NO
6	Relay Output NO								
3	Com	RO3						RO	NO
4	Relay Output NO								
7	Com	RO4						RO	NO
8	Relay Output NO								

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Circuit Diagram
CTD Davit
IO List

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-KF2.5 Beckhoff EL2911

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	+	DIO1							
2	-								
5	+	DIO2							
6	-								
3	+	DIO3							
4	-								
7	+	DIO4							
8	-								
4`	+	DIO5							
3`	-								
8`	+	DIO6							
7`	-								
2`	+	DIO7	/7.B1	Valve Bank	CTD	Stop Valve	OUT		
3`	-								
6`		DIO8							
7`	-								

-KF2.6 Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/7.B2	Valve Bank	Valve	Telescope	In	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/7.B3					DI	
2	PWM Output B1	PWM2		Valve Bank	Valve	Telescope	Out	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

Rev.	Description	Date	Rev. by	Standard	
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Circuit Diagram
CTD Davit
IO List

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-KF2.7 — Beckhoff EL2535-0002-

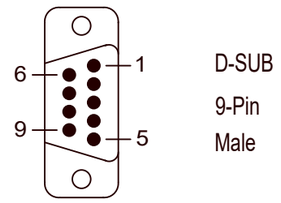
Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/7.B3	Valve Bank	Valve	Tilt	In	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/7.B4					DI	
2	PWM Output B1	PWM2		Valve Bank	Valve	Tilt	Out	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

-KF2.8 — Beckhoff EL2535-0002-

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	PWM Output A1	PWM1	/7.B4	Valve Bank	Valve	Docking Head	In	AO+	PWM
5	PWM Output A2								
3	0Va								
4	Digital Input	DI1	/7.B4					DI	
2	PWM Output B1	PWM2		Valve Bank	Valve	Docking Head	Out	AO+	PWM
6	PWM Output B2								
7	0Vb								
8	Digital Input	DI2						DI	

-KF2.9 — Beckhoff EL6751

DSUB-9	Pin Description	IO Type	Ref
1		CAN	/1.B6
2	CAN-L		
3	CAN-G		
4			
5			
6	CAN-G		
7	CAN-H		
8			
9			



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Circuit Diagram
CTD Davit
IO List

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-X0:+ 24VDC
-X0:- 0VDC
/1.A8
/1.E8

-X0:+ 24VDC
-X0:- 0VDC
/6.C1
/6.E1

-X0 -
-X0 -

-KF2.2
Emergency Stop
DIN/DOUT
/1.B3
I3
+ -
5

-KF2.2
Emergency Stop
DIN/DOUT
/1.B3
I4
+ -
7

-KF2.3 DO4
Valve Bank
Emergency Stop
Light
DO
6

-KF2.2
Emergency Stop
DIN/DOUT
/1.B3
I1
+ -
1 2

-KF2.2
Emergency Stop
DIN/DOUT
/1.B3
I2
+ -
3 4

-KF2.3 DO1
Deck Area
Emergency Stop
Light
DO
1

-X3 23 24 25 26 27 28

-X3 31 32 33 34 35 36

-W305 23 24 25 26 27 28

-WI-09 1 2 3 4 5 6

+Z33

+X31

23 24 25 26 27 28

-WI-01 1 2 3 4 5 6

-S1 21 22

-S1 23 24

-S1 X1 X2

Valve Bank

+Z30

-S2 21 22

23 24

X1 X2

Deck Equipment Area

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06	For customer review	22.12.2024	WJ	Drawn by	KS			
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Rev.	Description	Date	Rev. by	Standard				

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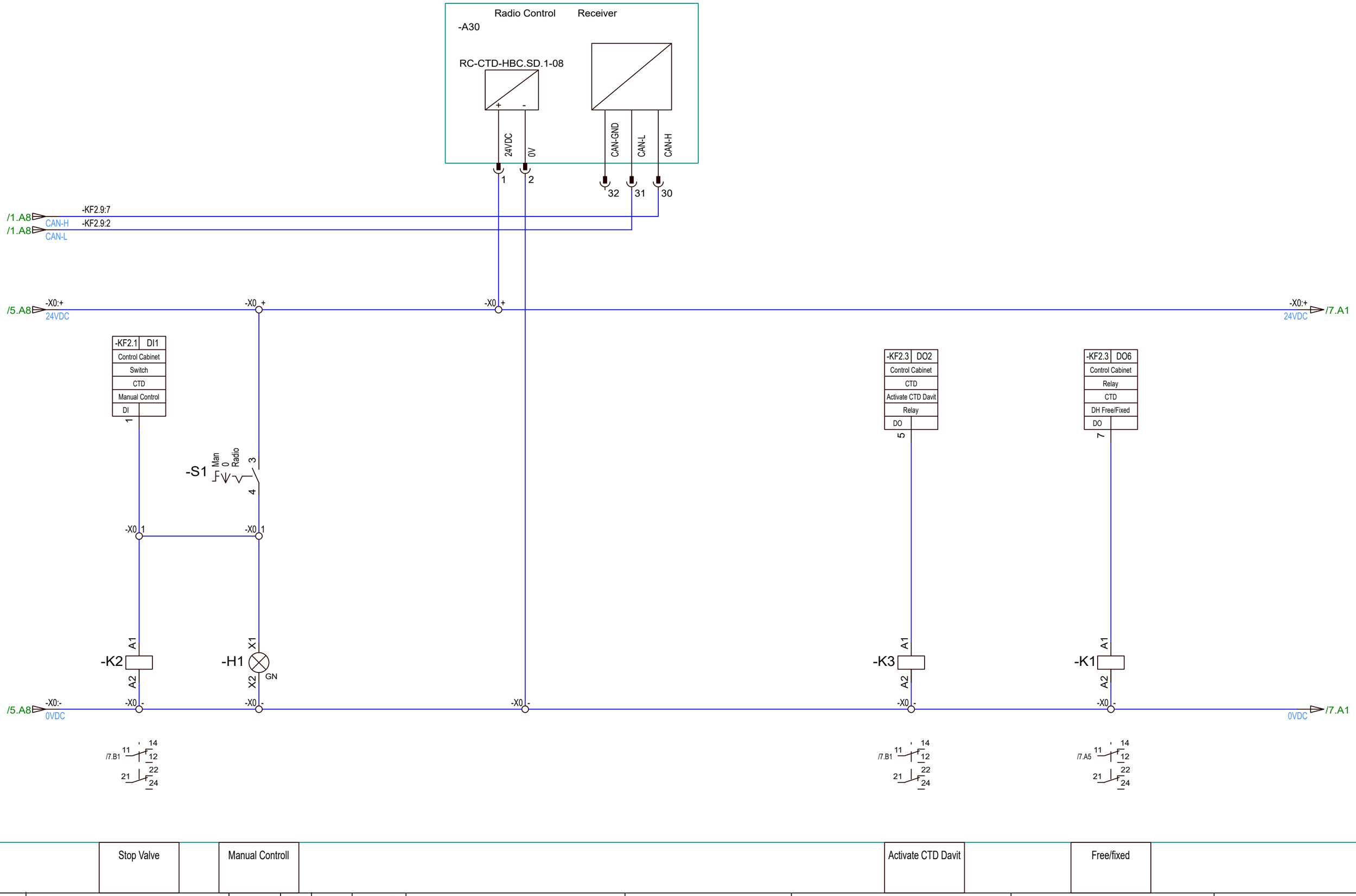

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Circuit Diagram
CTD Davit
Control Cabinet

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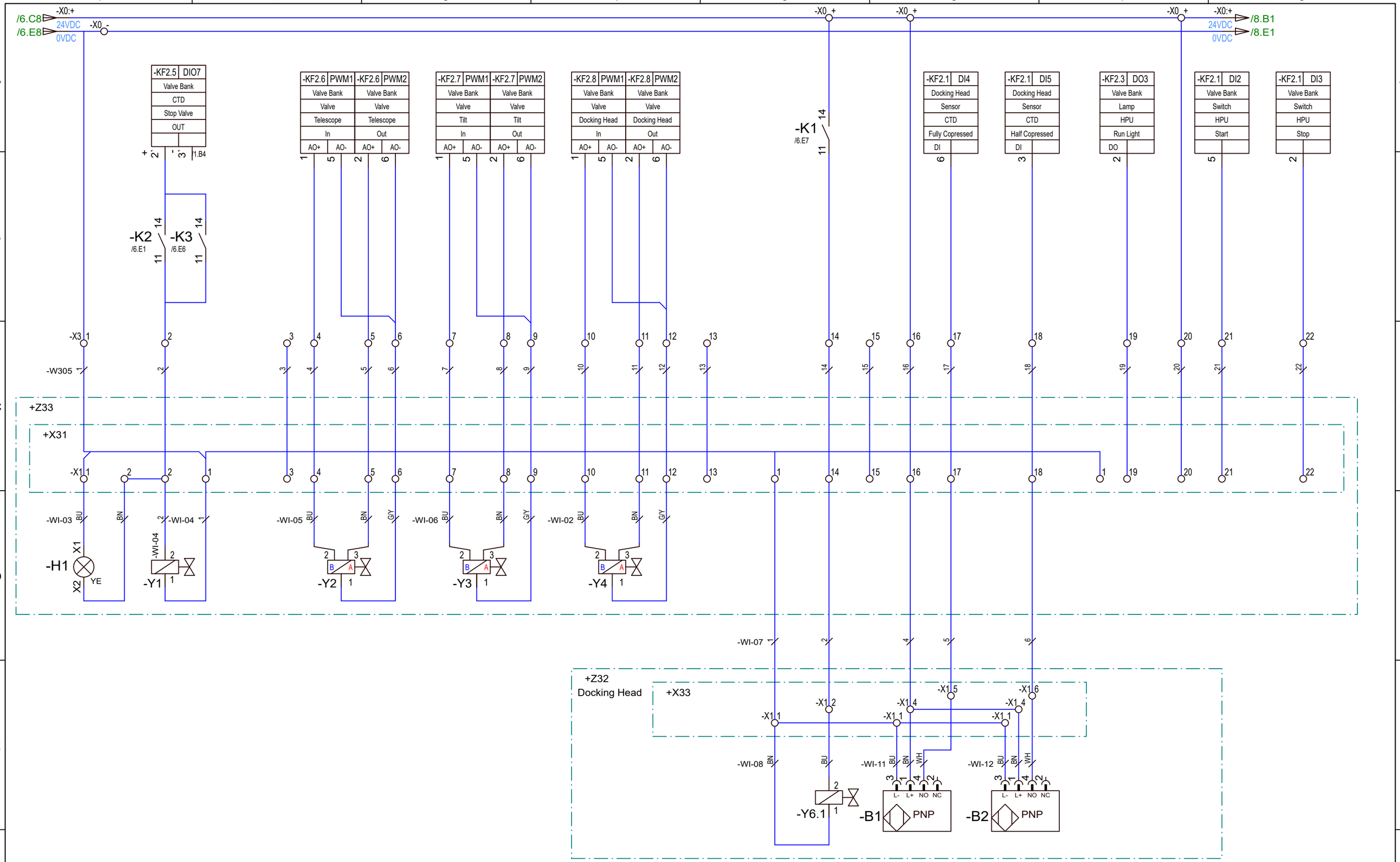
Template:



CPH Active Light	CPH Stop Valve	Telescope		Tilt		Docking Head		DH Free/fixed	Docking Head Fully Compressed	Docking Head Half Compressed
		2 In	3 Out	2 In	3 Out	2 In	3 Out			

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Circuit Diagram
CTD Davit
Control Cabinet

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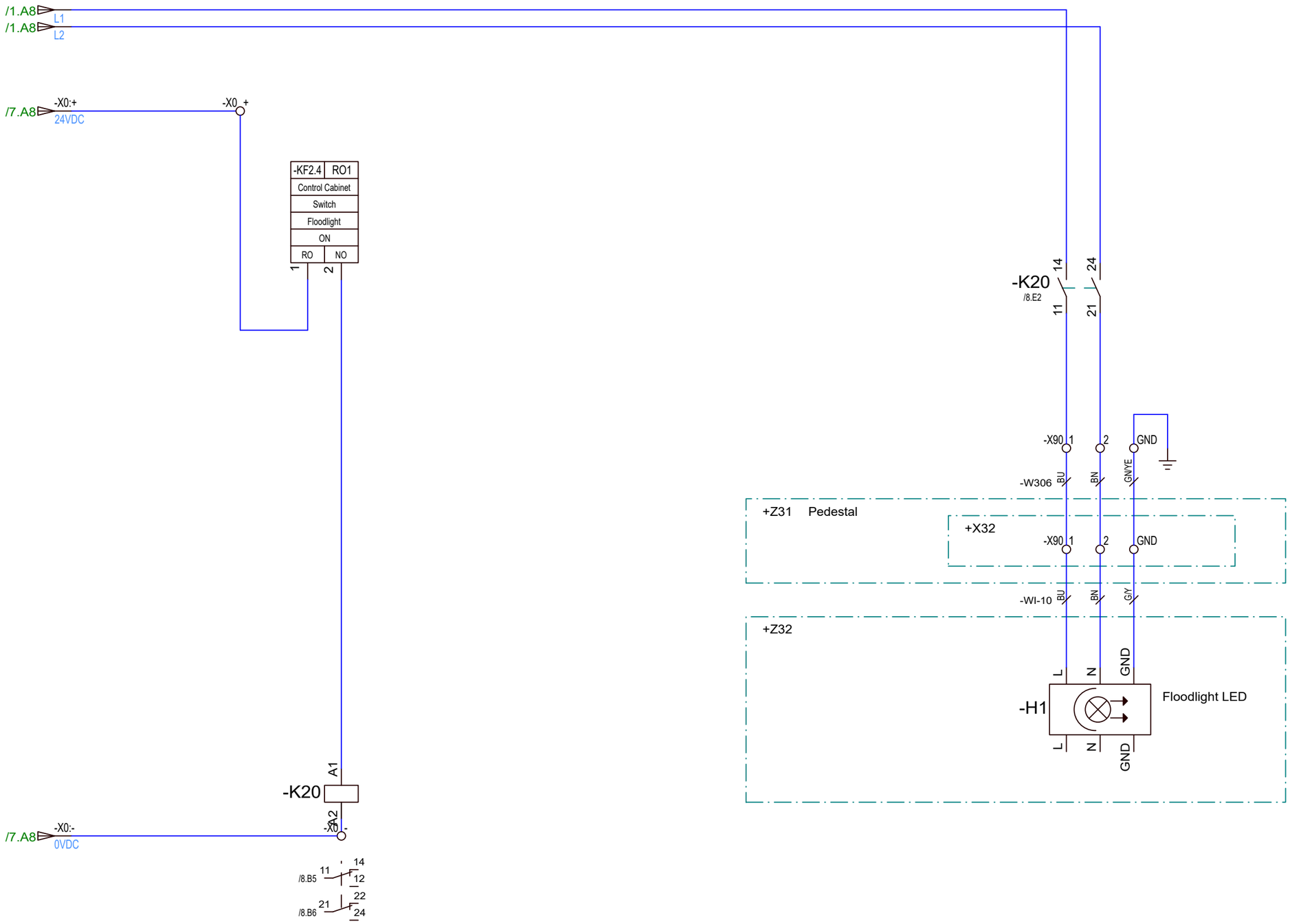

Floodlight

Floodlight LED

Rev.	Description	Date	Rev. by		
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Circuit Diagram
CTD Davit
Control Cabinet

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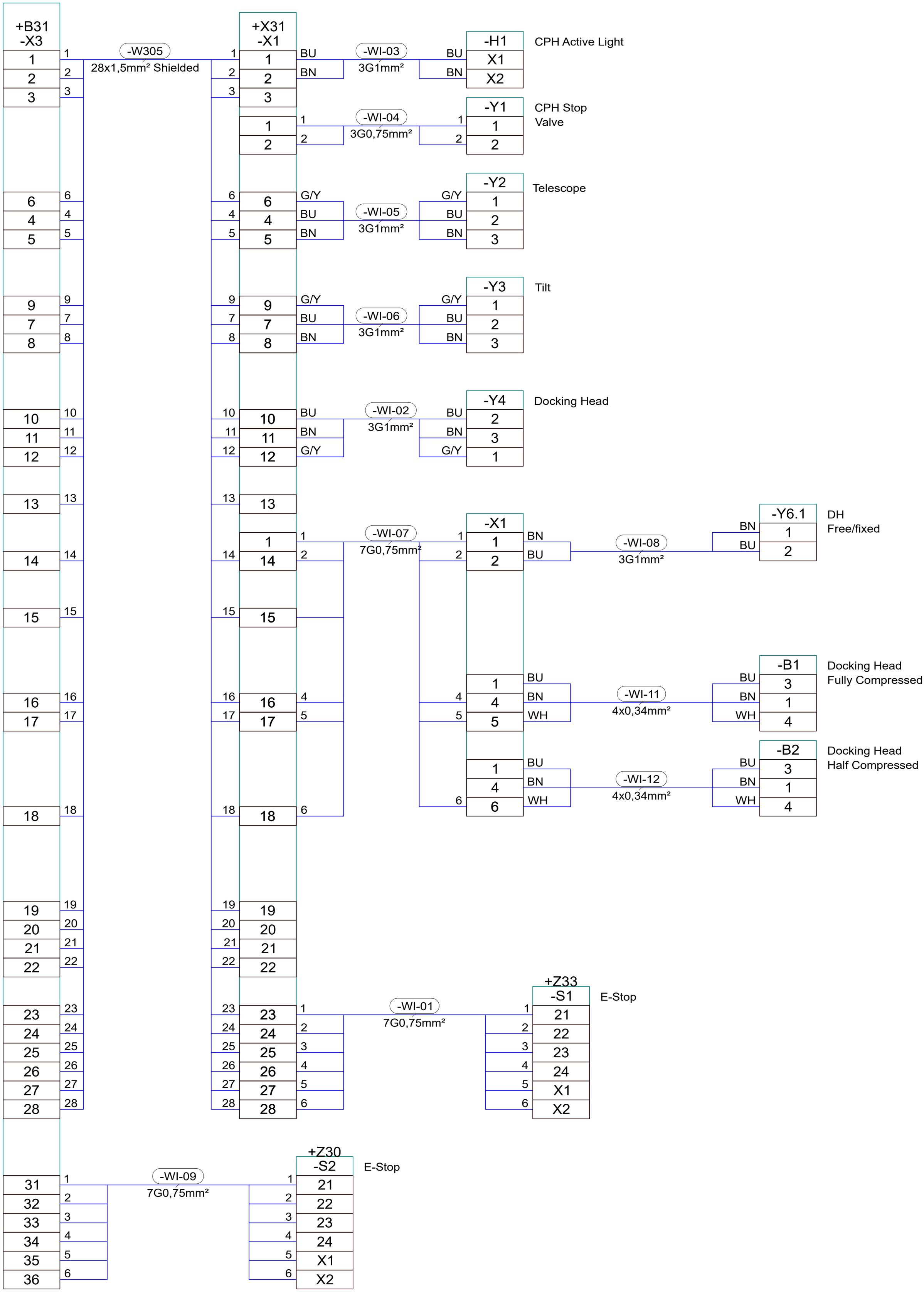

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Termination Diagram
CTD Davit

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-WI-01,-WI-07,-WI-09	ROFLEX 7G0.75	07915015		3	Pcs	CABLE, 7G0,75mm²	Lapp	
-WI-02,-WI-03,-WI-05,-WI-06,-WI-08,-WI-10	ROFLEX 3G1	07915017		6	Pcs	CABLE, 3G1mm²	Lapp	
-WI-04	7074-18021-2360500	07930051		1	Pcs	CONNECTOR, VALVE, MURR, 5M, SS	Murr	
-WI-11,-WI-12	V1-WV4A-5M-PUR	07917043		2	Pcs	SENSOR, CABLE, M12, 4-PIN, ANGLE, 5M	Pepperl & Fuchs	

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Part List
CTD Davit

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-A31	RC-CTD-HBC.SD.1-08	400198451		1	Pcs	CTD-Davit 08	HBC	
-CAB1	ADO201	07939034	24 138 75	1	Pcs	CABINET, DOORSTOPPER, ADO, ELDON	Eldon	
-CAB1	MAS0605030	400089006	24 174 95	1	Pcs	CABINET, 600x500x300 ELDON*	Eldon	
-DUCT1..-DUCT4	HA760040	07920015	12 857 18	1.222	M	CABLE TRAY, 60X40, GREY, W/LID	Tehalit Hager	
-DUCT5	HA760025	07920014	12 857 17	0.2	M	CABLE TRAY, 60X25, GREY, W/LID	Tehalit Hager	
-F1	iC60H/C 02-2	07938004	16 760 61	1	Pcs	FUSE, AUTOMAT, 2A, 2-POLE, C	Schneider	
-G1	CS10.241	07949016	66 040 29	1	Pcs	POWER SUPPLY, PULSE, 10A, 230/24	Puls	
-GL1	WADI-TEC EMC M40 Ø24-30	400075304	12 492 78	1	Pcs	CABLE GLAND, BRASS, EMC, Ø24-30	Elis	
-GL3,-GL4	WADI-TEC EMC M32 Ø17-24	07928087	12 492 76	2	Pcs	CABLE GLAND, BRASS, EMC, Ø17-24	Elis	
-GL5,-GL6	WADI-TEC EMC M25 Ø10-14.5	07928084	12 492 70	2	Pcs	CABLE GLAND, BRASS, EMC, Ø10-14,5	Elis	
-GL8..-GL10	WADI-TEC EMC M20 Ø8-12.5	07928083	12 492 68	3	Pcs	CABLE GLAND, BRASS, EMC, Ø8-12,5	Elis	
-H1	ZBVB3	07924016	43 032 26	1	Pcs	LAMP, LED, GN, 24V	Schneider	
-K1..-K3,-K20	C7A20FX24D	07936015	43 783 87	4	Pcs	RELAY, RELECO, 2-POLE, 24V DC, 10A	Releco	
-K1..-K3,-K20	S7-I/O			4	Pcs	RELAY, SOCKET	Releco	
-KF2.0	EK1101	400142335		1	Pcs	EtherCAT Coupler w ID settings	Beckhoff	
-KF2.1	EL1008	400142339		1	Pcs	8 Digital Inputs	Beckhoff	
-KF2.2	EL1904			1	Pcs	TwinSAFE 4 Digital Inputs	Beckhoff	
-KF2.3	EL2008	400142342		1	Pcs	8 Digital Outputs	Beckhoff	
-KF2.4	EL2624	400142344		1	Pcs	4 Relay Outputs	Beckhoff	
-KF2.5	EL2911	400142346		1	Pcs	TwinSAFE 4 Digital Inputs, 1x Output	Beckhoff	
-KF2.6,-KF2.7,-KF2.8	EL2535-0002-	400142343		3	Pcs	2 PWM Outputs, 2 Digtal Inputs	Beckhoff	
-KF2.9	EL6751	400142409		1	Pcs	CANopen master/slave terminal	Beckhoff	
-KF2.10	EL9011	400142410		1	Pcs	Bus end cap	Beckhoff	
-RAIL1..-RAIL4	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	1.323	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S1	ZB4BK1333	07960019	43 025 24	1	Pcs	CONTR. SWITCH, 3 POS, LED GN	Schneider	
-S1	ZB4BZ009	07961012	43 027 45	1	Pcs	CONTR. ACC, SOCKET, METAL	Schneider	
-S1	ZBE101	07961013	43 004 23	2	Pcs	CONTR. ACC, CONTACTBLOCK, 1NO	Schneider	
-TAG1	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-TAG2	US-EMLP-HA 24	400075270		1	Pcs	TAG, SIGN, THERMOMARK CARD	Phoenix Contact	
-X0	AEP 3C 2.5	400069937	12 694 11	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0	AEP AP12			1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0 (1,1)	A3C 2.5	400069932	12 654 01	2	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X0 (-)	AAP12 10/4X2.5 LO-LI BL			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	

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Part List
CTD Davit

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-X0 (-,-,-,-,2)	AAP12 2.5 LI BL			5	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+)	AAP12 10/4X2.5 LO-LI RD			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+,+,+)	AAP12 2.5 LI RD			3	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (GND)	JORDSKINNE 21	07918007		1	Pcs	RAIL, GRN, BRASS, 21 SLOT	Weidmüller	
-X0 (GND)	WPE 4	07918003	12 688 16	1	Pcs	-TERMINAL BLOCK, GND, 101010	Weidmüller	
-X0 (GND,GND)	A3C 2.5 PE	400074010	12 654 16	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X0,-X3,-X90	AEB 35 SC/1	400073887	12 654 34	8	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X3	AEP 3T 2.5	400209845	12 694 40	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X3 (1,4,7,10,13,16,19,22,25, 28,31,34)	A3T 2.5			12	Pcs	TERMINAL BLOCK, SNAP-IN, THREE HIGHTS	Weidmüller	
-X90 (1-2)	A2C 2.5	400069931	12 654 00	2	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X90 (GND)	A2C 2.5 PE	400074009	12 654 15	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X91,-X92	IE-TO-RJ45-FJ-B	07930061		2	Pcs	CONNECTOR, FEMALE, RJ45, RAIL MOUNT	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
06	For customer review	22.12.2024	WJ	Drawn by	KS
05	For customer review	24.02.2023	GM	Appr. by	WJ

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A MacGregor company

Part List
CTD Davit

=CTD DAVIT
+B31

E-4503 - 07
Rev. 07
3 / 10

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1	ST-M 32 x 1.5	07928035	12 477 16	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø17-25	Lapp	
-GL2..-GL8	ST-M 16 x 1.5	07928032	12 477 13	7	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.2	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEP 2C 2.5	400069933	12 694 10	3	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1,1,1-2,2-15,15-28),-X2 (1-2)	A2C 2.5	400069931	12 654 00	35	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X1,-X2	AEB 35 SC/1	400073887	12 654 34	4	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
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Part List
CTD Davit

=CTD DAVIT
+X31

E-4503 - 07
Rev. 07
4 / 10

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1,-GL2	ST-M 25 x 1.5	07928034	12 477 15	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø12-18	Lapp	
-JB1	CPG-220	07904002		1	Pcs	JUNCTION BOX, POLYESTER, 122x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.1	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X90	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X90 (1-2)	A2C 2.5	400069931	12 654 00	2	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X90 (GND)	A2C 2.5 PE	400074009	12 654 15	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
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Part List
CTD Davit

=CTD DAVIT
+X32

E-4503 - 07
Rev. 07
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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL4	ST-M 16 x 1.5	07928032	12 477 13	4	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.2	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	2	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1,1-2,4,4-6)	A2C 2.5	400069931	12 654 00	8	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	

Rev.	Description	Date	Rev. by		
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Part List
CTD Davit

=CTD DAVIT
+X33

E-4503 - 07
Rev. 07
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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-S2	XALK178W3B140G	400208317	4322660	1	Pcs	CONTR. PUSH, EM STOP	Schneider	

Rev.	Description	Date	Rev. by		
07	Update	05.02.2025	WJ	Date	14.10.2021
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05	For customer review	24.02.2023	GM	Appr. by	WJ

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Part List
CTD Davit

=CTD DAVIT
+Z30

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Rev. 07
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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-S2	XB4BW73731B5_Mod	07961026	43 014 04	1	Pcs	CONTR. PUSH BUTTON, DOUBLE, I - 0 W/LED	Schneider	

Rev.	Description	Date	Rev. by	Standard	
07	Update	05.02.2025	WJ	Date	14.10.2021
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05	For customer review	24.02.2023	GM	Appr. by	WJ

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Part List
CTD Davit

=CTD DAVIT
+Z31

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Rev. 07
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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B1,-B2	NBN40-L2-A2-V1	07917215		2	Pcs	SENSOR, PROX, 40X40, NO/NC, SN40, M12	Pepperl & Fuchs	
-H1	FL60 9000 850 120 M24 MB	400072975		1	Pcs	FLOODLIGHT, LED, 80W, 120V, MEDIUM BEAM	Glamox	
-Y6.1	HAWE STOP VALVE			1	Pcs	VALVE, ON/OFF	Hawe	

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Part List
CTD Davit

=CTD DAVIT
+Z32

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Rev. 07
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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-H1	853 310 55	07959005		1	Pcs	LAMP, BEACON, LED, YE, FLASH, 24V	Werma	
-S1	XALK178W3B140G	400208317	4322660	1	Pcs	CONTR. PUSH, EM STOP	Schneider	
-Y1	HAWE STOP VALVE			1	Pcs	VALVE, ON/OFF	Hawe	
-Y2..-Y4	HAWE PROP VALVE			3	Pcs	VALVE, PROPOTIONAL	Hawe	

Rev.	Description	Date	Rev. by	Standard	
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Part List
CTD Davit

=CTD DAVIT
+Z33

E-4503 - 07
Rev. 07
10 / 10

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Template:

=HPU 2X87KW

Customer : CNP Freire
Ship/Hull : MBARI
Project no. : 4/60185
Drawing no.: E-4504

04	Update	05.02.2025	WJ	Date	14.10.2021
03	For customer review	14.02.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ
Rev.	Description	Date	Rev. by	Standard	

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Front Page
Hydraulic Power Pack

=HPU 2X87KW

E-4504 - 00

Rev. 04

Revision log: E-4504 =HPU 2X87KW

Rev.	Name	Date	Description
01	KS	11.10.2021	- Changed HPU from 2x128kW to 2x153kW. Resizing of starter cabinets +B102, +B103. - Added Moltec remote HPU control, -W1041, - W1042.
02	KS	28.10.2021	- Added Moltec signals, Pump1 Failure (-1K5), Pump2 Failure (-2K5). - Added cabinet layout, front panel, +B103.
04	WJ	22.12.2024	- EtherCat loop connection update

04	Update	05.02.2025	WJ	Date	14.10.2021
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Rev.	Description	Date	Rev. by	Standard	

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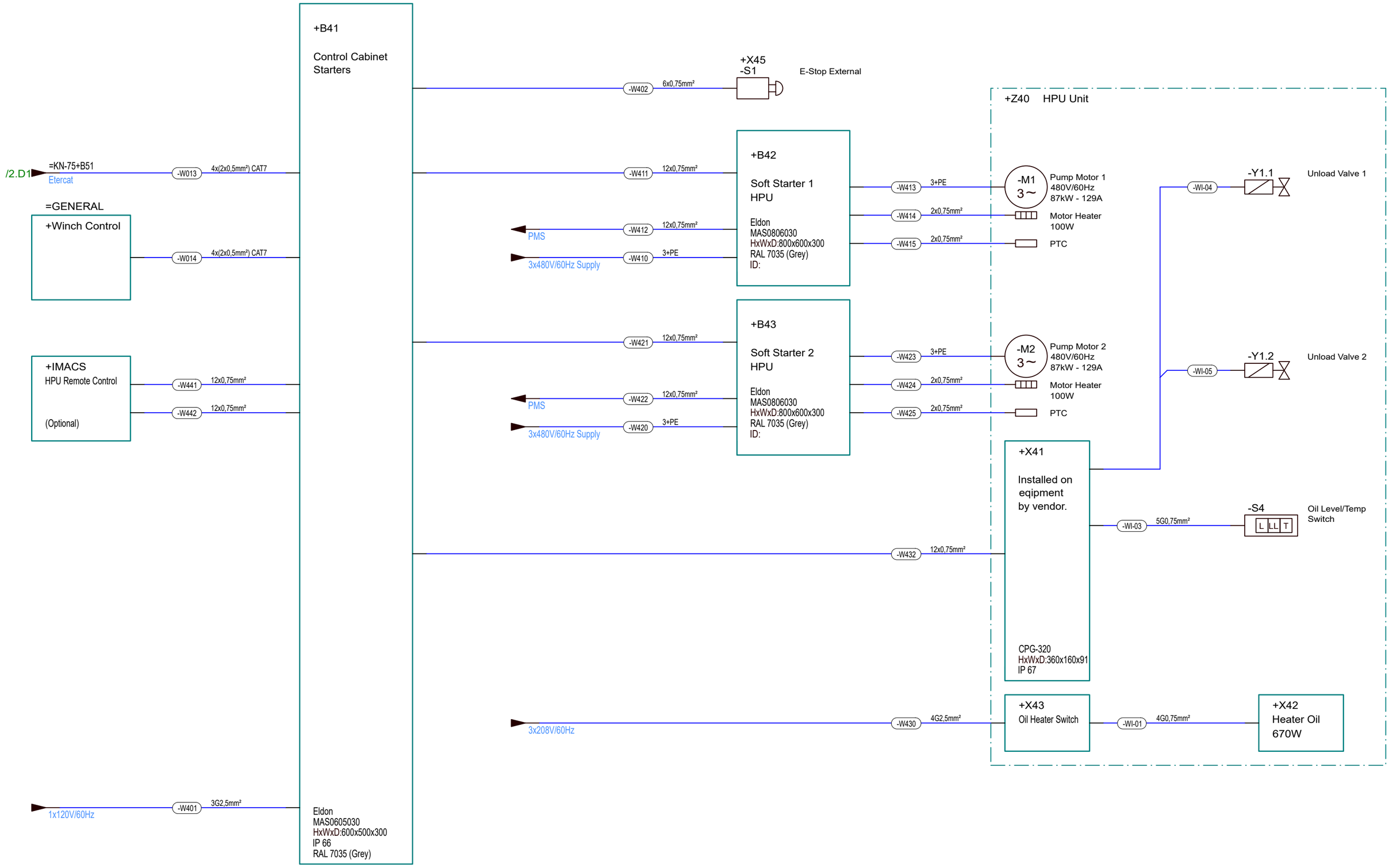
Front Page
Hydraulic Power Pack
Revision Log

=HPU 2X87KW

E-4504 - 00

Rev. 04 2 / 2



Rev.	Description	Date	Rev. by	Standard	
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Single Line
Hydraulic Power Pack

=HPU 2X87KW

E-4504 - 01

Rev. 04

1 / 1

-CAB1

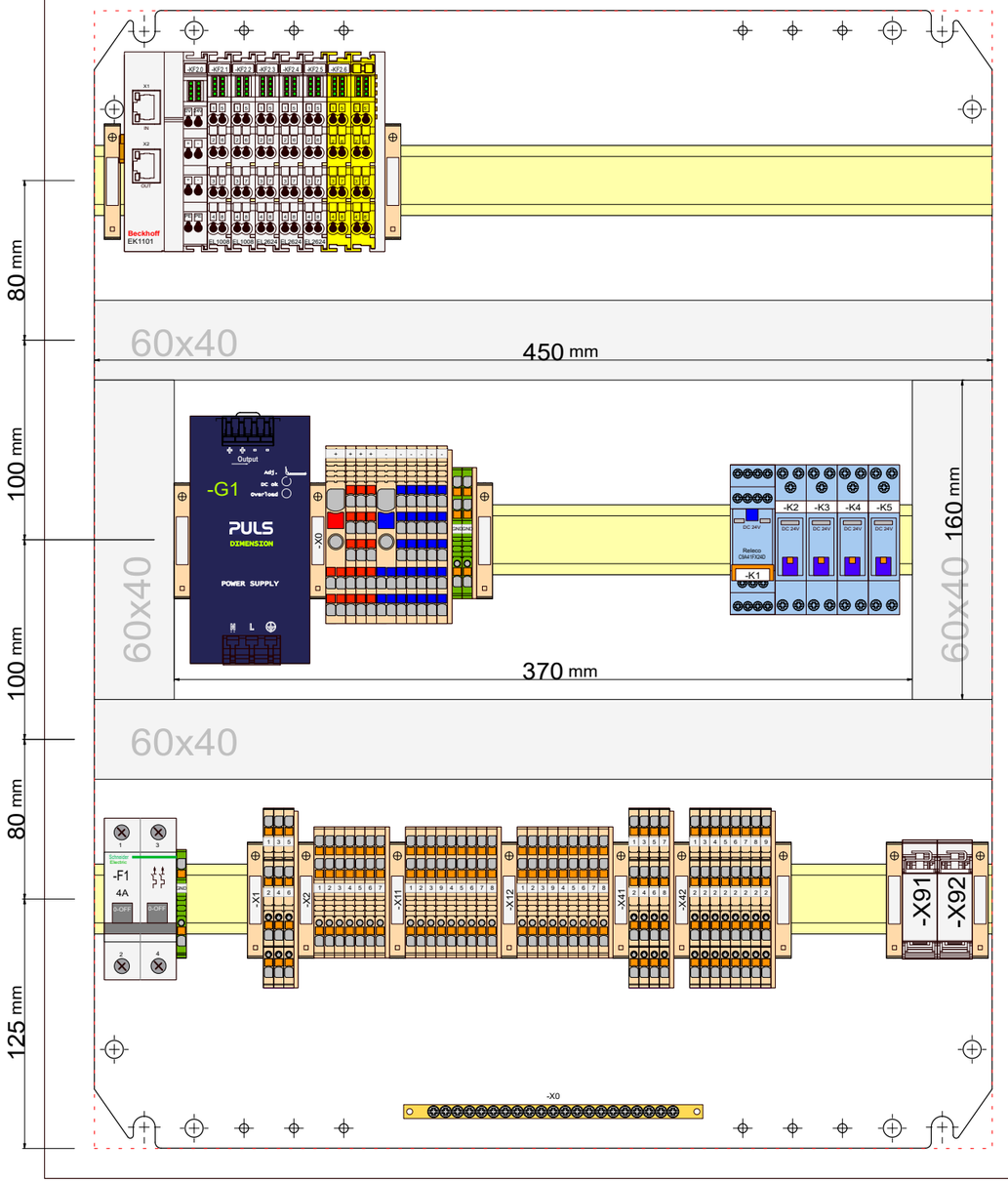
250 mm

Triplex
Control Cabinet
Starters
+B41

90 mm

90 mm

250 mm



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Layout
Hydraulic Power Pack
Control Cabinet Starters

=HPU 2X87KW

+B41

E-4504 - 03

Rev. 04

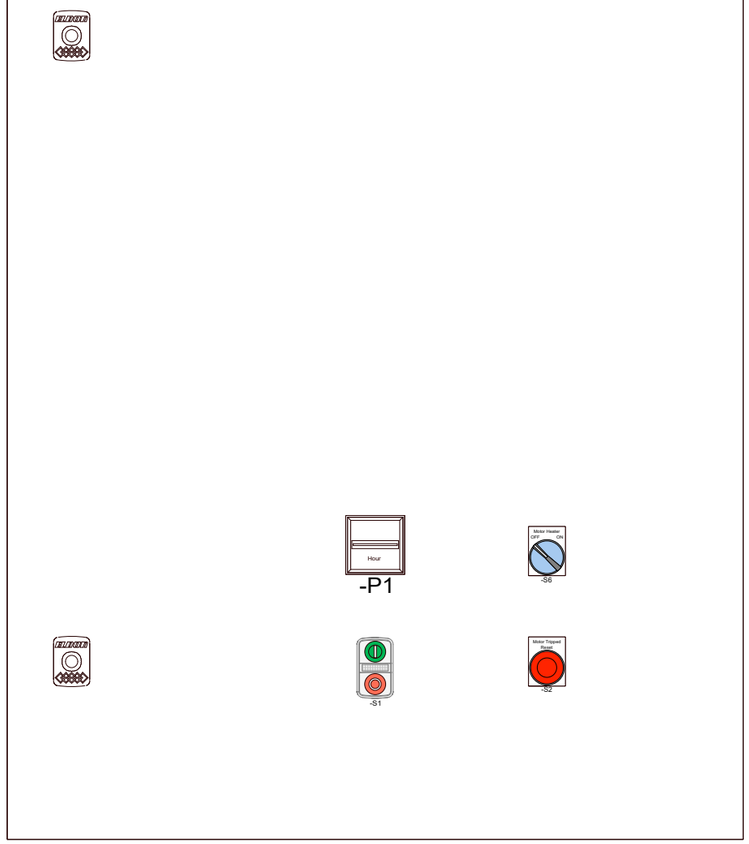
1 / 6

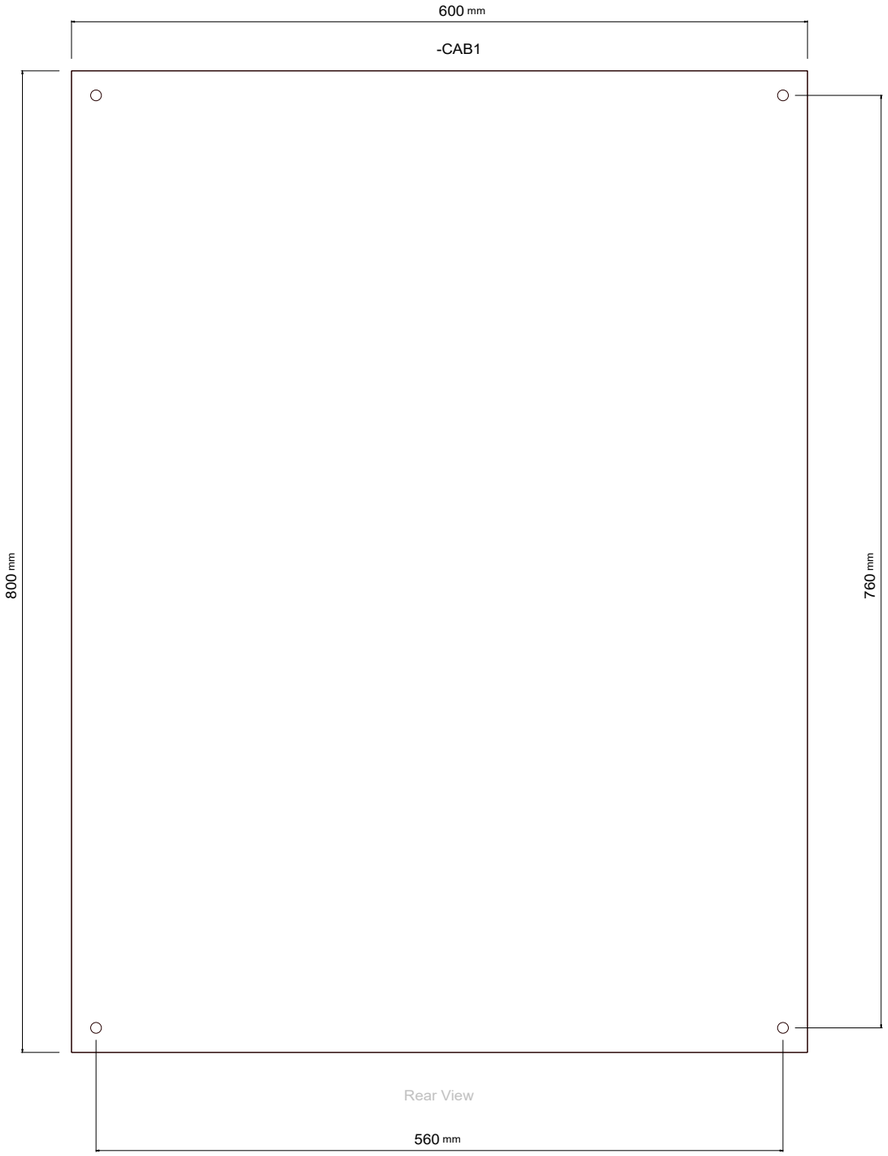
Printed: 05.02.2025 11:06

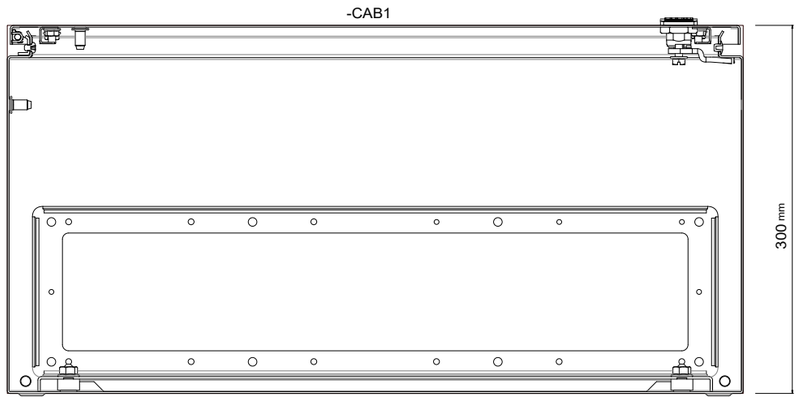
Template:

-CAB1

Triplex
Starter Cabinet 1
HPU
+B42







Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
03	For customer review	14.02.2023	GM	Drawn by	KS
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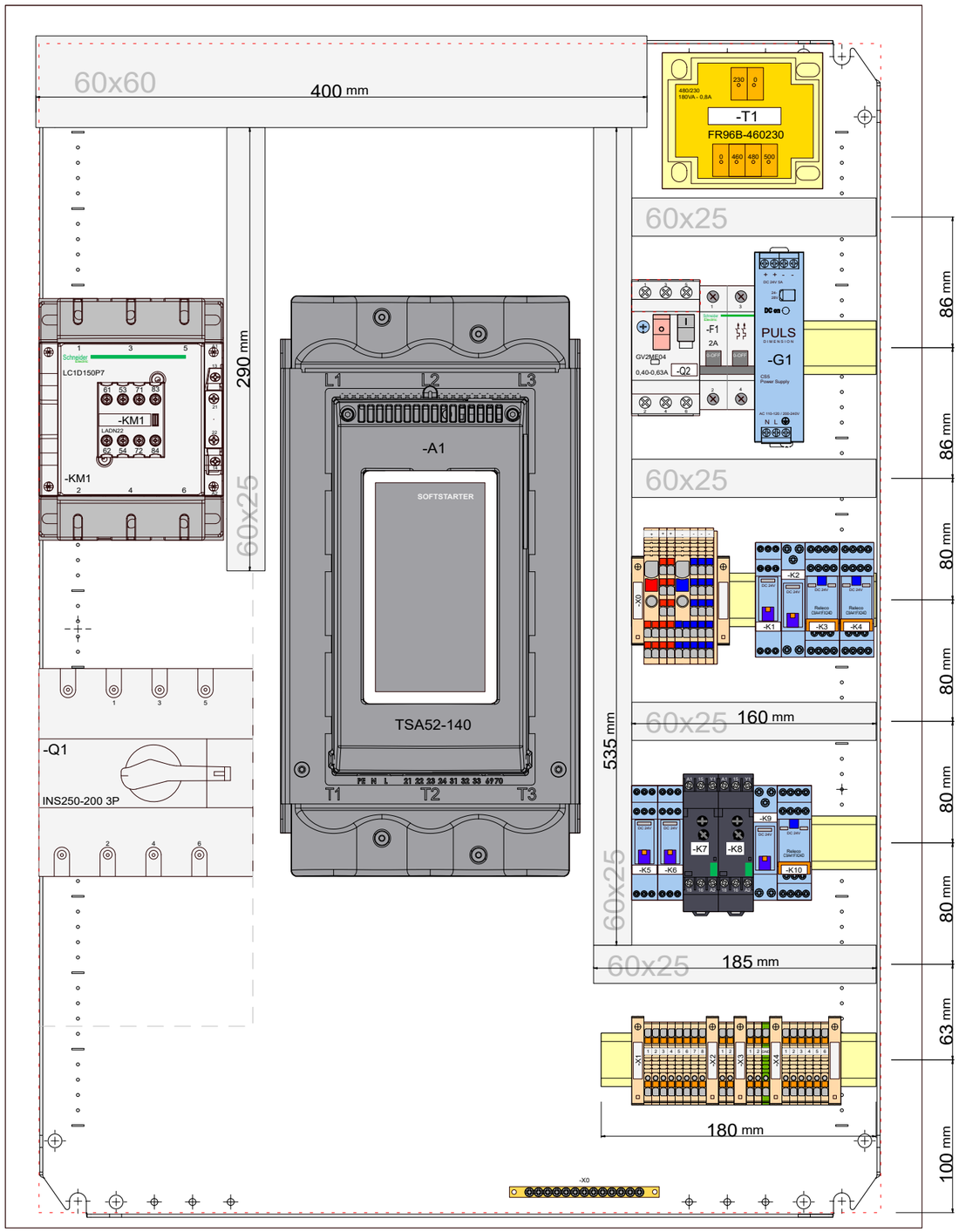
Layout
Hydraulic Power Pack
Soft Starter 1

=HPU 2X87KW
+B42

E-4504 - 03
Rev. 04
2 / 6

-CAB1



Rev.	Description	Date	Rev. by	Standard	
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Layout
Hydraulic Power Pack
Soft Starter 1

=HPU 2X87KW
+B42

E-4504 - 03
Rev. 04
3 / 6

-CAB1

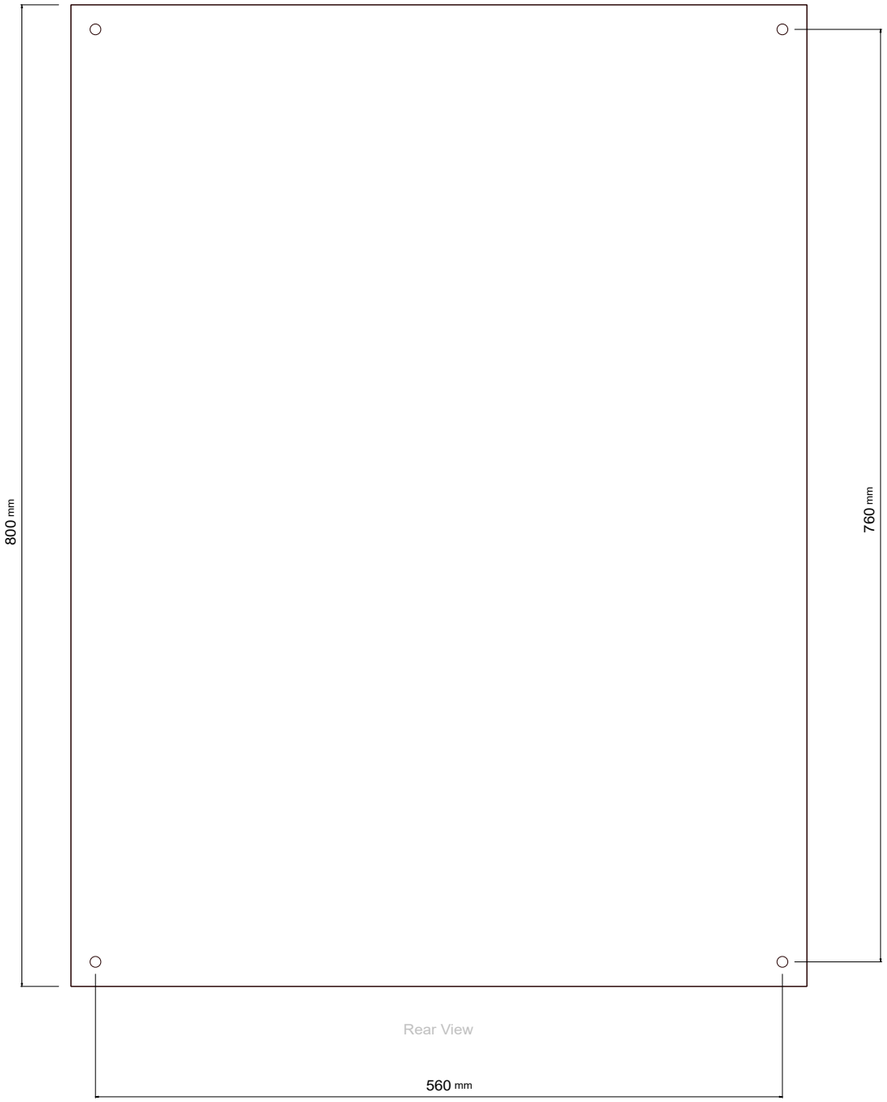
Triplex
Starter Cabinet 2
HPU
+B43

-P1

-S6

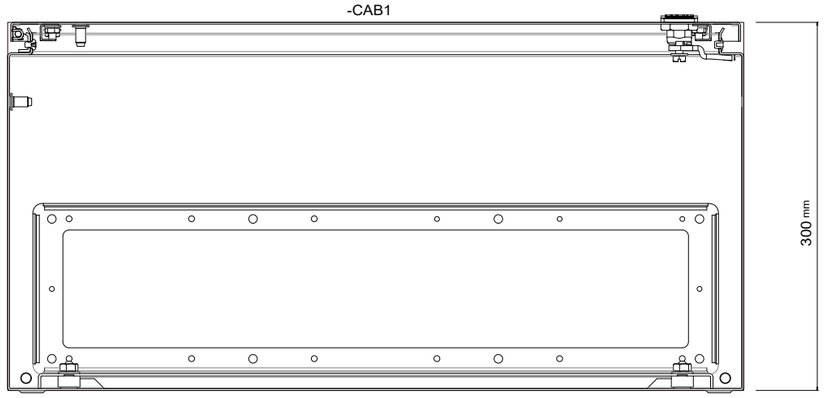
-S1

-S2



Rear View

-CAB1



Bottom View

Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
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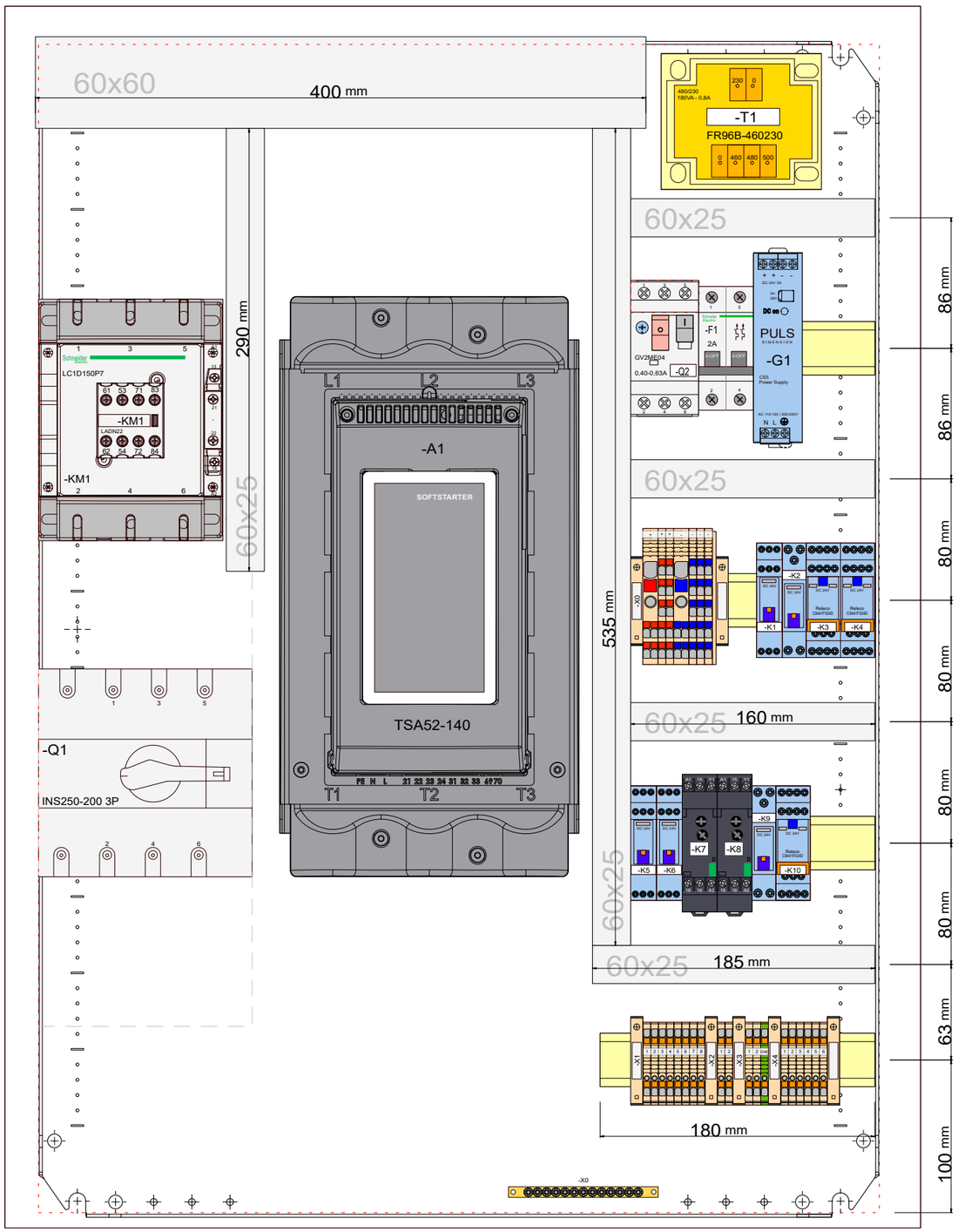
Layout
Hydraulic Power Pack
Soft Starter 2

=HPU 2X87KW
+B43

E-4504 - 03
Rev. 04
4 / 6

-CAB1



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Layout
Hydraulic Power Pack
Soft Starter 2

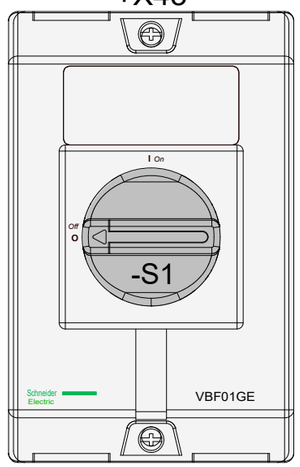
=HPU 2X87KW
+B43

E-4504 - 03
Rev. 04
5 / 6

-CAB1

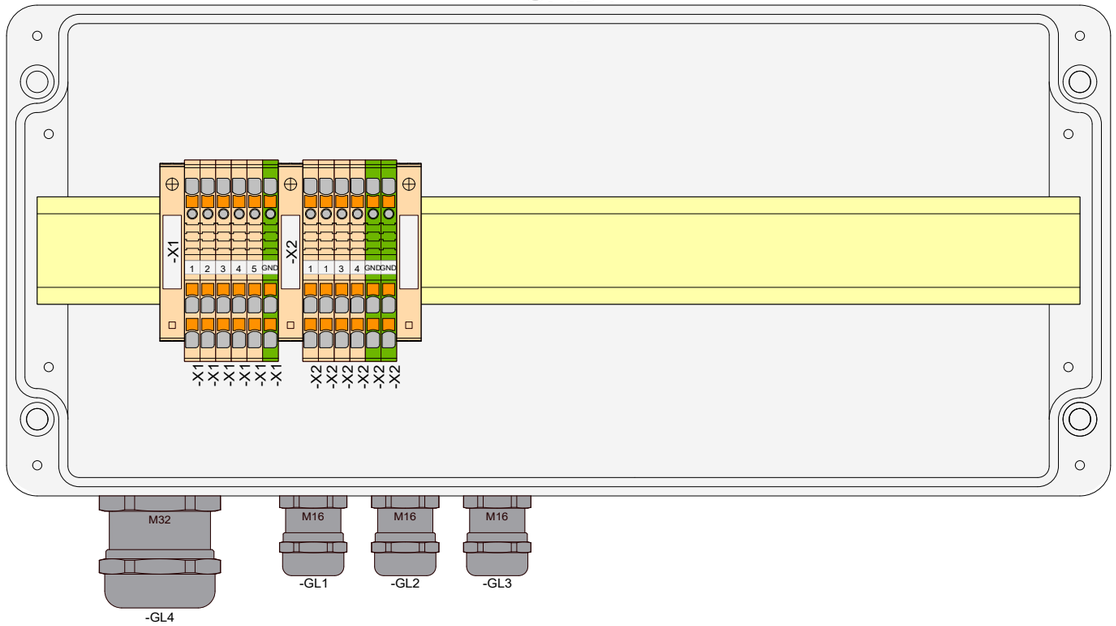
Triplex
Junction Box
HPU
+X41

+X43



349 mm

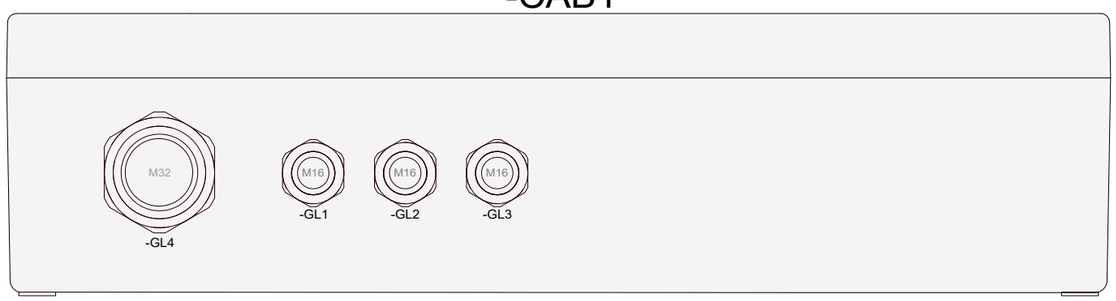
-CAB1



154 mm

Bernstein
CPG-320
360x160x91
IP 67
RAL 7000 (Grey)

-CAB1



87 mm

Rev.	Description	Date	Rev. by	Standard	
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Layout
Hydraulic Power Pack
Junction Box HPU

=HPU 2X87KW
+X41

E-4504 - 03
Rev. 04
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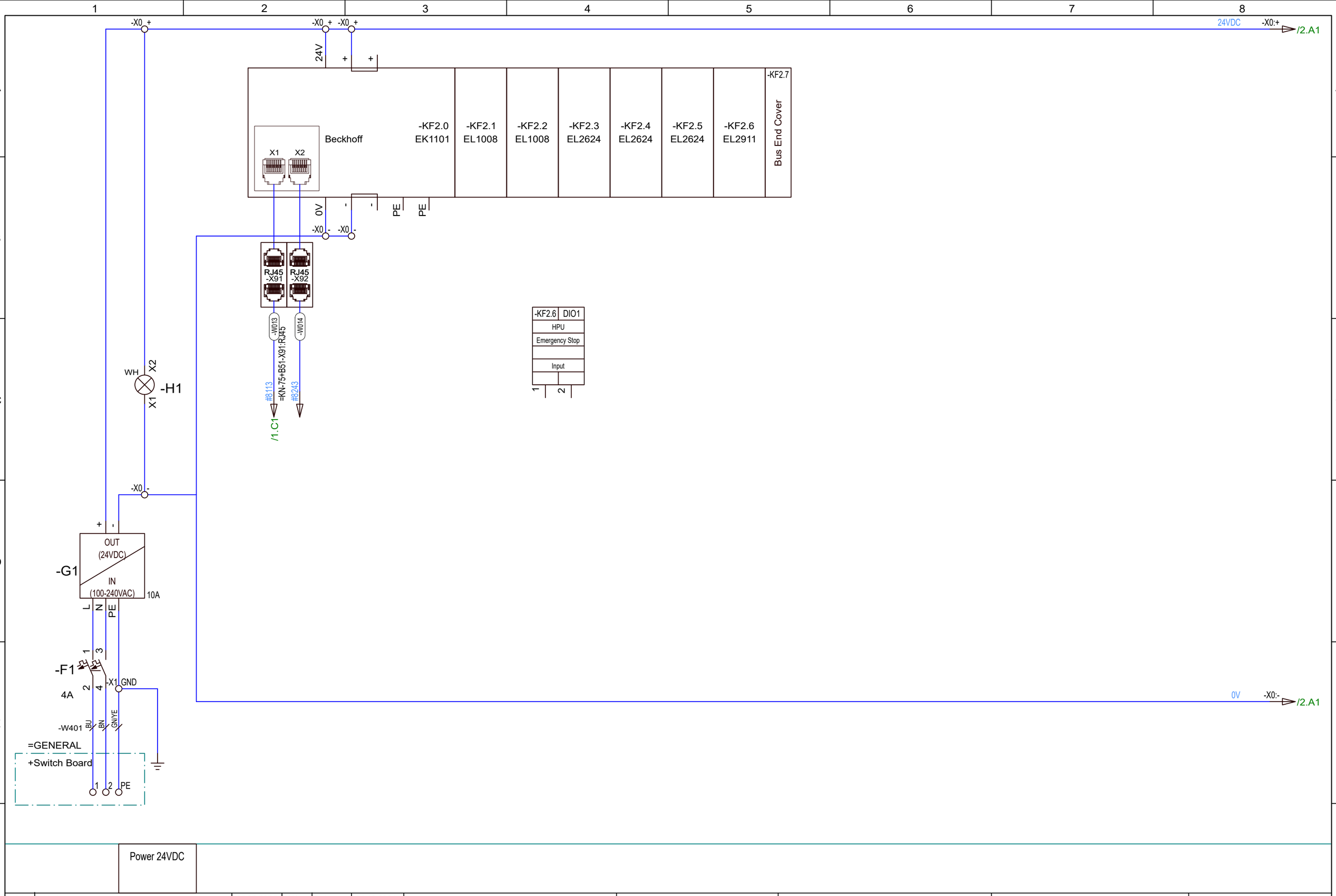

Power 24VDC

Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
03	For customer review	14.02.2023	GM	Drawn by	KS
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Circuit Diagram

HPU Control Cabinet

=HPU 2X87KW

+B41

E-4504 - 04

Rev. 04

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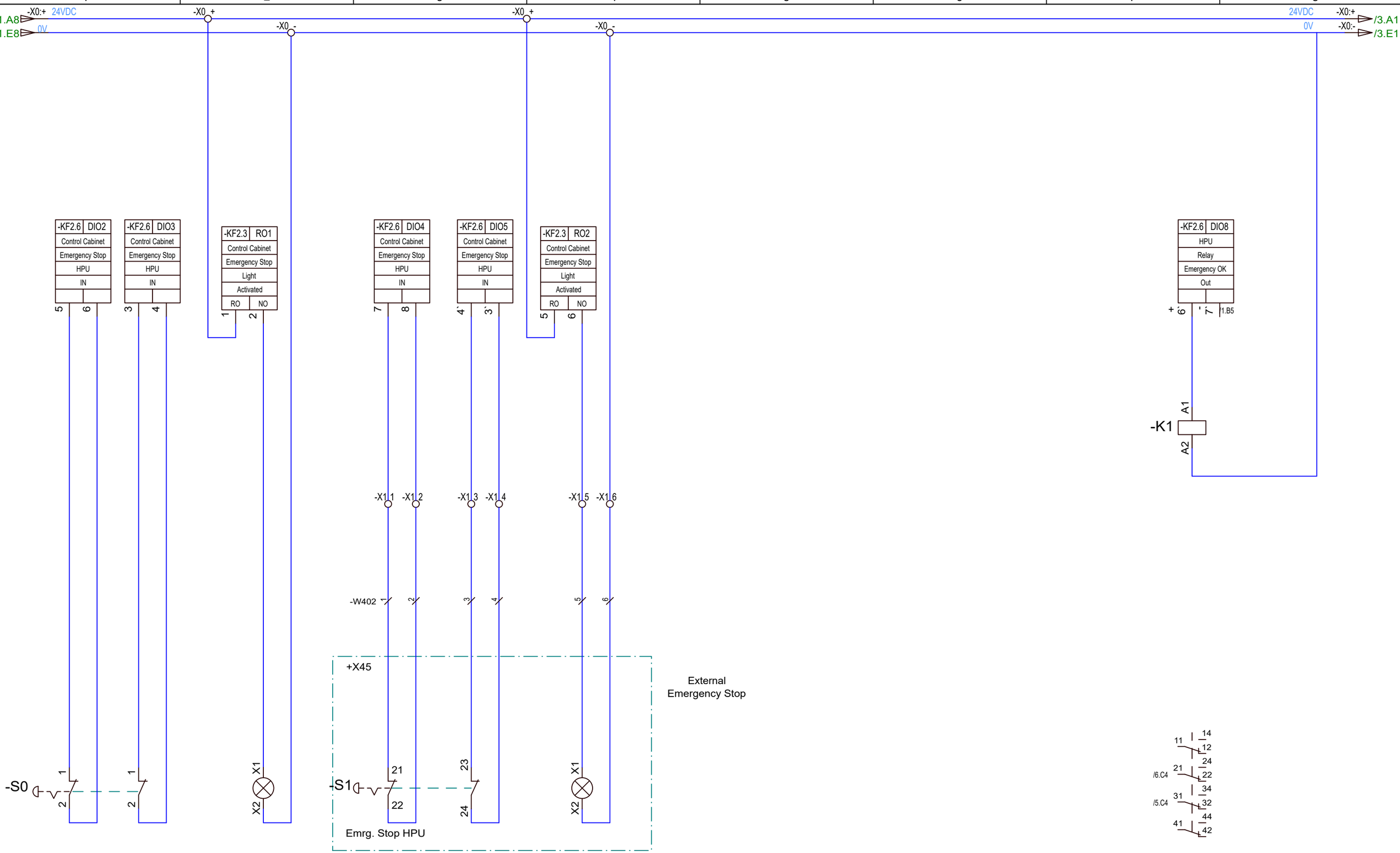
Template:



E-Stop on cabinet door

E-Stop External

Emergency Stop OK

Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
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Circuit Diagram
Hydraulic Power Pack
HPU Control Cabinet

=HPU 2X87KW
+B41

E-4504 - 04
Rev. 04
2 / 16

Printed: 05.02.2025 11:06

Template:

-X0:+ 24VDC /2.A8

-X0_+

-X0_+

24VDC -X0:+ /4.B1

-KF2.1	DI1
HPU	
Sensor	
Alarm	
Oil Lev. Shut Down	
DI	

1

-KF2.1	DI2
HPU	
Sensor	
Alarm	
Oil Temp. High	
DI	

5

-KF2.1	DI3
HPU	
Sensor	
Alarm	
Oil Level Warn.	
DI	

2

-X2 1 2 3 4 5

-W432 1 2 3 4 5

+X41 HPU JB

-X1:1 0V /13.A1

-X1:2 24VDC /13.A2

-X1:3 Oil Level Shut Down /13.A2

-X1:4 Oil Temp. High /13.A3

-X1:5 Oil Level Warning /13.A3

-K3 A1 A2 -X0-

-K4 A1 A2 -X0-

-K3 12 14 11 /3.E4

-K4 12 14 11 /3.E4

-H2 X1 X2 YE -X0-

/3.D5 11 12 14

/3.D6 11 12 14

0V -X0- /2.A8

-X0:- 0V /4.E1

Oil Level Warning	Temp. High Warning		Oil Level Low / Temp High Warning

04	Update	05.02.2025	WJ	Date	14.10.2021
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Rev.	Description	Date	Rev. by	Standard	

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Circuit Diagram
Hydraulic Power Pack
HPU Control Cabinet

=HPU 2X87KW
+B41

E-4504 - 04
Rev. 04
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Printed: 05.02.2025 11:06

Template:

=GENERAL
+IMACS

From remote control

To remote control

0V
-OUT
Pump1 Stop
Pump1 Start
Pump2 Stop
Pump2 Start
-W441
-X41
0V
24V
-IN
-W442
-X42
Pump 1 Running
Pump 2 Running
Pump 1 Tripped
Pump 2 Tripped
General Alarm

-X0:+ 24VDC -X0:+ /3.A8

24VDC -X0:+ /5.A1

-KF2.1	DI4
HPU	
Contact	
Pump 1	
Stop	
DI	

-KF2.1	DI5
HPU	
Contact	
Pump 1	
Start	
DI	

-KF2.1	DI6
HPU	
Contact	
Pump 2	
Stop	
DI	

-KF2.2	DI1
HPU	
Contact	
Pump 2	
Start	
DI	

-KF2.3	RO3
HPU	
Switch	
Pump 1	
Running	
RO	NO

-KF2.3	RO4
HPU	
Switch	
Pump 2	
Running	
RO	NO

-KF2.4	RO1
HPU	
Switch	
Pump 1	
Tripped	
RO	NO

-KF2.4	RO2
HPU	
Switch	
Pump 1	
Tripped	
RO	NO

-KF2.4	RO3
HPU	
Switch	
Alarm	
General	
RO	NO

-X42 2

-X0:- 0V -X0 - /3.E8

0V -X0:- /5.A1

Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
03	For customer review	14.02.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

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Circuit Diagram
Hydraulic Power Pack
HPU Control Cabinet

=HPU 2X87KW
+B41

E-4504 - 04
Rev. 04
4 / 16

-X0:+ 24VDC
-X0:- 0V
/4.B8
/4.E8

-X0 +
-X0 -

24VDC -X0:+ /6.A1
0V -X0:- /6.A1

-K1
/2.E7
32 34 31

-K5
/5.F5
12 14 11

-KF2.4	RO4
HPU	
Switch	
Pump 1	
Stop	
RO	NO

7 8 A1 -K5 A2 9

-KF2.5	RO1
HPU	
Switch	
Pump 1	
Start	
RO	NO

1 2 9

-KF2.2	DI2
HPU	
Sensor	
Pump 1	
Running	
DI	

5

-KF2.2	DI3
HPU	
Sensor	
Pump 1	
Tripped	
DI	

2

-X1 1 2 3 4 5 6 7 8
-W411 1 2 3 4 5 6 7 8

+B42

0V	-X1:1	/8.A10
24VDC	-X1:2	/8.A10
Emrg. Ok	-X1:3	/8.A3
Pump 1 Stop	-X1:4	/8.A5
Pump 1 Start	-X1:5	/8.A6
Pump 1 Running	-X1:6	/8.A7
Pump 1 Tripped	-X1:7	/8.A8
Unload Valve 1	-X1:8	/8.A8

-X2 6

+X41
HPU JB

Unload Valve 1	-X2:3	/13.A4

/5.D4 11 12 14

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Circuit Diagram
Hydraulic Power Pack
HPU Control Cabinet

=HPU 2X87KW
+B41

E-4504 - 04
Rev. 04
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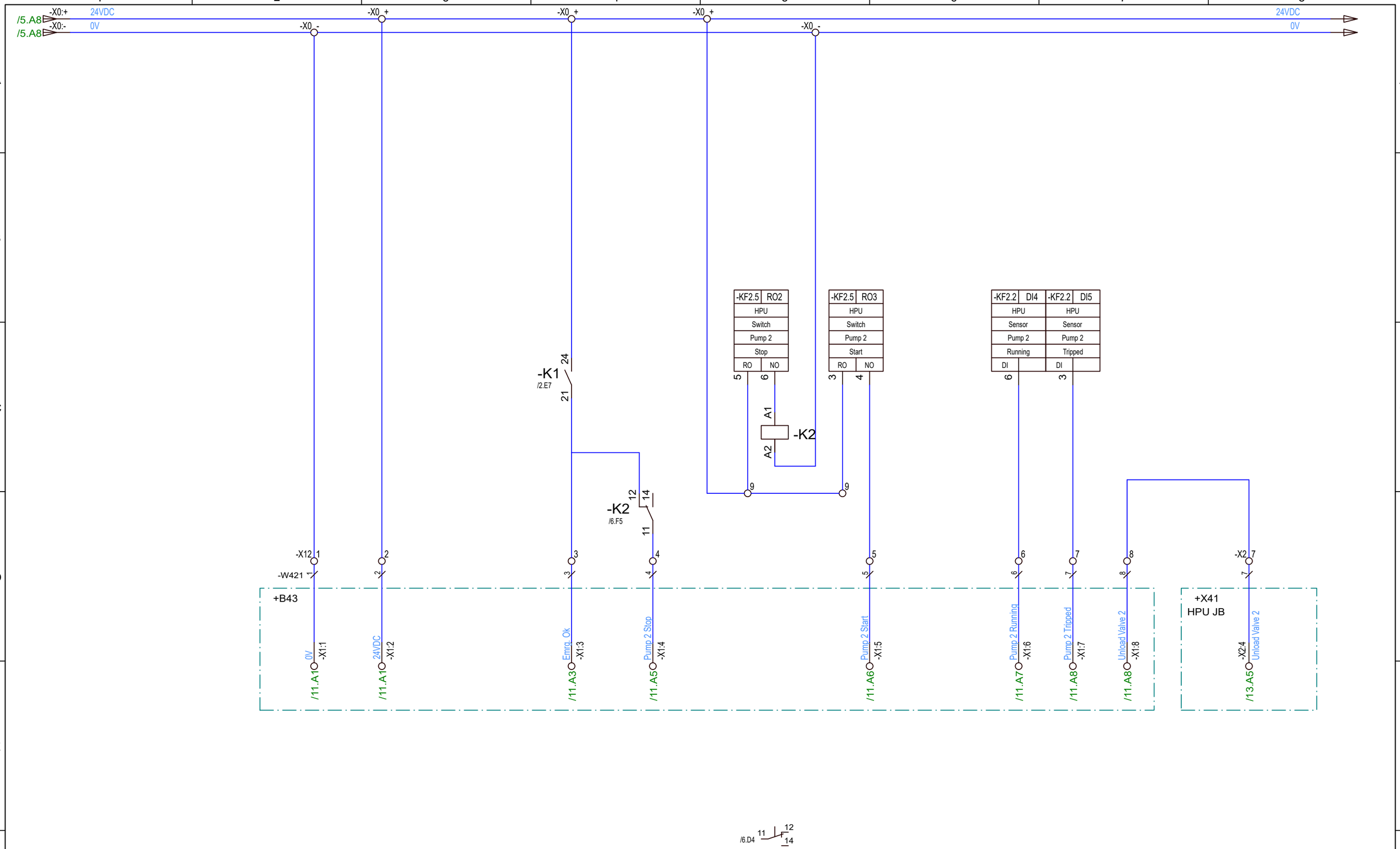

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Circuit Diagram
Hydraulic Power Pack
HPU Control Cabinet

=HPU 2X87KW
+B41

E-4504 - 04
Rev. 04
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Template:

=GENERAL

+Switch Board

1 2 3 PE

-W410 BK BN GY GN/YE

-T1

500 480 460 0 — 230 0

480/230
180VA - 0,8A

-Q1

-Q2

0,47A

-F1

2A

-G1

L N PE — IN (100-240VAC) — OUT (24VDC) — + -

5A

-X0:+ 24VDC /8.C1

-KM1 /7.E4

-K6 /8.E8

-K1 /8.E3

L1 L2 L3 PE

L N PE

-A1
TSA52-140

PTC

T1 T2 T3 GND

69 70

-W413 BK BN GY GN/YE

-X3 1 2 -W415

-X2 1 2 -W414

U V W PE

Pump Motor 1
480V/60Hz
87kW - 129A

-M1
3 ~

PTC
+t°c

L1 L2

Motor Heater
100W

-KM1 A1 A2

-X0:- 0V /8.E1

/7.E4
/7.C1
1 2
3 4
5 6
13 14
21 22

Pump Motor 1 | Motor Heater On | Pump Run

04	Update	05.02.2025	WJ	Date	14.10.2021
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Rev.	Description	Date	Rev. by	Standard	

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Circuit Diagram
Hydraulic Power Pack
Soft Starter 1

=HPU 2X87KW
+B42

E-4504 - 04
Rev. 04
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+B41 Control Cabinet

0V -X11:1 /5.D2
24VDC -X11:2 /5.D3
Emrg_Ok -X11:3 /5.D4
Pump 1 Stop -X11:4 /5.D4
Pump 1 Start -X11:5 /5.D5
Pump 1 Running -X11:6 /5.D6
Pump 1 Tripped -X11:7 /5.D7
Unload Valve 1 -X11:8 /5.D7

-W411
-X1:1 -X1:2 -X1:3 -X1:4 -X1:5 -X1:6 -X1:7 -X1:8

-G1:+ 24VDC /7.C8
-X0:+

-K5 /8.E4
-K8 /9.E3
-K4 0,5s
-K5
-K4
-K1 /8.E3

-K10 /9.E4
-S2
-S1.1
-S1.2
-K3
-S6 OFF ON

-A1 TSA52-140
DI1 Run FWD
DI2 Stop
DI4 Reset
+24V
Run
By Pass
Trip

-K7 /9.E2
-K10 /9.F4
-K10 /9.F4
-K2

-K1 -P1 -K4 -H4 -K5 -H5 RD -K2 -K3 -K6 -H6 BU
A1 A2 X1 X2

-G1:- 0V /7.E8
-X0:- 0V /9.E1

/7.C4 /8.B8
/8.B7 /8.B8 /9.D4 /9.B4
/8.B8 /8.B5
/8.D6
/8.C6 /9.C2 /9.C3
/7.C3 /7.C3

Pump Run	Pump Running	Pump Tripped	Pump Stop	Pump Start Request	Motor Heater

Rev.	Description	Date	Rev. by	Standard	
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Circuit Diagram
Hydraulic Power Pack
Soft Starter 1

=HPU 2X87KW
+B42

E-4504 - 04
Rev. 04
8 / 16

Printed: 05.02.2025 11:06
Template:

=GENERAL

+PMS System

(Insert jumper between 3-4
if PMS is not in use.)

Request | Feedback | Pump Running

-W412 1 2 3 4 5 6

-X4 1 2 3 4 5 6

-K4 /8.F3 44 41

/8.C8 -X0:+ 24VDC

-X0 +

-K3 /8.E5 24 21 34 31

-K4 /8.F3 32 31

-K9 A1 A2 14 11

-K10 14 11

-K7 A1 Y1 A2 30s /9.E3

-K8 A1 Y1 A2 0,5s /9.E4

-K10 A1 A2

/8.E8 -X0:- 0V

-X0 -

/8.D5 15 16 18

/8.B7 15 16 18

/9.D4 11 12 14

/9.D5 11 14 12

/8.C2 21 24 22

/8.D6 31 34 32

/8.D8 41 44 42

PMS Request Timer		PMS Request Blink	PMS Request Approved	Pump Start

04	Update	05.02.2025	WJ	Date	14.10.2021
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Rev.	Description	Date	Rev. by	Standard	

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Circuit Diagram
Hydraulic Power Pack
Soft Starter 1

=HPU 2X87KW

+B42

E-4504 - 04

Rev. 04

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=GENERAL
+Switch Board
1 2 3 PE
-W420 BK BN GY GN/YE
-T1
500 480 460 0
230 0
480/230
180VA - 0,8A
-Q1
-Q2
0,47A
-F1
2A
-KM1
/10.E4
L1 L2 L3 PE
L N PE
-K6
/11.E8
14 24
11 21
-K1
/11.E3
14
11
-G1
L N PE
IN (100-240VAC)
OUT (24VDC)
5A
+ -
-X0:+
24VDC
/11.C1
-A1
TSA52-140
PTC
T1 T2 T3 GND
69 70
-W423 BK BN GY GN/YE
-X3 1 2
-W425
-X2 1 2
-W424
Pump Motor 2
480V/60Hz
87kW - 129A
U V W PE
-M2
3 ~
PTC
+t°c
Motor Heater
100W
L1 L2
-KM1
A1
A2
-X0:-
0V
/11.E1
/10.E4
/10.C1
1 2
3 4
5 6
13 14
21 22

Pump Motor 2 | Motor Heater On | Pump Run

Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
03	For customer review	14.02.2023	GM	Drawn by	KS
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Circuit Diagram
Hydraulic Power Pack
Soft Starter 2

=HPU 2X87KW
+B43

E-4504 - 04
Rev. 04
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Printed: 05.02.2025 11:06
Template:

+B41 Control Cabinet

-W421

-X12:1 0V /6.D2 -X1:1
-X12:2 24VDC /6.D3 -X1:2
-X12:3 Emrg_Ok /6.D4 -X1:3
-X12:4 Pump 2 Stop /6.D4 -X1:4
-X12:5 Pump 2 Start /6.D5 -X1:5
-X12:6 Pump 2 Running /6.D6 -X1:6
-X12:7 Pump 2 Tripped /6.D7 -X1:7
-X12:8 Unload Valve 2 /6.D7 -X1:8

-G1:+ 24VDC /10.C8

-A1 TSA52-140
DI1 Run FWD
DI2 Stop
DI4 Reset
+24V
Run
By Pass
Trip

-K10 /12.E4
-S2
-K5 /11.E4
-S1.1
-S1.2
-K3
-K8 /12.E3
-K4 0,5s
-K5
-K4
-K1 /11.E3
-S6 OFF ON
-K7 /12.E2
-K10 /12.F4
-K2
-K10 /12.F4

-K1 -P1 -K4 -H4 -K5 -H5 RD -K2 -K3 -K6 -H6 BU

-G1:- 0V /10.E8
-X0:+ 24VDC /12.C1
-X0:- 0V /12.E1

/10.C4 /11.B8 /11.B7 /11.B8 /12.D4 /12.B4 /11.B8 /11.B5 /11.D6 /11.C6 /12.C2 /12.C3 /10.C3 /10.C3

Pump Run	Pump Running	Pump Tripped	Pump Stop	Pump Start Request	Motor Heater

Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
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Circuit Diagram
Hydraulic Power Pack
Soft Starter 2

=HPU 2X87KW
+B43

E-4504 - 04
Rev. 04
11 / 16

Printed: 05.02.2025 11:06

Template:

=GENERAL

+PMS System

(Insert jumper between 3-4
if PMS is not in use.)

Request | Feedback | Pump Running

-W422

-X4

-K4 /11.F3

/11.C8 -X0:+ 24VDC

-X0 +

-K3 /11.E5

-K4 /11.F3

-K9

-K10

-K7 /12.E3 30s

-K8 /12.E4 0,5s

-K10

/11.E8 -X0:- 0V

-X0 -

/11.D5

/11.B7

/12.D4

/12.D5

/11.C2

/11.D6

/11.D8

PMS Request Timer		PMS Request Blink	PMS Request Approved	Pump Start

04	Update	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company
03	For customer review	14.02.2023	GM	Drawn by	KS		
02	For customer review	29.08.2022	RSI	Appr. by	WJ		
Rev.	Description	Date	Rev. by	Standard			

Circuit Diagram
Hydraulic Power Pack
Soft Starter 2

=HPU 2X87KW

+B43

E-4504 - 04

Rev. 04

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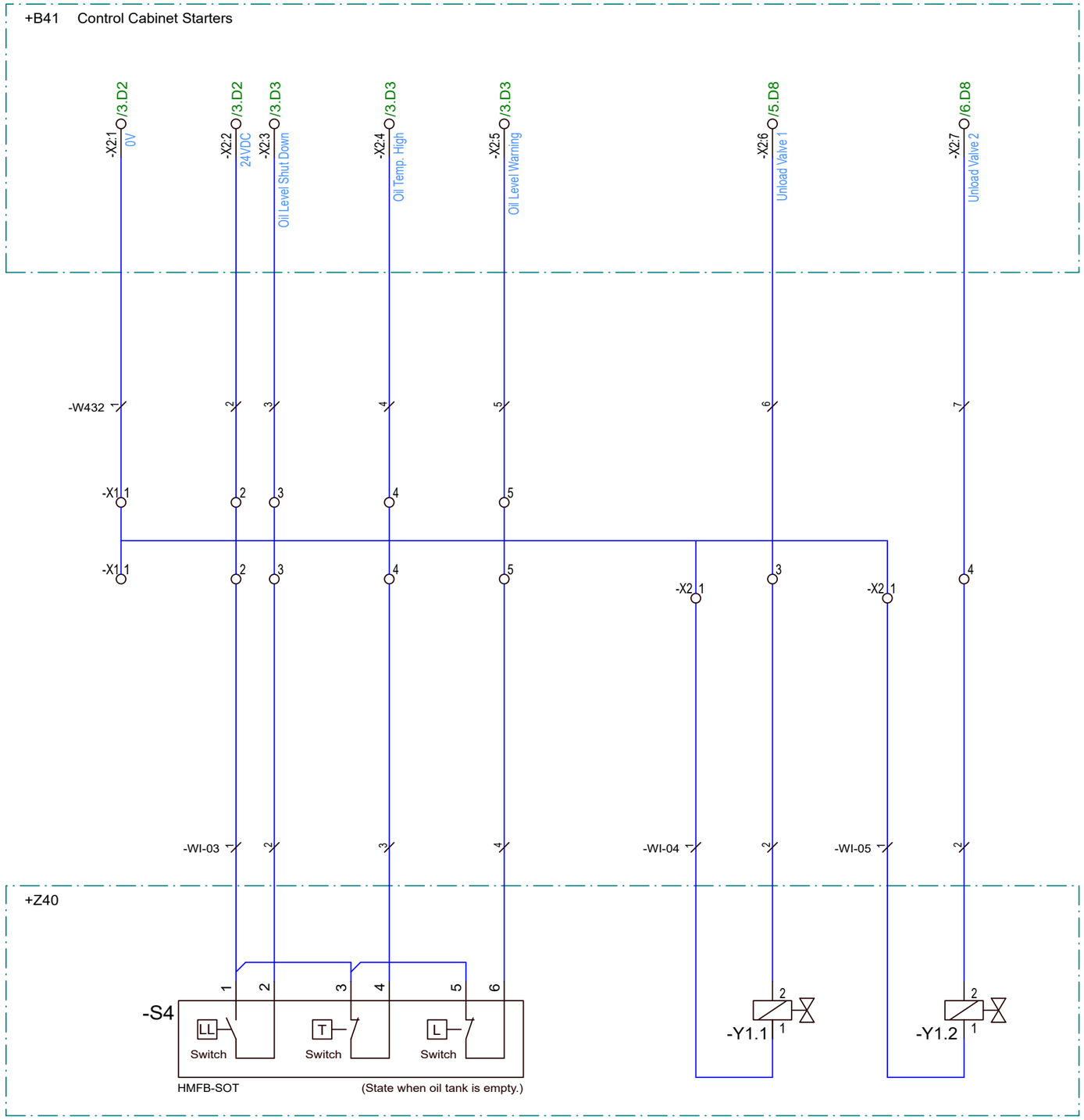
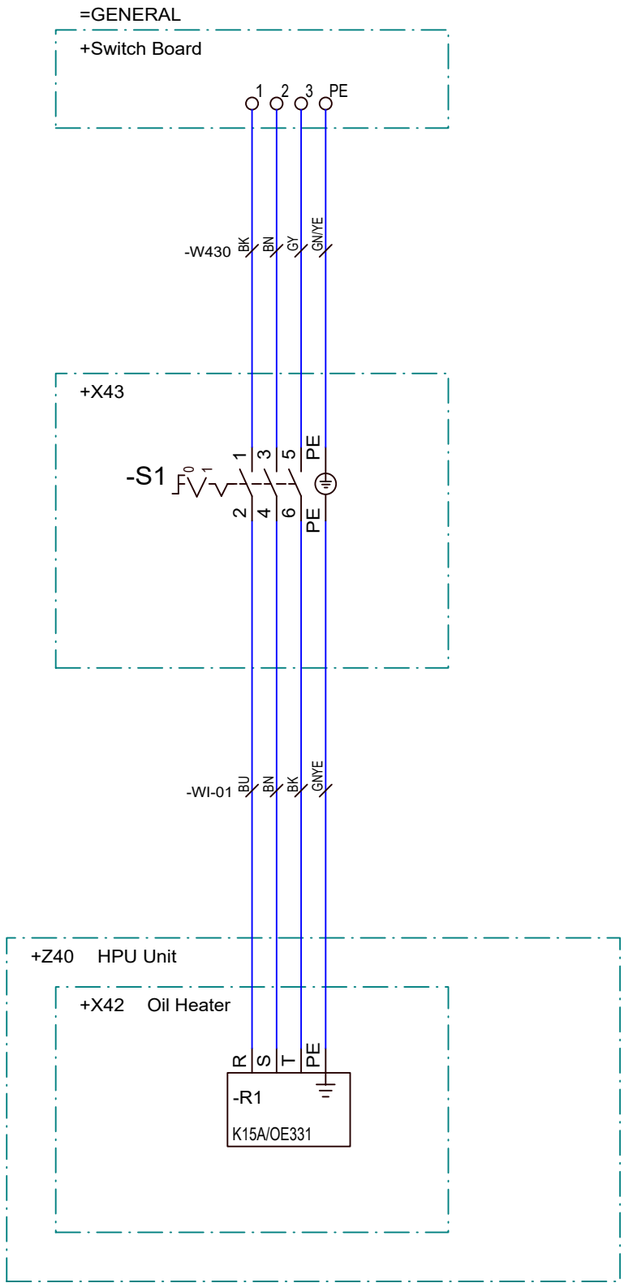


Oil Level/Temp Switch	Unload Valve 1	Unload Valve 2

04	Update	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company	Circuit Diagram Hydraulic Power Pack HPU Unit
03	For customer review	14.02.2023	GM	Drawn by	KS			
02	For customer review	29.08.2022	RSI	Appr. by	WJ			
Rev.	Description	Date	Rev. by	Standard				

=HPU 2X87KW		E-4504 - 04	
+X41		Rev. 04	13 / 16



Oil Heater

Rev.	Description	Date	Rev. by		
04	Update	05.02.2025	WJ	Date	14.10.2021
03	For customer review	14.02.2023	GM	Drawn by	KS
02	For customer review	29.08.2022	RSI	Appr. by	WJ

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Circuit Diagram
Hydraulic Power Pack
HPU Unit

=HPU 2X87KW
+X41

E-4504 - 04
Rev. 04
14 / 16

Printed: 05.02.2025 11:06

Template:

-KF2.1 Beckhoff EL1008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Input	DI1	/3.C3	HPU	Sensor	Alarm	Oil Lev. Shut Down	DI	
5	Digital Input	DI2	/3.C3	HPU	Sensor	Alarm	Oil Temp. High	DI	
2	Digital Input	DI3	/3.C3	HPU	Sensor	Alarm	Oil Level Warn.	DI	
6	Digital Input	DI4	/4.C2	HPU	Contact	Pump 1	Stop	DI	
3	Digital Input	DI5	/4.C3	HPU	Contact	Pump 1	Start	DI	
7	Digital Input	DI6	/4.C3	HPU	Contact	Pump 2	Stop	DI	
4	Digital Input	DI7						DI	
8	Digital Input	DI8						DI	

-KF2.2 Beckhoff EL1008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Input	DI1	/4.C4	HPU	Contact	Pump 2	Start	DI	
5	Digital Input	DI2	/5.C6	HPU	Sensor	Pump 1	Running	DI	
2	Digital Input	DI3	/5.C7	HPU	Sensor	Pump 1	Tripped	DI	
6	Digital Input	DI4	/6.C6	HPU	Sensor	Pump 2	Running	DI	
3	Digital Input	DI5	/6.C7	HPU	Sensor	Pump 2	Tripped	DI	
7	Digital Input	DI6						DI	
4	Digital Input	DI7						DI	
8	Digital Input	DI8						DI	

-KF2.3 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/2.C2	Control Cabinet	Emergency Stop	Light	Activated	RO	NO
2	Relay Output NO								
5	Com	RO2	/2.C4	Control Cabinet	Emergency Stop	Light	Activated	RO	NO
6	Relay Output NO								
3	Com	RO3	/4.C5	HPU	Switch	Pump 1	Running	RO	NO
4	Relay Output NO								
7	Com	RO4	/4.C5	HPU	Switch	Pump 2	Running	RO	NO
8	Relay Output NO								

-KF2.4 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/4.C6	HPU	Switch	Pump 1	Tripped	RO	NO
2	Relay Output NO								
5	Com	RO2	/4.C7	HPU	Switch	Pump 1	Tripped	RO	NO
6	Relay Output NO								
3	Com	RO3	/4.C7	HPU	Switch	Alarm	General	RO	NO
4	Relay Output NO								
7	Com	RO4	/5.C5	HPU	Switch	Pump 1	Stop	RO	NO
8	Relay Output NO								

-KF2.5 Beckhoff EL2624

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Com	RO1	/5.C5	HPU	Switch	Pump 1	Start	RO	NO
2	Relay Output NO								
5	Com	RO2	/6.C5	HPU	Switch	Pump 2	Stop	RO	NO
6	Relay Output NO								
3	Com	RO3	/6.C5	HPU	Switch	Pump 2	Start	RO	NO
4	Relay Output NO								
7	Com	RO4						RO	NO
8	Relay Output NO								

Rev.	Description	Date	Rev. by		
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Circuit Diagram
Hydraulic Power Pack
IO List

=HPU 2X87KW
+B41

E-4504 - 04
Rev. 04
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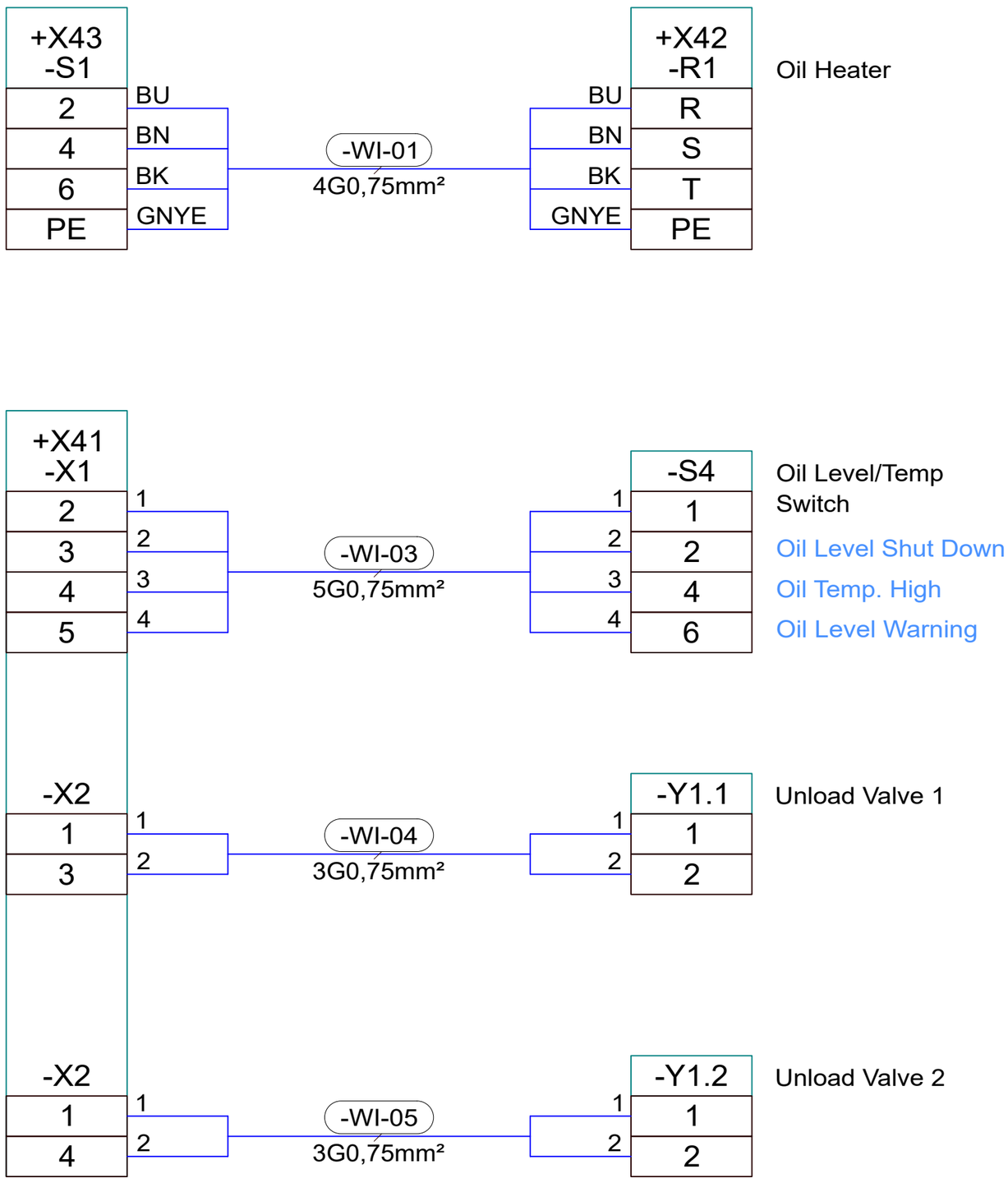

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Termination Diagram
Hydraulic Power Pack

=HPU 2X87KW

E-4504 - 05

Rev. 04 1 / 1

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-WI-01	ROFLEX 4G0.75	07915027		1	Pcs	CABLE, 4G0,75mm²	Lapp	
-WI-03	ØLFLEX FD 855 CP 5G0.75	400115191		1	Pcs	CABLE, 5x0,75mm², SHIELDED	Lapp	
-WI-04,-WI-05	7074-18021-2360500	07930051		2	Pcs	CONNECTOR, VALVE, MURR, 5M, SS	Murr	

Rev.	Description	Date	Rev. by	Standard	
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Part List
Hydraulic Power Pack

=HPU 2X87KW

E-4504 - 07

Rev. 04

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-CAB1	ADO201	07939034	24 138 75	1	Pcs	CABINET, DOORSTOPPER, ADO, ELDON	Eldon	
-CAB1	MAS0605030	400089006	24 174 95	1	Pcs	CABINET, 600x500x300 ELDON*	Eldon	
-DUCT1..-DUCT5	HA760040	07920015	12 857 18	1.42	M	CABLE TRAY, 60X40, GREY, W/LID	Tehalit Hager	
-F1	C60H/C 04-2	07938005	16 760 63	1	Pcs	SIKRING AUTOMAT 4A, 2-POL	Schneider	
-G1	CS10.241	07949016	66 040 29	1	Pcs	POWER SUPPLY, PULSE, 10A, 230/24	Puls	
-H1	ZB4BV013	400063390	43 004 13	1	Pcs	LAMP HEAD, LED, WH	Schneider	
-H1	ZBVB1	07924015	43 032 23	1	Pcs	LAMP, LED, WH, 24V	Schneider	
-H2	ZB4BV053	400063393	43 027 55	1	Pcs	LAMP HEAD, LED, YE	Schneider	
-H2	ZBVB5	07924018	43 032 32	1	Pcs	LAMP, LED, YE, 24V	Schneider	
-K1	C9A41FX24D	07936016	43 785 77	1	Pcs	RELAY, RELECO, 4-POLE, 24V DC, 5A	Releco	
-K1	S9-M	07942014	43 786 79	1	Pcs	RELAY, SOCKET, 4-POLE	Releco	
-K2..-K5	C10A10X24D	07936014	43 781 45	4	Pcs	RELAY, RELECO, 1-POLE, 24V, DC, 10A	Releco	
-K2..-K5	S-10	07942012	43 782 84	4	Pcs	RELAY, SOCKET, RELECO 1-POLE	Releco	
-KF2.0	EK1101	400142335		1	Pcs	EtherCAT Coupler w ID settings	Beckhoff	
-KF2.1,-KF2.2	EL1008	400142339		2	Pcs	8 Digital Inputs	Beckhoff	
-KF2.3,-KF2.4,-KF2.5	EL2624	400142344		3	Pcs	4 Relay Outputs	Beckhoff	
-KF2.6	EL2911	400142346		1	Pcs	TwinSAFE 4 Digital Inputs, 1x Output	Beckhoff	
-KF2.7	EL9011	400142410		1	Pcs	Bus end cap	Beckhoff	
-RAIL1..-RAIL4	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	1.32	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S0	45-2D36.1920.000	07960036		1	Pcs	CONTR. PUSH, RD, EM STOP, Ø40	EAO	
-S0	45-312.1Z10			2	Pcs	CONTR. ACC, CONTACTBLOCK, 1NC	EAO	
-S0	45-320.1E16			1	Pcs	LAMP, LED, RD, 24V	EAO	
-TAG1..-TAG2,-TAG6..-TAG7	US-EMLP-HA 24	400075270		4	Pcs	TAG, SIGN, THERMOMARK CARD	Phoenix Contact	
-TAG4	US-EMLP 70X15	07958307	18 004 50	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-TAG5	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X0	AEP AP12			1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0..-X2,-X11..-X12,-X41..-X42	AEB 35 SC/1	400073887	12 654 34	14	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X0 (-)	AAP12 10/4X2.5 LO-LI BL			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (-,-,-,-,-)	AAP12 2.5 LI BL			5	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+)	AAP12 10/4X2.5 LO-LI RD			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+,+,+)	AAP12 2.5 LI RD			3	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (GND)	JORDSKINNE 21	07918007		1	Pcs	RAIL, GRN, BRASS, 21 SLOT	Weidmüller	
-X0 (GND,GND)	A3C 2.5 PE	400074010	12 654 16	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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04	Update	05.02.2025	WJ	Date	14.10.2021
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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-X0,-X2,-X11..-X12	AEP 3C 2.5	400069937	12 694 11	4	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,3,5),-X41 (1,3,5,7),-X42 (1,3-9)	A2T 2.5	400073880	12 654 14	15	Pcs	TERMINAL BLOCK, SNAP-IN, TWO HIGHTS	Weidmüller	
-X1 (GND)	A2C 2.5 PE	400074009	12 654 15	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1,-X41..-X42	AEP 2T 2.5	400073883	12 694 40	3	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X2 (1-7),-X11 (1-9),-X12 (1-9)	A3C 2.5	400069932	12 654 01	25	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X91,-X92	IE-TO-RJ45-FJ-B	07930061		2	Pcs	CONNECTOR, FEMALE, RJ45, RAIL MOUNT	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-A1	TSA52-140			1	Pcs	SOFTSTARTER, 200-525VAC, 50/60Hz, 140A, 75kW	Emotron	
-CAB1	ADO201	07939034	24 138 75	1	Pcs	CABINET, DOORSTOPPER, ADO, ELDON	Eldon	
-CAB1	MAS0806030	07939032	24 176 15	1	Pcs	CABINET, 800x600x300 ELDON	Eldon	
-DUCT1..-DUCT2,-DUCT4,-DUCT6..-DUCT7,-DUCT9	HA760025	07920014	12 857 17	1.49	M	CABLE TRAY, 60X25, GREY, W/LID	Tehalit Hager	
-DUCT5	HA760060	07920016	12 857 19	0.4	M	CABLE TRAY, 60X60, GREY, W/LID	Tehalit Hager	
-F1	C60H/C 02/2	07938004	16 760 61	1	Pcs	FUSE, AUTOMAT, 2A, 2-POLE, C	Schneider	
-G1	CS05.241	07949015	66 040 28	1	Pcs	POWER SUPPLY, PULSE, 5A, 230/24	Puls	
-H5	ZBVB4	07924017	43 032 29	1	Pcs	LAMP, LED, RD, 24V	Schneider	
-H6	ZBVB6	400056715	4303235	1	Pcs	LAMP, LED, BU, 24V	Schneider	
-K1,-K5..-K6	C12A21X24D	07936028	43 791 08	3	Pcs	RELAY, RELECO, 2-POLE, 24V, DC, 5A	Releco	
-K1,-K5..-K6	S-12	07942015	43 791 01	3	Pcs	RELAY, SOCKET, RELECO, 2-POLE	Releco	
-K2,-K9	C10A10X24D	07936014	43 781 45	2	Pcs	RELAY, RELECO, 1-POLE, 24V, DC, 10A	Releco	
-K2,-K9	S-10	07942012	43 782 84	2	Pcs	RELAY, SOCKET, RELECO 1-POLE	Releco	
-K3..-K4,-K10	C9A41FX24D	07936016	43 785 77	3	Pcs	RELAY, RELECO, 4-POLE, 24V DC, 5A	Releco	
-K3..-K4,-K10	S9-M	07942014	43 786 79	3	Pcs	RELAY, SOCKET, 4-POLE	Releco	
-K7	RE22R1AMR	07948014	41 720 21	1	Pcs	RELAY, TIMER, 24V DC, ON-DELAY	Schneider	
-K8	RE22R1DMR	400090666	41 720 24	1	Pcs	RELAY, TIMER, 24-240V AC/DC, BLINK	Schneider	
-KM1	LADN22	07916006	41 765 22	1	Pcs	AUXILIARY BLOCK, 2NO/2NC	Schneider	
-KM1	LC1D150P7	07922025	41 766 84	1	Pcs	CONTACTOR, 150A, 230V, 3P, 1NO/1NC	Schneider	
-P1	BG4017-1248		80 502 73	1	Pcs	COUNTER, HOUR, 12-48VDC	Müller	
-Q1	INS250-200 3P		43 212 34	1	Pcs	BREAKER, 200A, 3-POLE	Schneider	
-Q2	GV2ME04		43 217 19	1	Pcs	THERMAL RELAY, SWITCH, 0,40-0,63A	Schneider	
-RAIL1..-RAIL5	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.71	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S1	XB4BW73731B5	07961026	43 014 04	1	Pcs	CONTR. PUSH BUTTON, DOUBLE, I - 0 W/LED	Schneider	
-S2	ZB4BW343	07960032	43 027 35	1	Pcs	CONTR. PUSH, RD, LED	Schneider	
-S2,-S6	ZBE101	07961013	43 004 23	2	Pcs	CONTR. ACC, CONTACTBLOCK, 1NO	Schneider	
-S6	ZB4BK1263	07960021	43 025 22	1	Pcs	CONTR. SWITCH, 2 POS, LED, BU	Schneider	
-T1	FR96B-460230	400056236	66 224 63	1	Pcs	TRAFO, 180VA, 460-480-500/230V	Noratel	
-TAG1,-TAG2	US-EMLP-HA 24	400075270		2	Pcs	TAG, SIGN, THERMOMARK CARD	Phoenix Contact	
-TAG3	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X0	AEP AP12			1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0..-X4	AEB 35 SC/1	400073887	12 654 34	7	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-X0 (-)	AAP12 10/4X2.5 LO-LI BL			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (-,-,-)	AAP12 2.5 LI BL			3	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+)	AAP12 10/4X2.5 LO-LI RD			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+,+)	AAP12 2.5 LI RD			2	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (GND)	JORDSKINNE 13	07918006		1	Pcs	RAIL, GRN, BRASS, 13 SLOT	Weidmüller	
-X1 (1-8),-X2 (1-2),-X3 (1-2), -X4 (1-6)	A2C 2.5	400069931	12 654 00	18	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X3 (GND)	A2C 2.5 PE	400074009	12 654 15	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-A1	TSA52-140			1	Pcs	SOFTSTARTER, 200-525VAC, 50/60Hz, 140A, 75kW	Emotron	
-CAB1	ADO201	07939034	24 138 75	1	Pcs	CABINET, DOORSTOPPER, ADO, ELDON	Eldon	
-CAB1	MAS0806030	07939032	24 176 15	1	Pcs	CABINET, 800x600x300 ELDON	Eldon	
-DUCT1..-DUCT2,-DUCT4,-DUCT6,-DUCT8,-DUCT10	HA760025	07920014	12 857 17	1.49	M	CABLE TRAY, 60X25, GREY, W/LID	Tehalit Hager	
-DUCT5	HA760060	07920016	12 857 19	0.4	M	CABLE TRAY, 60X60, GREY, W/LID	Tehalit Hager	
-F1	C60H/C 02/2	07938004	16 760 61	1	Pcs	FUSE, AUTOMAT, 2A, 2-POLE, C	Schneider	
-G1	CS05.241	07949015	66 040 28	1	Pcs	POWER SUPPLY, PULSE, 5A, 230/24	Puls	
-H5	ZBVB4	07924017	43 032 29	1	Pcs	LAMP, LED, RD, 24V	Schneider	
-H6	ZBVB6	400056715	4303235	1	Pcs	LAMP, LED, BU, 24V	Schneider	
-K1,-K5..-K6	C12A21X24D	07936028	43 791 08	3	Pcs	RELAY, RELECO, 2-POLE, 24V, DC, 5A	Releco	
-K1,-K5..-K6	S-12	07942015	43 791 01	3	Pcs	RELAY, SOCKET, RELECO, 2-POLE	Releco	
-K2,-K9	C10A10X24D	07936014	43 781 45	2	Pcs	RELAY, RELECO, 1-POLE, 24V, DC, 10A	Releco	
-K2,-K9	S-10	07942012	43 782 84	2	Pcs	RELAY, SOCKET, RELECO 1-POLE	Releco	
-K3..-K4,-K10	C9A41FX24D	07936016	43 785 77	3	Pcs	RELAY, RELECO, 4-POLE, 24V DC, 5A	Releco	
-K3..-K4,-K10	S9-M	07942014	43 786 79	3	Pcs	RELAY, SOCKET, 4-POLE	Releco	
-K7	RE22R1AMR	07948014	41 720 21	1	Pcs	RELAY, TIMER, 24V DC, ON-DELAY	Schneider	
-K8	RE22R1DMR	400090666	41 720 24	1	Pcs	RELAY, TIMER, 24-240V AC/DC, BLINK	Schneider	
-KM1	LADN22	07916006	41 765 22	1	Pcs	AUXILIARY BLOCK, 2NO/2NC	Schneider	
-KM1	LC1D150P7	07922025	41 766 84	1	Pcs	CONTACTOR, 150A, 230V, 3P, 1NO/1NC	Schneider	
-P1	BG4017-1248		80 502 73	1	Pcs	COUNTER, HOUR, 12-48VDC	Müller	
-Q1	INS250-200 3P		43 212 34	1	Pcs	BREAKER, 200A, 3-POLE	Schneider	
-Q2	GV2ME04		43 217 19	1	Pcs	THERMAL RELAY, SWITCH, 0,40-0,63A	Schneider	
-RAIL1..-RAIL4	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.66	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S1	XB4BW73731B5	07961026	43 014 04	1	Pcs	CONTR. PUSH BUTTON, DOUBLE, I - 0 W/LED	Schneider	
-S2	ZB4BW343	07960032	43 027 35	1	Pcs	CONTR. PUSH, RD, LED	Schneider	
-S2,-S6	ZBE101	07961013	43 004 23	2	Pcs	CONTR. ACC, CONTACTBLOCK, 1NO	Schneider	
-S6	ZB4BK1263	07960021	43 025 22	1	Pcs	CONTR. SWITCH, 2 POS, LED, BU	Schneider	
-T1	FR96B-460230	400056236	66 224 63	1	Pcs	TRAFO, 180VA, 460-480-500/230V	Noratel	
-TAG1,-TAG2	US-EMLP-HA 24	400075270		2	Pcs	TAG, SIGN, THERMOMARK CARD	Phoenix Contact	
-TAG3	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X0	AEP AP12			1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0..-X4	AEB 35 SC/1	400073887	12 654 34	7	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-X0 (-)	AAP12 10/4X2.5 LO-LI BL			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (-,-,-)	AAP12 2.5 LI BL			3	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+)	AAP12 10/4X2.5 LO-LI RD			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+,+)	AAP12 2.5 LI RD			2	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (GND)	JORDSKINNE 13	07918006		1	Pcs	RAIL, GRN, BRASS, 13 SLOT	Weidmüller	
-X1 (1-8),-X2 (1-2),-X3 (1-2), -X4 (1-6)	A2C 2.5	400069931	12 654 00	18	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X3 (GND)	A2C 2.5 PE	400074009	12 654 15	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-CAB1	CPG-320	07904006		1	Pcs	JUNCTION BOX, POLYESTER, 360x160x91	Bernstein	
-GL1..-GL3	ST-M 16 x 1.5	07928032	12 477 13	3	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-GL4	ST-M 32 x 1.5	07928035	12 477 16	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø17-25	Lapp	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.34	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1 (1-5),-X2 (1,1,3-4)	A3C 2.5	400069932	12 654 01	9	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (GND),-X2 (GND,GND)	A3C 2.5 PE	400074010	12 654 16	3	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1,-X2	AEB 35 SC/1	400073887	12 654 34	3	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	

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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-S1	VBF01GE		14 747 85	1	Pcs	SWITCH, 16A, 3-POLE	Schneider	

Rev.	Description	Date	Rev. by		
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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-S1	XALK178W3B140G	400208317	4322660	1	Pcs	CONTR. PUSH, EM STOP	Schneider	

Rev.	Description	Date	Rev. by	Standard	
04	Update	05.02.2025	WJ	Date	14.10.2021
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Part List
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Customer : CNP Freire
Ship/Hull : MBARI
Project no. : 4/60185
Drawing no.: E-4505

Rev.	Description	Date	Rev. by		
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
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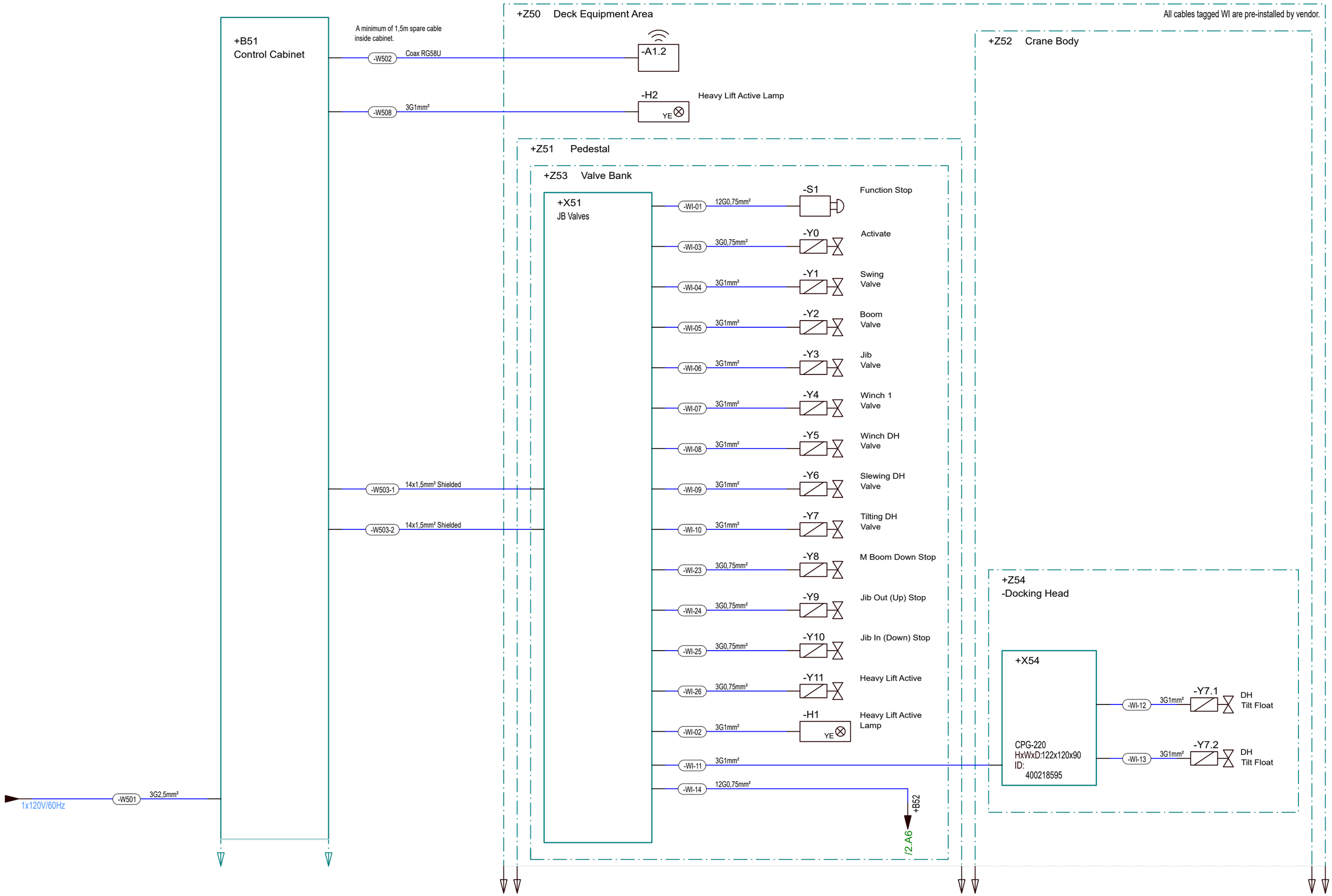

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
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Single Line
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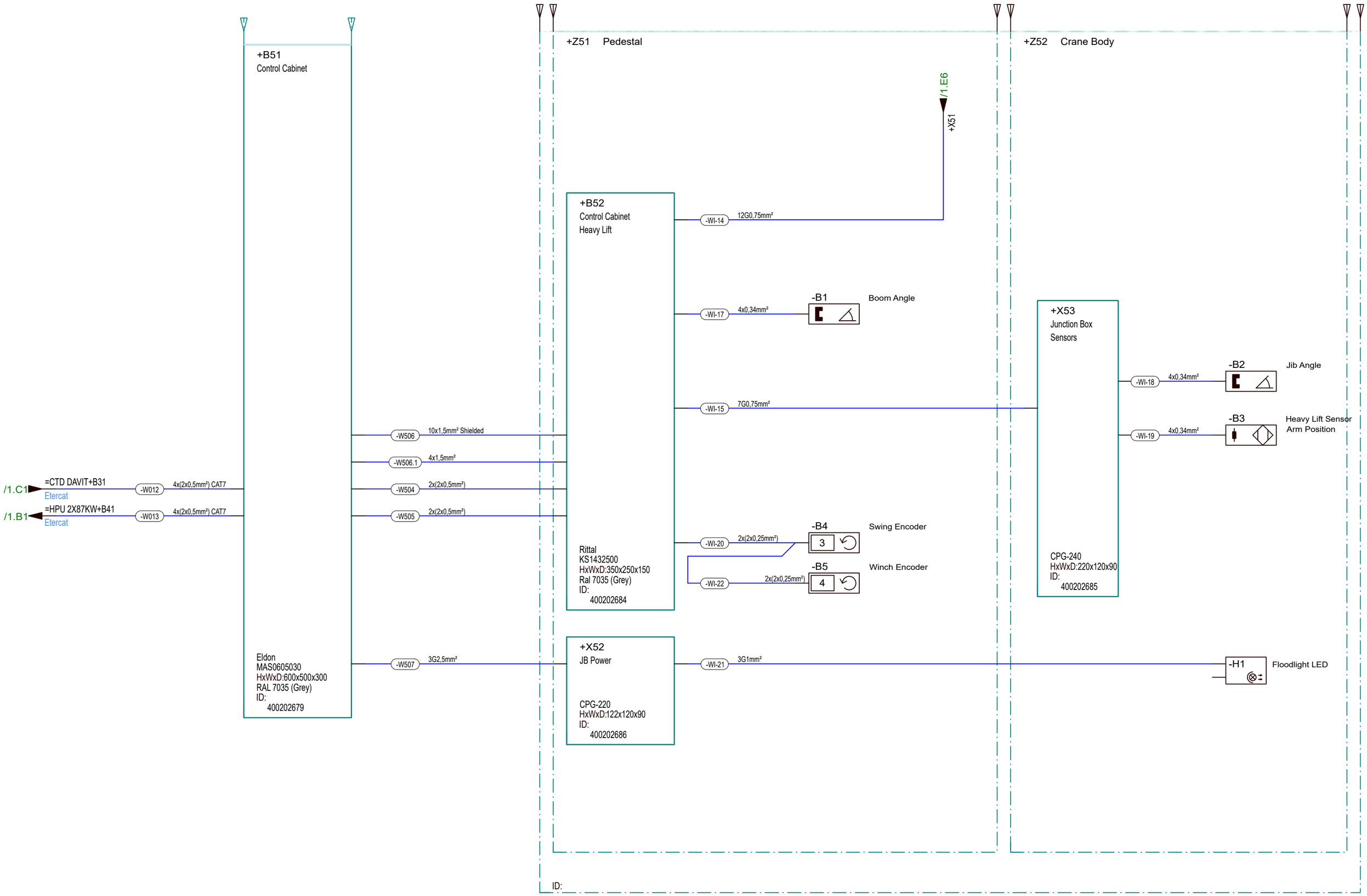

Rev.	Description	Date	Rev. by		
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
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Template:

-CAB1

Triplex
Control Cabinet
KN-75
+B51

06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ
Rev.	Description	Date	Rev. by	Standard	

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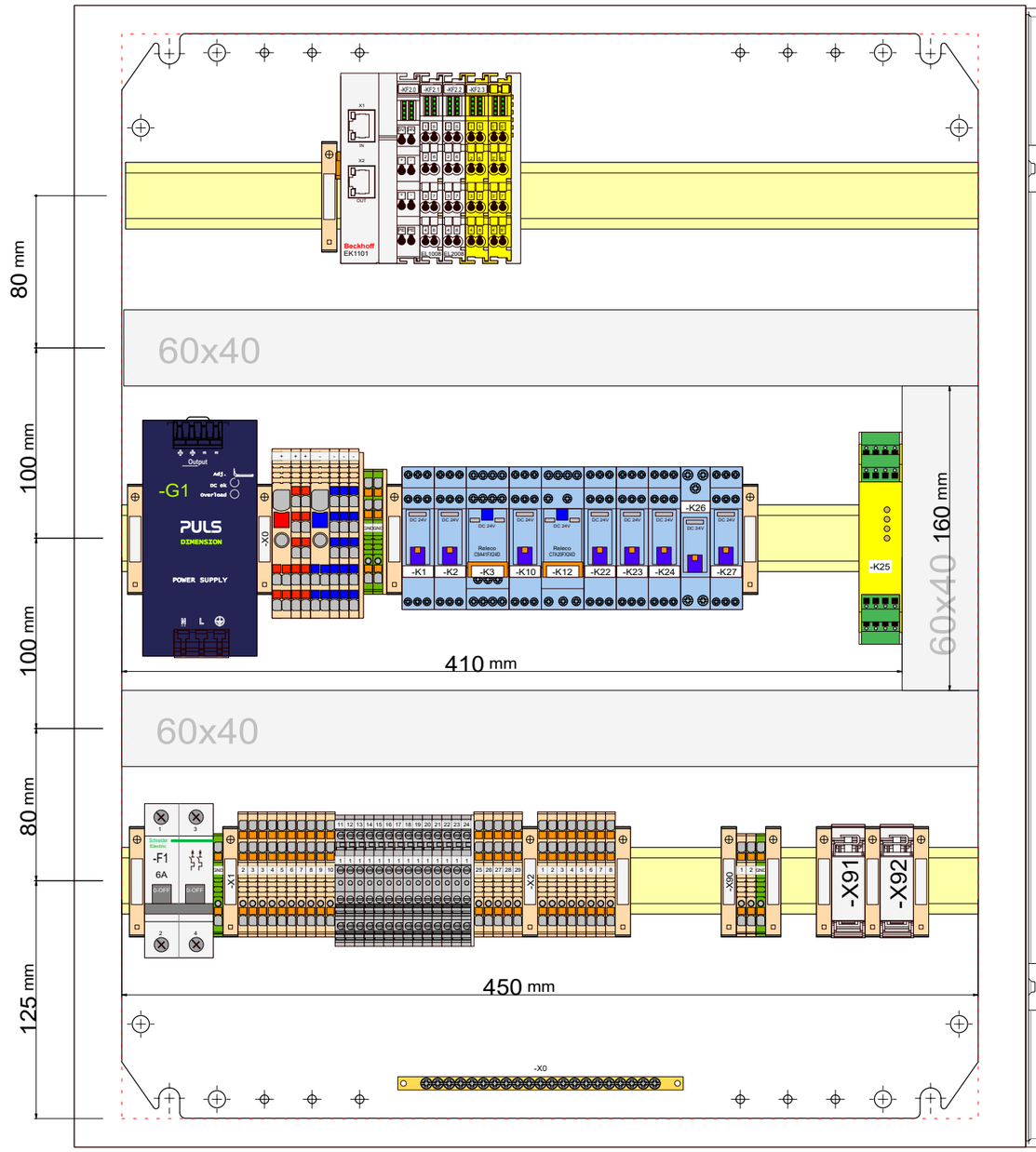
TRIPLEX
A MacGregor company

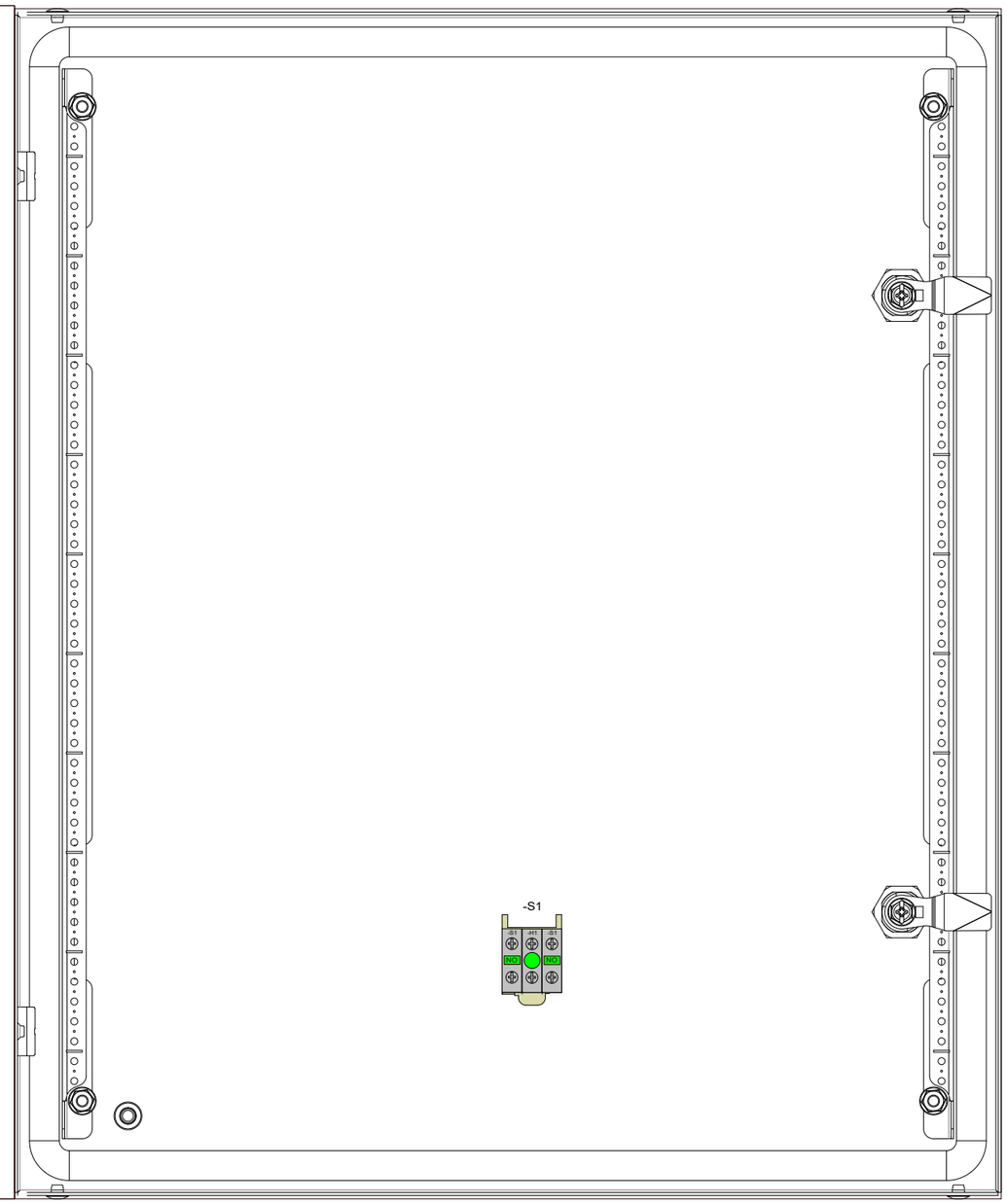
Layout
Deck Crane AUV
Control Cabinet Radio - Outside

=KN-75
+B51

E-4505 - 03
Rev. 06
1 / 11

-CAB1





Door Inside

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
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TRIPLEX
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Layout
Deck Crane AUV
Control Cabinet Radio - Inside

=KN-75
+B51

E-4505 - 03
Rev. 06
2 / 11

Printed: 05.02.2025 10:48

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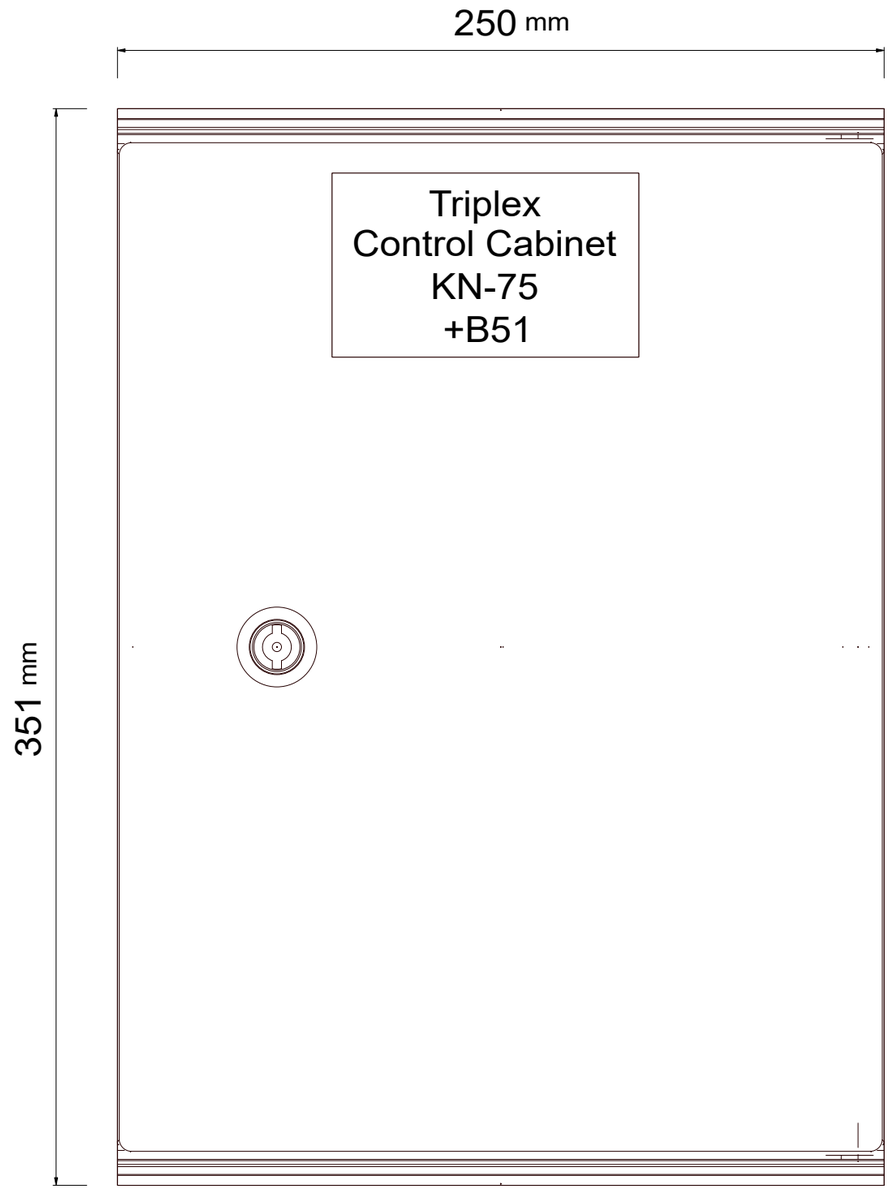

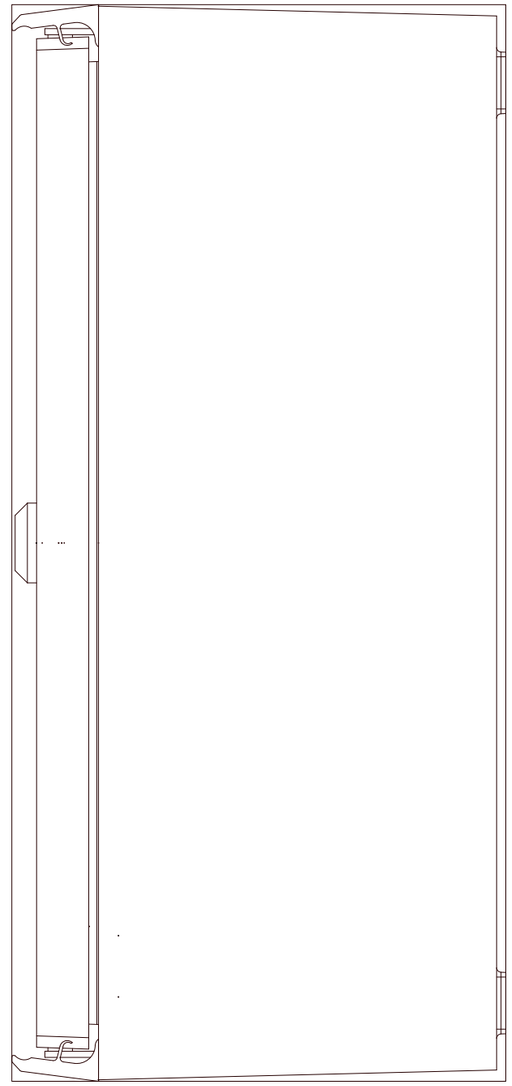

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
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TRIPLEX
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Layout
Deck Crane AUV
Control Cabinet Heavy Lift

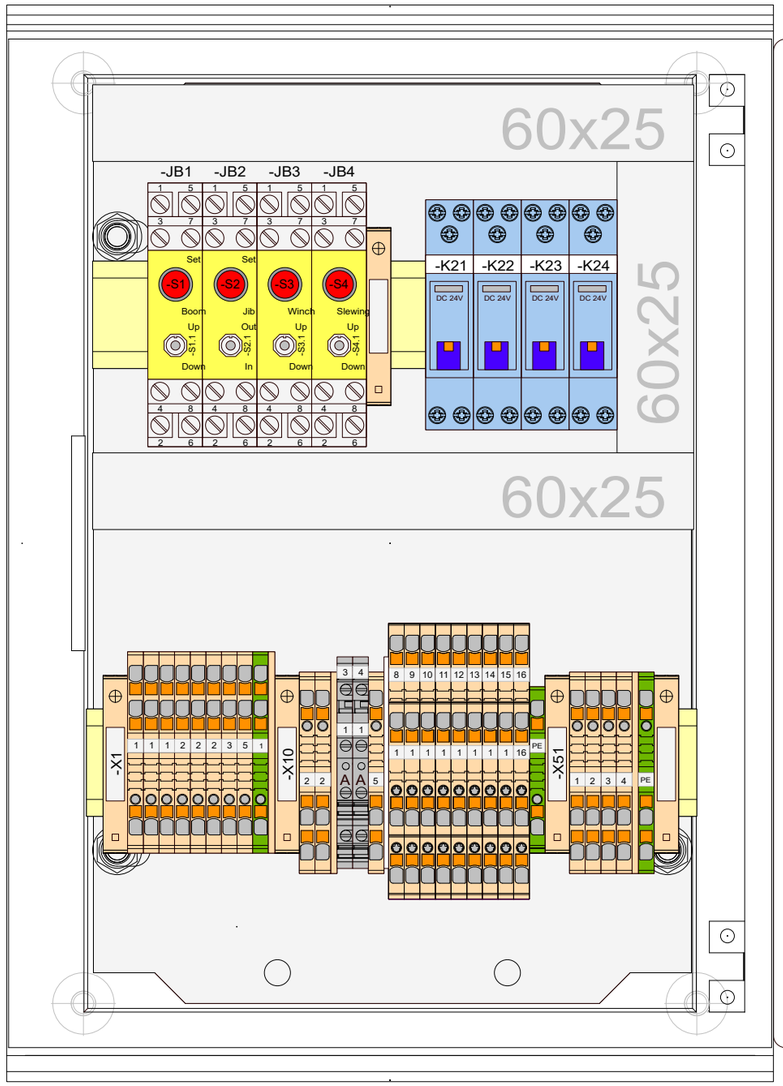
=KN-75
+B53

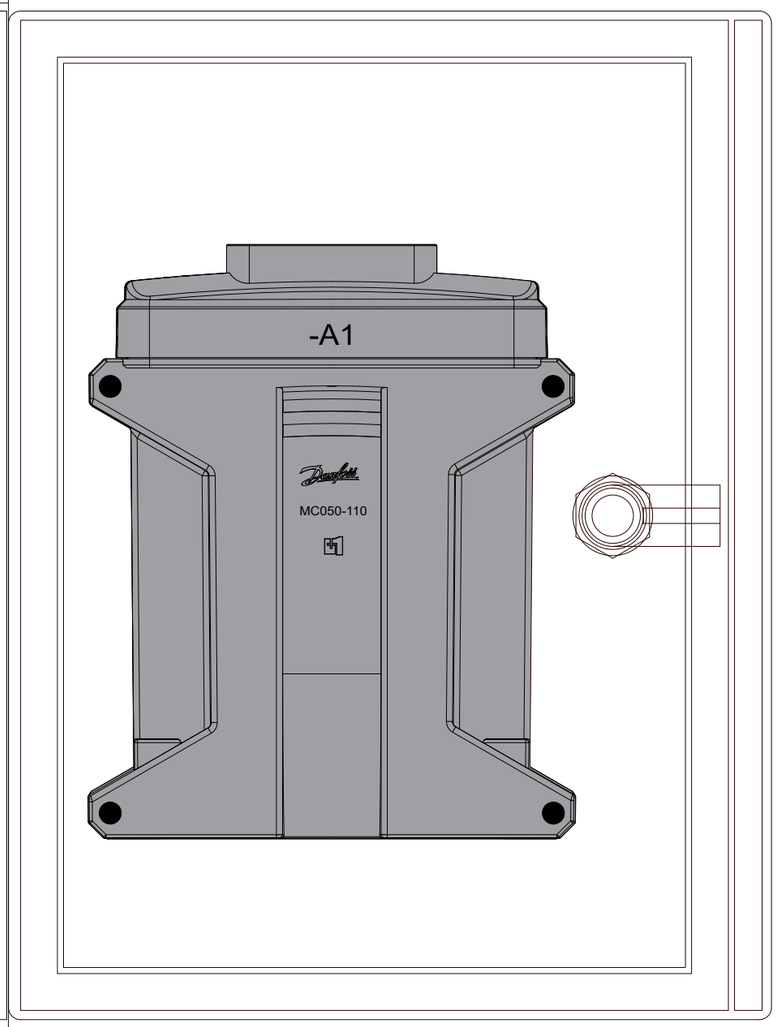
E-4505 - 03
Rev. 06
3 / 11

Printed: 05.02.2025 10:48

Template:

-CAB1





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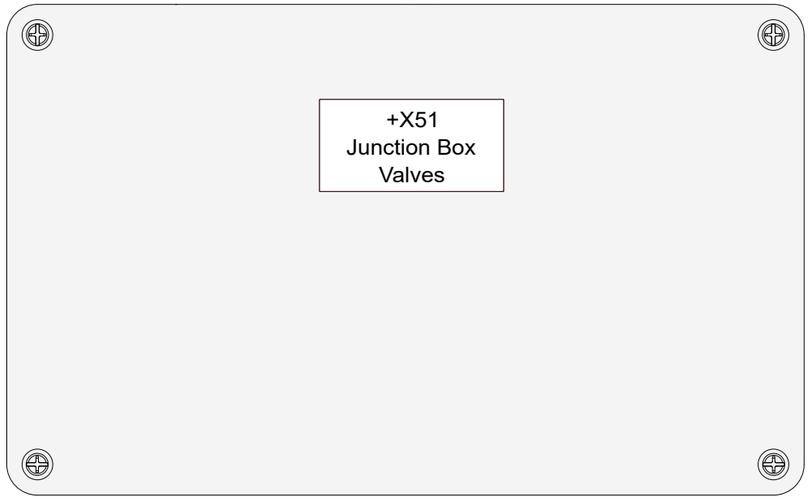
TRIPLEX
A MacGregor company

Layout
Deck Crane AUV
Control Cabinet Heavy Lift

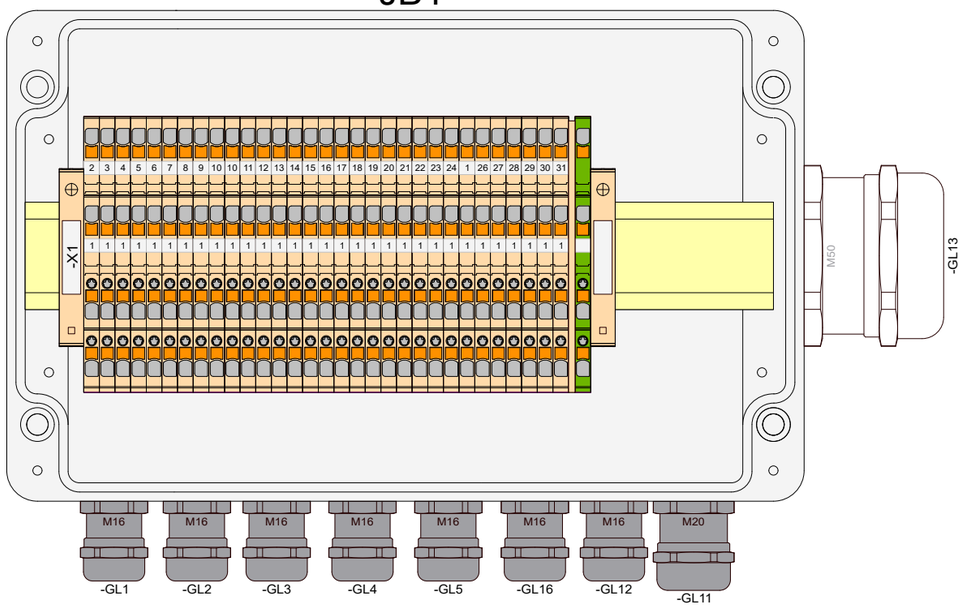
=KN-75
+B52

E-4505 - 03
Rev. 06
4 / 11

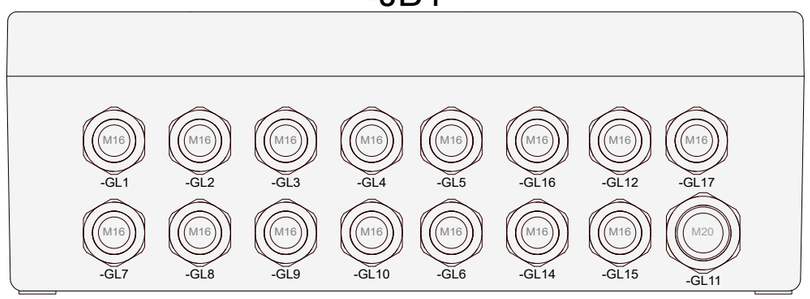
-JB1



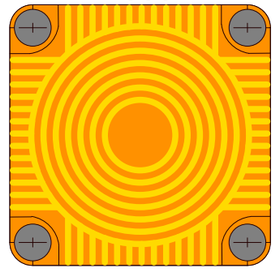
-JB1



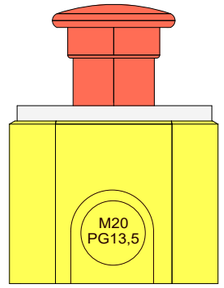
-JB1



-H1

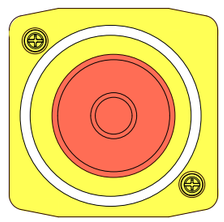


-S1



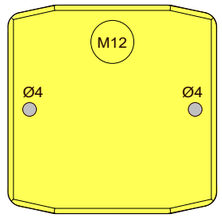
Top/Bottom View

-S1



Front View

-S1



Rear View

Component installed on equipment

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
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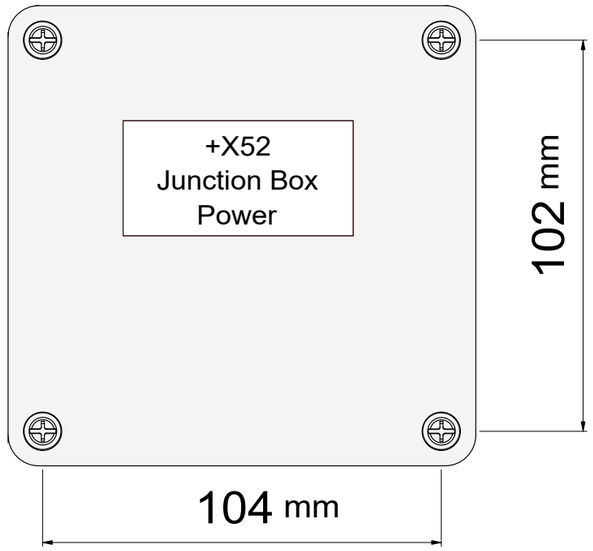
TRIPLEX
A MacGregor company

Layout
Deck Crane AUV
JB Valves

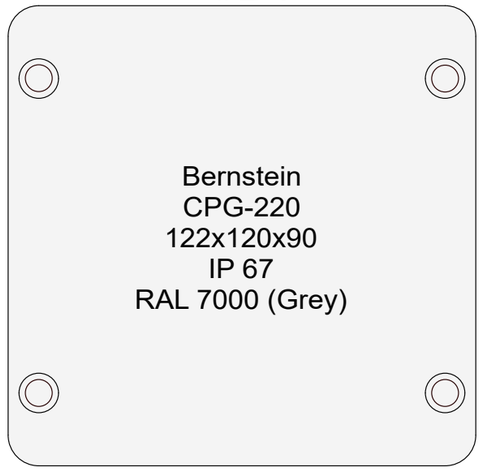
=KN-75
+X51

E-4505 - 03
Rev. 06
5 / 11

-JB1



-JB1



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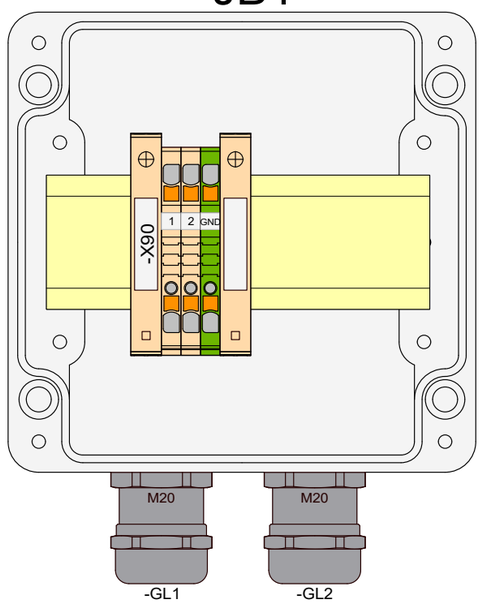

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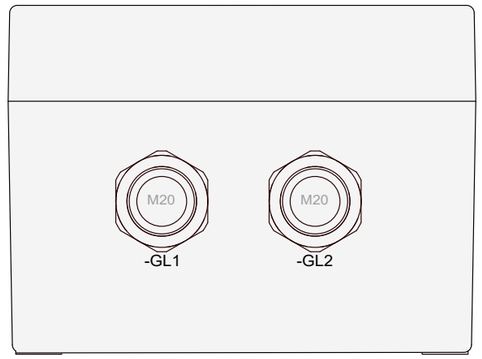

Rev.	Description	Date	Rev. by		
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TRIPLEX
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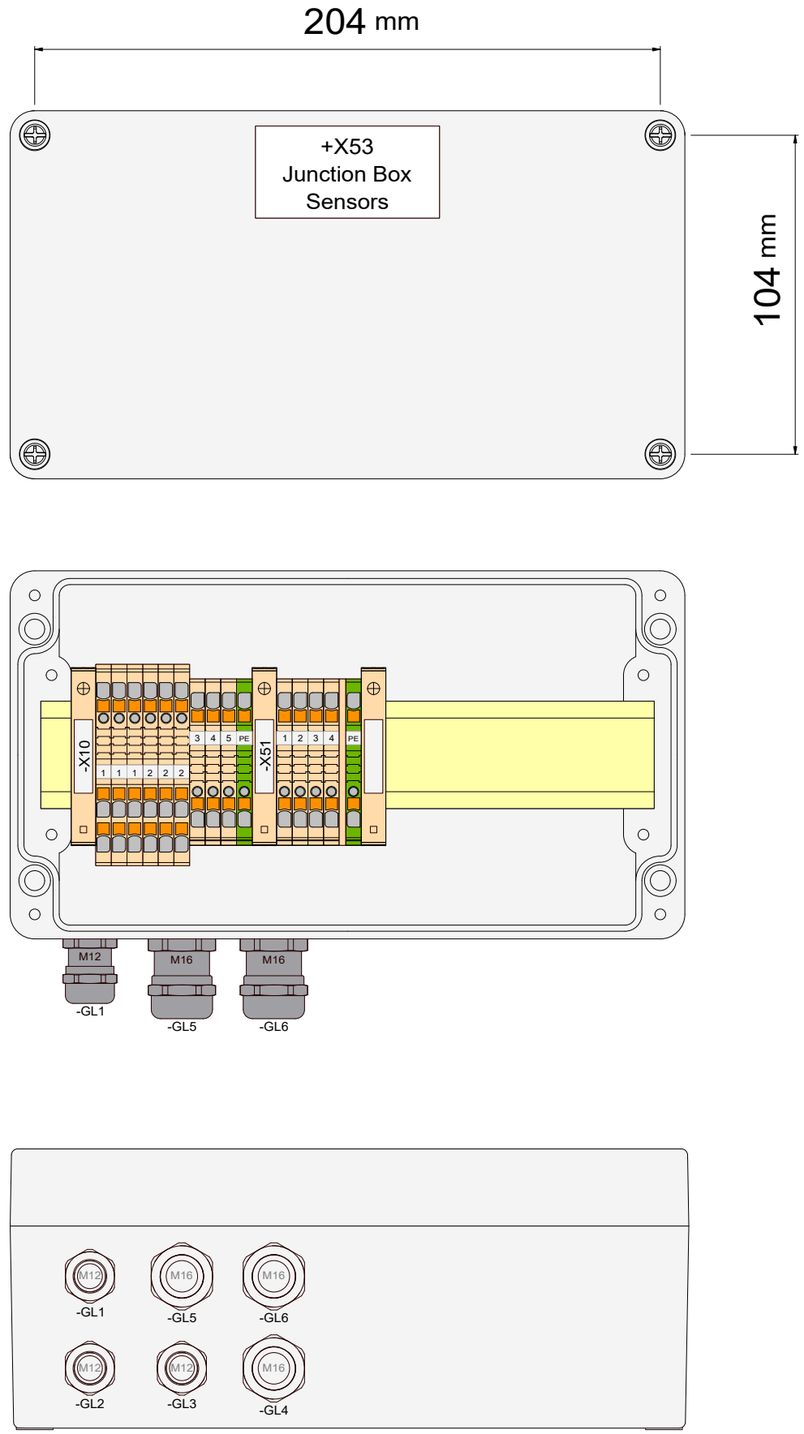
Layout
Deck Crane AUV
JB Power

=KN-75
+X52

E-4505 - 03
Rev. 06
6 / 11



Component installed on equipment

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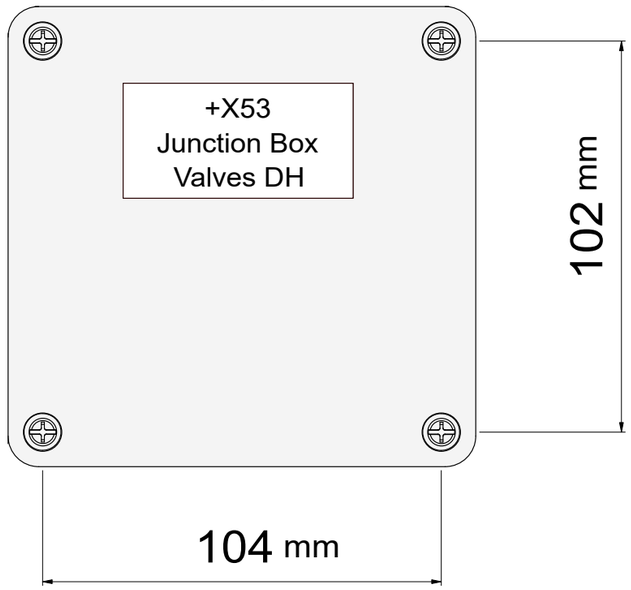
TRIPLEX
A MacGregor company

Layout
Deck Crane AUV
JB Sensors

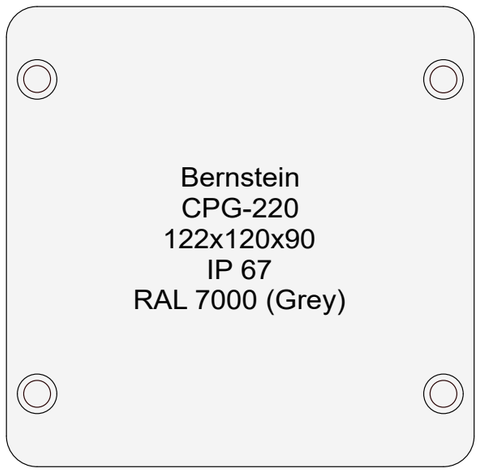
=KN-75
+X53

E-4505 - 03
Rev. 06
7 / 11

-JB1

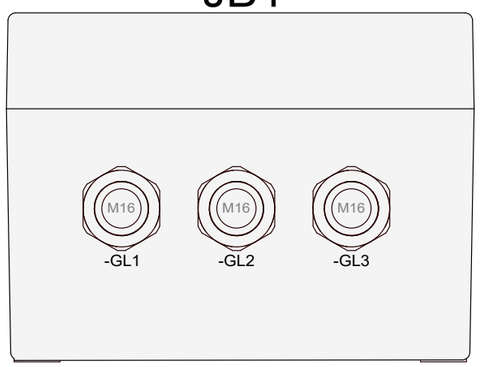


-JB1



-JB1

-JB1



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TRIPLEX
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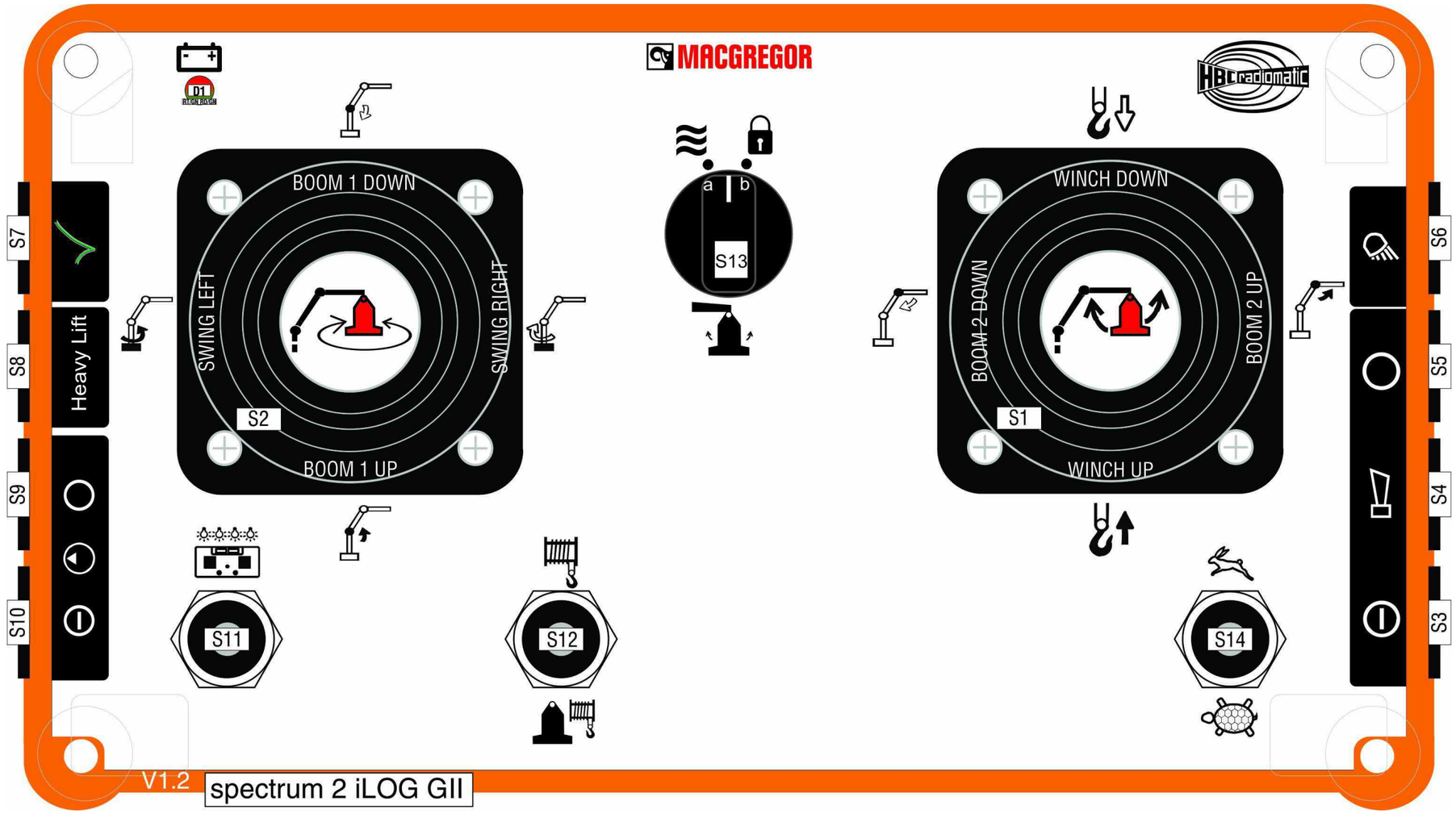
Layout
Deck Crane AUV
JB Valves DH

=KN-75
+X54

E-4505 - 03
Rev. 06
8 / 11

-A1.3



Rev.	Description	Date	Rev. by	Standard	
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TRIPLEX
A MacGregor company

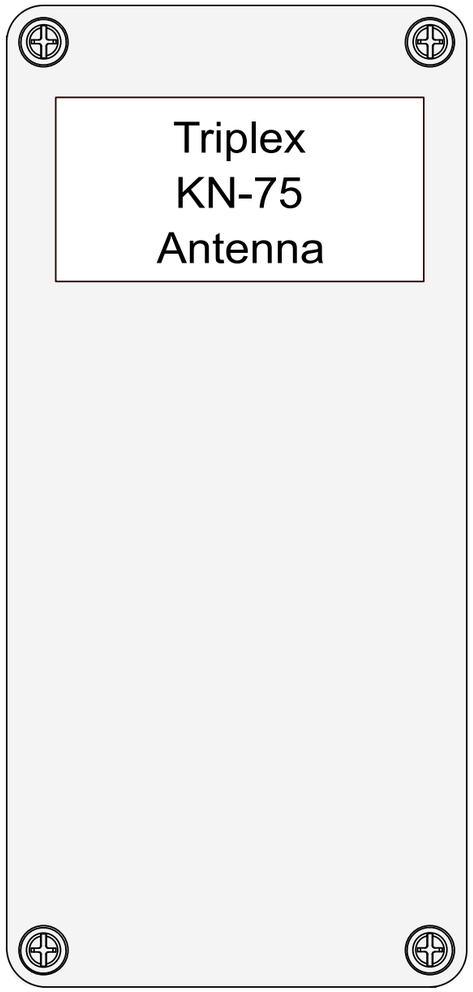
Layout
Deck Crane AUV
RC Transmitter

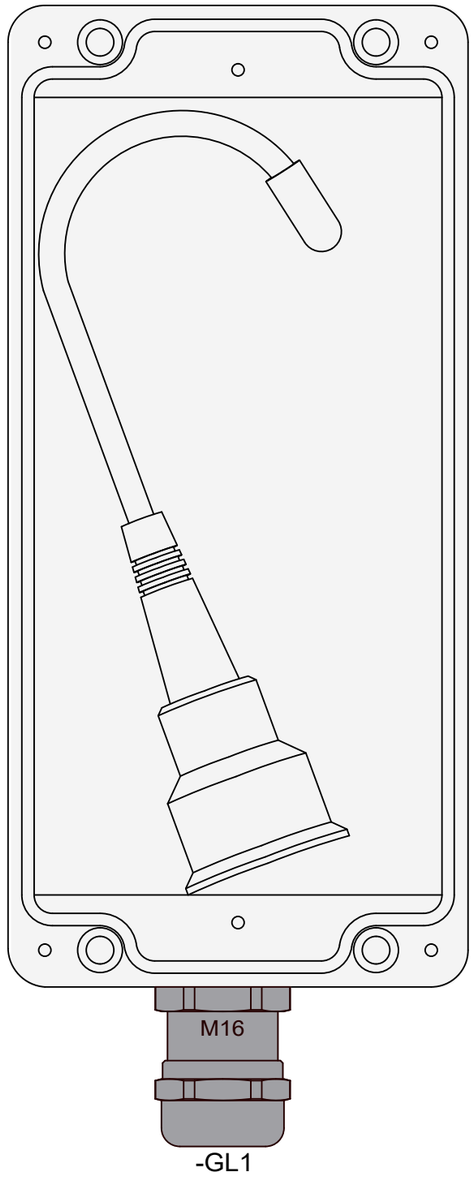
=KN-75
+B51

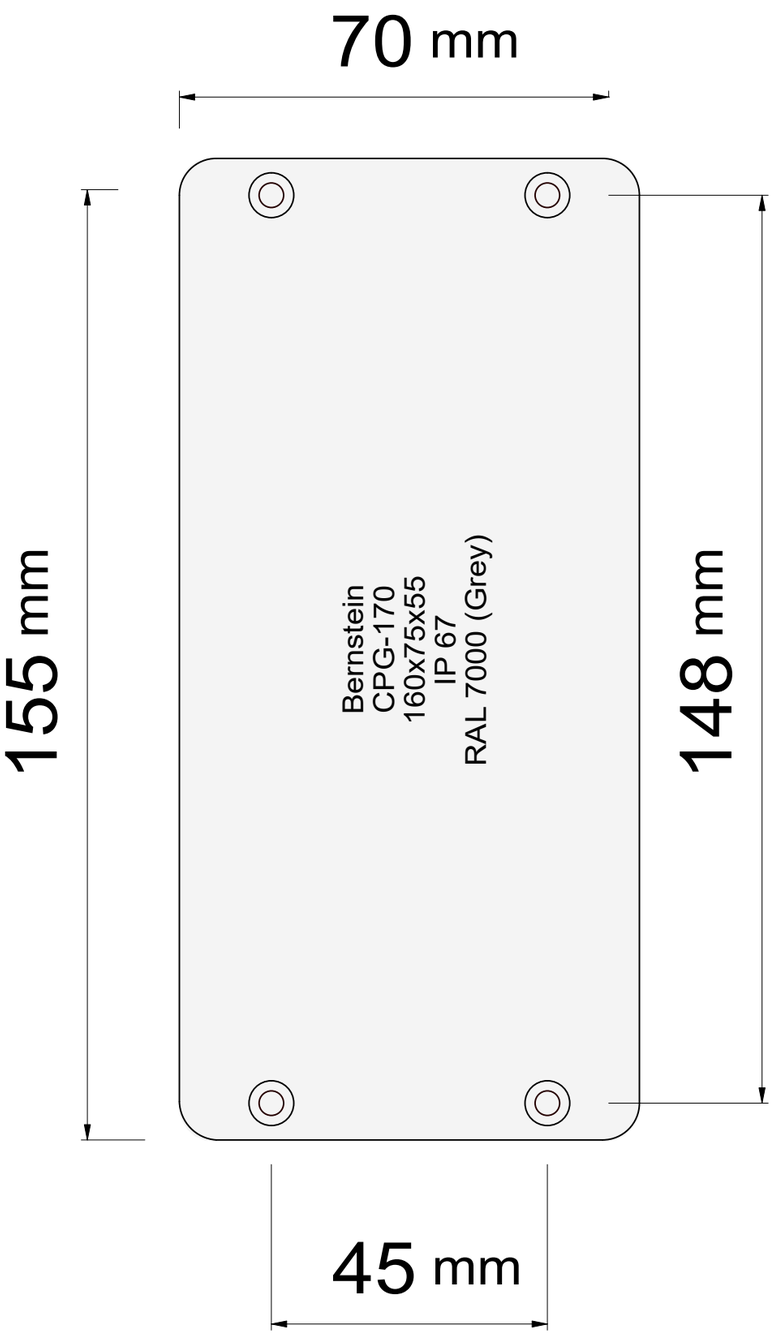
E-4505 - 03
Rev. 06
9 / 11

06	As built SAT	05.02.2025	WJ	Date	14.10.2021	4/60185 CNP Freire MBARI	TRIPLEX A MacGregor company	Layout Deck Crane AUV RC Transmitter Side View	=KN-75	E-4505 - 03
05	Issued for production	20.12.2024	WJ	Drawn by	KS				+B51	Rev. 06 10 / 11
04	Issued for production	07.07.2023	GM	Appr. by	WJ					
Rev.	Description	Date	Rev. by	Standard						

- To be placed outdoor as near as poosible to the main control cabinet.
- Free view to the operational area with no large obsticles to get the best signal perfomance.
- Cable gland facing downwards.
- It is recommended to find a spot that is protected from the environmental effects.
- Recommended cable length <30m.







Rev.	Description	Date	Rev. by	Standard	
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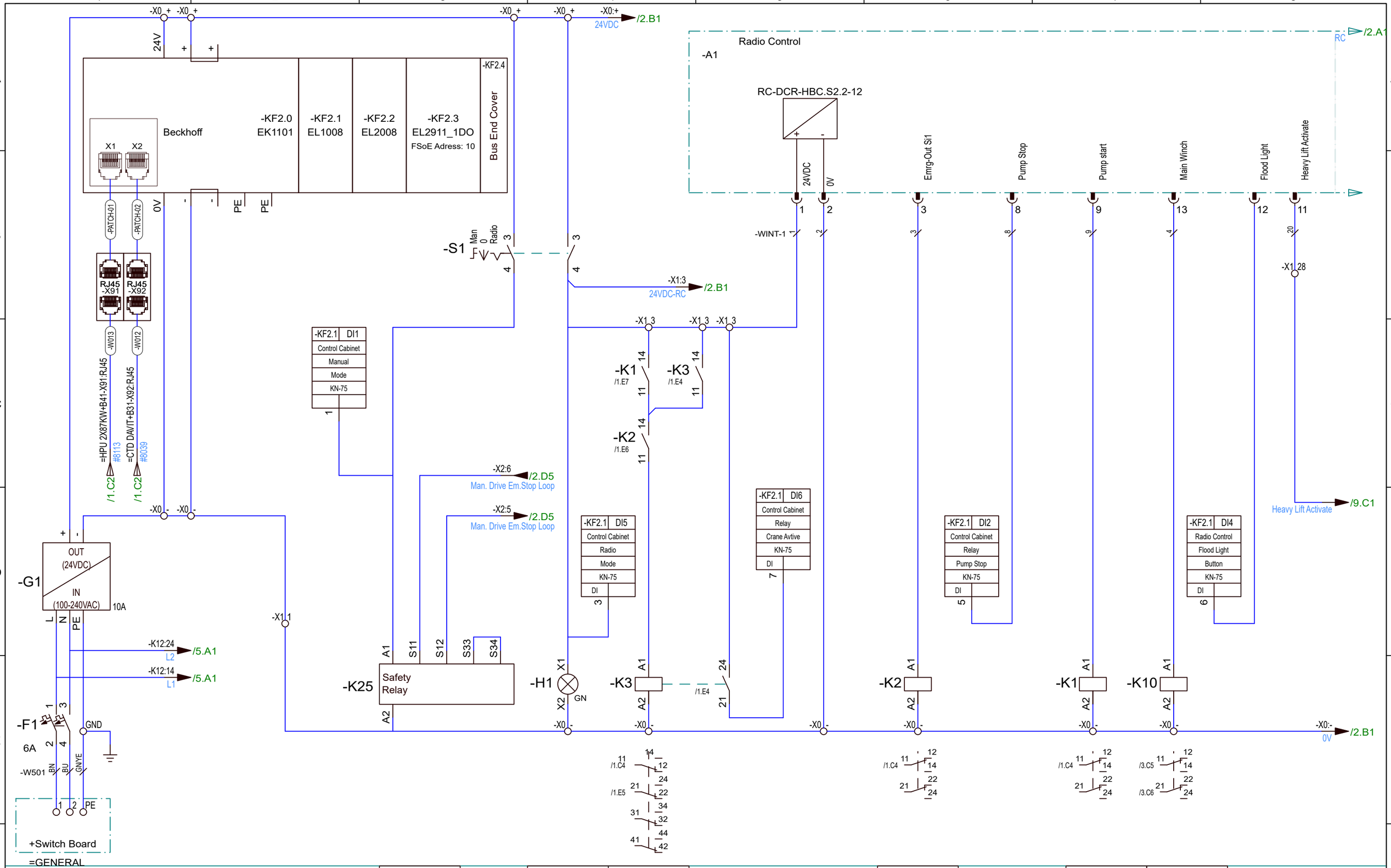
TRIPLEX
A MacGregor company

Layout
Deck Crane AUV
RC Antenna

=KN-75
+B51

E-4505 - 03
Rev. 06
11 / 11



Man. Drive Em.Stop Relay		Control From Radio	Crane Active	Crane Function Stop	Activate Crane	Main Winch

Rev.	Description	Date	Rev. by	Standard	
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Circuit Diagram
Deck Crane AUV
Control Cabinet Radio

=KN-75
+B51

E-4505 - 04
Rev. 06
1 / 11

/1.A8 RC — RC /3.A1

/1.E8 -X0:- 0V — -X0 - — -X0:- 0V /3.D1

/1.B4 -S1:4 24VDC-RC

/1.A4 -X0:+ 24VDC — -X0 + — -X0 + — -X0:+ 24VDC /3.B1

-KF2.3	DI1
Valve Bank	
Emergency Stop	
Button	
KN-75	
DI	

1 2

-KF2.3	DI2
Valve Bank	
Emergency Stop	
Contacts	
KN-75	
DI	

5 6

-KF2.2	DO2
Valve Bank	
Emergency Stop	
Light	
KN-75	
DO	

5

/1.C3 Man. Drive Em.Stop Loop -K25:S11

/1.D3 -K25:S12 Man. Drive Em.Stop Loop

-X1 2 3 4

-W503-1 2

+X51 JB Valves

-X1 2

+B52-X1:2 24VDC /6.C1

-X2 1 2 3 4 5 6 7

-W503-1 3 4 5 6 7 8 9 /3.E1

-X1 3 4 5 6 7 8 9 1 /3.E1 0V

-WI-01 1 2 3 4 5 6 7 8 /3.E1

+Z53 Valves

-S1 21 22 23 24 11 12

X1 X2 RD

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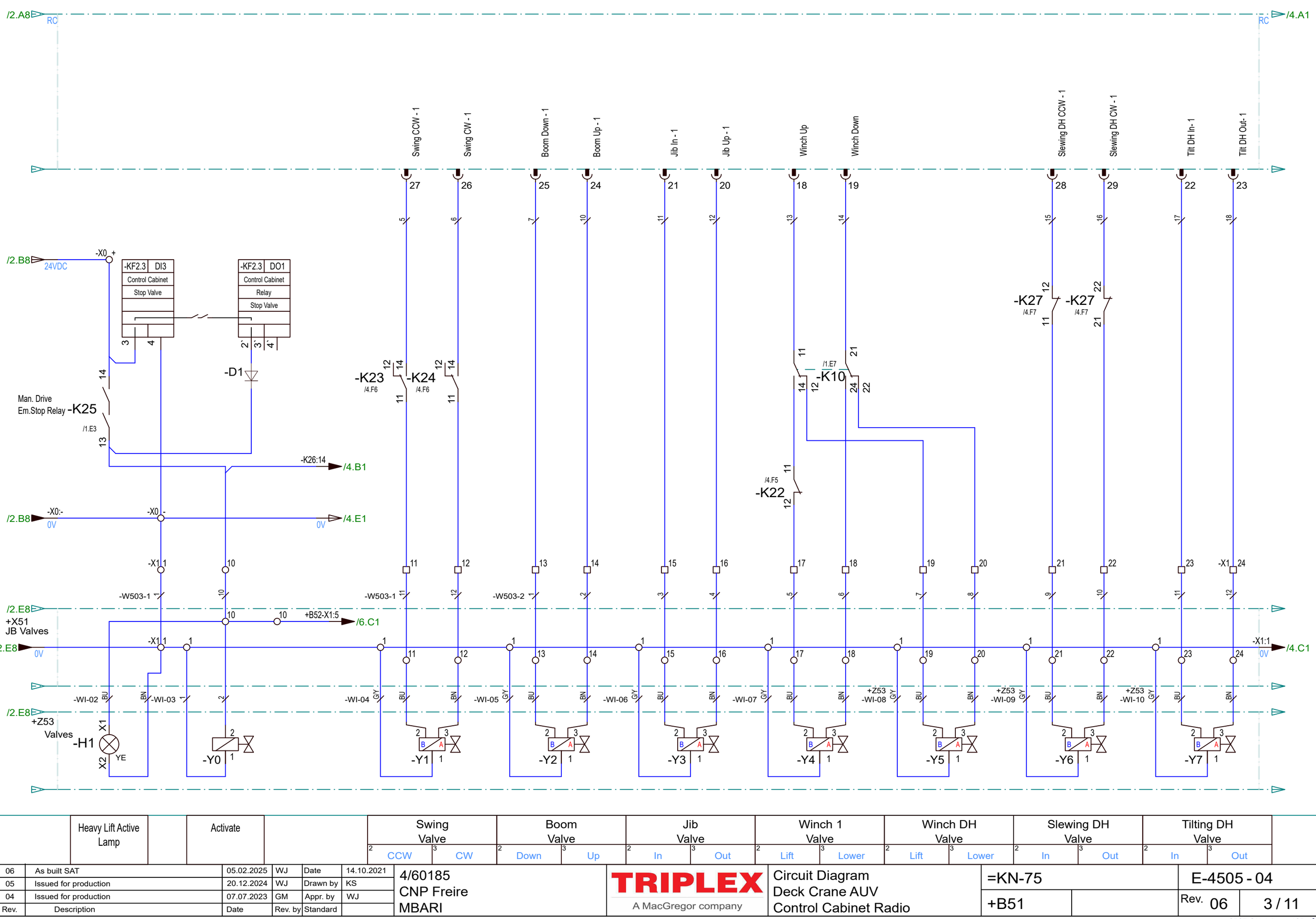
Circuit Diagram
Deck Crane AUV
Control Cabinet Radio

=KN-75
+B51

E-4505 - 04
Rev. 06
2 / 11



Heavy Lift Active Lamp	Activate	Swing Valve	Boom Valve	Jib Valve	Winch 1 Valve	Winch DH Valve	Slewing DH Valve	Tilting DH Valve
		2 CCW 3 CW	2 Down 3 Up	2 In 3 Out	2 Lift 3 Lower	2 Lift 3 Lower	2 In 3 Out	2 In 3 Out

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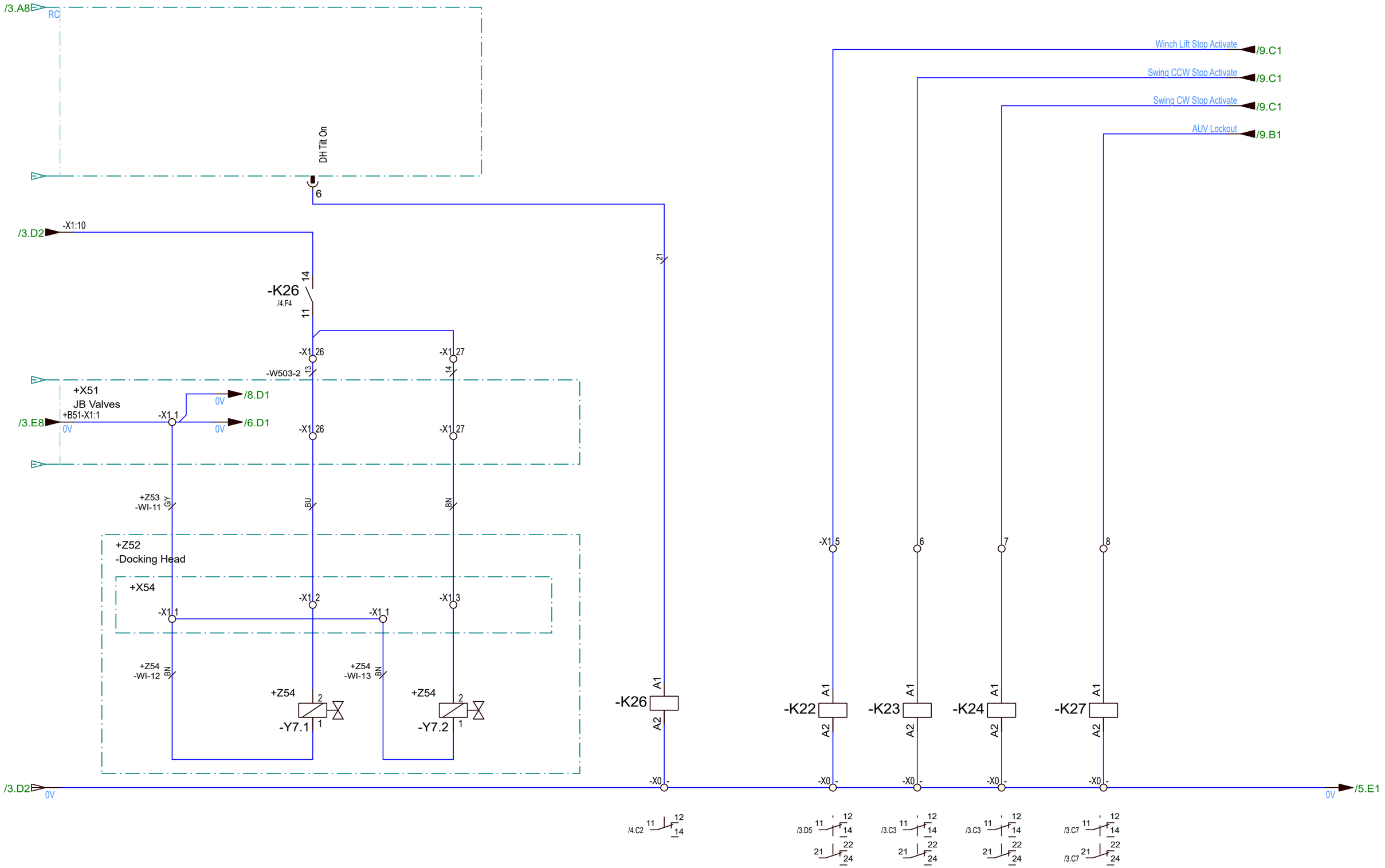
TRIPLEX
A MacGregor company

Circuit Diagram
Deck Crane AUV
Control Cabinet Radio

=KN-75
+B51

E-4505 - 04
Rev. 06
3 / 11



DH Tilt Float		DH Tilt Float	DH Tilt On		Winch Lift Stop	Swing CCW Stop	Swing CW Stop	AUV Lockout

Rev.	Description	Date	Rev. by	Standard	
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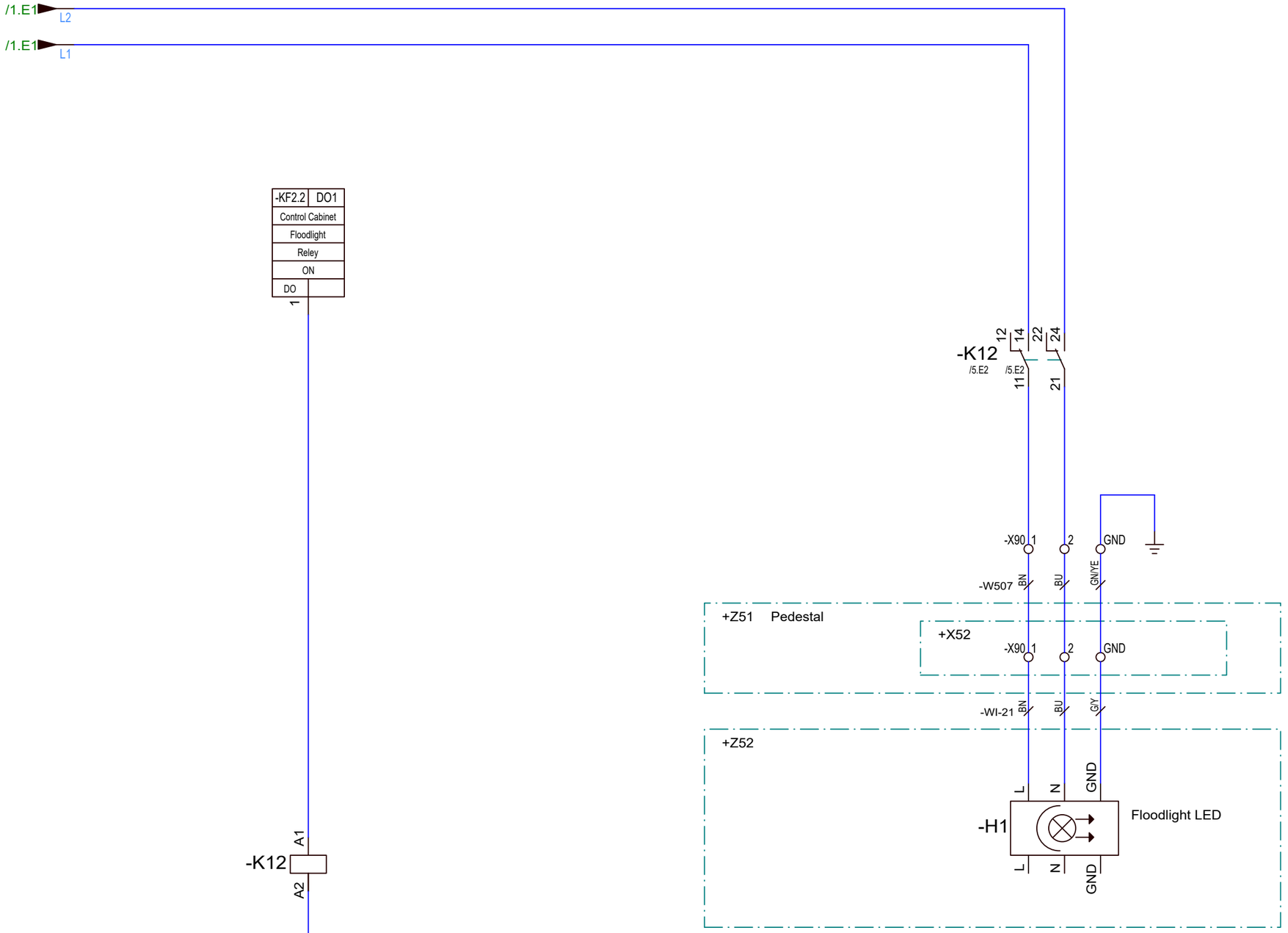
Circuit Diagram
Deck Crane AUV
Control Cabinet Radio

=KN-75
+B51

E-4505 - 04
Rev. 06
4 / 11



Floodlight

Rev.	Description	Date	Rev. by	Standard	
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Circuit Diagram
Deck Crane AUV
Control Cabinet Radio

=KN-75
+B51

E-4505 - 04
Rev. 06
5 / 11

Printed: 05.02.2025 10:48

Template:

+Z51

-WI-22 WH BN YE GN

-B4 0V +V CH CL CG, On 5 4 3 2 1, 3, Off, Lo, Hi

-B5 0V +V CH CL CG, On 5 4 3 2 1, 4, Off, Lo, Hi, R120

-B1 360° 0V +24V 4-20mA

+Z52

-B2 360° 0V +24V 4-20mA

-B3 NO/NC PNP L- L+ NO NC

-WI-20 GN YE BN WH

-WI-17 BU BN WH

-WI-18 BU BN WH

-WI-19 BU BN WH

+X53 -X10 1 2 4 -X10 1 2 5 PE

-WI-15 1 2 4 5 GNYE

+B52 Control Cabinet
Heavy Lift

-X51 1 2 3 4 R120

-X10 1 2

-WI-14

+X51-X1:2 2 -X1 2 /2.E5 24VDC

3

+X51-X1:10 5 5 /3.E2

1 -X1 1 /4.C2 0V

-X10 3 R250 1 3

-X10 4 R250 1 4

-X10 5

/7.C1 24VDC

/7.C1 0V

C1-P2 C2-P47 C2-P48 C2-P49 C2-P50 C1-P3 C1-P4 C1-P20 C1-P21

PWR+ PWR+ PWR+ PWR+ PWR+ CAN0-H CAN0-L CAN1-H CAN1-L

Danfoss
MC050-110

-A1

Node: 1

0V 0V Sensor

C1-P1 C1-P9

C1-P6

Crane Active
KN-75
Cabinet HL
DIN
MC050-110
-A1

C1-P14

Boom Angle
KN-75
Cabinet HL
DIN/AIN
MC050-110
-A1

C1-P15

Jib Angle
KN-75
Cabinet HL
DIN/AIN
MC050-110
-A1

C1-P13

Arm Position
KN-75
Cabinet HL
DIN
MC050-110
-A1

Swing Encoder	Winch Encoder	Boom Angle	Jib Angle	Heavy Lift Sensor Arm Position

Rev.	Description	Date	Rev. by	Standard	
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05	Issued for production	20.12.2024	WJ	Drawn by	KS
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Circuit Diagram
Deck Crane AUV
Control Cabinet Heavy Lift

=KN-75
+B51

E-4505 - 04
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+B52 Control Cabinet
Heavy Lift

/6.C8 -X10:2 24VDC → /8.A1 24VDC

/6.C8 0V → /8.C1 0V

-JB1

-S1

-S1.1 Boom Up / Boom Down

1 → 2 → C1-P11 → Set Boom Up

6 → C1-P12 → Set Boom Down

Set Boom Up	Set Boom Down
KNM-75	KNM-75
Cabinet HL	Cabinet HL
DIN	DIN
MC050-110	MC050-110
-A1	-A1

-JB2

-S2.1 Jib Out / Jib In

1 → 2 → C1-P7 → Set Jib Out

6 → C1-P10 → Set Jib In

Set Jib Out	Set Jib In
KNM-75	KNM-75
Cabinet HL	Cabinet HL
DIN	DIN
MC050-110	MC050-110
-A1	-A1

-JB3

-S3.1 Winch Out / In

1 → 2 → C1-P17 → Set Winch Out

6 → C1-P18 → Set Winch In

Set Winch Out	Set Winch In
KNM-75	KNM-75
Cabinet HL	Cabinet HL
DIN/AIN	DIN/AIN/FreqIN
MC050-110	MC050-110
-A1	-A1

-JB4

-S4.1 Slewing Out / In

1 → 2 → C1-P23 → Set Slewing Up

6 → C1-P24 → Set Slewing In

Set Slewing Up	Set Slewing In
KNM-75	KNM-75
Cabinet HL	Cabinet HL
DIN/AIN/FreqIN	DIN/AIN/FreqIN
MC050-110	MC050-110
-A1	-A1

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+B52 Control Cabinet
Heavy Lift

/7.C4 24VDC

-K21 /9.F6 12 14 11
-K22 /9.F6 12 14 11
-K23 /9.F7 12 14 11
-K24 /9.F8 12 14 11

-W506.1 4

-X1 8
9
10
11

/7.C4 0V -X0 - 0V /9.E2

-X1 29

-W508 BN BU

+Z50
Deck Area

-H2 X1 X2 YE

-WI-14 8
9
10
11

+X51 JB Valves

/4.C2 0V

28 1
29 1
30 1
31 1

-WI-26 7 2
-WI-23 7 2
-WI-24 7 2
-WI-25 7 2

+Z53 Valves

-Y11 2 1
-Y8 2 1
-Y9 2 1
-Y10 2 1

Heavy Lift Active Lamp	Heavy Lift Active	M Boom Down Stop	Jib Out (Up) Stop	Jib In (Down) Stop

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Circuit Diagram
Deck Crane AUV
Control Cabinet Heavy Lift

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+B52 Control Cabinet
Heavy Lift

-W506

/4.B7	AUV Lockout	5	-X1 16
/1.D8	Heavy Lift Activate	4	12
/4.A7	Winch Lift Stop Activate	1	13
/4.A7	Swing CCW Stop Activate	2	14
/4.A7	Swing CW Stop Activate	3	15

C1-P37 C1-P38 C1-P39 C1-P19 C1-P44 C1-P43 C1-P40 C1-P41 C1-P42

-A1
MC050

Swing CW Stop	Swing CCW Stop	Winch Lift Stop	HL Active	AUV Lockout	HL Active	Boom Down Stop	Jib Up (Out) Stop	Jib Down (In) Stop
KN-75	KN-75	KN-75	KN-75	KN-75	KN-75	KN-75	KN-75	KN-75
Cabinet HL	Cabinet HL	Cabinet HL	Cabinet HL	Cabinet HL	Cabinet HL	Cabinet HL	Cabinet HL	Cabinet HL
MF-Out	MF-Out	MF-Out	DIN/AIN/FreqIN	MF-Out	MF-Out	MF-Out	MF-Out	MF-Out
MC050-110	MC050-110	MC050-110	MC050-110	MC050-110	MC050-110	MC050-110	MC050-110	MC050-110
-A1	-A1	-A1	-A1	-A1	-A1	-A1	-A1	-A1

-K21 -K22 -K23 -K24 (A1 / A2)

/8.C2 0V

/8.B2 /8.B3 /8.B3 /8.B4 (11 / 12 / 14)

Heavy Lift Active	M Boom Down Stop	Jib Up (Out) Stop	Jib Down (In) Stop

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Circuit Diagram
Deck Crane AUV
Control Cabinet Heavy Lift

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-A1		Danfoss MC050-110				Node:1
Pin	Dest.	Pin Type	Ref	Item	Function	Signal Type
C1-P1		GND	/6.D1			
C1-P2		PWR+				
C1-P3		CAN-H				
C1-P4		CAN-L				
C1-P5		AIN/CAN0				
C1-P6		DIN	/6.D4	Cabinet HL	KN-75	Crane Active
C1-P7		DIN	/7.D2	Cabinet HL	KNM-75	Set Jib Out
C1-P8		Sensor 5VDC+				
C1-P9		GND Sensor				
C1-P10		DIN	/7.D3	Cabinet HL	KNM-75	Set Jib In
C1-P11		DIN	/7.D1	Cabinet HL	KNM-75	Set Boom Up
C1-P12		DIN	/7.D2	Cabinet HL	KNM-75	Set Boom Down
C1-P13		DIN	/6.D6	Cabinet HL	KN-75	Arm Position
C1-P14		DIN/AIN	/6.D4	Cabinet HL	KN-75	Boom Angle
C1-P15		DIN/AIN	/6.D6	Cabinet HL	KN-75	Jib Angle
C1-P16		DIN/AIN				
C1-P17		DIN/AIN	/7.D3	Cabinet HL	KNM-75	Set Winch Out
C1-P18		DIN/AIN/FreqIN	/7.D3	Cabinet HL	KNM-75	Set Winch In
C1-P19		DIN/AIN/FreqIN	/9.D3	Cabinet HL	KN-75	HL Active
C1-P20		CAN1-H				
C1-P21		CAN1-L				
C1-P22		AIN/CAN1				
C1-P23		DIN/AIN/FreqIN	/7.D4	Cabinet HL	KNM-75	Set Slewing Up
C1-P24		DIN/AIN/FreqIN	/7.D4	Cabinet HL	KNM-75	Set Slewing In
C1-P25		DIN/AIN/FreqIN				
C1-P26		DIN/AIN/FreqIN				
C1-P27		AIN/Temp/Rheo				
C1-P28		AIN/Temp/Rheo				
C1-P29		AIN/Temp/Rheo				
C1-P30		AIN/Temp/Rheo				
C1-P31		DOUT				
C1-P32		DOUT				
C1-P33		DOUT				
C1-P34		DOUT/PVG PWR				
C1-P35		DOUT/PVG PWR				
C1-P36		DOUT/PVG PWR				
C1-P37		MF-Out	/9.D2	Cabinet HL	KN-75	Swing CW Stop
C1-P38		MF-Out	/9.D2	Cabinet HL	KN-75	Swing CCW Stop
C1-P39		MF-Out	/9.D3	Cabinet HL	KN-75	Winch Lift Stop
C1-P40		MF-Out	/9.D4	Cabinet HL	KN-75	Boom Down Stop
C1-P41		MF-Out	/9.D4	Cabinet HL	KN-75	Jib Up (Out) Stop
C1-P42		MF-Out	/9.D5	Cabinet HL	KN-75	Jib Down (In) Stop
C1-P43		MF-Out	/9.D4	Cabinet HL	KN-75	HL Active
C1-P44		MF-Out	/9.D3	Cabinet HL	KN-75	AUV Lockout
C1-P45		MF-Out				
C1-P46		MF-Out *				
C2-P47		PWR+				
C2-P48		PWR+				
C2-P49		PWR+				
C2-P50		PWR+				

-KF2.1 Beckhoff EL1008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Input	DI1	/1.C2	Control Cabinet	Manual	Mode	KN-75		
5	Digital Input	DI2	/1.D6	Control Cabinet	Relay	Pump Stop	KN-75	DI	
2	Digital Input	DI3		Control Cabinet	Relay	Pump Start	KN-75	DI	
6	Digital Input	DI4	/1.D8	Radio Control	Flood Light	Button	KN-75	DI	
3	Digital Input	DI5	/1.D4	Control Cabinet	Radio	Mode	KN-75	DI	
7	Digital Input	DI6	/1.D5	Control Cabinet	Relay	Crane Avtive	KN-75	DI	
4	Digital Input	DI7						DI	
8	Digital Input	DI8						DI	

-KF2.3 Beckhoff EL2911_1DO

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	+	DI1	/2.C6	Valve Bank	Emergency Stop	Button	KN-75	DI	
2	-								
5	+	DI2	/2.C6	Valve Bank	Emergency Stop	Contacts	KN-75	DI	
6	-								
3		DI3	/3.C1	Control Cabinet	Stop Valve				
4									
7		DI4							
8									
2`	Digital Output	DO1	/3.C2	Control Cabinet	Relay	Stop Valve		DO	
3`	0VDC								
4`	24VDC								
6`		DO1							
7`									
8`									

-KF2.2 Beckhoff EL2008

Pin	Pin Description	IO Type	Ref	IO Device Location	IO Device Type	IO Function Target	IO Function	IO Used	Signal
1	Digital Output	DO1	/5.B2	Control Cabinet	Floodlight	Reley	ON	DO	
5	Digital Output	DO2	/2.C7	Valve Bank	Emergency Stop	Light	KN-75	DO	
2	Digital Output	DO3						DO	
6	Digital Output	DO4						DO	
3	Digital Output	DO5						DO	
7	Digital Output	DO6						DO	
4	Digital Output	DO7						DO	
8	Digital Output	DO8						DO	

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Circuit Diagram
Deck Crane AUV
IO List

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+Switch Board

+B51 -F1

2	BN	-W501 3G2,5mm²	BN 1
4	BU		BU 2
GND	GN/YE		GN/YE PE

+B51 -X1

1	1	-W503-1 14x1,5mm² Shielded	1	+X51 -X1 1
2	2		2	2
3	3		3	3
1	4		4	4
2	5		5	5
3	6		6	6
4	7		7	7
5	8		8	8
6	9		9	9
7	10		10	10
10	11		11	11
11	12		12	12
12				1
13	1	-W503-2 14x1,5mm² Shielded	1	13
14	2		2	14
15	3			1
16	4			
17	5		3	15
18	6		4	16
19	7			1
20	8			
21	9		5	17
22	10		6	18
23	11			1
24	12			
26	13		7	19
27	14		8	20
				1
			9	21
			10	22
				1
			11	23
			12	24
				1
			13	26
			14	27
				1

8	1	-WI-01 12G0,75mm²	1	-S1 21
1	2		2	22
2	3		3	23
3	4		4	24
4	5		5	11
5	6		6	12
6	7		7	X1
7	8		8	X2

Function Stop

1	1	-WI-03 3G0,75mm²	1	-Y0 1
2	2		2	2

Activate

BU	11	-WI-04 3G1mm²	BU	-Y1 2
BN	12		BN	3
G/Y	1		G/Y	1

Swing Valve

BU	13	-WI-05 3G1mm²	BU	-Y2 2
BN	14		BN	3
G/Y	1		G/Y	1

Boom Valve

BU	15	-WI-06 3G1mm²	BU	-Y3 2
BN	16		BN	3
G/Y	1		G/Y	1

Jib Valve

BU	17	-WI-07 3G1mm²	BU	-Y4 2
BN	18		BN	3
G/Y	1		G/Y	1

Winch 1 Valve

BU	19	-WI-08 3G1mm²	BU	-Y5 2
BN	20		BN	3
G/Y	1		G/Y	1

Winch DH Valve

BU	21	-WI-09 3G1mm²	BU	-Y6 2
BN	22		BN	3
G/Y	1		G/Y	1

Slewing DH Valve

BU	23	-WI-10 3G1mm²	BU	-Y7 2
BN	24		BN	3
G/Y	1		G/Y	1

Tilting DH Valve

BU	26	-WI-11 3G1mm²	G/Y	+X54 -X1 1	BN	-WI-12 3G1mm² BN -Y7.1 1
BN	27		BU	2	BU	BU 2
G/Y	1					
			BN	1	BN	-WI-13 3G1mm² BN -Y7.2 1
			BN	3	BU	BU 2

DH Tilt Float

DH Tilt Float

+B51 -X0

-	BU	-W508 3G1mm²	BU -H2 X2
			BN X1

+B51 -X1

29	BN

Heavy Lift Active Lamp

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Termination Diagram
Deck Crane AUV

=KN-75

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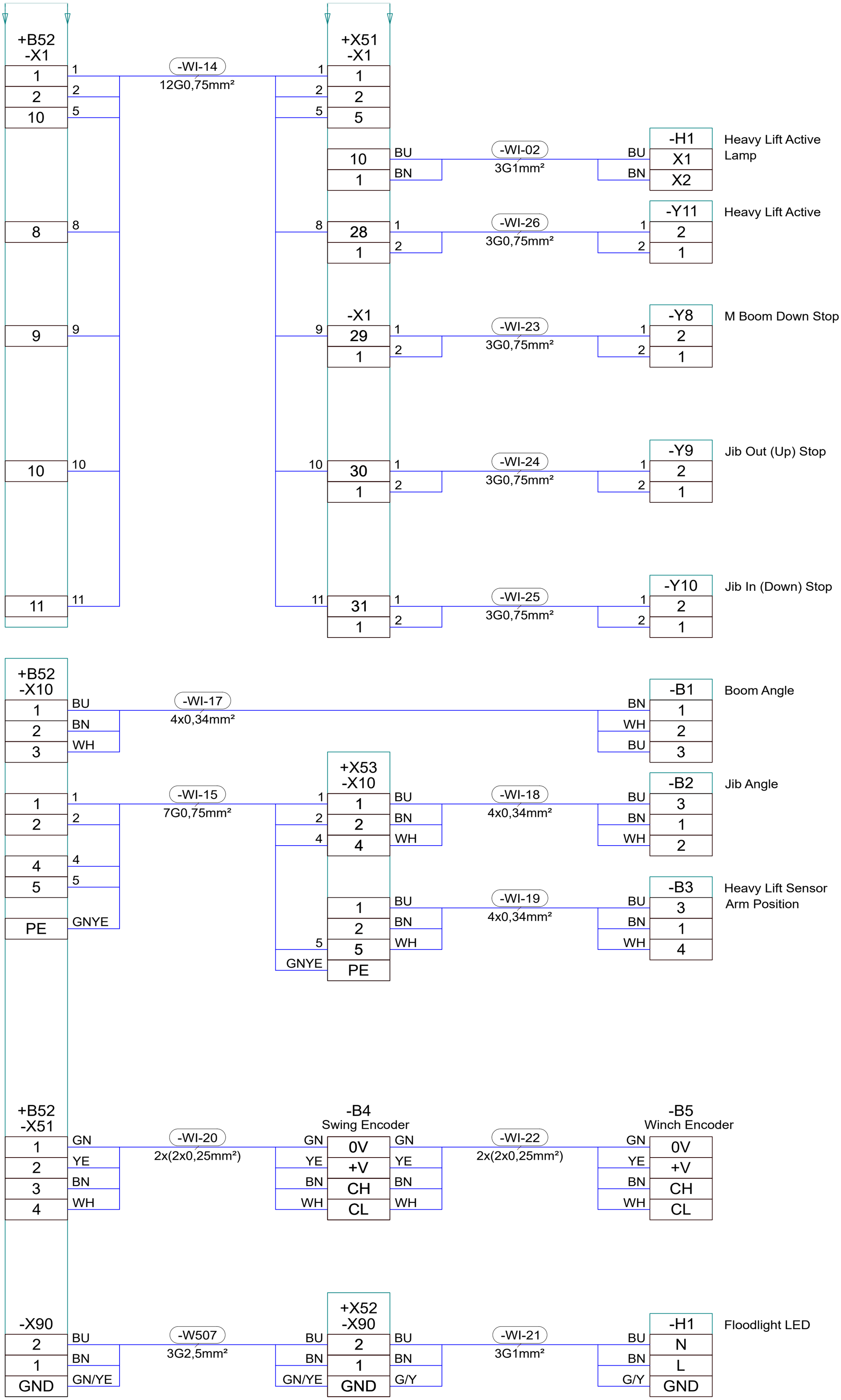

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Termination Diagram
Deck Crane AUV

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E-4505 - 05

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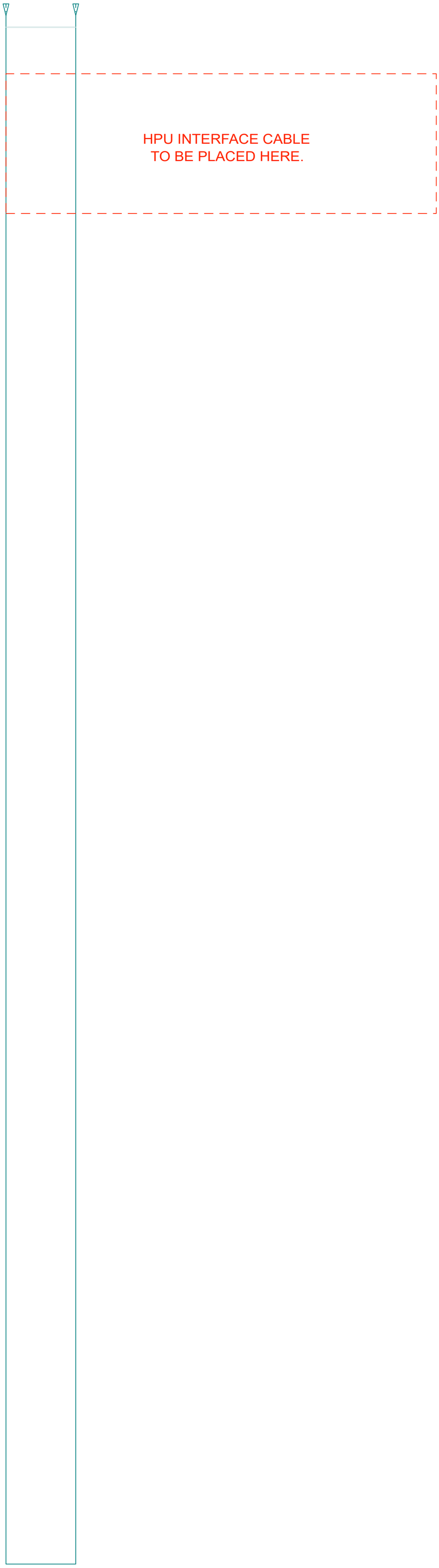

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Termination Diagram
Deck Crane AUV

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-A1	RC-DCR-HBC.S2.2-12	400198452		1	Pcs	Deck Crane 12	HBC	
-CAB1	ADO201	07939034	24 138 75	1	Pcs	CABINET, DOORSTOPPER, ADO, ELDON	Eldon	
-CAB1	MAS0605030	400089006	24 174 95	1	Pcs	CABINET, 600x500x300 ELDON*	Eldon	
-D1	1N4007	07908003		1	Pcs	Diode, 1kV, 1A	Diotec	
-DUCT1..-DUCT3	HA760040	07920015	12 857 18	1.005	M	CABLE TRAY, 60X40, GREY, W/LID	Tehalit Hager	
-F1	C60H/C 06-2	07938006	1676064	1	Pcs	FUSE, AUTOMAT, 6A, 2-POLE, C	Schneider	
-G1	CS10.241	07949016	66 040 29	1	Pcs	POWER SUPPLY, PULSE, 10A, 230/24	Puls	
-GL1	ST-M 16 x 1.5	07928032	12 477 13	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-H1	ZBVB3	07924016	43 032 26	1	Pcs	LAMP, LED, GN, 24V	Schneider	
-JB1	CPG-170	07904003		1	Pcs	JUNCTION BOX, POLYESTER, 160x75x55	Bernstein	
-K1..-K2,-K10,-K22..-K24,-K27	C12A21X24D	07936028	43 791 08	7	Pcs	RELAY, RELECO, 2-POLE, 24V, DC, 5A	Releco	
-K1..-K2,-K10,-K22..-K24,-K27	S-12	07942015	43 791 01	7	Pcs	RELAY, SOCKET, RELECO, 2-POLE	Releco	
-K3	C9A41FX24D	07936016	43 785 77	1	Pcs	RELAY, RELECO, 4-POLE, 24V DC, 5A	Releco	
-K3	S9-M	07942014	43 786 79	1	Pcs	RELAY, SOCKET, 4-POLE	Releco	
-K12	C7A20FX24D	07936015	43 783 87	1	Pcs	RELAY, RELECO, 2-POLE, 24V DC, 10A	Releco	
-K12	S7-I/O			1	Pcs	RELAY, SOCKET	Releco	
-K25	PSR-SPP- 24UC/ESA2/4X1/ 1X2/B	400109393	29 639 54	1	Pcs	SAFETY RELAY	Phoenix Contact	
-K26	C10A10X24D	07936014	43 781 45	1	Pcs	RELAY, RELECO, 1-POLE, 24V, DC, 10A	Releco	
-K26	S-10	07942012	43 782 84	1	Pcs	RELAY, SOCKET, RELECO 1-POLE	Releco	
-KF2.0	EK1101	400142335		1	Pcs	EtherCAT Coupler w ID settings	Beckhoff	
-KF2.1	EL1008	400142339		1	Pcs	8 Digital Inputs	Beckhoff	
-KF2.2	EL2008	400142342		1	Pcs	8 Digital Outputs	Beckhoff	
-KF2.3	EL2911_1DO	400142346		1	Pcs	TwinSAFE 4 Digital Inputs, 1x Output	Beckhoff	
-KF2.4	EL9011	400142410		1	Pcs	Bus end cap	Beckhoff	
-PATCH-01,-PATCH-02	Patch Cable STP Kat.6A 1m	400221331		2	Pcs	CABLE, S/FTP 4x2x0,16mm², SHIELDED	Lanse	
-RAIL1..-RAIL3	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	1.308	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S1	ZB4BK1333	07960019	43 025 24	1	Pcs	CONTR. SWITCH, 3 POS, LED GN	Schneider	
-S1	ZB4BZ009	07961012	43 027 45	2	Pcs	CONTR. ACC, SOCKET, METAL	Schneider	
-S1	ZBE101	07961013	43 004 23	2	Pcs	CONTR. ACC, CONTACTBLOCK, 1NO	Schneider	
-TAG1	US-EMLP-HA 24	400075270		1	Pcs	TAG, SIGN, THERMOMARK CARD	Phoenix Contact	
-TAG2	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-TAG3	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	

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Part List
Deck Crane AUV

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E-4505 - 07
Rev. 06
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Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-X0	AEP 3C 2.5	400069937	12 694 11	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0	AEP AP12			1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X0..-X2,-X90	AEB 35 SC/1	400073887	12 654 34	14	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X0 (-)	AAP12 10/4X2.5 LO-LI BL			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (-,-,-)	AAP12 2.5 LI BL			3	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+)	AAP12 10/4X2.5 LO-LI RD			1	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (+,+)	AAP12 2.5 LI RD			2	Pcs	TERMINAL BLOCK, SNAP-IN,	Weidmüller	
-X0 (GND)	JORDSKINNE 21	07918007		1	Pcs	RAIL, GRN, BRASS, 21 SLOT	Weidmüller	
-X0 (GND,GND)	A3C 2.5 PE	400074010	12 654 16	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1	WAP WDK 2.5	07935011	12 689 10	1	Pcs	TERMINAL BLOCK, END PLATE	Weidmüller	
-X1 (2-3,3-10,25-29),-X2 (1-8) ,-X52 (CAN-Loop)	A3C 2.5	400069932	12 654 01	24	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (11-24)	WDK 2.5/D/3 Transient	05914001		14	Pcs	TERMINAL BLOCK, 102310, ELECTRONICS	Triplex	
-X1 (GND),-X90 (GND)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X90 (1-2)	A2C 2.5	400069931	12 654 00	2	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X91,-X92	IE-TO-RJ45-FJ-B	07930061		2	Pcs	CONNECTOR, FEMALE, RJ45, RAIL MOUNT	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

=KN-75
+B51

E-4505 - 07
Rev. 06
2 / 12

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-A1	DTM-50	6796300502		1	Pcs	CONNECTOR, SET, DANFOSS, MC050, TERMINATED	Danfoss	
-A1	MC050-110	07963055		1	Pcs	PLC, DANFOSS, MICROCONTROLLER, 22IN/ 16OUT	Danfoss	
-CAB1	KS1432500	07939008	24 302 52	1	Pcs	CABINET, 350x250x150 RITTAL PLASTIC	Rittal	
-DUCT1..-DUCT3	HA760025	07920014	12 857 17	0.487	M	CABLE TRAY, 60X25, GREY, W/LID	Tehalit Hager	
-JB1..-JB4	CMEB	07904039		4	Pcs	JUNCTION BOX, PLASTIC, CMEB, F/DIN TS35	Camdenboss	
-K21..-K24	C10A10X24D	07936014	43 781 45	4	Pcs	RELAY, RELECO, 1-POLE, 24V, DC, 10A	Releco	
-K21..-K24	S-10	07942012	43 782 84	4	Pcs	RELAY, SOCKET, RELECO 1-POLE	Releco	
-R1	RND 155M207F120RTKRTB5K0	07998018		1	Pcs	Resistor, 120Ω, 0.6W, 1%	RND Components	
-RAIL1,-RAIL2	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.37	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-S1.1..-S3.1,-S4.1	5637AB	07905040		4	Pcs	SWITCH, ROCKER 1-0-1	Apem	
-S1..-S4	1.15.106.301/0313	07905041		4	Pcs	PUSH BUTTON, 0-1, Ø9.1MM, RD	Rafi	
-TAG1	US-EMLP 100X60 4 Line	07958308		1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1 (1),-X51 (PE)	A3C 2.5 PE	400074010	12 654 16	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1 (1,1,1-2,2,2-3,5),-X51 (1-4,CAN-Loop),-X52 (CAN-Loop)	A3C 2.5	400069932	12 654 01	14	Pcs	TERMINAL BLOCK, SNAP-IN, DOUBLE	Weidmüller	
-X1 (8-16)	A2T 2.5	400073880	12 654 14	9	Pcs	TERMINAL BLOCK, SNAP-IN, TWO HIGHTS	Weidmüller	
-X1 (PE)	A2C 2.5 PE	400074009	12 654 15	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1,-X10,-X51	AEB 35 SC/1	400073887	12 654 34	5	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1,-X10,-X51	AEP 3C 2.5	400069937	12 694 11	3	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X10	WAP WDK 2.5	07935011	12 689 10	1	Pcs	TERMINAL BLOCK, END PLATE	Weidmüller	
-X10 (3-4)	WDK 2.5 ANALOG	05914006		2	Pcs	TERMINAL BLOCK	Triplex	

Rev.	Description	Date	Rev. by		
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

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+B52

E-4505 - 07
Rev. 06
3 / 12

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL10,-GL12,-GL14..-GL17	ST-M 16 x 1.5	07928032	12 477 13	15	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-GL11	ST-M 20 x 1.5	07928033	12 477 14	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-GL13	ST-M 50 x 1.5	07928037	12 477 18	1	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø26-38	Lapp	
-JB1	CPG-300	07904005		1	Pcs	JUNCTION BOX, POLYESTER, 260x160x91	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.244	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2T 2.5 PE	400074011	12 654 22	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X1	AEP 2T 2.5	400073883	12 694 40	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1-10,10-24,26-31)	A2T 2.5	400073880	12 654 14	31	Pcs	TERMINAL BLOCK, SNAP-IN, TWO HIGHTS	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

=KN-75
+X51

E-4505 - 07
Rev. 06
4 / 12

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1,-GL2	ST-M 20 x 1.5	07928033	12 477 14	2	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø6-12	Lapp	
-JB1	CPG-220	07904002		1	Pcs	JUNCTION BOX, POLYESTER, 122x120x90	Bernstein	
-RAIL2	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.1	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X90	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X90 (1-2)	A2C 2.5	400069931	12 654 00	2	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	
-X90 (GND)	A2C 2.5 PE	400074009	12 654 15	1	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

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+X52

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Rev. 06
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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL3	ST-M 12 x 1.5	07928031	12 477 12	3	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3-6,5	Lapp	
-GL4..-GL6	ST-M 16 x 1.5	07928032	12 477 13	3	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-JB1	CPG-240	07904004		1	Pcs	JUNCTION BOX, POLYESTER, 220x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.2	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X10 (PE),-X51 (PE)	A2C 2.5 PE	400074009	12 654 15	2	Pcs	TERMINAL BLOCK, SNAP-IN, GND	Weidmüller	
-X10,-X51	AEB 35 SC/1	400073887	12 654 34	3	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X51	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

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Rev. 06
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Printed: 05.02.2025 10:48

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-GL1..-GL3	ST-M 16 x 1.5	07928032	12 477 13	3	Pcs	CABLE GLAND, PLASTIC, SKINTOP, Ø3,5-8	Lapp	
-JB1	CPG-220	07904002		1	Pcs	JUNCTION BOX, POLYESTER, 122x120x90	Bernstein	
-RAIL1	TS 35X7.5 6.2MM HULLET	07940001	12 692 14	0.1	M	RAIL, PERFORATED, TS35 x 7,5 x 6,2mm	Weidmüller	
-TAG1	US-EMLP 60X30	07958306	12 684 08	1	Pcs	TAG, SIGN, THERMOMARK CARD, W/GLUE	Phoenix Contact	
-X1	AEB 35 SC/1	400073887	12 654 34	2	Pcs	TERMINAL BLOCK, SNAP-IN, END LOCK	Weidmüller	
-X1	AEP 2C 2.5	400069933	12 694 10	1	Pcs	TERMINAL BLOCK, SNAP-IN, END PLATE	Weidmüller	
-X1 (1,1-3)	A2C 2.5	400069931	12 654 00	4	Pcs	TERMINAL BLOCK, SNAP-IN, SINGLE	Weidmüller	

Rev.	Description	Date	Rev. by		
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
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+X54

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Rev. 06
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Printed: 05.02.2025 10:48

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-H2	853 300 55	400063431		1	Pcs	LAMP, BEACON, LED, YE, 24V	Werma	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

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+Z50

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Printed: 05.02.2025 10:48

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B1	RFC 4801 636 121 501	07917056		1	Pcs	SENSOR, ANGLE, 24V, 4-20mA, 360°, M12	Novotechnik	
-B4,-B5	K-8.5868.3221.2113C	07917203		2	Pcs	SENSOR, ROTATION, ABSOLUT, MULTITURN, 10x20mm	Kübler	
-R2	RND 155M207F120RTKRTB5K0	07998018		1	Pcs	Resistor, 120Ω, 0.6W, 1%	RND Components	
-WI-14	ROFLEX 12G0.75	07915014		1	Pcs	CABLE, 12G0.75mm²	Lapp	
-WI-15	ØLFLEX FD 855 CP 7G0.75	400111231	10 905 14	1	Pcs	CABLE, 7x0,75mm², SHIELDED	Lapp	
-WI-17	V1-WV4A-30M-PUR	400090572		1	Pcs	SENSOR, CABLE, M12, 4-PIN, ANGLE, 30M	Pepperl & Fuchs	
-WI-20,-WI-22	BUS FD P CAN UL/CSA 2x2x0.25	07915044		2	Pcs	CABLE, 2x2x0,25mm²	Lapp	
-WI-21	ROFLEX 3G1	07915017		1	Pcs	CABLE, 3G1mm²	Lapp	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

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+Z51

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Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-B2	RFC 4801 636 121 501	07917056		1	Pcs	SENSOR, ANGLE, 24V, 4-20mA, 360°, M12	Novotechnik	
-B3	NBN40-L2-A2-V1	07917215		1	Pcs	SENSOR, PROX, 40X40, NO/NC, SN40, M12	Pepperl & Fuchs	
-H1	FL60 9000 850 120 M24 MB	400072975		1	Pcs	FLOODLIGHT, LED, 80W, 120V, MEDIUM BEAM	Glamox	
-R2	RND 155M207F120RTKRTB5K0	07998018		1	Pcs	Resistor, 120Ω, 0.6W, 1%	RND Components	
-WI-18,-WI-19	V1-WV4A-30M-PUR	400090572		2	Pcs	SENSOR, CABLE, M12, 4-PIN, ANGLE, 30M	Pepperl & Fuchs	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

=KN-75
+Z52

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Rev. 06
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Printed: 05.02.2025 10:48

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-H1	853 300 55	400063431		1	Pcs	LAMP, BEACON, LED, YE, 24V	Werma	
-S1	XALK178W3B140G	400208317	4322660	1	Pcs	CONTR. PUSH, EM STOP	Schneider	
-S1	ZBE102	07961015	43 004 24	1	Pcs	CONTR. ACC, CONTACTBLOCK, 1NC	Schneider	
-WI-01	ROFLEX 12G0.75	07915014		1	Pcs	CABLE, 12G0.75mm²	Lapp	
-WI-02,-WI-04,-WI-05,-WI-06,-WI-07,-WI-08,-WI-09,-WI-10,-WI-11	ROFLEX 3G1	07915017		9	Pcs	CABLE, 3G1mm²	Lapp	
-WI-03,-WI-23,-WI-24,-WI-25,-WI-26	7074-18021-2360500	07930051		5	Pcs	CONNECTOR, VALVE, MURR, 5M, SS	Murr	
-X53				1	Pcs			
-Y9,-Y10	HAWE ON/OFF VALVE			2	Pcs	VALVE, ON/OFF	Hawe	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
04	Issued for production	07.07.2023	GM	Appr. by	WJ

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Part List
Deck Crane AUV

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+Z53

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Rev. 06
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Printed: 05.02.2025 10:48

Template:

Device ID	Device	Part No.	El. No.	Qty	Unit	Description	Manufacturer	Link
-WI-12,-WI-13	ROFLEX 3G1	07915017		2	Pcs	CABLE, 3G1mm²	Lapp	

Rev.	Description	Date	Rev. by	Standard	
06	As built SAT	05.02.2025	WJ	Date	14.10.2021
05	Issued for production	20.12.2024	WJ	Drawn by	KS
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Part List
Deck Crane AUV

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+Z54

E-4505 - 07
Rev. 06
12 / 12

Printed: 05.02.2025 10:48

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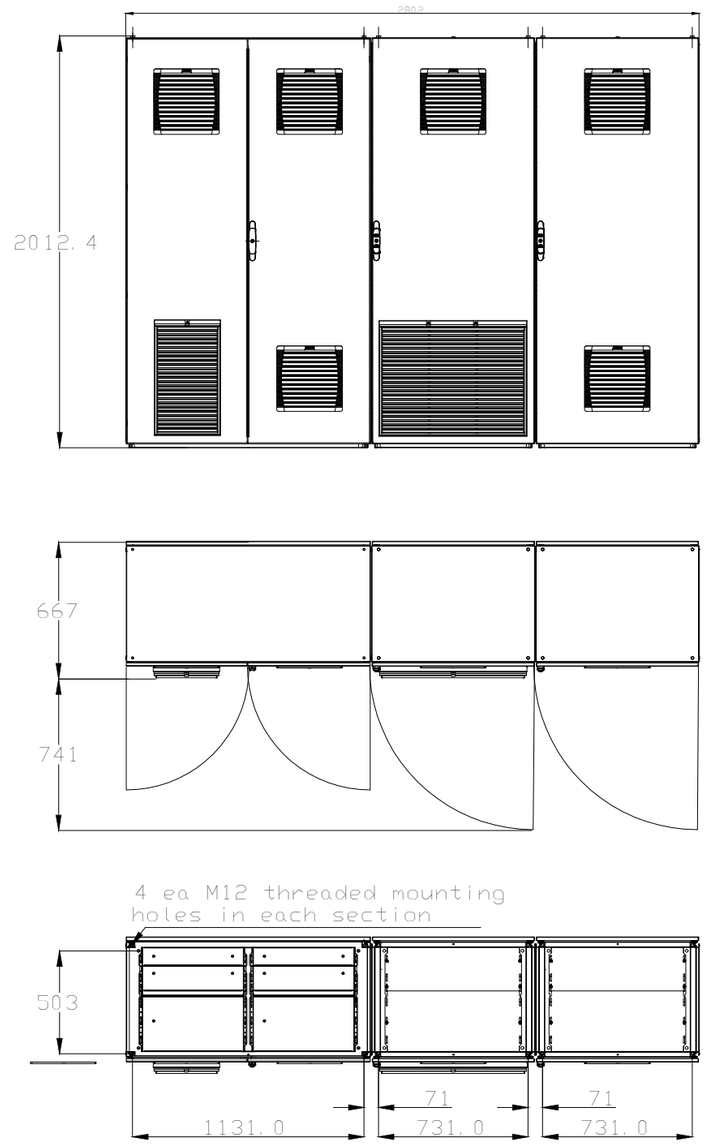

CABLE POSSITION	-UH1	-U2	-UH3

Designed by	Modified by	Date	ECO			
T Rånes		15.02.2022	ECO-2056868			

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Name	Weight
Dimension Drawing	0 kg
Description	Scale (A3)
MBARI VFD Cabinet	
Document ID 2000005807	Revision A

RADIO CONTROL

RADIO CONTROL

RADIO CONTROL

RADIO CONTROL

STERN
A–FRAME
(2x Aux W)

CTD
WINCH

CTD
DAVIT

ROV
STORAGE
DRUM

ROV
TRACTION
WINCH

OVERHEAD
CRANE
(1x Aux W)

KN–75
CRANE
(2x Aux W)

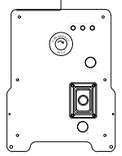
Hydraulic Local
Emergency Control

Hydraulic Local
Emergency Control

Hydraulic Local
Emergency Control

Hydraulic Local
Emergency Control

Hydraulic Local
Emergency Control
(In pedestal)



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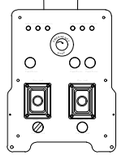

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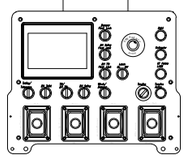

HANGAR
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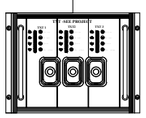
LxBxH 370x450x?

AFT
CONTROL
STATION



CONTROL ROOM PANEL
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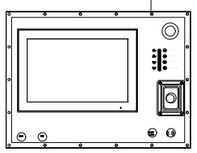
LxBxH
260x349x127



CONTROL ROOM PANEL
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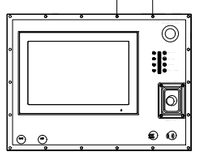
LxBxH
355x480x140

CONTROL ROOM PANEL
2000005995
LxBxH
260x187x127



CONTROL ROOM PANEL
2000003404
LxBxH
355x480x140

ROV
CONTROL
ROOM

Designed by	Modified by	Date	ECO			
R Olsen	13.10.2022	13.10.2022	ECO-2058122			

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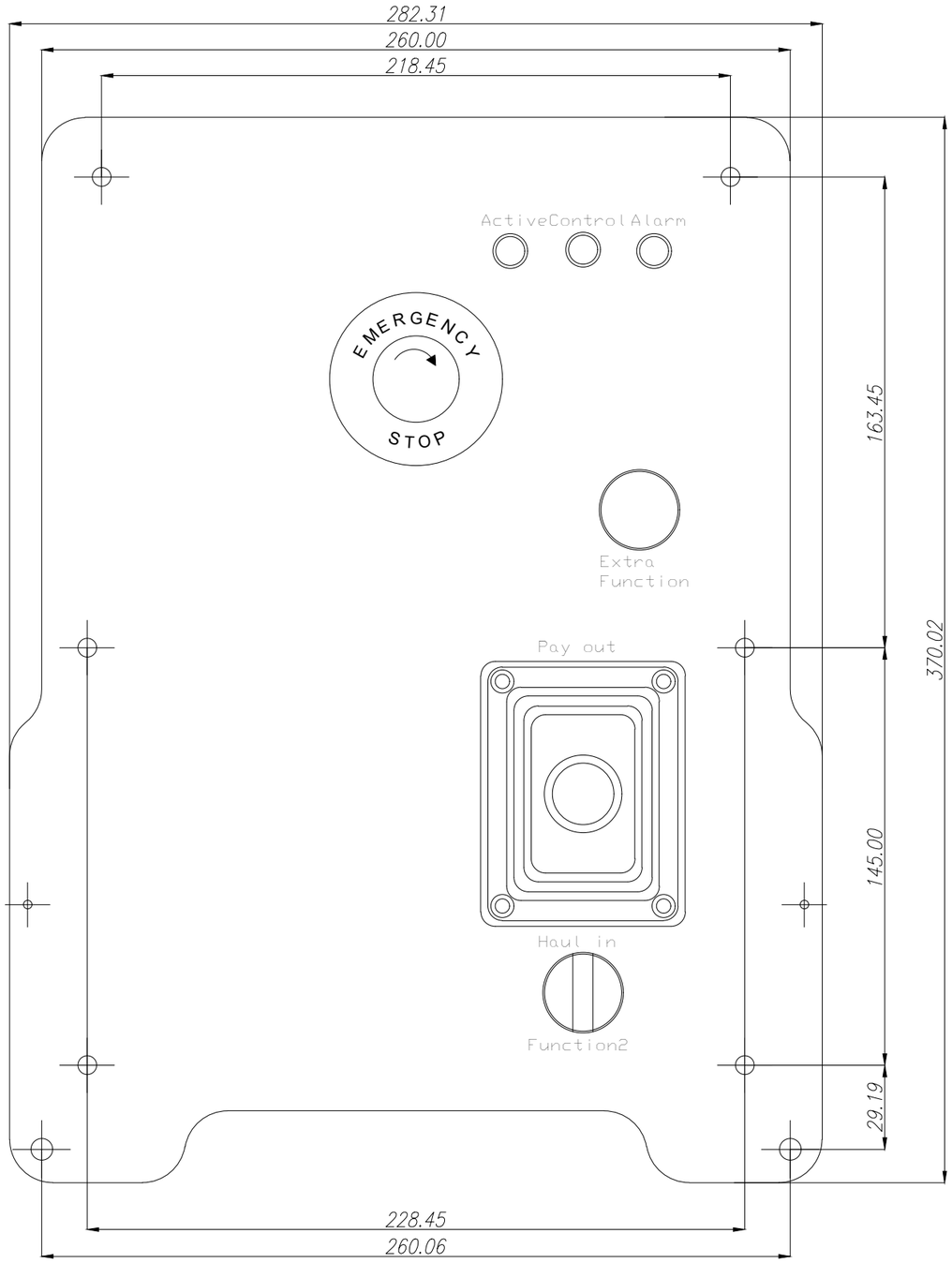
Name	Weight
System overview	0 kg
Description	Scale (A3)
Panel overview - MBARI	
Document ID: 2000005332	Revision: D



Designed by	Modified by	Date	ECO			
G Skaiå		19.01.2022	ECO-2056901			

MACGREGOR

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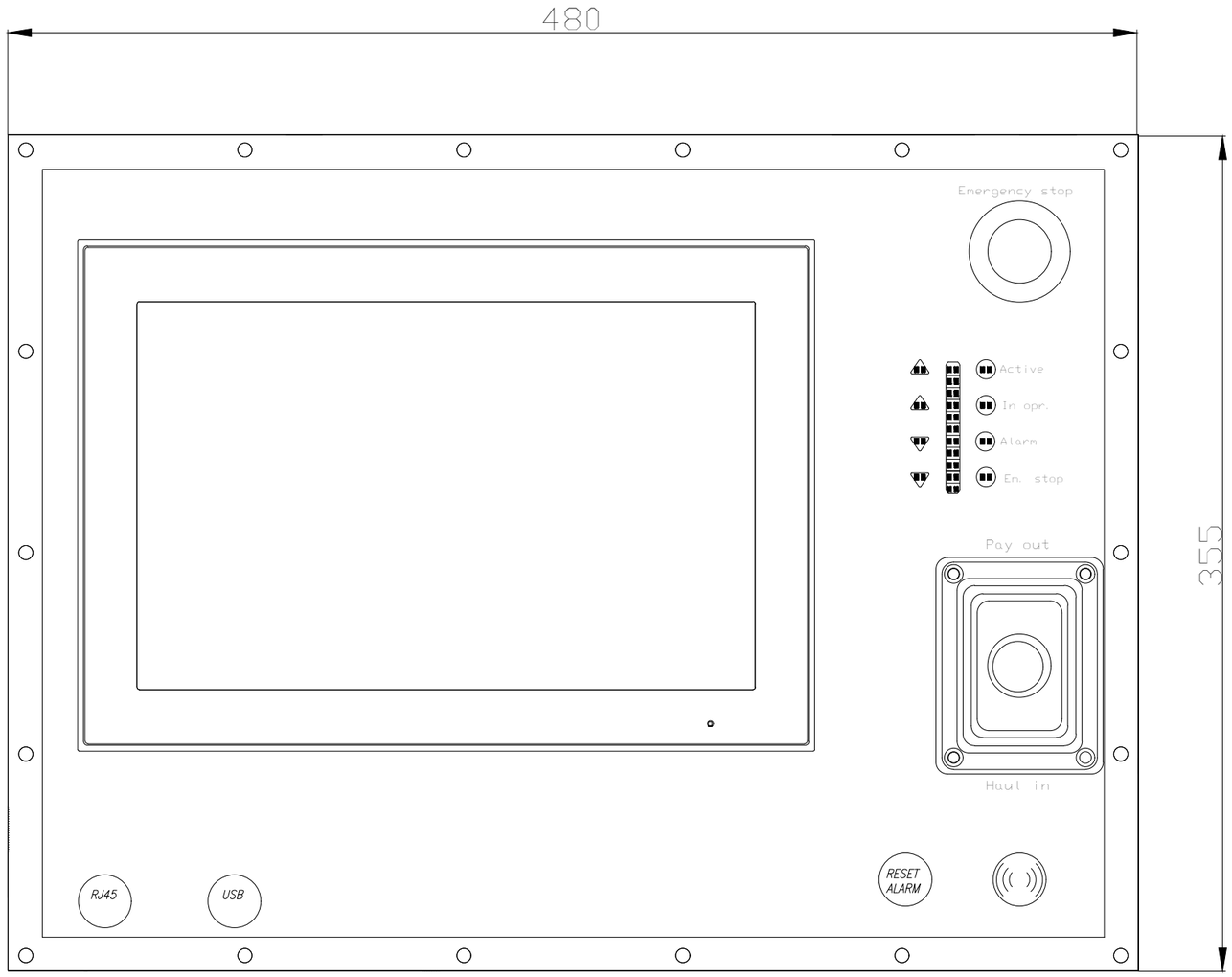
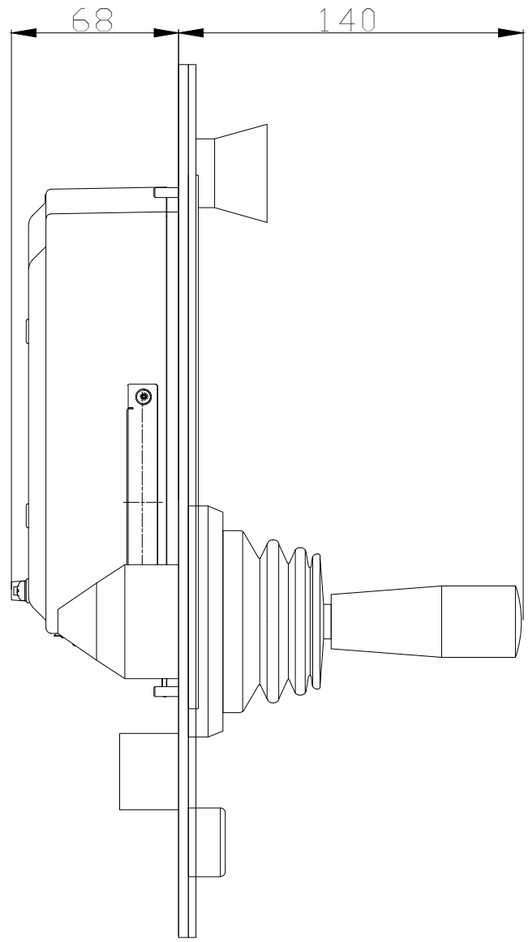
Name	Weight
Dimension Drawing	0 kg
Description	Scale (A3)
Console Deck Panel J1P0C2EMS (BBQ type)	
Document ID: 2000004949	Revision: A





Designed by	Modified by	Date	ECO			
G Skaiå	22.02.2022	22.02.2022	ECO-2056901			

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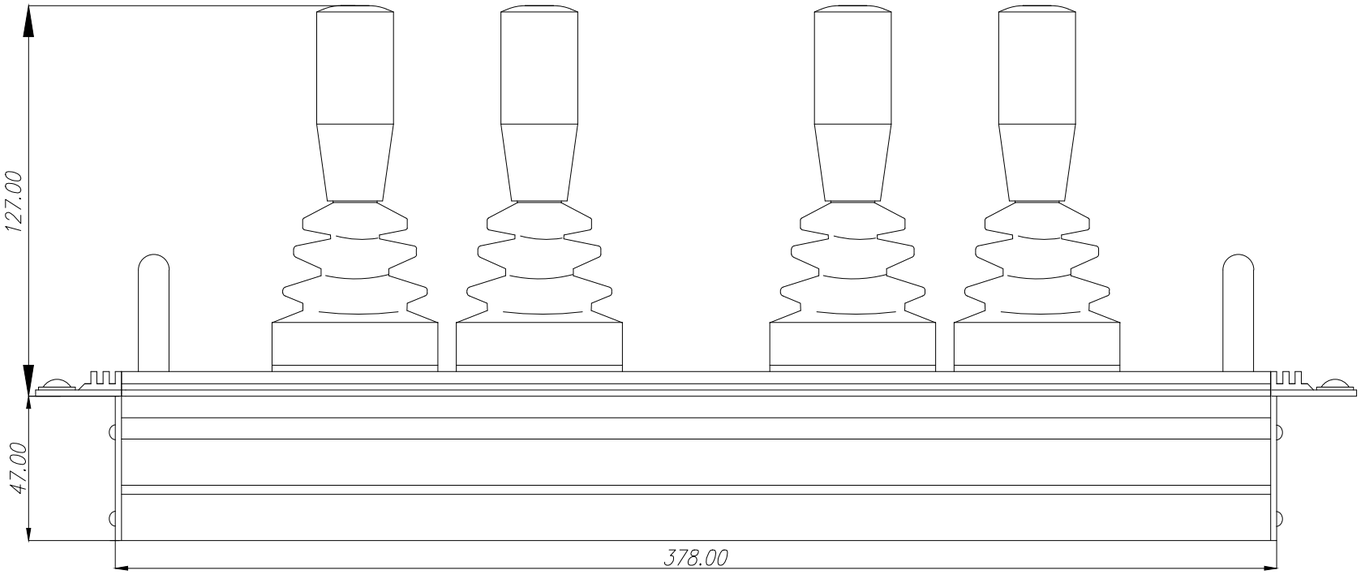
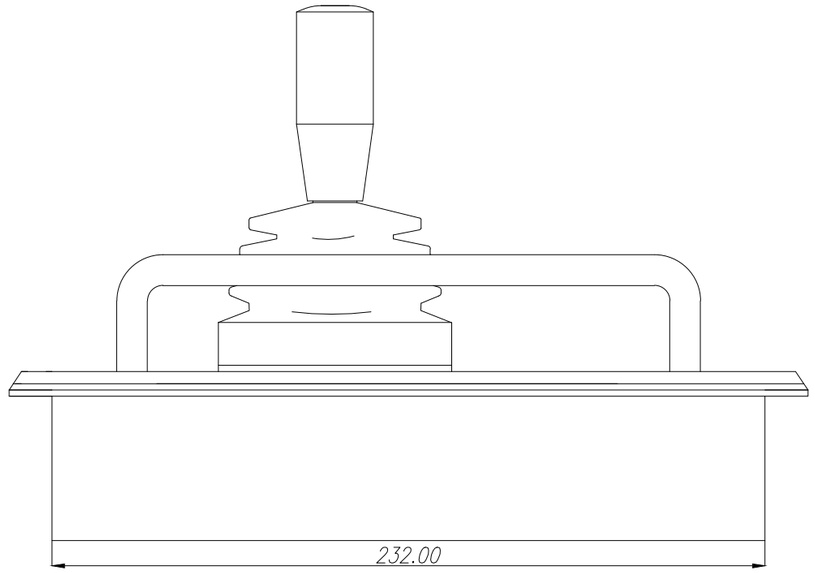
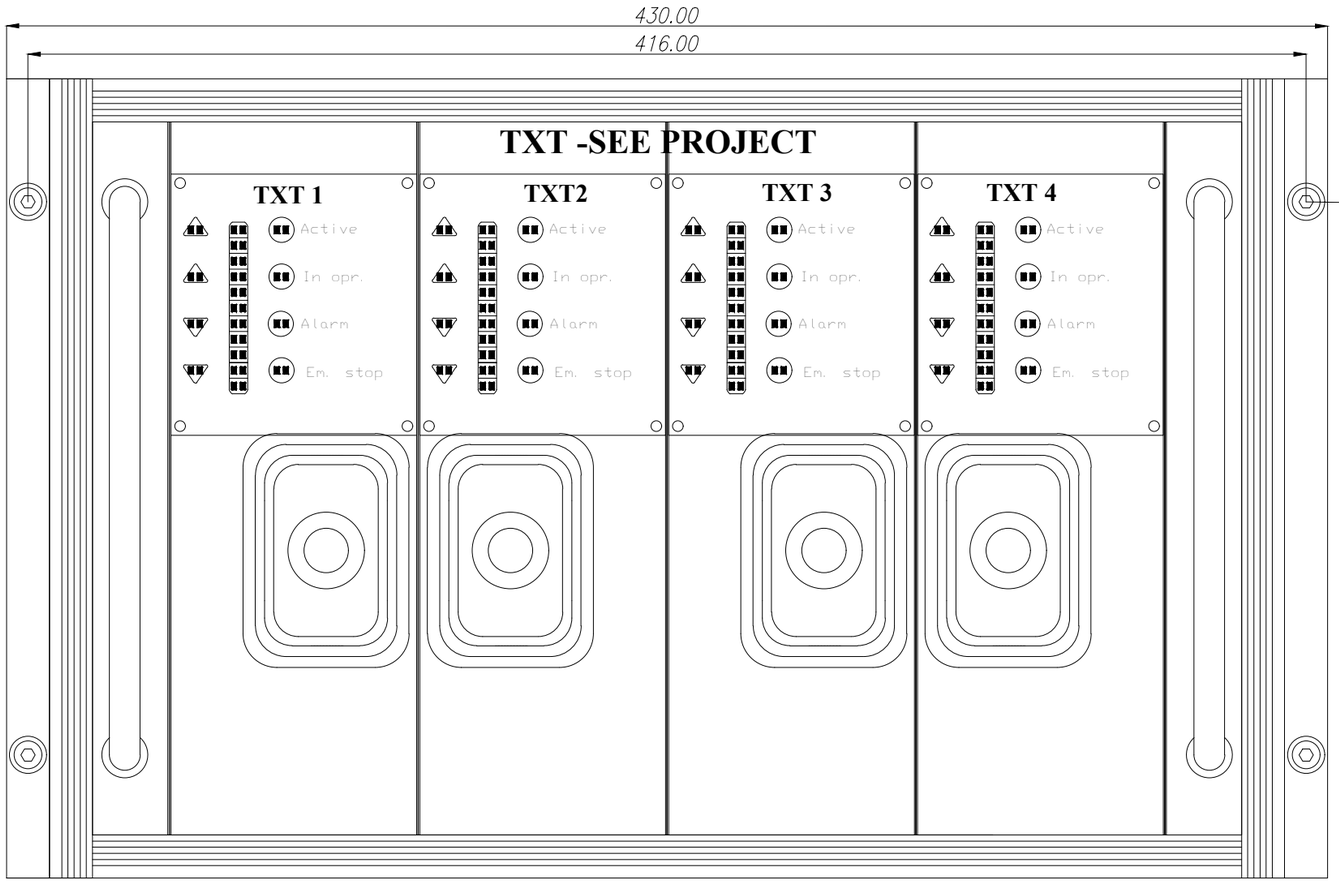
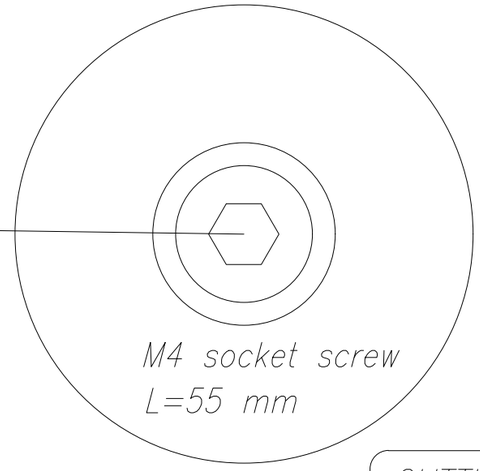
Name	Weight
Dimension Drawing	0 kg
Description	**Scale (A3)**
Control Room Panel PC-Touch,J1P0C4EMS	
Document ID	**Revision**
2000003404	B









CUTTING DIMENSION IN BOARD FOR THE PANEL IS 388 x 242 mm.

Panel labels are only for illustration purposes
It can vary as project specifics

Designed by	Modified by	Date	ECO			
G Skaiå		24.02.2022	ECO-2056928			

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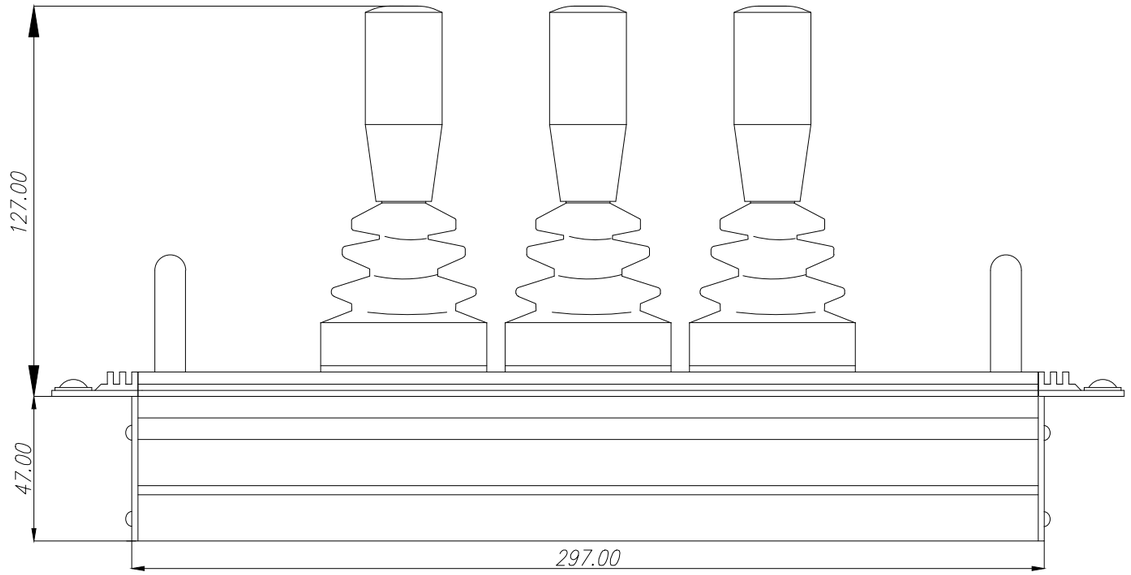
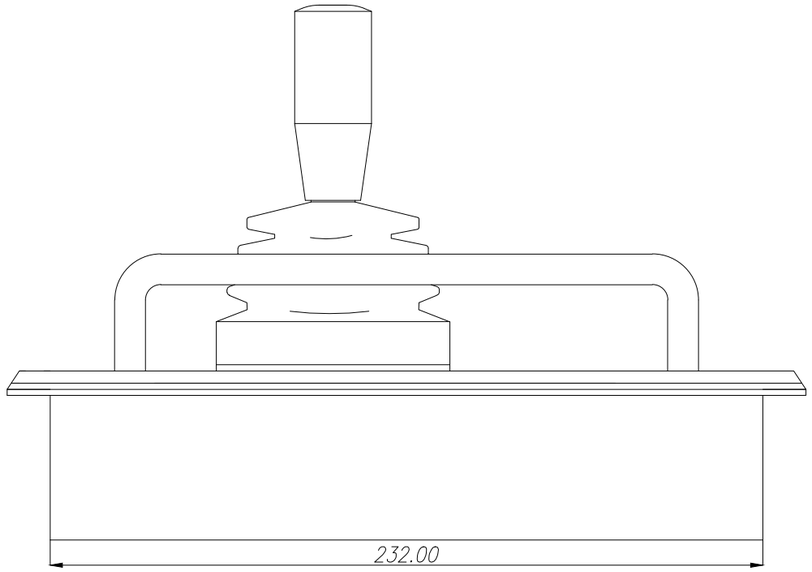
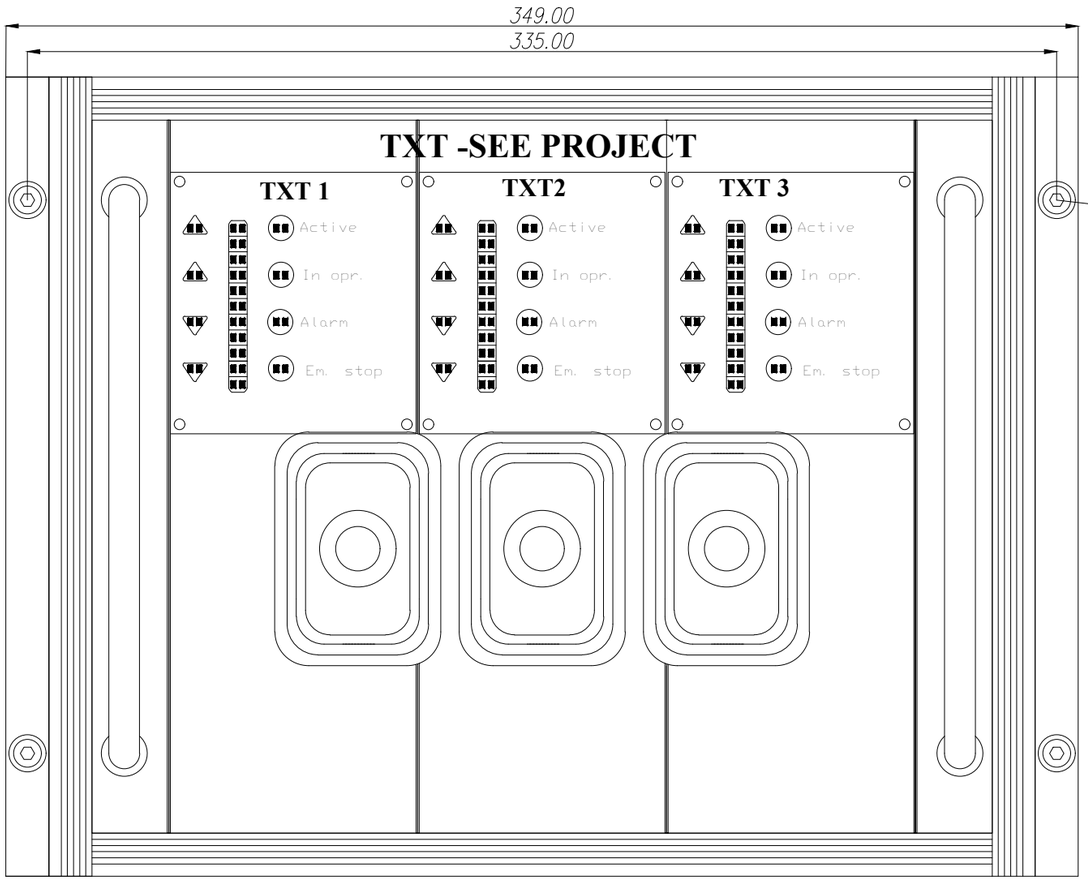
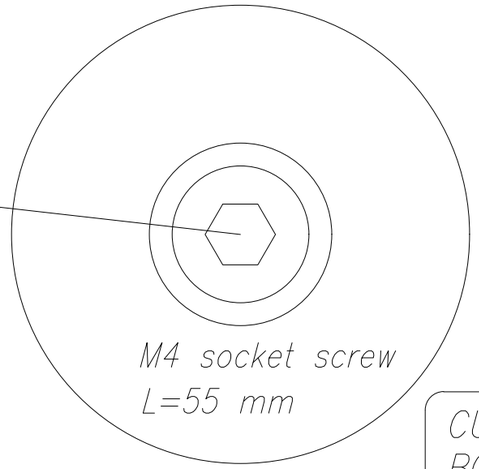
Name	Weight
Dimension Drawing	0 kg
Description: Bridge Panel J4P0C0 Layout	Scale (A3)
Document ID: 2000005997	Revision: A









CUTTING DIMENSION IN BOARD FOR THE PANEL IS 307 x 242 mm.

Panel labels are only for illustration purposes
It can vary as project specifics

Designed by	Modified by	Date	ECO			
G Skaiå	25.02.2022	25.02.2022	ECO-2056928			

MACGREGOR

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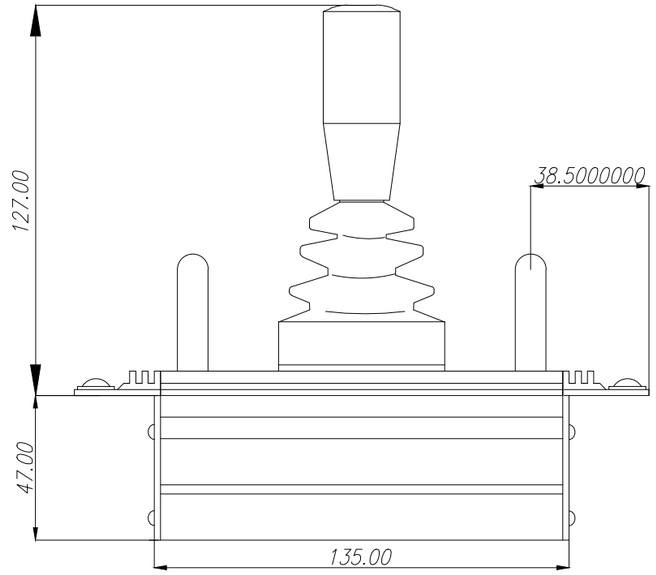
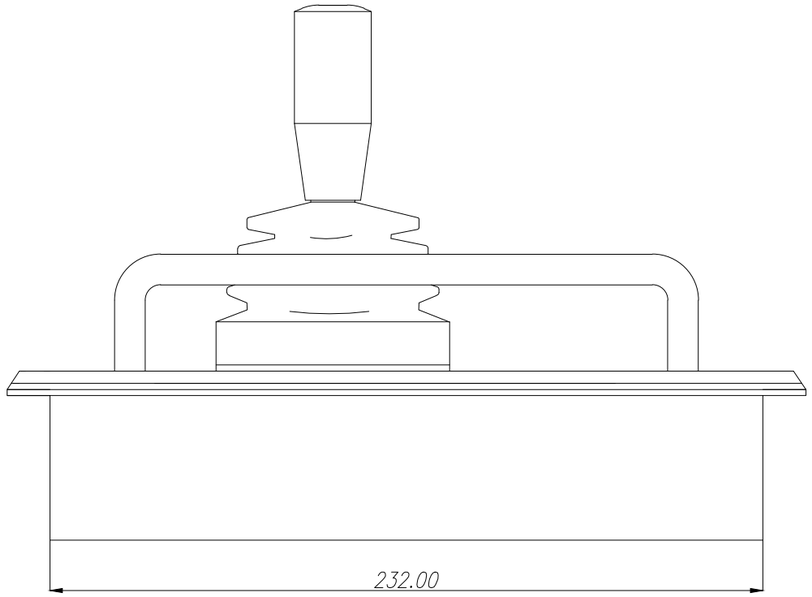
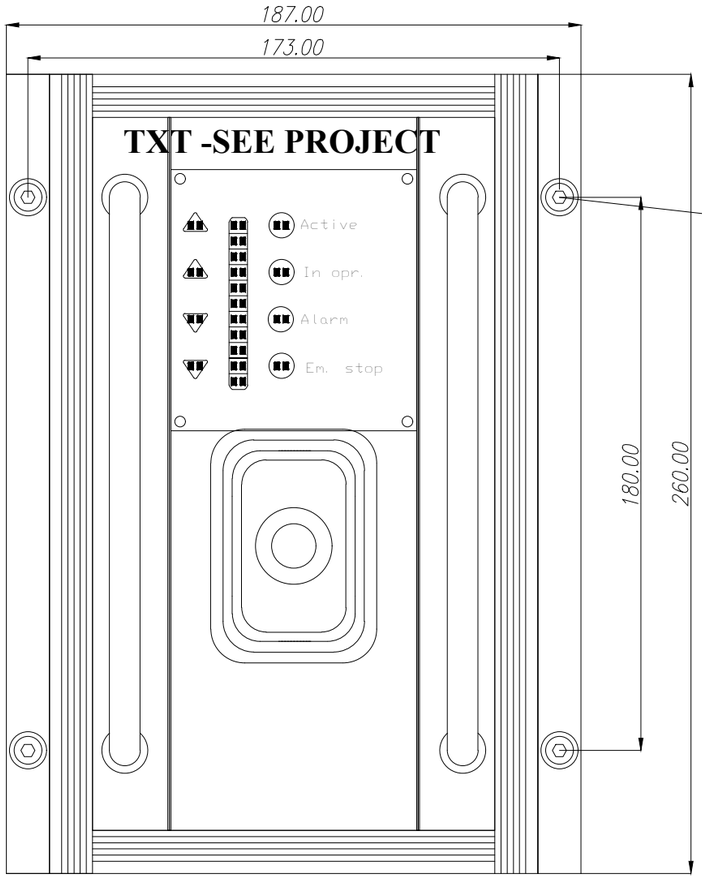
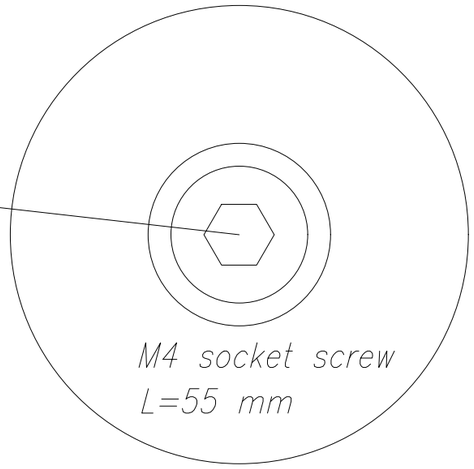
Name	Weight
Dimension Drawing	0 kg
Description	Scale (A3)
Bridge Panel J3P0C0 Layout	
Document ID: 2000005996	Revision: A









CUTTING DIMENSION IN BOARD FOR THE PANEL IS 145 x 242 mm.

Panel labels are only for illustration purposes
It can vary as project specifics

Designed by	Modified by	Date	ECO			
G Skaiå		24.02.2022	ECO-2056928			

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Name	Weight
Dimension Drawing	0 kg
Description	Scale (A3)
Bridge Panel J1P0C0 Layout	
Document ID: 2000005995	Revision: A

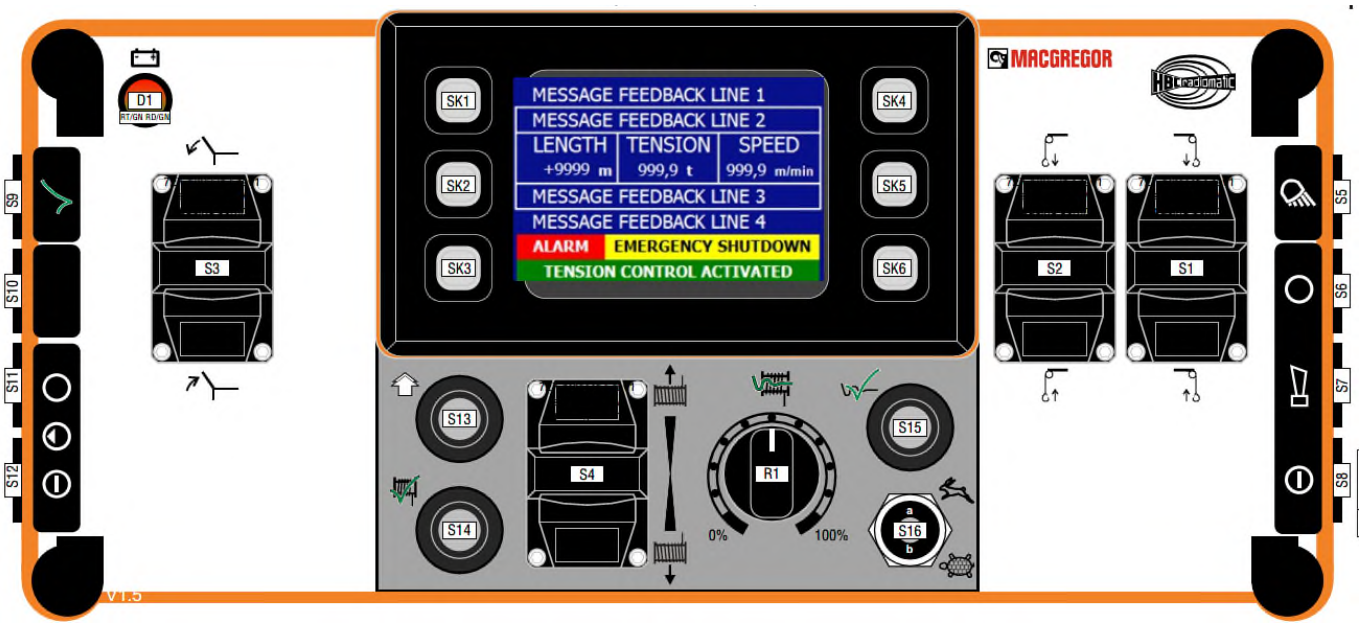
Section 4

Operating Instructions

Annex B – User Manuals

DESCRIPTION	DOC/DRW #	REV #	PAG #
Stern A-Frame Radio Control Panel Functions	-	-	3
Stern A-Frame Radio Control Operating Instructions	-	-	4
Stern A-Frame Manual Control (Valve Central)	-	-	30
CTD Davit Radio Control Panel Functions	-	-	31
CTD Davit Radio Control Operating Instructions	-	-	32
KN-75 Main Crane Radio Control Panel Functions	-	-	61
KN-75 Main Crane Radio Control Operating Instructions	-	-	62
KN-75 Main Crane Manual Control (Valve Central)	-	-	85
KN-75 Main Crane Calibration	-	-	86
ROV OHC Radio Control Panel Functions	-	-	89
ROV OHC Radio Control Operating Instructions	-	-	90
ROV OHC Manual Control (Valve Central)	-	-	123
ROV OHC One Stick Launch and Recovery	-	-	124
Pentagon 7Seas Research Users Guide	-	-	125
Pentagon 7Seas Research Users Guide - Tension Log Annex	-	-	170
Radio Control Operating Instructions, Spectrum 2 (KN-75 Main Crane)	-	-	177
Radio Control Operating Instructions, Spectrum D (Stern A-Frame, CTD Davit)	-	-	217
Radio Control Operating Instructions, Spectrum E (ROV OHC)	-	-	257

A-Frame Radio Control



Switch	Description
D1	Battery Indicator
S1	Port Winch
S2	Starboard Winch
S3	Tilt A-Frame
S4	External Winch
S5	Floodlight (on/off)
S6	Shut off radio and deactivate A-Frame
S7	Horn
S8	Turn on radio and activate A-Frame
S9	N/A
S10	N/A
S11	Stop HPU
S12	Start HPU
S13	Activate Rapp Winch (CTD)
S14	Constant tension CTD winch
S15	Manual Tension potmeter control
S16	Speed
R1	Tension Control

TRIPLEX
by MacGregor

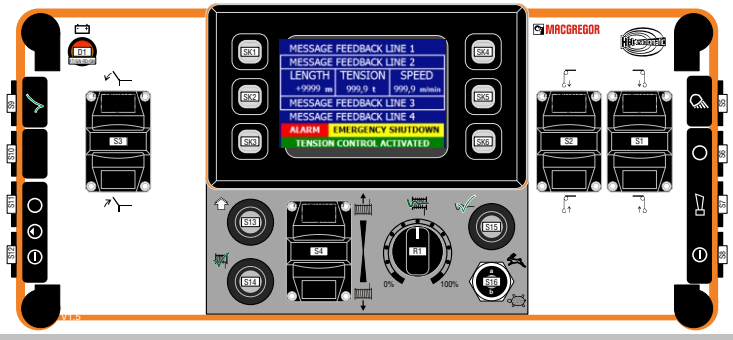
Operating Instructions

Project: MBARI R/V David Packard / A-FRAME

Triplex item nr. 400198449 RC-AFR-HBC.SD.1-22
WBS Element 4/60185.1.C1
order nr.: 4504420729

Serial nr.: 727-1802317
Model: spectrum D iLOG GI
Frequence: 2.4GHz / TC241 / Focus-T

Delivery date: 12.12.2022



spectrum D

HBC-radiomatic Norge AS
www.hbc-radiomatic.no

CE

Vedlegg 1: sikkerhets informasjon

Tilleggsinformasjon om sikkerhet

Vennligst les gjennom følgende viktig sikkerhetsinformasjon

Reservesender:
Reserve iLOG
Reserve iON

Det er ikke tillatt å bruke to sendere med samme kode (iLOG/iON) samtidig.
Reservesender eller originalsender må være innelåst !

Reservemottaker:

Det er ikke tillatt å bruke to mottakere med samme kode samtidig.
Reservemottakere eller originalmottaker må være innelåst !

Reservefunksjon:

Forhandleren har ansvar for eventuelt merking av tilleggsfunksjoner hvis reserveknapper eller reservejoysticker blir tatt i bruk

Gjenvinning av batterier:

Batterier skal ikke kastes sammen med annet avfall. I stedet, returnere batterier til godkjent gjenvinningsstasjon eller batteri forhandler som HBC-radiomatic Norge AS

Attachment 1: safety information

Additional information on safety

Please read through the following safety information

Spare transmitter:
Spare iLOG
Spare iON

It is not allowed to use two transmitters with the same code (iLOG/iON) at the same time.
Either the spare transmitter or original transmitter must be secured!

Spare receiver

It is not allowed to use two receivers with the same code at the same time.
Either the spare receiver or original receiver must be secured!

Spare function:

This system be delivered with spare buttons or joysticks. **The dealer is responsible for marking any additional functions** which may be connected in the future.

Battery disposal:

Batteries must not be disposted of with regular waste. Instead, return batteries to an approved recycling station or battery dealer. HBC-radiomatic Norge AS will take batteries in return.

The clients PLC must continuously evaluate the Active Stop command and communication OK circut!
The client has requested the ‘active stop’ function, and is thereby responsible to integrate it with their PLC system.

HBC-radiomatic Norge AS
Gamleveien 87
N-4315 Sandnes
Org.nr. 994 038 516 MVA

www.radiomatic.no
brev@radiomatic.no
Tel.: +47 47 93 49 00
Fax: +47 52 97 30 89

Bank: SR Bank
Account nr. 3201 44 58033
IBAN: NO 3432 0144 5803 3
SWIFT (BIC): SPRONO22

HBC-radiomatic
TRIPLEX
Operating Instructions
Project: MBARI R/V David Packard / A-FRAME
Triplex item nr. 400198449 RC-AFR-HBC.SD.1-22
WBS Element 4/60185.1.C1
order nr.: 4504420729
Serial nr.: 727-1802317
spectrum D
HBC-radiomatic
Operating Instructions
spectrum D
inkludert
"Tilleggsinformasjon om
sikkerhet" i bruksanvisning
727
RADIO CONTROLLED
WHEN WORKING ON THE SYSTEM, KEEP THE
RADIO CONTROL TRANSMITTER IN YOUR
POSSESSION OR PUT IT IN A SECURE PLACE
HBC-radiomatic Norge AS
www.radiomatic.no
RADIO CONTROLLED
WHEN WORKING ON THE SYSTEM, KEEP THE
RADIO CONTROL TRANSMITTER IN YOUR
POSSESSION OR PUT IT IN A SECURE PLACE
HBC-radiomatic Norge AS
www.radiomatic.no
CAUTION - VORSICHT - ATTENTION - ATTENZIONE - ATENCIÓN
RADIO REMOTE CONTROLLED
FUNKGESTEUERT
RADIOCOMMANDÉ
RADIOCOMANDATO
RADIO COMANDO
HBC-radiomatic GmbH
5m
10m
US
EU

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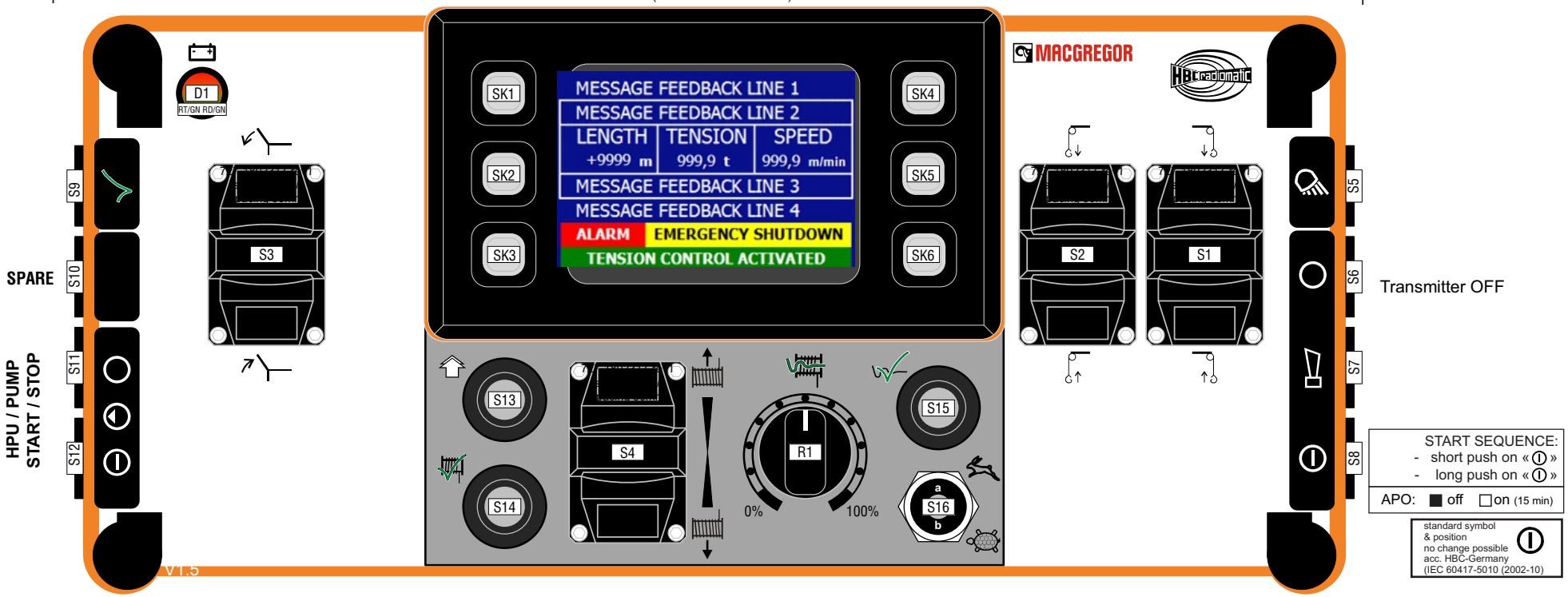
HBC-radiomatic GMBH

360 mm
(incl. roll over bar)



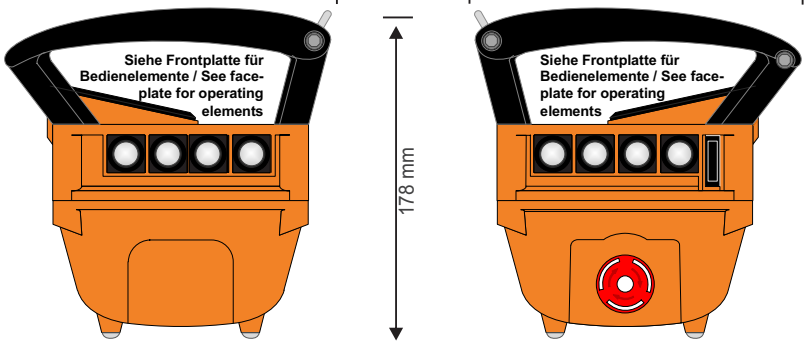
Transmitter OFF

START SEQUENCE:
- short push on «⏻»
- long push on «⏻»

APO: ■ off □ on (15 min)

standard symbol & position no change possible acc. HBC-Germany (IEC 60417-5010 (2002-10))

Links / left — Seitenansicht / sideview — Rechts / right



radiomatic ® iLOG
NOT-STOP / E-STOP

Rollover bar: stainless steel

Frontplatte / faceplate
Art / Type: Drucker
Hintergrundfarbe: weiß
Background color: white
Beschriftungsfarbe: schwarz / farbig
Label color: black / coloured

MACGREGOR

Project: MBARI
R/V David Packard / A-FRAME
400198449 RC-AFR-HBC.SD.1-22
WBS Element 4/60185.1.C1

MBARI
Monterey Bay Aquarium Research Institute

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

Rev.	Änderung	Datum	Name		
				Datum	23.03.2018
				Gezeichnet	avns
				Geprüft	avle
				Genehmigt	

Kunde HBC-radiomatic Norge
Kommission
Bestellnummer 23641
Orig. | Ersetzt | Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_02317-rev1.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung
Fabrikationsnummer 727-1802317
Auftragsnummer 21731693
V1.3
1 / 11 Bl.

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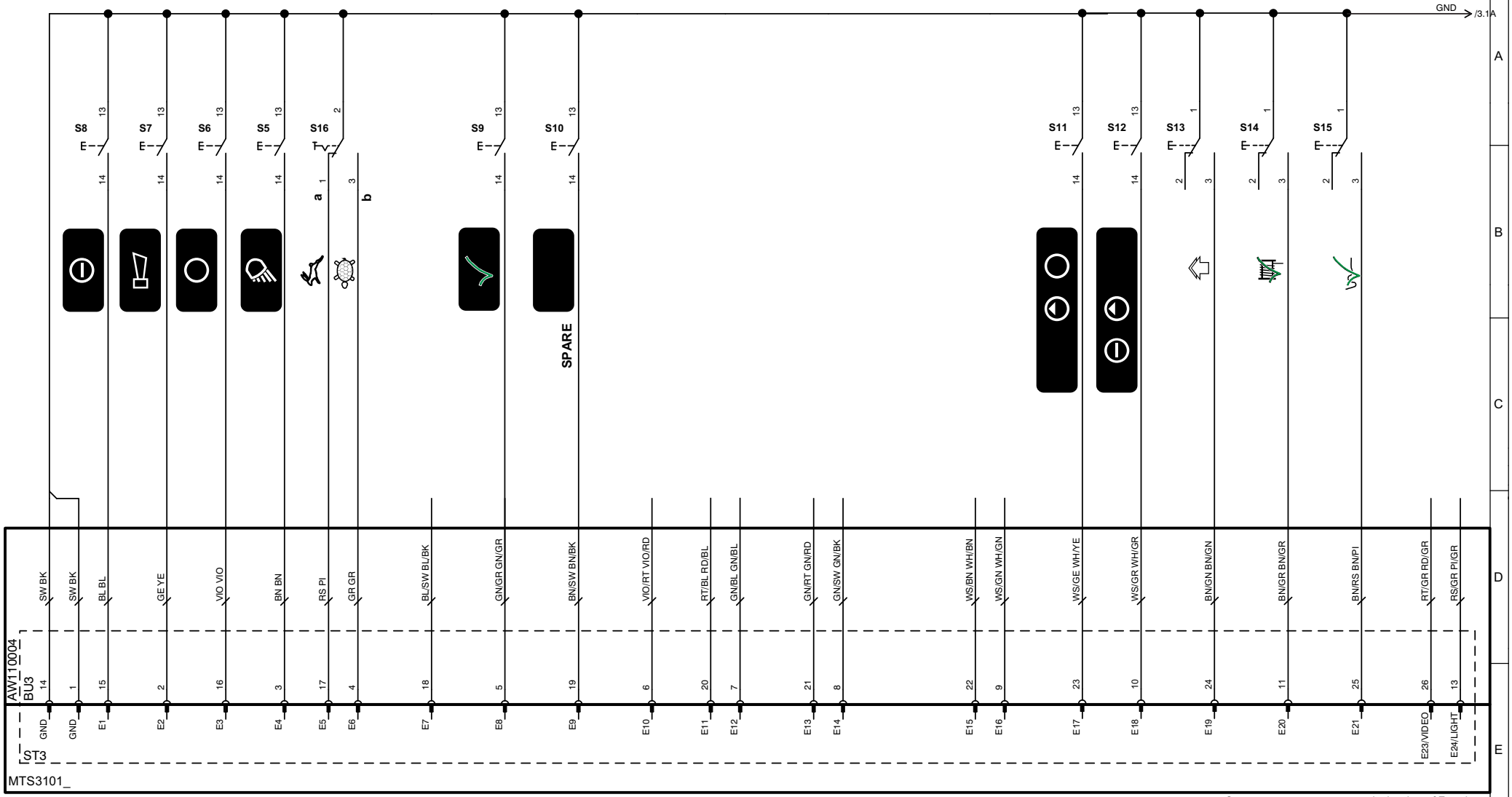

1) Generalfreigabe 062

	Funk-Start radio start
	Kran-Ein-Verriegelung crane on interlock
	radiomatic® infrakey
	Kabeloption cable option

	radiomatic® zero-g
	radiomatic® roll-detect
	radiomatic® shock-off
	inclination switch

15	APO-Zeit (min.) APO-time (min.)

Funktion E17-24 function E17-24	LB2	▮▮
Funktion E9-16 function E9-16	LB3	▮▮
Funktion E41-43 function E41-43	LB4	▮▮
▮▮ SI1	▮▮ SI2	

E1-8 immer SI1
E1-8 always SI1

4	Hidden-Switch

Start
start

LB8
▮▮

Lötbrücke auf Encoder
solder strap up Encoder

LB1	LB2	LB3
▮▮	▮▮	▮▮

▮▮ Start via Ein-/ Start-Taster
start via on-/ start-pushbutton
▮▮ Start via iCON
start via iCON

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name

Datum	23.03.2018	
Gezeichnet	avns	
Geprüft	avle	
Genehmigt		
Orig.		

Kunde HBC-radiomatic Norge
Kommission
Bestellnummer 23641
Ersetzt
Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_02313-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung
Fabrikationsnummer
727-1802317
Auftragsnummer
21731693
V1.2
2 / 11 Bl.

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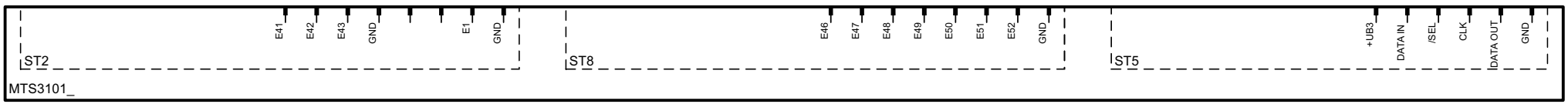

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

				Datum	23.03.2018	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter	Zeichnung	
				Gezeichnet	avns	Kommission			ADCON-Konfig.: 727_18_02313-rev_.sg1	Fabrikationsnummer	Auftragsnummer
				Geprüft	avle	Bestellnummer	23641		iON-Konfig.:	727-1802317	21731693
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch	iLOG-Konfig.: KSD10001		V1.2 3 / 11 Bl.

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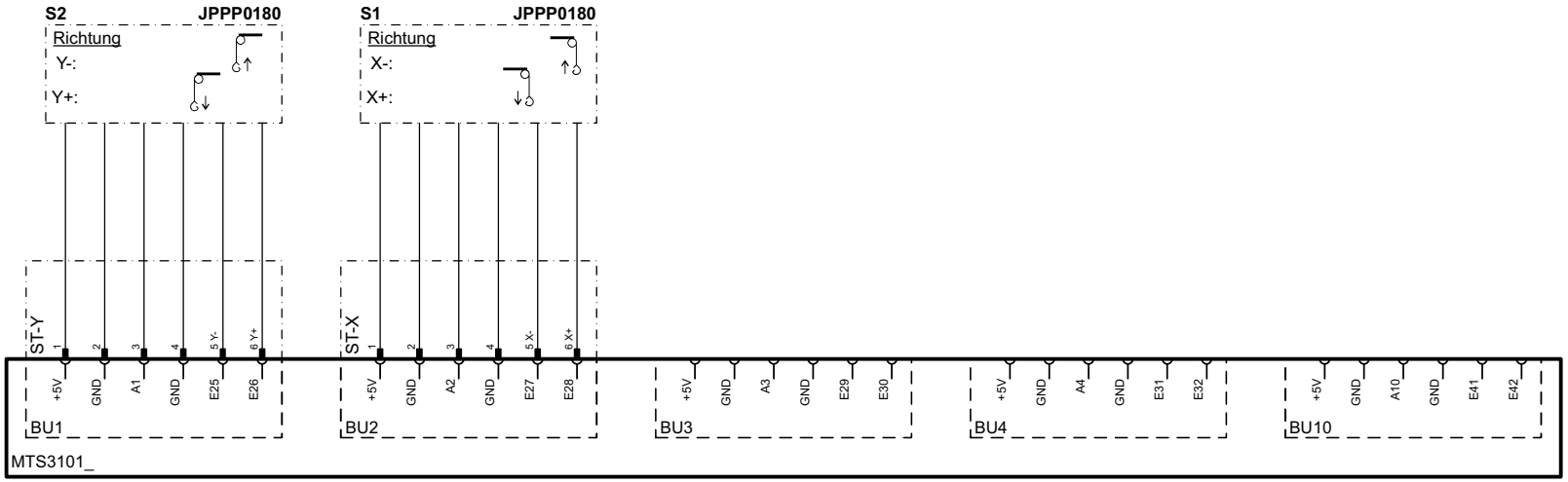
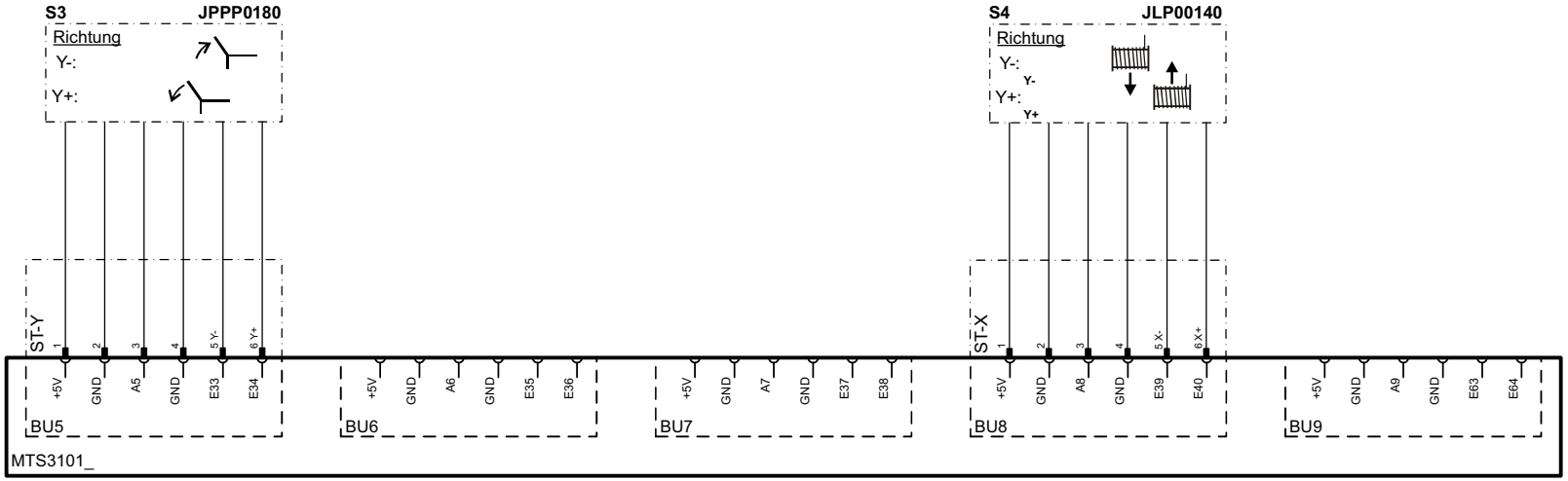
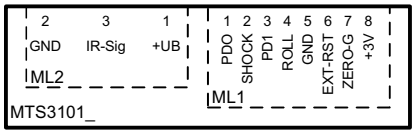
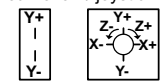
HBC-radiomatic GMBH







Beispiel: Linearhebel / KMS
Example: linear lever / joystick



Platinenansicht von Frontplattenseite/
PCB-view from faceplate side

BU5 BU6 BU7 BU8 BU9 BU10 BU4 BU3 BU2 BU1

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

				Datum	23.03.2018	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter	Zeichnung	
				Gezeichnet	avns	Kommission			ADCON-Konfig.: 727_18_02313-rev_.sg1	Fabrikationsnummer	Auftragsnummer
				Geprüft	avle	Bestellnummer	23641		iON-Konfig.:	727-1802317	21731693
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch	iLOG-Konfig.: KSD10001		V1.2 4 / 11 Bl.

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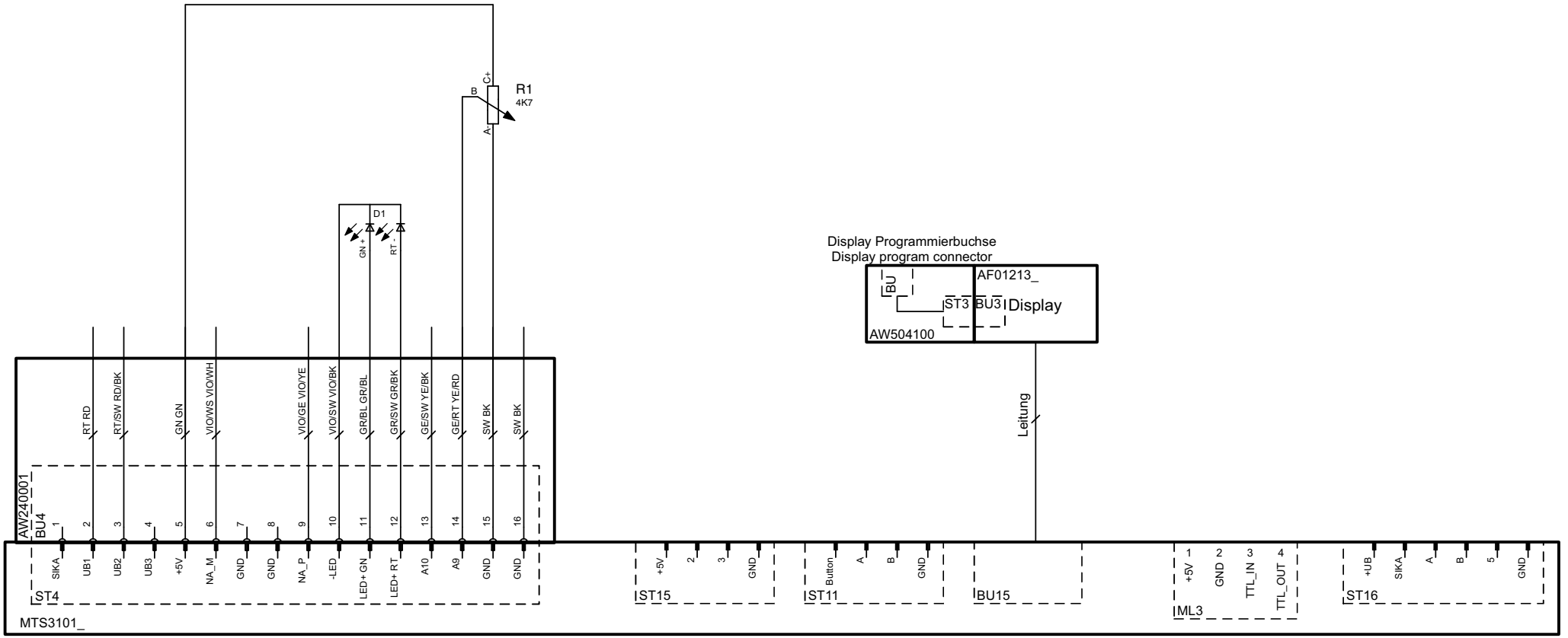

Display-Software : SF001007
Display-Konfiguration: 727_15_17515-rev_.TDP

Edit-Software :

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

Rev.	Änderung	Datum	Name		
				Datum	23.03.2018
				Gezeichnet	avns
				Geprüft	avle
				Genehmigt	

Kunde HBC-radiomatic Norge
Kommission
Bestellnummer 23641
Orig. | Ersetzt | Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_02313-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung
Fabrikationsnummer 727-1802317
Auftragsnummer 21731693
V1.2
5 / 11 Bl.

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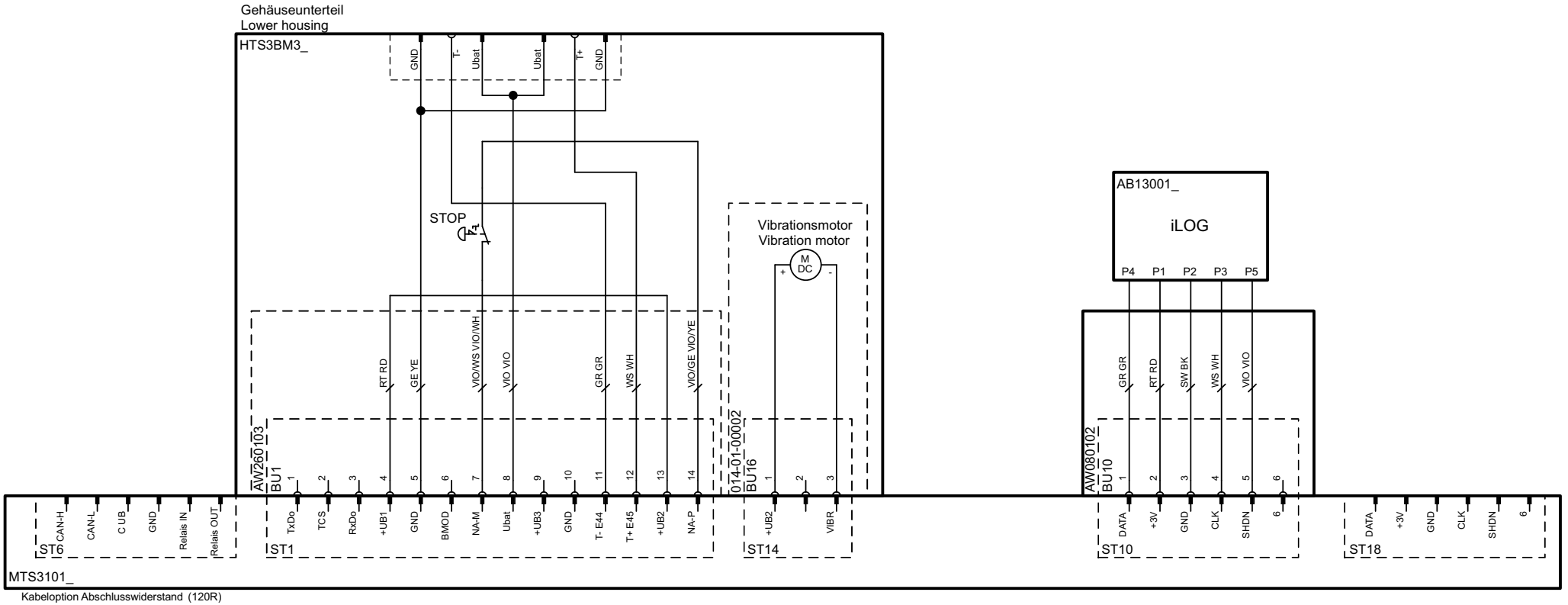

Kabeloption Abschlusswiderstand (120R)
cable option termination resistor (120R)

LB1

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

				Datum	23.03.2018	Kunde HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter ADCON-Konfig.: 727_18_02313-rev_.sg1 iON-Konfig.: iLOG-Konfig.: KSD10001	Zeichnung		
				Gezeichnet	avns	Kommission			Fabrikationsnummer 727-1802317	Auftragsnummer 21731693	V1.2
				Geprüft	avle	Bestellnummer 23641					6 / 11 Bl.
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch			

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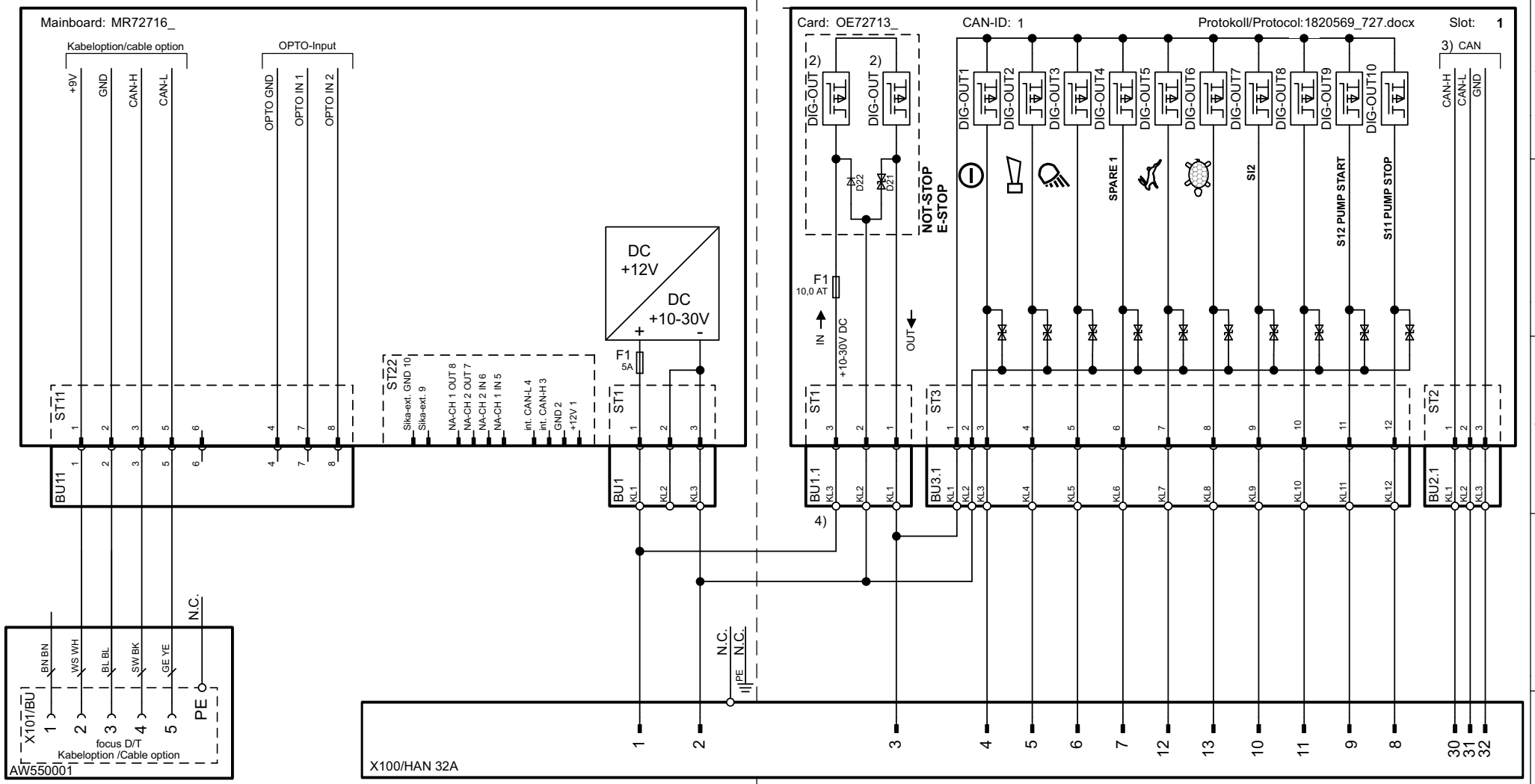

LB1
int. CAN Abschlusswiderstand (120R)
int. CAN termination resistor (120R)

LB2
CAN Abschlusswiderstand (120R)
CAN termination resistor (120R)

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

4) Zur Inbetriebnahme des Systems muss der Eingang des NOT-STOP Kreises (BU1.1 KL3) mit +10-30V DC versorgt werden.
To activate the system the input of the E-STOP circuit (BU1.1 KL3) must be supplied with +10-30V DC

Bei Bus-Systemen muss die maschinenseitige Elektronik alle Schaltbefehle, die dem Sicherheitskreis 2 unterliegen, über den funkseitigen Si-2-Hardwareausgang auf Plausibilität prüfen und beim Auftreten von Implausibilitäten unmittelbar in den sicheren Zustand versetzen.
For bus systems, the electronics of the machine needs to examine all drive commands that are part of the safety circuit 2 for plausibility via the Si-2 hardware output on the side of the radio and initiate the safe state in case of implausibilities.

OUT1-4	LB4 ▮▯	LB5 ▮▯	LB6 ▮	LB7 ▯▮	LB8 ▯▮
OUT5-6	LB9 ▯▮	LB10 ▮▯	LB11 ▮	LB12 ▯▮	LB13 ▯▮
OUT7-10	LB14 ▯▮	LB15 ▯▮	LB16 ▯▮	LB17 ▮	LB18 ▯▮
	12V	SI0	SI1	SI2	SI2v

2) NOT-STOP im Betriebszustand geschlossen
E-STOP closed in operating condition

im Teach-Modus (ca. 1sec)
in teach-mode (ca. 1sec)

Die NOT-STOP-Kette muss in der nachgeschalteten Anlage durch einen von den übrigen Schaltbefehlen unabhängigen Kreis ausgewertet werden!
The E-STOP contacts have to be utilized to control a main emergency stop circuit which is to be independent from all other control functions!

3) LB3 ▮
CAN Abschlusswiderstand (120R)
CAN terminating resistor (120R)

S3 12345678 OFF ON DIP-Switch 1
S4 1234 OFF ON DIP-Switch 4

Funktion S3/4 siehe Protokoll
Function S3/4 see protocol

				Datum	23.03.2018	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Empfänger / Receiver	Zeichnung	
				Gezeichnet	avns	Kommission					
				Geprüft	avle	Bestellnummer	23641		ADCON-Konfig.: 727_18_02314-rev_.cmc	Fabrikationsnummer 727-1802318	Auftragsnummer 21731693
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch			V1.2 7 / 11 Bl.

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Sender Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen	Software
1	006-02-00267	006-02-00267	Housing transmitter spectrum D Oberteil Housing transmitter spectrum D upper housing	orange orange		
2	107-90-00021	107-90-00021	radiomatic® ADCON			
3	107-90-00022	107-90-00022	radiomatic® iLOG			
4	AB13001_	AB13001_	iLOG-Lesemodul für spectrum			
5	AF01213_	AF01213_	Display spectrum D / E (10cm Flachbandkabel) Display spectrum D / E (10cm ribbon cable)			SF001007
6	AP00160_	AP00160_	Überrollbügel spectrum 3/D (Edelstahl) rollover bar spectrum 3/D (stainless steel)			
7	D1	009-10-00025	LED-Fassung ,Kunststoffeinsatz & DUO-LED	d=8mm		
8	EE00315_	EE00315_	Encoder	Encoder spectrum VDT2 iLOG		SE0D211_ / SS00210_
9	HTS3BM3_	HTS3BM3_	Housing transmitter spectrum 3 Unterteil	Stop-Schlagschalter / Vibrationsmotor orange		
10	MTS3101_	MTS3101_	Mainboard transmitter spectrum 3/D	VDT2		
11	R1	IE340001	Potentiometer potentiometer	d=10mm		
12	S1	JLP00140	Linear Lever HBC	black		
13	S2	JLP00140	Linear Lever HBC	black		
14	S3	JLP00140	Joystick Linearhebel proportional, 140mm Kabel Joystick linear lever proportional, 140mm Cables	schwarz black		
15	S4	JLP00140	Joystick Linearhebel proportional, 140mm Kabel Joystick linear lever proportional, 140mm Cables	schwarz black		
16	S5	IE230017	KHT, kurz KHT, short	d=16mm		
17	S6	IE230017	KHT, kurz KHT, short	d=16mm		
18	S7	IE230017	KHT, short	d=16mm		
19	S8	IE230017	KHT, kurz KHT, short	d=16mm		
20	S9	IE230017	KHT, kurz KHT, short	d=16mm		
21	S10	IE230017	KHT, short	d=16mm		
22	S11	IE230017	KHT, kurz KHT, short	d=16mm		
23	S12	IE230017	KHT, kurz KHT, short	d=16mm		
24	S13	IE230001	D-JET pushbutton	d=12mm		
25	S14	IE230001	D-JET pushbutton	d=12mm		
26	S15	IE230001	D-JET pushbutton	d=12mm		
27	S16	IE120009	toggle switch maintain-maintain small	d=12mm		

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name

Datum 23.03.2018 | Gezeichnet avns | Geprüft avle | Genehmigt

Kunde HBC-radiomatic Norge
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Haller-Straße 45-53
74564 Crailsheim

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Zeichnung

Fabrikationsnummer 727-1802317

Auftragsnummer 21731693

V1.3

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Sender Kabelbaum Transmitter Harness

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen
1	AW080102	AW080102	Verdrahtungshilfe harness	AMP-Buchse 6pol., 5 Adern, eco 2 UT	
2	AW110004	AW110004	Verdrahtungshilfe harness	AMP-Buchse 26pol., 28 Adern, spectrum	
3	AW240001	AW240001	Verdrahtungshilfe harness	AMP-Buchse 16pol., 14 Adern, spectrum	
4	AW504100	AW504100	Binder auf USB, Editier-Schnittstelle für TFT-Display		

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name

Datum 23.03.2018
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Fabrikationsnummer 727-1802317

Auftragsnummer 21731693

V1.3

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Empfänger Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen	Software
1	107-90-00021	107-90-00021	radiomatic® ADCON			
2	BU1	010-02-00499	Buchsenleiste 3-polig female connector strip 3-polig			
3	BU1.1	010-02-00011	Buchsenleiste 3-polig female connector strip 3-polig			
4	BU1.2	010-02-00526	Buchsenleiste 21-polig female connector strip 21-polig			
5	BU2.1	010-02-00506	Buchsenleiste 3-polig female connector strip 3-polig			
6	BU3.1	010-02-00507	Buchsenleiste 12-polig female connector strip 12-polig			
7	CM7372__	CM7372__	CAN-Manager	CAN-Manager TC20/38		SA00320_ / SB00320_ / SY00320_
8	HR168913	HR168913	Kunststoff-Gehäuse FSE727, HAN 32/50, BNC - MMCX, MR72716_ plastic-case FSE727, HAN 32/50, BNC - MMCX, MR72716_	orange orange		
9	MR72716_	MR72716_	Mainboard Empfänger 727 Mainboard Receiver 727	DC 10-30V mit geox, Kabeloption, Optokoppler DC 10-30V with geox, cable option, optical isolator		
10	OE72713_	OE72713_	NOT-STOP-Ausgabekarte E-STOP-output card	DC, 10xHigh-Side-Switch + CAN Safety		SOE0130__.s19 / SOE0220__.hex

Steckeinheit Plug-in unit

Zeile	Name	Material	Typbezeichnung	Beschreibung	Katalognummer	Hersteller
2	X100/HAN 32A	010-03-00097	Anbaugehäuse Size 32A addition housing Size 32A	gerade, niedrige Bauart, 2 Bügel straight, low Type of Construction, 2 clamp	09 20 032 0301	Harting
3	010-03-00080	010-03-00080	Steckereinsatz HAN 16A (Size 16/32A) plug insert HAN 16A (Size 16/32A)	Crimpanschluß crimp connection	09 20 016 3001	Harting
4	010-03-00102	010-03-00102	Steckereinsatz HAN 32A (Size 32A) plug insert HAN 32A (Size 32A)	Crimpanschluß crimp connection	09 20 016 3011	Harting

Kabelbaum Harness

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name

Datum 23.03.2018
Gezeichnet avns
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Kunde HBC-radiomatic Norge
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74564 Crailsheim

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Zeichnung

Fabrikationsnummer 727-1802317

Auftragsnummer 21731693

V1.3

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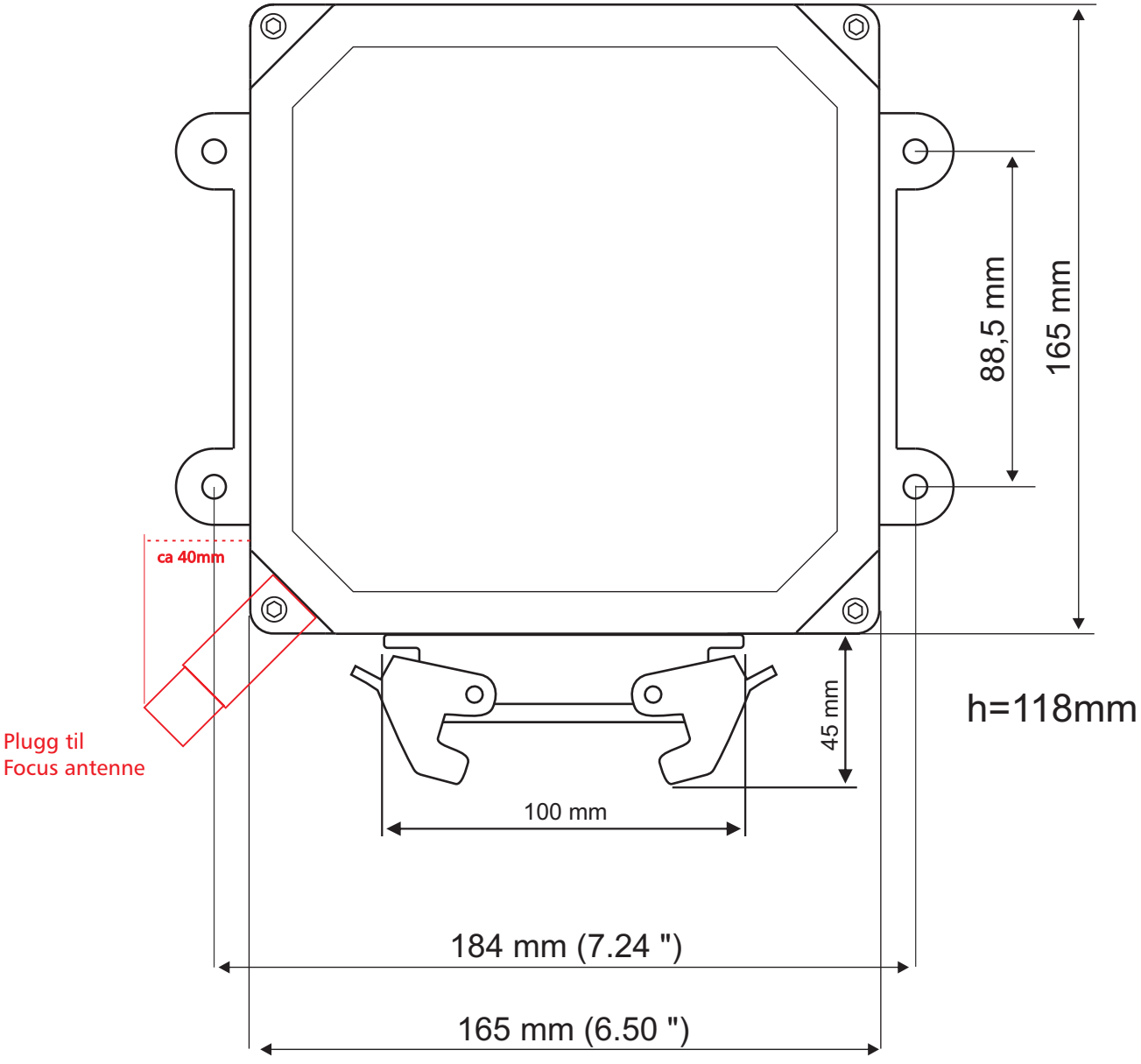
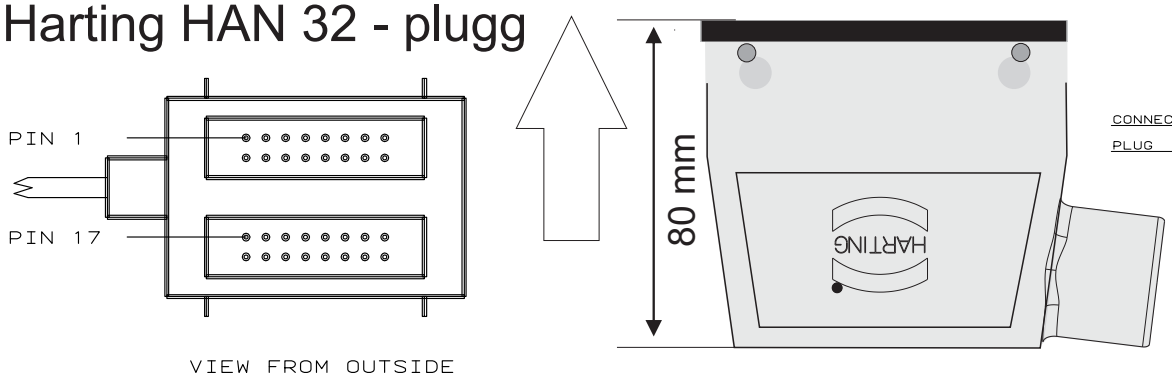
Receiver FSE 727 (HR 168)

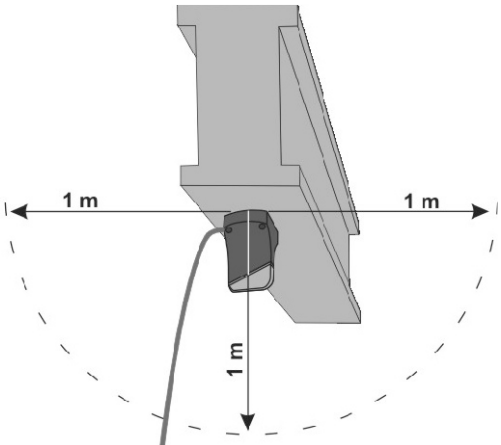


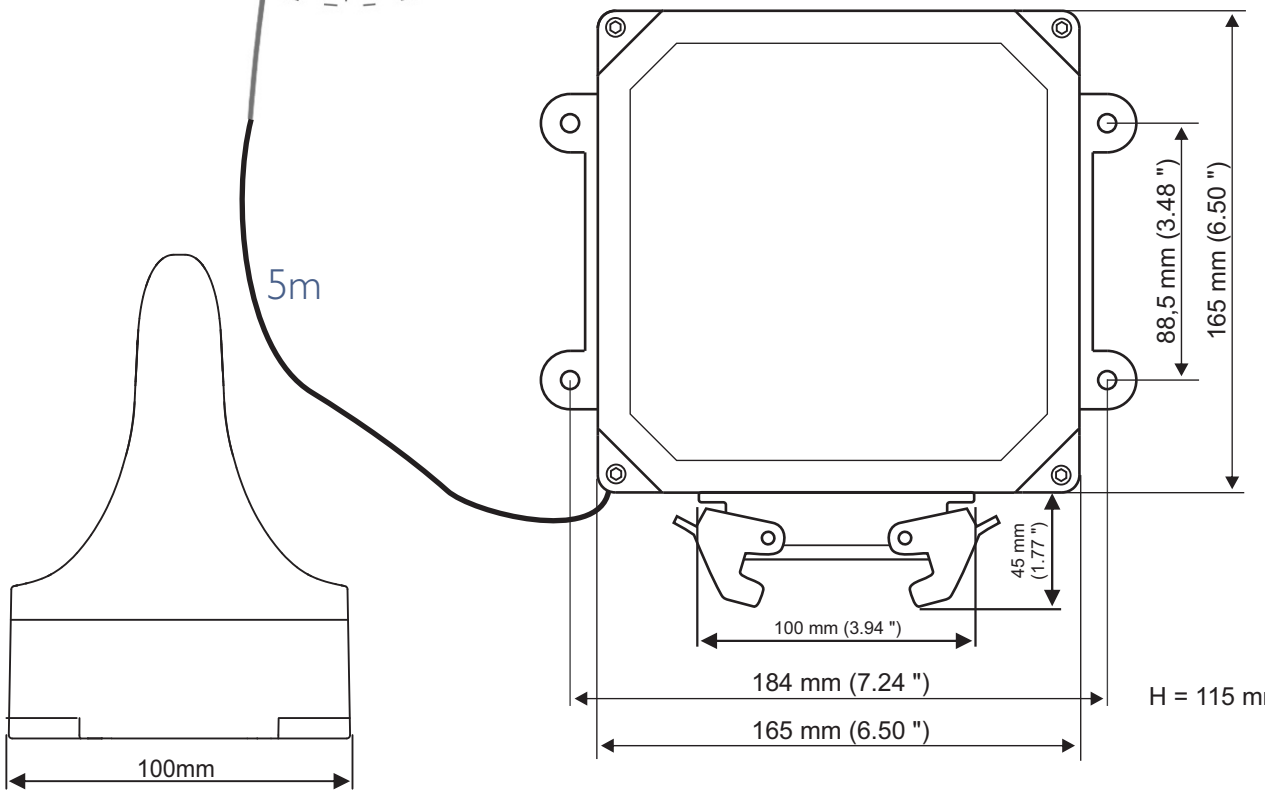
Harting HAN 32 - plugg

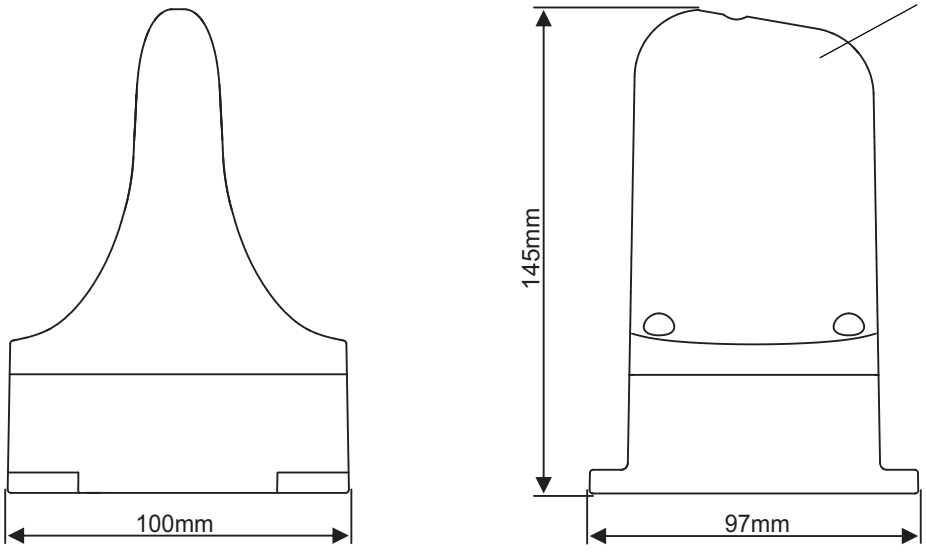


Mottaker FSE 727 focus T 2,4GHz

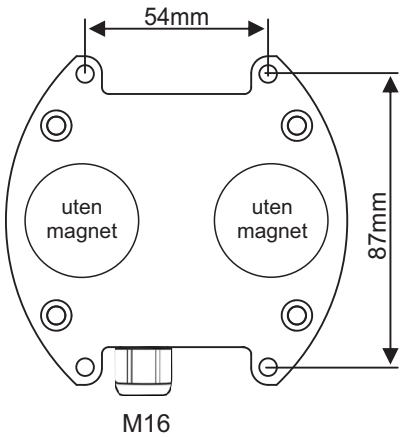
focus T 2,4 GHz mottaker unit standard:
5m kabel lengde
Opsjon: skjøtekabel med 5m,10m, 20m eller 50m lengde







MONTERING.
Til montering brukes to av de diagonale hullene.



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1. Dip-Schalter / dip-switch

1.1. S3

- Einstellung der CANopen Node-ID/adjustment of CANopen Node-ID

Schalter/switch S3			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Node-ID CANopen		x
2	2^1 x D	Node-ID CANopen		x
3	2^2 x D	Node-ID CANopen	x	
4	2^3 x D	Node-ID CANopen	x	
5	2^4 x D	Node-ID CANopen	x	
6	2^5 x D	Node-ID CANopen	x	
7	2^6 x D	Node-ID CANopen	x	
8		reserviert/reserved	x	

- Node-ID [dez]: **4**

1.2. S4

- Einstellung der Bitrate CAN/adjustment of bit rate CAN

Schalter/switch S4			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Bit-Rate CAN		x
2	2^1 x D	Bit-Rate CAN	x	
3	2^2 x D	Bit-Rate CAN	x	
4		reserviert/reserved	x	

Wert	Bit Rate [kBit/s]
0	50
1	125
2	250
3	500
4	1000
5	keine Funktion/no function
6	keine Funktion/no function
7	keine Funktion/no function

- CAN-Bit-Rate[kBit/s]:**125**

2. Globale Einstellungen / global configuration

2.1. Heartbeat

aktiv	Zykluszeit/ cycle time
☒	1s

2.2. CANopen-Safety

aktiv	Zykluszeit/ cycle time
☐	50ms

- CANopen Safety SRDOs

SRDO1-Objekt	ID	1	2
Inhalt/content	default**	NA*	NA inv*

SRDO2-Objekt	ID	1	2
Inhalt/content	default**	NA inv*	NA*

* NA = 0xFF (Notauskreis geschlossen/emergency stop closed)
NA = 0x00 (Notauskreis offen/emergency stop open)

** ID = default (ID-SRDO1 = 0xFF+2*Node-ID, ID-SRDO2 = 0x100+2*Node-ID)
ID = 0x___ (Festwert konfiguriert / fixed value configured)

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3. TX-Data

3.1. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	01	0	RADIO ON S8	0/1	1.SI1/0
		1		0/1	1.SI1/1
		2	HORN S7	0/1	1.SI1/2
		3	LIGHT S5	0/1	1.SI1/3
		4	(SLOW MODE) TURTLE S16b	0/1	1.SI1/4
		5	(FAST MODE) HARE S16a	0/1	1.SI1/5
		6		0/1	1.SI1/6
		7	ACCU LOW	0/1	1.SI1/7
	02	0		0/1	2.Si1/0
		1	S9	0/1	2.Si1/1
		2	S10 (SPARE)	0/1	2.Si1/2
		3		0/1	2.Si1/3
		4		0/1	2.Si1/4
		5		0/1	2.Si1/5
		6		0/1	2.Si1/6
		7		0/1	2.Si1/7
	03	0		0/1	3.Si1/0
		1		0/1	3.Si1/1
		2		0/1	3.Si1/2
		3		0/1	3.Si1/3
		4		0/1	3.Si1/4
		5		0/1	3.Si1/5
		6		0/1	3.Si1/6
		7		0/1	3.Si1/7
	04	0		0/1	4.Si1/0
		1		0/1	4.Si1/1
		2		0/1	4.Si1/2
		3		0/1	4.Si1/3
		4		0/1	4.Si1/4
		5		0/1	4.Si1/5
		6		0/1	4.Si1/6
		7		0/1	4.Si1/7
	05	0		0/1	5.Si1/0
		1		0/1	5.Si1/1
		2		0/1	5.Si1/2
		3		0/1	5.Si1/3
		4		0/1	5.Si1/4
		5		0/1	5.Si1/5
		6		0/1	5.Si1/6
		7		0/1	5.Si1/7
	06	0		0/1	6.Si1/0
		1		0/1	6.Si1/1
		2		0/1	6.Si1/2
		3		0/1	6.Si1/3
		4		0/1	6.Si1/4
		5		0/1	6.Si1/5
		6		0/1	6.Si1/6
		7		0/1	6.Si1/7
	07	0		0/1	7.Si1/0
		1		0/1	7.Si1/1
		2		0/1	7.Si1/2
		3		0/1	7.Si1/3
		4		0/1	7.Si1/4

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		5		0/1	7.Si1/5
		6		0/1	7.Si1/6
		7		0/1	7.Si1/7

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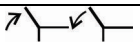
3.2. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	08	0	HPU START S12	0/1	1.SI2/0
		1	HPU STOP S11	0/1	1.SI2/1
		2	ACTIVATE WINCH S13	0/1	1.SI2/2
		3	SELECT WINCH S14	0/1	1.SI2/3
		4	TENSION CONTROL S15	0/1	1.SI2/4
		5		0/1	
		6		0/1	
		7	PILOT VALVE S4	0/1	Logic
	09	0	PILOT VALVE S1-S3	0/1	Logic
		1		0/1	Logic
		2	PILOT VALVE S1 – S4	0/1	Logic
		3	PILOT R1 (OUT OF ZERO)	0/1	Logic
		4		0/1	2.SI2/4
		5		0/1	2.SI2/5
		6		0/1	2.SI2/6
		7		0/1	2.SI2/7
	0A	0	S1 Y+	0/1	Logic
		1	S1 Y-	0/1	Logic
		2	S2 Y+	0/1	Logic
		3	S2 Y-	0/1	Logic
		4		0/1	Logic
		5		0/1	Logic
		6		0/1	Logic
		7		0/1	Logic
	0B	0	S3 Y+	0/1	Logic
		1	S3 Y-	0/1	Logic
		2		0/1	Logic
		3		0/1	Logic
		4	S4 Y+	0/1	Logic
		5	S4 Y-	0/1	Logic
		6		0/1	Logic
		7		0/1	Logic
	0C	0		0/1	Logic
		1		0/1	Logic
		2		0/1	5.SI2/2
		3		0/1	5.SI2/3
		4		0/1	5.SI2/4
		5		0/1	5.SI2/5
		6		0/1	5.SI2/6
		7	R1 (OUT OF ZERO)	0/1	Logic
	0D	0		0/1	6.SI2/0
		1		0/1	6.SI2/1
		2		0/1	6.SI2/2
		3		0/1	6.SI2/3
		4		0/1	6.SI2/4
		5		0/1	6.SI2/5
		6		0/1	6.SI2/6
		7		0/1	6.SI2/7
	0E	0	SI 1 (COMUNICATION CIRCUIT OK)	0/1	
		1	SI 2 (ZERO POSITION TEST)	0/1	

		2		0/1	
		3		0/1	
		4	TELEGRAM COUNTER 2^0	0/1	
		5	TELEGRAM COUNTER 2^1	0/1	
		6	TELEGRAM COUNTER 2^2	0/1	
		7	TELEGRAM COUNTER 2^3	0/1	

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	0F	0	NA Zustand / E-Stop State	0/1	SI1
		1	NA Zustand / E-Stop State	0/1	SI1
		2	NA Zustand / E-Stop State	0/1	SI1
		3	NA Zustand / E-Stop State	0/1	SI1
		4	NA Zustand / E-Stop State	0/1	SI1
		5	NA Zustand / E-Stop State	0/1	SI1
		6	NA Zustand / E-Stop State	0/1	SI1
		7	NA Zustand / E-Stop State	0/1	SI1
	10	0	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		1	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		2	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		3	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		4	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		5	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		6	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		7	NA Zustand invertiert / E-Stop inverted	0/1	SI1

3.3. Analogeingänge/Analog inputs

Index/ index	Subindex/ subindex	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6400	01	S1 Y- (FF-80) / S1 Y+ (00-7F)	-128 … +127	Prop 1
	02	S2 Y- (FF-80) / S2 Y+ (00-7F)	-128 … +127	Prop 2
	03		-128 … +127	Prop 3
	04		-128 … +127	Prop 4
	05	S3 Y- (FF-80) / S3 Y+ (00-7F) 	-128 … +127	Prop 5
	06		-128 … +127	Prop 6
	07	S4 Y- (FF-80) / S4 Y+ (00-7F)	-128 … +127	Prop 7
	08		-128 … +127	Prop 8
	09		-128 … +127	Prop 9
	0A	R1 POTI TENSION 0…100%	0 … 127	Prop 10

3.4. TX PDO-Mapping

- 1. TX PDO (0x180+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/01	6000/02	6000/03	6000/04	6000/05	6000/06	6000/07	6000/0F

- 2. TX PDO (0x280+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/08	6000/09	6000/0A	6000/0B	6000/0C	6000/0D	6000/0E	6000/10

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- 3. TX PDO (0x380+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6400/01	6400/02	6400/03	6400/04	6400/05	6400/06	6400/07	6400/08

- 4. TX PDO (0x480+Node-ID)

PDO-Objekt	1	2
Mappingparam.	6400/09	6400/0A

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4. RX-Data

4.1. Digitalausgänge/Digital outputs

Index/ Index	Subindex/ subindex		Funktion/ funktion	Darstellung/ description	Wertebereich/ range	Ziel/ target
6200	01		LENGHT (Bit 0 – 7)	DISPLAY LINE 4a +/- 0…99999	(-99999) – (+99999)	TxB 1/1
	02		LENGHT (Bit 8 – 15)			TxB 1/2
	03		LENGHT (Bit 16 – 23)			TxB 1/3
	04		LENGHT (Bit 24 – 31)			TxB 1/4
	05		TENSION (Bit 0 – 7)	DISPLAY LINE 4b 0…999,9	0 – 9999	TxB 1/5
	06		TENSION (Bit 8 – 15)			TxB 1/6
	07		SPEED (Bit 0 – 7)	DISPLAY LINE 4c 0…999,9	0 – 9999	TxB 1/7
	08		SPEED (Bit 8 – 15)			TxB 1/8
	09		MESSAGE 1	DISPLAY LINE 1	0-255	TxB 2/1
	0A		MESSAGE 2	DISPLAY LINE 2	0-255	TxB 2/2
	0B		MESSAGE 3	DISPLAY LINE 5	0-255	TxB 2/3
	0C		MESSAGE 4	DISPLAY LINE 6	0-255	TxB 2/4
	0D					TxB 2/5
	0E					TxB 2/6
	0F					TxB 2/7
	10					TxB 2/8
	11	0	DISPLAY LINE 1 (OFF/ON)		0/1	TxB 3/1
		1	DISPLAY LINE 1 (OFF/FLASH)		0/1	
		2	DISPLAY LINE 2 (OFF/ON)		0/1	
		3	DISPLAY LINE 2 (OFF/FLASH)		0/1	
		4	DISPLAY LINE 3 (OFF/ON)		0/1	
		5	DISPLAY LINE 3 (OFF/FLASH)		0/1	
		6	DISPLAY LINE 4 (OFF/ON)		0/1	
		7	DISPLAY LINE 4 (OFF/FLASH)		0/1	
	12	0	DISPLAY LINE 5 (OFF/ON)		0/1	TxB 3/2
		1	DISPLAY LINE 5 (OFF/FLASH)		0/1	
		2	DISPLAY LINE 6 (OFF/ON)		0/1	
		3	DISPLAY LINE 6 (OFF/FLASH)		0/1	
		4	DISPLAY LINE 7A (OFF/ON)		0/1	
		5	DISPLAY LINE 7A (OFF/FLASH)		0/1	
		6	DISPLAY LINE 7B (OFF/ON)		0/1	
		7	DISPLAY LINE 7B (OFF/FLASH)		0/1	
	13	0	DISPLAY LINE 8 (OFF/ON)		0/1	TxB 3/3
		1	DISPLAY LINE 8 (OFF/FLASH)		0/1	
		2	LENGTH DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		3	LENGTH DISPLAY LINE 4 VALUE 2^1 *			
		4	TENSION DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		5	TENSION DISPLAY LINE 4 VALUE 2^1 *			
		6	SPEED DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		7	SPEED DISPLAY LINE 4 VALUE 2^1 *			
	14	0			0/1	TxB 3/4
		1			0/1	
		2			0/1	
		3	VIBRATION		0/1	
		4	back to display “MAIN PAGE”		0/1	
		5			0/1	
		6			0/1	
		7			0/1	

* Einheit Zuordnung siehe Tabelle 4.2 / Unit assignment, see table 4.2.

Index/ Index	Subindex/ subindex	Funktion/ funktion		Darstellung/ description	Wertebereich/ range	Ziel/ target
6200	15	0	Decimal point LENGTH Value 2^0		0-3	TxB 3/5
		1	Decimal point LENGTH Value 2^1			
		2	Decimal point TENSION Value 2^0		0-3	
		3	Decimal point TENSION Value 2^1			
		4	Decimal point SPEED Value 2^0		0-3	
		5	Decimal point SPEED Value 2^1			
		6			0/1	
		7			0/1	
	16	0			0/1	TxB 3/6
		1			0/1	
		2			0/1	
		3			0/1	
		4			0/1	
		5			0/1	
		6			0/1	
		7			0/1	
	17	0	not used in this sys-tem	(Shift-Register LED A1)	0/1	TxB 3/7
		1	not used in this sys-tem	(Shift-Register LED A2)	0/1	
		2	not used in this sys-tem	(Shift-Register LED A3)	0/1	
		3	not used in this sys-tem	(Shift-Register LED A4)	0/1	
		4	not used in this sys-tem	(Shift-Register LED A5)	0/1	
		5	not used in this sys-tem	(Shift-Register LED A6)	0/1	
		6	not used in this sys-tem	(Shift-Register LED A7)	0/1	
		7	not used in this sys-tem	(Shift-Register LED A8)	0/1	
	18	Reserve			0 – 255	TxB 3/8

4.2. Einheit Zuordnung / Unit assignment

DISPLAY LINE 4 (LENGTH)

Wertebereich/ range	Einheit/ unit
0	m
1	feet
2	ft
3	

DISPLAY LINE 4 (TENSION)

Wertebereich/ range	Einheit/ unit
0	t
1	LBS
2	Kg
3	

DISPLAY LINE 4 (SPEED)

Wertebereich/ range	Einheit/ unit
0	m/min
1	m/s
2	feet/min
3	ft/min

4.3. Dezimalpunkt / Decimal point

Wertebereich/ range	Dezimal-punkt/ Decimal point
0	0
1	0,0
2	0,00
3	0,000

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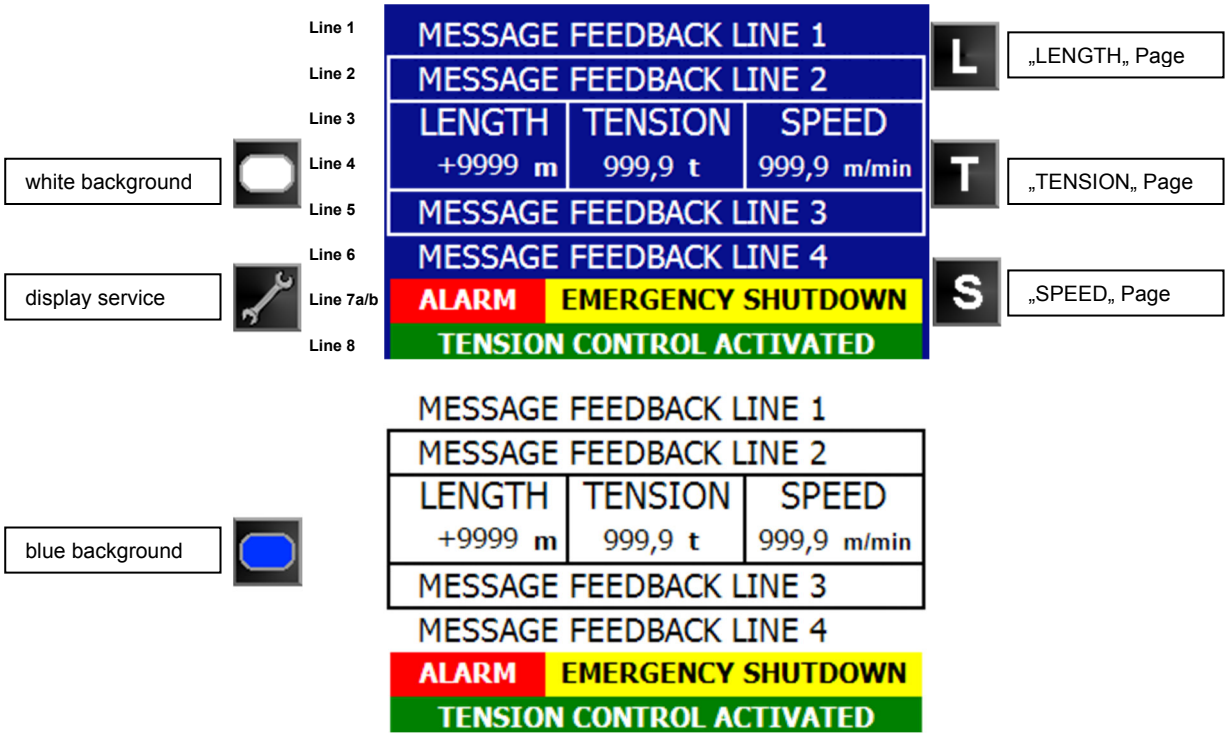
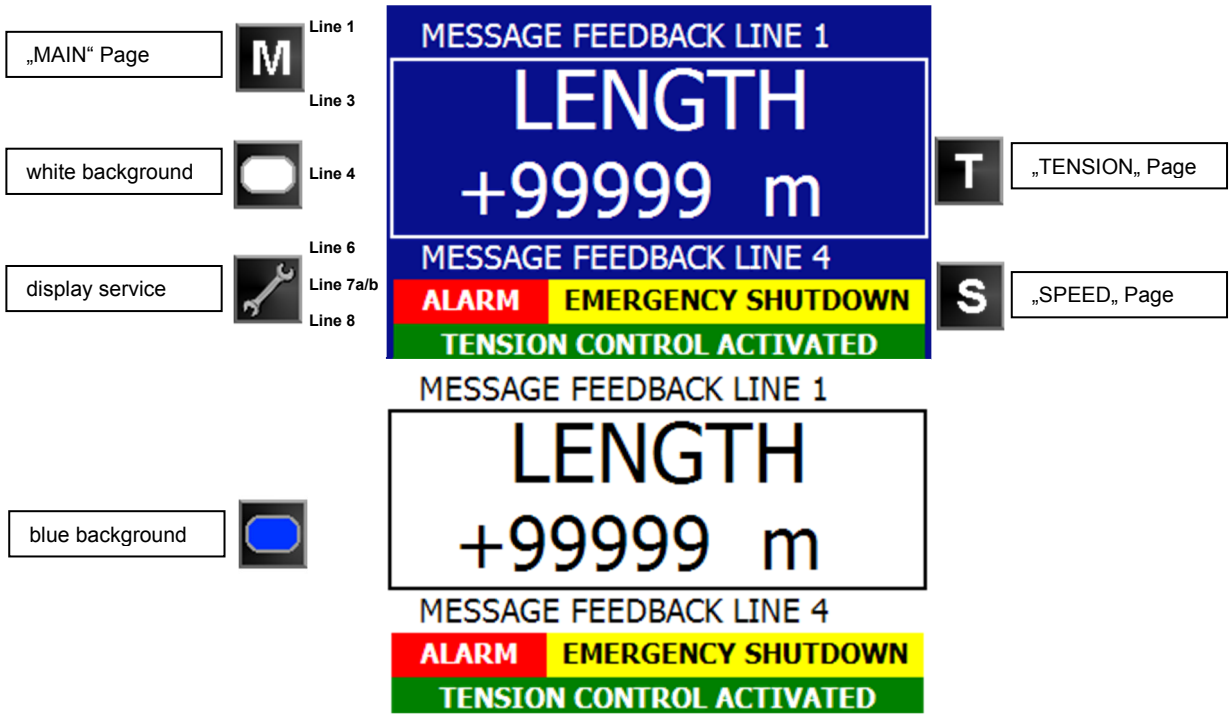
MAIN Page



LENGTH Page



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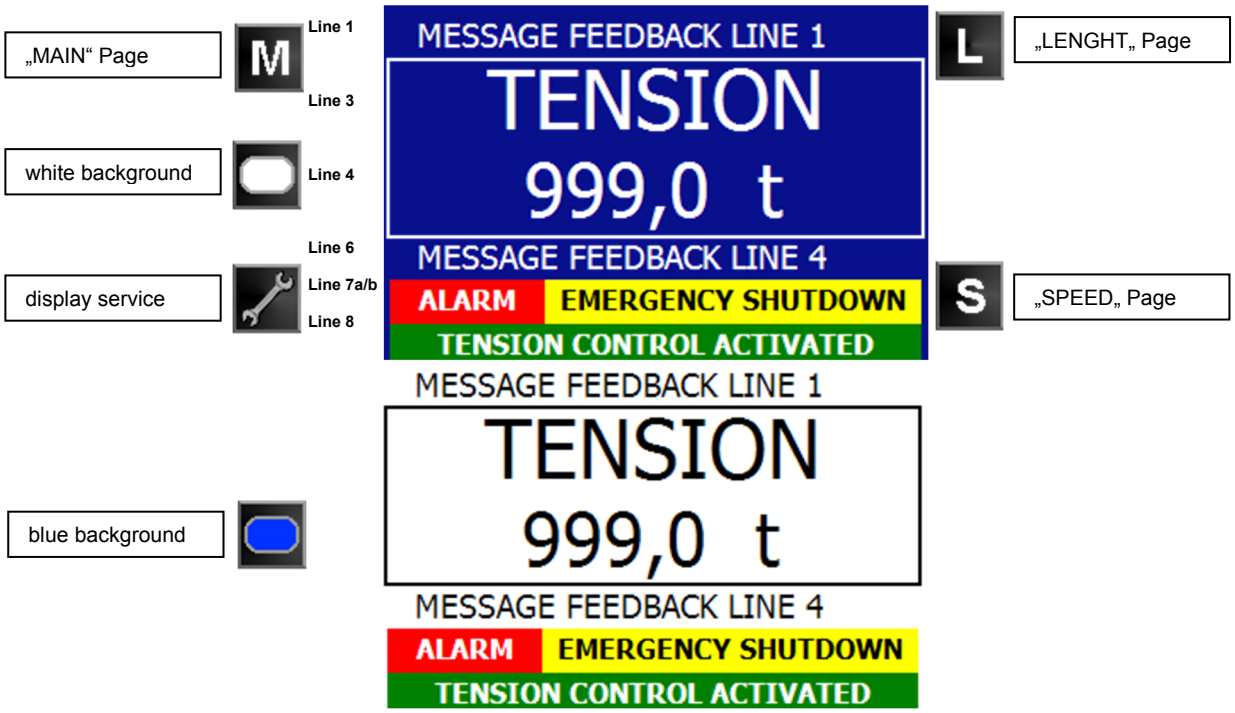
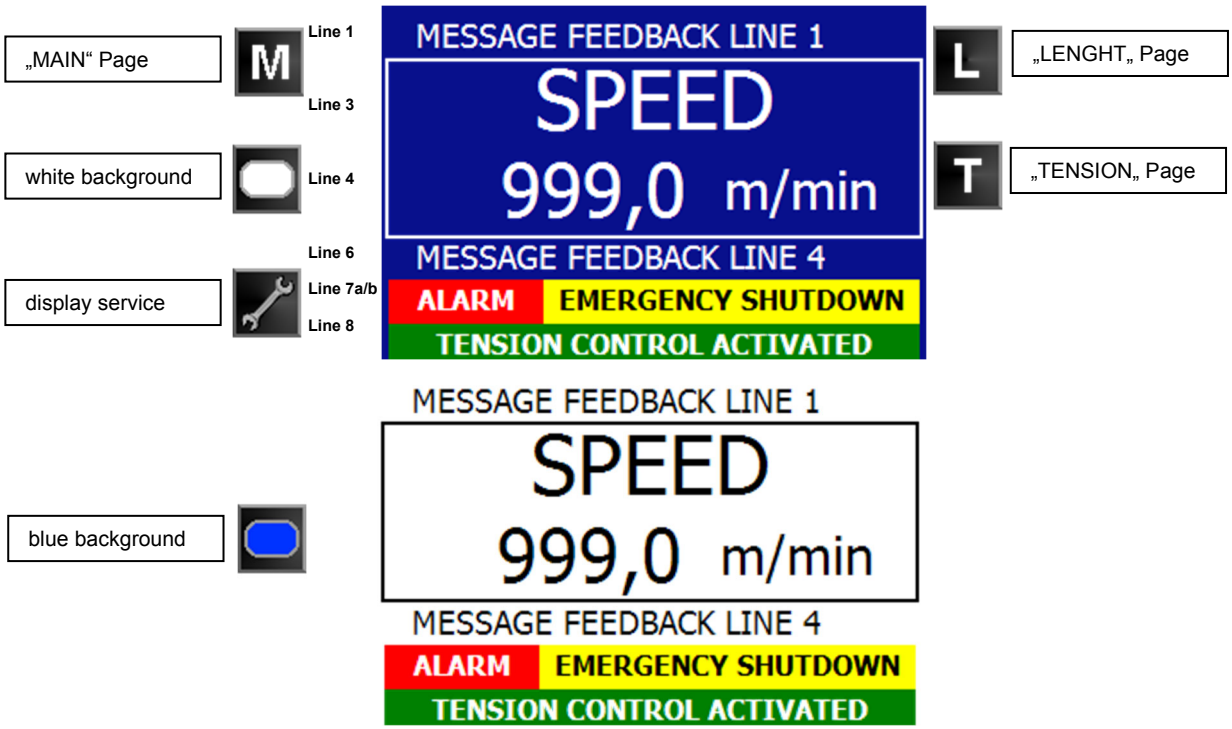
TENSION Page



SPEED Page



Back to “MAIN PAGE” also with pushbutton S13 (SELECT WINCH) or feedback-command 6200/14/ Bit 4.
Each “MESSAGE LINE” has an own editable (with special HBC-USB-connecting-cable) text-file in the display folder TXT. In all display text files the first text-line has no text (only one space character) and is used for NO TEXT-OUTPUT on the display.

4.4. RX PDO-Mapping

- 1. RX PDO (0x200+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/01	6200/02	6200/03	6200/04	6200/05	6200/06	6200/07	6200/08

- 2. RX PDO (0x300+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/09	6200/0A	6200/0B	6200/0C	6200/0D	6200/0E	6200/0F	6200/10

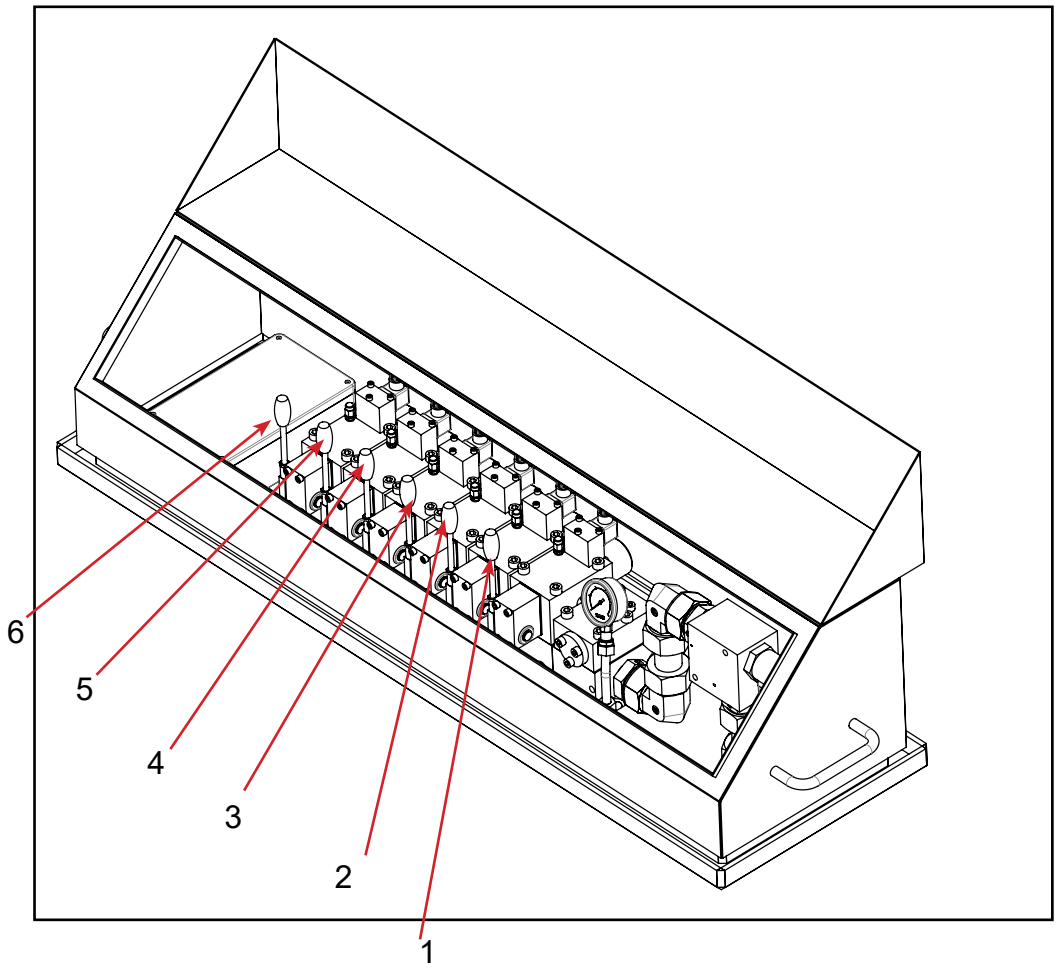
- 3. RX PDO (0x400+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/11	6200/12	6200/13	6200/14	6200/15	6200/16	6200/17	6200/18

- 4. RX PDO (0x500+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/19	6200/1A	6200/1B	6200/1C	6200/1D	6200/1E	6200/1F	6200/20

MANUAL CONTROL



POS.	DESCRIPTION
1	Winch stb : A: Lower B: Lift
2	Winch port: A: Lower B: Lift
3	A-Frame Tilt 2 stb: A: Cylinder 1 out B: Cylinder 1 in
4	A-Frame Tilt 2 port: A: Cylinder 1 out B: Cylinder 1 in
5	A-Frame Tilt 1 stb: A: Cylinder out B: Cylinder in
6	A-Frame Tilt 1 port: A: Cylinder out B: Cylinder in

CTD Davit Radio Control

Switch	Description
D1	Battery Indicator
S1	Docking Head Tilt
S2	Telescope
S3	Boom
S4	External Winch
S5	Floodlight (on/off)
S6	Shut off radio and deactivate CTD Davit
S7	Horn
S8	Turn on radio and activate CTD Davit
S9	N/A
S10	N/A
S11	Stop HPU
S12	Start HPU
S13	Activate winch Rapp
S14	Activate constant Tension
S15	Manual tension potmeter control
S16	Speed
S17	Fixed/Free Docking Head
R1	Tension Control

Safety Note: The docking head can not be tilted outwards if the proximity switch for the docking head upper position is activated. This prevents high tension on the bullet, winch, or wire

TRIPLEX
by MacGregor

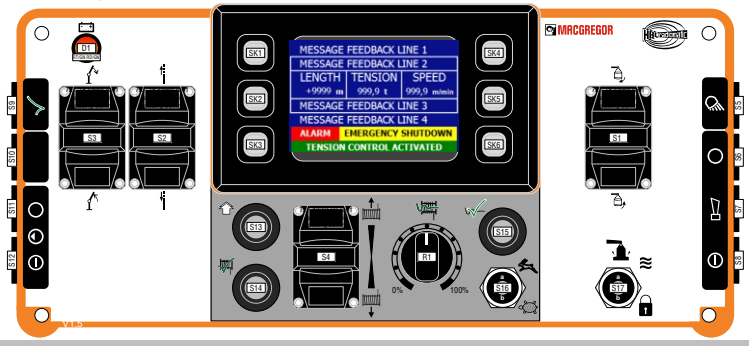
Operating Instructions

Project: MBARI R/V David Packard / CTD-DAVIT

Triplex item nr. 400198451 RC-CTD-HBC.SD.1-08
WBS Element 4/60185.1.C3
order nr.: 4504420729

Serial nr.: 727-1820569
Model: spectrum D iLOG GI
Frequence: 2.4GHz / TC241 / Focus-T

Delivery date: 09.12.2022



spectrum D

HBC-radiomatic Norge AS
www.hbc-radiomatic.no

CE

Vedlegg 1: sikkerhets informasjon

Tilleggsinformasjon om sikkerhet

Vennligst les gjennom følgende viktig sikkerhetsinformasjon

Reservesender:
Reserve iLOG
Reserve iON

Det er ikke tillatt å bruke to sendere med samme kode (iLOG/iON) samtidig.
Reservesender eller originalsender må være innelåst !

Reservemottaker:

Det er ikke tillatt å bruke to mottakere med samme kode samtidig.
Reservemottakere eller originalmottaker må være innelåst !

Reservefunksjon:

Forhandleren har ansvar for eventuelt merking av tilleggsfunksjoner hvis reserveknapper eller reservejoysticker blir tatt i bruk

Gjenvinning av batterier:

Batterier skal ikke kastes sammen med annet avfall. I stedet, returnere batterier til godkjent gjenvinningsstasjon eller batteri forhandler som HBC-radiomatic Norge AS

Attachment 1: safety information

Additional information on safety

Please read through the following safety information

Spare transmitter:
Spare iLOG
Spare iON

It is not allowed to use two transmitters with the same code (iLOG/iON) at the same time.
Either the spare transmitter or original transmitter must be secured!

Spare receiver

It is not allowed to use two receivers with the same code at the same time.
Either the spare receiver or original receiver must be secured!

Spare function:

This system be delivered with spare buttons or joysticks. **The dealer is responsible for marking any additional functions** which may be connected in the future.

Battery disposal:

Batteries must not be disposted of with regular waste. Instead, return batteries to an approved recycling station or battery dealer. HBC-radiomatic Norge AS will take batteries in return.

The clients PLC must continuously evaluate the Active Stop command and communication OK circut!
The client has requested the ‘active stop’ function, and is thereby responsible to integrate it with their PLC system.

HBC-radiomatic Norge AS
Gamleveien 87
N-4315 Sandnes
Org.nr. 994 038 516 MVA

www.radiomatic.no
brev@radiomatic.no
Tel.: +47 47 93 49 00
Fax: +47 52 97 30 89

Bank: SR Bank
Account nr. 3201 44 58033
IBAN: NO 3432 0144 5803 3
SWIFT (BIC): SPRONO22

TRIPLEX
Operating Instructions
Project: MBARI R/V David Packard / CTD-DAVIT
Triplex item nr. 400198451 RC-CTD-HBC.SD.1-08
WBS Element 4/60185.1.C3
order nr.: 4504420729
Serial nr.: 727-1820569
spectrum D
HBC-radiomatic
TRIPLEX
Operating Instructions
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WBS Element 4/60185.1.C3
order nr.: 4504420729
Serial nr.: 727-1820569
spectrum D
HBC-radiomatic
inkludert
"Tilleggsinformasjon om sikkerhet" i bruksanvisning
727
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WHEN WORKING ON THE SYSTEM, KEEP THE RADIO CONTROL TRANSMITTER IN YOUR POSSESSION OR PUT IT IN A SECURE PLACE
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CAUTION - VORSICHT - ATTENTION - ATTENZIONE - ATENCIÓN
RADIO REMOTE CONTROLLED
FUNKGESTEUERT
RADIOCOMMANDÉ
RADIOCOMANDATO
RADIO COMANDO
HBC-radiomatic GmbH
EU
US
5m
10m
MACGREGOR

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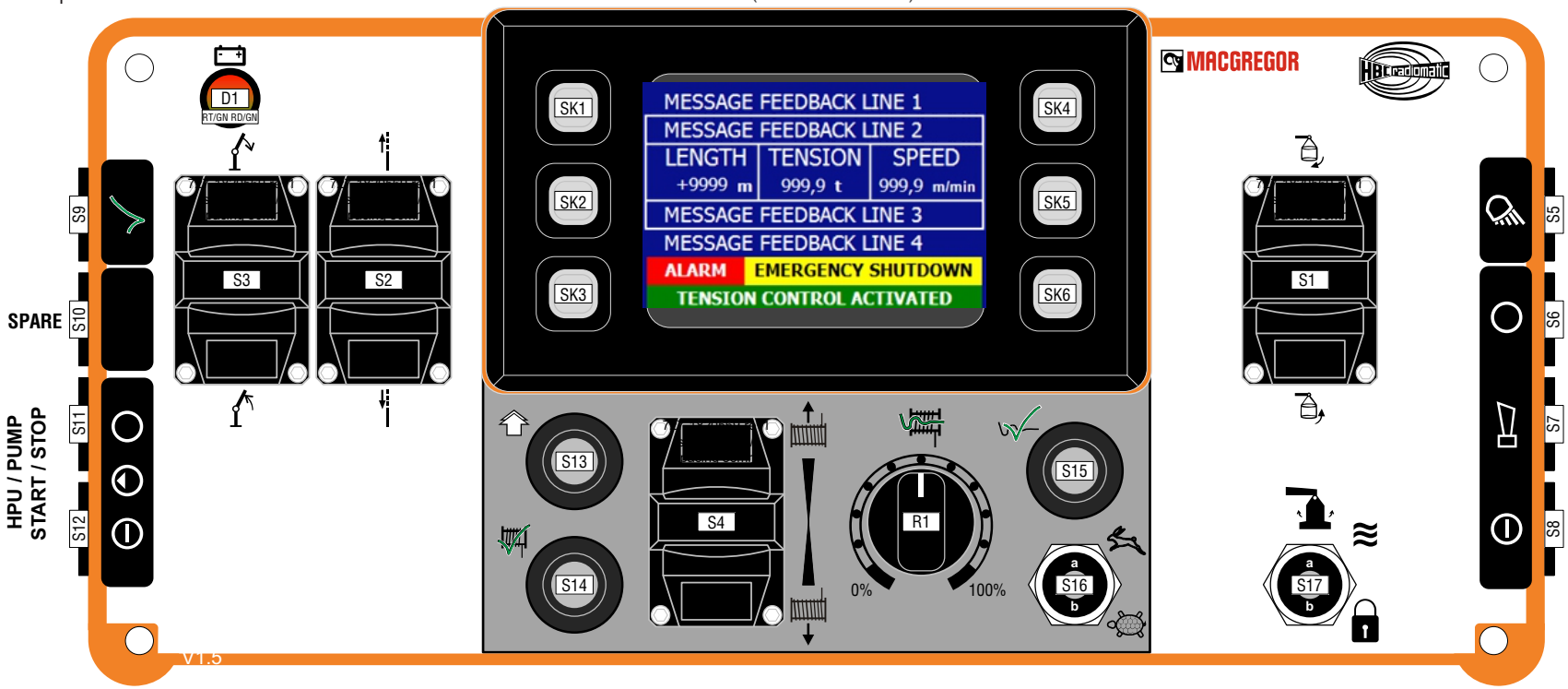
360 mm
(incl. roll over bar)

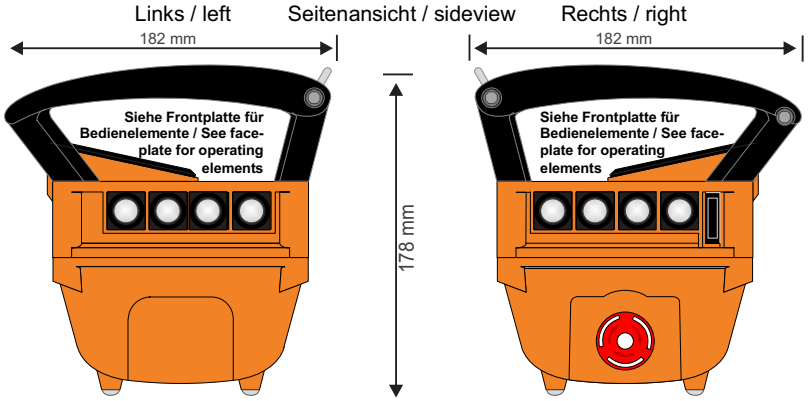


Transmitter OFF

START SEQUENCE:
- short push on «⏻»
- long push on «⏻»

APO: ■ off □ on (15 min)

standard symbol & position no change possible acc. HBC-Germany (IEC 60417-5010 (2002-10))



radiomatic ® iLOG
NOT-STOP / E-STOP

Rollover bar: stainless steel

Frontplatte / faceplate
Art / Type: Drucker
Hintergrundfarbe: weiß
Background color: white
Beschriftungsfarbe: schwarz / farbig
Label color: black / coloured

MACGREGOR

Project: MBARI
R/V David Packard / CTD-DAVIT
400198451 RC-CTD-HBC.SD.1-08
WBS Element 4/60185.1.C3

MBARI
Monterey Bay Aquarium Research Institute

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

				Datum	18.01.2019	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter	Zeichnung	
				Gezeichnet	avns	Kommission			ADCON-Konfig.: 727_18_20569-rev_.sg1	Fabrikationsnummer 727-1820569	Auftragsnummer 21818648
				Geprüft	avle	Bestellnummer			iON-Konfig.:		V1.4
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch	iLOG-Konfig.: KSD10001		1 / 11 Bl.

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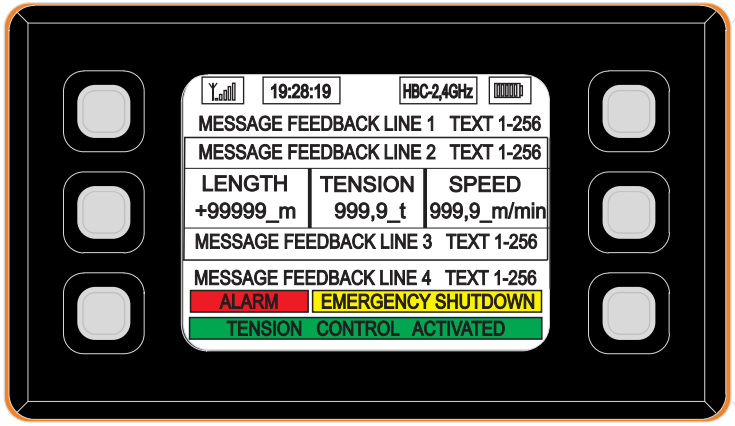
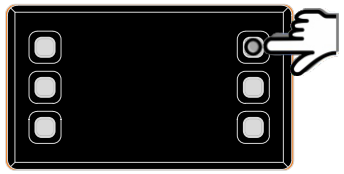
Start picture during the start procedure:

After start procedure

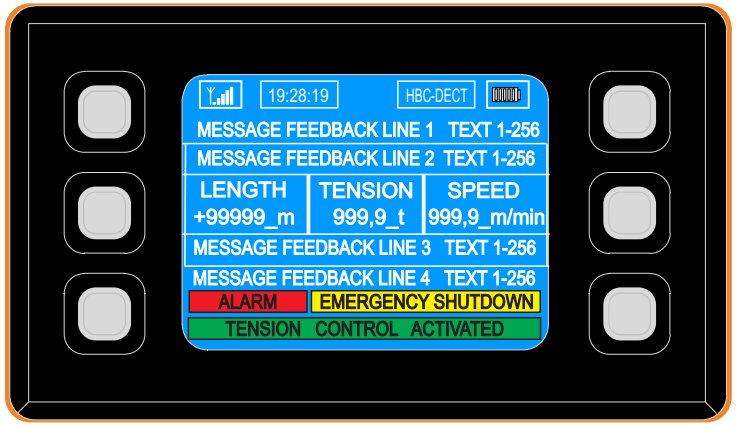




push button once

push button again to show
the alternative information display

Low battery flashing



				Datum		Kunde HBC-radiomatic Norge		HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / transmitter ADCON-Konfig.: iON-Konfig.: iLOG-Konfig.:	Zeichnung	
				Gezeichnet		Kommission				Fabrikationsnummer 727-1820569	Auftragsnummer
				Geprüft		Bestellnummer					V1.2
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch			1 / 11 Bl.

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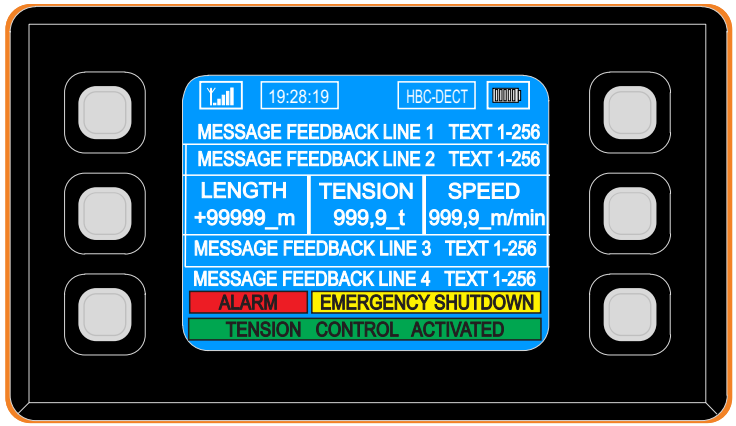
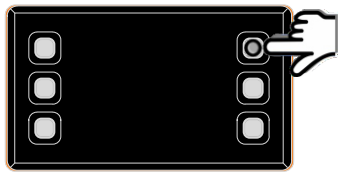
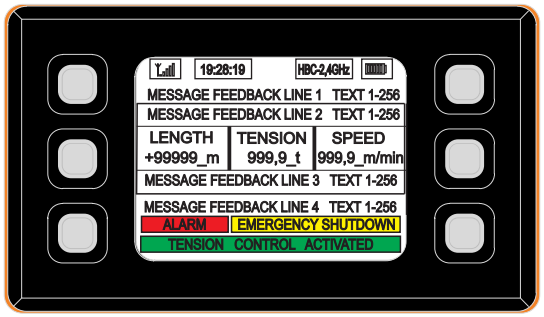
HBC-radiomatic GMBH



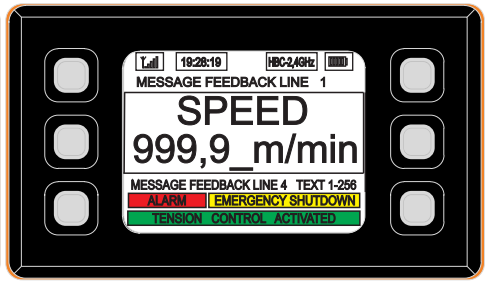


push button once

push button again to show
the alternative information display



retur to main display if bit X is activated



				Datum		Kunde HBC-radiomatic Norge		HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / transmitter ADCON-Konfig.: iON-Konfig.: iLOG-Konfig.:	Zeichnung	
				Gezeichnet		Kommission				Fabrikationsnummer 727-1820569	Auftragsnummer
				Geprüft		Bestellnummer					V1.2
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch			1 / 11 Bl.

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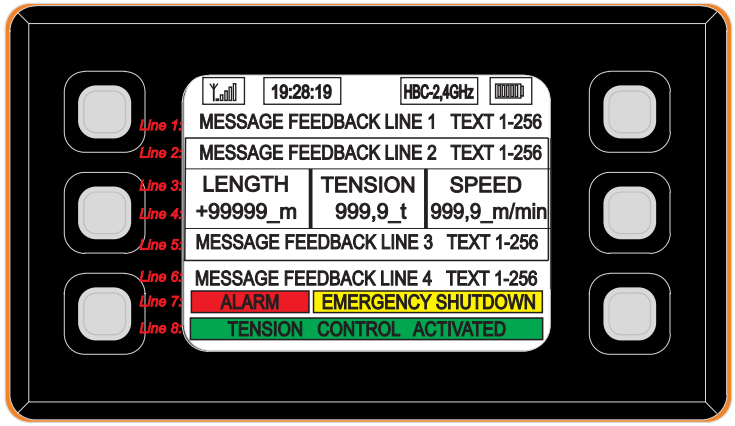
HBC-radiomatic GMBH



Line 1: MESSAGE FEEDBACK LINE 1 1-256

1x bit for flashing
1x activate line 1

Line 2: MESSAGE FEEDBACK LINE 1 TEXT 1-256

1x bit for flashing
1x activate line 2

TEXT 1: WINCH 1
TEXT 2: WINCH 2
TEXT 3: WINCH 3
TEXT 4: WINCH 4
TEXT 5: WINCH 5
TEXT 6: WINCH 6
TEXT 7: WINCH 7
TEXT 8: WINCH 8
TEXT 9: WINCH 9
TEXT 10: WINCH 10
TEXT 11: SPARE 1
TEXT 12: SPARE 2
.
.
.
TEXT 256: .....

Line 3: LENGTH | TENSION | SPEED

Line 4: +99999_m | 999,9_t | 999,9_m/min

(-99999)-(+99999) | (0-999,9) | (0-999,9)

Wertebereich/ range	Einheit/ unit
0	m
1	feet
2	ft
3	

Wertebereich/ range	Einheit/ unit
0	t
1	LBS
2	
3	

Wertebereich/ range	Einheit/ unit
0	m/min
1	m/s
2	feet/min
3	ft/min

DISPLAY RIGHT LINE 4

Wertebereich/ range	Einheit/ unit
0	m
1	feet
2	ft
3	

DISPLAY RIGHT LINE 5

Wertebereich/ range	Einheit/ unit
0	t
1	LBS
2	
3	

DISPLAY RIGHT LINE 6

Wertebereich/ range	Einheit/ unit
0	m/min
1	m/s
2	feet/min
3	ft/min

Line 5: MESSAGE FEEDBACK LINE 2 TEXT 1-256

TEXT 1: GENERAL_ALARM
TEXT 2: PLC COMMUNI.ERROR
TEXT 3: REMOTE RADIO ERROR
TEXT 4: EMERGENCY STOP
TEXT 5: LOAD CELL FAULT
TEXT 6: OVERLOAD 90%
TEXT 7: OVERLOAD 100%
TEXT 8: OVERLOAD 110%
TEXT 9: OIL TEMPER. TOO HIGH
TEXT 10: OIL TEMPER. HIGH
TEXT 11: OIL TEMPER. S.FAULT
TEXT 12: OIL LEVEL LOW
TEXT 13: OIL LEVEL LOW LOW
TEXT 14: HYDRAUL.PUMP OVERLOAD
TEXT 15: HYDR:PUMP FAULT
.
.
TEXT 256: .....

1x bit for flashing
1x activate line

Line 6: MESSAGE FEEDBACK LINE 2 TEXT 1-256

TEXT 1: GENERAL_ALARM
TEXT 2: PLC COMMUNI.ERROR
TEXT 3: REMOTE RADIO ERROR
TEXT 4: EMERGENCY STOP
TEXT 5: LOAD CELL FAULT
TEXT 6: OVERLOAD 90%
TEXT 7: OVERLOAD 100%
TEXT 8: OVERLOAD 110%
TEXT 9: OIL TEMPER. TOO HIGH
TEXT 10: OIL TEMPER. HIGH
TEXT 11: OIL TEMPER. S.FAULT
TEXT 12: OIL LEVEL LOW
TEXT 13: OIL LEVEL LOW LOW
TEXT 14: HYDRAUL.PUMP OVERLOAD
TEXT 15: HYDR:PUMP FAULT
.
.
TEXT 256: .....

1x bit for flashing
1x activate line

Line 7: ALARM | EMERGENCY SHUTDOWN

1x bit for flashing
1x activate line

1x bit for flashing
1x activate line

Line 8: TENSION CONTROL ACTIVATED

1x bit for flashing
1x activate line

				Datum		Kunde	HBC-radiomatic Norge		HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / transmitter	Zeichnung
				Gezeichnet		Kommission				ADCON-Konfig.:	
				Geprüft		Bestellnummer				iON-Konfig.:	Fabrikationsnummer 727-1820569
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch		iLOG-Konfig.:	Auftragsnummer

V1.2
1 / 11 Bl.

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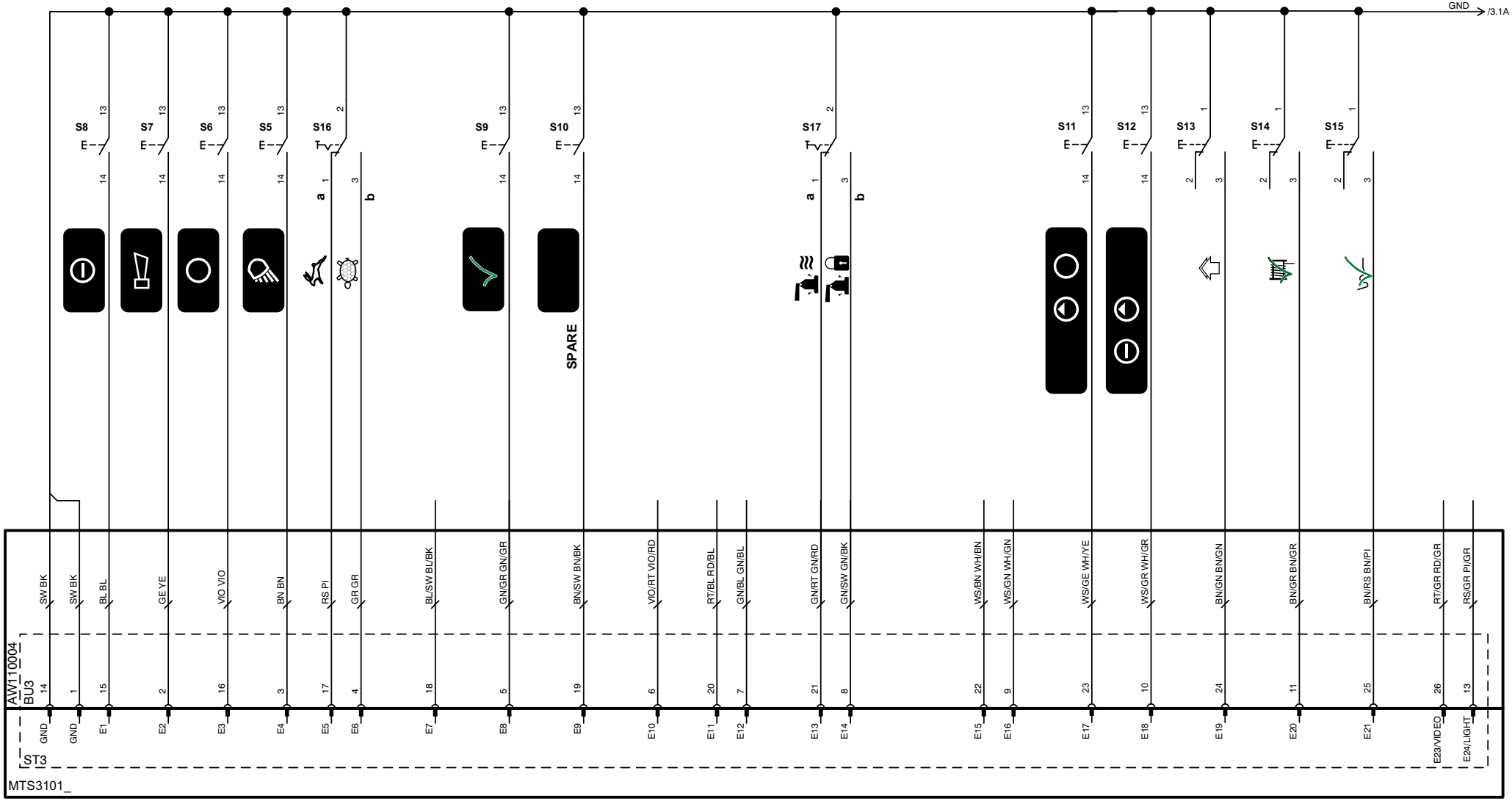

	Funk-Start radio start
	Kran-Ein-Verriegelung crane on interlock
	radiomatic® infrakey
	Kabeloption cable option

	radiomatic® zero-g
	radiomatic® roll-detect
	radiomatic® shock-off
	inclination switch

15	APO-Zeit (min.) APO-time (min.)

Funktion E17-24 function E17-24	LB2	▮▮
Funktion E9-16 function E9-16	LB3	▮▮
Funktion E41-43 function E41-43	LB4	▮▮
▮▮ SI1	▮▮ SI2	

E1-8 immer SI1
E1-8 always SI1

4	Hidden-Switch

Start
start

LB8
▮▮

Lötbrücke auf Encoder
solder strap up Encoder

LB1	LB2	LB3
▮▮	▮▮	▮▮

▮▮ Start via Ein-/ Start-Taster
start via on-/ start-pushbutton
▮▮ Start via iCON
start via iCON

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name		
				Datum	18.01.2019
				Gezeichnet	avns
				Geprüft	avle
				Genehmigt	

Kunde HBC-radiomatic Norge
Kommission Triplex KN150/Fassmer Atair
Bestellnummer 24049-CK
Orig. REF: 727-1819447 | Ersetzt | Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_20567-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung
Fabrikationsnummer 727-1820569
Auftragsnummer 21818648
V1.3
2 / 11 Bl.

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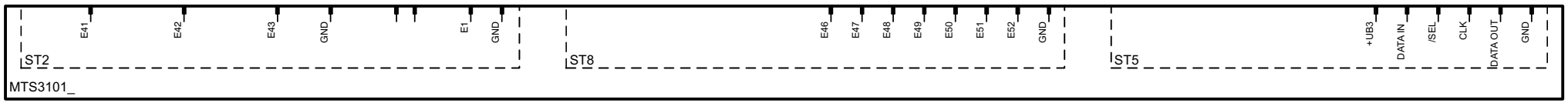

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

				Datum	18.01.2019	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter	Zeichnung	
				Gezeichnet	avns	Kommission	Triplex KN150/Fassmer Atair		ADCON-Konfig.: 727_18_20567-rev_.sg1	Fabrikationsnummer	Auftragsnummer
				Geprüft	avle	Bestellnummer	24049-CK		iON-Konfig.:	727-1820569	21818648
Rev.	Änderung	Datum	Name	Genehmigt		Orig. REF: 727-1819447	Ersetzt	Ersetzt durch	iLOG-Konfig.: KSD10001		V1.3 3 / 11 Bl.

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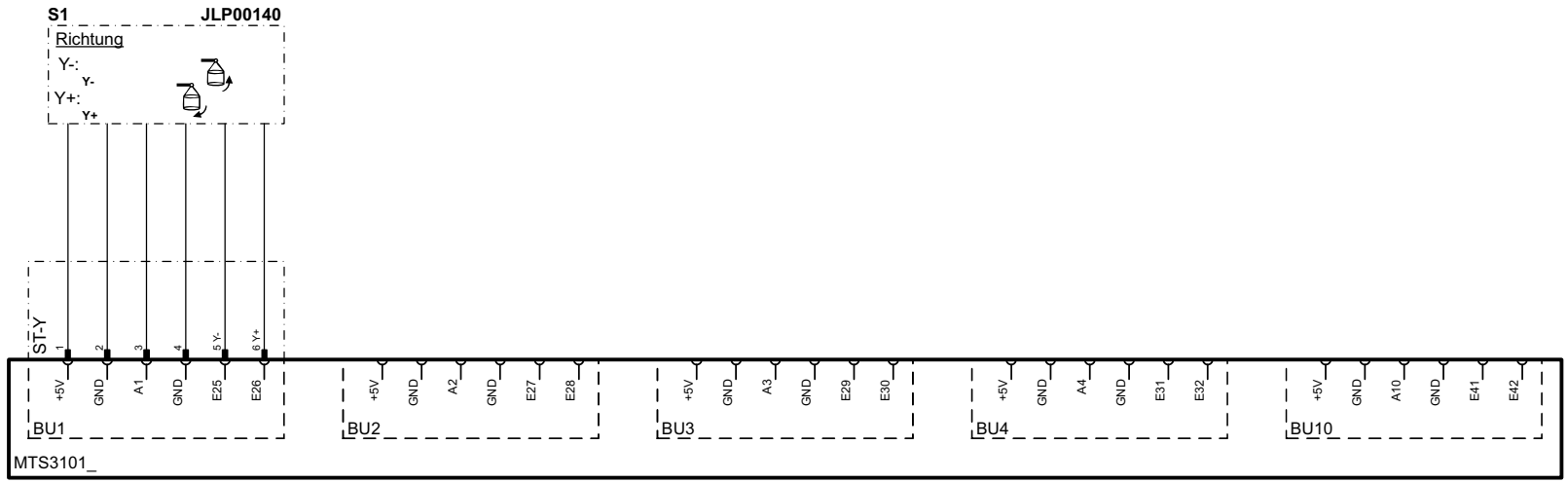
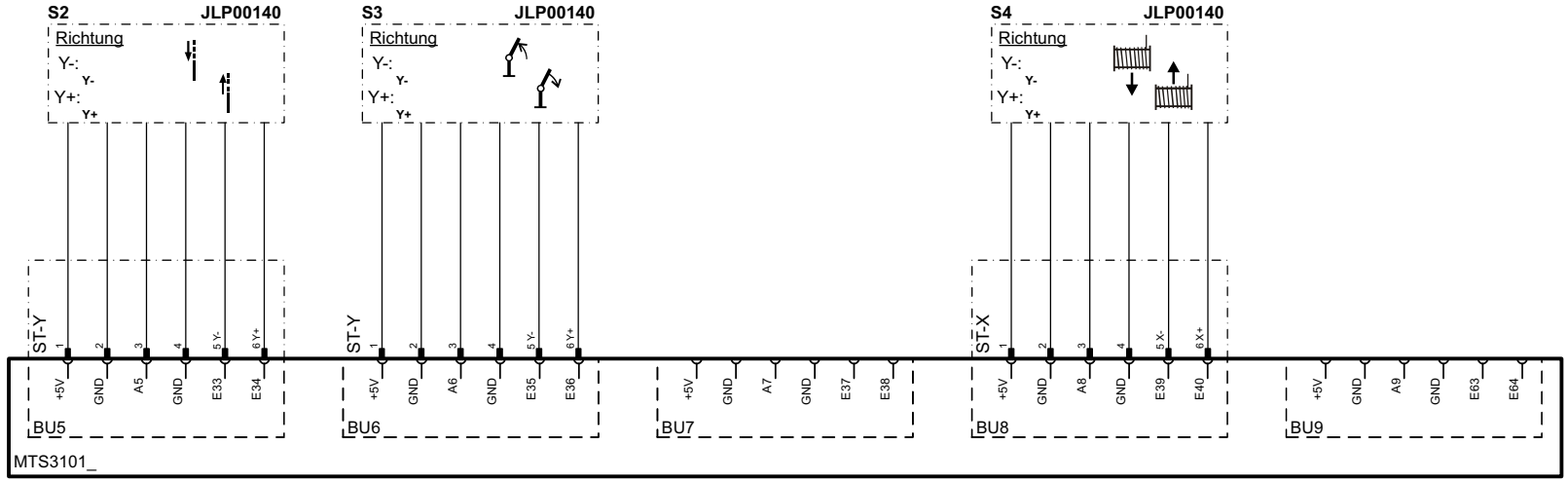
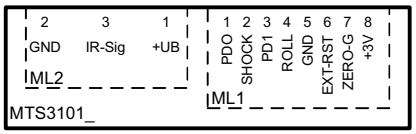
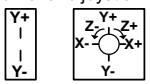






Beispiel: Linearhebel / KMS
Example: linear lever / joystick



Platinenansicht von Frontplattenseite/
PCB-view from faceplate side

BU5 BU6 BU7 BU8 BU9 BU10 BU4 BU3 BU2 BU1

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

				Datum	18.01.2019	Kunde	HBC-radiomatic Norge		
				Gezeichnet	avns	Kommission	Triplex KN150/Fassmer Atair		
				Geprüft	avle	Bestellnummer	24049-CK		
Rev.	Änderung	Datum	Name	Genehmigt		Orig. REF: 727-1819447	Ersetzt	Ersetzt durch	

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_20567-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung

Fabrikationsnummer
727-1820569

Auftragsnummer
21818648

V1.3

4 / 11 Bl.

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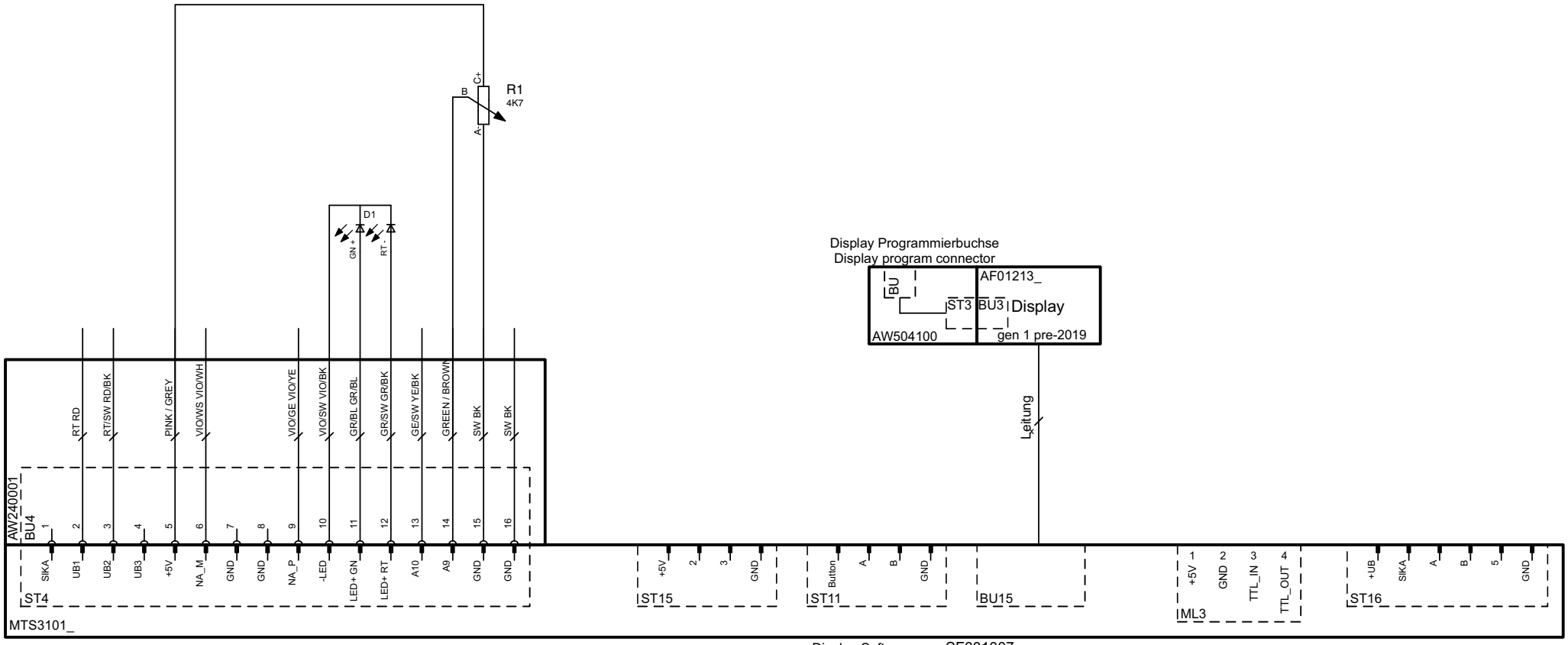

Display-Software :SF001007
Display-Konfiguration:727_15_17515-rev_.TDP

ST15 PIN1
LB9
ohne/without +5V
mit/with +5V

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

				Datum	18.01.2019	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter ADCON-Konfig.: 727_18_20567-rev_.sg1 iON-Konfig.: iLOG-Konfig.: KSD10001	Zeichnung	
				Gezeichnet	avns	Kommission	Triplex KN150/Fassmer Atair			Fabrikationsnummer 727-1820569	Auftragsnummer 21818648
				Geprüft	avle	Bestellnummer	24049-CK				V1.3
Rev.	Änderung	Datum	Name	Genehmigt		Orig. REF: 727-1819447	Ersetzt	Ersetzt durch			5 / 11 Bl.

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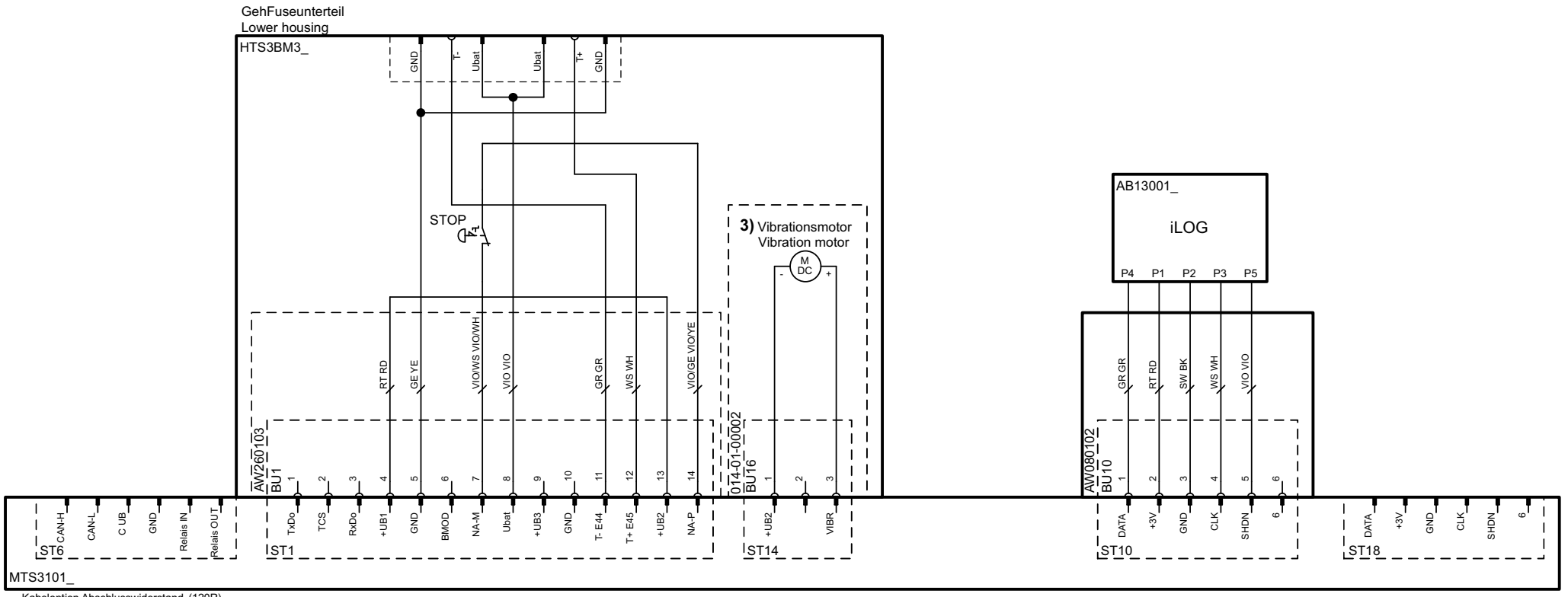

Kabeloption Abschlusswiderstand (120R)
cable option termination resistor (120R)

LB1

3) Vibrationsmotor wird bei Unterspannung und über Rückmeldung angesteuert
Motor for vibration is active by undervoltage and via feedback

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

				Datum	18.01.2019	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter ADCON-Konfig.: 727_18_20569-rev_.sg1 iON-Konfig.: iLOG-Konfig.: KSD10001	Zeichnung	
				Gezeichnet	avns	Kommission	Triplex KN150/Fassmer Atair			Fabrikationsnummer 727-1820569	Auftragsnummer 21818648
				Geprüft	avle	Bestellnummer	24049-CK				V1.3
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch			6 / 11 Bl.

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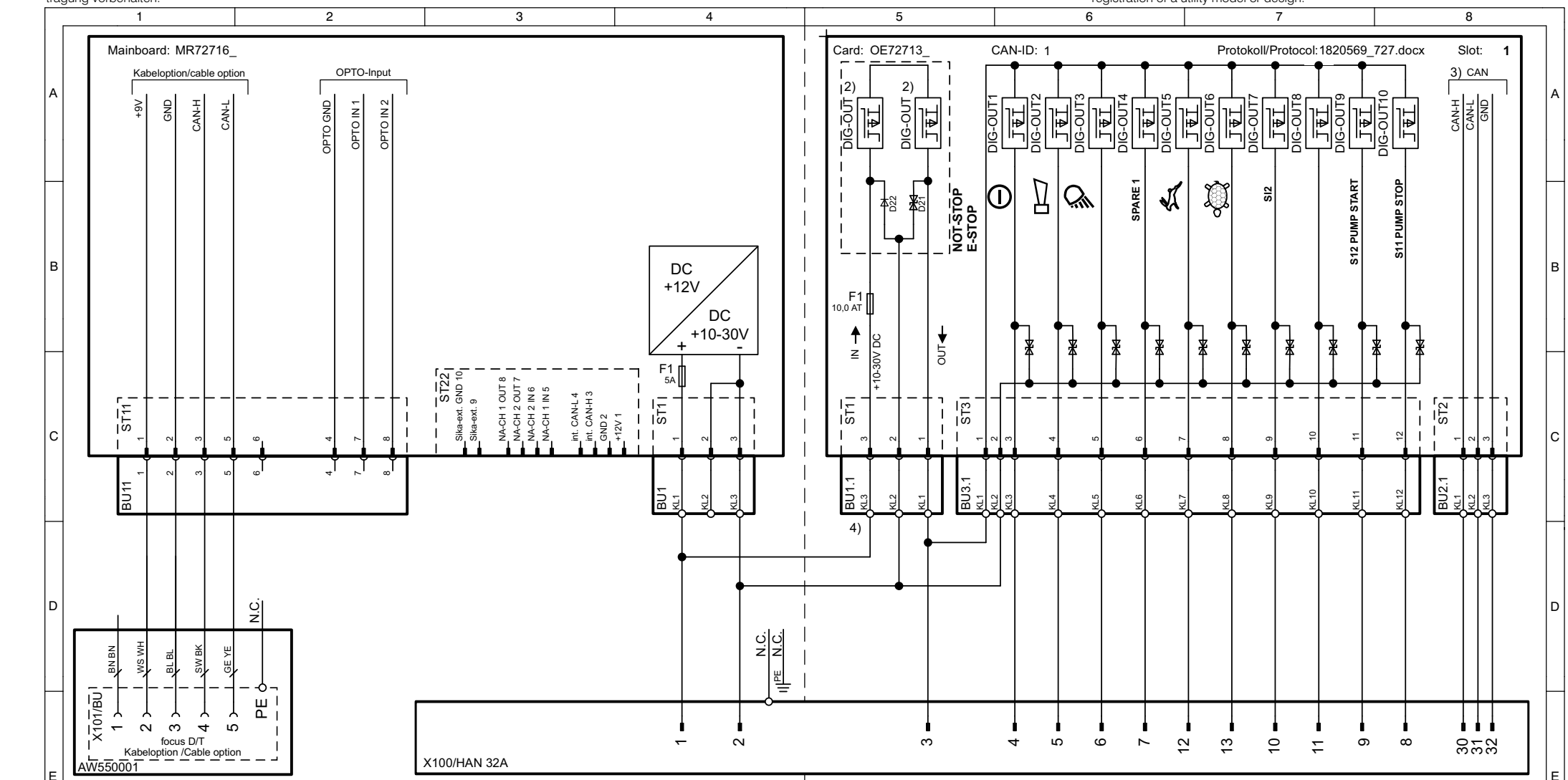
HBC-radiomatic GMBH



LB1
int. CAN Abschlusswiderstand (120R)
int. CAN termination resistor (120R)

LB2
CAN Abschlusswiderstand (120R)
CAN termination resistor (120R)

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

4) Zur Inbetriebnahme des Systems muss der Eingang des NOT-STOP Kreises (BU1.1 KL3) mit +10-30V DC versorgt werden.
To activate the system the input of the E-STOP circuit (BU1.1 KL3) must be supplied with +10-30V DC

Bei Bus-Systemen muss die maschinenseitige Elektronik alle Schaltbefehle, die dem Sicherheitskreis 2 unterliegen, über den funkseitigen Si-2-Hardwareausgang auf Plausibilität prüfen und beim Auftreten von Implausibilitäten unmittelbar in den sicheren Zustand versetzen.
For bus systems, the electronics of the machine needs to examine all drive commands that are part of the safety circuit 2 for plausibility via the Si-2 hardware output on the side of the radio and initiate the safe state in case of implausibilities.

OUT1-4	LB4	LB5	LB6	LB7	LB8
OUT5-6	LB9	LB10	LB11	LB12	LB13
OUT7-10	LB14	LB15	LB16	LB17	LB18
	12V	SI0	SI1	SI2	SI2v

2) NOT-STOP im Betriebszustand geschlossen
E-STOP closed in operating condition

im Teach-Modus (ca. 1sec)
in teach-mode (ca. 1sec)

Die NOT-STOP-Kette muss in der nachgeschalteten Anlage durch einen von den übrigen Schaltbefehlen unabhängigen Kreis ausgewertet werden!
The E-STOP contacts have to be utilized to control a main emergency stop circuit which is to be independent from all other control functions!

3) LB3
CAN Abschlusswiderstand (120R)
CAN terminating resistor (120R)

S3 12345678 OFF ON DIP-Switch 1
S4 1234 OFF ON DIP-Switch 4

Funktion S3/4 siehe Protokoll
Function S3/4 see protocol

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	20.09.2022	avel	

Datum	20.09.2022
Gezeichnet	avel
Geprüft	avrb
Kunde	HBC-radiomatic Norge
Kommission	MacGregor / Triplex
Bestellnummer	26165-KLE
Orig.	
Ersetzt	
Ersetzt durch	

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Empfänger / Receiver
ADCON-Konfig.: 727_18_20570-rev_.cmc

Zeichnung	
Fabrikationsnummer	727-1820570
Auftragsnummer	26165
	V1.2
	10 / 13 Bl.

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Sender Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen	Software
1	006-02-00267	006-02-00267	Housing transmitter spectrum D Oberteil Housing transmitter spectrum D upper housing	orange orange		
2	107-90-00021	107-90-00021	radiomatic® ADCON			
3	107-90-00022	107-90-00022	radiomatic® iLOG			
4	AB13001_	AB13001_	iLOG-Lesemodul für spectrum			
5	AB15701_	AB15701_	Antenne Modul für TC240 antenna module for TC240			
6	AF01213_	AF01213_	Display spectrum D / E (10cm Flachbandkabel) Display spectrum D / E (10cm ribbon cable)			SF001007
7	AP00160_	AP00160_	Überrollbügel spectrum 3/D (Edelstahl) rollover bar spectrum 3/D (stainless steel)			
8	D1	009-10-00025	DUO-LED rot/grün matt mit Fassung & Sammellinse DUO-LED red/green dim with socket & collecting lens	d=8mm		
9	EE00315_	EE00315_	Encoder	Encoder spectrum VDT2 iLOG		SE0D211_ / SS00210_
10	HTS3BM3_	HTS3BM3_	Housing transmitter spectrum 3 Unterteil	Stop-Schlagschalter / Vibrationsmotor orange		
11	MTS3101_	MTS3101_	Mainboard transmitter spectrum 3/D	VDT2		
12	S1	JLP00140	Linear Lever HBC			
13	S2	JLP00140	Linear Lever HBC			
14	S3	JLP00140	Linear Lever HBC			
15	S4	JLP00140	Linear Lever HBC			
16	S5	IE230017	KHT, kurz KHT, short	d=16mm		
17	S6	IE230017	KHT, kurz KHT, short	d=16mm		
18	S7	IE230017	KHT, kurz KHT, short	d=16mm		
19	S8	IE230017	KHT, kurz KHT, short	d=16mm		
20	S9	IE230017	KHT, kurz KHT, short	d=16mm		
21	S10	IE230017	KHT, kurz KHT, short	d=16mm		
22	S11	IE230017	KHT, kurz KHT, short	d=12mm		
23	S12	IE230017	KHT, kurz KHT, short	d=12mm		
24	S13	IE230001	D-JET pushbutton	d=12mm		
25	S14	IE230001	D-JET pushbutton	d=12mm		
26	S15	IE230001	D-JET pushbutton	d=12mm		
27	S16	IE120009	toggle switch maintain-maintain small	d=12mm		
28	S17	IE120009	toggle switch maintain-maintain small	d=12mm		
29	R1	IE340001	potentiometer	d=10mm		

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name
			Datum 18.01.2019
			Gezeichnet avns
			Geprüft avle
			Genehmigt

Kunde HBC-radiomatic Norge
Kommission Triplex KN150/Fassmer Atair
Bestellnummer 24049-CK
Orig. REF: 727-1819447 | Ersetzt | Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Listen / Lists

Zeichnung

Fabrikationsnummer 727-1820569

Auftragsnummer 21818648

V1.3

9 / 11 Bl.

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Sender
Transmitter
Kabelbaum
Harness

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen
1	AW080102	AW080102	Verdrahtungshilfe harness	AMP-Buchse 6pol., 5 Adern, eco 2 UT	
2	AW110004	AW110004	Verdrahtungshilfe harness	AMP-Buchse 26pol., 28 Adern, spectrum	
3	AW240001	AW240001	Verdrahtungshilfe harness	AMP-Buchse 16pol., 14 Adern, spectrum	
4	AW504100	AW504100	Binder auf USB, Editier-Schnittstelle für TFT-Display		

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name		
				Datum	18.01.2019
				Gezeichnet	avns
				Geprüft	avle
				Genehmigt	

Kunde HBC-radiomatic Norge
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Empfänger
Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen	Software
1	107-90-00021	107-90-00021	radiomatic® ADCON			
2	BU1	010-02-00499	Buchsenleiste 3-polig female connector strip 3-polig			
3	BU1.1	010-02-00011	Buchsenleiste 3-polig female connector strip 3-polig			
4	BU1.3	010-02-00526	Buchsenleiste 21-polig female connector strip 21-polig			
5	BU2.1	010-02-00506	Buchsenleiste 3-polig female connector strip 3-polig			
6	BU3.1	010-02-00507	Buchsenleiste 12-polig female connector strip 12-polig			
7	BU11	010-02-00346	Buchsengehäuse, 8-polig			
8	CM7372__	CM7372__	CAN-Manager	CAN-Manager TC20/38		SA00320_ / SB00320_ / SY00320_
9	HR168B73	HR168B73	Kunststoff-Gehäuse FSE727, HAN 32/50, Buchse 5-polig (L), MR72716_ plastic-case FSE727, HAN 32/50, female connector 5-pole (L), MR72716_	orange orange		
10	MR72716_	MR72716_	Mainboard Empfänger 727 Mainboard Receiver 727	DC 10-30V mit geox, Kabeloption, Optokoppler DC 10-30V with geox, cable option, optical isolator		
11	OE72713_	OE72713_	NOT-STOP-Ausgabekarte E-STOP-output card	DC, 10xHigh-Side-Switch + CAN Safety		SOE0130__.s19 / SOE0220__.hex

Steckeinheit
Plug-in unit

Zeile	Name	Material	Typbezeichnung	Beschreibung	Katalognummer	Hersteller
1	X100/HAN 32A	010-03-00097	Anbaugehäuse Size 32A addition housing Size 32A	gerade, niedrige Bauart, 2 Bügel straight, low Type of Construction, 2 clamp	09 20 032 0301	Harting
2	010-03-00080	010-03-00080	Steckereinsatz HAN 16A (Size 16/32A) plug insert HAN 16A (Size 16/32A)	Crimpanschluß crimp connection	09 20 016 3001	Harting
3	010-03-00102	010-03-00102	Steckereinsatz HAN 32A (Size 32A) plug insert HAN 32A (Size 32A)	Crimpanschluß crimp connection	09 20 016 3011	Harting

Kabelbaum
Harness

Zeile	Name	Material	Typbezeichnung	Beschreibung	Bemerkungen
1	AW550001	AW550001	Verdrahtungshilfe harness	focus D, Kabeloption focus D, cable option	

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
			Datum	18.01.2019
			Gezeichnet	avns
			Geprüft	avle

Kunde HBC-radiomatic Norge
Kommission Triplex KN150/Fassmer Atair
Bestellnummer 24049-CK
Orig. REF: 727-1819447 | Ersetzt | Ersetzt durch

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74564 Crailsheim

Listen / Lists

Zeichnung

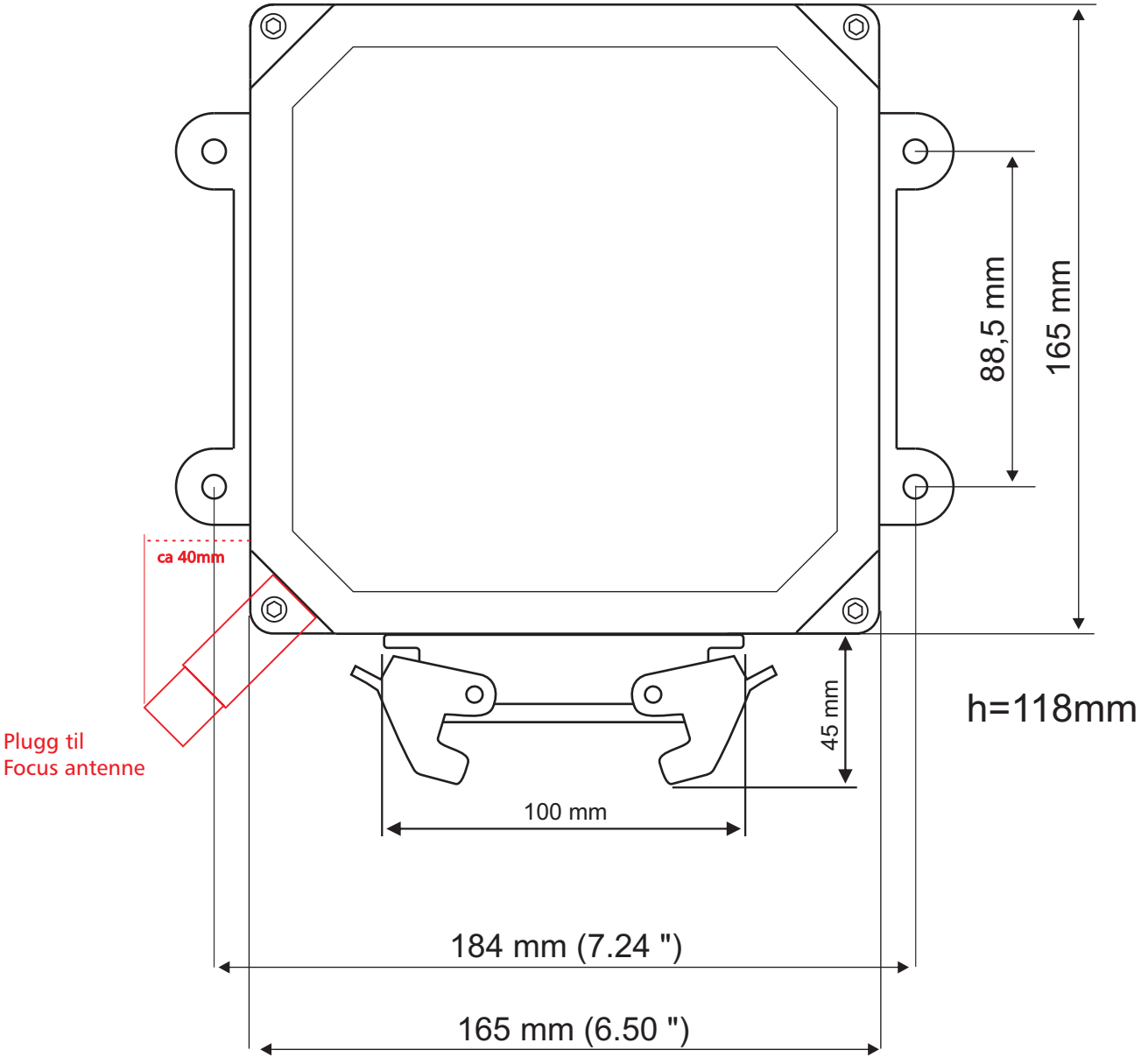
Fabrikationsnummer
727-1820569

Auftragsnummer
21818648

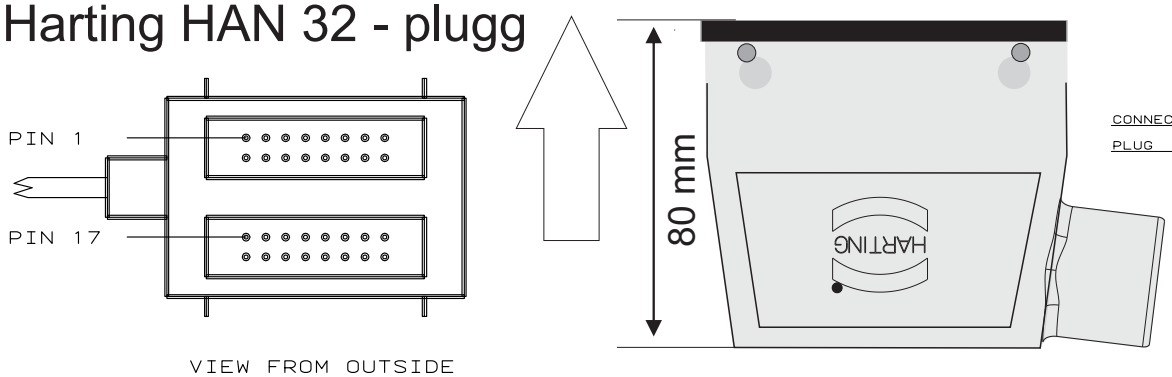
V1.3

11 / 11 Bl.

Receiver FSE 727 (HR 168)

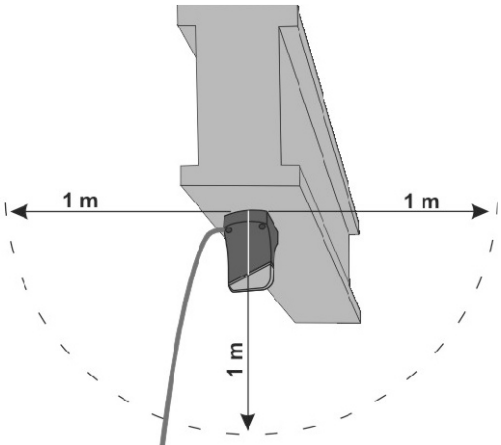


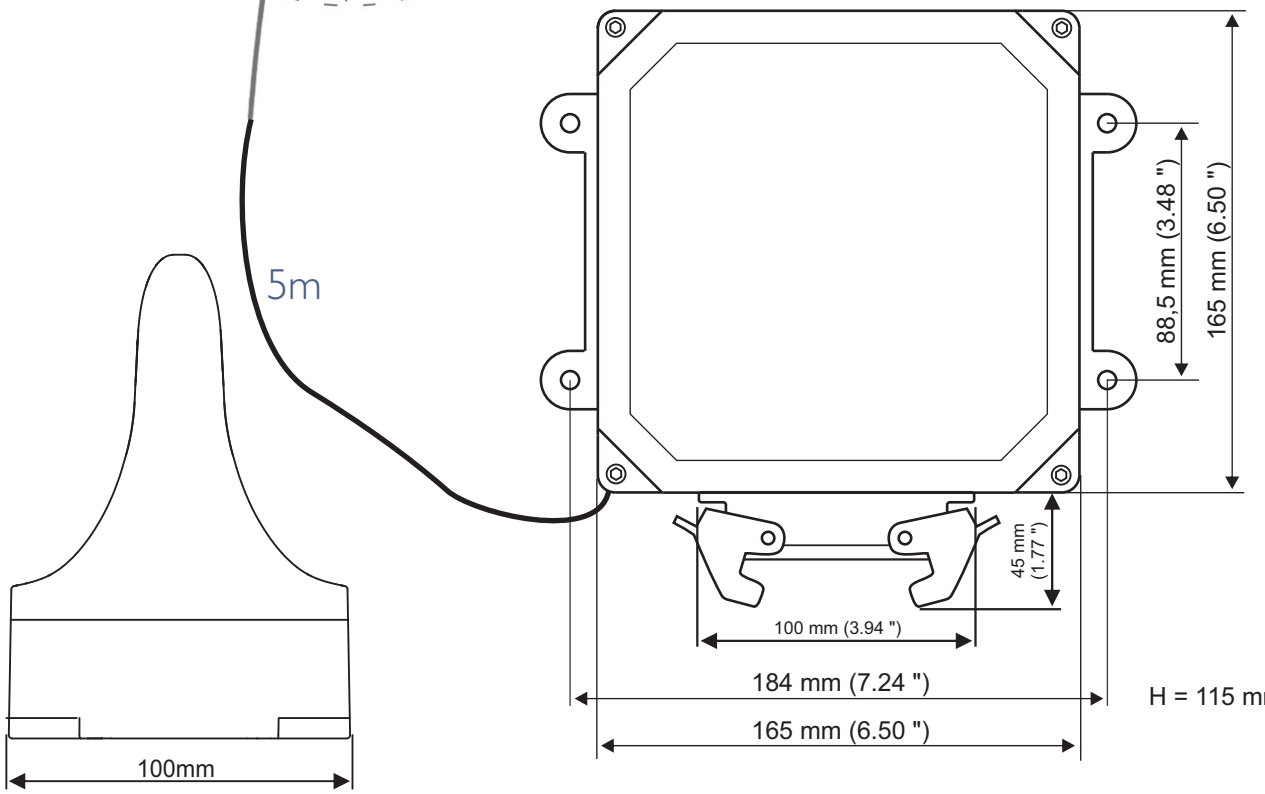
Harting HAN 32 - plugg

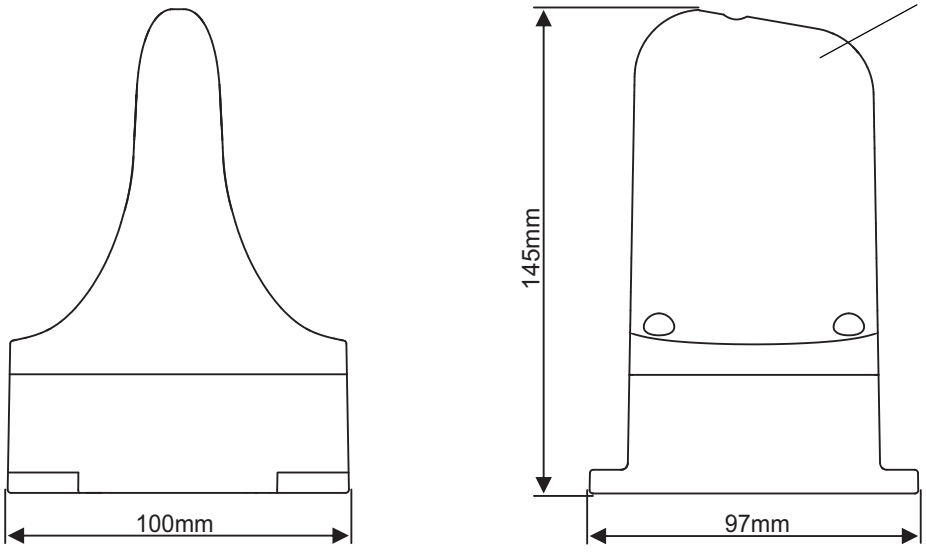


Mottaker FSE 727 focus T 2,4GHz

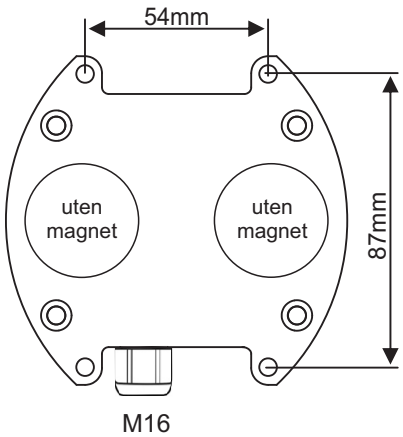
focus T 2,4 GHz mottaker unit standard:
5m kabel lengde
Opsjon: skjøtekabel med 5m,10m, 20m eller 50m lengde







MONTERING.
Til montering brukes to av de diagonale hullene.



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1. Dip-Schalter / dip-switch

1.1. S3

- Einstellung der CANopen Node-ID/adjustment of CANopen Node-ID

Schalter/switch S3			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Node-ID CANopen		x
2	2^1 x D	Node-ID CANopen		x
3	2^2 x D	Node-ID CANopen	x	
4	2^3 x D	Node-ID CANopen	x	
5	2^4 x D	Node-ID CANopen	x	
6	2^5 x D	Node-ID CANopen	x	
7	2^6 x D	Node-ID CANopen	x	
8		reserviert/reserved	x	

- Node-ID [dez]: **3**

1.2. S4

- Einstellung der Bitrate CAN/adjustment of bit rate CAN

Schalter/switch S4			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Bit-Rate CAN		x
2	2^1 x D	Bit-Rate CAN	x	
3	2^2 x D	Bit-Rate CAN	x	
4		reserviert/reserved	x	

Wert	Bit Rate [kBit/s]
0	50
1	125
2	250
3	500
4	1000
5	keine Funktion/no function
6	keine Funktion/no function
7	keine Funktion/no function

- CAN-Bit-Rate[kBit/s]:**125**

2. Globale Einstellungen / global configuration

2.1. Heartbeat

aktiv	Zykluszeit/ cycle time
☒	1s

2.2. CANopen-Safety

aktiv	Zykluszeit/ cycle time
☐	50ms

- CANopen Safety SRDOs

SRDO1-Objekt	ID	1	2
Inhalt/content	default**	NA*	NA inv*

SRDO2-Objekt	ID	1	2
Inhalt/content	default**	NA inv*	NA*

* NA = 0xFF (Notauskreis geschlossen/emergency stop closed)
NA = 0x00 (Notauskreis offen/emergency stop open)

** ID = default (ID-SRDO1 = 0xFF+2*Node-ID, ID-SRDO2 = 0x100+2*Node-ID)
ID = 0x___ (Festwert konfiguriert / fixed value configured)

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3. TX-Data

3.1. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	01	0	RADIO ON S8	0/1	1.SI1/0
		1		0/1	1.SI1/1
		2	HORN S7	0/1	1.SI1/2
		3	LIGHT S5	0/1	1.SI1/3
		4	(SLOW MODE) TURTLE S16b	0/1	1.SI1/4
		5	(FAST MODE) HARE S16a	0/1	1.SI1/5
		6		0/1	1.SI1/6
		7	ACCU LOW	0/1	1.SI1/7
	02	0		0/1	2.Si1/0
		1	S9	0/1	2.Si1/1
		2	S10 (SPARE)	0/1	2.Si1/2
		3	(E23)	0/1	2.Si1/3
		4	(E24)	0/1	2.Si1/4
		5		0/1	2.Si1/5
		6		0/1	2.Si1/6
		7		0/1	2.Si1/7
	03	0		0/1	3.Si1/0
		1		0/1	3.Si1/1
		2		0/1	3.Si1/2
		3	S17a	0/1	3.Si1/3
		4	S17b	0/1	3.Si1/4
		5		0/1	3.Si1/5
		6		0/1	3.Si1/6
		7		0/1	3.Si1/7
	04	0		0/1	4.Si1/0
		1		0/1	4.Si1/1
		2		0/1	4.Si1/2
		3		0/1	4.Si1/3
		4		0/1	4.Si1/4
		5		0/1	4.Si1/5
		6		0/1	4.Si1/6
		7		0/1	4.Si1/7
	05	0		0/1	5.Si1/0
		1		0/1	5.Si1/1
		2		0/1	5.Si1/2
		3		0/1	5.Si1/3
		4		0/1	5.Si1/4
		5		0/1	5.Si1/5
		6		0/1	5.Si1/6
		7		0/1	5.Si1/7
	06	0		0/1	6.Si1/0
		1		0/1	6.Si1/1
		2		0/1	6.Si1/2
		3		0/1	6.Si1/3
		4		0/1	6.Si1/4
		5		0/1	6.Si1/5
		6		0/1	6.Si1/6
		7		0/1	6.Si1/7
	07	0		0/1	7.Si1/0
		1		0/1	7.Si1/1
		2		0/1	7.Si1/2

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		3		0/1	7.Si1/3
		4		0/1	7.Si1/4
		5		0/1	7.Si1/5
		6		0/1	7.Si1/6
		7		0/1	7.Si1/7

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3.2. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	08	0	HPU START S12	0/1	1.SI2/0
		1	HPU STOP S11	0/1	1.SI2/1
		2	ACTIVATE WINCH S13	0/1	1.SI2/2
		3	SELECT WINCH S14	0/1	1.SI2/3
		4	TENSION CONTROL S15	0/1	1.SI2/4
		5		0/1	
		6		0/1	
		7	PILOT VALVE S4	0/1	Logic
	09	0	PILOT VALVE S1-S3	0/1	Logic
		1		0/1	Logic
		2	PILOT VALVE S1 – S4	0/1	Logic
		3	PILOT R1 (OUT OF ZERO)	0/1	Logic
		4		0/1	2.SI2/4
		5		0/1	2.SI2/5
		6		0/1	2.SI2/6
		7		0/1	2.SI2/7
	0A	0		0/1	Logic
		1		0/1	Logic
		2	S1 Y+	0/1	Logic
		3	S1 Y-	0/1	Logic
		4		0/1	Logic
		5		0/1	Logic
		6	S2 Y+	0/1	Logic
		7	S2 Y-	0/1	Logic
	0B	0	S3 Y+	0/1	Logic
		1	S3 Y-	0/1	Logic
		2		0/1	Logic
		3		0/1	Logic
		4	S4 Y+	0/1	Logic
		5	S4 Y-	0/1	Logic
		6		0/1	Logic
		7		0/1	Logic
	0C	0		0/1	Logic
		1		0/1	Logic
		2		0/1	5.SI2/2
		3		0/1	5.SI2/3
		4		0/1	5.SI2/4
		5		0/1	5.SI2/5
		6		0/1	5.SI2/6
		7	R1 (OUT OF ZERO)	0/1	Logic
	0D	0		0/1	6.SI2/0
		1		0/1	6.SI2/1
		2		0/1	6.SI2/2
		3		0/1	6.SI2/3
		4		0/1	6.SI2/4
		5		0/1	6.SI2/5
		6		0/1	6.SI2/6
		7		0/1	6.SI2/7
	0E	0	SI 1 (COMUNICATION CIRCUIT OK)	0/1	
		1	SI 2 (ZERO POSITION TEST)	0/1	

		2		0/1	
		3		0/1	
		4	TELEGRAM COUNTER 2^0	0/1	
		5	TELEGRAM COUNTER 2^1	0/1	
		6	TELEGRAM COUNTER 2^2	0/1	
		7	TELEGRAM COUNTER 2^3	0/1	

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	0F	0	NA Zustand / E-Stop State	0/1	SI1
		1	NA Zustand / E-Stop State	0/1	SI1
		2	NA Zustand / E-Stop State	0/1	SI1
		3	NA Zustand / E-Stop State	0/1	SI1
		4	NA Zustand / E-Stop State	0/1	SI1
		5	NA Zustand / E-Stop State	0/1	SI1
		6	NA Zustand / E-Stop State	0/1	SI1
		7	NA Zustand / E-Stop State	0/1	SI1
	10	0	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		1	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		2	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		3	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		4	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		5	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		6	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		7	NA Zustand invertiert / E-Stop inverted	0/1	SI1

3.3. Analogeingänge/Analog inputs

Index/ index	Subindex/ subindex	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6400	01		-128 … +127	Prop 1
	02	S1 Y- (FF-80) / S1 Y+ (00-7F)	-128 … +127	Prop 2
	03		-128 … +127	Prop 3
	04	S2 Y- (FF-80) / S2 Y+ (00-7F)	-128 … +127	Prop 4
	05	S3 Y- (FF-80) / S3 Y+ (00-7F)	-128 … +127	Prop 5
	06		-128 … +127	Prop 6
	07	S4 Y- (FF-80) / S4 Y+ (00-7F)	-128 … +127	Prop 7
	08		-128 … +127	Prop 8
	09		-128 … +127	Prop 9
	0A	R1 POTI TENSION 0…100%	0 … 127	Prop 10

3.4. TX PDO-Mapping

- 1. TX PDO (0x180+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/01	6000/02	6000/03	6000/04	6000/05	6000/06	6000/07	6000/0F

- 2. TX PDO (0x280+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/08	6000/09	6000/0A	6000/0B	6000/0C	6000/0D	6000/0E	6000/10

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HBC-radiomatic GMBH

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- 3. TX PDO (0x380+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6400/01	6400/02	6400/03	6400/04	6400/05	6400/06	6400/07	6400/08

- 4. TX PDO (0x480+Node-ID)

PDO-Objekt	1	2
Mappingparam.	6400/09	6400/0A

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4. RX-Data

4.1. Digitalausgänge/Digital outputs

Index/ Index	Subindex/ subindex		Funktion/ funktion	Darstellung/ description	Wertebereich/ range	Ziel/ target
6200	01		LENGHT (Bit 0 – 7)	DISPLAY LINE 4a +/- 0…99999	(-99999) – (+99999)	TxB 1/1
	02		LENGHT (Bit 8 – 15)			TxB 1/2
	03		LENGHT (Bit 16 – 23)			TxB 1/3
	04		LENGHT (Bit 24 – 31)			TxB 1/4
	05		TENSION (Bit 0 – 7)	DISPLAY LINE 4b 0…999,9	0 – 9999	TxB 1/5
	06		TENSION (Bit 8 – 15)			TxB 1/6
	07		SPEED (Bit 0 – 7)	DISPLAY LINE 4c 0…999,9	0 – 9999	TxB 1/7
	08		SPEED (Bit 8 – 15)			TxB 1/8
	09		MESSAGE 1	DISPLAY LINE 1	0-255	TxB 2/1
	0A		MESSAGE 2	DISPLAY LINE 2	0-255	TxB 2/2
	0B		MESSAGE 3	DISPLAY LINE 5	0-255	TxB 2/3
	0C		MESSAGE 4	DISPLAY LINE 6	0-255	TxB 2/4
	0D					TxB 2/5
	0E					TxB 2/6
	0F					TxB 2/7
	10					TxB 2/8
	11	0	DISPLAY LINE 1 (OFF/ON)		0/1	TxB 3/1
		1	DISPLAY LINE 1 (OFF/FLASH)		0/1	
		2	DISPLAY LINE 2 (OFF/ON)		0/1	
		3	DISPLAY LINE 2 (OFF/FLASH)		0/1	
		4	DISPLAY LINE 3 (OFF/ON)		0/1	
		5	DISPLAY LINE 3 (OFF/FLASH)		0/1	
		6	DISPLAY LINE 4 (OFF/ON)		0/1	
		7	DISPLAY LINE 4 (OFF/FLASH)		0/1	
	12	0	DISPLAY LINE 5 (OFF/ON)		0/1	TxB 3/2
		1	DISPLAY LINE 5 (OFF/FLASH)		0/1	
		2	DISPLAY LINE 6 (OFF/ON)		0/1	
		3	DISPLAY LINE 6 (OFF/FLASH)		0/1	
		4	DISPLAY LINE 7A (OFF/ON)		0/1	
		5	DISPLAY LINE 7A (OFF/FLASH)		0/1	
		6	DISPLAY LINE 7B (OFF/ON)		0/1	
		7	DISPLAY LINE 7B (OFF/FLASH)		0/1	
	13	0	DISPLAY LINE 8 (OFF/ON)		0/1	TxB 3/3
		1	DISPLAY LINE 8 (OFF/FLASH)		0/1	
		2	LENGTH DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		3	LENGTH DISPLAY LINE 4 VALUE 2^1 *			
		4	TENSION DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		5	TENSION DISPLAY LINE 4 VALUE 2^1 *			
		6	SPEED DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		7	SPEED DISPLAY LINE 4 VALUE 2^1 *			
	14	0			0/1	TxB 3/4
		1			0/1	
		2			0/1	
		3	VIBRATION		0/1	
		4	back to display “MAIN PAGE”		0/1	
		5			0/1	
		6			0/1	
		7			0/1	

* Einheit Zuordnung siehe Tabelle 4.2 / Unit assignment, see table 4.2.

Index/ Index	Subindex/ subindex	Funktion/ funktion	Darstellung/ description	Wertebereich/ range	Ziel/ target
6200	15	0	Decimal point LENGTH Value 2^0	0-3	TxB 3/5
		1	Decimal point LENGTH Value 2^1		
		2	Decimal point TENSION Value 2^0	0-3	
		3	Decimal point TENSION Value 2^1		
		4	Decimal point SPEED Value 2^0	0-3	
		5	Decimal point SPEED Value 2^1		
		6		0/1	
		7		0/1	
	16	0		0/1	TxB 3/6
		1		0/1	
		2		0/1	
		3		0/1	
		4		0/1	
		5		0/1	
		6		0/1	
		7		0/1	
	17	0	not used in this sys-tem (Shift-Register LED A1)	0/1	TxB 3/7
		1	not used in this sys-tem (Shift-Register LED A2)	0/1	
		2	not used in this sys-tem (Shift-Register LED A3)	0/1	
		3	not used in this sys-tem (Shift-Register LED A4)	0/1	
		4	not used in this sys-tem (Shift-Register LED A5)	0/1	
		5	not used in this sys-tem (Shift-Register LED A6)	0/1	
		6	not used in this sys-tem (Shift-Register LED A7)	0/1	
		7	not used in this sys-tem (Shift-Register LED A8)	0/1	
	18	Reserve		0 – 255	TxB 3/8

4.2. Einheit Zuordnung / Unit assignment

DISPLAY LINE 4 (LENGTH)

Wertebereich/ range	Einheit/ unit
0	m
1	feet
2	ft
3	

DISPLAY LINE 4 (TENSION)

Wertebereich/ range	Einheit/ unit
0	t
1	LBS
2	Kg
3	

DISPLAY LINE 4 (SPEED)

Wertebereich/ range	Einheit/ unit
0	m/min
1	m/s
2	feet/min
3	ft/min

4.3. Dezimalpunkt / Decimal point

Wertebereich/ range	Dezimal-punkt/ Decimal point
0	0
1	0,0
2	0,00
3	0,000

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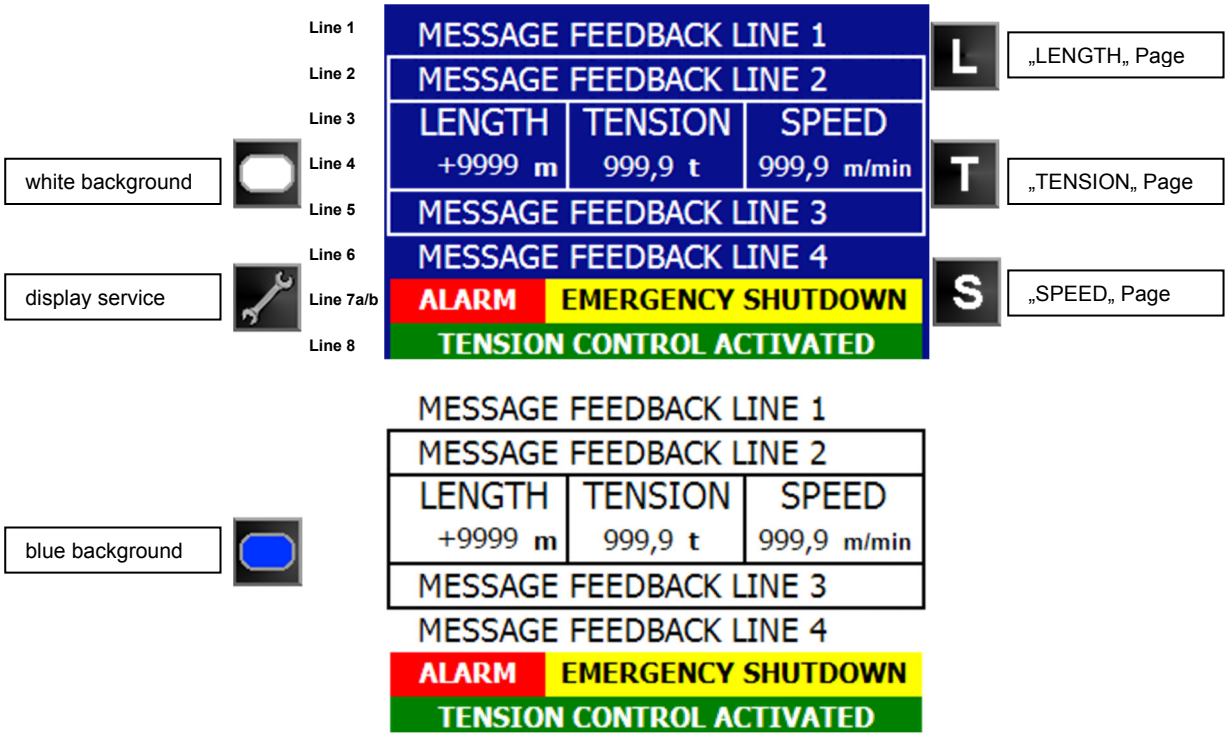
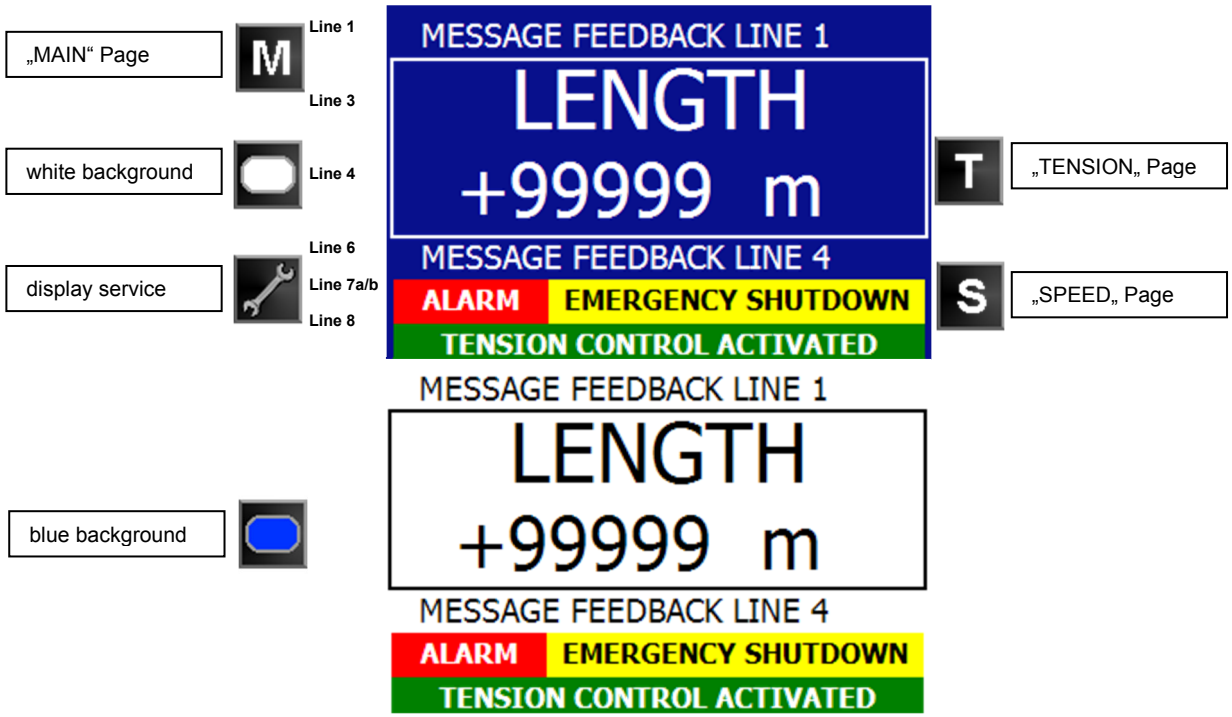
HBC-radiomatic GMBH

MAIN Page



LENGTH Page



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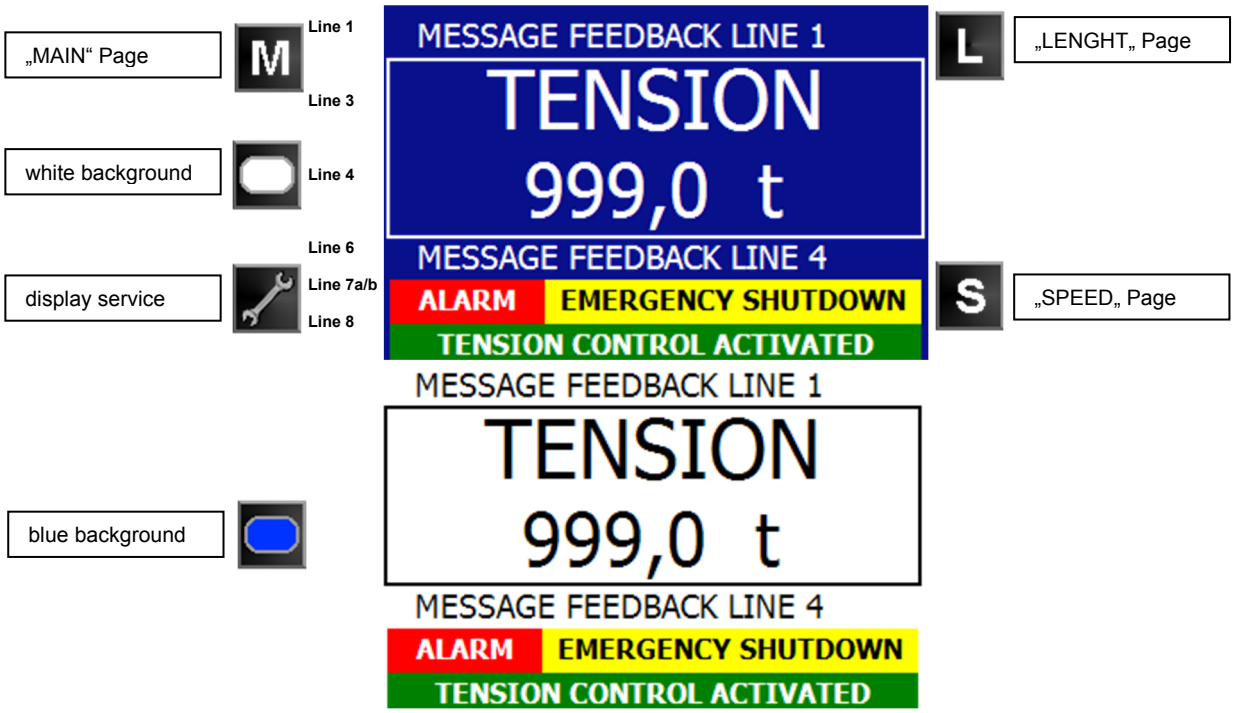
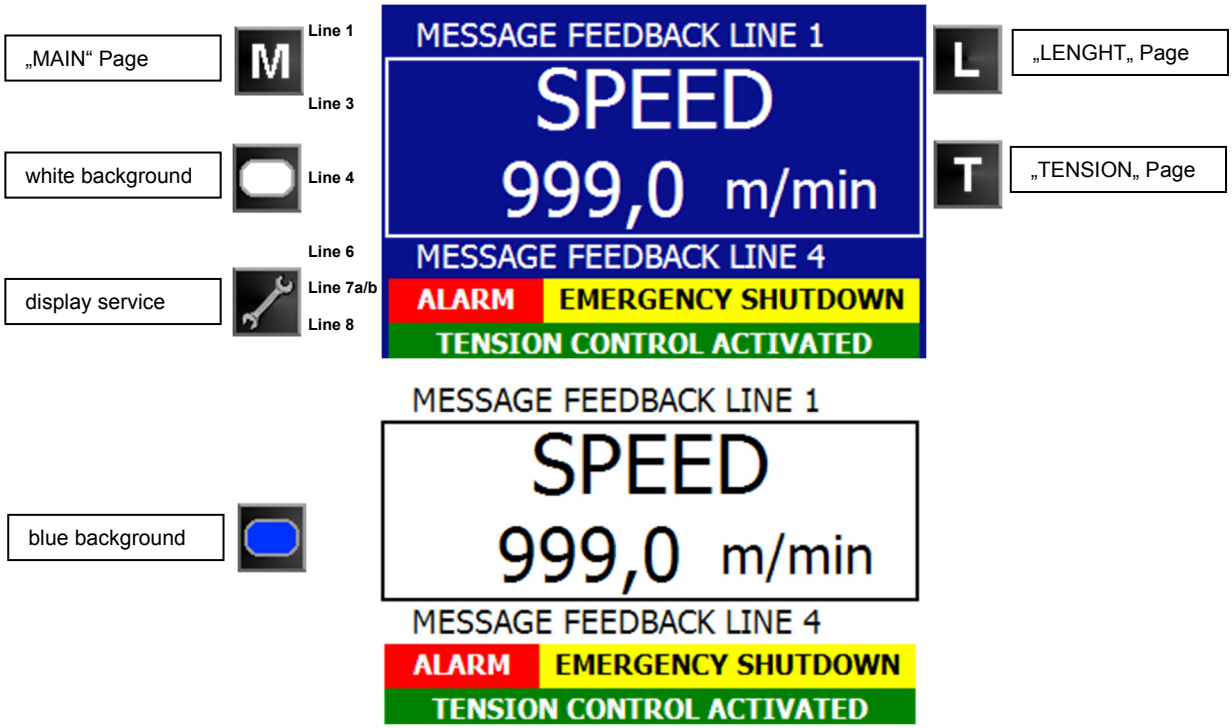
TENSION Page



SPEED Page



Back to “MAIN PAGE” also with pushbutton S13 (SELECT WINCH) or feedback-command 6200/14/ Bit 4.
Each “MESSAGE LINE” has an own editable (with special HBC-USB-connecting-cable) text-file in the display folder TXT. In all display text files the first text-line has no text (only one space character) and is used for NO TEXT-OUTPUT on the display.

4.4. RX PDO-Mapping

- 1. RX PDO (0x200+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/01	6200/02	6200/03	6200/04	6200/05	6200/06	6200/07	6200/08

- 2. RX PDO (0x300+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/09	6200/0A	6200/0B	6200/0C	6200/0D	6200/0E	6200/0F	6200/10

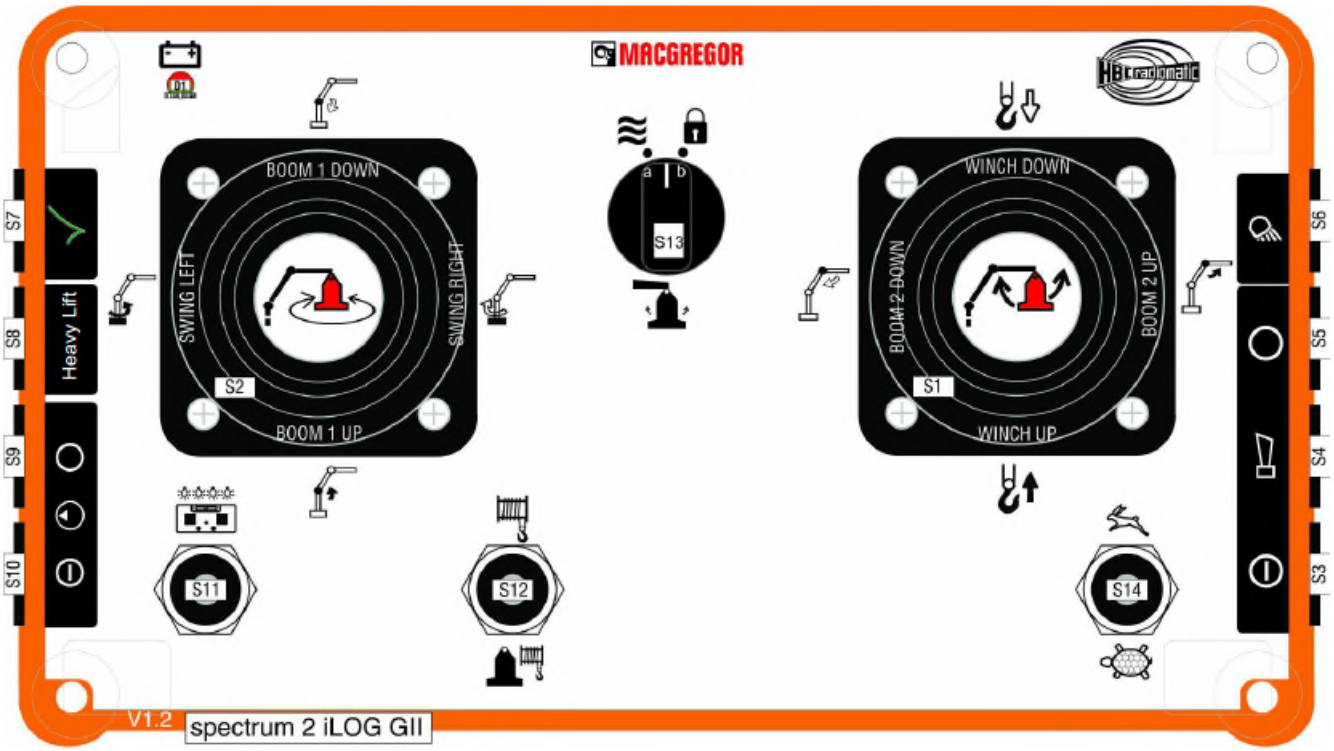
- 3. RX PDO (0x400+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/11	6200/12	6200/13	6200/14	6200/15	6200/16	6200/17	6200/18

- 4. RX PDO (0x500+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/19	6200/1A	6200/1B	6200/1C	6200/1D	6200/1E	6200/1F	6200/20

KN-75 Deck Crane Radio Control



Switch	Description
S1	Winch/Boom Joystick
S2	Jib/Slewing Joystick
S3	Turn on radio and activate crane
S4	Horn
S5	Shut off radio and deactivate crane
S6	Floodlight (on/off)
S7	Toggle on/off Docking Head
S8	Activate Heavy Lift
S9	Stop HPU
S10	Start HPU
S11	Rollover Bar Light
S12	Docking Head Winch/ Crane Winch
S13	Fixed/Free Docking Head
S14	Speed

TRIPLEX
by MacGregor

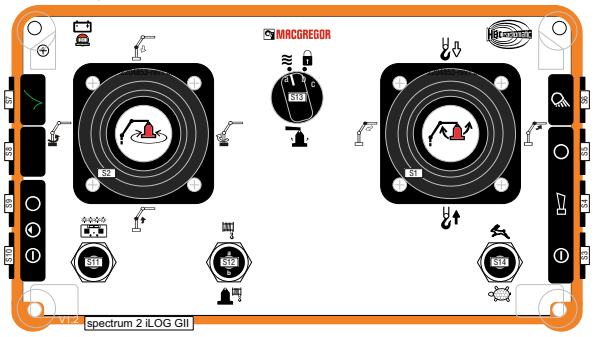
Operating Instructions

Project: MBARI R/V David Packard
KN-75 Deck Crane W/DOCKING HEAD
PWM + CANBUS

Triplex item nr. 400198452 RC-DCR-HBC.S2.2-12
WBS Element 4/60185.1.C5
order nr.: 4504420729

Serial nr.: 727-2204853
Model: spectrum 2 iLOG GII
Frequence: 2.4GHz / TC241

Delivery date: 12.12.2022



spectrum 2

HBC-radiomatic Norge AS
www.hbc-radiomatic.no

CE

Vedlegg 1: sikkerhets informasjon

Tilleggsinformasjon om sikkerhet

Vennligst les gjennom følgende viktig sikkerhetsinformasjon

Reservesender:
Reserve iLOG
Reserve iON

Det er ikke tillatt å bruke to sendere med samme kode (iLOG/iON) samtidig.
Reservesender eller originalsender må være innelåst !

Reservemottaker:

Det er ikke tillatt å bruke to mottakere med samme kode samtidig.
Reservemottakere eller originalmottaker må være innelåst !

Reservefunksjon:

Forhandleren har ansvar for eventuelt merking av tilleggsfunksjoner hvis reserveknapper eller reservejoysticker blir tatt i bruk

Gjenvinning av batterier:

Batterier skal ikke kastes sammen med annet avfall. I stedet, returnere batterier til godkjent gjenvinningsstasjon eller batteri forhandler som HBC-radiomatic Norge AS

Attachment 1: safety information

Additional information on safety

Please read through the following safety information

Spare transmitter:
Spare iLOG
Spare iON

It is not allowed to use two transmitters with the same code (iLOG/iON) at the same time.
Either the spare transmitter or original transmitter must be secured!

Spare receiver

It is not allowed to use two receivers with the same code at the same time.
Either the spare receiver or original receiver must be secured!

Spare function:

This system be delivered with spare buttons or joysticks. **The dealer is responsible for marking any additional functions** which may be connected in the future.

Battery disposal:

Batteries must not be disposted of with regular waste. Instead, return batteries to an approved recycling station or battery dealer. HBC-radiomatic Norge AS will take batteries in return.

The clients PLC must continuously evaluate the Active Stop command and communication OK circut!
The client has requested the ‘active stop’ function, and is thereby responsible to integrate it with their PLC system.

HBC-radiomatic Norge AS
Gamleveien 87
N-4315 Sandnes
Org.nr. 994 038 516 MVA

www.radiomatic.no
brev@radiomatic.no
Tel.: +47 47 93 49 00
Fax: +47 52 97 30 89

Bank: SR Bank
Account nr. 3201 44 58033
IBAN: NO 3432 0144 5803 3
SWIFT (BIC): SPRONO22

TRIPLEX
Operating Instructions
Project: MBARI R/V David Packard
KN-75 Deck Crane W/DOCKING HEAD
PWM + CANBUS
Triplex item nr. 400198452 RC-DCR-HBC.S2.2-12
WBS Element 4/60185.1.C5
order nr.: 4504420729
Serial nr.: 727-2204853
spectrum 2
HBC-radiomatic
16m
SMA / RF240 / minicrimp
f = 2,4 GHz
RADIO CONTROLLED
WHEN WORKING ON THE SYSTEM, KEEP THE RADIO CONTROL TRANSMITTER IN YOUR POSSESSION OR PUT IT IN A SECURE PLACE
HBC-radiomatic Norge AS
www.radiomatic.no
CAUTION - VORSICHT - ATTENTION - ATTENZIONE - ATENCIÓN
RADIO REMOTE CONTROLLED
FUNKGESTEUERT
RADIOCOMMANDÉ
RADIOCOMANDATO
RADIO COMANDO
HBC-radiomatic GmbH
Tel.: 449 - 7951 - 393 - 0
www.hbc-radiomatic.com
System
727
Since 1947.
75 YEARS
MACGREGOR
inkludert
“Tilleggsinformasjon om sikkerhet” i bruksanvisning

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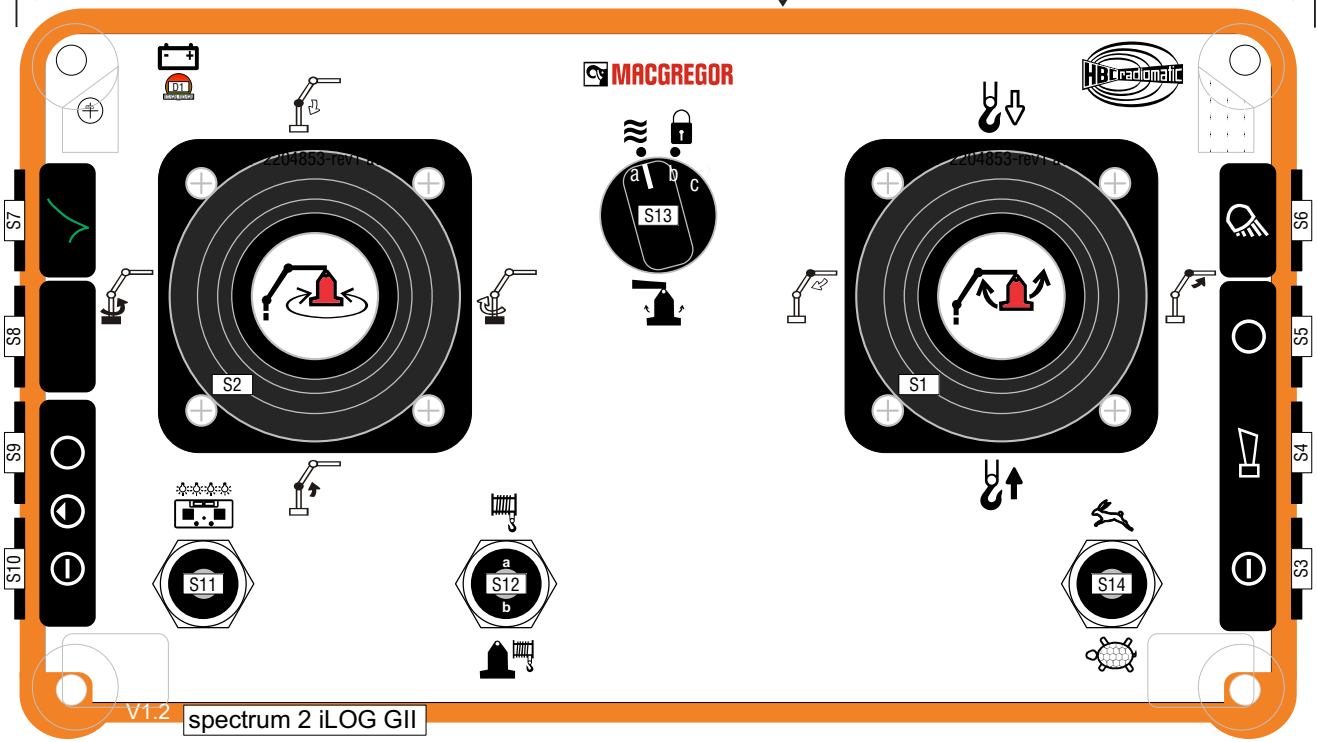
HBC-radiomatic GMBH

300 mm (incl. overrollbar)



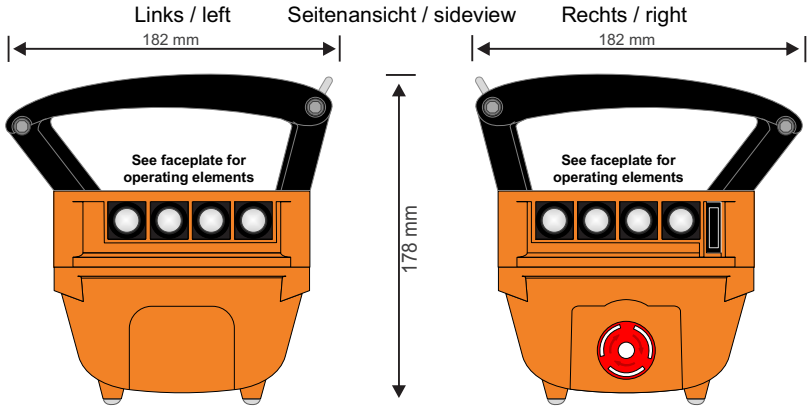
SMART CARD FOR PWM TEACHING

standard symbol (IEC 60417-5010 (2002-10) for STOP or OFF
TRANSMITTER OFF

START SEQUENCE:
- short push on «⏻»
- long push on «⏻»

APO: ■ off □ on (15 min)

standard symbol & position no change possible acc. HBC-Germany (IEC 60417-5010 (2002-10)



radiomatic ® iLOG
Stop-Schlagschalter/stop switch

Rollover bar: aluminum + LED

Frontplatte / Faceplate
Art / Type: Drucker
Hintergrundfarbe: weiß
Background color: white
Beschriftungsfarbe: schwarz
Label color: black

MACGREGOR

Project: MBARI / R/V David Packard
KN-75 Deck Crane w/Docking Head
400198452 RC-DCR-HBC.S2.2-12
WBS Element 4/60185.1.C5

MBARI
Monterey Bay Aquarium Research Institute

WARNING: Operating elements without labeling must receive weather resistant labels in order to be approved for use (GF_062)

CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
1	Umbau	14.09.2022	avel	Datum	10.02.2022	Kunde	HBC-radiomatic Norge	
				Gezeichnet	avhr	Kommission	Flaa	
				Geprüft	avmr	Bestellnummer	25580	

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_22_04853-rev_.scg
iON-Konfig.:
iLOG-Konfig.: KSG10001

Zeichnung

Fabrikationsnummer: 727-2204853

Auftragsnummer: 22142290

V1.4

1 / 13 Bl.

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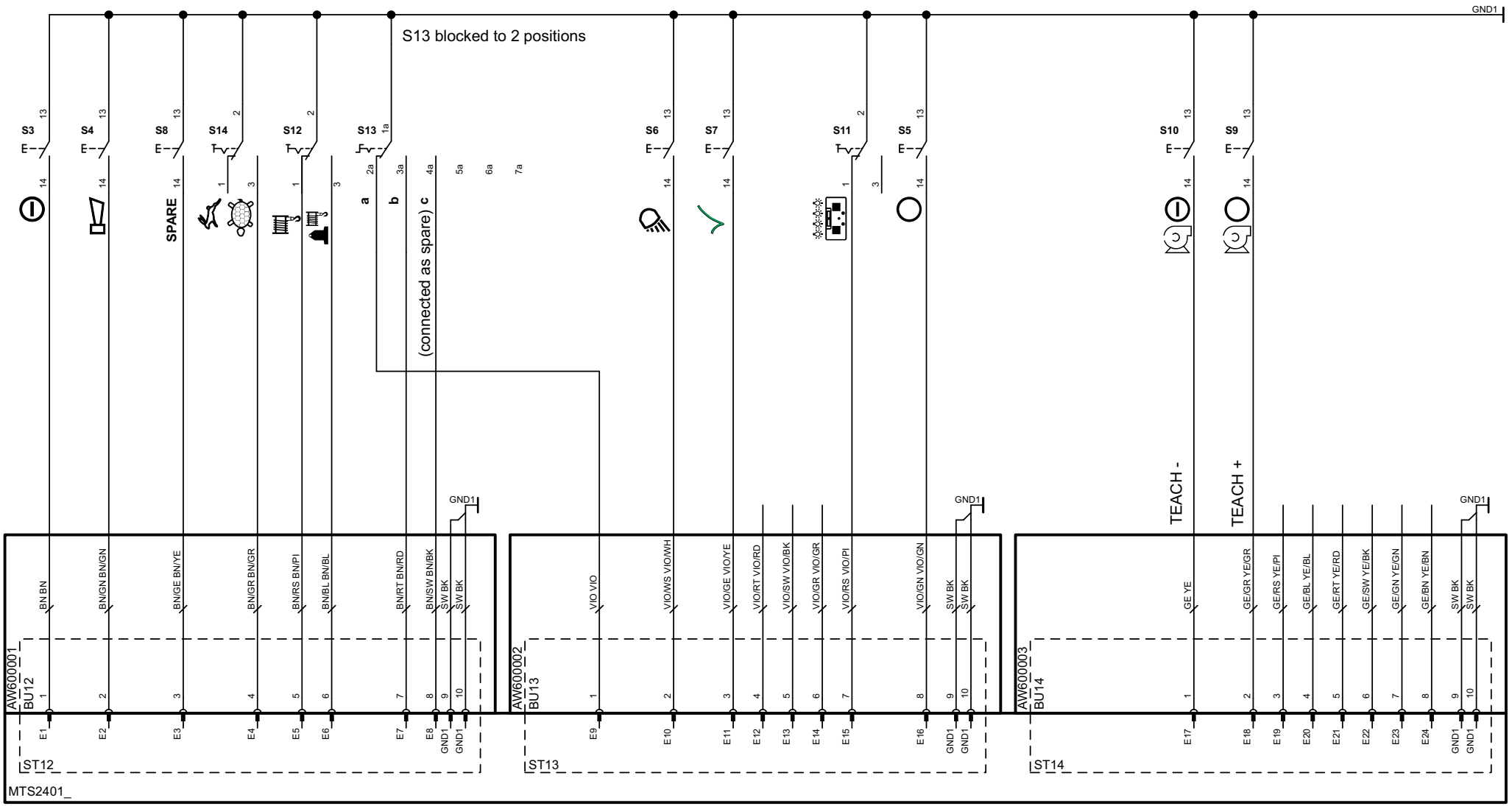

Start über E2 Start via E2	LB22

	Funk-Start Radio start
	Kran-Ein-Verriegelung Crane on interlock
	radiomatic® infrakey
	Kabeloption Cable option

	radiomatic® zero-g
	radiomatic® roll-detect
	radiomatic® shock-off
	inclination switch

	AMO-Zeit (min.) AMO-time (min.)
15	APO-Zeit (min.) APO-time (min.)

Funktion E9-16 Function E9-16	LB7
Funktion E17-24 Function E17-24	LB8

SI1 SI2

C	Hidden-Switch

E1-8 immer SI1
E1-8 always SI1

Lötbrücke auf Encoder
Solder strap up Encoder

	A	B
LB1	■	■
LB2	■	■
LB3	■	■
LB4	■	■

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	14.09.2022	avel	

Datum	10.02.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avhr	Kommission	Flaa
Geprüft	avmr	Bestellnummer	25580
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_22_04853-rev_.scg
iON-Konfig.:
iLOG-Konfig.: KSG10001

Zeichnung

Fabrikationsnummer
727-2204853

Auftragsnummer
22142290

V1.3

2 / 13 Bl.

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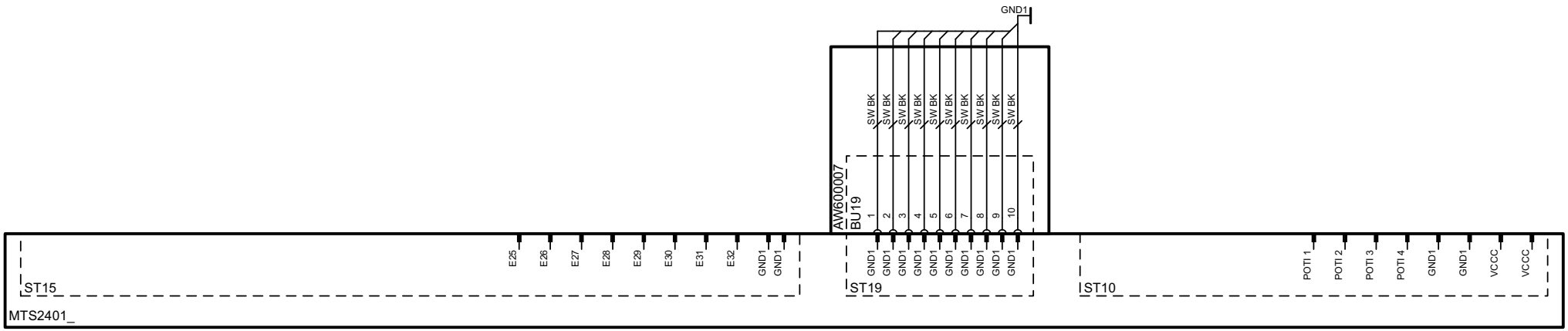

Funktion E29-30 Function E29-30	LB11	▮▮	
Funktion E25-28 Function E25-28	LB12	▮▮	
▮▮ SI1	⋈ SI2		

Funktion E32 Function E32	LB9	▮▮	
Funktion E31 Function E31	LB10	▮▮	
▮▮ SI1	⋈ SI2		

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name
1	Umbau	14.09.2022	avel

Datum	10.02.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avhr	Kommission	Flaa
Geprüft	avmr	Bestellnummer	25580
Genehmigt		Orig.	Ersetzt / Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_22_04853-rev_.scg
iON-Konfig.:
iLOG-Konfig.: KSG10001

Zeichnung

Fabrikationsnummer
727-2204853

Auftragsnummer
22142290

V1.3

3 / 13 Bl.

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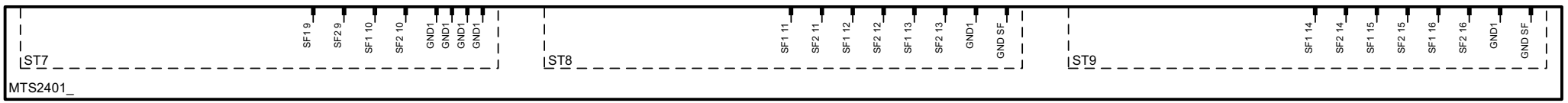

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
1	Umbau	14.09.2022	avel	Datum	10.02.2022	Kunde HBC-radiomatic Norge		
				Gezeichnet	avhr	Kommission Flaa		
				Geprüft	avmr	Bestellnummer 25580		

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_22_04853-rev_.scg
iON-Konfig.:
iLOG-Konfig.: KSG10001

Zeichnung

Fabrikationsnummer
727-2204853

Auftragsnummer
22142290

V1.3
4 / 13 Bl.

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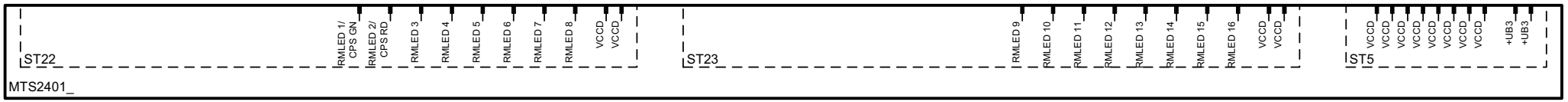

CPS-LED
CPS LED
LB21

Extern / External (ST22 PIN 1/2)
Intern / Internal (Onboard)

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
1	Umbau	14.09.2022	avel	Datum	10.02.2022	Kunde HBC-radiomatic Norge		
				Gezeichnet	avhr	Kommission Flaa		
				Geprüft	avmr	Bestellnummer 25580		

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_22_04853-rev_.scg
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Zeichnung

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Auftragsnummer
22142290

V1.3

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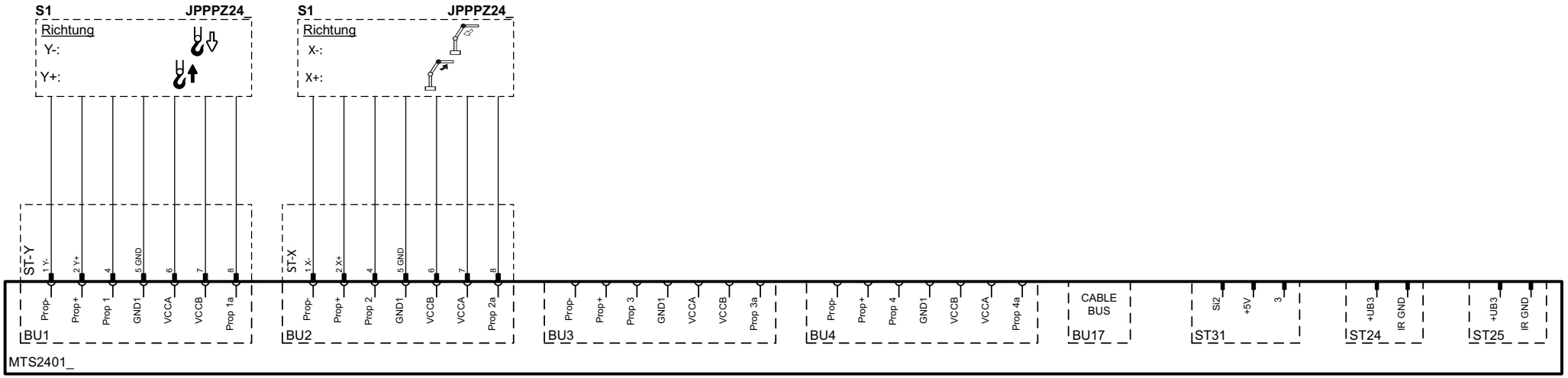
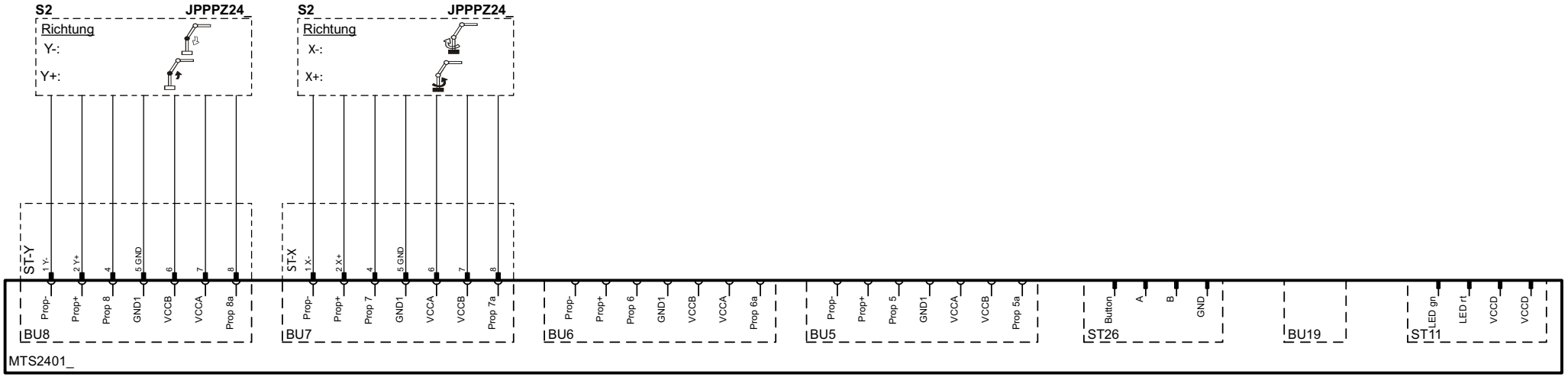
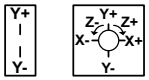


Abschlusswiderstand (475R)
Terminating resistor (475R)
LB19



Beispiel: Linearhebel / KMS
Example: linear lever / joystick



Platinenansicht von Frontplattenseite/
PCB view from faceplate side

BU8 BU7 BU6 BU5 BU4 BU3 BU2 BU1

Betriebszustands-LED
Operating status LED
LB20
Extern / External (ST11)
Intern / Internal (Onboard)

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	14.09.2022	avel	

Datum	10.02.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avhr	Kommission	Flaa
Geprüft	avmr	Bestellnummer	25580
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_22_04853-rev_.scg
iON-Konfig.:
iLOG-Konfig.: KSG10001

Zeichnung

Fabrikationsnummer
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Auftragsnummer
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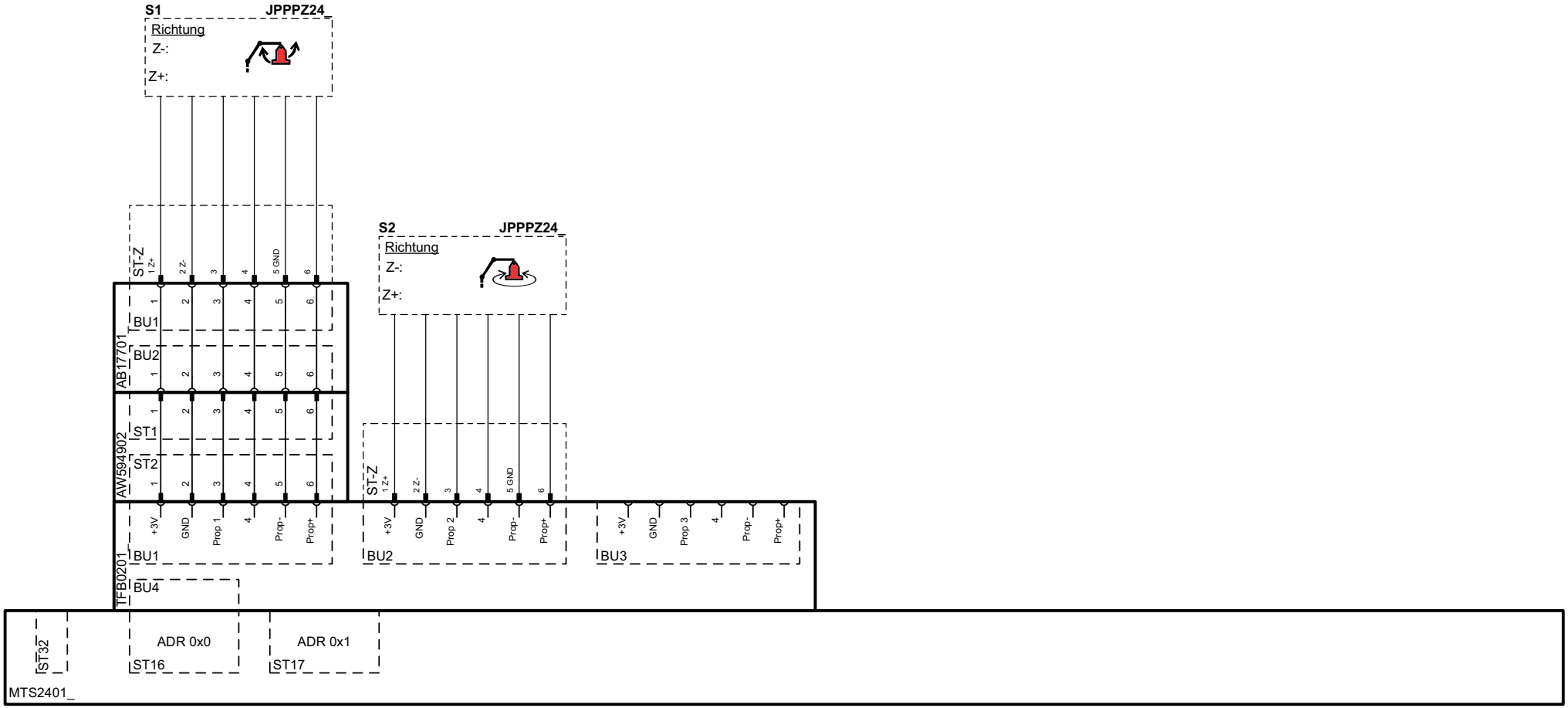

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

1	Umbau	14.09.2022	avel	Datum	10.02.2022	Kunde	HBC-radiomatic Norge	HBC-radiomatic GmbH Haller-Straße 45-53 74564 Crailsheim	Sender / Transmitter	Zeichnung	
				Gezeichnet	avhr	Kommission	Flaa		ADCON-Konfig.: 727_22_04853-rev_.scg	Fabrikationsnummer	Auftragsnummer
				Geprüft	avmr	Bestellnummer	25580		iON-Konfig.:	727-2204853	22142290
Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch	iLOG-Konfig.: KSG10001		V1.3 / 7 / 13 Bl.

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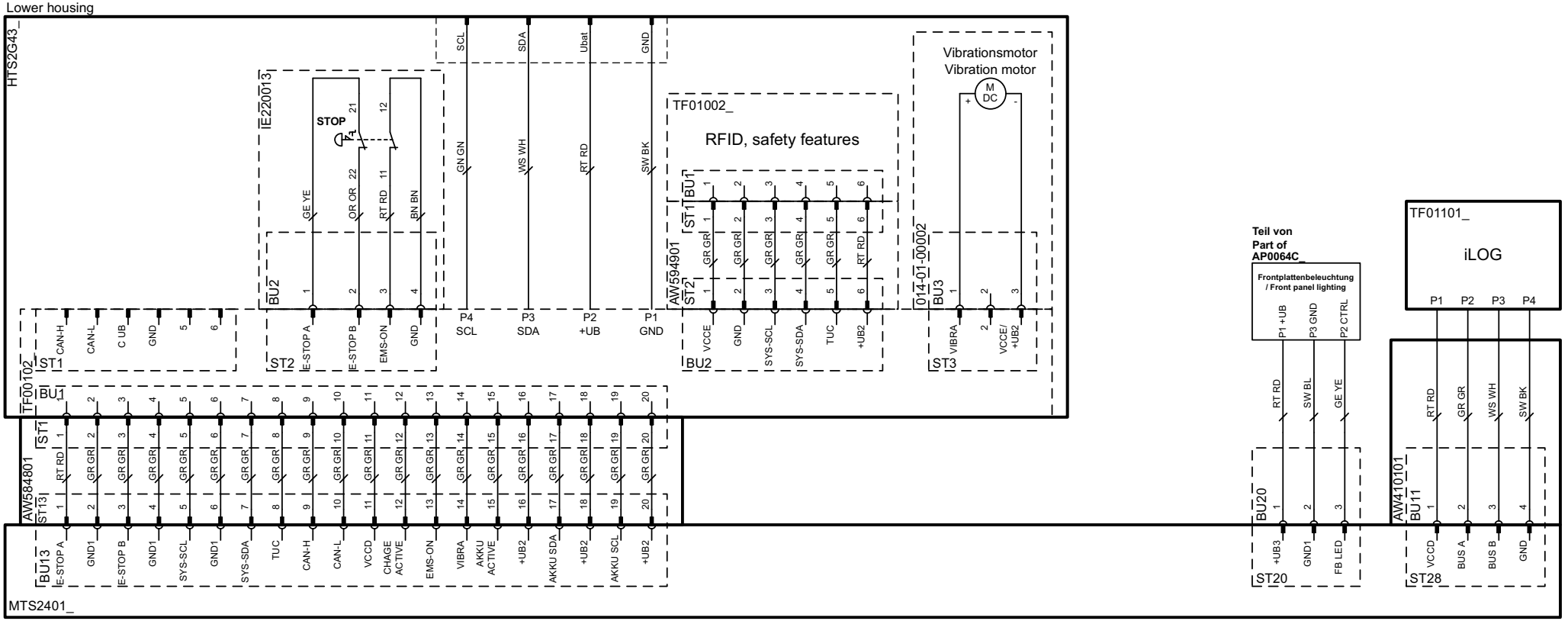
HBC-radiomatic GMBH



Kabeloption Abschlusswiderstand (120R)
Cable option terminating resistor (120R)

LB1
▮

Lötbrücke auf TF00102_ ST3
Solder strap up TF00102_ ST3

	A	B
LB1	▮	▮
+UB2	▮	▮
VCCE	▮	▮

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

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				Geprüft	avmr			

Kunde HBC-radiomatic Norge
Kommission Flaa
Bestellnummer 25580

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_22_04853-rev_.scg
iON-Konfig.:
iLOG-Konfig.: KSG10001

Zeichnung

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Auftragsnummer
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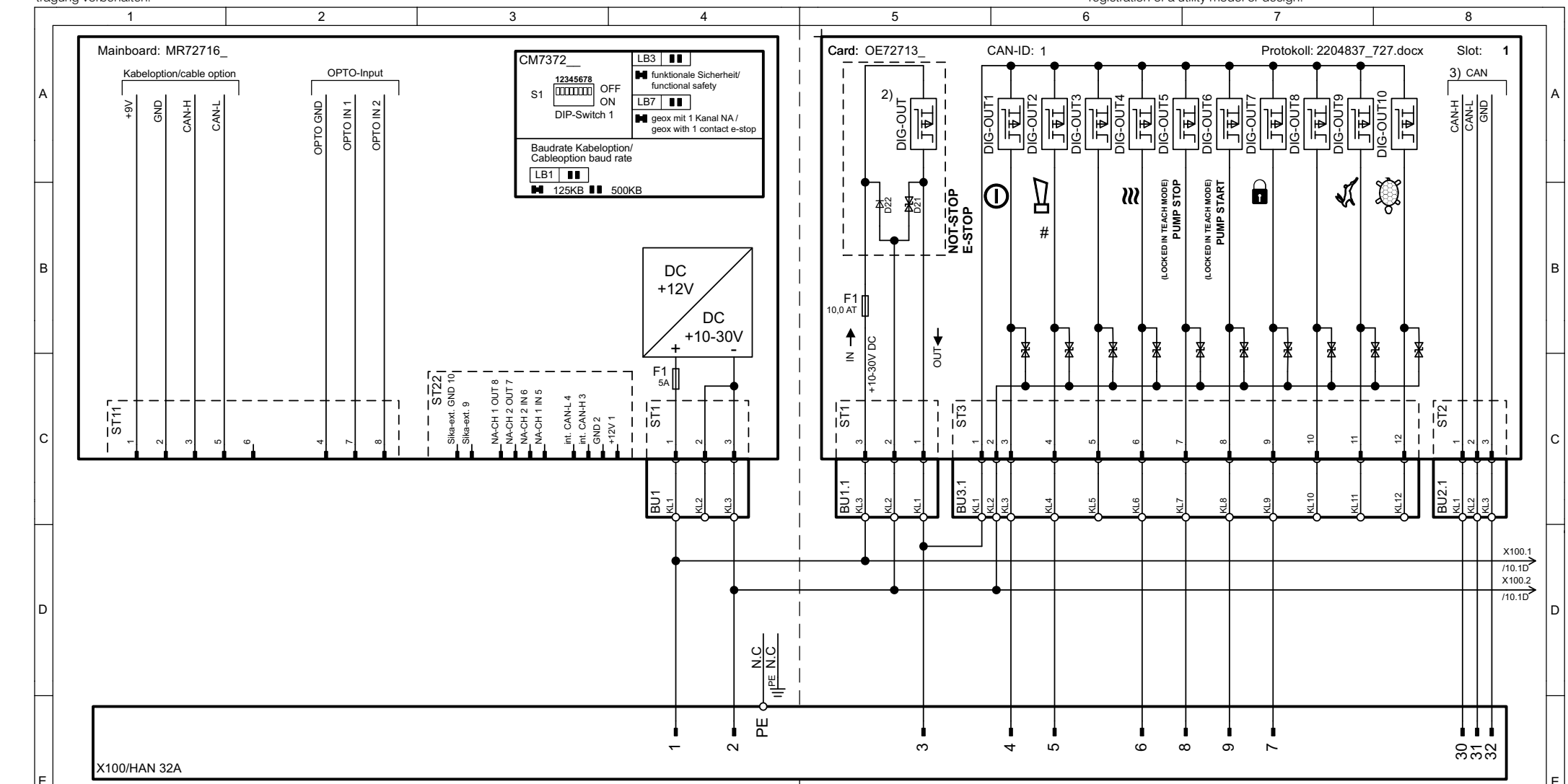

LB1
int. CAN Abschlusswiderstand (120R)
int. CAN termination resistor (120R)

LB2
CAN Abschlusswiderstand (120R)
CAN termination resistor (120R)

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

OUT1-4	LB4	LB5	LB6	LB7	LB8
OUT5-6	LB9	LB10	LB11	LB12	LB13
OUT7-10	LB14	LB15	LB16	LB17	LB18
	12V	SI0	SI1	SI2	SI2v

2) NOT-STOP im Betriebszustand geschlossen
E-STOP closed in operating condition

im Teach-Modus (ca. 1sec)

in teach-mode (ca. 1sec)

Die NOT-STOP-Kette muss in der nachgeschalteten Anlage durch einen von den übrigen Schaltbefehlen unabhängigen Kreis ausgewertet werden!
The E-STOP contacts have to be utilized to control a main emergency stop circuit which is to be independent from all other control functions!

3) LB3
CAN Abschlusswiderstand (120R)
CAN termination resistor (120R)

S3 12345678 OFF ON DIP-Switch 1
S4 1234 OFF ON DIP-Switch 4

Funktion S3/4 siehe Protokoll
function S3/4 see protocoll

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	14.09.2022	avel	

Datum	10.02.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avhr	Kommission	Flaa
Geprüft	avmr	Bestellnummer	25580
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Empfänger / receiver

ADCON-Konfig.: 727_22_04854-rev_.cmc

Zeichnung	
Fabrikationsnummer	727-2204854
Auftragsnummer	22142290
	V1.2
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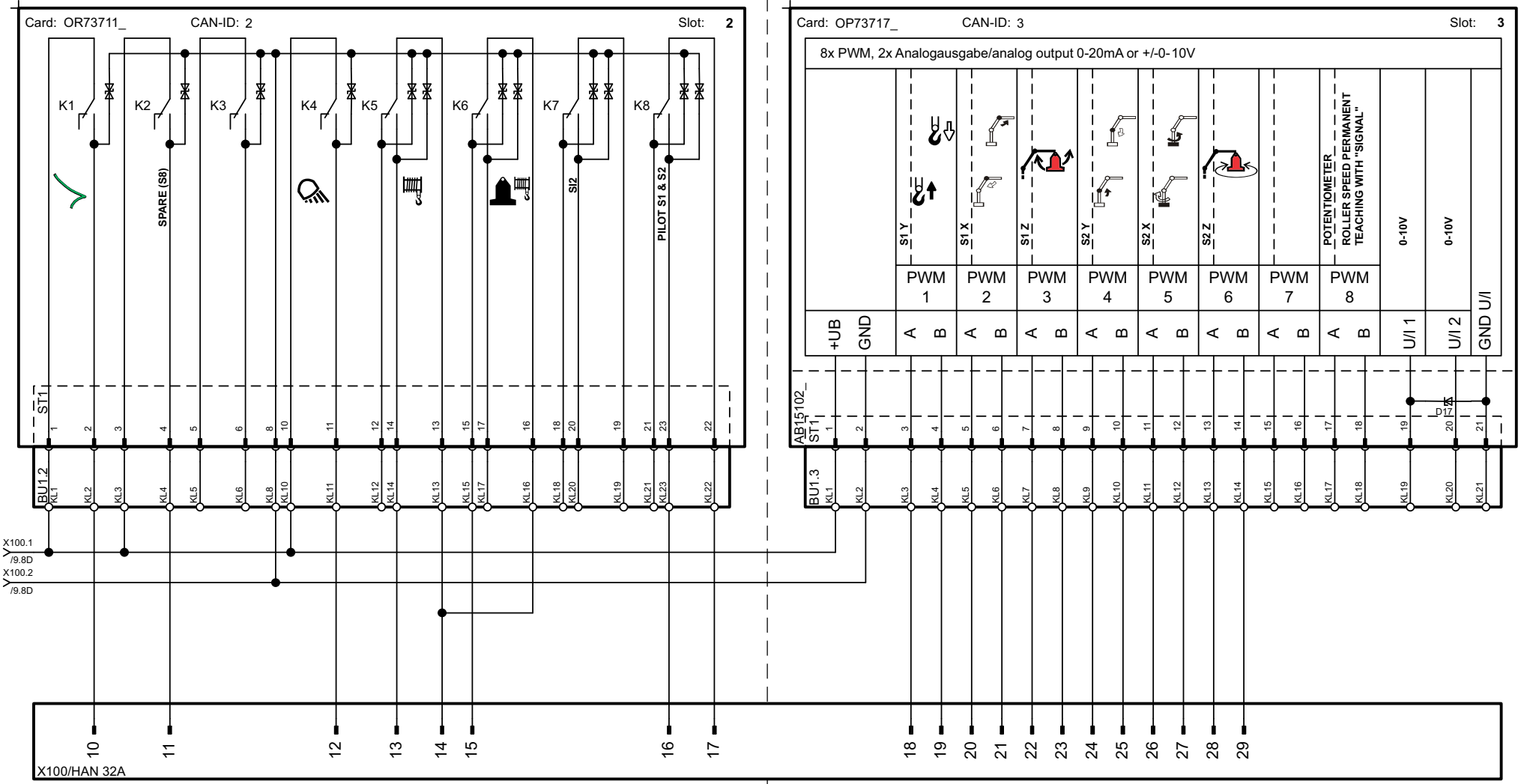

Rel. 1-4	LB1 ▮▮	LB2 ▮▮	LB3 ▮▬	LB4 ▮▮	LB5 ▮▮
Rel. 5-6	LB6 ▮▮	LB7 ▮▮	LB8 ▮▬	LB9 ▮▮	LB10 ▮▮
Rel. 7-8	LB11 ▮▮	LB12 ▮▮	LB13 ▮▮	LB14 ▮▬	LB15 ▮▮
	12V	SI0	SI1	SI2	SI2v

PWM1-6	LB23 ▮▮	LB1 ▮▮	LB2 ▮▮	LB3 ▮▮	LB4 ▮▬
PWM7-8	LB24 ▮▮	LB5 ▮▮	LB6 ▮▬	LB7 ▮▮	LB8 ▮▮
AN1-2	LB25 ▮▮	LB9 ▮▮	LB10 ▮▬	LB11 ▮▮	LB12 ▮▮
	12V	SI0	SI1	SI2	SI2v

AN-OUT	U/I1			U/I2		
LB	17 ▮▮	18 ▮▬	19 ▮▬	20 ▮▮	21 ▮▬	22 ▮▬
0-20mA	▬	▮▮	▮▮	▬	▮▮	▮▮
0-10V	▮▮	▬	▬	▮▮	▬	▬

Spannung PWM1-8 voltage PWM1-8	LB15 ▮▮
▮▮ 12V/2,4A ▮▬ 24V/1,2A	

PWM 1-4
FAST: 200mA -550mA
SLOW: 200mA -400mA

PWM 8
FAST: 200mA -580mA
SLOW: 200mA -580mA

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
1	Umbau	14.09.2022	avel	Datum	10.02.2022	Kunde HBC-radiomatic Norge		
				Gezeichnet	avhr	Kommission Flaa		
				Geprüft	avmr	Bestellnummer 25580		

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Empfänger / receiver
ADCON-Konfig.: 727_22_04854-rev_.cmc

Zeichnung

Fabrikationsnummer
727-2204854

Auftragsnummer
22142290

V1.2
10 / 13 Bl.

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Platine / Bedienelemente/ usw.
PCB´s / Operating elements / etc.

Stückliste Sender / Bill of material Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Software
1	107-90-00021	107-90-00021	radiomatic® ADCON				
2	107-90-00047	107-90-00047	radiomatic® iLOG 2. Generation				
3	AB17701_	AB17701_	Adapter für KMS-Kabel adapter for KMS-Cables				
4	AP0064C_	AP0064C_	Überrollbügel spectrum 2/B (Alu) rollover bar spectrum 2/B (aluminum)	beleuchtet, Handschmeichler orange illuminated, hand charmer orange			
5	BU20	010-02-00263	Buchsengehäuse, 3-polig socket housing, 3-pole	gerade, einreihig, weiß straight, single row, white			
6	D1	003-90-00886	Kunststoff-Lichtleiter plastic-light pipe	d=4,6 / 5,4x50mm			
7	EE00601_	EE00601_	Encoder	Encoder spectrum VDT2 iLOG GII			SE00910_ / SS00910_
8	HTS2G43_	HTS2G43_	Housing transmitter spectrum 2 Unterteil Housing transmitter spectrum 2 lower housing	Stop-Schlagschalter / Vibrationsmotor, orange Stop-switch / vibration motor, orange			
9	HTS2J23_	HTS2J23_	Housing transmitter spectrum 2 iLOG GII Oberteil Housing transmitter spectrum 2 iLOG GII upper housing	Std.-Bearbeitung mit 2xKMS, 9xBedienelemente, orange std.-machining with 2xKMS, 9xoperating element, orange			
10	MTS2401_	MTS2401_	Mainboard transmitter spectrum 2/B	VDT2			SG19920_
11	S1	JPPPZ24_	Joystick proportional, Prop/Prop mit Z-Achse, 30° Joystick proportional, Prop/Prop with Z-axis, 30°	Niederhalter (003-90-00006) + Faltenbalg (003-90-00004 or 003-90-00628 VITON) downholder (003-90-00006) + rubber bellow (003-90-00004 or 003-90-00628 VITON)			
12	S2	JPPPZ24_	Joystick proportional, Prop/Prop mit Z-Achse, 30° Joystick proportional, Prop/Prop with Z-axis, 30°	Niederhalter (003-90-00006) + Faltenbalg (003-90-00004 or 003-90-00628 VITON) downholder (003-90-00006) + rubber bellow (003-90-00004 or 003-90-00628 VITON)			
13	S3	IE230017	KHT, kurz KHT, short	d=16mm			
14	S4	IE230017	KHT, kurz KHT, short	d=16mm			
15	S5	IE230017	KHT, kurz KHT, short	d=16mm			
16	S6	IE230017	KHT, kurz KHT, short	d=16mm			
17	S7	IE230017	KHT, kurz KHT, short	d=16mm			
18	S8	IE230017	KHT, kurz KHT, short	d=16mm			
19	S9	IE230017	KHT, kurz KHT, short	d=16mm			
20	S10	IE230017	KHT, kurz KHT, short	d=16mm			
21	S11	IE120009	Kippschalter Rast-Rast klein toggle switch maintain-maintain small	d=12mm			
22	S12	IE120010	Kippschalter Rast-Rast groß std. toggle switch maintain-maintain big std.	d=12mm			

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name
1	Umbau	14.09.2022	avel

Datum 10.02.2022 | Gezeichnet avhr | Geprüft avmr | Genehmigt

Kunde HBC-radiomatic Norge
Kommission Flaa
Bestellnummer 25580
Orig. | Ersetzt | Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

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Zeichnung

Fabrikationsnummer 727-2204853

Auftragsnummer 22142290

V1.3

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HBC-radiomatic GMBH

Platine / Bedienelemente/ usw.
PCB´s / Operating elements / etc.

Stückliste Sender / Bill of material Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Software
23	S13	IE320015	ELMA Drehschalter 2x6 ELMA rotary switch 2x6	d=12mm	011-01-00331		
24	S14	IE120009	Kippschalter Rast-Rast klein toggle switch maintain-maintain small	d=12mm			
25	TF01002_	TF01002_	Frontmodul spectrum mit RFID, safety features front-end module spectrum with RFID, safety features				SI00310_
26	TF01101_	TF01101_	iLOG-Lesemodul für spectrum iLOG-reading module for spectrum				SI00210_
27	TFB0201_	TFB0201_	Senderbusmodul 3xProp Eingänge spectrum transmitter bus module 3xProp Inputs spectrum				SI00510_

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name
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Kabelbäume
Harness

Stückliste Sender / Bill of material Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Katalognummer
1	AW410101	AW410101	Verdrahtungshilfe iLOG Lesemodul harness iLOG reader module	AVX-Buchse 4-polig, 4 Adern AVX-female connector 4-pole, 4 strands			
2	AW584801	AW584801	Verdrahtungshilfe technos A harness technos A	Micro Match 20-polig auf Micro Match 20-polig (120mm) Micro Match 20-pole at Micro Match 20-pole (120mm)			
3	AW594901	AW594901	Verdrahtungshilfe technos A harness technos A	Micro Match 6-polig auf Micro Match 6-polig (130mm) Micro Match 6-pole at Micro Match 6-pole (130mm)			
4	AW594902	AW594902	Verdrahtungshilfe spectrum 4/E harness spectrum 4/E	Micro Match 6-polig auf Micro Match 6-polig (250mm) Micro Match 6-pole at Micro Match 6-pole (250mm)			
5	AW600001	AW600001	Verdrahtungshilfe Input spectrum Serie harness Input spectrum Serie	AVX-Buchse 10-polig, 10 Adern AVX-female connector 10-pole, 10 strands			
6	AW600002	AW600002	Verdrahtungshilfe Input spectrum Serie harness Input spectrum Serie	AVX-Buchse 10-polig, 10 Adern AVX-female connector 10-pole, 10 strands			
7	AW600003	AW600003	Verdrahtungshilfe Input spectrum Serie harness Input spectrum Serie	AVX-Buchse 10-polig, 10 Adern AVX-female connector 10-pole, 10 strands			
8	AW600007	AW600007	Verdrahtungshilfe GND spectrum Serie harness GND spectrum Serie	AVX-Buchse 10-polig, 10 Adern AVX-female connector 10-pole, 10 strands			

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

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Listen / Lists

Zeichnung	
Fabrikationsnummer	727-2204853
Auftragsnummer	22142290
	V1.3
	12 / 13 Bl.

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Platinen / Gehäuse / usw.
PCB´s / Housings / etc.

Stückliste Empfänger / Bill of material Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Software
1	107-90-00021	107-90-00021	radiomatic® ADCON				
2	BU1	010-02-00499	Buchsenleiste 3-polig female connector strip 3-polig				
3	BU1.1	010-02-00011	Buchsenleiste 3-polig female connector strip 3-polig				
4	BU1.2	010-02-00524	Buchsenleiste 23-polig female connector strip 23-polig				
5	BU1.3	010-02-00526	Buchsenleiste 21-polig female connector strip 21-polig				
6	BU2.1	010-02-00506	Buchsenleiste 3-polig female connector strip 3-polig				
7	BU3.1	010-02-00507	Buchsenleiste 12-polig female connector strip 12-polig				
8	CM7372__	CM7372__	CAN-Manager	CAN-Manager TC20/38			SA00320_ / SB00320_ / SY00320_
9	HR168913	HR168913	Kunststoff-Gehäuse FSE727, HAN 32/50, BNC - MMCX, MR72716_ plastic-case FSE727, HAN 32/50, BNC - MMCX, MR72716_	orange orange			
10	MR72716_	MR72716_	Mainboard Empfänger 727 Mainboard Receiver 727	DC 10-30V mit geox, Kabeloption, Optokoppler DC 10-30V with geox, cable option, optical isolator			
11	OE72713_	OE72713_	NOT-STOP-Ausgabekarte E-STOP-output card	DC, 10xHigh-Side-Switch + CAN Safety			SOE0130__.s19 / SOE0220__.hex
12	OP73717_	OP73717_	PWM-Ausgabekarte PWM-output card	8x PWM, 2x Analogausgabe/analog output 0-20mA or +/-0-10V			SOP0112__.s19
13	OR73711_	OR73711_	Relais-Ausgabekarte relay-output card	DC, 4xNO 4xWechsler DC, 4xNO 4xChange Over Contact			SOR0110_

Steckverbinder
Plug-in connector

Stückliste Empfänger / Bill of material Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Katalognummer	Hersteller
1	AA080009	AA080009	Antennenkabel BNC + MMCX,240mm antenna cable BNC + MMCX,240mm	d=9,5mm			HBC
2	X100/HAN 32A	010-03-00097	Anbaugehäuse Size 32A addition housing Size 32A	gerade, niedrige Bauart, 2 Bügel straight, low Type of Construction, 2 clamp		09 20 032 0301	Harting
3	010-03-00080	010-03-00080	Steckereinsatz HAN 16A (Size 16/32A) plug insert HAN 16A (Size 16/32A)	Crimpanschluß crimp connection		09 20 016 3001	Harting
4	010-03-00102	010-03-00102	Steckereinsatz HAN 32A (Size 32A) plug insert HAN 32A (Size 32A)	Crimpanschluß crimp connection		09 20 016 3011	Harting

Kabelbäume
Harness

Stückliste Empfänger / Bill of material Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Katalognummer

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	14.09.2022	avel	

Datum	10.02.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avhr	Kommission	Flaa
Geprüft	avmr	Bestellnummer	25580
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

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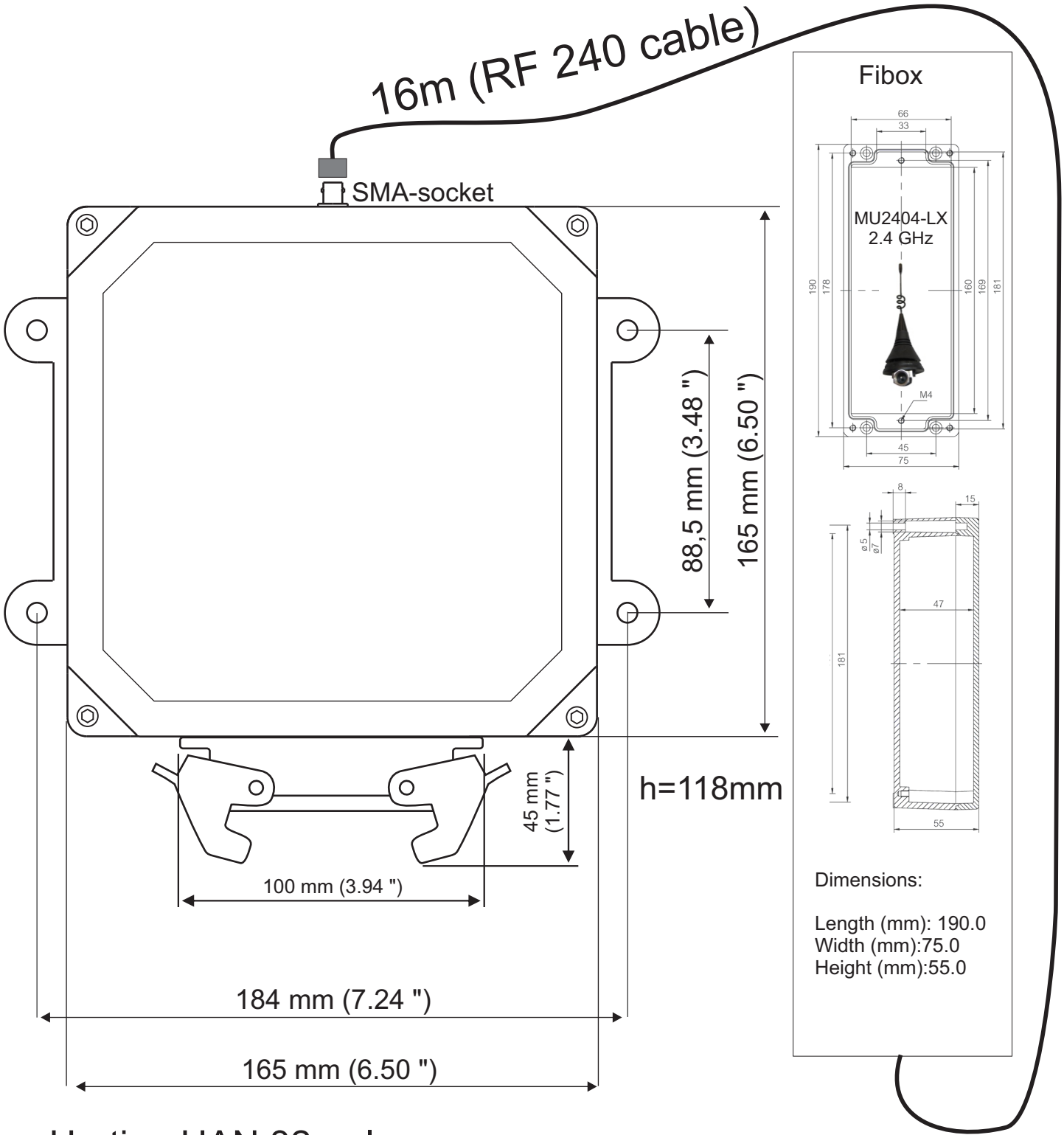
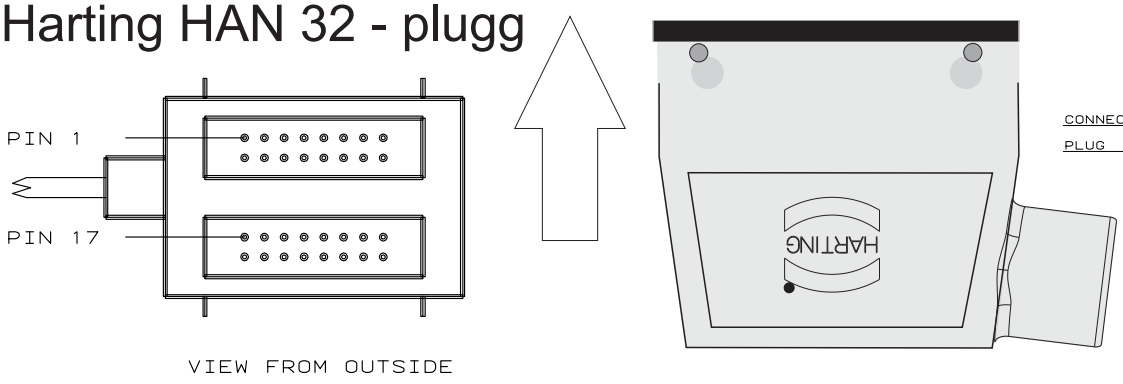
Zeichnung	
Fabrikationsnummer	727-2204853
Auftragsnummer	22142290
	V1.3
	13 / 13 Bl.

Receiver FSE 727 (HR 168)



Harting HAN 32 - plugg



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1. Dip-Schalter / dip-switch

1.1. S3

- Einstellung der CANopen Node-ID/adjustment of CANopen Node-ID

Schalter/switch S3			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Node-ID CANopen		x
2	2^1 x D	Node-ID CANopen		x
3	2^2 x D	Node-ID CANopen	x	
4	2^3 x D	Node-ID CANopen	x	
5	2^4 x D	Node-ID CANopen	x	
6	2^5 x D	Node-ID CANopen	x	
7	2^6 x D	Node-ID CANopen	x	
8		reserviert/reserved	x	

- Node-ID [dez]: **3**

1.2. S4

- Einstellung der Bitrate CAN/adjustment of bit rate CAN

Schalter/switch S4			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Bit-Rate CAN	x	
2	2^1 x D	Bit-Rate CAN	x	x
3	2^2 x D	Bit-Rate CAN	x	
4		reserviert/reserved	x	

Wert	Bit Rate [kBit/s]
0	50
1	125
2	250
3	500
4	1000
5	keine Funktion/no function
6	keine Funktion/no function
7	keine Funktion/no function

- CAN-Bit-Rate[kBit/s]:**250**

2. Globale Einstellungen / global configuration

2.1. Heartbeat

aktiv	Zykluszeit/ cycle time
☒	1s

2.2. CANopen-Safety

aktiv	Zykluszeit/ cycle time
☐	50ms

- CANopen Safety SRDOs

SRDO1-Objekt	ID	1	2
Inhalt/content	default**	NA*	NA inv*

SRDO2-Objekt	ID	1	2
Inhalt/content	default**	NA inv*	NA*

* NA = 0xFF (Notauskreis geschlossen/emergency stop closed)
NA = 0x00 (Notauskreis offen/emergency stop open)

** ID = default (ID-SRDO1 = 0xFF+2*Node-ID, ID-SRDO2 = 0x100+2*Node-ID)
ID = 0x___ (Festwert konfiguriert / fixed value configured)

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3. TX-Data

3.1. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	01	0	TRANSMITTER ON S3	0/1	1.SI1/0
		1	HORN S4	0/1	1.SI1/1
		2	SPARE S8	0/1	1.SI1/2
		3	S14	0/1	1.SI1/3
		4	S12 a	0/1	1.SI1/4
		5	S12 b	0/1	1.SI1/5
		6	S13 b	0/1	1.SI1/6
		7	S13 c (SPARE)	0/1	1.SI1/7
	02	0	S13 a	0/1	2.Si1/0
		1	S6	0/1	2.Si1/1
		2	S7	0/1	2.Si1/2
		3		0/1	2.Si1/3
		4		0/1	2.Si1/4
		5		0/1	2.Si1/5
		6		0/1	2.Si1/6
		7		0/1	2.Si1/7
	03	0	AKKU LOW	0/1	3.Si1/0
		1		0/1	3.Si1/1
		2		0/1	3.Si1/2
		3		0/1	3.Si1/3
		4		0/1	3.Si1/4
		5		0/1	3.Si1/5
		6		0/1	3.Si1/6
		7		0/1	3.Si1/7
	04	0	R1 (out of zero position (SPARE))	0/1	4.Si1/0
		1		0/1	4.Si1/1
		2		0/1	4.Si1/2
		3		0/1	4.Si1/3
		4		0/1	4.Si1/4
		5		0/1	4.Si1/5
		6		0/1	4.Si1/6
		7		0/1	4.Si1/7
	05	0		0/1	5.Si1/0
		1		0/1	5.Si1/1
		2		0/1	5.Si1/2
		3		0/1	5.Si1/3
		4		0/1	5.Si1/4
		5		0/1	5.Si1/5
		6		0/1	5.Si1/6
		7		0/1	5.Si1/7
	06	0		0/1	6.Si1/0
		1		0/1	6.Si1/1
		2		0/1	6.Si1/2
		3		0/1	6.Si1/3
		4		0/1	6.Si1/4
		5		0/1	6.Si1/5
		6		0/1	6.Si1/6
		7		0/1	6.Si1/7
	07	0		0/1	7.Si1/0

		1		0/1	7.Si1/1
		2		0/1	7.Si1/2
		3		0/1	7.Si1/3
		4		0/1	7.Si1/4
		5		0/1	7.Si1/5
		6		0/1	7.Si1/6
		7		0/1	7.Si1/7

3.2. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	08	0	PUMP START S10	0/1	1.SI2/0
		1	PUMP STOP S9	0/1	1.SI2/1
		2		0/1	1.SI2/2
		3		0/1	1.SI2/3
		4		0/1	1.SI2/4
		5		0/1	1.SI2/5
		6		0/1	1.SI2/6
		7		0/1	1.SI2/7
	09	0	PILOT S1-S2	0/1	2.SI2/0
		1		0/1	2.SI2/1
		2		0/1	2.SI2/2
		3		0/1	2.SI2/3
		4		0/1	2.SI2/4
		5		0/1	2.SI2/5
		6		0/1	2.SI2/6
		7		0/1	2.SI2/7
	0A	0		0/1	3.SI2/0
		1		0/1	3.SI2/1
		2		0/1	3.SI2/2
		3		0/1	3.SI2/3
		4		0/1	3.SI2/4
		5		0/1	3.SI2/5
		6		0/1	3.SI2/6
		7		0/1	3.SI2/7
	0B	0		0/1	4.SI2/0
		1		0/1	4.SI2/1
		2		0/1	4.SI2/2
		3		0/1	4.SI2/3
		4		0/1	4.SI2/4
		5		0/1	4.SI2/5
		6		0/1	4.SI2/6
		7		0/1	4.SI2/7
	0C	0		0/1	5.SI2/0
		1		0/1	5.SI2/1
		2		0/1	5.SI2/2
		3		0/1	5.SI2/3
		4		0/1	5.SI2/4
		5		0/1	5.SI2/5
		6		0/1	5.SI2/6
		7		0/1	5.SI2/7
	0D	0		0/1	6.SI2/0
		1		0/1	6.SI2/1
		2		0/1	6.SI2/2
		3		0/1	6.SI2/3
		4		0/1	6.SI2/4
		5		0/1	6.SI2/5
		6		0/1	6.SI2/6
		7		0/1	6.SI2/7
	0E	0	SI1 (comunication OK)	0/1	7.SI2/0
		1	SI2 (zero position test)	0/1	7.SI2/1
		2		0/1	7.SI2/2
		3		0/1	7.SI2/3
		4	Telegramm counter 2^0	0/1	7.SI2/4
		5	Telegramm counter 2^0	0/1	7.SI2/5
		6	Telegramm counter 2^0	0/1	7.SI2/6
		7	Telegramm counter 2^0	0/1	7.SI2/7
Index/	Subindex/	Bit/	Funktion/	Wertebereich/	Quelle/

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index	subindex	bit	Funktion	range	source
6000	0F	0	NA Zustand / E-Stop State	0/1	SI1
		1	NA Zustand / E-Stop State	0/1	SI1
		2	NA Zustand / E-Stop State	0/1	SI1
		3	NA Zustand / E-Stop State	0/1	SI1
		4	NA Zustand / E-Stop State	0/1	SI1
		5	NA Zustand / E-Stop State	0/1	SI1
		6	NA Zustand / E-Stop State	0/1	SI1
		7	NA Zustand / E-Stop State	0/1	SI1
	10	0	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		1	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		2	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		3	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		4	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		5	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		6	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		7	NA Zustand invertiert / E-Stop inverted	0/1	SI1

3.3. Analogeingänge/Analog inputs

Index/ index	Subindex/ subindex	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6400	01	S1 Y+ WINCH (FF-80)/ S1Y- (00-7F)	-128 … +127	Prop 1
	02	S1 X+ BOOM 2 (FF-80)/ S1X- (00-7F)	-128 … +127	Prop 2
	03	S2 Y+ BOOM 1 (FF-80)/ S2 Y- (00-7F)	-128 … +127	Prop 3
	04	S2 X+ SWING (FF-80)/ S2 X- (00-7F)	-128 … +127	Prop 4
	05	S1 Z+ (FF-80)/ S1 Z- (00-7F)	-128 … +127	Prop 6
	06	S2 Z+ (FF-80)/ S2 Z- (00-7F)	-128 … +127	Prop 7
	07			
	08			
	09	SPARE (Potentiometer R1 (Roller Speed))	0 … 255	Prop 5
	0A		0 … 127	

3.4. TX PDO-Mapping

- 1. TX PDO (0x180+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/01	6000/02	6000/03	6000/04	6000/05	6000/06	6000/07	6000/0F

- 2. TX PDO (0x280+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/08	6000/09	6000/0A	6000/0B	6000/0C	6000/0D	6000/0E	6000/10

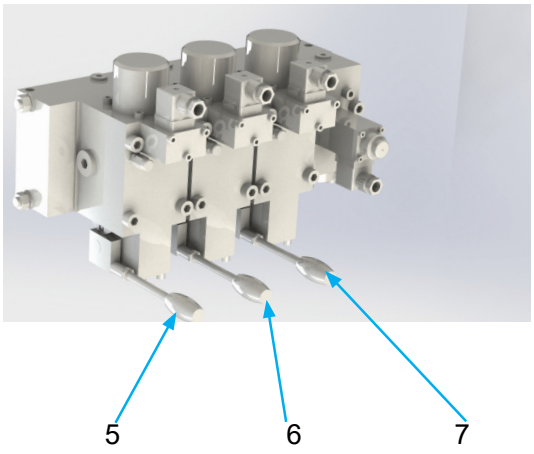
- 3. TX PDO (0x380+Node-ID)

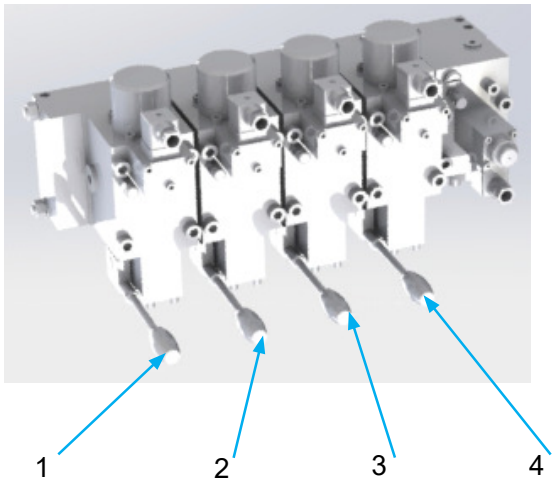
PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6400/01	6400/02	6400/03	6400/04	6400/05	6400/06	6400/07	6400/08

- 4. TX PDO (0x480+Node-ID)

PDO-Objekt	1	2
Mappingparam.	6400/09	6400/0A

MANUAL CONTROL





POS.	DESCRIPTION	OPERATION
1	SWING	CLOCKWISE / COUNTER CLOCKWISE
2	MAIN DERRICK	CYL. IN / CYL. OUT
3	JIB	CYL. OUT / CYL. IN
4	WINCH	LOWER / LIFT
5	SLEWING DOCKING HEAD	CLOCKWISE / COUNTER CLOCKWISE
6	WINCHDOCKING HEAD	LOWER / LIFT
7	TILT DOCKING HEAD	CYL. OUT / CYL. IN

Calibration procedure for the KN-75 Crane

If the sensors (Swing Encoder, Boom Angle Sensor, Jib Angle Sensor) need to be replaced, the setpoints must be calibrated again.
This is to make sure that the heavy lift area around the crane does not change and all of the functions for the heavy lift mode are correct.

Inside the foundation of the crane, the Heavy Lift Calibration Cabinet, which contains:

A PLC Controller

Calibration switces for all the functions of the crane

To calibrate the Boom Angle Sensors:

1. Move the Boom to its lowest position (Boom Cylinder is fully retracted).
2. Press and hold the switch for the Boom in the -Down position.
3. While holding the switch, press the -Set button.
4. The light on the PLC Controller will blink green to indicate that the position is saved.
5. Move the Boom to its highest position (Boom Cylinder is fully extended).
6. Press and hold the switch for the Boom in the -Up position.
7. While holding the switch, press the -Set button
8. The light on the PLC Controller will blink green to indicate that the position is saved.

To calibrate the Jib Angle Sensors:

1. Move the Jib to its lowest position (Jib cylinder is fully retracted).
2. Press and hold the switch for the Jib in the -In position
3. While holding the switch, press the -Set button.
4. The light on the PLC Controller will blink green to indicate that the position is saved.
5. Move the Jib to its highest position (Jib cylinder is fully extended).
6. Press and hold the switch for the Jib in the -Out position.
7. While holding the switch, press the -Set button.
8. The light on the PLC Controller will blink green to indicate that the position is saved.

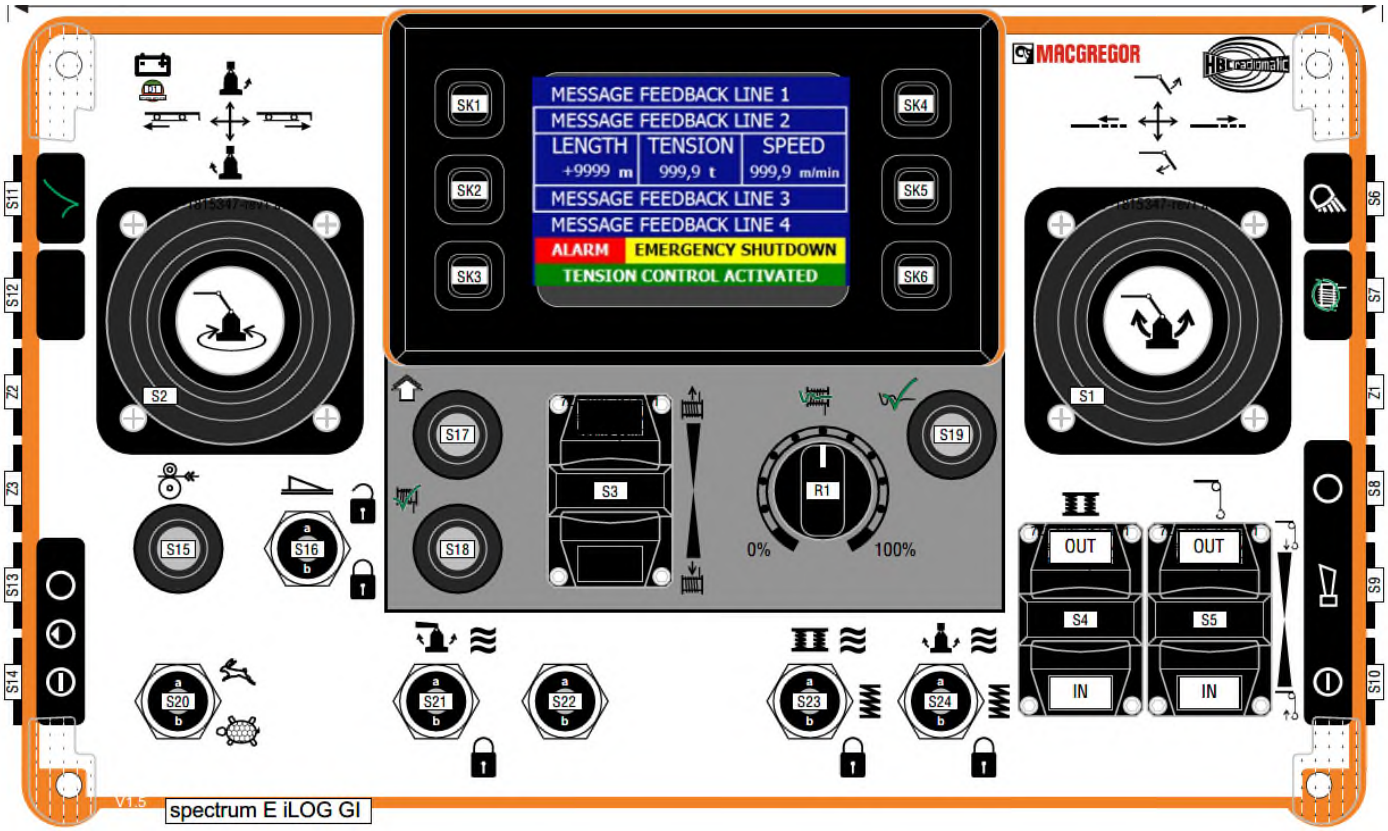
If the slewing encoder is replaced, the maximum rotations, Clockwise and Counter Clockwise, must be calibrated.

1. After encoder replacement, rotate crane to the Parked position
2. Rotate the crane Clockwise a maximum of 3 rotations.
3. Push the Slewing switch to -Up and hold.
4. While holding the -Up switch, push the -Set button.
5. The light on the PLC Controller will blink green to indicate that the position is saved.
6. Rotate the crane Counter Clockwise to the Parked position.
7. Rotate the crane Counter Clockwise a maximum of 3 rotations.
8. Push the Slewing switch to -Down and hold.
9. While holding the -Down switch, push the -Set button.
10. The light on the PLC Controller will blink green to indicate that the position is saved.
11. Rotate the crane Clockwise to the parked position.

After replacing the winch wire or changing the wire length, the winch wire end point needs to be calibrated.

1. Set the Radio Remote Control to Heavy Lift mode.
2. Wind the wire up to the desired position.
3. Press and hold the switch for the Winch in the -Up position.
4. While holding the switch, press the -Set button
5. The light on the PLC Controller will blink green indicating the position is saved.
6. Verify the end point by paying out the wire and hauling the wire back.
7. Set the Radio Remote Control to Normal mode.
8. Wind the wire up to the desired position.
9. Press and hold the switch for the Winch in the -Up position.
10. While holding the switch, press the -Set button.
11. The light on the PLC Controller will blink green indicating the position is saved.
12. Verify the end point by paying out the wire and hauling the wire back.

ROV OHC Radio Control



Switch	Description
D1	Battery Indicator
S1	Tilt/Telescope Joystick
S2	Trolley in out (X axis) / DH forward, aft (Y axis)/ DH slew cw, ccw (Z axis)
S3	Winch
S4	Spring plate up, down
S5	Bullet winch hoist, lower
S6	Floodlight (on/off)
S7	Bullet winch constant tension
S8	Turn off radio and deactivate OHC
S9	Horn
S10	Turn on radio and activate OHC
S11	Activate one stick Launch/Recovery
S12	N/A
S13	Stop HPU
S14	Start HPU
S15	Outhauler engage
S16	DH lock/Unlock
S17	Activate winch system Rapp
S18	Constant tension Rapp winch
S19	Manual Tension potmeter control Rapp
S20	Speed
S21	DH tilt Fixed/Free
S22	Spare??
S23	Spring plate Fixed/Free
S24	DH sideways Fixed/Free
R1	Tension Control

Safety Note: If there is a failure of the tension potentiometer, the PLC program will detect this and will set the tension to maximum to prevent any load from falling.

TRIPLEX
by MacGregor

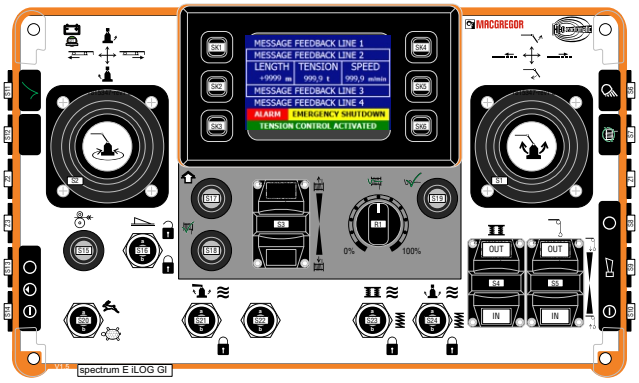
Operating Instructions

Project: MBARI OVERHEAD CRANE

Triplex item nr. RC-OHC-HBC-07 / 400198450
order nr.: 4504420729

Serial nr.: 727-1815347
Model: spectrum E iLOG GI
Frequence: 2.4GHz / TC241 / Focus-T

Delivery date: 07.12.2022



spectrum E

HBC-radiomatic Norge AS
www.hbc-radiomatic.no

CE

Vedlegg 1: sikkerhetsinformasjon

Tilleggsinformasjon om sikkerhet

Vennligst les gjennom følgende viktig sikkerhetsinformasjon

Reservesender:
Reserve iLOG
Reserve iON

Det er ikke tillatt å bruke to sendere med samme kode (iLOG/iON) samtidig.
Reservesender eller originalsender må være innelåst !

Reservemottaker:

Det er ikke tillatt å bruke to mottakere med samme kode samtidig.
Reservemottakere eller originalmottaker må være innelåst !

Reservefunksjon:

Forhandleren har ansvar for eventuelt merking av tilleggsfunksjoner hvis reserveknapper eller reservejoysticker blir tatt i bruk. Skiltene skal være slitasjesterke og værbestandige.

Gjenvinning av batterier:

Batterier skal ikke kastes sammen med annet avfall. I stedet, returnere batterier til godkjent gjenvinningsstasjon eller batteri forhandler som HBC-radiomatic Norge AS

Aktiv Stopp:

HVIS systemet levers med en 'aktiv stopp' krets. (Kun bit / rele utgang fra stopp bryter), **SÅ** oppfyller dette ikke kategorien EN954 + EN ISO 13849-1 krav til nødstopp
Kundens PLS må kontinuerlig vurdere aktiv stoppkommandoen og kommunikasjon OK krets
Kunden har bedt om en 'aktiv stopp' funksjon, og er dermed ansvarlig for å tolke dette i sin PLS.

Attachment 1: safety information

Additional information on safety

Please read through the following safety information

Spare transmitter:
Spare iLOG
Spare iON

It is not allowed to use two transmitters with the same code (iLOG/iON) at the same time.
Either the spare transmitter or original transmitter must be secured!

Spare receiver:

It is not allowed to use two receivers with the same code at the same time.
Either the spare receiver or original receiver must be secured!

Spare function:

This system be delivered with spare buttons or joysticks. **The dealer is responsible for marking any additional functions** which may be connected in the future. The label should be weather and abrasion resistant.

Battery disposal:

Batteries must not be disposted of with regular waste. Instead, return batteries to an approved recycling station or battery dealer. HBC-radiomatic Norge AS will take batteries in return.

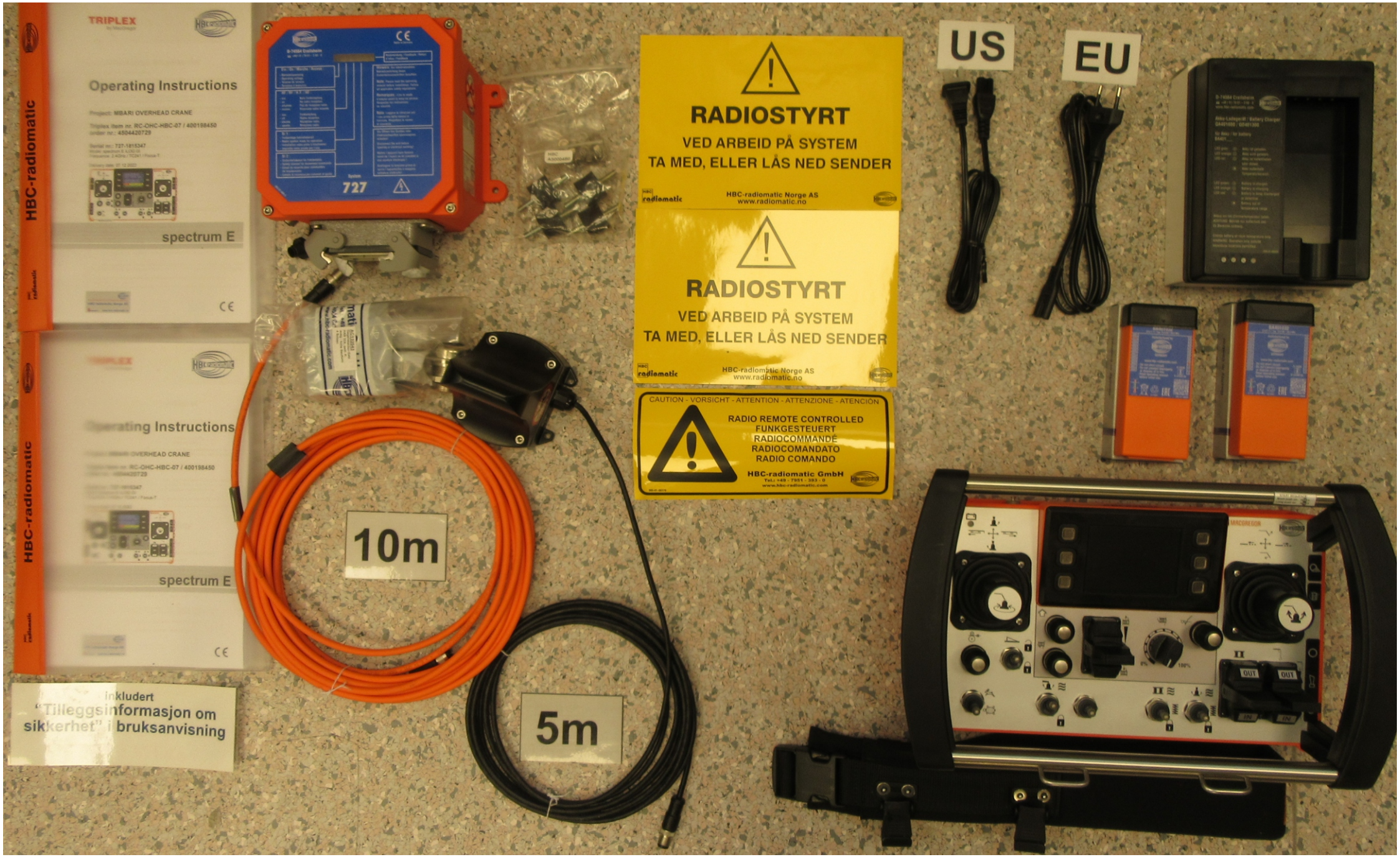
Active Stop:

IF This system is delivered with an 'active stop' circut. (Only bit /relay output from stop switch), **THEN** it does not meet the category EN954 + EN ISO 13849-1 requirements for emergency stop.
The clients PLC must continuously evaluate the Active Stop command and communication OK circut!
The client has requested the 'active stop' function, and is thereby responsible to integrate it with their PLC system.

HBC-radiomatic Norge AS
Gamleveien 87
N-4315 Sandnes
Org.nr. 994 038 516 MVA

www.radiomatic.no
brev@radiomatic.no
Tel.: +47 47 93 49 00
Fax: +47 52 97 30 89

Bank: SR Bank
Account nr. 3201 44 58033
IBAN: NO 3432 0144 5803 3
SWIFT (BIC): SPRONO22


TRIPLEX
HBC-radiomatic
Operating Instructions
spectrum E
CE
727
RADIOSTYRT
VED ARBEID PÅ SYSTEM
TA MED, ELLER LÅS NED SENDER
HBC-radiomatic Norge AS
www.radiomatic.no
RADIOSTYRT
VED ARBEID PÅ SYSTEM
TA MED, ELLER LÅS NED SENDER
HBC-radiomatic Norge AS
www.radiomatic.no
CAUTION - VORSICHT - ATTENTION - ATTENZIONE - ATENCIÓN
RADIO REMOTE CONTROLLED
FUNKGESTEUERT
RADIOCOMMANDÉ
RADIOCOMANDATO
RADIO COMANDO
HBC-radiomatic GmbH
US
EU
10m
5m
Inkludert
"Tilleggsinformasjon om
sikkerhet" i bruksanvisning

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373mm

MESSAGE FEEDBACK LINE 1
MESSAGE FEEDBACK LINE 2
LENGTH +9999 m | TENSION 999,9 t | SPEED 999,9 m/min
MESSAGE FEEDBACK LINE 3
MESSAGE FEEDBACK LINE 4
ALARM | EMERGENCY SHUTDOWN
TENSION CONTROL ACTIVATED

SK1 SK2 SK3 SK4 SK5 SK6

MACGREGOR

SPARE

HPU / PUMP START / STOP

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 R1

0% 100%

OUT OUT IN IN

Transmitter OFF

START SEQUENCE:
- short push on « ⏻ »
- long push on « ⏻ »

APO: ■ off □ on (15 min)

standard symbol & position no change possible acc. HBC-Germany (IEC 60417-5010 (2002-10))

V1.5 spectrum E iLOG GI

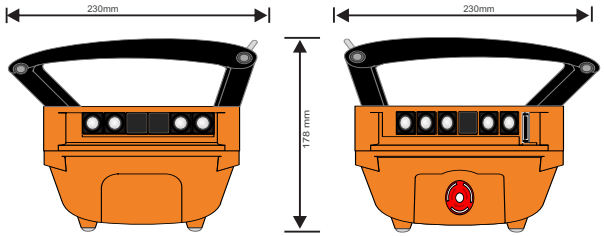
Rollover bar: stainless steel

Frontplatte / Faceplate
Art / Type: Drucker
Hintergrundfarbe: weiß
Background color: white
Beschriftungsfarbe: schwarz / farbig
Label color: black / coloured

MACGREGOR

Prosjekt: MBARI OHC
400198450 RC-OHC-HBC-07
WBS Element 4/60185.1.C2

MBARI Monterey Bay Aquarium Research Institute



CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	20.09.2022	avel	

Datum 20.09.2022 | Gezeichnet avel | Geprüft avrb

Kunde HBC-radiomatic Norge
Kommission MacGregor / Triplex
Bestellnummer 26165-KLE
Orig. | Ersetzt | Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung
Fabrikationsnummer 727-1815347
Auftragsnummer 26165
V1.4
1 / 13 Bl.

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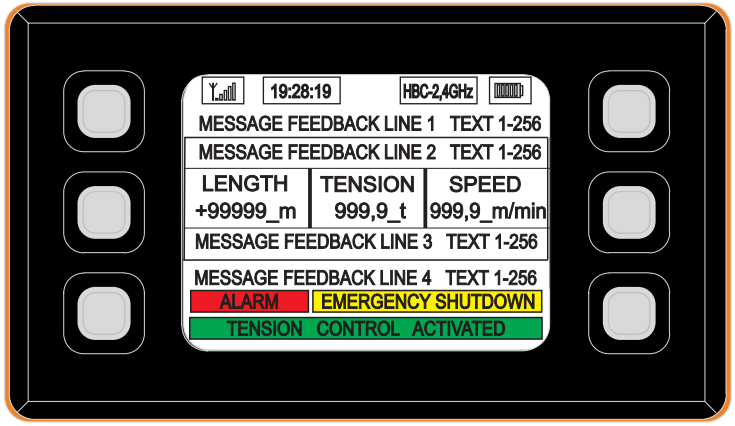
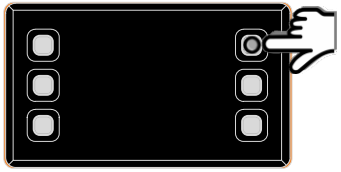
HBC-radiomatic GMBH

Start picture during the start procedure:

After start procedure

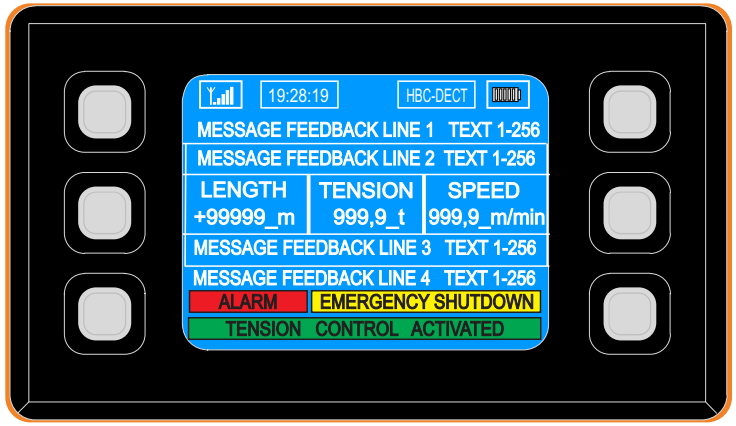




push button once

push button again to show
the alternative information display

Low battery flashing



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1a / 13 Bl.

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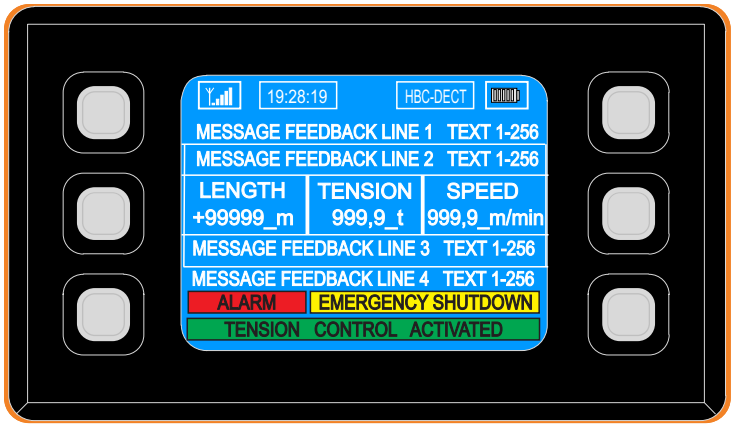
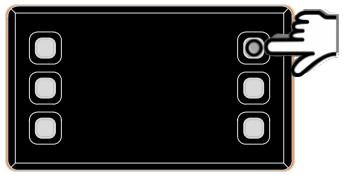
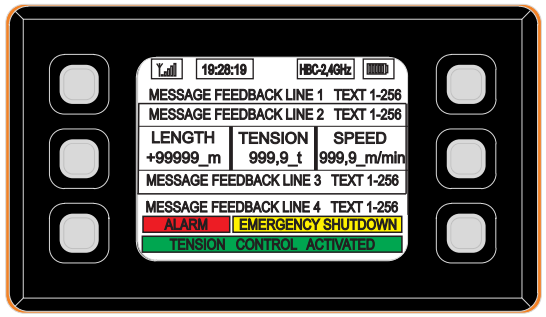


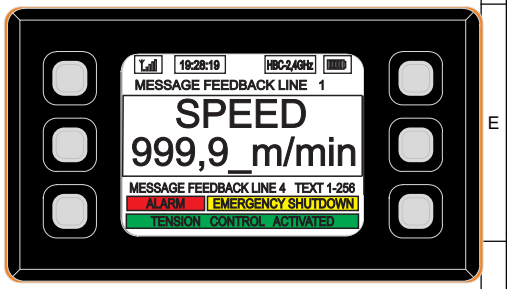


push button once

push button again to show the alternative information display



retur to main display if bit X is activated



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74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung

Fabrikationsnummer 727-1815347

Auftragsnummer 26165

V1.4

1b / 13 Bl.

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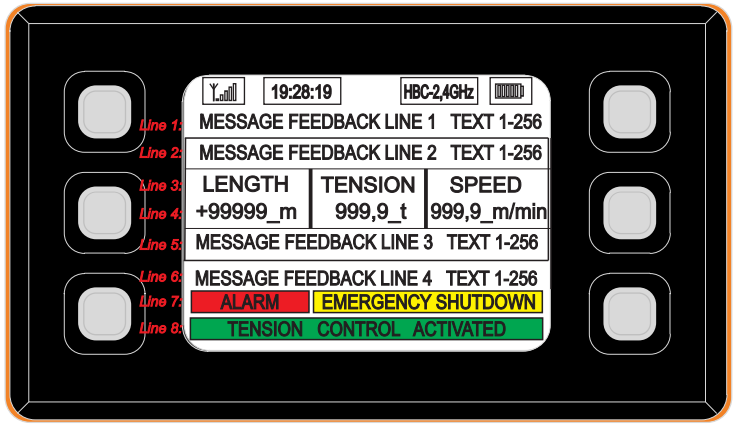

Line 1: MESSAGE FEEDBACK LINE 1 1-256

1x bit for flashing
1x activate line 1

Line 2: MESSAGE FEEDBACK LINE 1 TEXT 1-256

1x bit for flashing
1x activate line 2

TEXT 1: WINCH 1
TEXT 2: WINCH 2
TEXT 3: WINCH 3
TEXT 4: WINCH 4
TEXT 5: WINCH 5
TEXT 6: WINCH 6
TEXT 7: WINCH 7
TEXT 8: WINCH 8
TEXT 9: WINCH 9
TEXT 10: WINCH 10
TEXT 11: SPARE 1
TEXT 12: SPARE 2
.
.
.
TEXT 256: .....

Line 3: LENGTH | TENSION | SPEED

Line 4: +99999_m | 999,9_t | 999,9_m/min

(-99999)-(+99999) | (0-999,9) | (0-999,9)

Wertebereich/ range	Einheit/ unit
0	m
1	feet
2	ft
3	

Wertebereich/ range	Einheit/ unit
0	t
1	LBS
2	
3	

Wertebereich/ range	Einheit/ unit
0	m/min
1	m/s
2	feet/min
3	ft/min

DISPLAY RIGHT LINE 4

Wertebereich/ range	Einheit/ unit
0	m
1	feet
2	ft
3	

DISPLAY RIGHT LINE 5

Wertebereich/ range	Einheit/ unit
0	t
1	LBS
2	
3	

DISPLAY RIGHT LINE 6

Wertebereich/ range	Einheit/ unit
0	m/min
1	m/s
2	feet/min
3	ft/min

Line 5: MESSAGE FEEDBACK LINE 2 TEXT 1-256

TEXT 1: GENERAL_ALARM
TEXT 2: PLC COMMUNI.ERROR
TEXT 3: REMOTE RADIO ERROR
TEXT 4: EMERGENCY STOP
TEXT 5: LOAD CELL FAULT
TEXT 6: OVERLOAD 90%
TEXT 7: OVERLOAD 100%
TEXT 8: OVERLOAD 110%
TEXT 9: OIL TEMPER. TOO HIGH
TEXT 10: OIL TEMPER. HIGH
TEXT 11: OIL TEMPER. S.FAULT
TEXT 12: OIL LEVEL LOW
TEXT 13: OIL LEVEL LOW LOW
TEXT 14: HYDRAUL.PUMP OVERLOAD
TEXT 15: HYDR:PUMP FAULT
.
.
TEXT 256: .....

1x bit for flashing
1x activate line

Line 6: MESSAGE FEEDBACK LINE 2 TEXT 1-256

TEXT 1: GENERAL_ALARM
TEXT 2: PLC COMMUNI.ERROR
TEXT 3: REMOTE RADIO ERROR
TEXT 4: EMERGENCY STOP
TEXT 5: LOAD CELL FAULT
TEXT 6: OVERLOAD 90%
TEXT 7: OVERLOAD 100%
TEXT 8: OVERLOAD 110%
TEXT 9: OIL TEMPER. TOO HIGH
TEXT 10: OIL TEMPER. HIGH
TEXT 11: OIL TEMPER. S.FAULT
TEXT 12: OIL LEVEL LOW
TEXT 13: OIL LEVEL LOW LOW
TEXT 14: HYDRAUL.PUMP OVERLOAD
TEXT 15: HYDR:PUMP FAULT
.
.
TEXT 256: .....

1x bit for flashing
1x activate line

Line 7: ALARM | EMERGENCY SHUTDOWN

1x bit for flashing
1x activate line

1x bit for flashing
1x activate line

Line 8: TENSION CONTROL ACTIVATED

1x bit for flashing
1x activate line

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				Geprüft	avrb			

Kunde: HBC-radiomatic Norge
Kommission: MacGregor / Triplex
Bestellnummer: 26165-KLE

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung:
Fabrikationsnummer: 727-1815347
Auftragsnummer: 26165
V1.4
1c / 13 Bl.

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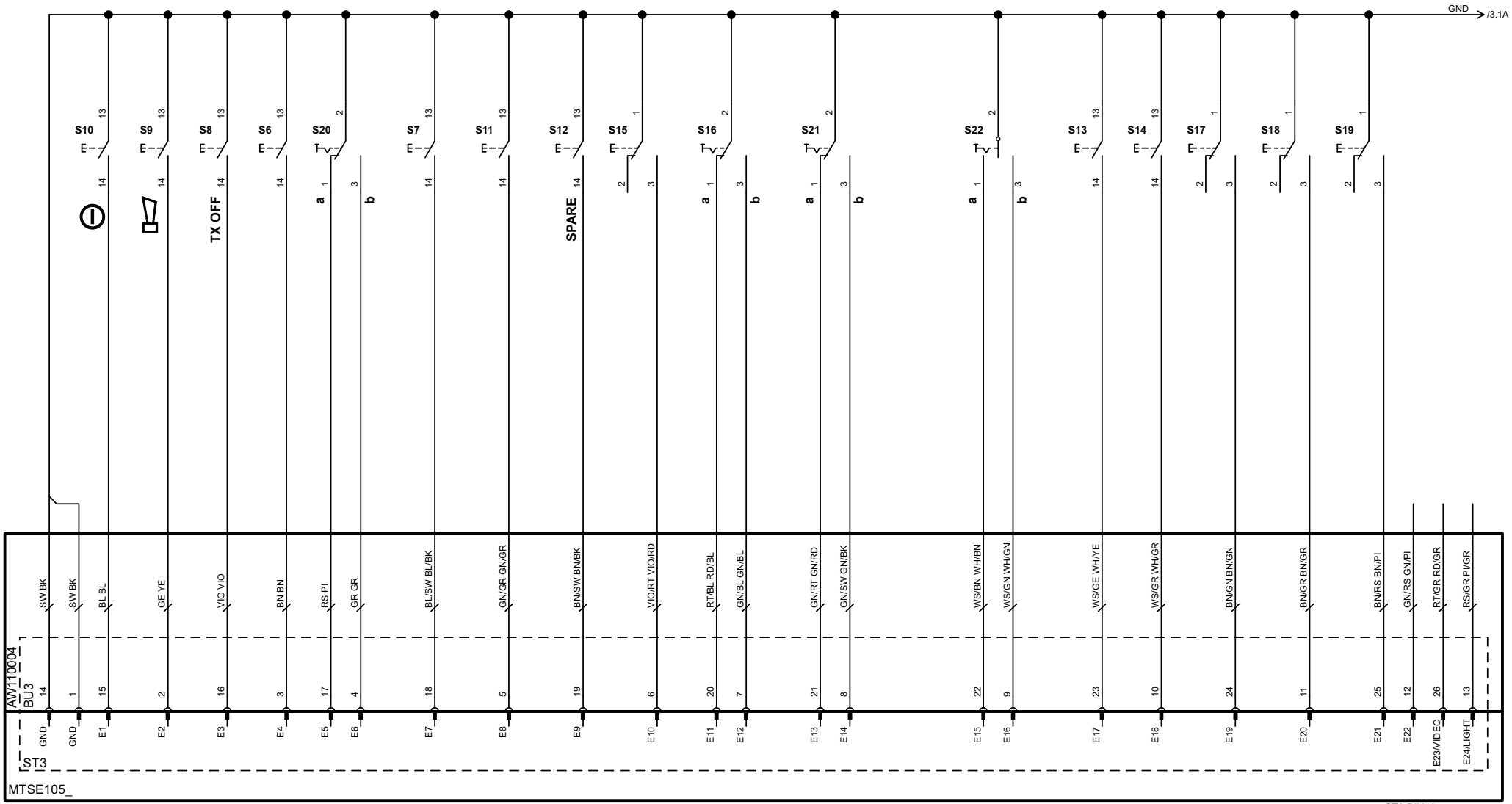

	Funk-Start Radio start
	Kran-Ein-Verriegelung Crane on interlock
	radiomatic® infrakey
	Kabeloption Cable option

	radiomatic® zero-g
	radiomatic® roll-detect
	radiomatic® shock-off
	inclination switch

15	APO-Zeit (min.) APO-time (min.)

Funktion E17-24 Function E17-24	LB11	▮▮
Funktion E9-16 Function E9-16	LB12	▮▮
Funktion E41-43+63/64 Function E41-43+63/64	LB10	▮▮
▮▮ SI1 ▮▮ SI2		

E1-8 immer SI1
E1-8 always SI1

4	Hidden-Switch

Start
Start

LB9	▮▮

▮▮ Start via Ein-/ Start-Taster
Start via on/ start pushbutton
▮▮ Start via iCON
Start via iCON

ST3 PIN13

LB21	▮▮
E24	▮▮
Light	▮▮

ST3 PIN26

	A B
LB22	▮▮
E23	▮▮
Video	▮▮

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	20.09.2022	avel	

Datum	20.09.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avel	Kommission	MacGregor / Triplex
Geprüft	avrb	Bestellnummer	26165-KLE
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung

Fabrikationsnummer
727-1815347

Auftragsnummer
26165

V1.3
2 / 13 Bl.

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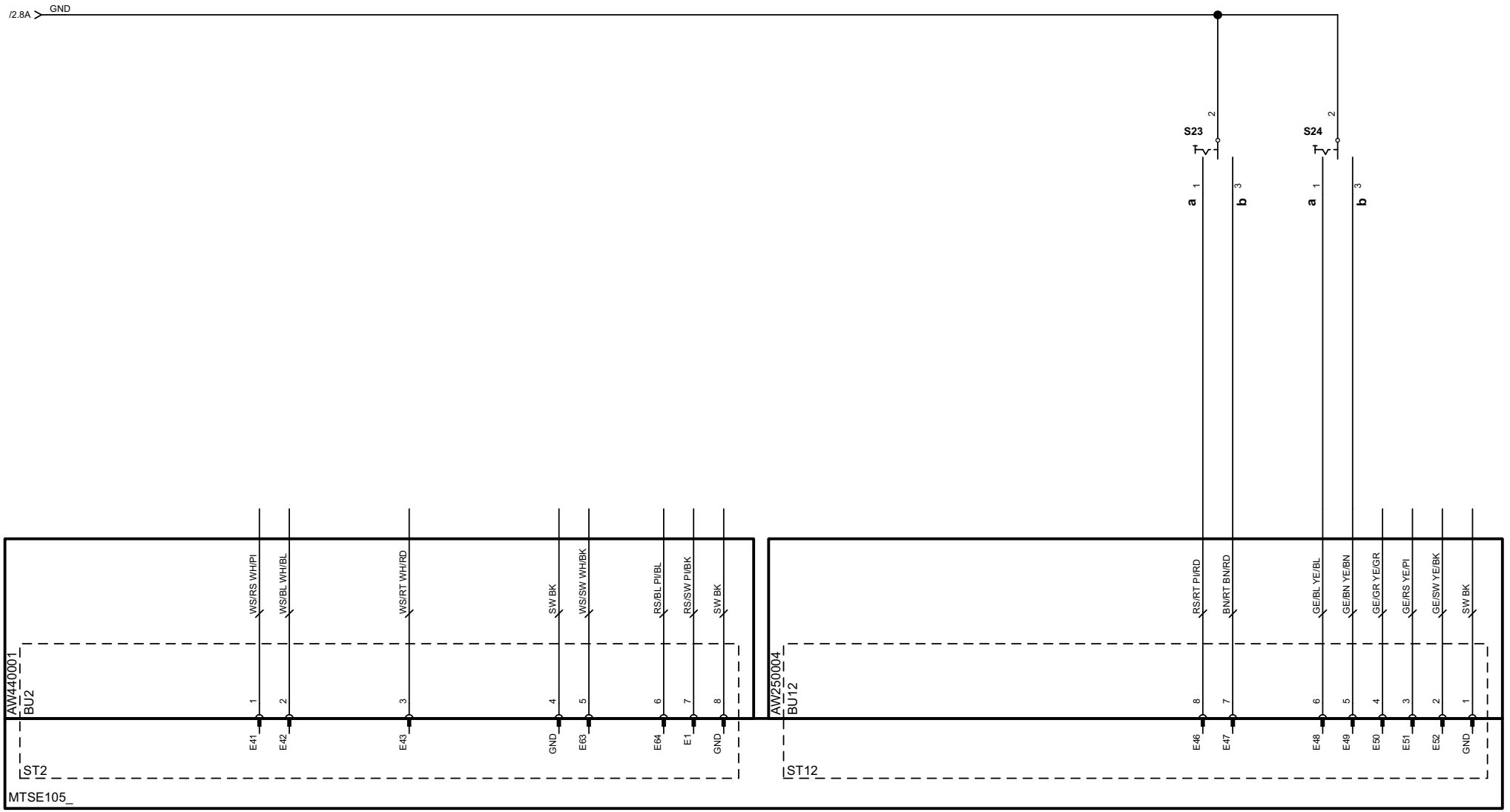

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

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V1.3

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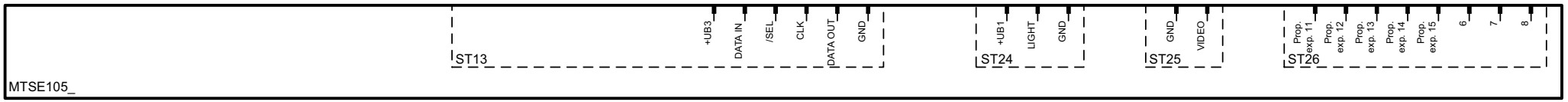

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Zeichnung

Fabrikationsnummer
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Auftragsnummer
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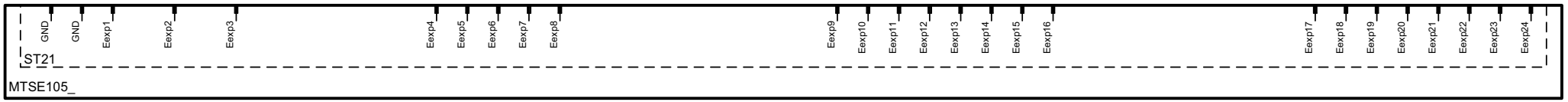

Funktion Eexp1-8 Function Eexp1-8	LB16	▮▮
Funktion Eexp9-16 Function Eexp9-16	LB15	▮▮
Funktion Eexp17-24 Function Eexp17-24	LB18	▮▮
▮▮ SI1 ▮▮ SI2		

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
1	Umbau	20.09.2022	avel	Datum	20.09.2022			
				Gezeichnet	avel			
				Geprüft	avrb			

Kunde: HBC-radiomatic Norge
Kommission: MacGregor / Triplex
Bestellnummer: 26165-KLE

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung

Fabrikationsnummer: 727-1815347

Auftragsnummer: 26165

V1.3

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HBC-radiomatic GMBH

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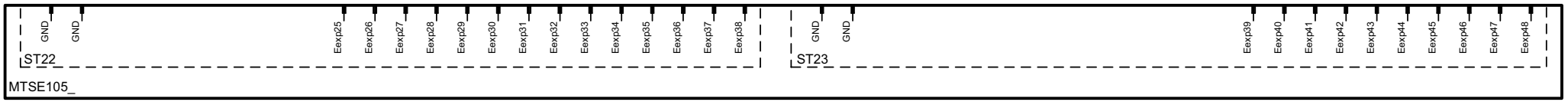

Funktion E25-32 Function E25-32	LB14	▮▮
Funktion E33-40 Function E33-40	LB13	▮▮
Funktion E41-48 Function E41-48	LB17	▮▮
▮▮ SI1 ▮▮ SI2		

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
1	Umbau	20.09.2022	avel	Datum	20.09.2022			
				Gezeichnet	avel			
				Geprüft	avrb			

Kunde HBC-radiomatic Norge
Kommission MacGregor / Triplex
Bestellnummer 26165-KLE

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung

Fabrikationsnummer
727-1815347

Auftragsnummer
26165

V1.3

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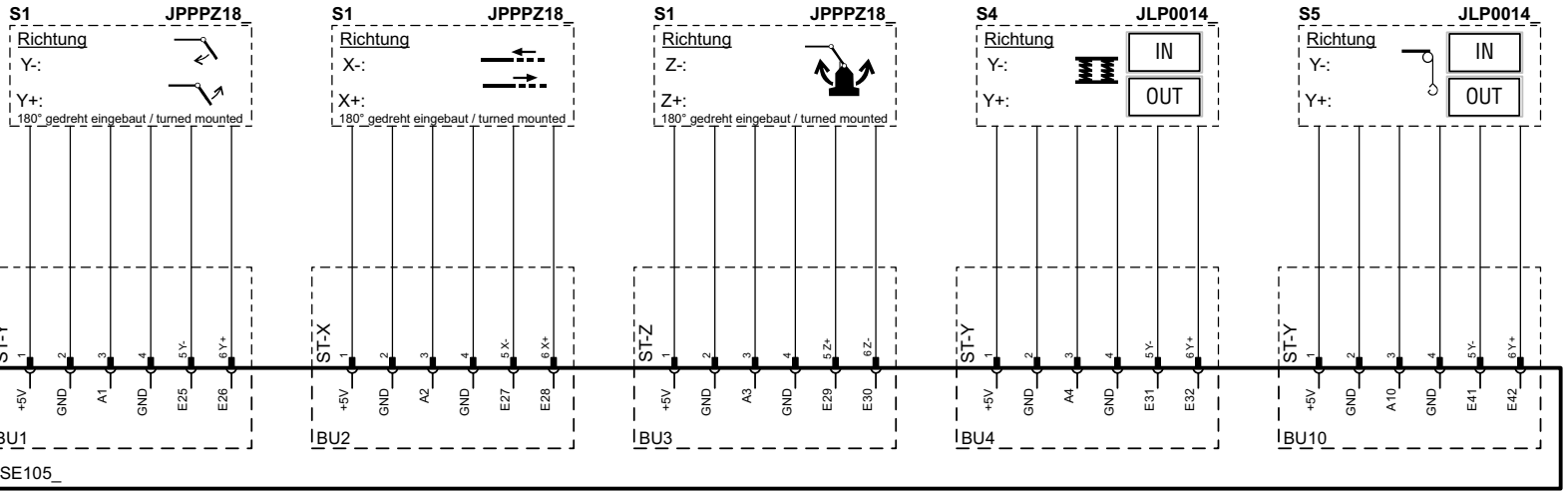
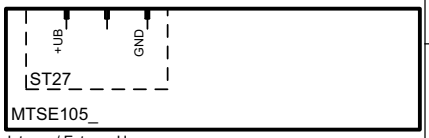
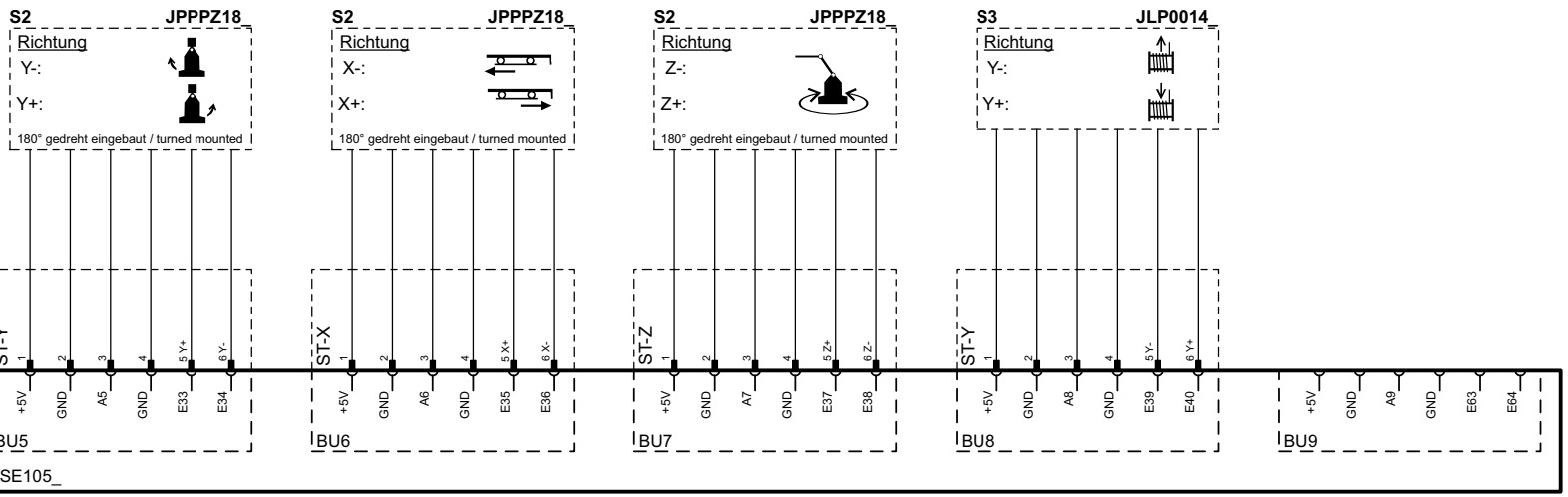
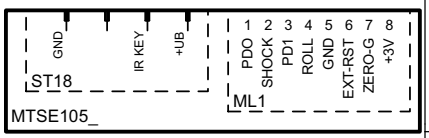




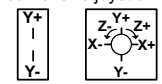
Interne / Externe Hupe
Internal / External horn
LB23

Externe Hupe / External horn
Interne Hupe / Internal horn

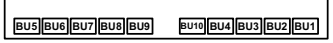




Beispiel: Linearhebel / KMS
Example: linear lever / joystick



Platinenansicht von Frontplattenseite/
PCB view from faceplate side



CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
1	Umbau	20.09.2022	avel	Datum	20.09.2022	Kunde	HBC-radiomatic Norge	
				Gezeichnet	avel	Kommission	MacGregor / Triplex	
				Geprüft	avrb	Bestellnummer	26165-KLE	

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung

Fabrikationsnummer: 727-1815347

Auftragsnummer: 26165

V1.3

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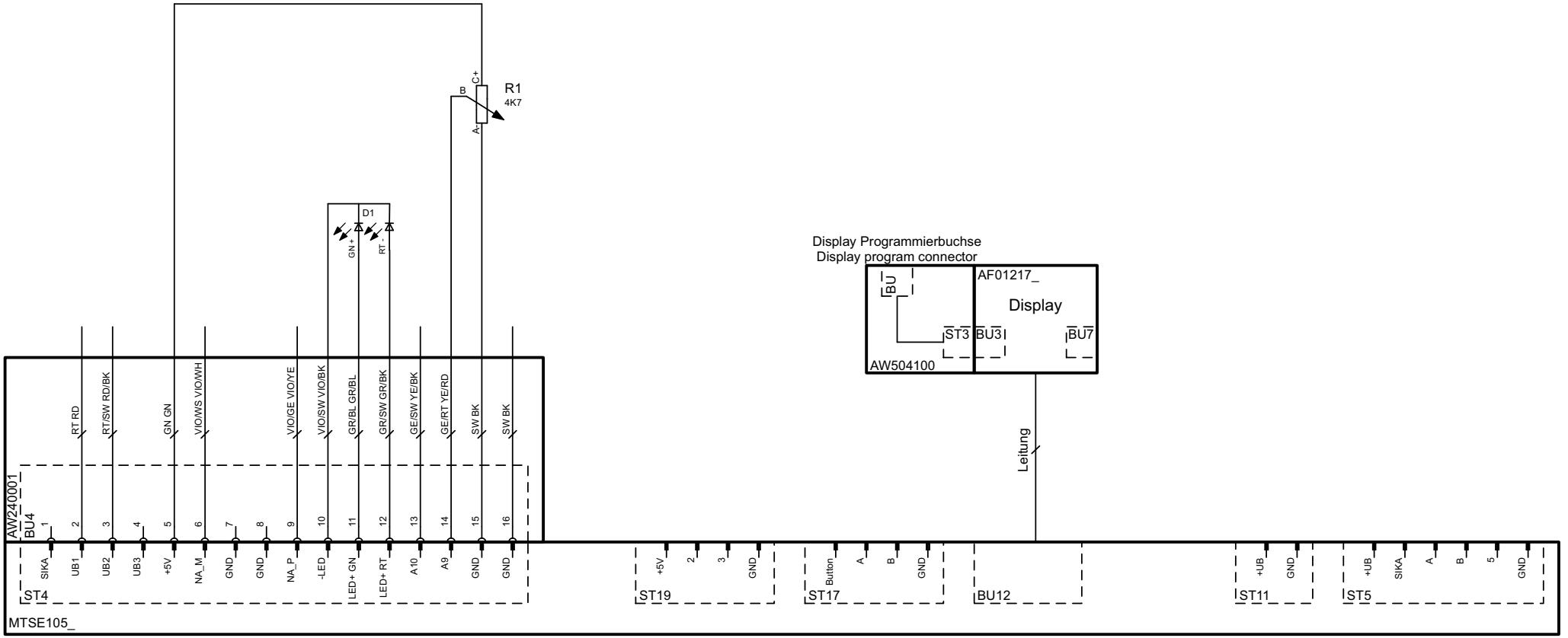

Display-Software :SF001007 / SF004011
Display-Konfiguration:727_18_15347-rev_.tdp

Edit-Software :

ST11 Frontplattenbeleuchtung
ST11 Face plate illumination

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name
1	Umbau	20.09.2022	avel

Datum	20.09.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avel	Kommission	MacGregor / Triplex
Geprüft	avrb	Bestellnummer	26165-KLE
Genehmigt		Orig.	Ersetzt / Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung
Fabrikationsnummer 727-1815347
Auftragsnummer 26165
V1.3
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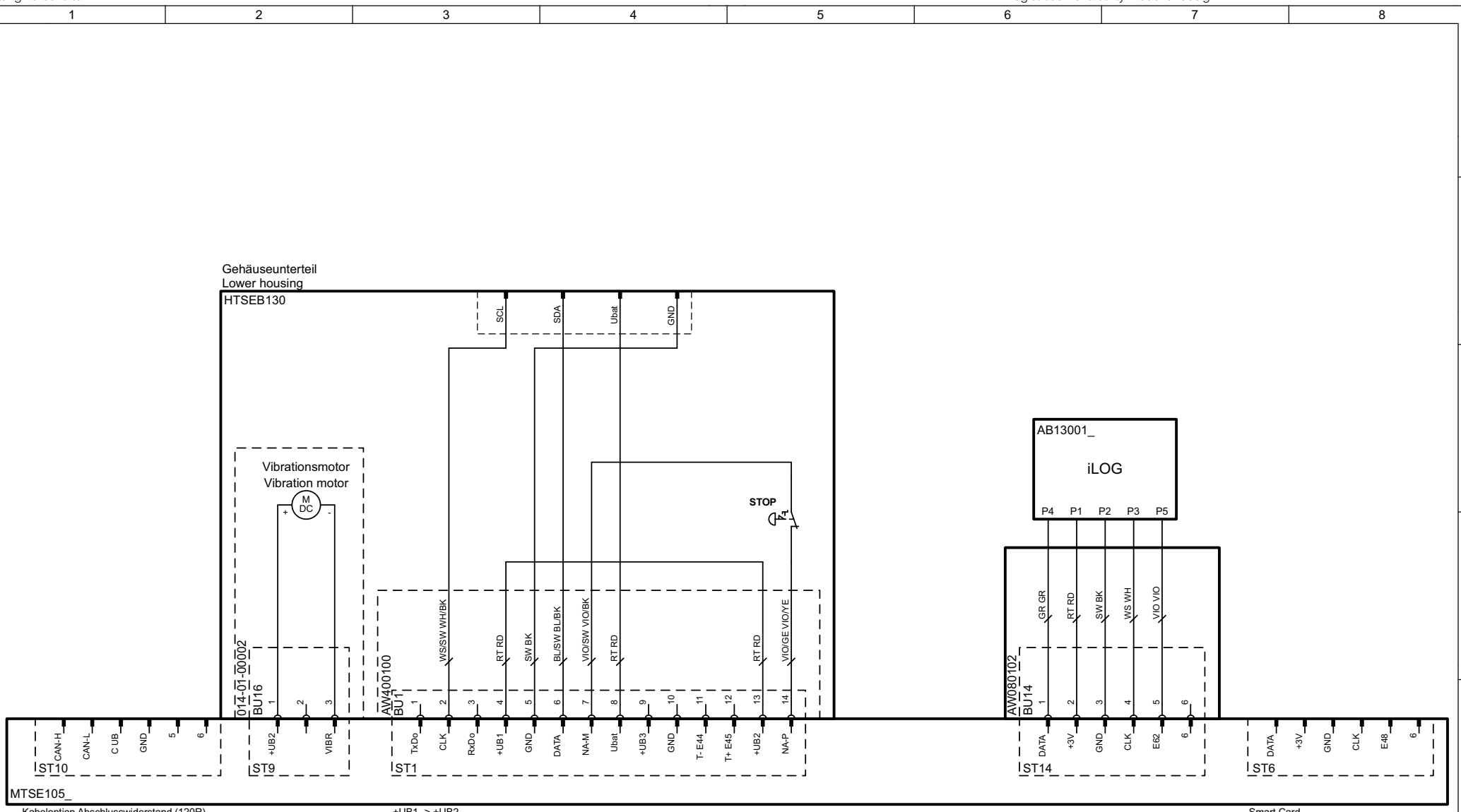
HBC-radiomatic GMBH



CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt		Orig.	Ersetzt	Ersetzt durch
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				Geprüft	avrb	Bestellnummer	26165-KLE	

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Sender / Transmitter
ADCON-Konfig.: 727_18_15347-rev_.sg1
iON-Konfig.:
iLOG-Konfig.: KSD10001

Zeichnung

Fabrikationsnummer
727-1815347

Auftragsnummer
26165

V1.3

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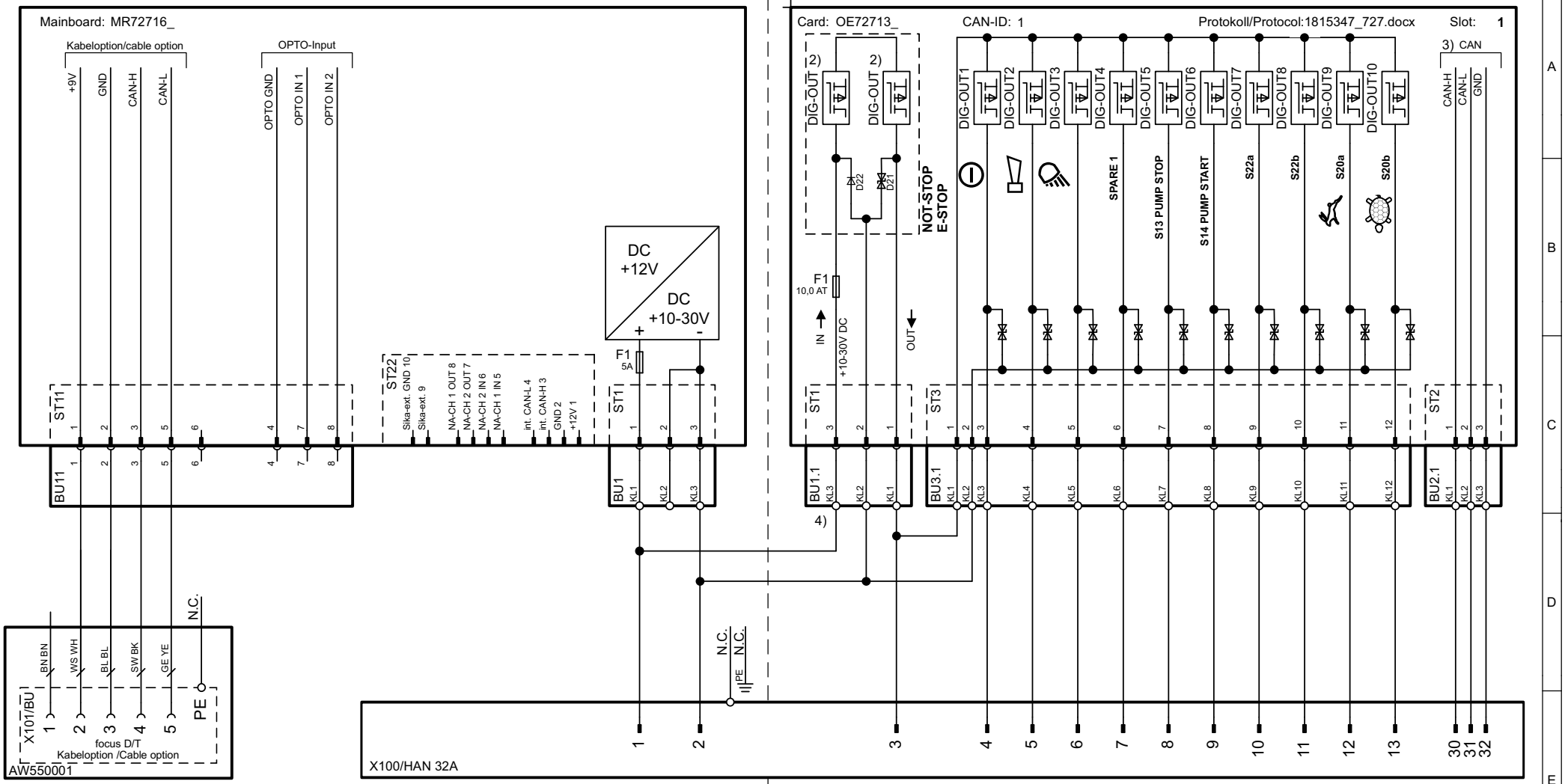
HBC-radiomatic GMBH



LB1
int. CAN Abschlusswiderstand (120R)
int. CAN termination resistor (120R)

LB2
CAN Abschlusswiderstand (120R)
CAN termination resistor (120R)

OPTO-Inputs may only be applied power if the receiver is already energized.

4) Zur Inbetriebnahme des Systems muss der Eingang des NOT-STOP Kreises (BU1.1 KL3) mit +10-30V DC versorgt werden. To activate the system the input of the E-STOP circuit (BU1.1 KL3) must be supplied with +10-30V DC

Bei Bus-Systemen muss die maschinenseitige Elektronik alle Schaltbefehle, die dem Sicherheitskreis 2 unterliegen, über den funkseitigen Si-2-Hardwareausgang auf Plausibilität prüfen und beim Auftreten von Implausibilitäten unmittelbar in den sicheren Zustand versetzen.
For bus systems, the electronics of the machine needs to examine all drive commands that are part of the safety circuit 2 for plausibility via the Si-2 hardware output on the side of the radio and initiate the safe state in case of implausibilities.

OUT1-4	LB4	LB5	LB6	LB7	LB8
OUT5-6	LB9	LB10	LB11	LB12	LB13
OUT7-10	LB14	LB15	LB16	LB17	LB18
	12V	SI0	SI1	SI2	SI2v

2) NOT-STOP im Betriebszustand geschlossen
E-STOP closed in operating condition

Die NOT-STOP-Kette muss in der nachgeschalteten Anlage durch einen von den übrigen Schaltbefehlen unabhängigen Kreis ausgewertet werden!
The E-STOP contacts have to be utilized to control a main emergency stop circuit which is to be independent from all other control functions!

3) LB3
CAN Abschlusswiderstand (120R)
CAN terminating resistor (120R)

S3 12345678 OFF ON DIP-Switch 1
S4 1234 OFF ON DIP-Switch 4

Funktion S3/4 siehe Protokoll
Function S3/4 see protocol

CAD-Zeichnung, keine manuellen Änderungen
CAD - Drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	20.09.2022	avel	

Datum	20.09.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avel	Kommission	MacGregor / Triplex
Geprüft	avrb	Bestellnummer	26165-KLE
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Empfänger / Receiver
ADCON-Konfig.: 727_18_15348-rev_.cmc

Zeichnung

Fabrikationsnummer: 727-1815348

Auftragsnummer: 26165

V1.2

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Platine / Bedienelemente/ usw.
PCB´s / Operating elements / etc.

Stückliste Sender / Bill of material Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Software
1	107-90-00021	107-90-00021	radiomatic® ADCON				
2	107-90-00022	107-90-00022	radiomatic® iLOG				
3	AB13001_	AB13001_	iLOG-Lesemodul für spectrum				
4	AF01217_	AF01217_	Display spectrum D/E - mit Videoschnittstelle Display spectrum D/E - with video interface	20 cm Flachbandkabel 20 cm ribbon cable			SF001007 / SF004011
5	AP00400_	AP00400_	Überrollbügel spectrum E (Edelstahl) rollover bar spectrum E (stainless steel)				
6	D1	008-13-00168	LED grün/rot	d=5mm			
7	HTSE0_3_	HTSE0_3_	Housing transmitter spectrum E iLOG Oberteil Housing transmitter spectrum E iLOG upper housing	orange orange			
8	HTSEB130	HTSEB130	Housing transmitter spectrum E Unterteil	Stop-Schlagschalter orange			
9	MTSE105_	MTSE105_	Mainboard transmitter spectrum E	VDT2			SE0D212_ / SS00210_
10	R1	IE340001	Potentiometer potentiometer	d=10mm			
11	S1	JPPPZ18_	Joystick proportional Prop./Prop. mit Z-Achse, 30° Joystick proportional Prop./Prop. with Z-axis, 30°	Niederhalter (003-90-00006) + Faltenbalg (003-90-00206 or 003-90-00628 VITON) downholder (003-90-00006) + rubber bellow (003-90-00206 or 003-90-00628 VITON)			
12	S2	JPPPZ18_	Joystick proportional Prop./Prop. mit Z-Achse, 30° Joystick proportional Prop./Prop. with Z-axis, 30°	Niederhalter (003-90-00006) + Faltenbalg (003-90-00206 or 003-90-00628 VITON) downholder (003-90-00006) + rubber bellow (003-90-00206 or 003-90-00628 VITON)			
13	S3	JLP0014_	Joystick Linearhebel proportional, 140mm Kabel Joystick linear lever proportional, 140mm Cables	schwarz black			
14	S4	JLP0014_	Joystick Linearhebel proportional, 140mm Kabel Joystick linear lever proportional, 140mm Cables	schwarz black			
15	S5	JLP0014_	Joystick Linearhebel proportional, 140mm Kabel Joystick linear lever proportional, 140mm Cables	schwarz black			
16	S6	IE230017	KHT, kurz KHT, short	d=16mm			
17	S7	IE230017	KHT, kurz KHT, short	d=16mm			
18	S8	IE230017	KHT, kurz KHT, short	d=16mm			
19	S9	IE230017	KHT, kurz KHT, short	d=16mm			
20	S10	IE230017	KHT, kurz KHT, short	d=16mm			
21	S11	IE230017	KHT, kurz KHT, short	d=16mm			
22	S12	IE230017	KHT, kurz KHT, short	d=16mm			
23	S13	IE230017	KHT, kurz KHT, short	d=16mm			
24	S14	IE230017	KHT, kurz KHT, short	d=16mm			

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name
1	Umbau	20.09.2022	avel

Datum	20.09.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avel	Kommission	MacGregor / Triplex
Geprüft	avrb	Bestellnummer	26165-KLE
Genehmigt		Orig.	Ersetzt / Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

Listen / Lists

Zeichnung	
Fabrikationsnummer	727-1815347
Auftragsnummer	26165
	V1.3
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HBC-radiomatic GMBH

Platine / Bedienelemente/ usw.
PCB´s / Operating elements / etc.

Stückliste Sender / Bill of material Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Software
25	S15	IE230001	D-Jet	d=10mm			
26	S16	IE120010	Kippschalter Rast-Rast groß std. toggle switch maintain-maintain big std.	d=12mm	IE120026		
27	S17	IE230001	D-Jet	d=10mm			
28	S18	IE230001	D-Jet	d=10mm			
29	S19	IE230001	D-Jet	d=10mm			
30	S20	IE120009	Kippschalter Rast-Rast klein toggle switch maintain-maintain small	d=12mm			
31	S21	IE120010	Kippschalter Rast-Rast groß std. toggle switch maintain-maintain big std.	d=12mm	IE120026		
32	S22	IE120019	Kippschalter Rast-0-Rast groß std. toggle switch maintain-0-maintain big std.	d=12mm	IE120027		
33	S23	IE120019	Kippschalter Rast-0-Rast groß std. toggle switch maintain-0-maintain big std.	d=12mm	IE120027		
34	S24	IE120019	Kippschalter Rast-0-Rast groß std. toggle switch maintain-0-maintain big std.	d=12mm	IE120027		
35	Z1	003-90-00447	KHT, blind kurz KHT, blind short	d=16mm			
36	Z2	003-90-00447	KHT, blind kurz KHT, blind short	d=16mm			
37	Z3	003-90-00447	KHT, blind kurz KHT, blind short	d=16mm			

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
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Datum	20.09.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avel	Kommission	MacGregor / Triplex
Geprüft	avrb	Bestellnummer	26165-KLE
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

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Zeichnung

Fabrikationsnummer: 727-1815347

Auftragsnummer: 26165

V1.3

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Kabelbäume
Harness

Stückliste Sender / Bill of material Transmitter

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Katalognummer
1	AW080102	AW080102	Verdrahtungshilfe harness	AMP-Buchse 6pol., 5 Adern, eco 2 UT			
2	AW110004	AW110004	Verdrahtungshilfe harness	AMP-Buchse 26pol., 28 Adern, spectrum			
3	AW240001	AW240001	Verdrahtungshilfe harness	AMP-Buchse 16pol., 14 Adern, spectrum			
4	AW250004	AW250004	Verdrahtungshilfe	AVX-Buchse 8pol., 8 Adern			
5	AW440001	AW440001	Verdrahtungshilfe harness	AMP-Buchse 8pol., 8 Adern, spectrum E41-43			
6	AW504100	AW504100	Binder auf USB, Editier-Schnittstelle für TFT-Display				

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name
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Zeichnung

Fabrikationsnummer 727-1815347

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Platinen / Gehäuse / usw.
PCB´s / Housings / etc.

Stückliste Empfänger / Bill of material Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Software
1	107-90-00021	107-90-00021	radiomatic® ADCON				
2	BU1	010-02-00442	Buchsenleiste 3-polig female connector strip 3-polig				
3	BU1.1	010-02-00011	Buchsenleiste 3-polig female connector strip 3-polig				
4	BU2.1	010-02-00506	Buchsenleiste 3-polig female connector strip 3-polig				
5	BU3.1	010-02-00507	Buchsenleiste 12-polig female connector strip 12-polig				
6	CM7372__	CM7372__	CAN-Manager	CAN-Manager TC20/38			SA00320_ / SB00320_ / SY00320_
7	HR168F13	HR168F13	Kunststoff-Gehäuse FSE727, HAN 32/50, SMA - MMCX, MR72716_ plastic-case FSE727, HAN 32/50, SMA - MMCX, MR72716_	orange orange			
8	MR72716_	MR72716_	Mainboard Empfänger 727 Mainboard Receiver 727	DC 10-30V mit geox, Kabeloption, Optokoppler DC 10-30V with geox, cable option, optical isolator			
9	OE72713_	OE72713_	NOT-STOP-Ausgabekarte E-STOP-output card	DC, 10xHigh-Side-Switch + CAN Safety			SOE0131__.s19 / SOE0220__.hex

Steckverbinder
Plug-in connector

Stückliste Empfänger / Bill of material Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Katalognummer	Hersteller
1	AA080011	AA080011	Antennenkabel SMA + MMCX, 240mm antenna cable SMA + MMCX, 240mm	d=9,5mm			HBC
2	X100/HAN 32A	010-03-00097	Anbaugehäuse Size 32A addition housing Size 32A	gerade, niedrige Bauart, 2 Bügel straight, low Type of Construction, 2 clamp		09 20 032 0301	Harting
3	010-03-00080	010-03-00080	Steckereinsatz HAN 16A (Size 16/32A) plug insert HAN 16A (Size 16/32A)	Crimpanschluß crimp connection		09 20 016 3001	Harting
4	010-03-00102	010-03-00102	Steckereinsatz HAN 32A (Size 32A) plug insert HAN 32A (Size 32A)	Crimpanschluß crimp connection		09 20 016 3011	Harting

Kabelbäume
Harness

Stückliste Empfänger / Bill of material Receiver

Zeile	Name	Material	Typbezeichnung	Beschreibung	Alternativ-Material	Bemerkungen	Katalognummer

CAD-Zeichnung, keine manuellen Änderungen
CAD drawing, no manual changes

Rev.	Änderung	Datum	Name	Genehmigt
1	Umbau	20.09.2022	avel	

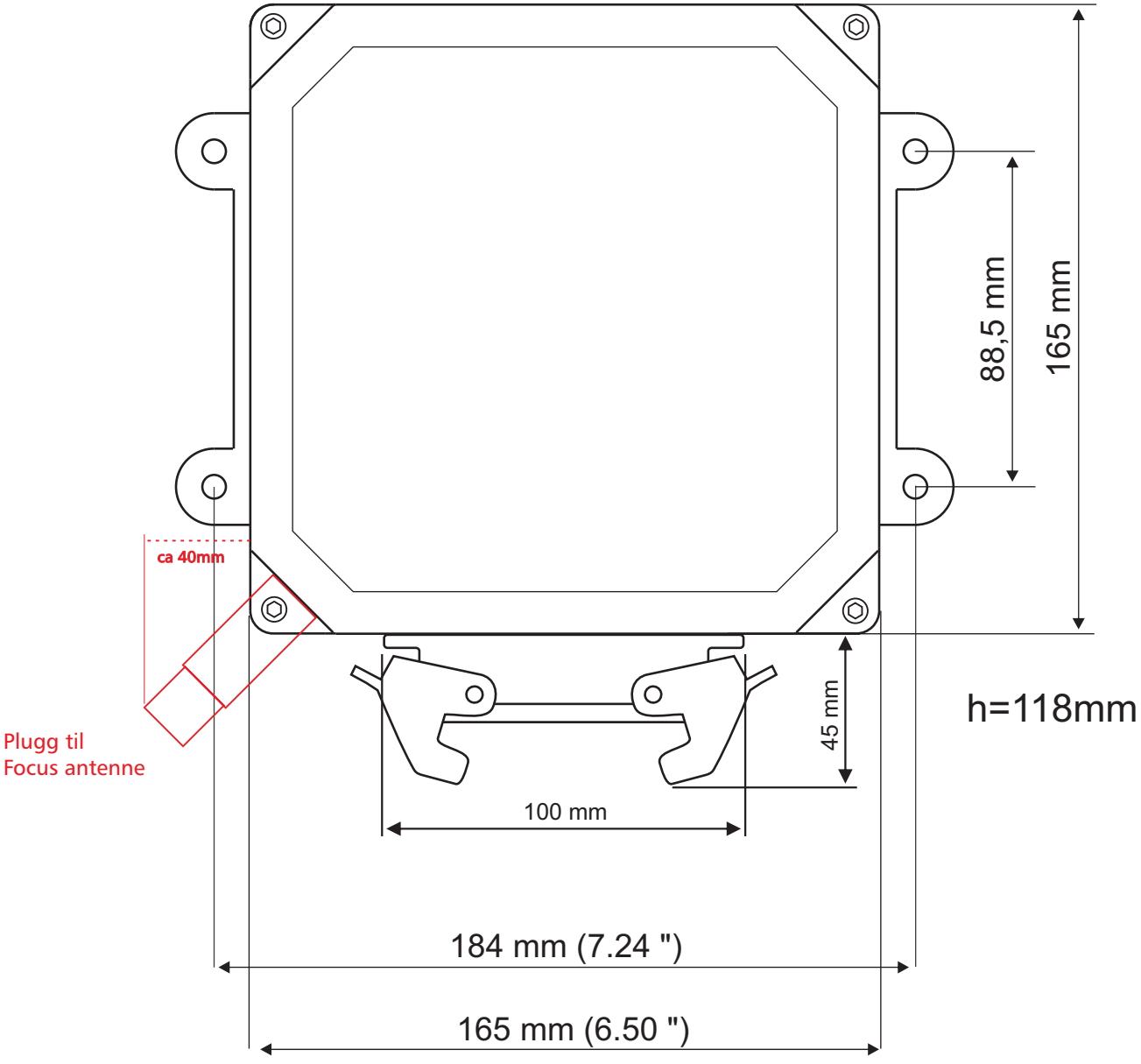
Datum	20.09.2022	Kunde	HBC-radiomatic Norge
Gezeichnet	avel	Kommission	MacGregor / Triplex
Geprüft	avrb	Bestellnummer	26165-KLE
Orig.		Ersetzt	Ersetzt durch

HBC-radiomatic GmbH
Haller-Straße 45-53
74564 Crailsheim

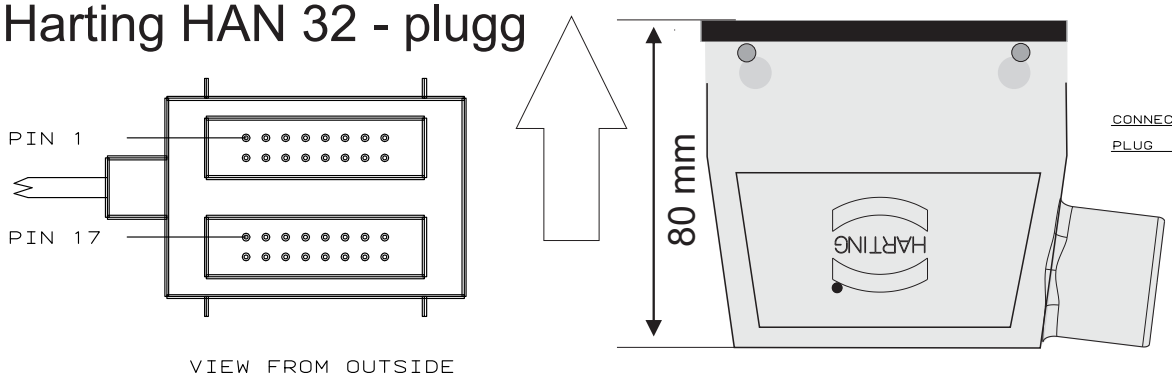
Listen / Lists

Zeichnung	
Fabrikationsnummer	727-1815347
Auftragsnummer	26165
	V1.3
	13 / 13 Bl.

Receiver FSE 727 (HR 168)

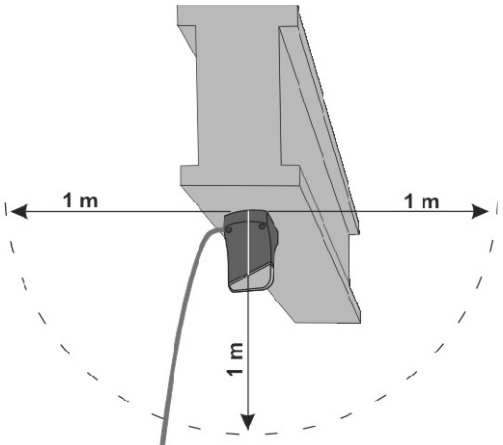


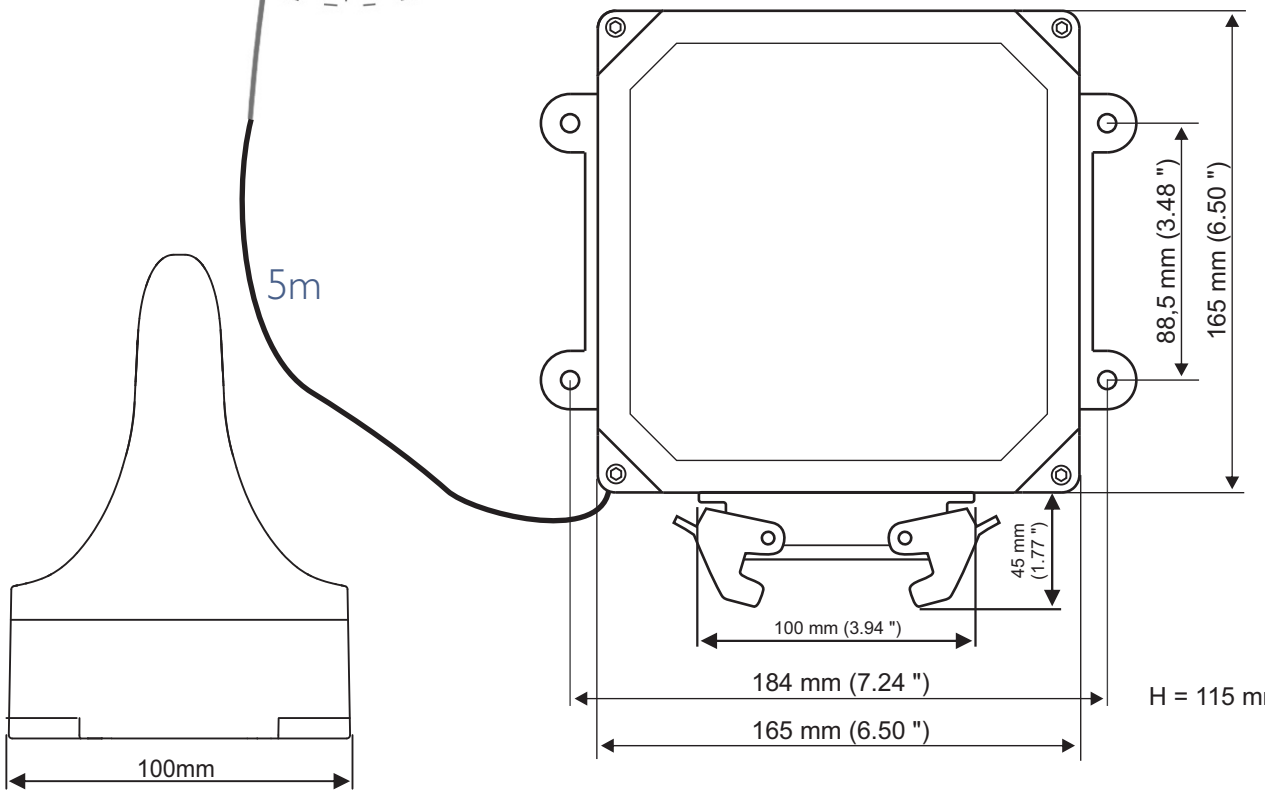
Harting HAN 32 - plugg

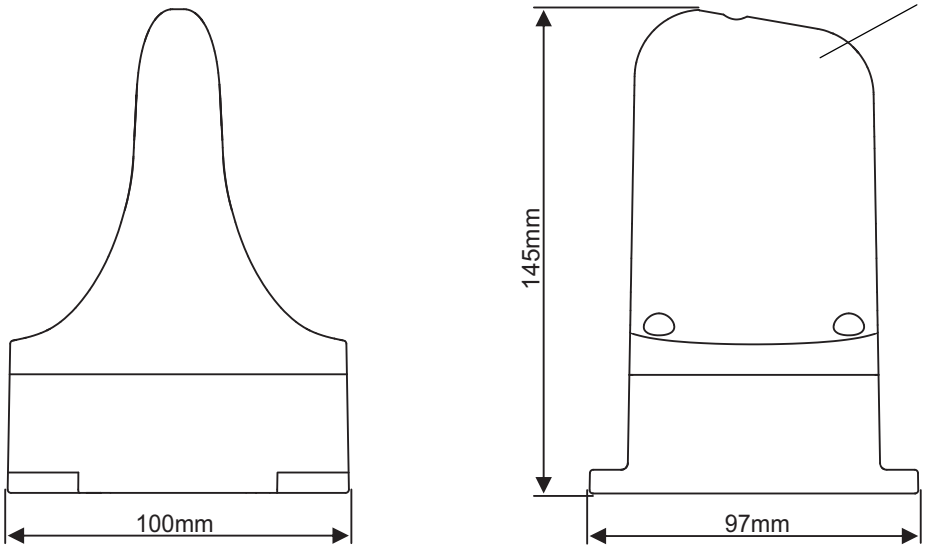


Mottaker FSE 727 focus T 2,4GHz

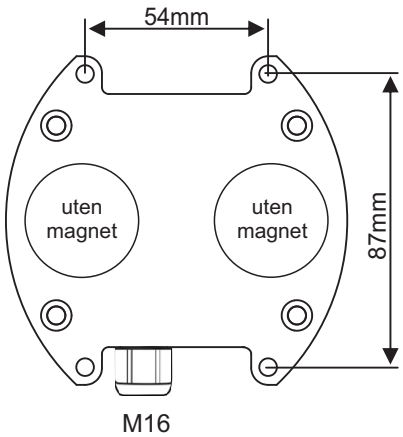
focus T 2,4 GHz mottaker unit standard:
5m kabel lengde
Opsjon: skjøtekabel med 5m,10m, 20m eller 50m lengde







MONTERING.
Til montering brukes to av de diagonale hullene.



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1. Dip-Schalter / dip-switch

1.1. S3

- Einstellung der CANopen Node-ID/adjustment of CANopen Node-ID

Schalter/switch S3			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Node-ID CANopen	x	
2	2^1 x D	Node-ID CANopen		x
3	2^2 x D	Node-ID CANopen	x	
4	2^3 x D	Node-ID CANopen	x	
5	2^4 x D	Node-ID CANopen	x	
6	2^5 x D	Node-ID CANopen	x	
7	2^6 x D	Node-ID CANopen	x	
8		reserviert/reserved	x	

- Node-ID [dez]: **2**

1.2. S4

- Einstellung der Bitrate CAN/adjustment of bit rate CAN

Schalter/switch S4			Stellung/position	
Pos.	Wert/value	Funktion/function	off	on
1	2^0 x D	Bit-Rate CAN		x
2	2^1 x D	Bit-Rate CAN	x	
3	2^2 x D	Bit-Rate CAN	x	
4		reserviert/reserved	x	

Wert	Bit Rate [kBit/s]
0	50
1	125
2	250
3	500
4	1000
5	keine Funktion/no function
6	keine Funktion/no function
7	keine Funktion/no function

- CAN-Bit-Rate[kBit/s]:**125**

2. Globale Einstellungen / global configuration

2.1. Heartbeat

aktiv	Zykluszeit/ cycle time
☒	1s

2.2. CANopen-Safety

aktiv	Zykluszeit/ cycle time
☐	50ms

- CANopen Safety SRDOs

SRDO1-Objekt	ID	1	2
Inhalt/content	default**	NA*	NA inv*

SRDO2-Objekt	ID	1	2
Inhalt/content	default**	NA inv*	NA*

* NA = 0xFF (Notauskreis geschlossen/emergency stop closed)
NA = 0x00 (Notauskreis offen/emergency stop open)

** ID = default (ID-SRDO1 = 0xFF+2*Node-ID, ID-SRDO2 = 0x100+2*Node-ID)
ID = 0x___ (Festwert konfiguriert / fixed value configured)

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3. TX-Data

3.1. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	01	0	RADIO ON S10	0/1	1.SI1/0
		1	(E22)	0/1	1.SI1/1
		2	HORN S9	0/1	1.SI1/2
		3	LIGHT S6	0/1	1.SI1/3
		4	(SLOW MODE) TURTLE S20b	0/1	1.SI1/4
		5	(FAST MODE) HARE S20a	0/1	1.SI1/5
		6		0/1	1.SI1/6
		7	ACCU LOW	0/1	1.SI1/7
	02	0	S7	0/1	2.Si1/0
		1	S11	0/1	2.Si1/1
		2	S12 (SPARE)	0/1	2.Si1/2
		3	(E23)	0/1	2.Si1/3
		4	(E24)	0/1	2.Si1/4
		5		0/1	2.Si1/5
		6		0/1	2.Si1/6
		7		0/1	2.Si1/7
	03	0	S15	0/1	3.Si1/0
		1	S16a	0/1	3.Si1/1
		2	S16b	0/1	3.Si1/2
		3	S21a	0/1	3.Si1/3
		4	S21b	0/1	3.Si1/4
		5	S22a (SPARE)	0/1	3.Si1/5
		6	S22b (SPARE)	0/1	3.Si1/6
		7	S23a	0/1	3.Si1/7
	04	0	S23b	0/1	4.Si1/0
		1	S24a	0/1	4.Si1/1
		2	S24b	0/1	4.Si1/2
		3		0/1	4.Si1/3
		4		0/1	4.Si1/4
		5		0/1	4.Si1/5
		6		0/1	4.Si1/6
		7		0/1	4.Si1/7
	05	0		0/1	5.Si1/0
		1		0/1	5.Si1/1
		2		0/1	5.Si1/2
		3		0/1	5.Si1/3
		4		0/1	5.Si1/4
		5		0/1	5.Si1/5
		6		0/1	5.Si1/6
		7		0/1	5.Si1/7
	06	0		0/1	6.Si1/0
		1		0/1	6.Si1/1
		2		0/1	6.Si1/2
		3		0/1	6.Si1/3
		4		0/1	6.Si1/4

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		5		0/1	6.Si1/5
		6		0/1	6.Si1/6
		7		0/1	6.Si1/7
	07	0		0/1	7.Si1/0
		1		0/1	7.Si1/1
		2		0/1	7.Si1/2
		3		0/1	7.Si1/3
		4		0/1	7.Si1/4
		5		0/1	7.Si1/5
		6		0/1	7.Si1/6
		7		0/1	7.Si1/7

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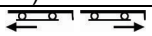
3.2. Digitaleingänge/digital inputs (Schalter/switches)

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	08	0	HPU START S14	0/1	1.SI2/0
		1	HPU STOP S13	0/1	1.SI2/1
		2	ACTIVATE WINCH S17	0/1	1.SI2/2
		3	SELECT WINCH S18	0/1	1.SI2/3
		4	TENSION CONTROL S19	0/1	1.SI2/4
		5		0/1	
		6		0/1	
		7	PILOT VALVE S3	0/1	Logic
	09	0	PILOT VALVE S1-S2	0/1	Logic
		1	PILOT VALVE S4-S5	0/1	Logic
		2	PILOT VALVE S1 – S5	0/1	Logic
		3	PILOT R1 (OUT OF ZERO)	0/1	Logic
		4		0/1	2.SI2/4
		5		0/1	2.SI2/5
		6		0/1	2.SI2/6
		7		0/1	2.SI2/7
	0A	0	S1 X+	0/1	Logic
		1	S1 X-	0/1	Logic
		2	S1 Y+	0/1	Logic
		3	S1 Y-	0/1	Logic
		4	S1 Z+	0/1	Logic
		5	S1 Z-	0/1	Logic
		6	S2 X+	0/1	Logic
		7	S2 X-	0/1	Logic
	0B	0	S2 Y+	0/1	Logic
		1	S2 Y-	0/1	Logic
		2	S2 Z+	0/1	Logic
		3	S2 Z-	0/1	Logic
		4	S3 Y+	0/1	Logic
		5	S3 Y-	0/1	Logic
		6	S4 Y+ OUT	0/1	Logic
		7	S4 Y- IN	0/1	Logic
	0C	0	S5 Y+ OUT	0/1	Logic
		1	S5 Y- IN	0/1	Logic
		2		0/1	5.SI2/2
		3		0/1	5.SI2/3
		4		0/1	5.SI2/4
		5		0/1	5.SI2/5
		6		0/1	5.SI2/6
		7	R1 (OUT OF ZERO)	0/1	Logic
	0D	0		0/1	6.SI2/0
		1		0/1	6.SI2/1
		2		0/1	6.SI2/2
		3		0/1	6.SI2/3
		4		0/1	6.SI2/4
		5		0/1	6.SI2/5
		6		0/1	6.SI2/6

		7		0/1	6.SI2/7
	0E	0	SI 1 (COMUNICATION CIRCUIT OK)	0/1	
		1	SI 2 (ZERO POSITION TEST)	0/1	
		2		0/1	
		3		0/1	
		4	TELEGRAM COUNTER 2^0	0/1	
		5	TELEGRAM COUNTER 2^1	0/1	
		6	TELEGRAM COUNTER 2^2	0/1	
		7	TELEGRAM COUNTER 2^3	0/1	

Index/ index	Subindex/ subindex	Bit/ bit	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6000	0F	0	NA Zustand / E-Stop State	0/1	SI1
		1	NA Zustand / E-Stop State	0/1	SI1
		2	NA Zustand / E-Stop State	0/1	SI1
		3	NA Zustand / E-Stop State	0/1	SI1
		4	NA Zustand / E-Stop State	0/1	SI1
		5	NA Zustand / E-Stop State	0/1	SI1
		6	NA Zustand / E-Stop State	0/1	SI1
		7	NA Zustand / E-Stop State	0/1	SI1
	10	0	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		1	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		2	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		3	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		4	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		5	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		6	NA Zustand invertiert / E-Stop inverted	0/1	SI1
		7	NA Zustand invertiert / E-Stop inverted	0/1	SI1

3.3. Analogeingänge/Analog inputs

Index/ index	Subindex/ subindex	Funktion/ funktion	Wertebereich/ range	Quelle/ source
6400	01	S1 X- (FF-80) / S1 X+ (00-7F)	-128 … +127	Prop 1
	02	S1 Y- (FF-80) / S1 Y+ (00-7F)	-128 … +127	Prop 2
	03	S1 Z- (FF-80) / S1 Z+ (00-7F)	-128 … +127	Prop 3
	04	S2 X- (FF-80) / S1 X+ (00-7F) 	-128 … +127	Prop 4
	05	S2 Y- (FF-80) / S1 Y+ (00-7F)	-128 … +127	Prop 5
	06	S2 Z- (FF-80) / S1 Z+ (00-7F)	-128 … +127	Prop 6
	07	S3 Y- (FF-80) / S3 Y+ (00-7F)	-128 … +127	Prop 7
	08	S4 Y- (FF-80) / S4 Y+ (00-7F) IN OUT	-128 … +127	Prop 8
	09	S5 Y- (FF-80) / S5 Y+ (00-7F) IN OUT	-128 … +127	Prop 9
	0A	R1 POTI TENSION 0…100%	0 … 127	Prop 10

3.4. TX PDO-Mapping

- 1. TX PDO (0x180+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/01	6000/02	6000/03	6000/04	6000/05	6000/06	6000/07	6000/0F

- 2. TX PDO (0x280+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6000/08	6000/09	6000/0A	6000/0B	6000/0C	6000/0D	6000/0E	6000/10

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- 3. TX PDO (0x380+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6400/01	6400/02	6400/03	6400/04	6400/05	6400/06	6400/07	6400/08

- 4. TX PDO (0x480+Node-ID)

PDO-Objekt	1	2
Mappingparam.	6400/09	6400/0A

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4. RX-Data

4.1. Digitalausgänge/Digital outputs

Index/ Index	Subindex/ subindex		Funktion/ funktion	Darstellung/ description	Wertebereich/ range	Ziel/ target
6200	01		LENGHT (Bit 0 – 7)	DISPLAY LINE 4a +/- 0…99999	(-99999) – (+99999)	TxB 1/1
	02		LENGHT (Bit 8 – 15)			TxB 1/2
	03		LENGHT (Bit 16 – 23)			TxB 1/3
	04		LENGHT (Bit 24 – 31)			TxB 1/4
	05		TENSION (Bit 0 – 7)	DISPLAY LINE 4b 0…999,9	0 – 9999	TxB 1/5
	06		TENSION (Bit 8 – 15)			TxB 1/6
	07		SPEED (Bit 0 – 7)	DISPLAY LINE 4c 0…999,9	0 – 9999	TxB 1/7
	08		SPEED (Bit 8 – 15)			TxB 1/8
	09		MESSAGE 1	DISPLAY LINE 1	0-255	TxB 2/1
	0A		MESSAGE 2	DISPLAY LINE 2	0-255	TxB 2/2
	0B		MESSAGE 3	DISPLAY LINE 5	0-255	TxB 2/3
	0C		MESSAGE 4	DISPLAY LINE 6	0-255	TxB 2/4
	0D					TxB 2/5
	0E					TxB 2/6
	0F					TxB 2/7
	10					TxB 2/8
	11	0	DISPLAY LINE 1 (OFF/ON)		0/1	TxB 3/1
		1	DISPLAY LINE 1 (OFF/FLASH)		0/1	
		2	DISPLAY LINE 2 (OFF/ON)		0/1	
		3	DISPLAY LINE 2 (OFF/FLASH)		0/1	
		4	DISPLAY LINE 3 (OFF/ON)		0/1	
		5	DISPLAY LINE 3 (OFF/FLASH)		0/1	
		6	DISPLAY LINE 4 (OFF/ON)		0/1	
		7	DISPLAY LINE 4 (OFF/FLASH)		0/1	
	12	0	DISPLAY LINE 5 (OFF/ON)		0/1	TxB 3/2
		1	DISPLAY LINE 5 (OFF/FLASH)		0/1	
		2	DISPLAY LINE 6 (OFF/ON)		0/1	
		3	DISPLAY LINE 6 (OFF/FLASH)		0/1	
		4	DISPLAY LINE 7A (OFF/ON)		0/1	
		5	DISPLAY LINE 7A (OFF/FLASH)		0/1	
		6	DISPLAY LINE 7B (OFF/ON)		0/1	
		7	DISPLAY LINE 7B (OFF/FLASH)		0/1	
	13	0	DISPLAY LINE 8 (OFF/ON)		0/1	TxB 3/3
		1	DISPLAY LINE 8 (OFF/FLASH)		0/1	
		2	LENGTH DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		3	LENGTH DISPLAY LINE 4 VALUE 2^1 *			
		4	TENSION DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		5	TENSION DISPLAY LINE 4 VALUE 2^1 *			
		6	SPEED DISPLAY LINE 4 VALUE 2^0 *		0 – 3	
		7	SPEED DISPLAY LINE 4 VALUE 2^1 *			
	14	0			0/1	TxB 3/4
		1			0/1	
		2			0/1	
		3	VIBRATION		0/1	
		4	back to display “MAIN PAGE”		0/1	
		5			0/1	
		6			0/1	
		7			0/1	

* Einheit Zuordnung siehe Tabelle 4.2 / Unit assignment, see table 4.2.

Index/ Index	Subindex/ subindex	Funktion/ funktion		Darstellung/ description	Wertebereich/ range	Ziel/ target
6200	15	0	Decimal point LENGTH Value 2^0		0-3	TxB 3/5
		1	Decimal point LENGTH Value 2^1			
		2	Decimal point TENSION Value 2^0		0-3	
		3	Decimal point TENSION Value 2^1			
		4	Decimal point SPEED Value 2^0		0-3	
		5	Decimal point SPEED Value 2^1			
		6			0/1	
		7			0/1	
	16	0			0/1	TxB 3/6
		1			0/1	
		2			0/1	
		3			0/1	
		4			0/1	
		5			0/1	
		6			0/1	
		7			0/1	
	17	0	not used in this sys-tem	(Shift-Register LED A1)	0/1	TxB 3/7
		1	not used in this sys-tem	(Shift-Register LED A2)	0/1	
		2	not used in this sys-tem	(Shift-Register LED A3)	0/1	
		3	not used in this sys-tem	(Shift-Register LED A4)	0/1	
		4	not used in this sys-tem	(Shift-Register LED A5)	0/1	
		5	not used in this sys-tem	(Shift-Register LED A6)	0/1	
		6	not used in this sys-tem	(Shift-Register LED A7)	0/1	
		7	not used in this sys-tem	(Shift-Register LED A8)	0/1	
	18	Reserve			0 – 255	TxB 3/8

4.2. Einheit Zuordnung / Unit assignment

DISPLAY LINE 4 (LENGTH)

Wertebereich/ range	Einheit/ unit
0	m
1	feet
2	ft
3	

DISPLAY LINE 4 (TENSION)

Wertebereich/ range	Einheit/ unit
0	t
1	LBS
2	Kg
3	

DISPLAY LINE 4 (SPEED)

Wertebereich/ range	Einheit/ unit
0	m/min
1	m/s
2	feet/min
3	ft/min

4.3. Dezimalpunkt / Decimal point

Wertebereich/ range	Dezimal-punkt/ Decimal point
0	0
1	0,0
2	0,00
3	0,000

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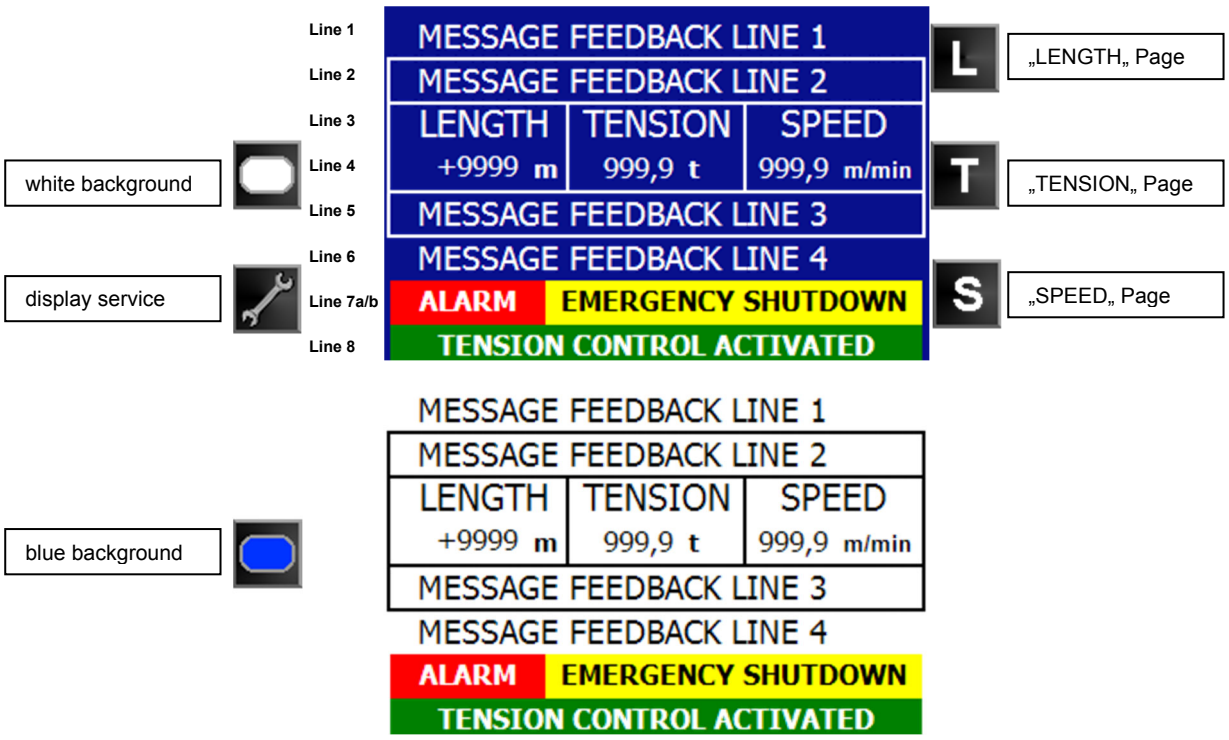
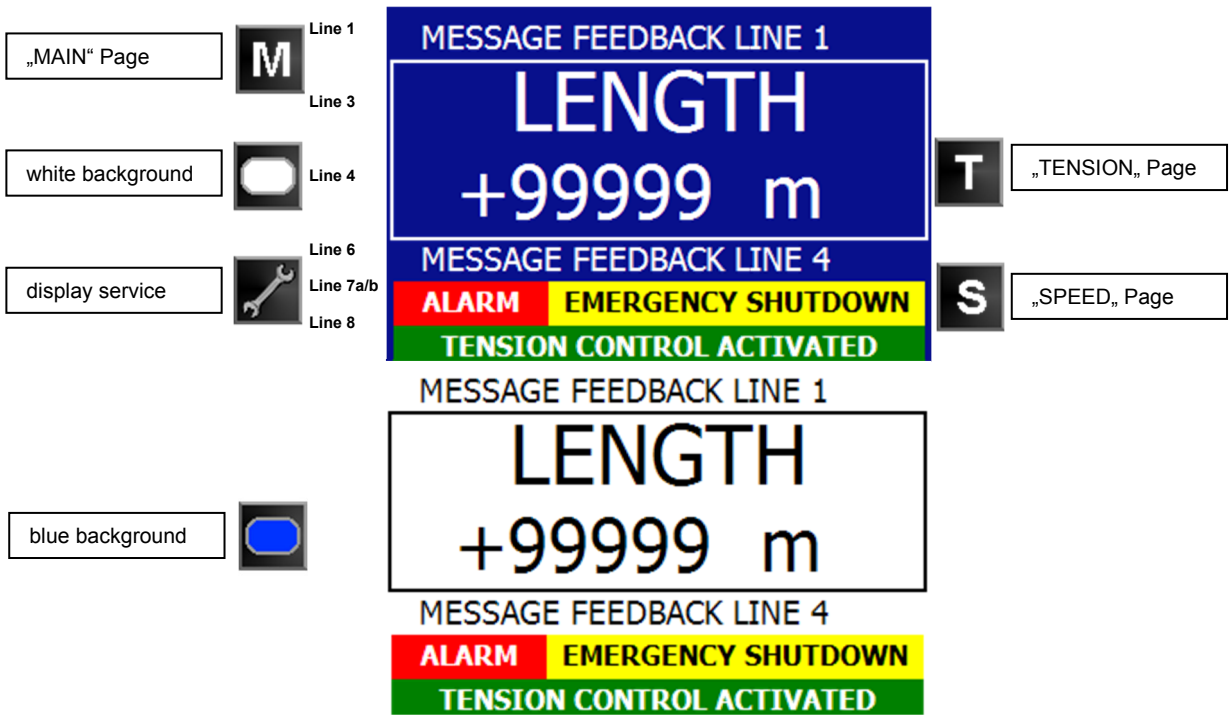
HBC-radiomatic GMBH

MAIN Page



LENGTH Page



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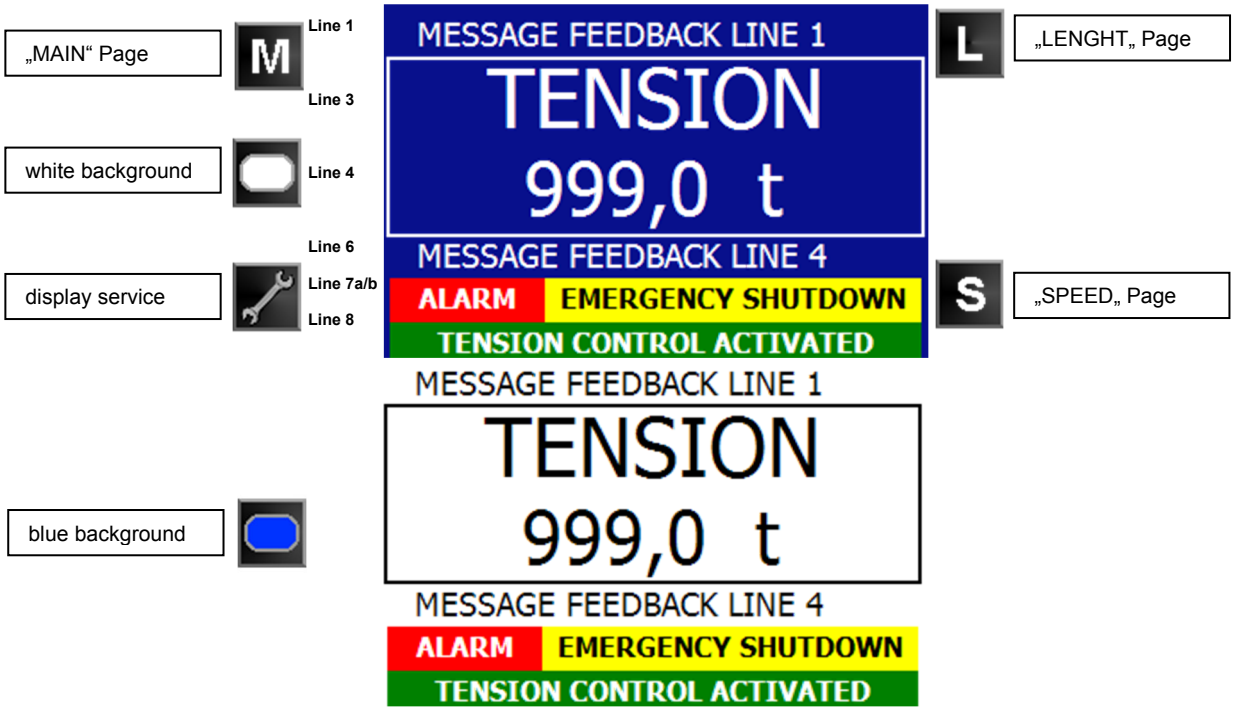
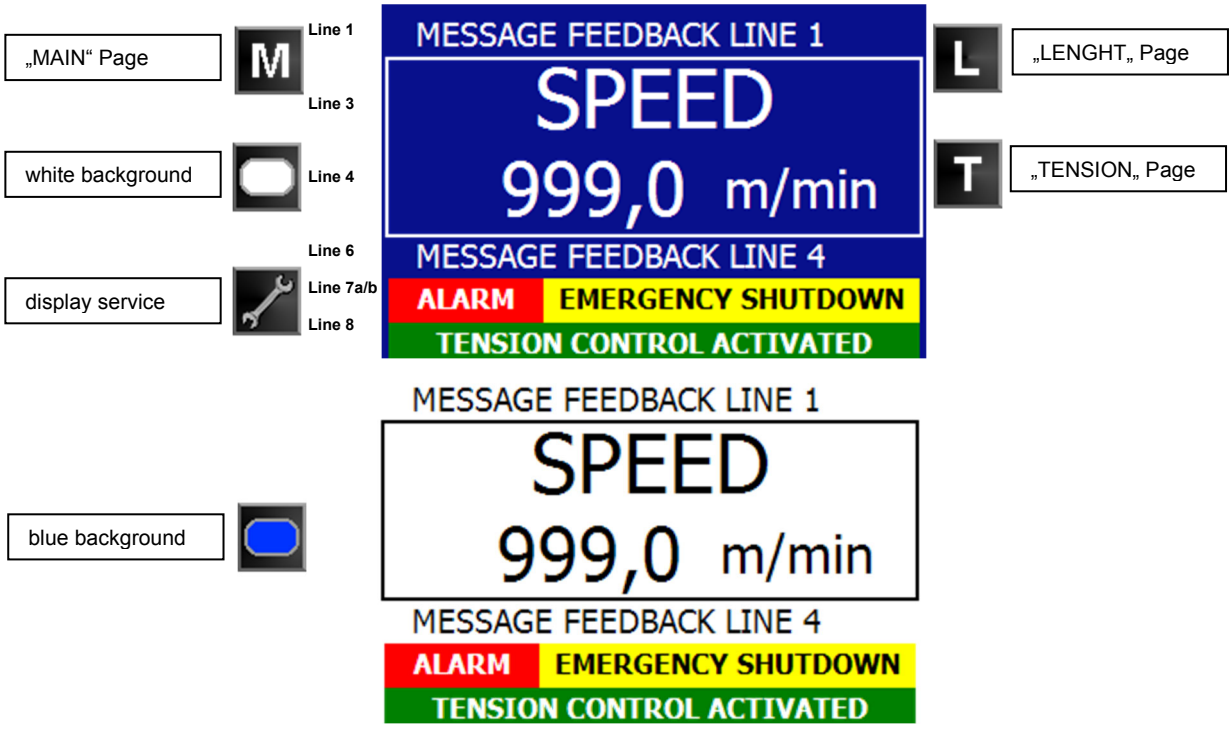
TENSION Page



SPEED Page



Back to “MAIN PAGE” also with pushbutton S13 (SELECT WINCH) or feedback-command 6200/14/ Bit 4.
Each “MESSAGE LINE” has an own editable (with special HBC-USB-connecting-cable) text-file in the display folder TXT. In all display text files the first text-line has no text (only one space character) and is used for NO TEXT-OUTPUT on the display.

4.4. RX PDO-Mapping

- 1. RX PDO (0x200+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/01	6200/02	6200/03	6200/04	6200/05	6200/06	6200/07	6200/08

- 2. RX PDO (0x300+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/09	6200/0A	6200/0B	6200/0C	6200/0D	6200/0E	6200/0F	6200/10

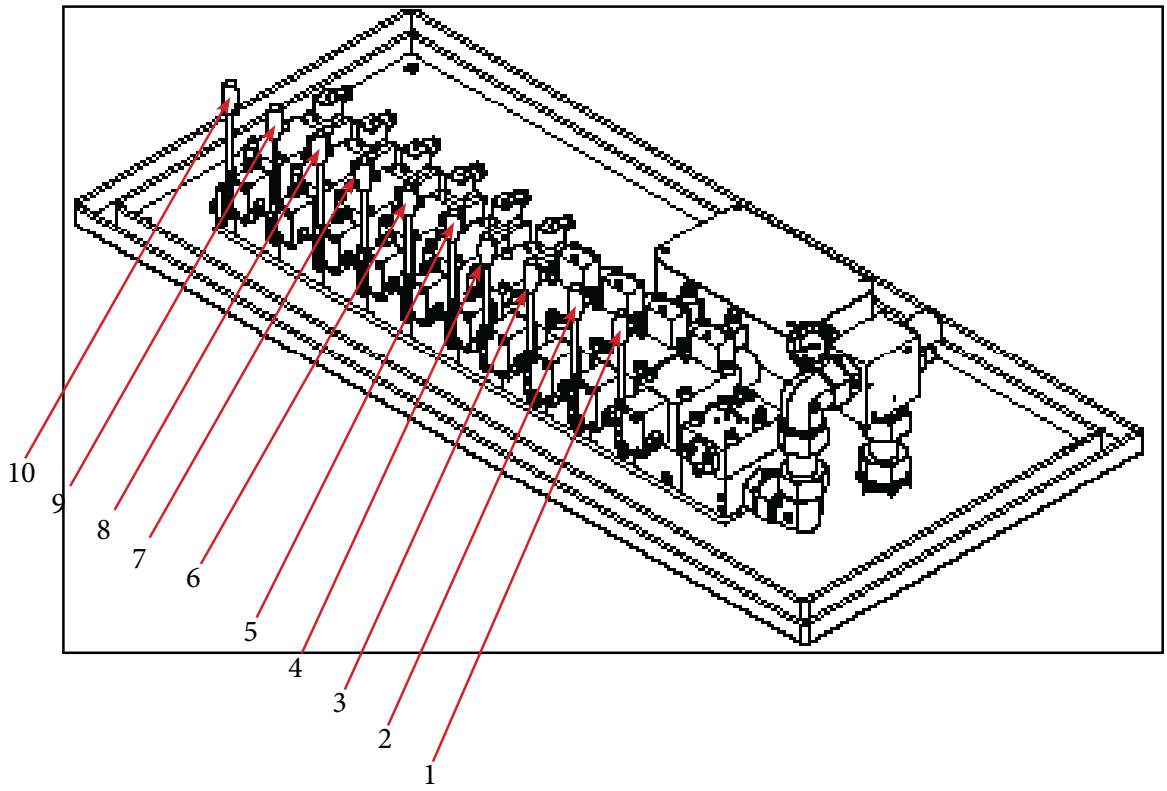
- 3. RX PDO (0x400+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/11	6200/12	6200/13	6200/14	6200/15	6200/16	6200/17	6200/18

- 4. RX PDO (0x500+Node-ID)

PDO-Objekt	1	2	3	4	5	6	7	8
Mappingparam.	6200/19	6200/1A	6200/1B	6200/1C	6200/1D	6200/1E	6200/1F	6200/20

MANUAL CONTROL

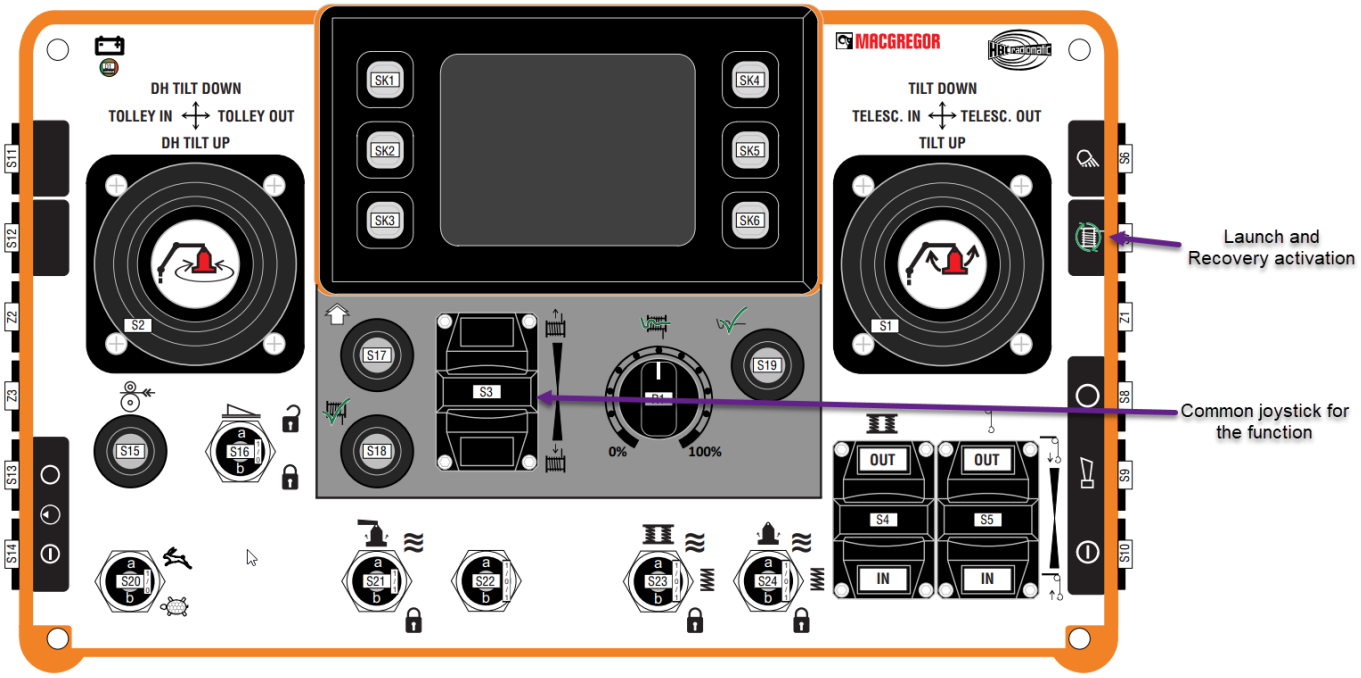


POS.	DESCRIPTION
1	Main boom : A: Cylinder out B: Cylinder in
2	Trolley motor: A: LARS stb: LARS port
3	Telescope boom: A: Cylinder out B: Cylinder in
4	Winch: A: Lower B: Lift
5	Along tilt cylinder: A: Cylinder out B: Cylinder in
6	Latch cylinder: A: Cylinder out B: Cylinder in
7	Docking head twist: A: Counter Clockwice B: Clockwice
8	Out hauler cylinder: A: Cylinder out B: Cylinder in
9	Research sheave across tilt: Aft/*forward
10	Spring plate cylinders: A: Cylinder out B: Cylinder in

MACGREGOR

One stick launch/recovery system

Radio control has function «One stick launch/Recovery» function selection



One Stick Launch function

When the ROV OHC is in inboard position and the ROV is located in the snubber, the system is ready for launch and the “One Stick Launch” function is available, by pressing activation button. Control system is launching the ROV in sequences with the Overhead crane and ROV winch synchronized. All movements are controlled by using common joystick for the function.

Sequences are: manually latch the ROV to the docking head by hoisting the lifting winch. Automatic movements: trolley out – tilt down - extension out. After the sequence is completed, the operator shall manually activate the lifting winch, lift the ROV in order to release the fail-safe latching mechanism and release the ROV while it’s in the splash zone. When the ROV is released from the docking head, the boom shall be tilted up and the ROV latch is to be released manually by pulling the wire from the ROV Latch release mechanism. In order to add umbilical floats and remove the ROV latch, the boom tip shall be driven in close to the door for the operator to be able to reach the umbilical cable. When the ROV latch is removed and the umbilical floats are added, the Overhead LARS can be driven fully out by trolley movement and kept in most outboard position. Telescope can be extracted or retracted, depending on the needed outreach while the ROV is buoyant, but in case of recovery with the boom horizontally out, the telescope shall be retracted.

One stick Recovery

When the ROV is operated through the splash zone, umbilical floats removed and ROV Latch attached to the ROV, and latched in docking head, the system is ready for recovery, the “One Stick Recovery” function is available. By pressing the activation button, control system is recovering the ROV in sequences with the ROV LARS and winch synchronized with the common joystick. Extension in – tilt up - trolley in. When inboard, the ROV shall be manually lowered to deck by the lifting winch.

Pentagon 7 Seas

(Research)

Operator's Manual

Version: 1.0

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1 – About Pentagon 7 Seas

In this manual, you will find information about operating the Pentagon 7 Seas (P7S) System.

The purpose of this document is to describe the operation of the Winch Control System from the operator screens (HMI) using the P7S Software. It contains a description and a user guide for the display.

It provides a walk-through of the various settings necessary to enable the safe and efficient operation of the Pentagon 7 Seas (P7S) system.

Electronic Control System

This section gives a general definition and description of the ECS (Electronic Control System).

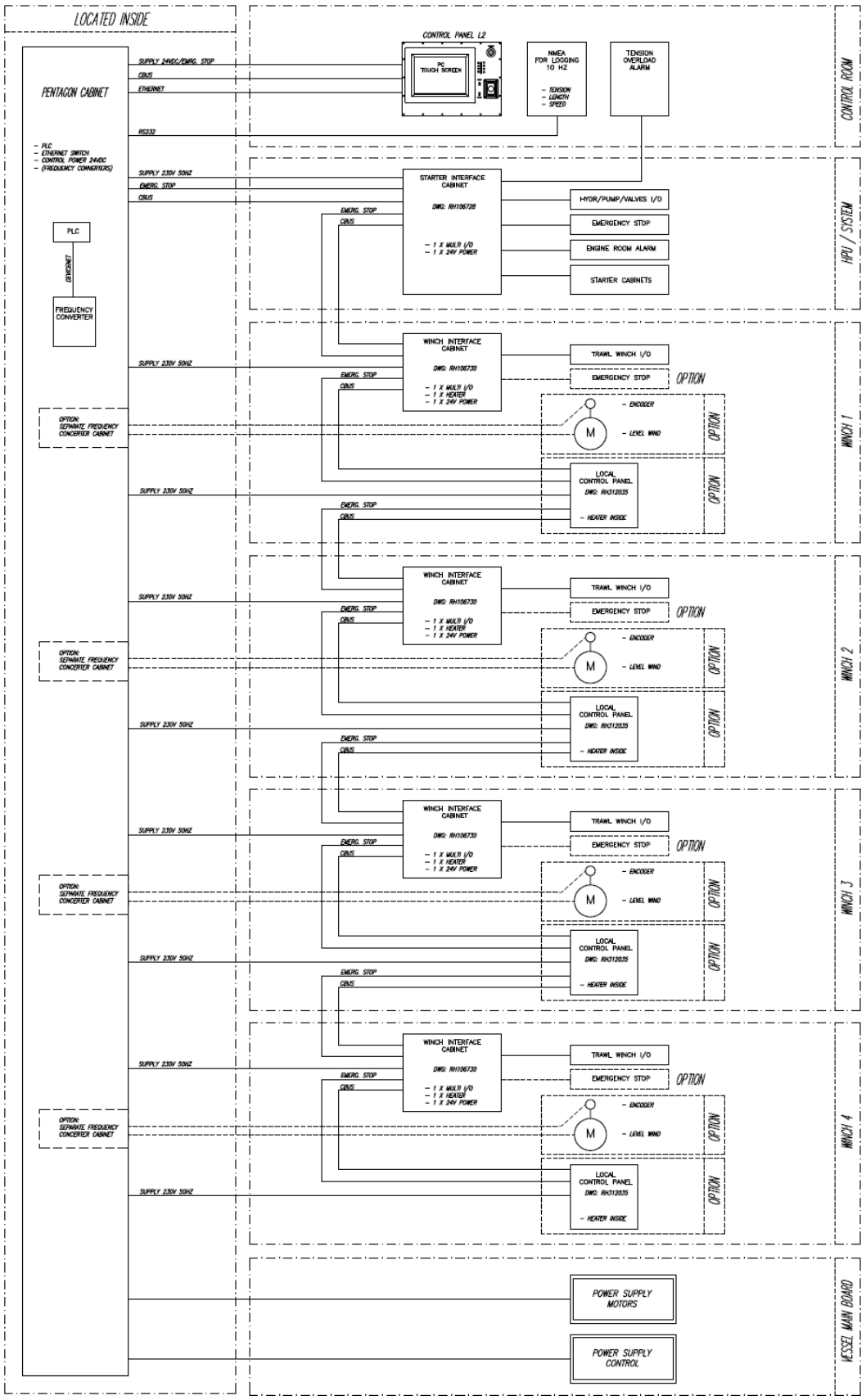
The system ECS topology is configured and based on the following main principles:

- A PLC inside the cabinet is used for all the sensor inputs, control functions, and for interfacing with external systems through dedicated communication channels. The PLC is qualified to run different software application program modules on a common CPU module.

- Multiple HMI operator stations for winch control monitoring, sequencing, operational modes, panel control status, brake & HPU status, shut down status, sensors, system status, and housekeeping.

- Ethernet network connecting the PLC to the HMIs and control panels/displays via an Ethernet switch placed within the cabinet and other control locations.

- Emergency control panels are wired to the PLC, causing the PLC`s shut-down logic to override any HMI operations.



Example of a Control System Configuration

HMI & Display Software Structure

The operating panels (HMIs) are running Microsoft Windows 7/10 and Exor Jmobile.

Software and data are stored locally on the HMI computer.

Two HMI touch screens are delivered for this system:

- 1ea forward ROV winch system
- 1 ea aft CTD winch system

The display is a visualization unit for system status, alarms, and events.

All HMIs ensure that communication with PLC is present.

Booting and start-up of the application software in HMIs will run automatically.

Control Philosophy

To view or operate the system, the user has to be logged in. The login is password protected so, the HMI ensures that approved operators give all commands. The access will not be granted if the user/password combination is incorrect. If an emergency stop is initiated, the system will still stop and manual control is given.

Nomenclature

Auto Mode
Automatic mode to Haul In or Pay Out until the Set Point Length that is defined at the Winch Card.

Active Heave Compensation
The heave compensation is required to function by applying changes to the speed and direction of rotation of the winch in response to an absolute position reference signal derived from a motion reference unit (MRU).

Bearing Side
The side of the hose reel where the bearing is (opposite of the motors).

Block
A block is a sheave mounted outside of the winch, receiving the cable from the deck below. This block (sheave) has a separate mounting device, that allows additional measurements of velocity and tension.

Brake Resistor
The resistor that is used to “burn off” the effect produced while braking.

Brake Transistor
The brake chopper controls the “burn off” effect on the brake resistor.

Dead Band
This is the value for min and max dead band length around the set point, as deviation from the desired set length.
Also used as a name for the joystick's non-working range, where there is no signal sent out from the joystick.

Display Unit
The Display Unit is a “screen” to show telemetry in any location that is needed. An example can be found at radio control or in a decentralized control location.

End of Wire
An alarm pops up if the wire length is less than 100 meters longer than the preset total wire length.

Encoder
A pulse generator mounted on a motor. Used to determine the position of the unit driven by the motor (Spool Wagon or Winch).

Fleet Angle
The angle between the center line through the lead sheave and the centerline of the rope leading to the drum.

Jet Water Flush
A washer unit for cleaning the wire.

Inner
Closest to the motors.

Integral-Time
Regulator parameter for speed, length, and tension control.

Motor Side
The side of the hose reel where the motors are.

Outer
Further away from the motors.

Outhauler
Mechanism to help hold the wire in place with the correct tension.

Proportional Gain
Regulator parameter for speed, length, and tension control.

Raw Value
The PLC value. An analog input signal.

Remote Panel
Radio control panel (portable).

Safety Distance
When the end of the wire is within a certain distance from the vessel, none of the automatic modes are available. Within the safety range, Winch must be operated manually. The range is operator configurable as Auto Start/Stop in the menu [Operation Settings] and is defined as units.

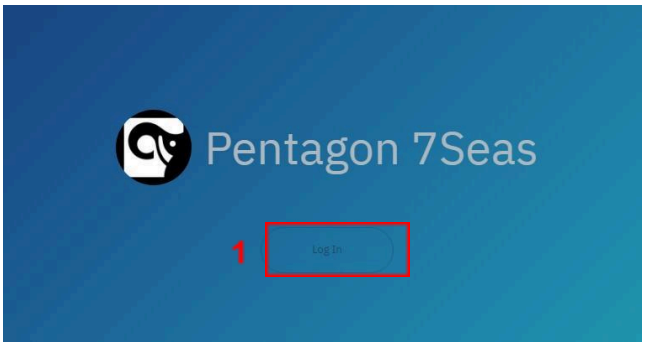
Spool Deviation
The set point value of the Spool Wagon and its actual value.

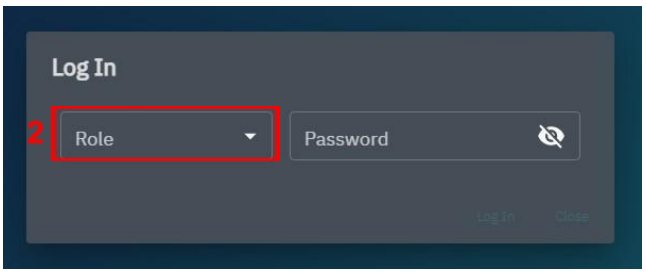
2 – Operation Instructions P7S (Operator)

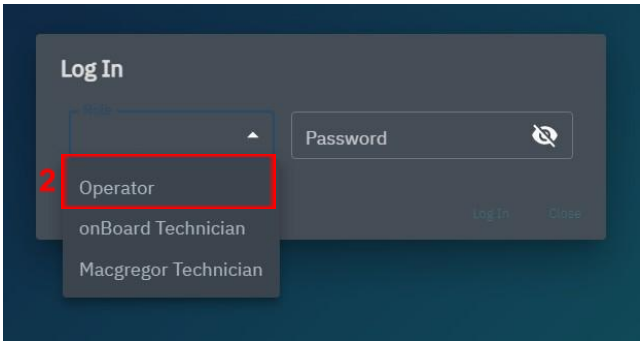
Log In

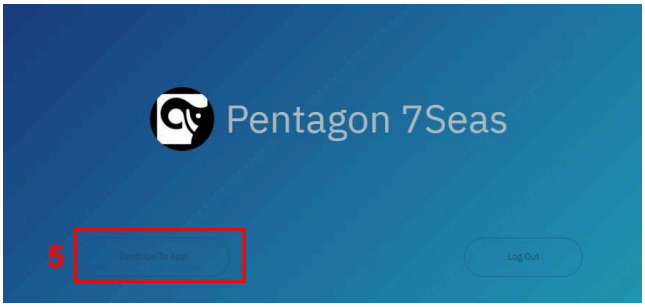
This is the Login Pentagon 7 Seas process:

1 - Click on the Log In button
2 - Select the role “Operator”
3 - Enter the Password
4 - Click on the Log In button
5 - Click on the “Continue to app” button



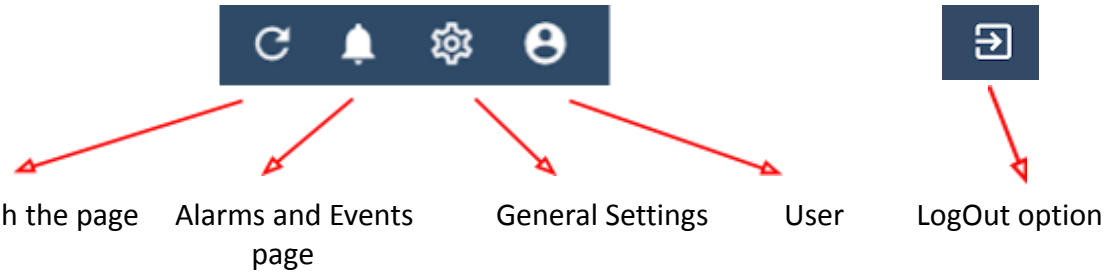






Icons

In the top right corner, icons provide relevant information as follows:



General Settings

When you click the icon of General Settings at the top right corner of the screen you can find the following options:

Settings

1 - Brightness Mode
- Day
- Night

2 - Brightness bar

3 - Language options (English or Norwegian)

4 - Units options (Metric or Imperial)

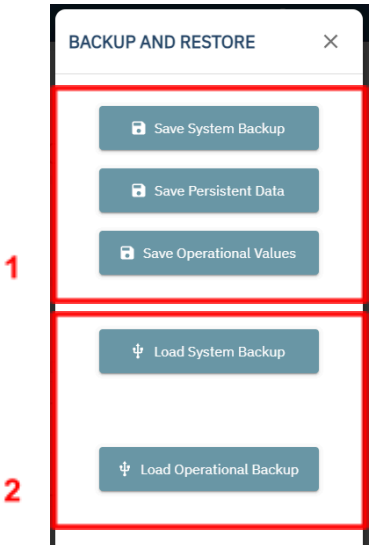
5 - Backup and Restore Menu button

Backup and Restore

In the backup and restore menu you have the option to Save different types of data, as well as load backups.

1 - Save options
- System backup
- Persistent Data
- Operational Values

2 - Load options
- System Backup
- Operational Backup



Alerts / Alarms

Emergency Stop Alerts

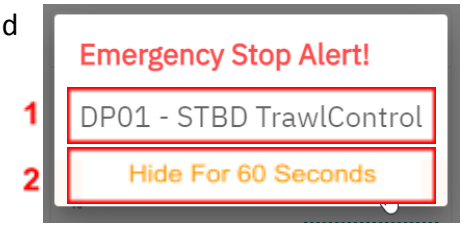
The emergency stop alerts can be activated by any emergency stop in any area or at any control panel in this system.

These alerts pop up in the middle of the screen and give information about the name of the panel that had its emergency stop button engaged.

The name displayed in the alert is the same as the one in the electrical drawings. This alert can be hidden for 60 seconds to allow the user to briefly operate the system.

1 - Information regarding the name of the panel that had problems, according to the electrical drawing.

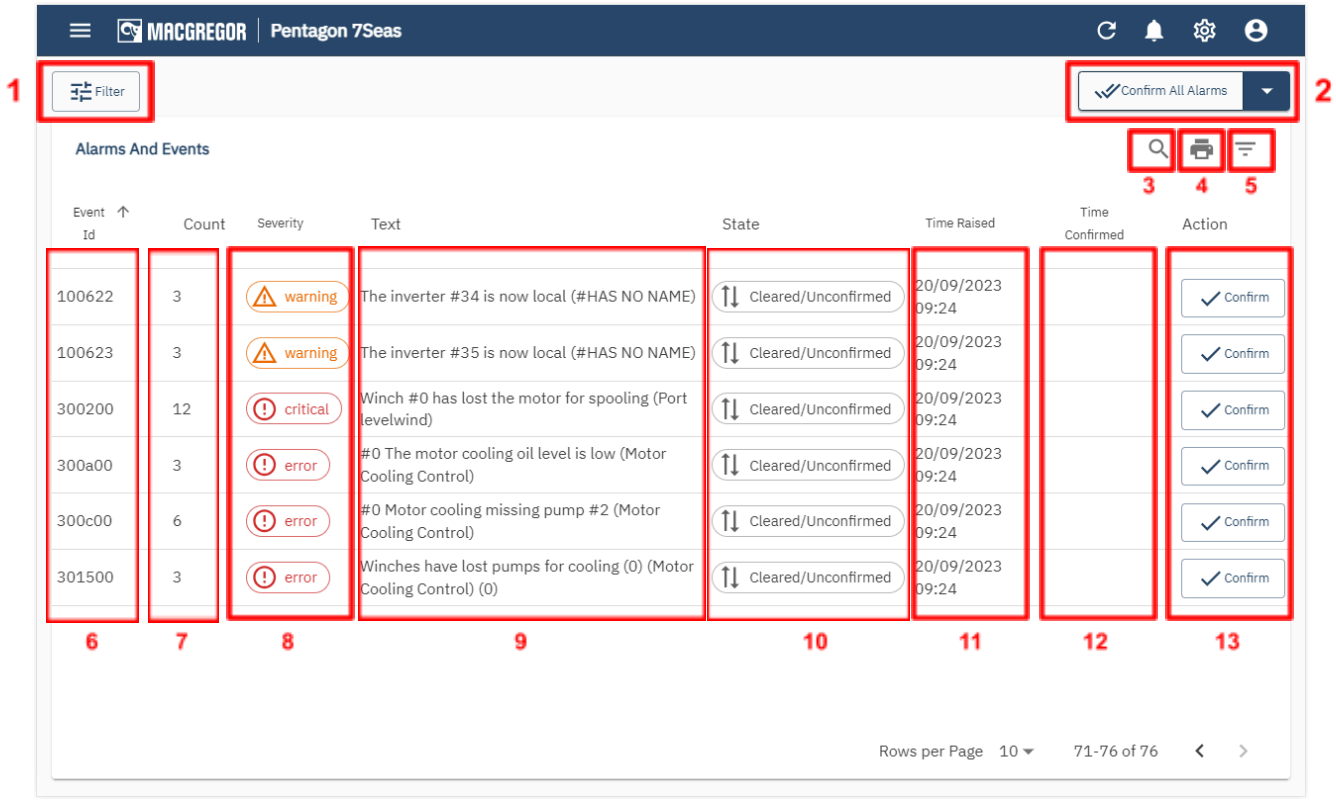
2 - The button to “Hide for 60 seconds” this alert.
This allows the user to operate the system briefly.



Example of an Emergency Alert at Deck Panel one (DP01) that is being used for the Starboard Trawl Control.

Alarms

When an alarm occurs this information is added to the alarm log. Click on the icon “Alarms and Events page” to access the following page.



Alarms and Events Notification page

1 - Filter button
2 - Option to “Confirm All Alarms” at the same time
3 - Search button
4 - Print button
5 - Sort button
6 - Alarm event ID
7 - Number of occurrences
8 - Alarm Severity
9 - Alarm Description
10 - Alarm State
11 - Alarm Raised Time
12 - Alarm Confirmed Time
13 - Alarm Confirm button

Alarm Severity

The Alarm Severity provides information about the importance of each alarm message, as described below:

Warning message - reflects potential reduction or inhibit usage of the equipment.

Critical message - the operation can not continue.

Error message - reflects a threshold that has been reached (eg. high-temperature alarm).

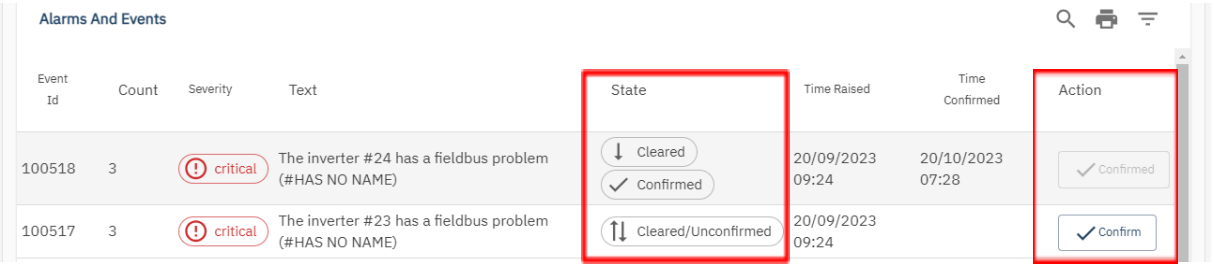
Alarm State

The Alarm State provides information about the current status of each alarm, as described below:

Active - The information that triggered the alarm is still active.
Cleared - The information that triggered the alarm is no longer active.
Unconfirmed - The operator still has not confirmed the acknowledgment of the alarm.
Confirmed - The operator has confirmed the acknowledgment of the alarm.

There are different combinations of these states, such as:

- Active and Unconfirmed
- Active and Confirmed
- Cleared and Unconfirmed
- Cleared and Confirmed



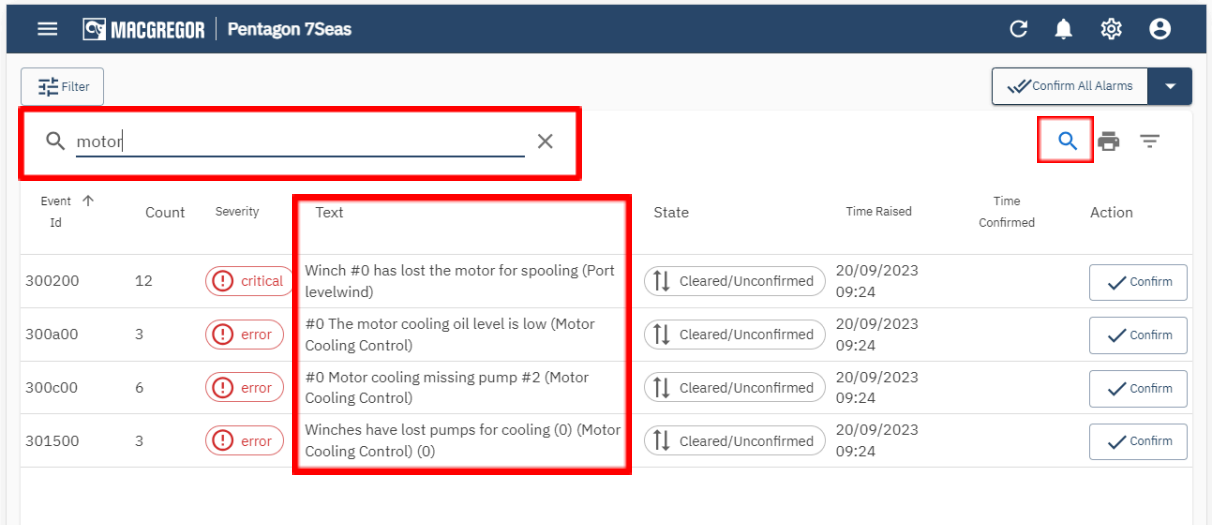
Alarm with Cleared and Confirmed State Example

To Confirm an alarm you must go to the Alarms / Notifications page and click on the Alarm Confirmation button (see page 12 - “Alarms and Events”, area 13). After confirmation, you will receive the timestamp validating the alarm. However, it will remain in the log until it is both confirmed and cleared.

NOTE: The alarm will remain active until the alarm threshold has been cleared by the system (e.g., the high-temperature alarm won't disappear until the temperature is below the threshold).

Alarm Search

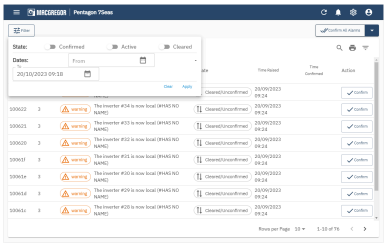
The information presented in the alarm description (text) can be searchable by clicking on the Search button.

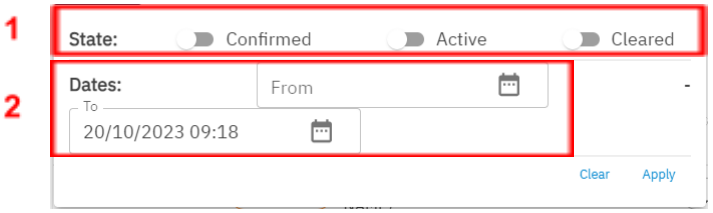


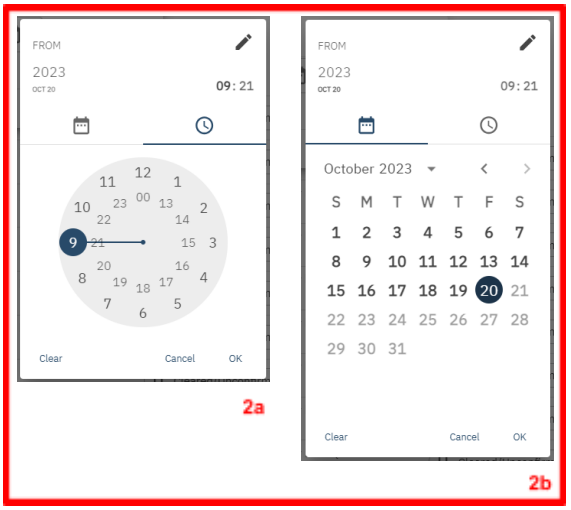
Example of Alarm Search using the keyword "motor"

Alarm Filter

The alarm list can be filtered by State and by Date or Timestamp.







1 - State filter: "Confirmed", "Active" or "Cleared"
2 - Date filter: "Time Raised" and "Time Confirmed"
2a - Timepicker
2b - Datepicker

Menu Display

The Main Menu presents the features and settings as follows:

- Winch Operation
    - CTD Operation
    - ROV Operation
- Hydraulic
    - Brake HPU
    - Gear Cooling HPU
    - Deck HPU
- Configuration
    - Winch
    - Extended Winch
    - Drive
    - Levelwind Config (also includes calibration option)
    - Control Unit
    - Sheaves (also includes calibration option)
    - Slack Wire
- Calibration
    - OHC (Overhead Crane)
    - A-Frame
- Power Management (PMS)
- Clean Screen

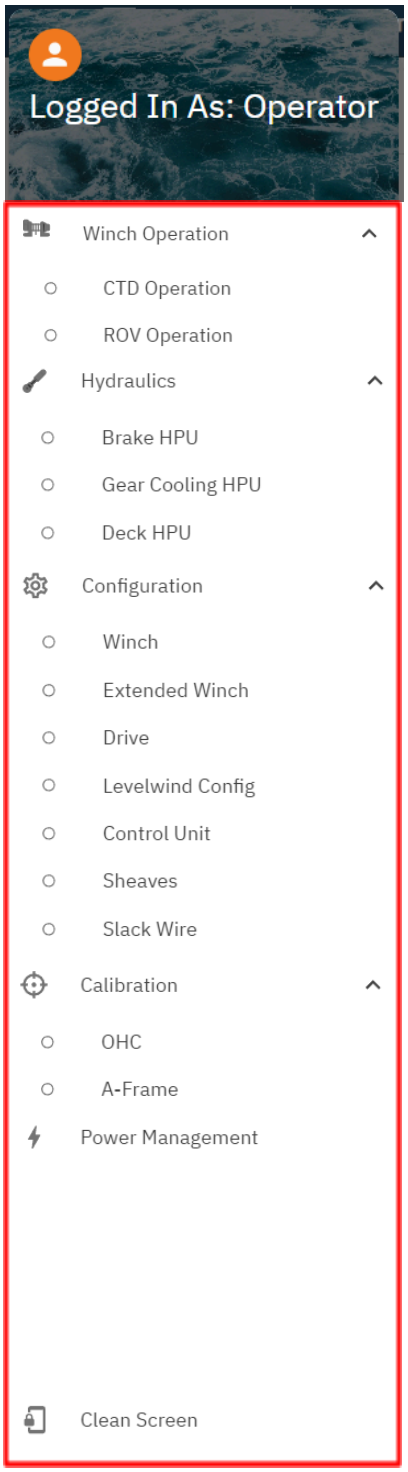
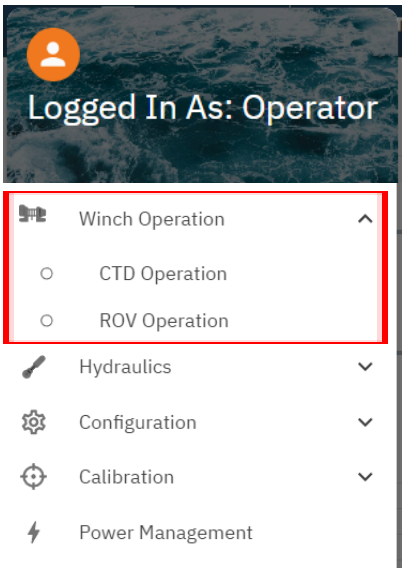


Image of the Main Menu structure

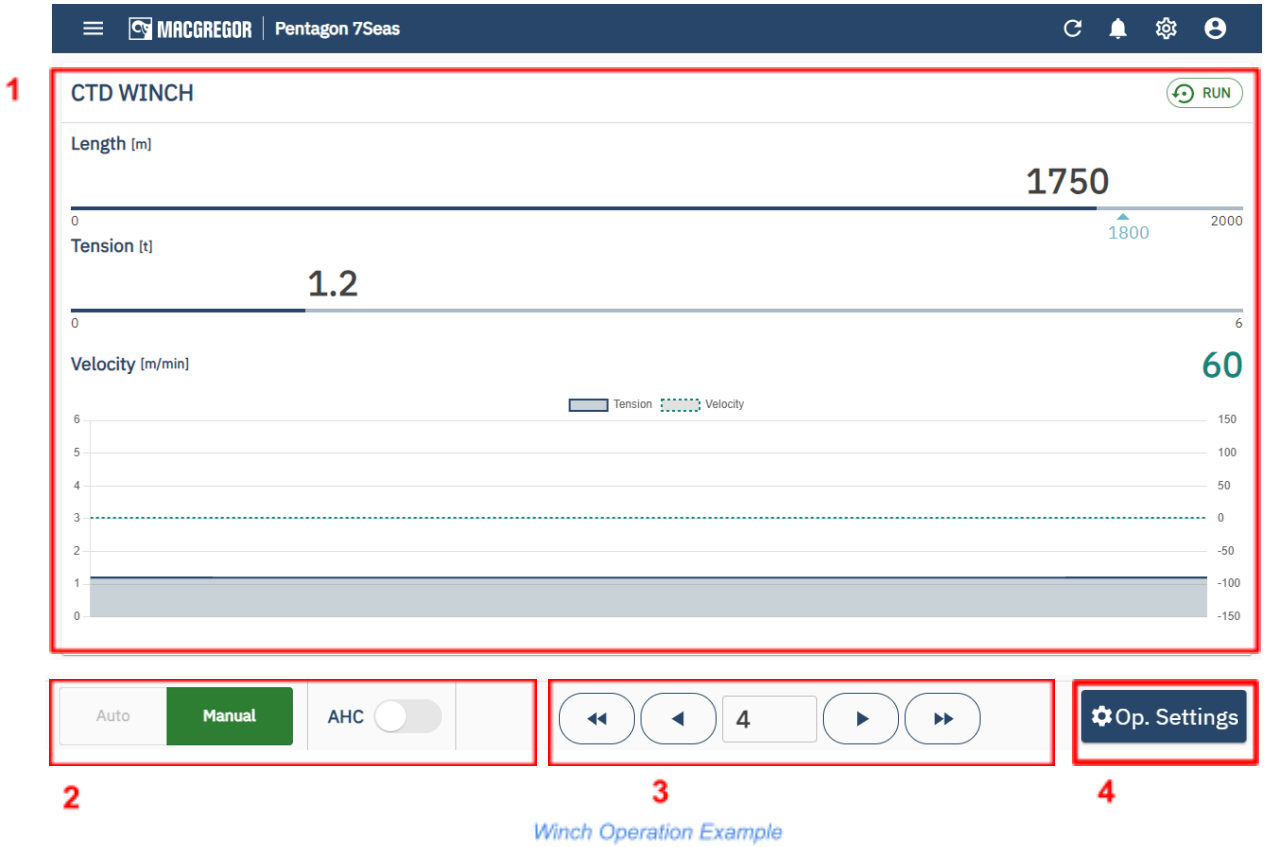
Winch Operation

The Winch Operation Menu will present the options for the features and settings that follow:

- Winch Operation
  - CTD Operation
  - ROV Operation



The image that follows explains the different areas and the telemetry for each winch from a winch operation screen.



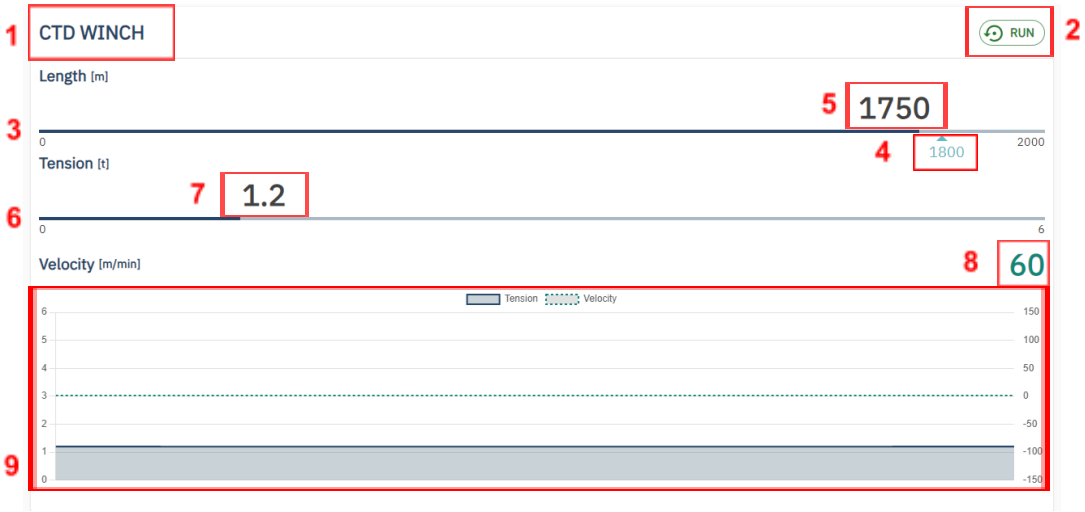
Winch Operation Example

1 - Winch Card
2 - Operation Modes
3 - Set Point Length
NOTE: This will change the value in the Length graph bar - Winch Card (position 4)

4 - Operation Settings Button

Winch Card

The Winch Card shows the telemetry for each winch.



Winch Card

1 - Winch identification

2 - State of the winch

3 - Graph bar representing the cable Length (m or ft) from the winch or from the block.
NOTE: The option to see the Length from the block must be selected in the Operation Settings.

4 - The set point for the winch to reach when it is in automatic mode.

5 - Live data from the current length (m or ft) that is being fed out of the drum of the winch.

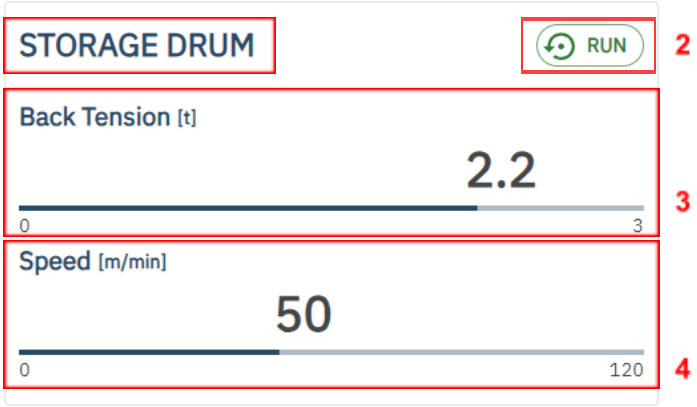
6 - Tension graph bar (from 0 to a configured value).
CAUTION: The maximum pull force of the winch is set at the commissioning phase. The operator must not change this value. This can cause damage to the equipment.

7 - Tension live data (t) measured at the winch or at the block.
NOTE: The option to see the Tension from the block must be selected in the Operation Settings.

8 - Velocity instant value (m/min or ft/min).

9 - Velocity and Tension graph.

Storage Drum Card



The Storage Drum Card shows the telemetry from the Storage Drum component of the ROV system.

1 - Winch identification.

2 - State of the winch.

3 - Graph bar representing the Back Tension (t).
NOTE: The maximum and minimum Back Tension can be configured by the user in the operation settings.

4 - Graph bar representing the rotation Speed (m/min or ft/min)

Slack Wire Compensator Card

The Slack Wire Compensator Card shows the telemetry from this component of the ROV system.

1 - Component identification

2 - State of the component

3 - Slack Wire Compensation Piston Position (m or ft)

Operational Information Cards

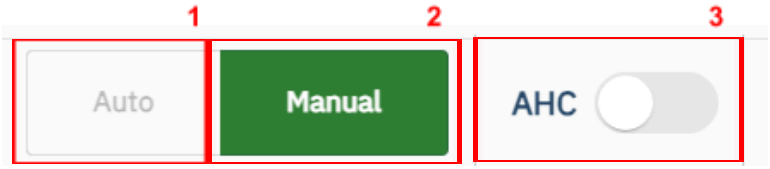
1 - Bullet connected LED
NOTE: If the bottom Bullet connected LED is ON, the ROV connection is locked into the Docking Head.

2 - Split mode active LED
NOTE: If the top Split mode active LED is ON, the Traction Winch and the Slack Wire Compensator can be run separately, using 2 different joysticks located in the ROV room. This option can be activated at the Control Panel inside the ROV room.

3 - Outhauler Status that indicates if the Outhauler is Stopped or Running.
4 - Switch to start or stop the rotation of the outhauler.

Modes

The available Modes are described below.



Modes Information

1 - AUTOMATIC Mode (available only after the safety distance is guaranteed)

2 - MANUAL Mode (can be selected at any moment and be controlled with the joystick)

3 - Active Heave Compensation (AHC) Mode. The winch will compensate the waves to keep the cable length with the set point value.

NOTE 1: AHC can be selected at the same time as the other manual or automatic modes).

NOTE 2: The working values for these automatic modes can be set in the Operations Settings.

NOTE 3: The Auto Mode will automatically Haul In or Pay Out until the value which is defined at the Set Point Length.

Set Point Length

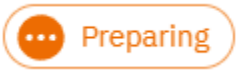
The working mode of the Set Point Length function is described below.

Set Point Length Control

1 - Button to decrease (Big Steps) the Set Point Length, in the Winch operation screen
2 - Button to decrease (Small Steps) the Set Point Length, in the Winch operation screen
3 - Set Point Length for the cable
NOTE: This will change the value in the Winch Card (position 4)
4 - Button to increase (Small Steps) the Set Point Length, in the Winch operation screen
5 - Button to increase (Big Steps) the Set Point Length, in the Winch operation screen

Winch State Chips

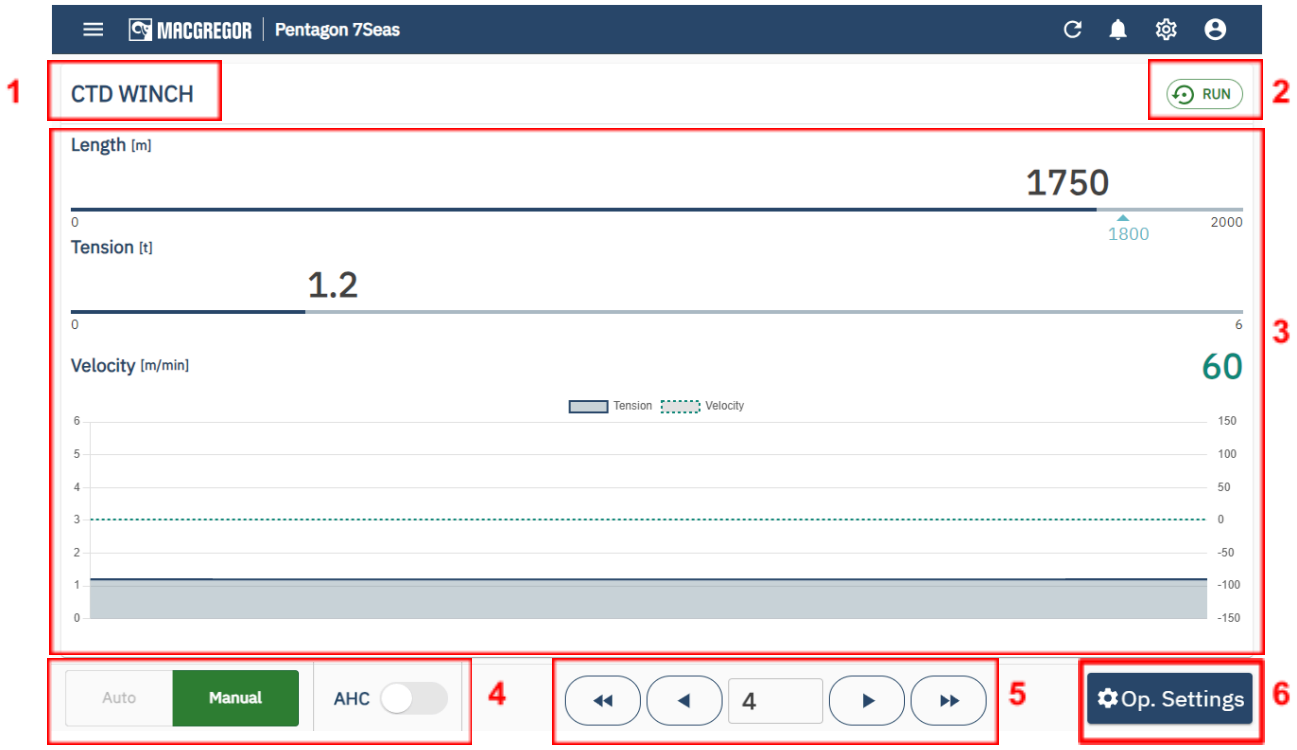
The Winch State information is provided in the top right corner of the Winch Card and indicates the state of the winch as described as follows:

	Winch not available for use
	Winch preparing to run
	Winch is running
	Winch in pause mode (usually between modes)
	Winch is stopped
	Server error - No value from PLC

NOTE: When all winches are in RUN the system is ready to operate the winches.

CTD Operation System

This is the CTD Winch operation screen. The image that follows explains the different areas and the telemetry for this winch.



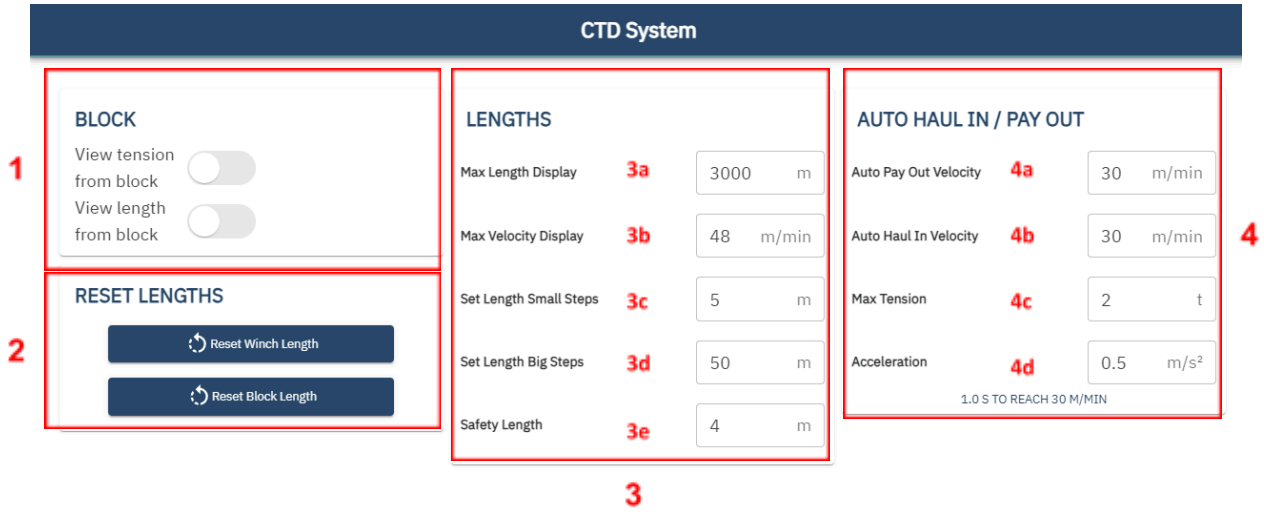
CTD Winch Operation Screen

1 - Winch Identification
2 - State of the Winch
3 - Telemetry from the Winch
4 - Operation Modes
5 - Set Point Length
NOTE: This will change the value in the Length graph bar - Winch Card (position 4).
6 - Operations Settings Button

NOTE: Explanations of the individual cards are in the “Winch Operation” section - see page 17.

CTD Operation Settings

This is the CTD Winch operation settings screen. The image that follows explains the different areas and the telemetry for these winch cards.



CTD System Operation Settings

1 - Option to view tension and length information from the Block, instead of the Winch.
2 - Option to Reset Cable Length from the Winch and Reset Cable Length from the Block.

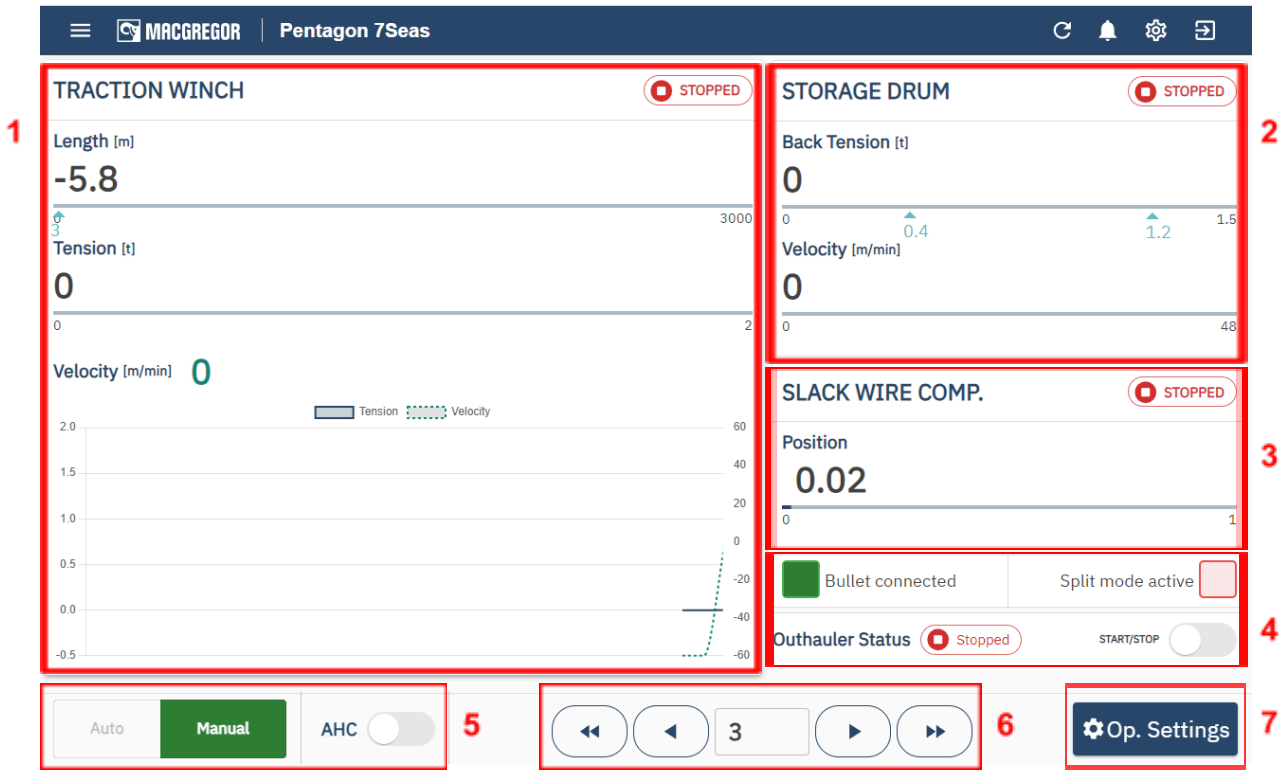
3 - Lengths settings
3a - Maximum length value displayed on the graph
3b - Maximum velocity value displayed on the graph
3c - Value to be increased or decreased to the "Set Point Length", defined in small increments (Small Steps Button)
3d - Value to be increased or decreased to the "Set Point Length", defined in large increments (Big Steps Button)
3e - Safety Length input.
NOTE: The Auto Mode can not be activated with a cable length below the Safety Length.

4 - Automatic HAUL IN / PAY OUT Settings
4a - Velocity (m/min or ft/min) of the automatic Pay Out
4b - Velocity (m/min or ft/min) of the automatic Haul In
4c - Maximum tension (t) during the automatic mode operation
4d - Acceleration (m/s2) during the automatic mode operation

NOTE: To change the units from metric to imperial see General Settings - see page 11.

ROV Operation System

The ROV operating system consists of a traction winch, a storage drum and a slack wire compensator. The topics that follow explain the different areas and the telemetry for each component.



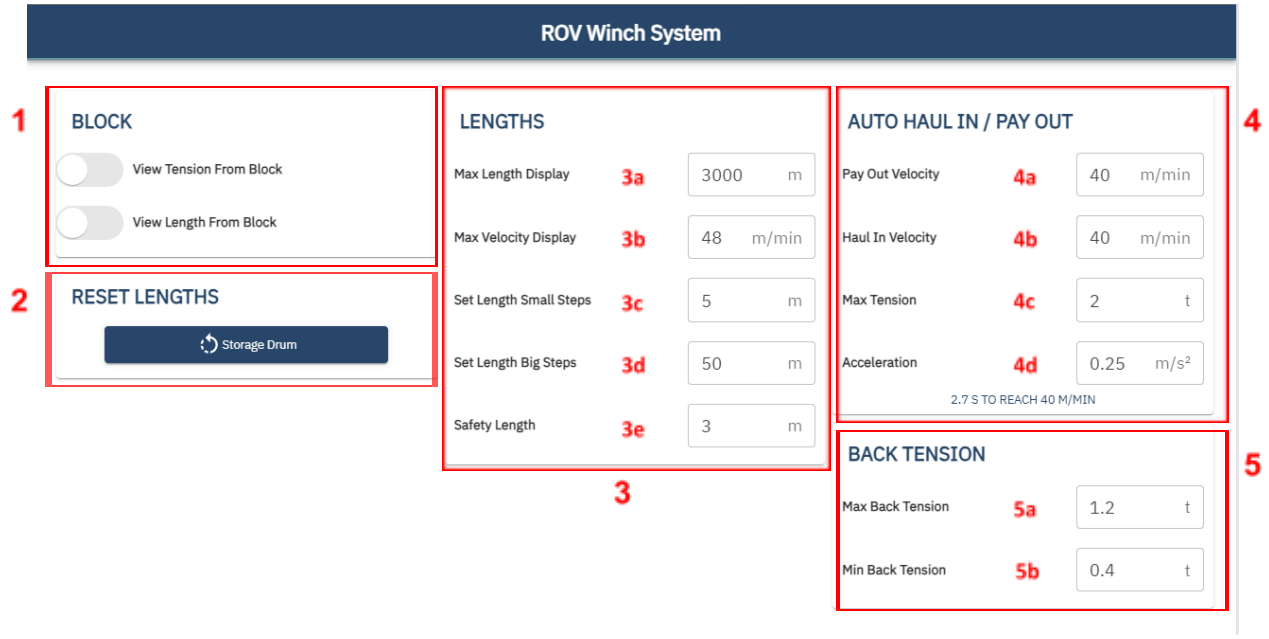
ROV Operation System Screen

1 - Traction Winch card
2 - Storage Drum card
3 - Slack Wire Compensator card
4 - Operational Information cards
5 - Operation Modes
6 - Set Point Length
NOTE: This will change the value in the Length graph bar - Winch Card (position 4)
7 - Operation Settings button

NOTE 1: Explanations of the individual cards are in the “Winch Operation” section - see page 17.

ROV Operation Settings

The ROV operation settings are composed of a Traction Winch, a Storage Drum, and a Slack Wire Compensator. The topics that follow explain the different areas and the telemetry for each component.



ROV Winch Settings screen

1 - Option to view tension and length information from the Block, instead of the Winch.
2 - Option to Reset Cable Length from the Winch and Reset Cable Length from the Block.
3 - Lengths settings
3a - Maximum length value displayed on the graph
3b - Maximum velocity value displayed on the graph
3c - Value to be increased or decreased to the "Set Point Length", defined in small increments (Small Steps Button)
3d - Value to be increased or decreased to the "Set Point Length", defined in large increments (Big Steps Button)
3e - Safety Length value input.
NOTE: The Auto Mode can not be activated with a cable length below the Safety Length.

4 - Automatic HAUL IN / PAY OUT Settings
4a - Velocity (m/min or ft/min) of the automatic Pay Out
4b - Velocity (m/min or ft/min) of the automatic Haul In
4c - Maximum tension (t) during the automatic mode operation
4d - Acceleration (m/s2) during the automatic mode operation

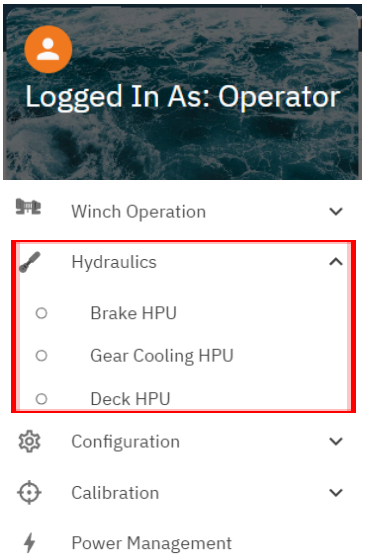
5 - Back Tension Settings
5a - Maximum Back Tension at the Storage Drum (graph display)
5b - Minimum Back Tension at the Storage Drum (graph display)

NOTE: To change the units from metric to imperial see General Settings - see page 11.

Hydraulics

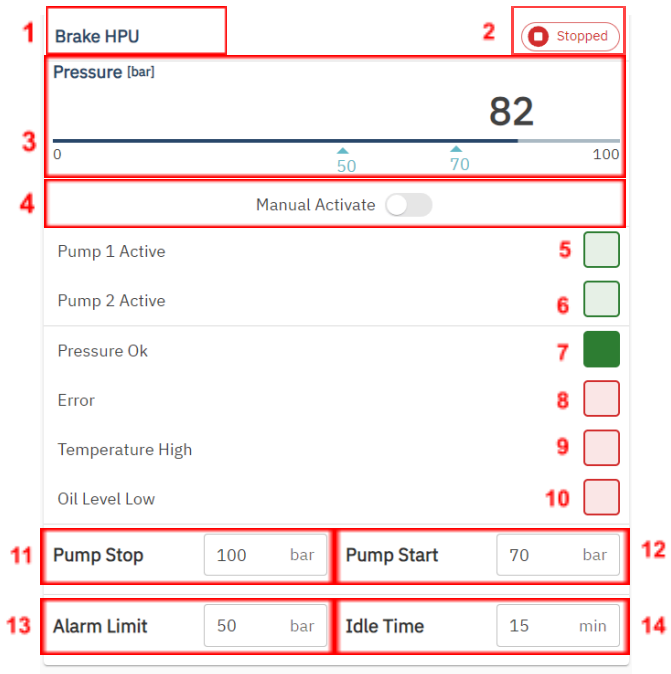
The Hydraulics Menu presents the options to access and operate the features and settings that follow:

- Hydraulics
  - Brake HPU
  - Gear Cooling HPU
  - Deck HPU



Brake HPU

A system might have one or more Brake HPUs.



Brake HPU Card

1 - Brake HPU identification

2 - State of the HPU

3 - Pressure (bar) graph with spans of the operation and Switch for Manual Activate

4 - Manual Activate switch

5 - LED indicates that Pump 1 is running

6 - LED indicates that Pump 2 is not running

7 - LED indicates that the Pressure in the system is OK

8 - LED indicates an Error at the brake HPU

9 - LED indicates High Temperature

10 - LED indicates Oil low level

11 - Pump Stop Pressure value (bar)

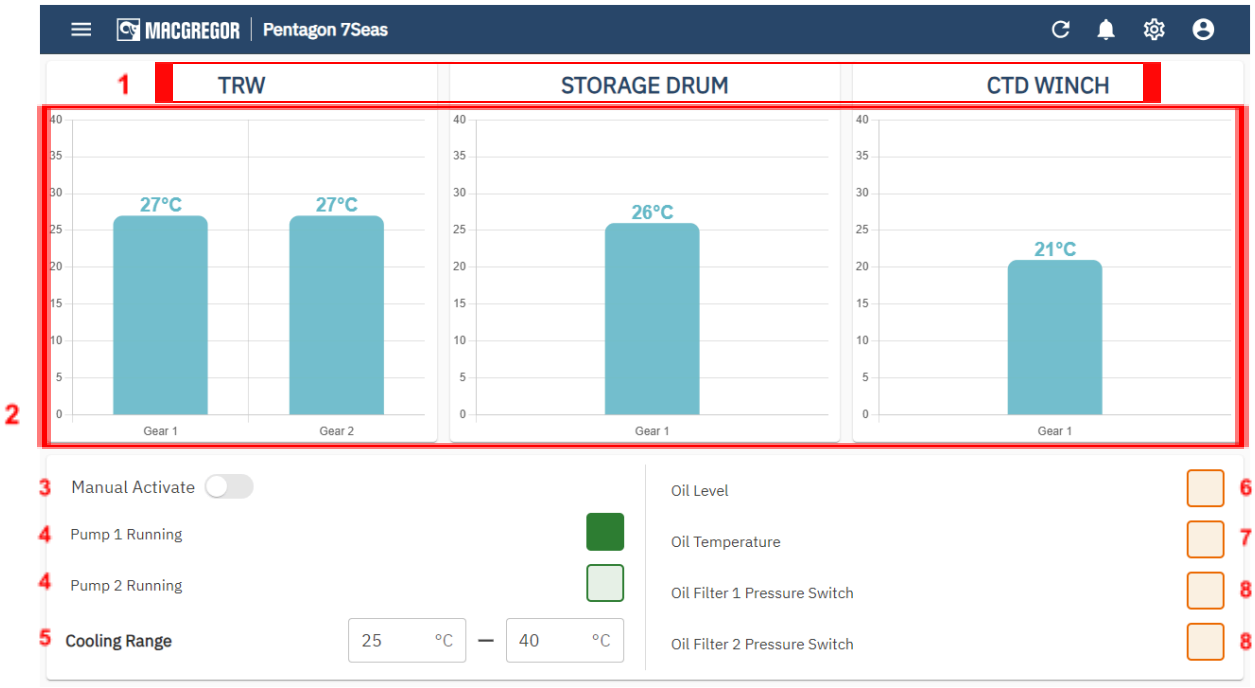
12 - Pump Start Pressure value (bar)

13 - Alarm Limit Pressure value (bar)

14 - Idle Time value (min)

Gear Cooling HPU

There is a Gear Cooling HPU on the CTD Winch, as well as on the Storage Drum. At the Traction Winch, there are two Gear Cooling HPU.



Temperature and Gear Cooling Card

1 - Winches Units Identification

2 - Temperature graph (ºC or ºF) from the different Gears

3 - Manual Activate switch
NOTE: This toggle must be switched ON to start HPU without using the winches.

4 - LED that indicates if the Pump is running

5 - Configuration of the Cooling Range (ºC or ºF) for all the Gear Cooling Units

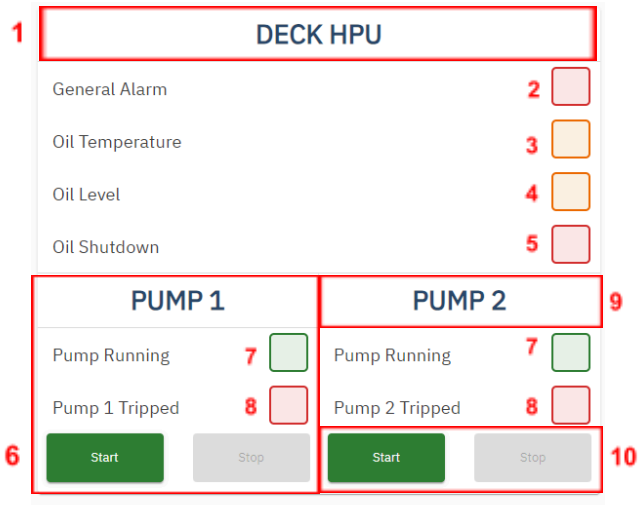
6 - LED that indicates if the Oil is below the level

7 - LED that indicates if the Oil temperature exceeded the maximum temperature at the thermostat present at the HPU.

8 - LED that indicates if the Pressure at the filter is too high. This value is based on the information from the filter guard sensor.

Deck HPU

This card is for the Deck HPU, which contains all relevant information.



Deck HPU Card

1 - HPU identification

2 - LED indicates a General Alarm

3 - LED indicates Oil High Temperature

4 - LED indicates Oil Low Level

5 - LED indicates Oil Shutdown - a critical oil level was reached

NOTE: The pumps will stop and will prevent them from being able to start up again.

6 - Pump information

7 - LED indicates that the pump is running

8 - LED indicates that the pump has been tripped

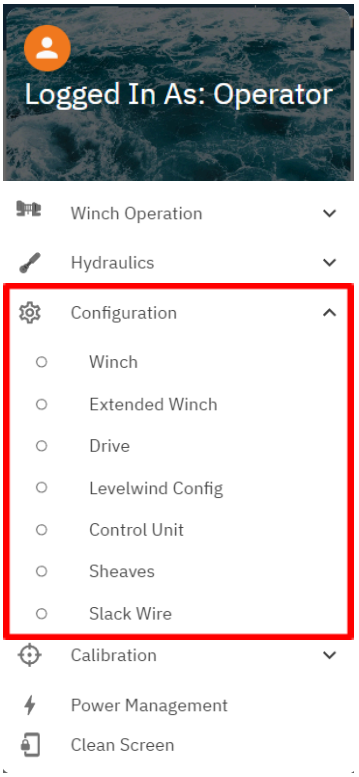
9 - Pump identification

10 - Buttons to Start/Stop the pump

Configuration

The Configuration Menu will present access as follows:

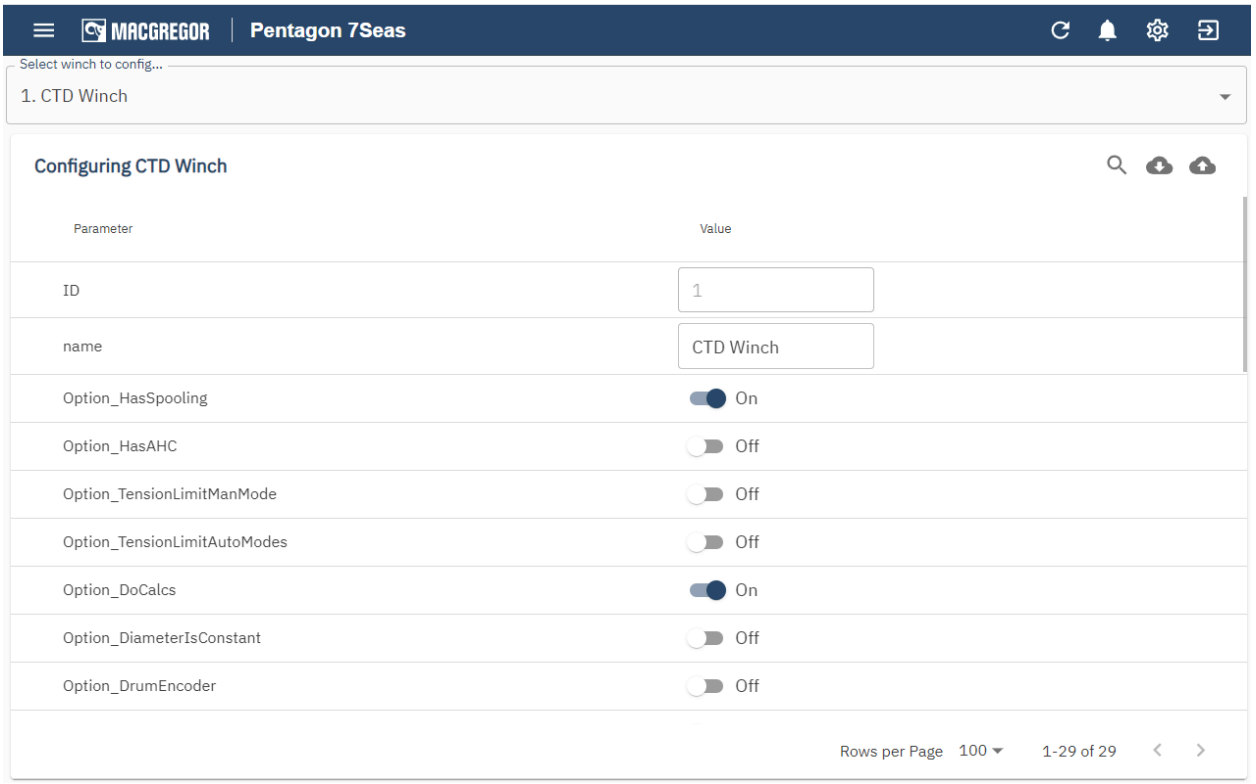
- Configuration
  - Winch
  - Extended Winch
  - Drive
  - Levelwind Config (also included calibration)
  - Control Unit (to control Joystick and Pot Meter)
  - Sheaves (also included calibration)
  - Slack Wire

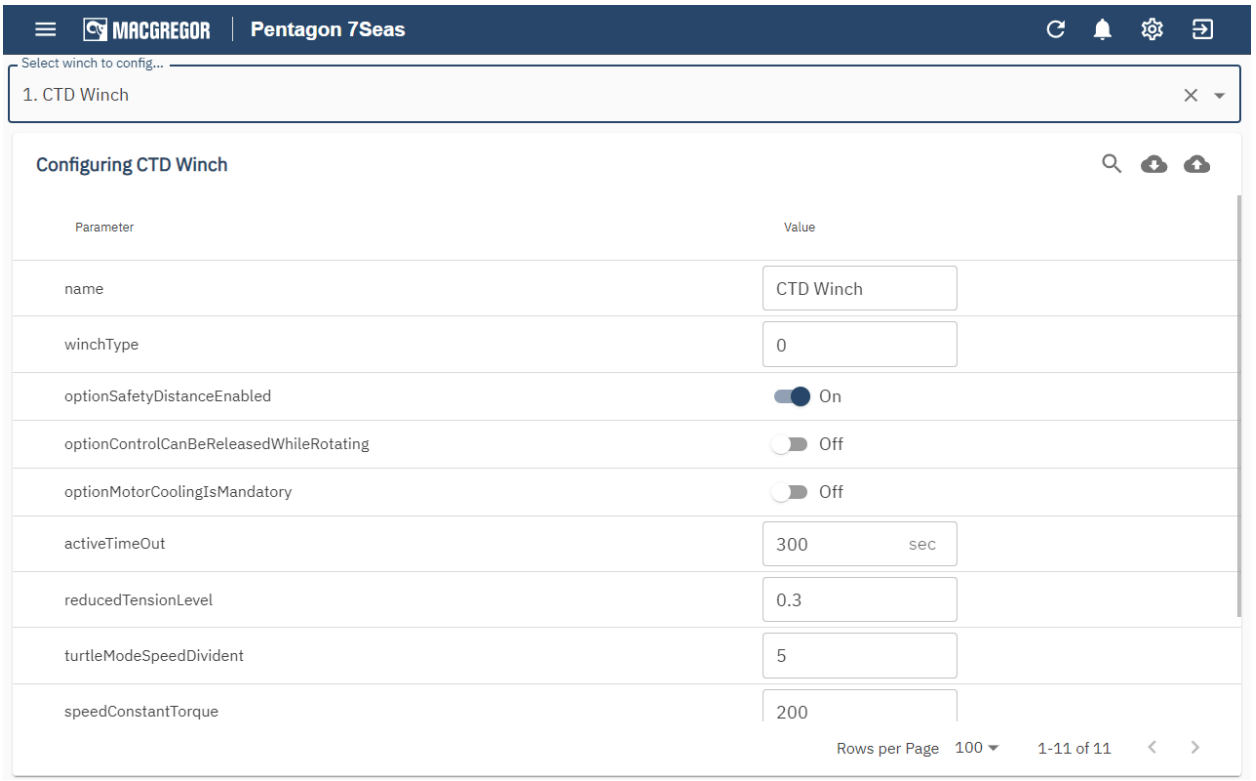


NOTE: To access the Configuration sub-menus it is necessary to be logged in. An Operator will be able to see the configuration screens but not change any configuration value. An Operator can also access this menu to calibrate the Levelwind and the Sheaves.

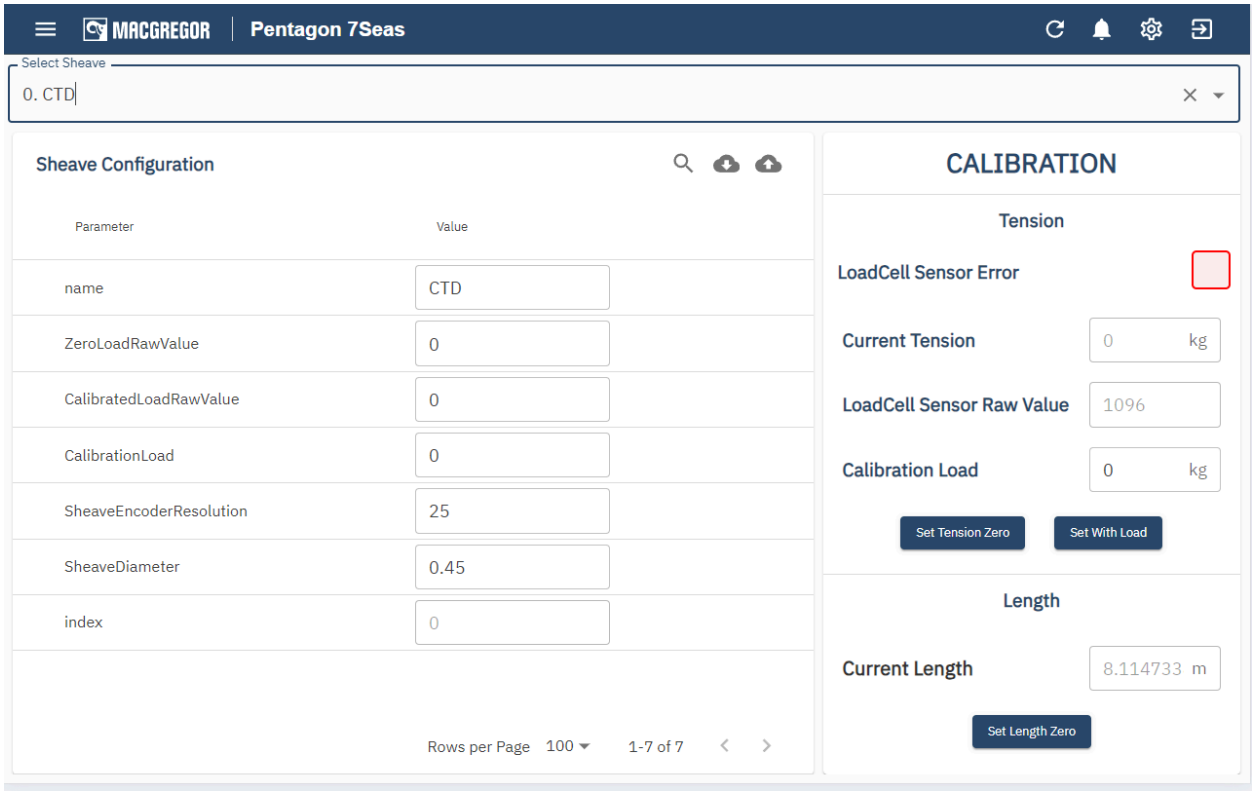
The images that follow indicate some examples of the Configuration screens.

CTD Winch Configuration





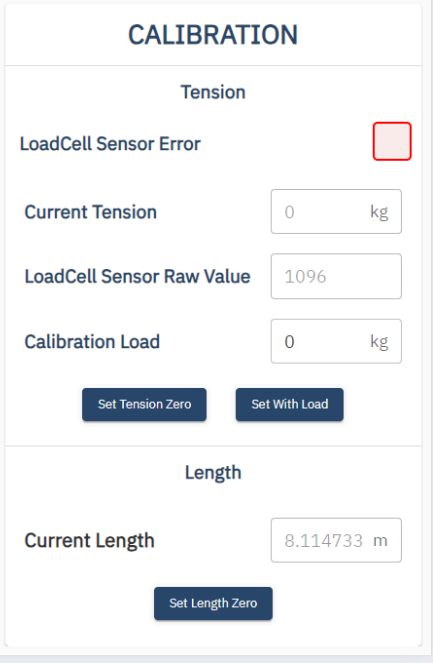
CTD Sheave Configuration and Calibration



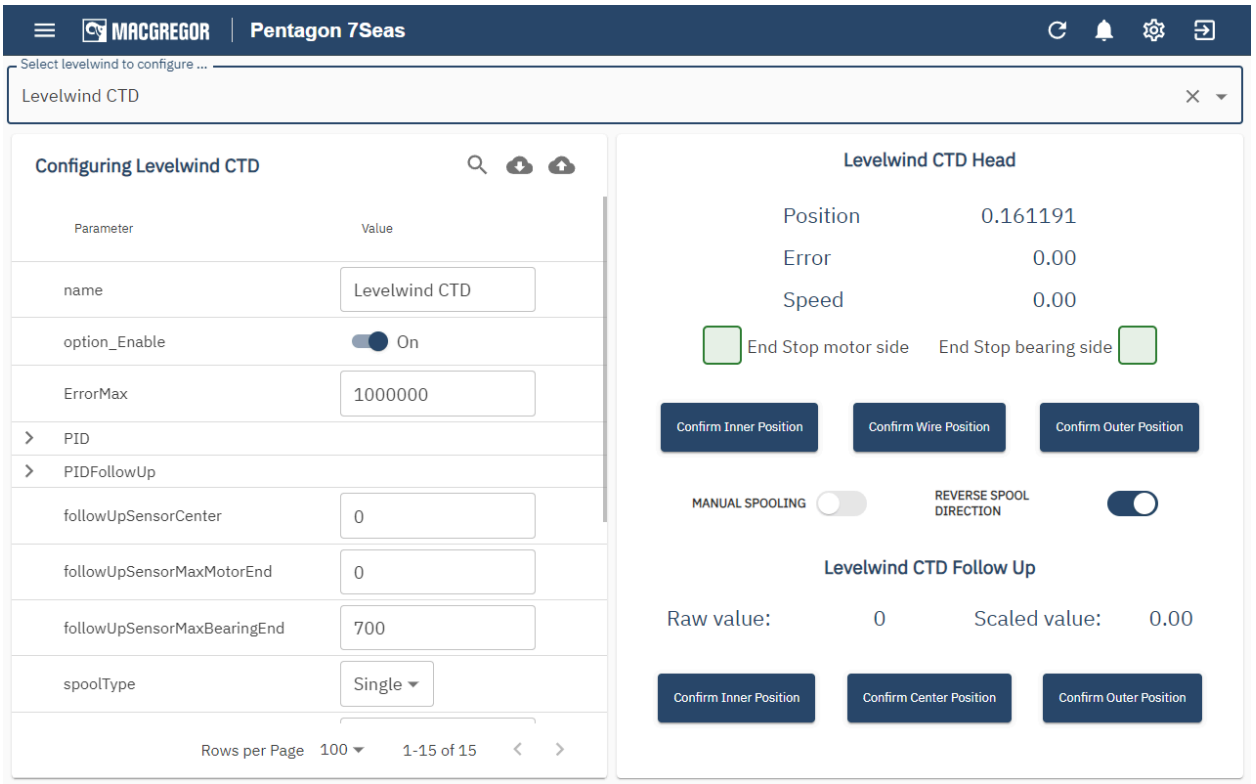
Instructions for calibration of the Sheave

1. Make sure there is no weight at the Sheave / Block.
2. Press the button “Set Tension Zero”.
3. Insert the desired value (in kg) into the Calibration Load field.
4. Press the button “Set With Load”.
5. Confirm if the current length of the cable is in position to be defined as “zero”.
6. Press the button “Set Length Zero”.

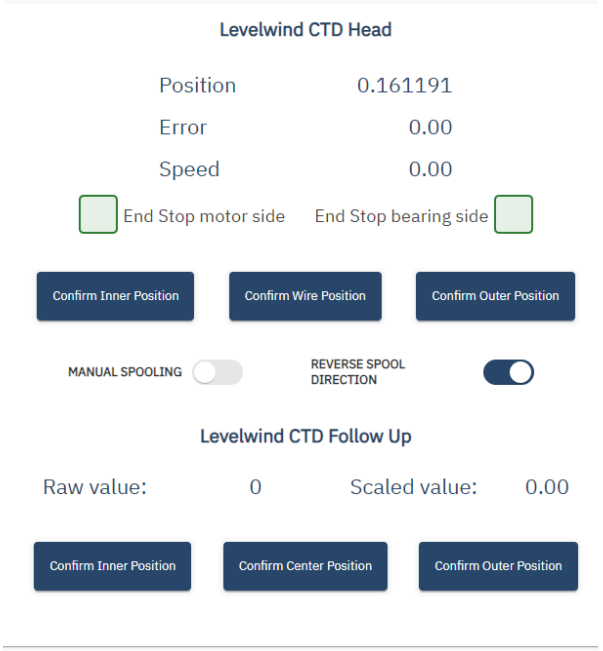
NOTE: If the LoadCell Sensor Error LED turns ON, there is a fault in the equipment. Request maintenance or proceed with fault finding.



CTD Levelwind Configuration and Calibration



Instructions for calibration of the CTD Levelwind



<u>Calibration of the Levelwind CTD Head</u>

1. Run the winch to the Inner side, until you have a fleet angle of 1,5º.
2. Press the button “Confirm Inner Position”.
3. Run the winch to the Outer side, until you have a fleet angle of 1,5º.
4. Press the button “Confirm Outer Position”.

If there is deviation and manual adjustment of the winch is needed, proceed as follows:

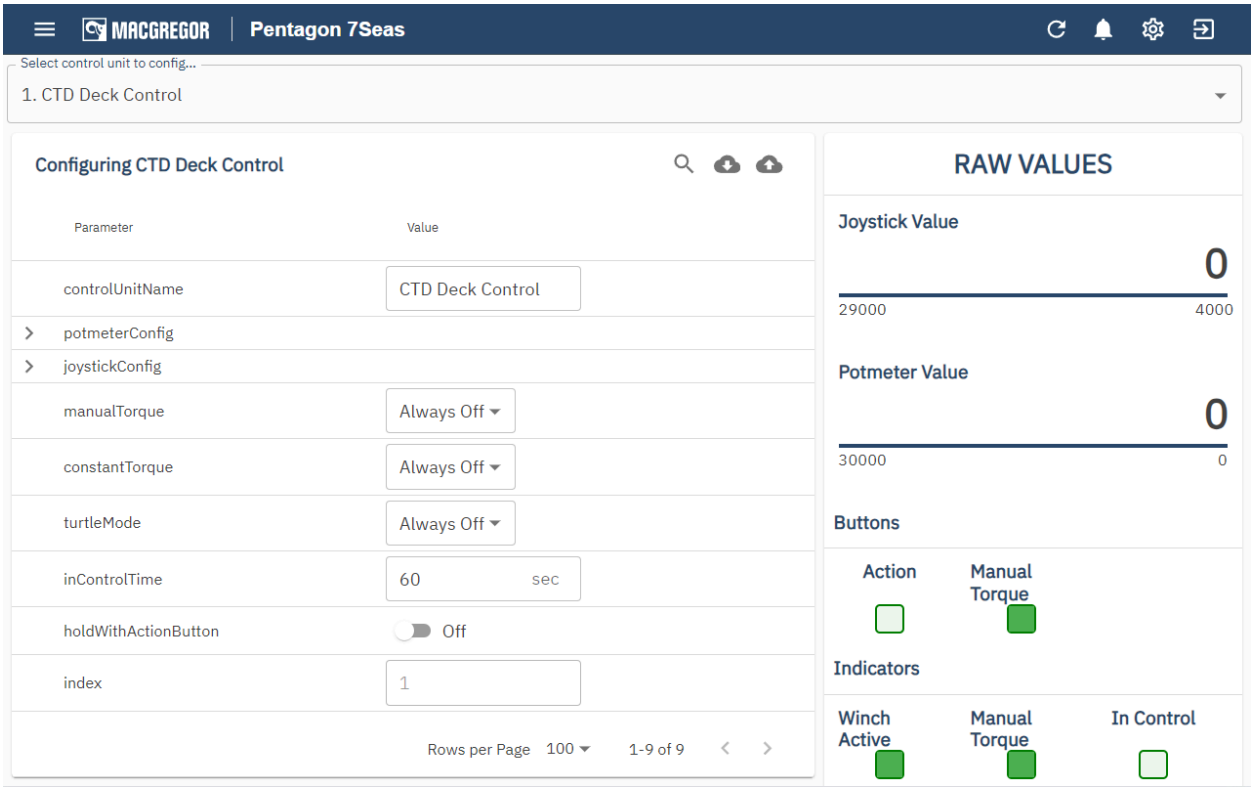
1. Activate the “Manual Spooling” switch
2. Run the carriage until the wire lines up with the wire on the drum using the Local Control Panel.
3. Press the button “Confirm Wire Position”.

NOTE: When the calibration is complete confirm the spooling direction. If you need to reverse the direction of the spool, activate the “Reverse Spool Direction” switch.

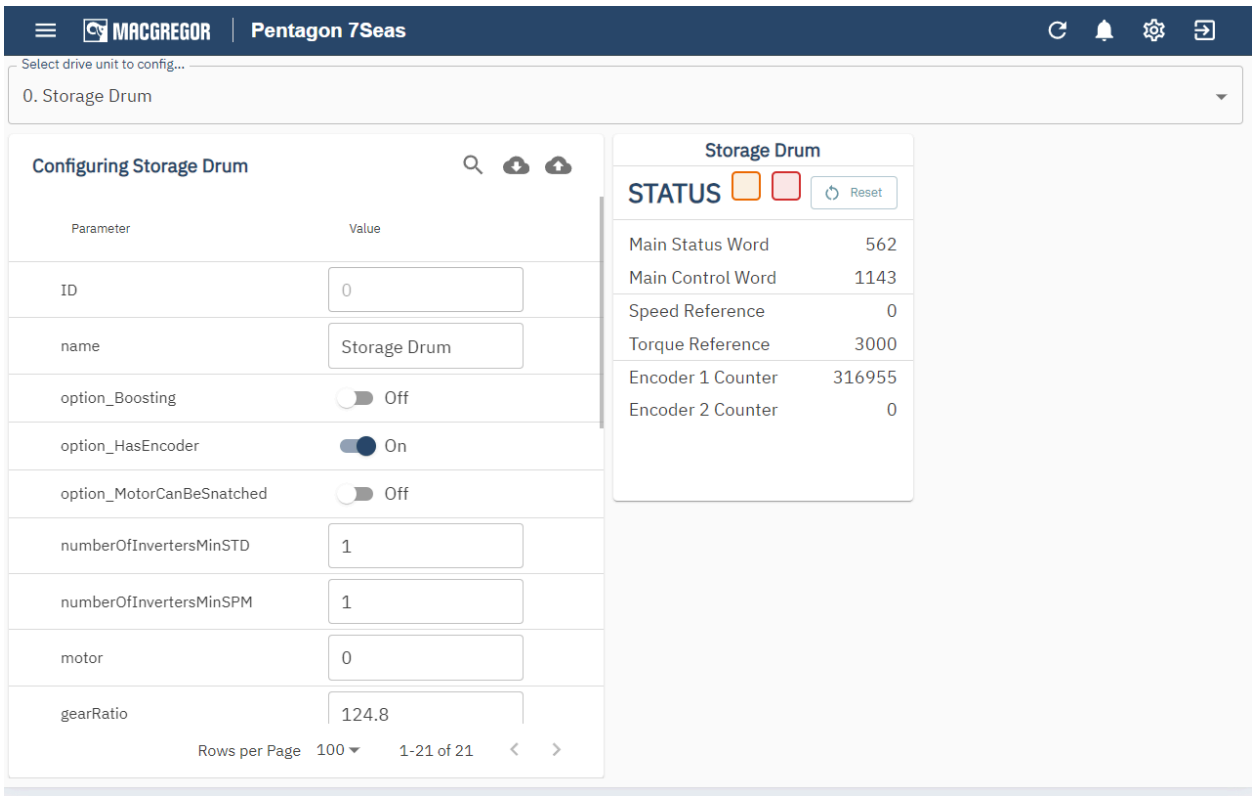
Calibration of the Levelwind CTD Follow-Up

1. Pull the Follow-Up assembly fully towards the Inner side.
2. Press the button “Confirm Inner Position”.
3. Pull the Follow-Up assembly fully towards the Outer side.
4. Press the button “Confirm Outer Position”.
5. Release the Follow-Up assembly that will move to the Center.
6. Press the button “Confirm Center Position”.

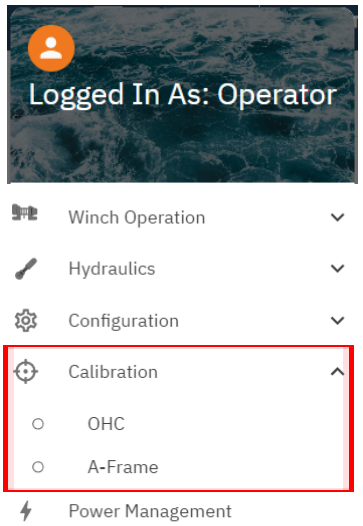
CTD Deck Control Configuration



Storage Drum Configuration



Calibration



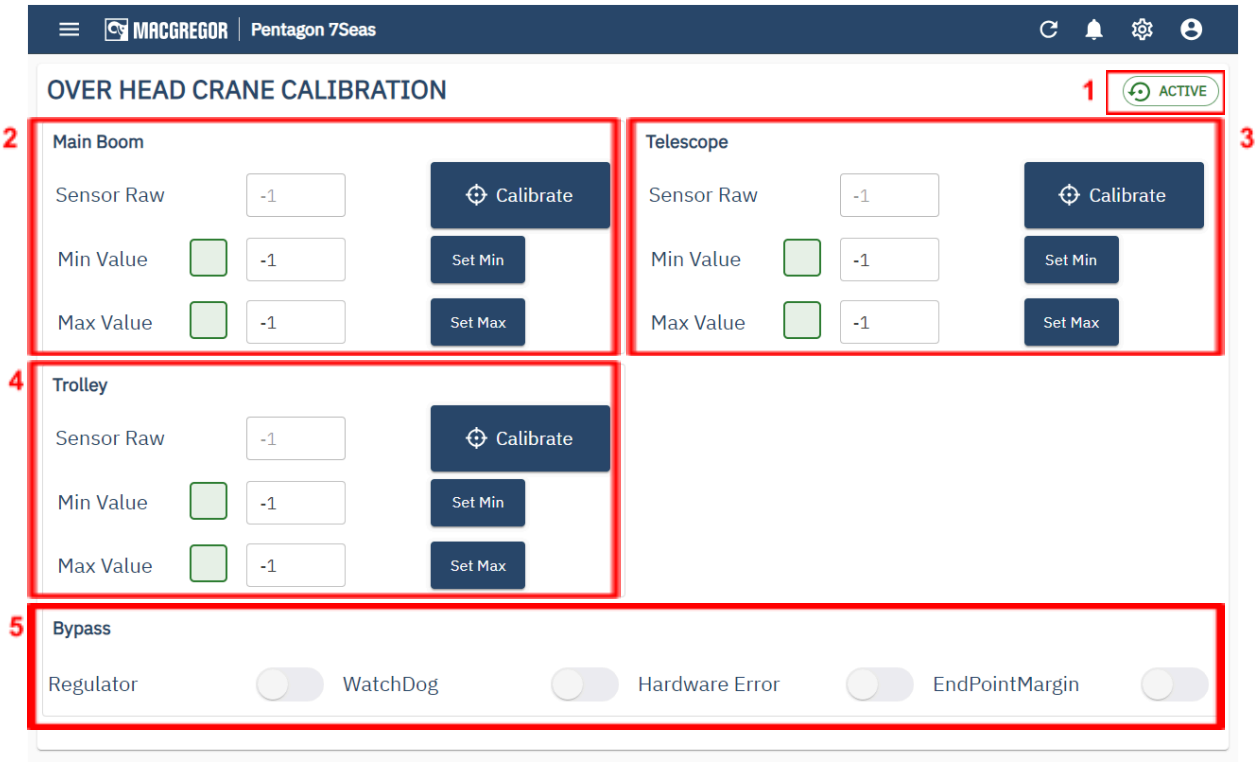
The Calibration Menu will present access as follows:

- Calibration
  - OHC (Overhead Crane)
  - A-Frame

CAUTION: The Calibration is set during commissioning. Any change in calibration must be done by a MacGregor Technician or a Trained OnBoard Technician. Damage can occur to the equipment.

OHC - Overhead Crane Calibration

This is the screen for the Calibration of the Overhead Crane.



WARNING: When you are in calibration mode the system deactivates all the safety features. Be careful you can drive the system without the safety stop function. Injury to the operator or damage to equipment can occur.

1 - State of the OHC

2 - Main Boom card
3 - Telescope card
4 - Trolley card
Inside each card you will find the following information and buttons:

- Raw value (m or ft) from the sensor of the OHC part
- The minimum value (m or ft) set to the OHC part (if the value was set correctly the LED turns ON)
- The maximum value (m or ft) set to the OHC part (if the value was set correctly the LED turns ON)
- “Calibrate” button (this button must be pressed to make the system enter calibration mode for the selected OHC part)
- “Set Min” button (this button must be pressed to set the minimum course of the OHC part)
- “Set Max” button (this button must be pressed to set the maximum course of the OHC part)

NOTE: To change the units from metric to imperial see General Settings - see page 11.

5 - Bypass options for the functions that follow:
Regulator - This function allows automatic correction of the deviations.
WatchDog - Safety mechanism that stops the system when a high deviation is reached.
Hardware error - Error from a sensor or a valve of the hardware.
End Point Margin - A designated point where the tilt cannot be further retracted or extended.

NOTE1: Only MacGregor Technician Login can activate bypass options.
NOTE2: When the Bypass option is active, the operator must manually check at the HMI or the equipment.
NOTE3: When a bypass option is activated a new alarm will be active at the alarm log. The new alarm can be Confirmed but will remain Active - see page 14.

Instructions for calibration of the Overhead Crane

WARNING: When you are in calibration mode the system deactivates all the safety features. Be careful you can drive the system without the safety stop function. Injury to the operator or damage to equipment can occur.

Calibration of the Main Boom

1. Press the “Calibrate” button.
2. Drive the boom cylinder fully retracted and then press the “Set Min” button
3. Make sure the “Min value” LED turns ON.
4. Drive the boom cylinder fully extended and then press the “Set Max” button.
5. Make sure the “Max value” LED turns ON.
6. When the “Min value” LED and “Max value” LED are turned ON the calibration is complete and exit calibration automatically.

NOTE: If needed you can exit calibration mode by pressing the “Calibrate” button. The values will not be stored in the system.

Calibration of the Telescope and Bullet Winch

1. Press the “Calibrate” button.
2. Drive the boom cylinder fully retracted.
3. Drive the bullet wire winch all the way in until you reach the bullet in position. and then press the “Set Min” button.
4. Make sure the “Min value” LED turns ON.
5. Drive the winch out to create distance/space for the telescope to move.
6. Drive the boom cylinder fully extended.
7. Drive the bullet wire winch all the way in until you reach the bullet in position. and then press the “Set Max” button.
8. Make sure the “Max value” LED turns ON.
9. When the “Min value” LED and “Max value” LED are turned ON the calibration is complete and exit calibration automatically.

NOTE: If needed you can exit calibration mode by pressing the “Calibrate” button. The values will not be stored in the system.

NOTE: When calibrating the telescope the bullet winch must be calibrated at the same time.

Calibration of the Trolley

1. Press the “Calibrate” button.
2. Drive the boom all the way into the starboard (until the rubber stopper), then press the “Set Min” button.
3. Make sure the “Min value” LED turns ON.
4. Drive the boom all the way out to the port (until the rubber stopper), then press the “Set Max” button.
5. Make sure the “Max value” LED turns ON.
6. When the “Min value” LED and “Max value” LED are turned ON the calibration is complete and exit calibration automatically.

NOTE: Sensor raw values are the current value read by PLC and will be utilized to set the Min/Max value.

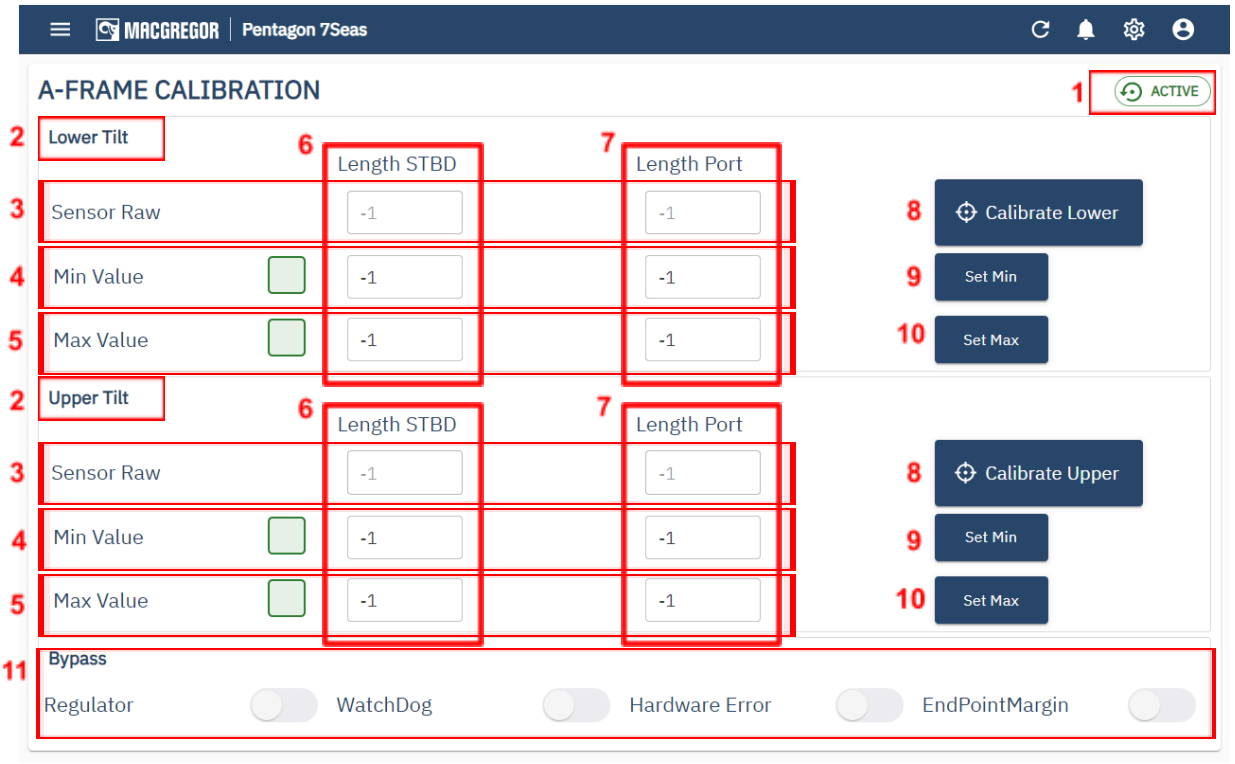
OHC State Chips

These images indicate the possible states of the Overhead Crane.

	Error connecting the PLC
	Idle OHC operation
	OHC is active
	OHC in manual mode
	OHC in calibration mode
	System error. Please check the alarm log.
	The emergency spot button was pressed

A-Frame Calibration

This is the screen for the Calibration of the A-Frame.



WARNING: When you are in calibration mode the system deactivates all the safety features. Be careful you can drive the system without the safety stop function. Injury to the operator or damage to equipment can occur.

1 - State of the A-Frame
2 - A-Frame part identification
3 - Raw values (m or ft) from the sensor of the A-Frame part
4 - Minim values (m or ft) set to the A-Frame part
5 - Maxim values (m or ft) set to the A-Frame part
6 - Values (m or ft) from the A-Frame part from the starboard side
7 - Values (m or ft) from the A-Frame part from the port side
NOTE: To change the units from metric to imperial see General Settings - see page 11

8 - “Calibrate” button (this button must be pressed to make the system enter in calibration mode for the selected A-Frame part)
9 - “Set Min” button (this button must be pressed to set the minimum course of the A-Frame part)
10 - “Set Max” button (this button must be pressed to set the maximum course of the A-Frame part)
11 - Bypass options for the functions that follow:

Regulator - This function allows automatic correction of the deviations.
WatchDog - Safety mechanism that stops the system when a high deviation is reached.
Hardware error - Error from a sensor or a valve of the hardware.
End Point Margin - A designated point where the tilt cannot be further retracted or extended.

NOTE1: Only MacGregor Technician Login can activate bypass options.
NOTE2: When the Bypass option is active, the operator must manually check at the HMI or the equipment.
NOTE3: When a bypass option is activated a new alarm will be active at the alarm log. The new alarm can be Confirmed but will remain Active - see page 14.

Instructions for calibration of the A-FRAME

Calibration for the Lower Tilt

1. Press the “Calibrate Lower” button.
2. Drive the Lower Tilt until be fully retracted and then press the “Set Min” button.
3. Make sure the “Min value” LED turns ON.
4. Drive the Lower Tilt until be fully extended and then press the “Set Max” button.
5. Make sure the “Max value” LED turns ON.

NOTE: When the Set Min LED and Set Max LED are turned ON the calibration is complete and the system exits the calibration mode automatically.

Calibration for the Upper Tilt

1. Press “Calibrate Lower” button
2. Drive the Lower Tilt until be fully retracted and then press the “Set Min” button.
3. Make sure the “Min value” LED turns ON.
4. Drive the Lower Tilt until be fully extended and then press the “Set Max” button.
5. Make sure the “Max value” LED turns ON.

NOTE: When the Set Min LED and Set Max LED are turned ON the calibration is complete and the system exits the calibration mode automatically.

NOTE: If needed you can exit calibration mode by pressing the “Calibrate” button again. The values will not be stored in the system if the LED does not turn ON.

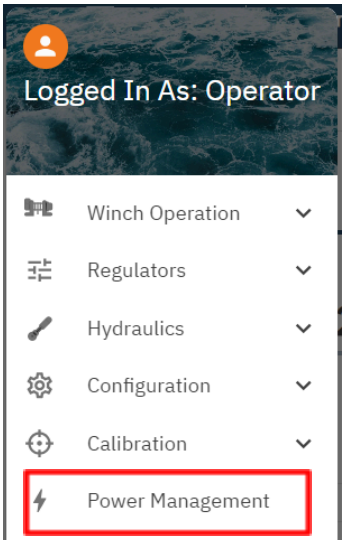
A-Frame State Chips

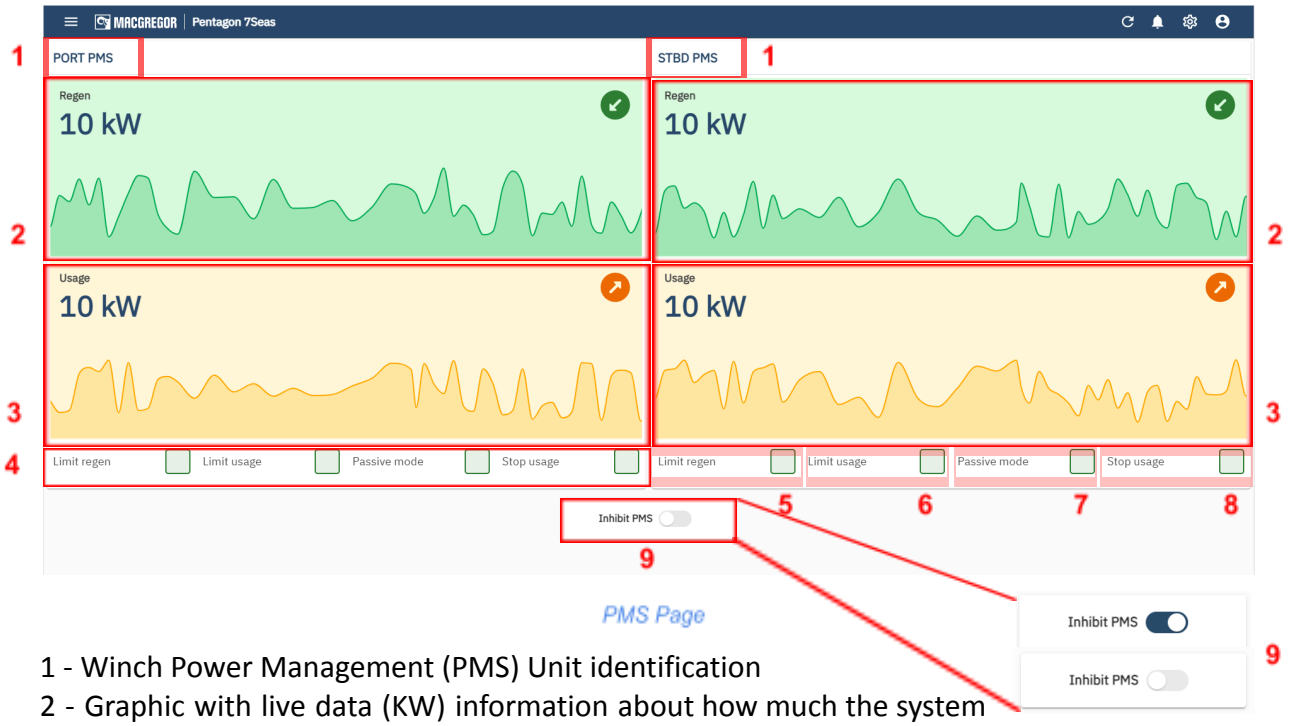
These images indicate the possible states of the A-FRAME.

	Error connecting the PLC
	Idle A-FRAME operation
	A-FRAME is active
	A-FRAME in manual mode
	A-FRAME in calibration mode
	System error. Please check the alarm log.
	The emergency spot button was pressed

Power Management

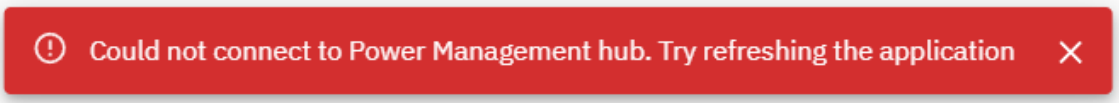
The Power Management (PMS) screen shows telemetry with live data regarding how much energy the system is using and regenerating.





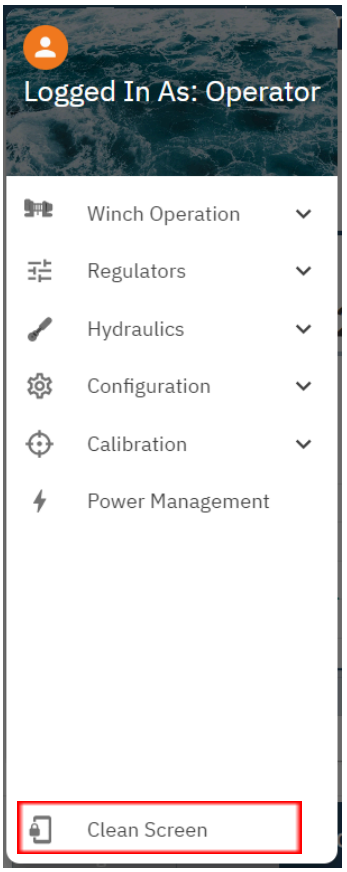
1 - Winch Power Management (PMS) Unit identification
2 - Graphic with live data (KW) information about how much the system is regenerating
3 - Graphic with live data (KW) information about how much the system is using
4 - Modes available for the Power Management System
5 - LED that indicates if the Limit Regeneration Mode is ON
6 - LED that indicates if the Limit Usage Mode is ON
7 - LED that indicates if the PMS system is in Passive Mode
8 - LED that indicates if the PMS system is Stopped
9 - Button to Inhibit the Power Management System from work

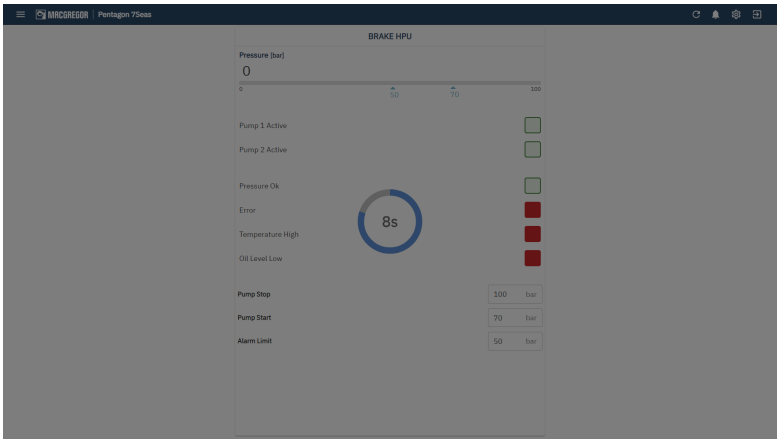
NOTE: If the Power Management hub loses the connection, this message will appear. Please refresh the application.



Clean Screen

The Clean Screen option is a functionality that allows the operator to wipe off the screen without having to turn off the entire system.





Clean Screen

When the Clean Screen option is selected the screen becomes darker and a timer shows up in the middle of the screen. The timer starts to count down from 10 to 0 and during that time, none of the touch functionality works.

This function allows the operator to wipe off the screen.

ANNEX

Tension Log

Pentagon 7 Seas

(Research)

Operator's Manual

Version: 1.0

Tension Log

The Tension Log information is available at the **CTD Winch operation settings** and **ROV Winch operation settings**. This Tension Log information is available for all logged-in users.
This functionality allows the user to access the detailed view of the tension history of the CTD and ROV winches.

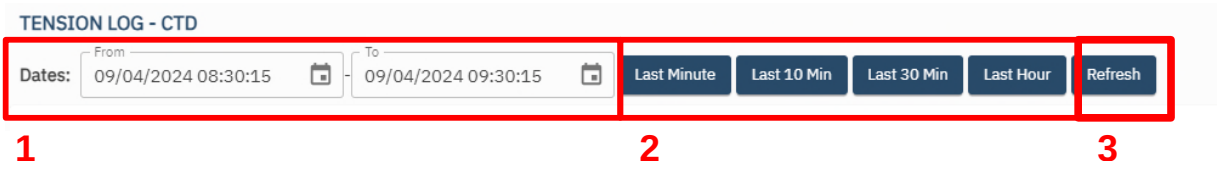
How the Tension Log works

The **PLC (Programmable Logic Controller)** logs the winch tension value every 20 milliseconds (ms). To handle this fast logging rate, the PLC temporarily stores the values in a **ring buffer**. Every 500 ms, the PLC sends the buffered tension values to the **HMI server** and saves these values to its database.

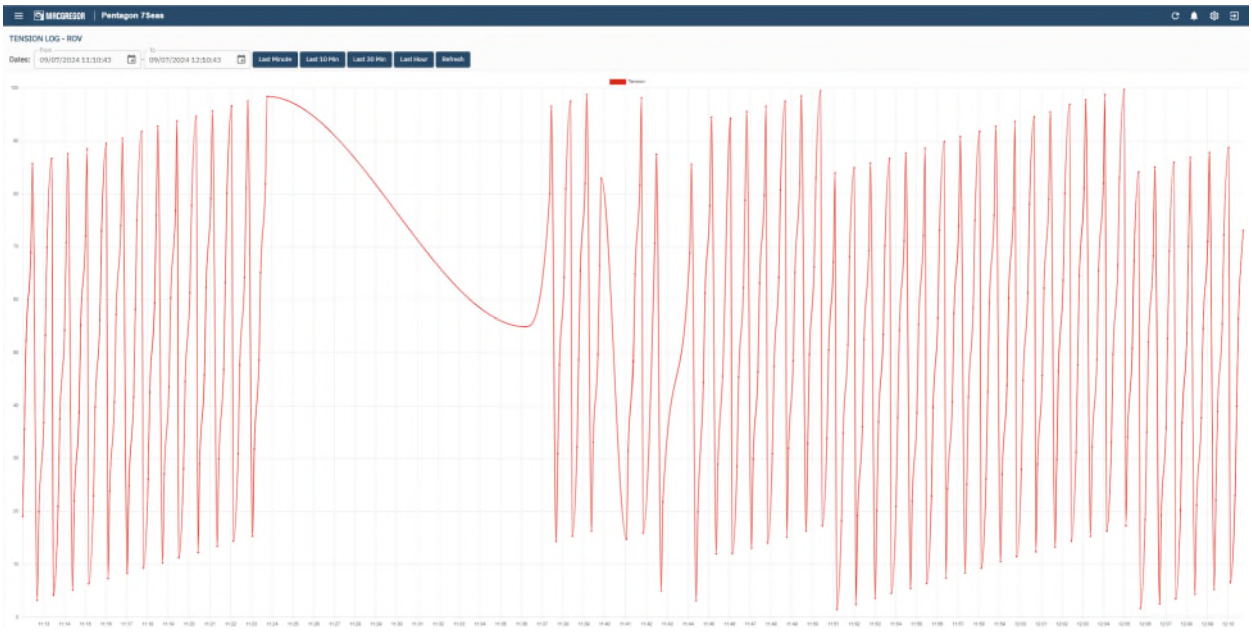
The **Tension Log View** gets the stored values from the database and displays the tension log data.

Tension Log Controls

To view tension logs for a specific time range use the controls that follow:



1 - Tension Log time range
2 - Tension Log time range predefined buttons (last min., last 10min., last 30min., last hour)
3 - Tension Log Refresh button (to load the selected time range into the graph view)



ROV Tension Log

NOTE: The tension log graph also supports zoom in and zoom out with a mouse. After zooming in or out, the user must click on the Refresh button to adjust the data.

Tension Alarm Limits

The tension alarm limits for CTD Winch operation and ROV Winch operation can be set in their operational settings menu.

NOTE: When the tension of the winch reaches the defined Tension Alarm Limit, an alarm is activated and added to the alarm log. Click on the icon “Alarms and Events page” to access the alarm information.

NOTE 2: A sound alarm will also be activated.

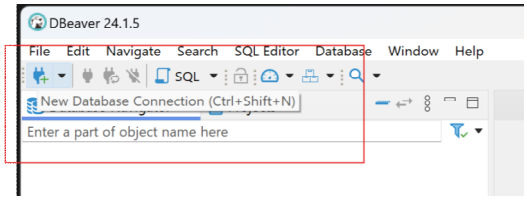
How to access the Tension Log raw data

The PLC stores its data in a database on the HMI server. The HMI server is a Windows computer with the IP address **10.183.6.171.**
This computer is inside the same electrical cabinet as the PLC. For more information, see the electrical documentation.
To access the raw data, the user must log in to the Windows computer using Remote Desktop.

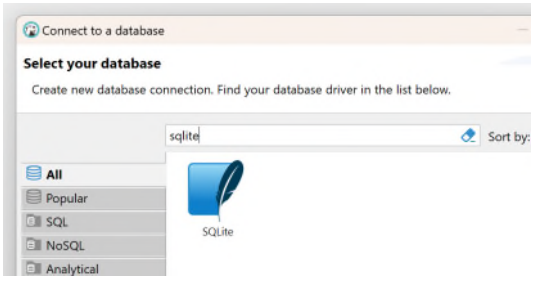
Instructions to to access and use the database:

1. **Log in to the HMI server:**
    - Start the Remote Desktop application.
    - Enter the IP address: **10.183.6.171**.
    - Use these credentials to log in:
        - Username: **Administrator**
        - Password: **jbv38a**
2. **Find the database file:**
    - Open the file explorer on the HMI server.
    - Go to: **C:/p7s/p7hmi.db**.
3. **Open the database in DBeaver:**
    - Start DBeaver:
        - Open the **Start menu**.
        - Type **DBeaver** in the search bar.
        - Select **DBeaver** from the results.
    - Create a new connection:

        - Click **New Database Connection**.

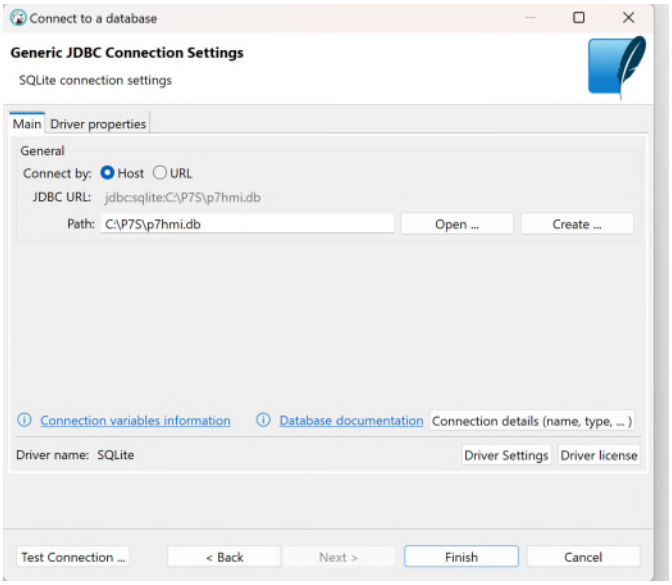


        - Select **SQLite**.



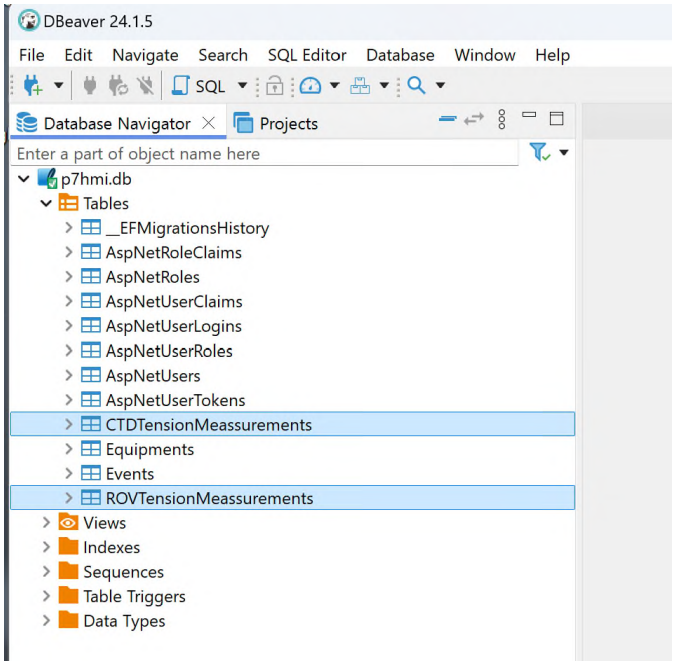
        - Click **Next**.

- Select the database file:
  - Click **Open**.
  - Go to: **C:/p7s/p7hmi.db**.
  - Click **Finish**.

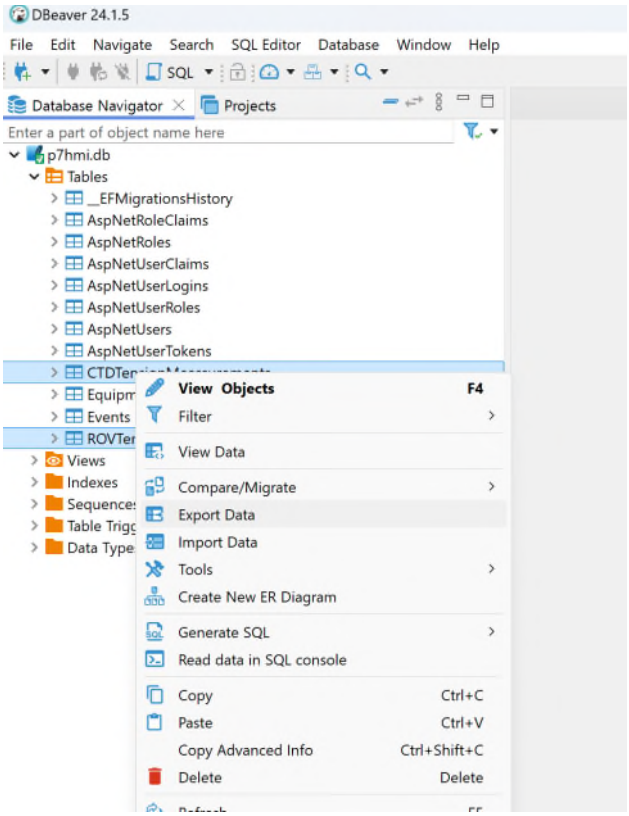


NOTE: The database should open in DBeaver.

4. **Use the DBeaver database:**
   - Open these tables to view the data:
     - **CTDTensionMeasurements**
     - **ROVTensionMeasurements**



- To export data:
  - Right-click the table you want to export.
  - Click **Export Data**.
  - Follow the steps in the **Export Data** wizard.



NOTE: You can query data in these tables or export data to a wide range of formats via the "Export Data" wizard.

Operating Instructions

Original Operating Instructions

spectrum 2

YOS100G0

HBC radiomatic

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Attachments: Frequency list for EU member states, EFTA states, and Turkey, EU Declaration of Conformity, system specific views, circuit diagrams and / or output wiring.

Pictographs

Danger due to electrical voltage. Touching live parts inside the unit can be fatal or cause serious injuries.

Instructions for occupational health and safety. Not following these instructions can lead to accidents that can cause damage, serious injuries or even death.

Important information about the operation of the radio system.

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Safety Instructions

Read these operating instructions carefully before working with the radio system. This applies in particular to the installation, commissioning and maintenance of the radio system.
The operating instructions are a constituent part of the radio control system and must always be kept close at hand for the responsible personnel.
The term 'machine' is used in the operating instructions for the different possible uses of the radio system.

Intended Use

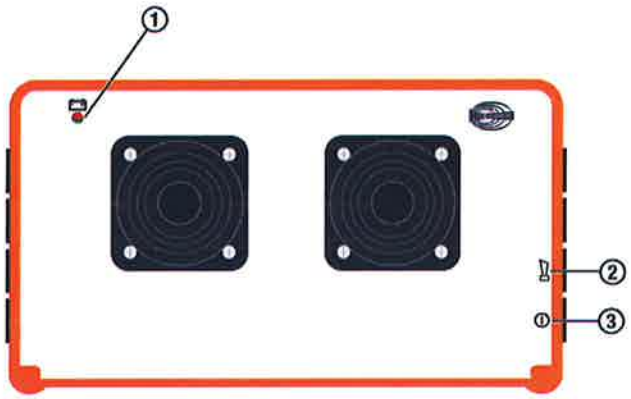
- The radio system is used for the control of machines and for data transfer. Observe the occupational safety and accident prevention regulations applicable to each application.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved for these uses by the manufacturer.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The safety devices of the radio control system must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete E-STOP system are not allowed.

Safety Instructions for Installation and Operation

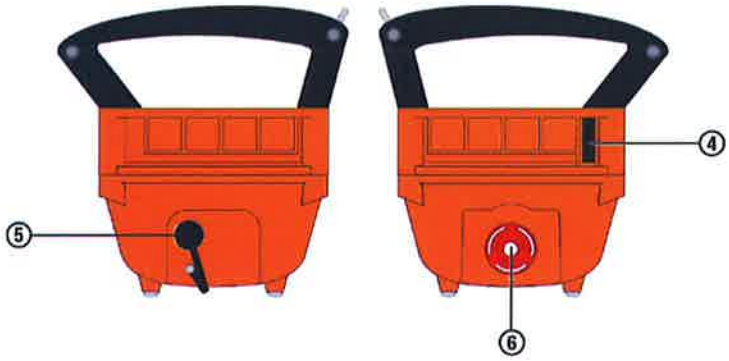
- The electrical connection according to the enclosed output wiring diagram must be established by a qualified electrician exclusively.
- The receiver may only be opened by trained personnel. Components inside the receiver can be energized at life-threatening voltages. The supply voltage for the machine must be disconnected before the receiver is opened.
- Please also note that, with radio systems, the presence of persons in the danger zone – in particular beneath the load (cranes!) – is prohibited in all cases.
- Select a safe location for radio control, from which you have a good and complete view of the working movements of the machine, the load movements and the surrounding working conditions.
- It is not permissible to leave a radio transmitter unattended when it is activated. Always switch off the radio transmitter when it is not required. This applies in particular if you change location, when working without radio control, during breaks and at the end of work. Always protect the radio transmitter against use by unauthorized persons, for example by locking it away.
- In the event of an emergency and with all faults, switch off the radio transmitter immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could influence safety must be rectified by specialists who have been trained and authorized by HBC-radiomatic before the system is put back into operation.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before starting to work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.

- Before starting to work, examine the STOP switch for mechanical ease of motion and electronic function at least once a day:
  When you press the STOP switch with the transmitter on, the status LED of the transmitter has to go out. If the status LED does not go out then you have to disable the radio control system immediately. Remove the battery and the radiomatic® iLOG from the transmitter and inform a service technician.
- Switch the transmitter off at least once per working day and restart it.

Transmitter Equipment



① Status LED
② Signal button (option)
③ Start button
④ radiomatic® iLOG
⑤ Connection for cable control (option)
⑥ STOP switch



The images are just examples, so the delivered product may look different. Please refer to the enclosed transmitter layout and wiring diagram for the equipment of your radio transmitter.

Operation

The transmitter is equipped with an electronic radiomatic® iLOG key. radiomatic® iLOG contains all the data required for operating the transmitter. Operation is not possible without radiomatic® iLOG! Depending on the version the radiomatic® iLOG can also be used for operation of replacement transmitters of identical construction.

When activating the transmitter and if the radio connection is interrupted (e.g. if the connection is lost or the transmission range is exceeded), the transmitter reacts with the so-called enforced zero-position. Release all operating elements so they can return to the zero-position and actuate the start button. The machine will not react if the operating elements are not in zero-position. This prevents uncontrolled machine movements after the radio connection has been interrupted.

Activating the Transmitter

Note:
Whenever you activate the radio system, make sure the receiver is switched on before the transmitter.

With start sequence

The steps 3 and 4 need to be carried out within **5 seconds**.

1. Insert a charged battery into the battery compartment.
2. Turn the STOP switch to unlock.
3. Shortly press the start button and then release. The transmitter will switch off if the button is pressed for longer than half a second!
4. Press the start button again until an acoustic signal sounds and the status LED flashes green. Then release the button. The transmitter is now ready for operation.
5. Depending on the application, you must press the start button again before movement commands can be carried out.

Note:
The transmitter switches off if

- the start button is pushed for longer than half a second in step 3 of the start sequence.
- the start sequence (steps 3 and 4) takes over 5 seconds.
- another button is pressed during the start sequence.

You must then repeat steps 3 and 4 or 3 to 5.

Caution:
Before starting work always trigger the acoustic signal. This warns all colleagues that the machine is about to move.

With merlin® TUC

1. Insert a charged battery into the battery compartment.
2. Unlock the STOP switch by turning it. The status LED flashes green 2 times per second, and one red.
3. Hold the merlin® TUC at the position on the transmitter marked with this symbol (cf. illustration).

   The transmitter vibrates and an acoustic signal sounds.

   When the status LED blinks green, the transmitter is ready to operate.
4. Depending on the application, you may need to press the Start button before control commands can be executed.

Note:
The transmitter can only be activated with a valid merlin® TUC. If you use a card that does not match the respective transmitter or is not approved for this transmitter, the transmitter vibrates 3 times. At the same time an acoustic signal sounds. The transmitter is automatically shut down after 2 seconds. Please contact your superior in such cases. If this happens, please contact your superior, a service technician in your company or your contact at HBC.

The transmitter also shuts down if the start sequence is not completed within 10 seconds.
In this case press the start button and repeat the procedure!

Caution:
Before starting work always trigger the acoustic signal. This warns all colleagues that the machine is about to move.

Deactivating the Transmitter

Press the STOP switch.

Note:
Replace the battery when the status LED in the transmitter flashes red, an acoustic signal sounds and the transmitter vibrates. Otherwise, the transmitter will switch off in a few minutes.
Recharge the empty battery in the respective charger.

Automatic Power Off (APO) Function

The transmitter is equipped with an automatic power off function (APO) and will switch off automatically after a preset time without command input.
The automatic power off serves to increase safety and also saves battery power.

Note:
The default switch-off time is 15 minutes. If you would like to adjust the switch-off time or to deactivate the APO function, please contact your responsible HBC service partner.

After an automatic power off, the transmitter must be reactivated as described in the chapter "Operation".

Caution:
The automatic power off does not relieve the operator of the responsibility to turn off the transmitter with the STOP switch when not in use.

Automatic Movement Off (AMO) Function

After a defined time after the last movement command has been operated, the transmitter switches into the AMO operating mode and no more movement commands can be executed. Commands, such as horn, can still be executed.

You can leave the AMO operating mode by pressing the start button for one second. All operating elements for movement commands must be in zero position during this operation. This prevents unintended machine movements when the AMO operating mode is exited.

Note:
The default AMO time is set to 5 minutes. To change the AMO time and de-activate the AMO function, proceed as described in the chapter "Display Content and Functions" under "Safety functions".

Battery and Battery Charger

Li-ion Battery

The battery capacity (= the amount of electric current that can be stored) and the battery charge (= the actual amount of stored current) depend on the age of the battery and the environment temperature. If the temperatures are below 0 °C (32 °F) or above 40 °C (104 °F), less current can be retrieved.

Please adhere to the following safety notifications in all cases. When the Li-ion battery is improperly handled, there is the risk of explosion and of fire. This could lead to life-threatening injuries that might result in death under specific circumstances.

Safety instructions:

- Use the batteries only in connection with the designated devices.
- Never use or charge damaged or faulty batteries.
- Do not throw the batteries into fire, short-circuit, damage or open them.
- Use only the associated charger by HBC-radiomatic to charge the battery.
- Charge the battery at an ambient temperature of 0 – 45 °C (32 – 113 °F).
- Do not expose the batteries to direct sunlight.
- The batteries have to be recycled or disposed of properly.

Notes:

- In all cases, charge the batteries completely before initial use. This ensures that the batteries have their full capacity in use.
- A battery charge of 30 – 50 % is ideal for storing Li-ion batteries. This charge is reached after charging an empty battery for approx. 1 hour.
- Store the batteries at -15 – +35 °C (5 – 95 °F).
- When storing Li-ion batteries, recharge them after a maximum time of 3 months and adapt the charging time correspondingly.

When handled properly, Li-ion batteries by HBC-radiomatic can reach up to 500 charging cycles. Even after that, your batteries can be used for some time with a slightly decreased capacity.

DC battery charger

The scope of delivery of the battery charger includes a DC connection cable with a suitable wall plug and an AC wall plug transformer.

Please adhere to the following safety notifications in all cases. When the charger is improperly handled, there is the risk of fire and of electrical shock. This could lead to life-threatening injuries that might result in death under specific circumstances.

Safety instructions:

- Use this charger only to charge the batteries specified on the type plate.
- The charger may not be used in hazardous areas or in the vicinity of flammable materials.
- The charger has to be operated with the voltage indicated on the back.
- The charger has to be used in vehicles or indoors only.
- Use the charger only within the specified temperature range of 0 – 45 °C (32 – 113 °F).
- Protect the charger against heat, dust and humidity.
- Do not cover the charger while it is in use.
- Disconnect the charger from the power supply when it is not in use.
- In case of any fault of the charger or the connecting cable disconnect it immediately and put it out of operation.
- Do not make technical changes to the charger or the connecting cable.

Maintenance and servicing:

- Disconnect the plug before cleaning the charger.
- Make sure that the contacts of the charger and the battery pack are free from dirt in order to ensure a faultless functioning of the charger.

Charging the Battery

1. Connect the charger to the power supply via the connecting cable or the wall plug transformer.
2. Insert the battery into the compartment.
   Charging will start automatically.

A duo LED indicates the current operating state of the battery.

The battery is charged

The battery is charging

The battery is defective

The battery temperature is below 0 °C (32 °F) or above 45 °C (113 °F).

Technical Data QD405000	
Operating voltage	10 – 30 V DC
Charging time	6 – 8 h
Operating temperature	0 – 45 °C (32 °F – 113 °F)
Housing material	PC-ABS
Protection class	III
Charging method	CC-CV
End-of-charge voltage	4.2 V

Technical Data AC Wall Plug Transformor	
Operating voltage	100 – 240 V AC
Input current	≤ 1 A
Output voltage	12 V DC
Output current	3 A

Frequency Management

Fixed Frequency

If the identification plate in the battery compartment of the transmitter shows a frequency value (e.g. 433,500 MHz), the transmitter operates with a fixed frequency.
Please contact your service department if the frequency has to be changed because the radio channel is already assigned to another user.

Manual Frequency Switching

If the identification plate in the battery compartment of the transmitter shows the label **man**, the transmitter features manual frequency switching.
This function can be used to change the radio channel during radio operation.
Actuate the start button until an acoustic signal sounds. Then release the button.
Please contact your service department if all available frequencies are occupied.

radiomatic® AFS

If the identification plate in the battery compartment of the transmitter shows the label **AFS**, the transmitter is equipped with radiomatic® AFS (Automatic Frequency Selection).
When activating the transmitter radiomatic® AFS will check if the present radio channel is free. If the radio channel is occupied, the system automatically finds and saves a free radio channel.
If the radio channel currently in use is occupied by another radio control system, you must switch the transmitter off and on again in order to allow radiomatic® AFS to switch to a free radio channel.
The radiomatic® AFS option also includes the manual frequency switching function.

Note:
If radiomatic® AFS is to perform optimally, all the other radio systems in the immediate working environment (e.g. the factory hall or building site) should be switched on before starting to use the radio system for the first time. This allows radiomatic® AFS to detect automatically which radio channels are already being used in the working area, and thereby to choose a suitable free channel for its own use.
In addition, when switching the radio system on for the first time, the user should make sure that his distance from the radio receiver and from the machine is a realistic reflection of the working situation.

DECT

DECT technology is an extremely convenient method for uninterrupted radio control without frequency conflicts. The operator always works on a free radio channel and does not need to make manual settings.

Adaptive Frequency Hopping (AFH)

If the identification plate in the battery compartment of the transmitter shows the label **AFH**, the transmitter is equipped with Adaptive Frequency Hopping.
AFH (Adaptive Frequency Hopping) works with automatic frequency coordination in the 2.4 GHz frequency band and thus ensures interruption-free working in areas with many radio users. Manual frequency coordination is not necessary. With the worldwide 2.4 GHz frequency band AFH can be used all over the world.

Enhanced Safety Functions for the Operator (Optional)

The availability of the following options depends on the design and configuration of your radio control system.

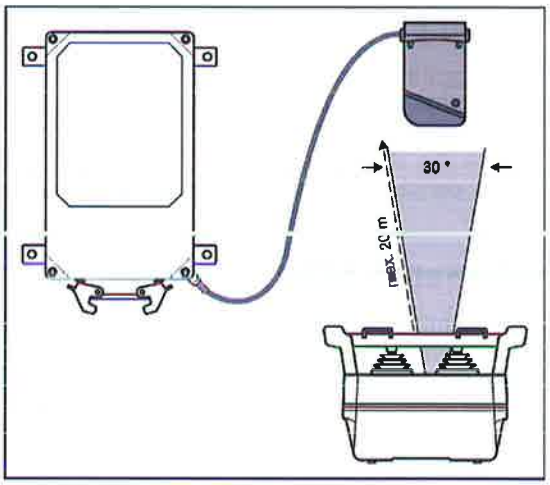
Protection from Unintended Machine Operation

radiomatic® infrakey

The radio system can only be activated via an infrared link between the transmitter and the receiver. This increases the safety of operation, i.e. the machine can not become inadvertently enabled.

radiomatic® infrakey operates either with an infrared module in the receiver housing (radiomatic® infrakey internal) or with the offset infrared antenna focus I (radiomatic® infrakey external).

To activate radiomatic® infrakey, actuate the start button on the transmitter.



Function of radiomatic® infrakey with focus I

Notes:

- The range of the infrared beam is max. 20 m (66 ft).
- The angle of radiation is 30°.
- The front panel of the receiver must be visible (only radiomatic® infrakey internal).

Enabling Switch

The two-step enabling switch provides enhanced safety during maintenance and service work on or in the machine as well as for applications with multiple users. In order to transmit control commands to the machine, the operator has to keep the switch pushed into the first step. Only then are the other operating elements activated. If the operator releases the button or pushes it into the second step (e.g. as the result of a cramp), all machine functions are immediately stopped. With this, the operator is protected from dangerous unintended movements of the machine in case he should lose consciousness or no longer has control over the transmitter.
If an application is controlled by more than one operator, movement commands can only be performed if all operators keep the enabling switch pushed into the first step.

Joystick with Deadman Function

In order to issue control commands, the button integrated into the joystick must be pressed before the joystick is moved. The function then locks and remains effective until the joystick is back in the zero position. This avoids of potential risks through the unintentional actuation of the joystick.

radiomatic® touch-to-activate

radiomatic® touch-to-activate allows for enabling of control commands or operating elements by touching (= touch-to-activate) the joystick button or the roll-over bar. The operating elements and control functions to be enabled by means of radiomatic® touch-to-activate can be configured according to the customer's wishes.

Activation with the Joystick Button

- Touch the joystick button from above.
  The joystick will vibrate briefly.
- Immediately grip the joystick button at the side with two or more fingers.
  Now movement commands can be executed by deflecting the joystick.

Depending on the configuration of the radio transmitter, one or several movement commands can be enabled.

Activation with the Roll-Over Bar

Depending on the configuration of the radio transmitter, you have to

- place one hand on the left roll-over bar.
- place one hand on the right roll-over bar.
- place a hand on both roll-over bars.

One or several movement commands can be enabled.

Activation is indicated by

- LEDs on the respective joystick or
- a message on the color display (if the radio system is equipped accordingly).

Shut-off on Implausible Control Commands

The automatic shut-off will activate after a sequence of multiple questionable movement commands, for example if the operator moves the joystick successively in different directions in an irregular manner. This function protects the operator and the whole work environment from potential dangers as well as the machine from wear resulting from rapid and erratic movements.

Depending on the ordered version this function can operate in three different ways:

- The complete radio system is shut down.
- Safety-relevant functions are deactivated.
- A previously defined function (e. g. crane horn) is activated.

To deactivate the function, press the start button until the status LED flashes green.
Then the transmitter is ready to operate again.

radiomatic® shock-off / zero-g / inclination switch

In specific emergency situations, these safety features can prevent unintended movement commands from being given to the machine, protecting the operator as well as other personnel in close proximity to the machine in use.

radiomatic® shock-off can react if the transmitter receives a hard impact.

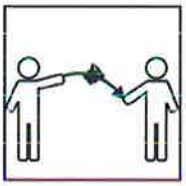
radiomatic® zero-g can react if the transmitter is falling down or being thrown.

radiomatic® inclination switch can activate if the transmitter exceeds an inclination angle of approx. 45° for a specified time and/or is positioned upside down.

Depending on the ordered version the features can operate in three different ways:

- The complete radio system is shut down.
- Safety-relevant functions are deactivated.
- A previously defined function (e. g. crane horn) is activated.

To deactivate the features, press the Start button until the status LED flashes green. Then the transmitter is ready to operate again.



The safety features do not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.

Protection Against Incorrect Operation

Micro Drive

With the micro drive function the speed of the machine is limited to a preselected level. Even at full movement of the joystick/linear lever, the operator can not exceed this speed limit. In this manner demanding drive maneuvers can be managed and inexperienced users can be protected from potential dangers that can result from "speeding".

Orthogonal Drive (Electronic Cross Gate)

With the orthogonal drive function dangerous situations, caused by unintentional diagonal movements are being prevented. The operator will have to return the joystick back to zero position before another directional command can be activated. This function is suitable for example for situations where the operator has to make precision commands in confined areas. Diagonal movements are not possible.

Additional Work Safety

Integrated LED Flashlight

The integrated LED flashlight is activated and de-activated by means of a button on the transmitter.

Caution:
In order to avoid blinding, never look directly into the beam of light and do not point the flashlight in the eyes of humans or animals. Irritations from blinding may result in dangerous situations, such as overlooking obstacles or other dangerous areas.

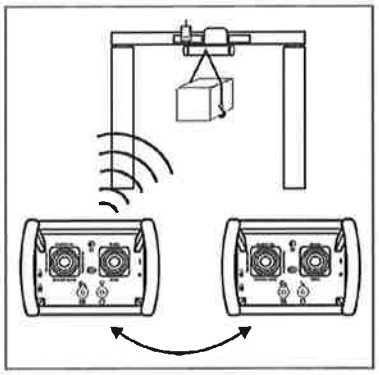
Front Panel Lighting

The front panel lighting is activated and de-activated by means of a button on the transmitter.

Extended Control Concepts (Optional)

The availability of the following options depends on the design and configuration of your radio control system.

Catch-Release



Via the Catch-Release option two or more transmitters can control a machine alternately.
When the receiver is switched on, the machine can initially be controlled via any associated transmitter. Once the receiver is taken over by one transmitter, the other transmitters no longer have access.

Take over machine

1. Switch the transmitter on.
2. Enter the "Catch" command on the transmitter and actuate the start button.

The access rights for the machine remain with that transmitter until the "Release" command is issued by that transmitter.

Release machine

1. Enter the "Release" command on the transmitter.
2. Switch the transmitter off.

The access rights for the machine are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over the machine. Transmitter 2 is to be given control.

1. Enter the "Release" command on transmitter 1.
2. Switch transmitter 1 off.
3. Switch transmitter 2 on.
4. Enter the "Catch" command on transmitter 2 and actuate the start button.

Transmitter 2 now has sole access to all machine functions.

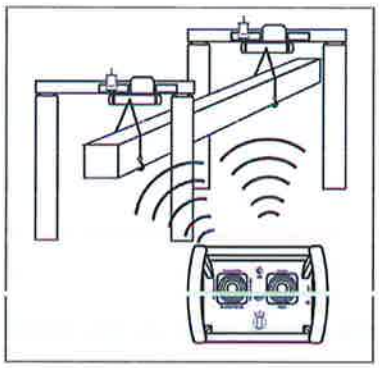
Notes:

- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver is disrupted, the receiver has to be catched by the transmitter again.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. In this case, deactivate all transmitters paired with the receiver and shortly disconnect the operating voltage from the receiver. This will reset the system to the starting condition described above.
- Always activate the "catch" command after the radio connection has been disrupted in order to maintain the connection of your radio transmitter to the selected radio receiver(s).

Tandem Operation

Note:
If your radio system is equipped with tandem operation, there must be a radio link to both receivers at all times since otherwise no control commands can be given. This also applies if you would like to control the machines individually.

The radio system consists of 1 transmitter and 2 receivers for 2 machines. The transmitter can control the machines individually or in parallel.



The machines are selected at the transmitter via a rotary switch:
A only machine A
A+B machine A + machine B
B only machine B

Catch-Release-Tandem Operation

Note:
If your radio system is equipped with tandem operation, there must be a radio link to both receivers at all times since otherwise no control commands can be given. This also applies if you would like to control the machines individually.

With the Catch-Release-Tandem Operation two or more transmitters can control several machines alternately.
Each machine is equipped with a receiver that can receive and monitor all transmitter frequencies.
After activating the receivers all transmitters have equal access to the radio control system.

Take over machine

1. Switch the transmitter on.
2. Turn rotary switch on the transmitter to the respective position.
3. Enter the "Catch" command on the transmitter and actuate the start button.

The transmitter with control over the machine(s) retains the access to the receiver until the operator has issued the "Release" command.

Release machine

1. Enter the "Release" command on the transmitter.
2. Switch the transmitter off.

The access rights for the machine(s) are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over machine A. Transmitter 2 is to be given control over machine A+B.

1. Enter the "Release" command on transmitter 1.
2. Switch transmitter 1 off.
3. Switch transmitter 2 on.
4. Turn rotary switch on transmitter 2 to A+B.
5. Enter the "Catch" command on transmitter 2 and actuate the start button.

Transmitter 2 now has sole access to all machine functions.

Notes:

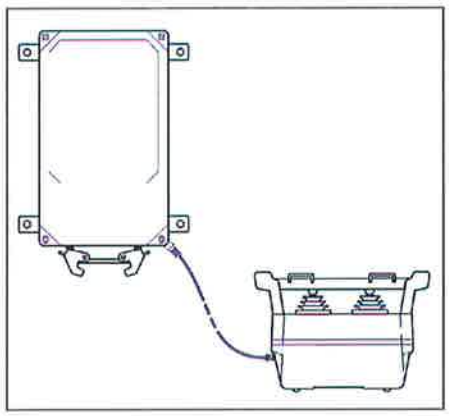
- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver is disrupted, the receiver has to be catched by the transmitter again.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. In this case, deactivate all transmitters paired with the receiver and shortly disconnect the operating voltage from the receiver. This will reset the system to the starting condition described above.
- Always activate the "catch" command after the radio connection has been disrupted in order to maintain the connection of your radio transmitter to the selected radio receiver(s).

Pre-selection of Trolley or Hoist

The operator is able to select the trolley or hoist that he wishes to control. It is also possible to simultaneously control both trolleys/hoists, for example in order to transport particularly long or wide loads.

Cable Option

With a cable you can generate a direct data connection between the transmitter and receiver. The radio transmission is disabled. At the same time, the power supply of the transmitter is provided through the cable, as well.



Connecting the cable

1. Switch the transmitter off.
2. Remove the screw lock on the transmitter and receiver.
3. Connect the transmitter and the receiver with the cable. Ensure that the connector is locked.
4. Switch the transmitter on.

Notes:

- If you connect the cable while working with the system, the transmitter will switch off automatically. Activate the transmitter as describe in the chapter "Operation" to switch to cable operation.
- When the system is in cable mode the transmitter will receive the supply voltage from the receiver, i.e. the transmitter can be used without the battery.
- If you disconnect the cable from the transmitter and receiver, the system will switch off automatically. Activate the transmitter as describe in the chapter "Operation" to switch to radio operation.

Performance and Availability (Optional)

The availability of the following options depends on the design and configuration of your radio control system.

Bank Switch

By switching operating levels via rotary switch or push button, the operator can choose between different operating levels. The number of available commands can be multiplied, even for small transmitters.

Reporting (Optional)

The availability of the following options depends on the design and configuration of your radio control system.

radiomatic® report – User Identification with merlin® TUC

The user identification function enables the management of access rights to your machines and protects them from unauthorized use. The login card merlin® TUC (Transmitter User Card) serves as a key to activate the control (see the description in the chapter "Activation with merlin® TUC"). In addition, the card can be configured individually. In connection with an HBC data logger, which is connected to the radio receiver, a user-based collection and detailed evaluation of diverse operational data of the radio system is possible.

Feedback to the Operator

Feedback by LED

Using this function, system or machine data can be displayed on the transmitter by LEDs.

Vibration Alarm

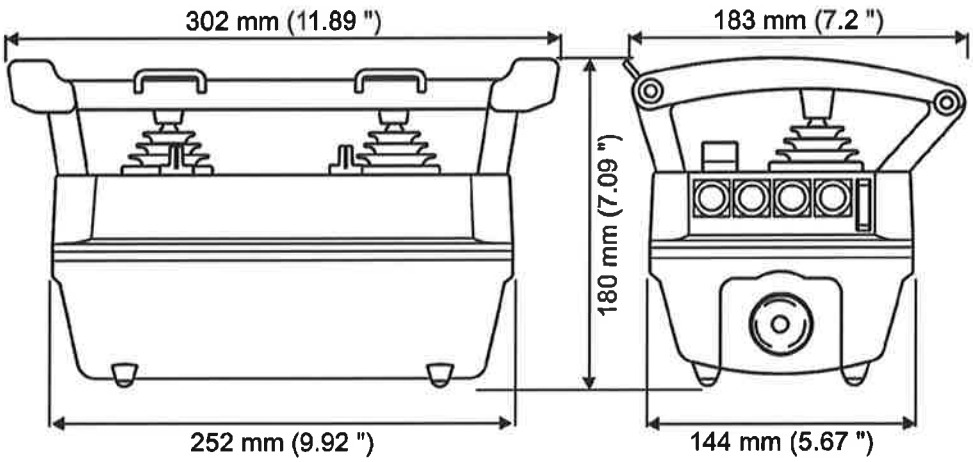
With the vibration alarm, the operator can be informed of an impending need to change the battery and/or potential dangers on the machine through the vibration of the transmitter. This information can be for example pre-warnings for high wind or threatening excess crane loads.

Technical Data

Max. number of control commands	Up to 32 switching commands (On / Off); up to 8 stepless commands for master switch / linear lever, up to 4 further stepless commands, e.g. for potentiometer; Number of control functions expandable via radiobus® modules
Unique system addresses	Over 1.000.000 combinations
Supply voltage	3,6 V
Safety function	E-STOP: Performance Level d, category 3 according to EN ISO 13849-1:2015
Frequency ranges	Narrow band: 405 – 475 MHz[1], 865 – 870 MHz, 902 – 928 MHz 2.4 GHz: 2402 – 2480 MHz DECT: 1790 – 1930 MHz
Channel spacing	Narow band: 12.5 / 25 kHz 2.4 GHz: 1 MHz DECT: 1.728 MHz
Antenna	Internal
Battery type	BA405___ (Li-Ion)
Battery capacity	6,4 Ah
Continuous operating time	Approx. 40 h
Operating temperature range	-20 °C ... +70 °C (-4 °F ... +158 °F)
Housing material	Glass-fiber reinforced plastic / PA6 GF30
Dimensions	302 x 180 x 183 mm (11.89 x 7.09 x 7.2 inches)
Weight (incl. battery)	Approx. 2.0 kg (4.41 lbs.)
Protection class	IP65

[1] Not all frequency ranges available.

Dimensions



Troubleshooting

Note:
Please check the functions using the cabin or cable controls first!

Problem	Possible Cause	Remedy
Transmitter does not react when switched on.	– No power.	– Check battery contacts for damage or contamination. – Insert a fully charged battery into the battery compartment. – Recharge battery.
No radio communication.	– Start-up routine has not been properly performed. – The receiver is out of the radio range of the transmitter (distance between transmitter and receiver is too large). – Radio link is impaired due to an obstacle (e.g. a building). – Interference in the radio channel (only for radio systems without automatic frequency management). – Source of interference (e.g. walkie-talkie) in close proximity to the transmitter or receiver.	– Activate the receiver before you switch on the transmitter. – Change your location or reduce the distance between transmitter and receiver. – Change the radio channel (for radio systems with manual / partially automatic frequency management). – If possible, remove the source of interference.
Low-power indication after minimal operating time.	– Battery contacts are contaminated or damaged. – Battery not charged. – Battery defective.	– Check battery contacts for damage or contamination. – Recharge battery. – Ensure that recharging process runs correctly. – Check transmitter functions using a fully charged or replacement battery.
The display in the transmitter flashes green but it is not possible to effect control commands.	– Receiver has no voltage. – No radio communication.	– Check the connecting cable to the receiver. – Check the functions via the LEDs in the radio status panel of the receiver.
Some commands are not carried out.	– Receiver defective. – Interruption in the connecting cable to the machine.	– Check if all connecting cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, distributor or HBC-radiomatic.

Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Check the STOP switch functionality at regular intervals. Dirt deposits on the switch can hinder the mechanism and impair the function.
- Check the rubber bellows or rubber seals of the operating elements at regular intervals for leak-tightness. Replace immediately if cracks appear since the penetration of dirt and humidity may damage the function of the operating elements.
- Never use a high-pressure cleaner or sharp or pointed objects to clean the transmitter.
- Charge and discharge transmitter batteries regularly.

In the Event of a Fault

Warning:
Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer warranty.
  - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and original spare parts.
  - Always send in the complete radio system (transmitter, receiver, batteries, battery charger, connection cables, and other equipment) and attach a detailed fault description.
  - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system; otherwise pack securely. Send the consignment to your distributor or to the following address:

  HBC-radiomatic GmbH
  Haller Str. 45 – 53
  74564 Crailsheim, Germany
  Phone: +49 7951 393-0
  Fax: +49 7951 393-50
  E-Mail: info@radiomatic.com
- If you wish to bring a defective radio system to your distributor or the factory by yourself, we kindly ask you to make an appointment in advance.

For an overview of our worldwide service and sales contacts, please visit our website www.hbc-radiomatic.com under "Contact".

Frequency List

Country block	Frequency range	Power	Channel spacing	AT	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GB	GR	HR	HU	IE	IS	IT	LI	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SK	SI	TR
	MHz	*mW e.r.p.*	*kHz*	*Country code according to ISO 3166*																																
AT-3	439.390 - 439.430	50	20	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-2*	456.170 - 456.430	10	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-72*	456.170 – 456.430	50	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-3*	466.170 - 466.410	10	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-73*	466.170 - 466.410	50	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-4*	456.170 - 456.430	10	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-74*	456.170 - 456.430	50	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-5*	459.530 - 459.590	10	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE-75*	459.530 - 459.590	50	20	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EU-1	433.100 - 434.750	10	25	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-
EU-2	433.100 - 434.675	10	12.5	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-
EU-3	869.725 - 869.975	5	25	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EU-5	434.075 - 434.775	10	25	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EU-7	434.075 - 434.775	10	12.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
EU-75*	434.075 - 434.775	50	25	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EU-83	863.100 - 869.950	25	45	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
FI-8*	408.575 - 409.975	10	12.5	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FI-9*	406.125 - 407.000	10	25	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FI-10*	441.200 - 442.750	10	25	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SE-1	438.025 - 439.975	10	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-
SE-71	438.025 - 439.975	50	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-

* National frequency range is subject to approval

Technology / System	Frequency range	Power	Channel spacing	Availability
	MHz	*mW e.i.r.p.*	*MHz*	
DECT	1790 - 1930	250	1.728	Available in all EU Member States, EFTA countries, Turkey and Great Britain.
2.4 GHz	2402 - 2480	100	< 1	Available in all EU Member States, EFTA countries, Turkey and Great Britain.
radiomatic® photon	2408 – 2472.5	50	3.5	Available in all EU Member States, EFTA countries, Turkey and Great Britain.

Translation

EN	Frequency List	Country block	Frequency range	Power	Channel spacing	Technology / System	National frequency range is subject to approval	Available in all EU Member States, EFTA countries, Turkey and Great Britain.
DE	Frequenzliste	Länderblock	Frequenzbereich	Leistung	Kanalraster	Technologie / System	Länderblock ist zulassungspflichtig	Verfügbar in allen EU-Mitgliedstaaten, EFTA-Staaten, Türkei und Großbritannien.
ES	Lista de frecuencias	Bloque de países	Gama de frecuencia	Potencia	Banda de canales	Tecnología / Sistema	El bloque de países está sujeto a aprobación	Disponible en todos los Estados miembros de la UE, Estados AELC, Turquía y Gran Bretaña.
FR	Liste des fréquences	Bloc pays	Gamme de fréquence	Puissance	Espacement des canaux	Technologie / Système	Le bloc pays est soumis à autorisation	Disponible dans tous les États membres de l'UE, les États de l'AELE et en Turquie ainsi qu'en Grande-Bretagne.
IT	Elenco delle frequenze	Blocco di Paesi	Campo di frequenza	Potenza	Griglia dei canali	Tecnologia / Sistema	Il blocco di Paesi è soggetto a obbligo di immatricolazione	Disponibile in tutti gli Stati membri dell'UE, negli Stati AELS, in Turchia e in Gran Bretagna.
PT	Lista de frequências	Bloco de países	Gama de frequência	Potência	Largura de banda do canal	Tecnologia / Sistema	O bloco de países é sujeito a autorização	Disponível em todos os Estados-Membros da EU, nos países da EFTA, na Turquia e no Reino Unido.
NL	Frequentielijst	Landenblok	Frequentiebereik	Vermogen	Kanaalraster	Technologie / Systeem	Landenblok is onderworpen aan goedkeuring	Beschikbaar in alle EU-lidstaten, EVA-landen, Turkije en in Groot-Brittannië.
RO	Lista de frecvențe	Bloc de țări	Domeniul de frecvență	Putere	Rester canale	Tehnologie / Sistem	Blocul de țări este supus aprobării	Disponibil în toate statele membre ale UE, statele EFTA, Turcia și Marea Britanie.
RU	План распределения частот	Группа стран	Диапазон частот	Мощность	Канальная сетка	Технология / Система	Для использования диапазона радиочастот в группе стран требуется лицензия	Доступно во всех странах-членах ЕС, странах ЕАСТ, Турции и Великобритании.
DA	Frekvensliste	Landeblok	Frekvensområde	Ydelse	Kanalraster	Teknologi / System	Landeblok kræver godkendelse	Fås i alle EU-medlemsstater, EFTA-stater og Tyrkiet og Storbritannien.
IS	Tíðnilisti	Landahópur	Tíðnisvið	Afköst	Résamörk	Tækni / Kerfi	Landahópur þarfnast samþykkis	Fáanleg í öllum aðildarríkjum ESB, EFTA-ríkjum Tyrklandi og Bretlandi.
NO	Frekvensliste	Landblokk	Frekvensområde	Effekt	Kanalrutenett	Teknologi / System	Landblokk krever godkjenning	Tilgjengelig i alle EU-medlemsland, EFTA-land Tyrkia og Storbritannia.
SV	Frekvenslista	Landsblock	Frekvensområde	Effekt	Kanalraster	Teknologi / System	Landsblocket kräver tillstånd	Tillgänglig i alla EU:s medlemsstater, EFTA-länderna, Turkiet och Storbritannien.
FI	Taajuusluettelo	Maaryhmä	Taajuusalue	Teho	Kanavarasteri	Teknologia / Järjestelmä	Maaryhmä edellyttää hyväksymismenettelyä	Saatavana kaikissa EU:n jäsenmaissa, EFTA-maissa, Turkissa ja Isossa-Britanniassa.
ET	Sagedusloend	Riigiblokk	Sagedusvahemik	Võimsus	Kanaliraster	Tehnoloogia / Süsteem	Riigiblokk vajab kasutusluba	Saadaval kõigis EL liikmesriikides, EFTA riikides, Türgis ja Suurbritannias.
HU	Frekvencialista	Országblokk	Frekvenciatartomány	Teljesítmény	Csatornaraszter	Technológia / Rendszer	Az országblokk engedélyköteles	Rendelkezésre áll minden EU-tagállamban, EFTA-tagállamban, Törökországban és Nagy-Britanniában.
LT	Dažnių sąrašas	Šalių blokas	Dažnių diapazonas	Galia	Kanalų išskirstymas	Technologija / Sistema	Šalių blokui būtinas leidimas	Yra visose ES valstybėse narėse, EFTA šalyse, Turkijoje ir Didžiojoje Britanijoje.
LV	Frekvenču saraksts	Valstu bloks	Frekvenču diapazons	Jauda	Kanālu tīklaine	Tehnoloģija / Sistēma	Valstu bloks ir jāsertificē	Pieejams visās ES dalībvalstīs, EFTA valstīs, Turcijā un Lielbritānijā.
PL	Lista częstotliwości	Blok międzynarodowy	Zakres częstotliwości	Moc	Rester kanałowy	Technologia / System	Blok międzynarodowy wymaga zezwolenia	Dostępne we wszystkich państwach członkowskich UE, państwach EFTA, Turcji i Wielkiej Brytanii.
CS	Seznam frekvencí	Blok zemí	Frekvenční rozsah	Výkon	Kanálový rastr	Technologie / Systém	Blok zemí vyžaduje povolení	K dispozici ve všech členských státech EU, státech EFTA, v Turecku a Velké Británii.
SK	Zoznam frekvencií	Blok krajín	Frekvenčný rozsah	Výkon	Kanálový raster	Technológia / Systém	Blok krajín si vyžaduje povolenie	K dispozícii vo všetkých členských štátoch EÚ, štátoch EFTA, Turecku a Veľkej Británii
SL	Seznam frekvenc	Blok držav	Razpon frekvenc	Moč	Širina kanala	Tehnologija / Sistem	Za blok držav je potrebna odobritev	Na voljo v vseh državah članicah EU, državah EFTA, Turčiji in Veliki Britaniji.
HR	Popis frekvencija	Blok država	Područje frekvencija	Snaga	Matrica kanala	Tehnologija / Sustav	Blok država zahtijeva odobrenje	Raspoloživo u svim državama članicama EU-a, EFTA-e, u Turskoj i u Velikoj Britaniji.
SR	Lista frekvencija	Grupa zemalja	Frekventni područje	Snaga	Rester kanala	Tehnologija / Sistem	Za grupu zemalja je obavezna dozvola	Dostupno u svim državama članicama EU, državama EFTA, Turskoj i Ujedinjenom Kraljevstvu.
BG	Списък с честотите	Блок от държави	Честотен диапазон	Мощност	Канален растер	Радиотехнология / Система	Блокът от държави подлежи на одобрение	На разположение във всички държави-членки на ЕС, държавите-членки на ЕАСТ, Турция и Великобритания.
EL	Λίστα συχνοτήτων	Ομάδα χωρών	Περιοχή συχνοτήτων	Ισχύς	Απόσταση καναλιών	Τεχνολογία / Σύστημα	Για την ομάδα χωρών υπάρχει υποχρέωση αδειοδότησης	Διατίθε(ν)ται σε όλες τις χώρες-μέλη της ΕΕ, στις χώρες της Ευρωπαϊκής Ζώνης Ελεύθερων Συναλλαγών (ΕΖΕΣ), στην Τουρκία και στη Μεγάλη Βρετανία.
TR	Frekans listesi	Ülke bloğu	Frekans alanı	Güç	Kanal bant genişliği	Teknoloji / Sistem	Ülke bloğu için ruhsat zorunludur	Tüm Avrupa Birliği ülkelerinde, EFTA ülkelerinde ve Türkiye'de ve Büyük Britanya'da mevcut.

EU Declaration of Conformity

Manufacturer: HBC-radiomatic GmbH | Haller Straße 45 - 53 | 74564 Crailsheim | Germany

Product designation:
Fabrication number:

spectrum 2
G II
727-2204853

The manufacturer hereby declares under sole responsibility that the product mentioned above conforms to the following EU harmonization legislation:

- 2006/42/EG Machinery Directive, Annex II 1 A (safety component)
- 2014/53/EU Radio Equipment Directive (RED)
- 2011/65/EU Directive on the Restriction of Hazardous Substances (RoHS)

The product mentioned above also complies with the protective goals of the following EU Directives:

- 2014/35/EU Low Voltage Directive (see Annex I, 1.5.1 of the Machinery Directive 2006/42/EG)
- 2014/30/EU Directive relating to electromagnetic compatibility (EMC)

The following harmonized standards were applied:

- EN ISO 13849-1:2015
- EN 60204-1:2018
- EN 60204-32:2008
- EN 61010-1:2010
- EN IEC 61010-2-201:2018
- EN 13557:2003 + A2:2008 (Annex C)
- EN 301 489-1 V1.9.2
- EN IEC 63000:2018
- EN 300 330 V2.1.1
- EN 62479:2010
- EN 62745:2017

For short-range device systems: EN 300 220-2 V3.1.1
For private mobile radio systems: EN 300 113 V2.2.1
For DECT systems: EN 301 406 V2.2.2
For 2.4 GHz systems: EN 300 328 V2.2.2

Valid signature:

Place, date: Crailsheim, 2021-11-22
Authorized person for documentation: Timo Becker

First name, last name: Dr.-Ing. Friederike Brendel
Position: Technical CEO

Quality in Control.

Operating Instructions

Original Operating Instructions

FSE 727 radiobus®

YO7200G0

HBC radiomatic

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Attachments: System specific views, circuit diagrams and / or output wiring.

Pictographs

Danger due to electrical voltage. Touching live parts inside the unit can be fatal or cause serious injuries.

Instructions for occupational health and safety. Not following these instructions can lead to accidents that can cause damage, serious injuries or even death.

Important information about the operation of the radio system.

Manufacturer:
HBC-radiomatic GmbH • Haller Straße 45 – 53 • 74564 Crailsheim • Germany • Tel. +49 7951 393-0 • info@radiomatic.com.

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Safety Instructions

Read these operating instructions carefully before working with the radio system. This applies in particular to the installation, commissioning and maintenance of the radio system.
The operating instructions are a constituent part of the radio control system and must always be kept close at hand for the responsible personnel.
The term 'machine' is used in the operating instructions for the different possible uses of the radio system.

Intended Use

- The radio system is used for the control of machines and for data transfer. Observe the occupational safety and accident prevention regulations applicable to each application.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved for these uses by the manufacturer.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The safety devices of the radio control system must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete E-STOP system are not allowed.

Safety Instructions for Installation and Operation

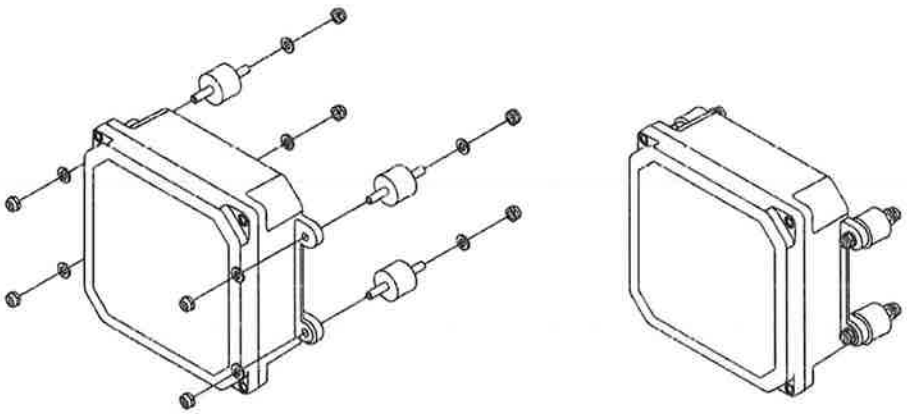
- The electrical connection according to the enclosed output wiring diagram must be established by a qualified electrician exclusively.
- The receiver may only be opened by trained personnel. Components inside the receiver can be energized at life-threatening voltages. The supply voltage for the machine must be disconnected before the receiver is opened.
- The power supply of the machine control as well as the contacts for external switching devices may only be connected to electrical circuits that have an all-pole separation device. (One separation device for the power supply and at least one separation device for the external switching devices.)
- For bus systems, the electronics of the machine needs to examine all control commands that belong to the Safety Circuit 2 for plausibility using the Si-2 hardware output on the side of the radio; in case there are implausibilities, it has to initiate the safe state immediately.
- Please also note that, with radio systems, the presence of persons in the danger zone – in particular beneath the load (cranes!) – is prohibited in all cases.
- Select a safe location for radio control, from which you have a good and complete view of the working movements of the machine, the load movements and the surrounding working conditions.
- It is not permissible to leave a radio transmitter unattended while it is activated. Always switch off the radio transmitter when it is not needed. This applies in particular if you change location, when working without radio control, during breaks and at the end of work. Always protect the radio transmitter against use by unauthorized persons, for example by locking it away.
- In the event of an emergency and with all faults, switch off the radio transmitter immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could influence safety must be rectified by specialists who have been trained and authorized by HBC-radiomatic before the system is put back into operation.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before starting to work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.

Installation

- The receiver should be mounted vertically with the cable connection downwards.
- Ensure that there are no metal parts within a radius of 1 m (3 feet) above the receiver.
- When the receiver has to be mounted in a control cabinet, a car antenna must be installed.
- Receivers with external antenna must be installed in such a way that the antenna stands freely and does not touch walls or metal parts. Otherwise a car antenna must be used, which can be supplied if needed.
- Receivers with plastic housing should be protected against direct sunlight (UV radiation) by appropriate measures.

Installation with Mounting Loops

The receiver is installed via the integrated mounting loops on the receiver sides. Use the shock mounts provided for installation to dampen any vibrations that may occur.



Module focus C/D/T (Option)

focus C

When several cranes are operated in tandem operation, a safe communication between the cranes is crucial. I. For example, one crane reaches the limit switch and is stopped automatically, the other crane has to be stopped as well in order to prevent dangerous situations.

focus C ensures a smooth crane communication in tandem operation. Using a CAN interface saves a great amount of wiring effort and thus valuable time!

focus D

As an external RF module with DECT interface, focus D ensures an optimal radio connection, even under difficult circumstances.

focus T

As an external RF module, focus T offers a perfectly working radio connection, even under difficult circumstances over a great distance. Depending on the working situation, up to 15 modules can be installed in different positions. As additional radio receivers, they receive all commands from the radio transmitter and relay it to the central receiver. There, they are analyzed and sent to the machine as output commands.

Obstacles in the radio path can thus be efficiently avoided and even long distances can be bridged with ease.

focus T can be combined with all HBC receivers of the radiobus® generation.

Installation

- Mount the module with 4 screws (M 5) via the provided drill holes (refer to chapter Dimensions).
- Do not install the module into a niche or a control cabinet.
- Ensure that there are no metal parts within a radius of 1 m (3 feet) above the module base.

Electrical Connection

The module is connected to a radio receiver via a 5-pin circular connector.
Please observe that the module may only be connected to the supply voltage indicated on the type plate!

Warning – shock hazard

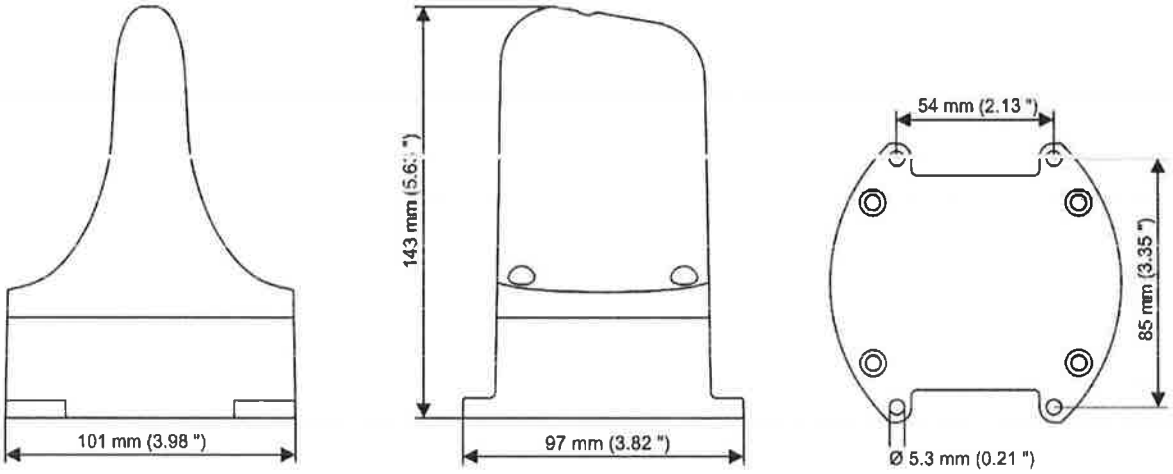
- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.

Control LED

A dual LED is located next to the cable connection in the module base.

- The LED illuminates red as soon as operating voltage is present at the module. The connection to the radio receiver is established and the internal operating voltage (10 – 30 V) is present.
- The LED illuminates green when the transmitter is switched on and the module receives a valid signal on its radio frequency.

Dimensions



Electrical Connection

Depending on the version, the radio receiver is connected either via a cable gland or with a Harting plug connection to the machine electrics.
Please observe that the receiver may only be connected to the supply voltage indicated on the type plate!

Warning – shock hazard!

- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.
- Switch off the supply voltage before opening the receiver. There is a risk of fatality from touching live parts inside the housing!

Control Display

A control display with LEDs indicating the operating state of the radio system is located in the upper housing part.

The LEDs have the following meaning:

Control display		**Simplex procedure** (Data are only transmitted from the transmitter to the receiver.)
Meaning	**Color**	**Receiver**
On	yellow	Illuminates as soon as the receiver is connected to the supply voltage.
RF	red	Illuminates as soon as the radio connection is interrupted.
Si1	green	Illuminates as soon as the E-STOP relays are closed.
Si2	green	Illuminates as soon as a drive command is output.
Feedback	yellow	Off. (Not available for FSE 508 / 509 / 512.)

Control display		**Duplex procedure** (Data are transmitted in both directions. Non-safety-relevant data are transmitted in the feedback.)
Meaning	**Color**	**Receiver**
On	yellow	Illuminates as soon as the receiver is connected to the supply voltage.
RF	red	Illuminates as soon as the radio connection is interrupted.
Si1	green	Illuminates as soon as the E-STOP relays are closed.
Si2	green	Illuminates as soon as a drive command is output.
Feedback	yellow	Illuminates as soon as a feedback telegram is transmitted. (Not available for FSE 508 / 509 / 512.)

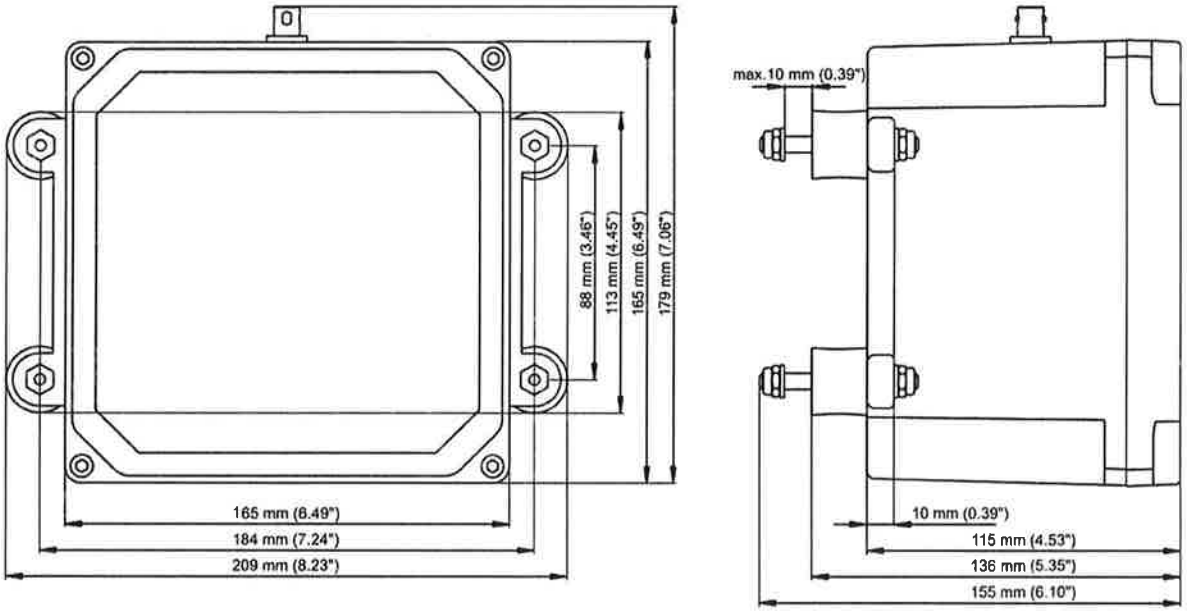
Technical Data

Max. number of control commands	26 digital or 10 analog (maximum number of digital commands depending on the configuration)
Unique system addresses	Over 1 000 000 combinations
Supply voltage	10 – 30 V DC
Power consumption	Max. 14 W
Inputs	Analog / digital: depending on equipment with input modules
Outputs	-
Interfaces	CANopen, CANsafety, Profibus-DP, RS485, RS232, DeviceNet, SAE J1939, Profinet, IQAN Cable option
E-STOP resp. Si1, Si2 control unit	1 x E-STOP output, high-side switch 10 A
Safety function	E-STOP: Performance Level d, category 3 according to EN ISO 13849-1:2015
Frequency ranges	405 – 475 MHz[1], 865 – 870 MHz, 902 – 928 MHz, 1210 – 1258 MHz[1] 2,4 GHz: 2402 – 2480 MHz DECT: 1790 – 1930 MHz
Channel spacing	12.5 / 20 / 25 / 50 / 250 kHz 2.4 GHz: 1 MHz DECT: 1.728 MHz
Connection	Harting Han 32 Option: Harting Han 25 or Han 50 Option: cable glands (metric M20/32)
Antenna	External, FL 30 or FL 70 Option: car antenna with 5 m cable and BNC connector Internal (option DECT) focus D (option DECT)
Operating temperature range	-25 °C ... +70 °C (-13 °F ... +158 °F)
Housing material	Plastic
Dimensions	165 x 165 x 115 mm (6.5 x 6.5 x 4.5 inches)
Weight	Approx. 2.6 kg (5.7 lbs.)
Protection class	IP 65

[1] Not all frequency ranges available.

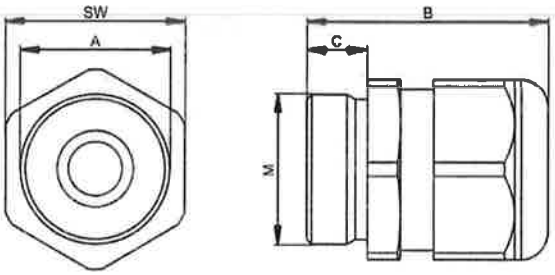
Dimensions

Receiver Housing HR168



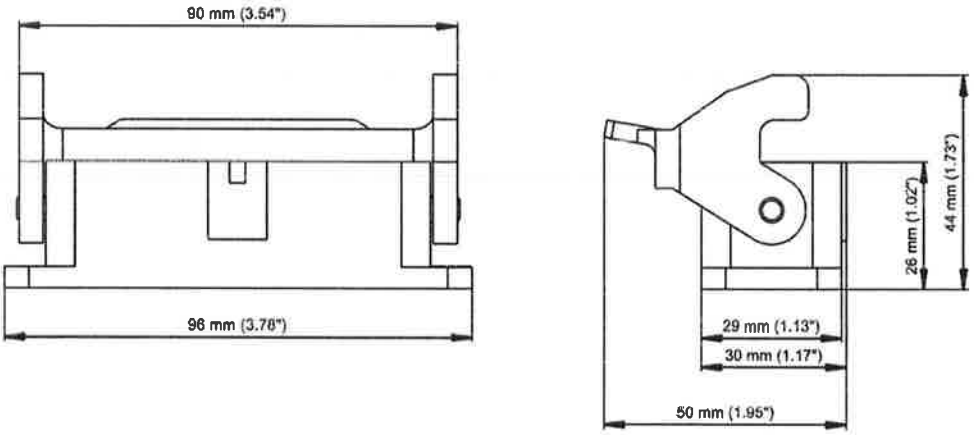
Connection Options

Metrical Cable Glands M20/32

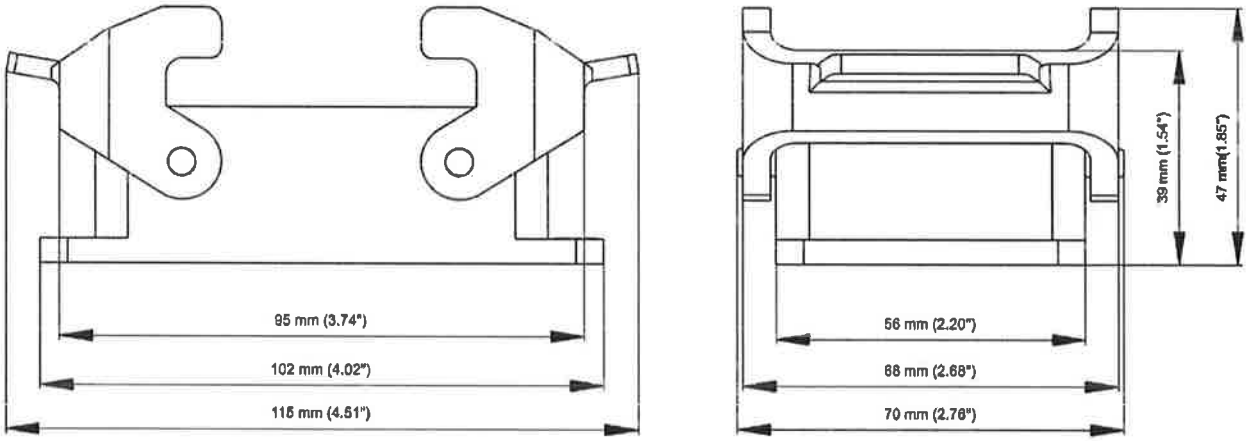


M	SW	A	B	C
M20	24 mm	5-9 mm	36 mm	9 mm
M32	36 mm	11-21 mm	47 mm	10 mm

Harting Plug Connection Han 25



Harting Plug Connection Han 32/50



Troubleshooting

Note:
Please check the functions using the cabin or cable control first!

Problem	Possible Cause	Measures
Transmitter does not react when switched on.	– No power.	– Check battery contacts for damage or dirt. – Insert a fully charged battery into the battery compartment. – Recharge battery.
Low-power indication after minimal operating time.	– Battery contacts are dirty or damaged. – Battery not charged. – Battery defective.	– Check battery contacts for damage or dirt. – Recharge battery. – Ensure that recharging process runs correctly. – Check transmitter functions using a fully charged or replacement battery.
Some commands are not carried out.	– Receiver defective. – Interruption in the connecting cable to the crane or machine.	– Check if all connecting cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, dealer or HBC-radiomatic GmbH.

Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Never use a high pressure cleaner or sharp or pointed objects to clean the receiver.
- Whenever welding the machine:
  - Switch off the radio control system.
  - Switch off the machine.
  - Disconnect all electrical connections to the receiver.

  Otherwise the receiver electronics can be destroyed.

In the Event of a Fault

Warning:
Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer warranty.
  - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and OEM spare parts.
  - Always send in the complete radio system (transmitter, receiver, batteries, battery charger, connection cables, and other equipment) and attach a detailed fault description.
  - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system; otherwise pack securely. Send the consignment to your distributor or to the following address:

  HBC-radiomatic GmbH
  Haller Str. 45 – 53
  74564 Crailsheim, Germany
  Phone: +49 7951 393-0
  Fax: +49 7951 393-50
  E-Mail: info@radiomatic.com
- If you wish to bring a defective radio system to your distributor or the factory by yourself, we kindly ask you to make an appointment in advance.

For an overview of our worldwide service and sales contacts, please visit our website www.hbc-radiomatic.com under "Contact".

EU Declaration of Conformity

Manufacturer: HBC-radiomatic GmbH I Haller Straße 45 - 53 I 74564 Crailsheim I Germany

Product designation: FSE 727
Fabrication number: 727-2204854

The manufacturer hereby declares under sole responsibility that the product mentioned above conforms to the following EU harmonization legislation:

- 2006/42/EG Machinery Directive, Annex II 1 A (safety component)
- 2014/53/EU Radio Equipment Directive (RED)
- 2011/65/EU Directive on the Restriction of Hazardous Substances (RoHS)

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For private mobile radio systems: EN 300 113 V2.2.1
For DECT systems: EN 301 406 V2.2.2
For 2.4 GHz systems: EN 300 328 V2.2.2

Valid signature:

Place, date:	Crailsheim, 2021-11-23	First name, last name:	Dr.-Ing. Friederike Brendel
Authorized person for documentation:	Timo Becker	Position:	Technical CEO

Quality in Control.

Operating Instructions

Original Operating Instructions

spectrum D

AOSDOG03

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Attachments: Frequency list for EU member states, EFTA states, and Turkey, EU Declaration of Conformity, system specific views, circuit diagrams and /or output wiring.

Pictographs

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Manufacturer:
HBC-radiomatic GmbH • Haller Straße 45 – 53 • 74564 Crailsheim • Germany • Tel. +49 7951 393-0 • info@radiomatic.com

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- In the event of an emergency and with all faults, switch off the radio transmitter immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could influence safety must be rectified by specialists who have been trained and authorized by HBC-radiomatic before the system is put back into operation.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before starting to work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.
- Before starting to work, examine the STOP switch for mechanical ease of motion and electronic function at least once a day:
  When you press the STOP switch with the transmitter on, the status LED and the display of the transmitter have to go out. If the status LED and the display don't go out then you have to disable the radio control system immediately.
  Remove the battery and the radiomatic® iLOG from the transmitter and inform a service technician.

Operation

The transmitter is equipped with an electronic radiomatic® iLOG key. radiomatic® iLOG contains all the data required for operating the transmitter. Operation is not possible without radiomatic® iLOG!
Depending on the version the radiomatic® iLOG can also be used for operation of replacement transmitters of identical construction.

When activating the transmitter and if the radio connection is interrupted (e.g. if the connection is lost or the transmission range is exceeded), the transmitter reacts with the so-called enforced zero-position.
Release all operating elements so they can return to the zero-position and actuate the start button. The machine will not react if the operating elements are not in zero-position. This prevents uncontrolled machine movements after the radio connection has been interrupted.

Activating the Transmitter

The steps 3 and 4 need to be carried out within **5 seconds**:

1. Insert a charged battery into the battery compartment.
2. Turn the STOP switch to unlock.
3. Shortly actuate the start button and then release. The transmitter will switch off if the button is pressed for longer than half a second!
4. Actuate the start button again until the status LED flashes green. Then release the button.
   The transmitter is now ready for operation.
5. Depending on the application, you must actuate the start button again before movement commands can be carried out.

Note:
The transmitter switches off when

- the start button is pressed for longer than half a second in step 3 of the start sequence.
- the start sequence (steps 3 and 4) takes over 5 seconds.
- another button is pressed during the start sequence.

You must then repeat steps 3 and 4 or 3 to 5.

With HBC Smart Card

1. Insert a charged battery into the battery compartment.
2. Turn the STOP switch to unlock.
3. Press the start button. The status LED flashes green 2 times and red 1 time per second.
4. Hold the HBC Smart Card to the position on the transmitter marked with this symbol (cf. illustration). The transmitter vibrates and an acoustic signal sounds. When the status LED flashes green, the transmitter is ready to operate.

Note:
The transmitter can only be activated with a valid Smart Card. If you use a card that does not match the respective transmitter or is not approved for this transmitter, the transmitter vibrates 3 times. At the same time an acoustic signal sounds. The transmitter is automatically shut down after 2 seconds. Please contact your superior in such cases.

The transmitter also shuts down if the start sequence is not completed within 10 seconds. In this case press the start button and repeat the procedure!

Caution:
Before starting work always trigger the acoustic signal. This warns all colleagues that the machine is about to move.

Deactivating the Transmitter

Press the STOP switch.

Note:
Replace the battery when the battery display illuminates red, an acoustic signal sounds, the status LED flashes red and the transmitter vibrates (option). Otherwise, the transmitter will switch off in a few minutes.
Recharge the empty battery in the respective charger.

Automatic Power Off (APO) function

The transmitter is equipped with an automatic power off (APO) function and will automatically shut off approx. 15 min after the last command input.
The automatic power off serves to increase safety and also saves battery power.

After an automatic power off, the transmitter must be reactivated as described in the chapter "Operation".

Caution:
The automatic power off does not relieve the operator of the responsibility to turn off the transmitter with the STOP switch when not in use.

Display

Field strength

The field strength indication provides information about the quality of the radio connection. With an optimum connection, all 5 bars are displayed. The field strength indication is always visible when the transmitter is turned on.

Field strength is indicated in the following degrees:

Strong received signal

Weak received signal

No signal

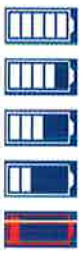
Note:

If symbol is displayed the risk of the radio connection being interrupted is imminent. Ensure that the radio connection is not impaired by an obstacle (e.g. a building) and ensure that you are within the range of the radio system. It may be necessary to change the working position.

Battery

The battery indication provides information about the current condition of the battery. It is always visible when the transmitter is turned on.

The battery status is displayed in the following degrees:



The battery is charged.

Pre-warning: The battery needs to be charged soon.

The battery needs to be charged. The status LED in the transmitter flashes red and an acoustic signal sounds. Exchange the battery. Otherwise, the transmitter will switch off in a few minutes. Recharge the empty battery in the respective charger.

Note:

A detailed description of the display has to be part of the operating manual of the specific machine in use. All instructions the operator has to follow in connection with the feedback information have to be written there as well.

Battery and Battery Charger

NiMH Battery

The battery capacity (= amount of electric current that can be stored) and the battery charge (= actual amount of stored current) depend on the age of the battery and the environment temperature. Older batteries begin to lose their capacity over time. At temperatures below 0 °C (32 °F) and above 40 °C (104 °F), less current can be obtained.

Please observe the following safety instructions in any case. Improper use can lead to injuries.

Safety instructions:

- Only use the batteries with the respective intended devices.
- Never use or charge damaged or faulty batteries.
- Do not short-circuit, damage or open batteries or expose them to fire. Always use the enclosed protection cap for storing the batteries.
- Charge the batteries completely before storing them for a longer period. The battery may be deep discharged otherwise. Observe the date on the battery.
- Only charge the batteries with the respective HBC charger.
- Charge the batteries at an ambient temperature of 10 – 40 °C (50 – 104 °F).
- Do not expose the batteries to direct sunlight.
- Recycle or dispose of batteries according to the respective regulations.

Notes:

- Completely charge all batteries before initial use. This ensures that the batteries have their full capacity available when used for the first time.
- Charge the battery only when the battery display illuminates red, an acoustic signal sounds, the status LED flashes red and the transmitter vibrates (option).
- Store the batteries at -15 – +35 °C (5 – 95 °F).
- When they are stored, recharge the batteries at intervals not exceeding 6 months.

When handled properly, NiMH batteries by HBC-radiomatic can reach up to 500 charging cycles. Even after that, your batteries can be used for some time with a slightly decreased capacity.

Battery Charger

Depending on customer selection, an AC or DC charger is available. A connection cable with a suitable power plug is included in the delivery.

Please observe the following safety instructions in any case. Improper use of the charger may result in fire or electric shocks. This can lead to life-threatening injuries, which may be fatal under certain circumstances.

Safety instructions:

- Only use the charger to charge batteries indicated on the type plate.
- Do not use the charger in hazardous locations or near explosive substances.
- Use the charger only with the supply voltage indicated on the bottom of the charger.
- Only use the charger in vehicles or dry rooms.
- Only use the charger within the indicated temperature range of 10 – 40 °C (50 – 104 °F).
- Protect the charger from overheating, dust and moisture.
- Do not cover the charger during the charging operation.
- If the charger is not being used, disconnect it from the power supply.
- Do not use the charger if there is a fault on the device or the connection cable.
- Do not perform technical alterations on the charger or the connection cable.

Maintenance and servicing:

- Disconnect the power plug before cleaning the charger.
- Keep the contacts of the charger and the battery free from dirt in order to ensure the perfect functioning of the charger.

Charging the Battery

1. Connect the charger to the power supply via the connection cable.
2. Insert the battery into the charging slot.

The charging process will start automatically.

Charging indication:

The current operating status is indicated via three LEDs.

LED **green**: Illuminates when the battery is charged.
LED **orange**: Illuminates when the battery is being charged.
LED **red**: Illuminates when the battery is deep discharged or faulty.

Note:
When a deep discharged battery is inserted into the charger, the red LED illuminates for some time before the charging process (orange LED illuminates) starts.

Technical Data QA115600 / QD115300	
Operating voltage	100 – 240 V AC (QA115600) 10 – 30 V DC (QD115300)
Charging time	< 5 h
Operating temperature	10 – 40 °C (50 – 104 °F)
Housing material	Plastic
Protection class	II
Charging method	CC

Options

The availability of the following functions depends on the design and configuration of your radio control system.

Safety Features

radiomatic® shock-off / zero-g / inclination switch

In specific emergency situations, these safety features can prevent unintended movement commands from being given to the machine, protecting the operator as well as other personnel in close proximity to the machine in use.

radiomatic® shock-off can react if the transmitter receives a hard impact.

radiomatic® zero-g can react if the transmitter is falling down or being thrown.

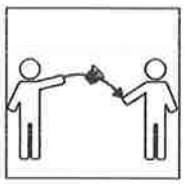
inclination switch can activate if the transmitter exceeds an inclination angle of approx. 45° for a specified time and/or is positioned upside down.

Depending on the ordered version the features can operate in three different ways:

- The complete radio system is shut down.
- Safety-relevant functions are deactivated.
- A previously defined function (e. g. crane horn) is activated.

In addition the symbol SAFETY FEATURE is shown in the display.

To deactivate the features, press the start button until the status-LED flashes green and the symbol SAFETY FEATURE disappears. Then the transmitter is ready to operate again.



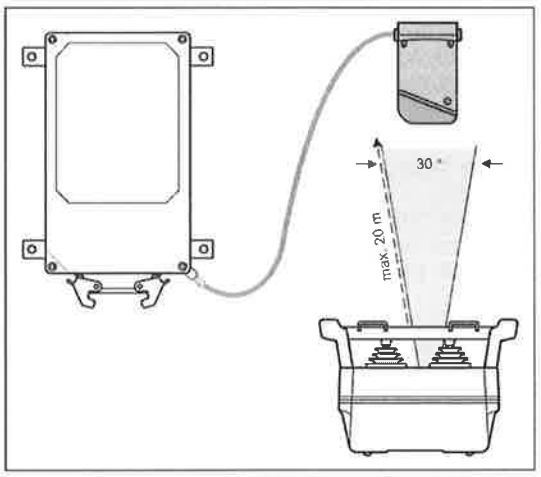
The safety features do not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.

radiomatic® infrakey

The radio system can only be activated via an infrared link between the transmitter and the receiver. This increases the safety of operation, i.e. the machine can not become inadvertently enabled.

radiomatic® infrakey operates either with an infrared module in the receiver housing (radiomatic® infrakey internal) or with the offset infrared antenna focus I (radiomatic® infrakey external).

To activate radiomatic® infrakey, actuate the start button on the transmitter.



Function of radiomatic® infrakey with focus I

Notes:

- The range of the infrared beam is max. 20 m (66 ft).
- The angle of radiation is 30°.
- The front panel of the receiver must be visible (only radiomatic® infrakey internal).

Joystick with Deadman Function

In order that it is possible to issue control commands the button integrated into the joystick must be pressed before the joystick is moved. The function then reverts to self-locking and remains effective until the joystick is back in the zero position. This enables the avoidance of potential risks through the unintentional actuation of the joystick.

radiomatic® report – User Identification

The "user identification" function with the HBC Smart Card enables a simple personalization of the radio system as well as the storage of all user profiles in the radio system. Safety relevant functions can be released to authorized personnel only and unauthorized users can be protected of potentially dangerous situations. In addition the radio system can store user-related all operating processes as well as the respective on time of the radio system. This data can be read from the radio system and shows how long the radio system was in use and how the individual operators used the various functions of the radio system.

Enabling switch

The two-step enabling switch provides enhanced safety during maintenance and service work on or in the machine as well as for applications with multiple users. In order to transmit control commands to the machine, the operator has to keep the switch pushed into the first step. Only then the other operating elements are activated. If the operator releases the button or pushes it into the second step (e.g. as the result of a cramp), all machine functions are immediately stopped. With this, the operator is protected from dangerous unintended movements of the machine in case he should lose consciousness or no longer has control over the transmitter.

If an application is controlled by more than one operator, movement commands can only be performed if all operators keep the enabling switch pushed into the first step.

Vibration Alarm

With the vibration alarm, the operator can be informed of an impending need to change the battery and/or potential dangers on the machine through the vibration of the transmitter. This information can be for example pre-warnings for high wind speeds or threatening excess crane loads.

Front Panel Lighting

With the front panel lighting potential dangers resulting from incorrect operation, based on poor visibility, can be prevented. The operator simply switches on multiple LEDs, which are integrated into the rollover bar, with a switch or button on the transmitter.

Shut-off on Implausible Control Commands

The automatic shut-off will activate after a sequence of multiple questionable movement commands. If for example, the operator moves the joystick successively in different directions in an irregular manner.
This function protects the operator and the whole work environment from potential dangers as well as the machine from wear resulting from rapid and erratic movements.

Depending on the ordered version this function can operate in three different ways:

- The complete radio system is shut down.
- Safety-relevant functions are deactivated.
- A previously defined function (e. g. crane horn) is activated.

To deactivate the function, press the start button until the status LED flashes green.
Then the transmitter is ready to operate again.

Micro Drive

With the micro drive function the speed of the machine is limited to a preselected level. Even at full movement of the joystick/linear lever, the operator can not exceed this speed limit. In this manner demanding drive maneuvers can be managed and inexperienced users can be protected from potential dangers that can result from "speeding".

Orthogonal Drive (Electronic Cross Gate)

With the orthogonal drive function dangerous situations, caused by unintentional diagonal movements are being prevented. The operator will have to return the joystick back to zero position before another directional command can be activated. This function is suitable for example for situations where the operator has to make precision commands in confined areas. Diagonal movements are not possible.

Frequency Management

Fixed Frequency

If the identification plate in the battery compartment of the transmitter shows a frequency value (e.g. 433,500 MHz), the transmitter operates with a fixed frequency.
Please contact you service department if the frequency has to be changed because the radio channel is already assigned to another user.

Manual Frequency Switching

If the identification plate in the battery compartment of the transmitter shows the label **man**, the transmitter features manual frequency switching.
This function can be used to change the radio channel during radio operation.
Depending on the version move the cursor to the corresponding softkey and press the radiomatic® iCON until an acoustic signal sounds. Then release the radiomatic® iCON. Or press the ⏻ button until an acoustic signal sounds. Then release the button.
Please contact your service department if all available frequencies are occupied.

radiomatic® AFS

If the identification plate in the battery compartment of the transmitter shows the label **AFS**, the transmitter is equipped with radiomatic® AFS (Automatic Frequency Selection).
When activating the transmitter radiomatic® AFS will check if the present radio channel is free. If the radio channel is occupied, the system automatically finds and saves a free radio channel.
If the radio channel currently in use is occupied by another radio control system, you must switch the transmitter off and on again in order to allow radiomatic® AFS to switch to a free radio channel.
The radiomatic® AFS option also includes the manual frequency switching function.

Note:
If radiomatic® AFS is to perform optimally, all the other radio systems in the immediate working environment (e.g. the factory hall or building site) should be switched on before starting to use the radio system for the first time. This allows radiomatic® AFS to detect automatically which radio channels are already being used in the working area, and thereby to choose a suitable free channel for its own use.

In addition, when switching the radio system on for the first time, the user should make sure that his distance from the radio receiver and from the machine is a realistic reflection of the working situation.

radiomatic® AFM

If the identification plate in the battery compartment of the transmitter shows the label **AFM** the transmitter is equipped with radiomatic® AFM (Automatic Frequency Management).
radiomatic® AFM detects available radio channels constantly. If the radio channel currently in use is occupied by another radio control system, radiomatic® AFM switches automatically to a free radio channel.

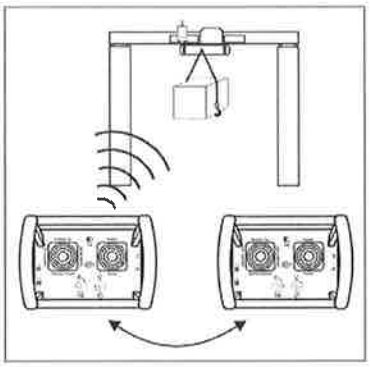
DECT

DECT technology is an extremely convenient method for uninterrupted radio control without frequency conflicts. The operator always works on a free radio channel and does not need to make manual settings.

2.4 GHz technology

2.4 GHz technology works with automatic frequency coordination and thus ensures interruption-free working in areas with many radio users. Manual frequency coordination is not necessary. With the worldwide frequency band, 2.4 GHz technology can be used all over the world.

Catch-Release



Via the Catch-Release option two or more transmitters can control a machine alternately.
When the receiver is switched on, the machine can initially be controlled via any associated transmitter. Once the receiver was taken over by one transmitter, the other transmitters no longer have access.

Take over machine

1. Switch the transmitter on.
2. Enter the "Catch" command on the transmitter and actuate the start button.

The access rights for the machine remain with that transmitter until the "Release" command is issued by that transmitter.

Release machine

1. Enter the "Release" command on the transmitter.
2. Switch the transmitter off.

The access rights for the machine are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over the machine. Transmitter 2 is to be given control.

1. Enter the "Release" command on transmitter 1.
2. Switch transmitter 1 off.
3. Switch transmitter 2 on.
4. Enter the "Catch" command on transmitter 2 and actuate the start button.

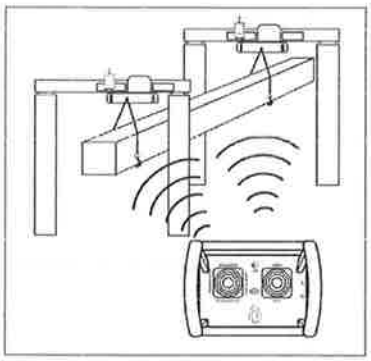
Transmitter 2 now has sole access to all machine functions.

Notes:

- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver fails, the receiver returns to the starting condition in which it can be adopted by any transmitter. If necessary, the receiver must be adopted anew.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. The starting condition described above can only be resumed by deactivating the operating voltage at the receiver.

Tandem Operation

Tandem Operation T1



The radio system consists of 1 transmitter and 2 receivers for 2 machines. The transmitter can control the machines individually or in parallel.

The machines are selected at the transmitter via a rotary switch:
A only machine A
A+B machine A + machine B
B only machine B

Tandem Operation T2

The radio system consists of 2 transmitters and 2 receivers for 2 machines. Both transmitters are master transmitters and can control the machines individually or in parallel.
During normal operation transmitter 1 controls machine A and transmitter 2 controls machine B. In order to be able to switch to machine B or A+B at transmitter 1, for example, the key must be removed from transmitter 2 and inserted in transmitter 1.

The machines are selected at the transmitter via a rotary switch:
A only machine A
A+B machine A + machine B
B only machine B

Operating Example: Control of machine A + B via transmitter 1.
1. Switch transmitter 1 and 2 off and remove the key from transmitter 2.
2. Insert the key from transmitter 2 in transmitter 1.
   Machine selection via transmitter 1 is activated.
3. Turn the rotary switch of transmitter 1 to A+B.
4. Switch transmitter 1 on and actuate the start button.

The radio system now operates in tandem mode.

Warning:
For safety reasons, it is imperatively required that only one key is available for each transmitter. The spare key must be stored at a superior, authoritative position and only be handed out in clarified cases.

Tandem Operation TM/TS

The radio system consists of 2 transmitters and 2 receivers for 2 machines. One transmitter is a master transmitter and can control the machines individually or in parallel. The other transmitter is a slave transmitter and can only control machine B.
In order to be able to switch to machine B or A+B at the master transmitter, the key must be removed from the slave transmitter and inserted in the master transmitter.

The machines are selected at the transmitter via a rotary switch:
A only machine A
A+B machine A + machine B
B only machine B

Operating Example: Control of machine A + B via master transmitter.
1. Switch master and slave transmitter off and remove the key from slave transmitter.
2. Insert the key from slave transmitter in master transmitter.
   Machine selection via master transmitter is activated.
3. Turn the rotary switch of master transmitter to A+B.
4. Switch master transmitter on and actuate the start button.

The radio system now operates in tandem mode.

Warning:
For safety reasons, it is imperatively required that only one key is available for each transmitter. The spare key must be stored at a superior, authoritative position and only be handed out in clarified cases.

Catch-Release-Tandem Operation

With the Catch-Release-Tandem Operation two or more transmitters can control several machines alternately.
Each machine is equipped with a receiver that can receive and monitor all transmitter frequencies.
After activating the receivers all transmitters have equal access to the radio control system.

Take over machine

1. Switch the transmitter on.
2. Turn rotary switch on the transmitter to the respective position.
3. Enter the "Catch" command on the transmitter and actuate the start button.

The transmitter with control over the machine(s) retains the access to the receiver until the operator has issued the "Release" command.

Release machine

1. Enter the "Release" command on the transmitter.
2. Switch the transmitter off.

The access rights for the machine(s) are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over machine A. Transmitter 2 is to be given control over machine A+B.

1. Enter the "Release" command on transmitter 1.
2. Switch transmitter 1 off.
3. Switch transmitter 2 on.
4. Turn rotary switch on transmitter 2 to A+B.
5. Enter the "Catch" command on transmitter 2 and actuate the start button.

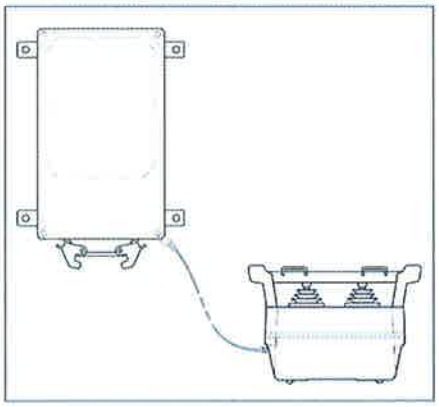
Transmitter 2 now has sole access to all machine functions.

Notes:

- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver fails, the receiver returns to the starting condition in which it can be adopted by any transmitter. If necessary, the receiver must be adopted anew.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. The starting condition described above can only be resumed by deactivating the operating voltage at the receiver.

Cable Control

With a cable you can generate a direct data connection between the transmitter and receiver. The radio transmission is disabled. At the same time, the power supply of the transmitter is provided through the cable, as well.



Connecting the cable

1. Switch the transmitter off.
2. Remove the screw lock on the transmitter and receiver.
3. Connect the transmitter and the receiver with the cable. Ensure that the connector is locked.
4. Switch the transmitter on.

Notes:

- If you connect the cable while working with the system, the transmitter will switch off automatically. Actuate the start button to switch to cable operation.
- When the system is in cable mode the transmitter will receive the supply voltage from the receiver, i.e. the transmitter can be used without the battery.
- If you disconnect the cable from the transmitter and receiver, the system will switch off automatically. Actuate the start button to switch back to radio operation.

RF-amplifier

If the transmitter is equipped with an RF-amplifier, please refer to the transmitter wiring diagram. There you can also find the directions on how to activate the RF-amplifier.

Utilization of Button ⏻ as Shift Key

The RPM+ and RPM– buttons have a dual function.
If the button ⏻ is kept depressed and the RPM+ resp. RPM– button is also activated, the Motor Start resp. Motor Stop command will be output.

Pre-selection of Trolley or Hoist

The operator is able to select the trolley or hoist that he wishes to control. It is also possible to simultaneously control both trolleys/hoists, for example in order to transport particularly long or wide loads.

Feedback by LED

Using this function, system or machine data can be displayed on the transmitter by LEDs.

Bank Switch

By switching operating levels via rotary switch or push button, the operator can choose between different operating levels. The number of available commands can be multiplied, even for small transmitters.

Rotary Switch for Preselected Speed

Using the rotary switch it is possible to choose between four maximum machine speeds, which are set in accordance with the customer's requirements.

The symbols for the speed adaptation have the following meanings:

= maximum speed 100 %

= maximum speed, limited to 75 %

= maximum speed, limited to 50 %

= maximum speed, limited to 25 %

Transmitter Key up

With the transmitter key up function, radio commands are only transmitted at the touch of a key and the transmitter will automatically be switched off after 7 seconds of non-use. For example, self-monitoring gates can thus be opened or closed by several operators.
During longer breaks the transmitter must be switched off by pressing the STOP switch.
The "transmitter key up" function also saves battery power.

Caution:
The transmitter key up function does not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.

radiomatic® CPS

With radiomatic® CPS (= Continuous Power Supply), the battery of the radio control can be changed without interrupting power. For this, the transmitter is equipped with 2 battery compartments. If a battery has to be changed, the LED blinks red and the process automatically switches to the other battery in the second battery compartment without interruption. The radio system remains active. By means of 2 LEDs, the operator can at all times see which battery is in use and if a battery needs to be charged.

This function is ideal if long and interruption-free crane or machine operations are required.

radiomatic® iBAR

radiomatic® iBAR stands for a newly developed, intelligent over-roll bar. With this, the function range of the control can be considerably expanded.
radiomatic® iBAR can be configured with diverse additional operating elements, e.g. push buttons.
In addition, LCDs for data indication can be integrated.

Slewing Gear Release

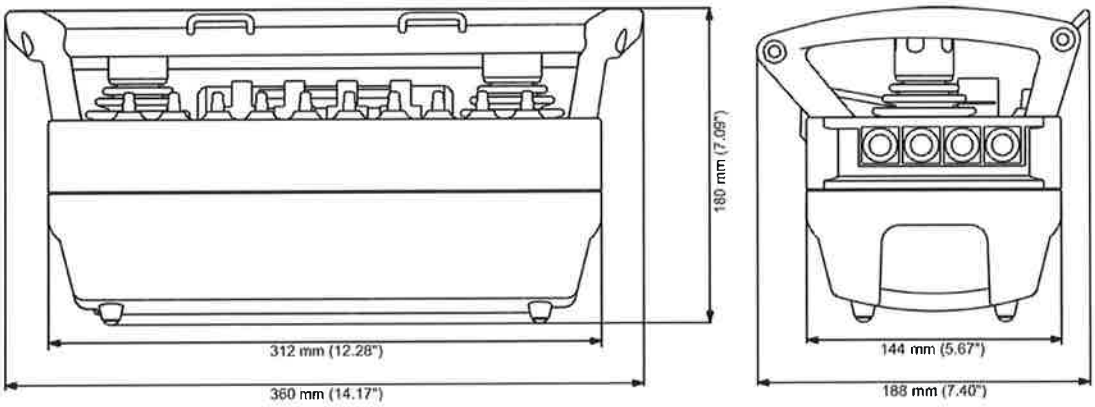
Note:
Whenever the command "slewing gear release" is actuated by means of the radio control, it is important that the respective check be made.
Due to the above, a clearly visible indicator lamp should be installed on the machine.

Technical Data

Max. number of control commands	-
Unique system addresses	Over 1.000.000 combinations
Supply voltage	6 V
Safety function	E-STOP: Performance Level d, category 3 according to EN ISO 13849-1:2015
Frequency ranges	405 – 475 MHz[1], 865 – 870 MHz, 902 – 928 MHz, 1210 – 1258 MHz[1] 2,4 GHz: 2402 – 2480 MHz DECT: 1790 – 1930 MHz
Channel spacing	12.5 / 20 / 25 / 50 / 250 kHz 2.4 GHz: 1 MHz DECT: 1.728 MHz
Antenna	Internal Option: external
Battery type	BA213___ (NiMH)
Battery capacity	2 x 2100 mAh
Continuous operating time	Approx. 11 h
Operating temperature range	-20 °C ... +70 °C (-4 °F ... +158 °F)
Housing material	Glass-fiber reinforced plastic / PA6 GF30
Dimensions	360 x 188 x 180 mm (14.17 x 7.4 x 7.09 inches)
Weight (incl. battery)	Approx. 3.0 kg (6.61 lbs.)
Protection class	IP 65

[1] Not all frequency ranges available.

Dimensions



Troubleshooting

Note:
Please check the functions using the cabin or cable controls first!

Problem	Possible Cause	Remedy
Transmitter does not react when switched on.	– No power.	– Check battery contacts for damage or contamination. – Insert a fully charged battery into the battery compartment. Recharge battery.
Low-power indication after minimal operating time.	– Battery contacts are contaminated or damaged. – Battery not charged. – Battery defective.	– Check battery contacts for damage or contamination. – Recharge battery. – Ensure that recharging process runs correctly. – Check transmitter functions using a fully charged or replacement battery.
The display in the transmitter flashes green but it is not possible to effect control commands.	– Receiver has no voltage. – No radio communication. – "Crane On" command has not been given.	– Check the connecting cable to the receiver. – Check the functions via the LEDs in the radio status panel of the receiver.
Some commands are not carried out.	– Receiver defective. – Interruption in the connecting cable to the machine.	– Check if all connecting cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, dealer or HBC-radiomatic GmbH.

Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Check the STOP switch functionality at regular intervals. Dirt deposits on the switch can hinder the mechanism and impair the function.
- Check the rubber bellows or rubber seals of the operating elements at regular intervals for leak-tightness. Replace immediately if cracks appear since the penetration of dirt and humidity may damage the function of the operating elements.
- Never use a high-pressure cleaner or sharp or pointed objects to clean the transmitter.
- Charge and discharge transmitter batteries regularly.

In the Event of a Fault

Warning:
Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer warranty.
  - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and OEM spare parts.
  - Always send in the complete radio system (transmitter, receiver, batteries, battery charger, connection cables, and other equipment) and attach a detailed fault description.
  - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system; otherwise pack securely. Send the consignment to your distributor or to the following address:

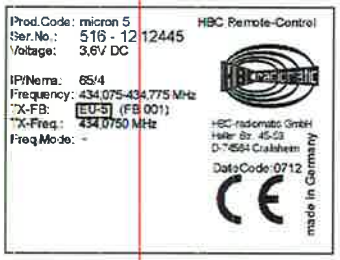
  HBC-radiomatic GmbH
  Haller Str. 45 – 53
  74564 Crailsheim, Germany
  Phone: +49 7951 393-0
  Fax: +49 7951 393-50
  E-Mail: info@radiomatic.com
- If you wish to bring a defective radio system to your distributor or the factory by yourself, we kindly ask you to make an appointment in advance.

For an overview of our worldwide service and sales contacts, please visit our website www.hbc-radiomatic.com under "Contact".

Frequency list for EU member states, EFTA states, and Turkey

Country block (cf. type plate)	Frequency range in MHz	Duty cycle	Power	Channel spacing	Marking according to RTTE directive	Country codes according to ISO 3166																																		
						AT	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IS	IT	LI	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SK	SL	TR	UK
AT-2	440,5250 – 441,4750	100%	10 mW e.r.p	25 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
AT-3	439,3900 – 439,4300	100%	10 mW e.r.p	20 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
CZ-1	430,0000 – 433,1000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-2	456,1780 – 456,4300	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-3	466,1700 – 466,4100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-1	433,5750 – 434,0250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-2	445,1250 – 445,8750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-1	433,1000 – 434,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-2	433,1000 – 434,6750	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-3	869,7250 – 869,9750	100%	5 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-4	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-5	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-6	434,0750 – 434,7500	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-7	434,0750 – 434,7750	100%	10 mW e.r.p	12,5 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FI-5	408,5750 – 408,8250	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-6	406,4000 – 406,6000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-7	442,5250 – 442,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-4	468,2750 – 468,6750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FR-1	407,7000 – 407,9250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NL-3	450,9300 – 451,1100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-2	440,0000 – 442,0000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-3	440,7250 – 441,7250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
SE-1	438,0250 – 439,9750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗
DECT	1880 – 1900	100%	10 mW e.i.r.p	1,728 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC240	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC241	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
radiomatic® photon analog	5725 – 5875	–	25 mW e.i.r.p	–	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
radiomatic® photon digital	2402 – 2480	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✗ = May **not** be used in the respective country
✓ = May be used in the respective country



As of 04/2014
Specifications and design subject to change without notice
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EU Declaration of Conformity

The manufacturer:

727-1802317

HBC-radiomatic GmbH
Haller Straße 45 – 53 • 74564 Crailsheim • Germany

hereby declares that the following product:

conforms to the following relevant Community harmonization legislation:

2006/42/EC	Machinery Directive, Annex II 1 A (safety component)
2014/53/EU	Radio Equipment Directive (RED)
2011/65/EU	Directive on the Restriction of Hazardous Substances (RoHS)

The designated product also adheres to the following European directives in regards to their protective goals:

2014/35/EU	Low Voltage Directive (see Annex I, 1.5.1 of the Machinery Directive 2006/42/EC)
2014/30/EU	Directive relating to electromagnetic compatibility (EMC)

The following harmonized standards were applied:

EN ISO 13849-1:2015
EN 60204-1:2006/AC:2010
EN 60204-32:2008
EN 60950-1:2006/AC:2011
EN 13557:2003 + A2:2008 (Annex C)
EN 301 489-1 V1.9.2
EN 50581:2012

With Short-Range Devices:
EN 300 220-2 V3.1.1

With DECT systems:
EN 301 406 V2.2.2

With 2.4 GHz systems:
EN 300 328 V2.1.1

Authorized person for documentation: Martin Schuster

Place and date: Crailsheim, 25.08.2017

Valid signature:

First name, name: Wolfgang Brendel
Position: Managing Director

Operating Instructions

Original Operating Instructions

FSE 727 radiobus®

AO727G07

HBC radiomatic

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Attachments: Frequency list for EU member states, EFTA states, and Turkey, EU Declaration of Conformity, system specific views, circuit diagrams and /or output wiring.

Pictographs

Danger due to electrical voltage. Touching live parts inside the unit can be fatal or cause serious injuries.

Instructions for occupational health and safety. Not following these instructions can lead to accidents that can cause damage, serious injuries or even death.

Important information about the operation of the radio system.

Manufacturer:
HBC-radiomatic GmbH • Haller Straße 45 – 53 • 74564 Crailsheim • Germany • Tel. +49 7951 393-0 • info@radiomatic.com.

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Safety Instructions

Read these operating instructions carefully before working with the radio system. This applies in particular to the installation, commissioning and maintenance of the radio system.
The operating instructions are a constituent part of the radio control system and must always be kept close at hand for the responsible personnel.
The term 'machine' is used in the operating instructions for the different possible uses of the radio system.

Intended Use

- The radio system is used for the control of machines and for data transfer. Observe the occupational safety and accident prevention regulations applicable to each application.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved for these uses by the manufacturer.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The safety devices of the radio control system must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete E-STOP system are not allowed.

Safety Instructions for Installation and Operation

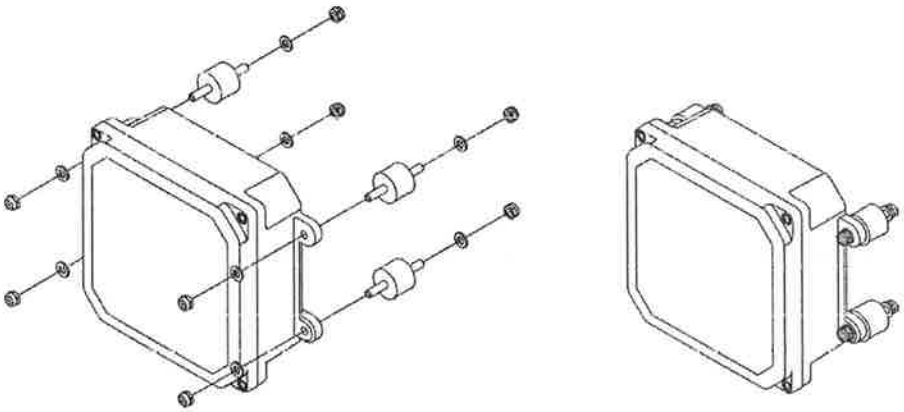
- The electrical connection according to the enclosed output wiring diagram must be established by a qualified electrician exclusively.
- The receiver may only be opened by trained personnel. Components inside the receiver can be energized at life-threatening voltages. The supply voltage for the machine must be disconnected before the receiver is opened.
- The power supply of the machine control as well as the contacts for external switching devices may only be connected to electrical circuits that have an all-pole separation device. (One separation device for the power supply and at least one separation device for the external switching devices.)
- For bus systems, the electronics of the machine needs to examine all control commands that belong to the Safety Circuit 2 for plausibility using the Si-2 hardware output on the side of the radio; in case there are implausibilities, it has to initiate the safe state immediately.
- Please also note that, with radio systems, the presence of persons in the danger zone – in particular beneath the load (cranes!) – is prohibited in all cases.
- Select a safe location for radio control, from which you have a good and complete view of the working movements of the machine, the load movements and the surrounding working conditions.
- It is not permissible to leave a radio transmitter unattended while it is activated. Always switch off the radio transmitter when it is not needed. This applies in particular if you change location, when working without radio control, during breaks and at the end of work. Always protect the radio transmitter against use by unauthorized persons, for example by locking it away.
- In the event of an emergency and with all faults, switch off the radio transmitter immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could influence safety must be rectified by specialists who have been trained and authorized by HBC-radiomatic before the system is put back into operation.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before starting to work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.

Installation

- The receiver should be mounted vertically with the cable connection downwards.
- Ensure that there are no metal parts within a radius of 1 m (3 feet) above the receiver.
- When the receiver has to be mounted in a control cabinet, a car antenna must be installed.
- Receivers with external antenna must be installed in such a way that the antenna stands freely and does not touch walls or metal parts. Otherwise a car antenna must be used, which can be supplied if needed.
- Receivers with plastic housing should be protected against direct sunlight (UV radiation) by appropriate measures.

Installation with Mounting Loops

The receiver is installed via the integrated mounting loops on the receiver sides. Use the shock mounts provided for installation to dampen any vibrations that may occur.



Module focus C/D/T (Option)

focus C

When several cranes are operated in tandem operation, a safe communication between the cranes is crucial. I. For example, one crane reaches the limit switch and is stopped automatically, the other crane has to be stopped as well in order to prevent dangerous situations.

focus C ensures a smooth crane communication in tandem operation. Using a CAN interface saves a great amount of wiring effort and thus valuable time!

focus D

As an external RF module with DECT interface, focus D ensures an optimal radio connection, even under difficult circumstances.

focus T

As an external RF module, focus T offers a perfectly working radio connection, even under difficult circumstances over a great distance. Depending on the working situation, up to 15 modules can be installed in different positions. As additional radio receivers, they receive all commands from the radio transmitter and relay it to the central receiver. There, they are analyzed and sent to the machine as output commands.

Obstacles in the radio path can thus be efficiently avoided and even long distances can be bridged with ease.

focus T can be combined with all HBC receivers of the radiobus® generation.

Installation

- Mount the module with 4 screws (M 5) via the provided drill holes (refer to chapter Dimensions).
- Do not install the module into a niche or a control cabinet.
- Ensure that there are no metal parts within a radius of 1 m (3 feet) above the module base.

Electrical Connection

The module is connected to a radio receiver via a 5-pin circular connector.
Please observe that the module may only be connected to the supply voltage indicated on the type plate!

Warning – shock hazard

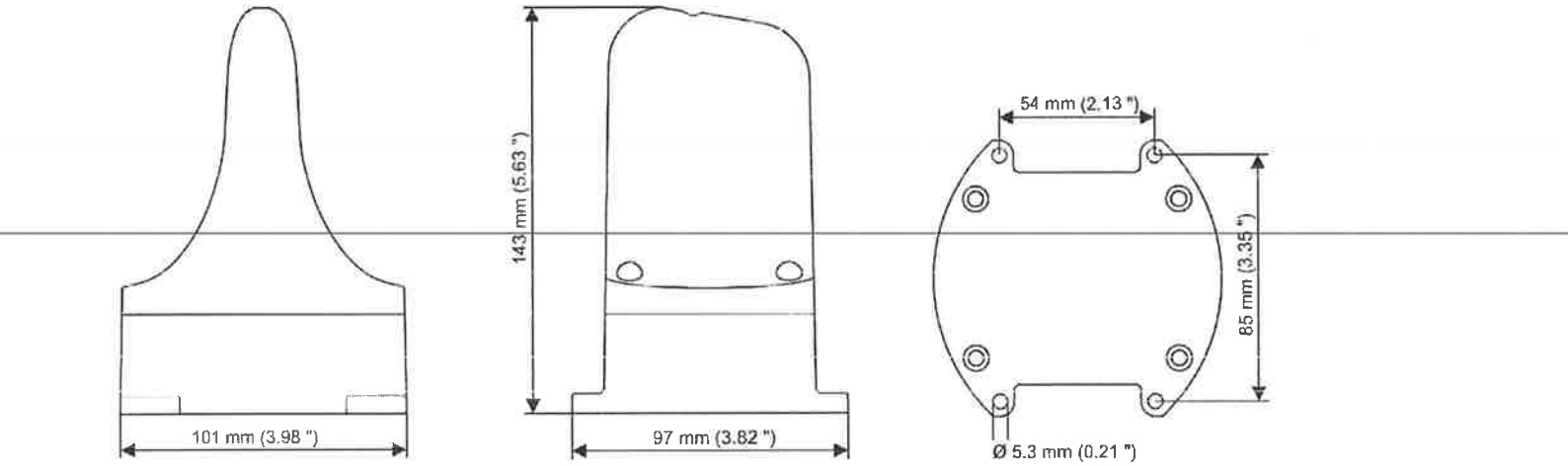
- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.

Control LED

A dual LED is located next to the cable connection in the module base.

- The LED illuminates red as soon as operating voltage is present at the module. The connection to the radio receiver is established and the internal operating voltage (10 – 30 V) is present.
- The LED illuminates green when the transmitter is switched on and the module receives a valid signal on its radio frequency.

Dimensions



Electrical Connection

Depending on the version, the radio receiver is connected either via a cable gland or with a Harting plug connection to the machine electrics.
Please observe that the receiver may only be connected to the supply voltage indicated on the type plate!

Warning – shock hazard!

- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.
- Switch off the supply voltage before opening the receiver. There is a risk of fatality from touching live parts inside the housing!

Control Display

A control display with LEDs indicating the operating state of the radio system is located in the upper housing part.

The LEDs have the following meaning:

Control display		**Simplex procedure** (Data are only transmitted from the transmitter to the receiver.)
Meaning	**Color**	**Receiver**
On	yellow	Illuminates as soon as the receiver is connected to the supply voltage.
RF	red	Illuminates as soon as the radio connection is interrupted.
Si1	green	Illuminates as soon as the E-STOP relays are closed.
Si2	green	Illuminates as soon as a drive command is output.
Feedback	yellow	Off. (Not available for FSE 508 / 509 / 512.)

Control display		**Duplex procedure** (Data are transmitted in both directions. Non-safety-relevant data are transmitted in the feedback.)
Meaning	**Color**	**Receiver**
On	yellow	Illuminates as soon as the receiver is connected to the supply voltage.
RF	red	Illuminates as soon as the radio connection is interrupted.
Si1	green	Illuminates as soon as the E-STOP relays are closed.
Si2	green	Illuminates as soon as a drive command is output.
Feedback	yellow	Illuminates as soon as a feedback telegram is transmitted. (Not available for FSE 508 / 509 / 512.)

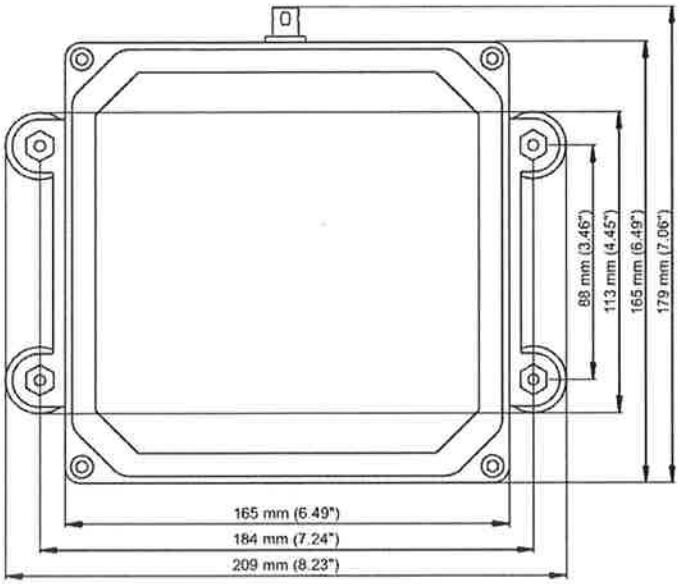
Technical Data

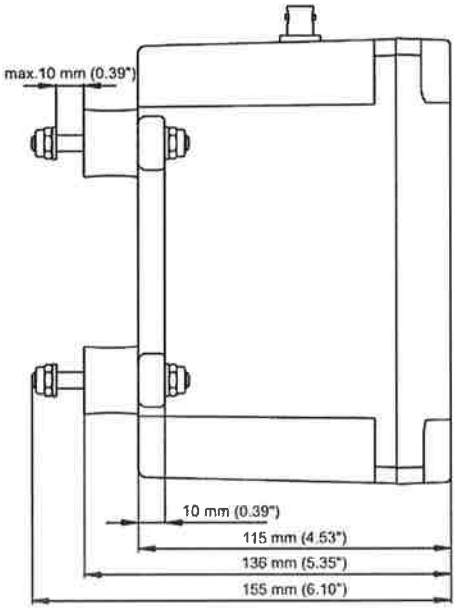
Max. number of control commands	26 digital or 10 analog (maximum number of digital commands depending on the configuration)
Unique system addresses	Over 1 000 000 combinations
Supply voltage	10 – 30 V DC
Power consumption	Max. 14 W
Inputs	Analog / digital: depending on equipment with input modules
Outputs	-
Interfaces	CANopen, CANsafety, Profibus-DP, RS485, RS232, DeviceNet, SAE J1939, Profinet, IQAN Cable option
E-STOP resp. Si1, Si2 control unit	1 x E-STOP output, high-side switch 10 A
Safety function	E-STOP: Performance Level d, category 3 according to EN ISO 13849-1:2015
Frequency ranges	405 – 475 MHz[1], 865 – 870 MHz, 902 – 928 MHz, 1210 – 1258 MHz[1] 2,4 GHz: 2402 – 2480 MHz DECT: 1790 – 1930 MHz
Channel spacing	12.5 / 20 / 25 / 50 / 250 kHz 2.4 GHz: 1 MHz DECT: 1.728 MHz
Connection	Harting Han 32 Option: Harting Han 25 or Han 50 Option: cable glands (metric M20/32)
Antenna	External, FL 30 or FL 70 Option: car antenna with 5 m cable and BNC connector Internal (option DECT) focus D (option DECT)
Operating temperature range	-25 °C ... +70 °C (-13 °F ... +158 °F)
Housing material	Plastic
Dimensions	165 x 165 x 115 mm (6.5 x 6.5 x 4.5 inches)
Weight	Approx. 2.6 kg (5.7 lbs.)
Protection class	IP 65

[1] Not all frequency ranges available.

Dimensions

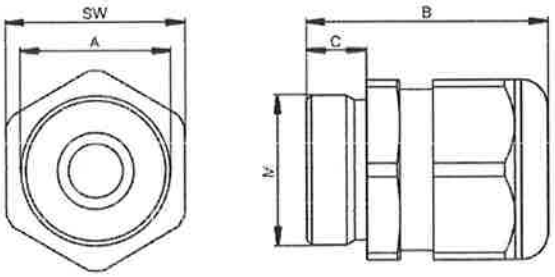
Receiver Housing HR168





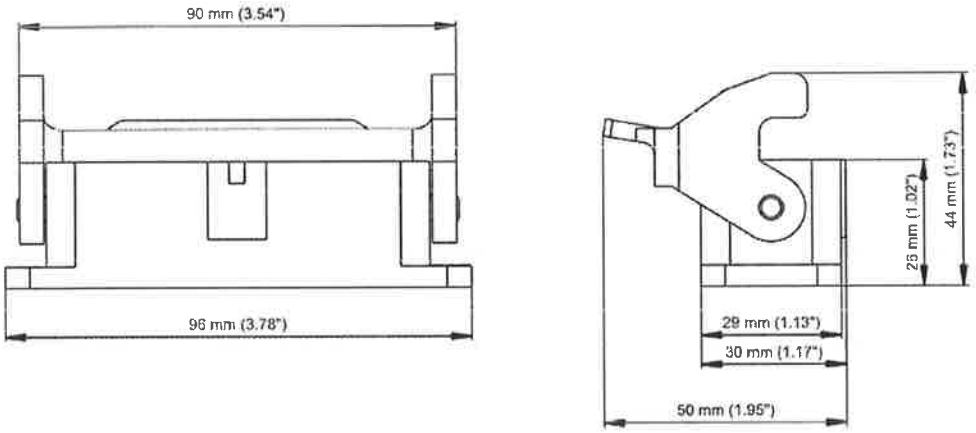
Connection Options

Metrical Cable Glands M20/32

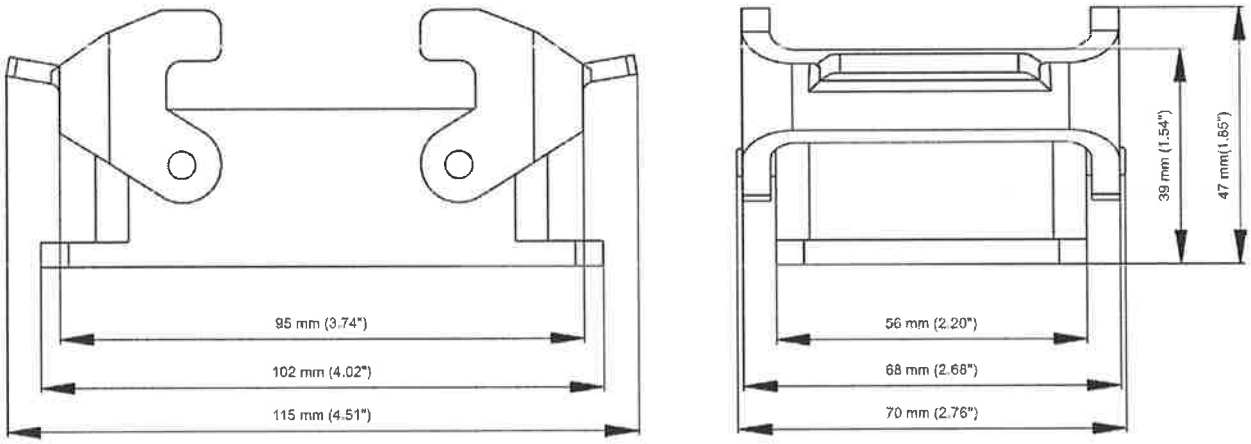


M	SW	A	B	C
M20	24 mm	5-9 mm	36 mm	9 mm
M32	36 mm	11-21 mm	47 mm	10 mm

Harting Plug Connection Han 25



Harting Plug Connection Han 32/50



Troubleshooting

Note:
Please check the functions using the cabin or cable control first!

Problem	Possible Cause	Measures
Transmitter does not react when switched on.	– No power.	– Check battery contacts for damage or dirt. – Insert a fully charged battery into the battery compartment. – Recharge battery.
Low-power indication after minimal operating time.	– Battery contacts are dirty or damaged. – Battery not charged. – Battery defective.	– Check battery contacts for damage or dirt. – Recharge battery. – Ensure that recharging process runs correctly. – Check transmitter functions using a fully charged or replacement battery.
Some commands are not carried out.	– Receiver defective. – Interruption in the connecting cable to the crane or machine.	– Check if all connecting cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, dealer or HBC-radiomatic GmbH.

Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Never use a high pressure cleaner or sharp or pointed objects to clean the receiver.
- Whenever welding the machine:
  - Switch off the radio control system.
  - Switch off the machine.
  - Disconnect all electrical connections to the receiver.

  Otherwise the receiver electronics can be destroyed.

In the Event of a Fault

Warning:
Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer warranty.
  - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and OEM spare parts.
  - Always send in the complete radio system (transmitter, receiver, batteries, battery charger, connection cables, and other equipment) and attach a detailed fault description.
  - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system; otherwise pack securely. Send the consignment to your distributor or to the following address:

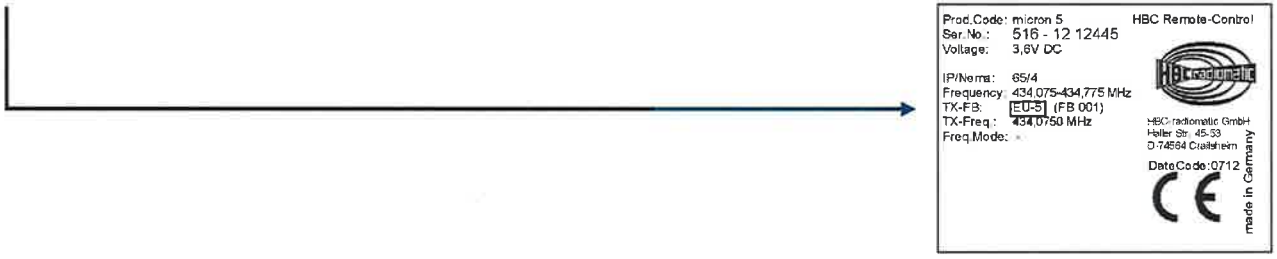
  HBC-radiomatic GmbH
  Haller Str. 45 – 53
  74564 Crailsheim, Germany
  Phone: +49 7951 393-0
  Fax: +49 7951 393-50
  E-Mail: info@radiomatic.com
- If you wish to bring a defective radio system to your distributor or the factory by yourself, we kindly ask you to make an appointment in advance.

For an overview of our worldwide service and sales contacts, please visit our website www.hbc-radiomatic.com under "Contact".

Frequency list for EU member states, EFTA states, and Turkey

Country block (cf. type plate)	Frequency range in MHz	Duty cycle	Power	Channel spacing	Marking according to RTTE directive	Country codes according to ISO 3166																															
						AT	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IS	IT	LI	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SK	SL	TR	UK
AT-2	440,5250 – 441,4750	100%	10 mW e.r.p	25 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
AT-3	439,3900 – 439,4300	100%	10 mW e.r.p	20 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
CZ-1	430,0000 – 433,1000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-2	456,1700 – 456,4300	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-3	466,1700 – 466,4100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-1	433,5750 – 434,0250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-2	445,1250 – 445,8750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-1	433,1000 – 434,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-2	433,1000 – 434,6750	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-3	869,7250 – 869,9750	100%	5 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-4	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-5	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-6	434,0750 – 434,7500	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-7	434,0750 – 434,7750	100%	10 mW e.r.p	12,5 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FI-5	408,5750 – 408,8250	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-6	406,4000 – 406,6000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-7	442,5250 – 442,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-4	466,2750 – 466,6750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FR-1	407,7000 – 407,9250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NL-3	450,9300 – 451,1100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-2	440,0000 – 442,0000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-3	440,7250 – 441,7250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗
SE-1	438,0250 – 439,9750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
DECT	1880 – 1900	100%	10 mW e.i.r.p	1,728 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC240	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC241	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
radiomatic® photon analog	5725 – 5875	–	25 mW e.i.r.p	–	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
radiomatic® photon digital	2402 – 2480	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✗ = May **not** be used in the respective country
✓ = May be used in the respective country



As of 04/2014
Specifications and design subject to change without notice
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EU Declaration of Conformity

The manufacturer:

HBC-radiomatic GmbH
Haller Straße 45 – 53 • 74564 Crailsheim • Germany

727-1802318

hereby declares that the following product:

conforms to the following relevant Community harmonization legislation:

2006/42/EC	Machinery Directive, Annex II 1 A (safety component)
2014/53/EU	Radio Equipment Directive (RED)
2011/65/EU	Directive on the Restriction of Hazardous Substances (RoHS)

The designated product also adheres to the following European directives in regards to their protective goals:

2014/35/EU	Low Voltage Directive (see Annex I, 1.5.1 of the Machinery Directive 2006/42/EC)
2014/30/EU	Directive relating to electromagnetic compatibility (EMC)

The following harmonized standards were applied:

EN ISO 13849-1:2015
EN 60204-1:2006/AC:2010
EN 60204-32:2008
EN 60950-1:2006/AC:2011
EN 13557:2003 + A2:2008 (Annex C)
EN 301 489-1 V1.9.2
EN 50581:2012

With Short-Range Devices:
EN 300 220-2 V3.1.1

With DECT systems:
EN 301 406 V2.2.2

With 2.4 GHz systems:
EN 300 328 V2.1.1

Authorized person for documentation: Martin Schuster

Place and date: Crailsheim, 25.08.2017

Valid signature:

First name, name: Wolfgang Brendel
Position: Managing Director

Operating Instructions

Original Operating Instructions

spectrum E

AOSEOG01

HBC radiomatic

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Attachments: Frequency list for EU member states, EFTA states, and Turkey, EU Declaration of Conformity, system specific views, circuit diagrams and / or output wiring.

Pictographs

Danger due to electrical voltage. Touching live parts inside the unit can be fatal or cause serious injuries.

Instructions for occupational health and safety. Not following these instructions can lead to accidents that can cause damage, serious injuries or even death.

Important information about the operation of the radio system.

Manufacturer:
HBC-radiomatic GmbH • Haller Straße 45 – 53 • 74564 Crailsheim • Germany • Tel. +49 7951 393-0 • info@radiomatic.com

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Safety Instructions

Read these operating instructions carefully before working with the radio system. This applies in particular to the installation, commissioning and maintenance of the radio system.
The operating instructions are a constituent part of the radio control system and must always be kept close at hand for the responsible personnel.
The term 'machine' is used in the operating instructions for the different possible uses of the radio system.

Intended Use

- The radio system is used for the control of machines and for data transfer. Observe the occupational safety and accident prevention regulations applicable to each application.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved for these uses by the manufacturer.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The safety devices of the radio control system must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete E-STOP system are not allowed.

Safety Instructions for Installation and Operation

- The electrical connection according to the enclosed output wiring diagram must be established by a qualified electrician exclusively.
- The receiver may only be opened by trained personnel. Components inside the receiver can be energized at life-threatening voltages. The supply voltage for the machine must be disconnected before the receiver is opened.
- Please also note that, with radio systems, the presence of persons in the danger zone – in particular beneath the load (cranes!) – is prohibited in all cases.
- Select a safe location for radio control, from which you have a good and complete view of the working movements of the machine, the load movements and the surrounding working conditions.
- It is not permissible to leave a radio transmitter unattended when it is activated. Always switch off the radio transmitter when it is not required. This applies in particular if you change location, when working without radio control, during breaks and at the end of work. Always protect the radio transmitter against use by unauthorized persons, for example by locking it away.
- In the event of an emergency and with all faults, switch off the radio transmitter immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could influence safety must be rectified by specialists who have been trained and authorized by HBC-radiomatic before the system is put back into operation.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before starting to work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.
- Before starting to work, examine the STOP switch for mechanical ease of motion and electronic function at least once a day:
  When you press the STOP switch with the transmitter on, the status LED and the display of the transmitter have to go out. If the status LED and the display don't go out then you have to disable the radio control system immediately.
  Remove the battery and the radiomatic® iLOG from the transmitter and inform a service technician.

Operation

The transmitter is equipped with an electronic radiomatic® iLOG key. radiomatic® iLOG contains all the data required for operating the transmitter. Operation is not possible without radiomatic® iLOG!
Depending on the version the radiomatic® iLOG can also be used for operation of replacement transmitters of identical construction.

When activating the transmitter and if the radio connection is interrupted (e.g. if the connection is lost or the transmission range is exceeded), the transmitter reacts with the so-called enforced zero-position. Release all operating elements so they can return to the zero-position and actuate the start button. The machine will not react if the operating elements are not in zero-position. This prevents uncontrolled machine movements after the radio connection has been interrupted.

Activating the Transmitter

The steps 3 and 4 need to be carried out within **5 seconds**:

1. Insert a charged battery into the battery compartment.
2. Turn the STOP switch to unlock.
3. Shortly actuate the start button and then release. The transmitter will switch off if the button is pressed for longer than half a second!
4. Actuate the start button again until the status LED flashes green. Then release the button. The transmitter is now ready for operation.
5. Depending on the application, you must actuate the start button again before movement commands can be carried out.

Note:
The transmitter switches off if

- the start button is pressed for longer than half a second in step 3 of the start sequence.
- the start sequence (steps 3 and 4) takes over 5 seconds.
- another button is pressed during the start sequence.

You must then repeat steps 3 and 4 or 3 to 5.

With HBC Smart Card

1. Insert a charged battery into the battery compartment.
2. Turn the STOP switch to unlock.
3. Press the start button. The status LED flashes green 2 times and red 1 time per second.
4. Hold the HBC Smart Card to the position on the transmitter marked with this symbol (cf. illustration). The transmitter vibrates and an acoustic signal sounds. When the status LED flashes green, the transmitter is ready to operate.

Note:
The transmitter can only be activated with a valid Smart Card. If you use a card that does not match the respective transmitter or is not approved for this transmitter, the transmitter vibrates 3 times. At the same time an acoustic signal sounds. The transmitter is automatically shut down after 2 seconds. Please contact your superior in such cases.

The transmitter also shuts down if the start sequence is not completed within 10 seconds. In this case press the start button and repeat the procedure!

Caution:
Before starting work always trigger the acoustic signal. This warns all colleagues that the machine is about to move.

Deactivating the Transmitter

Press the STOP switch.

Note:
Replace the battery when the battery display illuminates red, an acoustic signal sounds, the status LED flashes red and the transmitter vibrates (option). Otherwise, the transmitter will switch off in a few minutes.
Recharge the empty battery in the respective charger.

Option Internal Battery

In order to ensure an uninterrupted operation when the battery is being replaced, the transmitter is equipped with an internal battery. When the external battery needs to be replaced, the transmitter is supplied by the internal battery.
The internal battery is automatically charged during the radio operation when needed.

Battery and charging status indication

Indication	Meaning
Gleams green	The transmitter is supplied by the external battery.
Blinks red	The transmitter is supplied by the internal battery. The external battery needs to be replaced.
Gleams red	The transmitter is supplied by the internal battery. There is no external battery inserted.
Off	The internal battery is not (completely) charged and is not being charged at the moment.
Gleams orange	The internal battery is being charged.
Gleams green	The internal battery is completely charged.
Blinks red	The temperature of the internal battery is below 0 °C or above 45 °C. The charging process has been interrupted.

Automatic Power Off (APO) function

The transmitter is equipped with an automatic power off (APO) function and will automatically shut off approx. 15 min after the last command input.
The automatic power off serves to increase safety and also saves battery power.

After an automatic power off, the transmitter must be reactivated as described in the chapter "Operation".

Caution:
The automatic power off does not relieve the operator of the responsibility to turn off the transmitter with the STOP switch when not in use.

Display

Field strength

The field strength indication provides information about the quality of the radio connection. With an optimum connection, all 5 bars are displayed. The field strength indication is always visible when the transmitter is turned on.

Field strength is indicated in the following degrees:

Strong received signal

Weak received signal

No signal

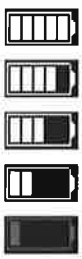
Note:

If symbol is displayed the risk of the radio connection being interrupted is imminent. Ensure that the radio connection is not impaired by an obstacle (e.g. a building) and ensure that you are within the range of the radio system. It may be necessary to change the working position.

Battery

The battery indication provides information about the current condition of the battery. It is always visible when the transmitter is turned on.

The battery status is displayed in the following degrees:



The battery is charged.

Pre-warning: The battery needs to be charged soon.

The battery needs to be charged. The status LED in the transmitter flashes red and an acoustic signal sounds. Exchange the battery. Otherwise, the transmitter will switch off in a few minutes. Recharge the empty battery in the respective charger.

Note:

A detailed description of the display has to be part of the operating manual of the specific machine in use. All instructions the operator has to follow in connection with the feedback information have to be written there as well.

Option additional operating elements

Instead of the display, the space on the transmitter can be used for additional operating elements, as toggle or rotary switches.

Battery and Battery Charger

Li-ion Battery

The battery capacity (= the amount of electric current that can be stored) and the battery charge (= the actual amount of stored current) depend on the age of the battery and the environment temperature. If the temperatures are below 0 °C (32 °F) or above 40 °C (104 °F), less current can be retrieved.

Please adhere to the following safety notifications in all cases. When the Li-ion battery is improperly handled, there is the risk of explosion and of fire. This could lead to life-threatening injuries that might result in death under specific circumstances.

Safety instructions:

- Use the batteries only in connection with the designated devices.
- Never use or charge damaged or faulty batteries.
- Do not throw the batteries into a fire, short-circuit, damage, or open them. Always use the protective cap provided in the accessory to store the battery.
- Charge the battery fully before storing it for a prolonged period. Otherwise total discharge of the battery may occur. Please note the date code on the battery.
- Use only the associated HBC charger to charge the battery.
- Charge the battery at an ambient temperature of 0 – 45 °C (32 – 113 °F).
- Do not expose the batteries to direct sunlight.
- The batteries have to be recycled or disposed of properly.

Notes:

- In all cases, charge the batteries completely before initial use. This ensures that the batteries have their full capacity in use.
- Store the batteries at -15 – +35 °C (5 – 95 °F).
- Charge the batteries at intervals not exceeding 3 months when they are stored.

When handled properly, Li-ion batteries by HBC-radiomatic can reach up to 500 charging cycles. Even after that, your batteries can be used for some time with a slightly decreased capacity.

Battery Charger

Depending on customer selection, an AC or DC charger is available. A connection cable with the appropriate plug is included in the delivery.

Please adhere to the following safety notifications in all cases. When the charger is improperly handled, there is the risk of fire and of electrical shock. This could lead to life-threatening injuries that might result in death under specific circumstances.

Safety instructions:

- Use this charger only to charge the batteries specified on the type plate.
- The charger may not be used in hazardous areas or in the vicinity of flammable materials.
- The charger has to be operated with the voltage indicated on the back.
- The charger has to be used in vehicles or indoors only.
- Use the charger only within the specified temperature range of 0 – 45 °C (32 – 113 °F).
- Protect the charger against heat, dust and humidity.
- Do not cover the charger while it is in use.
- Disconnect the charger from the power supply when it is not in use.
- In case of any fault of the charger or the connecting cable disconnect it immediately and put it out of operation.
- Do not make technical changes to the charger or the connecting cable.

Maintenance and servicing:

- Disconnect the plug before cleaning the charger.
- Make sure that the contacts of the charger and the battery pack are free from dirt in order to ensure a faultless functioning of the charger.

Charging the battery

1. Connect the charger via the connecting cable to the power supply
2. Insert the battery into the compartment.

Charging will start automatically.

Display:

Three LEDs indicate the actual operating state of the battery.

LED **green**: Illuminates when battery is charged.
LED **orange**: Illuminates when battery is charging.
LED **red**: Illuminates when battery is defective.
Flashes when the battery temperatures are below 0 °C (32 °F) or above 45 °C (113 °F).
The battery is not charged in this case.

Technical Data QA401600 / QD401300	
Operating voltage	100 – 240 V AC (QA401600) 10 – 30 V DC (QD401300)
Charging time	< 4 h
Operating temperature	0 – 45° C (32 – 113 °F)
Housing material	Plastic
Protection class	II
Charging method	CC/CV
End of charging voltage	4,2 V

Options

The availability of the following functions depends on the design and configuration of your radio control system.

Safety Features

radiomatic® shock-off / zero-g / inclination switch

In specific emergency situations, these safety features can prevent unintended movement commands from being given to the machine, protecting the operator as well as other personnel in close proximity to the machine in use.

radiomatic® shock-off can react if the transmitter receives a hard impact.

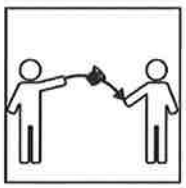
radiomatic® zero-g can react if the transmitter is falling down or being thrown.

inclination switch can activate if the transmitter exceeds an inclination angle of approx. 45° for a specified time and/or is positioned upside down.

Depending on the ordered version the features can operate in three different ways:

- The complete radio system is shut down.
- Safety-relevant functions are deactivated.
- A previously defined function (e. g. crane horn) is activated.

In addition the symbol SAFETY FEATURE is shown in the display.



To deactivate the features, press the start button until the status-LED flashes green and the symbol SAFETY FEATURE disappears. Then the transmitter is ready to operate again.

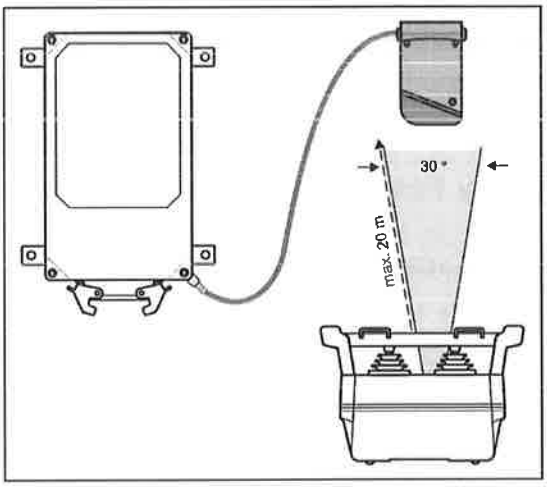
The safety features do not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.

radiomatic® infrakey

The radio system can only be activated via an infrared link between the transmitter and the receiver. This increases the safety of operation, i.e. the machine can not become inadvertently enabled.

radiomatic® infrakey operates either with an infrared module in the receiver housing (radiomatic® infrakey internal) or with the offset infrared antenna focus I (radiomatic® infrakey external).

To activate radiomatic® infrakey, actuate the start button on the transmitter.



Function of radiomatic® infrakey with focus I

Notes:

- The range of the infrared beam is max. 20 m (66 ft).
- The angle of radiation is 30°.
- The front panel of the receiver must be visible (only radiomatic® infrakey internal).

Joystick with Deadman Function

In order to issue control commands, the button integrated into the joystick must be pressed before the joystick is moved. The function then locks and remains effective until the joystick is back in the zero position. This avoids of potential risks through the unintentional actuation of the joystick.

radiomatic® report – User Identification

The "user identification" function with the HBC Smart Card enables a simple personalization of the radio system as well as the storage of all user profiles in the radio system. Safety relevant functions can be unlocked for authorized personnel only and unauthorized users can be protected from potentially dangerous situations. In addition the radio system can store all operating processes for each individual user as well as the respective operating time of the radio system. This data can be read from the radio system and shows how long the radio system was in use and how the individual operators used the various functions of the radio system.

Enabling switch

The two-step enabling switch provides enhanced safety during maintenance and service work on or in the machine as well as for applications with multiple users. In order to transmit control commands to the machine, the operator has to keep the switch pushed into the first step. Only then are the other operating elements activated. If the operator releases the button or pushes it into the second step (e.g. as the result of a cramp), all machine functions are immediately stopped. With this, the operator is protected from dangerous unintended movements of the machine in case he should lose consciousness or no longer has control over the transmitter.

If an application is controlled by more than one operator, movement commands can only be performed if all operators keep the enabling switch pushed into the first step.

Vibration Alarm

With the vibration alarm, the operator can be informed of an impending need to change the battery and/or potential dangers on the machine through the vibration of the transmitter. This information can be for example pre-warnings for high wind speeds or threatening excess crane loads.

Front Panel Lighting

With the front panel lighting potential dangers resulting from incorrect operation, based on poor visibility, can be prevented. The operator simply switches on multiple LEDs, which are integrated into the rollover bar, with a switch or button on the transmitter.

Shut-off on Implausible Control Commands

The automatic shut-off will activate after a sequence of multiple questionable movement commands, for example if the operator moves the joystick successively in different directions in an irregular manner.
This function protects the operator and the whole work environment from potential dangers as well as the machine from wear resulting from rapid and erratic movements.

Depending on the ordered version this function can operate in three different ways:

- The complete radio system is shut down.
- Safety-relevant functions are deactivated.
- A previously defined function (e. g. crane horn) is activated.

To deactivate the function, press the start button until the status LED flashes green.
Then the transmitter is ready to operate again.

Micro Drive

With the micro drive function the speed of the machine is limited to a preselected level. Even at full movement of the joystick/linear lever, the operator can not exceed this speed limit. In this manner demanding drive maneuvers can be managed and inexperienced users can be protected from potential dangers that can result from "speeding".

Orthogonal Drive (Electronic Cross Gate)

With the orthogonal drive function dangerous situations, caused by unintentional diagonal movements are being prevented. The operator will have to return the joystick back to zero position before another directional command can be activated. This function is suitable for example for situations where the operator has to make precision commands in confined areas. Diagonal movements are not possible.

Frequency Management

Fixed Frequency

If the identification plate in the battery compartment of the transmitter shows a frequency value (e.g. 433,500 MHz), the transmitter operates with a fixed frequency.
Please contact you service department if the frequency has to be changed because the radio channel is already assigned to another user.

Manual Frequency Switching

If the identification plate in the battery compartment of the transmitter shows the label **man**, the transmitter features manual frequency switching.
This function can be used to change the radio channel during radio operation.
Depending on the version move the cursor to the corresponding softkey and press the radiomatic® iCON until an acoustic signal sounds. Then release the radiomatic® iCON. Or press the ⏻ button until an acoustic signal sounds. Then release the button.
Please contact your service department if all available frequencies are occupied.

radiomatic® AFS

If the identification plate in the battery compartment of the transmitter shows the label **AFS**, the transmitter is equipped with radiomatic® AFS (Automatic Frequency Selection).
When activating the transmitter radiomatic® AFS will check if the present radio channel is free. If the radio channel is occupied, the system automatically finds and saves a free radio channel.
If the radio channel currently in use is occupied by another radio control system, you must switch the transmitter off and on again in order to allow radiomatic® AFS to switch to a free radio channel.
The radiomatic® AFS option also includes the manual frequency switching function.

Note:
If radiomatic® AFS is to perform optimally, all the other radio systems in the immediate working environment (e.g. the factory hall or building site) should be switched on before starting to use the radio system for the first time. This allows radiomatic® AFS to detect automatically which radio channels are already being used in the working area, and thereby to choose a suitable free channel for its own use.

In addition, when switching the radio system on for the first time, the user should make sure that his distance from the radio receiver and from the machine is a realistic reflection of the working situation.

radiomatic® AFM

If the identification plate in the battery compartment of the transmitter shows the label **AFM** the transmitter is equipped with radiomatic® AFM (Automatic Frequency Management).
radiomatic® AFM detects available radio channels constantly. If the radio channel currently in use is occupied by another radio control system, radiomatic® AFM switches automatically to a free radio channel.

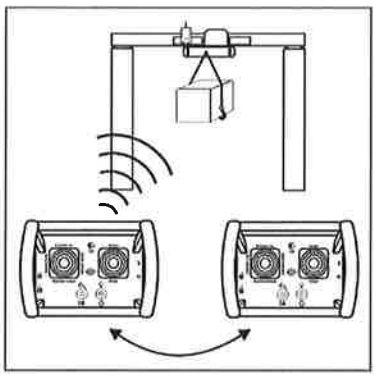
DECT

DECT technology is an extremely convenient method for uninterrupted radio control without frequency conflicts. The operator always works on a free radio channel and does not need to make manual settings.

2.4 GHz technology

2.4 GHz technology works with automatic frequency coordination and thus ensures interruption-free working in areas with many radio users. Manual frequency coordination is not necessary. With the worldwide frequency band, 2.4 GHz technology can be used all over the world.

Catch-Release



Via the Catch-Release option two or more transmitters can control a machine alternately.
When the receiver is switched on, the machine can initially be controlled via any associated transmitter. Once the receiver is taken over by one transmitter, the other transmitters no longer have access.

Take over machine

1. Switch the transmitter on.
2. Enter the "Catch" command on the transmitter and actuate the start button.

The access rights for the machine remain with that transmitter until the "Release" command is issued by that transmitter.

Release machine

1. Enter the "Release" command on the transmitter.
2. Switch the transmitter off.

The access rights for the machine are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over the machine. Transmitter 2 is to be given control.

1. Enter the "Release" command on transmitter 1.
2. Switch transmitter 1 off.
3. Switch transmitter 2 on.
4. Enter the "Catch" command on transmitter 2 and actuate the start button.

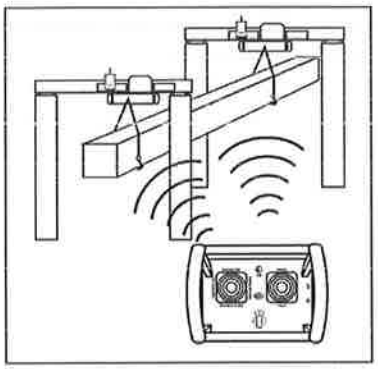
Transmitter 2 now has sole access to all machine functions.

Notes:

- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver fails, the receiver returns to the starting condition in which it can be adopted by any transmitter. If necessary, the receiver must be adopted anew.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. The starting condition described above can only be resumed by deactivating the operating voltage at the receiver.

Tandem Operation

Tandem Operation T1



The radio system consists of 1 transmitter and 2 receivers for 2 machines. The transmitter can control the machines individually or in parallel.

The machines are selected at the transmitter via a rotary switch:
A only machine A
A+B machine A + machine B
B only machine B

Tandem Operation T2

The radio system consists of 2 transmitters and 2 receivers for 2 machines. Both transmitters are master transmitters and can control the machines individually or in parallel.
During normal operation transmitter 1 controls machine A and transmitter 2 controls machine B. In order to be able to switch to machine B or A+B at transmitter 1, for example, the key must be removed from transmitter 2 and inserted in transmitter 1.

The machines are selected at the transmitter via a rotary switch:
A only machine A
A+B machine A + machine B
B only machine B

Operating Example: Control of machine A + B via transmitter 1.
1. Switch transmitter 1 and 2 off and remove the key from transmitter 2.
2. Insert the key from transmitter 2 in transmitter 1.
   Machine selection via transmitter 1 is activated.
3. Turn the rotary switch of transmitter 1 to A+B.
4. Switch transmitter 1 on and actuate the start button.

The radio system now operates in tandem mode.

Warning:
For safety reasons, it is imperatively required that only one key is available for each transmitter. The spare key must be stored at a superior, authoritative position and only be handed out in clarified cases.

Tandem Operation TM/TS

The radio system consists of 2 transmitters and 2 receivers for 2 machines. One transmitter is a master transmitter and can control the machines individually or in parallel. The other transmitter is a slave transmitter and can only control machine B.
In order to be able to switch to machine B or A+B at the master transmitter, the key must be removed from the slave transmitter and inserted in the master transmitter.

The machines are selected at the transmitter via a rotary switch:
A only machine A
A+B machine A + machine B
B only machine B

Operating Example: Control of machine A + B via master transmitter.
1. Switch master and slave transmitter off and remove the key from slave transmitter.
2. Insert the key from slave transmitter in master transmitter.
   Machine selection via master transmitter is activated.
3. Turn the rotary switch of master transmitter to A+B.
4. Switch master transmitter on and actuate the start button.

The radio system now operates in tandem mode.

Warning:
For safety reasons, it is imperatively required that only one key is available for each transmitter. The spare key must be stored at a superior, authoritative position and only be handed out in clarified cases.

Catch-Release-Tandem Operation

With the Catch-Release-Tandem Operation two or more transmitters can control several machines alternately.
Each machine is equipped with a receiver that can receive and monitor all transmitter frequencies.
After activating the receivers all transmitters have equal access to the radio control system.

Take over machine

1. Switch the transmitter on.
2. Turn rotary switch on the transmitter to the respective position.
3. Enter the "Catch" command on the transmitter and actuate the start button.

The transmitter with control over the machine(s) retains the access to the receiver until the operator has issued the "Release" command.

Release machine

1. Enter the "Release" command on the transmitter.
2. Switch the transmitter off.

The access rights for the machine(s) are cancelled. Machine control can be taken over by another transmitter.

Operating Example:

Transmitter 1 has taken over machine A. Transmitter 2 is to be given control over machine A+B.

1. Enter the "Release" command on transmitter 1.
2. Switch transmitter 1 off.
3. Switch transmitter 2 on.
4. Turn rotary switch on transmitter 2 to A+B.
5. Enter the "Catch" command on transmitter 2 and actuate the start button.

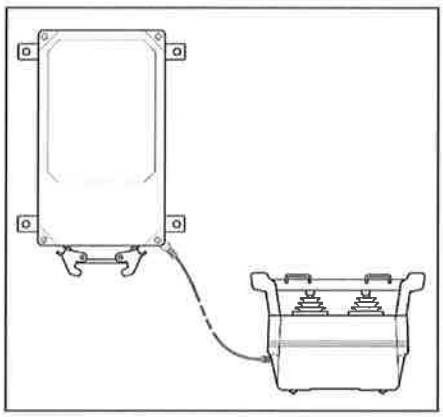
Transmitter 2 now has sole access to all machine functions.

Notes:

- If a receiver has already been adopted by a transmitter can be displayed via a lamp on the machine.
- If the operating voltage of the receiver fails, the receiver returns to the starting condition in which it can be adopted by any transmitter. If necessary, the receiver must be adopted anew.
- If the transmitter is deactivated without the command "Release" having been issued, the other transmitters have no access to the receiver. The starting condition described above can only be resumed by deactivating the operating voltage at the receiver.

Cable Control

With a cable you can generate a direct data connection between the transmitter and receiver. The radio transmission is disabled. At the same time, the power supply of the transmitter is provided through the cable, as well.



Connecting the cable

1. Switch the transmitter off.
2. Remove the screw lock on the transmitter and receiver.
3. Connect the transmitter and the receiver with the cable. Ensure that the connector is locked.
4. Switch the transmitter on.

Notes:

- If you connect the cable while working with the system, the transmitter will switch off automatically. Actuate the start button to switch to cable operation.
- When the system is in cable mode the transmitter will receive the supply voltage from the receiver, i.e. the transmitter can be used without the battery.
- If you disconnect the cable from the transmitter and receiver, the system will switch off automatically. Actuate the start button to switch back to radio operation.

RF-amplifier

If the transmitter is equipped with an RF-amplifier, please refer to the transmitter wiring diagram. There you can also find the instructions on how to activate the RF-amplifier.

Utilization of Button ⏻ as Shift Key

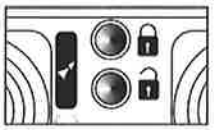
The RPM+ and RPM– buttons have a dual function.
If the button ⏻ is kept pressed and the RPM+ resp. RPM– button is also activated, the Motor Start resp. Motor Stop command will be output.

Pre-selection of Trolley or Hoist

The operator is able to select the trolley or hoist that he wishes to control. It is also possible to simultaneously control both trolleys/hoists, for example in order to transport particularly long or wide loads.

Feedback by LED

Using this function, system or machine data can be displayed on the transmitter by LEDs.



Bank Switch

By switching operating levels via rotary switch or push button, the operator can choose between different operating levels. The number of available commands can be multiplied, even for small transmitters.

Rotary Switch for Preselected Speed

Using the rotary switch it is possible to choose between four maximum machine speeds, which are set in accordance with the customer's requirements.

The symbols for the speed adaptation have the following meanings:

= maximum speed 100 %

= maximum speed, limited to 75 %

= maximum speed, limited to 50 %

= maximum speed, limited to 25 %

Transmitter Key up

With the transmitter key up function, radio commands are only transmitted at the touch of a key and the transmitter will automatically be switched off after 7 seconds of non-use. For example, self-monitoring gates can thus be opened or closed by several operators.
During longer breaks the transmitter must be switched off by pressing the STOP switch.
The "transmitter key up" function also saves battery power.

Caution:
The transmitter key up function does not relieve the operator of his responsibility to turn off the transmitter with the STOP switch when not in use.

radiomatic® iBAR

radiomatic® iBAR stands for a newly developed, intelligent over-roll bar. With this, the function range of the control can be considerably expanded.
radiomatic® iBAR can be configured with diverse additional operating elements, e.g. push buttons.
In addition, LCDs for data indication can be integrated.

Slewing Gear Release

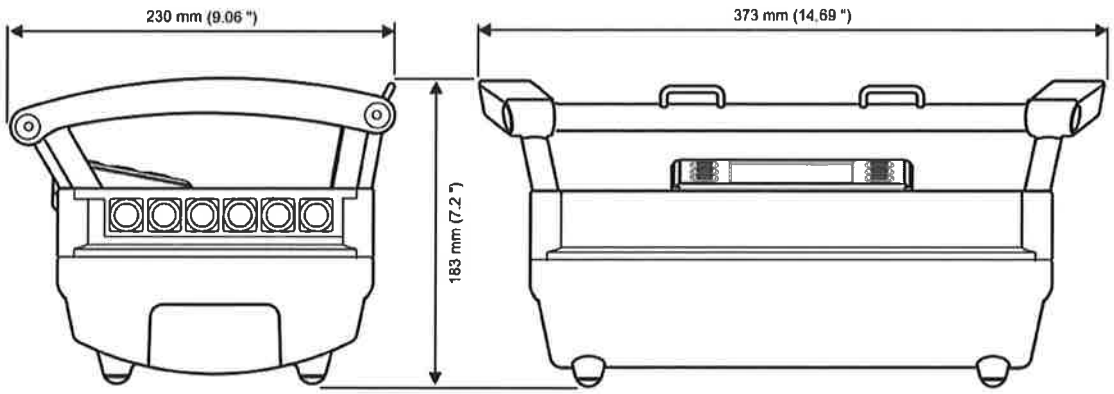
Note:
Whenever the command "slewing gear release" is actuated by means of the radio control, it is important that the respective check be made.
Due to the above, a clearly visible indicator lamp should be installed on the machine.

Technical Data

Max. number of control commands	-
Unique system addresses	Over 1.000.000 combinations
Supply voltage	3.6 V
Safety function	E-STOP: Performance Level d, category 3 according to EN ISO 13849-1:2015
Frequency ranges	405 – 475 MHz[1], 865 – 870 MHz, 902 – 928 MHz, 1210 – 1258 MHz[1] 2,4 GHz: 2402 – 2480 MHz DECT: 1790 – 1930 MHz
Channel spacing	12.5 / 20 / 25 / 50 / 250 kHz 2.4 GHz: 1 MHz DECT: 1.728 MHz
Antenna	Internal Option: external
Battery type	BA401_ _ _ (Li-Ion)
Battery capacity	10 Ah
Continuous operating time	Transmitter with LCD and without internal battery: approx. 18 h
Operating temperature range	-20 °C ... +70 °C (-4 °F ... +158 °F)
Housing material	Glass-fiber reinforced plastic / PA6 GF30
Dimensions	373 x 230 x 183 mm (14.69 x 9.06 x 7.2 inches)
Weight (incl. battery)	Approx. 3.5 kg (7.7 lbs.)
Protection class	IP 65

[1] Not all frequency ranges available.

Dimensions



Troubleshooting

Note:
Please check the functions using the cabin or cable controls first!

Problem	Possible Cause	Remedy
Transmitter does not react when switched on.	– No power.	– Check battery contacts for damage or contamination. – Insert a fully charged battery into the battery compartment. – Recharge battery.
Low-power indication after minimal operating time.	– Battery contacts are contaminated or damaged. – Battery not charged. – Battery defective.	– Check battery contacts for damage or contamination. – Recharge battery. – Ensure that recharging process runs correctly. – Check transmitter functions using a fully charged or replacement battery.
The display in the transmitter flashes green but it is not possible to effect control commands.	– Receiver has no voltage. – No radio communication. – "Crane On" command has not been given.	– Check the connecting cable to the receiver. – Check the functions via the LEDs in the radio status panel of the receiver.
Some commands are not carried out.	– Receiver defective. – Interruption in the connecting cable to the machine.	– Check if all connecting cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, distributor or HBC-radiomatic GmbH.

Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Check the STOP switch functionality at regular intervals. Dirt deposits on the switch can hinder the mechanism and impair the function.
- Check the rubber bellows or rubber seals of the operating elements at regular intervals for leak-tightness. Replace immediately if cracks appear since the penetration of dirt and humidity may damage the function of the operating elements.
- Never use a high-pressure cleaner or sharp or pointed objects to clean the transmitter.
- Charge and discharge transmitter batteries regularly.

In the Event of a Fault

Warning:
Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer warranty.
  - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and OEM spare parts.
  - Always send in the complete radio system (transmitter, receiver, batteries, battery charger, connection cables, and other equipment) and attach a detailed fault description.
  - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system; otherwise pack securely. Send the consignment to your distributor or to the following address:

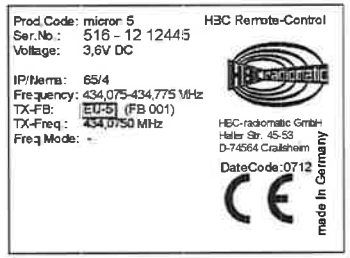
  HBC-radiomatic GmbH
  Haller Str. 45 – 53
  74564 Crailsheim, Germany
  Phone: +49 7951 393-0
  Fax: +49 7951 393-50
  E-Mail: info@radiomatic.com
- If you wish to bring a defective radio system to your distributor or the factory by yourself, we kindly ask you to make an appointment in advance.

For an overview of our worldwide service and sales contacts, please visit our website www.hbc-radiomatic.com under "Contact".

Frequency list for EU member states, EFTA states, and Turkey

Country block (cf. type plate)	Frequency range in MHz	Duty cycle	Power	Channel spacing	Marking according to RTTE directive	Country codes according to ISO 3166																																				
						AT	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IS	IT	LI	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SK	SL	TR	UK
AT-2	440,5250 – 441,4750	100%	10 mW e.r.p	25 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
AT-3	439,3900 – 439,4300	100%	10 mW e.r.p	20 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
CZ-1	430,0000 – 433,1000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-2	456,1700 – 456,4300	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-3	466,1700 – 466,4100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-1	433,5750 – 434,0250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-2	445,1250 – 445,8750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-1	433,1000 – 434,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-2	433,1000 – 434,6750	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-3	869,7250 – 869,9750	100%	5 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-4	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-5	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-6	434,0750 – 434,7500	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-7	434,0750 – 434,7750	100%	10 mW e.r.p	12,5 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FI-5	408,5750 – 408,8250	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-6	406,4000 – 406,8000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-7	442,5250 – 442,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-4	468,2750 – 468,5750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FR-1	407,7000 – 407,9250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NL-3	450,9300 – 451,1100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-2	440,0000 – 442,0000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-3	440,7250 – 441,7250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
SE-1	438,0250 – 439,9750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗
DECT	1880 – 1900	100%	10 mW e.i.r.p	1,728 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC240	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC241	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
radiomatic® photon	2408 – 2472,5	100%	80 mW e.i.r.p	3,5 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✗ = May not be used in the respective country
✓ = May be used in the respective country



As of 01/2017
Specifications and design subject to change without notice
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EU Declaration of Conformity

The manufacturer:

HBC-radiomatic GmbH
Haller Straße 45 – 53 • 74564 Crailsheim • Germany

hereby declares that the following product:

spectrum E
727-1815347

spectrum E
727-1815347/01

conforms to the following relevant Community harmonization legislation:

2006/42/EC	Machinery Directive, Annex II 1 A (safety component)
2014/53/EU	Radio Equipment Directive (RED)
2011/65/EU	Directive on the Restriction of Hazardous Substances (RoHS)

The designated product also adheres to the following European directives in regards to their protective goals:

2014/35/EU	Low Voltage Directive (see Annex I, 1.5.1 of the Machinery Directive 2006/42/EC)
2014/30/EU	Directive relating to electromagnetic compatibility (EMC)

The following harmonized standards were applied:

EN ISO 13849-1:2015
EN 60204-1:2006/AC:2010
EN 60204-32:2008
EN 60950-1:2006/AC:2011
EN 13557:2003 + A2:2008 (Annex C)
EN 301 489-1 V1.9.2
EN 50581:2012

With Short-Range Devices:
EN 300 220-2 V3.1.1

With DECT systems:
EN 301 406 V2.2.2

With 2.4 GHz systems:
EN 300 328 V2.1.1

Authorized person for documentation: Martin Schuster

Place and date: Crailsheim, 25.08.2017

Valid signature:

First name, name: Wolfgang Brendel
Position: Managing Director

Operating Instructions

Original Operating Instructions

FSE 727 radiobus®

AO727G07

HBC radiomatic

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Attachments: Frequency list for EU member states, EFTA states, and Turkey, EU Declaration of Conformity, system specific views, circuit diagrams and /or output wiring.

Pictographs

Danger due to electrical voltage. Touching live parts inside the unit can be fatal or cause serious injuries.

Instructions for occupational health and safety. Not following these instructions can lead to accidents that can cause damage, serious injuries or even death.

Important information about the operation of the radio system.

Manufacturer:
HBC-radiomatic GmbH • Haller Straße 45 – 53 • 74564 Crailsheim • Germany • Tel. +49 7951 393-0 • info@radiomatic.com

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Safety Instructions

Read these operating instructions carefully before working with the radio system. This applies in particular to the installation, commissioning and maintenance of the radio system.
The operating instructions are a constituent part of the radio control system and must always be kept close at hand for the responsible personnel.
The term 'machine' is used in the operating instructions for the different possible uses of the radio system.

Intended Use

- The radio system is used for the control of machines and for data transfer. Observe the occupational safety and accident prevention regulations applicable to each application.
- The intended use also includes reading the operating instructions and adhering to all safety information contained therein.
- The radio system must not be used in areas where there is a risk of explosion, nor for the control of machines used to convey persons, unless it is explicitly approved for these uses by the manufacturer.
- Modifications to the radio system may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. All modifications must be documented at the factory in the radio control master file.
- The safety devices of the radio control system must not be modified, removed or bypassed. In particular, modifications to any part of the radio system's complete E-STOP system are not allowed.

Safety Instructions for Installation and Operation

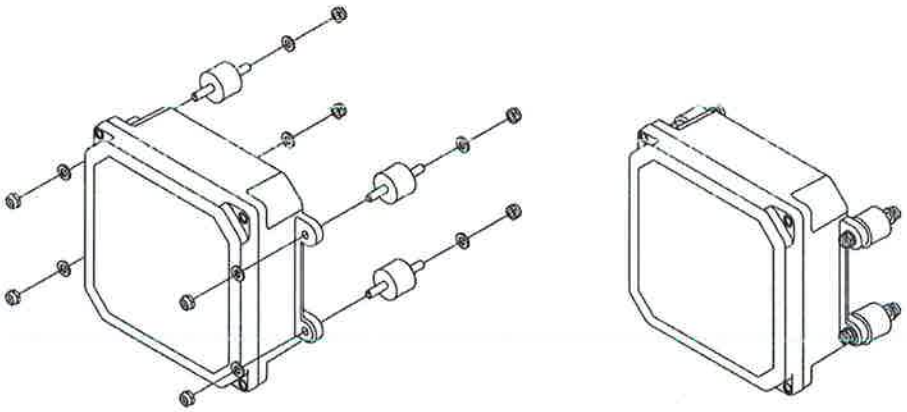
- The electrical connection according to the enclosed output wiring diagram must be established by a qualified electrician exclusively.
- The receiver may only be opened by trained personnel. Components inside the receiver can be energized at life-threatening voltages. The supply voltage for the machine must be disconnected before the receiver is opened.
- The power supply of the machine control as well as the contacts for external switching devices may only be connected to electrical circuits that have an all-pole separation device. (One separation device for the power supply and at least one separation device for the external switching devices.)
- For bus systems, the electronics of the machine needs to examine all control commands that belong to the Safety Circuit 2 for plausibility using the Si-2 hardware output on the side of the radio; in case there are implausibilities, it has to initiate the safe state immediately.
- Please also note that, with radio systems, the presence of persons in the danger zone – in particular beneath the load (cranes!) – is prohibited in all cases.
- Select a safe location for radio control, from which you have a good and complete view of the working movements of the machine, the load movements and the surrounding working conditions.
- It is not permissible to leave a radio transmitter unattended while it is activated. Always switch off the radio transmitter when it is not needed. This applies in particular if you change location, when working without radio control, during breaks and at the end of work. Always protect the radio transmitter against use by unauthorized persons, for example by locking it away.
- In the event of an emergency and with all faults, switch off the radio transmitter immediately by pressing the STOP switch.
- Only operate the radio system when it is in perfect working order. Faults and defects that could influence safety must be rectified by specialists who have been trained and authorized by HBC-radiomatic before the system is put back into operation.
- Note that the operational directions of the operating elements may appear inverted depending on location and viewing angle to the machine. This applies in particular to rotary cranes if your location changes from inside to outside the radius of the crane. The operator must make himself familiar with the directional markings on the machine before starting to work.
- Repairs may only be carried out by specialist personnel who have been trained and authorized by HBC-radiomatic. Use original replacement parts and accessories (e.g. rechargeable batteries) exclusively; otherwise it is possible that the equipment safety can no longer be guaranteed and our extended warranty will be voided.
- Remain vigilant when working with the radio system and familiarize yourself with its functions. This applies in particular if you are working with it for the first time or if you work with it only occasionally.

Installation

- The receiver should be mounted vertically with the cable connection downwards.
- Ensure that there are no metal parts within a radius of 1 m (3 feet) above the receiver.
- When the receiver has to be mounted in a control cabinet, a car antenna must be installed.
- Receivers with external antenna must be installed in such a way that the antenna stands freely and does not touch walls or metal parts. Otherwise a car antenna must be used, which can be supplied if needed.
- Receivers with plastic housing should be protected against direct sunlight (UV radiation) by appropriate measures.

Installation with Mounting Loops

The receiver is installed via the integrated mounting loops on the receiver sides. Use the shock mounts provided for installation to dampen any vibrations that may occur.



Module focus C/D/T (Option)

focus C

When several cranes are operated in tandem operation, a safe communication between the cranes is crucial. I. For example, one crane reaches the limit switch and is stopped automatically, the other crane has to be stopped as well in order to prevent dangerous situations.

focus C ensures a smooth crane communication in tandem operation. Using a CAN interface saves a great amount of wiring effort and thus valuable time!

focus D

As an external RF module with DECT interface, focus D ensures an optimal radio connection, even under difficult circumstances.

focus T

As an external RF module, focus T offers a perfectly working radio connection, even under difficult circumstances over a great distance. Depending on the working situation, up to 15 modules can be installed in different positions. As additional radio receivers, they receive all commands from the radio transmitter and relay it to the central receiver. There, they are analyzed and sent to the machine as output commands.

Obstacles in the radio path can thus be efficiently avoided and even long distances can be bridged with ease.

focus T can be combined with all HBC receivers of the radiobus® generation.

Installation

- Mount the module with 4 screws (M 5) via the provided drill holes (refer to chapter Dimensions).
- Do not install the module into a niche or a control cabinet.
- Ensure that there are no metal parts within a radius of 1 m (3 feet) above the module base.

Electrical Connection

The module is connected to a radio receiver via a 5-pin circular connector.
Please observe that the module may only be connected to the supply voltage indicated on the type plate!

Warning – shock hazard

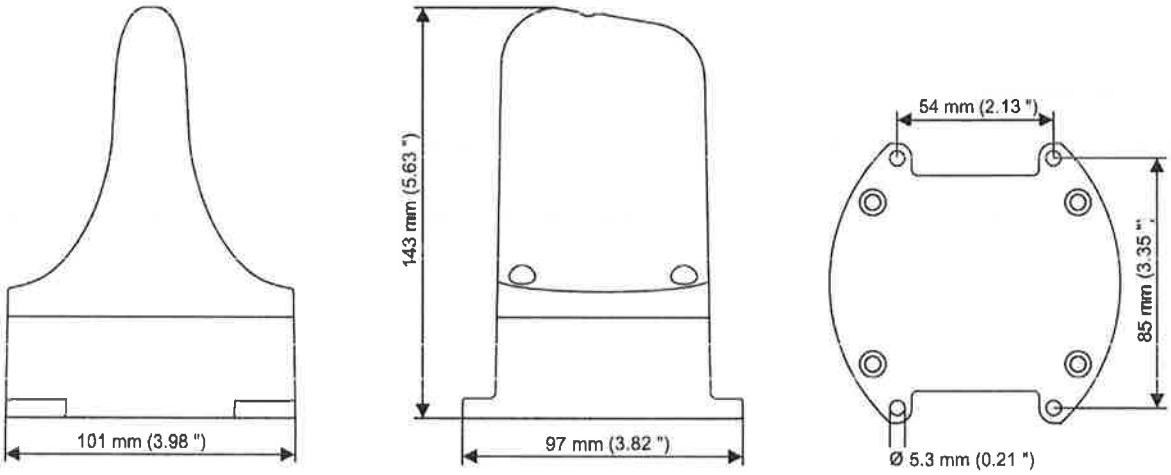
- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.

Control LED

A dual LED is located next to the cable connection in the module base.

- The LED illuminates red as soon as operating voltage is present at the module. The connection to the radio receiver is established and the internal operating voltage (10 – 30 V) is present.
- The LED illuminates green when the transmitter is switched on and the module receives a valid signal on its radio frequency.

Dimensions



Electrical Connection

Depending on the version, the radio receiver is connected either via a cable gland or with a Harting plug connection to the machine electrics.
Please observe that the receiver may only be connected to the supply voltage indicated on the type plate!

Warning – shock hazard!

- The electrical connection may only be carried out by skilled personnel.
- The electrical connection must comply with the enclosed wiring diagram.
- Switch off the supply voltage before opening the receiver. There is a risk of fatality from touching live parts inside the housing!

Control Display

A control display with LEDs indicating the operating state of the radio system is located in the upper housing part.

The LEDs have the following meaning:

Control display		**Simplex procedure** (Data are only transmitted from the transmitter to the receiver.)
Meaning	**Color**	**Receiver**
On	yellow	Illuminates as soon as the receiver is connected to the supply voltage.
RF	red	Illuminates as soon as the radio connection is interrupted.
Si1	green	Illuminates as soon as the E-STOP relays are closed.
Si2	green	Illuminates as soon as a drive command is output.
Feedback	yellow	Off. (Not available for FSE 508 / 509 / 512.)

Control display		**Duplex procedure** (Data are transmitted in both directions. Non-safety-relevant data are transmitted in the feedback.)
Meaning	**Color**	**Receiver**
On	yellow	Illuminates as soon as the receiver is connected to the supply voltage.
RF	red	Illuminates as soon as the radio connection is interrupted.
Si1	green	Illuminates as soon as the E-STOP relays are closed.
Si2	green	Illuminates as soon as a drive command is output.
Feedback	yellow	Illuminates as soon as a feedback telegram is transmitted. (Not available for FSE 508 / 509 / 512.)

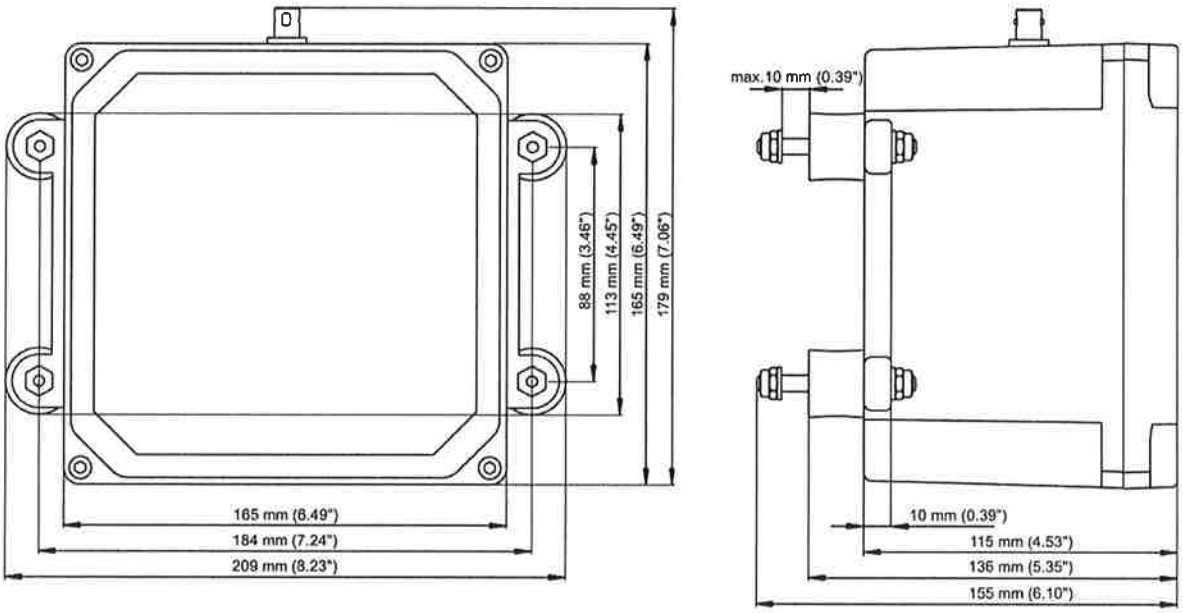
Technical Data

Max. number of control commands	26 digital or 10 analog (maximum number of digital commands depending on the configuration)
Unique system addresses	Over 1 000 000 combinations
Supply voltage	10 – 30 V DC
Power consumption	Max. 14 W
Inputs	Analog / digital: depending on equipment with input modules
Outputs	-
Interfaces	CANopen, CANsafety, Profibus-DP, RS485, RS232, DeviceNet, SAE J1939, Profinet, IQAN Cable option
E-STOP resp. SI1, SI2 control unit	1 x E-STOP output, high-side switch 10 A
Safety function	E-STOP: Performance Level d, category 3 according to EN ISO 13849-1:2015
Frequency ranges	405 – 475 MHz[1], 865 – 870 MHz, 902 – 928 MHz, 1210 – 1258 MHz[1] 2,4 GHz: 2402 – 2480 MHz DECT: 1790 – 1930 MHz
Channel spacing	12.5 / 20 / 25 / 50 / 250 kHz 2.4 GHz: 1 MHz DECT: 1.728 MHz
Connection	Harting Han 32 Option: Harting Han 25 or Han 50 Option: cable glands (metric M20/32)
Antenna	External, FL 30 or FL 70 Option: car antenna with 5 m cable and BNC connector Internal (option DECT) focus D (option DECT)
Operating temperature range	-25 °C ... +70 °C (-13 °F ... +158 °F)
Housing material	Plastic
Dimensions	165 x 165 x 115 mm (6.5 x 6.5 x 4.5 inches)
Weight	Approx. 2.6 kg (5.7 lbs.)
Protection class	IP 65

[1] Not all frequency ranges available.

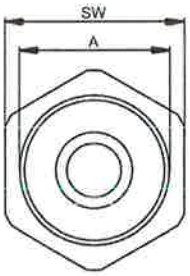
Dimensions

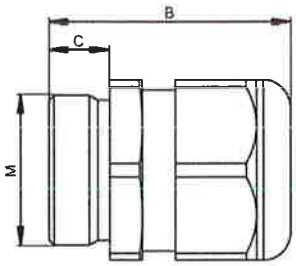
Receiver Housing HR168



Connection Options

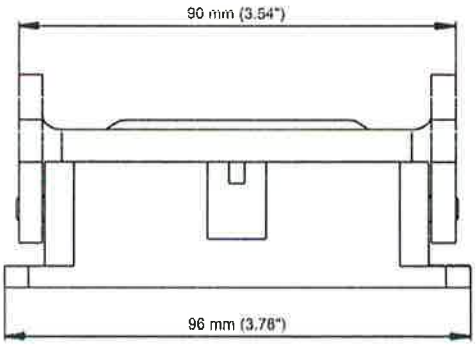
Metrical Cable Glands M20/32

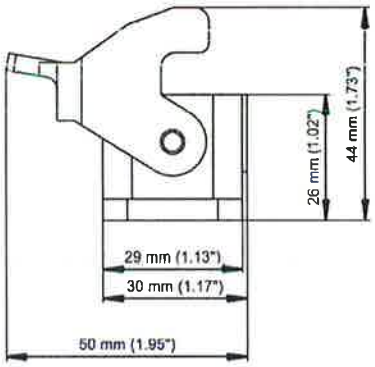




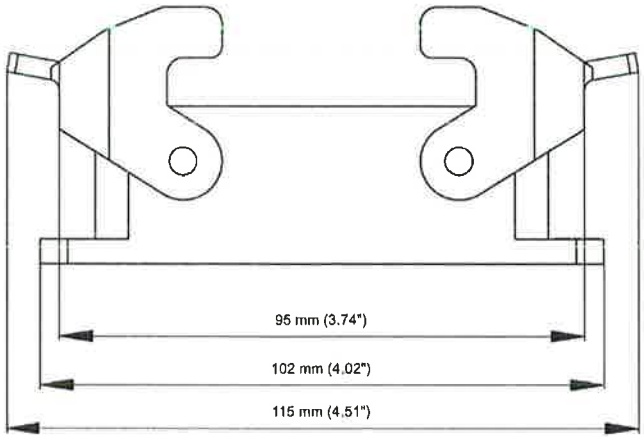
M	SW	A	B	C
M20	24 mm	5-9 mm	36 mm	9 mm
M32	36 mm	11-21 mm	47 mm	10 mm

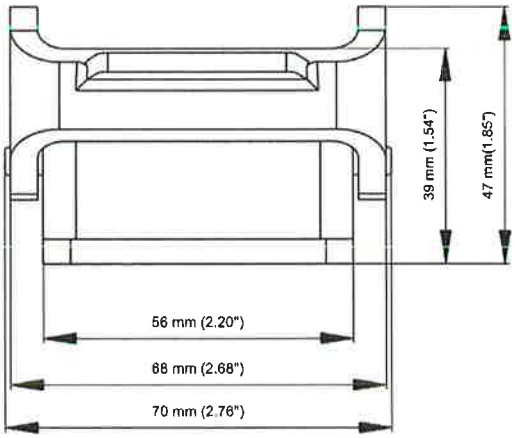
Harting Plug Connection Han 25





Harting Plug Connection Han 32/50





Troubleshooting

Note:
Please check the functions using the cabin or cable control first!

Problem	Possible Cause	Measures
Transmitter does not react when switched on.	– No power.	– Check battery contacts for damage or dirt. – Insert a fully charged battery into the battery compartment. – Recharge battery.
Low-power indication after minimal operating time.	– Battery contacts are dirty or damaged. – Battery not charged. – Battery defective.	– Check battery contacts for damage or dirt. – Recharge battery. – Ensure that recharging process runs correctly. – Check transmitter functions using a fully charged or replacement battery.
Some commands are not carried out.	– Receiver defective. – Interruption in the connecting cable to the crane or machine.	– Check if all connecting cables and cable junctions are tight.

If none of the measures mentioned resolve the problem, then please contact your service technician, dealer or HBC-radiomatic GmbH.

Maintenance

The radio control system is virtually maintenance-free. Please observe the following points:

- Never use a high pressure cleaner or sharp or pointed objects to clean the receiver.
- Whenever welding the machine:
  - Switch off the radio control system.
  - Switch off the machine.
  - Disconnect all electrical connections to the receiver.

  Otherwise the receiver electronics can be destroyed.

In the Event of a Fault

Warning:
Never operate a machine with a faulty or defective radio control system!

- Never try to repair the electronics of the radio control system! Opening the transmitter or receiver housing terminates the manufacturer warranty.
  - Send any defective or faulty equipment to your local distributor or to the manufacturer. They are experts and have the necessary know-how and OEM spare parts.
  - Always send in the complete radio system (transmitter, receiver, batteries, battery charger, connection cables, and other equipment) and attach a detailed fault description.
  - Do not forget to enclose your address and telephone number so that we can get in touch with you quickly if necessary.
- To avoid damage during transport, use the original packing supplied with the radio control system; otherwise pack securely. Send the consignment to your distributor or to the following address:

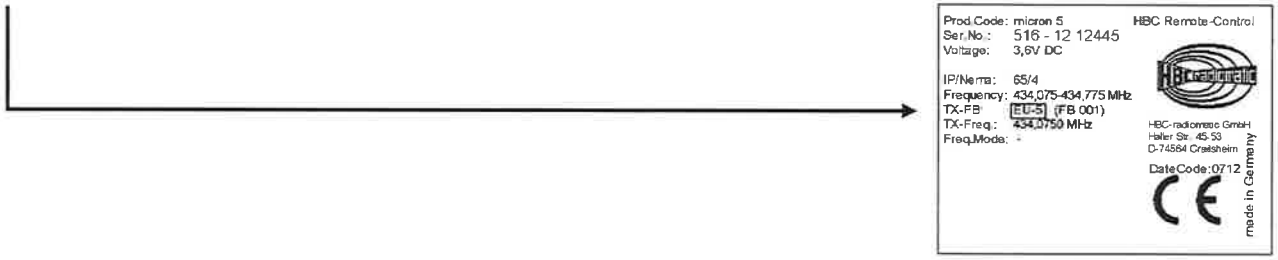
  HBC-radiomatic GmbH
  Haller Str. 45 – 53
  74564 Crailsheim, Germany
  Phone: +49 7951 393-0
  Fax: +49 7951 393-50
  E-Mail: info@radiomatic.com
- If you wish to bring a defective radio system to your distributor or the factory by yourself, we kindly ask you to make an appointment in advance.

For an overview of our worldwide service and sales contacts, please visit our website www.hbc-radiomatic.com under "Contact".

Frequency list for EU member states, EFTA states, and Turkey

Country block (cf. type plate)	Frequency range in MHz	Duty cycle	Power	Channel spacing	Marking according to RTTE directive	Country codes according to ISO 3166																																
						AT	BE	BG	CH	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HR	HU	IE	IS	IT	LI	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SK	SL	TR	UK
AT-2	440,5250 – 441,4750	100%	10 mW e.r.p	25 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
AT-3	439,3900 – 439,4300	100%	10 mW e.r.p	20 KHz	CE!	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
CZ-1	430,0000 – 433,1000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-2	456,1700 – 456,4300	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DE-3	466,1700 – 466,4100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-1	433,5750 – 434,0250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DK-2	445,1250 – 445,8750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-1	433,1000 – 434,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-2	433,1000 – 434,6750	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
EU-3	869,7250 – 869,9750	100%	5 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-4	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-5	434,0750 – 434,7750	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-6	434,0750 – 434,7500	100%	10 mW e.r.p	25 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EU-7	434,0750 – 434,7750	100%	10 mW e.r.p	12,5 KHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FI-5	408,5750 – 408,8250	100%	10 mW e.r.p	12,5 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-6	406,4000 – 406,6000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-7	442,5250 – 442,7500	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FI-4	468,2750 – 468,6750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
FR-1	407,7000 – 407,9250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NL-3	450,9300 – 451,1100	100%	10 mW e.r.p	20 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-2	440,0000 – 442,0000	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
NO-3	440,7250 – 441,7250	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
SE-1	438,0250 – 439,9750	100%	10 mW e.r.p	25 KHz	CE!	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗
DECT	1880 – 1900	100%	10 mW e.i.r.p	1,728 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC240	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TC241	2400,000 – 2483,500	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
radiomatic® photon analog	5725 – 5875	–	25 mW e.i.r.p	–	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
radiomatic® photon digital	2402 – 2480	100%	100 mW e.i.r.p	1 MHz	CE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✗ = May **not** be used in the respective country
✓ = May be used in the respective country



As of 04/2014
Specifications and design subject to change without notice
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EU Declaration of Conformity

The manufacturer:

HBC-radiomatic GmbH
Haller Straße 45 – 53 • 74564 Crailsheim • Germany

FSE 727
727-1815348

hereby declares that the following product:

conforms to the following relevant Community harmonization legislation:

2006/42/EC	Machinery Directive, Annex II 1 A (safety component)
2014/53/EU	Radio Equipment Directive (RED)
2011/65/EU	Directive on the Restriction of Hazardous Substances (RoHS)

The designated product also adheres to the following European directives in regards to their protective goals:

2014/35/EU	Low Voltage Directive (see Annex I, 1.5.1 of the Machinery Directive 2006/42/EC)
2014/30/EU	Directive relating to electromagnetic compatibility (EMC)

The following harmonized standards were applied:

EN ISO 13849-1:2015
EN 60204-1:2006/AC:2010
EN 60204-32:2008
EN 60950-1:2006/AC:2011
EN 13557:2003 + A2:2008 (Annex C)
EN 301 489-1 V1.9.2
EN 50581:2012

With Short-Range Devices:
EN 300 220-2 V3.1.1

With DECT systems:
EN 301 406 V2.2.2

With 2.4 GHz systems:
EN 300 328 V2.1.1

Authorized person for documentation: Martin Schuster

Place and date: Crailsheim, 25.08.2017

Valid signature:

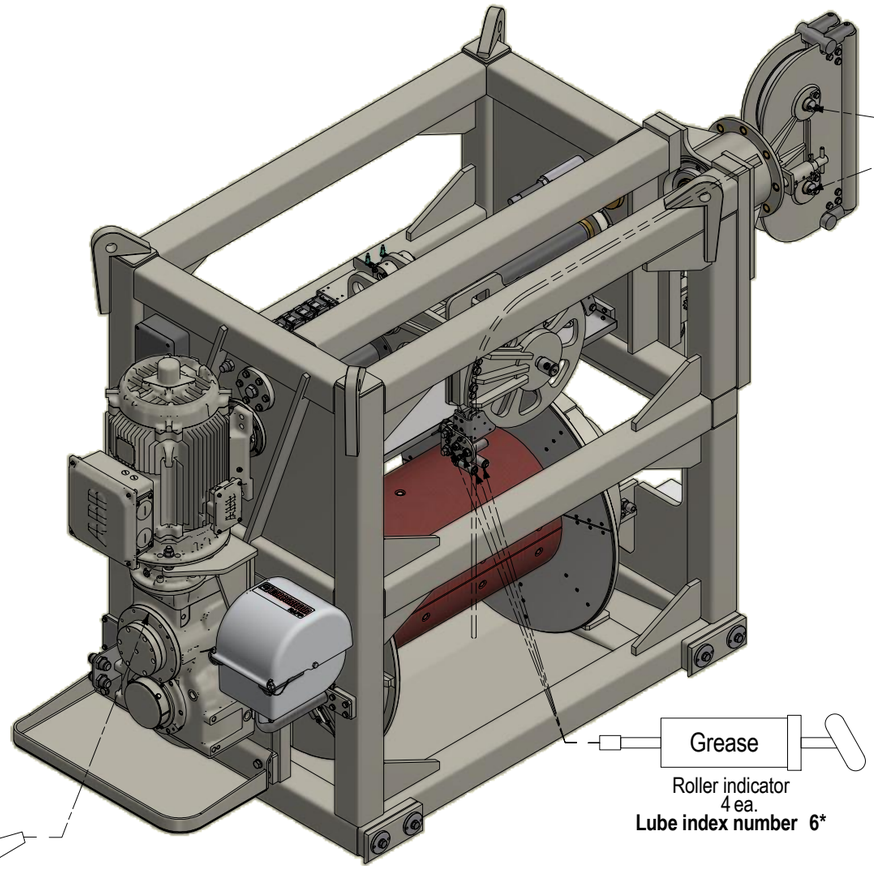
First name, name: Wolfgang Brendel
Position: Managing Director

Section 5

Periodic Maintenance

Lube Charts

DESCRIPTION	DOC/DRW #	REV #	PAG #
WINCHES			
CTD Winch	2000005634	A	2
Traction Winch	400092475-LUBE	A	3
Storage Drum	400092447-LUBE	A	4
Levelwind with Slack Wire Compensator	2000004322	A	5
CRANES			
Aux Winch ROV OHC	2000011851	B	6
Aux Winch KN-75 Main Crane Docking Head	2000012051	B	7
ROV Overhead Crane	-	-	8
CTD Davit	-	-	15
A-Frame	-	-	18
KN-75 Main Crane	-	-	21

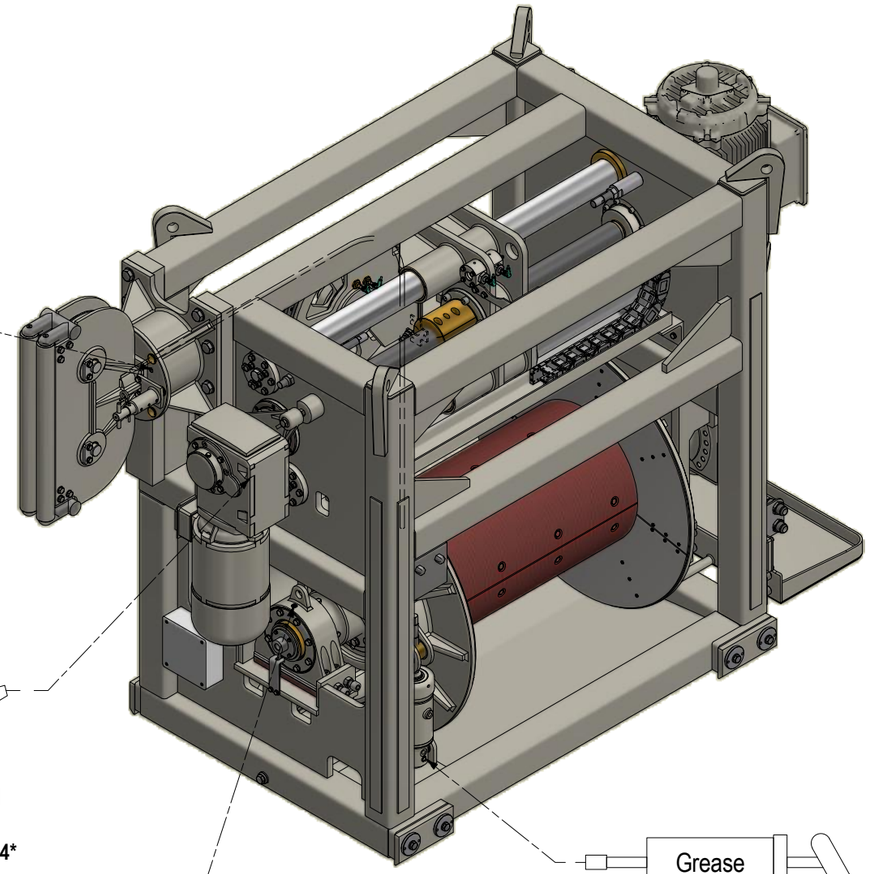


Grease
Pivot sheave
2 ea.
Lube index number 6*

Grease
Pivot sheave bracket
1 ea.
Lube index number 6*

Grease
Roller indicator
4 ea.
Lube index number 6*

Oil
Gearbox - BPH323K
Oil volume: 25 L
1 ea.
Lube index number 4*

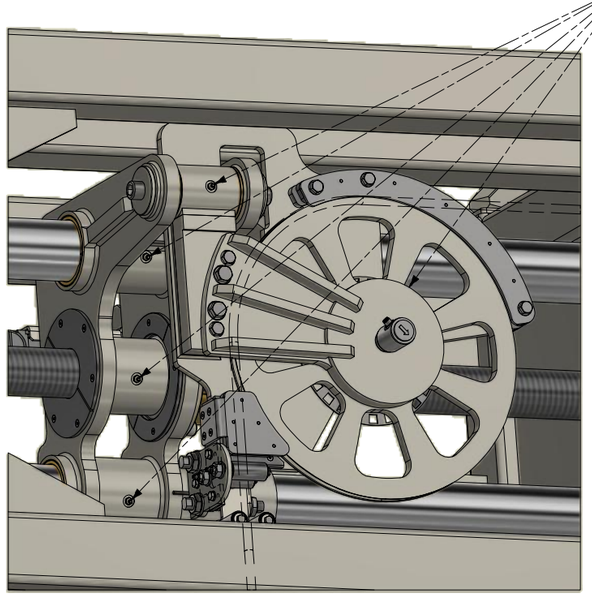


Oil
Gearbox - SK9032.1
Oil volume: 5.2 L
1 ea.
Lube index number 4*

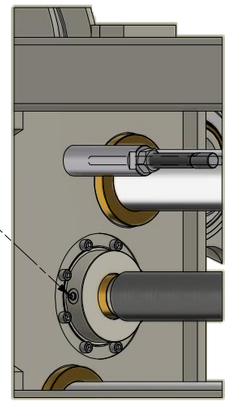
Grease
Brake arrangement
3 ea.
Lube index number 6*

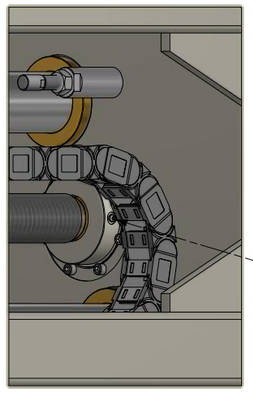
Grease
Drum bearing
1 ea.
Lube index number 6*

Grease
Pivot hub and shafts
4 ea.
Lube index number 6*



Grease
Trapeziodal screw bearing
1 ea.
Lube index number 6*





Grease
Trapeziodal screw bearing
1 ea.
Lube index number 6*

***NOTE!** See document **#6313 RAPP MARINE Lubrication Chart** for Lube Index No.

Designed by	Date	Modified by	ECO / CO			
D Petrovic	09.02.2022.	P Pantovic	ECO-2056698			

MACGREGOR

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Name	Weight (kg)
LUBRICATION PLAN	4215
Description	**Scale (A3)**
CTD WINCH, HW515FST90/URP	1 : 20
Document ID	**Revision** / **Sheet**
2000005634	A / 1 / 1

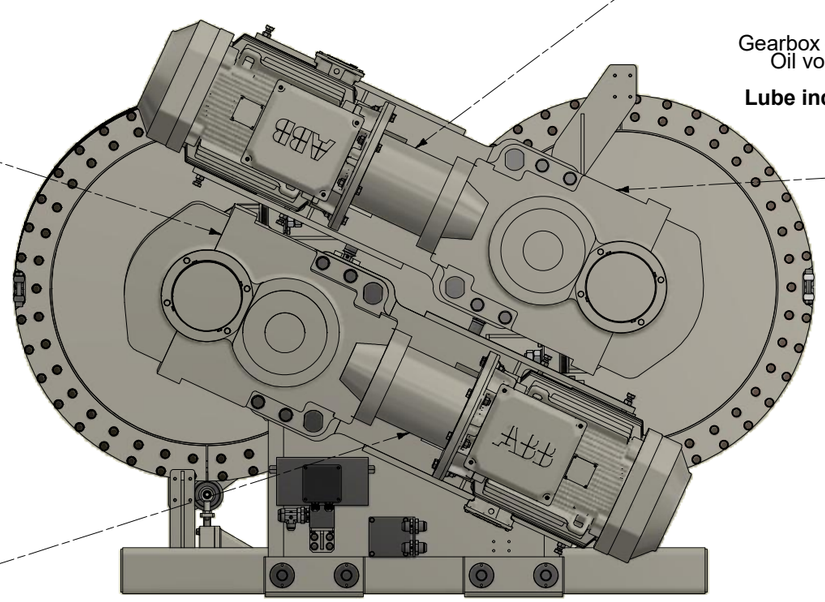
HYDRAULIC AND BRAKE SYSTEM:
- Gearboxes connected to the Cooling System
- Brakes supplied with oil from Hdraulic Brake System (*)

Oil

Gearbox - Wet Disk Brake
Oil volume: L
1ea.
Lube index number 2*

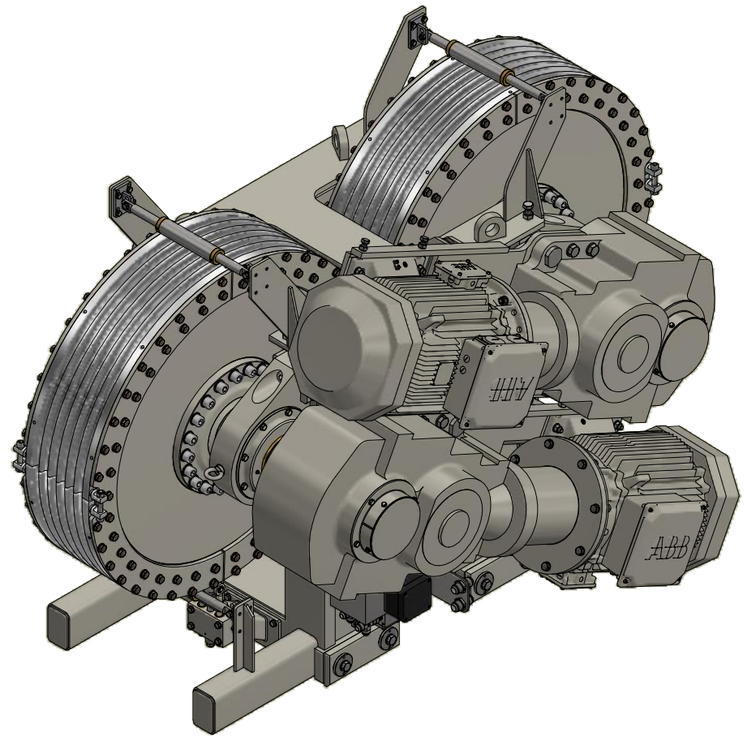
Oil

Gearbox - BPH328K
Oil volume:60L
1ea.
Lube index number 5*



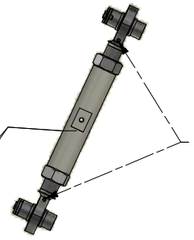
Oil

Gearbox - BPH328K
Oil volume:60L
1ea.
Lube index number 5*



Oil

Gearbox - Wet Disk Brake
Oil volume: L
1ea.
Lube index number 2*



Grease

Moment bar
4ea.
Lube index number 3*

Grease

Bearing housing cover
2ea.
Lube index number 6*

Grease

Bearing housing cover
2ea.
Lube index number 6*

***NOTE:** See document **#6313 RAPP MARINE Lubrication Chart** for Lube Index No.

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	26.10.2021.	RZPPA

Weight 7400 kg	TRACTION WINCH TRW-4004E-01R1 LUBRICATION PLAN			MACGREGOR
Scale (A3) 1 : 20	*Sheet* 1 / 1			*Drw number* 400092475-LUBE
	Material (for part)	*Status* Production	*Drawn by / Date (dd/mm/yy)* PETRODC 26.10.2021.	*Checked by / Date (dd/mm/yy)* RZPPA 26.10.2021.	*Partlist* 400092475

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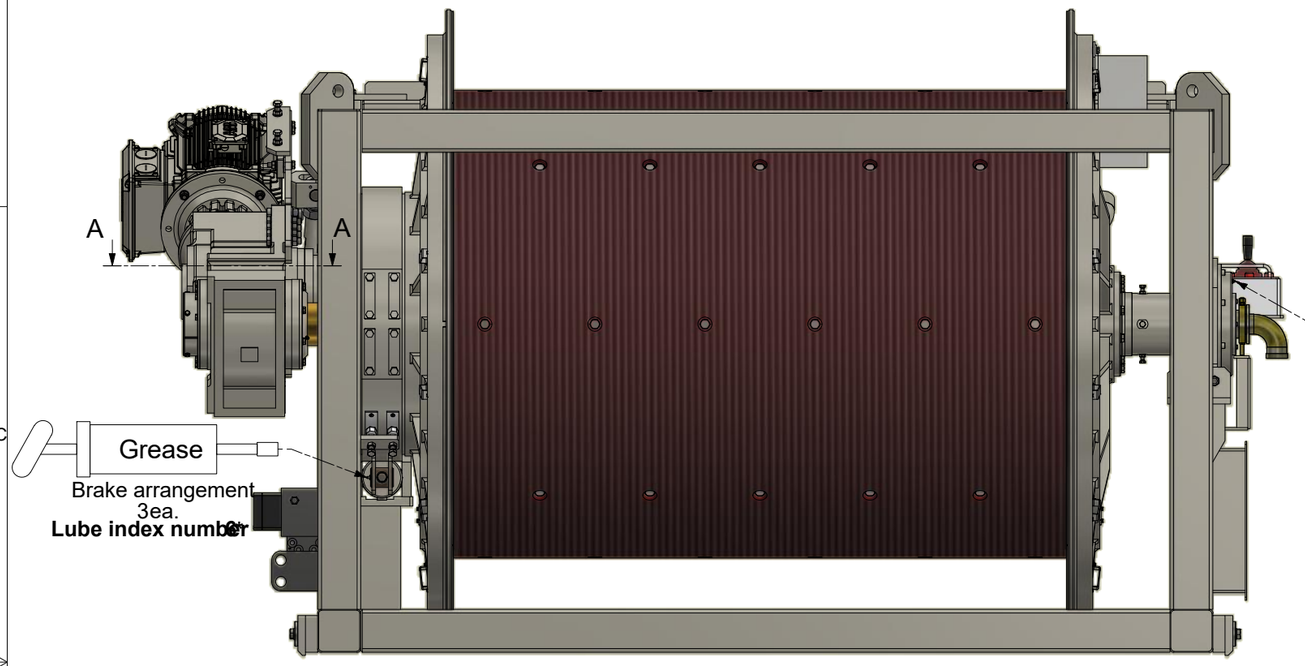
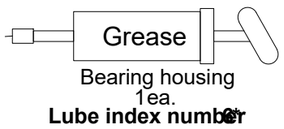
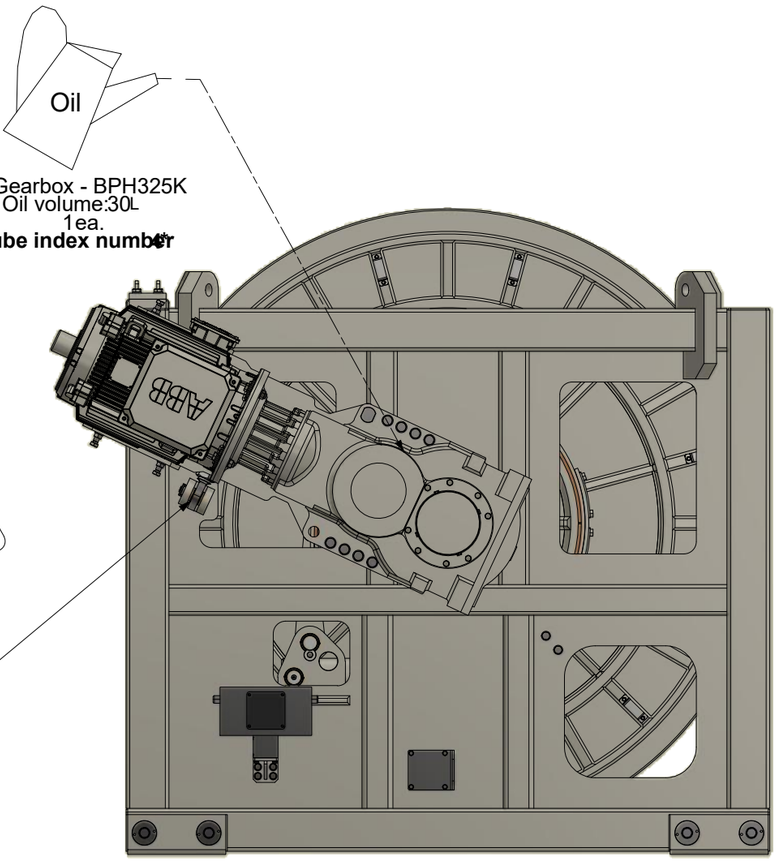
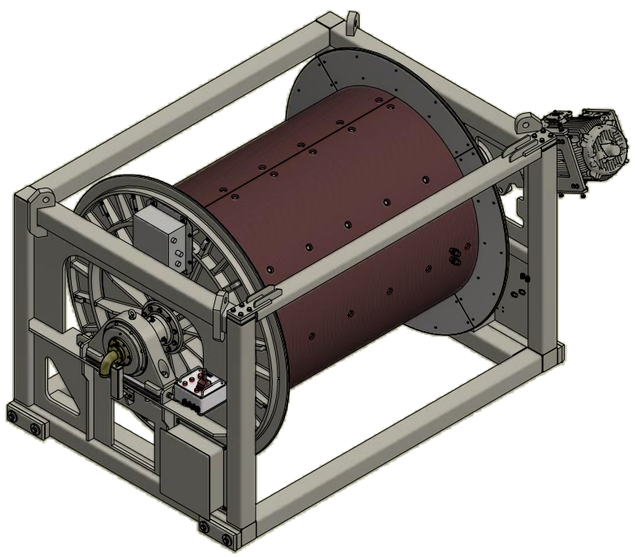
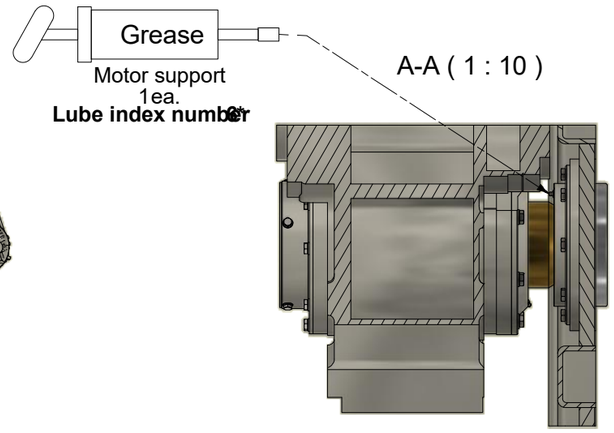




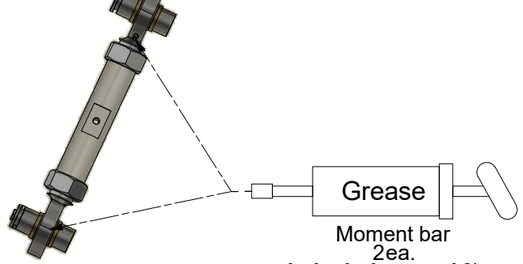


ISO VIEW (1 : 40)





A-A (1 : 10)



TYPE #1 OF MOMENT BAR **0 POINTS (NO GREASING REQUIRED)**
TYPE #2 OF MOMENT BAR **2 POINTS (GREASING REQUIRED)**

***NOTE:** See document **#6313 RAPP MARINE Lubrication Chart** for Lube Index No.

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	20.10.2021.	RZPPA

Weight 9500 kg	STORAGE DRUM RW-2372EBS, OLN LUBRICATION CHART	MACGREGOR	
Scale (A3) 1 : 20 / *Sheet* 1 / 1		*Drw number* 400092447-LUBE	
Material (for part)	*Status* Production / *Drawn by / Date (dd/mm/yy)* PETRODO 20.10.2021. / *Checked by / Date (dd/mm/yy)* RZPPA 20.10.2021.	*Partlist* 400092447	

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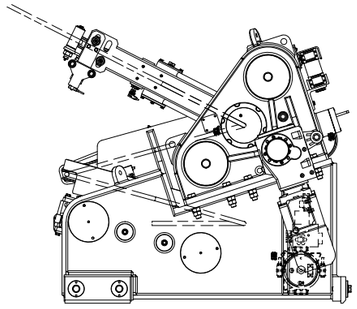
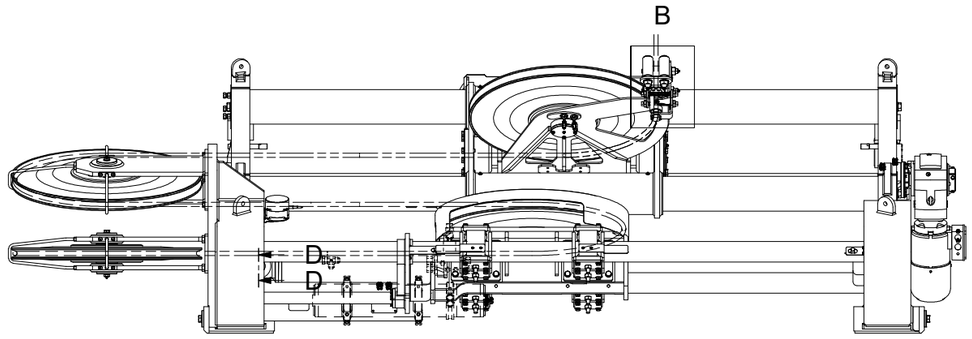
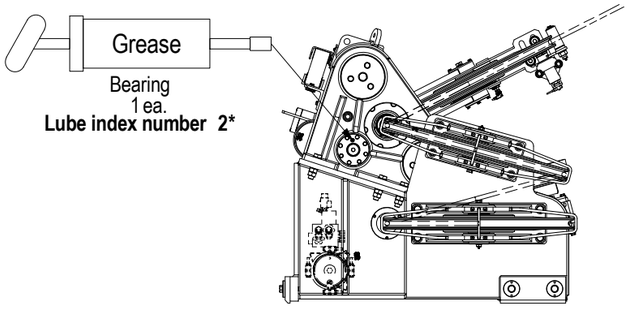
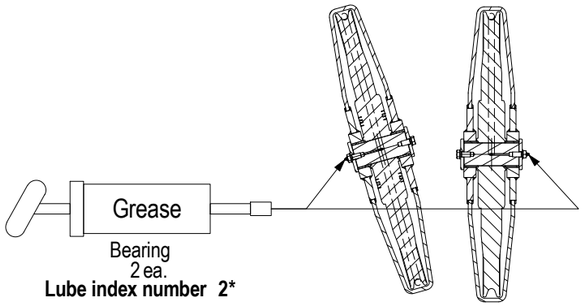
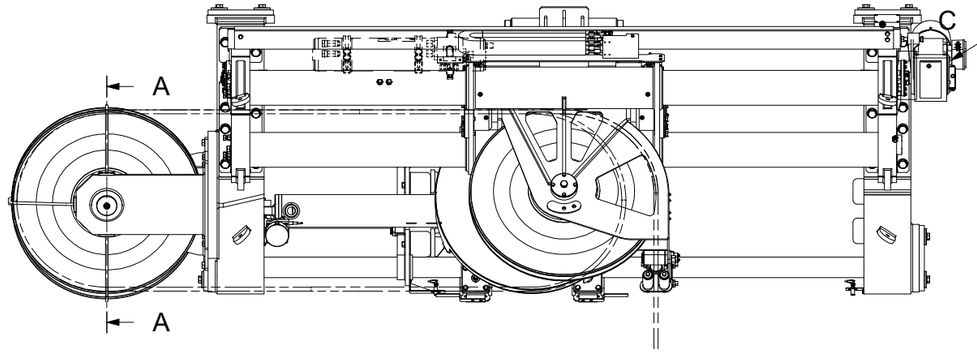


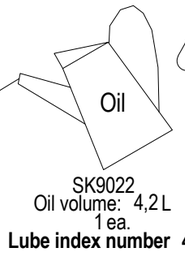
A-A (1 : 20)

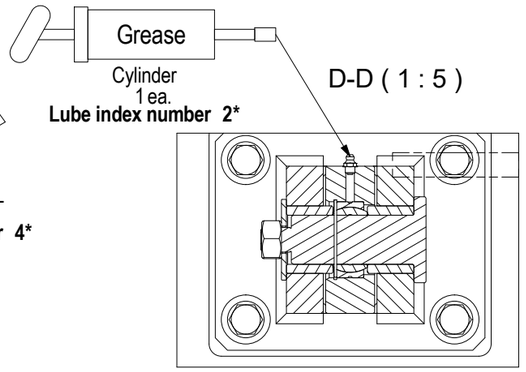




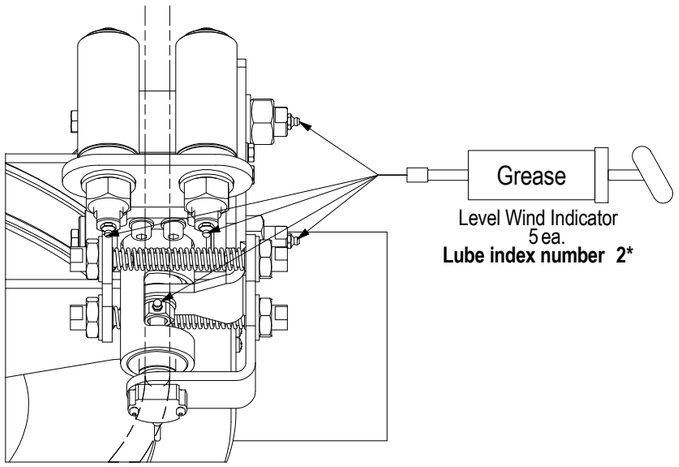




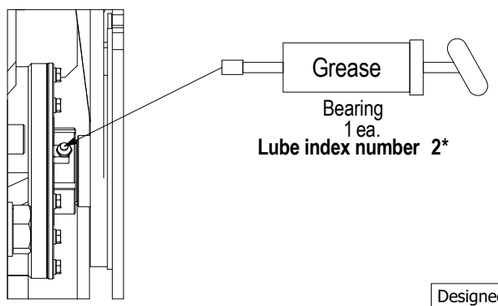


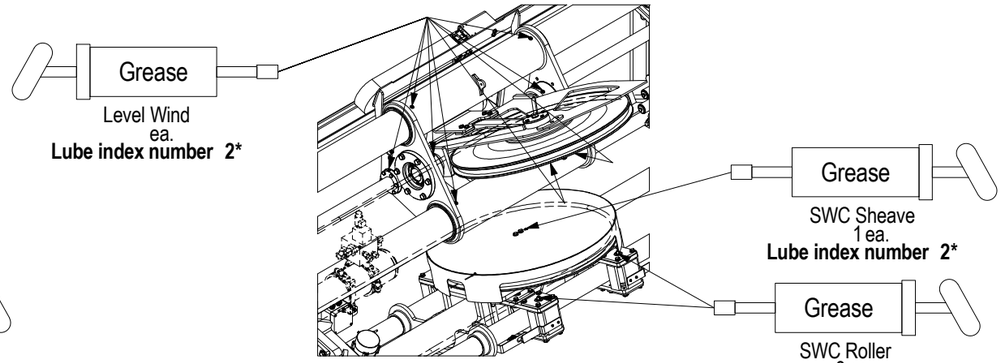


B (1 :5)



C (1 : 5)





Designed by	Date	Modified by	ECO / CO			
P Pantovic	27.12.2021.	P Pantovic	ECO-2056483			

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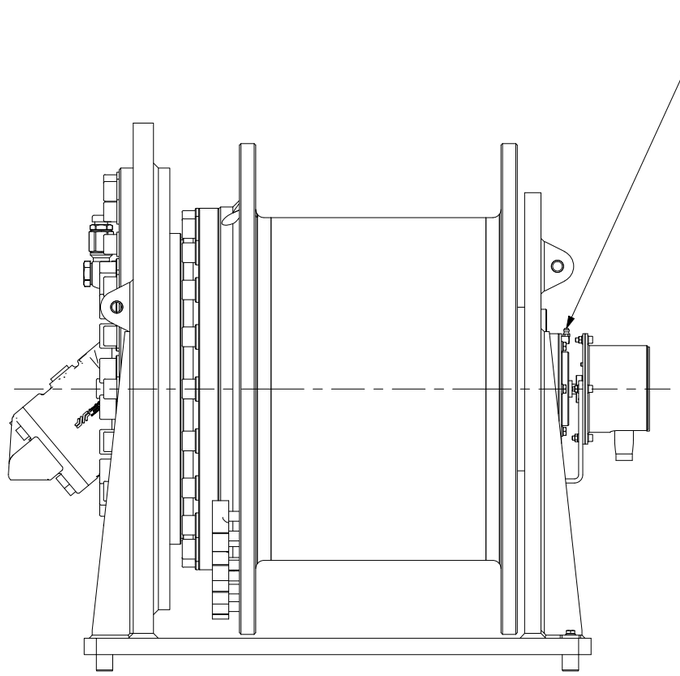
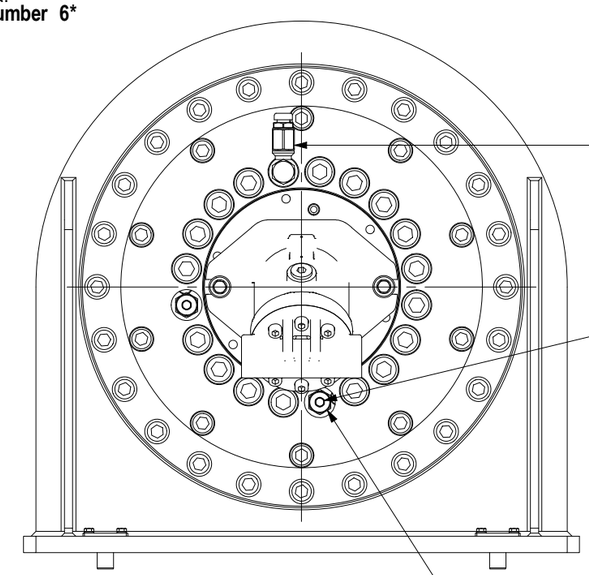
Name	Weight
LUBRICATION PLAN	4540 kg
Description	Scale (A3)
LEV. WITH SLACK WIRE, LSWC5000/01L1	1 : 30
Document ID 2000004322	Revision A / Sheet 1 / 1

***NOTE!** See document **#6313 RAPP MARINE Lubrication Chart** for Lube Index No.





Grease

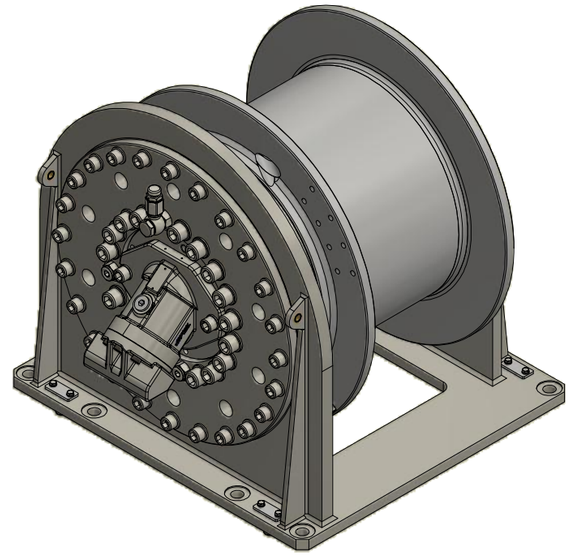
Bearing bracket
1 ea.
Lube index number 6*

PUT **PLUG** INSTEAD OF BREATHER
WHEN MOUNTING ON CRANE
(The Winch will be mounted upside down)

PUT **BREATHER** INSTEAD OF PLUG
WHEN MOUNTED ON CRANE
(The Winch will be mounted upside down)

Oil

Gearbox PWD3300_CF
Oil volume: 3 L
1 ea.
Lube index number 4*



***NOTE!** See document **#6313 RAPP MARINE Lubrication Chart** for Lube Index No.

Designed by	Date	Modified by	ECO / CO			
S Vasilijevic	2.9.2022.	A Karaic	ECO-2058000			

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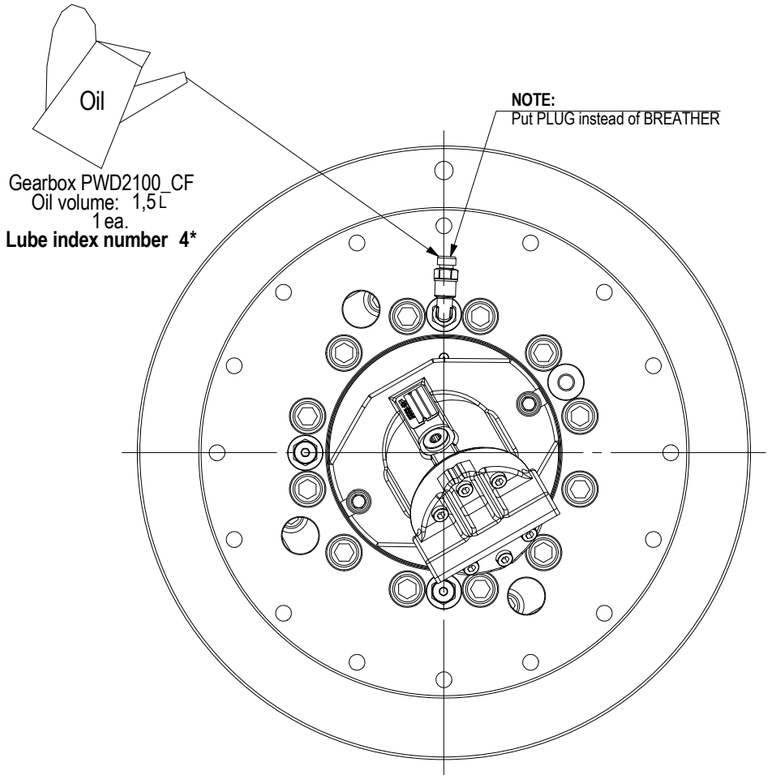
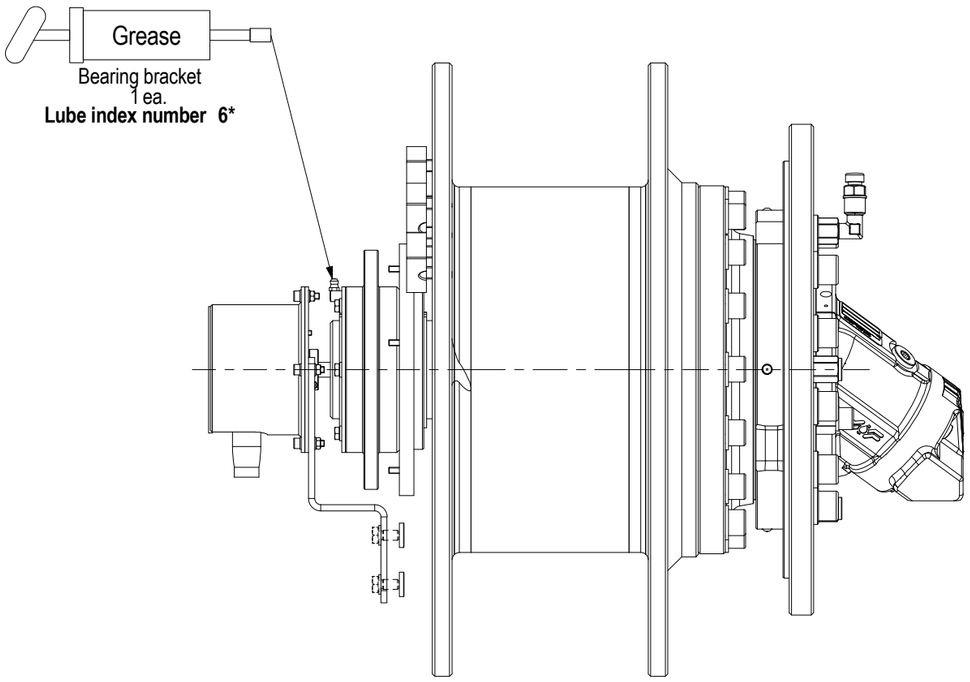
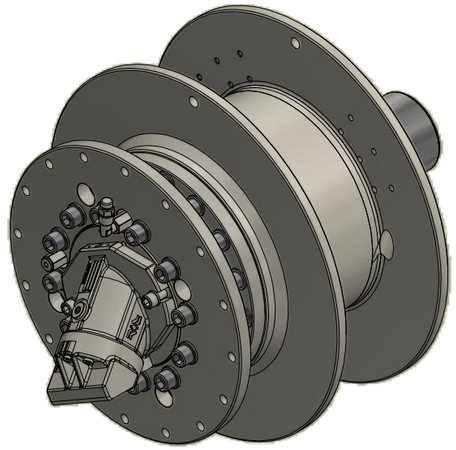
Name	Weight (kg)
LUBRICATION CHART	531
Description	**Scale (A3)**
Gilson Winch GW-1000, LU, RO	1 : 7,5
Document ID	**Revision** / **Sheet**
2000011851	B / 1 / 1





ISO VIEW (1 : 7.5)



ISO VIEW (1 : 7.5)

***NOTE!** See document **#6313 RAPP MARINE Lubrication Chart** for Lube Index No.

Designed by	Date	Modified by	ECO / CO			
S Vasilijevic	09.09.2022.	B Simic	ECO-2058000			

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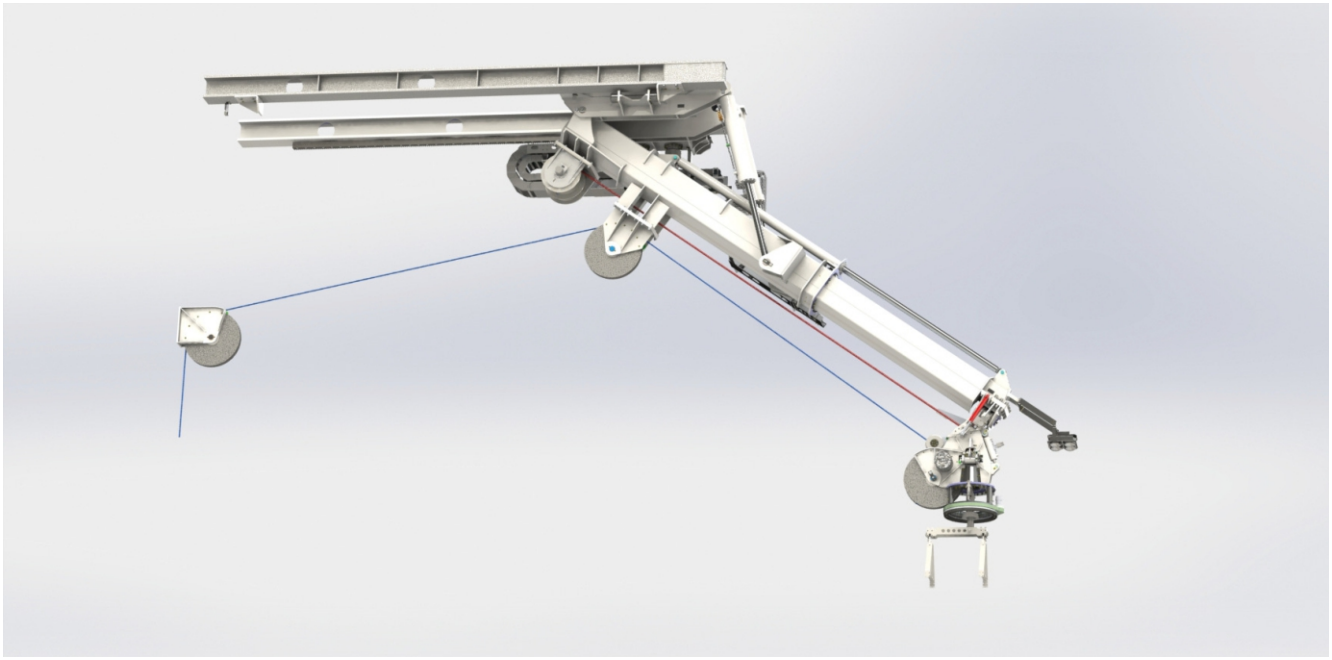
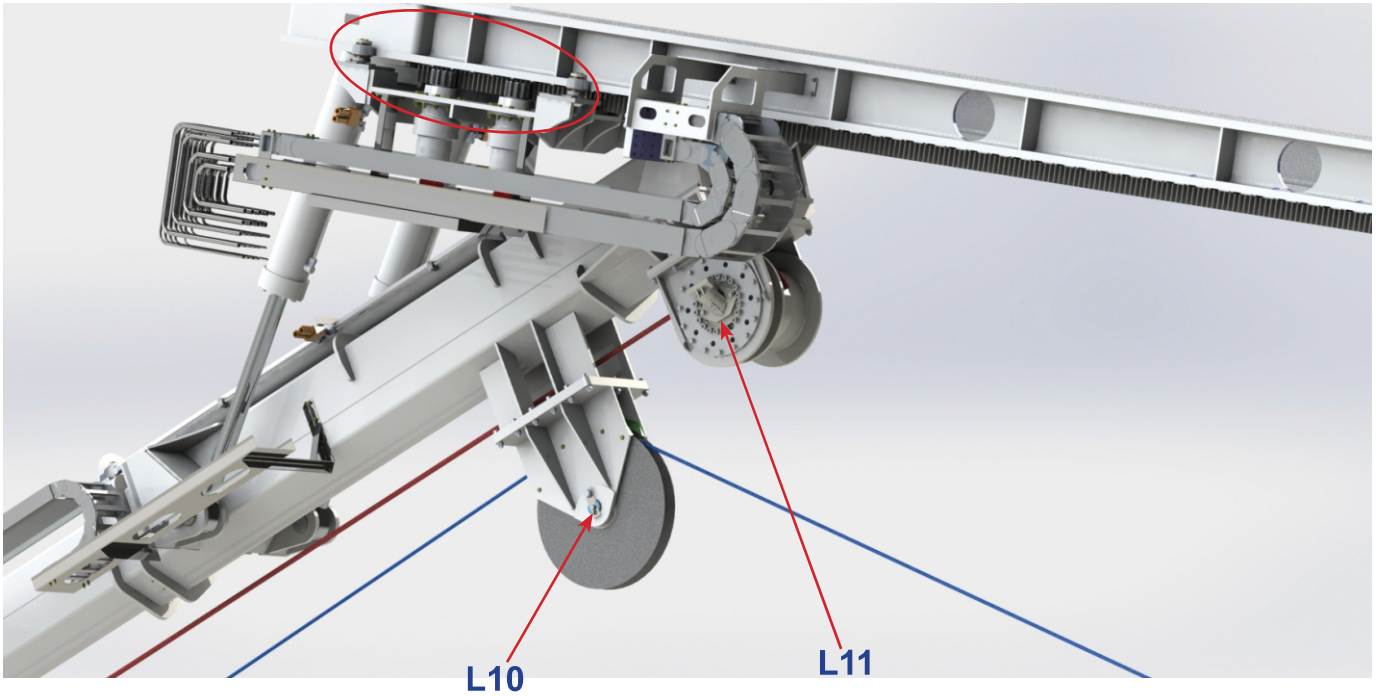
Name	Weight (kg)
LUBRICATION CHART	178
Description	Scale (A3)
GW-1000-UV, LO	1 : 5
Document ID	Revision / Sheet
2000012051	B / 1 / 1

Overhead Crane Lubrication

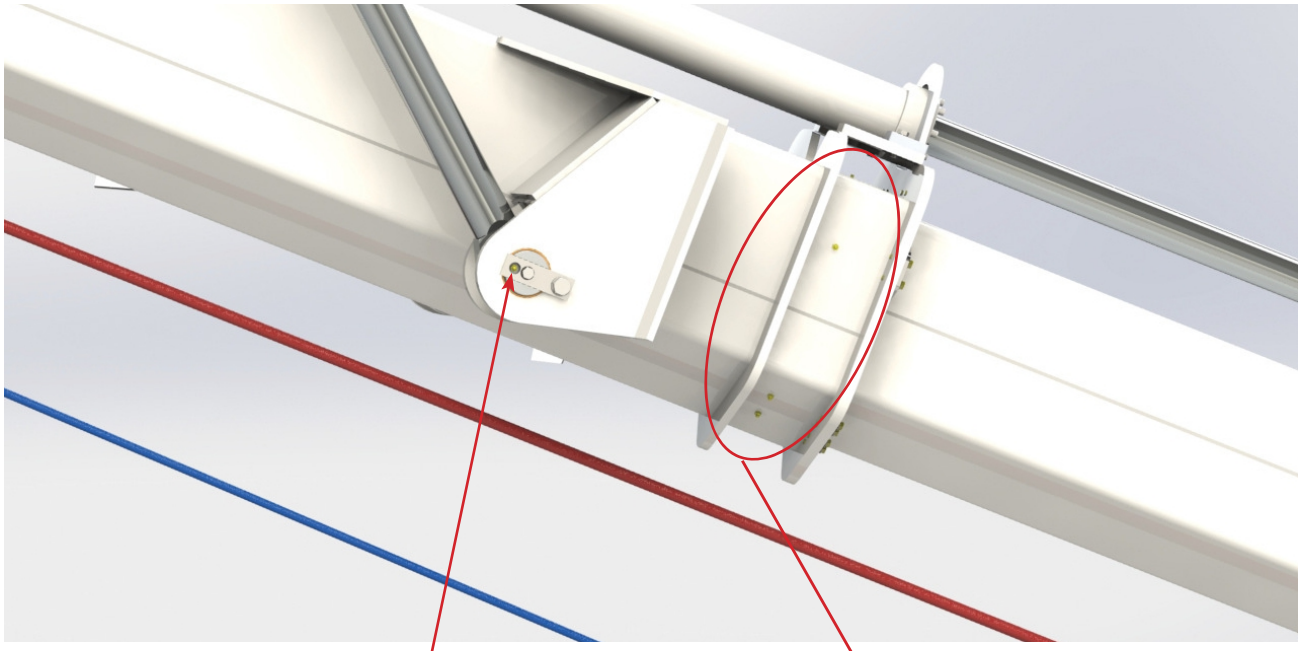
Lubrication chart

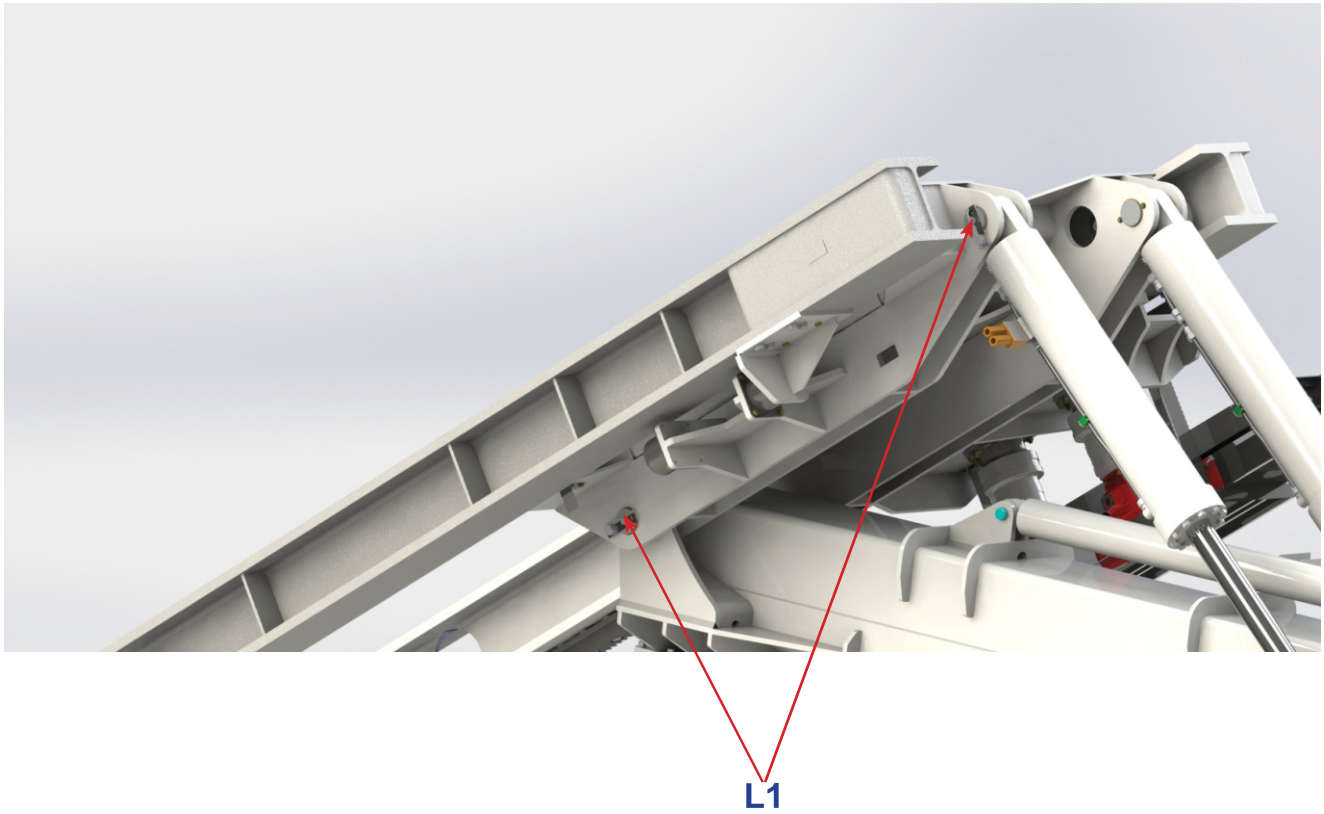




Overhead Crane Lubrication

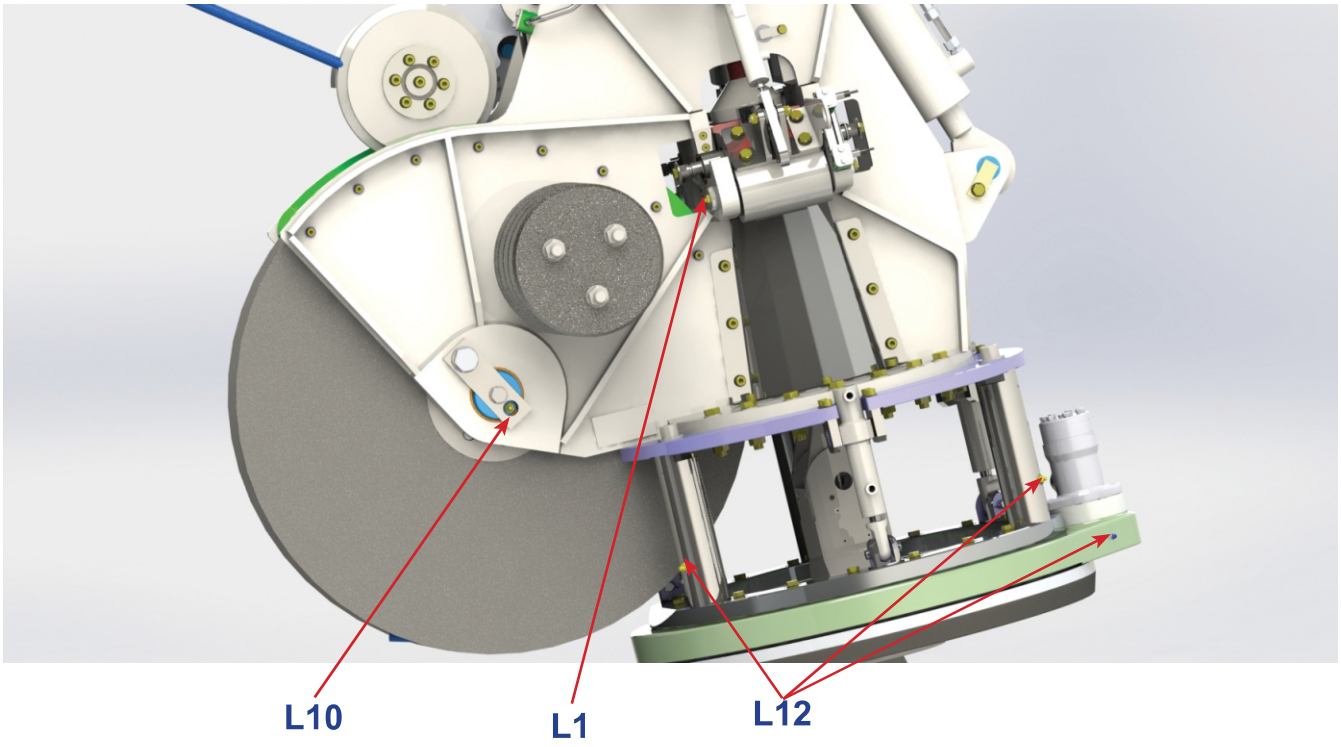
Lubrication chart

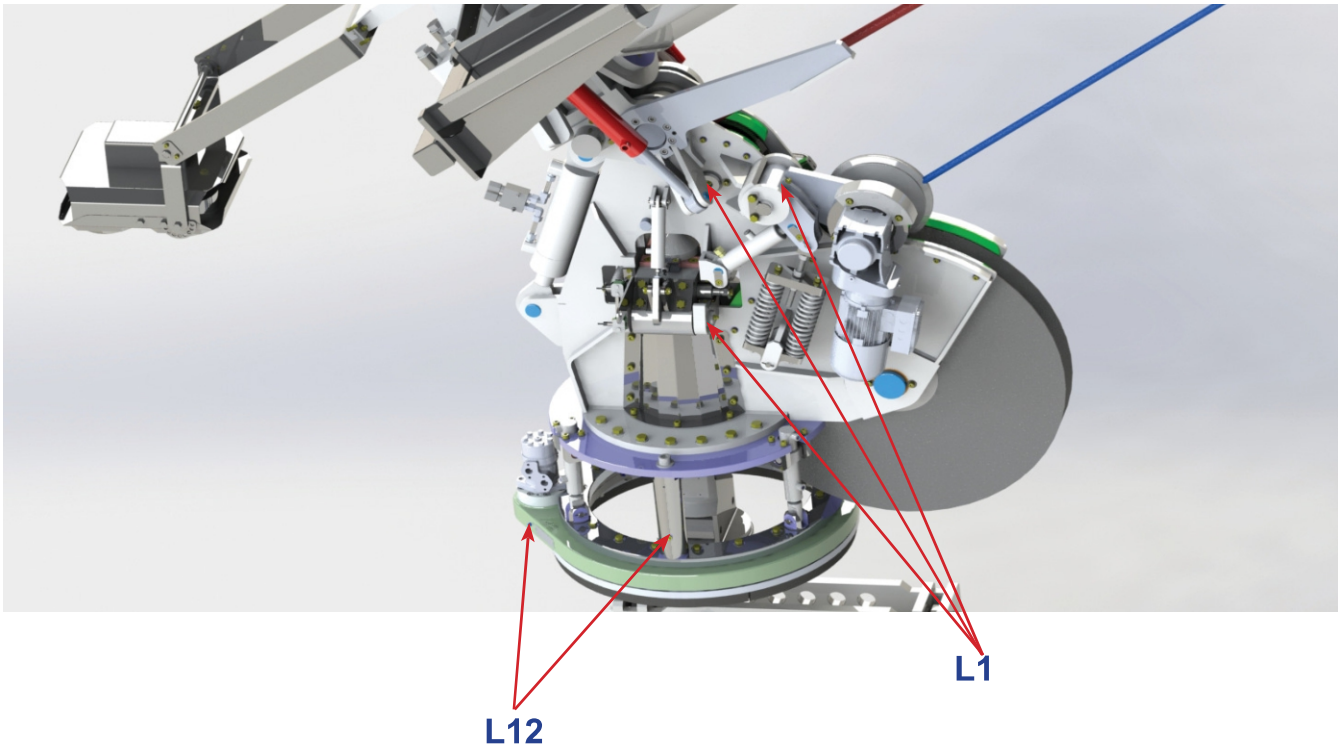




Overhead Crane Lubrication

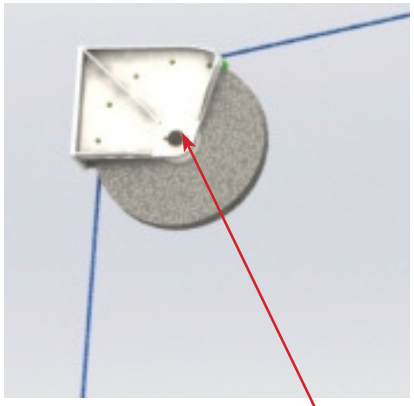
Lubrication chart

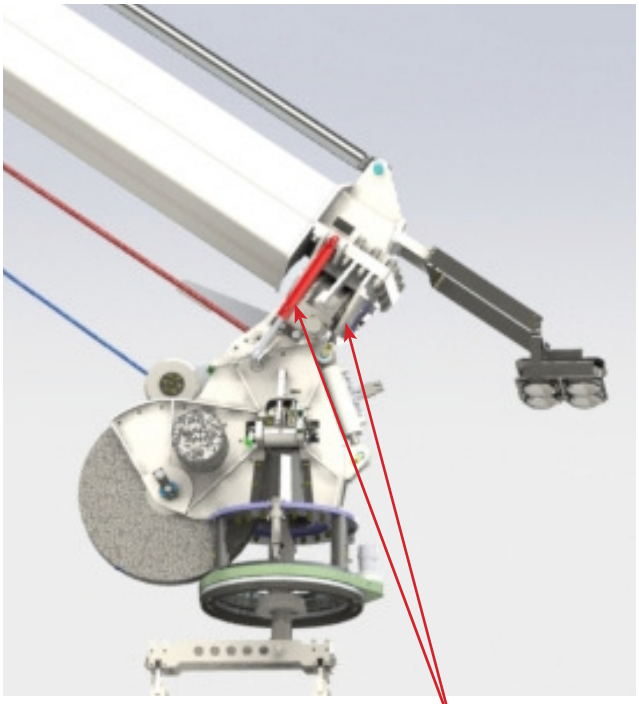


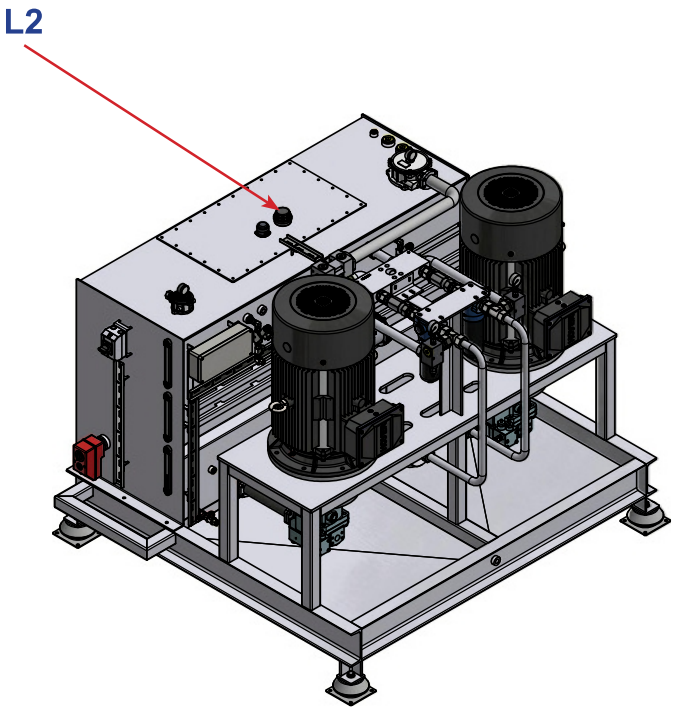


Overhead Crane Lubrication

Lubrication chart





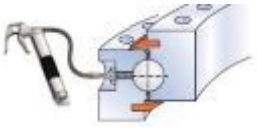


Overhead Crane Lubrication

Pos.	Item	Oil Quality	Volume	Schedule
L1	Bolts	Shell Gadus S2 V220		Monthly lubrication daily control
L2	Hydraulic system	Recomended oil type 20-40°C Shell Tellus S2 V 32 40-50°C Shell Tellus S2 V 46 50-60°C Shell Tellus S2 V 68 60-70° Shell Tellus S2 V 100 or equivalent dependent on system temp.		Weekly control. Yearly oil change.
L3	Gearbox	Shell Omala S2 G Shell Omala S4GX / VI	2,6 l	See: "RE-gearbox maintenance"
L4	Brake	Shell Tellus S2 V32	Level plug	See: "RE-gearbox maintenance"
L6	Telescope	Shell Gadus S2 V220		Monthly lubrication daily control
L7	Tooth bar	Shell Gadus S3 A1300C **(Open gear grease)**		Monthly lubrication daily control
L8	Trolley wheels	Shell Gadus S2 V220		Monthly lubrication daily control
L10	Wire block	Shell Gadus S2 V220		Monthly lubrication daily control
L11	Winch	**Shell Omala S2 G150 (220 from TRIPLEX) (ISO VG 150)**	**Fill the drum to it's horizontal axis.**	**Oil change every 6 months or afther 600 hours of use**
L12	Docking head	Shell Gadus S2 V220		Monthly lubrication daily control

MPORTANT:

Lubricate gear teeth and pinion with open gear grease. This lubrication should be carried out by opening hatches on the side of the foundation. Use spray or brush for applying grease on gear teeth.



Press grease into all grease nipples connected to the slewing ring while revolving the slewing ring, until a continuos grease collar forms under both of the seals.

Overhead Crane Lubrication

Lubricants specification

Shell Gadus V220			Method	2
NLGI Consistency				2
Soap Type				Lithium
Base Oil				Mineral
Kinematic Viscosity	@ 40°C	cSt		220
	@ 100°C	cSt	IP 71 / ASSM D445	19
Dropping Point		°C	IP 396	180
Cone Penetration	@ 25°C	0.1mm	IP 50 / ASTSM D217	265-295

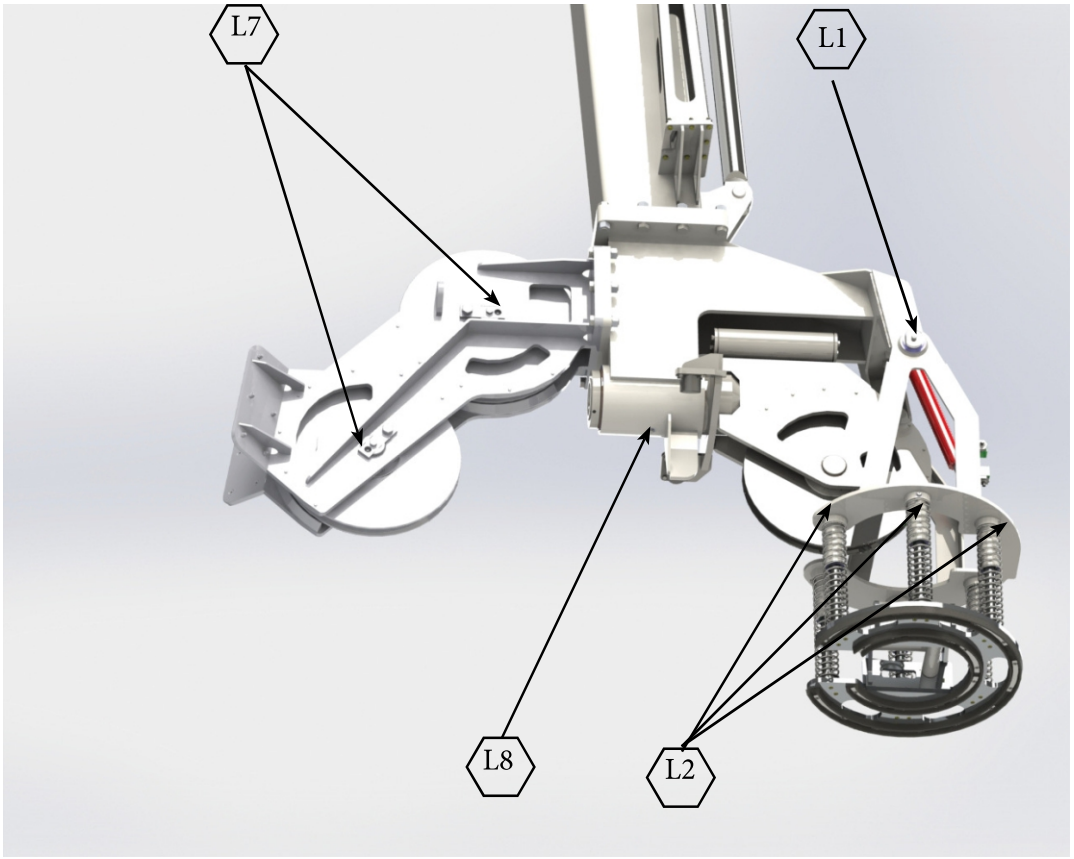
Shell Tellus S2 V		Method	32	46	68	100
Iso Viscosity grade		ISO 3448	32	46	68	100
ISO Oil Type		ISO fluid type	HV	HV	HV	HV
Kinematic Viscosity	@ -20°C	ASTM D445	1300	2350	*	*
	@ 40°C	ASTM D445	32	46	68	100
	@ 100°C	ASTM D445	6,1	7,9	8,6	14
Viscosity Index		ISO 2909	143	143	142	142
Density	@ 15°C kg/m^3	ISO 12185	0872	0.872	0.877	0.880

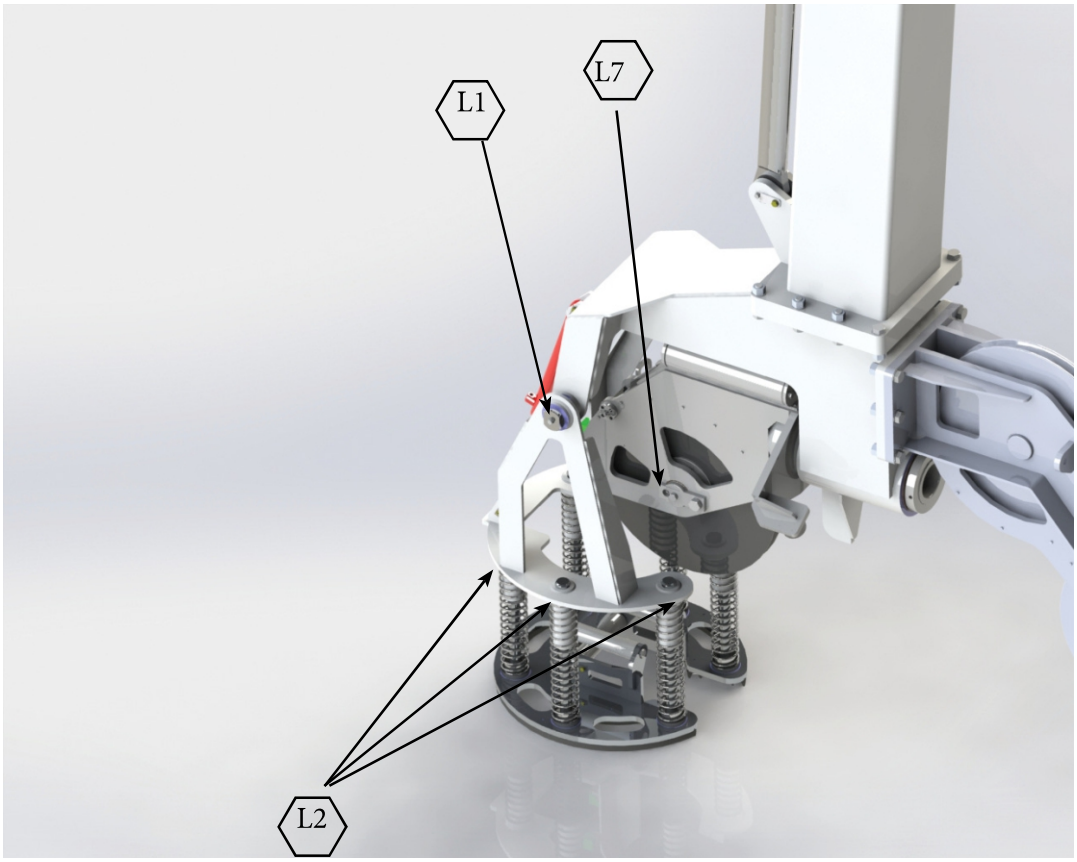
Shell Omala S2 G			Method	150
Iso Viscosity grade			ISO 3448	150
Kinematic viscosity	@ 40°C	cSt	ISO 3104	150
	@ 100°C	cSt	ISO 3104	15
Viscosity Index			ISO 2909	100
Density	@ 15°C kg/m3		ISO 12185	897
Flash Point		°C	ISO 2592	240
Pour Point		°C	ISO 3016	-24

Overhead Crane Lubrication

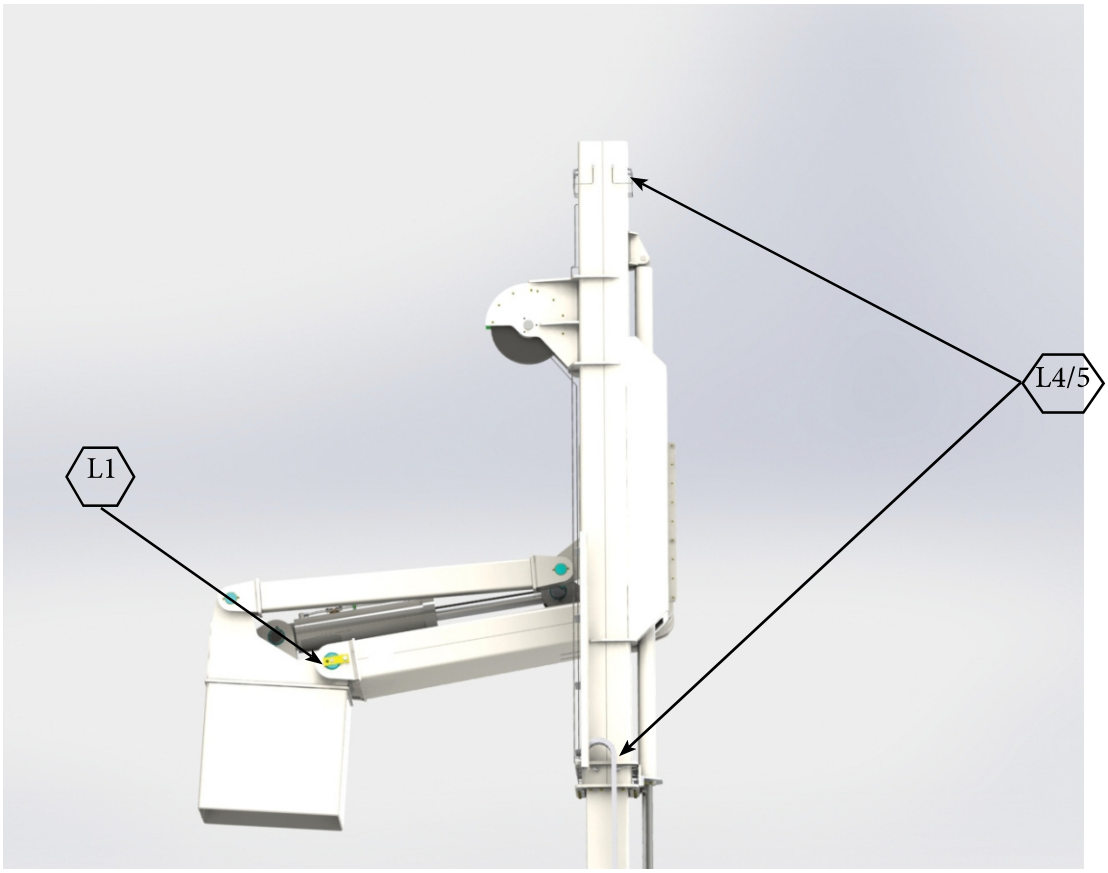
Shell Gadus S3 A1300C			Method	
NLGI Consistency				2
Penetration, worked 60 strokes		0.1mm	IP 50 / ASTM D217	265-295
Dropping Point		°C	IP 396	>140
Base Oil Viscosity	@400°C	cSt	IP 71 / ASTM D445	1300
	@1000°C	cSt	IP 71 / ASTM D445	106
Rust Preventing Properties : SKF Emcor distilled water				Pass
Rust Preventing Properties : SKF Emcor WWO distilled water				Pass
Lubricating Ability SKF R2F A				Pass
Lubricating Ability SKF R2F B	@120°C			Pass
Water Washout			ASTM D1264	5%
Colour				Red
Temperature Range (temporarily)		°C		-25/+110 (120)

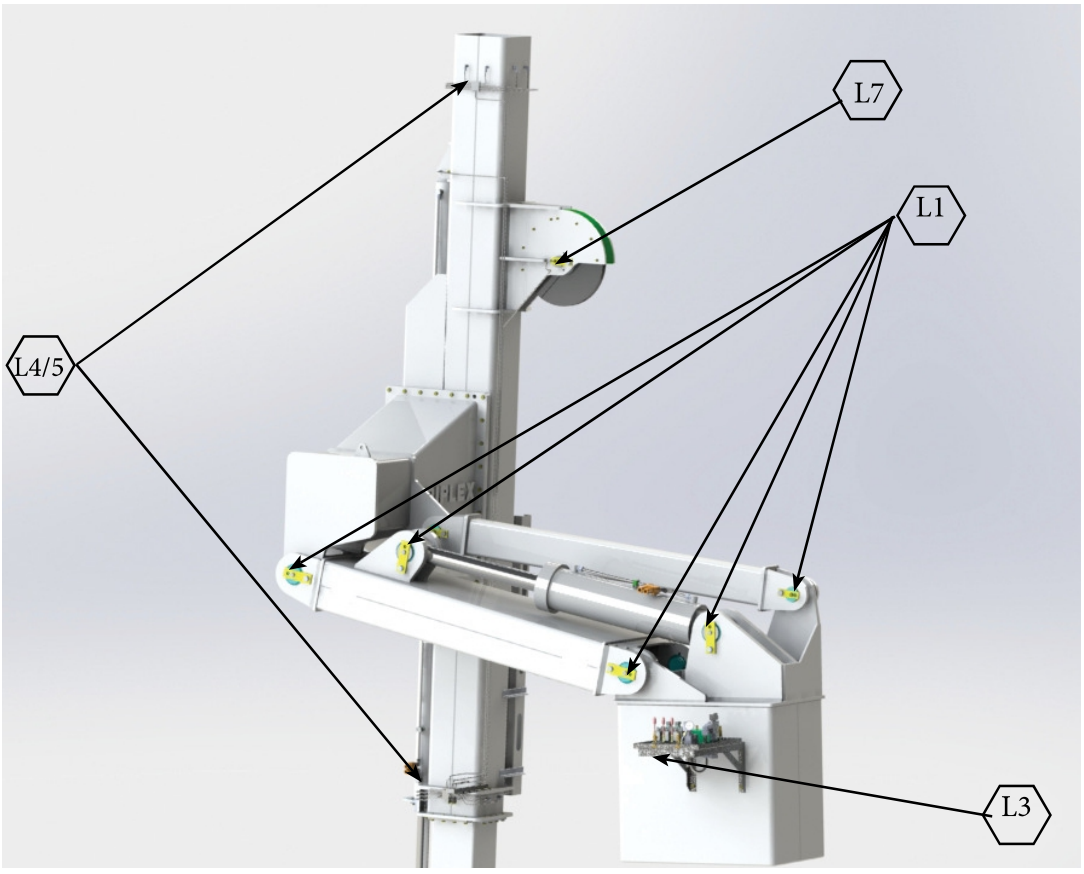
Lubrication





Lubrication





KN-75 LUBRICATION

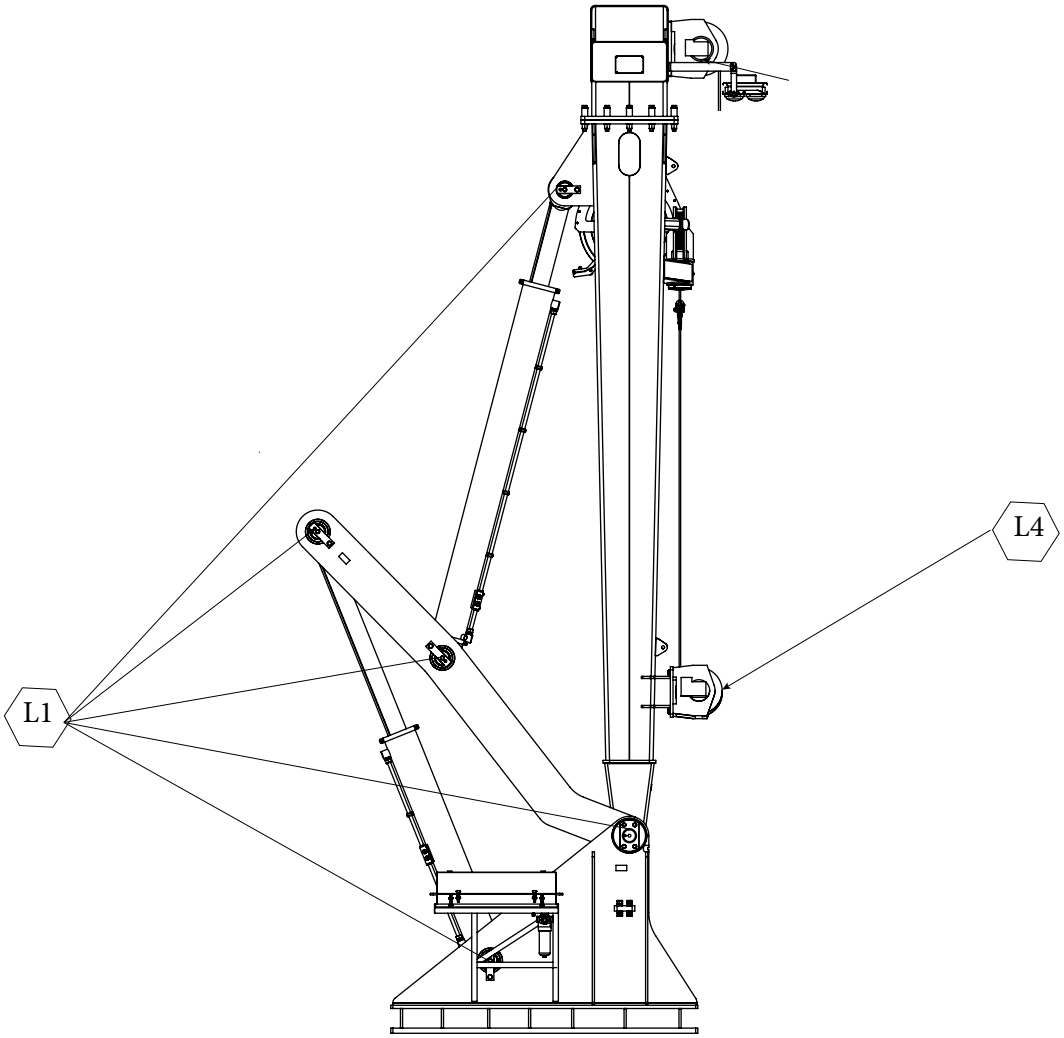
Lubrication table

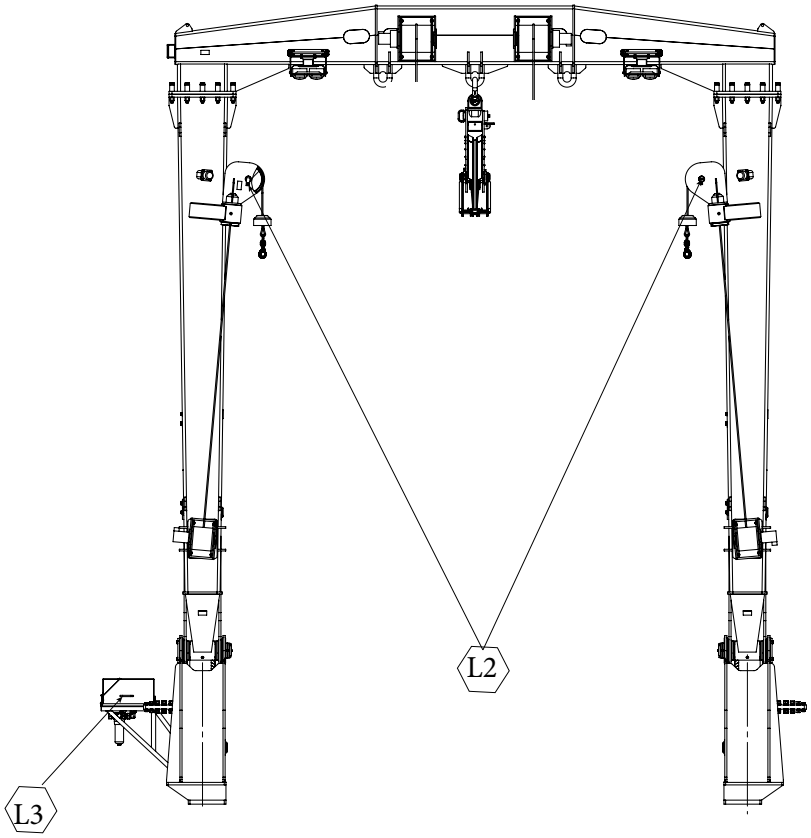
Standard lubricants

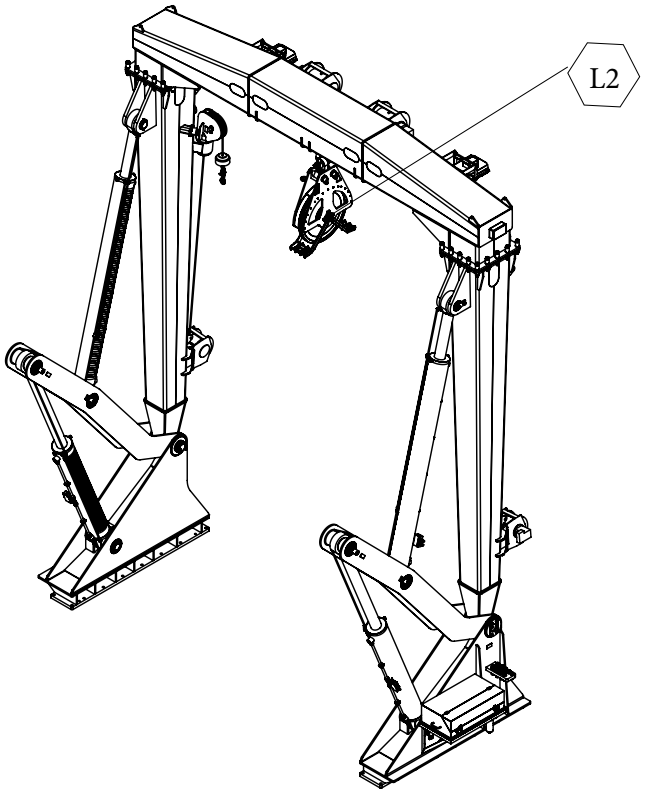
Lubricants Table

Pos.	Item	Oil Quality	Volume	Schedule
L1	Bolts	Shell Gadus S2 V220		Monthly lubrication. Daily control.
L2	Cross Bolts	Shell Gadus S2 V220		Monthly lubrication. Daily control.
L3	Hydraulic System	Recommended oil type 20-40°C Shell Tellus S2V T32 40-50°C Shell Tellus S2V T46 50-60°C Shell Tellus S2V T68 60-70°C Shell Tellus S2V T100 or equivalent dependent on system temp.		Weekly control. Yearly oil change.
L4	Lubrication divider SSV 8 (Inner Telescope)	Shell Gadus S3 A1300C	Apply a sufficient layer of grease on the load bearing surfaces.	Monthly lubrication. Daily control.
L5	Lubrication divider SSV 8 (Outer Telescope)	Shell Gadus S3 A1300C	Apply a sufficient layer of grease on the load bearing surfaces.	Monthly lubrication. Daily control.
L6	Bearing Pin for Telescope Cylinder	Shell Gadus S2 V220		Monthly lubrication. Daily control.
L7	Sheave Bolt	Shell Gadus S2 V220		Monthly lubrication. Daily control.
L8	Bearing Housing	Shell Gadus S2 V220		Monthly lubrication. Daily control.

Lubrication




L2
L3


L2

LUBRICATION

Lubrication table

Standard lubricants

Pos.	Item	Oil quality	Volume	Schedule
L1	Bolts	Shell Gadus S2 V220 2		Monthly lubrication. Daily control
L2	Wire block	Shell Gadus S2 V220 2		Every 48 hours at continuous use or at least once each 4th week.
L3	Hydraulic system	Recommended oil type 20-40°C Shell Tellus S2 V 32 40-50°C Shell Tellus S2 V 46 50-60°C Shell Tellus S2 V 68 60-70°C Shell Tellus S2 V 100 or equivalent dependent ot system temp.		Weekly control Yearly oil change.
L4	Winch SE-27	Hydraulic oil HLP ISO VG 150 (Shell Omala S2 G 150 normal) or equivalent	Fill the drum to it's horizontal axis. 3,5L	After every 250 hours of operation, grease the internal parts of the drum.

KN-75 LUBRICATION

Lubrication table

LUBR. PLACE	OIL QUALITY	VOLUME	SCHEDULE
HYDR. SYSTEM	20-40 C Shell Tellus S2 V32 40-50 C Shell Tellus S2 V46 (normal) 50-60 C Shell Tellus S2 V68 60-70 C Shell Tellus S2 V100 (dependent on system temp.)		Weekly control. Yearly oil change
GEAR SWING (RE 1023) BRAKE	Shell Omala S2 G 150 (220 from Triplex) Shell Tellus S2 V32	Level plugs 4,8L	Refill every 50 hour. Oil change after 2000 hours or annually.
SLEEWING BEARING BEARING RACES 4 ea. nipples	Shell Gadus S2 V220		Monthly lubrication. Daily control.
GEAR TEETH	Shell Gadus S2 OGH		Monthly lubrication. Daily control.
ROTARY COUPLING 1 ea. nipple	Shell Gadus S2 V220		Monthly lubrication.
BOLTS (8 stk. nipples KN-60) (4 stk. nipples KN-75)	Shell Gadus S2 V220		Monthly lubrication. Daily control.
WINCH SE45V	Shell Omala S2 G 150 (220 from Triplex)	9,5L	Oil change every 6 months or afther 600 hours of use
Wire rope	**Shell gadus S2 OG 40 (50)**	**Apply a suffi cient layer of grease on the wire surfaces**	**Monthly lubrication. Daily control**

Section 5

Periodic Maintenance

Annex C - Maintenance

DESCRIPTION	DOC/DRW #	REV #	PAG #
Maintenance Guidelines Winches	-	-	2
Oil Selection Chart Winches	6313	17	21
Oil Selection Deck Handling	-	-	24
Maintenance Guide Aux Winches (A-Frame-SE27) (KN-75 Main Crane Docking Head-SE45V)	-	-	25

MAINTENANCE GUIDELINES

FOR

RAPP MARINE A/S

DECK MACHINERY

MACGREGOR

11.09.2020

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2 REFERENCES

In Operation & Maintenance Manual for project; see section 8 for “Periodic Maintenance”, containing charts, drawings and documents indicating references to specific project documents related to maintenance schedules and logs.

These are critical documents in the ongoing working condition of Rapp Marine equipment.

3 GENERAL SAFETY

OPERATION AND MAINTENACE OF THE WINCH SYSTEM SHALL BE EXECUTED IN ACCORDANCE WITH REQUIREMENTS OF THIS INSTRUCTION AND WITH VESSEL SAFETY REGULATIONS.

THE DECK MACHINERY MUST BE OPERATED BY QUALIFIED PERSONNEL THAT HAVE STUDIED THE DOCUMENTATION, INSTRUCTIONS AND REQUIREMENTS.

NEGLIGENCE OF OPERATIONS AND LIMITATIONS SPECIFIED IN THIS INSTRUCTION CAN CAUSE FAILURE OF EQUIPMENT, DAMAGE OF PROPERTY OR INJURY OF PERSONNEL.

4 INTRODUCTION

The equipment is designed to provide maximum service with minimum maintenance. Nevertheless, certain checks and maintenance operations have to be carried out in order to keep the units serviceable and in good condition. This is for transport, storage and during operation to ensure safe and reliable operation through the lifetime of the equipment.

The maintenance schedules are designed to provide a basis for a preventative maintenance schedule and an equipment status reporting system. These schedules should be adjusted to account for local working practices and operational considerations.

The following manual is a general schedule which must be implemented for all Rapp Marine equipment. For specifics on lubrication amounts, detailed logs and drawings related to specific projects please refer to the “references” section of this document and view the related specific documents.

On a regular basis maintenance should be performed according the maintenance timetable.

WARNING Before doing any work on the unit, the operator must be aware of the dangers within the system, technicians and operators must take all necessary precautions as outlined in the personal safety section

MAINTENANCE GUIDELINES

The following manual is applicable for winch systems provided by Rapp Marine. The manual includes the following chapters and a brief outline of what they detail:

Maintenance timetable – This section details what parts of the system must be serviced and when. It shows the maximum lifetime on critical parts of the system. This timetable is critical in the lifetime of the overall equipment and should be adhered to strictly with a maintenance journal being regularly kept for the equipment for all operators & servicers use and knowledge.

Oil & Lubricant Requirements – This section details the specific lubricants required to be used on specific parts of the system. Typically for winch systems three types of lubricants are required these are: Hydraulic oil, gear and grease. Outlined in this section is the type required, the conditions in which to use the oil, storage, replacement and typical work conditions and lifecycle. It is also of critical importance that the oil be regularly cleaned and changed according to this chapter in order to ensure safe and reliable operation through the lifetime of the equipment.

5 PERIODIC MAINTENANCE / MAINTENANCE IN GENERAL

During operation, it is important that the operator records all findings and rectifies any malfunctioning components. In addition to the maintenance timetable plan for the equipment, the following periodic maintenance table shows typical things to be checked regularly to ensure safe operation of the winch system. Some of these items may be repeated within the maintenance timetable.

Item	Description	Before Every job	Daily	Weekly
1.	Check gear oil level	X		
2.	Check hydraulic system oil level	X		
3.	Check gear oil for water condensation			X
4.	Check Lubrication oil level	X		
5.	Check for leaks	X		
6.	Check electrical cables and components for damages		X	
7.	Check fuses working correctly		X	
8.	Check system structure for damage		X	
9.	Check for loose bolts, screws and connections			X
10.	Check winch wires and umbilicals for damage or fraying	X		

Item	Description	Before Every job	Daily	Weekly
11.	Check shackles, lifting slings, wire ropes, pad eyes and sheaves for damage or failure points			X
12.	Check cooling system is in working order and no overheating is occurring within the system	X		
13.	Check for any unusual sounds, observations or working movements. If so stop operation and report immediately to Rapp Marine			X

NOTE: Ensure no dirt enters the system during maintenance. Use recommended brush or clean rags.

NOTE: Never use cotton waste for cleaning.

6 RECORD KEEPING – MAINTENANCE LOG

Please keep records of maintenance activities and follow the Rapp Marine lubrication timetable. It is critical to the system that these activities be followed to ensure good working order and minimize problems and damage to the system. Making use of the experiences concerning maintenance is important for system knowledge hence systematic reporting and registration is required.
The records should be kept in the form of a manual or report to be on hand whenever it is required containing all necessary and previous information. In general Rapp Marine shall provide a template for a maintenance log which should be integrated to the operator's routine.

The maintenance log/manual should contain:

- A description of problems and impurities, and the date when they were discovered.
- A description of the initial inspection, and its results.
- A description of repairs made, the spare parts used, the date of the repairs and the length of time in which the system was shut down.
- Notes of when the oil is refilled or replaced, and when filter elements are replaced and strainers etc. are cleaned.
- A report of the data from oil analysis.
- Operational data print-out from auto-trawl computer (if any).

These reports and registrations will, when analyzed, often indicate areas with recurring problems which require special attention. This is done in order to be able to foresee future problems and take preventative actions, before damage or a complete shutdown of the system occurs.

Supplier's service technician.
Despite this, if service personnel have to be called up, performing the following could save time and expenses:

- Keep drawings, spare parts and clean rags available.
- Dismount covers and clean the machine thoroughly.
- Keep the report concerning maintenance at hand, and have an experienced person who knows the system at service man's disposal.

7 MAINTENANCE TIMETABLE

During operation, it is important that the operator records all findings and rectifies any malfunctioning components. In addition to the daily inspection during operation of the equipment, the following maintenance program is recommended to ensure safe operation of the winch system.

NOTE: Units are as follows; H = hours, D = days, W = weeks, M = monthly, Q = quarterly, Y = yearly

General Maintenance Timetable				
Equipment Group	Description	Period	Unit	Information and Notes
Drum unit	Lubricate spline shaft	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate drum bearing	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
Brake arrangement	Lubricate linings in brake band lugs	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate linings in brake cylinder	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate brake band adjustment nut	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate bolts at brake arrangement	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Check brake lining	3	M	Measure thickness of brake lining. If thickness is less than 70% of original thickness, replace brake band
	Check oil level on Hydraulic power pack (HPU) for the main brake	1	W	Visually check on HPU sight glass, level shall be on the top of the level glass
	Replace Accumulator on HPU's for the main brake	5	Y	Make sure to deactivate and lock (with brake) the system. Relieve pressure on HPU before disconnecting pipes/Accumulator. Make sure that the new accumulator is prefilled with nitrogen
	Replace hydraulic hoses	2	Y	Replace hydraulic hoses which are worn through use and time. It is important to identify hoses that are in exposed places. System pressure must be released before handling any pressurised hose.
	Check hydraulic hose integrity	1	M	Visual check of the hydraulic hoses within the system for damage, cracks, tears, nicks, hardness or colour changes.

General Maintenance Timetable				
Equipment Group	Description	Period	Unit	Information and Notes
	Replace brake cylinder(s)	5	Y	Replace brake cylinder(s) or replace/overhaul brake cylinder(s) by replacing brake plate springs
Level wind arrangement	Lubricate bearings on diamond screw	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate guide shaft	1	W	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate linings in level wind carriage	1	W	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate pilot tap	1	W	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate guide rollers	1	W	See grease map for lubrication position. See lubrication chart for type of lubrication
	Visually check oil level in level glass for level wind gearbox	1	D	Visually check sight glass on the level wind gearbox, shall be on the top of the level glass
	Visually check oil reservoir for water	1	W	Look for discolouration of oil. Change oil if discoloured
	Check pilot tap and diamond screw	3	M	Visually check the diamond shaft and pilot tap for damages on the surfaces and wearing
	Check guide rollers	3	M	Check guide rollers for rotating and no considerable wearing on surface
	Change oil on Level Wind Gearbox (1st time: 500H, 2nd time: 2500H)	5000/1	H/Y	See grease map for lubrication position. See lubrication chart for type of lubrication
	Clean and re-lubricate diamond screw	1	Y	Visually check the diamond shaft and pilot tap for damages on the surfaces as well as wear before re-lubricating
T90 level wind sheave	Lubricate bearings in sheave wheel	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate bush for sheave pivot shaft	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate bearings in sheave indicator	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Lubricate bearings in indicator rollers	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication

General Maintenance Timetable				
Equipment Group	Description	Period	Unit	Information and Notes
Winch Drive Unit	Lubricate roller bearing	1	M	See grease map for lubrication position. See lubrication chart for type of lubrication
	Visually oil level in level glass	1	D	Visually check sight glass on the gearbox, shall be on the top of the level glass
	Visually check oil reservoir for water	1	W	Look for discolour of oil. Change oil if discoloured
	Change oil on Gearbox WDU (1st time: 500H, 2nd time: 2500H)	5000 / 1	H / Y	See grease map for lubrication position. See lubrication chart for type of lubrication
	The following applies to electric driven winches only:			
	Visually control of mechanical damages and conditions of connections.	1	W	Check structure, bolts, seals, paint etc.
	Keep the motor(s) clean an ensure free ventilation airflow	1	W	Clean with detergent for electric equipment
	Inspect electric motors	1	Y	Check conditions of shaft seals, connections, coils etc.
	Lubricate and re-grease of bearings	*	H	* See information from manufacturer regarding intervals, lubrication information etc.

General Maintenance Timetable				
Equipment Group	Description	Period	Unit	Information and Notes
Hydraulic system and units	Check for oil leaks	1	D	Check for hydraulic oil leaks, especially around couplings, hose and pipe connections, oil tanks and hydraulic power units
	Visual control of oil level and condition	1	D	Refill if low level. Change oil if discoloured
	Change HPU filter elements	1	Q	Make sure to shutdown system and relieve pressure before replacing filters with new ones
	Change hydraulic oil	1*	Y*	*Depending of working conditions (temperature, pressure etc.) hydraulic oil can be used from 5000 to 25000 hours. Use laboratory analysis for decision
	Hydraulic oil sample control	1	Q	Send a sample to laboratory for analysis
	Clean hydraulic oil tank	2	Y	Reservoir / oil tank must be emptied and cleaned a minimum of every 2-5 years
	Check accumulator on HPU (if present)	1	Y	
	Replace HPU accumulator (if present)	5	Y	Ensure to shutdown system and relieve pressure on HPU before disconnecting. Ensure that the new accumulator is prefilled with nitrogen gas
	Control of hydraulic control valves	1*	M*	*If not in regular use it is important to move the lever / hand wheels from time to time, lubricate around the entrance of the moving parts to prevent the lever / hand wheels from sticking
	Recalibrate Pressure Safety Valves	1	Y	As according to ship schedules to ensure safety of the system
	Recalibrate Pressure indicators and transmitters	1	Y	These should be re-calibrated yearly to ensure correct readings are given
	Electric Motors and Pumps	1	Y	Check that the pumps are functioning correctly and the current consumption of the motors. Ensure no overheating
	Replace hydraulic hoses	2	Y	Replace hydraulic hoses which are worn through use and time. It is important to identify hoses that are in exposed places. System pressure must be released before handling any pressurised hose.
	Check hydraulic hose integrity	1	M	Visual check of the hydraulic hoses within the system for damage, cracks, tears, nicks, hardness or colour changes.

General Maintenance Timetable				
Equipment Group	Description	Period	Unit	Information and Notes
Electric system units	Check electric cables and components for damages	1	D	
	Check fuses	1	D	"Blown" fuses can be an indicator of failures in the electrical system
	Clean control system computers and cabinets for dirt and dust	1	M	Use only dry air gun inside
	Open control panels for inspection	1	Y	Clean if necessary and check if heater (only present in deck panels) is working
	The following applies to electric driven winches with Frequency Drives only:			
	Replace air filters on inverter cabinets	1	Y	Shutdown system before performing maintenance. Replace the filters in the ventilating system
	Check inverter cooling fans	1	Y	**MUST BE DONE WITH POWER ON!** *When* activating the system the inverter will start up and the internal cooling fan shall start. See inverter user manual for fan information's. If abnormal noise or vibration is seen the fan needs to be replaced
	Check inverter and breakers cabinet door cooling fans	1	Y	**MUST BE DONE WITH POWER ON!** Open the inverter door and turn down the blue thermostat until the fan starts. If abnormal noise or vibration is seen the fan needs to be replaced. Adjust the thermostat back to start setting
	Power up spare inverters for extending lifetime on capacitors	1	Y	See user manual for inverters for details.
	Replace inverter cooling fans	2	Y	Shutdown system before performing maintenance**.** Replace the components according to inverter instructions
	Replace inverters DC bus and PCB capacitors (including spare)	5	Y	Shutdown system before performing maintenance**.** Replace the components according to inverter instructions

General Maintenance Timetable				
Equipment Group	Description	Period	Unit	Information and Notes
Fish Pump	Lubrication of bearings with grease	1*	W*	* Lubricate two strokes with the grease gun weekly or after every five time use of the fish pump. See applicable lubrication chart in the Service & Instruction manual for more info.
	Lubrication of bearings with grease, with the Set-Screws disassembled (Electric fish pump only)	1	M	Lubricate until all the air is out and clean grease are coming out of the "Set-Screw" hole. See applicable lubrication chart in the Service & Instruction manual for more info.
	Check that the pressure inside the fish pump is correct (Electric fish pump only)	1*	W*	*The pressure should be checked regularly and especially before operating the fish pump. Correct pressure: 0.3 BAR at 20 degrees Celsius / 0.5 BAR at 50 degrees Celsius See "Bleeding and pressurization procedure" in the Service & Instruction manual for more info.

8 OIL AND LUBRICANT REQUIREMENTS

The choice & use of oil and lubricants for the system is important for continued operation of the equipment and a full lifecycle. Rapp recommend using the approved oil and lubricants for the system as specified below. Use of any other oil and lubricants may be harmful to the system and cause unwanted effects, Rapp cannot be responsible for any problems should this be the case.
If there are any doubts about choosing oil or lubricant, contact Rapp Marine for written confirmation.

NOTE: It is prohibited to mix oil of different quality/brands.

8.1 Proper use of lubricants

This chapter covers the safe handling of lubricants. Improper handling of lubricants can create a health hazard or the danger of fatal injury. The following instructions must be complied with. Before handling lubricants, always check the corresponding safety data sheet.

Prolonged and repeated contact with the skin should be avoided as far as possible.

Areas of the skin splashed with lubricant should be cleaned with soap and water. Apply skin protection while working and a greasing skin cream after completing work. Where appropriate, wear oil-resistant protective clothing (e. g. gloves, apron).

Do not wash your hands with petroleum, solvents or cooling lubricants which can be or are already mixed with water.

Oil mist must be extracted at the point where it arises.

Protective goggles must be worn to prevent contact with the eyes. If lubricant should nevertheless get into the eyes, rinse the affected area with copious amounts of water. If irritation of the eyes persists, consult an ophthalmologist.

Under no circumstances should you induce vomiting if lubricant is accidentally swallowed. Seek medical help immediately.

As a rule, safety data sheets are available for lubricants, in accordance with 91/155/EEC. Here, you will find detailed information on health and environmental protection and accident prevention.

Most lubricants are hazardous to water. For this reason, they must never be allowed to get into the soil, water or sewage system.

8.1.1 Hydraulic oil

Oil for Rapp Marine's hydraulic system should correspond to the following specifications:

Kinematic viscosity cSt		
	at 40°C	**46**
	at 50°C	**30**
	at 100°C	**9,1**
	at -20°C	**5000**
Flash point, °C		**175**
Solidification temperature °C, not higher than		**-48**
In compliance with		**DIN-52524 (2) type: H-LP**
Anti wear quality	IP 281	**< 20 mg**
Gear test	FZG	**≥ 11**
Viscosity index		**> 175**

8.1.2 Type

Rapp Marine recommends using Shell Tellus Oil "T" as the hydraulic oil. Other brands may be used which are approved by Rapp Marine or are on the lubrication chart.

8.1.3 Condition

Daily visual checks of the condition of the oil must be performed by operator. The oil can be seen using the level glass typically on the tank and checking the oil colour. A gray color of hydraulic oil indicates that there has been an ingress of water. It is strictly prohibited to use hydraulic oil containing seawater.
The first oil sample analysis should be taken after initial system flushing then stored and recorded. After which oil samples shall be taken 3-4 times per year or every 20 operating hours, depending on the frequency of use where the following must be checked:

- Spectrometri;
- Water content;
- Particle count (ISO-norm, levels for automatic particle counters);
- Viscosity at common temperature;
- Total Acid Number (TAN).

8.1.4 Cleanliness

The cleanliness of the hydraulic oil is very important quality measurement and used as the quality control of hydraulic oil formulations. The hydraulic oil should always pass the following metrics, if it does not the equipment must be flushed until it meets these minimum criteria or changing of the oil may be required.

Particle level ISO-4406- 1999 "or"	max.: 18/16/13
Particle level SAE AS4059 Class 7B-F "or"	max.: 7
Particle level grade (SAE 749)	max.: 4
Optimal working viscosity (cSt) at +40°C	46
Water content	< 0,1%
Filter element rating (Absolute)	12 µm or better.

During the warranty period, a copy of results from all sample analyses must be sent to Rapp Marine A/S.

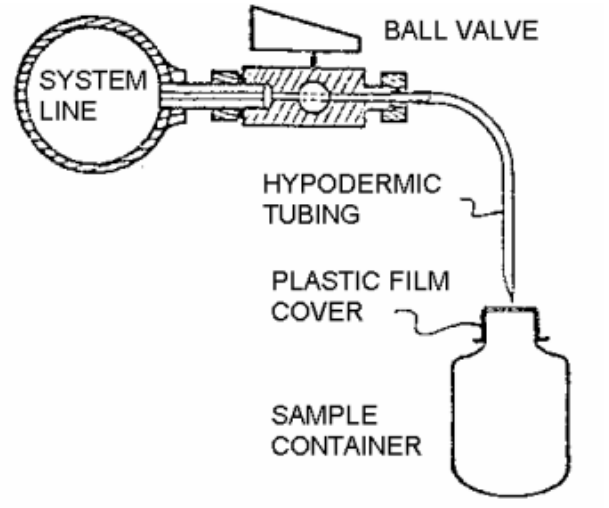
NOTE: If the specified viscosity level during use of the system drops more than 5%, heavier hydraulic oil must be added to the system to maintain the specified level.

"No system has ever failed from being too clean"

8.1.5 **Oil sampling for contamination control**

An accepted procedure for extracting samples from dynamic fluid lines is ISO standard 4021.

Details of procedure:



1. Before extracting or collecting the sample, a quantity of oil should be allowed to flush from the assembly equal to at least five times the volume between the port and the existing point.
2. Sufficient sample should be withdrawn from the line to yield enough oil to fill approximately 70% of the sample bottle volume. This leaves enough room to effectively shake the bottle before analysis.
3. Although the rate of sampling does not affect the quality of the sample, the sampling rate should in general not exceed 1% of the main line flow.
4. Oil is extracted through fully open ball valves from high pressure lines. To reduce the oil velocity in the sample line, the size and length of the hypodermic or capillary tubing can be varied.
5. Take at least two samples from each sampling place in the system
6. Mark the bottles clearly.

8.1.6 **Storage**

Always keep at least 20% of the tank volume as a spare amount of oil for hydraulic system.
Hydraulic oil shall be supplied in sealed drums. The oil must be stored indoors in dry, dust clean environment with a constant temperature with as little variance as possible.
If a special storage tank is used, the filling system to the main tank must be approved by Rapp Marine in writing.

NOTE: Long storage at low temperature causes deposit which, if introduced into the system, can clog and degrade the equipment.

8.1.7 **Working conditions**

Control of the oil temperature is crucial for equipment operation. Heat develops in the fluid as it is forced through the pumps, motor tubing, and relief valves. In conventional systems, excessive temperatures will oxidize the oil and can lead to varnish and sludge deposits in the system. Conversely, running the temperature too low will allow condensation in the reservoir and increase the likelihood of pump cavitation. The following table shows the ideal and limiting operating temperatures and viscosities for typical hydraulic systems employed by Rapp Marine.

Allowable Temperatures and viscosities:	
Nominal operating temperature	+40°C
Maximum operating temperature	+70°C
Maximum allowable system temperature not to be exceeded	+80°C
Minimum oil temperature before operating deck equipment/machinery	+15°C
Nominal operating viscosity	46 cSt @ +40°C
Operational viscosity range	30-100 cSt
Minimum allowable viscosity	10 cSt @ +75°C
Maximum allowable viscosity for pump start	2000 cSt @ -15°C

NOTE: Use pumps to work in idle mode to get minimum oil temperature of 15°C before operating deck machinery.

Keep cooling system in good working condition. High working temperatures reduces oil quality.

8.1.8 **Change of oil**

The time at which a change of hydraulic fluid is required is dependent on the operating conditions like temperature, pressure and contamination. The general guideline for oil change is between 5000 and 25000 operating hours. During this range it is up to the discretion of the operator to assess when it is necessary to completely change the oil. The decision should be made on data received from the oil analyses over time from first analysis to current analysis. When oil change is required the following procedure is to be followed.

Fluid Change-Out Recommendations — these are the proper steps to follow when changing the hydraulic fluid in a system.

1. Drain the system while the fluid is hot to keep contaminants in suspension.
2. Empty fluid from cylinders, accumulators and lines that might not drain properly.
3. Mop, siphon, or pump out oil left in the reservoir.
4. Wipe reservoir clean with lint free rags and remove rust and free paint.
5. Replace or clean filter elements and strainers and clean filter housings.
6. Refill the system with new fluid making sure to vent high points.
7. Restart and check system for proper operation.
8. For systems that exhibit high deposit, sludge and/or varnish formation: a petroleum based cleaner may be required. Follow manufacturer's recommendations.

8.2 Gear oil

Gear oil is used in gearboxes and chain drive housing boxed used in the level wind arrangement. The main parameter for selecting gear oil is the ***viscosity group***.

For ambient temperatures from ranging from -20°C to +35°C the recommended gear oil is of viscosity group **ISO VG 150**. For other working conditions contact Rapp Marine for written confirmation.

8.2.1 Type

Rapp Marine recommends using gear oil type Shell OMALA 150. Other brands may be used which are approved by Rapp Marine or are on the lubrication chart.

8.2.2 Conditions

There is a high risk that water may condense in the transmission housing and therefore the gear oil reservoir must be visually checked every week. A grey color of oil indicates that there has been ingress of oil. In case of black oil color check conditions of the gears. To drain out condensed water, at the bottom of housing there should be a ball valve installed, open this slowly to drain out all of the contaminated fluid and replace with clean fluid.

8.2.3 Change of oil

The first change of gear oil should be performed after 500 operating hours. Second change after 2500 operating hours. Thereafter the periodical changes should be every 5000 operating hours or at least every year. The guidelines below shall be followed for each oil change.

- The oil level in the transmission housing should be at the level indicated on the sight glass.
- Quantity of gear oil is specified on the lubrication chart for individual equipment.

The Following table shows the quantity of gear oil for main types of winch gear drives used by Rapp Marine.

8.3 Grease Lubricants

Lubricants used for the winch systems produced by Rapp Marine is typically grease. Grease is an integral part of the system ensuring tight seals between mechanical parts and preventing excessive part degradation. In Rapp Marines winches grease is typically used for greasing of working parts like the diamond screw, bearings and shafts etc. The amount of grease applied is also important because too little grease leads to metal-to-metal contact and premature failure and equipment degradation. Whereas excessive amounts of grease cause the operating temperature within the equipment to rise rapidly, particularly when running at high speeds.

NOTE: Grease and oils are not interchangeable

8.3.1 Type

The following table shows the recommended grease lubricants to be used for Rapp Marine equipment.

Part Description	Grease Type
General greasing	SHELL lubricants ALVANIA EP LF 2 or RETINAX-EP2
Roller bearings of electric motors	SKF-LGMT-2

NOTE: Other brands may be used which are approved by Rapp Marine or are on the lubrication chart.

8.3.2 Replenishment

The grease must be replenished at the correct frequency and in the proper amount so that there is always a sufficient amount of grease to maintain fluid films. Grease may be applied by hand-operated grease guns, screw-down or spring-loaded grease cups, or centralized grease systems.
Refer to the equipment lubrication charts, located in the engineering manuals, for application points for the grease

9 RAPP MARINE CONTACT INFORMATION

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Title:	Date:	Doc. Id:	Version:
FAR lubrication chart	22/12/2021	**6313**	17
Author:	Approver:		Page:
Hallvard Johanssen	Mads Bergdal		1 (3)
Doc. Applies to:	Department:		
MacGregor FAR	Engineering & Technology		

MACGREGOR

Revision history

5	Shell BIO oils added to lubrication chart	21/12/2021	HKJ	MB	MB
4	Grease for Fish Pump added, Mobilgrease FM221 & FM222	09/07/2020	HKJ	MB	MB
3	Oil for Fish Pump added, Mobil SHC Cibus 32 (Mineral)	27/01/2020	HKJ	BB	BB
2	More detailed text in Note 1 (both Mineral and Bio). Rapp Marine logo and web address replaced with MacGregor	22/05/2019	ST	BB	BB
1	Added lube index no.8: Fish pump	07/03/2019	GJK	BB	BB
0	Added lube indexes 1 - 7 for each kind of machinery	15/02/2019	GJK	BB	BB
Rev.	**Description**	**Date DD/MM/YY**	**Made by**	**Checked by**	**Approved by**

Title:	Date:	Doc. Id:	Version:	Page:
RAPP MARINE lubrication chart	09/07/2020	**6313**	16	2 (3)

LUBRICATION CHART, MINERAL OILS

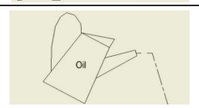
RECOMMENDED OIL AND LUBRICATION FOR RAPP MARINE A/S SYSTEMS, GEAR AND WINCHES

Important! Always check belonging lubrication plans for product

LUBE INDEX	APPLICATION	Updated Jan 2020	Updated Jun 2013	Updated Dec 2010	Updated Jun 2013	Updated Jan 2018	Updated Dec 2010	Updated Dec 2010	Updated Dec 2010	Updated Oct 2017	Updated Dec 2017	Updated Dec 2010	Updated Feb 2018	Updated Feb 2019
1	**HYDRAULIC MAIN SYSTEMS** **SERVO SYSTEMS**	Mobil DTE 10 Excel 46	Unvis N 46	Hydran HV 46	Equivis ZS 46	Hyspin AWH-M 46	Mechanism LPS 46	Rando Oil HD Z 46	HydraWay HVXA 46	Tellus S2 VX 46	HIDO HV 46	Handel 46	TBD	
2	**HYDRAULIC SERVO SYSTEMS**	Mobil DTE 10 Excel 32 Mobil DTE 10 Excel 46	Unvis N 32 Unvis N 46	Hydran HV 32 Hydran HV 46	Equivis ZS 32 Hydroflo CT Equivis ZS 46	Hyspin AWH-M 32 Hyspin AWH-M 46	Mechanism LPS 32 Mechanism LPS 46	Rando Oil HD Z 32 Rando Oil HD Z 46	HydraWay HVXA 32 HydraWay HVXA 46	Tellus S2 VX 32 Tellus S2 VX 46	HIDO HV 32 HIDO HV 46	Handel 32 Handel 46	TBD	
3	**RAPP FLUID COOLED ELECTRIC MOTORS**	Mobil DTE 10 Excel 15	Unvis N 15	Hydran HV 15	Equivis ZS 15	Hyspin AWH-M 15	Mechansim LPS 15	Rando Oil HD Z 15	HydraWay HVXA 15	Tellus S2 VX 15	HIDO HV 15	Handel 15	TBD	
4	**GEAR BOXES (NOTE 1)** **MAIN MULTIPLE MOTOR GEAR BOX (WDU)** **CHAIN BOX**	Mobilgear 600 XP 150 Mobil SHC 630 (synth) Mobilgear SHC 220	Spartan EP 150	Giran 150	Carter EP 150 Carter SH 220	Alpha SP 150 or Alpha SYN HG 220	NL Gear Compound 150	Meropa 150	LoadWay Marine 150	Omala S2 G 150	Famredol Ultra 150	Goya 150 El Greco 220 Schumann 220	Klüberoil GEM1-150 N	
5	**GEAR W/OIL CIRCULATION**	Mobilgear 600 XP 68	Spartan EP 68	Giran 68	Carter EP 68	Alpha SP 68	NL Gear Compound 68	Meropa 68	LoadWay Marine 68	Omala S2 G 68	Famredol Ultra 68	Goya 68	Klüberoil GEM1-68 N	
6	**GREASE LUBRICATED BEARINGS** **SLIDE BEARINGS** **GREASE FILLED WORM GEAR** **GREASE FOR SPOOLING SHAFT (DIAMOND SCREW)**	Mobilgrease XHP 222 Mobilith SHC 460 (synth)	Beacon EP 2 Unirex N 3	Marson EPL 2	Multis Complex EP 2	Castrol High Temperature Grease Molub-Alloy OG 936 SF heavy	Dura-Lith Grease EP 2	Multifak EP 2	UniWay LIX 62	Gadus S2 V220 2 Gadus SE OG 40	FOR LPD	Rubens WB	Klüberplex AG 11-462	
7	**OPEN GEAR WHEELS** **MAIN DRIVING GEAR**	Mobiltac 375 NC	Dynagear		Ceran AD Plus	Molub-Alloy OG 936 SF Heavy	Open Gear Grease	Texclad 2	GreaseWay OG	Gadus S2 A320 2 Gadus S2 OG 40		Giotto Complex	Klüberplex AG 11-462	
8	**OIL FISH PUMP** **GREASE LUBRICATED BEARINGS FISH PUMP**	Mobil SHC Cibus 32 Mobilgrease FM221 & FM222												Cassida Fluid HF 32
	NOTES	Year 2010 products for the marine section	Classic products for the industry								Used for winch testing and FAT procedures in fabric Gruza			

SYMBOLS USED IN DRAWINGS:

Illustration, Grease gun:
Grease (firm) to be used



Illustration, Oil can:
Oil (fluid) to be used

Matrix above displays the general recommended lubricants for Rapp Marine equipment, to be used for different parts of the winch system. The left hand columns describe the parts which need to be lubricated.
The top row with the company symbols describe the manufacturers of lubricants, with the type described below, and the recommended one to be used in the corresponding row for each part.
If operators wish to use lubricants not listed it will be on your own risk, and Rapp Marine can't be held responsible if problems occur due to this.
Please contact Rapp Marine (www.rappmarine.com) to check compatibility for any lubricant not listed.

NOTE 1: New spooling drive gearboxes are delivered with 220 oil viscosity. For refill or replacement of oil, please follow lubrication plan.

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LUBRICATION CHART, BIO OILS

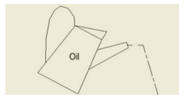
RECOMMENDED OIL AND LUBRICATION FOR RAPP MARINE A/S SYSTEMS, GEAR AND WINCHES

Important! Always check belonging lubrication plans for product

LUBE INDEX	APPLICATION	RSC Bio Solutions	EXXON Mobil	ESSO	FINA	TOTAL	Castrol	Chevron	TEXACO	STATOIL	Shell	FAM	Q8	KLÜBER LUBRICATION
		Updated Sep 2018					Updated Jan 2018							Updated Feb 2018
1	**HYDRAULIC MAIN SYSTEMS** **SERVO SYSTEMS**	Futerra 46					Biobar 46				Naturelle S2 HF 46			Klüberbio LR 9-46
2	**HYDRAULIC SERVO SYSTEMS**	Futerra 32 Futerra 46					Biobar 32 Biobar 46				Naturelle S2 HF 32 Naturelle S2 HF 46			Klüberbio LR 9-32 Klüberbio LR 9-46
3	**RAPP FLUID COOLED ELECTRIC MOTORS**	EnviroLogic HF 15									Naturelle S2 HF 15			
4	**GEAR BOXES (NOTE 1)** **MAIN MULTIPLE MOTOR GEAR BOX (WDU)** **CHAIN BOX**	EnviroLogic GO 150					Biostat 150				Naturelle S4 Gear Fluid 150			Klüberbio EG 2-150
5	**GEAR W/OIL CIRCULATION**	EnviroLogic GO 68					Biostat 68				Naturelle S4 Gear Fluid 68			Klüberbio EG 2-68
6	**GREASE LUBRICATED BEARINGS** **SLIDE BEARINGS** **GREASE FILLED WORM GEAR** **GREASE FOR SPOOLING SHAFT (DIAMOND SCREW)**	EnviroLogic Grease 2					BioTac MP				Naturelle S5 V120P 2			Klüberbio AG 39-602
7	**OPEN GEAR WHEELS** **MAIN DRIVING GEAR**	NA									Naturelle S2 Grease A600P 1.5 Naturelle S2 Grease A600P 1.5			Klüberbio AG 39-602
	NOTES													

SYMBOLS USED IN DRAWINGS:

Illustration, Grease gun:
Grease (firm) to be used



Illustration, Oil can:
Oil (fluid) to be used

Matrix above displays the general recommended lubricants for Rapp Marine equipment, to be used for different parts of the winch system. The left hand columns describe the parts which need to be lubricated.
The top row with the company symbols describe the manufacturers of lubricants, with the type described below, and the recommended one to be used in the corresponding row for each part.
If operators wish to use lubricants not listed it will be on your own risk, and Rapp Marine can't be held responsible if problems occur due to this.
Please contact Rapp Marine (www.rappmarine.com) to check compatibility for any lubricant not listed.

NOTE 1: New spooling drive gearboxes are delivered with 220 oil viscosity. For refill or replacement of oil, please follow lubrication plan.

Equivalent oils/lubricants from different manufacturers

MANUFACTURER:	MINERAL OILS:	GEAR OILS:	GREASE:	GEAR FAT: WIRE FAT:
EXXON MOBIL	Mobil DTE 10 Excel 15 Mobil DTE 10 Excel 32 Mobil DTE 10 Excel 46	Mobilgear 600 XP 68 Mobilgear 600 XP 150 Mobil SHC 630 (synth) Mobil SHC 220 (synth)	Mobilgrease XHP 222 Mobilith SHC 460 (synth) Mobilith SHC 100 (synth)	Mobiltac 375 NC
SHELL	Tellus S2 VX15 Tellus S2 VX32 Tellus S2 VX46	Omala S2 G 68 Omala S2 G 150	Gadus S2 V220AC 2 Gadus S2 OG 40 Gadus S5 V100 2	Gadus S2 A320 2 Gadus S2 OG 40
ESSO	Unvis N 15 Unvis N 32 Unvis N 46	Spartan EP 68 Spartan EP 150	Beacon EP 2 Unirex N3 unirex N2	Dynagear
FINA	Hydran HV 15 Hydran HV 32 Hydran HV 46	Giran 68 Giran 150	Marson EPL 2	
TOTAL	Equivis ZS 15 Equivis ZS 32 Hydroflo CT Equivis ZS 46	Carter EP 68 Carter EP 150 Carter SH 220	Multis Complex EP 2 Multiplex S 2 A	Ceran AD Plus
CASTROL	Hyspin AWH-M 15 Hyspin AWH-M 32 Hyspin AWH-M 46	Alpha SP 68 Alpha SP 150 Alpha SYN HG 220	Castrol High Temp. Grease Molub-Alby OG 936 SF havy	Molub-Alloy OG 936 SF Heavy
CHEVRON	Mechanism LPS 15 Mechanism LPS 32 Mechanism LPS 46	NL Gear Compound 68 NL Gear Compound 150	Dura-Lith Grease EP 2	Open Gear grease
TEXACO	Rando oil HD Z 15 Rando oil HD Z 32 Rando oil HD Z 46	Meropa 68 Meropa 150	Multifac EP 2	Texclad 2
EQUINOR	Hydraway HVXA 15 Hydraway HVXA 32 Hydraway HVXA 46	LoadWay Marine 68 LoadWay Marine 150	UniWay EP 2	GreaseWay OG
FAM	HIDO HV 15 HIDO HV 32 HIDO HV 46	Famredol Ultra 68 Famredol Ultra 150	FOR LPD Famredol Ultra 150	
Q8	Handel 15 Handel 32 Handel 46	Goya 68 Goya 150 El Greco 220 Schumann 220	Rubens WB	Giotto com-plex
KLÜBER	TBD	Klüberoil GEM1-68 N Klüberoil GEM1-150 N	Klüberplex AG 11-462 Klüberplex BEM 41-132	Klübeflex AG 11-462

5 START-UP INFORMATION

5.1 START-UP

Safety instructions

Danger
Before work commences, signs or other appropriate measures must be in place to warn users that it is forbidden to approach or remain in the danger zone due to loads being lifted. A danger warning plate must be placed on the machine informing users of the danger presented by the running cables wrapped around the pulleys and drum, and forbidding anyone from approaching the moving parts. This plate must be reproduced in the user manual of the crane or the operating machine that it is installed on.

- Check the condition of the lifting parts (cable, hook, etc.) before using the winch.
- When carrying out start-up operations, the operator and any other team members must remain a safe distance from the cable, to avoid injury in the event of it breaking.
- The first few lifting operations should be carried out with a modest load no more than 1 metre from the ground, to check that the lowering operation is controlled.
- Carry out manoeuvres gradually, avoiding sudden movements and swinging.
- Bring the winch to its limit position and gently push the distributor lever to purge any air from the system.

6 SERVICING INFORMATION

6.1 WARNING

Attention
Ensure that the machine that the winch is installed on is stopped and cannot be started while being serviced.

6.2 SERVICING SCHEDULE

Operation	Frequency			Chapter in manual
	8 hours	250 hours	500 hours	
Cable inspection	•			6.3
Oil level check		•		6.4
Cable lubrication		•		6.3
Screw tightness check		•		4.4
Gearbox oil change			•(*)	6.4

(*) Carry out the first change after 500 working hours, and then once per year.

6.3 CABLE

Cable inspection

- Check the condition of the cable carefully, along its en-tire length. If it has any dents, crushed sections, bulges or a number of broken strands, it must be replaced with a cable of the same specifications and length.
- Replace the cable when its nominal diameter has re-duced by 10 % due to wear or the elementary strands breaking.
- Replace the cable when corrosion or any kind of warp-ing occurs.
- Replace the cable when the lead coating on the cable lug is damaged.

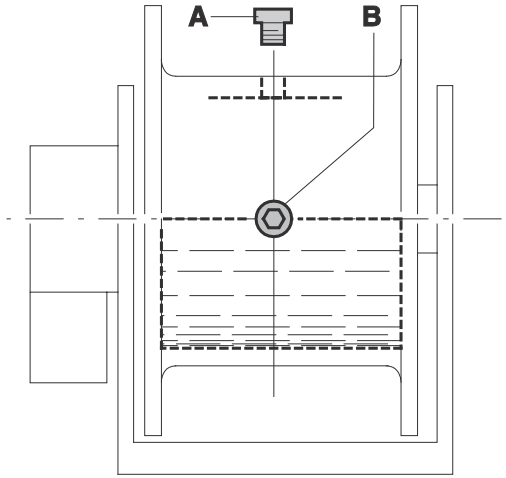
Cable lubrication

- Clean the cable to remove any traces of dirt, dust or sand.
- To reduce corrosion, lubricate the cable with a specialist product.

6.4 GEARBOX LUBRICATION

6.4.1 Oil level check and change

(winch series NP - NPA - A - S - SE - SW - SF)



Information
Do not release used oil into the environment. Collect it and send it to authorised centres for disposal.

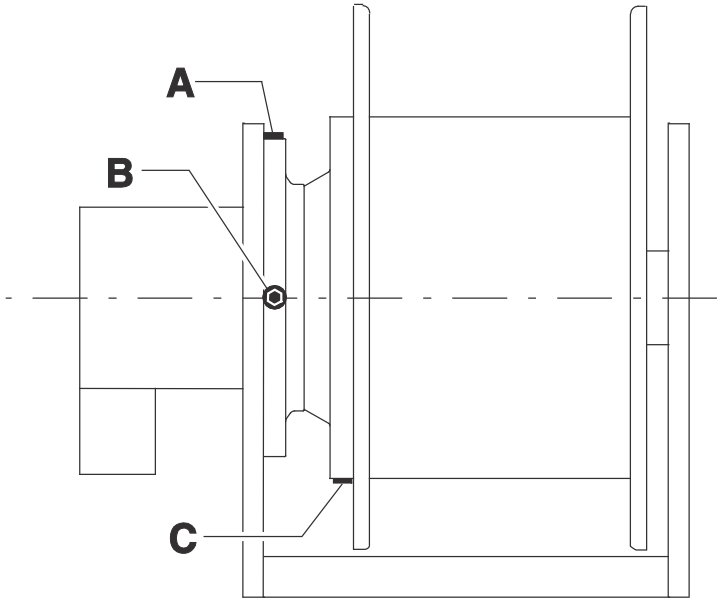
Unwind the cable until filling cap “A” and level cap “B” are visible. If the oil level is low, top up through the hole in cap “A” until oil escapes from the hole in cap “B” (in horizontal position). For oil types, see section “6.5 Oil quantity”.

To change the oil:

- Place a container under the winch to collect the used oil.
- Turn the drum to so that the oil level hole is at the bottom.
- Completely drain the oil.
- Turn the drum so that the level hole is on the horizontal axis and the filling hole is at the top.
- Add oil through the filling hole until it flows out of the level hole.
- Refit level cap “B” and filling cap “A”.

6.4.2 Oil level check and change

(winch series SR - SWR - SFR)



Information
Do not release used oil into the environment. Collect it and send it to authorised centres for disposal.

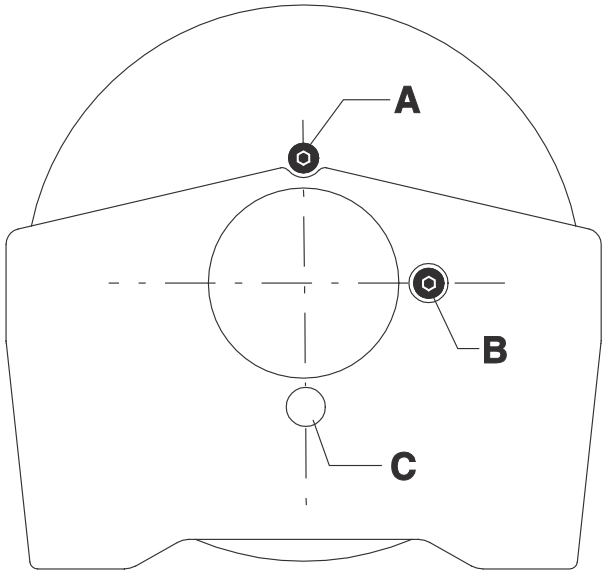
If the oil level is low, top up through the hole in cap “A” until oil escapes from the hole in cap “B” (in horizontal position). For oil types, see section “6.5 Oil quantity”.

To change the oil:

- Place a container under the winch to collect the used oil.
- Turn the drum so that the oil drain hole “C” is at the bottom.
- Completely drain the oil.
- Close the drain hole “C” with the appropriate cap.
- Add oil through the filling hole until it flows out of the level hole.
- Refit level cap “B” and filling cap “A”.

6.4.3 Oil level check and change

(winch series S - SE)



Information
Do not release used oil into the environment. Collect it and send it to authorised centres for disposal.

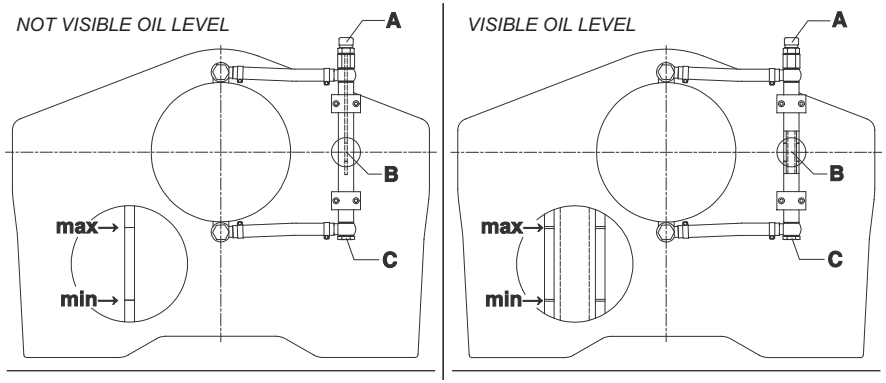
If the oil level is low, top up through the hole in cap “A” until oil escapes from the hole in cap “B” (in horizontal position). For oil types, see section “6.5 Oil quantity”.

To change the oil:

- Place a container under the winch to collect the used oil.
- Turn the drum so that the oil level hole is at the bottom “C”.
- Completely drain the oil.
- Turn the drum so that the hole of level cap “B” is on the horizontal axis and the hole of filling cap “A” is at the top.
- Add oil through the filling hole until it flows out of the level hole.
- Refit level cap “B” and filling cap “A”.

6.4.4 Oil level check and change

(winch series SRD - SWD - WDD)



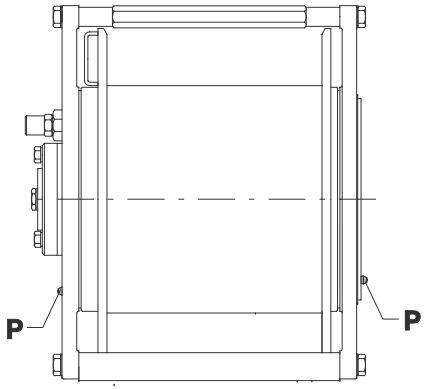
Information
Do not release used oil into the environment. Collect it and send it to authorised centres for disposal.

If the oil level is low, top up through the hole in cap “A” until the oil reaches the level “B” between the min. and max. indicators. For oil types, see section “7.5 Oil quantity”.

To change the oil:

- Place a container under the winch to collect the used oil.
- Remove cap “C” and drain the oil completely.
- Add oil through the filling hole “A” until the oil reaches the level “B” between the min. and max. filling indicators “A” above.
- Refit cap “A”.

6.4.5 Gearbox lubrication with grease (winch series P)



The winch must be greased on the gears fitted inside the drum and on the drum guide rings. For the lubrication, use Renbrand EP/2 - Q8 lithium gear grease or equivalent. After every 250 hours of operation, grease the internal parts of the drum using the lubricators “P” located on the supports.

6.5 OIL QUANTITY

The following table contains the quantities of oil (in litres) for the main series of winches in the catalogue.

Series	Oil type HLP ISO VG 46	Series	Oil type ISO VG 150
NP05-NP10-NP12	0.6	SE20/3 V-SE25/3 V-SE27/3 V	3.5
NPA18-NPA19	1.2	SE30V-SE35V	6
A30	0.8	S45V/2	7
A44	1.2	SE45V	9.5
A60	1.4	SRD A60	2.5
A80	3.5	SRD B80	4.5
S15-S19	1	SRD C100	4
S20-S25-S27	1.7	SRD D120	5
S30/2-S35/2	3.5	SRD E150	7
S45/2	6	SRD F180	10
SE20/3-SE25/3-SE27/3	3.5	SRD G230	14
SE30-SE35	6		
SE45	9.5		

6.6 CLEANING

Attention
Clean the winch with detergents that comply with applicable standards. In order to prevent damage, do not point the jet at the electrical equipment when washing with liquid under pressure.

6.7 DISMANTLING AND DISPOSAL

The machine must be dismantled by technically specialist, qualified personnel with the required knowledge of hydraulics and mechanics. Components must be separated according to the materials they are composed of and sent to authorised collection centres. In accordance with the WEEE Directive (Waste Electrical and Electronic Equipment), the electrical and electronic parts, marked with the relevant symbol, must be disposed of at authorised collection centres.

7 PROBLEMS AND SOLUTIONS

7.1 PROBLEMS, CAUSES AND SOLUTIONS

In the event of the winch malfunctioning, please refer to the table below to identify the problem, its cause and possible solutions.
If the problem persists, contact one of the Manufacturer's authorised workshops.

Problem	Possible cause	Solution
Noise in the hydraulic circuit	Presence of air in the circuit	Purge the circuit
Noise while lifting without loads, ac-companied by jerky rotation	Insufficient circulation of oil in the cir-cuit	Lift gradually increasing loads until the winch rotates normally and the noise disappears. If this happens, increase the quantity of oil in the circuit. If this is not possi-ble, contact the manufacturer's tech-nical office. **ATTENTION!!!** Insufficient circulation may be caused by prolonged choking of the oil flow by the operator manoeuvring the lever of the distributor. **This is dangerous**
The load being lowered tends to fall	Impurities in the valve	Remove the valve and clean it. Check the circuit filter cartridge and replace it if necessary.
	Cable wound in opposite direction to that shown by the arrow	Wind the cable in the direction shown by the arrow (see paragraph 4.5)
With the distributor set in the centre, the load tends to lower	Excessively high backpressure	Connect the motor drain hole directly to the tank
	Brake springs are broken	Replace the springs. This should be done at an authorised workshop or by the manufacturer.

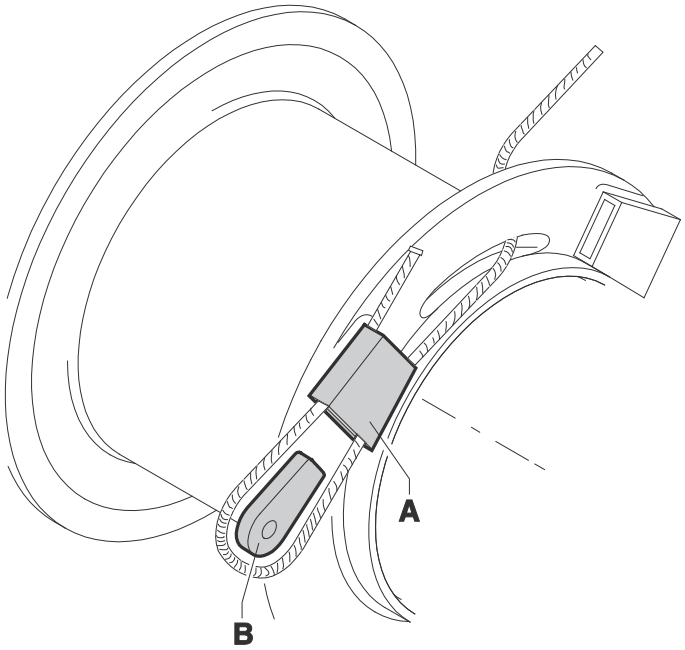
Load cannot be lifted	Insufficient pressure in the hydraulic circuit	Ensure the pressure relief valve on the control distributor is set correctly.
	Damaged motor	Check the motor drainage. If the oil flow exceeds 1 litre per min-ute, replace the motor.

8 REPLACEMENT OF PARTS

8.1 CABLE REPLACEMENT

The cable must always be replaced when:
- It has a number of broken strands (approximately 10 %).
- It is permanently warped (reduction in cross section, dented, squashed, etc.).
- The lead coating on the cable lug is damaged.
- Corrosion or any kind of warping occurs.

Removing the cable with a thimble

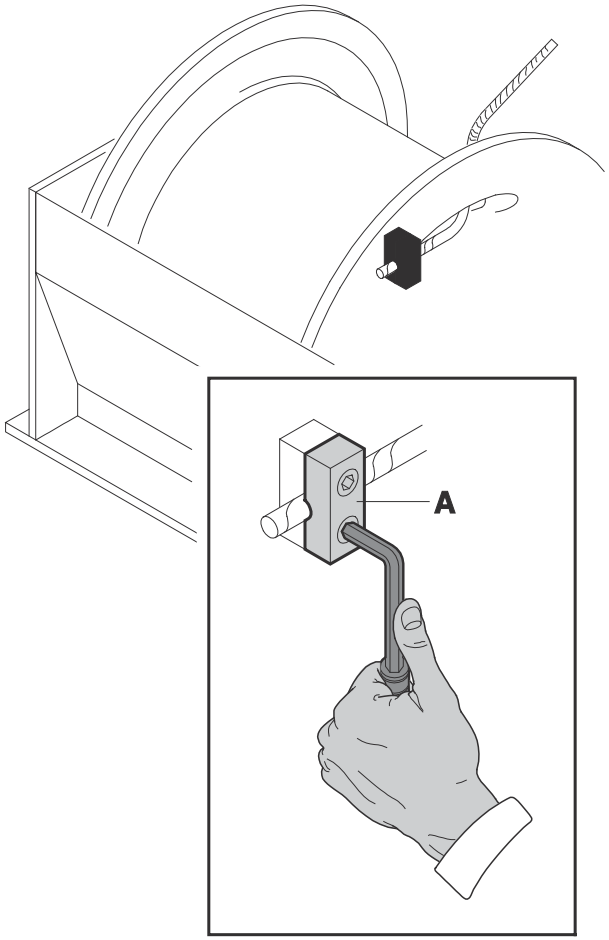


1) Completely unwind the cable.
2) Remove the cable and thimble “B” from pocket “A”.
3) Unthread the cable.

Installing

See paragraph 4.8 “Installing the cable”.

Removing the cable with clamps



1) Completely unwind the cable.
2) Loosen the clamp screws “A”.
3) Unthread the cable.

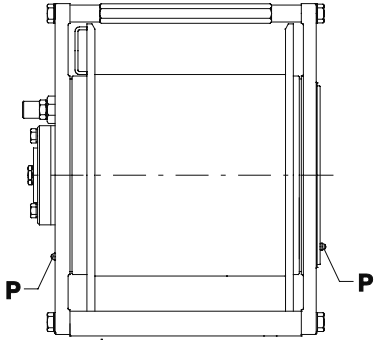
Installing

See paragraph 4.8 “Installing the cable”.

9 ANALYSIS OF RESIDUAL RISKS

Note	Directive 2006/42/ CE Annex I	Description	Remarks
18	1.3.3	Risks due to falling or flying objects	The operation and servicing manual ex-plains how to unpack and handle winches. The customer is responsible for taking these instructions into account while handling.
19	1.3.4	Risks posed by surfaces, edges or angles	The customer is responsible for protecting the operator from risks due to rough surface edges or corners during installation.
22	1.3.7	Risks related to moving parts	The customer is responsible for protecting the operator from potential risks related to moving parts
23	1.3.8	Choice of protection against risks arising from moving parts	The customer is responsible for protecting the operator from potential risks related to moving parts
25	1.4.1	General requirements for guards and pro-tective devices	The customer is responsible for choosing the requirements for guards and protective devices
26	1.4.2.1	Fixed guards	The customer is responsible for fitting any fixed guards
28	1.4.2.3	Adjustable guards restricting access	The customer is responsible for fitting any adjustable guards restricting access
29	1.4.3	Special requirements for protective devices	The customer is responsible for choosing the requirements for guards and protective devices

6.4.5 Gearbox lubrication with grease (winch series P)



The winch must be greased on the gears fitted inside the drum and on the drum guide rings. For the lubrication, use Renbrand EP/2 - Q8 lithium gear grease or equivalent. After every 250 hours of operation, grease the internal parts of the drum using the lubricators “P” located on the supports.

6.5 OIL QUANTITY

The following table contains the quantities of oil (in litres) for the main series of winches in the catalogue.

Series	Oil type HLP ISO VG 46	Series	Oil type ISO VG 150
NP05-NP10-NP12	0.6	SE20/3 V-SE25/3 V-SE27/3 V	3.5
NPA18-NPA19	1.2	SE30V-SE35V	6
A30	0.8	S45V/2	7
A44	1.2	SE45V	9.5
A60	1.4	SRD A60	2.5
A80	3.5	SRD B80	4.5
S15-S19	1	SRD C100	4
S20-S25-S27	1.7	SRD D120	5
S30/2-S35/2	3.5	SRD E150	7
S45/2	6	SRD F180	10
SE20/3-SE25/3-SE27/3	3.5	SRD G230	14
SE30-SE35	6	CW13R-CW16R-CW20R	1.6
SE45	9.5		
CW08-CW10-CW12	0.8		
CW13-CW16-CW20	1.6		

Section 6

BOMs & Assembling Drawings

Parts List & Assembling Drawings

DESCRIPTION	DOC/DRW #	REV #	PAG #
B.O.M. & Assembly Guideline	-	A	3
400092447 BOM			6
	400092447	B	13
	400096381	A	14
	400096308	B	15
	RH504844/NVE – RH202569	C	16
	RH317214	A1	17
	RH318400	C	18
	RH328794	A	19
	RHHEBRGC-Q – RH411171	A	20
400092475 BOM			21
	400092475	B	26
	400096386	A	28
	400096390	A	29
	400095411	A	30
	400095410	A	31
	RH317083	C1	32
	RH329285	A	33
	RH321167	A	34
	RH321167	A	35
	400203203 – 2000011556	A	36
	RHHEBRGC-M1 – RH411181	C	37
400092566 BOM			38
	400092566 – 2000004320	C	46
	400180581 – 2000004088	B	48
	400180511 – 2000004040	A	49
	RH329298	B	50
	RH317245	B	51
	RH329308	A	52
	RH328834	A	53
	400181022 – 2000004252	A	54
	400181045 – 2000004277	A	55
	400177707 – 2000003665	A	56
	400181046 – 2000004281	A	57
	RH318591	A	58
	400182378	-	59
	RHHSWC-E – RH319631	F	65

Section 6

BOMs & Assembling Drawings

Parts List & Assembling Drawings

DESCRIPTION	DOC/DRW #	REV #	PAG #
4000092573 BOM			66
	400092573 - 2000005715	B	74
	400184715 - 2000005163	A	76
	400185445 – 2000005622	A	77
	400185138 – 2000005409	A	78
	RH328074	B	79
	400185288 – 2000005484	A	80
	400185290 – 2000005486	A	81
	RH318747	A	82
	RH318468	B	83
	RH318063	B	84
	RH317304	A	85
	400185508 – 2000005580	A	86
	400186258 – RH327524	B	87
	RH327556	A	88
	RH329338	A	89
	RH328792	A	90
	RH328382	A	91
A-Frame STB Leg Assembly			92
A-Frame STB Foundation Assembly			93
A-Frame Main Assembly			95
A-Frame Aux Winch			96
KN-75 Main Crane Docking Head Aux Winch BOM			99
SE45V Assembly Drawing			102

B.O.M & Assembly Guideline

A	08/04/2022	Release for Approval	DASMV		
Rev.	**Date**	**Reason to issue**	**Prepared**	**Checked**	**Approved**
Title: BOM & Assembly Guideline				**Doc ID:** N/A	**Version:**
Doc. Applies to: MacGregor FAR - Bodø			**Department:** Project Management		

Prepared by Michael Van Epps
08/04/2022, Revision A

Purpose

This document specifies how MacGregor implements BOMs and assemblies collections. It should be used as a guideline to “navigate” through the delivered data.

Location of data

The generated documents will be made available together with this manual.
Direct Link: **BOM&ASSEMBLIES**

Prepared by Michael Van Epps
08/04/2022, Revision A

Guideline for OMM section 4

The first level to show, it presents the items as listed just like in the technical specification. The main rules of these BOMs are:

a) Part Name; MacGregor Part Number, and MacGregor Serial Number.
b) Blue items are assemblies.
c) All other items are single pieces, this could be purchased OEM parts to be delivered or integrated, ex: HPUs (of not MacGregor manufacturing).
d) Hyperlinks for easy navigation between sales order and specific item BOM assembly to view or retrieve a specific part number.
e) Hyperlinks to assembly BOMs, assembly drawings are at the end of each assembly BOM

To navigate through the BOMs list just click the hyperlink on the “Part ID” of an assembly (marked in blue). With this action, we can see the specific BOM of that assembly with all the associated parts.

If we want to see a specific BOM or assembly drawing the process is done in the same manner, just navigate through the BOM list and click on the “Part ID” of the chosen assembly.

NOTE: All BOMs and drawings are in PDF format.

Project Part List	SAP Project No.	
Rapp Marine Sales Order:		
Rapp Marine Project Name:		
Report Date:		
PART NAME	ITEM NUMBER	SERIAL NUMBER

Fig.: 1 - First Level of BOM List

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
1				400092447	Storage Drum	STORAGE DRUM, RW-2372BS, OLN; 2Ton, PCD1525/Ø2050x2000, MOTOR ABB200 (RHMERW2372BS/OLN)
2	010	1	PCS	400092359	Gear	POSIPLAN, BPH425K/i=124,8 IEC200 (GETBI452-I200/00)
2	020	1	PCS	EMOAB200B35-EI/00	Electric Motor	M3BP200MLC4 B35, IP56/ENC ISOL; 47kW (EMOAB200B35-EI/00)
2	030	1	PCS	400096381	Winch Foundation	FRAME , RW-2372BS/OLN; ASSEMBLY
3	010	1	PCS	400096383	Winch Foundation	FRAME, RW-2372BS/OLN; MACHINING
3	020	1	PCS	400096384	Winch Foundation	REMOVABLE FRAME BAR, RW-2372BS/OLN; WELDING ASSEMBLY
3	030	4	PCS	RH318376	Bracket	GROUND BRACKET, 2xD50 / T=25, MACHINING; MACHINING, 320x120x25, 2xØ50
3	040	8	PCS	RH312860	Locking Plate	LOCKING WASHER, D80/d50/d22x44; MACHINING
3	050	8	PCS	FA0933G20075	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x75; FULLY THREADED (FA0933G20075)
3	060	8	PCS	FA0933G16040	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x40; FULLY THREADED (FA0933G16040)
3	070	8	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
3	080	8	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
2	040	1	PCS	400096308	Wire Rope Drum	DRUM WITH LEBUS, D2050xd1465xL2010 LEBUS; ASSEMBLY
3	001	1	PCS	400096310	Wire Rope Drum	DRUM - RW2372BS, PCD1525xD2050x2000; MACHINING
3	002	1	PCS	400092373	Split Drum Sleeve	LEBUS NO. 10029007 PCD1525x2000/ø20 (LERW2372-01)
3	003	7	PCS	400096378	Shim	SHIM PLATE, PLATE 1439x493,2/T5; MACHINING
3	004	1	PCS	400096379	Shim	SHIM PLATE, PLATE 1439x493,2/T5; MACHINING
3	005	1	PCS	400092590	Bracket	T6 / 420 x 456
3	006	4	PCS	RH31843401	Distance Ring	DRUM BOLT SPACER, D30/d15x60
3	007	4	PCS	RH318437	Wire Rope Clamp	WIRE CLAMP, 18x18x61 (R11), RW-2371BS; MACHINING
3	008	24	PCS	400096380	Wire Rope Clamp	CABLE CLAMP, PLATE 145x30/T3; BENDING
3	009	2	PCS	RH318439	Locking Plate	LOCKING PLATE, RW-2371BS, MACHINING; MACHINING, 100x20x5
3	011	4	PCS	FA0912G08040	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M8x40; THREAD LENGTH: 28mm (FA0912G08040)
3	012	56	PCS	FA0933G20030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x30; FULLY THREADED (FA0933G20030)
3	013	4	PCS	FA0933G10080	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x80; FULLY THREADED (FA0933G10080)
3	014	4	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)
3	015	52	PCS	FA0933G06016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x16; FULLY THREADED (FA0933G06016)
3	016	78	PCS	FA7991G05012	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M5x12 (FA7991G05012)
3	017	4	PCS	FA0934G10	Nut	HEXAGON NUT, A4-80, DIN 934, M10 (FA0934G10)
3	018	12	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	019	52	PCS	FA0125G06	Washer	FLAT WASHER, A4, DIN 125 M6; Tykkelse h=1.6 d=6.4 (FA0125G06)
2	050	1	PCS	RH318355_NVE	Brake Unit	BRAKE ASSEMBLY TWS-3000 RW-2371BS; ASSEMBLY, D850
3	010	1	PCS	RH502491/NVE	Brake Band	BRAKE BAND ASSEMBLY, TWS-3000 NVE
4	010	1	PCS	RH604408/NVE	Brake Band	BRAKE BAND WELD&MACHINED TWS-3000 NVE; BRAKE BAND
5	060	8	PCS	FA0933G16030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x30; FULLY THREADED (FA0933G16030)
5	070	4	PCS	RH410451	Shear Pin	SHEAR PIN, D20h9x24 (M8)
5	080	4	PCS	RH410452	Locking Plate	LOCKING PLATE, 40x155x5
4	020	2.15	M	BLBCB100125	Brake Band	BRAKE LINING, 3/8" X5" (BLBCB100125)
4	030	58	PCS	BLRGB0822	Rivet	BRAKE LINING RIVET, Ø8X22mm, BRASS (BLRGB0822)
4	040	2	PCS	RH403166	Bearing Plain	LINING, D60/d50x30, TWS-820
4	050	4	PCS	FA0916G06010	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M6x10; CUP POINT (FA0916G06010)
4	060	1	PCS	GRRAX002S	Grease Nipple	GREASE NIPPLE, STRAIGHT, 1/4"R, A2 (GRRAX002S)

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
4	070	2	PCS	400095607	Protective Sleeve	INNER RING d64/D74/12, ROUND BAR D100x17; MACHINING
2	030	1	PCS	RH504844/NVE	Cylinder Assembly	BRAKE CYLINDER BHS-110/50-S NVE, ASSY; 59BREMSESY
3	010	1	PCS	RH303520/NVE	Pipe	CYLINDER PIPE BHS-110/50-S NVE-QUALITY; BHS110/50-S, NVE-quality
3	020	1	PCS	RH303519	Piston Rod	PISTON ROD BHS-110/50-S, MACHINING; BHS-110/50-S
3	030	1	PCS	RH402907/NVE	Piston	PISTON, D109/d35x42,5, BHS-110/50 (NVE)
3	040	1	PCS	RH409526	Stuffing Box	STUFFING BOX, BHS-110/50-S (NVE)
3	050	1	PCS	RH402909/NVE	Stuffing Box	STUFFING BOX NUT, BHS-110/50 (NVE)
3	060	1	PCS	RH401487	Bearing Plain	LINING, D60/d50x125, BHS-110/50-S
3	070	1	PCS	RH303521	Stroke Limiter	STROKE LIMITER BHS-110/50-S MACHINING; BHS-110/50-S
3	080	1	PCS	SEPSA006	Hydraulic Seal piston	PISTON SEAL, 110-96-16/32, SIMRIT, 110x110x96 (SEPSA006)
3	090	1	PCS	SEPRA011	Hydraulic Seal rod	PISTON ROD SEAL AUN-50-106, SIMRIT, 60x60x10 (SEPRA011)
3	100	1	PCS	SEDWA010	Hydraulic Seal rod	DIRT-WIPER AS-50-65-7/10, 65x65x10 (SEDWA010)
3	110	1	PCS	SEORA175	O-Ring	O-RING, Ø99,30 x 5,70, 100x100x6 (SEORA175)
3	120	1	PCS	SEORA062	O-Ring	O-RING, Ø34,52 x 3,53 (R4137), 35x35x4 (SEORA062)
3	130	24	PCS	BSPXX016	Spring	PLATE SPRING, DIN 2093, 100x51x5 (BSPXX016)
3	140	1	PCS	BETBS039	Thrust Ball Bearing	THRUST BALL BEARING, SINGLE DIR, 51213; d65/D100x27 (BETBS039)
3	150	1	PCS	FA0985E30	Nut	NUT NYLOCK HEXAGON, 8 ELZN, DIN 985 M30 (FA0985E30)
3	160	1	PCS	GRRAX002S	Grease Nipple	GREASE NIPPLE, STRAIGHT, 1/4"R, A2 (GRRAX002S)
3	170	0.2	M	SEGRA077	Guide Ring	GUIDE STRIP, 15x2.0 (PTFE), 15x15x2 (SEGRA077)
3	180	1	PCS	FCPPF051	Plug	HEXAGON SOCKET PLUG, DIN 908, A4, G3/8"; DIN 908 (ISO 228) (FCPPF051)
3	030	1	PCS	RH319718	Brake Adjusting Device	NUT FOR BRAKE SCREW, D63,5x74, MACHINING
3	040	3	PCS	GRRAX002S	Grease Nipple	GREASE NIPPLE, STRAIGHT, 1/4"R, A2 (GRRAX002S)
3	050	2	PCS	RH408161	Locking Plate	LOCK DISC, D40/d11x6, TWS-
3	060	2	PCS	RH316996	Bearing Plain	LINING, D60/d50x25, MACHINING
3	070	1	PCS	RH318365	Bolt	BOLT, D50x202, MACHINING
3	080	4	PCS	RH318364	Bearing Plain	LINING, D60/d50x20, MACHINING
3	090	1	PCS	RH318372	Bolt	BOLT, D50x202, MACHINING
3	100	2	PCS	FA0933G10020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x20; FULLY THREADED (FA0933G10020)
3	110	4	PCS	FA0916G06012	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M6x12; CUP POINT (FA0916G06012)
2	060	1	PCS	RH323401	Slipring Device Assembly	SLIPRING ARRANG.-FOCAL 176,RW2371,ASSE
3	010	1	PCS	RH313210	Bracket	SLIP RING TORQUIE BRACKET; WELDING ASSEMBLY, ROV4000, SLIP RING TORQUIE BRACKET
3	020	1	PCS	400092511	Slipring Device	FOCAL 176291 6xOPT,5xEL@4500V,4xEL@1000V (EACSL0471)
3	030	6	PCS	FA0912G08050	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M8x50; THREAD LENGTH: 28mm (FA0912G08050)
3	040	6	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
3	050	2	PCS	FA0933G10030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x30; FULLY THREADED (FA0933G10030)
3	060	4	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	070	2	PCS	FA0934G10	Nut	HEXAGON NUT, A4-80, DIN 934, M10 (FA0934G10)
2	070	1	PCS	RH317214	Bearing Housing	BEARING HOUSING S3044; ASSEMBLY, S3044 - WELDED
3	010	1	PCS	RH317211	Bearing Housing	BEARING HOUSING S3044; WELDING & MACHINING, S3044-WELD
3	020	1	PCS	RH317213	Cover	BEARING COVER, D390/d205, MACHINING
3	030	1	PCS	RH317212	Cover	BEARING COVER, D390/205, MACHINING
3	040	0.17	M2	COSEX080	Gasket	GASKOID GASKET MATERIAL, 0,4X1000 MM (COSEX080)
3	050	1	PCS	BEASS025	Spherical Bearing Sleeve	ADAPTER SLEEVE, H3044X; d200x126/Nut HM3044 (BEASS025)

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
3	060	1	PCS	BESRS1018	Spherical Roller Bearing	SPHERICAL ROLLER BEARING, 23044-E1-K; d220(taper 1:12)/D340x90 (BESRS1018)
3	070	8	PCS	FA0912G12030	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M12x30; FULLY THREADED (FA0912G12030)
3	080	1	PCS	FA0580G016	Eyebolt	LIFTING EYE BOLT, DIN 580, M16, A4; EYE SIZE Ø35 (FA0580G016)
3	090	8	PCS	FA0933G12030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x30; FULLY THREADED (FA0933G12030)
3	100	1	PCS	SESRA085	Rotary Shaft Lip Seal	SEAL, 200x230x15, 230x230x15 (SESRA085)
3	110	1	PCS	GRMFX004	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.0, A4 (GRMFX004)
3	120	1	PCS	SESRB085	Rotary Shaft Lip Seal	SEAL, 200x230x15, W/STAINLESS SPRING, 230x230x15 (SESRB085)
2	080	1	PCS	RH314192	Drive Shaft	DRUM SHAFT, RW-2326, MACHINING
2	090	1	PCS	RH317984	Support Shaft	DRUM SHAFT, BEARING D200/SLIPRING D140,2, BEARING SIDE, MACHINING
2	100	1	PCS	RH318400	Torque Arm	TORQUE ARM, RW2371BS, ASSEMBLY; ASSEMBLY, M39x3, MIN DIST. 405
3	010	1	PCS	BESPS100L	Radial Spherical Plain Bearing	ROD END, GAL-40-UK-2RS; d40x28 - M39x3 (Left hand thread) (BESPS100L)
3	020	1	PCS	BESPS100	Radial Spherical Plain Bearing	ROD END, GAR-40-UK-2RS; d40x28 - M39x3 (BESPS100)
3	030	1	PCS	RH318401	Bolt	TENSION BOLT, D60x200, M39x3(L&R); MACHINING
3	040	2	PCS	RH408161	Locking Plate	LOCK DISC, D40/d11x6, TWS-
3	050	4	PCS	RH31708301	Distance Ring	SPACER, D45/d40x6, MACHINING
3	060	2	PCS	RH317084	Shear Pin	SHEAR PIN, D40x101, MACHINING; GROOVE D28x6
3	070	1	PCS	FA0934E393	Nut	HEX.NUT, GRADE 8, ELZN, DIN 934, M39x3 (FA0934E393)
3	080	2	PCS	FA0933G10016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x16; FULLY THREADED (FA0933G10016)
3	090	2	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	100	1	PCS	FA0934E393L	Nut	HEX.NUT, Gr.8, ELZN, DIN 934, M39x3 LEFT; LEFT HAND THREAD (FA0934E393L)
2	120	1	PCS	RH319115	Support Plate	MOTOR SUPPORT PLATE, RW2371BS_OLP
2	130	1	PCS	RH328794	Cover	GEARBOX COVER, BPH.25, ASSEMBLY
3	010	1	PCS	RH328795	Cover	GEARBOX COVER, BPH.25, WELDING ASSEMBLY
3	020	4	PCS	FA0933G08008	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x8; FULLY THREADED (FA0933G08008)
3	035	8	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)
3	040	4	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
3	050	8	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	060	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	140	1	PCS	400095861	Cover	GEARBOX COVER_OPEN_BPH.25, (T30/D300xd145); MACHINING
2	150	1	PCS	RH314195	Cover	BEARING COVER, D260x32, RW-2326BS, MACH.
2	160	1	PCS	RH314194	Cover	BEARING COVER, D260x22, RW-2326BS, MACH.
2	170	1	PCS	RH312858	Shim	BEARING SHIM PLATE, 190x690x10 (2xD42); MACHINING, CENTER DISTANCE 580
2	180	1	PCS	COVVX019	Lifting Sling	EPOCAST 36 WITH HARDENER, 4 L; CHOCKING COMPOUND (COVVX019)
2	190	1	PCS	RH314201	Locking Plate	LOCKING DISC, BPH325, MACHINING; MACHINING, BPH325
2	200	1	PCS	RH314202	Locking Plate	LOCKING DISC, BPH325, MACHINING; MACHINING, BPH325
2	210	1	PCS	RH314196	Bearing Plain	LINING, D145/d132x23,5, MACHINING
2	220	1	PCS	400096385	Bushing	LINING, D140/d120/67,5; MACHINING
2	230	1	PCS	RH314197	Bearing Plain	LINING, D130/d121x20, MACHINING
2	240	1	PCS	RH318949	Bracket	BRACKET FOR RH203377PL & RH203378PL; WELDING & MACHINING, Ref. RH203377PL & RH203378PL
2	250	1	PCS	RH318968	Bracket	BRACKET FOR BULKHEAD UNION; BENDING, FOR BULKHEAD UNION, 2XØ34 / 90deg
2	260	1	PCS	RH321920	Shear Pin	SHEAR PIN, D35/M30, MACHINING
2	270	6	PCS	RH319054	Shim	SHIM - EL.MOTOR, D50/d17x6, MACHINING
2	280	1	PCS	RH314261	Key	KEY, 32x18, MACHINING

Level	Pos	Qty	Unit	Aras ID	Name	Description
2	290	1	PCS	RH410554	Fixed Support	BRAKE BAND SUPPORT, DSW- 4006E; L=185+20 2 x M16 (c-c = 70)
2	300	2	PCS	RH408797	Nut	SLIDE NUT WDU-4000/4500
2	310	2	PCS	RH408614	SLIDING PLATE, TWS-2000-10000	SLIDING PLATE, TWS-2000-10000
2	320	0.1568	M2	COSEX0821	Gasket	PREFLEX GASKET, 0,8x1000 MM; REPLACE GASKOID (COSEX0821)
2				RHHEBRGC-Q	Hydraulic Winch Assembly	HYDR. BRAKE CTRL. AND GEAR COOLING, (RHHEBRGC-Q)
3	010	1	PCS	RHHGMR15TRS	Hydraulic Fittings	TEST POINT SS. FOR TUBE Ø15PH STAINLESS (RHHGMR15TRS)
4	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
4	020	1	PCS	FTTFF002	Hydraulic Fittings	TRIP.LOK 10TT4X-SS 15/16 1/4" TEST P. F.; 10TT4MXSS (FTTFF002)
4	030	1	PCS	FTMSF005	Hydraulic Fittings	TRIP.LOK TX-SS 15 SLEEVE METRIC; TXSS15 (FTMSF005)
4	040	1	PCS	FTNUF004	Hydraulic Fittings	TRIP.LOK BTX-SS 15/16 NUT; 10 BTX-SS (FTNUF004)
4	050	1	PCS	FTUTF016	Hydraulic Fittings	TRIP.LOK R6X-SS 15/16 SWIVEL NUT RUN TEE; 10 R6X-SS (FTUTF016)
3	020	1	PCS	RHHGMR20TRS	Hydraulic Fittings	TEST POINT,SS.FOR TUBE Ø20PH SS (RHHGMR20TRS)
4	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
4	020	1	PCS	FTTFF003	Hydraulic Fittings	TRIP.LOK 12TT4X-SS 18/20 1/4" TEST P. F.; 12TT4MXSS (FTTFF003)
4	030	1	PCS	FTUTF017	Hydraulic Fittings	TRIP.LOK R6X-SS 18/20 SWIVEL NUT RUN TEE; 12 R6X-SS (FTUTF017)
4	040	1	PCS	FTNUF005	Hydraulic Fittings	TRIP.LOK BTX-SS 18/20 NUT; 12 BTX-SS (FTNUF005)
4	050	1	PCS	FTMSF008	Hydraulic Fittings	TRIP.LOK TX-SS 20 SLEEVE METRIC; TXSS20 (FTMSF008)
3	030	1	PCS	RHHGMR15TRS	Hydraulic Fittings	TEST POINT SS. FOR TUBE Ø15PH STAINLESS (RHHGMR15TRS)
4	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
4	020	1	PCS	FTTFF002	Hydraulic Fittings	TRIP.LOK 10TT4X-SS 15/16 1/4" TEST P. F.; 10TT4MXSS (FTTFF002)
4	030	1	PCS	FTMSF005	Hydraulic Fittings	TRIP.LOK TX-SS 15 SLEEVE METRIC; TXSS15 (FTMSF005)
4	040	1	PCS	FTNUF004	Hydraulic Fittings	TRIP.LOK BTX-SS 15/16 NUT; 10 BTX-SS (FTNUF004)
4	050	1	PCS	FTUTF016	Hydraulic Fittings	TRIP.LOK R6X-SS 15/16 SWIVEL NUT RUN TEE; 10 R6X-SS (FTUTF016)
3	040	1	PCS	RHHGMR15TRS	Hydraulic Fittings	TEST POINT SS. FOR TUBE Ø15PH STAINLESS (RHHGMR15TRS)
4	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
4	020	1	PCS	FTTFF002	Hydraulic Fittings	TRIP.LOK 10TT4X-SS 15/16 1/4" TEST P. F.; 10TT4MXSS (FTTFF002)
4	030	1	PCS	FTMSF005	Hydraulic Fittings	TRIP.LOK TX-SS 15 SLEEVE METRIC; TXSS15 (FTMSF005)
4	040	1	PCS	FTNUF004	Hydraulic Fittings	TRIP.LOK BTX-SS 15/16 NUT; 10 BTX-SS (FTNUF004)
4	050	1	PCS	FTUTF016	Hydraulic Fittings	TRIP.LOK R6X-SS 15/16 SWIVEL NUT RUN TEE; 10 R6X-SS (FTUTF016)
3	060	1	PCS	RHHHH123802S	Hydraulic Hose	BRAKE HOSE 3/8" 2 EA. INCL. SS FITT. PH; 2xslanger,2xF40,2xC6,2xB+T (RHHHH123802S)
4	010	2	PCS	HH2DK003	Hydraulic Hose	HP-HOSE 202206,S421,S425,L=0,5M,276BAR; 3/8" Bremseslange med syrefaste koblinger (HH2DK003)
4	020	2	PCS	FTCBF008	Hydraulic Fittings	TRIP.LOK F42X-SS 12-3/8" BSPP-CONNECTOR; 8F42EDMXSS (FTCBF008)
4	030	2	PCS	FTUEF011	Hydraulic Fittings	TRIP.LOK C6X-SS 12 SWIVEL NUT ELBOW; 8C6MXSS (FTUEF011)
4	040	2	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
4	050	2	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
3	070	1	PCS	HH2CS0026	Hydraulic Hose	LOW PRESS. HOSE 1" (ø28) MAX 100 BAR; ø20 - Stain. S. Couplings (HH2CS0026)
3	080	1	PCS	FTCBF015	Hydraulic Fittings	TRIP.LOK F42X-SS 18/20-1/2" BSPP-CONN.; 12-8F42EDMXSS (FTCBF015)
3	090	1	PCS	FTUEF013	Hydraulic Fittings	TRIP.LOK C6X-SS 18/20 SWIVEL NUT ELBOW; 12C6MXSS (FTUEF013)
3	100	1	PCS	HH2CS0029	Hydraulic Hose	LOW PRESS. HOSE 1,2" (ø20MM) MAX 100 BAR; ø15 - Stain. S. Couplings (HH2CS0029)
3	110	1	PCS	FTCBF012	Hydraulic Fittings	TRIP.LOK F42X-SS 15/16-1/2" BSPP-CONN.; 10F42EDMXSS (FTCBF012)
3	120	1	PCS	FTUEF012	Hydraulic Fittings	TRIP.LOK C6X-SS 15/16 SWIVEL NUT ELBOW; 10C6MXSS (FTUEF012)
3	130	1	PCS	RH600314S	Check Valve	VU 12F-12F 0,35 BAR DIA 15 PH; CHECK VALVE 0,35 BAR DIAM 15 PH
4	010	1	PCS	400190567	Check Valve	SS Check valve, 1/2", 0,35bar, VU12F12F (FASTER) Stainless steel !!! (available on request)

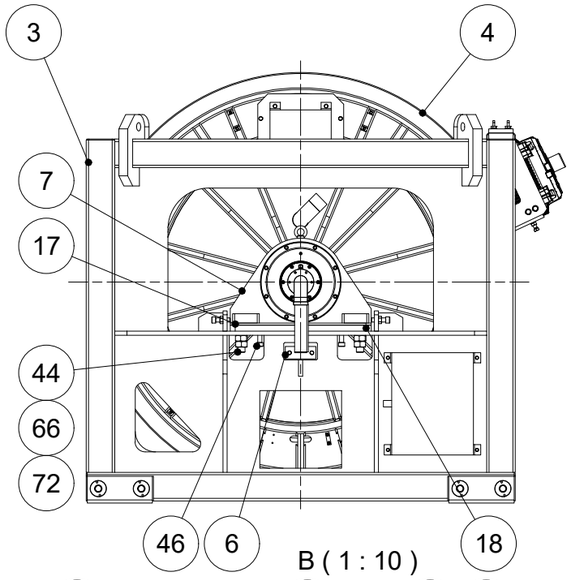
TITLE_BOM

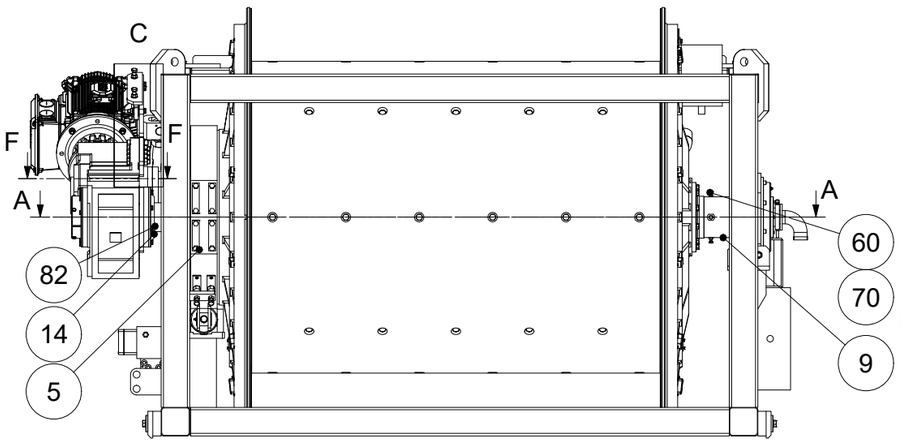
Level	Pos	Qty	Unit	Aras ID	Name	Description
4	020	2	PCS	FTMSF005	Hydraulic Fittings	TRIP.LOK TX-SS 15 SLEEVE METRIC; TXSS15 (FTMSF005)
4	030	2	PCS	FTNUF004	Hydraulic Fittings	TRIP.LOK BTX-SS 15/16 NUT; 10 BTX-SS (FTNUF004)
4	040	2	PCS	FTCBF012	Hydraulic Fittings	TRIP.LOK F42X-SS 15/16-1/2" BSPP-CONN.; 10F42EDMXSS (FTCBF012)
3	140	1	PCS	RHHRRNV0201201S	Pressure Reducing Valve	PRESS. RED.VALVE CH.VLV.20 LPM Ø12PH SS (RHHRRNV0201201S)
4	010	1	PCS	HRROC007	Pressure Reducing Valve	PRESS. RED.VALVE VRP-R-VU-05.90.19; VRPR059019 (HRROC007)
4	020	3	PCS	FTCBF008	Hydraulic Fittings	TRIP.LOK F42X-SS 12-3/8" BSPP-CONNECTOR; 8F42EDMXSS (FTCBF008)
4	030	3	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
4	040	3	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
4	050	1	PCS	FTUTF015	Hydraulic Fittings	TRIP.LOK R6X-SS 12 SWIVEL NUT RUN TEE; 8 R6X-SS (FTUTF015)
4	060	1	PCS	FTTFF001	Hydraulic Fittings	TRIP.LOK 8TT4X-SS 12 1/4" TEST P. F.; 8TT4MXSS (FTTFF001)
4	070	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
3	150	1	PCS	RHHSE1-600485S1	Solenoid Valve Assembly	SINGLE BOX, 4D01, 2xø15PH+2xø12PH SS; Syrefast fittings etc. (RHHSE1-600485S1)
4	010	1	PCS	RHHBOX1MDPEM	Enclosure	SINGEL VALVE BOX IN MDPE ASSEMBLED; m/NG6 blindplate. (RHHBOX1MDPEM)
4	020	1	PCS	HSEDE030	Coil	DIRECTIONAL VALVE 4D01-3151-0101-C1-G0Q (HSEDE030)
4	030	2	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
4	040	2	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
4	050	2	PCS	FTMSF005	Hydraulic Fittings	TRIP.LOK TX-SS 15 SLEEVE METRIC; TXSS15 (FTMSF005)
4	060	2	PCS	FTNUF004	Hydraulic Fittings	TRIP.LOK BTX-SS 15/16 NUT; 10 BTX-SS (FTNUF004)
4	070	2	PCS	FTCBF008	Hydraulic Fittings	TRIP.LOK F42X-SS 12-3/8" BSPP-CONNECTOR; 8F42EDMXSS (FTCBF008)
4	080	2	PCS	FTCBF012	Hydraulic Fittings	TRIP.LOK F42X-SS 15/16-1/2" BSPP-CONN.; 10F42EDMXSS (FTCBF012)
4	090	2	PCS	FCPPF015	Plug	HEXAGON HEAD PLUG, DIN 910, A4, G3/8"; DIN 910 (FCPPF015)
4	100	6	PCS	FCPPF010	Plug	HEXAGON HEAD PLUG, DIN 910, A4, G1/4"; DIN 910 (FCPPF010)
4	110	4	PCS	FA0912D05030	Screw	SOCKET HEAD SCREW 12.9 DIN 912 M5x30; THREAD LENGTH: 22mm (FA0912D05030)
4	120	2	PCS	SEBOB003	Bonded Seal	BONDED SEAL, PP 45-C, 3/8" R/BSP, A4, 24x24x4 (SEBOB003)
4	130	6	PCS	SEBOB002	Bonded Seal	BONDED SEAL, PP 45-B, 1/4" R/BSP, A4, 21x21x4 (SEBOB002)
3	160	1.5	M	TPPIF018	Pipe Clamp	HYDR. PIPE, Ø20X2.0 SEAML.AISI-316; Ø20X2.0 SEAMLESS ACID PROOF AISI-316 (TPPIF018)
3	170	3	M	TPPIF014	Pipe Clamp	HYDR. PIPE, Ø12X1.5 SEAML.AISI-316; Ø12X1.5 SEAMLESS ACID PROOF AISI-316 (TPPIF014)
3	180	6	PCS	TPCLFA1K012	Pipe Clamp	TUBE CLAMP COMPL. 12MM.AISI 316; TUBE CLAMP COMPL. SER.A.GR.1 12mm/AISI 316 (TPCLFA1K012)
3	190	3	PCS	TPCLFA2K015	Pipe Clamp	TUBE CLAMP COMPL. 15mm.AISI 316; TUBE CLAMP COMPL. SER.A.GR.2 15mm/AISI 316 (TPCLFA2K015)
3	200	3	PCS	TPCLFA3K020	Pipe Clamp	TUBE CLAMP COMPL. 20mm.AISI 316; TUBE CLAMP COMPL. SER.A.GR.3 20mm/AISI 316 (TPCLFA3K020)
3	210	1	M	TPPIF016	Pipe Clamp	HYDR. PIPE, Ø15X1.5 SEAML.AISI-316; Ø15X1.5 SEAMLESS ACID PROOF AISI-316 (TPPIF016)
3	220	1	PCS	FTUTF003	Hydraulic Fittings	TRIP.LOK JTX-SS 12 UNION TEE; 8JMTXSS (FTUTF003)
3	230	3	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
3	240	3	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
3	250	1	PCS	FTUTF015	Hydraulic Fittings	TRIP.LOK R6X-SS 12 SWIVEL NUT RUN TEE; 8 R6X-SS (FTUTF015)
3	260	1	PCS	FTUTF024	Hydraulic Fittings	TRIP.LOK S6X-SS 12 SWIVEL NUT BRANCH TEE; 8 S6X-SS (FTUTF024)
3	270	2	PCS	FTUNF012	Hydraulic Fittings	TRIP.LOK HX6-SS 12-12 SWIVEL NUT UNION (FTUNF012)
3	280	2	PCS	FTREF007	Hydraulic Fittings	TRIP.LOK TRTX-SS 15/16-12 REDUCER; 10-8TRMTXSS (FTREF007)
3	290	1	PCS	FTUNF004	Hydraulic Fittings	TRIP.LOK HTX-SS 15/16 UNION; 10HMTXSS (FTUNF004)
3	300	5	PCS	FTNUF004	Hydraulic Fittings	TRIP.LOK BTX-SS 15/16 NUT; 10 BTX-SS (FTNUF004)
3	310	5	PCS	FTMSF005	Hydraulic Fittings	TRIP.LOK TX-SS 15 SLEEVE METRIC; TXSS15 (FTMSF005)
3	320	1	PCS	FTUNF005	Hydraulic Fittings	TRIP.LOK HTX-SS 18/20 UNION; 12HMTXSS (FTUNF005)
3	330	5	PCS	FTNUF005	Hydraulic Fittings	TRIP.LOK BTX-SS 18/20 NUT; 12 BTX-SS (FTNUF005)

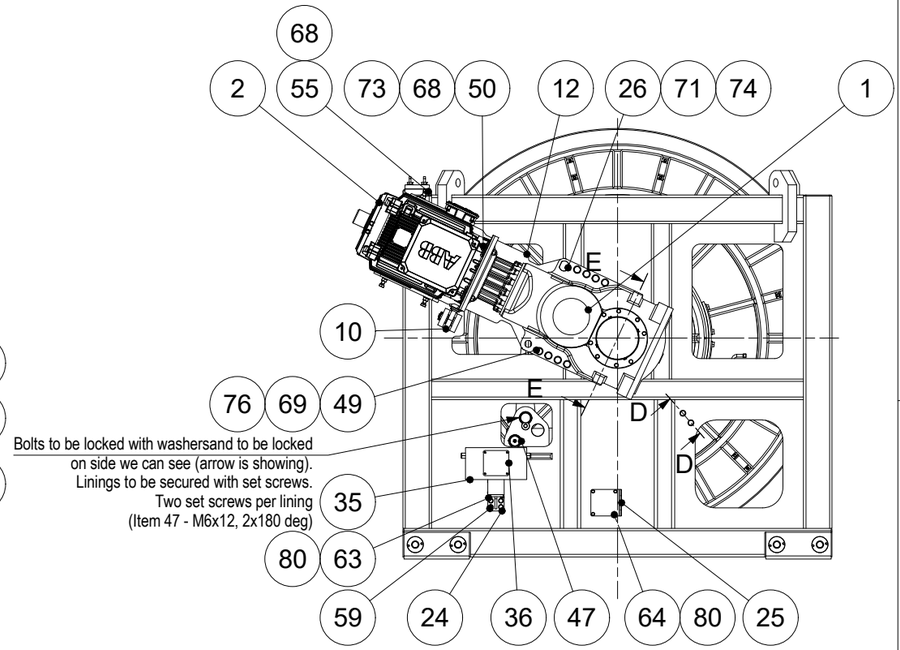
Level	Pos	Qty	Unit	Aras ID	Name	Description
3	340	5	PCS	FTMSF008	Hydraulic Fittings	TRIP.LOK TX-SS 20 SLEEVE METRIC; TXSS20 (FTMSF008)
3	350	1	PCS	FTUBF005	Hydraulic Fittings	TRIP.LOK WTX-WLN-SS 18/20 BULKHEAD UNION (FTUBF005)
3	360	1	PCS	FTUBF004	Hydraulic Fittings	TRIP.LOK WTX-WLN-SS 15/16 BULKHEAD UNION (FTUBF004)
3	370	1	PCS	FTBNA005	Hydraulic Fittings	TRIP.LOK FNTX-S 18/20 BLIND NUT; 12FNMTXS (FTBNA005)
3	380	3	PCS	FTBNA004	Hydraulic Fittings	TRIP.LOK FNTX-S 15/16 BLIND NUT; 10FNMTXS (FTBNA004)
2	370	1	PCS	BESRS091	Spherical Roller Bearing	SPHERICAL ROLLER BEARING, 23026-E; d130/D200x52 (BESRS091)
2	380	1	PCS	SESRB0782	Rotary Shaft Lip Seal	SEAL, 145x170x13 A-TYPE, SSS, 170x170x13 (SESRB0782)
2	390	1	PCS	SESRB077	Rotary Shaft Lip Seal	SEAL, 140x170x15, W/STAINLESS SPRING, 15x170x170 (SESRB077)
2	400	1	PCS	SESRB073	Rotary Shaft Lip Seal	SEAL, 130x160x12, W/STAINLESS SPRING, (SESRB073)
2	410	1	PCS	FA0471U1300	Circlip	CIRCLIP RING EXTERNAL,STEEL DIN 471 A130; SPRING STEEL, PHOSPHATED, HRC 44-49 (FA0471U1300)
2	420	1	PCS	FA0472A1200	Circlip	CIRCLIP RING INTERNAL,STEEL DIN 472 I120; SPRING STEEL, PHOSPHATED, HRC 44-49 (FA0472A1200)
2	430	1	PCS	FA0988U13016035	Ring	SUPPORT WASHER, DIN 988, SS-130x160x3,5; SS13016035 DIN988 Steel St 2 K 60 (FA0988U13016035)
2	440	2	PCS	FA0912U36220	Screw	SOCKET HEAD SC 12.9 ZNFC DIN 912 M36x220 (FA0912U36220)
2	450	4	PCS	FA0912G20070	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M20x70; FULLY THREADED (FA0912G20070)
2	460	4	PCS	FA0912G20060	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M20x60; FULLY THREADED (FA0912G20060)
2	470	4	PCS	FA0916G06012	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M6x12; CUP POINT (FA0916G06012)
2	480	1	PCS	400091256	Screw	HEX.HEAD SCREW 8.8 VZN, DIN 931 M24x100; THREAD LENGTH:54mm (FA0931H24100)
2	490	8	PCS	FA0931G20100	Screw	HEX.HEAD SCREW A4-80, DIN 931 M20x100; THREAD LENGTH:46mm (FA0931G20100)
2	500	4	PCS	FA0931G16065	Screw	HEX.HEAD SCREW A4-80, DIN 931 M16x65; THREAD LENGTH:38mm (FA0931G16065)
2	510	10	PCS	FA0931G16060	Screw	HEX.HEAD SCREW A4-80, DIN 931 M16x60; THREAD LENGTH:38mm (FA0931G16060)
2	520	6	PCS	FA0931G14080	Screw	HEX.HEAD SCREW A4-80, DIN 931 M14x80; THREAD LENGTH:34mm (FA0931G14080)
2	530	20	PCS	FA0933G20055	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x55; FULLY THREADED (FA0933G20055)
2	540	2	PCS	FA0933G16090	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x90; FULLY THREADED (FA0933G16090)
2	550	4	PCS	FA0933G16060	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x60; FULLY THREADED (FA0933G16060)
2	560	2	PCS	FA0933G16050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x50; FULLY THREADED (FA0933G16050)
2	570	7	PCS	FA0933G12055	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x55; FULLY THREADED (FA0933G12055)
2	580	16	PCS	FA0933G12030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x30; FULLY THREADED (FA0933G12030)
2	590	4	PCS	FA0933G12025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x25; FULLY THREADED (FA0933G12025)
2	600	4	PCS	FA0933G10050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x50; FULLY THREADED (FA0933G10050)
2	620	4	PCS	FA0933G08030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x30; FULLY THREADED (FA0933G08030)
2	630	4	PCS	FA0933G08025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x25; FULLY THREADED (FA0933G08025)
2	640	4	PCS	FA0933G08020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x20; FULLY THREADED (FA0933G08020)
2	650	4	PCS	FA7991G06016	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M6x16 (FA7991G06016)
2	660	4	PCS	FA0934U36	Nut	HEX.NUT, GRADE 12, Zn.F.C, DIN 934, M36; For 12.9 bolts (FA0934U36)
2	670	12	PCS	FA0934G20	Nut	HEXAGON NUT, A4-80, DIN 934, M20 (FA0934G20)
2	680	10	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
2	690	6	PCS	FA0934G14	Nut	HEXAGON NUT, A4-80, DIN 934, M14 (FA0934G14)
2	700	4	PCS	FA0934G10	Nut	HEXAGON NUT, A4-80, DIN 934, M10 (FA0934G10)
2	710	1	PCS	400091839	Nut	NUT NYLOCK HEXAGON, 8 VZN, DIN 985 M30 (FA0985H30)
2	720	2	PCS	FA6916H36	Washer	HARDENED WASHER, VZN, DIN 6916 M36; 300HV / FOR 10.9 BOLT (FA6916H36)
2	730	24	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
2	740	1	PCS	FA0125H30	Washer	FLAT WASHER, VZN, DIN 125 M30; Tykkelse h=4.0 d=31 (FA0125H30)
2	750	1	PCS	400091197	Washer	FLAT WASHER, 8.8 VZN, DIN 125 M24; Tykkelse h=4.0 d=25 (FA0125H24)

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
2	760	36	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
2	770	12	PCS	FA0125G14	Washer	FLAT WASHER, A4, DIN 125 M14; Tykkelse h=2.5 d=15 (FA0125G14)
2	780	11	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
2	800	12	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
2	810	1	PCS	GRMAX001S	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.5, A2 (GRMAX001S)
2	820	1	PCS	GRMXX002	Grease Nipple	GREASE NIPPLE, M8x1,0 STRAIGHT, A4 (GRMXX002)
2	850	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
1				400182467	Electrical Winch Assembly	Electrical system ROW/Storage Drum Mbari S1V1
2	001	1	PCS	400091474	Cabinet Basic	KLIPPON POK 121209 EX
2	002	1	PCS	400091486	Mounting Rail	TS35X7.5 ST K41
2	003	1	PCS	EACCA096	Prefabricated Cable	V1-WV4A-10M-PUR-ABG0, 10M PUR M12 90* (EACCA096)
2	004	1	PCS	EACPG270	Cable Gland	SKINTOP MS-M 12X1,5 (ØF 3-7MM) (EACPG270)
2	005	1	PCS	EACPG271	Cable Gland	SKINTOP MS-M 16X1,5 (ØF 4,5-10MM) (EACPG271)
2	006	1	PCS	EACPG280	Cable Gland	SM-M 12X1,5 SKINDICHT BRASS (EACPG280)
2	007	1	PCS	EACPG281	Cable Gland	SM-M 16X1,5 SKINDICHT BRASS (EACPG281)
2	008	1	PCS	EACPL0011	Prefabricated Cable	EL.PLUG W/KABEL 5 METER, 3P+PE BELDEN (EACPL0011)
2	009	1	PCS	EACPL007	Electronic Card	DIODE-ADAPTER A07C4-2-24VDC; ADAPTER (EACPL007)
2	010	14	PCS	EACPL0202	Terminal	TERMINAL ENDSTOPPER WEW 35/2 (EACPL0202)
2	011	2	PCS	EACPL02025	Terminal	TERMINAL GROUNDING, ZPE 2,5 WEIDMULLER (EACPL02025)
2	012	7	PCS	EACPL021401	Terminal	TERMINAL ZDU 2,5 AN (2 HOLES) WEIDMULLER (EACPL021401)
2	013	2	PCS	EACPL02144	Terminal	TW1 (FOR ZDU 2,5) END COVER (EACPL02144)
2	014	1	PCS	EACTT007	Temperature Sensor	AUTEK-MFT1M12-R0375-0010XXB-1AAB-RAPP (EACTT007)







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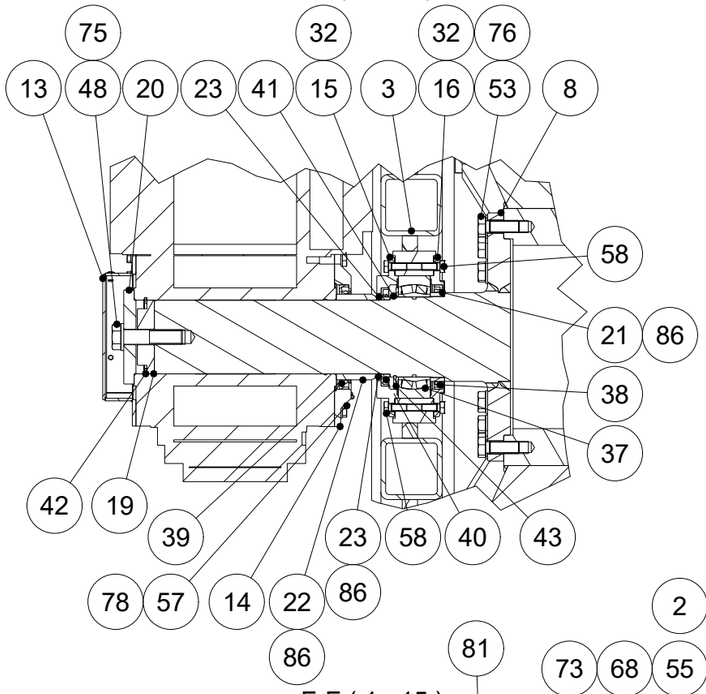

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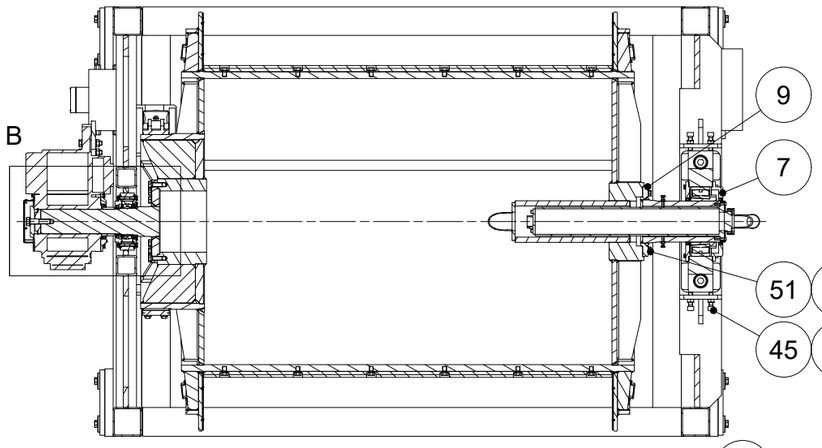

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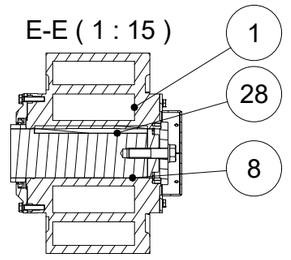
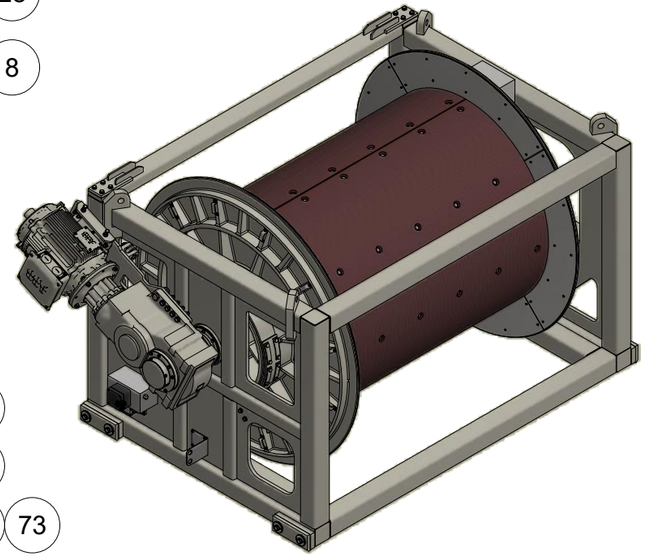


ISO VIEW (1 : 40)



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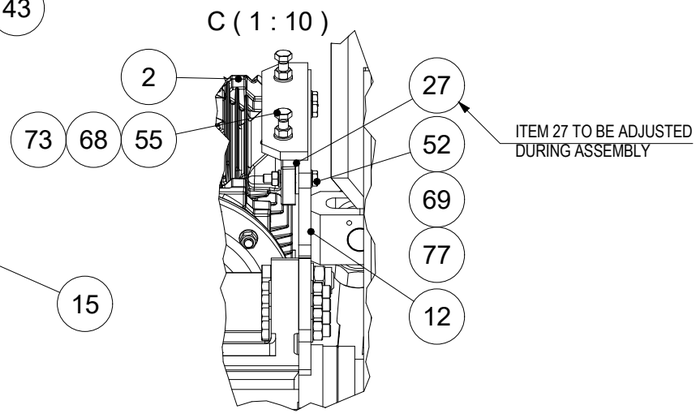

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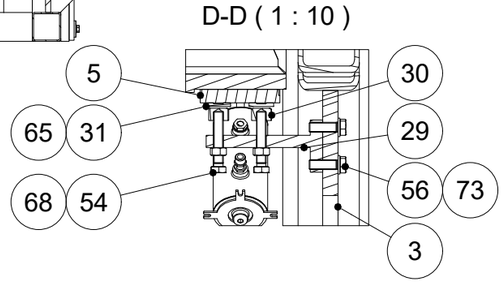

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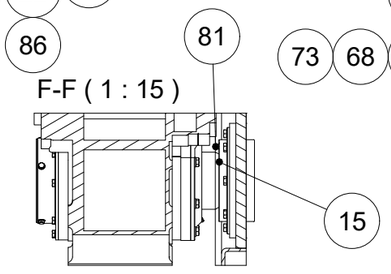

TIGHTENING TORQUE - ACC. DOC. #6402

***MCG SIGNS (Not shown on Drawing)**
***POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT**
***LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH**
***LOCTITE 638 - FOR BONDING OF CYLINDRICAL FITTING PARTS (GAP APPROX. 0,25 mm)**

83 84 85 86

Designed by	Date	Modified by	ECO / CO			
PETRODO	20.10.2021.	P Pantovic	ECO-2056896			

MACGREGOR

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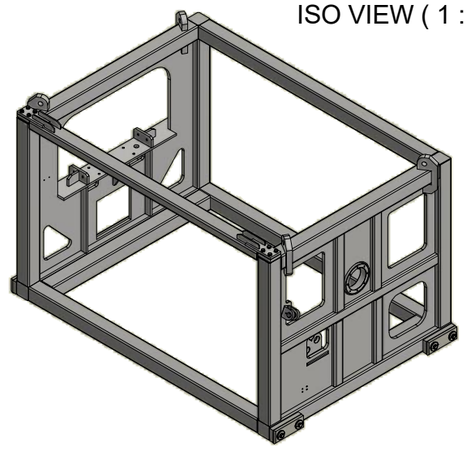
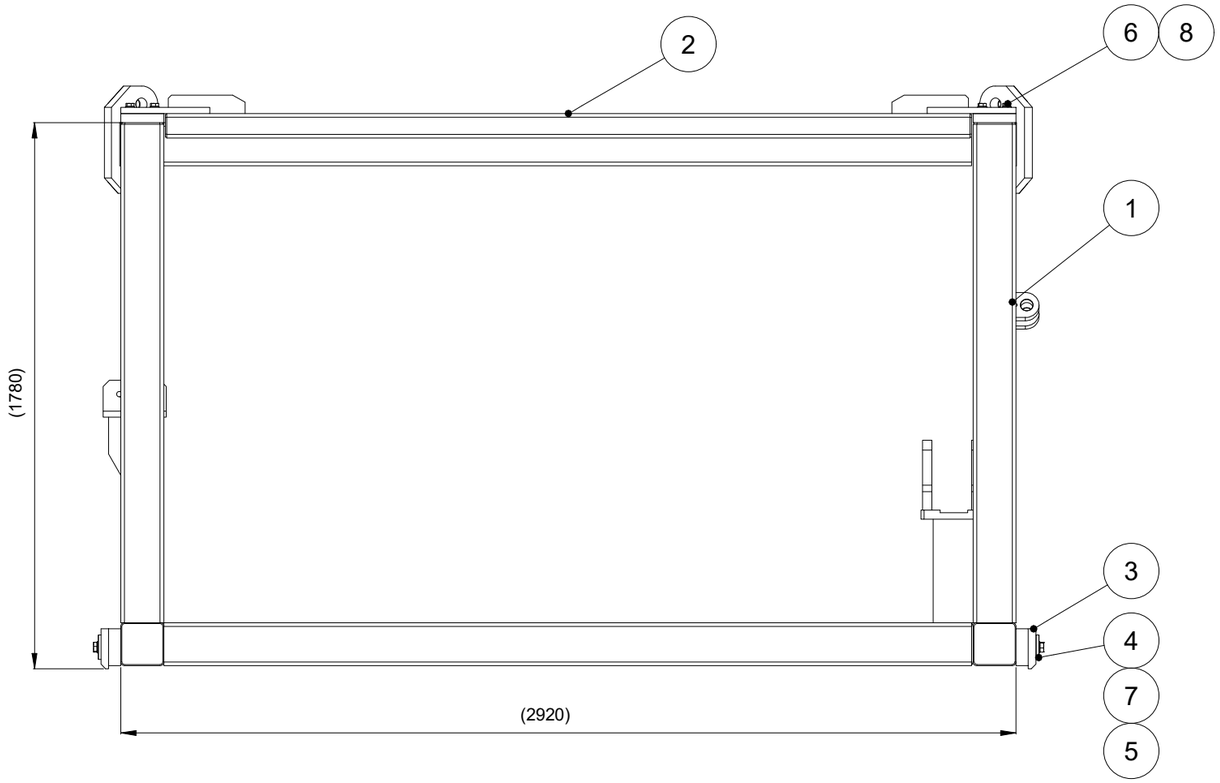
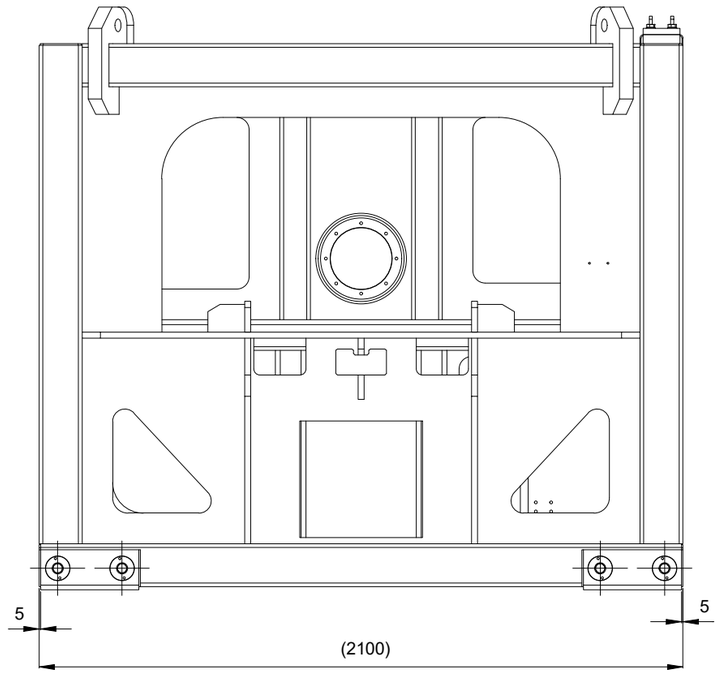
Name		Weight (kg)
ASSEMBLY		9500
Description		Scale (A3)
RW-2372BS, OLN		1 : 30
Document ID	Revision	Sheet
400092447-ASSY	B	1 / 1

ISO VIEW (1 : 50)







REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	19.10.2021.	RZPPA

Weight 1790 kg	FRAME RW-2372BS/OLN ASSEMBLY				MACGREGOR
Unspecified Tolerances According to:	*Scale (A3 Sheet)* 1:25	1 / 1			*Drw number* 400096381
Standard	*Tolerance Class*	*Material (for part)*	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*	*Partlist* 400096381
NS-ISO 2768-1	*m Medium*		Production	PETRODO 19.10.2021.	RZPPA 20.10.2021.	
NS-ISO 2768-2	*K*					

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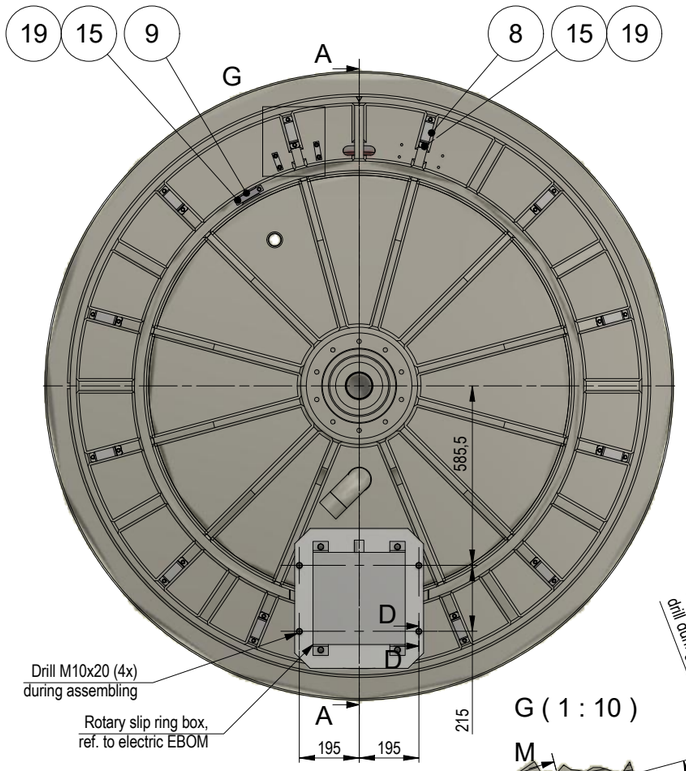

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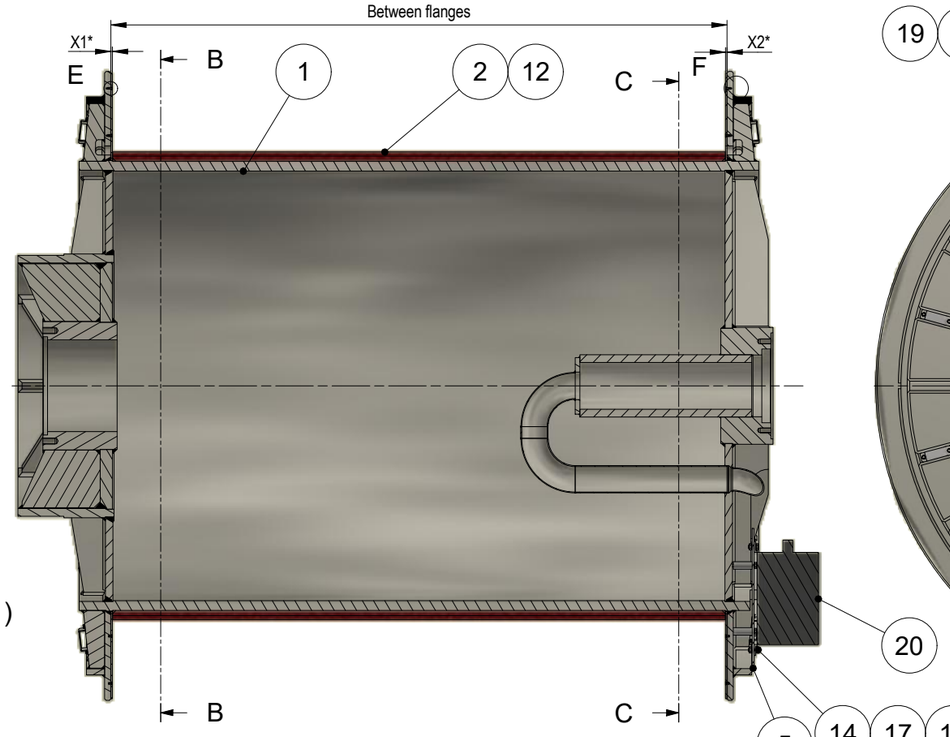
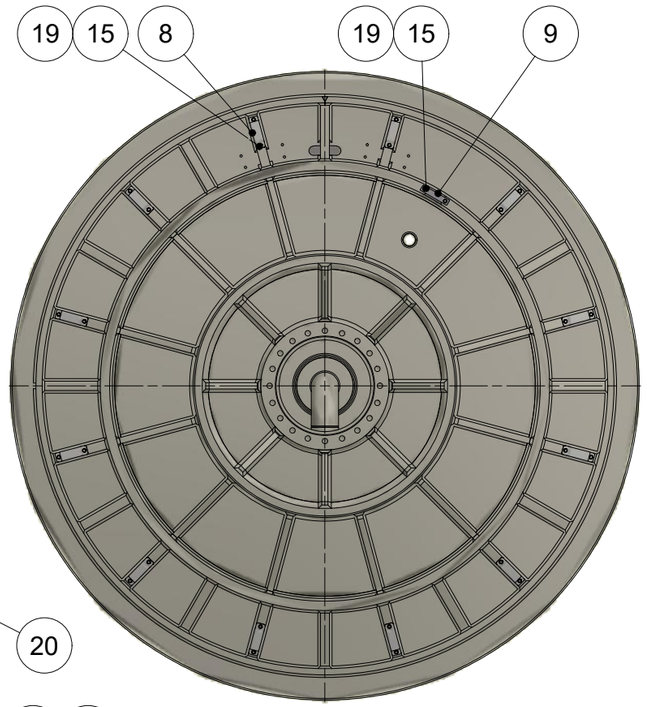
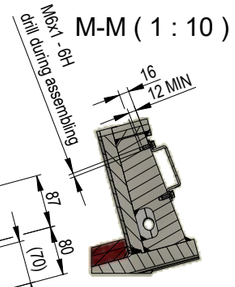
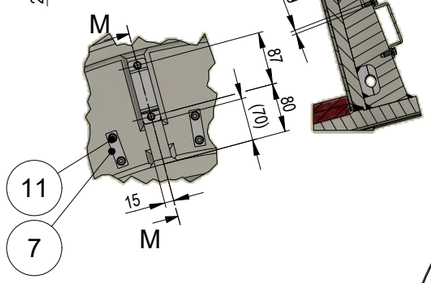




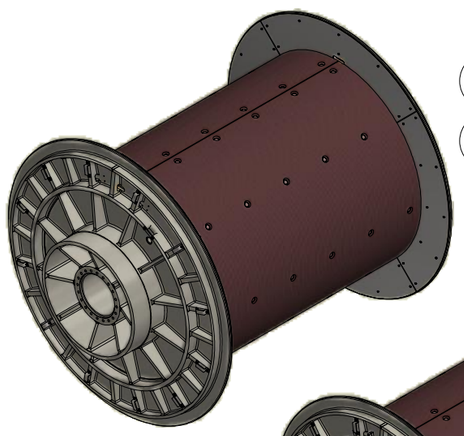
M-M (1 : 10)



G (1 : 10)



ISO VIEW (1 : 40)



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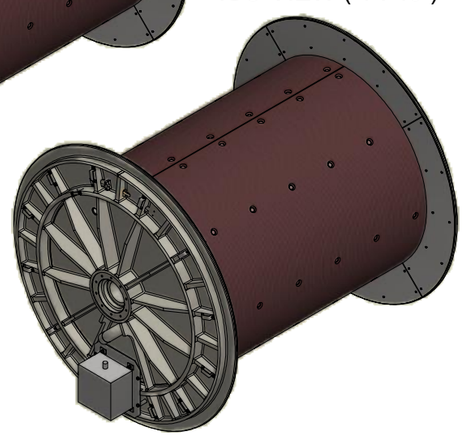
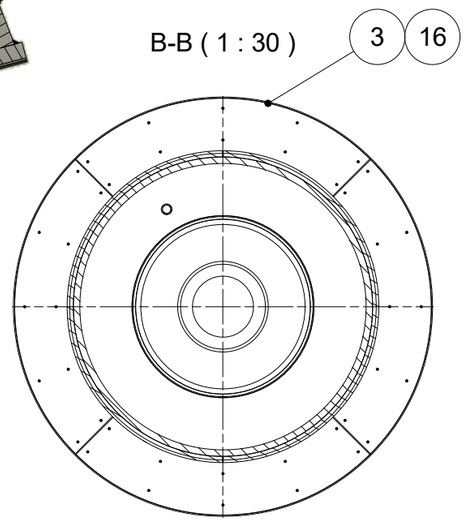
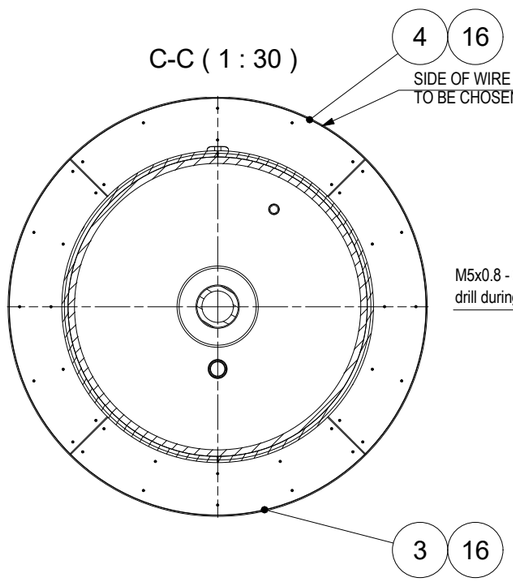


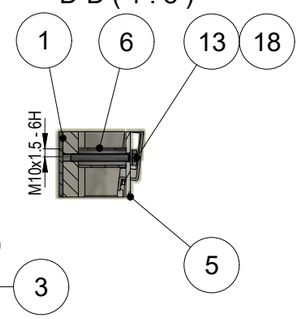
B-B (1 : 30)



C-C (1 : 30)



D-D (1 : 8)



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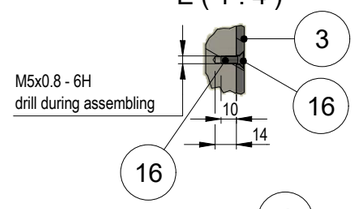
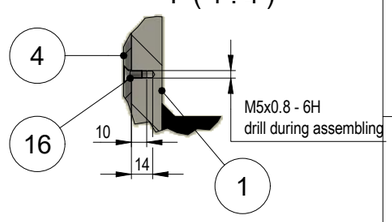


F (1 : 4)



X1*, X2* - REFF. TO LEBUS DRAWING

Designed by	Date	Modified by	ECO / CO			
PETRODO	18.10.2021.	P Pantovic	ECO-2056896			

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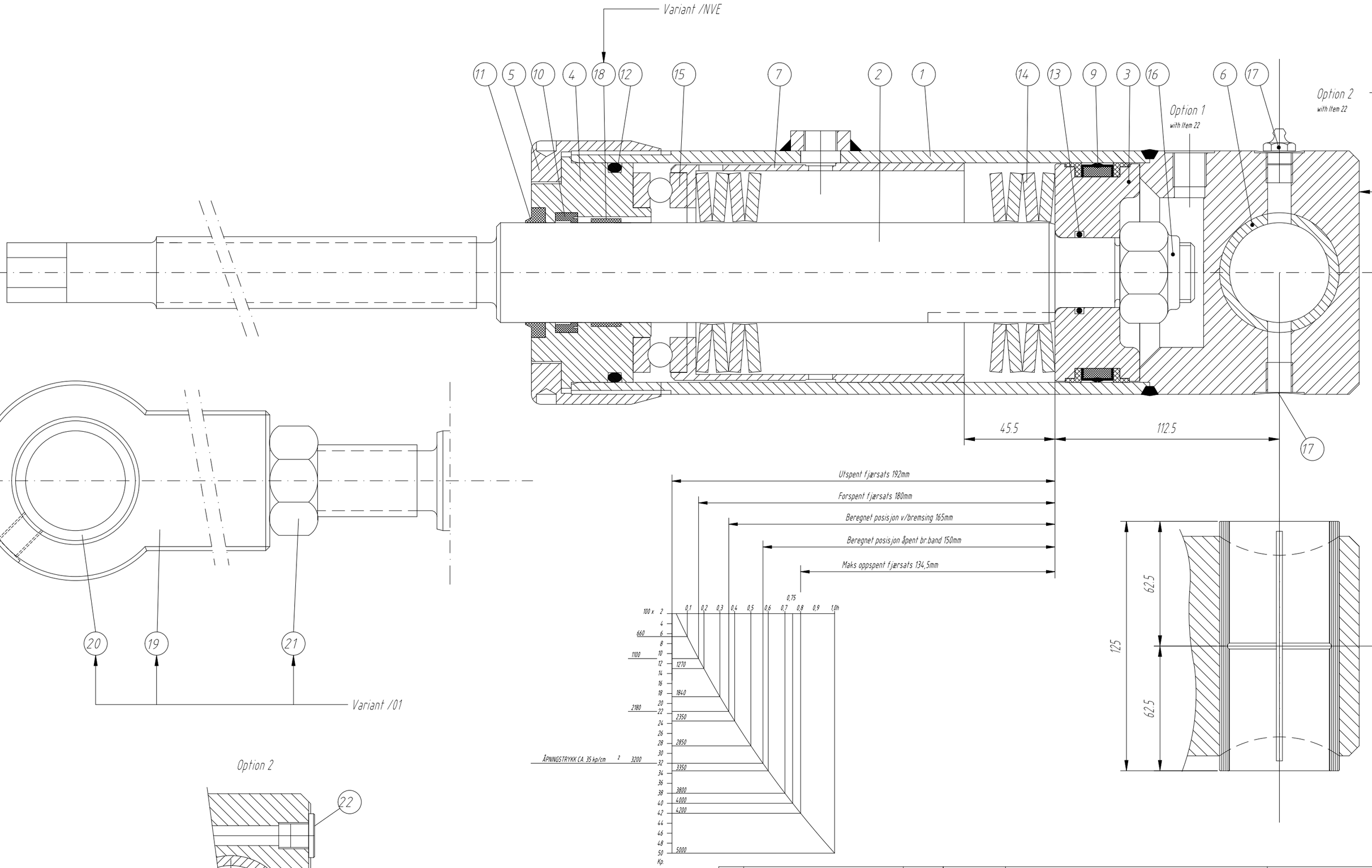
Name	Weight (kg)
DRUM WITH LEBUS	6289
Description	**Scale (A3)**
D2050xd1465xL2010 LEBUS	1 : 20
Document ID	**Revision** / **Sheet**
400096308	B / 1 / 1



PAKNINGSSETT: 5R 38/98

Rev.ID	Description of revision	Date/Sign
E		
D		
C	Item 22 added (option 1 and 2) IVITOD 16.03.17.	
B	Item 18 added. DHN 27.02.06	
A	Fjernet 1 muffe. EAB 19.03.90	

Tot.weight

RAPP HYDEMA
Phone: 75 55 01 00
Fax : 75 55 01 11
E-mail : office@rapphydema.com

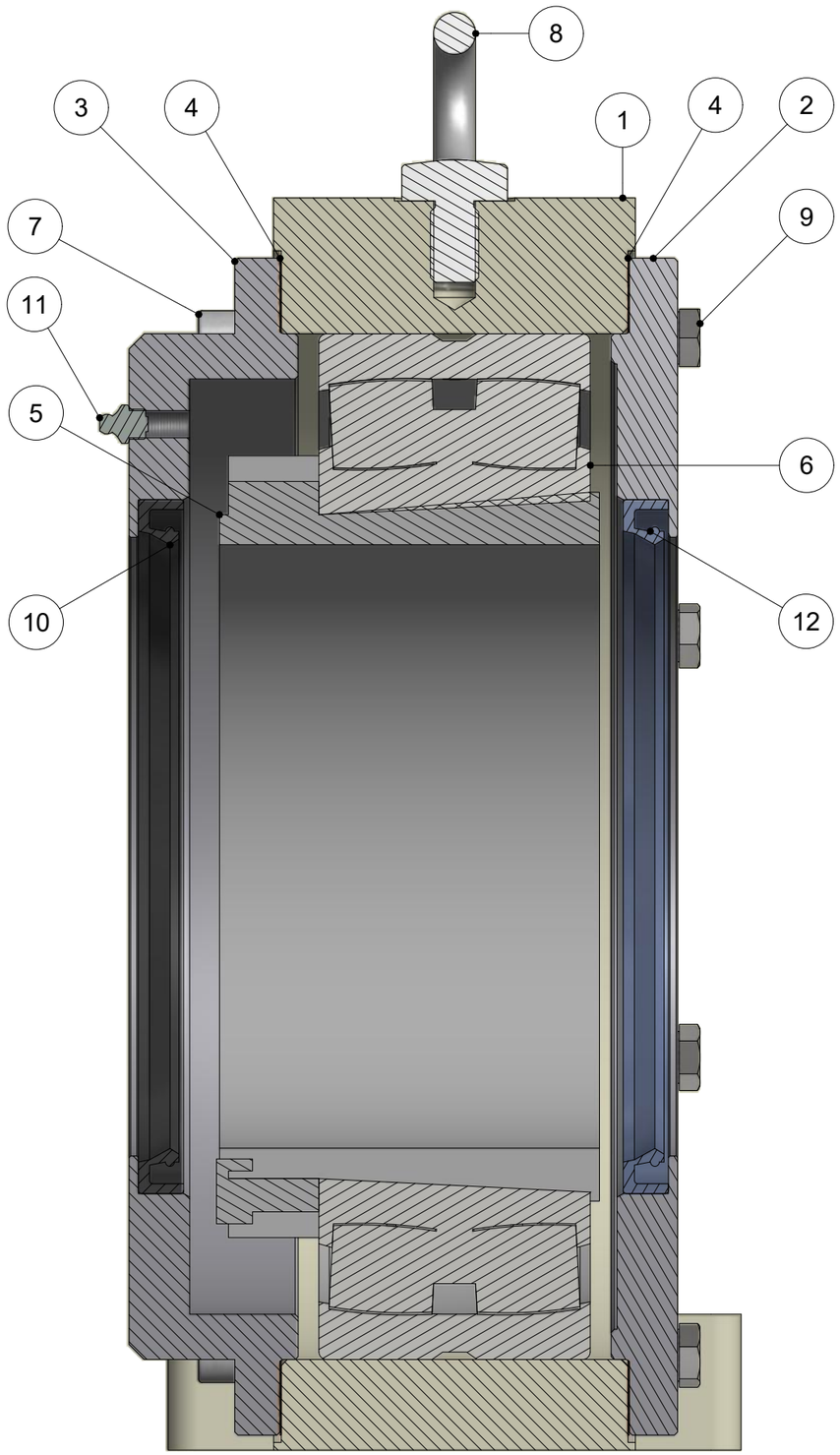
Drawn SS | Date 26.07.84 | Control RZNM | Approved RZNM

Scale 1:1

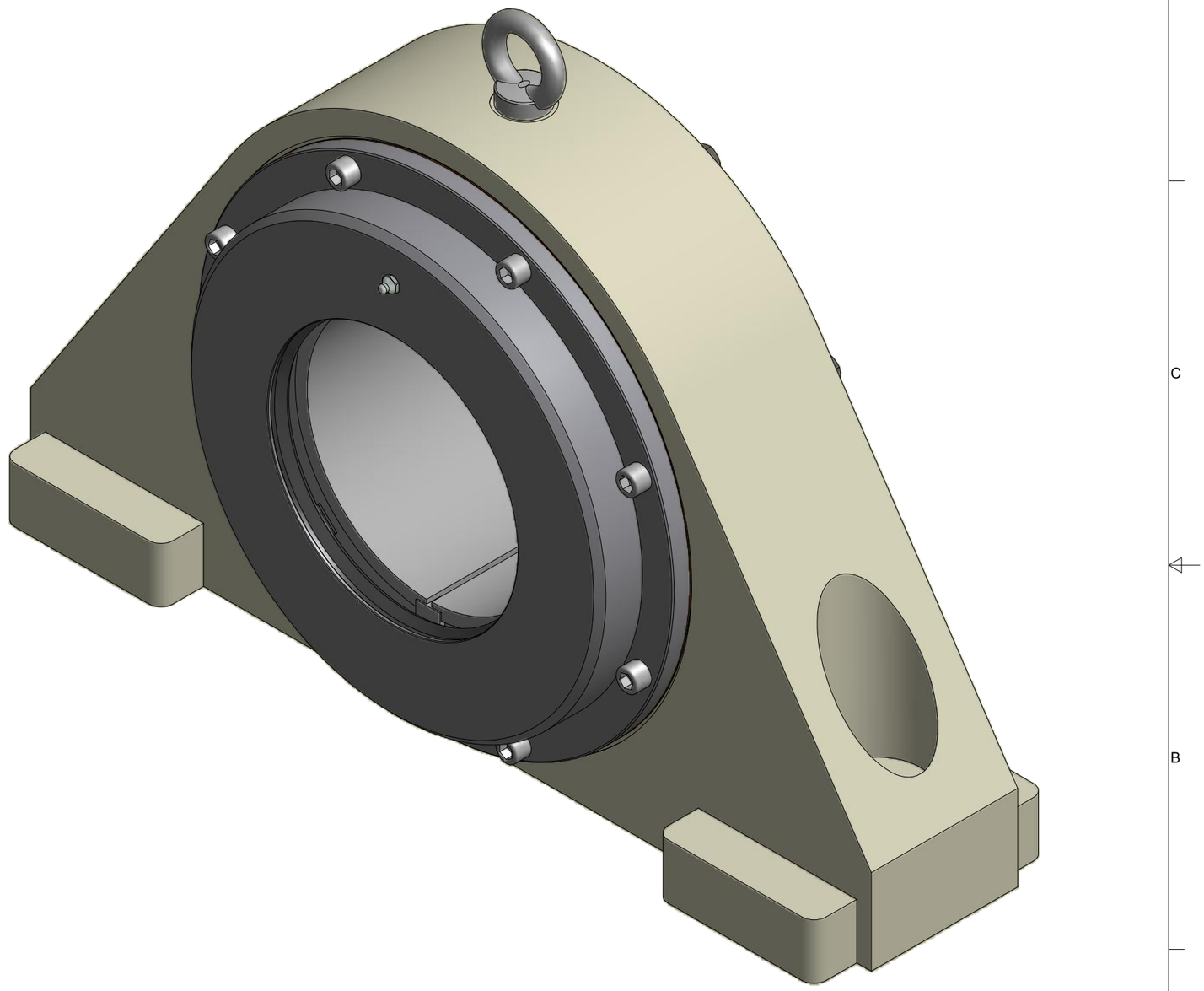
BRAKE CYLINDER BHS-110/50-S
BREMSESYLINDER

Part list RH504844/XXX
Subst.for: | Subst.by:
Drg.no. RH202569
Rev. ID. C | Approved DHN | Date 27.02.06

VIEW (1 : 2)



ISO VIEW (1 : 3)



REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	02.09.2013	RHJJ
A1	-	Oneof seals (Item 10) replaced to Item 12 - seal with stainless steel spring	17.12.2014 / APA	RHDHN

Weight 170 kg	BEARING HOUSING S3044 - WELDED ASSEMBLY			RAPP HYDEMA Phone: (+47) 75 55 01 00 Fax: (+47) 75 55 01 11 E-mail: office@rapphydema.com
Scale (A3) 1:2 *Sheet* 1 / 1				*Drw number* RH317214
	Material (for part)	*Status* Production	*Drawn by / Date (dd/mm/yy)* RHJJ 02.09.2013	*Checked by / Date (dd/mm/yy)* RHDHN 02.09.2013	*Partlist* RH317214

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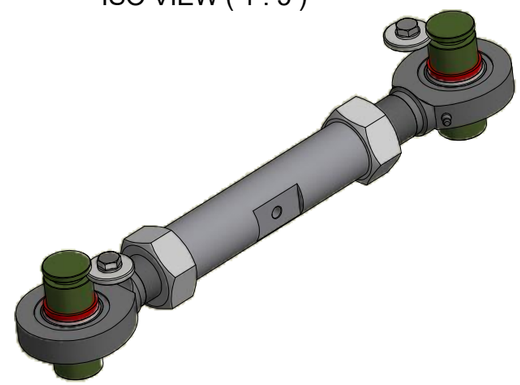
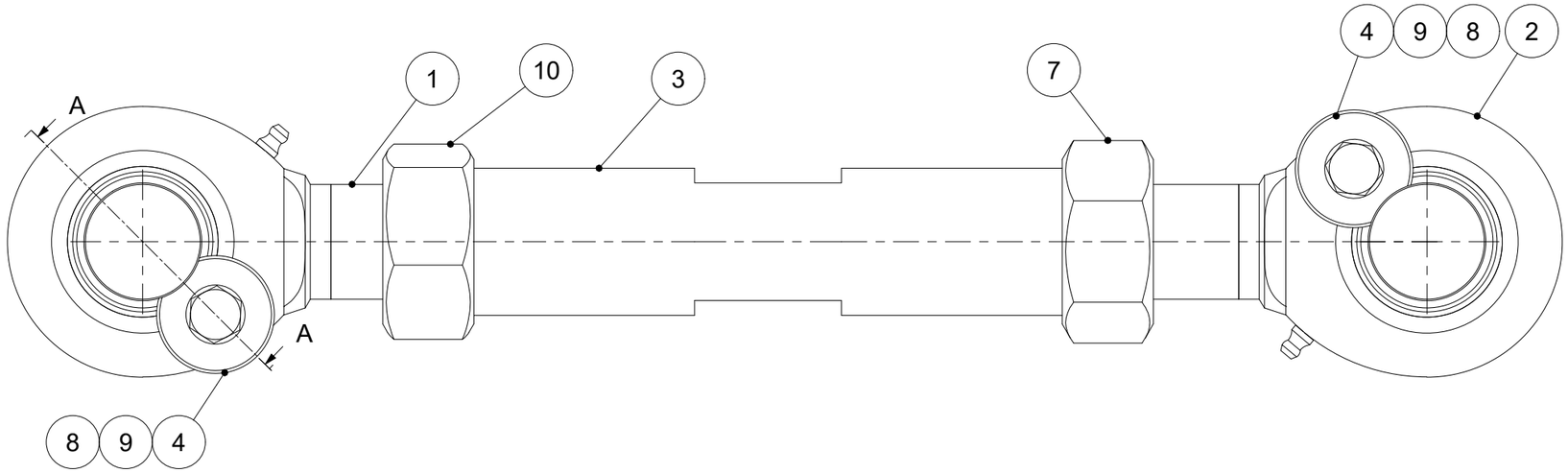
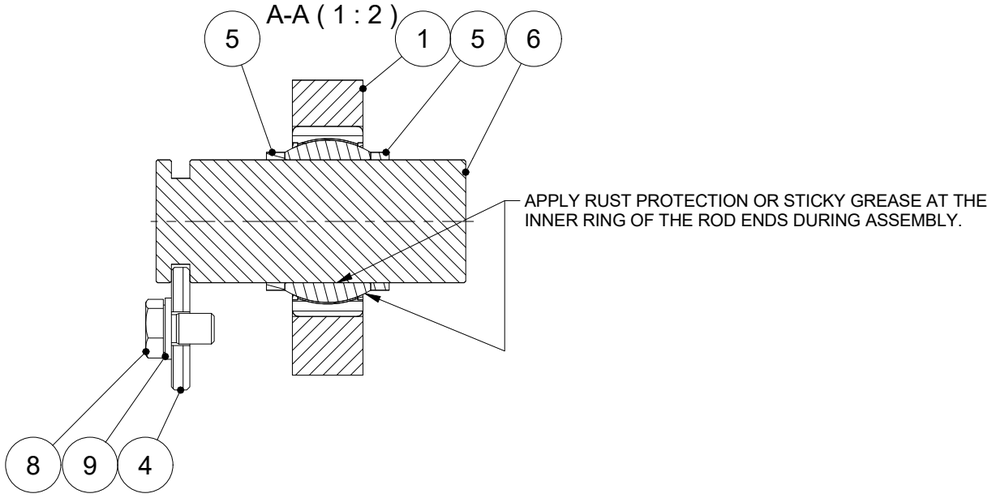
ISO VIEW (1 : 5)





A-A (1 : 2)



REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	1.7.2014	RHDHN
B		Item 10 added and number of Item 7 reduced to 1.	24.11.2014/BSI	RHDHN
B1		Text note added	31.10.2016	RHJJ
C		Hex nuts replaced with M39x3	04.05.2018/MAKSTO	RZBSI

Weight 6 kg

TORQUE ARM
RW2371BS
ASSEMBLY

RAPP HYDEMA
Phone: (+47) 75 55 01 00
Fax: (+47) 75 55 01 11
E-mail: office@rapphydema.com

Unspecified Tolerances According to:

Standard	*Tolerance Class*
NS-ISO 2768-1	*m Medium*
NS-ISO 2768-2	*K*

Scale (A3) 1:2 *Sheet* 1 / 1

Material (for part)

Status Production

Drawn by / Date (dd/mm/yy) STMOM 01.07.2014

Checked by / Date (dd/mm/yy) STMOM 01.07.2014

Drw number RH318400

Partlist RH318400

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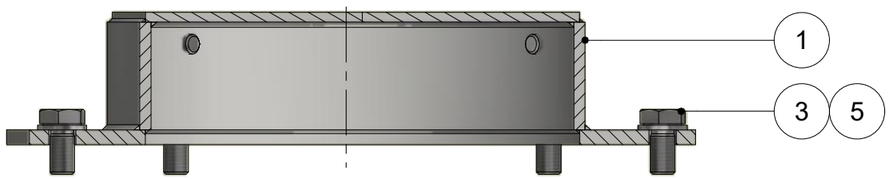
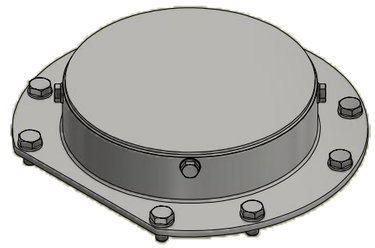
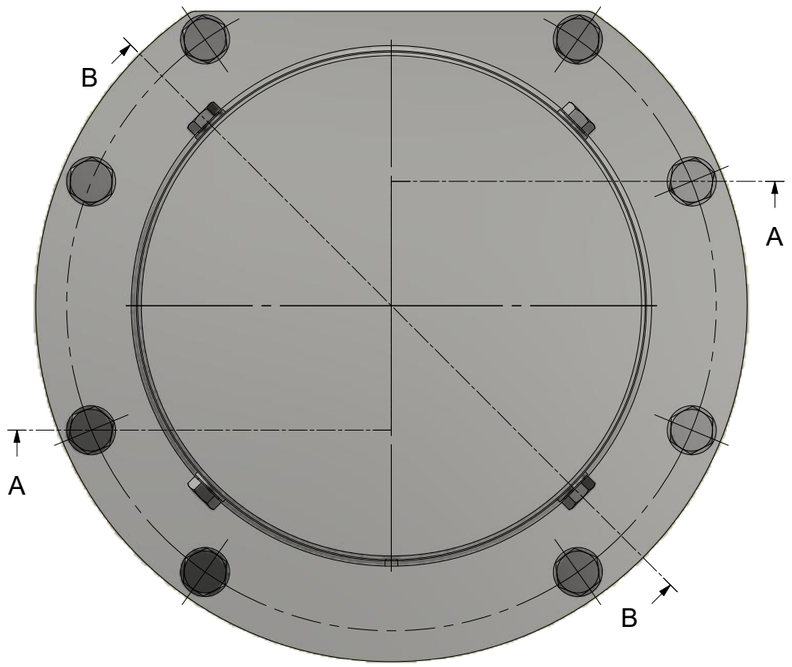
B975C9868BD747A8902B0B789202348A

A-A (1 : 2,5)

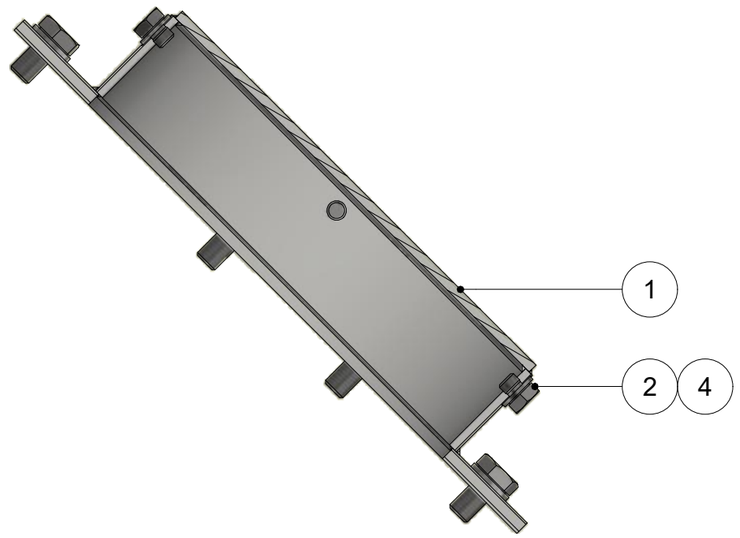


ISO VIEW (1 : 5)





B-B (1 : 2,5)



POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	07.08.2019.	RZBSI

Weight 3 kg	GEARBOX COVER BPH.25 ASSEMBLY		RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com	
Unspecified Tolerances According to:	*Scale (A3)* 1 : 2,5	*Sheet* 1 / 1	*Drw number* RH328794	
Standard NS-ISO 2768-1	*Tolerance Class* m Medium	*Material (for part)*	*Status* Production	*Drawn by / Date (dd/mm/yy)* MAKSTO 07.08.2019.
NS-ISO 2768-2	K			*Checked by / Date (dd/mm/yy)* RZBSI 07.08.2019.
				Partlist RH328794

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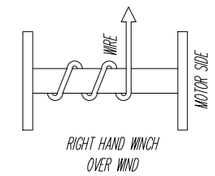
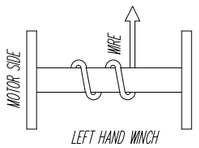
PIPING/ TUBING ON USA - MOUNTED WINCHES:

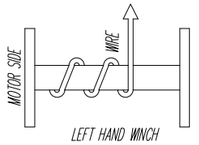
1/2" x .049 (ø 12 x 1.5)
3/4" x .049 (ø 15 x 1.5 / ø 20 x 2)
1" x .072 (ø 25 x 3)
1 1/4" x .095 (ø 30 x 3)
1 1/2"x .134 (ø 30 x 3)
1 1/2" sch 80 (ø 50 x 5)
2" sch 80 (ø 60 x 5)



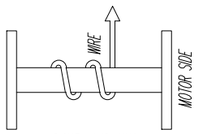
RIGHT HAND WINCH
OVER WIND



LEFT HAND WINCH
UNDER WIND



LEFT HAND WINCH
OVER WIND

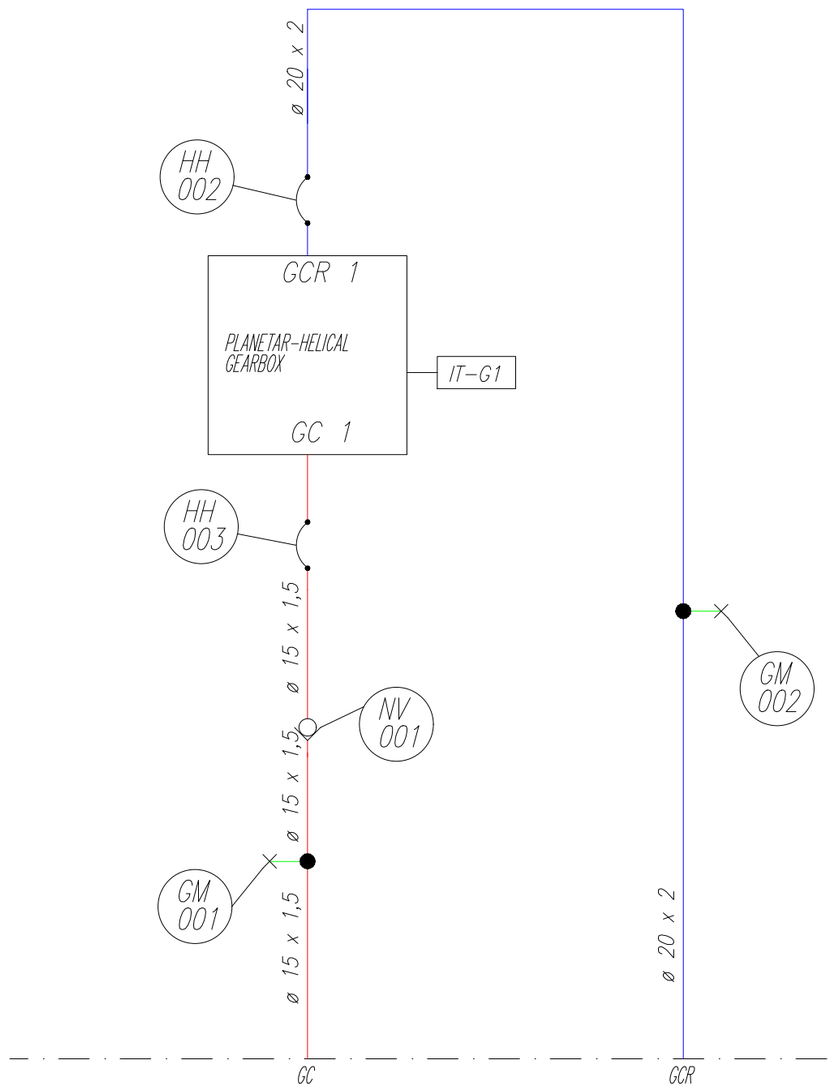


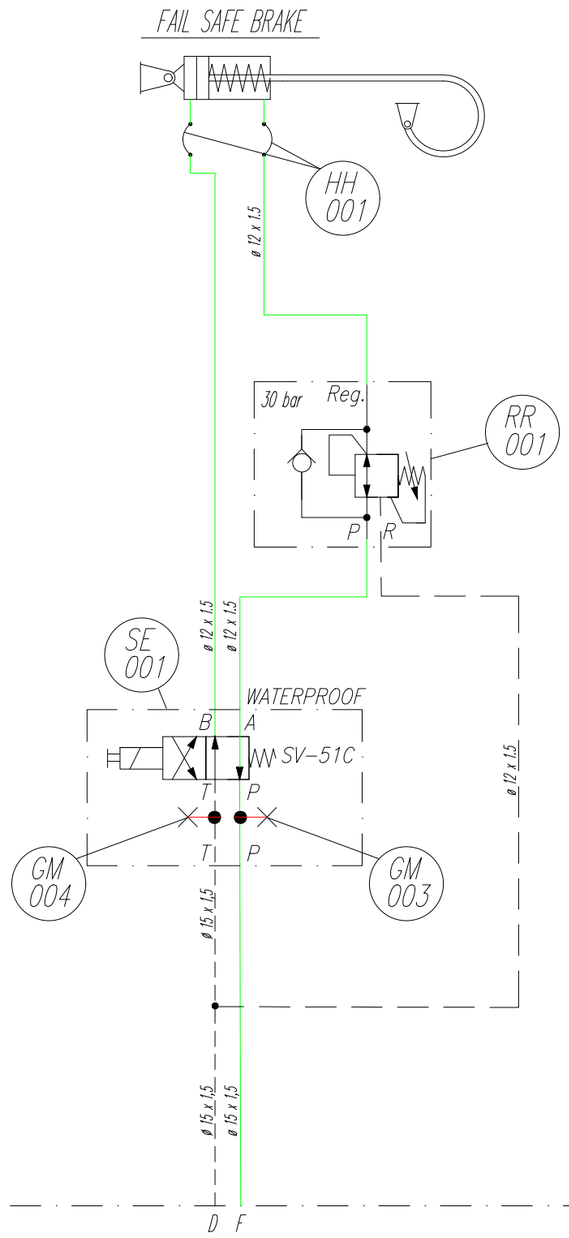
RIGHT HAND WINCH
UNDER WIND

DRAIN
SERVO
RETURN
PRESSURE

Note 1)
Gear cooling inlet to be in the center of the angle gearbox, and gear cooling outlet to be on the top of the angled part.
If plug on the outlet is located down, input part on the gear to be turned in position.

PIPE LENGTHS, FITTINGS AND BENDS ARE THUS TO BE CHOSEN WITH CARE.
PLEASE CONSULT SYSTEM DEPARTMENT.





XQ 001 Extra mounting equipment.

Designed by	Modified by	Date	ECO			
H Johansen		21-Feb-22	ECO-2056897			

MACGREGOR

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Name	Weight
HYDRAULIC BRAKE & COOLING SYSTEM,	0 kg
Description	Scale (A3)
Document ID: RH411171	Revision: A

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
1				400092475	Traction Winch	TRACTION WINCH, TRW-4004E-01R1; 15Ton, PCD1238, Cantilever (RHMETRW0404B/01R1)
2	010	1	PCS	RH321453	Frame	WINCH FRAME, TRW-4004, WELDING
2	020	1	PCS	400096386	Traction Drum	DRUM #1, TRW4004 (SS SLEEVE DESIGN); ASSEMBLY
3	010	1	PCS	400096387	Traction Drum	DRUM, TRW4000 (STAINLESS SLEEVE DESIGN); MACHINING
3	020	1	PCS	RH317059	Drive Shaft	DRIVE SHAFT, TRW4003EB, MACHINING; MACHINING, DRIVE SHAFT
3	030	1	PCS	400096389	Traction Drum	PCD1238,PITCH 40, 3,5Ton, 20 mm
3	040	2	PCS	400096388	Plate	FRICTION PLATE, TRW4000 (SS SLEEVE); MACHINING
3	050	8	PCS	RH314001	Bracket	TIGHTENING BRACKET,SPLIT SLV, TRW-20000E; MACHINING, SPLIT SLEEVE, TRW-20000E
3	060	1	PCS	RH314011	Key	KEY, 36x20x360
3	070	20	PCS	FA0912U24070	Screw	SOCKET HEAD SC 12.9 ZNFC, DIN 912 M24x70 (FA0912U24070)
3	080	4	PCS	FA0912G16100	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M16x100 (FA0912G16100)
3	090	148	PCS	400092390	Screw	HEX.HEAD SCREW 10.9, HDG, DIN933 M16x40; FULLY THREADED (FA0933W16040)
3	100	4	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
3	110	20	PCS	FA6916H24	Washer	HARDENED WASHER, VZN, DIN 6916 M24; 300HV / FOR 10.9 BOLT (FA6916H24)
3	120	148	PCS	FA6916H16	Washer	HARDENED WASHER, VZN, DIN 6916 M16; 300HV / FOR 10.9 BOLT (FA6916H16)
2	030	1	PCS	400096390	Traction Drum	DRUM #2, TRW4004 (SS SLEEVE DESIGN); ASSEMBLY
3	010	1	PCS	400096387	Traction Drum	DRUM, TRW4000 (STAINLESS SLEEVE DESIGN); MACHINING
3	020	1	PCS	RH317059	Drive Shaft	DRIVE SHAFT, TRW4003EB, MACHINING; MACHINING, DRIVE SHAFT
3	030	1	PCS	400096391	Traction Drum	PCD1238,PITCH 40, 3,5Ton, 20 mm
3	040	2	PCS	400096388	Plate	FRICTION PLATE, TRW4000 (SS SLEEVE); MACHINING
3	050	8	PCS	RH314001	Bracket	TIGHTENING BRACKET,SPLIT SLV, TRW-20000E; MACHINING, SPLIT SLEEVE, TRW-20000E
3	060	1	PCS	RH314011	Key	KEY, 36x20x360
3	070	20	PCS	FA0912U24070	Screw	SOCKET HEAD SC 12.9 ZNFC, DIN 912 M24x70 (FA0912U24070)
3	080	4	PCS	FA0912G16100	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M16x100 (FA0912G16100)
3	090	148	PCS	400092390	Screw	HEX.HEAD SCREW 10.9, HDG, DIN933 M16x40; FULLY THREADED (FA0933W16040)
3	100	4	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
3	110	20	PCS	FA6916H24	Washer	HARDENED WASHER, VZN, DIN 6916 M24; 300HV / FOR 10.9 BOLT (FA6916H24)
3	120	148	PCS	FA6916H16	Washer	HARDENED WASHER, VZN, DIN 6916 M16; 300HV / FOR 10.9 BOLT (FA6916H16)
2	040	2	PCS	400095411	Bearing Housing	BEARING HOUSING, BLIND, TRW-4004; ASSEMBLY
3	010	1	PCS	400095405	Bearing Housing	BEARING HOUSING, TRW-4004; WELDING & MACHINING
3	020	1	PCS	400095407	Cover	BEARING COVER, OPEN, D330; MACHINING
3	030	1	PCS	400095408	Cover	BEARING COVER, D330; MACHINING
3	040	1	PCS	BESRS1017	Spherical Roller Bearing	SPHERICAL ROLLER BEARING, 23036-E1-K; d180(taper 1:12)/D280x74 (BESRS1017)
3	050	1	PCS	BEASS023	Spherical Bearing Sleeve	ADAPTER SLEEVE, H3036-HG; d160x109/Nut KML36 (BEASS023)
3	060	1	PCS	400091226	Rotary Shaft Lip Seal	SEAL, 170x200x15, SS ring (SESRB)
3	070	1	PCS	FA0580G016	Eyebolt	LIFTING EYE BOLT, DIN 580, M16, A4; EYE SIZE Ø35 (FA0580G016)
3	080	16	PCS	FA0933G12030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x30; FULLY THREADED (FA0933G12030)
3	090	16	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
3	100	1	PCS	GRMFX004	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.0, A4 (GRMFX004)
3	110	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	050	2	PCS	400095410	Bearing Housing	BEARING HOUSING, TRW-4004; ASSEMBLY
3	010	1	PCS	400095405	Bearing Housing	BEARING HOUSING, TRW-4004; WELDING & MACHINING
3	020	1	PCS	400095406	Cover	BEARING COVER, OPEN, D330; MACHINING
3	030	1	PCS	400095407	Cover	BEARING COVER, OPEN, D330; MACHINING
3	040	2	PCS	400095409	Distance Ring	SPACER, (D280xT13/L6); MACHINING
3	050	1	PCS	BESRS1017	Spherical Roller Bearing	SPHERICAL ROLLER BEARING, 23036-E1-K; d180(taper 1:12)/D280x74 (BESRS1017)
3	060	1	PCS	BEASS023	Spherical Bearing Sleeve	ADAPTER SLEEVE, H3036-HG; d160x109/Nut KML36 (BEASS023)
3	070	2	PCS	400091226	Rotary Shaft Lip Seal	SEAL, 170x200x15, SS ring (SESRB)
3	080	1	PCS	FA0580G016	Eyebolt	LIFTING EYE BOLT, DIN 580, M16, A4; EYE SIZE Ø35 (FA0580G016)
3	090	16	PCS	FA0933G12030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x30; FULLY THREADED (FA0933G12030)
3	100	16	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
3	110	1	PCS	GRMFX004	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.0, A4 (GRMFX004)
3	120	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	060	1	PCS	GETBI039-I225B/00	Gearbox	POSIPLAN, BPH328 i=100,64 IEC225 BR
2	070	2	PCS	EMOAB225B35-EI/00	Electric Motor	EL MOTOR ABB M3BP225SMD4 B35, IP56 ENC ISOL; 68kW
2	080	2	PCS	RH317069	Support Plate	MOTOR/GEARBOX SUPPORT PLATE TRW-4003E; MACHINING, MOTOR/GEARBOX SUPPORT BRACKET
2	090	2	PCS	RH317083	Torque Arm	TORQUE ARM, TRW-4003E, ASSEMBLY
3	010	1	PCS	RH317085	Bolt	TENSION BOLT, TORK ARM, PREMACHINING
3	020	2	PCS	RH317084	Shear Pin	SHEAR PIN, D40x101, MACHINING; GROOVE D28x6
3	030	1	PCS	BESPS100L	Radial Spherical Plain Bearing	ROD END, GAL-40-UK-2RS; d40x28 - M39x3 (Left hand thread) (BESPS100L)
3	040	1	PCS	BESPS100	Radial Spherical Plain Bearing	ROD END, GAR-40-UK-2RS; d40x28 - M39x3 (BESPS100)

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
3	050	4	PCS	RH31708301	Distance Ring	SPACER, D45/d40x6, MACHINING
3	060	2	PCS	RH408161	Locking Plate	LOCK DISC, D40/d11x6, TWS-
3	070	1	PCS	FA0934E393	Nut	HEX.NUT, GRADE 8, ELZN, DIN 934, M39x3 (FA0934E393)
3	080	2	PCS	FA0933G10016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x16; FULLY THREADED (FA0933G10016)
3	090	2	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	100	1	PCS	FA0934E393L	Nut	HEX.NUT, Gr.8, ELZN, DIN 934, M39x3 LEFT; LEFT HAND THREAD (FA0934E393L)
2	100	2	PCS	RH329285	TENSION ROLLER DEVICE, TRW-4004,ASSEMBLY	TENSION ROLLER DEVICE, TRW-4004,ASSEMBLY
3	010	1	PCS	RH329282	GUIDING BLOCK,(T48/160x100),MACH	GUIDING BLOCK,(T48/160x100),MACH
3	020	4	PCS	RH328077	Bearing Plain	LINING, (D30 X d20 / L25), MACHINING
3	030	1	PCS	RH328629	Nut	SPRING LOADING NUT,ROUND M35/L77,MACHINI
3	040	1	PCS	RH328631	Nut	CYLINDER ROD NUT,ROUND D20/L13,MACHINING
3	050	1	PCS	RH328632	CYLINDER ROD PLATE,120x45/T12,MACHINING	CYLINDER ROD PLATE,120x45/T12,MACHINING
3	060	1	PCS	RH317923	Wheel	TENSION WHEEL, TRW-4003E, PREMACHINING; MACHINING, PCD99, D23,4, TENSION WHEEL
3	070	1	PCS	RH328627	Pin	PIN, ROUND D15 / L100, MACHINING
3	080	2	PCS	RH328628	Distance Ring	DISTANCE RING,PIPE(D20xd15/L26),MACHININ
3	090	2	PCS	RH328630	Guide Shaft	GUIDE SHAFT, ROUND D20 / L188, MACHINING
3	100	1	PCS	RH329284	Bracket	BRACKET, TENSION ROLLER DEVICE, W+M
3	110	1	PCS	PCCDS054	Gas Cylinder	GAS CYL.DICT. DV4 10-23-40-0 SS (PCCDS054)
3	120	1	PCS	SEORA153	O-Ring	O-RING, Ø22,50 x 3,00 (RM-0225-30), (SEORA153)
3	130	1	PCS	FA0916G06008	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M6x8; CUP POINT (FA0916G06008)
3	140	2	PCS	BESPS210	Radial Spherical Plain Bearing	ROD END, GIR-15-UK-2RS (BESPS210)
3	150	1	PCS	BEABS0003	Angular Contact Ball Bearing	ANGULAR CONTACT BALL B, 3202-BD-2HRS-TVH; d15/D35x15,9 (BEABS0003)
3	160	2	PCS	FA0471F0150	Circlip	CIRCLIP RING EXTERNAL, A2 DIN 471 A15; STAINLESS (material x40Cr13) (FA0471F0150)
3	170	2	PCS	FA0471F0200	Circlip	CIRCLIP RING EXTERNAL, A2 DIN 471 A20; STAINLESS (material x40Cr13) (FA0471F0200)
3	180	1	PCS	FA0472F0350	Circlip	CIRCLIP RING INTERNAL, A2 DIN 472 I35; STAINLESS (material x40Cr13) (FA0472F0350)
3	190	4	PCS	FA0931G12070	Screw	HEX.HEAD SCREW A4-80, DIN 931 M12x70; THREAD LENGTH:30mm (FA0931G12070)
3	200	4	PCS	FA0933G12035	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x35; FULLY THREADED (FA0933G12035)
3	210	8	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
2	110	3	PCS	RH321167	Protection	CABLE PROTECTION, BAR (L635), ASSEMBLY
3	020	2	PCS	RH32116702	Bearing Plain	HUB (Ø54 / ø30 x 30), MACHINING
3	030	1	PCS	RH32116703	Protection	PROTECTION BAR, ROUND BAR (Ø30x603),MAC
3	040	2	PCS	RH321126	Bracket	BRACKET, CABLE PROTECTION, WELDING
3	050	2	PCS	FA0933G12040	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x40; FULLY THREADED (FA0933G12040)
3	060	2	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
3	070	2	PCS	FA0985G12	Nut	NUT NYLOCK HEXAGON A4-80, DIN 985 M12 (FA0985G12)
3	080	2	PCS	FA0916G10012	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M10x12; CUP POINT (FA0916G10012)
2	120	1	PCS	RH321167	Protection	CABLE PROTECTION, BAR (L635), ASSEMBLY
3	020	2	PCS	RH32116702	Bearing Plain	HUB (Ø54 / ø30 x 30), MACHINING
3	030	1	PCS	RH32116703	Protection	PROTECTION BAR, ROUND BAR (Ø30x603),MAC
3	040	2	PCS	RH321126	Bracket	BRACKET, CABLE PROTECTION, WELDING
3	050	2	PCS	FA0933G12040	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x40; FULLY THREADED (FA0933G12040)
3	060	2	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
3	070	2	PCS	FA0985G12	Nut	NUT NYLOCK HEXAGON A4-80, DIN 985 M12 (FA0985G12)
3	080	2	PCS	FA0916G10012	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M10x12; CUP POINT (FA0916G10012)
2	130	2	PCS	400203203	Cover	BPH.28 GEARBOX COVER - ASSEMBLY
3	001	1	PCS	400203202	Cover	BPH.28 GEARBOX COVER - WELDING
3	002	4	PCS	FA0933G10020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x20; FULLY THREADED (FA0933G10020)
3	003	4	PCS	FA0933G08008	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x8; FULLY THREADED (FA0933G08008)
3	004	4	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	005	4	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
3	006	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	140	2	PCS	400096431	Cover	GEARBOX COVER_OPEN_BPH.28, D300xD170/T35; MACHINING
2	150	1	PCS	RH323103	Locking Plate	LOCKING DISC, BPH428 - TRW400X,MACHINING
2	160	4	PCS	RH314458	Shear Pin	SHEAR PIN, D70/D45/M36x123, MACHINING
2	170	8	PCS	RH318253	Locking Bolt	LOCKING BOLT, D50/22, MACHINING; MACHINING, Ø80(10), GUIDING Ø50x54
2	180	4	PCS	RH318376	Bracket	GROUND BRACKET, 2xD50 / T=25, MACHINING; MACHINING, 320x120x25, 2xØ50
2	190	8	PCS	RH321988	Washer	WASHER PLATE, T6 x 90x90, MACHINING
2	200	4	PCS	RH317081	Shim	SHIM PLATE, 560x160x10, MACHINING
2	210	2	PCS	RH314010	Locking Plate	LOCKING WASHER, D170/D140/d31x23; MACHINING
2	220	4	PCS	RH317082	CHOCKFAST, T20, MOUNTING DURING ASSEMBLY	CHOCKFAST, T20, MOUNTING DURING ASSEMBLY; CHOCKFAST LAYER, T20, MOUNTING DURING ASSEMBLY
2	230	6	PCS	RH318188	Wear Ring	WEAR RING, D160/d170x35, MACHINING
2	240	2	PCS	400096432	Wear Ring	WEAR RING, D160xD140x20; MACHINING

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Level	Pos	Qty	Unit	Aras ID	Name	Description
2	250	3	PCS	RH318189	Distance Ring	DISTANCE RING, D160/d170x20, MACHINING
2	260	1	PCS	RH318949	Bracket	BRACKET FOR RH203377PL & RH203378PL; WELDING & MACHINING, Ref. RH203377PL & RH203378PL
2	270	1	PCS	RH318968	Bracket	BRACKET FOR BULKHEAD UNION; BENDING, FOR BULKHEAD UNION, 2XØ34 / 90deg
1				RHHEBRGC-M1	Hydraulic Winch Assembly	HYDR. BRAKE CTRL. AND GEAR COOLING; Traction winch (RHHEBRGC-M1)
2	010	1	PCS	RHHGMR20TRM	Hydraulic Fittings	TEST POINT (STAINLESS STEEL); syrefast mutter og støttering. (RHHGMR20TRM)
3	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
3	020	1	PCS	FTTFA003	Hydraulic Fittings	TRIP.LOK 12TT4X-S 18/20 1/4" TEST P. F.; 12TT4XS (FTTFA003)
3	030	1	PCS	FTUTA017	Hydraulic Fittings	TRIP.LOK R6X-S 18/20 SWIVEL NUT RUN TEE; 12R6MXS (FTUTA017)
3	040	1	PCS	FTNUF005	Hydraulic Fittings	TRIP.LOK BTX-SS 18/20 NUT; 12 BTX-SS (FTNUF005)
3	050	1	PCS	FTMSF008	Hydraulic Fittings	TRIP.LOK TX-SS 20 SLEEVE METRIC; TXSS20 (FTMSF008)
2	020	1	PCS	RHHGMR25TRS	Hydraulic Fittings	TEST POINT,SS. FOR PIPE Ø25 (PH) (RHHGMR25TRS)
3	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
3	020	1	PCS	FTTFF003	Hydraulic Fittings	TRIP.LOK 12TT4X-SS 18/20 1/4" TEST P. F.; 12TT4MXSS (FTTFF003)
3	030	1	PCS	FTUTF019	Hydraulic Fittings	TRIP.LOK R6X-SS 25 SWIVEL NUT RUN TEE; 16 R6X-SS (FTUTF019)
3	040	2	PCS	FTNUF006	Hydraulic Fittings	TRIP.LOK BTX-SS 25 NUT; 16 BTX-SS (FTNUF006)
3	050	1	PCS	FTMSF009	Hydraulic Fittings	TRIP.LOK TX-SS 25 SLEEVE METRIC; TXSS25 (FTMSF009)
3	060	1	PCS	FTREF019	Hydraulic Fittings	TRIP.LOK TRTX-SS 25-18/20 REDUCER; 16-12TRMTXSS (FTREF019)
2	030	1	PCS	RHHGMR12TRS	Hydraulic Fittings	TESTPOINT FOR TUBE Ø12 (STAINLESS PH); M/T-FITTING(M/R-SVIVEL) FOR MONT.PÅ RØR. (RHHGMR12TRS)
3	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
3	020	1	PCS	FTTFF001	Hydraulic Fittings	TRIP.LOK 8TT4X-SS 12 1/4" TEST P. F.; 8TT4MXSS (FTTFF001)
3	030	1	PCS	FTUTF015	Hydraulic Fittings	TRIP.LOK R6X-SS 12 SWIVEL NUT RUN TEE; 8 R6X-SS (FTUTF015)
3	040	1	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
3	050	1	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
2	040	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
2	050	1	PCS	RHHGMR12TRS	Hydraulic Fittings	TESTPOINT FOR TUBE Ø12 (STAINLESS PH); M/T-FITTING(M/R-SVIVEL) FOR MONT.PÅ RØR. (RHHGMR12TRS)
3	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
3	020	1	PCS	FTTFF001	Hydraulic Fittings	TRIP.LOK 8TT4X-SS 12 1/4" TEST P. F.; 8TT4MXSS (FTTFF001)
3	030	1	PCS	FTUTF015	Hydraulic Fittings	TRIP.LOK R6X-SS 12 SWIVEL NUT RUN TEE; 8 R6X-SS (FTUTF015)
3	040	1	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
3	050	1	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
2	080	1	PCS	RHHHH123801S	Hydraulic Hose	BRAKE HOSE 3/8" 2 EA. INCL. SS FITT. PH; 2xslanger,2xF40,2xB+T (RHHHH123801S)
3	010	2	PCS	HH2DK003	Hydraulic Hose	HP-HOSE 202206,S421,S425,L=0,5M,276BAR; 3/8" Bremseslange med syrefaste koblinger (HH2DK003)
3	020	2	PCS	FTCBF008	Hydraulic Fittings	TRIP.LOK F42X-SS 12-3/8" BSPP-CONNECTOR; 8F42EDMXSS (FTCBF008)
3	030	2	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
3	040	2	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
2	090	2	PCS	FTSMF002	Hydraulic Fittings	TRIP.LOK F68x-SS 8 -M12x1.5 M.JIC.SWL (FTSMF002)
2	100	2	PCS	FTREF003	Hydraulic Fittings	TRIP.LOK TRTX-SS 12-8 REDUCER; 8-5TRMTXSS (FTREF003)
2	110	2	PCS	FTCBF016	Hydraulic Fittings	TRIP.LOK F42X-SS 18/20-3/4" BSPP-CONN.; 12F42EDMXSS (FTCBF016)
2	120	2	PCS	FTUEF013	Hydraulic Fittings	TRIP.LOK C6X-SS 18/20 SWIVEL NUT ELBOW; 12C6MXSS (FTUEF013)
2	130	2	PCS	HH2CS0027	Hydraulic Hose	LOW PRESS. HOSE 5,8" (ø24MM) MAX 100 BAR; ø20 - Stain. S. Couplings (HH2CS0027)
2	140	2	PCS	FTUEF013	Hydraulic Fittings	TRIP.LOK C6X-SS 18/20 SWIVEL NUT ELBOW; 12C6MXSS (FTUEF013)
2	150	2	PCS	FTCBF016	Hydraulic Fittings	TRIP.LOK F42X-SS 18/20-3/4" BSPP-CONN.; 12F42EDMXSS (FTCBF016)
2	160	2	PCS	HH2CS0027	Hydraulic Hose	LOW PRESS. HOSE 5,8" (ø24MM) MAX 100 BAR; ø20 - Stain. S. Couplings (HH2CS0027)
2	170	1	PCS	RH507944S	Check Valve	CHECK VALVE VU 38F-38F 0,35 BAR Ø12PH SS; Syrefast fittings.
3	010	1	PCS	400193497	Check Valve	SS Check valve, 3/8", 0,35bar, VU38F38F (FASTER) Stainless steel (available on request)
3	020	2	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
3	030	2	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
3	040	2	PCS	FTCBF008	Hydraulic Fittings	TRIP.LOK F42X-SS 12-3/8" BSPP-CONNECTOR; 8F42EDMXSS (FTCBF008)
2	180	2	PCS	RH508541S	Check Valve	CHECK VALVE VU 1F-1F 0,35 BAR Ø20 SS PH; 58TILBVU1F
3	010	1	PCS	400193501	Check Valve	SS Check valve, 1", 0,35bar, VU1F1F (FASTER) Stainless steel (available on request)
3	020	2	PCS	FTMSF008	Hydraulic Fittings	TRIP.LOK TX-SS 20 SLEEVE METRIC; TXSS20 (FTMSF008)
3	030	2	PCS	FTNUF005	Hydraulic Fittings	TRIP.LOK BTX-SS 18/20 NUT; 12 BTX-SS (FTNUF005)
3	040	2	PCS	FTCBF017	Hydraulic Fittings	TRIP.LOK F42X-SS 18/20-1"BSPP-CONNECTOR; 12-16F42EDMXSS (FTCBF017)
2	190	1	PCS	RHHSE1-600485S	Solenoid Valve Assembly	SINGLE BOX, 4D01, 4xø12PH SS, INTERNAL; Syrefast fittings etc. (RHHSE1-600485S)
3	010	1	PCS	RHHBOX1MDPEM	Enclosure	SINGEL VALVE BOX IN MDPE ASSEMBLED; m/NG6 blindplate. (RHHBOX1MDPEM)
3	020	1	PCS	HSEDE030	Coil	DIRECTIONAL VALVE 4D01-3151-0101-C1-G0Q (HSEDE030)
3	030	4	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)
3	040	4	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)
3	050	2	PCS	FTCBF008	Hydraulic Fittings	TRIP.LOK F42X-SS 12-3/8" BSPP-CONNECTOR; 8F42EDMXSS (FTCBF008)
3	060	2	PCS	FTCBF009	Hydraulic Fittings	TRIP.LOK F42X-SS 12-1/2" BSPP-CONNECTOR; 8-8F42EDMXSS (FTCBF009)
3	070	2	PCS	FCPPF015	Plug	HEXAGON HEAD PLUG, DIN 910, A4, G3/8"; DIN 910 (FCPPF015)
3	080	6	PCS	FCPPF010	Plug	HEXAGON HEAD PLUG, DIN 910, A4, G1/4"; DIN 910 (FCPPF010)

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Level	Pos	Qty	Unit	Aras ID	Name	Description	
3	090	4	PCS	FA0912D05030	Screw	SOCKET HEAD SCREW 12.9 DIN 912 M5x30; THREAD LENGTH: 22mm (FA0912D05030)	
3	100	2	PCS	SEBOB003	Bonded Seal	BONDED SEAL, PP 45-C, 3/8" R/BSP, A4, 24x24x4 (SEBOB003)	
3	110	6	PCS	SEBOB002	Bonded Seal	BONDED SEAL, PP 45-B, 1/4" R/BSP, A4, 21x21x4 (SEBOB002)	
3	120	2	PCS	FTUBF006	Hydraulic Fittings	TRIP.LOK WTX-WLN-SS 25 BULKHEAD UNION; 16WMTXWLNMSS (FTUBF006)	
2	200	0.003	M	TPPIF020	Pipe Clamp	HYDR. PIPE, Ø25X2.5 SEAML. AISI-316; Ø25X2.5 SEAMLESS ACID PROOF AISI-316 (TPPIF020)	
2	210	0.006	M	TPPIF014	Pipe Clamp	HYDR. PIPE, Ø12X1.5 SEAML.AISI-316; Ø12X1.5 SEAMLESS ACID PROOF AISI-316 (TPPIF014)	
2	220	6	PCS	TPCLFA1K012	Pipe Clamp	TUBE CLAMP COMPL. 12MM.AISI 316; TUBE CLAMP COMPL. SER.A.GR.1 12mm/AISI 316 (TPCLFA1K012)	
2	230	3	PCS	TPCLFA3K025	Pipe Clamp	TUBE CLAMP COMPL. 25mm.AISI 316; TUBE CLAMP COMPL. SER.A.GR.3 25mm/AISI 316 (TPCLFA3K025)	
2	240	4	PCS	FTUTF003	Hydraulic Fittings	TRIP.LOK JTX-SS 12 UNION TEE; 8JMTXSS (FTUTF003)	
2	250	3	PCS	FTMSF003	Hydraulic Fittings	TRIP.LOK TX-SS 12 SLEEVE METRIC; TXSS12 (FTMSF003)	
2	260	3	PCS	FTNUF003	Hydraulic Fittings	TRIP.LOK BTX-SS 12 NUT; 8 BTX-SS (FTNUF003)	
2	270	1	PCS	FTUTF024	Hydraulic Fittings	TRIP.LOK S6X-SS 12 SWIVEL NUT BRANCH TEE; 8 S6X-SS (FTUTF024)	
2	280	2	PCS	FTUNF012	Hydraulic Fittings	TRIP.LOK HX6-SS 12-12 SWIVEL NUT UNION (FTUNF012)	
2	290	2	PCS	FTUTF017	Hydraulic Fittings	TRIP.LOK R6X-SS 18/20 SWIVEL NUT RUN TEE; 12 R6X-SS (FTUTF017)	
2	300	1	PCS	FTUTF005	Hydraulic Fittings	TRIP.LOK JTX-SS 18/20 UNION TEE; 12JMTXSS (FTUTF005)	
2	310	2	PCS	FTUNF010	Hydraulic Fittings	TRIP.LOK 12HMX6SS SWIVEL NUT UNIO (FTUNF010)	
2	320	1	PCS	FTUBF005	Hydraulic Fittings	TRIP.LOK WTX-WLN-SS 18/20 BULKHEAD UNION (FTUBF005)	
2	330	2	PCS	FTUTF005	Hydraulic Fittings	TRIP.LOK JTX-SS 18/20 UNION TEE; 12JMTXSS (FTUTF005)	
2	340	14	PCS	FTMSF008	Hydraulic Fittings	TRIP.LOK TX-SS 20 SLEEVE METRIC; TXSS20 (FTMSF008)	
2	350	14	PCS	FTNUF005	Hydraulic Fittings	TRIP.LOK BTX-SS 18/20 NUT; 12 BTX-SS (FTNUF005)	
2	360	4	PCS	FTREF010	Hydraulic Fittings	TRIP.LOK TRTX-SS 18/20-12 REDUCER; 12-8TRMTXSS (FTREF010)	
2	370	2	PCS	FTREF019	Hydraulic Fittings	TRIP.LOK TRTX-SS 25-18/20 REDUCER; 16-12TRMTXSS (FTREF019)	
2	380	1	PCS	FTUTF006	Hydraulic Fittings	TRIP.LOK JTX-SS 25 UNION TEE; 16JMTXSS (FTUTF006)	
2	390	5	PCS	FTNUF006	Hydraulic Fittings	TRIP.LOK BTX-SS 25 NUT; 16 BTX-SS (FTNUF006)	
2	400	5	PCS	FTMSF009	Hydraulic Fittings	TRIP.LOK TX-SS 25 SLEEVE METRIC; TXSS25 (FTMSF009)	
2	410	3	PCS	FTUTF007	Hydraulic Fittings	TRIP.LOK JTX-SS 30/32 UNION TEE; 20JMTXSS (FTUTF007)	
2	420	3	PCS	FTNUF007	Hydraulic Fittings	TRIP.LOK BTX-SS 30/32 NUT; 20 BTX-SS (FTNUF007)	
2	430	3	PCS	FTMSF010	Hydraulic Fittings	TRIP.LOK TX-SS 30 SLEEVE METRIC; TXSS30 (FTMSF010)	
2	440	3	PCS	FTREF024	Hydraulic Fittings	TRIP.LOK TRTX-SS 30/32-18/20 REDUCER; 20-12TRMTXSS (FTREF024)	
2	300	2	PCS	EACPG220	Cable Gland	M20 X1,5MM FOR CABLE SIZE 6-12MM; Nipple for el.motor (EACPG220)	
2	310	2	PCS	SESRB080	Rotary Shaft Lip Seal	SEAL, 160x190x15, W/STAINLESS SPRING, (SESRB080)	
2	320	4	PCS	FA0912U30200	Screw	SOCKET HEAD SC 12.9 ZNFC DIN 912 M30x200 (FA0912U30200)	
2	330	4	PCS	FA0912U30180	Screw	SOCKET HEAD SC 12.9 ZNFC DIN 912 M30x180 (FA0912U30180)	
2	340	2	PCS	FA0931G30110	Screw	HEX.HEAD SCREW A4-80, DIN 931 M30x110; THREAD LENGTH:66mm (FA0931G30110)	
2	350	8	PCS	FA0933G24100	Screw	HEX.HEAD SCREW A4-80, DIN 933 M24x100; FULLY THREADED (FA0933G24100)	
2	360	16	PCS	FA0933G20080	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x80; FULLY THREADED (FA0933G20080)	
2	370	8	PCS	FA0933G20075	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x75; FULLY THREADED (FA0933G20075)	
2	380	8	PCS	FA0933G16090	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x90; FULLY THREADED (FA0933G16090)	
2	390	40	PCS	FA0933G16070	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x70; FULLY THREADED (FA0933G16070)	
2	400	4	PCS	FA0933G12025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x25; FULLY THREADED (FA0933G12025)	
2	410	32	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)	
2	420	4	PCS	FA0933G08025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x25; FULLY THREADED (FA0933G08025)	
2	430	14	PCS	FA0933G08020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x20; FULLY THREADED (FA0933G08020)	
2	440	4	PCS	FA0934G36	Nut	HEXAGON NUT, A4-80, DIN 934, M36 (FA0934G36)	
2	450	16	PCS	FA0934U30	Nut	HEX.NUT, GRADE 12, Zn.F.C, DIN 934, M30; For 12.9 bolts (FA0934U30)	
2	460	8	PCS	FA0934G24	Nut	HEXAGON NUT, A4-80, DIN 934, M24 (FA0934G24)	
2	470	16	PCS	FA0934G20	Nut	HEXAGON NUT, A4-80, DIN 934, M20 (FA0934G20)	
2	480	32	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)	
2	490	18	PCS	FA6916H30	Washer	HARDENED WASHER, VZN, DIN 6916 M30; 300HV / FOR 10.9 BOLT (FA6916H30)	
2	500	4	PCS	FA0125G36	Washer	FLAT WASHER, A4, DIN 125 M36; Tykkelse h=5.0 d=37 (FA0125G36)	
2	510	16	PCS	FA0125G24	Washer	FLAT WASHER, A4, DIN 125 M24; Tykkelse h=4.0 d=25 (FA0125G24)	
2	520	8	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)	
2	530	48	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)	
2	540	4	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)	
2	550	32	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)	
2	560	18	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)	
2	570	2	PCS	FA0471U1600	Circlip	CIRCLIP RING EXTERNAL,STEEL DIN 471 A160; SPRING STEEL, PHOSPHATED, HRC 44-49 (FA0471U1600)	
2	580	2	PCS	FA0472A1400	Circlip	CIRCLIP RING INTERNAL,STEEL DIN 472 I140; SPRING STEEL, PHOSPHATED, HRC 44-49 (FA0472A1400)	
2	590	2	PCS	GRMXX002	Grease Nipple	GREASE NIPPLE, M8x1,0 STRAIGHT, A4 (GRMXX002)	
2	620	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)	
2				400182377	Electrical Winch Assembly	MECHANICAL PART/WINCH/Electrical Winch Assembly	Electrical system ROW/Traction Winch Mbari S2V1
3	001	1	PCS	400091474	Cabinet Basic	ELECTRICAL PART/CABINET/Cabinet Basic	KLIPPON POK 121209 EX

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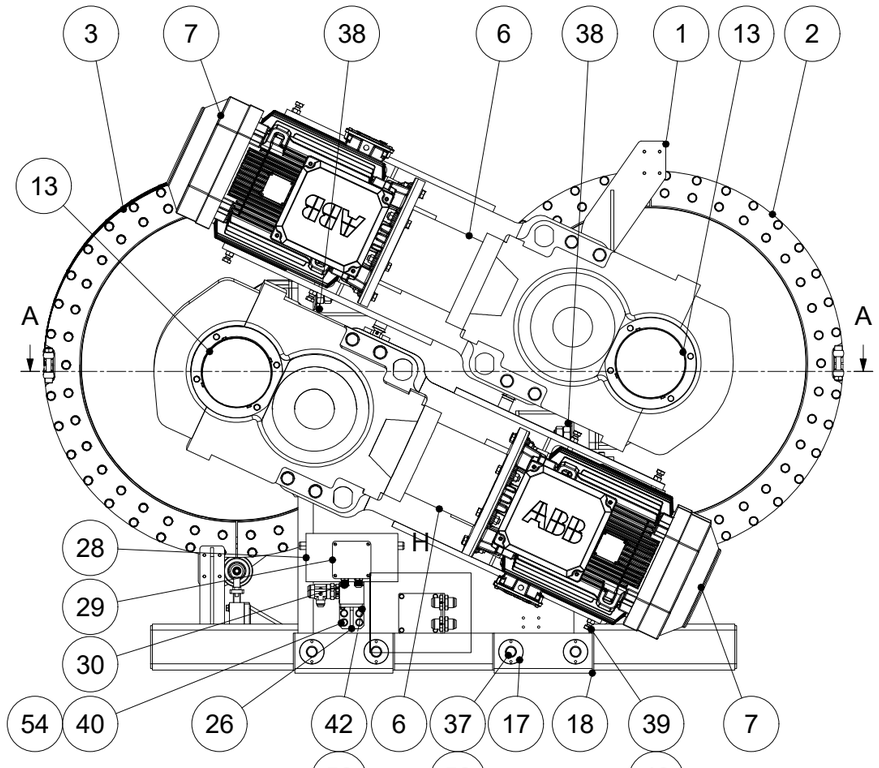
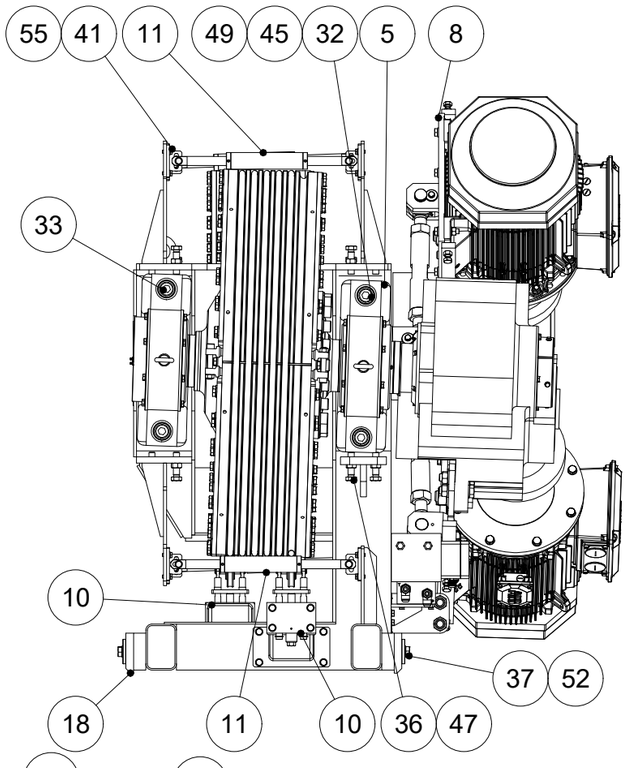
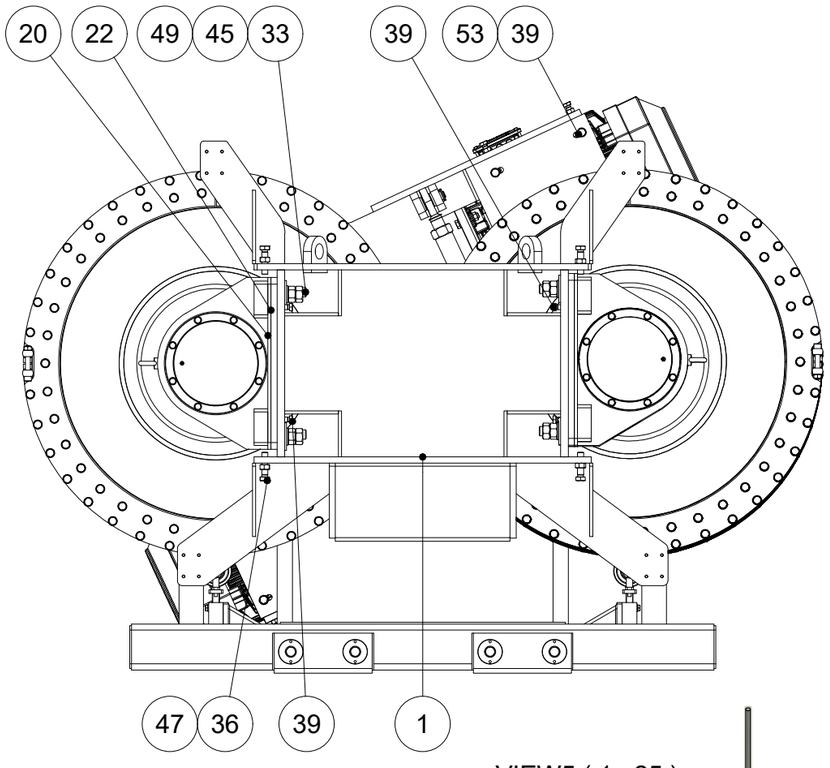
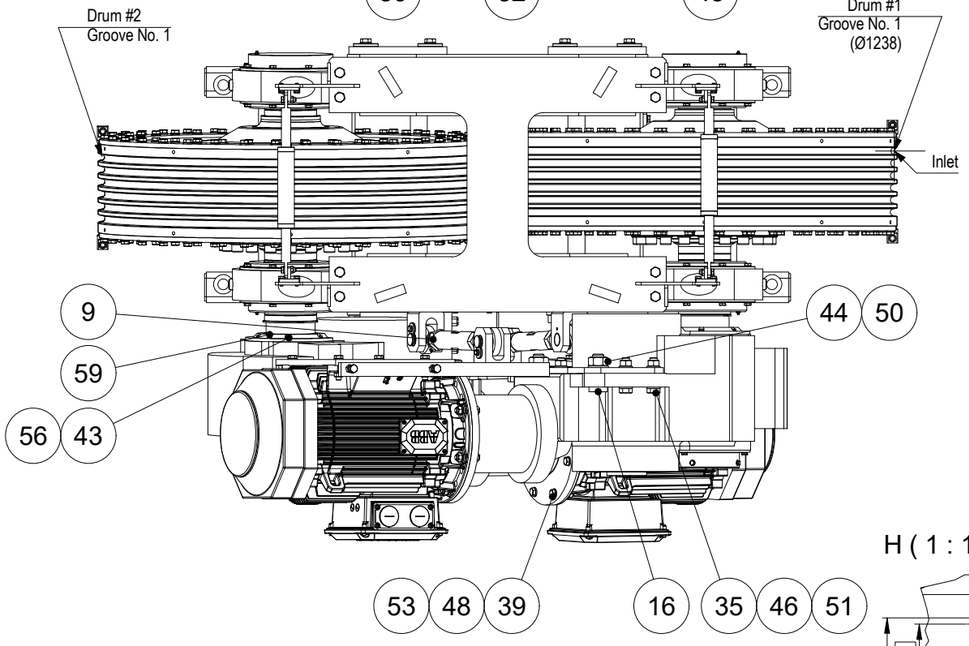
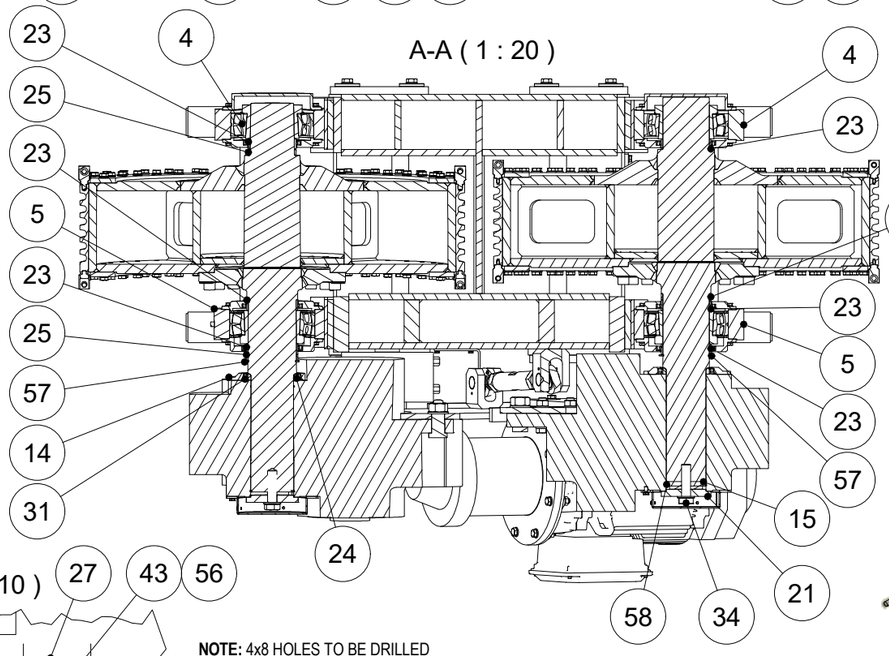
Level	Pos	Qty	Unit	Aras ID	Name	Description	
3	002	1	PCS	400091486	Mounting Rail	ELECTRICAL PART/FITTING/Mounting Rail	TS35X7.5 ST K41
3	003	2	PCS	400091997	Terminal	ELECTRICAL PART/Terminal	ZAP /TW (for ZDK 2,5) END COVER
3	004	2	PCS	EACCA096	Prefabricated Cable	ELECTRICAL PART/CABLE/Prefabricated Cable	V1-WV4A-10M-PUR-ABG0, 10M PUR M12 90* (EACCA096)
3	005	3	PCS	EACPG270	Cable Gland	ELECTRICAL PART/CABLE FITTING/Cable Gland	SKINTOP MS-M 12X1,5 (ØF 3-7MM) (EACPG270)
3	006	3	PCS	EACPG280	Cable Gland	ELECTRICAL PART/CABLE FITTING/Cable Gland	SM-M 12X1,5 SKINDICHT BRASS (EACPG280)
3	007	1	PCS	EACPL0011	Prefabricated Cable	ELECTRICAL PART/CABLE/Prefabricated Cable	EL.PLUG W/KABEL 5 METER, 3P+PE BELDEN (EACPL0011)
3	008	1	PCS	EACPL007	Electronic Card	ELECTRONIC PART/Electronic Card	DIODE-ADAPTER A07C4-2-24VDC; ADAPTER (EACPL007)
3	009	3	PCS	EACPL0202-2	Terminal	ELECTRICAL PART/Terminal	AEB 353SC/1 End Bracket (EACPL0202-2)
3	010	1	PCS	EACPL02025	Terminal	ELECTRICAL PART/Terminal	TERMINAL GROUNDING, ZPE 2,5 WEIDMULLER (EACPL02025)
3	011	4	PCS	EACPL02055	Terminal	ELECTRICAL PART/Terminal	TERMINAL DOUBLE, ZDK 2,5 WEIDMULLER (EACPL02055)
3	012	1	PCS	EACPL02056	Terminal	ELECTRICAL PART/Terminal	ZDK 2,5 PE Weidmuller (EACPL02056)
3	013	2	PCS	EACPL020T1-10	Terminal	ELECTRICAL PART/Terminal	TERMINAL NUMBERS (1-10); Dekafix 5-GW (1 to 10) (EACPL020T1-10)
3	014	3	PCS	EACPL021401	Terminal	ELECTRICAL PART/Terminal	TERMINAL ZDU 2,5 AN (2 HOLES) WEIDMULLER (EACPL021401)
3	015	1	PCS	EACPL02144	Terminal	ELECTRICAL PART/Terminal	TW1 (FOR ZDU 2,5) END COVER (EACPL02144)
3	016	2	PCS	EACPL02150	Terminal	ELECTRICAL PART/Terminal	TERMINAL END STOP MARKERS WAD 8 MC NE WS (EACPL02150)
3	017	2	PCS	EACTT007	Temperature Sensor	ELECTRICAL PART/SENSOR/Temperature Sensor	AUTEK-MFT1M12-R0375-0010XXB-1AAB-RAPP (EACTT007)

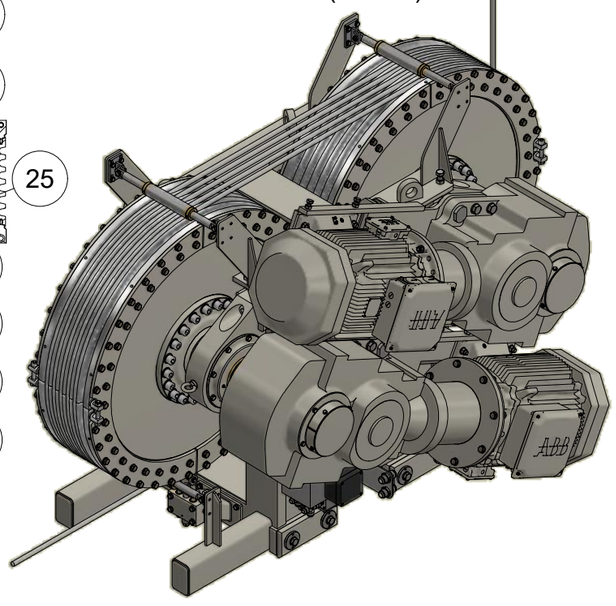


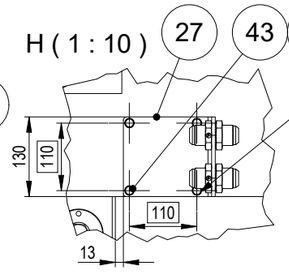












NOTE: 4x8 HOLES TO BE DRILLED & TAPPED DURING ASSEMBLING

TIGHTENING TORQUE - ACC. DOC. #6402

***MCG SIGNS (Not shown on Drawing)**
***POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT** — 60 61 62
***LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH**

Designed by	Date	Modified by	ECO / CO			
PETRODO	26.10.2021.	P Pantovic	ECO-2057046			

MACGREGOR

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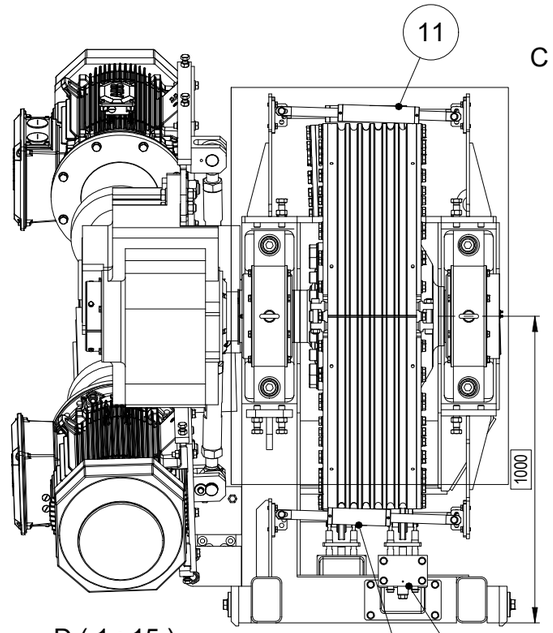
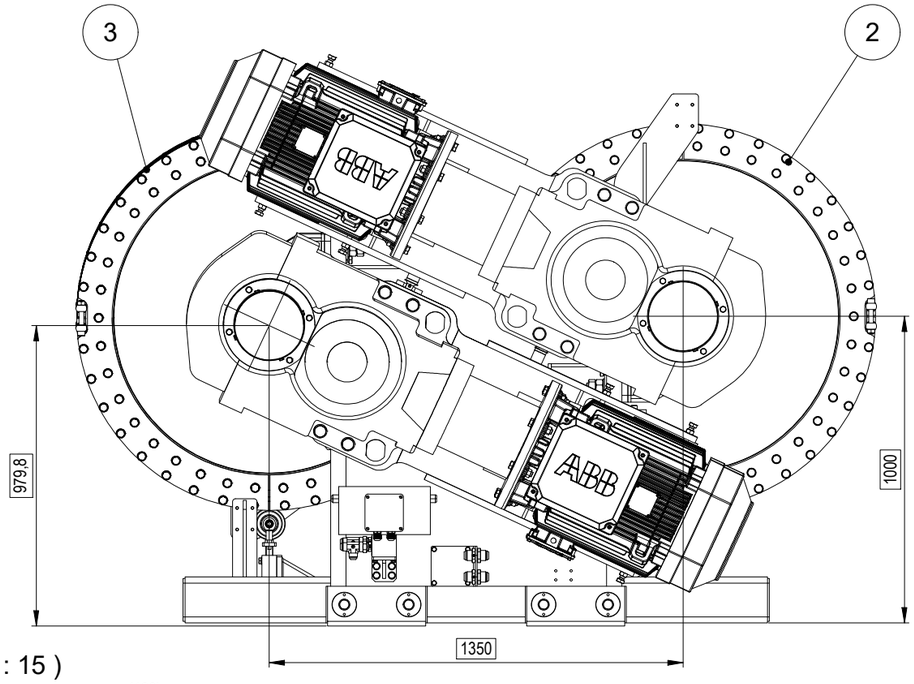
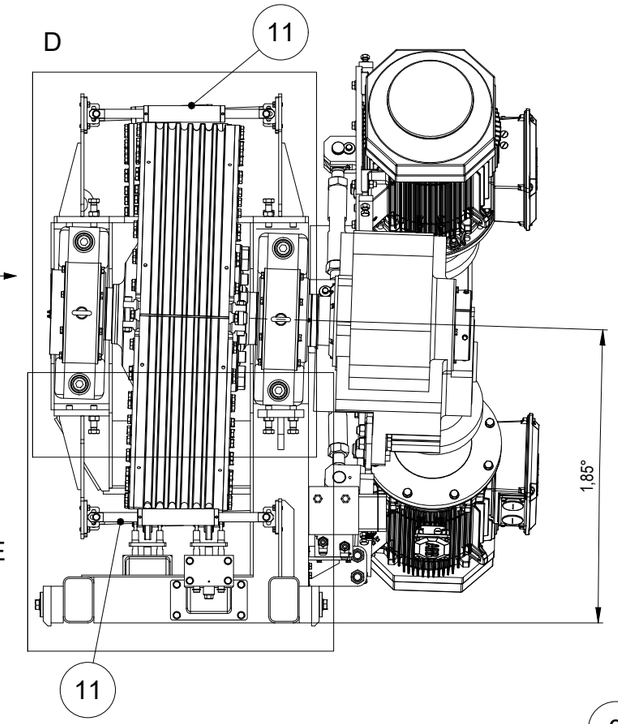
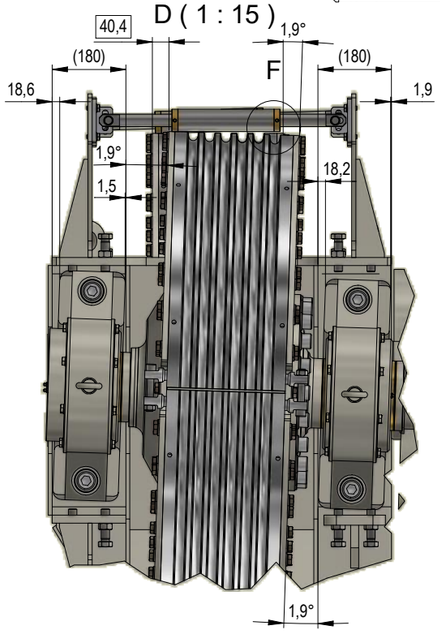
Name	Weight (kg)
TRACTION WINCH	7400
Description	Scale (A3)
TRW-4004E-01R1	1 : 20
Document ID: 400092475-ASSY	Revision: B — Sheet: 1 / 2







D (1 : 15)



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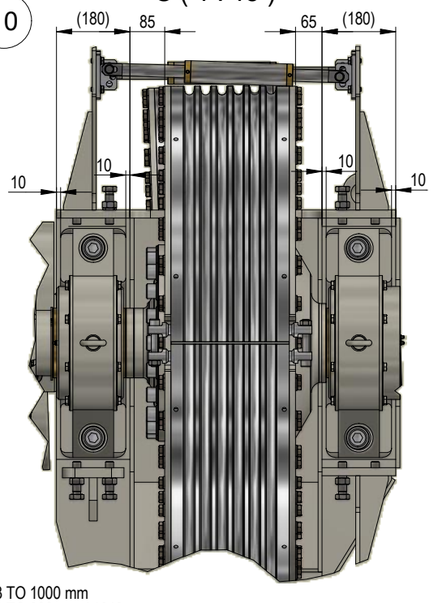

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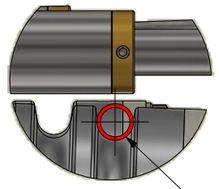
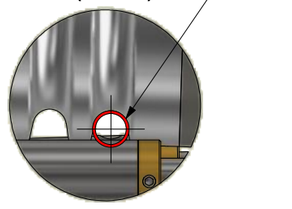
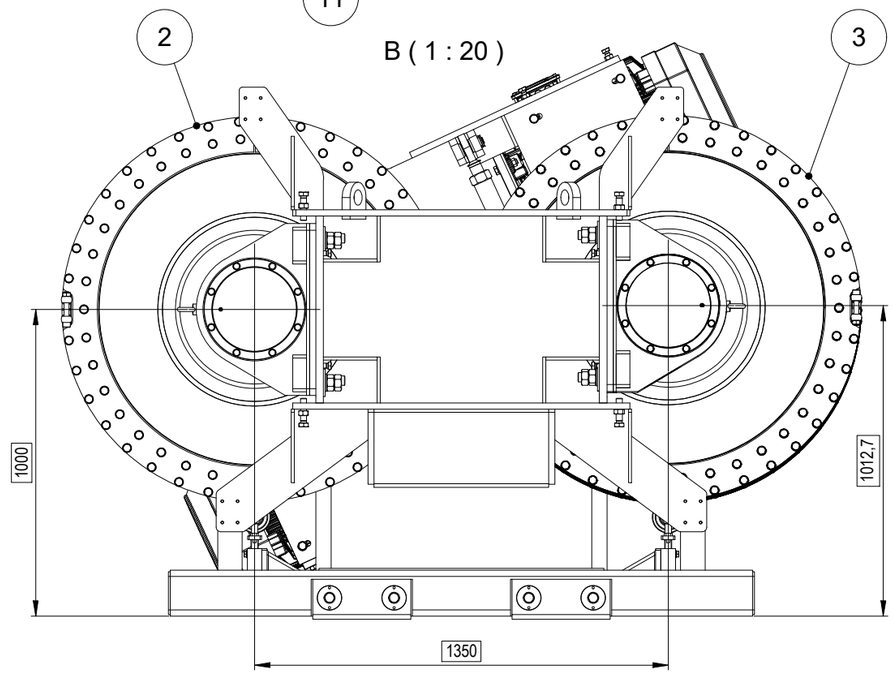


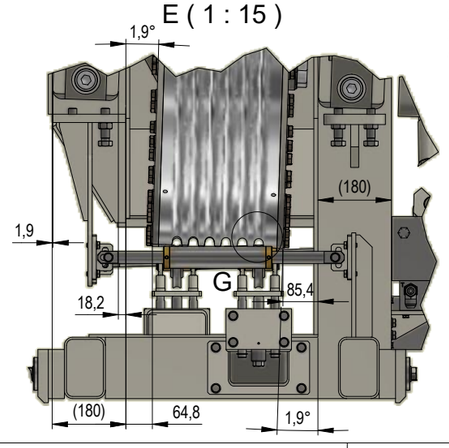
G (1 : 4)



B (1 : 20)

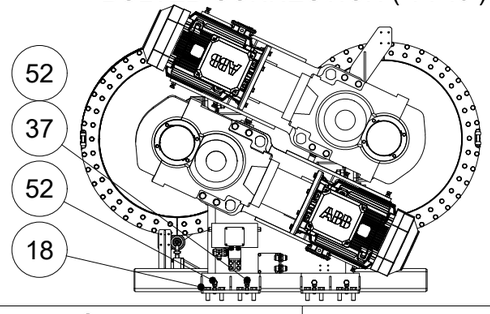


E (1 : 15)



1. ALIGN ITEM 3 TO 1000 mm
2. ALIGN ITEM 2 TO 980 mm / 1013 mm
3. FULFILLED ALIGNMENT OF 980 mm / 1013 mm GIVES 1,85° RELATIVE ANGLE BETWEEN WARPING HEADS
4. ALIGN TWO WARPING HEADS SO THE PIPE (Ø24) SMOOTHLY HIT FROM GROOVE 1 TO GROOVE 2 (DETAIL F) AS WELL AS THE PIPE SMOOTHLY HIT FROM GROOVE 1 TO GROOVE 1 (DETAIL G)

BOLTED CONNECTION (1 : 40)



Designed by	Date	Modified by	ECO / CO			
PETRODO	26.10.2021.	P Pantovic	ECO-2057046			

MACGREGOR

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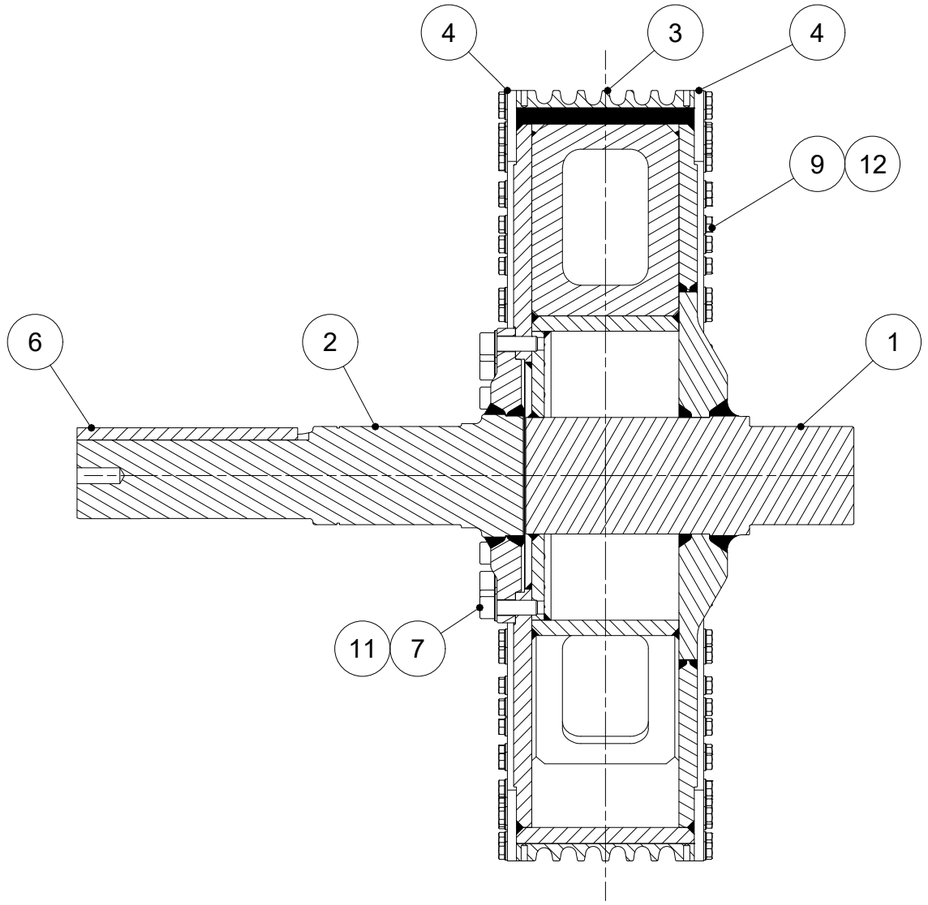
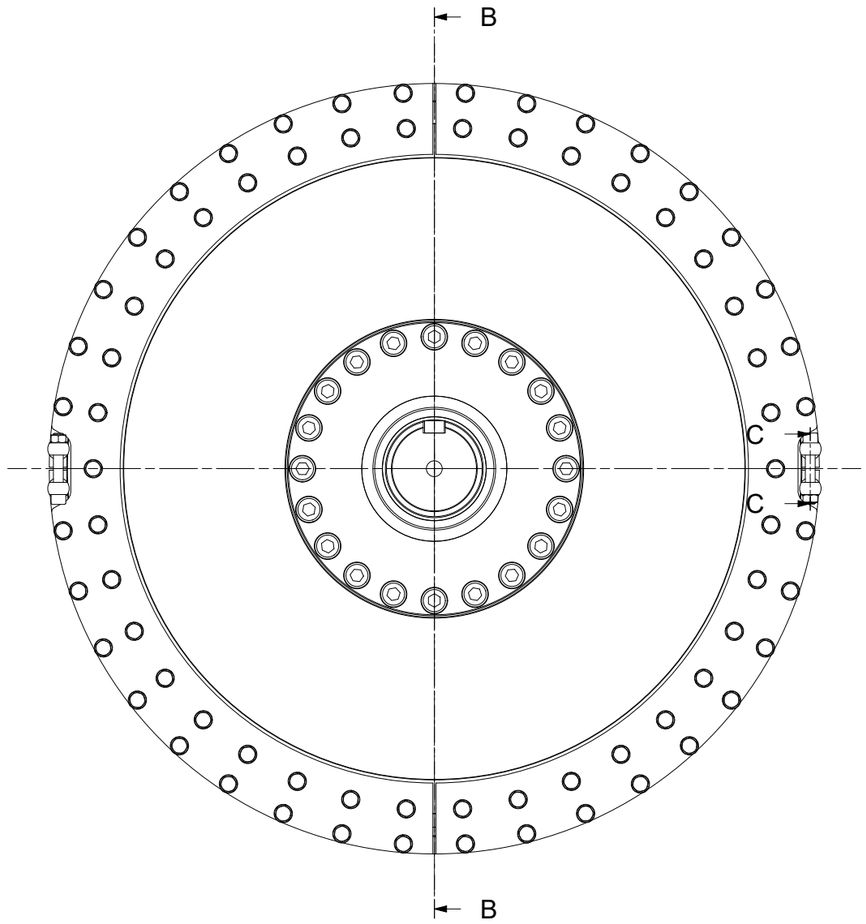
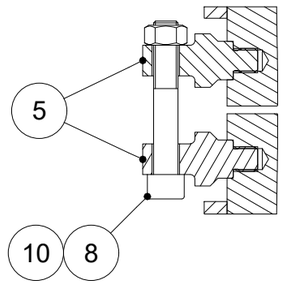
Name	Weight (kg)
TRACTION WINCH	7400
Description	Scale (A3)
TRW-4004E-01R1	1 : 20
Document ID: 400092475-ASSY	Revision: B / Sheet: 2 / 2

B-B (1 : 10)





C-C (1 : 4)



ISO VIEW 1 (1 : 20)

ISO VIEW 2 (1 : 20)

NOTE # 1
Verify tightening torque of 40 Nm on the tightening brackets/device (RH314001)

LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH 13

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	23.10.2021.	RZPPA

Weight 1353 kg	DRUM #1 TRW4004 (SS SLEEVE DESIGN) ASSEMBLY			MACGREGOR	
Unspecified Tolerances According to:	*Scale (A3 Sheet)* 1 : 10	1 / 1		*Drw number* 400096386	
Standard	*Tolerance Class*	*Material (for part)*	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*
NS-ISO 2768-1	*m Medium*		Production	PETRODC 23.10.2021.	RZPPA 25.10.2021.
NS-ISO 2768-2	*K*				*Partlist* 400096386

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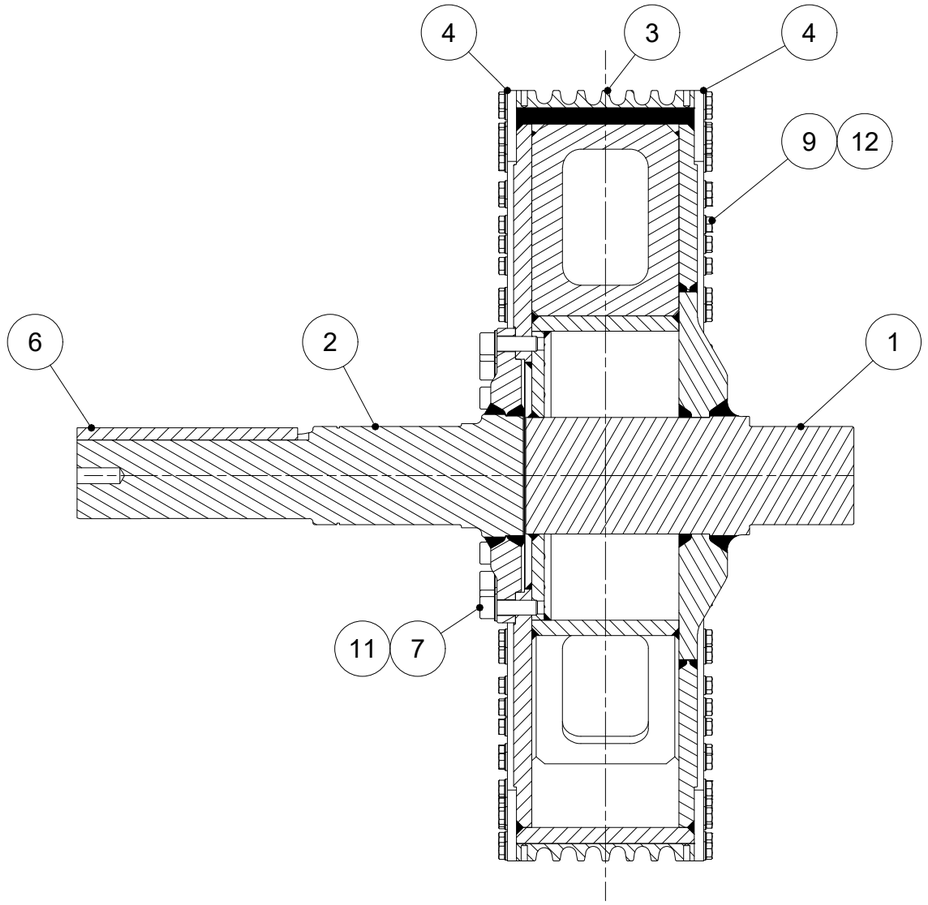
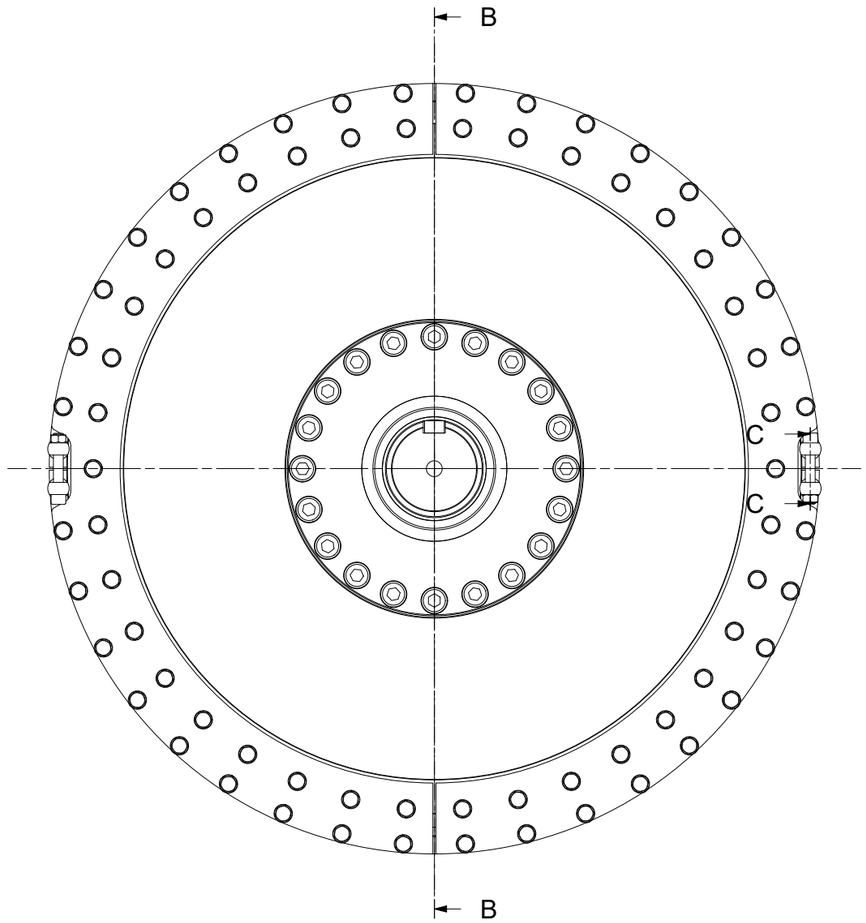
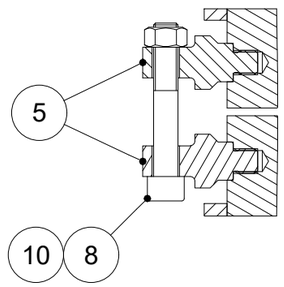
B-B (1 : 10)





C-C (1 : 4)



ISO VIEW 1 (1 : 20)

ISO VIEW 2 (1 : 20)

NOTE # 1
Verify tightening torque of 40 Nm on the tightening brackets/device (RH314001)

LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH 13

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	23.10.2021.	RZPPA

Weight 1390 kg	DRUM #2 TRW4004 (SS SLEEVE DESIGN) ASSEMBLY			MACGREGOR	
Unspecified Tolerances According to :	*Scale (A3 Sheet* 1 : 10 1 / 1			*Drw number* 400096390	
Standard	*Tolerance Class*	*Material (for part)*	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*
NS-ISO 2768-1	*m Medium*		Production	PETRODO 23.10.2021.	RZPPA 25.10.2021.
NS-ISO 2768-2	*K*				*Partlist* 400096390

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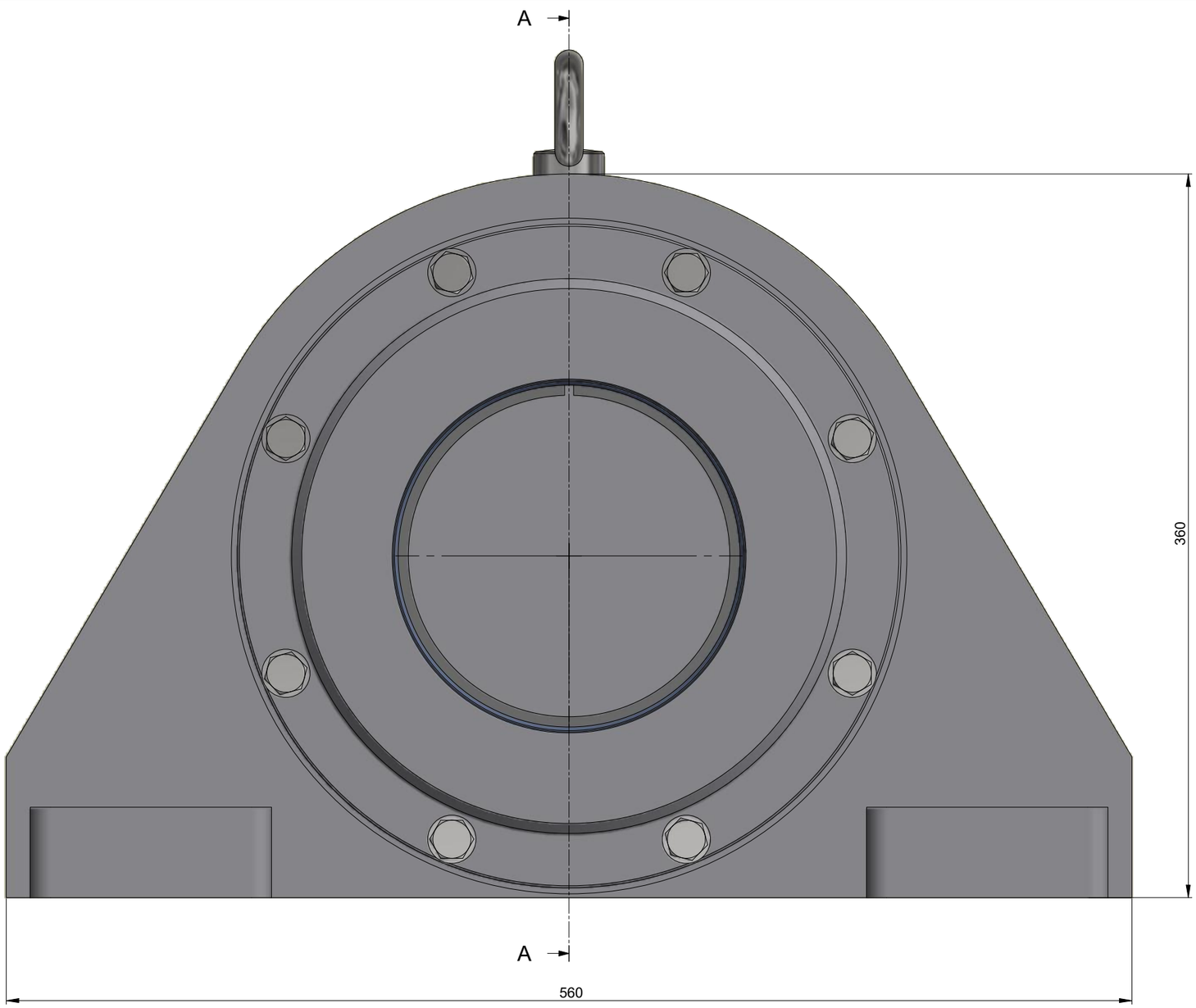

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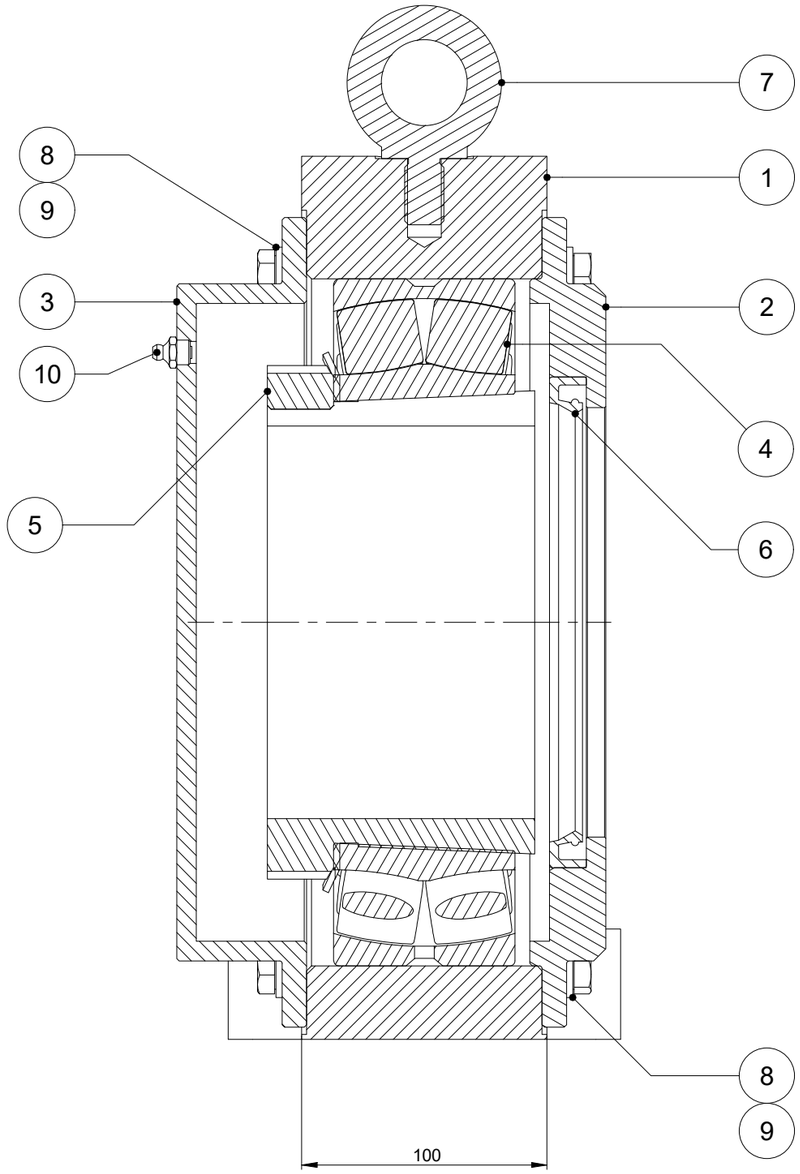
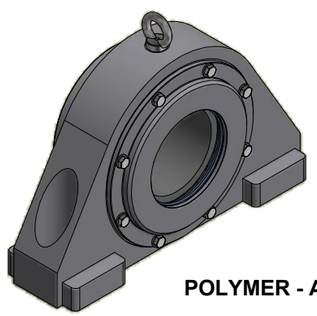


ISO VIEW (1 : 10)



POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	28.10.2020	RZPPA

Weight 106 kg	BEARING HOUSING, BLIND TRW-4004 ASSEMBLY	RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com	
Scale (A3) 1 : 2,5	*Sheet* 1 / 1	*Drw number* 400095411	
Material (for part)	*Status* Production	*Drawn by / Date (dd/mm/yy)* MAKSTO 28.10.2020	*Checked by / Date (dd/mm/yy)* RZPPA 28.10.2020
		Partlist 400095411	

Unspecified Tolerances According to :
Standard | *Tolerance Class*
NS-ISO 2768-1 m Medium
NS-ISO 2768-2 K

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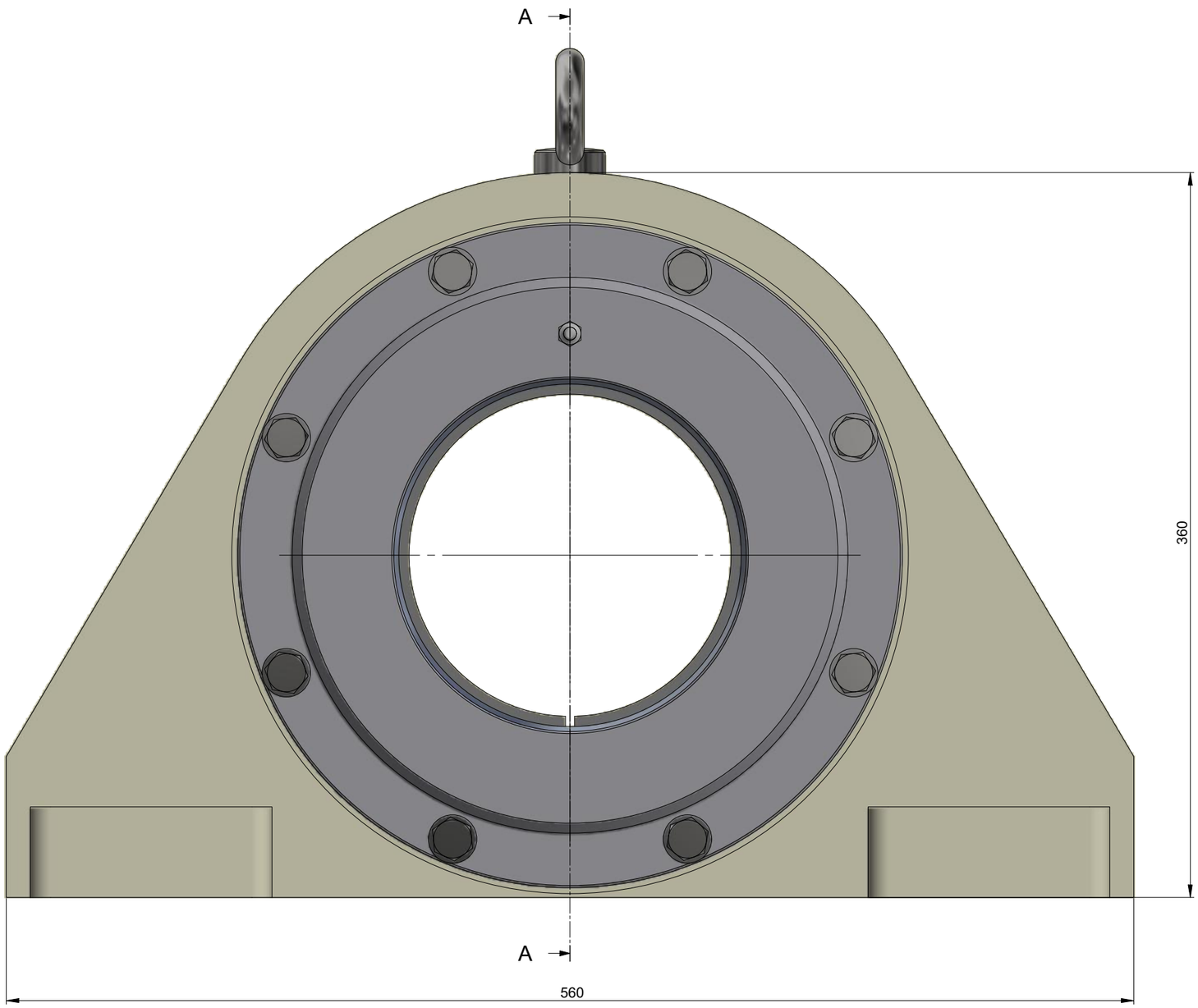
E440D9A5B19E404BBED181D3CD29CDEE



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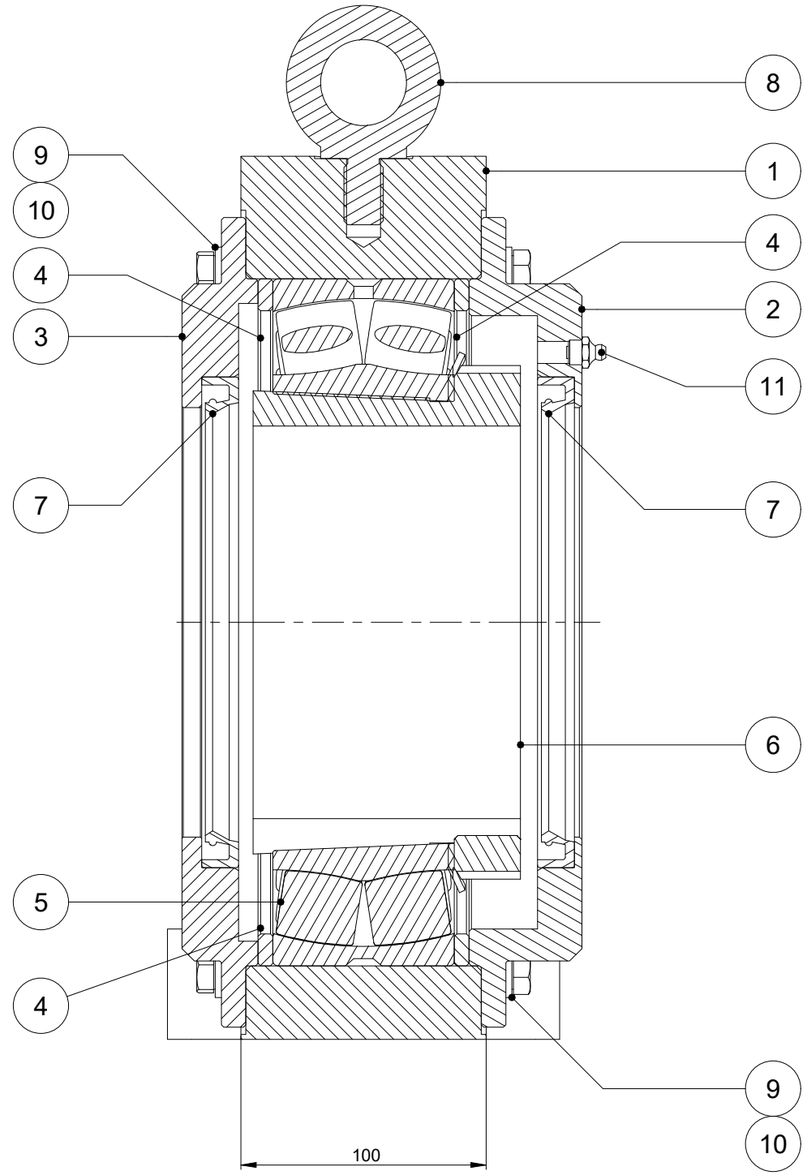
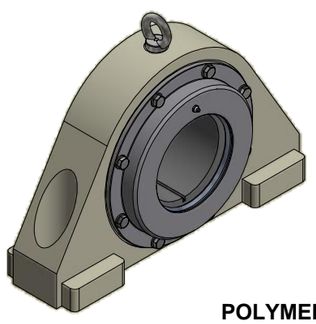


ISO VIEW (1 : 10)



POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT

12

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	28.10.2020	RZPPA

Weight 106 kg		BEARING HOUSING TRW-4004 ASSEMBLY	RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com		
Unspecified Tolerances According to:	*Scale (A3)* 1 : 2,5	*Sheet* 1 / 1		*Drw number* 400095410	
Standard	*Tolerance Class*				
NS-ISO 2768-1	*m Medium*	*Material (for part)*	*Status* Production	*Drawn by / Date (dd/mm/yy)* MAKSTO 28.10.2020	*Checked by / Date (dd/mm/yy)* RZPPA 28.10.2020	*Partlist* 400095410
NS-ISO 2768-2	*K*				

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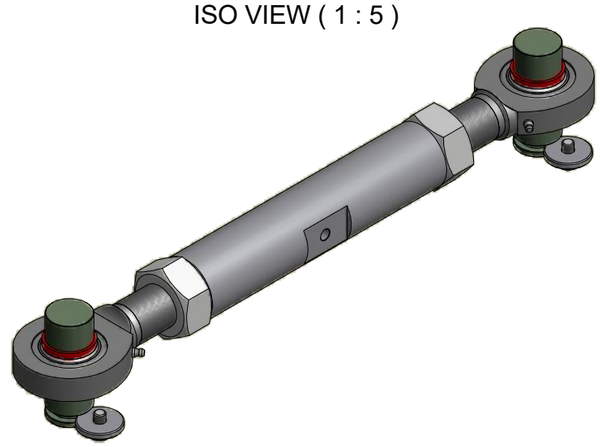
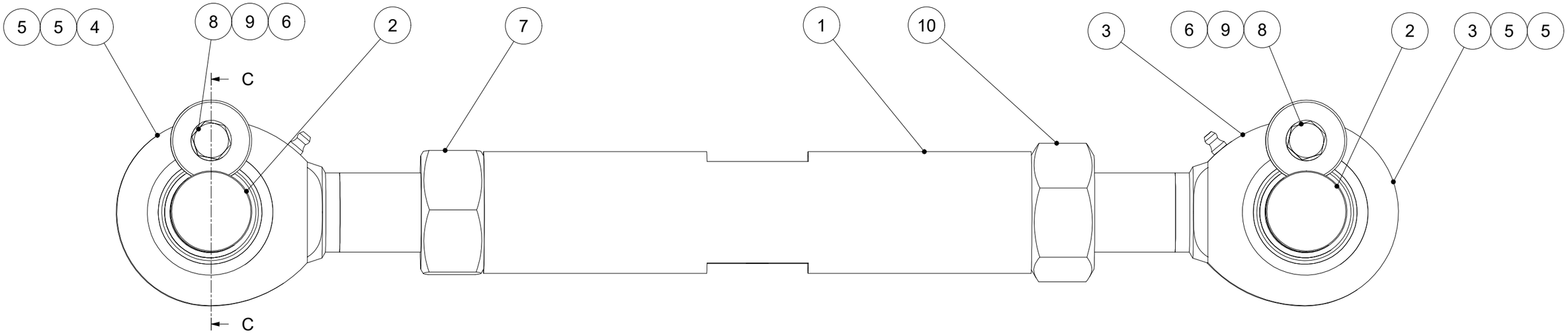
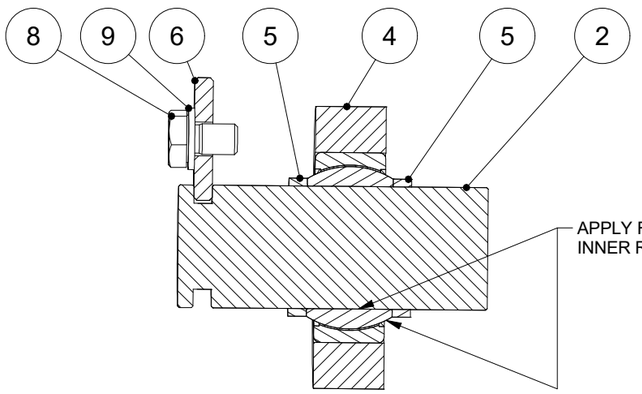
ISO VIEW (1 : 5)





C-C (1 : 2)



APPLY RUST PROTECTION OR STICKY GREASE AT THE INNER RING OF THE ROD ENDS DURING ASSEMBLY.

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	21.5.2014	RHDHN
B		Position 1 modified, overall lenght 270, was 320	31.10.14/RZPPA	RHDHN
C		Item 10 added and number of Item 7 reduced to 1.	24.11.2014/BSI	RHDHN
C1		Text note added	31.10.2016	RHJJ

Weight 6 kg

TORQUE ARM
TRW-4003E
ASSEMBLY

RAPP HYDEMA
Phone: (+47) 75 55 01 00
Fax: (+47) 75 55 01 11
E-mail: office@rapphydema.com

Unspecified Tolerances According to:		*Scale (A3)*	*Sheet*
Standard	*Tolerance Class*	1:2	1 / 1
NS-ISO 2768-1	*m Medium*		
NS-ISO 2768-2	*K*		

Material (for part)	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*
	Production	STNSI 21.05.2014	STNSI 21.05.2014

Drw number RH317083

Partlist RH317083

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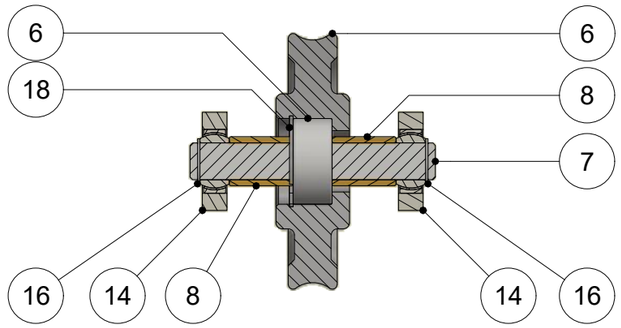
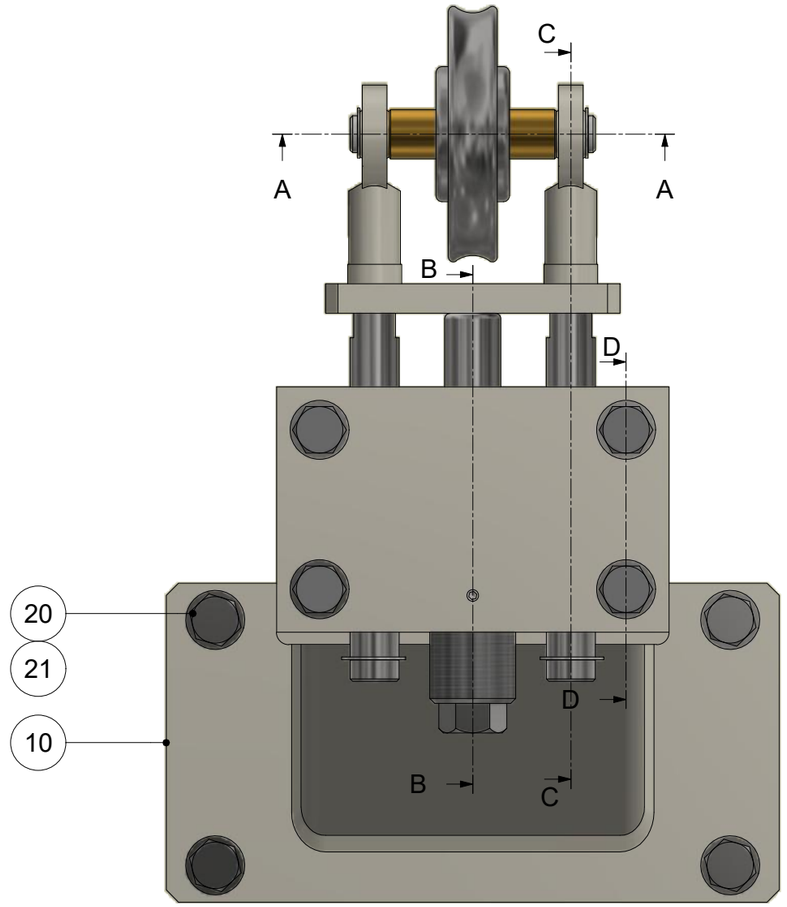
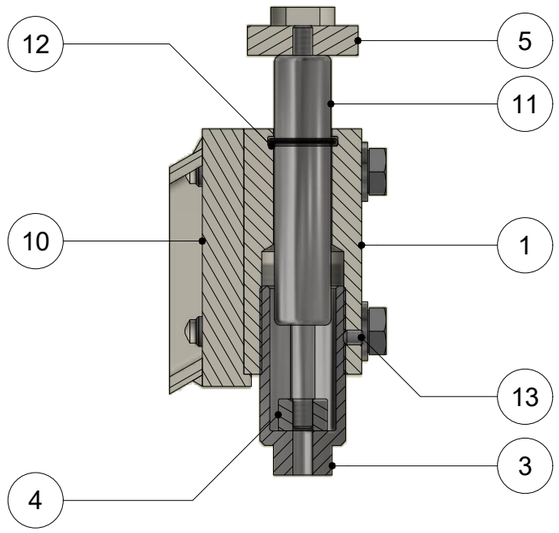
A-A (1 : 2,5)

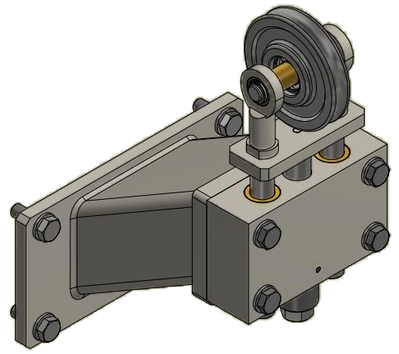




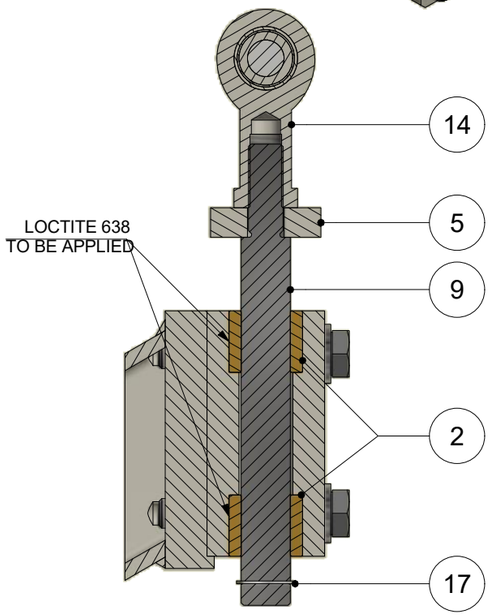
B-B (1 : 2,5)



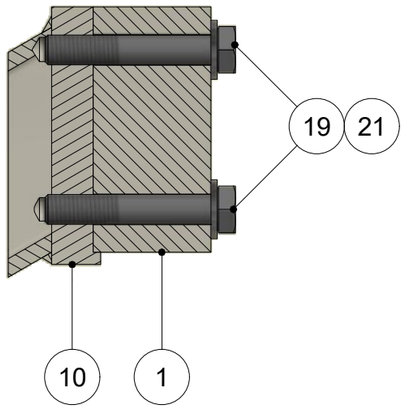
ISO VIEW (1 : 5)



C-C (1 : 2,5)



D-D (1 : 2,5)



TIGHTENING TORQUE:

M12 (A4-80): 75 Nm

LOCTITE 638 - TO BE USED FOR CYLINDRICAL PARTS FASTENING 22

LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH 23

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	14.01.2020	RZPPA

Weight 17,5 kg	TENSION ROLLER DEVICE TRW-4004 ASSEMBLY	RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com			
Unspecified Tolerances According to:	*Scale (A3)*	*Sheet*	*Drw number*		
Standard / *Tolerance Class*	1 : 2,5	1 / 1	RH329285		
NS-ISO 2768-1 m Medium	*Material (for part)*	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*	*Partlist*
NS-ISO 2768-2 K		Production	MAKSTO 14.01.2020	RZPPA 14.01.2020	RH329285

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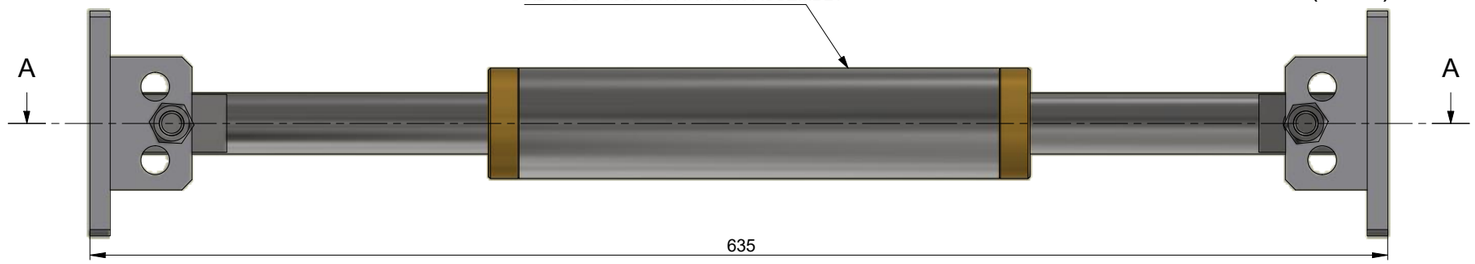
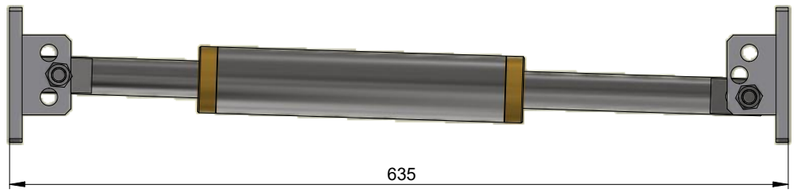
93FD0081EA8B408BA009B9AF98E90B27

POSITION 0 (1 : 3)

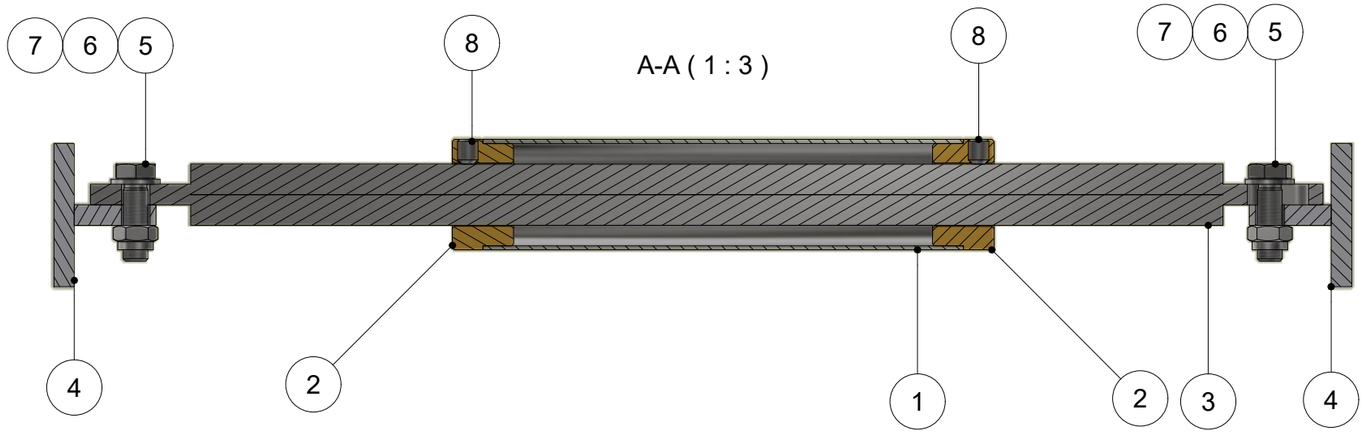


ISO VIEW (1 : 5)

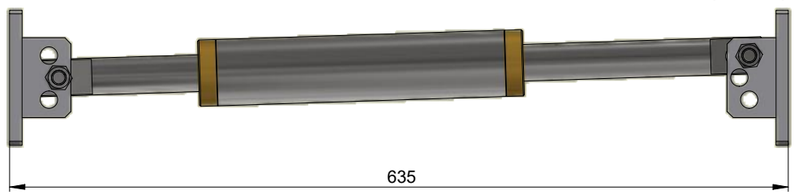
POSITION 1 (1 : 5)



A-A (1 : 3)



POSITION 2 (1 : 5)



REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	7.4.2016.	RHJJ

Weight 6,0 kg	CABLE PROTECTION BAR (L635) ASSEMBLY	RAPP HYDEMA Phone: (+47) 75 55 01 00 Fax: (+47) 75 55 01 11 E-mail: office@rapphydema.com	
Unspecified Tolerances According to : / *Standard* / *Tolerance Class* NS-ISO 2768-1 m Medium NS-ISO 2768-2 K	*Scale (A3)* 1:3 / *Sheet* 1 / 1	*Drw number* RH321167	
	Material (for part)	*Status* Production	*Drawn by / Date (dd/mm/yy)* RZBMI 07.04.2016. / *Checked by / Date (dd/mm/yy)* RHJJ 07.04.2016.	*Partlist* RH321167

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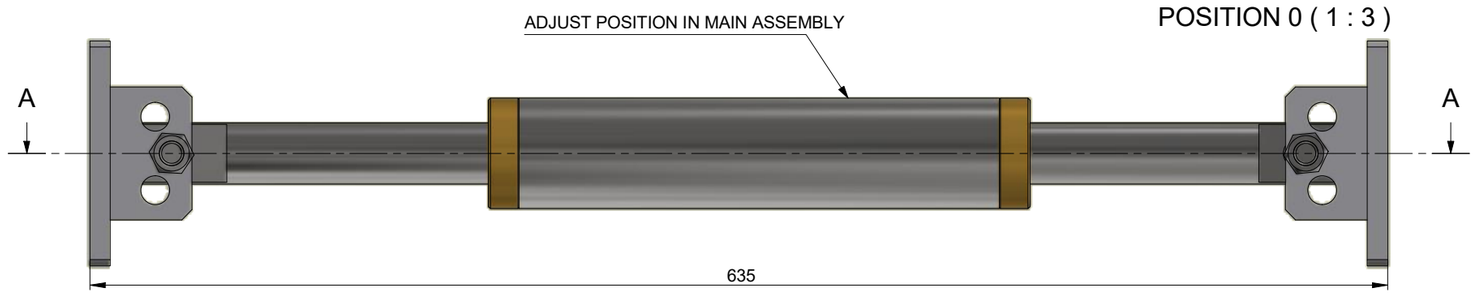
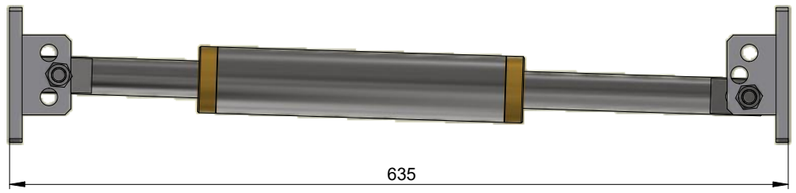
0FC431EC34E445B1A472B0B3CA75C33C

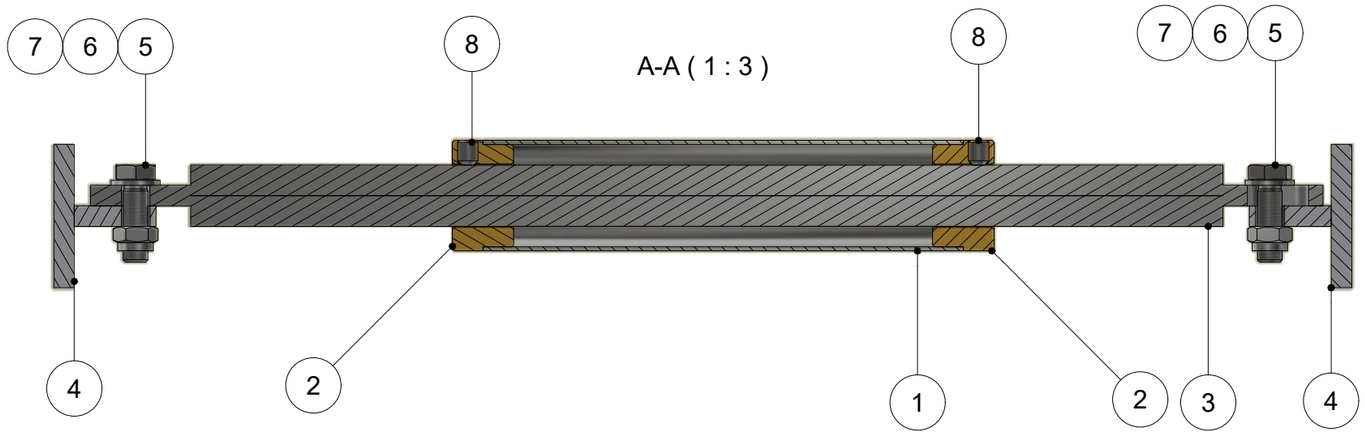


POSITION 0 (1 : 3)

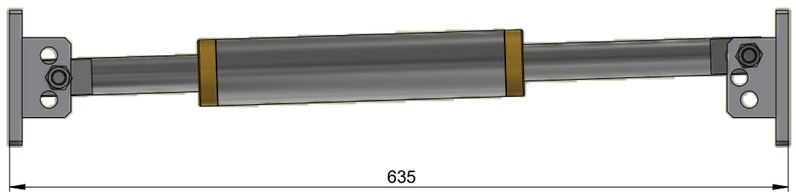
ISO VIEW (1 : 5)



POSITION 1 (1 : 5)



A-A (1 : 3)



POSITION 2 (1 : 5)

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	7.4.2016.	RHJJ

Weight 6,0 kg	CABLE PROTECTION BAR (L635) ASSEMBLY	RAPP HYDEMA Phone: (+47) 75 55 01 00 Fax: (+47) 75 55 01 11 E-mail: office@rapphydema.com	
Unspecified Tolerances According to : *Standard* / *Tolerance Class*: NS-ISO 2768-1 m Medium; NS-ISO 2768-2 K	*Scale (A3)* 1:3 *Sheet* 1 / 1	*Drw number* RH321167	
Material (for part)	*Status* Production	*Drawn by / Date (dd/mm/yy)* RZBMI 07.04.2016.	*Checked by / Date (dd/mm/yy)* RHJJ 07.04.2016.
		Partlist RH321167	

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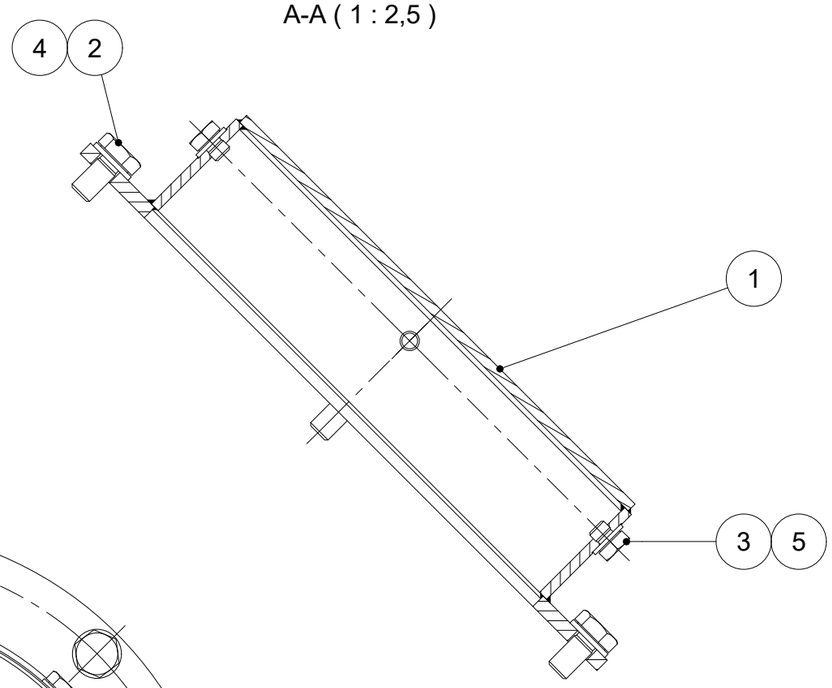
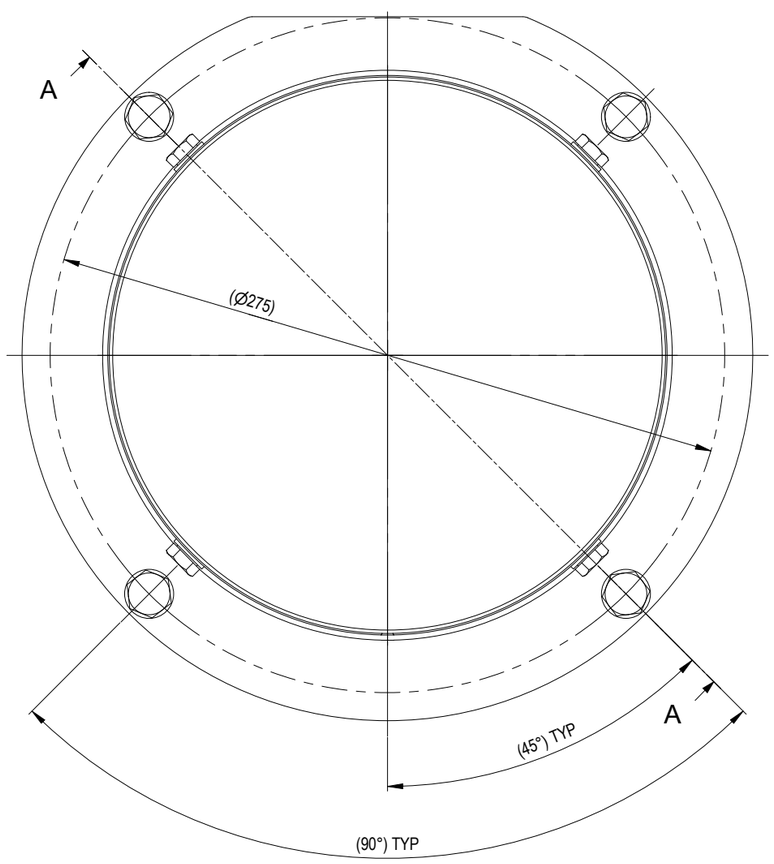
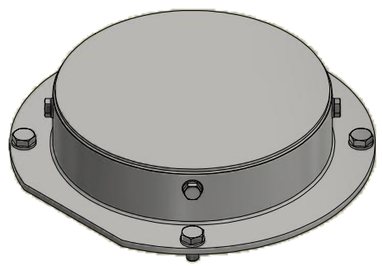
A-A (1 : 2,5)





ISO VIEW (1 : 5)



6

POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT

Designed by	Date	Modified by	ECO / CO			
MAKSTO	07.08.2019.	A Karaic				

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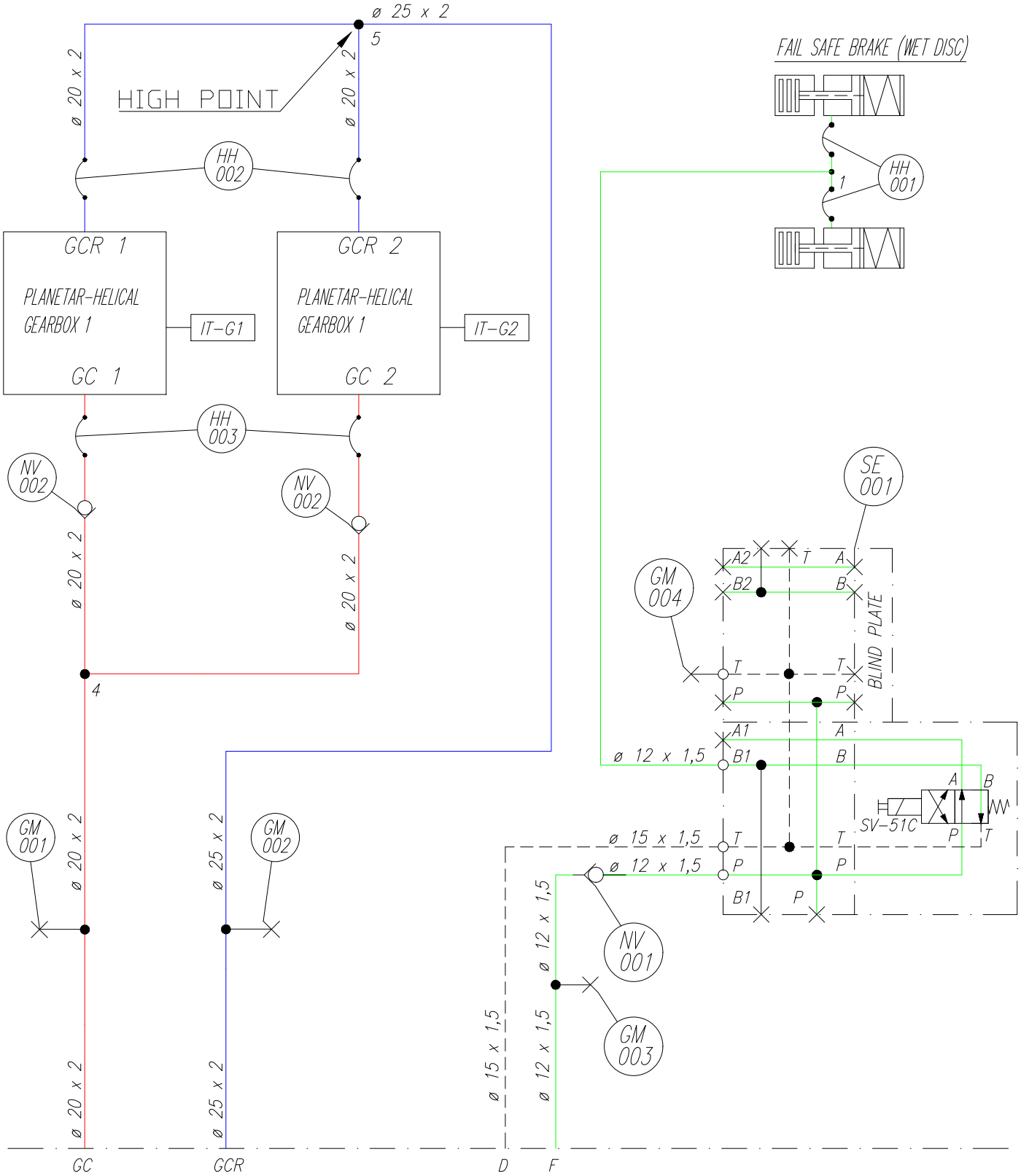
Name	Weight (kg)
Cover	3,9
Description	**Scale (A3)**
BPH.28 GEARBOX COVER - ASSEMBLY	1 : 2,5
Document ID	**Revision** / **Sheet**
2000011556	A / 1 / 1



Designed by	Modified by	Date	ECO			
H Johansen		21-Feb-22	ECO-2056897			

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Name	Weight
HYDRAULIC BRAKE & COOLING SYSTEM,	0 kg
Description	Scale (A4)
Document ID: RH411181	Revision: C

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
1				400092566	Level Wind	LEV. WITH SLACK WIRE, LSWC5000/01L1 (RHMELSWC5000/01L1)
2	001	1	PCS	400180581	Level Wind	LEV-5000E/900-L2000, L
3	001	1	PCS	400180323	Bracket	LW B SIDE BRACKET LW EL 5000-L2000; MACHINING, LW B-SIDE (L), DIS BTW GUIDE SHAFTS APROX 522
3	002	1	PCS	400180415	Bracket	LW M SIDE BRACKET LW EL 5000-L2000; MACHINING, LW M-SIDE (L), DIS BTW GUIDE SHAFTS APROX 522
3	003	1	PCS	400180511	Sheave Assembly	SHEAVE, LEFT, PCD900, LW EL5000; ASSEMBLY
4	001	1	PCS	RH318415	Sheave House	SHEAVE FRAME PCD900 LW EL5000 (L&R); MACHINING, PCD900 (L&R)
4	002	1	PCS	RH329298	SHEAVE INDICATOR (L&R), LW EL5000	SHEAVE INDICATOR (L&R), LW EL5000; ASSEMBLY
5	010	2	PCS	RH317245	Wire Rope Roller	INDICATOR ROLLER ASSEMBLY LW INDICATOR; ASSEMBLY, INDICATOR ROLLER, LEVEL WIND INDICATOR
5	020	1	PCS	RH329299	Bracket	PIVOT ROLLER BRACKET, L.WIND INDICATOR; MACHINING
5	030	1	PCS	RH329301	Bracket	INDICATOR BRACKET, LEVEL WIND INDICATOR; WELDING & MACHINING
5	040	1	PCS	RH329302	Bracket	TENSION SPRING BRACKET, L.WIND INDICATOR; WELDING & MACHINING
5	050	1	PCS	RH329303	ENCODER CONNECTION PIPE, D60,3x6,3/L90	ENCODER CONNECTION PIPE, D60,3x6,3/L90; MACHINING
5	060	1	PCS	RH314346	Cover	COVER, M45x1.5xD58, MACHINING
5	070	1	PCS	RH329304	Distance Ring	SPACER, ROUND BAR, D40x11, MACHINING
5	080	1	PCS	RH329305	Bolt	BOLT, ROUND BAR D25 X 104, MACHINING
5	090	1	PCS	RH329306	ENCODER ROTATIONAL CONNECTION, D50x27	ENCODER ROTATIONAL CONNECTION, D50x27; MACHINING
5	100	4	PCS	RH326639	SPRING PIN, M20x55, MACHINING	SPRING PIN, M20x55, MACHINING
5	110	2	PCS	RH329307	COMPRESSION SPRING, d2,5/D16x107	COMPRESSION SPRING, d2,5/D16x107
5	120	1	PCS	RH325844AS_RFC4800	ROTARY SENSOR	ROTARY SENSOR
5	130	2	PCS	BEDBS027	Deep Groove Ball Bearing	DEEP GROOVE BALL BEARING, 6004 2RS; d20/D42x12 (BEDBS027)
5	140	1	PCS	SESRB0012	Rotary Shaft Lip Seal	SEAL, 20x35x7, W/STAINLESS SPRING, 35x35x7 (SESRB0012)
5	150	1	PCS	FA0472A0350	Circlip	CIRCLIP RING INTERNAL, STEEL DIN 472 I35; SPRING STEEL, PHOSPHATED, HRC 47-52 (FA0472A0350)
5	160	1	PCS	FA0471U0200	Circlip	CIRCLIP RING EXTERNAL, STEEL DIN 471 A20; SPRING STEEL, PHOSPHATED, HRC 47-52 (FA0471U0200)
5	170	2	PCS	FA0912G10020	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M10x20; FULLY THREADED (FA0912G10020)
5	180	2	PCS	FA0912G04020	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M4x20 (FA0912G04020)
5	190	1	PCS	FA0916G08008	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M8x8; CUP POINT (FA0916G08008)
5	200	2	PCS	FA0916G05010	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M5x10; CUP POINT (FA0916G05010)
5	210	2	PCS	FA0916G05006	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M5x6; CUP POINT (FA0916G05006)
5	220	2	PCS	FA0933G08020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x20; FULLY THREADED (FA0933G08020)
5	230	2	PCS	400091318	Nut	HEXAGON NUT, GRADE 8, VZN, DIN 934, M24 (FA0934H24)
5	240	1	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
5	250	4	PCS	FA0439G2015	Nut	HEXAGON THIN NUT, A4, DIN 439, M20x1,5 (FA0439G2015)
5	260	2	PCS	400091197	Washer	FLAT WASHER, 8.8 VZN, DIN 125 M24; Tykkelse h=4.0 d=25 (FA0125H24)
5	270	4	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
5	280	1	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
5	290	2	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
5	300	2	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
5	310	4	PCS	FA0988U02002820	Ring	SUPPORT WASHER, DIN 988, SS-20x28x2; SS20282 DIN988 Steel St 2 K 60 (FA0988U02002820)
5	320	1	PCS	GRMXX001	Grease Nipple	GREASE NIPPLE, STRAIGHT, M6x1.0, A4 (GRMXX001)
5	330	2	PCS	FA0916G05006	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M5x6; CUP POINT (FA0916G05006)
5	340	2	PCS	400095148	Pipe	PIPE, (D10 X T1,5 / L75); MACHINING
4	003	2	PCS	RH317245	Wire Rope Roller	INDICATOR ROLLER ASSEMBLY LW INDICATOR; ASSEMBLY, INDICATOR ROLLER, LEVEL WIND INDICATOR
5	010	1	PCS	RH317247	Level Wind Indicator	LEVEL WIND INDIACTOR ROLLER; MACHINING, D50x103, LEVEL WIND INDIACTOR ROLLER
5	020	1	PCS	RH317246	Roller Shaft	ROLLER SHAFT LEVEL WIND INDICATOR; MACHINING, D50x163,5, ROLLER SHAFT, LEVEL WIND INDICATOR
5	030	1	PCS	RH316935	Bearing Plain	LINING, D30/d20x12, MACHINING
5	040	1	PCS	RH316936	Distance Ring	DISTANCE RING, D42/d35x8, MACHINING
5	050	1	PCS	RH317248	Distance Ring	DISTANCE RING, D28/d24x37, MACHINING

Level	Pos	Qty	Unit	Aras ID	Name	Description
5	060	1	PCS	RH408161	Locking Plate	LOCK DISC, D40/d11x6, TWS-
5	070	1	PCS	BECRI2520	Cylindrical Roller Bearing	NEEDLE R BRG, W/INNER RING, NKI 25/20-TV; d25/D38x20 (BECRI2520)
5	080	1	PCS	BEDBS025	Deep Groove Ball Bearing	DEEP GROOVE BALL BEARING, 6004; d20/D42x12 (BEDBS025)
5	090	1	PCS	SESRA006	Rotary Shaft Lip Seal	SEAL, 30x42x7, 42x42x7 (SESRA006)
5	100	2	PCS	FA0472F0420	Circlip	CIRCLIP RING INTERNAL, A2 DIN 472 I42; STAINLESS (material x40Cr13) (FA0472F0420)
5	110	1	PCS	FA0933G10020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x20; FULLY THREADED (FA0933G10020)
5	120	1	PCS	GRMFX004	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.0, A4 (GRMFX004)
5	130	1	PCS	SESRB0020	Rotary Shaft Lip Seal	SEAL, 30x42x7, W/STAINLESS SPRING, 42x42x7 (SESRB0020)
4	004	1	PCS	RH329308	COUNTER WEIGHT, LW EL5000 (L&R), ASSY	COUNTER WEIGHT, LW EL5000 (L&R), ASSY
5	010	1	PCS	RH31858401	COUNTER WEIGHT, D200x520, MACHINING	COUNTER WEIGHT, D200x520, MACHINING
5	020	1	PCS	RH329309	Bracket	COUNTER WEIGHT BRACKET, 534,3x240/T10; BENDING & PREMACHINING
5	030	2	PCS	RH32770303	COUNTER WEIGHT PLATE,(T30/D180),PREMACH	COUNTER WEIGHT PLATE,(T30/D180),PREMACH
5	040	2	PCS	FA0933G12050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x50; FULLY THREADED (FA0933G12050)
5	050	3	PCS	FA0933G12025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x25; FULLY THREADED (FA0933G12025)
5	060	5	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
4	005	1	PCS	RH318565	Bearing Plain	LINING, D95/d75x37, MACHINING
4	006	1	PCS	RH318566	Sheave Shaft	SHEAVE SHAFT, D128(11)/d75(174)x185; MACHINING, Ø128(11)/Ø75(174)x185
4	007	1	PCS	RH318567	Bearing Plain	LINING, D95/d75x42, MACHINING
4	008	1	PCS	RH318568	Clamp	CLAMPING DISC, D128/D95/d21x12 (PCD=108); MACHINING
4	009	1	PCS	RH31856401	Plate	WIRE GUIDE, PLATE (T40 / 105x140); T40
4	010	1	PCS	RH31856403	Plate	WIRE GUIDE, PLATE (T30 / 105x140); T40
4	011	2	PCS	RH328978	Shaft Adapter	ADAPTER, M20x2,5 - Ø8, MACHINING
4	012	2	PCS	400092338	XXTEXTSENSOR_M8	Please refer to the Legacy BOM report
4	013	8	PCS	FA7981G080	Screw	WOOD SCREW, DIN 7981, A4, 6,3x25 (FA7981G080)
4	014	4	PCS	FA0916G05010	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M5x10; CUP POINT (FA0916G05010)
4	015	1	PCS	FA0933G20060	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x60; FULLY THREADED (FA0933G20060)
4	016	4	PCS	FA0933G12025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x25; FULLY THREADED (FA0933G12025)
4	017	8	PCS	FA0933G08020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x20; FULLY THREADED (FA0933G08020)
4	018	2	PCS	FA0934G24	Nut	HEXAGON NUT, A4-80, DIN 934, M24 (FA0934G24)
4	019	2	PCS	FA0125G24	Washer	FLAT WASHER, A4, DIN 125 M24; Tykkelse h=4.0 d=25 (FA0125G24)
4	020	2	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
4	021	4	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
4	022	8	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
4	023	1	PCS	FA25201Q20	Washer	NORD-LOCK WASHER, ELZN DIN 25201 M20; 21,0x30,7x3,4 (FA25201Q20)
4	024	1	PCS	GRMAX001S	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.5, A2 (GRMAX001S)
3	004	1	PCS	400180510	Bracket	UNP 100 x 50 x 3225
3	005	2	PCS	400180579	Guide Shaft	D170 x 3216
3	006	1	PCS	400203401	Level Wind	LEVEL WIND CAR. LW EL5000 (L&R), AXIS DIST. APPR. 522mm; HIWIN Ball Nut
3	007	1	PCS	400092451	Ball Screw	BALL SCREW, D63x10, MACHINING
3	008	1	PCS	RH318419	Wear Ring	WEAR RING, D70/d50x79,5, MACHINING
3	009	1	PCS	RH318420	Cover	BEARING COVER, D176/d95x15, MACHINING; MACHINING, Ø176(5), Ø150(6) & Ø120(4)/Ø110x13, Ø95
3	010	1	PCS	RH318421	Wear Ring	WEAR RING, D70/d50x113, MACHINING
3	011	1	PCS	RH318422	Cover	BEARING HOUSING COVER, D156/d64x16; MACHINING, Ø156(8), Ø110x8/Ø75(14), Ø64
3	012	1	PCS	RH318423	Wear Ring	WEAR RING, D120/d80x23, MACHINING
3	013	1	PCS	RH318424	Distance Ring	THRUST RING, D145/d50x48,5, MACHINING
3	014	4	PCS	RH318425	Wear Ring	WEAR RING, D185/d170x68, MACHINING
3	015	2	PCS	RH318441	Cover	COVER, T=20, D=215/d26, MACHINING
3	016	2	PCS	400180580	Plate	T20 / D215 x d26

Level	Pos	Qty	Unit	Aras ID	Name	Description
3	017	4	PCS	RH318553	Bearing Plain	LINING, D190/d170x100, MACHINING
3	018	2	PCS	RH318554	Bearing Housing	SHEAVE FRAME, BEARING HOUSING, LW EL5000; MACHINING, Ø190/Ø170x100
3	019	1	PCS	RH318555	Bearing Plain	LINING, D100/d90x30, MACHINING
3	020	1	PCS	RH318556	Distance Ring	THRUST RING, D115/d37x10, MACHINING
3	021	1	PCS	RH318557	Cover	BEARING HOUSING COVER, D250x20; MACHINING, PCD220, Ø250x20
3	022	1	PCS	RH318558	Bearing Plain	LINING, D100xd90x26, MACHINING
3	023	1	PCS	RH318559	Bearing Plain	LINING, D100xd90x49, MACHINING
3	024	1	PCS	RH318570	Cover	COVER, D98/d63x6, MACHINING
3	025	1	PCS	RH31855701	Gasket	
3	026	1	PCS	RH31842001	Gasket	
3	027	1	PCS	400203461	Plate	T6 / D130 x d63; WIPE RING - SPLIT - HIWIN Ball Nut
3	028	2	PCS	RH312370	Protection	SENSOR HOLDER/PROTECTION, MACHINING; MACHINING, M18x1P
3	029	2	PCS	RH31253801	DETECTOR FOR PICK UP, D25 x L190 / M24	DETECTOR FOR PICK UP, D25 x L190 / M24; MACHINING
3	030	2	PCS	RH318112	Cover	BEARING HOUSING COVER RW-2340E-S90; MACHINING, D156/D74, BEARING HOUSING COVER
3	031	3	PCS	RH31811201	Gasket	
3	032	1	PCS	RH318114	Locking Nut	LOCKING NUT, M50x1,5 (T=45), MACHINING
3	033	1	PCS	RH314170	Key	KEY, 12x8x142
3	034	2	PCS	RH318783	Washer	LOCK WASHER, D55/d12x8, MACHINING
3	035	2	PCS	RH409939	Bracket	HOUSING FOR PICKUP
3	036	1	PCS	RH318119	Protection	CABLE CHAIN PROTECTION, T=6, BENDING
3	037	1	PCS	RH316978	Bracket	BRACKET FOR CABLE GUIDE RAIL ROVW-2021E; MACHINING, BRACKET FOR CABLE GUIDE RAIL
3	038	1	PCS	RH31722602	Bracket	BRACKET F CABLE GUIDE RAIL CTDW-520E-T90; MACHINING, BRACKET FOR CABLE GUIDE RAIL
3	039	2	PCS	RH31841103	Bracket	CABLE PROTECTION BRACKET, T=10; MACHINING
3	040	1	PCS	RH31841104	Bracket	CABLE PROTECTION BRACKET, T=5, MACHINING
3	041	2	PCS	RH319754	Plate	PLATE, T=8, MACHINING; PLATE
3	042	1	PCS	RH319119	Distance Ring	SPACER, D58/d40x16, MACHINING
3	043	1	PCS	400180582	Cable Chain	E4.32.05.063.0 - Series E4.32
3	044	1	PCS	GETGN1031	Gearbox	GEAR MTR 240NM/2,2KWI=16,3/EN/BR; GEAR MOTOR 240NM/2,2KW-100/SK9022/I=16,3/EN/BR (GETGN1031)
3	045	1	PCS	RH328834	Cover	GEARBOX COVER, SK9022, ASSEMBLY
4	010	1	PCS	RH328835	Cover	GEARBOX COVER, SK9022, WELDING ASSEMBLY
4	020	4	PCS	FA0933G08008	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x8; FULLY THREADED (FA0933G08008)
4	030	4	PCS	FA0912G08016	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M8x16; FULLY THREADED (FA0912G08016)
4	040	4	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
4	050	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
3	046	2	PCS	FA0471U0600	Circlip	CIRCLIP RING EXTERNAL, STEEL DIN 471 A60; SPRING STEEL, PHOSPHATED, HRC 44-49 (FA0471U0600)
3	047	3	PCS	FA0472A1300	Circlip	CIRCLIP RING INTERNAL,STEEL DIN 472 I130; SPRING STEEL, PHOSPHATED, HRC 44-49 (FA0472A1300)
3	048	2	PCS	BESRS041	Spherical Roller Bearing	SPHERICAL ROLLER BEARING, 22212-E1; d60/D110x28 (BESRS041)
3	049	1	PCS	BECTF086	Axial Roller Bearing Cylindrical	AXIAL CYLINDRICAL ROLLER BRNG, 81122-TV; d110/D160x38 (BECTF086)
3	050	2	PCS	BECRF014918	Cylindrical Roller Bearing	CYLINDRICAL ROLLER BEARING SL014918; d90/D125x35 (BECRF014918)
3	051	1	PCS	BECTF079	Axial Roller Bearing Cylindrical	AXIAL CYLINDRICAL ROLLER BRNG, 81118-TV; d90/D135x35 (BECTF079)
3	053	1	PCS	400203506	Ball Nut	BALL NUT R63-10T6-FSIDIN BP 2 (HIWIN)
3	054	4	PCS	FA0912G06016	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M6x16; FULLY THREADED (FA0912G06016)
3	055	8	PCS	FA0912G05012	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M5x12 (FA0912G05012)
3	056	8	PCS	FA0916G08012	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M8x12; CUP POINT (FA0916G08012)
3	057	1	PCS	FA0931G16120	Screw	HEX.HEAD SCREW A4-80, DIN 931 M16x120; THREAD LENGTH: 38mm (FA0931G16120)
3	058	8	PCS	FA0931G08090	Screw	HEX.HEAD SCREW A4-80, DIN 931 M8x90; THREAD LENGTH: 22mm (FA0931G08090)
3	059	1	PCS	FA0933E36080	Screw	HEX.HEAD SCREW 8.8 ELZN, DIN 933 M36x80; FULLY THREADED (FA0933E36080)
3	060	4	PCS	FA0933G24060	Screw	HEX.HEAD SCREW A4-80, DIN 933 M24x60; FULLY THREADED (FA0933G24060)

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Level	Pos	Qty	Unit	Aras ID	Name	Description
3	061	18	PCS	FA0933G24110	Screw	HEX.HEAD SCREW A4-80, DIN 933 M24x110; FULLY THREADED (FA0933G24110)
3	062	6	PCS	FA0933G16050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x50; FULLY THREADED (FA0933G16050)
3	063	12	PCS	FA0933G16055	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x55; FULLY THREADED (FA0933G16055)
3	064	28	PCS	FA0933G10020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x20; FULLY THREADED (FA0933G10020)
3	065	14	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)
3	066	3	PCS	FA0933G10030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x30; FULLY THREADED (FA0933G10030)
3	067	10	PCS	FA0933G10035	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x35; FULLY THREADED (FA0933G10035)
3	068	10	PCS	FA0933G06016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x16; FULLY THREADED (FA0933G06016)
3	069	40	PCS	FA0934G24	Nut	HEXAGON NUT, A4-80, DIN 934, M24 (FA0934G24)
3	070	7	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
3	071	5	PCS	FA0934G10	Nut	HEXAGON NUT, A4-80, DIN 934, M10 (FA0934G10)
3	072	8	PCS	FA0934G08	Nut	HEXAGON NUT, A4-80, DIN 934, M8 (FA0934G08)
3	073	1	PCS	FA25201Q36	Washer	NORD-LOCK WASHER, ELZN DIN 25201 M36; 36,6x58,5x4,6 (FA25201Q36)
3	074	44	PCS	FA0125G24	Washer	FLAT WASHER, A4, DIN 125 M24; Tykkelse h=4.0 d=25 (FA0125G24)
3	075	18	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
3	076	42	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	077	16	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
3	078	14	PCS	FA0125G06	Washer	FLAT WASHER, A4, DIN 125 M6; Tykkelse h=1.6 d=6.4 (FA0125G06)
3	079	2	PCS	SESRA118	Rotary Shaft Lip Seal	SEAL, BA-70-95-10, 95x95x10 (SESRA118)
3	080	3	PCS	SESRA061	Rotary Shaft Lip Seal	SEAL, 100x130x12, 130x130x12 (SESRA061)
3	081	1	PCS	SESRA053	Rotary Shaft Lip Seal	SEAL, 90x110x12, 110x110x12 (SESRA053)
3	082	1	PCS	SESRA026	Rotary Shaft Lip Seal	SEAL, 60x75x8, 75x75x8 (SESRA026)
3	083	1	PCS	SEORA092	O-Ring	O-RING, Ø82,14 x 3,53 (R4325), 82x82x4 (SEORA092)
3	084	8	PCS	GRMAX001S	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.5, A2 (GRMAX001S)
3	085	1	PCS	GRMAX003S	Grease Nipple	GREASE NIPPLE, 90°, M10x1.0, A2 (GRMAX003S)
3	086	1	PCS	GRMFX002	Grease Nipple	GREASE NIPPLE, STRAIGHT, M8x1.0, A2 (GRMFX002)
3	087	1	PCS	400092314	XXTEXTELECTRIC	Please refer to the Legacy BOM report
3	088	1	PCS	RH311907	CONNCTION BOX, L80 x B 75 x H55	CONNCTION BOX, L80 x B 75 x H55
3	089	1	PCS	RH409181	Shaft Coupling	CONNECTION BOX FOR LOAD CELL
3	091	1	PCS	COSEX084	Gasket	ANTI-CORR. TAPE, DENSO-50 MM x 10 M (COSEX084)
3	093	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	002	1	PCS	400180717	Bracket	WELDING/MACHINING
2	003	1	PCS	400180861	Bracket	WELDING/MACHINING
2	004	1	PCS	400181022	Frame	PCD900
3	001	1	PCS	400180946	Bracket	PCD900
3	002	3	PCS	400180969	Wire Rope Guide	PCD900
3	003	2	PCS	400180967	Wear Ring	D85 x 5 x 47.5
3	004	1	PCS	400180995	Bolt	D75 x 178
3	005	2	PCS	400181019	Plate	T10 / D100 x d18
3	006	4	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
3	007	2	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
3	008	4	PCS	FA0933G20045	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x45; FULLY THREADED (FA0933G20045)
3	009	2	PCS	FA0933G16035	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x35; FULLY THREADED (FA0933G16035)
3	010	12	PCS	FA7991G08020	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M8x20 (FA7991G08020)
3	011	1	PCS	GRMFX004	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.0, A4 (GRMFX004)
2	005	1	PCS	400181045	Frame	PCD900
3	001	1	PCS	400181036	Bracket	PCD900
3	002	3	PCS	400180969	Wire Rope Guide	PCD900

Level	Pos	Qty	Unit	Aras ID	Name	Description
3	003	2	PCS	400181019	Plate	T10 / D100 x d18
3	004	2	PCS	400180967	Wear Ring	D85 x 5 x 47.5
3	005	1	PCS	400180995	Bolt	D75 x 178
3	006	6	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
3	007	2	PCS	FA0933G16035	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x35; FULLY THREADED (FA0933G16035)
3	008	4	PCS	FA0933G16040	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x40; FULLY THREADED (FA0933G16040)
3	009	12	PCS	FA7991G08020	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M8x20 (FA7991G08020)
3	010	1	PCS	GRMFX004	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.0, A4 (GRMFX004)
2	006	1	PCS	400177707	Cylinder Assembly	SWC HYDRAULIC CYLINDER, S=1150mm
3	001	1	PCS	400177698	Cylinder Assembly	M155 x 3 / d135
3	002	1	PCS	RH318657	Stuffing Box	STUFFING BOX FOR CYLINDER SWC-5000; MACHINING, Ø148x187
3	003	1	PCS	RH318602	Plate	ROD BLOCKER, D110/d32x25, MACHINING
3	004	1	PCS	400177706	Piston Rod	D90x1498
3	005	1	PCS	RH310970	Assembly Plate	TERMINALS CONECTION PLATE, ASSEMBLY; M155x3
3	006	1	PCS	BESPS002	Radial Spherical Plain Bearing	RADIAL SPHERICAL PLAIN BNG, GE 40 UK-2RS; d40/D62x28 (BESPS002)
3	007	1	PCS	BESPS100	Radial Spherical Plain Bearing	ROD END, GAR-40-UK-2RS; d40x28 - M39x3 (BESPS100)
3	008	1	PCS	FA0472E0620	Circlip	CIRCLIP RING INTERNAL, ELZN DIN 472 I62; SPRING STEEL, PHOSPHATED, HRC 44-49 (FA0472E0620)
3	009	1	PCS	FA0985E30	Nut	NUT NYLOCK HEXAGON, 8 ELZN, DIN 985 M30 (FA0985E30)
3	010	1	PCS	GRMXX002	Grease Nipple	GREASE NIPPLE, M8x1,0 STRAIGHT, A4 (GRMXX002)
3	011	1	PCS	SEDWA014	Hydraulic Seal rod	DIRT-WIPER AS-90-100-7/10, 100x100x10 (SEDWA014)
3	012	1	PCS	SEPRA015	Hydraulic Seal rod	PISTON ROD SEAL AUN-90-107, SIMRIT, 110x110x12 (SEPRA015)
3	013	1	PCS	SEORA1375	O-Ring	O-RING, Ø120,00 x 7,00 (R8475), 120x120x7 (SEORA1375)
3	014	1	PCS	FCPPF050	Plug	HEXAGON SOCKET PLUG, DIN 908, A4, G1/4"; DIN 908 (ISO 228) (FCPPF050)
2	007	1	PCS	400181046	Sheave Assembly	LEV-SWC
3	001	1	PCS	RH318610	Sheave House	SHEAVE FRAME, SWC-5000, MACHINING; MACHINING, SWC, SHAFT Ø120
3	002	4	PCS	RH318591	ROLLER UNIT (D100), SWC-5000, ASSEMBLY	ROLLER UNIT (D100), SWC-5000, ASSEMBLY
4	010	1	PCS	RH318593	Frame	ROLLER UNIT FRAME, D100, SWC-5000; MACHINING, Ø100
4	020	2	PCS	RH31859205	Locking Plate	LOCKING PLATE, T30, MACHINING; MACHINING, 130x130x25
4	030	2	PCS	RH31859206	Hub	BOSS, D40/d22, MACHINING
4	040	2	PCS	RH31859207	Locking Plate	LOCKING PLATE, T25, MACHINING; MACHINING, 130x130x22
4	050	2	PCS	RH31859208	Drive Shaft	SHAFT, D31xL225, MACHINING; MACHINING, Ø31/Ø225 (Ø25)
4	060	2	PCS	RH31859210	Wire Rope Roller	ROLLER, D108x120, MACHINING
4	070	4	PCS	RH31859211	Wear Ring	WEAR RING, D32/d25x10, MACHINING
4	080	4	PCS	RH31859212	Wear Ring	WEAR RING, D52/d48 x 4, MACHINING
4	090	4	PCS	BETRS003	Taper Roller Bearing	TAPERED ROLLER BEARING, 30205; d25/D52x16,25 (BETRS003)
4	100	4	PCS	SESRA0085	Rotary Shaft Lip Seal	SEAL, BA-32-52-7 W/DUST LIP, 52x52x7 (SESRA0085)
4	110	4	PCS	BELWS005	Washer	LOCKING WASHER, MB-5; MB-5 (BELWS005)
4	120	4	PCS	BELNS005	Locking Nut	LOCK NUT, KM-5; M25x1,5 (BELNS005)
4	130	4	PCS	FA0472F0520	Circlip	CIRCLIP RING INTERNAL, A2 DIN 472 I52; STAINLESS (material x40Cr13) (FA0472F0520)
4	140	16	PCS	FA0933G12025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x25; FULLY THREADED (FA0933G12025)
4	150	16	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
4	160	4	PCS	FA0933G16035	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x35; FULLY THREADED (FA0933G16035)
4	170	4	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
4	180	2	PCS	GRMAX003S	Grease Nipple	GREASE NIPPLE, 90°, M10x1.0, A2 (GRMAX003S)
4	190	2	PCS	FA0934G20	Nut	HEXAGON NUT, A4-80, DIN 934, M20 (FA0934G20)
4	200	4	PCS	FA0916G06008	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M6x8; CUP POINT (FA0916G06008)
3	003	1	PCS	FA0471F1000	Circlip	CIRCLIP RING EXTERNAL, A2 DIN 471 A100; STAINLESS (material x40Cr13) (FA0471F1000)
3	004	1	PCS	GRMXX003	Grease Nipple	GREASE NIPPLE, M10x1,5 STRAIGHT, A4 (GRMXX003)

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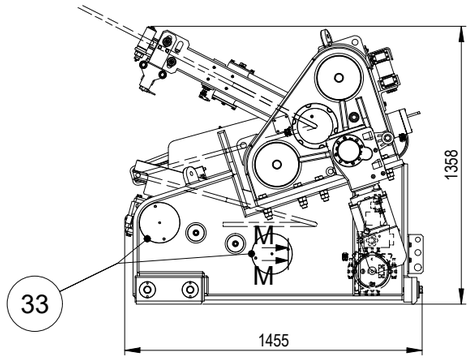
Level	Pos	Qty	Unit	Aras ID	Name	Description
2	008	1	PCS	400181047	Bracket	SWC Cylinder
2	009	1	PCS	400181050	Guide Support	LEV-SWC
2	010	1	PCS	400181060	Guide Support	80 x 40, L = 744
2	011	2	PCS	400181063	Guide Shaft	D100 x 3066
2	012	1	PCS	400197306	Bracket	SWC Cylinder
2	015	2	PCS	400181066	Wear Ring	D105 x 2.5 x 75
2	016	1	PCS	400181070	Bracket	M18 Sensor
2	017	1	PCS	400181069	Bracket	M18 Sensor
2	018	2	PCS	RH31860302	Bracket	INDICATOR BRACKET, T3/40x259, BENDING
2	019	1	PCS	RH318668	Cover	SHEAVE COVER, SWC-5000, MACHINING; MACHINING, SHEAVE, PCD900
2	020	8	PCS	RH312860	Locking Plate	LOCKING WASHER, D80/d50/d22x44; MACHINING
2	021	4	PCS	RH318171	Bracket	GROUND BRACKET, 2xD50 / T=25, MACHINING
2	022	4	PCS	RH318600	Bearing Plain	LINING, D115/d100x23, MACHINING
2	023	2	PCS	RH318666	Locking Bolt	LOCKING BOLT, D40, MACHINING
2	024	2	PCS	RH31450805	Locking Plate	LOCK DISC, D66/d22x=4, MACHINING
2	025	4	PCS	RH31860301	Bearing Plain	LINING, D55/d40x38, MACHINING
2	026	1	PCS	RH319297	FLAG, LEV05000, MACHINING	FLAG, LEV05000, MACHINING
2	027	1	PCS	RH31856404	FLAG SUPPORT, LEV05000, MACHINING	FLAG SUPPORT, LEV05000, MACHINING
2	028	1	PCS	RH411045	Bracket	Valve Bracket, WELDING
2				400182378	Electrical Winch Assembly	Electrical system SlackWire/Levelwind Mbari S9V1, Levelwind
3	001	1	PCS	400091476	Cabinet Basic	KLIPPON POK 162609 EX
3	002	1	PCS	400091488	Mounting Rail	TS35X7.5 ST POK 1626
3	003	2	PCS	400091997	Terminal	ZAP /TW (for ZDK 2,5) END COVER
3	004	8	PCS	EACCA096	Prefabricated Cable	V1-WV4A-10M-PUR-ABG0, 10M PUR M12 90* (EACCA096)
3	005	4	PCS	EACIN0203	Inductive Sensor	E2A-M18KS08-M1-B2, PNP/NC M12 PLUG; To be used with cable w/plug EACCA096 (EACIN0203)
3	006	2	PCS	EACIN022	Inductive Sensor	INDUCTIV PICK IMR-0802-BPSTC0S-PNP/NO (EACIN022)
3	007	10	PCS	EACPG270	Cable Gland	SKINTOP MS-M 12X1,5 (ØF 3-7MM) (EACPG270)
3	008	10	PCS	EACPG280	Cable Gland	SM-M 12X1,5 SKINDICHT BRASS (EACPG280)
3	009	2	PCS	EACPL0011	Prefabricated Cable	EL.PLUG W/KABEL 5 METER, 3P+PE BELDEN (EACPL0011)
3	010	1	PCS	EACPL007	Electronic Card	DIODE-ADAPTER A07C4-2-24VDC; ADAPTER (EACPL007)
3	011	4	PCS	EACPL0202-2	Terminal	AEB 353SC/1 End Bracket (EACPL0202-2)
3	012	1	PCS	EACPL02025	Terminal	TERMINAL GROUNDING, ZPE 2,5 WEIDMULLER (EACPL02025)
3	013	1	PCS	EACPL02026	Terminal	TERMINAL GROUNDING, ZPE 6 WEIDMULLER (EACPL02026)
3	014	19	PCS	EACPL02055	Terminal	TERMINAL DOUBLE, ZDK 2,5 WEIDMULLER (EACPL02055)
3	015	1	PCS	EACPL02056	Terminal	ZDK 2,5 PE Weidmuller (EACPL02056)
3	016	3	PCS	EACPL021401	Terminal	TERMINAL ZDU 2,5 AN (2 HOLES) WEIDMULLER (EACPL021401)
3	017	1	PCS	EACPL02144	Terminal	TW1 (FOR ZDU 2,5) END COVER (EACPL02144)
3	018	1	PCS	EACPL02152	Terminal	ZAP /TW 5 (FOR ZDU 6) END COVER (EACPL02152)
3	019	1	PCS	EACPO015	Wire Strain Gauge	STRING POT, SR1M-125 3175MM 4-20/20-4 MA; String potentiometer transducer (EACPO015)
3	031	1	PCS	400181473	Protection	T30 / D155 x d103
3	033	2	PCS	400181474	Protection Cover	SEALING COVER D200, ASSEMBLY
3	001	1	PCS	400181475	Protection Cover	SEALING COVER D200
3	002	2	PCS	FA0933G06020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x20; FULLY THREADED (FA0933G06020)
3	003	1	PCS	FA0933G05006	Screw	HEX.HEAD SCREW A4-80, DIN 933 M5x6; FULLY THREADED (FA0933G05006)
3	004	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	034	4	PCS	FA0125G05	Washer	FLAT WASHER, A4, DIN 125 M5; Tykkelse h=1.0 d=5.3 (FA0125G05)
2	035	3	PCS	FA0125G06	Washer	FLAT WASHER, A4, DIN 125 M6; Tykkelse h=1.6 d=6.4 (FA0125G06)
2	036	15	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)

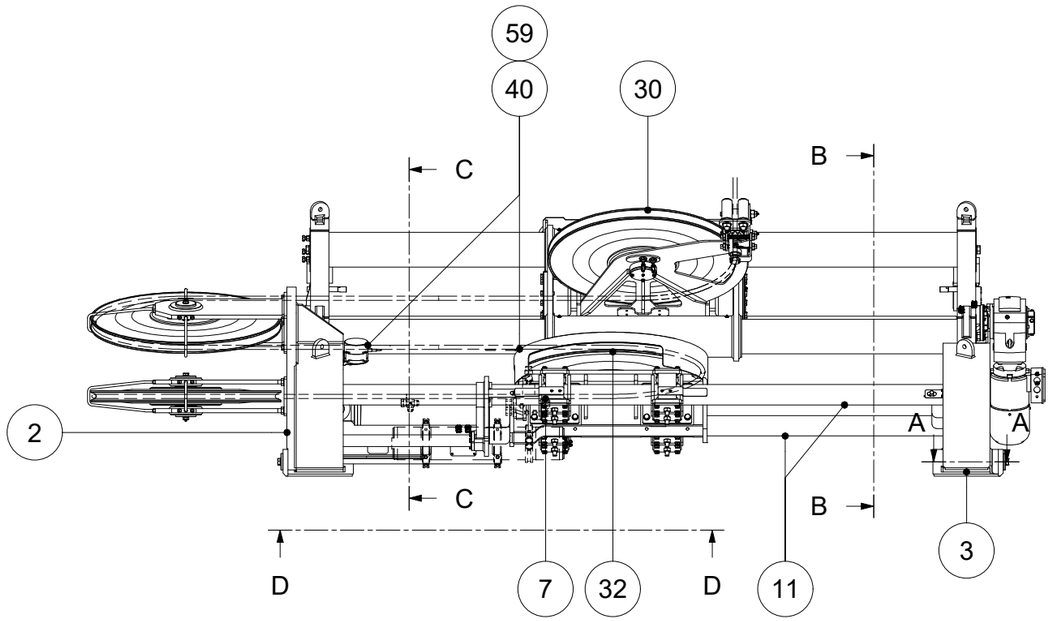
TITLE_BOM

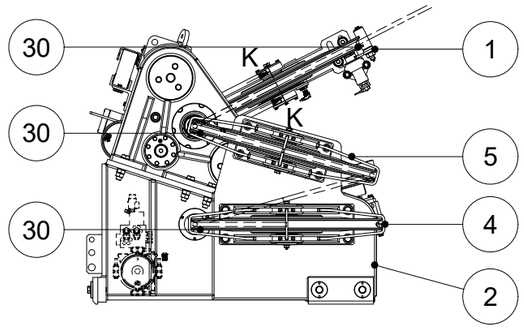
Level	Pos	Qty	Unit	Aras ID	Name	Description
2	037	58	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
2	038	8	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
2	039	12	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
2	040	1	PCS	FA0912G03010	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M3x10; FULLY THREADED (FA0912G03010)
2	041	4	PCS	FA0933G05010	Screw	HEX.HEAD SCREW A4-80, DIN 933 M5x10; FULLY THREADED (FA0933G05010)
2	042	6	PCS	FA0933G06010	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x10; FULLY THREADED (FA0933G06010)
2	043	3	PCS	FA0933G06016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x16; FULLY THREADED (FA0933G06016)
2	044	1	PCS	FA0933G08016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x16; FULLY THREADED (FA0933G08016)
2	045	4	PCS	FA0933G08025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x25; FULLY THREADED (FA0933G08025)
2	046	5	PCS	FA0933G08030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x30; FULLY THREADED (FA0933G08030)
2	047	4	PCS	FA0933G12025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x25; FULLY THREADED (FA0933G12025)
2	048	8	PCS	FA0933G12030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x30; FULLY THREADED (FA0933G12030)
2	049	6	PCS	FA0933G12045	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x45; FULLY THREADED (FA0933G12045)
2	050	36	PCS	FA0933G12055	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x55; FULLY THREADED (FA0933G12055)
2	051	4	PCS	FA0933G16045	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x45; FULLY THREADED (FA0933G16045)
2	052	4	PCS	FA0933G20050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x50; FULLY THREADED (FA0933G20050)
2	053	8	PCS	FA0933G20080	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x80; FULLY THREADED (FA0933G20080)
2	054	5	PCS	FA0934G08	Nut	HEXAGON NUT, A4-80, DIN 934, M8 (FA0934G08)
2	055	10	PCS	FA0934G12	Nut	HEXAGON NUT, A4-80, DIN 934, M12 (FA0934G12)
2	056	4	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
2	057	2	PCS	FA0934G20	Nut	HEXAGON NUT, A4-80, DIN 934, M20 (FA0934G20)
2	058	8	PCS	FA7991G05020	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M5x20 (FA7991G05020)
2	059	1	PCS	EACPO015	Wire Strain Gauge	STRING POT, SR1M-125 3175MM 4-20/20-4 MA; String potentiometer transducer (EACPO015)
2	061	4	PCS	CPXXAND125	Buffer	RUBBER BUFFER STOP, TYPE AND, D125 1XM16; TYPE AND (CPXXAND125)
2	063	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	066	1	PCS	400197410	Plate	T6 / 125 x 190
2				RHHSWC-E	Load Control Valve Assembly	HYD. SYST. F. SLACKW. COMP. (RHHSWC-E)
3	010	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
3	020	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
3	030	1	PCS	HH4CS002	Hydraulic Hose	HP-HOSE 109516,S421x2 ,L=0,5M,350BAR (HH4CS002)
3	040	1	PCS	FTCBF022	Hydraulic Fittings	TRIP.LOK F42X-SS 25 -1 1/4" BSPP-CONN.; 16-20F42EDMXSS (FTCBF022)
3	050	1	PCS	FTUEF006	Hydraulic Fittings	TRIP.LOK ETX-SS 25 UNION ELBOW (FTUEF006)
3	060	1	PCS	FTUNF006	Hydraulic Fittings	TRIP.LOK HTX-SS 25 UNION; 16HMTXSS (FTUNF006)
3	070	2	PCS	FTNUF006	Hydraulic Fittings	TRIP.LOK BTX-SS 25 NUT; 16 BTX-SS (FTNUF006)
3	080	2	PCS	FTMSF009	Hydraulic Fittings	TRIP.LOK TX-SS 25 SLEEVE METRIC; TXSS25 (FTMSF009)
3	090	1	PCS	EACPT008	Pressure Sensor	MBS3050-3411-1GB04 0-250 Bar; Pressure Transmitter 250 bar (EACPT008)
3	100	1	PCS	RHHRRRV2002501S	Pressure Reducing Valve	PRESS. RED.VALVE RV. 200 LPM ø25PH SS (RHHRRRV2002501S)
4	010	1	PCS	RHHBSLO010	Valve Assembly	VALVEBL.PRESS.RED.W/REL.NG30 24V,0.8Amet (RHHBSLO010)
4	020	1	PCS	HGMAS002	Hydraulic Pressure Test Nipple	TEST POINT 2703-01-18-10(312-01-04R) SS; TESTNIPPEL (HGMAS002)
4	030	1	PCS	FTCBF031	Hydraulic Fittings	TRIP.LOK C40X-SS 12 -1/4" BSPP-ELB.C.; 8-4C4OMXSS (FTCBF031)
4	040	1	PCS	FTCBF007	Hydraulic Fittings	TRIP.LOK F42X-SS 12-1/4" BSPP-CONNECTOR; 8-4F42EDMXSS (FTCBF007)
4	050	4	PCS	SEBOB002	Bonded Seal	BONDED SEAL, PP 45-B, 1/4" R/BSP, A4, 21x21x4 (SEBOB002)
4	060	1	PCS	FTUEF011	Hydraulic Fittings	TRIP.LOK C6X-SS 12 SWIVEL NUT ELBOW; 8C6MXSS (FTUEF011)
4	070	1	PCS	FTCBF011	Hydraulic Fittings	TRIP.LOK F42X-SS 15/16-3/8" BSPP-CONN.; 10-6F42EDMXSS (FTCBF011)
4	080	1	PCS	SEBOB003	Bonded Seal	BONDED SEAL, PP 45-C, 3/8" R/BSP, A4, 24x24x4 (SEBOB003)
4	090	1	PCS	FTNUF004	Hydraulic Fittings	TRIP.LOK BTX-SS 15/16 NUT; 10 BTX-SS (FTNUF004)
4	100	1	PCS	FTMSF005	Hydraulic Fittings	TRIP.LOK TX-SS 15 SLEEVE METRIC; TXSS15 (FTMSF005)
4	110	3	PCS	FTCBF022	Hydraulic Fittings	TRIP.LOK F42X-SS 25 -1 1/4" BSPP-CONN.; 16-20F42EDMXSS (FTCBF022)

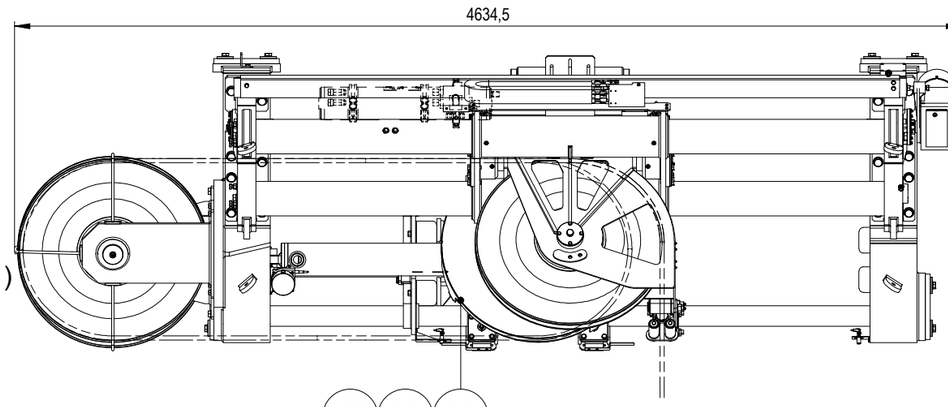
TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
4	120	3	PCS	SEBOB008	Bonded Seal	BONDED SEAL, PP 45-K, 1 1/4" R/BSP, A4, 52x52x3 (SEBOB008)
4	130	3	PCS	FTNUF006	Hydraulic Fittings	TRIP.LOK BTX-SS 25 NUT; 16 BTX-SS (FTNUF006)
4	140	3	PCS	FTMSF009	Hydraulic Fittings	TRIP.LOK TX-SS 25 SLEEVE METRIC; TXSS25 (FTMSF009)
3	110	1	PCS	RH411045	Bracket	Valve Bracket, WELDING
3	120	6	PCS	FA0933G08025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x25; FULLY THREADED (FA0933G08025)
3	130	1	PCS	RH606985	Hydraulic Accumulator	EHP2-C-0100-250-140-AKAFAAP00 W/CLAMPS
4	010	1	PCS	HVAOT060	Hydraulic Accumulator	ACCUMULATOR EHP2AKAFAAP00; Piston accumulator (HVAOT060)
4	020	2	PCS	HVAOT0704	Hydraulic Accumulator	FASTN.CLAMPS F.HVAOT060, 070,(ø168-172) (HVAOT0704)
3	140	1	PCS	FCSJF190	Hydraulic Adapter	ADAPTER, RI (1 1/2"-1")BSP AISI (FCSJF190)
3	150	1	PCS	FTCBF021	Hydraulic Fittings	TRIP.LOK F42X-SS 25 -1"BSPP-CONNECTOR; 16F42EDMXSS (FTCBF021)
3	160	1	PCS	RH411046	Bracket	ACCUMULATOR BRACKET, MACHINING
3	170	2	PCS	FA0933G10030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x30; FULLY THREADED (FA0933G10030)
3	180	3	PCS	RH606962S	Ball Valve	BALLVALVE BKH R 1 1123 W SWIVEL 25 PHSS
4	010	1	PCS	400192711	Ball Valve	Ball valve Stainless Steel ,1", BKH-DN25-G1 MHA Zentgraf (27673)
4	020	2	PCS	FTSBF011	Hydraulic Fittings	TRIP.LOK F64X-SS 25-1" BSPP.JIC.SWIVEL; 16F64OMXSS (FTSBF011)
4	030	2	PCS	SEBOB007	Bonded Seal	BONDED SEAL, PP 45-H, 1" R/BSP, A4, 43x43x3 (SEBOB007)
3	190	2	PCS	FTUTF006	Hydraulic Fittings	TRIP.LOK JTX-SS 25 UNION TEE; 16JMTXSS (FTUTF006)
3	200	3	PCS	FTUTF019	Hydraulic Fittings	TRIP.LOK R6X-SS 25 SWIVEL NUT RUN TEE; 16 R6X-SS (FTUTF019)
3	210	4	PCS	FTNUF006	Hydraulic Fittings	TRIP.LOK BTX-SS 25 NUT; 16 BTX-SS (FTNUF006)
3	220	4	PCS	FTMSF009	Hydraulic Fittings	TRIP.LOK TX-SS 25 SLEEVE METRIC; TXSS25 (FTMSF009)
3	230	4	PCS	FTUEF015	Hydraulic Fittings	TRIP.LOK C6X-SS 25 SWIVEL NUT ELBOW; 16C6MXSS (FTUEF015)
3	240	3	M	TPPIF020	Pipe Clamp	HYDR. PIPE, Ø25X2.5 SEAML. AISI-316; Ø25X2.5 SEAMLESS ACID PROOF AISI-316 (TPPIF020)
3	250	1	PCS	FTBNF004	Hydraulic Fittings	TRIP.LOK FNTX-SS 15/16 BLIND NUT (FTBNF004)
3	260	2	PCS	FTBNF006	Hydraulic Fittings	TRIP.LOK FNTX-SS 25 BLIND NUT (FTBNF006)









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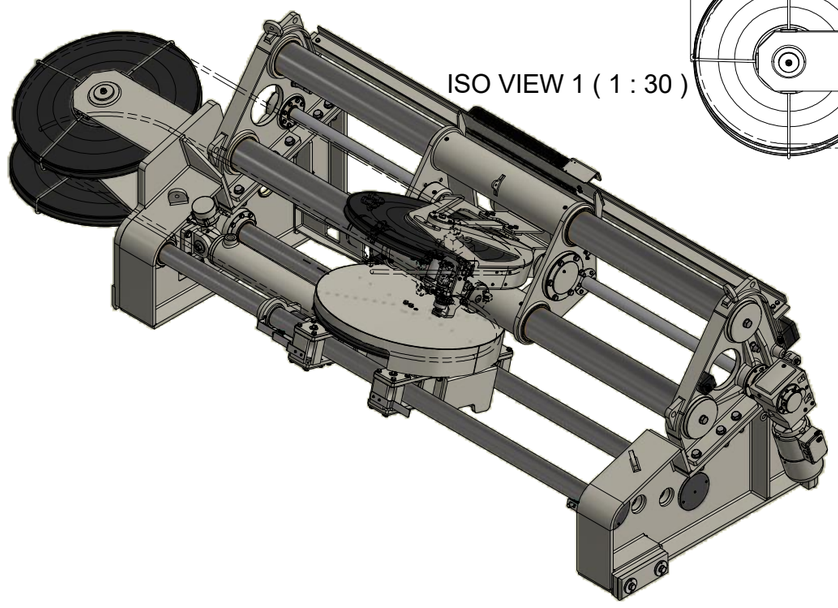

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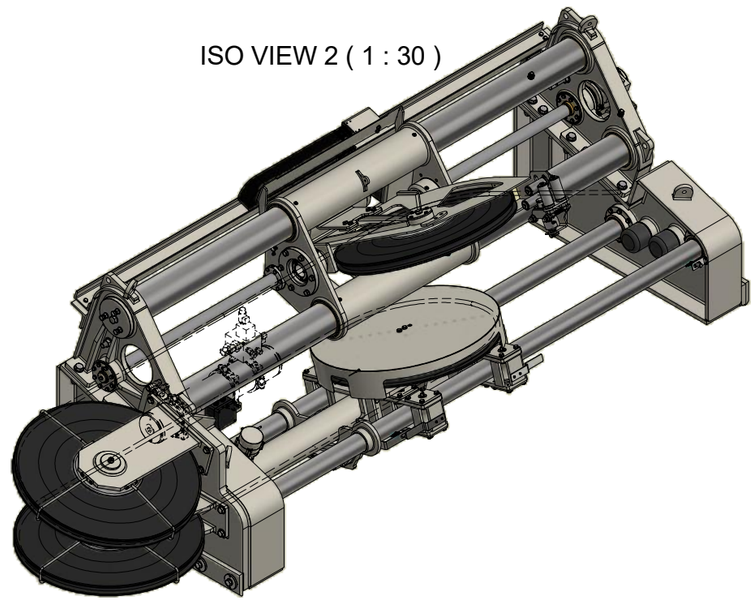

TIGHTENING TORQUE - ACC. DOC. #6402

***MCG SIGNS (Not shown on Drawing)**
***POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT**
***LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH**
***LOCTITE 638 - FOR BONDING OF CYLINDRICAL FITTING PARTS (GAP APROX. 0,25mm)**

62 63 64 65

Designed by	Date	Modified by	ECO / CO			
P Pantovic	27.12.2021	M Stojkovic	ECO-2057498			

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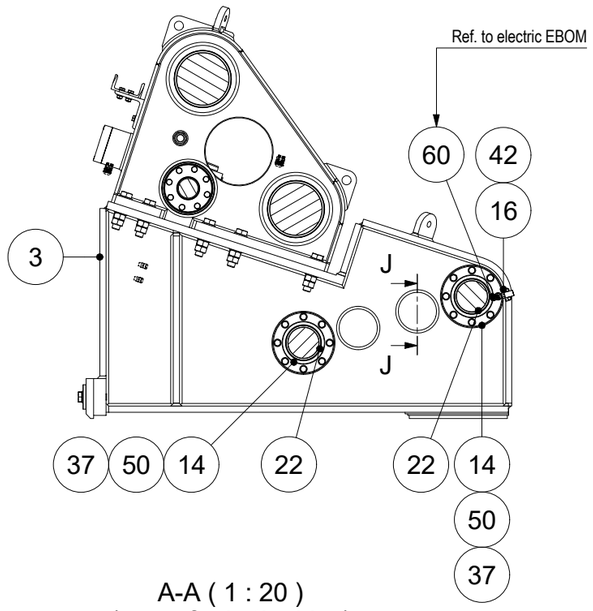
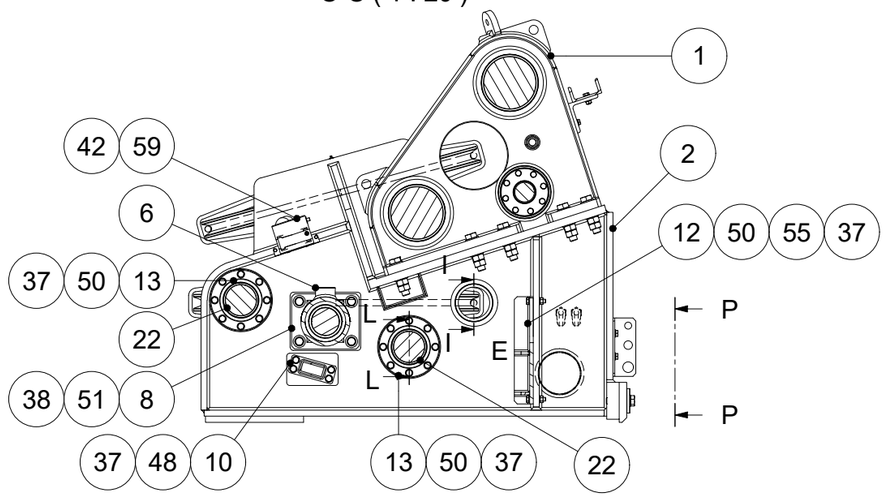
Name	Weight
ASSEMBLY	4544 kg
Description	Scale (A3)
LEV. WITH SLACK WIRE, LSWC5000/01L1	1 : 30
Document ID 2000004320	Revision C / Sheet 1 / 2

B-B (1 : 20)



C-C (1 : 20)



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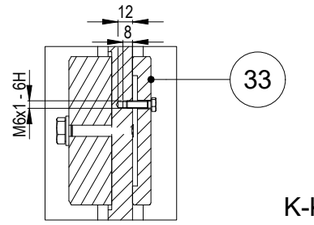

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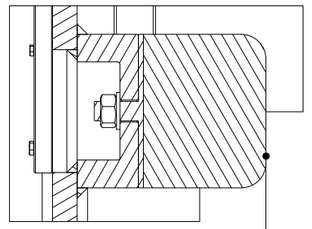

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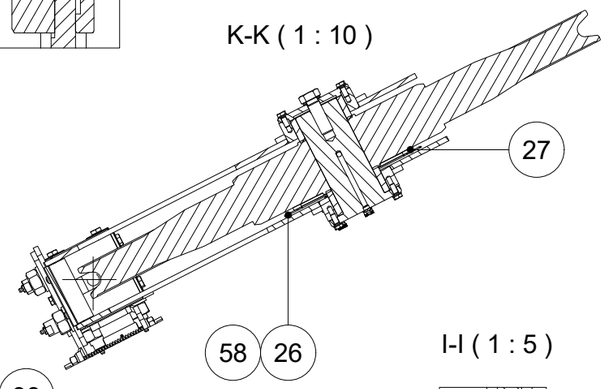
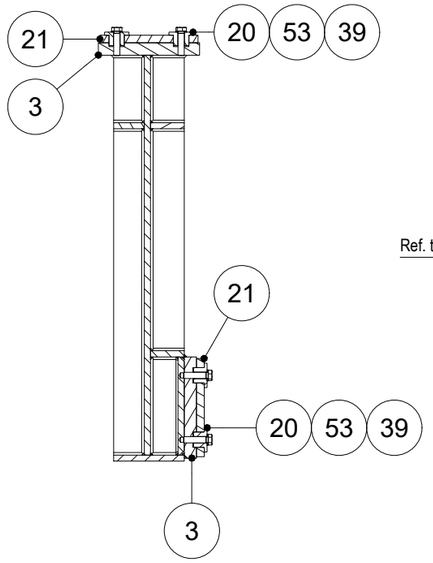


61 56 38

Same for both sheaves

A-A (1 : 20)
(same for both sides)



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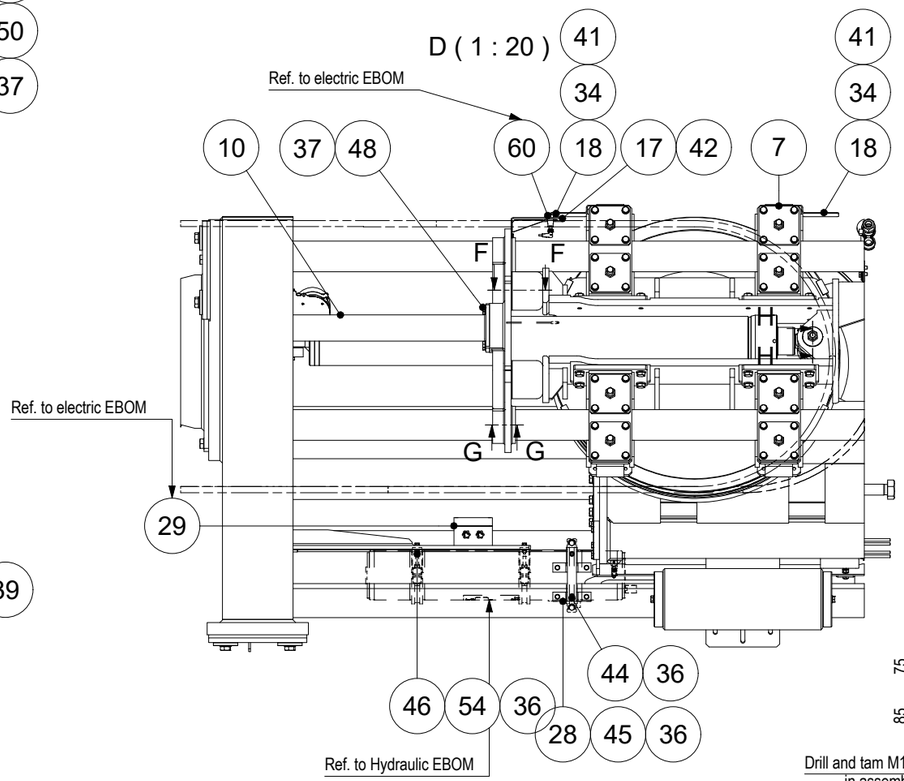

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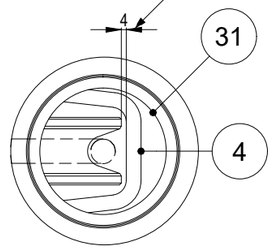

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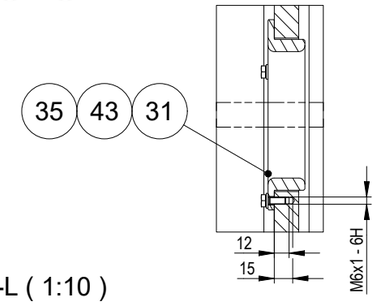

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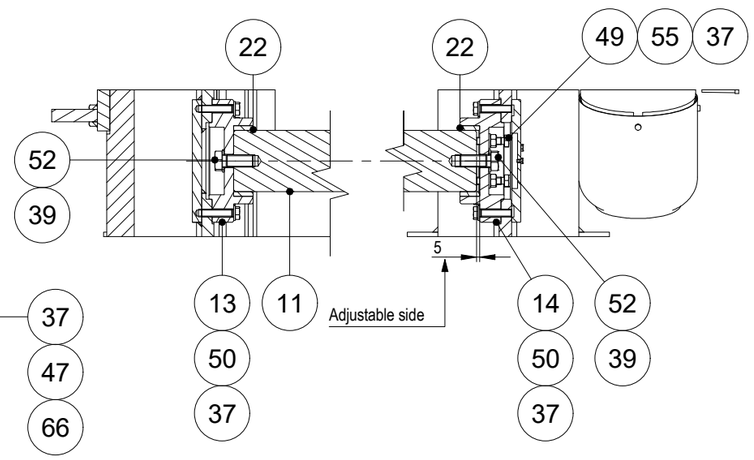

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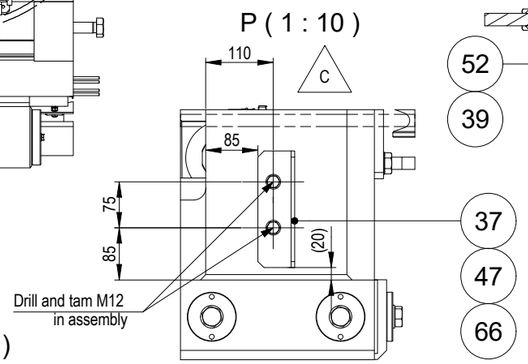

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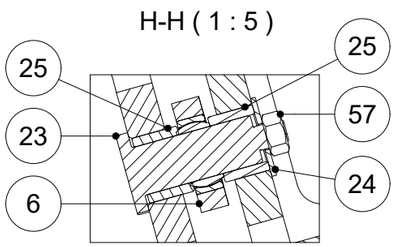

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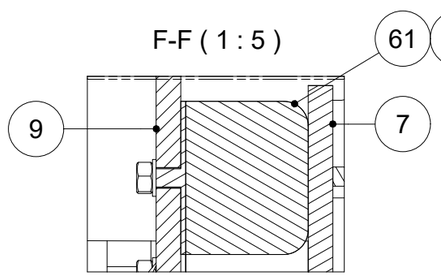

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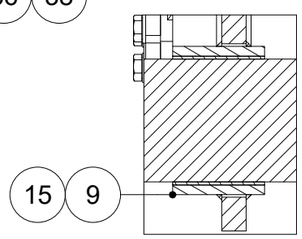

Designed by	Date	Modified by	ECO / CO			
P Pantovic	12/27/2021	M Stojkovic	ECO-2057498			

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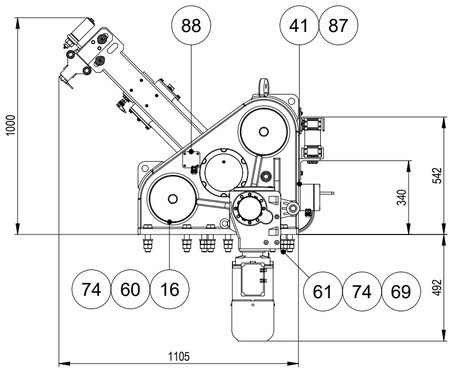
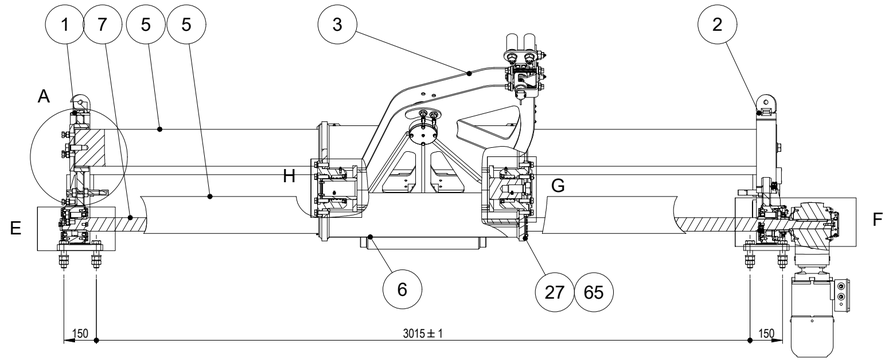
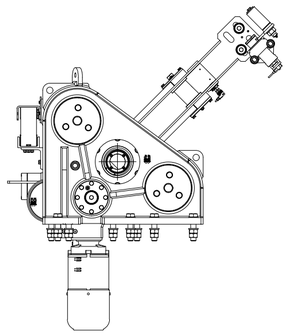
Name	Weight
ASSEMBLY	4544 kg
Description	Scale (A3)
LEV. WITH SLACK WIRE, LSWC5000/01L1	1 : 20
Document ID: 2000004320	Revision: C / Sheet: 2 / 2

Sheet Purpose:

ASSEMBLY

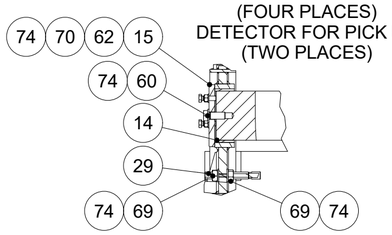


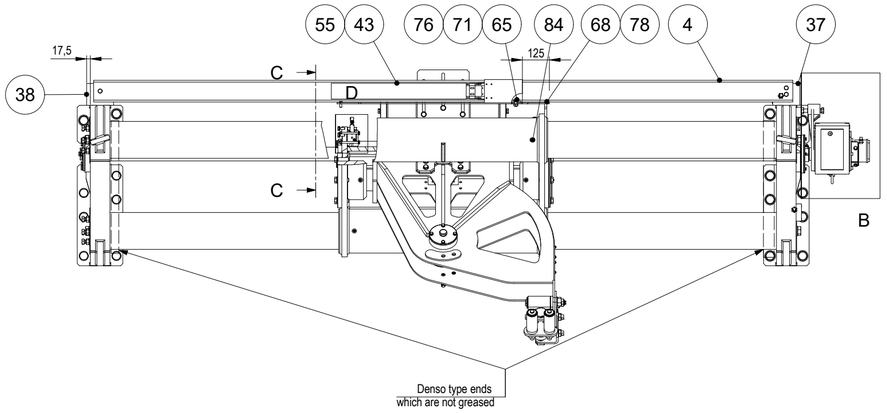


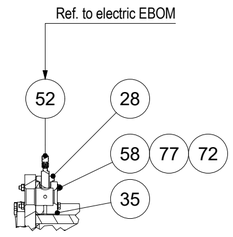


B (1 : 10)

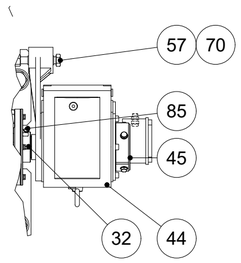
A (1 : 15)
END GUIDE SHAFT
(FOUR PLACES)
DETECTOR FOR PICK UP
(TWO PLACES)



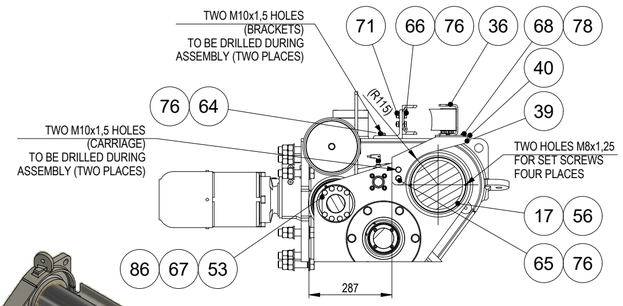




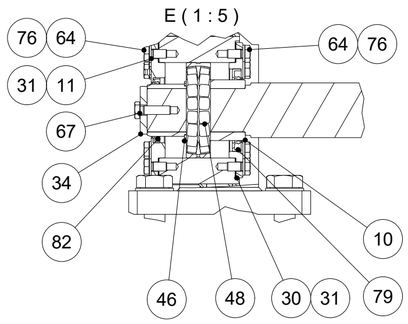
D (1 : 10)
TWO PLACES



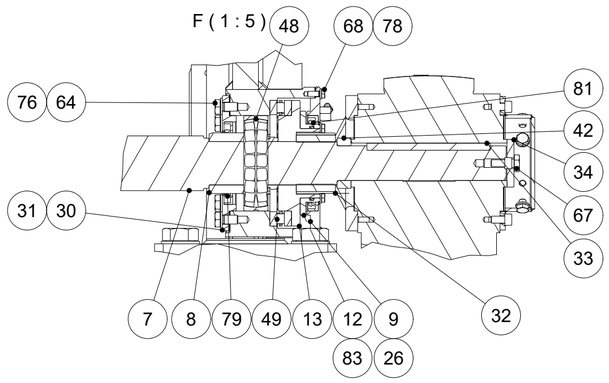
C-C (1 : 15)

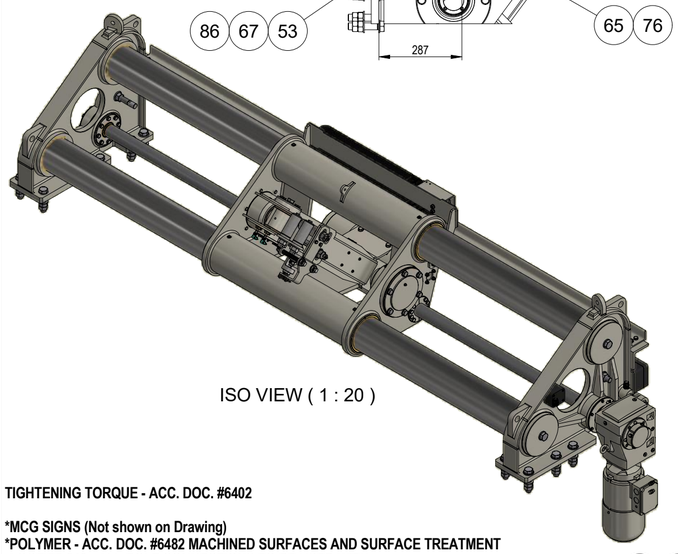


E (1 : 5)



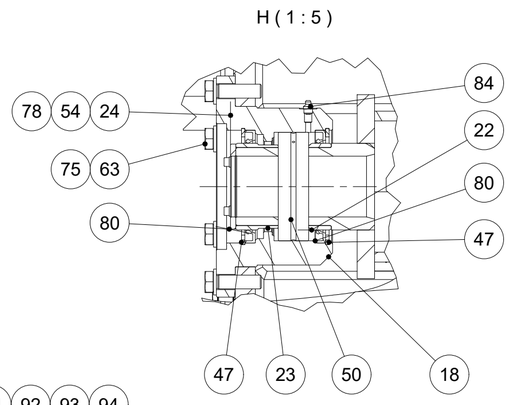
F (1 : 5)



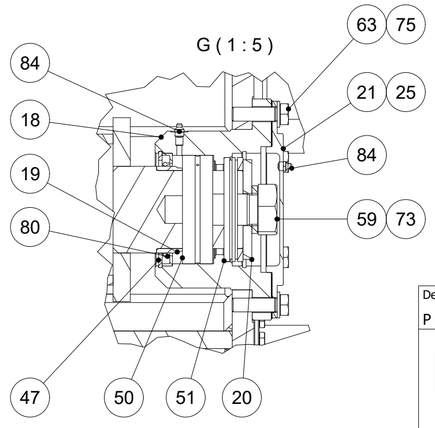


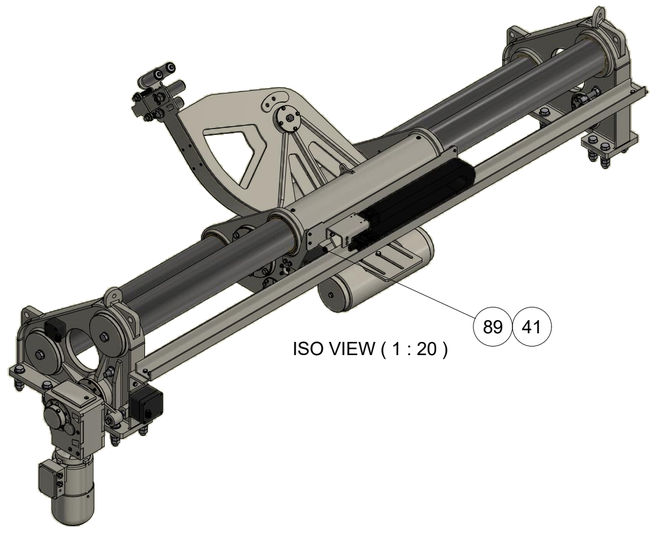
ISO VIEW (1 : 20)

H (1 : 5)



G (1 : 5)





ISO VIEW (1 : 20)

TIGHTENING TORQUE - ACC. DOC. #6402

***MCG SIGNS (Not shown on Drawing)**
***POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT**
***LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH**
***LOCTITE 638 - FOR BONDING OF CYLINDRICAL FITTING PARTS (GAP APROX. 0,25mm)**
***DENSO TAPE - TO BE APPLIED AT NOT PAINTED SURFACES**

90 91 92 93 94

Designed by	Date	Modified by	ECO / CO			
P Pantovic	16.12.2021.	A Karaic	ECO-2057843			

MACGREGOR

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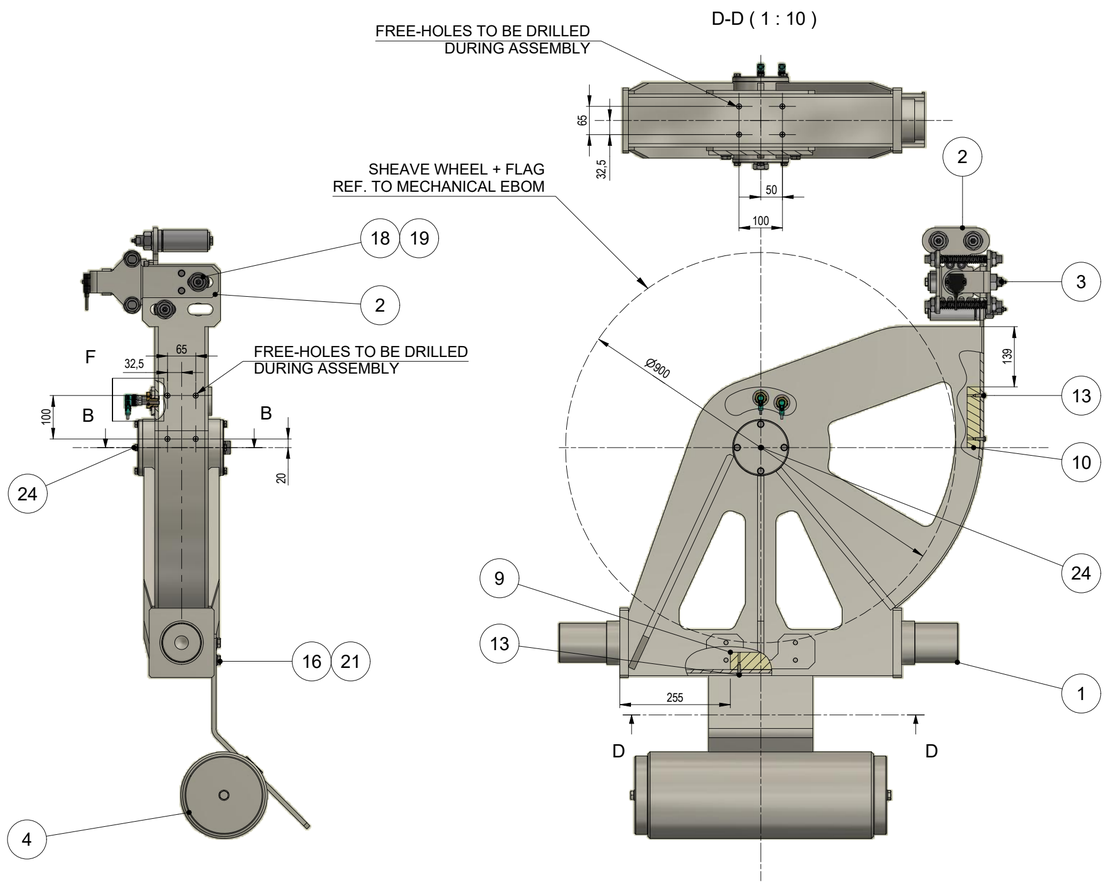
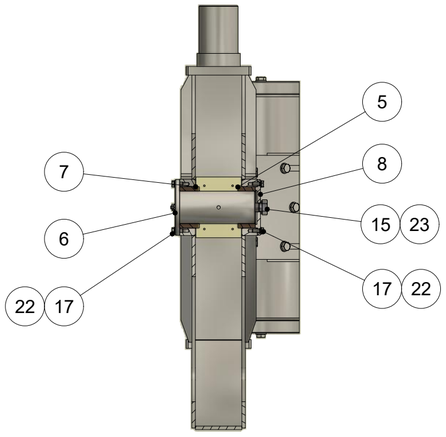
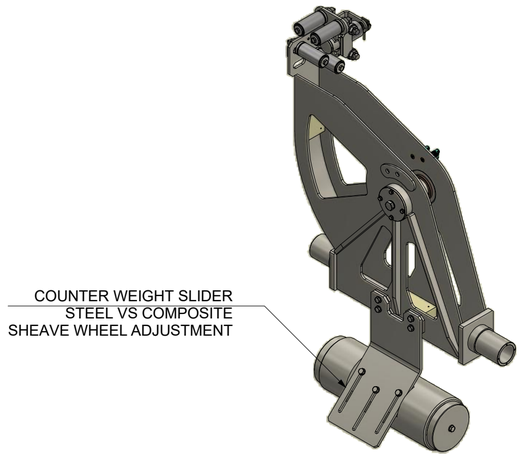
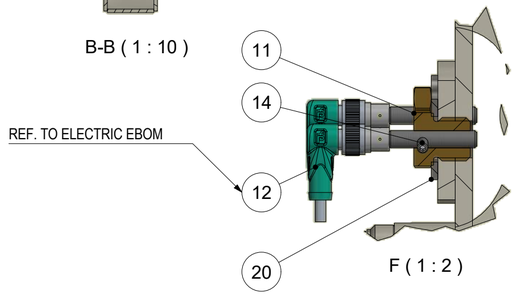
Name	Weight (kg)
Level Wind	2182
Description	Scale (A2)
LEV-5000E/900-L2000, L	1 : 20
Document ID	Revision / Sheet
2000004088	B / 1 / 1

LEFT

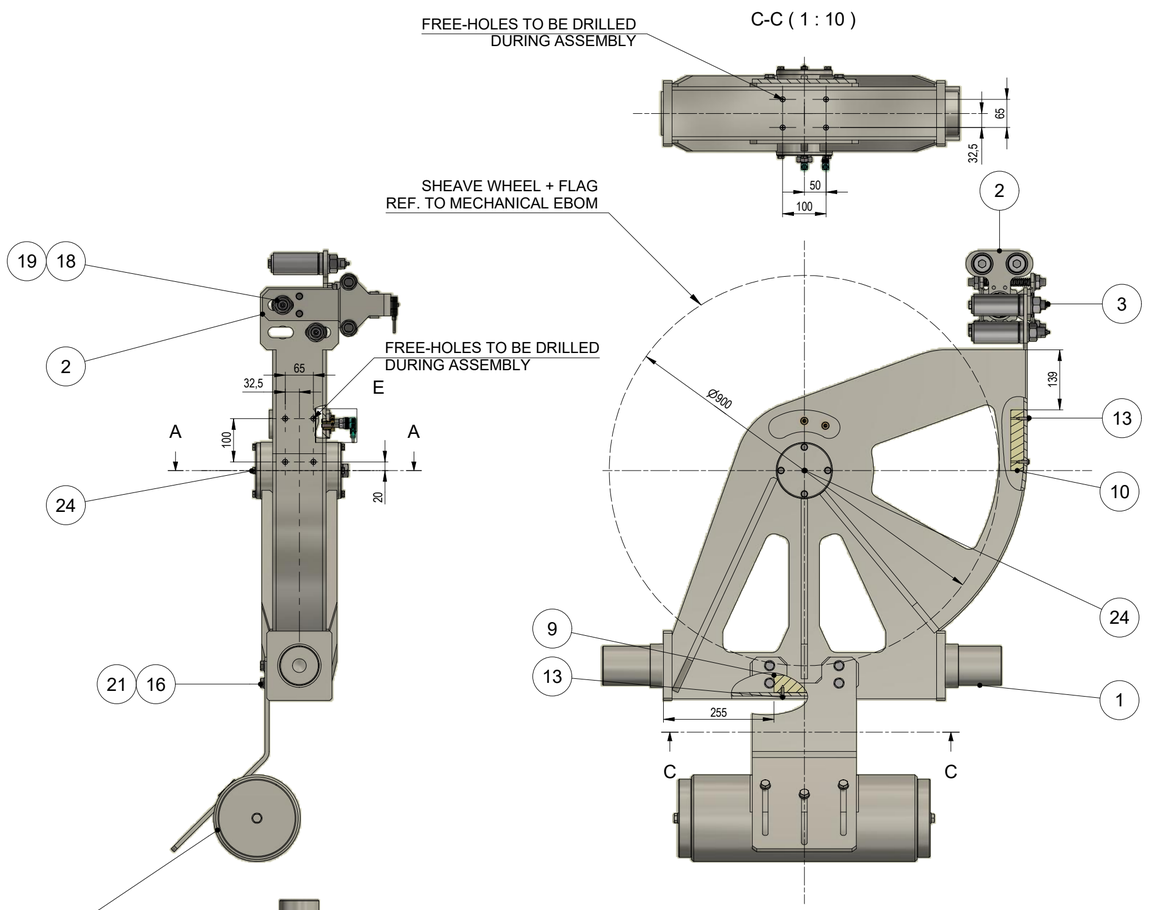


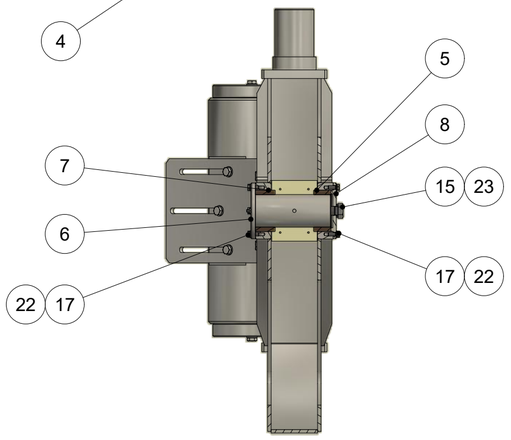


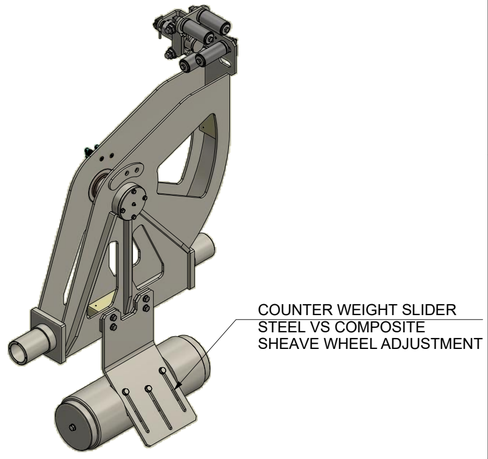


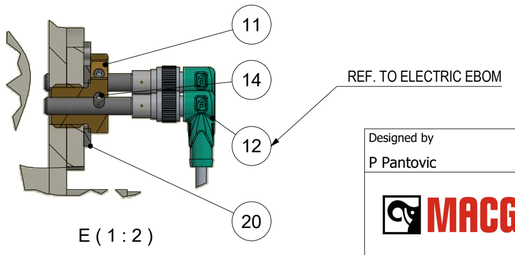


RIGHT









Designed by	Date	Modified by	ECO / CO			
P Pantovic	15.12.2021.	P Pantovic	ECO-2056483			

MACGREGOR

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Name	Weight
Sheave Assembly	0 kg
Description	**Scale (A2)**
SHEAVE, LEFT & RIGHT, PCD900, ASSEMBLY	1 : 10
Document ID	**Revision** / **Sheet**
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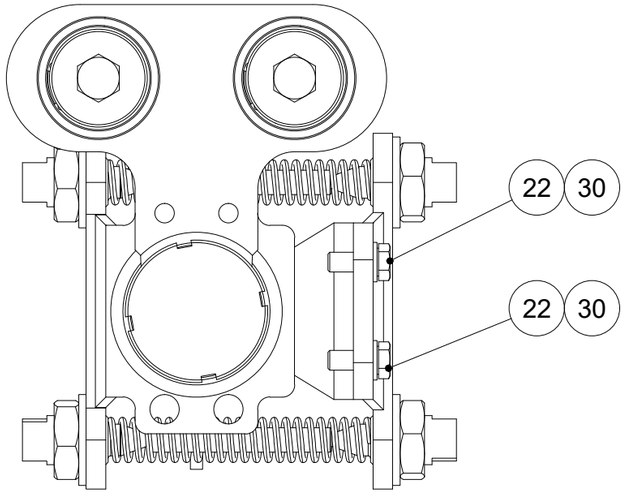
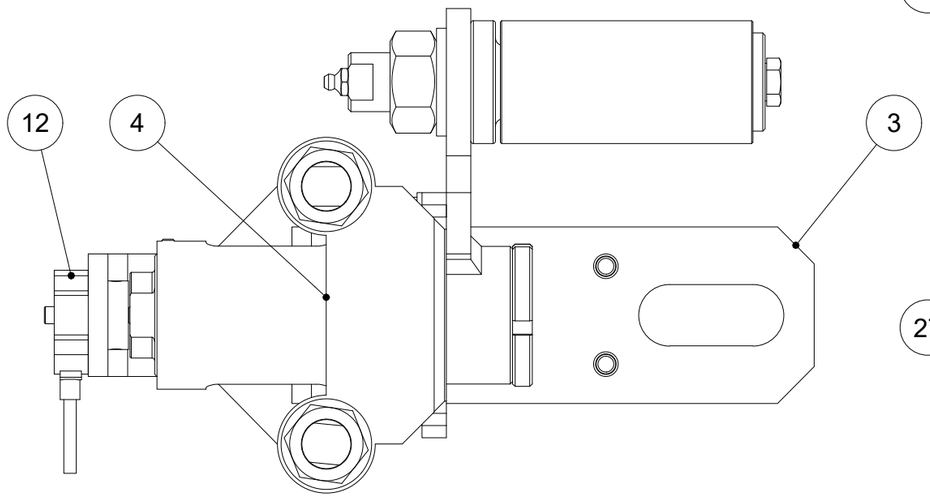
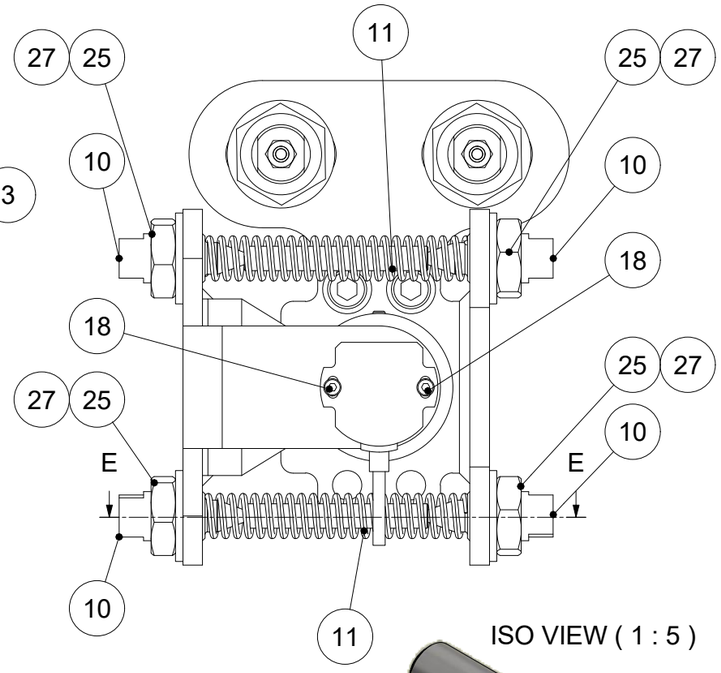
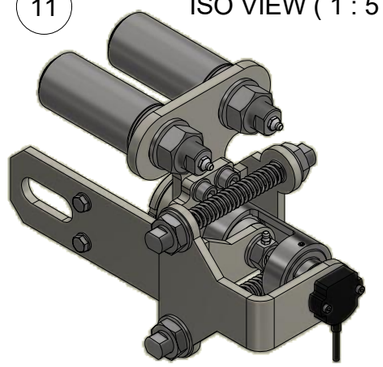


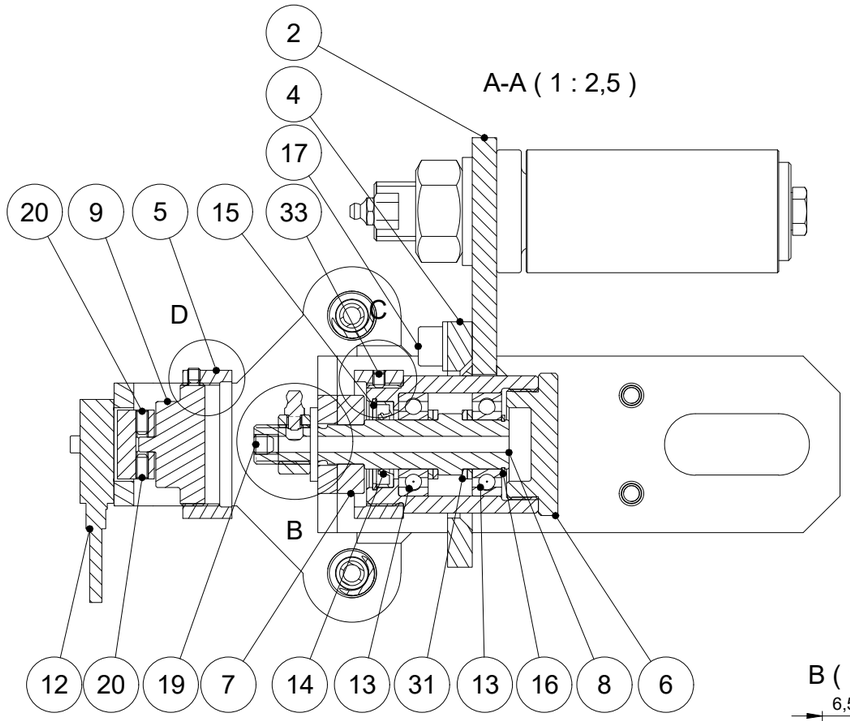


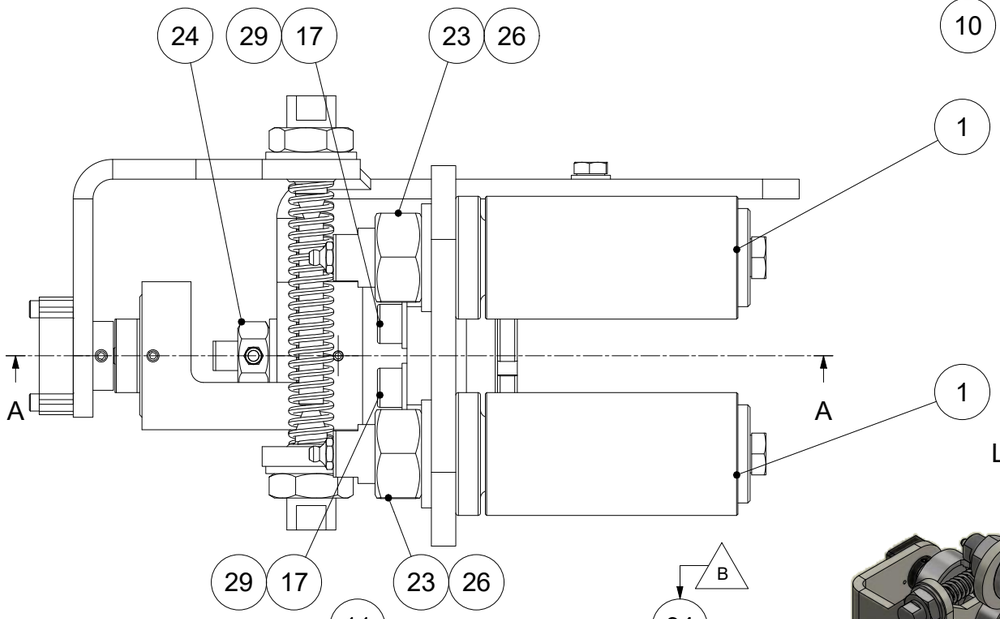


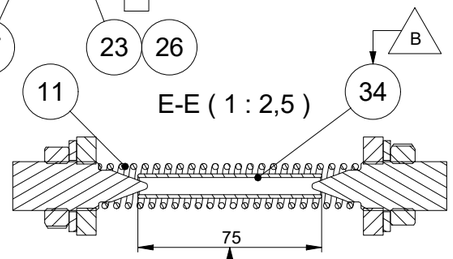
ISO VIEW (1 : 5)



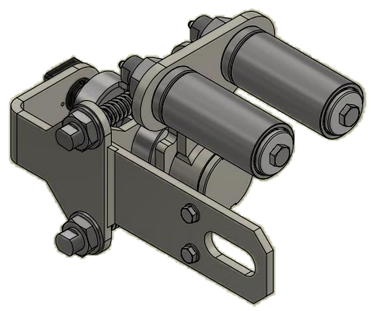
A-A (1 : 2,5)



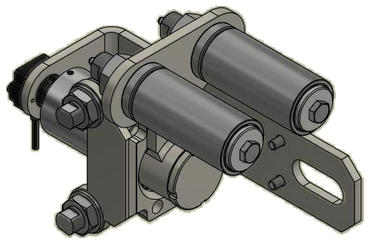




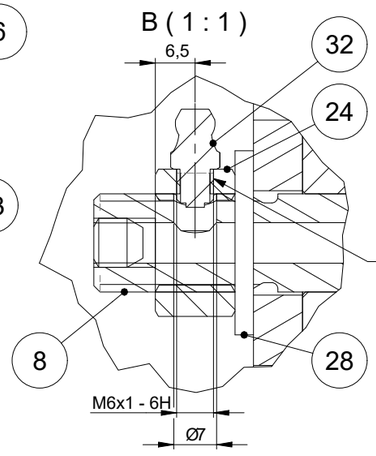
LEFT (1 : 5)



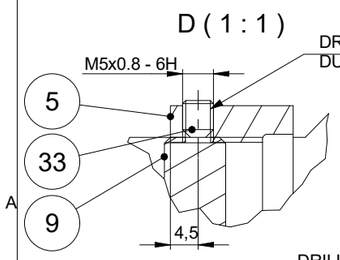
RIGHT (1 : 5)



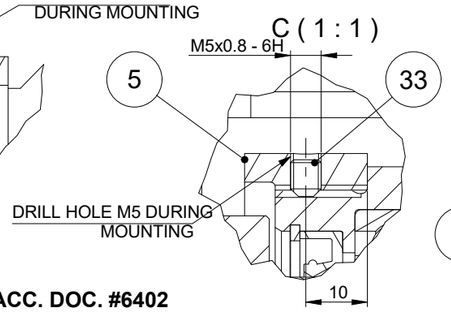
B (1 : 1)



D (1 : 1)



C (1 : 1)



DRILL HOLES M6x1 (NUT M16) AND
Ø7 (ITEM 8) DURING MOUNTING

TIGHTENING TORQUE - ACC. DOC. #6402

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	30.01.2020.	RZPPA
B		Item 34 added	23.07.2020/RZPPA	RZPPA

Unspecified Tolerances According to:		*Weight* 9,95 kg	SHEAVE INDICATOR FLAG & BRACKET (L&R)	RAPP MARINE	
Standard	*Tolerance Class*	*Scale (A3)* 1 : 2,5	*Sheet* 1 / 1	LW EL5000 ASSEMBLY	Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com
NS-ISO 2768-1	m Medium				*Drw number* RH329298
NS-ISO 2768-2	K	*Material (for part)*	*Status* Production	*Drawn by / Date (dd/mm/yy)* PETRODO 29.01.2020.	*Checked by / Date (dd/mm/yy)* RZPPA 30.01.2020.	*Partlist* RH329298

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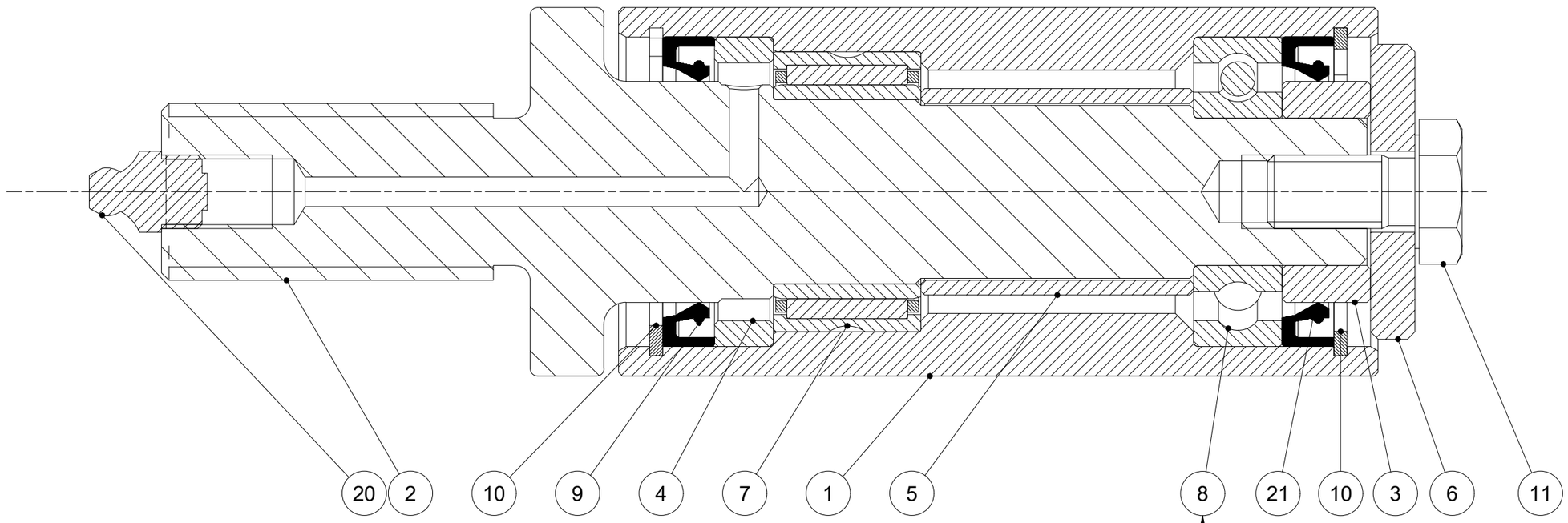
F8AA4CB267DB4792B1F31A8DF074495E

ISOVIEW (1 : 2)



NOTE:
If sealed bearing (2RS) is used, remove sealings before assembly.

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A	-	Issued for production	10.09.2013	DHN
B	B2	Item 21 added. Text note added.	19.09.2013	RHJJ

Weight 2 kg

INDICATOR ROLLER ASSEMBLY
LEVEL WIND INDICATOR ASSEMBLY

RAPP HYDEMA
Phone: (+47) 75 55 01 00
Fax: (+47) 75 55 01 11
E-mail: office@rapphydema.com

Drw number RH317245

Partlist RH317245

Unspecified Tolerances According to:		*Scale (A3)*	*Sheet*
Standard	*Tolerance Class*	1,5:1	1 / 1
NS-ISO 2768-1	*m Medium*		
NS-ISO 2768-2	*K*		

Material (for part)	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*
	Production	RZAVA 07.06.2013	DHN 10.09.2013

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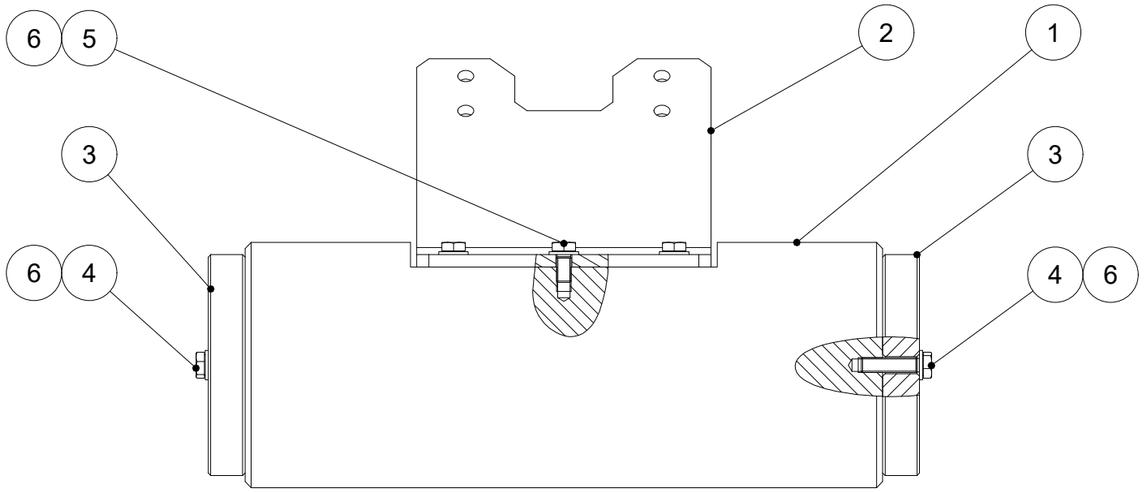
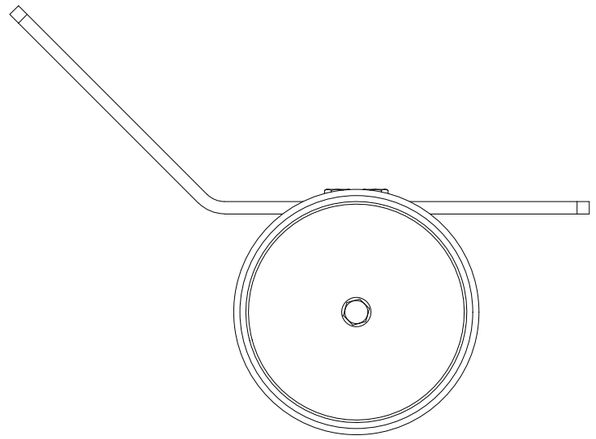
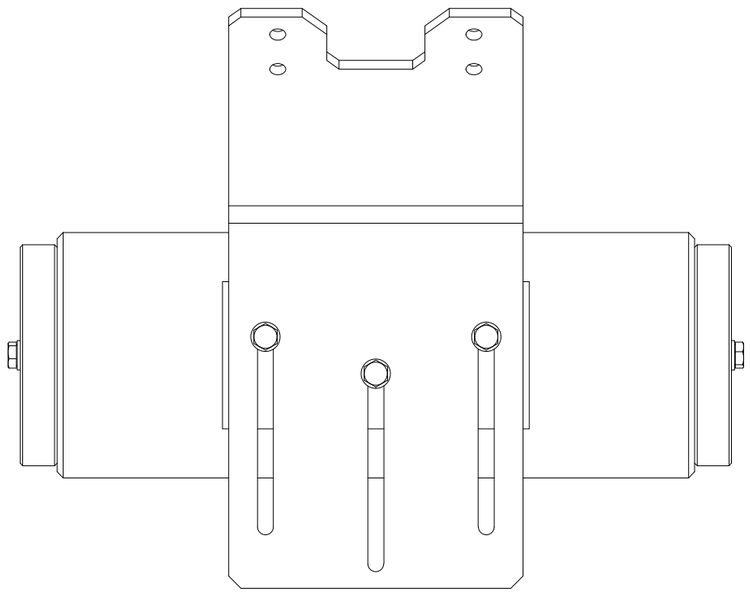
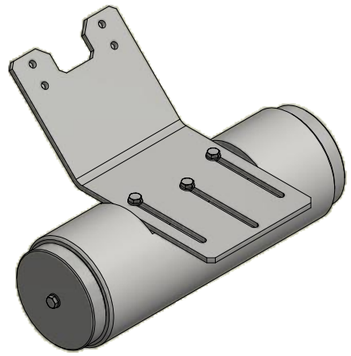






ISO VIEW (1 : 10)



REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	30.01.2020.	RZPPA

Weight 146 kg	COUNTER WEIGHT LW EL5000 (L&R) ASSEMBLY	RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com	
Unspecified Tolerances According to :	*Scale (A3)* 1 : 5	*Sheet* 1 / 1	*Drw number* RH329308
Standard / *Tolerance Class*	*Material (for part)*	*Status* Production	*Partlist* RH329308
NS-ISO 2768-1 m Medium	*Drawn by / Date (dd/mm/yy)* PETRODC 30.01.2020.	*Checked by / Date (dd/mm/yy)* RZPPA 30.01.2020.	
NS-ISO 2768-2 K			

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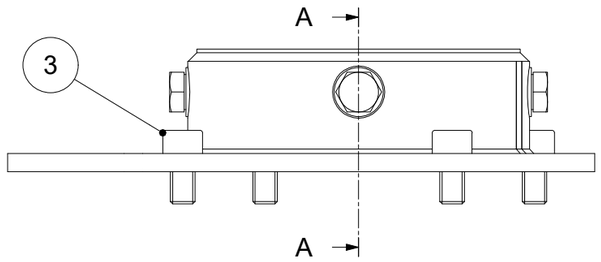
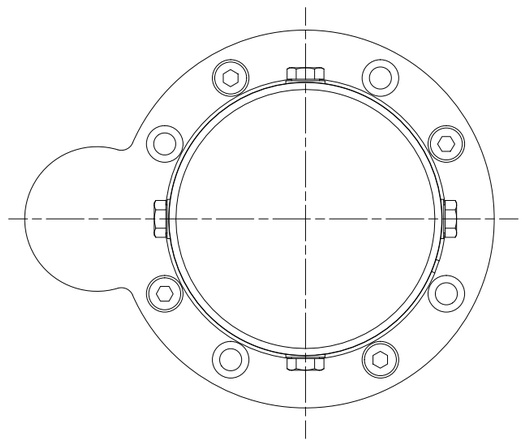
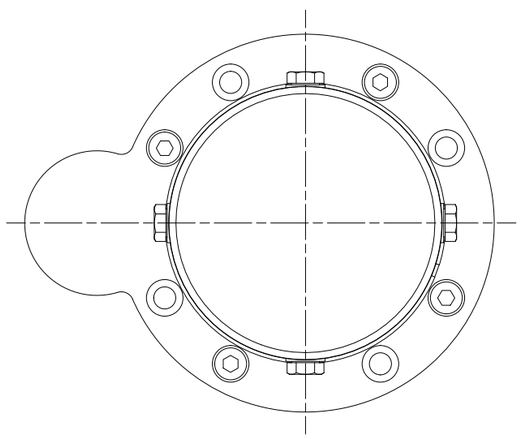
B07912EC46F4891B140B85BE9AA1611



BOLTING AT B SIDE (1 : 2,5)



BOLTING AT A SIDE (1 : 2,5)



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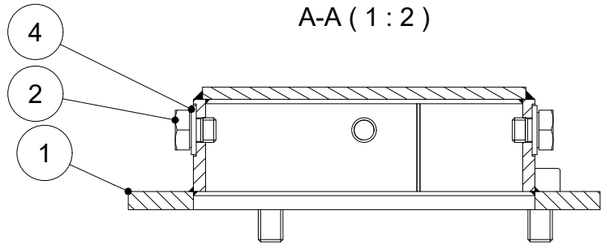
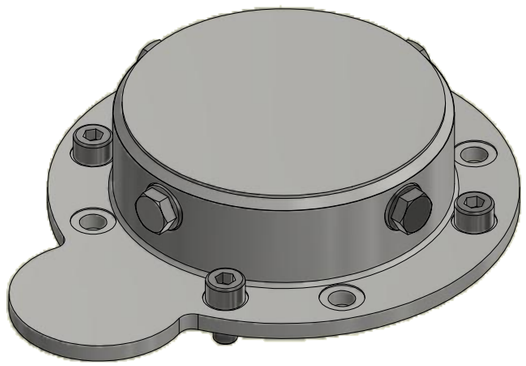


ISO VIEW (1 : 2)



POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATHMENT

5

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	09.08.2019.	RZBSI

Weight 1 kg	GEARBOX COVER SK9022 ASSEMBLY	RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com	
Unspecified Tolerances According to:	*Scale (A3)* 1 : 2	*Sheet* 1 / 1	*Drw number* RH328834
Standard / *Tolerance Class*	*Material (for part)*	*Status* Production	*Partlist* RH328834
NS-ISO 2768-1 m Medium	*Drawn by / Date (dd/mm/yy)* RZBSI 09.08.2019.	*Checked by / Date (dd/mm/yy)* RZBSI 09.08.2019.	
NS-ISO 2768-2 K			

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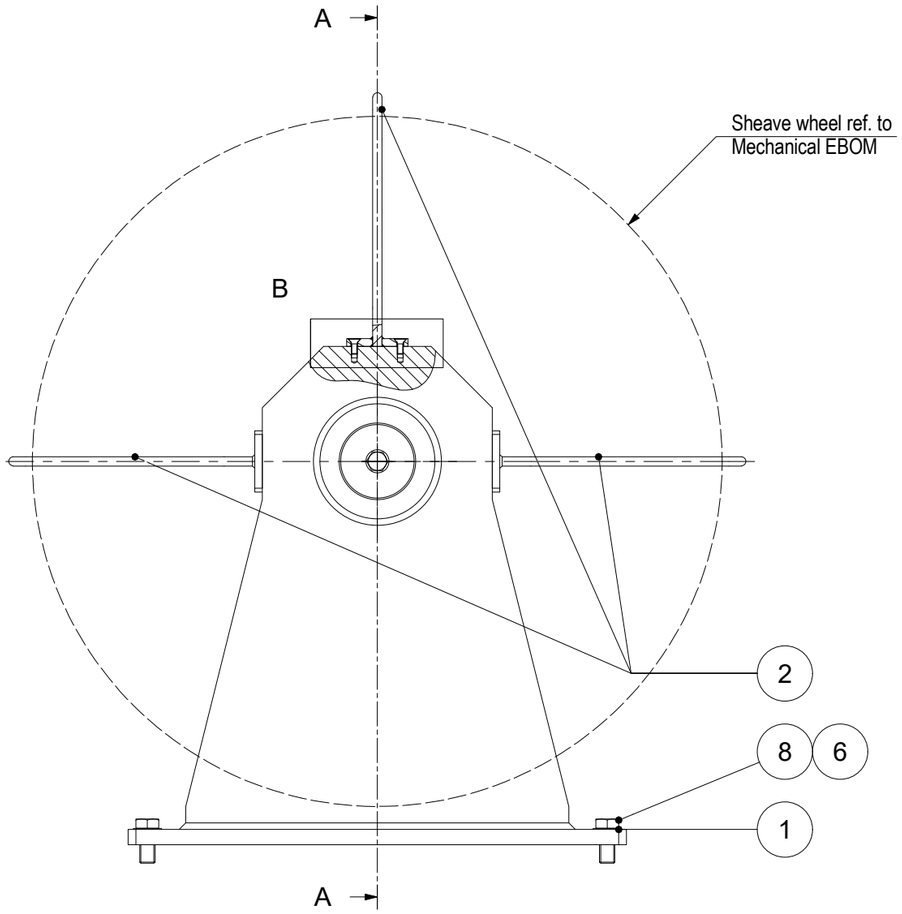
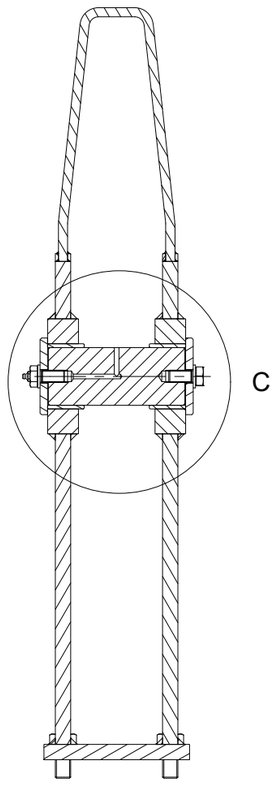
F58TEA4NCT3F4E3VA3GP1FDC0691634

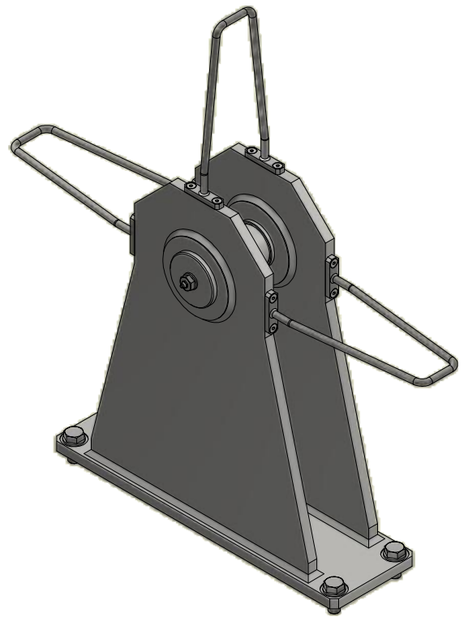
Sheet Purpose:	Sheet Purpose:	TOL. SYSTEM ACC. TO ISO	General tol. for dimensions
MACHINING	**ASSEMBLY**	Surface roughness R_a in µm	Machining ISO 2768 tol-class: mK Welding ISO 13920 tol-class: AE Therm. cut ISO 9013 tol-class: 441



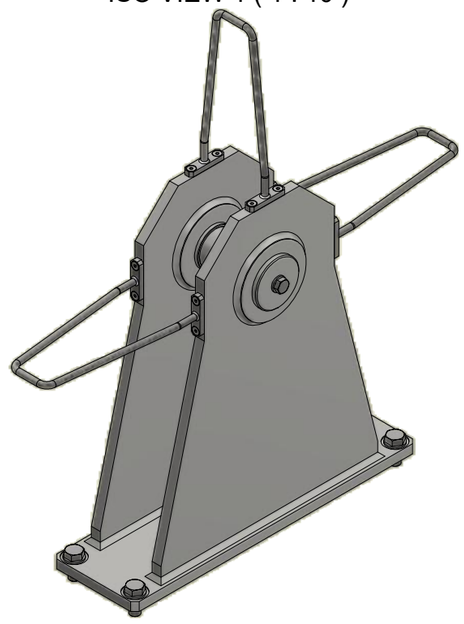
A-A (1 : 8)



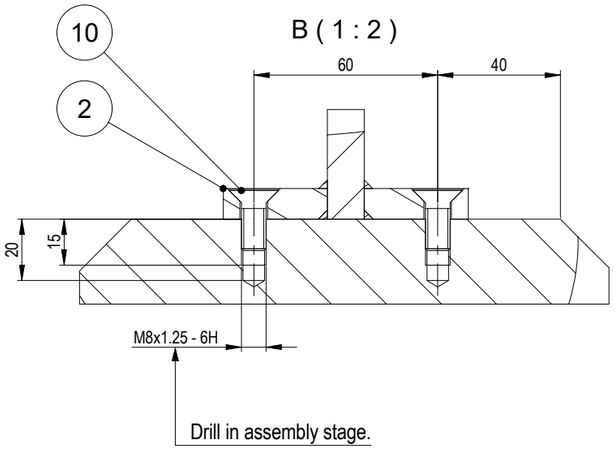
ISO VIEW 2 (1 : 10)



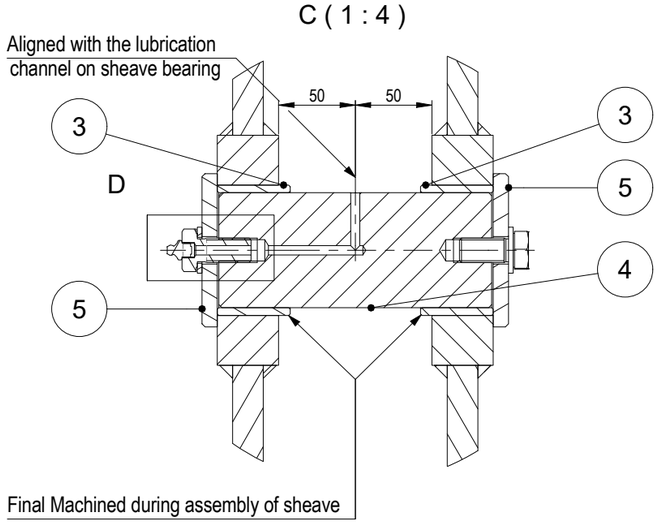
ISO VIEW 1 (1 : 10)



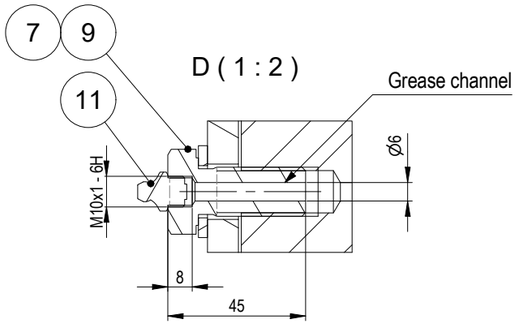
B (1 : 2)



C (1 : 4)



D (1 : 2)



Designed by	Date	Modified by	ECO / CO			
P Pantovic	23.12.2021.	P Pantovic	ECO-2056483			

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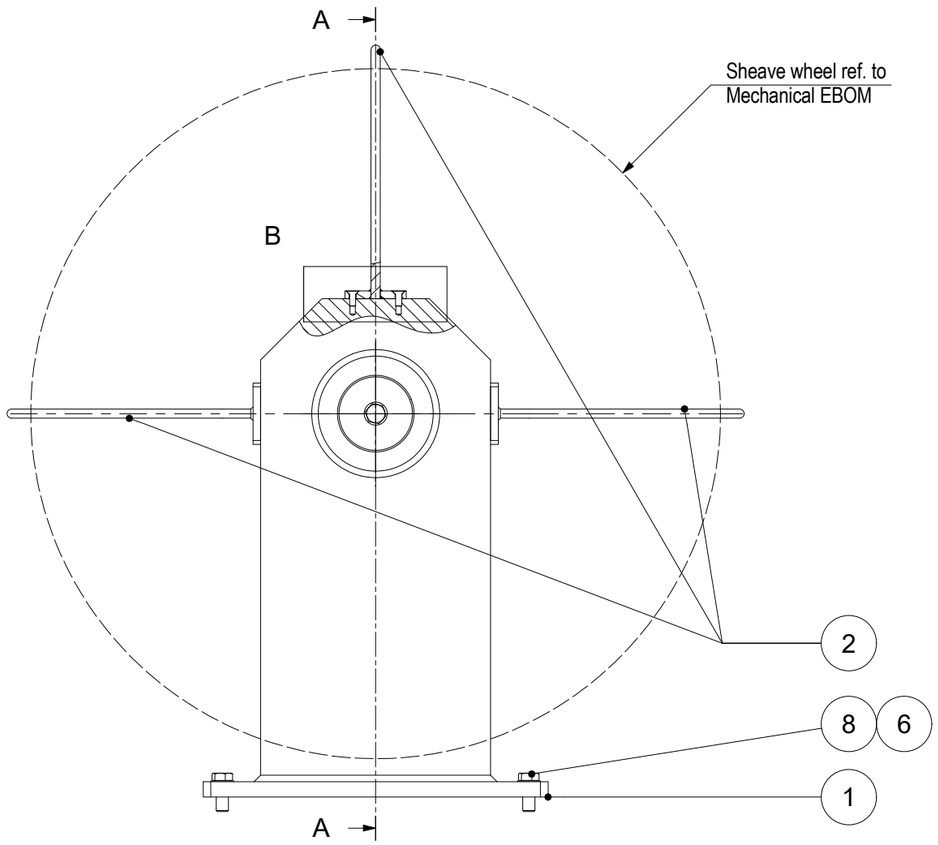
Name	Weight
Frame	106 kg
Description	Scale (A3)
PCD900	1 : 8
Document ID: 2000004252	Revision: A / Sheet: 1 / 1

Sheet Purpose:	Sheet Purpose:	TOL. SYSTEM ACC. TO ISO	General tol. for dimensions
MACHINING	**ASSEMBLY**	Surface roughness R_a in µm	Machining ISO 2768 tol-class: mK Welding ISO 13920 tol-class: AE Therm. cut ISO 9013 tol-class: 441



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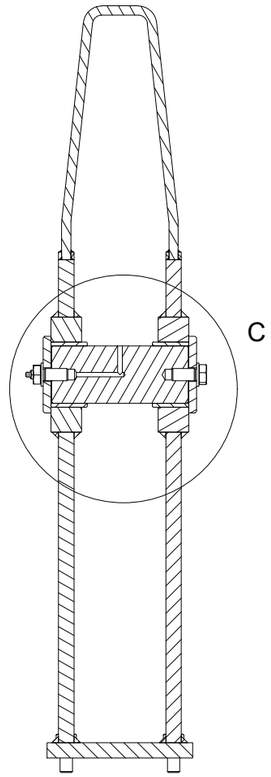

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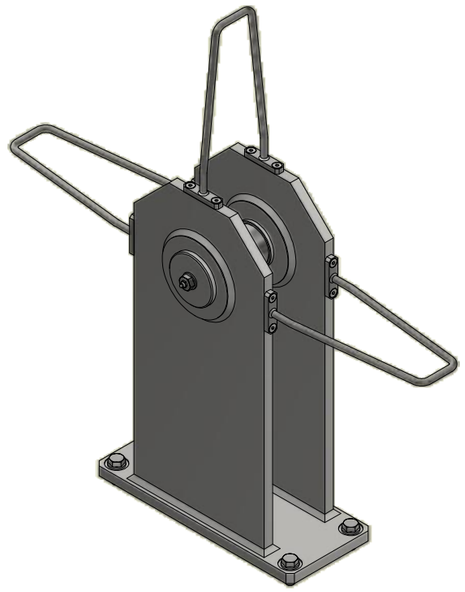
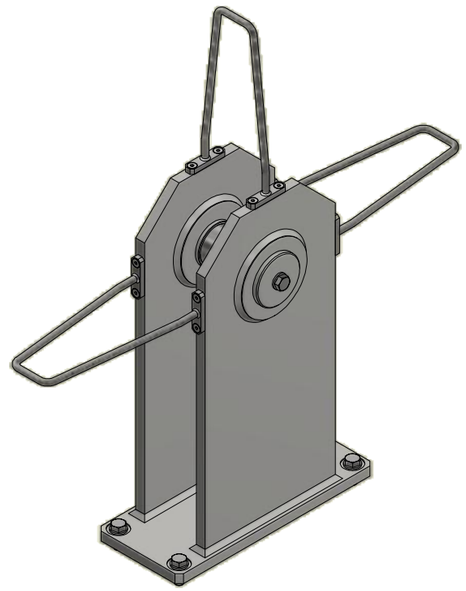
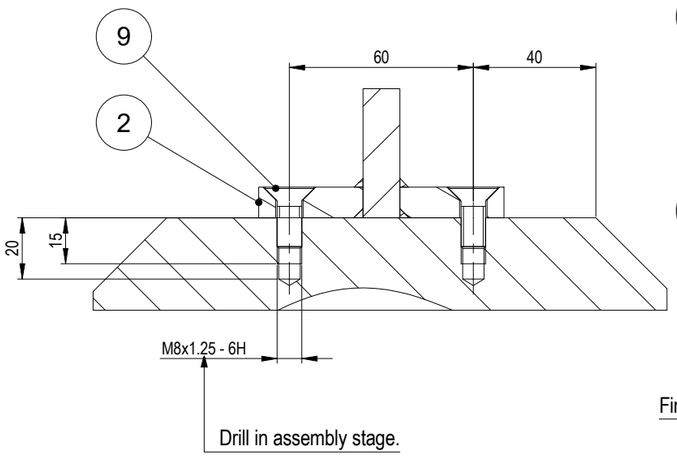


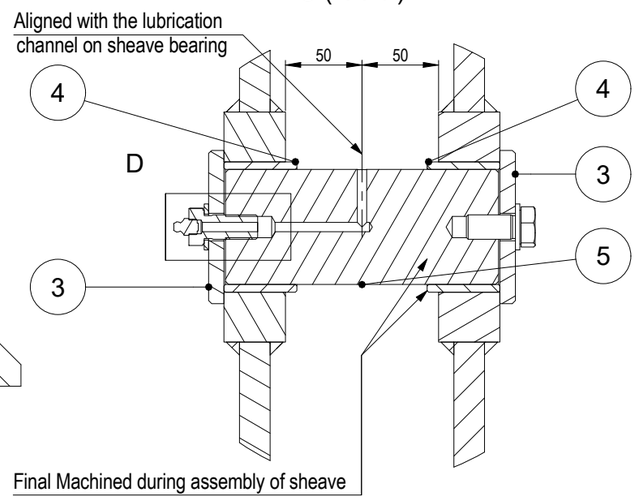
ISO VIEW 1 (1 : 10)



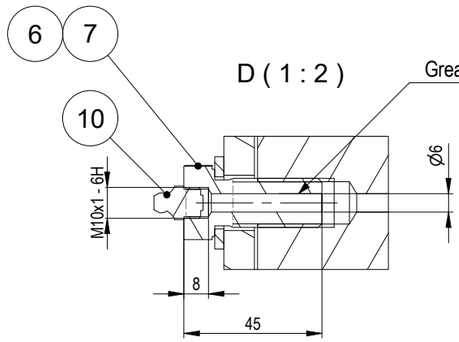
B (1 : 2)



C (1 : 4)



D (1 : 2)



Designed by	Date	Modified by	ECO / CO			
P Pantovic	23.12.2021.	P Pantovic	ECO-2056483			

MACGREGOR

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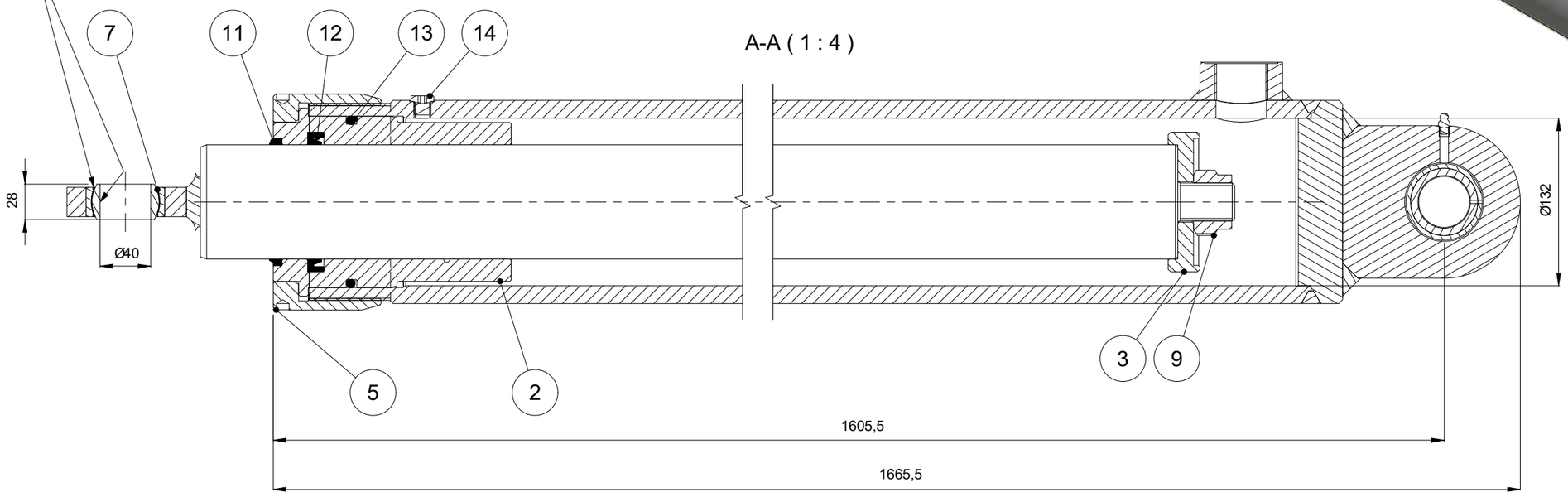
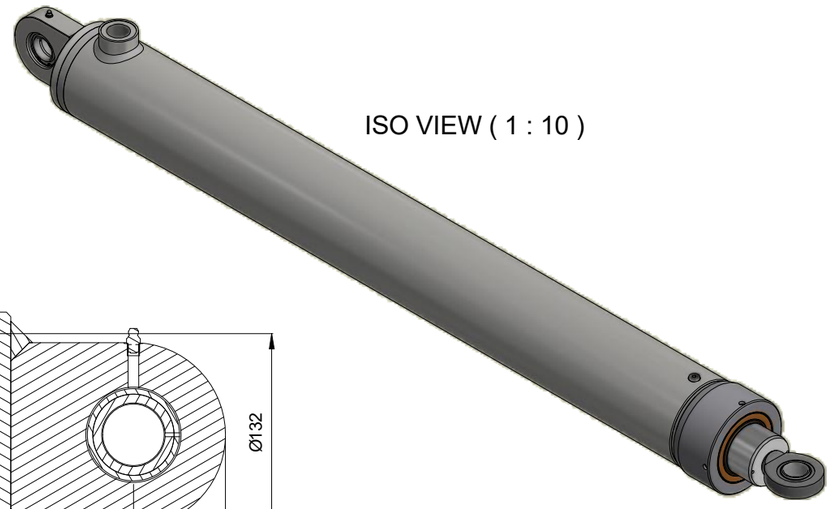
Name		Weight
Frame		85 kg
Description		Scale (A3)
PCD900		1 : 8
Document ID	Revision	Sheet
2000004277	A	1 / 1

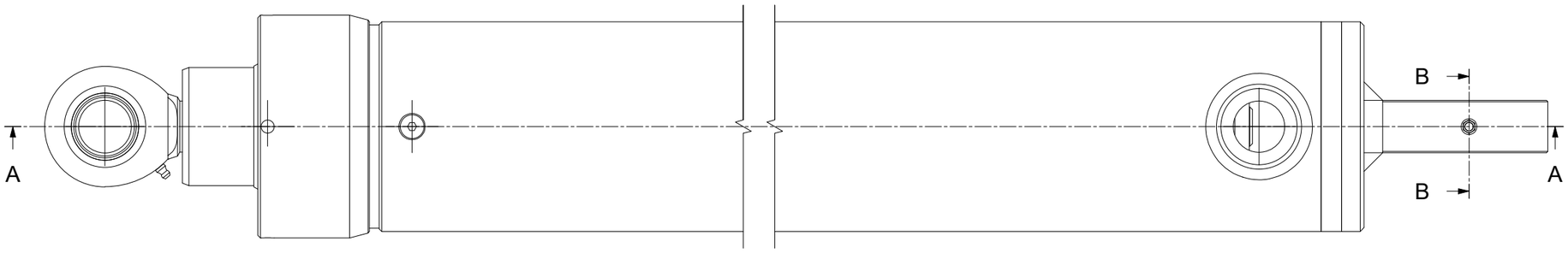
APPLY RUST PROTECTION OR STICKY GREASE AT THE INNER RING OF THE ROD ENDS DURING ASSEMBLY.

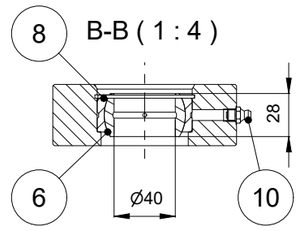


A-A (1 : 4)

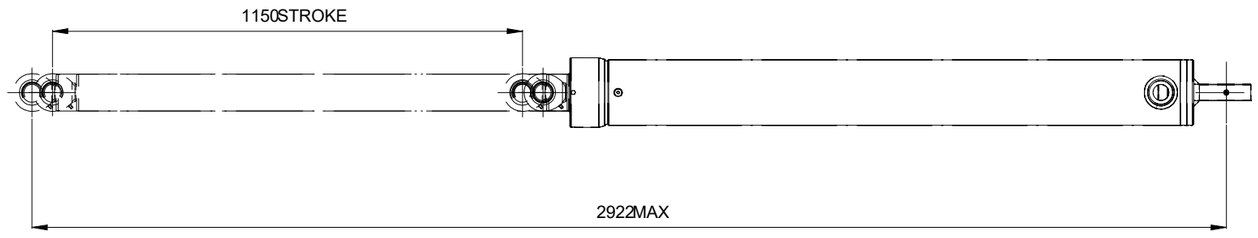


ISO VIEW (1 : 10)





B-B (1 : 4)



Designed by	Date	Modified by	ECO / CO			
P Pantovic	01.12.2021.		ECO-2056556			

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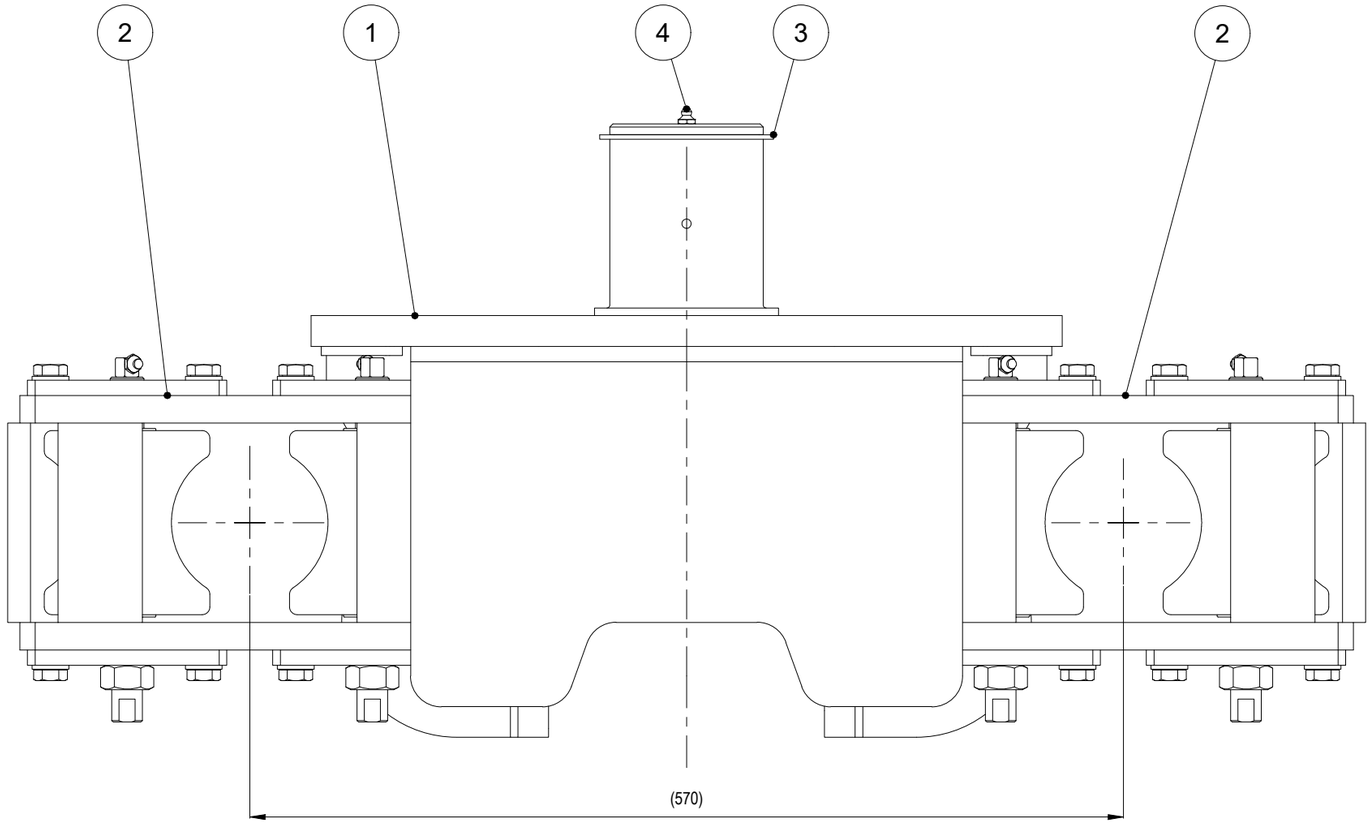
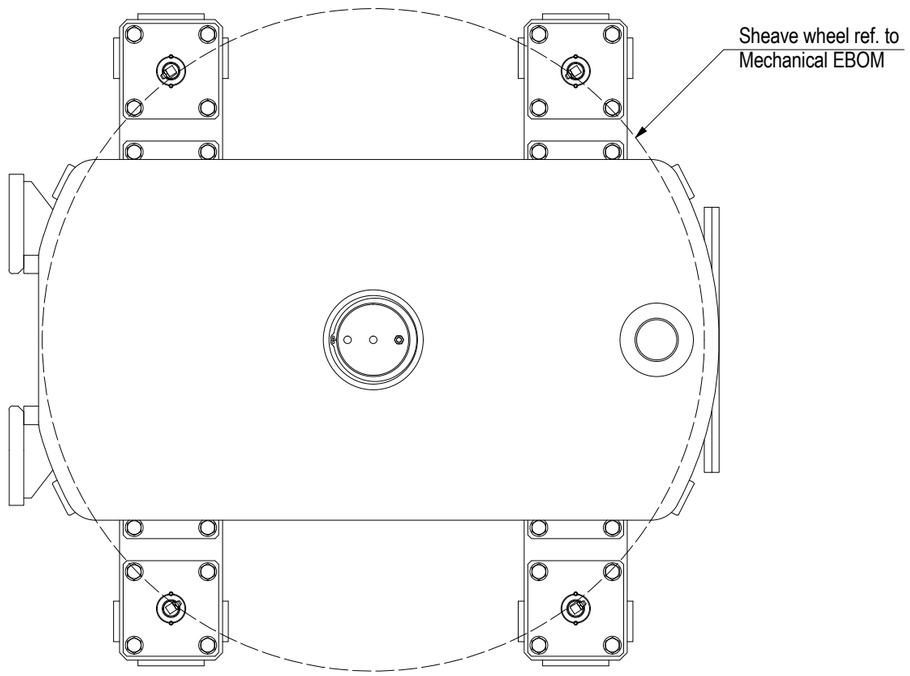
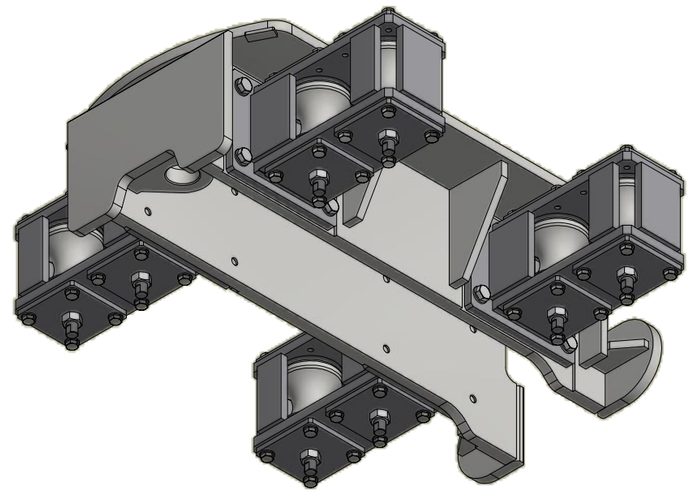
Name	Weight
Cylinder Assembly	173 kg
Description	**Scale (A3)**
SWC HYDRAULIC CYLINDER, S=1150mm	1 : 4
Document ID / **Revision** / **Sheet**	
2000003665 / A / 1 / 1	

Sheet Purpose:	TOL. SYSTEM ACC. TO ISO	General tol. for dimensions
ASSEMBLY	Surface roughness R_a in µm	Machining ISO 2768 tol-class: mK Welding ISO 13920 tol-class: AE Therm. cut ISO 9013 tol-class: 441

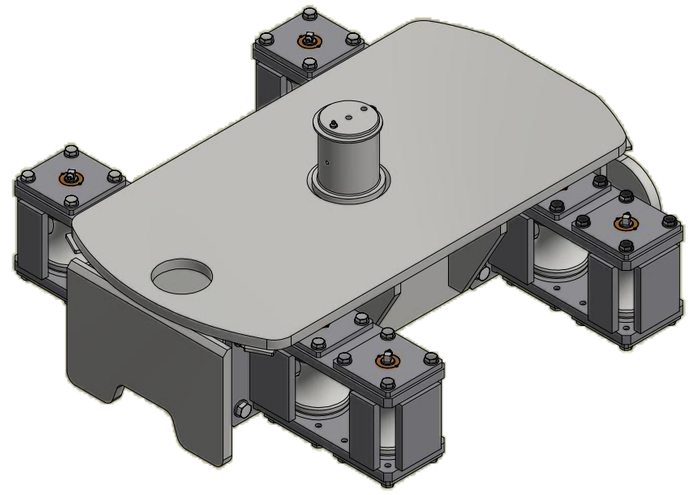




ISO VIEW 1 (1 : 10)



ISO VIEW 2 (1 : 10)



Designed by	Date	Modified by	ECO / CO			
P Pantovic	23.12.2021.	P Pantovic	ECO-2056483			

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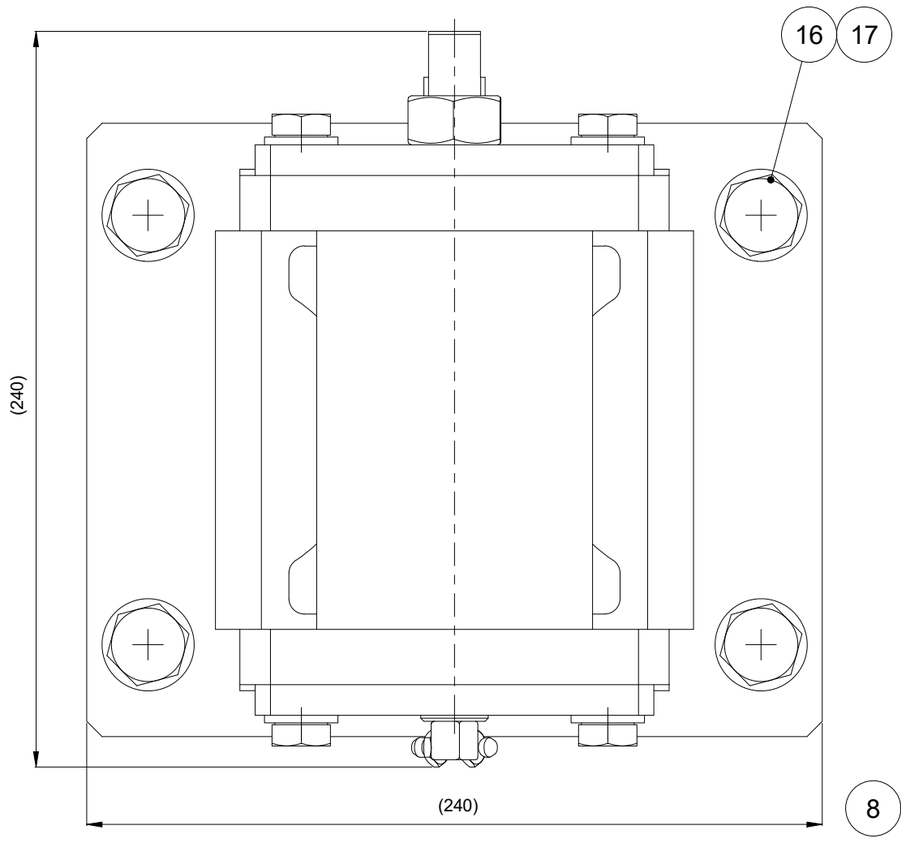
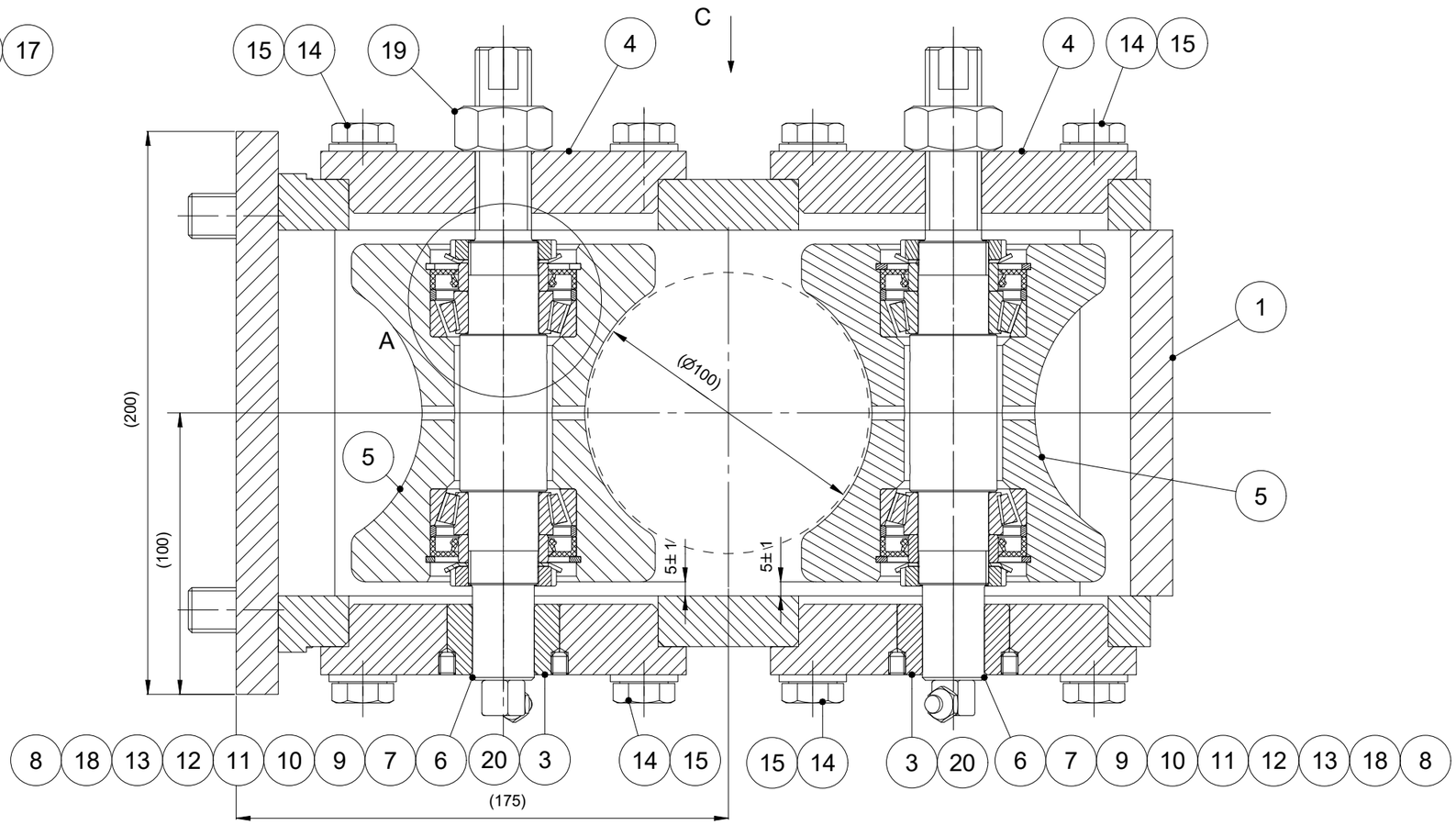
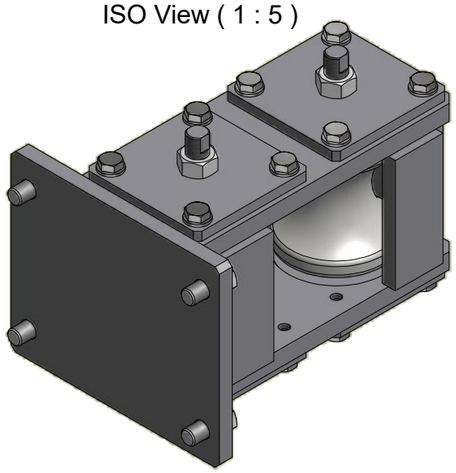
Name	Weight
Sheave Assembly	338 kg
Description	**Scale (A3)**
LEV-SWC	1 : 4
Document ID	**Revision** / **Sheet**
2000004281	A / 1 / 1

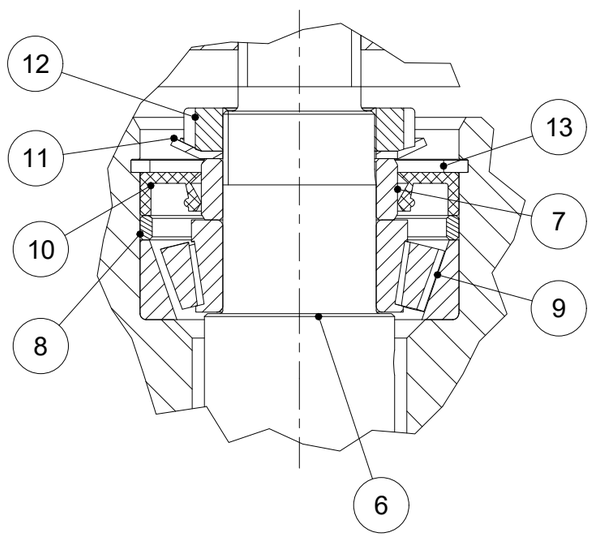




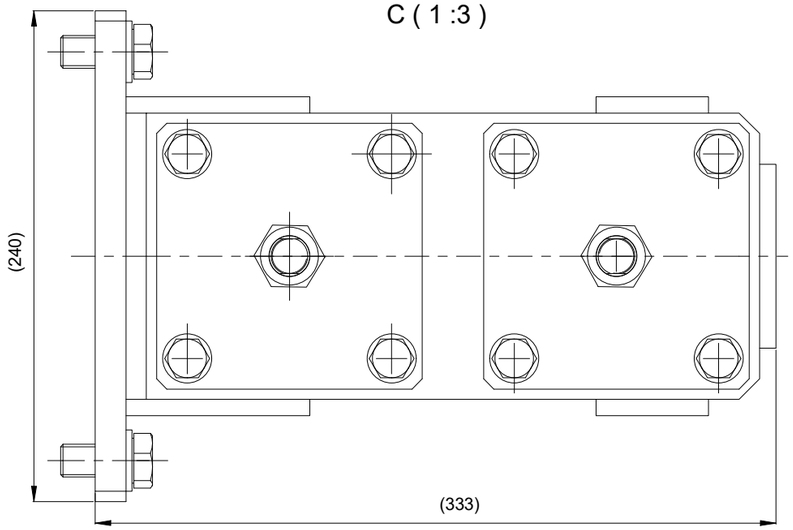
ISO View (1 : 5)



A (1 : 1)
4 places



C (1 :3)



REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	22.08.2014	RHDHN

Weight 38 kg		ROLLER UNIT SWC-5000 ASSEMBLY	RAPP HYDEMA Phone: (+47) 75 55 01 00 Fax: (+47) 75 55 01 11 E-mail: office@rapphydema.com
Unspecified Tolerances According to :	*Scale (A3)*	*Sheet*	*Drw number* RH318591
Standard / *Tolerance Class*	1:2	1 / 1	
NS-ISO 2768-1 m Medium			*Partlist* RH318591
NS-ISO 2768-2 K			

Material (for part)	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*
	Production	RZBSI 22.08.2014	RHDHN 22.08.2014

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38EC06E2F9214BBD88FC8FB54F93C702

Yard Connections

Internal Connections

Levelwind/Slack Wire

=WCS01
+UH03

Main VFD Cabinet
Pentagon
Brake HPU
Gear Cooling HPU

+UC01

-UB6 -WG1 PUR 4x0.34mm2 Shld → -BG1 End Stop 1 /1.B1

-UB7 -WG2 PUR 4x0.34mm2 Shld → -BG2 End Stop 2 /1.B2

-UB8 -WG3 PUR 4x0.34mm2 Shld → -BG3 Follow Up Sensor 1 /1.B3

-UB9 -WG4 PUR 4x0.34mm2 Shld → -BG4 Block Count /1.B3

-UB10 -WG5 PUR 4x0.34mm2 Shld → -BG5 Block Count /1.B4

-UB1 -WG6 PUR 4x0.34mm2 Shld → -BG6 SWC Limit Sensor 1 Pos In /1.B5

-UB2 -WG7 PUR 4x0.34mm2 Shld → -BG7 SWC Limit Sensor 2 Pos Out /1.B5

-UB3 -WG8 PUR 4x0.34mm2 Shld → -BG8 String Sensor

-UB4 -WG9 Valve Cable 3x0.75+PE → -BP1 Pressure Transmitter

-UB5 -WG10 Valve Cable 3x0.75+PE → -QM1 SWC Valve

=WCS01
+UH01

Main VFD Cabinet
Power Input
Levelwinds

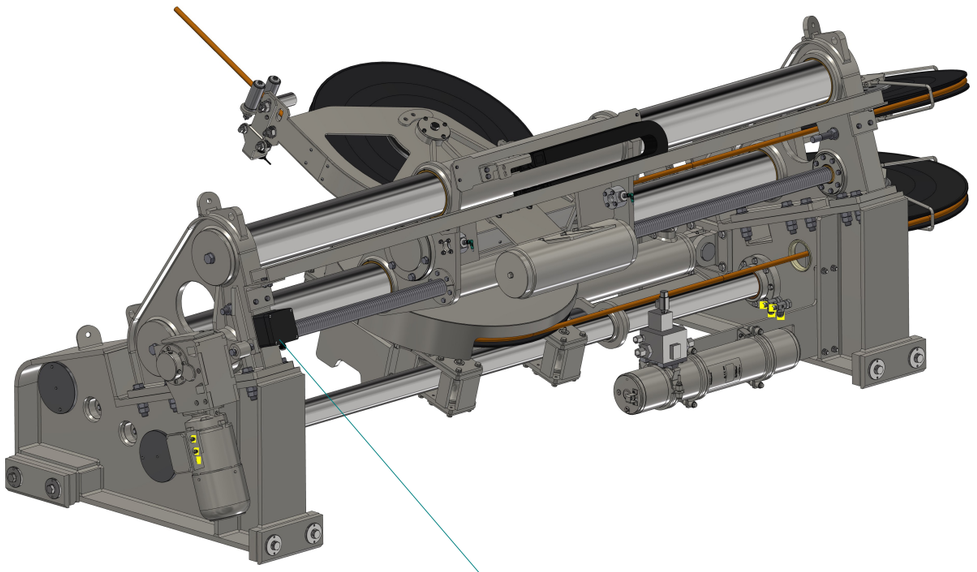
ENC
PWR
BRAKE
HEAT

M
3~

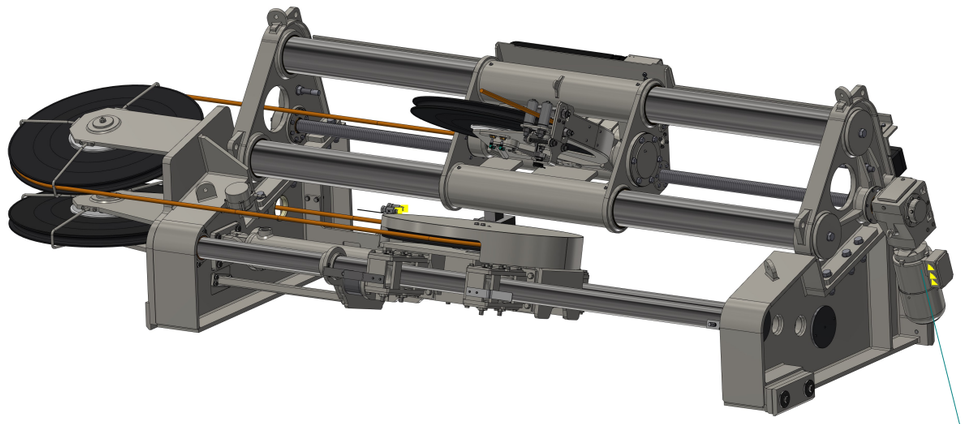
-MA1

2,2kW
5,22A
400V/50Hz
GETBI1031 2.2kW

				Date	17/11-2021	***CUSTOMER***	MACGREGOR	Levelwind & Slack Wire Compensator Levelwind & Slack Wire Compensator	400182378	=LEV01
				User	GSK	***PROJECTNAME***				
				Approved	RAJ				***PRONR*** -04 CD	Rev.
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 2



=LEV01
+UC01



=LEV01
-MA1

Iso view of winch (image might deviate from actual product)

General Picture
Winch might be mirrored

				Date	17/11-2021	***CUSTOMER***	MACGREGOR	Levelwind & Slack Wire Compensator	400182378	=LEV01	
				User	GSK	***PROJECTNAME***		Connection Point Overview			
				Approved	RAJ				***PRONR*** -04 CD	Rev.	Sheet 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1

End Stop Levelwind

Angle Sensor Levelwind

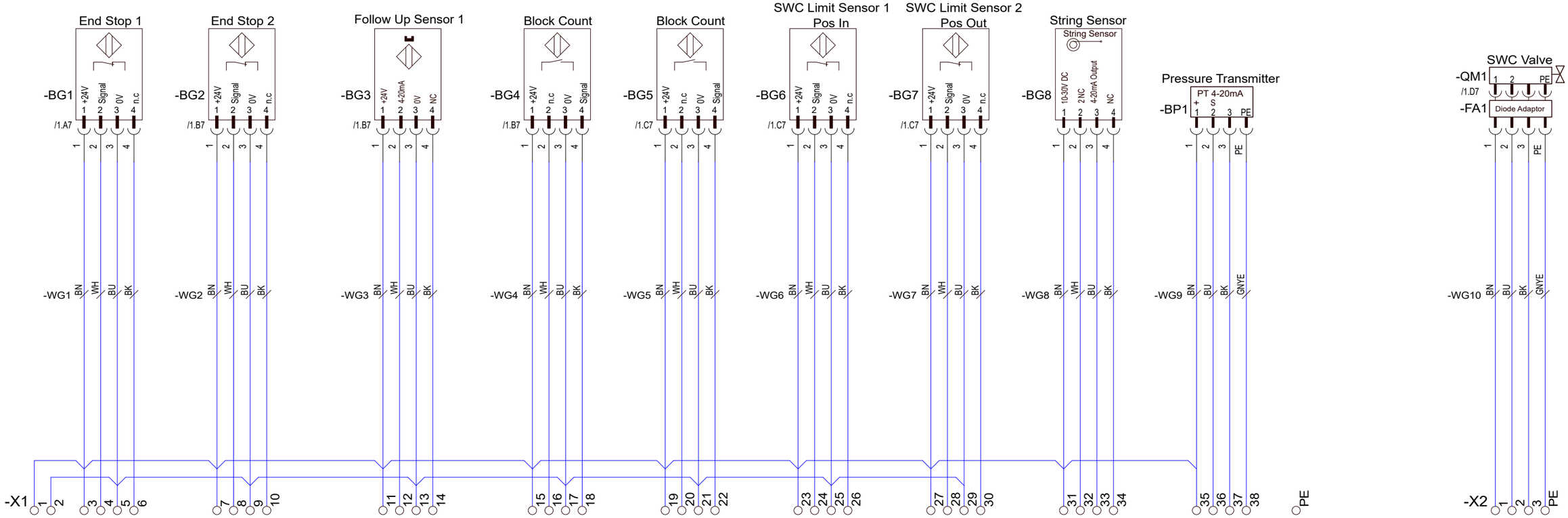
Block Count Levelwind

Limit Sensor Slack Wire

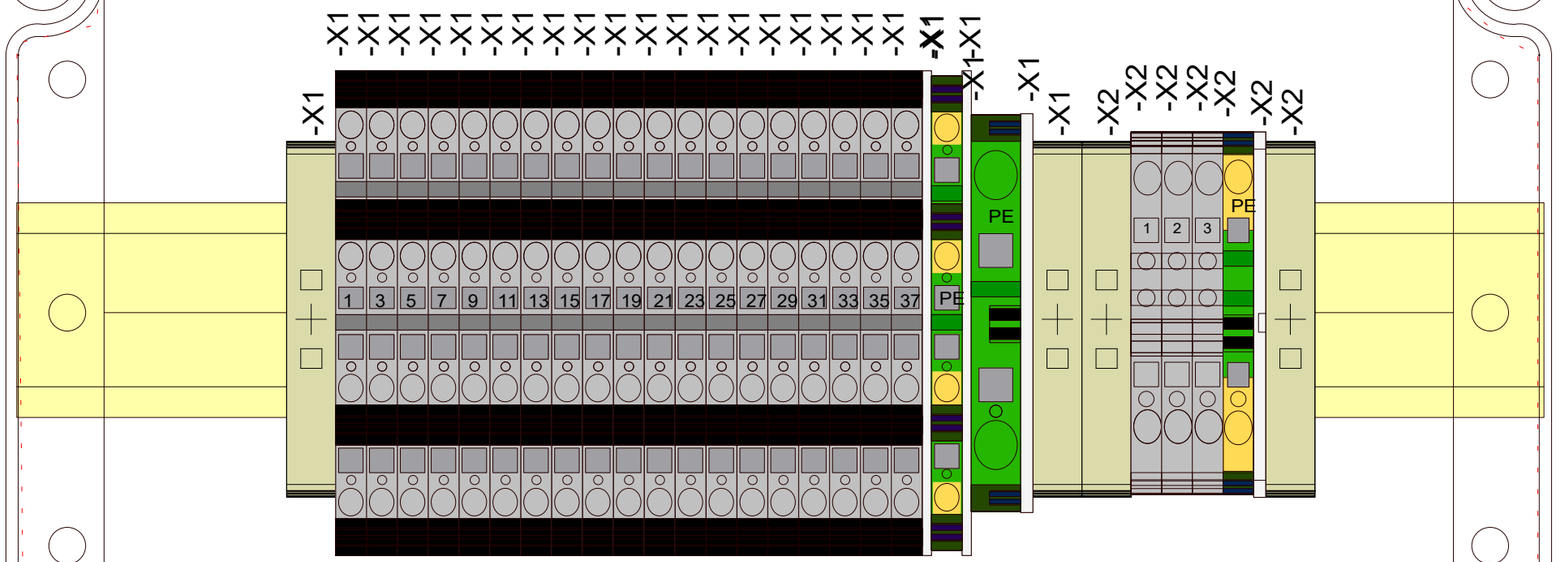
String Sensor Slack Wire

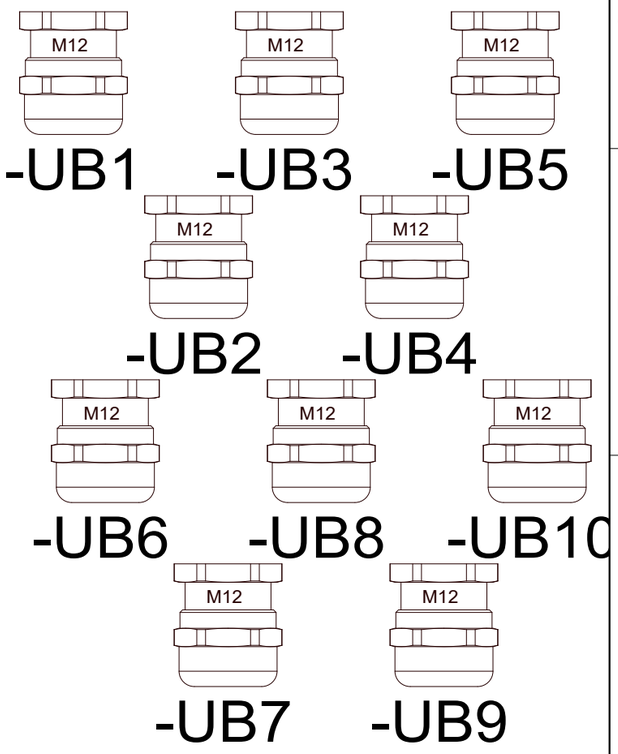
¨Pressure Transmitter

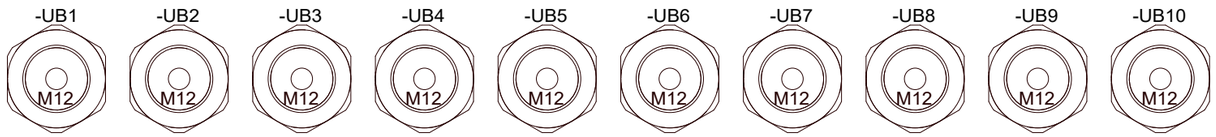
Brake Solenoid Valve



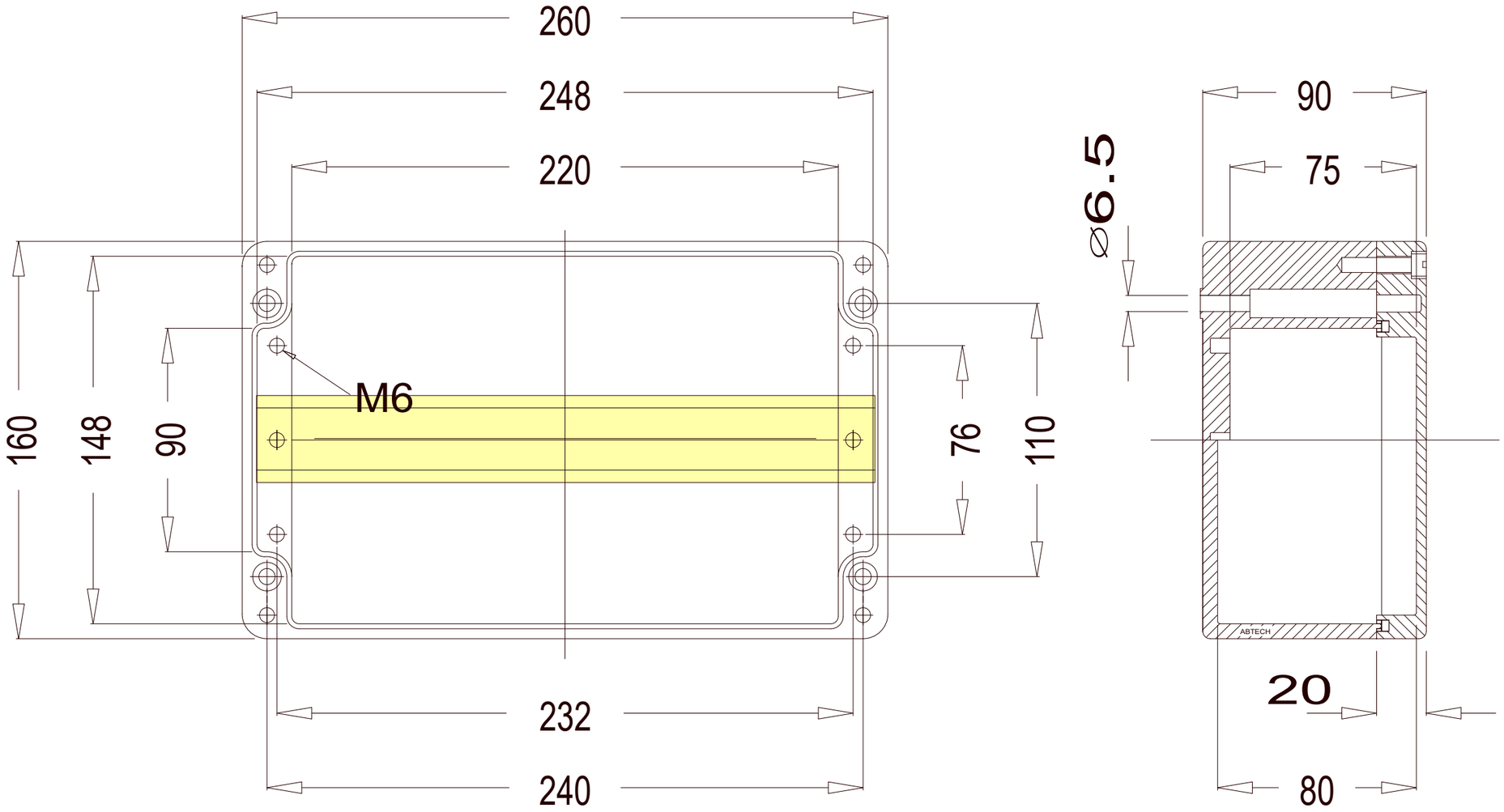
				Date	17/11-2021	***CUSTOMER***	MACGREGOR	Levelwind & Slack Wire Compensator Level Wind Connection Box Internal Connection	400182378	=LEV01
				User	GSK	***PROJECTNAME***				+UC01
				Approved	RAJ				***PRONR*** -04 CC	Rev.
Status	Change	Date	Name	Standard		Version	Index	Repl. by		Sheet 1 / Next 1







				Date	17/11-2021	***CUSTOMER***	MACGREGOR	Levelwind & Slack Wire Compensator Level Wind Connection Box Internal Connection	400182378	=LEV01
				User	GSK	***PROJECTNAME***				+UC01
				Approved	RAJ				***PRONR*** -04 GA	Rev. Sheet 1
Status	Change	Date	Name	Standard		Version / Index / Repl. by				Next 2



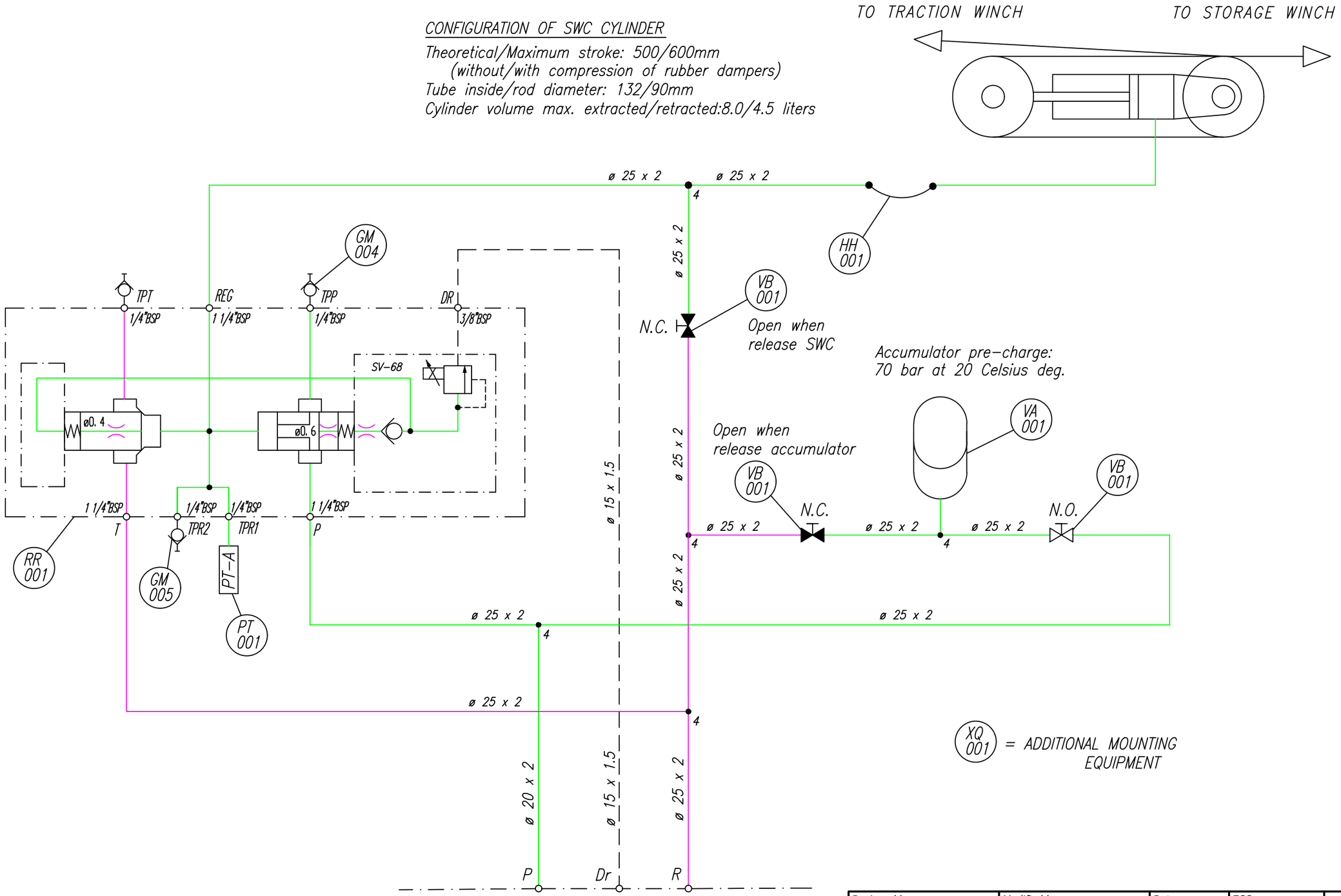
				Date	17/11-2021	***CUSTOMER***	MACGREGOR	Levelwind & Slack Wire Compensator	400182378	=LEV01	
				User	GSK	***PROJECTNAME***		Level Wind Connection Box		+UC01	
				Approved	RAJ			Internal Connection	***PRONR*** -04 GA	Rev.	Sheet 2
Status	Change	Date	Name	Standard		Version	Index	Repl. by			Next 1

Device ID	Device	Part Number	Qty	Unit	Description	Manufacturer	Datablad
-BG1..-BG2,-BG6..-BG7	E2A-M18KS08-M1-B2	EACIN0203	4	Pcs	Inductive Sensor M18, NC M12 Connector	Omron	D03E-EN-02+E2A+Datasheet[1].pdf
-BG3	Z RFC P08	EACPO051	1	Pcs	Position Marker Angle sensor	Novotechnik	RFC4800_analog_e_2010_04.pdf
-BG4,-BG5	IMR08-02BPSTCOS	EACIN022	2	Pcs	Inductive Sensor M8, NO M12 Connector	SICK	IMR08-02BPSTC0S.pdf
-BG8	String Sensor SR1M-125 4-20mA	EACPO015	1	Pcs	String Sensor SR1M-125 3175mm 4-20/ 20-4mA M12 Connector	Celesco	SR1M produktinfo.pdf
-FA1	Diode Adaptor for Solenoide Valve	EACPL007	1	Pcs	Diode Adaptor Plate	OEM Automatic AS	datasheet EACPL007. pdf
-UB1..-UB10	Lock Nut M12 Brass	EACPG280	10	Pcs	Nut Brass, Skindicht SM-M 12x1,5	Lapp Group	I
-UB1..-UB10	Skintop MS-M 12	EACPG270	10	Pcs	M12 Cable Gland Brass (3-7mm)	Lapp Group	LAPP MS-M.pdf
-UC1	KLIPPON POK 162609 EX	400091476	1	Pcs	90x260x160, GRP Connection box, EX Certified	Weidmüller	Datasheet
-UC1	TS35X7.5 ST POK 1626	400091488	1	Pcs	Rail, TS 35, TS 35 x 7.5, Length: 243 mm, without slot, Steel, galvanized, chromium-plated	Weidmüller	Datasheet
-WG1..-WG8	V1-WV4A-10M-PUR-ABG0 M12	EACCA096	8	Pcs	Cable With M12 Plugg, PUR 10M	Pepperl+Fuchs	V1-WV4A-10M-PUR-ABG0.pdf
-WG9,-WG10	Hirschmann plug with cable_A	EACPL0011	2	Pcs	Hirschmann plug with cable	Belden	EACPL0011 Rectangular_connectors.pdf
-X1	ZAP/TW 5	EACPL02152	1	Pcs	End Plate For ZDU/ZPE 6 Terminals)	Weidmüller	ZAP TW 5.pdf
-X1	ZAP/TW ZDK2.5	400091997	2	Pcs	End Plate For ZDK2.5 Terminal	Weidmüller	Weidmuller\ZAP TW ZDK2.5.pdf
-X1 (1,3,5,7,9,11,13,15,17,19, 21,23,25,27,29,31,33,35,37)	ZDK 2.5/1.5	EACPL02055	19	Pcs	Terminal 2 Levels	Weidmüller	ZDK 2.5.pdf
-X1 (PE)	ZDK 2.5 PE	EACPL02056	1	Pcs	PE Terminal 2 Levels	Weidmüller	ZDK 2.5PE.pdf
-X1 (PE)	ZPE 6	EACPL02026	1	Pcs	Terminal	Weidmüller	ZPE 6.pdf
-X1,-X2	AEB 35 SC/1	EACPL0202-2	4	Pcs	AEB 35 SC/1 End Bracket	Weidmüller	Datasheet
-X2	ZAP/TW 1	EACPL02144	1	Pcs	End Plate For ZDU/ZPE/ZTR 2.5 Terminals	Weidmüller	ZAP TW 1.pdf
-X2 (1-3)	ZDU 2.5 AN	EACPL021401	3	Pcs	Terminal	Weidmüller	ZDU 2.5.pdf
-X2 (PE)	ZPE 2.5	EACPL02025	1	Pcs	Terminal	Weidmüller	ZPE 2.5.pdf

				Date		***CUSTOMER***		Levelwind & Slack Wire Compensator	400182378		=LEV01		
				User		***PROJECTNAME***	MACGREGOR	Part list					
Status	Change	Date	Name	Standard		Version	Index	Repl. by		***PRONR*** -04 PL	Rev.	Sheet 1	Next

CONFIGURATION OF SWC CYLINDER

Theoretical/Maximum stroke: 500/600mm
(without/with compression of rubber dampers)
Tube inside/rod diameter: 132/90mm
Cylinder volume max. extracted/retracted:8.0/4.5 liters



XQ 001 = ADDITIONAL MOUNTING EQUIPMENT

Part list: RHHSWC-E

Designed by	Modified by	Date	ECO			
D Boc		03.06.2022	ECO-2057408			

MACGREGOR

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Name	Weight
Hydraulic Diagram	
Description	Scale (A3)
Slack Wire Compensator	
Document ID: RH319631	Revision: F

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
1				400092573	Hydrographic Winch	CTD WINCH, HW515FST90/URP (RHMEHW515FST90/URP)
2	001	1	PCS	EMOAB200B35-EI/00	Electric Motor	M3BP200MLC4 B35, IP56/ENC ISOL; 47kW (EMOAB200B35-EI/00)
2	002	1	PCS	GETBI0411-I200/00	Gearbox	POSIPLAN, BPH323 i=35,67 IEC200; PIV POSIPLAN BPH323 1:35,67 IEC200 (GETBI0411-I200/00)
2	003	1	PCS	GETGN120	Gearbox	GEAR MTR; SK9032/5,5kW I=25,03 ENCODER (GETGN120)
2	004	1	PCS	400184715	Wire Rope Drum	D990 x PCD510 x L982
3	001	1	PCS	400184693	Wire Rope Drum	D990 x d468 x 992
3	002	1	PCS	400092377	Split Drum Sleeve	LEBUS NO. 10026235, PCD:ø510/468x982/ø8,18 RH, Right-hand grooving for left-hand lay wire
3	003	3	PCS	400184709	Shim	T5 / D980 x d490
3	004	1	PCS	400184711	Shim	T5 / D980 x d490 (wire inlet)
3	005	1	PCS	RH31940403	Plate	T6 / 289 x 222
3	006	2	PCS	RH31940404	Wire Rope Clamp	WIRE CLAMP, HW-507E-FR-T90, MACHINING
3	007	14	PCS	RH410576	Wire Rope Clamp	CABLE CLAMP, TBW-520E
3	008	2	PCS	RH316070	Shaft Adapter	ADAPTER PIN, M20x1,5, MACHINING
3	009	2	PCS	RH316071	Nut	ADAPTER NUT, M20x1,5, MACHINING
3	010	4	PCS	RH31607001	Gasket	T2 / D26 x d21
3	011	40	PCS	FA0125G06	Washer	FLAT WASHER, A4, DIN 125 M6; Tykkelse h=1.6 d=6.4 (FA0125G06)
3	012	4	PCS	FA0912G06020	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M6x20; FULLY THREADED (FA0912G06020)
3	013	40	PCS	FA0933G06016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x16; FULLY THREADED (FA0933G06016)
3	014	22	PCS	FA0933G12030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x30; FULLY THREADED (FA0933G12030)
3	015	60	PCS	FA7991G05012	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M5x12 (FA7991G05012)
3	016	2	PCS	GRMAX003S	Grease Nipple	GREASE NIPPLE, 90°, M10x1.0, A2 (GRMAX003S)
3	017	5	PCS	EACPG220	Cable Gland	M20 X1,5MM FOR CABLE SIZE 6-12MM; Nipple for el.motor (EACPG220)
2	005	1	PCS	400184986	Frame	HW-500
2	006	1	PCS	400185445	Level Wind	L982
3	001	1	PCS	400185138	Wire Rope Sheave	PCD500
4	001	1	PCS	400185029	Sheave House	PCD510
4	002	1	PCS	RH314324	Bracket	SHEAVE WHEEL BRACKET CTD2330T90; MACHINING, CTD2330T90
4	003	1	PCS	400185070	Sheave Assembly	PCD500
4	004	1	PCS	RH314338	Bearing Plain	BUSH, D85/d60, MACHINING
4	005	1	PCS	400185108	Protection	T5 / D590 x d500
4	006	2	PCS	400185569	Protection	T12 / D590 x d520
4	007	3	PCS	RH314341	Distance Ring	SPACER, D15 x 1,5, MACHINING
4	008	3	PCS	RH314342	ROLLER, D20/d16, MACHINING	ROLLER, D20/d16, MACHINING; MACHINING, D20/D16
4	009	10	PCS	RH315280	Protection	PROTECTION PLATE, TBW-520E-T90; MACHINING, TBW-520E-T90
4	010	1	PCS	RH315279	FLAG, TBW-520E-T90, MACHINING	FLAG, TBW-520E-T90, MACHINING
4	011	2	PCS	RH315695	Shaft Adapter	ADAPTER, M20x1,5 - M8x1,0, MACHINING
4	012	1	PCS	400185097	Plate	T12 / 116 x 115
4	013	1	PCS	400185103	Protection	T6 / 105 x 182
4	014	1	PCS	400185118	Protection Cover	SEALING COVER D183, ASSEMBLY
4	015	1	PCS	RH328097	Plate	PLATE, 59.4X17 T=6, PART BLANK
4	016	1	PCS	RH328074	Level Wind Indicator	HW-2320E01-T90
5	001	1	PCS	RH326637	ROL. HOLDER (RH), ROL. INDIC.,WELD+MACH	ROL. HOLDER (RH), ROL. INDIC.,WELD+MACH
5	002	1	PCS	RH326638	INDIC. HOLDER, ROL. INDIC.,WELD+MACH	INDIC. HOLDER, ROL. INDIC.,WELD+MACH
5	003	4	PCS	RH318448	Wire Rope Roller	INDICATOR ROLLER ASSEMBLY, LW INDICATOR; ASSEMBLY, INDICATOR ROLLER, Ø30x62

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
5	004	1	PCS	RH326641	SPINDLE, M8/D30/D20, MACHINING	SPINDLE, M8/D30/D20, MACHINING
5	005	4	PCS	RH326639	SPRING PIN, M20x55, MACHINING	SPRING PIN, M20x55, MACHINING
5	006	2	PCS	RH326640	COMPRESSION SPRING, d2,5/D16x81,PU PART	COMPRESSION SPRING, d2,5/D16x81,PU PART
5	007	4	PCS	FA0439G2015	Nut	HEXAGON THIN NUT, A4, DIN 439, M20x1,5 (FA0439G2015)
5	009	2	PCS	FA0912G04025	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M4x25 (FA0912G04025)
5	010	4	PCS	FA0934G14	Nut	HEXAGON NUT, A4-80, DIN 934, M14 (FA0934G14)
5	011	6	PCS	FA0125G14	Washer	FLAT WASHER, A4, DIN 125 M14; Tykkelse h=2.5 d=15 (FA0125G14)
5	012	2	PCS	BEDBS01262	Deep Groove Ball Bearing	DEEP GROOVE BALL BEARING, 61804-2RS1 (BEDBS01262)
5	013	1	PCS	FA0471U0200	Circlip	CIRCLIP RING EXTERNAL, STEEL DIN 471 A20; SPRING STEEL, PHOSPHATED, HRC 47-52 (FA0471U0200)
5	014	1	PCS	FA7991G08020	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M8x20 (FA7991G08020)
5	015	4	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
5	016	1	PCS	SESRB0012	Rotary Shaft Lip Seal	SEAL, 20x35x7, W/STAINLESS SPRING, 35x35x7 (SESRB0012)
5	017	2	PCS	FA0916G05010	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M5x10; CUP POINT (FA0916G05010)
5	018	1	PCS	RH32664301	Gasket	CORK GASKET SHEET, 2 mm
4	017	2	PCS	RH316111	Distance Ring	DISTANCE RING, D48/d35, MACHINING
4	018	1	PCS	400185105	Plate	T12 / 105 X 93
4	019	1	PCS	400182482	Load Cell	0-62kN (max 100 kN)
4	020	5	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
4	021	8	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
4	022	2	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
4	023	3	PCS	FA0933G12080	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x80; FULLY THREADED (FA0933G12080)
4	024	2	PCS	FA0933G16040	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x40; FULLY THREADED (FA0933G16040)
4	025	5	PCS	FA0933G08016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x16; FULLY THREADED (FA0933G08016)
4	026	5	PCS	FA0934G12	Nut	HEXAGON NUT, A4-80, DIN 934, M12 (FA0934G12)
4	027	30	PCS	FA7991G05020	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M5x20 (FA7991G05020)
4	028	4	PCS	FA7991G06012	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M6x12 (FA7991G06012)
4	029	1	PCS	GRMXX003	Grease Nipple	GREASE NIPPLE, M10x1,5 STRAIGHT, A4 (GRMXX003)
4	030	1	PCS	GRMXX002	Grease Nipple	GREASE NIPPLE, M8x1,0 STRAIGHT, A4 (GRMXX002)
4	031	2	PCS	RH329137	Bolt	HEX HEAD SHOULDER BOLT,M12 16H8 L70,MACH
3	002	1	PCS	400185288	Cable Guide	HW-500
4	001	1	PCS	400185234	Cable Guide	HW-500
4	002	1	PCS	RH312645	Shaft Nut	TRAPZIODAL NUT, MACHINING
4	003	1	PCS	400185286	Protection Cover	SEALING COVER D210, ASSEMBLY
4	004	1	PCS	RH315232	Flange Adapter	ADAPTER FLANGE, TR 80x10 NUT; MACHINING, TR 80x10 NUT
4	005	1	PCS	400185287	Protection Cover	T6 / D210 x d82
4	006	4	PCS	RH314300	Bearing Plain	LINING, D115/D100x80, MACHINING
4	007	2	PCS	RH314301	Bearing Plain	LINING W/FLANGE, D65/d45x45, MACHINING
4	008	14	PCS	FA0912G16040	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M16x40; FULLY THREADED (FA0912G16040)
4	009	12	PCS	FA0916G06016	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M6x16; CUP POINT (FA0916G06016)
4	010	6	PCS	FA7991G06012	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M6x12 (FA7991G06012)
4	011	3	PCS	GRMXX003	Grease Nipple	GREASE NIPPLE, M10x1,5 STRAIGHT, A4 (GRMXX003)
3	003	1	PCS	400185290	Bracket	L1578
4	001	1	PCS	400185289	Bracket	100 x 50 x 1497
4	002	1	PCS	RH31722602	Bracket	BRACKET F CABLE GUIDE RAIL CTDW-520E-T90; MACHINING, BRACKET FOR CABLE GUIDE RAIL
4	003	1	PCS	RH316978	Bracket	BRACKET FOR CABLE GUIDE RAIL ROVW-2021E; MACHINING, BRACKET FOR CABLE GUIDE RAIL

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
4	004	4	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
4	005	2	PCS	FA0933G10030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x30; FULLY THREADED (FA0933G10030)
4	006	2	PCS	FA0934G10	Nut	HEXAGON NUT, A4-80, DIN 934, M10 (FA0934G10)
3	004	1	PCS	400185348	Screw	TR 80 x 10 x 2045,5
3	005	2	PCS	400185411	Guide Shaft	D100 x 1622,5
3	006	2	PCS	RH314288	Drive Shaft	SHAFT SUPPORT BUSHING, D150/d100x40; MACHINING
3	007	1	PCS	RH312728	Bearing Housing	BEARING HOUSING, D130; MACHINING
3	008	2	PCS	RH314289	Cover	COVER PLATE, D150, MACHINING
3	009	2	PCS	400185436	Cover	D150 x 25
3	010	1	PCS	RH312742	Bearing Plain	LINING, D70/d60x20, MACHINING
3	011	2	PCS	RH312748	Cover	COVER PLATE, D158/D125/d130/d100/d80x18; MACHINING
3	012	2	PCS	RH31274801	Gasket	T0.8 / D160 x d130
3	013	2	PCS	RH312727	Bearing Plain	LINING, D70/d60x50, MACHINING
3	014	1	PCS	RH313179	Washer	LOCK WASHER, D70/d12x8, MACHINING
3	015	1	PCS	RH313178	Key	KEY, 14x9x176
3	016	1	PCS	RH314358	Drive Shaft	SHAFT, D45, MACHINING
3	017	2	PCS	RH314359	Washer	TRUST WASHER, D80/d22x8, MACHINING
3	018	1	PCS	RH312538	DETECTOR FOR PICK UP, D25, MACHINING	DETECTOR FOR PICK UP, D25, MACHINING
3	019	1	PCS	RH314360	Bolt	STOP BOLT, D50 x L110 / M24, MACHINING
3	020	2	PCS	RH317269	Drive Shaft	SHAFT SUPPORT BUSHING, D150/d100x40
3	021	1	PCS	RH317270	Bearing Plain	LINING, D70/d60x20, MACHINING
3	022	2	PCS	RH312370	Protection	SENSOR HOLDER/PROTECTION, MACHINING; MACHINING, M18x1P
3	023	1	PCS	RH317271	Bearing Housing	BEARING HOUSING, D130; MACHINING
3	024	2	PCS	RH409939	Bracket	HOUSING FOR PICKUP
3	025	1	PCS	RH31253801	DETECTOR FOR PICK UP, D25 x L190 / M24	DETECTOR FOR PICK UP, D25 x L190 / M24; MACHINING
3	026	1	PCS	RH313187	Bolt	STOP BOLT, D50/M24x165, MACHINING
3	027	1	PCS	RH312859	Locking Nut	LOCKING NUT M60x2 T=45; MACHINING, M60x2 T=45
3	028	1	PCS	RH315260	Protection	CABLE CHAIN PROTECTION, B95xL175; BENDING
3	029	1	PCS	RH328136	Distance Ring	SPACER, D60/d50 L5, MACHINING
3	030	2	PCS	400185567	Protection Cover	T6 / D198 x d162
3	031	1	PCS	BETRF007	Taper Roller Bearing	TAPERED ROLLER BNG,31312-A-N11CA-A80-120; d60/D130x67 (BETRF007)
3	032	1	PCS	RHEACVA196-150_01	Cable Protection	ASSEMBLY CABLE PROTECTION (RHEACVA196-150_01)
3	033	1	PCS	BESRS012	Spherical Roller Bearing	SPHERICAL ROLLER BEARING, 21312-E1; d60/D130x31 (BESRS012)
3	034	1	PCS	BELWS012	Washer	LOCKING WASHER, MB-12; MB-12 (BELWS012)
3	035	8	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
3	036	6	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	037	30	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
3	038	4	PCS	400091197	Washer	FLAT WASHER, 8.8 VZN, DIN 125 M24; Tykkelse h=4.0 d=25 (FA0125H24)
3	039	8	PCS	FA0912G05012	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M5x12 (FA0912G05012)
3	040	16	PCS	FA0912G08025	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M8x25; FULLY THREADED (FA0912G08025)
3	041	8	PCS	FA0912G12035	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M12x35; FULLY THREADED (FA0912G12035)
3	042	8	PCS	FA0912G12045	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M12x45; FULLY THREADED (FA0912G12045)
3	043	2	PCS	FA0912G20030	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M20x30 (FA0912G20030)
3	044	4	PCS	400185190	Screw	HEX.HEAD SCREW A4-80, DIN 931 M8x140; THREAD LENGTH: 28mm (FA0931G08140)
3	045	6	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)

TITLE_BOM

Level	Pos	Qty	Unit	Aras ID	Name	Description
3	046	1	PCS	FA0933G10035	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x35; FULLY THREADED (FA0933G10035)
3	047	24	PCS	FA0933G12045	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x45; FULLY THREADED (FA0933G12045)
3	048	6	PCS	FA0933G12050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x50; FULLY THREADED (FA0933G12050)
3	049	4	PCS	400091267	Screw	HEX.HEAD SCREW 8.8 VZN, DIN 933 M24x70; FULLY THREADED (FA0933H24070)
3	050	4	PCS	FA0934G08	Nut	HEXAGON NUT, A4-80, DIN 934, M8 (FA0934G08)
3	051	6	PCS	FA0934G12	Nut	HEXAGON NUT, A4-80, DIN 934, M12 (FA0934G12)
3	052	2	PCS	400091318	Nut	HEXAGON NUT, GRADE 8, VZN, DIN 934, M24 (FA0934H24)
3	053	2	PCS	FA0985G24	Nut	NUT NYLOCK HEXAGON A4, DIN 985 M24 (FA0985G24)
3	054	4	PCS	SESRB041	Rotary Shaft Lip Seal	SEAL, 70x100x10, W/STAINLESS SPRING, 100x100x10 (SESRB041)
3	055	2	PCS	GRMAX002	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10X1.0, ELZN (GRMAX002)
3	056	1	PCS	FA0471F0600	Circlip	CIRCLIP RING EXTERNAL, A2 DIN 471 A60; STAINLESS (material x40Cr13) (FA0471F0600)
3	057	12	PCS	FA7991G06012	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M6x12 (FA7991G06012)
3	059	1	PCS	COSEX084	Gasket	ANTI-CORR. TAPE, DENSO-50 MM x 10 M (COSEX084)
2	007	1	PCS	RH318747	Brake Unit	BRAKE ARRANGMENT HW 500, D600, 22,5 kNm; ASSEMBLY, D850, TQ 22,5 KNm
3	010	1	PCS	RH101550	Brake Band	BRAKE BAND, D600, TWS-500
4	060	12	PCS	400207260	Screw	HEX.HEAD SCREW 8.8 VZN, DIN 933 M16x25; FULLY THREADED (FA0933H16025)
4	070	1.54	M	BLBCB080100	Brake Band	BRAKE LINING, 5/16" X4" (BLBCB080100)
4	080	45	PCS	BLRGB0619	Rivet	BRAKE LINING RIVET, Ø6,35X19mm, BRASS (BLRGB0619)
4	090	5	PCS	FA0964G06012	Screw	SLOTTED RAISED COUNTERS A4 DIN 964 M6x12; COUNTERSINK (FA0964G06012)
4	100	2	PCS	400095607	Protective Sleeve	INNER RING d64/D74/12, ROUND BAR D100x17; MACHINING
3	020	1	PCS	RH318468	Cylinder Assembly	BRAKE CYLINDER SOW-500 / HW-500; ASSEMBLY, MAX STROKE 25,5
4	010	1	PCS	RH318464	Cylinder Assembly	BRAKE CYLINDER,D125/d110,WELD/MACHINING
4	020	1	PCS	RH318465	Piston Rod	PISTON ROD, D50, MACHINING
4	030	1	PCS	RH318467	Piston	PISTON, D109x42,5, BHS-110/50
4	040	1	PCS	RH409526	Stuffing Box	STUFFING BOX, BHS-110/50-S (NVE)
4	050	1	PCS	RH402909/NVE	Stuffing Box	STUFFING BOX NUT, BHS-110/50 (NVE)
4	060	1	PCS	RH403177	Bearing Plain	LINING, D40/d30x95, TWS-820
4	070	1	PCS	RH318466	Stroke Limiter	STROKE LIMITER, D110, MACHINING; MACHINING, Ø110x110
4	080	1	PCS	SEPSA006	Hydraulic Seal piston	PISTON SEAL, 110-96-16/32, SIMRIT, 110x110x96 (SEPSA006)
4	090	1	PCS	SEPRA011	Hydraulic Seal rod	PISTON ROD SEAL AUN-50-106, SIMRIT, 60x60x10 (SEPRA011)
4	100	1	PCS	SEDWA010	Hydraulic Seal rod	DIRT-WIPER AS-50-65-7/10, 65x65x10 (SEDWA010)
4	110	1	PCS	SEORA175	O-Ring	O-RING, Ø99,30 x 5,70, 100x100x6 (SEORA175)
4	120	1	PCS	SEORA062	O-Ring	O-RING, Ø34,52 x 3,53 (R4137), 35x35x4 (SEORA062)
4	130	16	PCS	BSPXX016	Spring	PLATE SPRING, DIN 2093, 100x51x5 (BSPXX016)
4	140	1	PCS	BETBS014	Thrust Ball Bearing	THRUST BALL BEARING, SINGLE DIR, 51113; d65/D90x18 (BETBS014)
4	150	1	PCS	FA0985E30	Nut	NUT NYLOCK HEXAGON, 8 ELZN, DIN 985 M30 (FA0985E30)
4	160	1	PCS	FA0125E30	Washer	FLAT WASHER, ELZN, DIN 125 M30; Tykkelse h=4.0 d=31 (FA0125E30)
4	170	1	PCS	GRRAX002S	Grease Nipple	GREASE NIPPLE, STRAIGHT, 1/4"R, A2 (GRRAX002S)
4	180	1	M	SEGRA077	Guide Ring	GUIDE STRIP, 15x2.0 (PTFE), 15x15x2 (SEGRA077)
4	190	1	PCS	FA0913G08010	Threaded Insert	HEX.SCKT SET SCR, FLAT,A4, DIN913 M8x10; FLAT POINT (FA0913G08010)
4	200	1	PCS	400092374	Plug	THREADED PLUG, A2, BSPT 1/4", DIN 906; THREADED PLUG, A2, BSPT 1/4", DIN 906
3	030	1	PCS	RH403248	Brake Adjusting Device	BRAKE ADJUSTMENT NUT, D63.5/M30x74; AWW-1800
3	040	2	PCS	RH314558	Bearing Plain	LINING, D50/d40x25, MACHINING
3	050	1	PCS	RH314541	Bolt	BOLT, D40, MACHINING
3	060	1	PCS	RH314542	Bolt	BOLT, D30, MACHINING

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Level	Pos	Qty	Unit	Aras ID	Name	Description
3	070	2	PCS	RH408161	Locking Plate	LOCK DISC, D40/d11x6, TWS-
3	080	2	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)
3	090	4	PCS	FA0916G06010	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M6x10; CUP POINT (FA0916G06010)
3	100	3	PCS	GRRAX002S	Grease Nipple	GREASE NIPPLE, STRAIGHT, 1/4"R, A2 (GRRAX002S)
2	008	1	PCS	RH318063	Bearing Housing	BEARING HOUSING, D180x100, ASSEMBLY; ASSEMBLY, D120/H125, 100x320
3	001	1	PCS	RH318058	Bearing Housing	BEARING HOUSING, D180x90, MACHINING; MACHINING, D180/H125, 320x100
3	002	2	PCS	RH318059	Cover	BEARING HOUSING COVER, SEAL COVER; MACHINING, D230x145x17, DH=180, SEAL COVER
3	003	2	PCS	RH31805901	Gasket	D233 x d183 x 0,8
3	004	1	PCS	BESRS089	Spherical Roller Bearing	SPHERICAL ROLLER BEARING, 23024-E1; d120/D180x46 (BESRS089)
3	005	2	PCS	SESRB0732	Rotary Shaft Lip Seal	SEAL, 130x170x12, NBR, SSS, (SESRB0732)
3	006	16	PCS	FA0933G12020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x20; FULLY THREADED (FA0933G12020)
3	007	16	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
3	008	1	PCS	GRMAX001S	Grease Nipple	GREASE NIPPLE, STRAIGHT, M10x1.5, A2 (GRMAX001S)
2	009	1	PCS	400185476	Drive Shaft	HW-515-FS-T90/URP
2	010	1	PCS	400185485	Support Shaft	SLIP RING, PCD260x326 / d75
2	011	1	PCS	RH317304	Fixed Support	BRAKE BAND SUPPORT HW-520E-F-T90; ASSEMBLY
3	010	1	PCS	RH317303	Fixed Support	BRAKE BAND SUPPORT HW-520E-F-T90; MACHINING
3	020	2	PCS	RH408614	SLIDING PLATE, TWS-2000-10000	SLIDING PLATE, TWS-2000-10000
3	030	2	PCS	RH408797	Nut	SLIDE NUT WDU-4000/4500
3	040	2	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
3	050	4	PCS	FA7991G06025	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M6x25 (FA7991G06025)
3	060	4	PCS	FA0933G16030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x30; FULLY THREADED (FA0933G16030)
3	070	4	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
3	080	2	PCS	FA0933G16080	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x80; FULLY THREADED (FA0933G16080)
2	012	1	PCS	RH313890	Key	KEY, 28x16, MACHINING
2	013	1	PCS	400185508	Protection	DRIP TRAY - HW515-FS-T90/URP
3	001	1	PCS	400185539	Plate	T8 / 790 x 400
3	002	1	PCS	400185541	Plate	T8 / 1517,5 x 75
3	003	1	PCS	400185543	Plate	T8 / 796 x 140,8
3	004	1	PCS	RH32750002	DRIP TRAY PIPE,PIPE Ø30/24-L151,PBLANK	DRIP TRAY PIPE,PIPE Ø30/24-L151,PBLANK
2	014	1	PCS	400186258	Sheave Assembly	2 x PCD300 Swivel
3	001	1	PCS	RH327527	Bracket	PIVOT SHEAVE BRACKET,HW-2320E-T90,MACH
3	002	2	PCS	RH327556	INDICATOR ROLLER ASSE,HW-515E-T90,ASSE	INDICATOR ROLLER ASSE,HW-515E-T90,ASSE
4	020	1	PCS	RH32755602	Bearing Plain	ROLLING BUSH,PIPE D60/d40 L696,MACH
4	030	1	PCS	RH317016	Bearing Plain	LINING, D40,30/20x20, MACHINING
4	040	1	PCS	RH316935	Bearing Plain	LINING, D30/d20x12, MACHINING
4	050	1	PCS	RH316936	Distance Ring	DISTANCE RING, D42/d35x8, MACHINING
4	060	2	PCS	BEDBS027	Deep Groove Ball Bearing	DEEP GROOVE BALL BEARING, 6004 2RS; d20/D42x12 (BEDBS027)
4	070	2	PCS	FA0472F0420	Circlip	CIRCLIP RING INTERNAL, A2 DIN 472 I42; STAINLESS (material x40Cr13) (FA0472F0420)
4	080	2	PCS	SESRA006	Rotary Shaft Lip Seal	SEAL, 30x42x7, 42x42x7 (SESRA006)
3	003	2	PCS	RH327529	Bracket	PIVOT SHEAVE GUIDE ROLLER BRACKET, MACH
3	004	1	PCS	RH327533	Frame	PIVOT SHEAVE FRAME,HW-515E-T90,MACH
3	005	2	PCS	WIBLX080300-015-ST	Sheave Assembly	GUIDE SHEAVE PCD300,WØ8.18,D125 kN,ST (WIBLX080300-015-ST)
3	006	1	PCS	RH32752401	Bushing	BUSHING, PIPE D140/d120 L25, MACHINING
3	007	1	PCS	RH32752402	Bushing	BUSHING, PIPE D125/110 L25, MACHINING

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Level	Pos	Qty	Unit	Aras ID	Name	Description
3	008	1	PCS	RH32752403	Wire Rope Sheave	PIV. SHEAVE COV.,PL. D230/d67.5/T40,MACH
3	009	4	PCS	RH319473	Bearing Plain	LINING, D50/d40x21, MACHINING
3	010	2	PCS	RH32752405	Bolt	BOLT, D40x150, MACHINING
3	011	4	PCS	RH312592	Locking Plate	LOCKING PLATE, 35x75x8, MACHINING; MACHINING, T=8
3	012	1	PCS	RH329317	Cover	PIVOT SHEAVE COVER, D350/d147/T25, MACH
3	013	1	PCS	BELNS024	Locking Nut	LOCK NUT, KM-24; M120x2 (BELNS024)
3	014	1	PCS	BELWS024	Washer	LOCKING WASHER, MB-22; MB-24 (BELWS024)
3	015	2	PCS	GRMXX003	Grease Nipple	GREASE NIPPLE, M10x1,5 STRAIGHT, A4 (GRMXX003)
3	016	1	PCS	SESRB077	Rotary Shaft Lip Seal	SEAL, 140x170x15, W/STAINLESS SPRING, 15x170x170 (SESRB077)
3	017	2	PCS	BETRS0373	Taper Roller Bearing	TAPERED ROLLER BEARING, 33024 (BETRS0373)
3	018	1	PCS	SESRA070	Rotary Shaft Lip Seal	SEAL, 125x150x12, (SESRA070)
3	019	1	PCS	GRMXX002	Grease Nipple	GREASE NIPPLE, M8x1,0 STRAIGHT, A4 (GRMXX002)
3	020	12	PCS	FA0933G12030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x30; FULLY THREADED (FA0933G12030)
3	021	4	PCS	FA7991G08030	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M8x30 (FA7991G08030)
3	022	8	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	023	8	PCS	FA0933G10020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x20; FULLY THREADED (FA0933G10020)
3	024	12	PCS	FA0125G12	Washer	FLAT WASHER, A4, DIN 125 M12; Tykkelse h=2.5 d=13 (FA0125G12)
3	025	6	PCS	FA7991G08025	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M8x25 (FA7991G08025)
3	026	6	PCS	FA7991G08020	Screw	SOCKET HEAD CAP SCREW,A4, DIN 7991 M8x20 (FA7991G08020)
3	027	2	PCS	RH329338	Sheave Assembly	SHEAVE PIVOT LOCK, HW-515E-T90, ASSEMBLY
4	010	1	PCS	RH329318	GUIDE PINE SUPPORT, HW-515E-T90	GUIDE PINE SUPPORT, HW-515E-T90; WELDING & MACHINING
4	020	1	PCS	RH329319	Pipe	PIPE, HOLLOW BAR D35x3/L130, MACHINING
4	030	1	PCS	RH329320	Pin	GUIDE PIN, ROUND BAR D35xL232, MACHINING
4	040	1	PCS	RH32841303	Handle	HANDLE PIN, D12, MACHINING
4	050	4	PCS	FA0916G08010	Threaded Insert	HEX.SOCKET SET S, CUP. A4, DIN916 M8x10; CUP POINT (FA0916G08010)
4	060	2	PCS	FA0933G10030	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x30; FULLY THREADED (FA0933G10030)
4	070	2	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
4	080	1	PCS	FAXXXXX1774	Spring Pin	SPRING COTTER PIN, Ø6,3 DOUBLE, A4 (FAXXXXX1774)
3	028	8	PCS	RH329339	Bearing Plain	GUIDE BUSHING, D30/d21, MACHINING
2	015	2	PCS	400185557	Shear Pin	D35x65 / M12
2	016	1	PCS	RH410231	Clamp	CLAMPING DISC, BREVINI BPH323; MACHINING, Ø123/ø100/ø25x19, Brevini BPH323
2	017	1	PCS	RH328792	Cover	GEARBOX COVER, BPH.23, ASSEMBLY
3	010	1	PCS	RH328793	Cover	GEARBOX COVER, BPH.23, WELDING ASSEMBLY
3	020	4	PCS	FA0933G08008	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x8; FULLY THREADED (FA0933G08008)
3	030	4	PCS	FA0933G05012	Screw	HEX.HEAD SCREW A4-80, DIN 933 M5x12; FULLY THREADED (FA0933G05012)
3	040	4	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
3	050	4	PCS	FA0125G05	Washer	FLAT WASHER, A4, DIN 125 M5; Tykkelse h=1.0 d=5.3 (FA0125G05)
3	060	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	018	1	PCS	RH325991	Motor Bracket	MOTOR SUPPORT RH, BPH323K IEC200, W+M
2	019	1	PCS	RH325993	Motor Bracket	MOTOR SUPPORT LH, BPH323K IEC200, W+M
2	020	1	PCS	400185484	Protection	GREASE CONTAINER - HW515-FS-T90/URP
2	021	4	PCS	400185482	Washer	D45/d14 x 5
2	022	1	PCS	400185477	Protective Sleeve	INNER RING d40/D50/25
2	023	4	PCS	RH319511	Bracket	GROUND BRACKET, 250x120, T=20, MACHINING
2	024	8	PCS	RH317276	Locking Plate	LOCKING WASHER, D80/D50/d18x38; MACHINING

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Level	Pos	Qty	Unit	Aras ID	Name	Description
2	025	1	PCS	RH328382	Cover	GEARBOX COVER, SK9032, ASSEMBLY
3	010	1	PCS	RH328383	Cover	GEARBOX COVER, SK9032, WELDING ASSEMBLY
3	020	4	PCS	FA0933G08008	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x8; FULLY THREADED (FA0933G08008)
3	030	4	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)
3	040	4	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
3	050	4	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
3	060	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)
2	026	1	PCS	RH318968	Bracket	BRACKET FOR BULKHEAD UNION; BENDING, FOR BULKHEAD UNION, 2XØ34 / 90deg
2	027	1	PCS	RH319356	SOLENOID BOX HOLDER	SOLENOID BOX HOLDER
2	028	2	PCS	400095677	Plate	CONTAINER SUPPORT, PLATE 200x50/T20; MACHINING
2	029	1	PCS	400096323	Bushing	LINING, (D110xd100/L25); MACHINING
2	030	1	PCS	400095286	Cover	SHAFT SEAL COVER, (T25/D230xd120); MACHINING
2	031	1	PCS	400095754	Protective Sleeve	INNER RING d30/D40/15, ROUND BAR D50x20; MACHINING
2	032	1	PCS	400185480	Protective Sleeve	INNER RING d30/D40/25
2	033	1	PCS	400185481	Protective Sleeve	INNER RING d40/D50/35
2	034	4	PCS	RH325992	Distance Ring	SPACER, ROUND D32 / L10, MACHINING
2	035	1	PCS	RH318060	Shim	SHIM PLATE, BEARING SUPPORT, 120x320x10
2	036	6	PCS	RH329575	Distance Ring	SPACER, ROUND BAR (D45/L30), MACHINING
2	037	1	PCS	RH318067	Bearing Plain	LINING, D130/d120x45, MACHINING
2	038	1	PCS	400185733	Bracket	Control panel bracket
2	039	1	PCS	400185684	Plate	T5 / 156.5 x 45
2	040	1	PCS	COVVX019	Lifting Sling	EPOCAST 36 WITH HARDENER, 4 L; CHOCKING COMPOUND (COVVX019)
2	041	1	PCS	RH318070	Bearing Plain	LINING, D130/d120x39,5, MACHINING
2	042	31	PCS	FA0125G06	Washer	FLAT WASHER, A4, DIN 125 M6; Tykkelse h=1.6 d=6.4 (FA0125G06)
2	043	21	PCS	FA0125G08	Washer	FLAT WASHER, A4, DIN 125 M8; Tykkelse h=1.6 d=8.4 (FA0125G08)
2	044	8	PCS	FA0125G10	Washer	FLAT WASHER, A4, DIN 125 M10; Tykkelse h=2.0 d=10.5 (FA0125G10)
2	045	26	PCS	FA0125G16	Washer	FLAT WASHER, A4, DIN 125 M16; Tykkelse h=3.0 d=17 (FA0125G16)
2	046	16	PCS	FA0125G18	Washer	FLAT WASHER, A4, DIN 125 M18; Tykkelse h=3.0 d=19 (FA0125G18)
2	047	12	PCS	FA0125G20	Washer	FLAT WASHER, A4, DIN 125 M20; Tykkelse h=3.0 d=21 (FA0125G20)
2	048	9	PCS	400091197	Washer	FLAT WASHER, 8.8 VZN, DIN 125 M24; Tykkelse h=4.0 d=25 (FA0125H24)
2	049	8	PCS	FA6916H16	Washer	HARDENED WASHER, VZN, DIN 6916 M16; 300HV / FOR 10.9 BOLT (FA6916H16)
2	050	4	PCS	FA0912G16060	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M16x60; FULLY THREADED (FA0912G16060)
2	051	4	PCS	400186256	Screw	SOCKET HEAD SCREW 12.9 ZFC, DIN 912 M16x130 (FA0912U16130)
2	052	4	PCS	FA0912G20060	Screw	SOCKET HEAD SCREW A4-80, DIN 912 M20x60; FULLY THREADED (FA0912G20060)
2	053	2	PCS	FA0931G10090	Screw	HEX.HEAD SCREW A4-80, DIN 931 M10x90; THREAD LENGTH:26mm (FA0931G10090)
2	054	1	PCS	FA0931G16110	Screw	HEX.HEAD SCREW A4-80, DIN 931 M16x110; THREAD LENGTH: 38mm (FA0931G16110)
2	055	8	PCS	FA0931G18090-70	Screw	HEX.HEAD SCREW A4-70, DIN 931 M18x90; THREAD LENGTH: 42mm / A4-70 (FA0931G18090-70)
2	056	4	PCS	FA0931G18100-70	Screw	HEX.HEAD SCREW A4-70, DIN 931 M18x100; THREAD LENGTH: 42mm / A4-70 (FA0931G18100-70)
2	057	4	PCS	FA0933G06016	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x16; FULLY THREADED (FA0933G06016)
2	058	6	PCS	FA0933G06020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M6x20; FULLY THREADED (FA0933G06020)
2	059	13	PCS	FA0933G08020	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x20; FULLY THREADED (FA0933G08020)
2	060	2	PCS	FA0933G08025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x25; FULLY THREADED (FA0933G08025)
2	061	6	PCS	FA0933G08035	Screw	HEX.HEAD SCREW A4-80, DIN 933 M8x35; FULLY THREADED (FA0933G08035)
2	062	4	PCS	FA0933G10025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x25; FULLY THREADED (FA0933G10025)
2	063	4	PCS	FA0933G10050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M10x50; FULLY THREADED (FA0933G10050)

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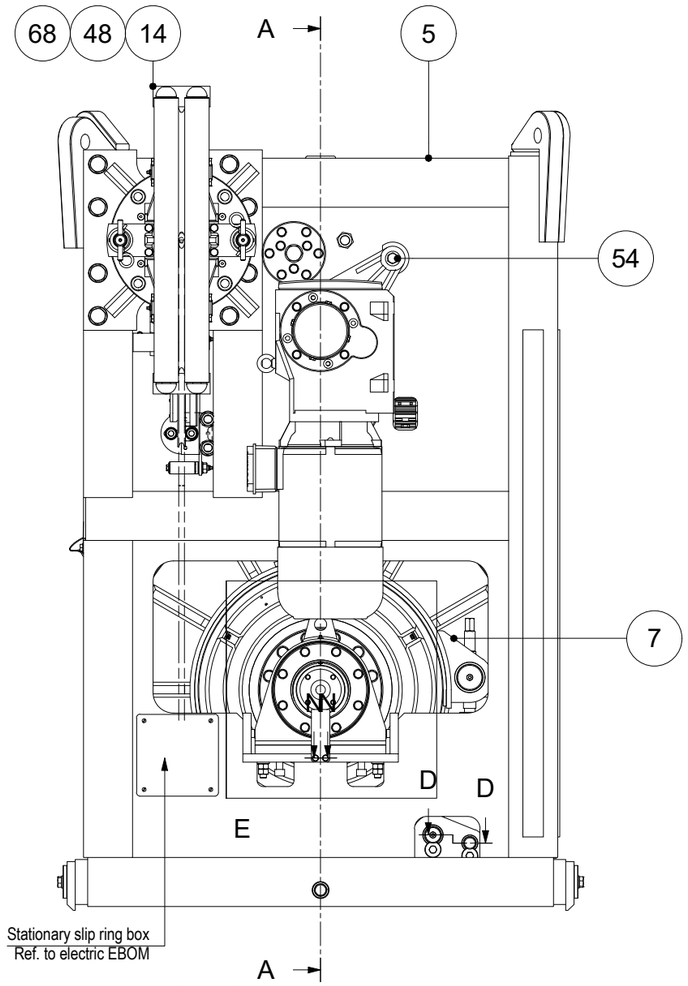
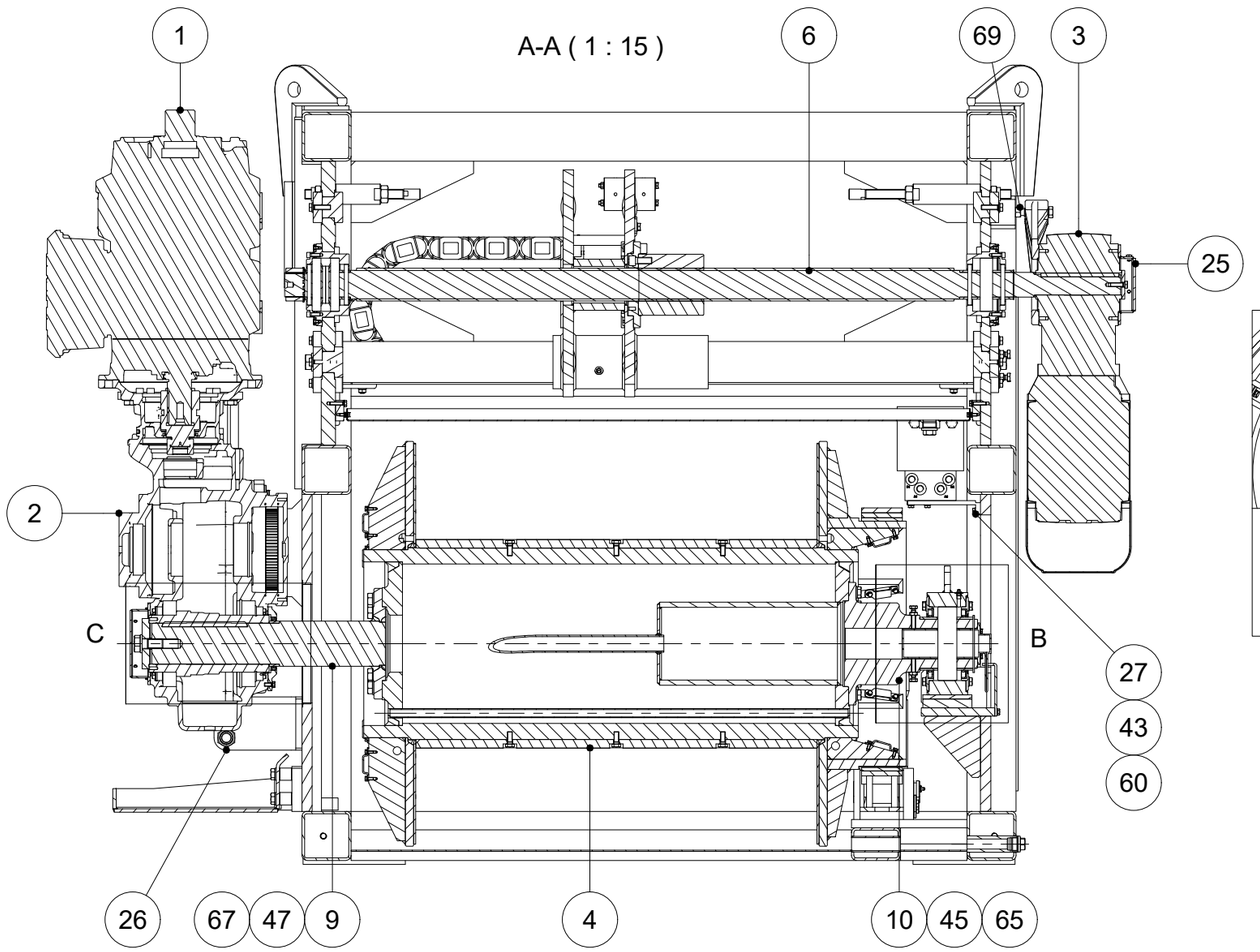
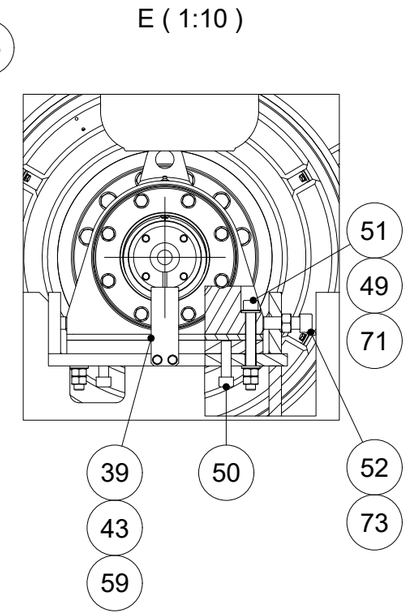
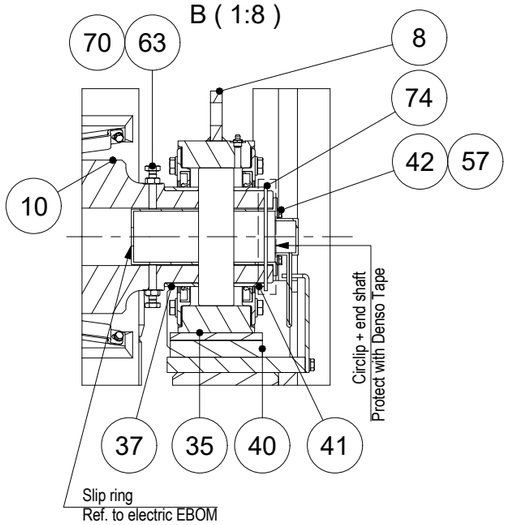
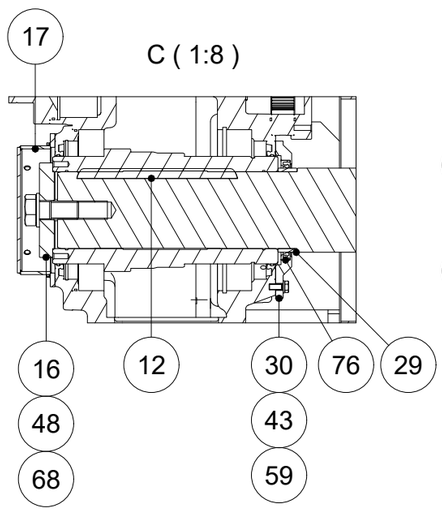
Level	Pos	Qty	Unit	Aras ID	Name	Description
2	064	4	PCS	FA0933G12025	Screw	HEX.HEAD SCREW A4-80, DIN 933 M12x25; FULLY THREADED (FA0933G12025)
2	065	12	PCS	FA0933G16040	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x40; FULLY THREADED (FA0933G16040)
2	066	14	PCS	FA0933G16060	Screw	HEX.HEAD SCREW A4-80, DIN 933 M16x60; FULLY THREADED (FA0933G16060)
2	067	12	PCS	FA0933G20050	Screw	HEX.HEAD SCREW A4-80, DIN 933 M20x50; FULLY THREADED (FA0933G20050)
2	068	9	PCS	400186159	Screw	HEX.HEAD SCREW 8.8 VZN, DIN 933 M24x55; FULLY THREADED (FA0933H24055)
2	069	1	PCS	FA0934G16	Nut	HEXAGON NUT, A4-80, DIN 934, M16 (FA0934G16)
2	070	6	PCS	FA0934G10	Nut	HEXAGON NUT, A4-80, DIN 934, M10 (FA0934G10)
2	071	8	PCS	400090942	Nut	HEXAGON NUT DIN934, GRADE 12.9ZFC, M16 (FA0934Z16)
2	072	4	PCS	FA0934G18	Nut	HEXAGON NUT, A4-80, DIN 934, M18 (FA0934G18)
2	073	4	PCS	FA0934G20	Nut	HEXAGON NUT, A4-80, DIN 934, M20 (FA0934G20)
2	074	1	PCS	FA0471F1200	Circlip	CIRCLIP RING EXTERNAL, A4 DIN 471 A120 (FA0471F1200)
2	075	2	PCS	FCPPF030	Plug	HEXAGON HEAD PLUG, DIN 910, A4, G1"; DIN 910 (FCPPF030)
2	076	1	PCS	SESRB063	Rotary Shaft Lip Seal	SEAL, 110x130x12, W/STAINLESS SPRING, 130x130x12 (SESRB063)
2	079	1	PCS	COSEX084	Gasket	ANTI-CORR. TAPE, DENSO-50 MM x 10 M (COSEX084)
2	080	1	PCS	COGLX041	Sealing Compound	WURTH MS 40, POLYMER B SEALANT (COGLX041)

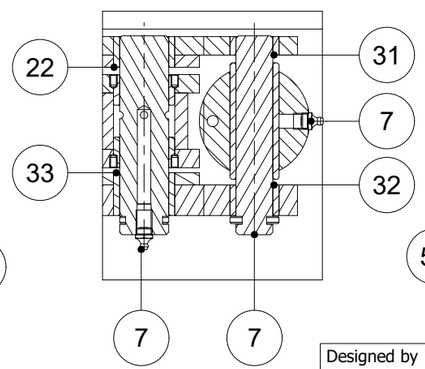


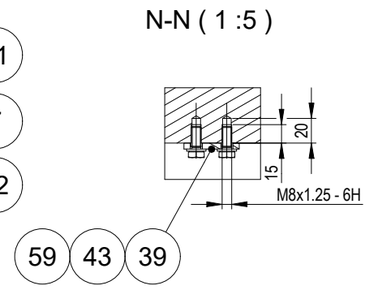












TIGHTENING TORQUE - ACC. DOC. #6402

***MCG SIGNS (Not shown on Drawing)**
***POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT**
***LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH**
***DENSO TAPE - TO BE APPLIED AT NOT PAINTED SURFACES**

77 78 79 80

Designed by	Date	Modified by	ECO / CO			
P Pantovic	09.02.2022.	D Petrovic	ECO-2058181			

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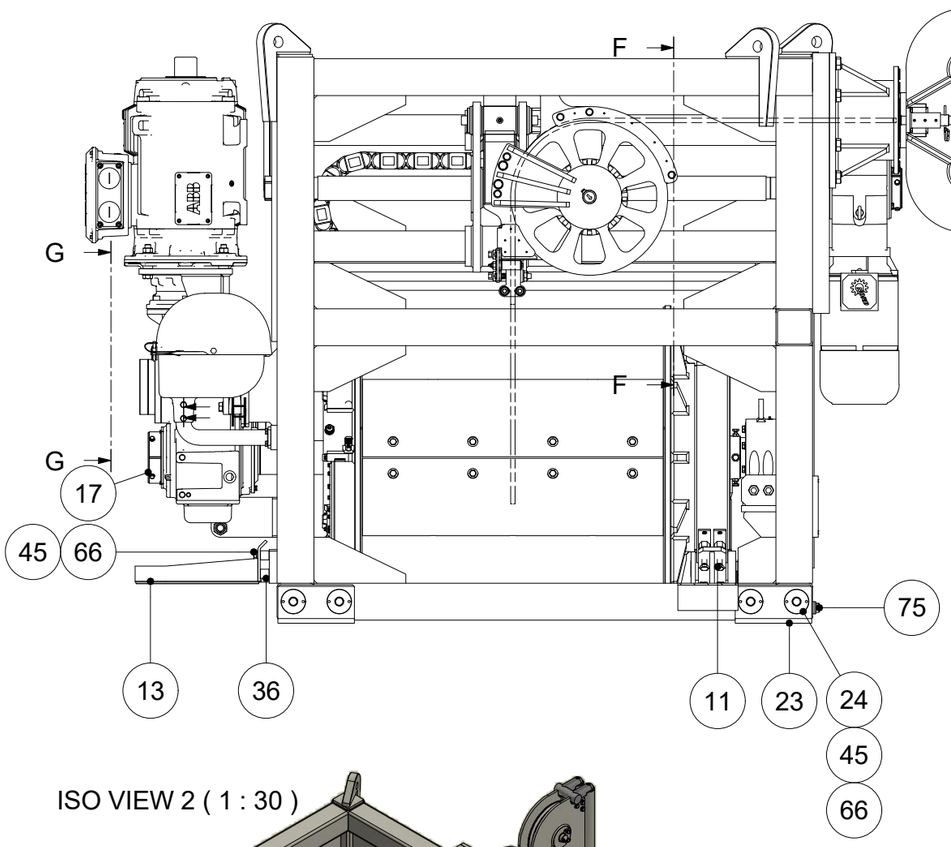
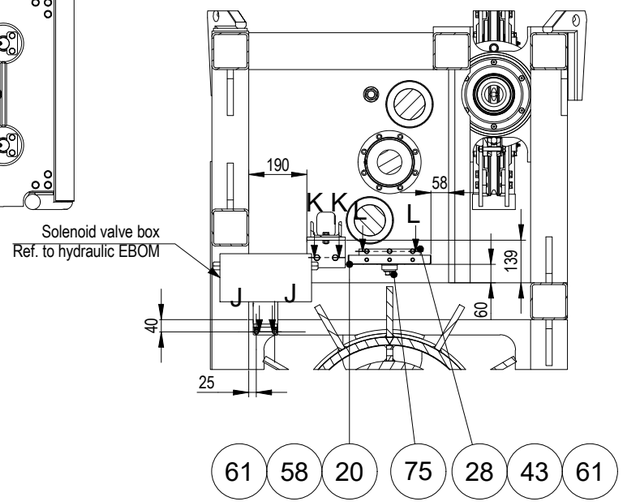
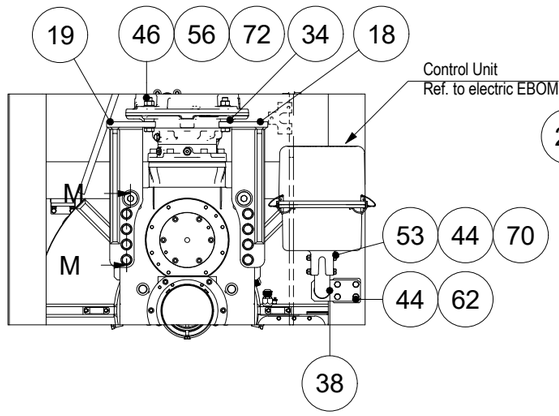
Name	Weight (kg)
ASSEMBLY	4215
Description	**Scale (A3)**
CTD WINCH, HW515FST90/URP	1 : 15
Document ID	**Revision** / **Sheet**
2000005715	B / 1 / 2



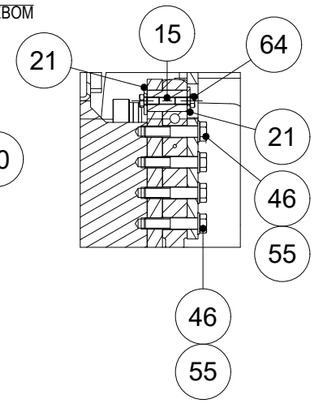
F-F (1 : 20)



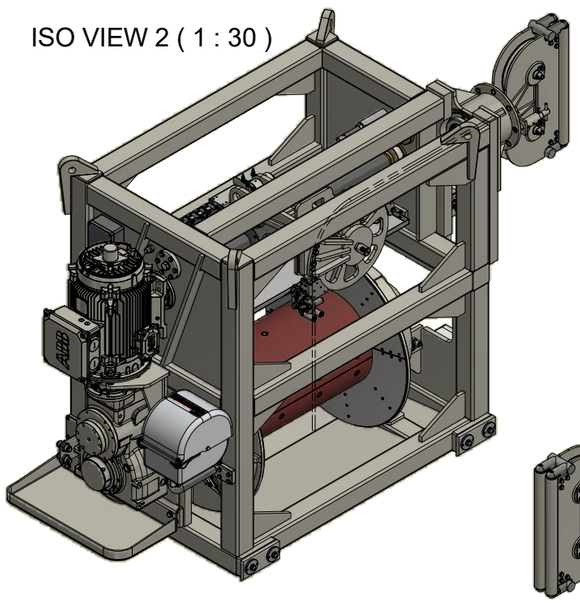
G-G (1 : 20)



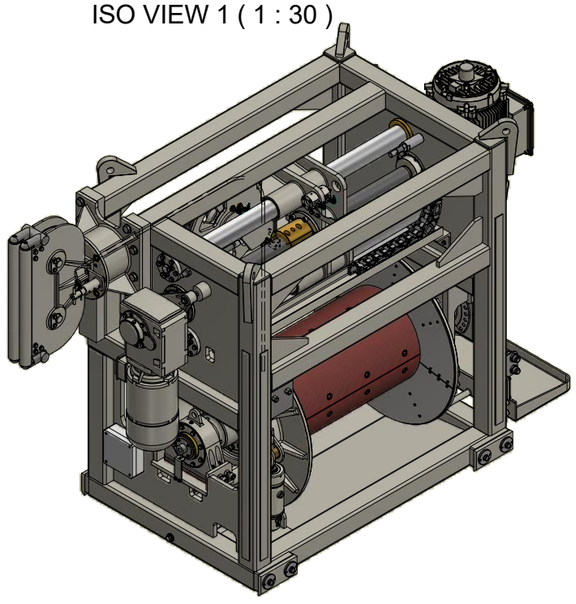
M-M (1 : 10)



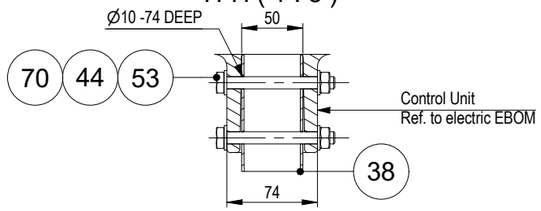
ISO VIEW 2 (1 : 30)



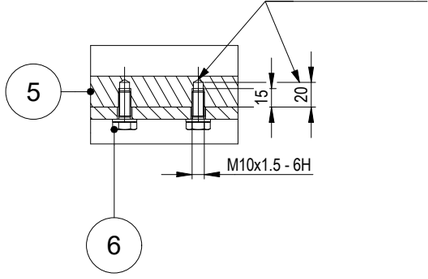
ISO VIEW 1 (1 : 30)



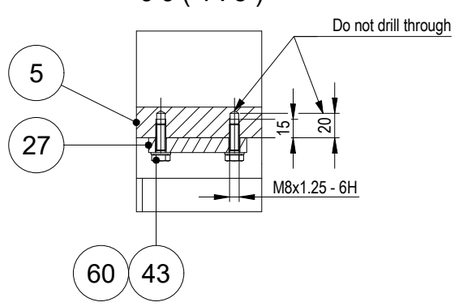
H-H (1 : 5)



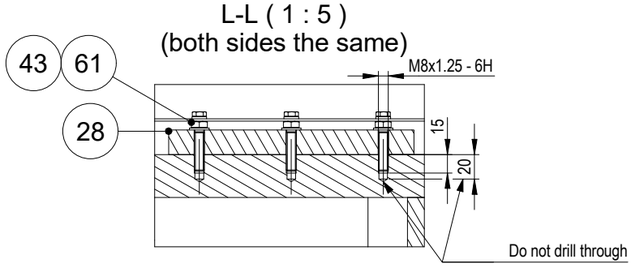
K-K (1 : 5)
(both sides the same)



J-J (1 : 5)



L-L (1 : 5)
(both sides the same)



Designed by	Date	Modified by	ECO / CO			
P Pantovic	2/9/2022	D Petrovic	ECO-2058181			

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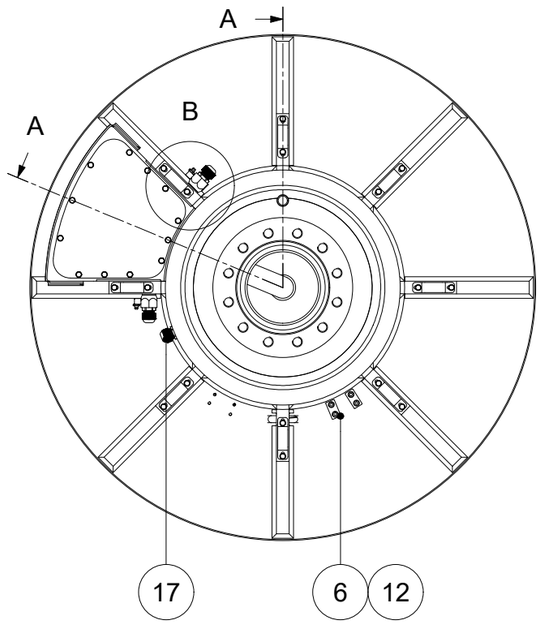
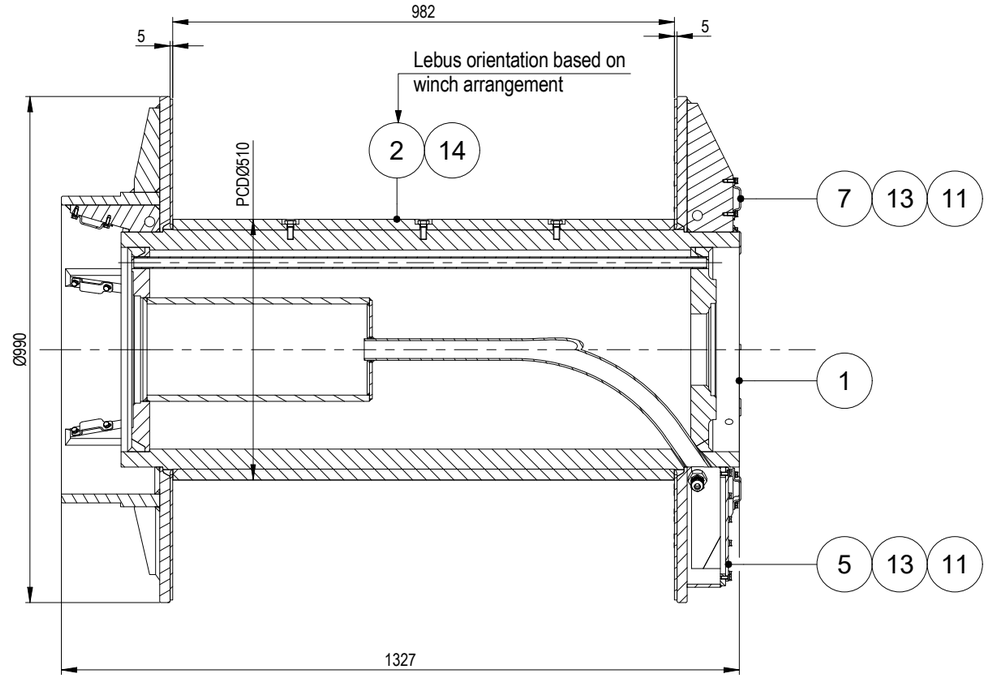
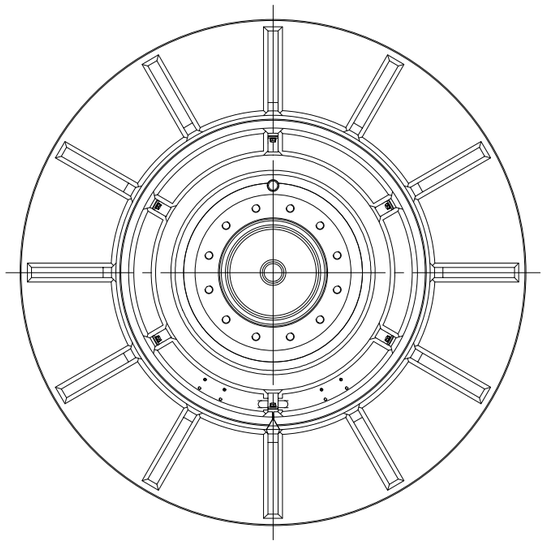
Name	Weight (kg)
ASSEMBLY	4215
Description	Scale (A3)
CTD WINCH, HW515FST90/URP	1 : 20
Document ID: 2000005715	Revision: B / Sheet: 2 / 2

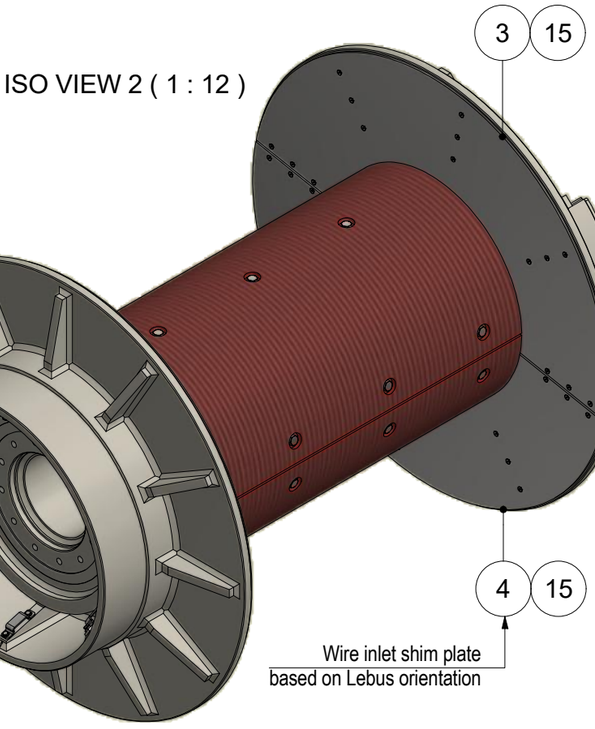
TOL. SYSTEM ACC. TO ISO	General tol. for dimensions
Surface roughness R_a in µm	Machining ISO 2768 tol-class: mK Welding ISO 13920 tol-class: AE Therm. cut ISO 9013 tol-class: 441



A-A (1 : 12)

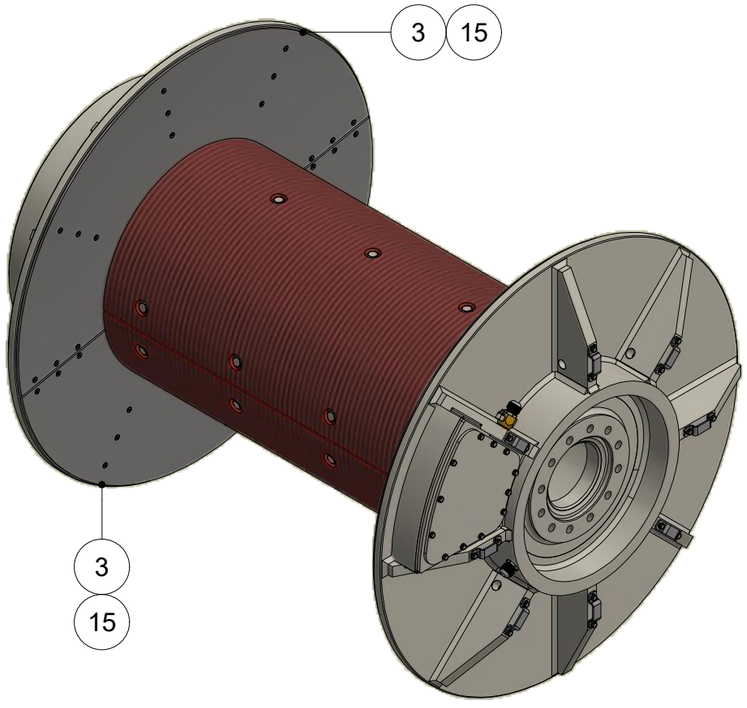




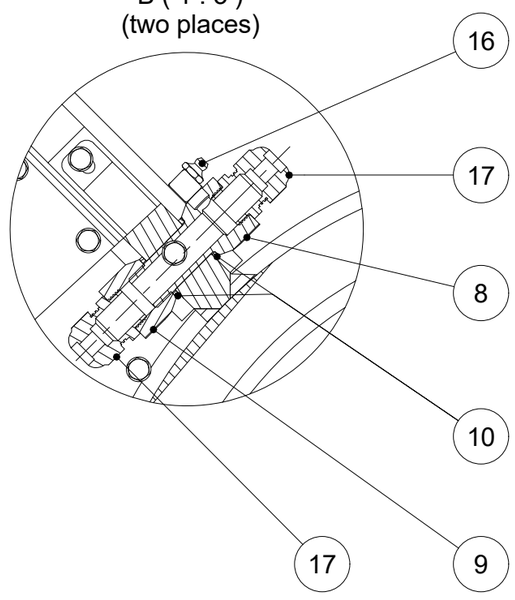


ISO VIEW 2 (1 : 12)

ISO VIEW 1 (1 : 12)



B (1 : 3)
(two places)



Designed by	Date	Modified by	ECO / CO			
P Pantovic	27.01.2022.	P Pantovic	ECO-2056698			

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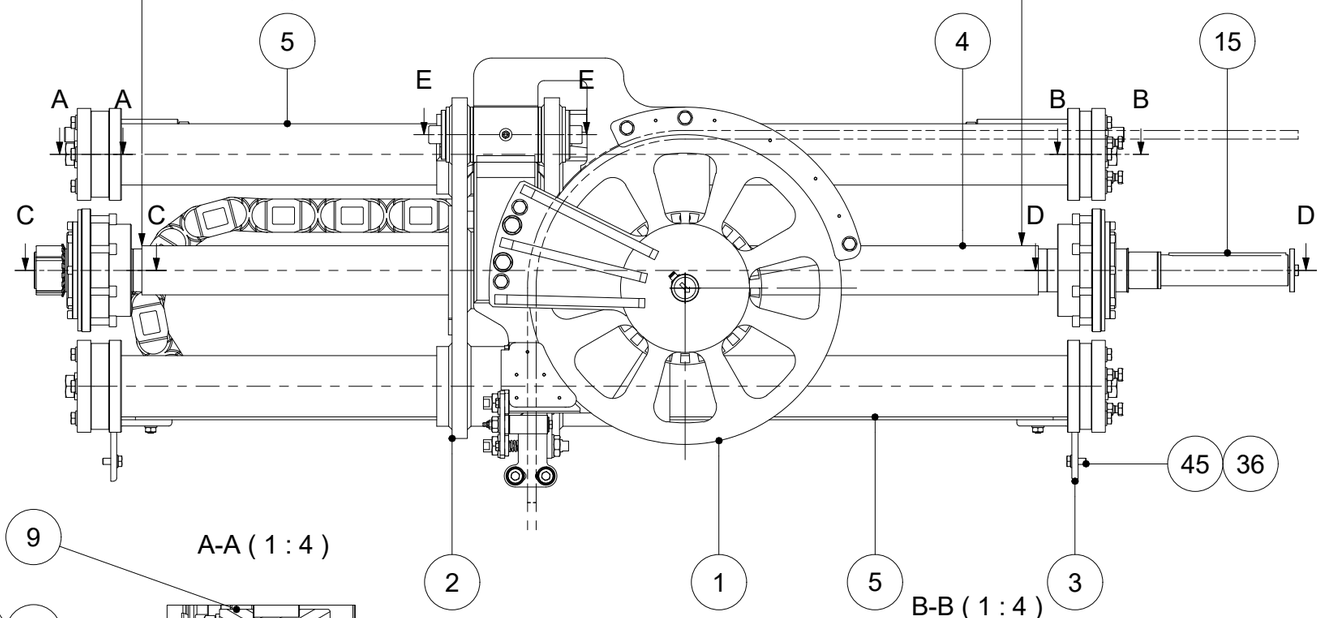
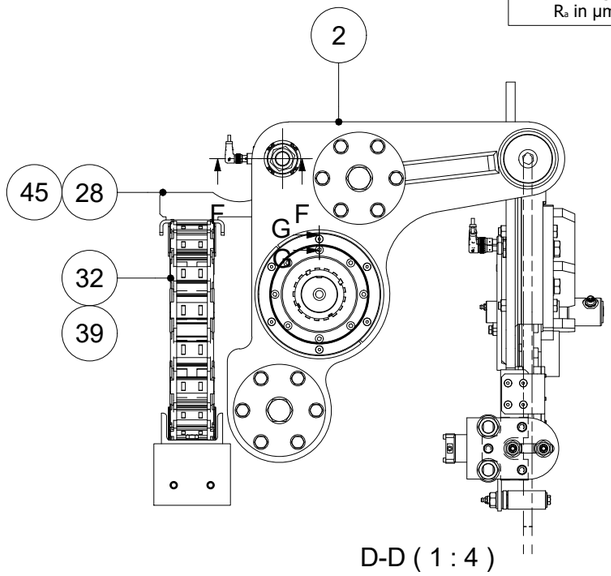
Name		Weight
Wire Rope Drum		1124 kg
Description		Scale (A3)
D990 x PCD510 x L982		1 : 12
Document ID	Revision	Sheet
2000005163	A	1 / 1

TOL. SYSTEM ACC. TO ISO	General tol. for dimensions
Surface roughness R_a in µm	Machining ISO 2768 tol-class: mK Welding ISO 13920 tol-class: AE Therm. cut ISO 9013 tol-class: 441

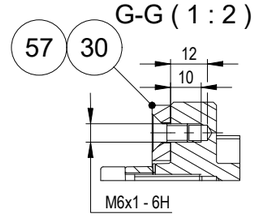
Ends which are not in contact with the nut, Protect with Denso tape

Ends which are not in contact with the nut, Protect with Denso tape

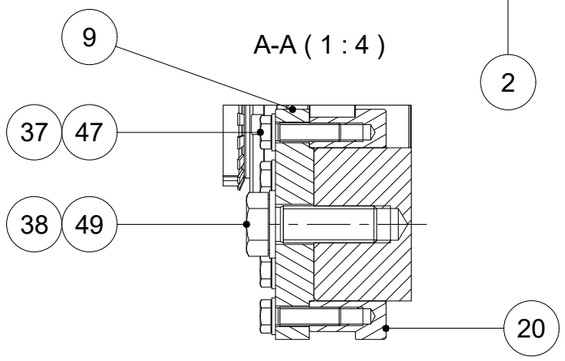




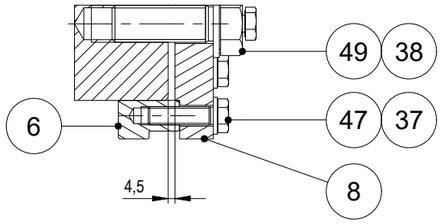
G-G (1 : 2)



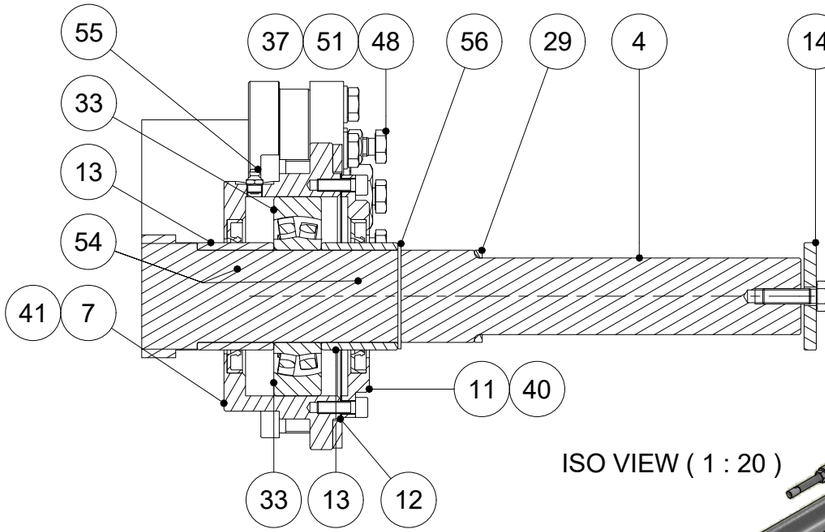
A-A (1 : 4)



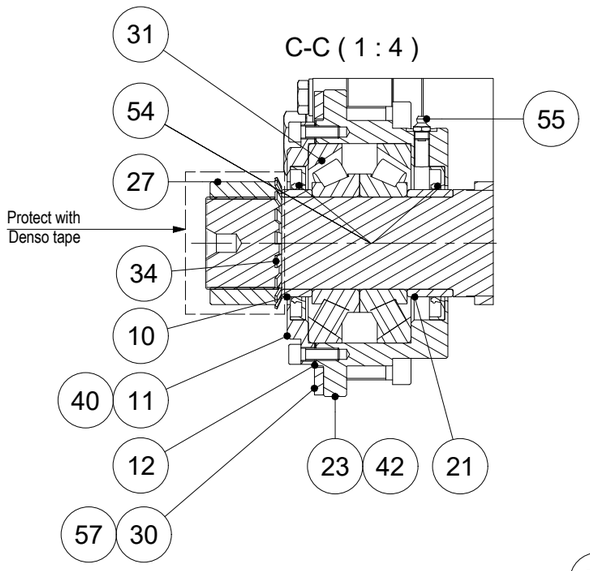
B-B (1 : 4)



D-D (1 : 4)

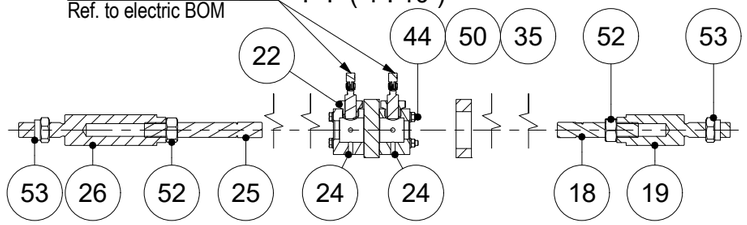


C-C (1 : 4)

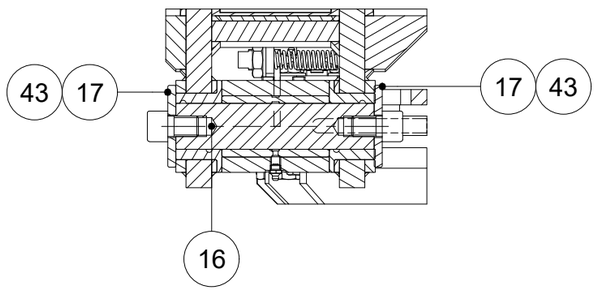


Proximity switch Ref. to electric BOM

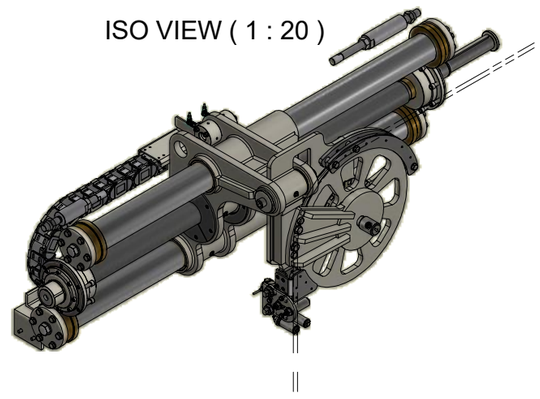
F-F (1 : 10)



E-E (1 : 6)



ISO VIEW (1 : 20)



58 59

TIGHTENING TORQUE - ACC. DOC. #6402

***LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH**
***DENSO TAPE - TO BE APPLIED AT NOT PAINTED SURFACES**

Designed by	Date	Modified by	ECO / CO			
P Pantovic	07.02.2022.	P Pantovic	ECO-2056698			

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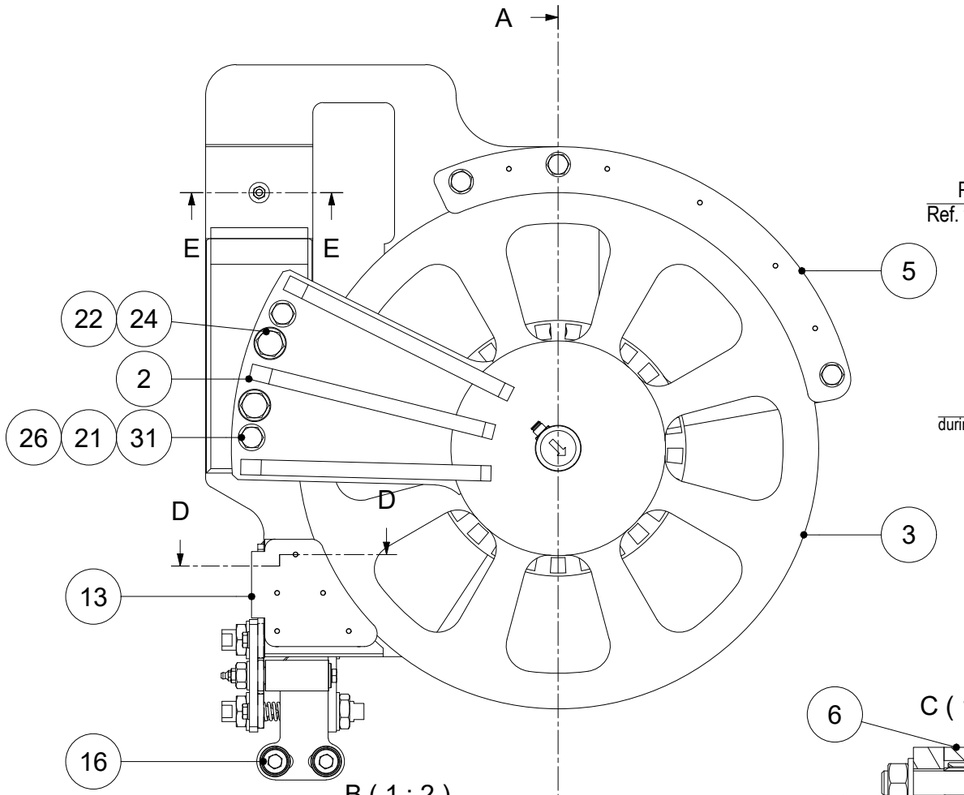
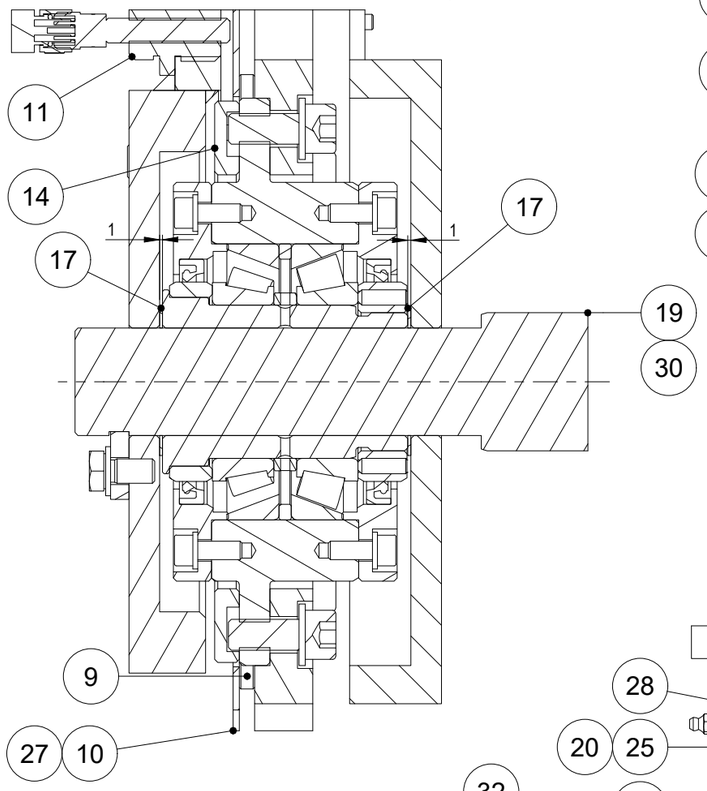
Name		Weight (kg)
Level Wind		543
Description		Scale (A3)
L982		1 : 10
Document ID	Revision	Sheet
2000005622	A	1 / 1

Sheet Purpose:	Sheet Purpose:	TOL. SYSTEM ACC. TO ISO	General tol. for dimensions
MACHINING	**ASSEMBLY**	Surface roughness R_a in µm	Machining ISO 2768 tol-class: mK Welding ISO 13920 tol-class: AE Therm. cut ISO 9013 tol-class: 441

12.5

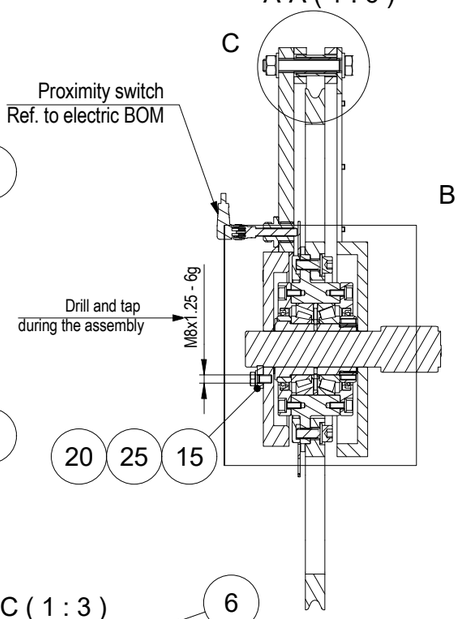


B (1 : 2)

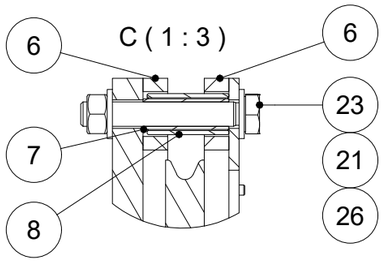


*LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH

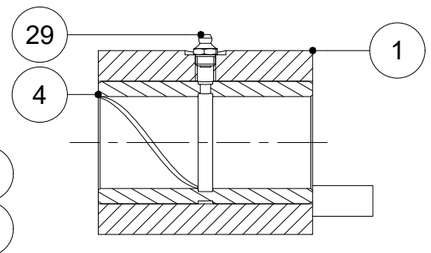
A-A (1 : 6)



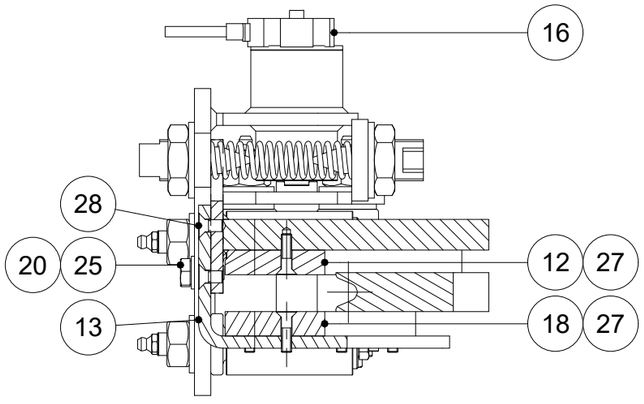
C (1 : 3)



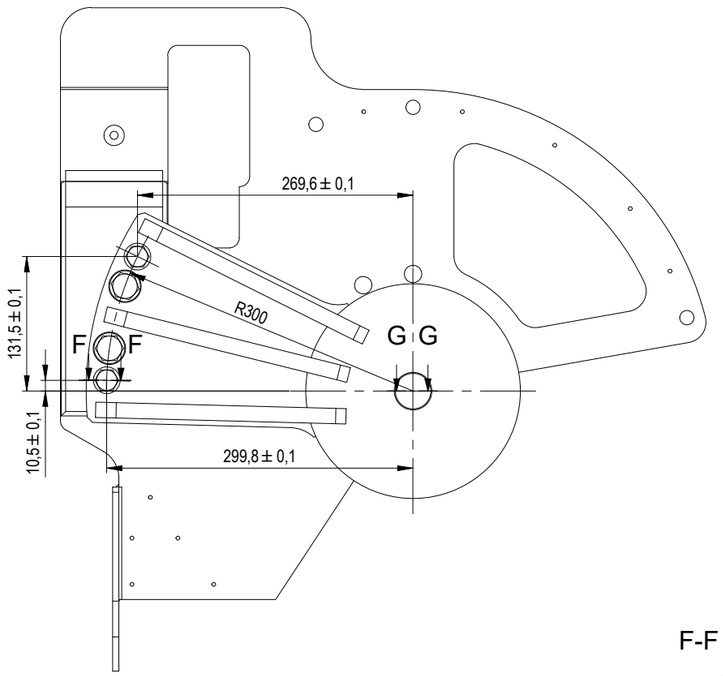
E-E (1 : 3)



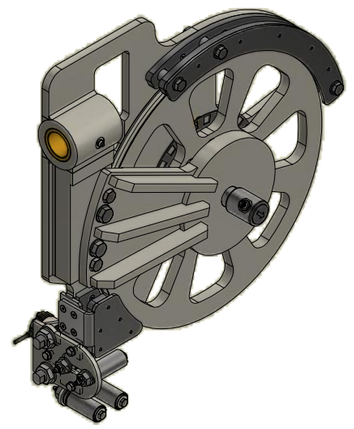
D-D (1 : 3)



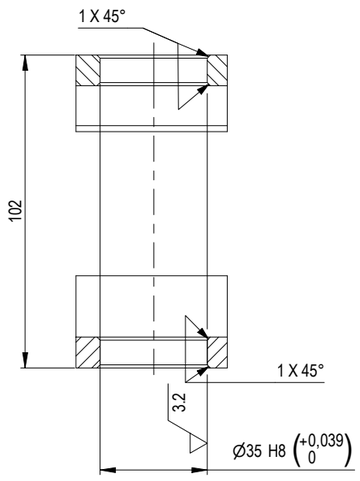
MACHINING VIEW (1 : 6)



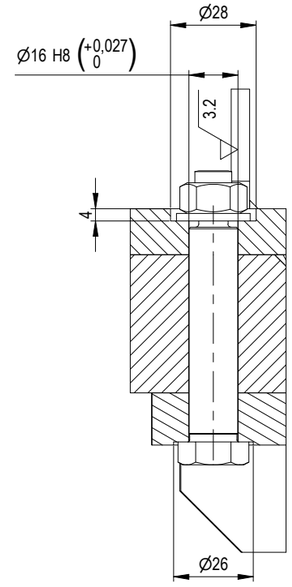
ISO VIEW (1 : 10)



G-G (1 : 2)



F-F (1 : 2)



Designed by	Date	Modified by	ECO / CO			
P Pantovic	02.02.2022.	P Pantovic	ECO-2056698			

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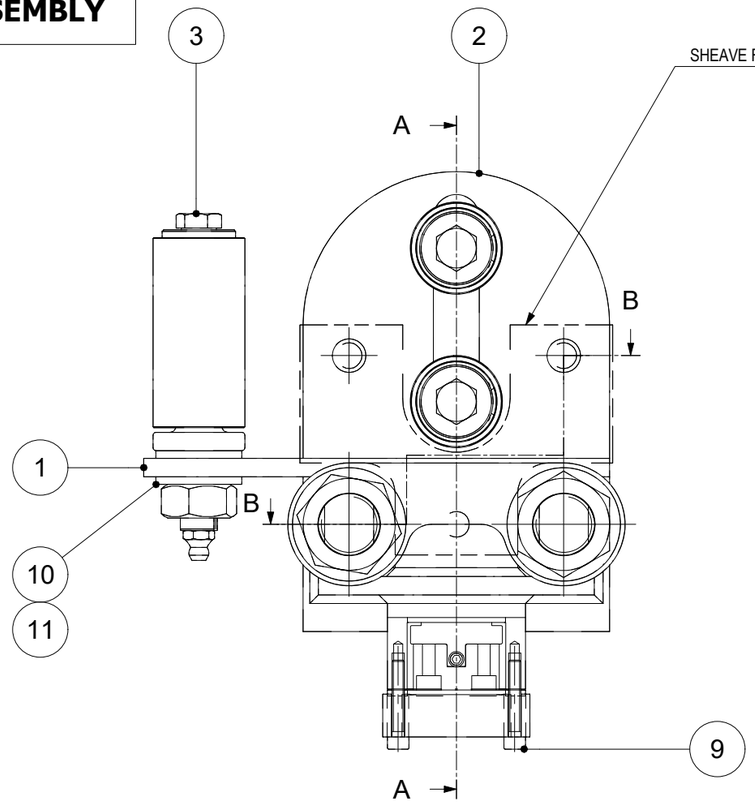
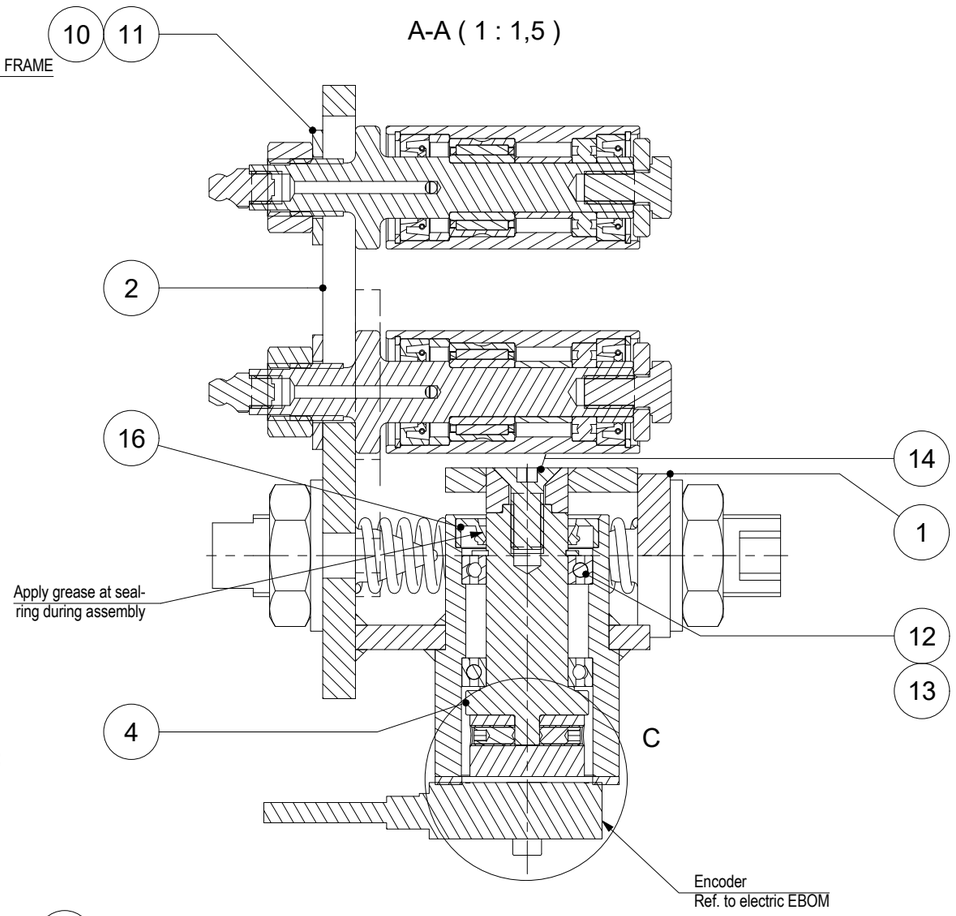
Name	Weight
Wire Rope Sheave	80 kg
Description	**Scale (A3)**
PCD500	1 : 6
Document ID	**Revision** / **Sheet**
2000005409	A / 1 / 1

Sheet Purpose:

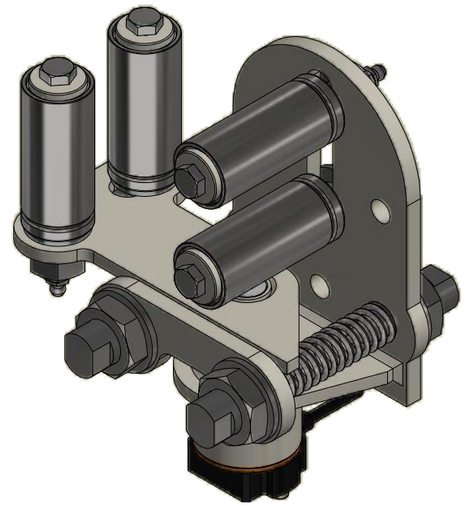
ASSEMBLY



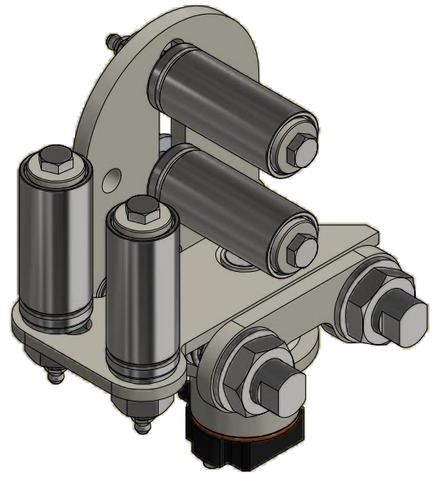
A-A (1 : 1,5)

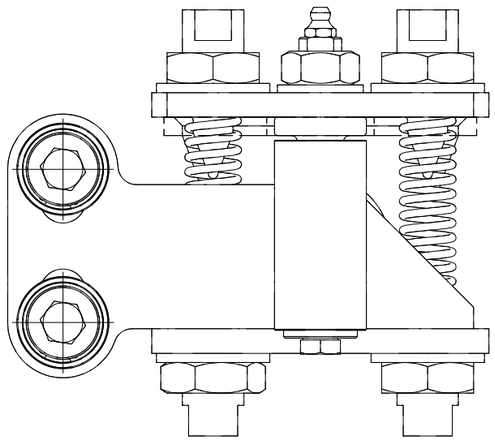


ISO VIEW (1 : 2,5)

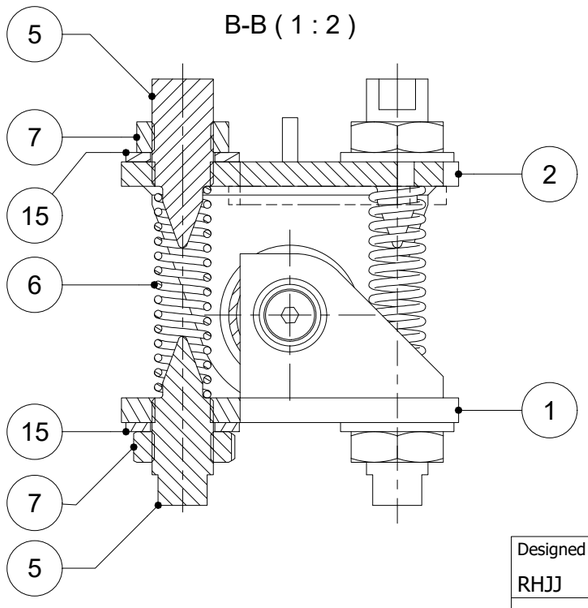


ISO VIEW (1 : 2,5)

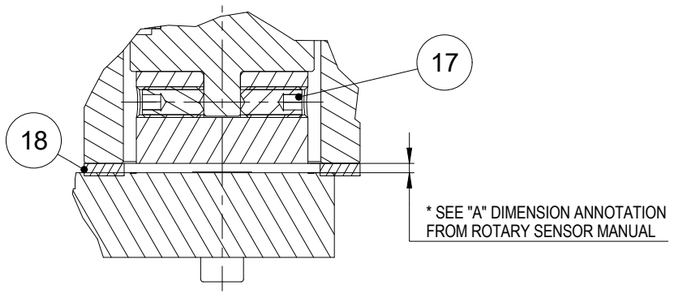




B-B (1 : 2)



C (1 : 1)



Designed by	Date	Modified by	ECO / CO			
RHJJ	26.04.2019.	D Petrovic	ECO-2057722			

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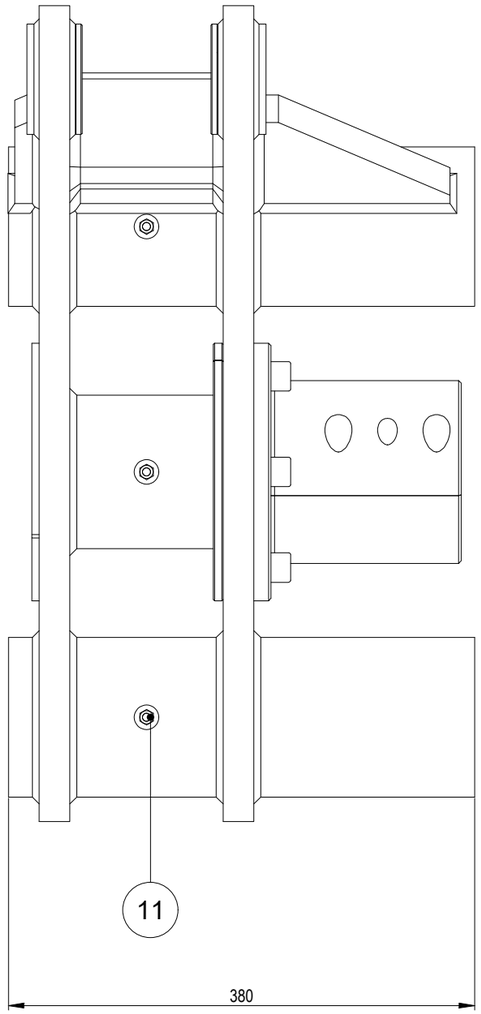
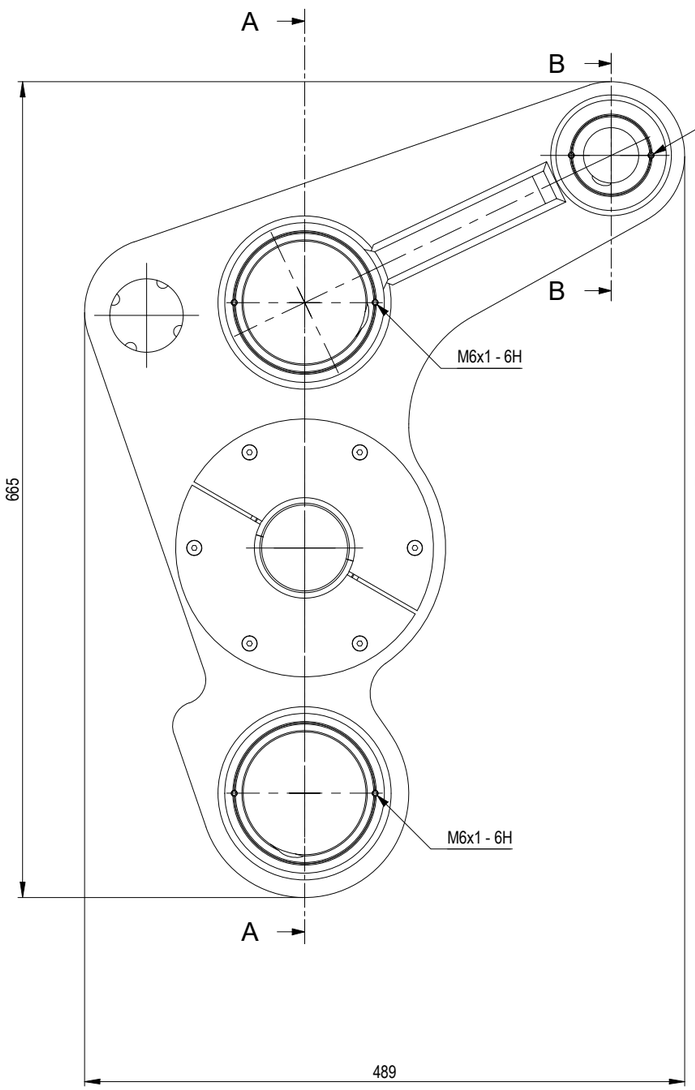
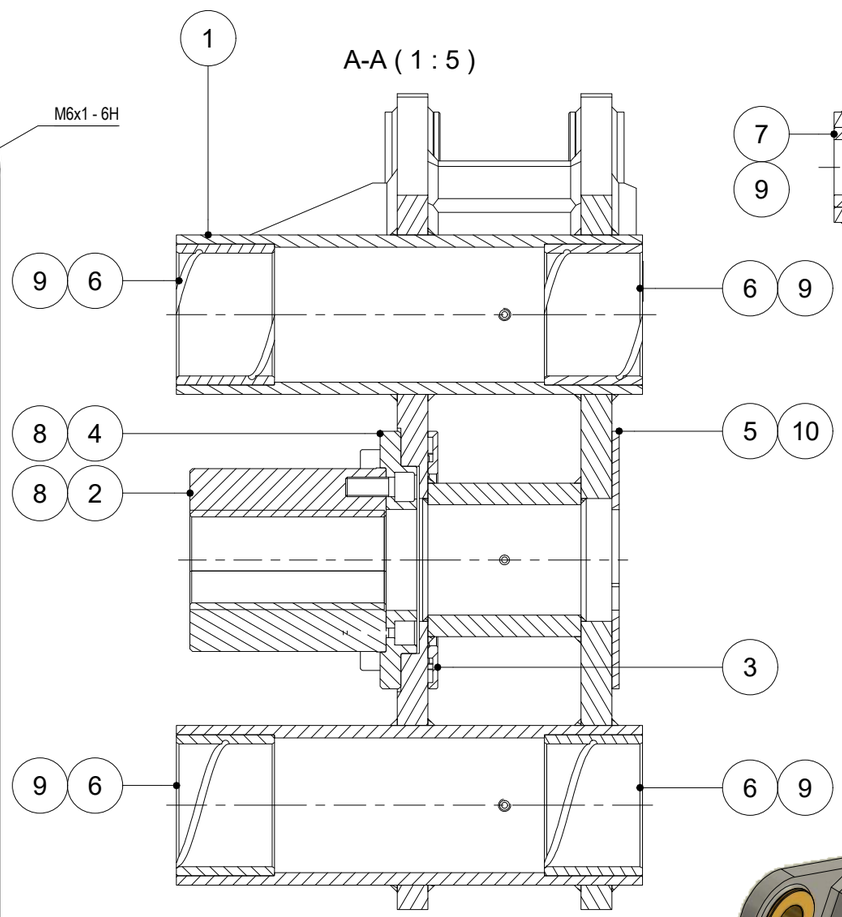
Name	Weight (kg)
LEVEL WIND INDICATOR	4,3
Description	**Scale (A3)**
HW-2320E01-T90	1 : 2
Document ID	**Revision** / **Sheet**
RH328074	B / 1 / 1

TOL. SYSTEM ACC. TO ISO	General tol. for dimensions		
Surface roughness R_a in µm	Machining ISO 2768	tol-class: mK	
	Welding ISO 13920	tol-class: AE	
	Therm. cut ISO 9013	tol-class: 441	

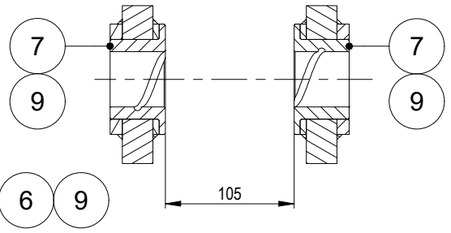




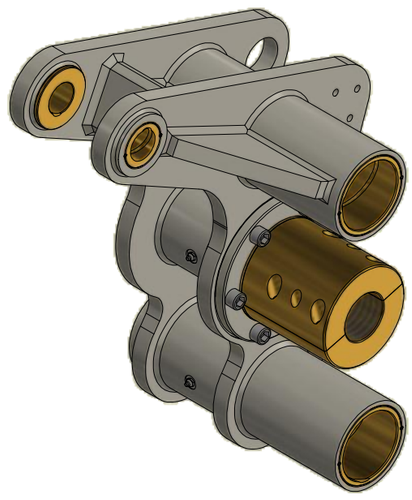
A-A (1 : 5)



B-B (1 : 5)



ISO VIEW (1 : 8)



TIGHTENING TORQUE - ACC. DOC. #6402

***POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT**
***LOCTITE 243 - ALL BOLT CONNECTIONS TO BE USED WITH**

Designed by	Date	Modified by	ECO / CO			
P Pantovic	04.02.2022.	P Pantovic	ECO-2056698			

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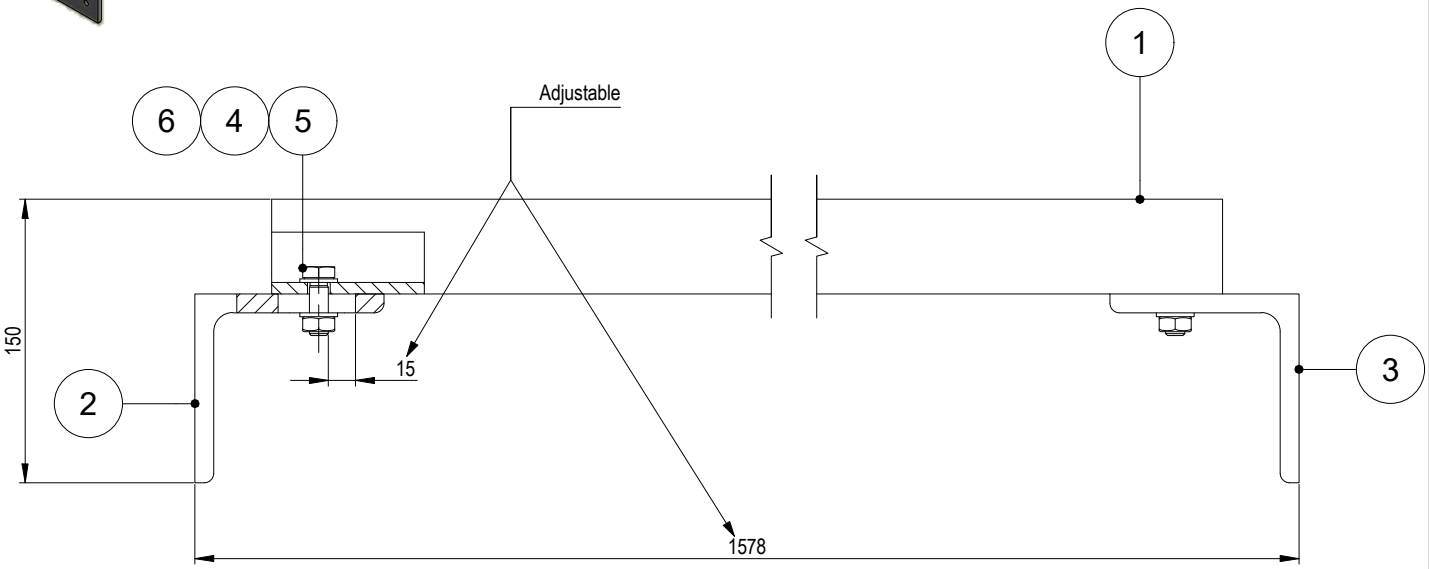
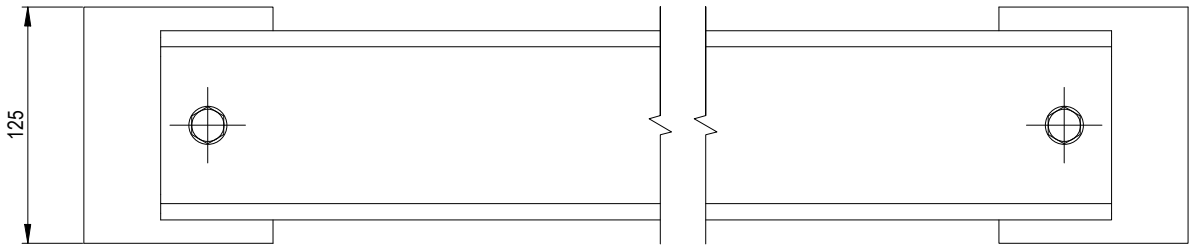
Name		Weight
Cable Guide		110 kg
Description		Scale (A3)
HW-500		1 : 5
Document ID	Revision	Sheet
2000005484	A	1 / 1

TOL. SYSTEM ACC. TO ISO	General tol. for dimensions	
Surface roughness R_a in µm	Machining ISO 2768	tol-class: mK
	Welding ISO 13920	tol-class: AE
	Therm. cut ISO 9013	tol-class: 441

ISO VIEW (1 : 15)





Designed by	Date	Modified by	ECO / CO			
P Pantovic	04.02.2022.	P Pantovic	ECO-2056698			

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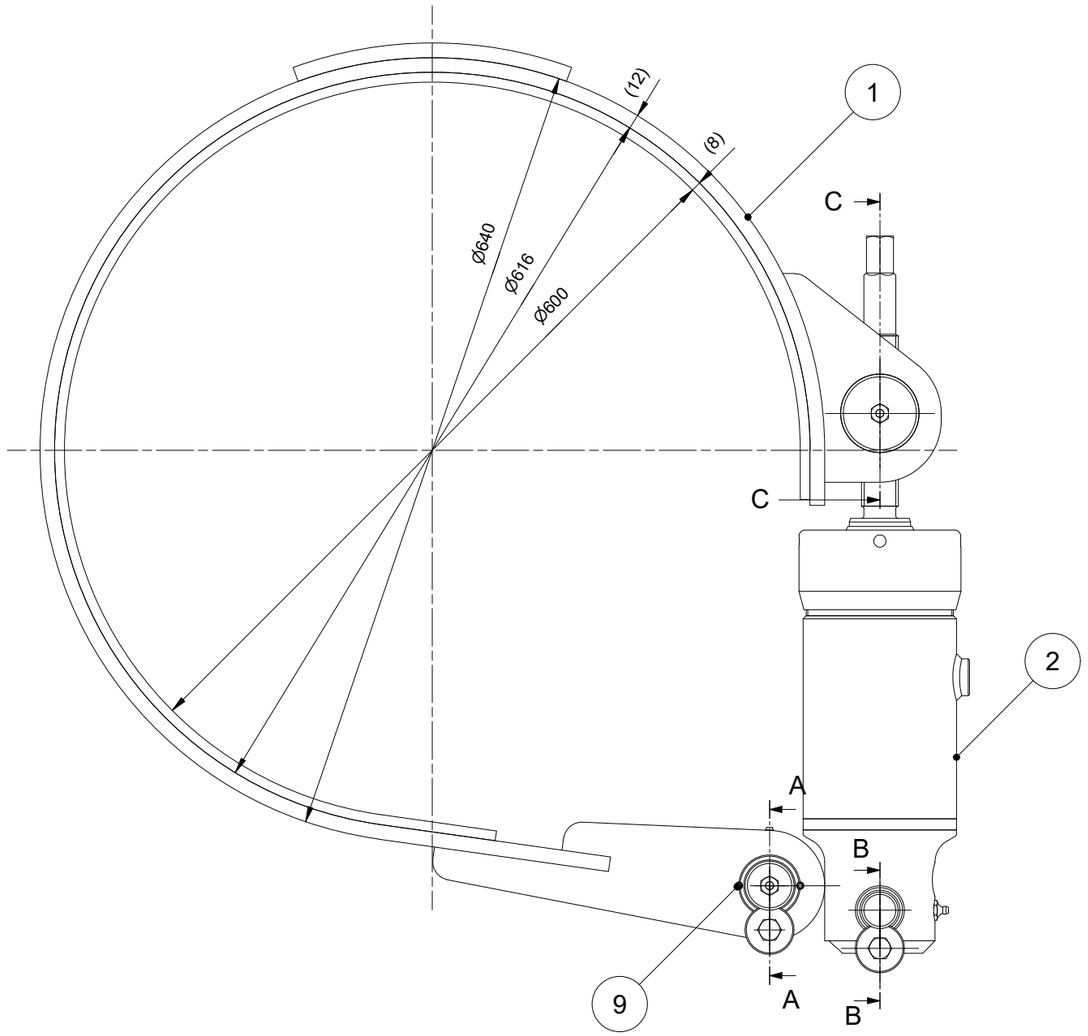
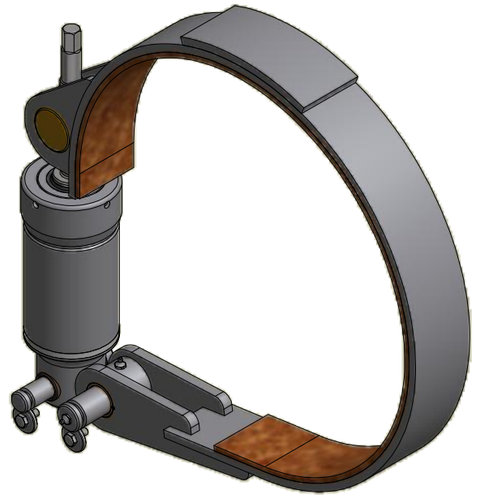
Name			Weight
Bracket			20 kg
Description			Scale (A4)
L1578			1 : 4
Document ID	2000005486	Revision A	Sheet 1 / 1

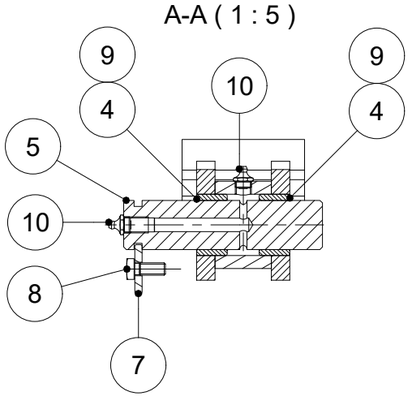


ISO VIEW - RIGHT HAND WINCH (1 : 8)
BOLTS POSITION

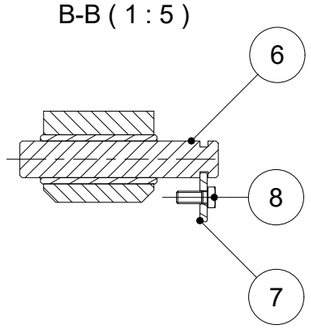
ISO VIEW - LEFT HAND WINCH (1 : 8)
BOLTS POSITION



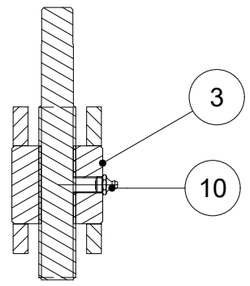
A-A (1 : 5)



B-B (1 : 5)



C-C (1 : 5)



REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A	-	Issued for production.	04.09.2014	RHDHN

Weight 64 kg	BRAKE ARRANGMENT HW 500 D600, Tq 22,5 kNm ASSEMBLY	RAPP HYDEMA Phone: (+47) 75 55 01 00 Fax: (+47) 75 55 01 11 E-mail: office@rapphydema.com			
Scale (A3) 1:5 *Sheet* 1 / 1		*Drw number* RH318747			
	Material (for part)	*Status* Production	*Drawn by / Date (dd/mm/yy)* RZBMI 04.09.2014	*Checked by / Date (dd/mm/yy)* RHDHN 04.09.2014	*Partlist* RH318747

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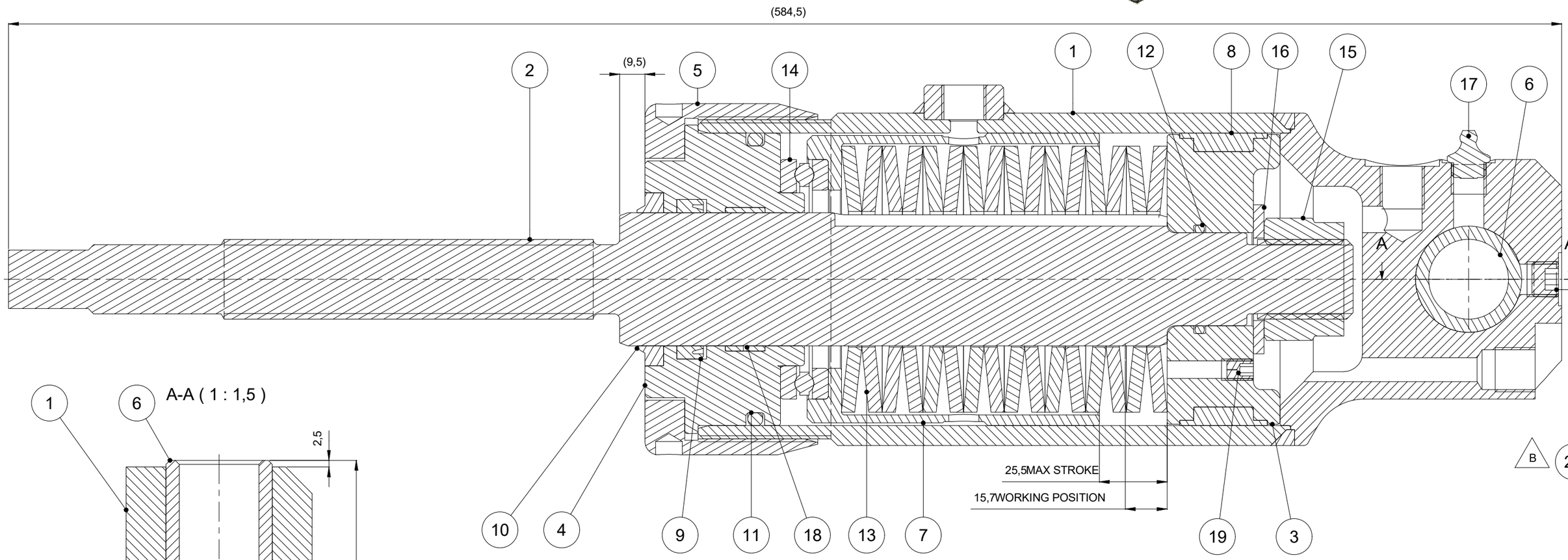
79A718E3F AAB40089BAC6CDC75EE2514

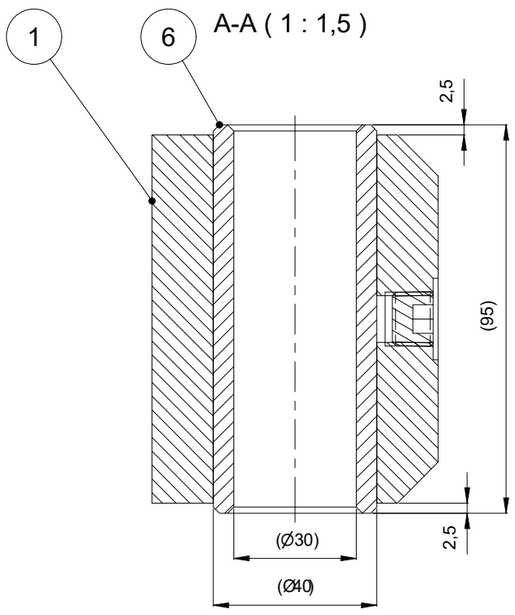
CYLINDER PRESSURE:
PRELOADED: 4 BAR
WORKING POSITION: 22,4 BAR
MAX COMPRESSION: 34,3 BAR

ISO VIEW (1 : 4)

VIEW1 (1 : 1,5)



A-A (1 : 1,5)



REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A		Issued for production	10.07.2014	RHJJ
B		Threaded plug added, pos. 21	29.09.2021/MAKS	TORZBSI

Weight 26 kg	BRAKE CYLINDER SOW-500 / HW-500 ASSEMBLY	RAPP HYDEMA Phone: (+47) 75 55 01 00 Fax: (+47) 75 55 01 11 E-mail: office@rapphydema.com	
Unspecified Tolerances According to:	*Scale (A3)* 1:1,5	*Sheet* 1 / 1	*Drw number* RH318468
Standard / *Tolerance Class*			
NS-ISO 2768-1 / *m Medium*			
NS-ISO 2768-2 / *K*	*Material (for part)*	*Status* Production	*Partlist* RH318468
		Drawn by / Date (dd/mm/yy) RHJJ 10.07.2014	*Checked by / Date (dd/mm/yy)* RHJJ 10.07.2014

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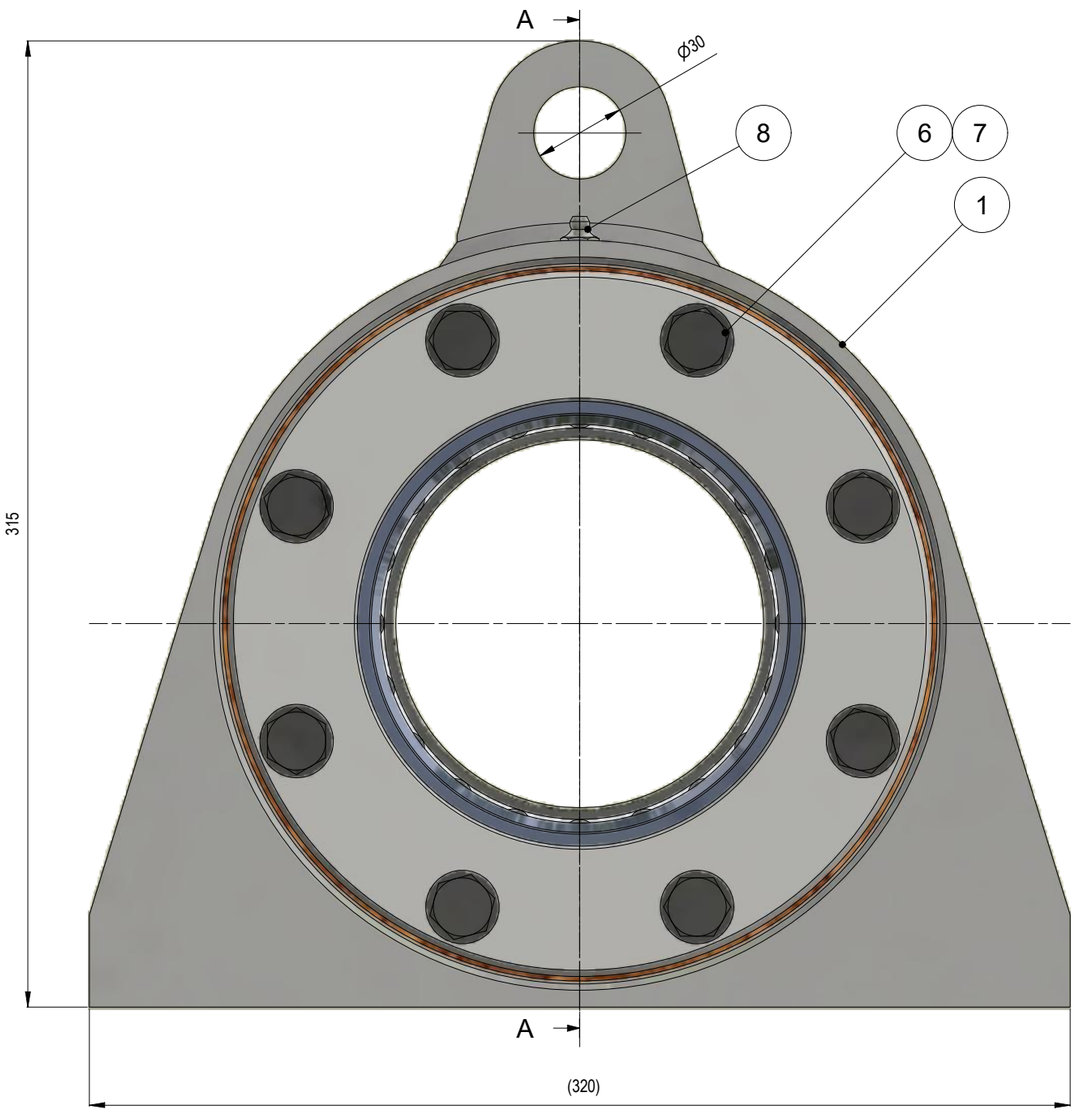
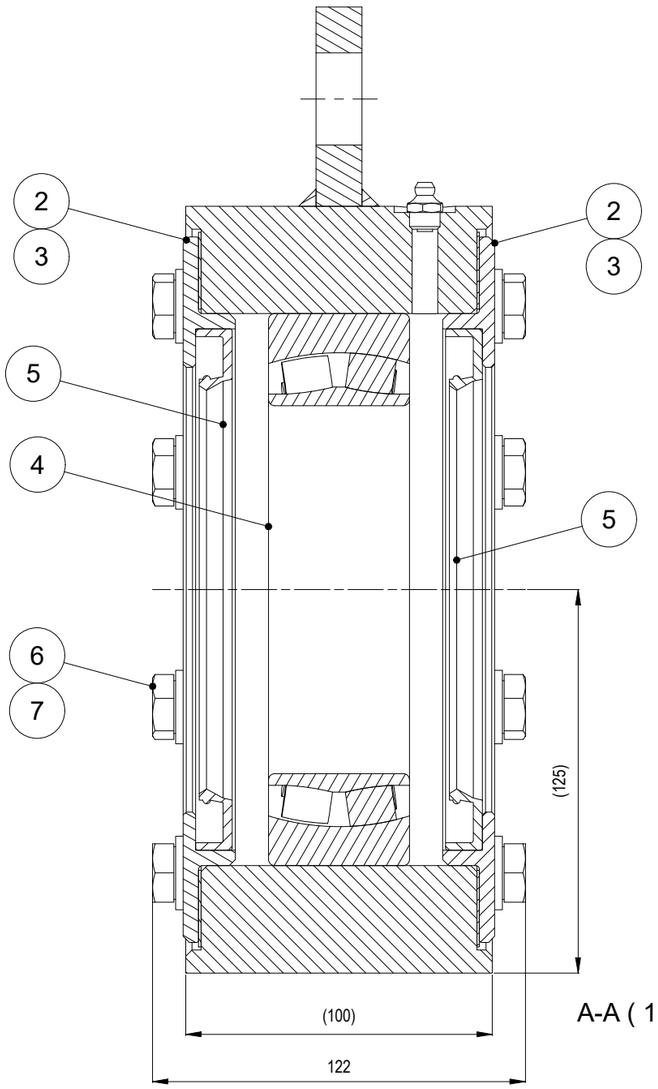
Sheet Purpose:

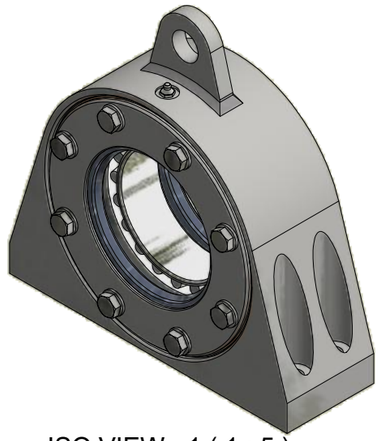
ASSEMBLY

TOL. SYSTEM ACC. TO ISO	General tol. for dimensions	
Surface roughness R_a in µm	Machining ISO 2768	tol-class: mK
	Welding ISO 13920	tol-class: AE
	Therm. cut ISO 9013	tol-class: 441





A-A (1 : 2)



ISO VIEW - 1 (1 : 5)

ISO VIEW - 2 (1 : 5)

Designed by	Date	Modified by	ECO / CO			
RZBMI	27.05.2014.	A Karaic	ECO-2057200			

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Name	Weight (kg)
BEARING HOUSING	
Description	Scale (A3)
BEARING HOUSING, D180x100, ASSEMBLY	1 : 5
Document ID: RH318063	Revision: B / Sheet: 1 / 1

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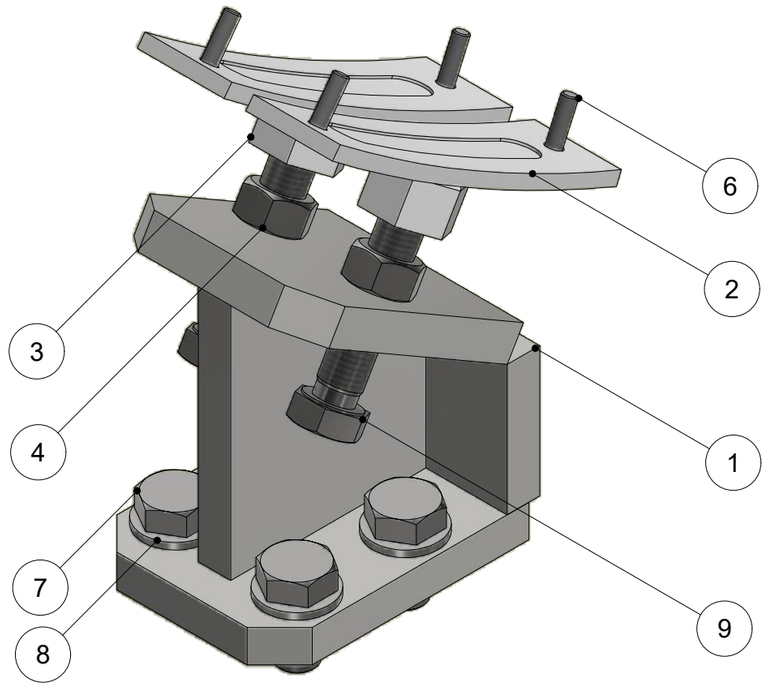

REV	ZONE	DESCRIPTION	DATE (dd/mm/yy)	APPROVED
A	-	Issued for production	13.09.2013	DHN

Weight 5 kg	BRAKE BAND SUPPORT HW-520E-F-T90 ASSEMBLY			RAPP HYDEMA Phone: (+47) 75 55 01 00 Fax: (+47) 75 55 01 11 E-mail: office@rapphydema.com	
Unspecified Tolerances According to:	*Scale (A3)* 1:2	*Sheet* 1 / 1		*Drw number* RH317304	
Standard *Tolerance Class* *NS-ISO 2768-1* *m Medium* *NS-ISO 2768-2* *K*		*Material (for part)*	*Status* Production	*Drawn by / Date (dd/mm/yy)* RZBMI 13.09.2013.	*Checked by / Date (dd/mm/yy)* DHN 13.09.2013.	*Partlist* RH317304	

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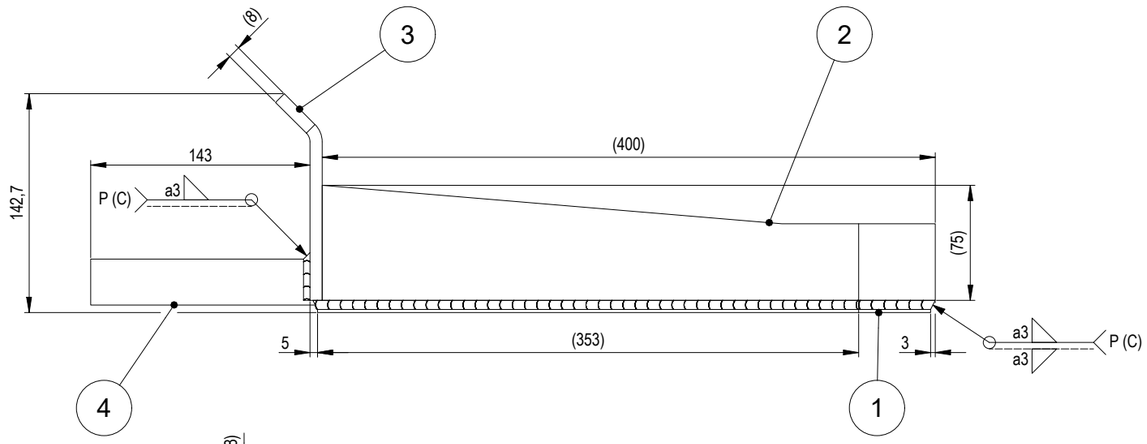
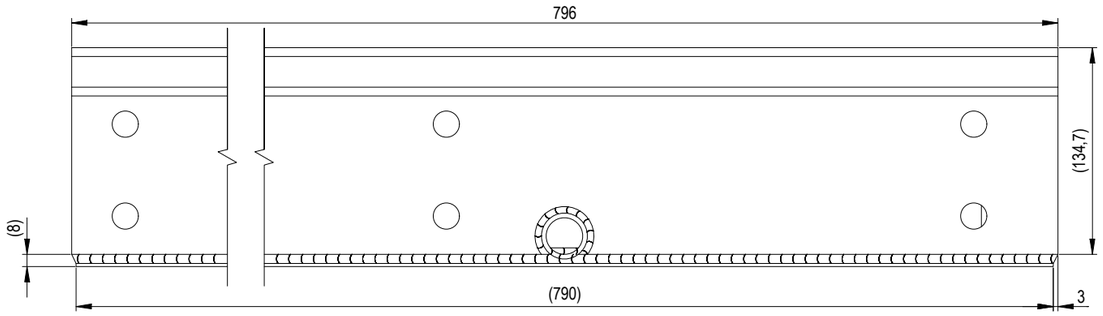
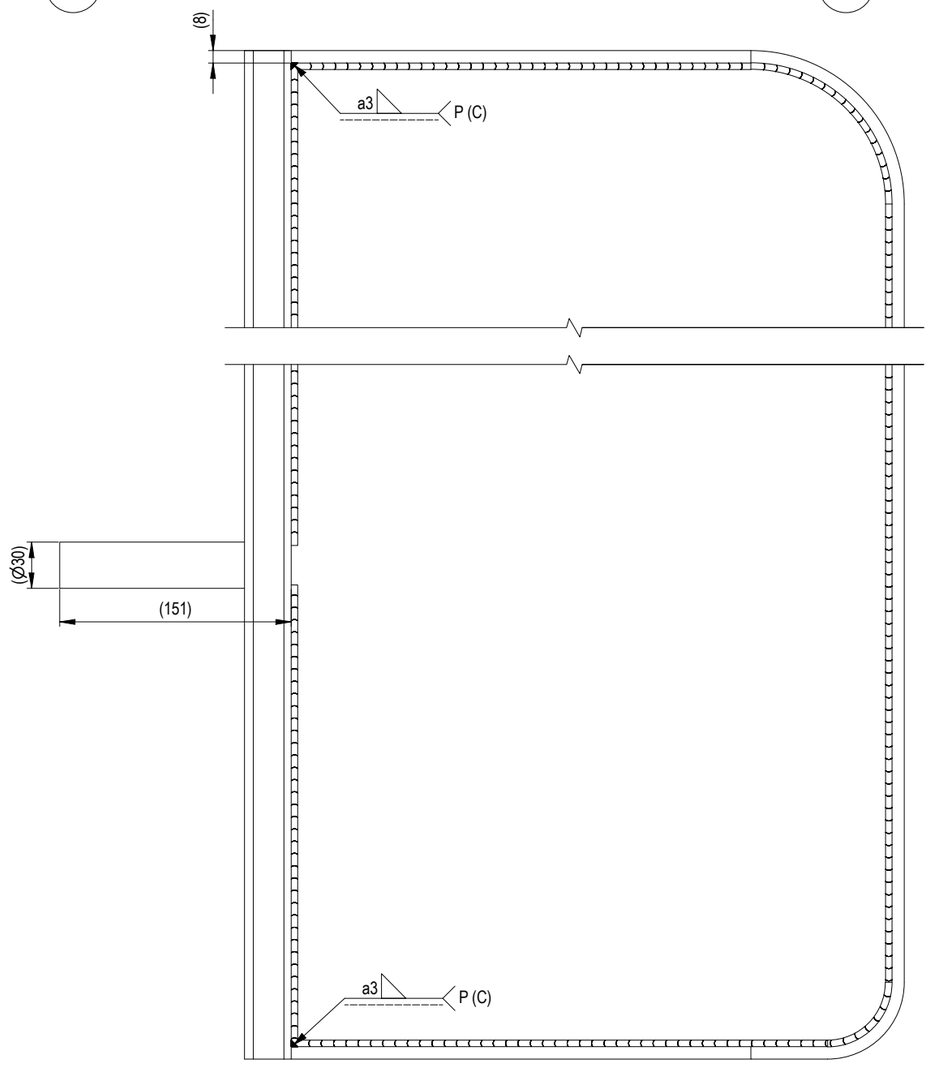
EA0254ED73B442F2AA180DECC773F39F

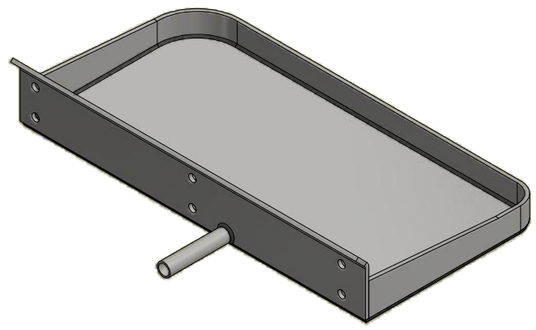
TOL. SYSTEM ACC. TO ISO	General tol. for dimensions
Surface roughness R_a in µm	Machining ISO 2768 tol-class: mK Welding ISO 13920 tol-class: AE Therm. cut ISO 9013 tol-class: 441







ISO VIEW (1 : 10)



WELD LOGS DESCRIPITION:
P = PRIMARY WELD;
S = SECONDARY WELD;
P , S (CATEGORY OF WELD) ACC. TO DNV 2.22
C , B (NDT ACCEPTANCE LEVEL) ACC. TO ISO 5817.

Designed by	Date	Modified by	ECO / CO			
D Petrovic	08.02.2022.	D Petrovic	ECO-2056698			

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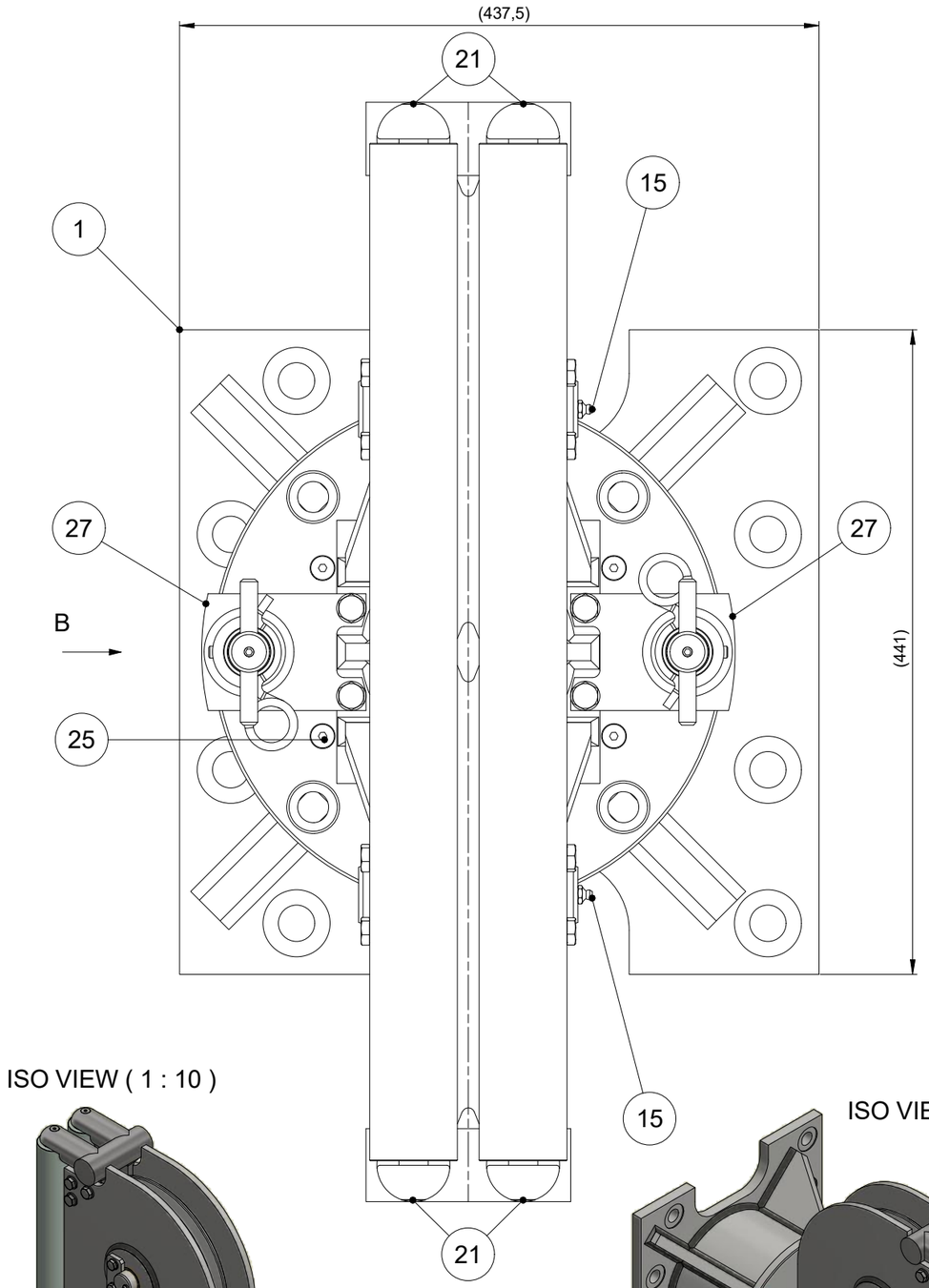
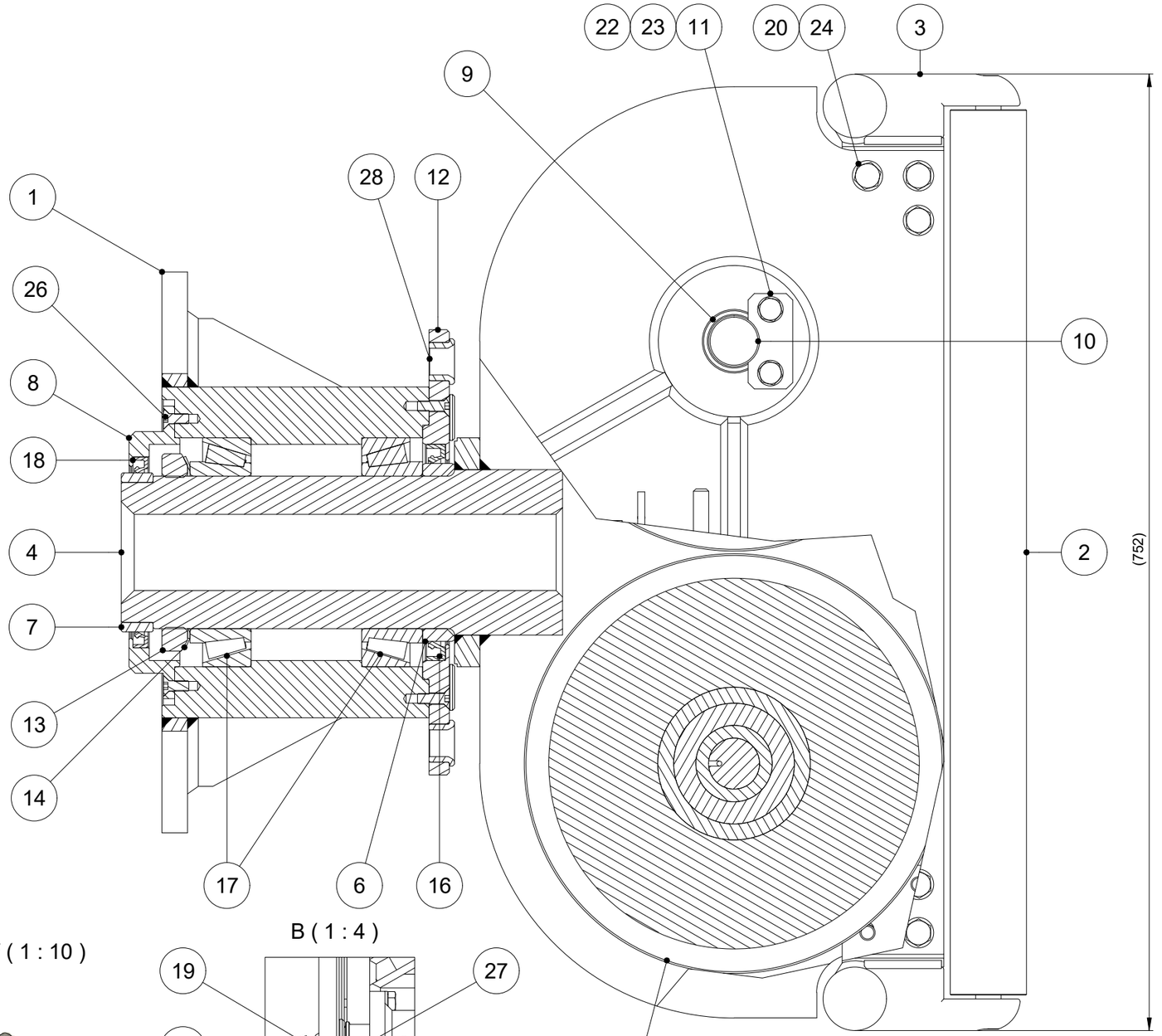
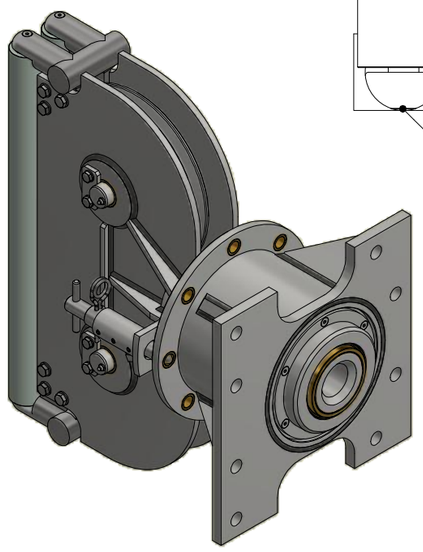
Name	Weight (kg)
Protection	32
Description	Scale (A3)
DRIP TRAY - HW515-FS-T90/URP	1 : 4
Document ID 2000005580	Revision A / Sheet 1 / 1

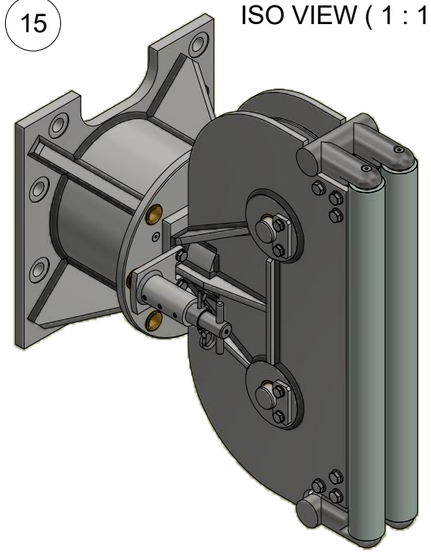




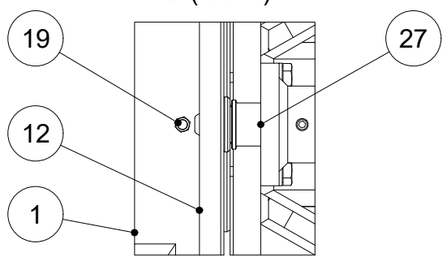
ISO VIEW (1 : 10)



ISO VIEW (1 : 10)



B (1 : 4)



REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	25.03.2019	RHJJ
B		Item 12 replaced with new one. Item 27 & 28 added. Weight corrected (was 255 kg)	06.02.2020./PETRODO	RZPPA

Weight 266 kg	PIVOT SHEAVE HW-515E-T90 ASSEMBLY	RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com				
Unspecified Tolerances According to:	*Scale (A3 Sheet)* 1 : 4	1 / 1	*Drw number* RH327524			
Standard	*Tolerance Class*	*Material (for part)*	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*	*Partlist* RH327524
NS-ISO 2768-1	m Medium		Production	RMJP 25.03.2019.	RHJJ 25.03.2019.	
NS-ISO 2768-2	K					

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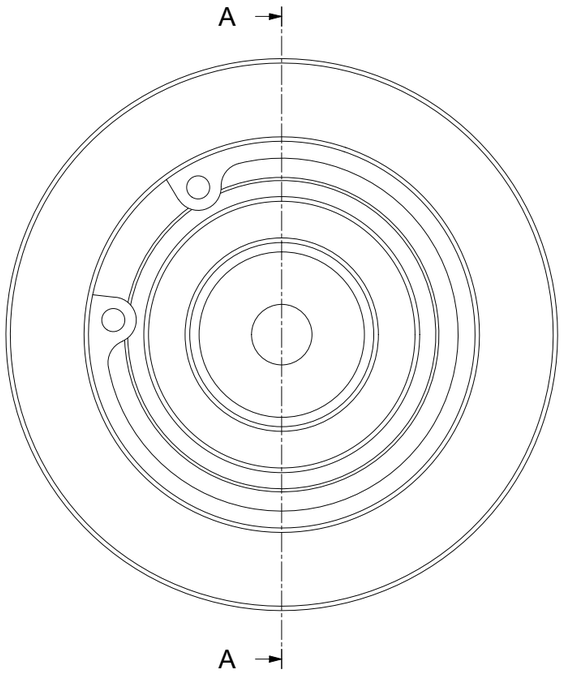
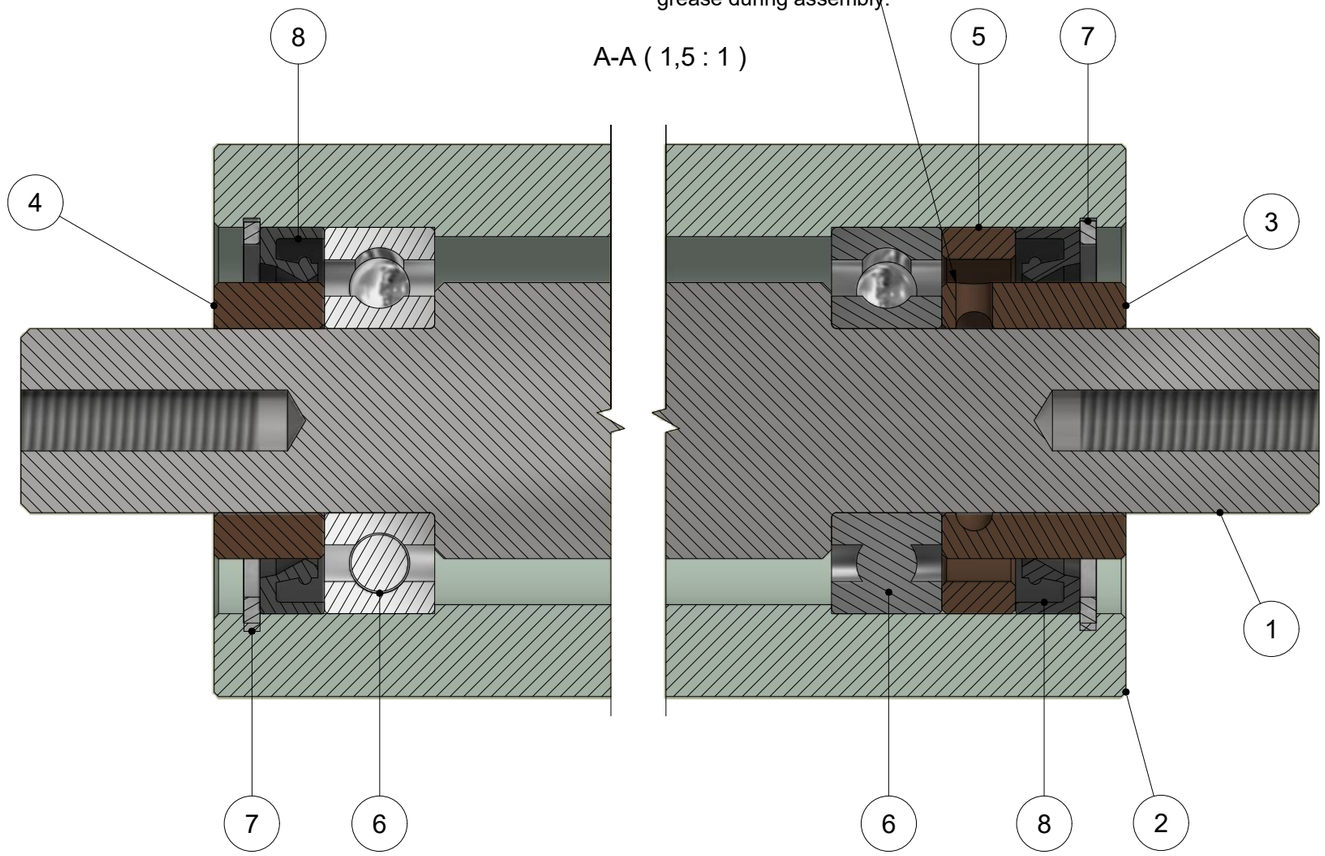
4EE4930155E3407ZADEC93CB4ABBAAA



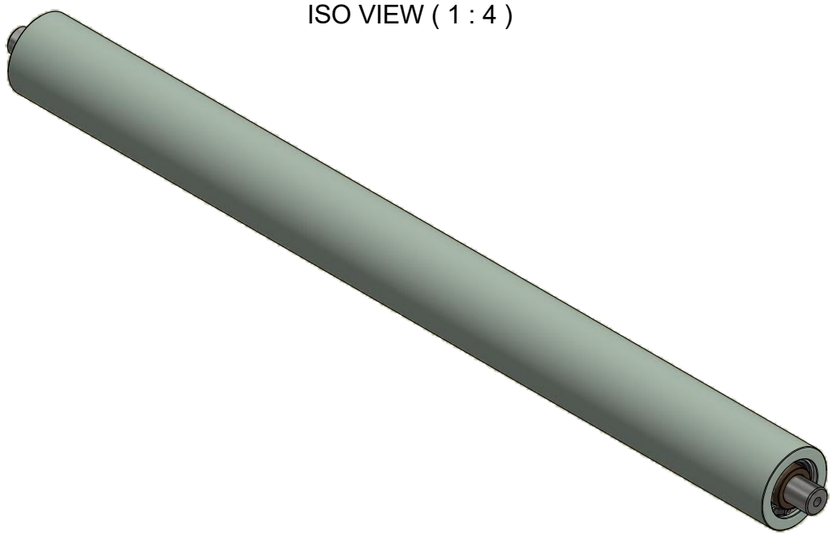
NOTE:

Lubrication seal with grease during assembly.

A-A (1,5 : 1)



ISO VIEW (1 : 4)



REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	22.03.2019	RHJJ

Weight 5,4 kg	INDICATOR ROLLER ASSEMBLY HW-515E-T90 ASSEMBLY	RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com	
Unspecified Tolerances According to:	*Scale (A3)* 1,5:1	*Sheet* 1 / 1	*Drw number* RH327556
Standard	*Tolerance Class*		
NS-ISO 2768-1	*m Medium*	*Material (for part)*	*Status* Production
NS-ISO 2768-2	*K*	*Drawn by / Date (dd/mm/yy)* RMJP 22.03.2019	*Checked by / Date (dd/mm/yy)* RHJJ 22.03.2019
			Partlist RH327556

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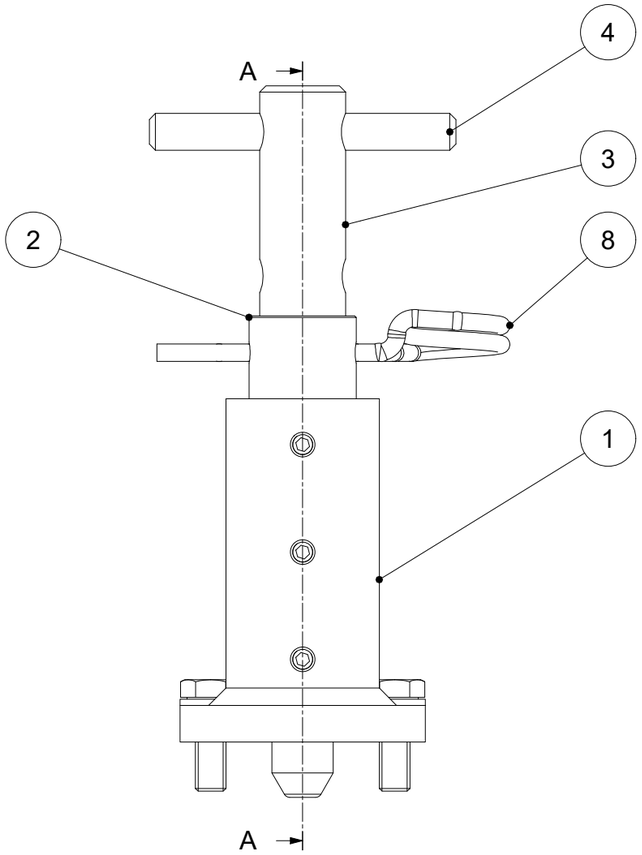
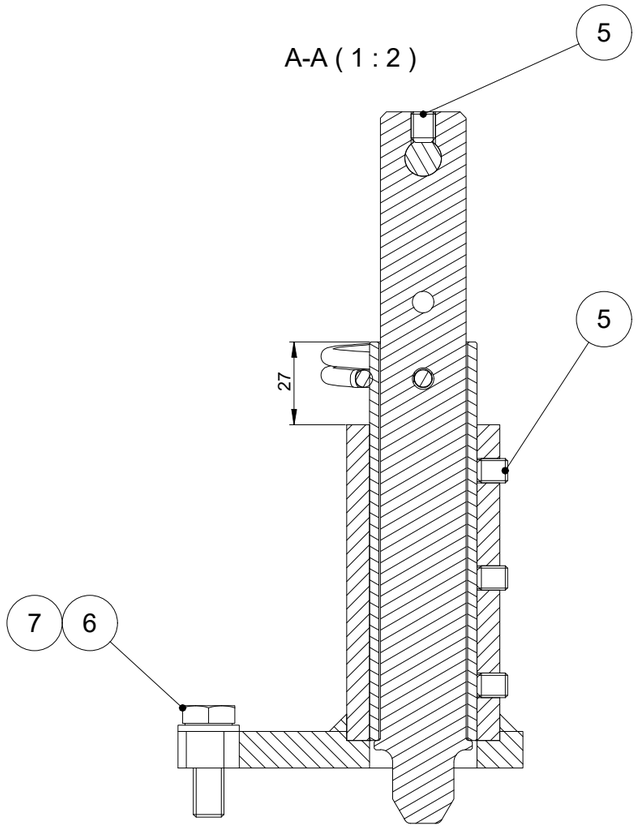
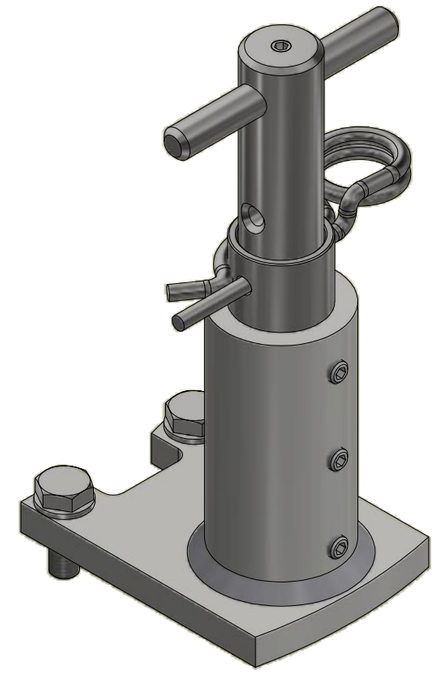
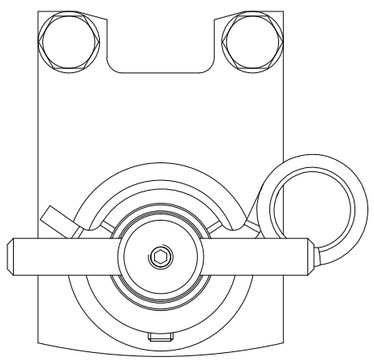


A-A (1 : 2)



ISO VIEW (1 : 2)





REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	06.02.2020.	RZPPA

Weight 3,06 kg		SHEAVE PIVOT LOCK HW-515E-T90 ASSEMBLY			RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com
Unspecified Tolerances According to:	*Scale (A3)* 1 : 2	*Sheet* 1 / 1			*Drw number* RH329338
Standard *Tolerance Class*		*Material (for part)*	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*	*Partlist* RH329338
NS-ISO 2768-1 *m Medium*			Production	PETRODO 06.02.2020.	RZPPA 06.02.2020.	
NS-ISO 2768-2 *K*						

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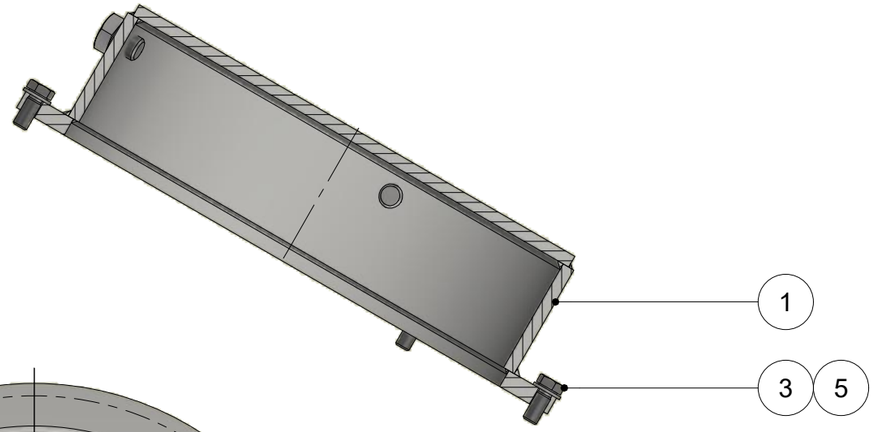
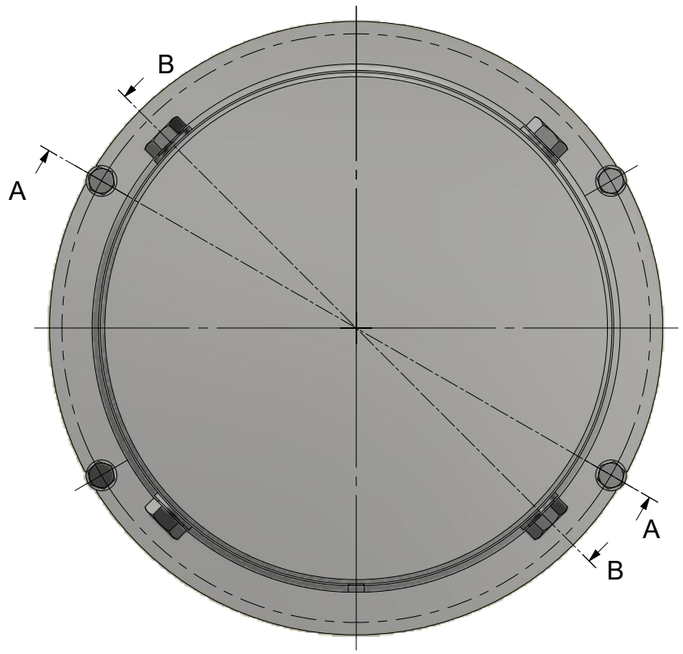
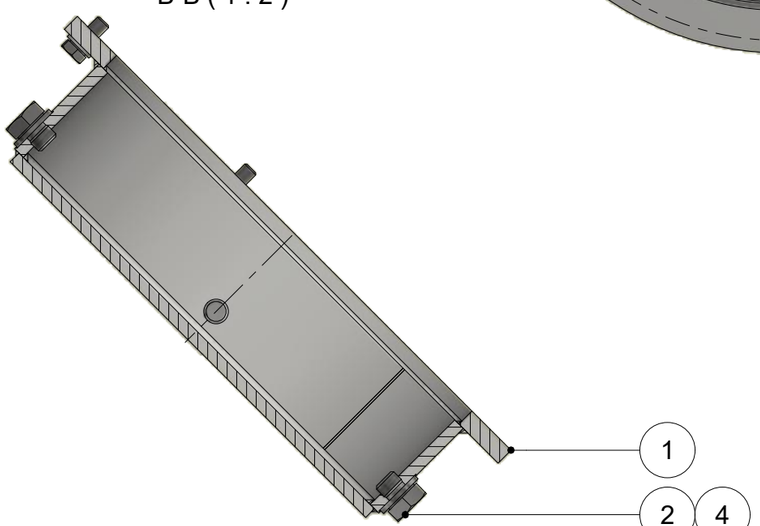
A-A (1 : 2)





ISO VIEW (1 : 2,5)

B-B (1 : 2)



POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATMENT

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	07.08.2019.	RZBSI

Weight 2 kg	GEARBOX COVER BPH.23 ASSEMBLY			RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com	
Unspecified Tolerances According to:	*Scale (A3)*	*Sheet*		*Drw number*	
Standard / *Tolerance Class*	1 : 2	1 / 1		RH328792	
NS-ISO 2768-1 m Medium	*Material (for part)*	*Status*	*Drawn by / Date (dd/mm/yy)*	*Checked by / Date (dd/mm/yy)*	*Partlist*
NS-ISO 2768-2 K		Production	MAKSTO 07.08.2019.	RZBSI 07.08.2019.	RH328792

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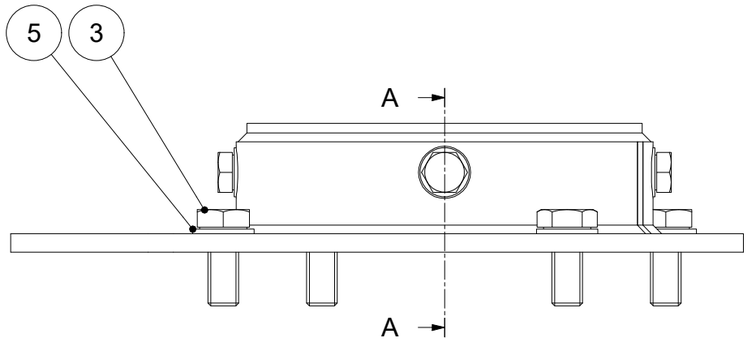
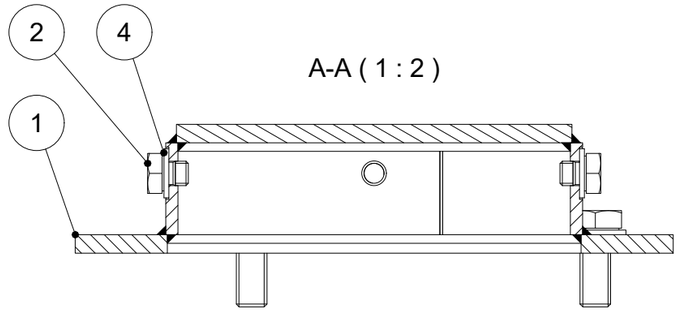
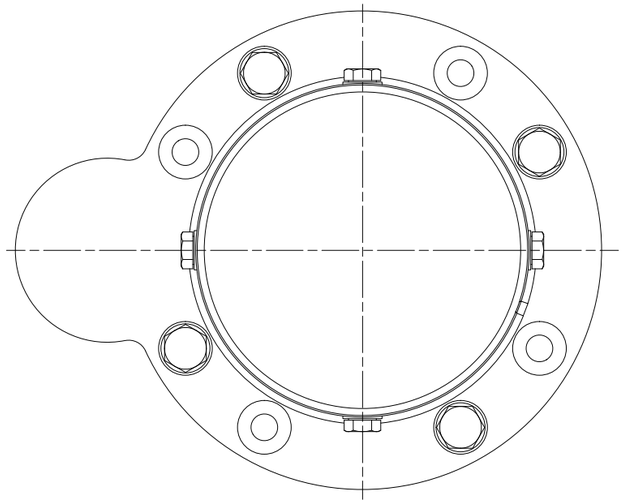


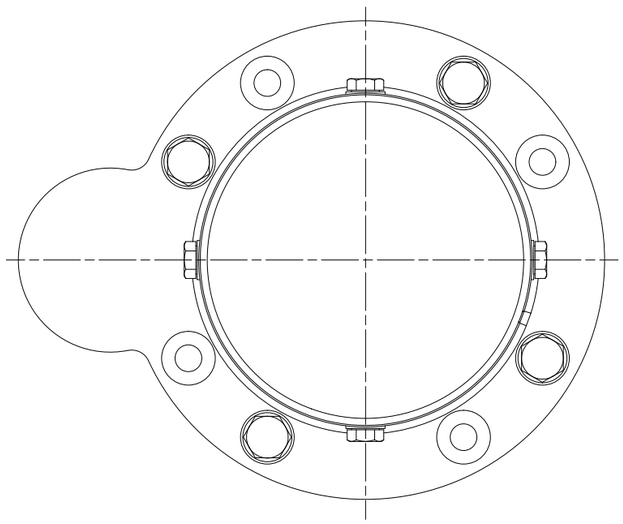


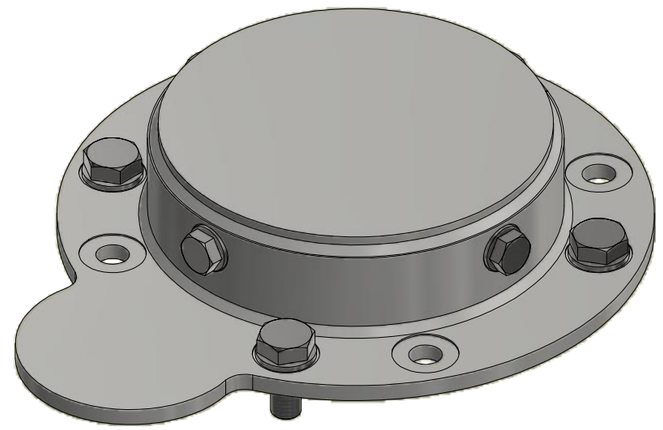
A-A (1 : 2)

BOLTING AT B SIDE (1 : 2,5)



BOLTING AT A SIDE (1 : 2,5)





POLYMER - ACC. DOC. #6482 MACHINED SURFACES AND SURFACE TREATHMENT 6

REV	ZONE	DESCRIPTION	DATE	APPROVED
A		Issued for production	25.06.2019.	RZBSI

Weight 2 kg	GEARBOX COVER SK9032 ASSEMBLY				RAPP MARINE Phone: (+47) 75 55 01 00 E-mail: office@rappmarine.com	
Unspecified Tolerances According to:	*Scale (A3)* 1 : 2	*Sheet* 1 / 1			*Drw number* RH328382	
Standard / *Tolerance Class*			*Material (for part)*	*Status* Production	*Drawn by / Date (dd/mm/yy)* PETRODO 24.06.2019.	*Checked by / Date (dd/mm/yy)* RZBSI 25.06.2019.
NS-ISO 2768-1 m Medium						*Partlist* RH328382
NS-ISO 2768-2 K						

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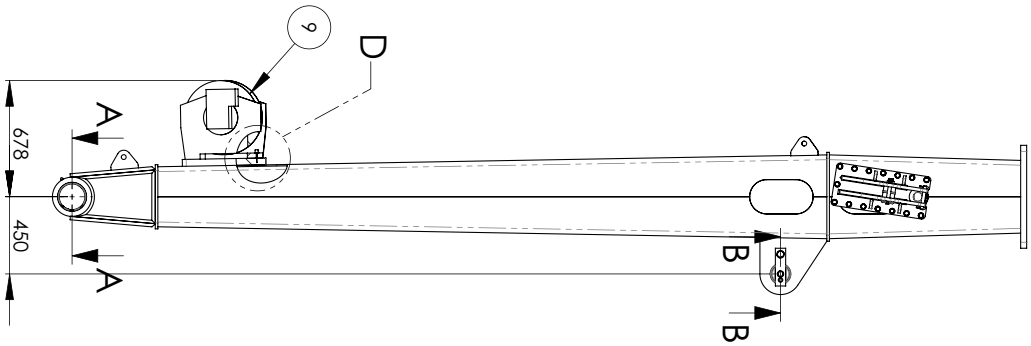
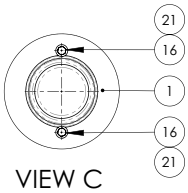
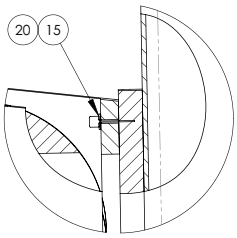
A6B26053C76F4F1EBAC0B7021944570

STB leg assembly

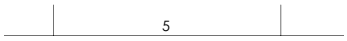


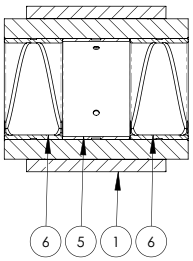


VIEW C
SCALE 1 : 5

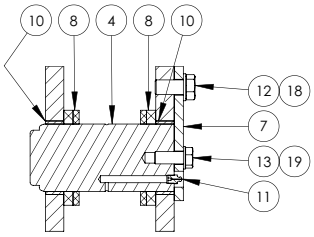


DETAIL D
SCALE 1 : 5





SECTION A-A
SCALE 1 : 5

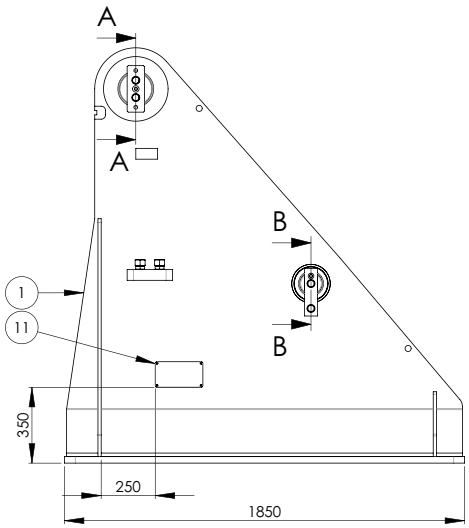


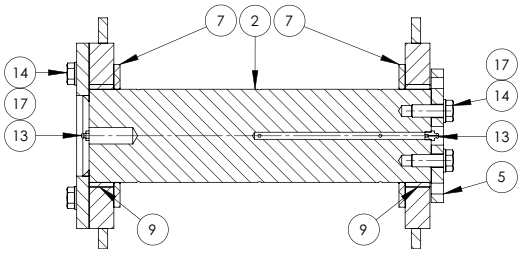
SECTION B-B
SCALE 1 : 5

Qty.	Pos	Description	Part no.	Drawing no.
1	1	STB LEG	400186001	24956
1	2	SHEAVE BLOCK ASSEMBLY	400186006	24960
1	3	GUIDE SHEAVE	400186295	25062
1	4	PIN	4102416	18237
1	5	SPACING PIPE	4186114	15860
2	6	BEARING	4122021	4221
1	7	LOCKING PLATE	4103063	16600
4	8	SPACER	04186124-10	18065
1	9	WINCH	7610233	
2	10	STEEL RING	7280031	
3	11	GREASE NIPPLE	7453017	
1	12	SCREW	7010097	
1	13	SCREW	7010050	
27	14	SCREW	400192060	
4	15	SCREW	400038900	
2	16	SCREW	7010636	
27	17	NUT	7060006	
1	18	WASHER	7050207	
1	19	WASHER	7050006	
58	20	WASHER	7050607	
2	21	WASHER	7050604	

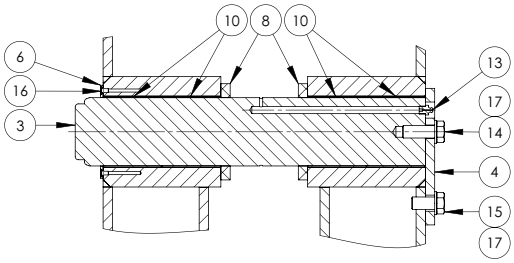
MACGREGOR

STB foundation assembly





SECTION A-A
SCALE 1 : 5



SECTION B-B
SCALE 1 : 5

PIN ASSEMBLY

Use wood tar on surface between pin and steel ring or steel.

Use grease Shell Alvania EP2 or similar on bearing surface.

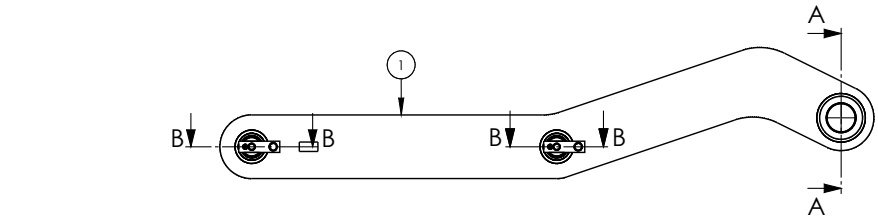
BEARING ASSEMBLY

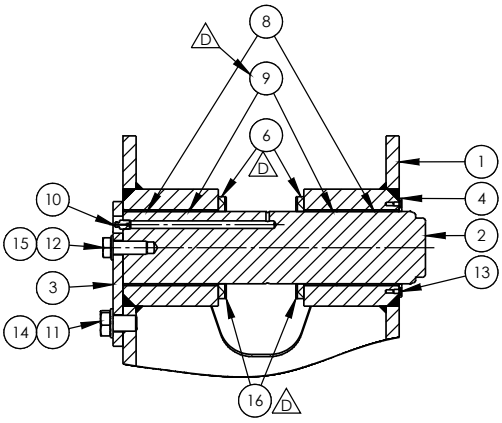
BEARINGS AND STEEL RINGS SECURED WITH LOCTITE NO.: 638

STEEL RINGS TO BE ALIGND WITH BOLT WHEN GLUED

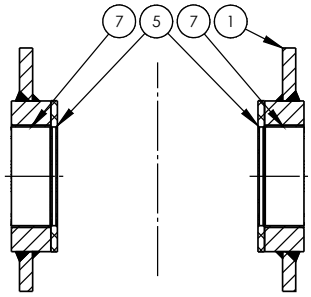
Qty.	Pos	Description	Part no.	Drawing no.
1	1	FOUNDATION STB	400185995	24950
1	2	BEARING PIN	400060940	20705
1	3	BEARING PIN	400060946	20702
1	4	LOCKING PLATE	4103063	16600
1	5	LOCK PLATE	4103058	15806
1	6	LOCK PLATE	4119083	18521
2	7	SPACER	04124143-10	16709
2	8	SPACER	04186124-15	18065
2	9	STEEL RING	7280010	
4	10	BEARING PLATE	7260056	
1	11	EL.BOX	7904004	
7	12	FITTING	75151044	
3	13	GREASE NIPPLE	7453017	
7	14	SCREW	7010090	
1	15	SCREW	7010048	
4	16	SCREW	7021602	
8	17	WASHER	7050006	

STB foundation assembly





SECTION B-B
SCALE 1 : 5



SECTION A-A
SCALE 1 : 5

PIN ASSEMBLY

Use wood tar on surface between pin and steel ring or steel.

Use grease Shell Alvania EP2 or similar on bearing surface.

BEARING ASSEMBLY

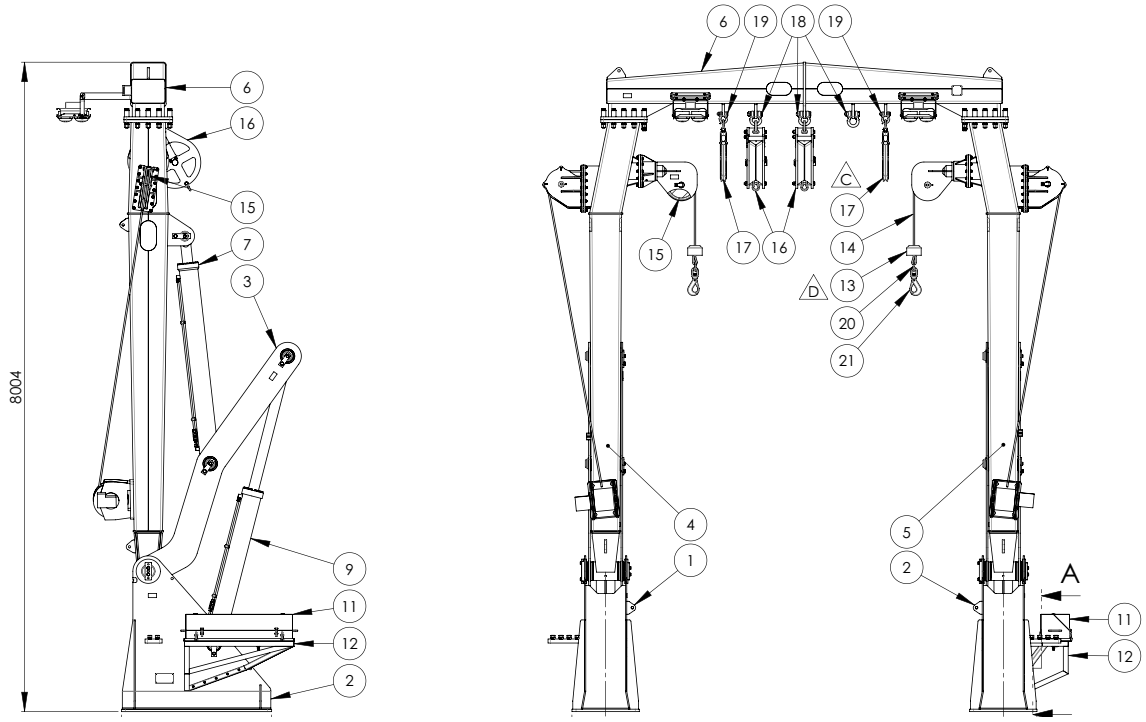
BEARINGS AND STEEL RINGS SECURED WITH LOCTITE NO.: 638

STEEL RINGS TO BE ALIGND WITH BOLT WHEN GLUED

Qty.	Pos	Description	Part no.	Drawing no.
1	1	LINK ARM	400185997	24952
2	2	BOLT	4102411	18067
2	3	LOCKING PLATE	4103063	16600
2	4	LOCK PLATE	4119083	18521
2	5	SPACER	04124143-10	16709
4	6	SPACER	04186124-10	18065
2	7	BUSHING	7260019	
4	8	BEARING PLATE	7260056	
4	9	BEARING PLATE	7260015	
2	10	GREASE NIPPLE	7453017	
2	11	SCREW	7010060	
2	12	SCREW	7010090	
8	13	SCREW	7021602	
2	14	WASHER	7050207	
2	15	WASHER	7050006	
4	16	SPACER	04186124-02	18065

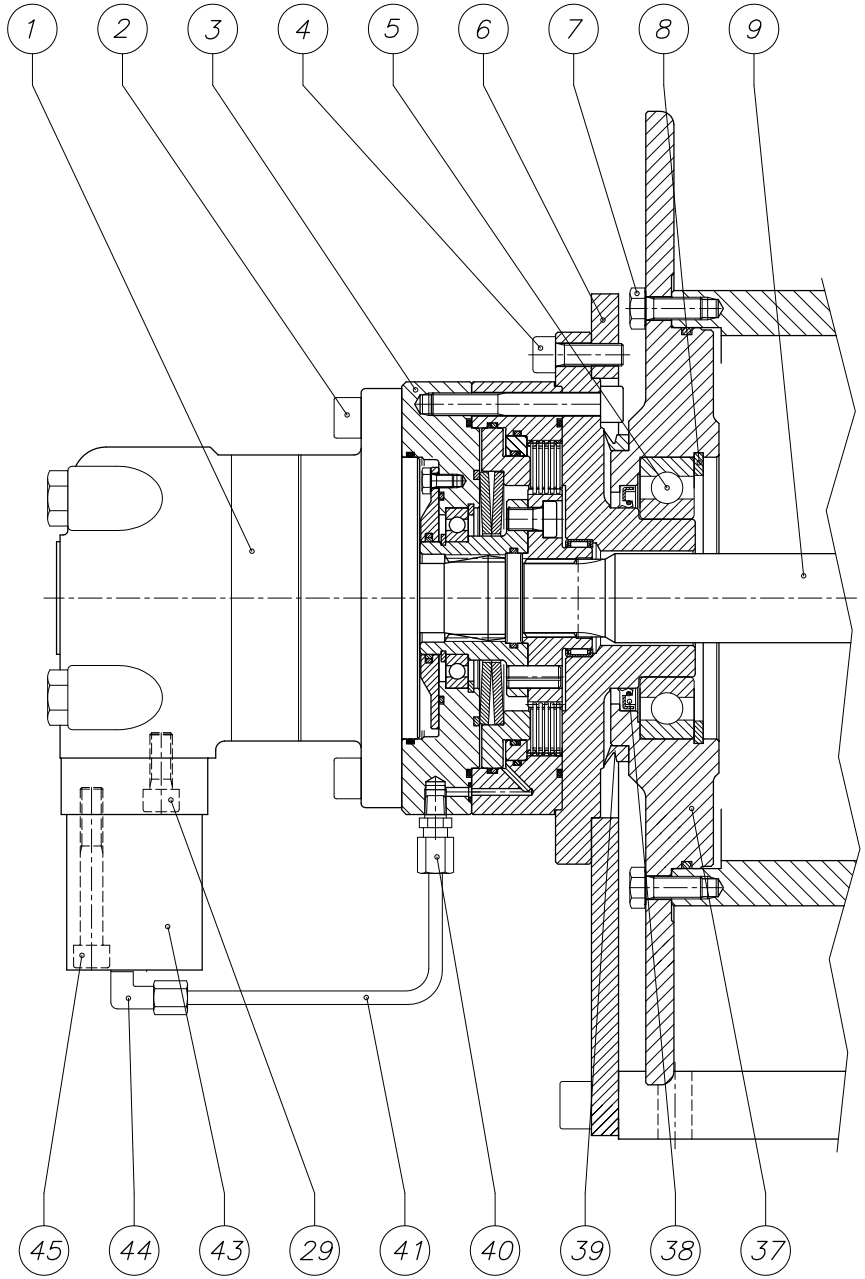
HYDRAULIC SYSTEM

The hydraulic pipe layout should be installed with reference to existing pipe installation charts. It is important to keep all components clean while installing the hydraulic pipe system.



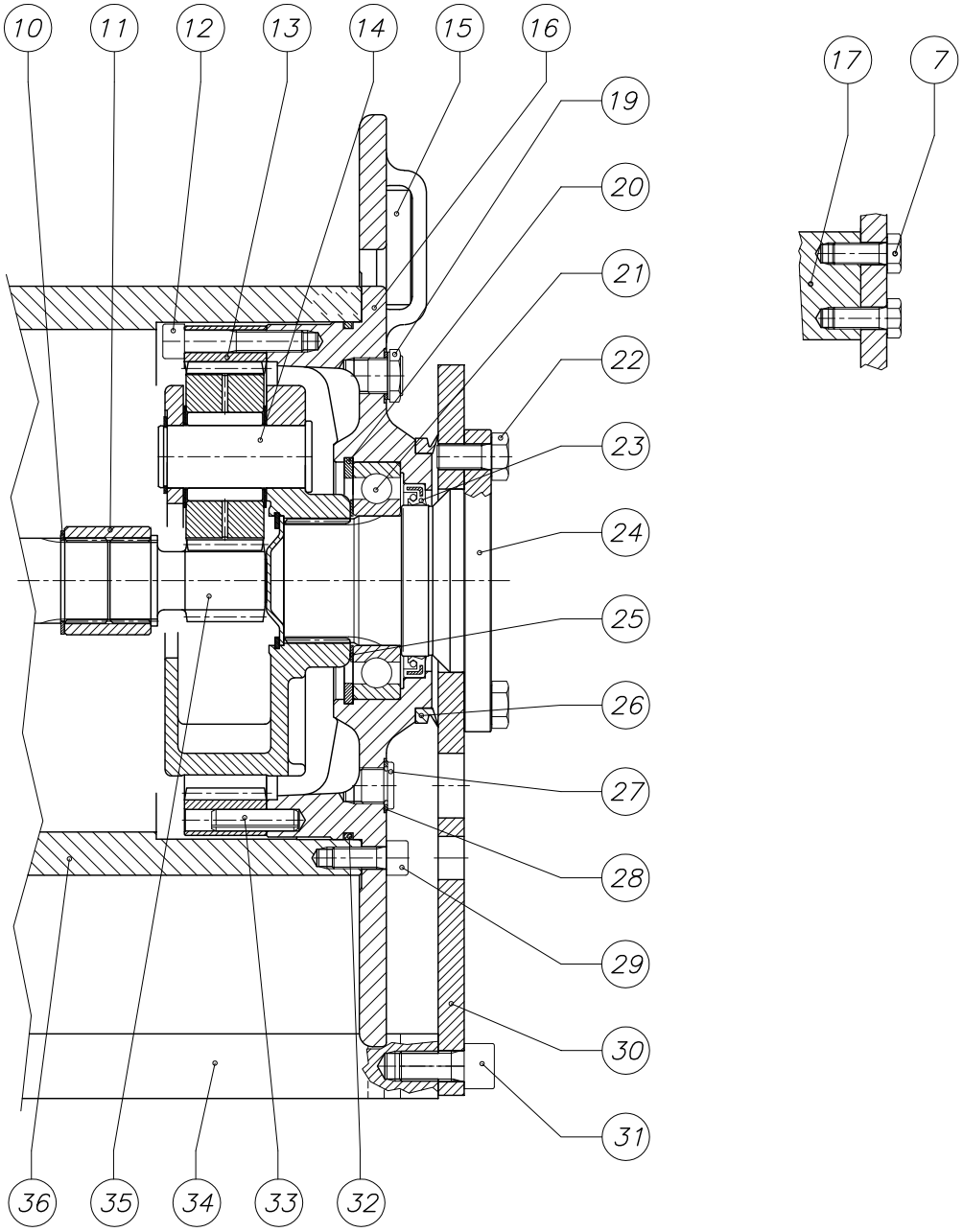
Qty.	Pos	Description	Part no.	Drawing no.
1	1	FOUNDATION PORT ASSEMBLY	400185990	24947
1	2	FOUNDATION STB ASSEMBLY	400185994	24949
2	3	LINK ARM ASSEMBLY	400185996	24951
1	4	PORT LEG ASSEMBLY	400185998	24953
1	5	STB LEG ASSEMBLY	400186000	24955
1	6	GANTRY BEAM ASSEMBLY	400186002	24957
1	7	HYDRAULIC CYLINDER	400052573	20175
1	8	HYDRAULIC CYLINDER	400052574	20175
1	9	HYDRAULIC CYLINDER	400052669	20181
1	10	HYDRAULIC CYLINDER	400052670	20181
1	11	VALVE CENTRAL	400185989	24821
1	12	BRACKET VALVE CENTRAL	400186565	25084
2	13	WIRE STOPPER 3T / 5T	5227001	15015
2	14	SYNTHETIC ROPE	400186008	
4	15	SHEAVE GLEIPNIR	400191136	
2	16	Hanging block	400186576	
2	17	CABLE BLOCK	400186577	
3	18	SHACKLE	7672001	
2	19	SHACKLE	7672036	
2	20	SHACKLE	400186578	
2	21	SWIVEL HOOK	7673002	
10	22	SCREW	7010609	
10	23	WASHER	7050606	

dinamic oil	Winch	Variant	Machine	SE 27/3	
			Machine	932700120I	1/1



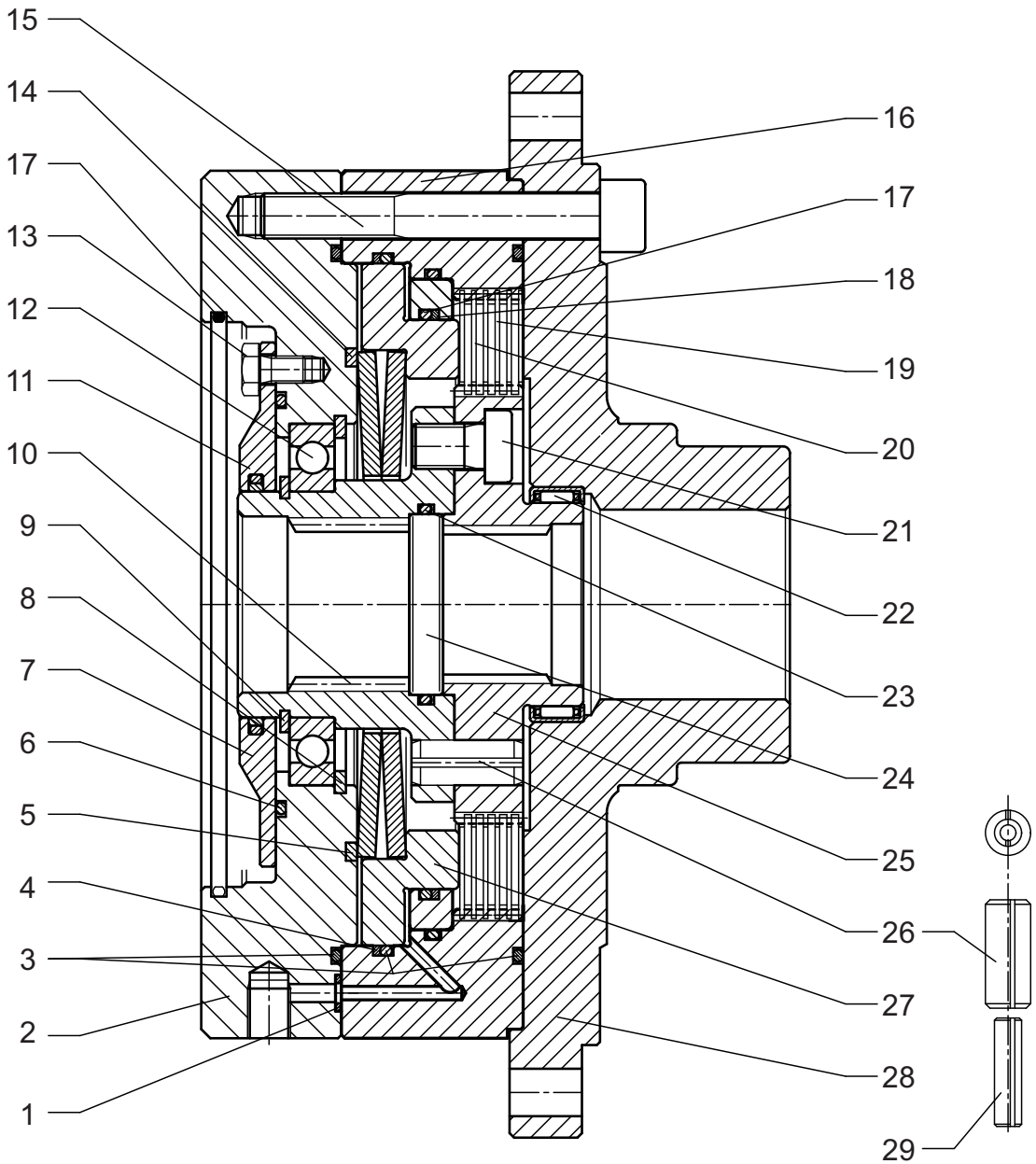
Pos	Code	Q.ty	Description
1	425020100	1	Hydraulic motor
2	410003400	4	Hex socked head cap screw
3	02981033	1	Brake unit
4	410401700	8	Hex socked head cap screw
5	400001600	1	Ball bearing
6	02340238	1	Motor side support
7	410260100	16	Hexagon screw
8	421102700	1	Seeger
9	02441008	1	Transmission shaft
29	410407000	12	Hex socked head cap screw
37	023210109	1	Side flange (motor side)
38	415002500	1	Oil retainer seal
39	406060100	1	V-Ring
40	440001000	1	Straight pipe fitting (Conical)
41	02671053	1	Brake pipe
43	438014600	1	Valve
44	440000100	1	90° Connection (Conical)
45	410002100	2	Hex socked head cap screw

dinamic oil	**Winch**	Variant	Machine	**SE 27/3**	
			Machine	**932700120I**	**1/1**



Pos	Code	Q.ty	Description
7	410260100	16	Hexagon screw
10	421000600	1	Seeger
11	263200600	1	Sleeve
12	410410200	12	Hex socked head cap screw
13	2030030600	1	Ring gear
14	99121900	1	Reduction gear unit
15	02410205	1	Thimble
16	02321001	1	Side flange (gear side)
17	02451008	2	Cross member (Upper)
19	419020600	1	Oil level plug
20	421102000	1	Seeger
21	400001900	1	Ball bearing
22	410030500	10	Hexagon screw
23	415004800	1	Oil retainer seal
24	02371003	1	Antirotation flange
25	427008500	1	Shim ring
26	406060500	1	V-Ring
27	419000700	1	Plug
28	423000600	1	Copper washer
29	410407000	12	Hex socked head cap screw
30	02340208	1	Gear side support
31	410409500	8	Hex socked head cap screw
32	406026900	2	O-ring joint
33	434002400	2	Spring pin
34	02451004	2	Fastening surface plate
35	2030032200	1	Driven shaft
36	023010111	1	Winch drum

dinamic oil	**Brake unit**	Variant	Machine	**SE 27/3**	
			Machine	**932700120I**	**1/1**



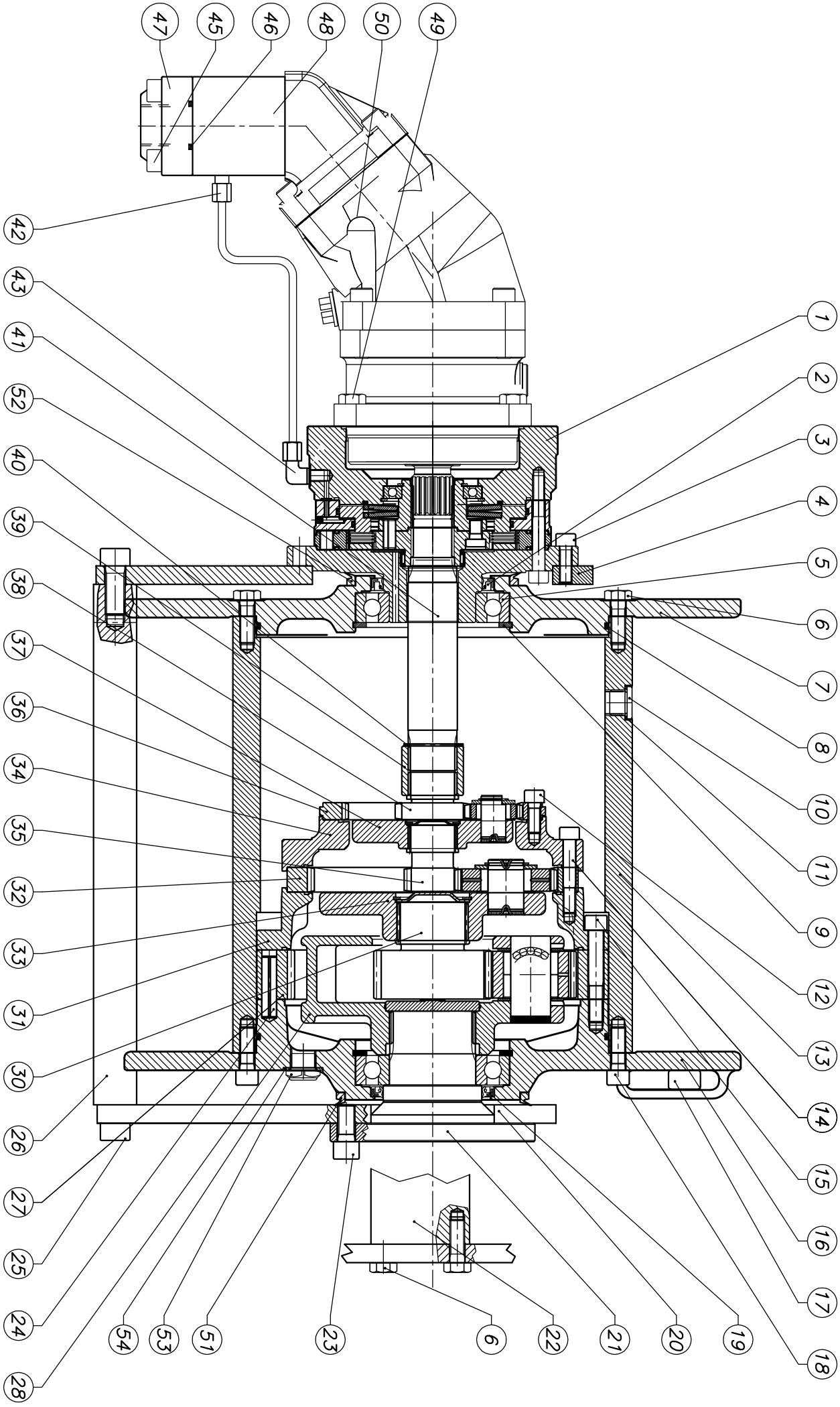
Pos	Code	Q.ty	Description
1	406001100	1	O-ring joint
2	02461026	1	Flange
3	406016800	3	O-ring joint
4	415068700	1	Antiextrusion ring
5	415025900	1	Shoulder ring
6	406013600	1	O-ring joint
7	02251002	1	Flange
8	421101500	1	Seeger
9	421000800	1	Seeger
10	02631002	1	Sleeve
11	415006300	1	Seal
12	400004100	1	Ball bearing
13	410211000	3	Hexagon screw
14	416203700	2	Belleville washer
15	410408000	8	Hex socked head cap screw
16	02971105	1	Brake body
17	406016700	2	O-ring joint
18	415068600	1	Antiextrusion ring
19	415040400	5	Disc
20	415030800	6	Disc (External)
21	410419000	3	Hex socked head cap screw
22	402005500	1	Roller bearing
23	406014400	1	O-ring joint
24	02741002	1	Insert
25	02241003	1	Gear
26	434017100	3	Spring pin
27	02271002	1	Piston
28	02331030	1	Supporting flange
29	434017200	3	Spring pin

Brake Body

Pos.	Qty.	Description	Drawing no.
1	1	PLUG HK050	414001600
2	1	BRAKE BODY THIN S20	024310111
3	1	O-RING 2-163 N 674-70 (PARKER)	406016800
4	1	MALE SPLINED RING FOR BRAKE S20	024310113

Pos.	Qty.	Description
1	1	BRAKE GROUP WINCH SE45V-SUNFAB 84
2	1	CONTAINING RING 80X100X10
3	8	HEX SOCKET HEAD CAP SCREW M10X30 8.8 UNI 5931
4	1	MOTOR SIDE SUPPORT PROFILE
5	2	BALL BEARING 6214 TYPE B
6	16	HEX HEAD CAP SCREW M12X35 10.9 UNI 5739
7	1	MOTOR SIDE FLANGE SE45
8	2	O-RING 2-275
9	2	CLIP RING DIA 125
10	1	PLUG 1/2" BSP PLUG DIN 908
11	2	SOFT COPPER WASHER 1/2" (21X27X2)
12	8	SCREW TCEI M10X25 12.9 UNI 5931
13	1	SMOOTH DRUM SE45
14	12	HEX SOCKET HEAD CAP SCREW M10X60 12.9
15	12	HEX SOCKET HEAD CAP SCREW M12X75 12.9 UNI 5931
16	1	GEARBOX SIDE FLANGE S45
17	1	WEDGE S20-SW27 Ø12-S45 Ø18
18	8	HEX SOCKET HEAD CAP SCREW M12X35 12.9
19	1	OIL SEAL 80X100X7/8 BABSL
20	1	OPPOSITE MOTOR SIDE SUPPORT S45/2-SE45
21	1	ANTIROTATION FLANGE TW4
22	2	UPPER CROSS MEMBER SE45V HY
23	12	HEX SOCKET HEAD CAP SCREW M14X30 12.9
24	4	ELASTIC PIN SPIROL Ø12X36 UNI6875
25	8	HEX SOCKET HEAD CAP SCREW M16X40 12.9 UNI 5931
26	2	FESTENING PLATE SE45V HY
27	1	RING GEAR RE810
28	1	GEAR SUBASSEMBLY RE 810 I=1:3.5 FOR WINCH
30	1	SUN GEAR 2ST R=3,56 RE 810
31	1	INTERMEDIATE FLANGE RE810/1020 X ARG.S45
32	1	RING GEAR RE300
33	1	GEAR SUBASSEMBLY RE 310 R=1:4,25
34	1	INTERMEDIATE FLANGE RE310/510 TO RE110/210
35	1	SUN GEAR 2ST R=4,25 RE 310
36	1	RING GEAR RE110 1 ST
37	1	GEAR SUBASSEMBLY RE 110 N 3,48
38	1	SOLAR GEAR R=1:3.48 RE 110
39	1	SPLINED COUPLING SW4 - S45
40	1	SHAFT SEEGER Ø40
41	1	DRIVE SHAFT SE30-SE45
42	1	STRAIGHT CONNECTOR 1/4"G CIL. FOR PIPE Ø6
43	1	CONNECTOR 90° 1/8"G CONICAL PIPE D6
45	8	HEX SOCKET HEAD CAP SCREW M12X115 8.8 UNI 5931
46	2	O-RING 2-219 NBR 70SH
47	2	FLANGE SAE 6000 1" GAS CFS 403
48	1	VALVE VOC190 F.MVS.SE.CH/1 3Y 06B F12-80 V14-110
49	4	HEX HEAD CAP SCREW M12X35 8.8 UNI 5739

50	1	MOTOR SUNFAB SCM084WH-I44-W35-V1-M-1-00
51	1	V-RING NBR VA 130
52	1	V-RING NBR VA 150
53	1	OIL LEVEL PLUG 1/2"(METAL)
54	1	SOFT COPPER WASHER 1/2" (21X27X2)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